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Proposed Energy Efficiency Standards for Federally Excluded and Exempted Linear Fluorescent Lamps

Staff Workshop

July 10, 2019

David Nichols, Supervisor
Appliances Office – Efficiency Division

Workshop Agenda

Time	Topic	Presenter
10:00 a.m.	**Housekeeping & Introduction**	David Nichols
10:10 a.m.	**Staff Presentation**	Soheila Pasha
11:00 a.m.	**Break (10 minutes)**	
11:10 a.m.	**Stakeholder Presentations (10 minutes each)**	Jasmine Shepard
11:20 a.m.	**Open Discussion and Public Comment**	
12:00 p.m.	**Adjourn**	

Housekeeping Items

- Note: This workshop is being recorded with a court reporter and WebEx.
- All comments today will be added to the public record.
- No Commissioners will be present today and no decisions will be made at this workshop.
- Restrooms are located outside this room to the left by the exit signs, and on the right (beyond the stairs and in back of the elevators).
- Refreshments
  - Water fountains located near the restrooms
  - There is a lounge on the second floor with vending machines.
- Emergencies
  - Lastly, if there is an emergency and the building is evacuated, please follow our staff to the appropriate exits. We will convene at Roosevelt Park, located diagonally across the street from this building.

Participation Guidelines

- For those participating online:
  - Please mute your phone.
  - Please use the raise hand feature to make comments.
    - We will unmute you.
  - Or use the chat feature to make comments.
    - We will read those comments into the record and respond accordingly.
  - Please remember to state your name and the organization you represent.
- We recommend you log-in into the WebEx event and use the audio pin or have WebEx call you.

Participation Guidelines

- For those participating in the room and wish to make comments:
  - Please go to the microphone provided at the podium. If needed, we can bring a microphone to you.
  - When you see a green light – the microphone is on. A red light indicates the microphone is off.
  - Please speak directly into the mic.
  - Please state your name and the organization you represent.
  - When done, please turn off the microphone (change to a red light).
  - Please provide your business card to the court reporter.

Document Availability

- Today's workshop is a part of the pre-rulemaking process. In a few moments, you will see the current timeline for this pre-rulemaking.
- All relative documents related to the Federally Exempted Linear Fluorescent Lamps workshop are available on the Energy Commission's website at: https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=18-AAER-08

Comments

- **Comments are due by 5:00 p.m. on August 26, 2019.**
- **To submit electronically:**
  - Go to https://efiling.energy.ca.gov/Ecomment/Ecomment.aspx?docketnumber=18-AAER-08.
- **To send a hard copy:**

  California Energy Commission
  Docket Unit, MS-4
  Re: Docket No. 18-AAER-08
  1516 Ninth Street
  Sacramento, CA 95814-5512

- **To send a digital copy:** email docket@energy.ca.gov, include docket number 18-AAER-08 and indicate "Federally Exempted Linear Fluorescent Lamps" in the subject line.

Proposed Energy Efficiency Standards for Federally Excluded and Exempted Linear Fluorescent Lamps

