Low Cost Lighting Competition for Emerging Economies







www.socialitelantern.org

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leek, Stockholm, Sweden December 8th



The City at Night





P 2

The Forgotten who Live in the Dark



Volta Region, Ghana



Who Are The Forgotten?



Nzega, Rwanda





Who Are The Forgotten?

TAY





Who Are The Forgotten?

Upper West, Ghana





Some Numbers

Population: 333 million

USA

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



8

Without electricity?

≈1,000,000,000 No light ⇒ no productivity after dark No connectivity -no telephone -no internet -uninformed ---impoverished —living in the dark ----illiterate ⇒ forgotten

Kibera, Nairobi, Kenya



Portable Lanterns



S. Sug

CT, USA

SL 006



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"

faded out. He mo ved the Game Boy ed the bedside table. It burst back to life

Alex looked at the bedside table. There was n lex looked at the shioned alarm clock, supplied by part from in one drawer. There was a Bible inside el. He opened in Spanish and English. Nothing else text printed in 5, Game Boy to act this way? Ho so it was causing the silent. He moved it back to the table

ed again

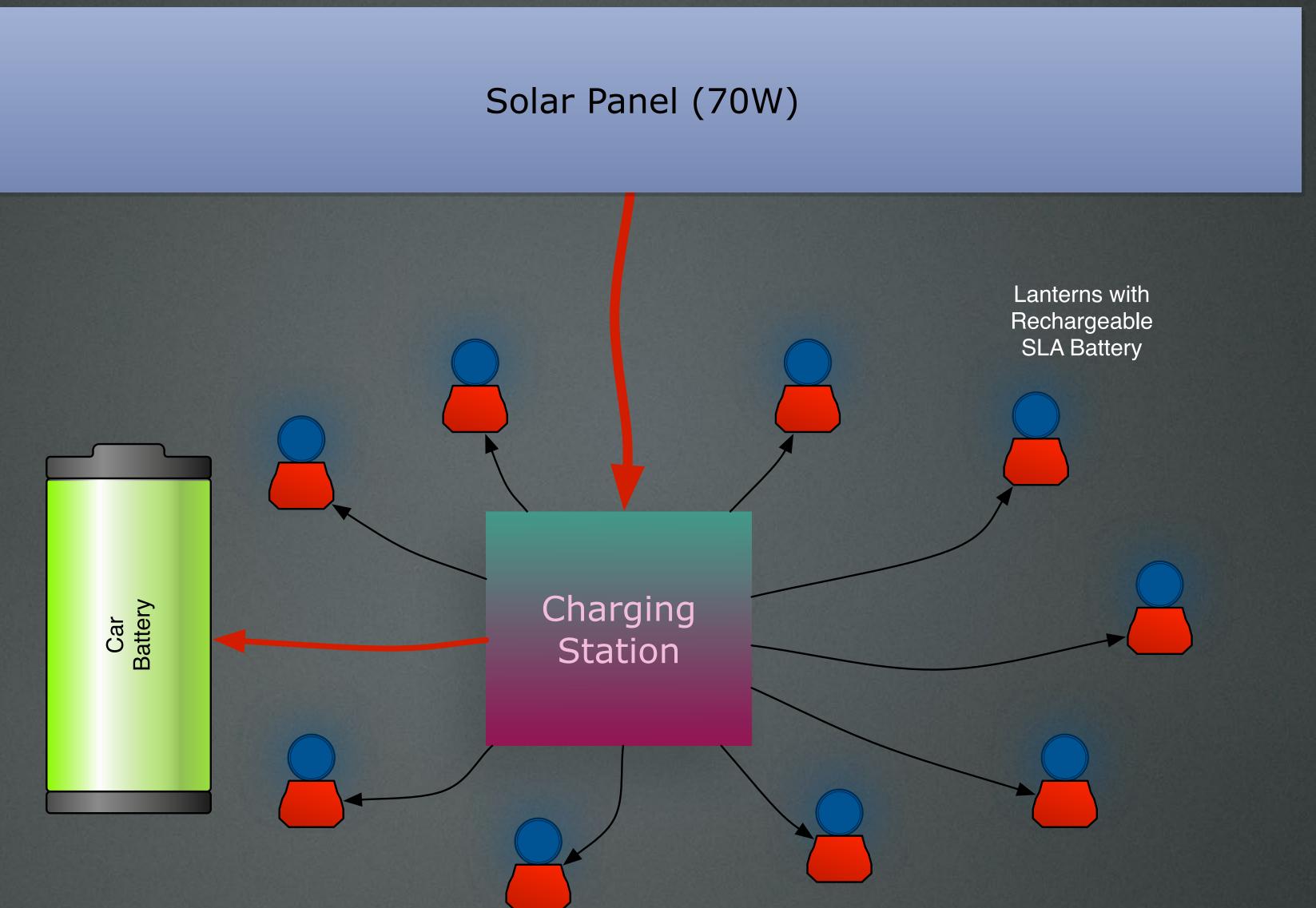
d more closely at the dial. The clock had a h e clock ... is face. He pressed the Gam appoinst the us face. He pressed the suddenly louder than ever

Converse series Troop or re served Hyperson has Notice the very start. Alon here's that he was all ame to his mind. Cuba. The 1900s.

couldn't be certain. He might be jumping to conthe fact was, the CIA had smuggled a Geiger Skeleton Key, and as crazy as it sounded, there nly one reason why they wanted it. were looking for a nuclear bomb.

