

LED Market Adoption: Status and Trends



DOE SSL Technology Development Workshop

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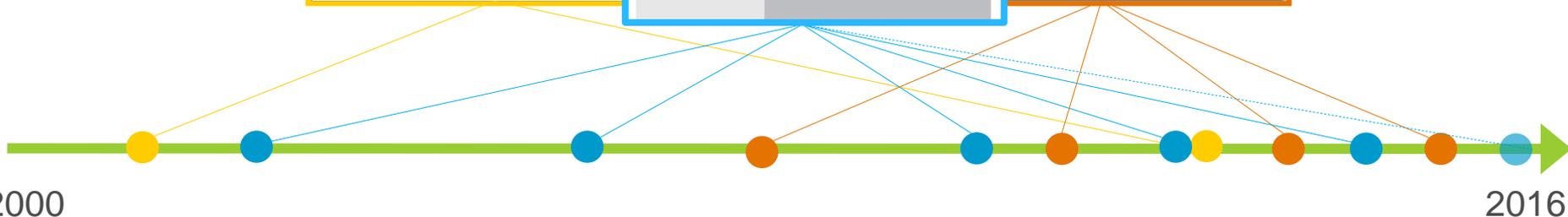
Principal and Founder



LED Market Studies

Over the past 15 years Navigant has conducted several market analyses for the U.S. DOE Solid-State Lighting (SSL) Program

- Lighting Market Characterization (2002, 2012)
- Energy Savings Forecast of SSL (2003, 2006, 2010, 2012, 2014)
- Adoption of LEDs in Common Lighting Applications (2008, 2011, 2013, 2015)



2000

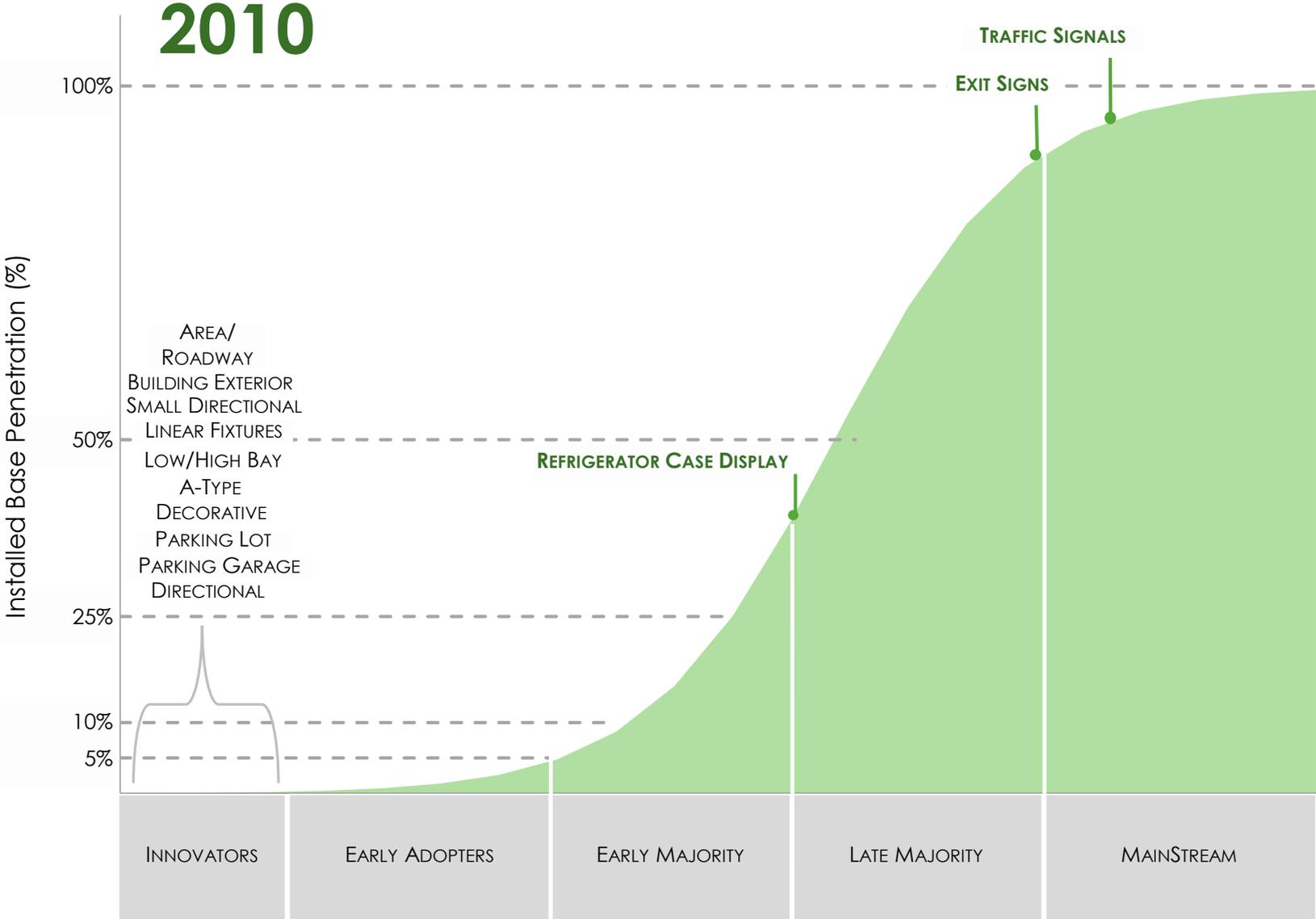
2016

Overview for U.S. LED Market Discussion

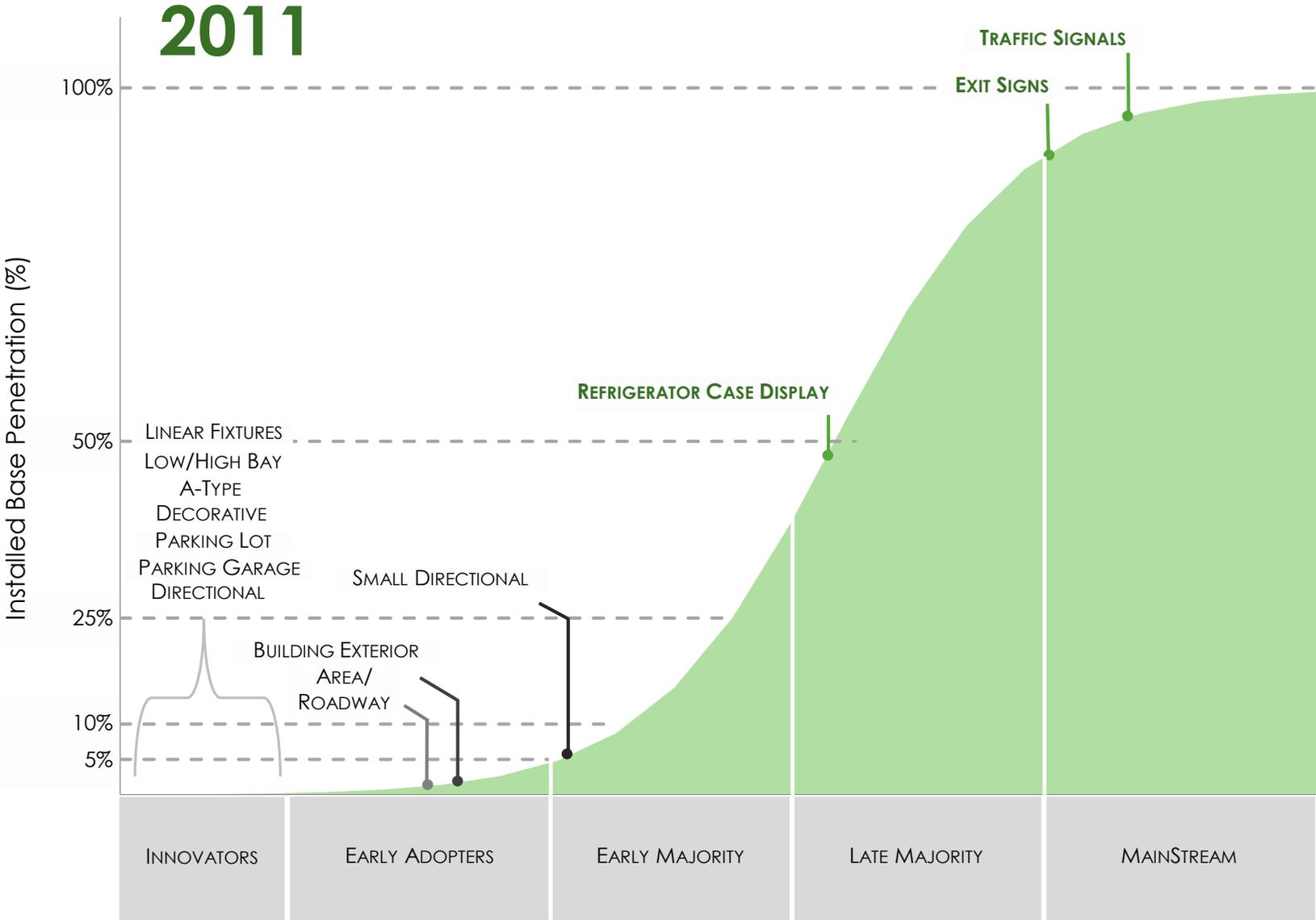
The lighting market is changing rapidly due to LED technology, today we will focus on:

