INTERVIEW WITH KELVIN KEMM

South Africa Builds on Its Nuclear Success

Dr. Kelvin Kemm is chairman of the board of the government-owned South African Nuclear Energy Corporation, known as NECSA, the acronym of its former name. He is also CEO of the consultancy, Nuclear Africa, through which he has consulted not only for the government of South Africa, but other governments including Turkey and Bolivia. Kemm received his doctorate in nuclear physics from the University of KwaZulu-Natal. He was interviewed by EIR*'s David Cherry on April 29.*

Warren Kemm

Kelvin Kemm

EIR: South Africa is the only country on the African continent that has nuclear power—the two reactors at Koeberg, in the Western Cape, produce about 5% of South Africa's electricity. But South Africa needs more of this cheap electricity to meet the needs of a growing population, while the country continues its industrialization. There have been different plans for more nuclear power plants at least since the time of Thabo Mbeki's Presidency. Dr. Kemm, what is the current plan?

Kemm: The current situation is that nuclear is still on the agenda exactly as it was; it's unchanged. There's been somewhat of a delay because of various issues—we have a new President now, as of a couple of months ago, and a new Minister of Energy. But nothing has changed with the plan to add 9,600 MW of nuclear—to the existing total from all sources of 45,000-plus MW of electric power.

However, the wind and solar people have been making a lot noise and made quite a few inroads, in that they've influenced the public thinking a lot. In doing this, they've done quite a bit of sabotage of nuclear, in the sense that they spread false stories that nuclear power will kill your children, and that there's an unsolved waste problem, and that South African workers will not be able to meet exacting nuclear standards.

In contrast, the nuclear professionals do not attack solar and wind. We say that you're not going to run electric trains across the country on solar and wind, you're not going run the gold mines; but we have no objection to solar and wind where they can work—in rural areas and in small applications, dedicated applications—which is in stark contrast to the anti-nuclear people, who condemn anything that has the word "nuclear" associated with it.

At this stage, everything is on track, but it's all been somewhat in a holding position in the public mind because of the fighting from the anti-nuclear lobby.

EIR: One of the things that they say, again and again, is that South Africa cannot afford nuclear.

Kemm: It's totally untrue. Right now, nuclear is South Africa's cheapest electricity by far. By far. It's way under the price of the wind and the solar, and below the price of coal. I am referring to the existing Koeberg Nuclear Power Station. Now some 30 years into its life, it's proven that the decision was right, and it's still got another 30 years to go; so, we've got 30 years ahead of us of cheap nuclear power.

But they don't want to look at the evidence and see that that is what will happen with the new power stations. Instead, they do spurious calculations. For example, take the cost of the new program, which is for 9600 MW of new nuclear, and that represents three new nuclear power stations to be built sequentially over a

10-year-plus period. When the total cost is quoted up front, it is quoted for the three power stations built sequentially over a decade. But the anti-nuclear lobby takes the projected cost and makes out as if the entire amount will be spent in cash once, in the first year. What is more, they've said that it will all go to a foreign country, which is completely false.

Most of the construction of a nuclear power station is not nuclear: It's pouring of concrete, it's digging foundations, it's building walls, it's putting electrical wiring inside. It's pumps, it's valves, and so on. It's only when you actually get to the reactor vessel, what's inside the reactor vessel, that you get to the nuclear part. The rest is all completely conventional civil construction, which can be done by South Africans in South Africa. We aren't going to be importing concrete from anybody, or importing welders or machinists or workers of that kind; we have all of them.

Kelvin Kemm

The Koeberg nuclear power plant, 30 km north of Cape Town, South Africa. The plant, which includes two pressurized water reactors running on enriched uranium, is rated at 1,860 MW. It is owned and operated by the state-owned electricity corporation, ESKOM.

The anti-nuclear lobby took the figure calculated by the professionals, a projected total cost of 650 billion Rand, and escalated it to 1 trillion Rand ($100 billion). And I've seen figures in the newspapers as high as 6 trillion Rand, where they say, well, there's bound to be a delay, so add some money onto this; there's bound to be this, there's bound to be that. They'll take the projected cost of the reactor and convert it to a foreign currency, as if we'll be importing concrete at British pound or euro prices, for example, which is ridiculous. They have completely distorted the story in the eyes of the public, and done calculations based on what they think the cost will be up front, using these false computations. And they come up with silly numbers, which the professionals keep saying are just plain and simply wrong.

Nuclear Fuel Is Reliably Cheap

Where nuclear really scores is in the predictability of the fuel price for so many decades into the future. Nuclear fuel occupies such a small volume. For example, in South Africa, the Koeberg Nuclear Power Station, which has two reactors, has been running for 30 years. All of the high-level waste, which is the spent fuel, will cover half a tennis court to no higher than a man—that's the total volume of waste for 30 years—that's all. Half a tennis court, to no higher than a man. That's all it is, and that was the volume of the uranium when it was all new. So, the total amount of uranium for 50 years, for argument's sake—half a century—will fit in something like a dozen trucks.

Even if the uranium price were to go up a lot, the amount of fuel is so small that the amount of uranium in the fuel price is little: The fuel has to be fabricated with high- precision technology, so when you buy the fuel element; only a portion of that cost is for the actual uranium inside. The fuel price is highly predictable and highly stable for very many decades into the future. And that's all you have to pay for basically, other than obviously standard maintenance and so on, which is not great because you haven't got lots of dirt around a nuclear power station. It's not like a coal-fired power station with its ash and dust and flames. A nuclear power station is a very clean operation.

They have just wangled the financial figures to the point where the public mind is distorted. It's not only a South African problem, it's worldwide. I have a colleague right now who's in Vienna at the International Atomic Energy Agency (IAEA), on a nuclear costing

course, and he sent me an email a couple of days ago saying that he'd been in discussion with classmates from other countries, and they all have the same problem: That the anti-nuclear lobby is distorting the minds of the public and the public is absolutely confused.

So, it is over decades now that the nuclear people have not gone to the public and explained to the public clearly; whereas the anti-nuclear extremists explain solar and wind, which are easier to explain, but they also lie about it. They completely omit to mention that there's no solar at night, for example. Time and again in our newspapers, they announce, "100 megawatts of new solar was switched on today," and they'll add, well, that's another 100 MW. But that power is only available in the daytime. And then when you say, "Well, what happens at night?" They say, "Well, we don't know, that's not our problem." And you say: "You can't have 100 MW which goes to zero at night. Then you would have to have something else, like another 100 MW of coal or nuclear, which you switch on when the Sun goes down." These sorts of things are not explained to the public, so the public is not comparing apples and apples.

EIR: Is there another country that is going ahead with nuclear and whose financing model can be used as an example of how it actually could be done in South Africa?

