

# Stanford Social Entrepreneurship Startup LED Lighting Project



**Matthew Scott**  
**MBA, Graduate School of Business**



# Agenda

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- **Setting the context**
  - The problem
  - Why are LEDs the answer?
  - How can we achieve sustainable change?
- **Country Highlights**
  - INDIA
  - CHINA
  - MEXICO
- **Design Review**
  - Product Design Process
  - Prototypes
- **Next Steps**
  - India Pilot, Light Up the World and SES Project



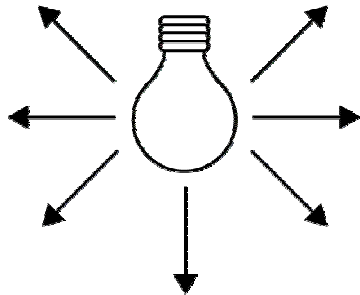
# Fuel-Based Lighting causes many problems

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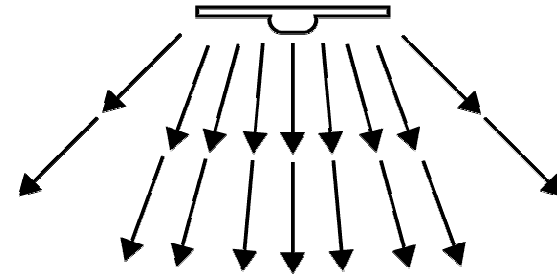
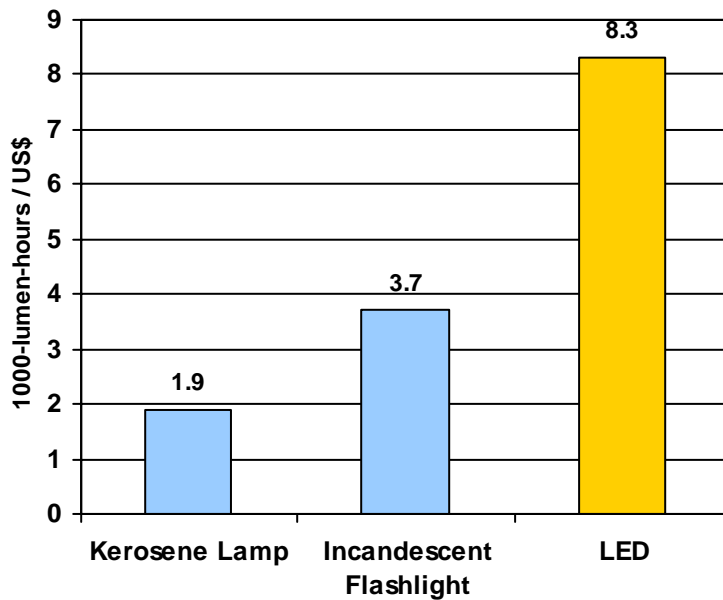
- Leads to Health Problems
- Limits Education
- Environmental Pollution
- Limits Productivity



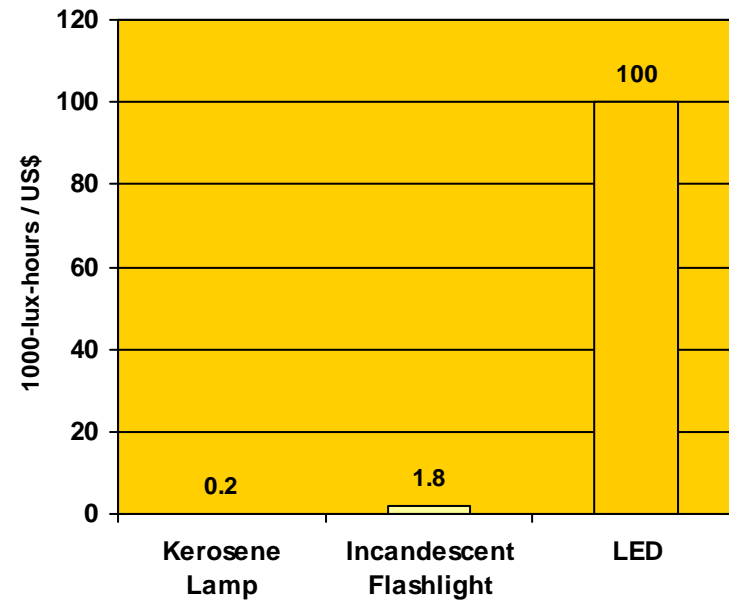
# LEDs are a more efficient technology



**Total Light Output per \$**



**Useful Light Output per \$**



Source: DRAFT: Evan Mills, Lawrence Berkeley National Laboratory



# LEDs Rapid Advancement and Low Power

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- Rapidly Advancing Technology  
3.8 L/W in 2001 to 30 L/W in 2003
- Durable
- No CO<sub>2</sub> emissions
- No naked flame or smoke



