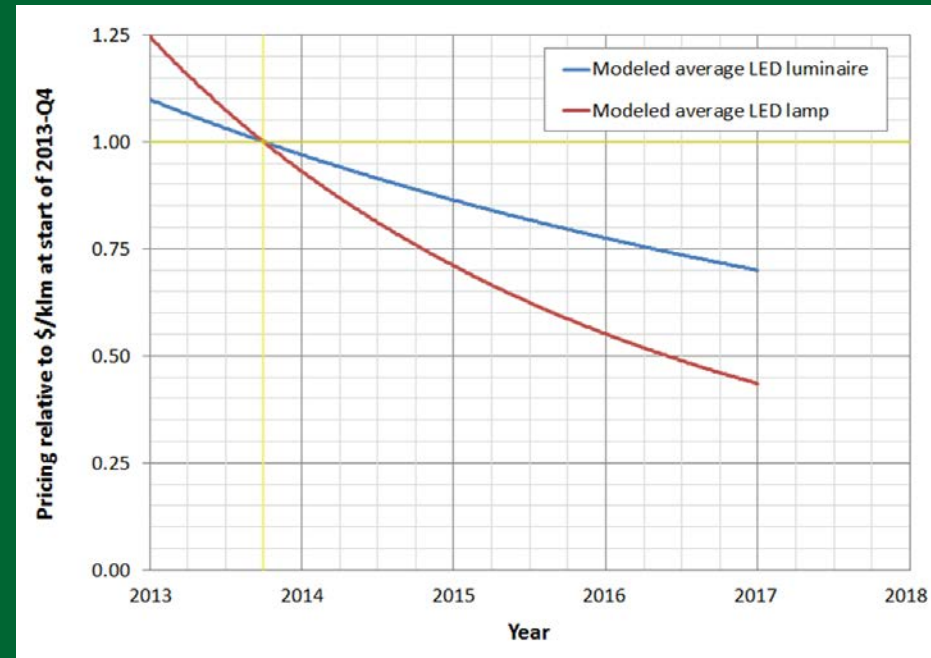


SSL Pricing and Efficacy Trend Analysis for Utility Program Planning



DOE SSL Market Introduction Workshop

Cost Effectiveness—Utility Perspective
November 13, 2013

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Pacific Northwest National Laboratory

Background

- April 2012 TINSSL Utility Planning Roundtable
 - Roadmap needed to forecast when important SSL product applications will become cost-effective, looking 2-3 years out
 - Price and performance projections
 - Provide time for planning
 - Enable prioritization by application or product category
 - Inform delivery and education approaches
 - Allow estimation of energy savings potential and appropriate incentive levels to overcome price barriers
 - DOE viewed as a credible source of such data for regulatory review

Background

- October 2013 report
 - Informed by additional input from Advisory Task Force
 - Appropriate type/timing/magnitude of energy efficiency activities will vary from organization to organization
 - Price is a primary barrier
 - Focused on category-specific projections of pricing and efficacy
 - Cost-effectiveness beyond scope
 - Historical data from
 - CALiPER
 - LED Lighting Facts (LF)
 - ENERGY STAR (ES)
 - DesignLights Consortium (DLC)
 - To serve as a starting point...

SSL energy savings potential

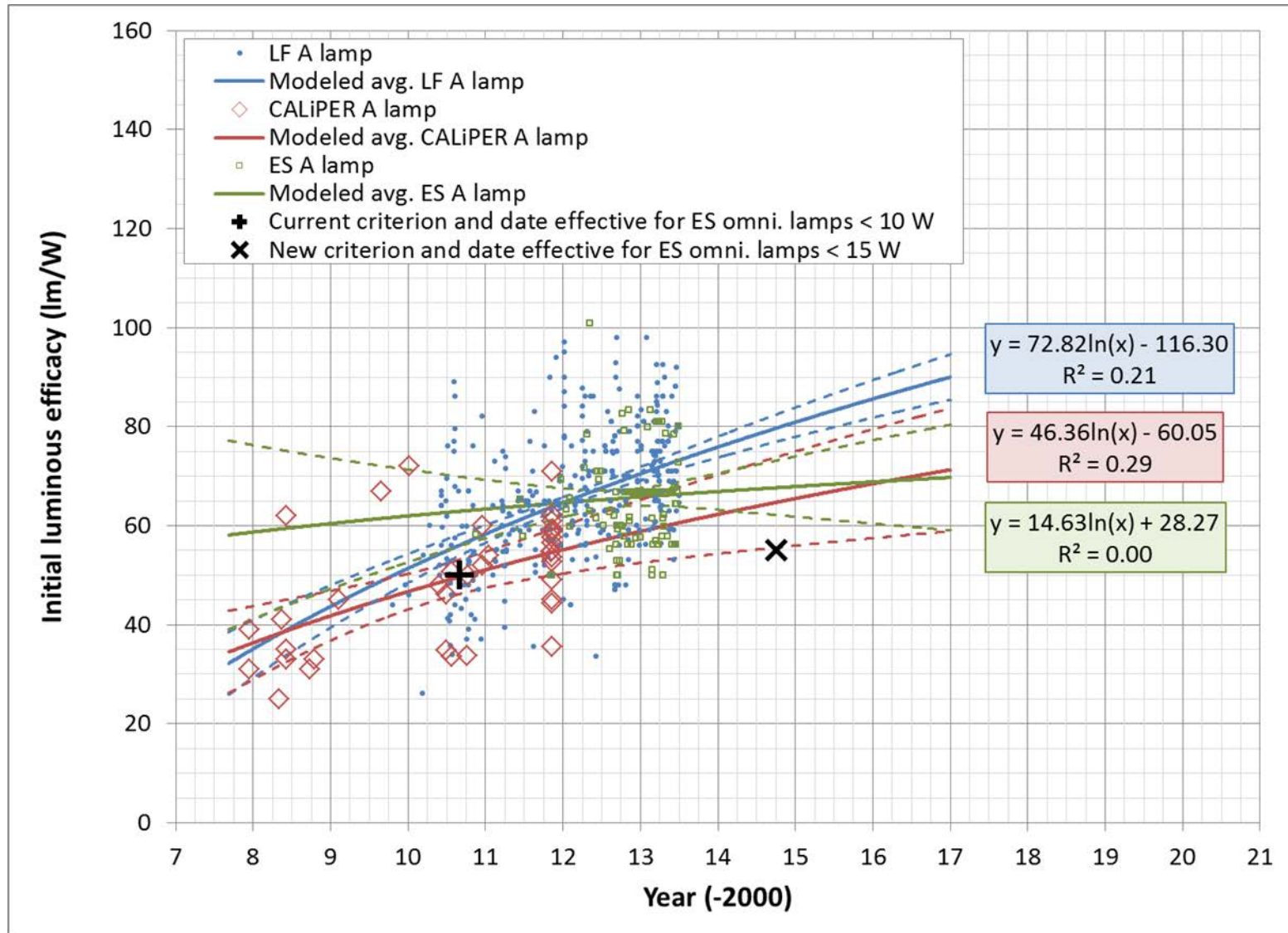
LED market penetration and savings potential in key categories

