

US DEPARTMENT OF ENERGY
SOLID STATE LIGHTING
2009 MULTI-YEAR PLAN
TECHNOLOGY R&D

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SSL's Multi-year Plan

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- The MYPP spells out how to reach DOE's goals
 - Chapter 4 is the Technology R&D Plan
- Performance targets (and status) in four flavors:
 - Conversion efficiencies (independent of spectrum)
 - Overarching *device* targets for efficacy, lifetime, cost
 - *Luminaire* targets
 - Detailed and specific subtask metrics and targets
- Many participate in developing the Plan, including the NGLIA, this workshop, and DOE managers

Why Have an MYPP?

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- It is the Strategic Plan for the Program
- Guides R&D Solicitations
 - Priorities
 - Interim goals for specific efforts
- Provides a record of progress
- Increases transparency
 - Describes the competitive process
 - Outlines the monitoring procedures

2009 MYPP Update Process

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- Roundtables in September kicked off the 2009 MYPP update
- Continued through teleconferences, leading to the present draft
- Did not consider task priorities, only the structure
- Prioritization is next
 - Workshop feedback in this forum
 - Priority decisions and edits by NETL/DOE
- Final publication targeted for March

What Happened in 2008?

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- Impressive progress on both OLED and LED efficacies... again!
 - No signs of slowing, yet...
 - But new issues such as color quality, cost, and lifetime are gaining prominence
- More good luminaires on the market
 - But still some problems with inaccurate claims and poor reliability
- Prices coming down but still too high

Consequences for the MYPP

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- R&D task structure completely revised; more emphasis on
 - Luminaire performance issues
 - Product development in general
 - Manufacturing, lifetime, and quality
- Only modest changes to the efficacy targets for LEDs or OLEDs
- Price targets updated, based on replacement lamps

LED Efficacy Asymptotes

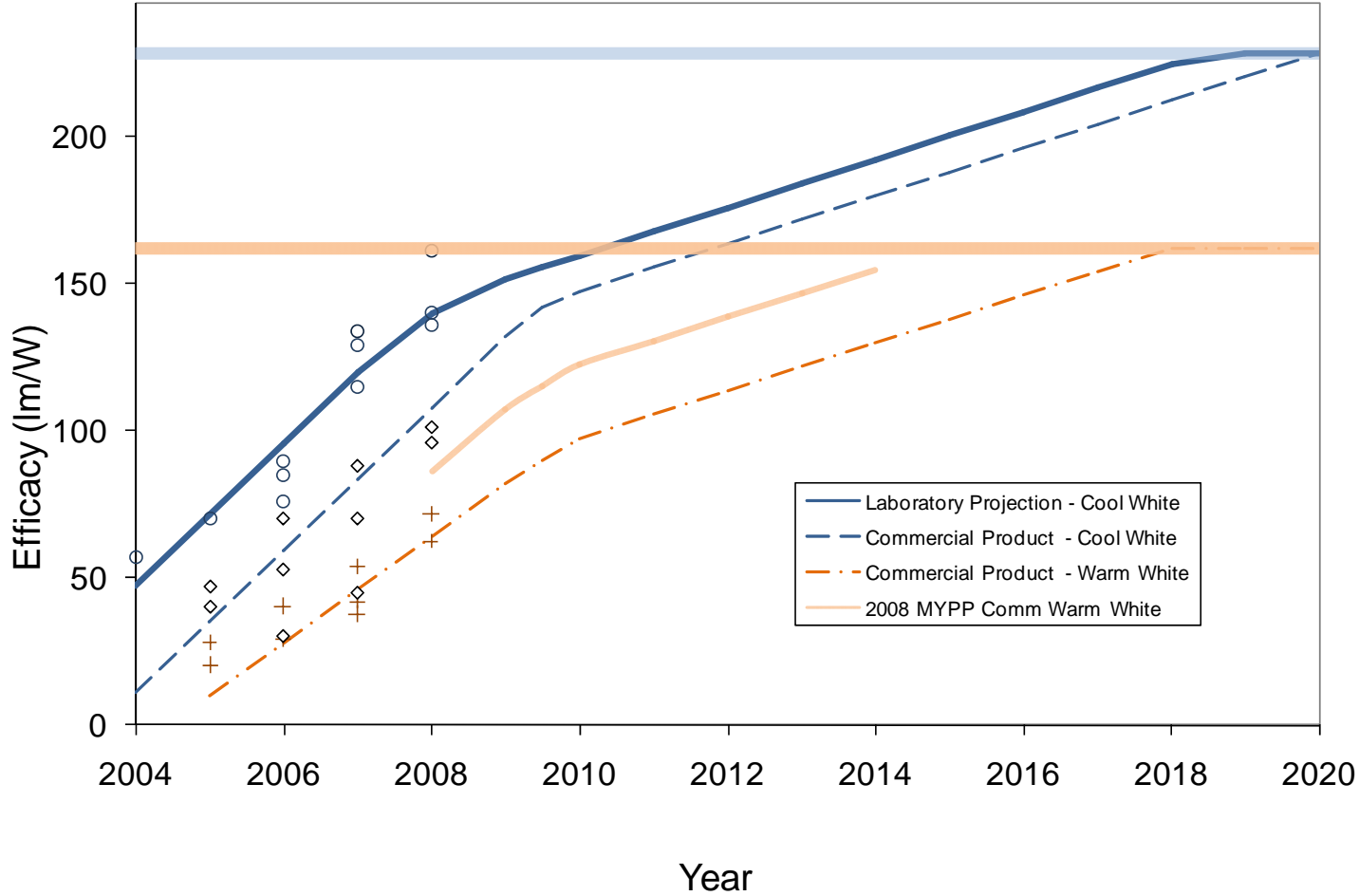
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- Efficacy depends on
 - Correlated color temperature (CCT)
 - Color quality (CRI)
 - Conversion efficiency
- Assumptions
 - a “good” spectrum
 - about 50% conversion

