A Program for U.S. Energy Development

Issued by the U.S. Labor Party

January 1977

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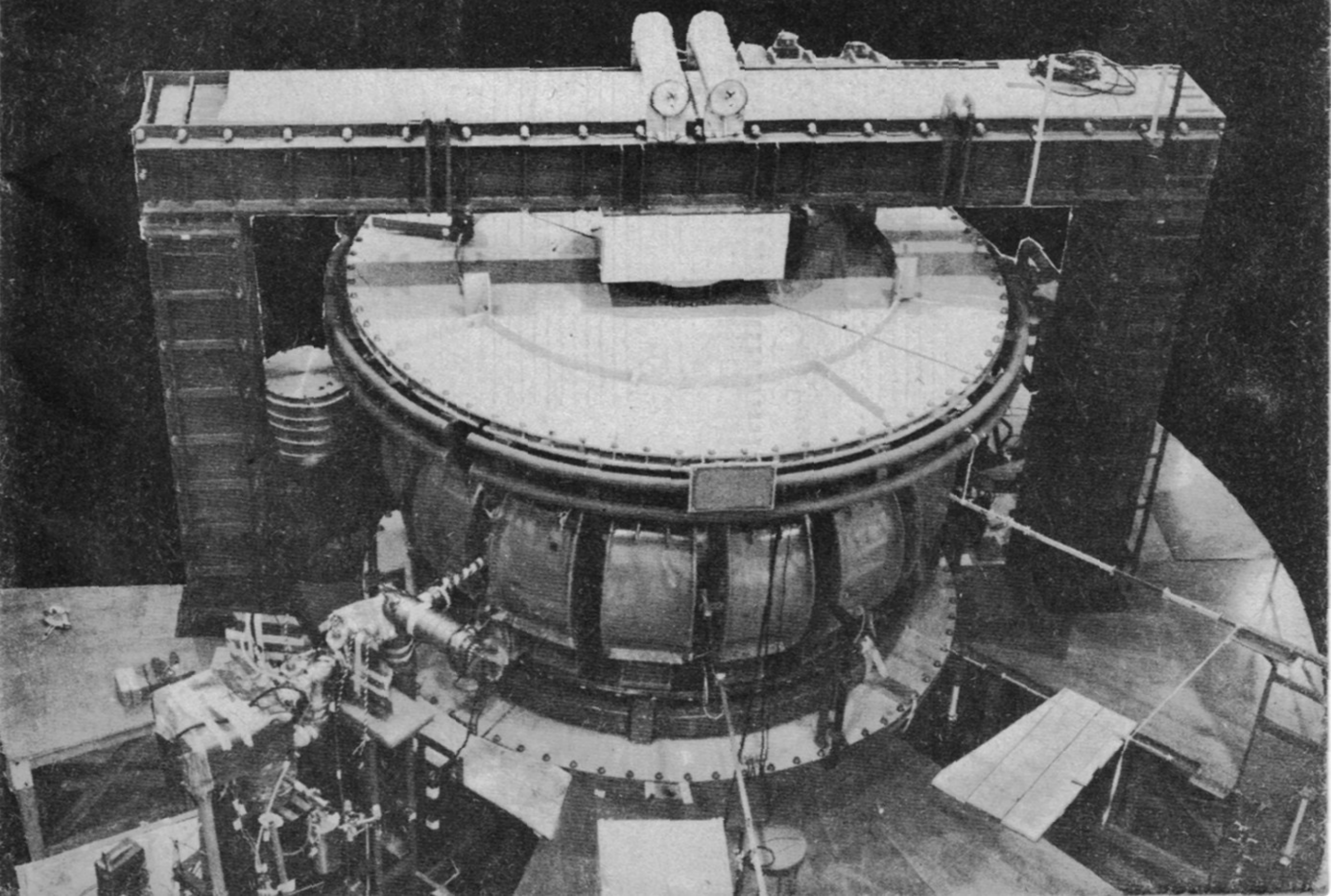

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ON THE COVER: In the foreground, a tokamak used in thermonuclear fusion experiments.

A Multi-Partisan Energy Policy

by Lyndon H. LaRouche, Jr.

National Chairman, U.S. Labor Party

Dec. 23,1976

Recent weeks' discussions have demonstrated that the basis exists for a multi-partisan tactical alliance characterized by the following leading points of agreement:

(1) Support for an accelerated and broadened program of "fusion energy" and related research and development.

(2) Expansion of high-technology industrial and agricultural export-levels of the United States, and correlated resistance to "de-industrialization" schemes of the sort associated with the spokesmanship of Rep. Harrington (D-Mass.).

(3) Resistance to fascist-modelled "labor service" and "national planning" proposals, including the Humphrey-Hawkins and similar schemes, and including the proposals of the corporatist ICNEP association.

(4) Support for legislative measures, court action and criminal proceedings to restore the integrity of the individual voter's secret ballot.

Such a tactical alliance would be dominated visibly by mainstream conservative currents among Republican and Democrat legislators and other elected officials, but would be aided inclusively by crucial research and other inputs from the U.S. Labor Party, and would be supported by numerous industrialists, rank-and-file trade-unionists, farmers and others.

Such a tactical alliance would enjoy the favorable strategic correlation of forces represented by movements in Western Europe and elsewhere toward a new, gold-based, development-oriented monetary system. Since such a new monetary system corresponds to the long-term interests of the United States as an industrialized nation, the relative success of Europeans and others in that direction would provide the favorable circumstances for the attempted hegemony of the pro-industrial development tactical alliance in the United States.

The U.S. Labor Party would properly assume a special contributing role in the work of such an alliance. As a political party, the U.S. Labor Party has an important voter base among several millions of working people and some others, concentrated in industrial centers in more than 20 key states. This represents an important direct channel of two-way communications with a key layer of rank-and-file working people, by-passing those elements of the labor bureaucracy typified by Leonard Woodcock, Jerry Wurf and other collaborators of Joseph Rauh and Marcus Raskin. The party also represents an important independent political intelligence activity, not only supplementing other available sources, but with areas of competence not ma ched by other available sources. The party has leading specialized competences in aspects of scientific research relevant to energy and other current policy questions. Generally, with several hundred of its members, chiefly highly-qualified professionals functioning on a voluntary basis, the party represents inclusively one of the world's leading strategic studies and policy research agencies.

At this juncture, the party has three essential literary contributions to make to the work of establishing and consolidating the indicated potential tactical alliance. In part, the materials represented in this memorandum and its attachments are a summary of material presented in other sources; in significant part, the attachments represent original work prepared for this submission. The three points to be covered by those materials as a whole are as follows.

(1) The principal flaw in the mainstream conservative political currents in the U.S. is that they have lacked an effectively articulated self-consciousness of the proper, essential elements of their conservative impulses. The present intersection of such currents with the efforts of the U.S. Labor Party exposes the real, underlying issues between conservatives and liberals in the most fruitful way. For various reasons, the U.S. Labor Party is advantaged to present to those conservatives a statement on this point with which they must tend to readily concur. Such contributions to an improved self-consciousness of purpose among those conservatives performs an essential function in establishing the proposed alliance as of *a deeply-principled* character.

(2) A principal flaw among mainstream conservative currents is a prevailing, traditional misapprehension of the nature of the intersection of the fundamental, respective self-interests of the United States and the Soviet Union. U.S. mainstream conservatives are presently to be confronted by a growing movement among Western European conservative parties and other forces (e.g., the Christian Democracies, Gaullists, industrialist factions, as well as the Schmidt-Callaghan axis among social democrats) toward new forms of economic and related cooperation with the Comecon bloc. Three-way cooperation among European OECD forces, leading sections of the developing sector, and the Comecon is the emergent strategic reality of the world. Without a correct perception of the implication of that for U.S. fundamental self-interests, no significant faction in U.S. political life could represent a viable policy-making current. In this connection, the U.S. Labor Party has special advantages for contributing essential knowledge.

(3) The third category of essential background contributions is technical. In this memorandum we include a summary of the essential concepts upon which an energy policy must be premised. In the attached materials, specific matters are presented.

In addition to those three cited points, we shall conclude this memorandum with a summary of the way in which an appropriate energy policy will affect key elements of the U.S. economy.

The Historic Basis for Contemporary U.S. Conservatism

The historic basis for defining contemporary mainstream conservatism in the USA is summarized in Section 1 of the *Constitution of the U.S. Labor Party*. We identify the leading elements to be considered here, adding the argument specifically relevant to an understanding of contemporary conservatism.

Capitalist republicanism as a political-economic philosophy is the outgrowth of European Renaissance humanism as defined through mediation of the Tudor Renaissance in England and parallel developments of notions of political economy in sixteenth and seventeenth century France.

Tudor England was distinguished by its emphasis upon the rudiments of technological progress, and by an associated emphasis upon developing the mental creative potential of English artisans and others. This was a characteristic outgrowth of the Renaissance — since progress emphasizes the *voluntary* element in human existence, *the potential powers of the individual mind to contribute, assimilate, transmit and apply new scientific and technological discoveries to the ultimately universal benefit of the human species.* Hence, the Tudor (and related) currents' emphasis upon technological progress and individual human freedom represented inextricably-interconnected principles.

The English settlements established on the Atlantic Coast of North America during the seventeenth and early eighteenth centuries carried the germs of this Tudor and subsequent English Commonwealth achievement, and established on those shores appropriate new institutions relatively free of aristocratic corruptions. As eighteenth century England regressed, away from the Tudor and Commonwealth thrusts toward republican political forms of industrial capitalist development, the dominant English political interests, centered around the British East India Company, attempted to impose upon the American English settlements a semi-colonial status of relative economic and cultural backwardness. London's persistence in that oppressive mercantilists' policy represented the basis for an irrepressible conflict between the Americans and their London rulers.

This struggle persisted even after 1783, as London recurrently and persistently intervened in U.S. internal affairs (Aaron Burr's Bank of Manhattan, Martin van Buren, August Belmont) in the effort to abort U.S. industrial development and to "balkanize" this continent into a squabbling set of contending nations, thus easily directed from London. Hence, from about 1763 until London abandoned such interventions at about 1863, represents in fact a century of the continuing American Revolution.

A direct comparison of the leading writings of Alexander Hamilton with those of the Tudor

Thomas Gresham most efficiently exposes the direct links between the roots of English industrial capitalism and the Federalist movement as a whole. On this point, the writings of the late historian Charles Beard are a vicious fraud, and a more naked fraud to the same effect is expressed by the late Thurman Arnold's *The Folklore of Capitalism*... the same New-Deal Arnold who established the law firm of Arnold and Porter, and who was the relevant legal sponsor of Marcus Raskin's avowedly neo-Fabian intelligence cover, the Institute for Policy Studies.

During the first century of U.S. history, the mainstream of the development of the Constitution and of the characteristically American philosophical world-outlook is represented successively by the Federalists, Clay's Whigs and the founding of the Republican Party. The principal subversive influences, usually witting agents of the United States' chief foreign enemies in London, were Aaron Burr, Martin van Buren (and Andrew Jackson), and August Belmont. From the middle of the 1820s into the middle of the 1860s, the Democratic Party ***as a national party*** of 1828-1864 was in fact, and without exaggeration, the party of treason. The Third National Bank is the key issue through which to unravel all the other connected major issues.

This is by no means to suggest that membership in the 1828-1864 Democratic Party was axiomatically treasonous. Rather, through control of the *national* Democratic Party by pro-monetarist British agents based chiefly in New York City, the honest duped constituency forces of the local Democratic Party organizations were more or less effectively manipulated to the purpose of frustrating and containing the effective industrialized development of the United States.

That tainted aspect of the national Democratic Party continues down to the present combination of forces grouped around the candidacy of Governor James Carter (cf. *Carter and The Party of International Terrorism,* and the current Cabinet-selection process).

From 1860 onwards, the picture becomes more complicated. In general, the present arrangement of the two major parties dates in principle from the mid-1860s. Today, the national Democratic Party machine is under the joint control of an uneasy alliance of Rockefeller-linked and U.S. Rothschild-linked monetarist forces, whereas the Republican Party is partially controlled by the Rockefeller-linked forces. Seward, Chase, and Stanton typify the powerful influence of such New York City forces in the Lincoln Cabinet — the original dating of the endemic conflict within the Republican Party between midwestern (e.g., Fremont, Lincoln) and New York City-centered currents.

With the adoption of the Versailles Treaty's German war reparations feature, the peace apparently won by the war was traded away for an inevitable World War II (cf. Keynes, 1919), and the pro-industrialist forces among the present OECD nations were administered a decisive setback in favor of the hegemony of the monetarist forces. Directly opposite to Hamilton's and Gresham's philosophical outlook, instead of basing the perception of national interest of the United States in the energetic, technologically-oriented expansion of industry and agriculture, industrial and agricultural growth was subordinated and contained according to the contrary interest of a cancerously-expanded permanent debt-structure. At Versailles, rather than writing off unpayable debts, in order thus to generate new credits for accelerated industrial and agricultural prosperity, New York City and London monetarist interests erected a debt-structure propped up by pre-discounting of scheduled German war reparations payments to subsidize French and other debt obligations (in net) to New York City.

The penalties of Versailles for the internal U.S. economy came in chain-reaction succession. The permanent decline in world industrial growth established by the Versailles Treaty immediately caused the virtual shutting-down of Ellis Island — an end to the U.S. "melting-pot" policy of the industrial expansion period. Rails began to decline about 1923-1924, U.S. agriculture went into decline during the middle 1920s. The late-1920s speculative bubble popped in 1929, and the pound and dollar collapsed in succession, in downward spirals of the 1931-1934 period.

Rather than correcting the error, the administration of Franklin Delano Roosevelt consolidated the hegemony of the extreme-monetarist factions at the expense of those factions which then represented a relatively greater emphasis on high rates of productive capital formation in basic industry. Under the direction of Rockefeller-linked "think-tanks," such as the Rockefeller Foundation, the Brookings Institution, the Russell Sage Foundation, et al., the New York City monetarist faction, acting through its leading political representative, Roosevelt, attempted first to impose an outrightly fascist policy, paralleling key features of Schacht's Nazi measures of 1933-1936 in Germany, and consciously modelled upon Italian fascism — the NRA. For various reasons, including the strike wave of the 1933-1937 period, the Roosevelt administration retreated from its original, blatantly-fascist policy profile, to the modified meliorist corporatism that became known, from the 1936-1940 period, as the "New Deal."

The mainstream of modern U.S. conservatism dates formally from the Roosevelt administration period of 1933-1940, and represents essentially a defensive reaction against the profound and sweeping subversion of the original U.S. philosophical outlook by the forces of pro-corporatist monetarism. *The mainstream political conservative in the U.S. is in the organic tradition of Gresham, Milton, Hamilton, Clay, and Lincoln. Such a conservative is essentially for that republican form of capitalist democracy whose essential material basis is the increasing per-capita wealth achieved through technological progress in industrial and agricultural expansion.*

The obvious hard-core social base for such mainstream conservatism has been the ownership and management of medium-to-small privately-held industries and closely-held corporations, and technologically-progressive farmers. However, simmering underneath the extensive control of trade unions by the Sidney Hillmans, the Fabians generally, there has been a corresponding, recurring manifestation of an allied conservatism among skilled and semi-skilled strata of working people, and, until the mid-1930s, among black Americans. The skilled and semi-skilled worker associates his or her sense of identity with his productive role in technological progress; the black American properly aspires to become assimilated into the same kind of social identity, which technologically-oriented industrial expansion uniquely offered to this effect.

The tendency for conservatism among working people erupted most visibly from about 1963, in direct and enraged reaction against the neo-Fabianism of the Ford Foundation projects and the Institute for Policy Studies. The reactionary, Orwellian "Triple Revolution" obscenity of the mid-1960s, Naderism, and overt zero-growth propanda campaigns launched beginning the Fall of 1969, were essential included features of the provocations prompting the "blue-collar conservative" upsurge of the 1960s and early 1970s.

