



**What to Build and When to Build It
Scenario Planning Workshop on
February 11, 2020 Strategies in Light**

Workshop Guide

What to Build and When to Build It: Scenarios for the Future of Lighting Workshop Introduction



Clifton Stanley Lemon

Lighting and technology companies today face complex challenges in planning products and systems including: 1) the intrusion of IT and big data into many industries, especially lighting; 2) rapid change in technology following a period of many decades of relative stasis in lighting; 3) incomplete understanding of rates of adoption and replacement; 4) a business culture that assumes “disruption” and blitzscaling that work for IT and consumer electronics also work for lighting; and 5) lack of perspectives on and tools for envisioning and managing the future of lighting, controls, and building technology.

This daylong workshop combines insights and tools from diverse sources: scenario planning; advanced midrange crowd-sourced forecasting; and behavioral economics. Workshop registrants will receive a pre-workshop primer with preparatory material, including macro scenarios that the speaker team has developed. The workshop begins with presentations from the panel that provide relevant ideas, case studies, and examples of improved decision making and successful strategy in different companies. Then teams are formed, each is given a specific hypothetical product roadmap with one or more critical decisions and challenged to think it through, creating 3-4 different scenarios that are used to test assumptions, test ideas, and set metrics for success. Each team then presents its scenarios to the speaker panel, who pose as investors interested in funding the project and offer comments and feedback.

The workshop is designed for product managers, engineers, designers, sales and marketing professionals, specifiers, technical advisors, and C level company officers, consultants, and investors in lighting and electronics manufacturing companies who need strategic decision support tools to help manage technology development and integration, sales and marketing, operations, logistics, SKU proliferation, certifications, code compliance, and supply chain coordination.

“We are called to be the architects of the future, not its victims”
– Buckminster Fuller



Learning Objectives

1. Improve product roadmap decisions in assessing and implementing new technologies, allocating development resources, investing, marketing, and product management
2. Use new perspectives on changes in adoption and replacement of components, systems, and infrastructure of communications, controls, lighting, and power distribution
3. Crowdsource collaborative networks with diverse views that test assumptions, key questions, roadmaps, and strengthen forecasting
4. Stimulate deep imagination and visualization by understanding, then moving beyond the limits of the past to actively creating the future

How the Workshop Works

Parameters

Goals/Deliverables

What are we trying to do here exactly? There are 4 main goals for each team:

1. Choose a Focal Issue

Pick a big problem that impacts the product roadmap to address with your team's scenario. Each team can choose whatever big problem they agree upon. Different teams can look at the same problem. Examples of big problems are: integrating technology into a product line; navigating regulatory issues, managing channel disruption. finding innovative business models.

2. Reverse Engineer Scenarios and/or Make a New Ones

All the scenarios are draft narratives, and to some degree "official futures." They can and should be revised partly or totally to fit the task of solving the big problem. Dig into the scenario in the context of the problem and ask questions like "what would have to happen to make this be true?" and "What are the main drivers of this narrative?"

3. Make a Strategy with the Scenario

Since we're at Strategies In Light, think about how the scenario provides strategic direction

4. Present your Scenarios and Strategy

At the end of the Workshop, each of 4 teams presents their work for group discussion.

Challenges

The big crazy idea for this workshop is to explore scenario planning, which typically takes months to execute, in a day-long workshop.

1. Cognitive Overload

We'll be looking at a lot of different information, divergent viewpoints, and many different technologies. It's no different than our daily lives, where we're basically "surrounded by chaos," to quote Scott Yu. This is usually overwhelming, but that's OK: we will find many paths through the fog.

2. Critical Thinking

Analyzing why a particular narrative is true or false can yield surprising new perspectives.

3. Moving Beyond Official Futures

We will be forcing ourselves as a group to identify and challenge "official futures" that we are inclined to accept without much reflection and use as the basis for critical decisions.

Tools and Help

In the workshop we're providing several things to help us tackle the big issues.

