The result is a hermetically sealed, coated particle of a little less than 1 millimeter diameter, which is extremely hard and high-temperature resistant. This multiple coating constitutes a practically fail-safe barrier to the release of the radioactive fission products generated in the uranium kernel as a result of the nuclear reactions. Approximately 15,000 of these coated particles are then mixed with graphite powder and resin, and pressed into a sphere of about 6 centimeters diameter, covered with an additional layer of pure carbon (graphite) as a "buffer," and finally sintered, annealed, and machined to extreme hardness.

The core of the PBMR module—the pebble bed—consists of 450,000-500,000 of these tennis-ball-size fuel elements. In the course of operation, the pile of fuel elements is constantly renewed and recycled, as fuel balls are gradually introduced into the annular-shaped core from the top, and withdrawn from the bottom. Each fuel ball makes about six passes through the core, with the degree of "burn-up" measured in between.

Because this is a continuous fueling process, it is no longer necessary to shut down the reactor at frequent (18-20 month) intervals for refueling, as is necessary for conventional, nuclear power stations. A pilot fuel-element production plant is already in operation, and has produced a small lot of 81 fuel balls, which are now being tested in Russia under reactor conditions.

A full-scale fuel element plant is scheduled to be commissioned in 2008-2009. Meanwhile, the South Africans are using the pilot plant to train technical staff for the commercial plant. This, as Makubire emphasized, is part of a broader policy of PBMR and the South African government, to use the nuclear energy program as a driver for labor-force development, focussing on so-called "localization" of production, and drawing into the process young Africans, who are the key to the country's future.

Crucial Role of Government Institutions

The conference drew to a close with a presentation by Mukesh Bhavan, executivevice president of South Africa's state-owned, but self-financed Industrial Development Corporation (IDC), and by final remarks by PBMR CEO Jaco Kriek.

Bhavan noted that the IDC's present role in the financing of the PBMR project continues a very long tradition of support for government-identified strategic projects directed toward developing South Africa's industry. A key success story was the creation of SASOL, the chemical giant which leads the world in the production of gasoline and other hydrocarbon products based on coal. At present, SASOL's coal liquification plants produce about a third of South Africa's gasoline and diesel consumption. The technology developed in the context of SASOL has had "phenomenal spin-offs" for the country's industry and economy generally, Bhavan said, "and we have the same vision for the PBMR." The IDC is increasingly engaged, also, in financing industrial projects in other African countries.

As a National Strategic Project of the South African government, the PBMR seems indeed to be on the road to success—reminding us of the kinds of things the United States and some other countries used to do so well, before the insane, radical "free market" ideology took over. Time for rethinking?

Meanwhile, South Africa is on the countdown, with officially 2,096 days to go, for its first pebble-bed modular reactor to go online.

Interview: Alex Erwin

PBMR Is 'Perfect' for Africa's Development

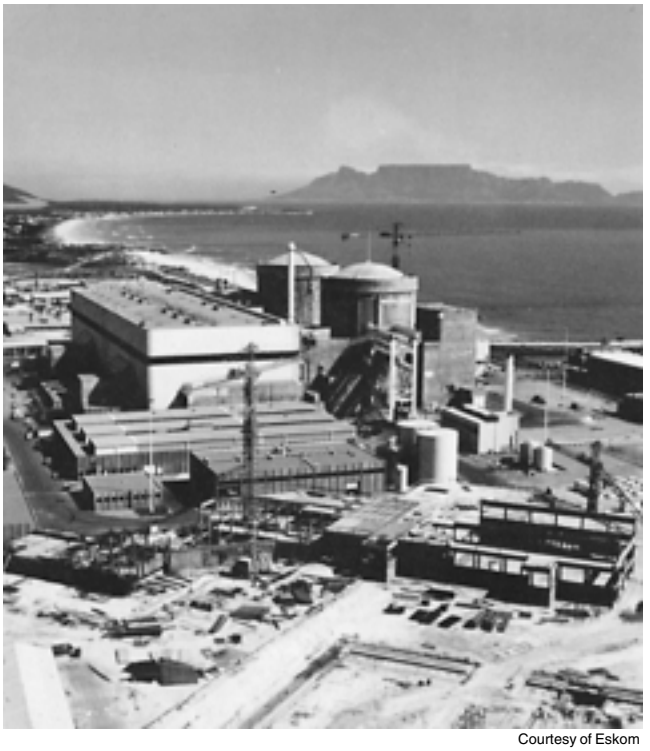
Mr. Erwin is Minister of Public Enterprises of the Republic of South Africa. He was interviewed by Jonathan Tennenbaum on Jan. 30 at the London conference on the PBMR.

