Market Acceptance Of Screwbase Compact Fluorescent Lamps (CFLs)

Lighting Research Center
Rensselaer Polytechnic Institute

Sponsors: US Environmental Protection Agency
US Department of Energy

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Project Team

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Research Project

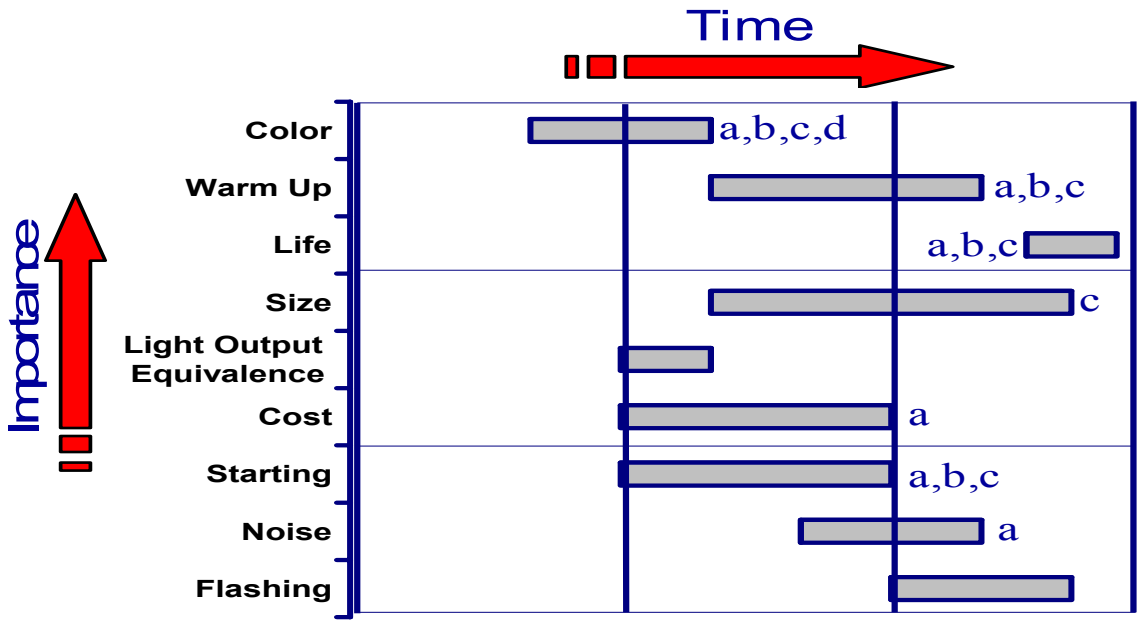
- The Lighting Research Center, in cooperation with the ENERGY STAR® program under the U.S. Environmental Protection Agency and the U.S. Department of Energy, investigated methods of increasing market acceptance of screwbase compact fluorescent lamps (CFLs).

Scope of the Project

- Perform limited laboratory measurements
  - Color
  - Warm-up time
- Verify the ranking of the issues/barriers associated with consumer acceptance of CFLs
- Suggest actions to overcome the identified issues.