Category	Savings potential in 2012 (TWh)	Penetration in 2012 (%)	Installed base in 2012 (million units)
Troffers et al.	110.4	< 0.1	0.7
A lamps	79.1	< 1	19.9
High-bay luminaires	46.5	< 1	0.3
Decorative lamps	28.7	< 1	4.7
Downlights	26.8	< 1	5.5
Parking lot luminaires	20.4	1	0.2
Parking garage luminaires	15.3	1	0.4
Streetlight luminaires	22.9	2	1.0
Directional lamps (PAR, BR, R)	16.7	4.6	11.4
MR16 lamps	6.2	10	4.8

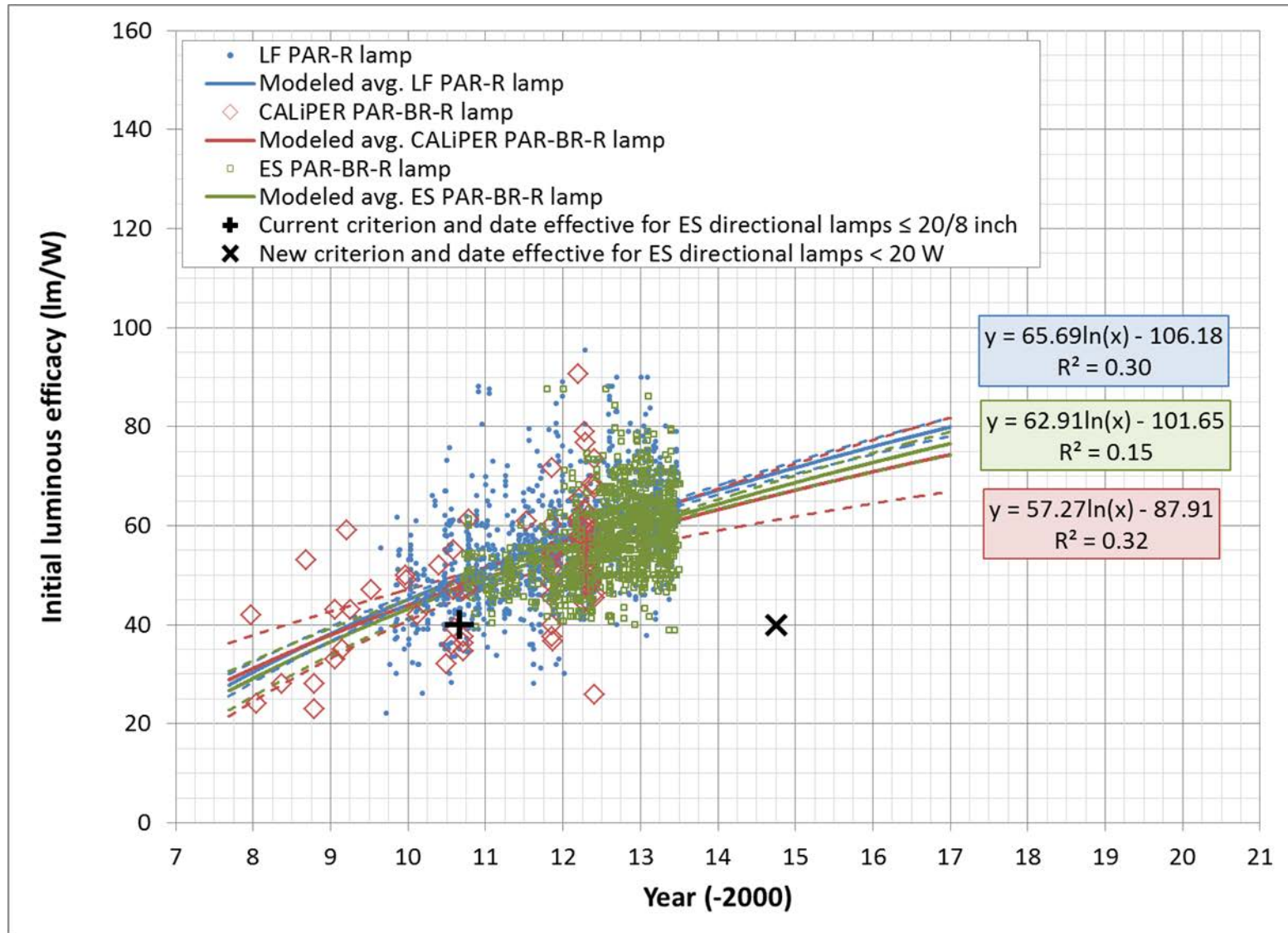
Adoption of Light-Emitting Diodes in Common Lighting Applications
(April 2013)

