Energy Conservation Standards Rulemaking
Peer Review Report

Prepared Pursuant to the Office of Management and Budget's "Final Information Quality Bulletin for Peer Review"

U.S. Department of Energy

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Table of Contents

LIST OF ACRONYMS 3
EXECUTIVE SUMMARY 4
1. INTRODUCTION 6
2. PURPOSE AND OBJECTIVE 6
3. SCOPE 7
4. CHARGE 8
5. RESULTS 10
6. THE REVIEW PANEL 10
7. THE REVIEW PROCESS 12
8. SUMMARY OF THE REVIEWS 13
8.1 RESULTS OVERVIEW 13
8.2 ANALYSIS A – SCREENING AND ENGINEERING ANALYSES 16
8.3 ANALYSIS B - MARKUPS FOR APPLIANCE PRICE DETERMINATION, LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS/LIFE-CYCLE COST, CONSUMER SUB-GROUP ANALYSIS 18
8.4 ANALYSIS C - SHIPMENTS ANALYSIS AND NATIONAL IMPACT ANALYSIS 20
8.5 ANALYSIS D - MANUFACTURER IMPACT ANALYSIS 22
8.6 ANALYSIS E - UTILITY IMPACT ANALYSIS, ENVIRONMENTAL ASSESSMENT, EMPLOYMENT IMPACT ANALYSIS, AND REGULATORY IMPACT ANALYSIS 24
9. RESPONSE TO PEER REVIEWER COMMENTS 27
9.1 CROSS-CUTTING: COMMENTS AND ISSUES 27
9.2 SCREENING AND ENGINEERING ANALYSES: COMMENTS AND ISSUES 32
9.3 MARKUPS FOR APPLIANCE PRICE DETERMINATION, LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS/LIFE-CYCLE COST, CONSUMER SUB-GROUP ANALYSIS: COMMENTS AND ISSUES 35
9.4 SHIPMENTS ANALYSIS AND NATIONAL IMPACT ANALYSIS: COMMENTS AND ISSUES 38
9.5 MANUFACTURER IMPACT ANALYSIS: COMMENTS AND ISSUES 41
9.6 UTILITY IMPACT ANALYSIS, ENVIRONMENTAL ASSESSMENT, EMPLOYMENT IMPACT ANALYSIS, AND REGULATORY IMPACT ANALYSIS: COMMENTS AND ISSUES 44

LIST OF ACRONYMS

AEO – Annual Energy Outlook
AFUE – Annual Fuel Utilization Efficiency
ANOPR – Advance Notice of Proposed Rulemaking
ANSI – American National Standards Institute
ASME – American Society of Mechanical Engineers
ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers
BT – Building Technologies Program
Btu – British Thermal Unit
CBECS – Commercial Buildings Energy Consumption Survey
DOE – Department of Energy
DT – Distribution Transformers
EERE – Office of Energy Efficiency and Renewable Energy
EIA – Energy Information Administration
GAO – U.S. Government Accountability Office
GRIM – Government Regulatory Impact Model
IMPLAN – Impact Analysis for Planning
LCC – Life-Cycle Cost
MIA – Manufacturer Impact Analysis
NAECA – National Appliance Energy Conservation Act
NAS – National Academy of Sciences
NETL – National Energy Technology Laboratory
NEMS – National Energy Modeling System
NES – National Energy Savings
NIA – National Impact Analysis
NOPR – Notice of Proposed Rulemaking
NPV – Net Present Value
OMB – Office of Management and Budget
OSTP – Office of Science and Technology
PBP – Payback Period
PI – Principal Investigator
RECS – Residential Energy Consumption Survey
SEC – U.S. Securities and Exchange Commission
TSD – Technical Support Document

U.S. Department of Energy
Building Technologies Program
Appliance Standards and Analysis Team

PEER REVIEW PROCESS DESCRIPTION

EXECUTIVE SUMMARY

The Department of Energy (DOE) prepared this report in response to the Office of Management and Budget's (OMB's) "Final Information Quality Bulletin for Peer Review" (the Bulletin). DOE's Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Program (BT), held formal in-progress peer reviews of the Appliance Standards Program's processes and analyses on June 28-29, 2005, at DOE headquarters in Washington, D.C.

DOE provided to the reviewers specific appliance standards rulemaking analyses for three product types: commercial unitary air conditioners and heat pumps; distribution transformers (DTs); and residential furnaces and boilers. These analyses are documented in the Technical Support Documents (TSDs), which accompanied the Advance Notices of Proposed Rulemakings (ANOPRs) published in July of 2004. The selection of reviewers, including consideration of expertise, panel balance, conflicts of interest, and independence; employment of the peer review mechanisms (e.g., letter reviews, panels, etc.); and maintenance of transparency of the review process were in compliance with OMB guidance.

The BT peer review covers the three major rulemakings currently or recently in the Appliance Standards Program portfolio at the time of the Peer Review. The evaluation is of these individual projects and is conducted against objective criteria. The Peer Review results are primarily being used to assist managers of the rulemakings that were reviewed, but they are also used at the Program level in crosscutting discussions to improve the analysis structure and also for budgetary planning purposes.

The program received a mean Overall Assessment score of 7.9 (on a scale from 1 to 10), with four analyses receiving a score of 8.0 and the fifth receiving a score of 7.4. These scores fall squarely into the "good" category (categories: poor, fair, average, good, and outstanding). In support of the good scores, the reviewers were complimentary of the program in the areas relating to the composition of the project teams, technical approach, and the level of stakeholder involvement. Reviewers noted the experience and technical diversity of staff included on each team (representing a mix of engineering and economic expertise). The technical approaches employed were judged to be rigorous, comprehensive, and meticulous. Reviewers were impressed with the level of stakeholder involvement in all of the projects and analyses which they regard as critical to building confidence and significantly reducing missteps.

The Review Panel's input also established several important themes that DOE will pay particular attention to in its rulemakings. These themes included analytical complexity, transparency of analysis, validity of assumptions (e.g., discount rates), characterization of uncertainty and variability, insurance of checks and balances on the rulemaking process, and the importance of identifying key drivers within specific analyses (e.g., identifying drivers of the engineering cost-efficiency relationships).

Section 9 of this report contains the Review Panel's specific comments, and DOE's detailed responses to these comments. Section 9 begins with a sub-section that incorporates comments that cut across all analyses including analysis complexity, verification of analysis assumptions, and the characterization of uncertainty and variability. Subsequently, the comments are organized in Section 9 according to analysis type. In some cases, DOE's responses serve to elucidate how its current processes and analytic structure sufficiently address the Panel's thematic concerns.

The comments received did not require changes to the three product analyses that the panel reviewed. However, the Review Panel's comments influenced the development of DOE's plan for conducting future standards rulemakings, as described in the DOE's January 2006 report to Congress. (See the January 2006 report: *Energy Conservation Standards Activities, Submitted Pursuant to Section 141 of the Energy Policy Act of 2005 and to the Conference Report (109-275) to the FY 2006 Energy and Water Development Appropriations Act*). In particular, DOE will make a concerted effort to reduce the analytical complexity of its analyses, where appropriate, with the goal of increasing the output of the program while simultaneously improving transparency and stakeholder participation. DOE plans to reduce complexity on a rule-specific basis, when supported by stakeholders through the notice and comment rulemaking process. One potential area for complexity reduction might involve limiting or reducing the number of product classes for which DOE conducts engineering analyses in a particular rulemaking (DOE would instead extrapolate results across product classes). DOE does not want to sacrifice the characterization of variability (and uncertainty) – vital to understanding the distributional effects of Appliance Standards rulemakings (and knowledge gaps) – as DOE endeavors to reduce analytical complexity. However, DOE will tailor the characterization of variability to each rulemaking taking into account factors such as: data availability, stakeholder input, and exclusion of variables from the variability analysis that have a minor impact on the results.

1. INTRODUCTION

DOE prepared this report in response to the Office of Management and Budget's (OMB's) "Final Information Quality Bulletin for Peer Review" (the Bulletin). On December 16, 2004, the Office of Management and Budget (OMB), in consultation with the Office of Science and Technology Policy (OSTP), issued the Bulletin. 70 FR 2664 (January 14, 2005). The Bulletin establishes that qualified specialists shall peer review certain scientific information, including influential scientific information related to agency regulatory actions before the Federal government disseminates it. The purpose of the Bulletin is to enhance the quality and credibility of the government's scientific information.

DOE's Office of Energy Efficiency and Renewable Energy (EERE), Building Technologies Program (BT), held formal in-progress peer reviews of the energy efficiency standards development process and analyses on June 28-29, 2005, at DOE headquarters, in Washington, D.C. The reviews covered all of the analyses performed in the course of a rulemaking: screening and engineering analyses; markups for appliance price determination; life-cycle cost and payback period analyses; consumer sub-group analysis; shipments analysis; national impact analysis; manufacturer impact analysis; utility impact analysis; environmental assessment; employment impact analysis; and regulatory impact analysis. Under the Bulletin, these analyses as applied to the appliance standards rulemakings are "influential scientific information." The Bulletin defines the term "influential scientific information" as "scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." 70 FR 2667 (January 14, 2005).

2. PURPOSE AND OBJECTIVE

On June 28-29, 2005, the BT Appliance Standards and Analysis Team held formal in-progress peer reviews covering the analyses performed in support of the development of new or revised minimum energy efficiency standards. For the purposes of this exercise, DOE defined "in-progress peer review" to mean a rigorous, formal and documented evaluation process using objective criteria and qualified and independent reviewers to make a judgment of the technical/ scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects.

DOE adapted this definition from definitions used by the DOE, National Academy of Sciences (NAS), OMB, the U.S. Government Accountability Office (GAO), and other Federal agencies and institutions. This definition distinguishes in-progress peer review from other types of peer review, such as merit reviews to select winners of competitive solicitations or readiness reviews to determine when a technology is ready to move to the next phase of development, as well as from other management activities such as quarterly milestone reviews or budget reviews.

3. SCOPE

This peer review exercise focused on the individual analysis sections which DOE conducts during the standards rulemaking process. These analyses and its purpose are described below:

- Screening Analysis - to review each technology option and determine if it is practicable to manufacture, install, and service; would adversely affect equipment utility or equipment availability; or would have adverse impacts on health and safety.

- Engineering Analysis - to develop cost/efficiency relationships that show the manufacturer's cost of achieving increased efficiency.

- Markup Analysis - to describe how manufacturer prices are marked up along distribution channels to obtain retail prices (including installation costs).

- Life-Cycle Cost (LCC) and Payback Period (PBP) Analysis - to calculate, at the customer level, the discounted savings in operating costs (less maintenance and repair costs) throughout the estimated average life of the covered equipment, compared to any increase in the installed cost for the equipment likely to result directly from the imposition of the standard.

- Shipments Analysis - to forecast shipments by product class, in the absence, and presence, of new energy conservation standards. DOE first develops a base-case forecast of equipment shipments in the absence of new standards. This forecast includes a distribution of shipments by efficiency level.

- National Impact Analysis - to assess the aggregate impacts at the national level, including national energy savings (NES) and the net present value (NPV) of total energy bill savings less increased equipment prices.

- Life-Cycle Cost Sub-Group Analysis - to evaluate variations in key factors (e.g., energy prices, equipment use behavior, installation costs) that might cause a standard to impact particular customer sub-populations differently from the overall population.

- Manufacturer Impact Analysis - to estimate the financial impact of standards on manufacturers and to calculate impacts on competition, employment, and manufacturing capacity.

- Utility Impact Analysis - to estimate the effects of proposed standards on electric and gas utilities.

- Employment Impact Analysis - to assess the aggregate impacts on national employment.

- Regulatory Impact Analysis - to present major alternatives to proposed standards and to compare its costs and impacts.

4. CHARGE

DOE conducted the peer reviews in accordance with the requirements outlined in Bulletin from OMB (Available at: http://www.whitehouse.gov/omb/memoranda/fy2005/m05-03.pdf). The selection of reviewers, including consideration of expertise, panel balance, conflicts of interest, and independence; employment of the peer review mechanisms (e.g., letter reviews, panels, etc.); and maintenance of transparency of the review process were in compliance with OMB guidance.

DOE assembled a panel of experts to review the analysis used in the standards rulemaking process. The peer review panel consisted of seven reviewers DOE determined to be qualified to evaluate the assigned group of analyses, in accordance with the Bulletin. Each group of analyses displayed some technical diversity. Therefore, in the reviewer-selection process DOE strived to have each analysis covered by at least two reviewers who are experts in the principal scientific or technical disciplines of the project. Panel members included reviewers from academic institutions, industry, research laboratories, consultancies and other entities, as appropriate. (The panel members are identified in section 6, below.)

DOE and BT structured the Peer Review based on the EERE Peer Review Guide dated August 2004 (Available at: http://www1.eere.energy.gov/ba/pdfs/2004peerreviewguide.pdf). DOE used the EERE Peer Review guide to develop the "Guidelines for Peer Reviewers" that DOE provided to the reviewers in advance of the Peer Review. The reviewers based their evaluation of each project on: a) written material (a project description and supporting documentation) and b) a formal presentation of the project, including a question-and-answer period at a peer review meeting for the relevant program area. The Principal Investigator (PI) for each project was responsible for preparing the written material and delivering the presentation before the Peer Review Panel.

The peer review was based on a consistent set of criteria for evaluating all analyses in all subprograms. The Building Technologies Program derived these criteria from the EERE Peer Review Guide, tailored to meet BT needs. The evaluation criteria are listed below.

