



Framework Public Meeting on Energy
Conservation Standards for Set-top
Boxes and Network Equipment

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Energy Efficiency & Renewable Energy

STB-RFI-2011-NOA-0067@ee.doe.gov

January 26, 2012

- 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

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Closing Remarks

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

9:00 – 9:30 am	Welcome, Introductions, Agenda Review, & Opening Statements
9:30 – 10:00 am	Standards Rulemaking Overview
10:00 – 11:00 am	Test Procedure Rulemaking Overview
11:00 – 11:15 am	Break
11:15 – 12:30 pm	Standards Rulemaking Analyses
12:30 – 1:30 pm	Lunch
1:30 – 3:00 pm	Standards Rulemaking Analysis - continued
3:00 – 3:30 pm	Next Steps and Closing Remarks

- At this time DOE welcomes opening remarks from interested parties.

Issue Box Throughout this presentation, specific issues will be raised for discussion on slides such as this, with identifying numbers. Comments concerning any part of this presentation are welcome.

Feedback Is Requested

Especially on Items Identified in Request for Information

- **In all correspondence, please refer to the Set-top Boxes rulemaking by:**
 - Set-top Boxes Rulemaking,
 - Docket Number EERE–2011–BT–NOA–0067, and
 - Regulatory Identification Number (RIN) 1904-AC52
- **Email:** STB-RFI-2011-NOA-0067@ee.doe.gov

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- **Comment period closes: March 15, 2012**

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Closing Remarks

- **Goal:** *“Achieve the maximum improvement in energy efficiency which is technologically feasible and economically justified.”*

Stakeholder Engagement

- Open Honest Dialogue with all stakeholders
- More involvement and input from stakeholders helps establish the best possible rule
- Data and Information from Stakeholders helps expedite rulemaking process

Innovation

- Recognize the challenges present for creating a rulemaking in a rapidly changing industry
- Create a rulemaking that increases energy efficiency while not impacting consumer utility or restriction of innovation.

- Part A of the Energy Policy and Conservation Act (EPCA) of 1975 (Public Law 94-163)
 - Established the “Energy Conservation Program for Consumer Products Other Than Automobiles.”
 - Subsequent amendments to EPCA gave DOE the authority to regulate the energy efficiency of several types of equipment.
 - DOE also has authority to classify additional types of consumer products as covered products (average annual per-house hold energy use of that product is likely to exceed 100 kWh/year).
- Energy Policy Act (EPACT) of 1992 (Public Law 102-486) & Energy Policy Act (EPACT) of 2005 (Public Law 109-58)
- Energy Independence and Security Act (EISA) of 2007 (Public Law 110-140)



- Notice of Proposed Determination (76 FR 34914, June 15, 2011)
 - DOE preliminarily determined that set-top boxes and network equipment meet the criteria for covered products
- Request for Information (76 FR 32325, December 16, 2011)
 - DOE seeks information and comments from stakeholders
- Today ...
 - DOE begins the process to consider potential energy conservation standards for set-top boxes.
 - Covered products must meet additional criteria before DOE may prescribe an energy conservation standard (Average household energy use exceeds 150 KWh/year and the aggregate national energy use exceeds 4.2 TWh).
 - DOE will issue a final determination at a later stage



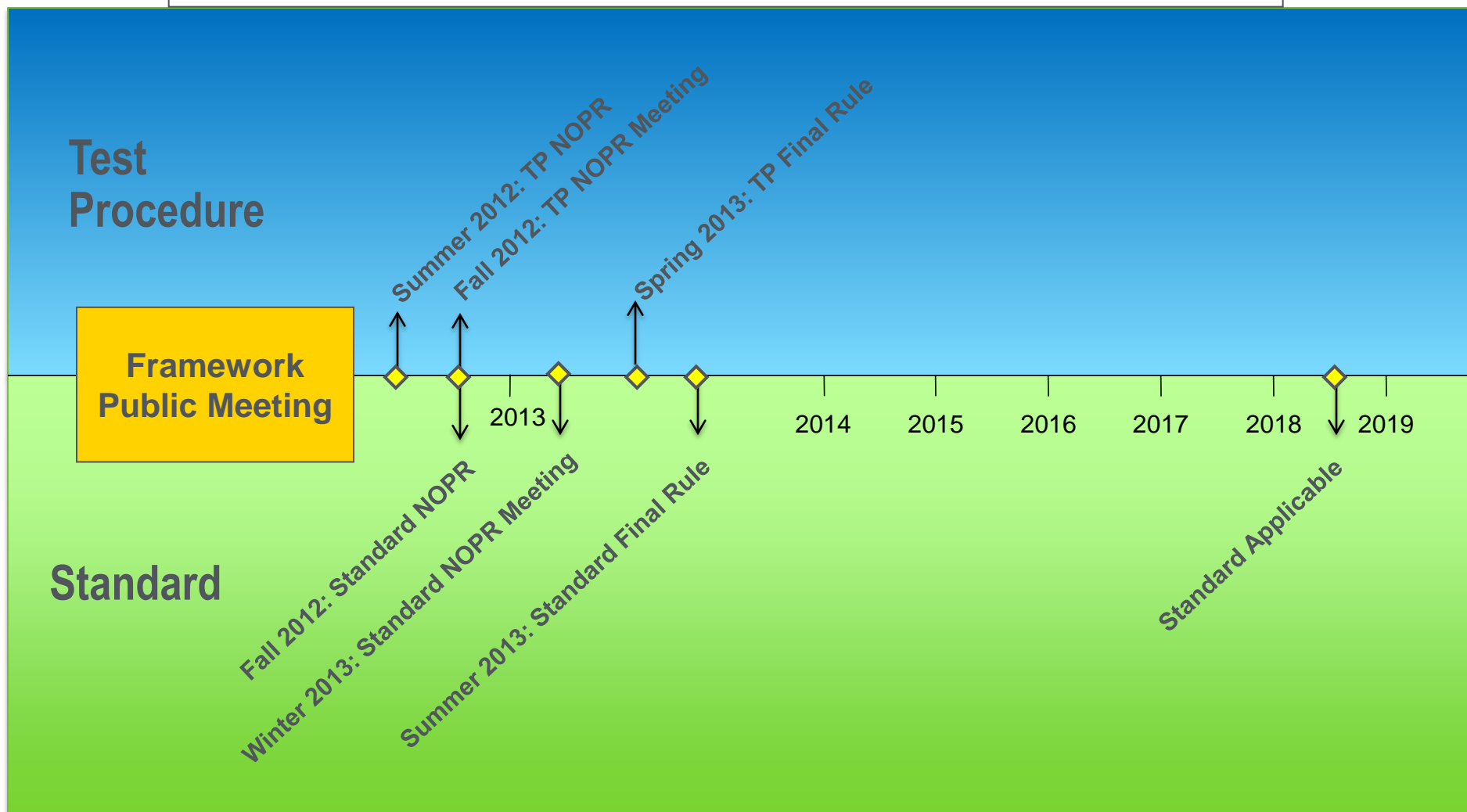
- 5-Year Compliance Period from the issuance of a Final Rule to the Compliance Date
- Rules apply to products manufactured for sale, assembled, or imported into the U.S. after the compliance date
- Products manufactured before the compliance date of the new standard may still be sold after the compliance date
- No Requirement for consumers to replace existing products

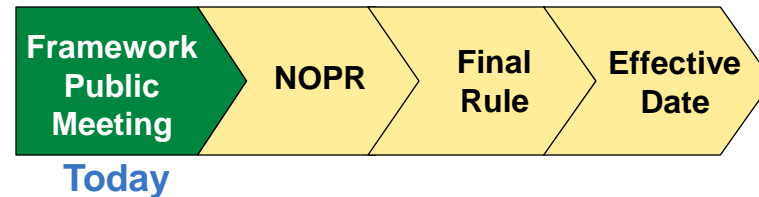
Today...

- DOE is initiating the rulemaking and data collection process for a Federal test procedure.
- Test Procedure will specify the test conditions for measuring the energy consumption of the product in various power modes

Stages for the Energy Conservation Standards for Set-top Boxes

Milestones for DOE





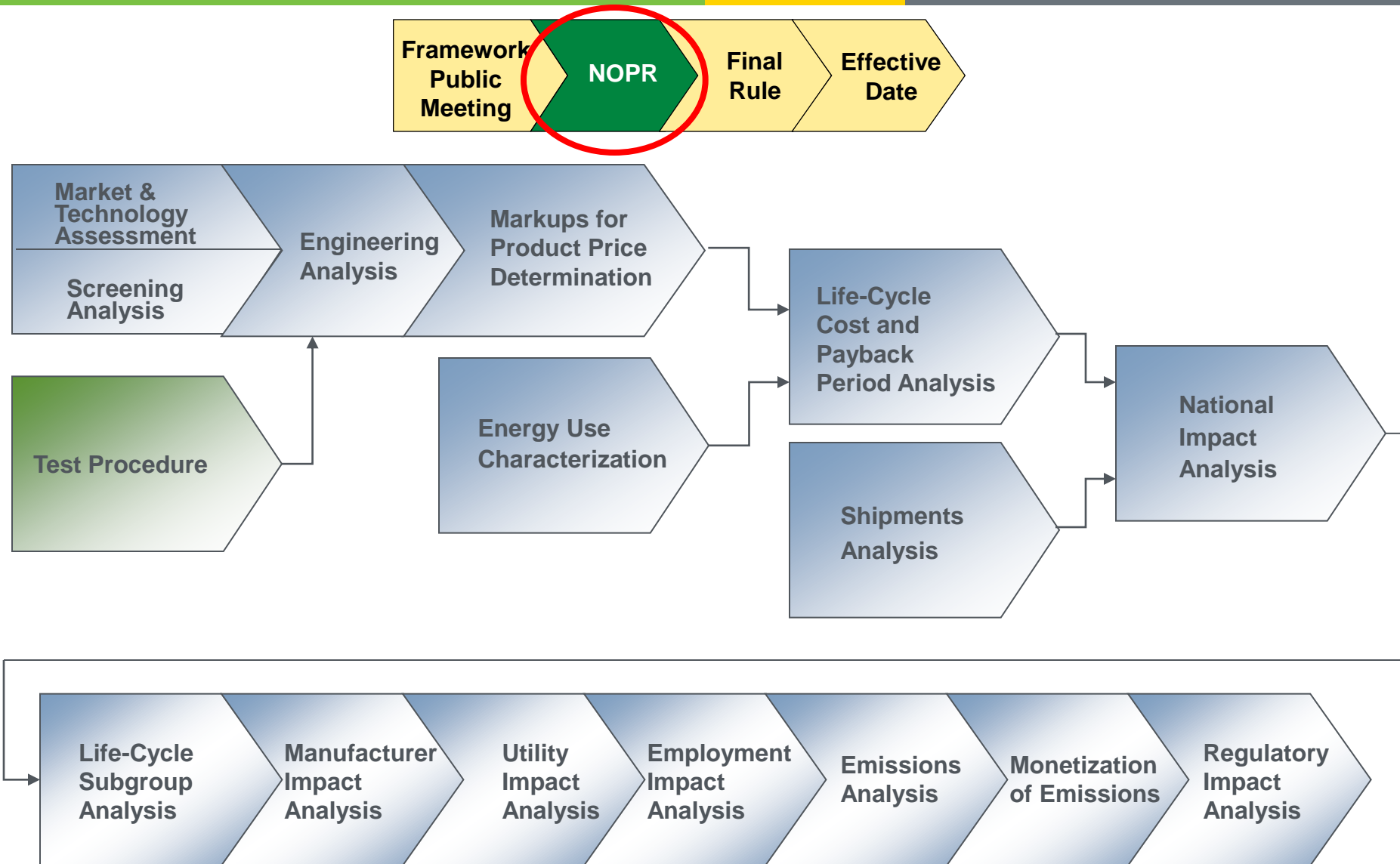
- Today's public meeting covers the rulemaking process for Set-top Boxes
- Federal Register Notice of Public Meeting, FR DOC # 2011-32325, December 14, 2011.
 - Gives notice of the public meeting and availability of the other materials being discussed today.
 - DOE encourages interested parties to submit comments by **March 15, 2012**.
 - Materials from today's public meeting and other materials related to this rulemaking are available online:

http://www1.eere.energy.gov/buildings/appliance_standards/residential/set_top_boxes.html

42 U.S.C. 6295(o)(2)(B)(i) directs DOE to consider seven factors when considering energy conservation standards for set-top boxes:

EPCA Factors	DOE Analysis
1. Economic impact on consumers and manufacturers	Life-Cycle Cost Analysis 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 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 Utility Impact Analysis Employment Impact Analysis

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



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Closing Remarks

- Objectives
 - To develop a representative test for measuring energy consumption
 - To measure active, standby, and off power modes as defined by EPCA (42 U.S.C 6295 (gg) (1))
 - To support data collection used in setting efficiency standards
- DOE will investigate test method to ensure that it:
 - Is repeatable
 - Represents typical household usage
 - Minimizes burden on labs



- Rule is split into three phases:
 - Request for Information (RFI)
 - Notice of Proposed Rulemaking (NOPR)
 - Final Rule
- Test procedure typically goes into compliance 75 days after Final Rule is published
- For both RFI and NOPR, stakeholders will be able to provide feedback:
 - Attend a public meeting held by DOE
 - Submit written comments
- Process will run concurrently with Standards rulemaking

- DOE will leverage existing test procedures
 - ENERGY STAR
 - IEC 62087
 - Industry test procedures
- The test procedure will need to:
 - Describe power measurements for different modes of operation
 - Define energy efficiency metric(s) used for standards

- The relevant modes of operation need to be identified
- ENERGY STAR measures power in the following modes of operation

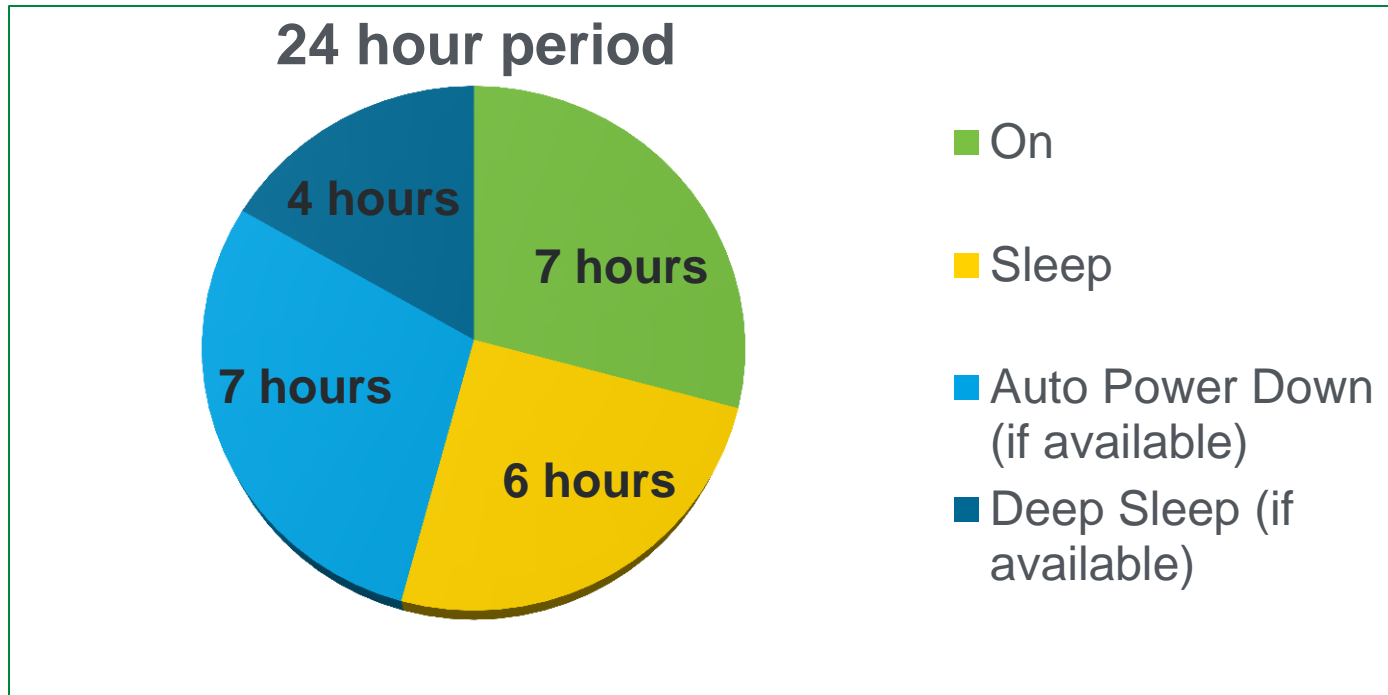
Active

- Watching live TV
- Recording live TV to DVR
- Playing back DVR recording
- Recording live TV to removable media
- Playing back removable media recording
- Playing video through a multi-room setup

Standby / Off

- Sleep
- Auto Power Down
- Deep Sleep

- DOE can consider different metrics for energy efficiency
- For example, ENERGY STAR uses a single metric (Typical Energy Consumption) based on the following time spent in each mode of operation



Test Procedure Questions: Impact of Service Provider Software

- Service providers program Set-top Box units
- The software permits added functionality and, as a consequence, dictates the unit's behavior

Added Functions	Controlled Behavior
<ul style="list-style-type: none">• Increased Security• Increased Communication w/ SP• Video on Demand• Electronic Program Guide	<ul style="list-style-type: none">• Low Power Modes (Idle/Sleep)• Automated Updates• Hardware Utilization

Issue #1: DOE seeks comment on how service provider software impacts Set-top Box energy consumption.

Issue #2: DOE seeks comment on how service provider software impacts idle or sleep behavior.

Test Procedure Questions: Live Network Testing

- Testing environment determines the nature/format of the incoming signal
- DOE is considering testing with a live service subscription

	Live Network	Closed Network
Pros	<ul style="list-style-type: none">• Reflects Typical Usage• Simple Test Setup• Low Service Provider Involvement	<ul style="list-style-type: none">• Controlled Environment
Cons	<ul style="list-style-type: none">• Subscription Availability• Geographical Variation• Time of Day Variation• Weather Variation• Video Format Uncontrollable	<ul style="list-style-type: none">• Large/Costly Equipment• Complex Setup• May Lack Certain Service Features• Heavy Service Provider Involvement

Test Procedure Questions: Live Network Testing

Issue #3: DOE seeks comment on how STB behavior will differ when on a live network as opposed to a closed network.

