EFFICIENCY FOR ACCESS

UK ENGINEERS WITHOUT BORDERS

Innovation – Designing for Usability

Funded by:

UKaid from the British people

IKEA Foundation

energy saving trust

Assessment Criteria

Innovation

How does your design compare and improve on solutions that are currently available to your target end-user?

Judges will want to see that you have demonstrated and understood the technological context that you are targeting, and that you have gone through a well-informed design process to improve on solutions currently available to the end user.

- What is the potential of your design to improve energy efficiency compared to existing alternatives? Consider how you define energy efficiency (energy used per service provided) and what the baseline is for comparison.
- What is the potential of your design to reduce production costs compared to existing alternatives? Consider materials used, price of components and cost of assembly.
- What is the potential of your design to improve usability compared to existing alternatives? Consider its ease of use, reliability and safety.

Sustainability

How does your design contribute to a positive impact on the environment?

Judges will want to see that you have understood the effects your solution could have and how you demonstrate your solution is worthwhile and contributes to achieving SDGs.

- Is your design reducing the environmental impact throughout its lifecycle compared to existing alternatives? Consider the whole product lifecycle: materials used, rep
- How does you greenhouse gas e other technologi the sustainability manufacturing, di scalability.
- How does your de Development Go – Affordable and you demonstrate connections with th other 17 SDGs and its associated targets? Consider how the different areas of this assessment framework are contributing to this.

Social impact

What difference does your design make to people's lives?

Judges will want to see how you have researched the needs of the people your solution could benefit. They will want to understand why you think your design will improve peoples' lives, and how you have considered social inclusion and equality in your solution.

- How well have you considered who will be using the

Scalability

How feasible is it that your design could get to market at scale?

Judges will want to see that you have considered the business case. Including considering the market opportunity, including market size, for your solution, and demonstrated how people will be able to access and afford this.

- How well have you considered the potential market target customer, size oposition.

how people will be product? Consider er payment models

model considered s, existing supply tion channels, local ated? Consider the pricing and costs strategies to make your business model commercially viable.

- What is the potential of your design to improve usability compared to existing alternatives? Consider its ease of use, reliability and safety.

Agenda

- Introductions
- Guest Speakers
  - **Stewart Craine**
  - **Michael Maina**
- Q&A
- Survey and Closing

