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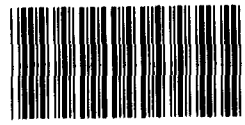
United States General Accounting Office

Report to the Chairman, Subcommittee on Investigations and Oversight, Committee on Science, Space, and Technology, House of Representatives

April 1992

ENERGY R&D

DOE's Prioritization and Budgeting Process for Renewable Energy Research



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United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-247986

April 29, 1992

The Honorable Howard Wolpe
Chairman, Subcommittee on Investigations
and Oversight
Committee on Science, Space,
and Technology
House of Representatives

Dear Mr. Chairman:

In response to your May 10, 1991, letter and subsequent discussions with your office, this report describes the Department of Energy's (DOE) processes for planning and budgeting research and development (R&D) projects for renewable energy technologies. Such technologies include electricity generation from solar, wind, and geothermal energy sources. Specifically, you asked us to review how DOE

- determines the annual budget for energy technologies, including renewable, fossil, and nuclear energy, and the role the Office of Management and Budget (OMB) plays in this process;
- allocates R&D funds among renewable energy technologies; and
- ensures that specific congressional directives for R&D programs for renewable energy technology are followed.

Results in Brief

To determine the annual budget for energy technology R&D, DOE primarily uses the preceding year's budget as a guide and adjusts program amounts to reflect specific initiatives or emphases. Starting with the fiscal year 1993 budget, DOE initiated a multiyear planning process and ranked research programs against the goals of the National Energy Strategy (NES).[1] OMB guides the DOE budget process by setting overall spending target levels, providing general policy and budgetary direction, and reviewing the budget request for inclusion in the annual federal budget.

Within the budget for renewable energy programs, DOE's proposed funding allocations are made by the Assistant Secretary for Conservation and Renewable Energy. These allocations are based on the results of an internal planning and budgeting process that recommends funding priorities as well as specific projects. Short- and long-range plans and the

[1]Completed in Feb. 1991, the NES expresses DOE's overall strategy for meeting the nation's future energy needs.

views of laboratory managers guide the overall direction of research programs. In developing the plans and budget, DOE officials also consider the recommendations of industry groups, utilities, and other end-users of renewable energy technologies.

DOE ensures that congressional directives[2] on renewable energy are followed by incorporating them into program plans and authorization documents for fieldwork by its laboratories. Our analysis of five congressional directives shows that the Office of Conservation and Renewable Energy takes steps to ensure that it complies with the directives.[3]

Background

DOE conducts R&D programs for a variety of electricity supply technologies, including those based on renewable, nuclear, and fossil energy sources. These civilian R&D programs are carried out within the Offices of Conservation and Renewable Energy, Nuclear Energy, and Fossil Energy, respectively. The proposed DOE civilian R&D budget request for fiscal year 1993 includes about $247 million for renewable energy, $310 million for nuclear energy, and $811 million for clean coal technology and other fossil fuel research.

Each Office is headed by an assistant secretary, and each has a planning office to help develop annual budgets. Under the assistant secretaries are deputy assistant secretaries and program offices, each responsible for a program area, such as utility or transportation-related technologies (see app. I). Program managers oversee groups of R&D projects carried out by national laboratories, universities, and private industry.

The Congress may affect DOE's research agenda by including spending directives in reports accompanying appropriation legislation. A directive may be general, steering funds to support a certain type of research, or more specific, targeting funds to a particular university or research center.

[2]We define directive to mean guidance in reports accompanying legislation, as well as statutory requirements.

[3]We judgmentally selected directives representing different research programs in the Office of Conservation and Renewable Energy.

Determining R&D Funding for Energy Sources

Using the preceding year's budget request to the Congress as a guide, DOE's Office of the Chief Financial Officer annually allocates OMB-established categorical spending targets for the fiscal year being planned, establishing budget targets for program offices (e.g., Fossil Energy and Conservation and Renewable Energy). Guided by the spending targets, program offices and research laboratories then develop proposals that may include new initiatives or increased funding for a particular research program or programs. In this "bottom-up" process, each program office develops proposals for three funding levels: (1) the budget target level, (2) the "decrement" level, which may vary from 10 percent to 20 percent below the target level, and (3) the "program planning level," which includes funding for essential program activities that cannot be funded within the target level.