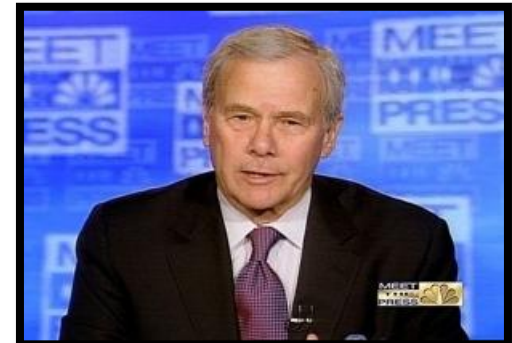
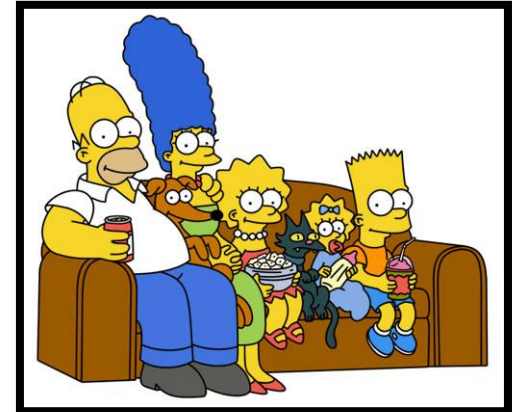
Issue #4: DOE seeks comment on how STB energy consumption will be affected by geographic location, time of day, and subscription package selected.

ENERGY STAR Reference Channels

- Any channel that meets the following requirements
- STBs without conventional tuners (e.g., IPTV) use equivalent video content from a source representative of typical usage

Reference Channel	Video Content	Minimum Resolution
A	Network Television	480i
B	Live or Recorded Sports	720p*
C	24-Hour News	480i

* If UUT is HD capable, otherwise 480i



Issue #5: DOE seeks comment on the modification service providers make to content providers' signals. Does a specific channel use similar frame rates, encoding, and bit rates across different service providers or locations?

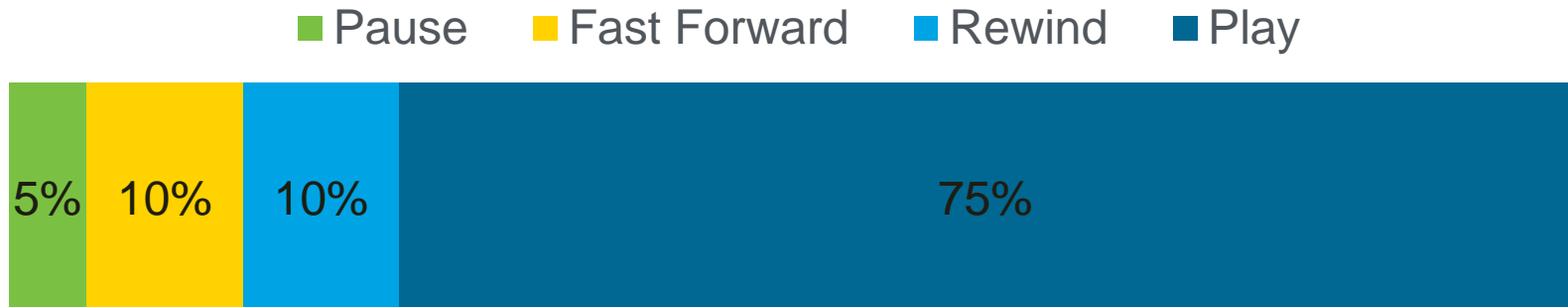
Issue #6: DOE seeks comment on the variance in energy based on the video content. Would sports content (more dynamic) have significant differences in energy consumption compared to news content (more static)?

Issue #7: DOE seeks comment on the feasibility of determining frame rate, bit rate, and video format being received by the STB.

Issue #8: DOE seeks comment on any other parameters of the video source that impact the energy consumption STBs

- ENERGY STAR testing requires splitting the active mode measurement between Pause, Fast Forward, Rewind, and Play for units with DVR
- A single measurement is taken, divvied up as indicated in the chart below

DVR Testing Breakdown



- DOE has concerns that the DVR test results depend on the order in which the operations are performed as well as the speed of Fast Forward and Rewind
- Furthermore, the ENERGY STAR method introduces an unnecessary human element into the results as testers must manually switch between DVR operations
- DOE is considering separating each DVR operation into independent tests

Issue #9: DOE seeks comment on handling DVR testing and requests data pertaining to typical usage of each operation (e.g., amount of time spent and speed used for each operation).

- Low Noise Blocks (LNB) improve signal reception for satellite STBs by down converting the high frequency television signal to frequencies more suitable for cable transportation
- LNBs can be powered independently or by a STB

Issue #10: DOE seeks comment on including LNB energy consumption in measurements. How much power does the LNB consume compared to the STB?

Issue #11: DOE seeks comment on what factors impact LNB energy consumption and whether they can be controlled in a lab setting.

Issue #12: DOE seeks comment on excluding LNB power from measurements. Is it possible to test the STB with the LNB disabled or disconnected? Are there any known methods for accurately measuring the LNB power to exclude it from the STB energy consumption?

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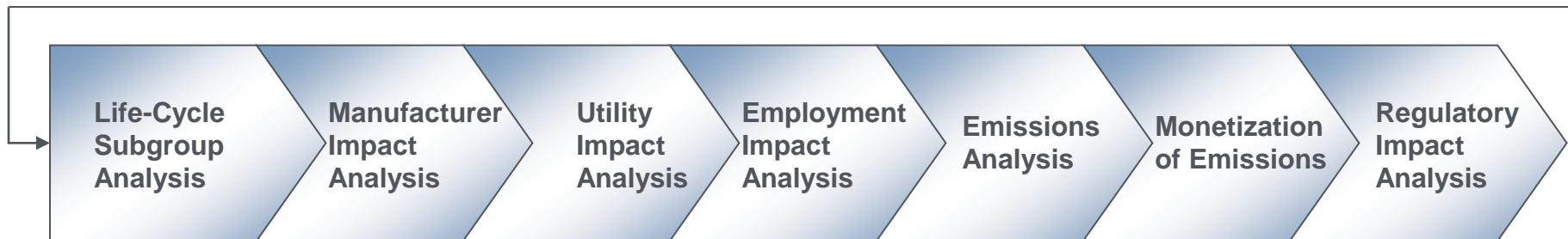
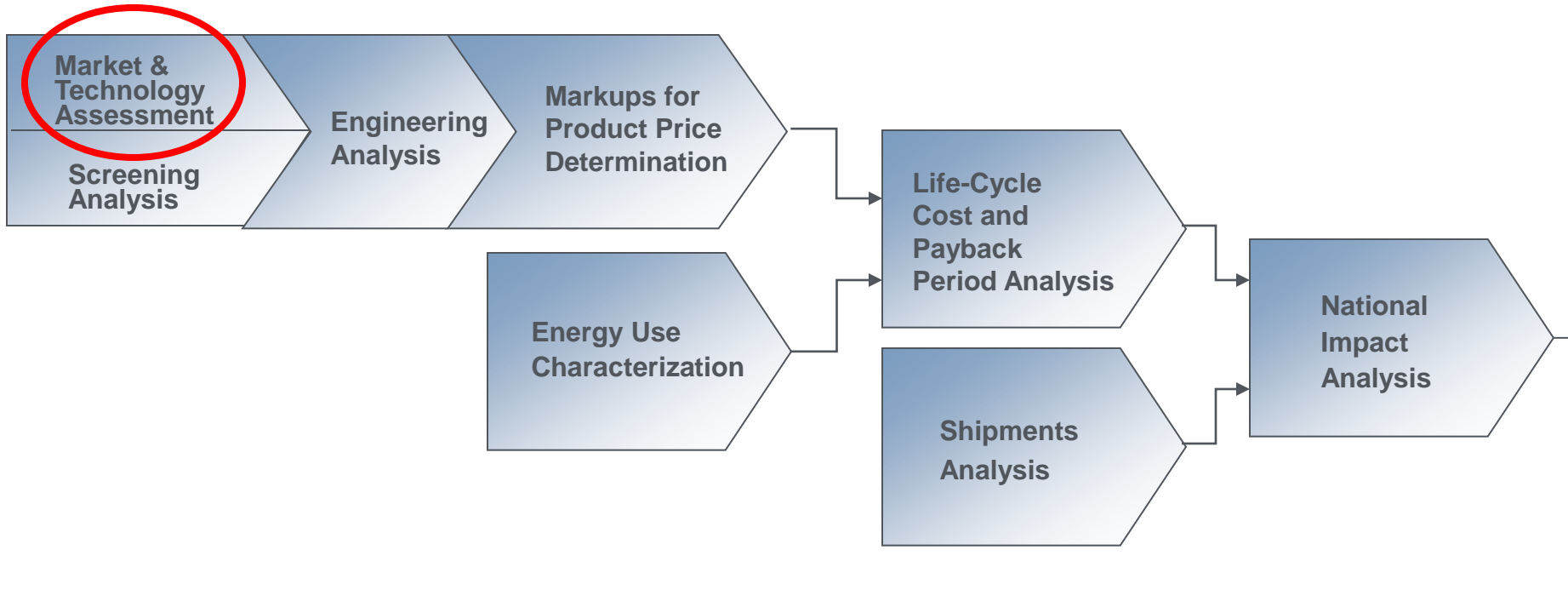
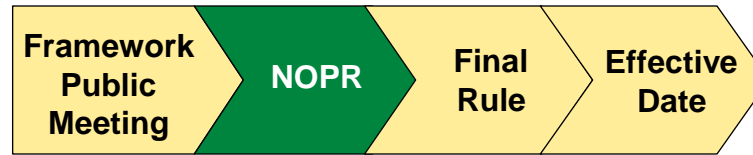
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Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



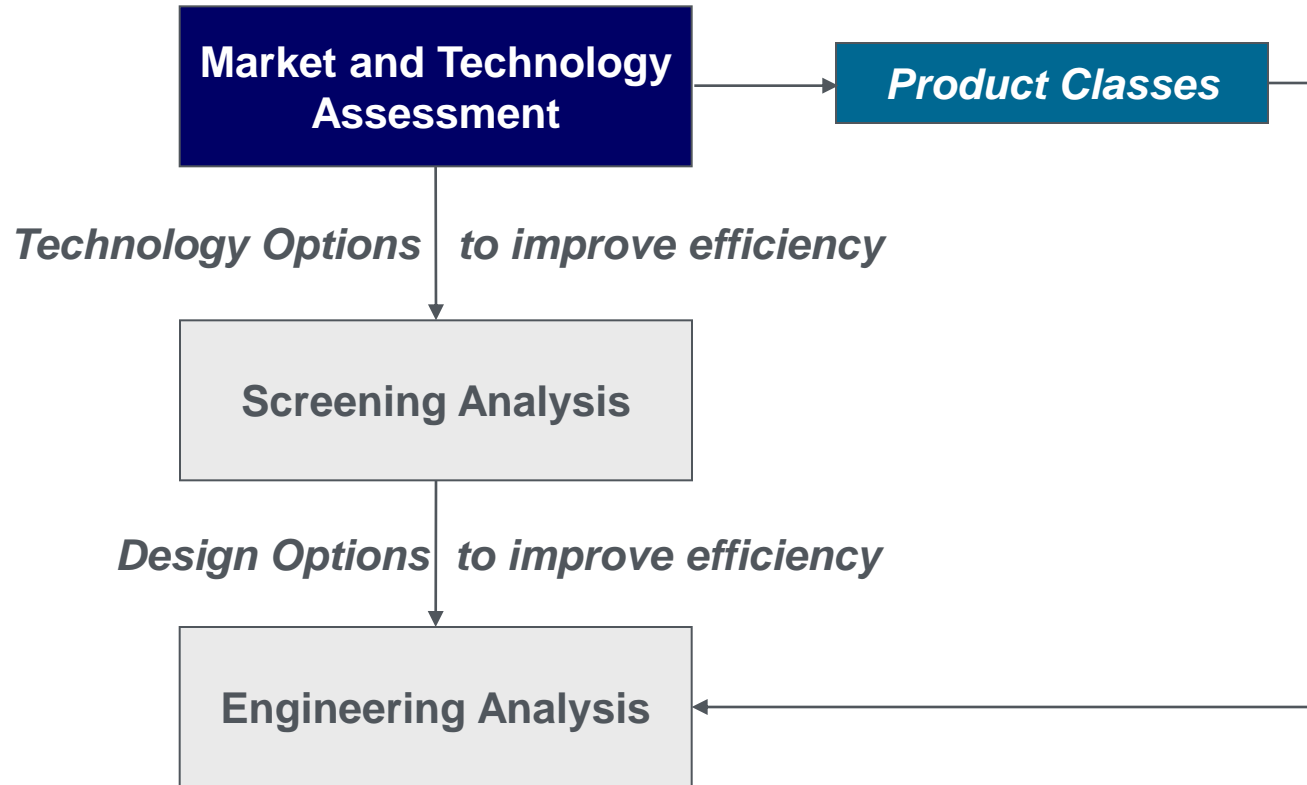
Purpose

- Characterize the markets, the relevant industries, and the measures to improve efficiency

Method

- Identify and characterize manufacturers and service providers of set-top boxes;
- Estimate shipments and trends in the market;
- Identify existing regulatory and non-regulatory initiatives applicable to the equipment covered under this rulemaking;
- Establish product classes; and
- Identify technologies that could improve efficiency.

Relationship of Market and Technology Assessment to Other Analyses



- ENERGYSTAR currently categorizes STBs into base functionalities (e.g., cable, satellite, IPTV) and additional allowances (e.g., HD, DVR, multi-room)
- For ENERGYSTAR, Each STB would have a specific energy consumption qualification based on the unique functionality and features of the STB.

ENERGYSTAR Allowances		
Base Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Cable	60	45
Satellite	70	50
Cable DTA	35	25
Internet Protocol (IP)	45	25
Terrestrial	22	18
Thin-Client / Remote	35	20
Additional Functionality	Version 3.0 Allowance (kWh/year)	Version 4.0 Allowance (kWh/year)
Advanced Video Processing	12	8
CableCARD	15	15
Digital Video Recorder (DVR)	45	36
DOCSIS®	20	15
High Definition (HD)	25	16
Home Network Interface (HNI)	10	8
Multi-room	40	30
Multi-stream (Cable/Satellite)	16	8
Multi-stream (Terrestrial/IP)	6	6
Removable Media Player	8	8
Removable Media Player/Recorder	10	10

- In general, classes are defined using information obtained in discussions with manufacturers, trade associations, and other interested parties.
- DOE is reviewing the ENERGY STAR base functionalities and energy allowances and seeing how DOE's product class criteria may be applied.
- DOE believes that some of these functionalities and allowances could be combined into the base product and thus, would not require separate product classes

Example of Cable Product Classes

- Advanced Video Processing (AVP), High Definition (HD), and Cable CARD assumed to be included in all future cable STBs.
- Removable Media does not require a different product class.
- DVRs would include multi-stream and multi-room functionality.
- Home Network Interface (HNI) and DOCSIS would be combined into a single “networking” functionality.

Description	Base Type	HD	AVP	DVR	Multi-stream	Multi-room	HNI	DOCSIS	Cable CARD
Cable Base	Cable	X	X						X
Cable with Networking	Cable	X	X				X	X	X
Cable DVR	Cable	X	X	X	X	X			X
Cable DVR with Networking	Cable	X	X	X	X	X	X	X	X

- AVP and HD assumed to be included in all future satellite STBs.
- Removable Media does not require a different product class.
- DVRs would include multi-stream and multi-room functionality.
- HNI would not require a different product class, but may be folded into the DVR or base type.

Description	Base Type	HD	AVP	DVR	Multi-stream	Multi-room	HNI
Satellite Base	Satellite	X	X				?
Satellite DVR	Satellite DVR	X	X	X	X	X	X

Example of IP Product Classes

- AVP, HD, and HNI assumed to be included in all future IP STBs.
- Removable Media does not require a different product class.
- IP boxes can provide multi-stream and multi-room independent of DVR functionality.

Description	Base Type	HD	AVP	DVR	Multi-stream	Multi-room	HNI
IP Base	IP	X	X				X
IP with Multi-room	IP	X	X		X	X	X
IP DVR	IP	X	X	X	X	X	X
IP DVR with Multi-room	IP	X	X	X	X	X	X

- Other product classes assumed to include HD and AVP.
- Terrestrial and Thin-Client would not be expected to have any other features requiring different product classes.