There is a direct, common connection between the conservative impulses of the industrialist and farmer, on the one side, and the blue-collar conservative on the other. One simple statistic sums it up best: the declining ratio of full-time equivalent employed operatives in manufacturing, mining, and transportation as a percentile of the total labor force. The acceleration of this tendency since approximately 1966 — as the frontier of industrial development, electronics and aerospace, aborted its growth — underlines the nature of the problem economically and sociologically.

Both principal currents of mainstream conservatism are also enraged by the socio-psychological correlatives of this economic rotting. Since approximately 1963, the moral fabric of the USA has been visibly eroded. Somewhere during the post-Korean War boom of 1954-1957 the rise of permissive child-rearing among young suburbanites represented in fact a loss of well-defined moral criteria within the parents' households. The humanist notion, of imbuing in the child an awesome regard for the necessity of making his or her life one of potential importance to the progress of the human species, was superseded by a destructive emphasis upon the child's heteronomic sensual gratification.

Heteronomic sensual gratification, meeting the heteronomic "felt psychological needs" of the neurotic infantile child and adolescent, became the emerging new ethic, replacing the notion of the need to locate one's sense of identity in connection with some moral purpose in living. The neurotic, paranoid child no longer acquired a corrective sense of becoming useful to humanity, but rather demanded that society be reformed toward a point of conformity with the individual neurotic's hysterical, infantile demand for personal sensual and psychological gratifications. From this moral decay of suburbia's permissive child-rearing erupted the "left" political intelligence factions' "New Left" Frankenstein, with its headlong rush toward a fascist ethic worthy of the early nineteenth century Max Stirner, Bakunin and the Weimar "counterculture" of 1920s Germany.

The conservative may have lacked an appropriate overview and understanding of the problem, but he knew that something was rotten, and in that he was absolutely correct.

Inevitably, out of the pages of Dr. Spock and suburban backyards fashionably littered with discarded toys, erupted a new generation of "superhero comics" addicts, whose axiomatic preoccupation with existentialist, heteronomic sensuality inevitably went over into drug addictions and an escalation in sodomy. These adolescent "liberals" and "radicals" of the "New Left" and of the "new sexual mores" emulated the fascist currents of Europe, in conceiving of "socialist utopias" to be premised upon an insurgent beggar's opera rabble, seeking the criteria for such Orwellian paradises in the utter amorality of black ghetto lumpen-existentialism.

It would be probably a fallacy of composition to omit mention of the Vietnam War from this account. Two essential facts concerning that war provide background to the point to be made. First, it was the wrong war in the wrong place, and a war *which could not be won according to the classical political doctrine of war-winning goals.* Yet, what was destroyed through the demoralizing effects of that war was the sense of the connection between the individual identity and a national purpose. It is not wrong, in principle, for young men to die in war: such sacrifices bring to the fore the essence of humanist principles concerning the individual's sense of social identity. One lives for a moral purpose outside one's immediate, individual existence. The Vietnam war represented a perversion of the sacrifices appropriate to such a sense of moral identity. Yet, what was lost was not the perversion, but to a large extent the moral sense which had been so abused.

Thus, although the growing opposition to the prolongation of that war reflected the proper anxiety of the population involved concerning *a wrong war*, the organized Anti-War Movement was in fact a massive intelligence operation against the people of the United States by in part the same sections of the intelligence community which had been engaged during 1960-1964 in impelling the United States into that war. Elements based in the Rand Corporation, among McGeorge Bundy's associates (such as Marcus Raskin), and others gleefully exploited the growing resentment against *their war* in an escalating judo intelligence operation against the political institutions of the United States.

The direct correlation of the intelligence establishment's controlled Anti-War Movement with the 1968 community control destabilization operation in New York City underscores the real character of that organized movement. The infantile liberal-radical main forces of the Anti-War movement were a perfervidly anti-labor, imminently proto-fascist rag-tag *to which the labor movement reacted inevitably with "blue-collar conservative" rage.* It was the same gang of bandits which, at least as early as 1970, plotted in New York City and elsewhere to launch the scenario (including the Rand "Pentagon Papers" caper) devised to Watergate Richard Nixon *as part of a contrived constitutional crisis.*

During all of these proceedings of the 1965-1973 period, every top insider in Washington and other relevant locations knew that Marcus Raskin's Institute for Policy Studies and the associated key agencies and projects of the "New Left" were covert operations of a prominent faction of the U.S. intelligence community. They knew that these operations were by no means spontaneous eruptions of independent radicalism, etc., but the antics of credulous dupes deployed in a massive covert destabilization operation of a major faction of the overall intelligence community variously linked to the U.S. National Security Council. Yet, just as Richard Nixon credulously "played the game" of self-defeat throughout the first eight months of 1973 and thereafter, one after another of the prominent, well-informed victims of this operation suffered public humiliation rather than blowing the cover off the rigged game.

The average conservative and blue-collar worker obviously lacked such refined insider's information concerning Raskin, Chomsky, Leslie Gelb, et al., but nonetheless reacted against the aromas of these operations, and, unfortunately, matched a growing sense of rage with a cultivated sense of impotence, resulting from the failure of any of his nominal leaders to counterattack resolutely against this awfulness.

In general, contemporary U.S. "liberalism" and "radicalism" are becoming organically fascist. American liberalism has been successively, broadly redefined, beginning with John Dewey, Charles Beard and similar Fabians, as axiomatically equal to the Fabian corporatism, the "soft fascism" impulses of the New Deal period. Radicalism has become the American echo of Weimar's fascist breeding-grounds, the cabarets and the counterculture. Since about 1963, liberalism has adapted itself to become a diluted radicalism, relative to whatever "counter-culture radicalism" appeared to be at that moment.

The continuing source of ambiguity in such a principled opposition of conservatism to liberalism is the foolish adherence of conservatives preponderently to the "right-wing" profile which liberal propagandists zealously attribute to them. Conservatives foolishly associate themselves accordingly with anti-labor postures and with a paranoid anti-Communism, postures contrary in fact to the basic positive principles which mainstream conservatives otherwise represent.

The relevant elements of the second point anti-communism, are more fully treated in the following section of this memorandum. The question of a self-interested conservative labor policy is considered here.

Since Gresham, it has been properly understood that the ability of a capitalist industrialized economy to effectively assimilate new productive technologies, and thus to increase per-capita social productivity, has been limited by the cultural development of the population from which the productive labor force is drawn. Gresham's, Milton's and traditional American leadership in public education partially exemplify the point. The material conditions of life, working conditions of employment, quantity and quality of leisure, are absolutely prerequisites for the enhanced per capita social productivity of the labor force.

In any industrialized economy, capitalist or socialist, there is a source of conflict here. On the one side, the rate of advancement of an economy is delimited by the rate of per-capita capital formation, which requires corresponding increases in per-capita social surplus "saved" from total production for this purpose. Yet, high rates of capital formation can not be effectively maintained without corresponding material and cultural advances in the conditions of the labor force. Meanwhile, the worker's proper struggle for more rapid self-development of the mental powers of himself, his household, must properly impel him to increase his real income, his quality of leisure for self-development, and so forth.

In a capitalist economy, this overall rational struggle for a balanced simultaneous growth of capital formation and incomes is immediately situated, more or less heteronomically, in the conflicts between individual employer and employee-groups. The sociology of that heteronomic form of the conflict is that under conditions of economic expansion workers tend to become more militant, but employers better situated to pay. The balance is achieved (for economic expansion conditions) by a minimal state intervention, to establish minimum scales of standards of income and working conditions as common to all employers, and to permit private conflicts between employers and labor unions to settle any disputed amounts above that standard.

A glance at the relevant data for age of capital stocks and so forth exposes the special predicament of the industrialist conservative at this juncture. The pro-industrialist capitalist political forces, finding themselves impotent to defeat the stagnation and de-industrialization policies of the monetarist factions, angrily demand that the labor movement make up for the losses actually caused by the policies of the New York City-centered monetarists! In this, conservatives tend to ally themselves with their bitterest enemies-in-fact, the New York City-centered monetarist factions, against the labor movement — thus isolating themselves and being meanwhile astonished at their consequent increased political impotence!

The role of conservatives in tolerating the transformation of New York City into a financier's dictatorship, under an economic policy directly modelled on Hjalmar Schacht's *Rentenmark* and *Mefo Bill* schemes, is exemplary of the way in which conservatives have foolishly assisted at the cutting of their own political throats. The fear by many conservatives of directly confronting the risk of an open, definitive break with the Rockefeller brothers is key background to the capitulation of the Ford administration and the present perilous situation of the United States.

The Present Strategic Situation

The leading irony of the present world strategic situation is that a combination of Labor Party and industrialist forces in the United Kingdom has joined with the Andreotti government of Italy in spearheading a European revolt against the thermonuclear and monetary policies of lower Manhattan. It is a delicious irony that Britain, formerly long the bastion of monetarist obscenities, the author of that bucolic obscenity the Holy Alliance, should be presently among the leaders of the struggle against those same monetarist policies!

Although Comecon foreign economic policy has been the crucial background factor in making this possible, the present revolt of Europe against the dollar did not originate in any of the Western European Communist parties, but has been spearheaded by pro-capitalist conservative political forces, typified by the Christian Democracy in Italy and Germany, the Gaullists in France, the conservatives in Scandinavia — and the *Zaibatsu* in Japan.

The immediate form of this struggle between Europe and the dollar has been determined by New York City monetarists' policy. Following the thrust of Versailles and the "American Century" doctrine, since Autumn 1973 the New York City financier interests have once again resorted to the half-century-old practice of attempting to stabilize a bankrupt dollar-linked debt overhang, by looting the developing-sector nations and Europeans. In the lower Manhattan accounts, such programs are viewed rather hysterically as desirable in the narrow terms of short-term reference represented by the dollar-denominated debt. In Europe, such short-term resorts on behalf of dollar debt are viewed differently, as causing the collapse of European industrial exports and a general collapse of internal industrial capacities.

Thus, an hysterical lower Manhattan has forced Europe to defend its most fundamental self-interests by revolting against the dollar. The means to accomplish a successful revolt exist in the possibility of setting up nests of trade and credit agreements among Europe, Japan, the Comecon and large portions of the developing sector, with OPEC (energy) resources marginally decisive in balancing such agreements. The functioning of such agreements demands only the additional instrument of a new, gold-based monetary system, which the new terms adopted for the Comecon transfer ruble provide embryonically.

I may add here that the work of myself and my close associates in persistently proposing such measures, since Spring 1974, has directly contributed to prompting the kinds of arrangements lately come to the surface in this connection.

The tempo of these recent steps toward a new monetary system has been accelerated by a shared Soviet and Western European governments' perception of the policies of thermonuclear confrontation and monetarist insanity which would be followed by an administration of James Carter's "Trilateral" controllers. It would be foolish for anyone to attempt to deprecate those facts, or to misread the ironies of current Soviet policies in that connection.

In this matter, the Soviets are operating currently with a strategy of what is for them unprecedented sophistication and daring. Although they are guided, insofar as their present economic policy itself is concerned, by a perception of the soundness of the policy itself, they are pursuing that policy with an energy and tempo reflecting their awareness that this represents the last major option for preventing a near-term general thermonuclear war. The relevant immediate, minimal effect of the consolidation of a new monetary system including the Comecon, Western Europe, and key parts of the developing sector, is to strategically contain a Carter administration to the effect of reducing the capability of a Carter-ruled U.S. for launching a credible thermonuclear provocation. The relevant further implication is that the U.S. will quickly discover that joining such a new monetary system is in its own fundamental strategic self-interest. If the policy option were to fail, then the Soviets would simply fall back upon their current military and civil-defense preparations for an early thermonuclear war.

Leading European governmental and related forces, including leading European intelligence agencies, are energized by the perception that the Soviet reading of the implications of a "Trilateral" Carter administration is entirely correct, and by the certainty that the Soviets are committed, in the last option, to respond to provocation with an immediate full-scale thermonuclear strike against the United States, *followed by* a military occupation of Western Europe. The leading Europeans correctly perceive that the strategic perceptions offered by James Schlesinger and the Committee on the Present Danger are both insane *and professionally incompetent militarily.* Hence, to the extent that the Soviets act with appropriate resolution, and New York City continues to demand its current Kissinger-Vance versions of foreign policy, the Europeans will tend to opt to make peace and economic agreements with the Comecon.

Any other received intelligence perception of the current strategic situation should be discarded as either simple incompetence or lying.

What must be understood is that the Europeans are acting on principles which exactly coincide with the immediate real strategic interests of the United States.

On a global scale, the Comecon should be viewed *primarily* as part of the world factional forces allied in fact or principle (at least) with pro-industrial capitalist factions *for global technologically-oriented expansion of industrial and agricultural production.* The Soviet Union is at the same time a pro-socialist, anti-capitalist state, otherwise encumbered by the heritage of a half-century of existence as a besieged garrison state. This political feature represents an endemic basis for conflict between the Soviets and the pro-industrial capitalist forces. However, for the near term, the potential alliance between the pro-industrial capitalists and the Comecon is *the primary strategic reality.*

Insofar as the Comecon is defined as a group of states, the foreign economic policy of those states coincides in effect with the self-interest of OECD nations as industrial-capitalist states. In that respect, the fundamental industrial self-interest of the Comecon states and the OECD nations are interdependently complementary.

The political conflict between capitalism and socialism, *as an internal feature of* the OECD and developing-sector nations, inevitably intersects the relationship among the two sets of states, but not as might be misconceived in a simplistic way.

First, insofar as OECD nations are concerned, there is no large nominally-Communist Party in any of these nations which is describable as "Leninist." Contrary to what most U.S. conservatives have been induced fearfully to believe, the Communist International was circumstantially foredoomed to fail almost from the beginning, and, as originally conceived, has been a failure in the industrialized countries since at least 1921-1923 in Germany. The most important of the facts bearing upon that is that from the outset the Communist parties — including to a certain degree, the Bolshevik leadership itself — were heavily penetrated by then-British-dominated political intelligence agencies.

Occasionally, conjunctural upsurges within the labor movement have challenged the preponderant control exerted by Atlanticist political-intelligence agencies, and minority currents of a "Leninist" potential exist within some of the European Communist parties. The actual situation is typified, for the Western Hemisphere, by the conditions of the Communist Party USA and Communist Party of Mexico. Both latter today are under the control, top-down, of the neo-Fabian U.S. intelligence cover known as the Institute for Policy Studies (as are the U.S. Socialist Workers Party, the Maoists, and most of the little "radical" sects). On balance, the leadership of the Communist parties of England, France, West Germany, Sweden, and other countries are also linked significantly to the New York Council on Foreign Relations and kindred agencies, through Fabian and neo-Fabian control networks associated with the Woodcock, Kirkland, Brandt, Palme currents of the international social democracy.

The illustrative case of the Italian Communist Party (PCI) is relevant. From 1963-1968 through the accession of the current Andreotti government of Italy, the leadership of the Italian Communist Party was overtly a political intelligence arm of the Rockefeller interests, directly tied to the Rockefeller apparatus, Brzezinski et al., around such points as Gianni Agnelli and the Bellagio Villa Serbelloni estate. Amendola and Berlinguer, the PCI leaders, were close collaborators of the CIA's own Ugo LaMalfa since Allen Dulles' days in wartime Switzerland, and integral to the continuation of the old Atlanticist-controlled circles of such as Togliatti, Lombardo Toledano, Carrillo, Amendola, Leo Bauer et al., circles which predominantly controlled the Western branches of the Communist International during the 1930s.