Nuclear weapons trained on

System Overview - Shared Resources



EID101C, Cooper Union, 2006

₽ 12





The Dream (2008)

- 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

New York, USA

P 1 4



System Specifications

Accessible

- Low Cost
- Income
- Location

Durable

- Culture
- Climate
- Usage

Nyitavuta, Ghana

Sustainable

- Technological
- Financial
- Operational

Maintainable

- Local
- Simple
- Low Cost



Lantern Components 2010

6V 4.5Ah SLA Battery

Lantern

Base

Three bicycle spokes



Kumasi, Ghana

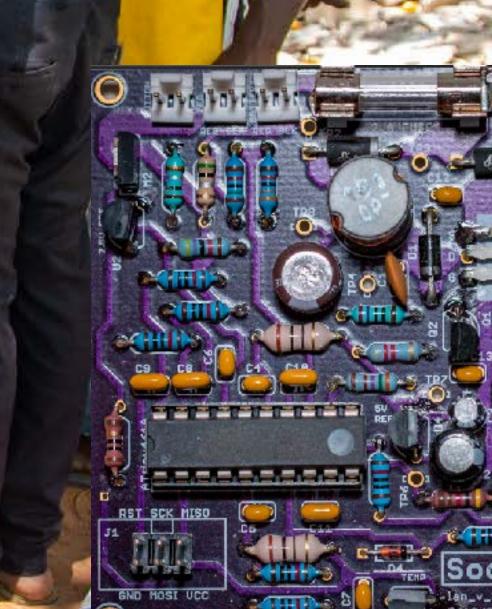
LED Drive & Battery Charging Light Diffuser



