II. Requirements for Development

DR. KELVIN KEMM

‘Our Objective Must Be To Double Electricity Consumption’ in Africa

Dr. Kemm was interviewed on March 2 by Jason Ross, and The LaRouche Organization has granted this publication to EIR. *The interview is excerpted and the full video is available here.*

Warren Kemm

Dr. Kelvin Kemm

Ross: Welcome! This is Jason Ross with The LaRouche Organization, and I am very happy to have a chance today to speak with Dr. Kelvin Kemm, a South African nuclear scientist, former board chairman of the South African Nuclear Energy Corporation, and the CEO of Stratek Business Strategy Consultants. Dr. Kemm, thank you for being here with us today.

Dr. Kemm: Well, thank you very much, Jason, I'm very pleased to be with you.

Ross: *Executive Intelligence Review* has published a report called *The Great Leap Backward: LaRouche Exposes the Green New Deal*. It covers the anti-development and population-reducing or-limiting intent behind the flurry of proposals and policies to reorient finance and politics around "green energy." So, from that standpoint, Dr. Kemm, I'd like to ask you about energy. There was an unusually cold period just recently in the U.S. State of Texas, where there was an energy disaster. The cold temperatures froze up wind turbines; snow was dumped on solar panels; the cold drove up heating demand; and there were other aspects, other problems of energy production, including, to some degree, with natural gas.

What is your take on what happened in Texas? Does this tell us anything about the drive for increasing investment in wind and solar?

Kemm: Well, here I am sitting in Pretoria, where it's been particularly hot. And we've been getting some stories about "freezing Texas." I was a guest speaker at Texas A&M a couple of years ago; not in the cold weather, but I can sit here and just imagine what it's like in Texas. I've got great sympathy for them.

I think that what has been shown by this, is that what you need is reliability. You must try to avoid putting in any fluctuations that you don't need. What's really interesting to watch, is that I discovered when I was there, that Texas is not connected to the rest of the U.S. grid for various historical reasons. So, it's interesting to watch Texas; it's almost like a separate country at the moment, operating all on its own.

And Texas has been driving toward wind and solar for a while now, which is leading to this whole farce of reducing carbon dioxide (I'm one of the people that does not believe in—but maybe we can come to that later). But what is indicated there, is that electricity consumption in going to go up. In the last 25 years, world electricity consumption had doubled. Here in South Africa we have 85% electrification in the country. The last 15% is people living, voluntarily, on hilltops or very far away.

South Africa is very big, by the way; South Africa is the same size as the whole of Western Europe added together. I'm in Pretoria at the moment. Cape Town is right at the bottom of the country. But the distance from Pretoria to Cape Town is the same as Rome to London. So, when we look at our challenges, they're completely different from Europe, and there's too much of a tendency here to say, "Oh, well, the Germans are doing it this way; so-and-so is doing it that way; why don't we follow suit?" It's completely different over there to what we have here.

So one's got to look at the circumstances and say, "Now we are 85% electrified. There are many African countries that are 15% electrified, 20% electrified. Our objective must be to double electricity consumption. A lot of those other African countries have got to double it, double it again, and then double it again, and then double it again."

Some of these stories you hear from Green extremists who say, "Cut electricity consumption worldwide; cut back." It's just not on. I can't see why, in the next 25 years, the *world* is not going to double its electricity consumption. In fact, I think it'll go faster. There's more and more electrical devices coming out every day. I saw some figures the other day that were just staggering, for the amount of electricity that's used every day just for Bitcoin mining around the world. It's the size of an entire country.

Now this type of thing is going to continue. So I think we need to get our psychology right: The world is going to double its electricity consumption. So is Texas. Certainly in South Africa here we have to, and in other African countries they've got to do a lot more than that. So therefore, using the Texas illustration as you asked: They must look to double their electricity consumption. This means, take all the uncertainties out that you possibly can, so that you're not faced with a very difficult situation to manage. And to my mind, wind and solar and all these things just add complications—why do that?