The Secretary meets individually with each of the assistant secretaries to review each Office's budget priorities and funding level recommendations. The DOE Controller and a representative from the Office of Policy, Planning and Analysis advise the Secretary at these meetings. Following the meetings, the Secretary convenes a group including the DOE Controller, the Deputy Secretary, and the Under Secretary and the Deputy Under Secretary for Policy, Planning and Analysis to advise him on the budget as a whole. The Secretary ultimately decides the funding levels for the program offices to be included in the Department's budget request to OMB.

In the past, DOE identified weaknesses in its departmentwide planning and budgeting process. For example, in documents accompanying DOE's fiscal year 1991 budget, the Secretary stated that DOE had no departmentwide, long-term program planning and "no good way" to establish budget priorities.

Fiscal Year 1993 Budget Process Was Tied to NES Objectives

In developing its fiscal year 1993 budget request, DOE linked energy R&D program funding priorities to NES goals. According to officials from the Office of Policy, Planning and Analysis, this represented a significant departure from prior years because it involved departmentwide planning and prioritization of programs. The NES reflects four broad goals: (1) improving energy supply and demand efficiency in a way that promotes economic efficiency; (2) reducing the adverse economic effects of oil supply disruptions; (3) strengthening the basic science research effort, including scientific education and technology transfer; and (4) enhancing environmental quality.

Strategic Planning Initiative

To enhance priority-setting departmentwide, DOE included a strategic planning initiative as part of the fiscal year 1993 budget process. According to a DOE Secretarial Notice, the purpose of the initiative is to establish a coordinated planning, programming, and budgeting capability that brings plans and programs into line with near-, mid-, and long-term NES goals. In addition, the initiative increases the involvement of senior Department officials in a top-down planning process that integrates with the bottom-up process.

The planning initiative calls for a broad strategic plan and a multiyear program plan for each Office to guide decisionmaking for both the fiscal year being planned and future years. The strategic plan includes a mission statement and key objectives and strategies. Multiyear plans present program overviews, objectives, strategies, and anticipated benefits.

For example, Conservation and Renewable Energy's Office of Utility Technologies is responsible for electric energy research. Its mission is to work with the utility sector and other interested parties to identify options available to electric utilities as they plan and acquire resources for the future and to help develop and implement options that show promise of societal benefits. The multiyear program plan provides details on basic programs, such as photovoltaics,[4] wind, and geothermal energy research. A research objective for the geothermal program is to double the amount of economically recoverable geothermal reserves; a major goal over the next 5 years is testing new geothermal exploration technology with industry.

R&D Ranking Process

In response to a Secretarial Notice, for the fiscal year 1993 budget process, DOE's Office of Policy, Planning and Analysis ranked civilian energy R&D programs—accounting for approximately one-third of DOE's $19.4 billion budget—according to their projected contributions to NES goals. The process focused on the first three main NES goals; the fourth, enhancing environmental quality, was treated as a sub-objective under each of the others.

The Office of Policy, Planning and Analysis divided the R&D activities into 39 "program units"—groups of R&D activities with a common theme or focus, such as increasing industrial demand efficiency. The Office then established three "portfolios" of program units, one for each of the broad NES goals. A six-member review panel of DOE experts was established to

[4]Technology that produces electricity from sunlight without the need for moving parts such as generators or turbines.

rank the program units. According to an Office of Policy, Planning and Analysis official, the panel consisted of DOE personnel who had comprehensive knowledge of many different technologies and programs.

The panel collectively scored each of the program units according to a set of criteria based on NES goals (see app. II for the criteria), then used the resulting scores to rank them. Using the budget target funding level as a baseline, the panel recommended increased funding for the higher-ranking program units and decreased funding for the lower-ranking ones. To keep total spending within the OMB-established target level for civilian energy R&D, the panel recommended reducing some program spending levels to compensate for increases in the higher-ranked programs.

