



Combined Meeting on Energy Conservation Standards & Test Procedures for Fluorescent and Incandescent Lamps

Tina Kaarsberg, PhD

Department of Energy
Energy Efficiency & Renewable Energy
GSFL-IRL_2011-STD-0006@ee.doe.gov,
Lamps-2011-TP-0012@ee.doe.gov

October 4, 2011

- Introductions (around the room)
- 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
 - One person speaks at a time (raise hand to be recognized; state your name for the record)
 - Set cell phones to silent/vibrate
- Housekeeping Items
- Agenda Review
- Opening Remarks

Introduction

9:00 – 9:30 am Welcome, Introductions, Opening Statements

Test Procedure

9:30 – 9:40 am Overview

9:40 – 10:15 am Updates to Industry Standards: GSFL, GSIL, IRL

10:15 – 10:30 am Break

10:30 – 10:50 am New GSIL Lifetime Test Procedure

10:50 – 11:00 am Questions/Discussion

Energy Conservation Standard

11:00 am–12:00 pm	Overview; Scope of Coverage; Market & Technology; Screening Analyses
12:00 – 1:00 pm	Lunch Break
1:00 – 1:45 pm	Engineering Analysis
1:45 – 2:15 pm	Product Price Determination; Energy Use
2:15 – 2:30 pm	Break
2:30 – 3:30 pm	Life-Cycle Cost and Payback Period Analysis
3:30 – 4:00 pm	Shipment Analysis; National Impact Analysis
4:00 – 4:35 pm	NOPR Analyses; Next Steps
4:35 – 5:00 pm	Questions/Discussion
5:00 – 5:10 pm	Closing Remarks

- Present DOE's proposed test procedures for general service fluorescent lamps (GSFLs), general service incandescent lamps (GSILs), and incandescent reflector lamps (IRLs) and DOE's proposed framework for GSFL and IRL energy conservation standards.
- Invite comment on the test procedure notice of proposed rulemaking (NOPR) and energy conservation standards framework document.
- Discuss next steps in the rulemakings.
- Invite participants to provide summary comments or statements and raise additional issues for discussion.

Issue Box: DOE welcomes comments, data, and information concerning its proposed test procedures for GSFLs, GSILs, and IRLs and framework for GSFLs and IRLs. Issues that correspond to those raised in DOE's published material will be numbered in accordance with that material. Whether invited by an issue box or not, comments are welcome on any part of DOE's analysis.

Issue box numbering corresponds to the list of issues published at the end of the each document, available at:

1. Test Procedure NOPR, published September 14, 2011:

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

Comment Period Ends: November 28, 2011

2. Framework, published September 14, 2011:

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

Comment Period Ends: October 31, 2011



Test Procedures for General Service Fluorescent, General Service Incandescent, and Incandescent Reflector Lamps Notice of Proposed Rulemaking

Tina Kaarsberg, PhD

Department of Energy
Energy Efficiency & Renewable Energy
Docket Number: EERE-2011-BT-TP-0012
Lamps-2011-TP-0012@ee.doe.gov

October 4, 2011

- 1 Overview
- 2 Updates to Industry Standards: GSFL, GSIL, IRL
- 3 New GSIL Lifetime Test Procedure

**Energy Policy and
Conservation Act, 1975
(EPCA)**

Established energy conservation standards and methods of test procedure development for consumer products.

**1994 Interim Rule, 59 FR
49468; 1997 Final Rule, 62
FR 29221**

1994 Interim Rule established test procedures for GSFLs, GSILs, and IRLs. 1997 Final Rule revised these test procedures.

**Energy Independence and
Security Act (EISA 2007)**

Required DOE to review test procedures for all covered products at least once every seven years. Established lamp lifetime requirement for GSILs.

**2009 Lamps Test
Procedure, 74 FR 31829**

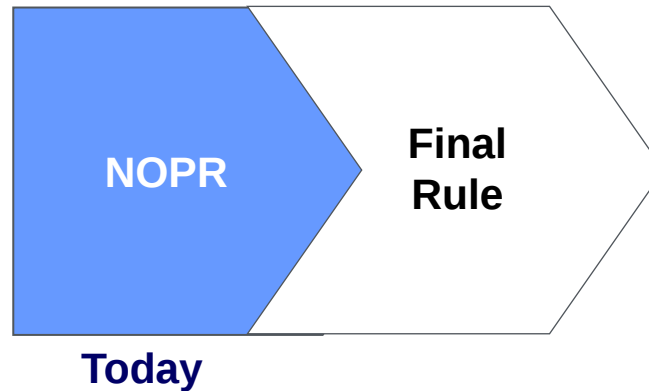
Revised test procedures for GSFLs, IRLs, and GSILs.

**2009 Lamps Standards,
74 FR 34080**

Adopted standards and test procedures for additional types of GSFLs.

**Current Test Procedure
Rulemaking**

Revise existing test procedures for GSFLs, IRLs, and GSILs. Adopt test procedure for GSIL lamp lifetime.



Milestone	Date
Notice of Proposed Rulemaking (NOPR)	September 14, 2011
Final Rule (projected)	<i>January 2012</i>
Compliance Date (projected)	<i>June 2012</i>

- Statutory obligation to review test procedures at least once every seven years requires DOE to:
 - (1) Amend the test procedure to improve measurement representativeness or accuracy or reduce burden; or
 - (2) Determine that such amendments are unnecessary. (42 U.S.C. 6293(b)(1)(A))
- NOPR examines industry best practices and technical developments relevant to GSFL, GSIL, IRL test procedures.
- NOPR proposes to update references to industry standards in the existing DOE test procedures for GSFLs and GSILs.
- Proposes a new test procedure for measuring lamp lifetime of GSILs.

Issue 1: DOE requests comments on all aspects of DOE's test procedures for GSFLs, GSILs, and IRLs.

- 1 Overview
- 2 Updates to Industry Standards: GSFL, GSIL, IRL
- 3 New GSIL Lifetime Test Procedure

Updates to Industry Standards Incorporated by Reference

The following updates to industry standards for the GSFL and GSIL test procedures are proposed.

