Value Created 1- Capabilities

Socio-Economic Impact

- GENERATED A POSITIVE SOCIO-ECONOMIC IMPACT
  - Employment of 920 people, thus retaining high tech skills in South Africa
  - Created SME's in nuclear & high tech industry including collaboration with other entities like Necsa
- GENERATED INTERNATIONAL POLITICAL CAPITAL FOR SA
  - International interest in Generation IV reactors
- CREATED IP FOR SA in NUCLEAR TECHNOLOGY
  - Nuclear Reactors System, structures & components
  - Fuel Plant systems, structures & component
  - Nuclear design tools

Program

1. **PBMR Technology aligned Bursary Scheme:**

   i. 29 Undergraduate bursars (28 Black and 1 White; 19 Male and 10 Female; studies in Mechanical; Chemical; Electrical; Metallurgical; Applied Math and Construction Management).

   ii. 26 students at various universities – 13 black and 13 white studying towards either Honours (1 student) Masters (19) and PHD degrees (6)

   iii. 7 Full-time employees studying towards PhD's local and international universities – 5 Black and 2 White. Those overseas are both black males.

   iv. Graduate-In-Training (GIT) Program - Once graduates complete their studies they join PBMR's 2 year internship program

   v. PBMR/ESKOM sponsored Carbon Technology Laboratories – PBMR has 2 PHD students with UPE

   vi. Masters Degree in Applied Radiation Science & Technology (MARST) – eight black students are sponsored by PBMR to complete their MARST program. PBMR also contributed to the completion of 3 laboratories at the university

Program

1. **Silver Parliament (SP) Program**
   i. The program is designed to transfer skills from the older PBMR generation that has reached retirement to the younger generations
   ii. PBMR has an estimated 34 retired employees contracted an annual basis. 24 of them are part of the SP program
   iii. The majority of these retirees are either Nuclear Scientists or Nuclear Engineers – nuclear knowledge and experience is scarce amongst the younger generation, and hence the re-contracting of these people to transfer the necessary skills
2. **PBMR School of Nuclear Technology (PSNT)**
   i. Launched in June 2009
   ii. 9 Silver Parliamentarians are lecturers
   iii. 9 modules in Nuclear Technology
   iv. 100 employees attended the school
   v. Efforts are being put in place to have the school accredited

Program

3. Accelerated Career Management Program (ACMP)

i. A 2-year program designed to fast-track the development and career path for black employees - launched in August 2009