Circuit Assembly







Lantern Housing



Ave Dakpa, Ghana



System Delivery

Katua, Ghana P 19



Community Appraisal



Maakoteng, Ghana

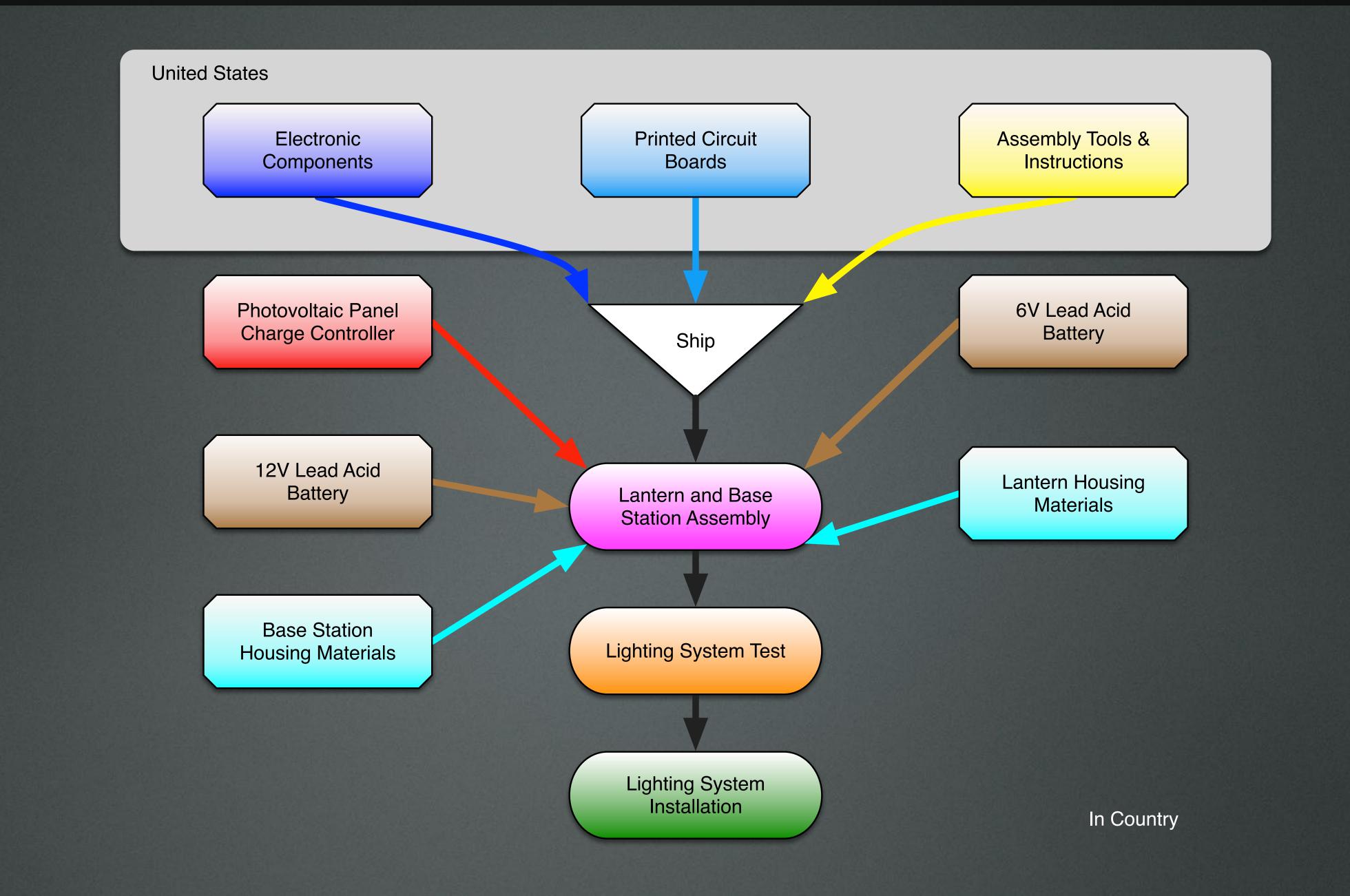
• Buck converter (shared) 12V - 6V

- 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 (night)
- Charge weekly

Service an int of



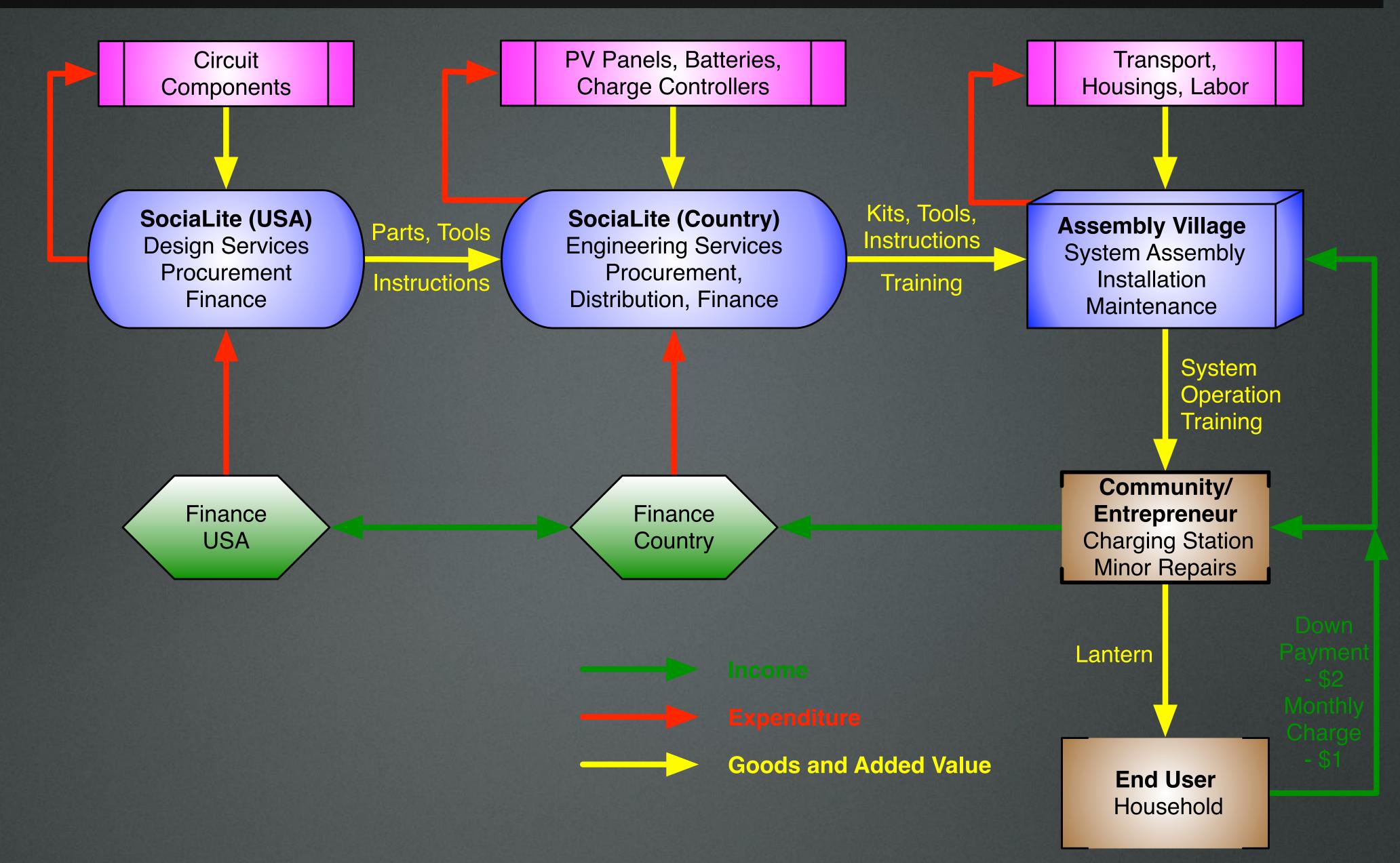
Supply Lines



SociaLite

°21

Value Chain — Self-Sustaining



SociaLite

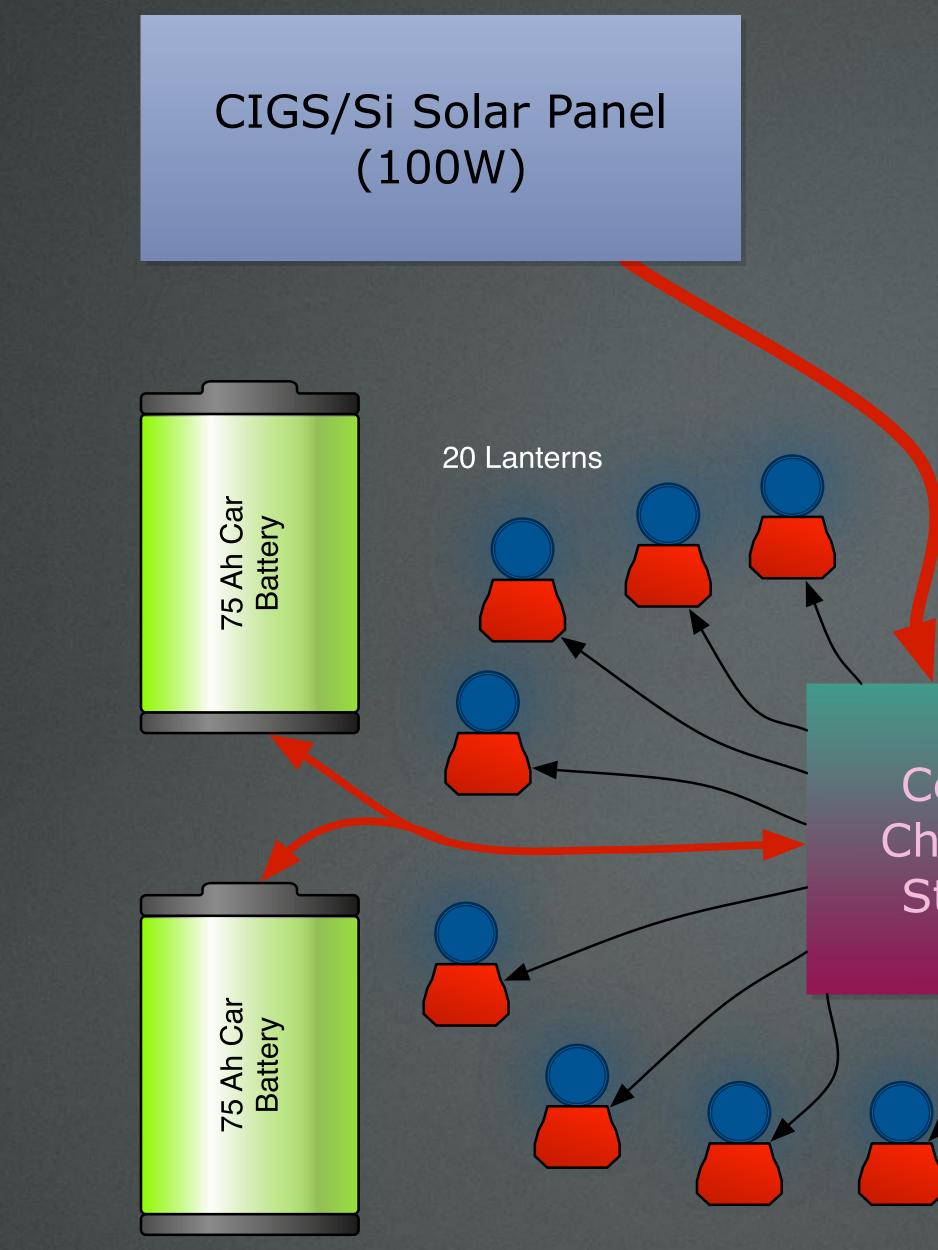
The Wonder of Light (2016)