Description	Base Type	HD	AVP	DVR	Multi-stream	Multi-room	HNI
Terrestrial	Terrestrial	X	X				
Thin-Client	Thin-Client	X	X				

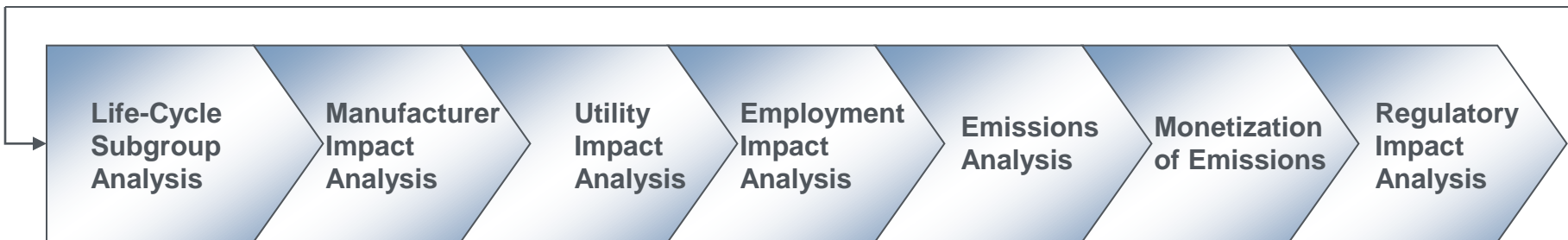
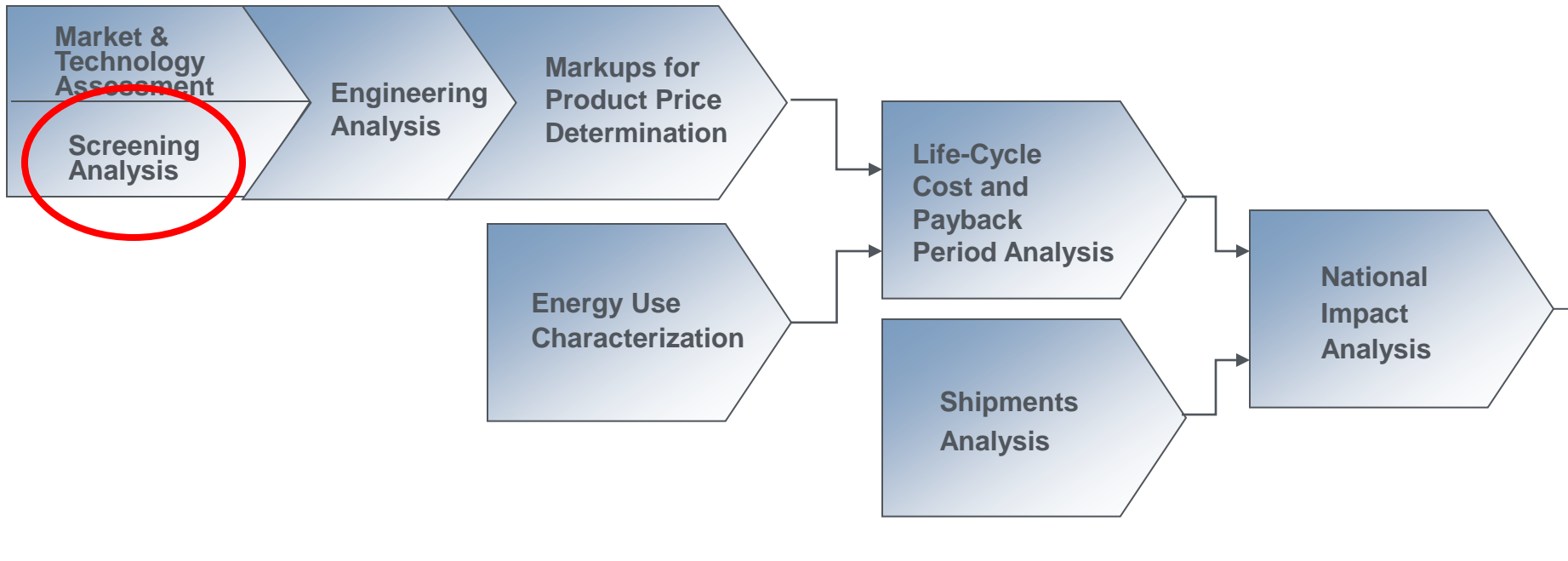
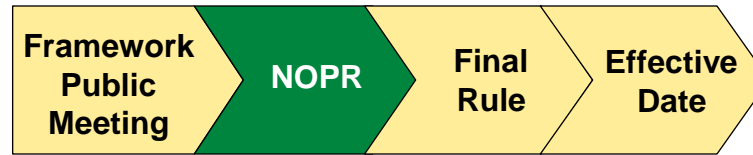
Issue #13: DOE welcomes feedback on what product classes should be considered, how many classes to consider, and potential methods to combine or reduce the number of product classes.

Issue #14: DOE welcomes feedback and the impact on baseline energy consumption of potential product classes

Issue #15: DOE welcomes feedback on the market share of potential product classes.

Issue #16: DOE welcomes comment on consideration of ENERGY STAR's definitions of base functionalities and additional features, as a starting point for determining product classes.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



Purpose

- Screen out technology options that DOE will not consider in the engineering analysis for set-top boxes.

Approach

- DOE will evaluate each technology option based on the following criteria:

Technological feasibility

Practicability to manufacture, install, and service

Adverse impacts on product or equipment utility or availability to consumers

Impacts on health or safety

- DOE has preliminarily identified the following strategies for improving the efficiency of STBs
 - Power management features
 - Place processor and video decoder in a low power state (e.g. powered off or low voltage/performance state).
 - Maintain active network connections needed for security.
 - Keep RAM powered to maintain state.
 - Multi-room setups. Secondary STBs in a home could be replaced by lower power thin clients that interface with a primary STB in the home. Whole-house STB energy use may be lower using multi-room setups.
 - More efficient components (e.g. power supplies and electronic components)
 - Reduced disk energy for DVR STBs (e.g. Solid State Drives)

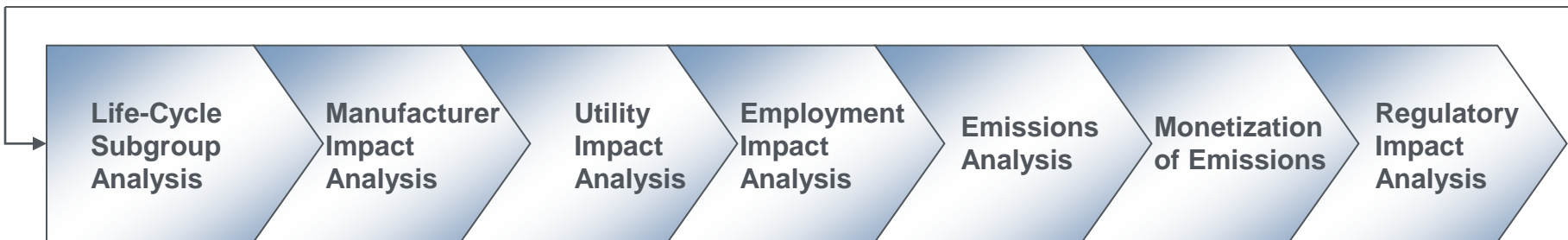
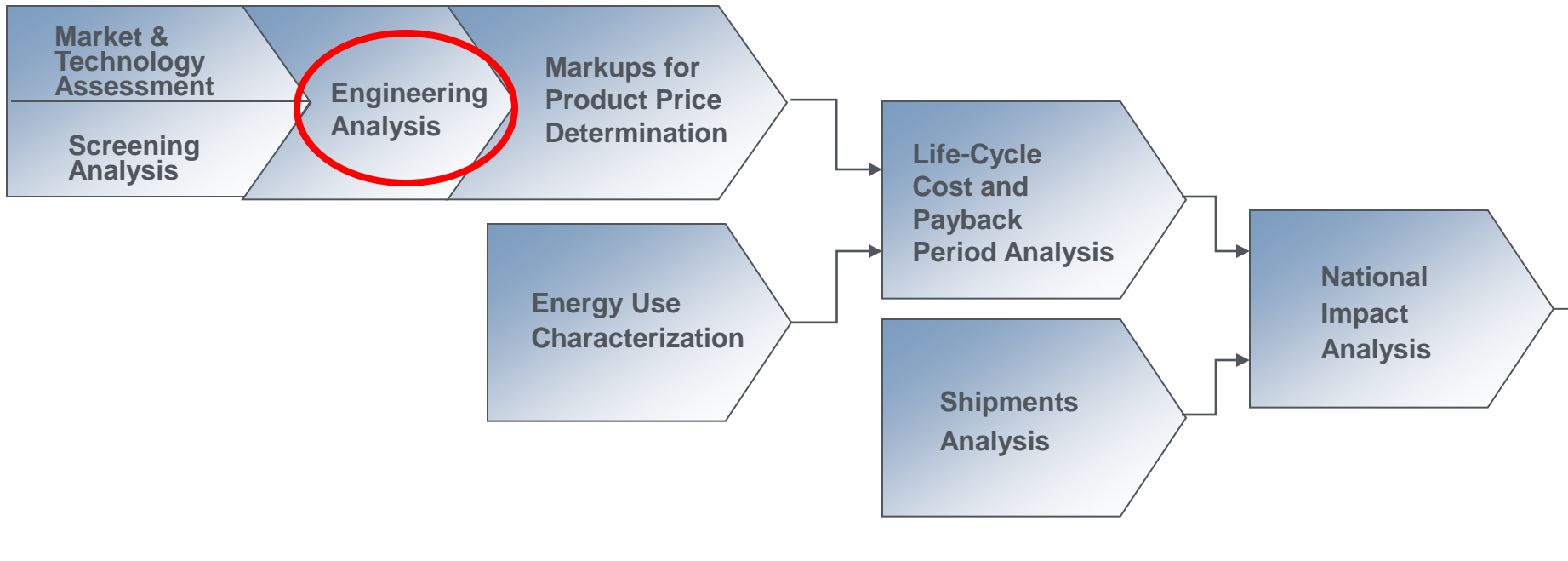
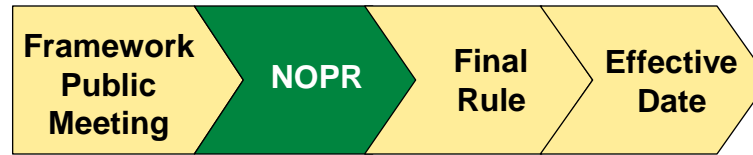
Issue #17: DOE welcomes comments on how the screening criteria might apply to the technology options discussed in the preliminary market and technology assessment.

Issue #19: DOE is also interested in other examples and data of energy-reducing technologies, configurations, or product designs, other than sleep modes, that could help improve the efficiency of STBs?

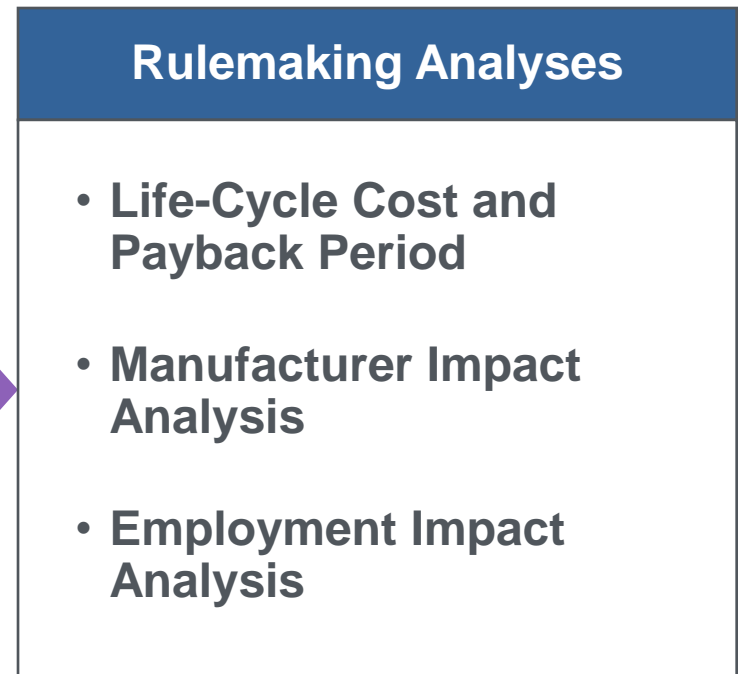
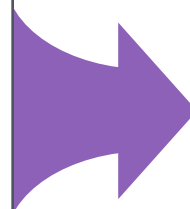
Issue #18: Comments, data, and input into technological, economic, and competitive impacts of using lower power light sleep and deep sleep modes for STBs. DOE is particularly interested in technological features that could significantly reduce energy consumption while providing for adequate communication with services providers and minimizing wake-up times when consumers power on their devices.

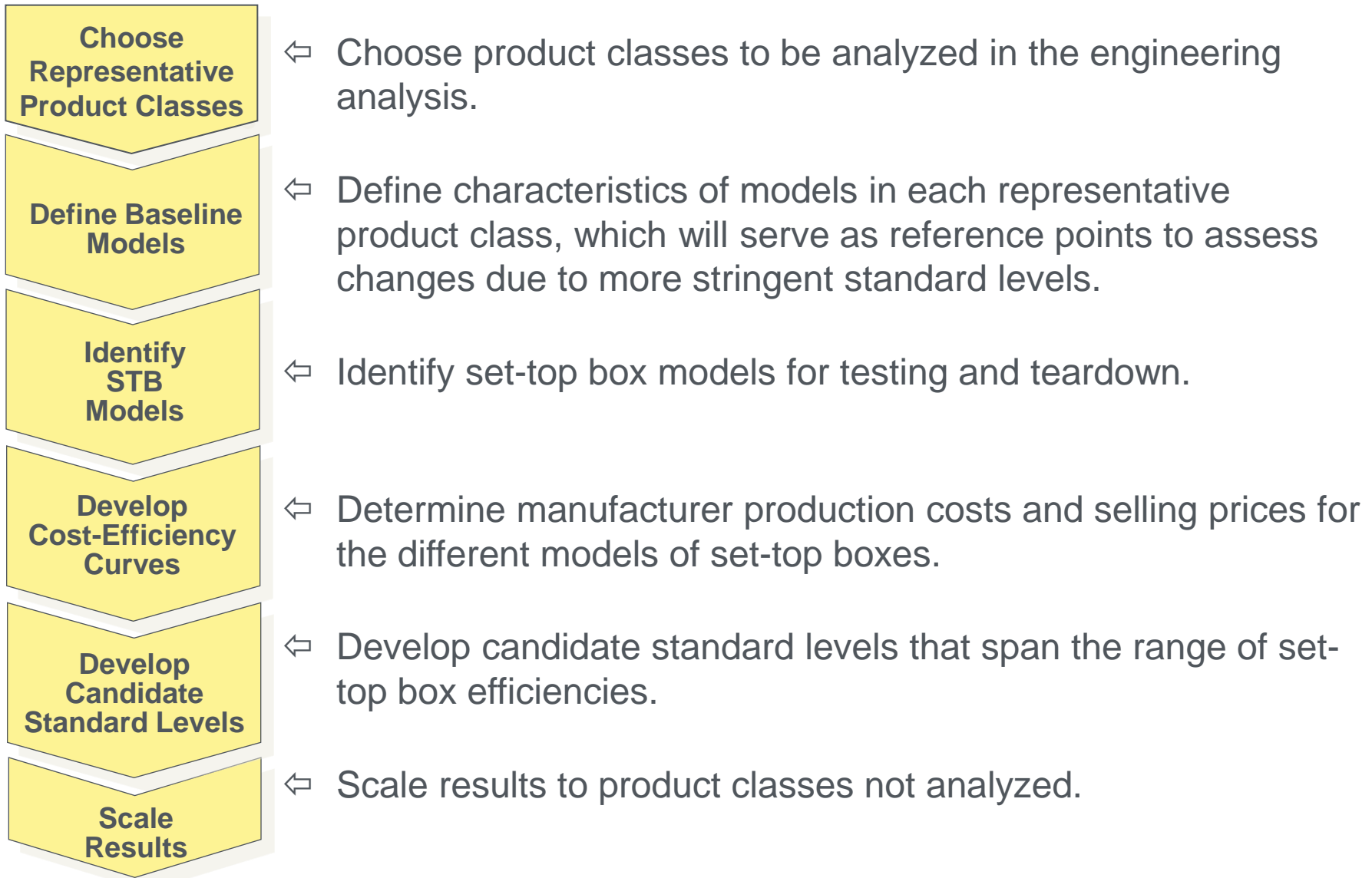
Issue #20: What design limitations are imposed on STBs by the cable, satellite, terrestrial, or internet infrastructure? How might this affect STB behavior/usage profiles? How might this affect STB energy consumption?

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking

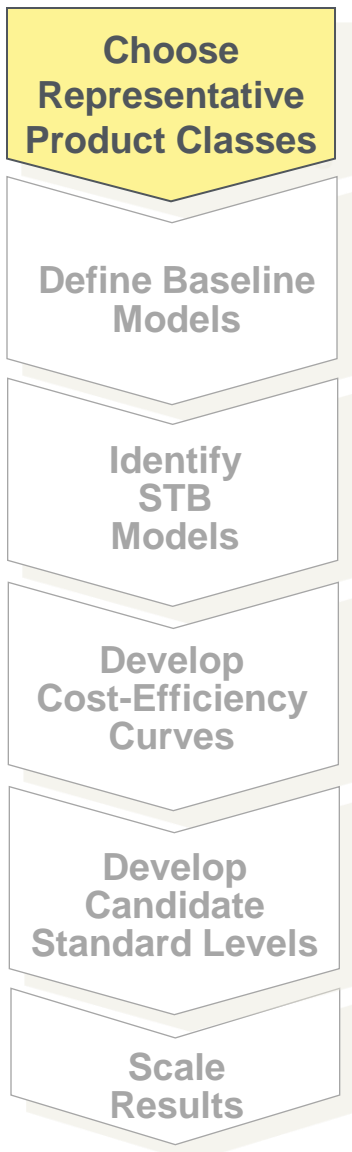


- A key factor in setting the standard is the increased cost of a more efficient product.
- The Engineering Analysis determines the relationship between cost and efficiency.





Choose Representative Product Classes



- DOE will choose a subset of product classes called “representative product classes” to analyze in the engineering analysis and life-cycle cost analysis.
- There may be too many product classes to analyze.
- Representative product classes are generally based on:
 - High volume products
 - Ability to scale to other classes
 - Unit availability
- For Set-top Boxes, all features relevant to energy consumption will be included in at least one representative product class.

Choose
Representative
Product Classes

**Define Baseline
Models**

Identify
STB
Models

Develop
Cost-Efficiency
Curves

Develop
Candidate
Standard Levels

Scale
Results

After the product classes are chosen, the characteristics of the baseline unit for each class are defined:

- Defines a reference point against which changes in efficiency and cost can be measured.
- Represents a commercially available unit including operating capabilities, energy efficiency and price.
- The baseline model is used in the life-cycle cost and payback analyses.
- To determine energy savings and change in price, each higher efficiency design option is compared with the baseline model.

Identify Higher Efficiency Set-top Box Models

Choose
Representative
Product Classes

Define Baseline
Models

Identify
STB
Models

Develop
Cost-Efficiency
Curves

Develop
Candidate
Standard Levels

Scale
Results

- In identifying higher-than-baseline-efficiency set-top boxes for analysis, DOE will begin by utilizing the ENERGY STAR qualified product lists for set-top boxes.
 - Higher efficiency models will be used to create cost vs. efficiency curves for each product class.
- DOE will evaluate all design options that are commercially available or present in a working prototype, including proprietary designs and technologies.
- DOE will include STBs with a wide variety of features in order to determine the cost and energy use related to each feature.
 - Example: Units with DVR and without DVR would be included in this selection.

