



U.S. Department of Energy
**Energy Efficiency
and Renewable Energy**

Bringing you a prosperous future where energy
is clean, abundant, reliable, and affordable

Building Technologies Program

U.S. Department of Energy

*Energy Conservation Program for Consumer Products
and Commercial and Industrial Equipment*

Framework Document Public Meeting on Energy Conservation Standards for General Service Fluorescent Lamps, Incandescent Reflector Lamps and General Service Incandescent Lamps

June 15, 2006
Washington, DC
Revised, June 20, 2006

http://www.eere.energy.gov/buildings/appliance_standards



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)
 - Turn down the volume on cell phones or place them on “stun”
- Housekeeping Items
- Agenda Review
- Opening Remarks



Morning Agenda

9:00 - 9:05 am	Welcome
9:05 - 9:20 am	Introductions, agenda review, opening remarks
9:20 - 9:35 am	Rulemaking overview; analytical methodology; product definitions
	ANOPR ANALYSES:
9:35 – 11:00 am	Market and technology assessment
11:00 - 11:15 am	Break
11:15 – 12:00 pm	Screening analysis and engineering analysis
12:00 - 1:00 pm	Break for Lunch



Afternoon Agenda

1:00 - 2:00 pm

Markups for equipment price determination; energy use and end-use load characterization; and life-cycle cost and payback period analysis

2:00 - 2:45 pm

Shipments analysis and national impact analysis

2:45 - 3:00 pm

Break

NOPR ANALYSES:

3:00 – 3:30 pm

Revisions to ANOPR analyses and LCC subgroup analysis

3:30 - 4:00 pm

Manufacturer impact analysis

4:00 - 4:30 pm

Utility impact analysis, employment impact analysis, environmental assessment, and regulatory impact analysis

FINAL RULE

4:30 - 5:00 pm

Other issues and comments; closing remarks



Public Meeting Agenda

- 1** Introduction
- 2 Rulemaking Overview
- 3 ANOPR Analyses
- 4 NOPR Analyses
- 5 Final Rule
- 6 Closing Remarks



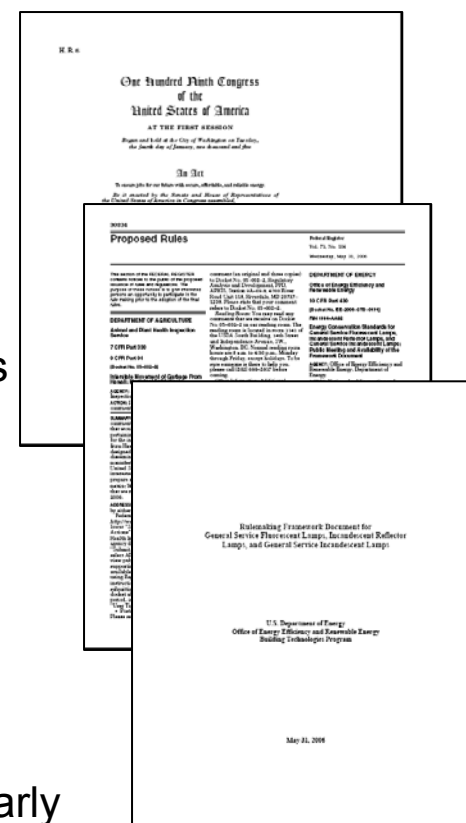
Purpose of the Framework Document Public Meeting

- Present the procedural and analytical approaches the U.S. Department of Energy (DOE or the Department) anticipates using to evaluate energy conservation standards for:
 - General Service Fluorescent Lamps
 - Incandescent Reflector Lamps
 - General Service Incandescent Lamps (which include incandescent reflector and non-reflector lamps)
- Provide a forum for public discussion of issues
- Encourage stakeholders to submit data, information, and written comments
- Inform stakeholders and facilitate the rulemaking process



Background

- **The Energy Policy and Conservation Act, as amended**
 - Grants DOE the authority to regulate fluorescent and incandescent lamps
 - Established energy conservation standards for general service fluorescent lamps and incandescent reflector lamps
 - Requires DOE to review and possibly amend the existing standards
 - Defines some terms applicable to these lamps
- **Federal Register - 71 FR 30834 (May 31, 2006)**
 - Gives public notice of the public meeting and availability of the Framework Document being discussed today
 - Encourages interested parties to submit comments
- **Framework Document**
 - Provides an overview of the rulemaking process and encourages early stakeholder participation
 - Invites comments on proposed approach and issues
 - The Framework Document is available online at http://www.eere.energy.gov/buildings/appliance_standards/





Energy Conservation Standard Rulemaking Authority

- This rulemaking bundles three products: General Service Fluorescent Lamps, Incandescent Reflector Lamps, and General Service Incandescent Lamps.
- It addresses two ‘backlog’ requirements from 42 USC 6295(i)(3) and (5):
 - (3) First review and possible amendment to General Service Fluorescent and Incandescent Reflector Lamp standards
 - (5) Determine whether standards should apply to additional General Service Fluorescent and General Service Incandescent Lamps

General Service Fluorescent Lamps	<ul style="list-style-type: none">• First review and possible amendment• Determine if standards apply to other types
Incandescent Reflector Lamps	<ul style="list-style-type: none">• First review and possible amendment• Determine if standards apply to other types*
General Service Incandescent Lamps	<ul style="list-style-type: none">• Determine if standards apply to other types

***Note: General Service Incandescent Lamp includes incandescent reflector and non-reflector lamps**

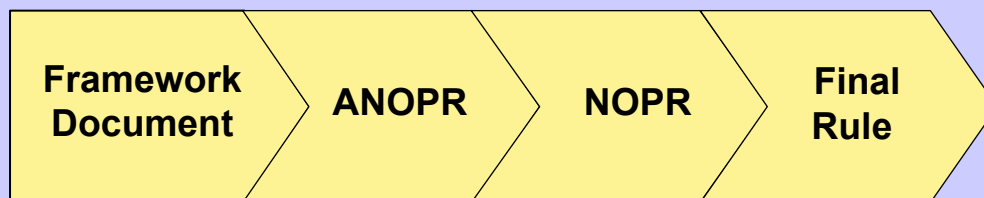


Public Meeting Agenda

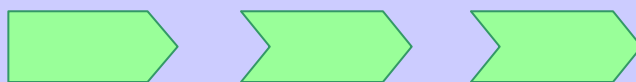
- 1 Introduction
- 2 Rulemaking Overview**
- 3 ANOPR Analyses
- 4 NOPR Analyses
- 5 Final Rule
- 6 Closing Remarks



Stages of the Rulemaking Process



Federal Register notices

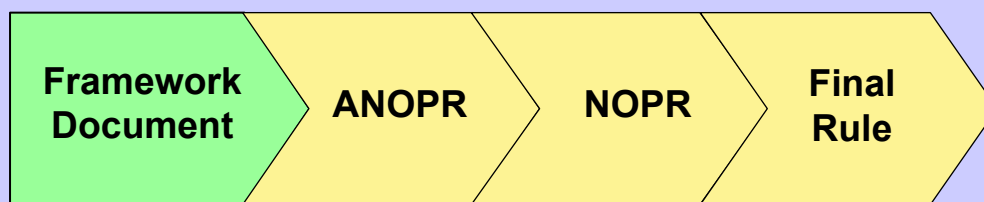


Stakeholder participation:

- Public meetings and oral comments
- Written comments on Federal Register notices, Technical Support Documents and Analytical Spreadsheets
- Consultative meetings



Framework Document

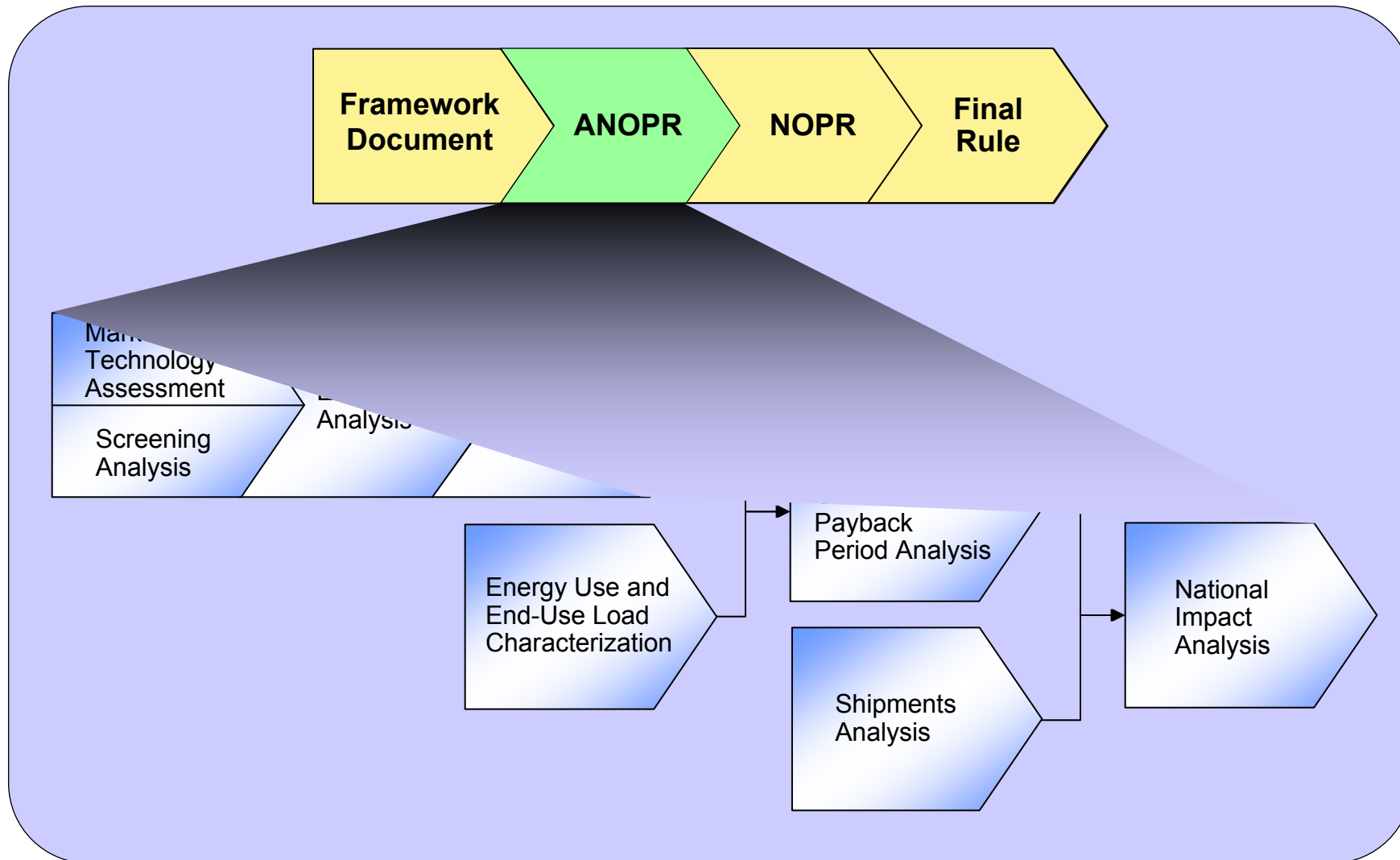


Today

- Today's public meeting covers the Framework Document for this rulemaking.
- The Framework Document provides an overview of the rulemaking process and encourages early stakeholder participation.
- The Department encourages all stakeholders to read the Framework Document, available at:
http://www.eere.energy.gov/buildings/appliance_standards/

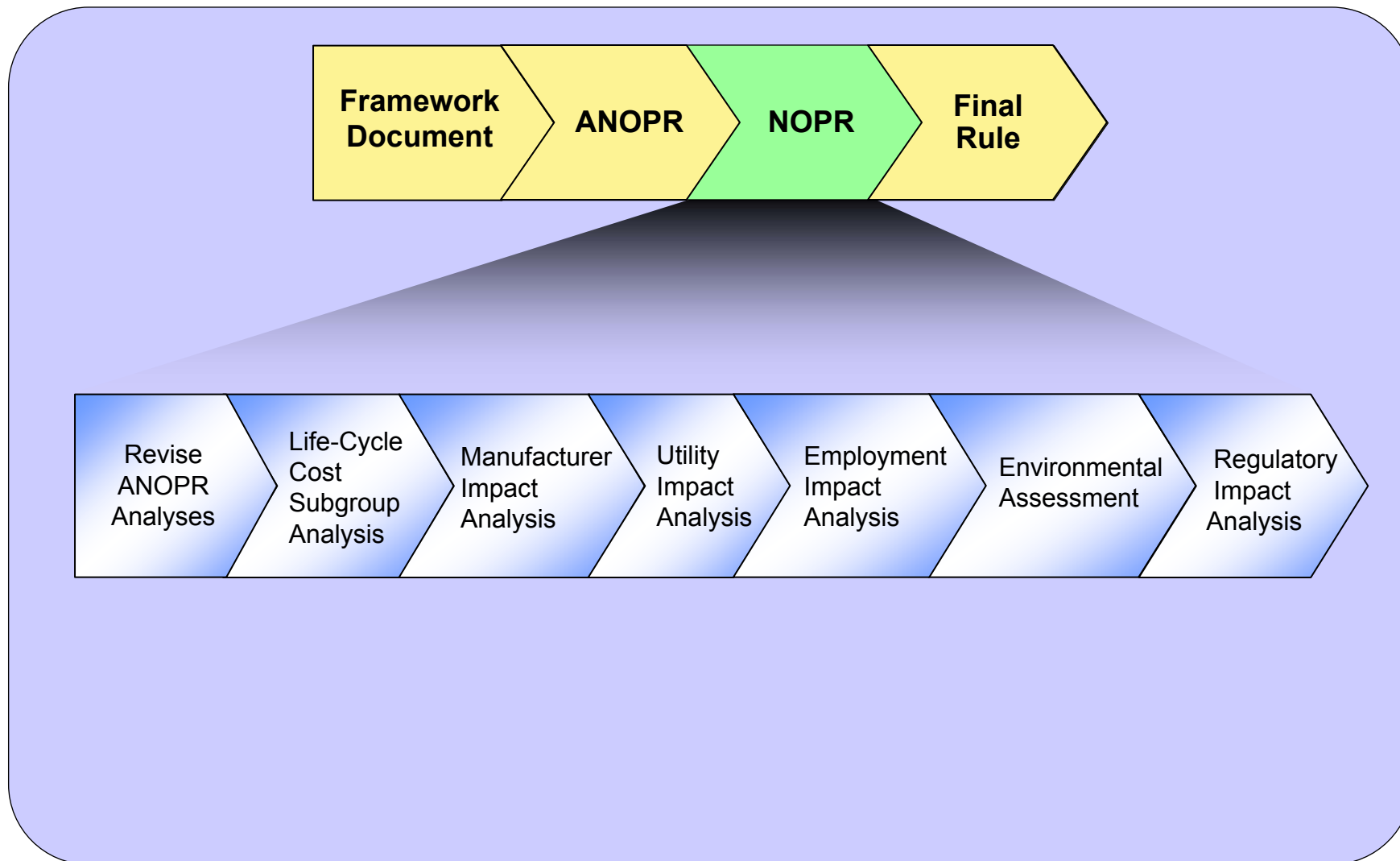


Analyses for Advance Notice of Proposed Rulemaking (ANOPR)



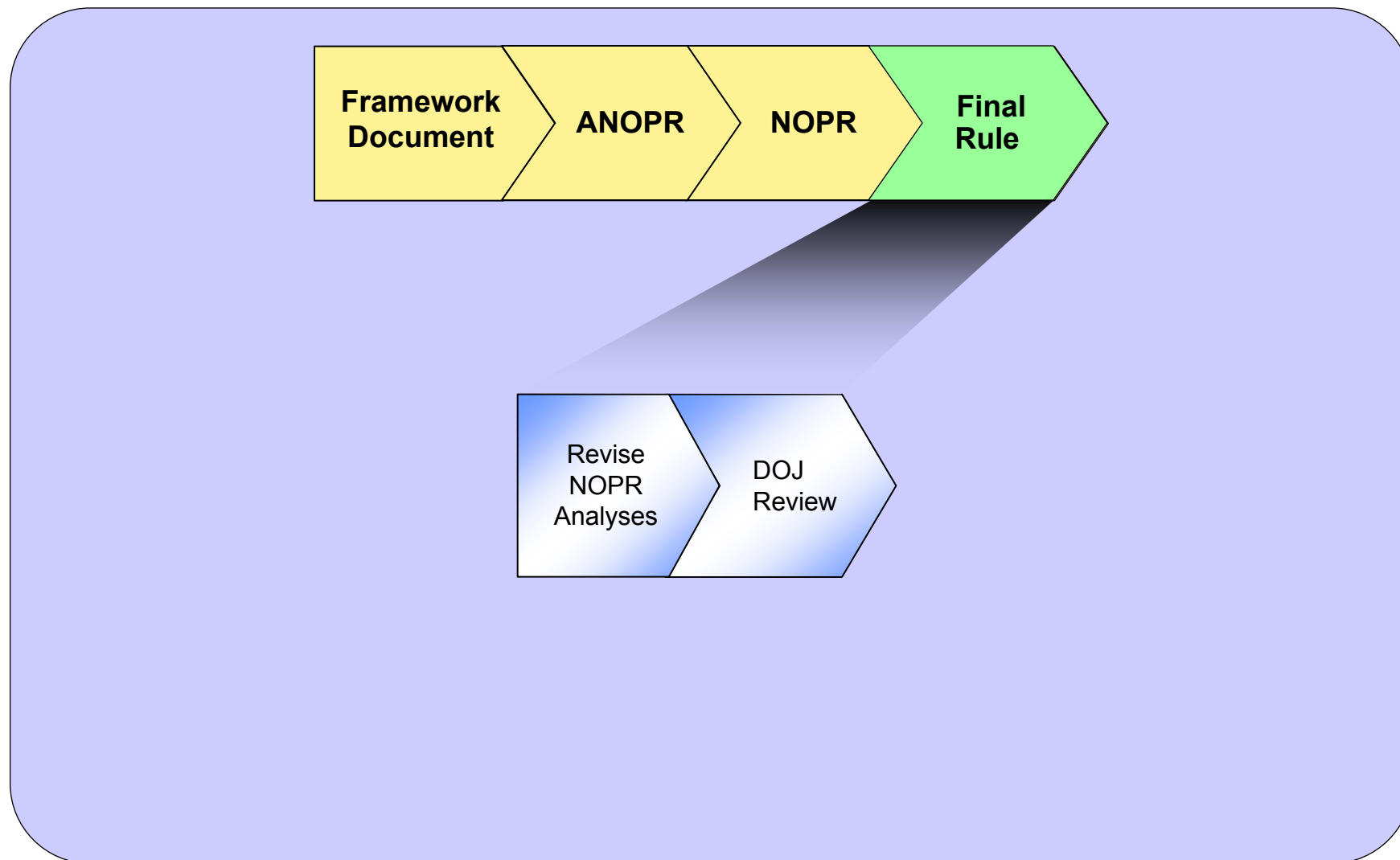


Analyses for Notice of Proposed Rulemaking (NOPR)



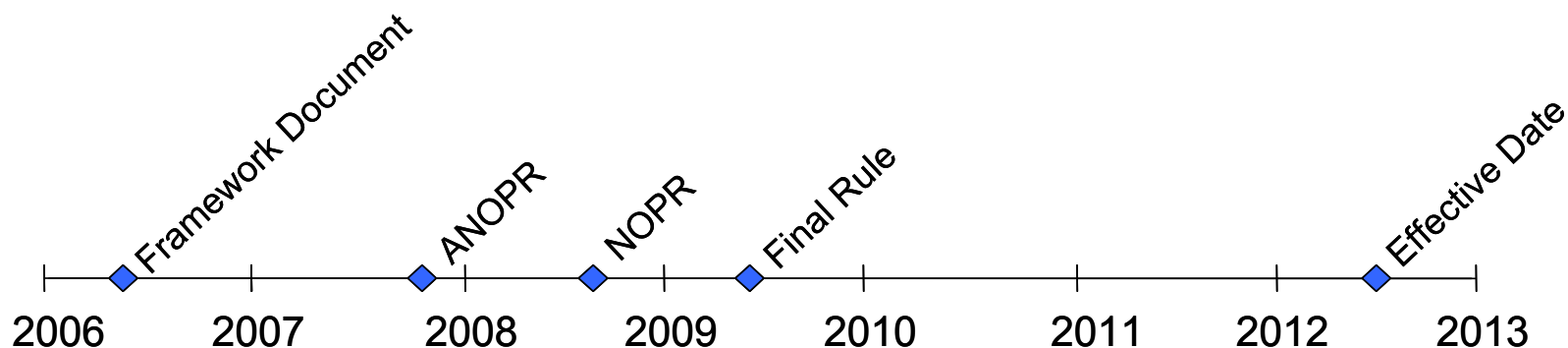


Analyses for Final Rule





Lamps Rulemaking Schedule



Milestone	Date
End of Comment Period on Framework	<i>June 29, 2006</i>
ANOPR Published in Federal Register	<i>November 2007</i>
NOPR Published in Federal Register	<i>October 2008</i>
Final Rule Published in Federal Register	<i>June 2009</i>
Effective Date	<i>June 2012</i>



Test Procedures

- DOE established test procedures for fluorescent & incandescent lamps on May 29, 1997. 62 FR 29222; Appendix R to Subpart B of Part 430—Uniform Test Method for Measuring Average Lamp Efficacy and Color Rendering Index (CRI) of Electric Lamps.
- The DOE test procedures for these lamps:
 - Apply to all lamps covered by this rulemaking.
 - Measure lamp efficacy* and color rendering index (CRI).**
 - Incorporate by reference specific industry standards.
- DOE does not intend to update these test procedures for this rulemaking.