- Where are LED lamps and luminaires penetrating the lighting market?
 - How has this changed over the past few years?
 - Which markets offer the greatest opportunities for LED penetration and/or energy savings?
- How are LEDs fairing in key residential, commercial/industrial, and outdoor lighting markets?
 - What is the current LED installed penetration rate compared to incumbent technologies?

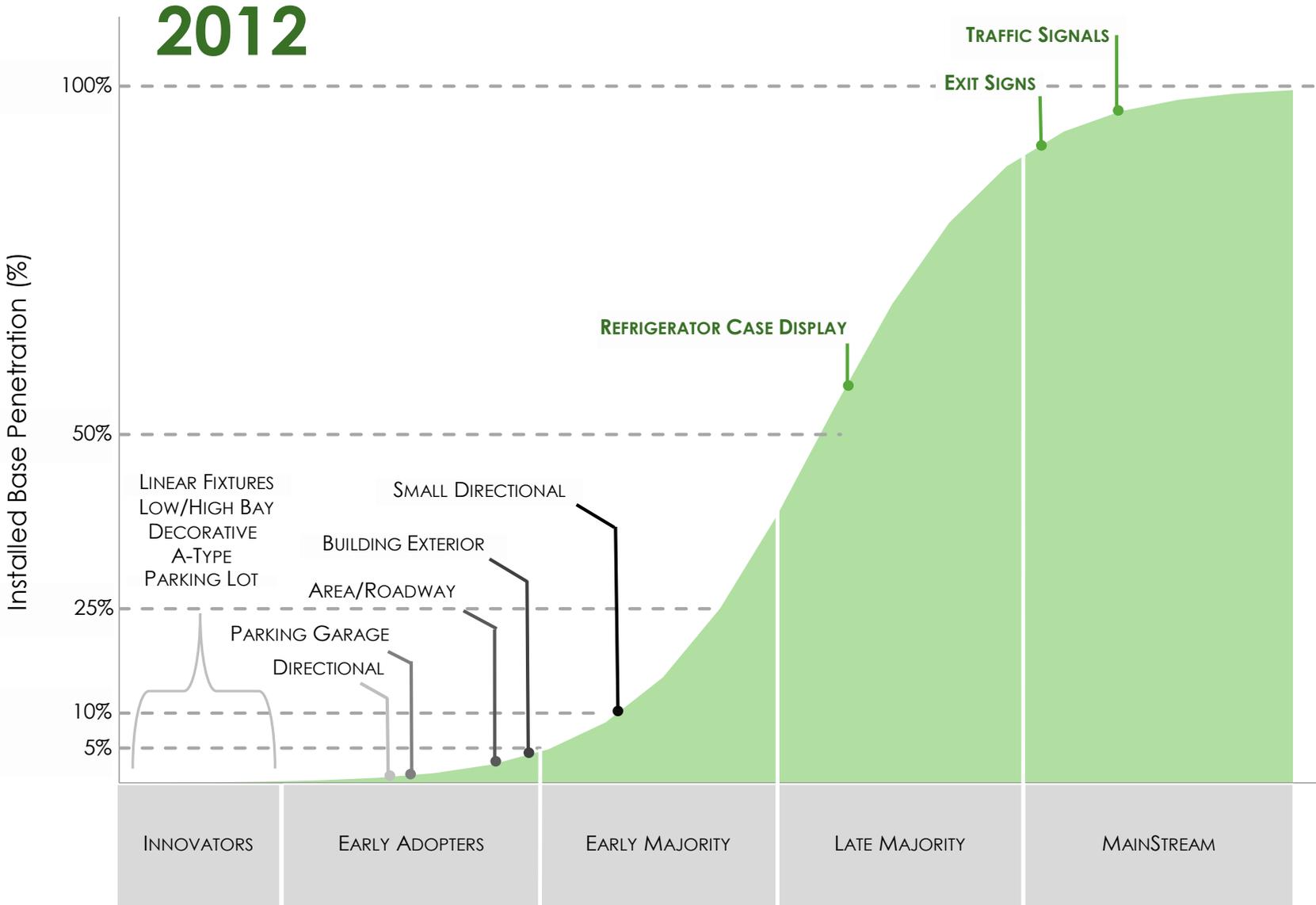
U.S. LED Installed Penetration



