

# Low Cost Lighting Competition for Emerging Economies



[www.socialitelantern.org](http://www.socialitelantern.org)

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Swedish Energy Lighting Week, Stockholm, Sweden December 8th 2023



# The City at Night

Marina Bay, Singapore

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# The Forgotten who Live in the Dark

Volta Region, Ghana

3





# Who Are The Forgotten?

Nzega, Rwanda

4





# Who Are The Forgotten?

Manga, Burundi

5





# Who Are The Forgotten?

Turkana, Kenya

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# Who Are The Forgotten?

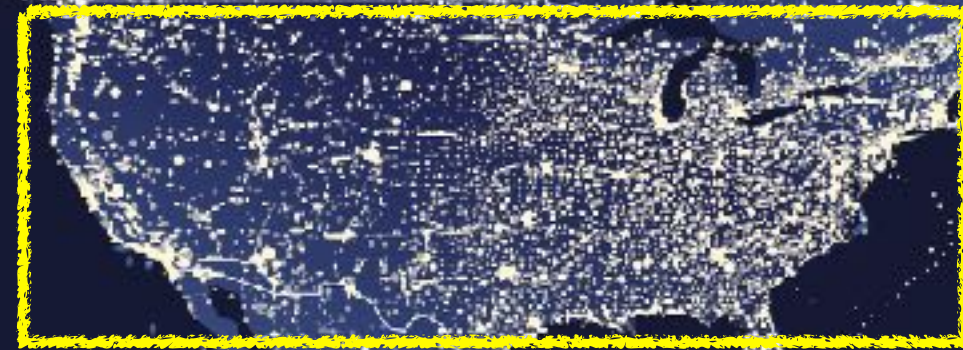
Upper West, Ghana

P 7