# Sell LEDs through market for lasting impact

Market based solutions *Long term social impact*

1) *End User Value Proposition*

**VALUE**

>

**Price**

2) *Profitable Supply Chain*

Manufacture

Distribution

Retail

3) *Donor Funds required to 'kick-start' market*

Create Supply Chain  
Raise Awareness  
**DONOR FUNDS**

Self-sustaining market for LEDs



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## Country Deep Dive: INDIA



**Ginger Turner**  
**MS, Management Science & Engineering**



# Introduction

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- **India: one of three country teams**
- **Current Need**
- **Proposed Solution**





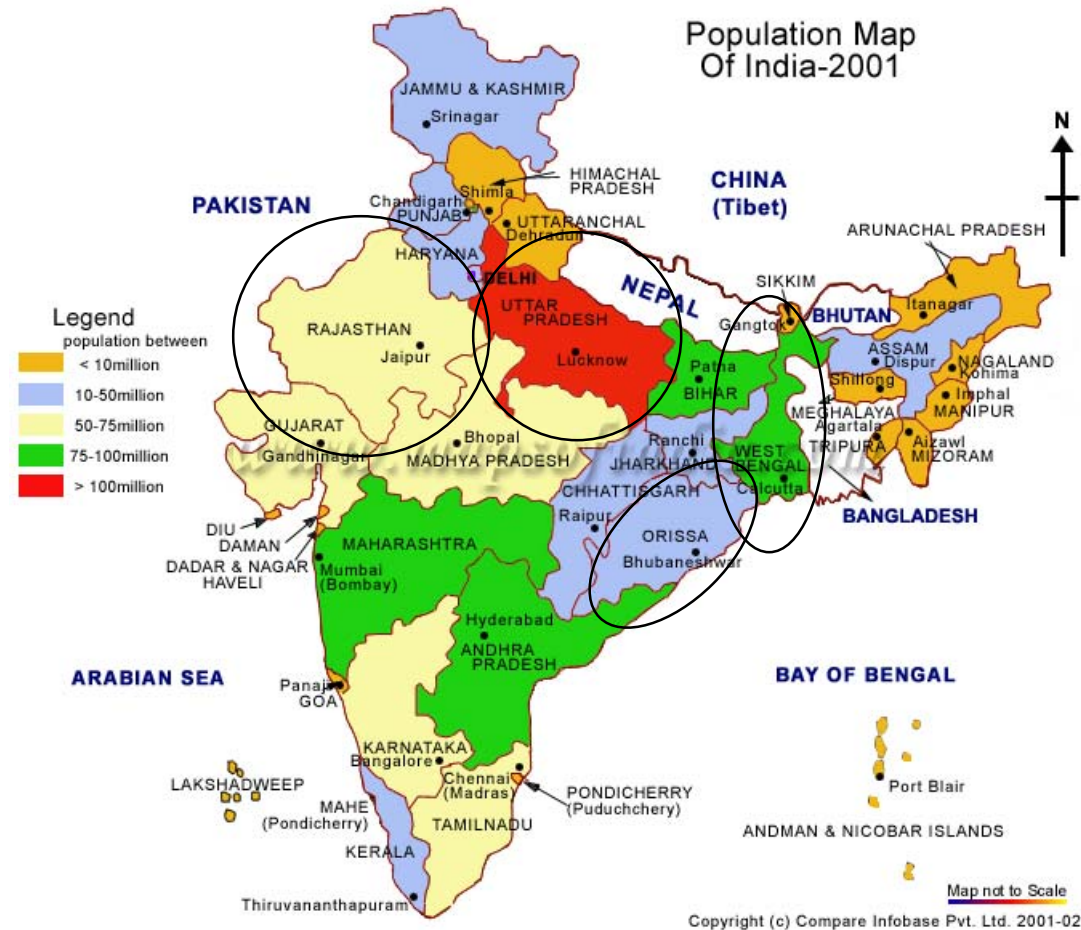
# The Market



- 150-300 million people lack electricity
- 80,000 rural villages off the electric power grid
- Unreliable electricity supplies (unavailable 6 – 7 hours per day)



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# User Feedback Process

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Prototypes and  
Surveys in the field:

- NGOs
- Rural Villagers
- Rural Schools
- IIT University Lab

Advisors:

- NGOs
- For-profit companies
- Manufacturers
- Rural micro-finance banks
- US and Indian governments