Kemm: Absolutely. In fact, right now, the best example is the Barakah Nuclear Power Plant in the United Arab Emirates (UAE), which is in its completion phase now and the first reactor is getting ready to supply electricity. At the beginning of this year, the UAE appointed an American team to handle all the operations and the switch-on. The Americans didn't succeed so they were fired. They were then replaced by 80 South Africans. Right now the head of reactors 1 and 2 is Darrel Aploon from Cape Town, and the head of reactors 3 and 4 is Kevin Engel, also from Cape Town. The personal advisor to the chief executive is Thegan Govender, also from South Africa. There are 80 South Africans there now, doing a very good job in all the operations and getting the reactors up and running to provide electricity according to the IAEA rules, because that's what they have to now do, not just to trip the switch. There is a whole sequence of events to go through to make sure it's legal and within the bounds of the IAEA regulations and those of the World Association of Nuclear Operators (WANO), which also oversees it, the head of which is a South African based in London.

Kelvin Kemm

The reactor pool of the SAFARI-1 reactor at Pelindaba, near Pretoria. This 20 MW, light water-cooled, beryllium reflected reactor is used by NECSA for the production of radioisotopes and for research.

So, we know what we're doing, and the UAE reactors have been built on time and on budget, and the cost is virtually identical to the South African calculation. If you work out what it's costing them, it is virtually to the dollar of what we calculated in the beginning: So the evidence is there, that it is right.

The German Failure

EIR: What you've just said about the UAE reactors, has that ever appeared in the South African press?

Kemm: The main daily press is not reporting this. It has only appeared, a couple of times, in technical magazines. However, in the last couple of weeks, a couple of editors have spoken to me, and it is as if they are slowly starting to see the light.

We've just had a fuss over the last month, arising from what President Ramaphosa said in January—just

before he was inducted as President—when he was at the World Economic Forum in Davos. In a discussion with the press, in which he was being pushed on economic issues, somebody suddenly asked the question, "What about the nuclear?" He said we have a surplus of electricity at the moment, so there's no need to rush into an expensive nuclear build. He said the word "rush," which everybody there omitted to mention in the stories they filed. Everyone reported that he said, "We don't need nuclear because we have a surplus"—which is not entirely true. We don't really have a surplus. I'll explain that in a moment.

Then a month after that, it was proposed that we spend 56 billion Rand on signing up for new wind and solar, which the Minister then did a fortnight ago. But nobody murmured a word in the newspapers about "what happened to the surplus that we had?" When they talked about the surplus for nuclear, all the newspapers were carrying a story that we had a surplus, we don't need the nuclear; so, it's been a very dishonest approach.

GovernmentZA

Former President Jacob Zuma visits NECSA in 2014. From right, NECSA CEO Phumzile Tshelane; Zuma; the then Energy Minister, Tina Joemat-Pettersson; and (pointing) Loyiso Tyabashe, Senior Manager for Nuclear New Build at ESKOM.

The claim of a surplus is also fictitious. Right now, on paper, we appear to have a bit of surplus electric power generating capacity. But what we actually have, for example, is 3,500 MW of gas turbine capacity for generating electricity. It's one of biggest gas turbine installations in the world. That was built as an emergency source that is only supposed to be used for an hour or two, in the event that you're really desperately short. That 3,500 MW stands switched off all day long, unless we get to an emergency situation, and it's horrendously expensive—way, way above the normal selling price of electricity. So that 3,500 is counted in, as part of the national electricity asset, and they count in solar and wind; but if it is night time and the wind doesn't blow, then that capacity just goes away like a wisp of smoke! And you only turn on the gas turbines if you have to, and then you really pay for it.

So, this apparent surplus is wrong. And in about a decade's time, between five and ten years, in fact, some of the older coal-fired power stations will be reaching end of life, and they should then be closed down. So we need to start the nuclear now, so when the nuclear is ready—the first reactor in half a dozen years' time—it will come on stream as the current, old coal-fired power stations are going out. The wind and solar over the next 18 months is not going to help you in seven years' time, when the current older coal-powered stations are reaching end of life.

Again, the decisions have been made and precipitated a lot by the press. Certainly one thing that Donald Trump has brought to the world is this concept of "fake news," and it's really quite horrendous how bad it is in the case of nuclear power. Newspapers somehow, all over the world, have an instinct to attack nuclear power and never say anything good about it. Meanwhile, they are always worshipping solar and wind, as if they were a solution.

One has to point out to the press that Germany has gone into its major solar and wind campaign, while France is the country with the highest percentage of nuclear power in the world—France is 75% nuclear. And yet, the German price of electricity is twice the price of France, and Germany's carbon dioxide production is three times that of France. And yet, Germany's reason for going into solar and wind was to reduce CO_2 production, to be environmentally friendly. At the moment they are failing miserably. The newspapers never tell you that Germany has now gone to an emergency measure, building coal-fired power stations, new ones, of which the first three have been built and commissioned, because the wind and solar program is failing. That's

not reported, *so this incredible distortion of the truth is really quite worrying*

COP21 Is Nonsense

EIR: What about this business of CO_2 as an environmental threat?

Kemm: Well, I don't believe it, anyway. But it certainly has become a political bargaining point at the moment. It is just a big hoax.

Some global warming is taking place, but that is a natural result of the movement of the planet, and the Solar system, and so on, for all time. If you look back more than a thousand years, you'll find there was a Medieval Warm Period, the MWP, it's very well documented in history. And at that stage, the temperatures were higher than they are now. That was followed by an event that's even better documented, the Little Ice Age, the LIA. And both of these phenomena were universal across the globe, they weren't localized. The Little Ice Age is documented, for example, in paintings that are hanging in art galleries now, of the Thames frozen over, to such a degree that people rode coaches up and down the Thames even in the 17th Century and after. And it was well known that crops failed; the cold periods were associated with misery, starvation, death, disease. The great plague in Europe happened during the Little Ice Age.

In contrast, the warm periods were healthy and full of prosperity. The crops all grew and people didn't die, and so on. So those are very well documented. And the current warming is just another one of them. Before the Medieval Warm Period was the Roman Warming, prior to that was the Minoan Warming, and the frequency is quite well established, and this is linked to the Solar cycle and the impingement of cosmic radiation on the Earth, which in turn affects cloud cover. And the amount of cloud cover only needs to change by about 10% or so for there to be a significant difference in the amount of sunlight getting through to the ground, and therefore either warming or cooling the planet.

There's a very good correlation between the level of Solar activity and climate. It was shown very clearly by Henrik Svensmark of Denmark. He did experiments on the theory and has written a very good book about it, called *The Chilling Stars* (2007) and there is a film, *The Cloud Mystery*. The book shows very clearly that there is a scientifically validated link between Solar activity and climate, which is being researched now. But the greenies don't want to accept that, because then they haven't got industry to blame. They need human beings to blame. If they've got people to blame, then they can accuse them and tax them and tell them to toe the line, so they can push them into their socialist-type agenda. That is the truth of the matter.

