Energy Conservation Standards for Residential Dehumidifiers: Framework Public Meeting

September 24, 2012

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Department of Energy
Energy Efficiency & Renewable Energy

Welcome and Introduction

- **Introductions**
- **Role of the Facilitator**
- **Ground Rules (Norms)**
  - Listen as an ally
  - Use short, succinct statements/keep to the point
  - Hold sidebar conversations outside the room
  - Focus on issues, not personalities
  - One person speak at a time (raise hand to be recognized; state your name for the record)
  - Set cell phones to silent/vibrate
- **Housekeeping Items**
- **Agenda Review**
- **Opening Remarks**

Afternoon Agenda

1:00 – 1:15 pm	**Welcome, Opening Remarks, and Agenda Review** *Doug Brookman*
1:15 – 1:20 pm	**Rulemaking Introduction and Background** *Stephen Witkowski*
1:20 – 2:20 pm	**Test Procedure, Market and Technology Assessment, Screening Analysis, and Engineering Analysis** *Judith Reich*
2:20 – 2:30 pm	**Preliminary and NOPR Manufacturer Impact Analysis** *Ben Barrington*
2:30 – 2:45 pm	**Break**
2:45 – 3:45 pm	**Markups for Equipment Price Determination, Energy Use Determination, Life-Cycle Cost and Payback Period Analysis, Shipments Analysis, National Impact Analysis, LCC Subgroup Analysis, Utility Impact Analysis, Employment Impact Analysis, Emissions Analysis, and Regulatory Impact Analysis** *Camilla Dunham-Whitehead*
3:45 – 4:00 pm	**Other Issues and Comments, Closing Remarks** *Stephen Witkowski*

Opening Remarks

Interested parties who contacted DOE to request an opportunity to issue an opening statement may speak now.

Public Meeting Agenda

1. Introduction
2. Background
3. Test Procedure
4. Preliminary Analysis
5. NOPR Analysis
6. Closing Remarks

Purpose of the Framework Document Public Meeting

- Present the analytical approaches to be used to evaluate energy conservation standards for residential dehumidifiers
- Provide a forum for public discussion of rulemaking issues
- Encourage interested parties to submit data, information, and written comments

Request for Comment

<u>Item #</u> DOE solicits comment on a range of specific issues throughout the Framework Document.

- Throughout this presentation, these issues will be highlighted for discussion in comment boxes such as this.
- Item numbers correspond to those in the Framework Document.
- DOE welcomes comments concerning these specific issues and any other issues related to the this rulemaking.

Instructions for Submitting Comments

- **In all correspondence, please refer to this Residential Dehumidifiers Rulemaking by:**
  - Docket Number EERE–2012–BT–STD–0027, and/or (RIN) 1904-AC81
- **Email: *ResDehumidifier2012STD0027@ee.doe.gov***
- **Postal Mail:** Ms. Brenda Edwards
  U.S. Department of Energy
  Building Technologies Program, Mailstop EE-2J
  1000 Independence Avenue, SW.
  Washington, D.C. 20585-0121
- **Courier:** Ms. Brenda Edwards, 950 L'Enfant Plaza, SW., Suite 600
- **Phone:** (202) 586-2945

Comment period closes October 17, 2012

Public Meeting Agenda

1. Introduction
2. **Background**
3. Test Procedure
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6. Closing Remarks

Legislative History

- Energy Policy and Conservation Act (EPCA) of 1975 established an energy conservation program for major household appliances (42 USC 6291 et seq.)
- The Energy Policy Act of 2005 (EPACT 2005), amended EPCA to establish energy conservation standards for dehumidifiers manufactured as of October 1, 2007.
- The Energy Independence and Security Act of 2007 (EISA 2007), subsequently amended EPCA to prescribe new energy conservation standards for dehumidifiers manufactured on or after October 1, 2012. DOE codified these standards in a final rule published March 23, 2009.
- EPCA requires that, not later than 6 years after the issuance of a final rule establishing or amending a standard, DOE publish a notice of proposed rulemaking (NOPR) proposing new standards or that the existing standards need not be amended.

Energy Conservation Standards

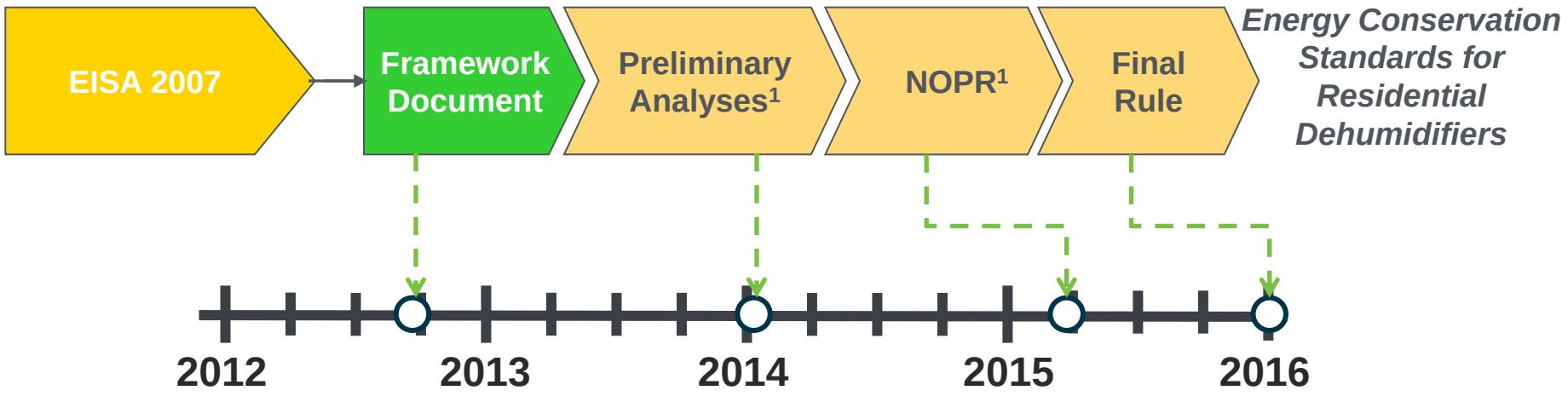
Dehumidifiers Manufactured On or After October 1, 2007

Product Capacity	EF (liters/kWh)
1. 25.00 pints/day or less	1.00
2. 25.01–35.00 pints/day	1.20
3. 35.01–54.00 pints/day	1.30
4. 54.01–74.99 pints/day	1.50
5. 75.00 pints/day or more	2.25

Dehumidifiers Manufactured On or After October 1, 2012

Product Capacity	EF (liters/kWh)
1. Up to 35.00 pints/day	1.35
2. 35.01–45.00 pints/day	1.50
3. 45.01–54.00 pints/day	1.60
4. 54.01–75.00 pints/day	1.70
5. 75.00 pints/day or more	2.5

Current Rulemaking for Residential Dehumidifiers



- To meet the EISA 2007 deadline, DOE initiated the current rulemaking on Residential Dehumidifiers.
- Today's public meeting is about the Framework Document.
- DOE expects to issue a test procedure soon to address standby mode and off mode energy use, as well as certain active mode updates.

[1] NOPR: Notice of Proposed Rulemaking

Technological Feasibility and Economic Justification

- New or amended standards must be designed to achieve the maximum improvement in energy or water efficiency that is technologically feasible and economically justified.
- DOE performs the following analyses to determine technological feasibility:

EPCA Requirement	Corresponding DOE Analyses
Technological Feasibility	• Market and Technology Assessment • Screening Analysis • Engineering Analysis

Rulemaking Process Overview

- **DOE must consider seven factors to determine whether new or amended standards are economically justified:**

EPCA Requirement	Corresponding DOE Analyses
1. Economic impact on consumers and manufacturers	• Life-Cycle Cost Analysis • Manufacturer Impact Analysis
2. Lifetime operating cost savings compared to increased product cost	• Life-Cycle Cost Analysis
3. Total projected energy savings	• National Impact Analysis
4. Impact on utility or performance	• Engineering Analysis • Screening Analysis
5. Impact of any lessening of competition	• Manufacturer Impact Analysis
6. Need for national energy conservation	• National Impact Analysis
7. Other factors the Secretary considers relevant	• Emissions Analysis • Utility Impact Analysis • Employment Impact Analysis

Public Meeting Agenda

1. Introduction
2. Background
3. **Test Procedure**
4. Preliminary Analysis
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6. Closing Remarks

Dehumidifier Test Procedure

- **The current DOE dehumidifier test procedure is codified at 10 CFR Part 430, Subpart B, Appendix X.**
- **As currently specified by EPCA (42 U.S.C. 6293(b)(13)), the test procedure measures capacity and Energy Factor (EF) according to:**

- American National Standards Institute (ANSI)/Association of Home Appliance Manufacturers (AHAM) Standard DH–1 is used to measure **capacity in pints of moisture removed per day.**
- Canada's CAN/ Canadian Standards Association (CSA)– C749–94 is used to calculate the **energy factor (EF) in terms of liters of moisture removed per kilowatt-hour (kWh).**

Standby Mode and Off Mode

- EPCA, as amended by EISA 2007, requires that DOE amend the test procedures for certain residential products, including dehumidifiers, to incorporate measures of standby mode and off mode energy use.
- DOE published a NOPR (75 FR 75290 (Dec. 2, 2010)) in which it proposed to incorporate by reference the International Electrotechnical Commission (IEC) Standard 62301, for measuring dehumidifier standby mode and off mode power consumption,
- DOE subsequently published a Supplemental Notice of Proposed Rulemaking (SNOPR) to propose referencing the updated version of IEC Standard 62301. 76 FR 58346 (Sept. 20, 2011).
- The final rule is expected to publish shortly.

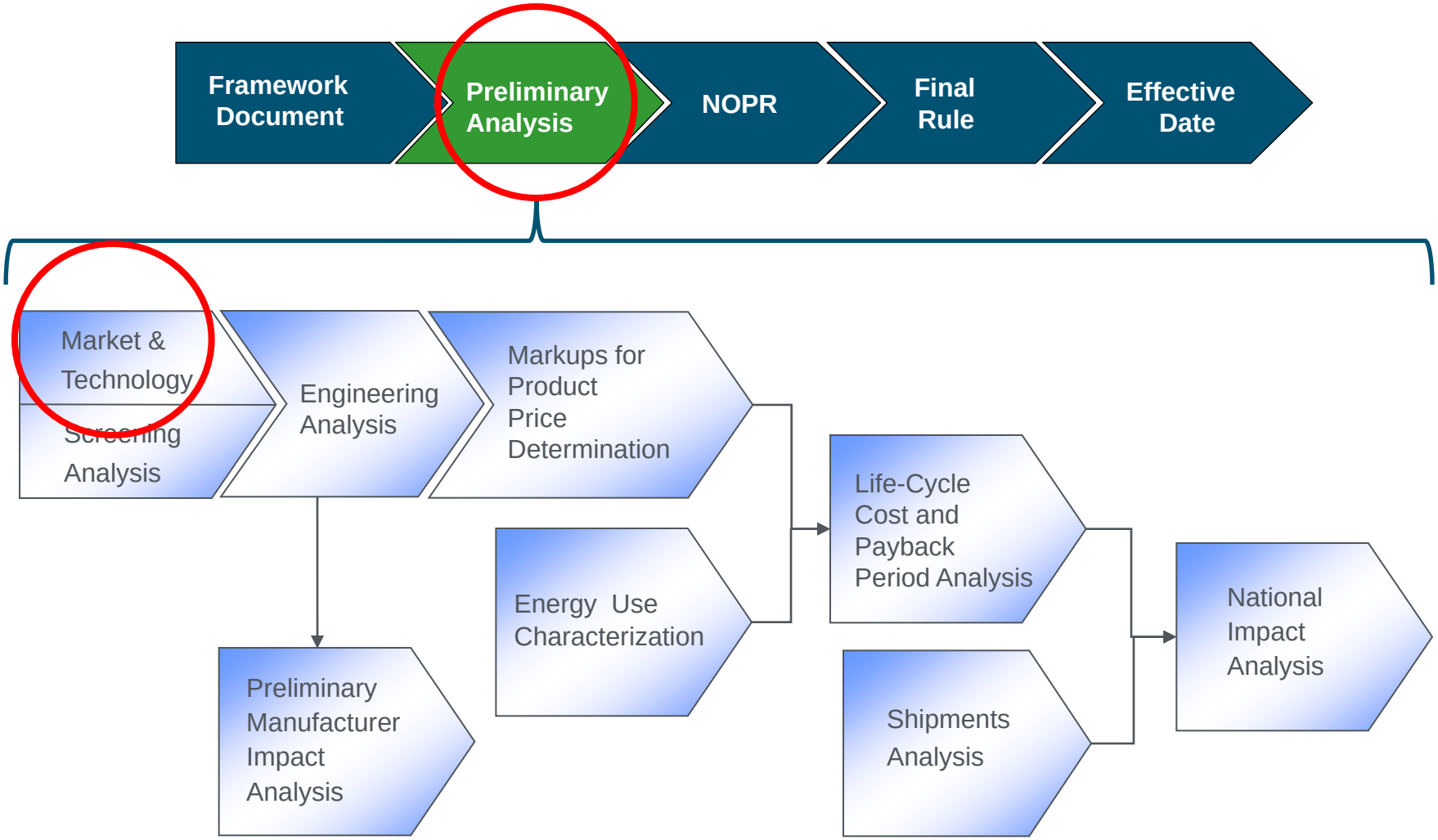
Active Mode

- In the rulemaking, DOE also proposed to measure both capacity and EF for dehumidifiers according to ANSI/AHAM DH-1-2008. 77 FR 31444 (May 25, 2012).
- The final rule is expected to publish shortly.

Public Meeting Agenda

1	Introduction
2	Background
3	Test Procedure
4	**Preliminary Analysis**
5	NOPR Analysis
6	Closing Remarks

Steps in the Standards Rulemaking: Preliminary Analysis



Market and Technology Assessment

- **Purpose:**
  - Characterize residential dehumidifier industry and market
  - Gather historical shipments and other relevant data
  - Identify technology options for improving efficiency
- **Method:**
  - Identify and characterize manufacturers of residential dehumidifiers
  - Estimate shipments and trends in the market
  - Identify technologies that could improve efficiency and
  - Identify regulatory and non-regulatory initiatives intended to improve the efficiency of the products covered under this rulemaking

Request for Comment

<u>Item 3-1</u> The Department requests information that would contribute to the market assessment (*e.g.*, current product features and efficiencies, product-feature and efficiency trends, historical product shipments and prices).