Identify Higher Efficiency Set-top Box Models

Choose
Representative
Product Classes

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Identify
STB
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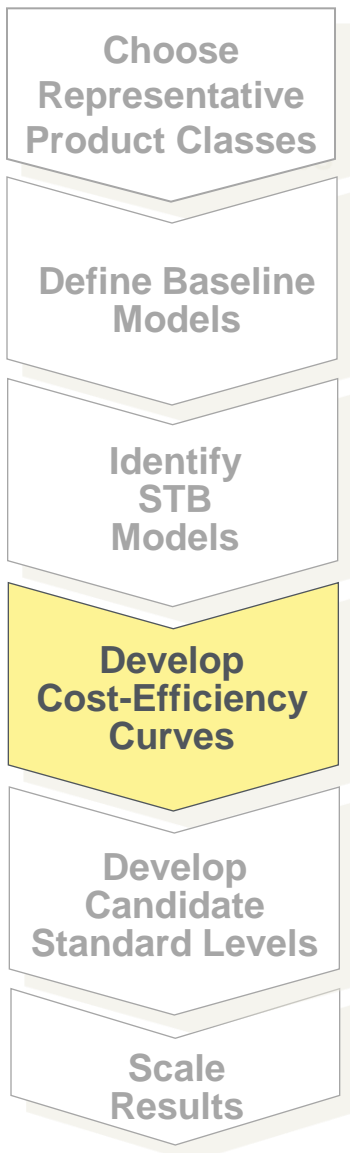
Develop
Cost-Efficiency
Curves

Develop
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Scale
Results

- Proprietary designs will only be considered if they do not present a unique path to a given efficiency level.

Issue #21: DOE welcomes comment on whether there are proprietary designs it should consider for any of the set-top box product classes under consideration in this rulemaking and, if so, how DOE should acquire the cost data necessary for evaluating these designs.



The engineering analysis may use one or more of the following approaches:

- The **survey approach** (the **efficiency** is known) relies on costs provided by manufacturers or from retail surveys to estimate the costs for various efficiency levels. (Quickest method)
- The **design options approach** (the **technology path** is known) uses estimates of the costs and performance of particular designs that increase efficiency. Design option efficiency increases can either be based on engineering calculations, test results or through the use of engineering computer simulation models.
- The **cost assessment approach** (the **efficiency** is known) estimates the manufacturing costs of efficiency levels by analyzing existing products, possibly including teardown of some units on the market.

Choose
Representative
Product Classes

Define Baseline
Models

Identify
STB
Models

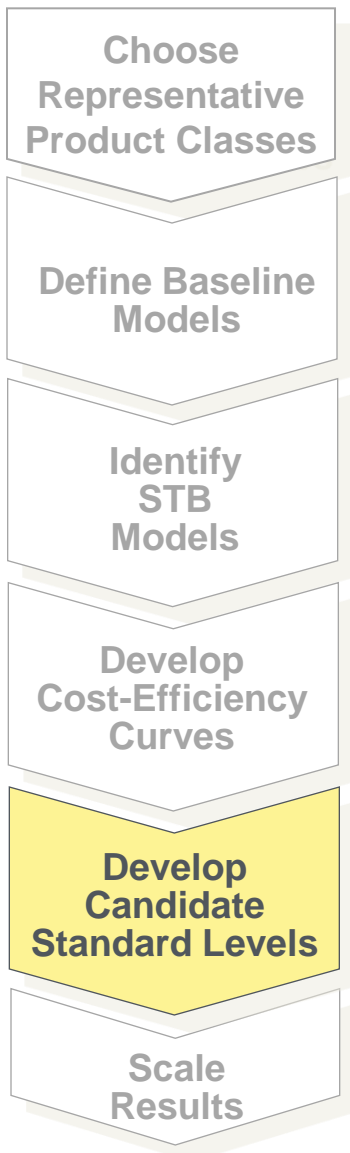
Develop
Cost-Efficiency
Curves

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Issue #22: DOE welcomes comment on approaches for developing estimates of STB costs.

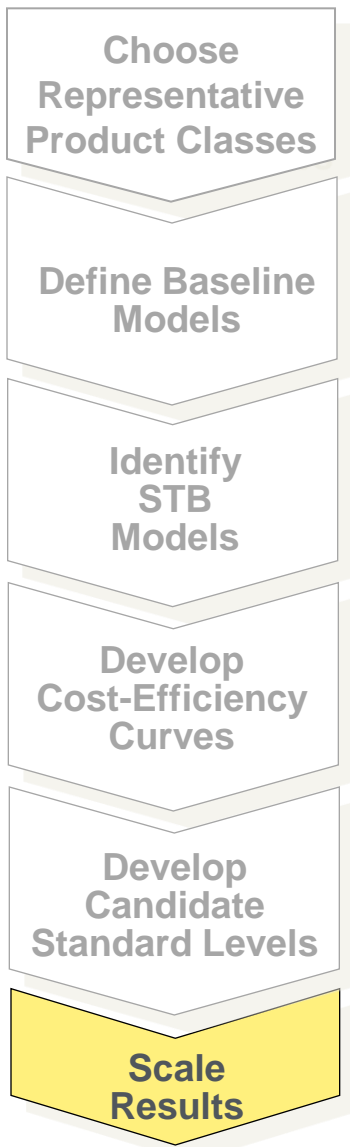
Issue #23: DOE welcomes comment on the above-described approaches to determining the relationship between STB cost and efficiency.



- Develop candidate standard levels (CSLs) that span the range of set-top box efficiencies from the baseline to the maximum technologically feasible.
- DOE is required to analyze maximum technologically feasible (“max-tech”) efficiency levels
 - “Max available” may not correspond to “max-tech” if some design options are not yet commercially available.
 - DOE will seek input from interested parties to develop a max-tech efficiency and cost.
- DOE may use ENERGY STAR specifications as intermediate CSLs



Issue #24: DOE welcomes interested parties to comment on methods and approaches employed to improve the efficiency of the set-top boxes, including the max-tech model. Detailed information on set-top box performance and the incremental manufacturing costs would be useful.



- Scale analyses conducted on representative product classes to other product classes.
- Representative set-top boxes will need to be scaled based on optional features TBD by DOE (e.g. DVR, Home networking, HD).
- Cost and efficiency values for each relevant feature will be generated by comparing STBs with and without each feature:
 - Component differences
 - Power differences
 - Architectural differences relevant to sleep/standby power modes

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Scale
Results

Issue #25: DOE welcomes comment from interested parties on the best methodology for scaling from the representative product classes to the remaining product classes, including the proposed methodology of assigning specific power requirements for additional features, similar to ENERGY STAR allowances.

- DOE takes into consideration the effects on manufacturers of other regulatory changes outside of the standards rulemaking process.

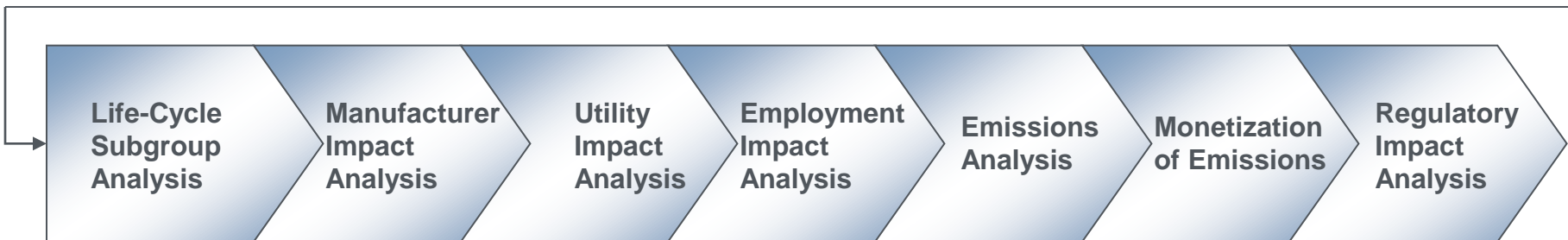
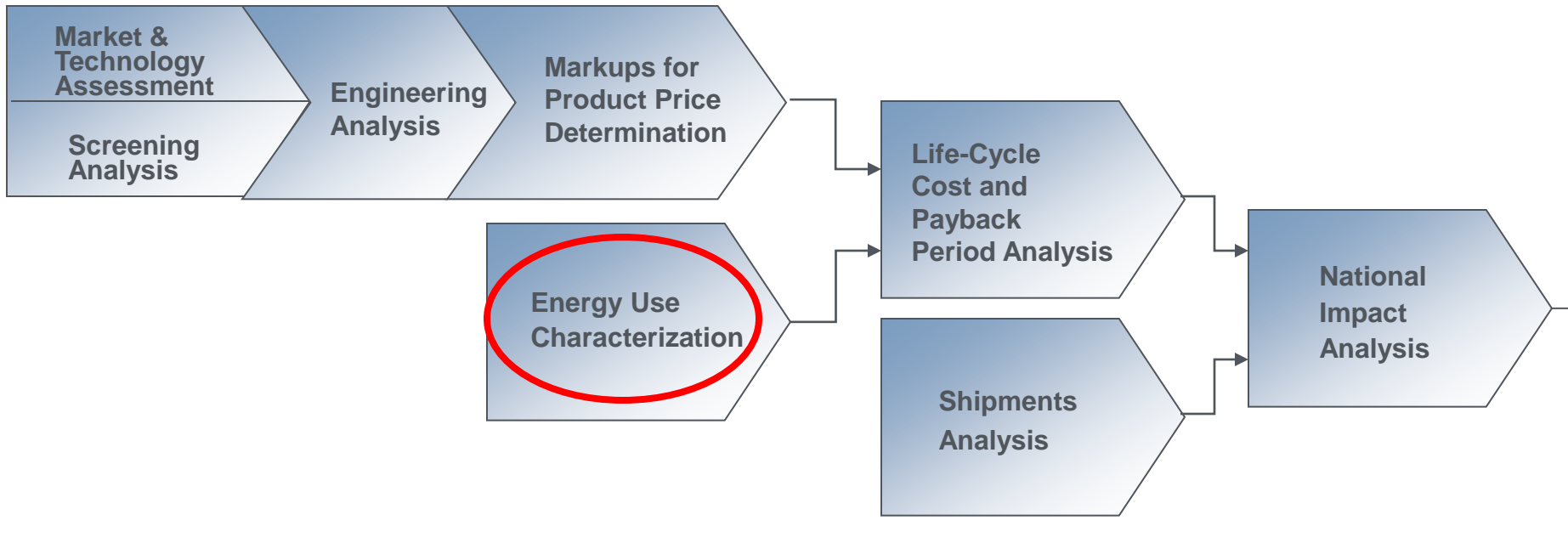
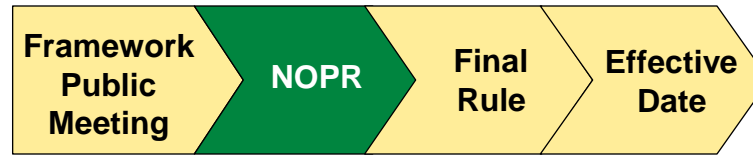
Issue #26: DOE welcomes comment on whether there are outside regulatory changes that DOE should consider in its engineering analysis of set-top boxes.

Issue #27: DOE seeks data on the energy use and configurations of current STBs in the market.

Issue #28: DOE would like to gain access to a subscription or head-end equipment similar to that of the consumer's access in order to test and perform physical teardowns of STBs.

Issue #29: DOE seeks additional data on STB markets and technologies, including updated energy use data on STBs by potential product class. This data includes numbers of installed devices, unit energy consumption, efficiency ranges, and usage profiles

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



Purpose

- Develop annual energy use data for set-top boxes based on field operating conditions, television viewing patterns, and STB usage patterns.

Method

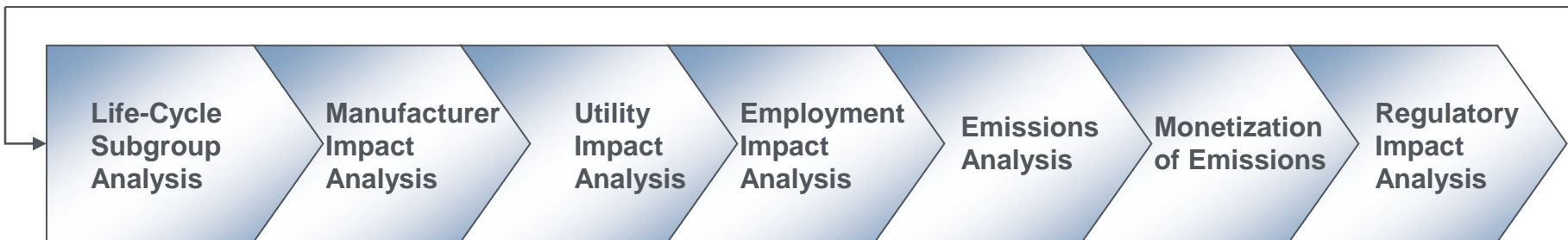
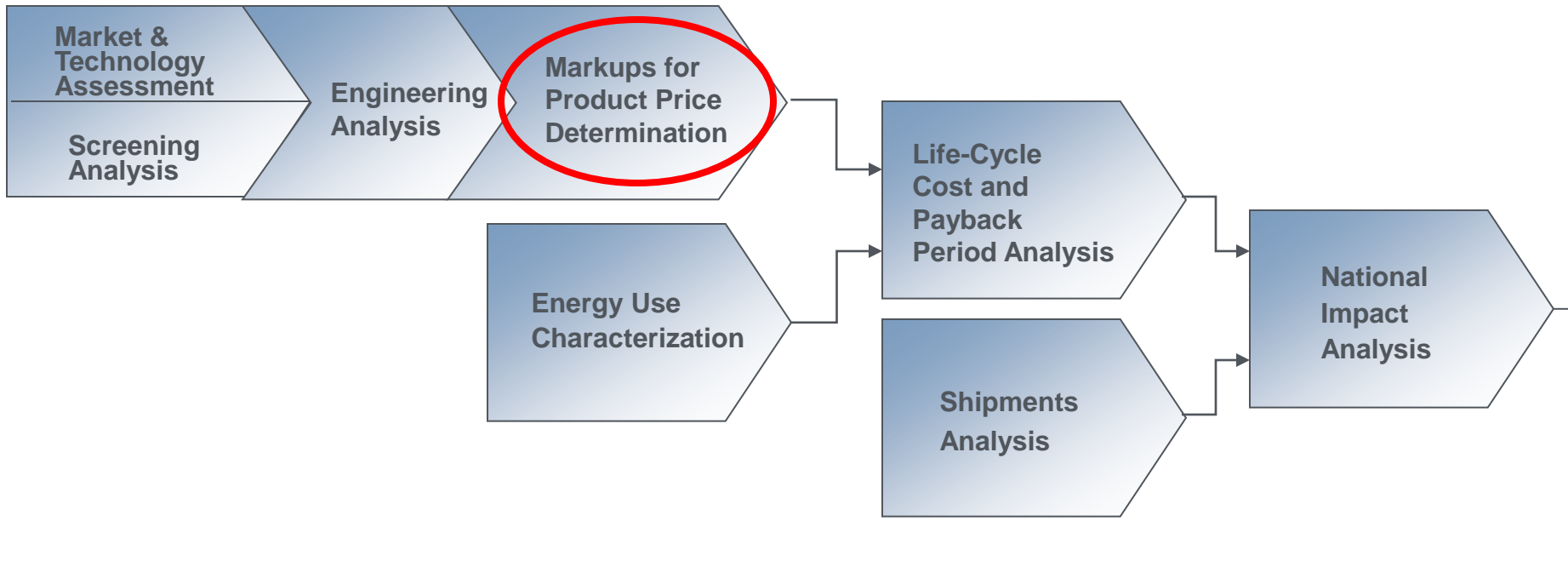
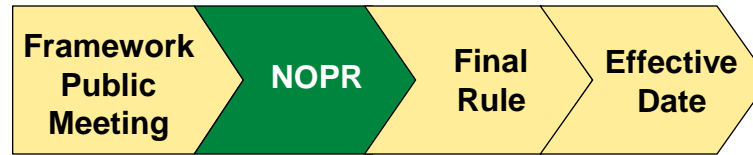
- Develop average energy use values by using typical television viewing patterns (both live and playback) and average set-top power levels in each mode.
- Develop distributions of set-top box operating hours and standby hours.
- Take into account operating variability by using a distribution of operating hours.

Issue #30: DOE seeks to identify and obtain detailed data on the typical usage profiles for set-top boxes considered in this rulemaking. If the range of energy use determined for each product class is large enough, DOE will conduct a sensitivity analysis to determine how high and low estimates of energy use might impact the economic feasibility of any potential energy conservation standards. DOE welcomes recommendations on sources of data that would provide usage profiles for each of the product classes covered under this rulemaking.

Issue #31: DOE welcomes comments on how the usage profiles are different (or similar) for each of the product classes covered under this rulemaking.

Issue #32: DOE welcomes comment on other end-use issues that could impact the energy use analysis

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



Purpose

- Determine consumer and service provider set-top box prices based on manufacturer costs, both for baseline and higher efficiency products.
- Characterize set-top box distribution channels.

Method

- Identify distribution channels.
- Estimate the consumer and service provider prices by applying markups (consisting of distribution channel markups and sales tax, if applicable) to manufacturer selling price estimates.
- Collect retail price data for validation purposes, if applicable.
- The engineering analysis will develop manufacturer markups.
- U.S. Census Bureau data
 - Manufacturing Industry Series data for calculating original equipment manufacturer (OEM) markups
 - Business Expenditure Survey for calculating distributor markups.

