

*Los Alamos Scientific Laboratory
Energy-Related History, Research,
Managerial Reorganization Proposals,
Actions Taken, and Results
1945-1979*

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**LOS ALAMOS SCIENTIFIC LABORATORY ENERGY-RELATED HISTORY,
RESEARCH, MANAGERIAL REORGANIZATION PROPOSALS,
ACTIONS TAKEN, AND RESULTS
1945-1979**

by

Edward F. Hammel

ABSTRACT

This report documents the development of major energy-related programs at the Los Alamos Scientific Laboratory between 1945 and 1979. Although the Laboratory's primary mission during that era was the design and development of nuclear weapons and most of the Laboratory's funding came from a single source, a number of factors were at work that led to the development of these other programs. Some of those factors were affected by the Laboratory's internal management structure and organization; others were the result of increasing environmental awareness within the general population and the political consequences of that awareness; still others were related to the increasing demand for energy and the increasing turmoil in the energy-rich Middle East.

This report also describes the various activities in Los Alamos, in Washington, and in other areas of the world that contributed to the development of major energy-related programs at Los Alamos. The author has a unique historical perspective because of his involvement as a scientist and manager at the Los Alamos Scientific Laboratory during the time period described within the report. In addition, in numerous footnotes and references, he cites a large body of documents that include the opinions and perspectives of many others who were involved at one time or another in these programs.

Finally the report includes a detailed chronology of geopolitical events that led to the development of energy-related programs at Los Alamos.

1.0 INTRODUCTION

During Harold Agnew's tenure as Director (1970–1979), the Laboratory's* basic managerial structure differed little from that established by Norris Bradbury in 1945. That structure consisted of a Director (Bradbury), a Technical Associate Director (Darol Froman and later Raemer Shreiber), several Assistant Directors [Max Roy (Production), Jane Hall (At Large), Henry Hoyt (Administration), William Crew (Scientific Personnel), Leslie Hawkins (Financial Planning) and Philip Belcher (Legal, Classification, and Security)], the Division Leaders and the Department Heads.¹ This group (see Attachment 1), which periodically assembled as the Tech Board, functioned primarily as a communication forum. I believe that it did not operate as a technical policy-making body.** That function was usually served by a series of specialized *ad hoc* committees, e.g., the Family Committee, including only the relevant Directors and the Leaders of the groups and divisions directly involved in the project.

From 1945 to 1970, LASL's organizational stability derived, in large measure, from:

- a. the 25 year tenure of a single director coupled with his apparent philosophy: "if it ain't broke, don't fix it,"
- b. the managerial stability provided by the parent federal executive agency [the Atomic Energy Commission (AEC)],
- c. the legislative stability, continuity, and independence granted by the Congress to the Joint Committee on Atomic Energy, and
- d. the continuing stability of the Laboratory's primary mission (nuclear weapons) supplemented by a succession of *major* non-weapons missions of recognized national significance.

Despite this surface stability, "problems" were claimed to exist by some individuals closely connected with LASL and many believed that they could be eliminated or minimized only by organizational changes. In addition, during Agnew's tenure the external environment (political, social, ecological, and technological) changed markedly and this also contributed to growing pressure for managerial changes.

2.0 MANAGERIAL PROBLEMS (1945–1970)

2.1 Internal Control Problems

All of the technical divisions as well as the Engineering Department reported to the Director*** until 1970 (this type of organization was established by Oppenheimer during the war and was continued more or less unchanged by Bradbury). Although demonstrably workable for a single mission project, it became progressively less effective and efficient as other unrelated major projects were undertaken. Even with a single LASL mission, however, and despite the fact that the Shops Department reported initially to Max Roy and the Service Departments and Groups to Henry Hoyt, that still left 21 different entities reporting to and interacting primarily with the Director! It is surprising (and a tribute to Norris Bradbury) that it worked as well as it did for as long as it did. One result was, however, a steady growth during this period in the power and the authority of the Division Leaders. Note that well-established management dogma *insists* that

*Between 1943 and 1981, the Laboratory was known as Los Alamos Scientific Laboratory (LASL); in 1981, the Laboratory's name was changed to Los Alamos National Laboratory (LANL).

**My recollection of those meetings that I attended in the late 1970s is that whenever a technical, administrative, or construction/engineering issue was under discussion, only those directly involved participated actively, while the other attendees more or less dozed off.

*** Sometimes via the Technical Associate Director.

an organization's leader and top manager can, at most, deal efficiently with only about seven next-lower-echelon subordinates.

2.2 The Growth of Major New Non-Weapons Programs (1950–1970)

An examination of Attachments 2 and 3 reveals that, beginning in the 1950s, several large-scale excursions (encouraged by Bradbury) into research and development (R&D) areas other than weapons occurred. As examples, a few of these are described below (in approximately chronological order):

- **Controlled thermonuclear reactors (magnetic fusion):** Some preliminary theoretical work on this topic took place at Los Alamos during the war, and experimental work, funded by Weapons Supporting Research, began in 1952 in P Division after J. Tuck returned to Los Alamos from England. Eventually, with the proliferation of fusion energy R&D in other AEC laboratories and in universities, the AEC established an Office of Fusion Research in its Division of Research and, thereafter, the Los Alamos magnetic fusion program, which concentrated on alternatives to the low β^* (tokamak magnetic confinement) concept, was funded by that Office. It became an independent LASL Programmatic Division in 1974 and continued as one of the Laboratory's major programs for almost 40 years² (until FY90 when it was abandoned because of funding problems).
- **Advanced nuclear reactors:** In 1954, a systematic investigation of advanced nuclear reactors, particularly those using plutonium as a fuel, was initiated under the leadership of D. Froman, and subsequently under that of D. Hall (the rationale for this initiative was that Los Alamos was the only place in the U.S. with expertise in handling and fabricating plutonium metal, its alloys, and certain of its compounds). Eventually, the Los Alamos reactor program was expanded to include seminal research on high-temperature/gas-cooled reactors. To accomplish these missions, K Division was formed. Again, initial funding was obtained from Weapons Supporting Research, but regular annual funding was eventually provided by the AEC's Division of Reactor Technology.

During the 18 years of K Division's existence, it designed, constructed, and tested several innovative nuclear reactors: LAPRE I (1956–1957), LAPRE II (1959), TURRET/UHTREX (1960–1968), and LAMPRE I (1961–1964).³ In 1968, the AEC decided to commit essentially all of its Reactor Research budget to its Liquid Metal Fast Breeder Reactor (LMFBR) R&D program and, in consequence, the LASL reactor development program was gradually phased out. It has been argued that the U.S. nuclear industry would have been vastly better off today had programs such as those being carried out at Los Alamos and other like-minded institutions been allowed to explore further the problems associated with the nation's first generation of nuclear reactors (including the safe disposition of nuclear wastes as well as the potential of alternative designs⁴).

- **The Nuclear Rocket Program:** In 1955 the LASL Nuclear Rocket Program (Rover) was initiated with the formation of N Division under the leadership of R. E. Schreiber and, subsequently, R. W. Spence. In early 1973, the program was terminated due to changes in the long range goals of the National Aeronautic and Space Administration (NASA). During the program's 18 year life, several reactors ranging in power from 100–4200 MW with propellant temperatures up to 4500°F were designed, constructed, and successfully tested. The testing was carried out by J Division at the Nevada Test Site under the direction of Keith Boyer.⁵

* β is defined as the plasma/magnetic energy density ratio.

- **The Vela Project:** Despite the unsuccessful 1958 Nuclear Test Ban talks in Geneva, it was recognized that the international acceptance of some sort of a test ban treaty was becoming increasingly probable and that reliable methods had to be developed and deployed to ensure the detection of clandestine nuclear test explosions in space. That same year at Los Alamos, the Vela Project was initiated under the general supervision of R. F. Taschek. Several P Division groups were involved in this highly classified project, particularly P-4 (J. Coon and H. Argo), P-1 (P. Glore) and also W-7 (W. Chambers). The objective of the project was to develop satellite-based radiation measuring instruments capable of discriminating between naturally occurring space radiation and that produced by a nuclear explosion (note that the 1958 Johnston Island high altitude tests provided important instrumentation data). On August 5, 1963, the Limited Test-Ban Treaty,* allowing only underground testing, was signed. Slightly more than two months later, the first two Vela satellites were launched. During the ensuing six years, five more pair-launchings occurred. In addition, earth-based monitoring stations provided complementary information.⁶
- **Subterrene and the Hot Dry Rock Geothermal Energy Program:** The early history of these two programs has recently been written by M. C. Smith.^{7a,b} Of considerable interest is the fact that the Hot Dry Rock (HDR) Energy Program (which originated in 1969^{7c}, formally began operations in 1971, (and is still being pursued, although on a *much* reduced scale) can be traced back to the early 1950s when, among the various reactor concepts being considered for use in the nuclear rocket program was a device called DUMBO (a fast reactor with a refractory-metal composite core built in the form of a honeycomb). A laboratory-scale resistively-heated model was constructed and used to demonstrate that hydrogen gas could be heated to 3000°C when passed through the reactor at rates appropriately scaled down for the smaller size of the test device. It was eventually decided not to use the DUMBO design in the Rover Program, but DUMBO's advocates were convinced that other equally important uses could be found for their creation. One option that emerged was to consider the use of such a reactor to melt holes in rock, either horizontally to produce tunneling or vertically to produce deep holes in the earth. The Subterrene was born to exploit the "horizontal" use of such a device and, again, an electrically heated device was first produced and successfully used to test the concept.^{7d,e,f}

At about the same time, prompted in part by the national energy crisis, another group was assembled to explore further the concept of extracting "heat" from the strata of natural hot rock lying thousands of feet below the earth's surface. In principle, by using conventional drilling techniques to create a hole with the lower portion angled toward the horizontal and deep enough to reach temperatures of several hundred degrees Celsius, then by pressurizing only the angled lower portion of the bore hole with water to create a series of more or less vertical, parallel, and successive hydraulic fractures, and finally by drilling a second hole to intersect these fractures, a heat extracting system could, in principle, be established by circulating cold water down one of the holes, through the fracture zones, and returning the heated water back to the surface through the second hole. The expectation was that the resulting heat production would be sufficient to operate an electric power plant.^{7a}

During the 1970s, the technical feasibility of the hot dry rock concept was successfully demonstrated.^{7b,c} Also, since hot dry rock is a non-polluting energy source, i.e., it generates no waste products requiring disposal, and since its resource base in the U.S. alone has been estimated to be immense, namely between 6 and 30 × 10⁶ quads** (compared with an

*Formally titled "Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water."

**One quad equals 10¹⁵ Btu.

annual U.S. usage of about 89 quads), it appeared to be a remarkable new idea certainly worth pursuing. It was pursued vigorously until 1980, when its federal funding was significantly and inexplicably reduced.

- **Laser Fusion and Laser Isotope Separation:** Studies of the feasibility of laser fusion began at Los Alamos in 1969 and it was recognized, almost from the outset, that extensive R&D would have to be undertaken in the following four areas:
 - a. developing suitable lasers,
 - b. understanding energy absorption and transport in the target,
 - c. developing suitable pellet design codes, and
 - d. developing fabrication techniques for the complex target pellets.

By 1970, the use of lasers to achieve the separation of isotopes had also been initiated as another one of LASL's major non-weapons programs.

In the laser development area, CO₂, glass, hydrogen fluoride-chemical, xenon, and free electron laser systems were investigated, constructed, and tested. Simultaneously, in other laser application areas, research was also being vigorously pursued. For example, in the laser isotope separation program, attempts were being made, with encouraging results, to achieve the selective dissociation of specific isotopes of uranium in samples of ordinary uranium hexafluoride by irradiating the gas with laser beams tuned to the dissociation frequency of the desired isotope. Subsequent research resulted in the achievement of encouraging separation factors, and an engineering demonstration system was well into its check-out phase when a decision was made by Department of Energy (DOE) Headquarters* to cancel work on the molecular-separation process in favor of the atomic-vapor process under development at the Livermore National Laboratory.⁸

- **Solar Energy:** An R&D program in active solar energy was initiated in the early 1970s to work, together with the LASL Division of Engineering, on the design, installation, and operation of a solar energy system to heat and cool the Laboratory's newly-proposed National Security and Resources Study Center. Subsequently, the Solar Energy Group focused its attention on passive and low energy solar R&D until FY88, after which this work was transferred to the Solar Energy Research Institute in Colorado.⁹
- **TSTA:** During FY81, plans were initiated at Los Alamos for the construction of the Tritium Systems Test Assembly (TSTA) facility capable of integrating and demonstrating technologies relating to the deuterium-tritium fuel cycle for all of the national fusion reactor R&D programs. Construction was completed and preliminary operation began in FY82. The facility is still functioning and it continues to test new fusion reactor components and fuel-related processes as they develop.¹⁰

The above descriptions of important Laboratory projects are deliberately brief and are included primarily to provide the reader with an appreciation of the type and magnitude of the major non-weapons (and primarily energy-related) R&D projects undertaken at the Laboratory during the 1945–1970 period. Many others (both energy- and nonenergy-related) are listed below only by title because comprehensive reports of their objectives and accomplishments are readily available (see the references given below):

- Los Alamos Meson Physics Facility (LAMPF),¹¹
- Los Alamos Weapons Neutron Research Facility (WNR) and the Los Alamos Neutron Scattering Center (LANSCE),¹²
- Nuclear Safeguards Program,¹³
- Isotopes of Carbon, Oxygen, Nitrogen, and Sulfur (ICONS),¹⁴

*The AEC became the ERDA (Energy Research and Development Administration) in 1975; in October 1977, ERDA became the Department of Energy (DOE).

- Superconducting Power Transmission Line (SPTL),¹⁵ and
- Los Alamos Superconducting Magnetic Energy Storage (SMES).¹⁶

2.3 Consequences of the Growth of Major New Non-Weapons Programs (1950–1970)

2.3.1 Multiplication of Program Funding Sources and the Resultant Increase in the Independence and Power of Divisions: As the number of non-weapons R&D projects being carried out by LASL divisions increased, their funding sources became AEC/HQ entities *other* than the Division of Military Application (DMA) as well as federal agencies *other* than the AEC. One result of this change was that negotiations on program objectives, content, and the level of funding tended to occur initially between a LASL Division Leader, the LASL Project Leader (or both), and the sponsoring agency, effectively by-passing the LASL management. A corollary result was a strengthening of the power of individual division leaders. Although Director's Office approval was required before external funding could actually be obtained and this, in turn, usually required a comprehensive, accurate, and well-documented proposal, initial negotiations on program content had frequently been completed and sponsor funding had been more or less assured *before* the project was even formally submitted for LASL management approval, i.e., management was often presented with a *fait accompli*.

In some instances these new programs rapidly grew to a size warranting the creation of new program divisions. This, in turn, added to the number of individuals reporting to the Director (via the relevant Associate Director), thereby exacerbating the problems outlined in 2.1.

2.3.2 Problems Inherent in Rapidly Growing Programmatic Divisions: As new initiatives grew to large R&D programs and ultimately to new multi-disciplinary divisions, two other consequences (discussed in the following bulleted paragraphs) emerged. The extent and importance of these consequences varied, but their existence was a cause for concern.

- LASL's policy had traditionally been to hire the most promising applicants and, thereafter, to encourage and facilitate the continued growth of their scientific capabilities. Less talented scientists and engineers were, however, occasionally employed by new programmatic divisions in order to meet externally-imposed milestones (especially when the size of the programs grew rapidly). At the same time, staff development tended to be neglected (which resulted in a consumption of the intellectual capital of the project staff in place of its periodic replenishment and improvement). Both these ideals were sacrificed on the altar of meeting programmatic "milestone" goals.

Staff improvement was originally carried out by the staff members themselves and was achieved by

- a. periodically changing jobs and responsibilities within LASL,
- b. attending professional meetings,
- c. participating in short advanced courses in a staff member's area of needed expertise, and
- d. applying for and receiving approval for leaves-of-absence designed to increase competence.

Requests such as these usually received a much more sympathetic hearing (and action to help implement) from managers who were themselves active in the same discipline than from a division leader or program manager running a large multidisciplinary project who saw only the costs of such activities and no immediate benefits to his program.

- Evidence also exists that some members of the LASL management team occasionally took a rather dim view of the whole idea of programmatic divisions and their leadership. For example, one ex-Associate Director wrote disparagingly about the Laboratory's past tendencies to "solve" management problems by organizing "around personalities and collecting scattered problems into one organization."^{17a}

Some of the dissatisfaction with programmatic divisions also derived from the diminution of Director's Office control over Divisional operations. During the seventies, for example, one frequently heard expressed among groups of fourth floor residents* such comments as, "All we seem to do here is to provide the service functions for these programmatic divisions: janitorial, purchasing, personnel, supply, travel, accounting, shops, etc." Furthermore, little evidence accumulated during the 70s that these programmatic divisions (or any others) assumed anything more than a minimal responsibility for contributing their expertise, when needed, to other major missions of the Laboratory (in fact, from their sponsor's point of view, such diversions of effort constituted an inappropriate use of the funding provided the project). This was not the way LASL operated during the first two decades after the war.^{17b}

24 Achievements

Despite the above-mentioned problems, I submit that any objective analysis of LASL's major non-weapons programs initiated during the 1950–1970 period would nevertheless conclude that the programs themselves were well-conceived, led by highly competent and highly respected scientists and engineers, well-executed, and technologically advanced, sophisticated, and successful (when they were allowed to proceed to completion). In any event, they were usually relatively large programs (frequently involving several hundred scientists, engineers, technicians, and support personnel) and they addressed major national technical problems: recognized as urgent, requiring the type of multidisciplinary resources such as exist at Los Alamos, and characterized by a sufficiently high risk of failure (despite their importance) that they were most unlikely to be addressed by private sector research laboratories. Although history will return a final judgment on the above assessment, the following preliminary summary may prove useful:

- **Magnetic Fusion:** LANL's R&D program to pursue, at a modest funding level, a basically different alternative to the main-line tokamak design, i.e., a high- β machine, seemed to make increasing sense the further along the favored (tokamak) approach advanced. The Los Alamos results were substantial, significant, and still demonstrating steady progress toward the project's goal when the entire operation was terminated for "budgetary reasons."
- **Advanced Reactor R&D:** One can argue in much the same way with respect to LASL's involvement in the advanced nuclear reactor development program.
- **The LASL Nuclear Rocket Program:** After 17 years of substantial progress, the Rover Program was terminated because NASA's goals changed.
- **LASL's Vela Program:** An unqualified success.
- **LAMPF and LANSCE:** Have surely justified their investments.
- **TESTA:** So long as magnetic fusion R&D continues, it appears that TESTA will also continue to be supported.

In other words, the Laboratory's *major* non-weapons R&D programs have clearly demonstrated the Laboratory's ability to address large and difficult technological problems and to achieve impressive technological successes. Equally clear, however, is the fact that most of

*From the early 1950s, when the Main Administration Building was built in the new Technical Area, the fourth floor became the location of the Director's office and his other administrative officers.

our major projects were not permitted to be carried through to a conclusion. The question naturally arises: "Why"? The generally agreed upon answer is sponsor fickleness of one sort or another, and enough documentation exists to support this conclusion. Nevertheless, related questions can (and probably should) be posed, namely: "Was LASL's initial *choice* of R&D projects flawed," "Could LASL management have identified, at the outset, projects more likely to succeed, encouraged them, and discouraged (or prohibited) the others," and "Had this been done, what sort of a completion or deployment rate would have occurred?" Perhaps a study of comparable programs undertaken by other national laboratories would be illuminating.

Finally, should similar questions be addressed by both the Congress and federal R&D funding agencies? Admittedly, the situations or the conditions responsible for initiating certain major research projects can evaporate (and have evaporated) as rapidly as they have arisen and, in that context, neither the federal government nor anyone else can exercise any control over their comings and goings. Nevertheless.....?

3.0 MANAGERIAL AND ORGANIZATIONAL CHANGES (PRIMARILY 1970-1978)

3.1 Introduction

The reason for distinguishing between the pre- and the post-1970 periods is that, during the latter, events occurring in the external world impacted more directly and more significantly upon Los Alamos than previously. Some of these events occurred in Washington, some in other parts of the U.S., and some in the Middle East. All required a response from the federal government and, eventually, from Los Alamos as well as from other national laboratories.

To further complicate matters, this period was characterized by continuing:

- political chaos in the Middle East;
- chaos, scandal, leadership changes, and organizational changes in Washington;
- environmental degradation in the U.S.;
- depletion of U.S. oil resources;
- increases in the price of oil; and
- periodic shortages of oil.

In order to understand the managerial and other changes that took place at Los Alamos during this period, it is necessary to know more precisely what external events provoked them, what national policies were developed to deal with these events, what *specific* response then occurred in Washington,* and what was finally done at Los Alamos. Consequently, we have elected to divide the 1970-78 period into several subperiods (each prefaced by an *important* precursor discussion) and during each of which the "external environment" was more or less constant. The following format** will be used for each of these presentations:

*It should be noted that the "responses" that occurred in Washington were *themselves* frequently characterized by successive major discontinuities, leading to repeated "stops," "restarts," and "changes in direction."

**Although this format seemed to make sense upon beginning this report, it was not recognized at that time that the year in which a given "response" occurred was seldom the same as, or even directly following, the so-called "provoking event." Indeed, a *series* of "provoking events" sometimes occurred before *any* "response" occurred. Furthermore, certain "responses" continued to be worked on over a period of years. We have, nevertheless, ordered (as systematically as possible) the "provoking events" and the "responses" chronologically.

- the External Provoking Events and Related Issues,
- the Federal Response, and
- the Los Alamos Response.

To assist the reader in relating these events to each other, a "Chronology" is included as Attachment 4.

3.2 The Environmental Precursor (1950–1970)

3.2.1 External Provoking Events and Internal Related Issues: During the 1950s and 1960s it was gradually recognized that the root cause of environmental pollution was our ever-increasing consumption of energy and that the former increased more or less linearly with the latter. To make it clear how closely these two are connected, we begin this section by introducing the concept of an elementary energy system, defined as a device the inputs to which are natural energy resources, e.g., fossil fuels or natural sources of energy [solar radiation (wind, hydro, ocean thermal, tidal, photovoltaic, passive solar, etc.) and the earth's heat (geothermal systems)]. The device outputs are useful work, heat, converted energy, waste products, and/or adverse environmental impacts.* Examples of "devices" are power plants, factories, animals (including human beings), transport systems, etc. Devices, so defined, have been around for a very long time and, throughout all of human history (until very recently), it has been possible with very few exceptions to dispose of device wastes directly into the environment: the atmosphere, the rivers, lakes, or oceans, and the soil.

Only with the advent of the industrial revolution did such dispositions begin to cause serious problems. Initially, these tended to be localized, were directly related to jobs, and were hence tolerated. Indeed, such adverse consequences tended to be accepted by the people impacted as a "part of life."

By the middle of the 20th century, however, industrial, commercial, and residential waste disposal issues became much more serious nationwide and, in 1955, the first Air Pollution Control Act was enacted by the U.S. government. By the 1960s, the U.S. began to identify systematically its own major environmental problems. These were air pollution (particularly in the nation's large industrial and urban areas), water pollution (in the nation's lakes, rivers, and coastal areas), and soil pollution (from landfills, leaking storage tanks, and pesticides).** It was therefore not surprising to discover that, during the late 1960s, under pressure from the public and especially from environmental activists, a host of federal laws were passed and regulations were issued controlling waste discharges into the atmosphere, rivers, waterways, lakes, coastal waters, and landfills. Subsequently these laws were strengthened by revision and amendment.

It is also important to note, in passing, that the federal actions taken during the 1950s and 1960s in response to environmental problems were all isolated and reactive. On the scale then being encountered (both in magnitude and in number) these problems were new phenomena. When faced with such problems, political entities attempt to formulate a rational and coherent policy to guide decision making. In today's complex world, however, that process requires time, study, understanding, and, ultimately, political agreement. Only then, and only if thoroughly researched, can policies adequate to guide subsequent courses of action be formulated and implemented. Responses to problems can then be *proactive*; but in the past, this seldom

*There are usually no "free lunches," only some much less costly than others.

**Although a detailed discussion of these environmental problems is irrelevant to the objectives of this report, what they were and where and when they occurred is important. The reader is, therefore, urged to consult the Chronology (Attachment 4) for the years 1930–1979 for an overview.

occurred. Instead, so-called "quick fixes" dominated policy formulation. These were always incomplete and usually counterproductive.

Clearly, no national environmental policy existed during the 1960s. Unfortunately, no such comprehensive policy for the environment (or for energy) exists even today (despite more than two decades of trying to achieve one), thereby demonstrating how extremely difficult it is to achieve policy consensus in a democracy, especially on controversial, i.e., vested interest, issues. The best that could be done during the 1960–1970 period was the formulation and implementation of some particular policy favored at the time by the party in power.* No guarantee existed that subsequent policies would be consistent with previous ones; indeed, they frequently turned out to be contradictory (and they still are). Our best hope is that facts or really serious crises will force convergence on these politically sensitive issues and eventually yield more rational and proactive responses.

Obviously, it was also particularly difficult in the United States** to reach a policy consensus on these issues because of deep-seated ideological convictions about the role of the federal government in regulating the behavior of corporate and private citizens. Yet another major problem was that the formulation of a comprehensive energy policy is exceedingly complicated. For example, although it is self-evident that our society requires energy and that, at whatever level of consumption is finally agreed upon, that energy must be supplied in such a way as to protect the environment and not impair national security, this overarching agreement on "goals" vanishes when the details begin to be considered. Without a consensus on both goals *and* implementation procedures, the formulation of an effective "policy" is impossible.

With respect to the "complexity" issue, policy formulation was then (and still is) difficult because of the many components and constituencies to be considered. Here it becomes necessary to achieve consistency and agreement among regional interests, national interests, international interests, the needs of competing energy industries, the government's responsibility to conserve publicly-owned energy resources, the needs of the extractive industries, environmental groups, economic ideologues and ideologies, etc. The complete list is immense.¹⁸

To emphasize the fact that environmental concerns did not surface coherently in the public and the governmental consciousness until the 1960s, we conclude this topic by noting that Lyndon Johnson, in an article written during the last days of his presidency and titled *Agenda for the Future*, devoted an entire section to the topic: Rescuing the Environment.¹⁹ It is equally noteworthy that "energy problems" were not even mentioned in that article.

In the energy area, 1970 turned out to be a harbinger of what the following decade had in store for the industrialized world. One month after Qaddafi's successful December 1969 counter coup in Libya, he demanded a 43¢/bbl increase in the posted price of Libyan crude. The major oil companies, having adequate alternative supplies, initially refused the Dictator's demand but, after negotiations lasting to the following November, even they finally yielded. In the meantime, Qaddafi concentrated on Occidental, whose *only* crude supplier was Libya, and to emphasize his ultimatum (no price increase, no oil) arbitrarily cut Occidental's production from 0.8 to 0.5 Mbbl/day in May. That same month, two pipelines (from Iraq and from Saudi Arabia to the eastern Mediterranean) were shut down*** and, since the Suez Canal was still closed, the world was almost immediately faced with a crude shortfall of about 1.3 Mbbl/day

*In some instances, such problems were completely ignored.

**See especially, S. M. Lipset, *American Exceptionalism*, W. W. Norton (1996).

*** One, the Tapline (Trans Arabian Pipeline) from Bahrain through Saudi Arabia, Jordan, and Lebanon to Sidon on the Mediterranean was cut by a tractor and the other, owned by the Iraq Petroleum Company (the IPC pipeline), from the head of the Persian Gulf through Iraq, Syria, and Lebanon to Tripoli, was closed by Syria.

(adequate crude was still available in the Persian Gulf, but the shortage was made very real by inadequate transport). For the U.S., the result was a succession of "brown outs" along the Atlantic coast, and a general tightening of coal, oil, and gas supplies, coupled with price increases, throughout the nation.

Occidental capitulated in early September, and by the end of the year *all* Persian Gulf oil "taxes" had been raised. As Yergin²⁰ has noted, "The Libyan agreements decisively changed the balance of power between the governments of the producing countries and the oil companies," and Qaddafi's actions in January 1970 can quite properly be identified as the beginning of the "Energy Crisis" for the nations of the Western world.

3.2.2 The Federal Response: In the mid 1950s, several environmental bills were passed by the Congress and signed into law by the President. These actions continued throughout the next two decades due to:

- a. increasing air pollution problems in cities and industrial areas,
- b. increasing concerns on the part of public interest groups regarding the long term hazards of current nuclear and other waste disposal practices,
- c. increasing problems with water pollution,
- d. problems arising from the increasing use of pesticides,
- e. the adverse consequences arising from the large scale use of chemical fertilizers in agriculture, etc.

The Chronology (Attachment 4) provides a listing (and occasionally a summary) of the environmental bills signed into law by successive Presidents. As noted earlier, practically all of this legislation was reactive, uncoordinated, and fragmented (in the sense that public and legislative attention was focused successively on one specific issue provoked by one specific crisis).

The reason for the neglect accorded environmental issues during the 1950s and the 1960s was that both governmental and public attention was focused on: wars (Korea and Vietnam), the civil rights movement, and both the benefits and the problems new technologies were providing. Toward the end of this period, however, environmental concerns again began to move toward center stage (see Attachment 5).

Recognizing that these problems were likely to become a major political issue in the 1970s, President Nixon's first State of the Union address to the Congress in January 1970 focused considerable attention on environmental issues. It is necessary to return to 1969, however, in order to understand how the Nixon Administration managed, for the first time in this country's history, to formulate embryonic (but nevertheless relatively coherent, comprehensive, and rational) national environmental and, subsequently, energy policies. Even more surprising, as may be seen from the Chronology (Attachment 4), is that this action was taken before *energy* became an issue of overwhelming public concern. As will be elaborated below, the first result of this effort was President Nixon's submission to the Congress on June 4, 1971 his first environmental-energy message.²¹ In a subsequent section, we shall discuss the contents of this message. For the present, it is important to understand how this proposal was put together by the White House staff.

Shortly after Nixon's inauguration in 1969, Lee A. DuBridg was appointed Presidential Science Advisor (PSA) and as such, he also became chairman of the President's Science Advisory Committee (PSAC) and director of the Office of Science and Technology (OST) which, during the Johnson Administration had maintained a small but not very influential energy policy staff headed by S. David Freeman. Freeman was an able and well-informed lawyer, and his organization was retained during the early days of the Nixon era.

Unfortunately, within a few months DuBridge was frozen out of the White House inner sanctum and hence from direct access to the President. During the summer of 1970, however, environmental pollution problems intensified, brownouts occurred periodically up and down the Atlantic seaboard, and (as mentioned previously) Libya reduced its oil exports, two oil pipelines across Syria from the Persian Gulf to Mediterranean ports were shut down, foreign oil became increasingly difficult to obtain, and U.S. supplies of coal, oil, and natural gas all grew tighter (see Chronology, Attachment 4).