Definition

- EPACT 2005, amended EPCA to add a definition of a residential dehumidifier (codified at 10 CFR 430.2) as:

A self-contained, electrically operated, and mechanically refrigerated encased assembly consisting of :

- A refrigerated surface (evaporator) that condenses moisture from the atmosphere;
- A refrigerating system, including an electric motor;
- An air-circulating fan; and
- Means for collecting or disposing of the condensate.

Equipment Product Classes

- **DOE will formulate a separate energy conservation standard for each product class.**
- **In general, DOE divides covered equipment into classes by:**
  - Type of energy used
  - Capacity of the equipment
  - Other performance-related features such as those that provide utility to the consumer, or others deemed appropriate by the Secretary that justify different standard levels (42 USC 6295(q))

Proposed Residential Dehumidifier Product Classes

- EPCA establishes product classes based on the capacity of the unit
- The Department is considering the following product classes, as established in the EISA 2007 amendments to EPCA for dehumidifiers manufactured on or after October 1, 2012:

Residential Portable Dehumidifiers*	
1. Up to 35.00 pints/day	4. 54.01–75.00 pints/day
2. 35.01–45.00 pints/day	5. Greater than 75.00 pints/day
3. 45.01–54.00 pints/day	

* The current product classes do not specify whether they apply only to portable dehumidifiers. DOE is considering such clarification because it may define a separate product class for whole-home dehumidifiers.

Proposed Additional Whole-Home Residential Dehumidifier Product Class

- **Whole-home units generally use equivalent dehumidification technologies as portable units, but are designed to operate in a ducted installation, typically in conjunction with the home's central air conditioning system.**
- **Differentiating characteristics of whole-home units:**
  - Performance is affected by the air flow and pressure impacts resulting from the ducting
  - May be installed with a fresh air intake rather than having conditioned air at the intake side
  - Capacity ranges from approximately 65 to 200 pints/day, with no distinct correlation between capacity and EF

Classification of Portable Dehumidifiers With Optional Ducting

- **Certain portable dehumidifiers may be operated in a ducted installation**
- **Several options exist for classification of such units:**
  - Portable (no ducting, least energy-intensive configuration)
  - Whole-home (ducted, most energy-intensive configuration)
  - Some other alternative or combination

Request for Comment

Item 3-2 The Department requests input from stakeholders on the proposed classes and criteria used for creating these product classes. Specifically, should additional or fewer criteria beyond those identified above be used as a basis for developing product classes? Should DOE consider separate product class(es) for whole-home dehumidifiers? How should DOE classify portable dehumidifiers that can be operated in a ducted installation?

Initial Technology Options for Residential Dehumidifiers

- DOE will consider technology options from previous rulemaking, plus any new available technologies

• Built-in hygrometer/humidistat
• Improved compressor efficiency
• Improved condenser performance
• Improved controls
• Improved defrost methods
• Improved demand-defrost controls
• Improved evaporator performance
• Improved fan-motor efficiency
• Improved fan efficiency
• Improved flow-control devices
• Low-standby-loss electronic controls
• Washable air filters
• Heat pipe technology

Request for Comment

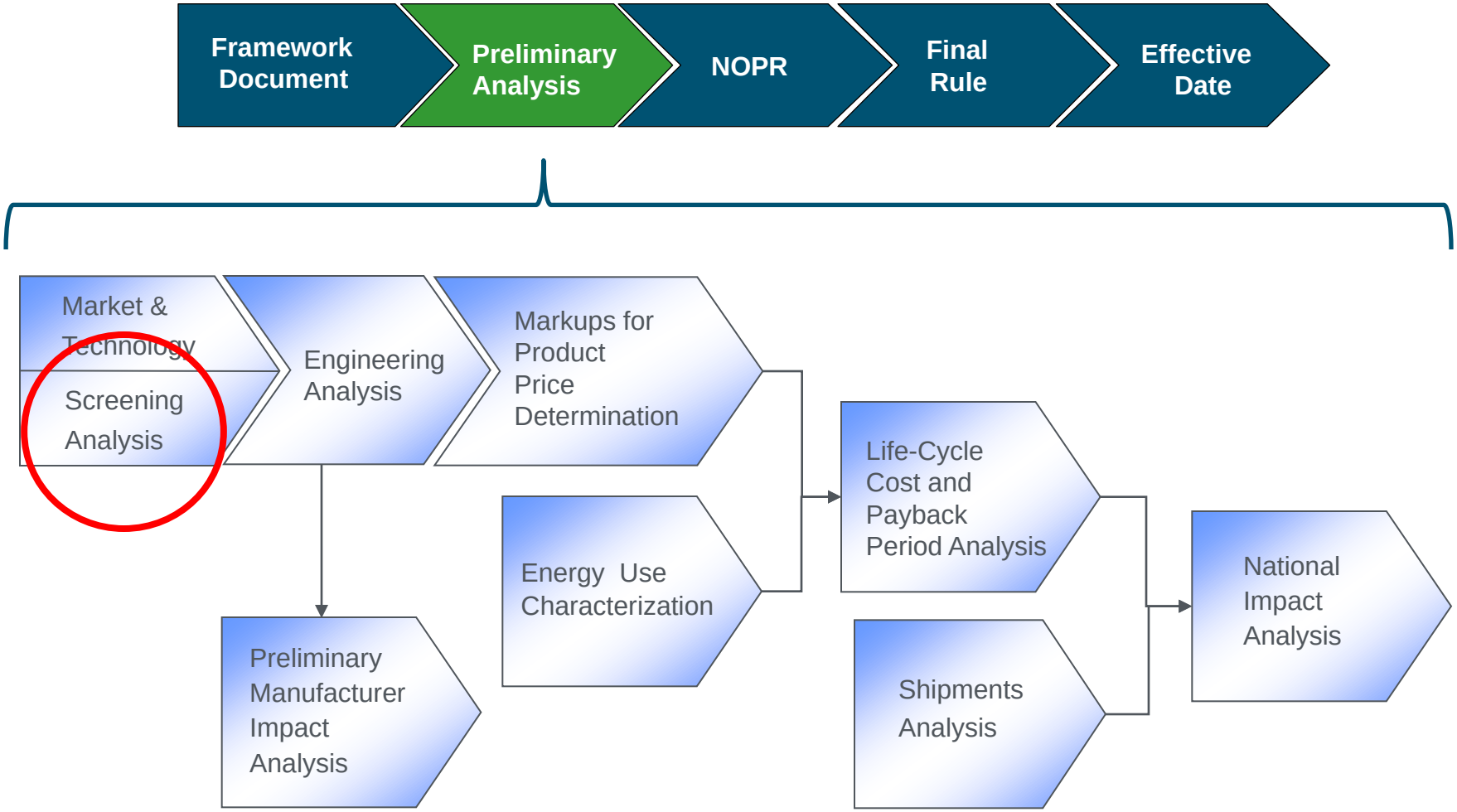
Item 3-3 Of the technologies listed, are there any that DOE should not consider because of their impacts on safety, performance, or consumer utility of the product?

Item 3-4 Are there other unlisted technologies that DOE should consider as design options and what, if any, impacts do the design options have on safety, performance, and consumer utility?

Request for Comment

Item 3-5 The Department seeks input from stakeholders on the selection of representative product classes for the engineering and LCC analyses, and on possible methods of extrapolating the engineering and LCC analyses from the representative dehumidifier product classes to the other two product classes (*e.g.*, maintaining relative incremental energy use specified in EPCA across product classes).

Screening Analysis

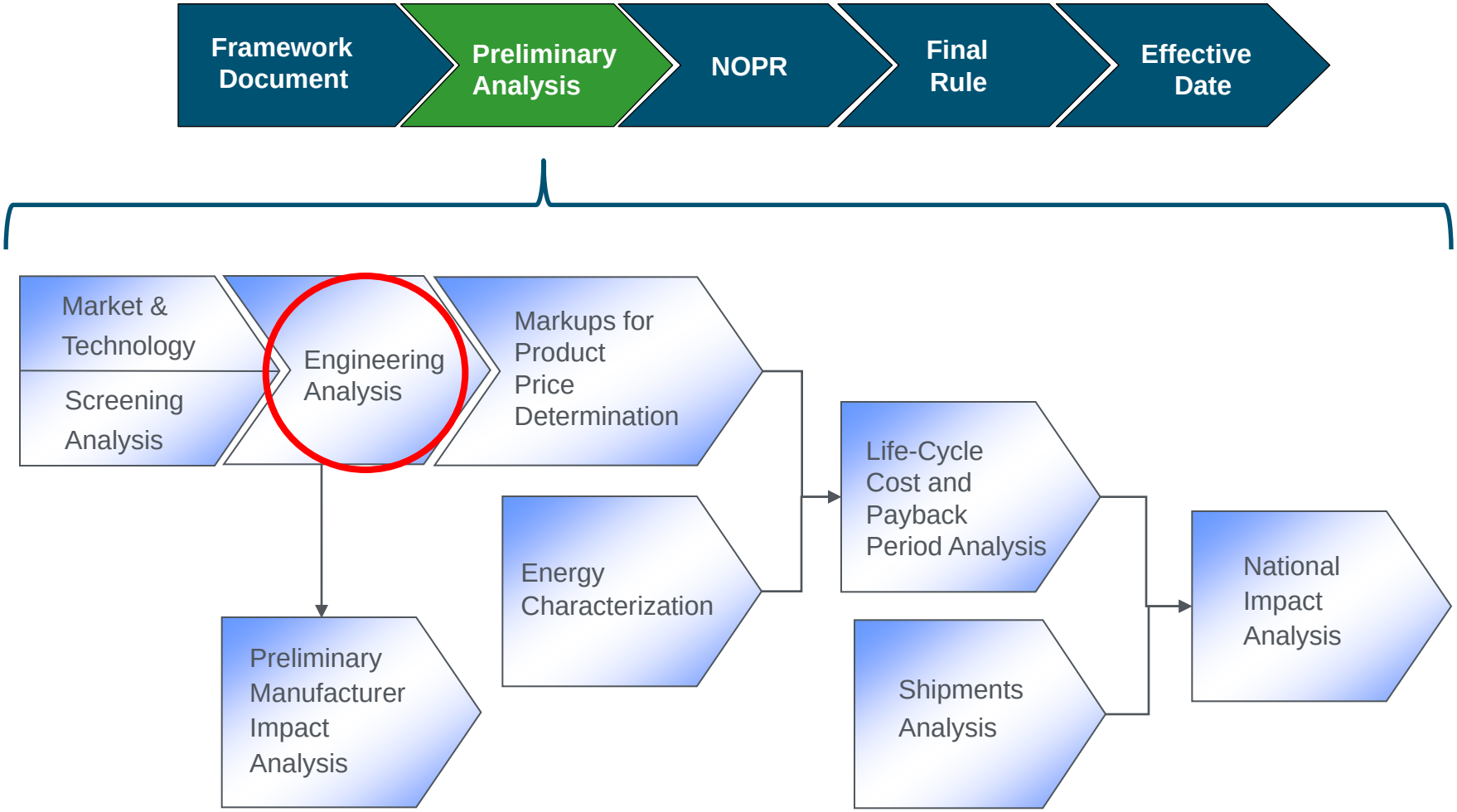


Screening Analysis

- **Purpose:**
  - Screen out technology options that DOE will not consider during the rulemaking

- **Criteria:**
  - Technological feasibility
  - Practicability to manufacture, install, and service
  - Adverse impacts on product utility or availability
  - Adverse impacts on health or safety

Engineering Analysis



Engineering Analysis

- **Purpose:**
  - Determine the relationship between manufacturer cost and energy efficiency

Residential Dehumidifier Baseline Models

Product Class	EF (liters/kWh)
1. Portable, up to 35.00 pints/day	1.35
2. Portable, 35.01–45.00 pints/day	1.50
3. Portable, 45.01–54.00 pints/day	1.60
4. Portable, 54.01–75.00 pints/day	1.70
5. Portable, greater than 75.00 pints/day	2.5
6. Whole-home	2.5*

*** Based on October 1, 2012 standards for dehumidifiers with a capacity greater than 75 pints/day**

Request for Comment

Item 5-1 DOE seeks input from stakeholders on whether the proposed energy efficiency levels are appropriate for characterizing the performance of baseline units.

Item 5-2 DOE seeks input on an appropriate baseline unit efficiency for whole-home dehumidifiers and whether the DOE test procedure is capable of measuring the performance of these units.

Item 5-3 DOE seeks information regarding the specific technological characteristics of the baseline model for each product class, including the technologies described for the Technology Assessment.

Approach for Determining Cost-Efficiency Relationship

- DOE proposes to use design-option approach using reverse engineering, because data suggests that there is little variation in EF within most product classes.
- Reverse-engineering will be used to identify cost and efficiency impacts from design options.
- DOE will conduct limited testing to establish what control strategies are being used by manufacturers in conjunction with design options and platform design.
- DOE will seek incremental cost data from manufacturers for each efficiency level, supplemented with stakeholder interviews and publicly available data.
- Cost-efficiency curves will be generated from incremental costs for each efficiency level.

Industry Cost Submittal

- **Direct material**
- **Direct labor**
- **Factory overhead**
- **Depreciation**

- **Sales & marketing**
- **Research & development**
- **Building**
- **Tooling/Equipment**

- Costs will be provided on a shipment-weighted, industry-aggregated basis.
- Data will not be provided for product classes and/or efficiency levels representing fewer than three manufacturers.
- DOE will request information about the depreciation method manufacturers use to expense conversion capital.

Request for Comment

Item 5-4 DOE requests feedback on the use of a design-option approach to determine the relationship between manufacturer cost and energy efficiency for residential dehumidifiers.

Product Classes Analyzed

- **DOE will conduct the engineering analysis (and LCC and PBP analyses) on the product classes for which it suggests efficiency levels.**
- **DOE proposes to analyze four product classes:**
  - Portable, 35.01–45.00 pints/day
  - Portable, 45.01–54.00 pints/day
  - Portable, 54.01–75.00 pints/day
  - Whole-home
- **DOE will extrapolate results to the other product classes.**

Max-Tech Efficiency Levels

- **DOE is required to analyze maximum technologically feasible ("max tech") efficiency levels**
  - In some cases, DOE defines the highest efficiency level based on maximum available efficiency currently on the market.
  - "Max available" may not correspond to "max tech" if, for example, some design options are not yet commercially available.
  - DOE will seek stakeholder input to resolve this potential discrepancy.