www.ssl.energy.gov/tech_reports.html

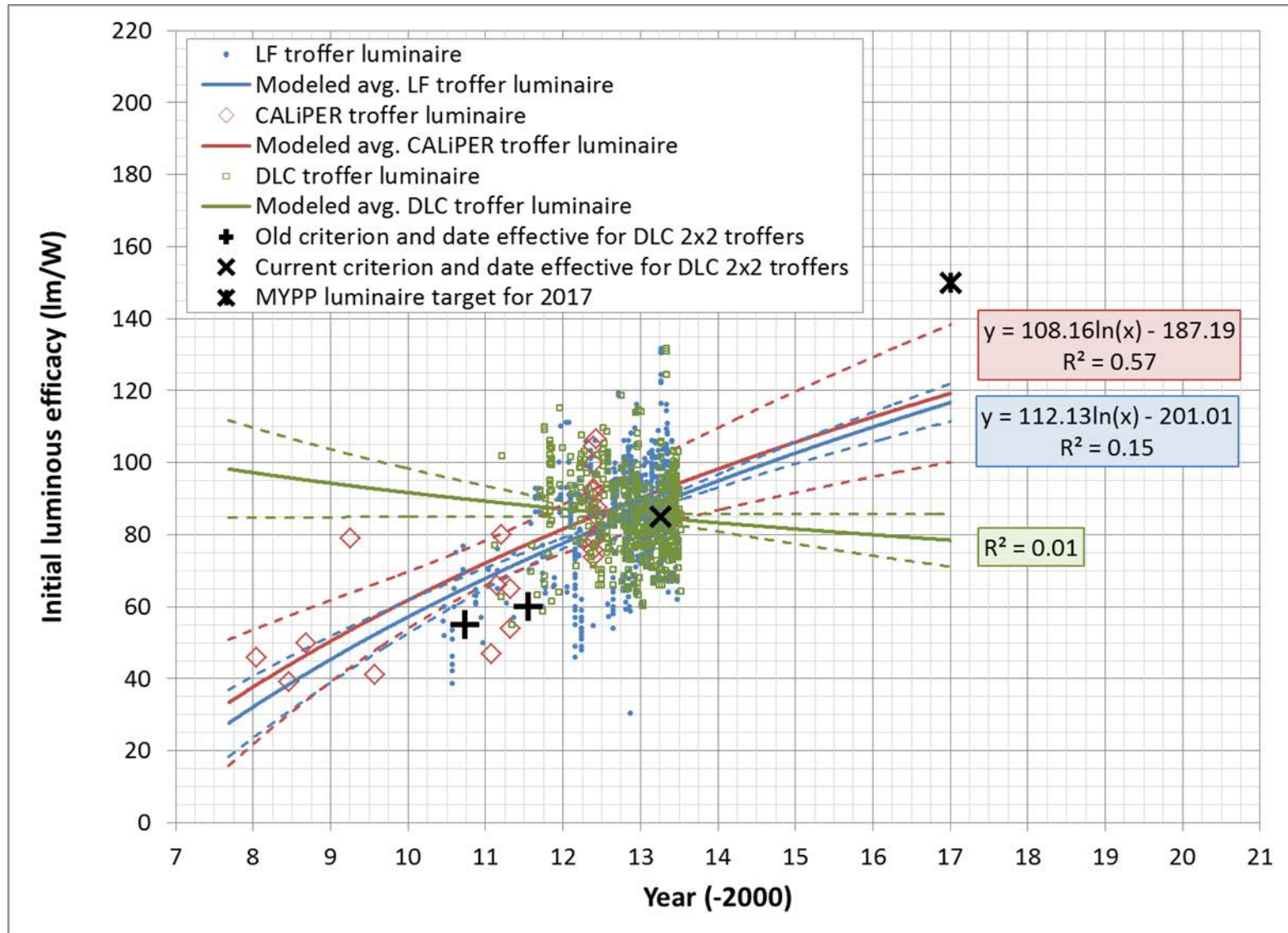
LED efficacy trends: Omnidirectional lamps



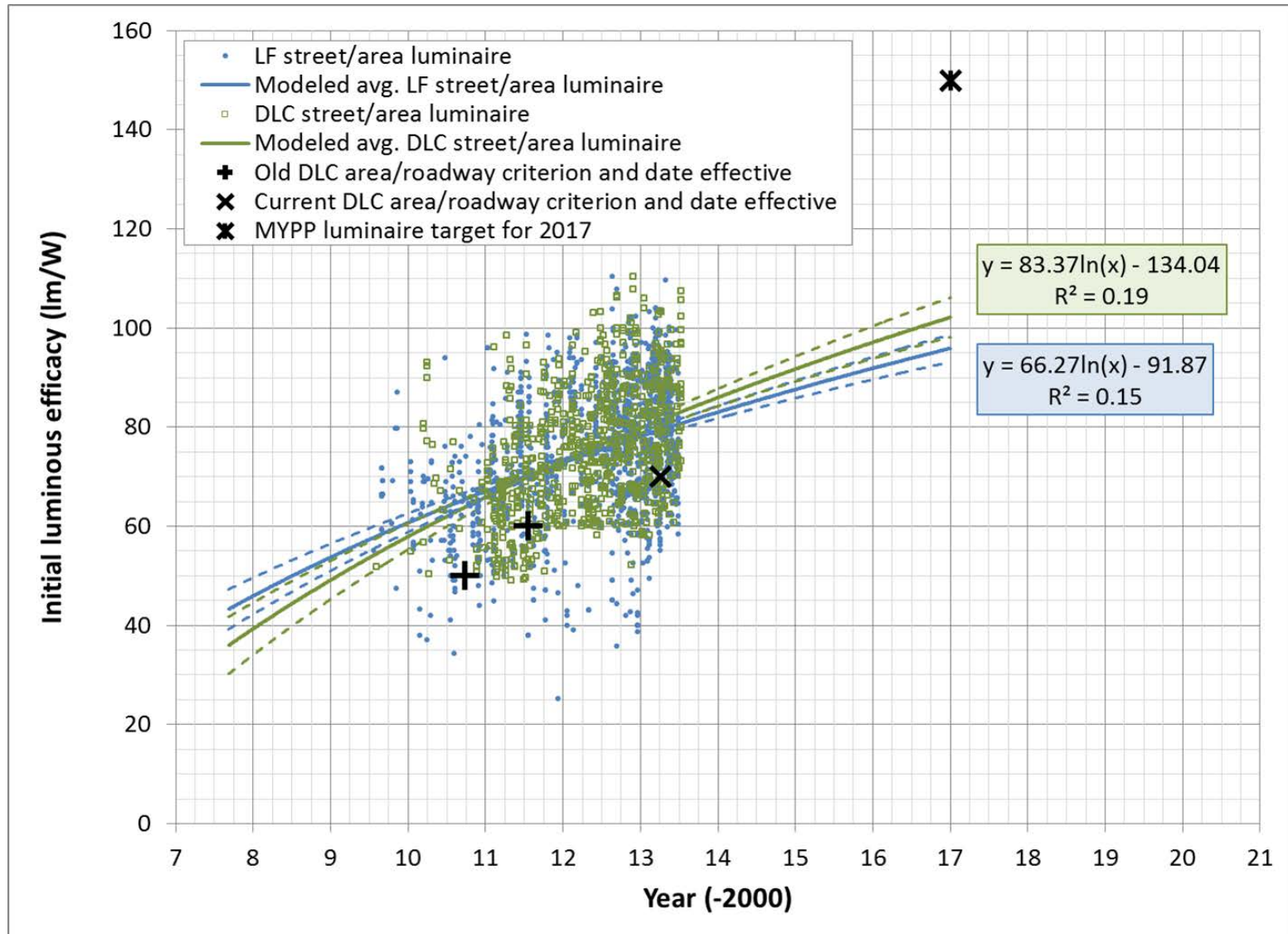
LED efficacy trends: Directional lamps (PAR-BR-R)