Meet our speakers

- **Stewart Craine –** Village Infrastructure Angels

- **Michael Maina –** CLASP

Stewart Craine – Village Infrastructure Angels

20 minutes

MICRO INFRASTRUCTURE PRODUCT DESIGN FOR THE GLOBAL POOR

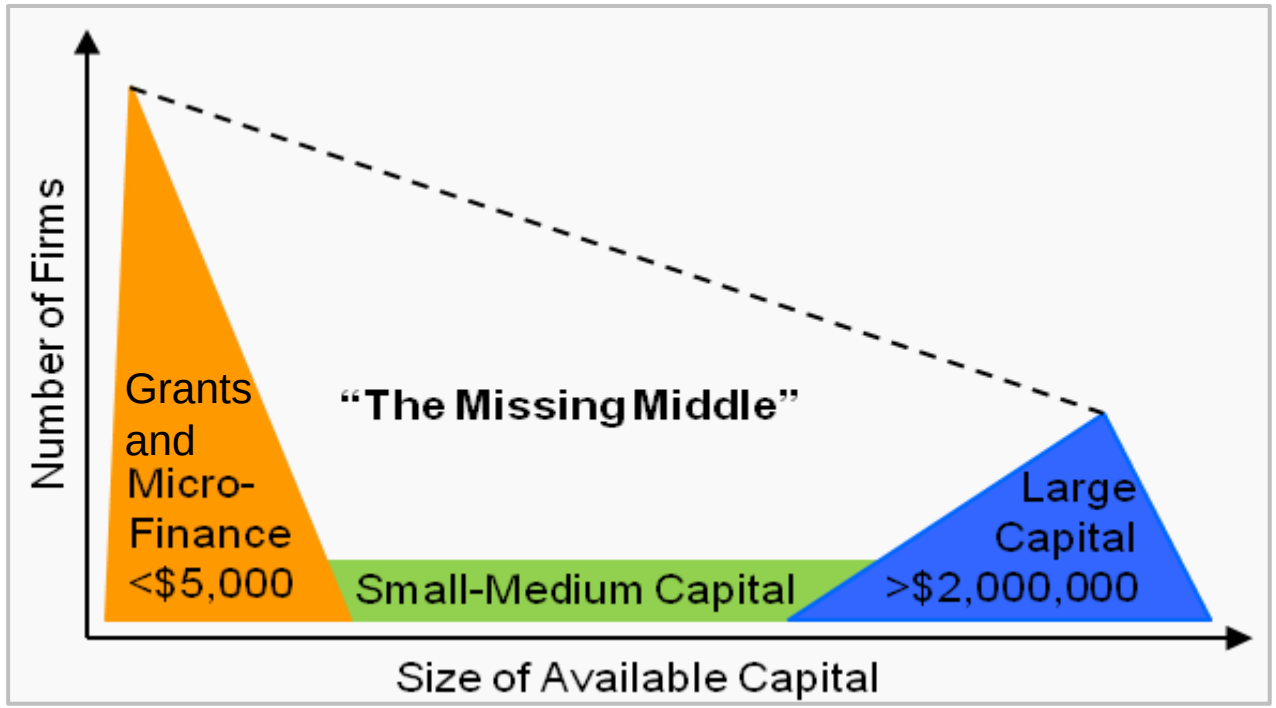
Stewart Craine, Village Infrastructure Angels

Introduction to VIA

Mission

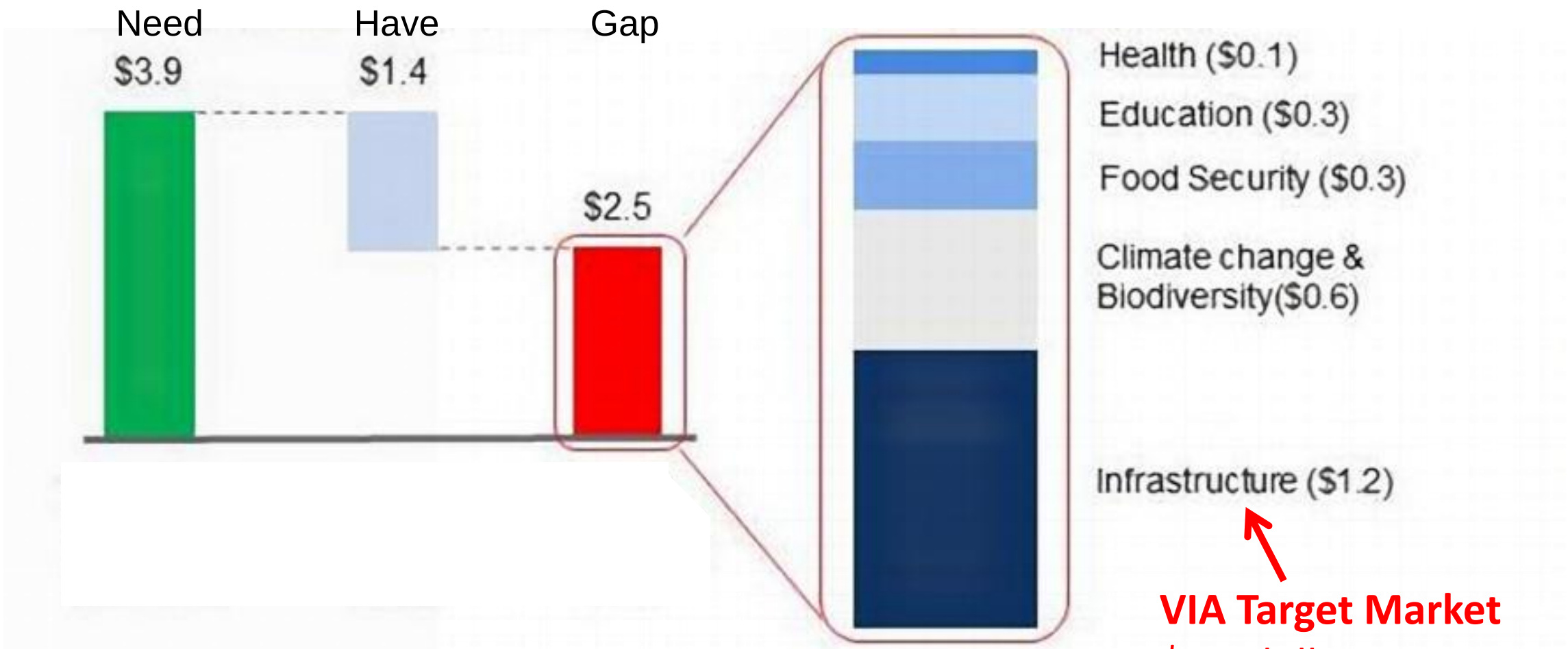
Village Infrastructure Angels is a concerned group of individuals and organizations that are helping bring poverty-alleviating infrastructure to the poorest 1-2 billion people on the planet, aligned to the 2030 Sustainable Development Goals.