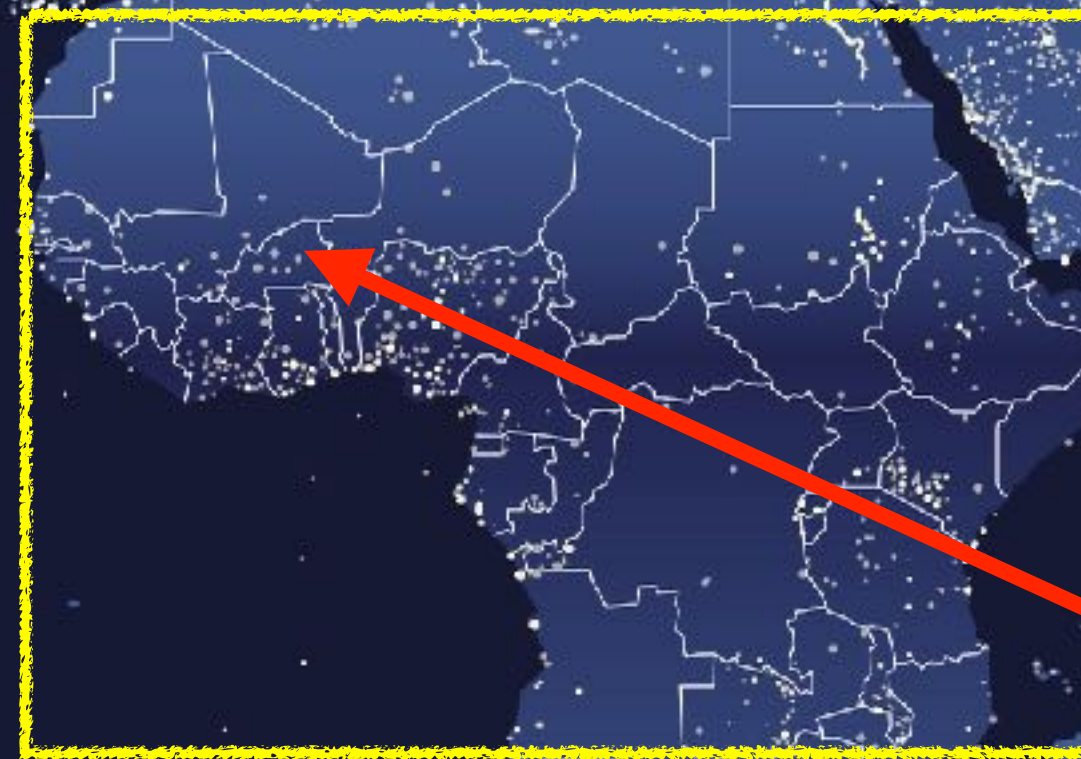
# Some Numbers



USA

Population: 333 million

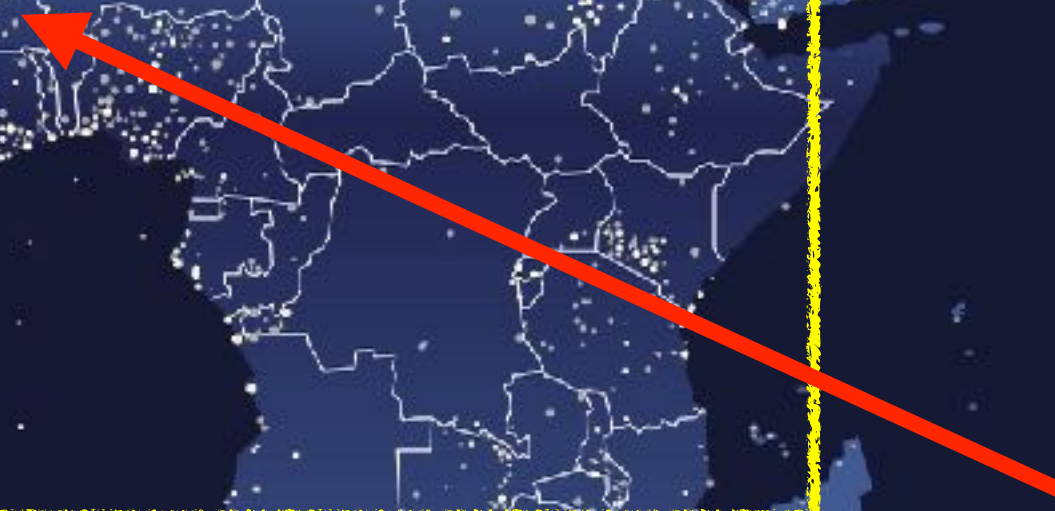
Energy Use: 12 MWh/person/year



Sub-Saharan Africa

Population: 1125 million

Energy Use: < 1 MWh/person/year



Burkina Faso

Population: 20 million

Energy Use: 0.07 MWh/person/year

0.6% USA resident



# Without electricity?

≈ 1,000,000,000

No light

⇒ no productivity after dark

No connectivity

—no telephone

—no internet

—uninformed

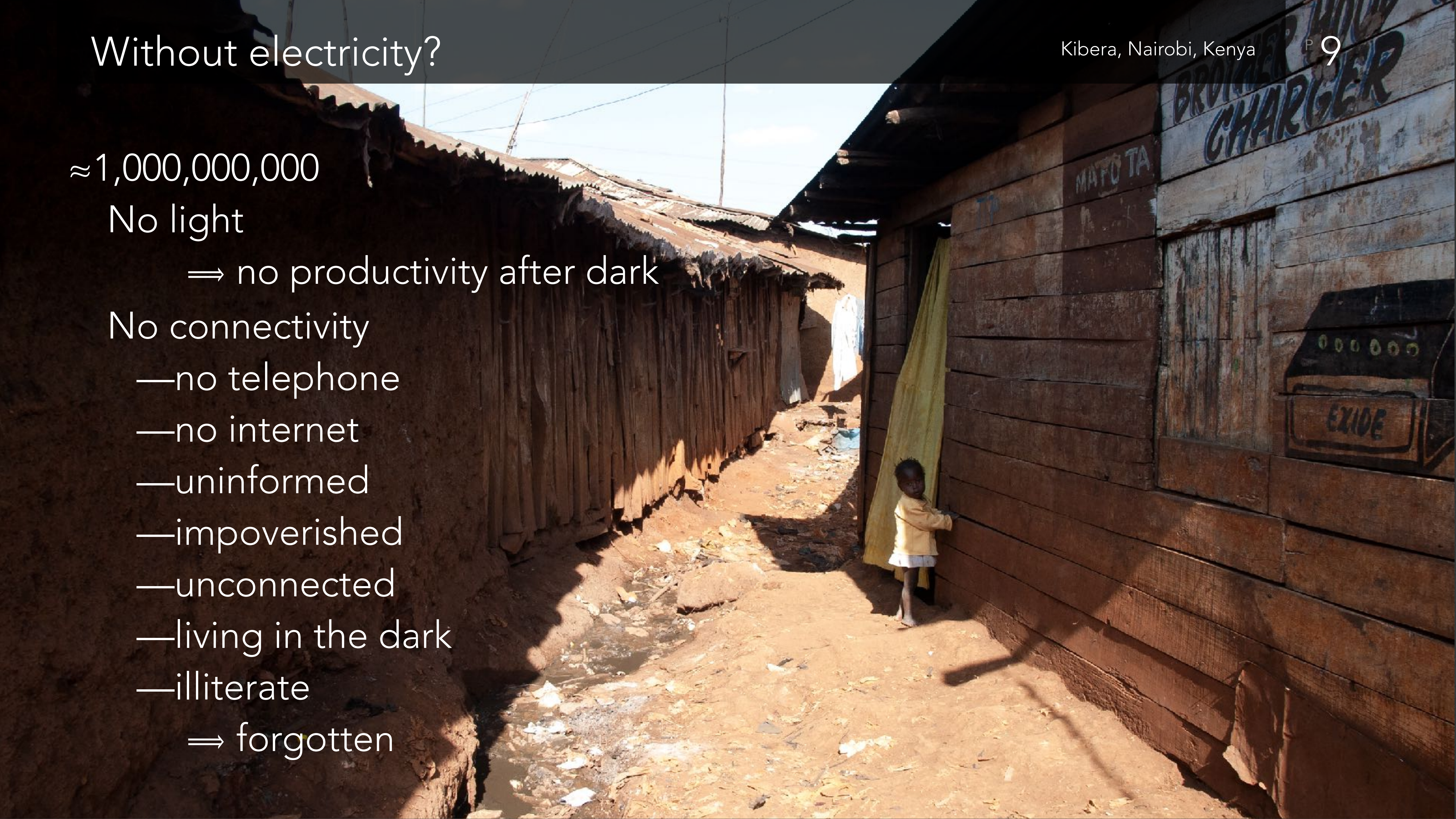
—impoverished

—unconnected

—living in the dark

—illiterate

⇒ forgotten



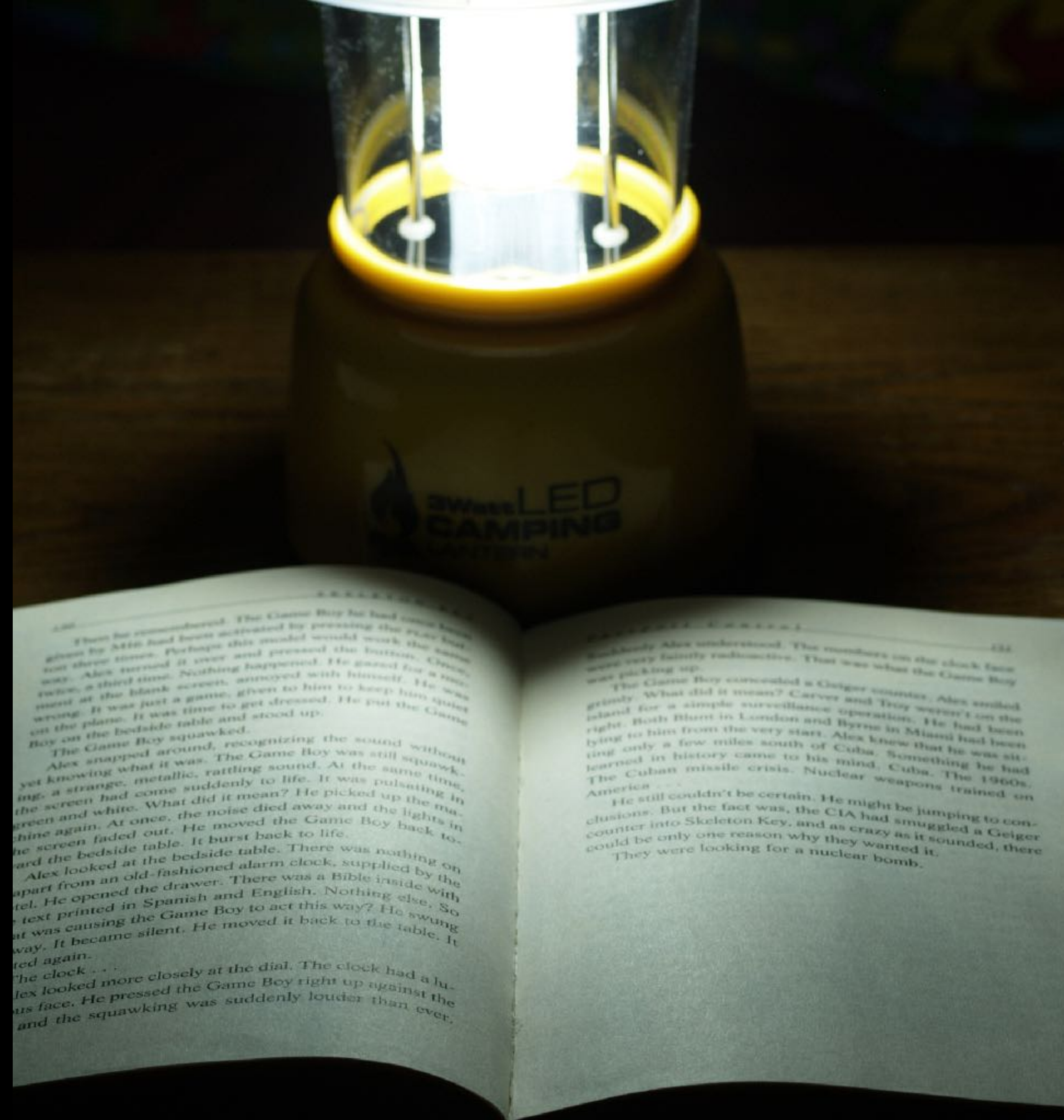




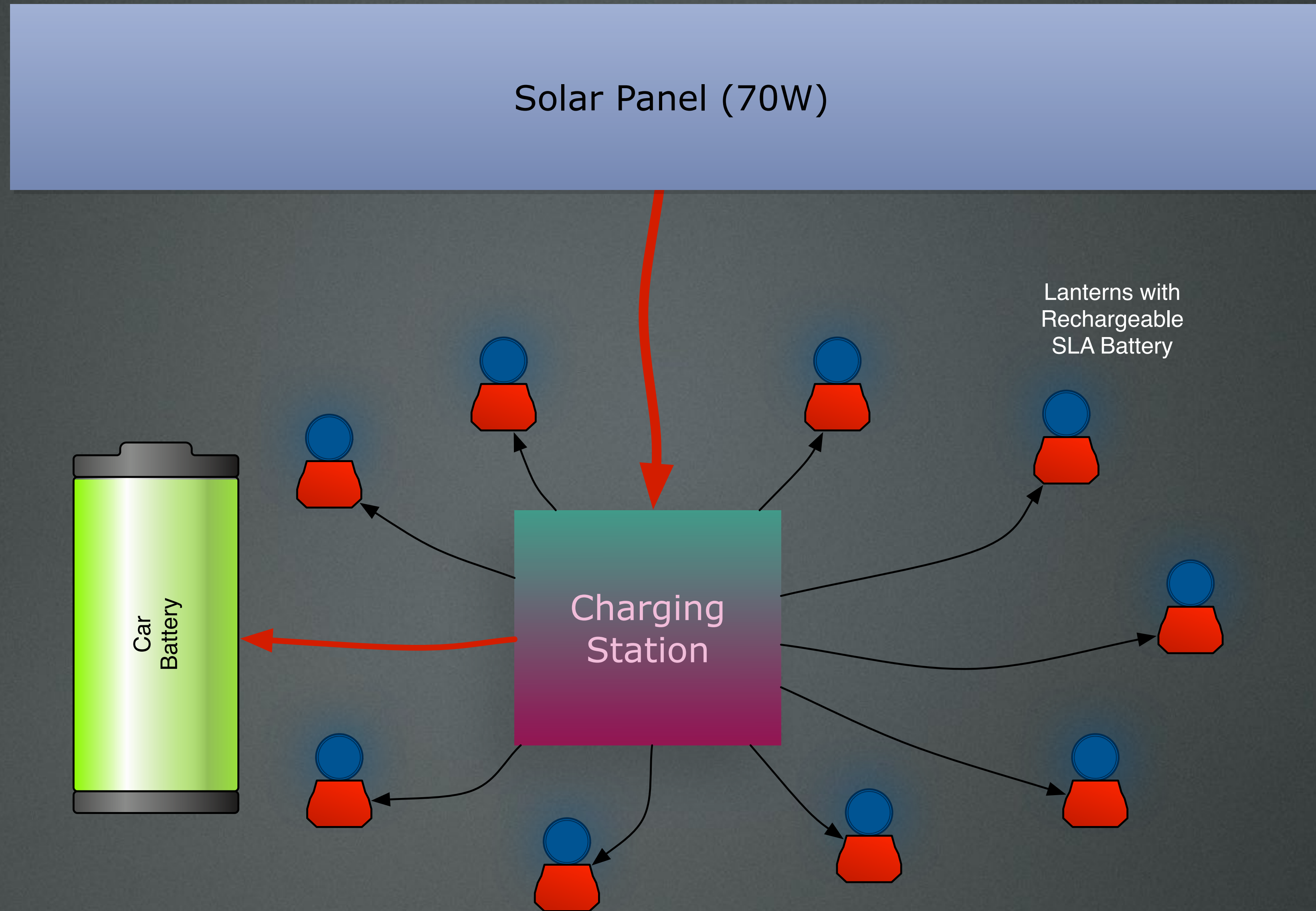


# Class Challenge - Fall 2006

- Design, build and evaluate -
