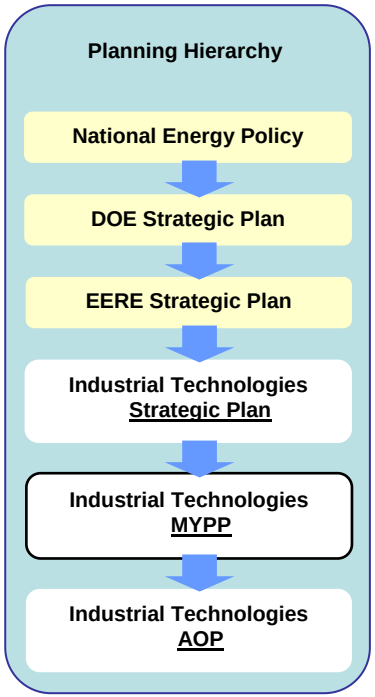
3 Program Portfolio Management

3.1 Program Portfolio Management Process

ITP's portfolio management process is described below.

3.1.1 Planning Inter-Relationships

The ITP Multi-Year Program Plan is designed to provide a mid-to-long range perspective on ITP programs, and is a critical component in meeting the U.S. Department of Energy's Goals in an environment of limited resources.



This plan is designed to provide a level of detail at the program level that is derived from top-level policy, beginning with the National Energy Policy and flowing down through the Department of Energy's Strategic Plan and EERE's Strategic Plan. The MYPP is designed to guide and support government officials and stakeholders alike as they examine internal and external environments; identify and evaluate alternatives, risks, and trends; anticipate change; prioritize actions in light of limited funding; and develop long-term understanding the long-term implications of current choices. The MYPP translates ITP's strategies and strategic objectives into specific technical, funding, and schedule requirements that meet all EERE expectations and requirements, including all metrics for effective performance evaluation

There are a series of critical planning documents that underpin EERE's Strategic Management System. The goal cascade in Section 1.5 and accompanying planning hierarchy graphic highlight the inter-relationship of other key strategic planning elements with the MYPP.

The MYPP is used to guide the allocation of resources and to identify the technology focus areas that are key to achieving ITP's goals of reducing industrial energy intensity and carbon emissions, specifically, a 25% reduction in energy intensity by 2017 in support of EPAct 2005. The plan identifies key technical focus areas, explains the primary technical and market barriers faced in accomplishing the objectives, lays out pathways for achieving the goals for each focus area, and defines metrics to help evaluate and adjust the pathways – thus keeping the plan flexible and current. The MYPP is designed to undergo periodic review and updates. The overall plan will be reviewed annually; each technology planning element will perform a quarterly update and review. The MYPP will serve as the foundation for integrating and prioritizing the technical objectives of the planning elements into a corporate-level resource request.

ITP currently utilizes the milestone planning process to provide planning structure for its current portfolio, and to assist in developing a vision for the future. The basic decision process is illustrated below in Figure 3-b.

The process begins with the consideration of the primary mission of EERE and the U.S. Department of Energy, and an understanding of how that mission fits within the planning, regulatory and budgetary framework faced by ITP (known as the "mission logic"). The mission logic is then combined with an understanding of ITP's customers, R&D needs, organizational strategy, and external stakeholders' needs; this refined logic is then cross-walked with DOE's mission and objectives. By balancing the needs and driving forces behind industry with the greater social good, priorities are set within the context of inherently governmental activities, resulting in the identification of technical objectives that serve both a public and private need.

At the federal decision-making level, these various inputs are translated into essential areas of R&D, represented by technology focus areas for each industry and cross-cut planning unit. A basic milestone chart is prepared for each technology focus planning area, essentially creating a 5-year opportunity analysis. Each opportunity analysis/milestone chart is a balance of goals against achievable metrics.

By taking into consideration the capabilities and resources of government, including knowledge of people in the organization, dollar size of the investments ITP can make, market opportunities and barriers, and potential impact of investment decisions, the planning process supports better-informed decision-making within ITP.

3.1.2 Critical Baseline Metrics

In addition to the broad metrics used to measure the success of the pathways in achieving desired goals in each technology focus area, ITP defines critical baseline metrics to evaluate technical progress in each focus area. These metrics connect R&D progress to programmatic performance by identifying and quantifying the key technical parameters of a specific focus area. By setting a starting point baseline for the parameter and then projecting a target baseline indicative of successful completion of R&D, continuing comparisons can be made that indicate the rate of technical progress achieved. In short, a critical baseline metric:

- Provides a technology dimension to the barrier-pathway-metrics logic
- Is associated with a particular focus area and provides a technology-related metric, not necessarily mission- related (e.g., Btus)
- Clarifies quantitatively the highest priority technical issues for each focus area, (e.g. cokeless ironmaking within Steel, as shown in Figure 3-a)
- Establishes a single technology-based baseline metric against which to judge progress of a focus area
- Includes a projected target metric that can be compared to the baseline metric to determine when a focus area effort is completed
- Provides a top-level view of measurable technical progress in a focus area