- **Approach –** This criterion is primarily a measure of the inputs to the project: the quality of the technical approach, people, facilities and other resources involved. This criterion also includes technical quality in the execution of the technical approach.

- **Accomplishments -** Accomplishments are a measure of progress and outputs: what has been achieved. This includes the overall progress (as measured by internal milestones) and the quality, volume and probable effectiveness of the deliverables and external outputs from the project.

- **Productivity -** Productivity is a relative measure of progress and outputs: what has been achieved and what is the value of the program's output compared to costs and risk levels.

- **Relevance** – Relevance is a measure of importance. Relevance means the degree to which the project contributes to the Program's and DOE's mission, goals, or strategy, and to society. For most analyses, relevance measures how well the project addresses important technical, market, or policy barriers. For more basic research, this criterion includes the project's contribution to the underlying science and the knowledge base.

- **Overall Assessment** - A general, overall rating of the project.

DOE asked the Peer Review Panel to review analyses with the EERE mission, BT Program goal, and the goal of the Appliance Standards program in mind.

- ***EERE Mission*:** Strengthen America's energy security, environmental quality, and economic vitality through public-private partnerships that: enhance energy efficiency and productivity; bring clean, reliable, and affordable energy production and delivery technologies to the marketplace; and make a difference in the everyday lives of Americans by enhancing their energy choices and their quality of life.

- ***BT Program Goal*:** By 2025, the Building Technologies Program will create technologies and design approaches that enable the construction of net-zero energy buildings at low incremental cost.

All principal investigators (PIs), who are the lead researchers at the National Laboratories or consultancies that support the Appliance Standards Program, had to complete and submit a project abstract limited to 2 pages, a project description not to exceed 10 pages, and supporting documentation, such as key project technical reports, before the start of the peer review meetings. Principal investigators were also required to give formal presentations at the meetings.

Reviewers received the project description and supporting documentation at least two full weeks before the peer review meetings. DOE expected reviewers to fully review the project description and selectively review supporting documentation prior to the meetings. The panel convened in a formal meeting to hear the oral presentations by the PIs, ask questions and evaluate analyses against the criteria. Reviewers completed their reports using the peer reviewer evaluation forms during the meetings so that the review process was essentially completed at the end of the meetings. DOE provided an agenda for the two days of meetings. DOE expects no follow-up action by the reviewers.

The expert panel members assessed the importance of achieving the project's objectives in terms of actual or potential contribution to the broader BT program mission, goals, or strategy and to society (energy savings, net present value of consumer benefit, and reduced emissions of nitrogen oxides and carbon dioxide). Reviewers also evaluated the adequacy of the analytical tools (i.e., models, spreadsheets, etc.) being used. For these analyses, reviewers considered the degree to which the project supports the proposed energy efficiency standards and/or how much critical information it adds to the knowledge base.

The Peer Review Panel reviewed DOE rulemaking analysis for three product types: commercial unitary air conditioners and heat pumps; distribution transformers (DTs); and residential furnaces and boilers. These analyses are documented in the Technical Support Documents (TSDs), which accompanied the Advance Notices of Proposed Rulemakings (ANOPRs) published in July of 2004.

DOE asked the panel to focus on the analyses described above in section 3, and to evaluate the analytical tools, assumptions and input data according to the above-described evaluation criteria (approach, accomplishments, productivity, relevance, and "Overall Assessment").

5. RESULTS

DOE required that each reviewer complete an evaluation form for each analysis presented. DOE treated the reviewers' evaluations separately, and there were no efforts to develop a consensus among peer reviewers on each project.

DOE management will use the peer review results to make decisions about whether to continue, modify, or redirect individual analyses, assess overall program performance and productivity, and identify areas where further study is desirable. DOE will also use results to provide input for the FY2007 planning process and meet the OMB requirements for rulemakings.

6. THE REVIEW PANEL

DOE selected the Review Panel based on the policies in the National Academy of Sciences (NAS), "Policy and Procedures on Committee Composition and Balance and Conflicts of Interest Used in the Development of Reports," dated May 12, 2003 (Available at: http://www.nationalacademies.org/coi/index.html). DOE required each reviewer to sign a conflict of interest statement and a nondisclosure agreement. A panel of seven reviewers evaluated five Appliance Standards-related analyses.

The Review Panel included:

John Cuttica is the coordinator of Energy and Environmental Programs at the University of Illinois at Chicago's Energy Resources Center. He holds an MS in Engineering Administration from George Washington University and a BSEE from Catholic University. He has more than 30 years experience managing the development of high-efficiency, energy-conserving consumer products and energy-conversion equipment. He has extensive experience in technology development, R&D program management, product commercialization, marketing, and market development.

Don Duckett is a Technical Sales Engineer for Hughes Supply. He holds a BSEE from the University of Texas, El Paso. He has more than 35 years experience in the design of transformers. He has been a working member of the IEEE Transformer Committee of the Power Engineering Society for over 35 years, and is currently co-chair of the working group on the guide for Distribution Transformer Efficiency.

James Fay is President of the North Star Energy Group, which focuses on helping energy companies with market and business analysis for new technologies, products and services. He has more than 20 years experience in the energy industry, primarily focused on natural gas-related issues. He holds a BSME.

Karl Johnson holds an MS in mechanical engineering/product design from Stanford University. He is currently a Program Manager at the California Institute for Energy and Environment where he serves as a research planner, manager and evaluator for various energy efficiency, peak electric demand, energy policy, sustainability, alliance development and market connection activities. He possesses more than 25 years of professional experience in energy management, energy-efficiency-technology development and implementation, strategic energy planning, utility deregulation, renewable and recycling technologies, integrated system analysis and utility-cost management.

James Mills served as the Program Director for the Federal Trade Commission's Appliance Labeling Program from 1980 until 2001. He concurrently served as an attorney in the Bureau of Consumer Protection from 1969 through 2001.

Mark Rea is a Professor of Architecture and Cognitive Sciences and the Director of the Lighting Research Center at Rensselaer Polytechnic Institute. He has more than 25 years experience in architectural lighting design research and practice. He holds a PhD in Biophysics from Ohio State University.

Steven Wade is a project leader/team leader at the DOE Energy Information Administration responsible for the design, implementation and management of structural energy forecasting models for the U.S. buildings sector as part of the National Energy Modeling System. He has more than 18 years experience with modeling the energy efficiency impacts of policies and standards, with a particular focus on the buildings sector. He has examined the impacts of distributed generation technologies on the buildings sector, the drivers behind energy equipment choices, and the impacts of

technological change and diffusion in the buildings sector. He holds a PhD in Economics from Arizona State University.

7. THE REVIEW PROCESS

During the Peer Review, members of each analysis team made presentations to the Review Panel, and Review Panel members were free to ask questions of the project teams. Following the presentations and question-and-answer sessions, Review Panel members evaluated each analysis using a 10-point scale as follows:

SCORE	LEVEL	QUALITY OR PERFORMANCE CHARACTERISTICS
9 – 10	Outstanding	Project is designed with an expert and innovative approach with exceptional execution by an outstanding team
7 – 8	Good	A skillful approach with highly effective execution by a capable, balanced team of experienced investigators
5 – 6	Average	A reasonable approach and appropriate execution with room for improvement by a good team that lacks some skills
3 – 4	Fair	An approach with a missing element or an out-of-date approach with some gaps in execution by a rather weak team
1 – 2	Poor	An approach with major weaknesses and poor execution by a team with serious shortcomings

The analyses were grouped into five categories for the purpose of the review:

Analysis A - Screening and Engineering Analysis;

Analysis B - Markups for Appliance Price Determination, Life-Cycle Cost and Payback Period Analysis/Life-Cycle Cost, Consumer Sub-Group Analysis;

Analysis C - Shipments Analysis and National Impact Analysis;

Analysis D - Manufacturer Impact Analysis; and

Analysis E - Utility Impact Analysis, Environmental Assessment, Employment Impact Analysis, and Regulatory Impact Analysis

For each of the five analyses, each Review Panel member assigned ratings in the following categories:

- Approach (including the quality of technical approach and the quality of the project team);
- Accomplishments (including technical progress and quality of work);
- Productivity; and
- Relevance of the work to BT's goals.

Review Panel members then assigned an Overall Assessment rating to each analysis. DOE encouraged the Review Panel members to elaborate upon their ratings in writing. DOE then compiled summaries of the reviewer's written comments, provided in section 8. In their written comments, reviewers identified issues that were not sufficiently addressed during the meeting of the Peer Review Panel. A summary of the reviewers' comments and the DOE response to these comments are provided in section 9 of this report.

8. SUMMARY OF THE REVIEWS

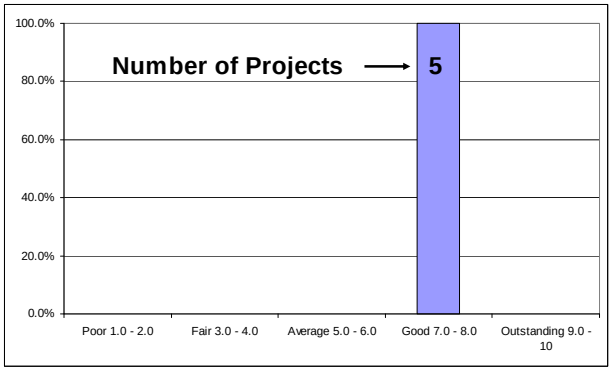
This section provides a summary of the reviewers' written comments and scores, as well as highlights of the evaluations provided by individual commenters. DOE provides specific responses to each comment in section 9.

8.1 RESULTS OVERVIEW

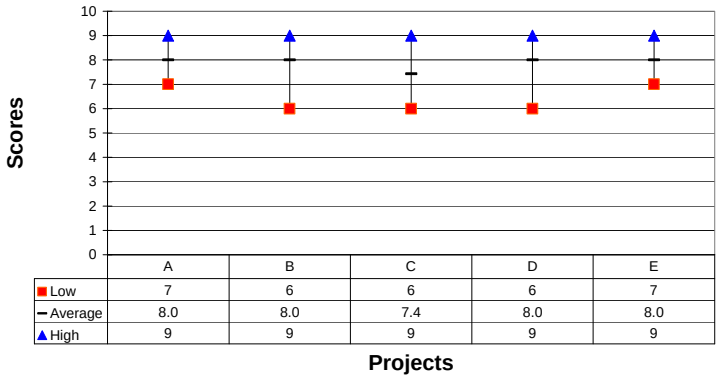
Looking across the five analyses identified in section 7 (alphabetical descriptors are assigned in section 7 and used below):

- Overall Assessment scores range from a low of 6 to a high of 9.
- Mean Overall Assessment score: 7.9.
- Median Overall Assessment score: 8.0.

The histogram at the right shows the concentration of reviewers' Overall Assessment scores; every analysis was judged to be Good based on the average score received. The chart at the right shows the range of Overall Assessment scores for each project.



Range of Scores for "Overall Assessments"



The evaluations of all analyses show a high degree of consensus among the reviewers. Where consensus is less (as indicated by a greater distance between the arrow and the box at the end of each bar), this is due either to a single outlying score (a single score of 6 in analyses B and D, for instance) or, in the case of analysis C, a relatively even spread of scores between the high and low

marks. There is very little to separate these five analyses in terms of its Overall Assessment scores.

Reviewers' marks in the four categories of approach, accomplishments, productivity, and relevance are shown graphically on the next page. Each graph corresponds to one of the four rating categories. On each graph, the letters A through E represent the analyses. For each analysis, the range of reviewers' scores is depicted by the length of a vertical arrow, with a black dash representing the average score of the reviewers. This average score across the reviewers is also reported numerically on the graphs. Taking the average of the reviewers' average scores across the analyses (not shown), the following observations can be made about the four rating categories:

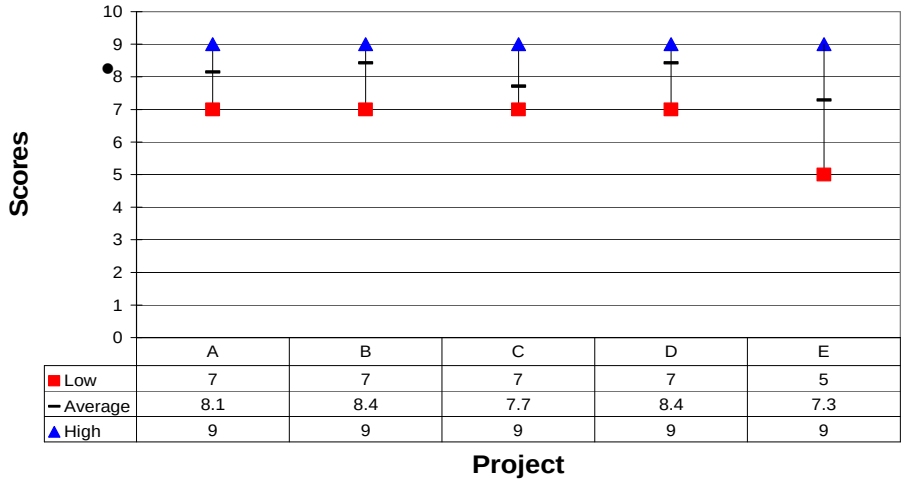
- "Productivity" and "Accomplishments" garnered the lowest average scores: 7.7 and 7.8, respectively.
- "Relevance" displayed the highest average score: 8.1.
- "Approach" received an 8.0.

