

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. 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.