- a portable, rechargeable lantern for the poorest people on the planet
- flashlight and general lighting
- for reading and studying
- runs for two days on a single charge
- costs < \$10 and is a "must have"













# The Dream ..... (2008)

New York, USA

P 14

- Design a lighting system that can be manufactured
  - anywhere by anyone
  - using the power from a 100 W PV panel
- Design a lighting system that
  - needs no infrastructure
  - requires no technical expertise to operate
  - is incredibly robust
  - is as economic as possible





## Accessible

- Low Cost
- Income
- Location

## Sustainable

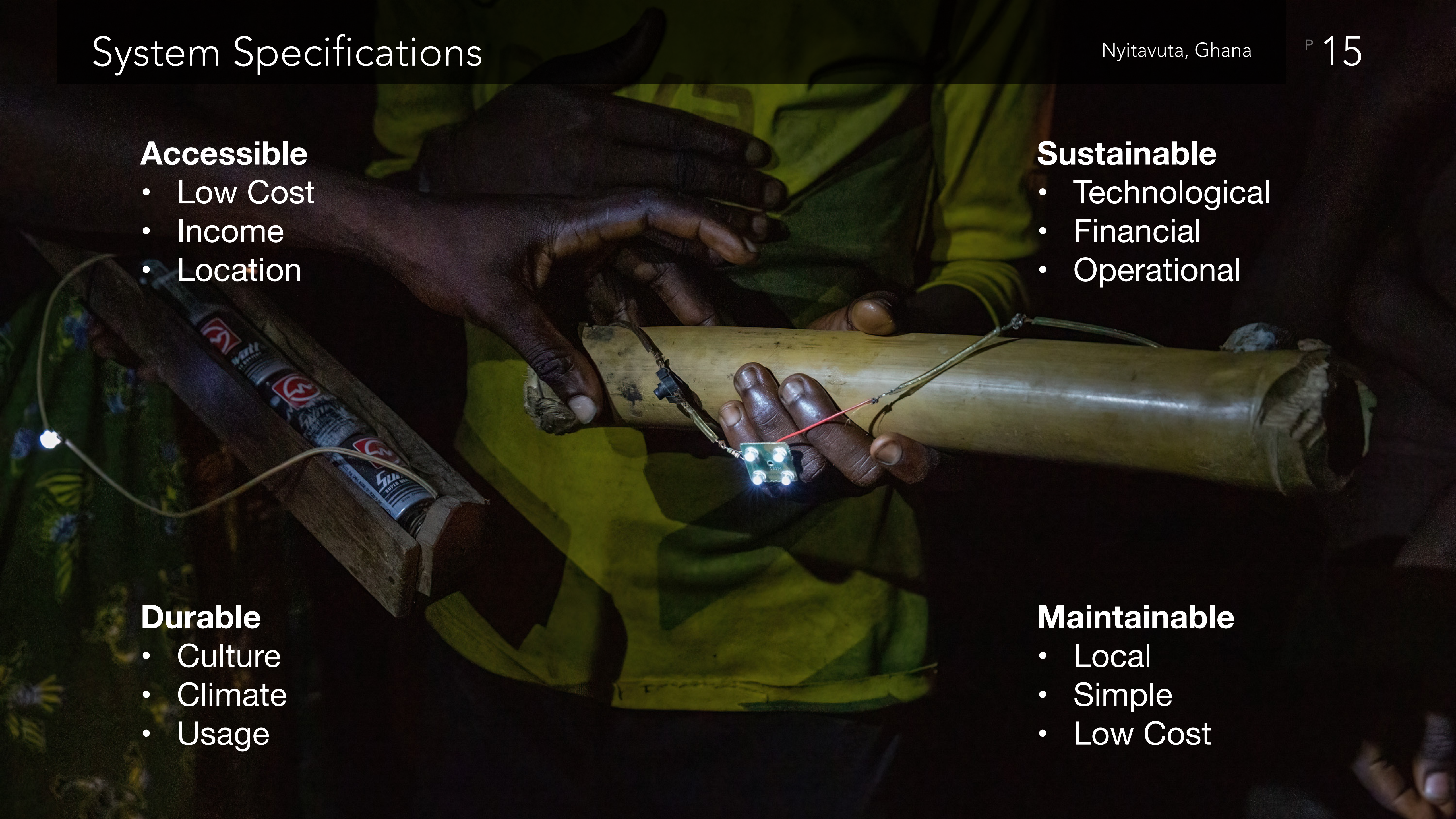
- Technological
- Financial
- Operational