ii. An external mentor was appointed for the participants

iii. 22 black employees (17 males and 5 females) in the program

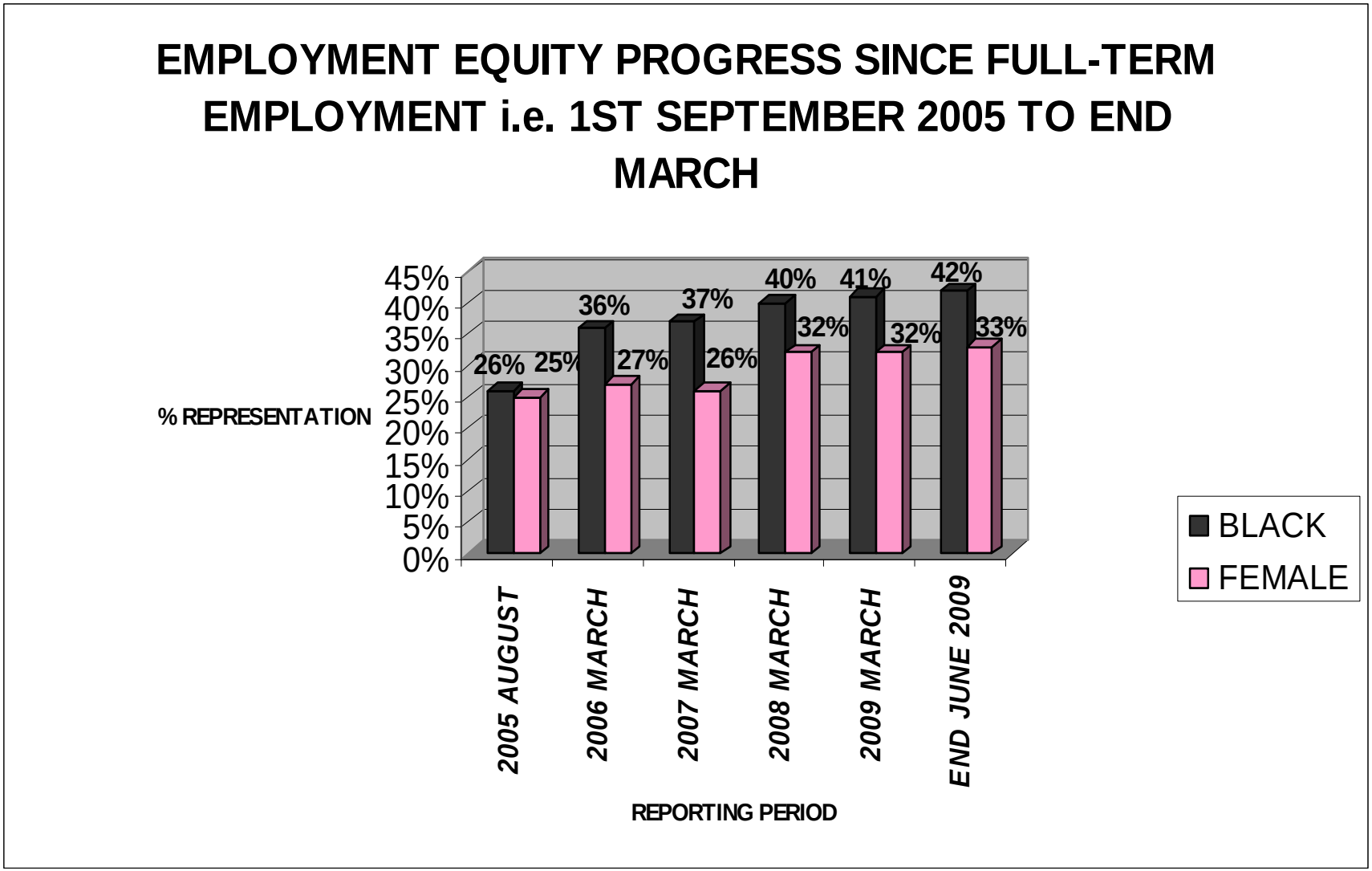
iv. All the employees are either engineers or scientists

v. Various development interventions have taken place

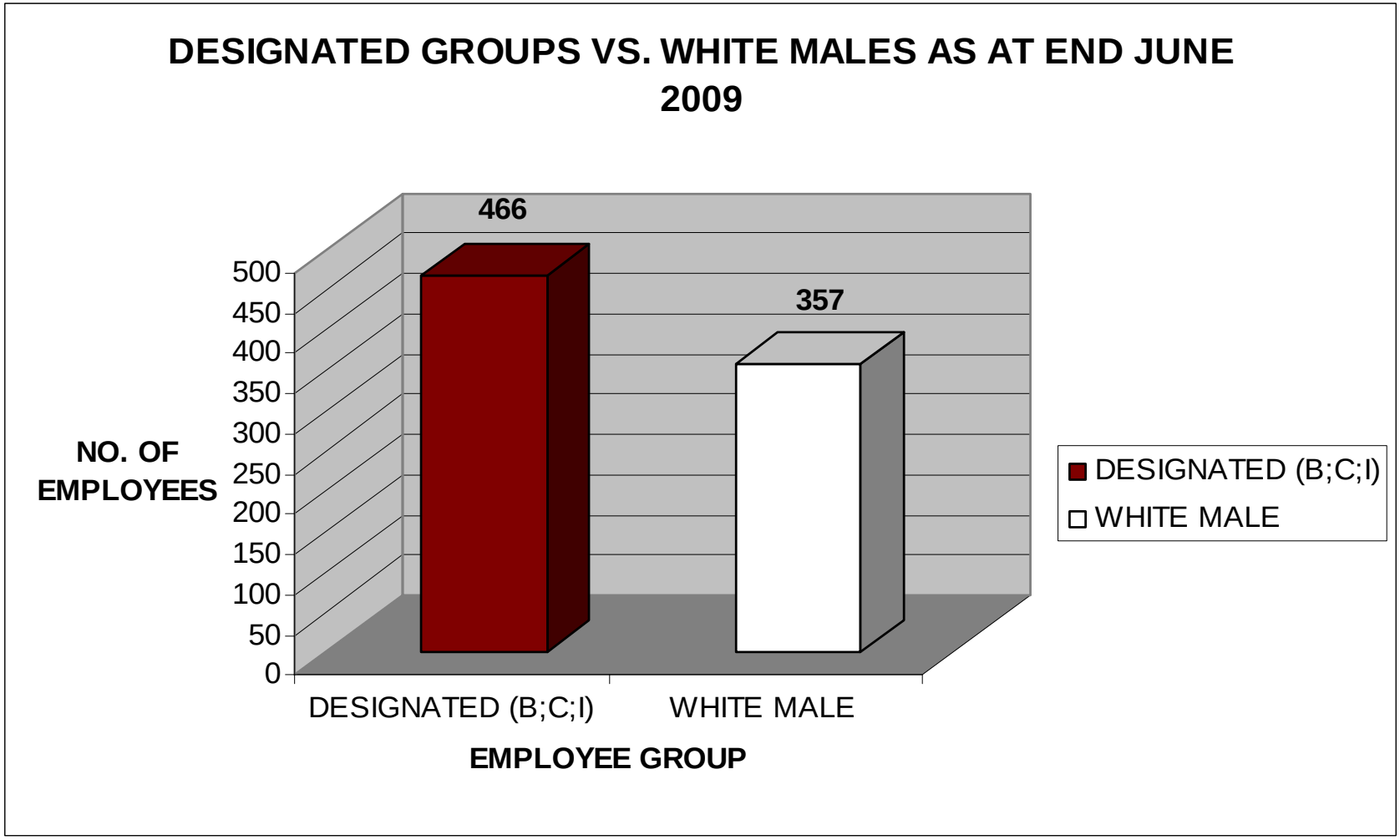
vi. Participants are assigned to executives as “shadows” for a month and are given assignments during this period