# Example Feedback: Kerosene Replacer

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Kutarbhai Nayak

- 7 family members
- Agricultural worker in rural Gujarat

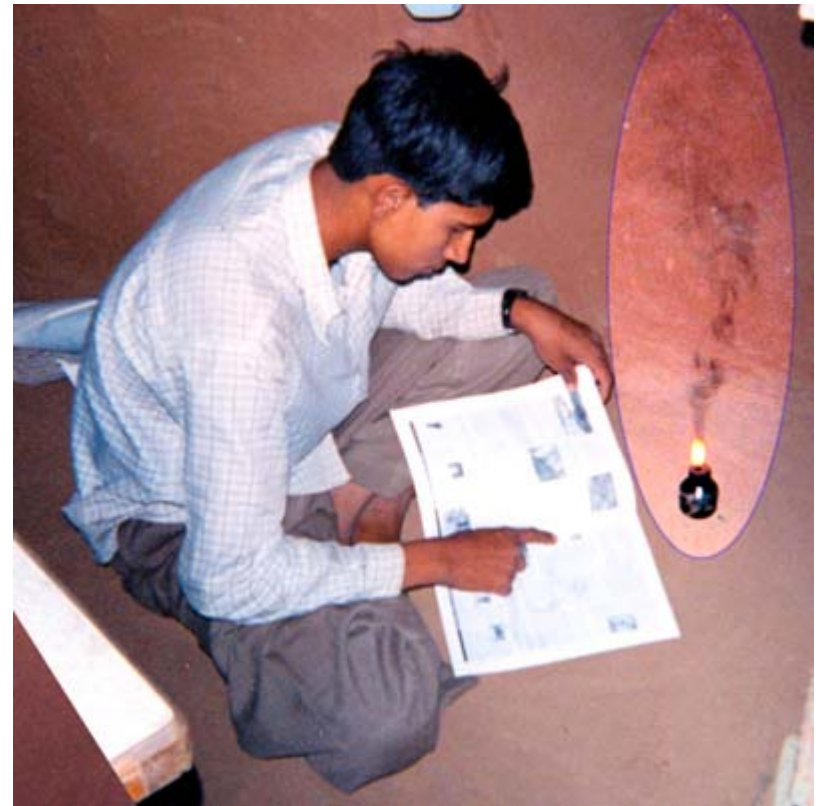


# Example Feedback: Kerosene Replacer



“Yellow light of kerosene is inconvenient”

- Requires light 30 min. in morning and 2-3 hrs. at night
- Uses 4 liters of kerosene/mo at Rs. 13 (\$0.26) /liter



# Example Feedback: Light Upgrader

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Bharatsinh Patel

- 11 family members
- Agricultural worker in semi-rural Gujarat



# Example Feedback: Light Upgrader

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- Connected to unreliable electrical grid (off 6-7 hrs/day)
- Uses 5 liters of kerosene/mo as a backup light at Rs. 15 (\$0.30) /liter
- Uses flashlights outside the home, buys 3 1.5 w batteries/mo at Rs. 8 (\$0.16)/cell



# Indian target segments

## 'Kerosene Replacer'

- Rural off-grid village
- Earns Rs 15,000 - 30,000 (\$300-600) /year
- Spends Rs 35-60 (\$0.70-1.20)/mo on kerosene (2-4% income)

## 'Light Upgrader'

- Semi-rural dweller (on or off grid)
- Earns Rs 30,000-100,000 (\$600-2000)/year
- Spends Rs 75-200 (\$1.50-4.00/mo on kerosene (2-4% income)

- Maximum upfront price: \$7 - \$10 (Rs 350-500)

- Max upfront price: \$20 (Rs 1000)