Nyitavuta, Ghana





SociaLite Lighting System with optional A/V Facilities



₽ 24 CIGS/Si Solar Panel (100W)

2020

12 Cell Phones Pico Projector Central Image Size 2.5m Diagonal Charging Station Stereo Sound System (200W)

Pico-Grid (May 2020)

Simple 12V

Power Tools

Audio Amplifier Off/On; Input; Volume; Output

2 x 85Ah SLA Batteries **MPPT Charge Controller Fuses**

12V Soldering Irons

> hone Charging

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Socia Lity

-

Name of State or other State of State

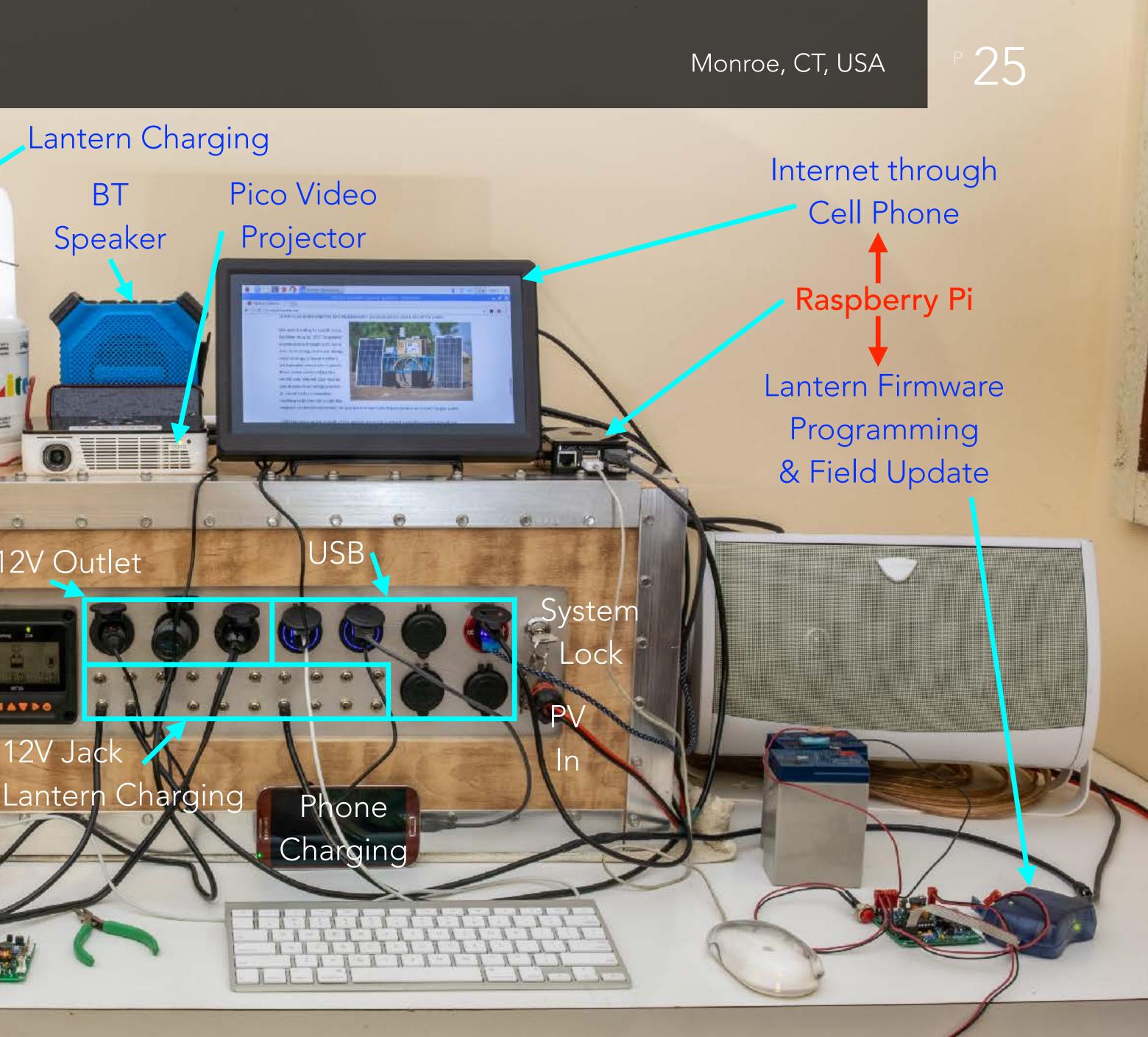
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Second 12V Outlet