More recently, the PCI has done an about-face from the pre-June 1976 period, realigning in support

YEARS BEFORE PRESENT	POPULATION (MILLIONS)	RATE OF GROWTH	SECOND ORDER RATE
1,000,000	.125	6x10^{-5}	9x10^{-6}
300,000	1.0	8x10^{-5}	1x10^{-4}
25,000	3.3	4x10^{-4}	3x10^{-3}
10,000	5.3	1.4x10^{-2}	-8x10^{-3}
6,000	87	2.4x10^{-3}	8x10^{-3}
2,000	133	1.2x10^{-2}	2x10^{-2}
300	5	6x10^{-2}	1.0x10^{-1}
200	730	1x10^{-1}	1.0x10^{-1}
160	900	1.2x10^{-1}	5x10^{-2}
60	1,600	1.5x10^{-1}	6x10^{-1}
25	2,400	3.5x10^{-1}	3x10^{-1}
0	33,300	5.0x10^{-1}	

Table shows evolution of per capita energy flows. Time is shown in years before present. Energy in Kilocalories per day per capita, rate of growth as the ratio of growth of energy flow per generation to energy flow. Second order growth is the ratio of the per-generation growth in the *rate of growth* to the rate of growth. (The exponential notation indicates the order of magnitude of the number, thus 10^{-1} is equal to .1, 10^{-2} .01, 10^{-3} .001, and so on.

YEARS BEFORE PRESENT	PER CAPITA ENERGY	RATE OF GROWTH	SECOND ORDER RATE
1,000,000	2	2.0x10^{-5}	4.4x10^{-6}
100,000	5	.8x10^{-4}	1.4x10^{-5}
5,000	12	3.6x10^{-4}	2.3x10^{-2}
500	26	6.0x10^{-2}	4.0x10^{-2}
100	77	1.6x10^{-1}	
0	230	1.5x10^{-1}	

Table shows evolution of human population. Population is in millions and the rate of growth of population and second order rate of growth are defined in table above. Thus, 25 years ago the rate of growth was 35 percent per generation and the rate of growth of this rate was 30 percent per generation.

of Andreotti and the Mancini faction of the Socialist Party of Italy — which is to say, in behalf of the capitalist faction of Eugenio Cefis and his allies.

Marchais, Kanapa, et al., of the Communist Party of France (PCF) are operating openly as agents of the New York Council on Foreign Relations, as French complements to the pro-Atlanticist twins, Giscard and Mitterrand. However, under a Gaullist upsurge into government, the logic of the PCI would be reenacted for the case of the PCF.

Not accidentally, part of the key to such turns by European Communist parties is the current split within the Socialist International. The pro-industrial development social democrats (Callaghan, Schmidt, et al.) are breaking openly with the monetarist Atlanticist social democrats, typified by Brandt, Palme, Mitterrand, Woodcock. The role of the social democrats in NATO intelligence operations, which they share with the conservatives, means that a break of some social democrats and conservatives from the dollar results in manipulating appropriate levers within Communist parties via political-intelligence network routes, to shift those parties' policies around to playing the role of left border-guard for the pro-industrial allied forces of conservatives and social democrats. Our profile-studies of relevant party officials, including reference to their specific links to elements of the intelligence establishment, shows this consideration to be ponderable respecting current factional shifts within social democratic and Communist parties.

The internal situation of the developing sector is overall to be viewed in somewhat different terms. The proper, stable basis for long-term strategic agreements with the Soviet Union is the mutual recognition of some agency such as the Non-Aligned Nations Group as a "third strategic bloc." Thus, to remove the developing sector from all "spheres of influence" conflicts. It must be anticipated that numbers of nations of the developing sector *will tend to* "go socialist" in the long term under such an arrangement, for reasons principally determined by the fact that many of those nations are economically underdeveloped regions committed in policy to high rates of forced capital formation.

The proper "Third World" policy of the United States for a such a situation is as follows. *First*, the policy of investment in the developing sector must become predominantly state-to-state. *Second*, the capital balances accrued by the United States through long-term capital advances to developing-sector states and regional agencies must be located as equity in the new monetary system. Thus, the United States government (Treasury-Federal Reserve) and the government's relationship to the new, gold-based international monetary system provide the financial interface between U.S. firms and their developing-sector clients. *Third*, the non-inflationary policies of the monetary system (low interest, hard-commodity constraints, re-financing loans) and the related durability of that monetary system become prime considerations for a new U.S. foreign policy.

The interest of the United States in the developing sector is to develop and maintain it as massive and growing market for U.S. high-technology exports. This means that the presently monetarist strategic economic policy of the United States must be entirely superseded by an industrialist foreign economic policy.

This is already the thrust of emerging European policy toward the developing sector.

Overall, the emerging trends in European policies divide the world into two primary factions, significantly cutting across national borders. The dominant industrialist currents of Europe, Soviet foreign policy, and the gist of the Colombo resolution represent a pro-industrialist faction. Opposite to this is the monetarist faction centered in lower Manhattan.

This dictates that a conservative-flavored tactical alliance in the United States is in effect allied in self-interest with the emerging factional currents of Western Europe.

Since the monetarist policies proposed by Carter's "Trilateral" controllers would ruin the United States, subvert its Constitution irreparably, and probably destroy the nation in thermonuclear holocaust, we must not regard European actions against the dollar monetary system as contrary to our national interest, but rather as an invaluable development forcing the United States to dump the Carter cancer and express its actual self-interest.

The Doctrine of Energy

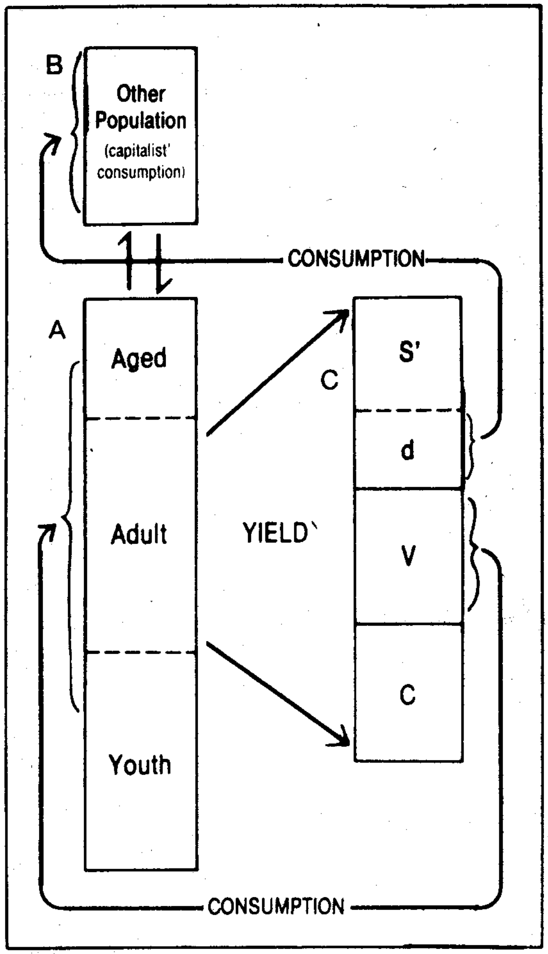
The crucial distinction of human existence, the historical fact which absolutely distinguished mankind from lower beasts, is that we have developed from a baboon-line culture during the Pleistocene — with an ecological population potential then in the order of a million or so — to a population approaching four billions today. This has been accomplished without any genetical alteration of our biological characteristics since the neolithic period (at least). The entirety of this achievement has originated in the potential of the human mental processes to make scientific discoveries, to progressively, voluntarily alter the mode of production and social institutions.

These advances in human culture are directly and necessarily correlated with increases in the effective energy-density of production and household consumption. (*See accompanying chart and description*).

This increase in energy-density is necessary for continued human existence. All modes of human existence depend upon what may be broadly termed "resources." Such "resources" are not absolutely defined for humanity for once and for all. What constitutes a resource is a relative matter; it is a resource in terms of the implicit technology of existing modes of production and existence. However, any such set of resources is inherently relatively-finite in both aggregate and in density of availability. Hence, all modes of existence, the longer they persist on even a fixed scale, deplete the material basis for continued human existence in such a mode. This predicament is surmounted only through technological developments which redefine resources. Since human development is negentropic, one may say that all solutions to the apparent limits problem have the characteristic form of increasing the per-capita "reducing power" of the society, of increasing the number of calories of energy per-capita disposable for production.

It is in this way that human creative powers, insofar as they are effectively realized to solve such problems of development, represent a line of self-development of human practical knowledge *such that creativity correlates with negentropy.* That appreciation of a rigorous process of creative progress in human knowledge converts the evidence of human technological progress into the body of fact upon which the notion of *science* is properly premised.

Man's dominion over nature is not embodied in the image of a super-jock seizing a club to beat the elephants and rhinoceri into attitudes of submission. Man's mastery of nature is, in effect, man's creative mastery of the fundamental laws of the universe, as practically proven to be a mastery through the rising energy-density of advancing modes of production and existence. Wittingly or not, as our ancestors applied their distinctively human creative powers to innovate superior forms of production and existence, they were proving that such creative processes of mind were mastering the



The Process of Social Reproduction: Bar *a* represents the totality of households from which productive agricultural extractive and manufacturing labor are obtained,i.e. the two classes of *farmers* and the *working class*. Bar *b* represents the classes who do not contribute directly to production principally composed of capitalists and various petit-bourgeois strata which act economically as employees of the capitalist class in production and in the administrative and service functions of capitalist society. Also included in bar *b* are the marginal populationsnotably including aristocrats and lumpenproletarians.

Within bar *a* the "youth" represent those who according to existing social modeshave not yet been matured to the level of productive workers. The "aged" represent those who also according to existing social practices — rather than any absolute biological distinctions — are not practically included in the age group corresponding to regular productive labor. A percentile of the age group lying between those two categories is the existing productive labor force.

Bar *c* represents the totality of productive activity of society. This totality produces an output of wealth which is divided into three principal categories. *V* is the portion of the total product required to maintain all households of the productive classes at the level of consumption and quality of leisure required to produce labor of the quality required for modern productive technologies. *C* is that portion of the total output which must be allocated to maintain factories machines tools natural resources improved agriculture and so forth in a condition of equipotentiality for continued production on at least the same whole scale with technologies at least as advanced as those presently existing.

These are the "prime costs" of simply reproducing the existing wealth-creating capacities of society. The residue of total production of society *S* is social surplus. Of the net social surplus *d* represents the portion which is appropriated by the non-productive classes for their household consumption and also the "capital goods" consumption (office buildings, computers,military equipment,etc.) of those classes' included activities. The remainder *S'* is the portion of the product which is available as absolute profit for productive expansion (See Lyn Marcus — a.k.a. Lyndon LaRouche — *Dialectical Economics* D.C. Heath 1975 for a fuller elucidation).

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most fundamental laws of the universe in practice and that science conceived in such terms of reference was a conscious mastery of the laws of the universe.

The current proposals for "de-industrialization" disabuse any rational observer of the illusion that current U.S. energy policies have the tolerable, limited objective of a more frugal and efficient use of energy. On the contrary, the obvious intent of the Naders and the Harringtons is to whip the United States back, in the direction of the Paleolithic.

The argument for "de-industrialization" — as a purported "full employment measure" by such dupes of Raskin and Rauh as Ed Sadlowski, Alperowitz, et al., is as follows: *Point One*: There is a sharply-curtailed amount of capital available. *Point Two*: if this capital is allotted to employment in technologically-advanced production forms, there are high rates of per-capita capital requirements. *Point Three*: if the same capital were distributed to create labor-intensive pick-and-shovel work, it would create more jobs. *Ergo*: technologically-advanced industries cause mass unemployment!

Such "full employement" policies mean, curiously enough, absolutely no jobs at all for workers in the steel union which Joe Rauh intends Sadlowski to command.

Such creatures as Joe Rauh, Harrington, Ed Sadlowski, and Gar Alperowitz, having exhibited their dedication to reaching the labor-intensive utopia of the baboon, ought in all compassion to be rushed to the nearest zoo to directly join the company of baboons on exhibit, and should not be attempting to turn the Halls of Congress into a bestiary by their legislative proposals.

In light of the most essential facts concerning the human species, our national energy policy must be dedicated to accelerating the available per-capita energy on a global scale. Respecting the nature of the process by which such results are to be obtained, the general approach for this purpose is to accelerate the effort dedicated to scientific research and development of the next available general breakthrough in energy technology.

What we require is cheap energy in abundance, to the end of increasing the number of calories per capita in production and household consumption, *thereby making possible increasing social productivity.*

Productivity

The most effective pedagogical device for analyzing the problem of social productivity is, from our experience, the accompanying bar-diagrammatic method. This approach states the relevant background knowledge on the basis most suitable to defining the problems of energy policy more profoundly — and more rigorously.

If we examine the constituents of the right-hand bar more closely, comparing successive epochs of production for the condition of development, the following notable considerations are evoked. If we measure the technology of production and household consumption in terms of caloric parameters from epoch to epoch, the following observations occur.

First, the caloric cost of the same bill of production rises for successive epochs, as the depletion of defined resources secularly increases the number of calories required to obtain the equivalent produced amounts — a secular tendency for increase in the "reducing" ratio. Therefore, the per-capita caloric content of production for successive epochs increases secularly even for fixed technology.

Second, to effect increases in per capita output, caloric throughputs must proceed at a doubled rate, one part to offset "reducing" ratios, another part to accomplish a net increase in per-capita output rates.

Third, improved technology requires an increased "fixed investment" in the material preconditions of production — tools, soil improvements, etc., whose maintenance becomes an added element of production cost. Hence, unless such capital improvements costs are to absorb production output increasingly to the effect of nullifying gains, productivity in man-hour and caloric rates per man-hour must increase to the effect that the combined per-capita cost-ratio of production is either maintained or declines as a consequence of additional improvements in technology.

Fourth, advances in technology correlate with required improvements in material and cultural conditions of household life, an increased cost which must be absorbed by offseting increases in technology.

Hence, the precondition for rising social productivity is *a secular exponential tendency* for increase in per-capita caloric through-put rates. ***This is also the general precondition for successfully continued human existence.*** The historical fact that technological innovation has accomplished such results *crucially demonstrates* the appropriate "mathematical physical" interpretation of the predicated effects of that sort of creative mental activity we associate with scientific discovery.

It also demonstrates, as a corrollary, that the fundamental lawful ordering of the universe is in conformity with such negentropic qualities of the mental creative process.

The Relevant Notion of Energy

This point, first developed by the Labor Committees in respect to political economy, produced the modified Riemann-Cantor notion of a *transfinite* ordering which underlies and permeates the Labor Party's economic-theoretical analytical and related programmatic work. However, although first developed and proven as specifically an economic-theoretical conception, this notion was not pursued in ignorance of the fact that the same conception had a direct, proper relevance for theoretical physics. Consequently it was not accidental that Labor Party physicists and biological researchers have made contributions to those fields along these same lines.

The application of this modified Riemann-Cantor notion of *primary negentropy* has found crucial experimental corroboration in phenomena of energy-dense plasmas, and is thus situated on the frontier of physics development. The demonstration of the principle affords us the rigorous basis for formulating science-technology policies appropriate to increasing national and global social-productivity.

We know, on the condition that such heuristic notions of a negentropic ordering in energy-dense plasmas are applied to broadened and accelerated basic scientific research and development of controlled plasmas, that the economically required results can be secured on condition only that the scope of the program and intellectual motivation of researchers is sufficient to that effect. We may also anticipate that by some time during the 1980s, such a program will have enabled us to escape the paradoxes inherent in a Maxwellian physics, and begin the theoretical elaboration of a new physics, and correlated new biological science. (The latter ought to be obvious: the primary solution to the physics of living processes must be found, uniquely, in the course of a rigorous effort to locate in the relevant molecular processes those organizing features of sub-processes which correspond to self-organized energy-dense plasma.)

We also know with absolute certainty that unless such a program is undertaken the human race is self-doomed by omission.

