

**THE WHITE HOUSE**

WASHINGTON

May 30, 2002

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: JOHN H. MARBURGER, III  
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

MITCHELL DANIELS  
DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET

SUBJECT: FY 2004 Interagency Research and Development Priorities

President Bush has set forth a science agenda for the next fiscal year that seizes important opportunities for discovery and development, and sustains the basic machinery of research and development (R&D) needed for continued global leadership in science and technology (S&T). The President's science agenda includes existing and emerging R&D priorities that require significant levels of interagency coordination and planning across several agencies. The priority-setting and coordination process reflects the Administration's objectives of maintaining excellence and maximizing the efficient and effective use of the Nation's R&D resources.

The multitude of opportunities requires wise choices, of not only which programs to launch, encourage, and enhance, but also which to reevaluate, modify, or redirect in keeping with our national needs and capabilities. This memorandum provides guidance on the types of R&D programs the Administration will favor when making fiscal year 2004 investment decisions, identifies priority activities requiring significant interagency coordination, and sets forth R&D investment criteria that departments and agencies should observe and implement.

The Office of Science and Technology Policy (OSTP) and the Office of Management and Budget (OMB) expect agencies to give these Administration priorities full consideration when developing FY 2004 budget requests. We encourage agencies to fund new, high-priority activities by reallocating resources from lower-priority or recently completed activities. Requests for funding above guidance levels will require a compelling rationale that the activity is important, that the agency is the best one to conduct the activity, and that funds from lower priority or recently completed programs cannot be substituted within the agency's guidance level.

## **R&D Program Guidance**

In general, the Administration will favor investments in federal R&D programs that:

- sustain and nurture America's science and technology enterprise through the pursuit of specific agency missions and stewardship of critical research fields and their enabling infrastructure;
- strengthen science, mathematics, and engineering education by enhancing access and broad availability of excellent educational programs and establishing and encouraging best educational practices;
- focus on long-term, potentially high-payoff activities that require a federal presence to attain national goals, including homeland security, environmental quality, economic growth and prosperity, and human health and well being;
- maximize efficiency and effectiveness of federal R&D investments through means such as employing competitive, peer-reviewed processes and phasing out programs that are neither productive nor important to an agency's mission; and
- use, when appropriate, collaborations among agencies, industry, academia, and states, as well as with other countries to advance common S&T goals.

## **Interagency Priorities for Research and Development Budgets**

Among the high-priority federal investments in science and technology, the National Science and Technology Council (NSTC) coordinates a small number of selected interagency science and technology investment priorities. During preparation of the FY 2004 Budget, the NSTC expects to focus on the six areas listed below. Ongoing NSTC crosscuts, such as Networking and Information Technology R&D (NITRD) and the National Nanotechnology Initiative (NNI), will proceed on course, while the other priority areas will develop or update: 1) a clear and concise definition of program activities and priorities; 2) an inventory of the programs in the baseline budget; and 3) an implementation plan.

Agencies involved in these six NSTC activities will participate in working groups that integrate development and planning of programs, including full exchange of budget information. In the fall, OSTP will attend agency-specific OMB budget hearings related to R&D, during which OMB and OSTP staff may engage each agency in a discussion of the listed interagency programs as appropriate.

This is not a comprehensive list of all Administration S&T priorities – it does not include priorities that fall within the purview of a single agency. Agencies with responsibilities for specific fields of science and engineering should consider the impact of their research investments on the sustained viability of these disciplines for national priorities. Some agencies operate programs or facilities whose capabilities are important to the missions of other agencies as well as to their own. Stewardship and continued development of these facilities and associated instrumentation can serve a range of scientific and engineering disciplines. These capabilities consequently carry an interagency coordination responsibility and will be given special consideration in the budget preparations. OSTP, through the NSTC process, will

evaluate how best to ensure the availability of instrumentation and facilities for priority science and technology needs.

