Public Service of Colorado Ponnequin Wind Farm

# Rulemaking Framework Meeting on Energy Conservation Standards for Residential Furnace Fans

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Energy Efficiency & Renewable Energy

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June 18, 2010

# 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



| | |
|---|---|
| **9:00 – 9:05 am** | Welcome |
| **9:05 – 9:15 am** | Attendee Introductions and Agenda Review |
| **9:15 – 9:20 am** | Introduction |
| **9:20 – 9:50 am** | Brief Opening Remarks from Interested Parties |
| **9:50 – 10:00 am** | Regulatory Authority and Rulemaking Authority |
| **10:00 – 10:45 am** | Scope of Coverage and Test Procedures |
| **10:45– 11:00 am** | Break |
| **11:00 – 11:45 am** | Test Procedure Continued |
| **11:45 – 12:30 pm** | Market and Technology Assessment, Screening Analysis, and Engineering Analysis |

# Agenda (Continued)

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

| | |
|---|---|
| **12:30 – 1:30 pm** | Lunch |
| **1:30 – 2:00 pm** | Markups for Product Price Determination, Energy Use Analysis, Life-Cycle Cost, and Payback Period Analysis |
| **2:00 – 2:30 pm** | Shipments Analysis, National Impact Analysis, and Life-Cycle Cost Subgroup Analysis |
| **2:30 – 3:00 pm** | Manufacturer Impact Analysis |
| **3:00 – 3:15 pm** | Utility Impact Analysis, Employment Impacts, Environmental Impacts, and Regulatory Impact Analysis |
| **3:15 – 3:45 pm** | Next Steps and Closing Remarks from Interested Parties |
| **3:45 pm** | Adjourn |

# Public Meeting Agenda



1. Introduction
2. Regulatory Authority
3. Rulemaking Overview
4. Scope of Coverage and Test Procedures
5. NOPR Analyses
6. Closing Remarks

# Purpose of the Framework Public Meeting



- Present the procedural and analytical approaches to evaluate energy conservation standards for residential furnace fans
- Provide a forum for public discussion of rulemaking issues
- Encourage interested parties to submit data, information, and written comments
- Inform interested parties of and facilitate the rulemaking process

# Request for Comment



**Issue Box** In the Framework Document for Residential Furnace Fans, DOE welcomes comment. Throughout this presentation, specific issues will be raised for discussion on slides such as this one, ***with identifying numbers corresponding to those in the Framework***. Nonetheless, comments concerning any part of the document or presentation are welcome.

# Feedback Is Requested

## Especially on Items Identified in Rulemaking Analysis Plan



- **In all correspondence, please refer to the Residential Furnace Fans rulemaking by:**
  - Residential Furnace Fans Rulemaking;
  - Docket Number EERE-2010-BT-STD-0011; and
  - Regulatory Identification Number (RIN) 1904-AC22.

- **Email:** FurnFans-2010-STD-0011@ee.doe.gov

**Postal:**

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950 L'Enfant Plaza, SW
Washington, DC 20024
Tel: 202-586-2945

- **Comment period closes July 06, 2010.**

# Interested Parties Opening Statements



- At this time DOE welcomes opening remarks on the framework document for residential furnace fans.

# Public Meeting Agenda



1. Introduction
2. **Regulatory Authority**
3. Rulemaking Overview
4. Scope of Coverage and Test Procedures
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# Regulatory Authority



- Energy Policy and Conservation Act (EPCA) of 1975 (Public Law 94-163):
  - Amended by the Energy Policy Act (EPACT) of 2005 (Public Law 109-58) to grant the Secretary the authority to:
    - *"… consider and prescribe energy conservation standards or energy use standards for electricity used for purposes of circulating air through duct work*."(42 U.S.C. 6295(f)(4)(D))
  - Amended by the Energy Independence and Security Act of 2007 (Public Law 110-140) to mandate that:
    - A final rule establishing energy conservation or energy use standards to be published "*not later than December 31, 2013*." (42 U.S.C. 6295(f)(4)(D))
    - *"Any new or amended energy conservation standard adopted after July 1, 2010, shall address standby mode and off mode energy use pursuant to 42 U.S.C. 6295(o).*" (42 U.S.C. 6295(gg)(3))

# Public Meeting Agenda



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# EPCA Factors



- 42 U.S.C. 6295(o)(2)(B)(i) directs DOE to consider seven factors when setting energy conservation standards for residential furnace fans:

| EPCA Factors | DOE Analysis |
|---|---|
| 1. Economic impact on consumers and manufacturers | Life-Cycle Cost Analysis<br>Manufacturer Impact Analysis |
| 2. Lifetime operating cost savings compared to increased cost for the product | Life-Cycle Cost Analysis |
| 3. Total projected energy savings | National Impact Analysis |
| 4. Impact on utility or performance | Engineering Analysis<br>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 | Environmental Assessment<br>Utility Impact Analysis<br>Employment Impact Analysis |

# Framework




- Today's public meeting covers the Framework for Residential Furnace Fans.
- Federal Register Notice of Availability, 75 FR 31323, June 3, 2010.
  - Gives notice of the public meeting and availability of the Framework Document being discussed today
- Framework Document:
  - Provides an overview of the rulemaking process
  - Provides detailed descriptions of the analytical approach, tools, and models that will be used to evaluate new standards for residential furnace fans
  - Provides a preliminary discussion of two approaches being considered to aid in developing a residential furnace fans test procedure
  - Encourages interested parties to submit comments by July 06, 2010
  - The Framework and materials from today's public meeting are available online: http://www.eere.energy.gov/buildings/appliance_standards/residential/furnace_fans_framework.html

# Next Steps in Standards Rulemaking



- Notice of Proposed Rulemaking
  - Discussion of comments received in response to this framework document
  - Analysis of the impacts of potential standards on consumers, manufacturers, and the Nation
  - Weighting of these impacts
  - Proposed standard levels for public comment

- Final Rule
  - Discuss comments received in response to the NOPR
  - Revise analysis of the impacts of standards
  - Weight of the impacts of the final rule
  - Determine the standard levels DOE will adopt
  - Establish the compliance date for the adopted standards

# Public Meeting Agenda

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

1. Introduction
2. Regulatory Authority
3. Rulemaking Overview
4. **Scope of Coverage and Test Procedures**
5. NOPR Analyses
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# Scope of Coverage



- A furnace fan is an electrically-powered device used in residential central heating, ventilation, and air conditioning (HVAC) systems for the purposes of circulating air through duct work.
  - A furnace fan consists of a fan motor and its controls, an impeller, and sheet metal housing.
- A furnace fan is typically integrated into central residential HVAC systems (referred to as furnace fan products), such as:
  - gas-fired, oil-fired, and electric residential furnaces;
  - split-system and packaged air conditioner and heat pump air handlers; and
  - modular fan coils.
- DOE does not consider the following to be furnace fans:
  - draft inducer fans;
  - exhaust fans; and
  - heat / energy recovery ventilators.
- EPCA does not specify which HVAC products use furnace fans or a range of any furnace fan characteristics, such as rated airflow capacity or rated motor horsepower, to aid in defining the scope of coverage.

# Request for Comment



**Item 1** DOE welcomes comments on its approach interpreting the relevant language in EPCA as referring to electricity used by any electrically-powered device used in residential central HVAC systems for the purposes of circulating air through duct work. Residential HVAC systems include, but are not limited to, furnaces, split-system and packaged central air conditioner and heat pump air handlers, and modular fan coils.

**Item 2** DOE seeks comment on any other residential central HVAC products that may also use furnace fans that should be included in the scope of coverage of this rule.

**Item 3** DOE welcomes comments on its interpretation of the relevant language in EPCA as excluding electricity used by draft inducer fans, exhaust fans, and heat/energy recovery ventilators.

**Item 4** DOE seeks comment on whether DOE should include a rated airflow capacity range or a rated horsepower range to help define test procedure applicability.

# Operation Modes



- **Active mode:**
  - The mode of operation during which the furnace fan product is powered and the impeller is in motion
- **Standby mode:**
  - The mode of operation during which the furnace fan product is powered and the impeller is not in motion
    - DOE believes furnace fan standby consumption is indistinguishable from the standby consumption of the furnace fan product because furnace fan controls are typically integrated into the controls of the furnace fan product.
    - DOE accounts for furnace fan standby consumption in the rulemakings for associated products (residential CAC and residential furnaces and boilers).
- **Off mode:**
  - The mode of operation during which the furnace fan product is not powered
    - DOE believes that consumers are unlikely to place their HVAC systems in off mode, therefore, there will be no off mode electrical consumption for the furnace fan.

# Request for Comment



**Item 5** DOE requests comment on its assumptions for the electrical energy consumption expected in each mode of operation (i.e., active mode, standby mode, and off mode).

# Test Procedures



- DOE is initially reviewing two approaches to aid in developing a furnace fan test procedure, including:
  - Using a draft version of the Canadian Standard Association (CSA) C823 *Performance Standard for Air Handlers in Residential Space Conditioning Systems* as a framework; or
  - Using the blower (furnace fan) electricity measurement, BE, specified in the DOE test procedure for residential furnaces, as shown in 10 CFR Part 430 Appendix N., as well as additional specifications or modifications to extend it's applicability to all furnace fan products, speed control settings, and operating functions and conditions.

# Summary of CSA C823



- **Purpose:** To calculate the Annual Electricity Consumption Rating (AECR) of air handlers based on the time-weighted sum of electricity consumption measurements for each available motor speed at various operating points
- **Methodology**: To superimpose a reference system load curve onto performance curves (airflow vs. external static pressure) for each speed control setting to determine the operating points and associated electricity consumption
- **References**: multiple existing industry test standards
  - American National Standards Institute (ANSI)/Air Movement and Control Association (AMCA) 210-07 | ANSI/ American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 51-07 *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating*
  - ANSI/ASHRAE Std 37-2005 *Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment*

# Request for Comment



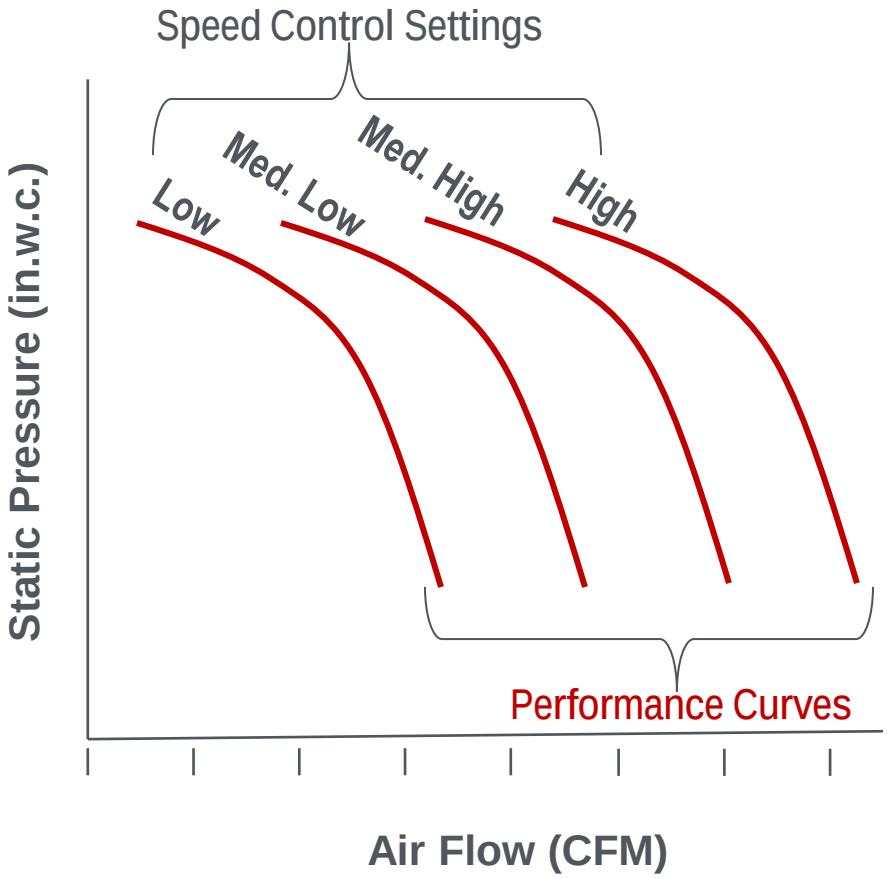
**Item 7** DOE welcomes comments on the use of Canadian Standard CSA C823 *Performance Standard for Air Handlers in Residential Space Conditioning Systems*, ANSI/AMCA 210-07 | ANSI/ASHRAE 51-07 *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating*, and NSI/ASHRAE Std 37-2005 *Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment* as reference test procedures.

**Item 8** DOE seeks comment on the existence and applicability of any other industry test procedure that DOE could consider for use in measuring the airflow and electrical energy consumption of furnace fans. In addition, DOE seeks comment as to what types of testing manufacturers currently conduct on furnaces fans and what test set-ups and methods are used.