Limitations of Wind, Solar, Batteries

Ross: I want to go in two directions now. One is to find out more about your view of the goal of trying to reduce carbon dioxide. Let's come right back to that after a question about solar and wind. Because the proponents of these technologies—you're right, many of them believe that we shouldn't be increasing energy production, to give you a sense of what their priorities are. But we hear that solar and wind, these technologies are always improving; that windmill design is improving; that new manufacturing techniques or discoveries in materials are improving solar panels. Is there a limit to how far these technologies can improve, or is this the sort of thing where the sky's the limit?

Courtesy of Kelvin Kemm

Dr. Kemm was one of the speakers during the technical tour to the Joint Institute for Nuclear Research in the science city of Dubna, Russia, as part of the AtomExpo 2017 forum. Africa was represented by Zambia, Nigeria, Egypt, South Africa, and others.

Kemm: Well, undoubtedly solar and wind have improved dramatically. One only has to look at the original windmills of Holland a couple of hundred years ago, and the wind turbines of today. And bear in mind that Albert Einstein got the Nobel Prize for explaining the photoelectric effect—not for relativity at the time. So, it's been known for over a century how solar works, and there've been great strides. But yes, there are limitations.

The sunlight hits the ground at about one kilowatt (kW) per square meter. Now of that one kW per square meter, you can only extract about 15% for solar electricity. That's the blue end of the spectrum. You can do certain heating with the other end of the spectrum, but you can get 15% of one kW/square meter and that's that. And that is only during the daytime, and only during the middle of the daytime when the Sun is vertical to the solar collector—unless you've got a very sophisticated one that's following the Sun, and so on. The same happens with wind. There's a limit in physics called the Betz Limit. And the Betz Limit tells you that you can't get more than 59.2% of the energy out of a wind flow, no matter what. Call it 60% for a round figure. That's all you're going to get.

Then people say, "Well, build a bigger wind turbine." That you can do. If you build a bigger wind turbine, though, these rules tell you they've got to be further apart. So there's also an amount of electricity that can be extracted, per square kilometer, out of wind, and that's that. You can't keep packing them or making them bigger. They've got to get further apart if they're bigger. So there's a limitation. And that is the limitation of physics—of course, let alone the other limitations, which are when the wind blows and when the Sun's not available, like nighttime.

Solar, generally speaking, gives you about a quarter of what's called its "nameplate energy." And I get so irritated when somebody says, "100 megawatts of solar has just been installed. This can power so many thousand houses." And they don't say, "Only at lunchtime, and not at all at night." So if you see 100 MW of solar, it means 25% of that on average, over the year, if you're lucky and not on rainy days, and such like. Wind will give you about one-third on average, over a year, and some days nothing! Of course your real snag, is when the wind drops at night. Then you've got neither.

So then you've got to say to yourself, "I've introduced all these instabilities and uncertainties." And the next step is that people say, "Well, why don't we have batteries? So we can now charge the batteries, so when the wind stops at night and there's a dip, we fill it up with the batteries." But the battery has come up not because it's a good engineering solution. It's a solution that's trying to solve the bad problem of the wind, because the wind isn't constant. So you have one bad solution trying to solve another bad solution.

Then what people don't tell you when you build a battery: You can't use the same wind turbine to charge the battery, because when it's charging [the battery], you're using it. You can't use the same solar panel to charge the battery that you want to use when the solar panel is not working. You've got to build another one. So you've got to build double the solar size. In fact, that's not adequate, because in the early morning and late evening you get very little; so you've got to build a *triple* solar size. You've got to build a triple solar size, in which two out of the three are charging the battery to use when the Sun goes down.

The same was true with the wind: You'll have extra wind turbines to charge the battery to use when the wind goes down. So this whole thing just becomes more, and more, and more complicated, 'til you start to get to a situation like Texas. I'm not saying that it's entirely wind and solar to blame in Texas. But definitely they didn't take into account an adequate backup to have in this event.

Then people are being seen—news items are appearing—saying "Texas must have a backup." How do you have a backup? If you're on wind and solar, you can't have a wind and solar backup, because if the wind isn't there, there isn't any wind. So now your back-up to your wind and solar has got to be something else, like coal or nuclear power. So now you get to the ridiculous situation that you want to use wind and solar with nuclear and coal as a backup. If you were going to do that, why didn't you just use the nuclear and the coal in the first place? This is what has been done for the past 100 years in the case of coal, for the past half-century in the case of nuclear.


cc/NJR ZA

Eighty-five percent of South Africans have access to electricity. Here, an electrical power transmission pylon.

