

ENERGY/MATTER CONVERSION CORPORATION

6505 Euclid Avenue, Suite 3, Manassas Park, VA 22111, (703) 330-7990

6 June 1995

Hon. Newt Gingrich, Speaker
U.S. House of Representatives
2428 Rayburn HOB
Washington, D.C. 20515

Hon. Robert L Livingston, Chairman
Haute Appropriations Committee
2406 Rayburn HOB
Washington, DC. 20515

Hon. Ralph Regula, Chairman
S/C on Interior and Reid. Agencies
2309 Rayburn HOB
Washington, D.C. 20515

Hon. Robert Dole, U.S. Senate
230 Capitol Building
Washington, DC, 20510

Hon. Robert S. Walker, Chairman
House Science Committee
2369 Rayburn HOB
Washington, D.C. 20515

Hon John R. Kasich, Chairman
House Budget Committee
1131 Longworth HOB
Washington, D.C. 20515

Hon. Frank Wolf
House Appropriations Committee
104 Cannon HOB
Washington, D.C. 20515

Hon. John S. Warner, U.S. Senate
225 Russell Building
Washington, D.C. 20510

Gentlemen:

By this note I am hoping that you will be moved to take one more step towards government cost reductions and a balanced budget while simultaneously creating a means to allow private industry to solve the nation's energy problem. This dual prospect is embodied in the draft legislation enclosed, that outlines a fundamental change in the way government engages in fusion energy development.

Currently the DoE monopolizes all work in fusion energy. It supports several federally-controlled laboratories (including some at major universities. e.g. Princeton), and rigidly directs all R&D effort in the field. Its program structure and control of resources effectively suppresses all incentive for private work in this field; who will 'compete' with the federal government?* Unfortunately, the path followed by the DoE is almost certainly not ever going to give the nation any safe, technically viable, or economically useful fusion power plants or systems.

The DoE commitment to very large fusion concepts (the giant magnetic tokamak) ensures only the need for very large budgets; and that is what the program has been about for the past 15 years - a defense-of-budget program, not a fusion-achievement program. As one of three people who created this program in the early 1970's (when I was an Assistant Director of the AEC's Controlled Thermonuclear Reaction Division) I know this to be true; we raised the budget in order to take 20% off the top of the larger funding, to try all of the hopeful new things that the mainline labs would not try.

Each of us left soon thereafter, and the second generation management thought the big program was real: it was not. Ever since then, the ERDA/DoE has rolled Congress to increase and/or continue big-budget support This worked so long as various Democratic Senators and Congressmen could see the funding as helpful in their districts. But fear of undermining their budget position

also made DoE bureaucrats very autocratic and resistant to any kind of new approach, whether inside DoE or out in industry. This led DoE to fight industry whenever a non-DoE hopeful new idea appeared.

I hope that this new Congress can and will reverse this situation, so that we can achieve clean, safe and economical fusion power sometime in the next 5-10 years. The country badly needs practical fusion for its near- and far-term survival; the enclosed bill has been constructed to do this.

As written, it:

1. Removes the government from all fusion development, but retains it in fundamental fusion research - this being defined as all those things that by their nature are not patentable. Government labs thus do "R", not R & "D".
2. Provides for an orderly 5-year transition to industry of the staff supported by the current government fusion R & D program.
3. Provides for 50:50 cost-sharing support of private industrial efforts in fusion development, limited to private firms that are majority-devoted to such work (i.e. prohibits government support of fusion development in large corporations whose primary business is other than fusion).
4. Provides 10 (ten) prizes in amount of \$100,000,000 each, for each of ten sequential improved achievements in the attainment of fusion power - culminating with the attainment of environmentally-attractive, economically-superior fusion systems operating on non-radiative ("aneutronic") fuels and reactions.

This bill was originally prepared in 1992-93 under the aegis of The Coalition for Science and Commerce. which helped in the creation of the "Launch Services Purchase Act" of 1990. that forced NASA to allow private industry into the space launch business. It could not move forward in the recent Democratically-controlled Congresses; now, perhaps, the new winds of reason can make this happen.

I personally know of three private companies which would be able to raise significant private funds and attack fusion development on original and hopeful lines if this legislation were adopted. One of them is our own company. here in Virginia, where we have been working towards small scale, clean. low-cost fusion for over a decade - (without the Dot?). With this bill passed, I believe that we could see practical fusion power here within 8 years, funded almost entirely by private investments. This is because the bill's prizes Provide the guaranteed market return for development success, that otherwise will take much longer to pay off than is acceptable to venture capital investors.