# CSA C823: Performance Curves



- Airflow (cfm) vs. Static Pressure (in.w.c).
- A separate performance curve for each available speed control setting over a range of operating conditions (e.g. static pressures)



# Request for Comment



**Item 9** DOE welcomes comment on the CSA CS823 methodology used to develop performance curves.

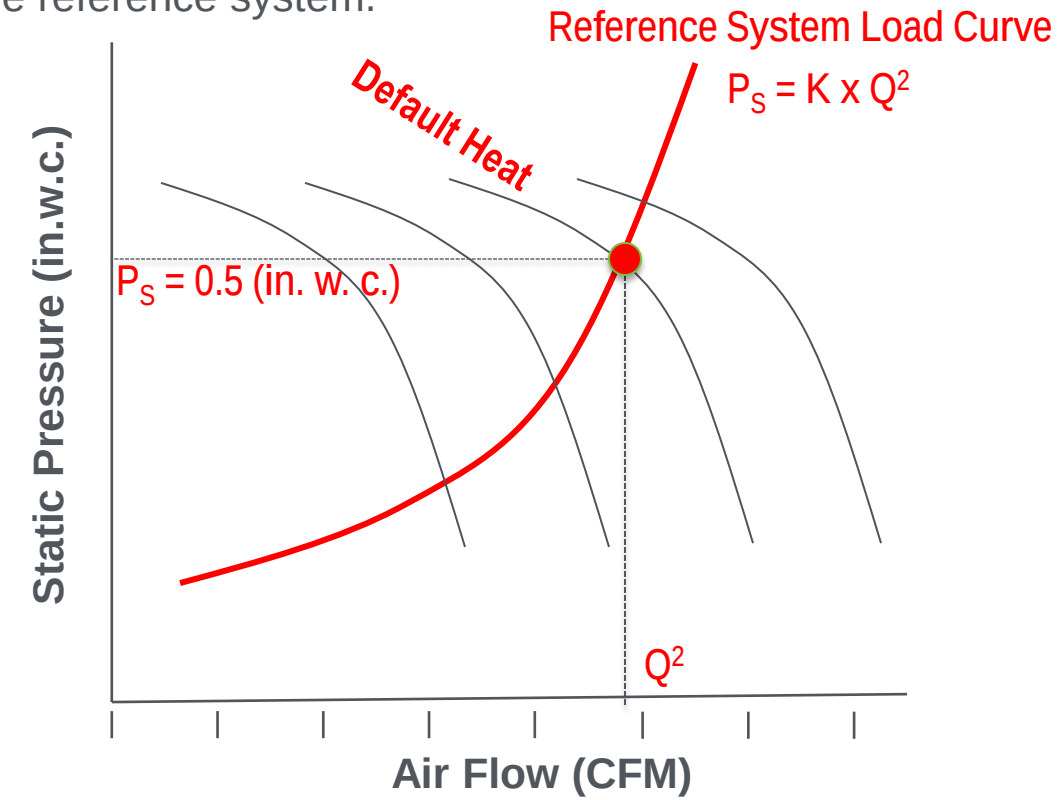
**Item 10** DOE seeks comment on the appropriate total number and range of static pressures necessary to encompass the expected operating conditions for furnace fans for the purposes of developing performance curves without being unduly burdensome. DOE also seeks data, which would show that testing at a reduced number of static pressures would provide similar results as testing over the entire range of static pressures.

**Item 11** DOE seeks comment on the CSA C823-specified method of selecting furnace fan speed control settings for testing. DOE also seeks comment on the relationship between speed control setting or speed tap and use in heating, cooling, or circulation functions of active mode furnace fan operation.

# CSA C823: Reference System Load Curve



- Illustrates relationship between static pressure, $P_S$, and airflow, Q, as determined by the physical characteristics, K, of the test system
- Determines performance at common operating conditions to allow for comparison across products
- The draft version of CSA C823 uses 0.5 (in.w.c.) in the default heat speed control setting as the reference system.



# Request for Comment



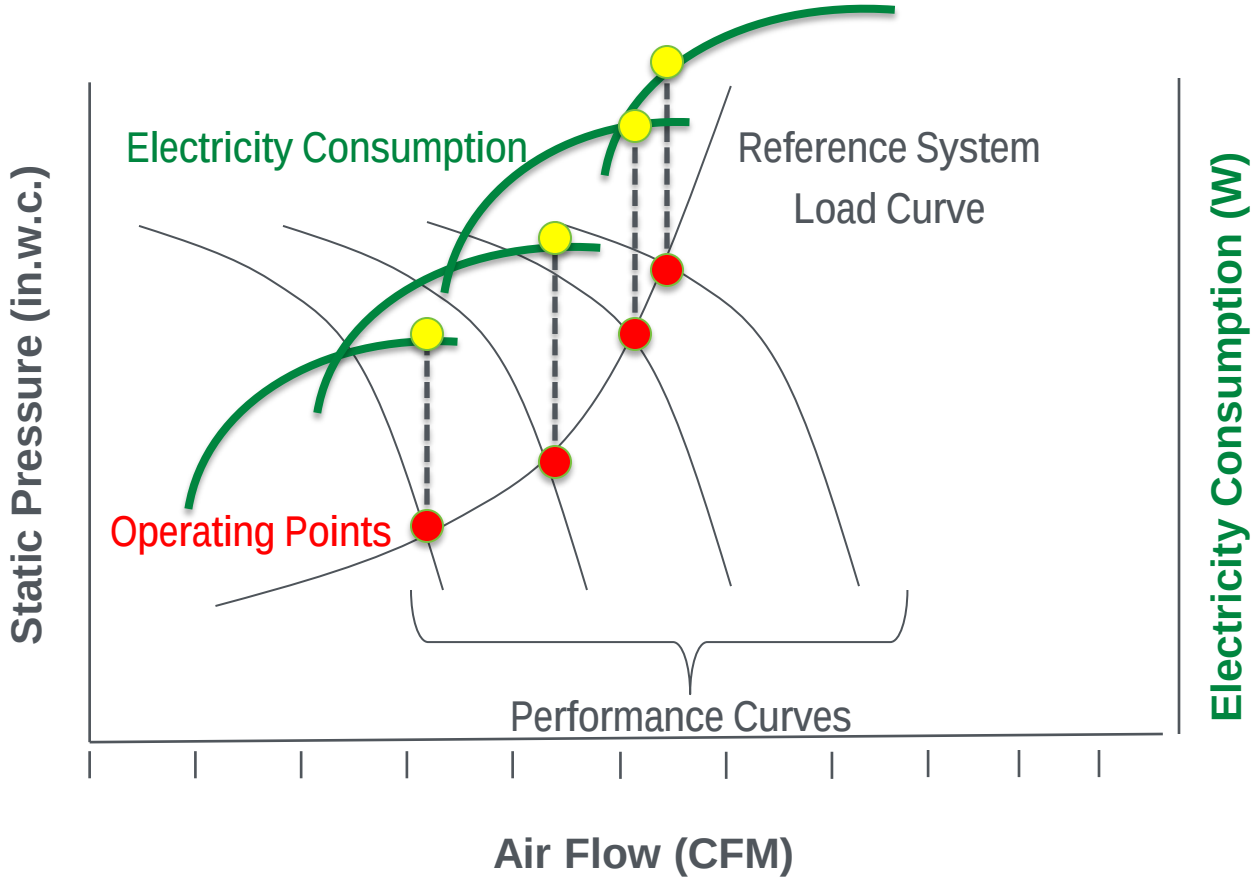
**Item 12** DOE requests comment on the use of 0.5 (in w.c.) in the default heating speed control setting to define the reference system and resulting rating point. DOE requests comment on whether changes are necessary to the reference system criteria to more accurately reflect furnace fan operation in the U. S.

**Item 13** DOE welcomes comment on the methodology outlined in CSA C823 to develop the reference system load curve.

# CSA C823: Operating Points



- Intersection of performance curves and reference system load curve
- Represent expected airflow performance of the system
- Electricity consumption at operating points will be used for calculating Annual Electricity Consumption Rating (AECR)



# Request for Comment



**Item 14** DOE welcomes comment on the methodology CSA C823 currently uses to identify furnace fan operating points.

# CSA C823: Annual Electricity Consumption Rating (AECR)



- Time-weighted sum of electricity consumption at each speed control setting's respective operating point

- AECR = (*AHeatH* x *ECh*) + ($AHeatH_{reduced}$ x $ECh_{reduced}$) + (*ACoolH* x $EC_c$) + (*ACircH* x *ECcirc*) + (*AstdbyH* x *ECstdby*)

  - *AHeatH* = annual heating hours;
  - *ECh*= electrical energy consumption rating while performing the heating function;
  - $AHeatH_{reduced}$ = annual reduced capacity heating hours (air-handler operating);
  - $ECh_{reduced}$ = electrical energy consumption rating for operation in performing the reduced heating function;
  - *ACoolH* = annual cooling hours;
  - *ECc* = electrical energy consumption rating while performing the cooling function;
  - *ACircH* = annual circulating hours;
  - *ECcirc* = electrical energy consumption rating while performing the circulation function;
  - *AStdbyH* = annual standby hours; and
  - *ECstdby* = electrical energy consumption rating for standby mode.

# Request for Comment



**Item 15** DOE seeks input on the CSA C823 equation for annual energy consumption rating (AECR).

**Item 16** DOE requests comment on the annual hourly multiplier methodology specified in CSA C823, as well as if and how this methodology and the annual hourly multiplier values could be modified to more specifically address furnace fan operation in the United States.

# Residential Furnace Blower Electricity (BE) Test



- **Purpose**: Use metrics and methods from the existing DOE test procedures of associated products to minimize the burden of rating furnace fan efficiency

- **Methodology**: Develop a rating method to determine an annual electrical energy consumption descriptor (kWh) based on the blower (furnace fan) power measurement, BE, as specified in the DOE residential furnace test procedure with additions and modifications to encompass all furnace fan products, speed control settings, and functions

- **Reference:**
  - ANSI/ASHRAE Standard 103-1993, *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers*

# BE Test: Limitations



- BE measurements are only specified for residential furnaces, not the other furnace fan products tentatively covered by this rulemaking.
- BE is only measured while the residential furnace is performing the heating function, not while performing other functions (i.e., circulation).
- BE is only measured at a minimum specified external static pressure in one or two speed control settings, not during other typical operating conditions and in other available speed control settings.
- BE is a power measurement (W), which will require additional calculations and assumptions to be converted to an annual electrical energy consumption descriptor (kWh).

# Request for Comment



**Item 17** DOE seeks comment on the potential merits of using the BE measurement specified in DOE's existing residential furnaces test procedure (10 CFR part 430, subpart B, appendix N) as the basis for its furnace fan test procedure.

**Item 18** DOE seeks comment on additional rating methods that would be necessary to cover the power consumption of furnace fans used in residential central HVAC products other than furnaces.

**Item 19** DOE seeks comment on how the BE measurement could estimate the power consumption of the furnace fan in the circulation function and account for furnace fan operation within an appropriate range of static pressures and in an appropriate number of speed control settings.

**Item 20** DOE seeks comment on the appropriate annual hourly multipliers to determine the number of hours annually that the furnace fan operates in each speed control setting or function.

# Public Meeting Agenda



1. Introduction
2. Regulatory Authority
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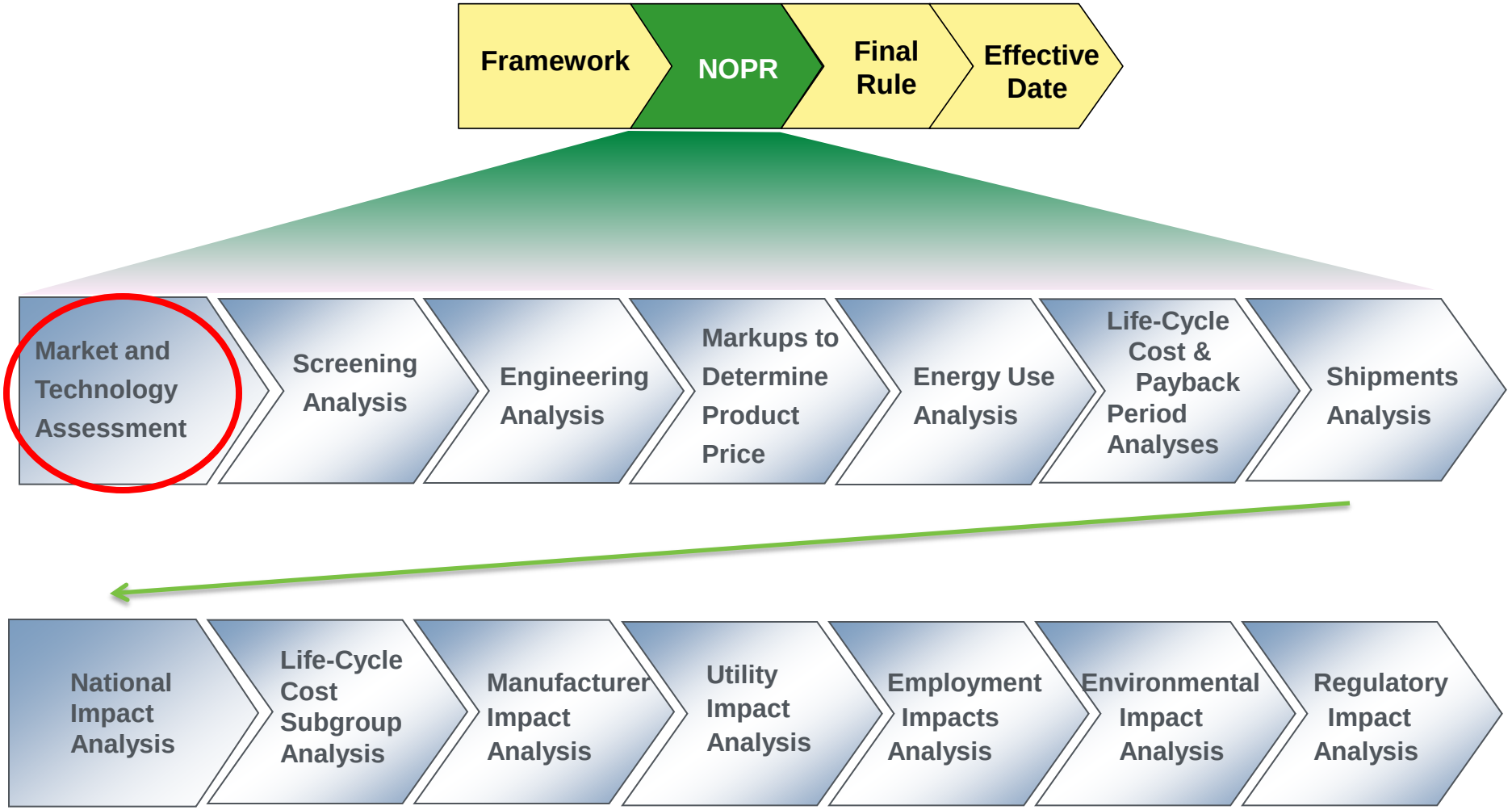
5. **NOPR Analyses**
6. Closing Remarks

# Steps in the Standards Rulemaking: NOPR





# Market and Technology Assessment



## Purpose

- Characterize the markets, the residential furnace fan industry, and the measures which improve furnace fan efficiency

## Method

- Identify and characterize manufacturers of residential furnace fans
- Estimate historical shipments and trends in the market
- Identify regulatory and non-regulatory initiatives intended to improve the efficiency of the products covered under this rulemaking
- Characterize products currently available on the market
- Identify technologies that could improve efficiency

# Request for Comment



**Item 21** DOE seeks comment on whether the manufacturers of furnace fans are also the manufacturers of the products that utilize furnace fans.

**Item 22** DOE welcomes input on estimates of market shares, products, features, and trends related to electricity consumption for the furnace fans covered in this rulemaking.