Despite DuBridge's communication problem, the above events eventually forced the Administration to accept the Science Advisor's repeated arguments that *both* the environmental and the energy problems facing the nation deserved more attention. In response, on August 6, 1970, John Ehrlichman created a National Energy Subcommittee of the Domestic Council (see Chronology, Attachment 4) to deal with the situation. Paul W. McCracken (Chm., Council of Economic Advisors) became the Subcommittee's chairman and, during the remaining months of 1970, McCracken's staff, together with that of the OST, began to formulate a national energy policy.

[**Note:** In order to maintain some semblance of chronological consistency, we are interrupting here our story of the development of a White House energy/environmental policy. It will be continued at the beginning of Section 3.3.2 dealing with the federal response to the events of 1971.]

3.2.3 The Los Alamos Response: During the 1950–1970 period both the energy and environmental research being carried out at Los Alamos tended to be relatively insulated from similar research occurring elsewhere in the AEC community, in industry, in universities, and in other scientific and engineering institutes (except, of course, the magnetic fusion program). This observation should not be surprising, because relatively little R&D of that nature was being carried out anywhere at that time.

What was going on in the energy and environmental areas at Los Alamos toward the end of this period was essentially a continuation of programs, many of which had been underway for years, namely:

- **The Magnetic Fusion Program:** studies with Scylla IV (a high- β descendant of the 1957 Scylla I machines).²²
- **The Environmental Monitoring Program:** continuation of a 20 year environmental studies program intended to prevent the migration of harmful concentrations of radiation, radioactive wastes, and toxic wastes outside the Technical Area (as well as controlling or preventing their accumulation within).²³
- **The Remains of the Fission Reactor Technology Program:** This program, the components of which were carried out in several different LASL divisions, included reactor safety studies (largely computational) and materials science projects, e.g., diagnostic examinations of irradiated reactor fuel elements.²⁴
- **The Magnetic Energy Transfer and Storage (METS) Program:** * This project was initiated in the late 1960s in response to the needs of the LASL magnetic fusion energy program. During 1970, this work led to preliminary studies of both energy storage and energy transmission applications of superconductivity in the electrical utility industry.^{15,16}
- **The Subterrene Program:** In mid 1970, experimental work began on the Subterrene project^{7c} (initially funded by LASL's Weapons Supporting Research program and described previously).

*This subsequently evolved into the Superconducting Magnetic Energy Storage (SMES) Program.

In September of 1970, Agnew succeeded Bradbury as Director and shortly thereafter a number of important management changes were made, in particular, the appointments of MacDougall and Taschek as Assistant Directors. During the latter part of 1970 it became increasingly clear that LASL's Project Rover would soon be terminated and some staff members in both N and other divisions began to explore possibilities for attracting new projects which LASL was well-prepared to carry out. Concurrently, increased management attention was given to promoting and increasing the scope of all of the programs listed above.

Recognizing that permanent funding for these projects would probably come from non-AEC federal funding agencies, Director Agnew hired Austin McGuire, in November 1970, to coordinate, facilitate, and encourage such interactions.

Another illustration of the increasing attention being paid energy and environmental issues by the Laboratory staff is obtainable from an examination of LASL research papers published and talks given at scientific and engineering meetings. This record shows that an almost discontinuous emergence of topics dealing with energy and environmental issues occurred during November and December of 1970.

Finally, the benefits likely to accrue to the nation's energy *and* environmental problems were emphasized with increasing intensity as continued funding was sought during 1970 for all of the above-mentioned major LASL projects.

3.3 The Emergence of Energy Concerns in the United States (1971)

3.3.1 External Provoking Events and Internal Related Issues: During 1971, environmental problems continued to plague the nation and, although it was a relatively calm year with respect to energy issues, a substantial number of events, occurring both in the U.S. and elsewhere in the world, began to focus attention on the future reliability of U.S. energy supplies and on the likelihood of their continuing availability at bargain prices. On the international scene, the turmoil that erupted in 1970 among the OPEC* nations regarding pricing policies and the transport disruptions accompanying those controversies appeared to have been resolved by early 1971, albeit at the cost of substantial price increases per barrel of crude oil (see Chronology, Attachment 4). Finally, the continuing growth in U.S. energy consumption coupled with the steadily decreasing domestic production of petroleum required ever-increasing oil imports and this, in turn, created serious balance of payment difficulties for the U.S. economy as a whole.

Finally, and most specifically, public attention during 1971 (insofar as it relates to this report) was concentrated on the continuing increase in environmental degradation and the growing body of evidence linking many of these problems to energy-related technologies, e.g., production of electricity, fuel transportation, refinery operations, off-shore oil spills, drilling accidents, etc. These concerns led, in turn, to increasing public consideration and discussion of more environmentally-benign alternative fuels, the R&D necessary to develop them, and the necessity for reducing, or preferably removing, industrial pollutants discharged into the atmosphere, the nation's waterways, coastal waters, and landfills.

3.3.2 The Federal Response: Returning now to the activities of the National Energy Subcommittee of the Domestic Council, which was established in August of 1970, a report outlining a new national energy strategy (written and cleared through the relevant federal agencies before being forwarded to the Subcommittee) was delivered to the President in

*Organization of Petroleum Exporting Countries (OPEC), formed in 1960 (see Attachment 8).

March 1971. That report was approved and then the Subcommittee staff together with the OST and the White House staff began the preparation of proposals, based on the report, in a form suitable for submission by the President to the Congress. This became the President's First Energy Message to the Congress, was titled Clean Energy Needs,²¹ and was delivered to the House of Representatives and the Senate on June 4, 1971. The key words in Nixon's introductory paragraphs were:

"... our growing awareness of the environmental consequences of energy production has demonstrated that we cannot take our energy supply for granted any longer. A sufficient supply of clean energy is essential if we are to sustain healthy economic growth and improve the quality of our national life. I am therefore announcing today a broad range of actions to ensure an adequate supply of clean energy for the years ahead."

The main thrusts of Nixon's proposal were:²¹

- increased support for SO₂ control technology,
- increased support for nuclear breeder reactor R&D,
- coal gasification R&D,
- increased support for other energy-related R&D efforts including coal mine health and safety, controlled thermonuclear fusion, coal liquefaction, magnetohydrodynamic power cycles, underground electric transmission, nuclear reactor safety and its supporting technology, advanced reactor concepts, solar energy, etc., and
- *formulation of a comprehensive, balanced, and imaginative R&D program to meet the twin goals of "supplying adequate energy and protecting the environment" (italics mine).*

Of these five initiatives, work was already underway on the first four in several federal agencies, e.g., the AEC, the National Science Foundation (NSF), and the Department of Interior (DOI).²⁵ To implement the *last initiative*, Nixon requested that his Science Advisor (to whom the Office of Science and Technology, Executive Office of the President reported) cooperate with the Council on Environmental Quality and other involved federal agencies "to make a detailed assessment of all the technological opportunities in this area and to recommend additional projects which should receive priority attention."

The OST contracted on June 25, 1971 with Associated Universities, Inc., responsible for the operation of Brookhaven National Laboratory (BNL), to carry out this program.^{26*} BNL, shortly thereafter, invited the Massachusetts Institute of Technology (MIT) to assist them in organizing this study.

The first substantive report originating from this effort was AET-7, Assessment of Energy Technologies—Report on Step I, issued in Nov. 1971.²⁷ It established the general methodology of the assessment and selected promising technical areas for further detailed evaluations.

Work on this initiative continued throughout 1972. Its discussion will be continued in Section 3.4.2 dealing with the federal energy-related events occurring in that year.

Another important action taken in Washington, which made a considerable difference in the way in which work at Los Alamos was funded, occurred on Aug. 11, 1971, when Congress passed P. L. 92-84, Title 2, Sect. 201, an amendment to the Atomic Energy Act of 1954. This

*The references designated as 1968–, 1971–, 1972–, 1973–, 1974–, 1976–, 1978–, 1979–, and 1991– in the Notes and References consist of several chronologically arranged notebooks (the contents of which are numbered serially) containing letters, memoranda, minutes of meetings, and copies of other relevant documents and reports relating to these efforts. Attachment 14 consists of a Table of Contents for this collection. The collection itself, together with copies of many of the other references in this report, have been transferred to the LANL Archives, Roger A. Meade, Archivist, MS-C322, LANL, P.O. Box 1663, Los Alamos, NM 87545.

amendment authorized the AEC and its laboratories to conduct R&D relating to the preservation and enhancement of a viable environment by developing more efficient methods to meet the nation's energy needs (see Sect. 31a.6 of the above-mentioned legislation). And in Sect. 33 relating to RESEARCH FOR OTHERS, the 1954 Act was amended to authorize the AEC "when it finds private facilities or laboratories inadequate for the purpose, ... to conduct for other persons, through its own facilities ... those activities as it deems appropriate to the development of energy." In this section, the Act previously read: "development of *atomic* energy." This amendment permitted AEC support of non-nuclear (as well as nuclear) energy R&D and added another relatively sympathetic source of funds for new non-nuclear energy work at Los Alamos.

This amendment immediately led to a reorganization at AEC Headquarters. The position of Assistant General Manager for Energy and Development Programs was established (John J. Flaherty was appointed to the position) and reporting to him were four AEC Divisions: Division of Naval Reactors under Admiral Hyman Rickover, Division of Reactor Research and Development (RRD) under Thomas A. Nemzek, Division of Space Nuclear Systems under Daniel Gabriel, and a new Division, the Division of Applied Technology (DAT) under Gerald W. Johnson.

It should also be noted that when this amendment was passed, the Congress unfortunately failed to appropriate any money to implement the agency's new assignment. It took about six months to get this omission rectified.

Yet another relevant event occurring in 1971 was that other government agencies, noting that future federal involvement in the energy business was likely to be substantial, began to stake out their own claims on any new energy R&D funds that might be provided by the Congress. For example, the NSF, which had just established its IRRPOS Program (Interdisciplinary Research Relevant to Problems of Our Society), replaced it with the RANN Program (Research Applied to National Needs), which included specific program elements in the energy area.

3.3.3 The Los Alamos Response: The pattern of steadily increasing interest in non-AEC-funded (and hence non-nuclear) energy and environmental R&D continued throughout 1971 since, despite the amendment to the Atomic Energy Act mentioned previously, the AEC had no funding to implement its new assignment. LASL staff members therefore continued to familiarize themselves with other federal agencies authorized to fund *non-nuclear* energy and environmental R&D, in particular the NSF Research Applied to National Needs (RANN) Program. At about the same time, staff members engaged in weapons projects became increasingly aware of environmental problems and moved to demonstrate how *their* already-developed technologies were also capable of contributing to the solution of national environmental concerns. For example, in 1969, a joint environmental project was undertaken between CNC-11 and the 58th Weather Reconnaissance Squadron at Kirtland Air Force Base (the relationship had originally been established to maintain and improve existing equipment and techniques for sampling and analyzing nuclear bomb test debris in the atmosphere as a part of the so-called Readiness Program). In this new initiative, LASL scientists proposed to the AEC Division of Military Application (DMA) that the collection and analysis of atmospheric emissions from industrial sources might serve as simulators for nuclear debris. Since the emissions from different sources in New Mexico and Arizona are unique and since such sources are widely separated, it was believed that these studies could also be used to "fingerprint" individual sources and thus contribute to the identification of air-pollution emitters as well as to air pollution enforcement procedures. DMA gave its approval and the studies began.²⁸ Unfortunately, the results were "too good"; objections raised by industry eventually forced LASL to confine these activities to weapons-related research!

As noted earlier, on June 4th, President Nixon submitted his first energy message, titled Clean Energy Needs, to the Congress. Until funding was made available, however, at Los Alamos, the message was "noted with interest" and life went on. Then, on June 30th, a "reduction-in-force" of 250 employees was announced, the first of that magnitude by a very large margin in the history of Los Alamos.²⁹ Some of the individuals impacted were rehired to assist in new non-AEC short-term projects funded by the Department of Defense (DoD), NASA, and the National Institutes of Health (NIH). Nevertheless, the event was traumatic, and it provided a substantial incentive to the remaining staff to try to develop new research activities consistent with LASL's existing capabilities and likely to obtain other-than-AEC funding. McGuire's new office provided considerable assistance to staff members engaged in this effort.

Throughout 1971, continuing efforts were made to obtain external funding for the Subterrene, the Hot Dry Rock (HDR), and the Superconducting Power Transmission Line (SPTL) projects. This required numerous trips to Washington for discussions with potential sponsors, the writing and rewriting of proposals to satisfy ever-changing format specifications, the reporting of experimental results, etc. Toward the end of 1971, prospects appeared bright for substantial NSF-RANN funding for both the Subterrene and the SPTL projects.^{30a,c,d} For the HDR project, although preliminary studies had been made and were encouraging, external funding was still in the "promises, promises" stage.^{7b,30b}

3.4 First Steps in the Formulation of a U.S. Energy R&D Policy (1972)

3.4.1 External Provoking Events and Related Issues: During 1972, no "provoking events" *per se* occurred which impacted significantly upon U.S. energy policy or actions. Rather, almost all of the previously discussed items continued to develop, often with increasing momentum. For example, the OPEC countries, motivated in large measure by the devaluation of the U.S. dollar, continued to press for increased oil prices. Publication of the Club of Rome Study* focused international attention on the consequences of continued world growth in population, resource consumption, and waste. U.S. oil production, which peaked at 9.6 million barrels in 1970, continued its downward trend. U.S. energy consumption continued to increase together with increasing oil imports, and the balance of payments deficit continued to grow.

In general, an awareness was developing that the U.S. would be obliged to shift, in the near future, from an era of almost unquestioned energy resource abundance and cheapness to one much more limited and more costly. The formulation of new national policies designed to cope with the consequences became imperative.

3.4.2 The Federal Response: Continuing with the OST's implementation of Nixon's June 4, 1971 request²¹ that an R&D program be formulated to provide an adequate supply of clean energy, a special committee of the Federal Council of Science and Technology (FCST), namely the Energy R&D Goals Committee, was created early in 1972 and charged with the organization of 11 different Technical Groups (TGs)** to study and evaluate the most promising energy R&D areas (previously identified by the Brookhaven/MIT study group). A final overall assessment, using input from the TGs, was to be made in late 1972 by an Overview Committee appointed by the OST.

*For more information on the Club of Rome, see pp. 136–148 in *Blaming Technology: The Irrational Search for Scapegoats*, Samuel C. Florman, St. Martin's Press, New York, 1981.

**LASL participated in this study as TG members and consultants; included were F. Ribe, E. Hammel, M. Smith, F. Edeskuty, and K. Boyer. See Attachment 6 and Ref. 31b.

To ensure that all of the TGs operated within a common framework using the same assumptions and data, the BNL group prepared a second excellent report: AET-8 (Reference Energy Systems and Resource Data for Use in the Assessment of Energy Technologies)^{31a} issued in April 1972.

During 1972, these TGs met frequently, issued their reports by October of that year, and by December 1972 the Overview Panel had completed its work and submitted a set of draft recommendations to the OST to be used in preparing the final report (note that Nixon was reelected President in November 1972).

Unfortunately, the expected benefits from this 18 month effort were abruptly trashed when, in late December 1972, President Nixon, in a fit of pique with both the PSA and the PSAC, abolished both of them, together with most of their supporting staffs and transferred all of their responsibilities to the National Science Foundation (NSF). Perhaps "trashed" is too strong a word since the documents survived.* Nevertheless, a new start with new players and new ideas followed. It took the NSF about three months to absorb what had already been done and then put together an organization capable of continuing to implement the assignment originally given the OST.**

In addition to the reports themselves, another residual consequence of the FCST exercise was that it focused attention on the fact that a sizable number of federal R&D "players"*** were already in the energy R&D game. This conclusion is derived from the fact that each of the FCST TGs and their Subgroups was "sponsored" by one of the following government agencies: Interior, AEC, HUD, NASA, NSF, and DOT (see Attachment 6). Many other federal players became known to the participants in this exercise as a result of the studies carried out. Nevertheless, the net result of this exercise was a conviction on the part of many of the TG members that the country would be well on its way toward developing and implementing a rational, well-thought-out, and coordinated *clean* energy R&D program if most of the FCST recommendations made were accepted. It should be emphasized, however, that this program was focused almost entirely on *technological* solutions to the nation's energy problems.

During the spring of 1972 while the OST Assessment study was getting underway, yet another energy-related initiative was undertaken at the White House. It had become increasingly apparent to some members of the National Energy Subcommittee of the Domestic Council that there was much more to a national energy policy than technology. More specifically, it was finally recognized by the Administration that *non-technical* questions relating to energy were also of immediate concern. These included:

- fuel supply, e.g., the shortage of domestic refining capacity, the lifting of oil import restrictions or quotas (first imposed by the Eisenhower Administration), price regulation (especially of natural gas), fuel price controls, access to fuel supplies on public lands, deepwater ports for supertankers, encouragement of fuel conservation measures, fuel rationing, the passage of legislation mandating increased mileage per gallon for the nation's vehicle fleet, lowering highway speed limits, etc.,
- politics (voter resentment against conservation measures interfering with accustomed lifestyles),
- government reorganization (for the purpose of dealing more effectively with national energy problems), and

*Doug Balcomb managed to collect a complete set of both the published and unpublished reports. They were originally kept in the Q-DOT library. I do not know what happened to them.

**The Nixon Administration's decision to abolish the OST was made in late December, 1972. The OST phase-out was complete by June 30, 1973.^{31d}

***By the end of 1972 more than 60 different federal agencies were carrying out energy R&D projects; those listed in Attachment 6 as "sponsors" were responsible for the largest of these programs.

- adverse environmental, economic, and other societal consequences arising from some proposed technical “solutions” to energy shortages.

In early 1972, Peter M. Flanigan (the main White House contact with the business community) took over from McCracken* and decided to formulate a comprehensive energy policy *including* its technical, economic, environmental, societal, and political components. By July 1972 a sizable collection of policy initiatives had been compiled and plans were underway for presenting them to senior administration officials when the entire project was abruptly canceled by Shultz, Ehrlichman, and Connally, presumably because Flanigan’s proposals were deemed “politically unwise” to surface so close to the forthcoming election. In October 1972, the chairmanship of the Subcommittee was transferred to Rogers C. B. Morton, Secretary of the Interior, and a short time later the entire Subcommittee was abolished.

The rationale for discussing this obviously abortive 1972 federal response to the nation’s energy problem is to emphasize the fact that it was finally beginning to be generally recognized that there had to be much *more* to a national energy policy (namely, in-depth and concurrent consideration of the related economic, societal, political, and cultural issues) than a collection of *technical fixes*. It was also beginning to be recognized that those directly involved in developing the so-called technical fixes ought *always* to maintain an awareness of the related nontechnical aspects of the general energy problem, abrupt changes in which could (and probably would) affect the public acceptance and hence the future funding of their programs.

3.4.3 The Los Alamos Response: It was in the context of both the federal and the LASL energy/environment developments of 1970 and 1971, that LASL began to reexamine its own activities in the Energy area. This process began in the office of the Associate Director for Research (ADR), R. F. Taschek, and many of the details were carried out by Glen Graves, who was at that time serving as an Assistant to the ADR. One of Graves’ first actions was to organize a series of talks on ongoing or proposed LASL energy-related programs in order to obtain an assessment of the current status of these activities. Throughout calendar 1972 additional proposals (but for projects considerably smaller in magnitude than those already discussed) were written and rewritten, new contacts were made in Washington (to whom these proposals were submitted), and many were funded. Some preliminary and encouraging experimental results were also obtained using Laboratory funds on the HDR and Subterrene projects.

The SPTL proposal was first submitted to RANN in January 1972.^{30c,d} By June it had successfully run the NSF gauntlet and substantial funding was momentarily expected when, in August, DAT suddenly and unexpectedly got some FY73 money. They first indicated a willingness to buy in, and finally took the project over altogether.¹⁵ In November, DAT also agreed to fund the Superconducting Magnetic Energy Storage (SMES) Project¹⁶ for peakshaving. In mid 1972, John Rowley was successful in obtaining NSF RANN funding for the Subterrene,⁷ and it finally began to look as if DAT would eventually receive approval from OMB for the LASL HDR^{7b} project; that finally happened in FY74.

As these technical developments were jelling, some of the larger implications of the national energy problem also became more generally evident at Los Alamos, and discussions were initiated relating to the feasibility of concentrating and thereby coordinating the management of the energy projects currently being carried out in several of the LASL divisions. In addition, a need was simultaneously recognized for attempting to understand the societal, the environmental, and the economic consequences of ongoing and future LASL energy programs (at that time, however, no mechanism—no organization as such—existed at LASL to address and respond to such problems).

*See Chronology, Attachment 4.

After some thrashing around, it was decided in the fall of 1972 to create a new division—an energy division (Q Division^{31c,32})—to deal with these issues. Components of the new division (it became operational in March of 1973) were the Controlled Thermonuclear Research (CTR) Program, the Georesources activities (HDR, the Subterrene, and the supporting geosciences research), the Cryogenics programs (SPTL, SMES, and the supporting research program in cryoengineering and low temperature physics), the N Division Heat Pipe work (which was redesignated Advanced Heat Transfer Technology), and finally, a group working out of the Division Office called Q-DOT or the Q Division Office of Analysis, Assessment, and Planning, which concerned itself with the development of new energy programs as well as with the economic, the societal, the ecological and the environmental impacts of ongoing as well as newly-proposed energy projects. Bob Duffield agreed to head up the new division, Fred Ribe ran the CTR operation, Ed Hammel was responsible for the rest of the Q-Division program, and Rod Spence helped everyone with the day-to-day operations.

3.5 The Energy Crisis (1973)

3.5.1 External Provoking Events: The most serious energy-related problem that occurred during 1973 was (for the first time) a major *worldwide* energy shortage. This was a consequence of the concatenation of several external provoking events, some of which had their roots in developments, customs, and trends initiated years, and even decades, before. We list the most important of these below and then comment briefly on each:

- Growth in the Demand for Energy,
- Nationalization of Foreign Oil Producing Industries,
- Middle East Oil Price Increases and OPEC,
- Arab-Israeli Antagonism,
- The Yom Kippur War and the Embargo.

3.5.1.1 Growth in the Demand for Energy: For more than two decades preceding 1973 world oil consumption had been growing at a rate of about 7% per year (doubling every decade). During most of that period, relatively little difficulty was experienced by the producers in keeping up with that increasing demand. As is well known, however, exponential growth rates are impossible to maintain indefinitely, and for the international oil industry, production rate increases began to fall behind the consumption rate increases during the 1960s. By the early 1970s, the world-wide oil “surplus” had essentially disappeared and the U.S. contributed substantially to that disappearance. For example, in 1970, annual United States oil production peaked at about 11 million barrels per day. For various reasons it has declined slowly (on average) ever since. Increasing imports were therefore required to make up for the domestic decline as well as satisfy the continually increasing U.S. appetite for energy. Environmental concerns forced shifts by U.S. industry from coal to oil or natural gas, and the projected nuclear power growth failed to materialize. Both of these developments contributed to an *increasing* U.S. demand for oil. Energy shortages, coupled with significant price increases for crude oil on the spot market, therefore occurred periodically but frequently during the first 9 months of 1973.

3.5.1.2 Nationalization of Foreign Oil Producing Industries: During the early years of this century, new major oil fields were (usually) discovered in underdeveloped or in developing countries. The technology for extracting and refining crude oil was, however, resident (primarily) in the U.S., Britain, and the Netherlands. International oil operations were therefore carried out by the major oil companies seeking (usually with help, pressure, or threats from their

governments) long-term “concessions” from prospective oil-source governments which permitted the companies unrestricted access to explore in a specified region and ultimately produce any oil discovered. In return, the companies paid the source government a fixed fee or royalty per barrel of oil produced.* This arrangement led to increasing dissatisfaction in the producing countries as they gradually became aware of the enormous disparity between their royalty payments and the oil companies profits. With time, dissatisfaction changed to resentment, to anger, to threats, and, ultimately, to action. This sequence was fanned by Arab nationalism and made meaningful by the slow but steady development of educated and sophisticated indigenous oil technologists and businessmen.

The “first”** *effective action* occurred in 1933 in Persia (and it provided a model for similar responses subsequently taken elsewhere). In that year, after much acrimonious discussion, an agreement between the Persian government and the Anglo-Persian Oil Company was signed giving the Persians *not only* royalties (independent of the price of oil) *but also* 20% of the company’s worldwide profits. Finally, and in addition, a minimum annual payment of £750,000 to Persia was guaranteed. This arrangement almost immediately became known as “participation.” In 1949, the Anglo-Iranian Oil Company*** (AIOC) was again forced to negotiate a “Supplemental Agreement” with the company giving Iran a large increase in royalty payments, a continuation of the 20% profit-sharing provision, and a substantial one-time lump-sum payment.

Nevertheless, pressure still continued to build for a “better deal” for Iran. By the autumn of 1950, AIOC finally proposed a 50-50 profit split, but by then Iranian nationalism had begun to explode. On May 1, 1951, the Iranian Parliament nationalized the oil industry. Attachment 8 provides the reader with an abbreviated account of these developments. The critically important result was that a new consortium, called the National Iranian Oil Company, was formed. The U.S. government, under political pressure from the U.S. independent oil companies, supported this action.

The details of how subsequent takeovers occurred in other Persian Gulf states are irrelevant to this analysis. In any event they can be obtained by anyone interested in many other more authoritative sources.²⁰ For our purposes it is sufficient to note that in:

- 1970: Libya gained control of most of its oil industry; the takeover was completed in Sept. 1973.
- 1971: Algeria nationalized its oil industry forming Sonatrach. Iraq nationalized the Iraq Petroleum Company (IPC). In 1961, Iraq had already revoked 99.5% of IPC’s concession.
- 1973: Practically all of the remaining Gulf producing nations *initiated* nationalization procedures and early in 1974 Qatar, Kuwait, Oman, United Arab Emirates, and Bahrain nationalized or otherwise took over control of their oil industries.

3.5.1.3 Middle East Oil Prices and OPEC: The history of oil price increases in the Middle East is so varied, so Byzantine, so irrational, so political, and hence so complicated that the following account includes only what the writer considers relevant to the issues here being considered (and even that is too much!).

*For approximately 30 years, the main source of revenue to the governments involved was these royalty payments.

**The “first” action actually occurred in 1917 in Mexico. The results were, however, not particularly successful and general awareness of the problems encountered by the Mexican government dissuaded other countries from attempting the same approach for about 16 years. See Attachment 7 for a brief account of the Mexican experience.

***Successor to the Anglo-Persian Oil Company (common use of the term Iran to designate the indefinitely-bounded country known as Persia began in about 1927 and was officially adopted in 1935).

Our story begins on May 28, 1901 when, after years of negotiations, W. K. D'Arcy (from Great Britain) managed to obtain from the Shah of Persia a 60 year "concession" permitting him (and what subsequently became the Anglo-Persian Oil Company) to explore for and own any oil found in a 400,000 sq. mile area of Southern Persia. Thereafter, the concessionaire was authorized to produce that oil as he deemed fit, and market it. In return, the Shah received an "upfront" payment of £20,000, £20,000 worth of stock in D'Arcy's company, and a promise of 16% of the profits (the word "profits" was initially not defined and it took years to reach an agreement). Seven years of exploratory drilling passed before the first "gusher" was found in southwestern Persia on May 26, 1908. No need exists to detail the subsequent discoveries in the Gulf area. What is of significance is that by 1912, D'Arcy's Anglo Persian Oil Company was producing 1,600 bbl/d and by 1918 this had increased to 18,000 bbl/d. It is also important to note that from 1914–1918 the entire area was in turmoil because of World War I (WWI). Although Persia was not one of the WWI combatants, the protection of its oil fields and refineries (which were an important source of oil and refined products for the Allies—Britain in particular) resulted in several successful British military operations against Turkish attacks in the area. In the post-war territorial settlements, Britain was awarded mandates over Iraq and all of the Persian Gulf states formerly controlled by Turkey. Because of the turmoil, little attention was paid by any of the parties to oil prices or further exploration until the 1920s. Then during the 1920s and 1930s, new concessions were granted, new Middle East fields were discovered (Iraq, 1927; Bahrain, 1932; Kuwait, 1938; Saudi Arabia, 1938; Qatar, 1938; etc.) and compensation to the producing nations gradually became "royalty" payments per barrel produced, paid by the oil companies, set at a fixed percentage of a so-called "posted price" determined by the oil companies, and claimed by them to be identical with the average world-wide market price.

In general, this pricing arrangement survived World War II and "worked" moderately well for the next two decades. "Moderately well" included:

- a. repeated demands for higher royalty payments from the producing countries, which were grudgingly and minimally met, and
- b. responses from the U.S. government helpful to the oil companies, e.g., setting aside antitrust regulations "in the interest of national security," encouraging the companies to pay higher royalties and then reimbursing them by granting them tax credits (more or less equivalent to their increased royalty payments).*

Relative price stability was nevertheless experienced by the international oil industry from about 1950–1970. Proof of this assertion is the fact that the average price per barrel of crude increased from \$2.50 to \$3.00 (in current dollars) between 1948 and 1970 (actually a price decrease when corrected for inflation). This stability, however, should not be interpreted as a period of calm and satisfaction with the status quo. Instead, it resulted from the fact that from the early 1950s to the early 1970s, an oil surplus existed in world oil markets. Despite the steadily increasing demand for crude oil, production increased even more rapidly because of:

* Actually, a gift to "big oil" from a sympathetic government; officially considered by the IRS since 1950 [see R. Stobaugh and D. Yergin, *Energy Future*, p. 21, Ballantine (1980)] as taxes paid to a foreign government and hence deductible from the oil companies' U.S. federal income taxes. During the "energy crisis" of late 1973 and much of 1974, the U.S. public and the Congress considered this "arrangement" one of the major sources of the oil companies' so-called "obscene profits." Legislation was supposed to have been introduced in the Congress in late 1974 to eliminate this tax loophole, but to date I have not been able to confirm that it was, in fact, enacted. See also R. O. Anderson, *Fundamentals of the Petroleum Industry*, Chap. 30, U. of Okla. Press (1984).

- a. the development of new fields in Algeria, Libya, Nigeria, etc. For example, oil was discovered in Libya in 1959. Ten years later, its output exceeded that of Saudi Arabia!
- b. the aggressive reentry of the Soviet Union into the international oil market and its achieving the position of the world's second largest oil producer by the end of the 1950s.
- c. the entry and participation in Middle East developments by independent oil companies, encouraged by the U.S. government because of its concern about the interlocking arrangements relating to pricing and production rates made by the big oil companies. A result of this action was increased competition, lower prices, and increased production. In 1946, nine oil companies operated in the region; by 1972 that number had increased to three hundred fifty!
- d. the initiation, by the oil producing nations, of major and very costly modernization programs. Given the existing market conditions, the only way of increasing their revenues was to produce more crude more efficiently.

The net result of these actions and policies was, not surprisingly (as D. Yergin and others have pointed out), "More oil was in search of markets than there were markets for oil."