Currently Referenced Standard	Updated Standard to be Referenced	Title
ANSI C78.81-2005, ANSI C78.81-2003	ANSI C78.81-2010	<i>American National Standard for Electric Lamps-Double-Capped Fluorescent Lamps-Dimensional and Electrical Characteristics</i>
IESNA LM-9-1999	IES LM-9-2009	<i>IES Approved Method for the Electrical and Photometric Measurement of Fluorescent Lamps</i>
IESNA LM-45-2000	IES LM-45-2009	<i>IES Approved Method for the Electrical and Photometric Measurement of General Service Incandescent Filament Lamps</i>

DOE proposes to update all references to ANSI C78.81 (both 2003 and 2005) to ANSI C78.81-2010.

- ANSI C78.81 addresses dimensional and electrical characteristics for double-capped fluorescent lamps.
- ANSI C78.81-2010 adds high-frequency and low-frequency lamp specifications for 25-watt (W), 28W, and 30W, reduced-wattage 4-foot T8 medium bipin (MBP) lamps.
- The low-frequency reference ballast specifications in ANSI C78.81-2010 for these lamps have no impact because they are identical to the specifications DOE currently directs manufacturers to use for those fluorescent lamps in section 4.1.2.1 of Appendix R.

DOE proposes to update IESNA LM-9-1999 to the more recent version IES LM-9-2009 for fluorescent lamps.

1. Addition of guidance for high-frequency testing: root mean square (RMS) voltage regulation, instrument frequency response, reference ballast impedance, circuit setup.
2. Modifies lamp stabilization method to require more consecutive measurements be taken until stabilization criterion is met.
3. Addition of lamp stabilization guidance unique to T5 linear fluorescent lamps.
4. Adds impedance thresholds for voltage and current inputs to multimeter and power sources.

DOE proposes to update IESNA LM-45-2000 to the more recent version IES LM-45-2009 for incandescent lamps.

1. Modifies lamp stabilization method requiring measurements to continue until stability criteria is met.
2. Modifies voltage and current regulation tolerances for AC power source.
3. Modifies instrument tolerances for AC voltage, current and wattage.
4. Adds impedance thresholds for voltage and current inputs to multimeter.
5. Adds a requirement for the degree of spectral match of the photo-detector measurements to the $V(\lambda)$ function.

Issue 2: DOE requests comments on its proposed incorporation of IES LM-9-2009, and its tentative conclusion that the update would neither significantly affect measured lamp efficacy nor increase the testing burden. In particular, DOE requests comments on the impact on lamp efficacy of high-frequency testing amendments and modifications to the lamp stabilization procedure in IES LM-9-2009.

Issue 3: DOE requests comments on its proposed incorporation of IES LM-45-2009, and its tentative conclusion that the update would neither significantly affect lamp efficacy values nor impose an undue testing burden.

Existing IRL test procedure incorporates IESNA LM-20-1994. 10 CFR part 430, subpart B, Appendix R

- Revised edition of the standard has not been published.
- Not aware of any current best practices or technical developments that necessitate modifications to the IRL test procedure.

Issue 4: DOE requests comment on whether any amendments to the IRL test procedure are necessary and welcome any suggestions for amendments.

- 1 Overview
- 2 Updates to Industry Standards: GSFL, GSIL, IRL
- 3 New GSIL Lifetime Test Procedure

- **EISA 2007 amended EPCA by prescribing GSIL minimum rated lifetime requirements to be phased in between January 2012 and January 2014.**
- **Proposed GSIL Lifetime Test Procedure**
 - Industry standard: IESNA LM-49-2001, “IESNA Approved Method for Life Testing of Incandescent Filament Lamps.”
 - o Coincides with rated voltage testing prescribed in the IESNA Lighting Handbook.
 - o Referenced by Federal Trade Commission in regulations for product labeling.
 - Definition of “rated lifetime for general service incandescent lamps”: rated lifetime is the length of operating time between first use and failure of 50 percent of the prescribed sample size.
 - Sample size of 20 lamps.

- Prescribes lifetime testing at a rated voltage.
- Requires lamp to be checked for failure at regular intervals and cooled on a daily basis.
- Provides instrument specifications for voltage, current and frequency.
- Specifies test conditions for vibration, temperature and airflow.
- Addresses lamp orientation, spacing, handling, marking of lamps, and lamp holder specifications.

- **DOE proposes to disallow use of accelerated lifetime testing**

- LM-49 permits accelerated lifetime testing for non-halogen GSILs; few non-halogen GSILs will meet 2012 energy conservation standards.
- Difficult to conduct for halogen lamps due to the tungsten-halogen regenerative cycle which is designed around certain operating temperatures.
- Accurate scaling factors will require numerous comparison tests and need to be developed for each lamp design.

Accelerated Lifetime Testing

- Operate lamps at overvoltage, increasing operating temperature and shortening lamp lifetime
- Use empirically derived scaling factors to determine full lifetime of lamp

DOE proposes a minimum sample size of 20 lamps.

- Minimum of two lamps per month for seven months of production out of a 12-month period
- Consistent with statutory definition of lifetime which requires “statistically large group of lamps.” (42 U.S.C. 6291(30)(P))
- Consistent with required sample size of 21 lamps for measuring lamp efficacy.

Issue 5: DOE requests comment on its proposal to adopt IESNA LM-49-2001 as the standard for GSIL lifetime testing.

Issue 6: DOE requests comments on its proposal to disallow accelerated lifetime testing as part of the GSIL test procedure.

Issue 7: DOE requests comments on its proposal to require a minimum sample size of 20 lamps for GSIL lifetime measurements.

GSIL new model filing requirements are similar to those for GSFLs and IRLs.

- Initial certification report describing the methodology by which it was determined the model meets or exceeds standards submitted prior to or concurrent with distribution of new model.
- Final certification report based on full sampling provisions to be submitted **one year** following the start of manufacturing of new model.

Issue 8: DOE requests comment on its proposal regarding GSIL certification filing requirements.

Issue 9: DOE seeks comment regarding whether the proposed amendments in today's NOPR would have a significant economic impact on any small entities. In particular, DOE requests comments on its preliminary analysis of initial setup and labor costs for conducting lifetime testing of GSILs.

DOE Seeks Comments on its Proposed Test Procedure

In all correspondence, include all of the following:

- Test Procedures for General Service Fluorescent Lamps, General Service Incandescent Lamps, and Incandescent Reflector Lamps
- Docket Number: EERE-2011-BT-TP-0012
- Regulatory Identification Number (RIN): 1904-AC45

Contact Information:

Email: Lamps-2011-TP-0012@ee.doe.gov

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

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Comment period closes: November 28, 2011 midnight EDT

Questions?