Staff Workshop

July 10, 2019

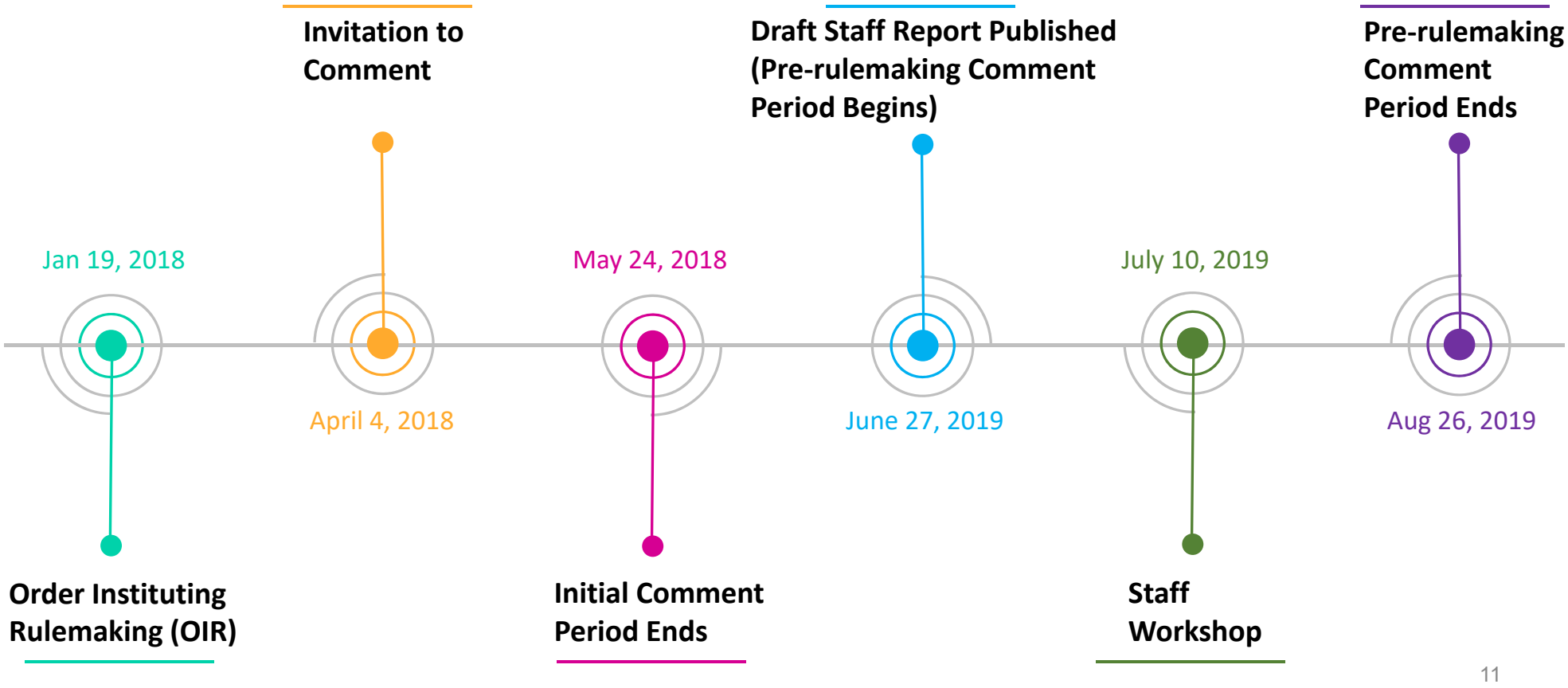
Presented by Soheila Pasha, Ph.D.
Appliances Office – Efficiency Division

Agenda

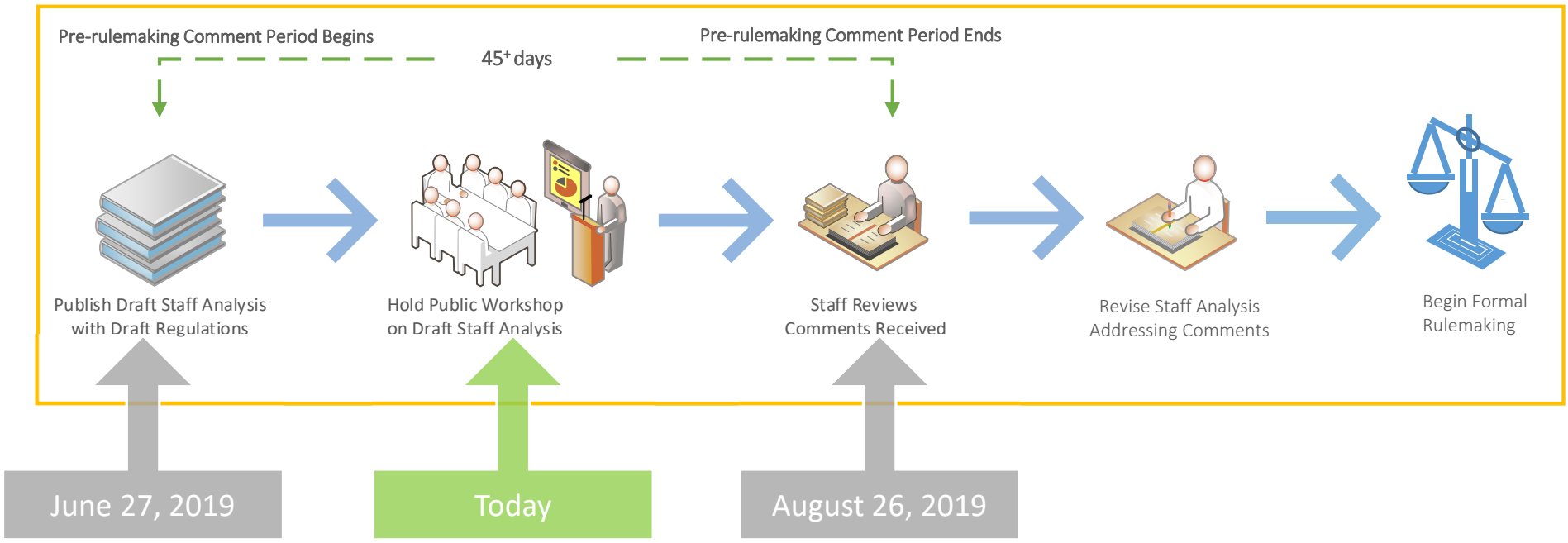
- Background:
  - Rulemaking Process
  - Linear Fluorescent Lamps
- Staff Proposal
  - Scope
  - Definitions
  - Efficiency Standards
  - Test Procedure
  - Product Certification
- Technical Feasibility
- Costs and Benefits: Energy Savings, Cost Analysis, and Environmental Impacts
- Conclusion
- Next Steps
- Questions?

