"Advanced Reactor Designs"

PBMR - Nuclear Power Beyond Electricity

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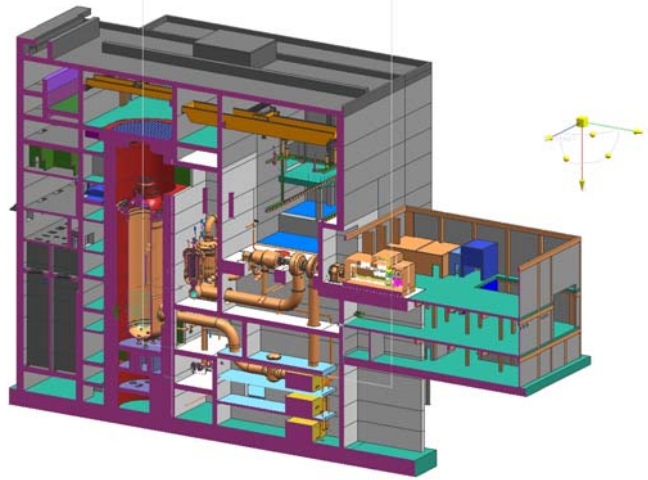
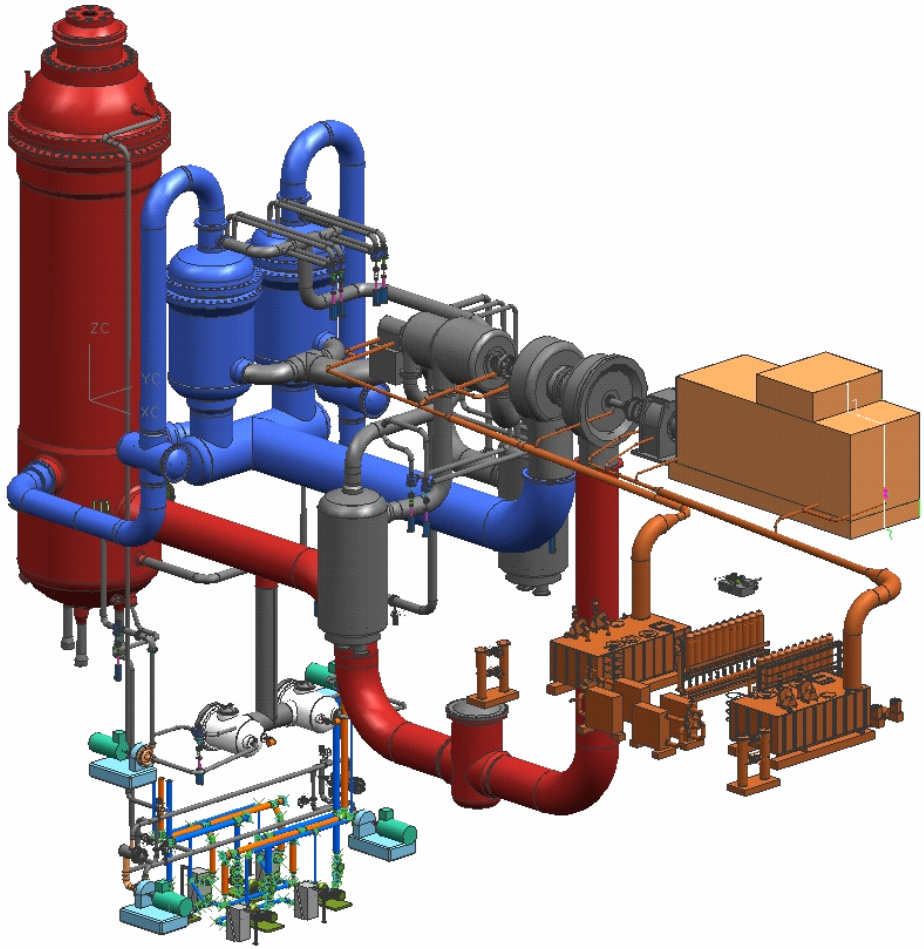
South African PBMR Demonstration

- Basic design completed and detailed design ongoing
- International supply team in place; long lead procurement started
- Extensive test programs underway
- Over 1200 full-time staff at PBMR and suppliers
- Construction scheduled 2008; criticality 2012
- Eskom issued LOI for follow-on plants to a total of 4,000 MWe
- Provides demonstration for expanded applications