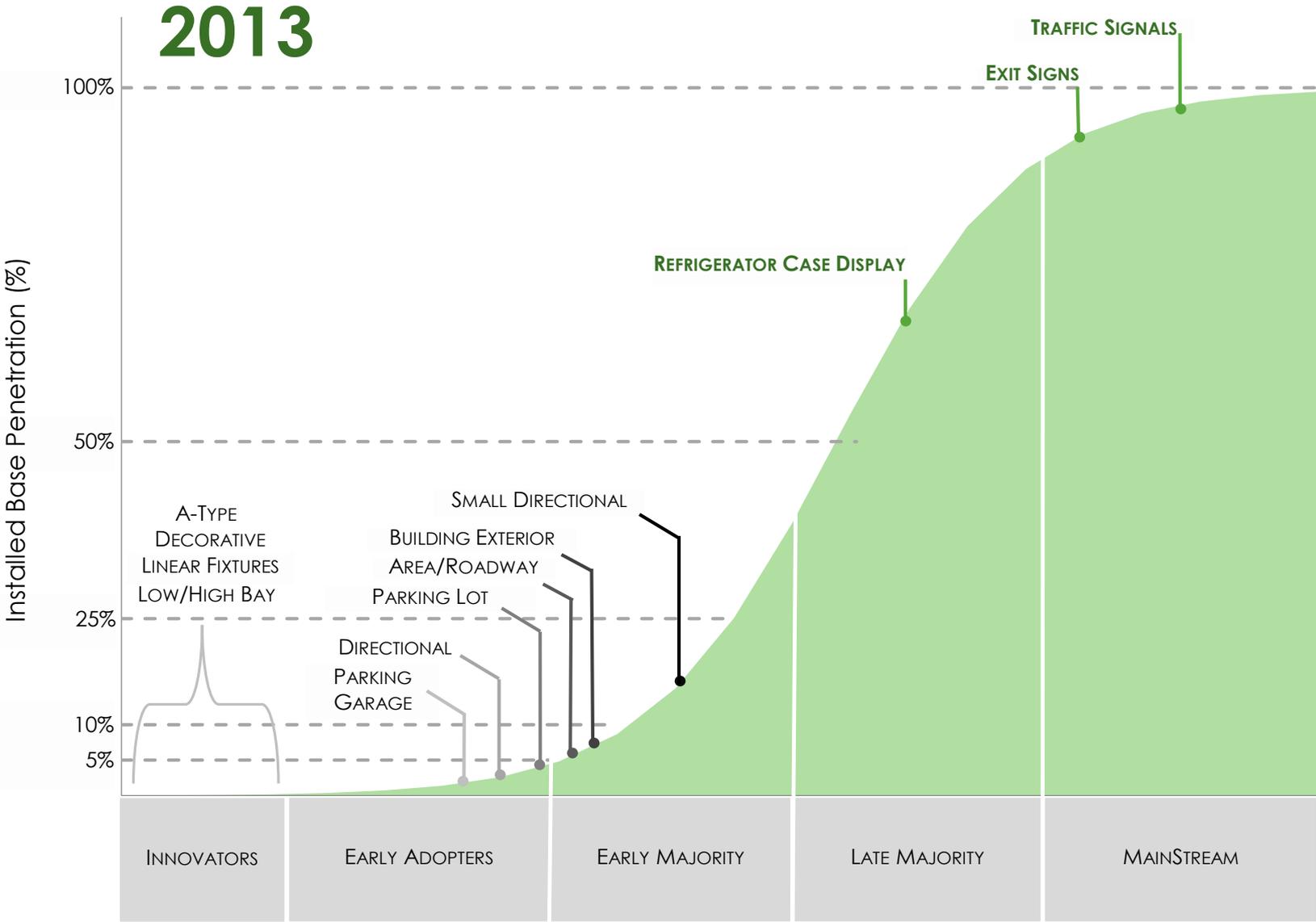
U.S. LED Installed Penetration



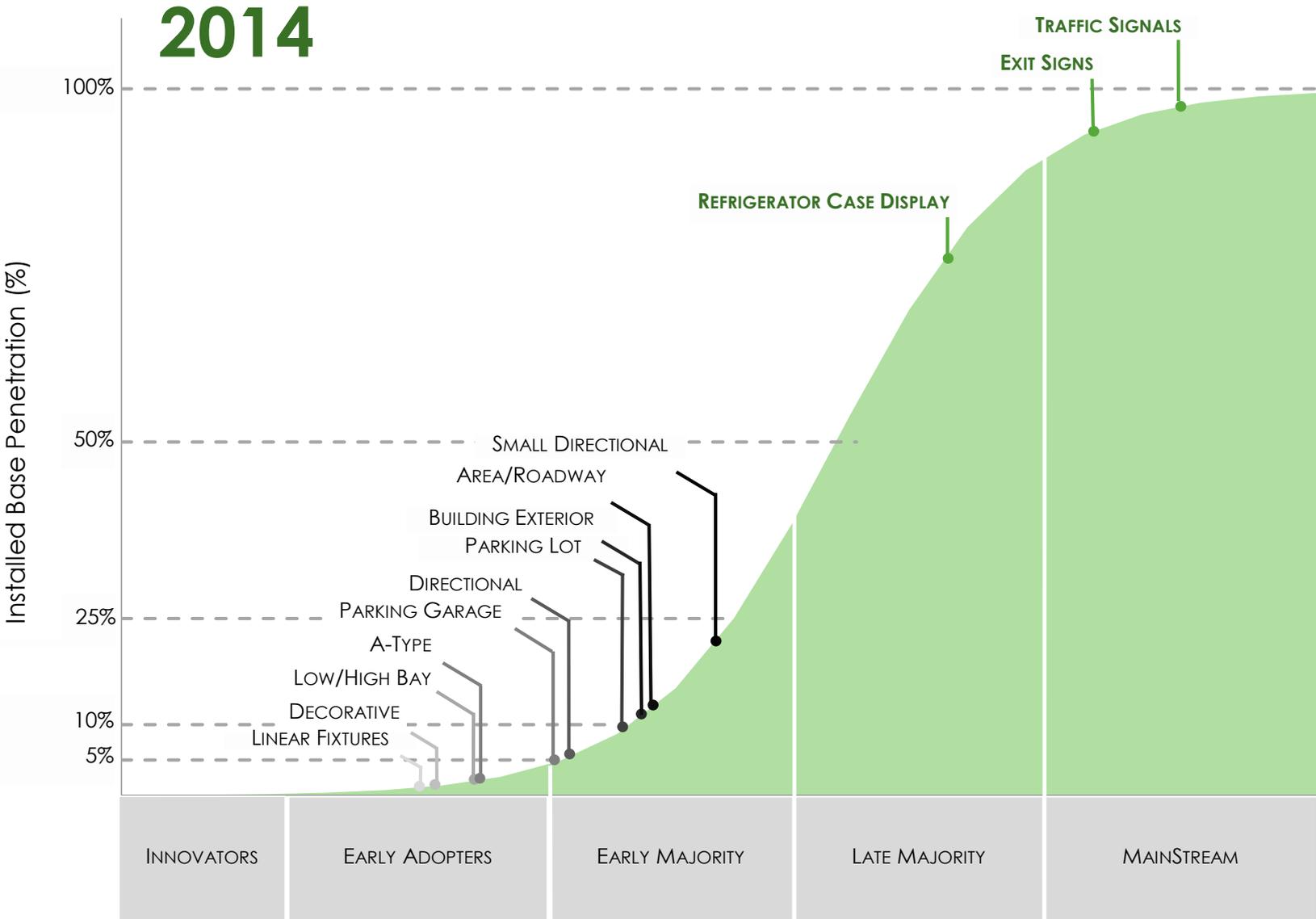
U.S. LED Installed Penetration



U.S. LED Installed Penetration



U.S. LED Installed Penetration



2014 LED Installations and Energy Savings by Application

While adoption of LED products is growing, market shares remain low overall, leaving substantial headroom to increase market penetration and related energy savings.

