



# Raising Money

For Solid State Lighting, General Illumination

**Paul Thurk**

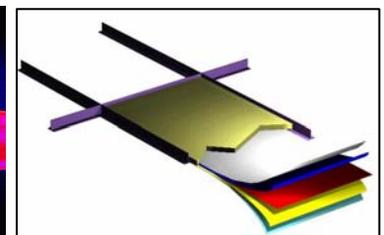
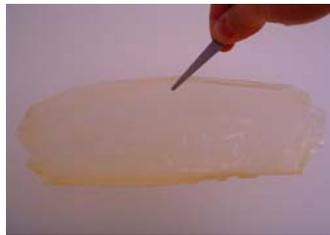
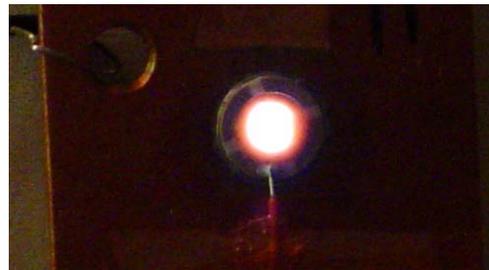
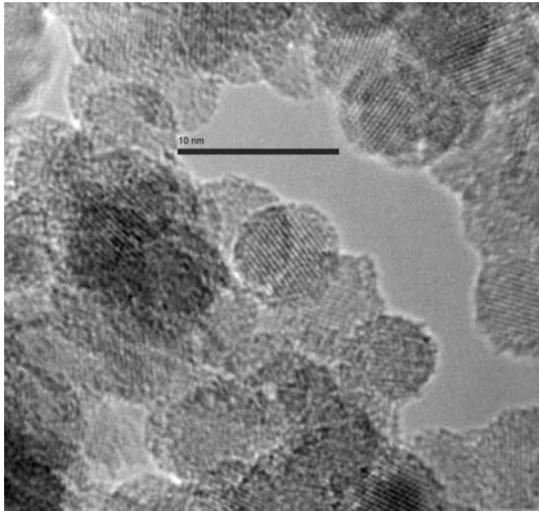
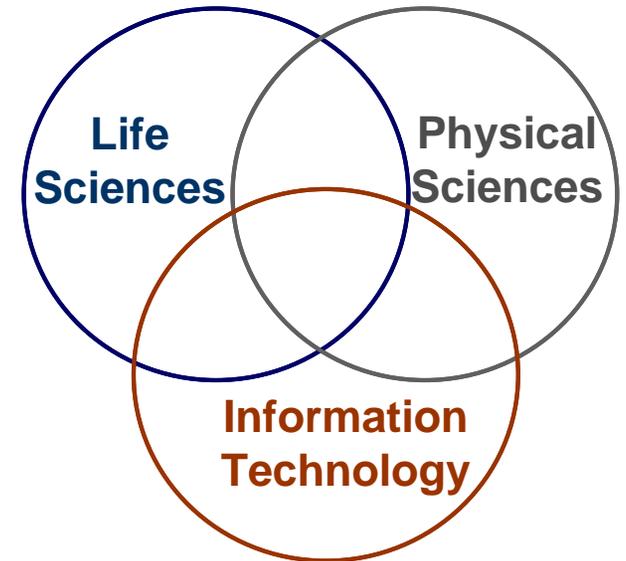


ARCH Venture Partners



# Background

- ARCH Venture Partners
  - 20 Years of Successful Investing
  - \$1.1B under management
  - Austin, Chicago, San Fran, Seattle
  - 12 Investment Professionals
- InnovaLight





# Raising Money

- Bootstrap, Credit Cards
- Friends & Family
- Vegas, lottery
- Angels
- Strategic investors
- Gov't Grants, Contracts
- **Venture Capital**
- Customer pre-pay; Supplier credit
- Traditional Lenders; Banks
- Venture debt, leasing
- Hedge Funds & Investment Banks





# Venture Capital

- Money invested in high risk/return companies with little or no near-term liquidity options
- Help manage and grow a portfolio of high potential companies
- VCs make money when a company is acquired or goes public.



# Risk/Return

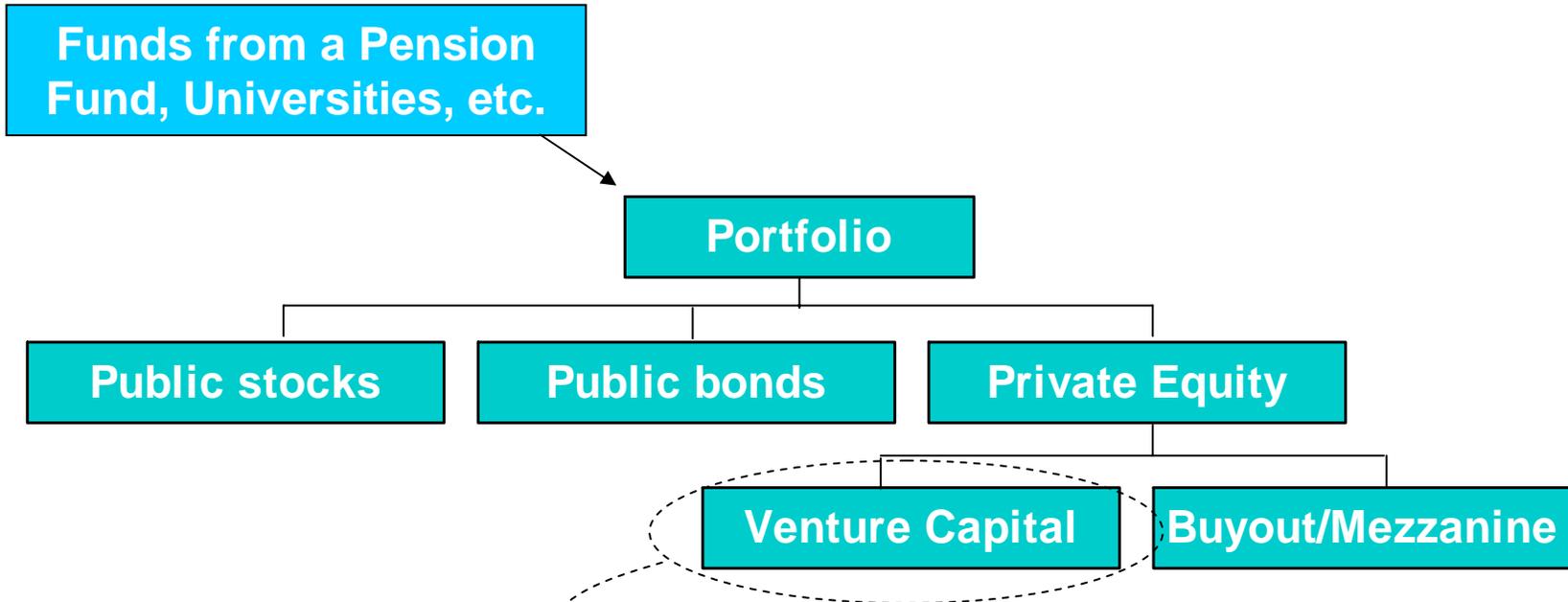
## 20 Year Returns (as of 6/30/06)