The Minimum Tactic

There ought to be two facets of energy policy from which no retreat is tolerated. These are, first, a commitment to accelerated and broadened "fusion" research and development, with a complementary fossil fuel and nuclear energy development program to bridge the period between now and targetted mid-1980s bringing of "fusion" energy sources on line. Second, there must be an absolute defense of our existing electronics and aerospace capacities, viewing this as a tactical approach to defense industry as whole through a focus on the technological frontier of current industrial development.

The two facets are obviously complementary, since the electronics and aerospace industries are an outstanding resource for fusion-related development projects and the automatic channel for realizing the many by-products spun off from fusion development efforts.

To begin with the most obviously economic feature of this approach, we must stabilize the development of our electronics and aerospace industries by minimizing their dependence upon the capricious faucets of the Department of Defense budget. They must be reoriented in emphasis to stable domestic capital goods markets and to export roles.

A proper approach to such a policy is adduced more effectively by examining more closely a prominent included feature of those industries as a whole.

In the history of capitalist industrial development, significant technological innovations tend to occur relatively as a feature of small, privately held firms committed to such innovations and innovative product policies, whereas efficient, large-scale production in terms of established technologies is properly the province of large-scale firms. Inevitably, the post-war history of the electronics and aerospace industries freshly illustrates that principle.

In part, the innovative capabilities of large firms could be improved by remedying some of the worst habits of bureaucracies. Even so, the specific role of the smaller high-technology enterprise would persist. Of course, a compromise exists in the creation of semi-autonomous pioneering sub-units by large firms. Such useful topics noted to that extent, the relevant fact of the electronics and aerospace industries is their organic capability for the general function of transforming new discoveries, often through the mediation of new and smaller firms, into large-scale applications. Not to deprecate the innovative role appropriate to other sectors of industry, the electronics-aerospace is the endoderm of the American industrial potato, the place where the technological progress of industry as a whole will most probably occur.

Thus, the electronics and aerospace industries complement the vital machine-tool industry and advanced features of the petrochemical industries in providing this nation with its vital tool-making capacity — in the appropriate, general sense of tool-making. Without those industries, and without expansion variously focussed in and mediated through those industries, our economy is headed downhill.

This conception of those industries, superseding the too-narrow "electronics" and "aerospace" rubrics, locates their proper evaluation for purposes of national policy respecting domestic capital-goods and export markets.

Fusion Education Policy

In respect to the science departments of universities and to private research laboratories, a broadened and accelerated fusion program has obvious by-product benefits, the only efficient means in sight at the moment for saving those vital institutions from "triage." This aspect of the matter must be examined in greater detail here.

The fallacy of current ERDA policy is that it focuses its fusion task orientation upon the narrowest options. This paring away of other actual and potential options undoubtedly saves in apparent, paid-out costs of the program, but also thereby ensures that the program as a whole is foredoomed to fail.

An associated problem of Federal legislative and Executive branch agencies, of which those bodies must rid themselves, is the misguided practice of evaluating scientific programs in terms of line-by-line cost-benefit evaluations. In scientific work, most of the essential lines of investigation and experimental development have no firmly predictable specific benefit, yet all of those activities, including those which subsequently appear to have failed, represent in aggregate the essential program, without all of which the benefits of any one particular line become doubtful.

In basic scientific research, the scope of the research problem breaks down, in detail, to a profile-collection of numerous particular topics of specific research and experiment. Successful outcome of the effort as a whole ironically depends crucially upon the ostensible failure of most of the projects so detailed. The pattern of resulting ostensible successes and failures, taken together, is essential to the efforts of the scientists, in the respect that this discovered pattern defines more or less exactly where the solution lies.

In respect to fusion work, Bardwell's observation in referring to a list of relevant reported observations shows how disastrous the traditional line-by-line cost-benefit approach must tend to be. The negentropic "non-linear effects," which Soviet work in particular has shown to be potentially (in two senses) of the most devastating importance, have been viciously overlooked because those phenomena were contra-indicated by the specifications of research budgets and relevant administrative policies.

Just to exploit the shock impact of connecting such matters to their weapons systems implications, the ionosphere is an energy-dense plasma characterized by processes of precisely the sort U.S. researchers have predominantly viciously overlooked. Laser or ion beam stimulation of the ionosphere causes the latter to act as a negentropic energy-dense plasma, amplifying induced signals by factors ranging from the order of 1,000 upwards toward "n." (The military applications of that ought to be obvious enough!)

In general, this illustrates the point that fusion programs must authorize pursuit of all surprising, repeatable special phenomena. If that policy is not established and maintained, the alternative policy of line-by-line cost-benefit predetermination virtually assures that the program will reach a dead-end as soon as experiment overturns one crucial hypothetical assumption of the funded narrower program.

The proper approach to realizing fusion breakthroughs is a broadly based stimulation of all relevant sub-areas of basic scientific research around a task-oriented emphasis on the importance of contributions to feasibility of more effective forms of fusion breakthrough. Every included line of inquiry which has scientific merit for investigation should be sponsored on the sufficient premise that the investigation has scientific merit.

Most of the benefits of such a broad spectrum of research perhaps will not prove to bear directly upon specific solutions to fusion breakthrough. They will however contribute to our fundamental knowledge of physics, and will thus lead directly to an unforseen range of producible benefits. Consequently, by illuminating what was previously terra incognita for physics knowledge, they will contribute indirectly but nonetheless in most essential way to fusion breakthrough.

As we have already emphasized, the recommended discarding of the line-by-line cost-benefit approach does not mean that we shoot wildly in the dark. We shall not fund development of square wheels — our national rail and urban rapid-transit systems already represent adequate experiment with square, elliptical and indifferently-shaped wheels. We shall not fund "flat earth" research, ESP projects, nor "socially-relevant astrology for sodomists." The failure of fusion experiments to "scale" according to digital computerizable projections, and the correlated observance of the crucial role of non-linear effects shows us in a delimitating way where the general possibility of fundamental scientific breakthroughs lies.

We should simultaneously crank up the effort to develop workable systems premised upon classical affine theoretical assumptions respecting the geometry of physics, and also push with equal or perhaps greater emphasis on experimental areas pertinent to non-linear effects. By looking for new paradoxical effects within cranked-up, epistemologically more simply-conceived experimental systems, and by simultaneously developing our knowledge of the underlying common features of negentropic and other "non-linear" anomalies of energy-dense plasmas in general, we shall catch the desired approximate and more basic solutions to the task in between these two approaches.

For such an approach, the nation is presently faced with a shortage of required scientist and engineering cadres and facilities available for such an effort. The shortage of trained cadres and facilities ought to be recognized as the principle immediate bottleneck. From the standpoint of programs of unquestioned scientific relevance and merit, we could commit billions annually to this effort. Unfortunately, the cadres and facilities required for broad-spectrum research on such a scale are not presently available.

It is useful to compare USA and Soviet statistics for the period beginning approximately Autumn 1962. There are two yardsticks to be applied to those data. First, one should consider the relative scales of total scientific and engineering cadres, with note of included distinctions respecting the areas of basic research and forms of research. Second, one should compare the data for scientists and engineers trained per capita of the available urban labor force and, by type of occupation, as a ratio of such cadres per capita in respect to the numbers of skilled and semi-skilled operatives in manufacturing, mining, and transportation.

From such observations one must properly adduce trend-lines. Evaluating such trend-lines against information concerning categories of research and development breakthroughs, we see that under existing trends the USA is reaching the point of relative depletion of accumulated previous comparative advantages, whereas the Soviets are beginning to realize the first wave of advances portending categorical superiority to the USA.

Even from the narrow standpoint of maintaining parity in dimensions of qualitative categories of strategic weapons systems, the USA would be obliged to immediately reverse post-1966 trends in production and employment of scientific and engineering categories to maintain intermediate-term strategic technological parity in systems. This emergent advantage of Soviet militarily relevant technology is now chiefly masked by the developed capabilities of our established electronics and aerospace industries. The demonstrations and commercial proposals by Soviet physicist L. Rudakov aptly underline precisely that latter irony of the momentary situation.

New dimensions of global weapons systems is not the direction any informed person would propose for USA-Soviet relations over the coming period. From what we already know in this connection, the implications of emerging new dimensions of global weapons systems is awesome, horrifying beyond anything which has yet impressed itself upon the informed non-specialist. However, insofar as the military technology heurism helps to make the relevant point more forcefully, the reference is appropriate here.

Military points aside, we are doomed as an industrial power unless we immediately reverse the post-1966 trends in training and employment of basic scientific and engineering cadres. Since such a policy perception positively intersects the requirements of an accelerated and broadened fusion program, the indicated fusion program becomes obviously the means for killing the proverbial two birds with one stone.

For the present near-term circumstances of austerity, de facto Federal higher educational fiscal policy ought to be to direct flows of funds into scientific and related training and research of universities, "triaging" existing liberal arts program subsidies to the degree necessary to maintain the indicated priorities. Physics, chemistry, biological research and agronomy, plus engineering and related professional skills ought to be the narrowed area of priorities, scuttling subsidies — whether direct or indirect — for "socially relevant higher basket-weaving," "touchy-feely group therapy," and even less exotic political science programs.

The socio-psychological effects of such an educational policy are warranted by the facts of current education, and by the positive contribution made to the fusion and related programs of national interest. We sorely need to reestablish a Renaissance-Enlightenment trend of work-ethic and individual social identity in this nation. By withholding subsidies from liberal arts areas now-heavily contaminated with Fabian corruption of the moral fibre of the nation, and by establishing economic and personal prestige incentives for improved technology of productive skills and in the scientific and engineering professions, we must influence the psyche of the nation away from a "service economy" of stagnation, waste and demoralization back to a "productive economy."

This should not be viewed as an anti-humanities policy. Rather, given the proliferation of refuse within departments of political science, sociology, anthropology, psychology, and so forth, the problem of sorting-out the good from the garbage in university curricula ought to be left for a time to the play of the "open marketplace in ideas." The Federal and state governments, guided by the influence of major private foundations, have been induced unfortunately to displace relatively competent instruction in the liberal arts by outright refuse, under the holy "liberal" name of social relevance." If the recipients of such liberal arts programs were obliged to pay for their education from limited means, one doubts that academic instructors in "socially relevant" exotics could have found a significant portion of the student population prepared to defray their salaries.

No doubt, as a nation, we are moving secularly toward extending public free education to the undergraduate institutions. In respect to science and certain other professional programs urgently in the national interest, we should accept that perspective-tendency for present direct and indirect aid to such programs. Yet, at the same time, let us gain some incidental benefit from these hard times by using the effects of the present monetary crisis as an opportunity for inducing the liberal arts departments to clean out the material which causes them to resemble the condition of the notorious Augean Stables. For "socially relevant higher basket-weaving," for "touchy-feely approaches to educated sodomy," the Federal and state governments should not pay.

Workers Education Policy

The Labor Party is presently working to develop a short curriculum which might be entitled "Basic conceptions of science introduced through crucial experiments." Such work by the Labor Party and by other agencies could make possible a low-cost but effective "adult education" program conducted through industrial firms, trade unions, with aid from relevant universities and industrial firms' in-house specialists. What are required are standard educational materials, instructors and classroom facilities readily, cheaply available at minimal incremental cost in plants and other suitable locations. A similar approach should be fostered for use of available facilities to provide such courses for unemployed and other adults throughout the nation. A basic presentation of the essential conceptions of the development of 19th century science should be supplemented by science and technical information education of demonstrable relevance to the same population.

Such programs should be immediately directed to upgrading the conceptual competence and motivations of the labor force *in the tradition of Gresham College.* They should also be intended to foster motivations among young adults for undertaking some form of technical education, and to aggregately neutralize the mental and moral Fabian diseases of "post-industrial society" and "zero-growth" ideology. Used in industrial firms and trade unions, such programs establish a foothold for broader programs directed to upgrading technical skills of the labor force, with obvious benefits in quality control, on-the-job problem-solving performance and upward mobility of employees.

The Transition to a Fusion Energy-Based Economy

From the standpoint of competent economic analysis, there can be only a very narrow range of choice for possible U.S. and global energy policies. These choices are defined by the conditions that, if the human race is to survive this century, controlled thermonuclear fusion power must be operating on a large scale by the mid-1980s, and in the interim period, oil, gas, uranium, and large portions of coal reserves must be exhausted in the course of generating overall world energy growth rates of not less than 20 per cent per year.

The reason for these conclusions, which sharply contradict projections of energy requirements and use emanating from the Rand Corporation, Herman Kahn, and others, stems from the necessary conditions for achieving rapid progress globally in science and technology and in the industrialization of the presently underdeveloped sectors of the world in the next 5 to 10 years.

From an economic standpoint, such policies of growth are essential to avoid the rapidly growing threat of plagues and related ecological crises which loom as a result of the global austerity policies being enforced by the World Bank and International Monetary Fund.

More importantly, if the political decision to adopt a policy of growth is put off now, the effects of the de-industrialization and austerity policies being advocated by the backers of Jimmy Carter will make it politically and economically impossible to adopt such policies in the future.

Within the necessary policy of growth, global energy consumption must be gauged to correspond to the necessity of exhausting existing energy resources sufficiently rapidly to create the per capita rate of energy consumption and standard of living required by a population whose skill levels are appropriate to the next necessary phase of human technological advance.

The problem today is to plan the transition to the economy which must exist after the exhaustion of currently available energy and mineral resources. The fundamental technologies in this economy will be based on what is called plasma processing. Once relatively high grade mineral ores are exhausted, there will be no feasible alternative to current methods of extracting and refining raw materials other than methods based on plasma separation, a process capable of utilizing the millions of times greater mineral reserves contained in very low grade ores. Plasma processing involves the transformation of ores into high-temperature (10,000 degrees C or more) charged gases, or plasmas. In this state, the elements of the ore can be easily separated by electromagnetic means.

Such a plasma-based economy will require a global workforce capable of dealing with technological levels comparable to and beyond those found in the most advanced sectors of U.S. industry today. Consequently, the standard of living minimally required by such a work force will have to be approximately equal to that of a skilled American worker at present. The per capita energy and per capita materials consumption for such a standard of living is about 15 times that of the world at present (or about 37-40 kilowatts per capita). And, this per capita level of energy production and materials exploitation must be achieved as a *prerequisite* to a transition to a plasma economy.

Once a plasma economy actually exists, since energy densities and associated temperatures will have to be at least three times higher than for present materials processing, per capita energy consumption will have to rise to at least 40-50 times present levels.

The basic fallacy in the widely circulated "systems analysis" approach to projections of energy requirements, as in such nonsense as the Rand studies, is that this approach critically ignores the necessity of raising the labor productivity of the population to the level required to man needed higher levels of technology. Such analyses therefore neglect the necessary increases in standards of living and accompanying higher per capita energy consumption which are needed to produce an adequately skilled labor force. Thus, Herman Kahn projects a fusion-powered society manned by a population fed on 2000 calories a day of synthetic food — a society which can only exist in the fertile imagination of squid-popper Kahn.

Why Fusion

In such a plasma technology-based economy, the only possible energy source is controlled thermonuclear fusion.

The most often proposed "alternative, inexhaustible" energy source — solar power — is absurd on its face. While in the long run, deep space solar energy platforms in the neighborhood of the sun can exploit the very high energy densities emanating from the sun, such massive space engineering is out of the question in the near or even medium-term future because of the tremendous investments involved. Solar energy on earth is ludicrous because of the extremely low energy densities involved: solar energy is so diffuse that a single generator capable of providing New York City with power at today's levels of consumption would cover four times the area of the city and weigh more than the Great Pyramids!

Nor would nuclear fission be an adequate alternative energy source for a plasma economy. Since fission processes do not operate at sufficiently high energy densities and temperatures to produce plasmas directly, energy concentration methods would be required which would raise total energy requirements by a factor of at least three times over that required for fusion, which does produce a plasma directly. Not only would this tremendously increase the cost of energy over the cost of fusion, it would exhaust uranium supplies in a few years.