Application	2014 LED Installed Penetration (%)	2014 LED Units Installed ¹ (Millions)	2014 Energy Savings (tBTU)
A-Type	2.4%	77.7	17.6
Decorative	1.5%	17.8	2.3
Directional	5.8%	67.0	30
Small Directional	21.8%	10.3	15.4
Linear Fixture	1.3%	12.5	22.8
Low/High Bay	2.2%	3.1	24.1
Area/Roadway	12.7%	5.7	9.0
Parking Lot	9.7%	2.8	8.4
Parking Garage	5.0%	1.8	1.7
Building Exterior	11.5%	7.6	5.5
Other	3.3%	8.3	6.4
Total All²	3.0%	215	143

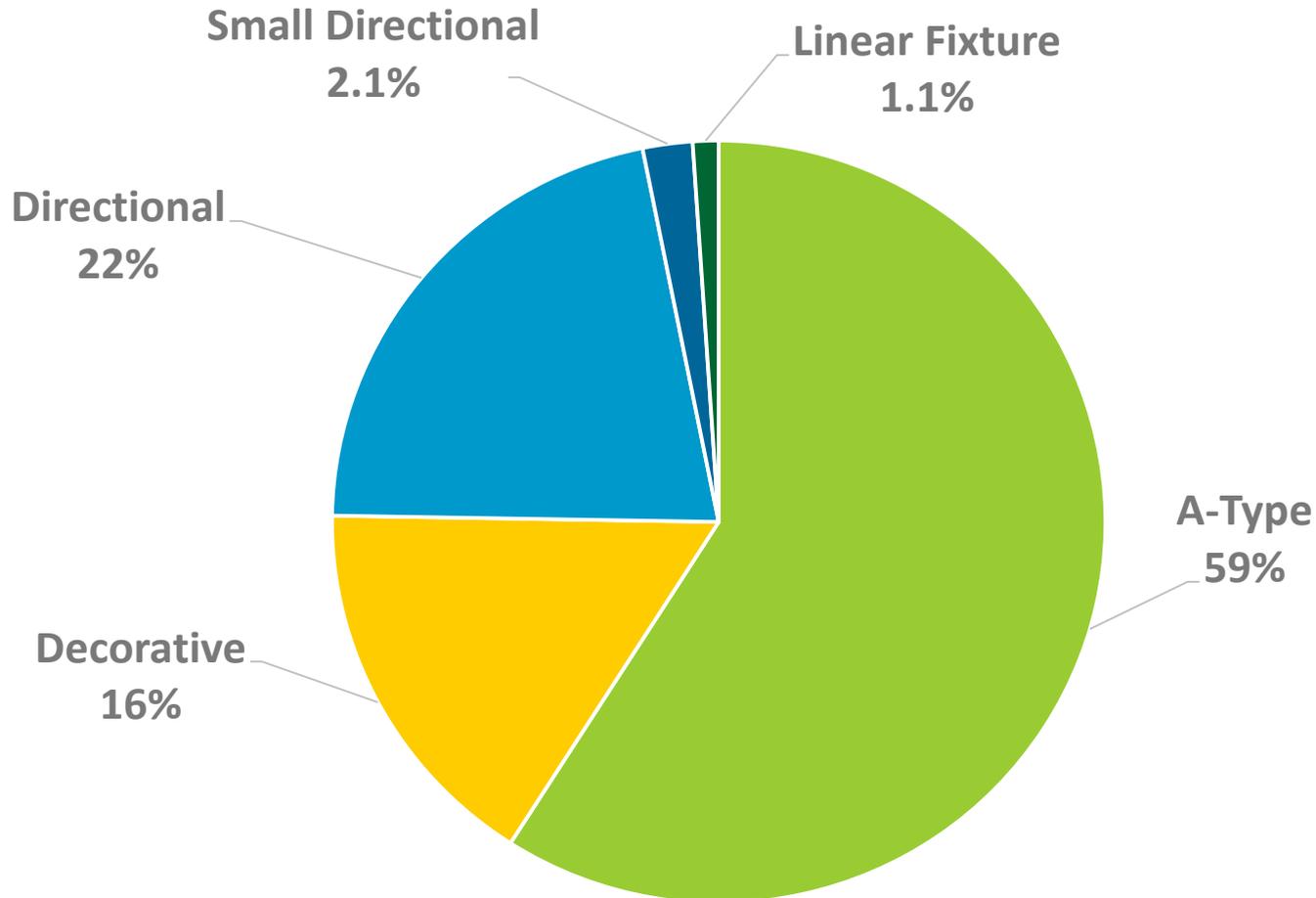
In 2014, **2.8%** of all **indoor lighting** installations were LED. Approximately half-and-half split between residential and commercial/industrial LED installations.

In 2014, **10%** of all **outdoor lighting** installations were LED.

1. Installations are the total cumulative number of LED lamps and luminaires that have been installed as of 2014.
2. Values may not add due to rounding.

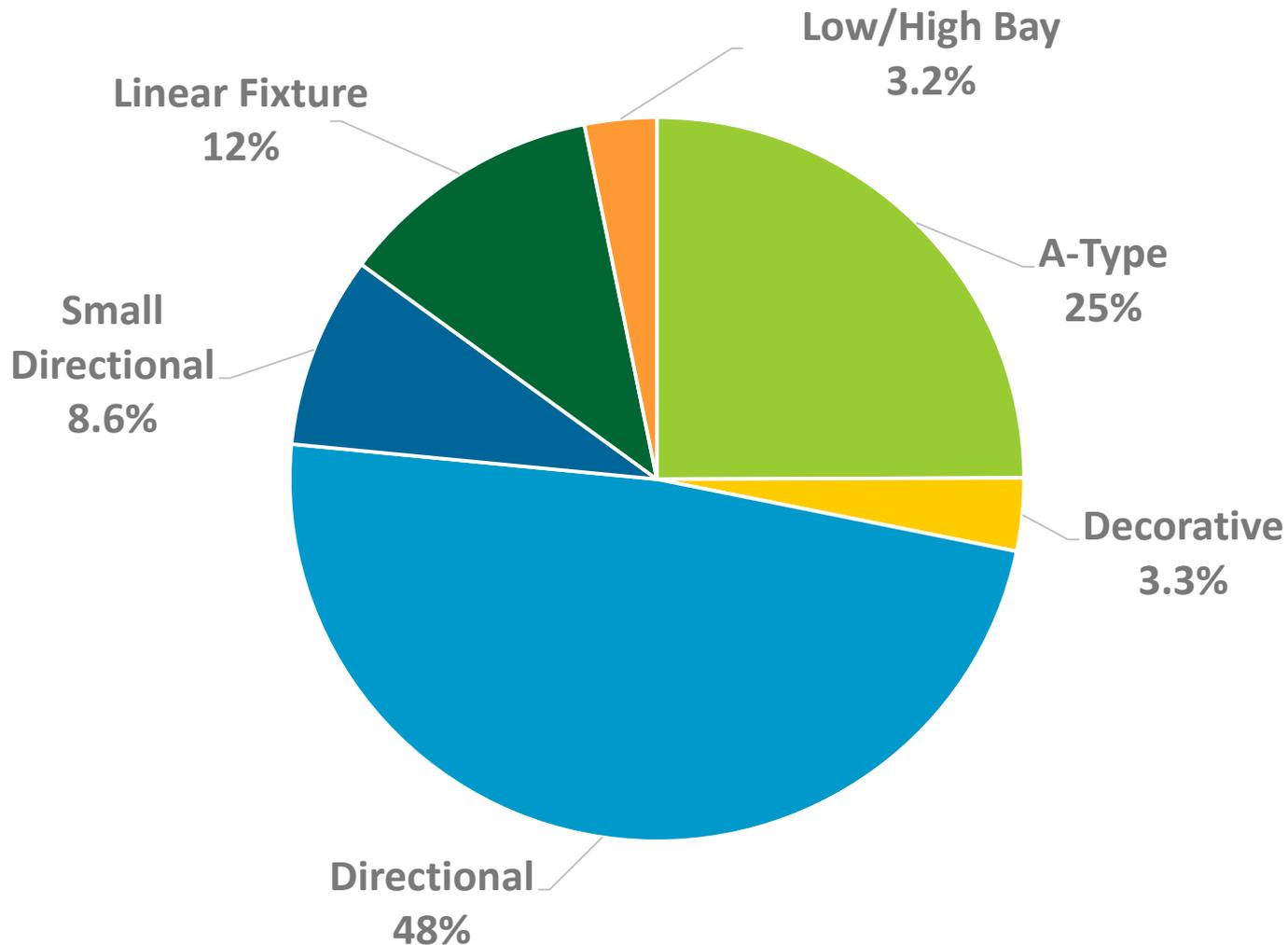
2014 LED Residential Installations

The vast majority of LED products installed in the residential sector are lamps. The top three are A-type, directional, and decorative respectively.