LED efficacy trends: Troffer luminaires



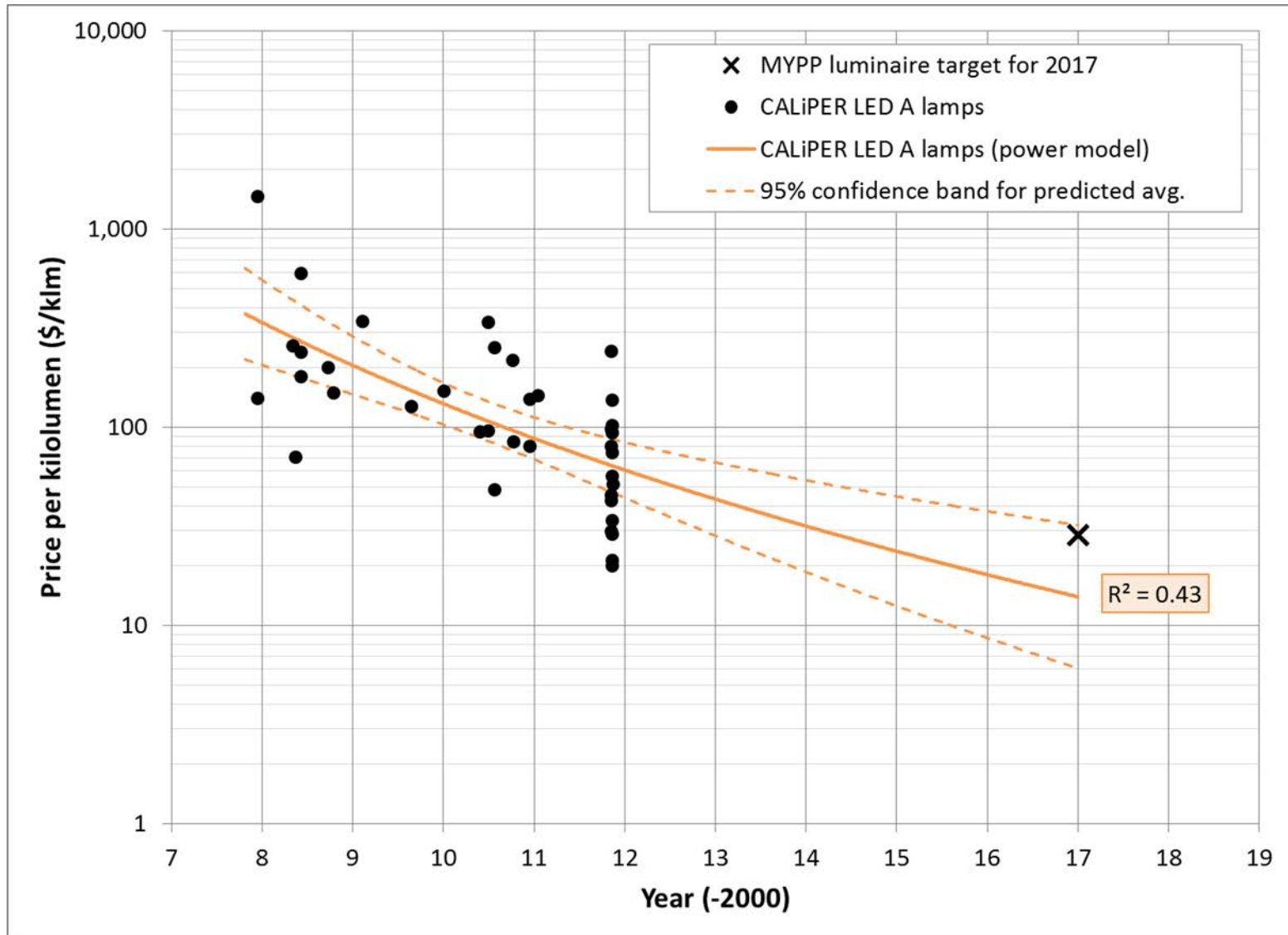
LED efficacy trends: Streetlight luminaires