<b>Early VC</b>	<b>21%</b>
<b>Later VC</b>	<b>14%</b>
<b>&gt; All VC</b>	<b>17%</b>
<b>Buyouts</b>	<b>13%</b>
<b>All PE</b>	<b>14%</b>
<b>S&amp;P 500</b>	<b>10%</b>
<b>NASDAQ</b>	<b>12%</b>

*Source Thomson Financial/NVCA*



# The Investor's Investor



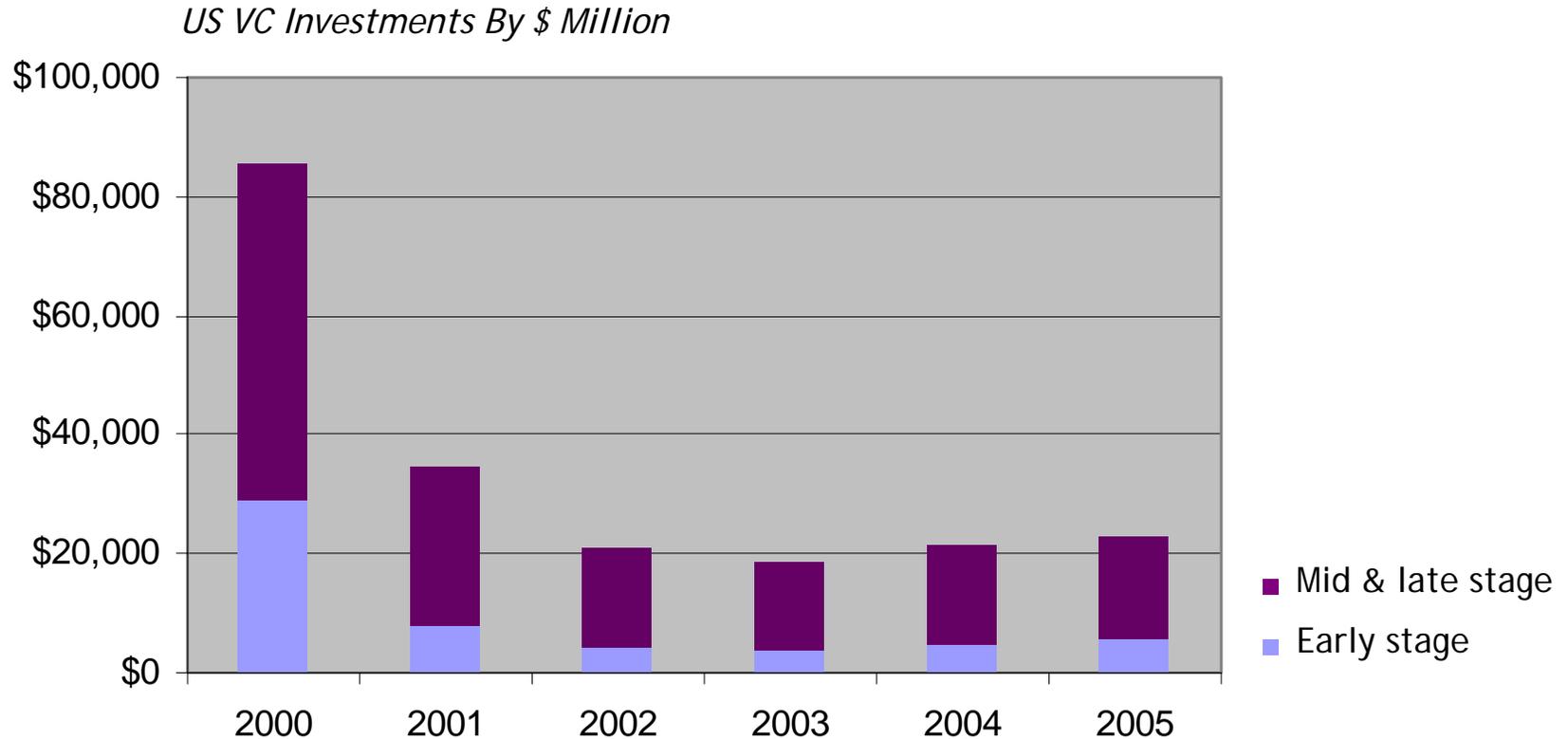
“Alternative Asset Class” requires:

- a) investments in high growth companies
- b) that can exit within 3-7 years and
- c) with the potential for large multiples