## Durable

- Culture
- Climate
- Usage

## Maintainable

- Local
- Simple
- Low Cost





6V 4.5Ah  
SLA Battery

Lantern  
Base

LED Drive  
& Battery  
Charging

Light  
Diffuser

Three  
bicycle  
spokes





# Circuit Assembly

Ave Dakpa, Ghana









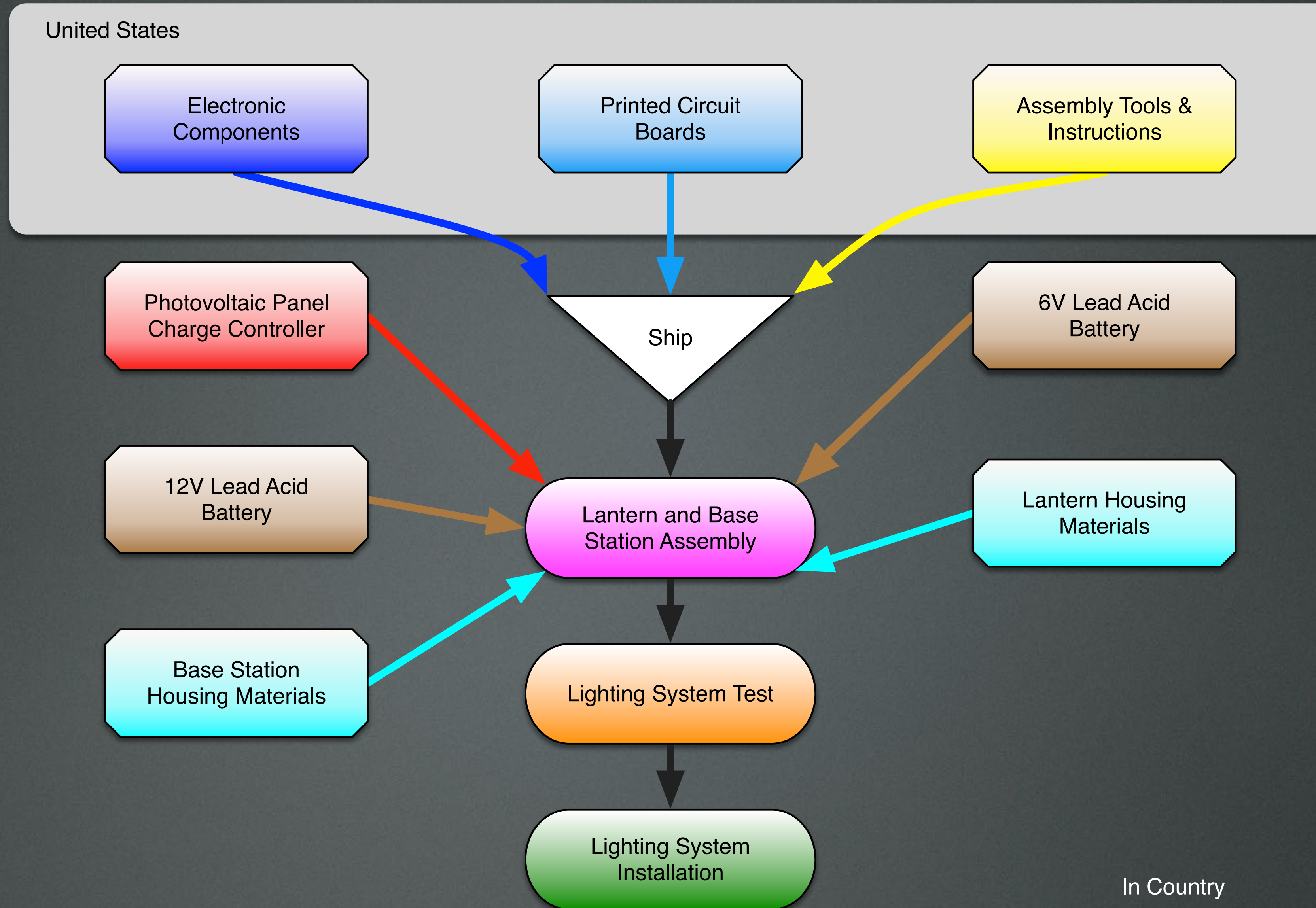






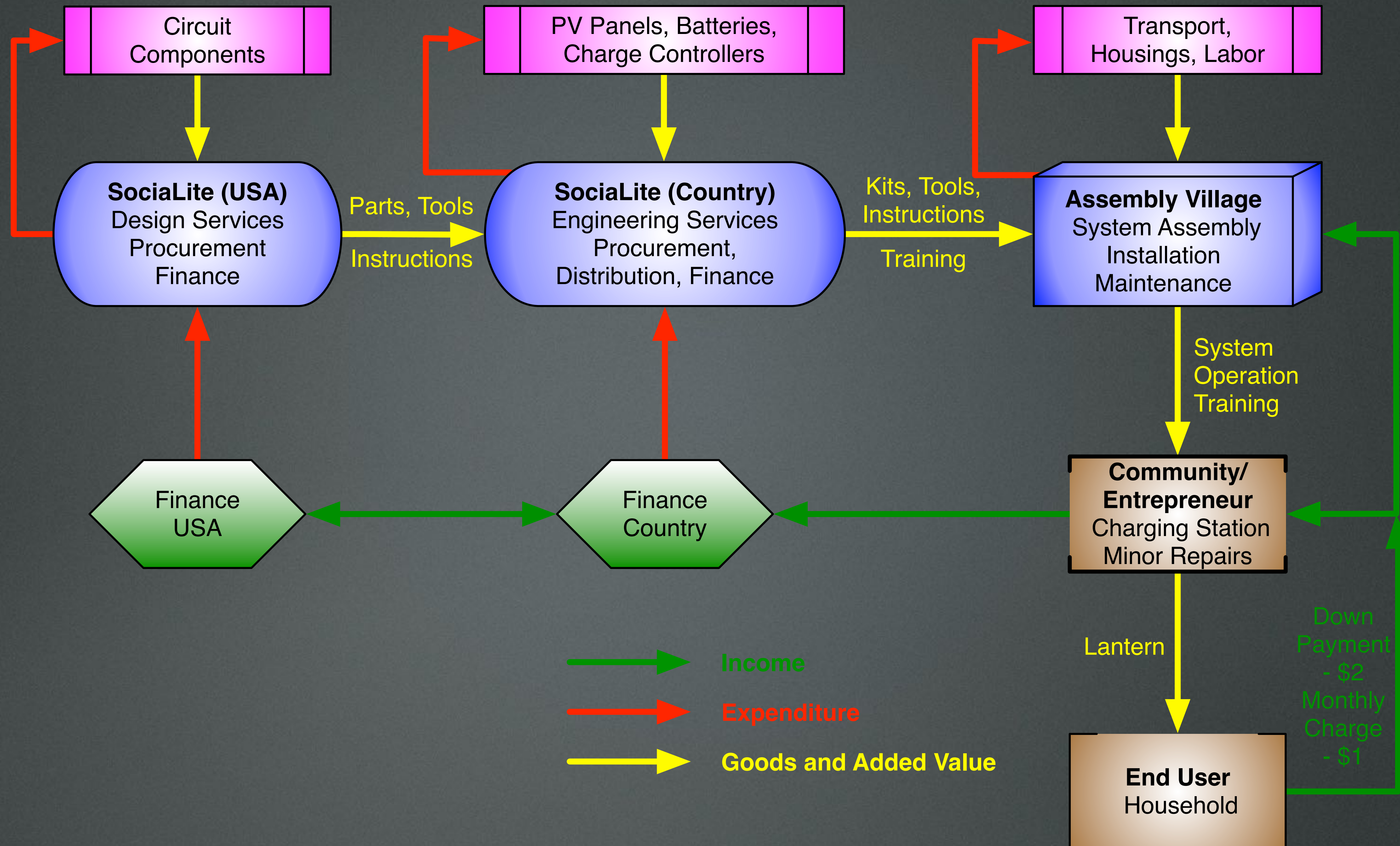
- Buck converter (shared) 12V - 6V (Battery)
- Buck converter (shared) 6V - 3V (LED)
- 6V 4.5 Ah SLA Battery
- Charge time  $\approx$  4 hours
- Battery life  $\approx$  4 years
- Single charge: 40 Hr (bright); 120 Hr (night)
- Charge weekly