Energy Conservation Standards *Framework* for General Service Fluorescent Lamps and Incandescent Reflector Lamps

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Department of Energy
Energy Efficiency & Renewable Energy
Docket Number: EERE-2011-BT-STD-0006
GSFL-IRL_2011-STD-0006@ee.doe.gov

October 4, 2011

1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
3	Engineering Analysis
4	Product Price Determination; Energy Use
5	Life-Cycle Cost and Payback Period Analyses
6	Shipment Analysis; National Impact Analysis
7	NOPR Analyses

Energy Policy and Conservation Act, 1992

Established standards for certain classes of GSFLs and IRLs; authorized DOE to conduct two rulemaking cycles to revise and amend and adopt standards for additional GSFLs, if warranted.

Energy Independence and Security Act of 2007 (EISA 2007)

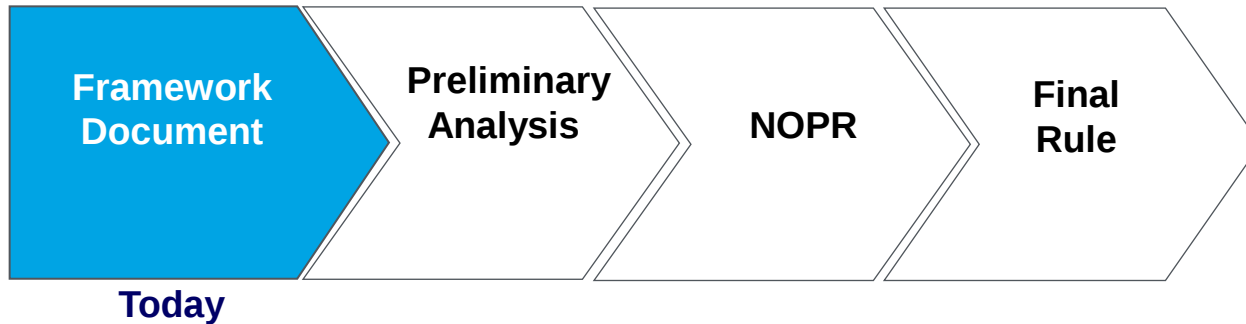
Set standards for and expanded definition of IRLs to include lamps with a diameter between 2.25 and 2.75 inches, as well as elliptical reflector (ER), bulged reflector (BR), parabolic aluminized reflector (PAR), bulged parabolic aluminized reflector (BPAR), or similar bulb shapes. Exempted certain IRLs.

2009 Lamps Standards Rule, 74 FR 34080

First revision of standards for GSFLs and IRLs.

Current Standards Rulemaking

Second review of GSFL and IRL standards.
Determines if coverage should be expanded to other GSFL types.



Milestone	Date
Framework Document	September 14, 2011
Notice of Public Meeting and Availability of the Preliminary Technical Support Document (projected)	<i>September 2012</i>
Notice of Proposed Rulemaking (NOPR) (projected)	<i>August 2013</i>
Final Rule (projected)	<i>April 2014</i>
Compliance Date (projected)	<i>April 2017</i>

EPCA directs DOE to consider seven factors when setting energy conservation standards.

Factor	Analysis
1. Economic impact on consumers and manufacturers	Life-cycle cost analysis; Manufacturer impact analysis
2. Lifetime operating cost savings	Life-cycle cost analysis
3. Total projected energy savings	National impact analysis
4. Impact on utility and performance	Screening analysis; Engineering 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

Energy conservation standards set for GSFLs by the 2009 Lamps Rule will become effective July 14, 2012.

Lamp Type	CCT	Energy conservation standard (lm/W)
4-foot Medium Bipin (MBP)	≤4500 K	89
	>4500 K and ≤7,000K	88
2-foot U-shaped	≤4500 K	84
	>4500 K and ≤7,000K	81
8-foot Single Pin (SP) Slimline	≤4500 K	97
	>4500 K and ≤7,000K	93
8-foot Recessed Double Contact (RDC) High Output (HO)	≤4500 K	92
	>4500 K and ≤7,000K	88
4-foot T5 Miniature BiPin (MiniBP) Standard Output (SO)	≤4500 K	86
	>4500 K and ≤7,000K	81
4-foot T5 MiniBP HO	≤4500 K	76
	>4500 K and ≤7,000K	72

Energy conservation standards set for IRLs by the 2009 Lamps Rule will become effective July 14, 2012.

Lamp Type	Diameter (inches)	Voltage	Energy conservation standard (lm/W)
Standard Spectrum	> 2.5	≥ 125 V	$6.8 * P^{0.27}$
		< 125 V	$5.9 * P^{0.27}$
	≤ 2.5	≥ 125 V	$5.7 * P^{0.27}$
		< 125 V	$5.0 * P^{0.27}$
Modified Spectrum	> 2.5	≥ 125 V	$5.8 * P^{0.27}$
		< 125 V	$5.0 * P^{0.27}$
	≤ 2.5	≥ 125 V	$4.9 * P^{0.27}$
		< 125 V	$4.2 * P^{0.27}$

Note: P is equal to the rated lamp wattage, in watts.

- **Covered GSFL Types**

- 4-foot medium bipin (MBP) ($\geq 25\text{W}$);
- 2-foot U-shaped lamps, MBP ($\geq 25\text{W}$);
- 8-foot high output (HO) lamps, rapid start (RS) lamp, recessed double contact (RDC) bases;
- 8-foot slimline lamps, instant start (IS) lamp, single pin bases, ($\geq 52\text{W}$);
- 4-foot miniature bipin (MiniBP) standard output (SO), ($\geq 26\text{W}$);
- 4-foot MiniBP high output (HO), ($\geq 49\text{W}$).