vii. 3x Deputy Executive positions have been established to be occupied by black employees. 1 position is already filled.

Employee Profile



Employee Profile



PBMR Financial Model

- De-risked
- Affordable
- Response to SA Nuclear Energy Policy
- Supports SA Nuclear Design Authority

Funding Principles

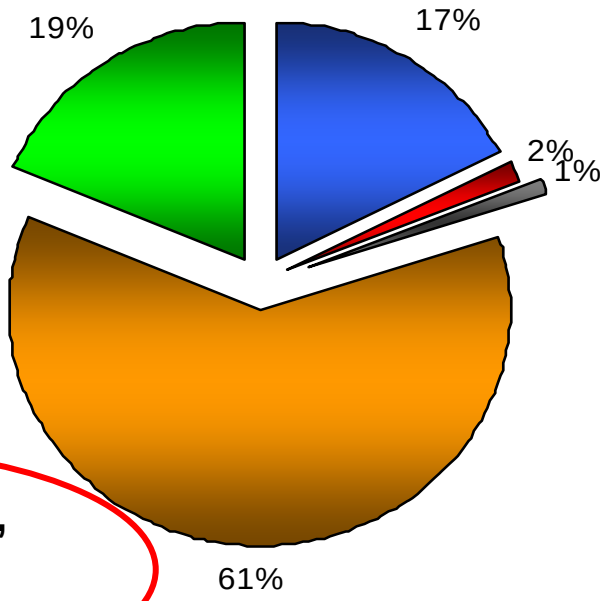
- Foreign Strategic Investment (China, US, Japan, Africa)
- Strategic Procurement – Fleet Strategy, OEM, localisation, job creation, poverty alleviation, BoP,
- Integration of PWR and PBMR programs – Design Authority, Technology Transfer
- Public Private Partnership in a transparent, predictable process (cost sharing, time lines, trust)
- Differentiated Long Term Funding Mechanism – Investor Funding, Tariffing, Debt Funding, FDI, Government Participation
- Wider active participation in SA -Long term

R8.1 billion – Value Created

Cost per Category R 8.1 billion
1999 to June 2009

75% invested over the past 3 years

Fuel & Fuel Plant Design, License & Labs



Reactor Design, Engineering, Licensing

Engineering, Licensing and Design Package – Funded against the proportional Class B investors 2009 to 2022

Description	***Amount (billion)***
Funding Requirement	16.6
Government's net funding through MTEF – 45%	7.2
Country Partner – 25%	4.0
Industry Partner – 20%	3.2
Industrial Development Corporation (IDC) - 10%	2.2