The NSTC also is actively involved in a number of interagency R&D areas that, unlike the issues described below, do not require near-term Administration policy or budget decisions. However, some of these areas may emerge as priorities for FY 2004 over the next few months. For example, the area of science for sustainability seeks to increase our understanding of complex systems and addresses challenges to global sustainability, e.g., energy, environmental protection, food/water, and health. Pursuing this as an upcoming priority could require extensive interagency coordination. The Administration may also review some of our existing priorities to accommodate these new needs. Agencies will be involved in the development of these emerging priorities.

Homeland Security and Antiterrorism R&D: Agency R&D efforts in this high priority area should dramatically reduce the Nation's vulnerability to terrorism. These include enhancing our capabilities for (a) early detection of catastrophic terrorist threats and any subsequent exposures, (b) rapid response to them and mitigation of their effects, and (c) physical decontamination techniques and prophylactic and treatment measures. Research should be focused on areas with the potential to dramatically enhance our capabilities for detecting the presence of, and responding to, nuclear, biological, chemical, radiological, and conventional explosive threats in air, sea, rail, and road transport, both beyond and within our borders. Other priority areas include advances in information technology for examining large and disparate databases to identify any anomalies that might indicate terrorist intent on the part of individuals or groups of individuals, and the development of better biometric techniques, applied at the phenotype or genotype levels, for verifying or determining terrorist identity. Additionally, this effort should identify and apply relevant computer and network security research, including research developed under NITRD. The NSTC, working closely with the Office of Homeland Security, is actively shaping more specific R&D priorities. This is an ongoing process requiring intensive interagency planning and coordination. Agency budget requests in these areas should factor in recommendations of the President's Critical Infrastructure Protection Standing Committee for Research and Development.

Networking and Information Technology R&D: NITRD continues to be an Administration priority. Improvements in computational and networking capacity, performance, and robustness directly affect research across the scientific disciplines. Agencies reliant on improvements in computational and networking capacity should prioritize research in these areas within their budgets. Special emphasis also should be given to research on computer and network security. Departments and agencies should promote and coordinate research for protection of information systems for critical infrastructure to reduce vulnerabilities and counter threats that could cause major damage to the security, economic vitality, and social well-being of the U.S. Agency budget requests in these areas should consider recommendations of the President's Critical Infrastructure Protection Standing Committee for Research and Development.

National Nanotechnology Initiative: This initiative holds great promise broadly across many scientific fields and most sectors of the economy. The nanoscale R&D agenda includes a balance of basic and applied research, nanoscale instrumentation and metrology, manufacturing,

and the dissemination of new technical capabilities to industry. Nanoscale R&D priority areas include material science, biotechnology, and research relevant to medical care and homeland security. Of particular importance are nanostructures that more effectively collect and deliver samples to sophisticated sensors (chemical, biological, radiological, electromagnetic, photonic, acoustic, or magnetic). The nanotechnology coordinating office, working through the NSTC, should review the definition of “nanotechnology” to better refine and focus the research included in this initiative.

Molecular-level Understanding of Life Processes: The past few years have seen major advances in the ability to sequence, analyze, and utilize complex genomic information from plants, animals, and microorganisms. Sequence and structure data, coupled to modern computational power and to our ability to manipulate biological systems at the molecular level, will yield new experimental approaches that have the potential to unravel the complexity of life at the molecular-, cellular-, and organismal levels. This basic research is leading to new applications in health care, agriculture, energy, and environmental management. Sequence data are also critical for homeland security forensic purposes. All NSTC genomics activities will prepare a coordinated budget that reflects program priorities.

Climate Change Science and Technology: A key aspect of the Administration’s science-based climate change policy is investment in R&D that will address major climate policy decisions and provide a framework for understanding and addressing long-term climate change. The newly established Committee on Climate Change Science and Technology Integration (CCCSTI) will establish priorities for R&D and monitoring programs that will be supported through the Climate Change Research Initiative and the National Climate Change Technology Initiative. The pre-existing U.S. Global Change Research Program will be coordinated fully with the CCCSTI. Implementation will include the identification of priority funding areas, which may include areas such as observations (e.g., atmospheric CO<sub>2</sub>, carbon, and aerosols), modeling and computing, and water and carbon cycles where additional data will accelerate the reduction of key uncertainties in the causes, magnitude, and direction of climate change.