So the whole global warming business is false—the anthropogenic part of it is false; it's not a result of industrial carbon dioxide. In fact, we've been coming through one of the lowest CO_2 concentrations in a very long time, and there is evidence that shows clearly that high levels of CO_2 in the atmosphere are very good for plants. There is no doubt about that. And therefore, a much higher level than we've got now would increase plant growth, which means improved crops and general benefit environmentally for the planet.

We've been through a carbon dioxide starvation period for some time now, which thankfully we're coming out of. So this paranoia about CO_2 is just wrong. There is no manmade carbon dioxide problem, therefore, there is no manmade global warming problem.

But certainly the psychology of the moment is that everybody is out to lower carbon dioxide emissions, and nuclear power does that: It doesn't emit any carbon dioxide. If you have carbon dioxide reduction as one of your agenda points, and you want to toe the line for the COP21 international climate change agreement, then you should go for nuclear.

I met [French President] Emmanuel Macron about a year ago, face to face, and we had a chat about nuclear, and I said, why don't you brag more about nuclear? And he said his government should do that. I also said to him, the CO_2 thing is nonsense, COP21 is nonsense—we were just talking privately, the two of us—he said, "Interesting point." He didn't say, "yes" to that, and I noticed, when he spoke to President Trump the other day, he emphasized the COP21 agreement, because he is obviously trying to get the United States to join in, whereas I think what Trump has done is right. Trump has pulled out of COP21 and is saying, "We're not going to do this; it's not in our interest." And I think that's the right thing to do.

The Geography of Power Production

EIR: Can you give us a picture of what will happen—of course, South Africa is not an island—but

let us attempt to visualize what will happen if South Africa does not go nuclear?

Kemm: South Africa *is* an electricity island, and that is something which is also very different from Europe. Look at a map of Europe—there's an Internet site where you can see a dynamic electricity map showing the flow of electricity throughout Europe. The whole of Western Europe is the same size as South Africa.

Now, I live in Pretoria. The distance from Pretoria to Cape Town is about the same as from Rome to London. In Europe, you'll find all electricity is interconnected, so there's no such thing as a "French" electricity grid, or a "German" electricity grid; there's one big pan-European grid. And it's all utterly automated, so if one country is short of electricity, it just flows in from its neighbors, and vice versa. A country like Germany—which is doing its wind and solar experiment—it's got a ring all the way around it of other supplies, one of the largest being the nuclear energy of France. Every time the German system doesn't work, the French nuclear flows in, which is often, to stop the German system from failing completely.

Nuclear Africa

International Atomic Energy Agency (IAEA) Director General Yukiya Amano addresses the Nuclear Africa conference, Pretoria, 2015. The conference is hosted annually by Dr. Kemm's consultancy.

But South Africa is an electricity island. We don't have such neighbors. We've got a couple of electricity agreements with neighbors, but their power production is tiny. It's like the schoolteacher of a Grade 1 class, saying to all the kids, "If one of us falls down and breaks her leg, then everybody else will carry her to hospital." And they say, "Yes, teacher." Now, if any kid breaks his leg, the teacher will take him to hospital. But if the teacher breaks her leg, the children aren't going to carry the teacher to hospital.

So while you've got an agreement to help each other out, in reality, it doesn't work out that way. We've got the Southern African Electricity Power Pool, a grouping of a dozen or more Southern African countries, all agreeing to collaborate in electricity, and supply each other with electricity when they are short. But we have such minor producers on our borders that even if they had enough to supply some to South Africa in times of need, it would be like a grain of sand in comparison to normal South African consumption. So, we've got nothing outside our borders in the event we have a failure. We can't just pick up the telephone to neighbors and say, "Can you help us out?" which is, in effect, what the Germans can do, and the Danes, the Belgians, and so on.

We've also got to stop looking to the First World for a solution, that "the Germans must be right." But what people don't say, is "the Germans did that, but with a major French nuclear backup sitting in the wings in case they've made a mistake." We don't have that. So we have to go nuclear.

Now, in South Africa's case, if you visualize South Africa, it is essentially a triangle standing on its apex with Cape Town at the bottom by the apex, and Pretoria up nearer to the right-hand vertex at the top. All of South Africa's coal is clustered near the right-hand vertex; it's in the northeast of the country, in Mpumalanga province and the northern parts of KwaZulu-Natal province.

Currently what's happening is, the nuclear power station down at the bottom, near Cape Town, is supplying about 50% of the electricity of the Western Cape region. But the other half is coming from the coal fields. As I said earlier, that is the equivalent of supplying London half of its electricity from Rome. When I gave a talk in London, I said, "How would you like it if half of London's electricity were coming from Rome?" They were all shocked. They said, "That would be dumb; we would never do anything that stupid. It's far too risky." But we're doing that at the moment: Half of

Nuclear Africa

Dr. Kemm in discussion with NECSA CEO Phumzile Tshelane (center) and others, at Nuclear Africa 2016.

the Western Cape's electricity is coming from the coal fields, farther away than London is from Rome. That's risky, particularly when we want to double the size of the country's economy. You can't double the size of the country's economy on the basis that Cape Town is put at a greater and greater risk.

If you look at cities on the eastern seaboard, like Port Elizabeth and East London, they produce zero electricity. All of their electricity comes from the coal fields. But at the moment there's a plan to build a nuclear power station at Thyspunt, near Port Elizabeth. So we have adequate coal supplies, to supply electricity to the country from the north downwards, and we have to put the nuclear power stations around the coastline from west to east—the three capes, that's the Northern Cape, Western Cape, and Eastern Cape provinces. It's those coastlines where we need the power stations, of which five sites have currently been identified and purchased. We will use seawater as a reactor coolant. The five sites are owned by Eskom, the government-owned electricity company, for nuclear development. And for two of them, the environmental impact assessments have been finished, so the sites are ready for construction to begin and site preparation can begin immediately without deciding on the international nuclear partner.

That's what we have to do. We're not trying to displace coal with nuclear. We're trying to make sure that there's adequate electricity from the south upwards with nuclear. And the demand for electric power will not be satisfied by wind and solar. You're not going to run electric trains on wind and solar; you're not going to power the giant harbor of Durban with wind and solar power: You just aren't. And the sooner people realize the reality of that, the better.

EIR: Is coal from KwaZulu-Natal and Mpumalanga being transported all the way to the Cape, a distance of almost 900 miles?