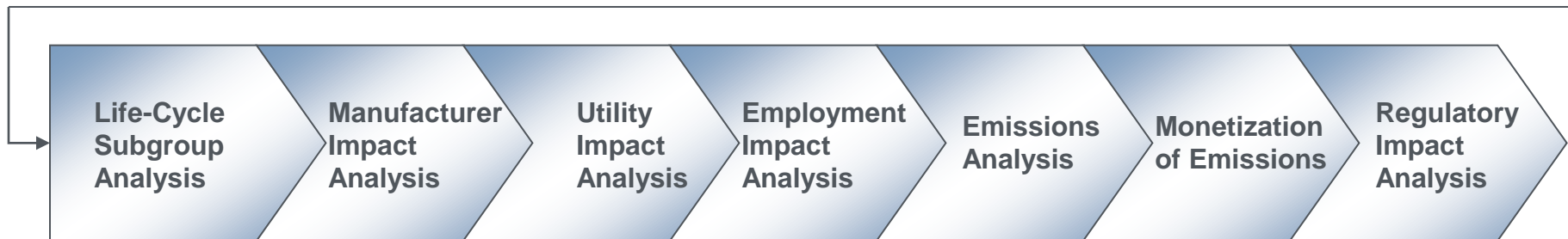
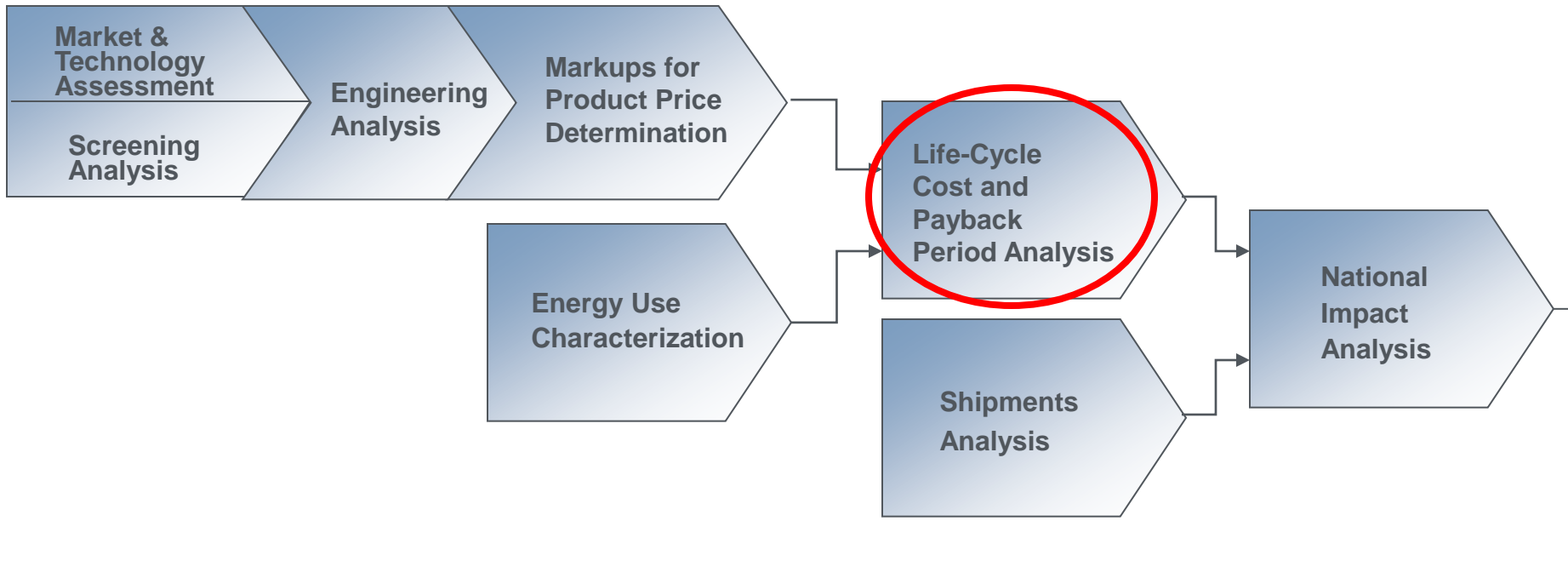
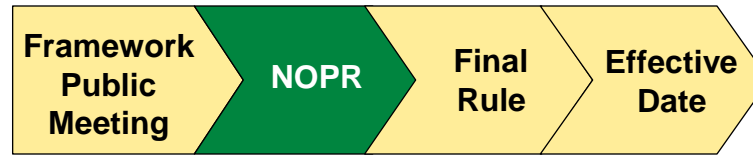
Unique Issues with STBs

- Equipment price actually paid by consumers can be difficult to assess
- Device may be “free”, though cost of device is actually included in base subscription fee
- Premiums for additional features (e.g., HD, DVR)
- Exact pricing strategy proprietary to service providers
- Some STBs rented or leased, others purchased from service providers
- Possible solutions:
 - confidential submission of data to accurately model equipment price markups from service providers to consumers
 - Simplifying assumptions – adopting same markups as from manufacturers to service providers

Issue #33: DOE welcomes feedback and data on how to properly address equipment price markups for set-top boxes. DOE also welcomes comment on the distribution chain for set-top boxes.

Issue #34: What changes to network infrastructure would be necessary for STB efficiency design options? What would be the cost of these changes? Would service providers pass these costs onto consumers in the form of increased fees?

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking

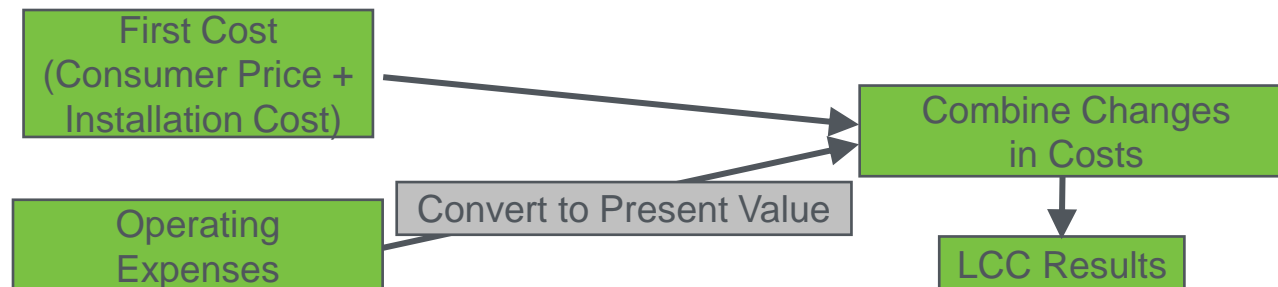


Purpose

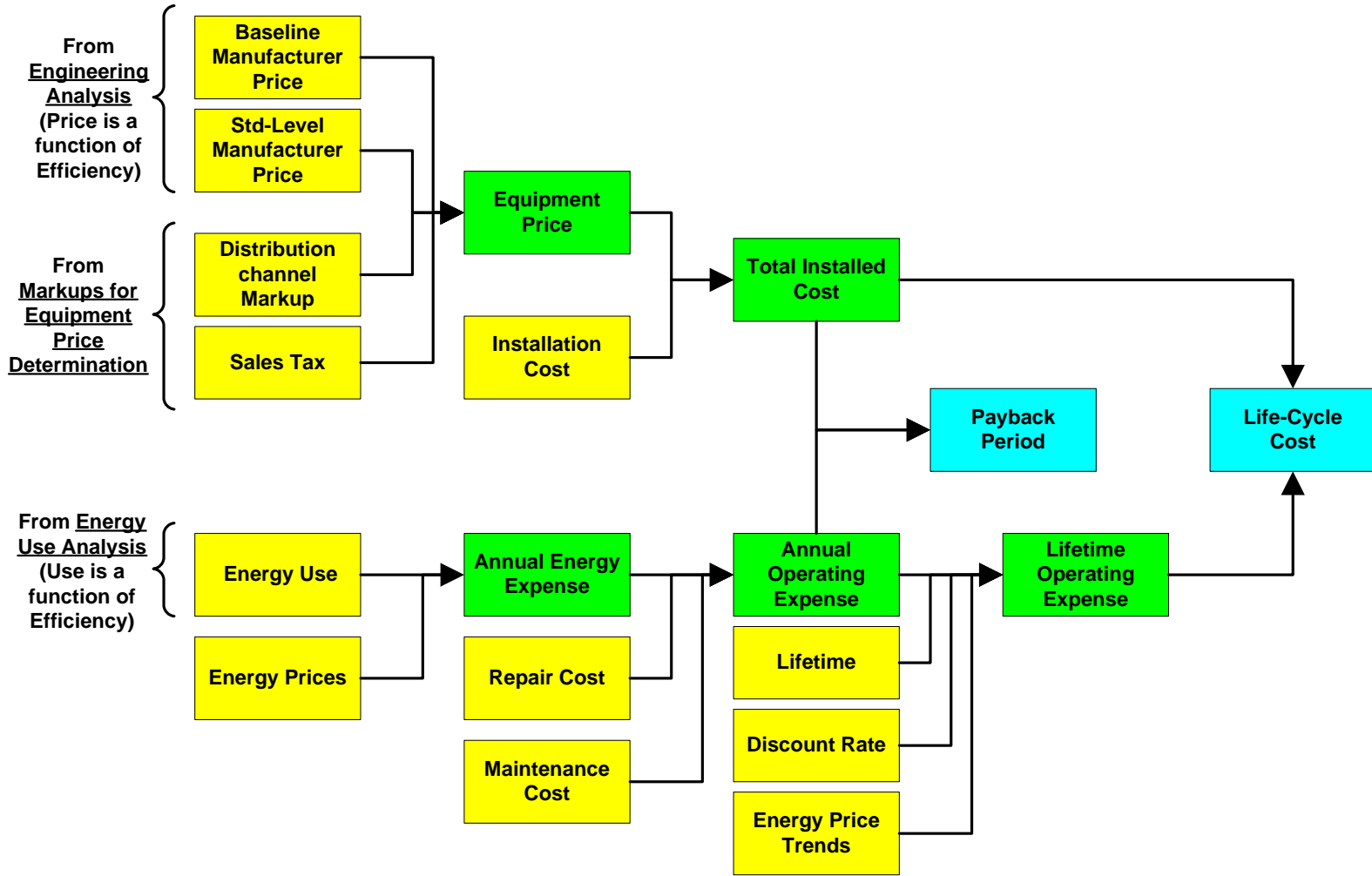
- Assess the LCC impacts and PBP for the consumers of set-top boxes under the considered efficiency levels.

Method

- LCC equals first costs plus the sum of annual 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 Analysis



- Electricity prices are used to convert energy use to energy costs.
- DOE will use projections of national average energy prices for residential customers – from the most recent EIA Annual Energy Outlook (AEO) – to forecast future energy prices for the LCC analysis.

Issue #35: DOE welcomes input on the proposed methodology for estimating current and future electricity prices.

- DOE uses the discount rate to determine the present value of lifetime operating expenses.
- DOE will derive a distribution of discount rates for the residential sector.
 - These distributions will be developed by estimating the weighted average cost of capital (WACC) for residential consumers of set-top boxes.
 - WACC includes:
 - Financial cost of any debt incurred to purchase products.
 - Opportunity cost of any equity to purchase products.

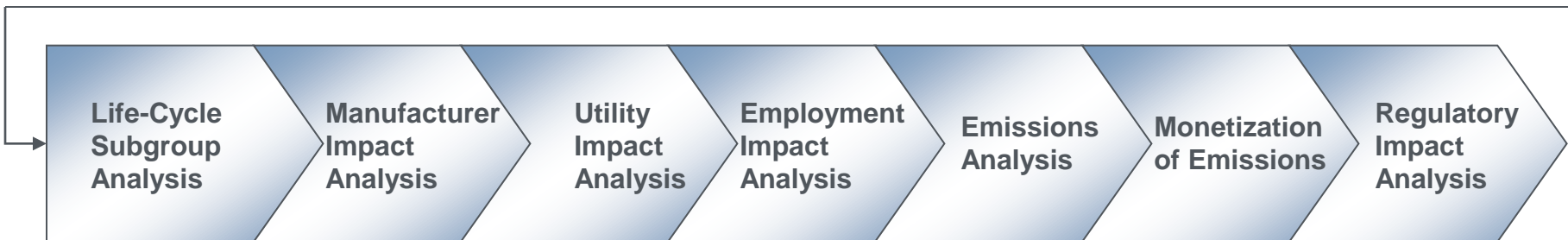
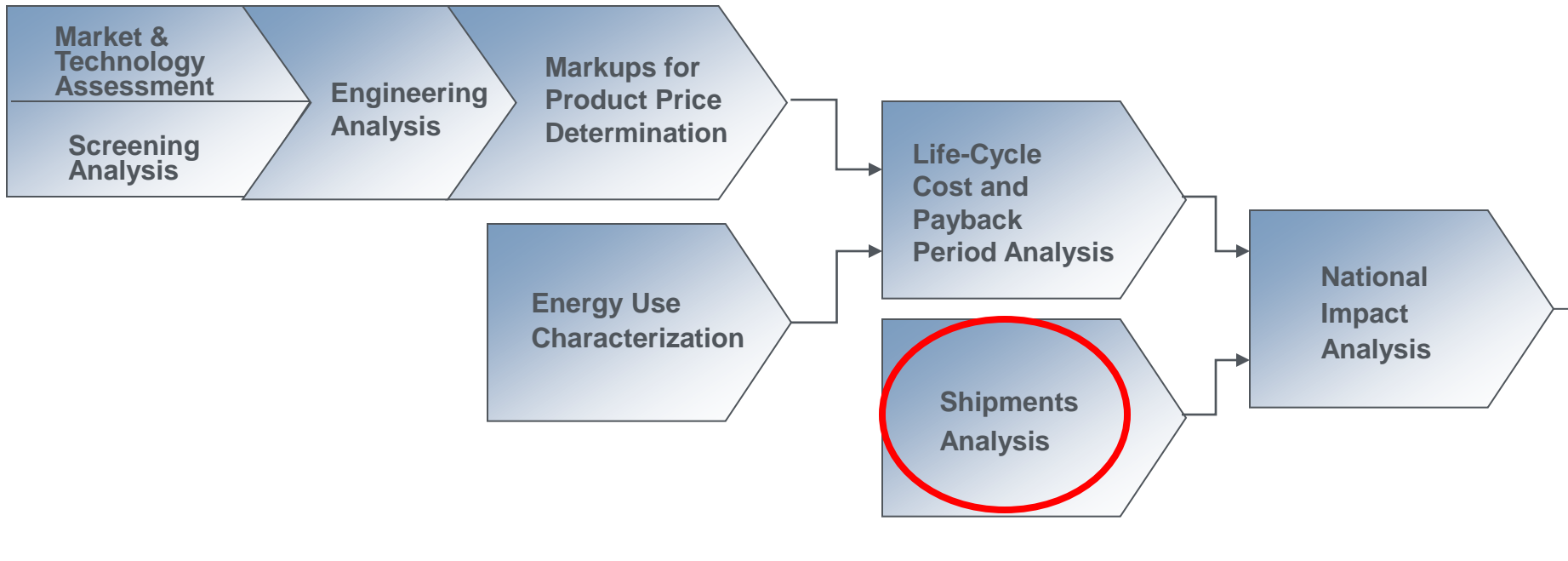
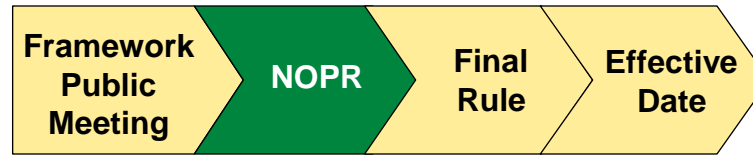
Issue #36: DOE welcomes input on the proposed approaches for estimating discount rates for consumers of set-top boxes covered under this rulemaking.

- DOE will evaluate how installation, maintenance, and repair costs change with increased efficiency, if applicable.
- DOE does not currently have information indicating that installation, routine repair, and maintenance costs are different for more efficient set-top boxes.

- DOE will use information from:
 - Manufacturer literature,
 - Various literature sources such as technical reports and conference proceedings, and
 - Inputs from manufacturers and other interested parties.
- DOE uses a distribution of lifetimes, based on the data available.
- For set-top boxes, will need to consider equipment returns and refurbishments when estimating total lifetimes

Issue #37: DOE welcomes comment and data on appropriate set-top lifetimes. DOE also welcomes comment on how returns and refurbishments impact total set-top lifetimes.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



Purpose

- To estimate set-top shipments in the base case and standards cases

Method

- The shipments model will rely on a range of data sources e.g.:
 - Manufacturers and industry organizations;
 - National market research reports;
 - National energy and set-top box use surveys.

- Option 1: Accounting methodology
 - New Installations: New STBs that are installed each year due to equipment growth in new housing. DOE proposes to determine this by using the EIA AEO 2011 projection of new housing starts.
 - Replacements: STBs that have failed. DOE bases this calculation on equipment sales and retirement rates.
 - Retrofits (early replacements): STBs replacing existing STBs during repair/update of equipment. This replacement may occur before the original STB has failed.
- Option 2: Model driven by total forecasted growth
 - Shipments model top-down, based on total shipments projections. Total shipments can be correlated to total housing projections or total population projections. This generally results in a changing household saturation of STBs.