- 99% of startups and angels are focused on the richer markets.
- Impact investors, the World Bank and donors don't do early stage well = “missing middle”.
- Opportunities lie with helping the poor, but it's hard, and it's different to normal venture capital investing



Sustainable Development Goals

$trillions needed for SDGs by 2030



Source: https://europeansting.com/2019/08/19/sustainable-development-funding-is-broken-heres-how-to-fix-it

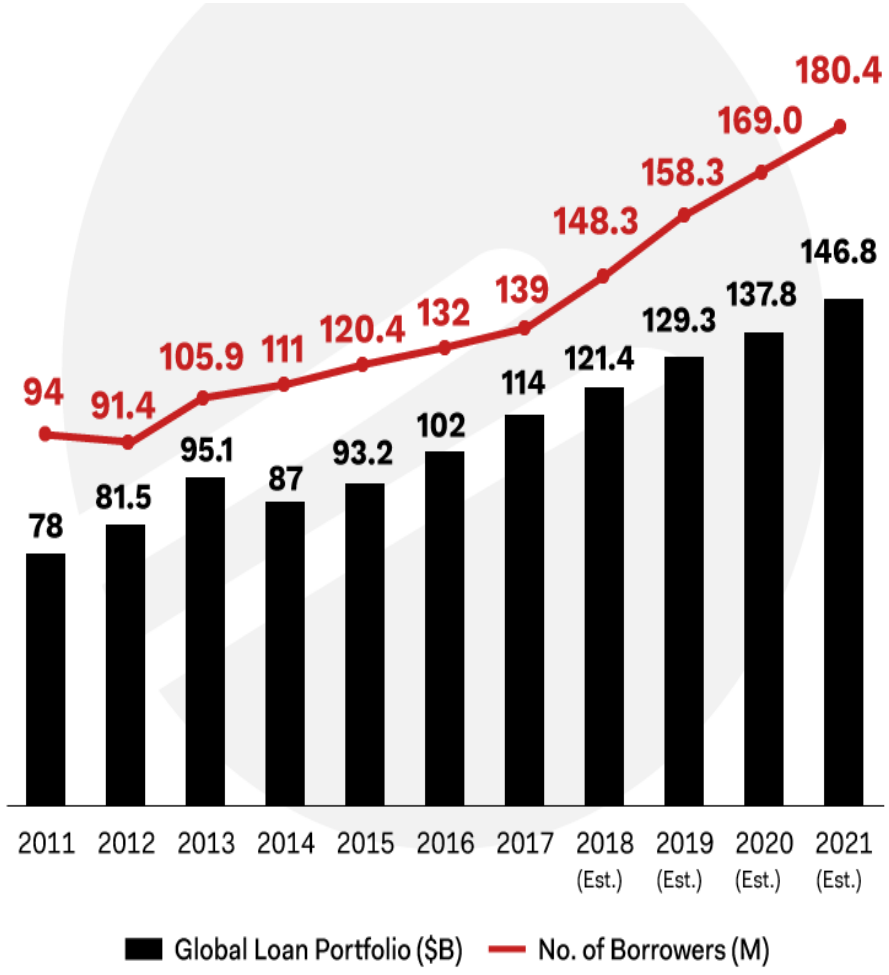
VIA Target Market
$120 billion per year

Micro Infrastructure Market Estimates (VIA)