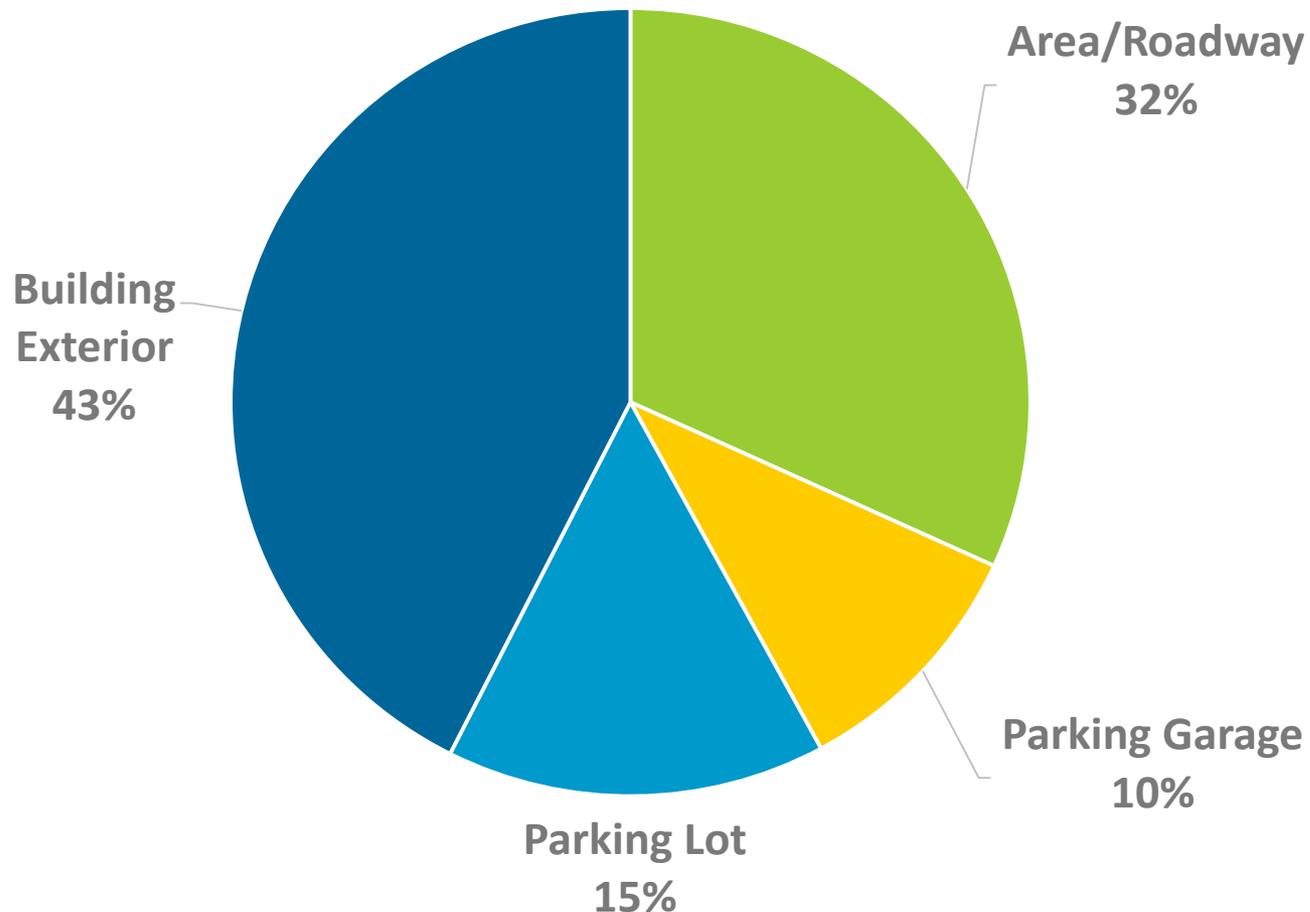
2014 LED Commercial/Industrial Installations

Similarly, in the commercial/industrial sectors, LED installations are also dominated by directional and A-type products, at 48% and 25% respectively.



2014 LED Outdoor Installations

In the outdoor sector, LED are predominately in Building Exterior applications, in 2014 representing 43% of all outdoor LED installations. This is followed by Area/Roadway (32%) and Parking (25%) applications.



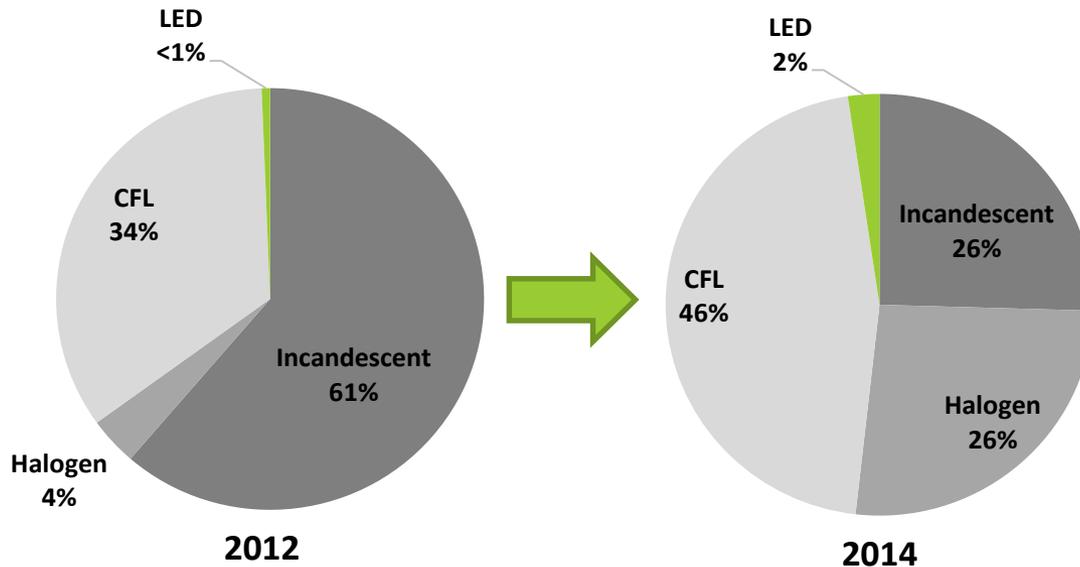
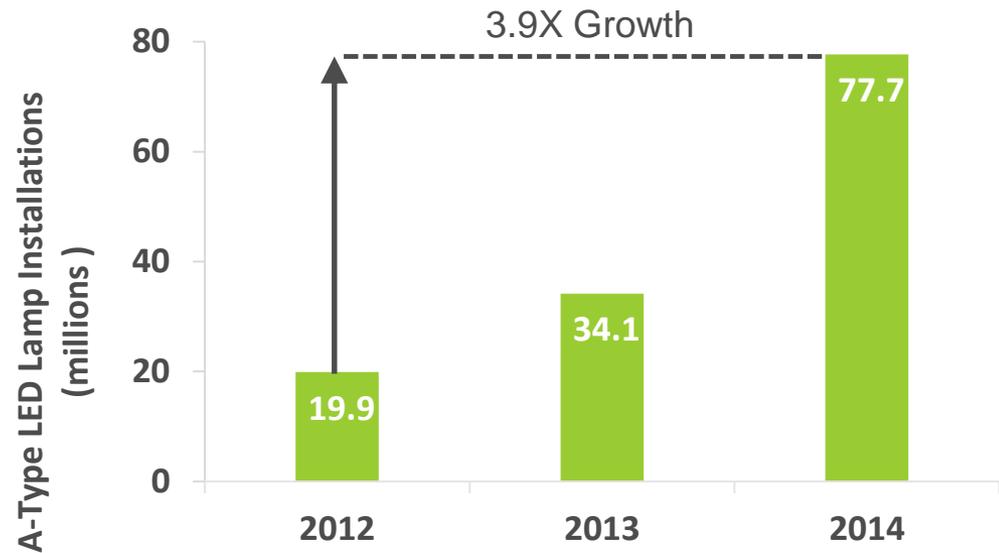
LED A-Type