Background: Rulemaking Process

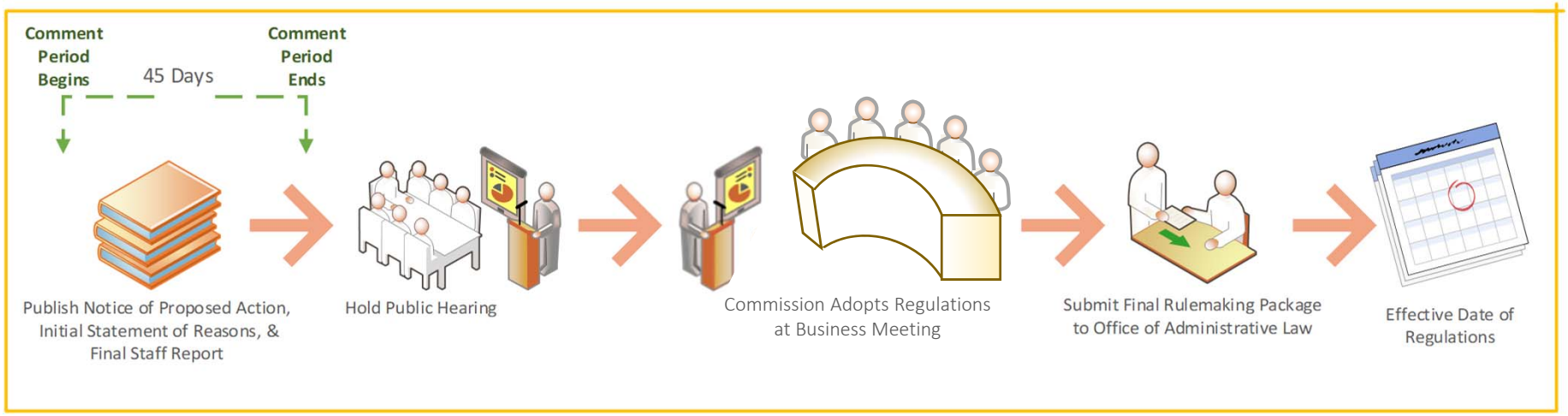
Background: History of Pre-Rulemaking Events



Background: Pre-Rulemaking Process



Background: Formal Rulemaking Process



Background: Linear Fluorescent Lamps

Background: Federal Regulations

Fluorescent Lamps

Federal General Service Fluorescent Lamps (GSFL)

- 4-foot lamps with standard output and medium or miniature bipin base
- 4-foot lamps with high output and miniature bipin base
- 8-foot lamps with standard output and single pin base
- 8-foot lamps with high output and recessed double contact base
- 2-foot U-shaped lamps with medium bipin base