# Product Classes



- DOE divides covered products into classes by:
  - the type of energy used;
  - capacity of the product; or
  - other performance-related features that justify different standard levels, such as features affecting consumer utility. (42 U.S.C. 6295(q))

- Based on the criteria above, DOE could consider using rated airflow capacity and/or rated fan motor horsepower to differentiate product classes.
  - Rated airflow capacities range from approximately 400 cfm to 2,200 cfm (in highest speed control setting).
  - Rated horsepower ranges from approximately 1/5 horsepower to 1 horsepower.

# Request for Comment



**Item 23** DOE welcomes comments on whether to use rated airflow capacity, rated motor horsepower, or an alternative approach to defining product classes in accordance with the requirements of 42 U.S.C. 6295(q.). DOE also seeks comment on how each of these specifications influences furnace fan product design decisions.

**Item 24** DOE seeks input on appropriate rated airflow or rated motor horsepower bins. Specifically, DOE is interested in information that could be used to determine the number of bins or range of each bin.

# Technology Assessment



- DOE uses information about existing and past technology options and prototype designs to identify technologies manufacturers could use to meet or exceed energy conservation standards.

- DOE will consider only technologies that improve the efficiency of the furnace fan.
  - These are the technologies manufacturers are most likely to implement in response to new energy conservation standards.

# Technology Assessment

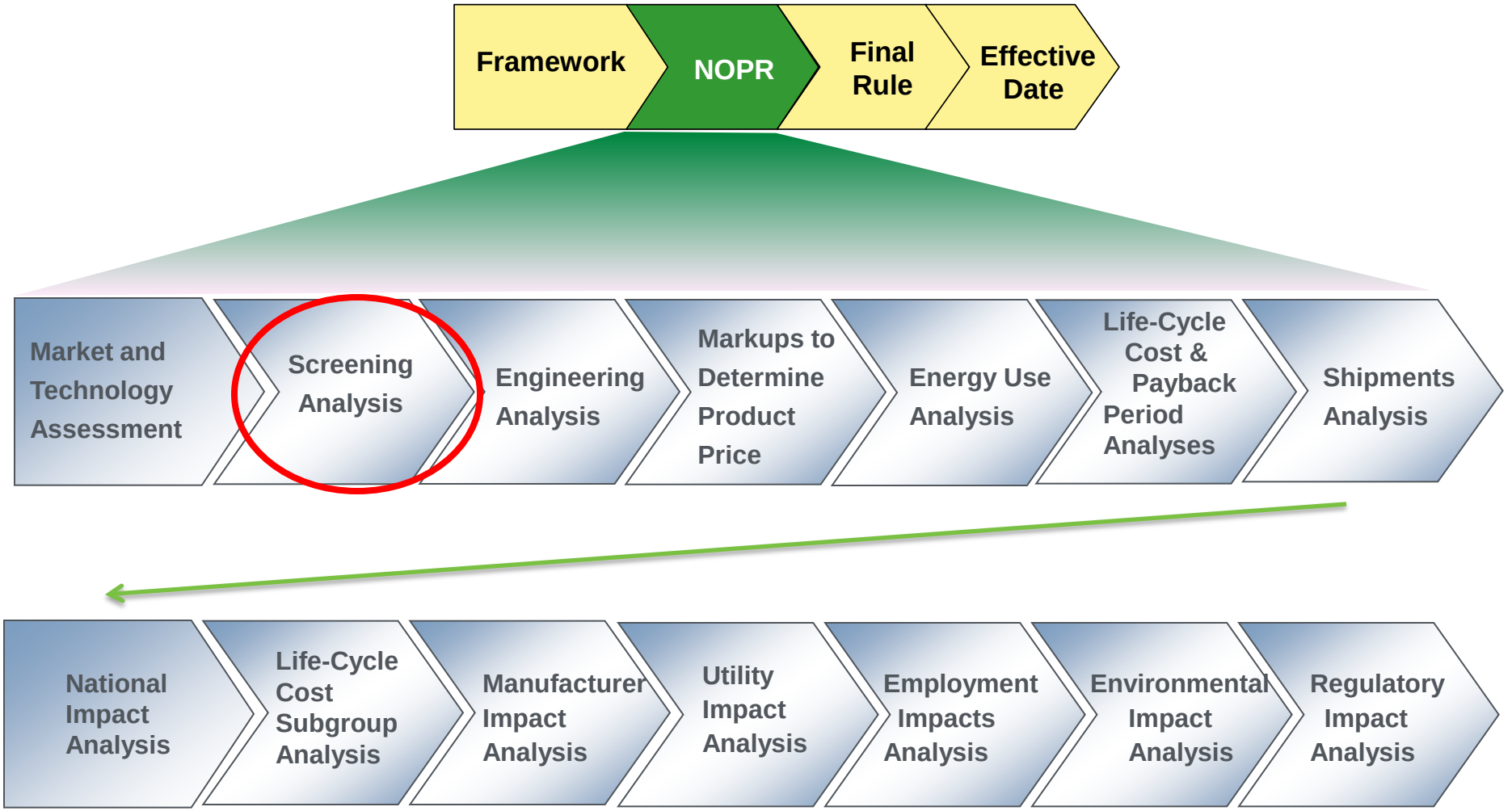


- Technology options
  - High-efficiency furnace fan motors
    - High-efficiency permanent split capacitor (PSC) motors or Electronically-commutated motors (ECM)
  - Improved impellers
    - Optimized for specific applications

**Item 25** DOE welcomes comments on the preliminary technology options identified in this slide (i.e., high-efficiency furnace fan motors and improved impellers) and whether there are other technology options it should consider. In commenting on technology options, please discuss their impacts, if any, on safety, performance, and consumer utility.

# Steps in the Standards Rulemaking: NOPR





## Purpose

- Screen out technology options that DOE will not consider in the engineering analysis for residential furnaces

## Approach

- 10 CFR Part 430, Subpart C, Appendix A, 4(a)(4) and 5(b) direct DOE to evaluate each technology option based on the following criteria:

Technological feasibility;

Practicability to manufacture, install, and service;

Impacts on product utility or availability to consumers; and

Impacts on health or safety.

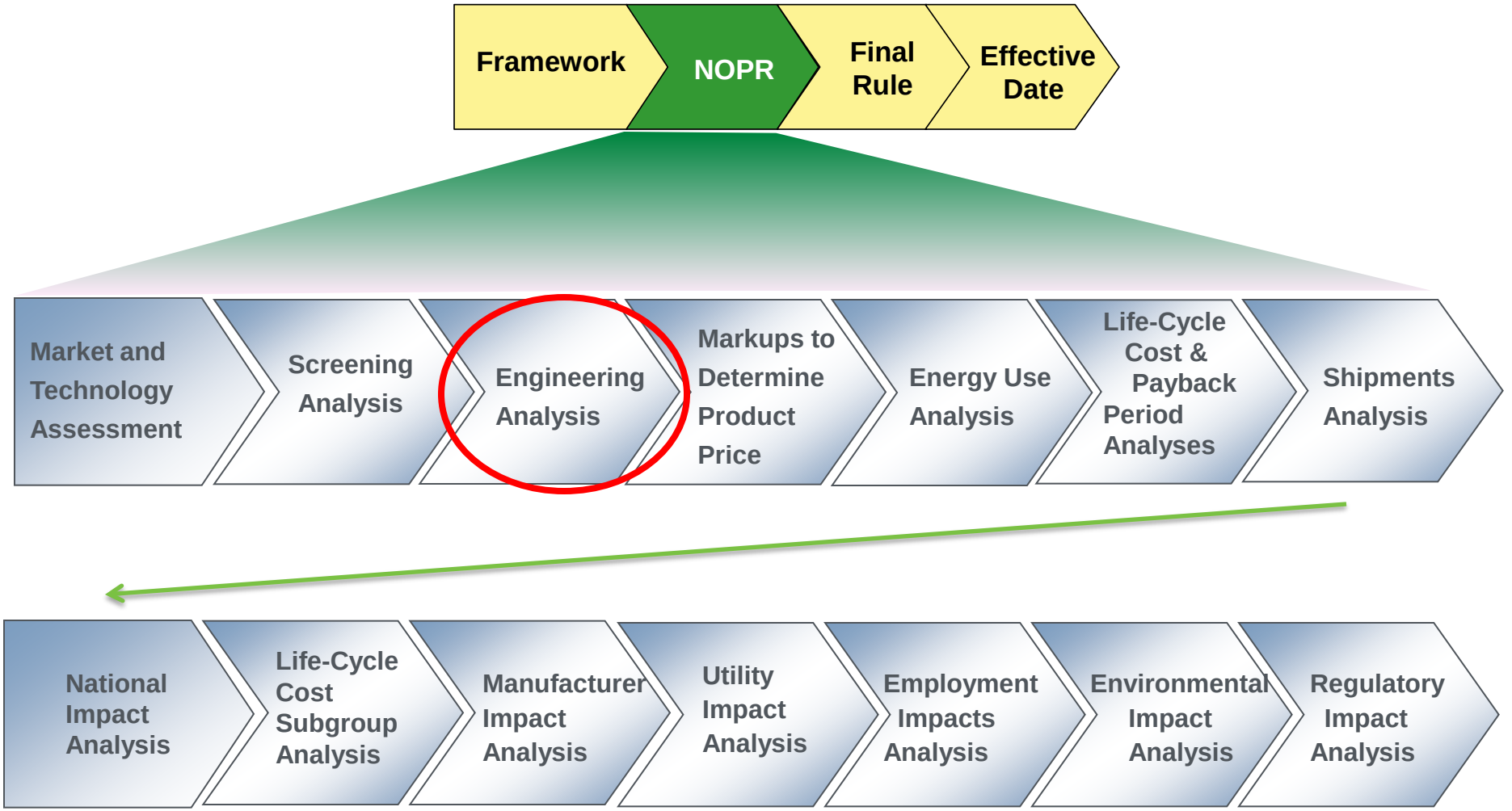
# Request for Comment



**Item 26** DOE welcomes comments on how the above four screening criteria might apply to any additional technology option(s) that an interested party recommends to DOE.

# Steps in the Standards Rulemaking: NOPR



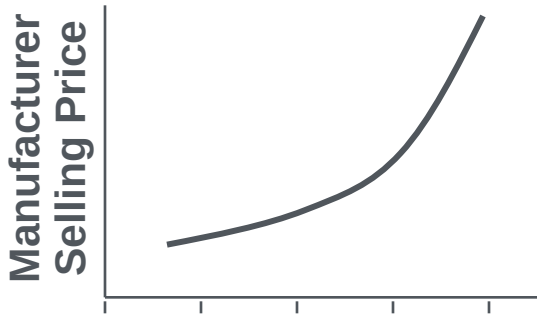


# Engineering Analysis: Purpose



- A key factor in setting the standard is the increased cost of a more efficient product.
- The Engineering Analysis determines the relationship between cost and efficiency.

**Manufacturer Selling Price – Efficiency Relationship**




**Rulemaking Analyses**

- **Life-Cycle Cost and Payback Period**
- **Manufacturer Impact Analysis**
- **Employment Impact Analysis**

# Engineering Analysis: Methodology



**Define Baseline Models**

⇦ Define characteristics of models in each product class, which will serve as reference points to assess changes due to more stringent standard levels.

**Identify Efficiency Levels**

⇦ Identify more-efficient substitutes from a database of commercially-available furnace fans.

**Perform Teardown Analysis**

⇦ Develop bill of materials (BOM) for baseline furnace fans and higher efficiency levels by disassembling select models.

**Develop Manufacturer Production Cost**

⇦ Determine manufacturer production cost for baseline furnace fans and higher efficiency levels based on BOMs from the teardown analysis and manufacturing cost model.

# Engineering Analysis: Teardown Analysis



- DOE estimates the manufacturer production costs of products through “teardown analysis” (i.e., reverse engineering of products).
  - DOE physically disassembles products to examine existing designs.
  - DOE records all characteristics of each component including the manufacturing processes required for fabrication to create a BOM.

- DOE will select furnace fans for teardown analysis across the full range of efficiencies analyzed in each product class that are:
  - representative of the product class;
  - manufactured in considerable volume;
  - from the same manufacturer and product series to the extent possible;
  - made by manufacturers with large market shares, with the exception of the max-tech products; and
  - minimize the occurrence of non-efficiency-related premium features.

# Request for Comment



**Item 28** DOE seeks comments on its approach to calculating the cost-efficiency relationship for furnace fans.

**Item 29** DOE welcomes comments on the methodology for selecting commercially-available furnace fans with incrementally increasing efficiency from the baseline model to max-tech for characterizing the efficiencies of furnace fans currently offered for sale.

**Item 30** DOE welcomes comments on how furnace fan efficiency varies with airflow capacity, motor type, motor rated horsepower, number of speed control settings, or any other furnace fan parameter.

