


The Promise of Progress

A bright sun rising over a calm blue ocean, with rays of light spreading across the sky. The sun is positioned in the center of the frame, just above the horizon line. The sky is a deep blue, and the water is a lighter blue, reflecting the sun's light. The overall mood is serene and hopeful.

Mark Lien LC, HBDP, CLEP, CLMC, LEED AP BD&C
Illuminating Engineering Society

A street lamp with a single glowing light fixture against a clear blue sky. The lamp is positioned on the left side of the frame, and the light is bright and warm. The sky is a uniform, clear blue.

YOU HAD ONE JOB

Scarcity or Abundance Mentality?

The same transformation from scarcity to abundance, from expensive to demonetized, is happening across a wide range of products and services~

- *Information* has become abundant and free through Google
- *Knowledge* has become abundant and free through Wikipedia
- *Energy* is becoming abundant through wind and solar
- *Communications* has become abundant through mobile networks
- *Entertainment* has become abundant through YouTube (more than 1 billion hours of free videos were served in 2016)
- *Transportation* is demonetizing 10x because of electric autonomous cars

This is an important lesson for entrepreneurs. What product or service will you dematerialize and demonetize and transform to abundance?



Why the World is Getting Better and Why Hardly Anyone Knows It.

- Read the news and you can see that the world is going to hell in hand-basket—and fast! Terrorism, nuclear weapons, economic stagnation, social unrest, autocratic leaders, structural unemployment, deskilling, growing hopelessness, the opioid epidemic, increasing inequality, xenophobia, economic migrations, recessions, financial bubbles and crashes, recessions, depressions—the list goes on.
- **So, when a recent [survey](#) asked “All things considered, do you think the world is getting better or worse?” the results were predictably bleak. In Sweden only 10% thought things are getting better, and in the U.S., it was only 6%. Hardly anyone thinks the world is getting better.**

Time Magazine – January 15th, 2018

Bill Gates-Guest Editor



”So why does it feel like the world is in decline? I think it is partly because of the nature of news coverage. Bad news arrives as drama, while good news is incremental-and not usually deemed newsworthy. A video of a building on fire generates lots of views, but not many people would click on the headline “Fewer buildings burned down this year”. It’s human nature to zero in on threats: evolution wired us to worry about the animal that wants to eat us”

The Tone of the News 1945-2010

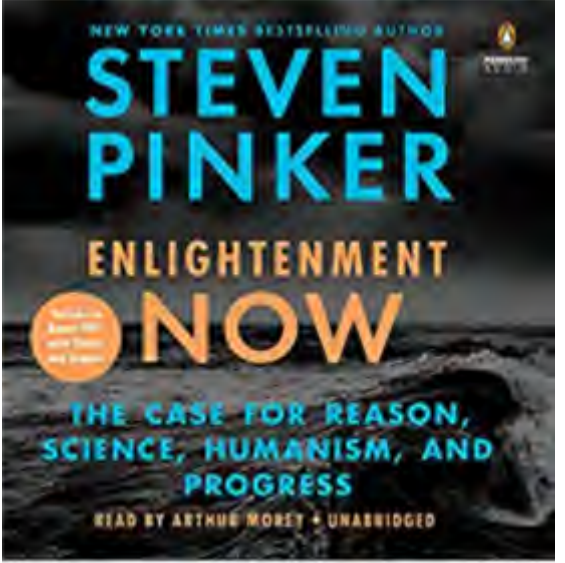
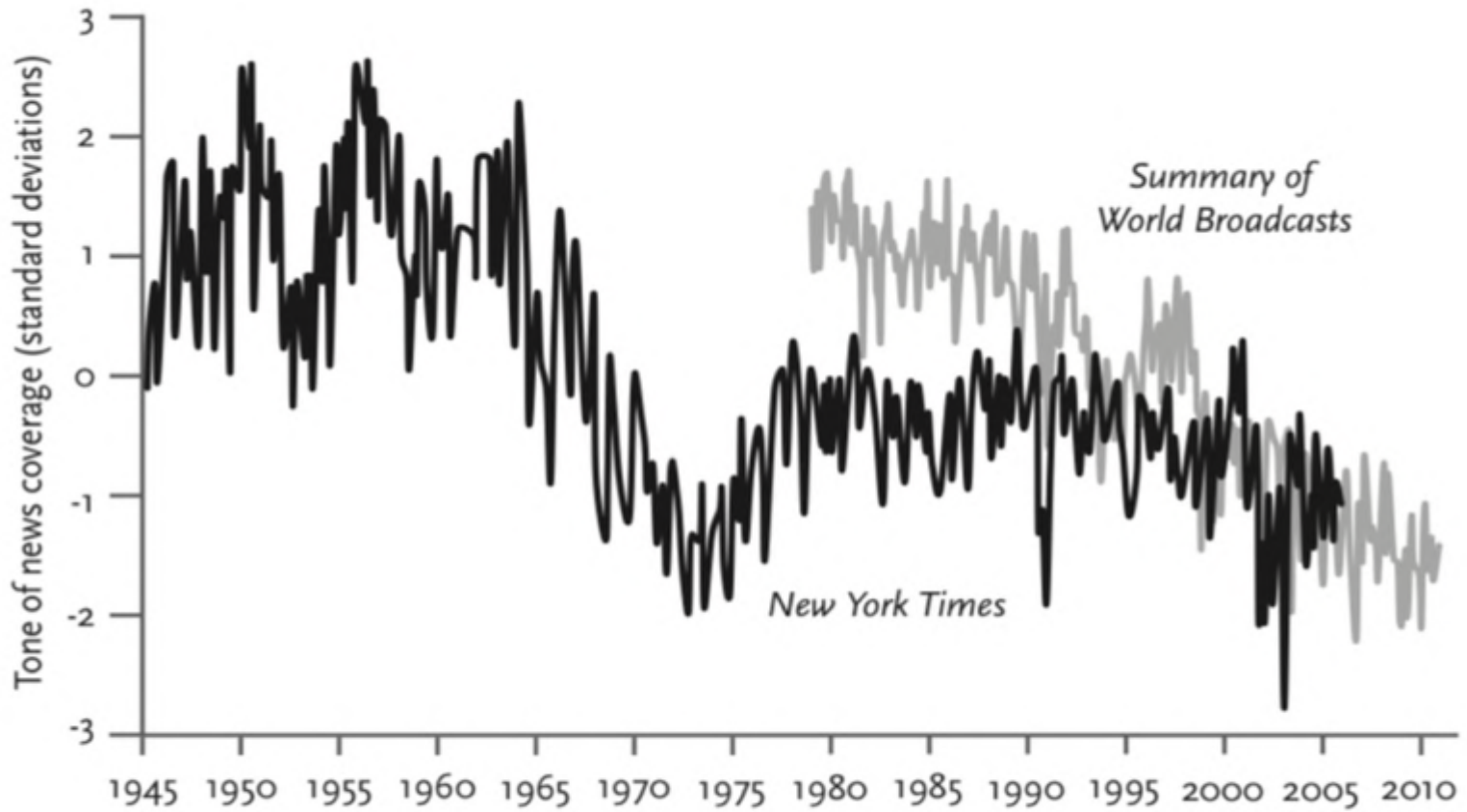


Figure 4-1: Tone of the news, 1945–2010
Source: Leetaru 2011. Plotted by month, beginning in January.

Pollution, Energy & Growth, US 1970-2015

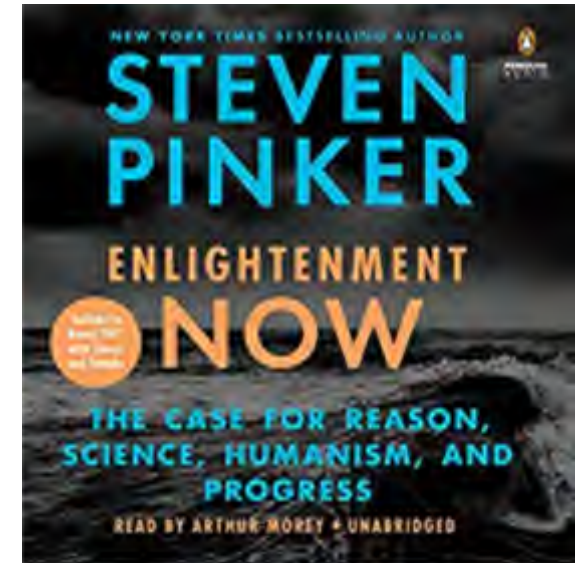
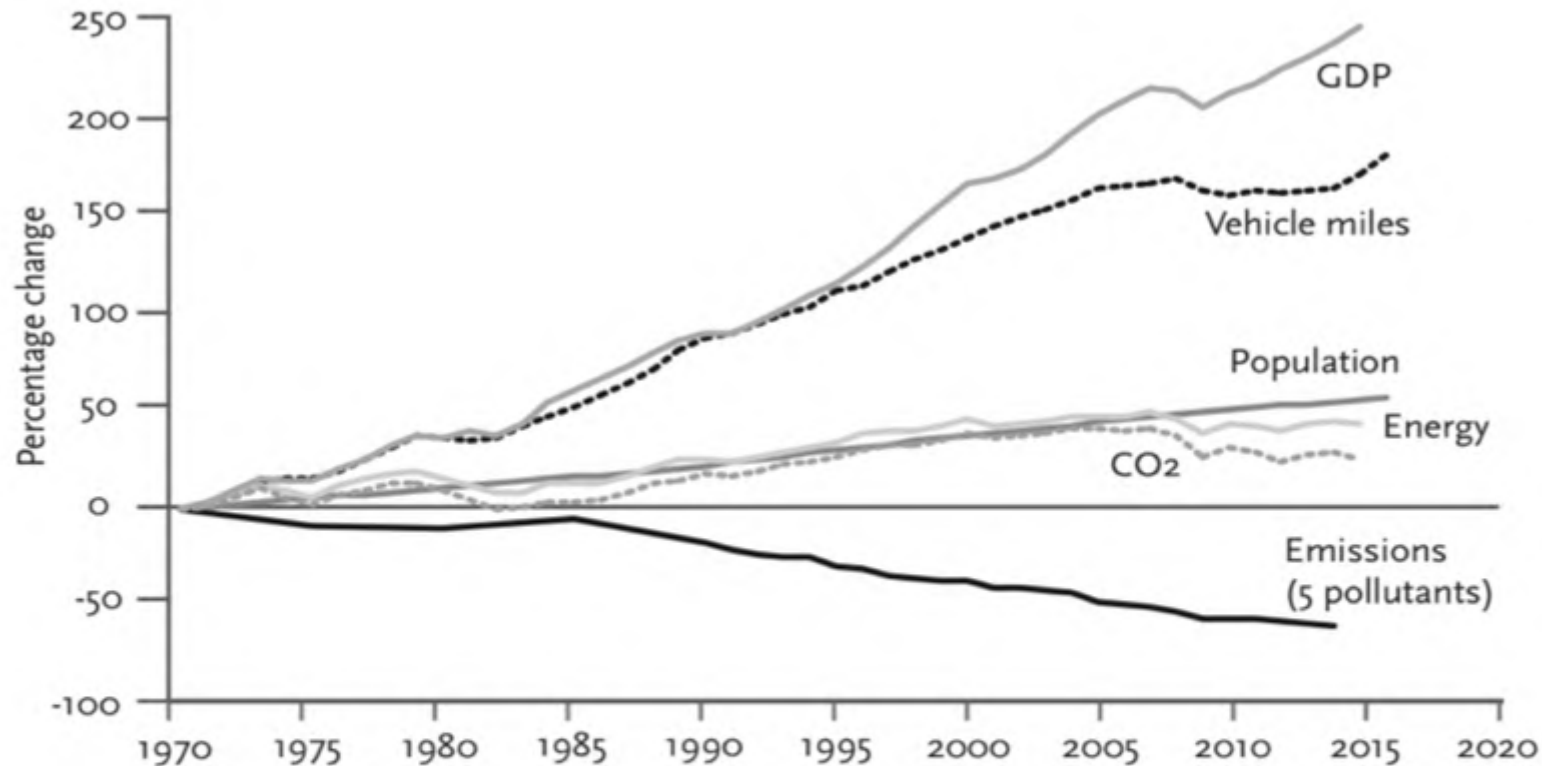