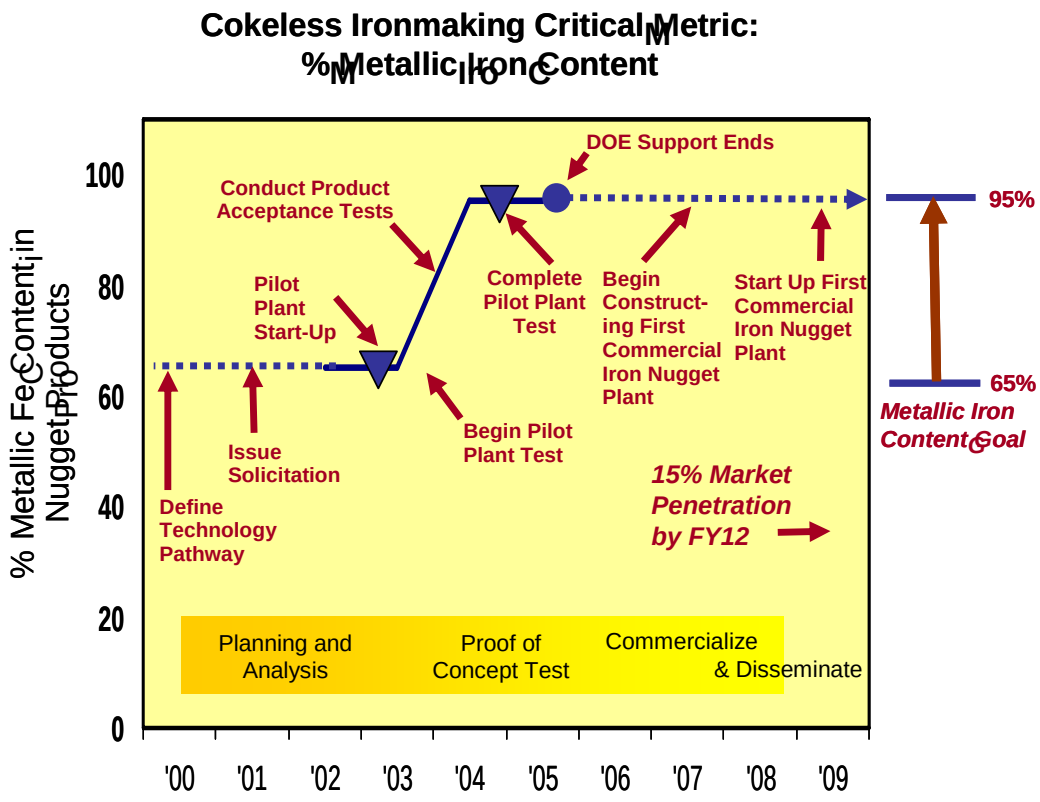


Figure 3-a. Example of a Critical Baseline Metric

3.1.3 Detailed Decision Components

As the opportunity analysis matures, additional analyses are performed that develop greater detail and provide an even higher quality analysis on which to base government investment decisions. Three examples of more detailed analyses are:

Total Development Cost (TDC) – TDC is defined as the total ITP dollars spent to achieve a key quantitative goal. A roll-up of all pathway costs determines the TDC of a focus area. The roll-up of the TDC for all focus areas equals the TDC for a milestone planning unit. By converting to cost, a determination is made of the cost it takes to achieve a key milestone endpoint that has a pass-off associated with it – to Best Practices (BP)/ Commercialization or somewhere outside the milestone chart.

Total Energy and Carbon Footprint – The total energy and carbon footprint of an opportunity indicates the magnitude of the potential impact that could be achieved. For the most energy-intensive industrial processes, ITP has developed energy bandwidths that indicate the percentage reduction in current energy use that could be achieved through R&D. These bandwidth data, combined with the energy/carbon footprint for a process, allow calculation of total potential energy savings for a given opportunity.

Multi-Year Prioritized Plan – A subset of the Milestone Chart or Opportunity Analysis is the Multi-Year Prioritized Plan. This plan consists of a multi-year plan that has been prioritized based on total available funds. Total available funds are defined as the total appropriated budget for the current year, and the revised projected budget, based on that

appropriation for out years through the end year of the MYPP. Projected funds are determined by ITP and EERE management, and represent the "most reasonable" estimate for future funding. Prioritized plans are prepared every year when AOP's are written for the upcoming year.

The decision process is illustrated in Figures 3-b and 3-c below.

3.1.4 Risk Assessment

ITP considers several types of risks during the development and eventual implementation of advanced industrial technologies, including:

- *Technical Risk*: Will the technology work as envisioned?
- *Financial Risk*: Will the costs and returns meet expectation?
- *Operation Risk:* Could the technology interrupt production if not successful?
- *Market Risk:* Will the technology become obsolete or less desirable during development?
- *Internal Risk:* Will changes in personnel or company objectives affect implementation?

ITP is incorporating Stage-Gate management and risk analysis into the planning and execution of its research activities. The program is placing increased emphasis on the evaluation of market risk for new technologies to be deployed in the industrial sector. Specifically, ITP is analyzing and documenting the market potential, commercial readiness, and technology payback periods of its key technology investments, as well as identifying strategies to address market barriers and facilitate commercialization. The Stage-Gate process was discussed further in Section 2.

