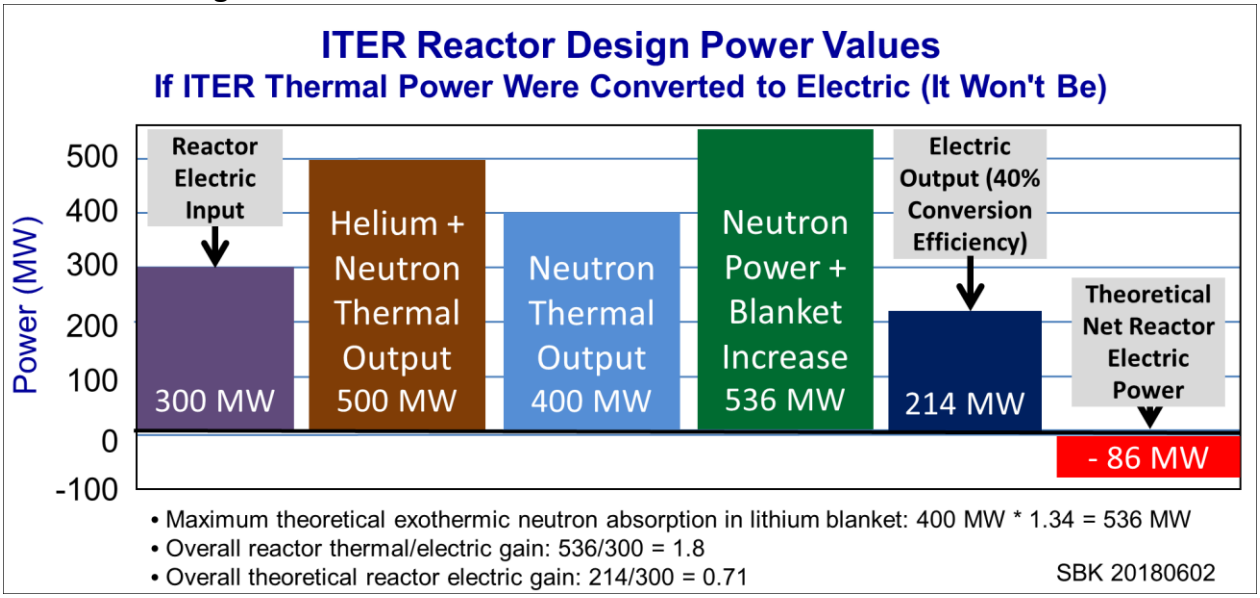
Appendix A — ITER Power Values

June 17, 2018 — By Steven B. Krivit

In the last half-century, more than 100 fusion reactors have preceded ITER. None has produced more power than it consumed. Neither will ITER. A common belief among members of the public is that ITER is designed to demonstrate the feasibility of controlled terrestrial energy from fusion processes. This is a false perception.

ITER Power Design — The Data



ITER Power Design — The History

Fusion scientists, among themselves, never expected ITER — as a reactor system — to demonstrate the feasibility of controlled terrestrial energy from fusion processes. Instead, their focus was only on the ratio of thermal power produced by the plasma to the thermal power injected into the plasma.

The key evidence for this is the July 2001 "Final Report of the ITER Engineering Design Activities," developed under the auspices of the International Atomic Energy Agency. Page 5 of the report provides a table of the "Summary of Detailed Technical Objectives." The top of the page describes the primary measurable result: "The nominal inductive operation produces a DT fusion power of 500 MW for a burn length of 400s, with the injection of 50 MW of auxiliary power."

That result was listed as the first of eight technical objectives. The document "Summary of the ITER Final Design Report" said almost the same thing, as shown in the section "ITER Detailed Technical Objectives and Performance Specifications" on Page 9 of that document.

In that primary measurable objective, the terms "fusion power," "injection" and "auxiliary power" all had precise, scientific meanings. The objective was stated accurately and transparently.