Education Research: Continuing as a high priority of the Administration, the No Child Left Behind (NCLB) Act of 2002 calls for research that enables the successful development and implementation of science-based programs and practices. The goals include: (a) strengthening mathematics, science, and reading education; (b) advancing the use of educational technology for improving both student achievement and teacher training; and (c) supporting state efforts to implement annual assessments for every child in grades 3-8. This education research agenda should build upon the ongoing efforts of the Interagency Education Research Initiative, though the coordinated efforts of the National Science Foundation, the Department of Education, and the National Institute of Child Health and Human Development, as well as the research programs of the individual agencies. Agency budget requests should reflect a coordinated, five-year interagency plan and address priorities established in the NCLB Act.

### **Research and Development Investment Criteria**

One way the Administration intends to improve R&D program management and effectiveness is through the application of explicit R&D investment criteria, as directed by the President’s

Management Agenda. The R&D investment criteria will help improve R&D program management, better inform R&D program funding decisions, and ultimately increase public understanding of the possible benefits and effectiveness of the federal investment in R&D. OMB encourages agencies to make the processes they use to satisfy the Government Performance and Results Act (GRPA) consistent with the goals and metrics they use to satisfy these R&D criteria. OMB will consider, under section 1115(b) of the GPRA, full use of the Administration's R&D investment criteria as an alternative form of reporting for R&D programs. Satisfying the R&D performance criteria for a given program should serve to set and evaluate R&D performance goals for the purposes of GPRA. OMB expects goals and performance measures that satisfy the R&D criteria to be reflected in agency performance plans.

All R&D managers should be able to demonstrate the extent to which their programs meet the following three tests:

- Relevance R&D programs must be able to articulate why this investment is important, relevant, and appropriate.
  - Agencies must provide complete plans, including clear goals and priorities, with requests for funding.
  - Agencies must be able to clearly articulate the societal benefits of proposed and existing programs.
  - Agencies must explain the mechanisms they use for reviewing the relevance of proposed programs and the results of those reviews for existing programs.
- Quality R&D programs must justify how funds will be allocated to ensure quality R&D.
  - Agencies must link the problems they propose to work on to an appropriate allocation of federal funding.
  - Agencies must explain the mechanisms they use for reviewing the quality of proposed programs and the results of those reviews for existing programs.
- Performance R&D programs must be able to monitor and document how well this investment is performing.
  - Agencies may be required to track and report relevant program inputs annually.
  - Agencies must define appropriate output and outcome measures, schedules, and provide explicit decision points for continuation, redirection or termination.
  - Agencies must document program performance annually.
  - Agencies must describe their responses to the performance criteria with sufficient precision and in such terms that would allow for an accurate, independent determination of whether the program activity's performance meets the criteria of the description. Descriptions of performance should not, however, be limited only to quantitative measures.

In addition, managers of R&D programs developing technologies that address industry issues must justify the appropriateness of the federal R&D investment and assess and compare programs based on proposed benefits and demonstrated performance.

While the criteria apply broadly to all types of R&D, agencies should not have the same expectations for planning and measuring the results of long-term, high-risk basic research as they have for applied research and development.

## **Next Steps**

Enclosed are the “Research and Development Investment Criteria.”

OSTP has convened an interagency working group under the NSTC to discuss implementation strategies for these investment criteria. This group is identifying existing mechanisms within agencies that can be used to satisfy these criteria.

The development of the President’s FY 2004 Budget will require a concerted effort across the federal agencies. OSTP and OMB look forward to working with the agencies to implement and manage effective and efficient programs that fully address the Nation’s R&D priorities and needs.