6

12V Jack

BT



Introducing Bush Cinema

Bulinjing, Ghana



Bush Cinema



27 Bulinging, Ghana



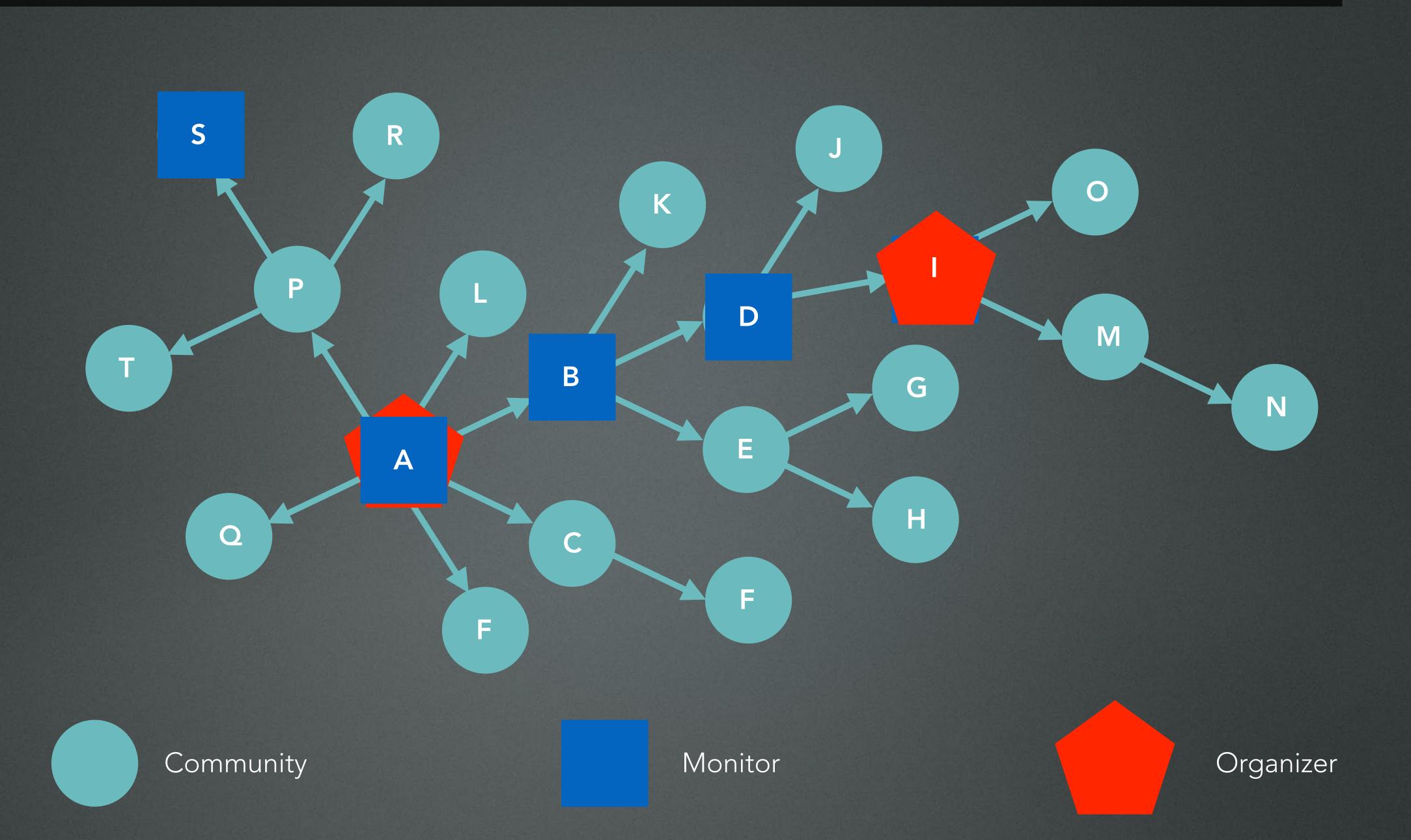
SociaLite Lighting Systems

WVAR

16 communities lit16 communities in line20 communities waiting



System Propagation



SociaLite



Approximate Financials

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
Total	17.60	22.57

Car Cha Pow Tota

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

For Orders 1000: 2020 - higher quality switches/jacks

Communities Served

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

Lant Lant Cell

*To date

SociaLite

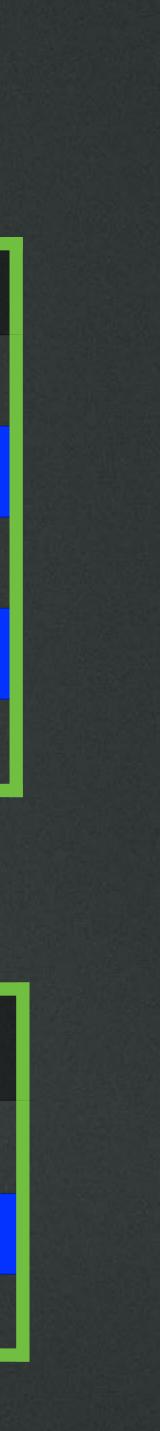
° 30

Charging Station Costs (USD)

Component	Specification	2013	2023
Panel	68W	200	200
Battery	> 66 Ah	100	125
arge Controller	Standard	20	120
ver Distribution	14 Outlets	100	300
al		420	745

Usage Charges (USD)

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



Acknowledgements







WRIGHT-INGRAHAM INSTITUTE



IEEE Future Directions - Smart Lighting Competition

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

https://smartlighting.ieee.org/competition



"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"

° 33

"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. "

^P 34

A Possible Future

"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."

Sir James Lovelock Phil. Trans. R. Soc. 366 1882 (2008)



"An ideal opportunity to fundamentally rethink artificial light in a very different, resource constrained, ecosystem" ° 36



IEEE SMART LIGHTING COMPETITION 2023

let's make

37

"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."

