



Project 8: Novel LED Downlights

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Project Summary



- The project seeks to commercialize a dimmable LED-based downlight, which will be more energy efficient and cost effective than CFL and incandescent light sources.
- We expect this project to result in Cooper Lighting marketing a properly designed, cost-effective LED downlight that will positively impact solid state lighting in the market place



Current Activities



- Market Analysis
- Rebate Assessment
- Pre-production prototypes
- Thermal and Optical refinement based on prototype evaluation

Market Analysis



Existing Products

	Standard Incandescent (BR30)	4-pin CFL Downlight System	LED Downlight System
Total # of Downlights	10	8	10
Delivered Lumens per Downlight	620	850*	650
Power per Downlight (watts)	65	28	12
Material Cost per Downlight	\$ 20	\$ 38	\$ 90
Installation Cost per Downlight	\$ 30	\$ 30	\$ 30
Total Kitchen Lamp Lumens	6200	6800	6500
Total Kitchen Power (watts)	650	224	120
Total Initial Installed Cost	\$ 500	\$544	\$ 1200
Operating Cost per year	\$99.65	\$34.34	\$18.40
Additional Initial Cost vs. Incandescent	n/a	\$ 44	\$ 700
Annual Savings vs. Incandescent	n/a	\$65.31	\$81.25
Simple Payback	n/a	0.67	8.62
CRI	100	~82	~92

Calculations based on an average use of 3.5 hrs/day, an electricity cost of \$0.12/kWh, and initial lamp lumens.

*Assumes a 50% luminaire efficiency. Luminaire efficiency taken from the following sources:

Davis, Roberts and Welhong Chen. Specifier Reports, "CFL Downlights," Vol. 3 No. 2, page 29. August 1995.

DOE – Building Technologies Program, "LED Application Series: Recessed Downlights." PNNL-SA-52145, November 2006.



Market Analysis



Samsung Product Goals

	Standard Incandescent (BR30)	4-pin CFL Downlight System	LED Downlight System
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TARGETED AREAS

Rebate Assessment



- Existing energy efficiency (EE) programs offer incentives for ENERGY STAR qualified luminaires ranging from \$5-\$20.
- SSL is not typically included in these existing programs.
- Of the 35 EE programs surveyed in the National Lighting Programs Nation Summary, only 3 offered any type of rebate/incentive for LED luminaires
 - San Diego Gas & Electric
 - SCE – Operation Light Exchange
 - Cape Light Compact
- SSL ENERGY STAR qualification went into effect September 30, 2007 and qualified SSL luminaires should gain inclusion into many more programs.
- Emerging Technology (ET) programs administered by the IOUs perform ET assessments and recommend new technologies for customized EE rebate/incentive programs, without the need for ENERGY STAR labeling.
- Customized EE rebate/incentive programs will tailor the incentive or rebate based on the actual costs and benefits of the technology, which could lead to rebates/incentives higher than the \$20 stated above.

Energy Star



- ***Recessed Downlights Requirements:***
- Minimum Light Output:
 - ≤ 4.5 " Aperture: 345 lumens (initial)
 - > 4.5 " Aperture: 575 lumens (initial)
- Zonal Lumen Density Requirement: Luminaire shall deliver a minimum of 75% of total lumens (initial) within the 0-60° zone (bilaterally symmetrical).
- Minimum Luminaire Efficacy: 35 lm/W
- Allowable CCTs: 2700 K, 3000 K and 3500 K for residential products; No restrictions for commercial.
- Reduced Air Leakage: Recessed downlights intended for installation in insulated ceilings shall be IC rated and be leak tested per ASTM E-283 to demonstrate no more than 2.0 cubic feet per minute (cfm) at 75 Pascals (1.57 lbs/ft²) pressure difference. The luminaire must include a label certifying "airtight" or similar designation to show air leakage less than 2.0 CFM at 75 Pascals when tested in accordance with ASTM E283.

Initial Product Specification

- 650 Lumens (based on white & specular reflectors)
- Light Output Comparable to:
 - 65Watt BR30
 - 18Watt CFL
- ~46 Lumens Per Watt
- ~14 Watts
- 83 CRI
- 3000K +/-125
- 50K Hours at 70% Lumen Maintenance
- 50D Cut-Off
- Dimmable Down to ~5% Total Light Output
 - Will Be Compatible with Multiple Standard Analog AC Dimmers
 - No Color Shift When Dimming
 - >90% Efficient, .9 Power Factor

Initial Product Specification

- LED Module
 - Fits Standard H7 – 7-1/2" Housings
 - UL Approved Connector & Edison Base Accessory
 - Meets SSL 2008 ENERGY STAR Requirements
- IC/Airtite New Construction Housing (No Edison Base)
 - T24 Applications
- Multiple Reflector Options
 - Matte White Trim & Matte White Reflector
 - Trim .160" at OD & .180 at ID
 - Matte White Trim & Specular Reflector
 - Trim .160" at OD & .180 at ID
 - Matte White Trim & Haze Reflector
 - Trim .160" at OD & .180 at ID
 - Matte White Regressed Shower Lens & Trim
 - Thinner Trim Option: Matte White Trim Ring
 - .120" at OD, .180 at ID



Market Barriers



- Total system cost
- Housing market