- Provides the basis to compare forecasts for higher efficiency levels (standards case)
- Depicts the situation where new or amended standards are not adopted.
- Depicts the current and forecasted mix of STB efficiencies sold in the absence of new regulation.
 - DOE will develop projected market shares of products by efficiency under the base case.
 - DOE will use data on recent market trends in STB efficiency, as well as efficiency distributions based on available models and information from STB experts, as a proxy.
- Data requirements:
 - Historical shipments.
 - Breakdown of shipments product class.
 - Market share efficiency data

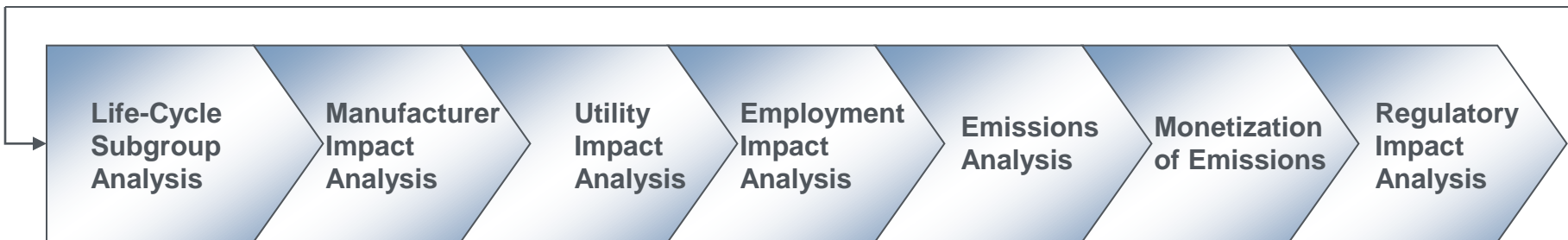
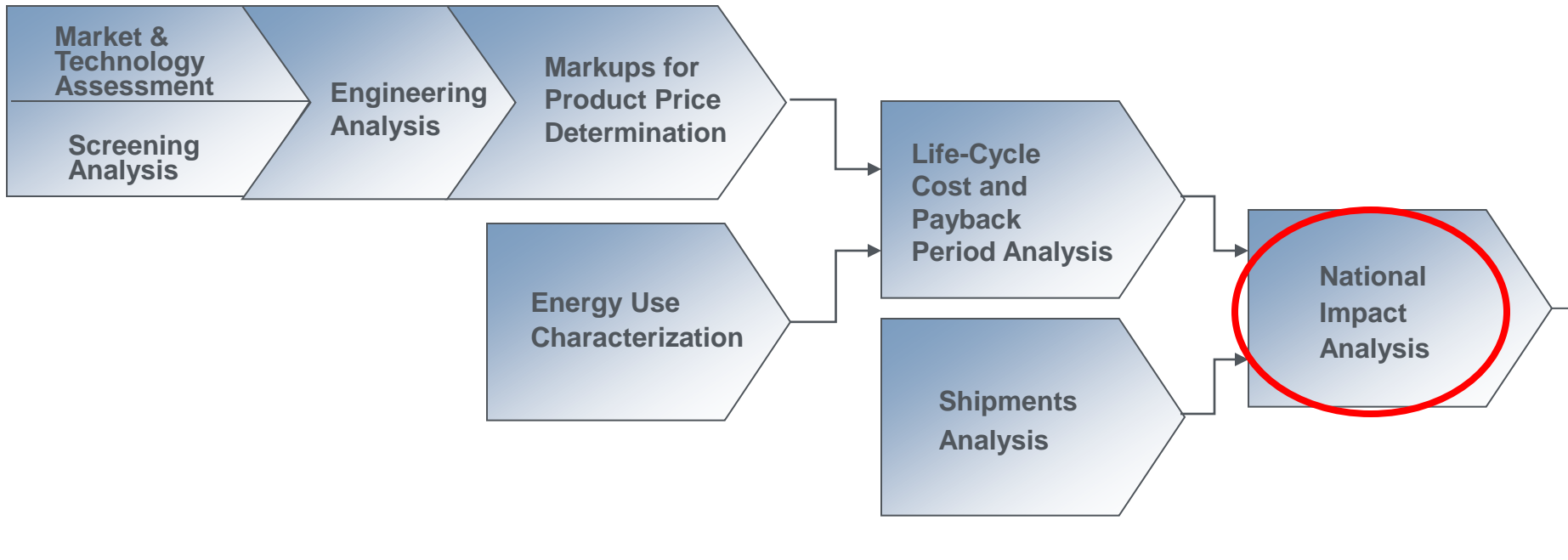
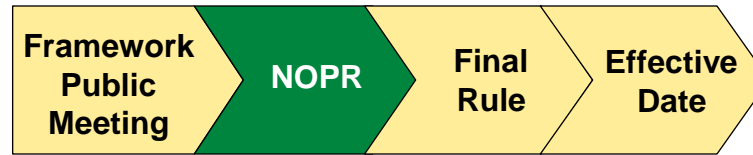
- DOE develops Standards-Case Forecasts from the same data it will use to develop the Base-Case Forecast.
- Standards-Case Forecasts may also use purchase price increases and operating cost savings to estimate shipments impacts (non-interactive effects).
- DOE is interested in cross-elasticity between different STB product classes covered in this rulemaking (interactive effects).
- DOE will also consider impacts from market-pull programs.

Issue #38: DOE welcomes recommendations on data sources for shipments of STBs by different product classes and long-term trends in STB shipments.

Issue #39: DOE welcomes comment on the shipment forecasting methodologies described above for each product class covered in this rulemaking. DOE also invites comments regarding the stock of STBs in use.

Issue #40: DOE welcomes comment on how any standard for STBs might impact shipments of these STBs, as well as interactions between various STB product classes. DOE also invites information about market-pull programs that promote the adoption of more-efficient STBs.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



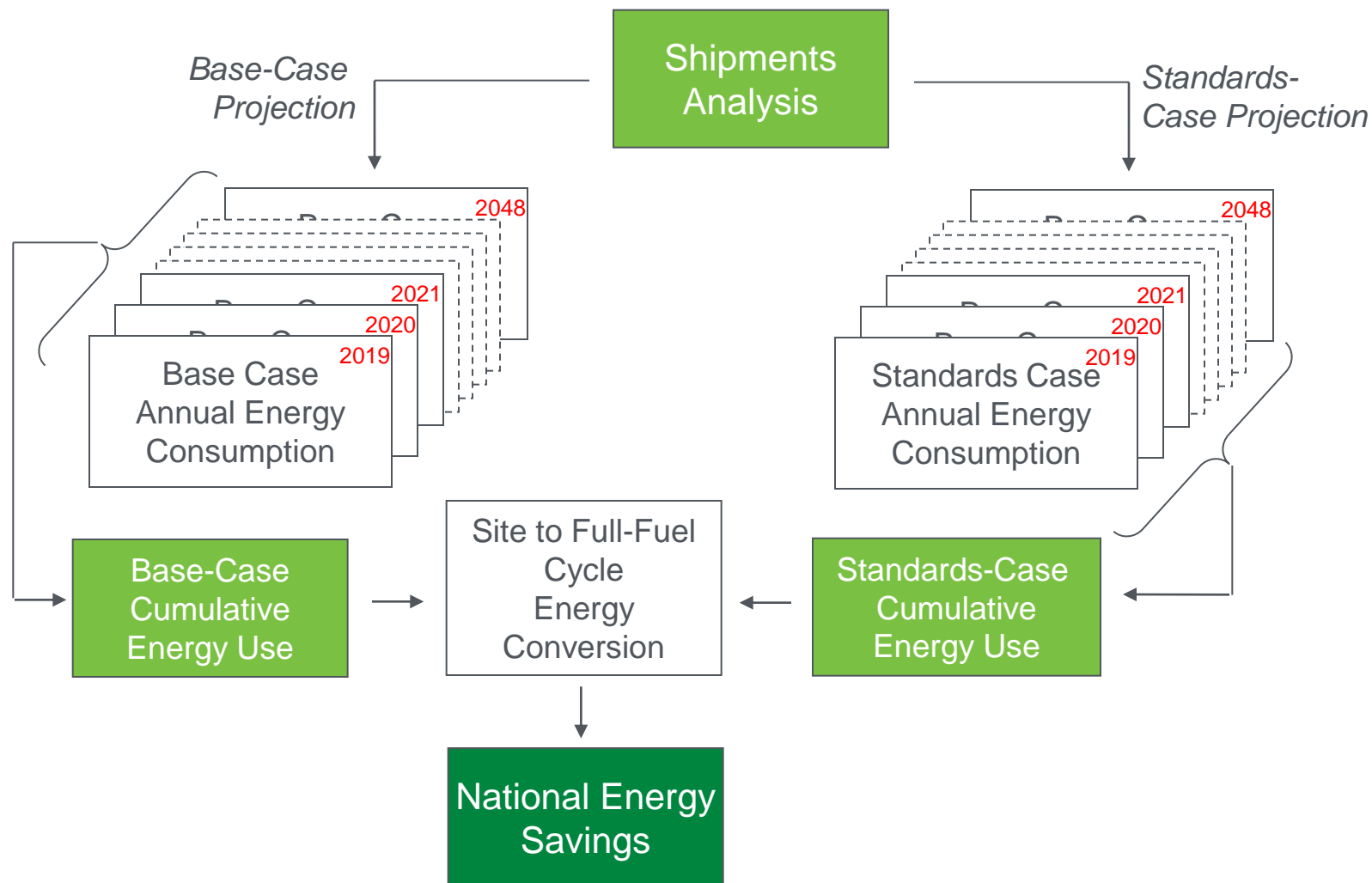
Purpose

- To assess the aggregate impacts at the national level of potential energy conservation standards for each of the product classes, in terms of net present value of total consumer economic impacts and national energy savings.

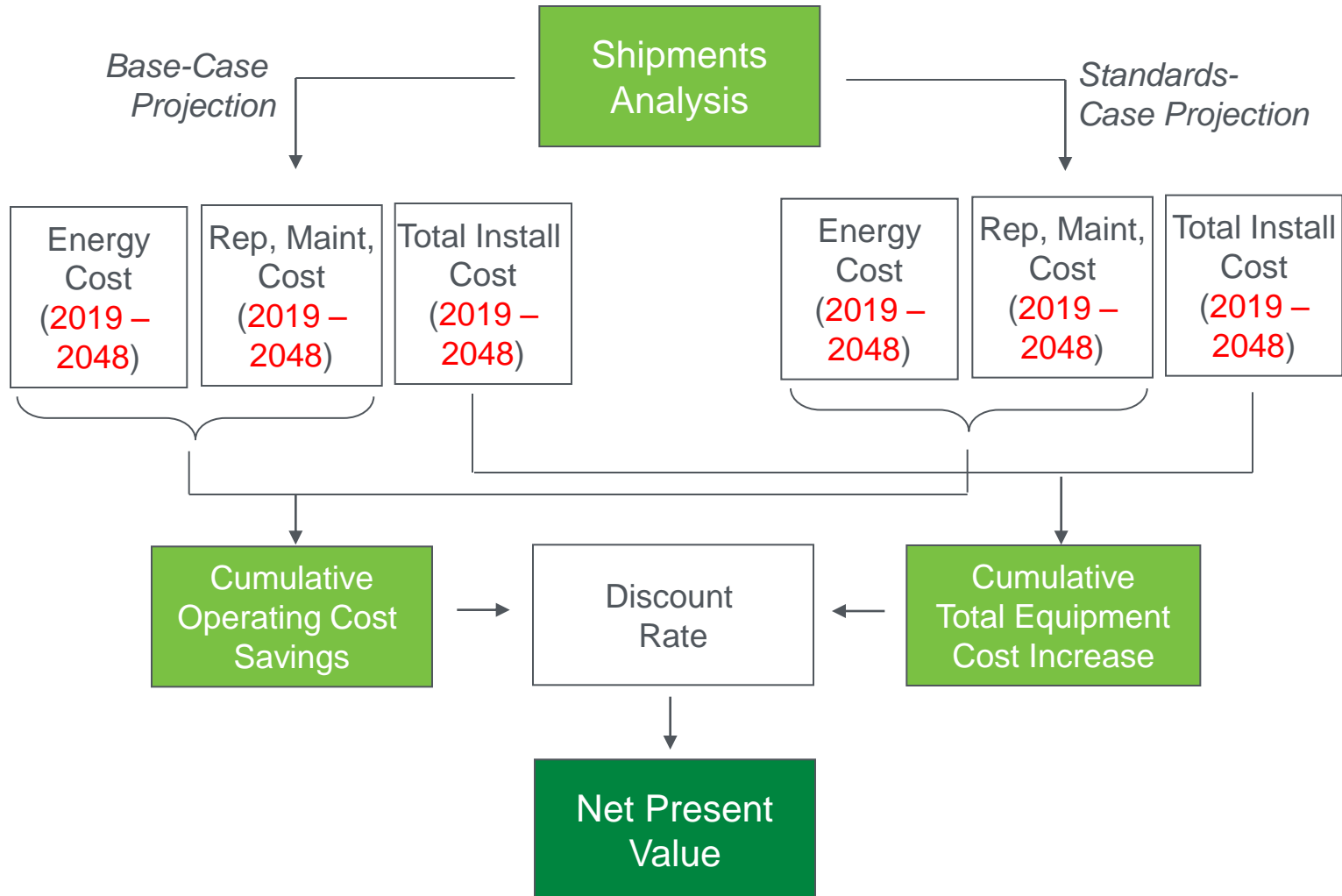
Method

- DOE calculates annual equipment expenditures by multiplying the price per unit by forecasted shipments. Operating expenses for each unit are tracked every year over the course of its lifetime.
- 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



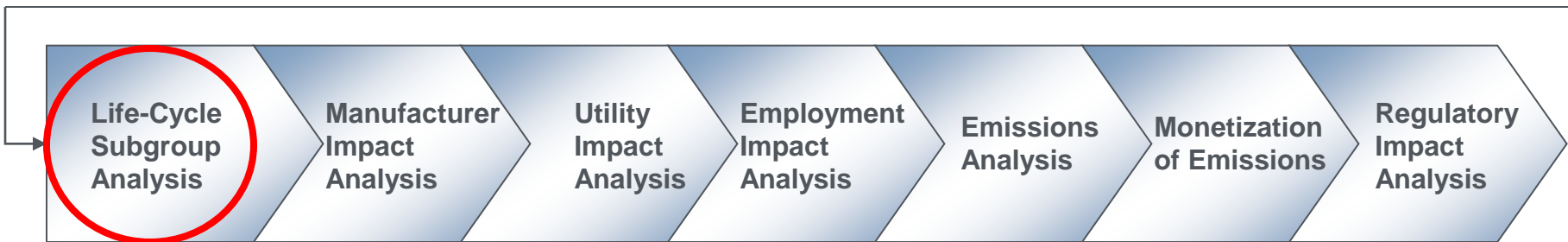
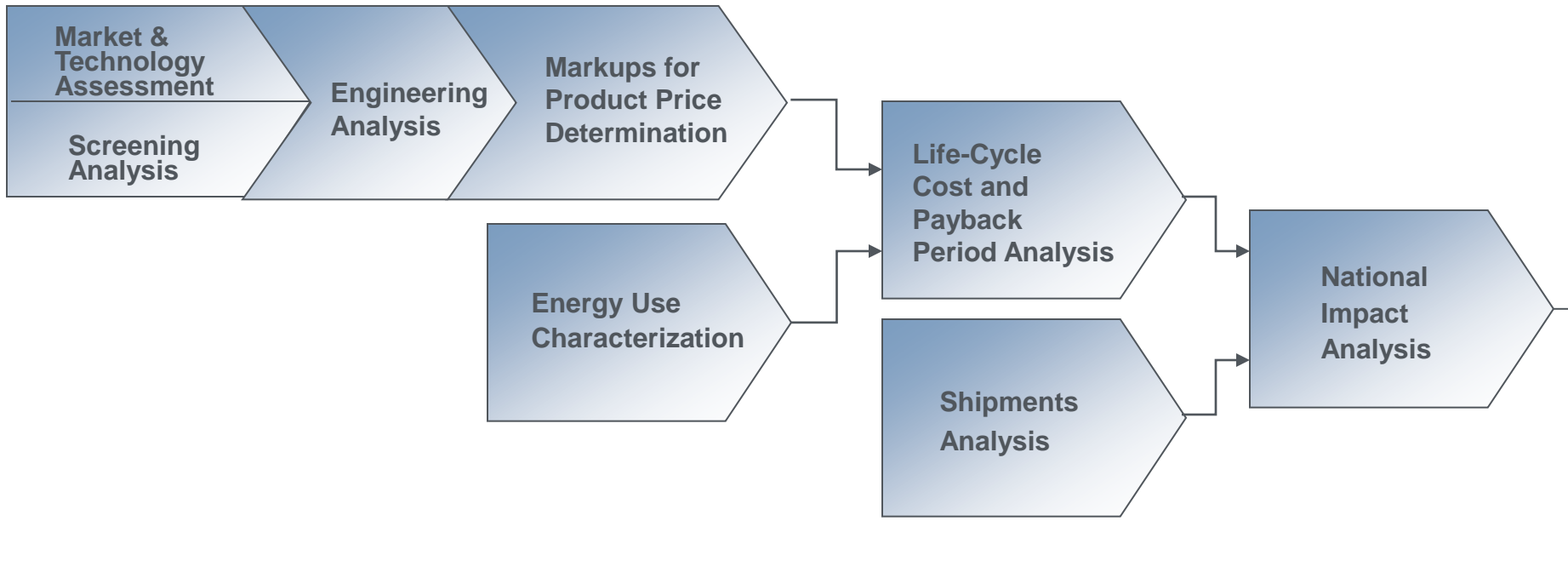
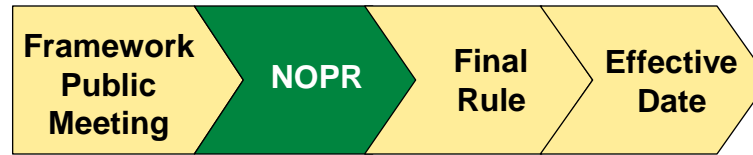
National Consumer Net Present Value Flow Diagram



- DOE intends to calculate national energy consumption for each year beginning with the expected compliance date of the standards and over a 30 year period.
- DOE will use the DOE National Energy Savings (NES) spreadsheet for standard rulemakings.