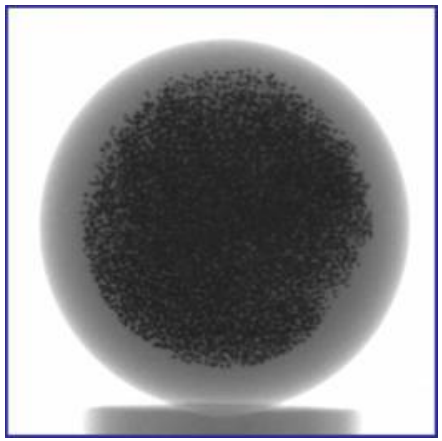


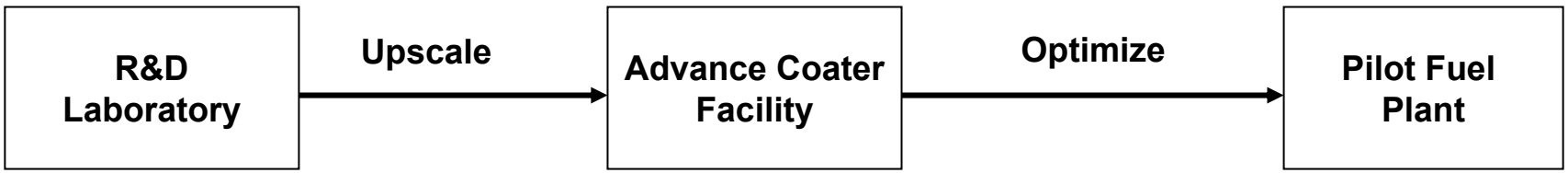
PBMR – Nuclear Gas Turbine

- 400 MWth/165 MWe
- Helium gas coolant
- Graphite moderated
- 900º C core outlet temp
- 9 MPa pressure
- Brayton power cycle
- On-line refueling
- Modular design and construction



Technology Development for PBMR Fuel Supply





- Technology Transfer
- Equivalence

Full Size 5 kg coater
Early fuel for testing

- Large scale batch process
- 270,000 fuel spheres/year

Test Facilities Supporting PBMR

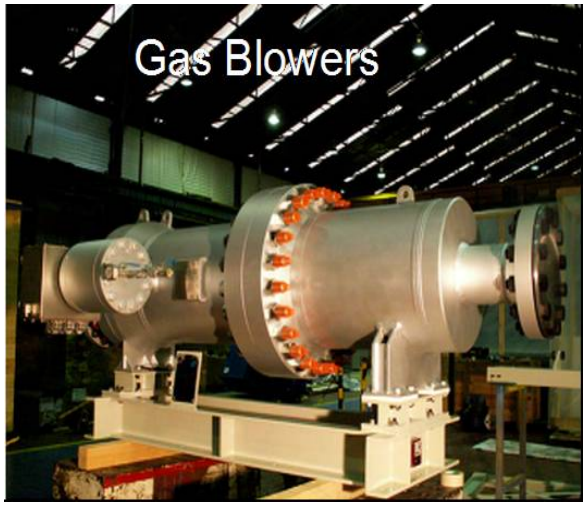
- Micro-Model
- Helium Test Facility
- Heat Transfer Test Facility
- Plate-out Test Facility
- Natural Convection with Corrosion (air ingress)
- Critical Facility