Barriers Ranked by LRC

9 Block Diagram

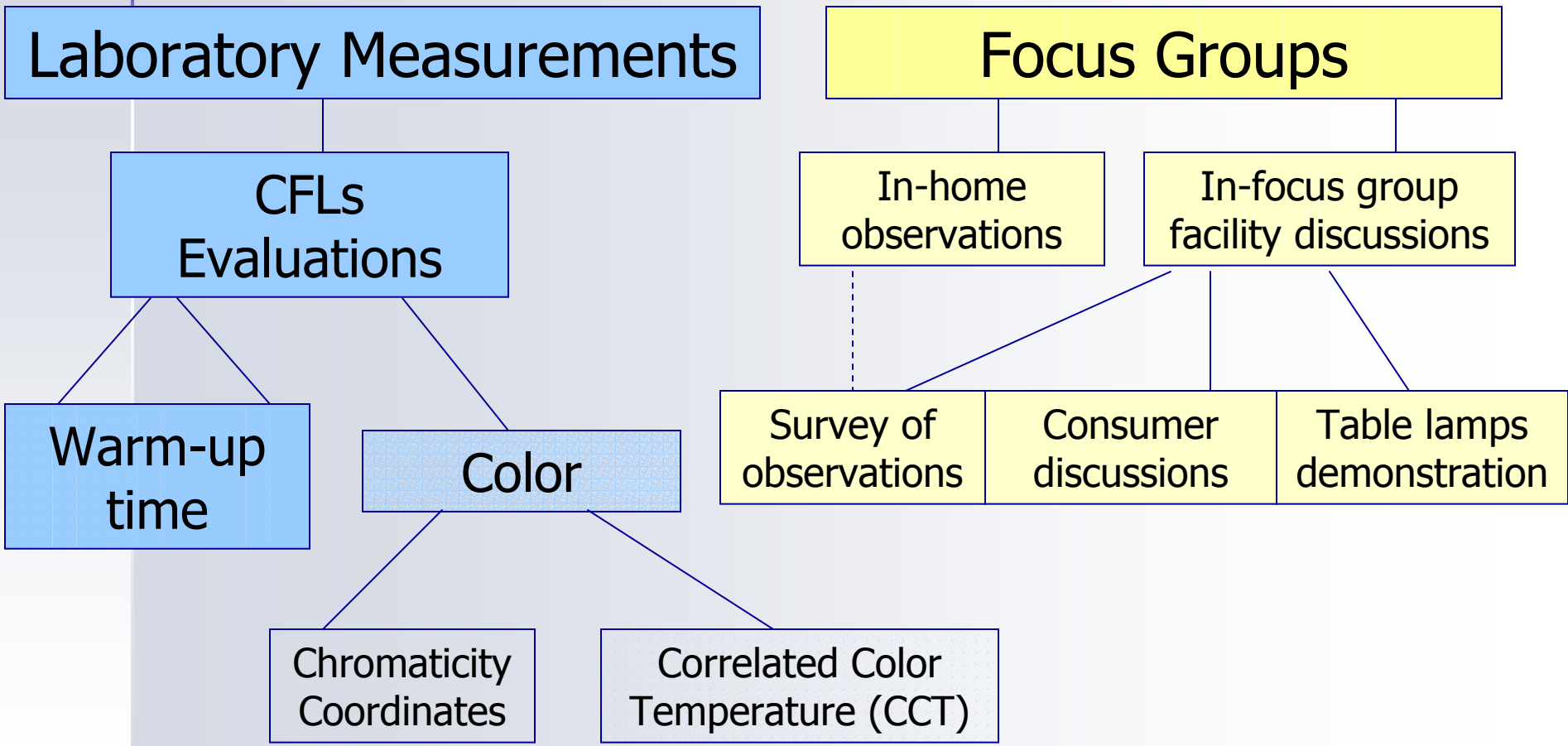


a: Evaluation
b: Education
c: Marketing
d: Standards

Barriers to Consumer Acceptance to be Verified

- Barriers that were verified through laboratory measurements and focus group discussions
  - Color
  - Warm-up time
  - Life
  - Equivalent light output