* Lamp efficacy: “the lumen output of a lamp divided by its wattage, expressed in lumens per watt (LPW).” (42 U.S.C. 6291(30)(M))

** Color rendering index (CRI): “the measure of the degree of color shift objects undergo when illuminated by a light source as compared with the color of those same objects when illuminated by a reference source of comparable color temperature.” (42 U.S.C. 6291(30)(J))

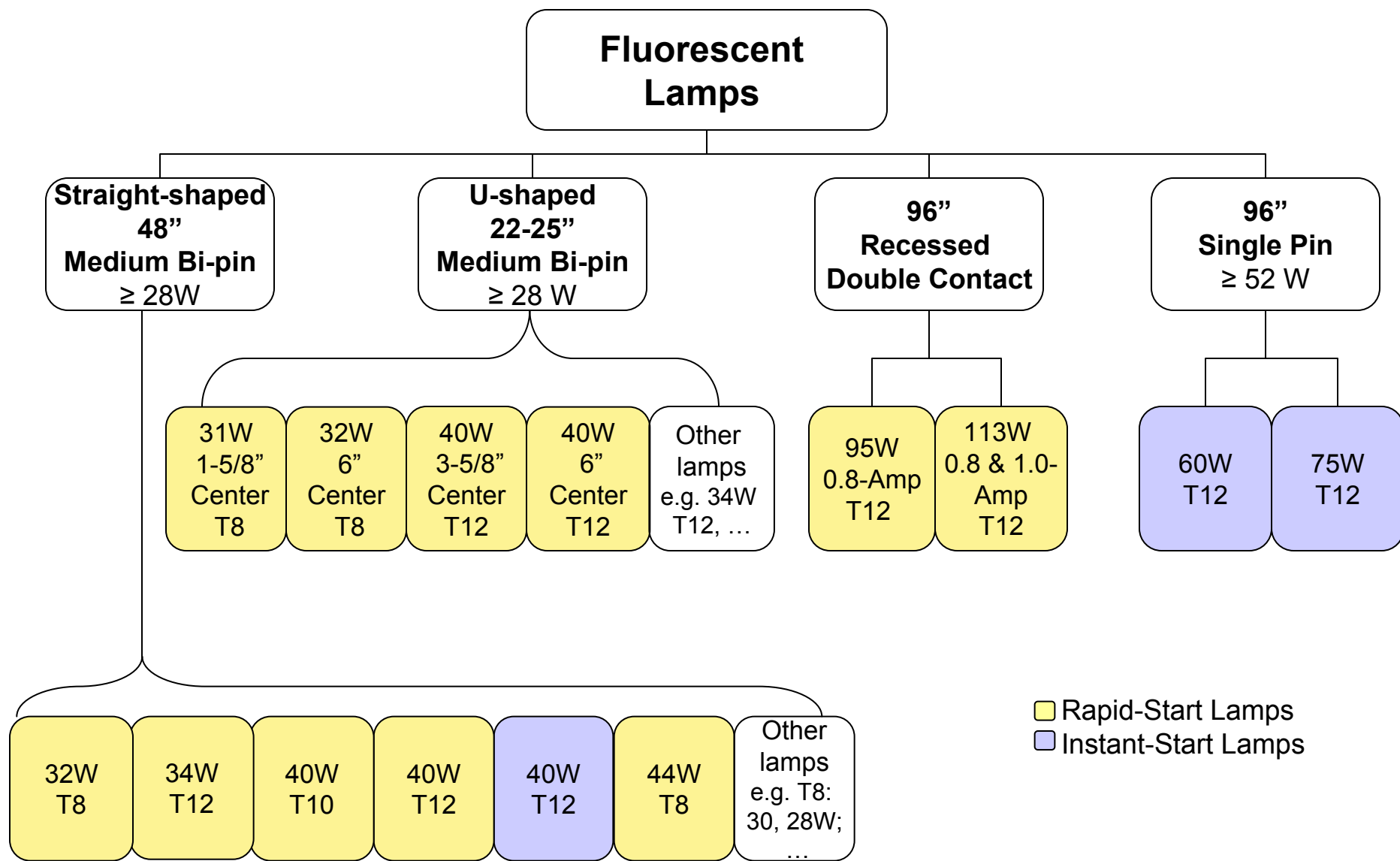


Fluorescent Lamps

EPCA defines “*fluorescent lamp*” as a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following:

1. 4-foot, medium bi-pin, straight-shaped lamps, rated wattage ≥ 28 .
2. 2-foot, medium bi-pin, U-shaped lamps, rated wattage of ≥ 28 .
3. 8-foot, recessed double-contact, rapid start, high output lamps, 0.800 nominal amperes, as defined in ANSI C78.1–1991.
4. 8-foot, single pin, instant start, slimline lamps, rated wattage of ≥ 52 , as defined in ANSI C78.3–1991.







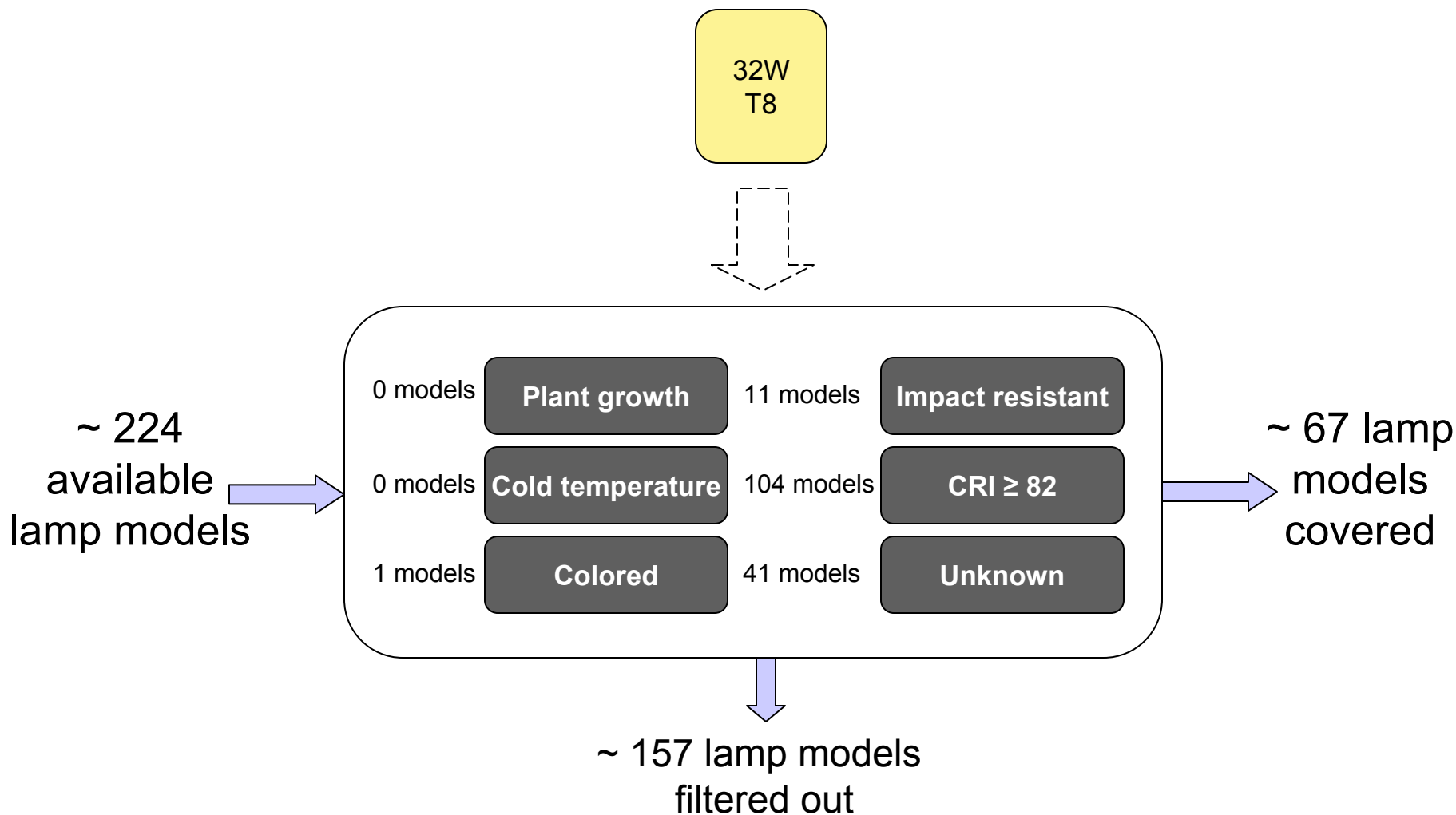
General Service Fluorescent Lamps

EPCA defines “general service fluorescent lamp” as fluorescent lamps which can be used to satisfy the majority of fluorescent applications, **but does not include any lamp designed and marketed for** the following non-general lighting applications:

- (1) Fluorescent lamps designed to promote plant growth.
- (2) Fluorescent lamps designed for cold temperature applications.
- (3) Colored fluorescent lamps.
- (4) Impact-resistant fluorescent lamps.
- (5) Reflectorized or aperture lamps.
- (6) Fluorescent lamps designed for use in reprographic equipment.
- (7) Lamps primarily designed to produce radiation in the UV region.
- (8) Lamps with a CRI \geq 82.



Covered General Service Fluorescent Lamps





Request for Comment

Item 1 The Department welcomes comment on the scope of this rulemaking, under the statutory requirement to consider additional general service fluorescent lamps. (42 U.S.C. 6295(i)(5))



Incandescent Lamps

EPCA defines “incandescent lamp” as a lamp in which light is produced by a filament heated to incandescence by an electric current, including only the following:

- Any lamp (commonly referred to as lower wattage non-reflector general service lamps, including any tungsten halogen lamp) that:
 - has a rated **wattage between 30-199 watts**,
 - has an **E26 medium screw base**,
 - has a **rated voltage** or voltage range that lies at least partially in the range of **115-130 volts**, and is not a reflector lamp.
- Any incandescent reflector lamp.
- Any general service incandescent lamp (high- or higher-wattage lamp) that has a **rated wattage above 199** (**above 205** for a high wattage **reflector lamp**).





Incandescent Reflector Lamps

EPCA defines “incandescent reflector lamp” as any lamp which:

- is not colored or designed for **rough or vibration service**,
- contains an inner reflective coating on the outer bulb to direct the light;
- is an R, PAR or similar bulb shape (**excluding ER or BR**) with an E26 medium screw base;
- has a **rated voltage** or voltage range that lies at least partially in the range of **115 and 130 volts**;
- has a **diameter that exceeds 2.75 inches**; and
- is either:
 - a low(er)-wattage reflector lamp that has a **rated wattage between 40 and 205**; or
 - a high(er)-wattage reflector lamp that has a **rated wattage above 205**.





Incandescent Reflector Lamp Terms Defined

- The CFR provides definitions for terms used in EPCA's definition of incandescent reflector lamps (cont'd.)
 - **Colored incandescent lamp:** an incandescent lamp designated and marketed as a colored lamp that has a CRI less than 50...; has a correlated color temperature less than 2,500K or greater than 4,600K; has a lens containing 5% or more neodymium oxide; or contains a filter to suppress yellow and green portions of the spectrum and is specifically designed, designated and marketed as a plant light.
 - **Rough or vibration service** incandescent reflector lamp: a reflector lamp in which a C-11 (5 support), C-17 (8 support), or C-22 (16 support) filament is mounted ...and that is designated and marketed specifically for rough or vibration service applications.



Incandescent Reflector Lamp Terms Defined

- The CFR provides definitions for terms used in EPCA's definition of incandescent reflector lamps
 - **ER Lamp:** a reflector lamp with an elliptical section below the bulb's major diameter and ...
 - **BR Lamp:** reflector lamp that has a bulged section below the bulb's major diameter and ... A BR30 lamp has a lamp wattage of 85 or less than 66 and a BR40 lamp has a lamp wattage of 120 or less.

Item 2 The Department welcomes comment on how a more stringent standard for incandescent reflector lamps might impact the market share of ER and BR lamps.





General Service Incandescent Lamps

- EPCA’s definition of “*general service incandescent lamp*” encompasses **any incandescent lamp** (other than a miniature or photographic lamp) that has an E26 medium screw base, a rated voltage range at least partially within 115 and 130 volts, **but does not include lamps specifically designed for:**
 - Traffic signal, or street lighting service;
 - Airway, airport, aircraft, or other aviation service;
 - Marine, or marine signal service;
 - Photo, projection, sound reproduction, or film viewer service;
 - Stage, studio, or television service;
 - Mill, saw mill, or other industrial process service;
 - Mine service;
 - Headlight, locomotive, street railway, or other transportation service;
 - Heating service;
 - Code beacon, marine signal, lighthouse, reprographic, or other communication service;
 - Medical or dental service;
 - Microscope, map, microfilm, or other specialized equipment service;
 - Swimming pool, or other underwater service;
 - **Decorative or showcase service;**
 - Producing colored light;
 - Shatter resistance which has an external protective coating; or
 - Appliance service.

Note: The majority of these terms remain undefined by EPCA or DOE



Request for Feedback

Item 4 The Department welcomes comment on which, if any, of the exemption categories in the statutory definition for general service incandescent lamps require clarification.



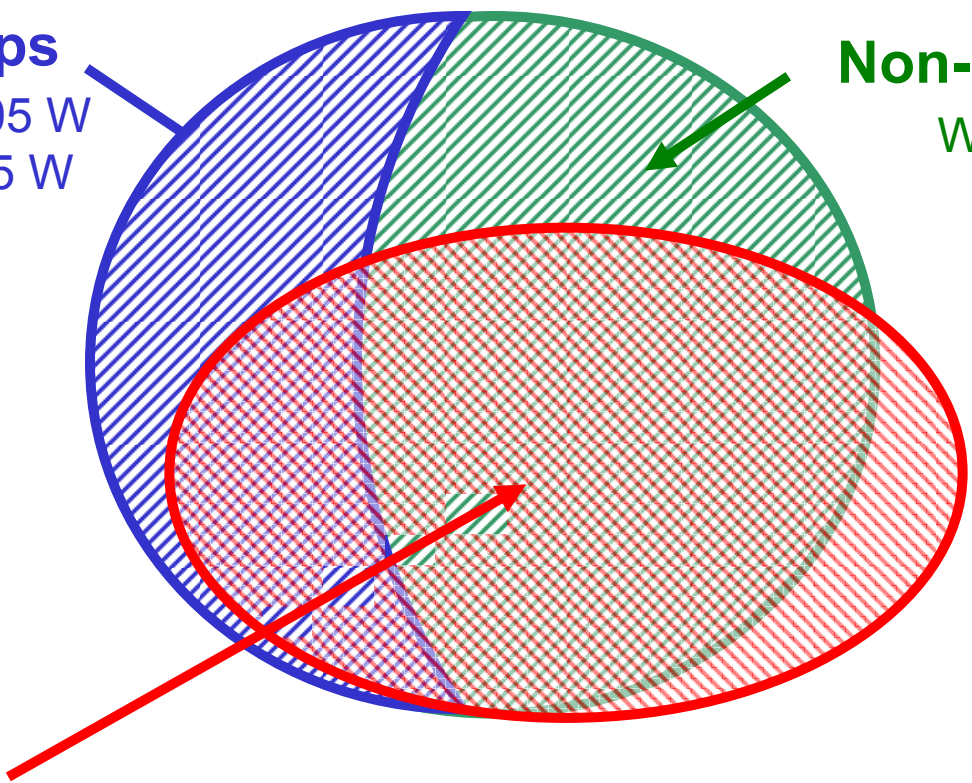
Incandescent Lamps

Reflector Lamps

Low-wattage: 40-205 W
High-wattage: > 205 W

Non-Reflector Lamps

Wattage: 30-199 W



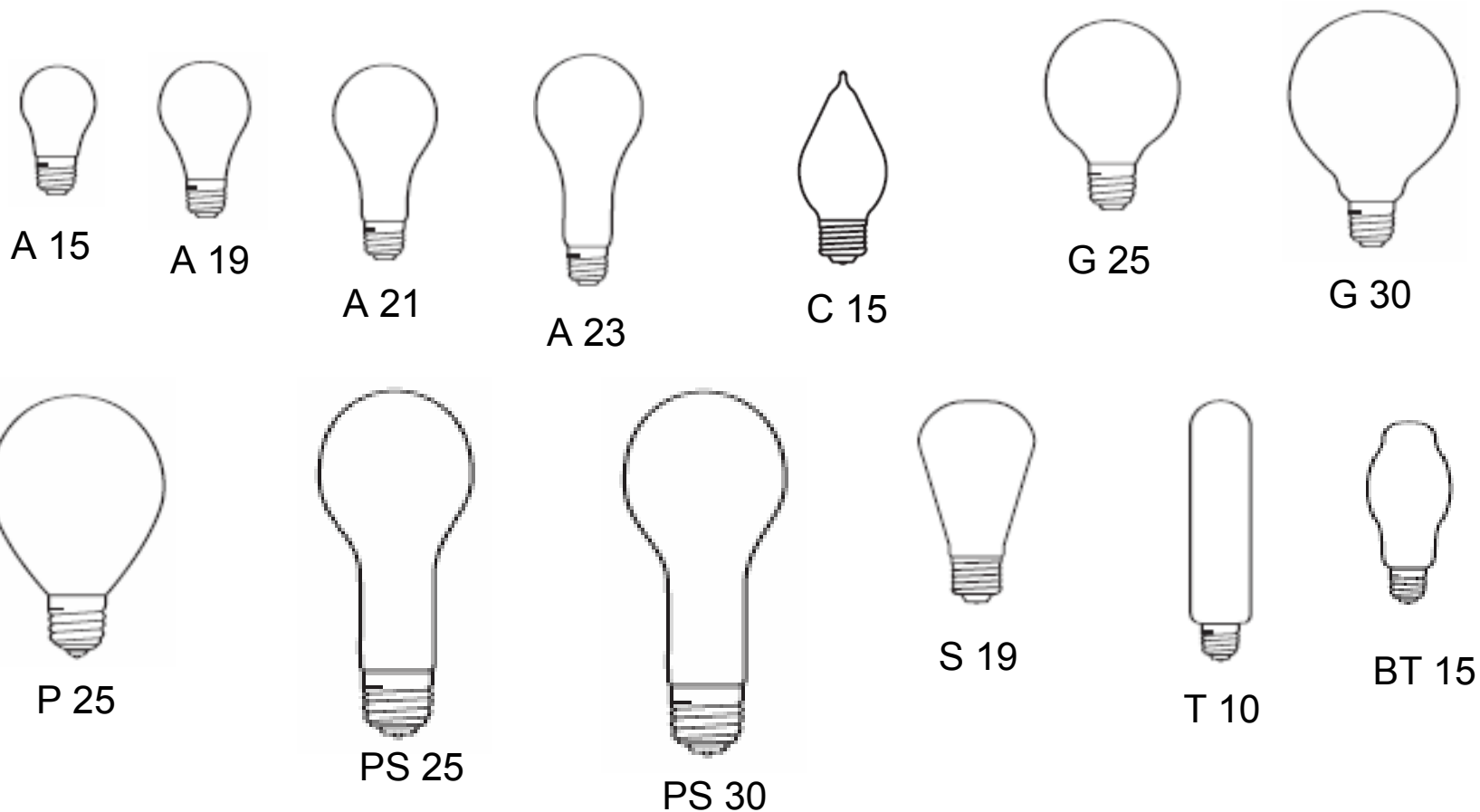
General Service Incandescent Lamps

Non-reflector Lamps Low-wattage: 30-199 W
Non-reflector Lamps High-wattage: > 199 W
Reflector Lamps: Low and High-wattage



General Service Incandescent Non-Reflector Lamp Shapes

These general service incandescent non-reflector lamp shapes are considered eligible for consideration under 42 USC 6295(i)(5).