Thus, after averaging across both reviewers and analyses, there is little variation in the scoring across categories.

The graphs on the next page also show that, within each category (i.e., on each graph), the average scores of the reviewers (represented by the black dashes) show little variation across the analyses (represented by the letters A through E).

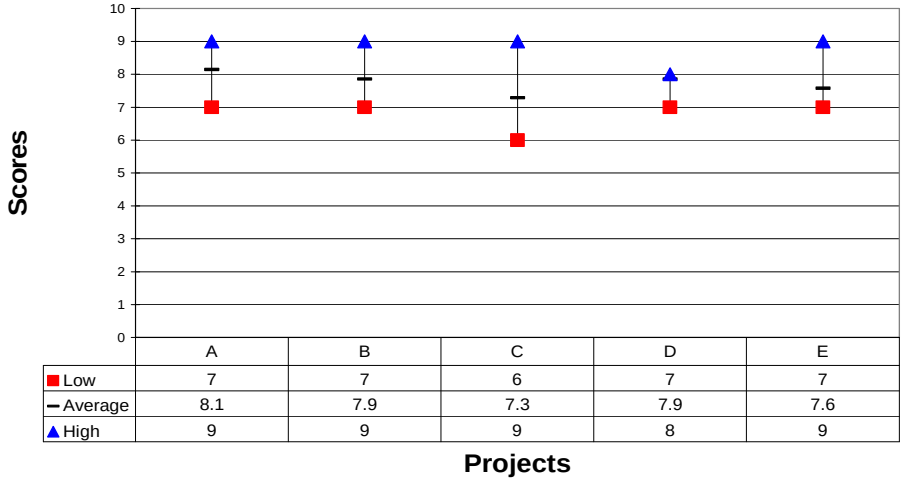
Finally, with a few exceptions, the reviewers' scores are relatively concentrated for a given category (i.e., for a given graph) within a given analysis (represented by the letters A through E). The most notable exception is the variation across reviewers' scores in the productivity category. The arrows are relatively long for four of the five analyses within the productivity category, indicating a lack of consensus among the reviewers about the level of productivity within each analysis.

Range of Scores for "Approach"



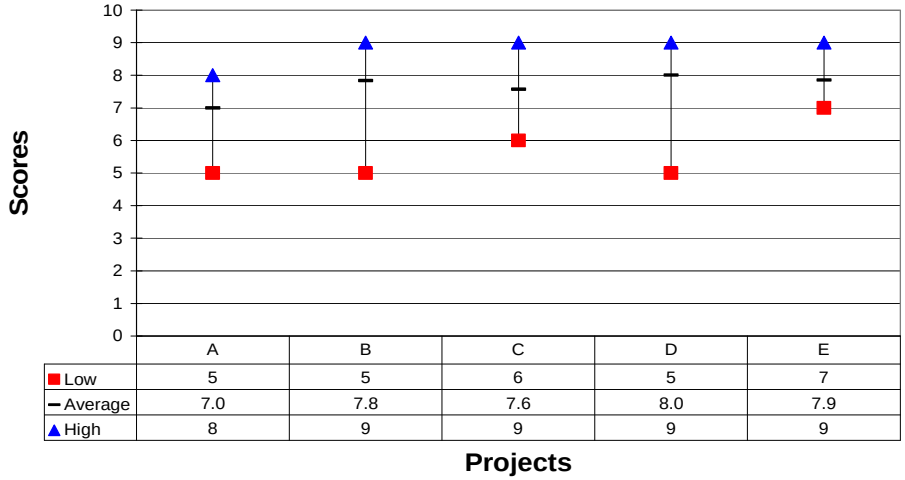
	A	B	C	D	E
Low	7	7	7	7	5
Average	8.1	8.4	7.7	8.4	7.3
High	9	9	9	9	9

Range of Scores for "Accomplishments"



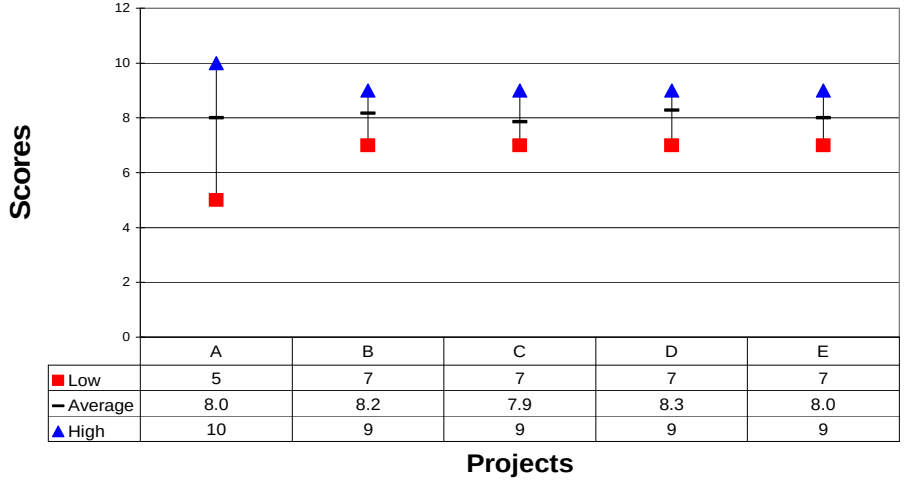
	A	B	C	D	E
Low	7	7	6	7	7
Average	8.1	7.9	7.3	7.9	7.6
High	9	9	9	8	9

Range of Scores for "Productivity"



	A	B	C	D	E
Low	5	5	6	5	7
Average	7.0	7.8	7.6	8.0	7.9
High	8	9	9	9	9

Range of Scores for "Relevance"



	A	B	C	D	E
Low	5	7	7	7	7
Average	8.0	8.2	7.9	8.3	8.0
High	10	9	9	9	9

8.2 ANALYSIS A – SCREENING AND ENGINEERING ANALYSES

Approach

Average Score: 8.1 Range of Scores: 7-9

Reviewers give very high Approach scores, citing "well thought-out and rigorous" procedures and an approach that has been refined over time. Reviewers note the approach is strengthened by incorporating multiple teams and obtaining "excellent stakeholder input." One reviewer appreciates the rigorous approach, saying that "[s]hortcuts or low quality in this phase would hamper the downstream analyses from achieving good results."

Reviewers would like to see more emphasis applied to "explaining the key drivers to the engineering analysis especially in terms of the computer simulations in the design options approach." One reviewer is concerned that the program is growing in complexity and cost, and would like to see if results or metrics have justified such increases. Another reviewer notes that the approach "needs to consider what is being developed in the rest of the world," and also points out a weakness in the approach:

> The rule bases for computer design simulations are limited to the vision, skills, and experiences of the people developing the programs. . . .[T]wo different teams will most likely come up with two completely different tools. . . .

Project Team

The project is said to have an "excellent staff," with reviewers impressed with their qualifications and "longevity/experience with the program." One notes that it "is difficult to completely comment on the adequacy of the supplemental components of the team (other DOE and subcontractors)" as information was only provided on the main project team members.

Accomplishments

Average Score: 8.1 Range of Score: 7-9

Reviewers assign very high Accomplishments scores, saying that "all milestones have been met" and that the "current work is compatible with targeted schedules." Reviewers note the high quality work, saying the "efficiency vs. cost relationships are developed from a deep analysis" and that the "engineering analysis seems to be quite rigorous."

Several reviewers note that keeping on schedule is a major accomplishment, and will be necessary to meet future rulemaking deadlines.[1]

[1] The program will need to substantially increase its output in order to meet currently scheduled rulemaking deadlines. The Review Panel's comments influenced the development of DOE's plan for conducting future standards rulemakings, as described in DOE's January 2006 report to Congress. (See the January 2006 report: *Energy Conservation Standards Activities, Submitted Pursuant to Section 141 of the Energy Policy Act of 2005 and to the Conference Report (109-275) to the FY 2006 Energy and Water Development Appropriations Act*). In particular, DOE will make a concerted effort to reduce analytical complexity with the goal of increasing the output of the program while simultaneously improving transparency and stakeholder participation.

Productivity

Average Score: 7.0 Range of Scores: 5-8

Reviewers express difficulty in evaluating productivity; one says it "[s]eems to be OK, but hard to judge the output productivity versus cost of the project." Another reviewer notes that it "seems that milestones were met, but the cost of getting there is impossible to determine."

However, it is noted that since the "overall/national effects of standards programs are so large, it would seem quite inappropriate to do any of the analyses 'on-the-cheap.'" This is supported by another reviewer who states: "Productivity is a bit hard to measure but overall the amount of money spent on (regulating) any technology is very small versus the potential savings to the U.S."

Reviewers that could evaluate the productivity say that the "data available on the web sites are considerable and very informative," and that "the screening and engineering analyses provide information that is critical to the rest of the program."

Relevance

Average Score: 8.0 Range of Scores: 5-10

Reviewers are split on the project's relevance. One reviewer gives a score of 5, indicating that "the uncertainties in the three approaches are not systematically carried through to projected energy savings resulting from the rulemaking," making it "very difficult. . .to gain confidence in this goal." The reviewer that gives a score of 10 to the Screening and Engineering Analysis notes that this analysis "represents the key initial steps taken in developing a standard. As a step in the project this is critical, since downstream results depend on what comes out of this stage."

Other reviewers note that the project's "relevancy is extremely high since the rest of the analyses are dependent on the results and accuracy of these initial analyses," and the "fundamental relationship between cost and efficiency is the basis for all the subsequent analysis."

One reviewer notes that the relevance could be improved by loading large utility transformers "at a higher percentage than the testing of 50%. The peak demand impacts as well as the energy savings will be different for the different categories of DTs." Another would like the analysis to "answer the question 'how do we know that the cost-efficiency relationship is really the one that will play out in the market if the proposed standards are implemented?'"

Overall Assessment

Average Score: 8.0 Range of Scores: 7-9

Reviewers give the project very good Overall Assessment scores. Several are concerned about "biases" and "uncertainties" in the spreadsheets and models, how these may impact later analyses, and the possibility that they "are not carried through to projected energy savings due to the rulemaking." They caution that the team must "always keep an open mind to new ideas and concepts and be ready to change as new information is presented."

The project is lauded for its inclusiveness. Says one reviewer: "Increased stakeholder involvement from the very beginning results in more trust, fewer surprises, better information,

and an overall better result. A more open and better-prepared rulemaking facilitates the entire process and everybody benefits, including the taxpayer."

Reviewers call for the team to "use as much actual testing and the cost assessment approach as much as possible." They also see room to include "more of the system impacts for the appliances" and to include additional technologies such as ground coupled heat pumps, solar water heating and solar photovoltaics.

One reviewer also questioned if "all of the areas of uncertainty [are] coming through in the engineering analysis?" The reviewer provided the example of core steel pricing uncertainty to illustrate this question (see section 9.1).

8.3 ANALYSIS B - MARKUPS FOR APPLIANCE PRICE DETERMINATION, LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS/LIFE-CYCLE COST, CONSUMER SUB-GROUP ANALYSIS

Approach

Average Score: 8.4 Range of Scores: 7-9

Reviewers give very high Approach scores, calling it an "outstanding experience and insight into the issues," and noting that the analyses "demonstrated understanding of both the large issues as to significance for the country and the small technical issues at every level needed to provide a sound basis for decision making."

Reviewers are impressed with the technical approach, saying that "the markup and LCC materials exude thoroughness and meticulousness and step through the analyses in a logical way." They are also appreciative that DOE "goes 'everywhere' necessary to find information not readily ascertainable," recognizing that this is key to accounting for "all of the variables that impact the different technologies."

Reviewers do express some concern regarding "checks and balances," in particular on the "economists' selection of assumptions;" one reviewer would like to see more information on "where in the process (and how) these reality checks" are applied. Another reviewer notes that it is "very important to cross-check and apply industry experience to the review and verification of the data."

Reviewers offer a host of suggested changes, including:

- "The concept of PAYBACK should be highlighted for use ONLY when the investment is for products where the future is uncertain. For transformers, we can be certain that the unit WILL be in operation for up to 30 years."
- "[N]ot sure that [the markup analysis] takes into account the non-energy benefits of the improved technology. For example, the improved water heaters can last longer or have improved recovery rates. . . ."

- "[M]ore details on the key factors that make the biggest difference for the paybacks and LCC should be highlighted."
- "Annualized costs should be considered vs. paybacks so that the life of the equipment, maintenance costs, etc. are taken into account."
- "DOE should consider raising the three year payback rule (if three years or less then that standard can be implemented without more analysis) to a seven year payback rule."

Project Team

The project team is said to have "strong" qualifications, and the staff "appear very knowledgeable and have tremendous experience." One reviewer notes the omission of "individuals bringing years of experience in markets."

Accomplishments

Average Score: 7.9 Range of Score: 7-9

Reviewers assign very high Accomplishments scores, saying that "the challenge of applying analytical rigor in areas that do not have robust sources of data (and in doing so in a way that will pass the kind of public scrutiny applied to this program) is very impressive," and that it is "an important accomplishment (and now a strength) is the transition to transparency."

Reviewers are impressed with the team's accomplishments, noting that the team "showed excellent progress during the project period," and that "the products are very innovative in its utilization of the incomplete, less-than-ideal nature of 'real-world' data." The team is judged to have generated "significant amounts of very important information for the standards process," and its "recognition of the different markets and different distribution channels as well as using the utility tariffs" is noted as a significant accomplishment.