1. Team of Experts

Our speaker/guides are carefully chosen to represent some of the most successful firms in the industry who each have a unique approach to thinking big about the future and winning.

2. Pre-Baked Scenarios

Rather than try to build scenarios from scratch, which typically takes months, we're providing draft scenarios that in some cases are based on work done by different individuals and groups in the lighting industry.

3. Crowd Sourcing

Each participant in the workshop provides a valuable, unique perspective in addressing the future of the lighting industry. The combination and cross fertilization of these perspectives adds richness and strength to any particular scenario.

4. Interaction and Feedback

Teams are encouraged to interact, steal ideas, and argue about key points. Workshop Guides are also available for advice and direction to all teams throughout the day.

5. Pre-loaded Scenario Factors and Critical Uncertainties

All teams have access to a draft list of common drivers, internal factors, and global factors that impact the future, as well as critical uncertainties. (See Page 3 for a sample).

6. Narrative Images

All teams will be provided with a set of images to use in constructing and reinforcing scenario narratives.

Driving Forces, Critical Uncertainties

Industry Driving Factors

This is a suggested list of known factors that drive the lighting industry today, the sorts of things that would be addressed in a typical business plan: customer demand, suppliers, competitors, production technologies, human resources, etc. What can you add to the list? what are some less obvious possibilities: What if there is a new entrant on the competi-

tive landscape? What if new disruptive technologies might emerge?

Trade Practice

- Emergence of System Integrators
- Slow changes to construction & electrical installation practices
- Loss of skilled trades- electrical, etc
- Lack of integration in trades- i.e. between electrical and IT, or other different building systems

Design Trends

- Modular "platform" approach to luminaires- interchangeable modules
- Visible fixtures (as opposed to recessed & hidden)
- More color & finish options

Technology

- OLED
- Dynamic Optics
- Hybrid LEDs
- Additive manufacturing (3D printing)
- Advances in drivers
- Evolving LED Integration: COB, CSP, DOB
- Warm dim
- Tunable white & Tunable color
- Light Field Sensing
- Laser LEDs
- Li Fi & VLC
- Adaptive Lighting
- Chips to Luminaire transition- Chip Scale Packaging
- Power Over Ethernet
- Quantum Dots
- Micro LEDs
- Quantum dots

Economics

- M&A activity by tech companies
- Consolidations & spinoffs
- Supply chain compression
- Cost reductions
- Rapidly Changing job descriptions
- Automation
- Non-lighting people entering industry
- Over hype on IoT
- Over hype on Human Centric/Circadian/health and wellness lighting
- Perception of Total Cost of Ownership
- Lighting as a Service

Energy

- Peak efficiency in lighting
- Continuing drive to 200+ LPW

Research

- Challenges in research design methods
- Declining research funding

Trending Media Narratives

- Blue Light Risk
- Circadian Everything- Health & Wellness
- "Smart" Lighting
- Anti-science reactionary propaganda
- IoT

Government/Regulatory

- Qualified Product Lists- DLC, CEC, others
- Proposed UL certification of Circadian lighting
- Over regulation
- Efficiency rollbacks for lightbulbs
- Non compliance- willful or not

Global Driving Factors

These are the more remote forces operating in the larger world, e.g., geopolitical, economic, social and technological forces that are often left out of the usual business plan. Climate change is one of the big ones, and on everyone's minds these days. Also consider opportunities and upside possibilities.

Economics

- Availability of rare-earth materials
- Trade wars -real or perceived
- Punitive tariffs
- Shortage of trade labor- electricians, etc
- Supply chain compression
- Boom & bust cycles in construction
- Decline in R&D investment
- Circular Economy
- Blockchain & cryptocurrencies
- Decentralization
- Silos in building system providers

Trade Practice

- Changing construction project delivery methods

Technology

- Blockchain
- Additive manufacturing
- Distributed AI

Energy

- Energy security
- Energy proces
- Convergence of renewables, advanced storage & smart networks
- Low voltage DC distribution

Government/Regulatory

- Limited RF bandwidth
- Rollback of PV subsidies
- Trump Rollback of Efficiency measures

Environment

- Climate change

Critical Uncertainties

Each driving factor must be assessed according to its degree of uncertainty, and factors that are well known and understood don't need much more analysis. The factors that are left that have a high degree of uncertainty are the ones that require th most critical thinking and imagination to find solutions for.