With cheap, clean, small-scale fusion plants, the nation's reliance on foreign energy supplies vanishes, they can be used to displace all forms of coal, gas and oil consumption, nuclear fission plants could cease, and our industrial base could be revitalized. And using clean fuels (e.g. hydrogen and boron, makes only helium) means that the main current combustion pollutants and greenhouse gases would stop forever.

Consider this bill; pass it and give us all a chance for a better world.

Very truly yours

Robert W. Bussard
Technical Director

Replacement of Public Law 96-389, sec 3

Oct. 7, 1980, 94 Stat. 1540

Chapter 101 -- FUSION ENERGY ENGINEERING

(Author's note: For a legislative history and purpose see 1980 U.S. Code Congress and Administration News, p. 3336.)¹

Sec 9301. Congressional findings and declaration of policy

(a) The Congress hereby finds that —

1. the United States and the world would enjoy enormous and critically needed benefits from the commercial availability of environmentally clear, and virtually inexhaustible sources of energy;
2. in theory, the fusion of light atomic nuclei can provide the basis for such energy sources;
3. the concept of fusion energy based on the confinement of high temperature plasmas has been the subject of ongoing government-funded research and development for over three decades;
4. during these decades our understanding of high temperature plasmas has progressed to the point that, with appropriate government incentives, the tradition of diversity and risk management in our free enterprise system can expand the frontiers of fusion energy technology at a rate far greater and at a cost far lower than centrally planned programs funded by the government alone;
5. progress in fusion energy systems is currently limited by the lack of a diversity in technical approaches being explored:
6. to ensure the timely commercialization of fusion energy systems, the United States Government must create an environment in which the inherent commercial rewards of fusion energy technology are leveraged by supplementary Federal funds so as to motivate many diverse inventors and investors in the private sector who will freely and rapidly develop the frontiers of fusion, energy technology;
7. it is vital that the Federal Government continue its direct financial support for scientific research in the physics of high temperature plasmas as this creates fundamental new knowledge of immense value which cannot be patented or reasonably treated as intellectual property:
8. it is a proper role for the Federal Government to stimulate accelerated commercial investment in the development and demonstration of fusion energy technologies; and
9. the stimulation of commercial investment in the development of fusion technology can be accelerated through the award of cash prizes to entrepreneurs achieving significant technical milestones and the granting of funds matching those put at risk by private investors.

¹ James Allen Bowery wrote this proposed legislation as Chairman of the Coalition for Science and Commerce with input actively solicited from all the privately financed fusion energy companies that were in existence during the early 1990s. The idea was to make a competition that the likely participants would view as not only fair, but also as likely to attract participation from capital sources not normally available to high-risk, long-term-payback development projects.

(b) It is therefore declared to be the policy of the United States and the purpose of this chapter to stimulate commercial investment in the development and demonstration of fusion energy systems and continued scientific research into the physics of high temperature plasma.. Further, it is declared to be the policy of the United States and the purpose of this chapter that the objectives of such a program shall be —

1. to promote an orderly transition from the current research and development program to a new one in which the private sector capitalizes and manages risks inherent in the development and demonstration of fusion energy technologies under the disciplined diversity of free enterprise while the government continues to directly fund plasma physics research;
2. to stimulate private sector investment in fusion energy technology by awarding substantial prizes for significant technical achievement and matching private investment with public grants;
3. to, over time, systematically remove public support for private investment in fusion energy development and demonstration commensurate with the removal of barriers to commercial deployment of fusion energy systems;
4. to continue international cooperation in plasma science for the benefit of all nations;
5. to give preferential treatment to aneutronic fusion cycles;
6. to give preferential treatment to fusion cycles that make use of readily available fuels;
7. to stimulate the commercial deployment of competitive fusion energy sources; and
8. to demonstrate that United States science in partnership with commercially financed technology development and operation continues the tradition of world leadership in science and technology.