Productivity

Average Score: 7.8 Range of Scores: 5-9

Reviewers stated that Analysis B is "very productive with a relatively small expense for large savings for the U.S."

Reviewers generally find very good productivity; only one reviewer does not issue a score of 8 or 9, noting that "the team seems rather large," and this impacts overall productivity.

Other reviewers note good productivity, but are a little concerned about cost (or at least the potential that the project team could lower its costs, but have not been encouraged to do so). One reviewer notes that the cost per person is "only slightly higher" than those found at universities, and that the "collected expertise seem unrivaled, so there is good value for the money." Another reviewer notes that "the 'matrix' management approach and rich and diverse backgrounds of the team members adds flexibility and is a very professional approach—likely to achieve lower costs than other approaches." The 'matrix' management approach draws staff from a resource pool and assigns them based upon their knowledge, skills, and expertise. For example, under the 'matrix' approach, staff with engineering expertise would be assigned to perform the engineering analyses across multiple projects rather than be dedicated to a single project that requires them to perform tasks that may not be well suited to their skill set.

Relevance

Average Score: 8.2 Range of Scores: 7-9
Reviewers assign very high Relevance scores, saying that it is "well directed and effective," and that it "probably makes a huge difference in improving energy efficiency in this country."

Reviewers see the project as "vital to the overall BT goals," "vital to a healthy economy and environment," and "the key activity in the standards process." Another remarks that the "LCC analysis is critical to supporting the legislative mandates to consider economic impacts for standards rulemaking, so relevancy is extremely high."

One reviewer notes that DOE could achieve greater relevance if the analyses considered the "sustainability" of equipment by examining the "cradle to grave" impacts.

Overall Assessment

Average Score: 8.0 Range of Scores: 6-9
Reviewers give the project very good Overall Assessment scores, calling it "outstanding, well reasoned, executed and presented."

Reviewers issue very strong Overall Assessment scores based on the strengths discussed above. They do make note of some weaknesses:

- "Would like to see more consumer input as a reality check."
- "[C]omplexity [of the tool] is beyond most of the end users. … [W]ould suggest a simple calculator downloadable from the web (or directly on the web) that could be tailored for and provide output for the specific user case. Put the source code in the public domain."
- Potentially, DOE should consider the "[E]fficiency-rebound effect" in future analyses.

8.4 ANALYSIS C - SHIPMENTS ANALYSIS AND NATIONAL IMPACT ANALYSIS

Approach

Average Score: 7.7 Range of Scores: 7-9
Reviewers are generally impressed with the approach, calling Analysis C a "comprehensive project that draws on an impressive array of information sources" and noting that "the different elements of the project are well-integrated among themselves and with the other projects/analyses within the program."

Reviewers do present a host of concerns regarding the approach, including:

- Discount rates. Reviewers feel that using 7% as the "REAL cost of money seems unrealistic," and feel the team should add inflation factors to the model. Another notes that this "national energy impact analysis should include a lower discount rate (say negative 1% so that 3% is in the middle) to account for national energy problems or other disturbances."

- "The impact of utility and state incentives for EE should also be factored into the analysis" as such incentives may move higher efficiency products into the market faster.
- "The analysis should include the impacts of programs that are not yet designed and implemented. . . .The AEO caveat of not incorporating the impacts of those programs for policy analysis purposes should not be adopted for standards analysis."
- There is "no basis to assume that a unique driver for technology-driven efficiency improvements (which is an assumption whose basis was unclear) will result in a future rate of improvement that is identical to the historical rate."
- One reviewer would like to see a "plot of cumulative savings."
- Input data (especially that related to market behavior in absence of a standard) "was not adequately explained" and is an area "that needs more attention in future analysis."

Project Team

Reviewers find the project team to be "quite strong," comprised of "a good mix of backgrounds covering engineering and economics" and containing individuals with "great experience and deep knowledge."

Accomplishments

Average Score: 7.3 Range of Score: 6-9

Reviewers give the project very good Accomplishments scores, saying that "the quality and clarity of the national impacts are appropriate for the process and provide balanced information to inform the process."

Reviewers find solid accomplishments, noting that this work is "an important step in the overall analysis required for the standards process." Reviewers note that the "availability and usability of the methods and models. . .appears to be a major accomplishment."

One reviewer is a bit disappointed, saying the accomplishments seemed "rather routine" and that given the "long-standing excellence of this team it is a little disappointing that more creative assumptions and approaches to modeling could not have been pursued."

Productivity

Average Score: 7.6 Range of Scores: 6-9

Reviewers find productivity to be "reasonable," and feel the matrix approach is a "relatively cost effective way to proceed." One reviewer questions if "the detail developed in many areas is warranted, given that assumptions that are critical are not provided equivalent depth'" and wonders why an uncertainty analysis was not conducted to "explain why added complexity (and added resources/costs) were warranted."

Relevance

Average Score: 7.9 Range of Scores: 7-9

Reviewers assign very high Relevance scores, stating that "This analysis. . . is an important input to the final decision on need/justification for implementing a standard. The relevance and importance are extremely high. . . ."

Reviewers find the analysis to be very relevant, citing that given the "mandated considerations for the DOE decision-making process this information needs to be provided—so it is entirely relevant." Others note that the project "will contribute a great deal to the knowledge base in this area" and that it is "right on target for DOE needs."

One notes a concern about discount rates, and that the relevance of the product could be enhanced through an evaluation of the impact and ramifications of using OMB-dictated rates.

Overall Assessment

Average Score: 7.4 Range of Scores: 6-9

One reviewer feels that "this is a very valuable project," and the others generally agree, although they do note some issues:

- Process needs "some method of checks and balances on the consumer side as there is on the [manufacturers'] side."
- "The discount rates used and the impacts of incentives from utilities should be evaluated for changes."
- "The project had a set of assumptions that were important and not provided the resources or depth of analysis that is warranted."

8.5 ANALYSIS D - MANUFACTURER IMPACT ANALYSIS

Approach

Average Score: 8.4 Range of Scores: 7-9

Reviewers give very high Approach scores, saying that "the teams appear to have done a very good job of researching and working with the manufacturers to gather the data." One reviewer stated that "I would rate both the quality of the technical approach and the project team to be very good."

Reviewers are universally impressed with the technical approach, offering appreciation for a host of stakeholder interactions including getting input "early and throughout the process" and "working with the manufacturing industry to get the Government Regulatory Impact Model (GRIM) developed and accepted." One reviewer notes that the "confidence in the effectiveness of the analysis is vested in the interaction with the manufacturers," and thus this stakeholder involvement is a critical component of the approach. Another reviewer comments that "early interaction with the regulated industry" has been key to building "a balanced foundation from the beginning of the process, which significantly reduces the likelihood of roadblocks downstream."

One reviewer notes that it "would have been good to know that there was successful closure with manufacturers (i.e., that the results of the financial characterization were reviewed and deemed consistent with the way they view their business.)"

Project Team

The team's quality is "very high," with one reviewer encouraged to hear that "individuals with [knowledge of] equipment manufacturing processes were on the project team."

Accomplishments

Average Score: 7.9 Range of Score: 7-8

Reviewers assign very high Accomplishments scores, noting the "care taken to get stakeholder input" and the "major challenge to maintaining progress and staying on schedule" presented by the manufacturer visits and other interactions. Reviewers note that the project has "met its goals and is on schedule with the deliverables."

One reviewer notes that there were "no data presented" and that a "great deal of faith" was expected from the Review Panel as there was no "supporting documentation in the PowerPoint [presentation]."

Productivity

Average Score: 8.0 Range of Scores: 5-9

Reviewers indicated that "Productivity or 'bang for the buck' seems very high."

Only one reviewer issued a score of less than 8, saying that the productivity "was probably satisfactory," but that the presentation did not provide enough information for the reviewer to adequately gauge the productivity.

The other reviewers note that a "lot of work has been accomplished" and that "this portion of the overall program is extremely productive compared to the cost to DOE." The "use of a single team to do both the screening/engineering and impact analysis seems to make the best use of funds" according to one reviewer. Another reviewer comments that the productivity "is clear in the increased understanding and communication with the manufacturers and DOE standards process and team," and that "the overall impact appears to be less 'pushback' and delays in the implementation of the DOE standards."

Relevance

Average Score: 8.3 Range of Scores: 7-9

Reviewers assign very high Relevance scores, stating that "this area is of course highly relevant due to the legislative mandate to consider manufacturer impacts."

Reviewers find the project to be highly relevant, saying that "[o]btaining the consensus of the manufacturers is extremely important" and that the "information that is being developed. . .on this project will clearly contribute a great deal of critical and useful information to the knowledge base for these industries and the rest of the public."

Reviewers find the tools "well-suited to obtaining and manipulating the information necessary to implement the standards-setting directive" and find the analysis "quite adequate."

Overall Assessment

Average Score: 8.0 Range of Scores: 6-9
All but one reviewer issues a score of 8 or 9; one reviewer issued a score of 6 primarily because the "presentation was remarkably lacking in substance and supporting documentation."

Other reviewers note as the reason for their high scores the project's "[d]irect interactions with the manufacturers" and the team's "[p]roviding stakeholders with as much information as possible in advance, and identifying and reaching preliminary agreement and simplification on sensitive issues," citing this as "as good a way as I know for a successful and cost-effective outcome for a rulemaking." One notes that "there are areas in the process where there is inevitable imprecision," but also notes that "the team has been diligent in implementing reasonable compensations."

Reviewers would like to see "a metric that measures the extent to which the final model results are consistent with manufacturers' views;" "a better analysis method, or scenario analysis and assumptions. . .to distinguish short-life and long-life products;" and the development of some more scenarios related to the initial investment figure to take into account that some non-USA products are more efficient than current products marketed in the U.S.

8.6 ANALYSIS E - UTILITY IMPACT ANALYSIS, ENVIRONMENTAL ASSESSMENT, EMPLOYMENT IMPACT ANALYSIS, AND REGULATORY IMPACT ANALYSIS

Approach

Average Score: 7.3 Range of Scores: 5-9
Reviewers generally give solid scores for DOE's analytical approach, saying the task has "[p]robably the right level of complexity" and that the "approach and quality have been very good considering the diverse nature of the assessment of impact on the various sub-groups being analyzed." One reviewer notes that the "approach appears sound, but the scope of issues to be addressed is a challenge. For example, the impacts of gas furnace standards on gas utilities was not addressed." Another compliments the team for using a "publicly vetted model" rather than proprietary tools.

Reviewers do note some weaknesses, however. One comments that the "results seem to look down from a very high level and it's hard to translate the results to the everyday decisions that impact the budget/operation decisions," while another would like to see a more rigorous analysis of the employment and environmental impacts.

Finally, one reviewer feels the "effort is too low and the results are not assigned an economic value." This reviewer notes that not having "these economic values incorporated into the NIA is a huge mistake because these are real impacts and have real value to the USA. Without these included I think you have a different answer from the NIA which may lead to different conclusions."

Project Team
Reviewers find the "high quality team" to have "very good skill sets."

Accomplishments

Average Score: 7.6 Range of Score: 7-9
Reviewers assign very high Accomplishments scores, citing that "the project has been good and the ability of the team to respond to on-going needs is a strength."

Reviewers find that the analysis seems "to have been done on a timely basis so far," and that the "total set of deliverables seems adequate." Reviewers express some difficulty gauging the accomplishments because "it is too early in the process." However, one reviewer notes "a comfortable feeling that the quality of the upcoming [NOPR] analyses will be well-considered and balanced."

Productivity

Average Score: 7.9 Range of Scores: 7-9
Reviewers stated that "productivity appears to be very high in this area," and that need only "small number of person hours to develop the results."

Reviewers find very good productivity, saying the use of the National Energy Modeling System (NEMS) is a "productive use of resources—especially since others at [Lawrence Berkeley National Laboratory] are using NEMS and the incremental cost to the standards analysis is a fairly minimal investment." Others note that "the results will be worth the costs."

Relevance

Average Score: 8.0 Range of Scores: 7-9
Reviewers assign very high Relevance scores, stating that "the evaluation of the utility, environmental and employment impacts is very significant and an essential part of the EERE mission statement and the Integrated Resource Planning requirements of the Energy Policy Act."

Reviewers see the project as very relevant, saying that the project "will contribute to the overall BT mission" and that these "three areas of investigation are entirely relevant to the standards analysis process."

Above and beyond the immediate relevancy of the work, one reviewer notes that the analyses "provide a very good context for discussions about government intervention into energy and the economy," and that by "looking at utility impacts, employment impacts, and comparisons with other methods, a more rational approach to government intervention can be achieved."

One reviewer comments that the work "seems to lack the details needed by the day-to-day users," which might hamper its relevance; another notes that need for a "technical review from outside experts to advise DOE to help ensure continued excellence in this important program."

Overall Assessment

Average Score: 8.0 Range of Scores: 7-9

Reviewers give the project very good Overall Assessment scores, calling it an "excellent program—well based and very mature—extremely important and makes a big contribution to the energy future of this country—program should continue and possibly grow."

Reviewers give the project very high Overall Assessment scores, citing the "well thought out" selection of models, the team's "understanding of the tool capabilities and limitations," and the in-depth "coverage of a broad range of disparate issues."