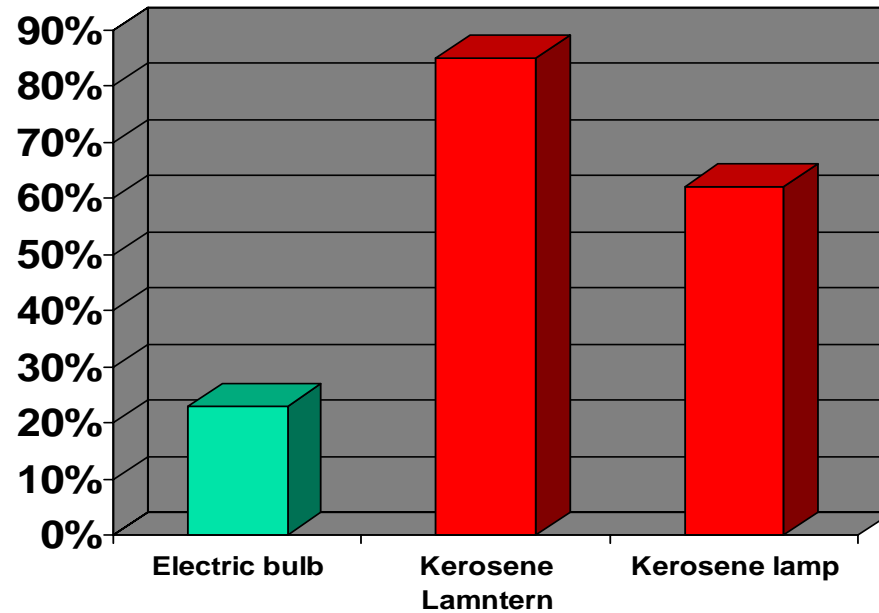




# The Competition: Kerosene

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Lighting Sources in West Bengal, 24 Parganas region



**Solution must replace kerosene and provide 2-4 hours of light per night**

Source: IDE Need Analysis Survey, 1999



# Our Proposed Solution: User Benefits

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- **Cost**
- **Health**
- **Education**
- **Income Generation**

तेज रोशनी  
"Tezz Roshni"



# Key Assumptions Tested

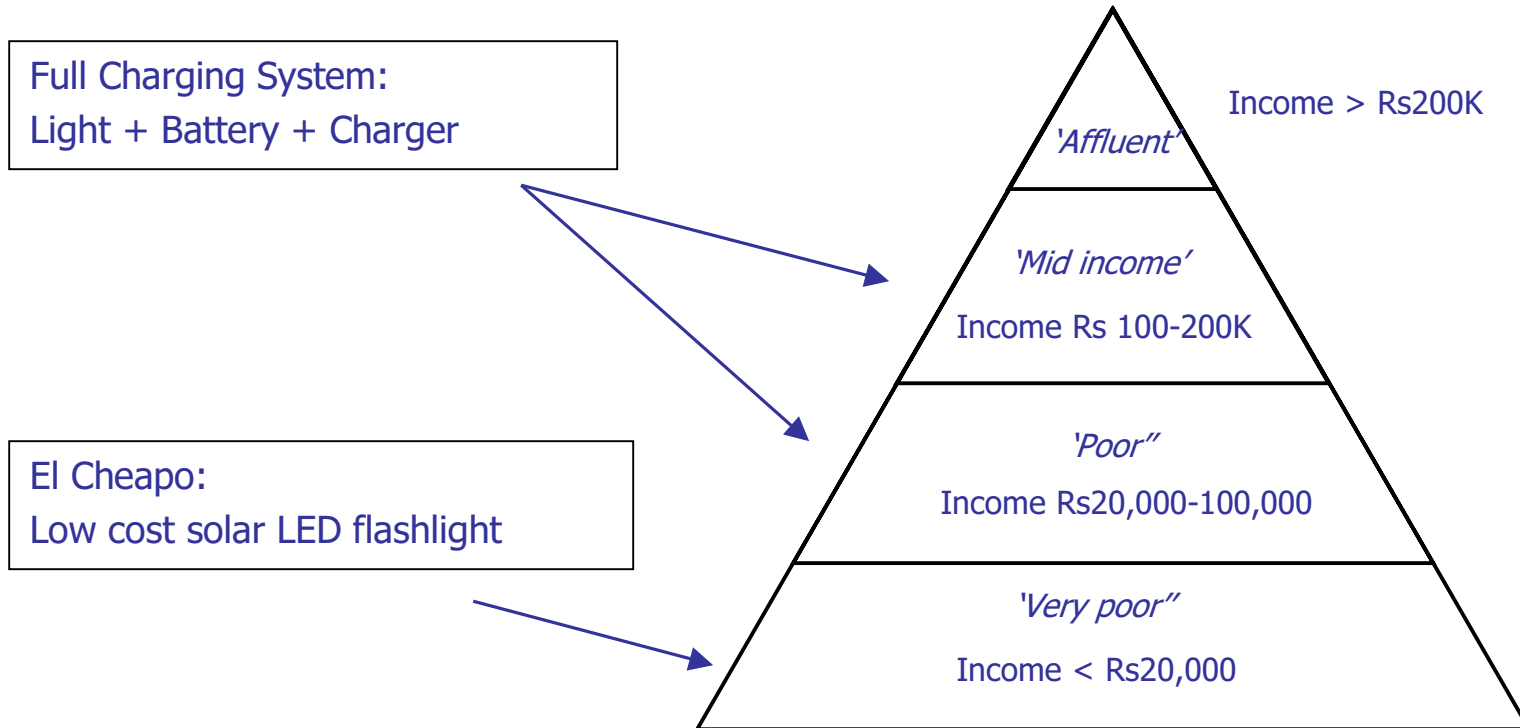
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- Human vs. solar power
- Community charging
- Government relationship
- Microfinance
- Manufacturing foreign vs. domestic



# Definition of product concepts

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# Summary

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## Unanswered Questions:

- Ability and willingness of customers to pay?
- What is the optimal manufacturing and distribution strategy?
- How to develop a rural marketing strategy?