# Engineering Analysis: Proprietary Designs

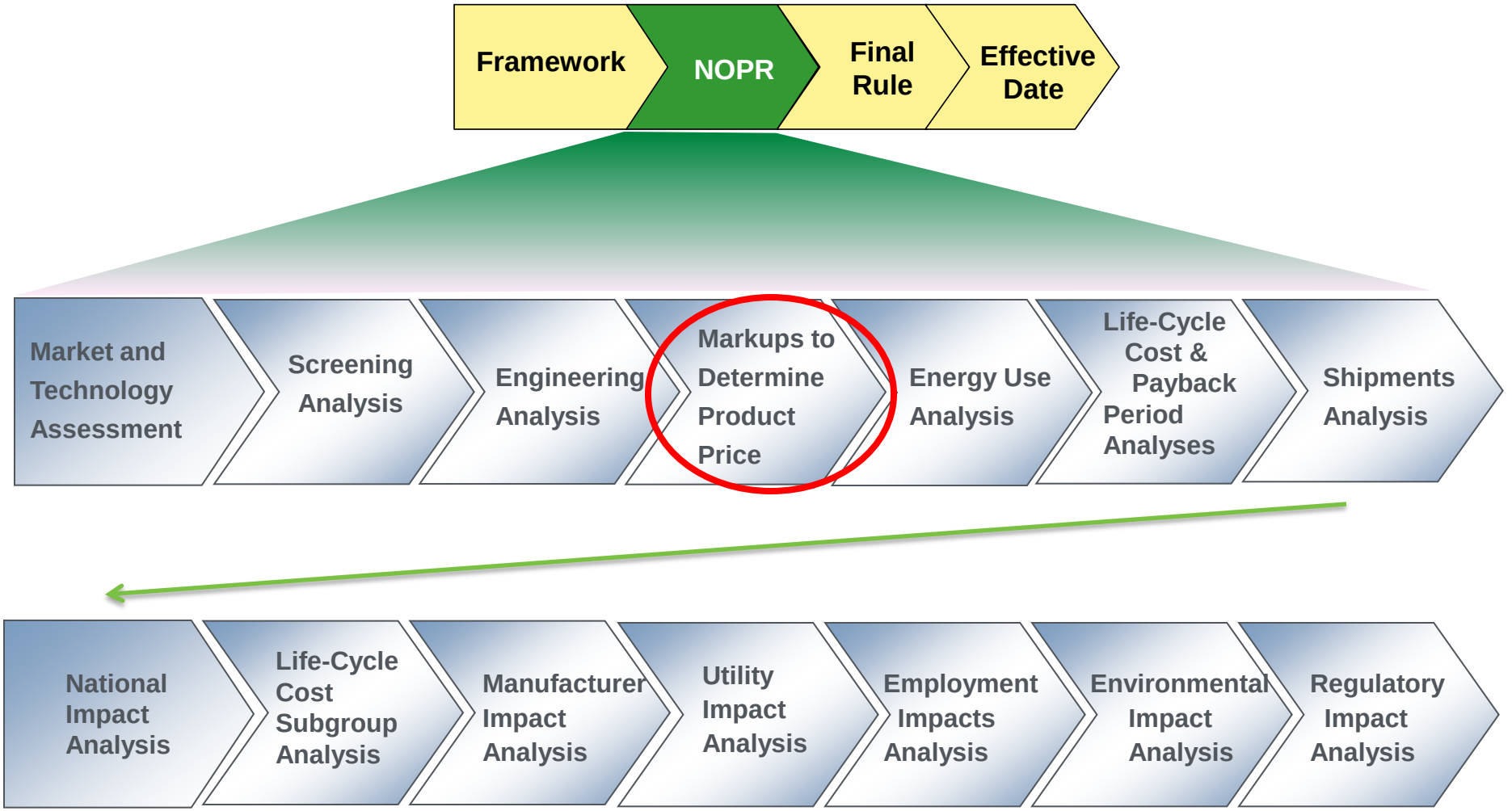


- DOE will consider all commercially-available or working prototypes that meet screening criteria.
  - If a proprietary design is the only approach to achieving a particular efficiency level, that level will be eliminated from analysis.
  - Standard levels that can only be achieved by using a single proprietary technology will be rejected because it is economically unjustifiable.

**Item 31** DOE seeks information on proprietary designs of which it should be aware for the furnace fans under consideration in this rulemaking and, if such proprietary designs exist, how DOE can acquire the cost data necessary for evaluating these designs.

# Steps in the Standards Rulemaking: NOPR





# Markups for Product Price Determination

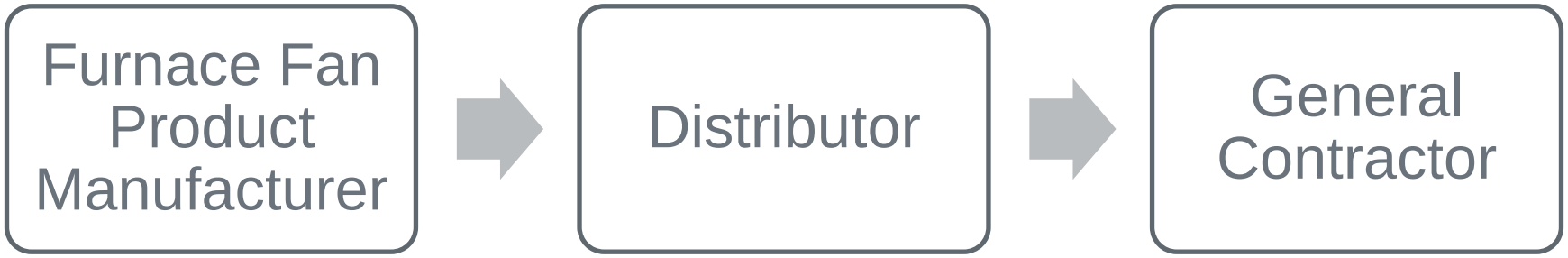


- **Purpose**
  - Determine consumer furnace fan prices based on manufacturer costs
  - Characterize furnace fan distribution channels and market segments
- **Method**
  - DOE will estimate the consumer prices by applying markups consisting of distribution channel markups and sales tax to manufacturer selling price estimates.
- **Inputs**
  - Financial Statements:
    - Wholesalers: HARDI Profit Survey Report (2008)
    - Contractors: ACCA Financial Analysis for the HVACR Contracting Industry (1995, 2005)
  - U.S. Census Bureau data:
    - Builders: Single-Family Housing Construction, Construction Industry Series (1997 and 2002 Economic Census, U.S. Department of Commerce)
- **Outputs**
  - Baseline and incremental markups:
    - Baseline markups relate price to cost prior to a change in efficiency.
    - Incremental markups relate the incremental change in consumer price to the incremental change in cost of goods sold.

# Distribution Channels




- Mechanical Contractors include mechanical contractors, dealers, and installers.




- General Contractors include builders because builders serve the same function in the HVAC marketplace as general contractors.

# Request for Comment

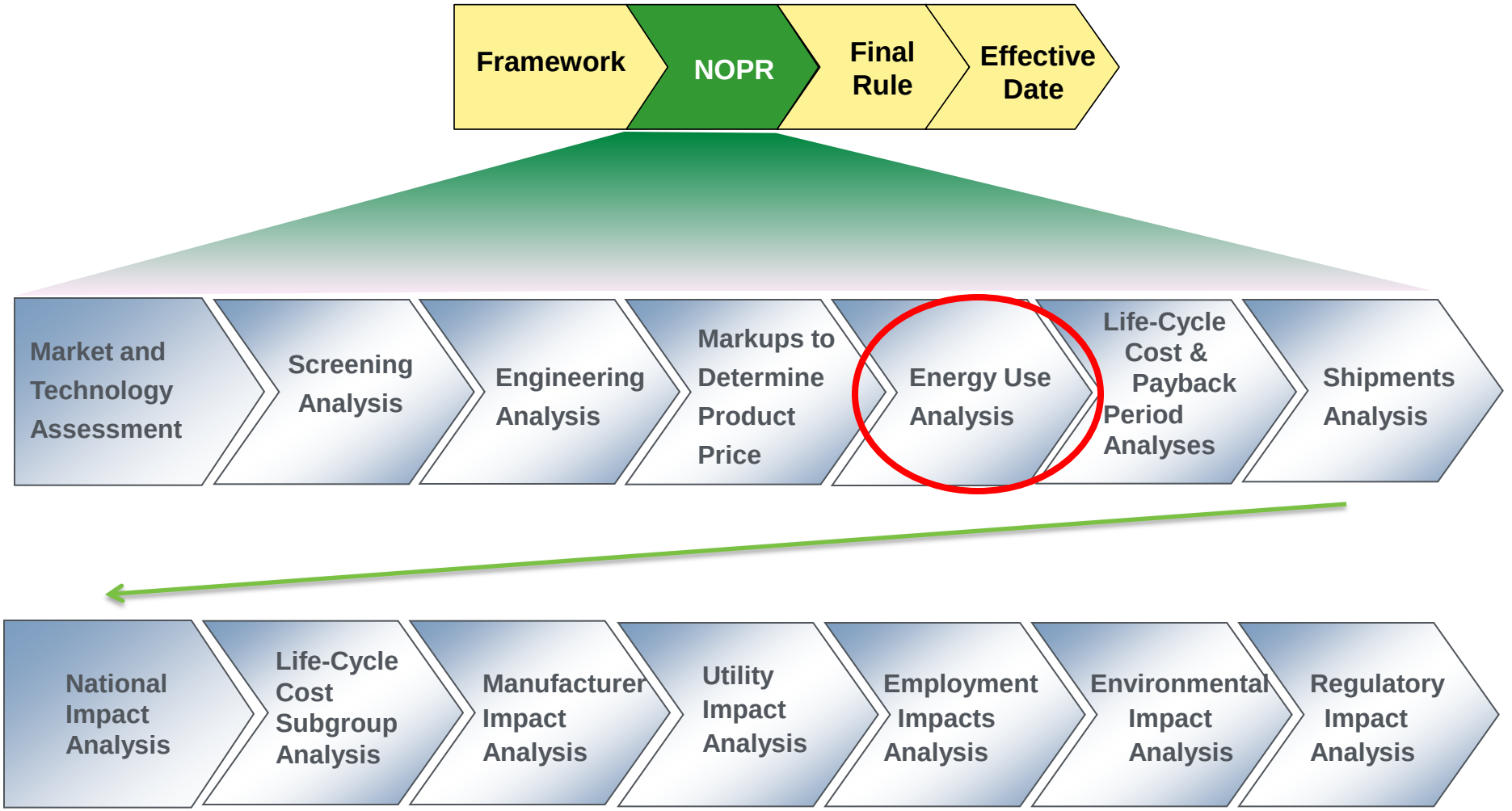


**Item 34** DOE requests comments on the planned distribution path for the furnace fans covered under this rulemaking and whether DOE should consider any additional paths. DOE also requests information on the relative fraction of shipments expected for each path.

**Item 35** DOE requests feedback on the overall markups for the furnace fans covered under this rulemaking for each path in the distribution chain.

# Steps in the Standards Rulemaking: NOPR





# Energy Use Analysis



## Purpose

- Identify the energy use of furnaces fans in the field and, thereby, the energy savings potential of energy efficiency improvements

## Method

- Estimate household heating and/or cooling load using adjusted heating/cooling equipment energy use* from RECS 2005
- Using heating and/or cooling load, determine heating/cooling equipment operating hours (includes accounting for furnace fan heat contribution)
- Using equipment operating hours, estimate furnace fan operating hours at each active mode (heating, cooling, and continuous ventilation)
- Estimate furnace fan electricity consumption for each considered efficiency level**

*Energy use for RECS 2005 homes adjusted using 30-year average heating degree data by Census Division or large state as well as adjusted for projected improvements in building thermal efficiency and changes in house floor area between 2005 and 2015 (standards effective date).

**Total energy consumption is adjusted to account for increased furnace gas use and reduced AC equipment electricity use due to higher furnace fan efficiency.

# Request for Comment

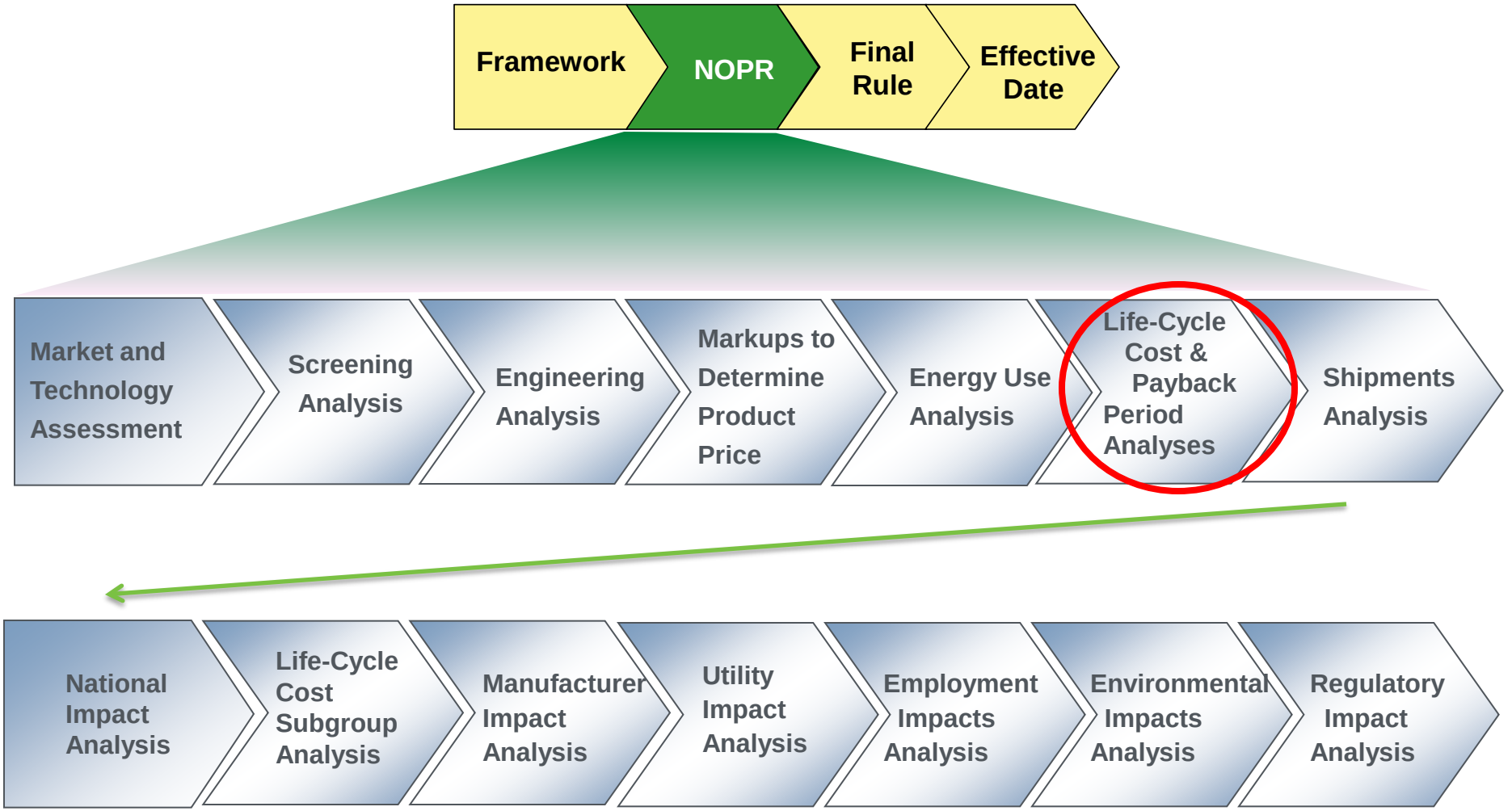


**Item 36** DOE seeks comments on the planned approach for determining the energy consumption of furnace fans in residential buildings.

**Item 37** DOE welcomes comments from interested parties as to whether a more-efficient furnace fan would be expected to be used more and whether such a rebound effect should be considered separately for this product.