Request for Feedback

Item 3 The Department welcomes comment on the issue of product coverage, specifically the requirement to consider additional general service incandescent lamps. (42 U.S.C. 6295(i)(5))

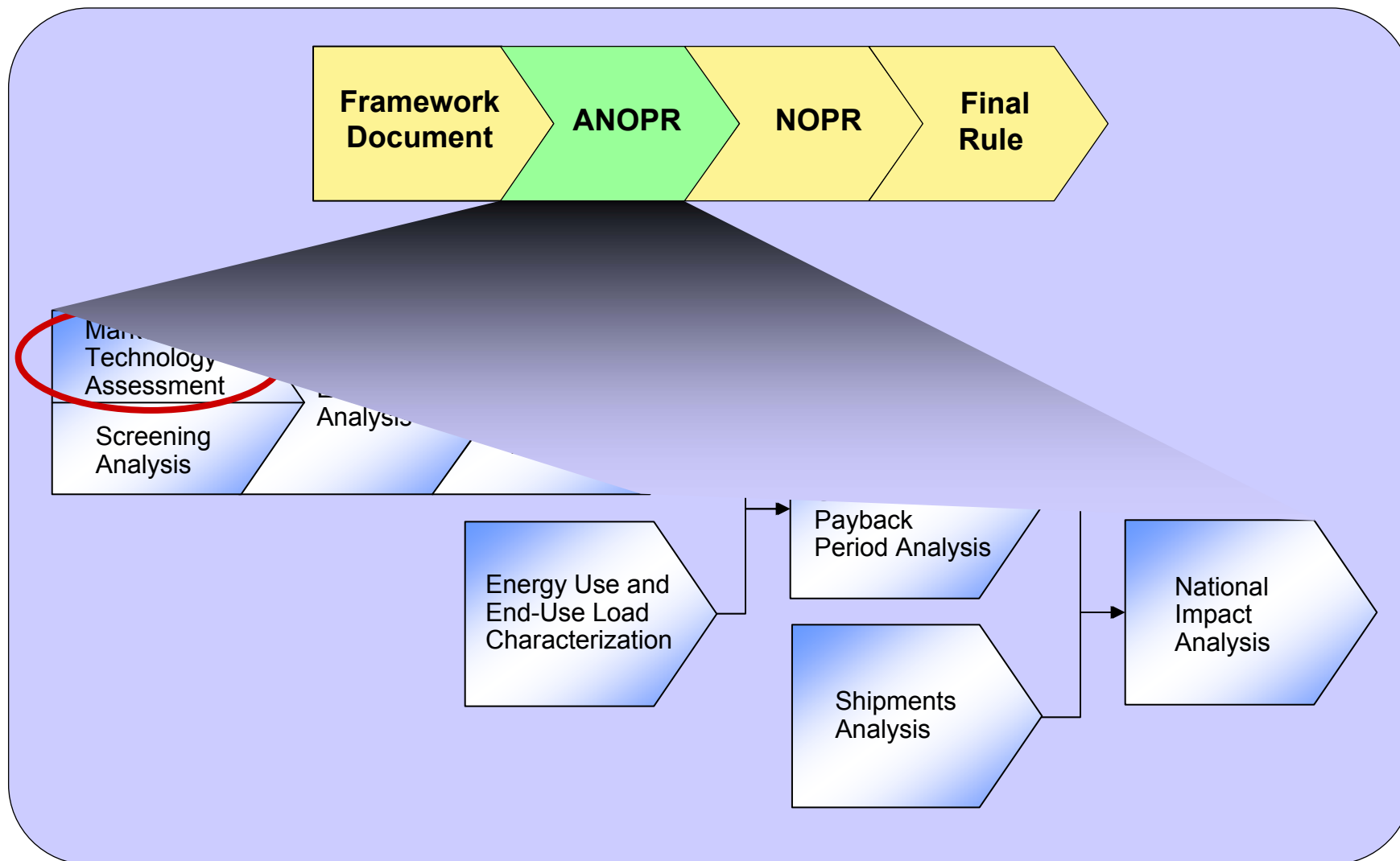


Public Meeting Agenda

- 1 Introduction
- 2 Rulemaking Overview
- 3 ANOPR Analyses**
- 4 NOPR Analyses
- 5 Final Rule
- 6 Closing Remarks



Analyses for Advance Notice of Proposed Rulemaking





Purpose

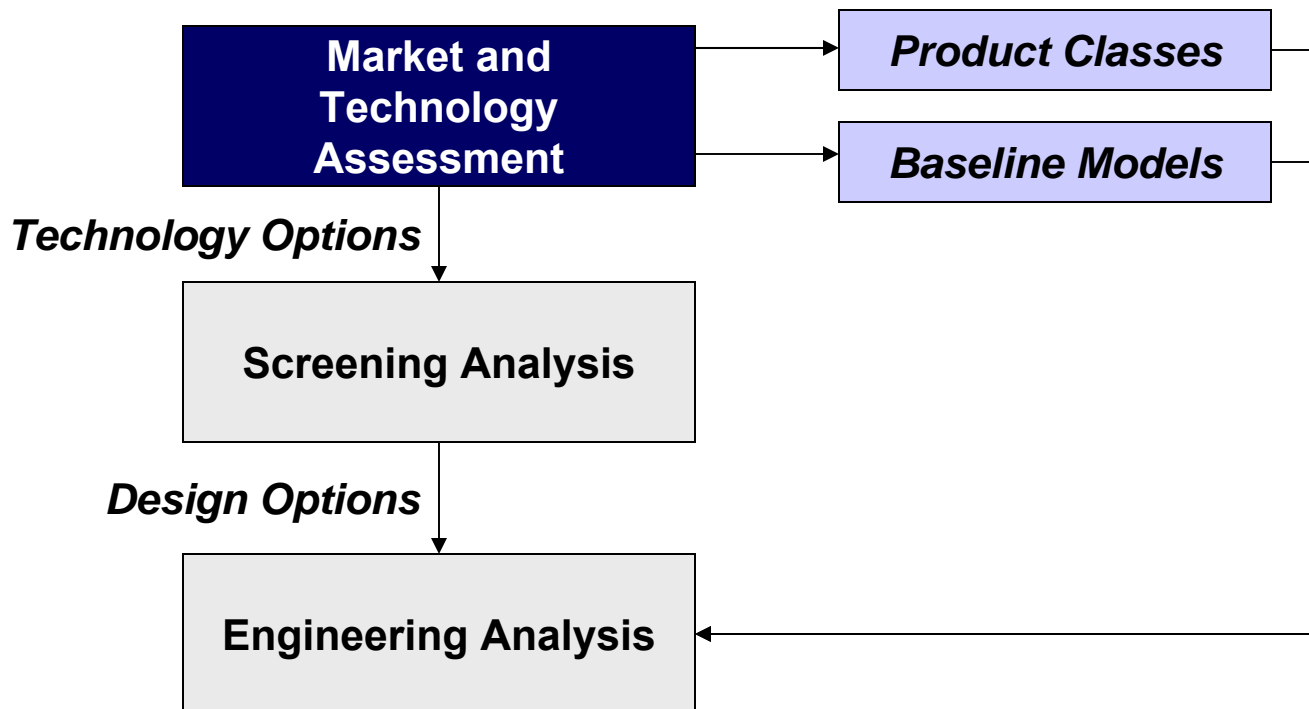
- Characterize the market, lamps industry and measures to improve efficacy.

Method

- Identify and characterize manufacturers of lamps;
- Estimate lamp type market shares (shipments) and trends in the market;
- Identify technologies that could improve lamp efficacy; and
- Identify regulatory and non-regulatory initiatives intended to improve the efficacy of lamps covered under this rulemaking.



Relationship of Analyses



Item 5 The Department welcomes information on shipments, manufacturing costs, distribution channels and estimates of market shares for the lamps considered in this rulemaking. In order for the data to be used to conduct energy savings calculations, a degree of disaggregation (e.g., by product class and wattage) is desirable.



General Service Fluorescent Lamp Product Classes

- EPCACT 1992 established 8 product classes based on lamp type (from fluorescent lamp definitions) and wattage.
- DOE is considering modifying the product classes for 4-foot and 2-foot lamps to account for new market diversity in lamp diameter.

Lamp Type	Nominal Lamp Wattage	Min. CRI	Min. Avg. LPW
4-foot medium bi-pin	> 35 W	69	75.0
	≤ 35 W	45	75.0
2-foot U-shaped	> 35 W	69	68.0
	≤ 35 W	45	64.0
8-foot slimline	> 65 W	69	80.0
	≤ 65 W	45	80.0
8-foot high output	> 100 W	69	80.0
	≤ 100 W	45	80.0



General Service Fluorescent Lamp Product Classes

Lamps with different diameters often require ballasts specifically designed to operate those lamps. Therefore, T8 and T12 lamps are not usually interchangeable with each other.

Lamp Type	Lamp Diameter	Nominal Lamp Wattage	Min. CRI
4-foot medium bi-pin	> T8	> 35 W	69
		≤ 35 W	45
	≤ T8	> 35 W	69
		≤ 35 W	45
2-foot U-shaped	> T8	> 35 W	69
		≤ 35 W	45
	≤ T8	> 35 W	69
		≤ 35 W	45
8-foot slimline	T12	> 65 W	69
		≤ 65 W	45
8-foot high output	T12	> 100 W	69
		≤ 100 W	45



Request for Feedback

Item 6 The Department welcomes comment on the modified product classes it is considering for general service fluorescent lamps. This includes whether specific lamp diameters or lamp diameter ranges would be more appropriate.

The Department is also interested in comment on the CRI distinctions and wattage bins provided in the existing product classes.



General Service Fluorescent Lamp Baseline Models

To limit redundancy, DOE is proposing to analyze representative product classes. From each representative product class, DOE would select a baseline model.

Lamp Type	Lamp Diameter	Nominal Lamp Wattage	Min. CRI	Baseline Model
4-foot linear	> T8	> 35 W	69	(scale from below)
		≤ 35 W	45	34W/48T12/RS
	≤ T8	> 35 W	69	(scale from below)
		≤ 35 W	45	32W/48T8/RS
2-foot U-shaped	> T8	> 35 W	69	40W/23T12/U6/RS
		≤ 35 W	45	(scale from above)
	≤ T8	> 35 W	69	(scale from below)
		≤ 35 W	45	31W/23T8/U1/RS
8-foot slimline	T12	> 65 W	69	75W/96T12/SP
		≤ 65 W	45	(scale from above)
8-foot high output	T12	> 100 W	69	(scale from below)
		≤ 100 W	45	95W/96T12/HO



Incandescent Reflector Lamp Product Classes

- EPACT 1992 established 6 product classes, grouping together lamp wattages.
- DOE is considering using the same product classes. However, DOE is interested in whether these lamps would be better classified in different wattage ranges.
- DOE considered separate product classes for spot versus flood reflector lamps. However, it appears that their efficacies are the same, so this consumer utility does not impact efficacy.

Wattage	Min. Avg. LPW
40-50 watts	10.5
51-66 watts	11.0
67-85 watts	12.5
86-115 watts	14.0
116-155 watts	14.5
156-205 watts	15.0



Request for Feedback

Item 7 The Department welcomes comment on the product classes it is considering for incandescent reflector lamps. This includes whether the wattage ranges need to be refined.



Incandescent Reflector Lamp Baseline Models

- To limit redundancy, DOE is proposing to analyze representative product classes. From each representative product class, DOE would select a baseline model.

Wattage	Product Class #	Baseline Model
40-50 watts	13	(scale from 75W)
51-66 watts	14	(scale from 75W)
67-85 watts	15	75W PAR
86-115 watts	16	(interpolate between 75W & 150W)
116-155 watts	17	150W PAR
156-205 watts	18	(scale from 150W)



General Service Incandescent Lamp Product Classes

- In the ANOPR, DOE will publish the Secretary's determination on whether to regulate general service incandescent lamps (which include high-wattage reflector lamps and non-reflector lamps).
- DOE is considering product classes for non-reflector lamps by:
 - Wattage or lumen output, and
 - Design features or consumer utility (e.g., 3-way lamps, lamp coating, design voltage and rough service).
- DOE is considering product classes for high-wattage reflector lamps by:
 - Wattage ranges to be consistent with product classes for low-wattage incandescent reflector lamp standards.
 - DOE will need to consider wattage ranges.



Request for Feedback

Item 8 DOE welcomes comment on what, if any, product classes DOE should consider for additional general service incandescent lamps. This includes, for non-reflector lamps, whether the classes should be based on lamp coatings, wattage ranges, lamp design voltages and/or lumen ranges, and whether 3-way lamps should be treated as a separate product class. For high-wattage incandescent reflector lamps, DOE welcomes comment on any appropriate product class(es).



General Service Incandescent Lamp Baseline Models

- Incandescent Non-Reflector Lamps:
 - DOE is still determining product classes and baseline models.
 - DOE understands that three A-line lamp wattages sold today dominate the A-line lamp market: 60W, 75W and 100W.
 - This information, along with stakeholder comments, will be considered when choosing representative product classes and baseline models for non-reflector lamps.
- DOE will also be evaluating high-wattage reflector lamps and welcomes input on product classes and baseline models.



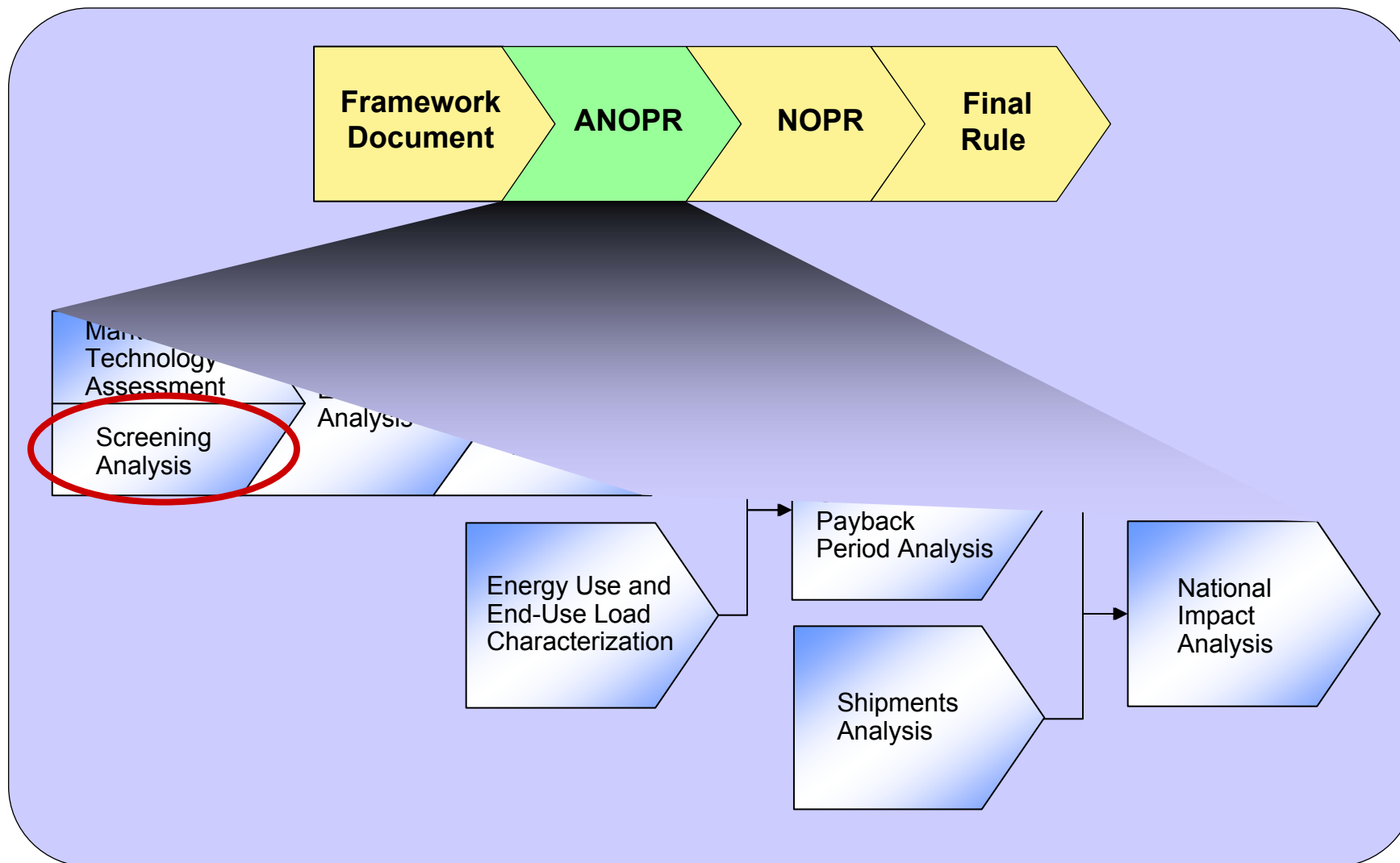
Request for Feedback

Item 10 The Department welcomes comment on the representative product classes proposed in section 3.4. Additionally, the Department welcomes comment on the scaling of findings from the representative product classes to other product classes that are not analyzed.

Item 11 The Department welcomes comment on the baseline models identified for each of the representative product classes. This includes specific technological information such as lamp size, wattage rating, CRI, CCT (correlated color temperature), operating life, etc.



Analyses for Advance Notice of Proposed Rulemaking





Purpose

- Screen out technology options that will not be considered in the rulemaking for fluorescent and incandescent lamps

Method

- Each technology will be screened based on the following four criteria:

Technological feasibility

Practicability to manufacture, install and service

Impacts on lamp utility or availability to consumers

Health or safety of technologies



Initial Technology Options

General Service Fluorescent Lamps

- Electrode materials & coatings
- Glass and coatings
- Lamp fill-gas composition
- Phosphor materials

Incandescent Reflector Lamps

- Higher temperature incandescent light sources
- Filament materials & coatings
- Reflector materials & coatings
- Lamp fill-gas



Initial Technology Options (cont'd)

Incandescent Non-Reflector Lamps

- Higher temperature incandescent light sources
- Filament materials & coatings
- Glass and coatings
- Lamp fill-gas

Item 9 The Department welcomes comment on the preliminary design options identified in this section for each of the three lamp types. More specifically, the Department welcomes comment on whether there are other technologies or design features that it should consider and what, if any, impacts they might have on safety, performance, and consumer utility.



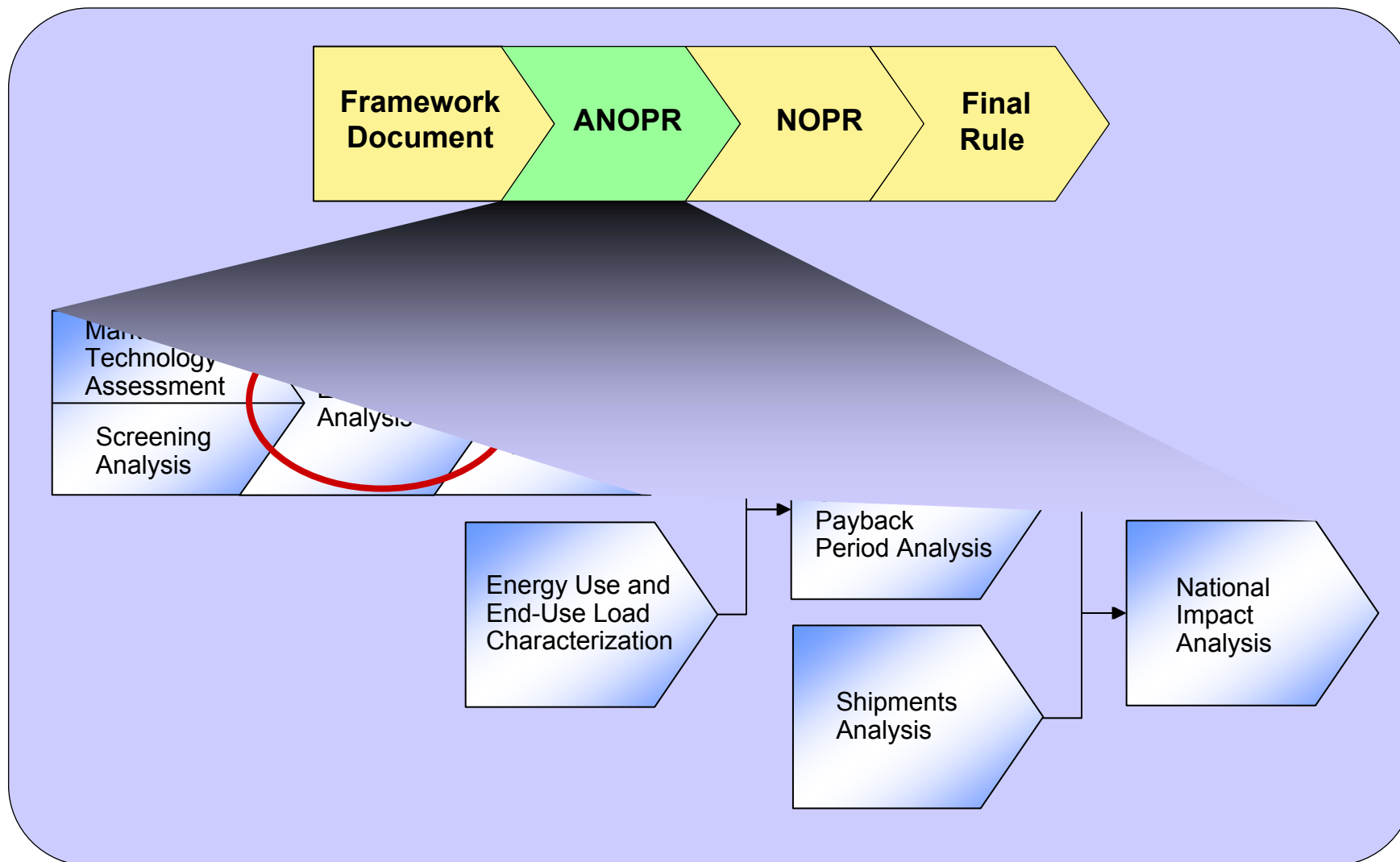
Request for Feedback

Item 12 The Department welcomes comment on whether the Department's analysis should allow incandescent (both reflector and additional general service incandescent) lamp life to vary in order to increase efficacy? If so, what would be a reasonable amount of variance (i.e., not a 'significant adverse impact') for reflector lamps and for general service incandescent lamps?