Dilute from 80% to 45%

Limited Government contribution to R 630 million per annum

Illustrative - Reactor Package – Structured against Government's Class A 2009 to 2022

Description	***Notes***	***Amount (R'billion)***
Total Nominal Value of the DPP200		27.4
Less: Revenue (Consortium of Customers)		12.0
Funding Requirement:		15.4
Premium to be paid by Country Partner (25% of R20 billion)	1	5.0
Premium to be paid by Industry Partner (20% of R20 billion)	2	4.0
Introduction of Debt Funding	3	6.4

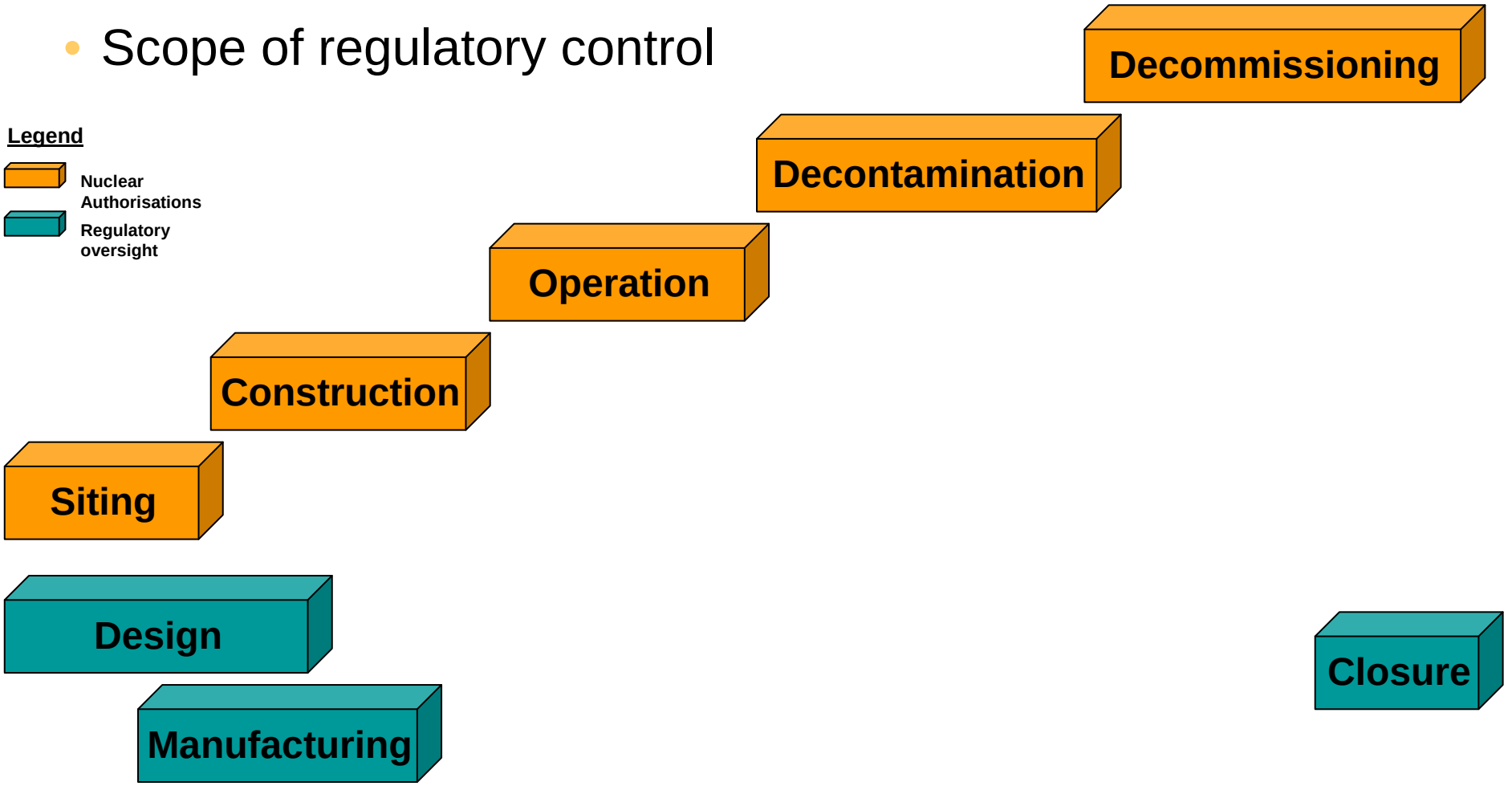
Debt introduced from 2016 based on Consortium off-take and explicit Gov. guarantee