## Next Steps:

- Summer field work
- Pilot Project



जेज शेशानी

**THE MIGHTY LIGHT**  
- A BRIGHT FUTURE IS IN YOUR HANDS -

*Buy one Today!*  
Every light comes with **FREE** batteries that last a year or longer!!!



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## CHINA



**Ashley Manning**  
**MBA, Graduate School of Business**



# China Roadmap

- Key lessons that drove business decisions
- Target market
- Business Model





# CHINA: Entrepreneurship is Everywhere

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...and local markets are the center of commerce



# Credit is informal

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- NGO activity is limited and micro-credit is in its infancy
- Women form groups of 20 and everyone contributes 200 Yuan per month to a different member of the group.
- Retailers often purchase goods on credit from suppliers
- Chinese government more likely to regulate markets NGOs



# Lighting market is highly fragmented

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- Homes with electricity do not use it due to cost and reliability
- Public Spaces: Coal and natural gas
- Households: Wood, gas, coal, biomass



# Target Market Progression



Primary: market vendors in rural, western China

Secondary: cottage industry



GOAL: Nomads / Rural poor



# Night Traders Lighting Needs

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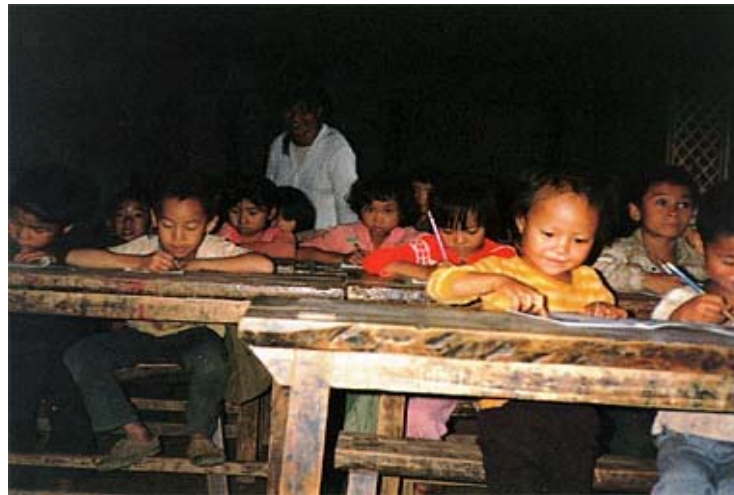
- Brightness and quality not size
- Save money compared to current lighting solutions
- Personal system (not community model)
- Convenient light for multiple uses in the market and at home
- Can be plugged into the grid



# The Business Case

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- Too much to tell! Please come talk to us about:
  - Distribution Model
  - Keys to breaking even in China
  - Pilot project recommendations



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## MEXICO



**Darren Johnston**  
**MBA, Graduate School of Business**



# Mexico Presentation

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- The Opportunity
- Special Considerations
- The Offering
- Implementation Strategy







# The Opportunity

Goal: Provide lighting for non-electrified households

Market: 1 million non-electrified households in Mexico.



69% of non-electrified households are in the south (darker colored states)

Rural Mexicans currently spend \$6 per month on batteries

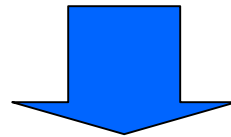


# Special Considerations

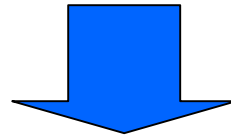


## Research Revelations

- Solar- not appropriate
- **Rechargeable solution- not desirable**
- Entrepreneurship model- tough sell
- **Cost- most important factor**



## Product Decisions



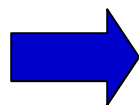
**Decided on an ambient LED lamp that would use traditional batteries**



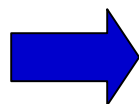
# The Offering



LED lamp replaces a household's flashlight.



6x savings in batteries purchased  
No behavior change  
1-2 month payback period on investment



End-users will achieve a savings of \$60 per year, which is 6.6% of the yearly expenses of the poorest families in Mexico



# Implementation Strategy

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**Organization:** Social venture for-profit company

## **Customer Mix:**

**Rural-** Target Customer

**Urban-** Occasional flashlight user

- Brings quality perception up
- Helps subsidize growth

**Marketing:** non-traditional approach

**Distribution:** utilize existing infrastructure



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# Design Overview

**Scott Cannon**  
**MS, Electrical Engineering**



# Design Overview

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## Design Goal:

To design a cost-effective and efficient lighting solution for the world's poorest people.