The Department also welcomes comment on a reasonable amount of variance for life and correlated color temperature (CCT) on general service fluorescent lamps?



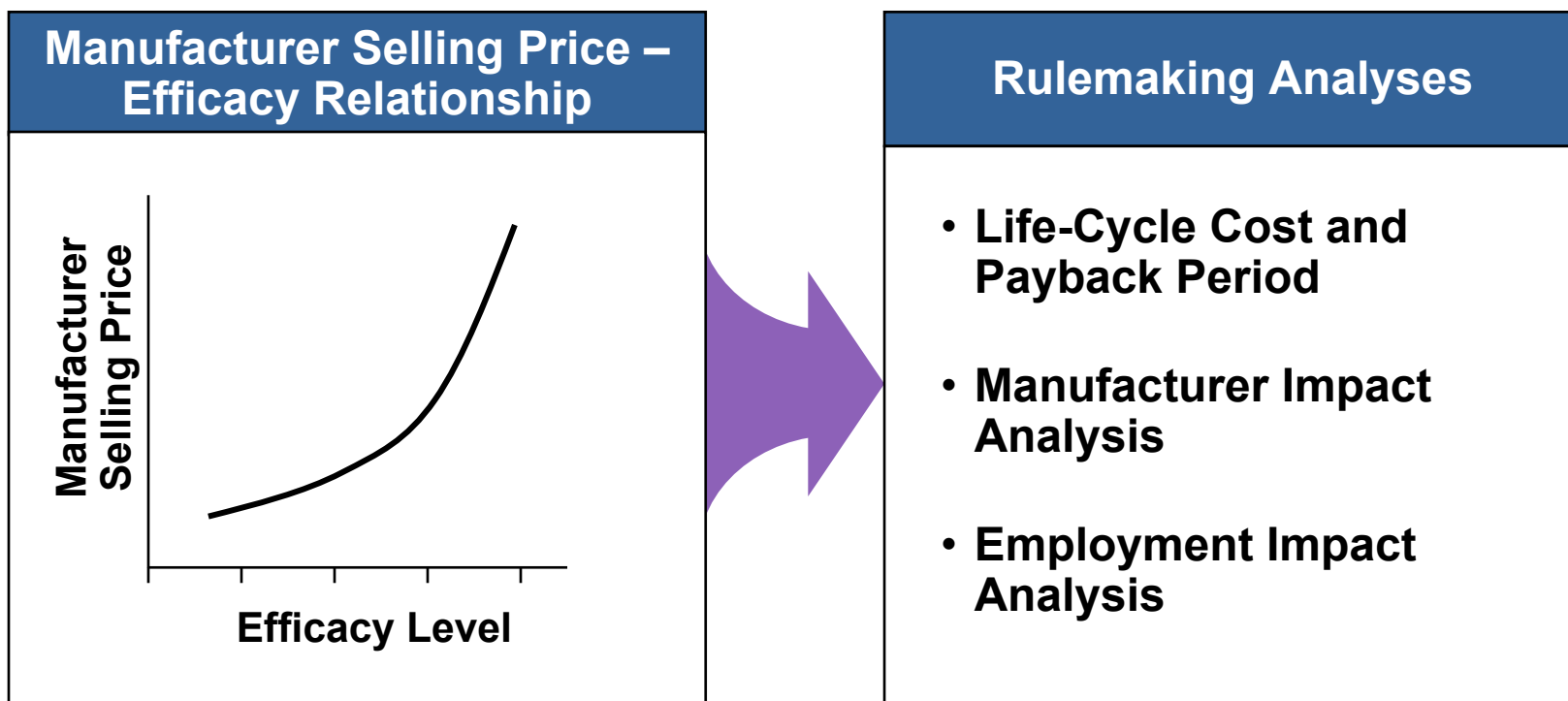
Analyses for Advance Notice of Proposed Rulemaking





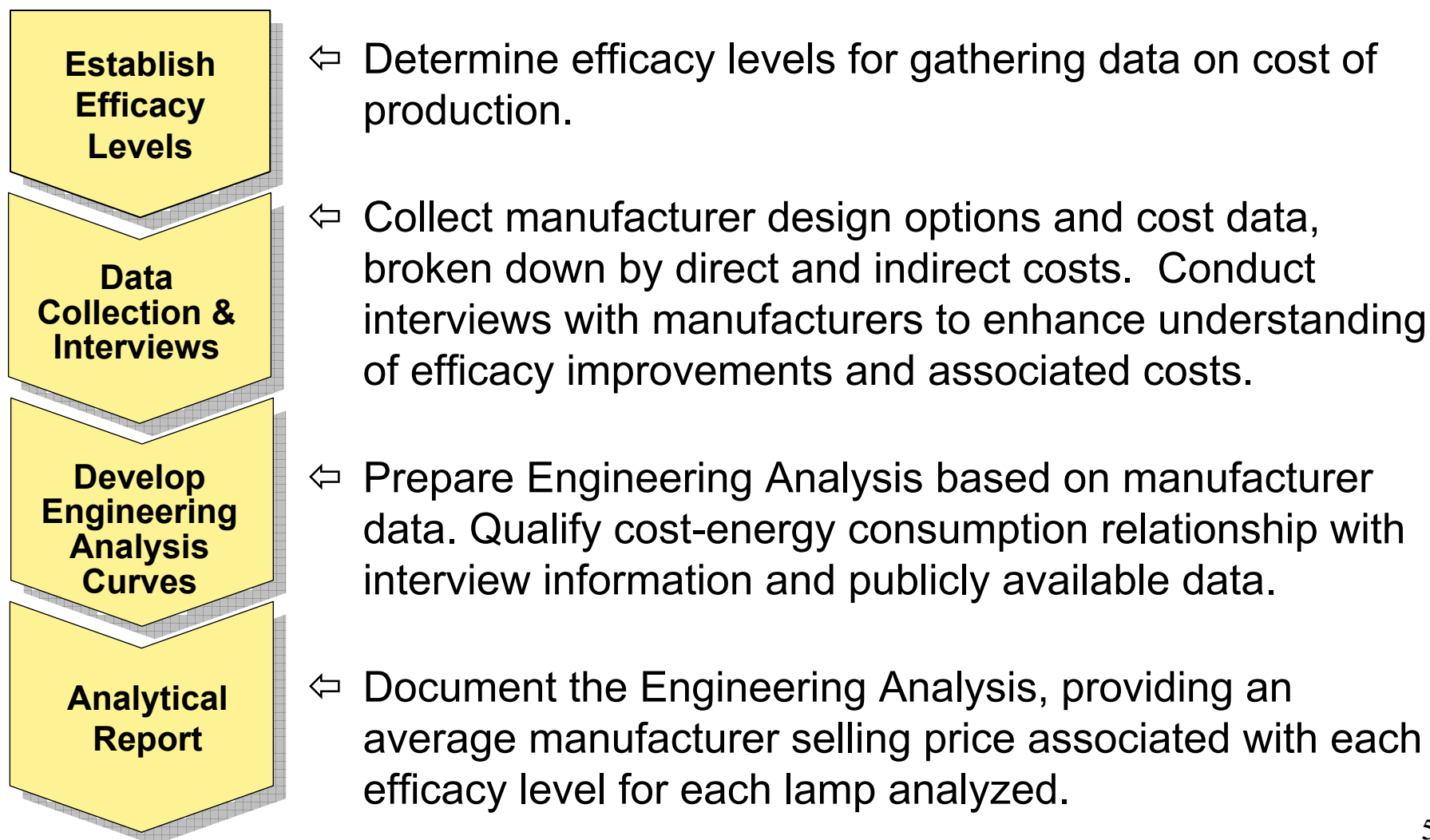
Purpose

- To characterize the relationship between manufacturer selling price and lamp efficacy.





Engineering Analysis Methodology





Manufacturer Production Cost

**Manufacturer
Production
Cost**

+

**Manufacturer
Markups**
(Non-Production Costs)

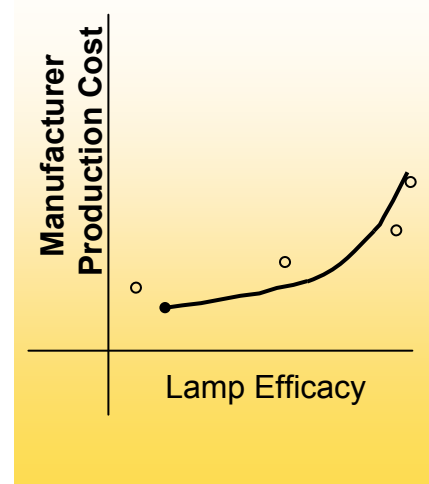
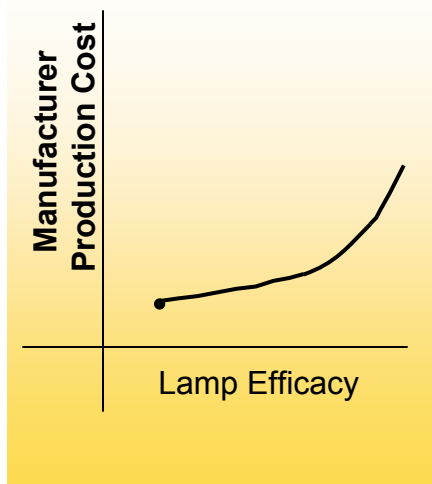
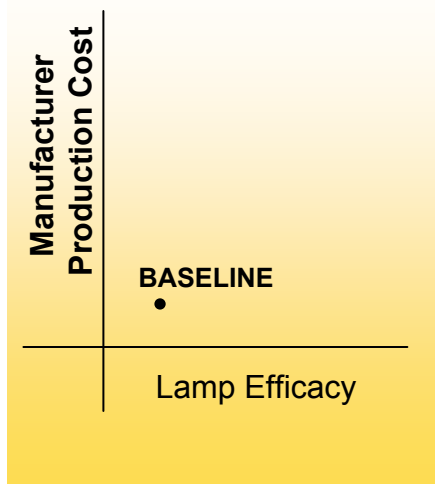
=

**Manufacturer
Selling Price**

- **Direct material**
 - **Direct labor**
 - **Factory overhead**
 - **Depreciation**
 - Sales, general & admin.
 - Research & development
 - Interest
 - Profit
- **Manufacturer Production Cost**
 - Conduct interviews with manufacturers
 - Develop cost – efficacy relationship
 - Qualify product costs using literature, raw material input prices
 - Retail price data



Development of Engineering Analysis Curves





Manufacturer Interview Guide

- The baseline lamp should represent a popular model, with high sales volume.
- The efficacy improvements over the baseline should:
 - Not reduce the operating life of the lamp by more than X%
 - Hold lumen output to within Y% of the baseline lamp (i.e., as efficacy increases, wattage must decrease so light output is ‘normalized’)
 - For fluorescent lamps, must be able to operate on the same ballast as the baseline lamp
- Max tech – if cost were no object, the highest efficacy lamp that is technologically achievable.



Request for Feedback

Item 13 For each product class, the Department welcomes information on design options and incremental manufacturing costs for five lamp efficacy levels above the baseline, one of which would be max tech. Detailed information on the lamp performance (e.g., energy consumption, light output, operating life, etc.) and the incremental manufacturing costs (e.g., material costs, labor costs, overhead costs (excluding depreciation), building conversion capital expenditures, tooling/equipment conversion capital expenditures, research and development (R&D) expenses, marketing expenses, etc.) would be welcome.

Item 15 The Department welcomes feedback on its proposal to normalize its engineering analysis around the lumen output of each baseline lamp.



Markups to Estimate Manufacturer Selling Price

**Manufacturer
Production
Cost**

+

**Manufacturer
Markups**
(Non-Production Costs)

=

**Manufacturer
Selling Price**

- Direct material
 - Direct labor
 - Factory overhead
 - Depreciation
 - **Sales, general & admin.**
 - **Research & development**
 - **Interest**
 - **Profit**
- Examples of publicly available information:
 - SEC 10-K reports
 - Company annual reports
 - Dun and Bradstreet reports
 - Value Line industry statistics
 - Standard and Poor's composite industry statistics
 - Ibbotson Associates reports



Request for Feedback

Item 14 The Department welcomes comment on the proposed approach to determining the relationship between manufacturer selling price and lamp efficacy.

Item 16 The Department welcomes comment on the markup approach proposed for developing estimates of manufacturer selling prices.



Proprietary Designs

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

Outside Regulatory Changes

- Consider the effects to manufacturers of other regulatory changes outside of the standards rulemaking process.



Regulatory Feedback

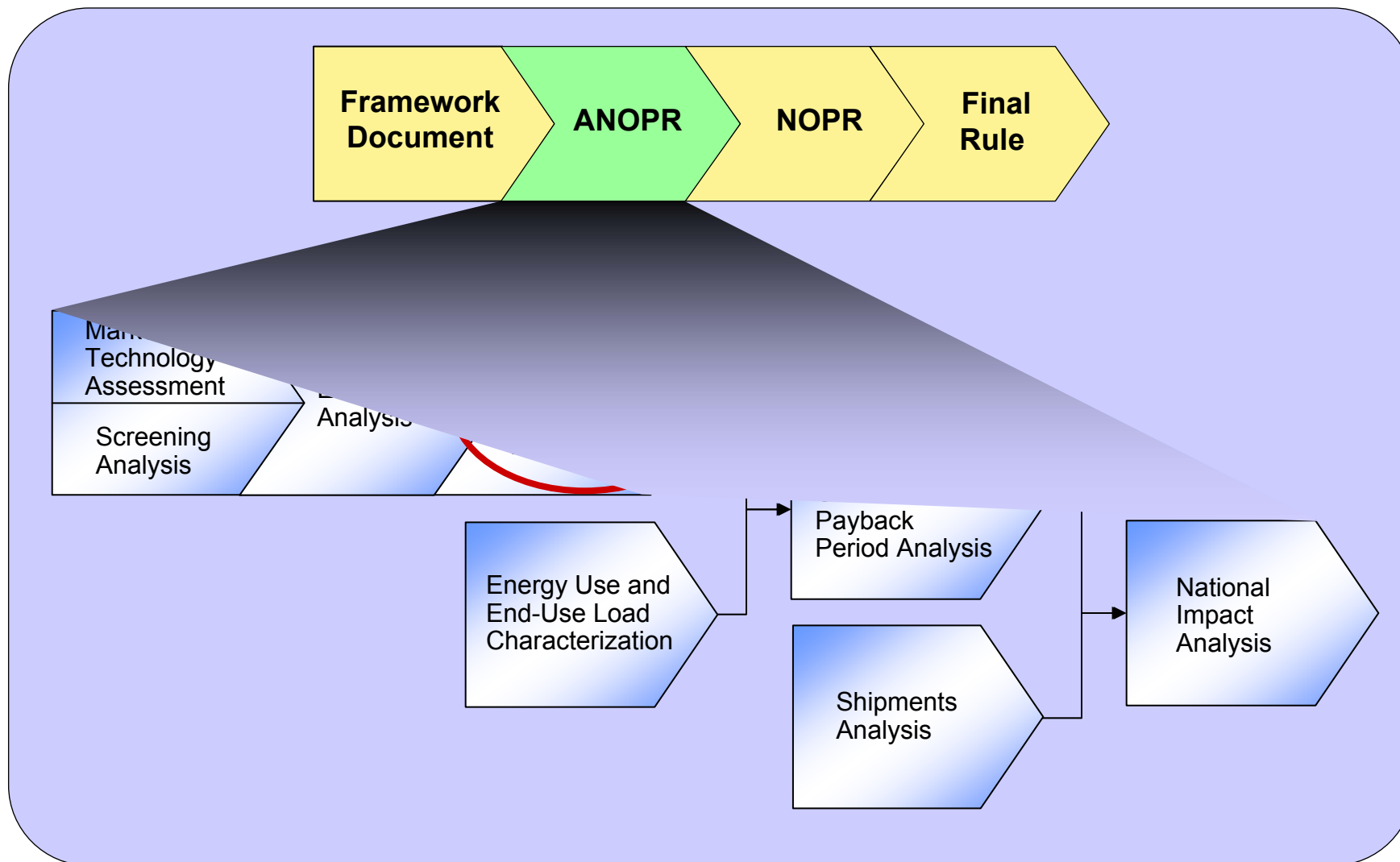
Item 17 The Department welcomes comment on whether there are proprietary designs that the Department should consider for any of the lamps under consideration by this rulemaking, and if so, how the Department should acquire the cost data necessary for evaluating these designs.

Item 18 The Department welcomes comment on whether there are outside issues that the Department should consider in its analysis of general service fluorescent lamps, incandescent reflector lamps and additional general service incandescent lamps.

Item 21 The Department welcomes comment on other engineering issues that could impact the engineering analysis.



