



hybrid halogen

Redesign of the Incandescent

ybrid
alogen



Advanced Lighting Technologies

- ADLT top line overview

- ADLT companies related to Hybrid Halogen (IR halogen)

Hybrid Halogen

- The technology: How it works

- Product benefits

The Hybrid Halogen Market

- PAR: Product performance vs. IRL requirements (June 2012)

 - Directional efficiency vs. non-directional efficiency

- A-line: Product performance vs. EISA2007 standards

 - Prototype testing

- MR16: Product performance

Prospects for Commercialization

- ADLT model

- Coating and capsule capacity



Energy efficient lighting materials and products



Hybrid coating equipment,
services



ADVANCED
LIGHTING
TECHNOLOGIES, INC.



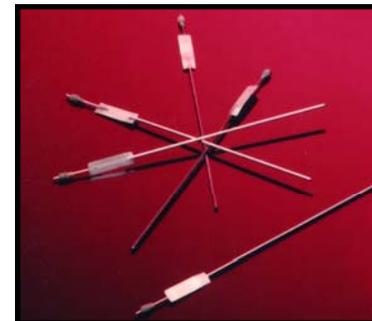
Metal Halide Salts
HPS Amalgams



Precision Reflectors



Pulse Start
Metal Halide Lamps



Metal Halide
Electrodes
HPS Electrodes



Joint Venture



Hybrid Capsule Coating Services and Coating Equipment

- Pioneered the application of coating for IR halogen
- Dominant world share
- Two industry leading technology platforms (PICVD and MicroDyn)
- Continued advancements in coating technology
- Coating services: Germany, expanding to Asia
- Coating equipment: California

Hybrid Capsules and Capsule Equipment

- Superior method of filament alignment
- Utilizes pre-coated formed bodies
- Single-ended and double-ended processes
- Achieves state-of-the-art performance





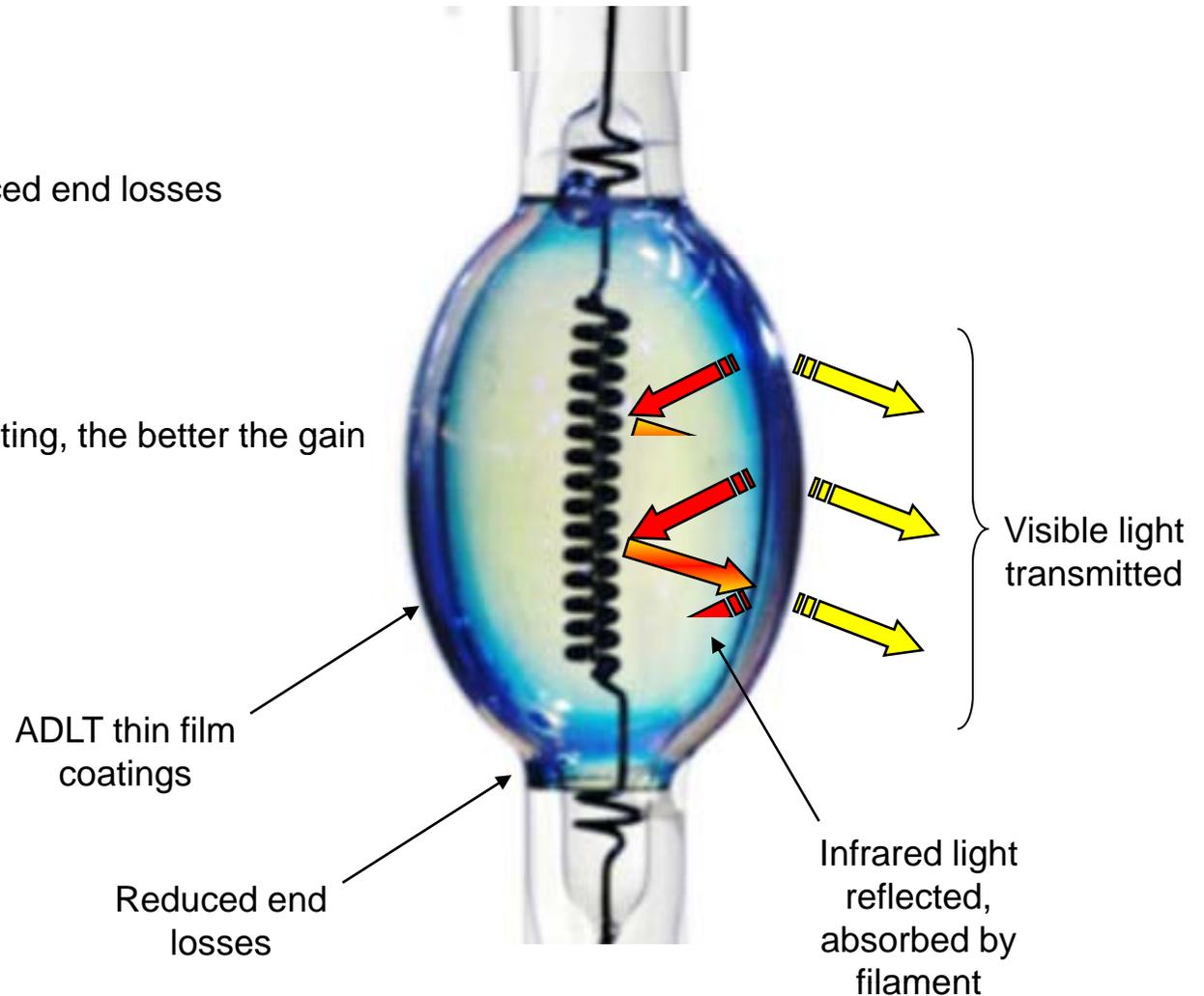
The Technology

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Hybrid Halogen: The Technology

