SMRs
MSRs
&
SMMSRs
Small (25 MWe up) reactors for near-term deployment – development well advanced

<table>
<thead>
<tr>
<th>Name</th>
<th>Capacity</th>
<th>Type</th>
<th>Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBER-300</td>
<td>300 MWe</td>
<td>PWR</td>
<td>OKBM, Russia</td>
</tr>
<tr>
<td>NuScale</td>
<td>50 MWe</td>
<td>PWR</td>
<td>NuScale Power + Fluor, USA</td>
</tr>
<tr>
<td>Westinghouse SMR</td>
<td>225 MWe</td>
<td>PWR</td>
<td>Westinghouse, USA*</td>
</tr>
<tr>
<td>mPower</td>
<td>180 MWe</td>
<td>PWR</td>
<td>Babcock &amp; Wilcox + Bechtel, USA*</td>
</tr>
<tr>
<td>SMR-160</td>
<td>160 MWe</td>
<td>PWR</td>
<td>Holtec, USA</td>
</tr>
<tr>
<td>ACP100</td>
<td>100 MWe</td>
<td>PWR</td>
<td>CNNC &amp; Guodian, China</td>
</tr>
<tr>
<td>SMART</td>
<td>100 MWe</td>
<td>PWR</td>
<td>KAERI, South Korea</td>
</tr>
<tr>
<td>PBMR</td>
<td>165 MWe</td>
<td>HTR</td>
<td>PBMR, South Africa; NPMC, USA*</td>
</tr>
<tr>
<td>Prism</td>
<td>311 MWe</td>
<td>FNR</td>
<td>GE-Hitachi, USA</td>
</tr>
<tr>
<td>BREST</td>
<td>300 MWe</td>
<td>FNR</td>
<td>RDIP, Russia</td>
</tr>
<tr>
<td>SVBR-100</td>
<td>100 MWe</td>
<td>FNR</td>
<td>AKME-engineering, Russia</td>
</tr>
</tbody>
</table>
As it heats up, the water rises until it reaches the top of the riser. It is drawn downward by the pumps. NuScale
NuScale Plant Overview

- Each Module Installed in its own Isolated Bay
  - Natural Circulation (No Reactor Coolant Pumps)
  - 37 Standard 17x17 PWR Fuel (Half-Height) Fuel Assemblies
  - Standard Magnetic Jack Control Rod Drives
  - Internal Helical Coil Steam Generators and Pressurizer
  - 50 MWe Gross Power

- Control Room provides enhanced security and state-of-the-art controls

- Factory Manufacturing
  - NuScale Power Module includes Containment and Reactor Vessel
  - Shipped by Truck, Rail, or Barge
  - Skid-Mounted Steam Turbine/Generator

- Each Module is refueled underwater while the remainder of the plant produces power
  - Refueled once every 24 months
  - Capable of 48-month fuel cycle
  - 10 day refueling target
Current Construction vs. Factory Built and delivered by truck.
A Nuclear Battery

- 2-3 MW output
- Completely passive
- No moving parts in reactor
- Sub-atmospheric pressure
- 12 year fuel lifetime
- Behaves like a thermal battery
- 840 MWth & 311 MWe
- Na cooled fast reactor
- Passive safety
- Modular/scalable
- Factory built
- Flexible fuel cycle (broad input composition)
- Metal or oxide fuel (metal pref.)
- Extensive component testing
Three Power Block Plant
2,280 MWe (net)

1. Reactor Building (2 NSSS/block)
2. Reactor Maintenance Facility
3. Control Facility
4. New and Spent Fuel Handling Facility
5. Assembly Facility
6. Cask Storage Facility
7. Turbine-Generator Facility
8. Maintenance Facility
9. Circulating Water Inlet Pump Station
10. Circulating Water Discharge
11. Waste Treatment
12. Parking Lot
13. Switch Yard
14. Optional Spent Fuel Facility
Plant Construction and Deployment

Moved to transport ship (dry tow, 10-12 knots) or launched to sea (wet tow, 6 knots)
Designed for Superior Safety

<table>
<thead>
<tr>
<th>Plant</th>
<th>Population within 10-mi radius</th>
<th>Evacuation plan</th>
<th>Distance from major load center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Point</td>
<td>~270,000</td>
<td>Yes</td>
<td>25 mi from NYC</td>
</tr>
<tr>
<td>OFNP NYC</td>
<td>0</td>
<td>No</td>
<td>&lt;15 mi from NYC</td>
</tr>
<tr>
<td>Turkey Point</td>
<td>~160,000</td>
<td>Yes</td>
<td>21 mi from Miami</td>
</tr>
<tr>
<td>OFNP Miami</td>
<td>0</td>
<td>No</td>
<td>&lt;15 mi from Miami</td>
</tr>
</tbody>
</table>
Build Nuclear Power Plants Like ULCC’s

Ultra large crude carrier cost $89M in 2001
Largest operating oil tankers in the world.
Hellespont Alhambra, Tara, Fairfax, Metropolis
Architected and managed by Jack Devanney

ThorConIsle
Each barge is 500 MWe
60% the size of ULCCs
Graphic shows two 500 MWe barges
plus a jetty surrounding them
Two ThorCon Islands being serviced by
Reactor yard produces 150--500 ton blocks. About 120 blocks per 1GWe plant. Blocks are pre-coated, pre-piped, pre-wired, pre-tested. Focus quality control at the block and sub-block level. Blocks dropped into place, and welded together at the shipyard berth. 100% labor at factory. Hyundai shipyard in Ulsan, South Korea pictured below is sufficient to manufacture 30 GWe Power Ships (or 100GWe land based ThorCon) per year.
ORNL director Alvin Weinberg's interest in molten salt reactors led to a 1959 lab proposal for funding from the US Atomic Energy Commission to develop the MSRE. Construction began in 1962. The MSRE reactor core, shown during assembly, contained 80 cubic feet of graphite formed into 513 graphite core blocks. Passages between the blocks, called fuel channels, held molten salt fuel when the reactor was in operation.
Safety status: walk-away safe

- Safety is intrinsic from physics, not add-on safety systems; overheating stops chain reaction.

- Any break will drain reactor fuel to cold shutdown fuel salt drain tank.

- Decay heat is removed by silo cooling wall continuous passive water circulation, even in power blackout.

- Radioactive fuel salt at low, garden-hose pressure can’t disperse in catastrophe.

- Fluoride salt chemically locks up hazardous fission products iodine-131, cesium-137, strontium-90.
PRISM + Thorcon + Recycling

A Perfect Synergy

Operate at atmospheric pressure
Designed for mass production
Reliable baseload power 24/7
Zero emissions
Proliferation resistant
Speedy & massive deployment