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Funding US nuclear power plants FREE

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Funding US Nuclear Power Plants

The US has substantial precedence and rationale for governmental support of the next generation of nuclear power plants (see "Nuclear Power Needs Government Incentives, Says Task Force," PHYSICS TODAY, May 2005, page 28). The early commercial nuclear plants were built with direct federal subsidies and loan guarantees; an example is the Yankee Rowe nuclear power plant built in 1960 under the Atomic Energy Commission's power-demonstration reactor program. The aim of those early demonstration plants was to prove to a fledgling industry that such facilities could be built and operated economically.

A significant era for US nuclear funding was the 1970s and 1980s, when nuclear units came in at costs often many times the original estimates. Some plants with billions of dollars invested were never completed. The overspending and stalled projects stemmed from government actions often in response to activists or legal maneuvering. Organizations and individuals with specific agendas took advantage of the Three Mile Island accident to exploit unrelated issues.[1] Plants already under construction were stymied by new requirements that caused tremendous uncertainty both in building and in the actual start-up of power production. The Long Island Lighting Co's Shoreham nuclear plant, for example, was completed at a cost of $5.6 billion, brought briefly to criticality, and then decommissioned, all because of activism and political demagoguery.[2]

Today, the reasons for government loan guarantees and other support programs are somewhat different. Vendors having gained experience with overseas projects know how to build advanced nuclear plants, although some of their advanced designs have yet to be implemented. Not surprisingly, any vendor or electric utility, before investing huge amounts, would want some assurance that it would be allowed to complete the plant at a reasonable cost and then operate it. Particularly important is that safety rules and systems requirements not change drastically during construction without very compelling reasons. Given the way governmental entities contributed to the problems of past nuclear power plant construction, it is only fitting that the federal government share substantially in the investment risk. Building nuclear plants is in the nation's interest.

References

1. See, for example, R. Duffy, *Nuclear Politics in America*, U. Press of Kansas, Lawrence (1997).
2. For a discussion of the Shoreham plant's difficulties, see S. McCracken, http://www.fortfreedom.org/p15.htm.

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Large Magnetic Fields in Small Spaces

The Search and Discovery story about hypermagnetized neutron stars (PHYSICS TODAY, May 2005, page 19) says that 10^{16} G is the strongest magnetic field found anywhere in nature or in the laboratory. The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory now produces magnetic fields of 8×10^{18} G. RHIC creates collisions between two 100-GeV beams of gold ions. The magnetic field midway between two gold nuclei that are passing at a distance of 20 fm so that there are no nuclear interactions is 8×10^{18} G. Within two years the Large Hadron Collider at CERN will smash lead ions together with a total energy of 1000 TeV. The magnetic field there will be 2×10^{20} G. The volume of these magnetic fields is small compared to that in a star, but it is still large enough for elementary-particle studies. As pointed out in the story, the large fields are interesting because they are greater than 4×10^{13} G, the critical quantum-electrodynamic field strength at which the vacuum becomes strongly birefringent and displays a number of interesting effects involving photons and electrons.

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Einstein, Masers, and Lasers: Asking New Questions

The link between Albert Einstein's 1916 proposal of downward stimulated atomic transitions and the development in the 1950s and 1960s of masers and lasers using stimulated emission is often noted and the question sometimes asked: Why did it take so long? The more interesting question might be, Did Einstein think that his proposed transitions represented a linear amplification process for the stimulating light? At that time, would he have encountered an amplifier of any kind? More broadly, would he or any physicist of that era have any familiarity with the basic concept of "coherent" amplification at any frequency, much less the concepts of feedback and coherent oscillation? Vacuum tubes had just begun to be explored; radio technologies used essentially incoherent spark-gap transmitters and crystal detectors; and stereo systems were far in the future. Insights on these queries from anyone familiar with Einstein's writing and thinking could be quite interesting.

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