Status of the Pebble Bed Modular Reactor Project

Tom Ferreira, Communication Consultant, Pebble Bed Modular Reactor (Pty) Ltd
Who, where and what is PBMR?
Our vision

To become the preferred global supplier of standardised nuclear energy systems, fuel and life-cycle support
What is the PBMR?
Who are our investors?

- South African government
- Eskom
- Industrial Development Corporation
- Westinghouse
- Other potential shareholders
PBMR’s competitive advantages

- Inherent safe characteristics
- Small emergency planning zone
- High efficiency (> 41%)
- Load following
- On-load refuelling
- Low proliferation risk
- Relatively low water requirements
- Short construction times
- Smaller capital cost increments
- Can be placed at point of demand
- Flexibility (can be structured to grid size)
- Process heat applications
How does the PBMR work?
The Pebble

The safest nuclear fuel in the world

Cast  Aged  Dried  Calcined  Sintered
Why the pebble is such a gem

TRISO Coated Particle
0.92mm diameter

Uranium Dioxide Fuel Kernel – 0.5mm diam
encased in a barrier of ....
Porus Carbon Buffer
encased in a barrier of ....
Inner Pyrolytic Carbon Shell
encased in a barrier of ....
Silicone Carbide Coating
encased in a barrier of ....
Outer Pyrolytic Carbon Shell
Why the pebble is such a gem

15000 coated particles embedded in a Graphite Matrix …
… protected by a 5mm thick Graphite layer

TRISO Coated Particle
0.92mm diameter

The final “Pebble”
60mm in diameter
Nuclear background - the reactor

- Pressure vessel = 20m x 6m

• Neutrons per second per cm² = 450 000!
Fuel handling system

- PBMR spent fuel to be kept on site
- A 165 MWe module will generate 32 tons of spent fuel pebbles per year, about one ton of which is uranium
- Fuel spheres are “pre-packaged” for final disposal purposes
- SA nuclear waste management policy approved by Cabinet
Status of the PBMR project
High-level programme status

- Modification of design to also serve process heat market
- Four test facilities commissioned and 76 patents registered
- Fuel particles manufactured using enriched uranium
- MOU signed with Chinese pebble bed developers
- Preparing for next phase of US project
The 43 m high Helium Test Facility at Pelindaba will test the helium blower, valves, heaters, coolers, recuperator and other components at pressures up to 95 bar and 1200 degrees C.
Inside the helium test facility at Pelindaba
Helium test facility at Pelindaba
High pressure test unit
High temperature test facility
Fuel Fabrication at Pelindaba
Is there a market for the technology?

- Current world demand is 4,000GW (~100 x Eskom)

World average growth of 3% per annum since 1980 equates to 600 PBMRs per year

- MIT forecasts global demand to triple by 2050

- Current world spending is about $100bn per year on new power stations
Resurgence of Nuclear Energy

Thirty nuclear plants are being built today in 12 countries around the world, and over 100 planned
PBMR applications
Two broad applications for the PBMR

- Electricity generation where smaller incremental market conditions prevail, including limited financing, transmission or cooling water resources. Also well suited for desalination.

- Process heat applications, ranging from near-term process steam/co-generation to hydrogen production.
Here are the world’s second largest oil reserves
US Co-generation Market

- In 2005, the US energy usage in the combined heat and power market was 54% for electricity and 46% for heat.
- 59% of the capacity was large enough to be served by a 500 MWt PBMR.
- Natural gas and – to a more limited extent coal – are the current energy sources used in cogeneration projects.
- US cogeneration market is projected to be the equivalent of about 50 PBMRs in the 2020 to 2030 time period.
“The South African PBMR technology will become the world's first successful commercial Generation IV reactor. It offers an enormous potential to expand the use of nuclear energy both in the electrical generation sector and the process heat sector”.

Dr Regis Matzie, Senior Vice-President and Chief Technology Officer Westinghouse
Thank you