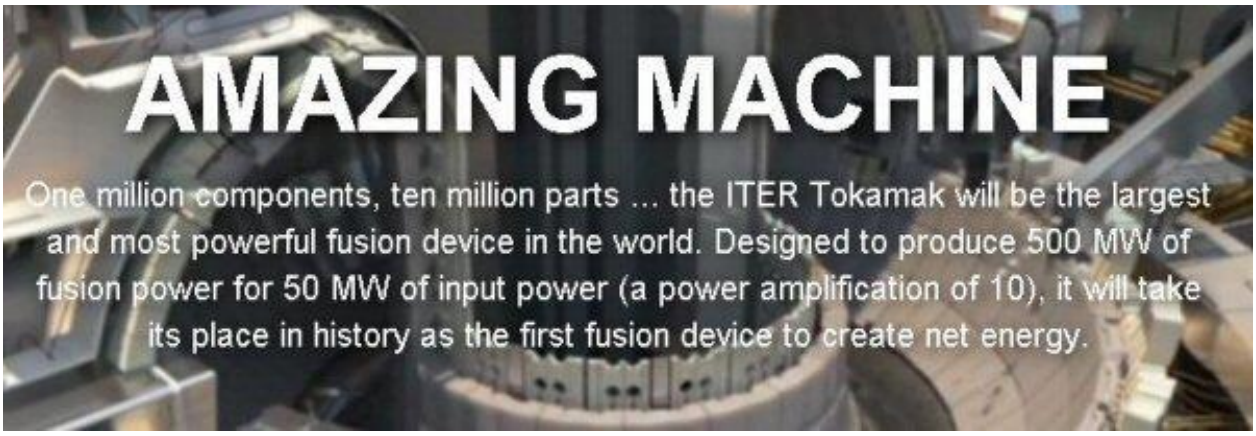
Nothing in that primary measurable objective stated or implied that the reactor would a) produce 500 MW of power, b) consume 50 MW of input power, or c) produce 10 times the power it would consume. All those false representations came later, when fusion scientists communicated with the public, news media and government officials.

This misrepresentation is best exemplified by Neil Calder, a former ITER spokesman, who taught attendees at his international communicators' workshop how to promote ITER to the world:

> The energy coming out of ITER will be 10 times greater than the energy going in. Input power 50 MW - output power 500 MW.

*False and misleading April 10, 2008, statement by Neil Calder, former head of ITER public communications (**Source**)*

The ITER organization continued to publish the falsehood for the next decade, as shown on this screenshot from the organization's home page on Jan. 12, 2017:



The Hidden Input Power

The 300 MW input power requirement for ITER was deeply buried in technical documents. Until *New Energy Times* published the value in 2017, it did not appear on any publicly accessible Web site. In early 2017, *New Energy Times* requested the input value from ITER director-general Bernard Bigot and his spokesman, Laban Coblentz. Neither provided the requested scientific data.

The initial three sources who provided the input value were Daniel Jassby, a former principal research physicist at the Princeton Plasma Physics Laboratory, Hartmut Zohm, the head of the Tokamak Scenario Development Division at the Max-Planck-Institute of Plasma Physics, and Steven Cowley, at the time the president of Corpus Christi College. Cowley is the former head of the Culham Centre for Fusion Energy in the U.K. and the former chief executive officer of the United Kingdom Atomic Energy Authority.

At a later time, *New Energy Times* located the ~300 MW input value on Page 31 in the German government document "Hearing on Nuclear Fusion before the Bundestag Committee for Education, Research and Technology Assessment, Berlin, 28 March 2001."

Transparency Only in Japan

Before *New Energy Times* published the fact that the ITER reactor would produce about zero net power in 2017, the only official government Web site to clearly and transparently inform readers of this fact was that of the JT60 fusion group in Japan.

For the convenience of readers of this Appendix, that Web page is duplicated below:

Will ITER make more energy than it consumes?

ITER will produce about 500 MW of fusion power in nominal operation, for pulses of 400 seconds and longer. Typical plasma heating levels during the pulse are expected to be about 50 MW, so power amplification (Q) is 10. Thus during the pulse the ITER plasma will create more energy than it consumes.

The efficiency of the heating systems is ~40%. Other site power requirements lead to a total steady power consumption of about 200 MW during the pulse. Now the fusion power of ITER is enhanced by about 20% due to exothermic nuclear reactions in the surrounding materials. If this total thermal power were then converted to electricity at 33% (well within reach of commercial steam turbines), about 200 MW of electrical power would be generated.

Thus ITER is about equivalent to a zero (net) power reactor, when the plasma is burning. Not very useful, but the minimum required for a convincing proof of principle. In ITER the conversion to electricity will not be made: the production of fusion power by the ITER experiment is too spasmodic for commercial use, and the ITER reactor can be designed with low temperature coolants which ease safety and licensing conditions with today's nuclear-licensed austenitic steels, and money can be saved on relatively well-known engineering.

This also explains ITER's interest in extending pulses to steady state. A reactor operating for only 7 minutes every 30 minutes is not attractive, since little electricity can be produced during much of the "dwell" time, but some plant power is nevertheless consumed then.

ITER will carry out tests of electricity production from fusion on a small scale. Some test blanket modules being used to develop power reactor blankets will include a complete steam-raising cycle and turbine in the port cell, allowing the generation of some electrical power even on ITER. The electric power delivered from such a small section of the ITER blanket will be ~ 1 MW.