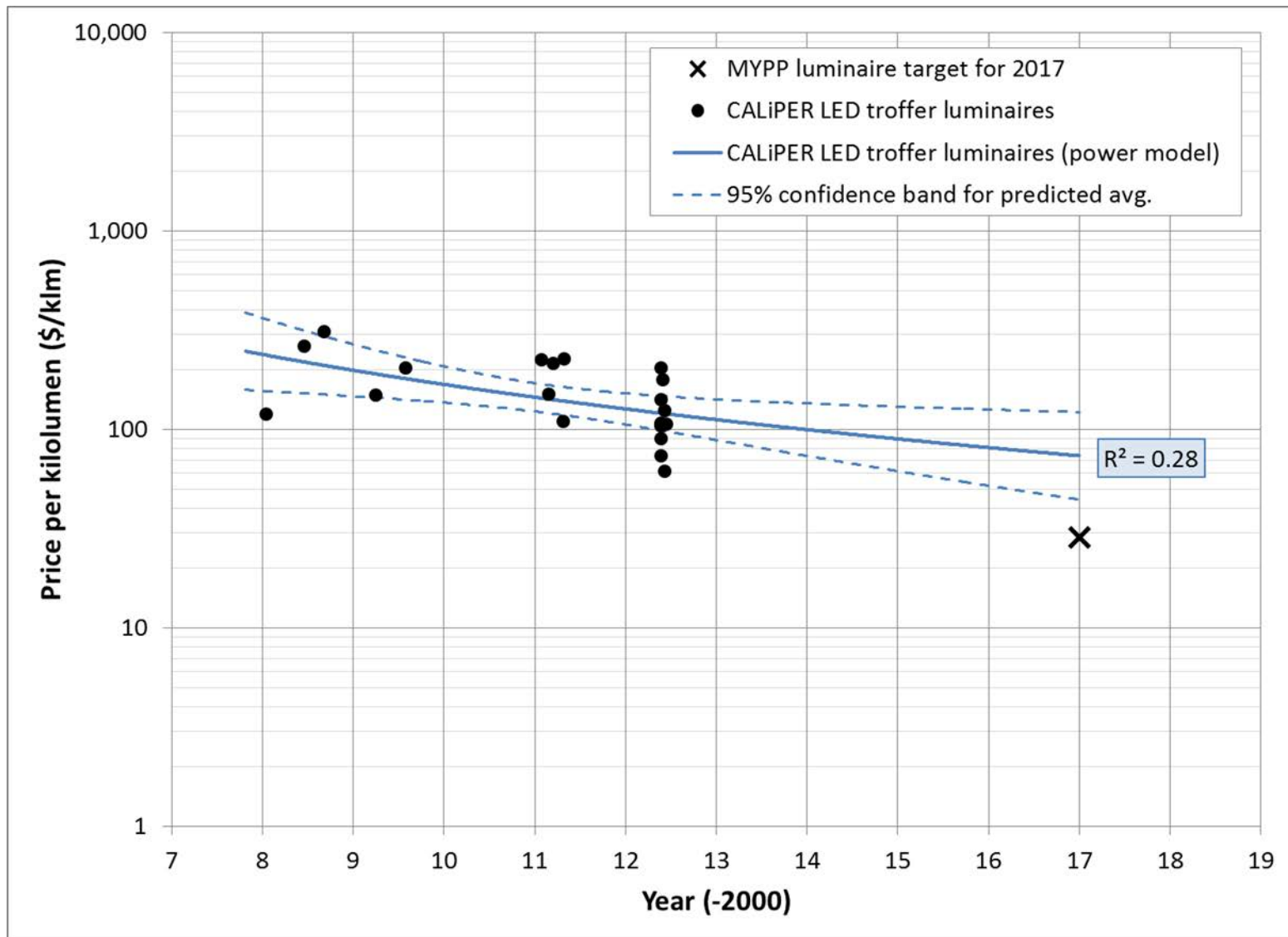
LED pricing trends

- Scoured CALiPER data for product categories meeting criteria
 - Substantial number of models for which purchase date, purchase price, and measured lumens could be determined
 - Rated life was not considered in this analysis
 - Purchases dispersed fairly well over time
 - Substantial span between oldest and most recent
- CALiPER datasets meeting criteria
 - Omnidirectional lamps
 - Decorative lamps
 - Directional lamps (PAR-BR-R and MR16)
 - Troffer luminaires
- Supplemented by Seattle City Light (SCL) streetlight luminaires
- Projections using least-squares regression fits to power mathematical models based on historical product data