- **Additional GSFL Types**

- 2009 Lamps Rule expanded GSFL coverage to 4-foot MiniBP lamps.
- In this rulemaking DOE is considering the following additional GSFLs:
 - o Pin-based compact fluorescent lamps (CFLs)
 - o Non-linear fluorescent lamps (e.g., circline)
 - o Fluorescent lamps with non-standard lengths (e.g., 2-,3-,5-foot)

- **Covered IRL Types**
 - Reflector type: reflector (R), ER, BR, PAR, BPAR, or similar bulb shapes with an E26 medium screw base;
 - Rated voltage between 115 and 130 volts;
 - Diameter that exceeds 2.25 inches;
 - Rated wattage that is 40 watts or higher;
 - Not colored or designed for rough or vibration service applications that contains an inner reflective coating on the outer bulb to direct the light.
- **Lamps not subject to EPCACT 1992 and July 2012 standards**
 - Lamps rated at 50 watts or less that are ER30, BR30, BR40, or ER40;
 - Lamps rated at 65 watts that are BR30, BR40, or ER40 lamps; and
 - Lamps rated at 45 watts or less that are R20.
- **Standards for these lamps are being set in a separate rulemaking.**

Item 2: DOE welcomes comment on additional GSFLs and IRLs that should be included for this rulemaking. For suggested additional lamp types, DOE requests market and shipment information as well as potential for efficacy improvements and energy savings.

- In this rulemaking, DOE plans to reevaluate the lumens/watt (lm/w) metric for measuring IRL efficacy.
- DOE is considering application efficacy (AE) as a metric.
 - AE is a type of directional lumens per watt.
 - Quantifies lamp effectiveness in terms of lamp delivering light to targeted locations.
 - Average luminous flux within a desired solid angle per unit power.

$$AE = \frac{\text{Luminous flux/power (lm/w)}}{\text{Solid angle (steradians)}} = \text{candelas/watt}$$

Item 1: DOE welcomes comment on establishing a new directional metric for IRL efficacy standards.

1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
3	Engineering Analysis
4	Product Price Determination; Energy Use
5	Life-Cycle Cost and Payback Period Analysis
6	Shipment Analysis; National Impact Analysis
7	NOPR Analyses

- **Market and Technology Assessment**
 - Determine product classes
 - Identify the technology options to improve lamp efficacy
- **Screening Analysis**
 - Screen out technology options that DOE will not consider in the engineering analysis based on (1) technological feasibility; (2) practicability to manufacture, install, and service; (3) adverse impacts on utility to consumers or availability; and (4) adverse impacts on health or safety.

Item 3: DOE welcomes information on shipments, product-feature and efficiency trends, distribution channels and estimates of market shares for the lamps considered in this rulemaking. For the data to be used to conduct energy savings calculations, please provide appropriate groupings (e.g., by product class and wattage).

- **DOE divides covered products into classes by:**
 - The type of energy used;
 - Capacity of the product; or
 - Any other performance-related features that require different standard levels, such as features affecting consumer utility.
(42 U.S.C. 6295(q))
- **DOE establishes separate energy conservation standards for each product class.**

- **GSFL product class factors under consideration**
 - physical constraints of lamps (i.e., lamp shape and length);
 - lumen package or quantity of light provided by lamp-ballast system (i.e., standard versus high output); and
 - correlated color temperature (CCT).
- **GSFL product classes being considered:**

Lamp Type	Product Class #	
	CCT ≤4500 K	CCT >4500 K
4-foot Medium Bipin (MBP)	#1	#2
2-foot U-shaped	#3	#4
8-foot Single Pin (SP) Slimline	#5	#6
8-foot Recessed Double Contract (RDC) High Output (HO)	#7	#8
4-foot T5 Miniature BiPin (MiniBP) Standard Output (SO)	#9	#10
4-foot T5 MiniBP HO	#11	#12

Item 4: DOE welcomes comment on the 12 product classes it is considering for general service fluorescent lamps. In particular, DOE welcomes comment on maintaining two separate product classes for T5 lamps.

- **IRL product class factors under consideration**
 - lamp spectrum;
 - lamp diameter; and
 - rated voltage.
- **IRL product classes under consideration**

		Product Class #	
Diameter (inches)	Voltage	Standard Spectrum	Modified Spectrum
> 2.5	≥ 125 V	#1	#2
	<125 V	#3	#4
≤ 2.5	≥ 125 V	#5	#6
	<125 V	#7	#8

Item 5: DOE welcomes comment on the product classes it is considering for incandescent reflector lamps.

GSFL Technology Options

Highly Emissive Electrode Coatings	Glass Coatings
Higher Efficiency Lamp Fill Gas Composition	Higher Efficiency Lamp Diameter
Higher Efficiency Phosphors	Multi-Photon Phosphors

- Lamp efficacy can be improved by increasing phosphor UV absorption; increasing its emission of radiation in the visible spectrum; or increasing the thickness of the phosphor layer.
- 2009 Lamps Rule analyzed the rare earth phosphor market in response to manufacturer concerns that GSFL standards would drive up prices of key rare earths phosphors/ cost of lamps; and whether there were sufficient recoverable phosphor sources.
- DOE welcomes comments, new information relating to this issue.
 - Composition of rare-earth phosphors being used in lamps;
 - Estimate of additional rare-earth phosphors necessary to go to higher standards;
 - Current/historical prices and availability of rare-earth phosphors;
 - Assessment and future predictions on the relationship between lamp costs and prices of rare-earth phosphors.

IRL Technology Options

Higher-Temperature Operation	Higher-Pressure Tungsten-Halogen Lamps
Microcavity Filaments	Non-Tungsten Regenerative Cycles
Novel Filament Materials	Infrared Glass Coatings
Thinner Filaments	Infrared Phosphor Glass Coating
Efficient Filament Coiling	Integrally Ballasted Low-Voltage Lamps
Crystallite Filament Coatings	Higher-Efficiency Reflector Coatings
Efficient Filament Orientation	Trihedral Corner Reflectors
Higher-Efficiency Inert Fill Gas	Efficient Filament Placement
Luminescent Gas	

Item 6: DOE welcomes comments on all of the technology options it is considering for this rule, including any omissions or revisions for the GSFLs and IRLs covered in this rulemaking. DOE also requests information on the feasibility, performance, impacts, and cost of the technology options—especially those reflecting recent technological developments.

Item 7: DOE welcomes comments regarding the technologies that were screened out for the 2009 Lamps Rule, including whether it is still appropriate to screen out these technologies and whether any additional technology options should be screened out for this rule.

1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
3	Engineering Analysis
4	Product Price Determination; Energy Use
5	Life-Cycle Cost and Payback Period Analysis
6	Shipment Analysis; National Impact Analysis
7	NOPR Analyses

**Choose
Representative
Product Classes**

⇐ Choose representative product classes and lamp types to be analyzed in the engineering and life-cycle cost analysis.

**Define Baseline
Models**

⇐ Define characteristics of baseline models in each representative product class.