EIR: Somebody might exclaim, "my goodness, Africa is starting at such a low level and now you are bringing in such an advanced technology like nuclear. Isn't this a complete mismatch?" What would you say to that?

Erwin: Well, I think that would be a naive view. If you look at the South African economy itself, it ranks as 25th largest in the world. It is an increasingly sophisticated manufacturing exporter. More than 60% of our exports are manufactured products. We are now a significant exporter of automotives and motor cars, and we make significant amount of avionic and aerospace equipment.

In South Africa you already have an industrial base that is strong, and if you look at Africa's needs, which are the exploitation of its mineral resources, increasing its agricultural potential, and so on, it needs energy to do that.

So, in fact, the contrary is true; this is the *perfect* technology for Africa—and not just for Africa, but for many developing countries. This is wonderful: You can take a plant, you can put it close to your energy needs, you can put it close to the surrounding town, and you don't have to put in gigantic grids, because the management of grids across an extensive



Courtesy of Eskom

South Africa's Koeberg Nuclear Power Plant has two conventional 922-MW reactors that have been in commercial operation since 1984 and 1985. Nuclear now supplies about 4.5 of South Africa's electricity.

terrain is a difficult process. In Africa only South Africa has that capacity. So I think this is actually one of the reasons we backed it so strongly: It *is* the most appropriate technology for the developing countries. It will allow Africa to exploit its massive potential.

EIR: Many think of nuclear as mainly a black box, only concerned with obtaining electricity as cheaply as possible, but what about the effect of having a nuclear energy program on the economy, on the labor force, and so on. How do you look at that?

Erwin: I am glad you raised that. There are three components which went into our strategic decision-making. Some relate to South Africa specifically; some are relevant for the rest of Africa.

First, we do have an industrial base. And this helps us to rebuild many of the heavier industrial componentry of our base, which were linked with the mining industry. Second, it allows us to enhance our scientific and technological capacity; it's a very useful component of that.

But third, the heat uses we can devise here are very very important. A very basic one for us is the prospect of desalination of water, which is very exciting for us. And we will be working with our own very big company, SASOL, which is a very advanced chemical company, pioneering gas-to-liquid technologies and coal-to-liquid technologies. We are going to do pilot plants with them.

So you have the spin-off effects from the point of view of your industrial base, your science and technology base, but also the heat-transfer uses that will have an important industrial effect on the economies.

EIR: In the United States, one of the big projects of Roosevelt was the rural electrification program, which had an enormous impact, especially in developing some of the poorest and most backward areas. What is the situation in your country, and how might the PBMR be brought into play beyond South Africa per se?

Erwin: South Africa is in a fortunate position. It has probably mounted one of the largest electrification programs in history. In the last ten years, we have connected 3.8 million households. Electricity connectivity now rises above 70% of the economy. We are now starting the second big round of doing that, reaching even farther into our rural areas. So it shows we can do it.

Now, we have the advantage of a big grid, that allows us to do that. What is wonderful about this PBMR technology, is that it would allow three things to happen for a developing country. You could start your mining activity, but now at the mine (with the PBMR as a heat and power source), you could put your processing activities directly at the mining point, so you get value addition. And you can at the same time supply surrounding electrification for agricultural activities and for residential and household uses. So I think the flexibility is tremendous.

We are now working on a massive project from the Inga hydroelectric project in the Congo, which will have very big transmission lines traversing southern Africa. Now to be able to complement that distribution network with the pebble-bed reactors along the way, would allow for a genuine electrification program for agricultural, industrial, mining, and residential use. So this is an exciting set of possibilities that will allow the African economies to develop.

African economies are short of energy. They are short of infrastructure. And both of these can, to an extent, be solved by the PBMR over time. So we are looking at the next ten years or more, but it is very exciting.