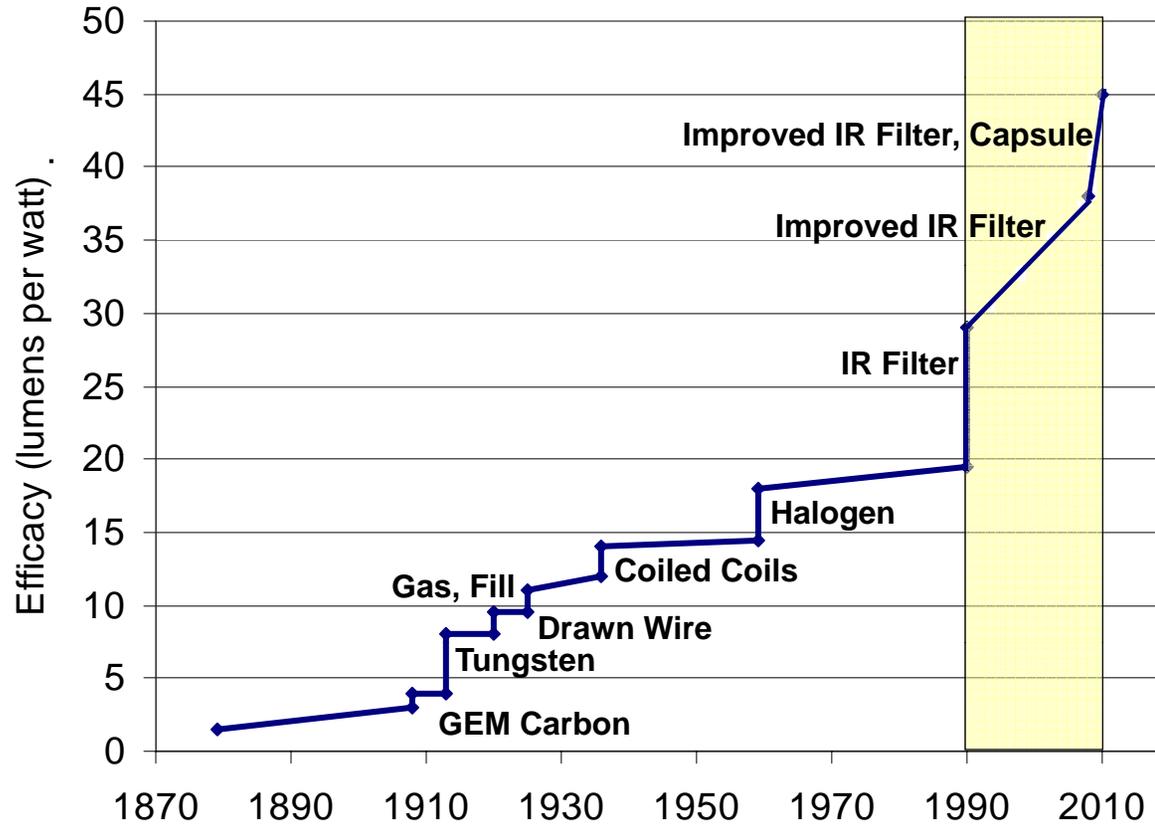


- **Precision filament**
Recrystallized for rigidity
- **Optimized capsule**
Smaller leg diameter = reduced end losses
Halogen gas
Correct geometry
- **Advanced thin-film coatings**
In general, the better the coating, the better the gain