Infrastructure subcategory	Number of people lacking access, billion	Cost ($) per person for solution	Investment need, $ billion
Energy	1.2	100	120
Water	0.7	50	35
Transport	1.0	50	50
Buildings	1.0	5	5
Communications	1.0	15	15
Machinery	1.0	15	15
Waste	2.4	50	120
	SUBTOTAL	285	360

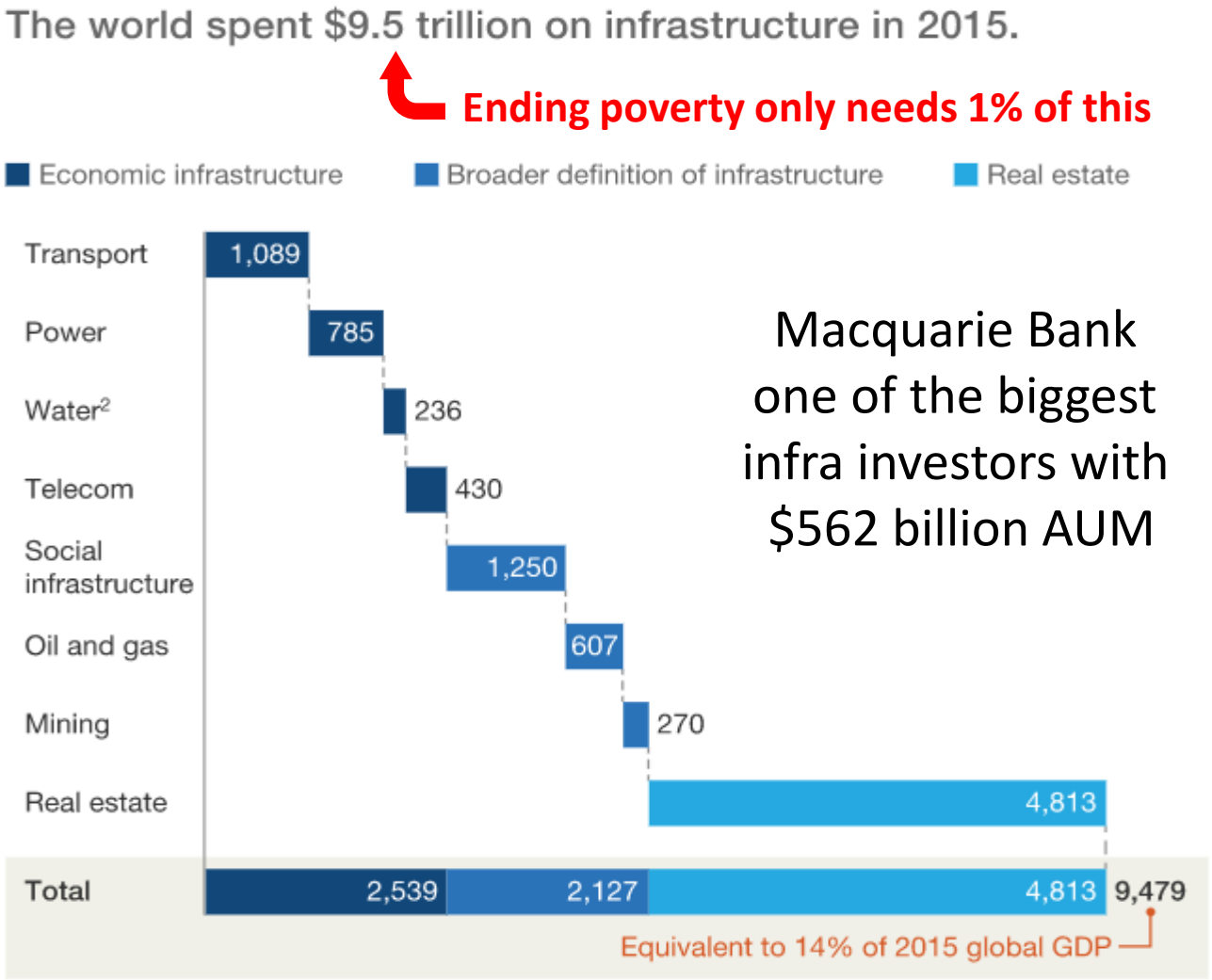