The Office of Policy, Planning and Analysis used the results of this process to advise the Secretary on funding allocations for the fiscal year 1993 budget. Specifically, the Office recommended that DOE emphasize programs to reduce oil vulnerability. To support this emphasis and remain within the OMB target, the Office proposed to shift $200 million (or about 4 percent of the total civilian R&D budget) from programs for increasing electricity efficiency to programs for reducing oil vulnerability. However, in its final submission to OMB, DOE exceeded the target level for civilian R&D, requesting an increase for programs to improve electricity efficiency and a smaller increase for programs to reduce oil vulnerability. Table 1 summarizes the target levels, Office of Policy, Planning and Analysis recommendations, and departmental budget request levels for each portfolio. Appendix II has further details.

Table 1: DOE Fiscal Year 1993 Budget Amounts for Civilian R&D

Dollars in millions

NES objective portfolio consisting of program units directed at	Target level	Office of Policy, Planning and Analysis recommendation	Department request submitted to OMB
Reducing oil vulnerability	$1,027	$1,227	$1,112
Improving electric efficiency	1,772	1,572	1,873
Supporting basic science research	2,451	2,450	2,325
Total	**$5,250**	**$5,249**	**$5,310**

Source: Office of Policy, Planning and Analysis, DOE.

We believe that it is difficult to determine the effect of the portfolio-ranking process on the budget that DOE submitted to OMB. The Office of Policy, Planning and Analysis recommended a budget shift while staying within the overall OMB target of $5.2 billion, but DOE's budget request to OMB was $60 million above the OMB target. In addition, according to Office of Policy, Planning and Analysis officials, the ranking process was not meant to recommend specific funding levels for individual programs but rather funding emphasis based on the objectives of the NES. Also, recommendations based on the ranking process were only one of several inputs to the Secretary.

After this first use of the portfolio-ranking procedure, DOE officials discussed potential improvements for future budget years, including

- making objective comparisons between technologies easier;
- tying the criteria upon which programs are ranked more closely to the NES;
- using more specific program categories, such as wind energy research, rather than the more general "program unit" category that includes all renewable electric technologies; and
- better recognizing the trade-offs between long- and short-term R&D activities.

OMB Provides Budget Targets and Policy Recommendations

OMB initiates the DOE budget process and provides general policy and budgetary direction. OMB also reviews the budget before it goes to the Congress for accordance with administration policy and other factors. Policy direction may consist of formal written directives or informal guidance.

About 18 months before the fiscal year being planned, OMB sends DOE an allowance letter setting budget planning estimates for DOE for the next 5 fiscal years and discussing certain administration policies. The OMB budget targets are based primarily on the preceding year's budget request. The estimates are given for broad spending categories, such as "general science" and "atomic energy defense activities," as well as for more detailed categories such as "energy supply research and development and energy conservation."

According to OMB Energy and Science Division officials, informal guidance for DOE's fiscal year 1993 energy R&D program was directed primarily at reducing expenditures and improving the quality of the programs. For example, OMB told DOE to (1) increase private sector participation in

federal research and (2) emphasize projects closer to commercialization. However, OMB discouraged DOE from funding near-term research that would be profitably commercialized within 1 year. According to Energy and Science Division officials, such research should be handled by the private sector.

These officials said they placed high priority on programs in which DOE shares the cost of research projects with partners from private industry. In particular, they stressed the consortium approach, in which federal research laboratories work with groups of private companies, pooling technology and financial resources while working toward common research goals. In the Office of Conservation and Renewable Energy, for example, the consortium approach is being used for programs to develop photovoltaics and batteries for electric vehicles.

The officials said that DOE more carefully considered the allocation of its R&D funds for the fiscal year 1993 budget request than in past years. They attributed this to the NES and the Secretary's increased emphasis on strategic planning.

Determining Funding Allocations Among Renewable Energy Technologies

The Assistant Secretary for Conservation and Renewable Energy's recommendations are based on program planning proposals from program offices and national laboratories, combined with input from top officials on where funding emphasis should be placed. During this internal planning and budgeting process, Office of Conservation and Renewable Energy officials consider both qualitative and quantitative information.