Issue #41: DOE welcomes comment on the NES spreadsheet models it proposes to use for estimating national impacts of energy conservation standards for STBs.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



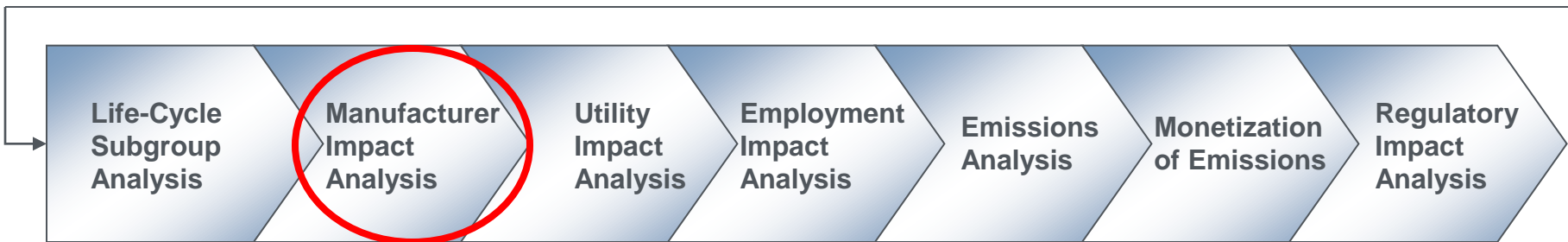
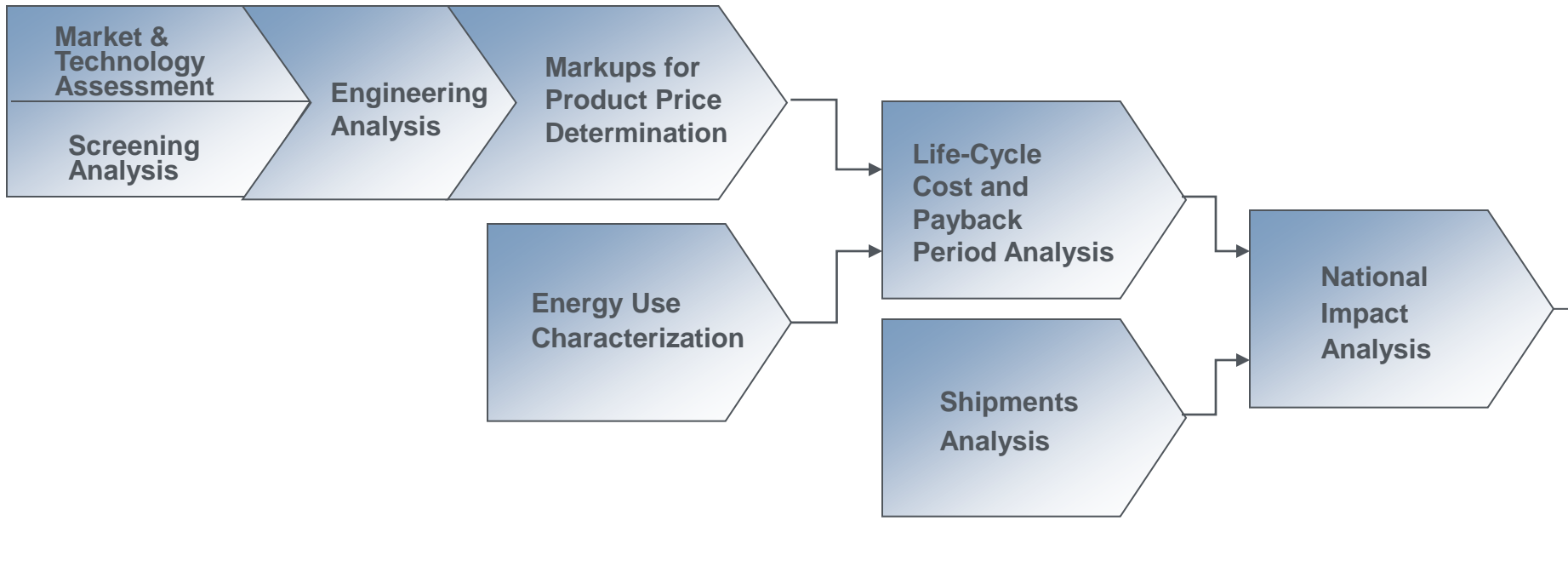
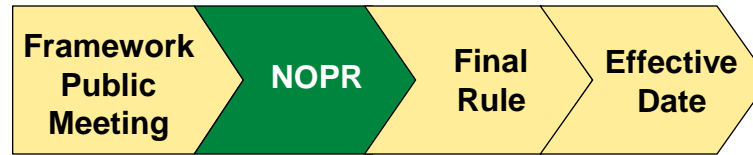
Purpose

- Analyze the economic impacts of standards on consumers, including subgroups who may be disproportionately impacted compared with the general user population.
 - A subgroup comprises a subset of the population likely to be disproportionately impacted by new or revised energy conservation standards (e.g., low-income households, seniors).

Method

- Extend the LCC analysis to examine the impacts for defined subgroups.
- DOE will use inputs specific to each of the considered consumer subgroups.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



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.

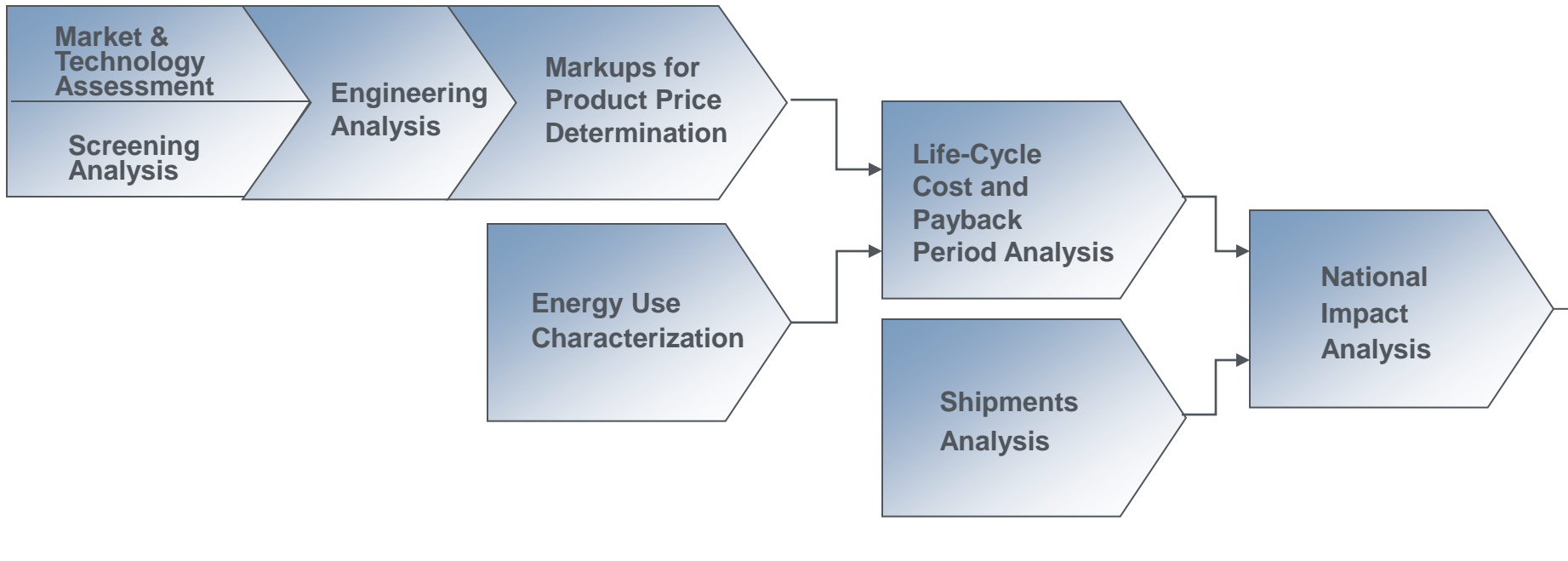
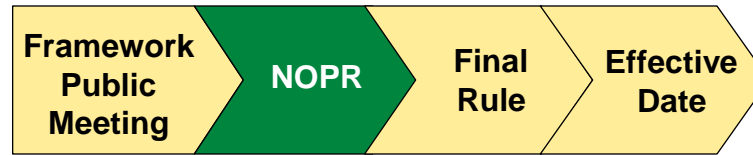
Method

- 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 NPV impacts
- Subgroup NPV impacts
- Direct employment impacts

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



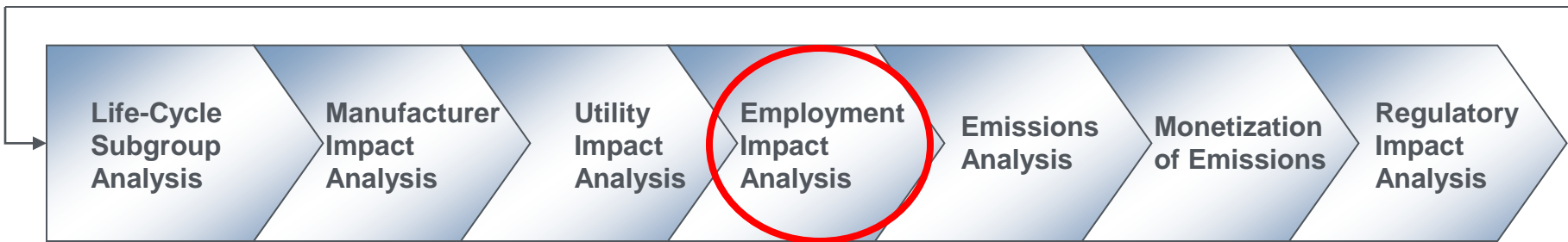
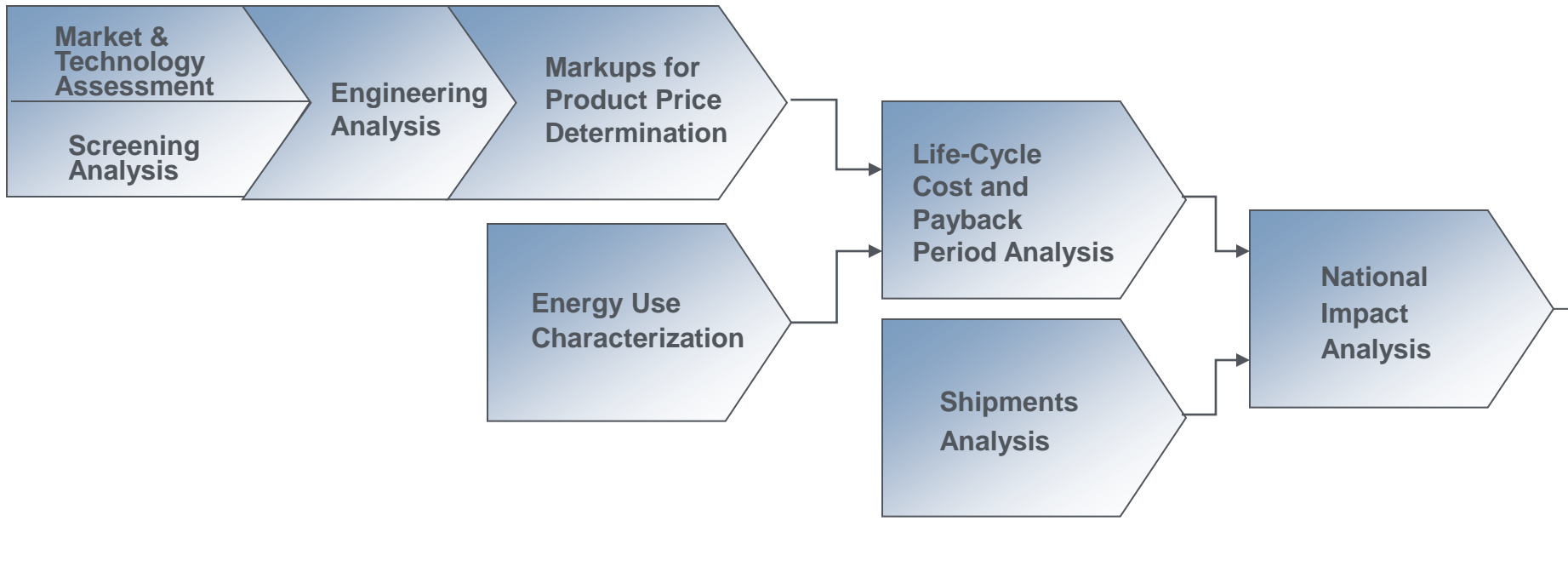
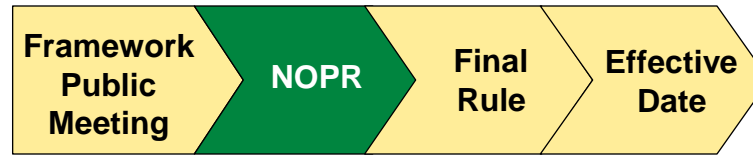
Purpose

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

Method

- DOE will model the energy savings impacts from amended energy conservation standards using NEMS-BT, developed and used by DOE/EIA for the AEO report, 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 a comparison of base and standards cases.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



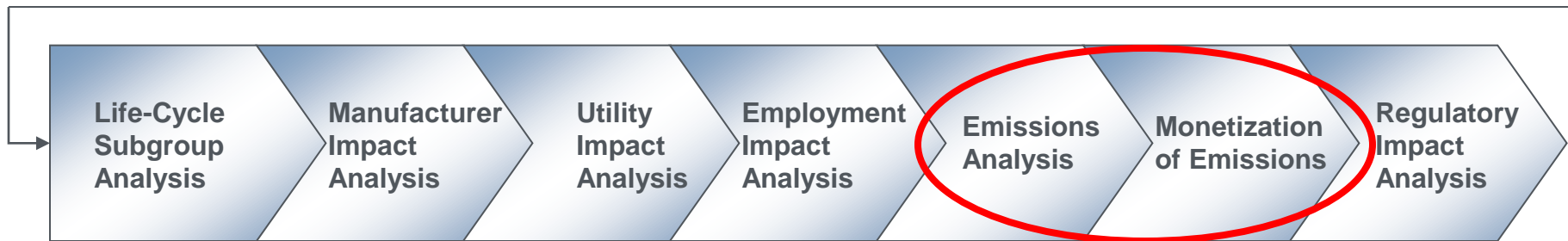
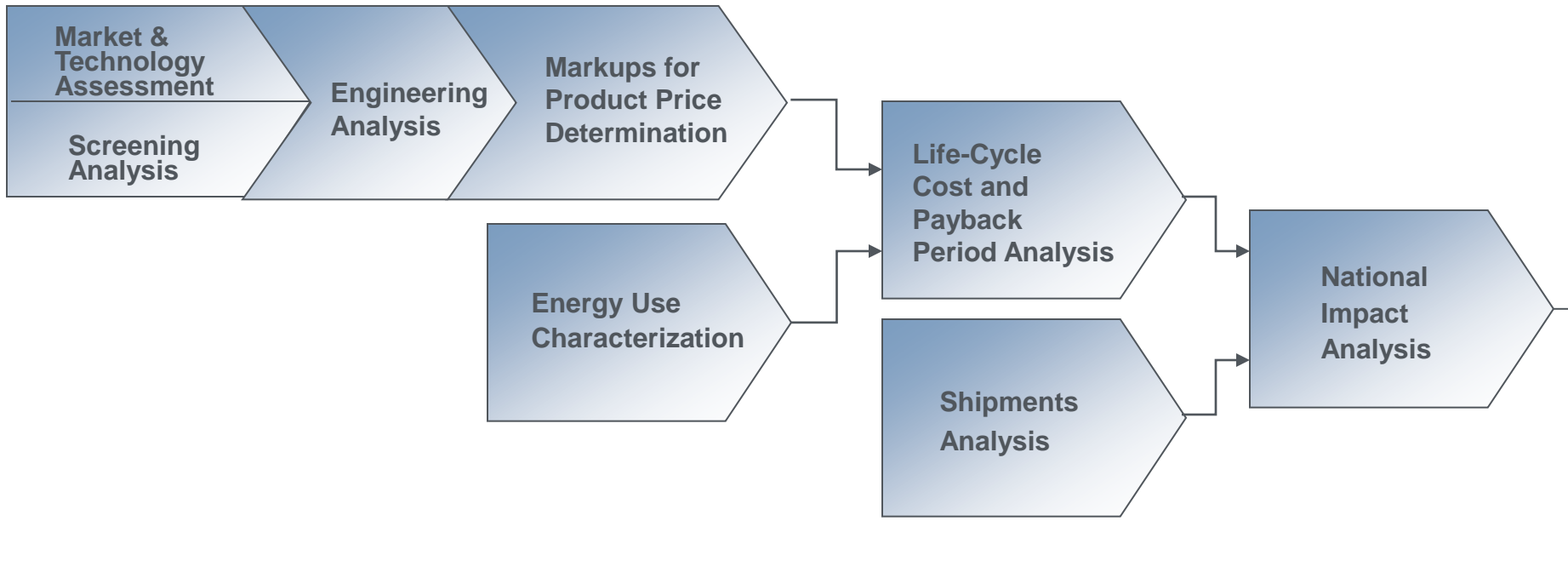
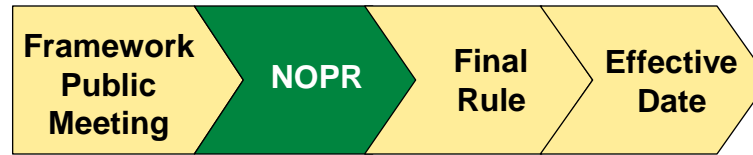
Purpose

- Assess the overall impact on national employment from the imposition of energy conservation standards at differing levels.
- Include both direct and indirect employment impacts.
 - Direct employment impacts are estimated in the manufacturer impact analysis.
 - Indirect employment impacts result from shifting consumer expenditures among goods and services (“substitution effect”) and changing equipment and energy costs (“income effect”).

Method

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

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



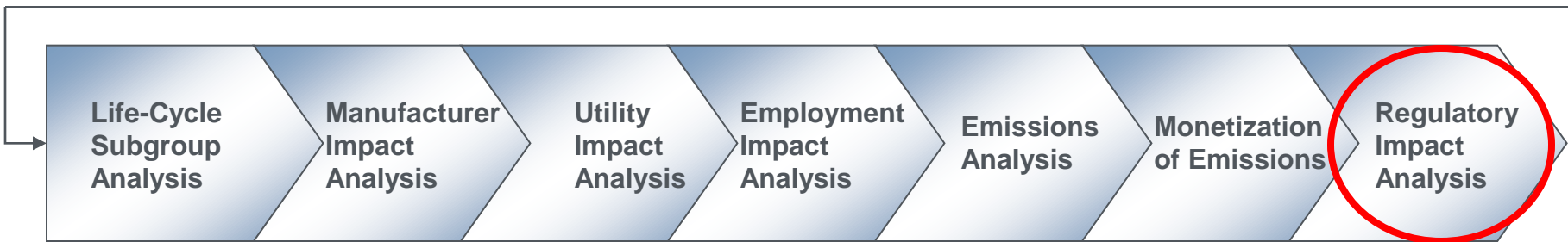
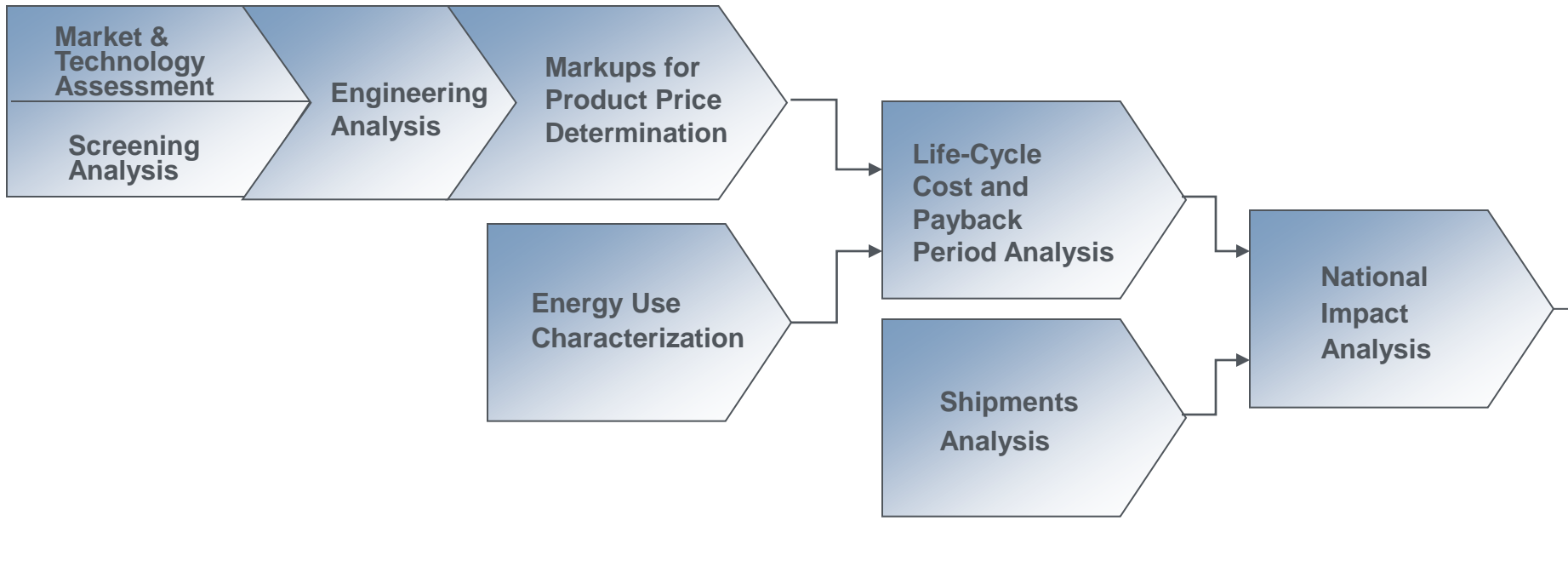
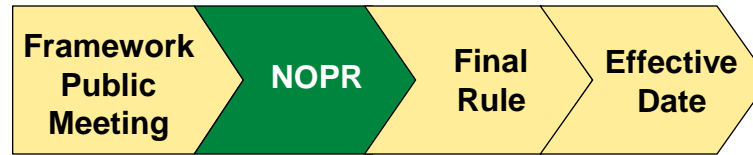
Purpose

- To report environmental impacts resulting from amended energy conservation standards, from changes in power plant emissions.