# Steps in the Standards Rulemaking: NOPR





# Life-Cycle Cost and Payback Period Analyses Approach

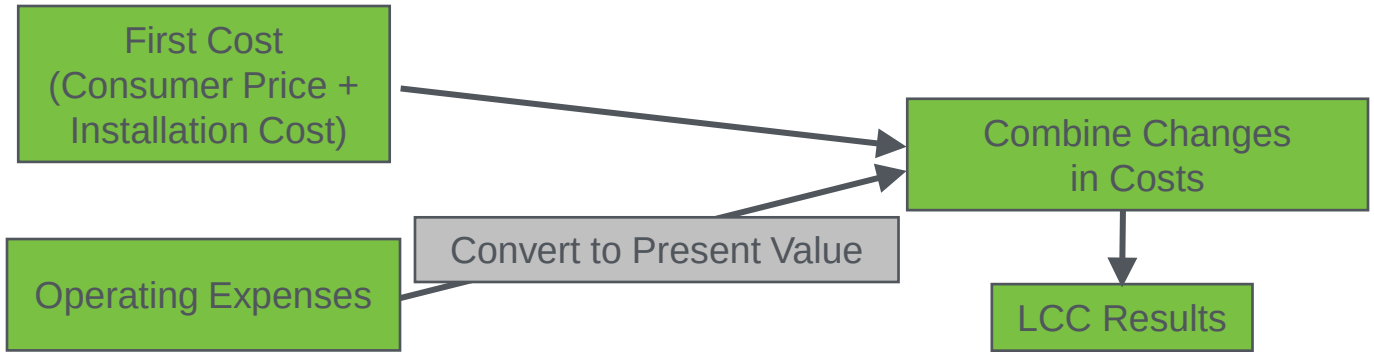


## Purpose

- Assess the net LCC impacts and PBP for the consumers of residential furnace fans under the considered efficiency levels

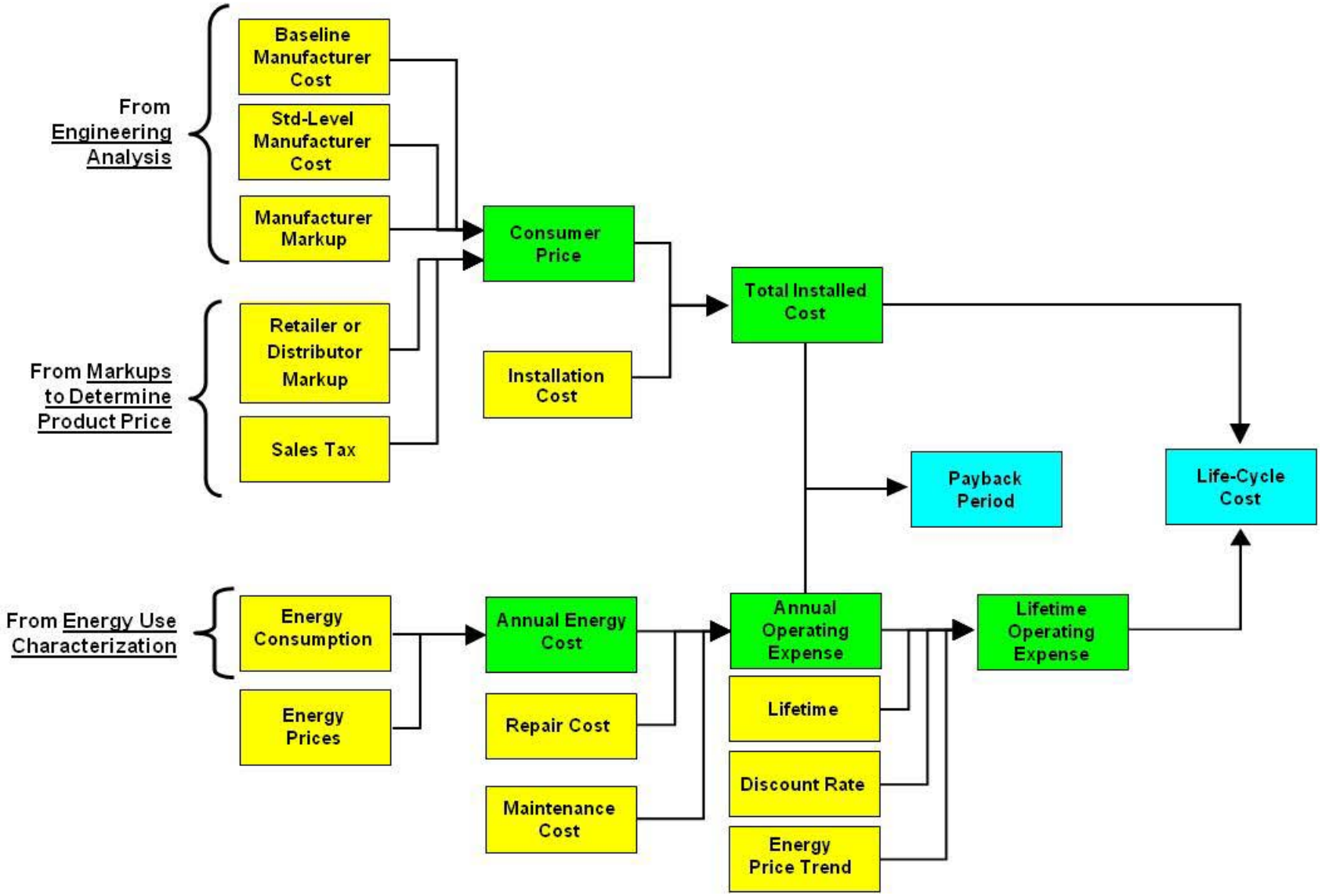
## Method

- LCC equals total installed cost plus the sum of operating costs discounted to a particular base year
- Analysis will model the uncertainty and variability of inputs using Monte Carlo approach and probability distributions
- Analysis will be implemented in MS Excel® spreadsheet combined with Crystal Ball®



# Life-Cycle Cost and Payback Period Analyses





# Energy Prices



- DOE will derive average monthly energy prices using recent EIA data for each of the Census divisions and large states to establish appropriate energy prices for each sample household.

- DOE will use projections of national average residential energy prices (from the most recent EIA *Annual Energy Outlook (AEO)*) to forecast future energy prices for the LCC analysis.

# Life-Cycle Cost Discount Rates



- DOE uses the discount rate to determine the present value of lifetime operating expenses.

- DOE will derive the discount rates from estimates of the "finance cost" to purchase residential products using the Federal Reserve Board's Survey of Consumer Finances. The finance cost can be interpreted as:
  - the financial cost of any debt incurred to purchase products (principally interest charges on debt); or
  - the opportunity cost of any equity used to purchase products (principally interest earnings on household equity).

**Item 38** DOE seeks input on its DOE's planned approach for estimating discount rates for consumers of residential furnace fans.

# Installation, Maintenance, and Repair Costs



- **Installation**
  - DOE does not plan to estimate installation costs because they are considered part of the manufacturing cost of a furnace.
- **Maintenance and Repair**
  - DOE will evaluate how maintenance and repair costs change with increased efficiency for furnace fans. Data sources will include:
    - RS Means;
    - manufacturer literature; and
    - expert consultants.
  - DOE will account for regional differences in labor costs.
  - The repair cost includes the installation of a replacement furnace fan.

**Item 39** DOE welcomes comments on the appropriate methods and data sources for assessing changes in installation costs and maintenance and repair costs for more efficient furnace fans.

# Furnace Fan Lifetimes



- DOE plans to use information from various literature sources and industry experts and input from manufacturers and other interested parties to determine a range for the lifetime of furnace fans.

**Item 40** DOE seeks comments on appropriate lifetimes for the furnace fans covered in this rulemaking.

# Energy Efficiency in the Base Case



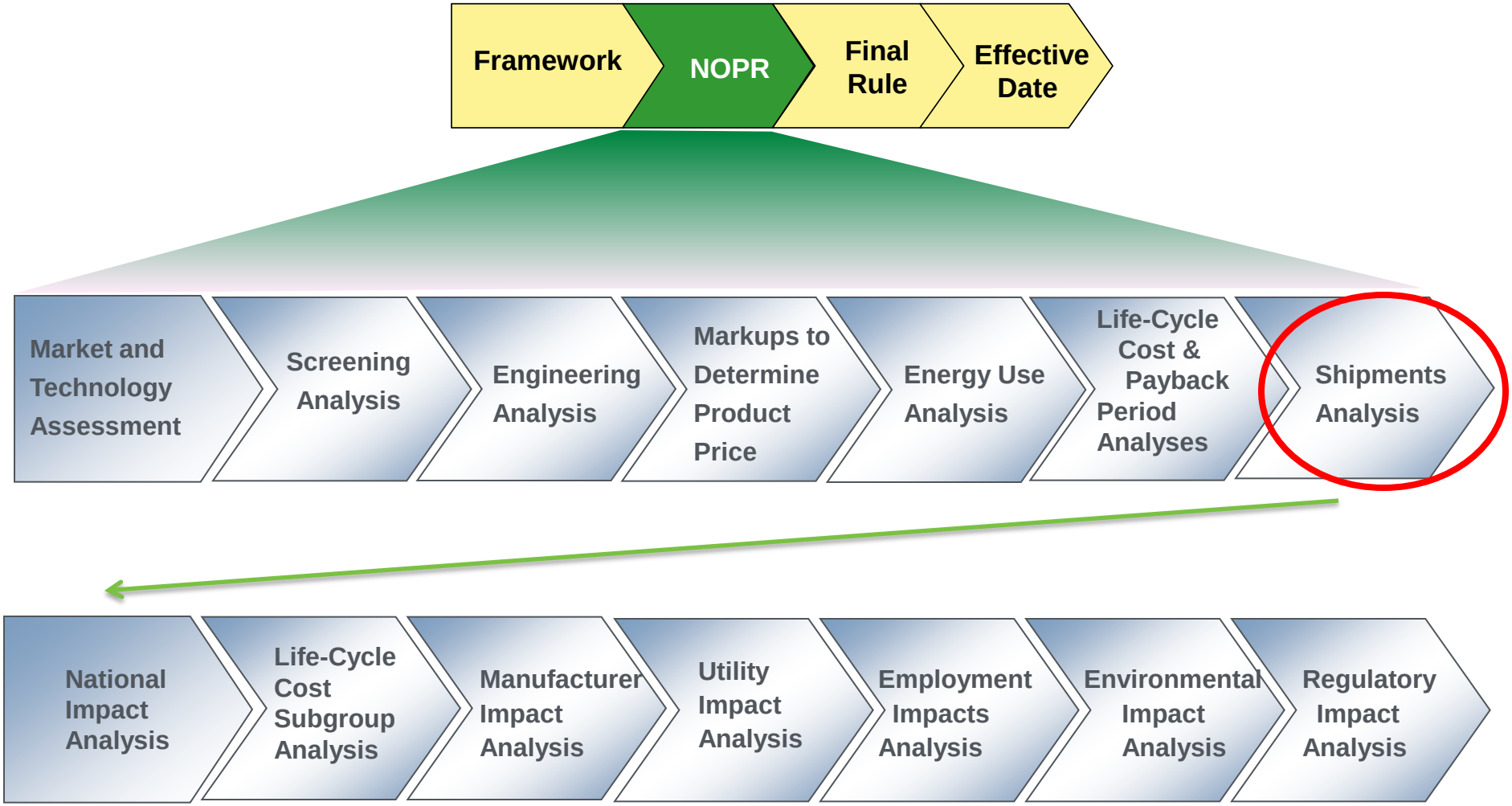
- DOE will develop projected market shares of products by efficiency under the base case for each Census Division and large state.

- DOE will use data on recent market trends in residential furnace and air conditioner efficiency, as well as potential impacts of the ENERGY STAR program and other policies that may affect the demand for more efficient furnace fans.

**Item 41** DOE seeks comments on the appropriate distribution of energy efficiencies for residential furnace fans in the absence of amended energy conservation standards.

# Steps in the Standards Rulemaking: NOPR





# Shipment Analysis



## Purpose

- Estimate furnace fan shipments in the base case and standards cases

## Method

- The model will apply accounting methodology to determine:
  - replacements in kind (replace with same equipment type and same fuel);
  - new housing installations; and
  - conversions from non-central heating to central heating with furnace fans;
  - fan retrofits into existing furnaces and cooling products if the fan fails.

- DOE intends to evaluate whether standards that require more-efficient furnace fans would have an impact on the number of fans shipped. DOE will consider application of elasticity parameters that relate changes in shipment quantities to changes in the installed cost of products with furnace fans.

# Base Case Shipments Forecast



- **Replacements:** DOE will develop retirement functions from the lifetime estimates and apply them to the existing products. The existing stock of products will be developed from historical shipments data.

- **New Construction:** DOE will use estimates of forecasted new housing construction and saturation rates of various furnace and cooling product types in new housing. In projecting future new housing saturation rates of residential furnaces and cooling products, DOE will consider expected trends in builder and consumer preferences, including competition among space heating and cooling products.

- **First Time Owners**: DOE plans to derive a historical rate of product adoption for the non-centrally-heated market. DOE plans to project future adoption rates by considering the historical trend as well as market saturation.

- **Retrofits:** DOE will estimate these shipments from the fan lifetime distribution.

- **Sources**: *Appliance Magazine*, AHRI data, EIA's AEO, U.S. Census Bureau's *Characteristics of New Housing*, and American Housing Survey data.