*Not all good opportunities fit these constraints*



# Where's the money?

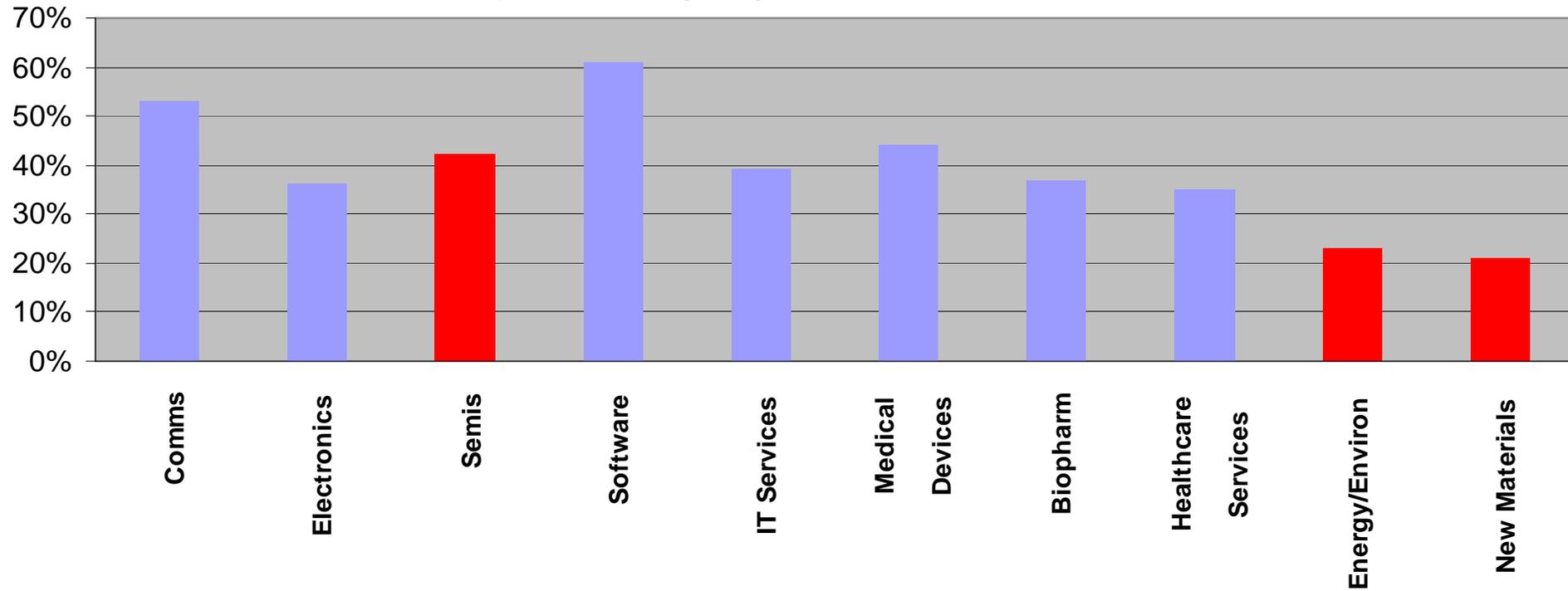


Source: VentureSource, 2006; TeleSoft Partners 2006



# Investment Focus

*Percent of VC Respondents Targeting Each Sector*

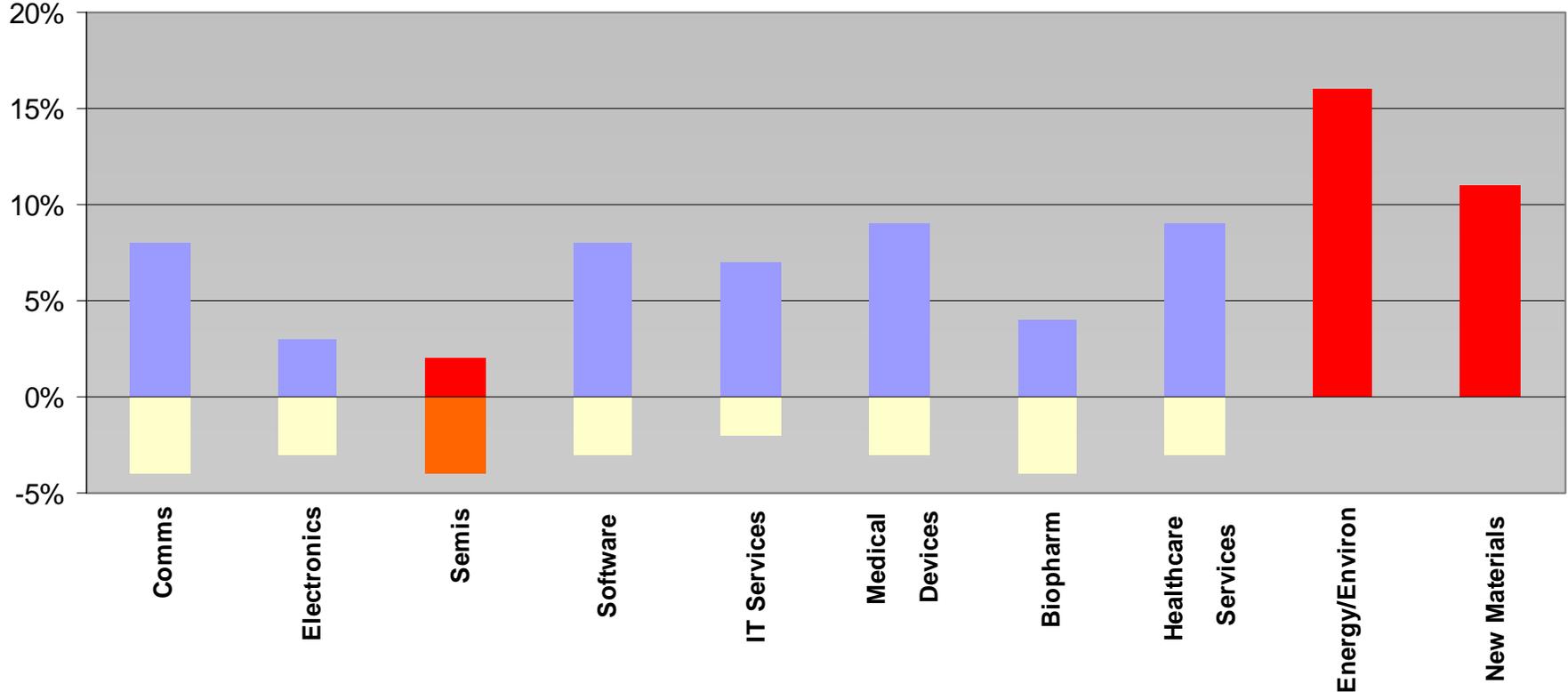


Source: Deloitte & Touche/NCVA, 2006, Telesoft Partners



# Investment Focus

*Percent of VC Respondents Planning To Increase/Decrease Investments By Sector*



➤ **\$2.9B in VC went into “Clean Technology” in 2006**

Source: Deloitte & Touche/NCVA, 2006, Telesoft Partners, CleanTech Venture Network