Efficiency Levels for Residential Dehumidifiers

Level	Efficiency Level Source	Efficiency Levels (liters/kWh)			
		Portable, 35.01–45.00 pints/day	Portable, 45.01–54.00 pints/day	Portable, 54.01–75.00 pints/day	Whole-Home
Baseline	DOE Standard	1.50	1.60	1.70	2.50†
1	ENERGY STAR* (Max Available for 35.01–45.00 pints/day, Gap Fill for 45.01–54.00 pints/day)	1.62	1.70	1.85	2.80
2	Gap Fill (Max Available for 45.01–54.00 pints/day	--	1.8	2.10	3.50
3	Maximum Available	--	--	2.47	4.17

* ENERGY STAR qualification criteria effective October 1, 2012, require all portable and whole-home dehumidifiers less than 75 pints per day to have an EF of at least 1.85 liters/kWh, which is greater than the maximum available efficiency of 35.01–45.00 pints/day units. Units with 75–185 pints/day capacity must have an EF of at least 2.80 liters/kWh, while dehumidifiers with a capacity greater than 185 pints/day are excluded.
† The baseline efficiency for the whole home product class is specified as the DOE standard effective October 1, 2012, for dehumidifiers with a capacity greater than 75.00 pints/day.

Request for Comment

Item 5-5 DOE seeks input from stakeholders concerning the efficiency levels it proposes to use for collecting incremental cost data from manufacturers of residential dehumidifiers. DOE also seeks input from stakeholders on appropriate maximum technologically feasible efficiency levels.

Proprietary Designs

- DOE will evaluate all design options that are commercially available or present in a working prototype, including proprietary designs and technologies.
- Proprietary designs will only be considered if they do not present a unique path to a given efficiency level.
- The confidentiality of manufacturers will be maintained

Request for Comment

Item 5-6 Are there proprietary designs or technologies of which DOE should be aware for any of the dehumidifiers under consideration in this rulemaking? If so, how should DOE acquire the cost data necessary for evaluating these designs?

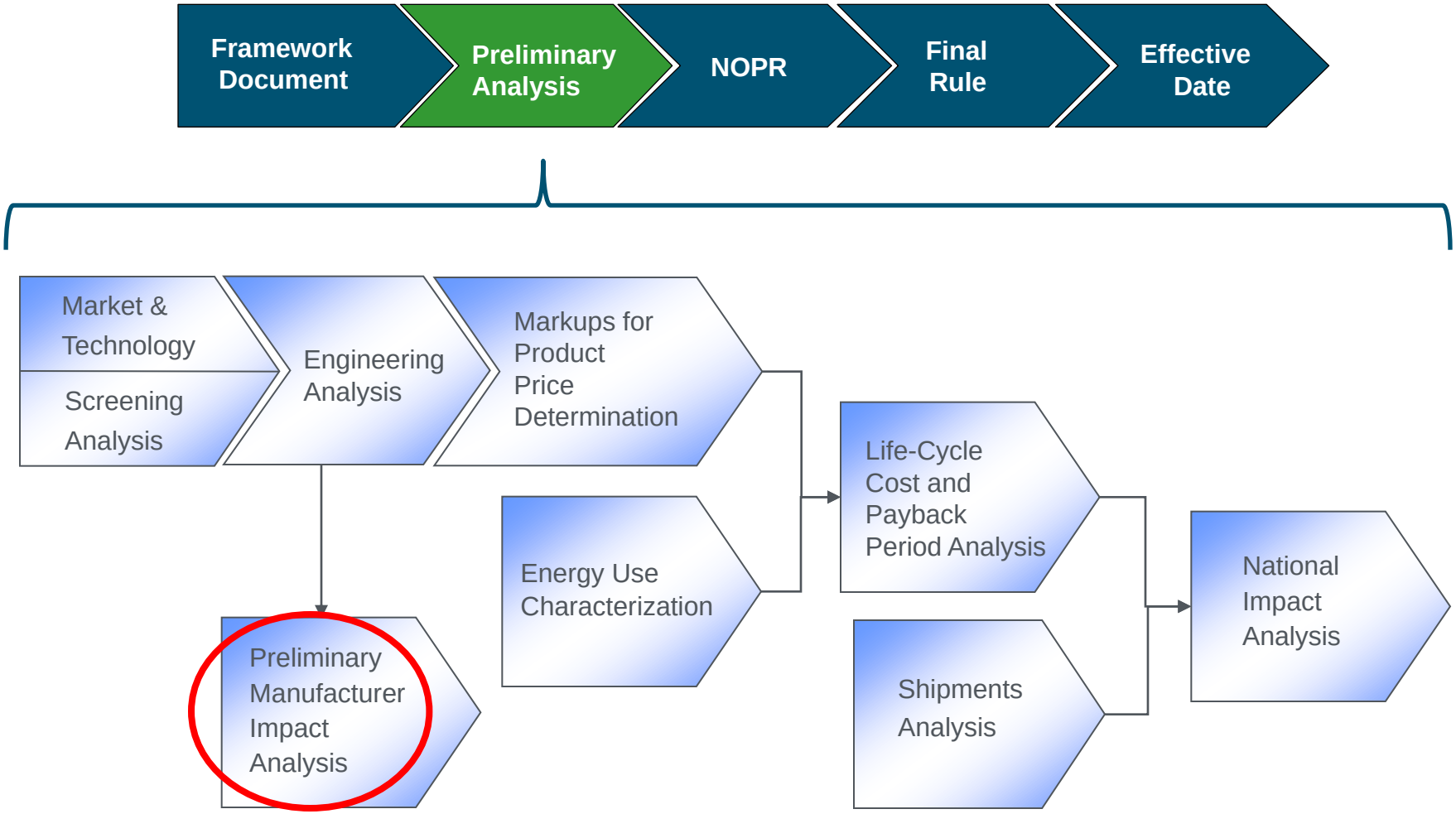
Outside Regulatory Changes

- **Consider the effects on manufacturers of other regulatory changes outside of the standards rulemaking process.**
- **Example: Some manufacturers in the residential dehumidifier industry are subsidiaries of larger parent companies that manufacture other products subject to Federal regulations**
  - Recent DOE standards for residential dishwashers, clothes washers, clothes dryers and room air conditioners
  - Reduction of Hazardous Substances (RoHS) EU directive

Request for Comment

<u>Item 5-7</u> Are there outside regulatory issues that DOE should consider in its analysis of residential dehumidifiers?

Markups for Product Price Determination



Legislative Requirements

- **The Manufacturer Impact Analysis (MIA) partially fulfills EPCA requirement to determine if a proposed standard is economically justified:**
  - Economic impact of standards on manufacturers
  - Impacts of any lessening of competition in the industry
- **MIA format changes are described in the 2006 report to Congress, at:**

  http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/congressional_report_013106.pdf

Preliminary Analysis (Phase I) MIA Methodology

Industry Profile

- Identify current and past industry structure
- Evaluate market characteristics and current trends
- Develop industry average financial parameters using publicly available information
- Identify manufacturer sub-groups including small business manufacturers

Preliminary Interviews

- Conducted in conjunction with the Pre-NOPR Phase Engineering Analysis interviews
- Identify key issues for manufacturers
- Inform preliminary analysis

Preliminary Analysis (Phase II) MIA Methodology

- **Framework for Analysis**
  - DOE will tailor the Governmental Regulatory Impact Model (GRIM) to reflect the industry structure
  - DOE will use this framework to determine what additional information is required to fully analyze the potential impacts to manufacturers
- **MIA Interview Guides**
  - DOE will develop an interview guide designed to collect responses that will help inform further analyses and develop key inputs to the GRIM
  - Topics include: key issues, market share, markup structure, shipments, financial parameters, capital and non-capital expenditures, cumulative regulatory burden, direct employment, manufacturing capacity, and the anticipated impacts to competition and manufacturer subgroups

NOPR (Phase III) MIA Methodology

- **MIA Interviews**
  - DOE will conduct confidential interviews with manufacturers to discuss the topics outlined in the interview guide, as well as any other relevant topics that manufacturers would like to address
- **Impacts to Industry**
  - Key quantitative metrics include the estimated impacts to industry net-present value (INPV) and domestic employment
  - Additionally, DOE will assess the cumulative regulatory burden associated with this rulemaking, the effect of the rulemaking on competition in the industry, and the disproportionate effects of the rulemaking on any previously identified manufacturer subgroups including small-business manufacturers

Manufacturer Subgroups

- **Groups of manufacturers that may be disproportionately affected by efficiency standards:**
  - DOE has identified five small business manufacturers of residential dehumidifiers

Cumulative Regulatory Burden

- **Regulations that could affect the industries impacted by this rulemaking include:**
  - DOE standards for residential dehumidifiers (October 2012), dishwashers, clothes washers, clothes dryers, and room air conditioners (existing and upcoming)
  - EPA-mandated phase-out of HCFCs
  - Reduction of Hazardous Substances (RoHS) directive

Request for Comment

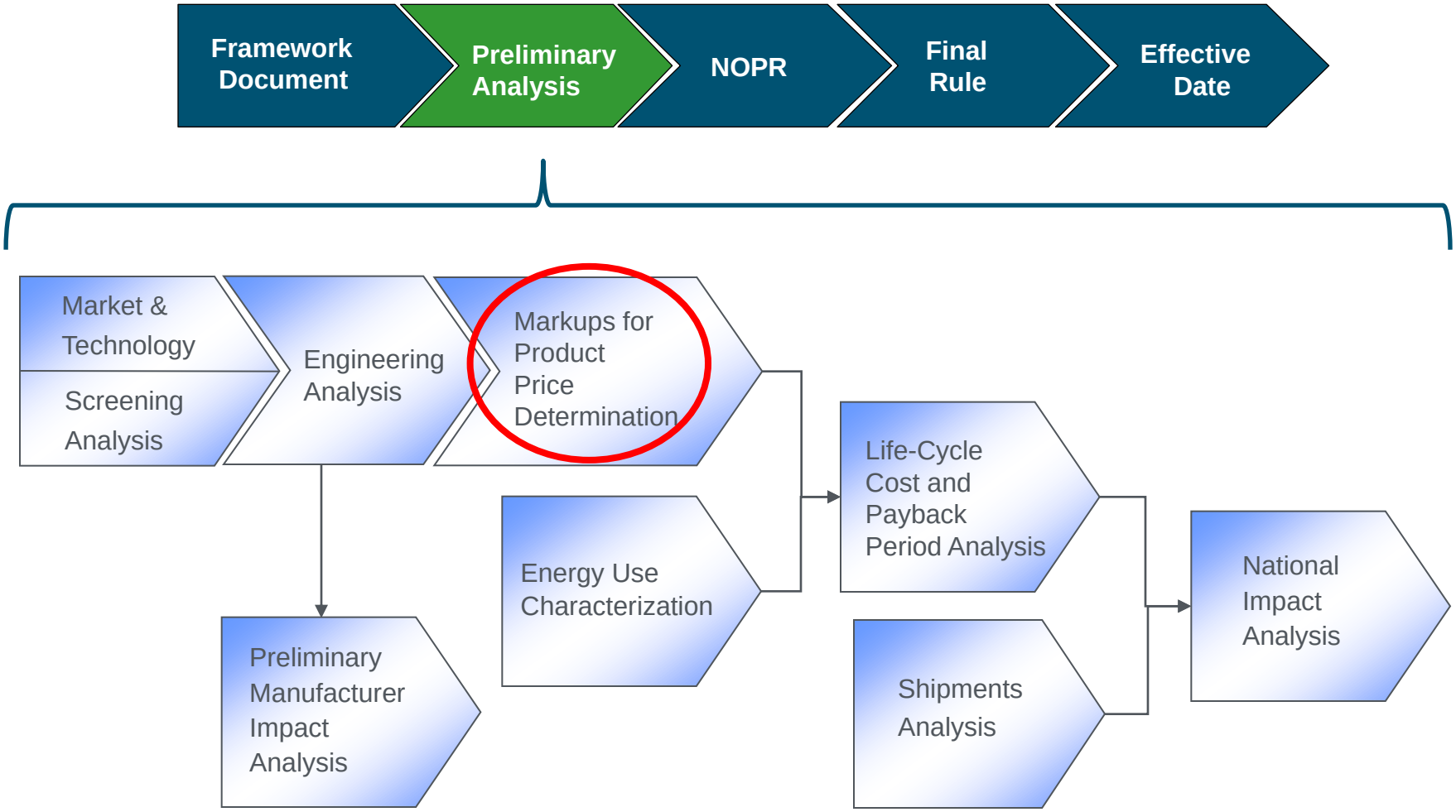
Item 12-1 DOE seeks comment on appropriate manufacturer subgroups, if any, that DOE should consider in a manufacturer subgroup analysis for residential dehumidifiers.

Item 12-2 DOE seeks comment on small businesses that could be impacted by energy conservation standards for dehumidifiers, and what the impacts on small businesses of potential standards might be.