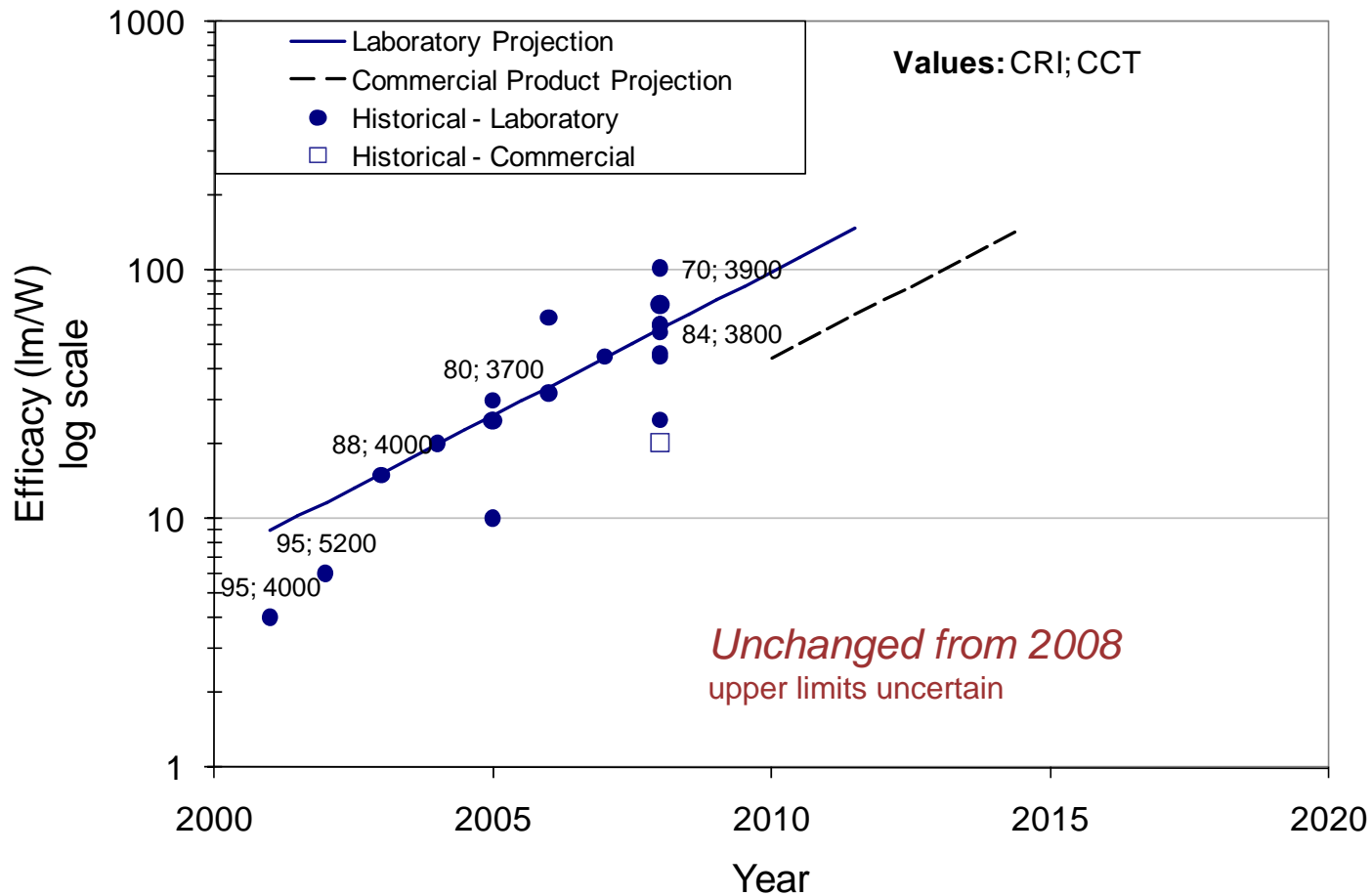
Maximum LED Efficacy (lumens/ Watt)			
CCT	75	CRI	90 CRI
3000K		182	162
4100K		220	193
6500K		228	186