# “CleanTech”

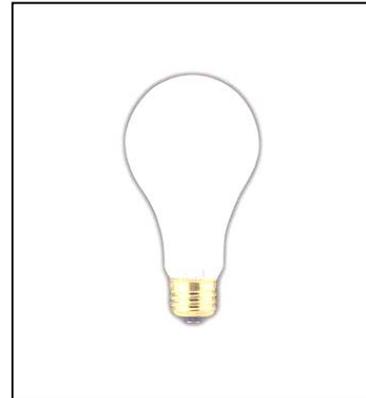
Make It



Move It



Use It



Lose It





# Solar VC 10X of SSL

Market	Market Size	VC Investment	VC/Mkt %
Solar <u>Modules</u>	\$6.375B [Piper Jaffray]	\$336M [Venture Power]	5.27%
Lighting, Lamps <i>(Buildings)</i>	~\$13B [BCC, Freedonia]	\$85M [Venture Power]	0.47%
<i>Lighting, Fixtures</i> <i>(Non-Portable)</i>	~\$50B [Freedonia]		0.14%



# Raising Money for an SSL start-up





# What investors want to see

- ❑ Great team
  - Proven entrepreneurs
  - Solid technologists
  - “*Done It Before*” and “*Know It Cold*”
- ❑ Opportunity
  - Addresses critical pain
  - Differentiated product
  - Margin leverage
  - Protectable
- ❑ Booming market:
  - Long-term growth
  - Exit possibilities
- ❑ A clear plan
  - Capital efficient
  - Honest



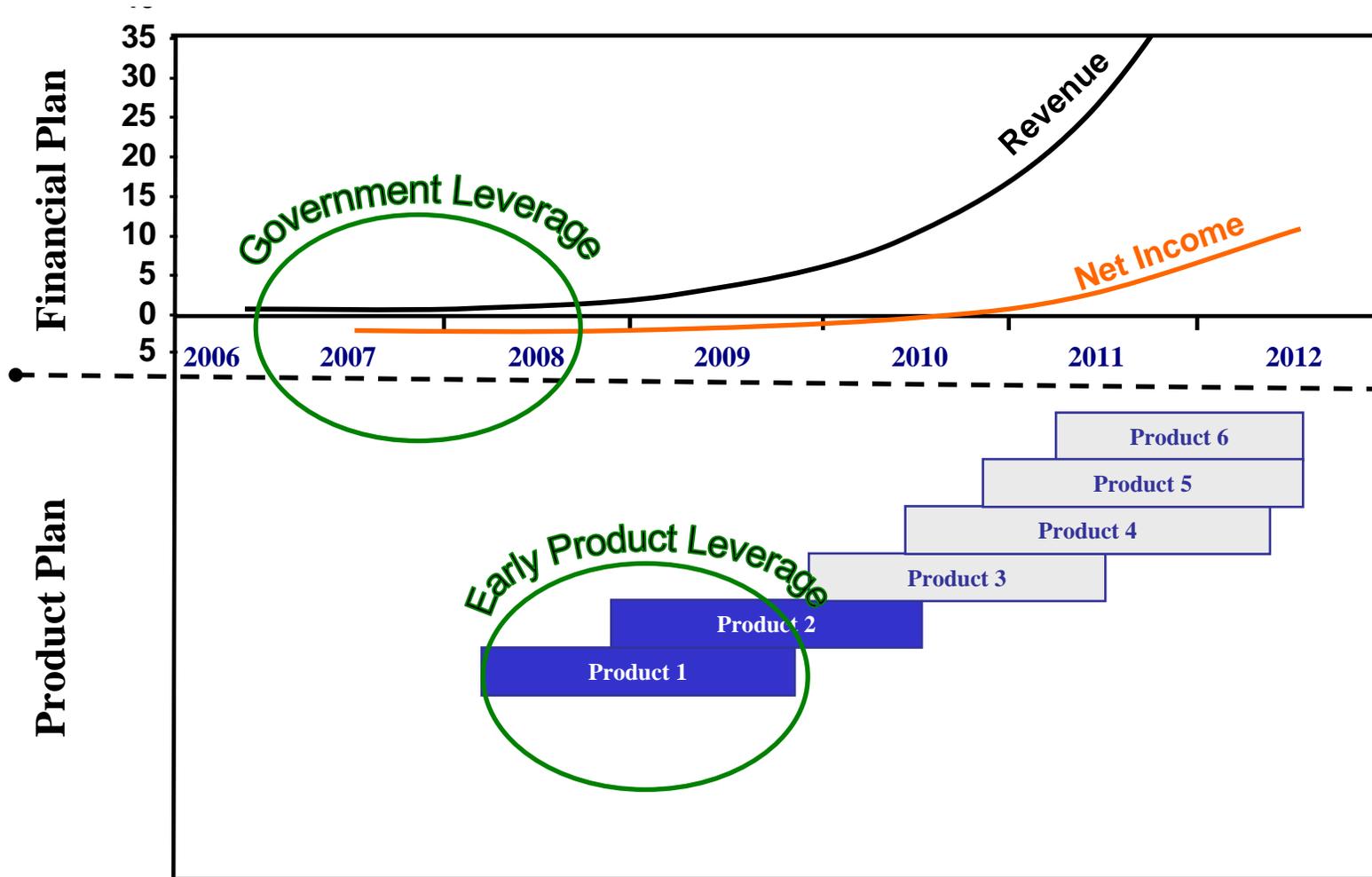
# Market

- Large Market: ~\$13B in (building) lamps; ~\$50B (non-portable) fixtures; \$4.2B+ HB-LEDs\*
- Market beginning to shift from *“indication”* to *illumination*.
- Timing. Typical lag between lab results and commercial product is 1.5-3 years. Several reports of 100 lm/watt.
- LED Market is growing, Lots of Near-Term Applications