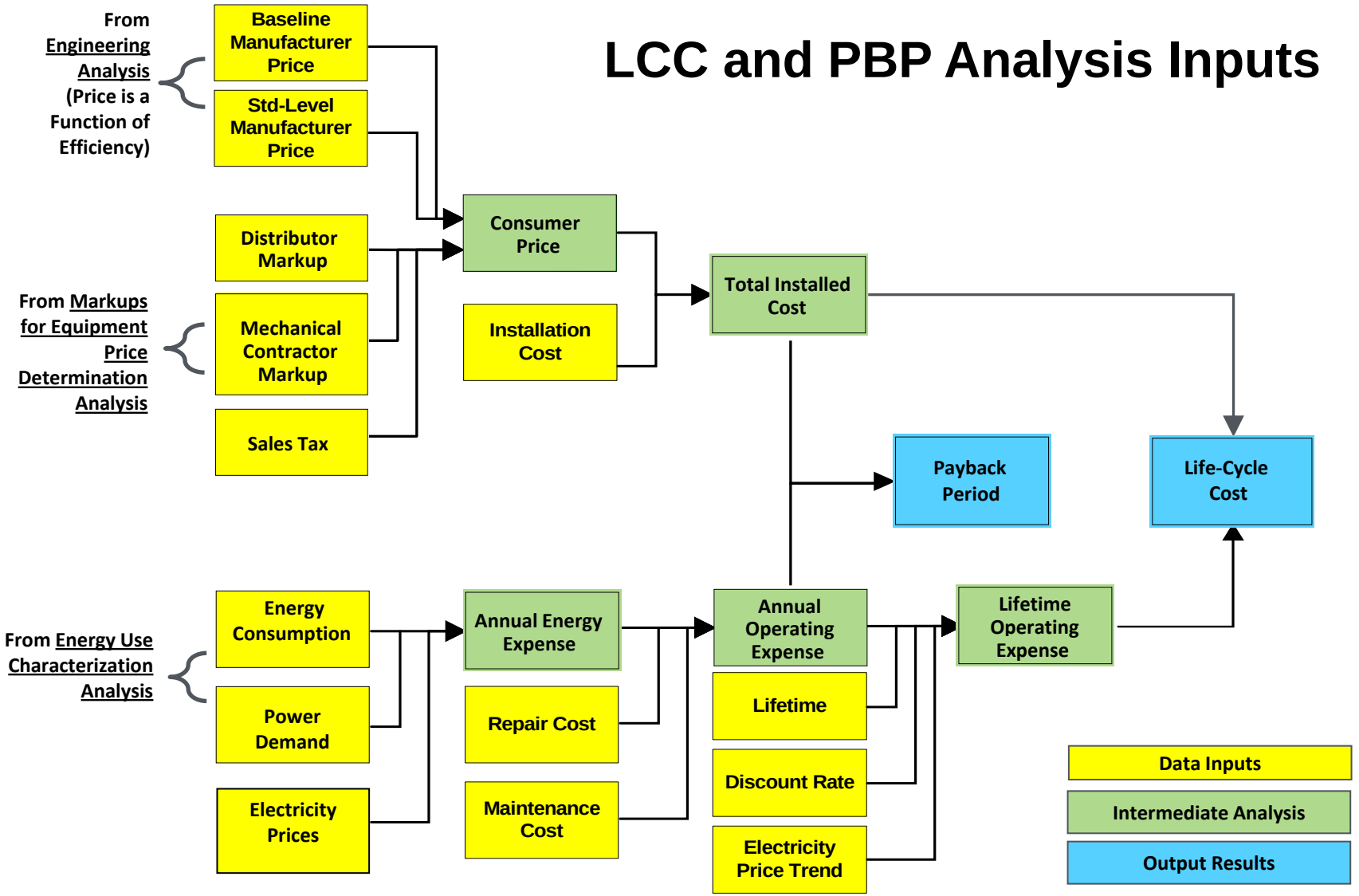
Request for Comment

Item 12-3 What other regulations or pending regulations should DOE consider in its examination of cumulative regulatory burden?

Markups for Product Price Determination



Life-Cycle Cost and Payback Period Analysis Inputs



Types of Markups in Distribution Chain

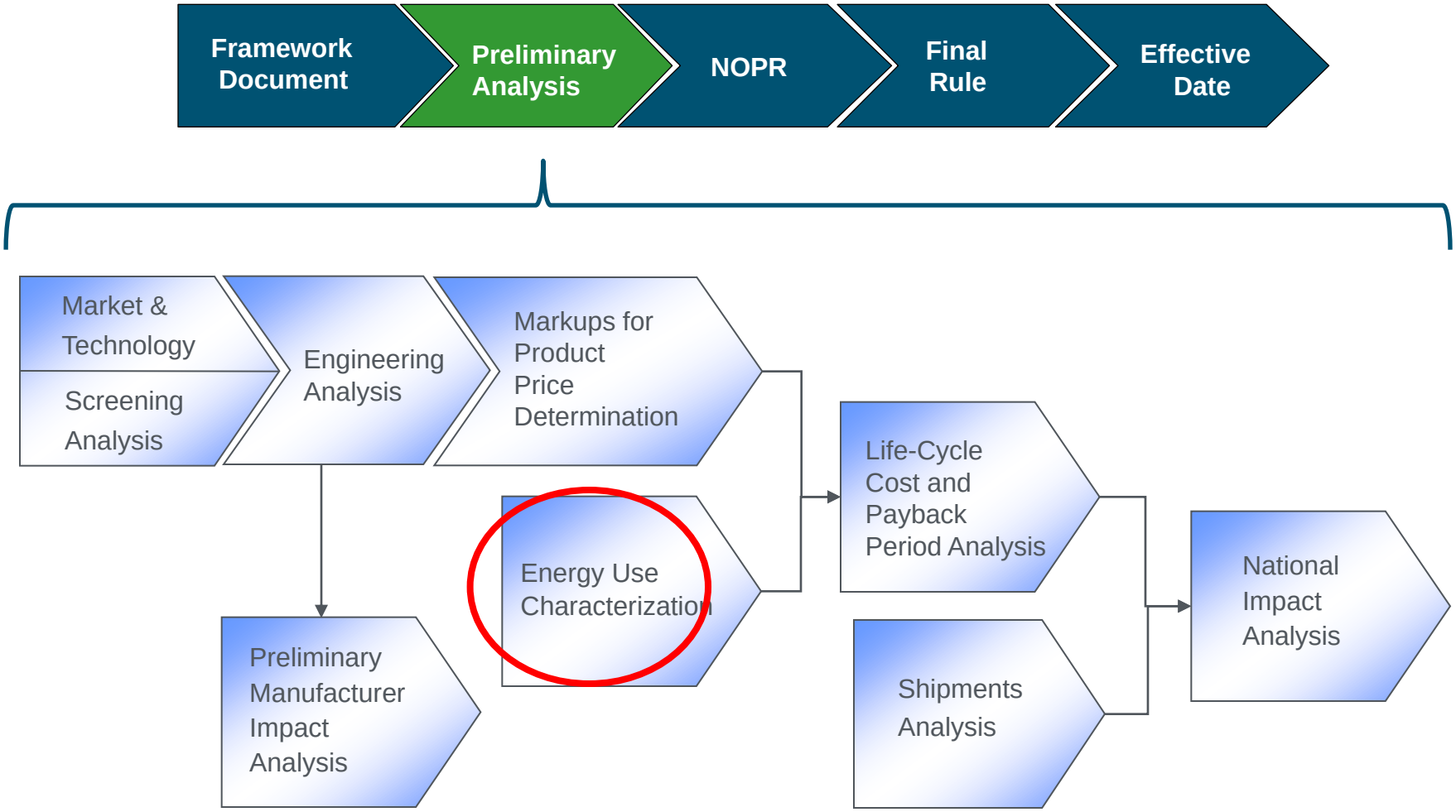
- **Baseline Markups:**
  - Markups relate consumer price to cost of goods sold (CGS).
  - Baseline markups relate price to cost prior to a change in efficiency.
  - Baseline markups indicate a consumer price that covers all of a distributor's or contractor's expenses plus profit.
- **Incremental Markups:**
  - Incremental markups relate the incremental change in consumer price to the incremental change in CGS.
  - Certain costs, such as direct labor costs (salaries, payroll, rental and occupancy), do not vary with efficiency induced changes in CGS and remain constant in the calculation of incremental markups.
  - Incremental markups cover only expenses that vary with CGS in this case, expenses that increase due to an increase in equipment efficiency.

Request for Comment

Item 7-1 DOE welcomes suggestions and comments concerning its proposed approach for developing estimates of retail prices.

Preliminary Analysis

Energy Use Determination



Energy Use Characterization

- **Purpose:**
  - Develop annual energy use data for the life-cycle cost and payback period analyses to calculate annual operating costs.
- **Method:**
  - Develop household samples from DOE-EIA's Residential Energy Consumption Survey (RECS) for the six product class to be analyzed in detail in the Engineering Analysis.

1. **Portable, up to 35.00 pints/day**
2. **Portable, 35.01–45.00 pints/day**
3. **Portable, 45.01–54.00 pints/day**
4. **Portable, 54.01–75.00 pints/day**
5. **Portable, greater than 75.00 pints/day**
6. **Whole-home**

  - Use RECS data along with Engineering Analysis, CEC, ENERGY STAR data to develop annual energy use on a per-household basis.

Energy Use Characterization Issues

- Typically, DOE relies on the RECS to estimate the appliance's annual energy consumption; RECS 2009 has additional, but still limited, information about dehumidifiers.
- DOE will augment the RECS household data with data from the California Energy Commission (CEC), ENERGY STAR, research reports, and possibly NPD Group sales data to estimate a range of annual energy use values and capacities for dehumidifiers.
- Additionally, DOE may rely on in situ field measurements as a means to characterize dehumidifier energy use.
- **Usage Sources from 2007 ANOPR**

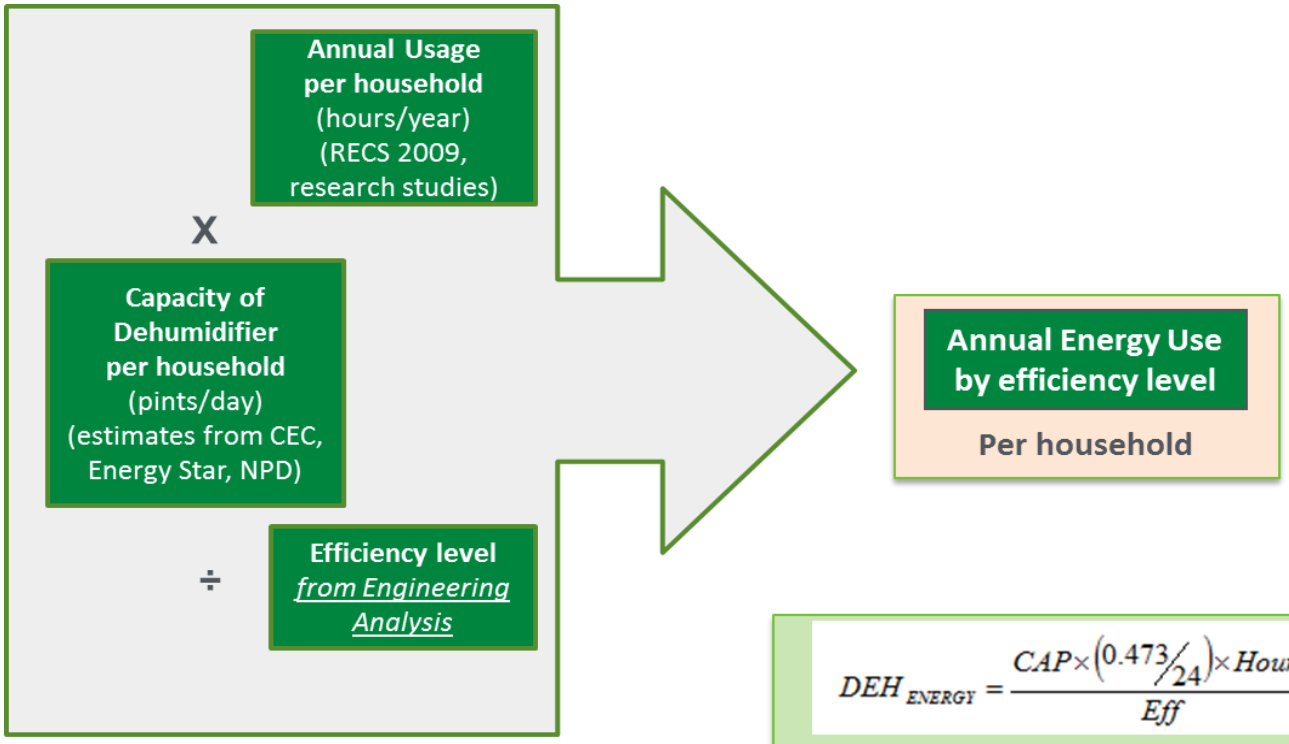
Source	Jan-Mar	Apr	May	June	July	Aug	Sept	Oct	Nov-Dec	Annual
	Hours/month									*Hours/year*
AHAM Low	0	0	70	210	245	245	70	35	0	875
AHAM Mid	0	14	86	231	288	288	130	58	0	1095
AHAM High	0	37	110	256	329	329	183	73	0	1315
ADL*	0	0	180	360	360	360	180	180	0	1620
Energy Star#	0	0	475	475	475	475	475	475	0	2851
LBNL-High†	1080	360	360	360	360	360	360	360	720	4320

* Based on peak dehumidification period of three months (at 360 hours/month) with half the usage (180 hours/month) during the remaining three months.

Based on six-month operation with 0.66 duty cycle.

† Monthly operation equal to ADL peak dehumidification period.

Energy Use Determination Approach



$$DEH_{ENERGY} = \frac{CAP \times \left(0.473/24\right) \times Hours}{Eff}$$

DEH_{ENERGY} =	Dehumidifier annual energy consumption (kWh/year),
CAP =	Dehumidifier capacity (pints/day),
0.473 =	Conversion factor for liters in a pint,
24 =	Number of hours in a day
$Hours$ =	Annual operating hours, and
Eff =	Dehumidifier efficiency (liters/kWh).