# Value Chain — Self-Sustaining





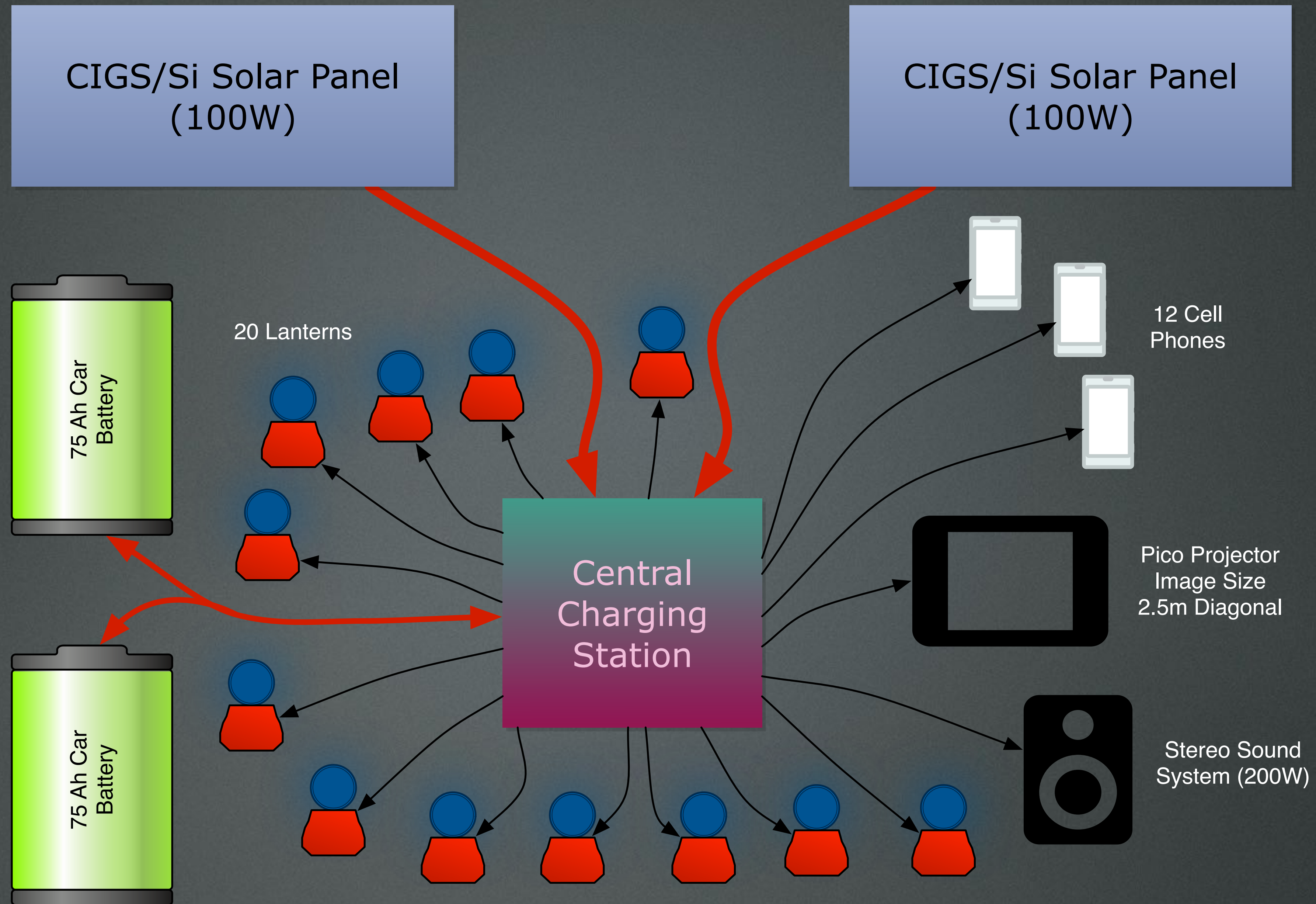
# The Wonder of Light (2016)