Room for dozens of "unicorn" companies

Microfinance



Source: Convergence Microfinance Barometer - 2018

(Big) Infrastructure



Macquarie Bank one of the biggest infra investors with $562 billion AUM

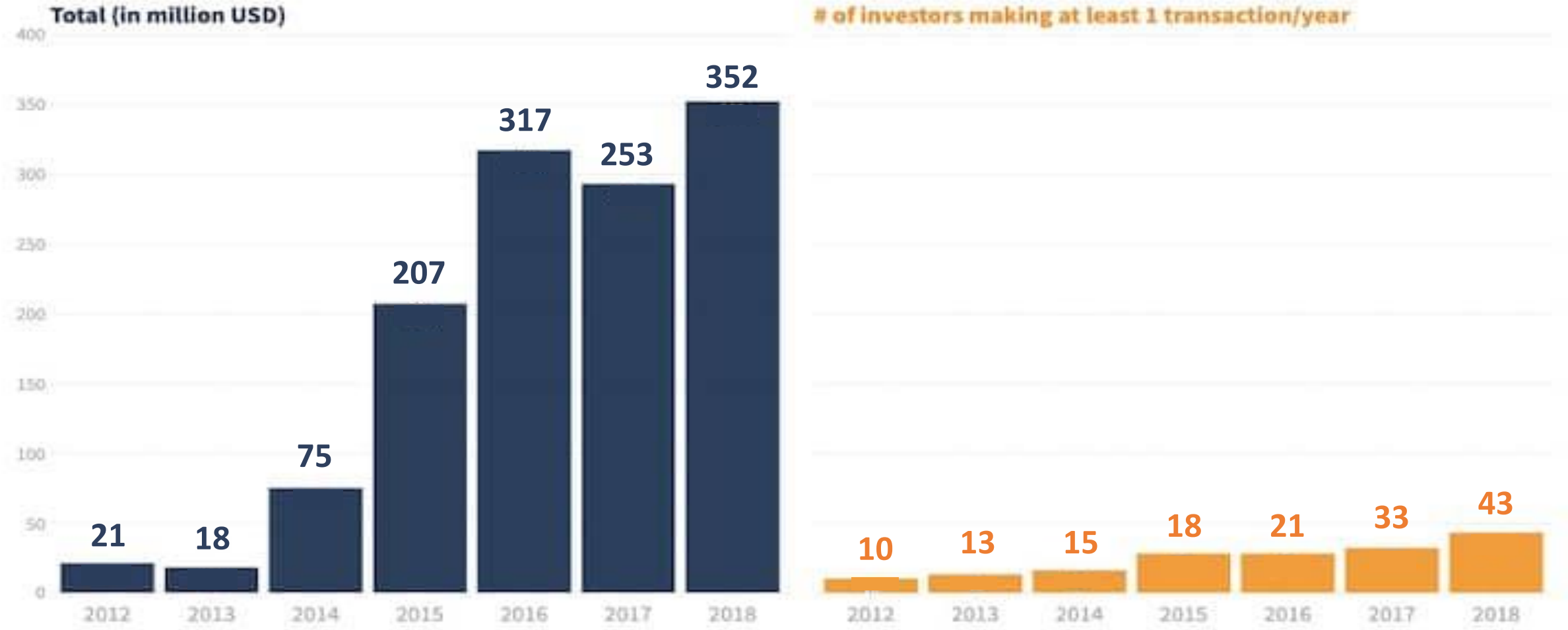
https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/bridging-infrastructure-gaps-has-the-world-made-progress