Technology

- Will technology advance rapidly or slowly?
- Will we be able to achieve appropriate standards and metrics?
- How can we make lighting controls work?

Design Trends

- Derivative vs Purpose built

Buyer Trends

- How important is product lifetime to end users?
- What's the role of distributors and other middlemen in the value chain?

Regulatory

- How can the industry help regulators to make better regulations and increase compliance?
- How can regulators facilitate business model innovation?

Economics

- Will Lighting as Service Business model evolve?

Behavior

- How to define metrics for Non-Energy Benefits: Lighting quality, productivity, health & Wellness, Visual Comfort?

Workshop Agenda

8:00 - 8:30	Clifton Stanley Lemon – Introduction: Prophecy, Predictions and Scenario Planning
8:30 - 9:00	Team Forming, Choosing Focal Issues
8:30 - 9:00	Scott Yu – Using strategy to drive the brand, mission, design language, and growth
9:00 - 9:30	Team Discussion
9:30 - 10:00	Jerry Mix – Using strategy to build a mission, a team, a brand, and an operational infrastructure
10:00 - 10:15	Break
10:15 - 10:45	Team Discussion
10:45 - 11:15	Paul Pickard – Strategy and Planning for Technology Integration
11:15 - 12:00	Team Discussion
12:00 - 1:00	Lunch
1:00 - 1:30	Clifton Stanley Lemon – Lightbulbs, Luminaires, Lifetime- Historical perspective on technology
1:30 - 2:00	Team Discussion
2:00 - 2:30	Eoin Billings – The Design Brief as a Strategic Tool
2:30 – 3:00	Team Discussion
3:00 – 3:30	David Wilts – Making Sense of Digital Technology in the Built Environment
3:30 – 4:00	Team Discussion
4:00 – 5:00	Presentation of scenarios and Group discussion

Workshop Leaders



Scott Yu, Chief Creative Officer, Owner, Vode Lighting

As a product designer, Scott has always worked with three criteria in mind: low to no production waste, low energy consumption, and long product life. Whether it was at Ford, Peugeot or Volvo – where his work on Citroen's ECO 2000, a research vehicle, delivered an unheard of 90 mpg – Scott has always made the environment a priority. He was first drawn to the lighting business at a time when it had yet to take seriously the imperatives of sustainability. He found LEDs to be an ideal platform for transforming the industry and, with Vode, a company where his ethos of doing more with less was championed. Before Vode, Scott co-founded San Francisco-based Gingko Design and led the firm in winning numerous awards, including IDEA, CES, iF, Good Design, ID Magazine, and Singapore Design. A graduate of the Art Center College of Design, Scott was the youngest manager at Ford, overseeing its Small Car Studio developing global platforms and designs. In his free time, Scott is a tinkerer, remodeling his house toward net-zero energy. He's also a devoted cyclist and a paraglider, the result of his life-long passion for non-motor-assisted flight.

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Jerry Mix, President, Finelite

Jerry is an experienced president with a long history of working in the electrical and electronic manufacturing industries. At Finelite he provides operational leadership and management of the company with full responsibility for meeting business development targets and technical and development milestones; identifying, developing, and executing strategies for profitable revenue growth from existing product capabilities. Jerry is widely recognized in the lighting industry for his ability to build, lead, and manage high-caliber teams focused on profitable revenue growth, creativity, technology advancement, innovation and quality. He is adept at defining markets and developing strategies to capitalize on technology, market conditions and segment opportunities. Jerry was a founder of Wattstopper and has been active as an investor and advisor in a number of successful lighting and electronics startups. In September 2019 he received the Pioneer Award from the IES San Francisco Section, in recognition of his role in pioneering Bay Area lighting businesses. He has a BSBA degree in Marketing from the University of Arizona.