- *More affordable than kerosene over time*
- *Greater light output than existing solutions*
- *Environmentally friendly and attractive to users*

## The Team:

- 12 Stanford product designers/engineers
- IDEO coaches
- Industry Advisors



# Design Overview

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## Discovery Driven Design

- 1) Develop assumptions
  - *Empathy: A deep understanding for users*
  
- 2) Test assumptions with prototypes
  - *Iterations drive design decisions*
  - *Technical research reinforces decisions*
  
- 3) Product design iterations
  - *Solutions that address customer needs*
  - *Design for manufacturing*

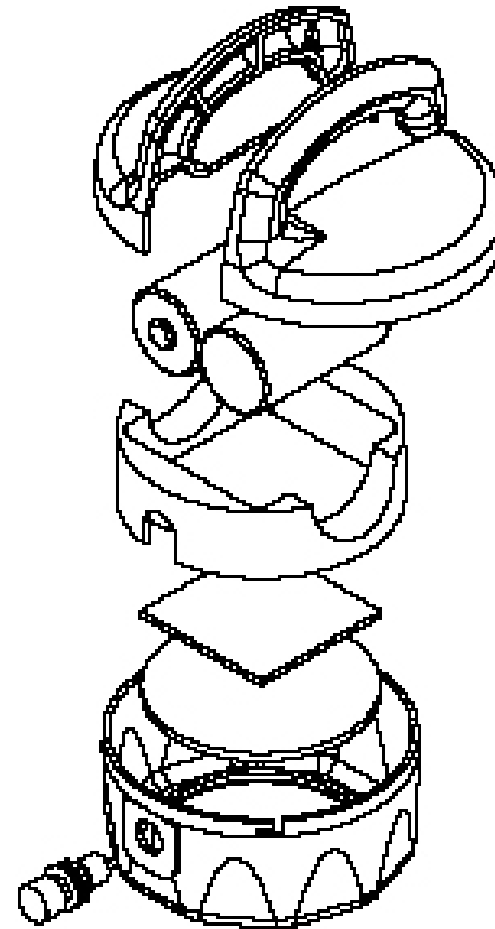


# Design Overview

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## Design Decisions

- Power Generation
- Power Storage
- Light and Optics
- Driver Circuitry
- Housing





# Design Overview

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## Power Generation

*Solar power fits our Asian Market*

- Lowest cost/watt for family (\$2.50/watt)
- Small (8x11.5cm for 1.2W single-crystalline silicon)
- Low maintenance cost



# Design Overview

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## Power Storage

### *AA NiMH Batteries in Asia*

- High charge density, long cycle life (~500+ cycles)
- Environmentally friendly and compact

### *D Alkalines in Mexico*

- Alkaline widely available in Mexico



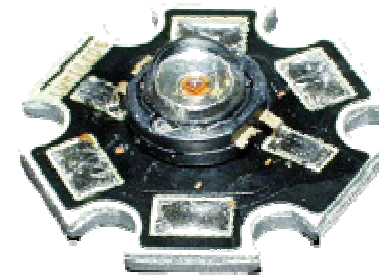
# Design Overview

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## LED Technology and Optics

*LEDs fit the needs of our target market:*

- Durable and Reliable
- Low power requirements
- More efficient than most other options
- Longest Life
- Actively developing technology