- *Phosphor LEDs not likely to reach warm white limits with present technology*
- *Mixed P-LEDs and monochromatic LEDs or new phosphors needed*
- *Color-mixed LEDs would require optimizing the available colors (e.g. deeper red)*

LED Efficacy Goals



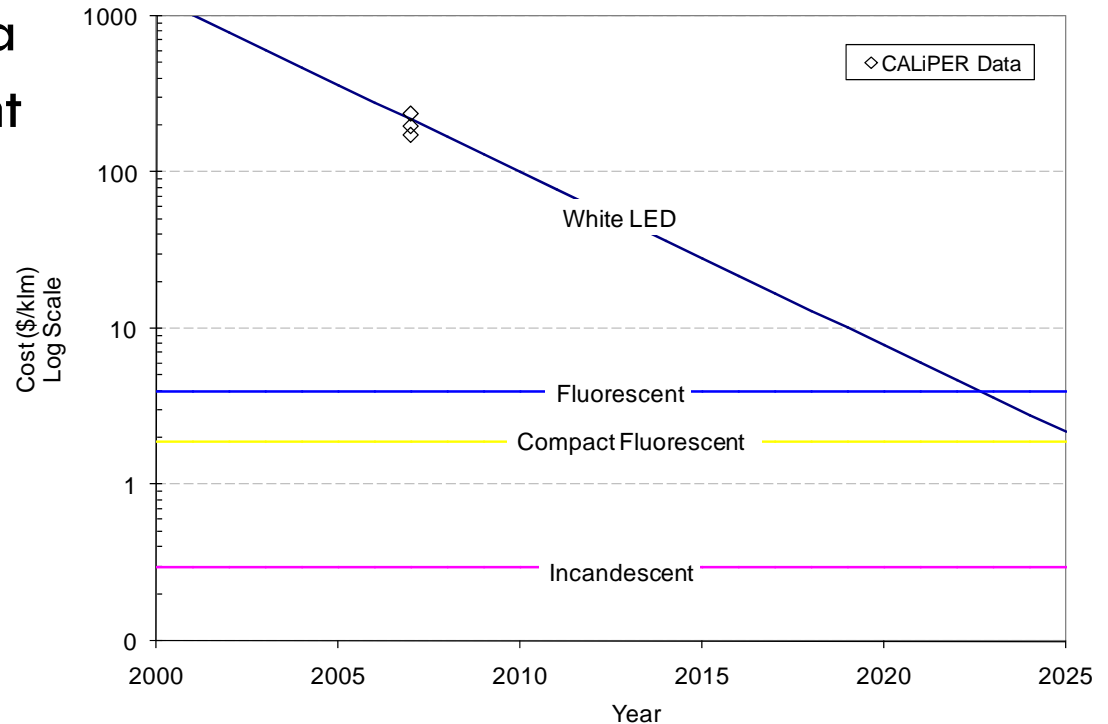
OLED Efficacy



LED Lamp Costs

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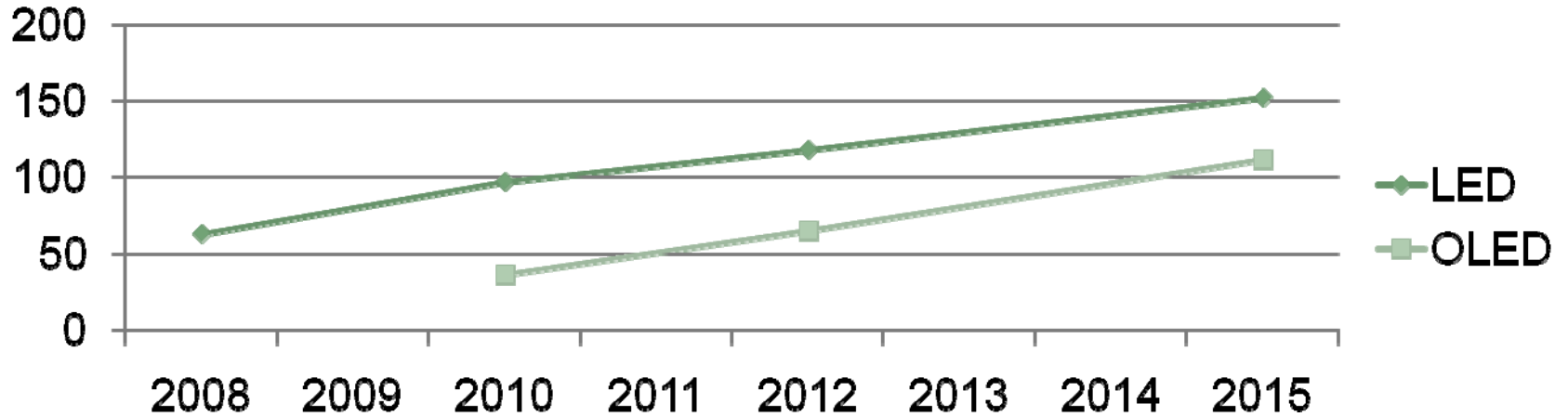
- Device costs are still a barrier to deployment
- Little hard data
 - Replacement lamp gives a hint ...
 - Still much too high
- Still estimating competitive first cost by end of program



Lamp cost projection and comparison
(showing information from CALiPER testing with
several hundred lumens total output)

Luminaire Targets

Efficacy (lm/W)	LED		OLED	
	2008	2015	2010	2015
Device	108	188	44	150
Luminaire	63	152	36	122



LED Milestones

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Milestone	Year	Target
Milestone 1	FY08	80 lm/W, < \$25/klm, 50,000 hrs device
Milestone 2	FY10	> 140 lm/W cool white device; >90 lm/W warm white device; < \$10/klm
Milestone 3	FY12	126 lm/W luminaire that emits ~1000 lumens
Milestone 4	FY15	< \$2/klm device

OLED Milestones

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Milestone	Year	Target
Milestone 1	FY08	>25 lm/W, < \$100/klm, 5,000 hrs device
Milestone 2	FY10	> 45 lm/W device
Milestone 3	FY12	< \$30/klm
Milestone 4	FY15	>100 lm/W device

MYPP Task Structure

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- Originally defined November 2003
 - Revised typology and prioritized in 2005
 - Priorities updated annually thereafter (some task modifications)
- We have outgrown the old structure
 - Product Development emphasis increasing
 - Parallel Core and Product Development tasks may not reflect current state of the technology or R&D needs
- Some task descriptions are confusing, or may appear redundant
 - Clarify descriptions, metrics, status, and targets

Task Breakdown Summary

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	LED	OLED
Core	12	9
Product Development	22	19
Total	34	29

Balance was not required

- in Core vs. PD*
- in OLED vs. LED*
- in number of technology categories*

- 53 tasks identified
 - About twice as many Product Dev as Core
 - Slightly fewer for OLEDs than LEDs
- Divided into technology categories
 - 7 for LEDs
 - 6 for OLEDs

What We Hope to See in 2009

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DOE's wish list:

- An OLED light in the general market
 - Panel >25 lpw, >500 lumens, reasonable cost
- LED commercially available devices >100 lpw
- Replacement lamp cost under \$135/klm
 - And we'd really like it a whole lot lower!
- Indoor LED luminaires >80 lpw, >1 klm
- Increased color consistency and reliability