Reviewers do pose a couple of concerns and suggestions:

- "[W]ould be nice to quantify some of the environmental benefits to supplement the National Energy Savings (NES). . .[L]ooking to future rulemakings, valuations should be considered, since these do represent a direct economic benefit to reduced energy consumption."
- "The level of effort (estimated at about 10% of the overall analysis) may be too low."
- "A program of this longevity. . .tends to grow in complexity, sophistication, staff, and budget. More emphasis should be placed on quantifying the benefits (incremental) based on the next incremental funding."
- "Retrospective review of some past predictions/forecasts and how they faired over time might be helpful in modifying present models and approaches."

9. RESPONSE TO PEER REVIEWER COMMENTS

This section provides a detailed summary of all PEER review comments that DOE received for each portion of the rulemaking analysis. The comments are grouped by common theme and DOE provides a comprehensive response that addresses all questions for each theme.

9.1 CROSS-CUTTING: COMMENTS AND ISSUES

Peer reviewers provided a number of comments which apply to all analysis areas. A common theme involved the trade-offs inherent in greater analytical complexity. Reviewers recommended that DOE more critically examine the benefits of complexity in the context of cost-effectiveness and desired transparency of the analysis. Peer reviewers also emphasized the need for increased stakeholder participation in the analysis process (particularly consumers). Reviewers see stakeholder participation as an essential means to ensure that the analysis process contained much needed checks and balances. Finally, reviewers were concerned that DOE did not sufficiently recognize sources of uncertainty and did not have these uncertainties ripple through all the analysis.

<table>
<tr><th colspan="2">Comment Category: Complexity of Analyses</th></tr>
<tr><th>Specific Comments</th><th>Agency Response</th></tr>
<tr><td>"I would have liked to hear more regarding the primary cost trade-offs faced and the rationale for decisions made. It is difficult to judge if added complexity pays off." (from comments on the Engineering analysis)</td><td rowspan="3">DOE acknowledges that greater complexity and more exhaustive analysis can consume considerable analytical resources without improving the standards-setting process and can contribute to rulemaking delays in several ways. But the complexity of the analysis is driven by the need to address the criteria laid out by EPCA and other statutory and regulatory procedures. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316) In addition, the Process Rule (Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products, 61 FR 36974 (July 15, 1996)) unintentionally increased the complexity of the analysis conducted in support of energy efficiency standards rulemakings. Many aspects of the Process Rule, which made the rulemaking analyses more robust, have also made it more voluminous, complex, and time-consuming. Therefore, DOE plans to engage stakeholders in a dialogue that might reduce the analytical burden without sacrificing the quality of the analysis. As part of its plan to ensure that the analyses conducted are only as complex as they need to be, DOE has laid out a plan for conducting future standards rulemakings. (See the January 2006 report: Energy Conservation Standards Activities, Submitted Pursuant to Section 141 of the Energy Policy Act of 2005 (Pub. Law 104-58) and to the Conference Report (109-275) to the FY 2006 Energy and Water Development Appropriations Act). DOE's plan to reduce the overall complexity of the analysis is also intended to make the analysis transparent and accessible for all to understand so that they may participate in the rulemaking process. Unnecessary complexity runs counter to this goal. Also, in order to effectively manage the project, DOE is identifying and obtaining the human resources for expanded rulemaking activity.

In the specific case of the engineering analysis, DOE uses one or more of three general approaches, each with its own benefits, drawbacks, and level of complexity. (See Screening and Engineering Analysis section under "identifying key drivers" for discussion.) In cases where DOE's engineering analysis becomes complex (either due to extensive numbers of product classes or increased</td></tr>
<tr><td>"In general, it appears to be a weakness that it cannot be shown that the tremendous detail and complexity of the process is only as expansive as it needs to be and not greater. This is a large burden (to show that the project is managed cost-effectively) and it has not been met." (from comments on the Life-Cycle Cost and Payback Period analysis)</td></tr>
<tr><td>"It was more difficult here to make sure that cost-effectiveness was a theme in decision-making. Is the analysis too detailed in some areas while glossing</td></tr>
</table>

over others? In terms of effective project management, this question should have been answered." *(from comments on the Life-Cycle Cost and Payback Period analysis)*	engineering sophistication), DOE will continue to explain the reasons that it has chosen to add complexity.
"The complexity is beyond most of the end users. Crystal Ball is a powerful but costly product and is typically available only to a few, especially in the Utility markets. To properly understand and use these tools requires training, which adds costs. I would suggest a simple calculator downloadable from the web (or directly on the web) that could be tailored for and provide output for the specific user case. Put the source code in the public domain." *(from comments on the Life-Cycle Cost and Payback Period analysis)*	
"It is unclear if the detail developed in many areas is warranted, given that assumptions that are critical are not provided equivalent depth. One of the benefits of an uncertainty analysis was explained to be the ability to distinguish what assumptions are important and what ones are not. That approach should have been adopted to explain why added complexity (and added resources/costs) were warranted." *(from comments on the Shipments and National Impact analysis)*	

Comment Category: Checks and Balances (Verification of Analysis Assumptions)	
Specific Comments	**Agency Response**
"It is very important to cross-check and apply industry experience to the review and verification of the data." *(from comments on the Life-Cycle Cost and Payback Period analysis)*	Verification of analysis methodologies and assumptions is extremely important to DOE. DOE's technical analyses go through an extensive review process before an advance notice of proposed rulemaking (ANOPR), notice of proposed rulemaking (NOPR), or final rule is published. Checks and balances are ensured by the guidance provided by the Process Rule (*Procedures for Consideration of New or Revised Energy Conservation Standards for Consumer Products*, 61 FR 36974 (July 15, 1996)). Following the guidance in the Process Rule, DOE actively encourages the participation and interaction of all stakeholders at all stages of the process. Early and frequent interactions among stakeholders, including manufacturers from the industries that are covered by proposed standards, have been useful for providing a balanced discussion of the critical information required to conduct the analysis that supports any standards. For example, DOE conducts manufacturer interviews as part of the rulemaking process to discuss issues that are most important to the industry. During the course of the interviews, DOE gives manufacturers the opportunity to provide data or comments on issues that are relevant to the technical analyses. In addition to the input that DOE actively solicits from stakeholders, the Office of Management and Budget (OMB) reviews all technical analyses before a NOPR or a final rule is published. Also, DOE's internal review process includes reviews by staff within the Building Technologies Program, the Office of Policy and International Affairs, and the Office of the General Counsel. Finally, as required by E.O. 12889, Implementation of the North American Free Trade Agreement (58 FR 69681 (December 27, 1993)), and as specified by the Process Rule, after publication of the ANOPR and the NOPR, there are two 75-day public comment periods and DOE holds at least two public meetings. On the basis of comments received, DOE may revise the analysis or the candidate standard levels. If major changes are required, DOE gives stakeholders and technical experts an opportunity to review the revised analyses. This information from DOE enables its stakeholders, including technical experts, to provide informed input to DOE at each step of the process. DOE is engaging stakeholders in a dialogue to reduce the analytical burden without sacrificing the quality of the analysis. Thus, DOE hopes to further increase the transparency of the analysis to allow increased verification of its analytical methods.
"Still have concern on the verification, or who is looking over the shoulder of LBL on the financial side. The 'industry' (mfgrs) do not comment very much, the consumer doesn't have the interest to comment at this point, so the results are very dependent on LBL assumptions. Would be good to see how more outside input could be solicited and secured." *(from comments on the Life-Cycle Cost and Payback Period analysis)*	
"The only concern is to make sure that there is outside review for checks and balances to keep the group from being myopic." *(from comments on the Shipments and National Impact analysis)*	
"Need to figure a way to get more consumer input as a checks and balance on the financial side of this analysis (same on the LCC analysis)." *(from comments on the Shipments and National Impact analysis)*	
"The validity of the assessments depends critically on the peer review process at the technical level. This is one area that we could not begin to assess in our Review Panel process. Therefore, I strongly recommend a technical	

review from outside experts to advise DOE to help ensure continued excellence in this important program." *(from comments on the Utility Impact, Environmental Assessment, Employment Impact, and Regulatory Impact analyses)*	
"It would be a giant step forward to develop this stakeholder input on the consumer side as a check & balance on the other LBL analyses." *(from comments on the Utility Impact, Environmental Assessment, Employment Impact, and Regulatory Impact analyses)*	
Comment Category: Characterizing Uncertainty and Variability	
Specific Comments	**Agency Response**
"The process should reflect that there will always be uncertainty in the cost-efficiency curve estimates that are given (as noted, for DTs the cost of steel has recently doubled)." *(from comments on the Engineering analysis)*	As required by the Process Rule, DOE must capture the uncertainty and variability inherent in the inputs to its technical analyses as well as in its approaches to conducting these analyses when determining the impacts of standards. As stated in the Process Rule, "in addition to understanding the aggregate costs and benefits of standards, DOE must seek to understand the distribution of those costs and benefits among consumers, manufacturers and others, and the uncertainty associated with these analyses of costs and benefits, so that any adverse impacts on significant subgroups and uncertainty concerning any adverse impacts can be fully considered in selecting a standard." (Process Rule 1(f)) In the case of the engineering analysis, uncertainty and variability are captured where these aspects are expected to be significant. However, DOE makes an effort to minimize the uncertainties. Such efforts include the use of actual material-supplier pricing information. (See Section 9(b) of the Process Rule.) For transformers in particular, DOE conducted a sensitivity analysis during the NOPR phase analysis to explicitly reflect volatile material prices (e.g., core steel prices). DOE researched the core steel market by doing the following: • Discussing the core steel market with manufacturers during manufacturer interviews, • Obtaining core steel suppliers' publicly available price lists, • Researching publicly available trade reports, • Interviewing core steel distributors, and • Interviewing and meeting with core steel producers. DOE presents the material price sensitivity analysis in the NOPR Technical
"I am most concerned about the uncertainties inherent in the three approaches [that] are not carried through to projected energy savings due to the rulemaking." *(from comments on the Engineering analysis)*	
"One question -- are all of the areas on uncertainty coming through in the engineering analysis? The DT example of the cost of steel is a good example of an area that may be ripe for inclusion (I do not recall if this is a part of the current TSD materials for DTs). Efficiency improvements could be much more costly to come by in the future	

than today. Perhaps this is addressed in the LCC analysis, but explicit scenarios might also be appropriate, since the economic impacts could be quite dramatically affected." *(from comments on the Engineering analysis)*	Support Document in both the engineering and LCC analyses. DOE treated the material price sensitivity analysis thoroughly in both the engineering and lifecycle cost analyses. Similarly, DOE conducted a material price sensitivity analysis for the furnaces and boilers rulemaking (This information is available on the DOE web site at: www.eere.energy.gov/buildings/appliance_standards/residential/fb_tsd_0906.html). Calculation of national energy savings at different (candidate) standard levels is a relatively straightforward accounting exercise. Complexities arise in calculating energy savings for analyses where there are not well defined baseline units or base-case efficiencies (such as transformers). In these cases, DOE explicitly seeks comment on its assumptions and base-case efficiency estimates (typically distributions) that result from the union of the engineering analysis and the LCC analysis. The other major uncertainties in projecting energy savings for the rulemaking are embedded in the shipments estimates. Both the base-case and standards-case shipments forecasts are uncertain. Recognizing that forecasts are always uncertain, DOE vets its forecasts with stakeholders after publication of both the ANOPR and the NOPR.
"[I]f the goal is to actually provide tangible energy savings through screening and engineering analyses, it is very difficult, if not impossible, to gain confidence in this goal. In particular, the uncertainties in the three approaches are not systematically carried through to projected energy savings resulting from the rule making. Indeed, the inference I draw is that consensus IS the primary goal, but unfortunately at the expense of adequate engineering assessment of projected energy savings." *(from comments on the Engineering analysis)*	

9.2 SCREENING AND ENGINEERING ANALYSES: COMMENTS AND ISSUES

PEER reviewers highlighted the need to identify the key drivers which most influence the results of the engineering analysis. In particular they noted the need to explain which inputs most influence the results of computer simulations. The foundational nature – and thus the importance of the engineering analysis – was emphasized, as was the need to get stakeholder validation of the resulting cost-efficiency relationships. One reviewer encouraged DOE to use the cost-assessment approach and product testing as much as possible.