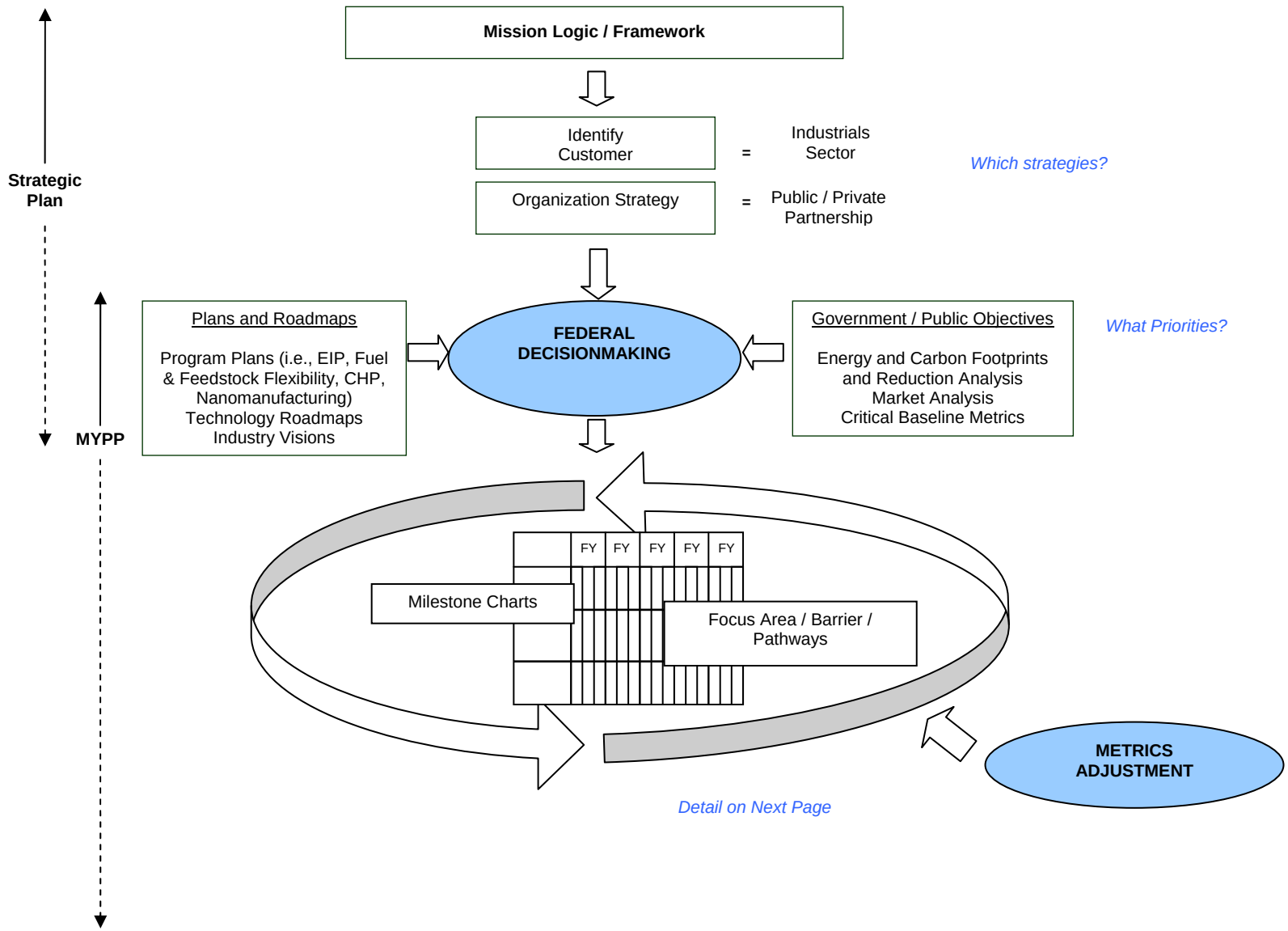


Figure 3-b. ITP Decision Process

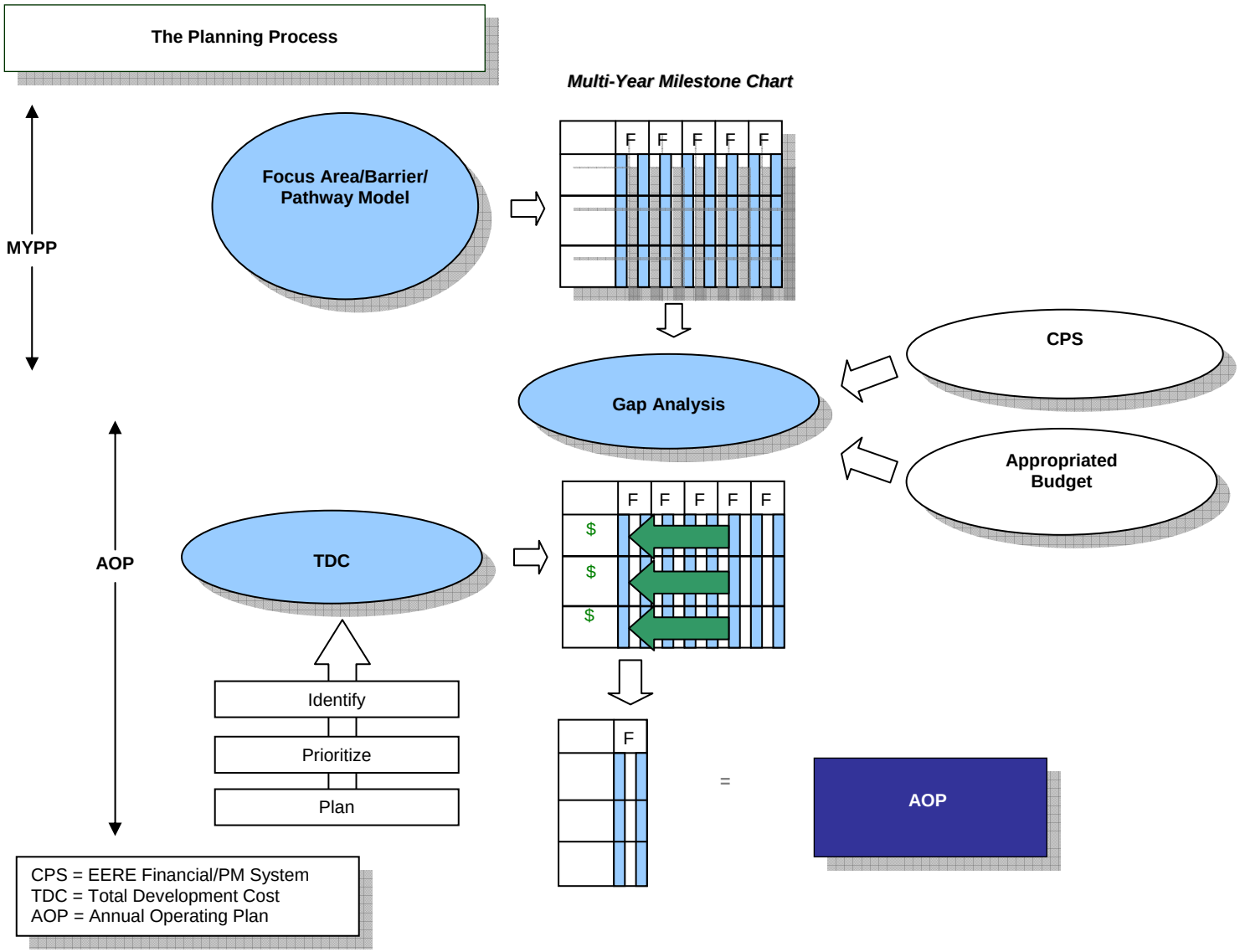


Figure 3-c. ITP Decision Process Detail

3.1.5 Peer Review Feedback Incorporation

As described in more detail in Section 3.3, ITP conducts peer review activities on a regular basis. Feedback from peer reviews is reviewed by ITP staff and actions are taken to address the feedback when appropriate. Actions undertaken could range from the re-direction of a research project to the re-direction or elimination of an element focus area. Feedback received could also influence the solicitation of future research topics. New technology areas could be suggested, or topic areas may receive additional emphasis to better balance the portfolio within an element.

3.1.6 Program Funding Mechanisms and Project Selection Process

ITP funds research projects through grants and cooperative agreements. Projects generally last from two to five years, and cost-sharing ranges from a minimum of 20% for applied research to a minimum of 50% for technology demonstrations. Projects are allocated funding on an annual basis. The Project Management Center (PMC) is responsible for executing research awards.

Universities selected through competitive solicitation to be in the Industrial Assessment Center program are also funded on an annual basis.

Each solicitation ITP conducts has a rigorous project selection process. Specific evaluation criteria are used to rate each proposal, with reviews being conducted by a merit review committee consisting of subject experts. A consensus is reached by the merit review committee, and specific projects are recommended. ITP then conducts a programmatic review before the Source Selection Official recommends approval of awards.

3.1.7 Cost Management and Monitoring