Even using breeder reactors, which can utilize natural uranium and thorium as fuels, existing uranium ores will not provide more than a 600 year energy supply at the current rate of use, or less than *four years* at the expected rates of a plasma economy. Uranium and trorium are so rare in the crust of the earth and in the oceans that it is exceedingly dubious that plasma extraction of fuel by this method would provide sufficient fuel to produce net energy.

In contrast, an advanced form of fusion reactor, using deuterium as its fuel, would provide sufficient energy for several million years at the projected rates of consumption. Even the more primitive deuterium-tritium fusion cycle, in which the tritium is produced from lithium, would be capable of extracting virtually unlimited supplies of lithium from the earth's crust, because of the far greater abundance of that metal than uranium. The development of fusion reactors which exploit the far more energy-dense self-organized plasma phenomenon now being studied by scientists, a "second generation" of fusion reactors, would be capable of reducing capital and labor inputs to the production of energy by several orders of magnitude.

The slower the rate of growth and the longer the period taken to achieve the necessary "threshold" of energy production, the greater the amount of current resources that will be consumed. Currently available resources of ore recoverable by present technologies do not much exceed 300 years' supply at present consumption levels. Total reserves of energy in fossil fuels, including coal, are also not much more than the energy equivalent of 300-400 years of current use. Assuming a minimal population growth rate of 2 per cent per year, it is easy to calculate that a full advanced-fusion economy will have to be achieved in no more than an absolute maximim of 23-25 years, or by the end of the century, and the minimal average rate of growth of energy consumption must be appoximately *18 per cent per year*. Otherwise, all existing resources will be used up before the conditions for the new technology are achieved.

The Transitional Energy Policy

Such seemingly enormous rates of growth, and even rates somewhat higher, are demonstrably achievable once the very large idle capital resources of the advanced industrial sector, especially the aerospace and defense industries, are mobilized.

During the period of transition to fusion-generated power, the basic policy must be the fullest exploitation of existing resources and, simultaneously, the maximization of the rate of economic growth through the maximization of labor productivity. The subsumed policy problem of this transition period is one created by the relatively high labor intensity of coal production and the relatively more limited available reserves of oil and natural gas. Because of the high degree of capital investment in coal extraction even under high-technology conditions, it is economically impossible to switch over to a pure-coal economy using coal gasification or coal powder technology after the exhaustion of oil and natural gas reserves without simultaneously massively and dangerously reducing the rate of economic growth. Further, the full exploitation of coal reserves (approximately 20 times larger than oil and natural gas reserves) would create major problems in the disposal of tremendous quantities of carbon dioxide waste, quantities far too large to be released into the atmosphere. Therefore, the use of coal in a transition period would necessarily be limited to those uses for which it has inherent compensating advantages over oil and natural gas — the production of steel, and, in areas of high coal reserves, the production of electricity.

Since, for these reasons, coal reserves are not fully exploitable, the real deadline for the transition to fusion is established by the exhaustion of far smaller reserves of oil and gas, supplemented by limited use of coal, nuclear fission and hydroelectric power. With this additional consideration, total usable energy reserves are reduced to the area of 100 years supply at current rates of consumption. To achieve even a simple fusion power-based economy, prior to a full transition to an all-plasma technology-based economy, per capita energy consumption of at least eight times present levels will be required. On this basis, simple calculations show that the transition to fusion will have to be substantially complete by 1993 at the latest, requiring average rates of economic expansion of 21-23 per cent per year even if all oil and gas reserves are fully exhausted. This implies the first coming on line of substantial amounts of fusion power no later than the late 1980s and the successful construction of a prototype reactor by 1982-83.

The only possibility for stretching the introduction of fusion power substantially beyond the exhaustion of oil and natural and gas fuels is through the expanded use of nuclear fission. Present light water reactors, based on the limited supply of U-235, have far too small potential energy production, only a few years at present world rates of energy production, to be of direct use. Fission breeder reactors can supply a hundredfold greater energy output through the breeding of plutonium from natural uranium. However, the rate of production of fuel, an increase of 8-10 per cent a year, is still far too slow to fuel the transition economy, growing at twice that rate.

If it becomes necessary to push back the introduction of pure fusion, the only available alternative would be the fusion-fission hybrid breeder, in which a primitive fusion device supplies neutrons for the breeding of fission fuel for standard light water fission reactors. Such hybrids could even use existing fusion devices. Due to the higher energy densities of the fusion process, this breeding process occurs at a six times faster rate of growth than fission breeding and will create sufficient fuel to postpone, if necessary, the transition to a full fusion economy by about five years, until the late 1990s. However, this would imply no substantial difference in rates of economic growth, since approximately the same skill levels are required for a fission-fusion hybrid economy as for the early stages of a pure fusion economy.

In all likelihood, such a resort to a hybrid transition will not be necessary, although it could be decided on as late as 1980-81 if development work is continued. Reasonably optimistic estimates of the results of a crash fusion development (along the lines authorized by the proposed Fusion Energy Research and Development Act of 1978; see below) would lead to the development of a working prototype by 1980, the initiation of a fusion transition by 1985, and its completion by 1990, a good three years ahead of the minimal schedule. Similarly, maximal rates of economic growth which are achievable over the course of the next decade are definitely in excess of the minimal 21-23 per cent rates.

Thus the overall conclusion which can be rigorously drawn is that the initiation of the widespread use of fusion energy is an absolute necessity, either in pure form or in the form of a hybrid with fission, by 1985-88 at the latest, and that a 20 per cent rate of growth in energy production must be maintained during the interim. Anything less will result in large scale resource shortages or shortages of skilled labor and economic debacle within a decade.

The Details of Transitional Energy Policy

These considerations define the context for a fairly detailed projection of energy consumption and production over the next 10-15 years. Calculation undertaken by the U.S. Labor Party staff have demonstrated that industrial growth rates of immediately 15 per cent per year and rising to 50-60 per cent per year by the end of the transition period for the world economy are possible. Industrial energy consumption in a rapidly growing economy will come to be dominated by the requirements of the main materials of the construction and machinery industries — steel and concrete, which together consume nearly 45 per cent of all energy. This is followed by the chemical industry and much smaller contributions of energy production to the machinery industry and agriculture.

Transportation energy uses are projected to grow at a considerably lower rate, since the systematic substitution of rail and magnetic levitation for auto and truck transport will tend to decrease the very large manpower and energy waste currently involved in the transport sector.

Because of the increasing role of steel production, the role of coal in overall energy production will tend to increase, despite its relative disadvantages in terms of productivity. Coal-generated energy will rise from about 25 per cent of all energy to about 40 per cent and will account for a large share of electric generation as well. In addition, the Jordan Process will allow, as a free by-product of steelmaking, a large amount of liquid methanol fuel production.

Conversely, energy output from oil and natural gas, mainly devoted to household use and the energy dense process industries, will decline in relative importance from 75 per cent to 55 per cent of output while rapidly increasing in absolute production, to levels of about six times present natural gas production and 3.5 times oil production.

Fission energy from conventional light water reactors can contribute a significant amount to the remaining needs for electricity production. At present prices, in fact at any oil prices above $3 per barrel, fission-produced electricity is fully competitive with any other source; with oil at $11 per barrel, fission-produced electricity is about 30 per cent cheaper than oil. Again, however, limitations on known uranium reserves, no more than 3 million tons, limits peak production to not much more than 15 per cent of world electricity output or 3 per cent of the total energy supply.

Present plans for nuclear plant construction already discussed in the major nuclear power-producing countries in fact already provide for about 3 per cent of total world power — .5 trillion watts — being produced by nuclear fission by 1985. The use of reprocessing of spent fuel, well worthwhile economically , could increase this production by perhaps as much as 50 per cent. However, it is clear that nuclear fission cannot, on a world scale, become a major contribution of overall energy supplies, although it certainly will be in certain regions of the world, in particular Europe.

Hydroelectric power supplies can in much of the underdeveloped sector be vastly increased — potentially rising twelvefold to as much as 3 trillion watts or 6 per cent of total energy supply. Despite its relatively high capital cost, the very high rate of efficiency of hydroelectric power will make its exploitation frequently economical for those countries which can make use of it without interfering with agricultural use of water.

Through such a policy of rapid energy growth, by the end of this period the global standard of living will be elevated above the present level of the United States and the future of the human race will be ensured.

The Northeast's Contribution to a Growing World Economy

The Northeast region of the United States has been targetted by leading advisors to the Jimmy Carter Administration for subjection to a calculated program of de-industrialization and destruction of the region's advanced scientific potentials. This program has been recently articulated both by the Coalition of Northeastern Governors at their meeting in Saratoga, N.Y. following the Nov. 2 presidential election, and by the Northeast-Midwest Economic Advancement Coalition led by Rep. Michael Harrington (D-Mass.).

The battle against this de-industrialization, and for the renewed development of the high-technology of the Northeast region, must become the spearhead of the battle to align the United States with the developing international movement towards formation of a new international monetary and credit system that will make possible rapid global industrial and technological expansion. The combined scientific, technical, and productive capabilities of the Northeast's electrical, aerospace and defense sectors represent the highest concentration of advanced technological know-how in the U.S., whose contribution is vital to the modernization of U.S. industry and to the industrialization of the developing sector. If Carter's backers succeed in their stated intention to destroy the Northeast's concentration of high-technology capabilities, not only will U.S. and world productive capabilities be crippled, but their success will become the model for a similar assault on the potential for industrial development represented by the manufacturing capacities of the closely related aerospace and defense sectors in the Far West and Southwest in particular, and advanced industry in the U.S. generally.

To allow such a dismantling of advanced industry is to put the United States on a course toward the medieval barbarism of work as physical labor and science replaced by astrology and superstition.

The center-piece of the de-industrialization proposals for the Northeast is a program for energy austerity, savings, and "independence" from foreign oil. Since last Spring, the Federal Energy Administration has been restricting deliveries of refined *domestic* oil to the Northeast region both to protect the markets of the multinational oil companies and to lay the "objective" basis to enforce an energy-austerity program. As expressed at the Saratoga, N.Y. meeting, if the Organization of Petroleum Exporting Countries failed to announce a drastic oil price increase at its December, 1976 meeting (OPEC in fact announced only a minimal price hike, coupled with an ambitious program of oil-for-advanced-technology deals with advanced sector nations), then the forces represented at Saratoga would themselves take whatever measures were necessary to impress upon the public the need to restrict energy consumption.

Engraving on this 1825 West Point diploma emphasizes the school's commitment to training scientists and engineers.

Whatever the public propaganda of the NMEAC and Coalition of Governors may mention about coal gassification, solar or other "renewable" energy resources, which are admittedly totally insufficient for industrial and consumer needs, the implementation of even these energy programs would require a level of capital investment which, in the present context of the bankruptcy of the dollar system, can only be generated by imposing measures to drastically cut the living standards of the U.S. population.

In particular, the use of labor-intensive coal mining to replace oil and gas, as proposed by Pennsylvania Governor Milton Shapp and others, would not only cripple New England's capital-intensive, oil-dependent industry, but, by increasing labor intensive labor, would both increase energy costs and destroy the basis for high technology techniques. Coal production must in fact be increased, but only by means of capital-intensive methods (see below) and only in conjunction with increased consumption of other forms of energy.

At the same time, the proposed Regional Energy Development Corporation, backed by $15 billion in federally-guaranteed bonds, will deliberately bankrupt the aerospace-electronics industry in New England, which is too energy-intensive by the Corporation's standards.

The public rationalization for this plunge back to the Middle Ages is the creation of jobs for the region's unemployed. According to the Carter forces' simple logic, as people lower the temperature in their homes to save fuel, they will save enough money to stimulate consumer buying which will in turn create 100,000 jobs!

The industrial base of New England has indeed been in a state of decline, along with the bulk of American industry, particularly since the end of World War II. However, the scientific and technological capability of New England, historically always the region's most important contribution to the development of the American economy, benefitted in particular from the U.S.'s commitment to the late-1950s-to-late-1960s program of space exploration, and from the less-productive post-war program of arms and weapons development. The scientific and technological spin-offs from these national programs have brought

U.S. industry to a point where it is now on the threshold of a revolution in computerization and automation of basic industrial processes and, most importantly, the leap to a new energy source—controlled thermonuclear fusion—which will make that technological revolution possible.

It is from this standpoint that the revitalization of the Northeast must take place, that the fight to immediately protect New England's scientific capabilities from dismantling by NMEAC must be mounted. It is the Northeast's historic and present potential contribution to U.S. and world development of advanced technological methods that defines the necessary program for development of the Northeast.

A Tradition of Excellence In Education

The basis for the Northeast's present and future contribution to scientific and technological progress is its continuing tradition of scientific education.

The establishment of the major scientific institutions in the century of the American Revolution from 1763 to 1863 took place exclusively in the New England region and was based on a commitment to the Renaissance conception of science as the foundation of a developing culture. The scientists and political thinkers who founded and fought for these institutions saw in America the possibility to further man's mastery over nature and his understanding of the physical universe spurred by the American people's commitment to progress. They saw their place as the leadership in the development of the U.S. frontier, the fight for economic freedom from Britain, and the struggle for freedom from the industrial and technological stagnation of Europe. These scientists became officers and soldiers for the Union Army in the Civil War, and developed the military technology to defend science and progress in the Northeast and the western frontier from the bestial southern slave system and the British.

The natural model for scientific and military education in the United States after the Revolutionary War was the effect on scientific thinking of the French Revolution. George Washington had been greatly impressed by the French engineers who were sent to aid the American cause, and both his and Benjamin Franklin's insistence on American independence and freedom to develop was connected to a desire for a national university to train the leadership of this new nation.

It was not until the Jefferson administration that such an institution was created: West Point. Jonathan Williams, Franklin's cousin and co-author with Franklin of a book on navigational science, became the first superintendent of the West Point Academy in 1802 and founded the Military and Philosophical Society at the same time to involve scientists and inventors in discussions on the development of not only military science but the transportation and infrastructure for the country as well. Participants in this Society included Jefferson himself, James Madison, John Quincy Adams, Robert Fulton, and Eli Whitney.

After the War of 1812, Sylvanus Thayer, a seventh-generation Puritan from Massachussetts was sent to Europe to study the most advanced military and scientific theory. There he met with the faculty of the Ecole Polytechnique in Paris and returned with maps, books, and a conception for the future development of West Point. The Ecole had been established as a Jacobin institution in 1794, before the period of Thermidorean Reaction following the French Revolution. The best scientific minds in Europe, including Laplace, Lagrange, Biot, and Monge worked at the Ecole, in the best of laboratories, side by side with the military thinkers who trained Napoleon's general staff and became France's finest military strategists.

When Thayer returned to New York he was named superintendent of West Point and transformed the academy into the leading scientific and military school in the nation. The purpose of the curriculum of architecture, military engineering, mathematics, French, and weapons and artillery development was to train the cadre to lead the nation in defense of its existence and provide the skilled technicians and engineers to build the canals, bridges and other infrastructure necessary for America's expanding industrial base. Most of the generals of the Civil War graduated from West Point. Many of the graduates were instrumental in founding other schools of engineering and technical education, such as the Lawrence School of Engineering at Harvard, the Sheffield School at Yale, and the Columbia School of Mines and the Engineering Department at the University of Michigan. Most importanly, West Point established the field of engineering to apply the advances of the theoretic sciences directly to technological improvement. Under the leadership of John Quincy Adams, the Board for Internal Improvement was set up to address the national direction of growth, and West Point graduates became the railroad engineers, metallurgists, and advisors for this national effort.

By the middle 1800s, the dream of linking the East to the West by rail was coming to fruition, and the frontiers of science were pushed forward to meet the challenges of developing the nascent textile and other light industries, transportation, mining, public health and education, and the general area of civil engineering.