The Progress of Nuclear

Ross: You had brought up how wind and solar have improved. How has nuclear technology and science advanced over the last 50 years since nuclear power came on line as a new technology? Where is this technology headed?

Kemm: I'm very glad you mentioned that, because of course that is also a strange human phenomenon as well, that everybody seems to think that scientists put a lot of effort into wind and solar, but somehow they don't do it with nuclear at the same time. We see the *Perseverance* rover landing on Mars, we see all these fantastic advances, but people assume somehow that nuclear stood still. But it certainly hasn't. Around the world, a number of countries have raced ahead.

Of course, one of the images that's in the minds of people is Fukushima. Fukushima was what was known as a Category 2 nuclear development; and it was an early Category 2, it was near the end of its life, heading for retirement anyway. Then what happened is, the biggest earthquake on record smacked into the neighborhood, followed by the biggest tsunami on record that smacked into the neighborhood. And the water jumped the protection of the reactor. The reactor suffered a core meltdown, in fact, more than one. All the worst things possible happened. The reactor, by the way, switched off like it was supposed to. When the earthquake occurred, Fukushima switched off; it did everything correctly. If the water hadn't arrived about an hour later, everything probably would have been OK. When the water arrived, it came in, and it wiped away the power lines that were bringing in electricity to run the cooling pumps. It also washed away the diesel suppliers which were in tanks sitting out in the carpark or something at the back.

So, these fellows were hit with an absolute barrage of the worst conceivable set of circumstances. There was a melt-down, there was this, there was that. Notwithstanding all of that, there was not one single death at Fukushima from nuclear radiation. There was not one single human injury from nuclear radiation at Fukushima. No private property was harmed by nuclear radiation at all.

cc/DFID-UK Urban Search and Rescue

Despite widespread destruction wrought by the earthquake and tsunami in March 2011, not one human injury resulted from nuclear radiation at the damaged Fukushima Daiichi Nuclear Power Plant, and no private property was harmed by nuclear radiation. Shown, rubble of the Unosumia suburb of Kamaishi, Japan.

I wrote an article that was published in Washington; in fact, the editor chose the title something to the effect that I said that Fukushima was not a nuclear accident. There was a barrage of reaction to it. But, in fact, Fukushima was *not* a nuclear accident. It was a Fukushima industrial accident like what would have happened at the airport, the car factory, anywhere else. The fact that it happened to be at a nuclear plant doesn't make the airport at Fukushima that got wiped out by the tsunami as well, doesn't turn that into an aircraft crash. It turns it into an airport smashed up. There was an oil refinery down the coast as well that was also hit. It burst into flames, and that picture is often used as supposedly Fukushima on fire, which it isn't. But there were no radiation effects. Even in an investigation afterwards by 28 countries that looked into any potential long-term effects for genetic damage, they found there wouldn't be any.

So, there you take a bad reactor that is out-of-date, badly run it turns out—they had some bad management and so on that came out later. You do the worst you can, and it shows you how incredibly safe it is. Meantime, in the big reactors they happen to call Generation 3+, there's even yet a newer one of small, modular reactors which is Generation 4. They're completely different. The Generations 3 and 3+ reactors now use a lot of natural physics for safety. So, for example, if something happens, there's automatic water up at the top under gravity that will run through the reactor by itself. It doesn't need the pumps like it used to. The people got clever. There are reactors where there will be plugs at the bottom that automatically open with certain small modular reactors to allow the fuel to run out to a safe mode, and so on. So, there is a huge amount of advance that has taken place.

Eskom

The Koeberg nuclear power station, near Cape Town, South Africa.

The image is that in the U.S., for example, that it has stopped; it hasn't. Westinghouse, for example, has developed very good reac-

cc/Wikiemirati

The Barakah nuclear power plant in the UAE, which commenced commercial operation this year, is shown under construction in 2017.

tor designs, but yes, there have been brakes put on in the rest of the world. Meantime, the Russians have gone ahead, the Chinese have gone ahead, the South Africans are pushing forward now, the South Koreans. India is going ahead on building extra reactors.