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Paul Pickard, Chief Technology Officer, Ecosense

Paul Pickard is a 21-year veteran of the lighting industry, having held technical leadership positions at Acuity Brands, LED Lighting Fixtures, Cree, and is currently CTO at Ecosense Lighting. He has provided technical leadership for a number of industry-first products, including the LLF LR6 downlight module, the Cree CR24 2x2 LED Troffer, the Cree LR24 LED Troffer family, and the first LED A-lamp offered below \$10, the Cree 40W equivalent bulb. A Mechanical Engineering graduate from the University of New Mexico, his current areas of focus are strategic technology development, systems engineering, optical innovation and color science. He holds over 190 US patents, with many more pending.

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Eoin Billings, Director, Billings Jackson

A founding partner of industrial design firm Billings Jackson Design, Eoin is responsible for architectural project work, and has worked as an industrial designer in architecture for twenty years. Eoin won the graduate's Gold Medal from the Society of Designers in Ireland in 1991 and went on to run major projects for the in-house industrial design department at Grimshaw where he met his business partner, Duncan Jackson. Collaboration is key to Eoin's professional approach and he runs regular design strategy workshops, drawing from a wide network of experts to fast-track the design development process. He is particularly interested in developing methods where craft, tools, materials and technology can be exploited to improve the time to manufacture and the quality of solutions.

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David Wilts, Founder & CEO, Digital Masterplanning

David's creative and entrepreneurial focus helped him to transform the companies he's worked for in the past. Always focusing on clients and end users, he's solved problems and invented solutions that draw on years of experience in planning, design, development, and operations - both in real estate and software. His firm, Digital Masterplanning (DMP) helps financiers, developers, and owners incorporate disruptive building technology into their organizations. Before DMP, David was an Associate Principal at Arup in Chicago, where he developed and led the firm's Digital Consulting work creating new offerings, including: Digital Masterplanning, Digital (Smart) Building Design, Technology Owner's Representation, BIM Master Planning, Building Technology (IT, AV, Security) Design, and Unified Collaboration. He was also the Global director of Integrated Building Technology for Crestron, developing the firm's design assist program for smart, integrated building technology and software and hardware to support an overall integrated building strategy and consulting on over 100 smart building projects around the world.

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Clifton Stanley Lemon, CEO, Clifton Lemon Associates

Clifton Lemon Associates is a San Francisco based consultancy providing strategy, product development, marketing, and education services to manufacturers and firms in the lighting and energy sectors. He was recently appointed Development Consultant for the California Energy Alliance, an energy stakeholder advocacy group. Clifton was formerly Marketing Communications Manager for Soraa, Director of Business Development at Integral Group in Oakland, and founder and CEO of BrandSequence, a customer research and brand management firm. Clifton has deep knowledge of sustainability, MEP, lighting, and LED technology, is well connected to the Bay Area, national, and international AEC and lighting and AEC communities, and is passionate about lighting, sustainable building, and behavioral issues in the built environment. He is an active writer and speaker and is a past president of the Illuminating Engineering Society, San Francisco Section, and is on the Advisory Boards of LightFair International, Strategies in Light, and LightShow West.

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Prophecy, Prediction, & Scenarios

Definitions

Clifton Stanley Lemon

Prediction and narrative are two of the most fundamental things our brains are hardwired for. Our cognitive functions depend on both, and they are related in fascinating ways. The need for narrative is so strong that our brains unconsciously create and adhere to narratives where there little or no basis in reality for them. For example, people typically trust management of financial portfolios to professionals who predict the fluctuations of the stock market when there is no evidence that they outperform random guesswork – the demonstrably false narrative we cling to is “money experts are smarter than I.” So we are basically unable to avoid creating narratives about the world we experience, and there is even a prevailing view that consciousness itself is basically constructed on the fly permanently and that there is no objective reality. This is the realm of quantum physics, and going down that deep (but really interesting) rabbit hole is rather beyond the scope of this discussion.