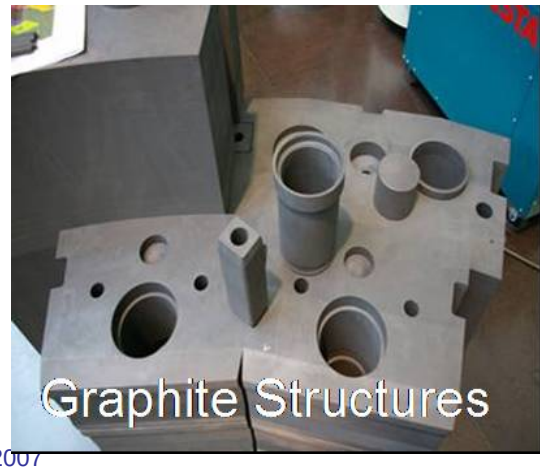
Helium Test Facility

Heat Transfer Test Facility

From Left to right: HPTU Main test vessel, Blower vessel, Water cooler

Manufacturing of Long Lead Components Already Started

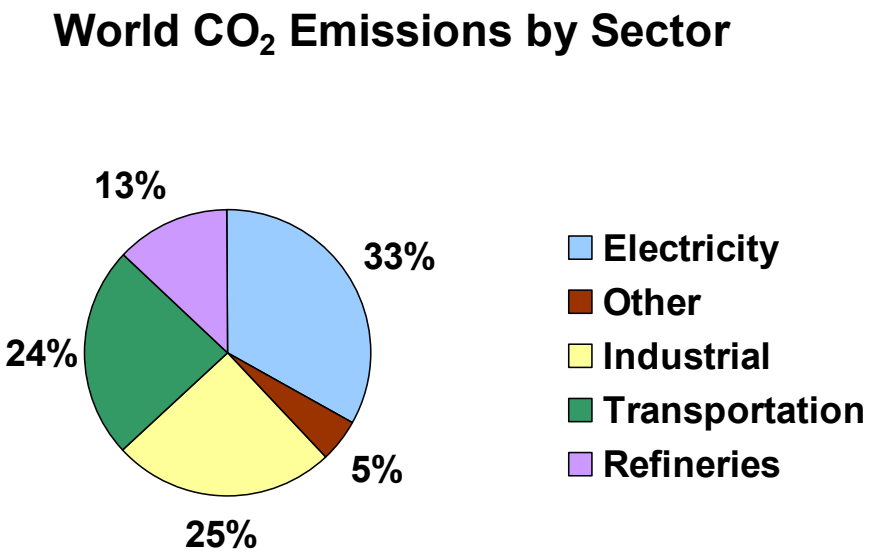




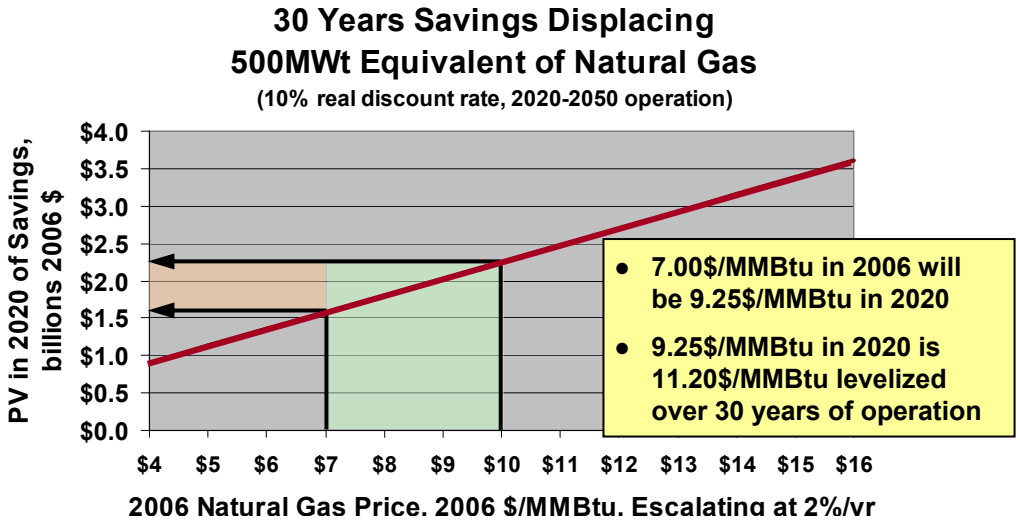
Process Heat Applications

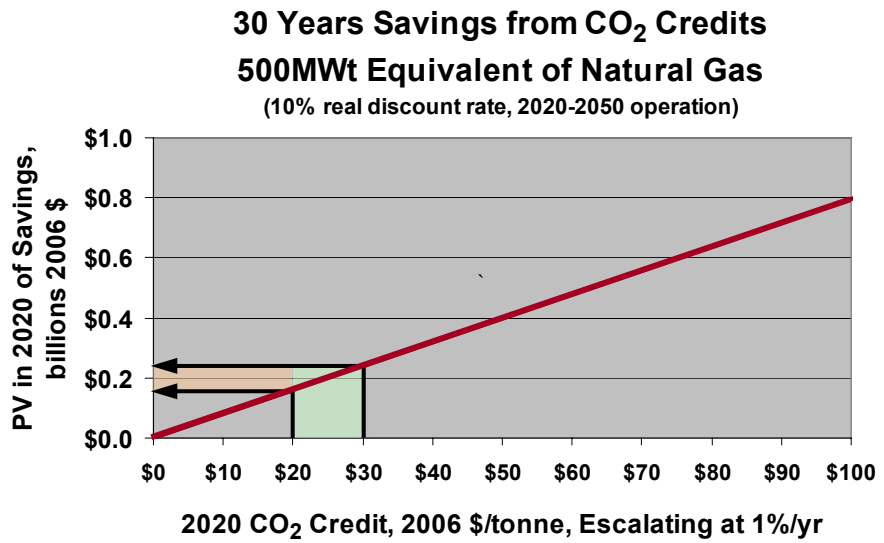
US Carbon Energy Use Perspective

- Fossil sources >90% of energy use
- Nuclear power supplies <20% of the electric sector and none of the remaining sectors
- Greater role by nuclear in electricity sector would have positive impact on CO_2 emissions
- Nuclear can further reduce CO_2 emissions in other energy sectors



