

Delivering real solutions while dealing with new levels of LED technology complexity

Spec it Forward

HOWARD YAPHE, CEO, Axis Lighting

November 7th, 2013

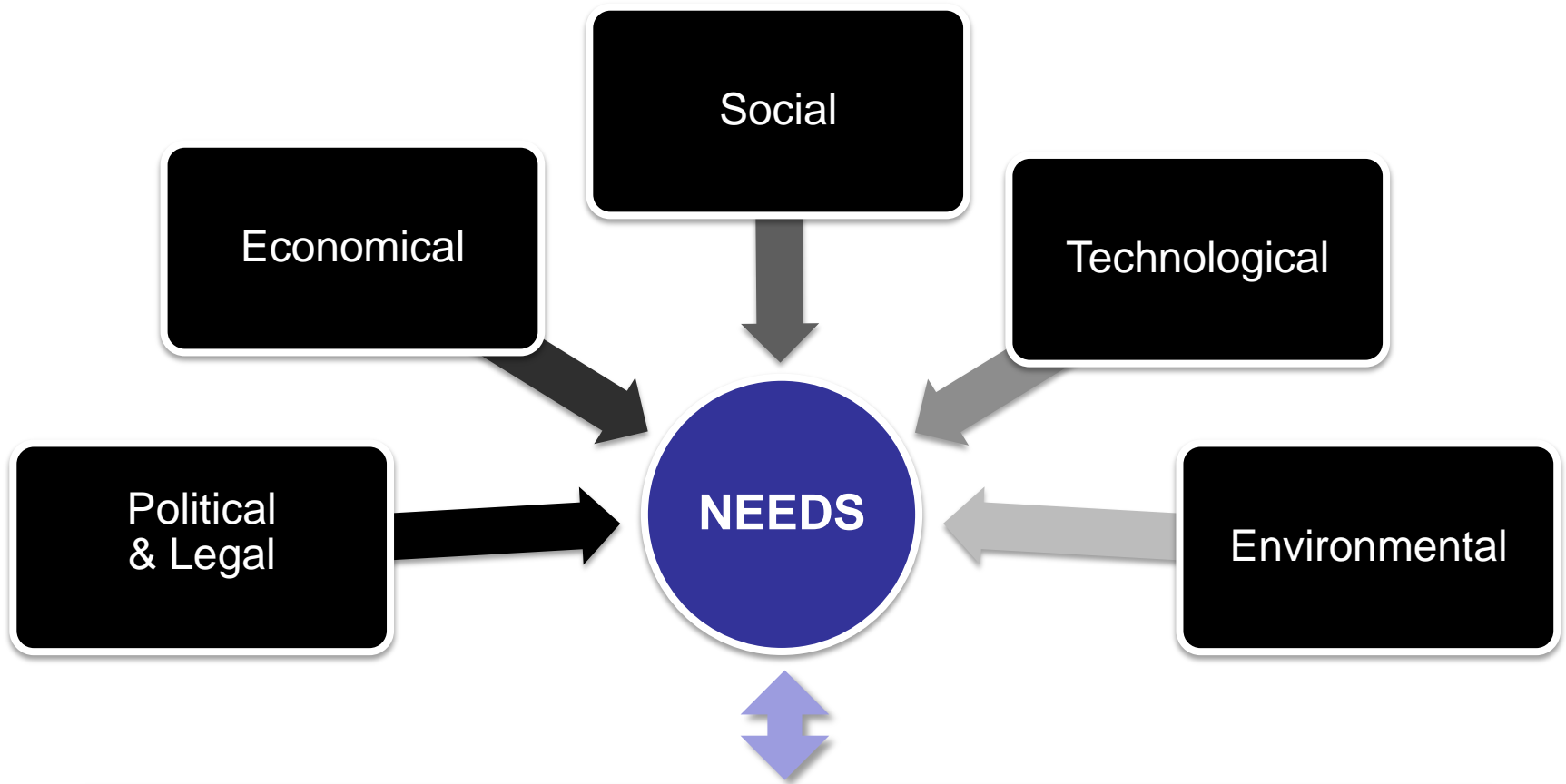


Advancing Lighting Design

- ``good Design is Good Business``
 - Thomas Watson Jr. former chairman and CEO IBM (1975)

- ``Good Lighting design value is Good Business``

EXTERNAL FACTORS



- ✓ Architect
- ✓ Lighting designer
- ✓ Interior designer
- ✓ Electrical engineer
- ✓ Mechanical engineer
- ✓ Contractor
- ✓ Distributor
- ✓ Manufacturer
- ✓ Owner / Tenant

Have you ever been faced with **discontinued product specified** by the time ground was broken?

Has a **better technology suddenly became available**, but it was too late to change the specification?

Has your client ever changed their mind?

Have you ever had a building take so long to build that the **code changes** affected the lighting design (or the customer decided to go for LEED in mid process)?

Have you ever seen **a spec change from LED to a conventional source** – or reverse?

CONSTRUCTION OF BUILDINGS IS A LONG PROCESS; IT CAN TAKE YEARS

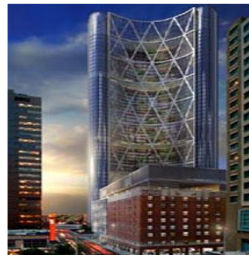


Apple delays construction of Campus 2 because of budget increase



Lawsuits alleging environmental risks delayed construction of Baltimore's casino

Calgary's EnCana building deferred the South block due to the slow down economy



Workers strike & political battles of a new hospital in Montreal caused delays in planning and construction



New Earthquake Laws hit Dubai, affecting building projects on the drawing table



The Empire State building, no construction delays

BIG VARIATION IN CONSTRUCTION TIMES

SKY ONE



0,3 year construction
+years in planning

BURJ KHALIFA

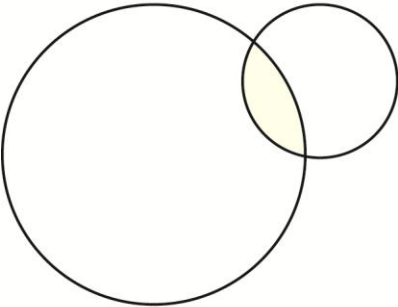


5,3 years
construction
+ planning

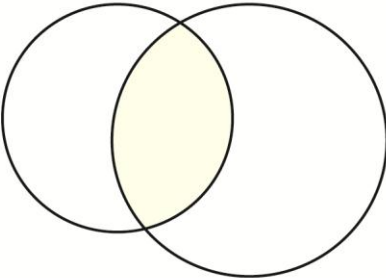


EVOLVING PERMUTATIONS

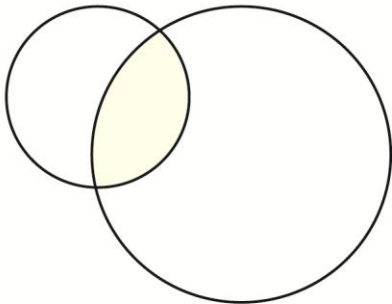
Event 1,2,3



Legislation 1,2,3



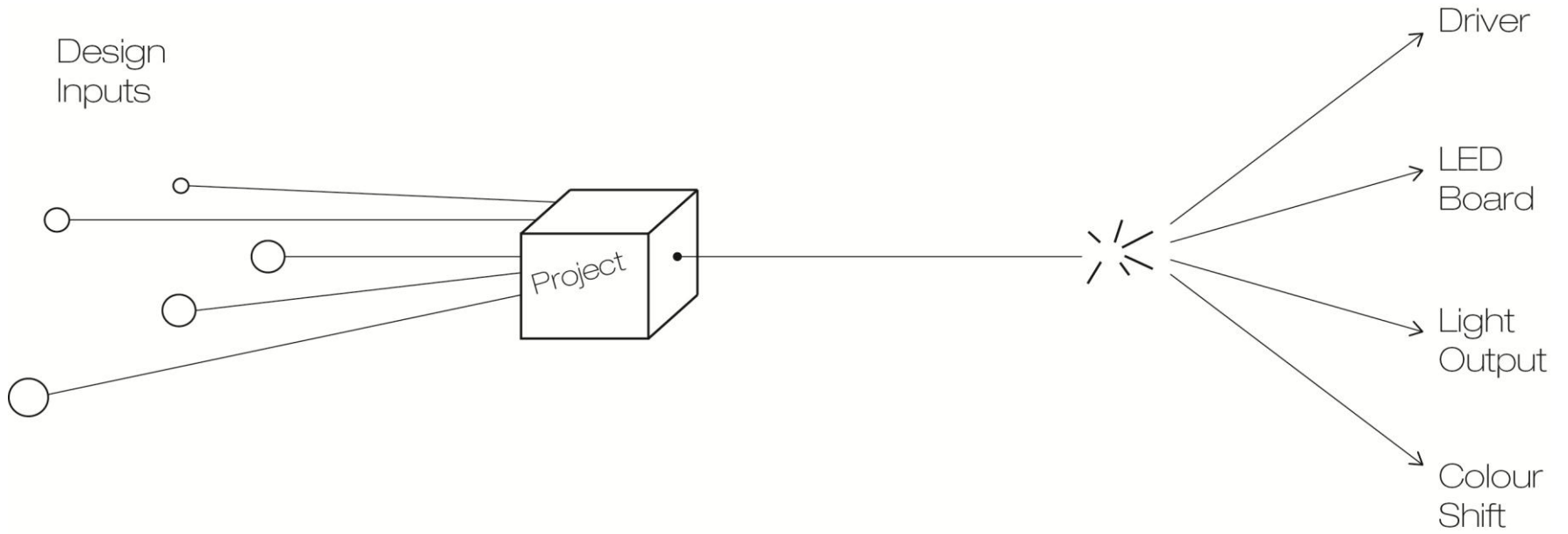
Technology 1,2,3



2013

2030

LIABILITY



Designer / Manufacturer Liability Over Time

HOW DO WE REINVENT CREATIVE TECHNIQUES?