° 39



The ideal lighting system

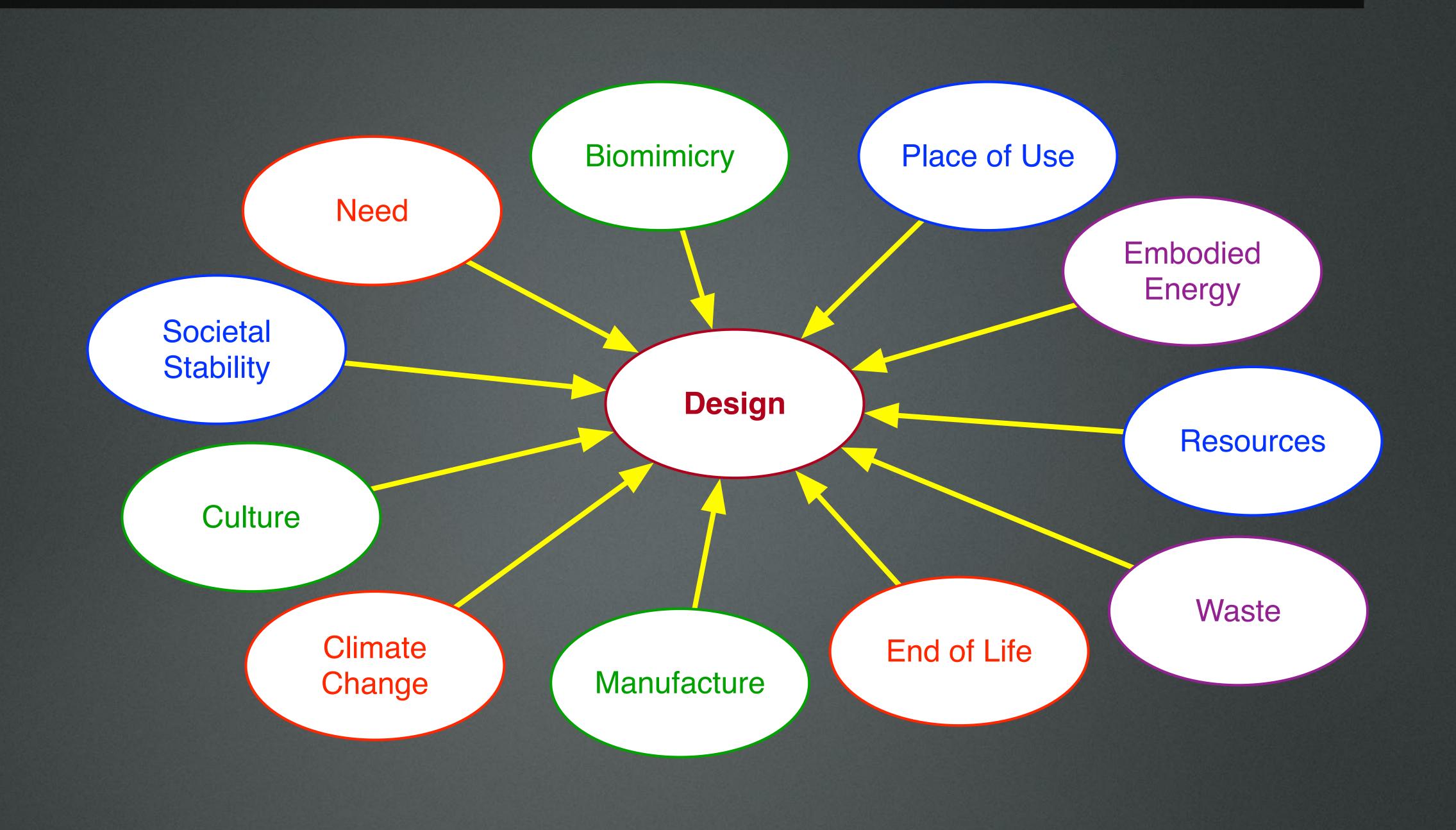
 universal availability universal accessibility extreme affordability local manufacture modular manufacture mechanically robust intuitive to use

New York, USA



 exemplary LCA energy efficient local repair circular economy electrically robust physically attractive integral power source