Only Includes

Exempts

- Impact-resistant fluorescent
- Lamps with a Color Rendering Index (CRI) of 87 or greater
- Fluorescent lamps designed to promote plant growth;
- Fluorescent lamps specifically designed for cold temperature applications;
- Colored fluorescent lamps;
- Reflectorized or aperture lamps;
- Fluorescent lamps designed for use in reprographic equipment;
- Lamps primarily designed to produce radiation in the ultra-violet region of the spectrum

Others

- 2-foot and 3-foot with standard output and medium or miniature bipin base

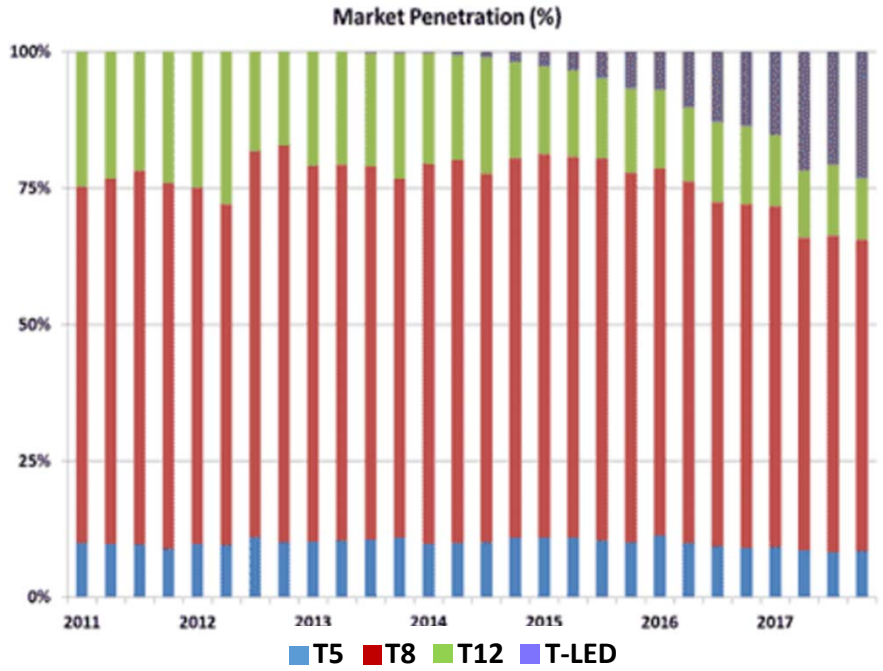
Problem Statement

- Some linear tubular fluorescent lamps are federally regulated.
- Several types of linear fluorescent lamps are exempted from federal standards. That includes **Impact resistant** lamps and lamps with a **CRI of 87 or more**.
- T12 lamps cannot meet the federal standards but use the federal exemptions to exist on the market.

- T8 lamps starting to make use of exemptions from the federal standards.

Problem Statement

- Per DOE 2015 LMC report, more than 26% of existing stock of linear lamps in the US are T12.
- In Q4 2017, T12 lamps accounted for 11.4 percent of national linear tube lamp shipments.
- This percentage has remained relatively stable since 2015. It appear TLEDs are primarily displacing T8s while T12s remained relatively stable
- These facts defy the “non-general application” reason for some of the federal GSFL exemptions.



Source: National Electrical Manufacturers Association

Problem Statement

- Less than 4-foot linear lamps include 2-foot and 3-foot linear lamps with general applications and currently are out of the scope of federal regulations.
- These lamps require a significant amount of energy on a statewide basis.
- There are energy efficient LED 2-foot and 3-foot replacement lamps available on the market.
- Staff is proposing new standards for less than 4-foot lamps used in general applications.

Stakeholders' Proposals

- CASE team proposed efficiency levels consistent with the efficiency of an average linear LED lamp for both State regulated GSFLs and less than 4-foot lamps.

- NEMA and Philips Lighting proposed not setting any state standards.