PRIZE-WINNING PROJECTS: 2013 IALD AWARD WINNERS



RETAIL



INSTITUTIONAL



TRANSPORT



ENTERTAINMENT



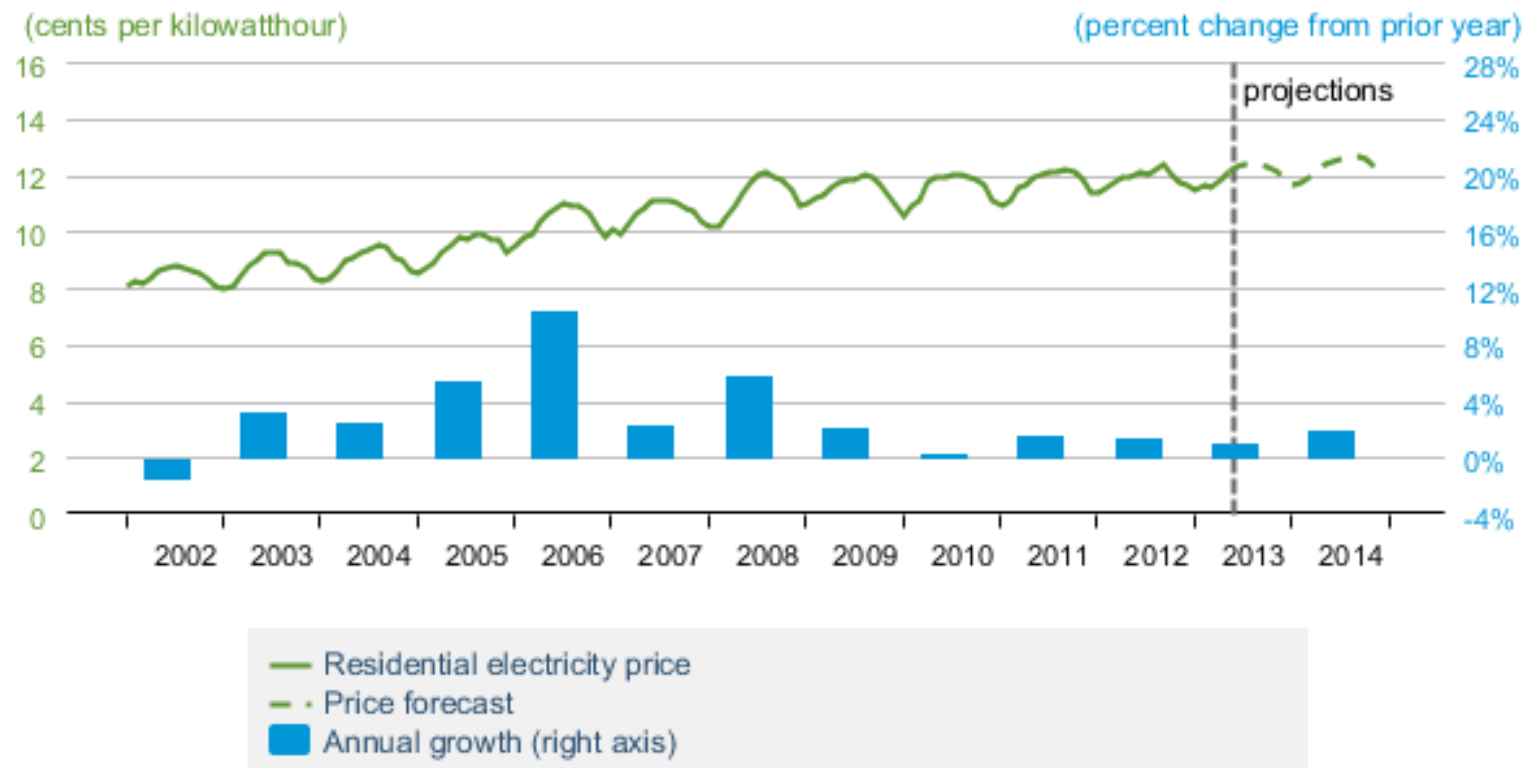
CIVIC



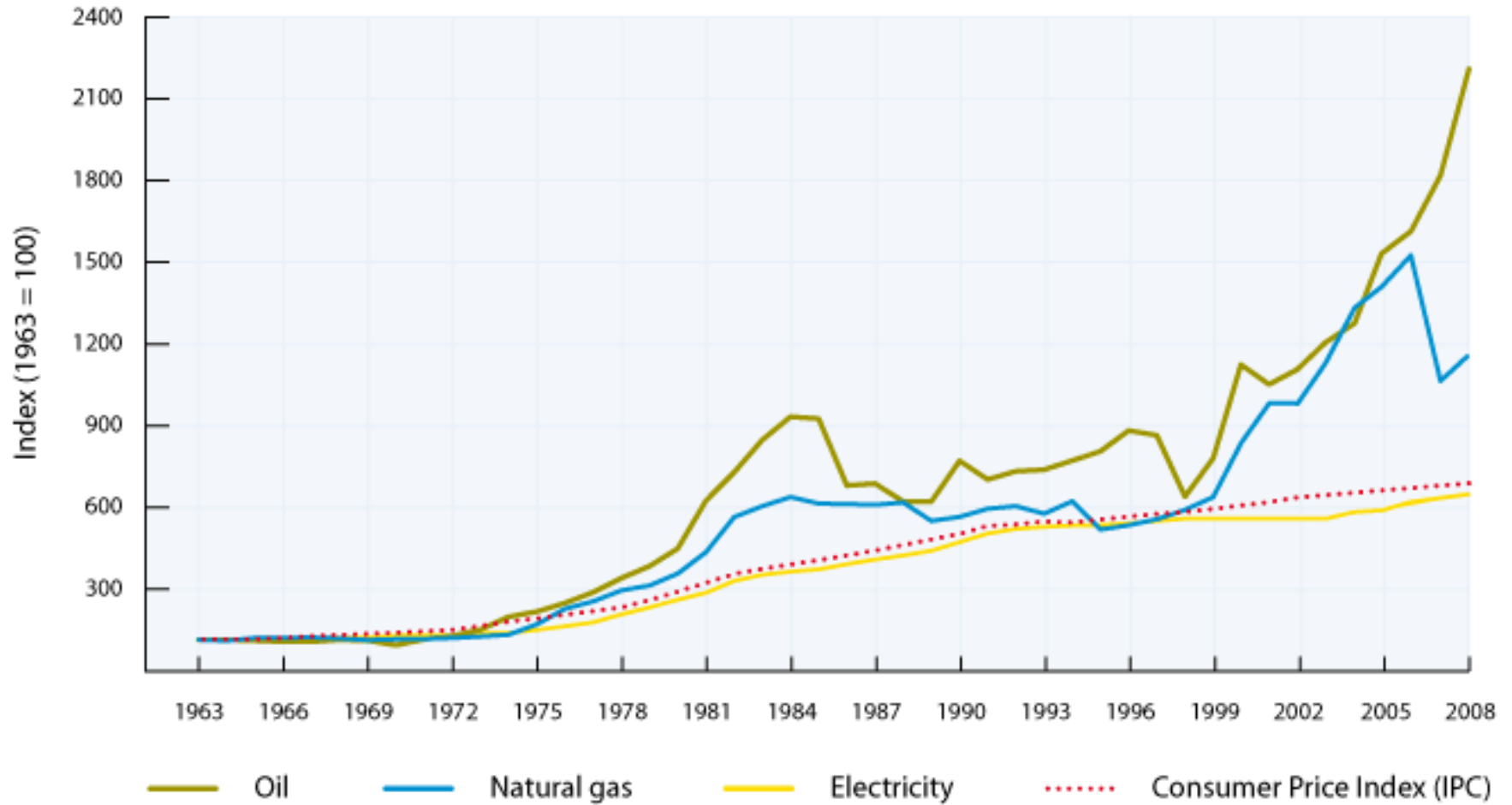
EXTERIOR

ENERGY PRICES ARE RISING

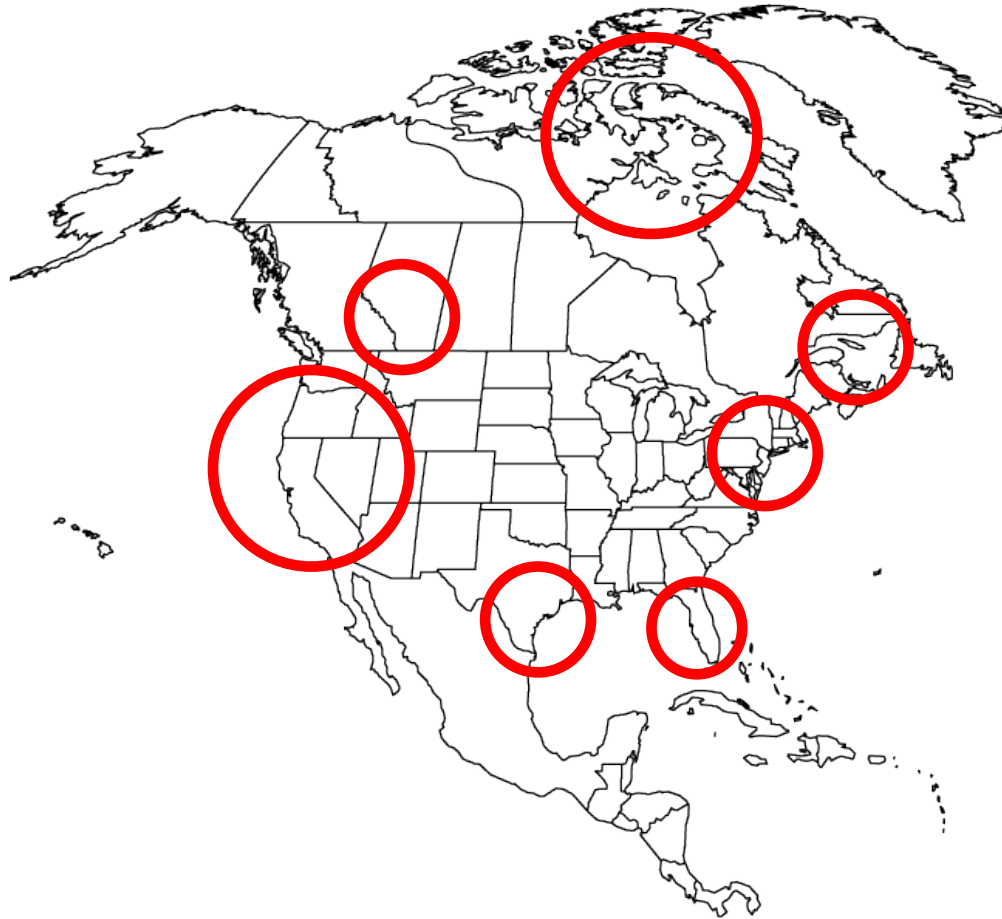
U.S. Residential Electricity Price



...EVEN IN QUEBEC



**ENERGY PRICES ARE RISING...
WHAT SHOULD WE DESIGN TO? WILL ALL BOATS RISE?**

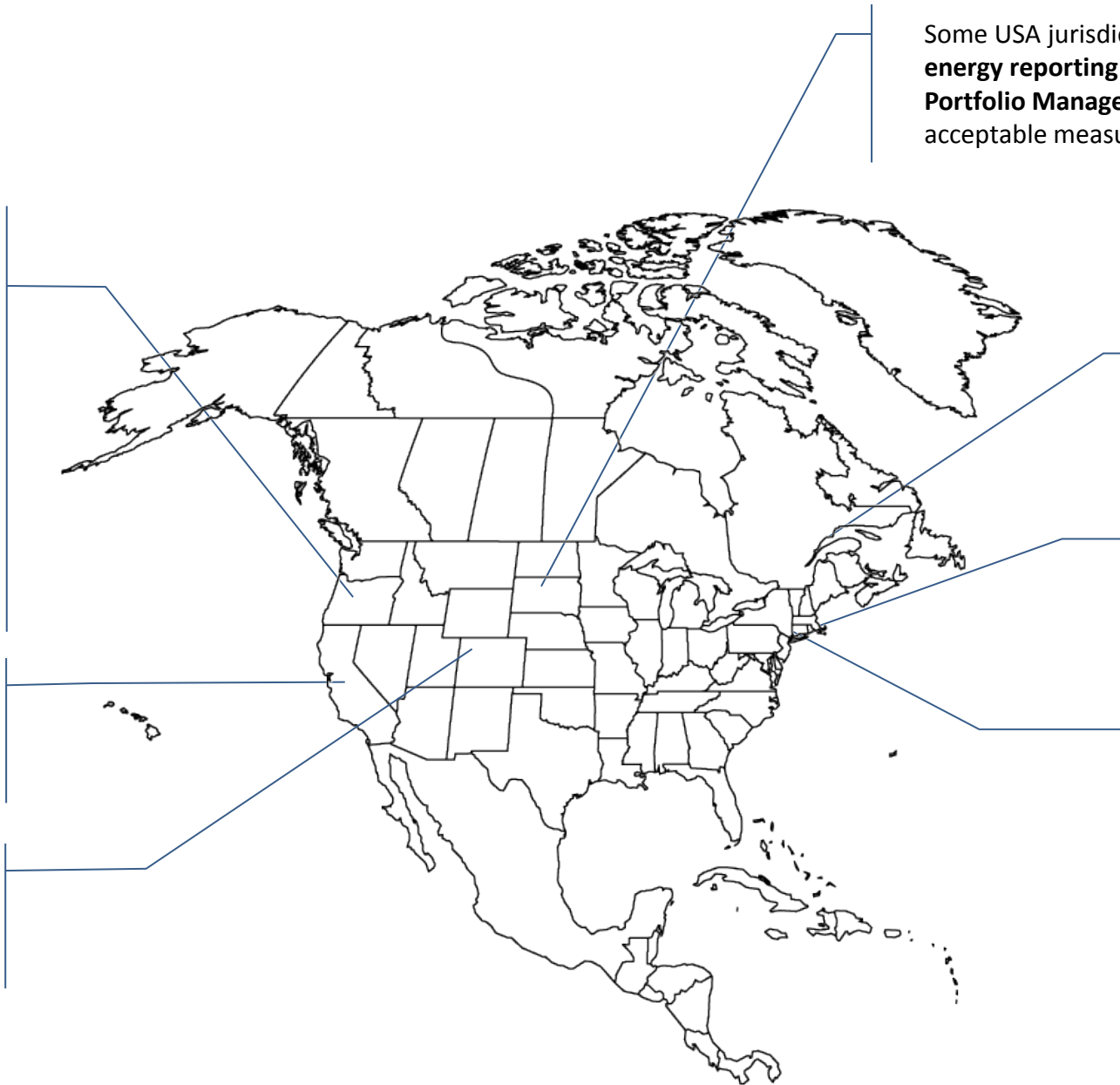


WHAT PRICE DO YOU SET ON ENERGY?