Nyitavuta, Ghana

23









Audio Amplifier  
Off/On; Input;  
Volume; Output

Simple 12V  
Power Tools

Lantern Charging

BT  
Speaker

Pico Video  
Projector

Internet through  
Cell Phone

Raspberry Pi

Lantern Firmware  
Programming  
& Field Update

2 x 85Ah SLA Batteries  
MPPT Charge Controller  
Fuses

12V Soldering  
Irons

Socialite

12V Outlet

USB

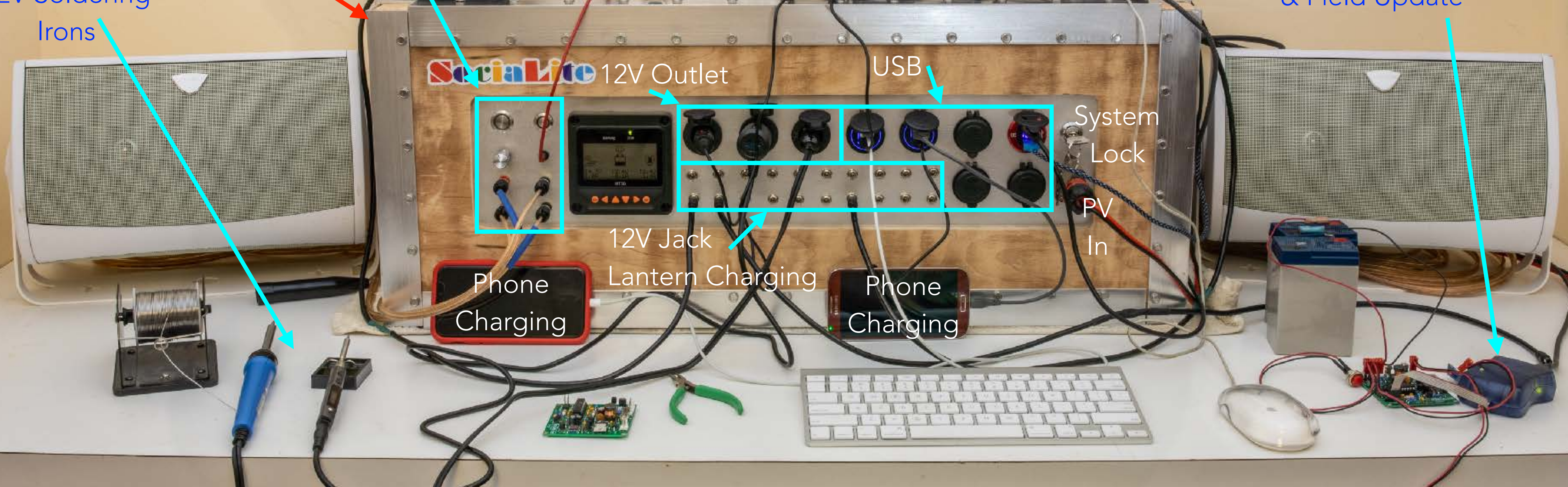
System  
Lock

PV  
In

Phone  
Charging

12V Jack  
Lantern Charging

Phone  
Charging













# SociaLite Lighting Systems

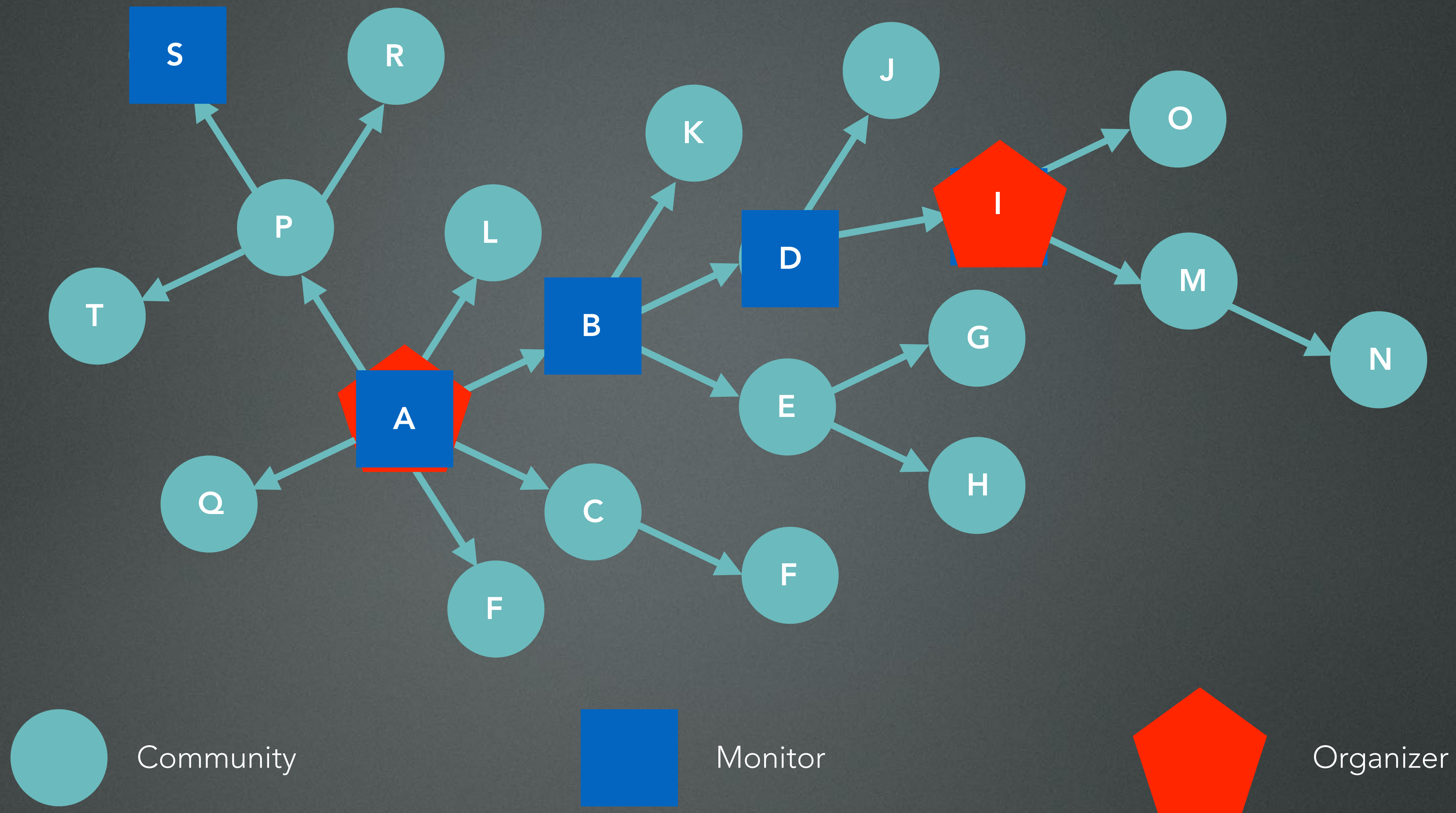
Wa, Ghana

28

16 communities lit  
16 communities in line  
20 communities waiting









## Lantern Costs (USD)

Component	2013	2023
LED	1.50	0.08
PCB	1.00	0.34
Electronics	6.50	10.00
Battery	5.60	7.75
Housing	1.00	3.40
Assembly	2.00	1.00
<b>Total</b>	<b>17.60</b>	<b>22.57</b>

For Orders 1000: 2020 - higher quality switches/jacks

## Communities Served

State	2013	2023
Operational	4	16*
Non-Operational	2	0

\*To date

## Charging Station Costs (USD)

Component	Specification	2013	2023
PV Panel	68W	200	200
Car Battery	> 66 Ah	100	125
Charge Controller	Standard	20	120
Power Distribution	14 Outlets	100	300
<b>Total</b>		<b>420</b>	<b>745</b>

\*Panel now 250W; Battery now 95Ah; Charge Controller MPPT (Efficiency 97%)

## Usage Charges (USD)

Type of Payment	2013	2023
Lantern (Downpayment)	3.50	1.00
Lantern (Monthly fee)	0.70	0.50
Cell Phone Charging/Movie (PPU)	—	0.10



# Acknowledgements







Design an affordable, accessible lighting system operational in impoverished, marginalized, forgotten communities across the globe.

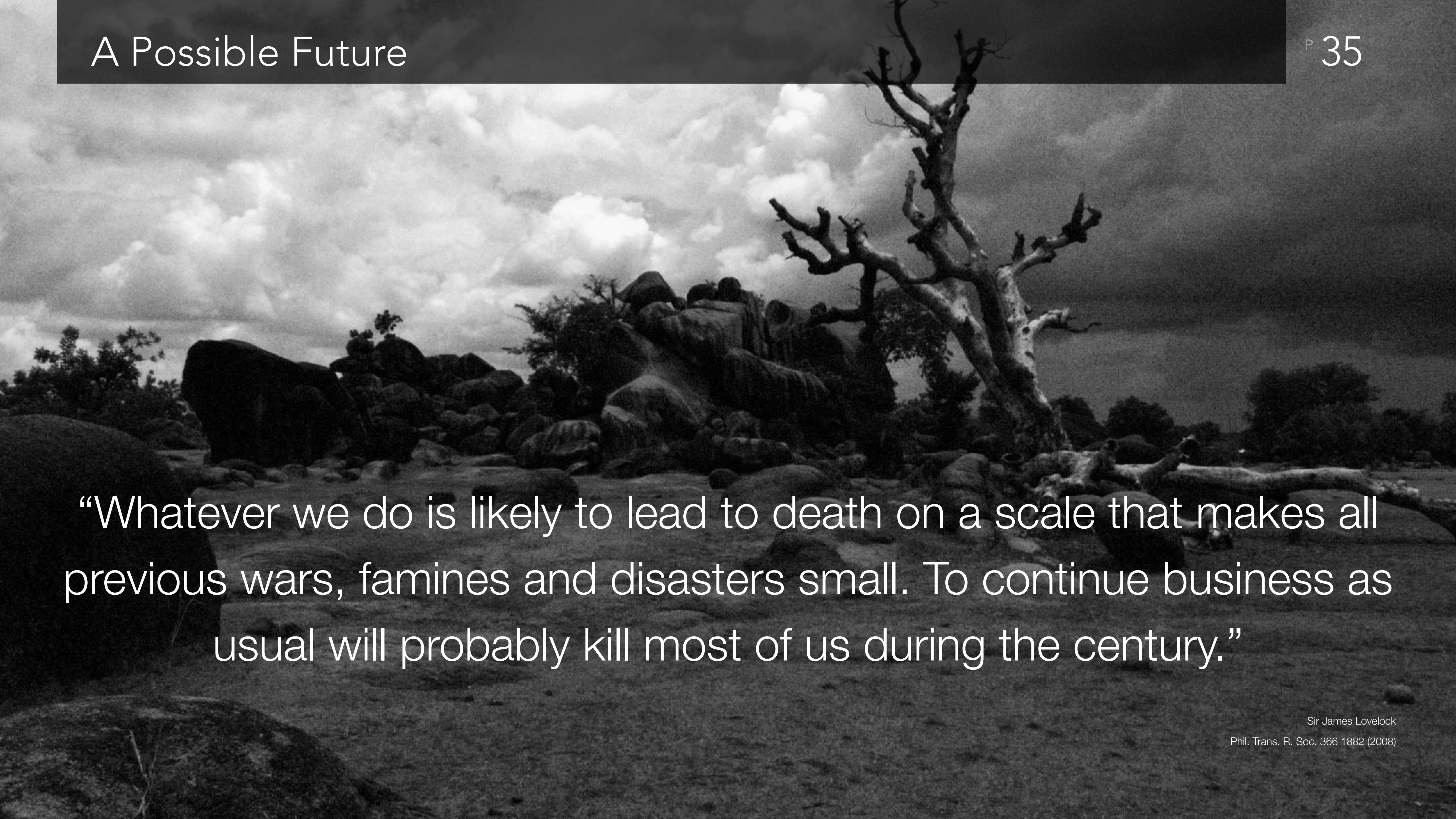


“In principle, with the required resources, it would be comparatively easy to light the world—but only in a way that perpetuates waste and the inequity we seek to eliminate”



“Currently, artificial light is responsible for about 14% of the global energy consumption. Without radical changes in design, manufacturing, and usage, adding a billion light sources will probably destroy our ecosystem.”





“Whatever we do is likely to lead to death on a scale that makes all previous wars, famines and disasters small. To continue business as usual will probably kill most of us during the century.”



“An ideal opportunity to fundamentally rethink artificial light in a very different, resource constrained, ecosystem”





let's  
make  
light

**IEEE SMART LIGHTING**  
**COMPETITION 2023**



“A smart light—able to provide the most efficient illumination required by anyone, anywhere without harm to animals or plants”