Nor can we exist without making basic predictions, even if they’re often wrong. But whether or not you chalk it up to some idea of continual improvement and evolution of humanity’s adaptive strategy- call it “progress,” some techniques for managing the future show promise, probably because advances in information technology makes it much easier to collaborate and “think” globally, with a “hive mind.” The wisdom of the crowd is often greater than that of any one individual.

Prophecy

One of the mistakes we make with predictions is taking them at face value as zero-sum declarations – the economy will grow or it will crash, wi-fi will become the dominant technology or it will fizzle – with little appreciation for

nuance or uncertainty. These amount to prophecies- statements made with great, unshakable confidence. Often black and white, zero-sum prophecies have little utility in making the crucial evidence-based decisions we need to make within companies trying to stay on top of technology, markets, profitability, and sustainability. Prophecies made by tech “evangelizers” in particular bear a very close resemblance to religious prophecy. The end of the world never quite materializes, so end-times prophets just move the date - believers never seem to care or even notice.

But even some of the magical practices of prophecy have their origins in evidenced based forecasting. For instance, the reading of animal entrails, called haruspicy, is described in ancient Roman author Vitruvius’ seminal Ten Books of Architecture. This was done by people evaluating sites for future cities (something the Romans had developed elaborate plans for) sending sheep and livestock out to graze for several weeks, then slaughter in them and examining the entrails to determine whether the landscape could support the population. And psychics and magicians are well trained in reading body language, facial expressions, and unconscious behaviors in order to make “predictions” about people they’ve never met.

Predictions and Forecasting

Predictions, however, can be more useful and accurate when they embrace the concept of probability, moving away from a reflexive zero-sum conclusion. Probability is not necessarily an intuitive concept, but once we get used to it, we use probability calculations all the time in decision making. It’s pretty hard to understand what a 60% chance of rain actually means – for instance, what happens when it actually rains, does the probability suddenly become

100%?, or is it only raining at 60% intensity? – we kind of have to blow past these confusing considerations as what we really need is something that works reasonably well that helps us decide whether to take an umbrella to work or to plant or harvest crops. And we have that with weather forecasting, which is nothing if not massively complex. It works reasonably well and is indeed getting better all the time.

In the book *Superforecasting*, by Philip E. Tetlock and Dan Gardner, through a series of well designed experimental trials, the authors demonstrate convincingly that crowd-sourcing forecasting can have surprisingly accurate results, within certain clear parameters. It seems to work best with very specific questions, like the future price of a commodity, or the future military actions of a country; and the accuracy of forecasting seems to decline considerably past 3 years out.

Forecasting using gradations of probability provides the underpinning for building larger versions of the future for the questions that are too big and complex to attack with simply a collection of granular approaches- this is where building scenarios comes in.

Scenario Planning

Scenario planning as we know it today came into being during the Cold War, where it evolved as a tool to manage the most powerful existential threat ever known to humanity – catastrophic nuclear destruction. It’s about not putting all our eggs in one basket but by simultaneously entertaining multiple plausible visions of the future, some of which may be dramatically different or conflicting.

Four Scenarios for the Future of Lighting



What's a Scenario Look Like? Four Futures for Lighting

The following scenarios were not created using a formal detailed group process, but have been developing over several years with a loosely organized group of lighting industry thought leaders. They are meant to demonstrate what the end product of the workshop- scenarios- look and feel like and also to serve as templates to be expanded upon, refined and improved.

They're in very rough form and need a lot of work, which is part of the point of the workshop!



