

# LED Lighting Market Trends and Intelligent Wireless Lighting Control

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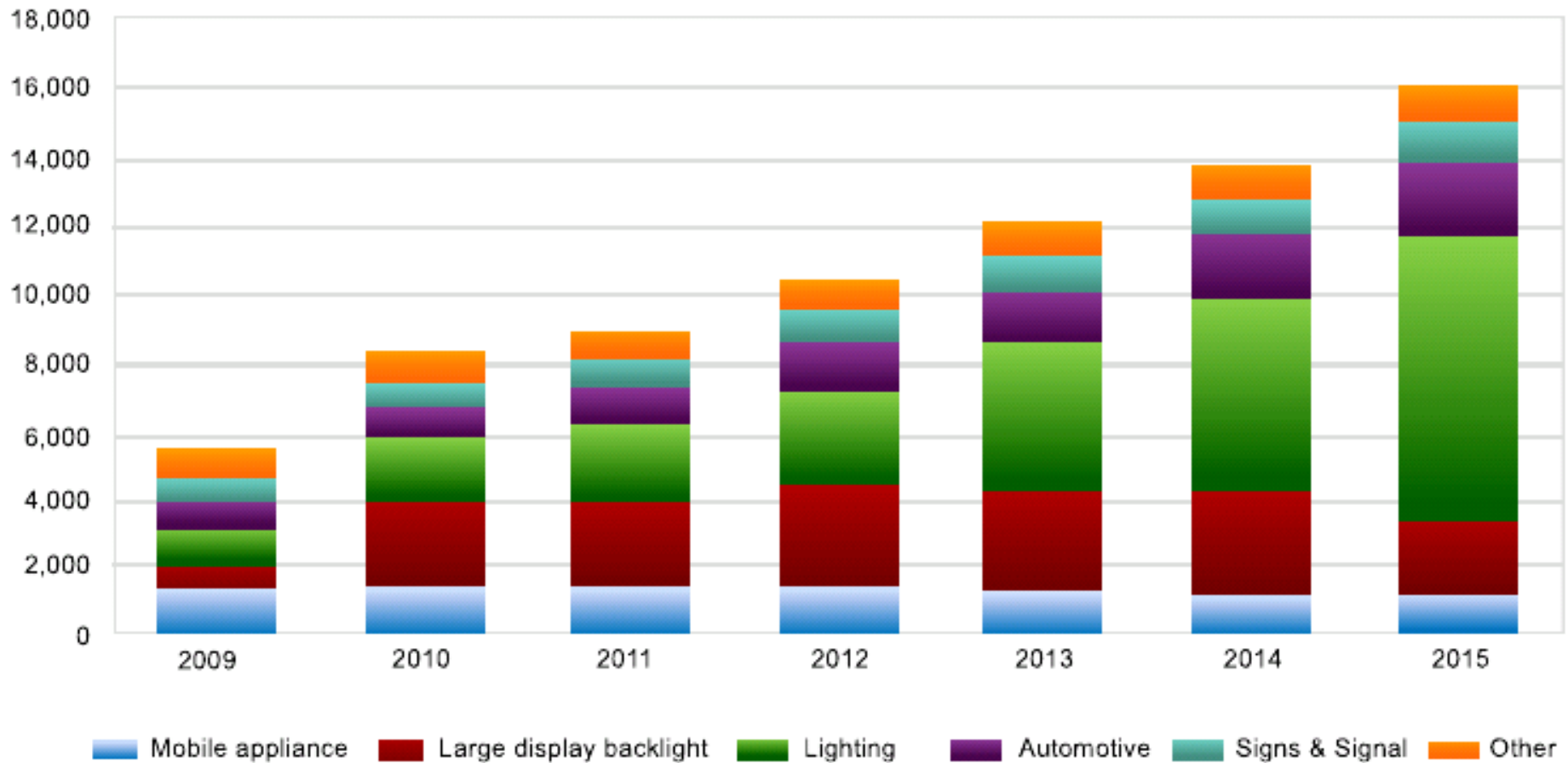
# Introduction

- **Lighting currently represents 17.5% of global electricity consumption.**
  - EMSD: lighting is the second largest electricity consumption in HK
- **There is growing trend to use LED to replace traditional lighting:**
  - Technical: Energy saving (>30%), long operating hours (>35,000 hrs) , non toxic, etc.
  - Government initiative: energy saving policy
- **What's next when LED is becoming mature?**
  - Answer: intelligent wireless lighting control
  - Further increase energy saving capability i.e. sensor control
  - Increase competitiveness in lighting market

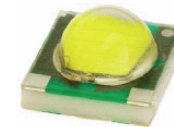
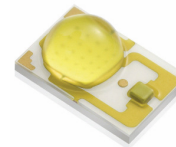
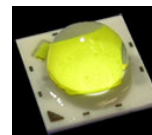
# LED Lighting Update