The "solution" to this problem was "discounting" on the part of the oil industry, i.e., selling oil in the world market at prices below the "posted price." Since the oil companies' contracts with the producing countries called for the payments of royalties and profits based upon a fixed percentage of the *posted price*, however, the result of discounting was a loss in oil industry profits with no concurrent loss suffered by the exporting nations. Finally, in early 1959, British Petroleum* (BP) announced a reduction of the *posted price* by about 10%. The reaction of the oil exporting nations, whose incomes had been arbitrarily and unilaterally cut, was outrage. They met and recommended that specific counteractions against the oil companies be taken. But the continually increasing oil glut prevented any of them from being implemented. On Aug. 9, 1960, a further cut in the posted price was announced by Standard Oil of New Jersey, and this reduction was immediately adopted by the other oil companies. This time, however, the exporting nations were sufficiently enraged to respond with a more formal action, namely, the creation on Sept. 14, 1960, of the Organization of Petroleum Exporting Countries (OPEC), the objective of which was the gaining of control, by collective action on the part of the producing nations, of their own oil resources (see Attachment 8). Despite this action, the implementation of OPEC's goals was delayed by more than a decade for two reasons: the continuing oil surplus and the fact that the concessionaire's contracts had, from the beginning, always transferred ownership of the oil, whenever and wherever discovered (within each company's allocated area), to the companies.

During the 1950 to 1970 period, however, oil consumption increased more rapidly than did production (despite the continuing discovery of new oil fields) and by the beginning of the 70s, the oil glut had virtually disappeared. The stage was now set for the emergence of an altogether new world oil policy.

3.5.1.4 Arab-Israeli Antagonism: This subject is so well known that, although important to our story, only a brief introduction followed by a summary of the relevant events will be presented here. Since the first Diaspora, which occurred with the expulsion of the Jews from Palestine by the Assyrians in 722 B.C., this process was repeated in 538 B.C. after the Babylonian conquest, repeated again in 70 A.D. after the Roman conquest of Palestine, and was continued throughout the Middle Ages. One of the subsequent, more notorious persecutions was that which occurred in Spain following issuance of the Edict of Expulsion by Ferdinand and Isabella in 1492. Although these European persecutions and expulsions

*The new name for the Anglo-Iranian Oil Co.

continued almost to the middle of the 20th century, Britain began to show some sympathy for re-establishing a Jewish state in Palestine during the mid-19th century, and an opportunity to do something about it presented itself in 1920 when Palestine became a British mandate as a part of the territorial resolutions of WWI. With this encouragement, Jewish immigration to Palestine began to increase. * To illustrate this point, in 1914, the population of Palestine was about 500,000, of which about 90,000 (or less than one fifth) were Jews. When World War II erupted in 1939, Palestine's population had increased to almost 1.5 million, one third of whom were Jews.

From the beginning of this substantial and continuing immigration, the "indigenous" Palestinians (mostly Arabic and Moslem) resented the resultant encroachment upon what had been their land and their way of life. They responded with sporadic campaigns of terrorism and armed conflict against the new settlers. Further resentment arose from the fact that the immigrants were establishing, in the midst of a slow-paced, partly nomadic, largely agricultural, and feudalistic Arabic way of life, a dynamic, Western-oriented, and highly technological society. One consequence of this latter development was an economic division of the population with the Arabic fraction gradually accepting the less-technically demanding, lower paying, and service-oriented employment opportunities offered by the Israelis.

From 1920 to 1947, peace (such as it was) was maintained between the two factions by British troops. After World War II and, particularly, after the full extent of the Holocaust horrors became more widely known, world support (with the exception of the Palestinian Arabs as well as those in neighboring states) for the creation of a Jewish homeland in Palestine intensified. Under the auspices of the United Nations, the state of Israel was created on May 14, 1948. The legitimacy of this action was not recognized by the Arabs, and almost immediately the first Arab-Israeli war began. ** On one side were the Israelis and arrayed against them were Lebanon, Syria, Jordan, Egypt, and Iraq. By Dec. 1948, after a series of spectacular military successes by the Israelis, an armistice (but no peace) was declared. Although the frontiers of the new state were not defined by the armistice, the *de facto* borders yielded a "State of Israel" with an area roughly 50% larger than that originally proposed by the U.N.

During the years that followed, three additional Arab-Israeli wars erupted. These were:

- a. The Suez Crisis: *** On July 26, 1956, Gamel Abdel Nasser† seized control of the Suez Canal. In the autumn of 1956, he sponsored guerilla raids into Israel and blockaded Israel's southern port of Elat on the Gulf of Aqaba. On Oct. 29, 1956, Israel launched an attack on the Sinai and by Nov. 5th, had occupied the entire peninsula. Under pressure from the U.S., the Soviet Union, and the United Nations, Israel finally completed its withdrawal from the Sinai by March 6, 1957.

*The first wave of Jewish immigration to Palestine occurred in 1882 as a result of massive outbreaks of torture, murder and pillage in Jewish settlements in Russia.

**Preparations for war and numerous skirmishes between Arabs and Jews actually began shortly after the United Nations General Assembly approved a plan for the partition of Palestine on Nov. 29, 1947.

*** See Attachment 4 and Ref. 20, Chapter 24.

†By 1954 the effective dictator of Egypt following the successful 1952 military coup forcing the abdication of King Farouk.

- b. The Six Day War: In May 1967, Nasser ordered U.N. observers out of the Sinai, blockaded once again the Gulf of Aqaba, sent troops into the Sinai, and began organizing other Arab states for a full scale attack on Israel. On June 5th, Israel went on the offensive against Egypt, Syria, and Jordan. Within six days, Israel was in command of the entire Sinai (including the Gaza strip), part of the eastern bank of the Suez Canal, all of Jerusalem, the West Bank of the Jordan River, and the Golan Heights. Subsequently, * control of the Sinai was relinquished to Egypt.
- c. The Yom Kippur War: See section 3.5.1.5, below.

We conclude this section by re-emphasizing that Arab-Israeli antagonisms, expressed by the above-mentioned wars plus terrorist acts and/or limited military actions on the part of both sides during the periods between the major conflicts, have continued for the same reasons as those outlined at the beginning of this section. The problems there noted have in fact become worse. By 1990, the Jewish population in Israel plus the relatively small number of settlers in the occupied territories had increased to more than 3.6 million. In contrast, the Arab population in Israel proper had gradually risen from a low of about 100,000** in 1952 to about 600,000.

3.5.1.5 The Yom Kippur War and the Embargo : For Egypt, one unresolved consequence of the Six Day War was the continued presence of Israeli troops on the east bank of the Suez Canal. This required a continuing allocation of a substantial fraction of Egypt's GNP for "defense purposes," which in turn prevented the government from undertaking much needed economic and social reforms. Anwar Sadat, who succeeded Nasser in 1970, was determined to achieve a meaningful peace agreement with Israel in order to reduce his own military expenditures. After several serious but fruitless attempts, he finally decided to try to achieve by war what seemed to be otherwise impossible. In April 1973, Sadat began a secret negotiation with the Syrian president, Hafez al-Assad, the objective of which was to initiate simultaneously a joint military attack against Israel. On Oct. 6, 1973, which in that year was Yom Kippur, the fourth Arab-Israeli war began as a surprise attack against Israel on both the Syrian and the Egyptian frontiers. For a variety of reasons, the Israeli military was almost totally unprepared for what turned out to be a massive offensive. During the first few days the Arabs achieved substantial victories and the Israelis, in a forced retreat, both consumed and lost large stocks of their military supplies. The Soviets, having armed Egypt and Syria in the first place, continued a vigorous resupply operation. With their own reserve supplies being rapidly depleted, and facing the very real possibility of being overwhelmed by their opponents, Israel requested emergency aid from the U.S., with delivery as soon as possible. Traditionally a strong supporter of Israel, the U.S. on this occasion found itself in a difficult situation, namely that of having become highly dependent upon imported Arab oil.*** The Nixon Administration, apprehensive that open support for Israel could cause serious oil import disruptions for the U.S., attempted to resupply Israel surreptitiously, but the attempt to keep the effort secret failed.

*One of the consequences of the 1977 Camp David agreements.

**All that remained after the flight of over 600,000 Arab refugees from those portions of Palestine that became the State of Israel in 1948.

*** In 1970, U.S. imports were 3.2 million bbl/day. By the summer of 1973 imports had risen to 6.2 million bbl/day, and by the mid-1990s, imports had increased to about 8-9 million bbl/day.

With the U.S. now recognized by the Arabs as an active ally of Israel, that portion of OPEC comprising the Arab oil exporters (OAPEC) responded by unleashing their so-called "oil-weapon." No matter that the Soviets were generously supporting the Egyptian and Syrian offensives!

The "oil weapon" was applied by OAPEC in several stages of increasing potency:

- a. On October 16th, the Gulf-state delegates, meeting in Kuwait City, raised the posted price of oil from \$2.90 to \$5.11/bbl.
- b. On October 17th, the Arab oil ministers, urged on by Iraq, agreed to an oil embargo to be implemented by a cut in production of 5% per month with the most severe cuts to be applied to the United States. In practice, several of the participating OAPEC countries announced that they would begin with 10% cuts.
- c. On October 19th, when President Nixon proposed a \$2 billion military aid package for Israel, Libya responded with a *total* embargo on all oil shipments to the U.S.
- d. On October 20th, Saudi Arabia cut off all shipments of oil to the U.S. The remaining Arab states followed suit. A total OAPEC oil embargo against the U.S. was now in effect. *
- e. On December 25th, OPEC raised its price of crude oil to \$11.65/bbl. A few days later, the embargo was slightly relaxed and was lifted entirely in 1974.

We began this section with the statement that "the most obvious energy-related problem that occurred during 1973 was a major worldwide energy shortage." The remainder of the section described how that shortage arose—a story that was complicated and many faceted. In the United States, that shortage created the following specific problems:

- a. A transportation fuel shortage, which first impacted the U.S. during the spring of 1973 and became more acute during the summer and early fall when local gasoline supplies throughout the nation could no longer be maintained. Service stations periodically ran out of fuel for several days at a time, prices rose, stations limited the quantity of gasoline that could be bought, they shortened their hours, they closed on weekends, and "gas lines" became common.
- b. Shortages of propane, kerosene, jet fuel, diesel fuel, and home heating oil. These all became increasingly difficult to obtain, and prices rose as the year progressed.
- c. Shortages of fuel for electric utilities. Without adequate fuel supplies, "brown outs" became common during periods of peak demand.

After the imposition of the oil embargo in October, *all* of the above problems became even more acute.

3.5.2 The Federal Response:** Before proceeding with the Federal Response to the External Provoking Events of 1973, it is essential to mention one internal "provoking" event which complicated *all* of the Nixon Administration's actions during that year, namely the fallout from the Watergate burglary of June 17, 1972.*** For our purposes it is important to note at the

*By mid-October 1973, with some American aid having already arrived (and more on the way), the Israelis were able to stop their opponents' advances and counterattack. From that point on, Israeli troops made steady progress in forcing an Egyptian and Syrian retreat. The fighting finally ended on October 24th with a cease-fire brokered by both the U.S. and the Soviet Union and with the Israelis in control not only of all the territory they were holding when the war began but also with troops occupying an 800–900 sq. mi. semicircle of Egyptian territory along the lower west bank of the Suez Canal and an additional 150–200 sq. mi. of the Golan Heights. It was not until May of 1974, after the embargo was lifted, that a final Syrian-Israeli disengagement was agreed upon and a formal peace process was able to begin.

**Following an introductory paragraph, this "Response" is divided into several chronologically coherent sections.

*** See Attachment 9.

outset that the ongoing Watergate revelations, followed by "damage control" exercises, resulted in continuing lapses of attention on the part of the President and his closest advisors to the nation's business, including, of course, energy and environmental problems. An additional complication was the organizational chaos created in the Administration as one after another of the "President's Men" responsible for the formulation of a National Energy Policy were forced to resign as their involvement in the Watergate "cover up" became known.

3.5.2.1 January to May 1973: We included in our temporal history of the 1972 "Federal Response" an account of President Nixon's firing his Science Advisor, abolishing the PSAC and the OST, and transferring all of their functions to the NSF (p. 17). To meet these new responsibilities in the energy area (which consisted of completing the OST assignment of "developing a national agenda for Energy R&D"), the NSF organized in April of 1973 an Energy R&D Task Force headed by Paul Donovan.³³ As noted previously, the OST [FCST] reports emphasized, almost exclusively, only technical fixes for the nation's energy problems. NSF's reaction, after assimilating the contents of the FCST reports, was to broaden the scope of the program to include the impact of new energy-related R&D programs upon the environment, economy, society, politics, conservation programs, and international (security of supply) relationships. In addition, since not all of the known alternative energy sources were examined in the FCST study, the NSF expanded the number of technologies treated. To give the reader some sense of the projected scope of the NSF undertaking, about 270 examples of policy-oriented energy research issues, not even mentioned in the FCST study, were listed in one of the early memos to the members of the NSF Task Force for their consideration.³³

At this point, it is important to remind the reader that during 1973, in addition to the chaos caused by Watergate, the energy-related activities initiated by the Nixon Administration were numerous, concurrent, overlapping, poorly coordinated, and frequently abruptly terminated long before they were completed (an example of this was the previously mentioned abortive energy policy study initiated in mid-1972 by Peter M. Flanigan).

In late 1972, before the NSF study had gotten underway, a State Department career foreign service officer and oil expert, James Akins, was detailed to assist Flanigan in the handling of energy-related issues. In response to the growing national concern regarding energy matters, Akins was able to persuade the White House high command that it was time for a second Presidential address to the Congress on energy. Nixon had already decided to abolish the oil quota system, established by Eisenhower in 1959,* and Akins was pressing for increased national attention not only to a strong energy R&D program but also to many of the related institutional and policy issues that had hitherto been neglected (but which the NSF Task Group was also preparing to address). Akins' first draft of the President's speech** was based upon a study of U.S. oil supply problems which he had recently completed while at the State Department.

Once again, it is necessary to interrupt this account by noting that, after the cashing of Flanigan's energy policy review in late 1972 (mentioned on p. 18), Erlichman established himself in January 1973 as the Administration's Energy Czar. In February, he was joined by George Schultz (then Secretary of the Treasury) and Henry Kissinger (Foreign Affairs Advisor). At about the same time, the new energy troika hired Charles Di Bona, a systems analyst (formerly head of the Center for Naval Analysis), to organize a small group of energy policy professionals to assist them. In addition, it should be mentioned here that, in President Nixon's first energy message to the Congress on June 4, 1971, several other recommendations and proposals were included which were not directly relevant to Los Alamos and hence have not

*See Attachment 10: A Chronology of the U.S. Oil Import Quota System.

**See Ref. 20, pp. 590 and 591.

been mentioned previously. Now, however, it is necessary to discuss one of them, namely, the recommendation that a new national energy entity be created, to be called the Department of Natural Resources. This new department would contain all of the energy resource development programs being carried out anywhere in the government. For various reasons, the Congress failed to react to this proposal during the remainder of 1971 and 1972. Consequently, on January 5, 1973, Nixon, in effect, accomplished much the same thing by establishing, in the Executive Office of the President, the position of Counselor (to the President) for Natural Resources, responsible for advising the President on (as well as coordinating) all of the government's energy resource programs. Secretary of Agriculture Earl L. Butz was assigned this job in addition to his other duties. The largest and most important agencies which Butz was expected to coordinate were those in Interior (coal research, oil leasing programs, etc.), Agriculture (Forest Service, Soil Conservation Service, and soil and water conservation research), Commerce (National Bureau of Standards, energy R&D programs, National Oceanic and Atmospheric Administration (NOAA), etc.), NSF (solar energy R&D, energy conversion R&D, etc.), the AEC (nuclear energy, etc.), Department of Transportation (Office of Pipeline Safety), etc. Finally, and additionally, yet another new piece of the national energy policy operation was simultaneously set up in the Department of the Interior with the appointment of a new Assistant Secretary for Energy and Materials (Steven Wakefield) and the establishment within the DOI of a new Office of Energy Conservation.³⁴

With all of the above-mentioned activity, the OMB could scarcely refrain from also participating in the process and it established a new Energy and Science Division headed by John Sawhill, a Baltimore financier. And finally, as if all this were not enough, George Schultz, already wearing four hats (Secretary of the Treasury, Special Counselor to the President, Chief Economic Advisor to the President, and member of the White House Energy Policy Troika), expanded his last-mentioned role by establishing another energy policy group (reporting directly to him) headed by William E. Simon (formerly an investment counselor from New York, who was currently serving as Schultz's Deputy Treasury Secretary).

The final group of actors in the President's energy policy stew was his so-called kitchen cabinet – the Voluntary Science and Engineering Council in Support of the President – formed just before the 1972 election, headed by William O. Baker, President of Bell Telephone Laboratories, and which continued (after the election) to provide advice on science and engineering matters to the White House.³⁵

In summary, despite these many (and overlapping) efforts to create and then manage an energy policy for the nation, nothing of significance, lasting or otherwise, ever emerged from these initiatives, largely because (in the author's opinion) no one person was ever really put in overall charge of the operation (or whoever was put in charge never remained long enough in that position to have had any long term impact).

Returning now to the subsequent history of Akins' first draft of the President's Second Energy Message to the Congress, it was not surprising that, given the turmoil and the vying for power over energy policy matters that existed in the White House during the first few months of 1973, Akins' version of the main thrust of the Congressional message was probably rewritten several times by other staffers whose identity I have not been able to determine. That significant changes were made in Akins' draft can be deduced from the fact that in April 1973 (at the same time as the President's Second Energy Message * was being submitted to the Congress), Akins went public with his concerns by publishing an article in *Foreign Affairs* titled: "The Oil Crisis: This Time the Wolf is Here."³⁶

*President Richard M. Nixon's Second Energy Message to the Congress, delivered April 18, 1973. See Ref. 1973-32a.

A careful comparison of the Akins' article and Nixon's proposal reveals the following:

- a. The first nine major sections of Akins' paper (Sect. I-IX) deal primarily with the strengths of the oil producers (their resources, their bargaining position vis á vis the consumers, production projections for the future, OPEC, Israeli vs Arab issues, the inability of the consuming nations to develop any effective opposition to OPEC by collective action, etc.). The last two sections outline the obvious conclusion to Akins' remarkably accurate assessment of the world oil situation, namely, that *action* (implicitly requiring additional federal funding) to develop substantial new alternative sources of energy was urgently needed. Concurrently, Akins urged that national measures be taken to conserve energy and to use energy more efficiently.
- b. In contrast, Nixon's message, delivered to the Congress on April 18, 1973, included *no* federal initiatives capable of making even a minor impact on the national energy problem. An extensive list of energy R&D projects currently underway (and hence already included in the FY73 budget) *was* emphasized. The message also suggested that the oil industry itself spend more dollars on such improvements as building new deep water ports³⁷ or offshore unloading facilities (the Administration would generously facilitate such actions by introducing the necessary permissive legislation), etc.

The reaction to Nixon's Second Energy Message to the Congress was that it was "long on rhetoric and short on Federal commitment".³⁸ This response was echoed in the national press and in scientific journals.³⁹ One telling indication of the Administration's reaction to Akins' ideas is a reported comment by John Ehrlichman: "Conservation is *not* the Republican ethic!"⁴⁰

The Nixon Administration was distressed by the unenthusiastic reception accorded its Second Energy Message as well as by the publication of Akins' *Foreign Affairs* article. Not surprisingly, Akins was soon dispatched to Saudi Arabia as the U.S. Ambassador, presumably to purge the White House of such unorthodox thinking. Work then began on Nixon's Third Energy Message to the Congress.

Before beginning any discussion of President Nixon's last energy message, it is important to record that on April 30, 1973, twelve days after the submission of his second message, the White House Chief of Staff, H. R. Haldeman, the Presidential Assistant for Domestic Affairs, John D. Ehrlichman, the Counsel to the President, John W. Dean III, and the U.S. Attorney General, Richard Kleindienst, all resigned for reasons related to the Watergate cover-up. One can image the chaos created among the White House energy policy planning staff by these events. Nevertheless, both the public and the political reaction to the second message was so disparaging that the White House determined to try to remedy the situation as rapidly as possible. Miraculously, Nixon's Third Energy Message was prepared and delivered to the Congress on June 29th (only seventy-two days after the second).

3.5.2.2 June to October 1973: In the public record, there appear to be no references, or even clues, to whom (of the remaining White House energy team) credit for producing Nixon's Third Energy Message to the Congress should be given. From the result, it can be concluded that someone technically qualified in energy R&D issues must have been assigned the job. My guess is that it was primarily the work of Charles DiBona and Dixy Lee Ray, Chairman of the AEC. The NSF Director, H. G. Stever, and the NSF Energy Task Force, under the direction of Paul Donovan, and J. Sawhill of the OMB probably contributed to the undertaking as well.

The major components of Nixon's Third Energy Message to the Congress* on June 29, 1973 were:

- The formation of a new White House Energy Policy Office (to be headed by Gov. John A. Love of Colorado) responsible for the formulation and coordination of the nation's energy policies. **
- A request to the Congress to authorize the formation of a new Cabinet-level Department of Energy and Natural Resources (first proposed in Nixon's 1971 Energy Message and called for again in his April 18, 1973 Second Energy Message).
- A request to the Congress to establish a new independent Energy Research and Development Administration (ERDA), which would assume responsibility for the planning, management, and conduct of the government's own energy R&D, and for working with industry to develop and implement promising new energy technologies (in July 1973, Rep. C. Holifield introduced House Bill 9090 establishing ERDA).
- The allocation of \$10 billion*** for energy R&D over the next five years.
- An immediate increase of \$100 million*** for new or accelerated high priority energy R&D projects in FY74 (in addition to a \$25 M Central Energy R&D fund, which had already been included in the Department of the Interior's FY74 budget). Of this latter amount, \$15 M had been earmarked for DOI's coal R&D programs. The remainder was to be distributed to other government agencies for *their* R&D programs (LASL, with AEC backing, was one of many organizations actively engaged in an attempt to acquire some of this money, but I think that the DOI ended up keeping most of it for its own non-coal projects).
- The initiation of a national energy conservation drive to reduce energy consumption by 5% over the next 12 months.

*President Nixon's Third Energy Message to the Congress, June 29, 1973; Ref. 1973-33.

**The collection of White House energy committees, councils, offices, etc. was abolished and replaced by a single Energy Policy Office (EPO). Its Director was also to serve as Assistant to the President for Energy and, as such, was expected to be the President's principal energy advisor. He would therefore be responsible for identifying major problems, reviewing alternatives, making policy recommendations, assuring that agencies develop (and implement) short and long term plans, and monitoring the implementation of approved energy policies (Charles DiBona and his staff were assigned to the EPO).

***We shall subsequently use M and B to represent million and billion respectively.

Responsibility for the implementation of these measures is, for the most part, self-evident from their wording. The one which involved Los Alamos directly was its involvement in the effort to establish a plan for spending *both* the additional \$100 M in FY74 and the \$10 B over the next five years. Responsibility for this undertaking was assigned to the Chairman of the Atomic Energy Commission, * Dr. Dixy Lee Ray, but several major constraints on the allocation of the \$100 M (imposed apparently by the OMB) were included in the message itself as follows:

- \$50 M for Coal R&D (to include production of clean fuels by gasification, liquefaction, and pretreatment; mining safety; improved mining productivity; and improved combustion systems),
- \$15 M for Advanced Energy Conversion Systems (emphasis on high temperature technologies),
- \$10 M for Geothermal Energy Development,
- \$5 M for Gas-Cooled Reactor R&D,
- \$10 M for Energy Conservation R&D (emphasis on increased efficiency),
- \$10 M for research on the elimination of SO₂ from stack gases.

Since an account of the implementation of this Presidential directive would require a lengthy report of its own, only the following paragraphs are included to provide an outline of what occurred:

- Chairman Ray was obviously faced with two major tasks, the first being the development of a \$100 M energy R&D program for FY74 and the second being a \$10 B follow-on program for FY75–FY79. To accomplish the latter, the Chairman initially established a Task Force on Energy R&D Programs composed of 15 individuals which met for the first time on July 12 and 13, 1973.**

*This assignment to the Chairman of the AEC can best be summarized by the following quotation from the message:

“Second, I am directing the Chairman of the Atomic Energy Commission to undertake an immediate review of Federal and private energy research and development activities, under the general direction of the Energy Policy Office, and to recommend an integrated energy research and development program for the Nation. This program should encourage and actively involve industry in cooperative efforts to develop and demonstrate new technologies that will permit better use of our energy resources. I am also directing the Chairman, in consultation with the Department of the Interior and other agencies, to recommend by September 1 of this year specific projects to which the additional \$100 million would be allocated during FY74. By December 1 of this year, I am asking for her recommendations for energy research and development programs which should be included in my fiscal year 1975 budget.”

My belief that the AEC was significantly involved in the preparation of the President's Third Energy Message is supported by the fact that only four days after its delivery to the Congress, Harold Agnew received a letter from G. W. Johnson announcing the organization of a Task Force to recommend specific R&D projects to be supported by the \$100 M additional FY74 funding (due Sept. 1, 1973) as well as the R&D program to be funded by the \$10 B allocation for FY75–FY79 (due Dec. 1, 1973). Johnson's letter also confirmed an oral request, made *earlier* to Agnew, that the author of this report serve as a member of the Task Force (see Ref. 1973-8).

**See letter Johnson to Agnew, July 3, 1973 in Ref. 1973-8, and see also notes and minutes of 7/12–13/73 meeting of Energy R&D Task Force (date of minutes 8/6/73) in Ref. 1973–9.

- At those meetings, Chairman Ray discussed the President's charge to her. R. E. Balzhiser, former Director of the 1972 OST study, outlined the results of that study, indicated that their reports had served as a basis "for the President's action to add \$100 M to the FY74 budget, and that this material could also be useful in formulating the \$10 B R&D program. In addition, Balzhiser indicated the willingness of the electric utility industry to participate in the government's new energy R&D programs as appropriate.*
- The third speaker was Dr. George Hill, Director, Office of Coal Research (OCR), DOI (formerly at the University of Utah and considered the nation's foremost expert in coal R&D). Dr. Hill reviewed R&D programs already in progress under the aegis of OCR and then provided the audience with an outline of what, in his opinion, still had to be done.
- Several more AEC speakers discussed various other aspects of the planning process, and then the Task Group Chairman, Dr. Gerald Johnson, concluded the meeting by stating that the working out of the details of the \$100 M FY74 add-on was being carried by a separate task force, called the Ad Hoc Committee for the Allocation of the FY74 Supplemental Energy Funds** (the dollar amounts to be allocated each category would follow those included in the President's message with an approximate \$8 M additional for in-situ processing). In addition, he confirmed that considerable use of the OST reports was expected to be made in determining and assigning priorities to specific programs. The general idea was that the revised FY74 energy budget would serve as a "platform for FY75 and beyond."
- With respect to the \$10 B FY75–FY79 assignment, Johnson announced the formation of three major subcommittees of an Energy R&D Task Force:
 - Coal and Shale Technology—Dr. George Hill, Chairman,
 - In-Situ Technology—Dr. Edward Fleming, Chairman, and
 - Advanced Energy Technology—Dr. James Bresee, Chairman.
 He also indicated that many sub-subcommittees would be established with staff from national laboratories, industry, and universities to develop and evaluate solicited R&D proposals and programs in specific areas.***

Within weeks, even days, these plans ran into the following difficulties:

- Since this exercise was to be directed by the *Chairman* of the AEC, the primary source of the individuals necessary to carry out the work was the AEC itself supplemented by staff from its laboratories (with the exception of the DOI's Office of Coal Research—since the AEC was quite deficient in the coal R&D area). This decision created considerable concern in other government agencies involved because of the possibility of a strongly AEC-biased final report.

*Balzhiser, after leaving the OST, became a Division head of the newly-formed Electric Power Research Institute (EPRI).

**This Ad Hoc Committee was created during the first week of July 1973. It was composed of AEC staff plus several individuals from the national laboratories (including Mort Smith of LASL; see July 23, 1973 memo titled: AEC Energy Budgets, M. C. Smith to distribution in Ref. 1973-11). Note also that one half of the \$100 M had already been allocated to coal R&D and that the disposition of those funds was the responsibility of the Dept. of the Interior's Office of Coal Research.

***For further information on these initial approaches to the President's directive, see Ref. 1973-11 and especially those portions mentioned in Refs. 1973-7 to 39. It is particularly important to record that the proposals for future R&D in *nuclear fission and fusion* were to be carried out by two *additional* subcommittees comprised *only* of AEC and AEC Laboratory personnel already completely familiar with the current scope of, and the future plans for, these programs.

- In working out both the \$100 M FY74 add-on and the \$10 B FY75–FY79 programs, to avoid creating counterproductive interference from potential outside contractors and other government agencies already involved in energy R&D, *all contact with such organizations to find out about their programs, plans, or capabilities was forbidden*. Nevertheless, the Ad Hoc Committee ground out by the middle of July a first cut at the allocation of the \$100 M and the several AEC subcommittees and *their* respective sub-subcommittees (for example, the Energy Technology Subcommittee was further divided into seven sub-subcommittees) completed by July 30th a fairly detailed outline for the report to be submitted to the President on December 1st.* About one week later, it was deemed appropriate to communicate officially (for the first time) with other government agencies involved in energy R&D.

The process finally selected for soliciting energy R&D proposals from other government agencies initially *appeared* to be flawed.** We have already mentioned the fact that none of these other agencies (with the exception of the DOI's OCR) was even consulted regarding their own energy R&D efforts and new ideas until the overall framework of the response to the President's June 29th energy message had been established by the AEC staff (an action which created antagonisms toward, and suspicions of high-handedness on the part of, the AEC). Despite these concerns, however, the AEC's argument, that to open the doors to all interested parties at the outset would have resulted in chaos, was probably correct. Consequently, an effort was made to ensure that fairness prevailed during the final phases of the enterprise, and (as will be apparent from the following) it more or less did.

After the Ad Hoc Committee had formulated its own draft R&D program for the FY74 \$100 M add-on funding, the process of inviting additional input was carried out in two stages:

- On July 31, 1973, Chairman Ray sent a letter to those government agencies already involved in energy-related research inviting them to respond with proposals capable of using portions of the \$100 M supplemental energy funding being added to the President's FY74 energy budget. Their recommendations were due Aug. 15th!
- On August 6, 1973, Chairman Ray sent a letter to all AEC Laboratory Directors advising them that the Ad Hoc Committee for Allocation of FY74 Supplemental Energy Funds had already identified "a number of AEC laboratories...as reasonable contractors for portions of the add-on money." The purpose of this letter was to make sure that no important AEC proposals had been overlooked. The deadline for submission of this information was set at August 10th.

*See Trip Report and in particular the Minutes of the 7/30/73 Second Meeting of the Energy Technology Subcommittee in Ref. 1975-18. To give the reader some feeling for the conditions under which this operation was carried out, the following quotation from a July 23, 1973 memorandum, M. C. Smith to Distribution follows: "To avoid creating unnecessary excitement, we were not permitted to call up potential contractors outside of the AEC, or other Government Agencies to find out about their programs and plans. The exercise was therefore not only very hasty, it was also very imaginative; where there was a gap, we made up something to fill it. The result was correspondingly spotty."