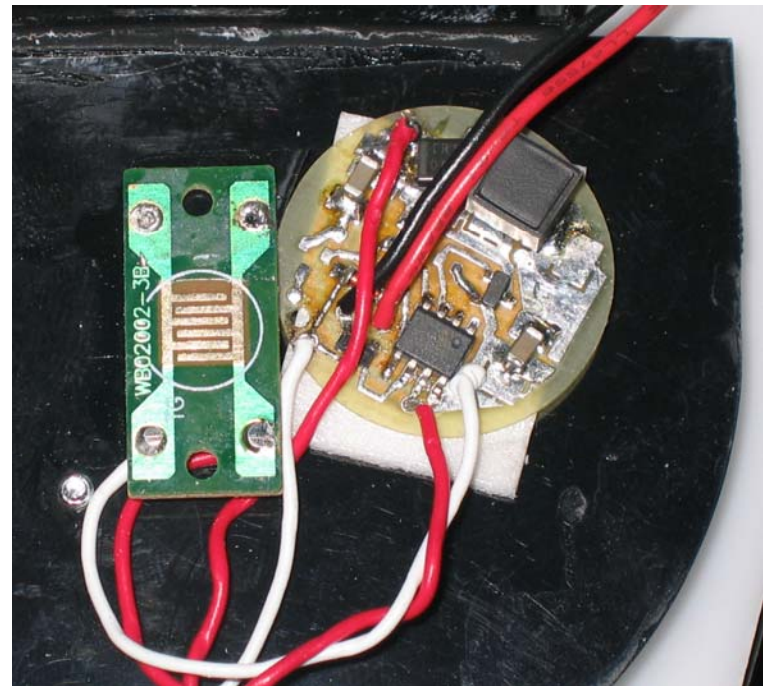
# Design Overview

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## Driver Circuitry

*Microprocessor controlled circuit*

- Minimal components, low cost
- Regulates LED and battery
- 90% energy efficient



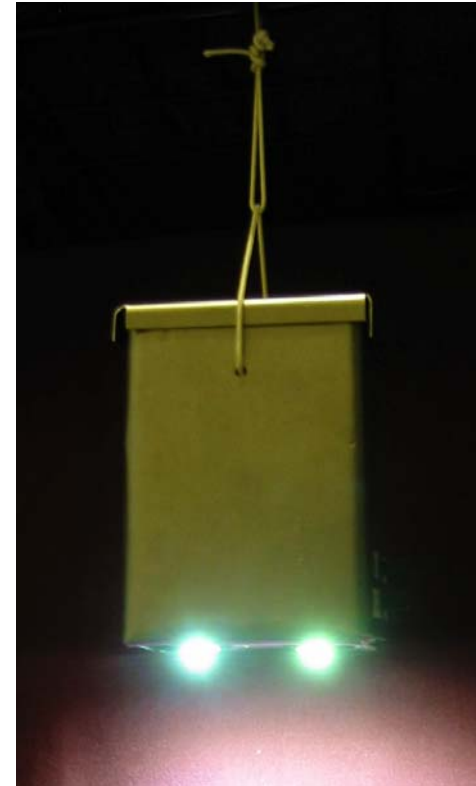
# Design Overview

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## Housing

*Plastic or stamped metal*

- Stamped sheet metal improves heat dissipation
- Injection molded plastic good at large quantities



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# Final Designs

**Sally Madsen**  
**MS, Mechanical Engineering**



# Design Parameters

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- **Form** - size, weight
- **Usage** - hanging, sitting on surface, portable
- **Light output** - ambient, task



# Prototype: “El Cheapo”

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**Point of view:** Cheapest design with power generation

**Intended users:** Any poor people w/o electricity





# Prototype: “El Cheapo”

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- Task lighting
- 1 0.6W PV panel
- 1 AA NiMH battery
- 3 .1W LEDs
- Injected plastic housing
- Estimated cost of goods \$7.30



# Prototype: China and India

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**Point of view:** Hanging light with power generation, adjustable focus

**Intended users:** Night market vendors, cottage industry workers, families



# Prototype: China and India

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- Task and ambient lighting - adjustable optics
- 1 1.2W PV panel, 45 degree angle to sun
- Optional charger from grid
- 2 AA NiMH batteries
- 1 1W LED
- Injected plastic housing
- Estimated cost of goods \$10.40



# Prototype: Mexico

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**Point of view:** Hanging light using 1/6 of current battery life  
**Intended users:** Families



# Prototype: Mexico

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- Ambient lighting
- 2 D alkaline batteries
- 1 1W LED
- Injected plastic housing
- Estimated cost of goods \$8.25



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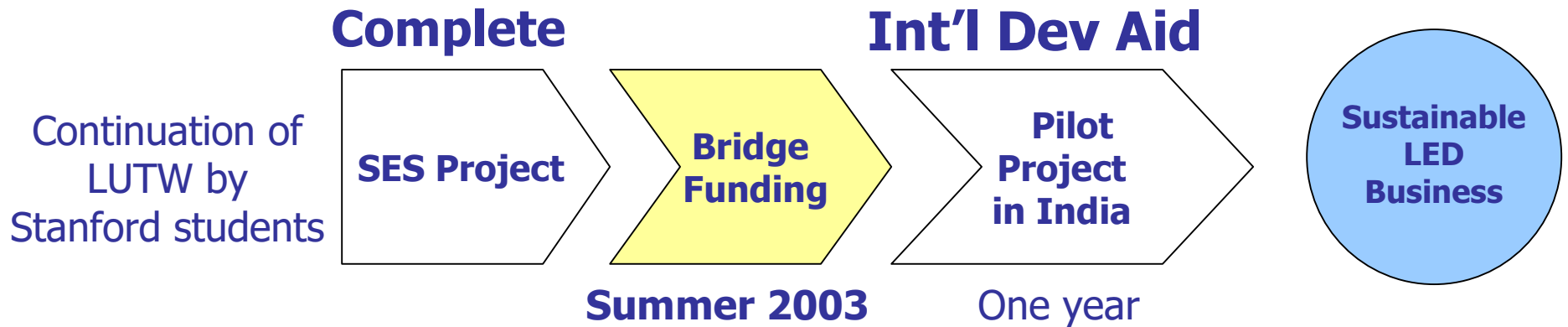
# NEXT STEPS