# LED Package Market Revenue

Millions (USD)



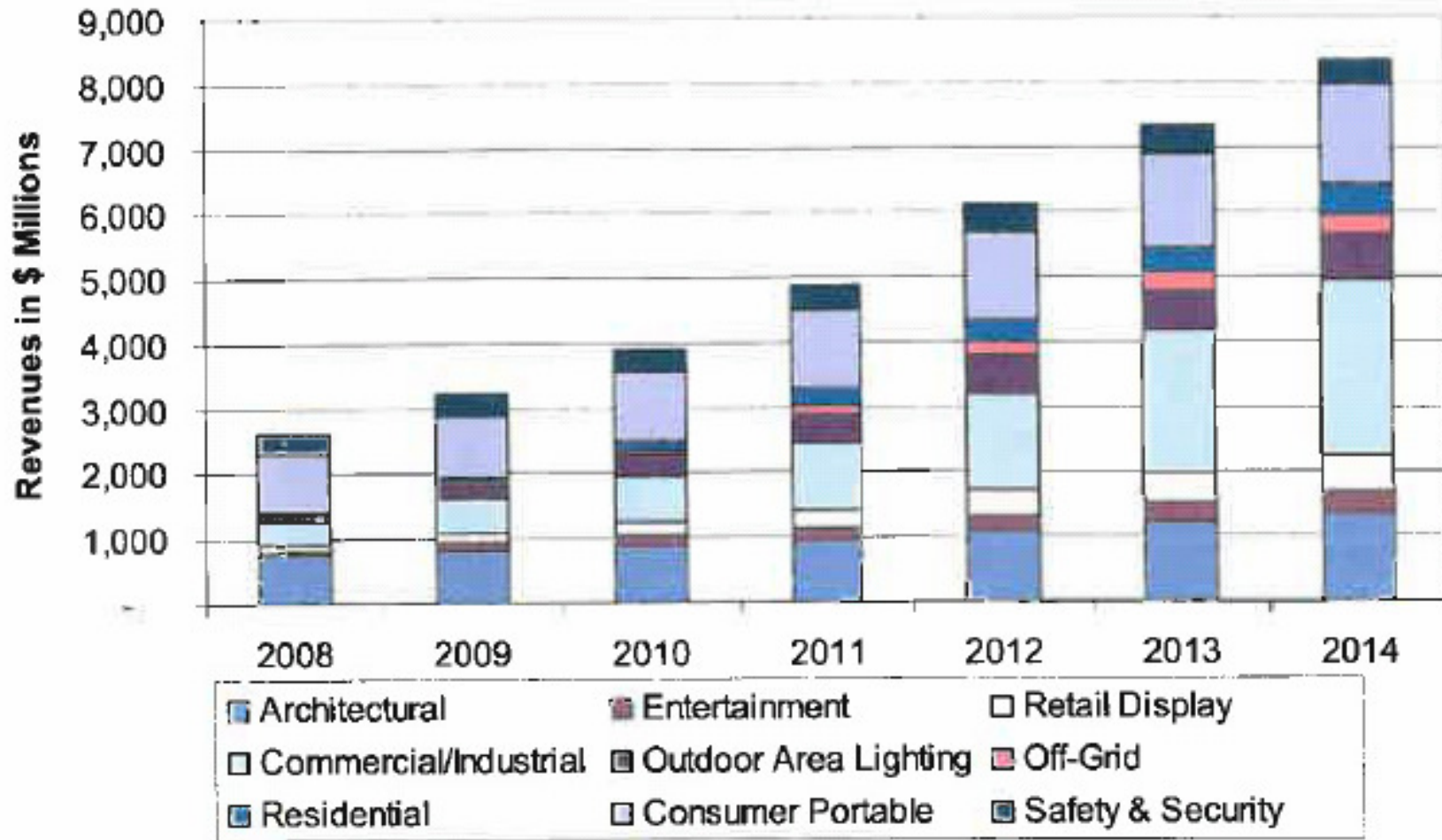
**LEDinside 2011**



ASTRI Proprietary



# LED Fixture Market Revenue



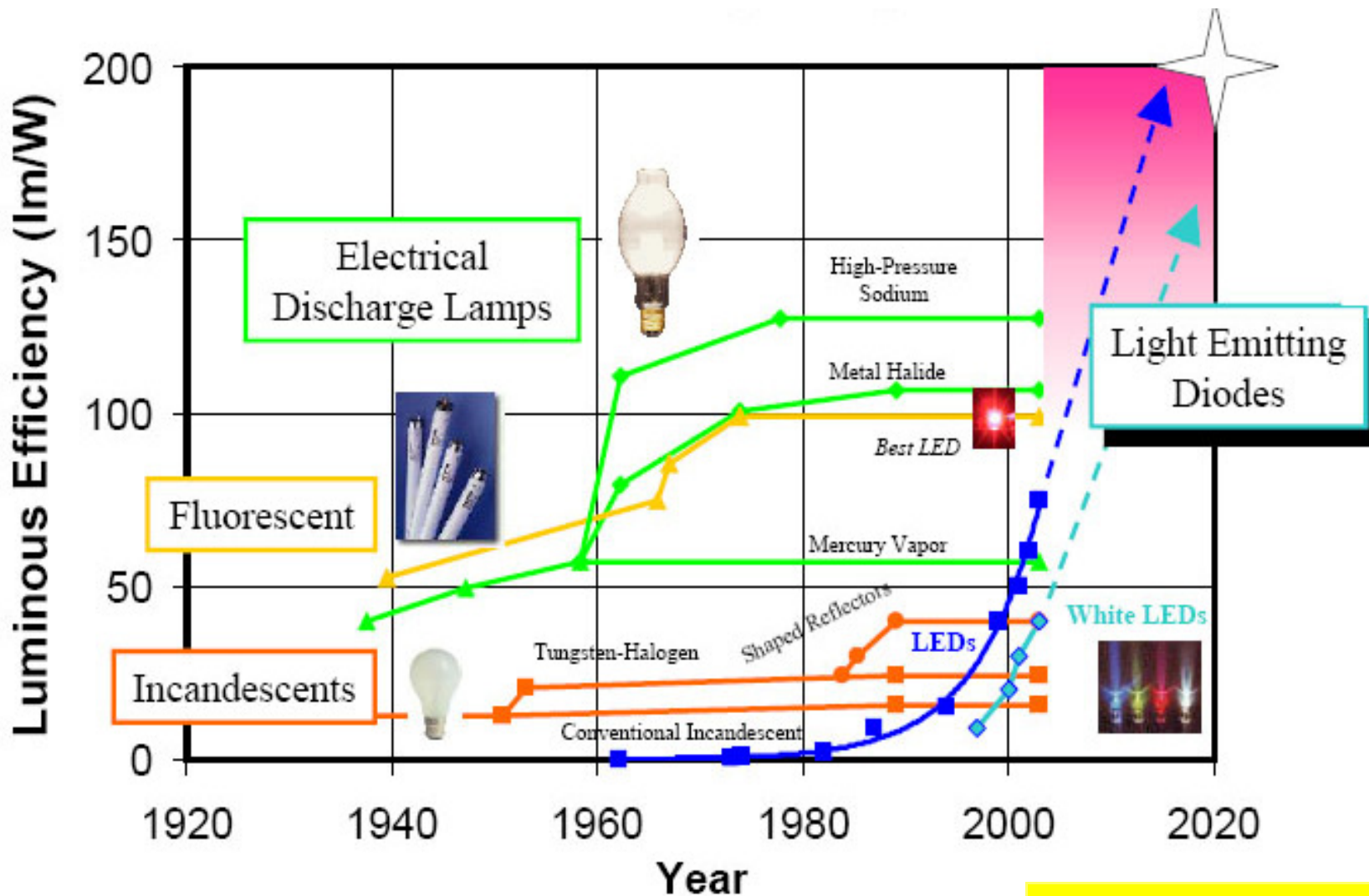
*Strategy Unlimited 2011*

# Traditional Light Sources

Type	Wattage (W)	Luminous flux, init. (avg) (lm)	Efficiency (lm/W)	$R_a$	CT (CCT) (K)	Life-time (hours)
Incandescent (120 V)	60	865	14.4	100	2790	1000
Tungsten halogen (120 V)	50	590	11.8	100	2750	2000
Fluorescent triphosphor	32	2,850 (2,710)	84	78	(4100)	24,000
Compact fluorescent	15	900 (765)	51	82	(2700)	10,000
Low-pressure sodium	90	12,750 (11,095)	123	-44	(1800)	16,000
High-pressure mercury	250	11,200 (8,400)	34	50	(3900)	24,000
High-pressure sodium	250	28,000 (27,000)	108	22	(2100)	24,000
Metal halide	400	36,000 (24,000)	60	65	(4000)	20,000
Induction	55	3,500 (2,800)	64	80	(3000)	100,000