Comment Category: Identifying Key Drivers	
Specific Comments	**Agency Response**
"More emphasis should be applied to explaining the key drivers to the engineering analysis especially in terms of the computer simulations in the design options approach." Present the key inputs that make the major difference in the analysis.	There are three approaches to conducting the engineering analysis (in increasing order of engineering rigor): • Efficiency-level approach – manufacturers report to DOE the relative costs of achieving energy efficiency improvements (technology neutral); • Design-option approach – manufacturers report to DOE the incremental costs of adding design options to a baseline model; and • Cost-assessment ("reverse engineering") approach – involves a "bottoms-up" manufacturing cost assessment based on a test report and bill of materials created by disassembling commercially available product. Each of the above approaches has its own benefits and drawbacks (engineering rigor vs. practicality and timing). At the beginning of each rulemaking, DOE discusses the approaches with stakeholders and then chooses the alternative (or alternatives) appropriate for the rulemaking. In general, there are several keys to developing sound engineering analyses: • Establishing representative material and labor prices, • Choosing baseline models that are representative of the technology in the marketplace prior to the rulemaking, and • Validating the models used to evaluate energy efficiency improvements When employing the design options approach, DOE includes a discussion of key drivers in the simulations conducted during the engineering analysis. For example, in the distribution transformer rulemaking, DOE documented the parameters used by the design software. Documented parameters included material prices (and a discussion of core steel prices), impedance values, flux density constraints, voltage regulation, etc.
Comment Category: Validating Analysis Results	
Specific Comments	**Agency Response**
"Question: Do we extend enough opportunity to get all stakeholder input	DOE recognizes the importance of the engineering analysis as a driver for the results in the subsequent analyses such as LCC and

to this end of the analyses (screening and engineering)? It appears one can't emphasize enough the need for accuracy and industry consensus on this end of total project analysis in order to make the rest of the analyses accurate and realistic. Poor results here will multiply in later analyses."	national impacts. DOE typically requests general stakeholder input about the engineering analysis at the Framework Analysis stage (well before the ANOPR is published). More formally, the rulemaking process then incorporates several opportunities for public comment as required by the Administrative Procedures Act (5 U.S.C. 551 et seq.), Executive Order 12889, and the Process Rule. DOE's Process Rule specifies a 75-day public comment period and at least one public meeting for both ANOPRs and NOPRs. (See Section 4.1.5 of the January 2006 Report to Congress and Section 4 of the Process Rule.) DOE provides several opportunities for stakeholder input into the engineering analysis. During the ANOPR analysis phase, DOE's contractors interview manufacturers to discuss the engineering analysis. DOE revisits these topics during the NOPR-phase manufacturer impact analysis interviews.
"I would have liked to see more emphasis on this aspect of the analysis (i.e., to answer the question 'how do we know that the cost-efficiency relationship is really the one that will play out in the market if the proposed standards are implemented?'"	DOE interviews manufacturers during the ANOPR engineering analysis and the NOPR manufacturer impact analysis. Scrutinizing DOE's estimated cost-efficiency relationship, and its relevance at high production volumes, is a central objective in both interviews. If DOE is using the design-options approach, it then uses the information obtained from the manufacturers to "reality-check" the curves represented by the design options. Conversely, if DOE is using the efficiency-level approach (primarily based upon manufacturer input), DOE typically supplements its analysis with engineered design options or even teardown analysis. Frequently, DOE surveys the existing products in the market to help determine the range of possible costs. As discussed in Section 9(c) of the Process Rule, the cost-efficiency curve and necessary models are subject to peer review (this peer review is discussed in Section 1(c) and Section 9(c) of the Process Rule), including the input of expert consultants, before DOE issues the ANOPR. In the case of distribution transformers, DOE received numerous comments about the engineering analysis after publication of the ANOPR. Consequently, during the NOPR analysis, DOE subjected the engineering analysis to third-party review and validation.
"I think that you should use as much actual testing and the cost assessment approach as much as possible. This gives a valuable data set for other parts of the program and the industry."	While DOE made commitments to streamline its analysis in Section 6.3.2 of the January 2006 Report to Congress, DOE recognizes that the cost-assessment approach solidly grounds the analysis and is necessary in some cases, either as a stand-alone approach or to supplement an alternative engineering approach. In both the distribution transformers and furnaces and boilers rulemakings, DOE employed teardown analysis to supplement the design-options approach.
Comment Category: Additional Technologies for Consideration	
Specific Comments	**Agency Response**
"Do you include ground coupled heat pumps in your technologies to be	DOE can interpret this question about additional technologies in two ways. If the question is about creating separate product classes for

evaluated?"	these technologies (i.e., to regulate them separately and explicitly), DOE believes that it does not have the authority to do so. The products that DOE regulates are determined by statutory mandate and are not generally at DOE's discretion. Section 3 of the January 2006 Report to Congress explains DOE's entire statutory mandate. However, if the question is about considering such alternative technologies as design options within conventional product classes, DOE could consider them during the screening analysis. At the beginning of a rulemaking, with stakeholder involvement, DOE creates a list of all potential design options. DOE then screens the list of design options based upon: 1) technological feasibility, 2) practicability to manufacture, install, and service, 3) (adverse) impacts on product utility or product availability, and 4) (adverse) impacts on health or safety. See section 4(a)(4) of the Process Rule.
"Have you considered adding solar water heating and solar photovoltaics and other renewable technologies to the list of appliances?"	

9.3 MARKUPS FOR APPLIANCE PRICE DETERMINATION, LIFE-CYCLE COST AND PAYBACK PERIOD ANALYSIS/LIFE-CYCLE COST, CONSUMER SUB-GROUP ANALYSIS: COMMENTS AND ISSUES

Peer reviewers highlighted the need to identify the key drivers which most influence the results of the life-cycle cost and payback period analysis. With regard to key drivers, peer reviewers provided comments specifically focusing on the approach that DOE uses to develop discount rates. For distribution transformers, reviewers also emphasized the need to account for the power factor, a key input. Peer reviewers also commented on the use of the payback period as a criterion for selecting a proposed standard. Other comments focused on the need to account for non-energy impacts in the consumer economic analyses. Finally, reviewers identified sustainability (i.e., the overall energy required to make, use and dispose of the equipment) as an issue to address in future standards analyses.

Comment Category: Discount Rates	
Specific Comments	**Agency Response**
"The approach on the LCC side for discount rates concerns me somewhat. How do you provide a checks and balance on the LBNL economists' selection of assumptions?"	Verification of analysis methodologies and assumptions is extremely important to DOE. As described earlier in section 9.1 in response to comments under the category "Checks and Balances (Verification of Analysis Assumptions)", DOE's technical analyses go through an extensive review process before DOE publishes an advance notice of proposed rulemaking (ANOPR), notice of proposed rulemaking (NOPR), or final rule. With regard specifically to discount rates, DOE uses a methodology that stakeholders have vetted extensively. For residential products, DOE derives discount rates from estimates of the interest or "finance cost" that consumers pay to purchase the products. For commercial equipment, DOE uses an approach that estimates the cost of capital of companies that purchase the equipment.
Comment Category: Payback Period	
Specific Comments	**Agency Response**
"The concept of PAYBACK should be highlighted for use ONLY when the investment is for products where the future is uncertain. For Transformers, we can be certain that the unit WILL be in operation for up to 30 years. While the current owner may change names, the unit will remain in operation!"	As EPCA prescribes, and the Process Rule reflects, DOE must consider the payback period when evaluating the economic justification for new or amended standards. (42 U.S.C. 6295(o)(2)(B)(i)(II)) The "payback period" is defined as the ratio of the increase in purchase price over the first year's operating cost savings. Therefore, an annualized time series of costs are not factored into the calculation of the payback period. But annualized costs are used in the calculation of the life-cycle cost (LCC), which is composed of the total installed cost of the product plus its (discounted) lifetime operating costs. One of the fundamental policies concerning the selection of standards established in EPCA is that a standard level is rebuttably presumed to be economically justified if the payback period is three years or less. (42 U.S.C. 6295(o)(2)(B)(iii)) Thus, DOE has determined in the Process Rule to identify candidate standard levels for an ANOPR based on criteria that include a combination of design options that have a payback period of not more than three years. (Process Rule 5(c)(3))
"Another important point is that the lifetime of the equipment is vital to equipment like distribution transformers. These last for decades—20 to 30 years—and thus have long term impacts before they are replaced. Thus its 'payback' should be longer than 3 years and longer than other equipment that lasts fewer years."	
"Annualized costs should be considered vs paybacks so that the life of the	

equipment, maintenance costs etc. are taken into account."	Although DOE considers the length of the payback period as one of the criteria for establishing new or amended standards, EPCA also states that for a standard to be economically justified its benefits must exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316) Thus, if a standard level's payback period exceeds three years, as long as its benefits exceed its burdens, the standard level can still be economically justified. For example, DOE can evaluate the length of the payback period relative to the product's expected lifetime as a partial basis for determining economic justification of a standard.
"DOE should consider raising the three year payback rule (if three years or less then that standard can be implemented with out more analysis) to a seven year payback rule."	
Comment Category: Non-Energy Impacts	
Specific Comments	**Agency Response**
"The focus on the markup analysis is good but I am not sure that it takes into account the non-energy benefits of the improved technology. For example, the improved water heaters can last longer or have improved recovery or??"	As directed by EPCA, DOE weighs seven criteria, some of which are based on non-energy impacts, to determine whether the benefits of standards exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i) and 42 U.S.C. 6316) One of the criteria calls for assessing the impact of a standard on a product's utility or performance. DOE utilizes the screening and engineering analyses to assess the impact of standards on product utility and performance. If a standard level would require a design option that adversely impacts a product's utility or performance, the screening analysis removes that design option from further consideration. If a standard improves utility or performance, the benefits are quantified economically in the life-cycle cost and payback period analysis. For the specific case of a longer product lifetime caused by more efficient designs, DOE has quantified this effect in past life-cycle cost analyses when appropriate. The most common example of capturing non-energy impacts in the analysis is the inclusion of marginal energy prices. DOE has used marginal energy prices in the life-cycle cost analyses ever since the Advisory Committee on Appliance Energy Efficiency Standards recommended in April, 1998, that national energy prices be developed to capture the full range of consumer marginal energy rates. Marginal energy prices inherently account for the price of energy during periods of peak demand. Other non-energy impacts accounted for in the life-cycle cost analysis include increases in repair, maintenance, and installation costs.
"The overall system impacts as well as the non-energy impacts (longer lifetime, reduced peak electric demand, etc.) need to be carefully evaluated and improved as needed."	
Comment Category: Identifying Key Drivers	
Specific Comments	**Agency Response**
"I think more details on the key factors that make the biggest difference for the markups and for the paybacks and LCC should be highlighted."	DOE has conducted analyses for past standards rulemakings to determine which inputs are most critical to the determination of life-cycle cost (LCC) and payback period. In the assessment of consumer impacts of standards, DOE uses sensitivity and scenario analysis for its rulemakings as it announced in the Process Rule. (Process Rule 11(e)(1)) In addition to using sensitivity and scenario analysis, DOE has also used probability distributions to express the uncertainty and variability of various inputs to determine which inputs are most critical to the determination of LCC and payback period. By characterizing inputs in this manner, it has allowed DOE to express the life-cycle cost and payback period results as the number of consumers experiencing economic impacts of different magnitudes. This has enabled DOE to satisfy the Process Rule requirement to determine any adverse impacts on significant subgroups of consumers. (Process Rule 1(f))

	To conduct its LCC and payback period analysis, DOE has developed spreadsheet models combined with Crystal Ball (a commercially available program). Thus, it has allowed DOE to explicitly model both the uncertainty and the variability in the inputs to the model using Monte Carlo simulation and probability distributions. The LCC and payback period results are displayed as distributions of impacts compared to the baseline conditions. Results are based on 10,000 samples per Monte Carlo simulation run.
Comment Category: Distribution Transformers – Power Factor	
Specific Comments	**Agency Response**
"One additional improvement especially for the distribution transformers is to have the power factor taken into account. This is important for some large customers like universities and industrial campuses."	Taking into account the power factor is effectively equivalent to adjusting the load on the distribution transformer. A power factor of less than one has the effect of increasing the current in the transformer windings (i.e., increasing the load). DOE's analysis has a high loading sensitivity where stakeholders can examine the approximate impact of this effect.
Comment Category: Sustainability	
Specific Comments	**Agency Response**
"Also another factor of the sustainability of the equipment should be included. By sustainability I mean the overall energy required to make, use and dispose of the equipment. This is referred to as cradle-to-grave impacts."	Addressing sustainability would significantly complicate the analysis and DOE has previously deemed this measure as beyond the scope of its rulemakings. Tracking the cradle-to-grave energy consumption impacts would require DOE to estimate the energy embodied in the capital equipment, utilized in the manufacturing processes, embodied in the appliances/products, utilized during the lifetime of the appliances/products, and used during disposal. Including estimation of sustainability effects would draw resources away from the core analyses required for each rulemaking (e.g., engineering analysis, life-cycle cost, national impacts, manufacturer impact, etc.) and would provide information of uncertain value for efficiency standards-setting purposes. DOE is taking steps to reduce the overall complexity of the analysis for purposes of making the analysis more transparent and accessible for all who participate in the rulemaking process (and to increase program output). Excessive complexity runs counter to this goal and has been an unintended consequence of the Process Rule. For future rulemakings, DOE plans to engage stakeholders in a dialogue – beginning at the initiation of each rulemaking – that might reduce the analytical burden without sacrificing the quality of the analysis. Therefore, DOE does not intend to address issues that would likely complicate the analysis, such as sustainability, particularly if such issues have uncertain value for standards-setting.

9.4 SHIPMENTS ANALYSIS AND NATIONAL IMPACT ANALYSIS: COMMENTS AND ISSUES

Peer reviewers highlighted the importance of conducting shipments forecasts with and without standards in order to estimate national impacts. Comments focused on the need to properly account for the factors that can influence future estimates. In particular they noted the need to accurately estimate forecasted equipment efficiencies as well as assessing the impact of programs to promote efficiency, such as market-pull programs. Comments also focused on the discount rates and the values that should be used when determining national consumer economic impacts.