Research Methods



Laboratory Measurements

Summary of Results

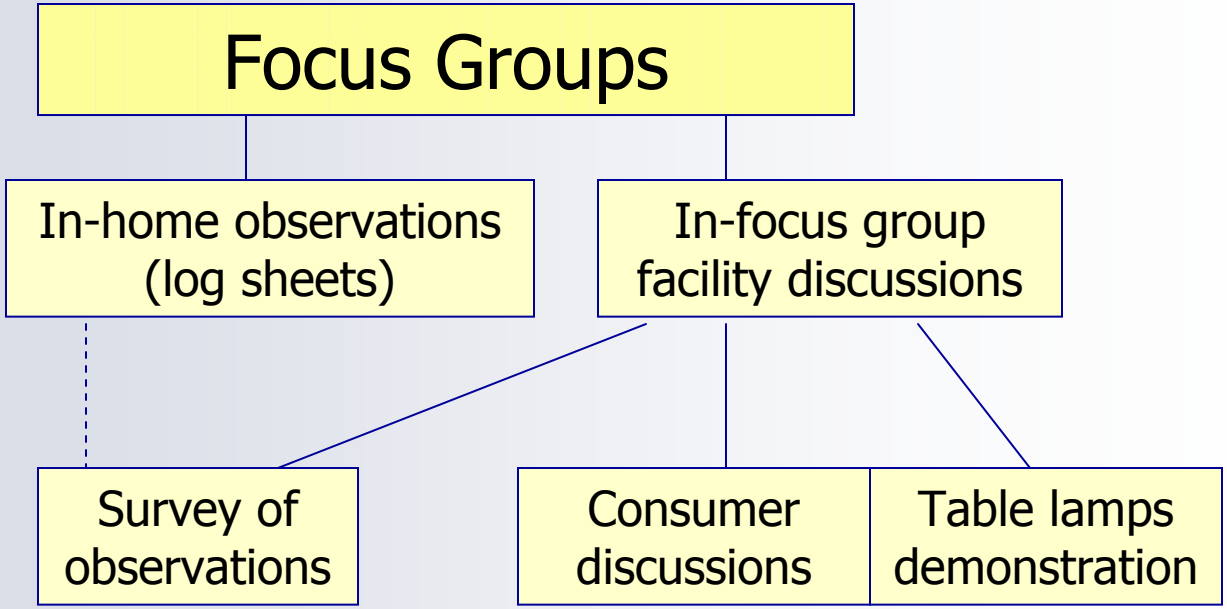
- Wide variation in CCT and chromaticity coordinates
  - Between manufacturers
  - Within manufacturers

CCT is not an unambiguous description of color

- Average warm-up times for most current CFLs is around 20 seconds, well within ENERGY STAR® specifications.

Focus Group

Outline



Focus Group

Criteria for selecting participants

Responsible for paying utility bills and purchasing lamps

Prior experience with CFLs

Minimum age of 25

10-12 participants from the Albany area per group

2 Groups of Satisfied CFL Users

2 Groups of Unsatisfied CFL Users

Focus Group - In-home evaluation

Methodology

- Participants were provided with 3 CFLs
  - 2 20-watt CFLs of noticeably different color (Lamps A and B)
  - 1 28- watt CFL for higher lumen output, slow start (Lamp C)
- A log sheet for participant description of where CFL was used and their overall impression of the lamps
- A disposable camera to take picture of lamp and surroundings
- Participants were asked to fill out a survey when attending the focus group discussion
- Instructions for installation and safety were provided.

All CFLs were seasoned and photometrically measured at LRC prior to distribution.

Focus Group - In-home evaluation

Methodology: Log Sheet Survey

- Questions included in the log sheet survey
  - Do lamps A and B appear the same?
    - If not, what is different?
  - Was the brightness of the bulbs satisfactory?
  - Was the color of the bulbs satisfactory?

Focus Group - In-home evaluation

Photometric Measurements

Lamp	CCT (K)	Warm-up time (sec)	Rated Light Output (Lumens)	Average Light Output (Lumens)
A	2892 ± 59	< 10	1200	1164 ± 47
B	3106 ± 29	< 10	1200	1060 ± 63
C	3111 ± 53	< 19	1600	1476 ± 49

Focus Group - In-home evaluation

Results: Log Sheet Survey

Consumer Groups	Was the brightness of the lamps satisfactory?		Was the color of the lamps satisfactory?	
	Yes	**No**	**Yes**	**No**
Satisfied	77.8%	22.2%	60.0%	40.0%
Unsatisfied	66.7%	33.3%	57.1%	42.9%