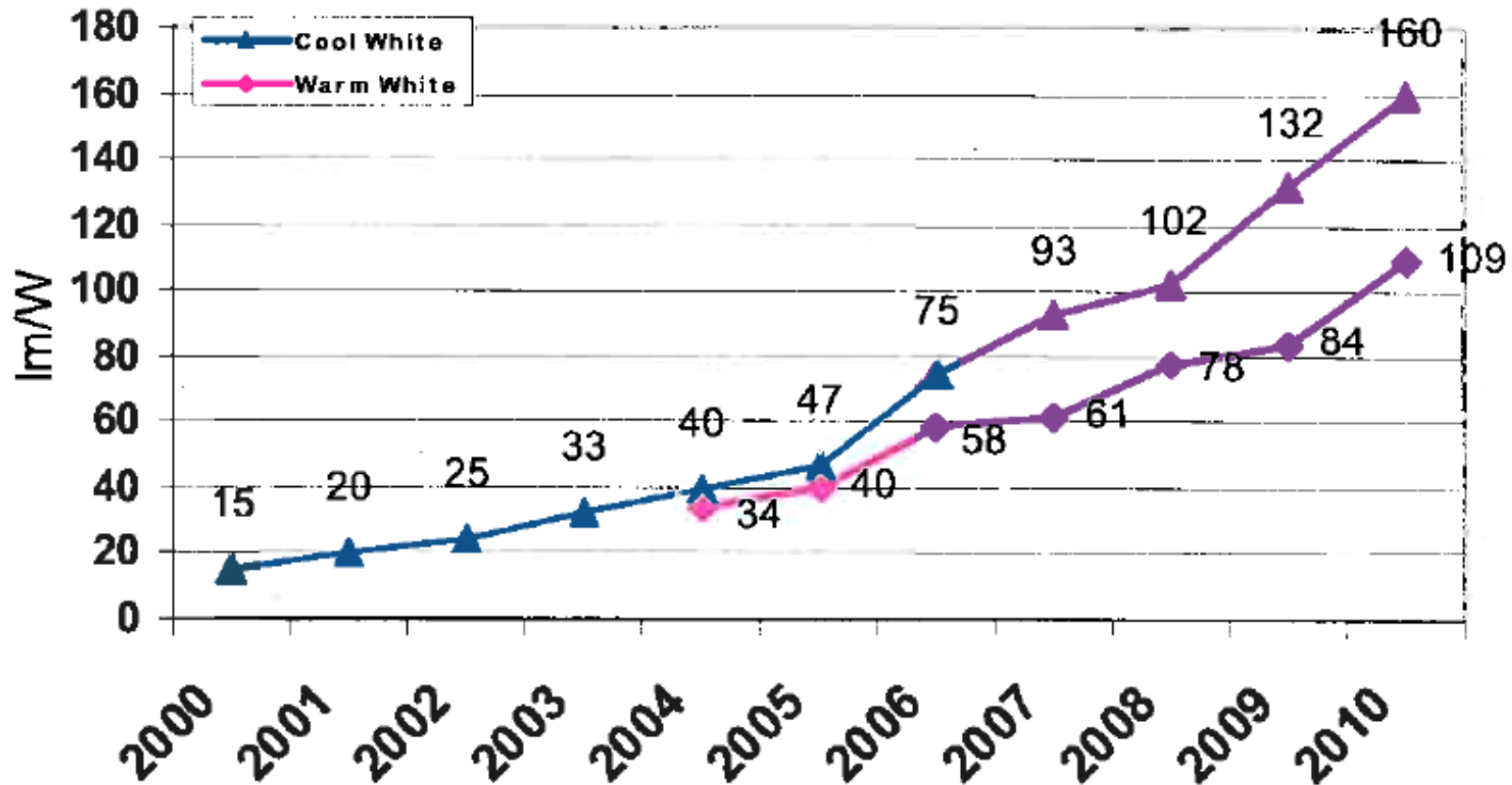


# LED vs Traditional Light



**Data FIVE years ago!**

# LED Efficiency



## Evolution of white LED efficacy

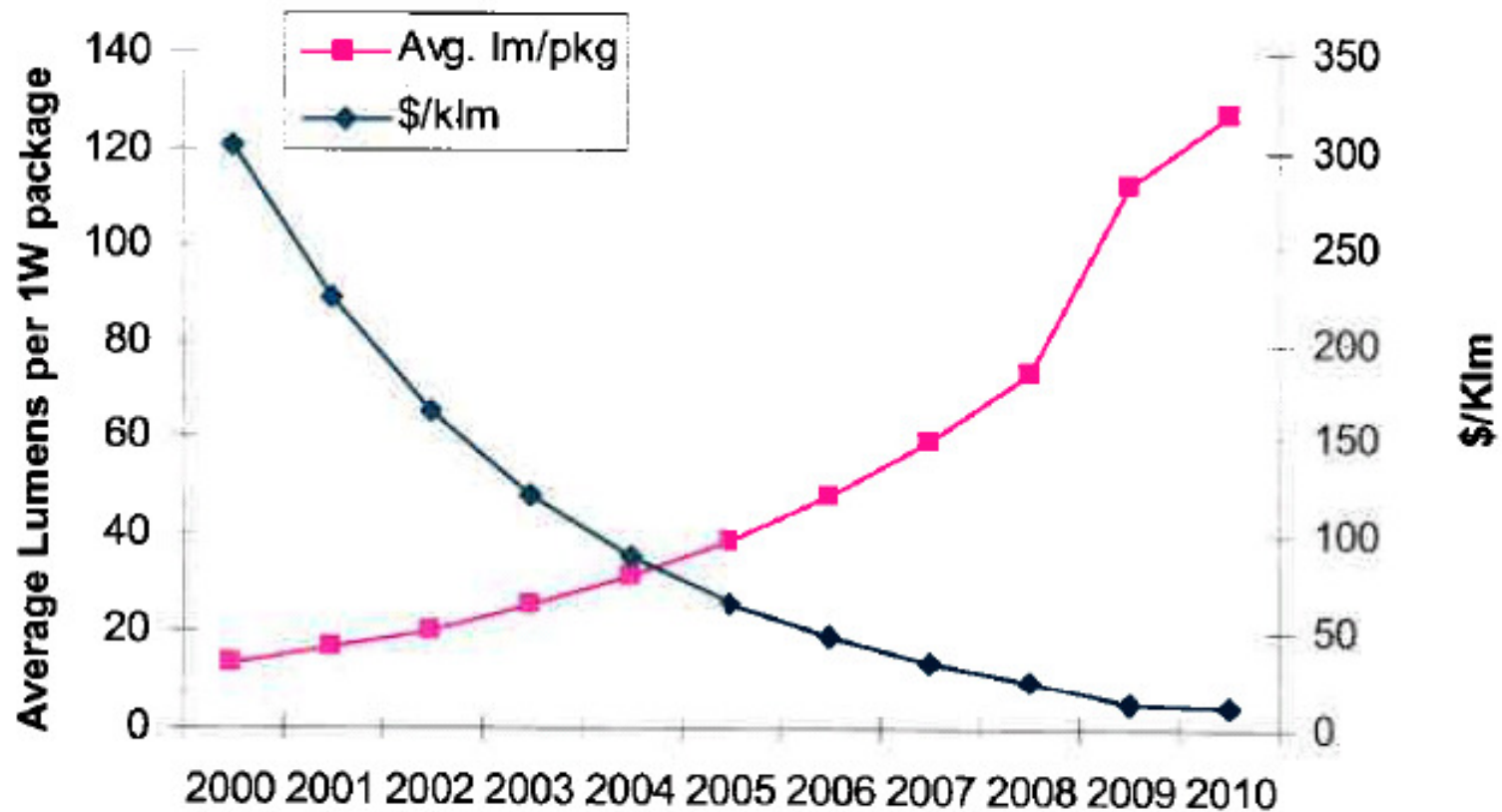
Best available commercial products

**Data TODAY!**

Strategy Unlimited 2011



# LED Cost



Average 1W LED cool white package

Strategy Unlimited 2011

# LED Performance

**Table 1. 6000-Hour Lumen Maintenance Thresholds**

	<b>Minimum lumen maintenance at end of 6000 hours (% of initial lumens; -3% tolerance)</b>	<b>Maximum L<sub>70</sub> Life Claim (hours)</b>	<b>ENERGY STAR Approval Available After 6000-hour test</b>
Minimum for Decorative	86.7%	15,000	<b>Full approval</b> (no additional lumen maintenance testing required)
Optional for Decorative	89.9%	20,000	
Minimum for Non-standard, Omnidirectional, and Directional Optional for Decorative	91.8%	25,000	
Optional for All Lamp Types	93.1%	30,000	<b>Initial approval</b> , pending completion of total required test period (see Table 2 below)
	94.1%	35,000	
	94.8%	40,000	
	95.4%	45,000	
	95.8%	50,000	

## Energy Star Lumen Maintenance Requirements



# Wireless Lighting Control

# Advantages

- **Cost reduction**

- ❑ Low installation cost due to reduction of wiring of cables
- ❑ Extra power saving with sensors e.g. motion sensor, daylight sensor, etc.

- **Increase flexibility**

- ❑ No limitation in installation of control device e.g. battery operated wall switch, sensors, etc.
- ❑ Remote controllable of lighting device e.g. remote controller, tablet, smart phone, etc.

- **Advanced control**

- ❑ Time scheduling
- ❑ Individual, group control
- ❑ Color mixing, CCT tunable, etc.

# Lighting Control Technologies

- Manual control

Wall switch, remote controller,  
etc.