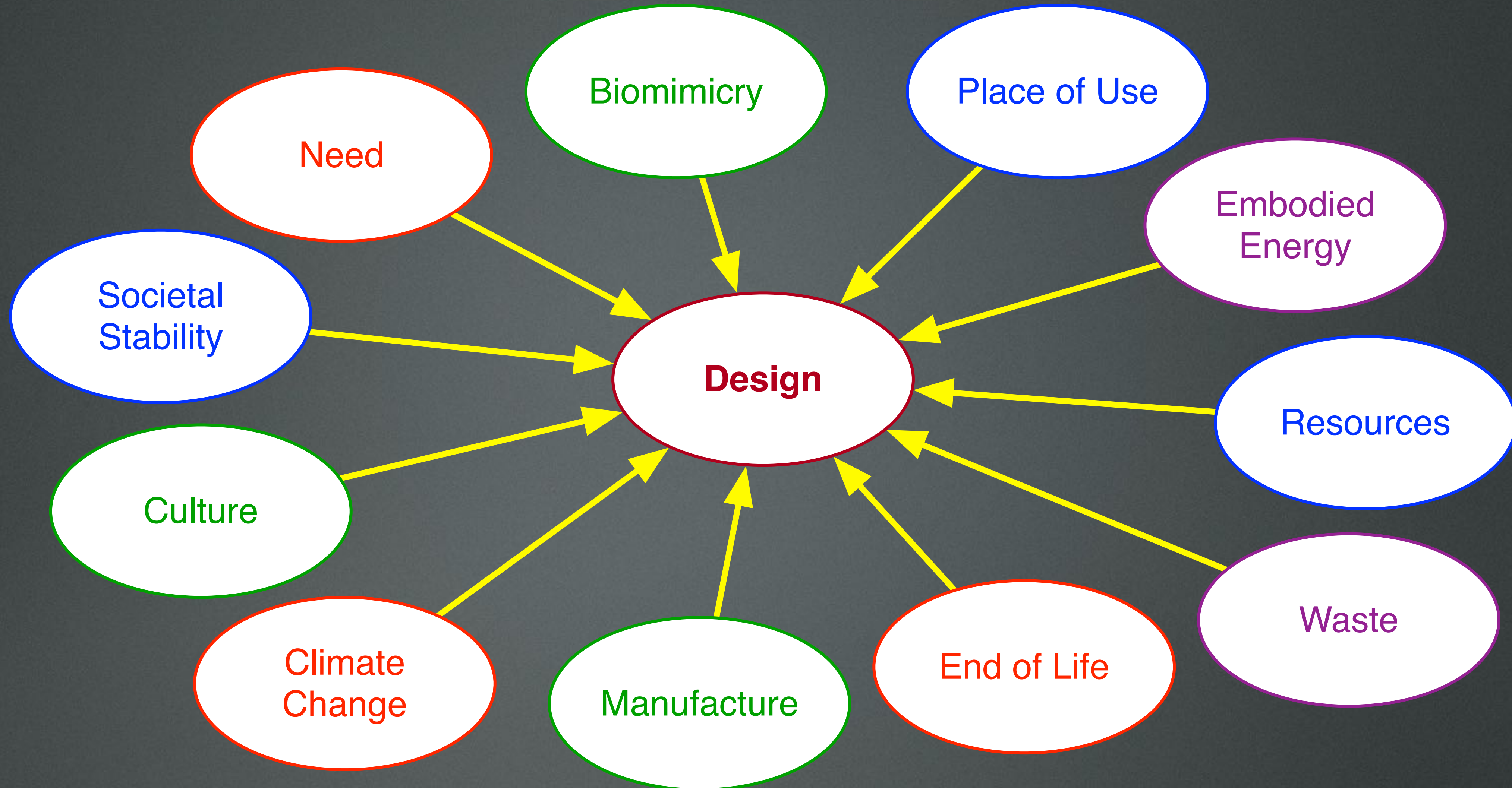


“The “intelligent” luminaire, deployed as a single or multi-source unit, should be able to provide low level, background light and higher brightness, directed illumination for human activities.”

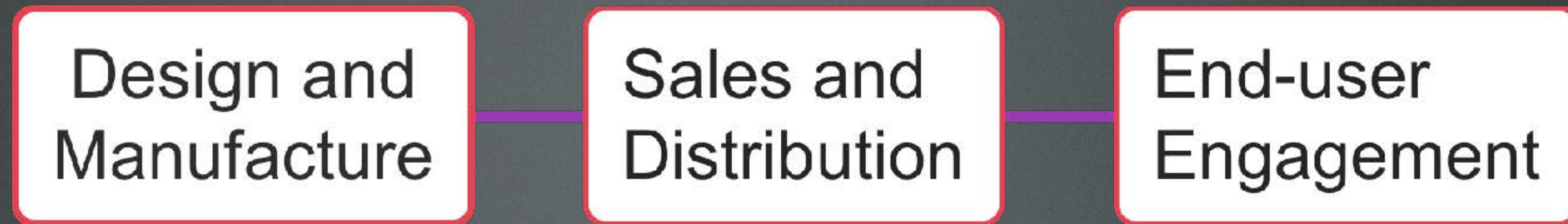


- universal availability
- universal accessibility
- extreme affordability
- local manufacture
- modular manufacture
- mechanically robust
- intuitive to use
- exemplary LCA
- energy efficient
- local repair
- circular economy
- electrically robust
- physically attractive
- integral power source