**Identify
Replacements**

⇐ Select more efficacious lamps for each baseline lamp or lamp-and-ballast system based on design options.

**Develop Efficacy
Levels**

⇐ Develop efficacy levels (ELs) that range from the baseline to the maximum technology feasible.

**Scale to Product
Classes Not
Analyzed**

⇐ Scale results to product classes not analyzed.

Representative Product Classes and Baselines: GSFLs

Choose
Representative
Product Classes

Define Baseline
Models

Identify
Replacements

Develop Efficacy
Levels

Scale to Product
Classes Not
Analyzed

DOE plans to consider the following lamp types with a correlated color temperature less than or equal to 4,500 Kelvin (K) as representative.

Baseline Lamp	Lamp Diameter	Nominal Watts	Rated Efficacy	Initial Light Output
		W	lm/W	lm
4-Foot MBP	T8	32	92.3	3,000
8-Foot SP Slimline	T8	59	98.2	5,900
8-Foot RDC HO	T8	86	91.9	7,900
4-Foot T5 MiniBP SO	T5	28	104.3	2,900
4-Foot T5 MiniBP HO	T5	54	92.9	5,000

Rated efficacy is based on rated wattage and initial light output. See [10 CFR 430.2](#) for the definition of rated wattage.

**Please note this table was revised 10/4/2011 to remove an extra row for the 8-foot RDC HO that was mistakenly included in the table in the previous version of the presentation and also a definition for rated efficacy was added.*

Item 9: DOE welcomes comments on the product classes that it has selected to analyze as representative for this rulemaking.

Item 10: DOE welcomes comments on the baseline lamps it is considering for GSFLs in this rulemaking and whether they are representative of products sold on the market in 2012. In particular, DOE requests comment on whether the baseline lamps under consideration have lower efficacies than their catalog-rated efficacy values. Additionally, DOE requests comment on whether it is appropriate to analyze only a T8 baseline for GSFL.

Representative Product Classes and Baselines: IRLs

Choose
Representative
Product Classes

Define Baseline
Models

Identify
Replacements

Develop Efficacy
Levels

Scale to Product
Classes Not
Analyzed

DOE is considering IRLs with standard-spectrum, voltage ratings less than 125 volts (V) and diameters greater than 2.5 inches as representative.

Baseline Lamp	Technology Option	Efficacy	Initial Light Output	Lamp Lifetime
		<i>lm/W</i>	<i>lm</i>	<i>hr</i>
40W PAR30	Improved HIR	17.0	680	4,000
55W PAR38	Improved HIR	19.1	1,050	4,000
66W PAR38	Improved HIR	19.8	1,310	4,000

Note: Halogen Infrared (HIR)

Item 11: DOE welcomes comments on the baseline lamps it is considering for IRLs in this rulemaking and whether they are representative of the products expected to be sold on the market in 2012. In particular, DOE requests comment on the expected lifetime and wattage of IRLs.

Identify Higher-Efficacy Replacements

**Choose
Representative
Product Classes**

- Select more efficacious lamps for each baseline lamp by considering technology options not eliminated in the screening analysis.

**Define Baseline
Models**

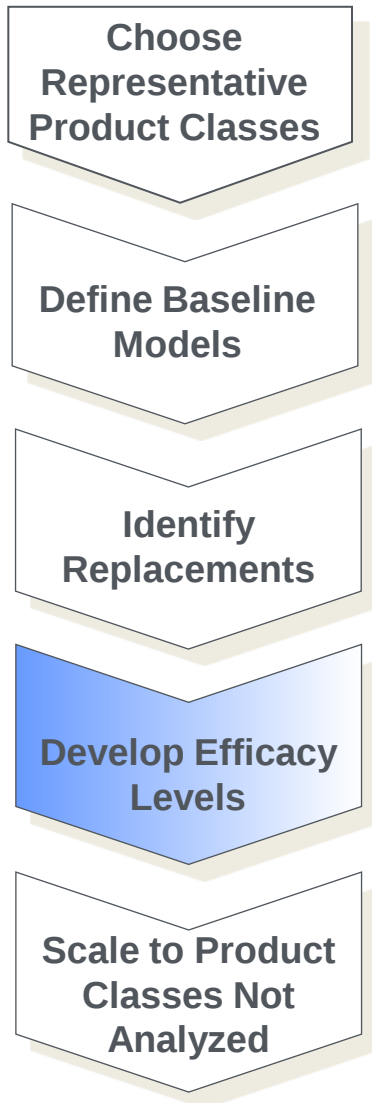
- Consider lamps that (1) emit lumens greater than or equal to the lumen output of the baseline lamp, or below by less than 10 percent; and (2) result in energy savings.

**Identify
Replacements**

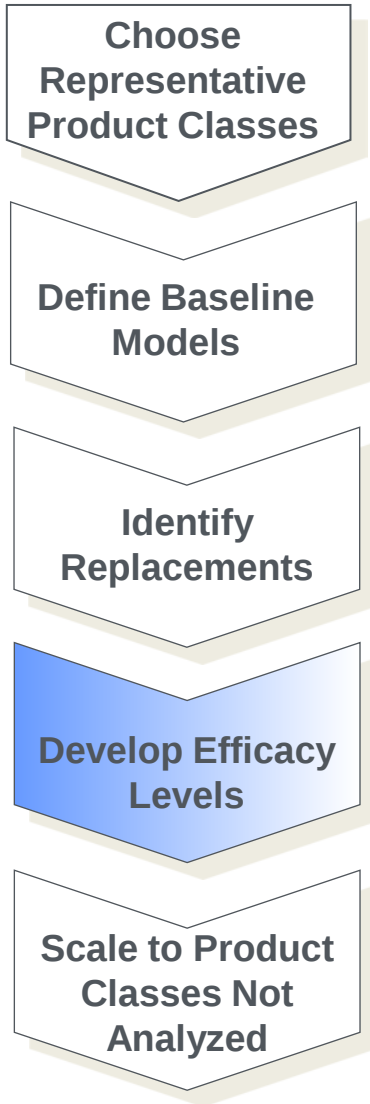
- Use database of commercially available GSFLs and IRLs to identify higher-efficacy replacements.