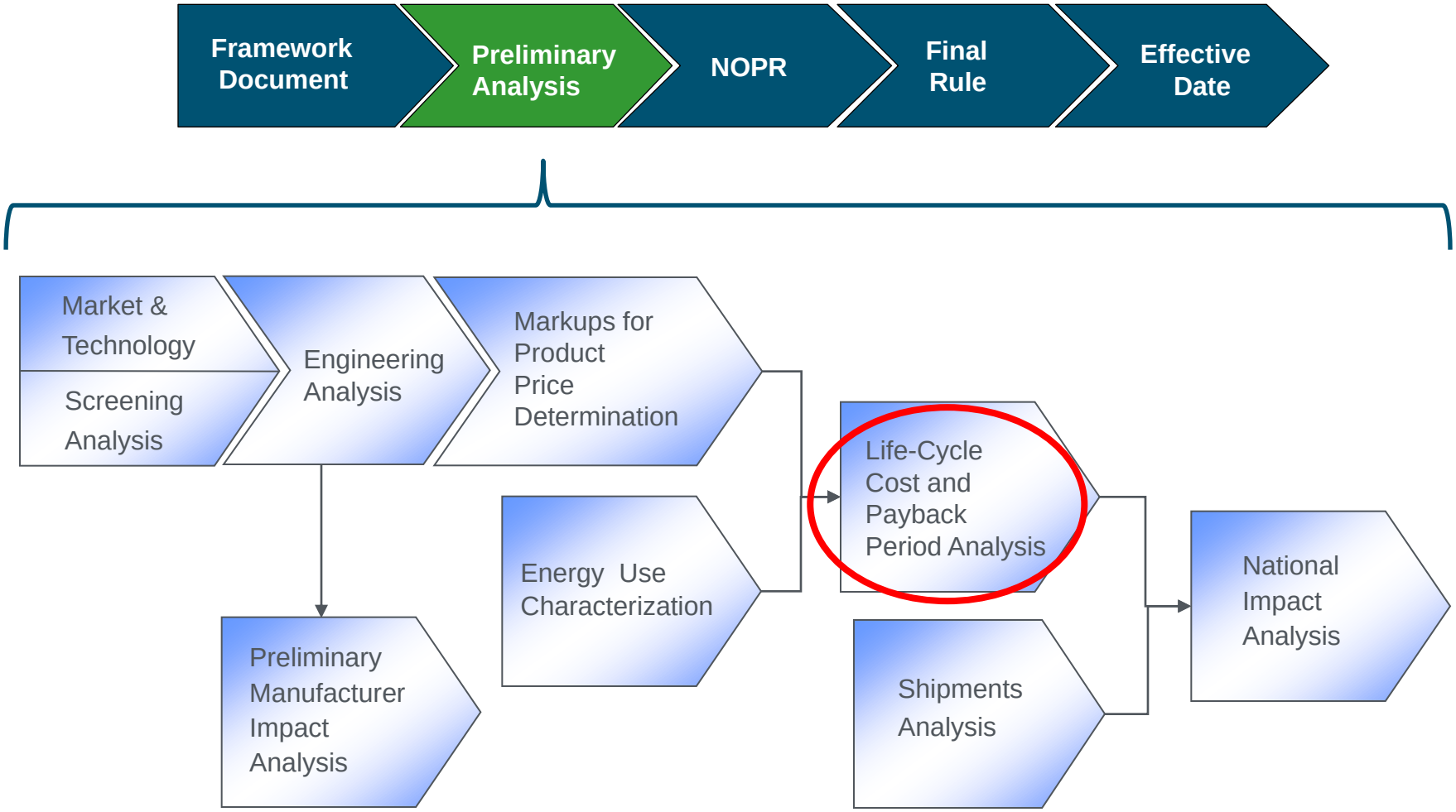
Energy Use Characterization

Request for Comment

Item 6-1 DOE seeks stakeholder input on its proposed approaches for specifying typical annual energy consumption. Most importantly, the Department is interested in sources of data that can assist in characterizing the annual energy consumption of dehumidifiers.

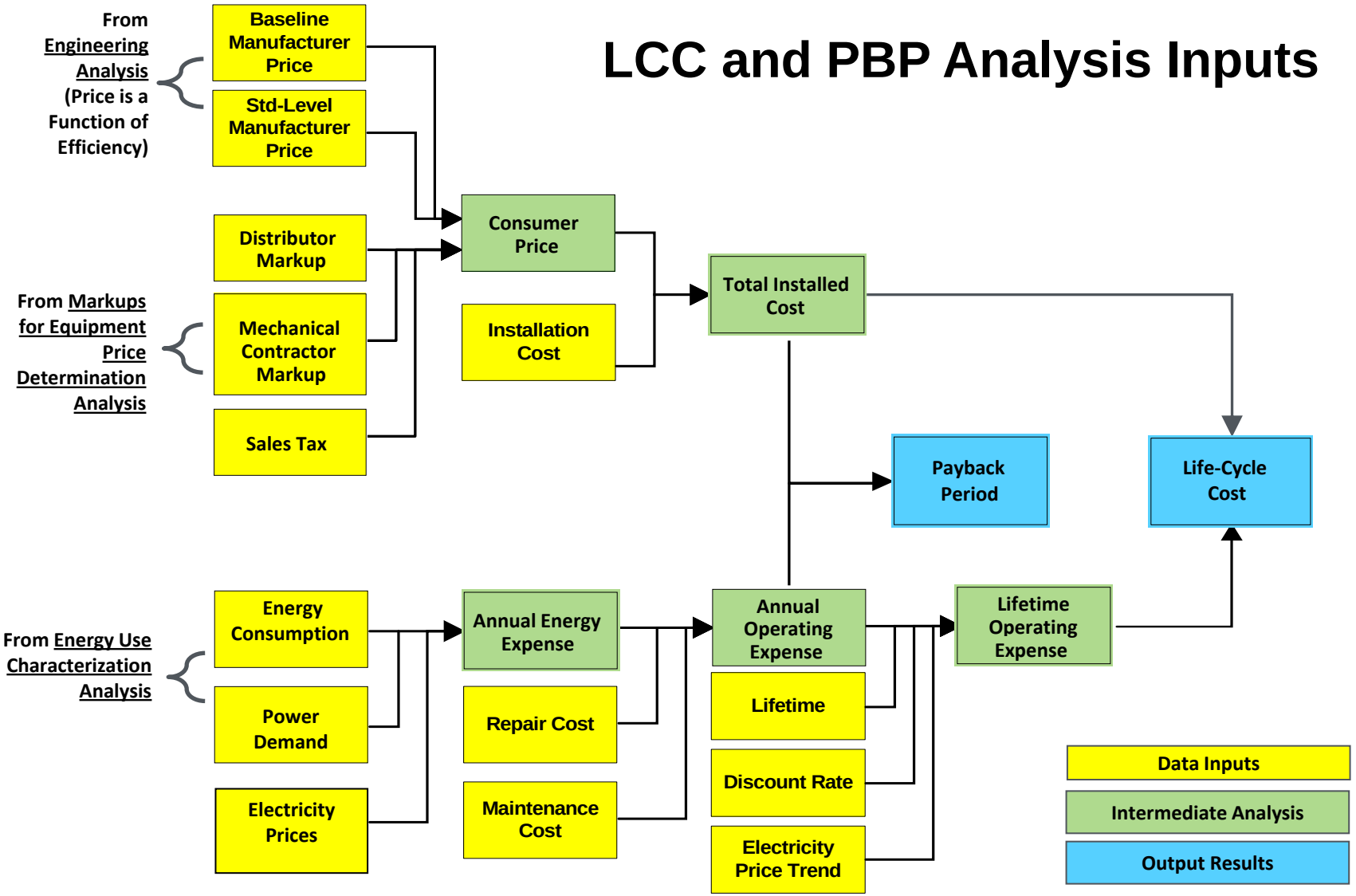
Item 6-2The Department seeks stakeholder input on data sources that it can use to characterize the variability in annual energy consumption for dehumidifiers. The Department is particularly interested in field monitoring studies and data.

Life-Cycle Cost and Payback Analysis



Life-Cycle Cost and Payback Period Analysis

LCC and PBP Analysis Inputs



Life-Cycle Cost (LCC) and Payback Period (PBP) Analysis Purpose

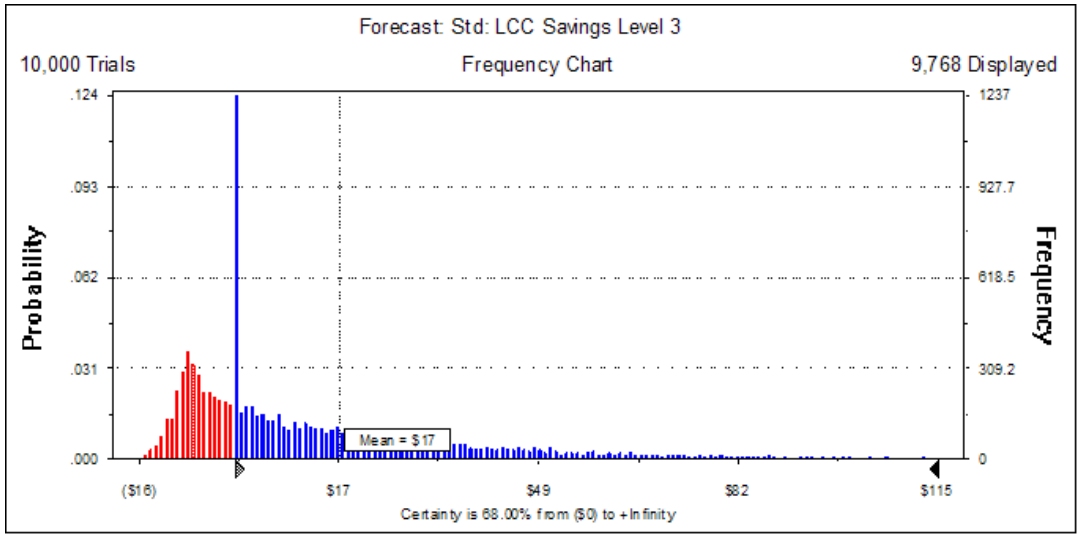
- Assess the net LCC and PBP for different efficiency levels.

- LCC equals consumer price plus the sum of annual operating costs discounted to a particular base year.
- Economic evaluation performed from the consumer perspective.
- Analysis implemented in an Excel spreadsheet.
- Results expressed as LCC difference (baseline minus standard level).
- Simple payback equals the incremental first cost divided by the operating cost savings for 1 year.

Approach

- **Monte Carlo simulation analysis to be used.**
  - Characterize the variability and uncertainty associated with the inputs using probability distributions.
  - RECS household samples will be used to characterize the variability in annual energy use and energy prices.
  - Probability distributions will be used to characterize the uncertainty in other operating cost inputs (e.g., discount rates, equipment lifetimes) and manufacturing costs.
- **One LCC and PBP analysis result per product class.**
  - Analysis to be conducted for each proposed product class to be analyzed in detail in the Engineering Analysis.
- **Base case efficiency distributions developed to avoid overstating the benefits from increasing product efficiency.**

Efficiency Distributions Example from Dishwasher LCC Analysis



Level	EF	Life-Cycle Cost			Life-Cycle Cost Savings				Payback Period (years)	
		Average Installed Price	Average Operating Cost	Average LCC	Average Savings	Households with Net Cost	Households with No Impact	Households with Net Benefit	Median	Average
Baseline	0.46	$700	$424	$1,124	-	-	-	-	-	-
1	0.58	$706	$339	$1,045	$4.1	0.1%	92.8%	7.1%	0.9	1.5
2	0.62	$712	$318	$1,029	$13.4	11.3%	32.8%	56.0%	2.8	5.1
3	0.65	$722	$303	$1,025	$16.8	32.6%	10.6%	56.8%	5.9	10.9
4	0.68	$747	$291	$1,038	$4.8	58.6%	3.1%	38.4%	11.9	22.2
5	0.72	$811	$275	$1,086	-$42.9	82.9%	0.6%	16.5%	22.5	42.3
6	0.80	$900	$249	$1,149	-$105.9	90.1%	0.4%	9.5%	28.3	51.5
7	1.11	$980	$183	$1,162	-$119.2	83.3%	0.3%	16.4%	21.9	39.3

Life-Cycle Cost and Payback Period Analysis

Request for Comment

Item 8-1 DOE seeks stakeholder input on the planned approach of using probability distributions and Monte Carlo simulation to conduct the LCC and PBP analysis.

Item 8-2 DOE requests data from stakeholders to characterize the current mix of dehumidifier efficiencies in the market.

Electricity Prices

- Electricity prices are used to convert energy use to energy costs.
- DOE will develop electricity prices from DOE-Energy Information Administration (EIA) Form 861 data.
- DOE will use the DOE-EIA Annual Energy Outlook (AEO) for projections of future average energy prices (reference, high, and low scenarios).
- DOE may evaluate other quantitative price projections provided by stakeholders as sensitivities.

Life-Cycle Cost and Payback Period Analysis

Request for Comment

Item 8-3 DOE seeks stakeholder input on the planned approach for estimating current and projected energy prices.

Installation, Maintenance, and Repair Costs

- DOE bases repair costs on annualized costs of key components and frequency of replacement in the field.
- Typically, small incremental changes in product efficiency incur little or no changes in repair and maintenance costs over baseline products.
- Unless the efficiency increases considered for this rulemaking result in significantly larger or heavier products, DOE expects that more-efficient dehumidification products will not incur increased installation costs.

Request for Comment

Item 8-4 DOE seeks stakeholder input on whether it is correct to assume that changes in maintenance, repair, and installation costs will be negligible for more-efficient residential dehumidifiers. If it is incorrect, DOE is interested in the reasons why this is so and in specific ways in which to correct this assumption.

Product Lifetimes

- DOE will use information from available literature sources as well as input from manufacturers and other stakeholders to establish specific dehumidifier lifetimes.

Request for Comment

Item 8-5 DOE seeks stakeholder input on appropriate product lifetimes for dehumidifiers both portable unit and whole-home. Specifically, DOE seeks data sources for establishing product lifetimes.

Discount Rates

- **Discount rates are used to convert streams of annual operating expenses to present value in the LCC analysis.**
- **DOE will use similar approach as for other residential product standards rulemakings.**
  - Derived from estimates of the "finance cost" to purchase residential products.
  - Finance cost based on:
    - Financial cost of any debt incurred to purchase products (*e.g.*, credit cards, home equity loans)
    - Opportunity cost of any equity to purchase products (*e.g.*, stocks, bonds, savings accounts)
  - Federal Reserve Board's Survey of Consumer Finances is a source of much of the equity and debt data.

Life-Cycle Cost and Payback Period Analysis

Request for Comment

Item 8-6 DOE seeks stakeholder input on the planned approach for estimating discount rates for residential consumers.