Design Revolution



New York, USA

₽41

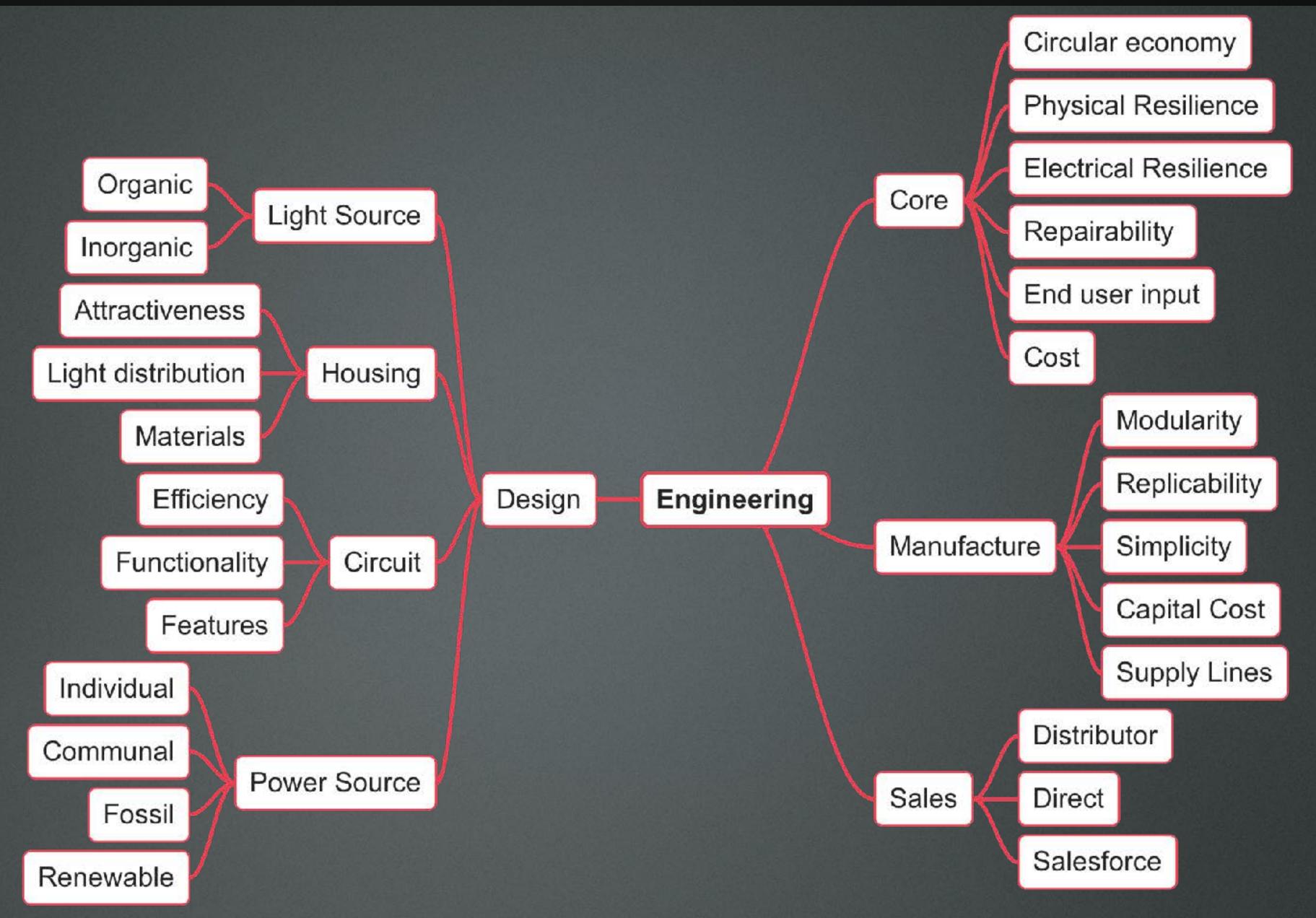
Competition Overview

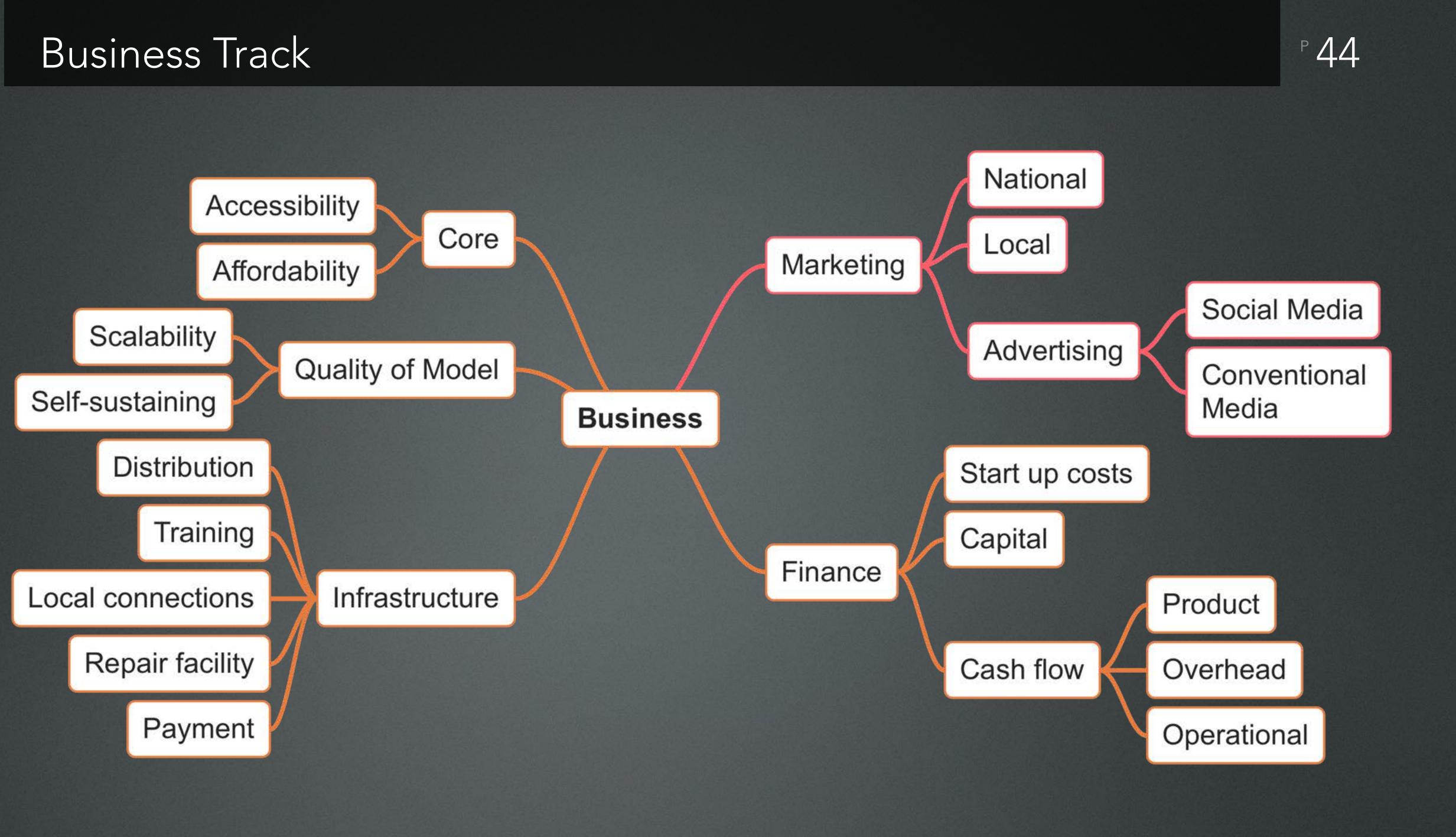
Design and Manufacture

Sales and Distribution

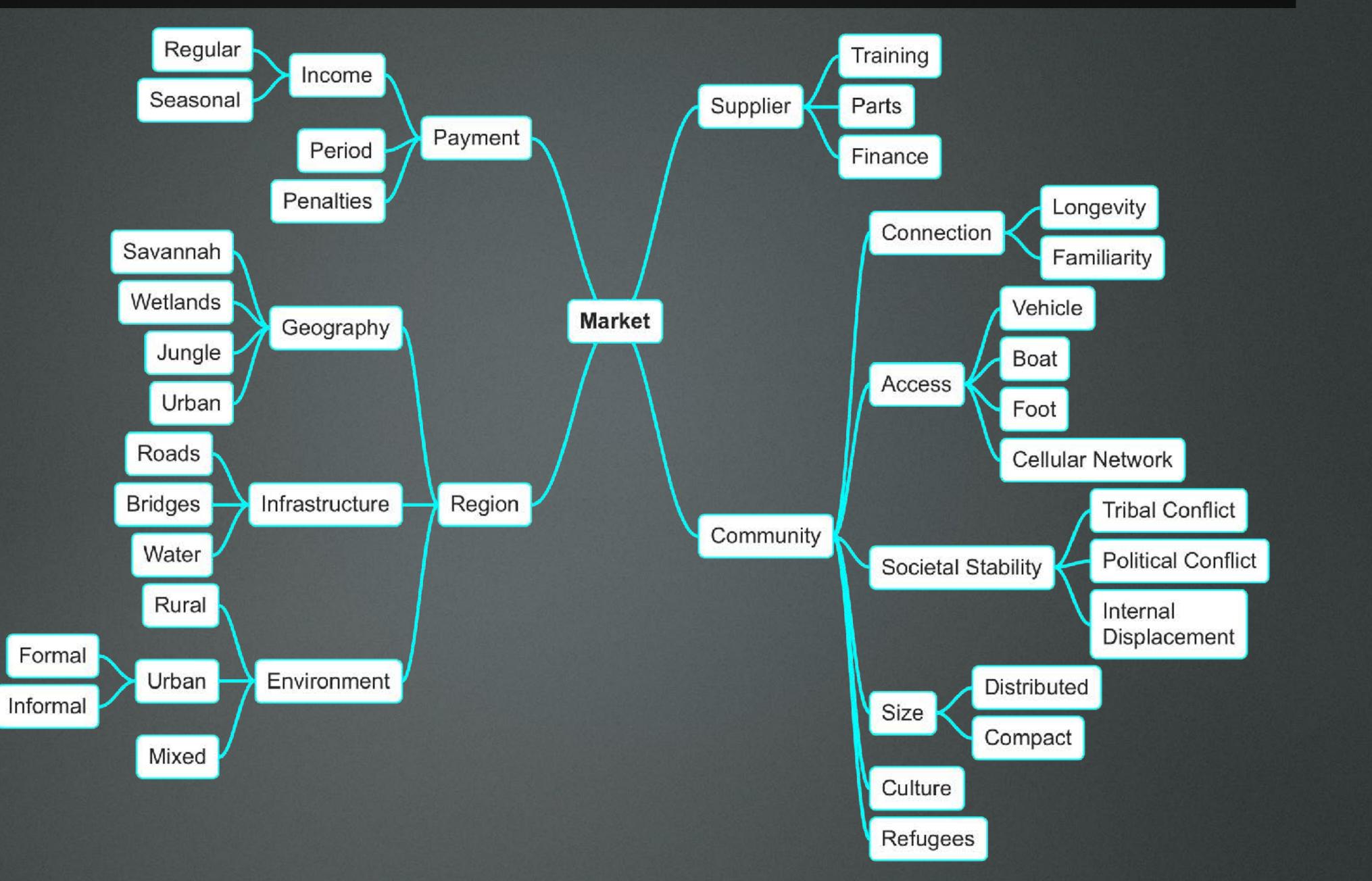
End-user Engagement

Engineering Track





Market Track



₽45

The Let's Make Light Committee

• Georges Zissis France Abdullateef Aliyu Nigeria Christofer Silfvenius Sweden • Jennifer Keller Jackson USA • Khanjan Mehta USA Lambros Doulos Greece Pritpal Singh USA England • Simone Abram

