

Target Performance of First Generation Fusion Power Plants

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Since any power plant should be economically competitive to the other power sources, the plant economics is an important issue, but is just one of the requirements. There are various requirements for future energy sources and it seems difficult to expect a favorable treatment to fusion plant by the electric power industry in their commercial use of the fusion energy. Therefore their basic requirements for the fusion power plants will be almost the same to other existent power plants. In the subcommittee of the fusion Council for Fusion Development Strategy [1], we proposed the consideration on the requirements for fusion power plants. Base data for the consideration and the possible targets of 1st generation of commercial plants which we proposed, are summarized in a table below.

A lower cost is no doubt more desirable, but it seems difficult to expect that a COE (cost of electricity) of 1st generation fusion plants is much lower than that of the existent plants which are well established technologically. From this view point, the maximum COE target is assumed at a slightly higher point where the fusion will be still competitive with future energy systems like a CO₂ controlled coal plant. On the other hand, the targets for Operation features, Output range, Availability and Possible introduction pace are severely defined in Table.

Note that these targets will be for the 1st commercial plants rather than the demo plant. But they should be achieved at the final stage in the operation plan of the demo plant.

	Request desirable for commercial use	Reference data	Possible Target of 1st generation of commercial plants
Economics	less than the present COE by 30% or more	COE of early LWR plants 11-12 yen/kWh CO ₂ cont. coal: less than 15 yen/kWh	Design value less than 10 yen/kWh is desirable. If impossible, 15 yen/kWh is upper limit.
Operation features output stability unscheduled interruption Load following capacity	+/-0% ~0% ~17%/h, 100%-50% range	perturbation in daily load curve: ~1% LWR:1.5%, 0.2 event/y 0.5 event/y (1985-90) LWR:baseload only in JP.	< 1% 0.5 event/year (incl. disruption) Partial load in emergency
Output range	design from 1GWe max 1.5-2.0GWe (but its demand will be limited)	ABWR: 1.35GWe 1.7GWe in French LWR FBR target 1-1.5GWe	Less than 2 GWe, as small as possible
Availability	higher than 80%	history of LWR : 1975:40 %, 1985:75%, 1995:80%	85% or higher in design value (w/o trouble repair) initial availability >70%
Possible introduction pace	similar to LWR	15GWe/y in average throughout the history	TBR~1.1 is desirable for 1st generation.

[1] "Reports on Technical Feasibility of Fusion Energy and Extension of the Fusion Program and Basic Supporting Researches", by The Subcommittee of the Fusion Council for Fusion development Strategy, May 17, 2000, In Japanese (English translation is available from JAERI).

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