So, you find there's a lot of movement taking place in the eastern part, and the non-First World western countries. That's where a lot of progress is taking place. Just recently in the UAE, they started extracting electricity from their first nuclear power plant called Barakah; it's got four reactors. Interestingly, of the staff that have put the Barakah plant together, there are over 140 South Africans, including the heads of all the reactors and the head of engineering; they're all South Africans who were trained here. They're all saying that as soon as their contract is up, they're coming home and they want to work on nuclear here.

cc/jbdodane

A wind farm in Western Cape, South Africa.

That was the UAE's first venture into nuclear, so they had all the legislation and all the procedural stuff to go through with the International Atomic Energy Agency and so on. But there, they're going ahead. The Barakah one was delivered effectively on time and on budget; it came up the way we wanted it to be and the way we expected it to be. But you'll never find it used a benchmark. They're always looking around, the anti-nuclear groups, to find somewhere that for some reason it went over budget and over time. There was one in Finland, there were all sorts of procedural reasons, and it went over budget, and people are forever using that reactor's administration [as an example], but not the Barakah one. Why not? Because this shows an intention to deceive, and not to be honest; and that's a great pity.

But yes, the reactor advances have been dramatic, and the small modular reactors which we can discuss in a few minutes; I'm sure you'll go there.

Ross: Yes, you brought up in Finland, for example, or here in the United States, one of the major costs in the nuclear reactors that have been built or completed in the recent period, essentially expanding old sites. One of the major costs is litigation, the delays, the drawing out of the completion of these projects, the carrying of the finance costs the whole time. These aren't physical costs; they're related to policy and this sort of thing.

But on the physical aspect of nuclear power, these are very complex systems. So, why is nuclear power so efficient? Why can these relatively tiny amounts of fuel, small pellets of uranium, why are they able to achieve the same kind of power output as let's say a coal plant being fed trainloads of coal, or an enormous plain full of windmills? Why is nuclear so efficient?

Kemm: There's just an incredible amount of power in nuclear.... This is why you can build a very small nuclear reactor—by small, what I mean is, on a football field you can build a nuclear reactor to supply an entire large town. If you wanted to supply a large town with wind and solar, you're talking about an area much larger than the town by far. So, you've got to have acres and acres of land to put solar on, and then, it's got to be facing the Sun, which means you can't have it on slopes, because they're not facing the Sun. Unless you now

cc/Oregon State University/NuScale

An artist's rendering of a small modular nuclear power plant designed by NuScale Power.

have a complex gimble mechanism that the solar follows the Sun, which adds to your costs, adds to your complexity, and so on. So, it's just surprising.

'Save the Planet, and Don't Advance'

Now, I want to emphasize, I've never ever said that I'm opposed to solar and wind. I've made a policy decision for myself: that I've never said I'm opposed to solar and wind *for uses for which they are applicable*. But I have said they're no good for baseload electricity for a country. You can't expect for them to be very reliable. Here in South Africa, we have some of the biggest and certainly the deepest mines in the world. I've been to the bottom of the deepest hole in the planet that it's possible for a human being to go to. That's a couple of kilometers below sea level. And down in those big South African mines, you have four, five, six thousand people on shift at a time, four kilometers below the surface of the earth. You can't have 4,000 people kilometers underground, and the electricity fails and somebody says, "Sorry, fellows, the wind isn't blowing." It's just far too big a risk; you can kill too many people. You've got to know that the powerful electricity is there all of the time….

If we're looking for doubling of the world electricity consumption, we better decide exactly how we're going to do this. Us people in Africa are not prepared to sit here, with some countries having 20% electrification, some countries having 15% electrification, and people come here from Switzerland and Germany and say, "Be happy the way you are, save the planet, and don't advance." Which is what *has happened*. They come here and tell people, "Do not go for more electricity. Stay the way you are, because you're doing good for the planet." "Sorry! I want to live like you Swiss live; I want to live like everybody else."

In South Africa, we see this as the most interesting country. We have, at the leading edge of South Africa, we have the most advanced first world systems. We had cellphone texting two years before the United States did, by the way. I've demonstrated it in the U.S. Senate. I had a whole crowd around me where I went; of the Senators, they were fascinated to find I could send a text message on my cell phone. So, it was a recollection of mine. We had GSM cellphone technology two years before you did. We have very advanced systems here.