# Request for Comment



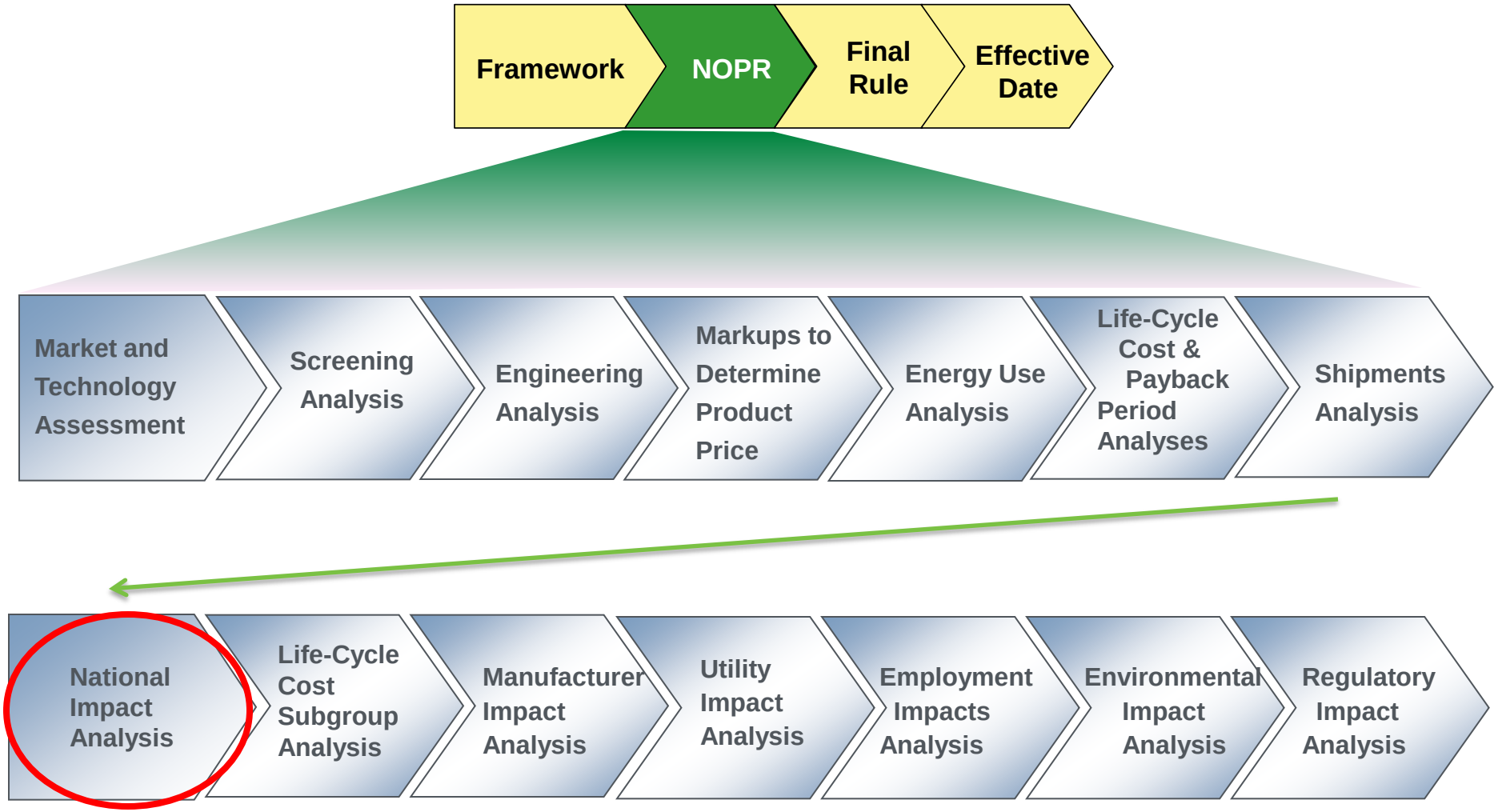
**Item 42** DOE seeks input on historical shipments data for furnace fans, including the distribution of shipments by efficiency.

**Item 43** DOE welcomes comments on the methodology described to forecast shipments of furnace fans.

**Item 44** DOE welcomes comments on whether energy conservation standards might affect shipments of furnace fans, as well as the anticipated extent of such impacts, if any.

# Steps in the Standards Rulemaking: NOPR





# National Impact Analysis



## Purpose

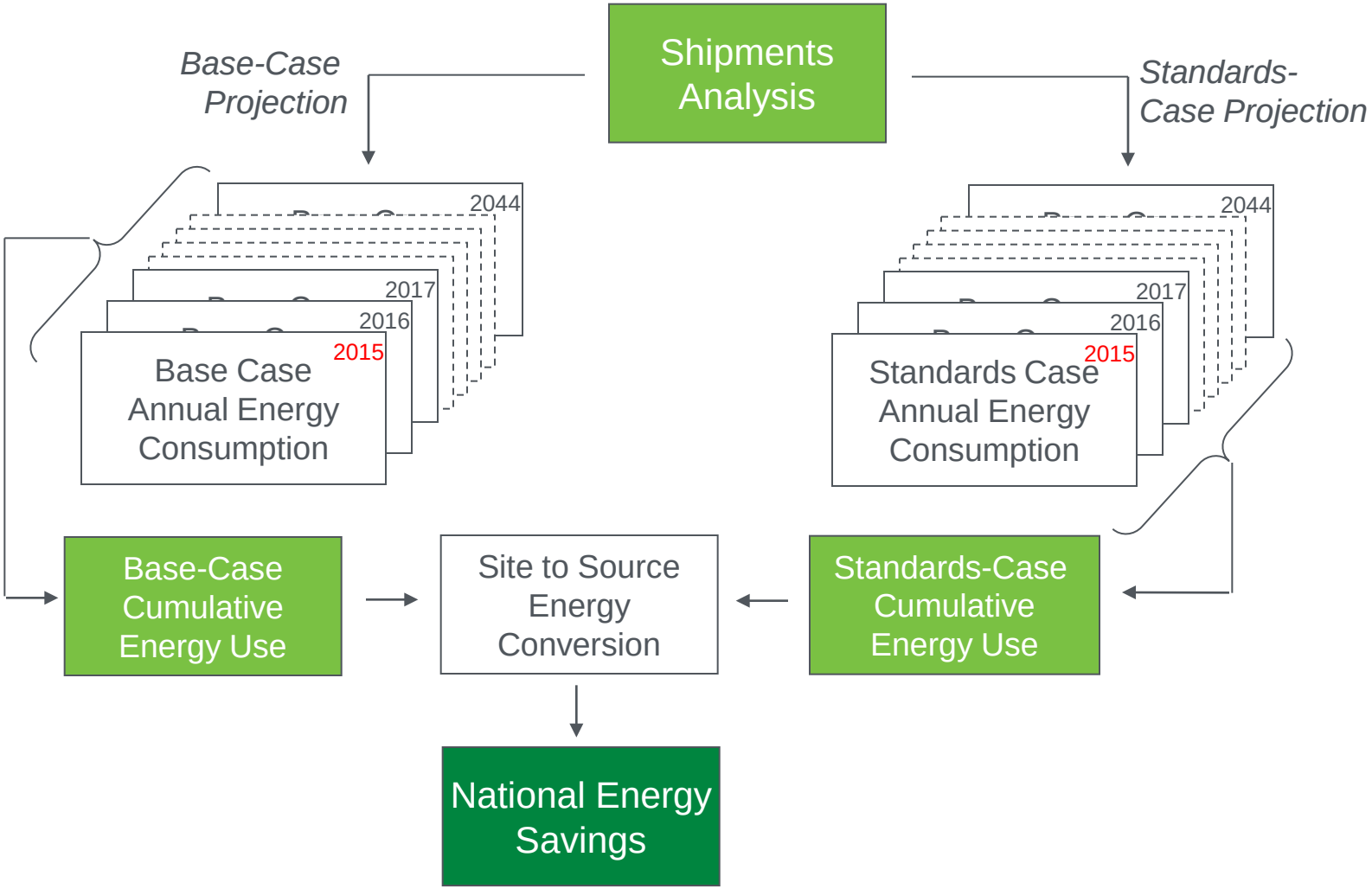
- Assess the aggregate impacts at the national level of potential energy conservation standards for each of the product classes, as measured by the net present value of total consumer economic impacts and the national energy savings

## Method

- DOE calculates annual equipment expenditures by multiplying the price per unit by forecasted shipments.
- The difference between base- and standards-case scenarios gives the national energy bill savings and increased expenditure in dollars.
- The difference each year between energy bill savings and increased equipment expenditures is the net savings (if positive) and net costs (if negative).

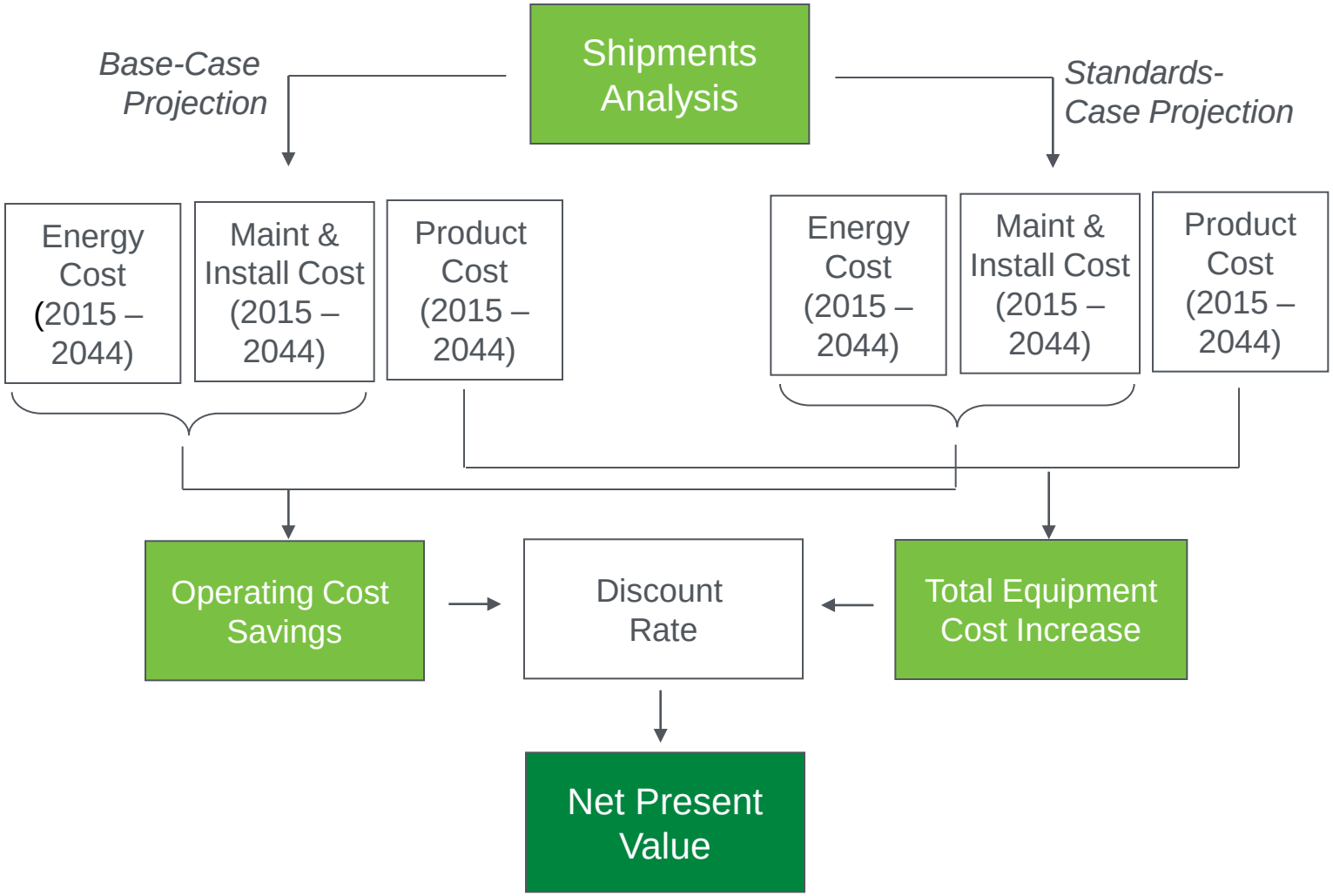
# National Energy Savings Flow Diagram





# National Consumer Net Present Value Flow Diagram





# Standards-case Efficiency Distributions



- DOE has used both the “roll-up” and “shift” scenarios for estimating the impact of standards on product efficiency distributions.
  - “Roll-up” scenario:
    - DOE assumes that product efficiencies in the base case that do not meet the standard level under consideration would “roll-up” to meet the new standard level, and product efficiencies above the standard level under consideration would not be affected.
  - “Shift” scenario:
    - DOE retains the pattern of the base-case efficiency distribution but re-orients the distribution at and above the new minimum energy conservation standard.

- DOE will evaluate whether one of these approaches is more reasonable for furnace fans, or whether it would be preferable to use both scenarios in its calculation of national impacts.

# Request for Comment

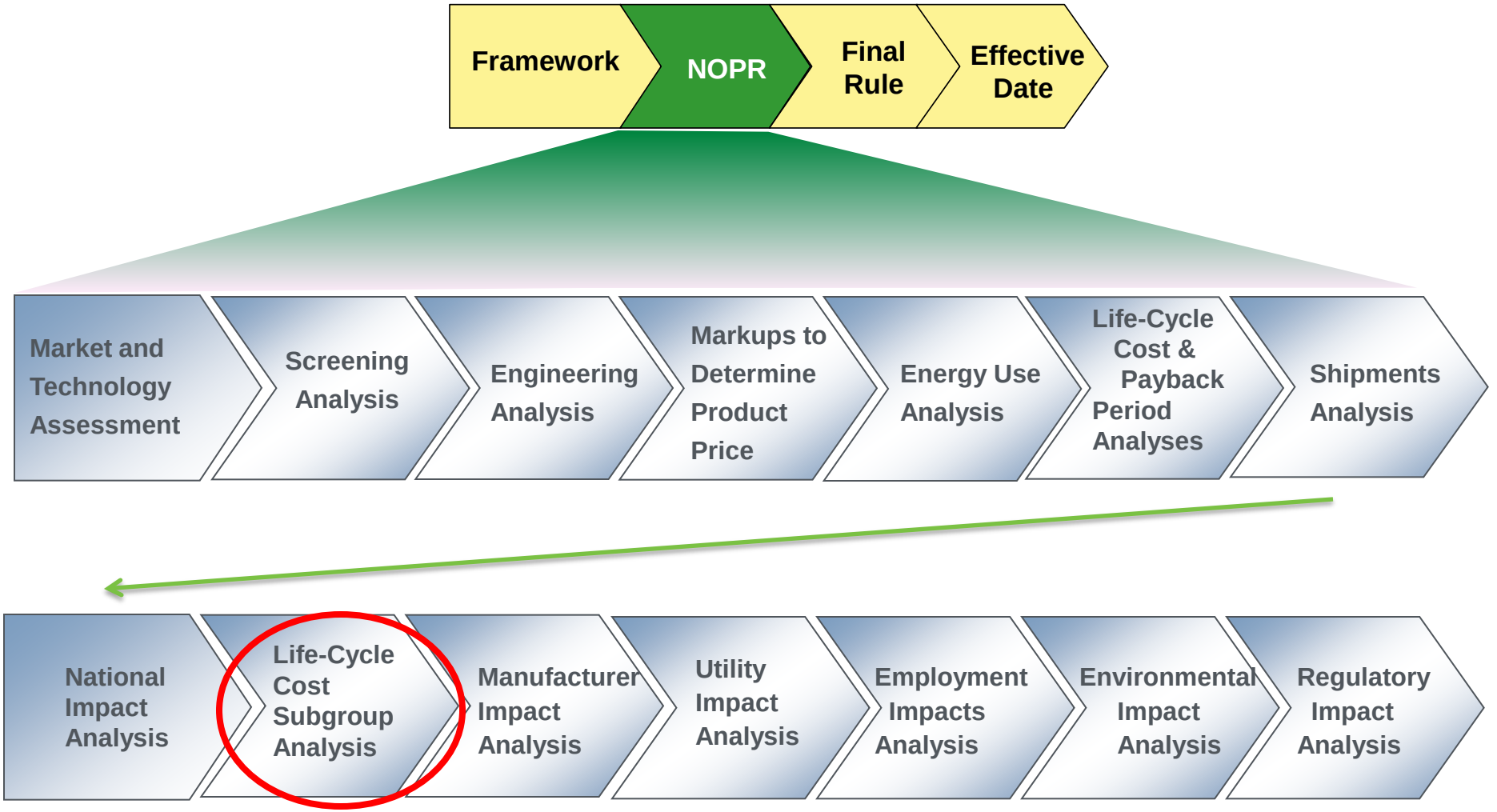


**Item 45** DOE seeks comments on the appropriate assumptions to use regarding long-run changes in furnace fan energy efficiency independent of amended energy conservation standards.