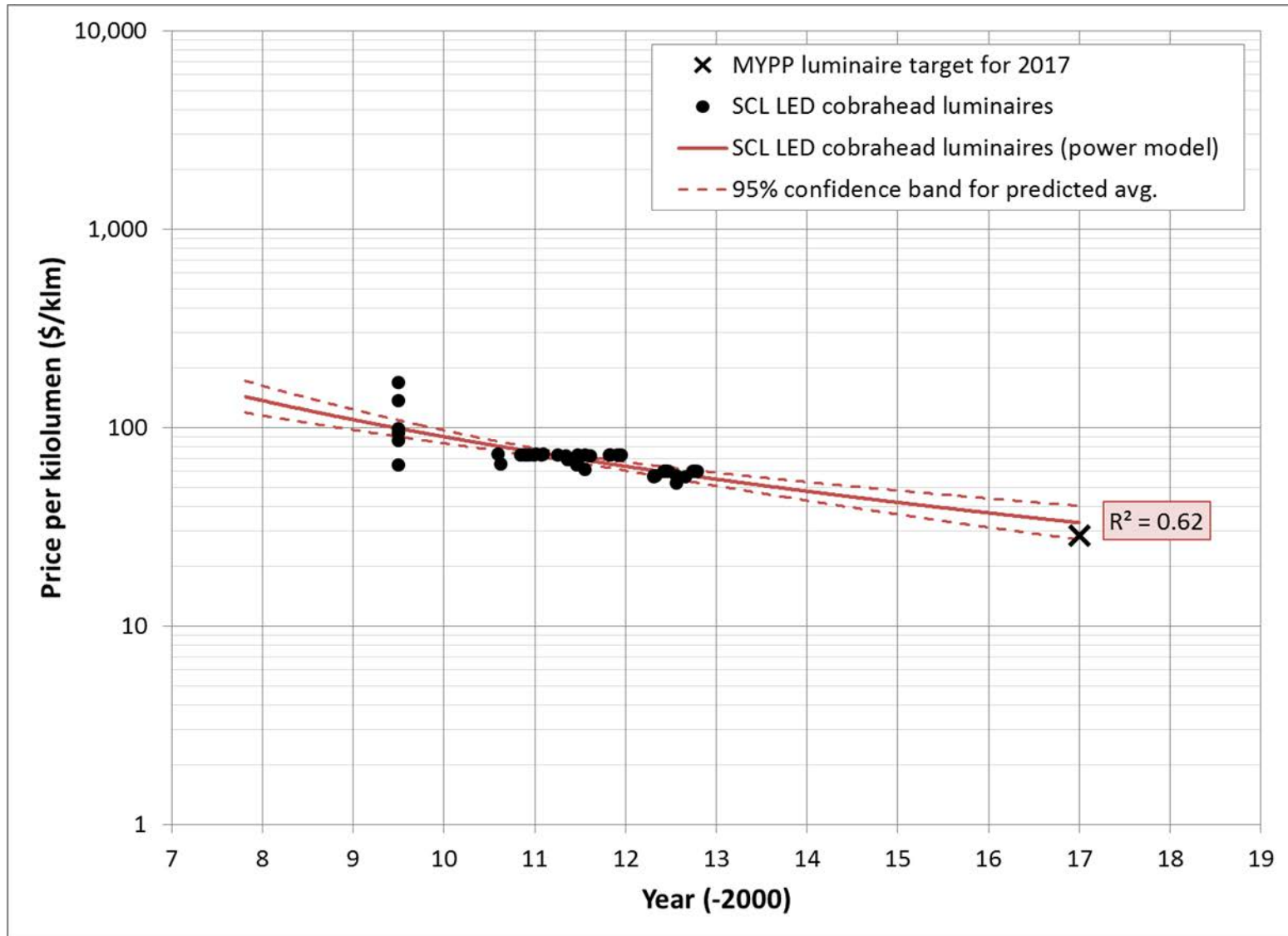
LED pricing trends: Omnidirectional lamps