The 2010 Oregon Energy Efficiency Code, which applies to all new building and renovation projects requiring a building permit, is a local adaptation of the **IECC**

California has enacted the first **statewide green building code**

Carbon taxes (e.g. Boulder, Col. And San Francisco Bay's Clean Air Act)



Some USA jurisdictions require **energy reporting using EPA's Portfolio Manager** or another acceptable measure.

All new municipal buildings in Montreal will be certified **LEED**

USGBC's **LEED** certification mandatory in Massachusetts

Some state and local governments have **energy reduction mandates** (e.g., NYC).

CODES WILL CONTINUE FORCING ENERGY DECREASE... DOWN TO ZERO

The **DOE** goal is to reduce energy consumption of commercial buildings by 70%.

All states must have an energy code as stringent as **ASHRAE 90.1-2010**

Increasingly, jurisdictions are requiring USGBC's **LEED** certification

ASHRAE 90.1 is providing guidance for NZB in 2020 in NA

International Green Construction Code (IGCC) encourages the practices which move toward NZB and that are beyond LEED.

IGCC allows jurisdictions to choose ASHRAE 189.1 (**High-Performance Green Buildings Except Low-Rise Residential Buildings**), the 1st comprehensive green standard written in mandatory code language.

Architecture 2030 pushes for near NZB with its Challenge 2030

THE 2030 CHALLENGE OF NEAR NET ZERO HAS BEEN ADOPTED BY...

States + individual cities (US Conference of Mayors – USCM)

American Institute of Architects - AIA

US Green Building Council - USGBC

American Society of Heating, Refrigerating and Air-Conditioning Engineers -
ASHRAE (supporter)

For all new and renovated federal buildings

**THE 2030 CHALLENGE TARGETS ARE FOR THE
YEAR OF THE PROJECT'S COMPLETION OF
DESIGN, NOT THE YEAR THAT THE PROJECT
BEGINS INITIAL DESIGN.**



**THE 2030 CHALLENGE NEAR NET ZERO GOAL IS POSSIBLE.
GOAL OF 50 KWH/M2**

	Average	Better	Best
Lighting	59	33	13
Heating	105	38	20
Plug load	55	27	21
Exterior	23	3	1
Pumps	22	23	10
Cooling	10	10	3
Total	274	134	68



Enermodal head office (Ontario, Canada)
68 kwh/m2
(triple leed platinum building)
and close to the 50 kwh/m2
required for net zero projects.

Lighting Design Value Propositions

New ways to be more relevant to the design community

- **Forward-Looking Innovation**
 - Equipping Systems with the latest and most worthwhile technologies
 - Being relevant today and tomorrow.
 - Inspiring design teams to surpass the benchmarks set by our government agencies, in a design language supported by the architectural and engineering community.
 - Always innovating towards Net Zero Integrated design philosophies
 - **Innovating for the future**

DO WE NEED A NEW DESIGNER OWNER CONVERSATION?

INITIAL PRICE



ENERGY SAVINGS



INSTALLATION & MAINTENANCES



ADDED REVENUES



RISK HEDGE INNOVATIVE

RISK

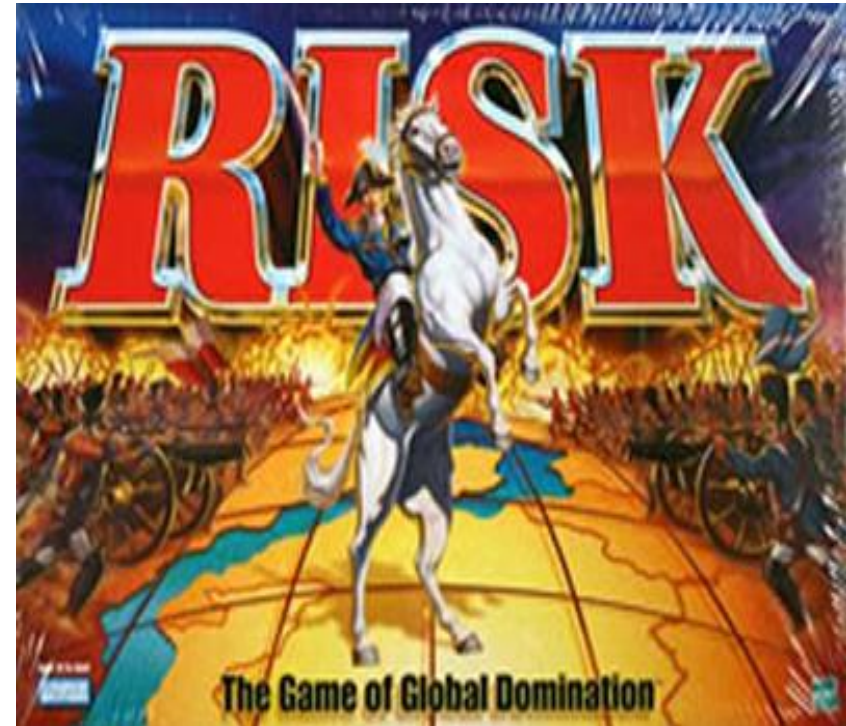
noun \ˈrisk\: the possibility that something bad or unpleasant (such as an injury or a loss) will happen

HEDGE

noun \ˈhej\: *intransitive verb* **b**: to minimize the risk of a bet

IN-NO-VATE

verb \ˈi-nə-, vāt\: to do something in a new way: to have new ideas about how something can be done



HOW TO KEEP PACE? RISK!

OLD MODEL OF PRACTICE



NEW MODEL OF PRACTICE



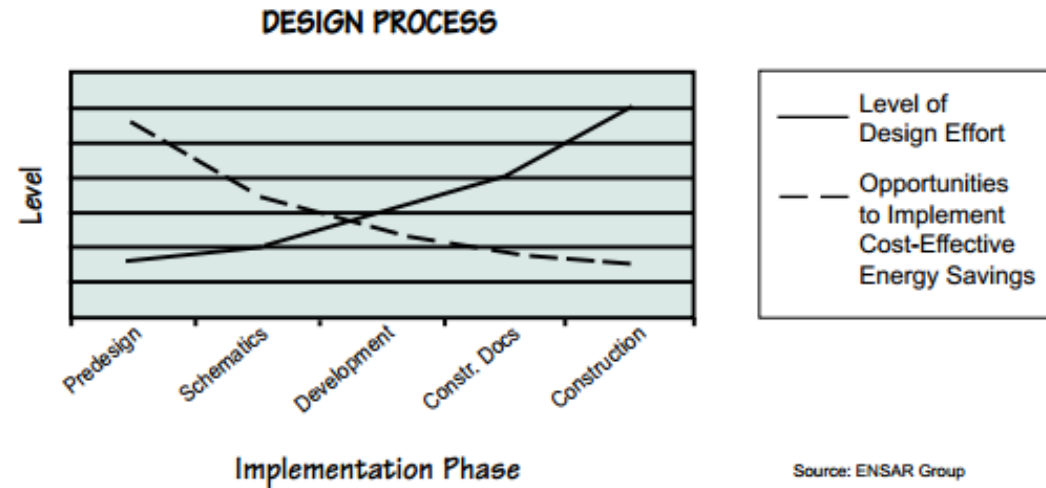
**WHAT RISKS IS YOUR PRACTICE
WILLING TO TAKE? WHY?**

DO WE EMBRACE AN INTEGRATED DESIGN APPROACH?

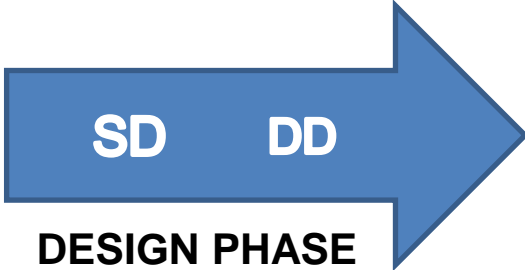
Normal design process is linear.

With sustainability issues and intelligent technology, everything interrelates.

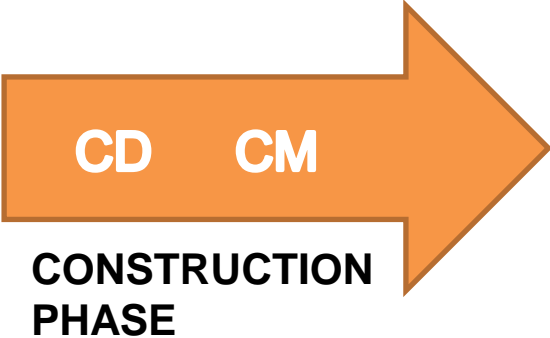
A team approach is better suited to overcome new building design challenges.