Consumer Groups	Do lamps A and B appear the same?	
	Yes	**No**
Satisfied	21.1%	78.9%
Unsatisfied	44.4%	55.6%

Focus Group - In-home evaluation

Results: Log Sheet Survey

- Most participants noticed that lamp C did not light immediately.
- Participants noticed the color differences between lamps A and B
  - Some participants had strong opinions about the differences
  - Participants noticed that color was affected by lamp shades and wall colors

Focus Group - Consumer Discussions

Responses: Experience with CFLs

- Consumers describe CFLs as:
  - Energy saving
  - Long lasting
  - Look/shape different
  - Some brighter than others
  - Expensive, but price has come down
  - Delayed start-up
  - Not as hot to touch

Focus Group - Consumer Discussions

Responses: Experience with CFLs

- Consumer expect color consistency and predictability
  - Consumers would have no problem returning a lamp with unsatisfactory color for a refund, not likely a replacement.
- Consumers are not familiar with industry terminology for color, neither do they look for this information on the package
  - Participants talk in terms of "soft" and "white" rather than "warm" and "cool"
  - Participants consider incandescent a "white" light and commonly objected to the "yellow" light from Lamp A (warmest lamp)
- Consumers do have specific preferences for colors, and they usually vary depending on the lighting application.

Focus Group - Consumer Discussions

Responses: Experience with CFLs

Lamp Life

- General belief that incandescent lamps last 3-6 months
- CFLs are expected to last 2-4 years
- Consumers don’t keep track of when they change lamps unless they are hard to change

Focus Group - Consumer Discussions

Survey Results: Experience with CFLs

Survey asked participants to:

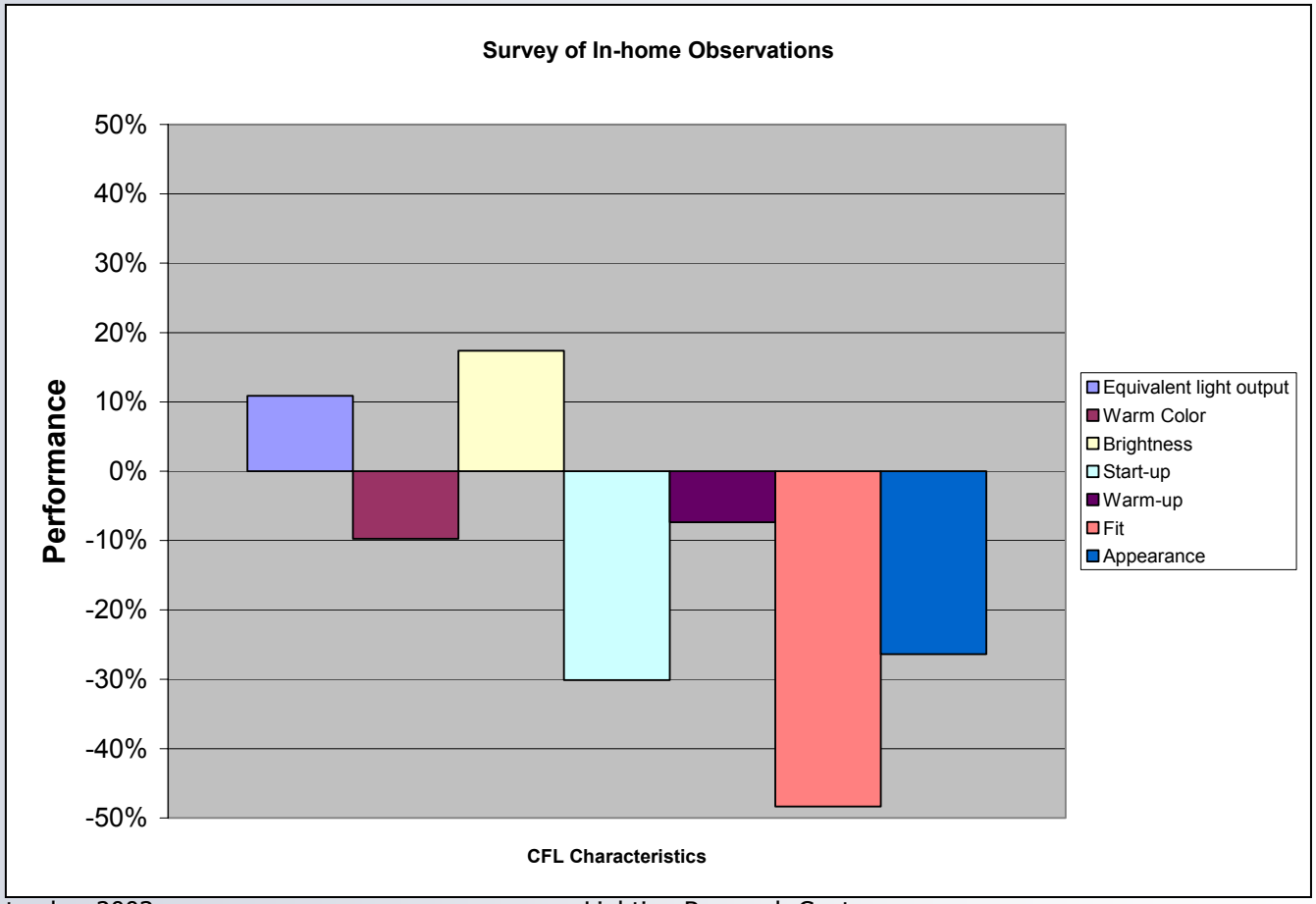
1) Rate the performance of the CFLs compared to expectations