**Matthew Scott**  
**MBA, Graduate School of Business**

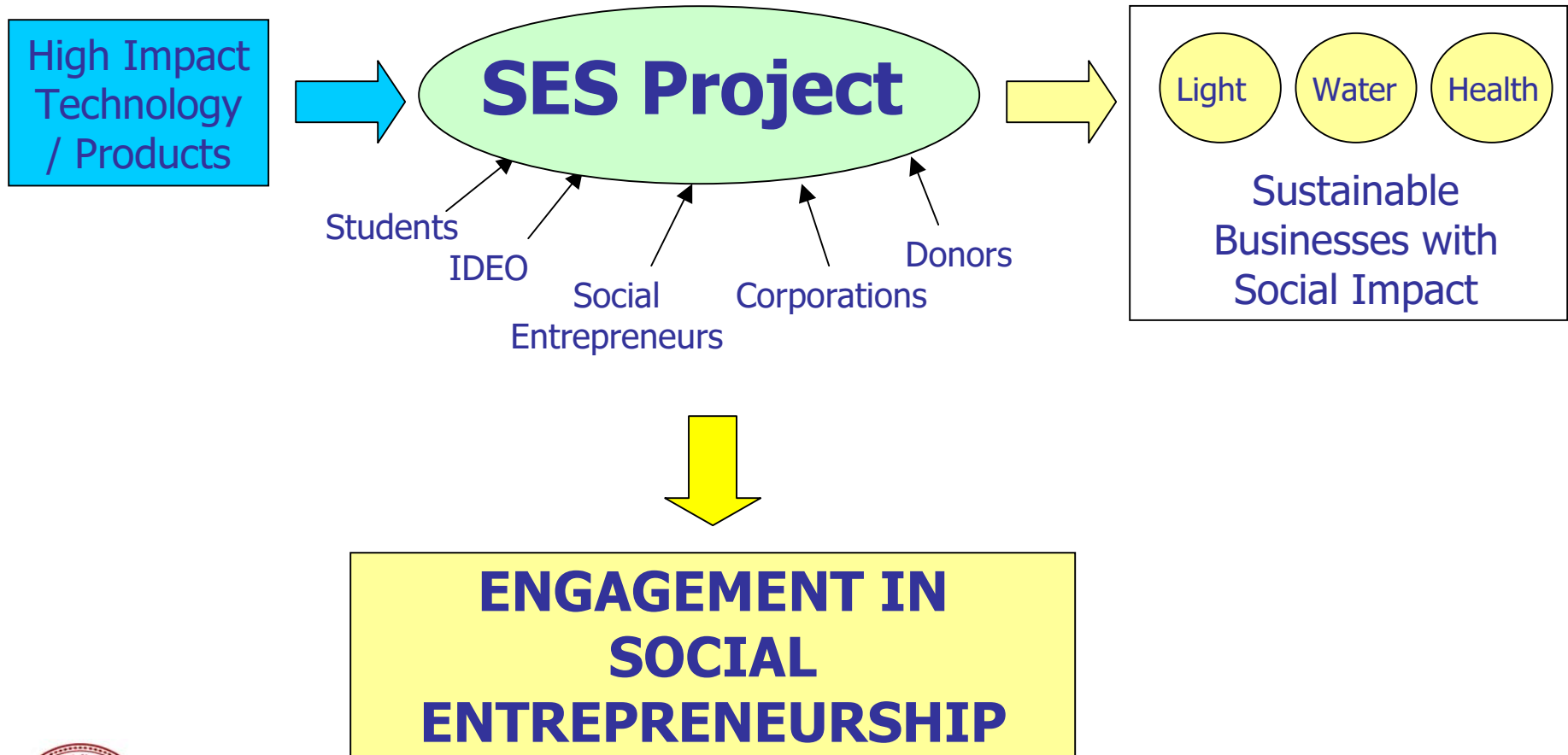


# NEXT STEPS: Funding to continue

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# Longer-term Vision for SES





# Immediate Need: Scaling up for Global Impact