Kemm: No. They build the power stations on top of the coal mines, so the coal-fired power stations are all clustered far in the northeast. There aren't any down at the Cape. So all of the coal-fired power stations are in the north of KwaZulu-Natal and in Mpumalanga, which represent 90%, just about, of the country's electricity production. It's like powering the whole of Western Europe, but only from Austria. [laughter] So Austria supplies electricity to London, to Rome, to Copenhagen, and so on. Now you'd look at that and say, "That's crazy. You shouldn't be doing that. It's too risky; the supply lines are too long."

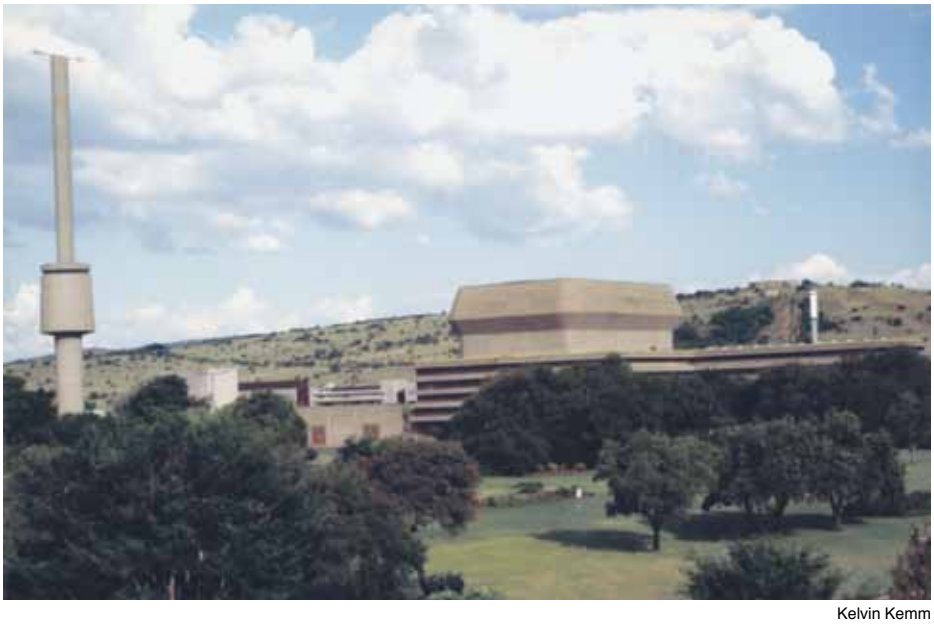
So we're basically supplying the entire country from the northeast corner of the triangle, with the exception of Koeberg nuclear and then a few hydro-electric schemes and a few other schemes scattered around, which make up collectively about 10% of the nation's power—a little bit more than that. But coal is just about 90%.

So, we're not trying to displace coal, we're trying to say, leave the coal in the north, but put some balancing nuclear in the south.

Alienation from Scientific Endeavor

EIR: How many years of coal does South Africa still have, assuming population increase of what—3, 4, 5% per year?

Kemm: There is still about a century's worth of coal. There have also been significant improvements in the technology of burning coal, crushing and so on. The coal is sprayed into boilers now, finer than talcum powder. It's not like the old steam locos, where you had a fireman shoveling in blocks of coal as big as your fist, or bigger. It is all ground up and then sprayed in as fine powder. So all that technology enables you to have a very high temperature, very fast burn. Also, more



Kelvin Kemm

The SAFARI-1 reactor building at Pelindaba.

modern mining methods mean that you take out all of the coal, whereas in the past you left considerable coal along the walls of the mine. So there's still a lot of coal left, for a long time.

EIR: But it's also a question of what kind of society South Africa intends to become: If you stay with coal, it will be different than if you say, "No, we want a society in which there are many more scientists, many more engineers. Do people ever think about that?

Kemm: Not enough. Because the scientists and engineers worldwide have traditionally not been very good marketers. We're pleased to see people like Elon Musk at the moment, who in fact comes from Pretoria, and went to Pretoria Boys High where he finished his schooling, and he's now becoming very visible, something like Bill Gates, at being a technology interpreter and showing what you can do with modern science and modern thinking. His adventurous ideas have seen him reversing spacecraft down and re-landing them on the ground successfully, and so on.

So, he's becoming a bit of a rock star of science and technology, which is what you want. But there have been pretty few of those throughout the centuries. The average man on the street knows about medicine and the names of all the surgeons in the neighborhood that are good, and they know the names of top lawyers and so on. So their work is well understood by our society at large. But society doesn't know what engineers really do. And science and engineering people haven't caught up and promoted it; kids grow up with the comics, and scientists are always guys in white coats in labs with bubbling test tubes, and they all appear half-crazy, pouring stuff from one flask to the other.

Kids don't grow up seeing scientists as people who save lives and do sensible things; they usually think of the mad scientist building the bomb to blow up the neighbors. So science and technology hasn't got a good image, in the sense that it doesn't sit well with members of the public.

Radioisotope Surprises

On that note, I'd like to branch into something else, that there's a lot of nuclear technology which is not nuclear *power*. So while the extreme greens are attacking the nuclear concept, they're doing a lot of other damage. For example, South Africa is currently the second biggest supplier in the world of nuclear medicine; we're major suppliers to the United States. In Pretoria we've got the only nuclear reactor in the world that runs 24 hours a day, seven days a week, producing nuclear medicine for the world, with deliveries taking place three or four times a day, every day of the year, including weekends and public holidays. We send this nuclear medicine around the world. It is a great life-saver for cancer patients, for example, and in diagnosing other diseases.

The science is now moving into nuclear therapy, very high-precision nuclear therapy. So we've been expanding that now. We have immediate plans now under way to take nuclear medicine into centers in other African countries. We have a big thrust, and I am one of those leading that thrust. We are also building a lot more centers in South Africa, and we've been just recently been invited to build new nuclear medicine centers in Europe and in the Middle East. In other words, people consider us world authorities in doing this.

Now we are also currently looking into nuclear methods to get rid of mosquitoes because of the malaria problem. We successfully killed off tsetse flies using nuclear methods. The tsetse flies in Zanzibar were completely wiped out by nuclear methods. That improved beef production by 300% and it improved human life considerably, because people have been dying from the diseases that you get from tsetse flies.

EIR: Amazing!

Kemm: Yes. We currently use nuclear methods to reduce the fruit flies in the Cape provinces, where farmers produce fruit for export. The number of fruit flies has been reduced considerably. They won't let us attempt to wipe them out entirely, because the biologists are not quite sure whether you might need the flies in some way, so they only allow the nuclear people to kill the majority of them and then they have to stop, in case you regret it, and you have to retrace your steps.