**No attempt was made to obtain R&D proposals from academia, industry, private R&D institutes, or environmental organizations. These exclusions were not specified in the President's energy message. They arose from Chairman Ray's decision (presumably on the basis of feasibility, given the short time allocated for the preparation of her recommendations) to distribute the FY74 \$100 M addition only to government agencies already involved in energy R&D. Recommendations for the \$10 B FY75–FY79 funding were planned from the outset to include proposals from the larger group.

The net result of those solicitations dealing with the \$100 M add-on funding, including all of the previous input from AEC staff, committees, and task forces, was a "mountain" of R&D proposals (between 300 and 400) with an estimated price tag of over \$400 M.⁴¹ During the last three weeks of August, the AEC Headquarters staff, assisted by national laboratory personnel, separated the proposals into categories, evaluated them, prioritized them, selected the most promising (consistent with the OMB dollar allocations), checked those selected to ensure a "reasonable" distribution among competing federal agencies with energy R&D capabilities, met with representatives from these agencies in each major energy category, and finally reached agreement on the allocations. After approval by Chairman Ray, the resulting add-on budget was submitted to the President. After receiving approval from Gov. Love's office, it was sent to the OMB for a final massaging. A copy of this budget is included in Attachment 11. Noteworthy is the fact that the proposed allocations were not dominated by AEC projects. It is also of interest to note that despite the intense effort to develop and reach agreement on this proposal in the time allowed, it proved impossible to distribute any new funding before December 1st and, hence, since the fiscal year was then almost half over, only about \$50 M of the advertised \$100 M was actually able to be spent in FY74. Nevertheless, it was a start.

Turning now to the \$10 B FY75-FY79 assignment, it has already been noted (p. 30) that, during the first week of July, Chairman Ray appointed an Energy R&D Task Force and charged it with developing the \$10 B follow-on program. Its first action, completed by July 27th, was the preparation of an outline for the Dec. 1st report to the President. * Then, at a meeting of the Energy Technology Subcommittee on July 30th several major changes in the plans were announced. ** These were:

- The Energy R&D Task Force was to concentrate *only* on the AEC portion of the \$10 B effort,
- The Chairman would, through her own office, solicit energy R&D proposals for the \$10 B program from academic institutions, environmental groups, industry and other government agencies. This action began on August 7, 1973, when Ray dispatched a letter to a larger group which included professional organizations, trade associations, environmental groups, energy policy organizations, additional government agencies, etc. In this letter, dealing with the President's five year, \$10 B energy R&D effort, she reiterated the goals of the exercise (self-sufficiency and R&D promising to "provide new options for meeting future energy needs"), invited proposals potentially capable of meeting those goals, and invited the addressees to nominate individuals technically qualified to assist the AEC staff in the screening and evaluating of the expected flood of submissions. Accompanying the letter was a 5 page standardized Program Proposal form (together with a 9 page set of instructions specifying in detail how the form was to be filled out). *** The deadline for submitting proposals was September 10th.

The sequence of developments from this point to the issuance of Ray's report on December 1st is far too involved to discuss in detail here. † Consequently the following paragraphs provide only an outline of how this task was accomplished:⁴²

- Perhaps because of external criticism that the initial planning for the \$10 B effort was too rooted in AEC philosophy and personnel, Chairman Ray organized an "independent"

*See Ref. 1973-17b, Aug. 2, 1973, E. F. Hammel to Distribution, Trip Report: Second Meeting of the Energy Technology Subcommittee of the AEC Energy Task Force July 30, 1973.

**See Ref. 1973-18, Aug. 3, 1973, J. C. Bresee to Distribution, Minutes of the Second Meeting (on July 30, 1973) of the Energy Technology Subcommittee. Presumably, the other subcommittees (and hence the entire Task Force) was informed of these changes at the same time.

***See Ref. 1973-21, Aug. 7, 1973, Ray to Distribution.

†Relevant to Los Alamos is the fact that several LASL staff members knowledgeable about energy matters were coopted by AEC Headquarters for most of the latter part of '73 to assist in this enterprise.

Coordinations Project, directed by Gorman C. Smith (one of Ray's chief assistants) and located in some not-very-pretentious offices in downtown Washington, to carry out the details of her assignment. Among other things, it became the responsibility of Smith's staff to receive, organize, and collate the responses from the recipients of Chairman Ray's August 7th letter and then integrate them with those received from the AEC.

- Smith's staff also established a set of Energy Workshops (under the sponsorship of Cornell University) which were charged with providing the Chairman with an independent assessment of the "major directions and the overall framework required for a national [energy R&D] program."
- Sixteen Technical Review Panels were then appointed.
- By the beginning of October, Smith's staff had received proposals from all of the federal and private organizations contacted, and Staff Director Richard M. Pastore had selected the chairmen, members, and consultants for the 16 different topical Technical Review Panels whose function it was to evaluate and prioritize the 1100 R&D proposals received. More than 400 individuals participated in the panel operations (121 federal employees and 282 consultants).
- Another assignment given these panels was to separate the proposals for which each panel was responsible (according to its area of expertise) into those necessary to achieve the President's objective (obtaining energy self-sufficiency for the U.S. by 1980) and those which did not satisfy this criterion. Three options were then to be considered: a "minimum viable" effort, an "orderly" program, and a "crash" program. Recalling that the President's Third Energy Message to the Congress (June 29, 1973) requested a total of \$10B, in support of a comprehensive energy R&D effort to be spent over the next five years, it was found, upon summing the results, that the cost of the first option was \$11 B, the second, \$16 B; and the third, \$30 B!
- A newly-formed and enlarged Ad Hoc Senior Management Committee (chaired by John Team)* met on September 24, 1973 at AEC Headquarters to review and approve the AEC's final submission.
- A multiagency Overview Panel was appointed** (consisting of seven senior Administration officials) and met on Oct. 31st. to review the recommendations from the Workshops, the Technical Panels, and the new Ad Hoc Senior Management Committee. Its charge was to confirm or modify, as required, the contents of the total package.
- Smith's staff was responsible for assembling, organizing, and editing the final report to the President.

Table 1 (p. 35) records the budget allocations, made by Gorman Smith's staff, which resulted from the integration of the results from these deliberations with those from other federal agencies. The entries in the column labeled "Actual" are the amounts submitted to the President together with all of the associated discussion and justifications in the Dixy Lee Ray report which was titled "The Nation's Energy Future," December 1973.^{42h}

Before commenting further on the results of this effort it is appropriate to make a few more remarks on the AEC submission to the Gorman Smith Coordination Project.

- We should first recall that, at the outset of the \$10 B FY75–FY79 allocation exercise, three subcommittees of the AEC's Energy R&D Task Force were established (see p. 31), but that their charter *excluded* consideration of all nuclear fission and fusion R&D. The preparation of research proposals in these areas was reserved for the AEC's own two fission and fusion divisions under the direction of Merrill Whitman, Reactor Research and Development (RRD) and Robert Hirsch CTR, respectively.

*See letter, John M. Teem to Distribution, Sept. 17, 1973, Ref. 1973-27h.

**See memo, E. F. Hammel to Distribution, Oct. 30, 1973, Ref. 1973-37.

Table I. Comparison of base, recommended, and actual energy R&D programs for fiscal years 1975-1979.*

	Base	Recommended	Actual	Percent Increase
Fossil option	<u>1,027</u>	<u>3,675</u>	<u>4,075</u>	258.0%
Conservation	95	1,340	1,440	(1,310.0%)
Reduced consumption	15	210	210	
Endorse conservation	5	150		
Improved management	10	60		
Increased conversion and distribution efficiency	80	1,130	1,230	1,313
High temperature gas turbine		225		
Other (low-temperature cycles, waste heat and fuels, fuel cells, and so forth)		200		
Advanced auto propulsion		300		
Rail, bus, and ship systems		205		
Energy and fuel transfer, distribution, and storage		200		
Increased supply	892	2,335	2,485	(162.0%)
Oil and gas	50	310	310	
Fluid injection		71		
Stimulation		97		
Oil shale <i>in situ</i>		126		
Drilling		16		
Coal	842	1,875	2,175	
Clean combustion		200		
Low Btu gas		250		
High Btu gas		265		
Liquefaction		375		
Support R&D		120		
Magnetohydrodynamics (MHD)		80		
Mining technology		325		
Environmental control technology		260		
Resource assessment	40	150	150	(275.0%)
Fission option	<u>4,090</u>	<u>4,390</u>	<u>4,090</u>	7.3%
High temperature gas reactor, safety, and waste management, etc.	1,560	1,660	1,246	(6.4%)
Breeder reactors	2,530	2,730	2,844	(7.9%)
Other programs	<u>1,505</u>	<u>1,935</u>	<u>1,835</u>	28.5%
Fusion	1,405	1,550	1,450	(10.3%)
Solar	80	200	200	(150.0%)
Geothermal	20	185	185	(825.0%)
Total program	<u>6,622</u>	<u>10,000</u>	<u>10,000</u>	51.0%

*In millions of dollars. All "Base" figures are totals of 5-year budget projections made by federal agencies before the White House committed itself to a \$10-billion program. [Sources: The President's Advisory Council on Energy R&D, Ref. 35c, and Table 2-4, p. 15 of Ref. 42h].

By early September, the AEC proposals had been developed, compiled, and totaled. An immediate shock to the AEC management was that the projected cost of *only the AEC program* substantially exceeded the amount proposed by the President for the entire national energy R&D effort! The origin of this problem was that the fission and fusion program managers had taken this opportunity to enlarge their programs well beyond their previous wildest dreams. This initial total was subjected to some fast hatchet work by the DAT staff and was then forwarded to the AEC's Senior Management Committee (which included the Laboratory Directors) for comment.* I think it's fair to say that LASL's reaction was one of dismay, to put it mildly. And even after a final massaging by the Headquarter's staff, the AEC still ended up staking a claim to about \$9.6 B (of the \$10 B total) and, of that amount, 80% continued to be allocated to fusion and fission R&D! See Attachment 12 for a copy of the TWX sent to HQ by LASL on this matter (TWXs from Sandia and Lawrence Livermore Laboratory also complained that the fission and fusion components were excessive, but not as strongly as did LASL's).

- Upon receiving these reactions from the Senior Management Committee, the AEC General Manager convened yet another Special Review Committee, which further reduced the cost of the AEC submission.

In summary and in retrospect, no doubt exists that this exercise was a prodigious effort, involving many of best-informed individuals on energy matters in the country for an extended period of time. It was also a very costly operation. It did not, however, generate any *new* ideas or concepts. What it did do was to assemble and integrate, more or less coherently, the conventional wisdom of the day regarding important and highly desirable energy R&D programs for the U.S. It also did address the critical issue of self-sufficiency but did so, unfortunately, by using a wishful thinking, planning, and projection technology⁴³ which claimed that, if the suggested R&D program was implemented, oil imports could be reduced to half of those originally projected by 1980 and to zero by 1985. My feeling is that this was a politically-motivated "conclusion" introduced to help sell the program to the Congress.

To some extent, the operation also included a somewhat fraudulent component from the outset, which many of the participants, I believe, failed to recognize. This was the fact that, whereas the advertised allocation by the federal government of \$10 B over the following five years to energy R&D was announced with great fanfare, the fact of the matter was, as Table I demonstrates, that more than \$6.6 B of that total was *already* in the "pipeline." Furthermore, one of the most significant results which emerged from the work of the Technical Groups was the fact that \$10 B was *marginally* adequate even to get the program rolling. The planned funding was (as has already been noted) entirely inadequate for the task to be performed and furthermore, the advertised outcomes of the Ray report were based upon an assumption that an *additional \$12 B* would be provided for the program by the private sector! More wishful thinking!

Finally, and despite the fact that the main thrust of the entire exercise was to propose an energy R&D program capable of making a significant contribution toward energy self-sufficiency by 1980, it is important to reiterate the fact that more than 55% of the total federal expenditures were allocated to the AEC's fission and fusion R&D programs which had absolutely no possibility of contributing *anything* to that goal within the specified time limit.

The fiscal objectives of this exercise were partially realized on October 11, 1973, when the White House accepted Dr. Ray's recommendations by announcing the inclusion of a \$115 M energy R&D increment to the President's FY74 budget.** Subsequently Dr. Ray's proposals for

*See Ref. 1973-27h [Draft proposals were actually distributed to the Ad Hoc Committee on Sept. 8th or 9th. Responses were to be returned to Eugene Fowler (DAT) on 9/11/73].

**See Attachment 11.

the first year of the \$10 B energy R&D program were included (relatively unchanged) in the Nixon Administration's FY75 budget submission to the Congress.*

We conclude this discussion of Dixy Lee Ray's response to the President's directive to her in his Third Energy Message to the Congress with two general comments:

- a. most of what has been described thus far consists of a more or less systematic unfolding of the technological energy-related R&D requirements and initiatives provoked by the events of 1970, 1971, 1972, and early 1973, and
- b. the federal responses to successive energy crises of one sort or another have, from the beginning, exhibited a dichotomy between *technical* responses advocated by most of the scientifically-trained governmental advisors and *socio/political* responses, e.g., regulation, energy conservation, lifestyle changes, the forging of international agreements designed to ensure energy supply, economic changes, etc., advocated by economists, political scientists, and other similar advisory groups; unfortunately, although the latter type of response is probably as important as the former (perhaps even more so in the short term), it carries with a considerable amount of ideological and cultural baggage,** which makes both its formulation and its execution very difficult.

3.5.2.3 November to December 1973: At the end of Section 3.5.1.5 (p. 25), several consequences for the U.S. of the 1973 Middle East controversies were listed. We note here how serious these problems became as the year progressed:

- During the summer, gasoline supplies dwindled. Service stations frequently ran out of gas and were obliged to close for several days at a time. Quantities purchasable by motorists were often limited.
- Other fuels (kerosene, jet fuel, diesel oil, home heating oil, and propane) became increasingly difficult to obtain. In October, the federal government instituted a mandatory allocation program for these fuels.
- In the Northwest, a record drought reduced river flows and hence the availability of hydroelectric power. Service to large users, e.g., aluminum plants, was curtailed.
- In late November, Nixon announced a 15% cut in gasoline supplies to wholesalers and substantial reductions in heating oil for residences, businesses, and industry.
- Congress reduced highway speed limits to 55 mph in December.
- Truckers went on strike to protest the new speed limit and blocked highways.
- Airlines canceled flights and otherwise curtailed schedules.
- Electric generating stations using oil were obliged to cut their power outputs.
- Air pollution controls were relaxed.
- Fuel conservation was encouraged or mandated throughout the nation.
- Congress approved legislation requiring the imposition of daylight-saving time for a period of two years beginning Jan. 6, 1974.

With these problems as well as other related ones surfacing one after the other, the result was an increasing popular demand for concerted, coherent, and *effective* federal action. Responsibility for such action had been assigned to Gov. Love, head of the White House Energy Policy Office. By this time, however, the President was preoccupied with ensuring his own survival in office, and neither he nor Love was particularly well informed or interested in energy issues. The White House staff was in disarray, and Henry Kissinger and George Schultz (both of whom had somehow managed to insulate themselves from the Watergate mess) were

*See Attachment 13.

**Another way of describing this problem is to note that little consensus existed on either the technical approaches proposed, i.e., the methods of monitoring and evaluating progress, or on the appropriate socio/political approaches necessary to accompany the technical programs.

the only senior Nixon Administration officials left to direct and manage all of the nation's foreign and domestic policy. Since neither was particularly well-informed regarding energy issues, little of any significance in that area was initiated during the period currently under discussion.

Toward the end of the year, Gov. Love and his staff did become increasingly convinced that gas rationing was an essential first step in addressing the energy crisis. Unfortunately for Love, Schultz strongly resisted the idea. Not surprisingly, Schultz won and Love resigned (or was dismissed) on Dec. 3rd. On Dec. 4th, William Simon, Schultz's deputy (and protégé) was appointed head of a new Federal Energy Office. Later, after Congressional approval, it became the Federal Energy Administration (FEA).^{42f}

Energy Czar Simon lost no time in responding visibly and vigorously to the nation's energy problems. Many new rules and regulations were issued by the FEA. They controlled the use of government limousines and restricted lighting in federal, commercial, and industrial buildings as well as on highways. Fuel allocations were revised downward, thermostats were ordered to be lowered, and many other energy conserving techniques were urged upon the public by frequent TV exhortations by Simon himself.⁴⁴

Before concluding this section, three other energy-related federal actions initiated in late 1973 should be mentioned. The last two of them continued into and were further developed in 1974. These three were:

- Having created the Federal Energy Administration, the need for a new Department of Energy and Natural Resources evaporated and the Nixon Administration therefore withdrew its request to the Congress to establish such an entity.
- In a major TV address to the nation, President Nixon, on November 7, 1973, acknowledged that the oil shortages were creating serious consequences for the economy and the public. To assure the country that his Administration was responding to this problem, Nixon announced the proposed formation of Project Independence, a new Federal Energy Administration initiative designed to provide a framework for developing a comprehensive national energy policy. In particular, as its name implies, the project's primary objective was to achieve national independence from imported oil by 1980 through reliance on domestic energy resources [coal, oil shale, nuclear energy, and the accelerated development of domestic oil resources (offshore drilling, secondary and tertiary recovery, etc.)] At the time of its announcement, few details relating to the project had been worked out. It did not, in fact, get actively underway until March 1974 but its scope eventually dwarfed even the Dixy Lee Ray undertaking.
- The Administration continued to press Congress for approval of a new Energy Research and Development Administration (ERDA) designed to coordinate, plan, fund, and manage all of the nation's energy R&D (as well as the AEC's responsibility for managing the nation's nuclear weapons development programs). In December 1973, the House of Representatives passed a revised version of HB-9090 establishing ERDA (see p. 29), namely House Bill 11510.

3.5.3 The Los Alamos Response: Keeping in mind that the momentous events of 1973 did not, for the most part, occur until June 29th (President Nixon's Third Energy Message) and intensified at the beginning of October (the OAPEC embargo), the first half of 1973 in Los Alamos was characterized primarily by a continued unfolding of the local energy-related initiatives that occurred in late 1972, in particular, the more detailed planning of Q Division. Q Division was formally established on March 1, 1973, with R. B. Duffield as the Division Leader, F. Ribe as the Associate Division Leader in charge of the CTR work, and E. F. Hammel as Associate Division Leader responsible for the remaining energy R&D of the new Division.

During January and February, both administrative and some laboratory space was acquired for the new division at TA-46 and miscellaneous organizational details were resolved. For example, Orson Anderson, Professor of Geophysics at UCLA, agreed to assist in the direction of the geosciences program, arrangements were made for the transfer of the seven CTR groups and the cryogenics group from P to Q Division. In addition, the heat transfer (heat pipe), Subterrene, hot dry rock, and some embryonic systems studies work was transferred from N to Q Division, and Rod Spence joined the Division Office a couple of months later. Altogether, the new division consisted of about twenty groups and over 200 personnel and although, in the succeeding months these newly coordinated energy R&D programs continued to operate in much the same way as they had before, a more clearly identifiable focus for energy R&D at Los Alamos had been established by this managerial change. Energy had "gone national" by 1973 and, in consequence, the number of visitors to LASL wanting to be briefed on the Laboratory's energy programs grew exponentially during 1973. So also did requests for LASL participation in state and regional energy organizations or committees. Invitations to provide speakers on energy issues, as well as requests from AEC Headquarters and Congressional committees for information about our programs also continued to multiply. In addition, and especially after the issuance of Nixon's Third Energy Message, senior laboratory staff members engaged in energy R&D were coopted by the AEC for lengthy and successive energy-related assignments in Washington. Much of this activity has already been chronicled in the preceding section as well as in Refs. 1973-6 to 39. Nevertheless, despite the creation of Q Division, it was recognized that what was still lacking in Los Alamos was any real identification, coordination, evaluation, or organized direction of all of the energy R&D underway at the Laboratory.

This writer was not privy to the final negotiations leading to the determination of those groups and programs which were selected to form the new Q Division, but it is probable that the arguments ran somewhat as follows:

- a focus was needed for LASL's energy R&D efforts as outlined in the previous paragraph,
- with the impending demise of the Rover Program, several N Division groups had already exhibited considerable initiative in preparing energy-related R&D proposals and, since they had already acquired or were expecting preliminary external funding for the necessary exploratory R&D, they were likely candidates for inclusion in the new division,
- the N Division office space and experimental facilities were available,
- the Cryogenics Group, P-8, was at that time substantially involved in energy R&D; in addition, although it had been transferred to P Division three years previously, no strong programmatic justification existed within that division's management for retaining it. Much the same could be said for P Division's CTR Program.

These last-mentioned groups therefore became the core programs that constituted the new Q Division.

Those energy-related LASL programs *not* included in Q Division were:

- the laser fusion and laser isotope separation programs (L Division),
- the reactor fuel-element R&D programs (CMB Division),
- some reactor safety code development programs (T Division),
- some reactor R&D (A Division),
- the Tularosa-Rio Grande Project being developed by the LASL Engineering Department jointly with New Mexico State University for the production of power, minerals, and water for irrigation in the Tularosa Basin,
- the PACER Project, which was being run out of the Director's Office.

It was eventually recognized that there were several good reasons for this particular split, not least of which was the fact that many of the excluded energy-related programs reported to D. P. MacDougall and the so-called weapons side of the house. In addition, many of them were

funded by the AEC's Division of Military Application, which had already negotiated program goals with the LASL managers. Another reason for not including all of the energy R&D at LASL in a single division was that some of these programs were so closely integrated (in terms of staff, facilities, location, and classification) with LASL's weapons R&D operations that any attempt to move them or place them under different administrative control would probably have caused more problems than benefits. A fourth reason was that some of those programs already existed as large LASL Divisions or large segments of other existing Divisions, and their inclusion in Q Division would not have been acceptable either to them or to their sponsors. Yet another reason for the failure to pursue a more consistent alternative to this integration issue was the fact that the Q-Division Leader, the two Associate Division Leaders, several of the Group Leaders, and many of the senior staff members were obliged to spend much of their time serving on various boards, panels, and advisory committees in Washington during this critical period.

A final organizational problem, recognized but not solved during this start-up period [and, by extension, still not solved], was the general question of leadership. To begin this discussion, the Laboratory's first Director, Oppenheimer, was intellectually so competent and worked so hard to achieve a working knowledge of all of the programs for which he was responsible that very few individuals questioned his decisions (on the other hand, it is also important to recognize his management skills were for the most part focused upon the successful accomplishment of a *single* objective). The second Director, Bradbury, was obliged to deal with more than one program, but at least all of them were large programs and there weren't very many of them. Beginning in the 1970s, however, the basic nature of all of the national laboratories changed in the sense that they became multiprogram laboratories. Specifically, almost all of them progressively shifted from essentially single purpose laboratories to those with a *small* collection of *major* R&D programs, and finally to those with a large collection of *mini* R&D programs (while retaining only one or two large programs). At present it is essentially hopeless to obtain either Directors or Division Leaders technically knowledgeable about all of the R&D programs being carried out under their leadership.

Returning now to the advent in the 1970s of non-nuclear energy programs at the national laboratories, I believe that it can also be convincingly argued that energy R&D is intrinsically inhomogeneous technically and that the inhomogeneity problem is compounded by the fact that concurrently, a large collection of nonscientific and nonengineering (societal, economic, cultural, environmental, etc.) issues must also be considered by the management of any organization undertaking such R&D. Given this caveat, the new Q Division Leader, Bob Duffield, probably did as good a job as was possible to do. Fred Ribe more or less independently managed the CTR groups* and although I was nominally responsible for the remainder of Q Division, my own expertise was primarily in low temperature and cryoengineering. There was therefore much for me to learn about the other energy-related technologies with which the division was involved before any even partially effective leadership could be provided. Complicating this learning process (as must have been evident from the preceding sections), was the fact that I spent more time in Washington during 1973 than in Los Alamos. After Rod Spence joined Q Division in June of 1973, he assumed much of the responsibility for directing and administering the non-CTR aspects of the Q Division programs.

In summary, although all of the energy R&D at LASL was not included in Q Division, the compromise adopted permitted the Q Division Office personnel to at least inform themselves about and keep up to date on the energy-related R&D going on elsewhere in the Laboratory.

*Within a year, these groups were nevertheless combined to form a new Division.

We all packed a set of viewgraphs and slides describing the complete spectrum of energy research being carried out at Los Alamos. Fortunately, the groups with whom we talked seldom sought detailed information about non Q Division activities!

Despite the *modus operandi* outlined above, it was recognized by Harold Agnew toward the end of 1973, as the public and the political furor about energy heightened, that *additional* LASL management changes were still needed if LASL was to respond optimally to new and expanded energy R&D requirements likely to be demanded by the public and the Congress. Consequently, in mid-December he established an Energy Planning Committee (EPC)⁴⁵ and requested that it consider how LASL might better respond to new developments relating to the national energy problem as then perceived.

The first objective of the EPC was to identify (given the time available) and categorize the energy-related R&D contemplated, about to be initiated, and actually going on at Los Alamos.* A second task assigned the committee was to identify specific technical capabilities (already existent at the Laboratory) capable, in principle, of being matched with national energy R&D needs. The third objective was to consider and finally propose managerial and organizational changes capable of providing leadership for, direction for, and a single spokesperson for all of the energy R&D underway at Los Alamos.

Since the conclusions reached by the EPC were presented to the Director in early 1974, both they and the actions finally taken will be presented in Section 3.6.3.

3.6 The Continuing Energy Crisis (1974)

3.6.1 External Provoking Events: The U.S. entered 1974 with the OAPEC oil embargo still in effect. Although military action had ceased, the warring parties were still far from anything resembling a peace agreement. On March 18th the embargos were lifted for the U.S. (with the exception of those imposed by Libya and Syria), but the world-wide impact of the "oil weapon" had by no means been overlooked either by its victims or by OPEC. Furthermore, the posted price of OPEC's crude rose from about \$2.50/bbl before the war to about \$11.50/bbl when the embargo was lifted and, during the remainder of the year, further increases resulted from changes in royalties, taxes, and production cutbacks.

3.6.2 The Federal Response: In most of the industrialized nations of the world, the response to the events of 1973 and early 1974 was a continuation of previously instituted preparations for surviving subsequent interruptions of, or further production cut backs in, imported oil supplies. In addition, explicit preparations were initiated in many countries to *reduce* oil consumption (these included fuel rationing, the banning of Sunday driving, the closing of gas service stations on weekends, the initiation of year-round daylight savings time, and, during the appropriate seasons, the turning down of thermostats in public buildings, a reduction in the use of air conditioning, etc.). In the United States, preparations for gas rationing were undertaken, but the embargo ended before they could be implemented. Nevertheless, during the Spring of 1974, gas lines at service stations were still common occurrences and purchases were limited.

*To provide the reader with a better appreciation of this problem, during the 1960s LASL was engaged in about six major programs. By the mid-1970s, this number had increased about 50-fold (with most of the additions being mini-projects involving very few staff members) and the number of different sponsors had increased by about 10-fold.

On August 9, 1974, President Nixon resigned as a consequence of the Watergate affair and Vice President Ford succeeded him. Despite this major leadership transition, the AEC continued to implement and coordinate the energy R&D program outlined in Chairman Ray's report, "The Nation's Energy Future."^{42h}

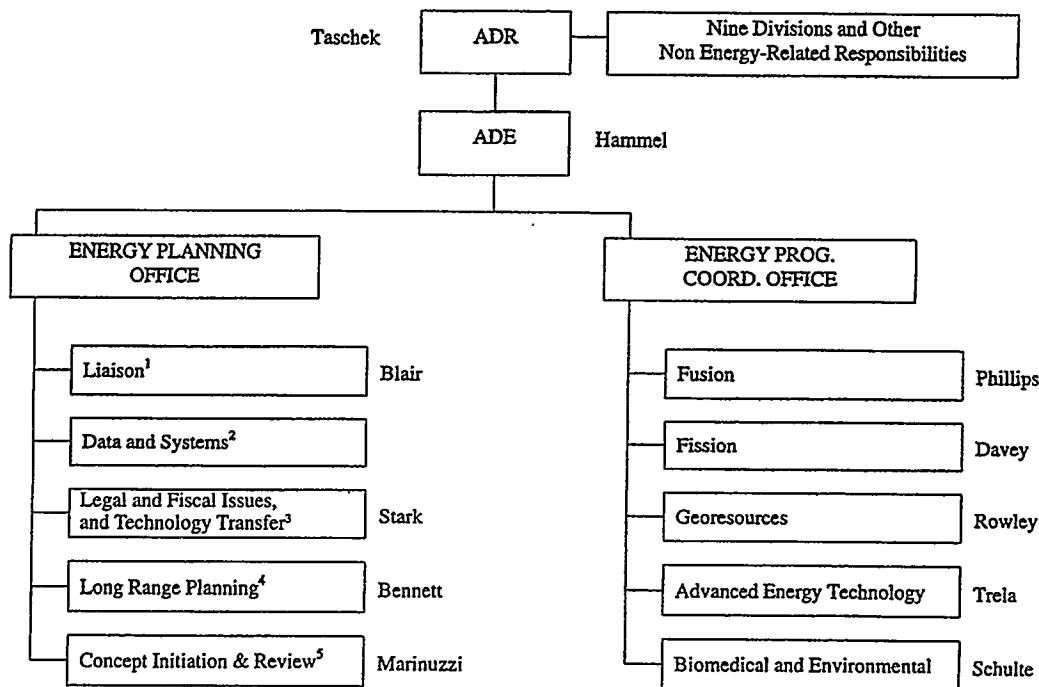
In July 1974, about a month before President Nixon's resignation, the Senate passed its own version of the ERDA legislation, namely SB-2744 and, after some massaging in the Conference Committee, the resulting bill passed both Houses of the Congress and was signed into law by President Ford in August 1974. It was initially expected that ERDA would come into being in October 1974 but, due to various delays its actual inauguration date occurred on January 19, 1975.* In the same legislation an independent Nuclear Regulatory Commission was established and assigned the nuclear energy regulatory responsibilities previously exercised by the AEC.

3.6.3 The Los Alamos Response: In January 1974, Alvin Weinberg was asked by President Nixon to organize the previously-mentioned national energy study called Project Independence. One of the first consequences for Los Alamos was the departure of R. B. Duffield, the Q-Division Leader, on a leave of absence to work with Weinberg in Washington. Then, in late February or early March, the EPC met with the Director, the Deputy Director, and the three Associate Directors to present its conclusions. Foremost among them was (and the writer recalls this as being a recommendation reached unanimously by the members of the Committee) the creation of a fourth Associate Directorship with line management responsibility for the Laboratory's energy programs.⁴⁶ To the best of my knowledge, no notes were taken of the ensuing discussion. My recollection is that Agnew, Schreiber, MacDougall, and Browne were generally supportive of the proposal. Taschek was strongly opposed to it (to put it mildly) on the basis that such a change was superfluous and hence totally unnecessary. Taschek's view prevailed. In place of the Committee's recommendation, on May 3, 1974, the Laboratory got a new Assistant Director for Energy, namely the author of this report, reporting to the ADR.