\*BCC 2006; Freedonia 2006;  
Strategies Unlimited 2006,



# Opportunities for early leverage

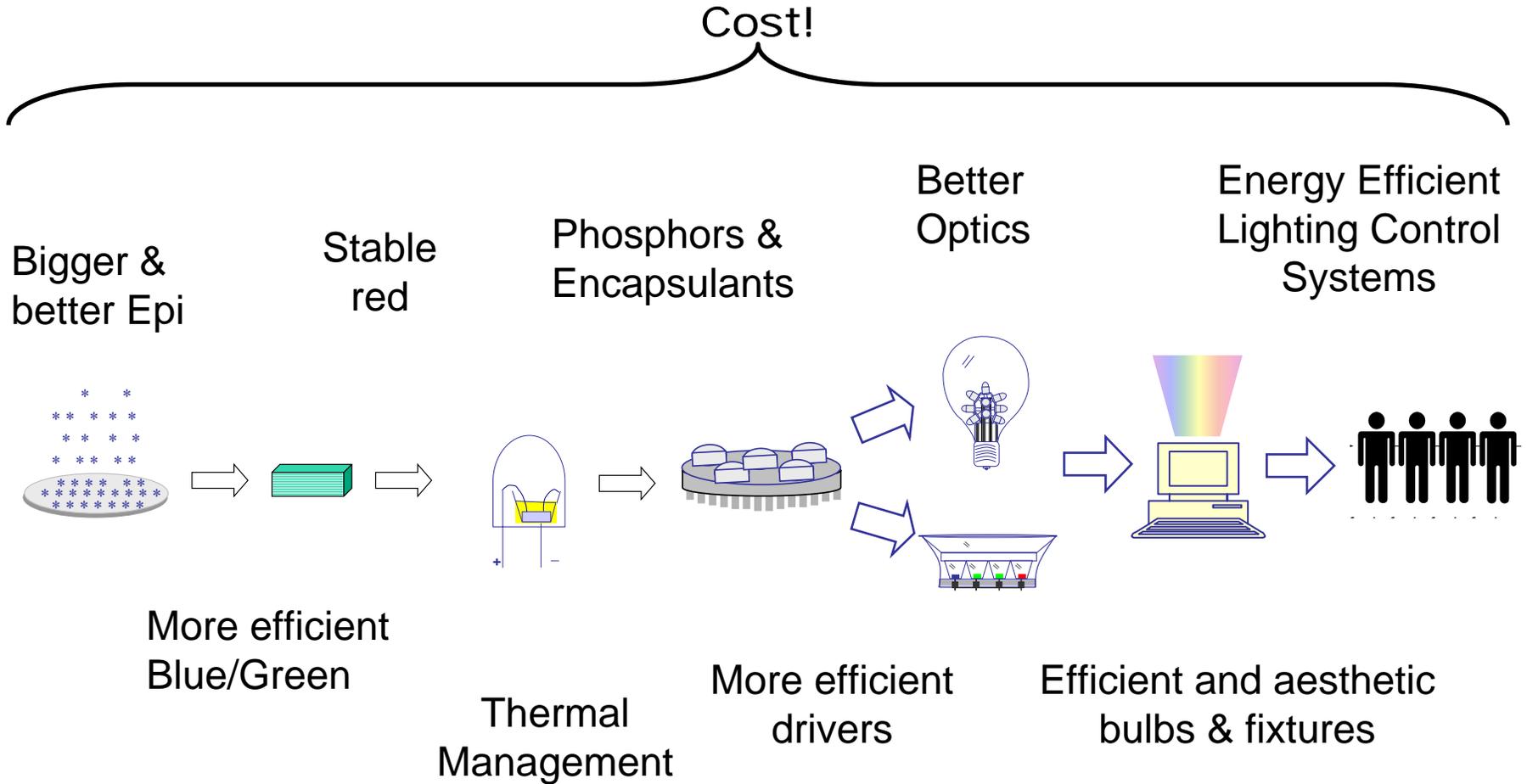




# Start-Up Opportunities in SSL

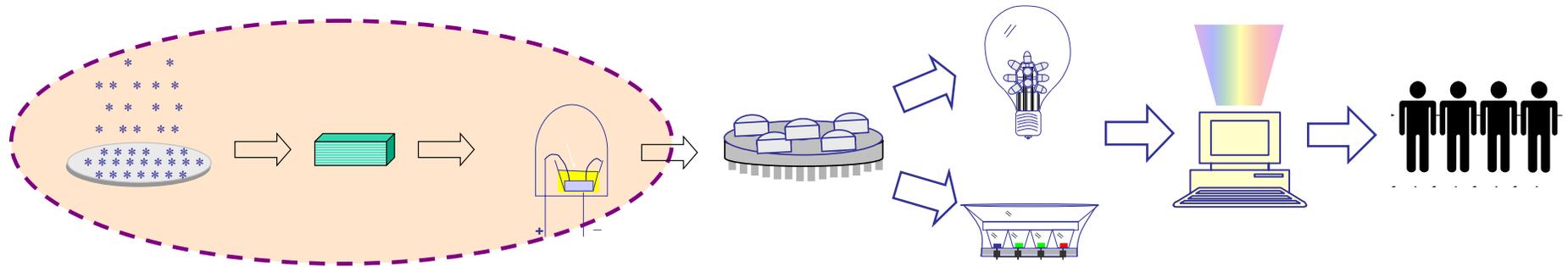


# Pain Across The Chain



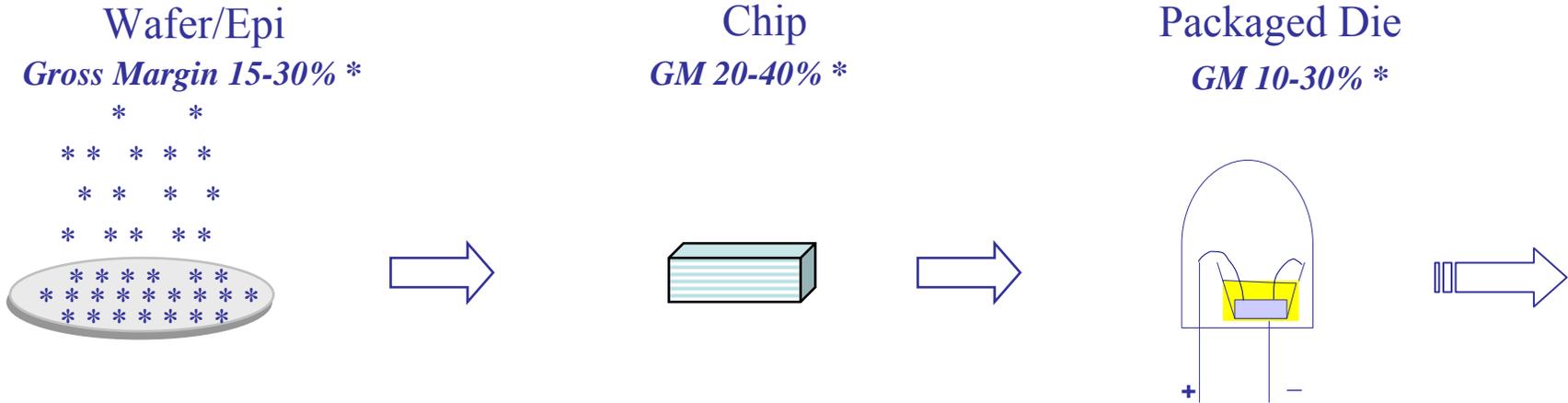


# “Front End”





# “Front End” Value Chain ....to Packaged Die



## Several Fundamental Challenges Remain

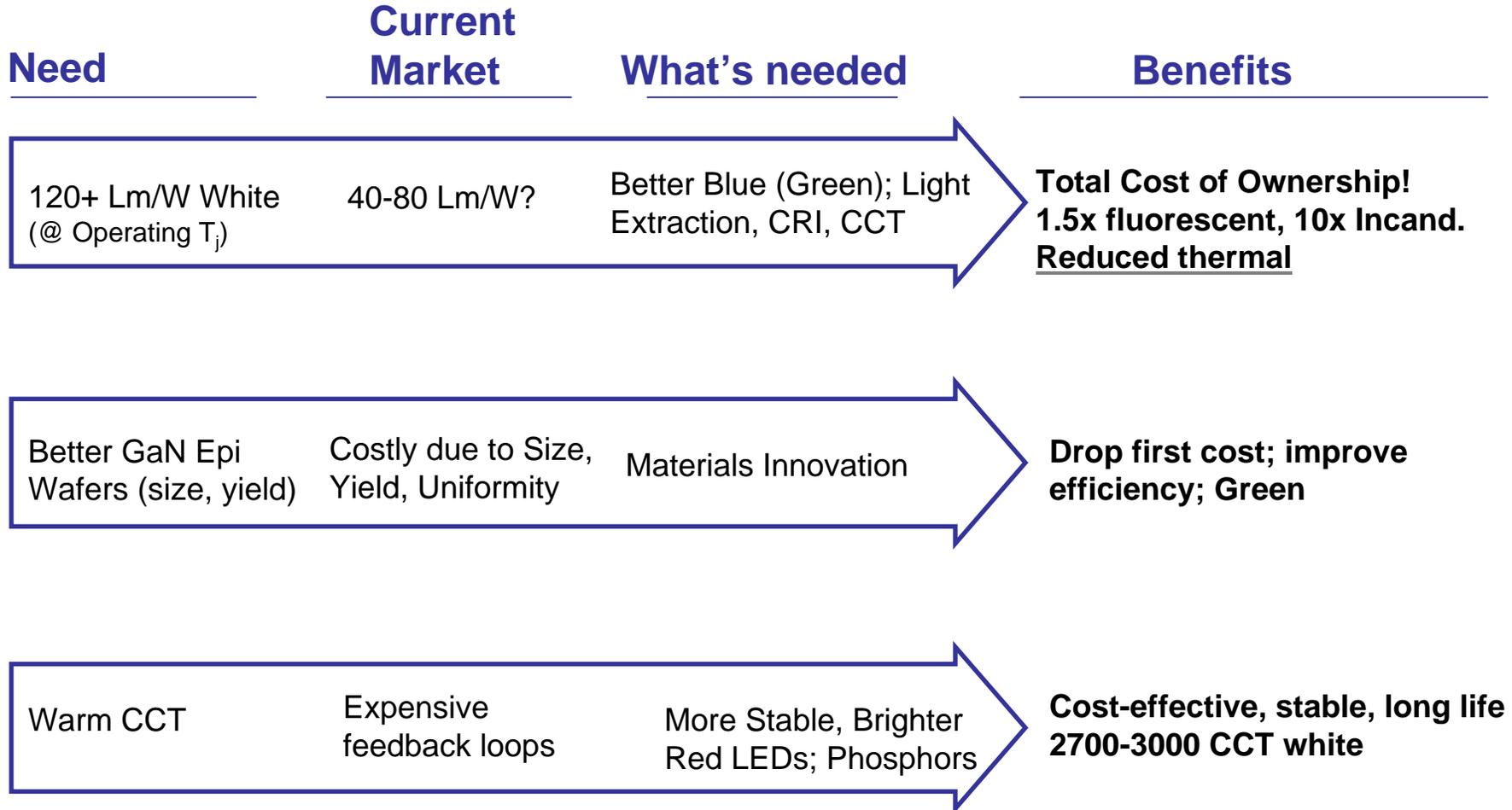
- Defects as high as  $10^8/\text{cm}^2$
- InGaN variations across wafer. Binning!
- Yield (esp. for large, high power LEDs)
- EQE Blue (40%), Green (15%)
- Wafer size (economics)
- TIR ( $\geq 25\%$ , worse for red)
- Thermal
  - Junction temp affects life,  $\lambda$ , IQE
  - Current  $\uparrow$ , flux  $\uparrow$ , Effic  $\downarrow$  (Heat!)
  - Worse for red
  - Shifts  $\lambda$  (effect phosphor absorption?)
- Package Costs, Thermal
- Color uniformity (white)
- Phosphor: red (CRI), efficiency, scattering, stability & differential aging