Using the top-down guidance called for by the Strategic Planning Initiative and the traditional bottom-up budget development process, each Conservation and Renewable Energy Office (Utility Technologies, Building Technologies, Industrial Technologies, Transportation Technologies, and Technical and Financial Assistance) develops proposed budgets for the Assistant Secretary's review. With advice from the Assistant Secretary's Office of Planning and Assessment, the Principal Deputy Assistant Secretary, and the Office of Management and Resources, the Assistant Secretary reviews the budgets of each of the program offices and approves program funding levels.

National Laboratories Recommend Priorities

To obtain the advice of laboratory researchers on budget priorities and enhance the researchers' understanding of the priority-setting process, the

Office of Conservation and Renewable Energy's Planning Office conducted a comprehensive review process beginning with the fiscal year 1993 budget. This process called for representatives from all of the DOE laboratories involved in conservation and renewable energy research to collectively rank the research programs against each other, according to their anticipated contribution to NES objectives. (This process differed from the departmentwide ranking process discussed above because, among other things, only conservation and renewable energy R&D programs were included and program units were not defined in the same way.) In addition, the process identified programs that should be cut if the budget was reduced from the OMB target. The Assistant Secretary considered the results of this process in fiscal year 1993 budget discussions with the Deputy Assistant Secretaries, according to a Planning Office official.

Conservation and Renewable Energy management officials identified two areas in which improvements could be made if the process is used in the future. First, the officials noted that laboratory officials might have vested interests in the particular programs they are involved with, creating a potential for bias. Second, the panels rated the programs on the basis of goals that needed further definition. Therefore, the Planning Office plans to develop clear definitions for NES goals for renewable energy and to quantify the criteria used to judge program contributions.

Private and Public Sector Users Make Recommendations

The Office of Conservation and Renewable Energy incorporates the recommendations and views of both industry and end-users in program planning and development. These groups participate in periodic reviews of research projects at the laboratories, and DOE officials attend meetings held by various industry trade groups. The Office responsible for the geothermal research program, for example, conducts an annual review of its program that draws industry, utility, and government participation. As part of the review, the National Geothermal Association (a trade association representing geothermal producers and developers) leads an industry critique of the program.

The Office of Conservation and Renewable Energy also solicits recommendations from industry participants about its technology-specific multiyear program plans. For example, the plan for 1991 through 1995 for photovoltaics incorporated industry comments and recommendations. The completed plans are distributed to industry, utilities, and other end-users.

Meeting Congressional Directives

Although the Office of Conservation and Renewable Energy has no written procedures for ensuring compliance with congressional spending directives, program officials make provisions for the directives. Officials told us they review congressional appropriations documents to identify such directives and incorporate them into annual operating and spending plans. These officials also stated that, when needed, they consult with congressional staff and/or with designated research fund recipients to implement the directives. Essentially, annual operating plans are agreements between DOE and the DOE laboratories that outline projects for the year and their funding levels. Spending plans, developed by each deputy assistant secretary, list expected allocations by budget category and include congressional directives as well. These spending plans are reviewed and approved by the Assistant Secretary, the Director of the Office of Management and Resources, and the Director of the Office of Planning and Assessment.

In fiscal year 1991, congressional appropriations documents contained spending directives totaling approximately $156 million, or 36 percent of the total appropriation for conservation and renewable energy programs.[5] To test DOE compliance with congressional directives, we tracked five such directives in the fiscal year 1991 appropriations reports for several Office of Conservation and Renewable Energy programs: solar building technologies, photovoltaics, biofuels, wind, and geothermal programs. In each case the funds for the congressionally directed activities were included in the annual operating plans, the spending plans, and the DOE documents that transfer the funds to DOE field offices.

Conservation and Renewable Energy officials provided examples of congressional directives that were incorporated into DOE's priorities. For example, in fiscal year 1991, the Congress directed DOE to allocate not less than $10 million to commercialize a specific type of solar energy technology. A DOE official told us that the Department accommodated this directive because it was general and closely related to work already planned. In another case, the Congress directed DOE to fund research by two centers to increase the energy efficiency of prefabricated housing. The directed funding of over $1 million was incorporated into DOE's Building Systems Research Program.