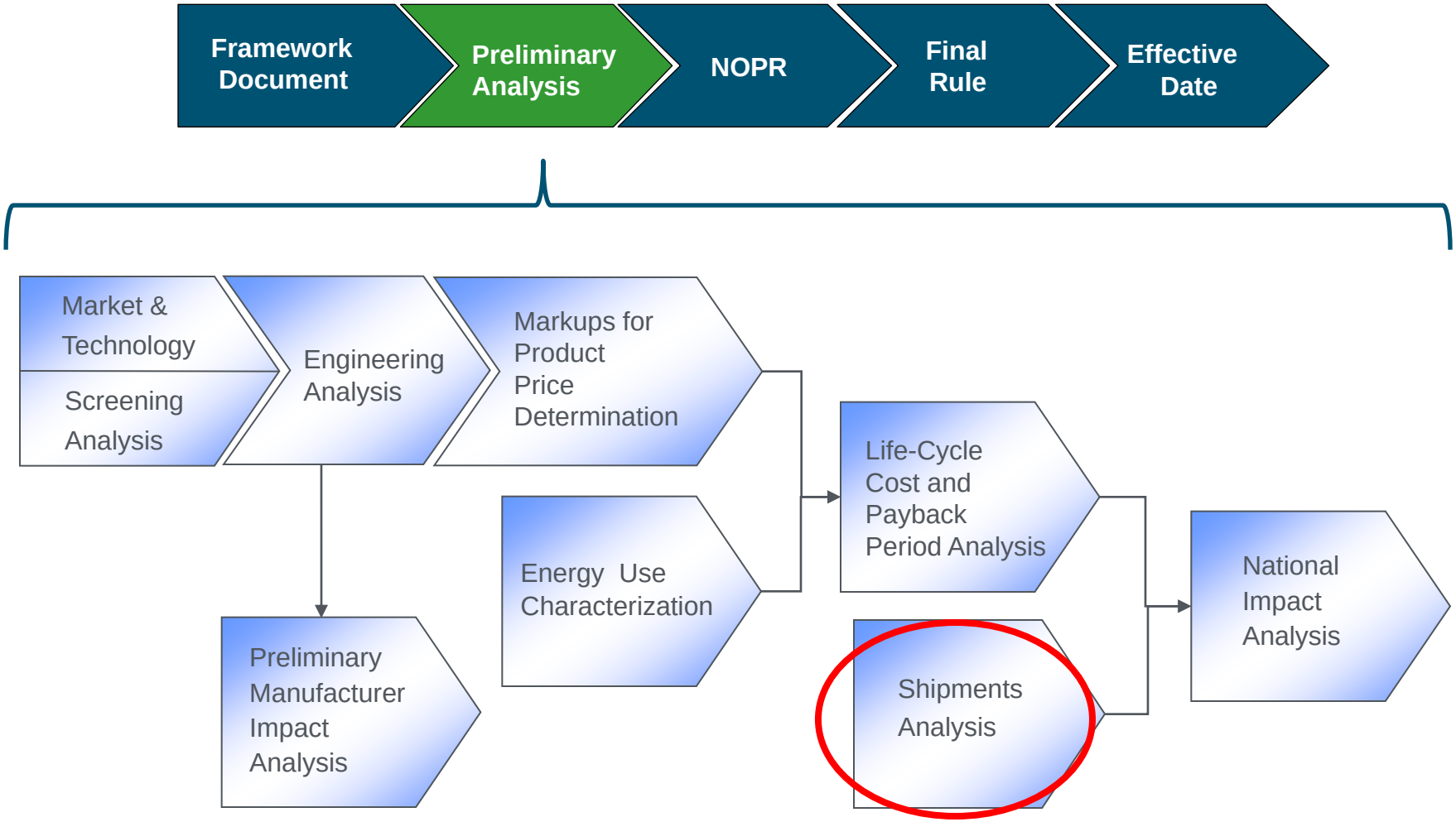
Energy Efficiency in the Base Case

- **Share of consumers affected by particular efficiency level captured by projected distributions of product efficiencies in first compliance year under base case.**
- **When market shares are not available, DOE will base efficiency distributions on available models as a proxy.**

Request for Comment

Item 8-7 DOE seeks stakeholder input on dehumidifier efficiency in the base case, historical efficiency data on dehumidifiers, and projected trends in dehumidifier efficiency. DOE is especially interested in any data pertaining to whole-home dehumidifiers.

Shipments Analysis



Shipments Analysis

- **Purpose:**
  - Quantify changes in product shipments due to potential new energy efficiency standards.
- **Method:**
  - The shipments model will rely on a range of data sources.
  - The model will only consider shipments of covered products.

Base-Case Shipments Projection Approach

- **Approach depicts the situation where new standards are not adopted.**
- **Shipment projection accounts for: (1) product sales to new construction and (2) replacements for failed units.**
  - New construction product sales
  - Replacements
- **Historical projections ("backcasts") calibrated to historical shipments.**
- **Base-case projections to be developed for four product categories**

Residential Dehumidifier Historical Shipments Data

- **DOE requests historical shipments data in order to calibrate its base-case shipments projections.**

Year	**Shipments, Domestic + Imports** (Thousands of Units)					
	Portable Units (pints / day)					**Whole Home (pints / day)**
	<35	**35 – 45**	45-54	54-75	>75	
1997						
1998						
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Standards Impacts on Shipments

- **DOE develops Standards-Case Projections from the same data it used to develop the Base-Case Projection.**
- **Standards-Case Projections also use purchase price increases and operating cost savings to estimate shipments impacts.**
- **It is difficult to obtain data showing sensitivity of shipments to purchase price and operating costs.**
  - DOE may project Standards-Case shipments projections with scenarios (i.e. specific percentage drops in annual shipments for particular efficiency levels).
- **DOE will consider impacts from market-pull programs.**

Request for Comment

Item 9-1 DOE seeks historical shipments data from stakeholders. If such data are provided, DOE requests that market share data be provided showing the percentage of product shipments in each of the dehumidifier product classes.

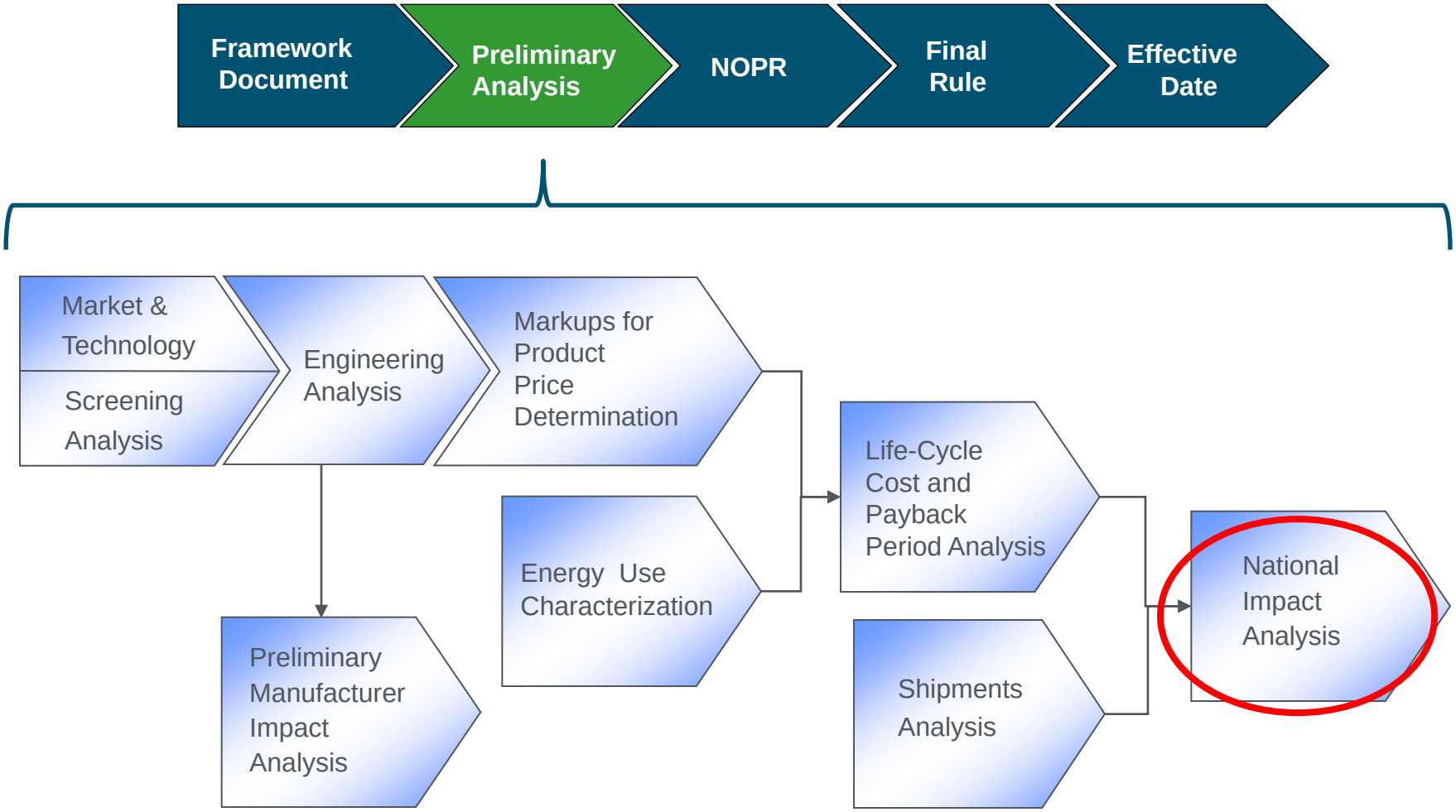
Item 9-2 If stakeholders are unable to provide historical shipments data, DOE seeks comment on which data source is more representative of historical shipments, the AHAM shipments data or possible NPD Group sales data.

Item 9-3 DOE seeks input on the types of approaches it should use to project base-case shipments.

Item 9-4 DOE also seeks input from other stakeholders on the potential impact of standards on product shipments.

Item 9-5 DOE also requests input on any market-pull programs that currently exist to promote the adoption of more-efficient dehumidifiers.