\*Different Markets & Products Command Different Margins



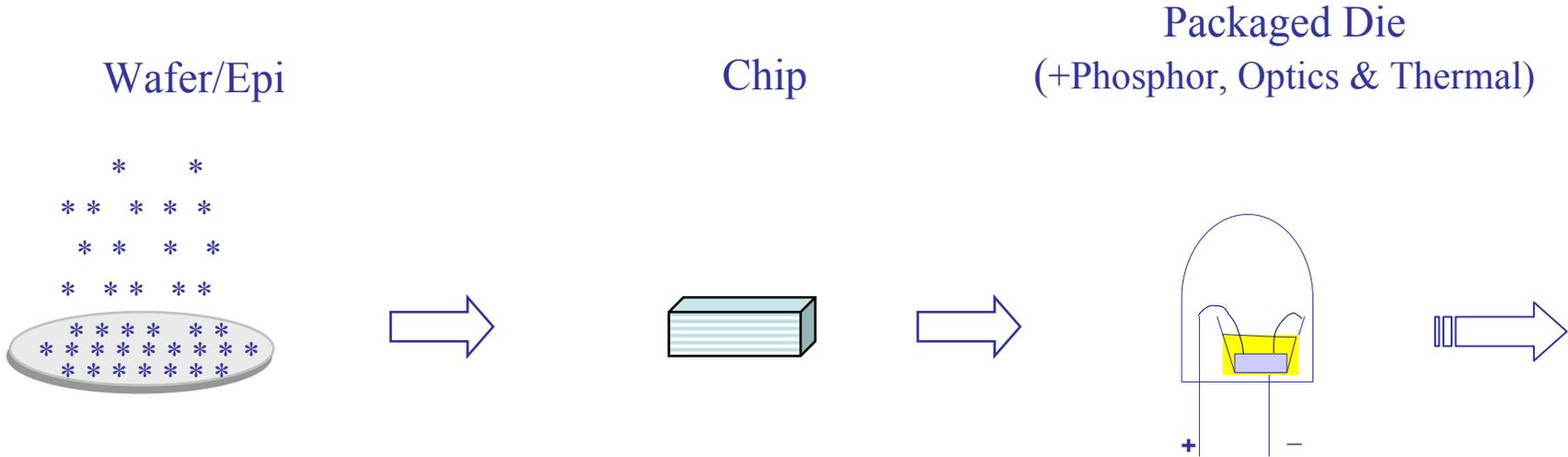
# Example Opportunities

## Front End of Value Chain





# Ripple Effect in Value



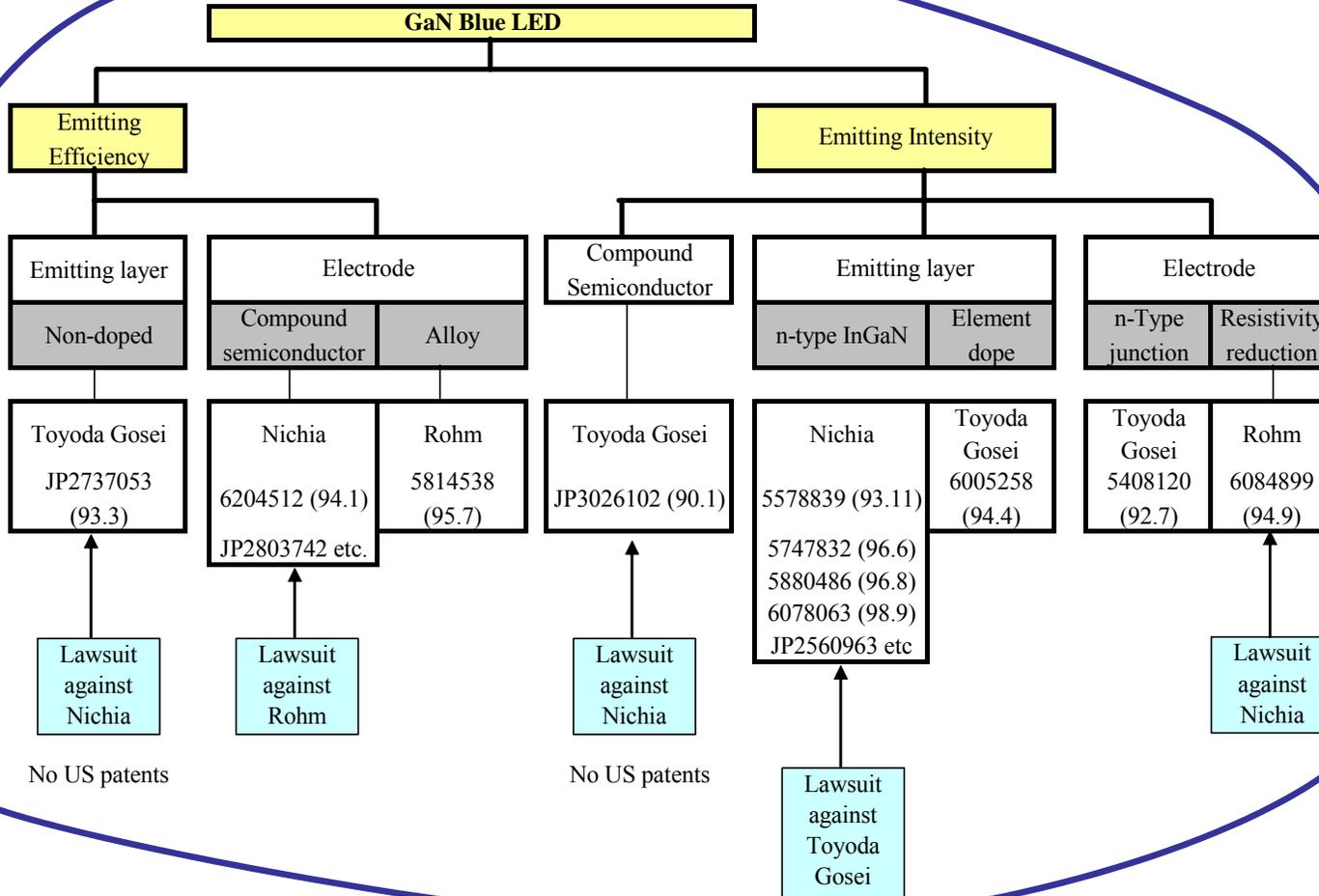
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# IP Challenges