Staff Proposal

Proposed Scope

- State-regulated general service fluorescent lamps:
  - Lamps with a CRI of 87 or greater
  - Impact resistant lamps

  Only includes:
    - 4-foot lamps with standard output and medium or miniature bipin base
    - 4-foot lamps with high output and miniature bipin base
    - 8-foot lamps with standard output and single pin base
    - 8-foot lamps with high output and recessed double contact base
    - 2-foot U-shaped lamps with medium bipin base

- State-regulated less than 4-foot linear lamps:
  - 2-foot linear lamps
  - 3-foot linear lamps

  Only includes:
    - standard output and medium or miniature bipin base

Proposed Definitions

"**State-regulated general service fluorescent lamp**" means any impact-resistant fluorescent lamp or high-CRI fluorescent lamp that is one of the following types:

- Any straight-shaped lamp (commonly referred to as 4-foot medium bipin lamps) with medium bipin bases of nominal overall length of 48 inches and rated wattage of 25 or more;
- Any U-shaped lamp (commonly referred to as 2-foot U-shaped lamps) with medium bipin bases of nominal overall length between 22 and 25 inches and rated wattage of 25 or more;
- Any rapid start lamp (commonly referred to as 8-foot high output lamps) with recessed double contact bases of nominal overall length of 96 inches;
- Any instant start lamp (commonly referred to as 8-foot slimline lamps) with single pin bases of nominal overall length of 96 inches and rated wattage of 49 or more;
- Any straight-shaped lamp (commonly referred to as 4-foot miniature bipin standard output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 25 or more; or
- Any straight-shaped lamp (commonly referred to as 4-foot miniature bipin high output lamps) with miniature bipin bases of nominal overall length between 45 and 48 inches and rated wattage of 44 or more.

Proposed Definitions

The term “state-regulated general service fluorescent lamp” **does not include** any lamp designed and marketed for the following applications:

- Lamps designed to promote plant growth;
- Lamps specifically designed for cold temperature applications;
- Colored lamps;
- Reflectorized or aperture lamps;
- Lamps designed for use in reprographic equipment; and
- Lamps primarily designed to produce radiation in the ultra-violet region of the spectrum.

Proposed Definitions

"**High-CRI fluorescent lamp**" means any fluorescent lamp with a CRI of 87 or greater.

"**Impact-resistant fluorescent lamp**" means any fluorescent lamp that:

1. Has a coating or equivalent technology that is compliant with NSF/ANSI 51 and is designed to contain the glass if the glass envelope of the lamp is broken; and
2. Is designed and marketed for the intended application, with:
   A. The designation on the lamp packaging; and
   B. Marketing materials that identify the lamp as being impact resistant, shatter-resistant, shatter-proof, or shatter-protected.

Proposed Definitions

“State-regulated less than 4-foot linear lamp” means any straight-shaped linear lamp with nominal length of 2-foot or 3-foot that has either a medium bipin base or a miniature bipin base.

The term “State-regulated less than 4-foot linear lamp” **does not include** any lamp designed and marketed for the following applications:

- Lamps designed to promote plant growth;
- Lamps specifically designed for cold temperature applications;
- Colored lamps;
- Reflectorized or aperture lamps;
- Lamps designed for use in reprographic equipment; and
- Lamps primarily designed to produce radiation in the ultra-violet region of the spectrum.

Proposed Definitions

“Designed and marketed” for state-regulated lamps means exclusively designed to fulfill the indicated application and, when distributed in commerce, designated and marketed solely for that application, with the designation prominently displayed on the packaging and all publicly available documents (e.g., product literature, catalogs, and packaging labels).

“Cold temperature fluorescent lamp” means a fluorescent lamp specifically designed to start at −20 °F when used with a ballast conforming to the requirements of ANSI C78.81 and ANSI C78.901, and is expressly designated as a cold temperature lamp both in markings on the lamp and in marketing materials, including catalogs, sales literature, and promotional material.

Proposed Efficiency Standards

- State-regulated general service fluorescent lamps:
  - Align with the federal standards for the federally regulated general service fluorescent lamps.
- State-regulated less than 4-foot lamps:
  - 115 LPW, consistent with the efficiency for an average LED linear lamp.
- Proposed effective date: January 1, 2021 or one year after the proposed standards are adopted.