The founder of the most significant institution dedicated to the wedding of the theoretic sciences and the common good, the Massachusetts Institute of Technology, was William Rogers, himself a medical doctor, chemist, and geologist. Along with most of the important scientific men of his time in the United States, Rogers periodically travelled to Europe throughout his life to meet with men like Dalton, Faraday and the leading geologist, Dr. Lyell, and discuss the latest developments in science.

In the early 1830s, basic geologic maps of the states had not been systematically prepared, and Rogers and his brothers, recognizing that the railroads and other infrastructure could not be built without such mapping, performed the geologic surveys for the states of Virginia and New Jersey. This required the use of chemical analysis in the process of being developed, as well as engineering techniques for surveying and the development of surveying instruments. Captured by the rapid development in industry, commerce and transport in the Boston area, Williams in 1928 began to draw up plans for a technical school. In 1861 MIT was founded to conduct basic research in the sciences and apply scientific breakthroughs to industry and public education. Until the early 1900s, the entire board of MIT was composed almost entirely of scientists who fought a 50-year-long battle to keep MIT independent of the nearby Harvard University complex from which many of MIT's scientists had graduated). These scientists were critical of Harvard's educational philosophy as sterile, backward-looking, and devoid of orientation toward the practical application of scientific knowledge, and they sought to ensure the existence of an institution committed to contributing basic scientific advances to aid the nation's growth.

MIT provided free public lectures modelled on those given by the Ecole Polytechnique, field trips during the summers so that students could become acquainted with industry and technology, journals to socialize ideas nationally and internationally, and a Museum of Technology with "the implements, materials and products of the practical arts and sciences." The School of Industrial Science was designed for instruction lectures, and laboratory work. In 1888 the Technology Quarterly began publication and MIT became recognized as the leading institution in the field of civil engineering. The curriculum stressed a grounding in physics, chemistry, mathematics, engineering and architecture with compulsory training in French and English grammar so that graduates could read and translate basic scientific works from the Ecole in Paris. Williams himself did translations of French work in calculus before founding MIT.

By the early 1870s entire new fields of scientific investigation were on the horizon and MIT established a department of Natural History to encompass studies in biology, medicine, geology, mineralology, and a Department of Philosophy for the study of modern languages and literature. In 1876 at the Centennial Industrial Exposition in Philadelphia, scientists from MIT participated in the discussions and exhibits and brought back to the Institute the excitement of new ideas from Europe.

Though by World War I, the directing body of MIT was passing out of the hands of the scientists and into the hands of the president of the American Telephone and Telegraph and other large corporations and banks, and the Institute was feeding people into the recently created Rockefeller Foundation, basic scientific work, and commitment to expanding technology was carried on by groups and outstanding individuals in the old MIT traditions. The work of Norbert Wiener, professor of Mathematics, in the field of cybernetics which led to the age of the computer, is a pre-World War II example.

During the war MIT's talent went to the development of defense and weapons systems. The most interesting is the development of the radar in the MIT radiation lab. Studies of high frequency radiation led to the exploration of the plasma qualities of the ionosphere and potentialities of electro-magnetic radiation in general. This work in plasma phenomena could have led directly to investigation of self-ordering plasma processes in fusion reactions had the government chosen to launch a national scientific effort in that direction.

By the post-war period the relationship between science and industry had come full circle—the needs of the expanding industrial base of post-Civil War America had demanded fundamental breakthroughs from science, and the advanced discoveries in physics, in particular in subatomic physics, had opened up the potential for whole new industries. It was lawful that these new areas of high-level industrial development would take place only miles from the laboratories where the scientists were working, with some of the the engineering and consulting companies founded by graduates of MIT.

Post-War Industrial Development in the Northeast

Massive unemployment resulted from the post-war recession in the late 1940s in New England, and the obsolete, rotting base of basic, heavy industry in the Midwest began its current decline in the late 1950s. Nevertheless the period from the mid-1950s until the late 1960s saw an explosion in advanced engineering and electronics in the Northeast. As a consequence of the shrinking real productive base of the U.S. economy, however, scientific research became progressively more dependent on government funding and resources. Unlike the era of post-revolutionary expansion, the two major national commitments made in scientific endeavor since World War II have been in aerospace and in defense. From the radiation lab at MIT the Distant Early Warning arctic radar system was engineered and built by IBM in the early 1950s. Sperry Rand, in New York's defense-industry packed Long Island, put its engineers and designers to work developing electronic guidance for the new generation of unmanned weapons. Kollsman Instrument in New York developed navigational equipment so bombers could be guided by the stars, and Grumman Aerospace, Fairchild Republic, and many others worked on the missile and submarine guidance systems which were later used in the unmanned space flights as well.

At the same time the value of computers and non-military electronics became apparent, and the boom in data processing and information storage and recall became widely applicable to business and industry. Westinghouse, General Electric, and smaller companies did pioneering work in research and consumer electronics. Other firms, such as United Technologies in Hartford and Raytheon developed the engineering and production capabilities for precision engines and aircraft components for both military and commercial flight. Another essential aspect of the role of this advanced industrial capability was the proliferation of companies specializing in applying computerized automation techniques to heavy industry. Unimation in Connecticut built the industrial robots for the Lordstown General Motors Assembly Division plant, allowing the repetitive work of welding to be performed by machines. Vogue Instrument in New York City was working on fully automating a Chevrolet engine plant in 1970, when the contract was cancelled during a United Auto Workers' strike.

An extremely important aspect of the most advanced industrial development in the Northeast has come in the area of components, private research and actual construction of nuclear power facilities. Aside from the government-funded laboratories and university programs, companies such as United Technologies and Combustion Engineering have taken on ambitious nuclear energy development programs. The larger industrial firms have made a commitment to advancing the knowledge of science in order to bring new energy technology on line.

With the winding down of the Vietnam war in the late 1960s and the accelerated slide into the current depression by early 1970, the cutbacks in government spending for scientific research in general and the aerospace and defense budgets in particular pulled the economic rug out from under the highly specialized and capital-intensive leading Northeast industries. After the first wave of layoffs in 1971, more than 15,000 non-clerical white collar workers in Massachusetts alone lost their jobs. The bulk of these were draftsmen, engineers, and researchers. In the second major collapse in 1974, 10,000 additional highly skilled and professional jobs were eliminated. Of these 25,000 unemployed, only a small fraction of such jobs lost in the entire New England region, 5-10 per cent left their fields of work altogether. About 50 per cent remained in their general field at a lower skill level and with a corresponding cut in salary. Men with 20 or more years of engineering experience went into the post office or opened pizza parlors rather than disrupt their families in an effort to find work in other parts of the country. The skill and knowledge that made it possible to put men on the moon, to begin to eliminate back-breaking assembly line work in industry, and to bring a necessary new energy source on line has been tossed out onto the street.

Few of the nation's colleges or universities are presently replenishing the supply of these talented and creative people. For the last 8-10 years, the United States has been destroying its ability to expand the limits to present scientific knowledge and technological know-how, which the nation is already confronting in its efforts to solve energy and other critical problems. The implementation of the Carterite deindustrialization and destruction-of-science policies will eliminate America's ability to ever return to its tradition of science for an industrially developing democracy, and will plunge the nation into medieval superstition.

The Role of the Northeast in U.S. Development

For the Northeast region to be able to assume the leading role it must play in the overall growth of the national economy, the question of its energy resources, in the short term, must be definitively settled. In the transition to a fusion-based economy over the period of the next ten years, increased consumption of oil in the Northeast must be complemented by greatly expanded fission energy, *high-technology* coal mining, and hydro-electric power. The Northeast is well-equipped at the present time, through the capacities at Combustion Engineering in particular, to greatly expand the full-scale construction of fission reactors and components. Even before fusion is ready for commercial introduction, increased energy production from fission will require advanced generating technology which is in use in aerospace and defense through turbines and generators developed by General Electric and Westinghouse in New York State.

In this transition period we will also need to expand and develop new reserves of fossil fuel, and in the Northeast the anthracite coal beds just now being explored in southeastern Massachusetts and Rhode Island are a potential source of high-quality, low polluting energy. The application of the highest level technology, as elaborated in the U.S. Labor Party's Mid-Atlantic Program (see below), would augment the needed fossil fuels for energy production.

All of the energy requirements for the Northeast must in addition be conceptualized in their relationship to the energy potential of Canada. Western Canada possesses uranium reserves which are necessary for fission reactors, and the potential for hydro-electric power generation in northeastern Canada is vastly under-utilized.

One of the most critical contributions the Northeast must make is in the advancement of the field of plasma physics itself, which is the prerequisite for developing and harnessing fusion energy. The National Laboratories at Princeton, MIT, and Brookhaven, as part of the national crash fusion program, must be fully funded and staffed. As well, private companies, such as United Technologies which has done basic laser and magnetic confinement research since 1958, must be integrated into this national scientific program.

In the national fusion effort, the Northeast has been and must continue to be crucial in non-plasma research and experimentation. Firms such as MCA and IGC, which have done pioneering work in superconductivity and materials development, represent necessary feeder industries for a commercial fusion program. Research must be directed to deal with the new magnitude of electric power that will be generated from fusion. Power storage, transmission and generation requiring a leap in both theoretical conception and practical engineering will be the job of General Electric, Westinghouse, and other Northeast-based companies.

In addition, as the nation works to meet the theoretical and engineering challenge of fusion, the companies in the Northeast, such as Combustion Engineering and Grumman Aerospace, which have been providing commercial and experimental reactors and components for the embattled nuclear fission industry, will be put to the test of continually up-grading and advancing design and engineering techniques to implement on-line fusion energy production. As the period of commercial introduction approaches, these same firms will begin the mass-production of nuclear reactors and components for the national economy and the world.

In addition to the above areas of energy production itself, the Northeast aerospace and defense capacities are crucial for the automation of basic industrial processes, the mass production of transportation equipment, and automating while vastly expanding the production of machine tools, whose production defines the rate of growth of all other productive sectors of an industrial society.

Companies like Unimation in Connecticut and Vogue Instruments in New York City have been in the forefront of applying advanced computer technology and electronics to industry. Up until the start of the current depression, automated technology was slowly being introduced into the mass-production auto industry, and this capability must be generalized throughout heavy industry to increase labor productivity and release labor poser from repetitive work for employment in more advanced technologies. One example of the integration of the latest scientific advances to industry will be in the area of mass transportation, where the work on superconducting magnets for the fusion program has opened up the possibility of magnetically levitated trains to replace inefficient and relatively slow air travel. Developed at MIT, this magnaplane vehicle can travel at potential speeds of thousands of miles per hour and can easily be mass produced through the conversion of the commercial aircraft and defense industry in the Northeast.

The aerospace industry's metal forming and metal bending capacity in the production of aircraft fuselage can be converted to transportation and containment building and vacuum chamber construction for nuclear fusion reactors. High-precision engine fabrication and engineering in aerospace and defense in the region can provide a major technological revolution in the conventional machine tool industry. Since the aerospace and defense industries as integrated facilities not only engineered and designed the equipment but also designed the machine tools and machinery for its production, they already have the skilled labor to redesign, automate, and standardize the machine tool industry as a whole. The aerospace-defense sector has more than twice the number of machine tools than the machine tool industry itself, and only the conversion of a large portion of these tools will allow the machine tool industry to approach rates of annual expansion nearing 100 per cent and introduce a new generation of machine tools. This is the rate of expansion of machine tool output that will be required to achieve a 20 per cent rate of growth in the economy overall.

The Northeast's experience and expertise in space exploration must also be immediately returned to pre-depression levels and quickly upgraded to increase the unmanned flights in the near future and lay the basis for the colonization of other planets in the early 1990s.

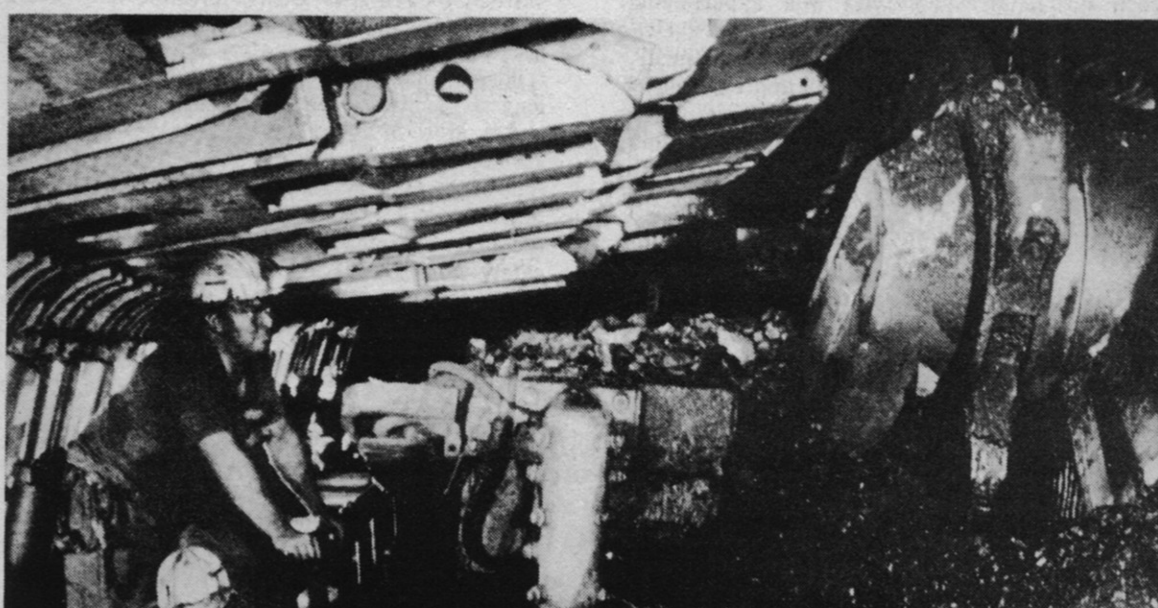
The Northeast's highly skilled workforce is the potential creativity for dealing with the country's most pressing needs — a new energy source, a sound technological basis for industry, a commitment to advances in science and research and an educational policy to provide cadres of scientists for the future. Our immediate job in defending the Northeast from the Carter deindustrializers is to protect U.S. science and industrial capacity from the encroachment of superstition and Medieval pick-and-shovel methods, and forge a link with the history of the century of the American Revolution by basing scientific development on the fight for democracy and industrial development.

Program for the Mid-Atlantic Region

High Technology Coal Mining for Industry

As soon as the International Development Bank programs are in operation — sometime in the next several months — U.S. industry will begin the most gigantic gearing up in its history. To fuel this gear-up during the period of transition to fusion power, existing reserves of fossil fuel, both domestic and foreign, will have to be exploited to the maximum. This will require a tremendous expansion in the U.S. coal industry, the largest in the world, through a coordinated Regional Development Plan for the Mid-Atlantic region. Steel production will double in two years under the impact of Jordan Process conversion of the industry, and beyond that, will continue to expand at rates rising rapidly above 50 per cent per year to fill global needs for housing and machinery. To fill this steel production requirement alone, coal production in the U.S. will have to increase by 130 million tons or 20 per cent in the next two years and by double that in three years. In addition, overall electric generation capacity for both residential and industrial use will be increasing within two years by more than 15 per cent a year, rapidly growing toward 25-30 per cent a year. In the first few years, more than 40 per cent of the resulting new demand for fuel will have to be filled by coal.