**Develop Efficacy
Levels**

**Scale to Product
Classes Not
Analyzed**



- **Develop efficacy levels (ELs) based on three factors:**
 - 1) the design options associated with the specific lamps being studied;
 - 2) the ability of lamps across wattages to comply with the EL of a given product class; and
 - 3) the maximum technologically feasible (max tech) efficacy level.
- **DOE is not considering efficacy levels that would require the use of reduced-wattage GSFLs due to potentially limited utility of these lamps.**
- **DOE is using certification reports to determine reported efficacies of the lamps to develop continuous equations.**



- Based on review of commercially available lamps, considering EL1 as the max tech level set by the 2009 Lamps Rule.

Lamp Type	CCT	EL1
		<i>lm/W</i>
4-Foot MBP	≤ 4,500K	93
8-Foot SP Slimline	≤ 4,500K	98
8-Foot RDC HO	≤ 4,500K	95
4-Foot T5 MiniBP SO	≤ 4,500K	90

- Exception: 4-foot T5 MiniBP HO for which only one standard proposed and reduced-wattage lamps not considered.

Choose
Representative
Product Classes

Define Baseline
Models

Identify
Replacements

Develop Efficacy
Levels

Scale to Product
Classes Not
Analyzed

Based on review of commercially available lamps, considering establishing EL1 as the max tech level set by the 2009 Lamps Rule.

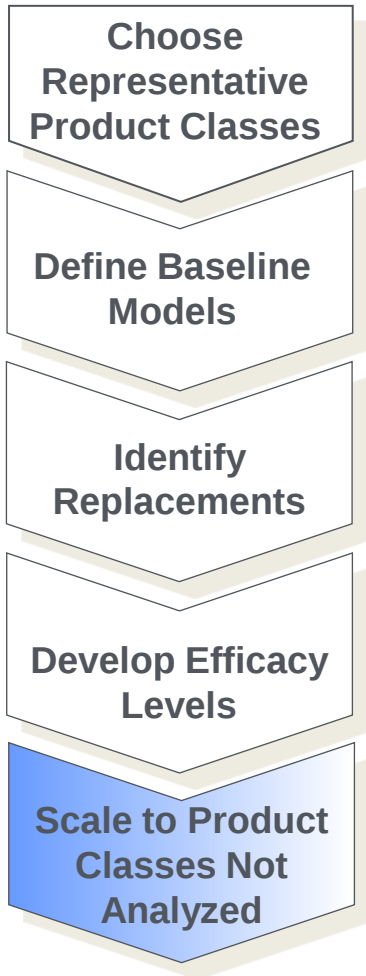
Lamp Type	Efficacy Level Equation*	Lamp Type	EL1
	<i>lm/W</i>		<i>lm/W</i>
Standard Spectrum, > 2.5 inches, < 125V	$6.4P^{0.27}$	40W PAR30	19.1
		51.7W PAR38	20.3
		60W PAR38	21.0

Note: P = wattage; Parabolic aluminized reflector (PAR); 30, 38 are diameters in 1/8th inches

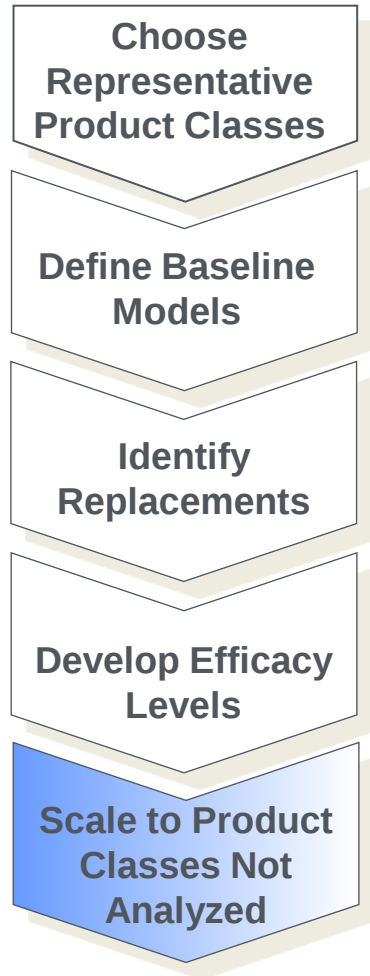
Item 8: DOE welcomes comments on the overall methodology for the engineering analysis.

Item 12: DOE welcomes comments on the methodology it is considering to select higher-efficacy lamp designs.

Item 13: DOE also welcomes comments on the potential efficacy levels identified and whether higher efficacy levels can be achieved through redesign of commercially available products. In addition, DOE requests comments on whether GSFL efficacy levels should be based on reduced-wattage lamps.



- **Develop scaling factors by comparing the efficacy level of the representative product class to compliance reports for the non-representative product class.**
- **Considering using the scaling factors developed in the 2009 Lamps Rule**



- **Proposed Scaling Factors for GSFLs**

- Reduction factor of 6.5 percent for 2-foot U-Shaped lamps from 4-foot MBP.
- Reduction factors within the range of 1.1 to 6.0 percent for lamps with CCTs above 4,500K from lamps with CCTs below or equal to 4,500K.

- **Proposed Scaling Factors for IRLs**

- Reduction factor of 15 percent for modified-spectrum IRL lamps from standard spectrum.
- Reduction factor of 15.5 percent for small-diameter lamps from large diameter.
- Increase by 15 percent for lamps operating at greater than or equal to 120V from those operating at less than 120V.

Item 14: DOE welcomes comments on the methodology to scale to products not directly analyzed and the specific scaling factors it is considering.

Item 15: DOE welcomes comments on proprietary designs it should be aware of for the GSFLs and IRLs that are the subject of this rulemaking.

Item 16: DOE welcomes comments on regulatory burdens or changes that should be considered in the engineering analysis.

Item 17: DOE welcomes comments on other engineering issues that could affect the engineering analysis.

1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
3	Engineering Analysis
4	Product Price Determination; Energy Use
5	Life-Cycle Cost and Payback Period Analysis
6	Shipment Analysis; National Impact Analysis
7	NOPR Analyses

- **Purpose**

- To determine a relationship between efficacy levels and end-user prices.

- **Methodology**

- Based on discounts applied to blue book prices (published end-user prices), from distributors, state contracts, and other public sources, calculate low, medium, high range of prices for each lamp.
- Use medium price ranges in the life-cycle cost (LCC) and national impact analysis (NIA); conduct low and high price analyses in LCC.
- For lamps where blue book prices are not available, extrapolate from available lamp prices.
- Apply sales tax determined from State and local taxes from data provided by the Sales Tax Clearinghouse (data represented weighted averages that included county and city rates).
- Conduct a price trends analysis and investigate several methods for forecasting future prices per DOE guidance.