Scenario 1 Human Free Lighting

Narrative

Built environments adapt automatically to individual and group behavior and preferences, automatically sensing motion, interaction, and ambient conditions and adjusting services to optimize comfort, health, energy and operational efficiency. Controls and systems have become too complex for most humans - every important function is now automated in order to remove human error. Deep sensor network collects data. Machine learning and AI optimize systems

Drivers

System Complexity Cognitive Overload
Preventative Maintenance
Energy Efficiency
Asset Management
Indoor Environmental Quality
Portfolio Management
Health & Productivity
Safety and Emergency Response
Security
Data Monetization

Tech Stack

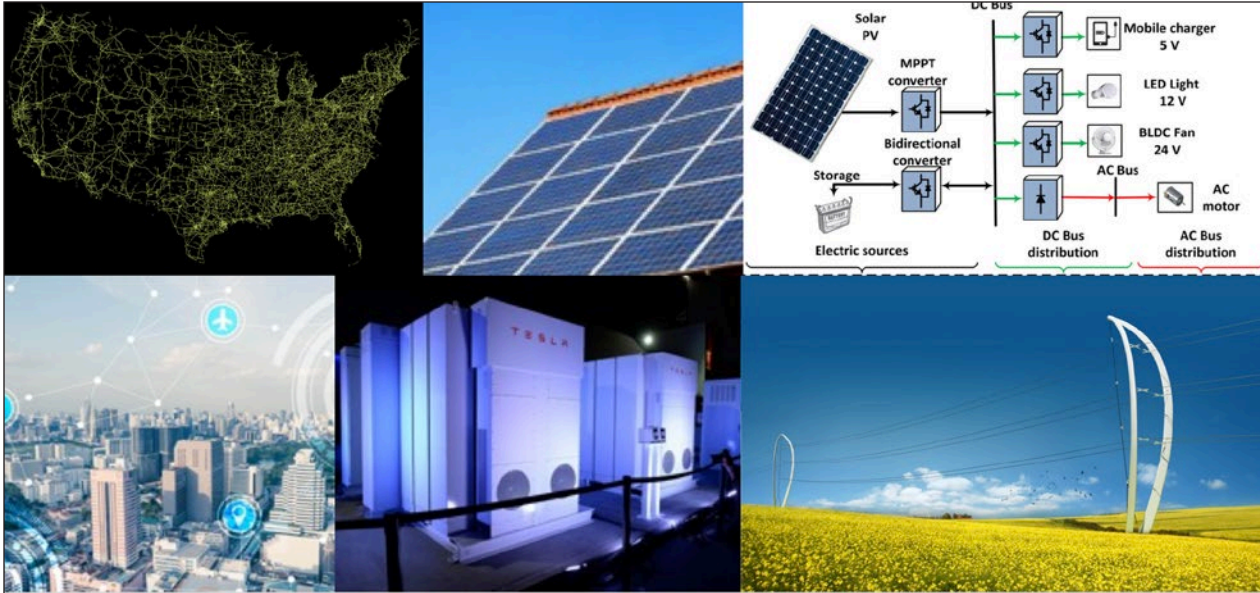
Biometrics – gait, emotion, thermal, identity
Ubiquitous sensors
Machine learning & AI
Integrated system controls
Light Field Sensing
LiFi, WiFi, VLC
Mobile Computing
GPS & IPS
Biomimetic Façade systems
Blockchain

Implications

Requires new ROI mindset
Requires new metrics for value of data
Requires new synthetic skillsets and job descriptions
Completely redefines maintenance roles
Requires a new concept of User Interface and entirely new designs and approaches
Requires advance new architectures for security of controls and data
Requires redefining emergency and backup power strategies

Early Signs

LiFi pilot projects- Paris Metro & others
Promising research prototypes in labs like LESA
Widespread deployment of sensor and data networks in lighting systems
Widespread use of asset tracking and space utilization
Pilot projects in integrated building controls
Advancements in emotion analytics, biometrics, and surveillance technology
Startups in wireless VLD space



Scenario 2 Convergent Grid

Narrative

Low voltage DC systems at the grid edge emerge, enabled by the convergence of advanced storage, distributed generation, microgrids and nanogrids, and smart networks. Distribution networks evolve that transmit power and data over the same lines. Low voltage DC lighting and other applications in homes, retail, and other building types drives the development of integrated energy and data systems and the conversion of large parts of the electrical grid to DC.