According to Conservation and Renewable Energy officials, congressional spending directives do not always align with DOE's program priorities.

[5]Fiscal year 1991 was the most recent year for which we were able to verify that DOE had included congressional directives in its planning documents. This figure excludes funds granted to states and others for energy conservation, which are a part of the conservation and renewable energy budget.

These officials estimated that such projects represented less than 10 percent of the funds appropriated for their programs for fiscal year 1991.[6] In some cases, the directives are for programs DOE considers a lower priority; in other cases, directives may apply to a program DOE wishes to discontinue. According to DOE officials, some directives restrict the Department because of their specificity, requiring that money be awarded to a certain research institute or university.

Observations

Conceptually, the processes that DOE initiated in developing the fiscal year 1993 budget request represent a more systematic approach to determining budget priorities and thus an improvement over past practices. The strategic planning initiative calls for specific objectives that relate DOE R&D programs (as well as other programs) to overall departmental objectives and specifically states that budget priorities should be linked to the plans. Continued use of the strategic planning process and the improvements to the budgeting process that DOE identified, if implemented, can further improve DOE's allocation of R&D funding.

Scope and Methodology

To respond to your request, we interviewed DOE's Chief Financial Officer and DOE officials from the Offices of Conservation and Renewable Energy, Nuclear Energy, Fossil Energy, and Policy, Planning and Analysis, all located at DOE headquarters in Washington, D.C. We also interviewed OMB officials and representatives of trade associations for companies involved in renewable energy technology. We reviewed DOE directives relating to planning and budgeting, budget documents for fiscal years 1991 to 1993, and appropriation committee reports for fiscal year 1991. We also obtained and analyzed documents concerning the Office of Policy, Planning and Analysis' portfolio analysis and the Office of Conservation and Renewable Energy's value-based budgeting system. To assess how DOE complies with congressional directives, we judgmentally selected directives for projects to cover a range of technologies and program offices. We selected projects that were relatively specific so that they could be readily traced through planning and budgeting documents.

We performed our work between October 1991 and March 1992 in accordance with generally accepted government auditing standards. As requested, we did not obtain written agency comments on this report. However, we did discuss a draft of this report with DOE and Office of

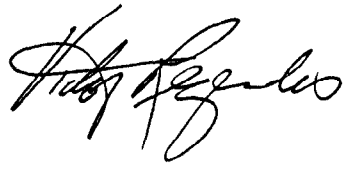
[6]This percentage represents a weighted average for Office of Conservation and Renewable Energy programs. It excludes funds granted to states and others for energy conservation.

Management and Budget officials, who expressed general agreement with the information presented. We have incorporated their comments where appropriate.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time we will send copies to the Secretary of Energy and other interested parties. We will also make copies available upon request.