**Item 46** DOE seeks comments on the use of the “roll-up” and “shift” efficiency scenarios to characterize the impact that potential standards would have on the product efficiency distributions.

# Steps in the Standards Rulemaking: NOPR





# Life-Cycle Cost Subgroup Analysis



## Purpose

- Analyze the economic impacts of standards on consumers, including subgroups who may be disproportionately impacted compared with the general user population (*e.g.*, low-income consumers or senior citizens)

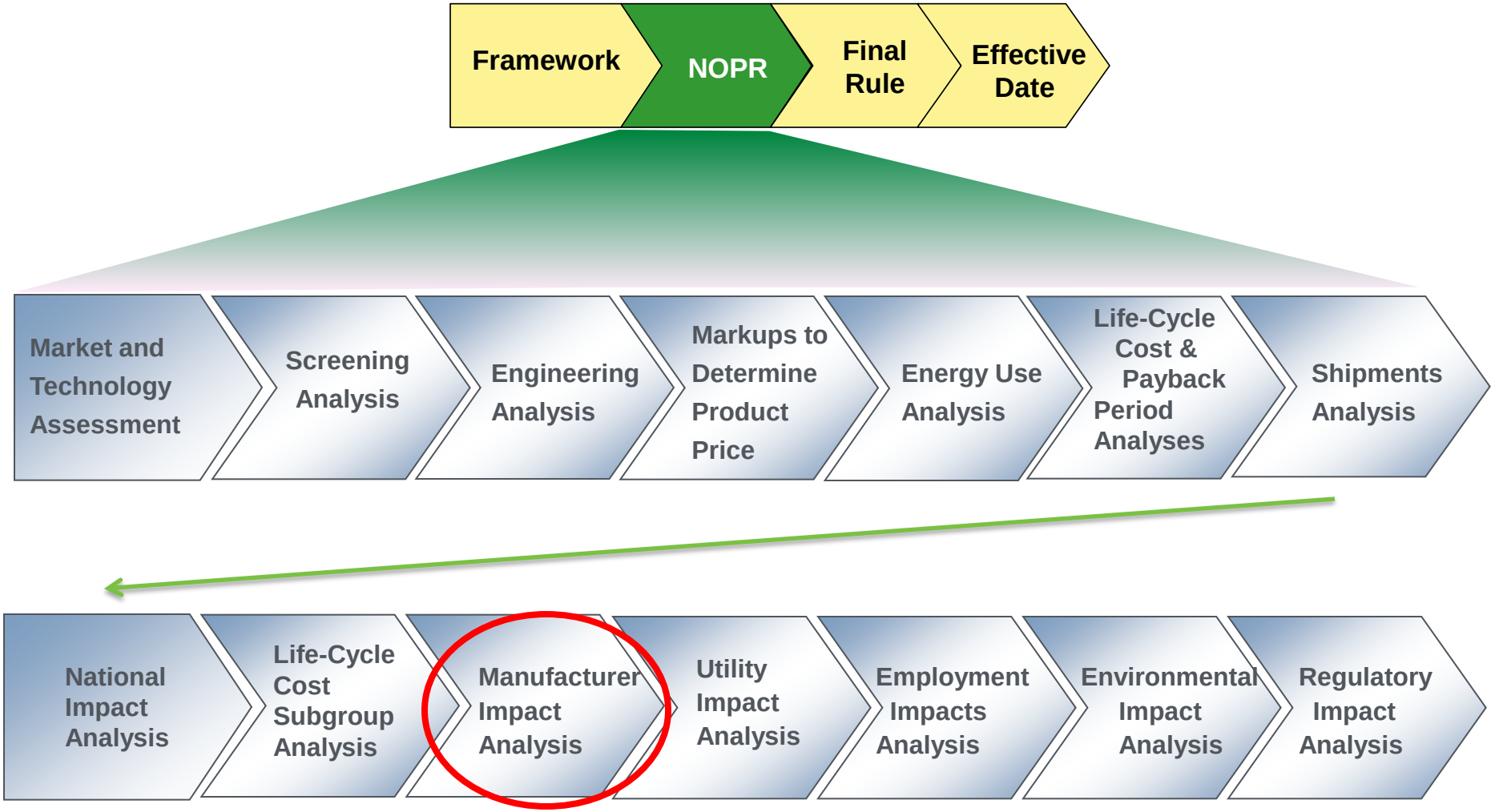
## Method

- Extend the LCC analysis to examine the impacts for defined subgroups
- Use inputs specific to each of the considered consumer subgroups

**Item 47** DOE welcomes comments from interested parties on which, if any, consumer subgroups should be considered when developing energy conservation standards for furnace fans.

# Steps in the Standards Rulemaking: NOPR





# Manufacturer Impact Analysis



## Purpose

- Assess the impacts of amended standards on manufacturers
- Identify and estimate impacts on manufacturer subgroups that may be more severely impacted than the industry as a whole
- Examine the impact of cumulative regulatory burden on the industry

## Method

- Analyze industry cash flow and net present value through use of the Government Regulatory Impact Model (GRIM)
- Interview manufacturers to refine inputs to the GRIM, develop subgroup analyses, and address qualitative issues

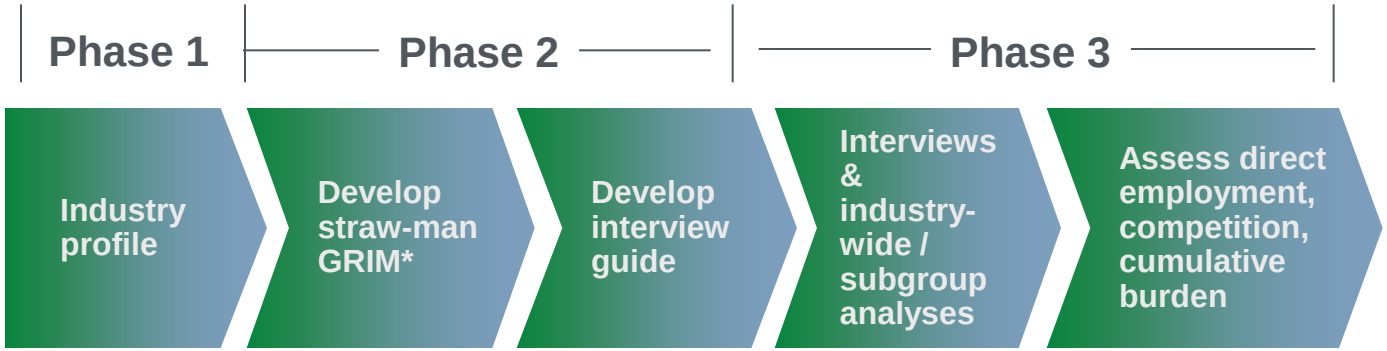
## Output

- Industry net present value (INPV) impacts
- Subgroup net present value (NPV) impacts
- Other impacts

# MIA Methodology



- The MIA consists of three main phases:



# Small Business Impacts



- DOE recognizes that small businesses may be disproportionately affected by the promulgation of amended energy conservation standards for residential furnace fans.
- Residential furnace fan manufacturing is classified under NAICS 333415, “Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.”
- The size threshold for a small business is 750 employees or fewer.

**Item 48** DOE seeks comments on the subgroups of furnace fan and furnace fan product manufacturers that it should consider in a manufacturer subgroup analysis.

# Cumulative Regulatory Burden

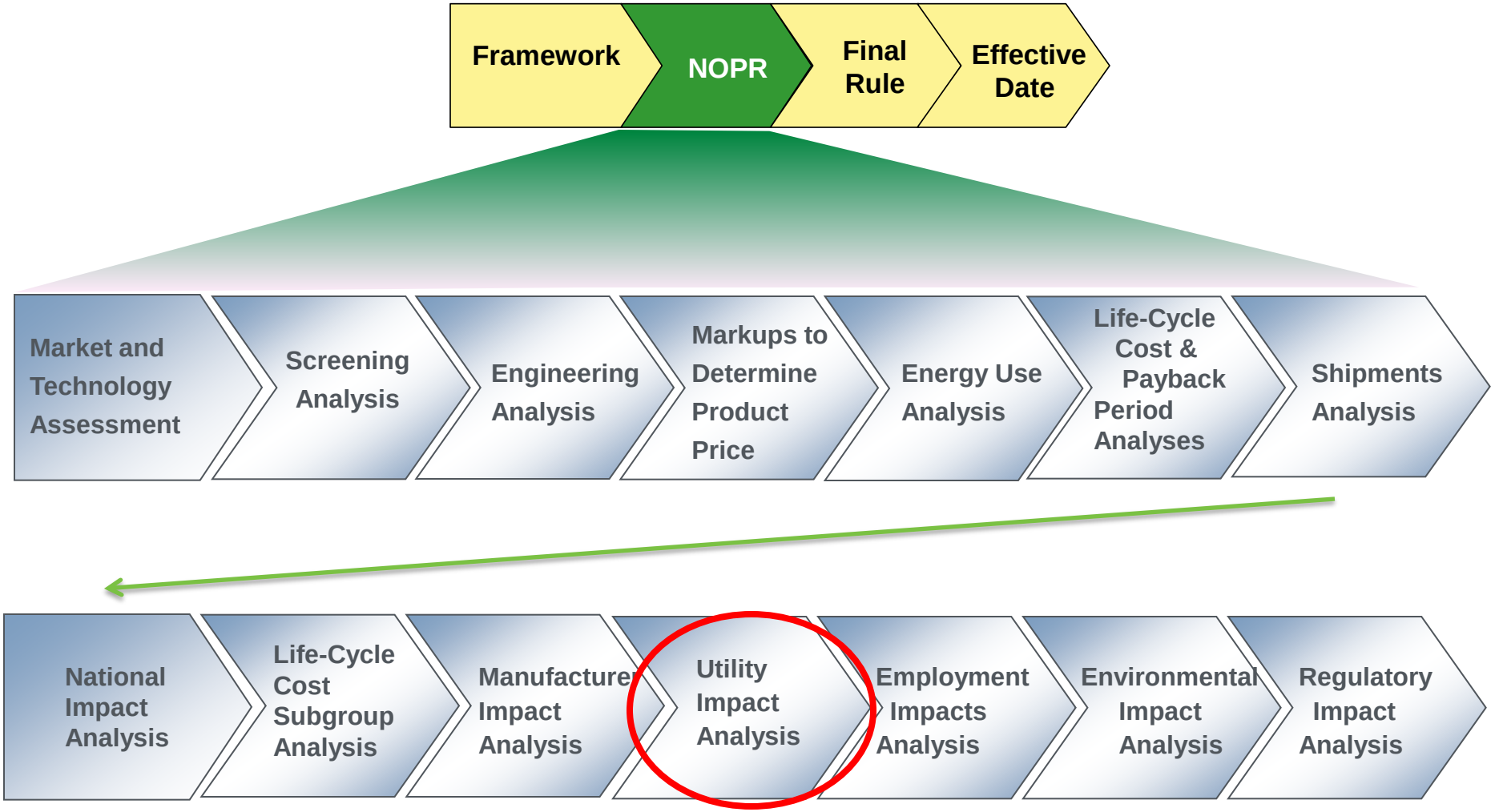


- Regulations that could impact the industry:
  - Energy Conservation Standards for Residential Furnaces and Boilers; and
  - Energy Conservation Standards for Residential Central Air Conditioners and Heat Pumps.

**Item 49** DOE welcomes comments on what other existing regulations or pending regulations it should consider in its examination of cumulative regulatory burden.

# Steps in the Standards Rulemaking: NOPR





# Utility Impact Analysis



## Purpose

- Assess selected impacts on energy supply that would result from the imposition of standards

## Method

- The Department proposes to use National Energy Modeling System (NEMS)-Building Technologies (BT), a variant of the NEMS used by EIA for their AEO report, as the basis of the Utility Impact Analysis.
- DOE will model the energy savings impacts from the considered standard levels using NEMS-BT to generate forecasts that deviate from the AEO reference case.
- Outputs of the utility impact analysis include forecasts of electricity generation and avoided capacity resulting from the considered standard levels.