At the other end of the spectrum, we've still got people living out in the bush in mud huts. So, we see what it's like to see from the front end of the First World to a very developing world element in one country. So, we know very well that there are many people in Africa that are still living in mud-hut conditions or a little bit better than that, with no electrification. The First World can't morally tell them to stay living in mud huts, to not have electrification or local clinics. To not have proper education systems because the Germans are telling you to save the planet according to their rules. You can't do that….

Ross: Looking forward into the future, let's say 50 years into the future. Could you describe how the world, or Africa in particular, would look in 50 years if we embark on a process of developing new technologies. Nuclear fission, and eventually bring on nuclear fusion as well. Could you contrast that image 50 years from now, with how the world or Africa will appear in 50 years if we decide to increasingly rely on windmills, solar, the so-called renewable energy sources?

Kemm: I think if we rely on the solar and wind, there's going to be endless problems, because of the size of Africa, and also the integration of these variances. Having day and night; having wind blowing and not blowing. You're just asking for trouble when you try and get a country run on that. If it's a little bit of bonus, it's one thing; but if you're leaving the country

In South Africa, members of the Energy Sector of NEHAWU, the National Education, Health and Allied Workers Union, march for nuclear energy in Pretoria.

run on that, you're asking for trouble.

Now what we have is not only the new, bigger reactors which are much more advanced—like 1,000MW reactors, 1,500MW reactors. We also have the small, modular reactor class, which are 100MW—about 5% to 10% the size of a big reactor. There are two basic brackets. One is water-cooled reactors, which run at about 250 or 300 degrees Celsius; and then high-temperature gas reactors. South Africa designed one called the Pebble-Bed Modular Reactor, with an output temperature of 940 degrees. Then there was another one designed in Pretoria called the HTMR-100, which they brought it down to 750, which has got a lot of advantages, because you can build it quicker and cheaper. Those reactors do not need water. We did it so we don't have to be near the sea, and we don't need to be near a big body of water; because there are many African countries being very large that do not have water. So, you've got to allow for aridity….

But small modular reactors are the answer not only for African countries. In fact, when I was in Minneapolis, I was asked to give a presentation on small modular reactors there, because the state authorities were interested in looking into them. That was some years ago already.

Indonesia is very interested. Indonesia is a set of islands, and there's water in between, so it becomes difficult. The head of Indonesian nuclear said to me, "How do we run cables between one island and another? We can't do that. We can't have an Indonesian grid in the conventional sense of the word." I said, "Good heavens! That's a good point." So, the market for small modular reactors is phenomenal. You refuel one of these big reactors every 18 months. So, once it's refueled, it runs for 18 months. The small modular reactors that we designed here, you *never* refuel them in the sense that you have to switch them off. You keep feeding new fuel in, because the fuel is a ball about as big as a baseball. The ones designed here, the fuel designed and manufactured in Pretoria, are about as big as a baseball, and there's 9 grams of enriched uranium in it. Three or four of those balls will sort out one individual for a lifetime's worth of electricity. You drop the balls in, and then there's a mechanism to check them, to see if the ball is burnt up. When the ball is used up, you take it out and put in another one. So, the reactor can run effectively forever.

You can also stockpile the fuel. That would be a political and economic decision. There's no way you can stockpile coal; the stockpile here in South Africa, we try to stockpile coal at coal-fired power stations. The plan is to try and have two weeks' buffer. Two weeks of coal is like one of the pyramids in Egypt actually. But you can stockpile on site, the nuclear fuel for years if you want to. All you have to do is buy it, and then get international agreement that you can have that amount of enriched uranium in bunkers or whatever. If you get rainstorms that happen and wash the road away, or wash the railway line or whatever, it does not switch off your reactor. Whereas, if you had a coal-fired power station that relies on trains arriving every couple of hours, or a conveyor belt continuously bringing coal into the furnace, one good Africa storm with a good flood of water, is going to potentially wash away your railway line or your road….

So, to my mind, small modular reactors are the answer for most African countries and for many other countries around the world. Those that want bigger power can get bigger reactors if they can put them near a source of water, such as the sea, or come up with some other cooling option that you have to take into account.

But I just see the face of Africa will be changed by nuclear power, because they need to double, double, and double again the electricity. You're not going to do that with solar and wind, I'm sorry.