Analyses for Advance Notice of Proposed Rulemaking



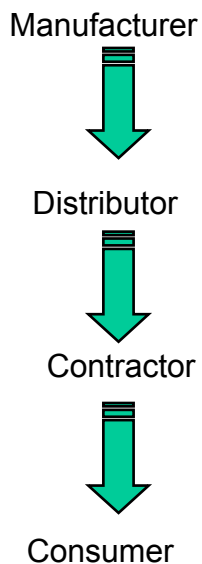


Purpose

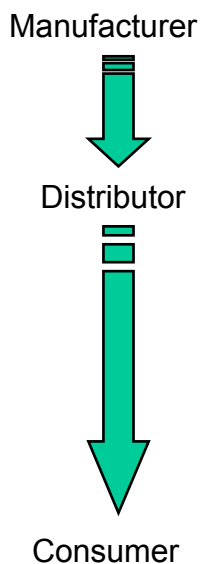
- Develop overall distribution chain price markups from the manufacturer to the consumer
- Establish the consumer prices for both baseline lamps and lamps at higher standard levels

Distribution Channel Examples

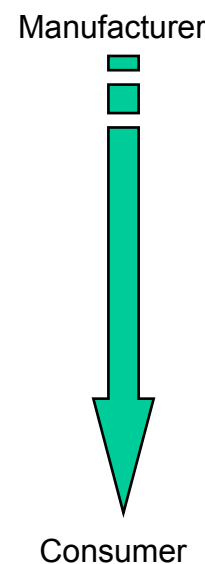
Distribution Channel 1



Distribution Channel 2



Distribution Channel 3 (Nat'l Acct)





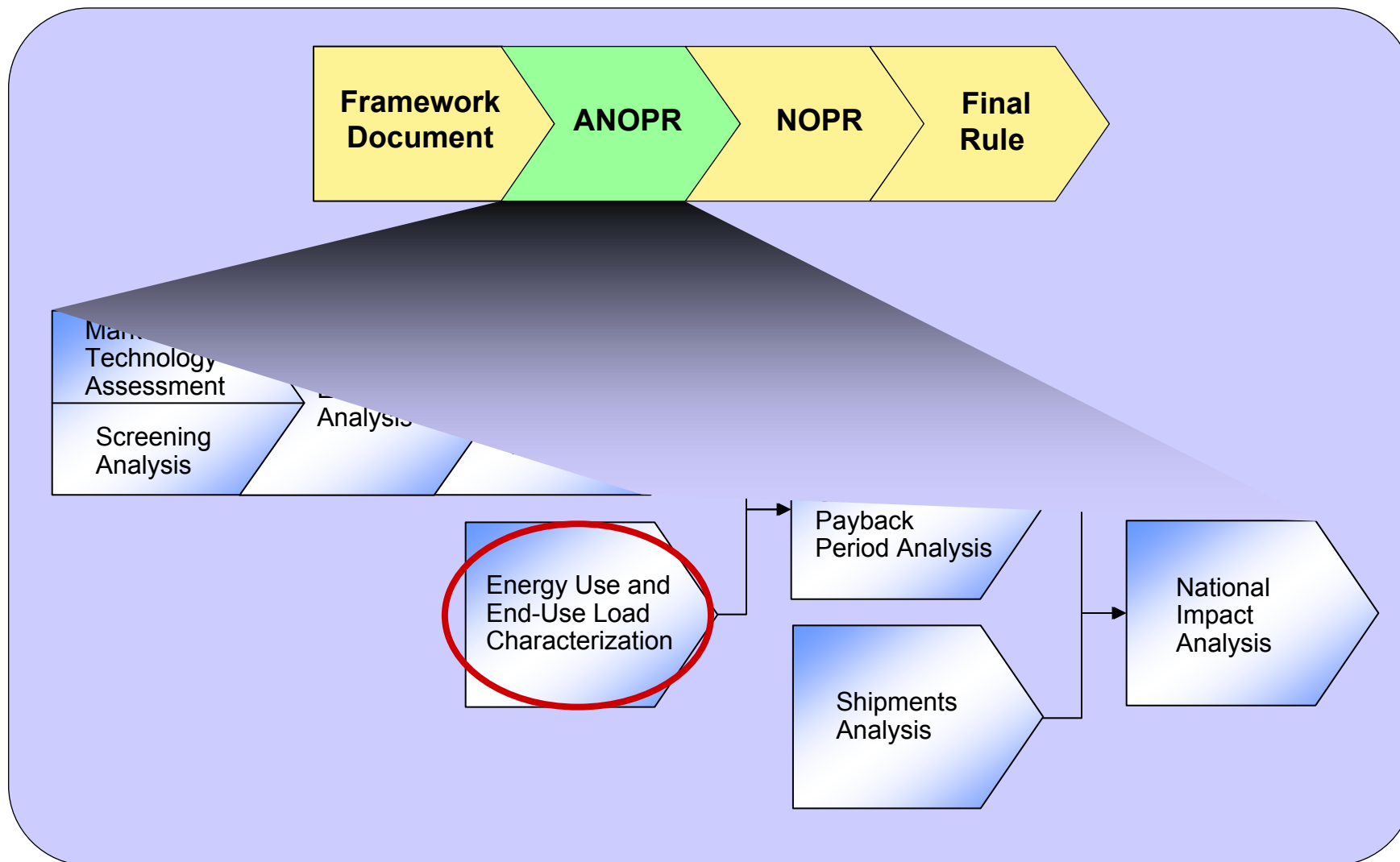
Request for Feedback

Item 22 The Department welcomes comment on the distribution chain for lamps, the key stakeholders in those distribution chains, the typical markups applied by those stakeholders, and the overall markup from manufacturer selling price to retail shelf.

The Department welcomes comment on the percentage of shipments by distribution chain, for each lamp type.



Analyses for Advance Notice of Proposed Rulemaking





Purpose

- To calculate operating costs for the life-cycle cost and payback period analyses.
- To develop energy use and demand characteristics relevant to each lamp type and its applicable sector.

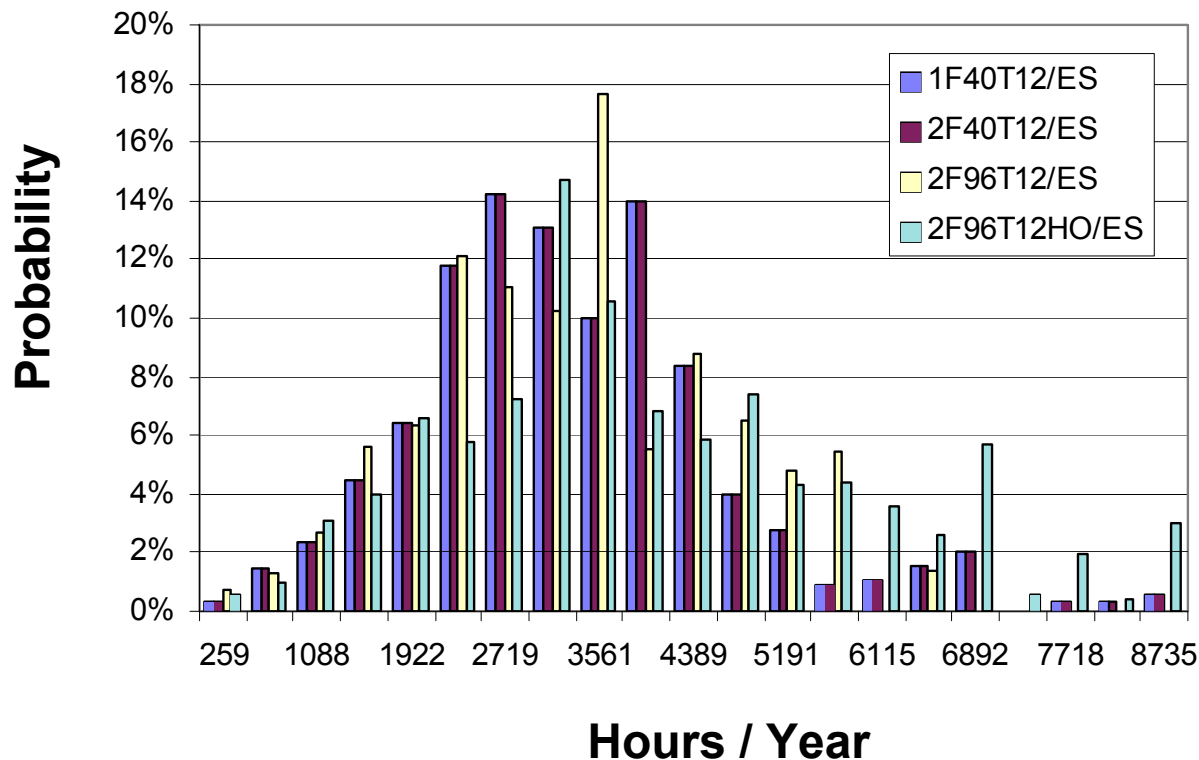
Method

- Develop average energy use values from lamp wattage and operating hour data.
- Take into account variability by using a distribution of operating hours.
- The Fluorescent Lamp Ballast Rulemaking provides insight into how DOE could consider lighting-HVAC interactions.



Inputs

- Lamp Wattage: Manufacturer information verified by catalogs.
- Operating Hours: Distribution of values as used by the Fluorescent Lamp Ballast rulemaking.





HVAC Interactions

- The Department could use the same methodology to consider HVAC interactions as used in the Fluorescent Lamp Ballast Rule.
 - The Fluorescent Lamp Ballast Rulemaking estimated national average savings of ~ 6.25% between 2003 and 2030 from HVAC interactions (when a change in building stock efficiency over time was considered).
 - Building stock played an important role in the size of a national HVAC impact.
 - The Fluorescent Lamp Ballast Rulemaking included the HVAC impact in the National Energy Savings (NES) analysis by using a multiplier on total energy savings. The Rule did not include HVAC interactions with the Life-Cycle Cost (LCC) analysis or the Net Present Value (NPV) calculation.



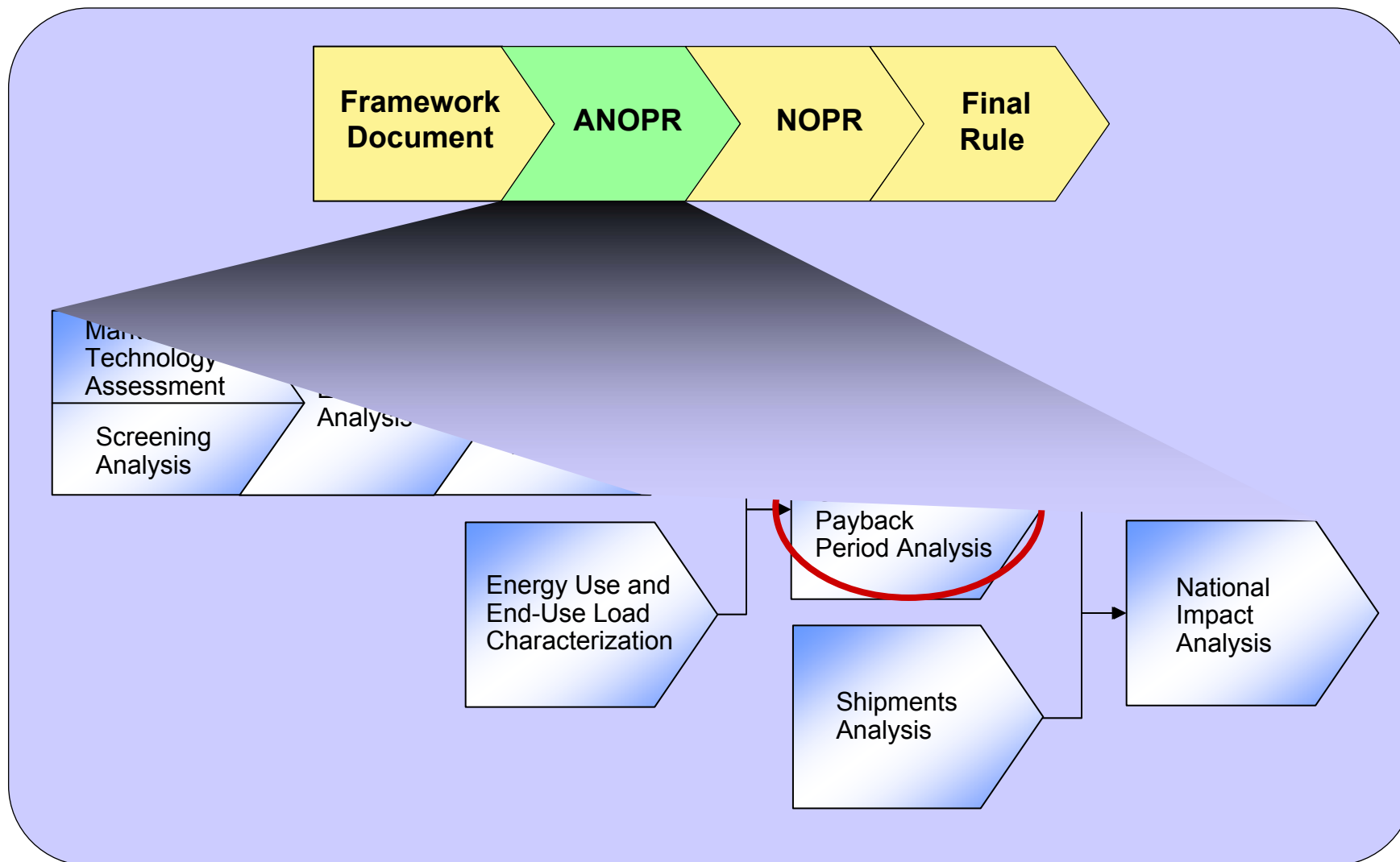
Request for Feedback

Item 19 The Department welcomes recommendations on sources of data that would provide end-use operating profiles for each of the lamp types covered under this rulemaking.

Item 20 The Department welcomes comment on whether the end-use operating profiles are different for each of the lamp types covered under this rulemaking, and if so, how.



Analyses for Advance Notice of Proposed Rulemaking



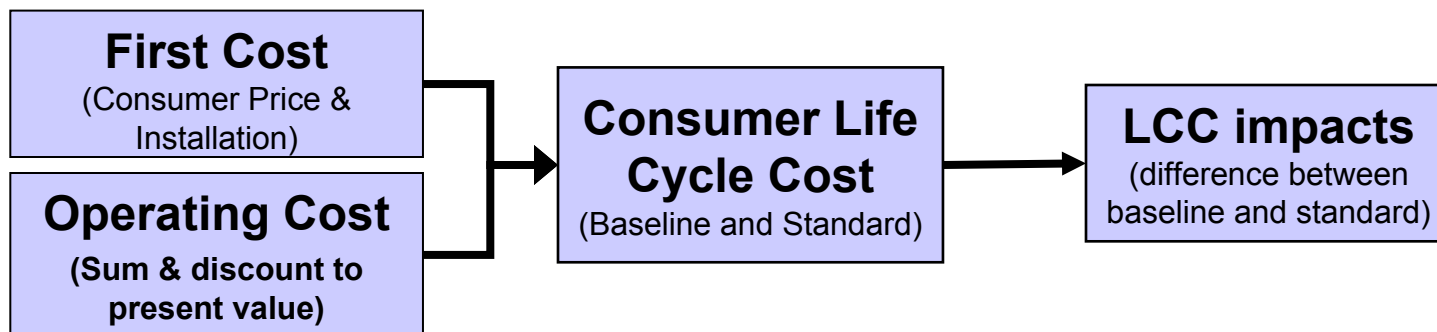


Purpose

- Assess the payback period (PBP) and the net life-cycle cost (LCC) impacts on the consumer of lamp efficacy standards.

Method

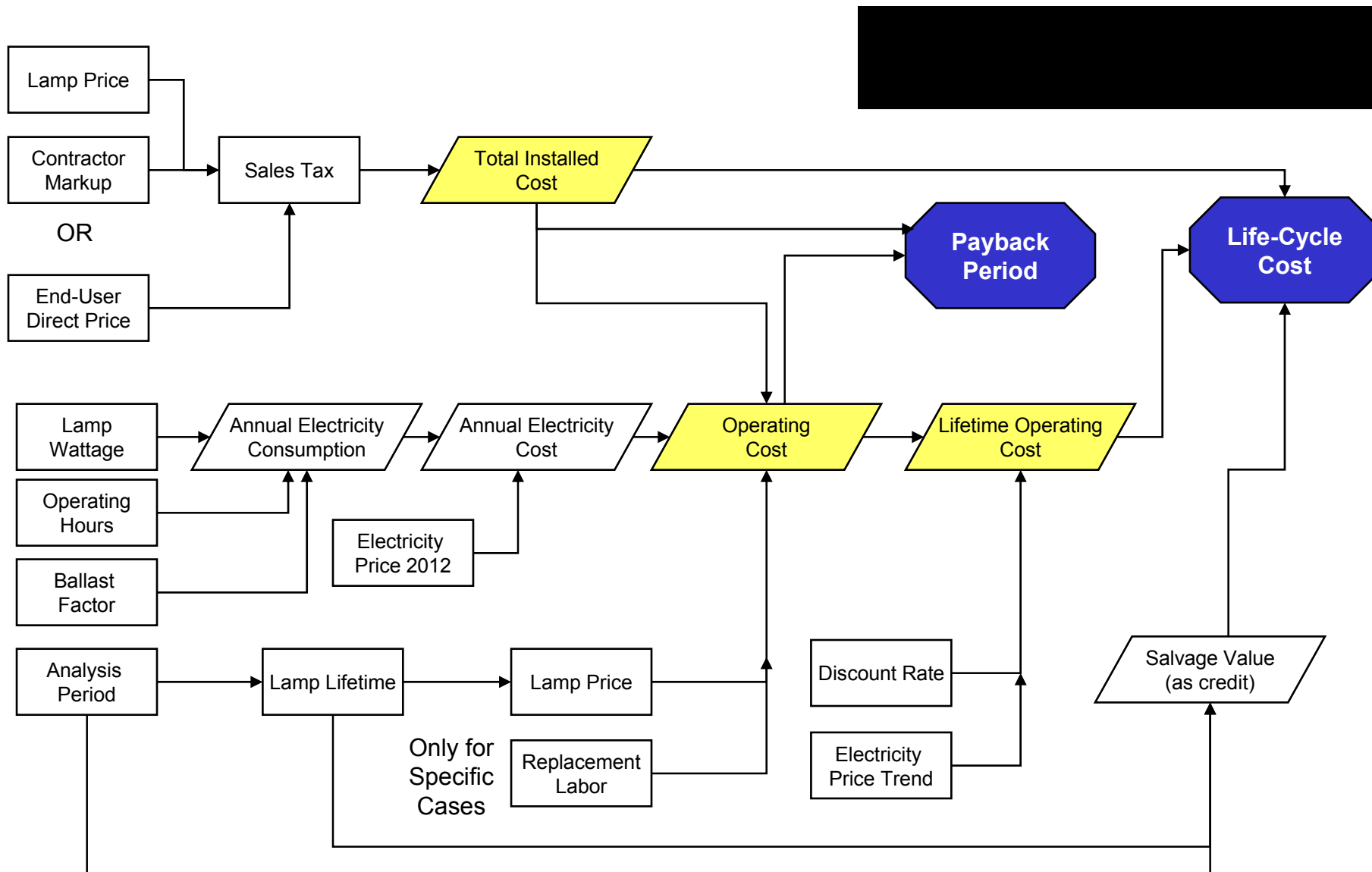
- LCC equals consumer price plus the sum of annual operating costs discounted to a particular base year
- Economic evaluation from the consumer perspective
- Analysis implemented in an Excel[®] spreadsheet
- Results are expressed as LCC difference (baseline minus standard level)
- Simple Payback (years) is also calculated and reported





Approach

- Because this rulemaking is only considering lamps, the LCC and PBP analyses will be based on socket-to-socket replacements.
- Monte Carlo analysis will allow DOE to consider end-user variability and conduct sensitivity analyses.
 - Consider different end-use sectors by weighting input distributions
 - Correlate inputs where necessary (e.g., electricity price and sector)
- One LCC and PBP analysis result per representative product class.



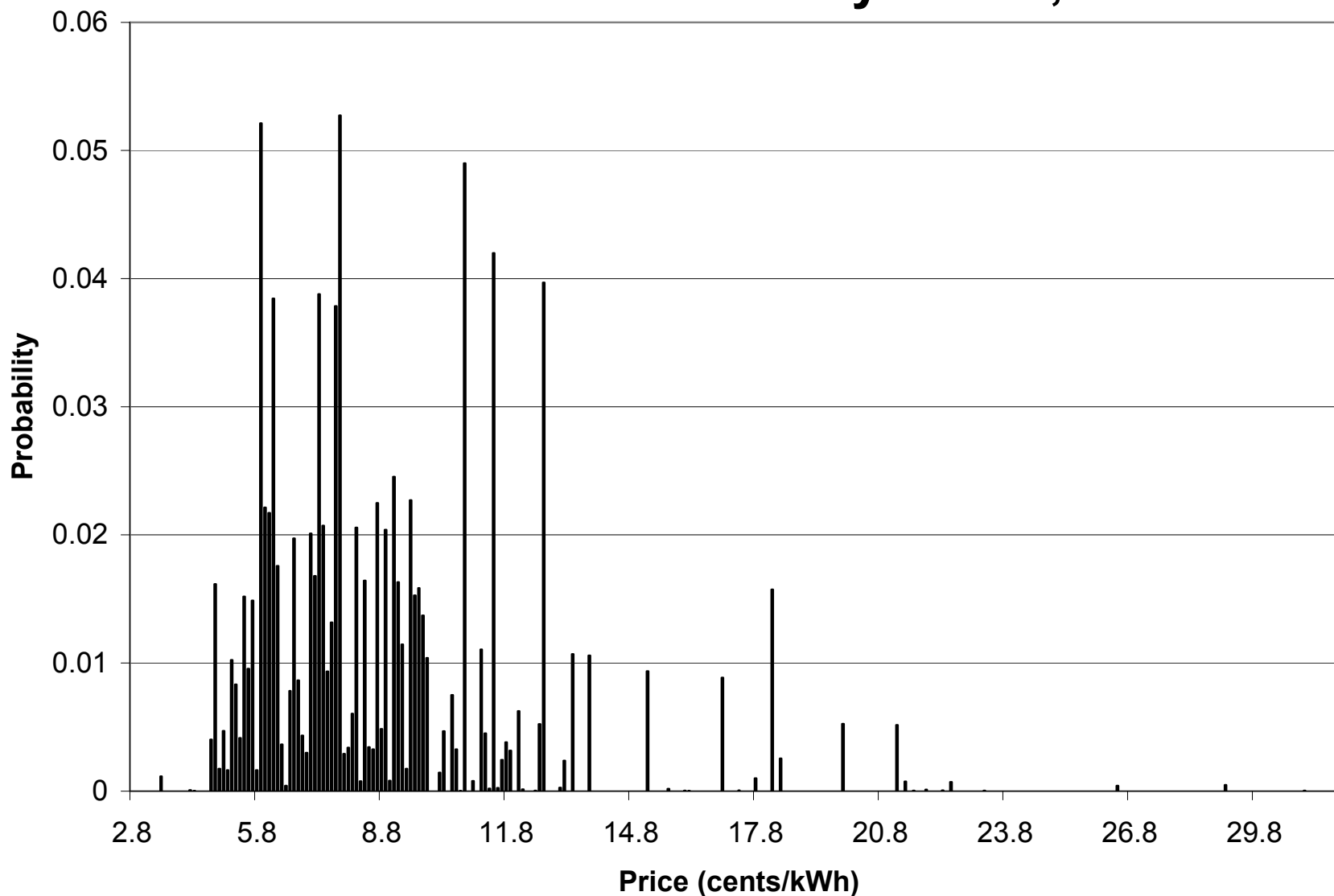


Annual Energy Costs

- Energy prices are used to convert energy use to energy costs.
- The Department proposes to use a distribution of average electricity prices based on EIA Form 826 for the commercial, industrial and residential building sectors.
- The Department will use the Energy Information Administration (EIA) *Annual Energy Outlook (AEO)* for projections of future average electricity prices (reference, high, and low scenarios).