Comment Category: Discount Rates	
Specific Comments	**Agency Response**
"The mandated 3% and 7% discount rates without inflation seem open to further discussions as the 7% used as the REAL cost of money seems unrealistic. I would suggest adding inflation factors to the model."	DOE uses both a seven-percent and three-percent discount rate in accordance with the OMB's guidelines on regulatory analysis (OMB Circular A-4, section E, September 17, 2003). The seven-percent rate is an estimate of the average before-tax rate of return to private capital in the U.S. economy, and reflects the returns to real estate and small business capital as well as corporate capital. DOE uses this discount rate to approximate the opportunity cost of capital in the private sector, since analysis cited by OMB in Circular A-4 has found the average rate of return to capital to be near this rate. In addition, DOE uses the three-percent rate to capture the potential effects of standards on private consumption (e.g., through higher prices for equipment and purchase of reduced amounts of energy). This rate represents the rate at which "society" discounts future consumption flows to its present value. This rate can be approximated by the real rate of return on long-term government debt (e.g., yield on Treasury notes minus annual rate of change in the Consumer Price Index), which has averaged about three percent on a pre-tax basis for the last 30 years. Although OMB directs that regulatory analysis be conducted with seven-percent and three-percent discount rates, they do acknowledge that in some cases opportunity costs may lie outside the range of three to seven percent. In those cases where the nature of the opportunity cost is uncertain, OMB recommends that sensitivity analyses be conducted. For its analysis of appliance standards, DOE does consider whether sensitivity analyses with discount rates outside the range of three to seven percent should be conducted. With regard to the use of inflation factors, DOE expresses its economic forecasts in real dollars rather than nominal dollars. The primary reason behind the use of real dollars is that energy price forecasts used by DOE are provided by the *Annual Energy Outlook (AEO)* in real dollars. Real dollars can be converted to nominal dollars, thereby incorporating inflation, by using price indices and inflation factors provided by the *AEO*. Although conversions to nominal dollars can be made, DOE does not believe that there would be significant analytical benefit to incorporating inflation in the economic analyses, in particular because of the large uncertainty associated with forecasting inflation over a 30-year analysis period. It is valid, and perhaps more clear, to conduct this type of analysis strictly in real terms.
"The national energy savings estimates are projected to 2035 and therefore the discount rate and projected energy rates are key to the results." "OMB sets the discount rates of 3% and 7% to bracket the cost of money and the economic risk factors. This national energy impact analysis should include a lower discount rate (say negative 1% so that 3% is in the middle) to account for national energy problems or other disturbances. This approach will capture the national risk of not having standards."	
"The overall usefulness of the discount rate for long time periods is also being debated by the top economists. As slide 17 shows after 35 years the discount rate of 7% completely dominates the analysis. Another example of the importance of the discount rate is that at 7% the economic point for the commercial unitary A/C is 11.5 but at 3% it is 12.0. For the nation over 25 years the 12.0 may be a much better standard."	
"The key issue for the adequacy is the determination of the discount rates. Now OMB dictates these for all evaluation. This needs to be evaluated. There needs to be a lower discount rate to represent a perturbation in the energy sector. This is a mater of national	

security as well as efficiency and the standard discount rate does not capture the potential value of these standards to the Nation."	
Comment Category: Impact of Programs that Promote Efficiency	
Specific Comments	**Agency Response**
"The analysis should include the impacts of programs that are not yet designed and implemented. They have historically impacted the market and will do so in the future. The analysis should seek to determine the incremental impact. It seems a better assumption can be made with regard to a baseline. The AEO caveat of not incorporating the impacts of those programs for policy analysis purposes should not be adopted for standards analysis. It is not a realistic assumption."	In its economic forecasts, DOE implicitly incorporates the impacts of existing programs that promote the adoption of more efficient equipment (e.g., market-pull programs). But in order to remain policy-neutral, DOE cannot speculate as to the impact of possible future programs on equipment efficiency. To conduct its forecasts, DOE relies on forecast data from the *Annual Energy Outlook (AEO)*. Because the analyses conducted for the *AEO* are required to be policy-neutral, the forecasts in the *AEO* are based on Federal and State laws and regulations that are in effect at the time the *AEO* is conducted. In other words, the potential impacts of pending or proposed legislation, regulations, and standards—or of sections of legislation that have been enacted but that require funds or implementing regulations that have not been provided or specified—are not reflected in the projections. DOE understands that laws, regulations, and programs go through a development stage before becoming finalized. But not all of these actions actually come to fruition. Thus, DOE cannot speculate as to which of these laws, regulations, and programs will actually take effect. To do so could lead to significant errors in its economic forecasts.
Comment Category: Forecasted Equipment Efficiencies	
Specific Comments	**Agency Response**
"The impacts of utility and state incentives for EE should also be factored into the analysis. The incentives typically require efficiencies that are at least 15% more efficient than the standards. Thus improving the standards will also move the higher efficiency products into the market faster as a direct consequence of the new standard. This is documented in the California experience and elsewhere."	Because of its effect on the national energy savings and net present value (NPV) due to standards, DOE recognizes the importance of properly forecasting equipment efficiencies. Due to the importance of forecasting reasonable efficiency trends, DOE relies to some extent on stakeholder input to conduct these forecasts. As a result, DOE's forecasts of equipment efficiencies are specific to the standards rulemaking. Regardless of how efficiency trends are forecasted, DOE collects any historical shipments data that can show the market share or distribution of equipment efficiencies. DOE typically obtains the historical data from the trade associations representing the manufacturers that are within the scope of new or amended standards. The historical data implicitly reflect the impact of State and utility incentives, as well as any other market-pull programs, to promote the adoption of more efficient equipment. Due to the uncertainty associated with forecasting equipment efficiencies and the impact of standards on future efficiencies, DOE has used various methods to forecast equipment efficiencies depending on the nature of the rulemaking and the input received from stakeholders. For some products, DOE has forecasted efficiencies based on the trend observed in the historical data. In other cases, DOE has held the efficiencies fixed at the levels indicated in the most recently available data. More important than the forecasted efficiency trend, is the predicted difference in equipment efficiencies between
"There is no basis to assume that a unique driver for technology-driven efficiency improvements (which is an assumption whose basis was unclear) will result in a future rate of improvement that is identical to the historical rate. There were many factors discussed which would explain the reason for the persistence of a sustained economic gap. Are those factors going to combine in the future to sustain the same economic gap into the future?"	
"On a deleted analysis from earlier	

rulemakings -- I liked the recognition of variability/uncertainty in the trend of efficiency post-standards that was undertaken in residential air conditioning – there were three different versions of how the efficiency of shipments would change after a standard was imposed. The assumption has a marked impact on both the NES and the NPV calculations. There may be a movement to reduce some of the scenarios and analyses in order to streamline the overall process; however, I think it is important to explicitly recognize how these two key results are affected by what is essentially one of several plausible post-standard results."	the base case (i.e., the case where standards are not adopted) and the standards case. Typically, DOE has maintained the efficiency gain caused by a standard throughout the forecast period. In other words, DOE has assumed that a sustained gap in the average equipment efficiencies between the standards case and the base case will be maintained after a new standard becomes effective. Of course, this assumption implies that market conditions under the standards and base cases effectively remain constant throughout the forecast period. The legitimacy of this assumption is always questionable and is the reason that DOE is always willing to analyze any reasonable scenarios for its default assumption. For example, in the case of the residential central air conditioner and heat pump standards rulemaking, DOE analyzed the impact of future standards on equipment efficiencies with three scenarios. Each of these scenarios affected the jump in average equipment efficiency in the year that standards were assumed to become effective and, as a result, had a different impact on the national energy savings and net present value that could be expected from standards.
Comment Category: Shipments Forecasts with and without standards	
Specific Comments	**Agency Response**
"The approach is based upon shipment data and the assumptions of the market with and without the standards. This is a difficult area and the assumptions and the sensitivity of them should be highlighted more."	DOE agrees that forecasting shipments can be difficult. That is why for past rulemakings, DOE has vetted with stakeholders its methodology and assumptions for conducting shipments forecasts. DOE determines forecasted annual shipments in the base case (i.e., the case where standards are not adopted) by accounting for new building construction and historical rates of product ownership (saturation rates). This method has the distinct advantage of separately accounting for units installed in new construction and existing buildings. More importantly, DOE can express product saturation rates as a function of consumer price and operating cost to capture its impact on future shipments. Standards-case forecasts (i.e., the case where standards are adopted) are derived using the same data sets as the base case forecasts; however, because the standards-case forecasts take into account the increase in purchase price and the decrease in operating costs caused by standards, forecasted shipments typically deviate from the base case. The magnitude of the difference between the standards-case and base-case shipment forecasts depends on the estimated purchase-price increase as well as the operating-cost savings caused by the standard. Because the purchase price tends to have a larger impact than operating cost on equipment purchase decisions, standards-case forecasts typically show a drop in product shipments relative to the base case. DOE's past standards analyses have attempted to quantify the sensitivity of shipments to increased purchase-price and operating-cost savings. Because the data required to develop these sensitivities are limited and often difficult to obtain, DOE will consider modeling standards-case shipments forecasts with scenarios (i.e., specified impacts to product shipments) rather than developing sensitivities to increased purchase-price or operating-cost savings.

9.5 MANUFACTURER IMPACT ANALYSIS: COMMENTS AND ISSUES

Peer reviewers commented on four aspects of the manufacturer impact analysis. Two comments addressed the need to better define the regulated industry in the era of the global marketplace. Another commenter highlighted the importance of the capital expenditure estimates and recommended the use of scenario analysis to evaluate the significance of those estimates. Another commenter suggested that a list of improvements to the Government Regulatory Impact Model be made. The final comment related to the importance of ensuring that modeled results are consistent with the views of manufacturers.

Comment Category: Industry Definition in Global Economy	
Specific Comments	**Agency Response**
"One key issue is what is a manufacturer—US based with or without manufacturing in the USA or non-USA with or without manufacturing in the USA. How does the global economy impact this approach and the impacts on USA jobs, etc.?"	In conducting the manufacturer impact analysis, DOE primarily estimates the impacts on that portion of the industry that ships product within US borders for domestic installation (irrespective of ownership or manufacturing location). DOE is interested in financial and employment impacts on foreign-owned, US-based manufacturing operations. DOE is also interested in the impacts on US-owned operations that are located in foreign countries but produce products for the US market. The manufacturer impact analysis typically does not assess the impact on foreign-owned firms, located outside the U.S., that supply the U.S. market. However, manufacturers that are both foreign-owned and foreign-located are becoming increasingly important to the US appliance market and DOE may need to address them.
"A better definition of the manufacturers is needed in this era of a global market."	
Comment Category: Estimating Capital Expenditures	
Specific Comments	**Agency Response**
"The initial investment figure is so key to this analysis and relative to the product cycles of the specific manufacturer that some more scenarios might be useful. This is particularly true with the global economy and with some or many non-USA products being more efficient than the current products marketed in the USA."	DOE recognizes that the estimate of conversion capital expenditures is one of the pivotal components of the entire rulemaking analytical framework. DOE estimates these initial investment figures based on detailed manufacturer interviews and independent calculations. DOE provided an illustration of how to develop different scenarios for Capital Investment for the recent rulemaking on Commercial Unitary Air Conditioners and Heat Pumps. DOE derived two sets of estimates for capital investments. DOE prepared the first set of estimates using the manufacturing cost model used in the engineering analysis. DOE built this model assuming that each manufacturer would construct an optimized new plant to produce equipment meeting the new standards. The model captures the capital costs needed to construct equipment at baseline efficiencies and at each of the Trial Standard Levels (TSLs). DOE obtained incremental capital costs by subtracting capital cost requirements at the baseline from the capital cost requirements at a particular TSL (e.g. 11 EER). The implicit assumption is that all plant and equipment currently used to manufacture baseline equipment would continue to be used unaltered in the manufacture of higher efficiency products. Capital investment numbers derived from the cost model only represent the lower limit on the range of possible capital investments since they ignore additional investments to retrofit a plant and expenditures to replace and remove assets that become obsolete under a new standard.

	DOE obtained a second, higher, estimate of capital requirements from the information gathered during the manufacturer interviews. Manufacturers explained how the different TSLs impacted their ability to use existing plants, warehousing, tooling and equipment. From these DOE was able to estimate what proportion of existing manufacturing assets needed to be replaced and/or reconfigured, and what additional manufacturing assets were required, to manufacture the higher-efficiency equipment. For example, manufacturers explained how they would either extend existing product lines or completely redesign and retool them. A larger proportion of existing assets need to be replaced usually as a result of higher standards.
Comment Category: List of Improvements to GRIM Model	
Specific Comments	**Agency Response**
"I would recommend that a short list of key improvements for the GRIM model and the overall approach be part of the final report."	As discussed in Section 10(i) of the Process Rule, DOE uses the GRIM model as its basis for the manufacturer impact analysis. The GRIM model structure was initially provided to DOE by three trade associations – the Association of Home Appliance Manufacturers (AHAM), the Gas Appliance Manufacturers Association (GAMA), and the Air-Conditioning and Refrigeration Institute (ARI). The policies outlined in DOE's Process Rule called for substantial revisions to the analytical framework of the manufacturer impact analysis. DOE held a public meeting on March 11 and 12, 1997, to describe, and get comment on, the (new) generic methodology to be used in performing manufacturing impact analyses of products covered under National Appliance Energy Conservation Act (NAECA). The Process Rule contains a list of key objectives which have direct bearing on the implementation of the manufacturer impact analyses. This list is relevant to the reviewer's comment because it illustrates DOE's willingness to adapt the GRIM to each and every rulemaking. The listed key objective are: 1. To provide opportunities for public input early in the rulemaking process and to seek early stakeholder advice in structuring the analyses. 2. To utilize an annual cash flow approach in determining the quantitative impacts on manufacturers. This must include a short-term assessment based on the cost and capital requirements during the period between the announcement of a regulation and the time when the regulation comes into effect, and a long-term assessment. 3. To develop estimates of critical variables with inputs from interested parties, drawing on multiple sources of both quantitative and qualitative information. 4. To understand and report the distribution of costs and benefits on different manufacturers, and the uncertainty associated with these assessments. 5. To use models that are clear and understandable, feature accessible calculations and recognize the range of uncertainties. 6. To take into account cumulative impacts of regulations on manufacturers. 7. To consider the impact of standards on manufacturing capacity, plant closures and loss of capital investment.