ITP monitors costs on a monthly basis, and receives detailed reports from the Project Management Center on costing information that is derived from DOE financial systems such as STARS.

The Project Management Center collects information on costing that is derived from DOE financial systems such as STARS and provides detailed reports to ITP staff monthly. Cost information is evaluated to determine funding actions and manage uncosted.

Extensive focus has been placed on the effective management of uncosted carryover balances to both reduce and optimize these balances using sound management practices. The Program has set an uncosted balances target for the end of FY 2008 that is at the minimum level considered necessary to ensure that the Program's progress continues unimpeded.

3.2 Program Analysis and Industry Input

ITP conducts rigorous analysis within its program elements, ranging from general trend studies and energy consumption analysis to potential opportunities and impacts of new technologies. ITP uses the results of its analytical activities to better focus its research activities. A broad look at the analytic approach and application is seen in the focus area/barrier/pathway model in Figure 3-d.

As shown in Figure 3-d, industry input (typically in the form of technology visions and roadmaps) is a key input to shaping the program. ITP works cooperatively with various industrial sectors to determine how industry priorities align with EERE/ITP mission and goals. The intersection of the industry input – mainly in the form of technology roadmaps – with Program goals has guided ITP in selecting R&D that will be valuable to industry, and will result in technologies that companies will adopt. The numerous industry technology roadmaps can be found on the ITP website.