CROSSING THE RUBICON*



SPEC-LINE

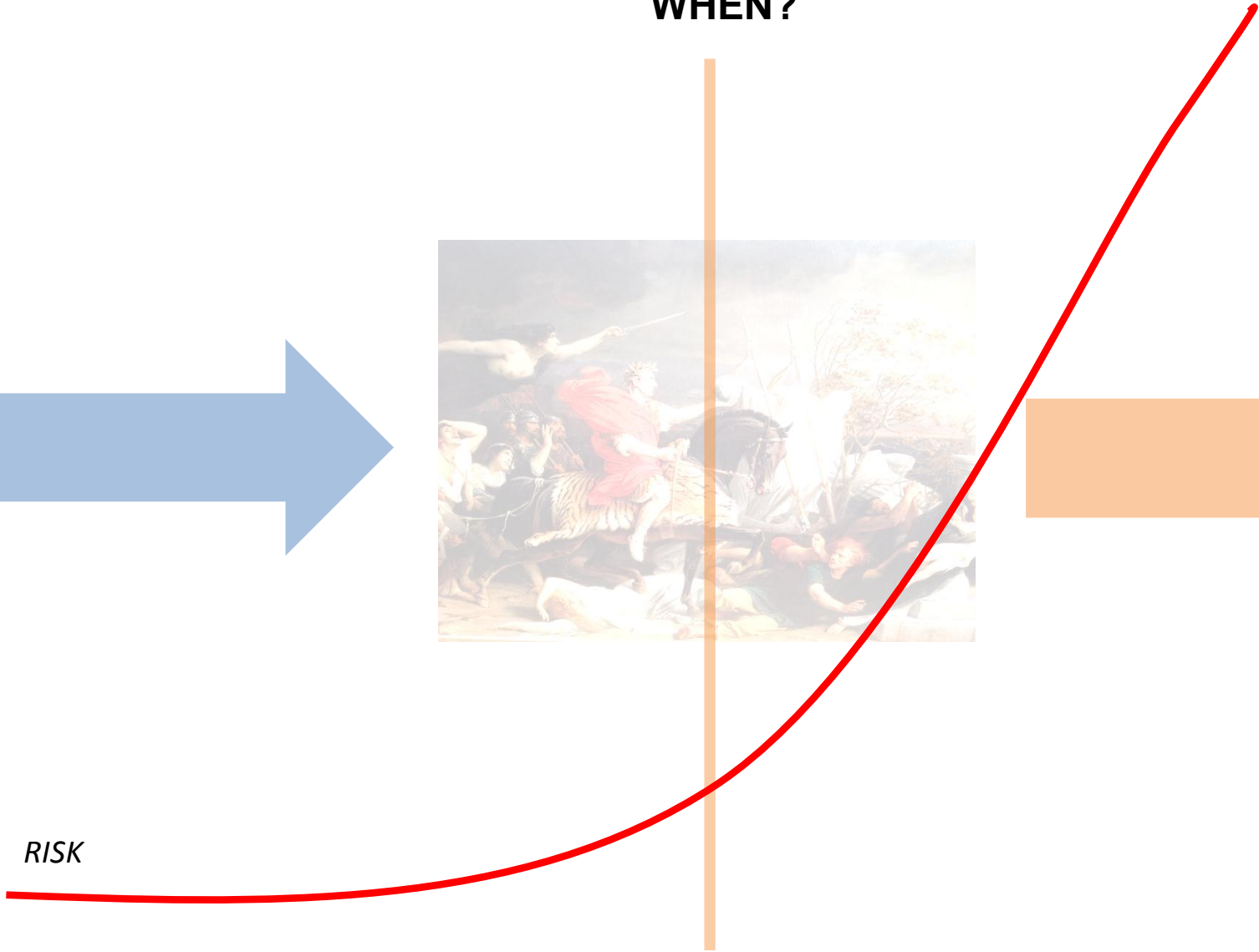


* Or the Delaware, if you are American

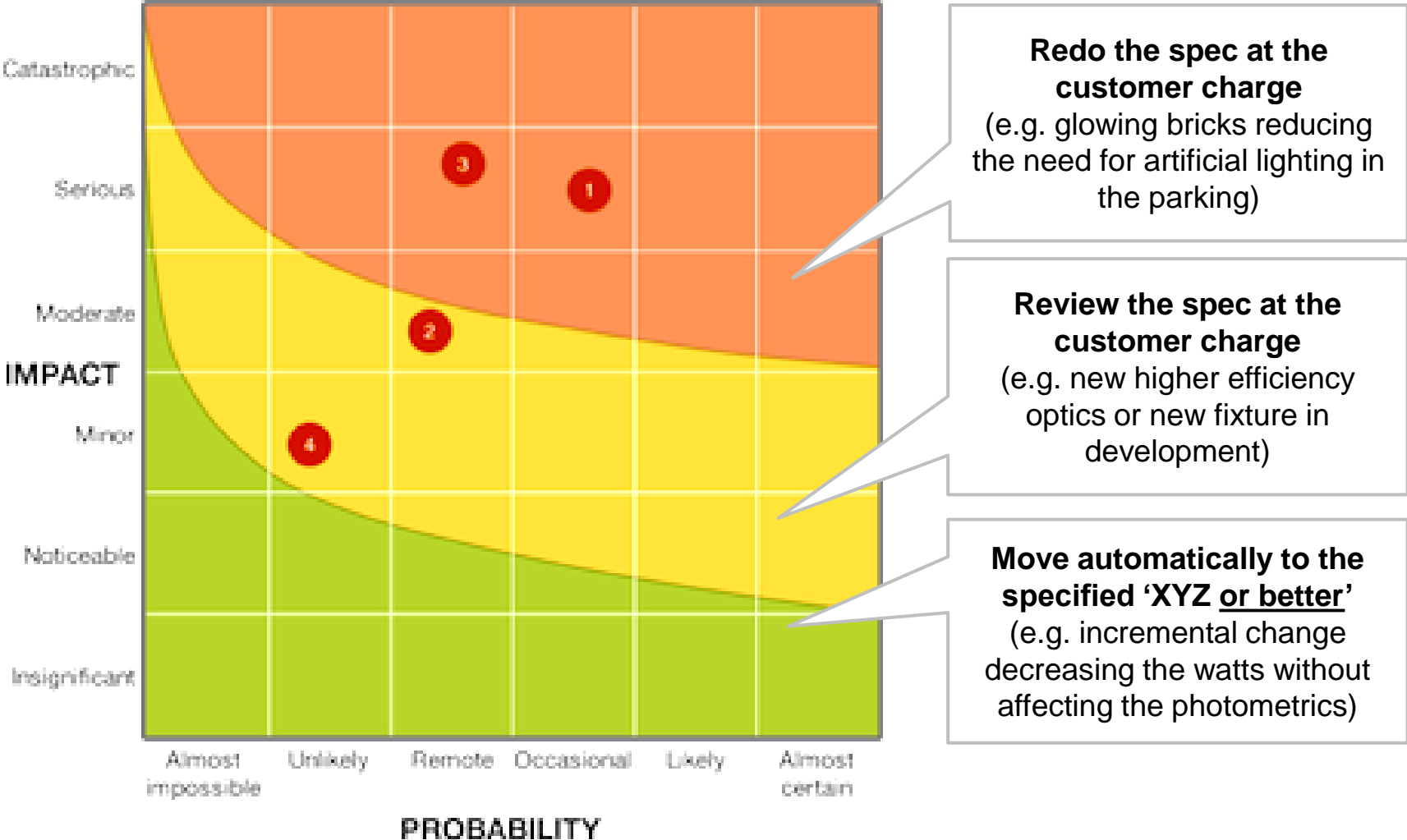
WHEN?



RISK



EVALUATE YOUR RISKS AND OPPORTUNITIES



DOWNSIDE OF RISK FOR EARLY ADOPTERS

DESIGNER

Reputation: of practitioner and profession

Adopting too soon on development curve:
inherent shortcomings of products

Loss of performance over time: colour
shift, output, component failure

MANUFACTURER

Reputation

Product failure and servicing cost
Investment cost of tooling and R&D

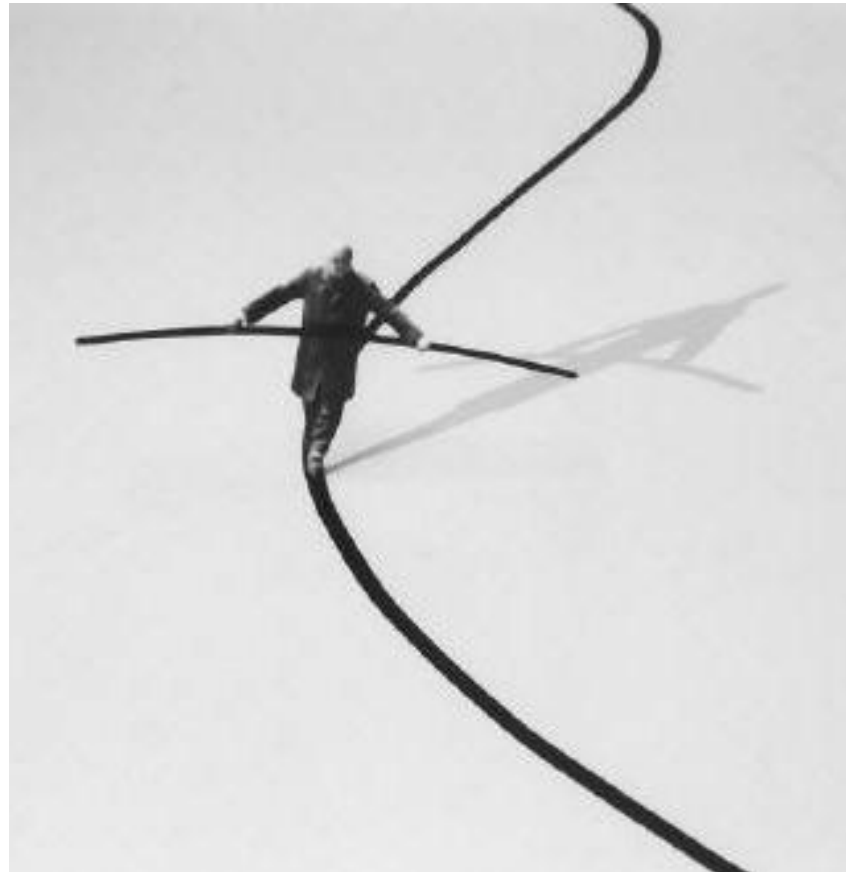
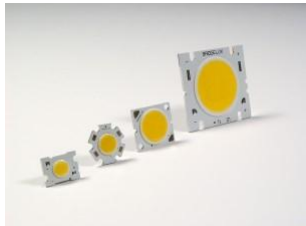
Cost of supporting divergent
technologies



DOES IT PAY TO BE AN EARLY ADOPTER?

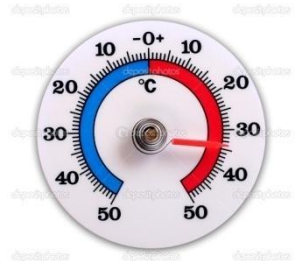
KEEPING CONTROL

Control
the Product



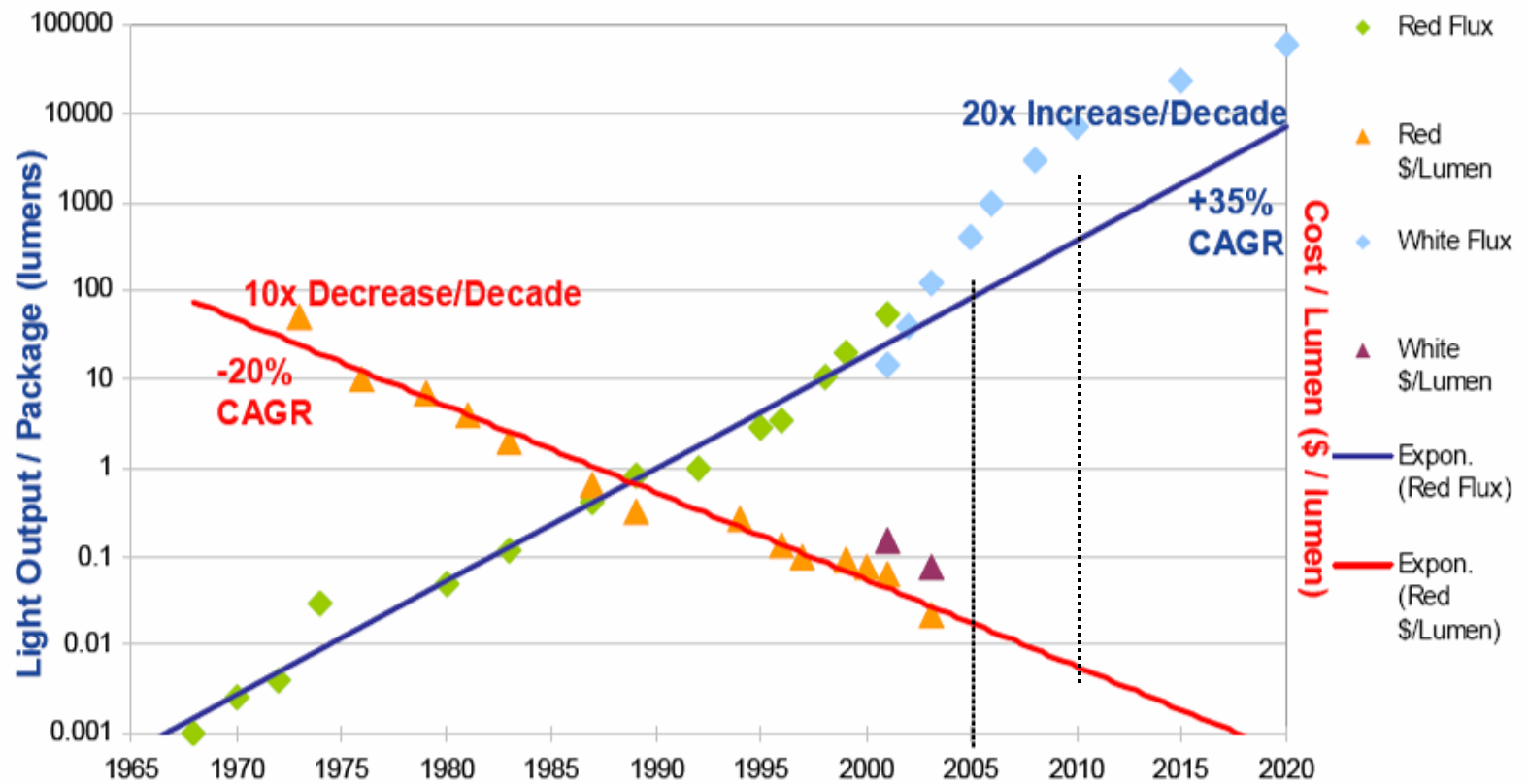
Control the Complexity....