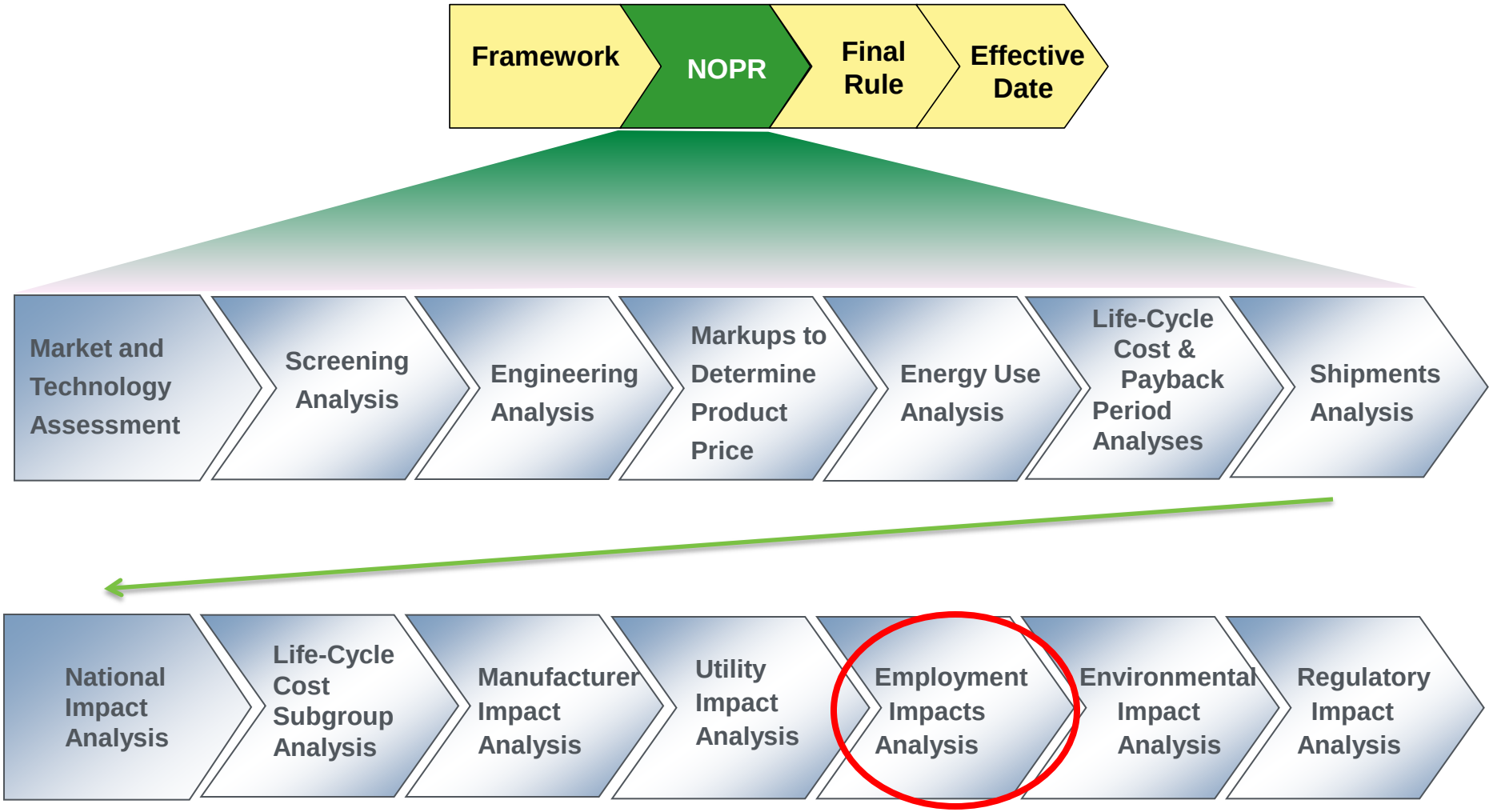
# Request for Comment

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

**Item 50** DOE seeks input on its plans to use NEMS-BT to conduct the utility impact analysis for the products covered under this rulemaking.

# Steps in the Standards Rulemaking: NOPR





# Employment Impact Analysis



## Purpose

- Assess the overall impact on national employment from the considered efficiency levels
- Focus on indirect employment impacts
  - Indirect employment impacts result from shifting consumer expenditures among goods and services and changing equipment and energy costs.
  - Direct employment impacts are estimated in the manufacturer impact analysis.

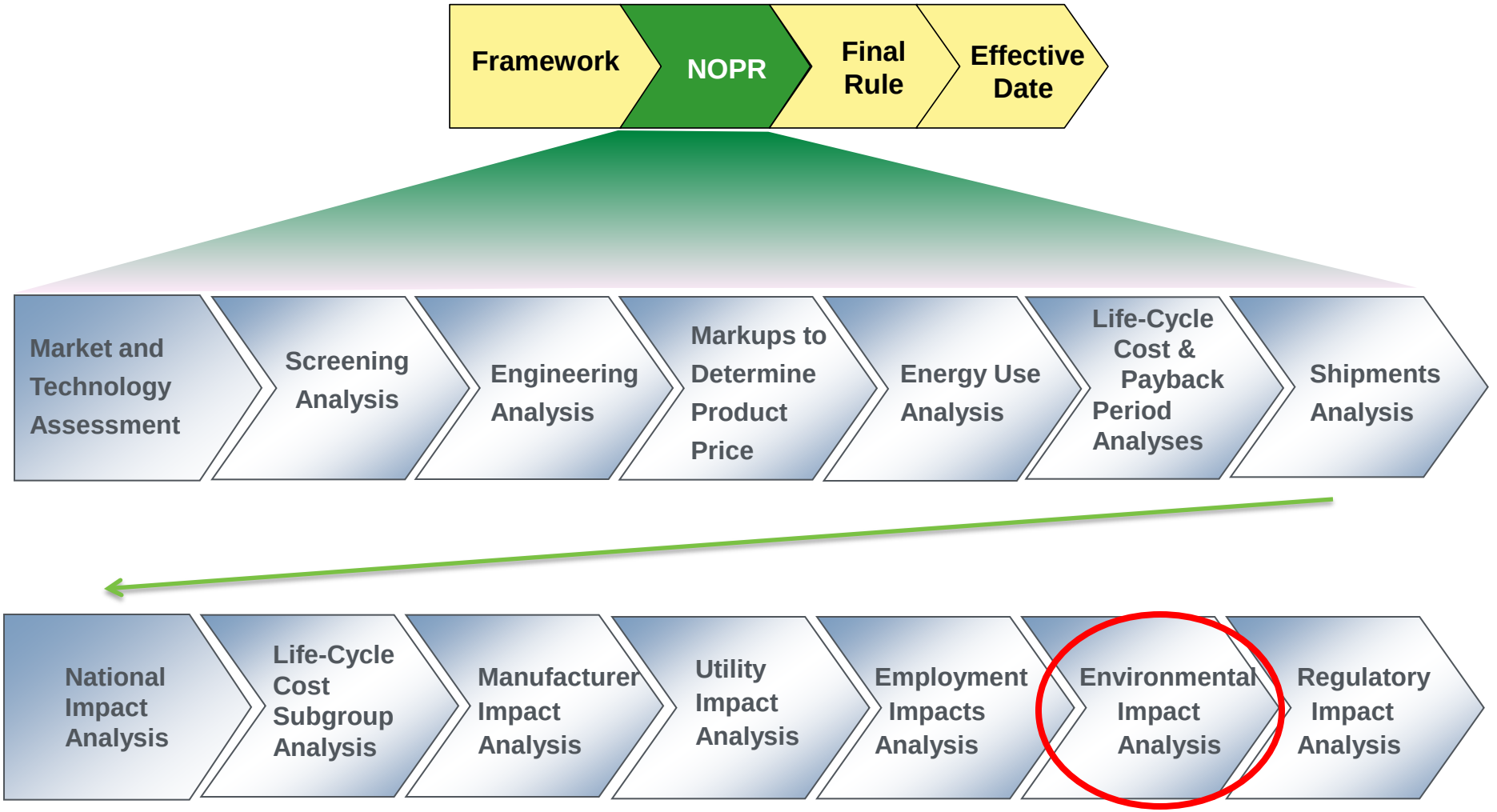
## Method

- DOE intends to use the Impact of Sector Energy Technologies (ImSET) model for the evaluation of indirect employment impacts. (Note: ImSET is an update of IMBUILD)

**Item 51** DOE requests comments on its approach to assessing employment impacts on the products covered under this rulemaking.

# Steps in the Standards Rulemaking: NOPR





# Environmental Assessment



## Purpose

- To report environmental impacts resulting from amended energy conservation standards, including changes in power plant emissions, as well as site emissions due to the use of gas and oil furnaces

## Method

- DOE intends to assess the environmental impacts using NEMS-BT.
  - The result is an estimate of national emission reductions of $CO_2$, $NO_x$, and mercury.
  - NEMS-BT estimates site $SO_2$ and $NO_x$ emitted by fossil-fuel fired appliances using emissions factors.

# 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 $CO_2$ emissions in 2010 are $4.7, $21.4, $35.1, and $64.9 per metric ton in 2007 dollars.
  - 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

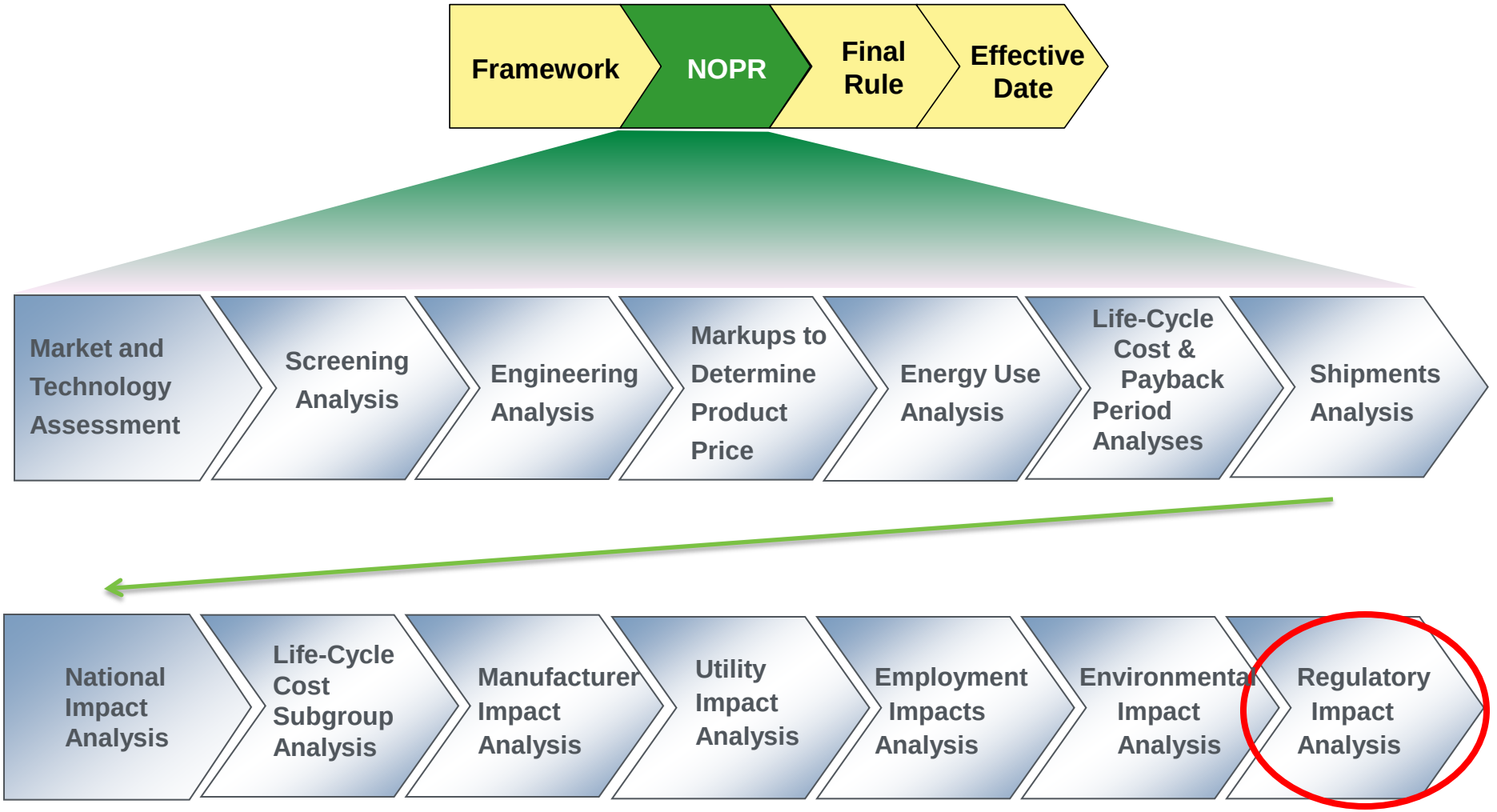


**Item 52** DOE seeks input on its plans to use NEMS-BT to conduct the environmental assessment for the products covered by this rulemaking.

**Item 53** DOE requests comments on the approach it plans to use for estimating monetary values associated with emissions reductions, or any widely-accepted values that could be used in DOE's analyses.

# Steps in the Standards Rulemaking: NOPR





# Regulatory Impact Analysis



## Purpose

- To investigate the national impacts of non-regulatory alternatives compared with mandatory energy conservation standards
- The non-regulatory alternatives that may be considered include:
  - consumer rebates;
  - consumer tax credits;
  - manufacturer tax credits;
  - voluntary efficiency targets;
  - early replacement; and
  - bulk government procurement.

## Method

- Modify NES spreadsheet model to consider non-regulatory scenarios
- Estimate impacts of non-regulatory scenarios based on experience with the considered policies
- Output will include National Energy Savings and Net Present Value of the non-regulatory alternatives

# Request for Comment



**Item 49** DOE welcomes comments on what other existing regulations or pending regulations it should consider in its examination of cumulative regulatory burden.

# Public Meeting Agenda



1. Introduction
2. Regulatory Authority
3. Rulemaking Overview
4. Scope of Coverage and Test Procedures
5. NOPR Analyses
6. Closing Remarks

# How to Submit Written Comments



- **In all correspondence, please refer to the Residential Furnace Fans rulemaking by:**
  - Residential Furnace Fans Rulemaking;
  - Docket Number EERE-2010-BT-STD-0011; and
  - Regulatory Identification Number (RIN) 1904-AC22.

- **Email**: FurnFans-2010-STD-0011@ee.doe.gov

**Postal:**

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Washington, DC 20024
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- **Comment period closes July 06, 2010.**

# Relevant URLs



- **DOE Appliance Standards**
  - http://www.eere.energy.gov/buildings/appliance_standards/
- **DOE Furnace Fan**
  - http://www.eere.energy.gov/buildings/appliance_standards/residential/furnace_fans.html
- **DOE Furnace Fan Framework**
  - http://www.eere.energy.gov/buildings/appliance_standards/residential/furnace_fans_framework.html