Hybrid Halogen: The Technology

Efficacy Advances vs. Time

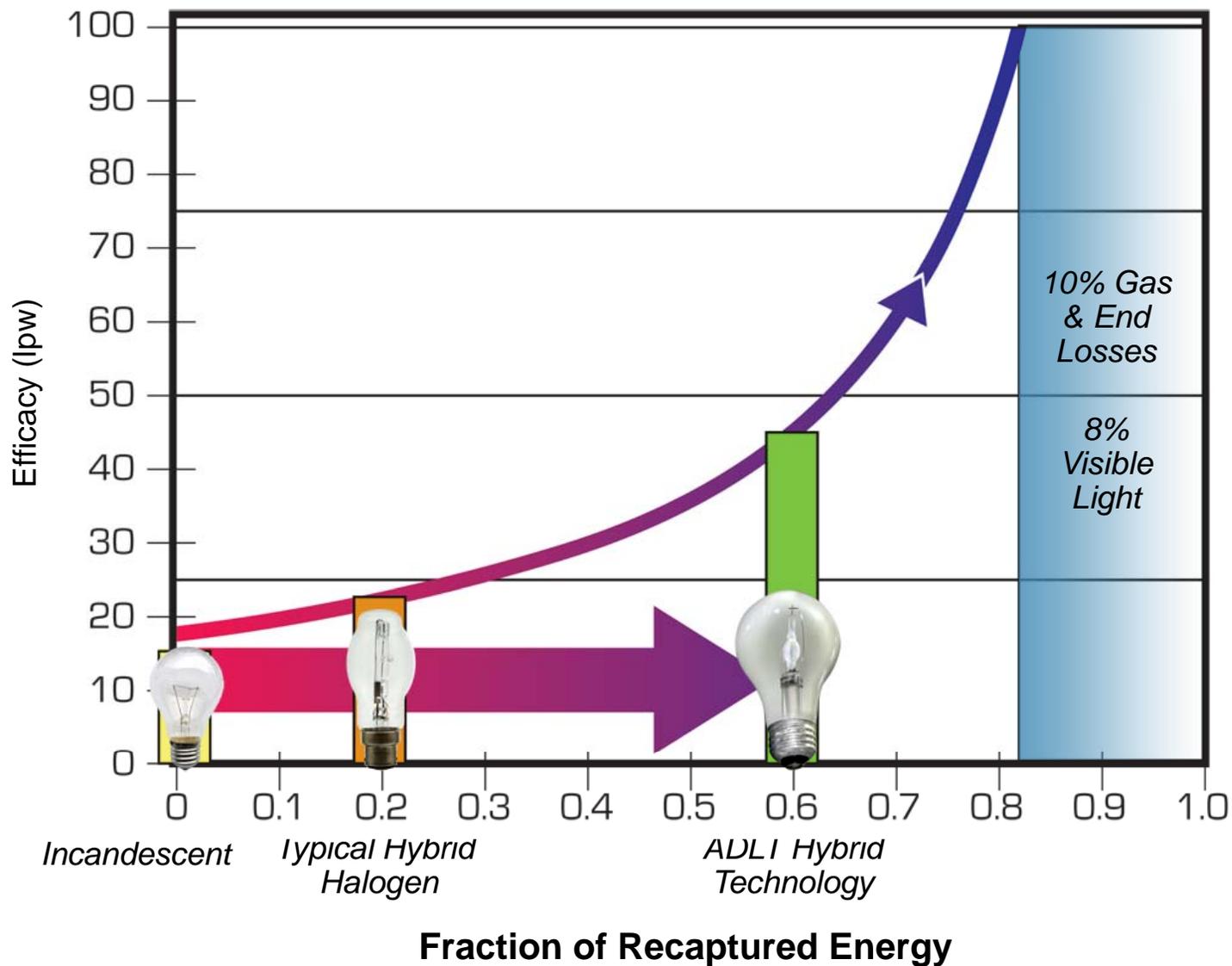


 ADLT influence

Hybrid Halogen: The Technology



Hybrid Halogen Theoretical Limit for IR Recapture



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Hybrid Halogen: The Technology



Benefits

Familiar Incandescent Light Quality

- 100 CRI
- Dimmable, motion sensor compatibility
- Same or smaller lamp configurations (e.g. PAR20 vs. PAR38)
- Instant light
- > 90% end of life performance

Associated as a safe product

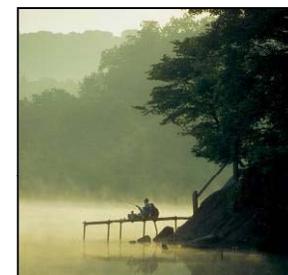
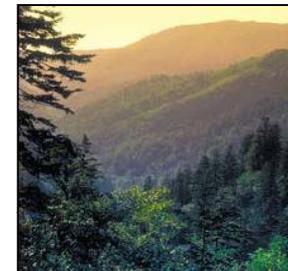
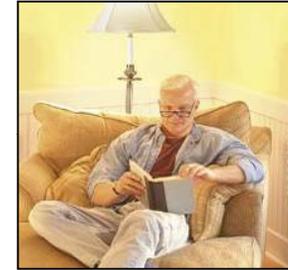
- No mercury
- RoHS compliant