Control for
the context



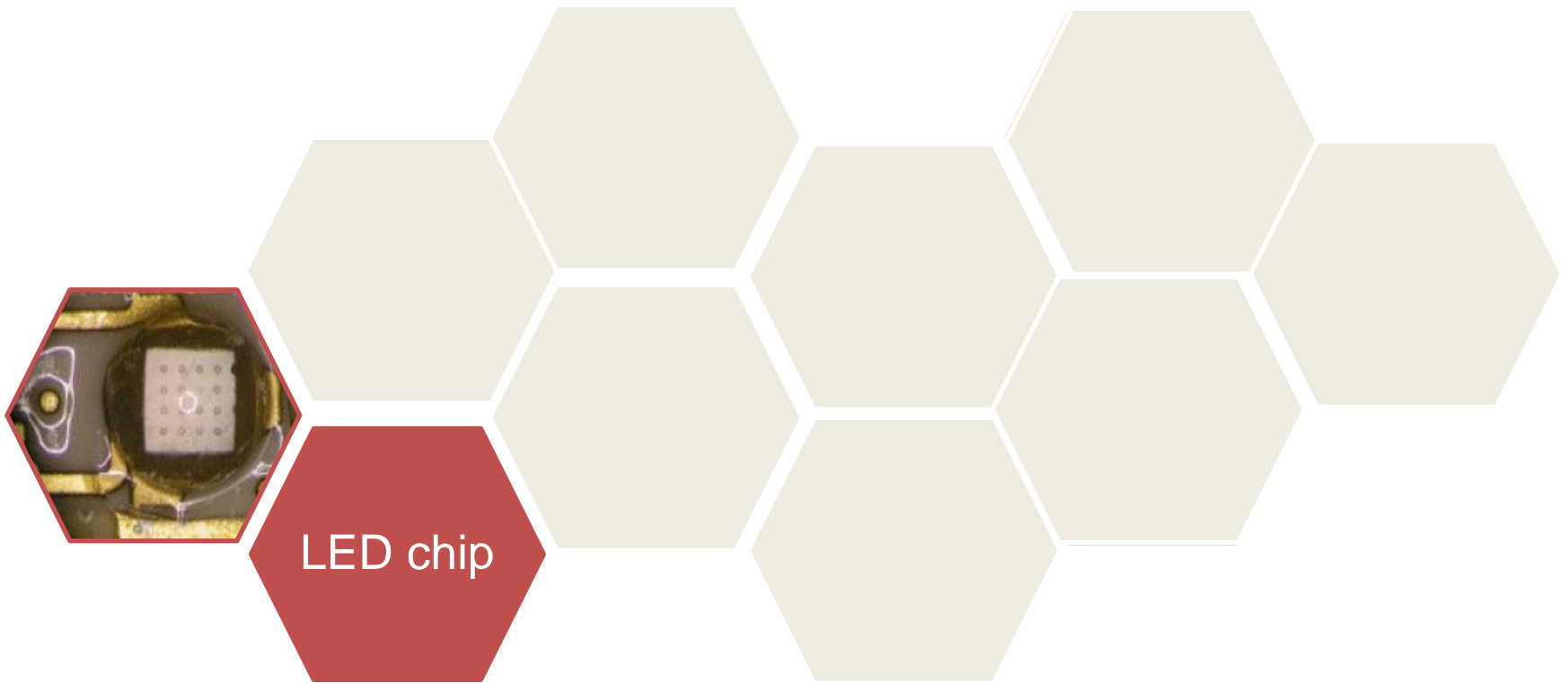
LED COSTS WITH DECREASE BY A FACTOR OF 10 EACH DECADE LED EFFICACY INCREASE BY A FACTOR OF 20 EACH DECADE

Haitz's Law



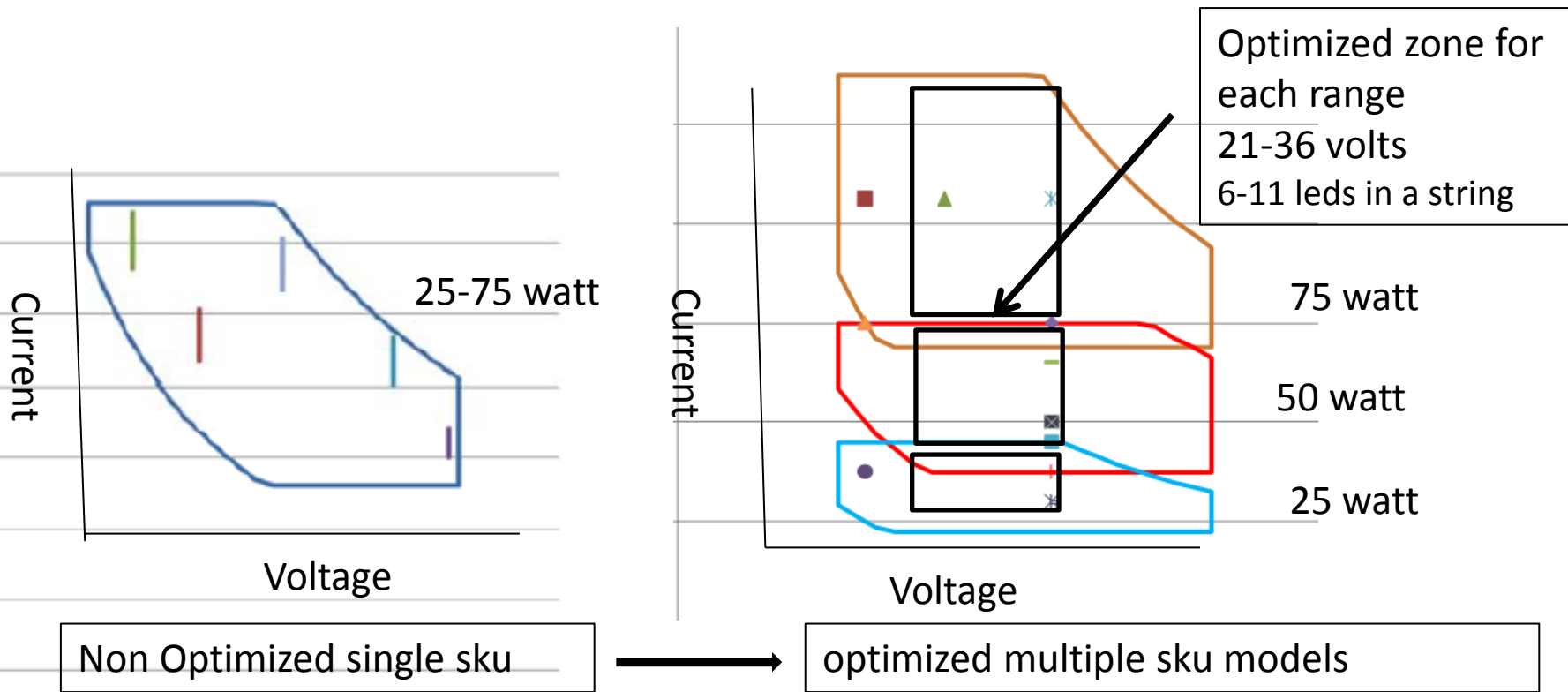
Integrated design at the manufacturer level

(DFMA) Design for Manufacturing and Assembly



Optimizing driver performance.

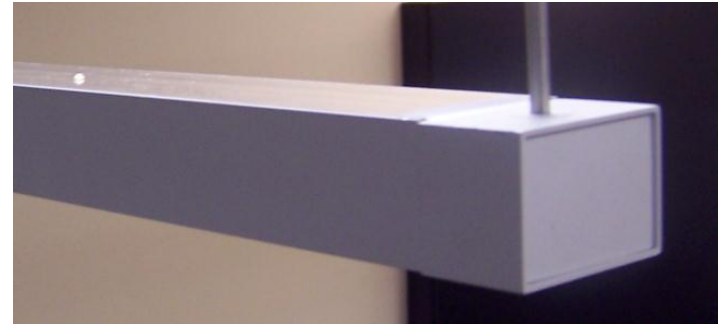
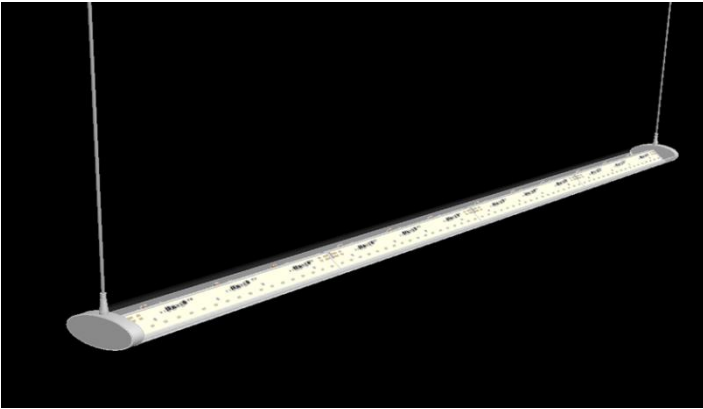
- A new driver class based on optimized operating ranges



A new optimized specifiable model based on ideal operating ranges

Creating new driver form and function model

- new architectural paradigms
 - A new miniature pencil driver provides next generation form and function leading the way for new driver architecture.