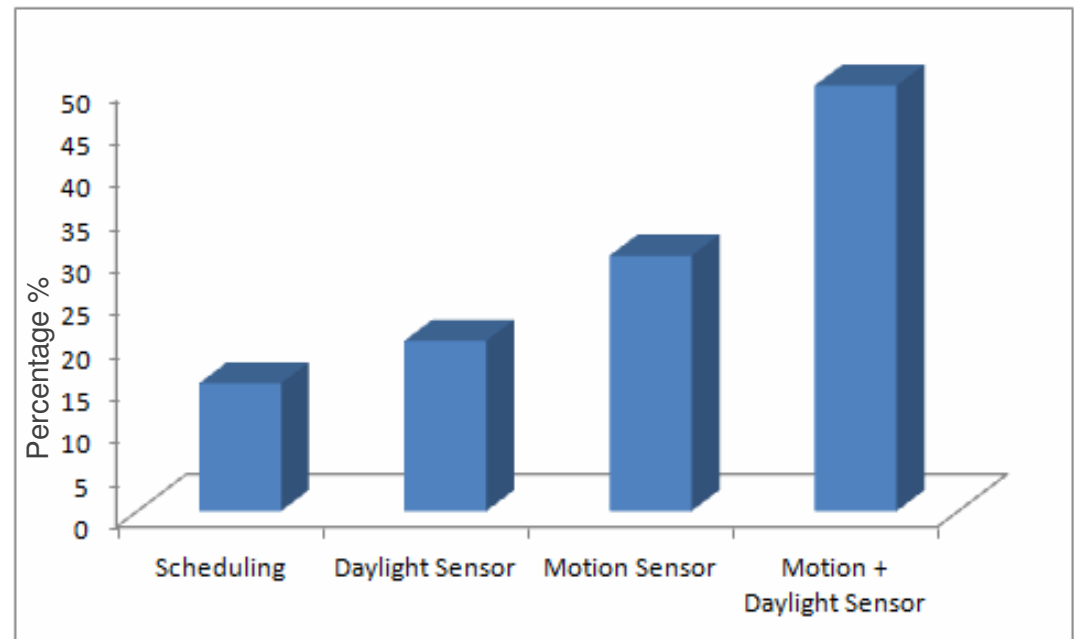
- Automatic control

- Scheduling

- Daylight sensor

- Motion sensor

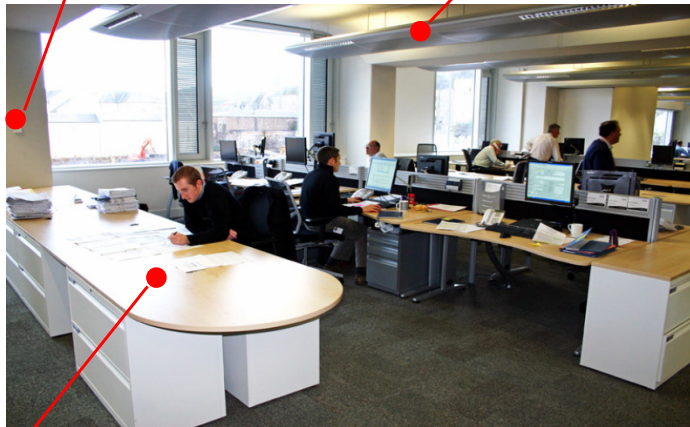
Energy saving capability for different types of control technologies