Great Directional Light Source

- Point source optics providing excellent MBCP / Watt
- Reduced heat

Energy Efficient. Yes, Energy Efficient

- Current potential for >50% energy savings





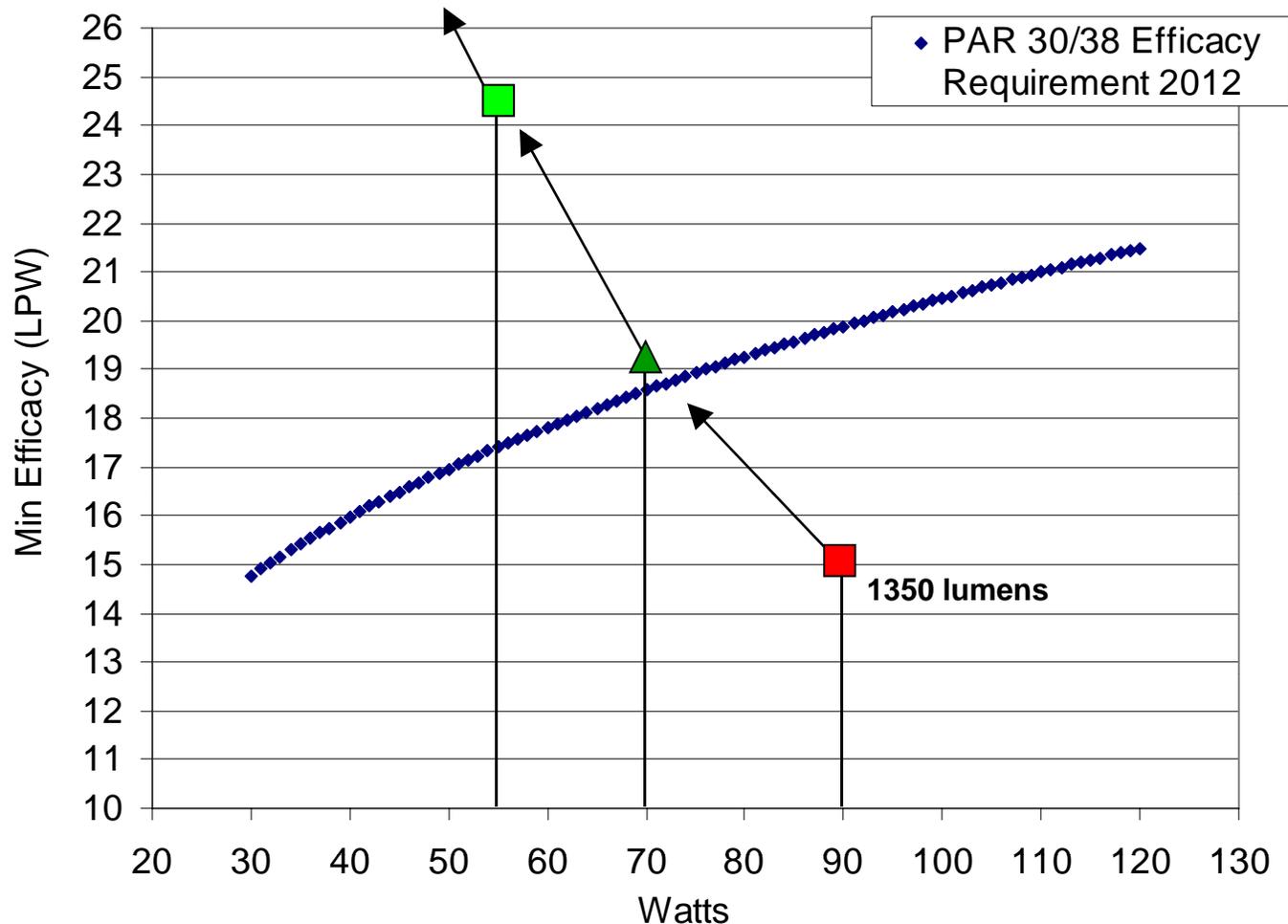
Hybrid Halogen PAR