Between those two demands, coal production in this country must approximately double in the next



High-technology long-wall mining at a depth of 800 meters.

three to four years. The key region of the U.S. which must supply this expansion of coal production is the Middle Atlantic, a region of mining and industry stretching from northern Pennsylvania through Philadelphia and central New Jersey to Delaware, Baltimore, and the West Virginia mines. In contrast to Nelson Rockefeller's idiotic "Project Independence" porkbarrel plan to mine the low-grade coal spread over the Rocky Mountains, a scheme involving vast waste of human resources and infrastructure, we must use the highest grade of coal to fuel the steel mills, coal found in the Appalachian region, and mine it with the most advanced technologies. The mines which have been shut down must be reopened and the present obsolete technology — as deadly as it is unproductive — must be replaced with safe and automated techniques.

The coal produced will go to run vastly expanded steel complexes in Bethlehem, Philadelphia, Baltimore, and Harrisburg, as well as providing feed stock, through the Jordan Process, to expand chemical and fertilizer industries in New Jersey and Delaware. Beyond the immediate area, the coal and steel produced in the Mid-Atlantic region will go to drive the even larger burgeoning industries of the Midwest.

With this perspective, we describe here the resources available for expanding U.S. coal production and the techniques for doing so.

Coal for Development

Reserves of metallurgical bituminous coal, currently used as coking coal in steel production and as a source for electric generation, currently amount to 100 billion tons. Presently about 650 million tons are mined per year. But mining of high-grade, low-sulphur anthracite coal, which burns without undesirable sulfur gas by-products, has been allowed to fall into a virtual collapse since it is no longer needed as a home heating fuel. The replacement of anthracite coal by natural gas and oil, particularly after World War II, intersected a general glut of coal on the market during the 1950s recession. Because of the depth and slope of the anthracite deposits, bituminous coal became less expensive to mine, and as steel coking needs and electricity generation expanded, bituminous grew to be the major coal source. Anthracite now makes up less than 2 per cent of all coal mined, most of it used for local home heating, carbon products, and export. The mines and towns of eastern Pennsylvania, the heart of American iron and coal production for over 100 years, have been abandoned, and the region was reduced to a depressed and devastated area, dotted with ghost towns.

In order to fuel the rates of growth necessary to steer the world back on to a course of development this must be reversed; the 16 to 18 billion tons of high-grade anthracite in the eastern Pennsylvania region will have to be reopened and the mining industry readied for an economic renaissance.

Miners Out Of The Mine

We do not, however intend to put miners back into the mines with the old, deadly dangerous technology. The most highly developed mining technology has been developed in Europe for underground *bituminous* mining. The longwall method was put into use 25 years ago to outfit the coal mines with a single machine that mines the coal by shearing the face, carries it out on a continuous conveyor belt, and at the same time provides steel support for the roof of the mine. This method, which produces 90 per cent of the European Common Market's coal, has been totally automated in several mines in Poland, where such machines run by remote control, guided by a computer. With the Polish computer system, a miner becomes a skilled technician who works on the surface, going into the mine only when it is necessary to repair the equipment.

Since 1900 one out of every seven miners — over 100,000 — has been killed on the job, making mining the most dangerous of all industries. Deaths from "black lung" and its complications push the toll far, far higher. These grim facts underline the necessity of automating and updating mining technology.

The major causes of accidents in the mines have been explosions from methane gas leakage, falling rocks from loose roof materials, and equipment failures. The important safety advantages of longwall technology, even if it isn't computerized and a crew of 10 miners is required below the surface, are first that the miner is not directly at the face of the mine inhaling the coal dust, and second that the apparatus's steel shield support protects the miner-operator from falling rock. For complete safety this must be combined with constant monitoring of the mine's methane level as well as water and general air quality. For further protection, the miner can also be enclosed in an air conditioned cab.

Therefore the *real* safety program for miners is not shutting down the coal mines through piecemeal, ineffective "safety rules," but the implementation of capital-intensive mining methods.

Currently, because of the "cost" of the longwall system, only 4 per cent of U.S. coal is mined this way. But it is from three to four times as productive as standard methods, producing up to 10,000 tons per day, with smaller mining crews than are required by the continuous mining now in use. Once an International Development Bank-type credit arrangement for trade is in effect, the U.S. mining industry can and must begin importing and gearing up its own production of this equipment to bring U.S. bituminous coal production into the modern era.

The Strip Mining Bugaboo

Anthracite is the highest grade of coal, and there are at least 16 billion tons in reserve in eastern Pennsylvania (plus newly explored deposits in Rhode Island). Yet for the reasons cited above, annual U.S. production is only 5.7 million tons. Anthracite, however, is not found in horizontal deposits, and lies deeper than bituminous. Longwall systems cannot at present be used on the 45 to 90 degree slopes of anthracite deposits, so in the next two to three years, while conversion of the steel industry to the Jordan Process is being completed, development and design of capital-intensive underground equipment for anthracite coal must be put into high gear.

Already Soviet engineers are looking at the possibility of using hyraulic mining, i.e., high-pressure water jets, as well as modifications of longwall equipment for this task.

To fuel the transition to full Jordan Process steel production and supply the growing needs of the power industry, a three-stage program for expanding anthracite production must immediately begin (see chart). There are approximately 120 million tons of coal in banks of waste abandoned at the sites of the old mines, left behind because the pieces were too small for home heating furnaces. These waste banks can be cleaned and separated on a water flotation process currently in use on a small scale; expanded, it will yield almost 100 million tons in two years.

THREE STAGE PROGRAM FOR EXPANSION OF ANTHRACITE PRODUCTION

	TECHNOLOGY	YIELD (million tons)
STAGE I 0-12 months	Current Production	5.7
	Conventional Strip	6-8
	Waste Bank Reclamation	25
	Total	**40**
STAGE II 6-24 months	Conventional Strip	25
	Waste Bank Reclamation	70
	Deep Pit	20
	Total	**115**
STAGE III 24-36 months	Conventional Strip	200
	Deep Pit	50
	New Underground Methods	*
	Total	**250+**

*to be determined

At the same time, the 2 to 3 billion tons of anthracite that are less than 1,000 feet below the earth's surface and are accessible by conventional strip mining must be exploited. Despite the Sierra Club-Zero Growth brouhaha about the evils of strip mining, it will be the major technology used for the first three years of anthracite mining. The "limit growth" lobbyists claim that strip mining almost irretrievably ruins land by removing the topsoil and encouraging erosion. In fact land reclamation can be done at minimal cost on strip-mined land, not only restoring the land but actually improving it. Instead of trying to return the land to its "original contour," as stipulated in the current mining law, for example, sculpturing the reclaimed area according to its use has accomplished 10 to 15 per cent increases in arable land. By back-hauling the pits with the soil from the next pit dug and properly treating the soil and water, the land can be used for farming, housing construction, or recreation.

For the anthracite reserves below sea level (780 feet) down to 2,000 feet, conventional strip mining can be combined with pumping in "deep-pit" mining developed by Dr. Charles Manulla at Pennsylvania State University. Conventional stripping sites that contain more coal under sea level can be extended to continue mining by widening the pit, pumping the water, and using conventional steam shovels, cranes, and trucks.

Thus, using these existing methods, anthracite production can be expanded to over 200 million tons per year capacity within three years while new, automated deep-mining equipment is being developed.

This latter problem will require the most advanced engineering effort among U.S., British, West German and Polish mining engineers, together with multilateral trade under International Development Bank arrangements, to fully exploit one of our most productive pre-fusion resources.

The expanded output of both anthracite and bituminous coals will be used primarily in the production of blast furnace pig iron as these furnaces are converted to the Jordan Process and and as fuel for the increased near-term electrical energy requirements for the entire U.S. reindustrialization program in all regions.

The steel mills in the vicinity of eastern Pennsylvania will receive anthracite by rail directly from these revitalized mines. This will include Sparrows Point near Baltimore and the major plants near Trenton, Philadelphia, Bethlehem, and Harrisburg. These eastern region steel mills will also continue to receive metallurgical grade bituminous coking coal from the mines of West Virginia and western Pennsylvania during the transition to the Jordan Process, since unconverted blast furnaces must continue to operate with coke. In addition, large quantities of low sulphur anthracite coal will be shipped via the Port of Philadelphia to fuel coal-fired electrical power plants in major population centers of the United States and Canada; the New York City area power stations will be a major recipient of much of this coal.

Over the next three to four year period, the increase in coal production must reach about 550 million tons per year above the current 650 million tons per year now produced, with 250 million tons of this yearly increase in anthracite and 300 million tons in bituminous. Although large portions of this coal will be used for power generation during the first few years of this industrial expansion program, this will change drastically five to ten years from now as fusion and other energy forms phase out coal power plants. During this period the coal requirements for steel production will eventually encompass the entire expanded output of all coal, both anthracite and bituminous. Since the Jordan Process blast furnaces can operate quite well on low-grade bituminous coals as well as on anthracite, additional vast and currently untapped reserves of coal will become available as fuel.

Other Industrial Development

Coal will also provide the basis for the expansion of existing and new chemical industries. The Jordan Process for the steel industry will not only double the output of iron from currently operative blast furnaces but will also provide large quantities of carbon monoxide feedstock that will be used in the creation of a greatly expanded chemical industry in this region producing methanol and fertilizer, two basic ingredients to the expansion of Third World and advanced sector agriculture.

All of the major steel plants in the mid-Atlantic region will be expanded to include chemical processing plants which use carbon monoxide as the basic input, since these steel plants have easy access to international shipping facilities. By the end of the three-year period during which U.S. steel production will be converted to the Jordan Process, steel plants in this area will increase their production from today's 23 million tons per year to over 50 million tons per year, and they will also produce 50 million tons of carbon monoxide annually. About 75 per cent of this "by-product" will be converted to 15 million tons per year of fertilizer primarily for the Third World, while 25 per cent will be converted to about 4 million tons of methanol annually. Methanol will be used as a feedstock to existing chemical synthetic processing plants in the region, and as a liquid fuel replacing gasoline in automobiles.

The petroleum-based chemical industry which today is a major industry in this region, particularly in northeastern New Jersey, the Philadelphia area, the Delaware Valley, and more recently the Lehigh Valley, must be expanded and integrated into this reindustrialization program. Some of this industry's major research centers are located in these areas (for example, Dupont Laboratories in Wilmington, Del.) and will immediately be given the task of determing the best and most efficient way of utilizing petroleum. For example, it is very likely that petroleum should be used for producing large quantities of high-strength plastics for use in the construction of modular housing and other building as one aspect of immediately required world reconstruction. Since methanol will eventually replace gasoline as an automobile fuel, petroleum can be diverted to other, higher-priority and more efficient uses. The technical expertise and knowledge needed for such decisions already exists within these highly developed industries on the eastern seaboard, and must be mobilized for and focused on this development program.

Improved Transportation Network Needed

Although some of this expanded output of coal, steel, fertilizer, methanol, and other chemicals will be used locally within the Mid-Atlantic region, the largest percentage will be exported, both to the rest of the U.S. and to other parts of the world. Thus this region, and the port of Philadelphia in particular, will become a major exporter as well as importer. This demands a mass-scale upgrading of the region's transportation system, particularly its rail, barge, and ocean shipping. The increase in coal mined, particularly the high-grade anthracite in eastern Pennsylavania, must be shipped by an improved and expanded rail network throughout the region as well as to the seaport of Philadelphia in large quantities. In order to handle such capacities; the Port of Philadelphia must be expanded considerably and modernized with the latest loading equipment, including the conversion of the Philadelphia Navy Yard to a commercial port and dry dock facility. The Port of Baltimore must also be upgraded in much the same way as that of Philadelphia so as to be capable of handling greatly increased shipping capacity. The Sparrows Point steel mill already receives large quantities of iron ore from Venezuela and other foreign countries; Jordan Process blast furnaces will require the doubling of these ore shipments. Finally, as coal continues to be supplied by rail from the West Virginia coal fields and from the newly redeveloped anthracite coal fields in eastern Pennslyvania, the area's railbeds and equipment will of course require extensive upgrading and expansion.

Fusion Energy Research and Development Act of 1977

BE IT ENACTED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA ASSEMBLED IN CONGRESS: that this Act may be cited as the Federal Fusion Energy Research and Development Act of 1977.

TITLE I

The Congress hereby finds that:

(a) The immediate development of controlled fusion is of priority concern to the Nation and World.

(b) The neglect of potential controlled fusion resources has led to deficiencies in the nation's array of available material resources.

(c) The nation's energy and resource requirements can be met if a national commitment is made now to dedicate the necessary financial resources, to enlist our scientific and technological capabilities, and to accord the proper priorities to developing controlled fusion to serve national needs, develop vital resources, and protect the environment.

(d) The urgency of the nation's and world's resource problems requires a commitment similar to those undertaken in the crash development Manhattan and Apollo projects; it requires that the nation undertake a long-range, top-priority research and development program in cooperation with all interested nations of the world.

TITLE II
General Policy

Section 2

The Congress hereby declares as policy:

(a) The Energy Research and Development Administration will undertake a national crash program of basic and applied research and development, including demonstrations of practical applications, with respect to all applications of controlled fusion.

TITLE III

Section 3

The Congress further authorizes the Energy Research and Development Administration to:

(a) Review the current status of all U.S. and other efforts into controlled fusion and furnish a full report to the Congress and the nation within two months after the enactment of this bill.

(b) Form a committee of the nation's leading scientists and engineers to review current and projected fusion research efforts and develop a detailed report on implementation of the crash program budgeted herein. The committee will further submit proposals for initiation and governance of the research centers budgeted herein. This report will be reported to Congress within two months of the enactment of this bill.

(c) Obtain under the authority of the Congress all classified scientific information and other materials which relate to the development of controlled fusion (particularly laser and electron beam fusion) and make this information public.

(d) Bring all facilities currently engaged in research on fast breeder nuclear fission reactor research under the fusion development program, and integrate breeder research facilities and personnel into the program for fission-fusion (hybrid) reactor systems.

(e) Report all of its activities to the Congress and the nation on a monthly basis.

(f) Set up a national communications and translation network to transmit scientific data and reports as rapidly as possible.

TITLE IV
Appropriate Authorization

Section 4

The Congress hereby authorizes the following appropriations for the crash development of nuclear controlled fusion:

(a) In the fiscal year of 1978, $6 billion will be appropriated to the Energy Research and Development Administration. The FY 78 budget of $6 billion (see Table I of Appendix I) would provide for the following major categories of expenditure:

(1) Basic Research: $1.92 billion to set up and maintain ten National Fundamental Research Centers and adjuncts (see Table II of Appendix I).

(2) Applied Research: $1.92 billion to construct and operate 30 major confinement system projects. (Funding for confinement system development is broken down as follows: construction, $900 million; operating, $600 million; scientific back-up, $557 million. $1.041 billion for upgraded laser and electron beam system development (see Totals, Tables IIIB and IV of Appendix I).

(3) Engineering: $948 million for technology development for reactors and experimental devices (see Total, Table V of Appendix I).

A detailed explanation and breakdown of the FY 78 budget appears in Appendix I.

APPENDIX I: EXPLANATION OF BUDGET PROPOSAL

INTRODUCTION

The present conjunction of significant experimental progress in several leading lines of fusion research, in spite of low funding, with the continued lack of commensurate progress in appropriate areas of theoretical science necessitates a thorough overhaul and redirection of the content and organization of the CTR program in the United. States. While it is necessary to vigorously pursue all existing lines of fusion research, an expanded "crash" program is justified only in a context of the primacy of fundamental research.

A new program specified in the Fusion Research and Development Act of 1977, and entailing expenditures of $5 billion for fiscal year 1978, is therefore based on two principal related features:

(1) Ten National Fundamental Research Centers (NFRC) shall be constructed, equipped and staffed in areas of the country already having institutions and individuals with significant competence and experience in the science and technology of fusion. All scientists in an NFRC region will have potential access to its facilities.