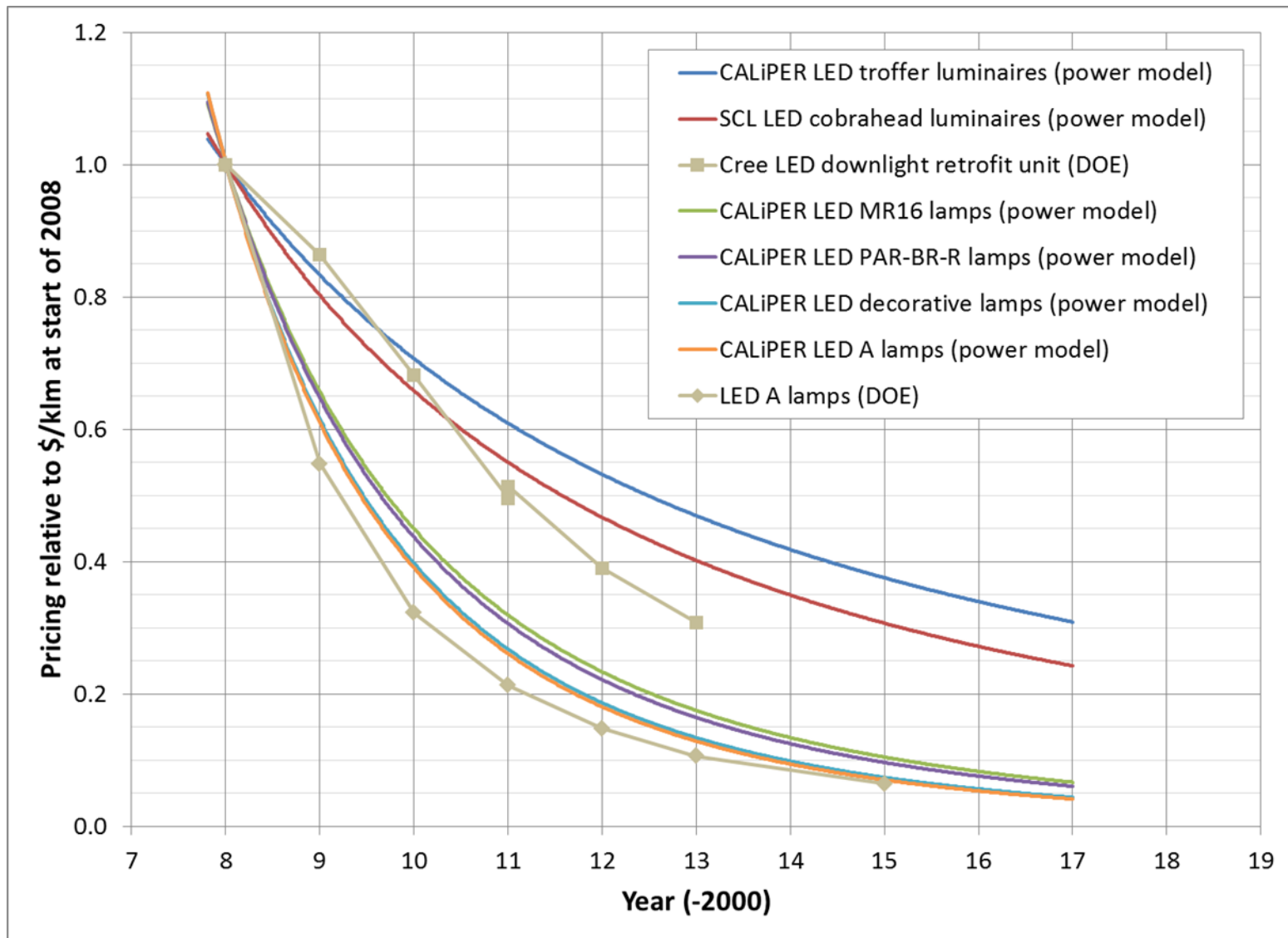
LED pricing trends: Troffer luminaires



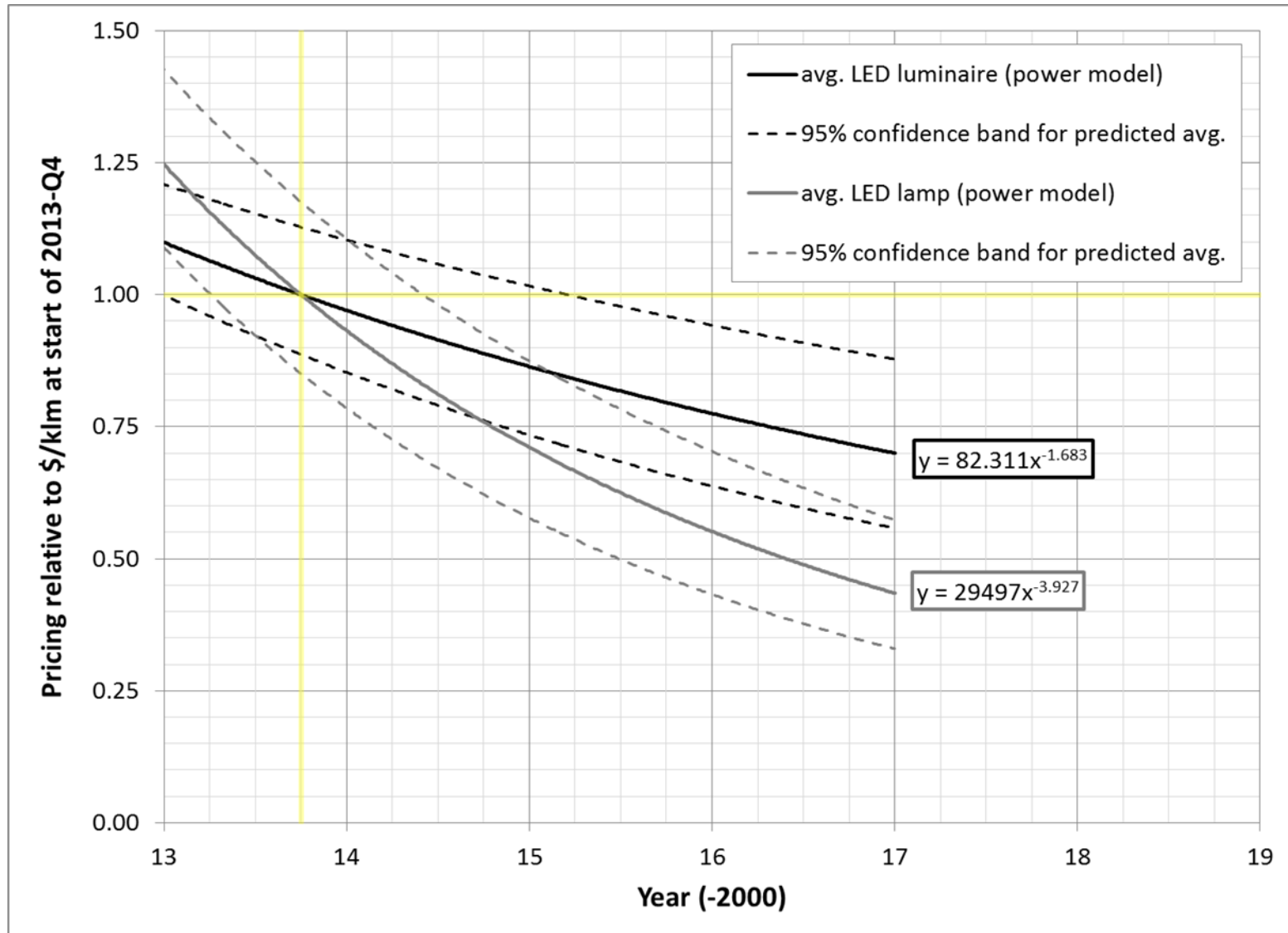
LED pricing trends: Streetlight luminaires



LED pricing trends—normalized to January 1, 2008



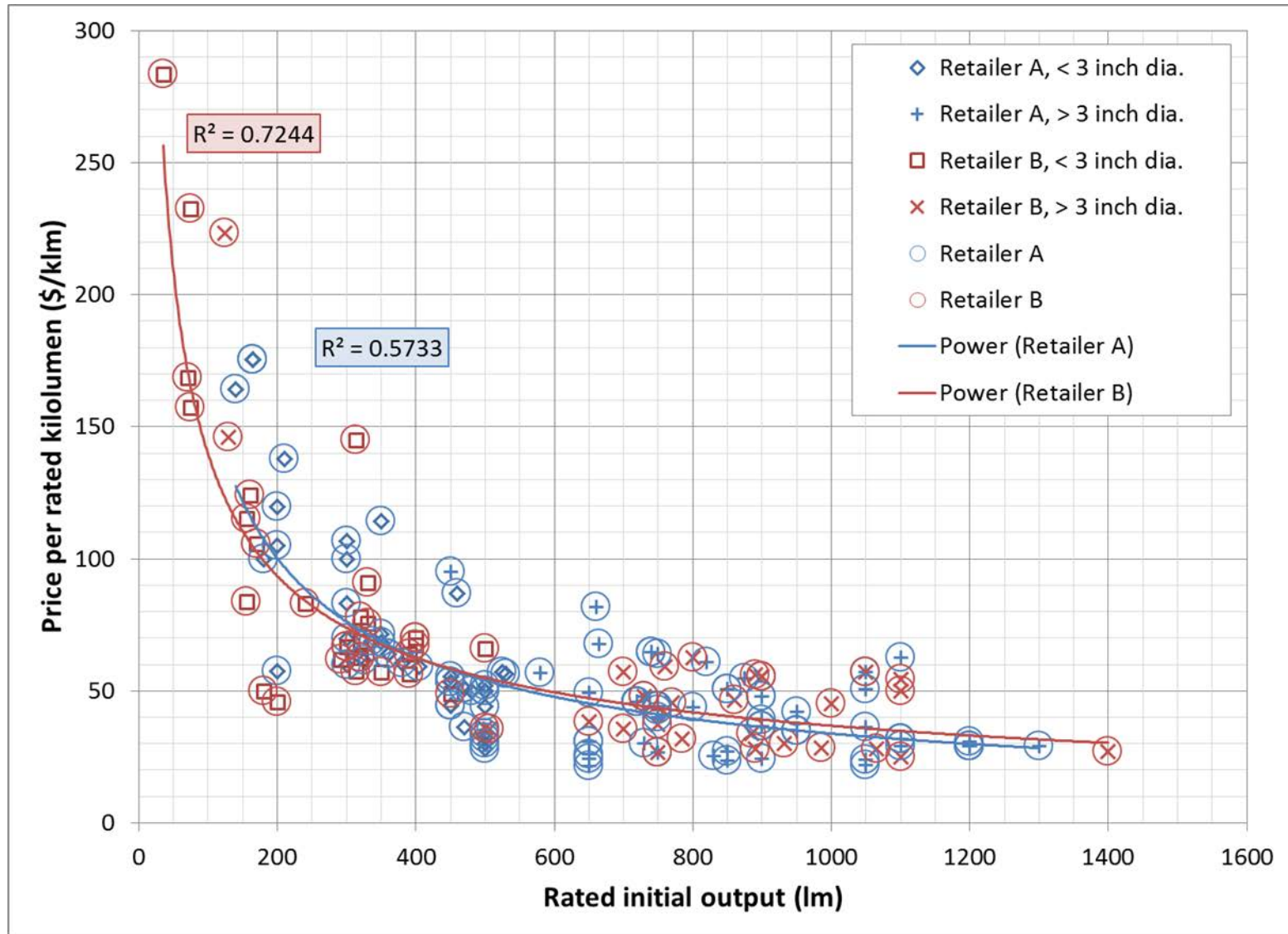
LED pricing trends—normalized to October 1, 2013