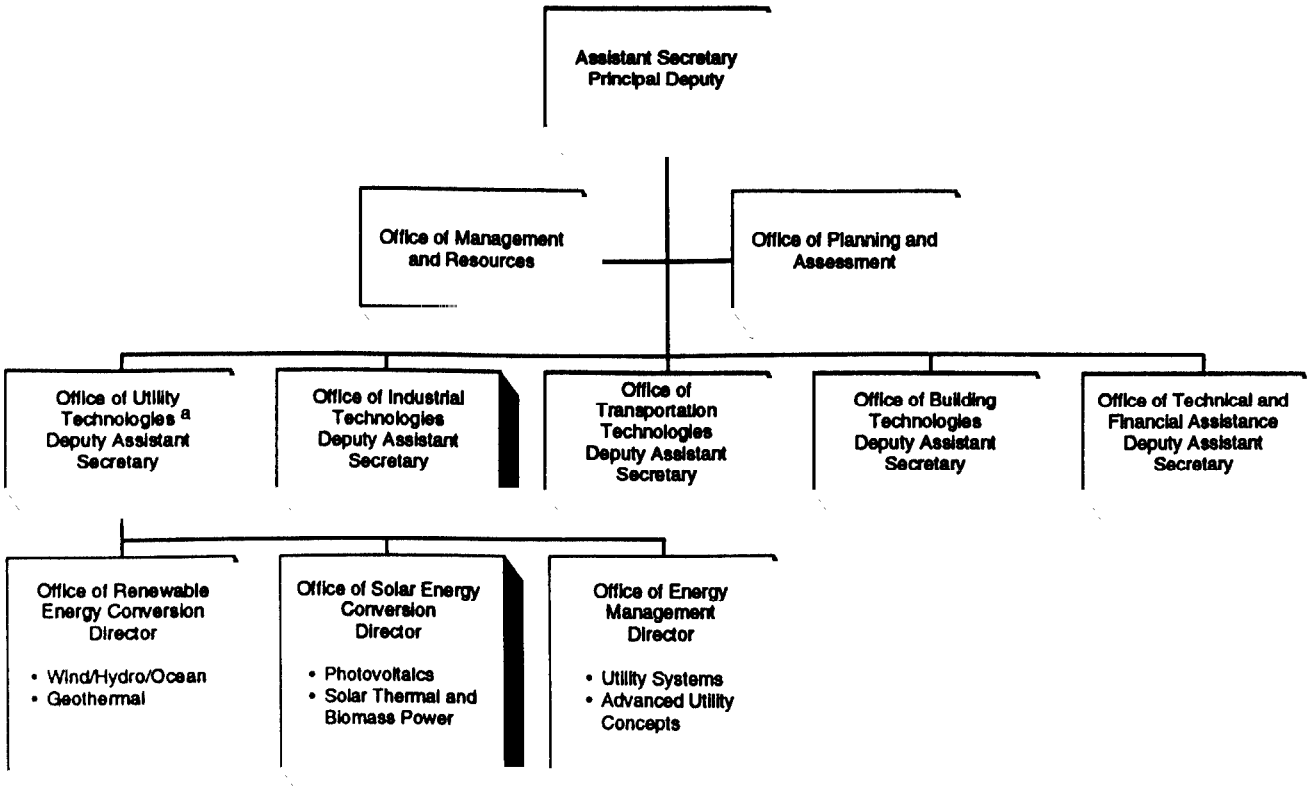
Please contact me at (202) 275-1441 if you or your staff have any questions. Major contributors to this report are listed in appendix III.

Sincerely yours,



Victor S. Rezendes
Director, Energy Issues

Office of Conservation and Renewable Energy



[a]For illustration purposes we have included sub-offices for the Office of Utility Technologies only.

Source: Department of Energy.

DOE Processes for Determining Civilian R&D Budget Allocations

Department of Energy (DOE) program offices start planning a given fiscal year budget about 18 months prior to the fiscal year. They plan their activities at three funding levels: (1) the budget target level, (2) the "decrement" level, approximately 10 percent to 20 percent below the preceding year's request, and (3) the "program planning level" or the level that includes funding for essential program activities that cannot be funded within the target level. Planning at three different funding levels helps determine which projects can be done, depending on the level of funding provided, according to a DOE official.

In developing the fiscal year 1993 budget, DOE's Office of Policy, Planning and Analysis established three "portfolios" of energy research and development (R&D) programs, each with an overall objective derived from one of three broad National Energy Strategy (NES) objectives. The Office divided the R&D activities into 39 "program units"—groups of R&D activities with a common theme or focus, such as increasing industrial demand efficiency. The Office then established three "portfolios" of program units, one for each of the three broad NES objectives. Individual program units were assigned to one or more of the portfolios, depending on their contribution to the portfolio's broad objective. In cases where programs were split between two portfolios, the percentage allocated to each portfolio was judgmental rather than the result of an analysis of individual projects within the programs.

A six-member review panel of DOE experts was established to rank the program units. The panel collectively scored each of the program units according to a set of criteria based on NES goals (see below), then used the resulting scores to rank them. Using target funding levels derived from OMB as a baseline, the panel recommended increased funding for the higher-ranking program units and decreased funding for the lower-ranking ones. To keep total spending within the OMB-established target level for civilian energy R&D, the panel recommended reducing some program spending levels to compensate for increases in the higher-ranked programs.