# User Scenario

Daylight sensor

Wireless wall switch



Remote control

Office



Time scheduling from central control

Corridor

Motion sensor

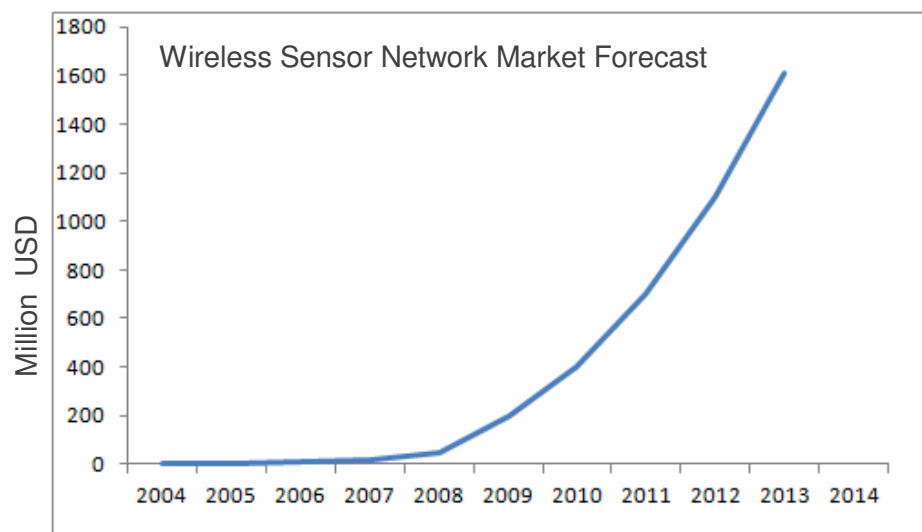


Staircase

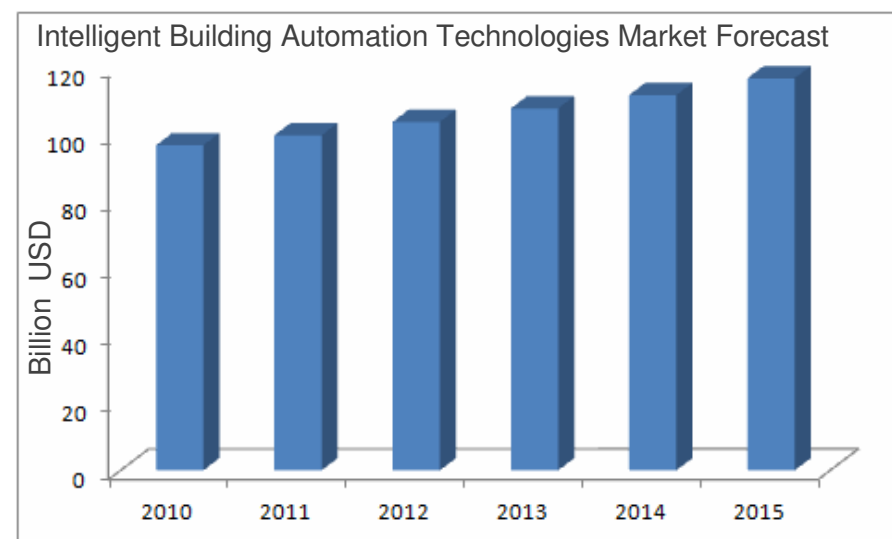
# Market Trends

- **Global market size** (source: Pike Research 2010):

- Global revenue of lighting control will increase from US\$1.3B to **\$2.6B** by 2016
- **Wireless technology in building management system** → **73% retrofit**



Source: Global Information, Inc



Source: Markets and Markets

- **Government initiative in Hong Kong:**

- **EMSD – The Building Energy Efficiency Ordinance (Cap.610)**
- **Housing Authority – Target to save 20% energy in lighting by adopting control system**

# Wireless Technologies Comparison

ZigBee and other wireless technologies				
Market Name Standard	ZigBee™ 802.15.4	GSM/GPRS CDMA/1xRTT	Wi-Fi™ 802.11b	Bluetooth™ 802.15.1
<b>Application Focus</b>	Monitoring & Control	White Area Voice & Data	Web, Email, Video	Cable Replacement
<b>System Resources</b>	4KB - 32KB	16MB	1MB	16KB
<b>Battery Life (days)</b>	100 - 1,000	1 - 7	.5 - 5	1 - 7
<b>Network Size</b>	Unlimited	1	32	7
<b>Bandwidth (KB/s)</b>	20 - 250	124 - 68	11,000	720
<b>Transmission Range (meters)</b>	1 - 100	1,000	1 - 100	1 - 10
<b>Success Metrics</b>	Reliability, Power, Cost	Reach, Quality	Speed, Flexibility	Cost, Convenience



# Why Zigbee?

- **Low power consumption**

Long battery life > 2 years

- **Reliable wireless network**

Mesh network for self healing

- **Interoperable**

Zigbee already products

- **Open standard for lighting**

Application profile “Light Link” (2012) for user friendly lighting control with internet access



# ASTRI Wireless Lighting Control Technology

# ASTRI's MPT Group

## LED



Indoor, Outdoor Lighting & Control



3D Pico-projectors

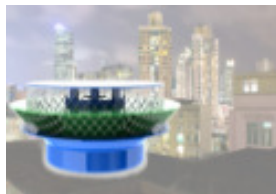


Touch Panel & Intelligent Display

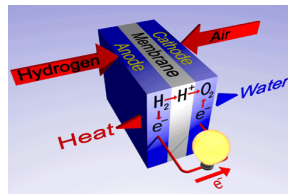
## Green Energy



CPV



Concentrating Wind Charger

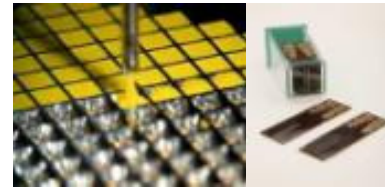


Fuel Cell



Li-ion Battery Anode Materials

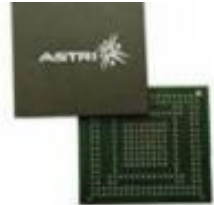
## Packaging & Sensing



Printed Electronics



TPMS



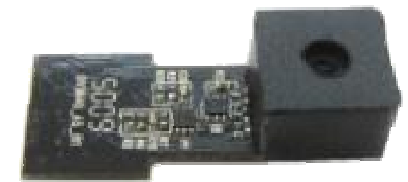
SiP



Anti-counterfeit Identification



Healthcare Electronics



Anti-shaking, Auto-focus & Optical Zoom Camera

- 173 US patents filed, 60 US granted/allowed, 88 counts licensed
- 127 technologies transferred to 75 companies, 1 spin-off
- 17 major awards from HK, China, US, Japan & Korea