Figure 10-3: Pollution, energy, and growth, US, 1970–2015

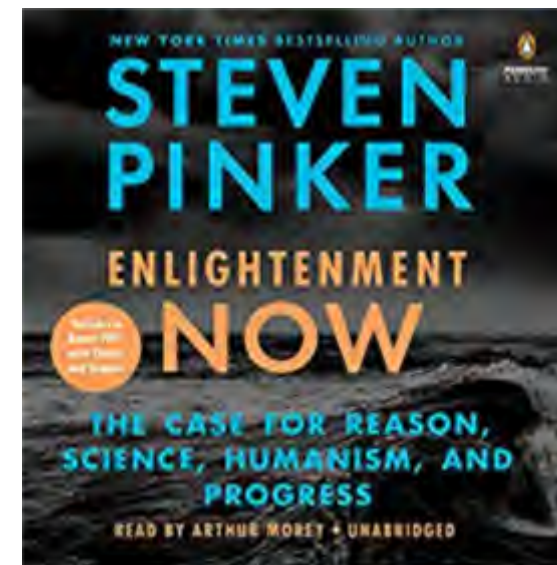
Sources: US Environmental Protection Agency 2016, based on the following sources. **GDP:** Bureau of Economic Analysis. **Vehicle miles traveled:** Federal Highway Administration. **Population:** US Census Bureau. **Energy Consumption:** US Department of Energy. **CO₂:** US Greenhouse Gas Inventory Report. **Emissions** (carbon monoxide, oxides of nitrogen, particulate matter smaller than 10 micrometers, sulfur dioxide, and volatile organic compounds): EPA, <https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data>.

Cost of Light, England 1300-2006 (Pre-LED)



Figure 17-4: Cost of light, England, 1300–2006

Source: *Our World in Data*, Roser 2016a, based on data from Fouquet & Pearson 2012. Cost of one million lumen-hours (about 833 hours from an 80-watt incandescent bulb), in pounds sterling (inflation-adjusted to the year 2000).



What is Newsworthy?



- “If newspapers came out once every 50 years it would not report half a century of celebrity gossip and political scandals. It would report momentous global changes such as the increase in life expectancy”
- “Plane crashes always make the news but car crashes which kill far more people almost never do. Not surprisingly many people have a fear of flying but almost no one has a fear of driving”
- “People rank tornados which kill about 50 Americans a year as a more common cause of death than asthma which kills about 4000 Americans a year presumable because tornados make for better television”

Good News!

The IBM Model 350 disk file with a storage space of 5MB from 1956 and a Micro SD Card

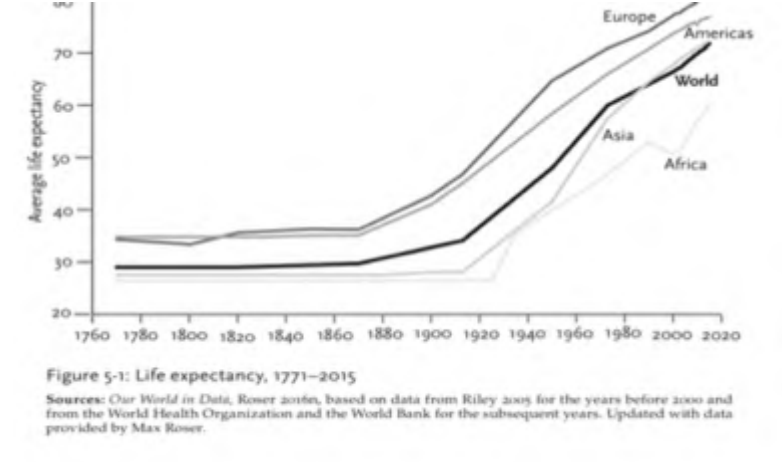
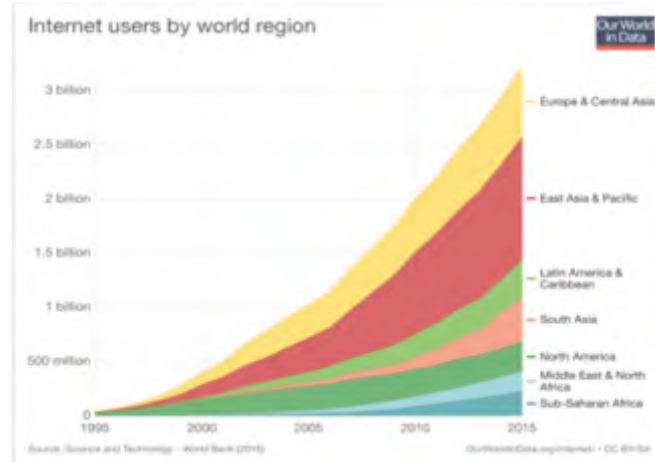
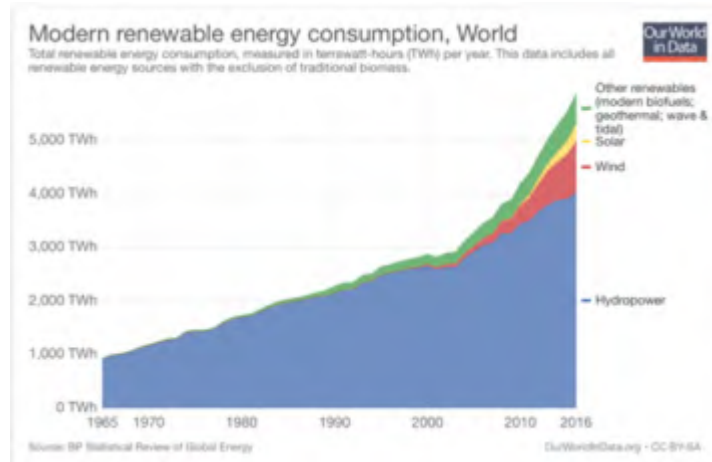
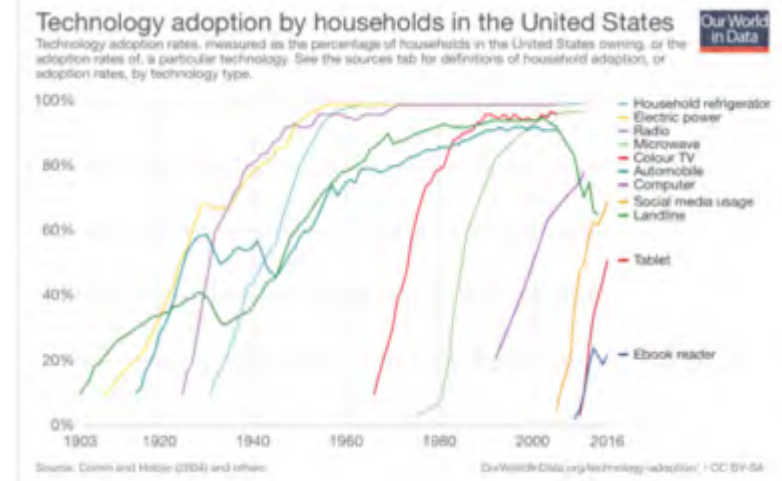


Figure 5-1: Life expectancy, 1771-2015
Sources: Our World in Data, Roser 2016, based on data from Riley 2005 for the years before 2000 and from the World Health Organization and the World Bank for the subsequent years. Updated with data provided by Max Roser.