National Impact Analysis

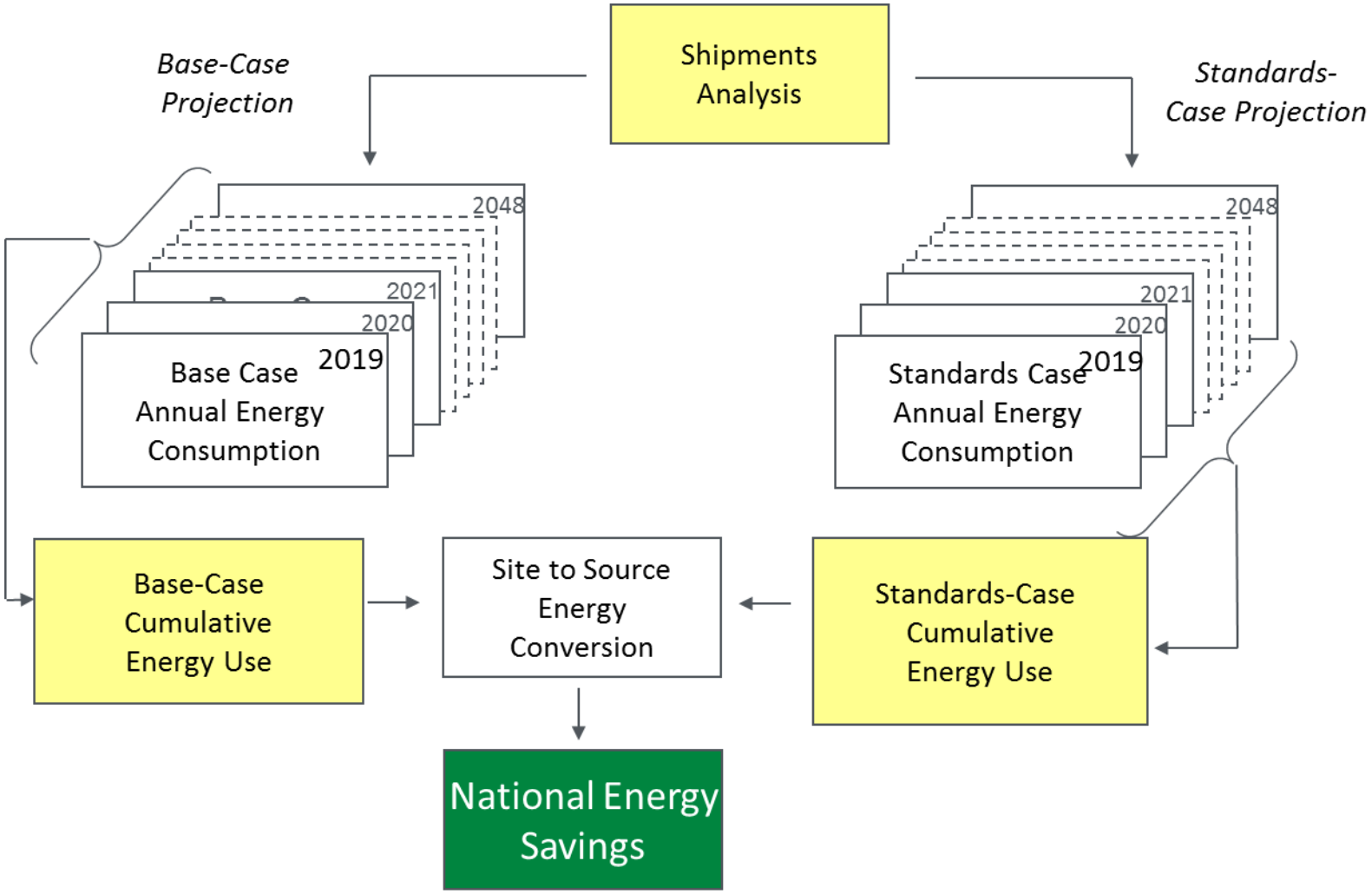


National Impact Analysis

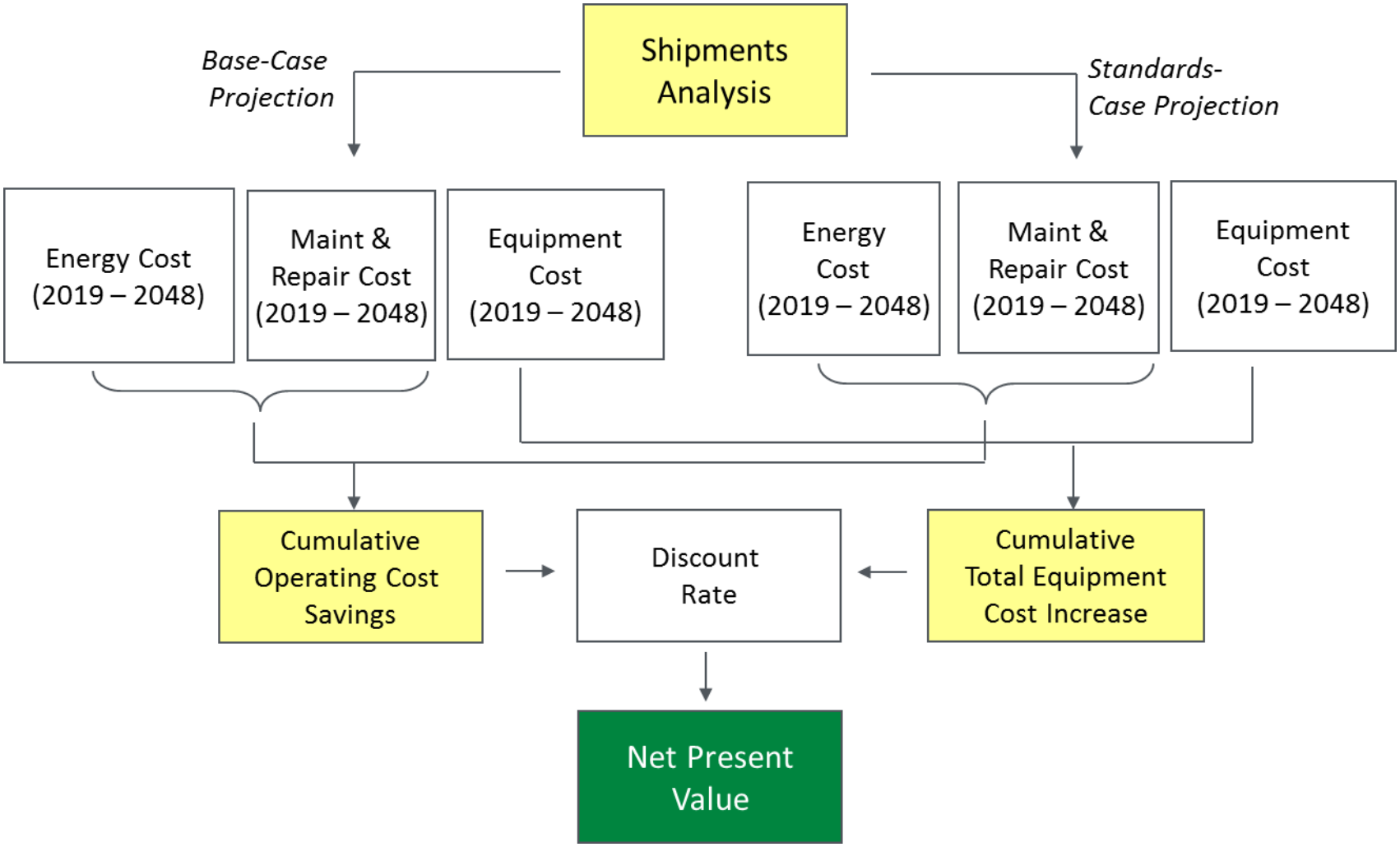
- **Purpose:**
  - Determine the projected national energy savings and consumer national net present value.
- **Method:**
  - Develop annual series of national energy and economic impacts.
  - Use the shipments model to estimate the total stock of appliances in service each year.
  - Aggregate the costs and energy use per unit in any given year.
  - Report estimates for economic impact as change in consumer National Net Present Value (NPV) (in constant year dollars).
  - Account for the time-value of money through defined discount rates.

National Impact Analysis

National Energy Savings Flow Diagram



National Consumer Net Present Value Flow Diagram



Shipment-Weighted and Market Share Efficiency Data

- **Shipment-weighted efficiency data:**
  - Key components of the national impact analysis are dependent on shipment-weighted efficiencies.
    - Per-unit annual energy consumption—needed to determine NES, NWS.
    - Retail price and per-unit annual operating costs—needed to determine NPV.
- **Market share efficiency data:**
  - Historical market share efficiency data help estimate how standards will impact base-case efficiencies and reveals the distribution of product efficiencies for a given year by product class.
  - Market share data (or base-case efficiency distributions) are requested in the LCC and PBP analysis and will also be used in the national impact analysis.
  - Market share data DOE has assumed a “roll up” scenario to project standards impacts in past standards rulemakings.

Dehumidifier Historical Shipment-Weighted Efficiency Data

	Portable Units (pints / day)										Whole Home			
	<35	35 – 45		45-54			54-75				>75				
Year / Efficiency Level		1.50	1.62	1.60	1.70	1.80	1.70	1.85	2.10	2.47		2.50	2.80	3.50	4.17
1994															
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National Impact Analysis (cont.)

- **Full fuel cycle (FFC) measure of energy and greenhouse gas and other emissions will now be measured in this and future conservation standards rulemakings.**
  - NEMS will be the model used to determine FFC
  - FFC multipliers will be presented and discussed in the preliminary analysis Technical Support Document (TSD).

Request for Comment

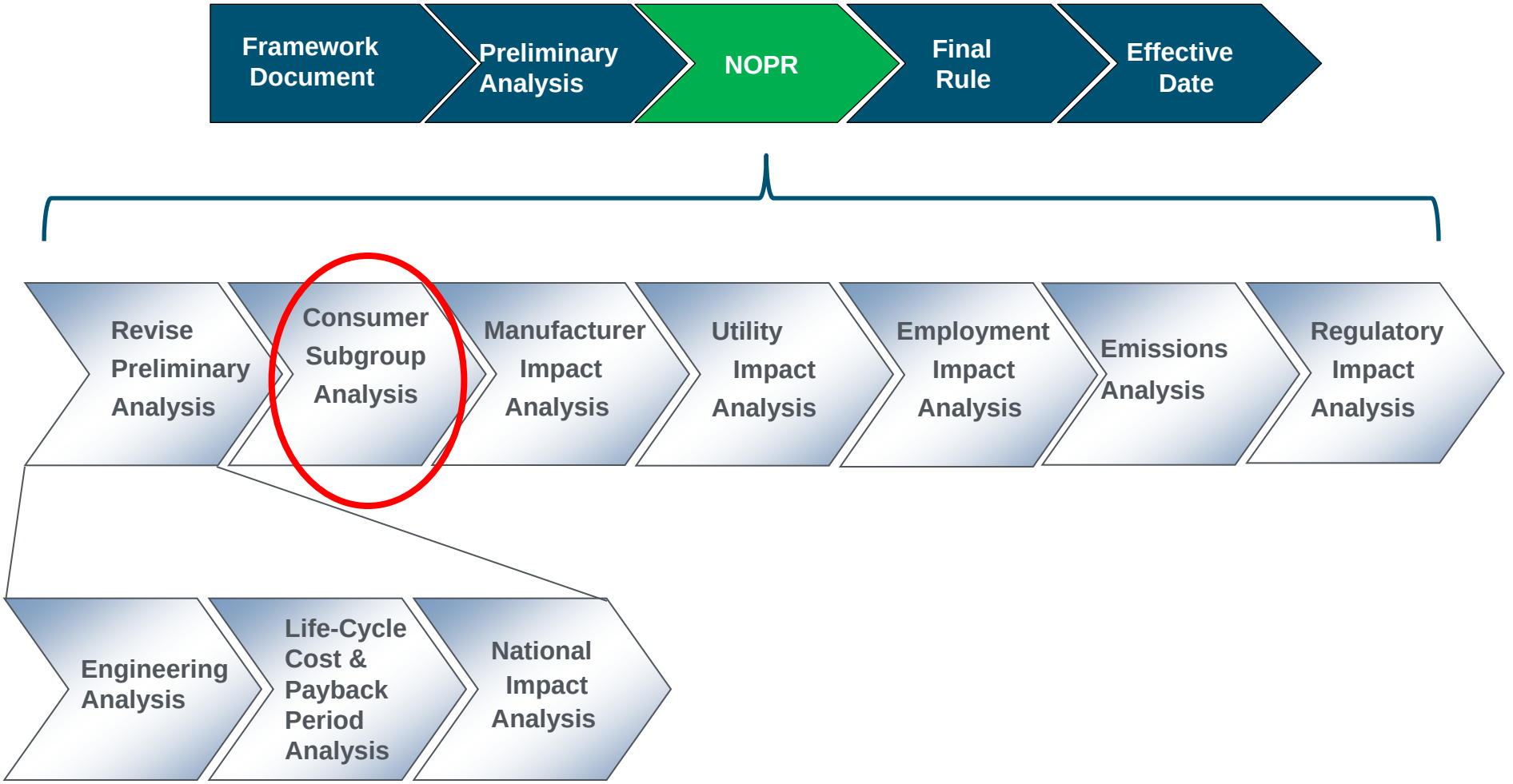
Item 10-1 DOE seeks historical SWEF data for dehumidifiers. DOE also seeks historical market share data showing the percentage of product shipments by efficiency level.

Item 10-2 DOE seeks input on its plan to develop NES spreadsheet models for estimating national impacts of amended energy conservation standards for dehumidifiers. For example, are spreadsheet models still the preferred approach for estimating national impacts?

Public Meeting Agenda

1	Introduction
2	Background
3	Test Procedure
4	Preliminary Analysis
5	**NOPR Analysis**
6	Closing Remarks

Consumer Subgroup Analysis



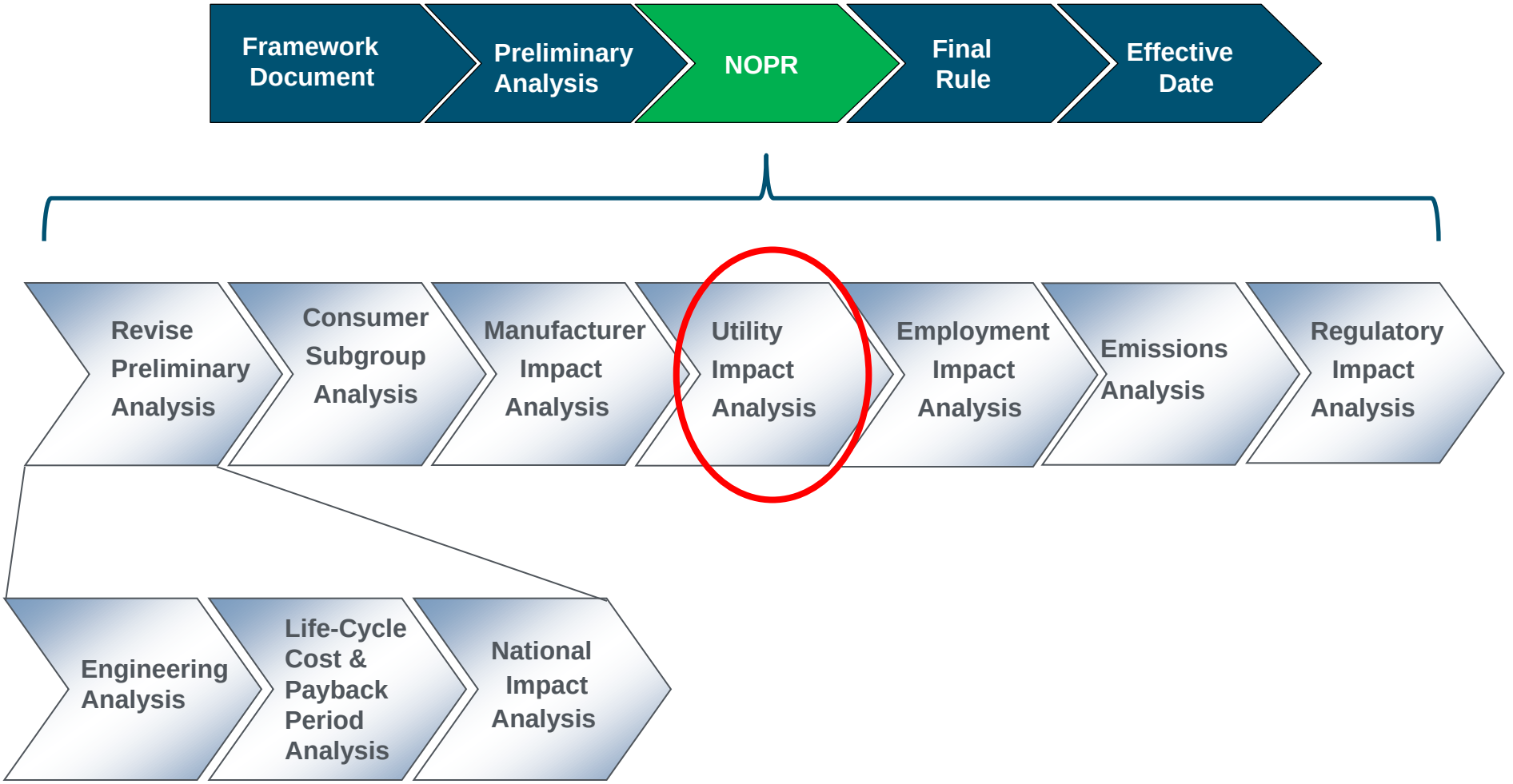
Consumer Subgroup Analysis

- **Purpose:**
  - Analyze the economic impacts of standards on consumers, including subgroups who may be disproportionately impacted compared with the general user population.
- **Method:**
  - Extend the LCC analysis to examine the impacts for defined subgroups.

Request for Comment

Item 11-1 DOE requests input as to which consumer subgroups, if any, it should consider when devising standards for residential dehumidifiers.