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Carole Grasse	IEEE (USA)
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The ideal artificial light?

AL

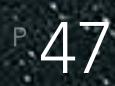
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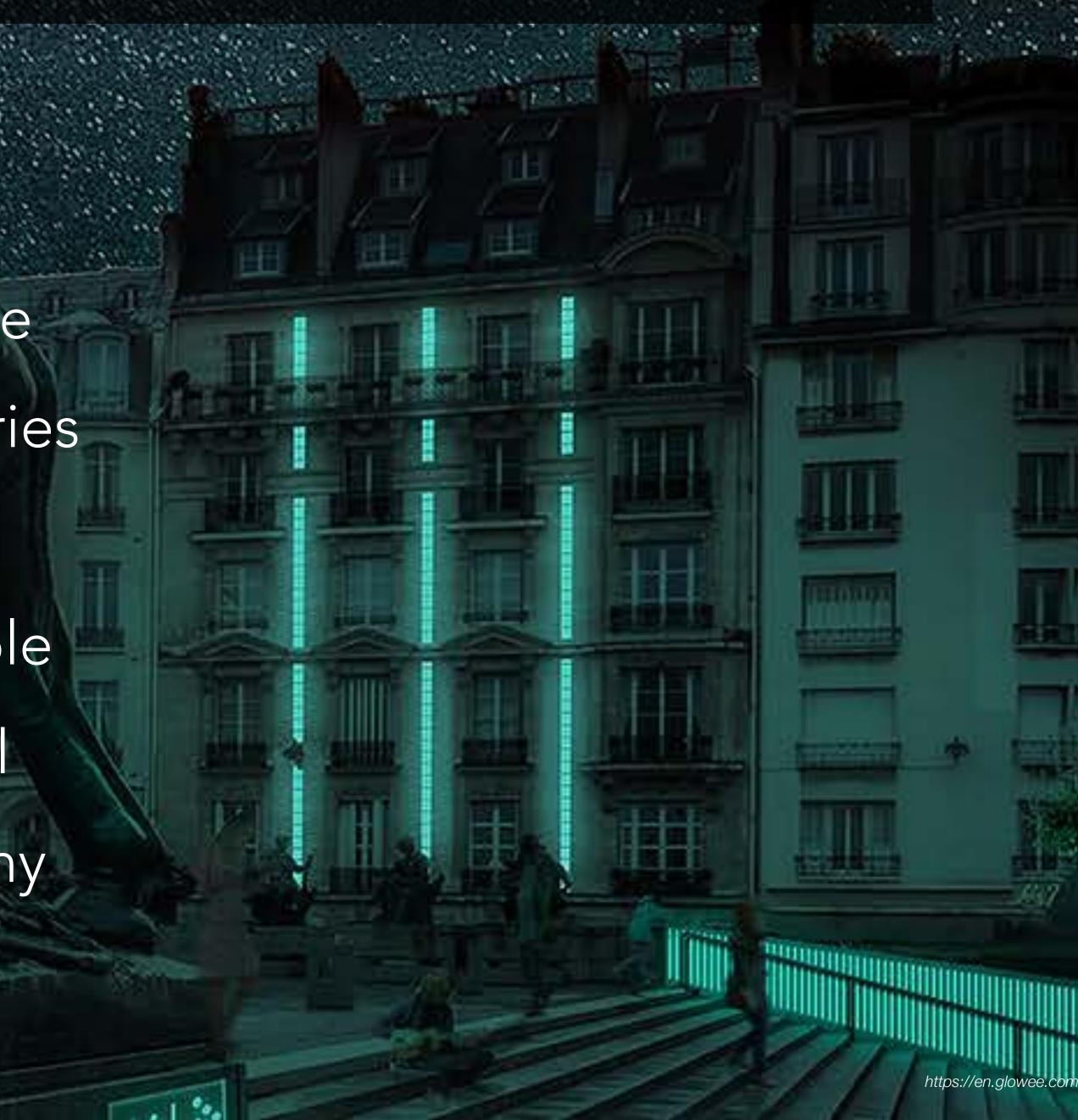
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FE

Bioluminescence Microbial batteries Smart Really sustainable Accessible to all Circular economy







Questions

tack själv!

Tack själv!