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Hybrid Halogen PAR: Improving Efficacy

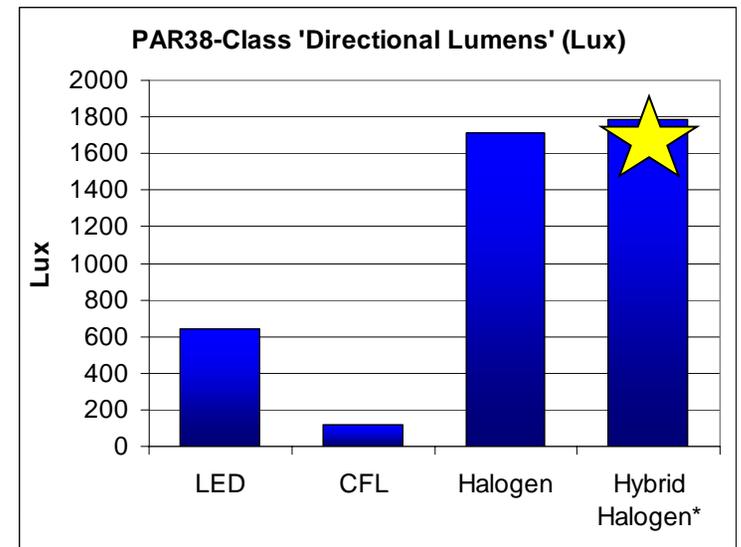
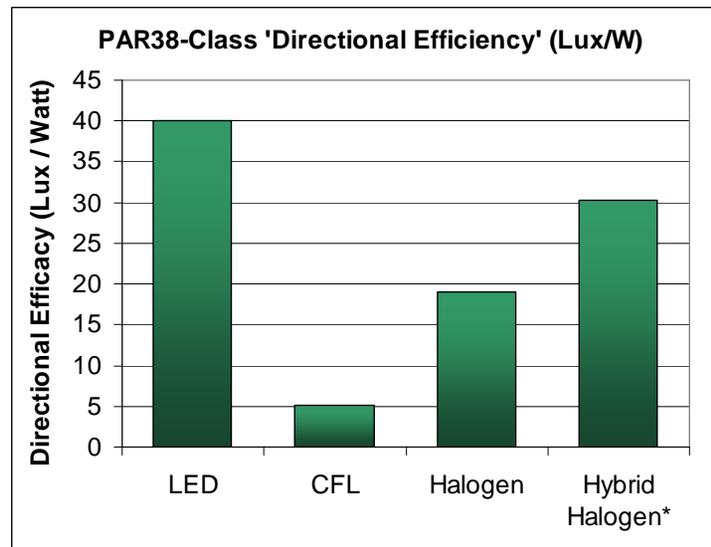
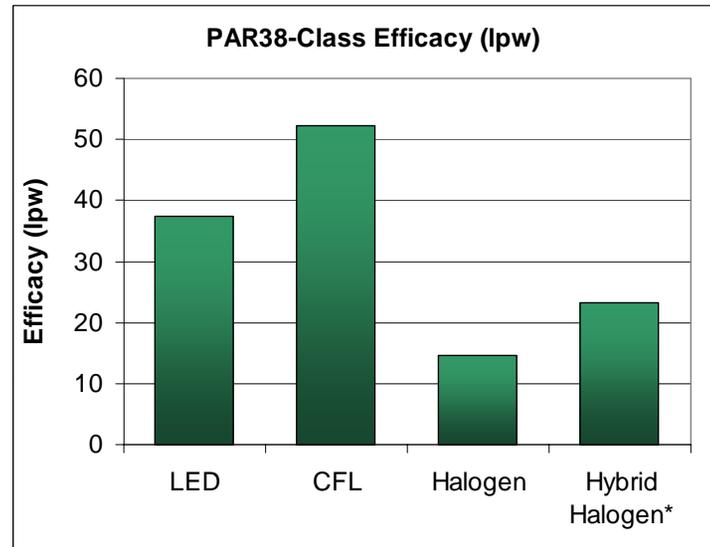
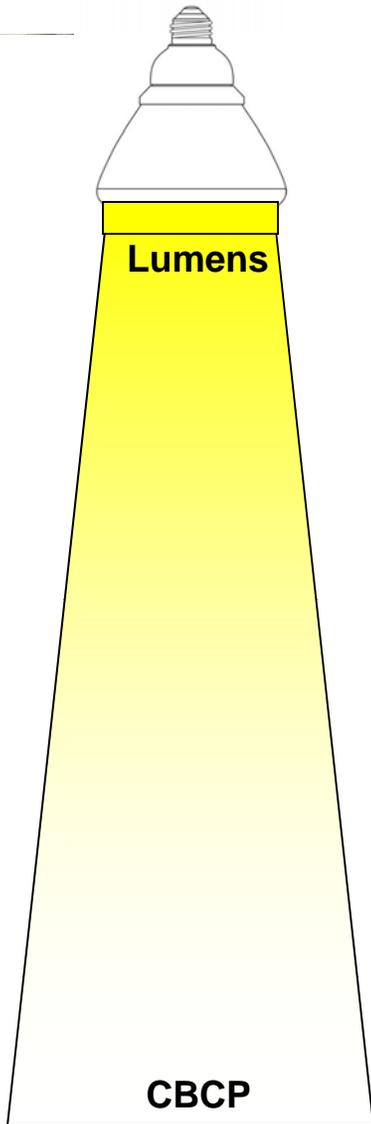