Utility Impact Analysis



Utility Impact Analysis

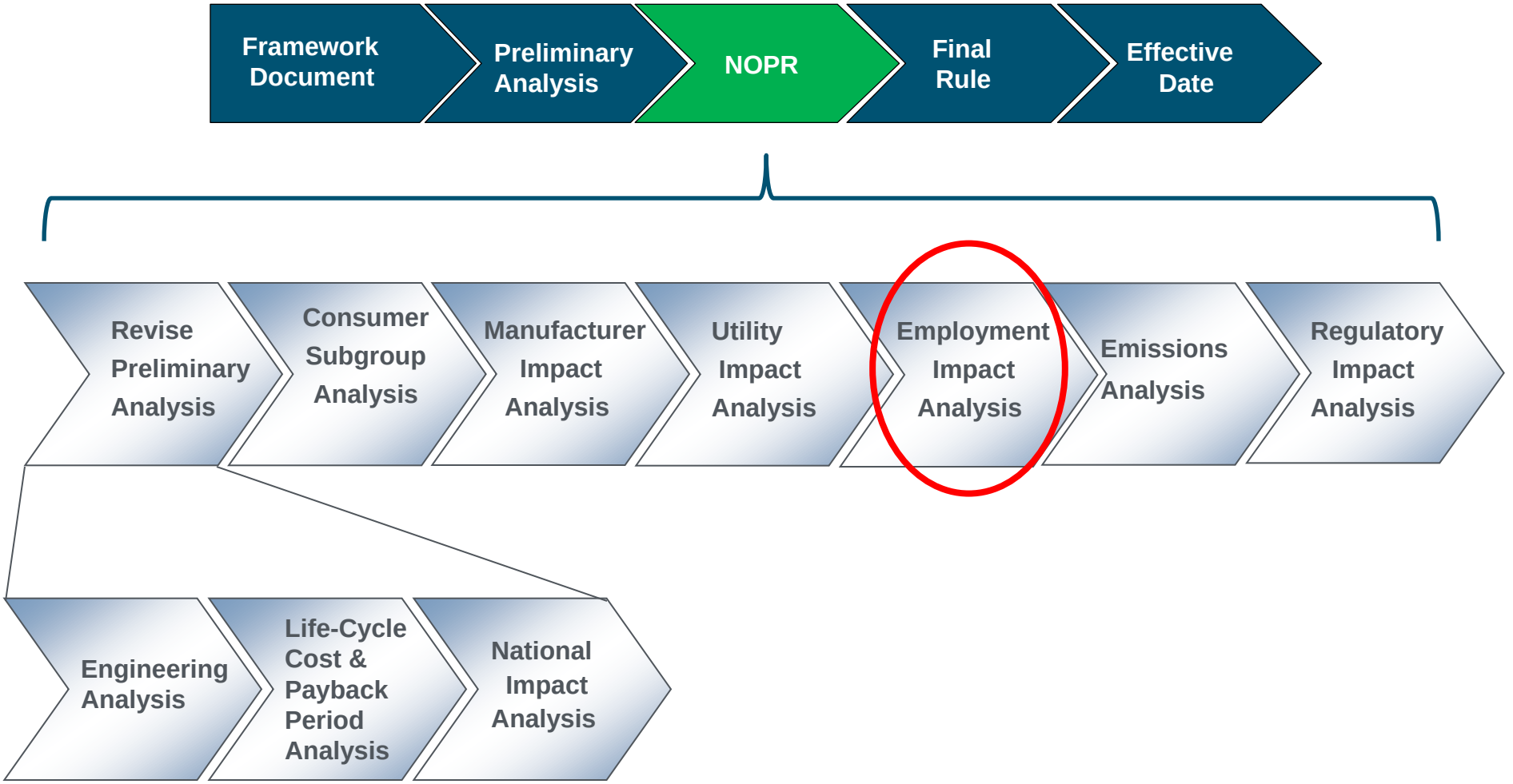
- **Purpose:**
  - Assess the overall impacts on domestic energy supplies that would result from the imposition of standards.
- **Method:**
  - DOE proposes to use NEMS-BT, a variant of the NEMS (National Energy Modeling System) developed and used by DOE/EIA for their Annual Energy Outlook (AEO) report, as the basis of the Utility Impact Analysis.
  - Outputs of the utility impact analysis include projections of electricity sales, price, and avoided capacity resulting from a comparison of base and standards cases.
  - DOE will model the energy savings impacts from amended energy conservation standards using NEMS-BT to generate projections that deviate from the AEO reference case.

Utility Impact Analysis

Request for Comment

Item 13-1 DOE seeks input from stakeholders on its plans to use NEMS-BT to conduct the utility impact analysis. Examples of the type of input sought by DOE include, but are not limited to, whether the NEMS-BT model is appropriate for assessing the utility impacts of efficiency standards — and if not, what would be a more appropriate model to use?

Employment Impact Analysis



Employment Impact Analysis

- **Purpose:**
  - Assess the overall impact on national employment from the imposition of efficiency standards at differing levels.
  - Include both direct and indirect employment impacts.
    - Direct employment impacts are estimated in the manufacturer impact analysis.
    - Indirect employment impacts result from shifting consumer expenditures among goods and services (“substitution effect”) and changing equipment and energy costs (“income effect”).
- **Method:**
  - DOE intends to use the ImSET (Impact of Sector Energy Technologies) model for the evaluation of indirect employment impacts.

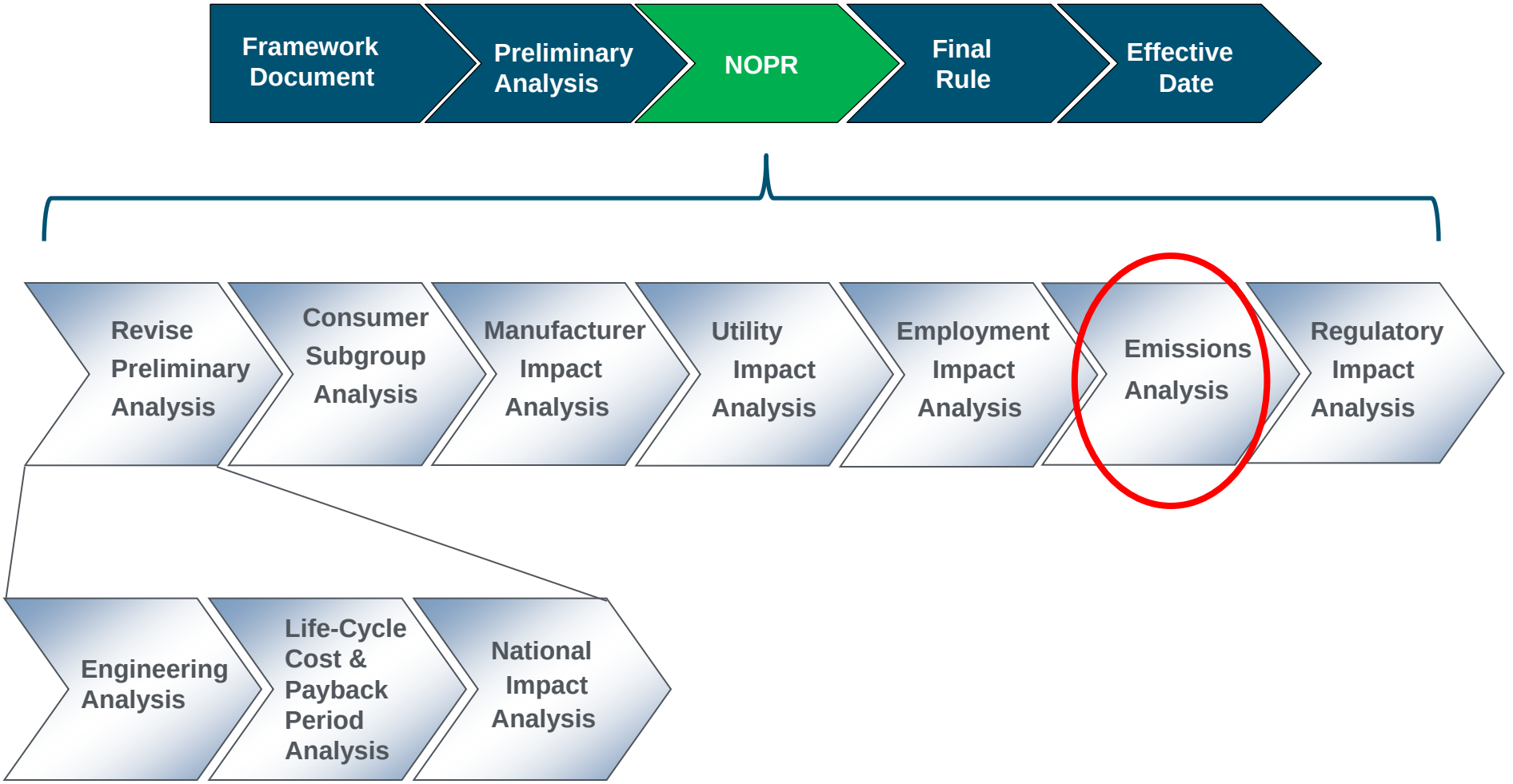
Employment Impact Analysis

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Request for Comment

Item 14-1 DOE welcomes feedback on its planned approach for assessing national employment impacts, both direct and indirect, and it is interested in whether other tools or factors should be considered as part of its analysis. If other tools or factors should be considered, please identify them and explain why, and how, they should be integrated into DOE's analysis

Emissions Analysis



Emissions Analysis

- **Purpose:**
  - Estimate environmental impacts from amended energy conservation standards for dehumidifiers including changes in Full Fuel Cycle (FFC) emissions
- **Method:**
  - DOE will base the emission factors for FFC on EIA's Annual Energy Outlook, supplemented by data from other sources. The following emissions are assessed:
  - Carbon dioxide (CO_2)
  - Sulfur dioxide (SO_2)
    - SO_2 emissions from affected electric generating units are subject to nationwide and regional emissions cap and trading programs
  - Nitrogen oxides (NO_x)
    - Clean Air Interstate Rule (CAIR) permanently caps NO_x emissions in 28 eastern States and DC
  - Methane (CH_4)
  - Nitrous Oxide (N_2O)
  - Mercury (Hg)

Monetization of Emission Reductions

- DOE intends to use the most current Social Cost of Carbon (SCC) values developed by interagency reviews.
  - SCC is intended to be a monetary measure of the incremental damage resulting from greenhouse gas (GHG) emissions, including but not limited to agricultural productivity loss, human health effects, property damage from rising sea level, and changes in the ecosystem.
- At present, the most recent interagency estimates of the potential global benefits resulting from reduced CO2 emissions in 2015, expressed in 2011$, were $6.1, $25.4, $41.0, and $77.7 per metric ton avoided.
  - For emission reductions that occur in later years, these values grow in real terms over time.
- DOE will also estimate the potential monetary benefit of reduced NO_x emissions resulting from the considered standard levels.

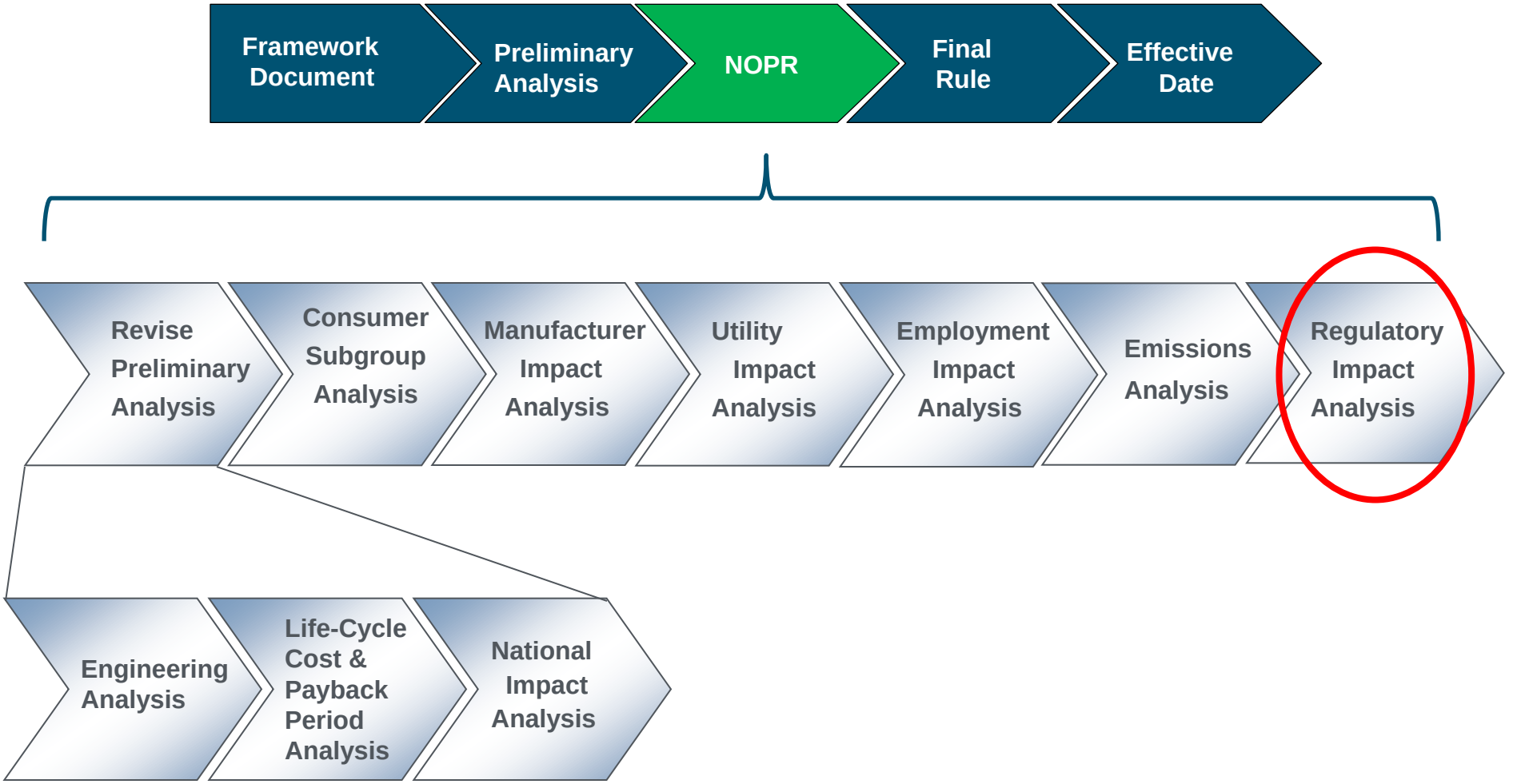
Request for Comment

Item 15-1 DOE seeks input on its plans to use NEMS-BT to conduct the environmental assessment for the products covered by this rulemaking.

Item 16-1 Are there any other environmental factors the Department should consider in this rulemaking?

Item 16-2 Are there other approaches to the emissions analysis that the Department should consider?

Regulatory Impact Analysis



Regulatory Impact Analysis

- **Purpose:**
  - Explore the potential for non-regulatory alternatives to new energy efficiency standards.
- **Method:**
  - Base the assessment on the actual impacts of any such initiatives to date, but consider information presented regarding the impacts that any existing initiative might have in the future.

Public Meeting Agenda

1. Introduction
2. Test Procedure
3. Energy Conservation Standards
4. Preliminary and NOPR Analyses
5. **Closing Remarks**

Instructions for Submitting Comments

- **In all correspondence, please refer to this Residential Dehumidifiers Rulemaking by:**
  - Docket Number EERE–2012– BT–STD–0027, and/or (RIN) 1904-AC81
- **Email: *ResDehumidifier2012STD0027@ee.doe.gov***
- **Postal Mail:** Ms. Brenda Edwards
  U.S. Department of Energy
  Building Technologies Program, Mailstop EE-2J
  1000 Independence Avenue, SW.
  Washington, D.C. 20585-0121
- **Courier:** Ms. Brenda Edwards, 950 L'Enfant Plaza, SW., Suite 600
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Comment period closes October 17, 2012