

# **The ORNL Point of View on the Direction of the U.S. Fusion Program**

Talk before the  
Fusion Energy Advisory Committee  
March 18, 1992

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I appreciate very much the opportunity to talk with you. I asked Bob Conn to be put on the agenda because I am deeply concerned about the future of the U.S. Fusion Energy Program particularly as it will be influenced by the decision about the next major capital expenditure. The cancellation of BPX has put the program at a fork in the road. I am concerned that one path being discussed may be a strategic dead end or at least a long detour on the journey to fusion power. The choice of which path needs to be thoroughly debated by this committee. You have a rare opportunity. I hope what I am going to say will help stimulate debate. Also, I hope people will not conclude from my remarks that we at Oak Ridge are trying to be self-serving. ORNL has always been a team player in the Fusion Program, and some have said we did it even to our own disadvantage. ORNL is still a team player and will so remain regardless of the outcome of the FEAC debates.

I come to you as a bit of an outsider. I am not a fusion expert. I am an energy technology policy expert. But, my message today derives from many discussions with my colleagues in the Fusion Energy Division, (particularly, John Sheffield) and it expresses the ORNL point of view including Al Trivelpiece and Murray Rosenthal.

Fusion energy is a long shot for both technical and political reasons. It is not that it will never be important, but it is a long shot that it will be important soon — say in 50 years. Why? Because it is not the only inexhaustible or near inexhaustible source of energy, because it is so

long term in development and the development will cost so much, and because the outcome is so uncertain, the Fusion Program is likely to continue to experience budget crises. How can fusion power become a reality under budget crises? This is W. D. Kay's argument in his recent paper published in *Issues*.<sup>1</sup> In a real sense, fusion is almost irrelevant in energy policy debates except that it is a big ticket item in the budget. So, it will be difficult to maintain a constant budget in constant dollar terms and much growth seems a remote possibility unless we can do something pretty exciting. This is the background situation that influences my thinking.

As indicated in the National Energy Strategy, the single goal of the Fusion Energy Program should be to demonstrate a practical source of electrical power as soon as possible given budgetary restraints. But, the program is not yet set up to pursue this goal. Fusion is a nuclear technology, but we have no nuclear qualified site at which to focus the U. S. development of the technology.

If you ask what is the most important next step the U.S. Program should take, we at ORNL would argue that it be to find and establish a nuclear qualified site to point the program to its goal. This is what the French did by putting Tore Supra at a nuclear site, Cadarache.

I applaud, therefore, the actions of this Committee in recommending DOE begin immediately the search for a U.S. candidate site for ITER, and I am glad to see DOE is following this advice. ITER is a great opportunity to move fusion along. However, we should be clear that it is an international program in which our stake is 25%. Hopefully ITER will be built, but it may not be in the U.S. What then should be our national program in parallel to ITER, or possibly in place of it, that satisfies U.S. objectives? To answer this question, I argue the committee consider going much further and recommend making this site also the home for the next major facility built by the U.S. Program.

<sup>1</sup> W. D. Kay, "The Politics of Fusion." *Issues in Science and Technology*, p. 40-46, Winter 91-92.

This facility should be a Nuclear Technology Machine. It is what Ron Parker calls the Steady State Burn Experiment (SBX), what John Sheffield calls the Small Fusion Development Plant and it is related to what Steve Dean calls a fusion pilot plant. It is a steady state device operating with  $Q \sim 1$ , and it would be as small as possible while achieving reactor relevant conditions at which to test systems such as the diverter, the breeding blanket, heat recovery, remote maintenance, waste management, etc. It would be a small nuclear machine, but it would have most of the pieces of a reactor. It would permit testing these technologies at smaller scale than would likely be possible with ITER and doing the experimentation earlier and with U.S. industry taking the lead and reaping the benefits.

The facility would be phased. The first phase would be designed to run steady state with deuterium, test diverter designs and explore the physics of concept improvement regimes. In other words, Phase I would be designed to accomplish essentially what is proposed for the Steady State Advanced Tokamak (SSAT or ASSET, a newly suggested acronym, Advanced Steady State Experimental Tokamak). This phase might involve a capital cost of \$0.6 - \$0.7B at a nuclear site.

The second phase would be DT operations requiring substantial upgrade to the facility which might cost in the range of \$200 - \$400M.

I would argue that the committee recommend to DOE that a major national competition be launched not only to find the best site but also to build the Nuclear Technology Machine on it. Part of that competition should be to include the management team in the proposal. The private sector should be involved in the leadership. In my view, because we are focusing on technology, industry must begin to take the lead. Also, DOE must think out an approach for a logical evolution to ensure the continued involvement of laboratories and universities, an essential condition.

Taking this direction says to the world we are serious about fusion energy, and we intend to achieve a practical reactor. It would bring some excitement back into the program which has been missing for some time. We might even light a lightbulb as Congressman Myers keeps asking us to do. Excitement and industry playing the key role can bring perhaps the budgets we need.

The ORNL view is that building SSAT (or ASSET) at a non-nuclear qualified site is an extravagance the U.S. Program cannot afford, because the Program would have to turn right around and build something like the Nuclear Technology Machine at a nuclear site. That would be much more expensive than building SSAT at a nuclear site in the first place where SSAT is the first phase of the Nuclear Technology Machine.

SSAT at a non-nuclear site forecloses future options and progress for too long; it will make declining budgets much more likely.

I would urge the committee to think about how to defeat Mr. Kay's fusion impossibility theory. SSAT upgradable to the Nuclear Technology Machine at a nuclear-qualified site capable of housing ITER, DEMO, and a 14 MeV neutron source seems to me to be the best strategy for making the program more exciting, relevant, and understandable, and keeping our options open while aggressively pursuing the goal of fusion power. Remember, the decisions to be made now are not just about which particular device should be built next. Instead, the entire strategic direction of the U.S. Program is the issue.