Total investment in the off-grid solar sector

Per year, in million USD

# of investors making at least 1 transaction in one particular year

Source: https://nextbillion.net/off-grid-solar-needs-investment using data from GOGLA



Leading companies (Greenlight Planet, Dlight Design, etc) have $50-100 million revenue

Disrupting Large Centralized Infrastructure

Decentralized small infrastructure, better suited reaching last mile villages, can compete with the “economies of scale” of larger centralized infrastructure. VIA's innovation is to bring together a wide range of hardware, new software and long-term microfinance.

Existing Problems

Light: Kerosene, candles

Food: No irrigation, spoilage

Income: No value-adding

Productivity: No time, tools

Water: Dirty and distant

Air: Indoor pollution, smoke

Health: no/poor local clinic

Education: no computers

Finance: no access to capital

Micro-infrastructure

Hardware

- Solar LED lighting kits
- Solar pumps, dryers
- Solar mills, packaging
- Power tools, other
- Water purification
- Solar electric stoves
- Solar refrigeration
- Computers, printers for teachers/schools
- Affordable homes

Software

Analyzes the spatial and engineering problem

Designs an appropriate mix of technological soultions.

Manage highly distributed project assets.

Help raise capital to visualize and build more projects.

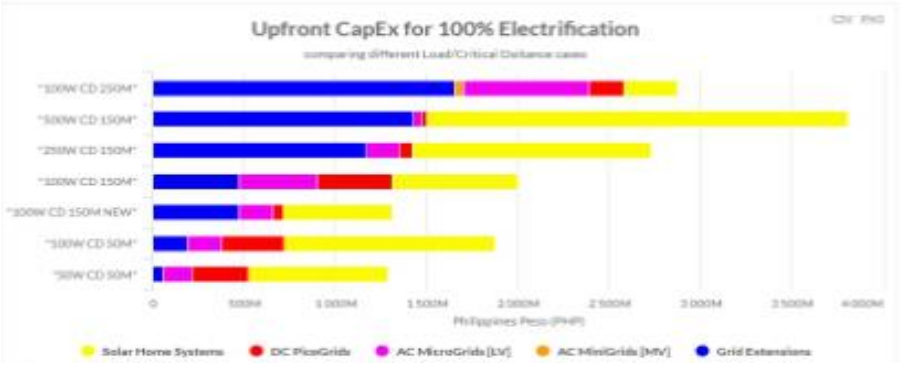
Finance

2-5 year loans for rural villages (lease-purchase).

May expand to 5-15 years loan periods as investors grow confident, matching terms enjoyed by big infrastructure projects.

Making Laplap

B2B Product Development



Software

- World class cloud-based GIS mapping software with BI, for micro infrastructure planning and management
- Already in use for national masterplans in Haiti and Ethiopia, repeat clients, processed over $3 billion of infra solutions
- Profitable, but limited customers / market

Hardware

- World's first range of solar powered mills developed
- Two companies have started from these efforts - PSS and Agsol
- >$1 million grants secured now to develop 4 new products
    - Better solar mills
    - Solar electric cookers
    - Solar washing machines
    - Solar/biomass hybrid dryers
- Historic experience in solar LED lights to displace kerosene lamps

Economic rate of return

Cost per household of services **$ 150-200 / household**

eg. solar lights, village mill, solar water pump

Economic benefit for customer **$770 / household**

- Reduced kerosene for lighting

  1.3-0.4 L / week x $1.50 / litre x 5 years $ 350 / household

- Reduced phone charging, torch battery costs

  50% of customers saved $2 / mth x 5 years $ 60 / household

- Increase in income from evening lighting

  + manual labour time saved

  30% x $20 / month $ 360 / household

Customer (economic) IRR = 35% **but what about investor/supplier IRR?**

•Product Design Issues

Cost - must not only be cheaper than existing technology = affordable, but also investable - max 3 year loans

eg. LTO batteries have 10,000-20,000 cycle life (27-55 years) and costs $500/kWh compared to
LFP batteries have 2,000-4,000 cycle life (5-10 years) and cost $200/kWh and
lead-acid batteries have 500-1000 cycle life (1.5-3 years) and costs $50/kWh