DOE Projections 9-7-16

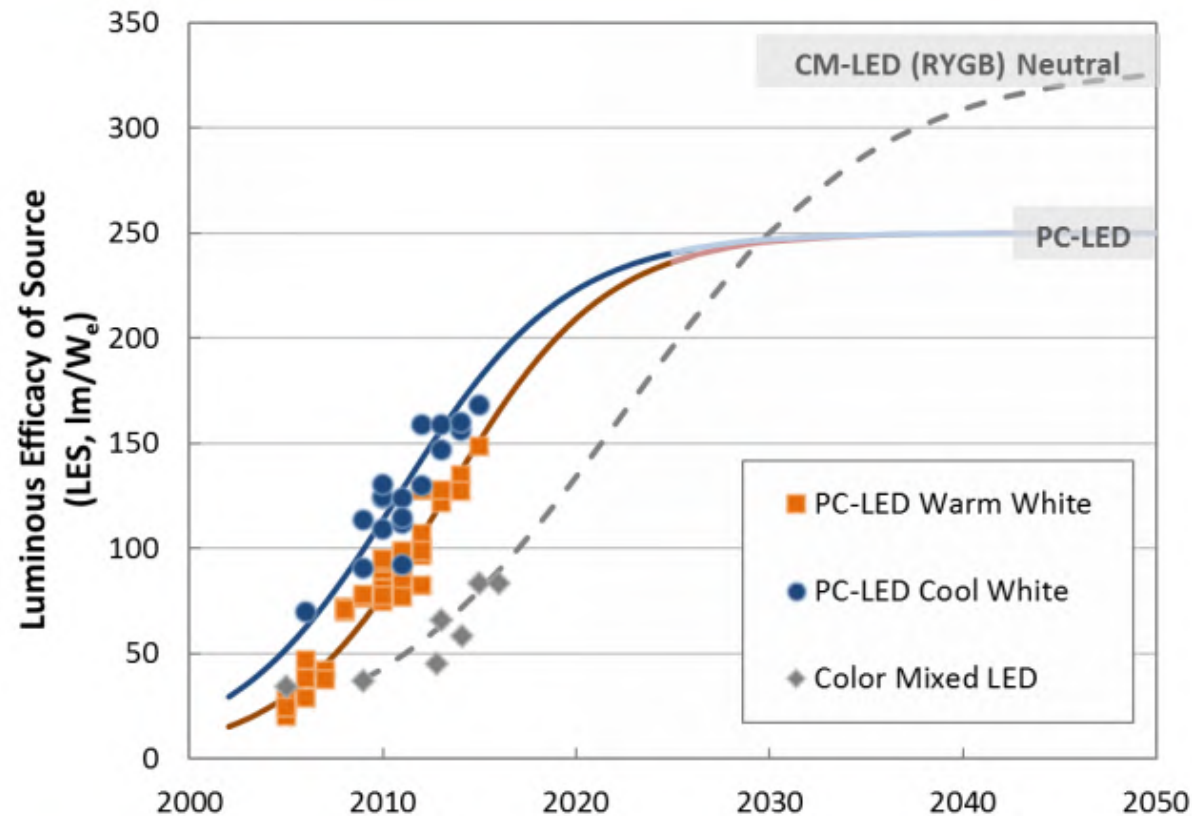
Table 4.1 U.S. LED Forecast Stock Results for the Current SSL Path Scenario

		2015 ²	2020	2025	2030	2035
Current SSL Path	LED Installed Stock (million units)¹	424	2,740	5,500	7,040	7,860
	Commercial	136	436	826	1,080	1,220
	Residential	260	1,610	3,550	5,040	5,970
	Industrial	5	19	36	43	44
	Outdoor	30	93	137	160	177
	LED Installed Stock Penetration (%)	6%	30%	59%	78%	86%
	Commercial	12%	36%	64%	80%	86%
	Residential	5%	28%	57%	77%	86%
	Industrial	8%	32%	65%	78%	83%
	Outdoor	19%	57%	79%	88%	93%

1. Installed stock for the DOE SSL Program Goal scenario is not provided as there are negligible differences between scenarios. LED installed stock is presented in terms of lighting systems (lamp(s), ballast and fixture are counted as one unit).
2. As a result of the lighting market model improvements discussed in Section 2.1, the LED penetration results for 2015 have been updated compared to previous DOE SSL Program market analyses.

LED Efficacy Projections

A Look Ahead: 2017 DOE Targets



**Researchers believe
250–350 lm/W
is possible**

SSL 2017 R&D Plan, <https://energy.gov/eere/ssl/downloads/solid-state-lighting-2017-rd-plan-suggested-research-topics>

The Future's So Bright...



THE FUTURE'S SO BRIGHT,
I GOTTA WEAR SHADES



FROM THE I. R. S. ALBUM
"GREETINGS FROM TIMBUK 3"
(IRS-9739)

I'LL DO ALL RIGHT

PRODUCED BY DENNIS HERRING
WRITTEN BY PAT MACDONALD
PUBLISHED BY MAMBADADDI MUSIC/
I. R. S. MUSIC, INC.
(BMI) ADMINISTERED BY
CRITERION MUSIC CORP.



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The Pope “gives blessing to LED revolution”



Osram chief Olaf Berlien went to Rome to see the Pope, and discussed the illumination of St Peter's Basilica

POPE FRANCIS has given his blessing to a major relighting of Saint Peter's Basilica which will see light levels significantly increased.

21 February 2018 · All regions ·

Pope gives blessing to LED revolution at St Peter's



Horticulture LED market to grow at 22.55% CAGR by 2020

<http://bizled.co.in/?s=horticulture+CAGR>

Industrial & commercial LED lighting market likely to reach \$79.49 bn

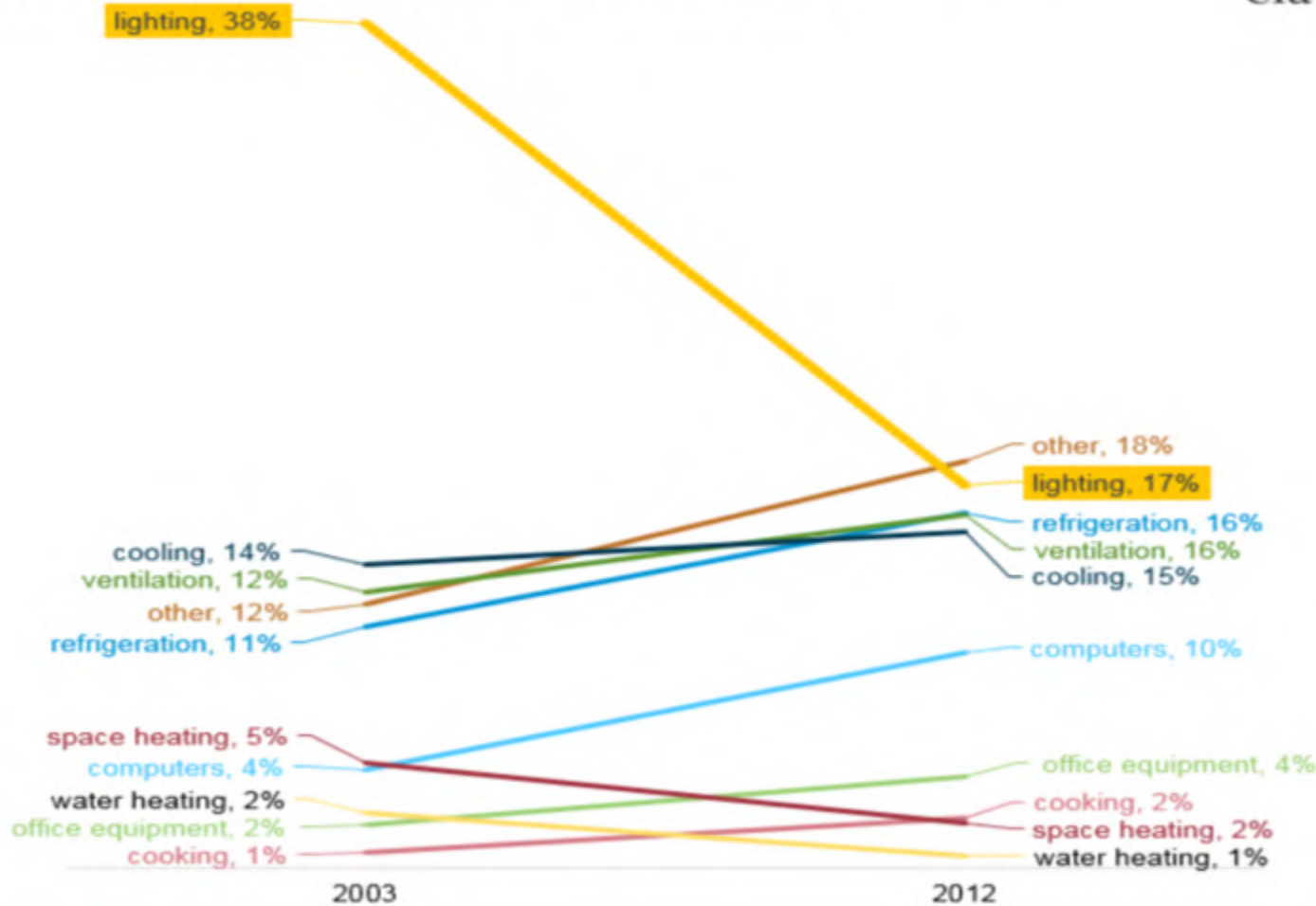
<http://bizled.co.in/industrial-commercial-led-lighting-market-likely-to-reach-79-49-bn/>

LED lighting market growing at 14% CAGR & will cross US\$ 105 bn by 2023

<http://bizled.co.in/led-lighting-market-growing-at-14-cagr-will-cross-us-105-bn-by-2023/>

Mission Accomplished

Figure 4: In the commercial sector, lighting is no longer the largest end use as a share of total electricity consumption



Trends in Lighting in Commercial Buildings

CBECS 2012 - Release date: May 17, 2017

Lighting Related Professional Certifications

- LC
- HBDP
- CLMC
- CLEP
- LEED AP
- CLD
- CLC/LS/LA
- CLCP
- CLMR
- CALCTP
- CSLC

Don't Be Blue

Technology

Blue-Light Hazard and LEDs: Fact or Fiction?

The advent of solid-state lighting in everyday applications has renewed research interest in whether its spectral profile can lead to increased health risks.