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A NECSA worker in the radioisotopes laboratory at Pelindaba. NECSA operates the SAFARI-1 reactor and is responsible for promoting the understanding of nuclear science and technology. The full scope of NECSA's work is illustrated in this promotional video: https://www.youtube.com/watch?v=UxPm7hVtI1s

We are also looking into nuclear methods for countering rhino poaching, for example, by putting a nuclear signal into a rhino horn that will automatically sound an alarm at a customer government's border check when it goes over the border. The details are secret. And there are certain other approaches.

We also use nuclear for nondestructive testing, for example, looking for cracks in pipes where you have high-precision welds, such as in the petrochemical industry. You put in a nuclear source and use, essentially, an X-ray type technique, but with gamma-rays, to detect if there are microscopic cracks residing in the welds, in which case you fix them, otherwise they'll fracture in due course.

So these sorts of things are being done. And there's quite a large number of them. We can also tell with nuclear techniques where an elephant lived, from its tusks. An elephant's tusks grow something like a tree, with rings. Every year the elephant's tusk has another ring, like tree rings; and depending where the elephant walks over its migratory cycle, it eats different vegetation, and the different vegetation has different nuclear signatures from its uptake of radioisotopes from the soil and atmosphere. So if you had an elephant that moved round and round in Zimbabwe for example, and another one that walked around in South Africa, we can take those two tusks and tell that this one was a Zimbabwean elephant and this one was a South African elephant; or a Kenyan elephant, or a Namibian elephant, and so on.

At the moment there's substantial ivory poaching that's going on in numbers of African countries. Every so often, tusks turn up here and the police intercept them. And a suspect will say, "No, that tusk belonged to my great-grandfather and was passed down through the family." But if it's suspected that the tusk is from another country, we now can read from these rings where the elephant walked, because you can read the vegetation that it ate. The biologist can match that vegetation to particular places. You can also read the date of death of the elephant, so you can tell the age of the tusk. So sometimes, when somebody says, "This tusk has been an heirloom in my family for 200 years," you can say, "No, this elephant was walking around four months ago."

Sex at Sterkfontein

Another interesting case recently has to do with a world-famous paleontological skull called "Mrs. Ples," found near Johannesburg; it was a real milestone in the development of paleontology and in understanding the development of humankind. It's called "Mrs." Ples be-

cause they thought it was a female; but Professor Francis Thackeray of the University of Witwatersrand has now come to the conclusion that Mrs. Ples is actually a young male. The skull was found at a cave in a place called Sterkfontein. Thackeray's paper, "Sex at Sterkfontein," reviews the gender question for this well- preserved skull. And that was done using nuclear beams from a nuclear reactor, for the first time in the world: The paleontologists were able to look at the material between the teeth and the bone of the jaw. And so, with nuclear methods, you can read the material between the teeth and the bone, and the paleontologists can then tell you whether it was a male or a female. And they've come to the conclusion now that it's almost certainly a juvenile male and not actually a female.

Kelvin Kemm

Worker inspecting a silicon crystal at Pelindaba. For making microchips, NECSA developed a highly efficient way to introduce phosphorus atoms uniformly throughout the silicon crystal, using a nuclear reaction between neutrons and silicon atoms.

EIR: Are you talking about the tissue between . . .

Kemm: Yes. The tissue between the teeth and the jawbone. And by reading that tissue, they can then come to a conclusion about the gender of the skull. And that was done here at Pelindaba, the NECSA facility in Pretoria.

There are all sorts of other nuclear processes that we carry out: We make chemicals here. It's very high precision work and very rare chemicals, and for some of them, we're the only maker—or one of two or three makers—in the world. Those chemical processes come as a spinoff of the uranium enrichment program. South Africa ran a record race towards the fabrication of nuclear weapons a number of years ago. And we then built up an arsenal of nuclear weapons. Then President F.W. de Klerk at the time announced that we had the nuclear weapons and that we planned to destroy them publicly, with IAEA supervision, which is what happened. We became the first country in the world to declare that we had nuclear weapons and to then destroy them, which was done.

But that uranium enrichment program, which is the main thing in building nuclear weapons—which is what the Iranians and the Koreans and others have battled with for so many years—produced various high-precision chemicals as a spinoff. So because of that ability, we are now able to make these high-precision chemicals, which then go into as mundane a thing as toothpaste, but also into electronic chips, making the electronic chips that go into cell phones and the like. And we make numbers of other things, such as alloys for certain types of high-precision steels.

So there is a whole chemicals industry—producing and exporting these chemicals—which is a spinoff from nuclear development. So nuclear technology should be seen as highly beneficial to society, saving lives, going into commercial products. It is often overlooked that nuclear power is only one aspect of modern nuclear technology, and that it's very beneficial for mankind. So it's very unreasonable for the anti-nuclear lobby just to be anti-nuclear, full stop, as if that's the end of the argument.

EIR: I think one of the countries that's building a nuclear medicine center is Uganda.

Kemm: They're working directly with us on that. We have just recently exchanged a Memorandum of Understanding for us to work together. I sent two NECSA board members to Uganda just before Christmas, to have meetings with the senior officials there, and they came back reporting great success. And we're moving ahead now, to build the units in Uganda.

It's also of interest that Zambia has recently ordered a research reactor from the Russians, from Rosatom,

LaRouche South Africa/Tsietsi Samuel Lepele

Representatives of China's State Power Investment Corporation (SPIC) with R.P. Tsokolibane, leader of LaRouche South Africa, at the SPIC exhibit at Nuclear Africa 2016. SPIC is one of China's three nuclear power developers and operators, and is the leading nuclear power technology supplier in China

and the Russians started a nuclear university in Zambia in December 2016. The idea is that it would be a dispersed nuclear university, catering to a lot of African countries who can send people there to gain nuclear skills. And we fully support that.

Quite a lot is happening. We've also got plans in South Africa to vastly increase the nuclear medicine production here, so that we can supply even more, and over a greater area. And we're doing that in collaboration with many of these other African countries, so that, until they will be able to make the medicine themselves, we are saying, "You build the center, we will guarantee you the supplies of the medicines."

Why Africa Demands the Pebble Bed

EIR: Coming back for a moment to the nuclear power question, aren't there many countries, many governments in Africa that are very keen on moving to nuclear power?

Kemm: Yes, there are many. Last year, in 2017, I was invited to speak at the inaugural African Union Economic Platform meeting in Mauritius. One of the things I mentioned in my presentation was nuclear power for other African countries, and I was inundated with reaction.

Half-a-dozen-plus countries, now, have already spoken to us directly, asking if we can supply nuclear power to them. Now, that is in the form of the pebble-bed modular reactor (PBMR), which South Africa developed a number of years ago. That reactor got to the point where we were ready to start constructing the first prototype, when the government of the day then put the project on ice. They didn't actually close it down, but they put it into such low gear that it eventually stumbled to an effective standstill.