Drivers

- Declining Cost of Solar
- Energy Efficiency- eliminating conversion losses
- Energy Security
- Grid balancing
- Resilience
- Decentralization
- Health & Productivity
- Security
- Safety
- Material Efficiency
- Simplified Compliance & Certifications

Tech Stack

- DC battery storage
- Solar and other renewables
- LEDs
- AI & Machine learning
- Electric Vehicles
- Smart Micro and Nanogrids
- Wireless Mesh Networks
- Data Analytics
- Advanced integrated controls
- New DC appliances

Digital Assistants
Blockchain

Implications

- All systems become safer, lighter, smaller, cheaper, more mobile, flexible, and efficient.
- New platform for products and applications
- Decentralized power impacts political, social, and economic organization
- Declining cost of energy means higher equality of economic opportunity
- Decarbonization is enhanced
- Legacy grid evolves to handle renewable loads better
- Role of Utilities is transformed dramatically
- Installation, operation, and maintenance of LVDC systems is much easier and cheaper
- LVDC systems help to balance the legacy grid

Early Signs

- LVDC pilot programs in retail & residential
- Many worldwide demonstration sites for DC systems
- Dramatic increase in solar
- Steady improvements in battery technology
- Emerging LVDC power systems, including power servers, wiring, and other components
- Widespread use of DC in data centers
- Investment in and deployment of PoE
- Widespread acceptance of EVs



Scenario 3 Illumigeddon

Illumigeddon functions as one the “Official Future” that most of those who talk about the future of lighting gravitate to: game over for business as usual- adapt or die (without offering much in the way of what adapting specifically entails).

Narrative

Giant telecom, electronics, and communications corporations take over the specialized, fragmented lighting industry. Oil & gas companies take over utilities. Traditional market and distribution channels are disrupted. Traditional specialized disciplines, along with everything else, are seriously “disrupted.”

Drivers

- Consolidation, M&A
- Disintermediation
- Integration of Lighting with Electronics
- Price drops in products
- Inertia & lack of innovation in lighting
- Declining R&D investment
- Disruption mindset
- Decline of Government leadership & regulation
- Financialization