Item 19: DOE welcomes comments on the methodology it is considering for lamp prices and sales tax estimates for this rulemaking. DOE also welcomes comment on the price forecasting methodologies it is considering.

- **Purpose**

- To identify how products are used by consumers, and thereby determine the energy savings potential of energy efficiency improvements.

- **Methodology**

- Annual energy consumption (kWh)
= system input power x annual operating hours
- Use various sources to determine annual operating hours for the commercial, residential, and industrial sectors including:
 - o Lighting Market Characterization (LMC), 2011
 - o Energy Information Administration (EIA) Commercial Building Energy Consumption Survey (CBECS), 2003
 - o EIA Residential Energy Consumption Survey (RECS), 2009
 - o EIA Manufacturing Energy Consumption Survey (MECS), 2006

Item 18: DOE welcomes comments on the methodology it is considering to determine energy use. In particular, DOE requests comments on its approach to calculate operating hours for the covered lamps.

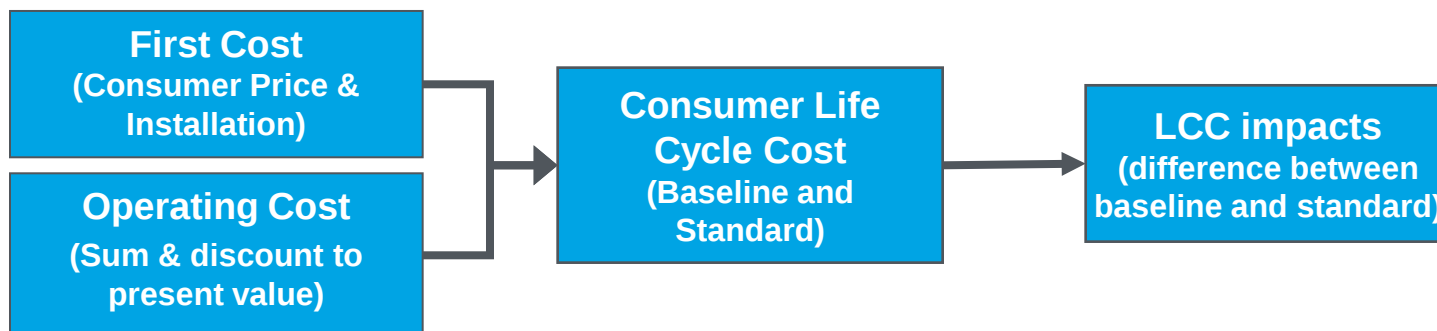
1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
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7	NOPR Analyses

- **Purpose**

- Assess the net LCC and PBP for a consumer due to energy conservation standards under several scenarios/events (e.g. new construction, replacement, renovation).

- **Methodology**

- LCC equals consumer price plus the cumulative of annual operating costs over the analysis period (baseline lamp lifetime divided by average operating hours) discounted to a particular base year.
- Results expressed as LCC difference (baseline minus standard level).
- Simple payback (years) is also calculated and reported.



- **Total Installed Price (First Cost)**

- Purchase price: *product price, sales tax.*
- Installation cost: *labor rate, time needed to install lamp (minutes).*
 - o Derive average labor times, rates, and costs using the latest “RS Means Electrical Cost Data” and data from the U.S. Bureau of Labor Statistics.

- **Total Operating Cost**

- Electricity consumption: *lamp wattage, operating hours.*
- Electricity cost: *electricity price, projected electricity price trend.*
 - o Derive average regional prices for 13 geographic areas consisting of nine Census Divisions with four large States, treated separately. (EIA-861, 2009)
 - o Use the EIA’s Annual Energy Outlook (AEO) for projections of future average electricity prices (reference, high, and low scenarios).

- **Use the discount rate to determine the present value operating expenses over the analysis period.**
- **Derive discount rates from estimates of the interest or “finance cost” to purchase products.**
- **Finance cost of raising funds to purchase products can be:**
 - Financial cost of any debt incurred to purchase products.
 - Opportunity cost of any equity used to purchase products.

Item 20: DOE welcomes comments on the approach it is considering to conduct the LCC and PBP analyses.

1	Overview; Scope of Coverage
2	Market & Technology; Screening Analyses
3	Engineering Analysis
4	Product Price Determination; Energy Use
5	Life-Cycle Cost and Payback Period Analysis
6	Shipment Analysis; National Impact Analysis
7	NOPR Analyses

- **Shipments Analysis**

- To estimate lamp shipments and the product mix of the stock over the analysis period in the base cases and standards cases.

- **National Impact Analysis**

- To estimate the National Energy Savings (NES) from energy conservation standards at different levels over the analysis period (30 years, 2017-2046)
- To estimate the national economic impact on the nation, or the Net Present Value (NPV), from energy conservation standards at different levels over the analysis period (30 years, 2017-2046).

- **Historical Shipments**

- Use shipments from NEMA and other publicly available sources to estimate historical shipments of each lamp.

- **Installed Stock**

- Calculate installed stock lamps using historical shipments and average lamp lifetime.

- **Develop shipment forecasts (2017-2046)**

- Apply growth, emerging technologies, and shipment assumptions.
- Develop market-share matrices with the percentage market share of each lamp type taking into account efficacy, power rating, light output, and lifetime of the lamp and lamp-and-ballast designs.

- **National Energy Savings (2017-2046) = Annual energy consumption (Base Case - Standards Case)**
 - Installed Stock
 - Unit Annual Energy Consumption
 - Electricity Site-to-Source Conversion Factors
 - o Conversion factors forecast using latest Annual Energy Outlook
 - Rebound Rate
 - o Commercial and Industrial sectors: 1 percent, Residential sector: 8.5 percent
- **Net Present Value (2017-2046) = Operating cost savings - Increased total installed costs (present value)**
 - Shipments
 - Per Unit Installed Cost
 - Electricity Prices
 - Discount Rate – 7 percent and 3 percent real per OMB.

Item 21: DOE seeks information on historical shipments of GSFLs and IRLs for each product class covered under this rulemaking, as well as industry-trend data regarding relative growth in each product class.

Item 22: DOE requests input on the potential impact of new energy conservation standards on shipments of GSFLs and IRLs. DOE also requests input on any other federal, state, and local programs that currently exist to promote the adoption of more-efficient lamps.