DOE Final Rule: PAR30 & 38 IRL Efficacy Requirement 2012



- Standard halogen
- ▲ Hybrid halogen (Commercial): Capsule efficacy ~ 24 lpw at 70W. Aluminum reflector coating.
- Hybrid halogen (Current Potential): Capsule efficacy ~27.6 lpw. Silver reflector coating.

Hybrid Halogen PAR Has Higher Directional Lumens (CBCP)



* ADLT prototype capsule (2,500+ hour life): Performance in EcoWhite Silver coated reflector (30-degree flood)
 Directional lumen comparisons based on 30-degree flood

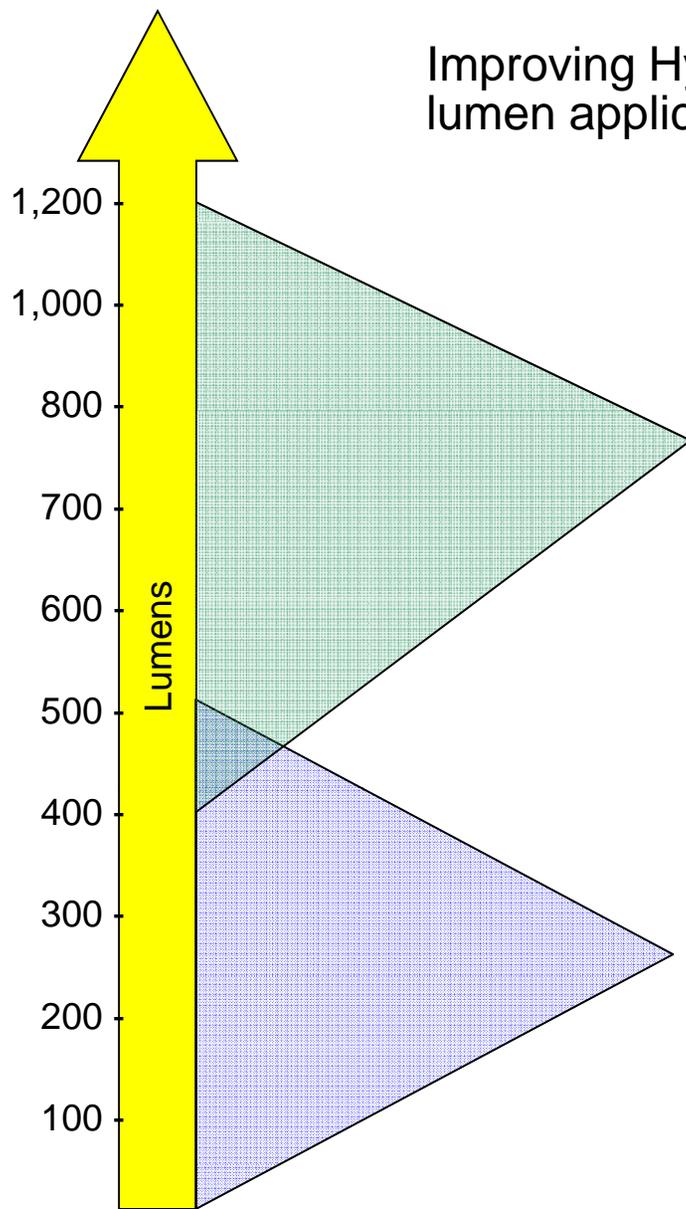


Hybrid Halogen MR16

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Hybrid Halogen MR16

Improving Hybrid Halogen efficacy in medium to high lumen applications



Hybrid Halogen MR16

- Current: 37W Hybrid replaces 50W standard (800 lumens)
- 2012: 30W Hybrid replaces 50W standard (800 lumens)
- Market Focus: Medium to high lumens
 - Beam control
 - Dimmability
 - Color quality

LED MR16

- Will increase in lumen output
- Thermal limitations
- Light density limitations (in small MR16 configuration)