## Research and Development Investment Criteria

While the FY 2003 Budget requests the highest level of federal funding for research and development (R&D) in history, the focus for policy officials and program managers should not be on how much we are spending, but rather on what we are getting for our investment. One way the Administration intends to improve R&D program management and effectiveness is through the application of explicit R&D investment criteria, as directed in the President's Management Agenda. Use of the criteria will allow policy makers to make decisions about programs based on information beyond anecdotes, prior-year funding levels, and lobbying of special interests. A dedicated effort to improve the process for budgeting, selecting, and managing R&D programs will help increase the return on taxpayer investment and the productivity of the federal R&D portfolio. This effort will build on the best of the planning and assessment practices that agency program managers use to plan and assess their programs. Implementation of the President's Management Agenda will be consistent with and not redundant with requirements of the Government Performance and Results Act (GPRA).

To facilitate interagency discussion on these criteria, the Office of Science and Technology Policy (OSTP) has convened an interagency working group under the National Science and Technology Council (NSTC). This group is identifying existing mechanisms within agencies that can be used to satisfy these criteria. The results of this process will inform the implementation of the investment criteria.

As part of the FY 2003 Budget process, the Office of Management and Budget (OMB) developed investment criteria to assist in allocation decisions among selected applied energy technology R&D programs at DOE. Useful data on the expected benefits and realized performance of many projects were missing in the pilot effort. Nevertheless, the criteria provided enough guidance to identify some opportunities for improving R&D performance. For example, in the fossil energy program, research to control greenhouse gases was increased, since there is little incentive for private investment in this area. Conversely, areas such as oil drilling technology, where the industry has the financing and incentive to do its own research, were funded at lower levels.

The Administration has worked with experts and stakeholders over the past year and has built upon the lessons learned from the DOE pilot. The result is a set of broad R&D investment criteria for all types of R&D programs across the agencies for the 2004 budget process.

All R&D managers should be able to show the extent to which their programs meet the following three tests:

- *Relevance* R&D programs must be able to articulate *why* this investment is important, relevant, and appropriate. Programs must have well-conceived plans that identify program goals and priorities and identify linkages to national and "customer" needs.
- *Quality* R&D programs must justify *how* funds will be allocated to ensure quality R&D. Programs allocating funds through means other than a competitive, merit-based process must justify these exceptions and document how quality is maintained.

- *Performance* R&D programs must have the plans and management processes in place to monitor and document *how well* this investment is performing. Program managers must define appropriate outcome measures and milestones that can be used to track progress towards goals, and assess whether funding should be enhanced or redirected.

In addition, managers of R&D programs developing technologies that address industry issues must justify the appropriateness of the federal investment by identifying the public benefits of the activity, indicating why R&D is a better way to achieve the benefits than other policy alternatives, and documenting how the market fails to motivate private sector investment. In addition, programs and projects with similar goals must provide consistent metrics of potential benefits and proven performance, to allow comparisons across these programs or projects.

The R&D criteria address not only planning, management, and prospective assessment but also retrospective assessment. Retrospective review of whether investments were well-directed, efficient, and productive is essential for validating program design and instilling confidence that future investments will be wisely invested. Retrospective reviews should address continuing program relevance, quality, and successful performance to date.

While the criteria are intended to apply to all types of R&D, the Administration is aware that predicting and assessing the outcomes of *basic* research in particular is never easy. Serendipitous results are often the most interesting and ultimately may have the most value. Taking risks and working towards difficult-to-attain goals are important aspects of good research management, and innovation and breakthroughs are among the results. However, there is no inherent conflict between these facts and a call for clearer information about program goals and performance towards achieving those goals. The Administration expects agencies to focus on improving the management of their research programs and adopting effective practices, and not on predicting the unpredictable.

The R&D investment criteria will help communicate the Administration's expectations for proper program management. The criteria and subsequent implementation guidance will also set standards for information to be provided in program plans and budget justifications. Finally, the processes and collected information promoted under the criteria will improve public understanding of the possible benefits and effectiveness of the federal investment in R&D.