# Development Direction

- **Green**

Target to develop energy saving wireless lighting control system for home & building automation

- **Low cost**

Implementation using commercial available components, function enhancement with simple modification & algorithm

- **Retrofit**

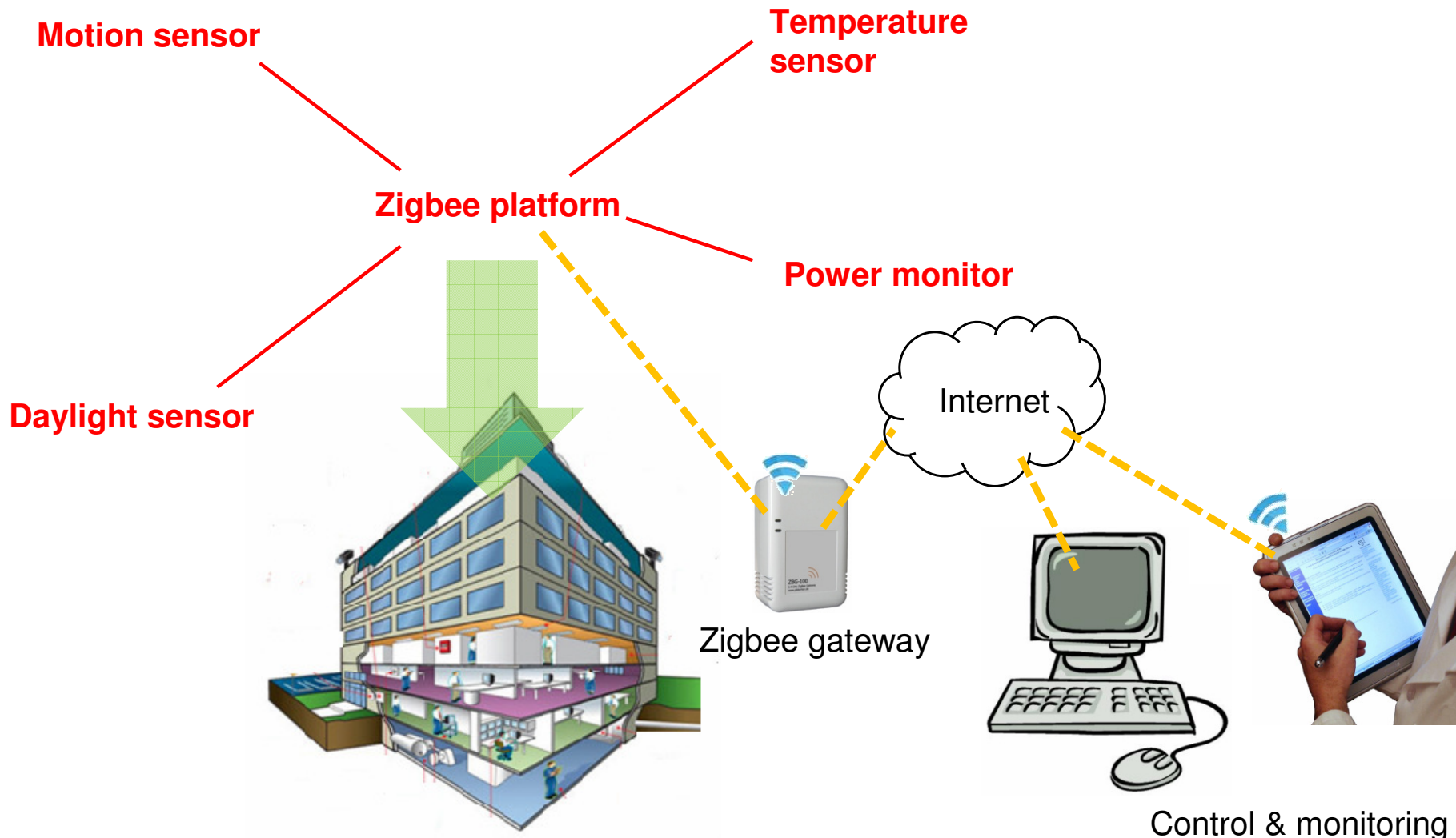
Wireless, embedded design → Simple installation without re-wiring

- **Intelligent**

Fully automation, interacts with environment & human

# User Scenario & Future Development

Low cost, intelligent & flexible wireless sensor network for green building



# End of Presentation

**Thank you. Questions are welcome.**

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