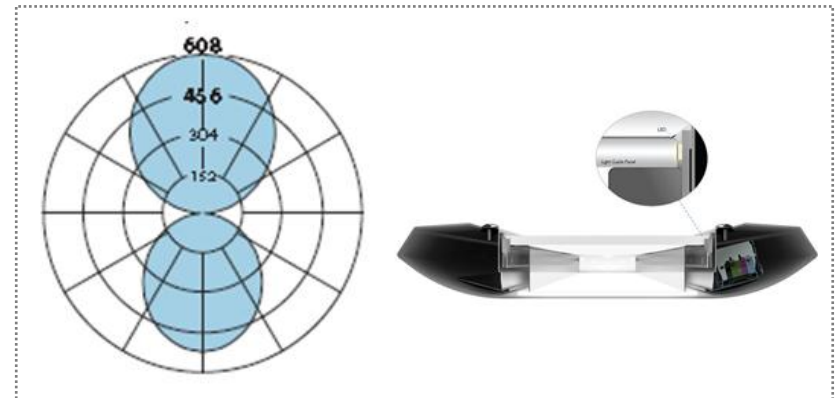
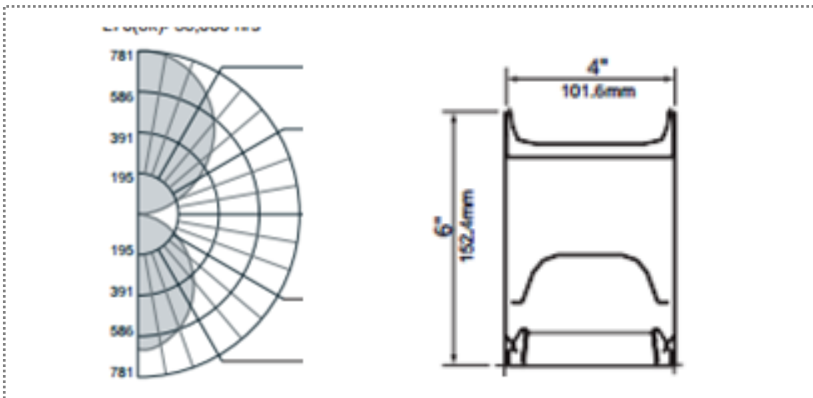
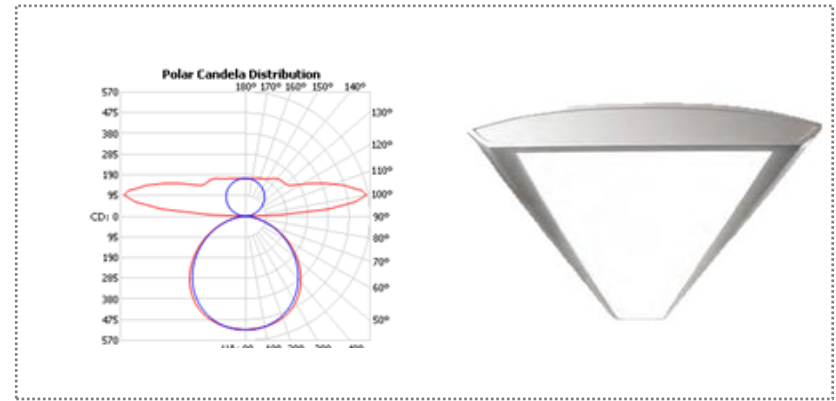
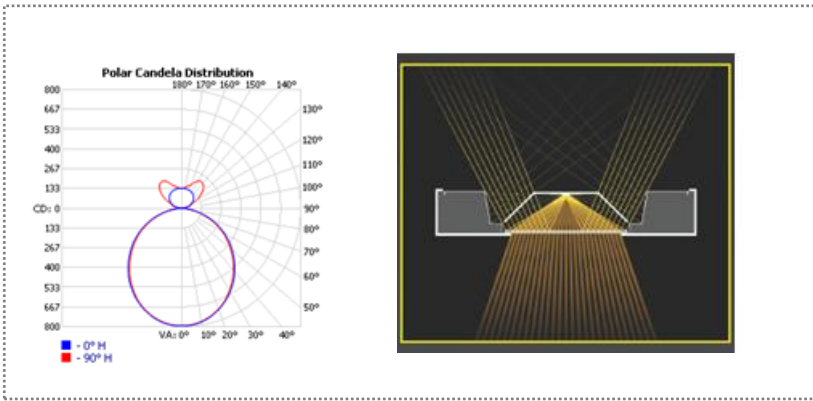


5/8``x 5/8``x 11`` driver form enabling the next generation of led design

DEALING WITH NEW COMPLEXITY: OPTICS

EG: DIRECT/INDIRECT OPTICAL SYSTEMS

Different optical technologies for the same specification

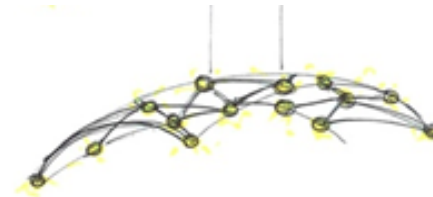


DEALING WITH COMPLEXITY: NEW LIGHT FORMS

TECHNOLOGIES CREATING NEW FORM AND FUNCTION



Embeds LED's in
the mould to
create light
volumes.



360 degrees
of light. Light
is visible from
any view
angle.



Flexible light source
that can be easily
integrated in surfaces.
A "flexible light guide".



A 2D surface as a light
source which is composed
of various connecting
elements that have some
degree of freedom
when moving three
dimensionally.

HOW DO WE REINVENT CREATIVE TECHNIQUES?

Can we make existing techniques more efficient?



Decorative luminaires



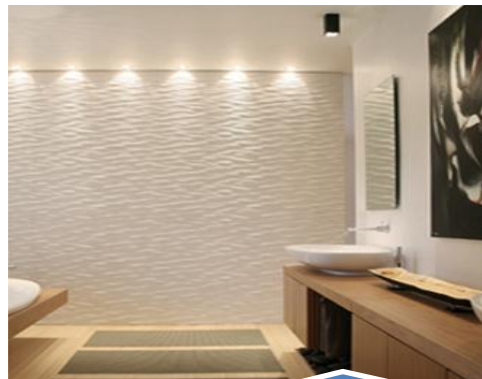
Lines of Light



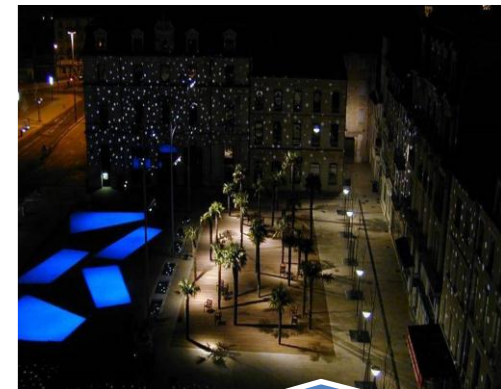
Point/plane
source ideas



Luminous surfaces



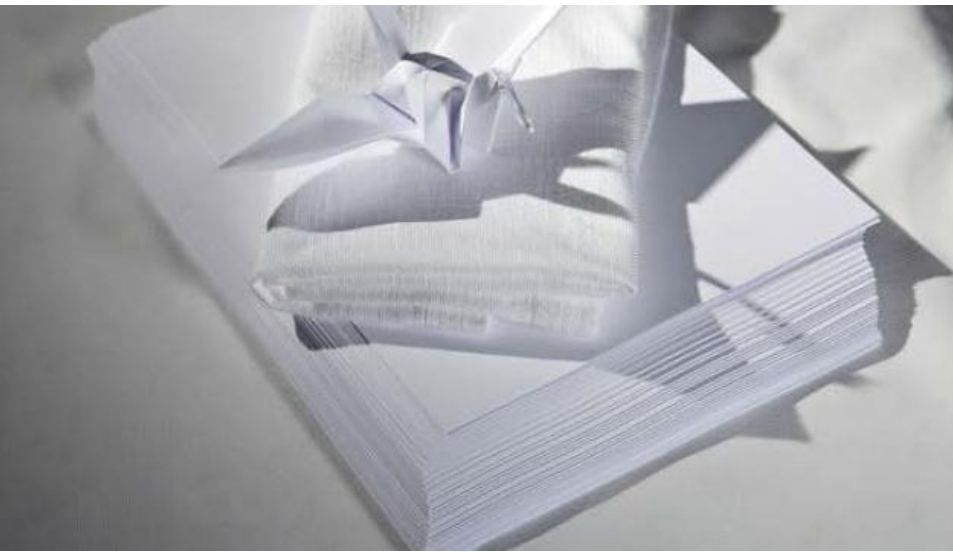
Perimeter lighting



Gobos

WHAT'S HAPPENING TO WHITE?

Dynamic white: tuning spectral samples
Saturation values by subject
Colour shift over time



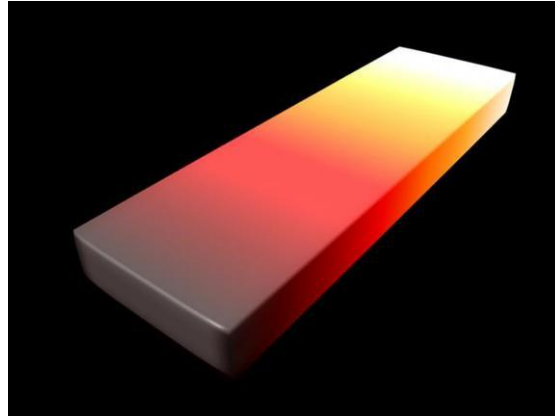
PSYCHOLOGICAL PRECONCEPTIONS

Are we dealing with an objective and
immutable baseline,
or a shifting point of reference?