LTO has the cheapest lifetime energy, but needs at least 10 year loans to be more affordable

Safety - AC voltages (>100V) can kill, while extra low voltage (<60V) DC voltages are not lethal
Solar is now the cheapest form of electricity and is generated in DC, but most appliances are in AC
Inverters change DC to AC but add cost and central point of failure

Field-ready - AC voltages need licensed electricians, but ELV DC does not, anyone can legally install them
No large solar panels - if it doesn't fit in the back of a 4WD or small boat, not “last mile” tech
Robust.....Murphys' Law applies, anything that can go wrong, will go wrong
Plug and play - easy to install

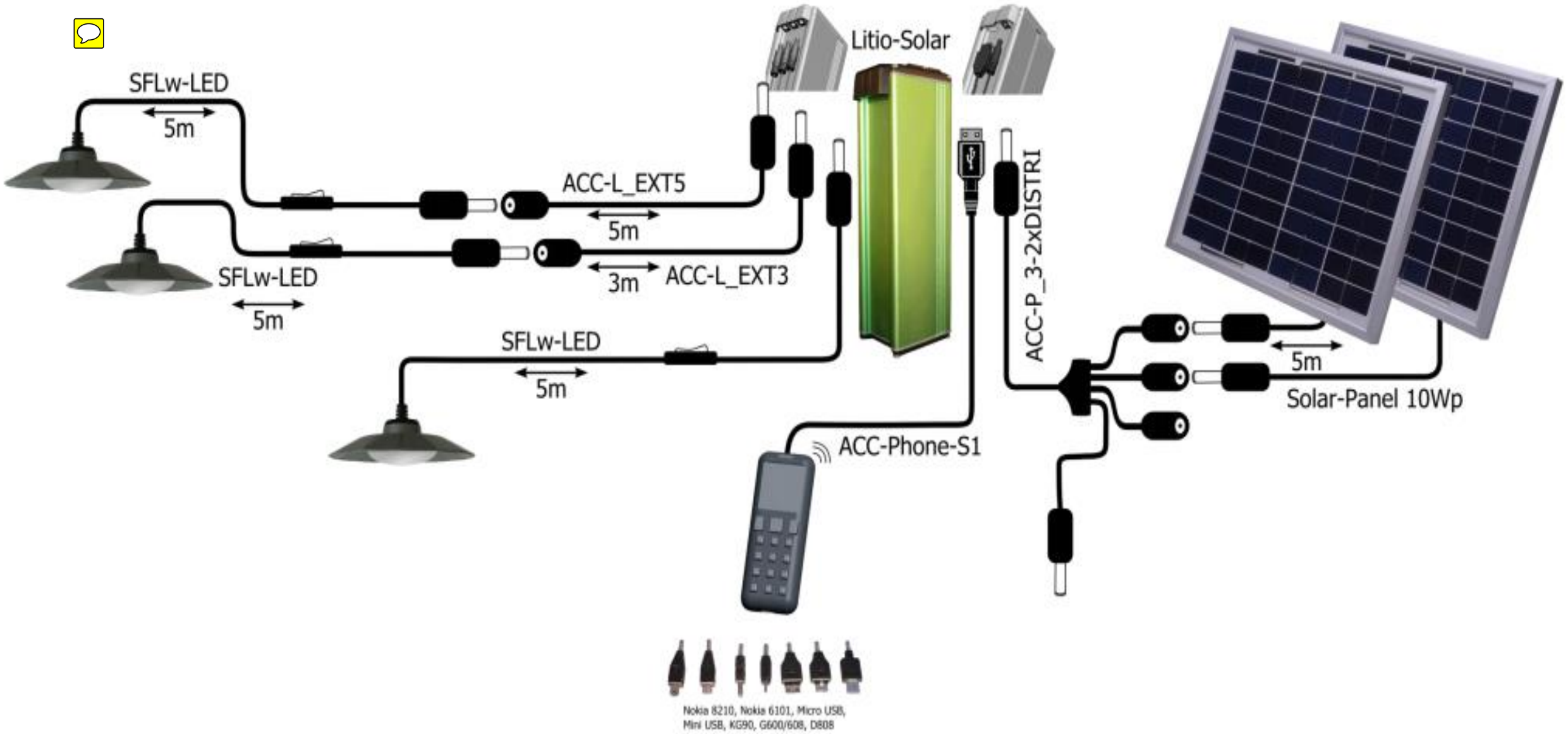
Disaster-ready - how does the techonology survive a category 4-5 hurricane/cyclone? or floods?