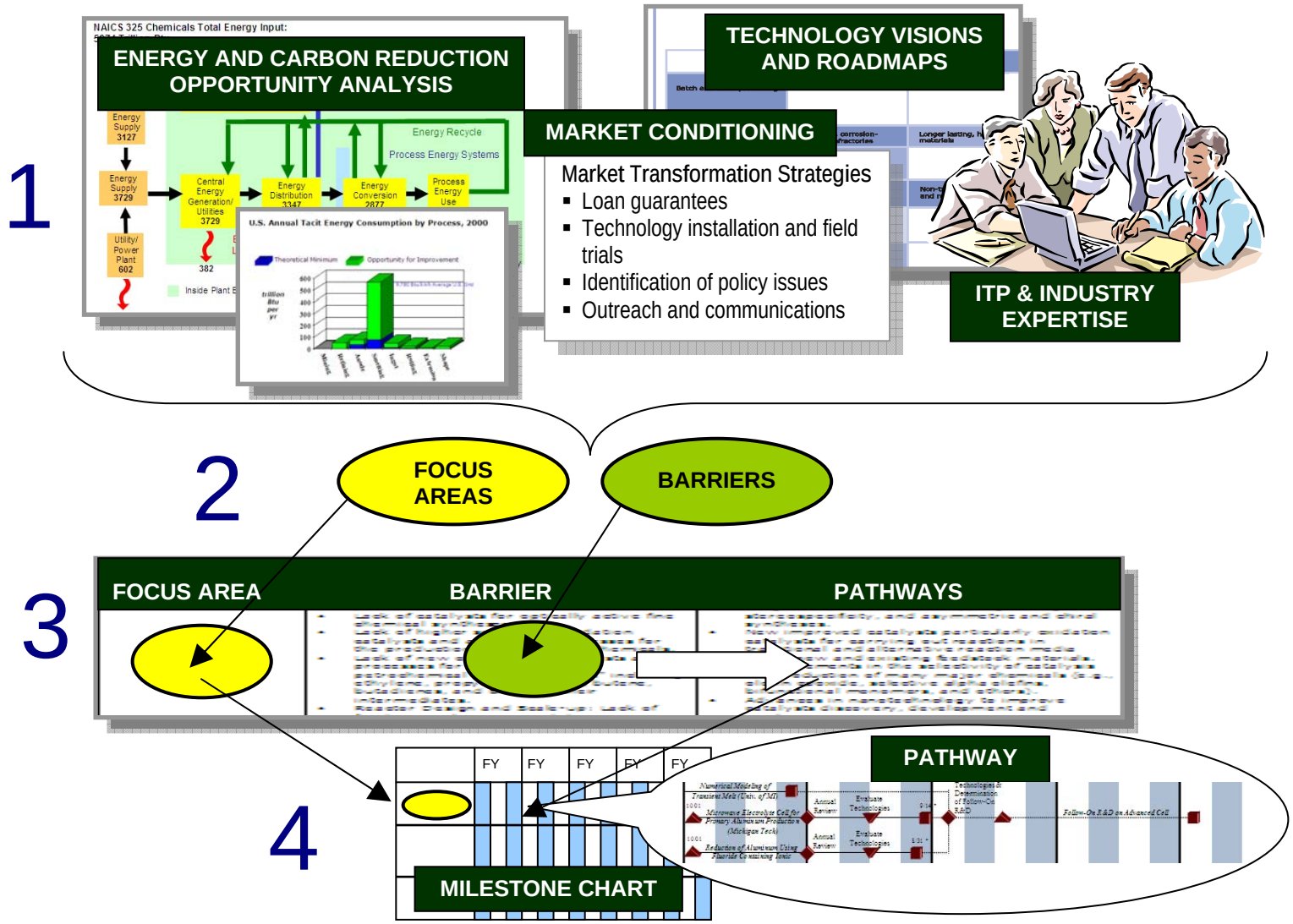


Figure 3-d. ITP Focus Area/Barrier/Pathway Model

3.2.1 Analytical Tools Used by the Program

The primary analytic tool ITP uses is the GPRA model for individual technology benefits.

3.2.2 Analytical Work Sponsored

Over the past several years, ITP has sponsored the development of numerous energy footprints and energy bandwidth reports. A description of these studies follows, and a summary of publications is listed in Section 3.2.5. ITP also sponsors the GPRA analysis annually, with the most recent official results presented in Section 3.3.2.

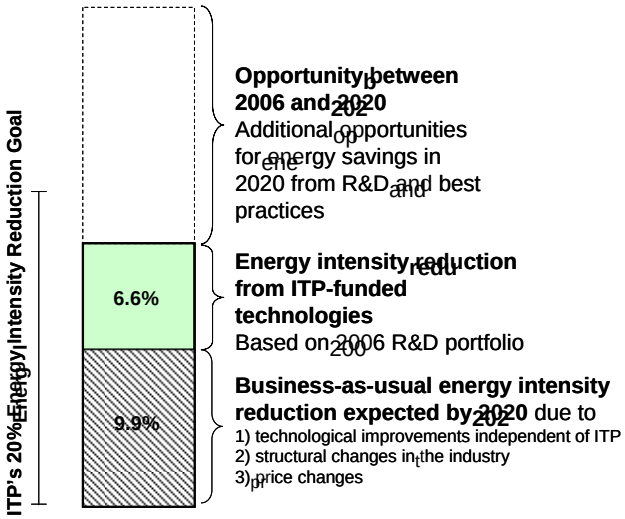
Contribution to Energy Intensity Reduction

Analysis is used to estimate the contribution that ITP-supported technologies will make toward meeting the Program's energy intensity reduction goals. For example, Figure 3-e shows the results of an analysis to determine the contribution of ITP-funded R&D projects to reducing the energy intensity of steel and aluminum manufacturing.

Bandwidth Studies

The purpose of a "bandwidth" study is to provide a realistic estimate of the potential amount of energy that can be saved in an industrial process. The bandwidth refers to the difference between the amount of energy that would be consumed in a typical process today using commercially available technology, the level of energy efficiency that is reasonably achievable, and the minimal amount of energy needed to carry out the process (based on the 2nd Law of Thermodynamics). Results from ITP's individual bandwidth studies for industry are included in the implementation plans found in Section 2, and are available on ITP's website.

Figure 3-e. Use of Analysis to Measure Contribution to Energy Intensity Reduction Goals (2006 Goal of 20% Reduction by 2020; Steel and Aluminum Portfolios Only)



Footprint Studies

A series of Energy Footprints has been developed to map the flow of energy supply and demand in U.S. manufacturing industries. Identifying the sources and end-uses of energy helps to pinpoint areas of energy-intensity and characterize the unique energy needs of individual industries.

Most importantly, the footprints identify where energy is lost due to inefficiencies, both inside and outside the plant boundary. Losses are critical, as they represent immediate opportunities to improve efficiency and lower energy consumption. Detailed energy footprint summaries for each of the industries that ITP focuses on are found in Section 2.

The results of the energy footprint and bandwidth studies helped inform the selection of the "technology platforms" that comprise ITP's Energy Intensive Process R&D (Figure 3-f).