By [Alice Liao](#)

“The exposure time necessary to do damage was equivalent to staring at the tropical noonday sun for 15 minutes without blinking.” –Ian Ashdown, chief scientist, Lighting Analysts, and president, ByHeart Consultants

<http://www.archlighting.com/technology/blue-light-hazard-and-leds-fact-or-fiction>



The EU on Blue

21 July 2017 · Robert Bain · All regions · Healthcare

EU gives LEDs a clean bill of health

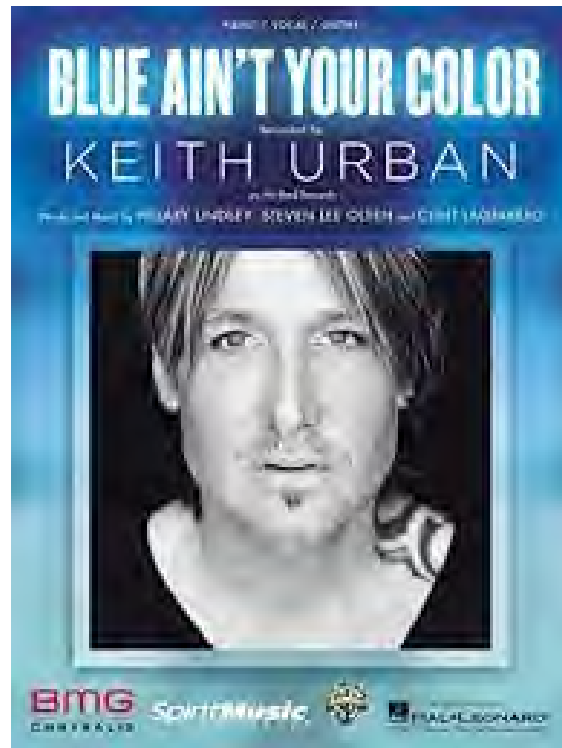


The EU committee said that studies pointing to health risks have tended to be based on conditions and exposure levels that don't reflect real life.

The Committee concluded that there is no evidence of direct adverse health effects from LEDs emission in normal use (lamps and displays) by the general healthy population. There is a low level of evidence that exposure to light in the late evening, including that from LED lighting and/or screens may have an impact on the circadian rhythm. At the moment, it is not yet clear if this disturbance of the circadian system leads to adverse health effects.

<http://luxreview.com/article/2017/07/eu-gives-leds-clean-bill-of-health?nocache=1>

The Best of Blue



The Night-Light Color That Can Actually Help Foster Sleep (VIDEO ...

https://www.huffingtonpost.com/2014/.../nightlight-color-better-sleep_n_6142098.html

Nov 12, 2014 - Unfortunately for many of us, waking in the middle of the night — either because of a child or because our bodies can't seem to relax — is an all too common occurrence, and the resulting consequences can have a lasting effect on the whole day. As a member of the Behavioral Sleep Medicine Program at ...

Light Bulbs That Help You Sleep - The New York Times

<https://www.nytimes.com/2017/02/10/realestate/light-bulbs-that-help-you-sleep.html>

Feb 10, 2017 - In the lamp by her mother's bedroom chair, for example, she placed a Good Night bulb by Lighting Science, with depleted blue spectrum light to help lull her to ... "People are exposing themselves to light and it's having a cascading effect on their health on multiple levels," said Dr. Michael J. Brous, a clinical ...

Nursery Lamps, Blue Light, and Sleep - SomniLight Light Therapy

<https://www.somnilight.com/nursery-lamps-blue-light-and-sleep.html>

Our bodies interpret blue and white light as daylight, so even a 5-minute exposure to bright lighting can cause a drastic alerting effect lasting up to 90 minutes ... While blue and green may seem like calming, restful colors, parents should resist the urge to use blue, green, or white nightlights or nursery lamps in the evening.

'Blue' light could help teenagers combat stress -- ScienceDaily

<https://www.sciencedaily.com/releases/2012/10/121022112847.htm>

Oct 22, 2012 - A new study shows that exposure to morning short-wavelength "blue" light has the potential to help sleep-deprived adolescents prepare for the challenges of the day and deal with stress, more so than dim light. ... The effect of short-wavelength light on other biomarkers has not been widely studied.

Choosing Light Bulbs for Optimal Sleep | Sleep.Org

<https://sleep.org/articles/choosing-lightbulbs/>

However, they emit significant amounts of blue light, which interferes with sleep, so you should keep them out of your bedroom and other areas where you spend time in the evening. If that's not possible, turn off CFBs about two hours before bed, or keep lamps that contain them a minimum of five feet away from you, as blue ...

What's in a Color? The Unique Human Health Effects of Blue Light

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2831986/>

by DC Holzman - 2010 - Cited by 70 - Related articles

In 1958, J. Woodland Hastings and Beatrice M. Sweeney tested the ability of different wavelengths of light—corresponding to different colors—to shift the circadian rhythm in the photosynthetic marine dinoflagellate *Gonyaulax polyedra*. The greatest power to reset the organism's daily meter lay in the blues, with a precipitous ...

blue light suicide

As News Images Videos Shopping Mail Settings Tools

About 3,830,000 results (0.48 seconds)

How Blue Lights on Train Platforms Combat Tokyo's Suicide Epidemic ...

https://nextcity.org/_/how-blue-lights-on-train-platforms-combat-tokyos-suicide-epidemic

Mar 20, 2014 - The most visible of the government's anti-suicide efforts can be found in Tokyo's train stations. Photo credit: Janne Maren via Flickr: There is a blue light at the end of the train platform, and has only one purpose: to stop people from jumping in front of oncoming trains and killing themselves. First installed on ...

Can Blue-Colored Light Prevent Suicide? - Psych Central

<https://psychcentral.com/blog/can-blue-colored-light-prevent-suicide/>

Jun 26, 2016 - An intriguing, anecdotal finding was recently reported by some news outlets that the implementation of blue-colored streetlights has reduced both crime and suicides. Glasgow, Scotland, introduced blue street lighting to improve the city's landscape in 2000 ... The Nara, Japan ...

Blue Streetlight Crime Reduction - Snopes.com

<https://www.snopes.com/politics/crime/bluelight.asp>

May 21, 2015 - Original: On 21 April 2015 a Reddit thread "today I learned" (11.) noted "that some areas in Scotland and Japan switched to blue street lights at night and saw a decrease in crime and suicide rates." The claim referenced in that thread was not a new one and was linked to a 2008 Psych Central article about ...

Japan links use of blue streetlights to drop in crime, suicide prevention ...

articles.chicagotribune.com/2008-10/0812180111_1_blue-lights-suicides-illumination

Dec 16, 2008 - Blue streetlights are believed by some to be useful in preventing suicides and street crime, a finding that is encouraging an increasing number of Japanese railway companies to install blue-light-emitting devices at stations to prevent people from jumping in front of trains. Success reported. Although experts ...

Does the installation of blue lights on train platforms prevent suicide ...

<https://www.sciencedirect.com/science/article/pii/S0165032712005873>

by T Mitsubayashi - 2013 - Cited by 22 - Related articles

Railway and metro suicides constitute a major problem in many parts of the world. Japan has experienced an increase in the number of suicides by persons diving in front of an oncoming train in the last several years. Some major railway operators in Japan have begun installing blue light-emitting-diode (LED) lamps on ...

Blue streetlights believed to prevent suicides, street crime | The Seattle ...

https://www.seattletimes.com/_/blue-streetlights-believed-to-prevent-suicides-street-crime

Dec 11, 2008 - TOKYO — Blue streetlights are believed to be useful in preventing suicides and street crime, a finding that is encouraging an increasing number of railway companies to install blue-light-emitting apparatus at stations to prevent people from committing suicide by jumping in front of trains. Although experts ...

Does the installation of blue lights on train platforms prevent suicide ...

<https://www.ncbi.nlm.nih.gov/pubmed/22980401>

by T Mitsubayashi - 2013 - Cited by 22 - Related articles

Sep 11, 2012 - Japan has experienced an increase in the number of suicides by persons diving in front of an oncoming train in the last several years. Some major railway operators in Japan have begun installing blue light-emitting-diode (LED) lamps on railway platforms and at railway crossings as a method of deterring ...

British police studying LED lights' effect on crimes



Benefits of Blue

Oct 16, 2017: With regard to advantages of blue LED lights, we have heard that its installation lights up an area or street more than the traditional lights. Many city authorities have also reported that since blue LED lights illuminate the streets so well that the rate of accidents and crime have gone down.

Hence, **it seems that blue LED lights really cut down the rate of crime, suicides, and accidents. In fact, the British Transport Police are investigating if LED lights are directly responsible for the cut down on crime.**

Crime fell in Buchanan Street in Glasgow, Scotland, when blue LED lights were installed. At a Tokyo railway station, where the rate of suicides was high, LED lights have resolved the problem, and track-jumping deaths have completely stopped. At Gatwick Airport railway station near London, the British transport police, have started a major trial of blue lights.

The British Transport Police is not only interested in suicides and crime, it is also hopeful on cutting down cases of intravenous drug injection in public places. The police wants to understand its effectiveness on crime and other serious issues.

<http://bizled.co.in/british-police-studying-led-lights-effect-on-crimes/>

Forget coffee. Blue LED light will stimulate drivers

Published on: May 24, 2017

By Mark Halper

Contributing Editor, LEDs Magazine, and Business/Energy/Technology Journalist

Eyewear that emits blue frequencies will keep drivers alert, while the red version will help them relax during their breaks, Osram said.

“Osram will be supplying activating light for drivers and engineers both before and during the race, enhancing their alertness and boosting their concentration,” Osram said. “LED light glasses are used to help the drivers prepare for races. The blue LED light prepares them for the competition by stimulating the central nervous system. In addition, special luminaires are installed in common rooms and the pit wall control center for the benefit of both drivers and engineers. This range of solutions is designed to mobilize the energy of drivers and engineers exactly when needed during the arduous 24-hour race and help them sharpen their focus.”

Unfinished Business-Barriers or Opportunities?