Proposed Test Procedure

- State-regulated general service fluorescent lamps:
  - Federal test procedure for federally regulated general service fluorescent lamps.
    - 10 C.F.R. section 430.23(r) (Appendix R to subpart B of part 430)
- State-regulated less than 4-foot lamps:
  - Federal test procedure for integrated LED lamps.
    - 10 C.F.R. section 430.23(ee) (Appendix BB to subpart B of part 430).
  - Federal test procedure for non-integrated LED lamps.
    - 10 C.F.R. section 430.23(gg) (Appendix DD to subpart B of part 430).
  - Federal test procedure for federally regulated general service fluorescent lamps.
    - 10 C.F.R. section 430.23(r) (Appendix R to subpart B of part 430)

Proposed Product Certification

- State regulated general service fluorescent lamps:
  - Certify linear **fluorescent** lamps within the scope.
    - Linear LED lamps are not in the scope of the proposed standards and are not required to be certified to the Energy Commission database.
- State regulated less than 4-foot lamps:
  - Certify linear **LED** and **fluorescent** lamps within the scope.
    - Note: currently only linear LED lamps on the market can meet the proposed standards.
- No product specific marking is proposed.

Technical Feasibility

Technical Feasibility: State-regulated general service fluorescent lamps

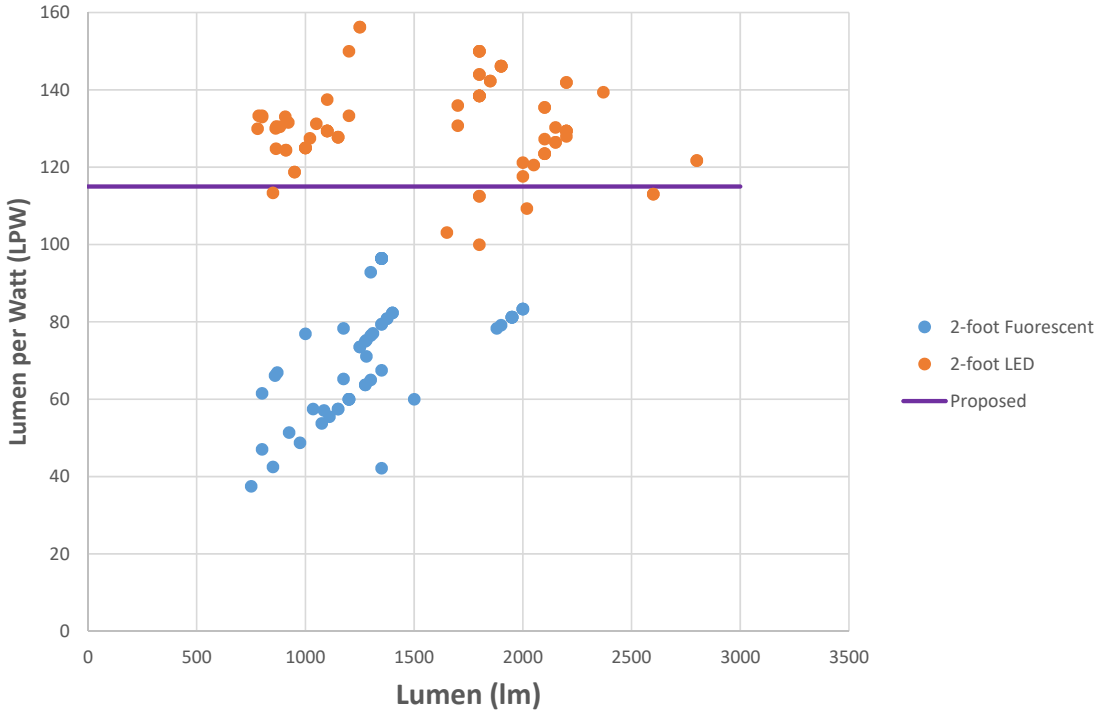
- For high-CRI fluorescent lamps, except 8-foot high-output, there are fluorescent or LED replacements:
  - With high CRI values (85^{+})
- For impact-resistant lamps, except 8-foot high-output, there are fluorescent or LED replacements.
- For 8-foot high-output, there are fluorescent replacement lamps available on the market.

There are compliant replacement lamps available and therefore the proposed standards are technically feasible for State-regulated general service fluorescent lamps.

Technical Feasibility
State-regulated less than 4-foot lamps

- 2-foot linear lamps

There are linear LED replacement lamps available on the market.