Sec. 9302. Definitions

For the purposes of this chapter —

1. “fusion” means a process whereby two light nuclei, such as deuterium and tritium, collide, forming a compound nucleus, which subsequently separates into constituents which are different from the original colliding nuclei, and which carry away the accompanying energy release;
2. “energy system” means a facility designed to utilize energy released in the fusion process for the generation of electricity and the production of hydrogen or other fuels;
3. “Secretary” means Secretary of Energy.
4. “scientific research” means activities that discover knowledge about natural phenomena, which, under existing statute, cannot be held as intellectual property via patent;
5. “scientific knowledge” means knowledge acquired or discovered through scientific research;
6. “development” means the acquisition of knowledge or reduction to practice of an invention which does not exist in nature and which has some practical value or which has value as intellectual property under patent law or other statutes;
7. “engineering break-even” means the production, by a fusion energy device, of a fusion burn which consumes at least 5% of the confined fusion fuel and which produces at least twice the energy consumed by the fusion energy device during the burn;

8. “commercial break-even” means the self-sustaining operation of a fusion energy device by feeding its power output back to its power input without the need for any outside input except its fuel;
9. “commonly available” is any fuel whose dollar (1992) per ounce commercial price multiplied by the number of tons of plant and equipment required to burn it per million watts sustained power product less than a quantity less than 10,000 dollar-tons per megawatt-ounce;
10. “energetically aneutronic” means any fuel which, when burned in a fusion energy system, produces neutron radiation carrying away less than 19% of the produced energy;
11. “environmentally aneutronic” means any fuel which, when burned in a fusion energy system, produces neutron radiation carrying away less than 1% of the produced energy;

Sec. 9303. Program activities

(a) Scientific research in areas where lack of knowledge limits the development of fusion energy systems;

1. The Secretary shall periodically survey commercial participants in fusion energy technology development or potential investors in same, to determine critical gaps in scientific knowledge;
2. The Secretary shall initiate scientific research emphasizing gaps in scientific knowledge as determined from the survey of commercial developers and investors;
3. The Secretary shall fully disclose to the public all discoveries made in the course of government funded research under this program;
4. The Secretary shall, on an annual basis, convene an independent panel, no member of which may have received Federal funds for fusion-related research or development in the last 5 years nor served on the panel in the last 5 years, to review scientific research activities to ensure Federal plasma physics funds are not being used for patentable fusion technology development purposes instead of unpatentable scientific research into plasma physics;
5. If the independent review panel determines an activity is development rather than research, the Federal funds used for such development must be repaid to the United States Treasury to reduce the federal debt;
6. Physicists receiving income from government-funded fusion energy research or development prior to the enactment of this legislation are to be awarded an annual grant for the next 5 years equal to their average annual income derived from Federally-funded fusion energy programs over the last 5 years, up to a limit of \$60,000 (1992) per year, the purpose of which is to recognize their commitment and contribution to the field and to aid in their transition to the new funding environment: and
7. Commercial Fusion Enterprises, as defined in 9303.b.1 may enjoin the government from continuing to directly fund scientific research in plasma physics which they believe to be in competition with their efforts to develop fusion technology.

(b) The stimulation of commercial investment in fusion technology development;

1. Any private, for profit, business owned or controlled by United States persons which is primarily engaged in the development of fusion technology qualifies as a Commercial Fusion Enterprise.

2. Every U.S. citizen possessing a patent for a fusion energy system is to be provided with full reimbursement of all tax-deductible expenses incurred the pursuit of their patent, up to a maximum of \$100,000: the purpose of which is to assist the inventor in the pursuit of private financing of further development of the patented technology under the incentives of the current Act.
3. Any facility owned or controlled by United States persons generally used by Commercial Fusion Enterprise. and primarily used for the development of fusion technology qualifies as a Commercial Fusion Center and also as a Commercial Fusion Enterprise.
4. Commercial Fusion Enterprises shall receive matching funds from the government for each private investment they make toward the development of fusion technology.
5. Funds provided by the government, as well as the private funds they match, shall be used to develop fusion energy technology. Failure to use such funds to develop fusion energy technology shall render the Commercial Fusion Enterprise liable for such damage. and criminal penalties as are warranted under the existing statutes against securities fraud currently enforced by the Securities and Exchange Commission.
6. The first Commercial Fission Enterprise to demonstrate engineering break-even shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund, which is hereby established, and whose contents are to be invested in 30 year Treasury instruments and whose disbursements are to be administered by the National Academy of Engineering.
7. The first Commercial Fission Enterprise to demonstrate engineering break-even using an cycle burning an energetically aneutronic fuel shall receive a \$100,000,000 prize from the fusion Energy Trust Fund.
8. The first Commercial Fusion Enterprise to demonstrate engineering break-even using an cycle burning an environmentally aneutronic fuel shall receive a \$100,000,000 prize from the fission Energy Tnit Fund.
9. The first Commercial Fusion Enterprise to demonstrate engineering break-even using using a cycle burning a commonly available energetically aneutronic fuel shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund,
10. The first Commercial Fusion Enterprise to demonstrate engineering break-even using a cycle burning a commonly available environmentally aneutronic fuel shall receive a 1100.000,000 prize from the Fusion Energy Trust Fund.
11. The first Commercial Fusion Enterprise to demonstrate commercial break-even shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund.
12. The first Commercial Fusion Enterprise to demonstrate commercial break-even based on a fusion cycle burning an energetically aneutronic fuel shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund.
13. The first Commercial Fusion Enterprise to demonstrate commercial break-even based on a fusion cycle burning an environmentally aneutronic fuel shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund.
14. The first Commercial Fission Enterprise to demonstrate commercial break-even using a cycle burning a commonly available energetically aneutronic fuel shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund.