LED pricing trends: Example projection

- September 2013 LED directional lamp pricing from major retailers
 - Ace Hardware, Best Buy, The Home Depot, Lowe's, Sears, True Value
 - No adjustment for possible upstream incentives
 - Cree, EcoSmart, Feit, GE, Insignia, LSGC, Philips, Samsung, Sylvania, Utilitech, and TCP
 - CCT of 2700-3000 K
 - CRI and ENERGY STAR certification not consistently indicated
 - Strong relationship between price and output—and diameter
 - Similar relationship observed for omnidirectional and decorative

LED pricing trends: Example projection



LED pricing trends: Example projection

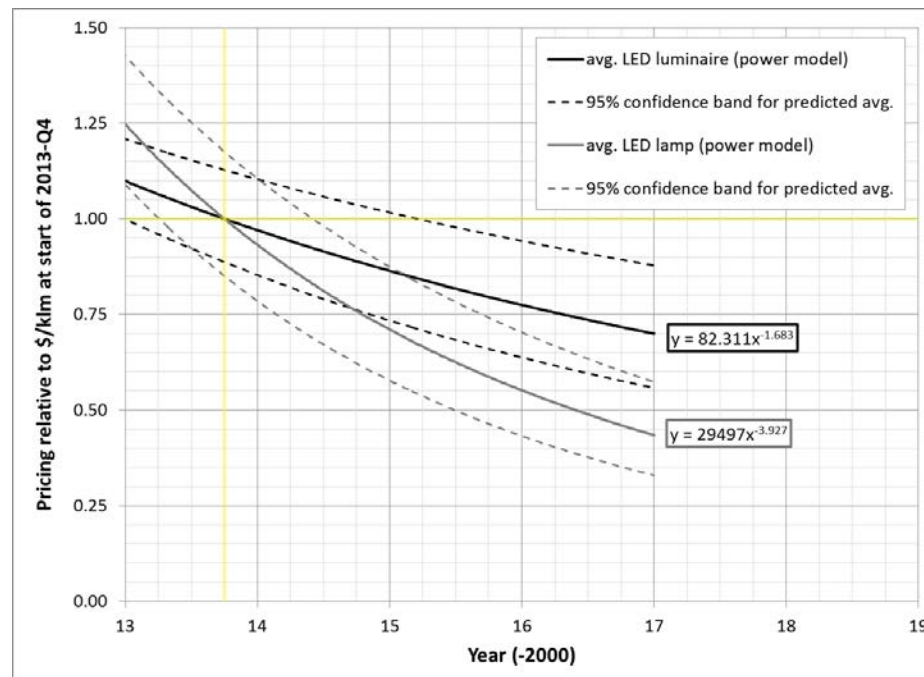
Brand	< 3" diameter		> 3" diameter	
	Lowest pricing (\$/klm)	Efficacy (lm/W)	Lowest pricing (\$/klm)	Efficacy (lm/W)
A	28	56	22	62
B	44	56	24	72
C	69	57	25	61
D	30	50	25	64
E	49	56	27	61
F	57	67	27	58
G	*	*	27	61
H	50	55	28	55
I	*	*	31	68
J	46	50	36	70
K	67	66	42	54
L	56	49	45	51
Mean	50	56	30	61

* No model available for this brand at these retailers.

LED pricing trends: Example projection

- Applied current values to normalized lamp curve for projections

Lamp diameter	\$/klm pricing at beginning of year			
	2014	2015	2016	2017
< 3 inch	47	36	28	22
> 3 inch	28	21	17	13



Key findings

- Projected average efficacies are below 2017 targets, but leading products might still reach these goals on or ahead of schedule
- In several key LED product categories, projected efficacies based on LED Lighting Facts listings are substantially higher than projections based on the corresponding ENERGY STAR or DLC listings
- Historical data indicates two distinct normalized curves—one for LED lamps, and one for LED luminaires—can be used to make projections from current \$/klm pricing for a given product category
- LED lamp \$/klm pricing is expected to decrease roughly 55% by 2017, relative to current pricing—a more modest decrease of 30% is projected for LED luminaires over this same period

End of slides

Thank you!