Table II.1 compares the recommended funding levels for each program unit at key stages of the budget cycle.

Table II.1: Proposed Expenditures for DOE Civilian R&D at Key Stages in the Fiscal Year 1993 Budget Cycle

Dollars in millions

DOE portfolio/program planning units	Fiscal year approp., 1992	Budget target from OMB	Program planning level	Office of Policy recommended emphasis	DOE request to OMB	Request to the Congress
Oil vulnerability						
Transportation demand efficiency	$ 88	$ 109	$ 157	$ 157	$ 120	$ 125
Industrial demand efficiency	50	47	68	68	53	48
Industrial waste minimization	9	10	20	20	11	11
Transportation fuels supply	52	56	107	107	68	76
Buildings demand efficiency	25	24	61	61	28	28
Gas program	7	4	14	14	19	20
Petroleum program	57	45	68	68	55	57
Strategic Petroleum Reserve	185	195	1,249	195	198	177
Engineering and geosciences	18	18	24	18	20	20
Chemical sciences	40	52	66	52	43	44
Materials sciences	64	89	112	89	71	73
Energy biosciences	12	12	16	12	14	14
State grants	198	37	93	37	137	137
Technical assistance & deployment	13	0	8	0	11	11
Coal liquids	39	29	51	29	24	24
Naval petroleum & oil shale reserves	232	300	396	300	240	238
Total, oil vulnerability	**1,089**	**1,027**	**2,510**	**1,227**	**1,112**	**1,103**
Electric efficiency						
Industrial demand efficiency	27	25	37	37	28	26
Industrial waste minimization	9	9	19	19	12	12
Utility demand efficiency	46	28	59	59	49	50
Buildings demand efficiency	25	24	65	24	29	27
Utility supply—renewables	139	139	151	139	142	144
Industry supply electric	12	19	30	19	18	15
Materials sciences	65	89	112	89	72	72
Chemical sciences	39	52	66	52	42	44
Gas program	6	4	14	4	19	20
Ultra-high efficiency power systems	92	25	81	25	35	35
High-efficiency power systems	148	86	170	86	95	95
First repository	166	149	406	148	298	248
State grants	66	24	50	12	46	46
Monitored retrievable storage facility	16	58	71	30	58	41
Transportation, integration & engineering	34	56	71	40	53	49

(continued)

Dollars in millions

DOE portfolio/program planning units	Fiscal year approp., 1992	Budget target from OMB	Program planning level	Office of Policy recommended emphasis	DOE request to OMB	Request to the Congress
Technical assistance & deployment	4	0	13	0	4	4
Clean coal	415	250	475	213	200	500
Light water reactor	63	69	69	58	59	59
Facilities—nuclear	98	101	101	85	100	95
Modular high temperature gas reactor	a	6	6	6	a	a
Advanced liquid metal reactor	60	48	77	41	54	50
Fusion energy	337	337	446	286	360	360
U-AVLIS	164	174	174	100	100	100
Total, electric efficiency	**2,031**	**1,772**	**2,763**	**1,572**	**1,873**	**2,092**
Fortifying foundations						
Chemical sciences	79	104	132	132	85	87
Materials sciences	120	177	223	223	144	145
Engineering & geosciences	18	18	24	24	20	20
Energy biosciences	12	12	16	16	14	14
Biological & environmental research	353	331	392	346	371	385
Applied math sciences	81	93	93	93	91	91
University & science education	55	46	55	46	51	56
Nuclear physics	354	343	391	343	320	364
High-energy physics	628	666	733	666	567	631
Superconducting super collider	484	650	650	552	650	650
Advanced energy projects	55	11	15	9	12	12
Total, fortifying foundations	**2,239**	**2,451**	**2,724**	**2,450**	**2,325**	**2,455**
Grand total	**$5,359**	**$5,250**	**$7,997**	**$5,249**	**$5,310**	**$5,650**

[a]Number included in the advanced liquid metal reactor category.

Source: Office of Policy, Planning, and Analyis.