Government leverage off value created by PBMR! Now worth more than R20 billion

Nuclear Authorisation Process

Context for New Licensing Strategy

- Scope of regulatory control



Licensing Environment

- **Regulatory Environment**
  - Licensing high temperature reactor within Light water reactor-centric regulatory framework and knowledge base
  - Roles & responsibilities for operator, owner, designer for first & fleet (e.g. currently operator/ Eskom engages regulator on design issues)
  - NNR Act being used first time for a new nuclear program

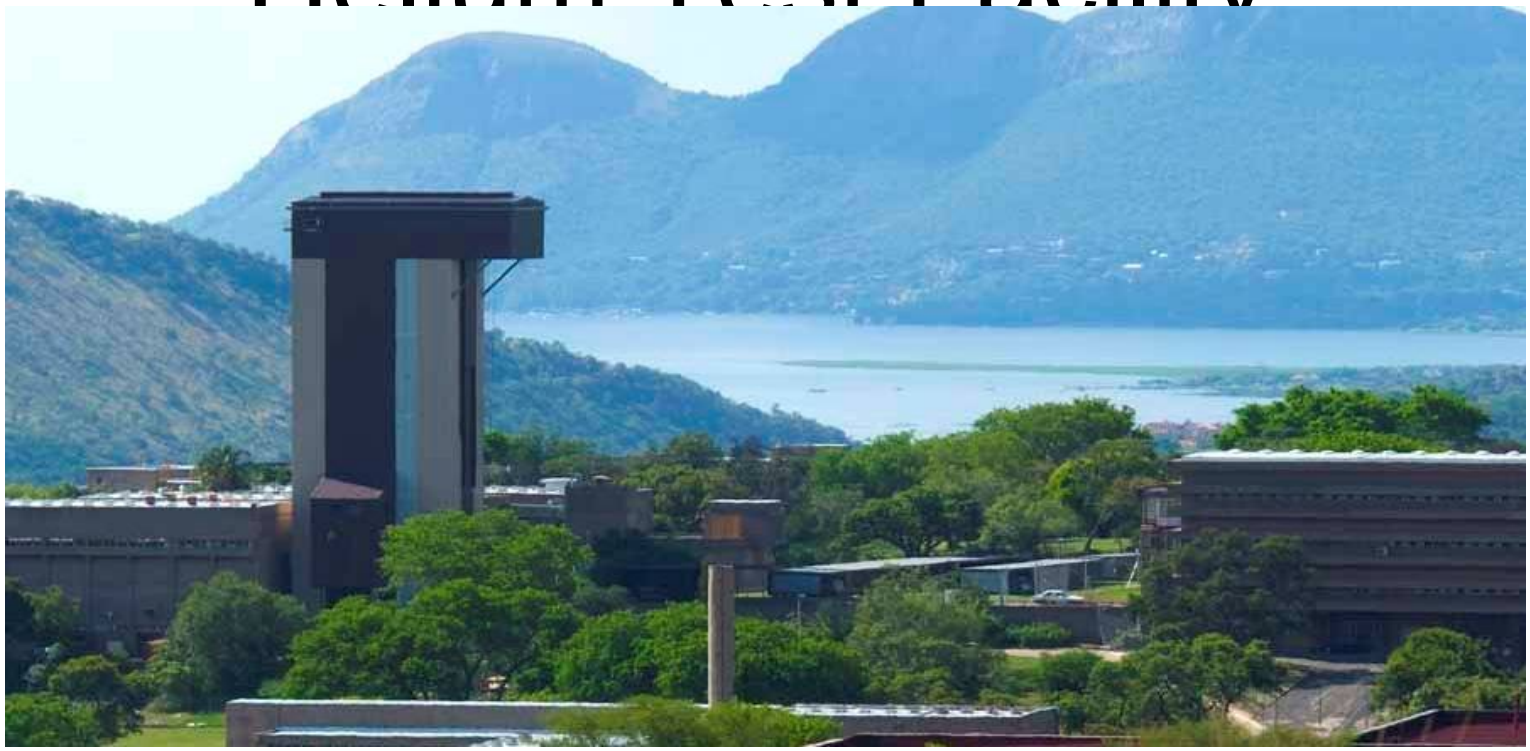
- **Key license strategy change**
  - De-couple licensing phases, hence roles and simultaneous processes
  - Maturing in PBMR the nuclear design authority capabilities (operating model, processes, people, tools/technology)