Present Value of Replacing Natural Gas in Process Heat Plant

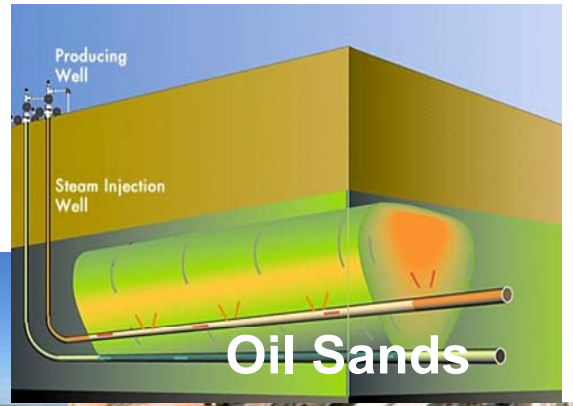


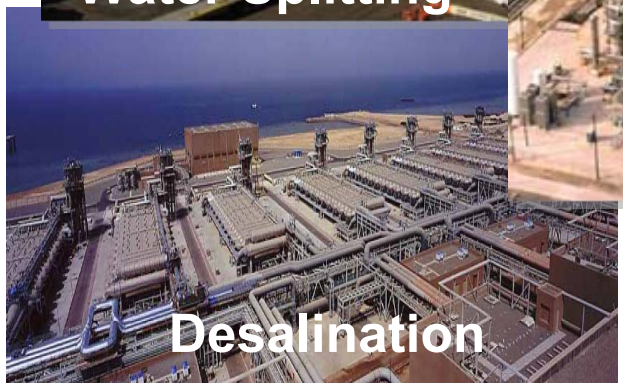


- **At $7.00/MBtu gas in 2006, the PV of the gas alone for process heat is $1.6B**
- **If gas as a heat source is displaced, the PV of the CO_2 credits @ $20/ton are worth another $150M**
- **This represents the minimum opportunity for nuclear plants** (excludes avoided capital costs of gas boilers, or sequestration equip.)

Process Heat Applications

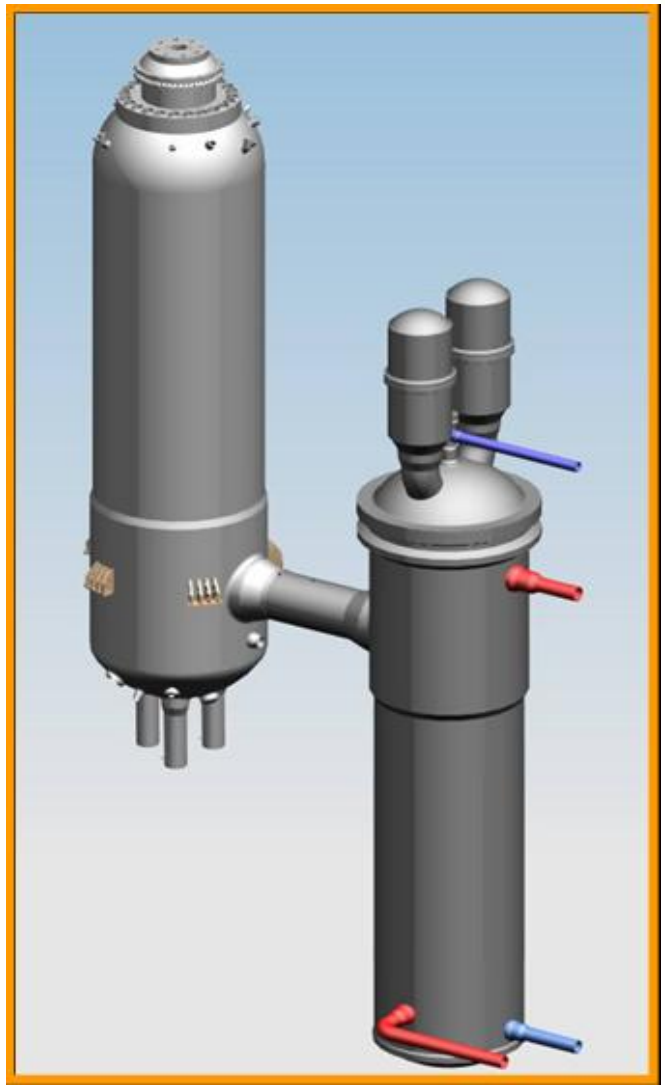
- Steam Generation
  - Oil Sands / Enhanced Oil Recovery / Shale Oil
  - Cogeneration
- Steam Methane Reforming
  - Hydrogen
  - Ammonia
  - Methanol
- Water-Splitting (H_2 & O_2)
  - Bulk Hydrogen
  - Coal-to-liquids
  - Coal-to-methane
- Desalination