## **Implementation**

The criteria have been written in a general way, so they apply to all types of R&D programs across the federal agencies. OMB and OSTP will work with each federal agency independently to establish more detailed guidance that is tailored to each agency, where appropriate, including the types of reports they use to satisfy the criteria.

The criteria address *programs* of research, but agencies will work with their respective OMB contacts to define appropriate levels of assessment. In some cases, fully addressing the criteria may require assessment at the account or activity level, but in others, assessment of individual large projects may be necessary. In all cases, OMB encourages agencies to assess their own programs at more detailed levels than what they provide to OMB. Improved investment and

performance of R&D will be achieved through improved management of R&D at all levels of the agency.

Implementation of these criteria is not meant to add an extra layer of reporting requirements to the agencies' existing GPRA requirements. These criteria are intended to be consistent with budget-performance integration efforts. OMB encourages agencies to make the processes they use to satisfy GPRA consistent with the goals and metrics they use to satisfy these R&D criteria. Satisfying the R&D performance criteria for a given program will serve to set and evaluate R&D performance goals for the purposes of GPRA. OMB will expect goals and performance measures that satisfy the R&D criteria to be reflected in agency performance plans.

All R&D programs identified by OMB are expected to fully address all criteria, except where the criteria note explicit exceptions or where explicit exceptions have been discussed in advance with OMB. These assessments will form the foundation for funding decisions in FY 2004.

## General R&D Investment Criteria

The following investment criteria apply to all R&D programs. Industry- or market-relevant applied research and development must meet additional criteria. These additional criteria immediately follow the general criteria in this document. Together, these criteria can be used to assess the need, relevance, appropriateness, quality, and performance of federal R&D programs.

### I. Relevance

R&D investments must have clear plans, must be relevant to national priorities, agency missions, relevant fields, and “customer” needs, and must justify their claim on taxpayer resources. Programs that directly support Presidential priorities may receive special consideration with adequate documentation of their relevance. Review committees should assess program objectives and goals on their relevance to national needs, “customer” needs, agency missions, and the field(s) of study the program strives to address. For example, the Joint DOE/NSF Nuclear Sciences Advisory Committee’s Long Range Plan and the Astronomy Decadal Surveys are the products of good planning processes because they articulate goals and priorities for research opportunities within and across their respective fields.

OMB will work with some programs to identify quantitative metrics to estimate and compare potential benefits across programs with similar goals. Such comparisons may be within an agency or among agencies.

#### A. Programs must have complete plans, with clear goals and priorities.

Programs must provide complete plans, which include explicit statements of:

- specific issues motivating the program;
- broad goals and more specific tasks meant to address the issues;
- priorities among goals and activities within the program;
- human and capital resources anticipated; and
- intended program outcomes, against which success may later be assessed.

#### B. Programs must articulate the potential public benefits of the program.

Programs must identify potential benefits, including added benefits beyond those of any similar efforts that have been or are being funded by the government or others. R&D benefits may include technologies and methods that could provide new options in the future, if the landscape of today’s needs and capabilities changes dramatically. Some programs and sub-program units may be required to quantitatively estimate expected benefits, which would include metrics to permit meaningful comparisons among programs that promise similar benefits. While all programs should try to articulate potential benefits, OMB and OSTP recognize the difficulty in predicting the outcomes of basic research. Consequently, agencies may be allowed to relax this as a requirement for basic research programs.

#### I. Programs must document their relevance to specific Presidential priorities to receive special consideration.

Many areas of research warrant some level of federal funding. Nonetheless, the President has identified a few specific areas of research that are particularly important. To the

extent a proposed project can document how it directly addresses one of these areas, it may be given preferential treatment.

- C. Program relevance to the needs of the Nation, of fields of S&T, and of program “customers” must be assessed through prospective external review.

Programs must be assessed on their relevance to agency missions, fields of science or technology, or other “customer” needs. A customer may be another program at the same or another agency, an interagency initiative or partnership, or a firm or other organization from another sector or country. As appropriate, programs must define a plan for regular reviews by primary customers of the program’s relevance to their needs. These programs must provide a plan for addressing the conclusions of external reviews.