DOE's Office of Policy, Planning and Analysis assigned each of the individual program planning units one of the three funding levels: the target level, the decrement level, or the program planning level. According to a Policy, Planning and Analysis official, these numbers were developed to indicate a relative emphasis for each of the three portfolios, not to recommend specific program funding levels. He said comparisons for the program planning units in the portfolios could be made only by noting

whether the Office of Policy, Planning and Analysis recommended an increased, decreased, or unchanged level of funding from the target and comparing this recommended emphasis to the DOE budget request to OMB (column 6). For example, comparing the recommended emphasis for fusion energy research with the budget target (column 3) shows the Office of Policy, Planning and Analysis recommended a decreased funding emphasis. In its request to OMB (column 6), DOE actually increased its emphasis on this program by recommending a budget higher than the target.

The criteria used to rank the program units were derived from three broad NES objectives: (1) improving energy supply and demand efficiency in a way that promotes economic efficiency, (2) reducing the adverse economic effects of oil supply disruptions, and (3) strengthening the basic science research effort, including scientific education and technology transfer. A fourth broad objective, enhancing environmental quality, was treated as a sub-objective under each of the others.

The Office of Policy, Planning and Analysis developed criteria from these broad objectives and assigned them weights. (Essentially, the weights represent the relative importance of each criterion.) One set of criteria and weights was developed for the portfolios related to the first two NES objectives and a separate set of criteria and weights was developed for the portfolio related to improving the basic science research effort. Using these weights, the panel determined a score for each program unit. The criteria and their weights are shown in tables II.2. and II.3.

Table II.2: Criteria and Weights Used in DOE's R&D Ranking Process for the Electric Efficiency and Oil Supply Portfolios

Criteria	Weights (in percent)
Energy significance	
Near-term (total energy produced per year before 2000)	9
Mid-term (total energy produced per year by 2010)	8
Long-term (total energy produced per year after 2010)	8
Subtotal, energy significance	**25**
National security/potential for reducing oil imports	
Percent of energy produced that can directly reduce oil imports	**10**
Economic competitiveness	
Economic benefits by reducing costs of meeting energy demands and/or improving U.S. trade balance	**10**
Environment	
Global (amount of greenhouse gas emissions)	8
Air & water (amount of SOx, NOx, water pollutants)	9
Land (amount of radioactive & hazardous wastes, land area used)	8
Subtotal, environment	**25**
Technical risk	
Probability of success in meeting cost and performance requirements of the potential market	**15**
Government role/market Risk	
Extent to which government support is needed overcome technology and market barriers	**15**
Grand total	**100**

Table II.3: Criteria and Weights Used in DOE's R&D Ranking Process for the Basic Science Research Portfolio

Criteria	Weights (in percent)
Basic research	25
Maintain a diverse and balanced portfolio of fundamental science and engineering research; contribute in particular to fundamental scientific understanding in one or more of 13 fields important to the NES	
Strategic research	
Energy objectives, namely, increasing energy efficiency, securing future energy supplies, and reducing oil vulnerability	10
Economic objectives, namely, increasing competition, diversifying the availability of technical choices, removing impediments to efficient market functioning, and spurring productivity	10
Environmental objectives, namely, enhancing environmental quality and improving understanding of the health, safety, and environmental consequences of energy production, transport and use	10
Infrastructure	15
Encourage industry, on its own, to increase research investments in energy science and technology Capitalize on the strengths and creativity of individual investigators by strengthening university and federal laboratory research capabilities, including upgrades of equipment and instrumentation Leverage scarce resources, through increased use of cost-shared research and development Maintain and staff high-priority, forefront, user- oriented research facilities vital to U.S. leadership in both science and industrial research Contribute to increased international collaboration in research activities involving high-cost, long- term experiments and facilities	
Technology deployment	15
Increase joint participation by both government and U.S.-based industry in R&D to speed the commercialization of NES-related technology Foster U.S. exports of energy-related technology	
Education	15
Enable Americans to better understand the role of energy in their lives, including its attendant costs and benefits Ensure that the United States has a reliable supply of highly skilled scientists and technicians in energy-related fields	
	100

Major Contributors to This Report

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Energy: Bibliography of GAO Documents January 1986-December 1989 (GAO/RCED-90-179, July 1990)

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