	8. To increase the use of outside technical experts in developing, performing, and reviewing the analyses. DOE notes that the 1997 public meeting resulted in a list of refinements that were then implemented to the GRIM model. DOE applies the refined GRIM model to other EPCA-related efficiency standards as well, tailoring the methodology for each rule on the basis of stakeholder comments. For example, during the residential clothes washers rulemaking, DOE adapted the GRIM to account for the fact that the standard was going to be implemented in two phases. As another example, during the lamp ballast rulemaking, DOE adapted the GRIM to account for assets that would be stranded at higher trial standard levels. Interested parties suggested enhancements to the GRIM which DOE will consider. As discussed in Section 10(i) of the Process Rule, DOE's policy is to make changes to the fundamental GRIM methodology only through a notice and comment process. Therefore, DOE does not propose a short list of improvements here. However, DOE will continue to adapt the GRIM for each rulemaking based upon stakeholder input.
Comment Category: Reconciling GRIM Results with Manufacturer Viewpoint	
Specific Comments	**Agency Response**
"It is difficult to identify and adopt a metric that measures the extent to which the final model results are consistent with manufacturer view; however, some definitive way to describe closure or agreement would help."	As described in Section 10(f) of the Process Rule, the results of the manufacturer impact analysis are the following: 1) (impacts on) Industry Net Present Value, with sensitivity analyses, 2) (free) cash flows, by year, and 3) other impacts such as changes in net income or return on equity. DOE also routinely estimates the employment impacts at each Trial Standard Level. The above-described results of this analysis are an aggregation of all the information obtained by DOE during its manufacturer impact analysis interviews. In this manner, they are consistent with the inputs from manufacturers. Moreover, manufacturers (and other stakeholders) have the opportunity to comment on the analysis results after publication of the NOPR.

9.6 UTILITY IMPACT ANALYSIS, ENVIRONMENTAL ASSESSMENT, EMPLOYMENT IMPACT ANALYSIS, AND REGULATORY IMPACT ANALYSIS: COMMENTS AND ISSUES

Peer reviewers highlighted the importance of the utility impact analysis, environmental assessment, and employment impact analysis when establishing new or amended energy efficiency standards. In highlighting the importance of these analyses, they noted the need for monetizing utility, environmental, and employment impacts. They also questioned the rigor of the environmental and employment impact analyses and wanted further explanation as to the scope of the utility impact analysis for the distribution transformer and residential furnace and boiler standards rulemakings. Other comments noted that the analyses generate results which are not useful or relevant to all users. Finally, reviewers suggested that retrospective analyses be conducted to verify the impact estimates from past rulemakings so that DOE can make any necessary modifications to analysis methods and models.

Comment Category: Monetizing Utility, Environmental, and Employment Impacts	
Specific Comments	**Agency Response**
"The project needs to expand its scope to include economic values for the areas studied."	DOE currently does not monetize the environmental, utility, or employment impacts of standards. In the case of environmental impacts, although the existence of caps on most air-borne power plant emissions (i.e., sulfur dioxide (SO_2), nitrogen oxides (NO_X), and mercury (Hg)) prevents the possibility of any real physical reductions, to the extent power generation demand decreases the demand for and price of emissions allowance permits, there is an environmentally related economic benefit from standards reducing emissions. But because individual standards rulemakings affect only a fraction of the Nation's power generation demand, any impact on the price of allowance permits would be small and highly uncertain. Therefore, DOE does not monetize the environmental impacts of standards. Each of the above three impact analyses is discussed in more detail below. The environmental assessment calculates the reduction in power plant emissions of carbon dioxide (CO_2), SO_2, NO_X, and Hg. With the exception of CO_2, existing legislation or regulations have set caps on the emissions due to power generation. The Clean Air Act (CAA) Amendments of 1990 set emission caps on SO_2, the Clean Air Interstate Rule (CAIR) promulgated by the Environmental Protection Agency (EPA) in March 2005 and published in the Federal Register as a final rule in May 2005 (70 FR 25162 (May 12, 2005)) has capped emissions of NO_X and has also set more stringent caps for SO_2, and the Clean Air Mercury Rule (CAMR), also promulgated by EPA in March 2005 and published in the Federal Register as a final rule in May 2005 (70 FR 28606 (May 18, 2005)), has set caps on mercury emissions. The attainment of the emission targets in the CAA, CAIR and CAMR, however, is flexible among generators and is enforced by applying market forces, through the use of emissions allowances and tradable permits. As a result, accurate simulation of SO_2, NO_X, and mercury trading tends to imply that the effect of efficiency standards on physical emissions will be near zero because emissions will always be at, or near, the ceiling. Also, as stated above, although standards may have an impact on reducing emissions, the effect of any single standards rulemaking on allowance prices is small and highly
"The economic value for at least the utility, environmental and employment impacts is not being used in the rest of the analysis such as the National Impact Analysis. This should be at least evaluated for the effect on the NIA."	
"It would be nice to quantify some of the environmental benefits to supplement the NES. Since emissions generally do not have a market value, placing a value of such would be controversial at present. However, looking to future rulemakings, valuations should be considered, since these do represent a direct economic benefit to reduced energy consumption."	
"The level of effort is too low and the results are not assigned an economic value. Thus in the end this project just lists impacts and does not affect the National Impact Analysis (NIA) estimate. Not having these economic values incorporated into the NIA is a huge mistake because these are real impacts and have real value to the USA. Without these included I think you have a different answer from the NIA which may lead to different conclusions. Not having an economic value assigned	

to the utility energy use and peak demand impacts is a good example. The capital required by our county to build and operate power plants versus appliance standards or other methods is definable and required as part of Integrated Resource Planning. Thus it seems that the utility impacts of this project should be assigned economic value and included in at least one scenario of the NIA"	uncertain. Therefore, DOE does not monetize the environmental impacts of SO_2, NO_X, and mercury reductions. It must be noted that the EPA has received several petitions regarding the CAIR and CAMR. In addition, several States and organizations have filed lawsuits against the CAMR. Thus, the ultimate decision of the courts will have a significant impact on the implementation of CAMR and could also have an impact on the implementation of the CAIR. With regard to CO_2, mandatory markets are not in place that apply to the entire United States to reduce the marginal cost of emission reductions. For past standards rulemakings, because there was no consensus on how to monetize environmental benefits, DOE did not assign monetary values. As the monetary benefit of CO_2 reductions becomes more certain, DOE may take action in the future to monetize CO_2 reductions. The employment impact analysis estimates the indirect impacts of standards on employment for the economy in general. Indirect impacts are impacts on the national economy other than in the manufacturing sector being regulated. Indirect impacts may result both from expenditures shifting among goods (substitution effect) and changes in income which lead to a change in overall expenditure levels (income effect). DOE defines indirect employment impacts from standards as net jobs eliminated or created in the general economy as a result of increased spending on the purchase price of equipment and reduced customer spending on energy. Although DOE determines indirect employment impacts, increases or decreases in the net demand for labor in the economy due to efficiency standards have historically been very small relative to total national employment. As a result, past standards rulemakings by DOE have not claimed with any certainty that indirect job losses or gains will occur due to standards. Because DOE fully expects that future standards rulemakings will show similarly small net changes in indirect employment, DOE does not see any need to monetize the indirect employment impacts from standards. The utility impact analysis estimates the impact of standards on the utility industry. DOE uses a variant of the U.S. DOE/Energy Information Administration (EIA)'s National Energy Modeling System (NEMS) to perform the analysis, The utility impact analysis reports the changes in installed capacity and generation, by fuel type, that result from standards as well as changes in building sector energy consumption. Historically, DOE's approach for the utility impact analysis has not evaluated the financial impacts of standards on utilities. As part of its plan to ensure that the analyses conducted are only as complex as they need to be, DOE has laid out a plan for conducting future standards rulemakings. (See the January 2006 report that was prepared in response to section 141 of the Energy Policy Act of 2005, Pub. L. 109-58.) For future rulemakings, DOE plans to engage stakeholders in a dialogue that might reduce the analytical burden without sacrificing the quality of the analysis. Thus, in order to not increase its analytical burden, DOE does not plan to monetize the financial impacts to the utility industry. With regard to peak demand impacts, NEMS can assess the economic value of peak demand impacts by comparing future energy prices with and without standards. For past standards rulemakings, DOE has used

	NEMS to perform such a check and has not observed significant (modeled) impacts on forecasted energy prices. Also, DOE has assessed peak demand impacts for past rulemakings by determining marginal energy prices in the life-cycle cost analysis. Ever since the Advisory Committee on Appliance Energy Efficiency Standards recommended in April, 1998, that national energy prices be developed to capture the full range of consumer marginal energy rates, DOE has based its life-cycle cost analyses on the use of marginal energy prices. Marginal energy prices inherently account for the cost of energy during periods of peak demand.
Comment Category: Rigor of Environmental and Employment Impact Analyses	
Specific Comments	**Agency Response**
"If any of these were to be made more rigorous it would be both the employment and environmental impacts." "More emphasis on the positive effect of minimum standards on jobs and economic growth."	DOE feels that the rigor of the employment and environmental impact analyses is sufficient. DOE believes that the peer reviewer comments criticizing these analyses primarily stem from non-monetized results (see above). DOE conducts both analyses using sophisticated models that have been developed for other offices and agencies within DOE. Each model addresses the impact of standards across most sectors of the economy. In the case of the environmental assessment, DOE conducts this analysis using a variant of the U.S. DOE/Energy Information Administration (EIA)'s National Energy Modeling System (NEMS). Results of the environmental assessment are similar to those provided in the *Annual Energy Outlook (AEO).* DOE intends the environmental assessment to provide emissions results to policymakers and stakeholders, and to fulfill relevant legal requirements concerning the evaluation of environmental effects of new standards rulemakings. The environmental assessment calculates the reduction in power plant emissions of CO_2, SO_2, NO_X, and (for some rulemakings) Hg. With regard to the employment impact analysis, DOE conducts this analysis using the Pacific Northwest National Laboratory's "Impact of Sector Energy Technologies" (ImSET) model. Pacific Northwest National Laboratory developed ImSET for DOE's Office of Planning, Budget, and Analysis, and estimates the employment and income effects of energy-saving technologies in buildings, industry, and transportation. In comparison with simple economic multiplier approaches, ImSET allows for more complete and automated analysis of the economic impacts of energy efficiency investments. In accordance with EPCA, DOE considers both environmental and employment impacts among other factors for determining whether the benefits of standards exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i), 42 U.S.C. 6313(a)(6)(B)(i), and 42 U.S.C. 6316) But DOE must consider and weigh equally the other criteria in EPCA and not place undue emphasis on environmental or employment impacts when determining the technological feasibility and economic justification of potential standards.
Comment Category: Relevance to Users	
Specific Comments	**Agency Response**
"The results seem to look down from a	The purpose of DOE's analyses is to provide results to policymakers

very high level and it's hard to translate the results to the everyday decisions that impact the budget/operation decisions."	and stakeholders, and to fulfill relevant legal requirements concerning the evaluation of standards impacts. Specifically, EPCA directs DOE to weigh seven criteria to determine whether the benefits of standards exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i), 42 U.S.C. 6313(a)(6)(B)(i), and 42 U.S.C. 6316) Thus, the intention of the standards analyses is not to provide information that may be relevant to each potential user.
"The adequacy of this work is good but seems to lacks the details needed by the day-to-day users"	
Comment Category: Scope of Utility Impact Analysis	
Specific Comments	**Agency Response**
"The scope of issues to be addressed is a challenge. For example, the impacts of gas furnace standards on gas utilities was not addressed."	DOE's utility impact analysis is limited in scope and typically determines the impacts on generation requirements and installed generation capacity. For distribution transformers, in addition to examining the impacts on generation and capacity, DOE also examined the cost benefit impacts on utilities that would be required to purchase more efficient transformers. With regard to the impact on gas utilities of furnace standards, DOE's approach for the utility impact analysis does not evaluate the financial impacts of standards on utilities. As part of its plan to ensure that the analyses conducted are only as complex as they need to be, DOE has laid out a plan for conducting future standards rulemakings. (See the January 2006 report that was prepared in response to section 141 of the Energy Policy Act of 2005, Pub. L. 109-58). For future rulemakings, DOE plans to engage stakeholders in a dialogue that might reduce the analytical burden without sacrificing the quality of the analysis. Thus, in order not to increase its analytical burden, DOE does not plan to monetize the financial impacts to the utility industry.
"Two products – gas furnaces/boilers and transformers – will have utility impacts that are much different than commercial cooling, for example. And it did not appear these issues were being addressed."	
Comment Category: Retrospective Analysis	
Specific Comments	**Agency Response**
"Retrospective review of some past predictions / forecasts and how they faired over time might be helpful in modifying present models and approaches."	DOE agrees that retrospective review of past forecasts might be useful in modifying present methods. Typically, DOE reviews past models and approaches when embarking on conducting technical analyses for a new standards rulemaking. For future rulemakings, DOE plans to engage stakeholders in a dialogue that might reduce the analytical burden without sacrificing the quality of the analysis.