Commercial Sector Electricity Prices, EIA 2006





Replacement Labor and Lamp Lifetime

- Replacement Labor only applies to C&I sectors, where the more efficient lamp lifetime is shorter or longer than the base case.
- Replacement Labor is a function of labor rates and duration.
- The Department may consider the impact of spot versus group re-lamping on lamp life and on replacement costs.

Item 25 The Department welcomes comment on whether and how to develop maintenance, repair and installation costs for all three lamp types. In particular, will policies of group re-lamping versus spot re-lamping impact the installation costs differentially with standard levels?

Item 26 DOE welcomes comment on appropriate lamp lifetimes for the three lamps types covered in this rulemaking. For the commercial and industrial sectors, should group re-lamping be taken into consideration, and if so, how should the Department characterize its impact on lamp lifetimes?



LCC Analysis Period

- Product lifetimes for the base case and standards case could be different, therefore DOE proposes to calculate a salvage value (discussed on next slide) to account for the value of an operating lamp at the end of the analysis period.
- LCC time period of analysis could be based on:
 - Variable Usage-Scaled Time Period: Constant baseline lamp life (hrs); Because usage patterns vary by customer, analysis period (yrs) would vary by customer (but would be the same in the base vs. standards cases for each customer).
 - Fixed Usage-Scaled Time Period: Constant analysis period (yrs) that is based on typical lamp life (hrs) and typical annual operating hours.

The Department welcomes input on which time period it should select for the LCC analysis.



Salvage Value

- A 'salvage value' of a lamp is the lamp replacement cost prorated by the lamp's remaining service life.

$$SV = Cost_{Lamp Rpl} \cdot \left[1 - \left(\frac{P_{analysis} - n \cdot Life_{Lamp}}{Life_{Lamp}} \right) \right]$$

where:

SV = total salvage value,

$Cost_{Lamp Rpl}$ = cost of the replacement lamp,

$P_{analysis}$ = analysis period,

n = number of lamp replacements within the analysis period, and

$Life_{Lamp}$ = average rated lamp life.



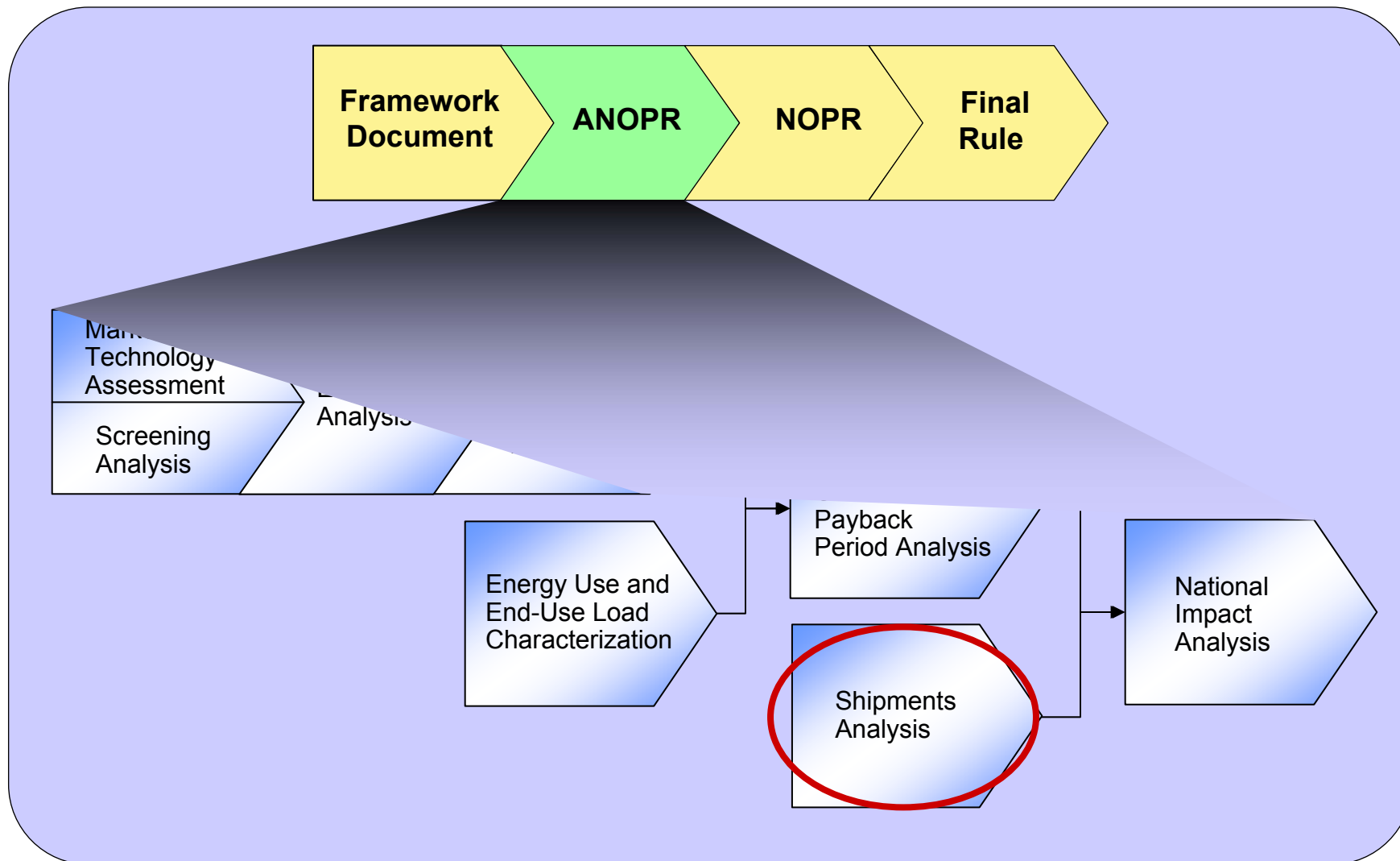
Discount Rate

- Discount rates are used to convert streams of annual operating expenses to present value in the LCC analysis.
- DOE will derive a distribution of discount rates for each sector.
 - Commercial and industrial sector discount rates by estimating the weighted average cost of capital (or WACC) for commercial consumers of lamps.
 - Residential sector discount rates from estimates of the interest or “finance cost” to purchase residential products.

Item 24 The Department welcomes input on the proposed approaches for estimating discount rates for residential and commercial consumers of lamps covered under this rulemaking.



Analyses for Advance Notice of Proposed Rulemaking





Purpose

- Quantify changes in lamp shipments due to potential new energy efficiency standards

Method

- Establish a base-case shipment forecast (absent standards) that takes into account market conditions and regulatory actions (e.g., ballast regulation)
- Develop revised shipments forecasts at each potential standard level
 - Consider only covered products in the base case, and
 - Use a “substitution analysis” to account for consumers who switch to non-covered lamps at higher standard levels



Substitution Analysis

- Approach: Consider consumer behavior in response to standards (e.g., installing substitute lamps that are not covered lamps, and thus are not regulated)
- Impact: The base-case sockets and associated energy savings potential may be eroded (or increased) by consumers substituting non-covered lamps
- Elasticity: The substitution analysis will replace shipments demand elasticity (i.e., the Department proposes to assume consumers will still want to fill all sockets that are operating in the base case, but not necessarily with covered lamps)
- Requirements: Substitute lamps should have similar light output and similar lamp shape, and must operate in the basecase socket
 - Apportion percentage of sockets migrating to substitutes
 - Percentages are likely to increase at higher standard levels



Fluorescent Lamp Shipments

- There is limited publicly available information on shipments of fluorescent lamps and the breakdown between lamp types and wattages
- The Department needs to project shipments of fluorescent lamps over 30 years
- Two possible approaches:
 - Shipment projection based on historical data
 - Shipment projection based on modeling the installed base of fluorescent ballasts nationally



Fluorescent Lamp Shipments – Historical Data

- Approach: project future fluorescent shipments by type, wattage and sector based on historical shipments
- Possible sources:
 - Trade association data
 - U.S. Census – ballast shipments & lamp shipments (note: no lamp data since 1992)
 - Distribution chains to estimate end-use sectors
- Apply expert advice to adjust projection to account for impact of existing and EPCACT 2005 ballast standards.
- Include a high, medium and low projection scenario, based on different assumptions to bound the analysis
- Approach is simple and transparent, facilitating stakeholder review



Fluorescent Lamp Shipments – Ballast Inventory Model

- Approach: develop a model of the installed base of fluorescent ballasts to predict shipments of fluorescent lamps
- Ballast Inventory Vintaging Model:
 - Consider three changes to installed base of ballasts that introduce new (magnetic and electronic) ballasts:
 - New Construction – new fixtures that are installed each year due to floor space growth in a particular sector.
 - Replacements – ballast replacements due to failure. Consider operating hours of end-use applications.
 - Retrofits – new fixtures replacing existing lamps and fixtures during renovation or remodeling.
 - Calibrate with U.S. Census ballast shipments
 - Impact of new ballast regulations (DOE standard, EPACK 2005)
- Lamp shipments calculated from ballast inventory model and operating hours



Incandescent Lamp Shipments

- Limited publicly available information on incandescent lamp shipments, sectors and the breakdown between lamp types and wattages
- Develop a projection of shipments from historical data
- Possible sources:
 - Trade association with total shipments
 - U.S. Lighting Market Characterization Volume I: National Lighting Inventory and Energy Consumption Estimate
 - Sockets by sector
 - Average operating hours
 - U.S. Census (although lamp data was last collected in 1992)



Data Needs

- The Department welcomes information to support its Shipments Analysis on:
 - Historical shipments of fluorescent lamps and incandescent lamps by type and wattage
 - Breakdown of shipments by end-use sector
 - Information on distribution channels for fluorescent lamps and incandescent lamps
 - Comments on trends or issues that may influence the projection of lamps



Request for Feedback

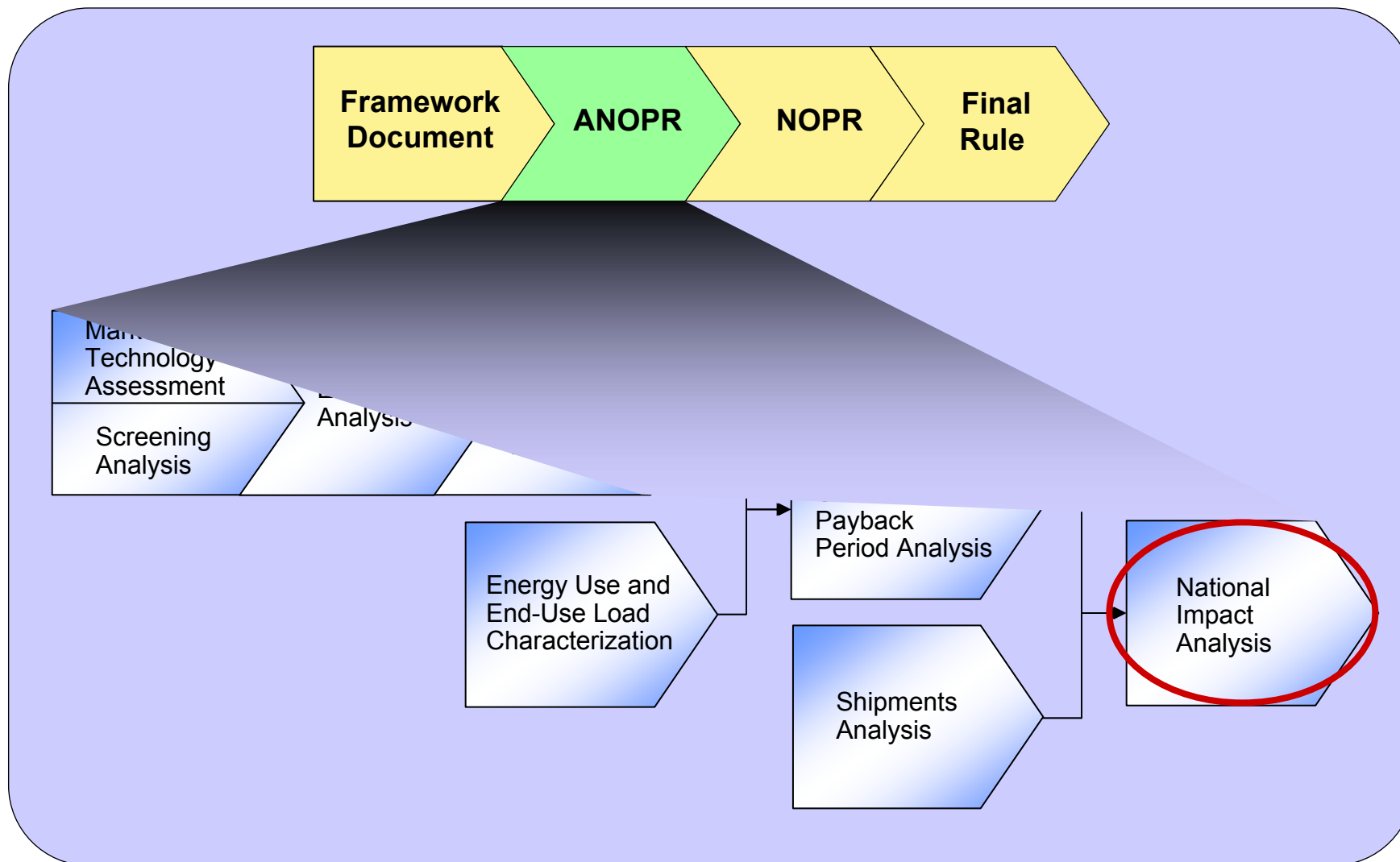
The Department welcomes input on the data needs and approaches for estimating lamp shipments.

Item 27 The Department welcomes comment on the proposed accounting methodology for new construction, replacements and retrofits for each of the lamp types covered in this rulemaking.

Item 28 The Department welcomes comment on how any amended standard for general service fluorescent lamps and incandescent reflector lamps, as well as a standard on general service incandescent lamps, might impact lamp shipments. The Department also invites input on market-pull programs that promote the adoption of more-efficacious lamps.



Analyses for Advance Notice of Proposed Rulemaking





Purpose

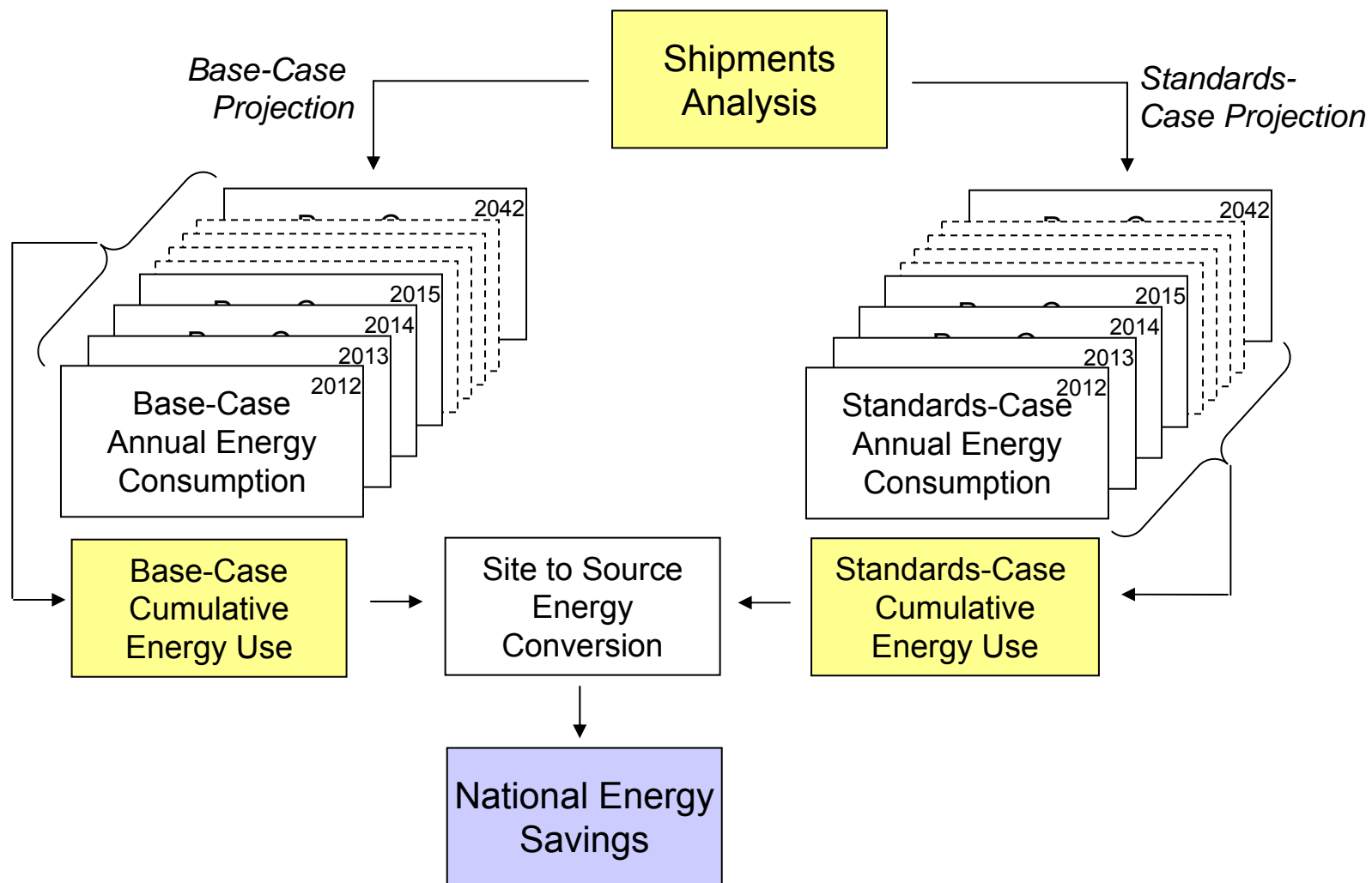
- Determine the projected national energy savings and national consumer net present value.