Impact on Roles and Responsibilities

- **Alignment of roles, responsibilities & expectations of stakeholders**

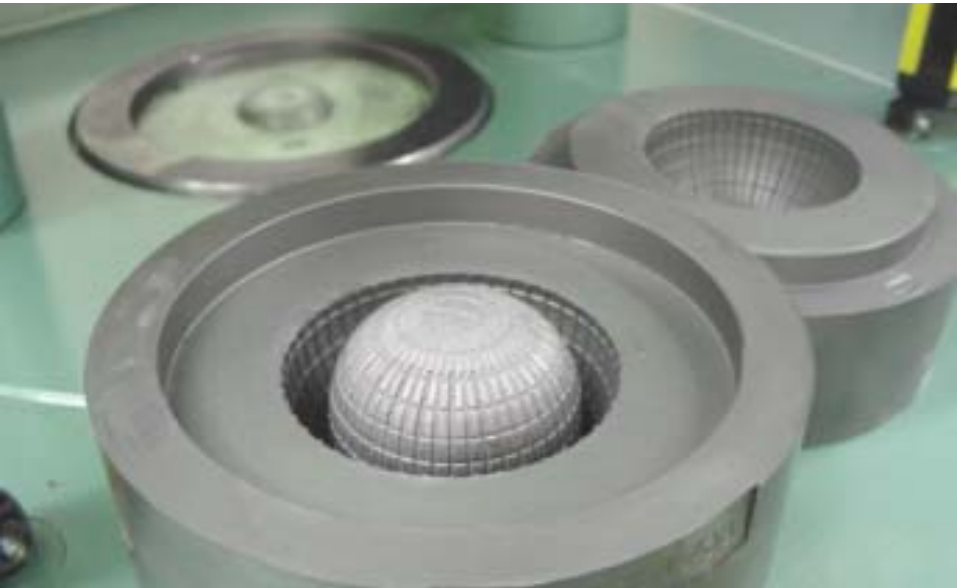
Authorisation Stage	Key Stakeholder	Output	Comment
Design Engagement Phase	Design Authority (PBMR)	Licensable Design	- DA direct interaction with NNR, Operator intelligent customer
Siting Authorisation	Site owner (Sasol/Eskom)	Siting license	Owner direct interaction with NNR, DA backup
Construction Licensing	Operator (Eskom)	Construction license	Eskom or a consortium. Operator direct to NNR, DA technical support

Helium Test Facility

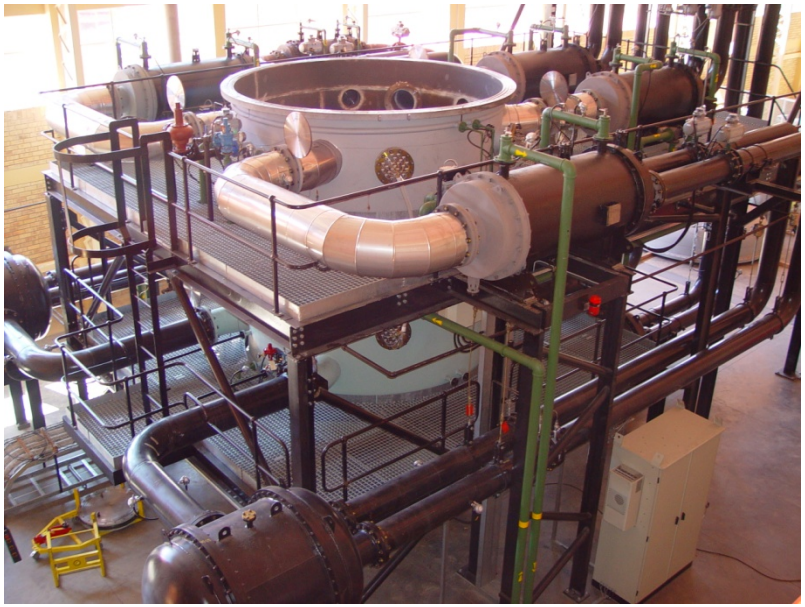


The HTF at Pelindaba tests the helium blower, valves, heaters, coolers, recuperator and other components at pressures up to 95 bar and 1200 degrees C.