However, a private company did continue with aspects of the development of the pebble-bed reactor. The pebble-bed reactor is about 5% to maybe 10% the size of the big reactors: Koeberg, for example, at the moment, is 2,000 MW; the new, big power stations that South Africa will build are going to be approximately 3,500 MW; each power station will consist of two reactors of, say, 1,500 MW each. So the pebble-bed reactor will be anywhere from 100 to 200 MW. Very small, but it's still big enough to run a smaller city—one reactor.

The huge advantage of the pebble-bed type reactors is they don't need large volumes of water for cooling, because they're gas cooled by putting helium through the core. A limitation of nuclear power up until now has been access to large volumes of water: The Russians, for example, build them on large inland lakes, and many other countries, like the United States, have tended to put them on coasts, or also on big lakes or very large rivers of guaranteed flow.

Now a lot of the landlocked African countries have not had access to water like that, because water is a reasonably scarce commodity in much of Africa. Yet many African countries are highly dependent on hydro-electric—numbers of them 100% dependent—and that's really bad news. I got quite a surprise a few years ago, when I was giving a presentation to a number of African countries, and they said to me, do you realize the difficulty with the hydro? They said that it varies depending on the rainfall. Now we've got some hydro-electric power production in South Africa, but so little that the rainfall really doesn't make a difference; if the hydro output goes down a bit, in the grand scheme of things it's not noticeable. But if hydro is 100% of your country's electricity, then it's very no-

Press Service, Rusatom International Network

There is great interest in nuclear power in Africa. Here, Zambian MPs visit Rosatom's Novovoronezh nuclear power plant in Russia, April 19, 2018. Patrick Matibini (fourth from left), head of delegation and chairman of the Zambian National Assembly, said, "Power is the lifeline of the economy. Most power in Zambia is produced from hydro, dependent on rainfall. And in the last years, we have had very little rainfall."

ticeable.

And at that point, I said to the people in the auditorium, "Gee whiz! If you lose 5 or 10% of your nation's output, that's serious!" And they said, "No, it's not 5 or 10%; it's 50%." The Tanzanians then took me aside and showed me some graphs. One of their power stations had lost 73% of its output! Another one, 46%. And they were averaging about 50% loss of the entire electricity output of the country, because it hadn't rained.

African dams are like saucers full of water; they tend to be pretty shallow, but with very large surface area, unlike Norwegian hydro with very steep-sided fjords. So where they've dammed the fjords, they've got a very deep head of water which is very constant, guaranteed by snow and ice run-off permanently from above, so there's no such thing as a Norwegian dam running half dry or three-quarters dry. But 50% loss of water in a South African or African dam is just common—in fact three-quarters is common. South Africa has just been going through such a drought; many of the dams are down by 75%. And when that happens, you've lost the pressure, the height of the water, to drive the turbines, and you've also lost the volume of water coming through.

So it suddenly struck me like a ton of bricks: "Golly, how can you have an African country dependent on rainfall to keep the lights on?" You just can't do that. And numbers of them said they had no coal, oil, or gas. They said, what's next?

The anti-nuclear lobby has been going on with their hand-waving and demonstrating, to get solar and wind, but many of them have been very senseless. Hey, wait a minute—you don't get solar at night. And so hopefully the wind blows. What happens when the wind doesn't blow? Now, you've got nothing. And the green just say, well, that's the way Mother Nature designed it: Live with it.

And so, many African countries have gotten wise about it, saying, wait a minute, we're about to get suckered here into this thing. And they've realized now that the only solution they've got is to go for PBMR-type nuclear. Because with nuclear, you can stockpile fuel very easily, for a very long period of time. It's very easy to keep a year or two, or three, or four of nuclear fuel supply in a couple of bunkers, because the volume is so small; whereas you could never keep two or three years' worth of coal in a pile around a power station. Here in South Africa, we try to keep a two-week emergency supply of coal at power stations, and even that is a mountain of coal "the size of an Egyptian pyramid." And they go through that very quickly.

The Package Deal

So a number of these African countries have realized that pebble-bed reactors are the answer, and they've been coming to us, asking if we can we supply pebble-bed reactors to them? And we've been saying, yes, we can do that because we've reactivated the pebble-bed program in South Africa now, over the past year. The program at the time we left off was very close to building the first reactor. We're now in the path back to building those reactors, such that we can export the pebble-bed reactors to other African countries.

But what we would like to do is—unlike many of the colonials in years gone by,— we're aware that if

SAYNPS/Mosala Super-Mogorosi

The first African Youth Nuclear Summit, in Nairobi, Kenya, March 27-30, 2017, was organized by the Kenyan Young Generation in Nuclear (KYGN) in collaboration with the African Young Generation in Nuclear (AYGN). The AYGN, founded earlier in 2017, with Gaopalelwe Santswere of NECSA (front row center, red tie) as its first president, has reached agreement with Russia's Rosatom to have its cooperation. Rosatom has an office in Johannesburg.

you sell somebody a nuclear reactor, you also need to sell them the fuel, and then you also need to be able to take the spent fuel away, so you don't give them the nuclear waste problem. You need to sell a package, like when you're buying a motor car, with—I don't know what you call it in the United States—the "freeway plan" that comes with it: You get your motor car plus the first five years of service and maintenance for free.

So the ideal would be to sell a nuclear reactor to another African country, plus the guaranteed fuel, plus the maintenance, plus guaranteed removal of the spent fuel afterwards, so they don't have to produce a national waste repository, and other things they would have to do before the International Atomic Energy Agency would sanction them getting the reactor in the first place. These are the advantages of going with a package deal, to say here's a solution, the reactor, plus the fuel, plus fuel removal, plus backup for things like emergencies.

It would mean that our nuclear regulator and their nuclear regulator would work hand-in-glove, because we've got a large, sophisticated nuclear regulator here, with about 150 staff, competent scientists, and also linkages into the defense forces—helicopters can be activated and troops, military and so on, if need be, if there's an emergency. Such regulators don't exist in other African countries; where they do have them, they've currently got a regulator with a staff of three or four people to sign off the legal forms for things like the delivery of nuclear materials to certain institutions. They haven't got plans for a nuclear accident at a nuclear power station, for example, which you do need to have in place.

We could collaborate, so in the event you find a problem developing, you'd call our regulator, and we would then activate the defense force exchanges which currently do exist with many of these countries, to send, say, military aircraft with helicopters, and drop Radiation Protection Officers down to examine what's going on. That way, you overcome a lot of the startup problem, if you supply the package deal.

I see Africa going nuclear. There's no option. And a few governments have already said so. The President of Uganda, Yoweri Museveni, has stated that he sees Uganda becoming a nuclear-powered country, and a few other presidents have said exactly the same thing, because they see the writing is on the wall. If they want to get a much larger electricity supply, one that is reliable, they can only look toward nuclear. Other sources are not going to give it to them.