- Cybersecurity for Lighting Products/Systems
- Flicker Metric
- Effect of Light on Human Metabolism (melanopic lux, circadian stimulus, etc) Both Metric & Health Recommendations
- Redefine the Lumen for Perceived Brightness
- Glare Metric
- Increased Broadband Access and Speed
- International Metrics for Color Quality of Light Sources Related to Perception & Preference



Outliers

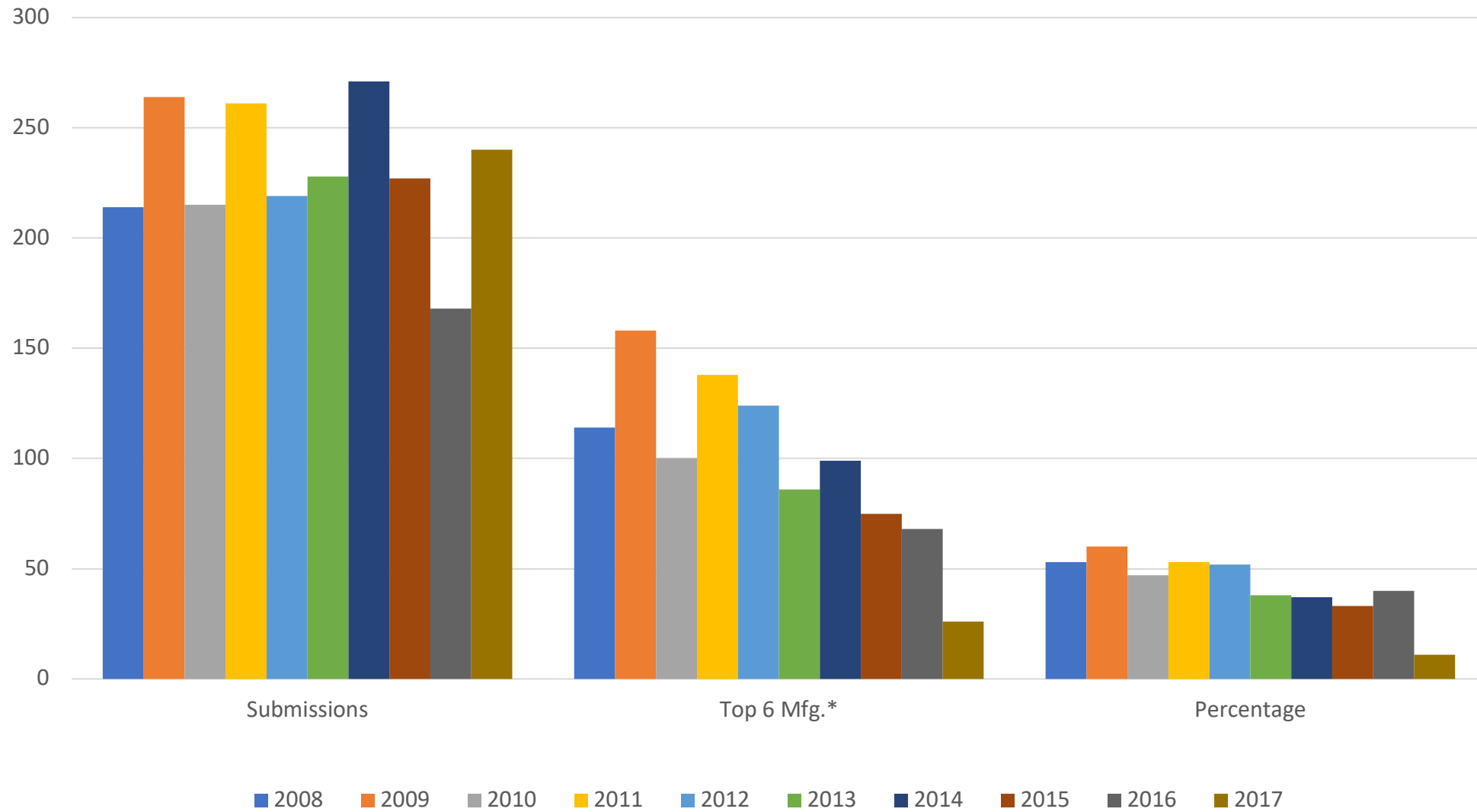


9 August 2017 · Lighting Spy · All regions ·

Shoddy, shabby, and at times, sleazy... Lighting Spy is back with 20 new lighting horrors!



Revealed in Progress Report 2017



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Submissions	214	264	215	261	219	228	271	227	168	240
Top 6 Mfg.*	114	158	100	138	124	86	99	75	26	26
Percentage	53	60	47	53	52	38	37	68	40	11

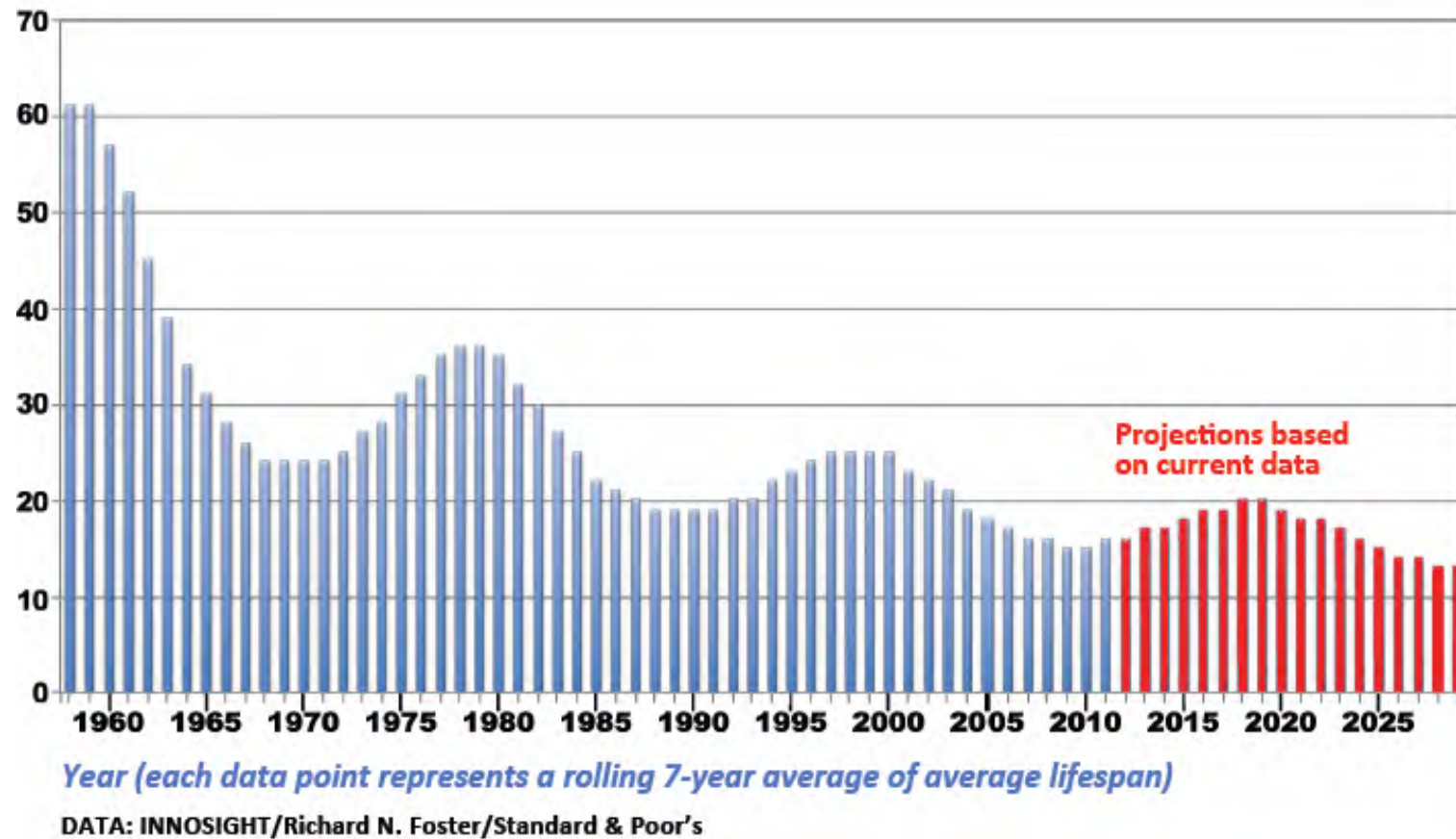
New Submitters in 2017

- Kobi
- Phosphor Tech
- Contraste
- Zotia
- Vode
- Invisia
- Vibia
- Coronet
- Luceco
- Holm
- Structura
- Zaniboni
- Deako
- Sielo
- Above All Lighting
- QSSI
- Flex
- Ligman Lighting
- CoeLux
- Volt
- LaraLee Optical
- OLED Devices
- LF Illumination
- Luxxbox
- Chrome –Q
- i2Systems

Lifespan of firms in the S&P 500

Hello...

e-bay
NETFLIX
Whole Foods
Amazon
Google
Comcast
E*Trade
etc.



Goodbye...

Eastman Kodak
Palm
New York Times
Sears
Comp USA
Circuit City
Radio Shack
etc.

Babson School of business projects that 10 years from now 40% of today's S&P 500 will not exist. By 2020 more than 100 will be companies that we have not heard of yet.

The Promise of Renewable Energy

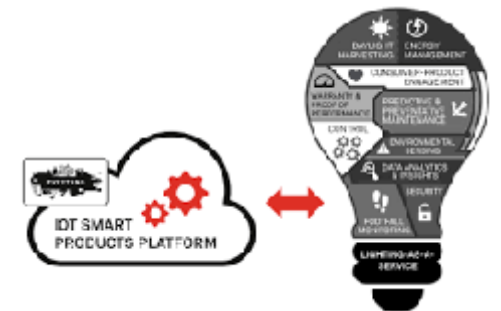
- **What it is:** The World Economic Forum recently reported that 2016 was the year solar panels officially became cheaper than fossil fuels in more than 30 countries
- **Why it's important:** One of the top advantages of solar energy that [Peter noted in his blog on the subject](#) was the cost efficiency of solar panels. Estimates suggest that perovskite solar panels could cost just 10 to 20 cents per watt, compared to 75 cents per watt for traditional silicon-based panels -- a cost savings ranging from 3X to 8X -- making solar panels much more affordable for the average consumer. The world has long had high hopes for solar, and it seems that potential has finally arrived.



<http://www.diamandis.com/blog/top-10-tech-trends-transforming-humanity>

The Promise of the Internet of Things

- In 2005, 500 million devices were connected to the internet
- In 2015 we had 8 billion devices connected
- In 2025 we are projected to have 50 billion devices connected
- In 2035 the projection is for 1 trillion devices to be connected
- We are 1% of the way into this transformation



The Promise of Implanted Lighting Controls

You will get chipped — eventually

Jefferson Graham, USA TODAY Published 12:38 p.m. ET Aug. 9, 2017 | Updated 9:17 a.m. ET



(Photo: Jeff Baenen, AP)

After a Wisconsin firm embedded microchips in its employees, social media wants to know—is my company next? Jefferson Graham has the answer, on #TalkingTech.