In retrospect, this particular solution solved nothing. The entire Laboratory continued with, and indeed further expanded, its entrepreneurial approach to acquiring new energy R&D projects. Nevertheless, an attempt was made to implement some of the recommendations of the EPC. Two new staff organizations, an Energy Planning Office and an Energy Program Coordinating Office were established by the Assistant Director for Energy (see Fig. 1**). The first-mentioned office attempted to ensure that the Energy R&D actually underway at LASL was consistent with and responsive to established national energy R&D goals. It also helped to obtain AEC Headquarters fiscal support for newly-proposed energy R&D programs (together with the direct participation of the staff members involved). An important part of this effort was to demonstrate to the responsible Headquarters' Program Managers that LASL already possessed the necessary expertise, facilities, and staff to carry out the work and that the programs themselves were consistent with current and emerging national energy goals. The primary task of the second office was to identify, as systematically as possible, what energy R&D programs

*See Ref. 47: 1974-40.

**This figure is included in order to demonstrate that (in addition to the items mentioned previously) an awareness was developing at LASL that viable, long-term, energy R&D programs *had to be concerned with, guided by, and, ultimately, partially controlled by* the societal, the economic, the environmental, and several other multidisciplinary aspects of the R&D being carried out. Without such input, our results, while technically sound, innovative, and successful, were certain to be accompanied by a high probability of being irrelevant.



1. Work with ADWP-2, Q-DOT, L-5 (contacts with state and regional organizations, e.g., Rocky Mountain Science Council, Governor's Energy Task Force; industrial organizations, e.g., EPRI, API, AGA; USAEC, e.g., Albuquerque Operations Office and Headquarters; Institutions, Universities, etc.
2. Use Q-DOT Library.
3. Work with FMO and Legal on Patents, Licensing, and Reimbursables, and (in addition) on Technology Transfer.
4. Build on TEPO reports and consult TEPO staff.
5. With Project Coordinators.

Fig. 1. Organization of the Office of the Assistant Director for Energy, 1974.

were actually going on in the Laboratory, analyze, assess, and summarize the progress being made in each of them on a monthly basis, and report that information to the Associate Director for Research and to the Director. During the remainder of 1974, these two Offices of the Assistant Director for Energy functioned as outlined above.

On June 25, 1974, I presented a LASL colloquium titled "The LASL Response to the National Energy Problem"⁴⁷ in which LASL's energy R&D programs and the activities of the LASL Energy Office were described in detail.*

It is now necessary to back away, temporarily, from events occurring in Los Alamos in late 1974 and focus upon the contemporary Washington scene which was, in many respects, a mirror image of the chaos being experienced at Los Alamos. In particular, many additional federal agencies and departments in Washington had, in response to the 1973 national energy crisis (oil embargo, gas lines, public unrest, etc.), quickly initiated energy R&D programs in their own areas of expertise. And then, with the dissolution of the AEC and its replacement with ERDA and the NRC, new ways of doing business with remaining old and familiar sponsors had to be worked out and contacts with new program managers had to be established. Finally, it is important to mention here a little-noticed provision of the legislation establishing ERDA which

*It is also appropriate to note here that several other national organizations were simultaneously exploring the U.S. energy situation. For example, in June 1974, the Ford Foundation Energy Policy Project (which was established in 1971 under the direction of S. David Freeman) issued a preliminary report titled "Exploring Energy Choices."⁴⁸

called for a comprehensive report to the President and the Congress on "The Energy-Related Applications of Helium," to be submitted to both parties in less than three months. This was the first report to be prepared by ERDA, and I was asked to serve as the Director of this study. I was not a party to any of the Headquarter discussions which led to my being asked to accept this position. I do have a copy of my response (which was in a "yes, but" format, listing ten other individuals who, in my judgment could do the job as well or better). But these suggestions were rejected, and I spent the next four months in Washington working on that report.⁴⁹ I commuted weekly to Los Alamos to keep up with the activities of the Los Alamos Energy Office, which was being run during that period very competently by Al Blair.

One unexpected outcome of my sojourn in Washington during the formative months of ERDA was a ringside seat at the establishment of a new major federal agency. First of all, it is necessary to emphasize that the primary objective of ERDA was to collect into one agency all of the energy R&D which, as we have already noted, was currently being carried out in about 60 different federal institutions and offices. Of these, the largest was the AEC, which had already branched out into several areas of non-nuclear energy R&D. The next largest energy R&D programs folded into ERDA were those from the Department of the Interior's Office of Coal Research and from its Underground Power Transmission Office, those from NSF's Solar as well as from its Advanced Energy Technology programs, and those from the Environmental Protection Agency's Resource Assessment and Stack Gas Clean-up programs. The remainder were relatively small programs from many other federal agencies.

As these programs were shifted to the newly-formed ERDA, most of their Program Managers (who were simultaneously responsible for many other projects), elected to remain with their parent agencies or departments. ERDA was therefore obliged to acquire rapidly the management structure necessary to carry out its new mission.

In the case of ERDA's AEC-acquired programs, few problems arose, since both the programs and their management structures were transferred intact. For those energy programs delivered to ERDA's doorstep from other agencies, however, new "managers" had to be acquired quickly. Unfortunately, two separate factors led to what many have described as the hurried recruitment of both a large and a largely incompetent (technically) group of Program Managers. Two of the major justifications for the above assertion are: a) "energy-related activities" appeared to be a sure-fire new growth area in the federal bureaucracy, i.e., with opportunities for both immediate employment and subsequent rapid advancement, b) the so-called "managerial revolution" espousing the philosophy that a good *manager* can manage *anything* (technical competence in the thing managed being irrelevant) was epidemic in Washington as well as in many large industrial organizations, and c) civil service regulations permitted "lateral" transfers, i.e., with no loss of salary, grade, or benefits, as opportunities presented themselves.

The most unfortunate consequence of ERDA's new management structure was (with the exception of its AEC-derived portion) a decrease in the size (and in the associated funding) for new projects. For the most part, the new ERDA managers were used to dealing with relatively small R&D programs (mini-projects from the AEC standpoint). Furthermore, since far less risk of massive failure was associated with a large "portfolio" of small projects, the support of many such programs per manager became the preferred operational style.

On the receiving end, this mini-project approach encouraged individual scientists, engineers, or spokesmen for small groups at LASL (and at other national laboratories as well as at universities and research institutes) to submit small energy R&D proposals to their project manager "friends or associates" at ERDA. Frequently, these proposals were informally approved and promised funding was already "in the pipeline" before the LASL management had even been notified that such a project was under consideration. Strange as this may seem, it

was in large measure a consequence of the previously-mentioned relative independence of LASL's division leaders, group leaders, and many staff members from any kind of *effective, overall* "management control" associated with LASL's energy R&D programs, a situation which was even further exacerbated whenever these projects originated in groups or divisions reporting to the Weapons Directorate.

We return now to the first four months of 1975 when I was in Washington and the office of the Assistant Director for Energy was still attempting to "get organized." Since this story is not directly relevant to the main thrust of this report, it will here be treated as a short parenthetical insert.

Upon returning to Los Alamos permanently toward the end of April 1975 (and having returned the previous weekend to catch up on developments in the Energy Office and found everything then functioning normally), I was astounded upon turning up for work the following Monday morning to find that the entire Energy Office and its staff had been completely disbanded by R. F. Taschek! To this day, I do not know what provoked this action and suspect that the less speculation the better (except to note that it probably originated from high level LASL political disagreements of which I was unaware). Informally, I subsequently functioned as Taschek's deputy and continued, at Harold Agnew's request, to represent LASL in Washington on almost all matters relating to energy.

It follows from the above insert that, from mid-1975 until I retired at the end of September 1979, few further efforts were made to influence the existing "management" of energy R&D at LASL. It tended to be a free-for-all, and the net result was a continued growth of mini energy-related projects initiated, acquired by, directed by, and "managed" by an interested, inspired, or influential staff member, group leader, or division leader. In support of this conclusion, about 18 years ago, I found that of approximately 400 separate energy-related DOE projects underway at LANL, 63% of them involved only 2 full-time equivalent personnel or less (if the energy-related Work-for-Others component of the Laboratory's operation had been included, the percentage would have been even higher!).

3.7 Comments on LASL Energy R&D and Related Issues (1975-1978)

3.7.1 A Chronology:

- a. U.S. Presidents
 - i. Jan. 20, 1969-Aug. 9, 1974: Richard M. Nixon
 - ii. Aug. 9, 1974-Jan. 20, 1977: Gerald M. Ford
 - iii. Jan. 20, 1977-Jan. 20, 1981: Jimmy S. Carter
- b. Federal Energy R&D Agencies
 - i. Jan. 1, 1947-Jan. 18, 1975: Atomic Energy Commission
 - ii. Jan. 19, 1975-Sept. 30, 1977: Energy Research and Development Administration
 - iii. Oct. 1, 1977-..... : Department of Energy.
- c. The Los Alamos Laboratory
 - i. 1943-1945: Manhattan Engineering District, Project Y, and for a few months at the end of 1945, designated as the Los Alamos Laboratory
 - ii. 1946-1981: The Los Alamos Scientific Laboratory
 - iii. 1981- : The Los Alamos National Laboratory

3.7.2 1975 Events:

- a. The Transfer Study: Section 307(b) of the Energy Reorganization Act of 1974 required that the "ERDA Administrator, in collaboration with the Secretary of Defense,..... conduct a thorough review of the desirability and feasibility of transferring to the Department of Defense or other Federal Agencies the functions of the Administrator respecting military application and restricted data....." During the latter part of 1975, nine LASL senior staff members contributed to the preparation of this study, ERDA-97, which was issued in January 1976 (as required by the above-mentioned legislation) and was titled "Funding and Management Alternatives for ERDA Military Applications and Restricted Data Functions."⁵⁰ Upon reviewing the completed study, the ERDA Administrator recommended retention of the Weapons Program within ERDA, and his recommendation was adopted by both the Congress and the Administration.
- b. On June 28, 1975, the Administrator of ERDA, Robert C. Seamans, Jr., submitted to the President of the United States, the President of the Senate, and the Speaker of the House of Representatives ERDA-48, Vol. I,* A National Plan for Energy Research, Development, and Demonstration: Creating Energy Choices for the Future.^{51a}
- c. At Los Alamos, a major new energy R&D program was launched in CMB Division (managed by M. Bowman) on the Development of Thermochemical Cycles for Hydrogen Production.**

3.7.3 1976–1977 Events: During these years, LASL pursued its existing energy-related operations under the aegis of ERDA and, except for the transfer of the CTR work from Q to a newly-established CTR Division, led by Fred Ribe, the Laboratory's energy-related R&D programs continued to operate as previously described.

In November 1976, Jimmy S. Carter was elected President and assumed office on January 20, 1977. Although ERDA had managed to maintain some semblance of a National Energy R&D Program,^{51b} frequent changes in its top management clearly suggested that it was an interim (or transitional) agency. This prognosis turned out to be correct, and one of the first initiatives of the Carter Administration was to obtain Congressional approval for the establishment of a new Cabinet department, the Department of Energy (into which a number of other energy-related agencies were incorporated). The DOE began operation on October 1, 1977, with James R. Schlesinger as its first Secretary.

As a postscript to the above paragraph, it is worth noting that, despite the fact that personnel from the national laboratories had previously been deeply involved from the outset in the formulation of successive national energy R&D programs, the planning leading to the above-mentioned legislation (its content, objectives, the creation of a new Department of Energy to replace ERDA, etc.) was all carried out by the Energy Policy and Planning Group in the Executive Office of the President. The resulting legislation, providing for the establishment of the Department, was submitted to the Congress on March 1, 1977. Then, on April 18th, the President addressed the nation on the general energy problem; on April 20th, he addressed a Joint Session of the Congress on the same subject and simultaneously released a Fact Sheet on his new Energy Program. Finally, on April 29, 1977, the White House released a 60 page document, outlining in considerable detail the new National Energy Plan.***

*Vol. II, Program Implementation, was to be submitted at a later date. See, Ref. 51b.

**See Ref. 3h, Chap. V, Applied Energy Technology, pp. 27 and 28.

***The above information was considered sufficiently important by Senator Henry M. Jackson, Chairman, Senate Committee on Energy and Natural Resources, to issue a compilation of these documents titled The President's Energy Program. See Ref. 52.

3.7.4 1978–1979 Energy-Related Events: These years were relatively uneventful with respect to LASL energy R&D issues. Some time was spent familiarizing Los Alamos project managers with their new DOE counterparts in Washington but, overall, very little of substance, i.e., reorganizing, redirecting, enlarging, or initiating new LASL energy programs, was accomplished at Los Alamos during this period. One important reason for this local “treading water” operation was that the DOE itself was reorganizing to address more effectively its own concept of what the most pressing national energy tasks were.

4.0 H. M. AGNEW RELATIONSHIPS (1978–1979)

The following assignments were only indirectly or peripherally related to LASL’s energy programs, but because they were carried out by the Laboratory’s Assistant Director for Energy and also because, had they resulted in different outcomes, they could have impacted adversely or positively on LASL’s energy programs, brief discussions of them are included in this report. Finally, so far as I am aware, relatively little historical material exists in the LANL Archives or anywhere else describing these events.

4.1 The Gerberding Committee and Its Report

In 1970, in anticipation of the forthcoming negotiations relative to the renewal of the “management contract” between the University of California and LASL (still, and primarily, one of The Nation’s two nuclear weapons research laboratories), considerable agitation arose among the UC faculty and the student body regarding the propriety of continuing the association (this was by no means surprising in view of the successive commotions occurring on all college campuses engendered by the Vietnam War). In response, the UC Academic Senate appointed a committee, chaired by Prof. Paul E. Zinner, to study the above-mentioned issue. Subject to the implementation of several recommendations designed to increase the “University’s knowledge of and influence upon the Laboratories (Los Alamos and Livermore)” a continuation of the contractual relationship was approved by a majority of the committee members.

In 1977, the next round of negotiations between UC and ERDA/DOE was initiated with the expectation that the contractual agreement would again be approved without any major changes. But renewed agitation *against* such an action once again arose on all of the UC campuses, prompting the UC President, David Saxon, to repeat the “Study Committee” approach. The new committee chairman was Dr. William Gerberding, formerly Vice Chancellor of the University of California, Los Angeles, who was currently the new chancellor of the University of Illinois at Champaign-Urbana. In addition to four faculty members from the University of California campuses and the President of the UC Berkeley Student Body, R. L. Wagner and I represented the two nuclear weapons laboratories under consideration.

Reference 53 includes a copy of the committee’s final report recommending continuance of the contractual agreement. It is probably not much of an exaggeration to note that my attendance at the many committee meetings, interviews with individuals desirous of testifying before the committee, studying the numerous written letters and other documents received, participating in scheduled public meetings on the issue, etc., occupied a goodly fraction of the year!

After the first committee meeting, it became abundantly clear to both Wagner and myself that *any* overt advocacy on the part of either of us for continuation of the management contract would be totally counterproductive. We therefore agreed at the outset to function only as

“resource” members of the committee, speaking only to clarify some technical point or otherwise explaining or providing “neutral” background information on various issues relating to the operation of the laboratories when it appeared appropriate to do so. I suspect that this was a prudent strategy to pursue, since (and I think that I can here speak for both of us) had a vote been taken after the first few meetings of the committee, it would certainly have been 6 to 2 against renewing the contract. In contrast, the final committee vote was *unanimous* in support of continuing the contractual relationship, despite the fact that the primary thrust of practically all of the letters received and all of the testimony presented was strongly supportive of severing the relationship! Finally, although most of the testimony focused upon the “propriety” of UC’s continued management of nuclear weapons laboratories, it appeared probable to both Wagner and myself that, should any management change occur, both the current and past tradition of multidisciplinary R&D at the laboratories directed toward *non-weapons* programs of national importance, e.g., energy R&D, would be likely to suffer.

4.2 Institutional Planning

- a. For Los Alamos, the precursor of the current DOE Institutional Planning Process was our response to a request from the AEC General Manager’s Office “to provide the information discussed in the July 12, 1974 meeting of the [AEC’s] Long Range Planning Committee.”⁵⁴ The result was DIR-2345.^{3h} This document, titled “Los Alamos Long-Range Planning Through Fiscal Year 1981” [actually, program and fiscal projections from FY75–FY81], constituted the first serious attempt on the part of the Laboratory’s management to examine, in considerable detail and completeness, LASL’s technical history, accomplishments, project costs, and expectations for the future.

I remember well the reaction of General Arthur Starbird, the AEC’s Director of its Division of Military Research (what I don’t remember is whether I delivered the report to him or was in his office on other business when he received it). It didn’t take him long, however, to find Table I, Cost of Operations (\$M), and Table II, Manpower Projections (FTE’s) from FY75–FY81, and to note that, during the next six years, LASL’s management was expecting to approximately double *both* of these items. In those days, the successive Directors of the Division of Military Application took their responsibility for preserving the long term *weapons R&D capabilities* of *their* Laboratories very, very seriously. Anything threatening to dilute or otherwise threaten those capabilities was totally unacceptable and General Starbird lost no time in informing the Laboratory management of his outrage at the implications of such projections.

I was obviously not privy to the discussions that ensued at Headquarters on this matter, but one outcome was the establishment of the ERDA/DOE Field and Laboratory Study Group and the issuance in 1975 of ERDA-100, outlining the study group’s recommendations for future annual institutional planning processes. Reference 55 summarizes the outcome of this effort insofar as it related to Los Alamos and provides references to the guidance documents prepared to ensure that future institutional planning would result in the preparation of comparable, consistent, and acceptable institutional plans from all of the national laboratories.

- b. By the Fall of 1978, after several institutional plans had been prepared and submitted according to current instructions, Robert S. Livingstone, who was responsible for the preparation of Oak Ridge National Laboratory’s institutional plan, proposed to his counterparts at the other DOE multiprogram laboratories that it might prove useful to organize annual workshops to discuss and review issues relevant to the institutional

planning process. His proposal was well-received by his associates at the other laboratories, and the first such workshop was held at Gatlinburg, Tenn. on October 30–31, 1978. In my opinion, it was a most productive meeting. Reference 56 consists of my trip report on that meeting together with a collection of reactions and reports generated by several of the other attendees.

Once again, in concluding this section, it is important to reiterate my belief that, although the institutional planning process does not deal exclusively with energy issues, these issues do constitute a major R&D effort in all of DOE's multiprogram laboratories, and it was generally agreed at this meeting that general discussions of energy issues (as well as other issues) should be included in all future Institutional Plans.

4.3 Reorganization Proposals and Analyses

During the last years of Harold Agnew's Directorship of the Los Alamos Scientific Laboratory, he became increasingly concerned regarding the adequacy of the Los Alamos management structure to respond effectively to both present and future challenges and opportunities. After further reflection, and possibly some encouragement from his closest advisors, he decided to employ a "management consultant" to review LASL's current organizational structure and to recommend changes if deemed necessary and appropriate. Having already had some direct experience with specific senior Arthur D. Little, Inc. executives who had more than satisfactorily carried out similar analyses, he made contact with that organization in June 1978, ascertained their interest and availability for carrying out a corresponding analysis for Los Alamos, and then initiated the formal contractual procedures to obtain their services. Concurrently, an internal (LASL) Management Discussion Group was organized and met regularly during the Summer and early Fall of 1978 to develop some internally-generated ideas on the same subject.

After several visits and many interviews with Los Alamos senior staff members, A. D. Little submitted a report on their findings and their resulting recommendations for changing LASL's management structure to Agnew on October 13, 1978.

The thrust of the A. D. Little report was:

- a. "that LASL's technical activities do not match the current organizational division of effort".
- b. that the current method of providing important planning and evaluation information to the Director in a timely and balanced manner is inadequate and this impedes his ability to make decisions responsive to LASL's established priorities as well as his ability to assess the performance of current, and the potential of proposed, R&D programs.
- c. specific organizational changes were proposed to correct these problems.

Concurrently, other reorganizational proposals (and justifications therefor) arising from discussions within (and without) the LASL Management Forum, simultaneously began to "pour" into the Director's Office.

Then, on November 3, 1978, an official LASL News Release announced the resignation of Harold Agnew as Director, effective March 1, 1979. On November 6, 1978, a second LASL news release announced a "Provisional Reorganization of LASL," approximately along the lines suggested by A. D. Little, Inc. This in no way diminished the *continued* flood of new organizational proposals being received daily by the Director's Office. In addition, various Associate and Assistant Directors maintained on their own office blackboards constantly changing new organizational arrangements preferred by themselves and/or their staffs. Agnew visited these offices from time to time, usually suggesting further changes. Altogether, by the end of November, reorganizational plans were still in a very fluid state.

On November 13, 1978, the resignations of two more senior LASL administrators were announced, specifically those of the Associate Director of Research, Richard F. Taschek, and the Leader of the Chemistry-Nuclear Chemistry Division, George A. Cowan.

Finally, on December 21, 1978, a third LASL news release announced that "Plans for a provisional reorganization of the Los Alamos Scientific Laboratory, announced by the Director in November, will not be implemented before Agnew's successor is named." For further information on these events, see the collection of memos, news releases and Reports assembled in Ref. 57.

5.0 CONCLUSIONS

The following remarks constitute my *personal* reactions after the passage of more than 20 years since the period during which the events described in this report took place.

Contributing to LASL's problems (and probably the problems at the other national laboratories) in no small way during the energy crisis of the 1970s was the continuing Administrative turmoil and the succession of organizational changes taking place in Washington throughout this period. What might have happened had there been no AEC to ERDA to DOE transitions, and no Watergate, is both impossible and useless to discuss meaningfully. This is not the case, however, if one restricts the discussion to "what should have happened?" Central to this issue is my conviction that, beginning in the mid-1970s and continuing thereafter, the national laboratories have not been optimally utilized by the succession of Washington-based organizations and agencies responsible for their operation.

We now call these scientific and engineering entities national multiprogram laboratories, in the sense that they are intrinsically large enough and their talents range over such a wide range of disciplines to enable them to investigate with considerable expertise (and with a high probability of success if the problem is technically soluble at all) almost any scientific and/or engineering R&D task assigned them. Another capability of these laboratories, amply demonstrated in the past, is their capability of tackling and solving *major* national problems of this type. For Los Alamos, several of these problems have been described in detail in previous sections of this report. But another essential aspect of these programs is the fact that the necessary scientific and engineering costs of investigating these problems can be predicted in advance to be high enough and the outcomes uncertain enough (despite their high potential payoffs for the nation as a whole if successful) to discourage the private sector from initiating such R&D projects.

My own conviction is that the undertaking of such major and nationally important technical problems is the proper role for the national laboratories and, as in the past, such programs should be accompanied by a very high quality, yet a modest, limited in scope, but relevant supporting research effort to maintain technical skills at the so-called cutting edge of each laboratory's main programs.

To the best of my knowledge, the format described above is not being carried out at any of this nation's multiprogram laboratories with the possible exception of the nuclear weapons programs underway at Los Alamos, Livermore, and Sandia. But even at those institutions, the remaining R&D programs constitute a multiplicity of relatively small and more or less unrelated technical activities (of high quality, but to emphasize the point, small). As such they are, almost by definition, at risk during periods of fiscal constraint and shortages.

Finally, no organization at any of the national laboratories has been established to systematically and authoritatively examine the non-technical, i.e. societal, implications of a potentially "successful" technical outcome of any given project, with the objective of having that

information used by the Laboratory's management to guide both the present and the future technical development of each such project.

ACKNOWLEDGMENTS

The author is deeply indebted to the following individuals who supported or otherwise assisted in the preparation of this report:

Karl R. Braithwaite, Director, Government Relations Office.

Edalia V. Lucero, Secretary, Director's Office.

Kathleen F. Maestas, Secretary, Director's Office.

Mary Moore, CIC-1; Dolores J. Gula, CIC-1; Kyle Wheeler, CIC-1; and especially to Katherine E. Valdez, CIC-1; who was responsible for the final typing and formatting of this report.

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NOTES AND REFERENCES*

1. a. See Attachment 1 for an Organization Chart, ca. 1968;
b. Attachment 2, known colloquially as the "Begat Chart," shows divisional changes made from 1945 to 1979;
c. A more detailed chart from *The Atom***¹⁷, No. 3, p. 24 (May-June, 1980) is given in Attachment 3. Also included is a LASL Organization Chart, ca. 1978.
2. a. *Los Alamos News*, Vol. 5, No. 1, p. 54 (Jan. 1, 1963);
b. J. A. Phillips, *LOS ALAMOS SCIENCE*, 4, No. 7, p. 64 (1983).
3. a. *Los Alamos Community News*, Vol. 2, No. 2, p. 3 (Jan. 28, 1960);
b. *ibid.*, Vol. 2, No. 12, p. 3 (June 16, 1960);
c. *ibid.*, Vol. 2, No. 26, p. 4 (Dec. 29, 1960);
d. *ibid.*, Vol. 3, No. 3, p. 1 (Feb. 9, 1961);
e. *ibid.*, Vol. 3, No. 7, p. 1 (April 6, 1961);
f. *ibid.*, Vol. 3, No. 10, p. 1 (May 18, 1961);
g. *Los Alamos News*, Vol. 5, No. 1, p. 46 (Jan. 1, 1963);
h. D. M. Kerr and R. E. Schreiber, DIR-2345, Long Range Planning Through Fiscal Year 1981, Chap II, Historical Background, V. Reactors, pp. 5-7;
i. *LASL* (Oct. 1968), p. 24, Ref. 1968-0.
j. *The Atom*, 3, No. 7, p. 10 (July, 1966).
4. Several of the best reports (and very critical ones) on the U.S. nuclear reactor program were prepared by R. Gillette (see *Science*, 177, 771, 867, 970, 1080 (1972); See also R. Stobaugh et al., *Energy Future*, Chap. 5, by I. C. Bupp and especially pp. 136-138, Ballantine (1980).
5. a. See Ref. 3i, p. 21;
b. See Ref. 3h, Chap. II, Historical Background, V. Reactors, p 6;
c. *Los Alamos News*, Vol. 5, No. 3, Project Rover, p. 31 (Jan. 31, 1963).
6. For further general information about the Vela program, see:
a. *Los Alamos Community News*, Vol. 22*** No. 21, p. 2 (Oct. 20, 1960) [This was the first announcement by the AEC of the existence of the Vela program];
b. See also references to Vela Hotel and Vela Sierra in the Complete Index, November 1958-December 1963, *Los Alamos Community News* and *Los Alamos News*;
c. *The Atom*, 6, No. 7, p. 4 (July 1969), *ibid.*, 7, No. 5, p. 3 (May 1970);
d. Ref. 3i, p. 30.

*Beginning with Ref. 3i, some references will consist of only a "year-numeral" entry. The data so referenced will be found in several notebooks consisting (in some cases) of about 40 numbered reports, memoranda, and handwritten notes collected by the author during the years 1968 through 1991 and arranged chronologically. They are located at the Los Alamos National Laboratory's Archives together with the Reference files for this report and with some copies of other traditionally-identified references, i.e., those readily available in scientific and technical libraries.

**Complete sets of the LASL publication "The Atom" (often referred to in this report) as well as of the "Los Alamos Community News" are located at the LANL Archives in File # A-93-067.

***A printing error exists in the *Los Alamos Community News*. The issues published from September 22 to October 20 were assigned the Volume number 22 instead of 2.

7. a. M. C. Smith, LOS ALAMOS SCIENCE, 4, No. 7, p. 86 (1983);
- b. M. C. Smith, Furnace in the Basement, Part I, LA-12809 (June 1994);
- c. LANL, Annual Report 1980, p. 20;
- d. The Subterrene was invented in 1960, primarily by members of Group CMF-4. During the late 1960s, scientists from other LASL groups began to recognize the potential environmental and economic benefits likely to result from the development and demonstration of such a device. They, together with several of the inventors, then persuaded the LASL management to provide preliminary support to initiate experimental work; see The Atom, 8, No. 10, p. 1 (1971);
- e. E. S. Robinson, R. M. Potter, B. B. McInteer, J. C. Rowley, D. E. Armstrong, R. L. Mills, and M. C. Smith, Editor, A Preliminary Study of the Nuclear Subterrene, LA-4547 (April 1971);
- f. The Atom, 8, No. 10, p. 10 (1971).
8. K. Boyer, A Brief History of the Los Alamos Laser Program, LA-UR-83-1139 (1983).
9. a. J. D. Balcomb, Passive and Low Energy Research and Development: A Global View, LA-UR-84-1507;
- b. J. D. Balcomb, LASL Solar Energy Program, LA-UR-75-446.
10. a. J. R. Bartlit and J. L. Anderson, The Tritium Systems Test Assembly: Overview and Recent Results, LA-UR-88-2796 (1988);
- b. Tritium Handling and Processing Experience at Los Alamos, LA-UR-94-1868 (1994);
- c. J. R. Bartlit, Ed., Fusion Engineering and Design, Special Issue on Tritium Facilities and Technology R&D, Vol. 12, No. 3 (June 1990), see especially The Tritium Systems Test Assembly at the Los Alamos National Laboratory, pp. 393–402 (available in the LANL Library).
11. a. Los Alamos Meson Physics Facility (LAMPF), Los Alamos News, Vol. 5, No. 4, p. 2 (Feb. 14, 1963) and *ibid.* No. 15, p. 3 (July 4, 1963);
- b. L. Rosen, LOS ALAMOS SCIENCE, 4, No. 7, p. 54 (1983).
12. Weapons Neutron Research (WNR) facility and the Los Alamos Neutron Scattering Center (LANSCE). Discussions of these facilities abound; see for example
 - a. 1983 LANL Annual Report (LALP 83-48) p. 42;
 - b. 1992 LANL Laboratory-Directed Research and Development (LA-12499-PR), pp. 172–174.
13. Ref. 3h, Chap. V, Program Detail, Nuclear Materials and Security Activities, pp. 1–3.
14. Ref. 3h, Chap. II, Historical Background, VI, Medicine and Biology, p. 8 and XII, ICONS (Isotopes of Carbon, Oxygen, Nitrogen and Sulfur), p. 14.
15. Superconducting Power Transmission Lines (SPTL):
 - a. E. F. Hammel, Case Study on the Superconducting Power Transmission Line Program, LA-13116-MS (1996);
 - b. Final Report on the DC Superconducting Power Transmission, Los Alamos National Laboratory, Progress Report #24, compiled by F. J. Edeskuty, April 1980, LA-8323-PR, UC-34 [NTIS-#CONS-2062-11];
 - c. Research and Development of Superconducting Transmission Lines, 1950–1980, History Associates, Inc., Jan. 4, 1985;
 - d. See also Ref. 30d, a separately bound collection of papers on SPTL.