- D. Program relevance to the needs of the Nation, of fields of S&T, and of program “customers” must be assessed periodically through retrospective external review.

Programs must periodically assess the need for the program and its relevance to customers against the original justifications. Programs must provide a plan for addressing the conclusions of external reviews.

## II. Quality

Programs should maximize the quality of the R&D they fund through the use of a clearly stated, defensible method for awarding a significant majority of their funding. A customary method for promoting R&D quality is the use of a competitive, merit-based process. NSF’s process for the peer-reviewed, competitive award of its R&D grants is a good example. Justifications for processes other than competitive merit review may include “outside-the-box” thinking, a need for timeliness (e.g., R&D grants for rapid response studies of *Pfisteria*), unique skills or facilities, or a proven record of outstanding performance (e.g., performance-based renewals).

Programs must assess and report on the quality of current and past R&D. For example, NSF’s use of Committees of Visitors, which review NSF directorates, is an example of a good quality-assessment tool. OMB and OSTP encourage agencies to provide the means by which their programs may be benchmarked internationally or across agencies, which provides one indicator of program quality.

- A. Programs allocating funds through means other than a competitive, merit-based process must justify funding methods and document how quality is maintained.

Programs must clearly describe how much of the requested funding will be broadly competitive based on merit, providing compelling justifications for R&D funding allocated through other means. (See OMB Circular A-11 for definitions of competitive merit review and other means of allocating federal research funding.) All program funds allocated through means other than unlimited competition must document the processes they will use to distribute funds to each type of R&D performer (e.g., federal laboratories, federally funded research and development centers, universities, etc.). Programs are encouraged to use external assessment of the methods they use to allocate R&D and maintain program quality.

- B. Program quality must be assessed periodically through retrospective expert review.

Programs must institute a plan for regular, external reviews of the quality of the program’s research and research performers, including a plan to use the results from these

reviews to guide future program decisions. Rolling reviews performed every 3-5 years by advisory committees can satisfy this requirement. Benchmarking of scientific leadership and other factors provides an effective means of assessing program quality relative to other programs, other agencies, and other countries.

### **III. Performance**

R&D programs should maintain a set of high priority, multi-year R&D objectives with annual performance outputs and milestones that show how one or more outcomes will be reached. Metrics should be defined not only to encourage individual program performance but also to promote, as appropriate, broader goals, such as innovation, cooperation, education, and dissemination of knowledge, applications, or tools.

OMB encourages agencies to make the processes they use to satisfy the Government Performance and Results Act (GRPA) consistent with the goals and metrics they use to satisfy these R&D criteria. OMB will consider, under section 1115(b) of the GPRA, full use of the Administration's R&D investment criteria as an alternative form of reporting for R&D programs. Satisfying the R&D performance criteria for a given program should serve to set and evaluate R&D performance goals for the purposes of GPRA. OMB expects goals and performance measures that satisfy the R&D criteria to be reflected in agency performance plans.

Programs must demonstrate an ability to manage in a manner that produces identifiable results. At the same time, taking risks and working towards difficult-to-attain goals are important aspects of good research management, especially for basic research. The intent of the investment criteria is not to drive basic research programs to pursue less risky research that has a greater chance of success. Instead, the Administration will focus on improving the management of basic research programs.

OMB will work with some programs to identify quantitative metrics to compare performance across programs with similar goals. Such comparisons may be within an agency or among agencies.

Construction projects and facility operations will require additional performance metrics. Cost and schedule earned-value metrics for the construction of R&D facilities must be tracked and reported. Within DOE, the Office of Science's formalized independent reviews of technical cost, scope, and schedule baselines and project management of construction projects ("Lehman Reviews") are widely recognized as an effective practice for discovering and correcting problems involved with complex, one-of-a-kind construction projects.