Mind Games and Fake News

EIR: Coming back for a moment to South Africa: Does business in South Africa support nuclear power?

Kemm: A lot of companies do, but a lot of them have not done so, because of this confusion. Over the last two years, there have been stories in the newspapers saying "nuclear's on," and then "nuclear's off." Now nuclear has never been off; but the anti-nuclear lobby that runs to the newspapers said, "Nuclear's stopped." For example, about a year ago now, there was a court case that the greens brought against Eskom and the Department of Energy when we had indicated that we were moving towards the beginning of the procurement cycle of the next nuclear power reactors.

The greens went to court to object to the public par-

ticipation procedure, which to my mind had been done totally in accordance with the law; there was no fault there. The greens brought the court case and made a big fuss about some silly things. For example, there's also a procedure by which, if you're intending to spend a large amount of money, you notify the Treasury, so the Treasury knows the money will flow. It's not a request for money; it's just a notification that a sufficiently large amount of money will be moved, that this can have economic consequences for the country. It's called a section 34 determination. You apply for one, and the Treasury grants the section 34 by saying that we recognize that you're planning to do this. It's not a money issue.

The greens went to court and argued that the section 34 is a request to spend a lot of taxpayers' money, which it isn't. The greens fought it through the newspapers. The Department of Energy sadly didn't do its homework properly, and it sent its legal counsel to court to argue the legal points, instead of realizing they're also fighting a battle through the newspapers for the hearts and minds of the public. So, with this public circus going on, the judge ruled that everything had to be done properly and that the section 34 had to be reapplied for. That's in essence what happened. What the judge did was legally right, but he never, ever stopped the process.

But the greens then announced to the world that the nuclear program had been stopped by the judge, and many newspapers carried this erroneous story. That sowed confusion in the minds of foreigners. I had numbers of foreign countries calling me and saying, "Have you stopped the nuclear program?" and I was saying to them, "No, we haven't." We were quite happy to do exactly what the judge instructed. There was no discord between the nuclear people and what the judge said.

So that was done, but it was reported in the newspapers in such a way that numbers of businesses thought the nuclear program had been stopped. So numbers of businesses that were gearing up to be part of nuclear, then slowed down; then started again, then slowed again, and then accelerated and slowed down. Many of them said, "Forget it, we don't know whether we're coming or going." It's like training to get a gold medal at the Olympic Games, but you don't know the date of the Olympics, it would be very difficult to design a training program. For many of them, they were gearing up to start, but they didn't know what the start date was.

There have also been a number of other businesses that have seen money in solar and wind, because it's been billed as a very attractive economic proposition—which it is, when you're the foreign country supplying the solar and wind technology, and walking away with all the money—the Germans, for example.

So a few of our businesses were seduced into believing this was a real solution. But certainly, the senior businessmen are realists. They understand that if you don't get big, reliable baseload power projected well into the future, you're in trouble.

Coal Chemistry

EIR: What is the attitude of the coal-mining companies?

Kemm: We've had an interesting situation just in the past month, actually, when the coal miners suddenly swung around behind nuclear to quite a degree. The miners are interested in looking after mining jobs, and looking after the jobs of all those companies that are related to the mining industry—the people that supply all the technical equipment for mining. When the government signed the large solar and wind contract just a couple of weeks ago, the miners suddenly realized that if solar and wind are coming in, in a big way from a foreign country, that's going to reduce the dependence on coal, just as the "anti" lobby said, because the anti-nuclear lobby is also anti-coal; they're pro-wind and pro-solar, full stop.

Then the coal miners suddenly said, wait a minute, this is not a good idea. So they started to fight against the wind and solar. I had some meetings with them, and they started to realize just how bad the wind and solar is, because of their intermittent nature, and so on. We said, you're not going to run coal mines on electricity from wind and solar. If you want the coal mines to run, you need baseload electricity from coal and from nuclear. But also, what about direct heat? Others agree with me. It's well known, I believe, that South Africa was the world leader in producing petrol—gasoline—from coal. Currently about 40% of South Africa's gasoline is produced from coal; and that's the SASOL process—we're still one of the few in the world. I believe SASOL is looking into building a SASOL-process plant in the United States…

CC/Zaian

A portion of Theewaterskloof reservoir, the largest serving Cape Town, was at 11% of capacity at the time of this photo in March 2018, showing tree stumps and sand usually submerged.

EIR: In Louisiana.

Kemm: Yes. A better future would be to use pebble-bed nuclear reactors to crack the coal, because at the moment, in a place like Secunda—a major SASOL base 80 miles from Johannesburg—of all the coal that gets trucked in there, 60% of the coal is burned to generate the heat to produce gasoline from the other 40%; but SASOL also produces things like boot polish and lipstick, and there are other fractions, even aspirin. We're the only country in the world that makes aspirin out of coal.

Coal has got a lot of valuable molecules in it, so it's a bit of a pity just to burn it. It's much more sensible to take the coal apart, molecule by molecule, so to speak, and make these waxes, like boot polish and lipsticks and aspirin and petrol and diesel and aviation fuel—there's a whole range of fuels that comes out of the different fractions of the catalytic process in the cracking of coal. I see the possibility of nuclear power turning the coal into petrol: In other words, no reduction in coal mining, so the coal miners' jobs would carry on; we just wouldn't burn it any more, we would much more clinically turn it into the valuable molecules that could be used for the building blocks for other things.

Nuclear Power for Desalination

EIR: That brings us also to the subject of using nuclear power to desalinate water cheaply.

Kemm: Yes. That is a big factor. We had a scare lately, in the last couple of months, because there has been a particularly bad drought in the Western Cape area. It even got to the point where the City of Cape Town thought it might run out of water round about now. But it hasn't; a bit of rainfall has come down. And now they're going into [southern hemisphere] winter, and that's a winter rainfall area, so they're expecting more rain to arrive. But the dams are still desperately short at the moment; some of the dams have dried up entirely—you can walk across the bottom. So the water situation is serious.

South Africa has been aware of this for centuries: We've got dams here that are designed to last for five years, for example, without any rainfall. That's unknown in Europe; in the UK, if it doesn't rain for two weeks, you get a drought, or water shortage. Here, dams are designed to sit for three or four years without rainfall.

To overcome that limitation, you'd need a much more regular water supply. How would desalination work for inland areas? Already, oil coming to South Africa from the Middle East is shipped to Durban, where it is refined to produce petrol. And that petrol is currently pumped to Johannesburg, underground, for 600 km via pipeline. It's very interesting—they put petrol into the pipeline, then they put a spacer in, and then they put diesel in, put another spacer, and put in a different grade of petrol. So you can have three or four grades of petrol or diesel and so on, travelling through the pipe, at the same time, with spacers that move through the pipe.