Method

- DOE intends to use the environmental impacts projected from the NEMS-BT modeling analysis used for the Utility Impacts Analysis.
 - Carbon dioxide (CO₂) will be the primary emissions reported.
 - Mercury (Hg) emissions will also be reported.
 - Nitrogen Oxide (NO_x) emissions will be reported for the 22 states where emissions are not capped.
 - Existing legislation cap Sulfur Dioxide (SO₂), so physical emission reductions will be zero or nearly zero from any single energy conservation standard.
- The emissions analysis will include a monetization of reduced emissions.
- Monetization values are based on most recent interagency reviews.

Steps in the Standards Rulemaking: Notice of Proposed Rulemaking



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.

Issue #42: DOE welcomes feedback and comments on any aspects of the Life-Cycle Subgroup Analysis, Manufacturer Impact Analysis, Utility Impact Analysis, Employment Impact Analysis, Emissions Analysis and Monetization, and/or Regulatory Impact Analysis.

1

Introduction

2

Rulemaking Overview

3

Test Procedure Rulemaking Overview

4

Rulemaking Analyses

5

Closing Remarks

Feedback Is Requested

Especially on Items Identified in Request for Information

- **In all correspondence, please refer to the Set-top Boxes rulemaking by:**
 - Set-top Boxes Rulemaking,
 - Docket Number EERE–2011–BT–NOA–0067, and
 - Regulatory Identification Number (RIN) 1904-AC52
- **Email:** STB-RFI-2011-NOA-0067@ee.doe.gov

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- **Comment period closes: March 15, 2012**

- **DOE Appliance Standards**
 - http://www1.eere.energy.gov/buildings/appliance_standards/
- **STBs & Network Equipment Rulemaking and Test Procedure**
 - http://www1.eere.energy.gov/buildings/appliance_standards/residential/set_top_boxes.html
- **Regulations.gov Rulemaking Docket**
 - <http://www.regulations.gov/>
 - *RFI) Docket ID# EERE-2011-BT-NOA-0067-0001*
 - *Determination) Docket ID# EERE-2010-BT-DET-0040-0001*

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DOE General Counsel

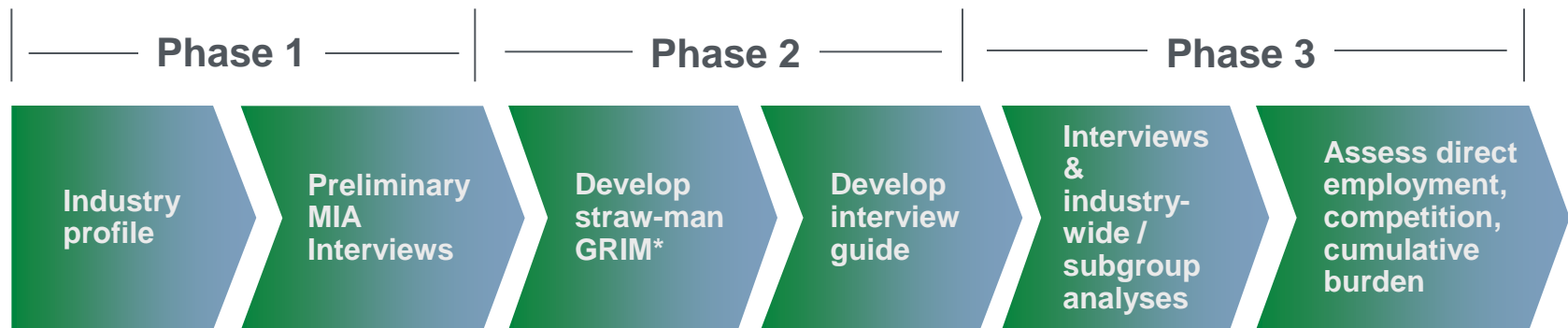
Ms. Celia Sher

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- The MIA consists of three main phases:



- DOE intends to use the most current Social Cost of Carbon (SCC) values developed by interagency reviews.
 - SCC is intended to be a monetary measure of the incremental damage resulting from greenhouse gas (GHG) emissions, including but not limited to agricultural productivity loss, human health effects, property damage from rising sea level, and changes in the ecosystem.
- At present, the most recent interagency estimates of the potential global benefits resulting from reduced CO₂ emissions in 2010 are \$4.9, \$22.3, \$36.5, and \$67.6 per metric ton in 2010 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.

- **Cable:** A STB whose primary function is to receive television signals from a broadband, hybrid fiber/coaxial, or community cable distribution system with conditional access and deliver them to a consumer display, thin-client/remote STB, and/or recording device.
- **Satellite:** A STB whose primary function is to receive television signals from satellites and deliver them to a consumer display, thin-client/remote STB, and/or recording device.
- **Cable Digital Transport Adapter (Cable DTA):** A minimally-configured STB whose primary function is to receive television signals from a broadband, hybrid fiber/coaxial, or community cable distribution system and deliver them to a consumer display and/or recording device.
- **Internet Protocol Television (IPTV):** A STB whose primary function is to receive television/video signals encapsulated in Internet Protocol packets and deliver them to a consumer display, thin-client/remote STB, and/or recording device.
- **Terrestrial:** A STB whose primary function is to receive television signals over the air or via community cable distribution system without conditional access and deliver them to a consumer display, thin-client/remote STB, and/or recording device.
- **Thin-client / Remote:** A STB that (1) is designed to interface between a multi-room STB and a TV (or other output device), (2) has no ability to directly interface with a Service Provider, and (3) relies solely on a multi-room STB for content. Any STB that meets the definition of a cable, satellite, IP, or terrestrial STB is not a thin-client/remote STB.

- **Advanced Video Processing (AVP):** The capability to encode, decode, and/or transcode audio/video signals in accordance with standards H.264/MPEG 4 or SMPTE 421M.
- **CableCARD:** The capability to decrypt premium audio/video content and services and provide other network control functions via a plug-in conditional access module that complies with the ANSI/SCTE 28 2007 HOST-POD Interface Standard.
- **Digital Video Recorder (DVR):** The capability to store video in a digital format to a rewritable disk drive or other non-volatile storage device integrated into a STB. This definition excludes video capture software for personal computers or server-based DVR capabilities.
- **DOCSIS:** The capability to distribute data and audio/video content over cable television infrastructure in accordance with the CableLabs® Data Over Cable Service Interface Specification.
- **High Definition (HD) Resolution:** The capability to transmit or display video signals with resolution greater than or equal to 720p.
- **Standard Definition (SD) Resolution:** The capability to only transmit or display video signals with resolution less than 720p.

- **Home Network Interface (HNI):** The capability to interface with external devices over a high bandwidth network (e.g., IEEE 802.11 (WiFi), MoCA, HPNA). For purposes of this specification, IEEE 802.3 wired Ethernet is not considered a Home Network Interface.
- **Multi-room (MR):** The capability to provide independent audio/video content to multiple devices within a single family dwelling. This definition does not include the capability to manage gateway services for multi-subscriber scenarios.
- **Multi-stream (MS):** The capability to deliver two or more simultaneous audio/video streams to a consumer display, thin-client/remote STB, or recording device. The simultaneous streams may be delivered via a physically separate input or via the primary input. This definition does not include out-of-band tuners.
- **Removable Media Player:** The capability to decode digitized audio/video signals on DVD or Blu-ray Disc optical media.
- **Removable Media Player / Recorder:** The capability to decode and record digitized audio/video signals on DVD or Blu-ray Disc optical media.

$$TEC_{COMBINED} = TEC_{PRIMARY} + TEC_{PLAY/REC}$$

$$TEC_{PRIMARY} = 0.365 \times ((T_{TV} \times P_{TV}) + (T_{SLEEP} \times P_{SLEEP}) + (T_{ADP} \times P_{ADP}) + (T_{DEEPSLEEP} \times P_{DEEPSLEEP}))$$

$$TEC_{PLAY/REC} = 0.365 \times [((P_{PLAYBACK} - P_{TV}) \times H_{PLAYBACK}) + ((P_{RECORD} - P_{TV}) \times H_{RECORD})]$$

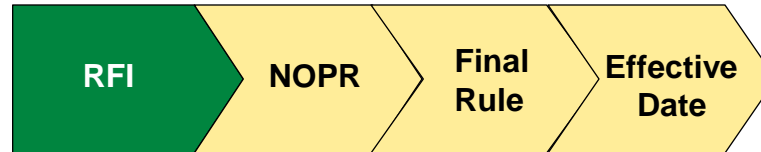
Primary Time Coefficients

APD to Sleep Enabled	ADP to Deep Sleep Enabled	T _{TV}	T _{SLEEP}	T _{APD}	T _{DEEPSLEEP}
NO	NO	14	10	0	0
NO	YES	14	6	0	4
YES	NO	7	10	7	0
YES	YES	7	6	7	4

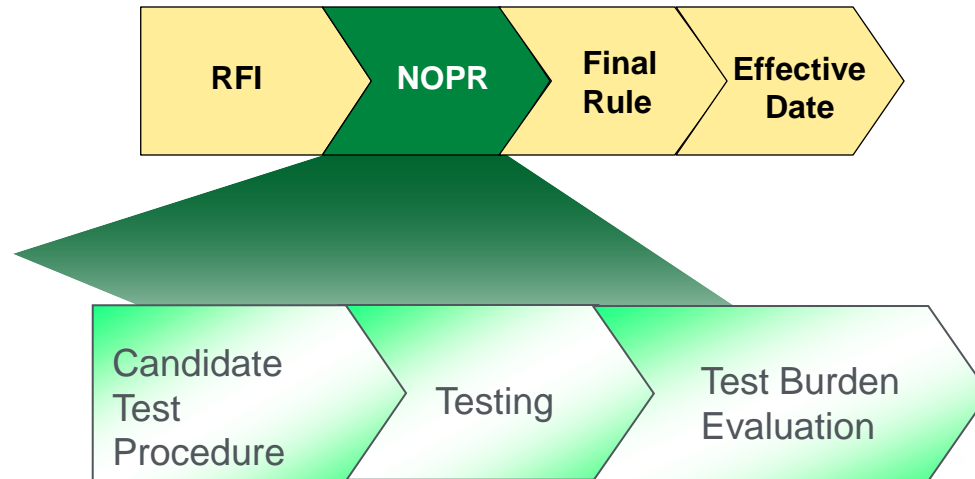
T = Time Coefficient from Table
P = Measured Power in that Mode

Playback Time Coefficients

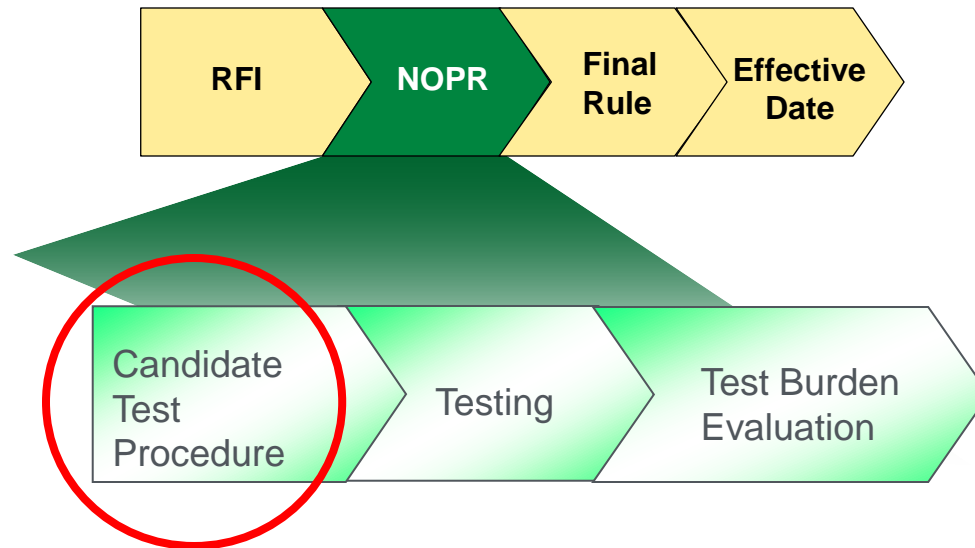
Function	DVR	Removable Media Playback	Removable Media Playback/Record
Playback Duration (HPLAYBACK)	2 hrs/day	2 hrs/day	2 hrs/day
Record Duration (HRECORD)	3 hrs/day	0 hrs/day	1 hr/day



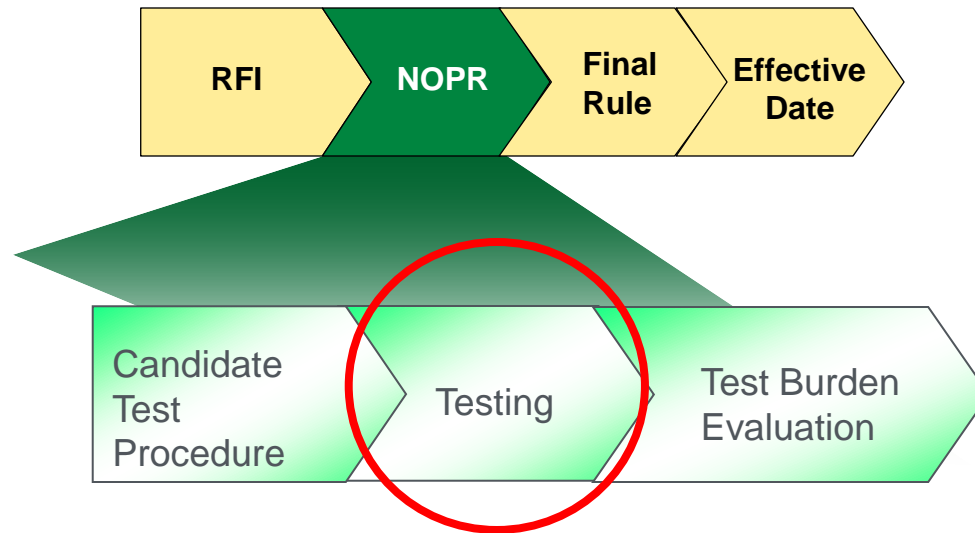
- Research on existing test procedures
 - ENERGY STAR
 - IEC 62087
 - Industry test procedures
- Feedback from stakeholders on specific technical questions
- Responses during public meeting (now) and written comments



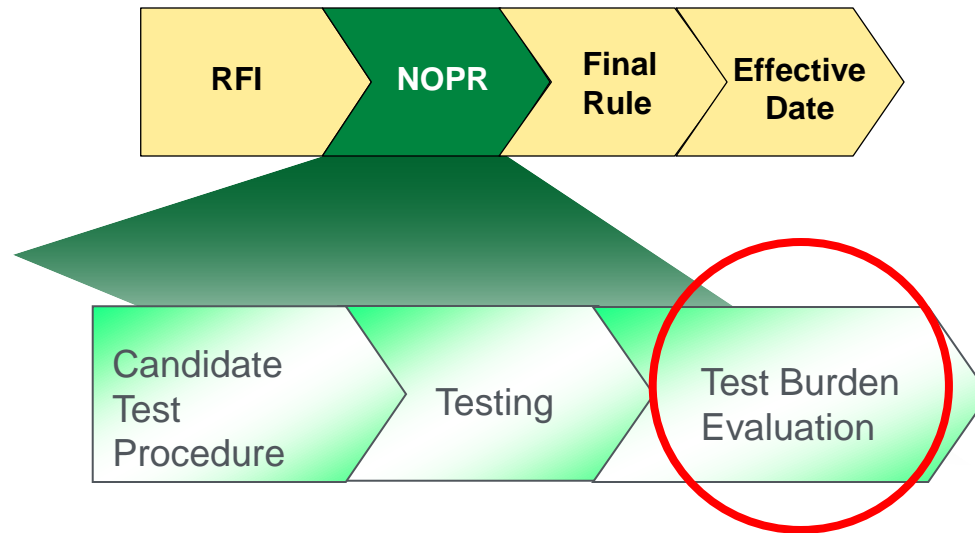
- Develop a Candidate Test Procedure (CTP)
- Perform trial testing and round robin testing (optional)
- Determine duration of testing and estimate test costs



- Develop a Candidate Test Procedure (CTP) based on existing test procedures and feedback from RFI
- Existing test procedures may come from industry and/or ENERGY STAR



- Trial testing based on acquired units
- Round robin testing to determine reproducibility (if needed)



- Estimated duration of test
- Estimated internal costs
- Estimated external costs



- Incorporates feedback from NOPR comments
- Final Rule test procedure will be used for Standards rulemaking and ENERGY STAR qualification
- Test procedure goes into effect 75 days after Final Rule is published