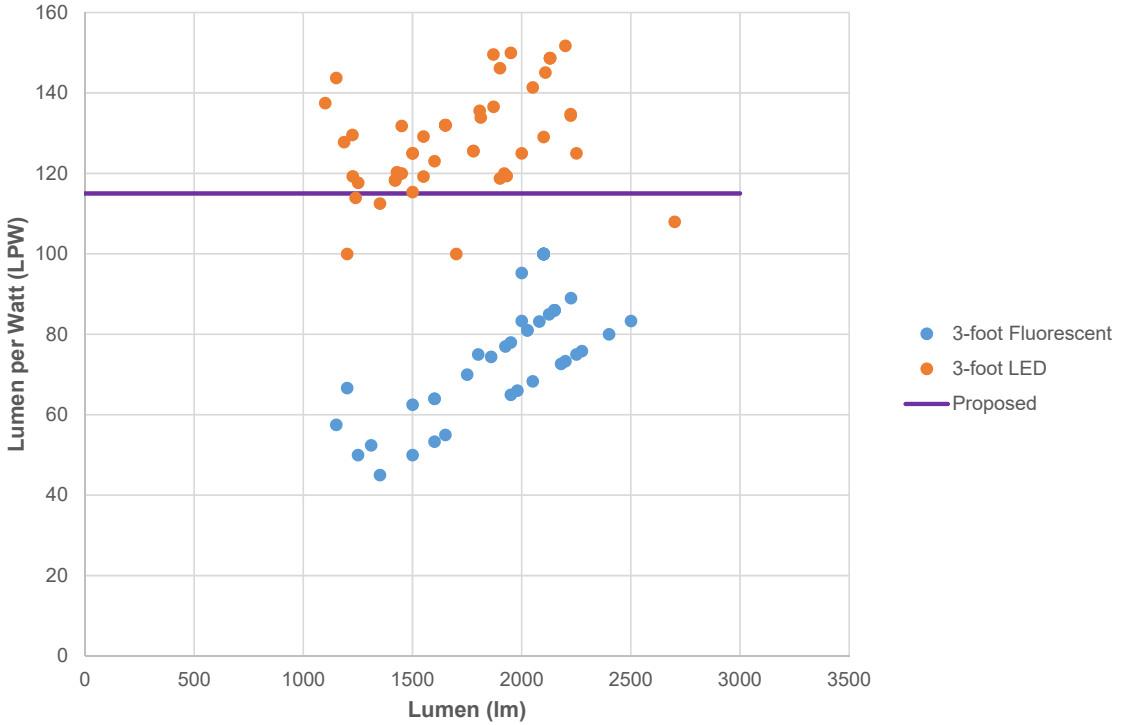


There are compliant replacement lamps available and therefore the proposed standards are technically feasible for 2-foot linear lamps.

Technical Feasibility
State-regulated less than 4-foot lamps

- 3-foot linear lamps

There are linear LED replacement lamps available on the market.



There are compliant replacement lamps available and therefore the proposed standards are technically feasible for 3-foot linear lamps.

Costs and Benefits: Energy Savings, Cost Analysis, and Environmental Impacts

Per Unit Energy Savings

Total Statewide First Year Energy Savings

Lamp Type	Baseline Energy Use (kWh/yr/Unit)	Compliant T8 Energy Use (kWh/yr/Unit)	Compliant LED Energy Use (kWh/yr/Unit)	Energy Saving (kWh/yr/Unit)
4-foot Standard Output T12	121.8	76.4	38.9	T8: 45.4 LED: 82.9
8-foot Standard Output T12	224.2	141.2	93.3	T8: 83.0 LED: 130.9
8-foot High Output T12	333.0	207.3	-	125.7
Less than 4-foot T12	72.6	-	23.3	49.3
Less than 4-foot T8	42.8	-	23.3	19.5
Less than 4-foot T5	44.1	-	23.3	20.8

First Year Energy Savings

Total Statewide First Year Energy Savings (2021)

Lamp Type	Annual Sales in 2021 (Thousands)	Replacement: Compliant T8	Replacement: Compliant LED	Energy Savings from Annual Sale (GWh/yr)
4-foot Standard Output T12	4,012	62%	38%	239.7
8-foot Standard Output T12	234	62%	38%	23.7
8-foot High Output T12	41	100%	-	5.2
Less than 4-foot T12	10	-	100%	0.5
Less than 4-foot T8	852	-	100%	16.6
Less than 4-foot T5	2,684	-	100%	55.7
Total	**7,833**	**-**	**-**	**341.4**

