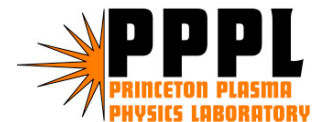


The Fastest Path to Commercial Fusion Power

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FNSF+ Could be the Pilot Plant for Commercial Fusion

Pilot Plant



Shippingport, 60 MWe, 1957



Oyster Creek, 620 MWe, 1969

Commercial Plant

- The smallest facility to *pilot* the route to commercial fusion – by doing fusion nuclear science, demonstrating practical operation, and making net electricity, based on
 - ITER + magnetic fusion R&D,
 - or NIF + inertial fusion R&D.
- Results from NIF + ITER *well underway* could trigger a common preparatory R&D program – if (and only if) we have a compelling roadmap to commercial fusion power.

A FNSF / Pilot Plant with $P_{\text{fus}} = 30\%$ of a Power Plant would Make Net Electricity

- Reduce linear dimensions to 2/3 power plant
- For fixed β , B, and T, P_{fus} down by $(2/3)^3 = 30\%$
- *Assume same absolute recirculating power. (!)*
- For $P_{\text{fus}} = 30\%$, $Q_{\text{eng}} \equiv P_{\text{gross}}/P_{\text{recirc}} > 1 \Leftrightarrow Q_{\text{eng}}$ of power plant > 3.33
- Pilot plant can do FNSF mission: Neutron flux $\sim 2/3$ power plant, surface area = 4/9, can adjust ${}^6\text{Li}$ enrichment.

Obviously there are other factors (e.g., neutron m.f.p.).

On the other hand $P_{\text{recirc}} = \text{constant}$ is conservative.

Initial looks at Tokamak, Stellarator, ST support 2/3 reduction

Much More Analysis is Required

- **What would such an FNSF / Pilot Plant look like?**
 - Advanced Tokamak (S/C for $Q_{\text{eng}} > 1$ & realistic maintenance)
 - Stellarator (Lowest recirculating power, no disruptions)
 - Spherical Torus (Cheapest, most readily maintained configuration)
 - Are there ICC game changers?

Any design must “pilot” the power plant maintenance approach.
- **What near-term program of modeling, test stands, toroidal facilities is necessary to support such an FNSF / Pilot Plant?**
 - Plasma performance
 - Integrated plasma material interface
 - Neutron interactive materials
- **There is much synergy between needed MFE & IFE R&D**
 - An IFE pilot plant should be studied as well