Pallets are 1m x 1m for small shipments

Last mile logistics

What will wear out first? Can it be locally replaced?

Plug and play design - low power (<200W)



Plug and play design - higher power (200-2000W)

- **For further discussions**

stewart@villageinfrastructure.org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Michael Maina – CLASP

20 minutes


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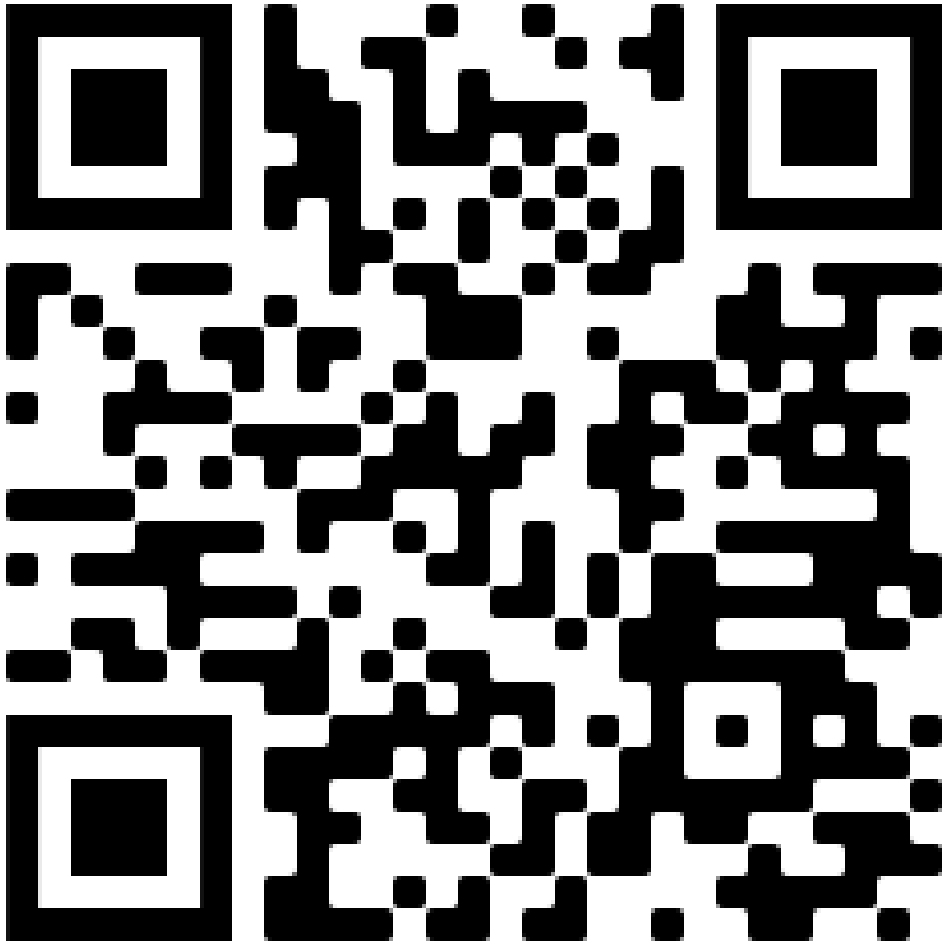
Q&A

Short feedback survey

Bit.ly/EforADCFeedbackSurvey2021-22

Newsletter sign up:



bit.ly/DesignChallengeNewsletter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