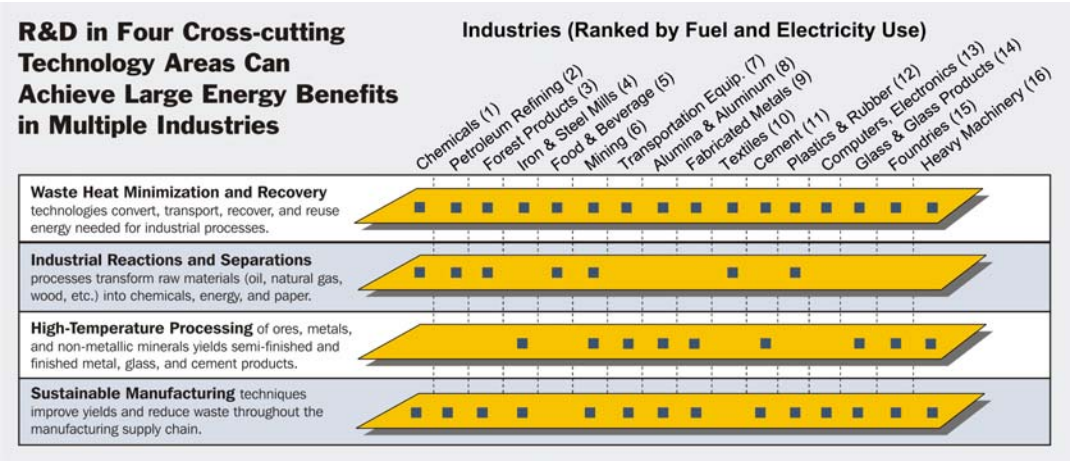


Figure 3-f. Technology Platforms Chosen Based on Rigorous Analysis

Market Analysis

Market analysis is a valuable tool for identifying the potential market(s) for a new technology, determining the likely acceptance and success of the technology in those markets, and estimating the future benefits that can be expected once the technology is commercialized and adopted. A variety of analyses are being performed to evaluate and characterize the potential markets for key technologies either proposed to or under development by ITP. These include:

- Development of market fact sheets that quantify expected markets and estimate technology penetration rates
- Thorough characterization of market potential, market barriers, and commercialization strategy as part of the solicitation and merit review process for new projects
- Development of commercial readiness assessments of key technologies, new program areas, and new projects
- Development of market transformation strategies in support of *the Save Energy Now* initiative and application of ITP technologies

ITP's Planning and Analysis Activities		
Element	2008 Milestones	Expected Completion
Planning	• Footprint and bandwidth studies • Energy Intensive Process research plan • CHP strategy document • Fuel and Feedstock Flexibility report • Nanomanufacturing workshop report	• FY07 • 1st Quarter • 1st Quarter • 2nd Quarter • 2nd Quarter
Focus	• Climate change/carbon analysis and projections • Commercial Readiness Assessments (CRAs) for 24 completed technologies • Initiation of next steps based on CRA recommendations • Initiate CRAs on new program/projects • Update *Impacts* commercialization database	• 1st Quarter • 2nd Quarter • 3rd Quarter • 4th Quarter • 2nd Quarter
Execution	• Solicitations and new starts based on the analyses • GPRA analysis • Stage-Gate evaluation of R&D projects • Incorporation of market risk identification and commercialization planning into solicitations • Work with RACs and MEPs for communication and outreach	• 3rd Quarter • 3rd Quarter • Ongoing • 2nd Quarter • Ongoing
Results	• Publication/dissemination of updated *Energy and Environmental Profile of the U.S. Petroleum Refining Industry* • Publication of EIP and CHP R&D plans and Fuel/Feedstock and Nanomanufacturing reports • Dissemination of GPRA results • Publication/dissemination of ITP *Impacts* report	• 1st Quarter • 2nd Quarter • 2nd Quarter • 2nd Quarter

3.2.3 Impact on Decision Process

Overview of Decision Process

ITP currently utilizes the milestone planning process to provide planning structure for its current portfolio and to assist in developing a vision for the future. The basic decision process is illustrated below in Figure 3-d.

The process begins with the consideration of the primary mission of EERE and the U.S. Department of Energy, and an understanding of how that mission fits within the planning, regulatory, and budgetary framework faced by ITP. This is known as the *mission logic*. Combining that logic with an understanding of ITP's customers, ITP's R&D needs, and a

firm understanding of the organizational strategy of ITP, the decision process then considers the needs of ITP's external stakeholders within the perspective of the objectives of government. By balancing the needs and driving forces behind industry with the greater social good, priorities are set within the context of inherently governmental activities, resulting in the identification of technical objectives that serve both a public and private need.

At the federal decision-making level, there is a translation of these various inputs into essential areas of R&D, represented by the technology focus areas that are identified in each industry and cross-cut planning unit. By narrowing the planning exercise to several high-level technology focus areas, it is possible to produce a basic milestone chart for each planning area that essentially represents a 5- year opportunity analysis.

Each opportunity analysis/milestone chart is a balance of goals against achievable metrics. By taking into consideration the capacities and capabilities of government, including knowledge of people in the organization, dollar size of the investments ITP can make, and potential impact of investment decisions, the planning process supports better-informed decision-making within ITP.

3.2.4 Key Analytic Assumptions Employed

ITP uses EIA data such as the Annual Energy Outlook and the Manufacturing Energy Consumption Survey, Department of Commerce data, and data provided by industry associations in its analysis. In forward-looking analysis, ITP attempts to be conservative in assumptions made.

3.2.5 Analytic Publications

The following studies are completed, with publications describing results available on the ITP website:

- *Energy and environmental profiles* for the aluminum, chemicals, forest products, glass, metal casting, mining, petroleum refining, steel, and supporting industries.
- *Bandwidth studies* for the aluminum, chemicals, forest products, glass, mining, metal casting, petroleum refining, and steel industries.
- *Energy footprints* for the aluminum, cement, chemicals, fabricated metals, food processing, forest products, glass, metal casting, mining, plastics, petroleum refining, steel, textiles, and transportation equipment industries (see Figure 3-g).
- *Energy use and loss analysis* identifying and quantifying opportunities for energy savings in manufacturing and mining.
- *Impacts CY 2005* quantifying the benefits of ITP-supported technologies that have been commercialized and are being deployed in the market.