2014 LED A-Type Installations

LED A-Type lamps represent the most installations of any other LED product type.

- The installed stock of LED A-Type lamps has nearly **quadrupled** since 2012 – now in 2014, LEDs represent 2% of all A-Type lamps.
- EISA 2007 had a significant impact on this market – with a **large transition from incandescent** to halogen and also CFLs.



Product Type	LED A19 60W (Dimmable)
Efficacy (lm/W)	75
CCT (K)	2700
L ₇₀ (hours)	25,000
Price (\$/unit)	\$9

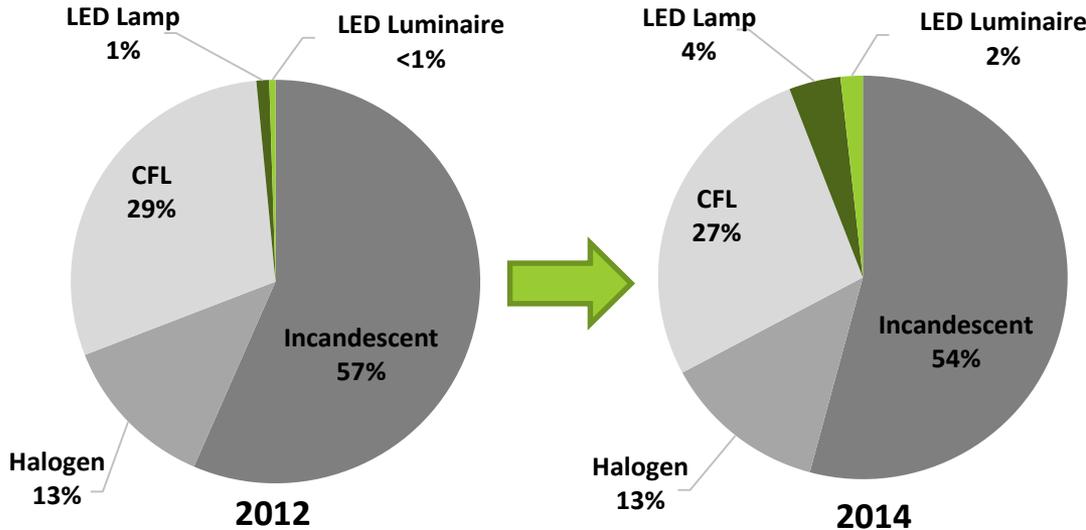
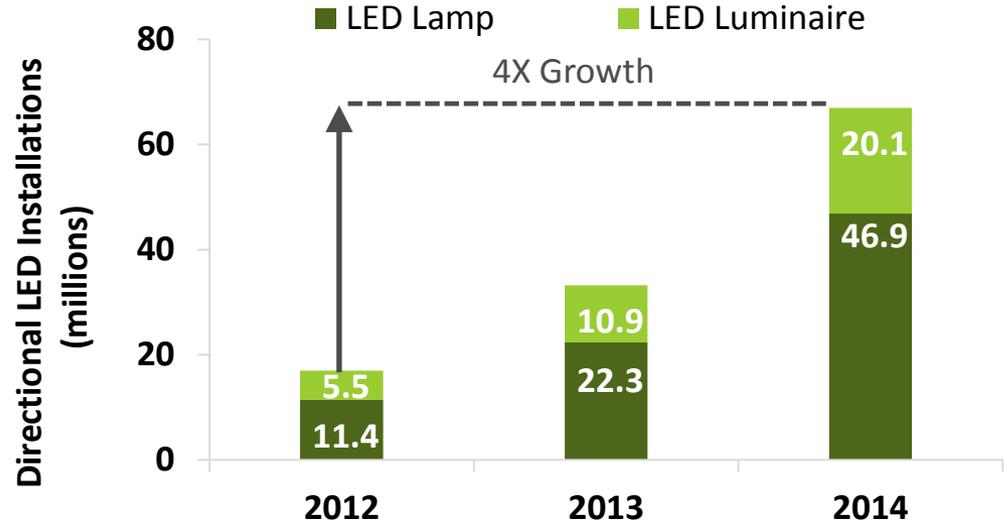
LED Directional



2014 LED Directional Installations

Directional applications (e.g. downlights, accent, track, pendant, etc.) make-up about 3% and 16% of all commercial/industrial and residential sector lighting respectively.

- In 2014, LED lamps represent 4% of all directional installations in the U.S, while LED luminaires are 2%.



Product Type	LED PAR38	LED 6" Downlight
Efficacy (lm/W)	67	60
CCT (K)	3000	3500
L ₇₀ (hours)	28,000	36,000
Price (\$/unit)	\$23	\$30