Annual Energy Savings

Total Statewide Annual Energy Savings

Lamp Type	Unit Stock in 2021 (thousands)	Weighted Average Electricity Rates ($/kWh)	Stock Turnover Year	Stock Energy Savings (GWh/yr)*
4-foot T12	41,887	0.149	2028	1,870.4
8-foot Standard Output	1,793	0.137	2025	91.9
8-foot High Output	316	0.137	2025	18.3
Less than 4-foot T12	64	0.147	2023	1.1
Less than 4-foot T8	3,227	0.147	2030	196.4
Less than 4-foot T5	10,259	0.147	2031	717.3
Total	**57,546**	**-**	**-**	**2,895**

* After stock turn over

Maximum stock energy savings in 2028 is 2,583.8 GWh/yr.

Cost Analysis Assumptions

- Lifecycle energy and cost savings are savings throughout the life of the replacement product.
  - Lifecycle cost savings include the avoided cost of non-compliant lamp replacements because compliant lamps last longer

- LED replacement lamps are assumed to be UL type-B: integrated LED lamps that bypass the fluorescent ballast.

Cost Analysis Assumptions

- Incremental cost includes the costs for:
  - Parts including lamp and ballast
  - Labor for installation (changing the ballast for fluorescent or bypassing the ballast for LED)
    - RS Means: $60.30 to $70.76 per 2-lamp light fixture → $30.15-$35.38 per lamp
    - GE: $31.30 per light fixture → $15.65 per lamp
  - Sales tax (7.25%)
  - Disposal of the removed ballasts (PCB Lighting Ballast for Recycle/Incineration www.ewastedisposal.net).
- All removed ballasts are assumed to be magnetic containing toxic PCB

Costs and Benefits

Unit Energy Savings and Lifecycle Benefits/Costs

Lamp Type	Design Life Baseline (years)	Design Life Compliant (years)	Life-Cycle Energy Saving (kWh/yr/unit)	Life-Cycle Cost Saving ($/unit)	Incremental Cost ($/unit)	Net Benefit Ratio (Benefit/Cost)	First year Reduced Electricity Cost ($M/yr)	Annual Reduced Electricity Cost ($M/yr)*
4-foot Standard Output T12	8	T8: 12 LED: 19	T8: 544.8 LED: 1,575.1	T8: $83.19 LED: $238.75	T8: $35.58 LED: $38.69	T8: 2.3 LED: 6.2	$35.7	$278.7
8-foot Standard Output T12	5	T8: 9 LED: 19	T8: 747 LED: 2,487.1	T8: $153.01 LED: $497.21	T8: $52.31 LED: $59.12	T8: 2.9 LED: 8.4	$3.2	$12.6
8-foot High Output T12	5	T8: 8	T8: 1005.6	T8: $144.49	T8: $74.00	T8: 1.9	$0.7	$2.5
Less than 4-foot T12	3	LED: 19	LED: 934.8	LED: $165.64	LED: $36.01	LED: 4.6	$0.07	$0.2
Less than 4-foot T8	10	LED: 19	LED: 369.4	LED: $56.46	LED: $38.48	LED: 1.5	$2.4	$28.9
Less than 4-foot T5	11	LED: 19	LED: 393.9	LED: $61.15	LED: $37.41	LED: 1.6	$8.2	$105.4
Total	-	-	-	-	-	-	$50.27	$428.3

*After stock turnover

Environmental Impacts

- Proposed standards don't impose an early replacement of inefficient lamps. They apply to the lamps manufactured on and after the effective date.
- Overall toxic waste is reduced: replacement lamps are more durable, and in the case of LED, replacement lamps are non-toxic.
- Proposed standards will save substantial energy:
  - Fewer power plants
  - Reduced GHG and criteria pollutant emissions
- Proposed standards may accelerate disposal of existing ballasts containing PCB but they don't increase the overall toxic waste.

Conclusion

Conclusion

- Proposed standards achieve energy efficiency savings not provided by the federal regulations for the GSFL.
- Proposed standards are cost effective, technically feasible, and save significant energy.
- Proposed standards don’t have an adverse environmental impact and will reduce the overall toxic waste, GHG, and criteria pollutant emissions.

Next Steps

Comments

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Questions?

Thank You!

Soheila Pasha

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Efficiency Division

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