A. Programs may be required to track and report relevant program inputs annually.

Programs may be expected to report relevant program inputs, which could include statistics on overhead, intramural/extramural spending, infrastructure, and human capital. These inputs should be discussed with OMB.

B. Programs must define appropriate output and outcome measures, schedules, and decision points.

Programs must provide single- and multi-year R&D objectives, with annual performance outputs, to track how the program will improve scientific understanding and its application. Programs must provide schedules with annual milestones for future competitions, decisions, and termination points, highlighting changes from previous schedules. Program proposals must define what would be a minimally effective program and a successful program. Agencies should define appropriate output and outcome measures for all R&D programs, but agencies should not expect fundamental basic research to be able to identify outcomes and measure performance in the same way that applied research or development are able to. Highlighting the results of basic research is important, but it should not come at the expense of risk-taking and innovation. For some basic research programs, OMB may accept the use of qualitative outcome measures and quantitative process metrics. Facilities programs must define metrics and methods (e.g., earned-value reporting) to track development costs and to assess the use and needs of operational facilities over time. If leadership in a particular field is a goal for a program or agency, OMB and OSTP encourage the use of benchmarks to assess the processes and outcomes of the program with respect to leadership. OMB encourages agencies to make the processes they use to satisfy GPRA consistent with the goals and metrics they use to satisfy these R&D criteria.

C. Program performance must be retrospectively documented annually

Programs must document performance against previously defined output and outcome metrics, including progress towards objectives, decisions, and termination points or other transitions. Programs with similar goals may be compared on the basis of their performance. OMB will work with agencies to identify such programs and appropriate metrics to enable such comparisons.

**IV. Criteria for R&D Programs Developing Technologies That Address Industry Issues**

The purpose of some R&D and technology demonstration programs and projects is to introduce some product or concept into the marketplace. However, some of these efforts engage in activities that industry is capable of doing and may discourage or even displace industry investment that would occur otherwise. For the purposes of assessing federal R&D investments, the following criteria should be used to assess industry-relevant R&D and demonstration projects, including, at OMB discretion, associated construction activities.

OMB will work with programs to identify quantitative metrics to measure and compare potential benefits and performance across programs with similar goals, as well as ways to assess market relevance.

- A. Programs and projects must articulate public benefits of the program using uniform benefit indicators across programs and projects with similar goals.

In addition to the public benefits required in the general criteria, *all* industry-relevant programs and projects must identify and use uniform benefit indicators (including benefit-cost ratios) to enable comparisons of expected benefits across programs and projects. OMB will work with agencies to identify these indicators.

- B. Programs and projects must justify the appropriateness of federal investment, including the manner in which the market fails to motivate private sector investment.

A lack of market incentives discourages private firms from investing in research where the benefits may occur far in the future, the risks may be too great for non-federal participants, or the benefits accrue to the public rather than private investors. Programs and projects must demonstrate that industry investment is sub-optimal and explain in what way the market fails that prevents the private sector from capturing the benefits of developing the good or service.

- C. Programs and projects must demonstrate that investment in R&D and demonstration activities is the best means to support the federal policy goals, compared to other policy alternatives.

When the federal government chooses to intervene to address market failures, there may be many policy alternatives to address those failures. Among the other tools available to the government are legislation, tax policy, regulatory and enforcement efforts, and an integrated combination of these approaches. In this context, projects to address issues of genuine federal concern should be able to illustrate how R&D and demonstration activities are superior to other policy tools in addressing federal goals, either by themselves or as part of an integrated package.

- D. Programs and projects must document industry or market relevance, including readiness of the market to adopt technologies or other outputs.

Programs must assess the likelihood that the target industry will be able to adopt the technology or other program outputs. The level of industry cost sharing is one indicator of industry relevance. Before projects move into demonstration or deployment stages, an economic analysis of the public and private returns on the public investment must be provided.

- E. Program performance plans and reports must include “off ramps” and transition points.

In addition to the schedules and decision points defined in the general criteria, program plans should also identify whether, when, and how aspects of the program may be shifted to the private sector.