15. The first Commercial Fusion Enterprise to demonstrate commercial break-even timing a cycle burning a commonly available environmentally aneutronic fuel shall receive a \$100,000,000 prize from the Fusion Energy Trust Fund.
16. The first Commercial Fusion Enterprise to demonstrate engineering break-even at power densities 1 million watts per ton of equipment shall receive a \$100,000,000 prize from the fusion Energy Trust Fund.
17. Interest income on the Fusion Energy Trust Fund shall be used to increase the value of all prizes according to the Producer Price Index. Excess income shall be returned to the United States Treasury used to reduce the national debt.
18. One year after this bill becomes law, The Secretary shall hold a series of 10 monthly publicly advertised auctions. At each auction 10 kilograms of Helium-3 will be sold to the highest bidder. The winning bidder must:
 - a) be a Commercial Fusion Enterprise.
 - b) not have already won a previous auction.
 - c) not have cross-ownership with any other Commercial Fusion Enterprise that has Already won at a previous auction.
 - d) have a board of directors and officers that do not overlap with the board of directors and officers of any other Commercial Fusion Enterprise that has already won at a previous auction and;
 - e) not have more than 10% of its ownership in common with any other Commercial Fusion Enterprise that has already won at a previous auction.
19. The Secretary shall make 100 acre. of the Nevada nuclear test range available to Commercial Fusion Enterprises. This land shall:
 - a) cost no more than \$1000 per month to lease per acre, including all user tee..
 - b) be remote enough that the instantaneous release of 1 gram of tritium gas per month will pose no significant health risk to those outside the test range.
 - c) be located on land suitable for construction.
 - d) have paved access to the center of the 100 acre area.

Sec. 9304 International cooperation

Scientific research, as defined specifically in this act, being of a limited and nonproprietary nature, shall be conducted in a spirit of academic freedom and openness wherein scientists shall freely cooperate and communicate with other scientists without regard to national boundaries. It is the intent of Congress that the State Department take action to facilitate the free international exchange of such purely scientific information and work.

Sec. 9305. Dissemination of information

(a) The Secretary shall take all necessary steps to assure all scientific knowledge relevant to fusion is made readily available to interested United States persons: Provided, *however*, that upon a showing to the Secretary by any person that any information or portion thereof provided to the Secretary directly or indirectly from such person would, if made public, divulge (1) trade secrets or (2) other

proprietary information of such person, the Secretary shall not disclose such information and disclosure thereof shall be punishable under section 1905 of Title 18.

(b) The Secretary shall maintain an aggressive program in the United States for the provision of public information and educational materials to promote widespread knowledge of fusion among educational, community, business, environmental, labor, and governmental entities and the public at large.

Sec. 9306. Annual report

As a separate part of the annual report submitted pursuant to section 7321 of this title, the Secretary shall submit to Congress an annual report of activities pursuant to this chapter. Such report shall include —

- (a) a list of recent scientific discoveries in plasma physics as funded under this chapter;
- (b) a list of Commercial Fusion Enterprises, their levels of capitalization, Fusion Energy Trust Fund prize applications and Fusion Energy Trust Fund prize awards;
- (c) an analysis of the progress made in commercializing fusion technology; and
- (d) suggestions for improvements in the national fusion program, including recommendations for legislation.

Sec. 9307. Authorization of appropriations; contract authority

There is hereby authorized to be appropriated to the Secretary, for the fiscal year ending September 30, 1993, such sums as are provided in the annual authorization Act pursuant to section 7270 of this title.