Tech Stack

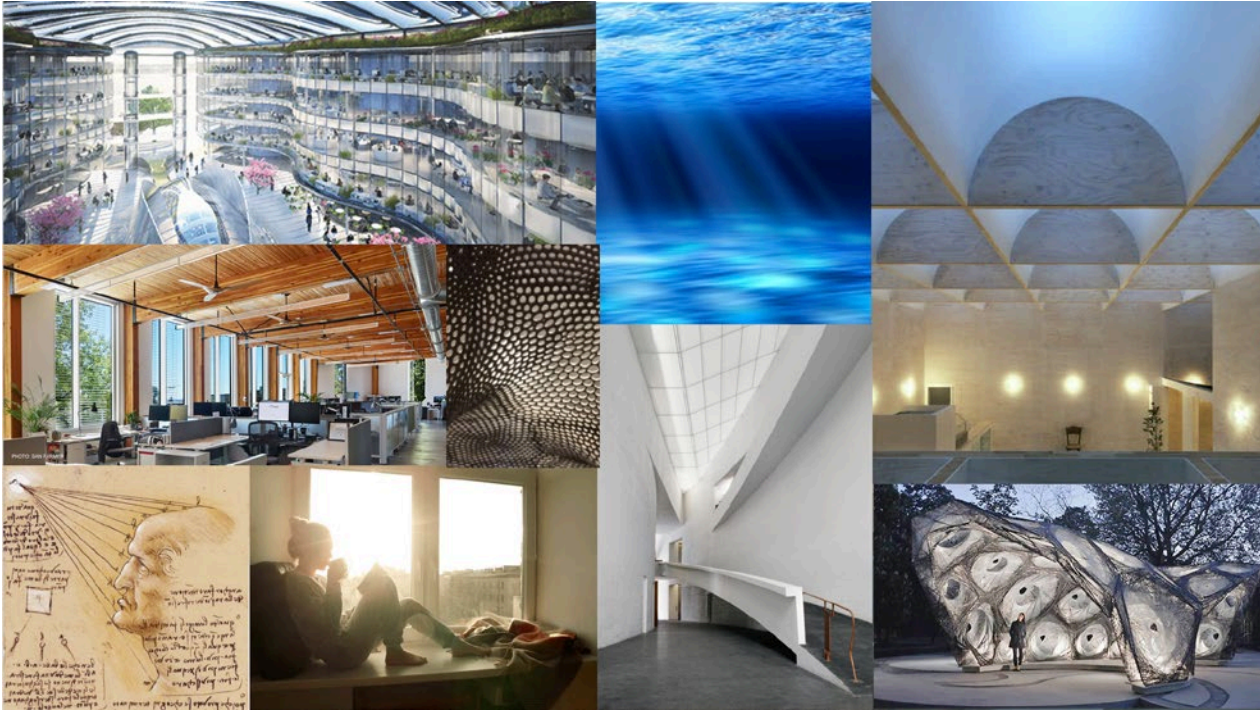
- Ubiquitous sensors
- Smart everything
- Big Data & Analytics
- AI
- Blockchain
- Advanced UI & UX

Implications

- Further siloization of architecture, engineering, construction and operation industries
- Less need for specialized lighting consultants
- Traditional distributors disappear
- New need for technicians with cross-disciplinary skills
- Declining consensus on standards
- Rapid commoditization of components
- Increasingly centralized power in the hands of private and semi-private corporations
- Declining innovation

Early Signs

- Sustained market churn – M&A musical chairs
- Traditional players selling off lighting businesses
- Entry of top tech firms into industry
- Rise of IoT
- Rapid commoditization of products
- Declining innovation in lighting



Scenario 4 Bioenlightenment

Narrative

Buildings evolve that are designed to make maximum use of daylight and allow electric lighting to be dramatically more efficient, effective, and beautiful. Time honored principles of architecture and biomimetic design converge in a new vision of sustainable architecture. Learning from nature is enhanced with the realization that humans are part of nature too, and that many other species offer innovative and useful design solutions to architecture, specifically how it can deliver optimal light.

Drivers

- Resilience
- Climate adaptation
- Biomimetic Design
- Health & Productivity
- Circular Economy
- Security
- Safety
- Energy Efficiency
- Lifecycle Impact Assessment
- Daylight & Views

Tech Stack

- Synbio (Synthetic Biology)
- Advanced Materials
- Generative/Parametric Design tools
- Advanced storage + renewables + smart grid
- LEDs
- AI & Machine learning

- Advanced sensors & Actuators
- Data Analytics
- Advanced integrated controls
- Dynamic Daylight Controls
- Blockchain

Implications

Lighting acquires a new significance as it reclaims its position as a primary driver for architectural form. Architecture, engineering, and construction disciplines become more integrated. A new focus on biological science informs design. We develop a better understanding of interconnections between lighting and other building systems, including HVAC. Emerging technology in glazing materials also impact performance of photovoltaic systems.

Early Signs

- Emerging prototype biomimetic buildings
- Advanced glazing and designs developed at Harvard Graduate School of Design
- Biomimetic design research projects at major universities
- Increasing interest in daylight and views
- Increased interest in generative and resilient design
- Developments in advanced glazing materials and systems

Resources

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