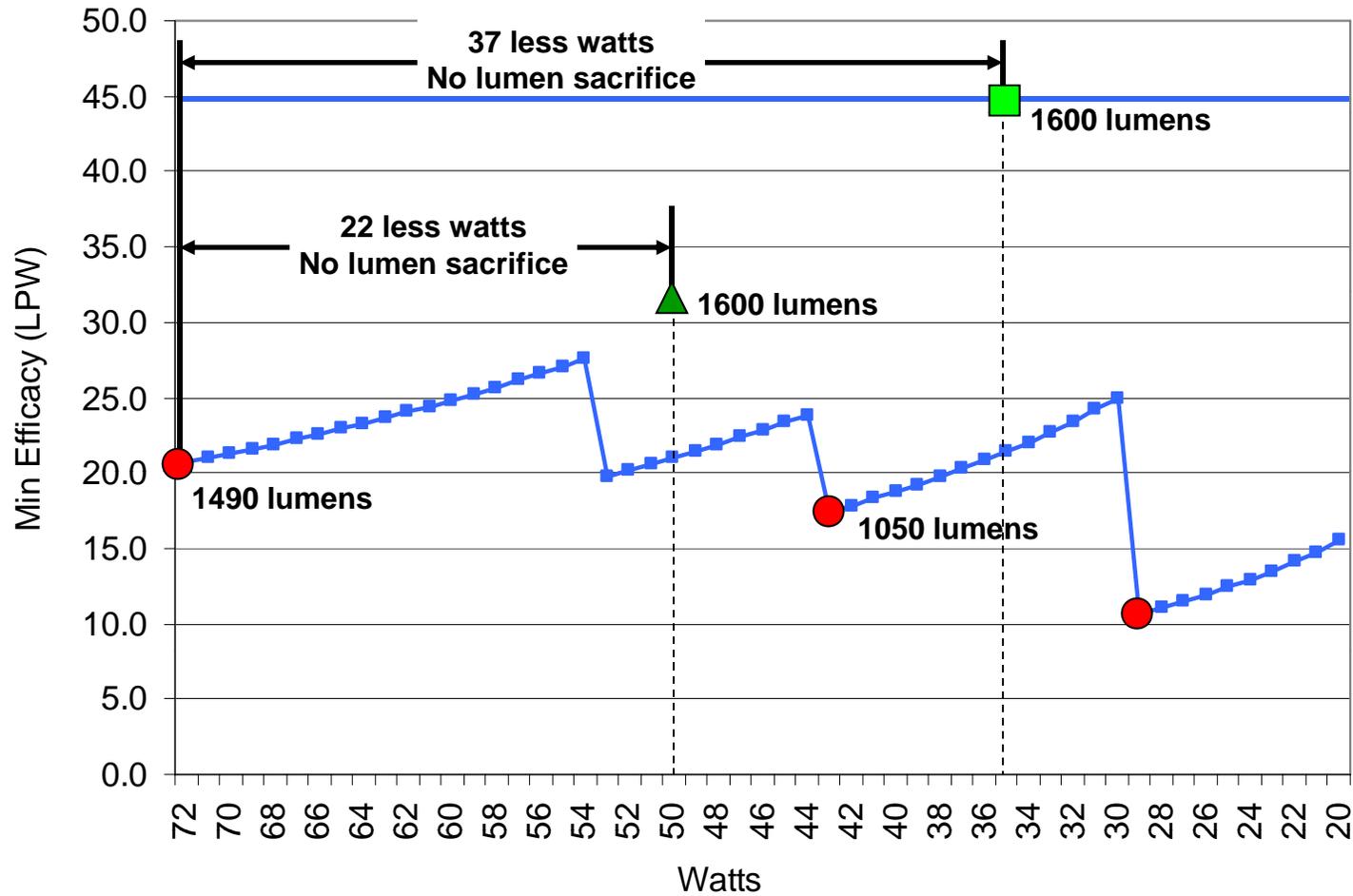
Hybrid Halogen A-Line

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Hybrid Halogen A-Line



EISA2007 A-Line Minimum Efficacy Requirement by Watts



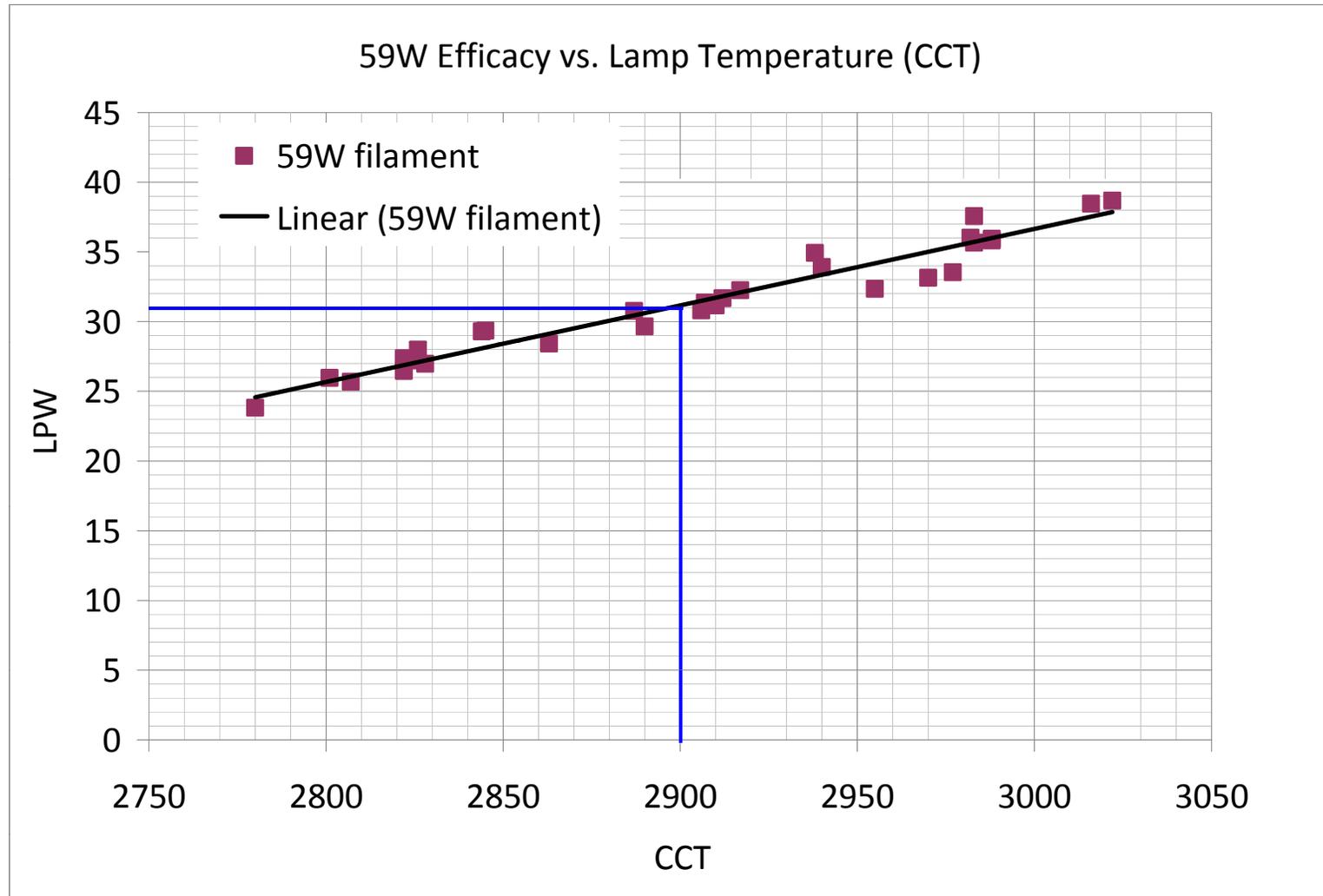
Phase 2:
2020 minimum

Phase 1:
2012-2014

- Standard halogen
- ▲ Hybrid halogen (2011): 50W = 100W
- Hybrid halogen (By 2020): 35W = 100W

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Hybrid Halogen A-Line: High LpW with Long Life Demonstrated



Current Capsule Prototype (59W)