Method

- Develops annual time series of national energy and economic impacts
- Utilizes the shipments model to estimate the total stock of impacted fluorescent and incandescent lamps in service each year
- Utilizes the LCC to estimate cost and energy use per unit in any given year
- Aggregates the costs and energy use for all years in the analysis period
- Reports energy savings in Quads of primary energy consumption
- Reports estimates for economic impact as change in consumer National Net Present Value (in constant year dollars)
- Accounts for the time-value of money through defined discount rates

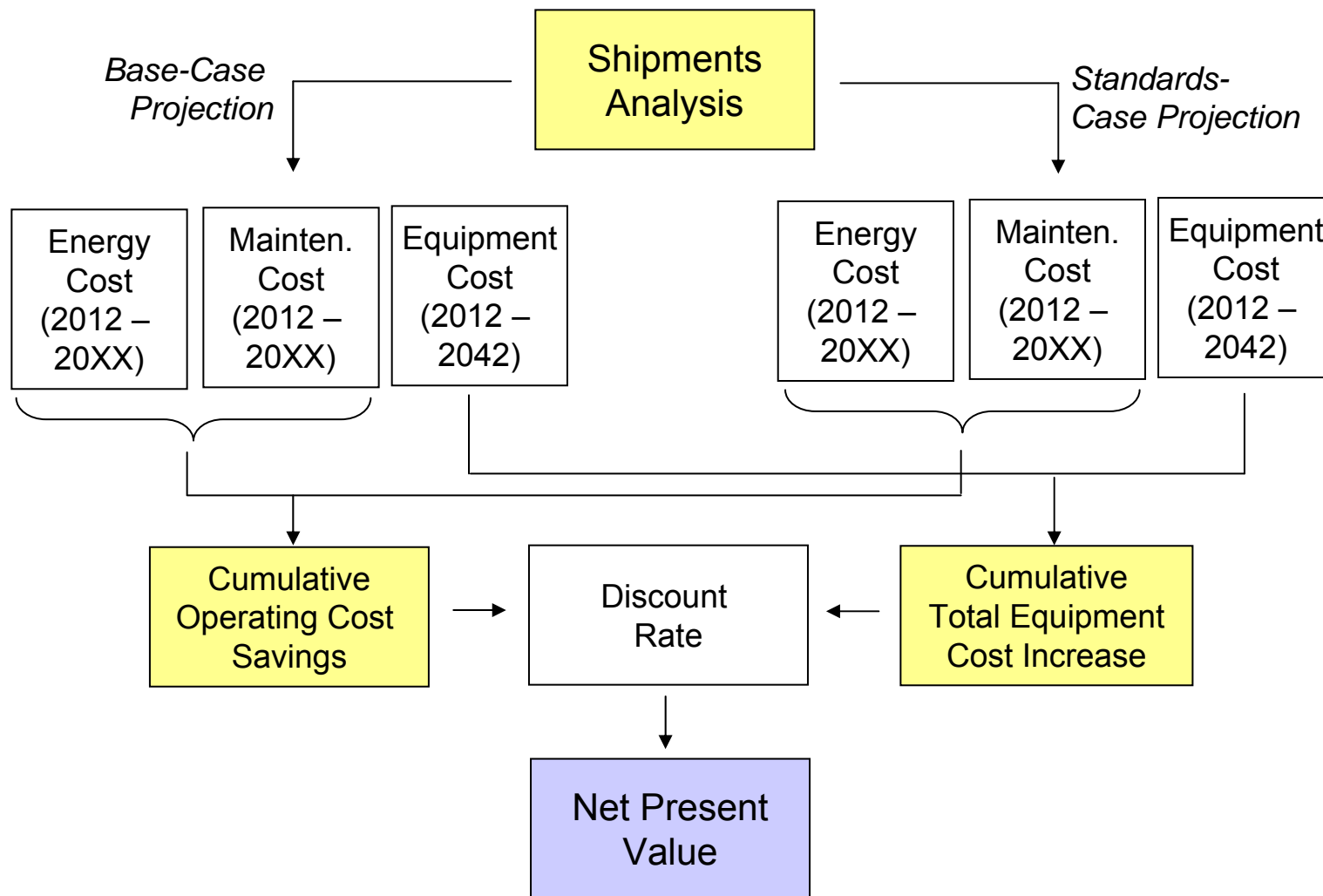


National Energy Savings Flow Diagram





National Consumer Net Present Value Flow Diagram





Request for Feedback

Item 29 The Department welcomes comment on the NES spreadsheet models used for estimating national impacts of amended energy conservation standards.

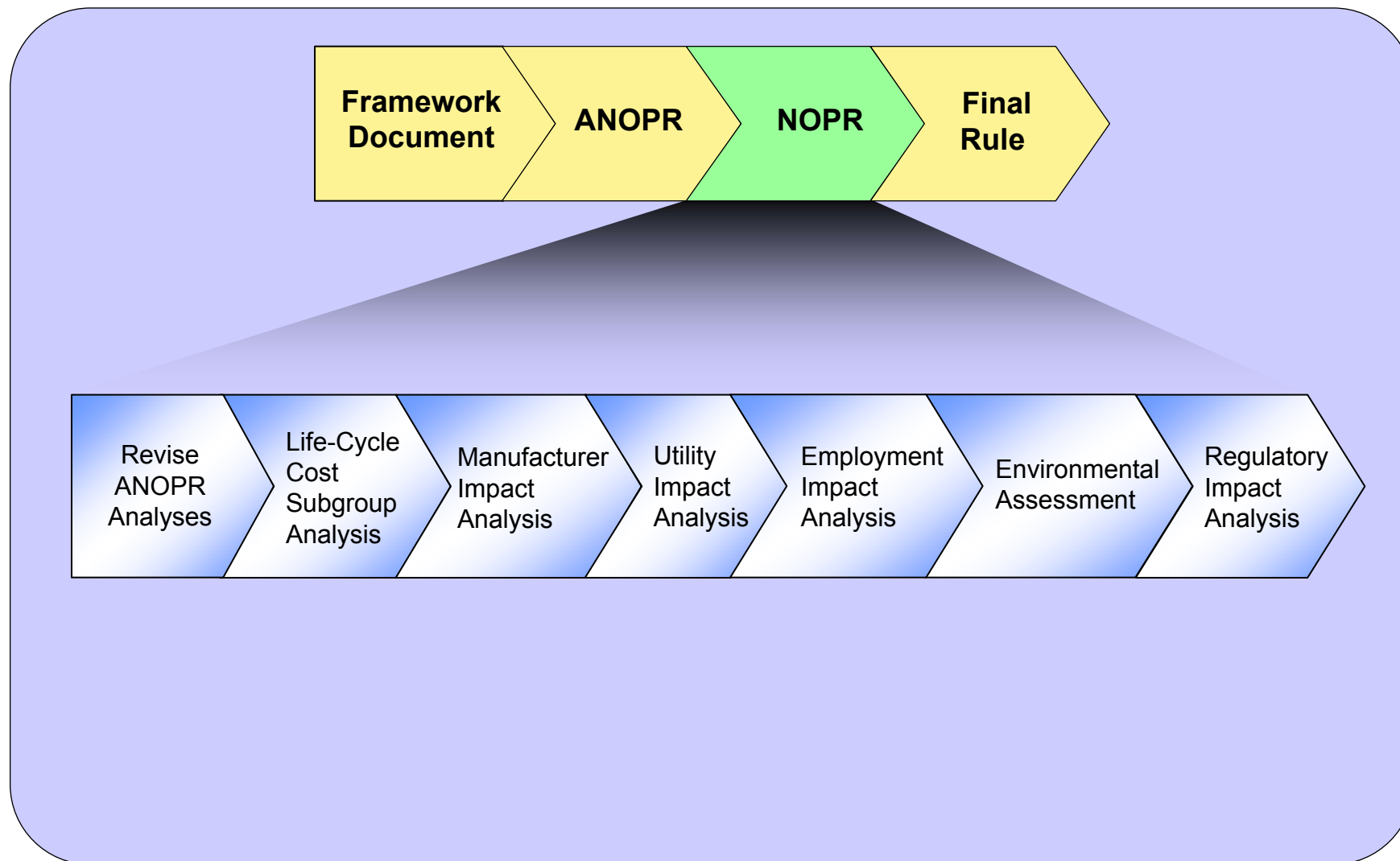


Public Meeting Agenda

- 1 Introduction
- 2 Rulemaking Overview
- 3 ANOPR Analyses
- 4 NOPR Analyses**
- 5 Final Rule
- 6 Closing Remarks

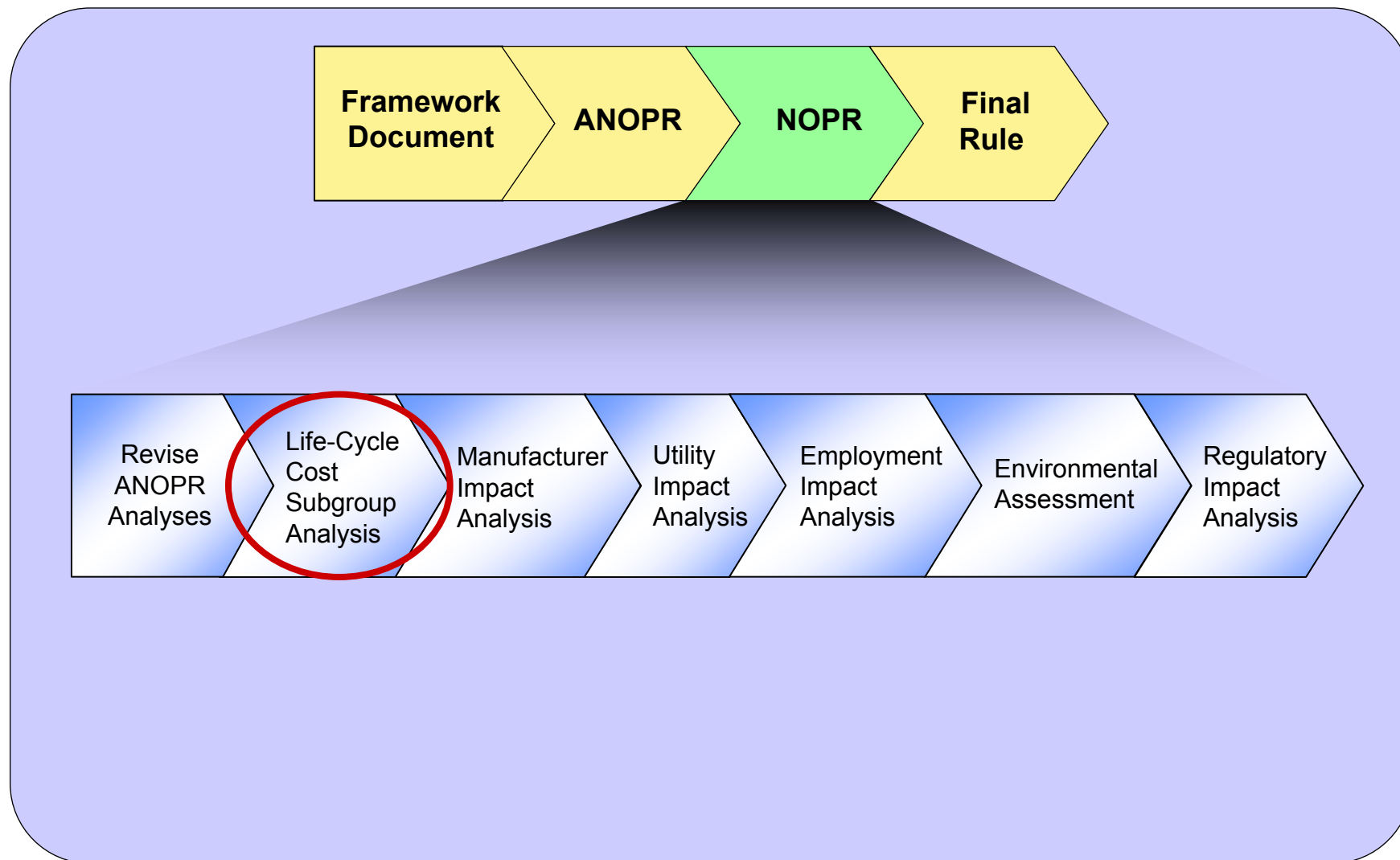


Analyses for Notice of Proposed Rulemaking





Analyses for Notice of Proposed Rulemaking





Purpose

- Analyze the economic impacts of standards on consumer subgroups who may be disproportionately impacted compared with the general user population

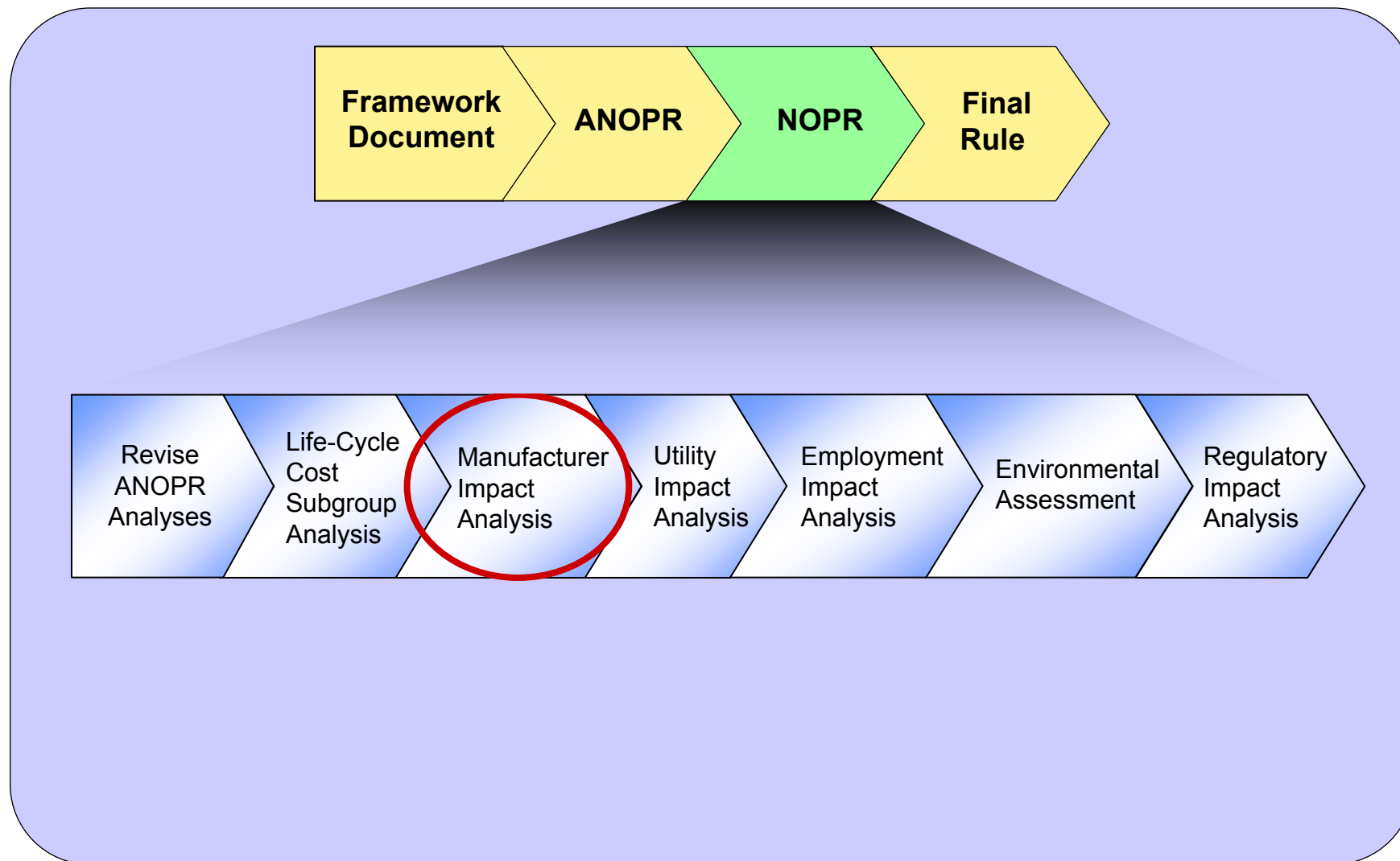
Method

- Extend the LCC analysis to examine the impacts for defined subgroups

Item 30 The Department welcomes comment on what, if any, consumer subgroups are appropriate in considering standards for general service fluorescent lamps, incandescent reflector lamps and additional general service incandescent lamps.



Analyses for Notice of Proposed Rulemaking





Legislative Requirements

- The Manufacturer Impact Analysis (MIA) fulfills a legislative requirement to determine if a proposed standard is economically justified.
 - EPCA provides 7 factors to evaluate in determining whether an efficiency standard is justified. Two factors are addressed in the MIA:
 - Economic impact of standards on manufacturers
 - Impacts of any lessening of competition in the industry
 - MIA format changes described in the 2006 report to Congress, at: http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html
 - DOE will collect, evaluate, and report preliminary MIA data in the ANOPR
 - Preliminary data includes: anticipated conversion capital expenditures by efficiency level and anticipated direct employment impacts



Purpose

- Assess the impacts of 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

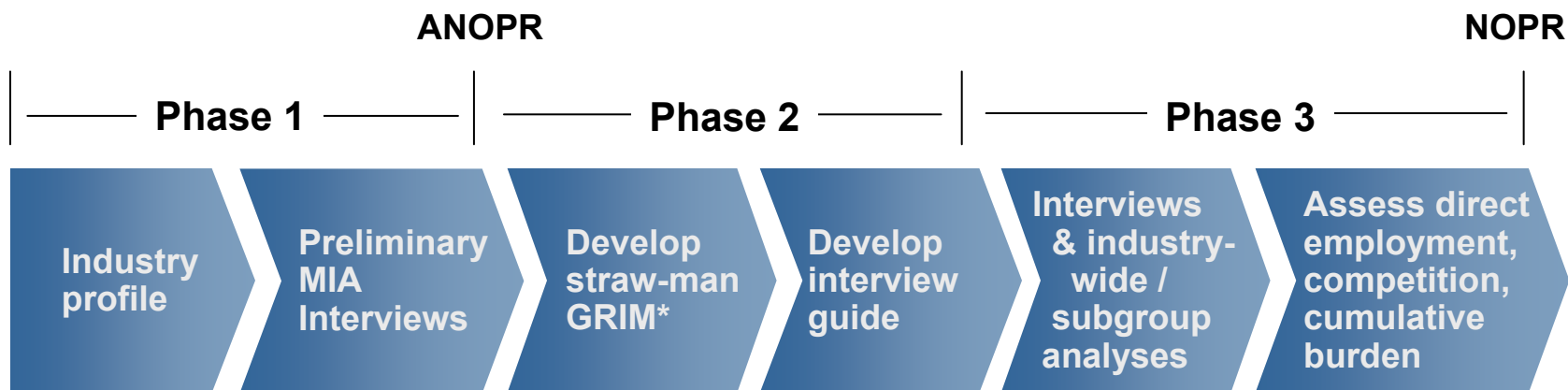
Output

- Industry Net Present Value impacts
- Subgroup Net Present Value impacts
- Other impacts



Methodology

- The MIA consists of three main phases



* Government Regulatory Impact Model (GRIM)



Methodology: Phase 1

- Consists of the industry profile and preliminary manufacturer impact analysis interviews

Industry Profile

- » Evaluate current and past industry structure and market characteristics
- » Produce an industry profile report with aggregated findings and characteristics
- » Identify critical issues that require special consideration in the MIA, for example:
 - » Types or groups of manufacturers
 - » Access to technology
 - » Potential regulatory scenarios

Preliminary MIA Interviews

- » Occurs during the engineering analysis
- » Topics include:
 - » Shipment projections
 - » Conversion costs
 - » Product mix and profitability
 - » Market shares and industry consolidation
 - » Cumulative regulatory burden



Methodology: Phase 2

- Consists of the straw-man GRIM and interview guide preparation

Straw-man GRIM

- » Starting point for discussion of impacts
- » Inputs include:
 - » Manufacturer prices
 - » Shipment forecasts
 - » Manufacturing cost estimates
 - » Financial information

Interview Guide Preparation

- » Interview topics include:
 - » Engineering analysis
 - » Shipments model
 - » Cost structure and financial parameters
 - » Conversion costs
 - » Cumulative burden
 - » Direct employment impacts
 - » Import / Export issues
 - » Consolidation / competitive impacts
 - » Replacement parts or refurbishments
 - » Impact of the standard's effective date



Methodology: Phase 3

- Consists of the manufacturer interviews, subgroup analyses, and assessment of industry impacts

Manufacturer Interviews

- » Confidential discussion of potential impacts resulting from standards, including:
 - » Obsolescence of existing manufacturing assets
 - » Tooling
 - » Investment

Assessment of Impacts

- » Assess competitive impacts on smaller, significant manufacturers
- » Assess cumulative regulatory burden on manufacturers from amended DOE standards and other regulatory actions
- » Assess impacts on industry employment levels
- » Assess impacts on manufacturer subgroups



Request for Feedback

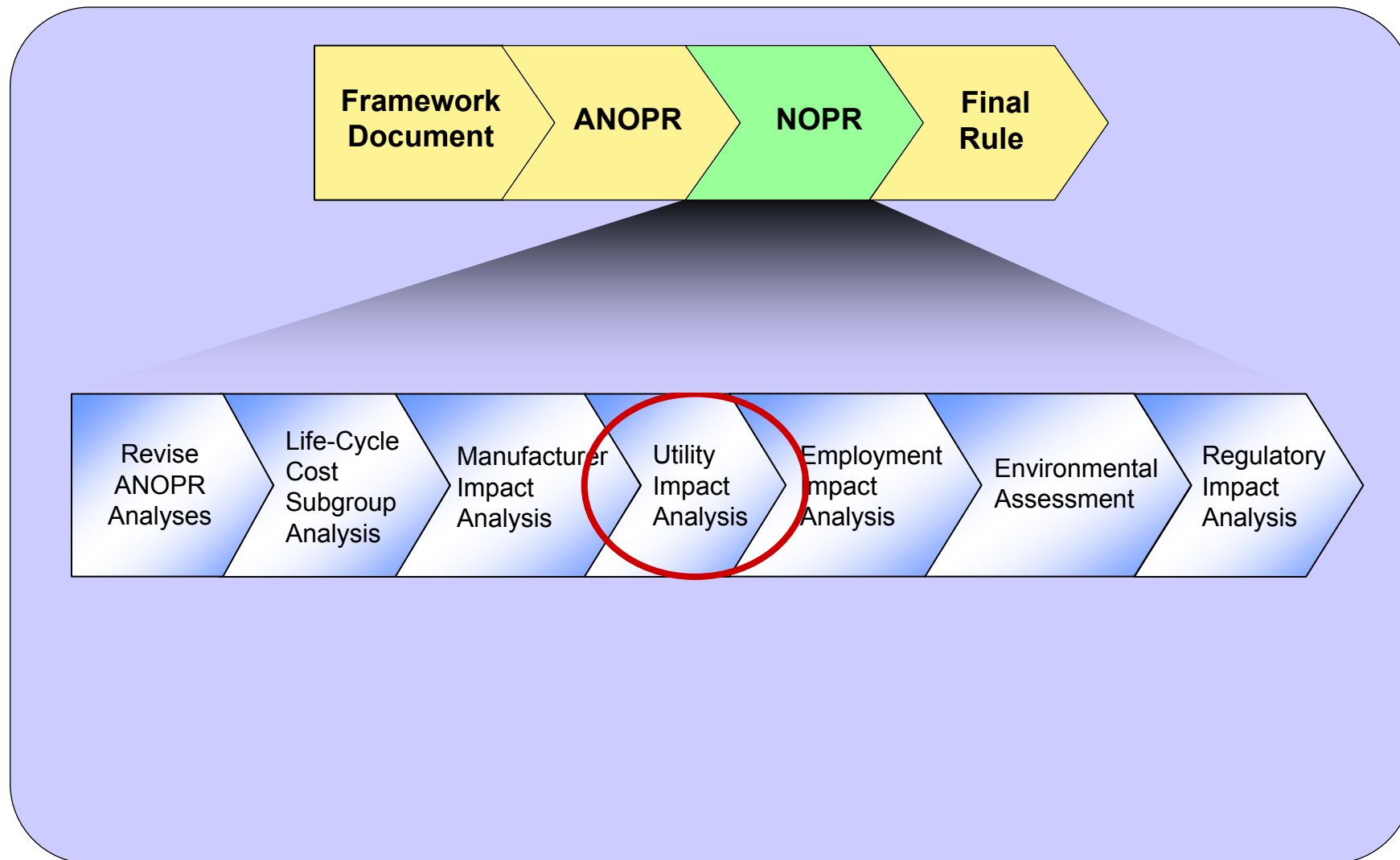
Item 31 The Department welcomes comment on interviewing companies to assess manufacturer impacts, and the procedures that the Department should follow when scheduling interviews and requesting information.