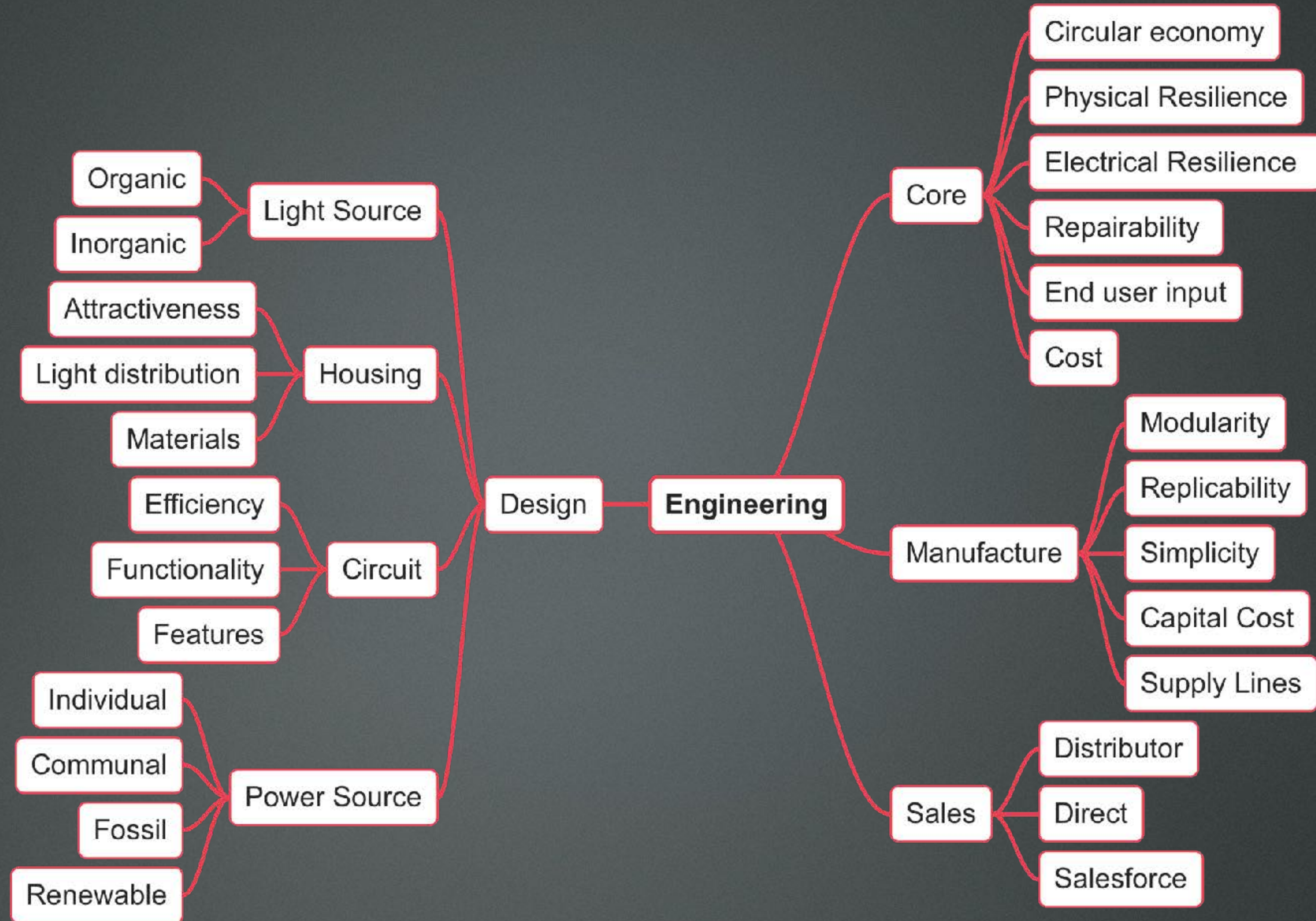




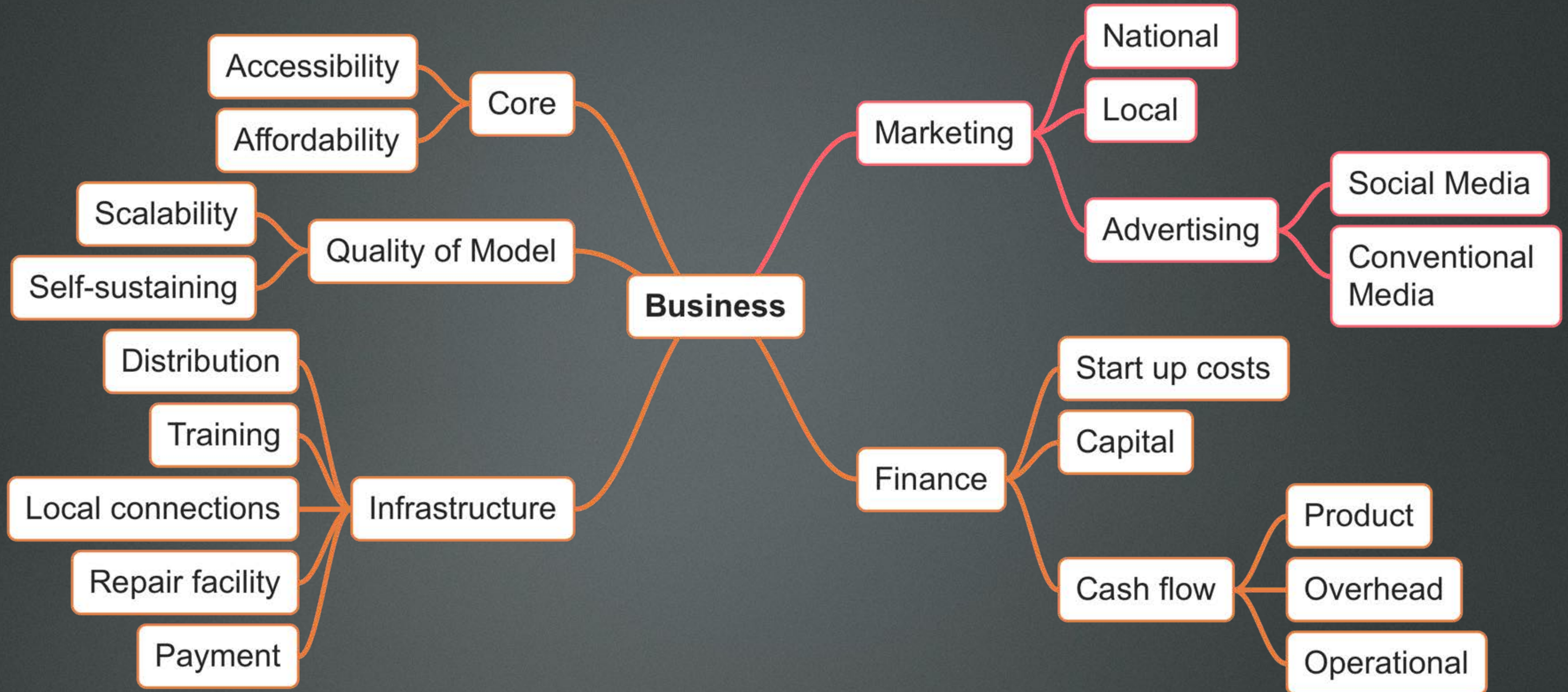




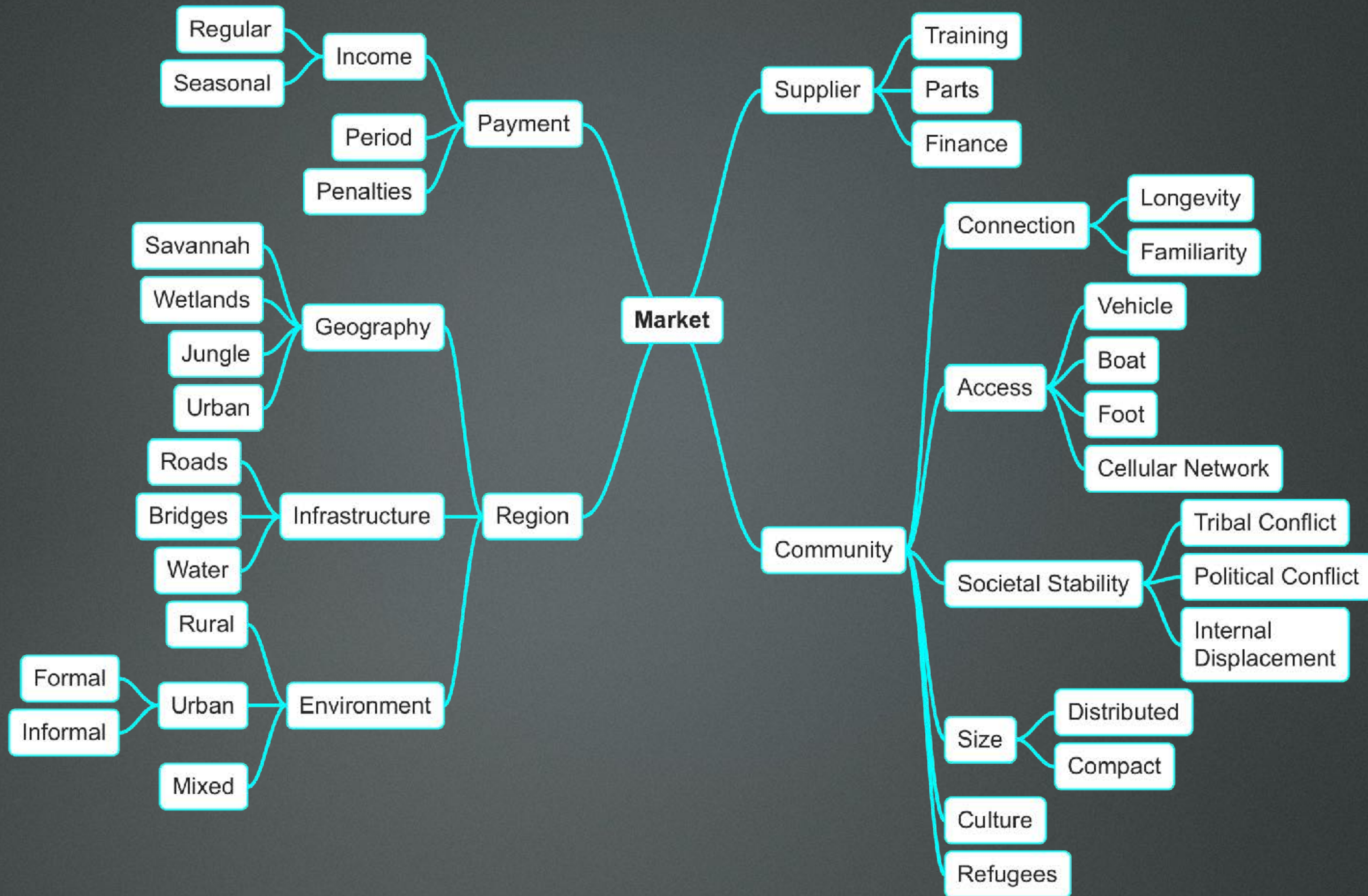














# The Let's Make Light Committee

- |                           |         |                    |            |
|---------------------------|---------|--------------------|------------|
| • Georges Zissis          | France  | • Sydney Lienemann | USA        |
| • Abdullateef Aliyu       | Nigeria | • Ravindra Desai   | India      |
| • Christofer Silfvenius   | Sweden  | • Salamatu Sani    | Nigeria    |
| • Jennifer Keller Jackson | USA     | • Chaltu Marta     | Kenya      |
| • Khanjan Mehta           | USA     | • Munir Mohammed   | India      |
| • Lambros Doulos          | Greece  | • John Nelson      | USA        |
| • Pritpal Singh           | USA     | • Carole Grasse    | IEEE (USA) |
| • Simone Abram            | England | • Toby Cumberbatch | USA        |



# The ideal artificial light?

Rambouillet, France

P. 47

Bioluminescence  
Microbial batteries  
Smart  
*Really* sustainable  
Accessible to all  
Circular economy



Tack själv!

Questions