LOS ANGELES — You will get chipped. It's just a matter of time. "It will happen to everybody," says Noelle Chesley, 49, associate professor of sociology at the University of Wisconsin-Milwaukee. "But not this year, and not in 2018. Maybe not my generation, but certainly that of my kids."

<https://www.usatoday.com/story/tech/2017/08/09/you-get-chipped-eventually/547336001/>

<http://www.grindhousewetware.com>



Server shows the implant just a few minutes after the procedure. The wound and Osterlund stretched a film over the skin. Photo: Motherboard



https://motherboard.vice.com/en_us/article/d7yzvj/biohackers-are-implanting-led-lights-under-their-skin

The Promise of Health Benefits from Lighting



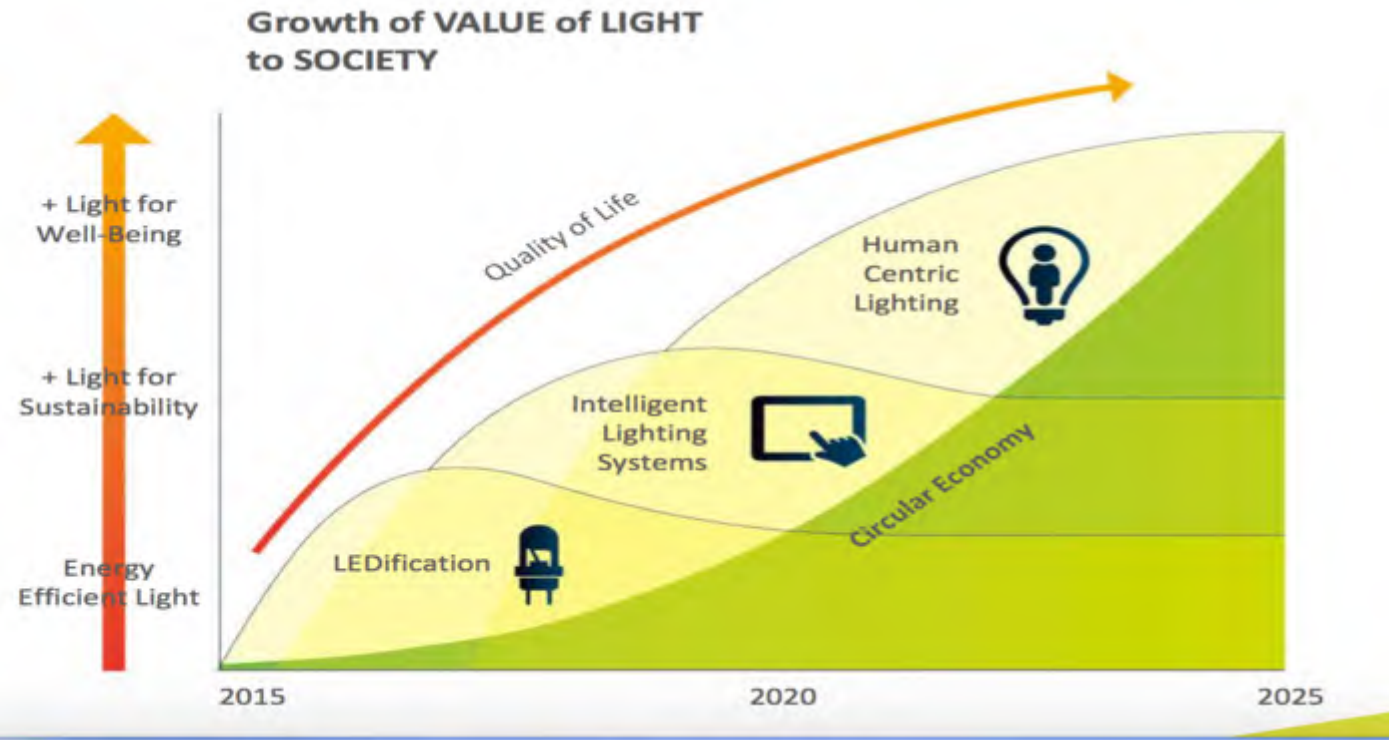
The Strategic Roadmap of LightingEurope demonstrates the increasing growth in the value of light to society.

In this process, **energy efficiency** is supplemented **with light for sustainability** and with **light for well-being**.

The European lighting industry is aiming together with European Regulators for the **growth of the European lighting market** by more intelligent lighting, increased renovation rates, Human Centric Lighting and by circular economy thinking.

A result will be an increased number of jobs in Europe.

Value of light to society



Light Kills Flu Viruses



A specialized form of UV light effectively kills the flu without being damaging to humans. Image Credit: sasint / pixabay

IN BRIEF

The flu has taken thousands of lives already this year and continues to tear through the United States. However, researchers have recently shown that a specialized form of UV light could kill flu viruses without harming human tissues.

The Promise of LED Lighting for Horticulture

18 January 2018 · Ray Molony · All regions

Wheat grows twice as fast under LEDs



'I'd like to think that in 10 years from now you could walk into a field and point to plants whose attributes and traits were developed using this technology', says Dr Brande Wulff of the John Innes Centre, pictured, of the LED lighting regime that has dramatically boosted wheat growing times. Pic: John Innes Centre 2017

- **A TEAM** of scientists has cut the growing time of wheat by **50 per cent** by using **LED lighting**.
- It's the latest breakthrough in the LED revolution sweeping the horticultural industry.
- Researchers from Australia and the UK grew wheat from seed to maturity in just eight weeks instead of the standard 16 week growing time for the cereal grown in spring.



[http://luxreview.com/article/2018/01/wheat-grows-twice-as-fast-underleds?cmpid=enl_lux_latest_lighting_news_2018-02-](http://luxreview.com/article/2018/01/wheat-grows-twice-as-fast-underleds?cmpid=enl_lux_latest_lighting_news_2018-02-01&pwid=691c4706c98359cf8ce8cb1b144dba7e32196a87d33966e9f8424d7ba4d8f58447349fa489e839bb0e9ecdd1c8066aebb1a173e105406e3f9fc3bedce6cc4434)

[01&pwid=691c4706c98359cf8ce8cb1b144dba7e32196a87d33966e9f8424d7ba4d8f58447349fa489e839bb0e9ecdd1c8066aebb1a173e105406e3f9fc3bedce6cc4434](http://luxreview.com/article/2018/01/wheat-grows-twice-as-fast-underleds?cmpid=enl_lux_latest_lighting_news_2018-02-01&pwid=691c4706c98359cf8ce8cb1b144dba7e32196a87d33966e9f8424d7ba4d8f58447349fa489e839bb0e9ecdd1c8066aebb1a173e105406e3f9fc3bedce6cc4434)

Lighting as a Service



GLOBAL REVENUE FOR LIGHTING AS A SERVICE EXPECTED TO REACH \$2.6 BILLION BY 2026

Posted on **January 28, 2018** by **BillAttardi** — **No Comments** ↓

Energy efficient decision makers within the commercial building industry struggle with the plethora of lighting product and controls available on the market. As a result of this struggle, the market is seeing a shift in how lighting and other building technologies are obtained and managed. These shifts and uncertainties will lead to the rise of lighting as a service (LaaS). Navigant Research broadly defines LaaS as the third-party management of a lighting system, including additional maintenance, financial, technical, or operational services. This Navigant Research report examines the LaaS market for commercial buildings, with a focus on financing, maintenance, and turnkey services. The study addresses market issues, including key drivers and barriers, related to LaaS solutions. Global market forecasts for LaaS revenue, segmented by service type, building type, and region, extend through 2026. The report also examines the key services related to LaaS, as well as the competitive landscape. <https://www.navigantresearch.com/research/>

Li-Fi integrated into products

14 February 2018 · Ray Molony · All regions ·

World's first Li-Fi light panel launched



It can deliver data such as the internet to computers and other devices using the visible light of the LEDs rather than the radio waves of Wi-Fi.

Developed by Virginia-based VLNComm, the panel is capable of a download speed of 108Mbps and an upload speed of 53Mbps, and provides 48 square metres of coverage.

Around 15 users can simultaneously receive data through the use of standard white LEDs.

The Promise of Laser Li-Fi

Laser Li-Fi is ten-times faster than LED Li-Fi



By BizLED Bureau

<http://bizled.co.in/laser-li-fi-is-ten-times-faster-than-led-li-fi/>

Oct 6, 2017: Li-Fi technology that uses LED lighting instead of radio waves to transmit data, will now use laser-based lighting, that will transmit data rate ten times faster.

Laser-based Li-Fi will have better light output than LED. The project is being conducted by Harald Haas, chairman of mobile communications at the University of Edinburgh. He is also a member of the Ultra-Parallel Visible Light Communications Project. Haas said that he believed that the next wave of energy efficient lighting will be laser diodes.

Li-Fi encodes data on the light emitted by LEDs. The rapid flickering cannot be seen by human eye, but a computer receiver or a mobile device can read the signal, and then send back to a transceiver, providing two-way communication. But many LEDs use phosphor coating to convert blue light to white, which limits the speed of the device for modulation.

The Promise of 3D Printed Lighting Components

Lighting
Research Center



Rensselaer

News from the Lighting Research Center

The LED Lighting Institute

Expanded with new content on 3D Component Printing, Connected Lighting and OLEDs!