Stimulation of and support for a growing spectrum of basic theoretical and experimental investigations is required in order to realize a systematic scientific understanding of the behavior of plasma in general and of particular configurations and ranges of plasma parameters appropriate to controlled fusion. The institution of NFRCs is vital to achieve this basic scientific objective, so that the U.S. can play its proper leading role in an upgraded, internationally coordinated fusion research program of the sort proposed by relevant authorities in Japan, the Soviet Union and Comecon sector, Sweden, Great Britain, Italy and the European Economic Community.

This policy component is required both to insure convergence on at least several viable reactor modes in the near term (1980s) as well as to insure that fusion development is properly regarded as an essentially open-ended practical-theoretical enterprise continuously contributing to and deriving support from an ever more productive economy and highly skilled population.

The National Fundamental Research Centers will provide the resources and facilities needed to promote small group innovating investigations, prototype development, cross-fertilization and synthesis of a multiplicity of approaches. Already existing government laboratories, public and private universities, and regional industry — particularly in the aerospace sector — receiving intellectual and economic inputs from these centers can, in turn, provide the necessary extensive pool of scientific-technical manpower for staffing and backup of the centers.

The breakdown of FY 78 funding by primary categories for the NFRCs is as follows:

(a) $720 million for scholarships and grants to be disbursed to 18,000 recipients working at an NFRC or affiliated institutions. The NFRCs will be governed by boards elected from all participants. Stipends are also to be used to maximize international cooperation and exchange.

(b) $480 million for operating and equipment costs.

(c) $720 million for construction, power supplies and renovation.

(2) There shall be a full allocation of funding to all currently developed and otherwise promising experimental devices, regardless of configuration type or previous level of support, to determine the ultimate potential of the systems as fusion reactors.

There are now approximately ten major confinement system concepts which, in their present form or after one or two stages of development, have significant potential of achieving "break-even" (i.e., net energy producing) conditions. These approaches must all be accelerated simultaneously, through full scientific and technological (industrial) support, in order to draw out the remaining physics and engineering problems, to determine which approaches are feasible as reactors in their present form, and most importantly, to evolve a body of comparative knowledge of plasma physics which cannot be obtained from any single device or simple sequence of devices. From this standpoint, even so-called failures will contribute in important ways to the overall program, through the scientific results they provide.

FY 78 construction and equipment costs for these major projects to be continued or undertaken primarily in existing major or secondary laboratories, totals $900 million. The construction, operating, and research costs for all magnetic and inertial confinement projects, respectively, are:

(a) $2.057 billion for magnetic confinement; and

(b) $1.044 billion for laser and electron beam.

EFFECT ON SCIENCE AND INDUSTRY

Several features of the total program are worth noting for their short- and long-term scientific and economic implications. Immediately, the required number of highly trained scientists, engineers, and technicians will strain the skilled manpower capacities of not only the existing fusion program, but of high-technology industry as well — in areas from materials and magnet design to electronics. The solution will be found only in the rapid training of experts in all areas of fusion research and development, developing a pool of such experts hundreds of times larger than that existing at present. This in turn will provide the basis for dramatic advances in future scientific capabilities in the U.S., particularly with regard to the fundamental theoretical issues indicated.

The provision of the NFRCs with stocks of conventional apparatus as well as a specialized power supply and computer capacities (linked to research center terminals internationally) will greatly increase the scientific effectiveness of research at the centers and throughout contiguous regions.

A typical NFRC will be allocated a budget and facilities comparable to a present major government research laboratory, such as the Los Alamos or Livermore National Laboratories, but will function in a wholly different way. Instead of a top-down definition of most of the research activity, as in projects charged with reactor-scale development, the NFRC will exist to service the creative activity of numerous self-defined small research groups or individuals working on fundamental questions of plasma dynamics.

When such groups reach the stage of testing hypotheses experimentally or computationally, or building fusion device prototypes based on their prior investigations, an elected committee of peers will allocate space, resources, and technical backup solely on the basis of the availability of resources. The guiding philosophy of the NFRC is "creativity must be trusted."

To avoid artificial competition for scarce resources, when expansion of facilities or construction of new facilities is justified by the quality or scope of scientific endeavor, the elected NFRC governing boards shall recommend such expansion to Congress and the Presidentially appointed administrators of the overall fusion program.

Finally, a construction budget of approximately $1 billion and a development, technology and equipment outlay of approximately $2 billion will provide a much needed stimulus to the construction of aerospace industries.

SUMMARY

The distinguishing feature of the legislation proposed here is its provision for a unique nexus of research centers primed to utilize the full scientific and productive potentialities of the United States for world development. The process these centers will set in motion will yield working fusion reactors as a by-product of fundamental scientific advances. In addition, the more specific spinoffs of this program will include the immediate accessibility of industry to fusion reactors for gross power supply as well as for adjustable interfacing with industrial processing.

The expected period of maturation of the indicated program is on the order of a decade, which coincides with the interval during which significant depletion of existing resources, under conditions of intensive development, is to be expected. The FY 78 proposal for fusion research must therefore be judged in terms of a long-term commitment whose first stage will extend over approximately the next decade, and during which a doubling of resources and manpower every two to three years will be required.

There is no question, however, that no other single program will have the self-developing positive effects of the program initiated with passage of this act.

THE FUSION ENERGY RESEARCH AND DEVELOPMENT BUDGET

Budget lines have been computed on the following general basis:

(1) For main line magnetic confinement experiments, allocations for FY 78 are, aside from small increments, equal to the total outlays for respective lines noted in the Nov. 1973 AEC-CTR Subpanel 11 "crash program" for magnetic confinement systems development. In the following tables, such budget lines are broken down by experiment and category.

(2) Allocations to laser and e-beam systems are based on capacities for growth indicated by leading U.S. researchers and the scale of the program of the Soviet Union.

(3) New allocations for national research centers.

Unless otherwise indicated, all figures are in millions of U.S. dollars 1977.

Table I: Proposed Total FY 78 Fusion Research Budget

COMPARISON OF FERDA, ERDA FISCAL 1978 AND
SUB-PANEL 11 (Maximum Program, FY '79 BUDGETS

A) MAGNETIC CONFINEMENT	FERDA	ERDA	SUB-PANEL 11
Operating			
research	1048	37.3	173
development and technology	162	43.9	126
confinement systems	600	74.6	450
fusion reactors	390	0.0	325
SUB-TOTAL	**$2,200**	**$155.8**	**$1,074**
Equipment			
research	708		85
development and technology	18		15
confinement systems	240		90
fusion reactors	48		40
SUB-TOTAL	**$1,104**	**$44**	**$230**
Construction			
research	720	3.7	00
development and technology	54	5.0	21
confinement systems	660	5.0	250
fusion reactors	276	0.5	230
SUB-TOTAL	**$1,710**	**$14.2**	**$501**
TOTAL	**$4,924**	**$214**	**$1,805**
B) LASER AND E-BEAM PELLET FUSION			
Operating			
Laser	192	62.3	
E-beam	72	7	
SUB-TOTAL	**$264**	**$69.3**	**$124.2**
Equipment			
Laser	180		
E-beam	60		
SUB-TOTAL	**$240**	**$7.2**	**$2.5**
Construction			
Laser	420		
E-beam	120		
SUB-TOTAL	**$540**	**$13.97**	**$26.5**
TOTAL	**$1,044**	**$90.5**	**$153.2**
GRAND TOTAL	**$5,968**	**$304.5**	**$1,958.2**

Table II: USLP Research Sub-Program for Magnetic Confinement and Fundamental Research

A) PERSONNEL FOR MAGNETIC CONFINEMENT PROGRAM

Scientists	1150
Technicians	1625
Support	1150
Other	1150

B) NUMBER OF GRADUATE AND POST-DOCTORATE CANDIDATES RECEIVING GRANTS, FELLOWSHIPS, AND SCHOLARSHIPS

Plasma Physicists and Mathematicians	3,000 at $39,600 each
Physical Sciences, and Engineering in general	15,000 at $39,600 each
	Total $720 million

C) NATIONAL FUNDAMENTAL RESEARCH CENTERS (10 centers)

Operating	10 each at $12 = $120 million
Equipment	10 each at $36 = $360 million
Construction and Capital Equipment	
2 Gigawatt Power Supply	10 each at $48 = $480 million
Building and renovation	10 each at $24 = $240 million
	Total $1.2 billion

TOTAL for NFRC's and Grants .... **$1.9 billion**

Proposed NFRC sites: Seattle, Wash.: Berkley, Calif.: Chicago, Ill.: Detroit, Mich.: Princeton, N.J.: New York, N.Y.: Boston, Mass.: Washington, D.C. area: Texas: Los Angeles, Calif.

Table IIIA) Magnetic Confinement Research Sub-Program Breakdown

Operating		Equipment*	
Computer	78	General	72
Plasma Properties	41	8 Class IV Computers	96
Plasma Production and Heating	26	10 Class IV Computers or equivalent	180
Plasma Measurements	18		
Exploratory Concepts	24		
Atomic, Molecular and Nuclear Physics	22		
SUB-TOTAL	**$209**	SUB-TOTAL	**$348**

TOTAL = **$557 million**

*Note: As referenced in text the two computer centers would be located at the Berkeley NFRC, and the New York City NFRC. Also it is presumed that existing NASA, or Department of Defense satellite systems would be used for world wide computer link-up.

Table IIIB) MAJOR CONFINEMENT SYSTEMS PROJECTS

FY 78 CONSTRUCTION AND EQUIPMENT	COSTS	SITE	ERDA TOTAL COSTS
Ormak (tokamak)	3.6	OR	30
Princeton Large Torus (tokamak)	9.6	PPPL	
Technology Test Assembly with Plasma (tokamak)	14.0	OR	
Technology Test Assembly without Plasma	60.0	OR	50
Doublet II Tokamak	2.4	GA	
Doublet III Tokamak	18.0	GA	26
Alcator I Tokamak	18.0	MIT	
Alcator II Tokamak	18.0	MIT	
Poloidal Divertor Experiment Tokamak	12.0	PPPL	19
Experimental Power Reactor (Tokamak)	12.0		600
Tokamak Fusion Test Reactor	258.0	PPPL	215
Stellarator I	24.0	PPPL	
Stellarator II	36.0	Chicago	
Scyllac/Staged Scyllac	14.4	LASL	
Staged Theta Pinch	7.2	LASL	
Scylla IV-P	12.0	LASL	
Large Staged Scyllac	72.0	LASL	55
Scyllac Fusion Test Reactor	12.0		85
Linear Theta Pinch Feasibility Experiment	96.0	Chicago	68
Linear Theta Pinch Test Reactor	12.0		1,000
Diffuse Toroidal Z Pinches (ZT-1, ZT-S, ZT-p, and ZT-2)	6.0	LASL	
ELMO Bumpy Torrus	24.0	OR	
Implosion Heating Experiment	6.0	Univ. of MD.	
High Beta Tokamak	4.8	LASL	
Mirror Feasibility Experiment	180.0	LLL	
Mirror Fusion Engineering Research Facility	120.0	LLL	
Plasma Focus I	6.0	LLL	
Plasma Focus II	6.0	LASL	
Plasma Focus III	24.0		
E-beam Mirror and Laser Solenoid	15.6		

SUB-TOTAL	$852
Miscellaneous Equipment and Construction	$48
Construction and Equip. Total	$900
Operating (IA)	$600
Research Sub-program (III A)	$557
TOTAL	**$2,957**

***NOTE**: Site names are as follows:
- OR - Oak Ridge National Laboratory
- PPPL - Princeton Plasma Physics Laboratory
- GA - General Atomic
- LASL - Los Alamos Scientific Laboratory
- LLL - Lawrence Livermore Laboratory

Table IV: Laser and E-Beam Pellet Fusion Breakdown

A) PERSONNEL	
Scientists	1000
Technicians	1000
Support	5000
Other	5000
B) MAJOR PROJECTS	
3 10 kilojoule glass laser systems at $50 each	180
3 E-beam 100 terrawatt or better facilities at $33.3 each	120
100 kilojoule glass laser system	120
100 kilojoule gas laser system	120
Total construction costs	**$540**
C) MAJOR AREAS OF STUDY	
New Lasers	120
Pellet Design	48
Pellet Experiments	48
Diagnostics	24
Reactor Systems	24
Total Operating costs	**$264**
D) EQUIPMENT, GENERAL	
Laser	180
E-beam	60
	$240
Total	**$1044**

Table V: Development and Technology; and Fusion Reactor Engineering

	Development and Technology	Fusion Reactors
A) PERSONNEL		
Scientists	900	2167
Technicians	900	2167
Support	680	1625
Other	75	1190
B) REACTOR TECHNOLOGY*	$714	
C) DEVELOPMENT TECHNOLOGY*	$234	
Total	**$948**	

*** Note: See Table 1A**

Program for Fusion Research

A summary of a program for theoretical and experimental research into nonlinear phenomenon

by Dr. Steven Bardwell
Staff, Fusion Energy Foundation

A number of leading plasma physicists have written reviews of the last 20 years of fusion and plasma research and have concluded that plasma physics is on the verge of, on the one hand, a breakdown of the present concepts that form the basis of our understanding of plasma physics, and, on the other, a series of breakthroughs in plasma physics which will revolutionize many fields in physics. The experimental evidence for this impending leap in scientific progress lies in the field of "nonlinear" phenomena.

At the present time, nonlinearity is a broad and ill-defined concept in plasma physics; however, several directions for a research program into this important phenomenon are evident. *First*, a class of experimental results on "self-ordered" phenomena. A high energy plasma, of the sort that must be achieved in a fusion reactor, possesses a striking and little understood property of growing self-organization as it gets hotter. In contrast to a normal gas, high-energy plasma will "clump up," form whirlpools of plasma, generate strong and structured magnetic fields, or accelerate well-defined bunches of particles. These phenomena have only recently been recognized as characteristic of a high energy plasma, but must now be reckoned with in a research program devoted to this type of nonlinearity.

Second, as a connected feature of the spontaneous formation of highly structured states, laboratory plasmas have also shown a tendency to create highly concentrated distributions of energy. The usual behavior of a physical system is to spread out the energy, particles, and fields in an even way. A high energy plasma shows the opposite tendency, in which differences in energy density (energy per unit volume) can vary by a factor of one-hundred thousand in the final state of a natural and unforced evolution. In many instances, this tendency has the effect of enhancing the amount of fusion that occurs in the plasma, and may, therefore, be a substantial aid in achieving the conditions necessary for fusion. However, the mechanisms involved in this unusual behavior are not understood at present.

In line with the principle that the realization of scientific breakthroughs depends on a broad-based stimulation of all relevant subareas, pursuit of the following general fields of research is clearly necessary in order to realize the potential for progress in fusion indicated by research in nonlinear phenomena so far:

1) Micro-diagnostics: It is imperative to improve as rapidly as possible the experimental tools for measuring the small scale (both in time and space) phenomena that occur in plasmas. This requirement is especially acute in the study of the short-lived and miniscule structures that a plasma creates in its non-linear regimes.

2) Experiments on structure and energy concentration: There are a number of plasma machines which have proved fruitful for the first glimpse into nonlinear phenomena. These must be expanded and funded. The most successful of these experiments involve electron beams (generating rings, self-accelerating "pancakes" of ions, and spikes of electric field), laser generated plasmas (generating "solitons"), and pinch experiments of various configurations. A greatly expanded program of research into similar phenomena in the ionosphere and magnetosphere would also be valuable for illuminating these phenomena.

3) Computer studies: A large part of the progress computer studies of plasmas. These researches must be expanded and the number of large machines increased to involve more scientists in this research.

4) Theoretical studies: Theoretical progress has been slow in the field of nonlinear effects in fusion plasmas. With funds for a greatly increased number of graduate students involved in plasma physics and an aggressive experimental program, the promising starts made in the last six months, especially in theoretical work can be pursued.

Judging by the initial insight that has been gained into plasmas and their amazing behavior, we are entering a period of scientific discovery and innovation that will rival that of Kepler and Newton. The support of a major research program is necessary to realize this promise.