**Circumvent Prior Art**



**Find the "White Space"**



# Game Over?

**Nichia Officially Announces 150lm/W White LED**

LIGHTimes Staff

**Philips Lumileds shatters solid state lighting efficiency records with 115 lm/Watt LED**

DARPA Press Release

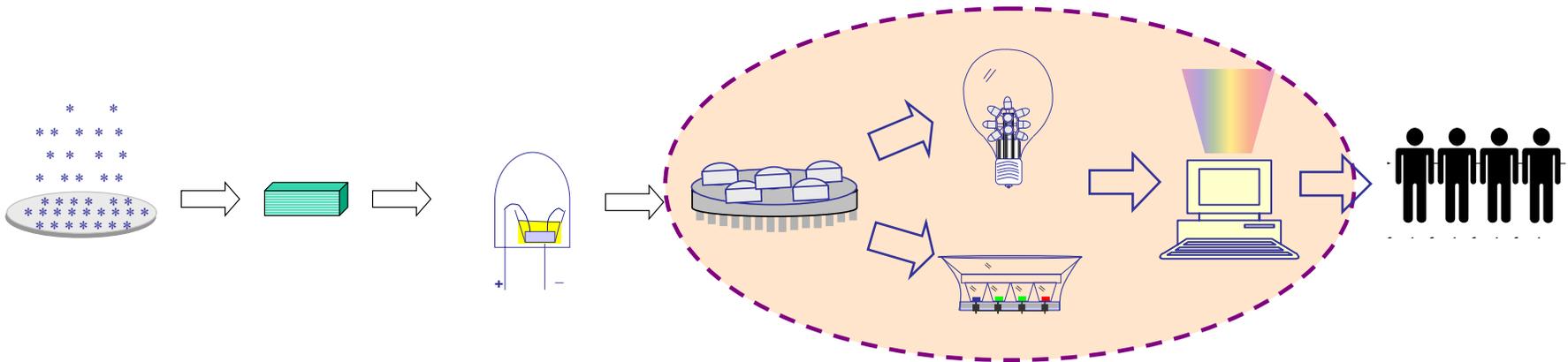
**Cree's new XLamp LED can produce up to 160 lumens at 700 mA, and has a typical output of 80 lm at 350 mA**

LEDs Magazine

**...Lots of announcements, difficult to interpret**



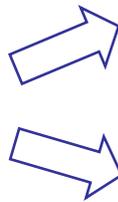
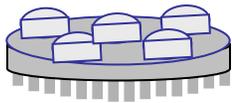
# “Back End” Adapters, Luminaires & Systems



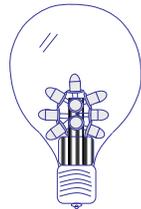


# “Back End” Value Chain

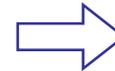
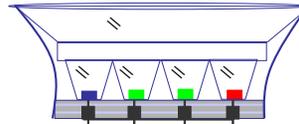
Components/Arrays  
Gross Margin 15-25%



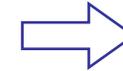
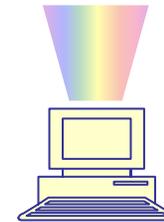
Adapters  
GM 25-35%



Luminaire  
GM 15-30%



Systems  
GM 30-40%



Distribution  
GM 20-30%



## What it includes

- ① Array assemblies
- ② Power Supply (expensive, 50¢/W)  
AC/DC, DC/DC (lose 15%)
- ③ Thermal Mgmt
- ④ Optics

## What it includes

- ① **Integration**
  - Drivers
  - Feedback loop
  - Optics, Lens, Diffusers
  - Housing, Reflectors
- ② Tech support
- ③ Warranty

## What it includes

- ① App spec s/w, drivers
- ② Integration
- ③ Customization
- ④ Accessories
- ⑤ Tech support
- ⑥ Warranty

## Key Issues

- ① Access to Channels
- ② 1<sup>st</sup> mover mkts  
(retail, hotel, etc)



# Example Opportunities

## Back End of Value Chain

<u>Need</u>	<u>Current Market</u>	<u>What's needed</u>	<u>Benefits</u>
Luminaires/Systems (Complete Solutions)	Specialty & Custom	Novel thermal mgmt, optics Easy integration. Cost!	<b>Specialty applications to achieve scale and drive cost.</b> <b>KSF: Access to channels.</b>
Edison Adapters	N/A	Thermal Mgmt, optics Compatibility with Edison sockets	<b>Large installed base of sockets</b>
Novel Thermal Management	Slugs & Heat Sinks	Cost effective, efficient and aesthetic solutions	<b>Drive harder, look better</b>



# Luminaires

- There's room at the top...

	Lamp lm/W	Fixture Effic.	Usable lm/W
LED Fixtures*	44	34%	15
CFL	60	50%	30
Incandescent	14	65%	9

**+ cost, color  
& uniformity!**

- Market Drivers, Momentum
  - Market Pain Increasing with Energy Prices
  - Regulation (Eg Title 24 & 22 in California)
    - New regs for efficient lighting in new homes
    - Mercury as “hazardous waste”.
  - DOE: Funding, Energy Star, Independent Testing, Standards
- Fixture industry is very fragmented
  - Top six fixture manufacturers have <15% of the market\*\*
  - All have efforts in SSL
  - Integration of lamp and fixture will change industry





# Value

- Value: harmonizing pieces into efficient and aesthetic (i.e. saleable) fixtures that are easy to buy and use.
  - Challenge: differentiation & barriers
- 
- Potential marketing challenge if poor quality lighting products make it out to the market before you do.



# Focus & Road Map



Adopted from Amar Bhidé, Archetypes, HBS



# Sizing Opportunities

- Size and validate specialty and fragmented market opportunities and work them into a product roadmap.



Thank You!