Industry	NAICS
All Manufacturing	
Alumina & Aluminum	3313
Cement	327310
Chemicals	325
Fabricated Metals	332
Food and Beverages	311,312
Forest Products	321,322
Foundries	3315
Glass & Glass Products, Fiber Glass	3272, 3296
Iron & Steel Mills	331111
Machinery & Equipment	333,334,335,336
Mining Energy	
Petroleum & Coal	324
Plastics & Rubber	326
Textiles	313,314,315,316

Figure 3-g. Available Energy Footprints

The following publications are being completed and will be disseminated to the appropriate audiences in FY08:

- *Program plans for new ITP areas* including Energy Intensive Processes, Fuel and Feedstock Flexibility, Combined Heat and Power, and Nanomanufacturing
- *Commercial readiness assessments* for 24 ITP technologies.

Other studies of importance to individual program elements are referenced in Section 2.

3.3 Performance Assessment

ITP engages in the following performance assessment activities, which are discussed further in the following section: results-based performance reporting, peer reviews, technology tracking, and other performance assessments.

3.3.1 Performance Assessment Strategy and Plan

ITP's strategy for performance assessment is centered on the activities listed below, which occur on an ongoing basis.

Results-Based Performance Reporting

ITP reports using DOE's Joule Performance Measurement Tracking System, R&D Investment Criteria, and OMB's Program Assessment Rating Tool (PART). These activities are coordinated with the EERE Business Administration office. ITP provides quarterly and annual results for the Joule system, annual results for PART, and the R&D Investment Criteria as required.

Peer Reviews

ITP regularly engages external peers to conduct both prospective and retrospective reviews of program activities in order to ensure that the program is focusing its scarce resources on the most important technical opportunities, selecting high quality research proposals, and prudently investing public funds to maximize program benefits. Along with the development of a more rigorous planning process, ITP has improved its multi-level review process. Peer review activities are conducted by outside, independent experts of both program and subprogram portfolios to assess quality, productivity, and accomplishments. Reviewers also assess relevance of program success to EERE strategic and programmatic goals and overall management. Below is a summary of the three major components that were instituted beginning in Fiscal Year 2004.

1. "State of the Program" Corporate Programmatic Peer Review

Conducted every other year, the corporate peer review focuses on the broader strategies and focus of the overall program. The last corporate peer review was conducted in 2006, and the next corporate peer review is scheduled for 2008.

Leader: ITP Program Manager
Reviewers: Independent "Panel" – Contract e.g. NAS, etc.
Presenters: Lead Technology Managers, Technology Managers, Selected Others
Participants: Industry, Other Programs, Other Agencies
Criteria:
1. Do we have the right goals?
2. Are our strategies correct?
   - Have we been achieving success (progress against objectives, energy savings, etc.)?
   - Are we positioned for future success?
3. Are our measures driving success?
4. Are our practices (business, communications, outreach) suitable and improving?
5. Add sessions on:
   - Strategy/Planning

Investment
Focus Areas

Results/Protocol: Programmatic peer review report – signed by panel with recommendations.

2. "PMC Project Reviews"

As part of its oversight and management of the ITP portfolio, the Project Management Center will conduct peer reviews of individual project performance. These project baseline reviews are conducted at least once a year for each project, and are conducted at the discretion of the project manager.

Leader: Golden or NETL
Reviewers: Golden or NETL, Headquarters Technology Managers
Presenters: Principal Investigators
Participants: Industry, Lab, Principal Investigators, Other Technology Managers, Other Programs
Criteria:
1. Status of the project against cost, technical, schedule, baselines?
2. Evaluate scope – (increased emphasis, redirect, downselect, no change

Results/Protocol: A memo to file per project – documenting review including any recommendations, to contractors or scope changes.

Technology Tracking

ITP has assessed the progress of the technologies supported by its research programs for more than 20 years. ITP managers have long recognized the importance of developing accurate data on the impacts of their programs. Such data are essential for assessing ITP's past performance and can help guide the direction of future research programs.

Energy savings associated with specific technologies are estimated by Pacific Northwest National Laboratory (PNNL) through a rigorous process for tracking and managing data. When a technology's full-scale commercial unit is operational in a commercial setting, the technology is considered commercially successful and is placed on the active tracking list. When a commercially successful technology unit has been in operation for about ten years, that particular unit is then considered a mature technology and typically is no longer actively tracked. The active tracking process involves collecting technical and market data on each commercially successful technology, including details on the following:

- Number of units sold, installed, and operating in the United States and abroad (including size and location)
- Units decommissioned since the previous year
- Energy saved
- Environmental benefits
- Improvements in quality and productivity achieved
- Any other impacts, such as employment and effects on health and safety
- Marketing issues and barriers

Information on technologies is gathered through direct contact with either the technology's vendors or end users. These contacts provide the data needed to calculate the technology's unit energy savings, as well as the number of operating units. Therefore, unit energy savings are calculated in a unique way for each technology. Technology manufacturers or end users usually provide unit energy savings or at least enough data for a typical unit energy savings to be calculated. The total number of operating units is equal to the number of units installed minus the number of units decommissioned or classified as mature in a given year – information usually determined from sales data or end-user input. Operating units and unit energy savings can then be used to calculate total annual energy savings for the technology.