EIR: I and my colleagues were involved in 1978 in writing a book, *The Industrialization of Africa,* which among other things included a proposal for an African railroad grid. Africa still does not have a modern transport grid. More recently, we have emphasized the importance of "infrastructure development corridors," in which transport, energy, communications, and water systems are "bundled" together as the most efficient means to develop a large territory. Are you looking in that direction for Africa?

Erwin: Yes, it's very interesting. Through the new partnership for Africa's development, NEPAD (New Partnership

for Africa's Development), which is now an African Union project, there are a range of projects. We took up that idea of the corridors; in fact, we financed it. If you look at the Maputo development corridor, we did just that. We built a new highway, we are upgrading the rail line, we upgraded the telecommunications; and the Mozambican government is bringing in new operators for their port.

So you've got a whole logistical and telecommunications passage going down through to Moputo. Obviously it's easier there because you can use the strength of the South African economy. But you can do this in many African countries. So we are looking at that.

And another point I should make, of course, is that with telecommunications you also need energy. The telecommunications industry in Africa is growing very fast, led in the main by the big South African telecommunications companies, and this is mainly wireless and mobile telephone, but that needs energy to get coverage. So again, you see the complementarity between the energy and the other infrastructure.

And quite clearly also with the rail system. There are a number of projects put forward in NEPAD that we are looking at developing. I would say that the main obstacle we are having on those projects at the moment is raising finances. In South Africa we can use more sophisticated public-private partnerships; our big state companies, rail companies can enter the capital markets successfully. Elsewhere in Africa, we are probably still dependent on a higher element of grant assistance, and that is a restraining factor in Africa at the moment which we need to change.

EIR: Neo-liberal dogma says that governments should stay out of the economy. But in South Africa, the government plays a crucial role in infrastructure and economic development. How do you see this issue?

Erwin: Our view is that you must examine your economic position at any point in time. The state will always play a role, also in the United States. But what role it plays and how it does that successfully is always a question of the moment. There are no religious dogmas on these things either way.

We have a very specific set of roles that we see the state playing. For example, the state will retain ownership of the electricity company, Eskom, because that gives us a much clearer strategic shareholding. But we then designed the total electricity system in a way that brings in private capital, through independent power producers (IPPs) and other areas. So you get a genuine structural partnership between the private and the public sectors. And you can adjust the proportionality of that partnership as the economic circumstances change.

For us in South Africa now, we need a strong state involvement; but the instruments we use are not necessarily the old-style ones. Our state-owned enterprises, as we call them, Eskom, our transport companies, and so on, have to be capable of entering the capital market, raising private capital at rates that are equal to the sovereign rate. So that puts a lot of pressure on the management and the boards to manage their companies efficiently. But we do give them an economic mandate. They are not profit-maximizers. We say that you have to meet these targets with social delivery.

For South Africa, we have an exceptionally important program. Because of poverty, we have a situation where we provide a basic free allowance of water, sewage treatment, and electricity to the poorest of poor households. So you get the basic allowance which is free, in terms of electricity, that is enough to keep your lights and cooking going for the year, and it allows kids to study, with a reasonable standard of living. We can do that because we use the instruments not just to maximize profit, but to achieve certain economic objectives.

But the mix with the private sector is very strong. We work closely with the private sector; we bring them into the investment plan. So this should not be some matter of religion, it should be a matter of concrete economics.

Interview: Dieter Matzner

A Safe, Foolproof Nuclear Reactor

Dieter Matzner is General Manager of the Power Plant Division of PBMR. He was interviewed by Jonathan Tennenbaum on Jan. 30 at the London conference on the PBMR.

PBMR/G.Bennett

EIR: I think that building a fundamentally new type of reactor has not happened for 40 years.

Matzner: Yes, it's probably 40 years.

EIR: What do you think are the most interesting and challenging features that people should keep in mind about the PBMR?

Matzner: I think the most important feature by far is that the PBMR reactor design utilizes ceramic fuel, and the whole core design is made of ceramics—that is graphite materials which can withstand very high temperatures. The basic advantage of this is that the fuel is meltdown-proof. A core melt is made *impossible* essentially by the choice of materials, and therefore there is no need even for discussion about a