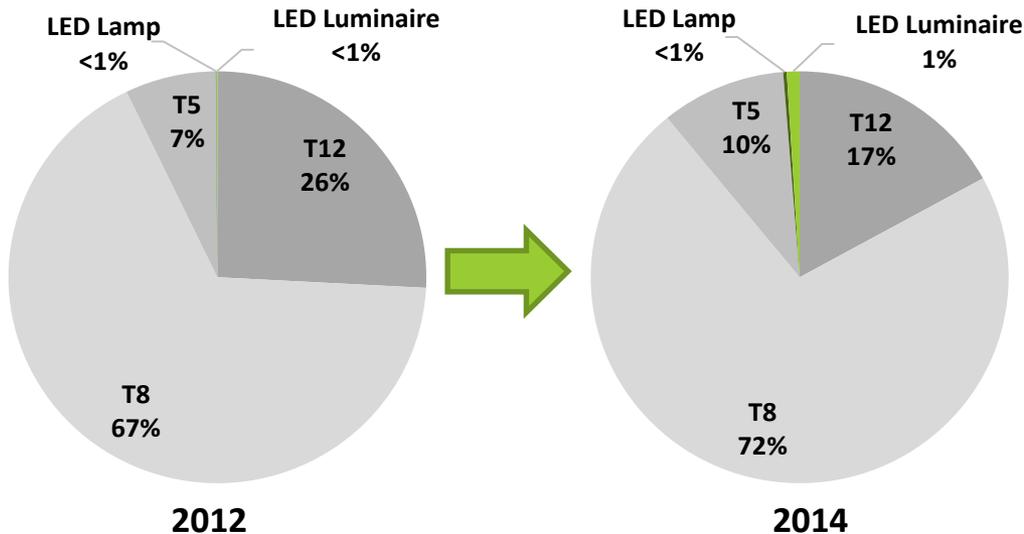
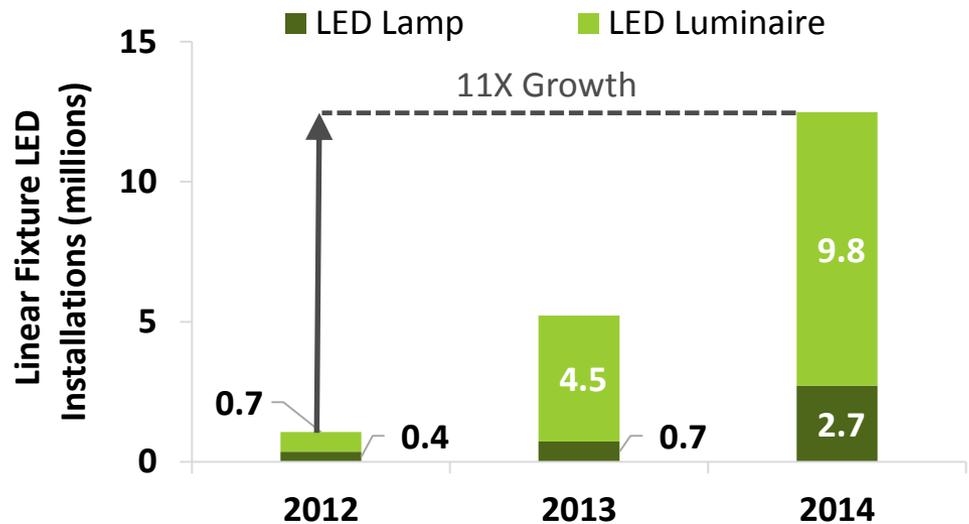
LED Linear Fixtures



2014 LED Linear Fixture Installations

Currently fluorescent systems represent nearly half of all lighting service (in lumen-hours) in the U.S. – and represent a huge opportunity for LEDs.

- While significant growth in installations has occurred (11X since 2012), combined LED lamps and luminaires **only represent a little over 1%** of the installed base.



Product Type	LED 4' T8 Tube	LED 2'x4' Troffer
Efficacy (lm/W)	108	100
CCT (K)	4100	3500
L ₇₀ (hours)	45,000	56,000
Price (\$/unit)	\$32	\$220

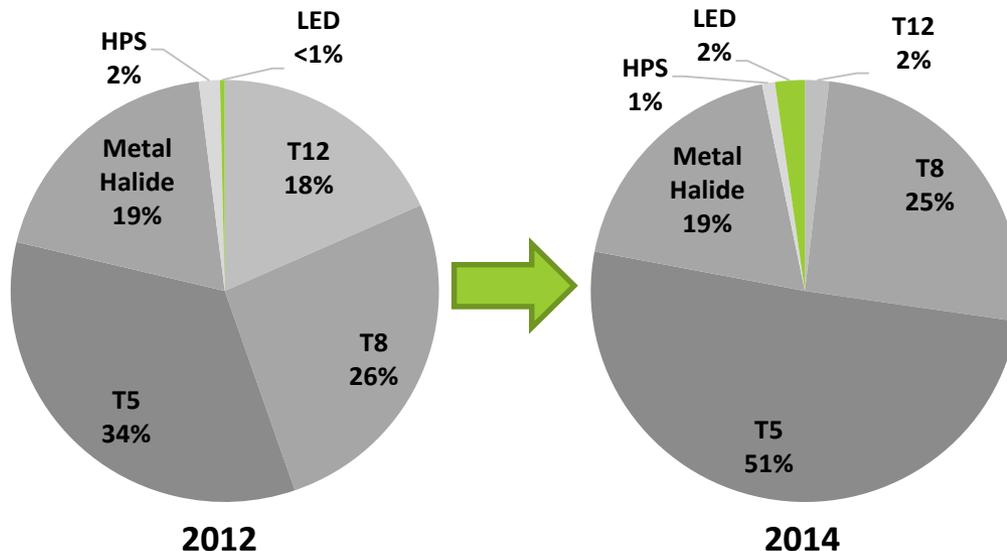
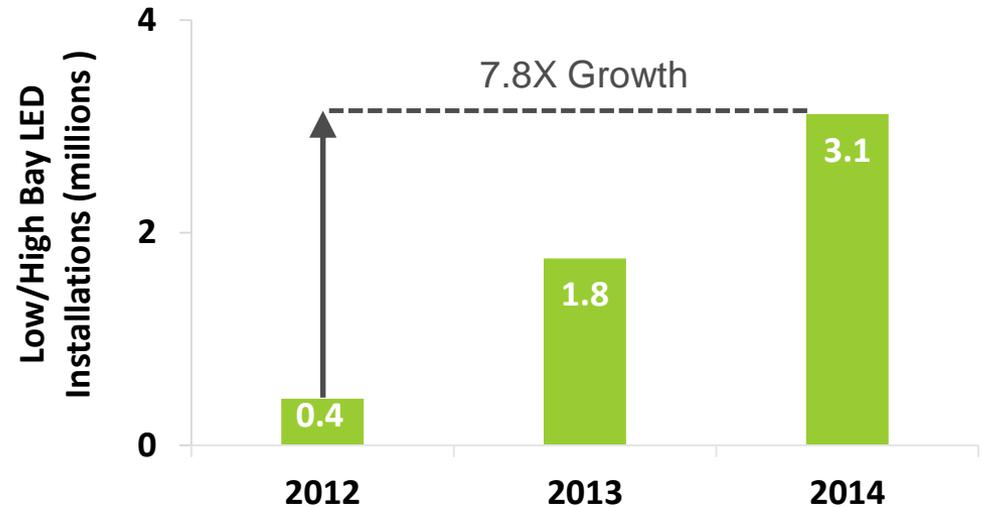
LED Low/High Bay



2014 LED Low/High Bay Installations

The market for LED low/high bay luminaires is one of the newest and is seeing early success.

- Not only seeing a shift to LED, but a more significant one to T5s, this will make it more challenging for LED to compete.
 - From 2012 to 2014, T5s have growth from 34% to half of all low/high bay installation



Product Type	LED Low/High Bay Luminaire
Efficacy (lm/W)	105
CCT (K)	4000
L ₇₀ (hours)	75,000
Price (\$/unit)	\$400

What About the LED Energy Savings?