16. Superconducting Magnetic Energy Storage (SMES):
 - a. F. J. Edeskuty, E. F. Hammel, H. L. Laquer, J. Marshall, J. D. Rogers, and F. Ribe, Pulsed Cryogenic Energy Storage, LA-4195-MS (June 6, 1969);
 - b. In 1983, a LASL-designed and constructed SMES system was successfully integrated into the Bonneville Power Administration's Tacona substation to help control oscillations in its power line grid stretching from Canada to California. J. D. Roger's group, CTR-9, played a major role in this technology transfer operation. See Ref. 12a, p. 33 (also included in this collection are several other related reports on SMES);
 - c. H. L. Laquer, D. B. Montgomery, and D. M. Weldon, Superconducting Energy Storage and Switching Experiments, Proc. XIII International Congress of Refrigeration, Vol. I, p. 457, Washington, D.C., 1971.
17. a. See memorandum, R. N. Thorn to H. M. Agnew (1978) and other comments in AOM-310 (1978), LANL Archives.
- b. This folder also contains a memo titled: LASL Organization, E. F. Hammel to D. M. Kerr, 9/28/79.
18. For further information, see I. Barbour, H. Brooks, S. Lakoff, and J. Opie, Energy and American Values, Praeger (1982). This entire book, of some 240 pages, analyzes the debate over energy policy. Other publications on the same subject abound.
19. Published in the Encyclopedia Britannica's 1969 Book of the Year. Incidentally, to the three well-known types of environmental pollution mentioned above, President Johnson (or more correctly, Lady Bird Johnson) added a fourth: visual pollution. Additional books and general articles calling attention to the growing national concern with environmental problems and published during the 1960s included:
 - Rachel Carson, Silent Spring (1962),
 - William O. Douglass, A Wilderness Bill of Rights, Encyclopedia Britannica's 1965 Book of the Year, pp. 49-80,
 - Theodore H. White, 1970: Introduction to the Politics of Change, *ibid.*, 1970 Book of the Year, pp. 26-44,
 - Gladwin Hill, Indestructible Trash, *ibid.*, pp. 211-212.
20. D. Yergin, The Prize, Simon & Schuster (1991).
21. Congressional Record, House, 117, #84, H4715 (1971); Pres. Nixon's June 4, 1971 First Energy Message to the Congress, titled Clean Energy Needs (see 1971-0' for a copy)
22. The Atom, 7, No. 1, p. 1 (1970).
23. The Atom, 7, No. 2, p. 16 (1970).
24. a. Ref. 3h, Chap. V, Programmatic Detail, Energy Programs: Fission Reactor Technology, pp. 1-14;
- b. Los Alamos News, Vol. 4, No. 25, p. 3, Nov. 8, 1962. This article, titled "Too Hot to Handle? Not in Wing 9" (of the CMR-Building), describes LASL's new remote handling facilities for carrying out physico-chemical and spectrographic analyses as well as assorted physical measurements and tests on highly irradiated (and hence extremely radioactive) materials, e.g., nuclear fuel elements after having been tested in the KIWI reactors at the Nevada Test Site.
25. Of the five initiatives, only two originated with Pres. Nixon and both were politically inspired. Increased funding for coal gasification resulted from heavy lobbying by the American Gas Association, and continued support for breeder reactor R&D resulted from a deal cut between the President and the Chairman of the Joint Committee on

Atomic Energy. These interventions are mentioned here to illustrate the political component of federal energy policy formulation.

26. 1972-2 (see footnote page 14, main text).
27. 1971-1
28. *The Atom*, **8**, No. 8, p. 8 (1971).
29. Caused primarily by the loss of funding for the K-Division program and the impending demise of the Rover Program. See also *The Atom*, **8**, No. 4, p. 14 (1971).
30. a. *The Subterrene*, *The Atom*, **8**, No. 10, p. 1 (1971);
b. *Hot Dry Rock*, *ibid.* p. 10;
c. *The Superconducting Power Transmission Line*, *ibid.* **9**, No. 2, p. 9 (1972);
d. E. F. Hammel, *A Proposal for a DC Superconducting Power Transmission Line Prototype Development*, Los Alamos Scientific Laboratory Report, LASL P-49 (1972). * See also Ref. 15.
31. a. 1972-3;
b. 1972-4;
c. 1972-5;
d. Briefing, *Science*, **181**, 140 (1973).
32. a. LASL Press Release, "LASL Forms New Division" Jan. 31, 1973. See 1973-6;
b. *The Atom*, **10**, No. 2, p. 11 (March 1973). See 1973-6a.
33. 1973-31;
34. Then directed by John M. Gibbons who, in 1978, became the third Director of the Congressional Office of Technology Assessment. In 1991 he was appointed to his third six year term. See also J. H. Gibbons and P. D. Blair, *U.S. Energy Transition: Getting From Here To There*, *Physics Today*, **44**, No. 7, p. 22 (1991) for an excellent recent review article. In 1994, Gibbons was appointed Science Advisor to President Clinton. A copy of Gibbon's *Physics Today* article is in the Reference 34 File for this report in the LANL Archives.
35. a. R. Gillette, *Science*, **178**, 375 (1972);
b. G. B. Lubkin, *Physics Today*, **26**, p. 97 (March 1973);
c. R. Gillette, *Science*, **182**, 898 (1973).
36. James E. Akins, *The Oil Crisis: This Time The Wolf Is Here*, *Foreign Affairs*, April 1973, p. 462 (also included in this reference file are the following related articles from *Foreign Affairs*: Carroll L. Wilson, *A Plan for Energy Independence*, July 1973, p. 657; J. Amuzegar, *The Oil Story: Facts, Fiction, and Fair Play*, July 1973, p. 676; and Walter J. Levy, *Oil and the Decline of The West*, February 1980, p. 999).
37. *Science (News and Comment)*, **181**, 825, August 31, 1973.

*This proposal was originally submitted to the National Science Foundation RANN Program. Following standard procedures, it was duplicated by the NSF and copies sent to 13 reviewers (primarily from electric power companies and to faculty members in the electrical engineering departments at major universities). Of the 13, eleven were returned with generally negative appraisals. With strong support from Prof. Simpson Linke, the RANN Program Manager for electrical engineering proposals, we prepared rebuttals to every one of the adverse reviews. The collected rebuttals comprised a new document lengthier than the original proposal! Upon receiving it, Linke sent it to the reviewers who had originally rejected our proposal and in response got more than half of them to reverse their original positions. With that new data in hand, Prof. Linke felt justified in submitting it to the full National Science Foundation Board for approval (which was required because of its high estimated cost), and it then received an overwhelming vote of approval from that body as well. As noted in the text, however, funding for our program was finally assumed by the AEC. Reference 30d also includes an extensive collection of supporting documents and memos.

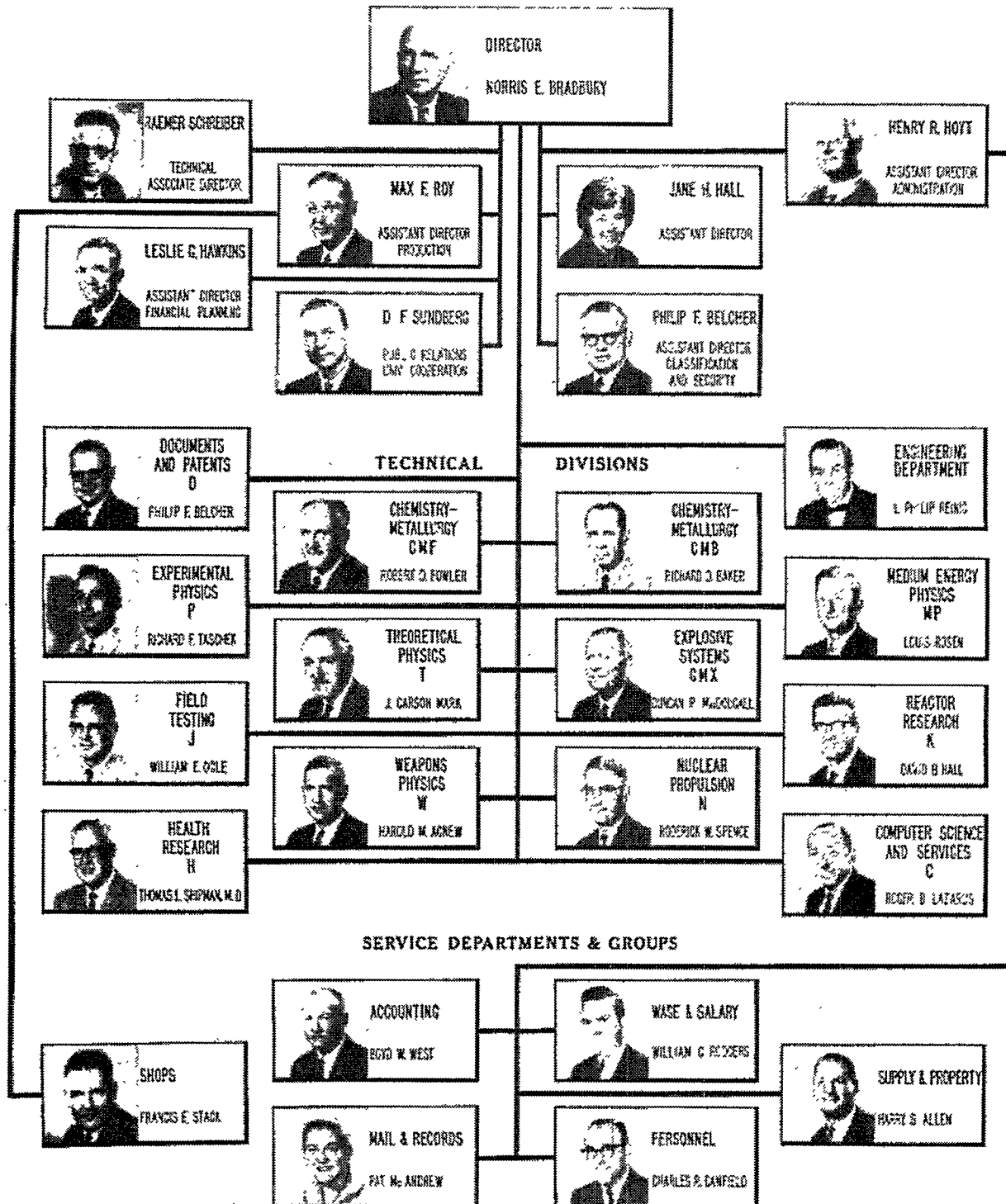
38. See, for example, the press release from the Office of Senator Jennings Randolph of West Virginia, April 18, 1973, a copy of which is included in Ref. 1973-32b.
39.
 - a. C. Holden, *Science*, **180**, 475 (1973);
 - b. *ibid.* p. 1155;
 - c. D. Shapley, *ibid.* p. 1157;
 - d. R. Gillette, *ibid.*, **181**, 140 (1973).
40. See Ref. 20, p. 591.
41. See Ref. 1973-35.
42.
 - a. See Ref. 1973-6 to 39 for the LASL point of view;
 - b. See Ref. 39d;
 - c. Briefing: ALH & RG, *Science*, **181**, 827 (1973);
 - d. *ibid.* R. Gillette, p. 1233 (1973);
 - e. *ibid.* **182**, 898 (1973);
 - f. *ibid.* p. 1225;
 - g. *ibid.* p. 1319;
 - h. and, finally, see WASH. 1281, *The Nation's Energy Future*, 1 December, 1973 (submitted to President Richard M. Nixon by AEC Chairman Dixy Lee Ray). A copy of this report is to be found in Ref. 1973-39.
43. See Chapter 2, p. 9, and Appendix B, pp. 133-144 in WASH-1281 (Ref. 1973-39).
44. *Time*, Dec. 24, 1973, p. 19; Dec. 31, 1973, p. 18; and Jan. 21, 1974, p. 22.
45. The members of this committee represented, almost equally, both the weapons and the nonweapons programs at LASL. They were E. F. Hammel (chairman), D. Balcomb, W. Bennett, C. M. Gillespie, R. Hanold, J. Lauderdale, D. M. Kerr, J. McNally, J. Phillips, and W. Reichelt. During January and February, 1974, this committee, supplemented by many additional staff members, organized itself into ten working groups: Energy/Resource Conservation, Oil and Gas Stimulation, Clean Fuels from Coal, Nuclear Energy (fusion), Nuclear Energy (fission), Renewable Energy Sources, Environmental Effects R&D, Energy Transmission and Storage, Synthetic Fuels, and Energy and Environmental System Studies (see especially, Ref. 1973-38a)
46. The same proposal resurfaced in 1978 and was finally adopted in late 1979.
47. See Ref. 1974-40.
48. See Ref. 1974-41.
49. See Ref. 1974-42. See also the collection of other relevant reports, letters, published articles, etc. contained in the Reference 49 folder for the present report, which is being kept at the LANL Archives. And, finally, also in the LANL Archives is an additional collection of *all* of the documents used in the preparation of ERDA-13, *The Energy-Related Applications of Helium.*; see File # A-89-022.
50. ERDA-97, *Funding and Management Alternatives for ERDA Military Application and Restricted Data Functions*, January, 1976.
51.
 - a. ERDA-48, *Creating Energy Choices for the Future*, June 28, 1975;
 - b. ERDA-77-1, *A National Plan for Energy Research, Development, and Demonstration*, June 23, 1977.
52. *The President's Energy Program* (A compilation of documents printed at the request of Henry M. Jackson, Chairman, Committee on Energy and Natural Resources, United States Senate, May 1977, Publication 95-16).
53. This reference, DIR-ESD-492, dated Oct. 21, 1987, and titled "Institutional Change at Los Alamos: A Case Study," was prepared for Frank Finch, DIR-GR, and includes a copy of the Gerberding Report.
54. See Forward, Ref. 3h.

55. Outline and references: LASL/ERDA/DOE Field and Laboratory Coordination Interactions.
56. Reports, memos, position papers, etc. prepared for and resulting from the October 30–31, 1978 meeting at Gatlinburg, Tenn. on the institutional planning process for the national laboratories.
57. Most of the documents relating to the proposed reorganization are in the LANL Archives File # AOM 310 (1978). See for example:
 - a. Memo: Agnew to Van Gemert, June 20, 1978: LASL Management Consultant;
 - b. Report on LASL Reorganization, A. D. Little, Oct. 23, 1978;
 - c. W. Lepkowski, Los Alamos Wrestles With Its Future, Chemical and Engineering News, September 25, 1978, p. 14;
 - d. LASL Press Release, November 3, 1978: Agnew resigns;
 - e. LASL Press Release, November 6, 1978: Provisional Reorganization Announced;
 - f. H. M. Agnew, Research Attitudes vs Funding, Text of speech presented to NCAR, October 2, 1978;
 - g. LASL Press Release, December 21, 1978: Reorganization Plans Deferred.

Originals or copies of most of these references are located at the LANL archives, Roger A. Meade, Archivist, Los Alamos National Laboratory, MS C322, Los Alamos, NM 87545.

Attachment 1

LOS ALAMOS SCIENTIFIC LABORATORY



Organization Chart, ca. 1968

From an October 1968 Los Alamos Scientific Laboratory publication titled only LASL; see pp. 36 and 37. See 1968-0.

Laboratory Organization

Dr. Norris E. Bradbury is the director of the Los Alamos Scientific Laboratory and is responsible to the president and the Regents of the University of California and ultimately the U.S. Atomic Energy Commission for carrying out Laboratory programs and policies in accordance with the contract between the university regents and the USAEC.

The technical associate director is the number two man in LASL's organizational make-up. A number of assistant directors do just that—assist the director—in supervising their assigned portions of the Laboratory's responsibilities.

Also reporting directly to the director are heads of the 14 technical divisions. Employees of these technical divisions are primarily the scientists, engineers and technicians who actually perform the research and development work at LASL. The six service departments perform supporting functions such as procurement, accounting, shops, personnel, etc.

Both the technical divisions and service departments are further divided into about 100 "groups" which concentrate their areas of research or programs into certain sections as defined by the division leader or department head. A group leader is in charge of each group and reports to the division leader or department head. The group leader also frequently appoints an alternate group leader, associate group leader and/or assistant group leader to help him in the administrative and supervisory work. (Division leaders and department heads also frequently appoint alternates, associates or assistants.)

The term "staff member" is used at LASL to denote a member of the scientific staff, i.e., a scientist or engineer. Approximately 40 per cent of LASL's employees are staff members.

FOR ADDITIONAL INFORMATION:

Science museum, group tours

Community Relations Office
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, New Mexico 87544
(505) 667-4444

LASL research programs, news media queries

Public Relations Office
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, New Mexico 87544
(505) 667-6101

Nuclear energy in general, Atomic Energy Commission, AEC programs

Division of Technical Information
USAEC
P. O. Box 62
Oak Ridge, Tennessee 37830
(615) 483-8611
(OR)
Division of Public Information
USAEC
Washington, D. C. 20545
(301) 973-3414

Los Alamos community affairs, tourist information

Los Alamos Chamber of Commerce
P. O. Box 888
Los Alamos, New Mexico 87544
(505) 662-5595

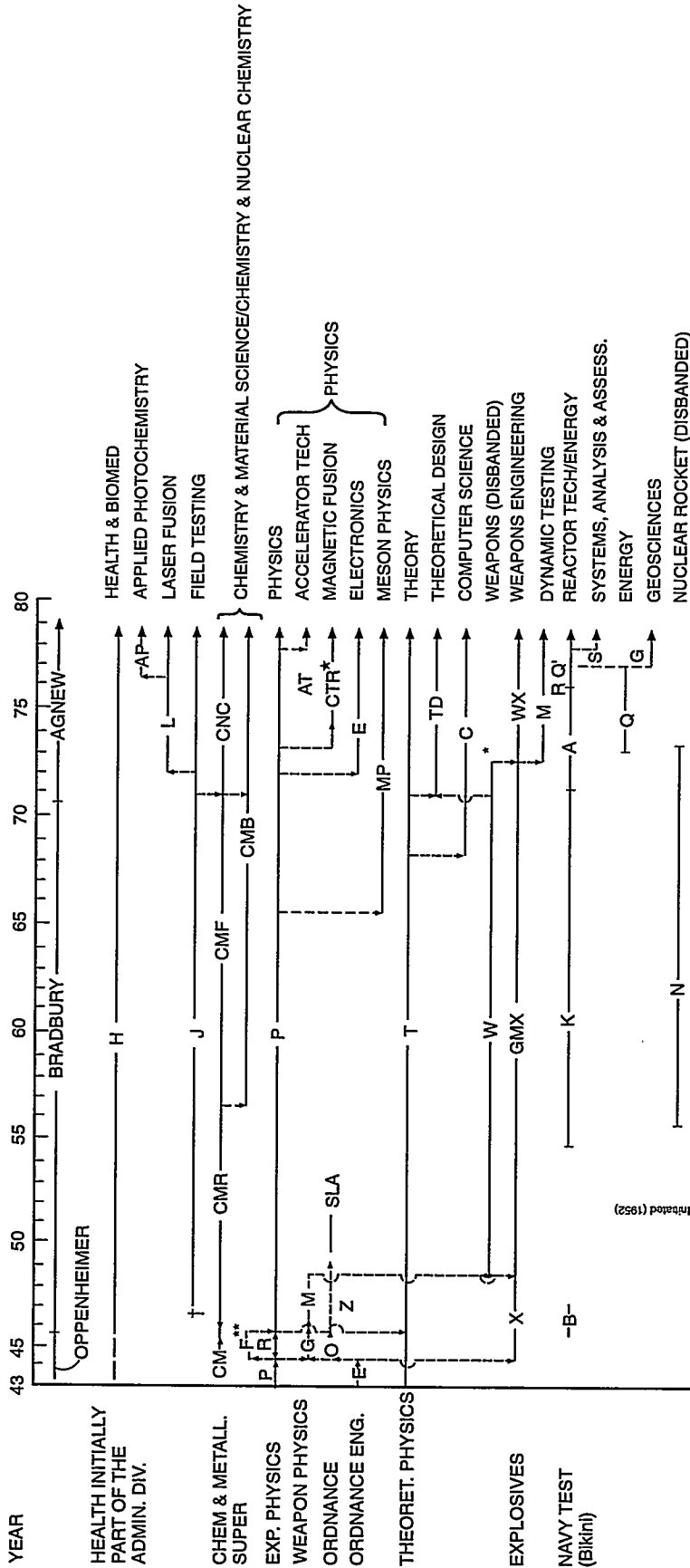
LASL employment opportunities

Personnel Department
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, New Mexico 87544

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Attachment 2

LOS ALAMOS SCIENTIFIC LABORATORY HISTORY OF THE TECHNICAL DIVISIONS



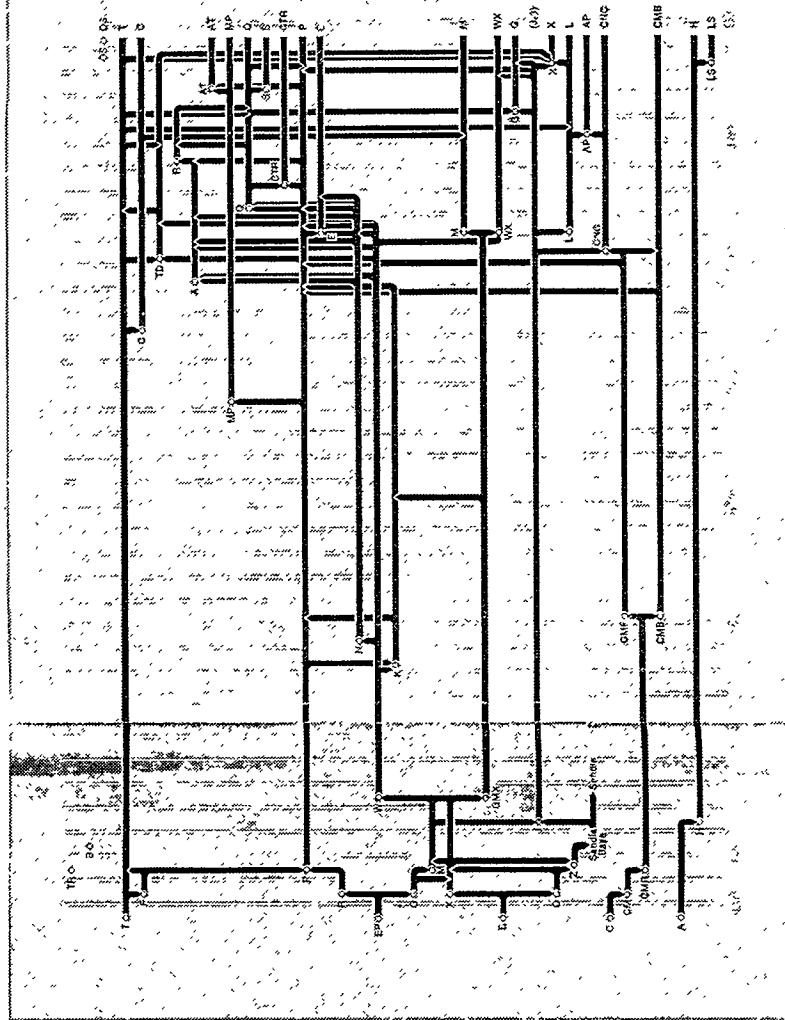
Water Boiler (5/9/44)
Crossroads (7/1/49)
Comanche (Pu Reactor) 3/49
Weapons (1950-)
Development of Thermonuclear Sherwood Inited (1952)
Rover Inited (1955)
LAPRE II Tested (59-60)
Turner Inited (1960)
LAMPRE I Cntal (1961)
LAMPF Inited (1964)
UHTREX Cntal (1967)
Rover Termined (1972)

† Formed from groups from Z & M Divisions
* From March 1973 to March 1974 "CTR" was a part of Q-Division
** Also formed from a part of T-Division



Attachment 3

US ROOTS



atom, May/June 1980

atom, May/June 1980

K: Reactor Development, 1954, part from GMX, 1961. Disbanded 1970, partly to P.
 L: Laser Research and Technology, 1972, part from J Part to AP, 1976, part from T, LS: Life Sciences, 1979, from M.
 M: Experimental and PL, 1945, from part of 1948. G Part to J, 1947, test to GMX and W, 1948.
 N: Dynamic Testing, 1972, from GMX Got part to C, 1978. Energy Physics, 1965, from P, Part to AT, 1978.
 O: Nuclear Propulsion, 1955, part from W, Part to A, 1970 and 1972, parts to P, A, O, E and C, 1978. Ordnance, 1944, from E, To Z and X in 1945. Operational Security/Security, 1950, from security and nuclear materials offices.
 P: Physics, 1945, from P and T, Part to L, 1978. Parts of K, 1956; W, 1972; N, 1973; J and O, 1979. 1973, from M and P. Got part of 1977, S, 1978; P, 1979.
 Q: Research, 1944, from EP. Went to P, 1945. Research, 1945, from EP. Went to P, 1945. Research, 1945, from EP. Went to P, 1945. Research, 1945, from EP. Went to P, 1945.
 R: Nuclear Safeguards, reactor Safety and Technology, 1975, from A To O when Disbanded, part to C, 1980; and 1978, from O.
 S: Theoretical Physics, 1943, Showned F, O, 1977. Theoretical Physics, 1945, Part to O, 1977. Theoretical Physics, 1945, Part to O, 1977. Theoretical Physics, 1945, Part to O, 1977. Theoretical Physics, 1945, Part to O, 1977.
 T: Trinity. Task force for 1945 test near Alamogordo, 1948, from M and X. Part to K, 1954 and N, 1955. Disbanded in 1972 to N, W, P, A, TD and ADWP.
 U: Weapons Engineering, 1972, from GMX and weapons parts of ENG, 1975; J, 1977. Absorbed parts of ENG, 1975; J, 1977. Explosives, 1944, from L, Part from O, GMX and W, 1948.
 V: Theoretical Applications, 1979, from TD, T, J. Weapons Engineering and Stockpile, 1945, from X and O. Transferred to Sandia Base, 1948, part to J, 1947, made part of Sandia, 1948.

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Attachment 4

**CHRONOLOGY OF EVENTS RELEVANT TO ENERGY,
THE ENVIRONMENT, AND LASL/LANL**

– 1930 –

12/1–6/30 Temperature inversion in the heavily-industrialized Meuse Valley near Liège, Belgium caused 63 deaths and thousands of respiratory disorders.

– 1948 –

10/26–31/48 A similar temperature inversion causes unprecedented respiratory distress in the industrial town of Donora, Pennsylvania. Twenty deaths and respiratory problems for about 6,000 residents occurred.

1948–1949 The first Arab-Israeli war.

– 1950 –

1950–1960 Temperature inversions with serious consequences occurred periodically in many of the nation's (as well as the world's) largest industrial cities, thereby calling public attention to the importance of the air pollution problem. It is also gradually recognized that a more or less linear relationship exists between energy consumption and pollution.

Increasing public concern regarding radioactive pollution of the atmosphere and the disposal of radioactive wastes from bomb tests and power reactor discharges.

– 1952 –

Smog concentrations in southern England kill an estimated 4,000 people.

– 1955 –

Passage of P. L. 159, 1955 Air Pollution Control Act.

– 1956 –

Enactment of P. L. 600, the Federal Water Pollution Control Act.

7/26/56 Nasser seizes Suez Canal.*

10/29/56 The second Arab-Israeli war: Israel invades Sinai peninsula.

11/3/56 Nasser scuttles ships in Canal.

*See K. Kyle, SUEZ, St. Martin's Press, NY (1991). See also the book review of SUEZ by Gaddis Smith on p. 7 of THE NEW YORK TIMES BOOK REVIEW, Aug. 18, 1991, Ref. 1991–46.

– 1956 – (Cont.)

- 11/5/56 British and French forces attack Canal Zone.
- 11/6/56 Eisenhower defeats Stevenson for the second time.
- 11/7/56 Suez cease-fire accepted.
- 11/56–4/57 Major oil crisis averted by rerouting oil tankers; no significant increase in oil prices occurs.
- England passes Clean Air Act.

– 1959 –

- 3/10/59 Eisenhower reluctantly announces the imposition of quotas for oil imports (amount of imported oil not to exceed 9% of total U.S. consumption).*

– 1960 –

- 9/9/60 Formation of OPEC (but no significant action is taken for about 13 years).

– 1961 –

- 1/20/61 John F. Kennedy becomes President.
- Water Pollution Control Act amended and strengthened.

– 1962 –

Publication of Rachael Carson's "Silent Spring" focuses national attention on environmental issues, especially the impact of pesticides. This prompts an explosion of media attention on all other types of environmental pollution.

The Kennedy administration further tightens the oil quota regulations.

*Shortly after the end of World War II, world-wide demand for oil began to increase, due largely to the availability of cheap crude from the Middle East and Venezuela. U.S. oil producers found it increasingly difficult to compete. Political pressure to impose high tariffs or to establish quotas on foreign imports began to be exerted in 1949 (on the Truman Administration) and these efforts continued for a decade. Eisenhower finally agreed to quotas (in response to overwhelming Congressional support for the idea) almost at the end of his second term.

– 1963 –

- The nation's first Clean Air Act is passed by the State of California.
- 11/22/63 Lyndon B. Johnson succeeds Kennedy as President.
- 12/10–12/63 First White House Conference on Air Pollution.
- 12/17/63 A national Clean Air Act becomes law superseding the 1955 Air Pollution Control Act.

– 1967 –

- 6/5/67 The third Arab-Israeli War (the Six Day War) begins.
- 6/6/67 Arab oil ministers call for an oil embargo against all countries friendly to Israel.
- ~10/67 Oil embargo fails; normal production resumes.

– 1968 –

Johnson Administration relaxes quota regulations slightly.

– 1969 –

- 1/20/69 Richard M. Nixon becomes President.
- ~2/1/69 Lee A. DuBridge appointed Presidential Science Advisor (PSA).
- 1/28/69 Santa Barbara Channel oil spill.
- Passage of the National Environmental Policy Act which establishes a permanent three-member council on Environmental Quality in the Executive Office of the President.
- Nixon establishes an Environmental Quality Council consisting of the Secretaries of six federal departments.
- Strong measures taken against polluters by the Federal Water Pollution Control Administration and the U.S. Air Pollution Control Administration.