The Lighting Research Center at Rensselaer Polytechnic Institute is offering its next LED Lighting Institute from October 31 to November 2, 2017. This popular, hands-on seminar for industry professionals covers the latest advances in solid-state lighting (SSL), Internet of Things (IoT) and manufacturing industries. The program culminates with participants designing, building, and evaluating their own lighting fixtures, now including custom 3D printed components. [Register Today!](#)



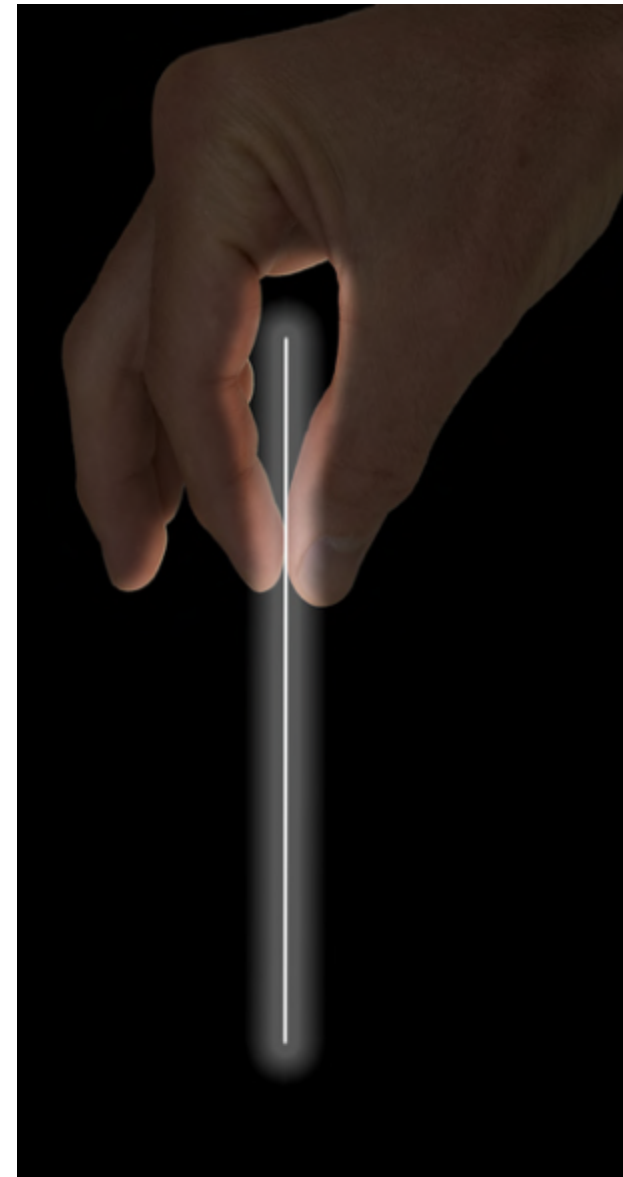
Rohinni produces the 'world's thinnest' LED lights using 3D printing, and it adds light anywhere

We print metals, food and even human organs using 3D printing technology. Imagine if light could be printed like paper, instead of those circular bulbs - how many applications you can think of?

That's exactly what Coeur d'Alene, Idaho-based startup Rohinni, a passionate team is working on. "We print light," writes Rohinni team on their Twitter statement.

Their goal is to enable the leading lighting option for endless applications. What they are developing is its Lightpaper, the world's thinnest LED lighting, with an approach where one can apply it to nearly any surface and in any shape.

The paper-thin Lightpaper is made by mixing ink and tiny LEDs together and then printing the mixture out on a conductive layer. This layer is then sealed between two additional layers. The tiny diodes are about the size of a red blood cell. When a current runs through the paper, the tiny, randomly-dispersed diodes will light up.



3D Printing OLED's , Optics, Luminaires...



3DPrinting.Lighting - The Leading Authority in Additive Manufacturing News for the Lighting Industry and a dedicated resource for Professionals in the Field of Lighting Technology, Design and Application.

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3D Printing OLED Light Fixtures

By Illumarco - Nov 14 2015



DIY: 3D Printing OLED Light Fixtures for Designers

OLED, one of the most advanced technologies in in todays lighting world meets the most innovative technology in printing. Still, the most important thing in a lighting fixture would be the light source itself. However, 3D printing technologies bring new and enhanced design possibilities closer to light design and engineering studios and help them create new and designful products. Here's a nice example from LG Chem about 3D Printing OLED Light Fixtures.

3D Printing OLED Light Fixtures - Do it Yourself!

Try designing your own light with 3D printing and an OLED light DIY Kit. OLED Task Lamp made with one 100x100mm LG Chem (OLED) module and a driver included in a LG Chem OLED light DIY kit.

For more information, visit <https://www.facebook.com/igoldedlight>

Optics Software and Additive Manufacturing: A Powerful Combination

To speed up the optics design and prototyping process Luxexcel and OPTIS combine software and 3D printing technologies to provide a complete service to optical designers. Users of the software can now virtually design their lens within the OPTIS software and 3D print their CAD design with Luxexcel's [Printoptical Technology](#).



With Luxexcel's 3D printing service for optical components, customization is now possible for optics and other products that require the highest standard in transparency



Luxexcel and OPTIS - fast way of getting new product tested and approved

The Promise of Nanotechnology

MIT engineers create nanobionic plants that emit light



BIZLED MAGAZINE
It's All About Good Life, Energy & Development (LED)

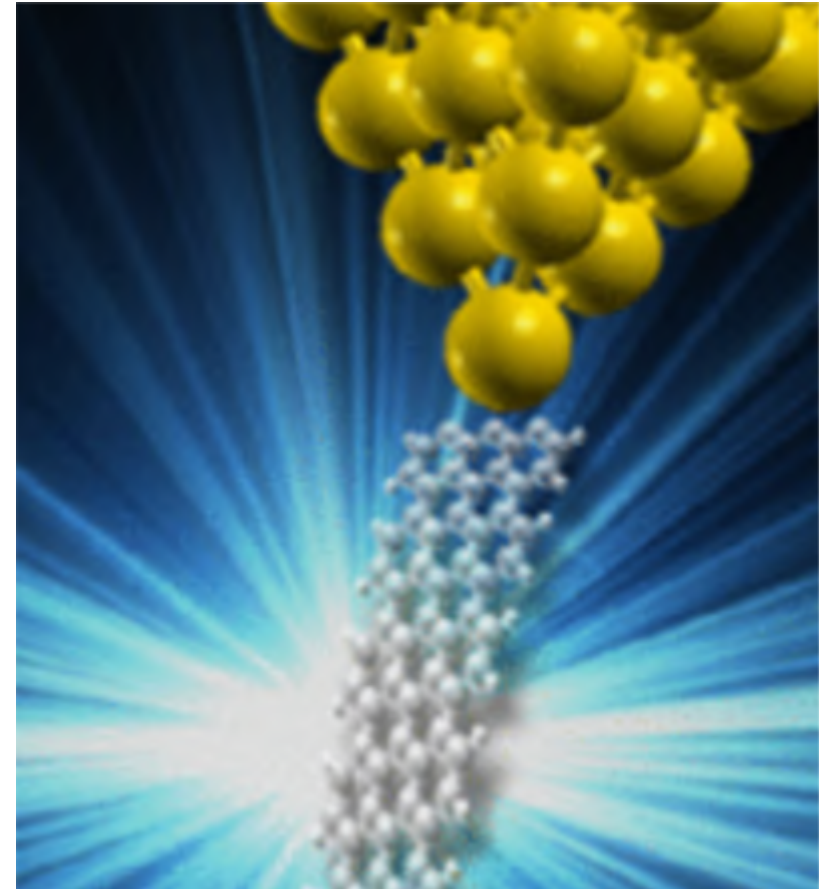
Dec 19, 2017: Plant nanobionics, a new research area pioneered by Strano's lab, aims to give plants novel features by embedding them with different types of nanoparticles. The group's goal is to engineer plants to take over many of the functions now performed by electrical devices. The researchers have previously designed plants that can detect explosives and communicate that information to a smartphone, as well as plants that can monitor drought conditions. **Lighting, which accounts for about 20 percent of worldwide energy consumption, seemed like a logical next target. "Plants can self-repair, they have their own energy, and they are already adapted to the outdoor environment," Strano says. "We think this is an idea whose time has come. It's a perfect problem for plant nanobionics."**

<http://bizled.co.in/mit-engineers-create-nanobionic-plants-that-emit-light/>

The Promise of Nanotechnology

Researchers demonstrate colour-tunable graphene-based LED

Jan 18, 2018: A team of researchers from the Université de Strasbourg (France) and the CNR-Nanoscience Institute (Modena, Italy) have demonstrated that due to highly tunable band gaps, graphene nanoribbons (GNRs) with atomically precise edges are emerging as mechanically and chemically robust candidates for nanoscale light emitting devices of modulable emission color. They have revealed their research in a paper entitled “Bright Electroluminescence from Single Graphene Nanoribbon Junctions” published in ACS’ Nano Letters. Graphene nanoribbons (GNRs), with atomically precise edges, were already known for their highly tunable band gaps. When cut into thin ribbons, just a few atoms wide, graphene obtains a sizable optical band gap, which is not possible with full graphene sheets that do not have any optical band gap.



The Promise of New LED Technologies

Technique creates more efficient LEDs and maybe cloaking

20 July 2017

A technique developed by a team from the University of Michigan could boost the efficiency of LED lighting by 50%, but might also enable invisibility cloaking devices.

The technique involves growing metallic nanoparticles on and below the surface of semiconductors. These nanoparticles increase the efficiency of LEDs in several ways: by acting as 'antennas' that turn more of the electricity running through the semiconductor into light; and by helping to reflect light out of the device.

"This is a seamless addition to the manufacturing process and that's what makes it so exciting," said Michigan Professor Rachel Goldman. "The ability to make 3D structures with these nanoparticles throughout is going to open a lot of possibilities."



Pic: Joseph Xu, Michigan Engineering

We're approaching "The Singularity" within the next 25 years. This is the point at which Artificial Intelligence revolutionizes the entire human experience... When computer generated *super intelligence* exceeds the abilities of the human brain. This is also the period during which we begin to enhance our own human intelligence by connecting our own brains with the cloud.

Anytime such a massive, disruptive change materializes, fortunes are made, industries are disrupted and the world changes forever. - Peter Diamandis email 10-16-17

Countdown to the Singularity

2018

Quantum Supremacy Achieved: The first demonstration of a quantum computation that can't be simulated with classical supercomputers is announced.

Emotion AI will become embedded into conversational interfaces. It will be socially acceptable to scream angrily at Alexa. She might respond with something like, "Please don't yell at me, that hurt my feelings."

2020

The 5G Network unleashes **10 – 100 Gigabit connection speeds** for mobile phones around the world.