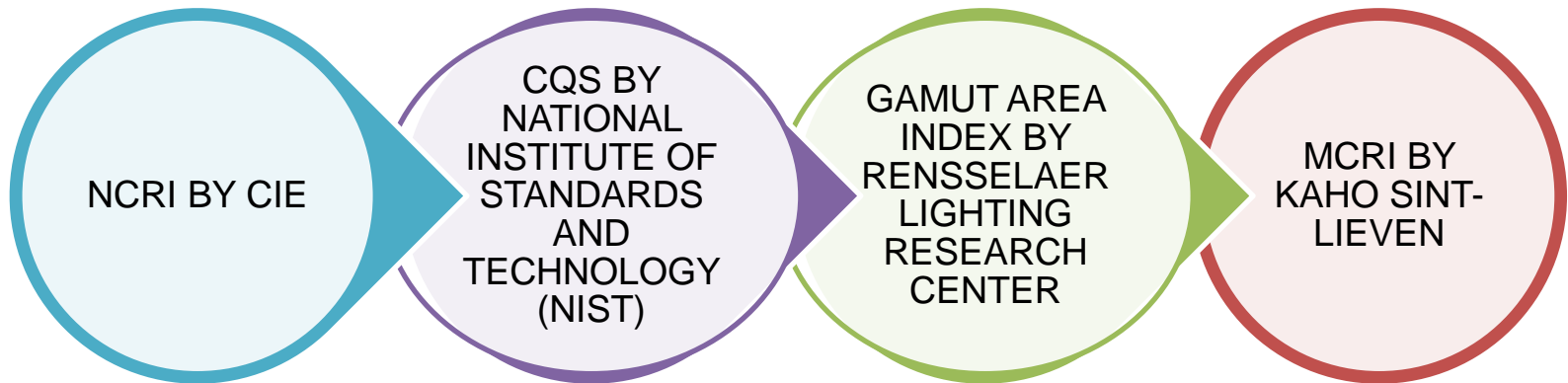
Cultural
Environmental
Task related



LEGACY METRICS HAVE EVOLVED



CRI & CCT



**SHOULD WE AGREE ON NEW METRICS
OR IS IT DESIGNER/CASE SPECIFIC?**

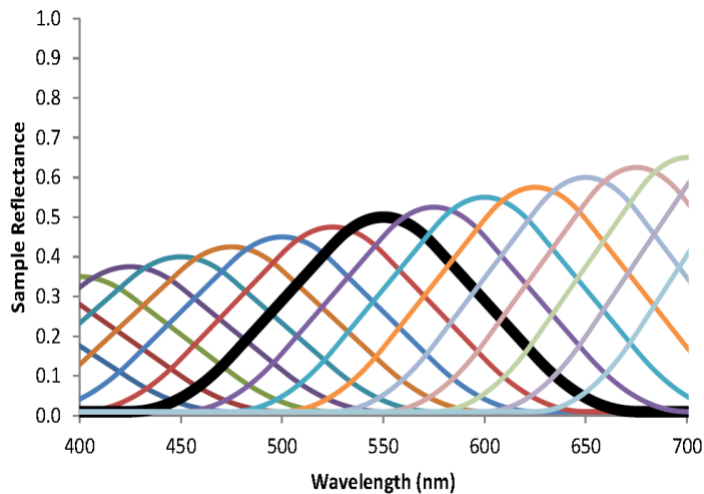
LORNE WHITEHEAD – EVOLVING CRI MODEL

Context dependant colour rendering

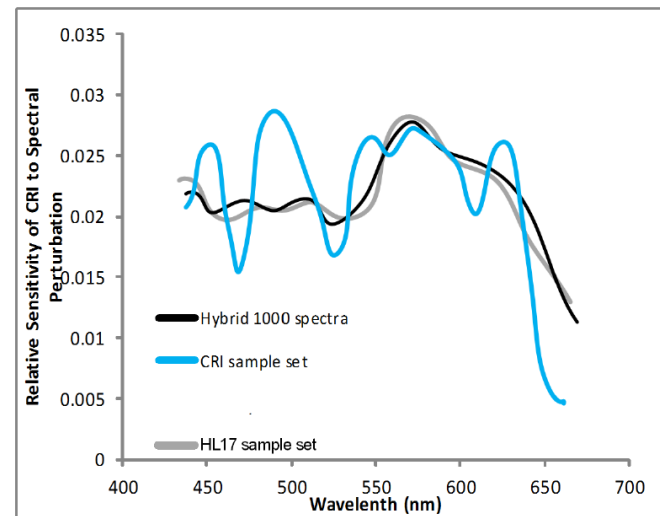
Efficiency vs. rendering trade-off

Quantity vs. quality debate

Improved spectral sample set / reference –
smooth spectral feature shifts



HL17 Spectral Set



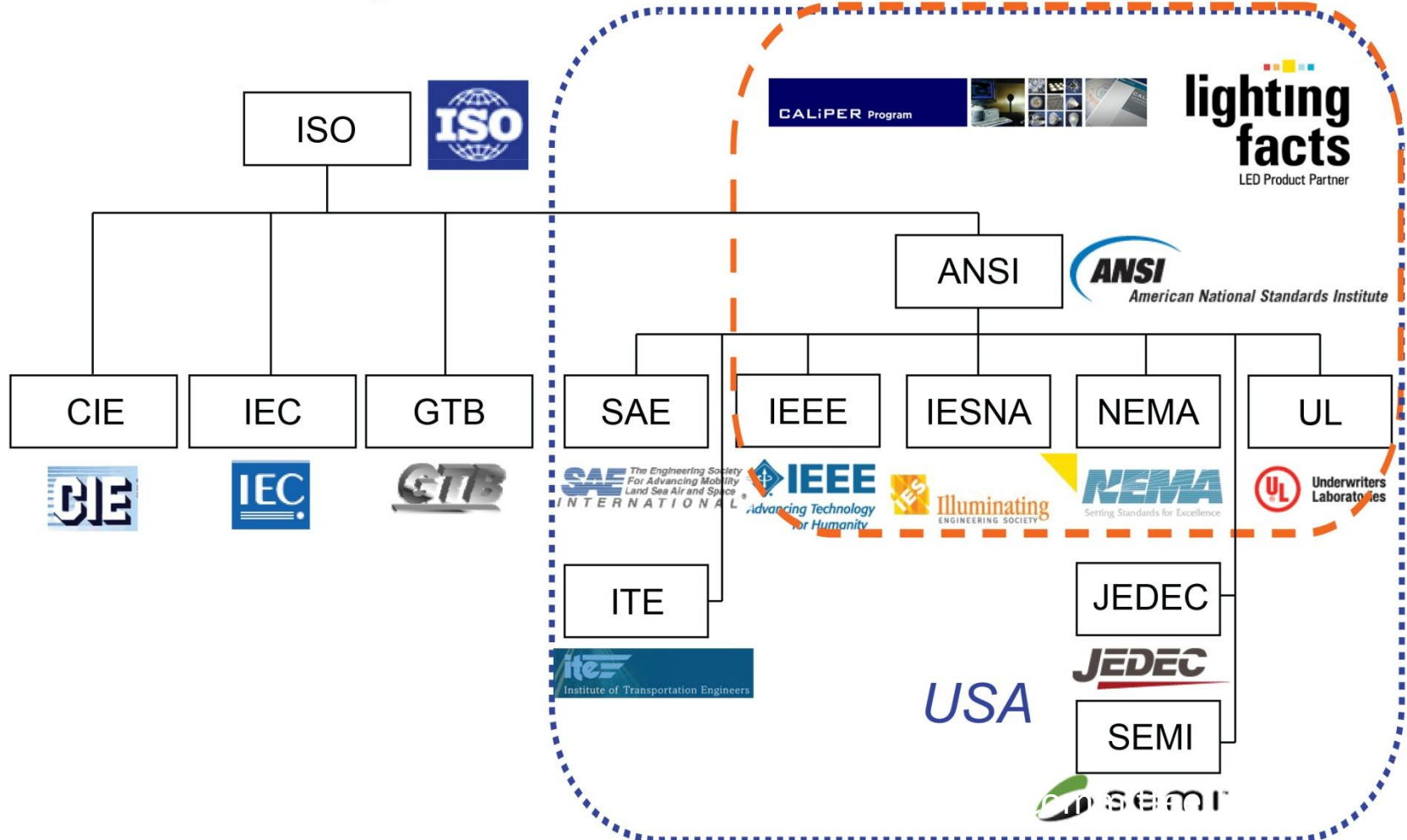
Sensitivity of CRI to Perturbations vs. Wavelength

WHO DEFINES THIS?

WHO MEASURES THIS ANYWAY?

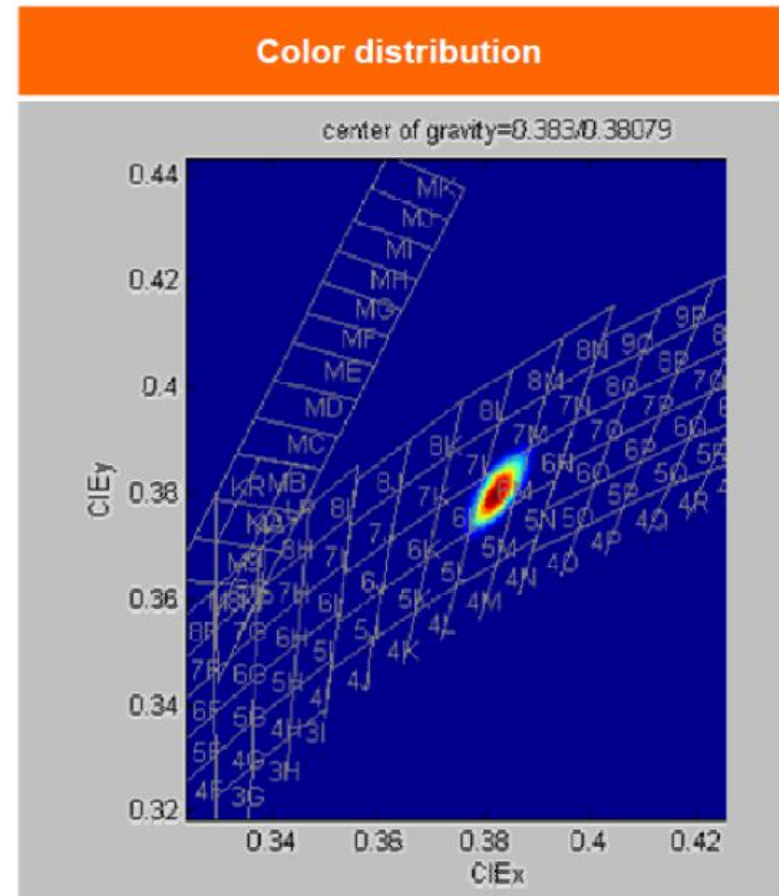
U.S. Standard Organizations

General Lighting



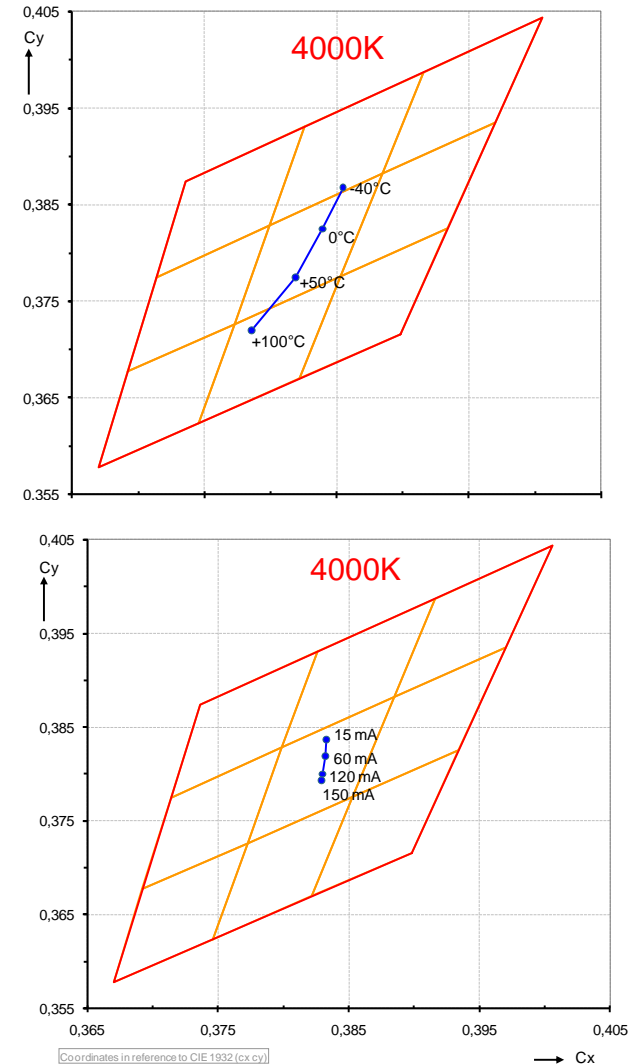
How to achieve High Color Tolerance

- Each sub bin is 2-step McAdams ellipse not including the corner of the bin and 3 step including all the bin.
- 2-step McAdam ellipse at 3000K is equivalent to $\pm 60\text{K}$ (2940-3060K) and can't be perceived by the human eye
- 3-step is the new standard to achieve high color stability over time
- Color stability within and in between luminaires



Stable Color Properties

- How to support applications over a broad range of light outputs
- How to support LED technology that is stable over all range of drive currents used and temperatures



Mid Power (~1W)

High Power (1W~)

DEALING WITH NEW COMPLEXITY:

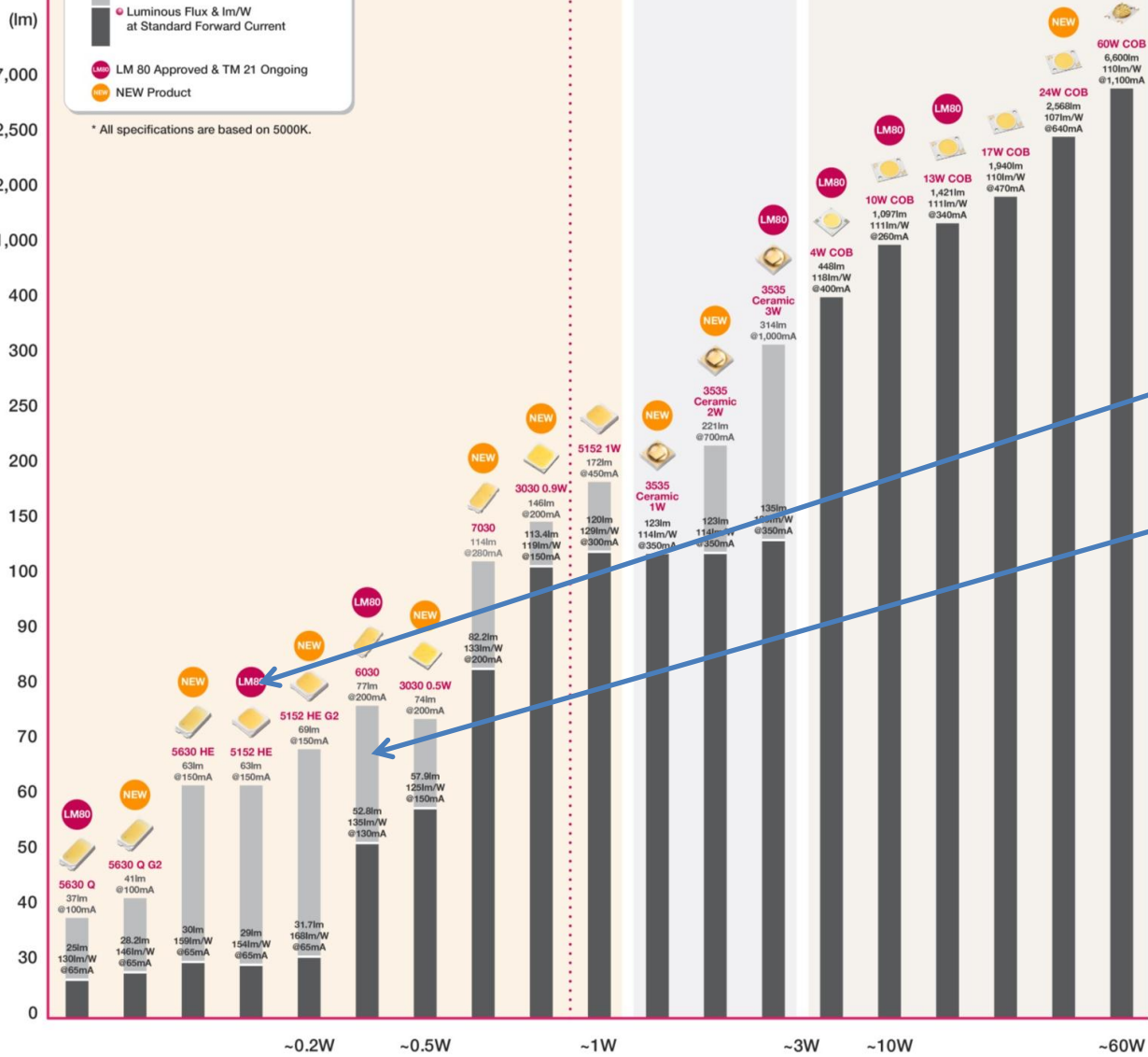
Lead Frame Type

Ceramic Type

COB Type



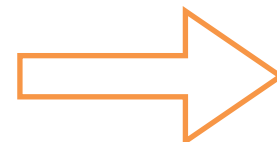
* All specifications are based on 5000K.



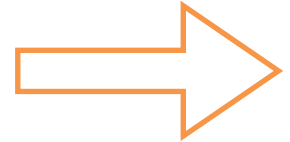
LED PACKAGE UPGRADES

Current LM80 Generation

LED in production - LM80 in 3 months



DEALING WITH NEW COMPLEXITY: EG: LED ROADMAP



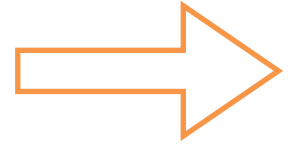
Lighting manufacturers starting to publish the version of their product.
An easy way is to change performance within the same architectural form

1	PRODUCT ID	2	SIZE	3	VERSION	4	NOMINAL LUMENS	5	COLOUR TEMP.	6	SHIELDING	7	FINISH
	DIALED dia led		22 2'X2'		B1 B1 (factory preset)		2500 2500 lm 3000 3000 lm 4000 4000 lm		35 3500k 30 3000k ⁽¹⁾ 40 4000k ⁽¹⁾		SO spotless lens		W white C custom
									(1) 8 Week lead time for 3000k and 4000k				

Light engine	Engine	CCT	CRI	Reflector ²
C3L085A Adjustable	01 MTG2 LED	27K 2700K	8 80	FSP Fresnel Spot SP Spot
C3L085AP Adjustable Pinhole		30K 3000K	9 90	NF Narrow Flood FL Flood
C3L085DL Downlight				WFL Wide Flood
C3L085DP Downlight Pinhole				
C3L085LW Lensed Wall Wash				

What if manufacturers would start publishing a 'spec forward' section on their spec sheets?

DEALING WITH NEW COMPLEXITY: EG: DESIGNING WITH A LIFE AT L₈₅



Designing at L₇₀...

±30% more luminaires and ±30% energy loss initially

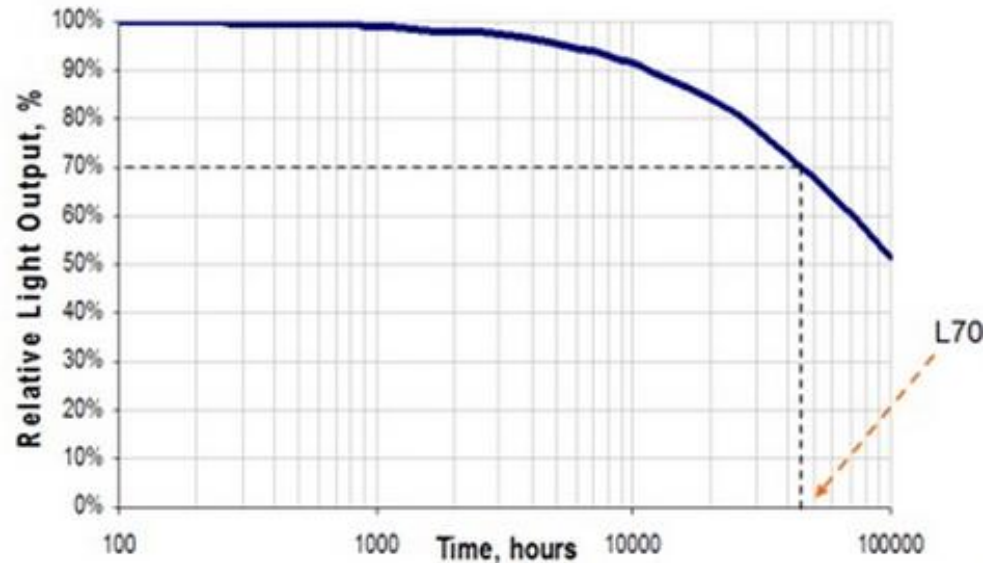
... vs. designing at L₈₅

Designer sets context and guides manufacturer choice of L70 or L85... or even L90.

Decision will affect W/sqft

Flourescent lamps are L95!

CLO constant light output?



The Luminance vs Illuminance story (low level)

	Luminance	table	65 degrees				
	Cd/sqm along	Cd/sqm 45 degrees	Cd/sqm across	Lumens per watt	Lumens	Lumens Per watt	Candela at 0 degrees
Beam 2	4622	4027	3514	102.6	1142	300	518
Beam 3	6021	5298	4622	98.5	2224	500	1069
Beam 4	5099	4511	3980	98.4	2222	500	1044
Beam 6	4450	4299	4125	91.7	2062	500	860
Beam 4 1-T5	3762	1607	1269		2123		910
Beam 2 1-T5	5280	1545	1140		1618		736

The Luminance vs Illuminance story (high level)

	Luminance	table	65 degrees			
	Cd/sqm along	Cd/sqm 45 degrees	Cd/sqm across	Lumens	Nominal Lumens Per foot	Candela at 0 degrees
Beam 2	13565	14040	14022	2995	800	1166
Beam 3	6021	5298	4622	3472	900	1619
Beam 4	5099	4511	3980	3744	900	1728
Beam 6	4450	4299	4125	3945	1000	1767
Beam 4 1- T5HO	6544	2761	2173	3671		1560

DEALING WITH COMPLEXITY: NEW CONTROLS CAPABILITIES GIVING BACK FLEXIBILITY

The novel characteristics of SSL

Spectral tuning

High resolution

High resolution digital addressability

Many other control possibilities which contributes to both performance and effort expectancies.

By using high-spatial resolution SSL lighting one can improve energy savings, by turning more lights off when not in use.
(Follow me technology)

GIVING BACK FLEXIBILITY

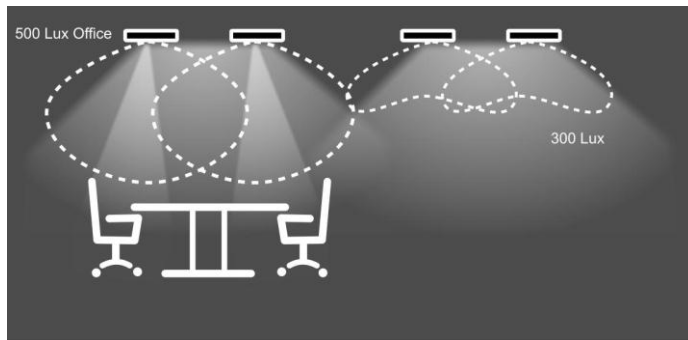
PERSONAL DIMMING

No fixed level can satisfy more than half of the occupants.

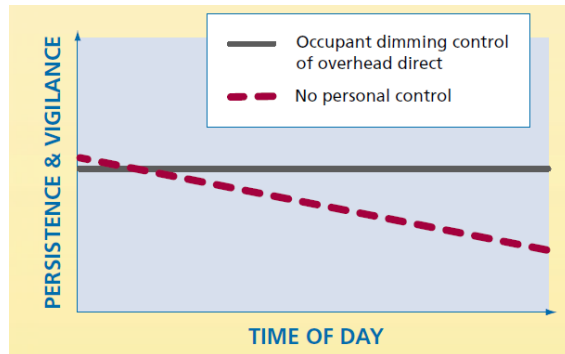
Personal control leads to higher satisfaction with lighting, overall environmental satisfaction, job satisfaction, organizational commitments, and health and well-being. It reduces organization costs for turnover and time off.

Would personal tunable colour add to the performance and cost benefits of SSL?

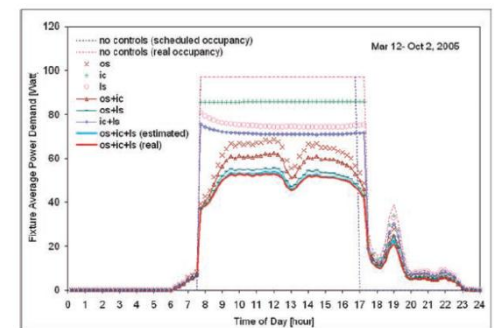
Personal luminaire design



Personal Productivity



Work station specific Energy savings



DEALING WITH COMPLEXITY FROM SPEC IT FORWARD TO REPLACE IT FORWARD...

Facilities managers will want to benefit from better energy savings (at a low cost) within the next decade

When does lighting get replaced properly? At L70? When LEDs cost nothing?

Should a procedure be proposed at construction?



“Old Style personal lighting control?”

HOW TO JUGGLE ALL THAT?