2) List the two most important factors from the list below:

- Equivalent light output
- Lighting color – warm, cool *
- Brightness
- Start-up
- Warm-up to full brightness
- Replacement bulb fit
- Appearance/looks

Focus Group - Consumer Discussions

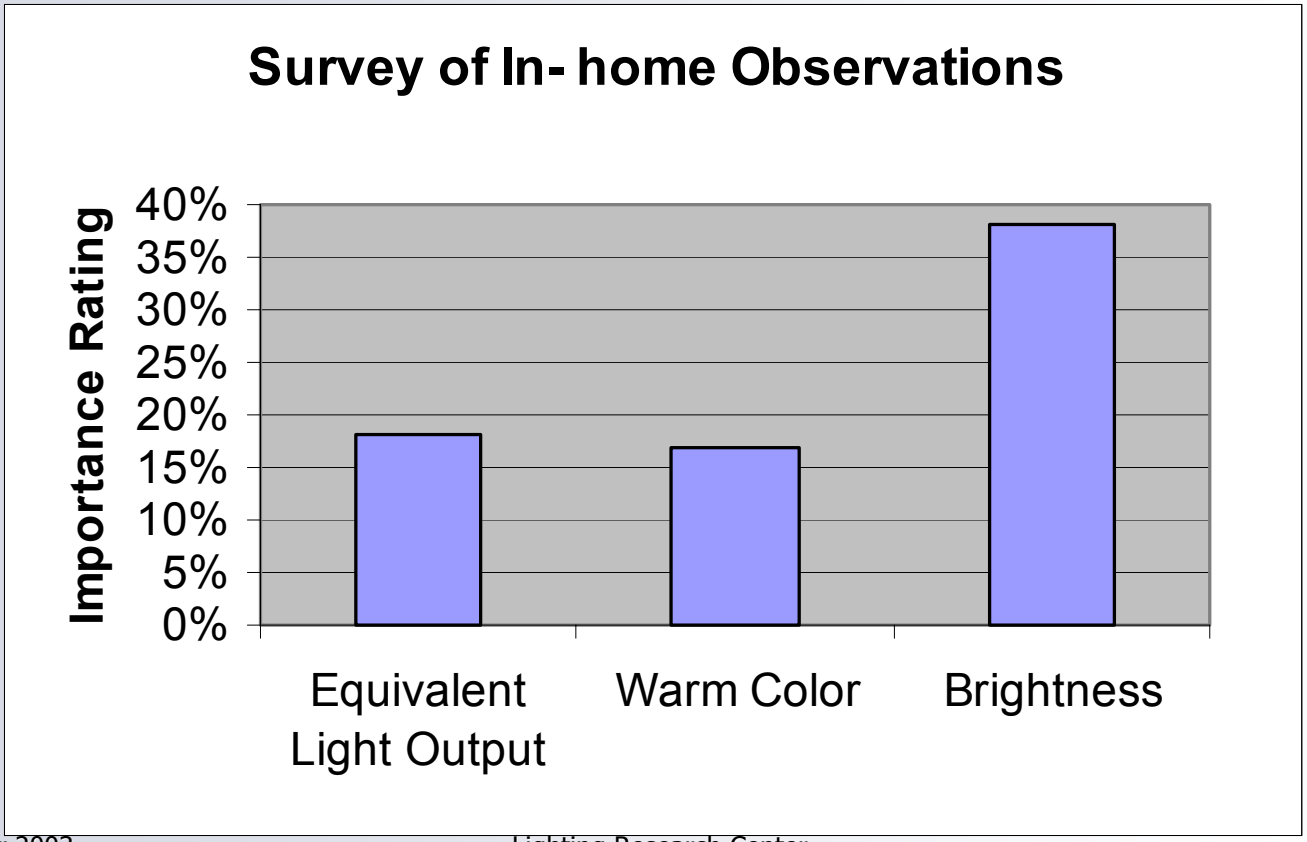
Survey Results: Experience with CFLs



Focus Group - Consumer Discussions

Survey Results: Experience with CFLs

Lighting factors rated as important to consumers



Focus Group - Consumer Discussions

Survey Results: Experience with CFLs

- Summary of survey
  - Main issues:
    - Size
      - Most participants had difficulty fitting the CFLs in their existent fixtures
    - Color
      - Most participants noted the color differences; some had negative opinions about these differences while others did not object to them
      - Color itself (“yellow”) seems to be a greater issue*

Focus Group - Consumer Discussions

Responses: Lighting and Energy

- Other interesting findings:
  - Participants do not read CFL packaging details, other than wattage and "soft white."
  - Participants purchase lamps by habit – buy familiar brand and wattages instinctively.
  - Some participants simply don't like fluorescent lamps.
  - Most all of the participants buy 3-way incandescent lamps.

Project Findings

Summary

- Issues that seem to be main barriers to the acceptance of CFLs are:
  - Size
  - Color
  - Initial cost
  - Warm-up time
  - Fluorescent technology itself
- Issues that do not seem to be main barriers to the acceptance of CFLs are:
  - Life
  - Light Output Equivalence (3:1 ratio is satisfactory)

Actions

- Color
  - Need to greater precision in color specification
    - CCT is not a good metric
  - Communication needs to be simpler
    - Avoid using industry jargon
- Size
  - Investigate best physical size for typical residential fixtures
- Initial Cost
  - Publicize cost of lighting energy use in homes and the benefits of energy-efficient lamps