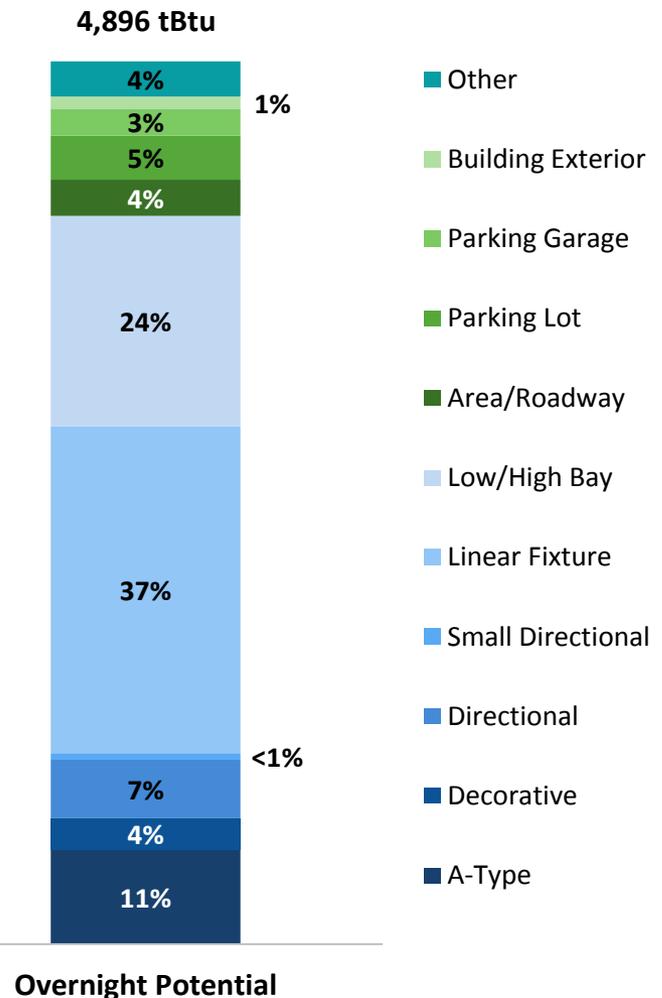
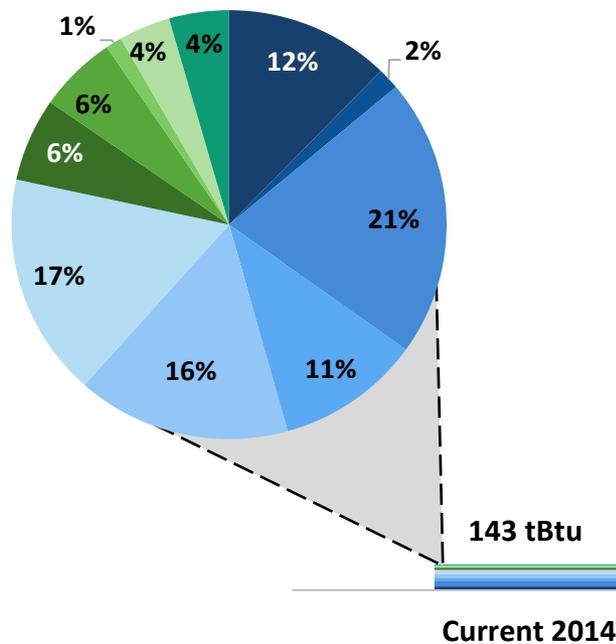
LEDs have come a long way, however, there is substantial headroom to increase market penetration and related energy savings.



In 2014, if all 7 billion light fixtures in the U.S. switched to the best available LEDs "overnight" they would provide...

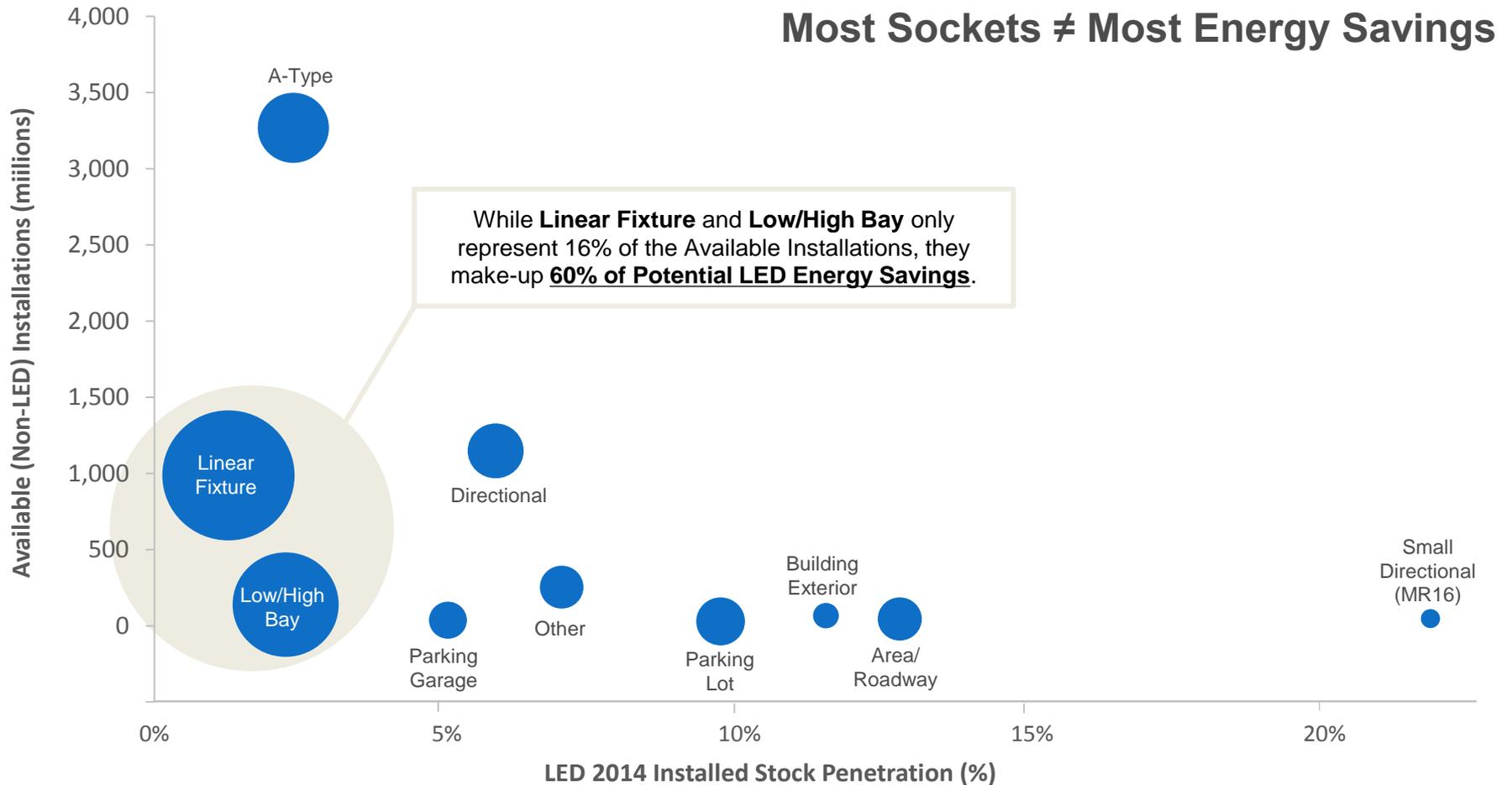
4,896 tBtu Energy Savings **\$49 Billion (U.S.)** Electricity Costs





Where are the Potential Opportunities for LED Lighting?

Due to the unique usage characteristics in each lighting application, the opportunities for LED installations and energy savings vary significantly.



Conclusions

The lighting market is changing rapidly due to LED technology, today major market trends we discussed include:

- While LED installations increased in all applications between 2012 and 2014, more than quadrupling to 215 million units overall, market penetration remains modest, climbing to 3% overall, versus less than 1% in 2012.
- LEDs enjoyed a 10% share of outdoor applications in 2014, versus just 2.8% of indoor applications.
- The greatest opportunity for LED installations is in the LED A-Type market, but the most energy savings potential is offered by commercial sector in linear fixture and low/high bay applications.
- LED A-Type represents the most installations of LED lamps, at 77.7 million, but LEDs in linear fixtures have seen the most growth (11X since 2012).