- 1/22/70 Nixon's first State of the Union message focuses on environmental pollution.
- 4/22/70 Earth Day (the first nation-wide observance, calling attention to environmental problems).
- 5/70 Libya orders Occidental to reduce production from 800,000 to 500,000 bbls/day.
- 6-8/70 A tractor ruptures the Trans-Arabian pipeline (Tapline).
Major "brownouts" along Atlantic seaboard.
- 7/9/70 President Nixon calls for a major reorganization of federal agencies concerned with environmental problems.
- 8/6/70 Nixon appoints a Subcommittee of the Domestic Council to study the National Energy situation: [Chairman (Ehrlichman), Members (Secretary of State, Secretary of Interior, Secretary of Commerce, Secretary of Treasury, Secretary of HEW, Administrator of the EPA, PSA, Chairman Council of Economic Advisors, Chairman Council of Environmental Quality, Director of the Office of Emergency Preparedness, Chairman of the Federal Power Commission, Chairman of the Atomic Energy Commission, Special Assistant to the President on Consumer Affairs, and the Director of OMB.)] Ehrlichman assigns the job of actual chairmanship to Paul W. McCracken, Chairman Council of Economic Advisors. McCracken becomes the nation's first nominal energy "czar."*
- 8/31/70 Lee A. DuBridges resigns as PSA; Edward E. David, Jr., replaces him.
- 9/1/70 Harold M. Agnew succeeds Norris E. Bradbury as Director of the Los Alamos Scientific Laboratory.
- 9/70 Libya negotiates a 20% increase in oil revenues from Occidental; Syria suspends oil transport by the pipeline from Iraq which crossed its territory; price of fuel oil doubles in New England; coal and gas supplies tight.
- 10/70 Amendments to and the strengthening of the Clean Air Act of 1963.
- ~12/70 Establishment of the Council on Environmental Quality (CEQ), the Environmental Protection Agency (EPA), and the National Oceanic and Atmospheric Agency (NOAA).

*See Congressional Record, 6/4/71.

– 1971 –

- 2/14/71 At Teheran, OPEC and the oil companies negotiate a new profit-sharing agreement: 55% to be the minimum government share and the price of oil to increase by 35 cents/bbl.
- 3/71 McCracken's subcommittee reports findings to the President. From this information, the Subcommittee, the OST, and the White House staff begin drafting the President's CLEAN ENERGY NEEDS message.
- 4/2/71 At Tripoli prices for Mediterranean oil arbitrarily increased by 90 cents per barrel; Libya's oil revenues increase by 50%. So much for the Teheran agreement which was supposed to last for 5 years.
- 6/4/71 President Nixon's first Energy Message, titled CLEAN ENERGY NEEDS, sent to the Congress.
- 6/25/71 Contract OST-30 signed between OST and Assoc. University Inc. (Brookhaven National Laboratory) to carry out an assessment of technological opportunities in the "clean energy" area.
- 8/11/71 Passage by the Congress of an Amendment to the Atomic Energy Act of 1954 authorizing the AEC to conduct R&D relating to the "preservation and enhancement of a viable environment by developing more efficient methods to meet the nation's energy needs."
- 11/71 Issuance of AET-7, Report on Step 1 by BNL.

– 1972 –

- 1/72 LASL SPTL Proposal formally submitted to SNF-RANN.
- 2-4/72 Appointment of AET Technical Groups by OSF/FCST and issuance of AET-8, Reference Energy Systems by BNL. Concurrently, Peter M. Flanigan (taking over from McCracken) organizes another White House review of energy policy.
- 6/72 Preliminary approval of SPTL by RANN.
Passage of a strengthened Federal Water Pollution Control Act.
- 6/17/72 Watergate burglary and arrests. The release of new Watergate revelations continues throughout the remainder of 1972 and 1973.
- 7/1/72 Flanigan's staff completes assembly of a collection of "major energy policy initiatives." These include deregulation of national gas, construction of deepwater ports for supertankers, energy conservation proposals, etc. These economic and political initiatives were to be coordinated with the energy R&D program being developed by the OST.

- 1972 - (Cont.)

- ~7/15/72 Flanigan's entire energy program vetoed by Schultz, Ehrlichman, and Connelly.
- 7/24/72 Engineering Foundation Conference on Energy Technologies for the Future (first major national conference on this topic); Proceedings filed with those of other related conferences, with the references to this report in the LANL Archives.
- 10/72 Final approval of SPTL by RANN; simultaneously AEC/DAT agreed to partial support of project; shortly thereafter AEC/DAT took over total responsibility for funding SPTL.
- Completion of OST Technical Group Reports.
- 11/1/72 Superconducting Magnetic Energy Storage (SMES) project-funded by AEC/DAT, Ref. LA-5258-PR.
- 11/72 Nixon reelected.
- 12/72 Completion of draft AET Overview Panel Assessment and Recommendations report.
- Dismissal of PSA, PSAC, and OTS.*
- NSF funding of Subterrene.

- 1973 -

- 1/73 Nixon's second term begins.
- Assignment of all OTS functions to NSF.
- John Ehrlichman appointed head of a triumvirate (Ehrlichman, Schultz, and Kissinger) to manage U.S. energy policy. Charles di Bona appointed Executive Director.
- 1/17/73 In response to critical shortages of home heating oil and diesel fuel, Nixon relaxes restrictions on crude oil imports.
- 1/27/73 Vietnam peace agreement signed.
- 2/7/73 U.S. Senate establishes the Select Committee to probe Watergate affair.

*Effective 1/19/73, see SCIENCE, 179, 160 (1973).

– 1973 – (Cont.)

- 3/23/73 In response to probable gasoline shortages, Nixon removes more oil import restrictions.
- 4/73 First practical application of the Subterrene.*
- 4/2/73 Formation of the NSF Energy R&D Task Force.
- 4/9/73 Memo: Donovan to Participants in the Development of the NSF Energy R&D Task Force Report (see Ref. 12).
- 4/11/73 EPA extends by 1 year the deadline for automakers to meet the 1975 emission control standards.
- 4/18/73 President Nixon's second Energy Message (prepared in part by James E. Akins, Economist, U.S. State Department). Among many other provisions in the message, Nixon abolishes the oil quota system.
- 4/30/73 Under Watergate cloud, Ehrlichman forced to resign. White House Energy triumvirate collapses.
- 5/11/73 Memo: Craig to NSF Energy R&D Task Force regarding its 3rd meeting scheduled for 5/16/73. Topic: Progress Reports on Major Areas (This is the last memorandum in Ref. 1973-31 which is itself Appendix II of a Sept. 24, 1973 memorandum, Hammel to Agnew; see also Refs. 1973-29 to 34).
- 6/73 LASL's HDR project receives AEC/DAT funding.
- 6/11/73 Libya nationalizes foreign oil operations (Occidental).
- 6/29/73 President Nixon's third Energy Message:
- Assigns Dixie Lee Ray the job of preparing a comprehensive Energy R&D Program.
 - Establishes Energy Policy Office, appoints former Gov. John A. Love of Colorado, to direct it.
 - Initiates a five-year \$10 B energy R&D development program beginning in FY75. An additional \$100 M will be committed in FY 74 to give impetus to this drive.
 - Requests Congress to create a new Department of Energy and National Resources and a new Energy Research and Development Administration.

*See The Atom, 10, No. 4, 1 (1973).

- 1973 - (Cont.)

- 8/15/73 NSF forms Office of Energy R&D policy (Paul Donovan, Director; Paul Craig, Deputy Director) to provide input to the newly formed Energy Policy Office headed by Gov. Love.
- 10/6/73 The fourth Arab-Israeli war; Egypt and Syria attack Israel (the Yom Kippur War begins).
- 10/7/73 Egypt claims control of entire east bank of Suez Canal; Syria reclaims Golan Heights.
- 10/9/73 Vice President Agnew resigns in disgrace.
- 10/11/73 Israel recaptures Golan Heights.
- 10/14/73 Major Egyptian attack in the Sinai.
- 10/15/73 Israel's task group crosses the Canal; the U.S. attempts surreptitiously to airlift arms to Israel but operation is discovered by the Arabs.
- 10/16/73 OAPEC announces a 17% increase in the price of crude oil, from \$2.90 to \$5.11/bbl. OAPEC simultaneously imposes a 70% increase in oil company taxes to be paid to producer nations. *
- 10/17/73 OAPEC cuts oil production 5% per month.
- 10/19/73 OAPEC oil embargo begins. Libya first cuts off all oil shipments to the U.S.
- 10/20/73 Major Israeli attack on west side of Suez Canal.
Saudi Arabia cuts oil shipments to the U.S.
The "Saturday Night Massacre" (Watergate).
- 10/21/73 Kuwait, Bahrain Qatar, and Dubai cut oil shipments to the U.S.
- 10/23/73 UN-imposed cease-fire announced but Israel troops continue to attack in Egypt.
- 10/24/73 Syria accepts UN cease-fire.
- 11/6/73 OAPEC reduces oil output to 75% of September value.

*Ref. D. Yergin, The Prize, p. 606, Simon and Schuster (1991).

– 1973 – (Cont.)

- 11/7/73 Nixon makes major Presidential Address to the nation recognizing the seriousness of the oil shortages, proposing Project Independence, urging conservation measures and recommending the establishment of the Energy Research and Development Administration (ERDA).
- 11/11/73 Egypt and Israel sign cease-fire.
- 11/16/73 Nixon approves bill authorizing construction of Alaskan oil pipeline.
- 11/22/73 Yamani threatens to blow up oil facilities if U.S. takes military action.
- 11/25/75 Nixon predicts 10–17% fuel shortage.
- 12/1/73 Dixie Lee Ray submits a formal plan, The Nation's Energy Future, for a \$10 B, five-year energy R&D program to the President.
- 12/3/73 Gov. Love resigns as U.S. Energy Czar.
- 12/4/73 Formation of a new Federal Energy Office (FEO) with William E. Simon, * Director; John C. Sawhill, ** Deputy Director. FEO's charter was to manage energy-related activities in the Departments of Commerce and Interior, the OMB, Cost of Living Council, AEC, etc. Budget: \$31 M; employees, 1300. ***
- 12/9/73 OAPEC cuts back production by another 5%.
- 12/13/73 Simon announces new energy conservation measures. Truck drivers strike.
- 12/25/73 OAPEC very slightly relaxes the oil embargoes against the U.S. and the Netherlands.
- OAPEC crude price increase: \$5.11 to \$11.65/bbl.

*Formerly Deputy Secretary of the Treasury.

**Formerly with OMB.

*** See SCIENCE, 182, 1225 (1973).

– 1974 –

- 1/74 Weinberg to White House. Project Independence begins.*
- 5/74 Oil embargo against the U.S. finally lifted.
LASL Assistant Director for Energy appointed.
- 8/9/74 Richard M. Nixon resigns.

Vice President Gerald R. Ford assumes the Presidency.
- 8/74 President Ford signs bill establishing ERDA.

– 1975 –

- 1/19/75 ERDA officially begins operation.
- 6/28/75 Robert C. Seamans, Jr., submits to the President ERDA-48, A National Plan for Energy Research Development and Demonstration.

– 1976 –

- 1/76 Issuance of ERDA-97, Funding and Management Alternatives for ERDA Military Applications and Restricted Data Functions.
LASL pursued ongoing Energy R&D programs.
- 11/76 Jimmy S. Carter elected President.

– 1977 –

- 4/29/77 White House issues a new National Energy Plan.
- 10/77 The Department of Energy begins operation.

James R. Schlesinger appointed by Secretary.

Gerberding Committee appointed.

– 1978–1979 –

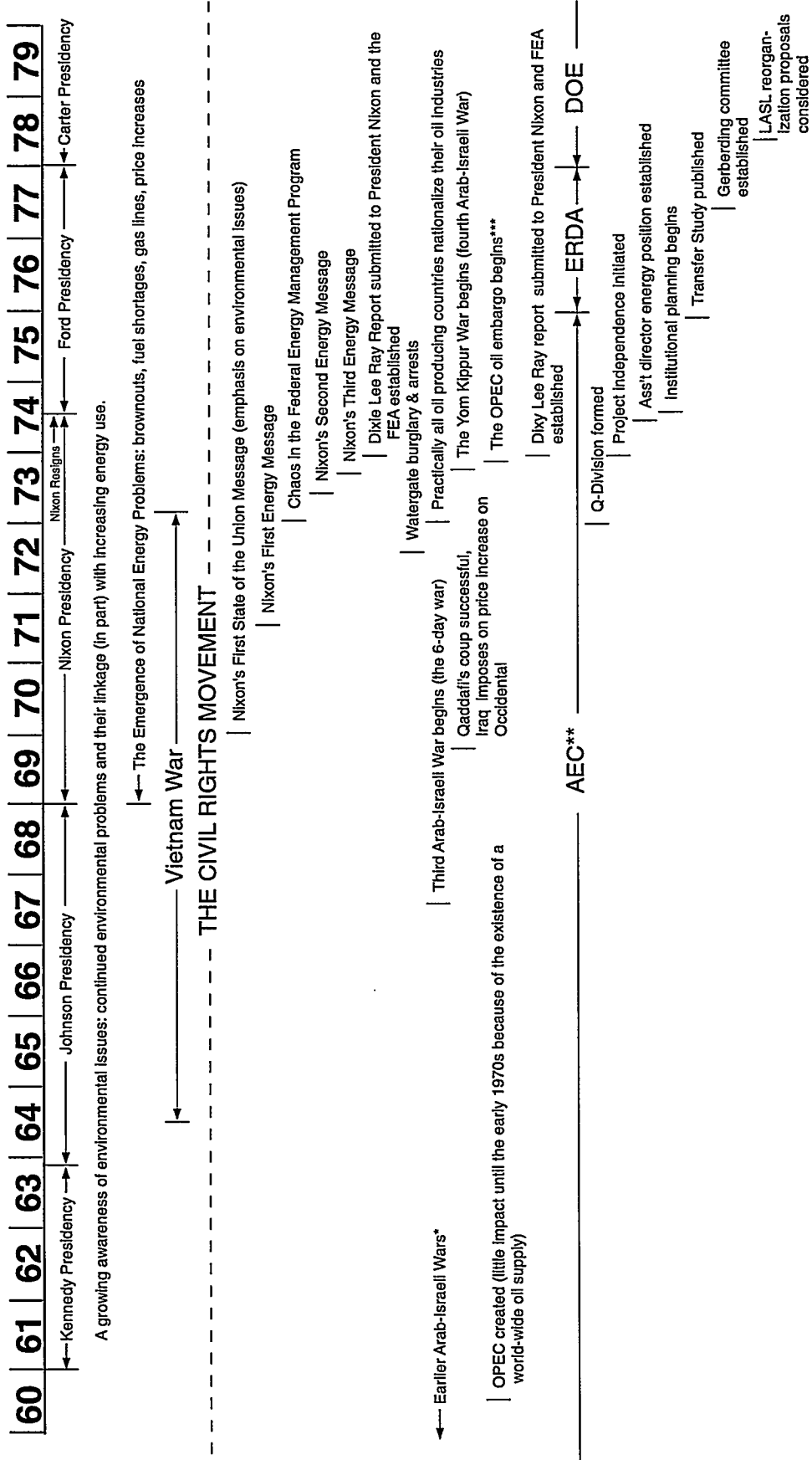
- Ongoing energy R&D continues at LASL.
- 1979 LASL reorganization discussions and studies initiated.

*Ref. Science **183**, 288 (1974); see also *ibid*; 60 (1974)].

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Attachment 5

A Visual Chronology of the Energy Issues of the 1970s and Their Precursors



*First Arab-Israeli War, 1948-1949
 Second Arab-Israeli War, 10/29/56; (Nasser scuttles ships in Suez Canal, 11/3/56)

**Federal Energy R&D Agencies

***This embargo was lifted in May 1974.
 Note that the first OPEC embargo, imposed in 1967, was unsuccessful

Attachment 6

**FCST ENERGY R&D GOALS
I. TECHNICAL AREAS**

Committee(s) and Area of Responsibility	Sponsoring Agencies	Contacts	Comments
1. Clean fuels from coal; low BTU gas, liquids, etc.	Interior	John Chilton	Nat'l. Acad. Engineering
2. Central station fossil-fueled electric power systems; NO _x particulates	Interior	John Chilton	Nat'l. Acad. Engineering
3. Electric transmission and systems	Interior	Francis Parry	Works with UnderSecy. DOI A. D. Little, ref. study.
4. Nuclear breeder strategy	AEC/DRDT	M. J. Whitman Milton Shaw	Labs/laser comm./off-site technology comm.
5. Controlled fusion	AEC/DCTR	Robert Hirsch	Will involve AEC labs. With ORNL, Utilities
6. Utilization and special systems Fuel cells & synthetic fuel systems (H ₂) Total energy systems; urban energy systems/use of waste heat; energy from urban wastes	AEC/DRDT HUD	M. J. Whitman Jack Vanderryn	
7. Solar energy	NASA & NSF	Bill Cherry U. Md. Staff	Panels: Biochemistry, Small Scale Thermo Elect. Power Stations, Photovoltaic, Special (ocean thermal grad., wind)
8. Geothermal energy	Interior	Dallas Peck	Workshop planned
9. Extraction of oil and gas; nuclear and conventional stimulation; oil shale, tar sands in-situ	Interior	Nat'l. Petroleum Council	
10. Transportation	Dept. Transportation		Cambridge lab
11. Environmental advisors and R&D	—	—	—

Prepared from J. F. Weinhold, Tech. Ass't. OST, notes of Dec. 9, 1971, and verbal comments of Weinhold Feb. 10, 1972.

H.T. Motz, Feb. 23, 1972

II. LASL PARTICIPATION IN THE FCST COMMITTEES OR TASK GROUPS (TG's):

- a. Ribe on #5, Controlled Fusion
- b. Hammel on one of the #6, Utilization and Special Systems subgroups, namely Synthetic Fuel Systems. F. J. Edeskuty, consultant

III. ADDITIONAL LASL INVOLVEMENT OR POSSIBLE INVOLVEMENT IN THE FOLLOWING AREAS:

- a. Transmission line
- b. Large scale storage of energy
- c. CTR
- d. Geothermal energy
- e. Synthetic Fuel Systems (H₂)

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Attachment 7

THE MEXICAN CONNECTION

Although oil seepages along Mexico's east coast have existed and have been utilized for millennia, significant crude production did not begin until 1910. Thereafter production increased spectacularly. Mexico became the world's second largest producer in 1918, and a peak annual production of 193 million barrels was reached in 1921. Mexico's subsequent problems with its oil industry and the relationship of those problems to the subject matter of this attachment can best be understood by the following historical note.

After achieving independence from Spain in 1821, Mexico endured almost a century of violent political turmoil. In 1917, after a new succession of revolutions and uprisings, a revised constitution was ratified which, among other things, declared that underground resources, e.g. oil, belonged to the state. Throughout the 1920s, and most of the 1930s, this provision was not enforced and business-as-usual* continued, albeit with steadily decreasing production (and hence decreasing revenues to the government). During the 1930s, however, revolutionary fervor and increasing nationalism once again became rampant; foreign businesses and especially the oil companies were blamed for Mexico's economic woes and despite repeated attempts by the oil companies to help resolve parts of the problem by increasing wages, President Cardenas, on March 18, 1938 signed an expropriation order taking over, in the name of the Mexican government, all foreign oil producing properties and equipment. Shortly thereafter, the world's first *national* oil company, Petróleos Mexicanos, was created. In the years that followed, this action proved to be only moderately successful in improving the lot of the Mexican people, partly because of the lack of technical expertise by the new owners and operators, partly because the other major international oil companies managed to "take over" a substantial share of the market previously served by Mexican oil, partly because of poor management, political interference, and corruption, and partly because of field depletion coupled with ineffective exploration efforts to discover new fields.

Although the Cardenas action served as a precedent which was eventually followed by most of the oil-rich nations in the Middle East, that option was not, with one exception, exercised by them for about 35 years. Instead, they moved in the direction of demanding successive increases in royalty payments and lucrative "participation" agreements of various sorts—in part because the results of the Mexican action were not encouraging, in part because the Middle East producing nations needed the technical and marketing capabilities of the big oil companies, and in part because conditions were not yet ripe.

*The granting of concessions to foreign-owned companies.

Attachment 8

HISTORICAL NOTES ON THE NATIONALIZATION OF OIL PRODUCTION IN IRAN AND THE FORMATION OF OPEC

- 1896 Muzaffar-ad-Din becomes Shah upon the assassination of his predecessor.
- 1901 Shah Muzaffar-ad-Din grants an oil concession to D'Arcy which eventually became the Anglo-Persian Oil Company (APOC).
- 10/06 Shah Muzaffar-ad-Din dies. Mohammed Ali succeeds father.
- 1907 Anglo-Russian agreement allocating commercial spheres of influence: Northern and Central Persia to Russia, Southwestern Persia to Britain.
- 10/08 Oil discovered in Southwestern Persia.
- ~4/09 Rebellion and Shah abdicates. The boy-king, Sultan Ahmad Shah, assumes throne.
- 6/17/11 Mohammed Ali fails in attempt to recover the throne.
- 1912–1921 General political chaos in Persia.
- 2/23/21 Riza Khan Pahlavi, commander of the Cossack brigade, effects a coup d'état and takes over as Head of State.
- 8/25 Riza Khan Pahlavi becomes Shah of Persia, with right of succession to his heirs. Begins modernization of Persia.*
- 1935 Persia formally becomes Iran; APOC becomes the AIOC.
- 1941 Russian/British occupation of Iran, abdication of Shah (he tried to play British and USSR off against the Germans).
Mohammed Riza Pahlavi (son of Riza Khan) ascends throne.
- 1951 Iranian/British dispute over Anglo-Iranian Oil Co. operations.
Mohammed Mossadegh (one of the deputies in the Majlis) proposes nationalization of the Iranian oil industry.
Turmoil, assassinations; Mossadegh achieves nationalization.
Mossadegh becomes Prime Minister. Britain brings case to World Court.
By Oct. 3, 1951, British out of Iran.

*See NYT Book Rev. 6/1/80.

1952

New elections are delayed.

Iran encourages friendly relations with USSR and other Iron curtain countries.

Big oil boycotts Iranian oil. Only sale made to an Italian company whose ship is impounded by the British at Aden.

Loss of oil revenues and political turmoil.

Loss of confidence in Mossadegh. On July 17, 1952, Mossadegh resigns.

New Prime Minister lasts four days; riots in Teheran.

Mossadegh back in power. In no hurry to settle with British. Makes unacceptable settlement proposals.

1953

Increased anarchy and disorder.

In May, Mossadegh announces no settlement could be devised which would be acceptable to the Iranian people.

Increasing conflict between Mossadegh and the Shah.

April to August: Increasing power struggle between supporters of Mossadegh and those of the Shah. More murders and assassinations.

In early August, Shah appoints an army general, Zahedi, Prime Minister, after Mossadegh had taken steps toward establishing a dictatorship.

August 15, Mossadegh's supporters arrested. Upon driving to Mossadegh's home to arrest him, the commander of the Imperial Guard was confronted with overwhelming force and was himself arrested.

The Shah flees the country, Zahedi goes into hiding. Mossadegh returns triumphantly as Prime Minister.

Three days later, August 19th, Mossadegh is overthrown by the army with CIA help.

Zahedi back in office, Shah returns, U.S. provides financial and military aid.

A new consortium is formed to replace the defunct Anglo-Iranian Oil Company. The National Iranian Oil Company (nominally "owning" Iran's oil resources and its facilities) is formed with strong U.S. government support.

The U.S. government wanted the majors involved because it was thought that they are the only ones capable of moving enough oil to provide the Shah with enough income to maintain himself.

Anti-trust problems arise. The Dept. of Justice waives any objections and terminates other pending anti-trust actions against the major oil companies.

1954

Final ownership in consortium: British Petroleum (formerly Anglo-Iranian) 40%, the five American majors 8% each, Royal Dutch Shell 14%, and France 6%.

Three major developments resulting from the resolution of the Iranian oil crisis.

- a. Iran becomes unquestioned proprietor of its own oil fields.
- b. U.S. government "persuades" the majors to allow some American independent oil companies to own a small share of the consortium.
- c. The independents found that marketing Iranian oil could be very profitable and are encouraged to try to make similar deals elsewhere. They succeeded and thus seriously impaired the almost total control that the majors had hitherto exerted in the oil industry.

1955

1955 marked the zenith of American oil power in the world. Exxon, Mobil, Gulf, Texaco, and Socal controlled 2/3 of the business; BP (British Petroleum) and RDS (Royal Dutch Shell), almost 1/3; and the French, only 2%.

1960

By the late 1950's, the independents were doing so well that the majors became worried. In particular, there was increasing competition to sell oil to refineries owned and operated by the independents (Note some "independents" were very large companies—SOHIO, Atlantic Richfield, Getty, etc.). Reacting to this situation, Exxon cuts its crude prices in 1959 and again in 1960 and simply "announced" to the producing countries each time that their revenues would be decreased correspondingly. With the decrease in prices and an abundant supply, consumption continued to grow and one important result was the even more rapid conversion of Western European and Japanese facilities from coal to oil as the preferred fuel. Another result was a further squeeze on the oil companies' profits. By the mid-60's, successive

royalty increases on the part of the producing nations had brought the oil companies to writing off 100% of their U.S. taxes and further increases promised to eat into profits (the oil companies *could* have raised prices, but to have done so would have transferred to the producing nations another traditional prerogative of the oil companies which they valued very highly as a matter of principle—namely setting the world price of oil).

Producing nations were outraged, but there was little they could do except accept the cuts.

In September 1960, Iraq invited five other major oil exporting nations to a conference in Baghdad. OPEC (The Organization of Petroleum Exporting Countries) was formed on September 14, 1960. One of the major aims of OPEC was to transfer the power of pricing oil from the companies to the producing governments. But this event was considered so unimportant by the Western World that the New York Times waited until September 25th to even report it.

New York Times announces of OPEC Formation, September 25, 1960.

MIDEAST OIL LANDS SEEK PRICE STABILITY*

BAGHDAD, Iraq, Sept. 24, 1960—(Reuters)—A five-nation oil conference held here earlier this month voted to demand that oil companies try to restore prices to their former level and keep them steady, it was announced here today.

The meeting, held after the major companies cut Middle Eastern crude oil prices, also voted to form a permanent Organization of Petroleum Exporting Countries to unify their oil policies and promote their individual and collective interests.

Iraq, Iran, Saudi Arabia, Venezuela, and the Persian Gulf sheikdom of Kuwait sent delegates to the conference. The sheikdom of Aqtar [sic] and the Arab League sent observers.

These states hold 90 percent of the world's oil reserves, according to the chief Saudi Arabian delegate.

Nothing then happened for almost 10 years. Indeed the price of crude declined further, reaching a low of \$1.00–\$1.20/bbl in the Persian Gulf in 1969. This decrease was caused in large measure by the independents (Libya had granted them 51 concessions) flooding the European and the Japanese market. In 1970 the situation abruptly changed. The U.S. reached its production limit. So also did Libya, Kuwait, Algeria and several others as well. Only Saudi Arabia and Iran were in a position to produce additional crude. The oil glut vanished. For further information, see "The Outlook: OPEC Sheiks Seem to be Over a Barrel," by Peter Truell, Wall Street Journal, September 30, 1991.

*This article has been reprinted with permission from Reuters. Copyright 1960.

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Attachment 9

WATERGATE REPORTS

1. See the Britannica Book of the Year 1974 (events of 1973) for:
 - a. Chronology of Watergate Events (p. 708).
 - b. The Significance of Watergate by Henry Steele Commager, pp. 709–710.
2. See also Ref. 1973–6a.

Attachment 10

CHRONOLOGY OF THE MANDATORY U.S. OIL IMPORT QUOTA SYSTEM

INTRODUCTORY NOTE

Shortly after the end of WWII, as Middle East and Venezuelan oil production began to expand to meet the growing world-wide demand for cheap oil, U.S. independent oil producers found it increasingly difficult to compete in the international market and were steadily losing even their U.S. market share. To protect their domestic sales, they began pressuring their Congressional delegations to get legislation enacted which would impose high tariffs or quotas on imported oil. The justification advanced for such an action was, not the real one, namely protectionism, but rather the one often appealed to in dubious cases, namely "national security", i.e., how important it was for the nation's security to maintain a vigorous and healthy domestic oil industry. The idea was first formally proposed in 1949 and rejected out-of-hand by President Truman. It was tried again several times during Eisenhower's Administration with, on each occasion, stronger political pressure being applied. Finally, partly as a result of the Suez crisis, a set of voluntary controls was put in place. Pressure for a mandatory system continued to be applied, and in early 1959 Eisenhower capitulated. The Mandatory Oil Import Program remained in place for the next 14 years.*

CHRONOLOGY

- 3/10/59 Eisenhower announces the imposition of a Mandatory Oil Import Quota System
- 1962 The Kennedy Administration further tightens the quota system
- 1968 Johnson relaxes the quota controls slightly
- 4/18/73 Nixon abolishes the quota system**

*See Ref. 20, pp. 535–540; for the "Party line;" see also pp. 11–13 of the Fact Sheet accompanying Pres. Nixon's 2nd Energy Message to the Congress, April 18, 1973, Ref. 1973-32a.

**Overall the quota system yielded mixed results. By 1968 U.S. oil production had risen by 29 percent. But the overall health of the oil industry, as measured by the number of drilling rigs in operation, declined steadily over the same period from about 2100 to 1100. By 1973 it had further declined to about 950.

Attachment 11

**THE WHITE HOUSE
FACT SHEET
ENERGY RESEARCH AND DEVELOPMENT**

OFFICE OF THE WHITE HOUSE PRESS SECRETARY

\$115 Million Increment to Energy R&D Budget for Fiscal Year 1974

On June 29, 1973, the President announced that, as a first step in his proposed \$10 billion energy R&D program, he would commit at least an additional \$100 million in Fiscal Year 1974 to accelerate high priority existing energy R&D programs and to initiate promising new ones. He requested Dr. Dixy Lee Ray, Chairman of the U.S. Atomic Energy Commission to submit recommendations by September 1 for specific projects to be funded in Fiscal Year 1974. These recommendations have now been reviewed and the President has determined that an additional \$115 million should be obligated in Fiscal Year 1974.

In general these increases provide for:

- improving certain existing technologies to accelerate their commercial availability (e.g., stack gas cleaning).
- accelerating the development of technologies that are clearly necessary for supplying our future energy needs and that have already shown reasonable promise of technical and economic success (e.g., coal gasification and liquefaction).
- strengthening the technical base of knowledge for future development efforts through expanding:
 - supporting technology
 - basic and applied research
- broadening the range of potential technical options especially at the earlier stages of development.
- reassessing the availability of energy resources and other requisite national resources (e.g., water and land) necessary for widespread commercial introduction of energy technologies.
- strengthening the understanding of the environmental and economic impacts of greater utilization of energy resources and accelerated implementation of energy technologies.
- exploring new approaches to energy conservation.

Summary of Increases

The increase of \$115 million in energy R&D in addition to the increases already provided for in the President's FY 1974 Budget raises the total Federal commitment in Fiscal Year 1974 to \$1,001.7 million, a 37 percent increase over the \$731 million obligated in Fiscal Year 1974.