Item 32 If appropriate, what are potential subgroups of lamp manufacturers that should be considered in a manufacturer subgroup analysis?

Item 33 The Department welcomes comment on what other regulations or pending regulations the Department should consider in its examination of cumulative regulatory burden.



Analyses for Notice of Proposed Rulemaking





Purpose

- Assess the overall impacts on domestic energy supplies that would result from the imposition of standards.

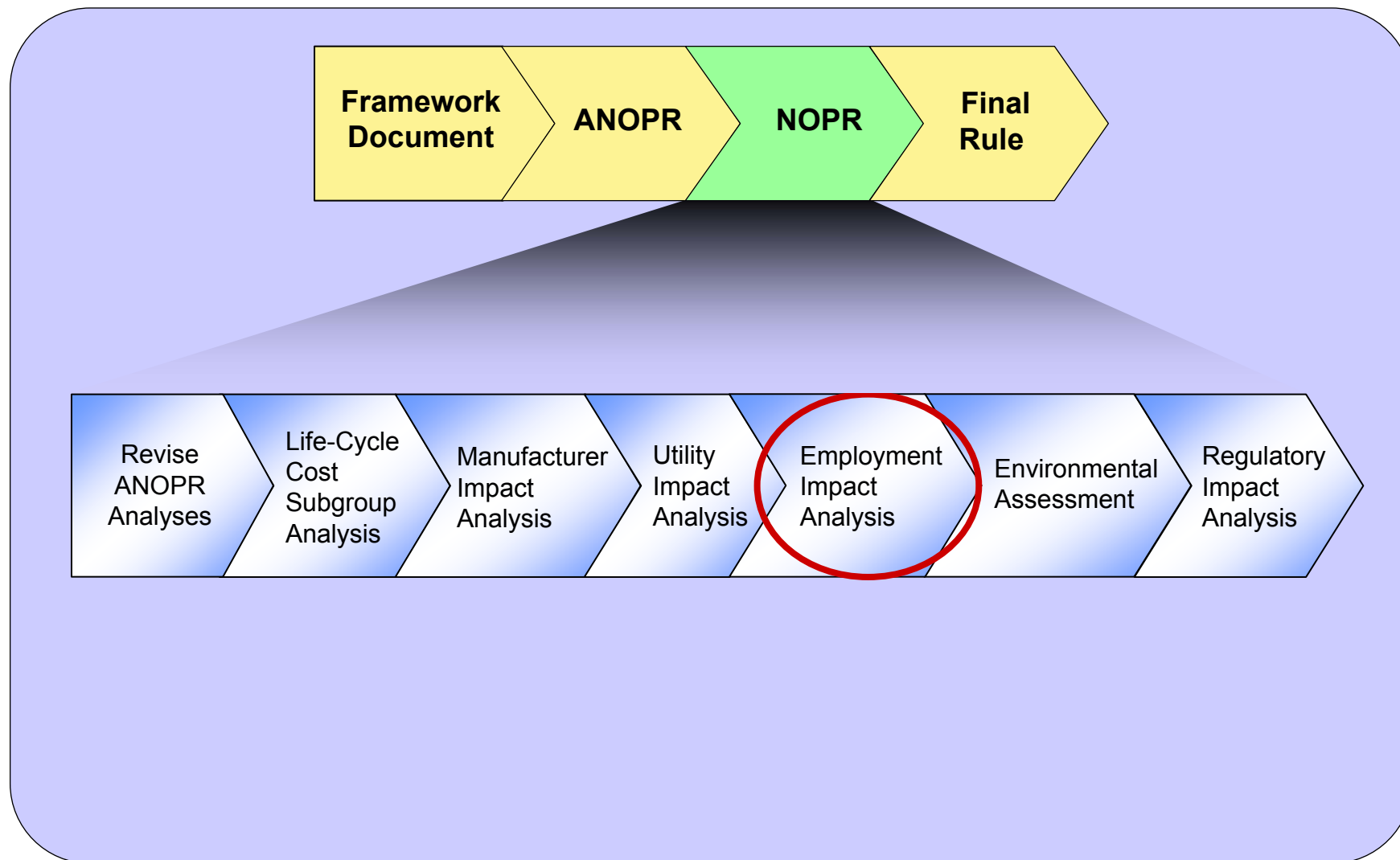
Method

- The Department 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 report, as the basis of the Utility Impact Analysis.
- Use the energy savings calculated from the NES spreadsheet analysis to reduce the sector electrical loads from the Building Demand Modules in NEMS-BT.
- Energy savings translated to a reduction in the electrical demand faced by the utility system over time.

Item 34 The Department welcomes input from stakeholders on its proposed use of NEMS-BT to conduct the utility impact analysis.



Analyses for Notice of Proposed Rulemaking





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”)

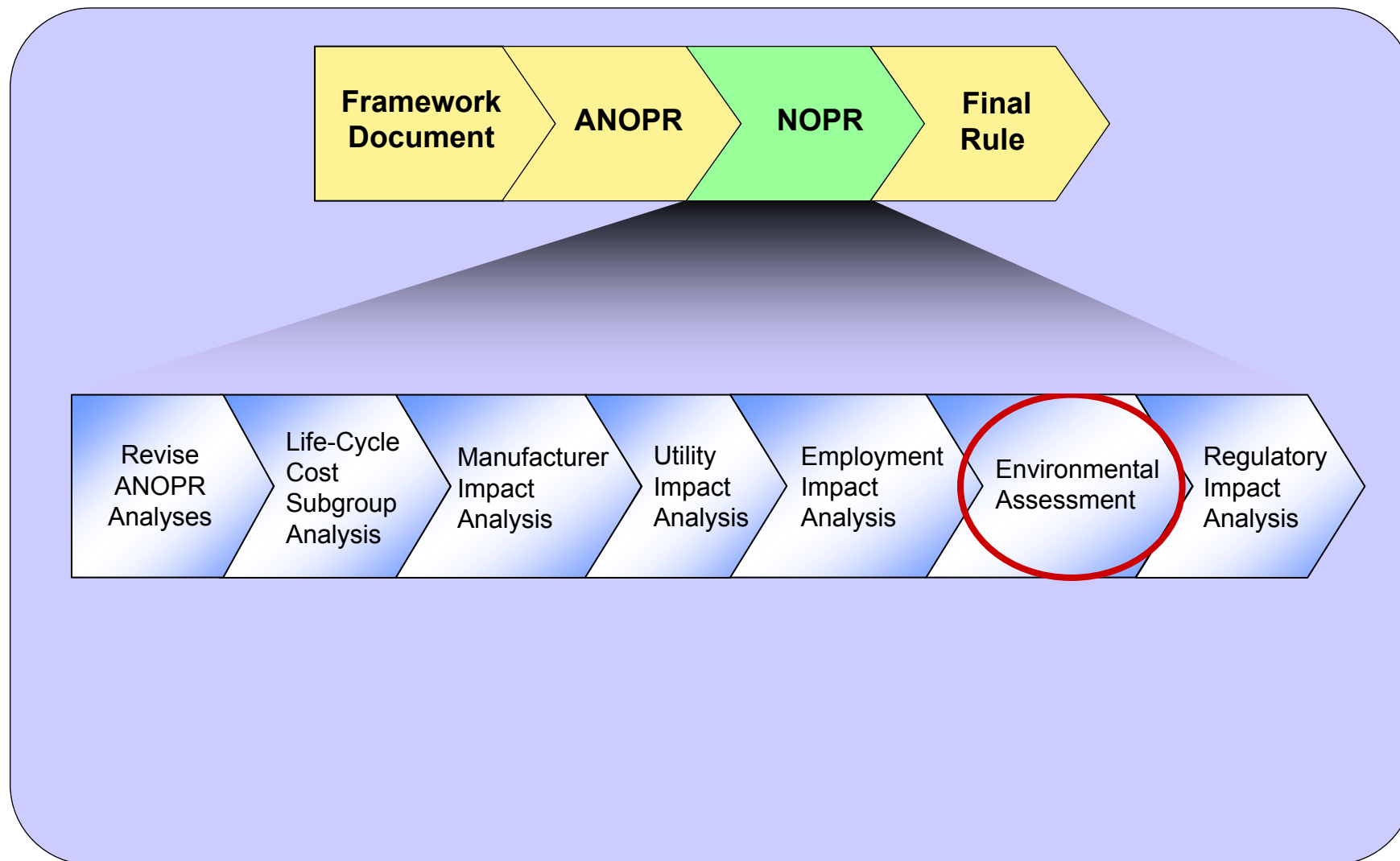
Method

- The Department intends to use the IMSET (Impact of Sector Energy Technologies) model for the evaluation of indirect employment impacts.

Item 35 The Department welcomes feedback on its proposed approach to assessing employment impacts, both direct and indirect.



Analyses for Notice of Proposed Rulemaking





Purpose

- Estimate national environmental impacts from new energy efficiency standards for lamps covered under this rule.

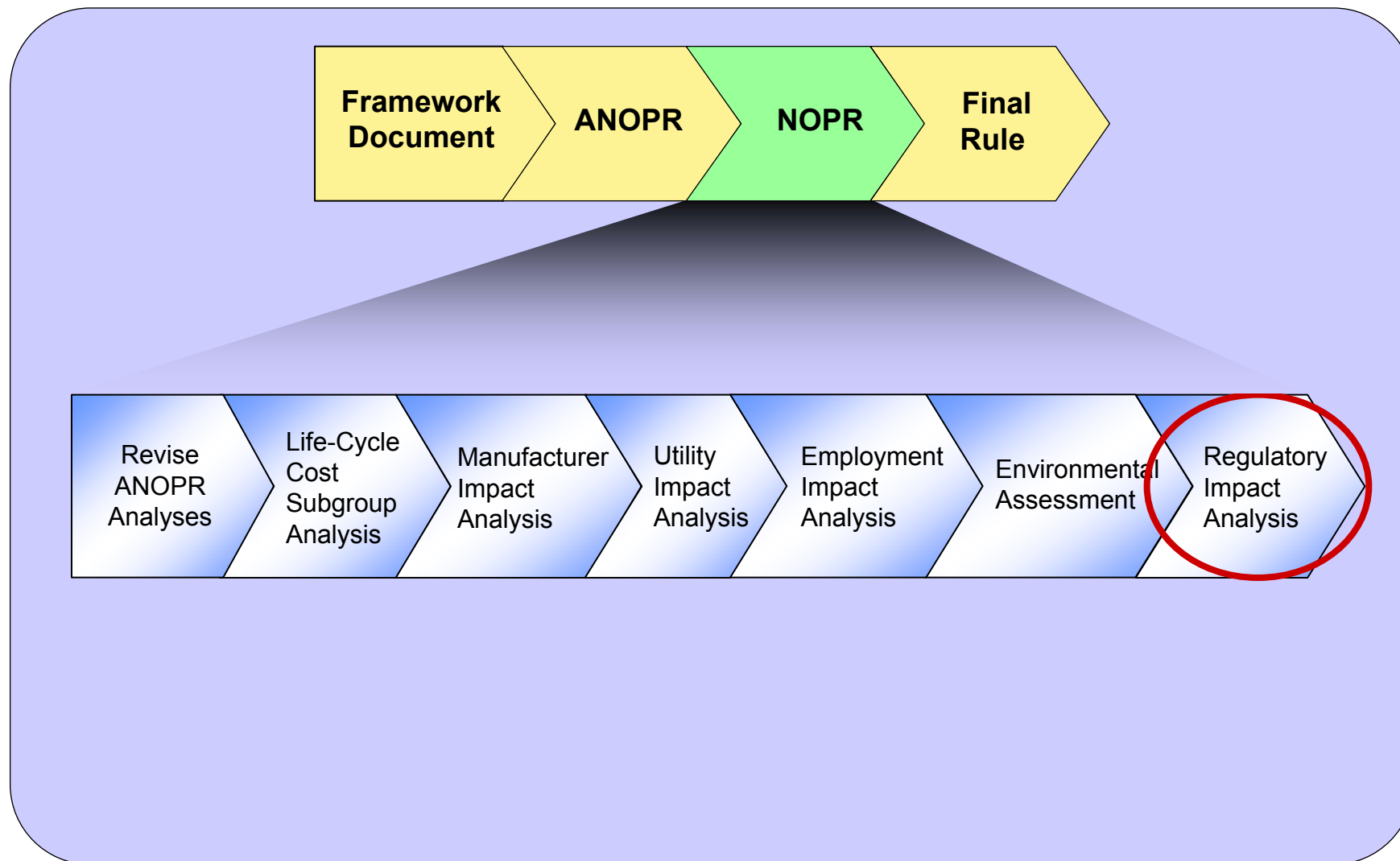
Method

- The Department intends to use the environmental impacts predicted from the NEMS-BT modeling analysis used for the Utility Impacts Analysis. Impacts calculated within NEMS include:
 - Quantities of U.S. emissions (CO₂) and nitrogen oxides (NO_x) from power plants
 - Direct environmental Impacts from reduction of fossil fuel use at the building level.
 - Any measurable impact from NEMS in terms of the trading price of sulfur dioxide (SO₂) in the utility sector and subsequent impact on SO₂ emissions.

Item 36 The Department welcomes feedback on its proposed approach to assessing environmental impacts, both direct and indirect.



Analyses for Notice of Proposed Rulemaking





Purpose

- Explore the potential for non-regulatory alternative to new manufacturing efficiency standards

Method

- Base the assessment on the actual impacts of any such initiatives to date, but will consider information presented regarding the impacts that any existing initiative might have in the future

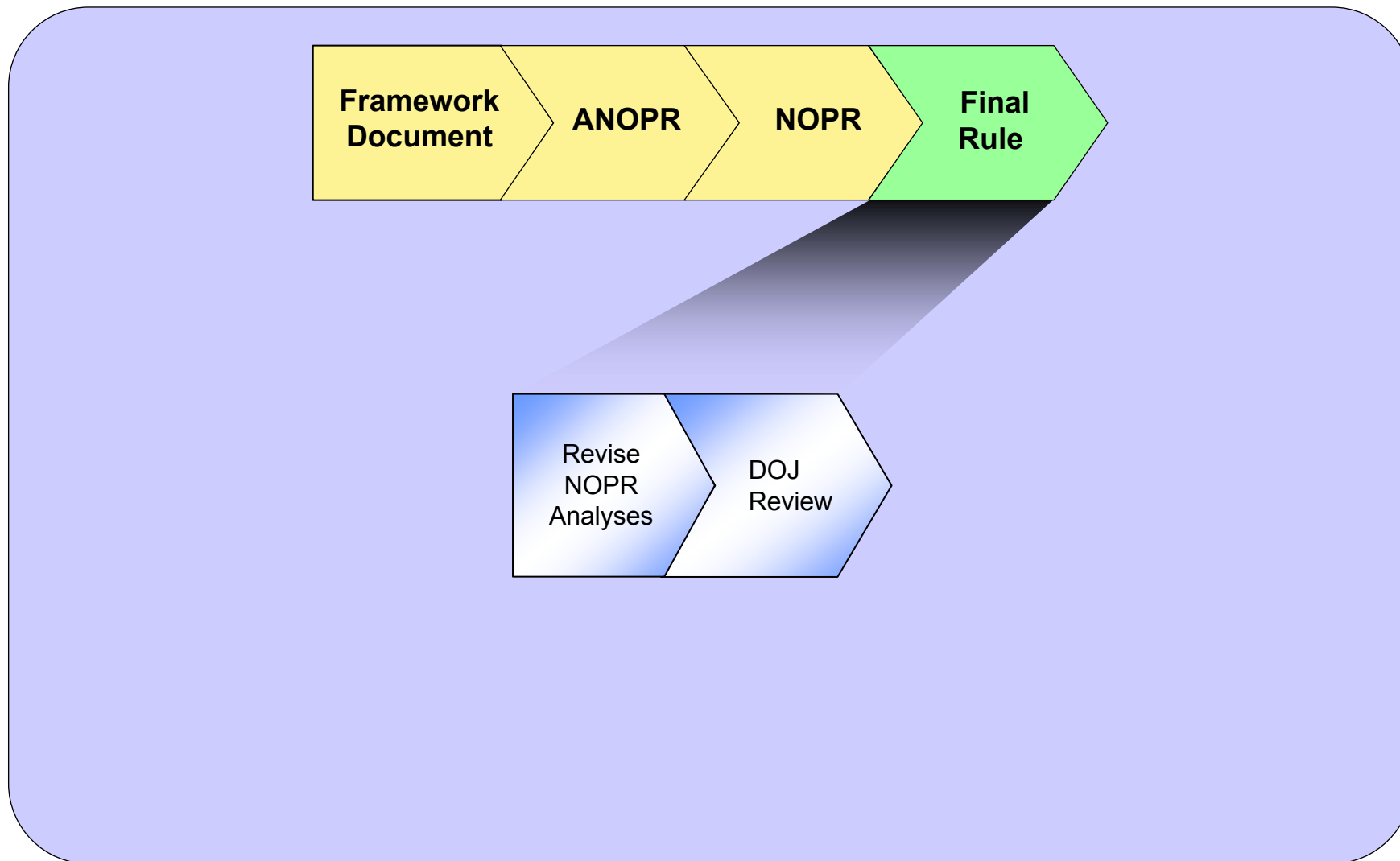


Public Meeting Agenda

- 1 Introduction
- 2 Rulemaking Overview
- 3 ANOPR Analyses
- 4 NOPR Analyses
- 5 Final Rule**
- 6 Closing Remarks



Final Rule





Public Meeting Agenda

- 1 Introduction
- 2 Rulemaking Overview
- 3 ANOPR Analyses
- 4 NOPR Analyses
- 5 Final Rule
- 6 Closing Remarks



How to Submit Written Comments

- **In all correspondence, please refer to the Fluorescent and Incandescent Lamps Rulemaking by**
 - Docket Number [EE-2006-STD-0131](#), or
 - Regulatory Identification Number (RIN) 1904-AA92.
- **Email:** fluorescent_and_incandescent_lamps.rulemaking@ee.doe.gov
- **Postal Mail:** Ms. Brenda Edwards-Jones
U.S. Department of Energy
Building Technologies Program, [Mail Stop EE-2J](#)
Fluorescent and Incandescent Lamps Rulemaking
RIN 1904-AA92
1000 Independence Avenue, SW
Washington, DC 20585-0121
- **Courier:** Same as above, except “[Room 1J-018](#)”
in place of “[Mail Stop EE-2J](#)”
202-586-2945
- **Comment period closes [June 29, 2006](#).**