The cumulative energy savings measure includes the accumulated energy saved for all units actively tracked. These energy savings include the earlier savings from now mature and decommissioned units. Once cumulative energy savings have been determined, long-term impacts on the environment are calculated by estimating the associated reduction of air pollutants. This calculation is based on the type of fuel saved and the pollutants typically associated with combustion of that fuel and uses assumed average emission factors.

Program benefits documented by PNNL are conservative estimates based on technology users' and developers' testimonies. These estimates do not include either derivative effects, resulting from other new technologies that spin off of ITP technologies or the secondary benefits of the energy and cost savings accrued in the basic manufacturing industries downstream of the new technologies. Therefore, actual benefits are likely to be much higher than the numbers reported here. Nonetheless, the benefits-tracking process provides a wealth of information on the program's successes.

Other Performance Assessments

From time to time, ITP's performance is assessed by other means. These studies are often conducted for the entire EERE office, and could be general program evaluation studies, or internal technical program reviews. No set schedule for these performance assessments. ITP also conducts an annual GPRA analysis of expected portfolio benefits.

3.3.2 Data Collection to Support Routine and Periodic Performance Assessment

Corporate Benefits Data

"Using the program-provided outputs and assumptions, PBA works with the Benefits Analysis Team to prepare the technical assumptions needed to run the GPRA-NEMS and GPRA-MARKAL models. These models estimate the economic, energy, and environmental outcomes that would occur over the next 20 and 50 years, respectively, if the program is successful and the future unfolds according to the business-as-usual scenario. PBA then compares the outcomes of model runs that include EERE's programs with the outcomes of runs without EERE's programs. The benefits of EERE programs are determined by the improved economic, energy, and environmental outcomes provided by EERE's activities.

"In the coming years, PBA will extend its benefits estimation tools to address a range of uncertainties. PBA is developing alternative scenarios that will be used to illustrate the value of the current EERE portfolio under different futures along with tools and methods to explore how alternative program goals, budgets, and schedules can make EERE's benefits more robust to withstand uncertainties."

Official Benefit Projections

The Government Performance and Results Act (GPRA) of 1993 seeks to shift the focus of government decision-making and accountability away from the preoccupation with the activities that are undertaken, such as grants dispensed, to a focus on the results of those activities, such as real gains in responsiveness, or program quality. Under the Act, agencies are to develop multi-year strategic plans, annual performance plans, and annual performance reports that evaluate the success of the organization's strategic plan. The intent is to make government more accountable for results to its ultimate customer – the taxpayer. Each year, ITP estimates the future benefits of its program activities, pursuant to the requirements of GPRA. These estimates (Figures 3-h and 3-i) are based on the composition of projects contained in the current portfolio, which varies from year to year.

Item	2010	2015	2020	2025	2030
Primary Energy Savings (TBtu)	192	721	1,526	2,337	2,086
Baseline Industrial Energy Use[1] (TBtu)	34,460	35,600	36,950	38,770	40,580
Primary Energy Savings as Percent of Baseline (%)	0.6	2.0	4.1	6.0	5.1

Figure 3-h. Industrial Technologies Program: GPRA 2008 QM Rollup[2]

[1] DOE/EIA, *Annual Energy Outlook 2006*, Reference Case Forecast.

[2] GPRA08 Quality Metrics Methodology and Results, INDUSTRIAL TECHNOLOGIES PROGRAM, October 2006

GPRA 2008 PROJECTED PROGRAM BENEFITS

INDUSTRIAL TECHNOLOGIES PROGRAM

Planning Element	YEAR 2010	YEAR 2020	YEAR 2030
	Primary Energy Savings (TBtu)	Primary Energy Savings (TBtu)	Primary Energy Savings (TBtu)
Aluminum	0.4	13.2	12.2
Chemicals	8.1	281.2	260.9
Forest Products	1.8	50.4	90.8
Metal Casting	0.0	39.5	87.4
Steel	15.8	98.8	277.5
Industrial Materials	0.04	93.7	308.7
Sensors & Automation	7.3	138.9	17.0
Combustion	2.0	294.7	572.4
IAC	8.4	75.1	98.2
Best Practices	147	456	456

Source: *GPRA08 Quality Metrics – Methodology and Results," Energetics Inc., October 2006*

Figure 3-i. Industrial Technologies Program: GPRA 2008 Projected Program Benefits

Unquantifiable Benefits and Externalities

Beyond direct energy and environmental savings, technologies developed by ITP also often provide other benefits that are not as easy to quantify. These benefits include increases in productivity, retention of jobs, and non-energy cost savings.

Program Impact in 2020 and 2050

The Industrial Technologies Program covers a wide range of technologies, industries, and end-use applications. The heterogeneity of the program's R&D activities makes it difficult to represent program activities explicitly in the MARKAL-GPRA06 framework. Instead, the projected ITP goals by various industries were aggregated into MARKAL-GPRA06 industrial energy-use demand categories as a set of conservation supply curves.

The potential savings represented in these conservation measures yield an overall reduction in delivered energy consumption. The reduction in electricity demand also leads to the reduction in coal and gas-based generation. Both conservation and reduction in electricity demand result in less investment in end-use devices and electric-generation capacity on the supply side. The environmental benefits estimated for ITP's R&D activities are shown in Figure 3-j.

Annual Benefits	2020	2050
Environmental		
Carbon Savings (million metric tons carbon equivalent/yr)	31	18
Cumulative Carbon Savings (million metric tons carbon equivalent)	174	791

Figure 3-j. FY07 Industrial Technologies Program: Environmental Benefits Estimates for (MARKAL-GPRA08)

Base Case without Program Activities in 2020 and 2050

Without ITP program activities, the industrial sector will consume a higher quantity of energy, as the development and adoption of energy-efficient technologies would be significantly reduced.