Item 23: DOE welcomes comment on the data sources it anticipates using to develop inputs for the national impact analysis.

Item 24: DOE welcomes comments on the quantitative and theoretical underpinnings of the rebound effect as well as results from newer studies of the size and sign of the rebound effect for residential, commercial, industrial, and municipal consumers.

Item 25: DOE welcomes comments on the NES spreadsheet models it plans to use for estimating national impacts of amended energy conservation standards for GSFLs and IRLs. DOE also welcomes comments on the inputs to the models and the sources used for determining the inputs.

Item 26: DOE welcomes comments on the inputs and methodology to calculate NES and NPV.

1	Overview; Scope of Coverage
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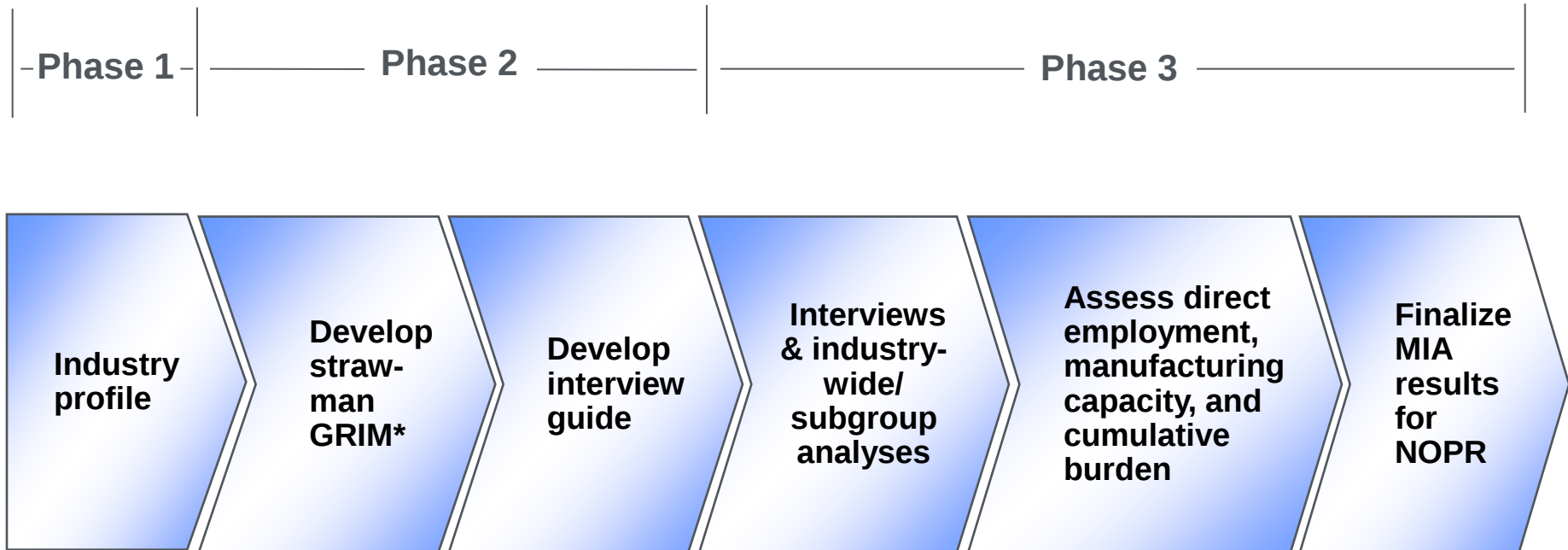
- **Purpose**

- To assess the economic impacts of standards on manufacturers;
- To identify and estimate impacts on manufacturer sub-groups that may be more severely affected than the industry as a whole; and
- To examine the direct employment impacts, manufacturing capacity, and the cumulative regulatory impact on the manufacturing industry.

- **Methodology**

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

Manufacturer Impact Analysis: Overview



*** Government Regulatory Impact Model (GRIM)**

Item 28: DOE welcomes comments on its methodology for assessing the impacts on product manufacturers covered under this rulemaking. DOE also requests information on manufacturing costs.

- **Life-Cycle Cost Subgroup Analysis**
 - Effects on various national consumer subgroups
- **Utility Impact Analysis**
 - Impacts on the generation capacity of utilities
- **Employment Impact Analysis**
 - Indirect impacts on overall national employment
- **Environmental Assessment**
 - Effects of airborne pollutant emission reductions
- **Regulatory Impact Analysis**
 - Impacts of non-regulatory alternatives

Item 27: DOE plans to assess the impacts on low-income households, institutions of religious worship, and institutions serving low-income consumers, and seeks input regarding which other consumer subgroups it should consider in this rulemaking.

Item 29: DOE welcomes comments on the approach it is considering to assess the impacts of potential standards under this rulemaking on electric utilities.

Item 30: DOE welcomes comments on the approach it is considering to assess national indirect employment impacts as a result of energy conservation standards.

Item 31: DOE seeks input on its plans to use latest version of EIA's National Energy Modeling System (NEMS-BT) to conduct the environmental assessment for the products covered by this rulemaking.

Item 32: DOE welcomes comments on the methodology it is considering for the regulatory impact analysis.

DOE Seeks Comments on its Framework Proposal

In all correspondence, include all of the following:

- Energy Conservation Standards for General Service Fluorescent Lamps and Incandescent Reflector Lamps
- Docket Number: EERE-2011-BT-STD-0006
- Regulatory Identification Number (RIN):1904-AC43

Contact Information:

Email: GSFL-IRL_2011-STD-0006@ee.doe.gov

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

Postal Mail:

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Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
950 L'Enfant Plaza, S.W., 6th Floor
Washington, DC 20024
Telephone: (202) 586-2945

Comment period closes: October 31, 2011, midnight EDT

DOE Seeks Comments on its Test Procedure Proposal

- **In all correspondence, include all of the following:**
 - Test Procedures for General Service Fluorescent Lamps, General Service Incandescent Lamps, and Incandescent Reflector Lamps
 - Docket Number: EERE-2011-BT-TP-0012
 - Regulatory Identification Number (RIN):1904-AC45

- **Contact Information**

Email: Lamps-2011-TP-0012@ee.doe.gov

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

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Comment period closes: November 28, 2011 midnight EDT

Questions?

BACK UP SLIDES