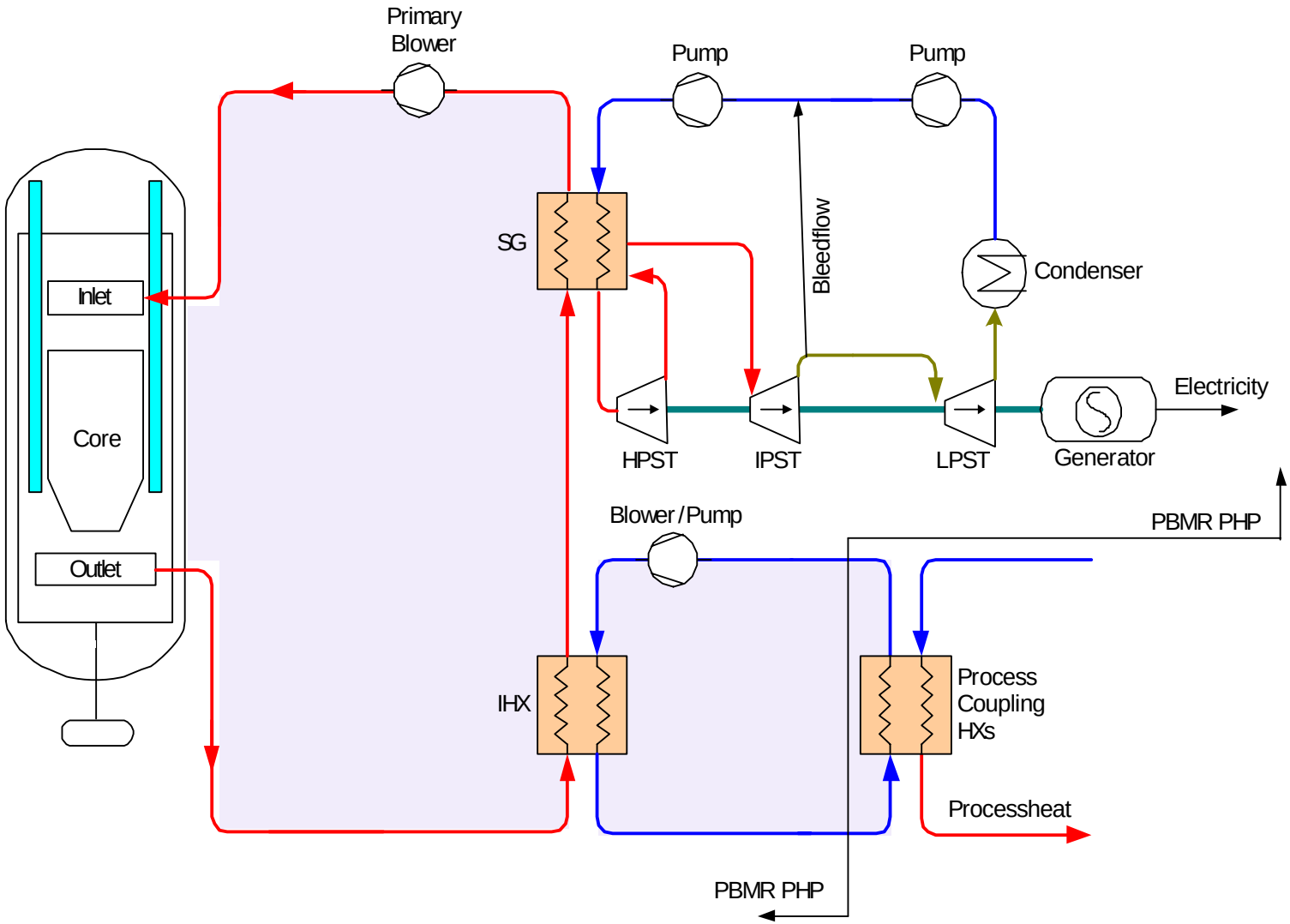


Process Heat Plant Builds on PBMR Basic Electric Plant

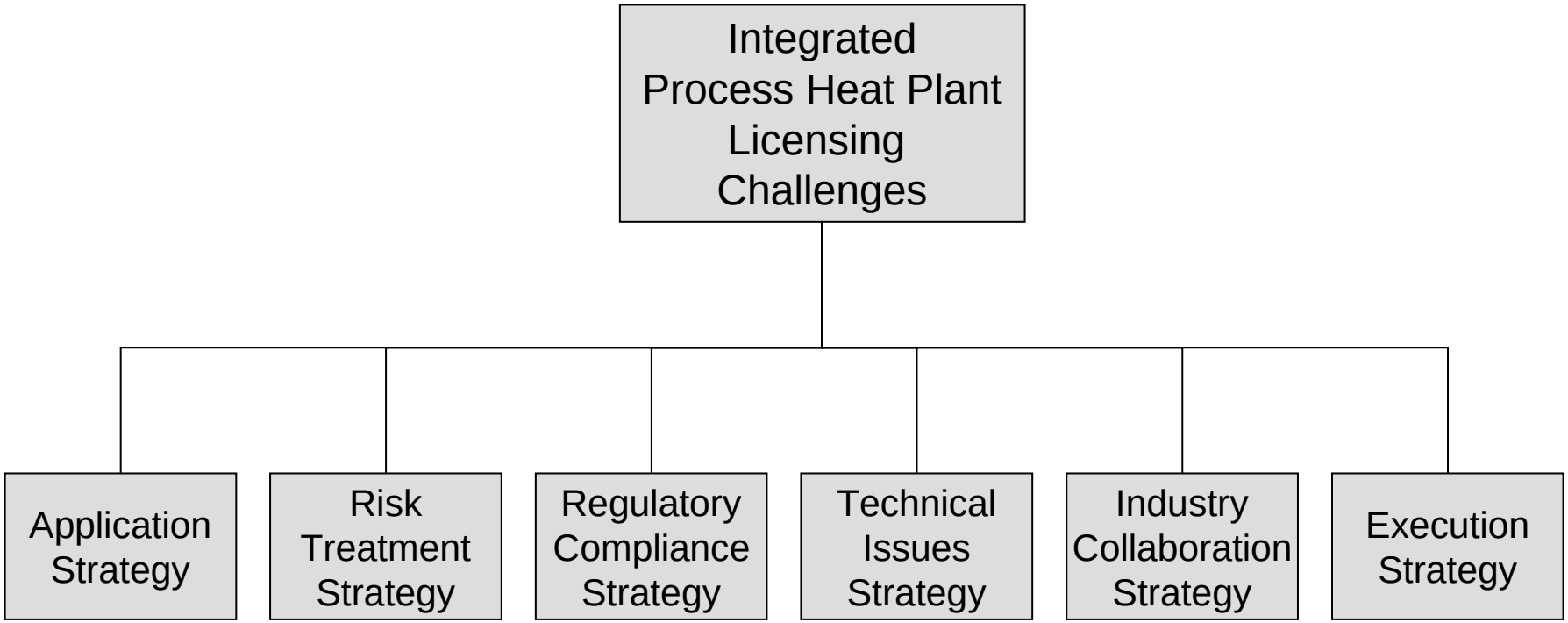
- Reactor and auxiliary systems identical
- Fuel identical
- Safety case has same bases plus interface issues
- Simplified primary circuit with intermediate heat exchanger replacing turbo-machinery
- Process plants use traditional equipment



PHP Configuration for Hybrid Sulfur



PHP Licensing Contain Unique Challenges



In Closing….

- The PBMR program is progressing rapidly towards construction of the first Generation IV reactor
- The key PBMR US licensing issues are important to generic NRC initiatives in regulatory reform and non-LWR licensing requirements including process heat applications
- Licensing challenges for process heat applications with a non-LWR add some new wrinkles that will benefit from early vendor, regulator, industry engagement
- PBMR design and licensing efforts lay the groundwork for the NGNP regulatory program required by the Energy Policy Act of 2005
- Cooperative research and development can broaden, leverage and accelerate the development of high temperature gas reactors as well as lead to more efficient and effective regulatory processes