AI based medical diagnostics & therapy recommendations are used in the majority of US healthcare.

Flying car operations take off in a few cities in the world.

Practical Quantum Circuit: the first new catalysts are discovered with a gate model quantum processor, marking the beginning of the end for traditional chemistry.

2022

3D printers can **print clothing** and modules to snap together a house or building.

People can legally travel in **autonomous cars all over the U.S.**

All kids toys are "smart" with built in machine learning.

Robots are commonplace in most middle-income homes, able to reliably read lips and recognize face, mouth and hand gestures.

Robots understand speech context well enough to interact with humans as receptionists, retail store assistants and clerks.

2024

The **first private human missions** have launched for the surface of Mars.

10,000,000 daily drone flights (today, there are about 100,000 daily airline flights).

Drones routinely deliver packages to rooftops of apartment buildings and surface robots deliver those packages from rooftops to doorsteps throughout the buildings.

The first **"one cent per kilowatt-hour"** deals for solar and wind are signed – one-fifth the price of the cheapest coal or gas deals today.

Building **new solar and wind is cheaper than building new coal** or gas across 90% of the world.

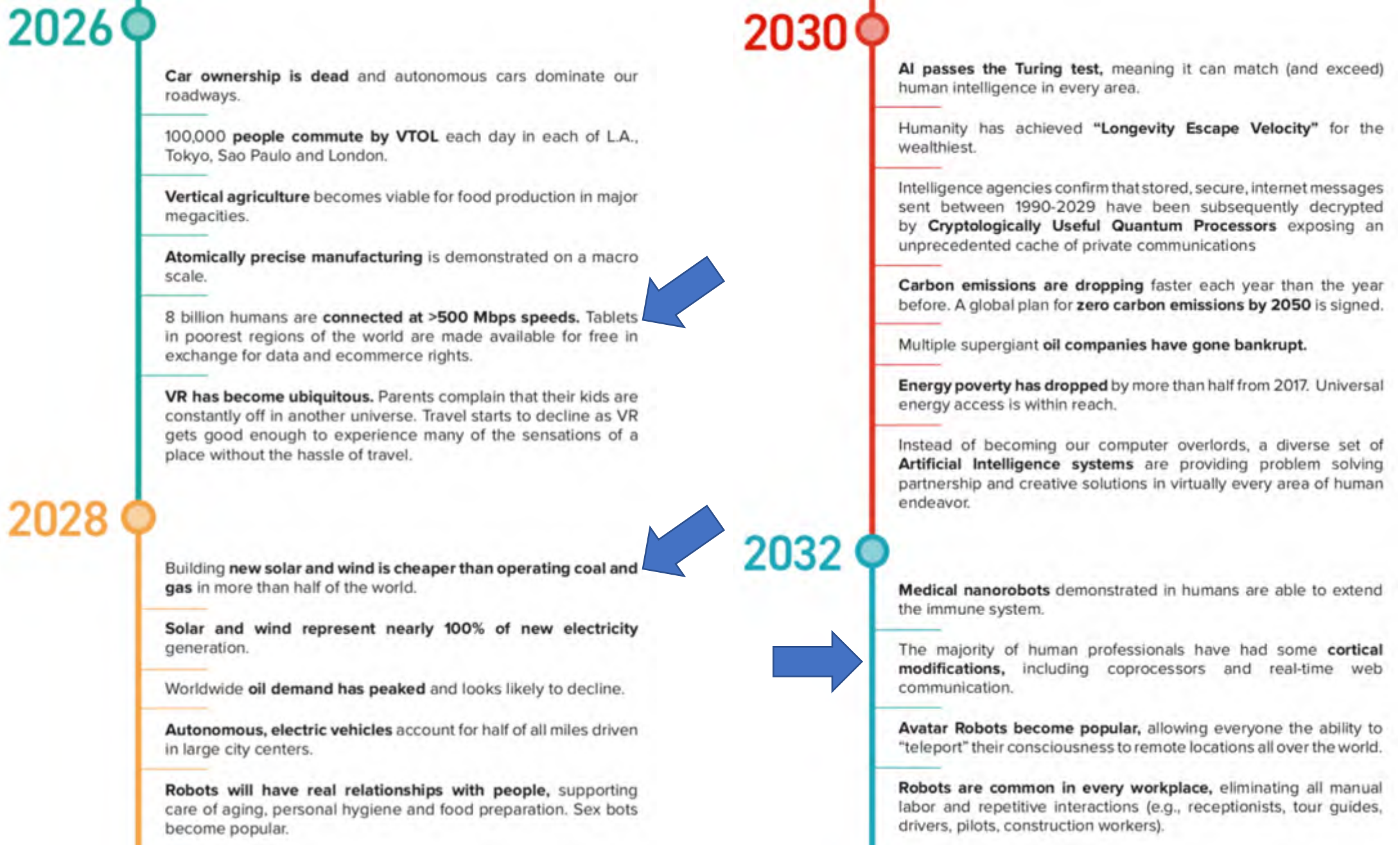
Electric vehicles are half of new vehicle sales.

China and India announce that they will **shut down hundreds of already built coal power plants.**

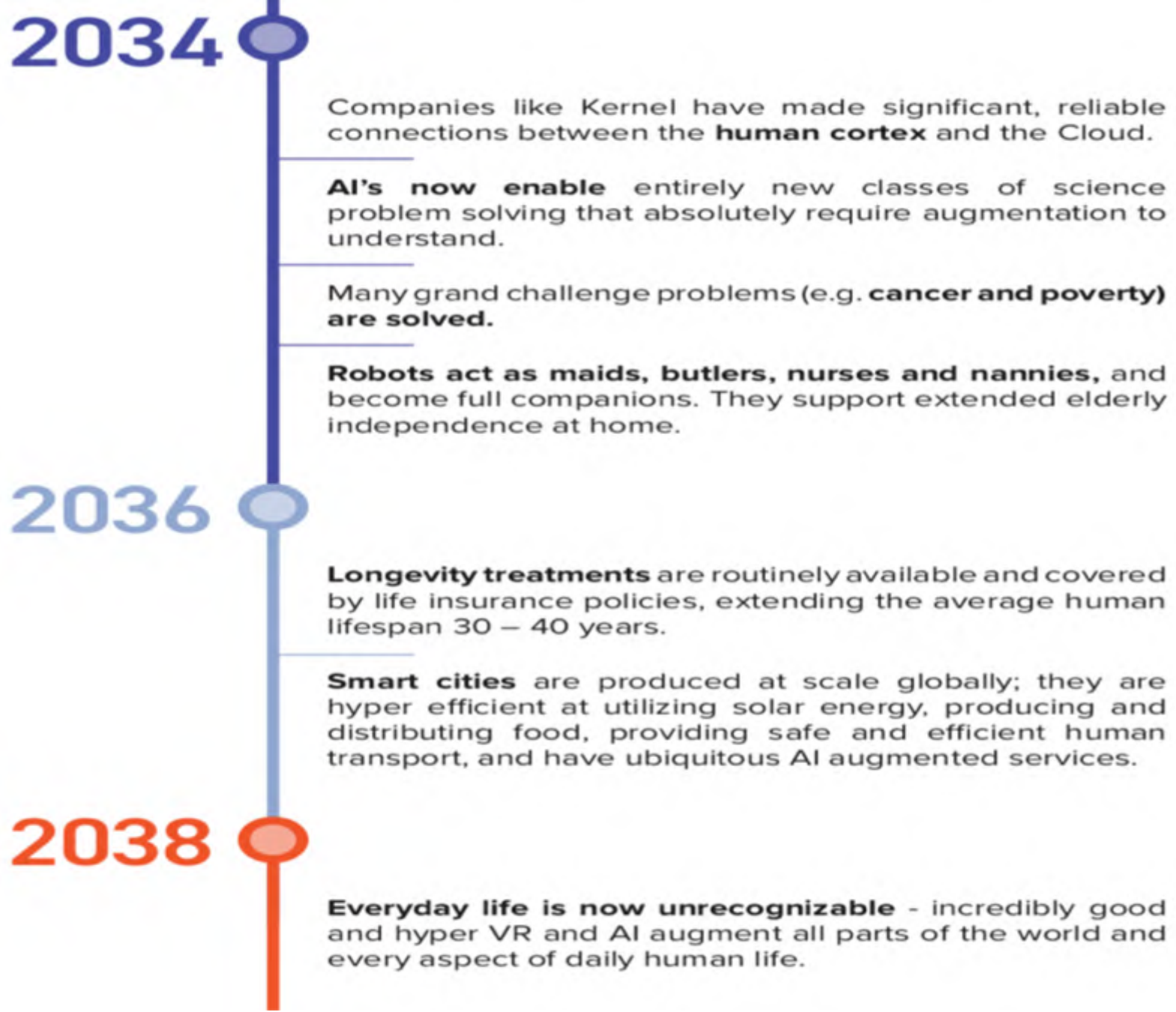
Carbon emissions have unambiguously peaked worldwide.

Artificial Intelligence augmentation is considered a requirement for most professional jobs.

Countdown to the Singularity



Countdown to the Singularity



The Promise of Progress

- **The disruption that our lighting community is experiencing offers unprecedented opportunities.**
- **We will create more wealth in the next ten years than the previous hundred.**
- **There is easier access now to capital, knowledge and expertise and advanced technologies than ever before.**
- **The cost of food, transportation, communications and energy have fallen dramatically over the past century.**
- **Miniaturization, lighting integration into the electrical infrastructure of buildings and SSL morphing with other trades is already occurring.**
- **The pace of future progress will quicken and non-energy benefits can assure the survival of our lighting community.**
- **We ultimately cannot protect the past from the future. The promise of progress is available to whoever best understands and addresses the exponential growth shifts we are facing.**

The Promise of Progress

A serene landscape featuring a bright sun rising over a calm, blue ocean. The sun is positioned in the center of the horizon, casting a wide, soft glow across the sky and reflecting on the water's surface. The sky transitions from a deep blue at the top to a lighter, hazy blue near the horizon. The water is dark blue with subtle ripples, and the overall atmosphere is peaceful and hopeful.

Mark Lien LC, HBDP, CLEP, CLMC, LEED AP BD&C
Illuminating Engineering Society