Actions

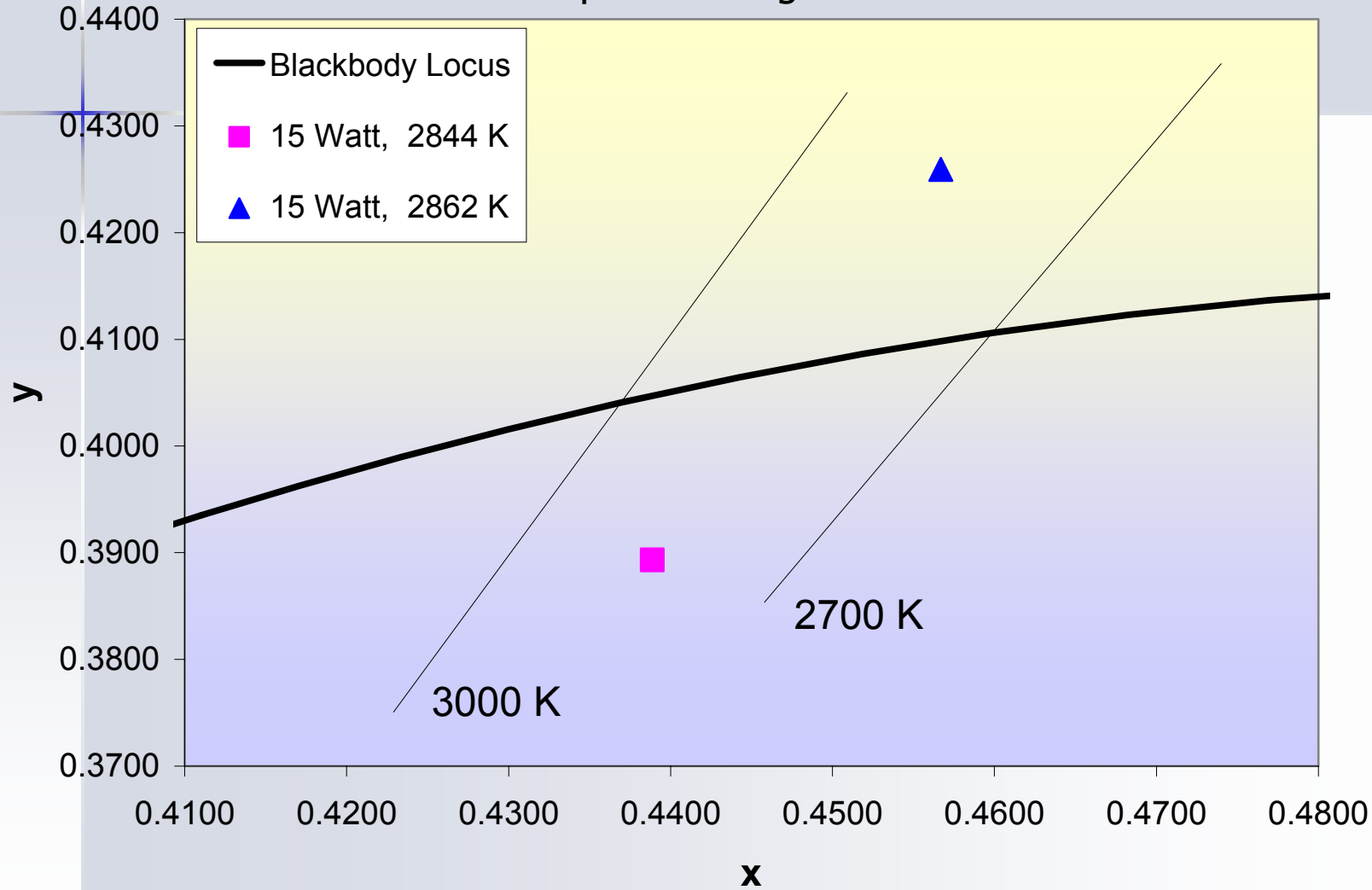
- Reduce "noise" in packaging
  - Provide more useful information and less "noise" in the packaging to make it simple and predictable for consumers to buy a CFL
- ENERGY STAR® metrics for size and color
  - Specify lamps and ballast dimensions
  - Establish more predictable way to characterize and "communicate" color
- Publicize of benefits of energy savings

Round Table Focus

- Color
  - Need to greater precision in color specification
    - CCT is not a good metric
  - Communication needs to be simpler
    - Avoid using industry jargon

CFL Color Differences

Both lamps are designated as 2700 K



Thank you