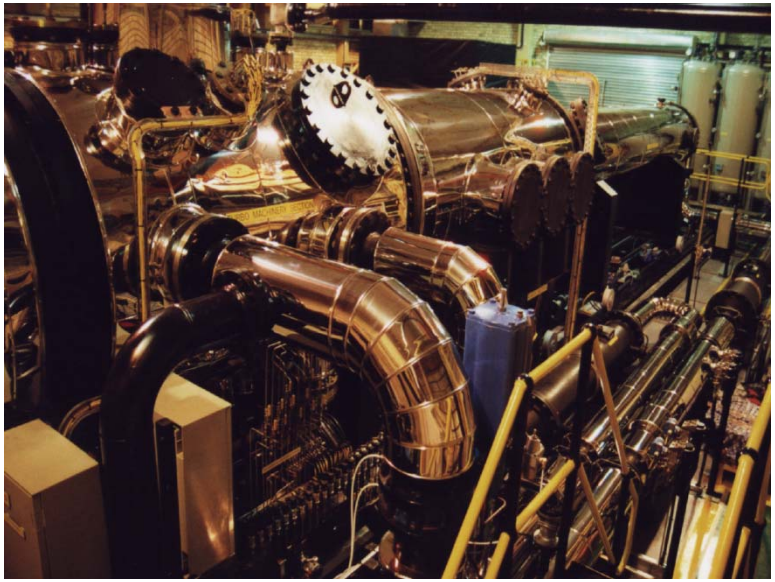
Fuel Fabrication at Pelindaba



Test facilities at the North-West University



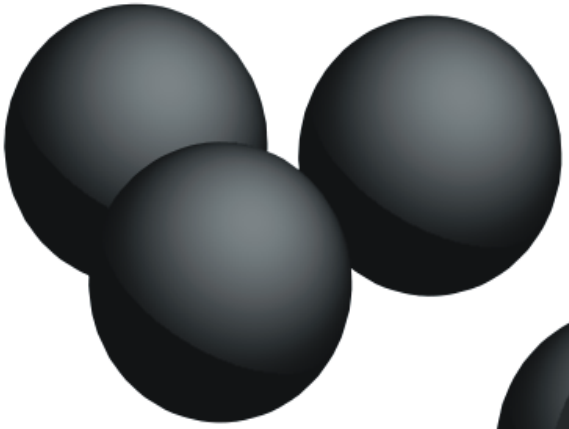
High Temperature Test Unit



Pebble Bed Micro Model

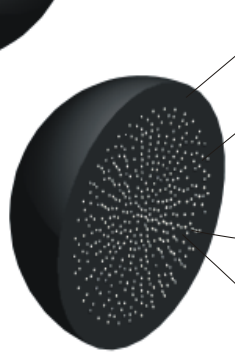
High Pressure Test Unit

PBMR Fuel

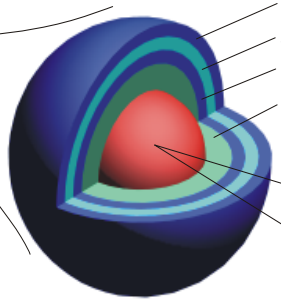


Dia. 60mm

Fuel Sphere



Half Section



Dia. 0,92mm

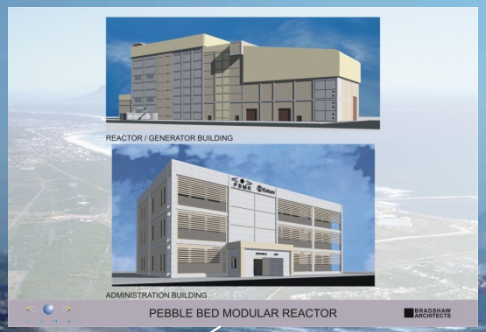
Coated Particle

Dia.0,5mm

Uranium Dioxide

Fuel

SGL Nuclear Machine Shop in Germany


REACTOR / GENERATOR BUILDING
ADMINISTRATION BUILDING
PEBBLE BED MODULAR REACTOR
BRADSHAW ARCHITECTS

Thank you