And that's been done for many years now, pumping petrol 600 kilometers. If you can pump petrol 600 km inland, you can do it with water very easily. So there is no reason why one can't desalinate on the coast, not only to immediately supply the Cape, for example, but also to supply locations much farther inland.

Consider what this could mean for farming. South Africa had its record maize [corn] crop ever, last year. The rainfall in the inland areas came at just the right time. But maize farming is very much like playing roulette: If you get a good rainfall year, then you get a bumper crop and you export. If you get poorer rainfall, you get a bad crop, and the country has to import maize. The unknown in the equation is the rainfall. If we could produce a lot of water, pumping it in from the coast, for example, so that you could guarantee irrigation to the maize lands, you should be able to guarantee bumper food crops every year.

So the economic advantage of desalination is not just in direct human consumption, but for an entire list of other opportunities, such as agriculture and factories, and numbers of other things that are very water dependent, which then links to the rainfall, because the rainfall is not high here.

So there is a lot of potential for nuclear power and, in fact, the pebble-bed reactors are ideally suited for desalination, because they run at very high temperatures, up to 1,000° Celsius, whereas conventional power reactors run at 200-300° Celsius. If you're running up to near 1,000° Celsius, your ability to evaporate water is much greater, so you need this greater efficiency from a small, high-temperature reactor like that. You take seawater and turn it into steam very fast and then condense the steam back into drinkable water.

EIR: Right. Is it possible that the opposition to desalination could be partly motivated by an anti-nuclear fear that if people went for desalination, it would drag in nuclear?

Kemm: Yes, there is some of that, but I think the fear of *no water* is greater. Because what we've had in the Cape, the last couple of months now, it's calmed down a little bit, but not that much; the seriousness of the water supply problem is still present now. I was in Cape Town two weeks ago and stayed in two different five-star hotels. Both hotels had removed all the bath plugs. And they just had little notices stuck on the wall saying, "Sorry you can't bathe, we haven't enough water. You can use the shower, and please keep it short." But they were actively stopping people from running full baths. There are many jokes going round about what happens when you've got no water. It's become quite a cartoonist's dream.

But it's been quite a scare. So, I think if one points out to the people that nuclear power can guarantee your water supply,— In fact, the Koeberg plant, early on, long before anybody else, started to see the drought coming. So Koeberg went into an urgent program to build an in-house desalination plant to ensure that it could supply itself.

They were three-quarters of the way through building it, when the drought was becoming very visible to the public. And then news got out that Koeberg was building a desalination plant, and people were saying, "Thank heavens, they're going to be supplying us with water." And Koeberg said, "No, we just built it for ourselves. We're going to use it, we're not giving it to anybody. It was merely to ensure that we don't run out." But they had pointed out that it can be done. And for themselves they did it in about a year or so, from scratch to design, and now, they're completely independent of the municipal water supply.

Of course, that's not the water for cooling the reactors. It's the water for running the building, the toilets, the washing of hands in the workshops, the day-to-day water consumption; some of the machinery uses freshwater, as against seawater. But it's not the vast amounts of water that's sucked out of the ocean for the reactor cooling.

EIR: But the Cape water crisis may reappear next year, isn't that true?

Kemm: It's still on, now; it's still there. But, now, at least—yes, it's highly likely to appear next year, because they're going into the rainfall season, but if the rainfall season isn't very good, if it's just normal, then it will not replenish entirely from where they stand now, because there's such a bad situation now, that it would take a particularly generous rainfall over the winter to bring them back up. But I imagine they're going to go to next year's drought season already short. So it's highly likely to come back next year.

Fusion, the Moon and Mars

EIR: Do you have thoughts about a nuclear fusion program for South Africa?

Kemm: Yes. Nuclear fusion is a dream of the whole world, and certainly as nuclear scientists, we all dream about it. South Africa ran some nuclear fusion studies quite a few years ago, and built a tokamak called the

Kelvin Kemm

Pebble-bed fuel ball for PBMR 1. They bounce.

Tokaloshe at Pelindaba here. The tokamak is one of the devices that look suitable for achieving sustained nuclear fusion. The Tokaloshe was worked on for a number of years and was developing a lot of the basic physics. It was never anticipated that it would actually be a power-generating plant, or anything like that. Because nobody in the world has got nuclear fusion right, yet; they've got it self-sustaining for a few moments, but there's likely to be a breakthrough at some stage. That, of course, is the dream.

So certainly, we aren't designing a nuclear fusion power plant right now, because the whole world is still waiting for the breakthrough. But everybody's got it in mind as the ideal nuclear source of power in due course. I'm sure, sooner or later, some solutions for nuclear fusion will emerge. There are not many scientific problems that stay unresolved forever.

EIR: Exactly. This is not the outlook of the pessimists!

Kemm: I also see nuclear power being the power source for the Moon and Mars, by the way—pebble-bed reactors. Because the pebble-bed fuel is about the size of a baseball, each fuel ball, whereas the fuel for a Koeberg-size power reactor is nearly a 4-meter-long metal assembly, quite a delicate metal assembly. If it was on a crane and you dropped it a couple of meters, you would wreck it. Whereas those fuel balls, you can throw them against the wall and they bounce. They're quite robust.

Fuel balls can be carried in a shopping packet [bag], basically, and they can easily be transported to the Moon and Mars in quite small containers. It's very easy to move the fuel out there. And these days, with the size of the rockets and the construction of this latest rocket of Elon Musk, the Falcon Heavy, they can lift a bus—a bus in volume and in weight.

So if it can lift a bus up into space, you can build a nuclear reactor in a number of Lego-type pods, and send it up to the Moon and drop the pods down onto the Moon's surface, or Mars, and put them together. So it's quite easy to build a whole reactor—bearing in mind it's not radioactive—until you put the fuel in it. So you have people working in the reactor, on the reactor and around the reactor, while you build it, on Mars, say. And then, come the day when you want to fuel it, you just put those fuel balls in, which could have been carried by a number of trips by then, and you can build up quite a stockpile, carrying the balls in boxes or cylinders, or however you want to pack them—as if you were transporting bread rolls or something.

EIR: Dr. Kemm, do you have a concluding thought for our readers?

Kemm: South Africa is very experienced in nuclear science and technology. This year, by the way, is the 70th anniversary of NECSA; South Africa's nuclear authority is only two years younger than the Atomic Energy Commission (AEC) of the United States. The U.S. AEC was formed in 1946; ours was formed in 1948.

The greens here often say that we're out of our depth; Africans don't understand what's going on; that we're only in the kindergarten stage, so we shouldn't be playing with the big boys; that we should stay out of this big, complicated nuclear business. But South Africa is one of the oldest nuclear countries in the world. We predate France, Japan, Russia, Germany—all of those countries. We've been in nuclear longer than they have.