Specific increases include:

- an additional \$50 million for coal R&D to conduct programs in liquefaction, low and high Btu. gasification, advanced combustion, and improved coal extraction and reclamation techniques. This represents an 82 percent increase in coal R&D over the FY 1973 funding levels.
- an additional \$7 million for geothermal energy development including resource appraisal and exploration, development of power generation technology and study of environmental impact. This almost triples the Federal level of funding in FY 1973.
- an additional \$12 million for accelerating completion of the development of environmental control technologies to facilitate widespread implementation of sulfur oxide (SO_x) removal technology in the next few years.
- an additional \$5 million to develop advanced energy conversion systems to improve overall efficiency in energy utilization and to reduce energy waste.
- an additional \$6 million for an expanded program in energy conservation, with emphasis on deriving near-term payoff from existing and new technologies especially in the residential/commercial sector. This more than doubles conservation R&D funding from the FY 1973 level.
- an additional \$7 million for R&D on gas-cooled nuclear reactors aimed at the use of thorium as an additional source of nuclear fuel, and at expanded efforts in high temperature gas-cooled reactor safety and fuel research.
- an additional \$6 million for identifying new automotive power system alternatives that can provide more efficient utilization of fuel.
- an additional \$5 million to strengthen the understanding of environmental effects of increased utilization of fossil fuels.
- an additional \$7 million to accelerate current research efforts in nuclear fusion by magnetic containment.
- an additional \$7 million for expanded programs related to electric transmission and distribution, energy storage, conversion of wastes, oil and gas recovery, resource assessment and oil shale development.

Detailed Statement of Increases

The attached table provides a detailed distribution of the \$115 million increment among the various energy R&D program areas. The table also shows the Fiscal Year 1973 funding levels, the funding levels currently estimated for the President's FY 1974 budget, and the total funding levels for Fiscal Year 1974, after addition of the \$115 million increment.

ENERGY R&D RECOMMENDED PROGRAM INCREASES

Energy R&D Program Area	FY 1973 Level	President's FY 1974 Budget	Additional FY 1974 Increment	Total FY 1974 Level
1. Coal	91.0	115.9	+49.5	165.4
a. Liquefaction	11.5	11.4	+19.0	30.4
b. Low Btu gasification	4.4	14.5	+ 8.0	22.5
c. Improved combustion	1.9	4.1	+6.0	10.1
d. High Btu gasification	27.1	26.0	+5.4	31.4
e. Extraction technology (inc. reclamation)	5.9	4.9	+5.0	9.9
f. Supporting technology, system studies and Administration	5.5	5.3	+6.1	11.4
g. Other (incl. mining, health & safety R&D)	34.7	51.2	+0.0	51.2
2. Geothermal	3.8	4.1	+7.0	11.1
a. Resource appraisal & exploration	3.4	3.2	+2.2	5.4
b. Extraction & power generation technology	0.4	0.7	+4.3	5.0
c. Environmental & institutional effects	0.0	0.2	+0.5	0.7
3. Environmental Control	37.1	46.5	+12.0	58.0
a. Near-term SO _x control (incl. TVA demo plant)	25.0	34.1	+5.7	39.8
b. Advanced SO _x control	3.0	1.7	+2.3	4.0
c. No _x , particulates, trace elements from fossil fuels	4.4	3.5	+2.2	5.7
d. Other control technology for fossil fuel treatment/ conversion, etc.	0.1	0.2	+1.8	2.0
e. Thermal pollution control	4.6	7.0	+0.0	7.0

ENERGY R&D RECOMMENDED PROGRAM INCREASES (Cont.)

Energy R&D Program Area	FY 1973 Level	President's FY 1974 Budget	Additional FY 1974 Increment	Total FY 1974 Level
4. Energy Conversion (incl. solar)	8.9	18.0	+5.0	23.0
a. Topping cycles (incl. MHD)	4.6	4.8	+1.2	6.0
b. Bottoming cycles	0.1	0.0	+0.4	0.4
c. Improved material	0.0	1.0	+0.4	1.4
d. Advanced power systems	0.0	0.0	+1.0	1.0
e. Studies	0.0	0.0	+1.0	1.0
f. Solar	4.2	12.2	+1.0	13.2
5. Conservation	6.8	9.2	+6.8	+15.5
a. Residential/Commercial	2.3	3.2	+3.0	+6.2
b. Industrial	0.0	0.1	+0.9	+1.0
c. Transportation (not included automotive power system)	2.5	3.3	+1.0	+4.3
d. General & policy studies	1.5	2.6	+1.4	+4.0
6. Gas-cooled Nuclear Reactors	8.1	9.1	+7.1	16.2
a. HTGR base program (incl. equipment)	4.7	5.3	+3.4	8.7
b. Thorium utilization	2.0	2.0	+2.5	4.5
c. Gas-cooled fast breeder	1.0	1.0	+0.0	1.0
d. Nuclear safety	0.6	0.8	+1.2	2.0
7. Automotive Energy R&D	19.2	16.7	+6.0	22.7
a. Management	2.6	3.0	+0.5	3.5
b. Basic and applied res.	3.0	4.7	+1.5	6.2
c. Exploratory development	0.3	1.3	+1.0	2.3
d. Engine development	13.8	7.7	+3.0	10.7
8. Environmental Effects	37.8	38.5	+5.4	43.9
a. Health effects research (inc. new pollutant ident.)	13.7	14.8	+4.3	19.1
b. Ecological effects & transport research	18.2	18.0	+0.9	18.9
c. Measurement & monitoring technology Development	5.9	5.7	+0.2	5.9
9. Electric Transmission & Distribution & Energy Storage	5.8	3.3	+3.2	6.5
a. Transmission & distribution	3.9	1.8	+2.1	3.9
b. Energy storage	1.8	1.5	+1.1	2.5

ENERGY R&D RECOMMENDED PROGRAM INCREASES (Cont.)

Energy R&D Program Area	FY 1973 Level	President's FY 1974 Budget	Additional FY 1974 Increment	Total FY 1974 Level
10. Nuclear Fusion (magnetic confinement)	39.7	48.5	+7.3	55.8
a. Magnetic confinement systems	25.1	31.1	+3.8	34.9
b. Fusion technology & materials research	6.4	9.0	+1.8	10.8
c. Magnet research	0.9	0.5	+0.6	1.1
d. Other (plasma research & computer simulation)	7.2	7.9	+1.1	9.0
11. Other Program Increases	30.4	16.4	+4.1	20.5
a. Conversion of wastes	10.4	0.0	+1.0	1.0
b. Oil & gas recovery	10.3	7.1	+1.8	8.9
c. Resource assessment (not incl. geothermal)	7.2	7.3	+1.0	8.3
d. Oil shale	2.5	2.0	+0.3	2.3
e. System studies	5.3	5.3	+1.5	6.8
f. International programs	0.0	0.0	+0.6	0.6
12. Energy R&D Programs not Receiving Further Increases in FY 1974				
a. Other nuclear fission R&D (incl. liquid metal fast breeder reactor) & nuclear materials process development	399.4	507.9	0.0	507.9
b. Laser fusion	35.1	42.9	0.0	42.9
c. Other	1.6	4.4	0.0	4.4
Total*	730.6	886.7	115.0	1001.7

*The obligations now shown for FY 1973 and for the 1974 Budget are higher than earlier reported in the 1974 Budget. The increase is attributable primarily to the inclusion of categories of R&D not previously reported under energy (e.g., automotive R&D, conservation, and research on environmental effects) and recalculation of program costs.

Attachment 12

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6. FROM R. F. TASCHEK ADR
UNIVERSITY OF CALIFORNIA
LOS ALAMOS SCIENTIFIC LABORATORY
LOS ALAMOS, NEW MEXICO

7. OFFICIAL BUSINESS

R. F. Taschek
(Signature of certifying official)

(TIME)

A.M.
P.M.

8. DATE

SEPTEMBER 11, 1973

9. TO E. E. FOWLER DIV APPLIED TECH USAEC WASH DC

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THE FOLLOWING COMMENTS APPLY TO THE AEC PROPOSED ENERGY R&D PROGRAM AND GENERALLY INCORPORATE THE REACTIONS OF AGNEW, TASCHEK, HAMMEL DUFFIELD AND OTHER LASL CONCERNED STAFF. WE FIRST MAKE SOME GENERAL REMARKS.

PROPOSED AEC ENERGY R&D PROGRAM: WE ARE APPREHENSIVE THAT THE FUNDING PATTERN OF THE SUBJECT PROGRAM MAY BE EXPLOITED BY OTHER FEDERAL AGENCIES TO SUSTAIN THEIR ALREADY ADVANCED THESIS THAT THE AEC IS NOT CAPABLE OF THINKING ABOUT ANYTHING ELSE THAN NUCLEAR ENERGY. AS A RESULT, THE AEC'S CLAIM THAT IT CAN BE DEPENDED UPON TO PROVIDE AN EVEN HANDED RESPONSE TO THE ENERGY PROBLEM COULD BE DISCREDITED.

SECONDLY, THE PRIMARY REASON FOR DEVELOPING A NATIONAL ENERGY R&D

BE BRIEF-ELIMINATE UNNECESSARY WORDS

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PAGE TWO

PROGRAM (AS ANNOUNCED BY CHAIRMAN RAY AT THE FIRST MEETING OF THE ENERGY TASK FORCE ON JULY 12) WAS TO ACHIEVE INDEPENDENCE FROM FOREIGN OIL AND GAS SUPPLIES BY 1980. THE FUNDING PATTERN OF THE PROPOSED AEC ENERGY R&D PROGRAM IS SUCH THAT APPROXIMATELY 80% OF THE TOTAL RESOURCES ARE ALLOCATED TO PROGRAMS THAT ARE INCAPABLE OF MAKING ANY IMPACT ON FOREIGN OIL AND GAS IMPORTS BY 1980.

THIRDLY, WHEN ONE EXAMINES CAREFULLY THE AEC'S FUNDING PATTERN IN THE NON-NUCLEAR AREA, THERE IS LITTLE INDICATION THAT NEW MAJOR PROGRAMS ARE BEING UNDERTAKEN. THE PROJECTED FUNDING FOR ALMOST ALL NEW PROGRAMS EITHER SATURATES AFTER A YEAR OR SO OR ELSE DECLINES AFTER AN INITIAL MODEST RISE.

WE THEREFORE RELUCTANTLY CONCLUDE THAT THIS EXERCISE IS NOT A VERY CONVINCING DEMONSTRATION THAT THE AEC IS ABLE TO RESPOND TO THE NATIONAL ENERGY PROBLEM IN AN IMAGINATIVE AND VIGOROUS MANNER. WE EXPECTED TO SEE A FUNDING PATTERN IN WHICH IT WAS CLEARLY DEMONSTRATED THAT THE R&D RESOURCES OF THE AEC LABORATORIES WERE BEING MARSHALLED TO ATTACK THE NATIONAL ENERGY PROBLEM. SUCH AN APPROACH IMPLIES A MUCH MORE EXPONENTIAL GROWTH PATTERN IN R&D EXPENDITURES THAN IS APPARENT IN THE PROPOSED PROGRAM.

WE ALSO BELIEVE THAT THE TOTAL FIVE YEAR FUNDING IS PROBABLY INADEQUATE BY ABOUT A FACTOR OF TWO SINCE STRONG SUPPORT OF THE FISSION AND FUSION EFFORTS CANNOT BE SACRIFICED TO SHORT TERM GOALS, THERE IS NO WAY OF REALLY IMPACTING UPON THE ADVERTISED GOAL OF THE ADMINISTRATION WITHOUT ADDITIONAL FUNDING. IN ANY EVENT, THE FUSION PROGRAM'S POSITION RELATIVE TO REQUESTED SHORT TERM SOLUTIONS APPEARS TO BE OVERBLOWN UNLESS THE TOTAL FUNDS PROVIDED ARE MARKEDLY INCREASED.

THE TRULY INNOVATIVE CONCEPTS, MANY WITH SHORT TERM RESPONSE CAPABILITIES, ARE TOO MODEST IN THEIR REQUESTS AND WILL DIE FROM

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STARVATION AS A RESULT OF THE EXPECTED CUT IN FUNDING WHEN AEC PROJECTS ARE EVALUATED TOGETHER WITH SUBMISSIONS FROM OTHER FEDERAL AGENCIES. IT WOULD SEEM ESSENTIAL, IF OUR NEW PROJECTS ARE TO SURVIVE IN A VIABLE FORM, THAT THEY BE VERY HEAVILY WEIGHTED VIS-A-VIS THE FISSION AND FUSION PROGRAMS.

FINALLY, WE DO NOT SEE THAT THERE ARE VISIBLE APPROACHES TO INSTITUTIONAL AND ADMINISTRATIVE PROBLEMS WHICH ARE CERTAIN TO ARISE—FOR INSTANCE, WHAT MECHANISMS AND FUNDING WILL BE PROVIDED TO TAKE CARE OF THE REGULATORY, SAFETY AND LICENSING PROBLEMS THAT WILL ARISE IN SOME OF THE NEW NON-NUCLEAR ENERGY SYSTEMS BEING FOSTERED.

WE NOW MAKE SOME SPECIFIC COMMENTS:

MINING: WE DO NOT SEE UNDER MINING NOR UNDER ENERGY SYSTEMS ANALYSIS NOR UNDER CONSERVATION NOR UNDER ENVIRONMENTAL CONTROL, PROVISION OF FUNDING FOR DEVELOPING TECHNOLOGICAL METHODS TO MINIMIZE IMPACTS OF STRIP MINING, SHALE OIL PROCESSING OR OTHER LARGE SCALE ENVIRONMENTAL DISASTERS. R&D ON COAL COMBUSTION PROCESSES, E.G., EFFECT OF COOLING RATE OF COMBUSTION PRODUCTS ON SIZE DISTRIBUTION OF FLY ASH REQUIRES MORE FUNDING.

IN SITU PROCESSES: THIS ACTIVITY HAS INADEQUATE EMPHASIS AS A NEW R&D AREA CONSIDERING ITS GREAT IMPORTANCE. THERE IS NEEDED MORE COMMENT ON HOW TO GET OUT THE OIL AND GAS LEFT IN EXISTING FIELDS. DO NOT OVEREMPHASIZE NUCLEAR EXPLOSION METHODS.

ENERGY SYSTEMS ANALYSIS: THIS IS MOST VALUABLE AND NECESSARY BUT THE FUNCTIONS ARE NOT WELL DEFINED. IS IT REASONABLE TO SUGGEST THAT, IN FY-79, 0.4% OF THE TOTAL R&D FUNDING IS ALL THAT IS NEEDED FOR SYSTEMS ANALYSIS OF ON-GOING AND PROPOSED PROGRAMS?

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ENVIRONMENTAL CONTROL R&D: IT MAY BE A MISTAKE TO RELY ON SPECIFIC TECHNOLOGIES TO GENERATE THEIR OWN ENVIRONMENTAL CONTROLS AND WE DON'T SEE ANY SPECIFIC MONIES SET ASIDE FOR THIS PURPOSE. WHO IS GOING TO DO THE HARD TECHNOLOGY—E.G., IN COMBUSTION PROCESS PROBLEMS?

BIOMEDICAL AND ENVIRONMENTAL RESEARCH: DESPITE A SUBSTANTIAL LEVEL OF FUNDING THE PROPOSED PROGRAM DOES NOT APPEAR TO BE RESPONSIVE TO THE BIOLOGICAL AND ENVIRONMENTAL RESEARCH ASPECTS OF NEWLY DEVELOPING TECHNOLOGIES SUCH AS GEOTHERMAL (STEAM, BRINES, DRY ROCK), GEORESOURCES (OIL, GAS STIMULATION, IN-SITU COAL), SOLAR ENERGY, TRANSMISSION AND STORAGE, ADVANCED POWER CYCLES, ADVANCED TRANSPORTATION, ETC. WHAT IS BEING PROPOSED IS FOR THE MOST PART AN OLD PROGRAM GEARED TO PAST B&E PROBLEMS ASSOCIATED WITH FISSION AND SOME FUSION.

ENERGY CONSERVATION, ETAL: THIS PROGRAM IS BADLY UNDERFUNDED RELATIVE TO ITS IMPORTANCE. DOES IT CONSIDER ACTIVITIES SUCH AS ELECTRIC UTILITY ADVERTISEMENTS NOT TO USE GAS BUT TO INCREASE THE APPLICATIONS OF ELECTRICITY? THE "BEHAVIORAL" STUDIES SHOULD INCLUDE EVALUATION OF THE "QUALITY OF LIFE" ASPECTS OF ENERGY CONSUMPTION ESPECIALLY AS RELATED TO TOTAL U.S. POPULATION. CAN FISSION PRODUCT HEAT AND ENERGY BE CONSERVED?

ENERGY TRANSMISSION, DISTRIBUTION, ETC.: VERY IMPORTANT AND INCREASED FUNDING IS WARRANTED. WE BELIEVE THAT THE PROGRAM IS SUFFICIENTLY NOVEL THAT EVEN IF FEASIBILITY CAN BE DEMONSTRATED WITHIN FIVE YEARS, ADDITIONAL ANCILLARY EQUIPMENT DEVELOPMENT WILL BE REQUIRED WHICH WILL KEEP THE FUNDING LEVEL HIGH. IN ADDITION, NO MONEY IS INDICATED FOR IN-HOUSE SYSTEM STUDIES WHICH PROBABLY CANNOT BE LEFT TO SYSTEMS ANALYSIS PEOPLE.

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ENERGY STORAGE: THERE IS TOO MUCH EMPHASIS ON BATTERIES RELATIVE TO MAGNETIC ENERGY STORAGE THOUGH ABSOLUTE DOLLARS ARE APPROPRIATE. DOUBLE THE SUPERCONDUCTING ENERGY STORAGE SUPPORT AND INCLUDE CONVERTER AND ANCILLARY GEAR DEVELOPMENT. THIS MIGHT ALLOW IMMEDIATE DEVELOPMENT FOR PEAKING APPLICATIONS BUT EVEN THEN A DEMONSTRATION DEVICE WOULD NEED MUCH MORE FUNDING.

GEOHERMAL ENERGY: THE IMPLICATIONS OF DRY GEOHERMAL ENERGY UTILIZATION RELATIVE TO THE NATURALLY OCCURRING SYSTEMS ARE SUCH THAT THE EMPHASIS IN THE SUMMARY IS INCORRECT. THE DRY GEOHERMAL ENERGY FUNDING SHOULD BE BROUGHT UP MUCH MORE RAPIDLY ESPECIALLY IN ORDER TO DO SEVERAL TESTS IN PARALLEL IN DIFFERENT GEOLOGIC FORMATIONS. THIS CAN BE A SHORT RANGE CONTRIBUTOR TO THE NATIONAL ENERGY SUPPLY.

SOLAR ENERGY: THE SMALL SIZE OF THE BUDGET REQUESTED INDICATES THAT THE AEC IS EITHER NOT VERY SERIOUS OR UNWILLING TO BECOME INVOLVED IN THIS SEEMINGLY IMPORTANT AREA. FOSSIL FUEL SAVINGS WOULD ACCRUE QUICKLY FROM WIDESPREAD APPLICATIONS ESPECIALLY TO BUILDING HEATING AND COOLING. SOLAR H₂ AND SOLAR ELECTRICITY PRODUCTION SHOULD NOT BE NEGLECTED.

ADVANCED AUTOMOTIVE SYSTEMS: WE SEE NO PLAN FOR BATTERY OR FUEL CELL POWER OF AUTOMOBILES NOR ADVANCED TURBINE SYSTEMS FOR VERY HIGH TEMPERATURE OPERATION.

ADVANCED ENERGY CONVERSION: THE BUDGET IS FAR TOO MODEST ESPECIALLY IF PROTOTYPES ARE TO BE TESTED—FOR INSTANCE, FOR MHD POWER CONVERSION. WE SEE NO MENTION OF HIGH TEMPERATURE TECHNOLOGY AS DEVELOPED FOR THE ROVER/NERVA REACTORS APPLIED TO EITHER NEW REACTOR SYSTEMS OR TURBINES. THERE SHOULD BE EXTENSIVE DEVELOPMENT OF SUPERCONDUCTING GENERATORS, SWITCH GEAR AND DC/AC CONVERTERS

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SHOULD BE PROPOSED AND FUNDED.

SUPPORTING PHYSICAL RESEARCH: HERE THE BUDGET APPEARS REALISTIC. IT SHOULD CALL OUT SPECIFICALLY RESPONSIBILITY FOR THE TOTAL DATA BASE INCLUDING ITS COMPILATION AND EVALUATION PLUS MEASUREMENT WHERE NECESSARY FOR USERS OR TO DEVELOP STANDARDS. MATHEMATICS AND COMPUTER SUPPORT SHOULD BE INCREASED AND PARTICULAR EFFORT SHOULD BE APPLIED TO RADIATION DAMAGE STUDIES.

NUCLEAR FISSION: THIS DOES NOT APPEAR TO BE AN IMAGINATIVE INNOVATIVE PROGRAM AS MIGHT BE RESPONSIVE TO THE CALL FOR ADVANCED ENERGY R&D. THERE ARE NO NEW CONCEPTS, NO POWER PARK AND UTILIZATION STUDIES. THE WASTE MANAGEMENT PROGRAM DOES NOT SEEM TO DIFFERENTIATE BETWEEN FISSION PRODUCT WASTES AND TRANSURANIC WASTE PROBLEMS.

WE BELIEVE HYBRID FUSION OR ACCELERATOR-DRIVEN REACTOR SYSTEMS SHOULD BE STUDIED FOR LONG RANGE FERTILE MATERIAL UTILIZATION. THIS PROGRAM SHOULD BE WELL FUNDED.

WE BELIEVE LASER ISOTOPE SEPARATION SHOULD BE PROVIDED WITH FULL FUNDING —THIS IS VERY IMPORTANT. WE ALSO SUGGEST ADDING THE FOLLOWING SENTENCE TO THE PARAGRAPH ENDING WITH "... SIMILARLY REDUCED." ON THE FIRST PAGE OF THE SECTION ON NUCLEAR MATERIALS PROCESS DEVELOPMENT.

"THE PROCESS WOULD RESULT IN SIGNIFICANTLY GREATER UTILIZATION OF URANIUM RESOURCES IN THAT ESSENTIALLY ALL ^{235}U WOULD BE RECOVERED IN THE ENRICHMENT PROCESS, WHEREAS THE GASEOUS DIFFUSION PROCESS EXTRACTS ONLY APPROXIMATELY 60% OF THE AVAILABLE ^{235}U ."

FUSION POWER: ALTHOUGH THIS IS AN EXTREMELY IMPORTANT PROGRAM ITS TIME SCALE IS SUCH THAT IT SHOULD NOT COMPETE DESTRUCTIVELY

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WITH ANY OR ALL OF THE OTHERS. IN PARTICULAR, ONE MAY BE CONCERNED THAT IT BE OVERSOLD RELATIVE TO THE OTHER PROGRAMS: THE CORRECT SOLUTION TO THIS PROBLEM IS TO PROVIDE MUCH LARGER FUNDING FOR THE TOTAL ENERGY PROGRAM.

CY: H. Agnew
R. Duffield
R. Spence
E. Hammel
G. Voelz
R. Taschek
ISD-5

Attachment 13

THE BUDGET OF THE UNITED STATES GOVERNMENT
FISCAL YEAR 1975

See: SCIENCE, 183, 635 (1974).

[See also Ref. 1974-40a].

Attachment 14

TABLE OF CONTENTS*

FOR DOCUMENT COLLECTIONS TITLED 1968-, 1971-, 1972-, 1973-, 1974-, 1976-, 1978-, 1979-, AND 1991-

1968

0. LASL, October/1968.

1971

- 0'. The Congressional Record, 117, No. 84, June 4, 1971: Clean Energy Needs, Presidential Message to the Congress.
1. AET-7, Assessment of Energy Technologies, November 1971.

1972

2. Notes for an informal LASL Energy Working Group meeting in which the President's June 4, 1971 Message to the Congress as well as the contract with Associated Universities, Inc. (signed on June 25, 1971) to prepare "a detailed assessment of the technical options for R&D in the area of commercial civilian energy technology" were discussed. These notes were prepared on March 9, 1972 for distribution to the Los Alamos Energy Working Group and were subsequently included as Appendix I in a September 24, 1973 memo from E. F. Hammel to H. M. Agnew. See also 1973-30a.
3. AET-8, Reference Energy Systems and Resource Data for use in the Assessment of Energy Technologies, April 1972.
4. a. Memorandum: E. F. Hammel to H. M. Agnew and R. F. Taschek, "LASL Activities in the Synthetic Fuels Area," Sept. 7, 1972 and an "Addendum," dated Sept. 8, 1972.
b. One example of the reports produced by the eleven FCST Energy R&D Goals Panels, namely that of Panel #6, Utilization and Special Systems, titled "Hydrogen and other Synthetic Fuels," TID-26136 (a Summary of the Work of the Synthetic Fuels Panel, dated September 1972).
5. Memorandum (dated October 3, 1972): E. F. Hammel to R. F. Taschek, "Notes on the LASL Energy Program: I. The Preparation of New Proposals, II. Synthetic Fuels, III. Proposal for a Study of Chemical Energy Storage for Peakshaving: Hydrogen-Oxygen Systems, IV. Activity Areas (for a LASL Energy Division), V. Publicity."

1973

6. a. Notes on Watergate chronology, etc.
b. LASL Press Release (Jan. 31, 1973), LASL Forms New Energy Division. Q-Division Formed, The Atom, Vol. 10, No. 2, March 1973.

*These documents are located at the Los Alamos National Laboratory Archives.

7. OMB Documents for \$100 M Supplement to FY-74 Energy R&D Budget (~6/73).
8. Letter: G. W. Johnson to H. Agnew; request for EFH to serve on Task Force to "review all Federal and private energy research and development activities and to recommend an integrated energy research and development program for the nation" (July 3, 1973).
9. Notes and minutes of 7/12 to 7/13/73 meeting of Energy R&D Task Force.
10. Letter: E. F. Hammel to G. W. Johnson: regarding industrial involvement in proposed Energy R&D program (7/16/73), enclosing a 6/20/73 memo, E. F. Hammel to R. F. Taschek titled Technology Transfer.
11. Memo on AEC Energy Budgets: M. C. Smith to Distribution (7/23/73).
12. First Meeting of the Energy R&D Task Force, Subcommittee on Energy Technology, July 23, 1973:
 - a. List of members.
 - b. Handwritten notes.
13. Second Meeting of Energy R&D Task Force, Subcommittee on Energy Technology, July 27, 1973:
 - a. List of members.
 - b. Draft outline by J. C. Bresee: Report to the President on Energy Research and Development, July 27, 1973.
14. Formal Minutes of First Meeting of the Energy R&D Task Force, Subcommittee on Energy Technology on July 23, 1973. Minutes issued 7/30/73.
15. Memo: R. L. Aamodt to R. B. Duffield, 7/31/73. Title: In Situ Process Technology Budget Meeting of 7/26 -7/27/73.
16. Memorandum dated July 31, 1973, Dixy Lee Ray to Distribution (all government agencies involved in Energy R&D).
17.
 - a. Hand-written notes (dated July 30, 1973) of Second Meeting of Energy Technology Subcommittee of AEC Energy Task Force (held on 7/30/73).
 - b. Trip Report: Second Meeting of the Energy Technology Subcommittee of the AEC Energy Task Force (dated August 2, 1973).
18. Official Minutes of Second Meeting of the Energy Technology Subcommittee, held on July 30, 1973 (2 copies) dated Aug. 3, 1973.
19. Letter dated Aug. 6, 1973, G. W. Johnson, DAT to George Vinyard, Director, BNL, explaining Memorandum DLR to Dist. 7/31/73 (item 16).

20. Follow-up letter, Johnson to Vinyard, dated Aug. 7, 1973 regarding list of consultants who should be consulted before submitting proposals to DAT.
21. Letter: Dixy Lee Ray to Distribution (distribution list attached) dated Aug. 7, 1973 inviting R&D proposals capable, in principle, of developing a national capability for energy self-sufficiency in the near term and for the future, copies of standard proposal submission forms enclosed.
22. Notes on Third Meeting of Energy Technology Subcommittee, Aug. 15, 1973.
23. Official Minutes of the Third Meeting of the Energy Technology Subcommittee held on 8/15/73. (Minutes dated 8/27/73).
24. Memo: L. Aamodt to R. B. Duffield, dated Aug. 20, 1973. Second Meeting of In Situ Subcommittee, DAT, Aug. 14 and 15, 1973.
25. Memo dated Aug. 28, 1973, to all Energy R&D Task Force Members, regarding Priority Rating of Research and Development Programs, from E. E. Fowler, DAT and announcing meeting on Aug. 30, 1973. Also included:
 - a. EFH hand-written notes on a preliminary meeting Aug. 27, 1973.
 - b. List of the Technical Panels established for a (final) review of the "December 1, 1973 Energy R&D Report to the President," dated Aug. 20, 1973.
 - c. List of Attendees at an 8/30/73 meeting of the "Energy R&D Task Force Review Group."
 - d. Handwritten notes of EFH on that 8/30/73 meeting.
 - e. "Chapter Outline" for final Report.
26. Press Release dated Aug. 31, 1973 from the Office of the White House Press Secretary prepared by John A. Love, Director, Energy Policy Office announcing a "Public Hearing for the Establishment of a Mandatory Allocation Program for Propane Fuel."
27. Senior Management Committee's responses to the AEC's Task Force Review Panel's Priorities. Page 1 is a 1991 summary of the contents of this section. The following is a list of its actual contents:
 - a. Copy of handwritten comments from H. Agnew to EFH regarding the proposed priorities.
 - b. Comments of J. D. Balcomb to the "priorities" dated 9/10/73.
 - c. Memo from D. Freiwald to R. B. Duffield and EFH regarding "priorities" dated 9/10/73.
 - d. EFH notes on Priorities dated 9/11/73.
 - e. Official LASL TWX on the AEC Proposed Energy R&D Program dated 9/11/73.

- f. Copy of official Sandia Labs response, 9/11/73.
 - g. Copy of official LBL response 9/18/73.
 - h. Letter from John M. Teem to Distribution (an ad hoc Senior Management Committee) dated Sept. 17, 1973 requesting that group to "prepare appropriate recommendations (to the AEC General Manager) based upon a review of the (proposed) energy research and development program compiled by the Energy R&D Task Force chaired by G. W. Johnson."
28. Letter, dated Sept. 19, 1973 from Pastore to Hammel requesting his services as a consultant to the subpanels of Federal Employees charged with reviewing the energy R&D proposals.
 29. Memo, Hammel to Agnew, Sept. 24, 1973, A Chronological History of the Federal Response to the Energy Problem.
 30. Appendix I to 9/24/73 memo, Hammel to Agnew, titled: "Notes for Informal Energy Working Group Meeting (3/9/72)."
 31. Appendix II to 9/24/73 Memo, Hammel to Agnew consisting of 4/11/1973 Staff Memorandum, National Science Foundation, Office of the Director; Subject: Establishment of Energy NSF R&D Task Force.
 32. a. Appendix III to 9/24/73 Memo, Hammel to Agnew: President Nixon's Second Energy Message to the Congress, presented April 18, 1973 and supporting documents.
b. Remarks on President Nixon's Second Energy Message to the Congress by Senator Jennings Randolph, West Virginia.
 33. Appendix IV to 9/24/73 Memo, Hammel to Agnew: President Nixon's Third Energy Message to the Congress, presented June 29, 1973 and supporting documents.
 34. Appendix V to 9/24/73 Memo, Hammel to Agnew: Dixy Lee Ray's Funding Study: the Specifics (Recommended Budget for Energy R&D in FY74).
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