Lamp CCT: 2900

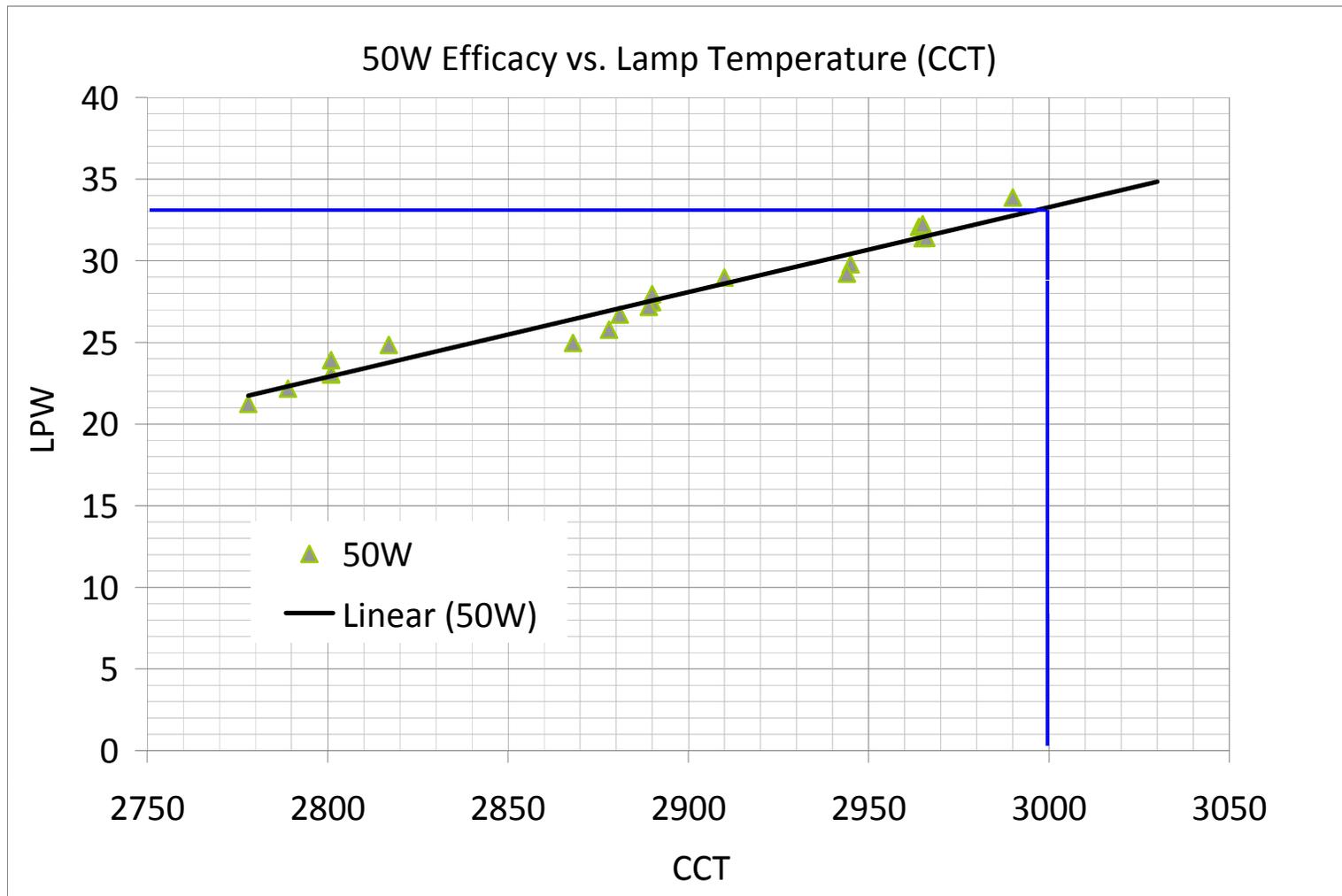
Life = ~3,000 hours

Capsule Efficacy = 31.5 lpw

Hybrid Halogen A-Line: 50W Replacement for 100W



Scheduled for 2011 Production



At 3,000 lamp CCT
Life = 1,000+ hours
Capsule Efficacy > 33 lpw
Supports A-Line 50W = 1600 lumens



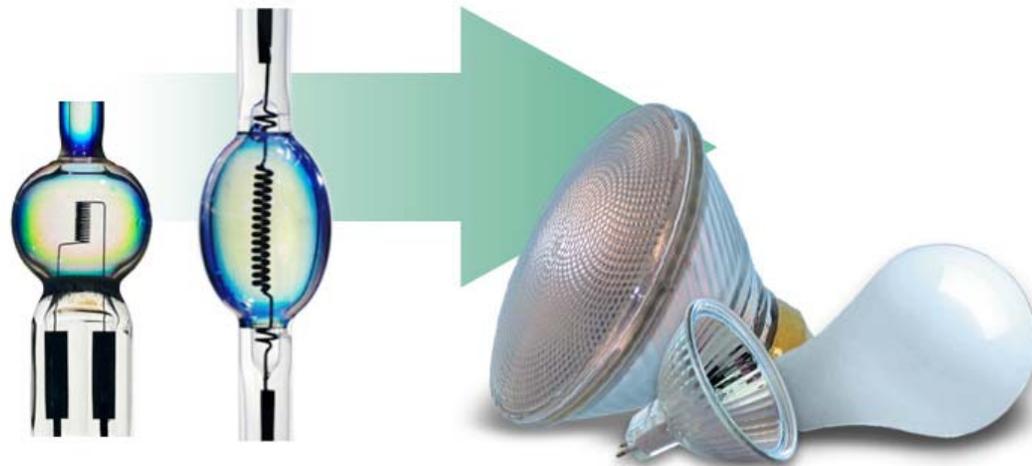
Commercialization



ADLT: 'Hybrid Halogen inside'

ADLT is supporting brand partners:

1. Advancing Hybrid Halogen technology
 - IR coatings
 - Coating and capsule interface
 - Capsule design
 - Manufacturing processes (faster, higher throughput, cheaper)
2. Building capacity
 - IR coating
 - Capsule



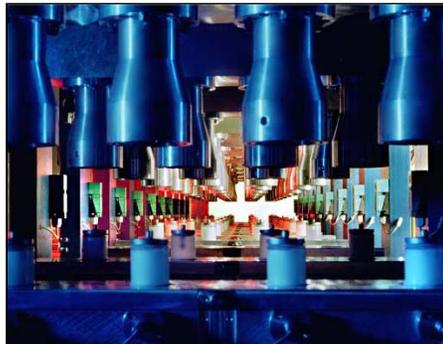


Key: Hybrid Halogen capsule capacity

Capacity

Hybrid Coatings

- Coating services
- Coating equipment
- Pre-coated bodies



PICVD Coating



MicroDyn Coating

Hybrid Capsules

- DE for A-line, PAR, BR
- SE for MR16



Capsule Manufacturing



Coating Capacity

- Germany: Expanding capacity, facilities
- India: Facilities in place
First coating operations 2011
- China: Coating operations 2012



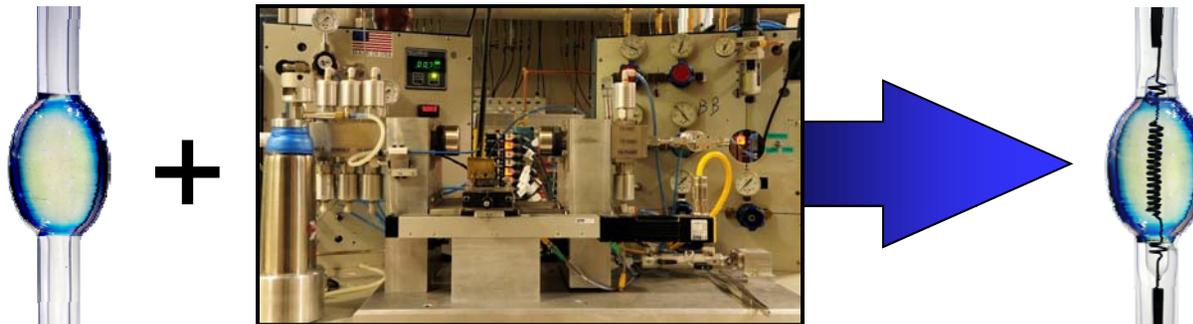
PICVD coating - Germany

Capsule Capacity

- Turnkey manufacturing equipment
- Key materials



Coating bays – India operations



hybrid
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hybrid halogen

“The Peoples Choice” – The only transparent replacement for the incandescent lamp

- Energy Efficient
- Dimmable
- No Mercury
- High Quality Light
- Instant On

ADLT is driving the pace of Hybrid innovation

- Performance
- Cost
- Availability

Hybrid Halogen is one leg of the energy efficient offering to the consumer channel

- Hybrid Halogen
- CFL
- LED