lab of tomorrow.

Bundesministerium für
wirtschaftliche Zusammenarbeit
und Entwicklung


Access to Affordable and Reliable Energy in Uganda
26 – 28 June 2017
at Siemens HQ in Munich, Germany

DISCAIMER

The following information is based on user research conducted in interviews with various stakeholders from the energy sector in Uganda.

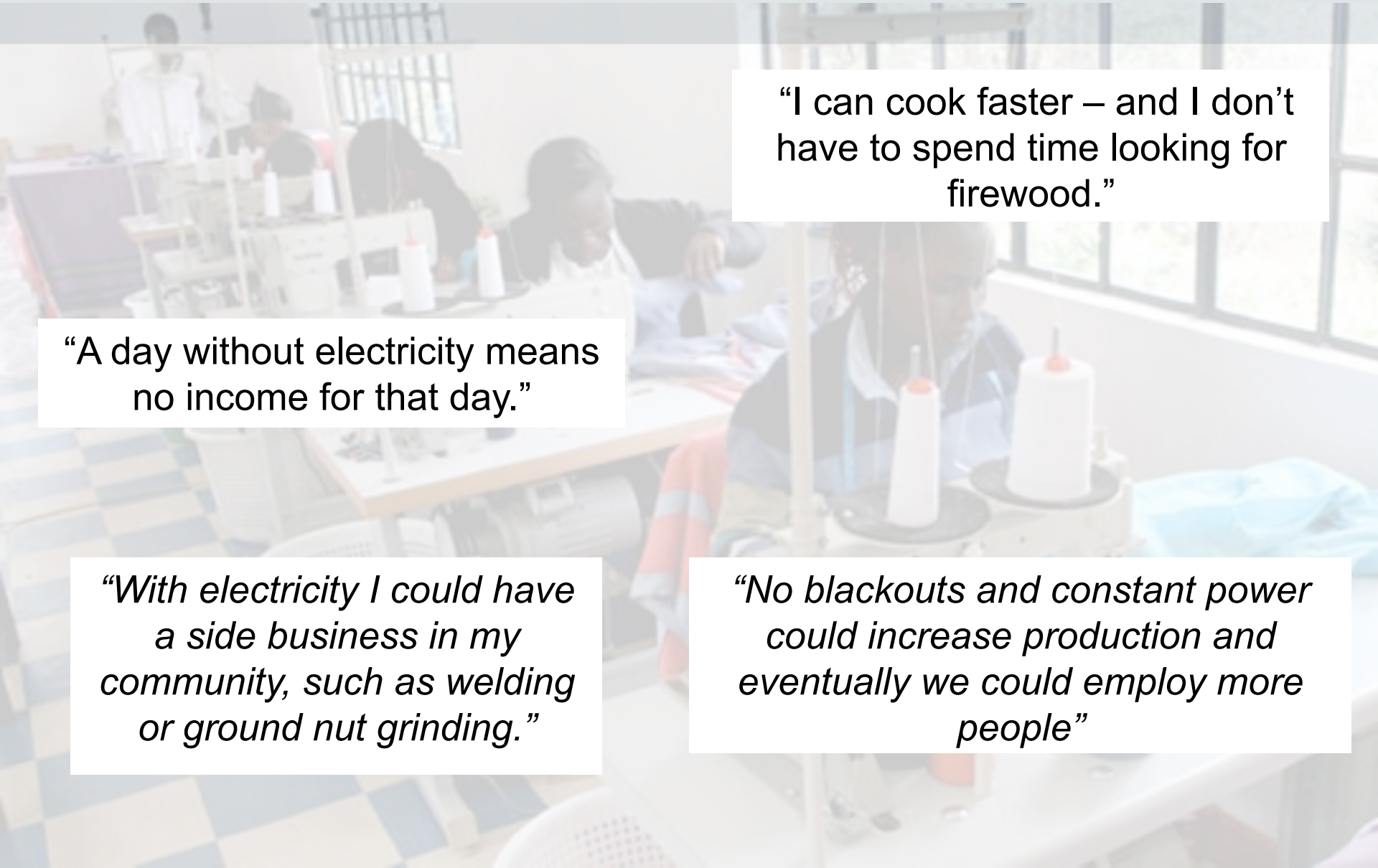
Statements are summarized and reflect the opinion of the individual.

It does not reflect the opinion of the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit).

Fact Finding Mission in Uganda

10	Days of Research
+50	Interviews % around Kampala
2	Remote interview task force
1	Researcher on the ground
1	Impact focused interviews
60%	Stakeholder interviews
40%	User interviews
+100	Pages of notes
∞	“Can you hear me?!”

Economic impact: increase productivity



"I can cook faster – and I don't have to spend time looking for firewood."

"A day without electricity means no income for that day."

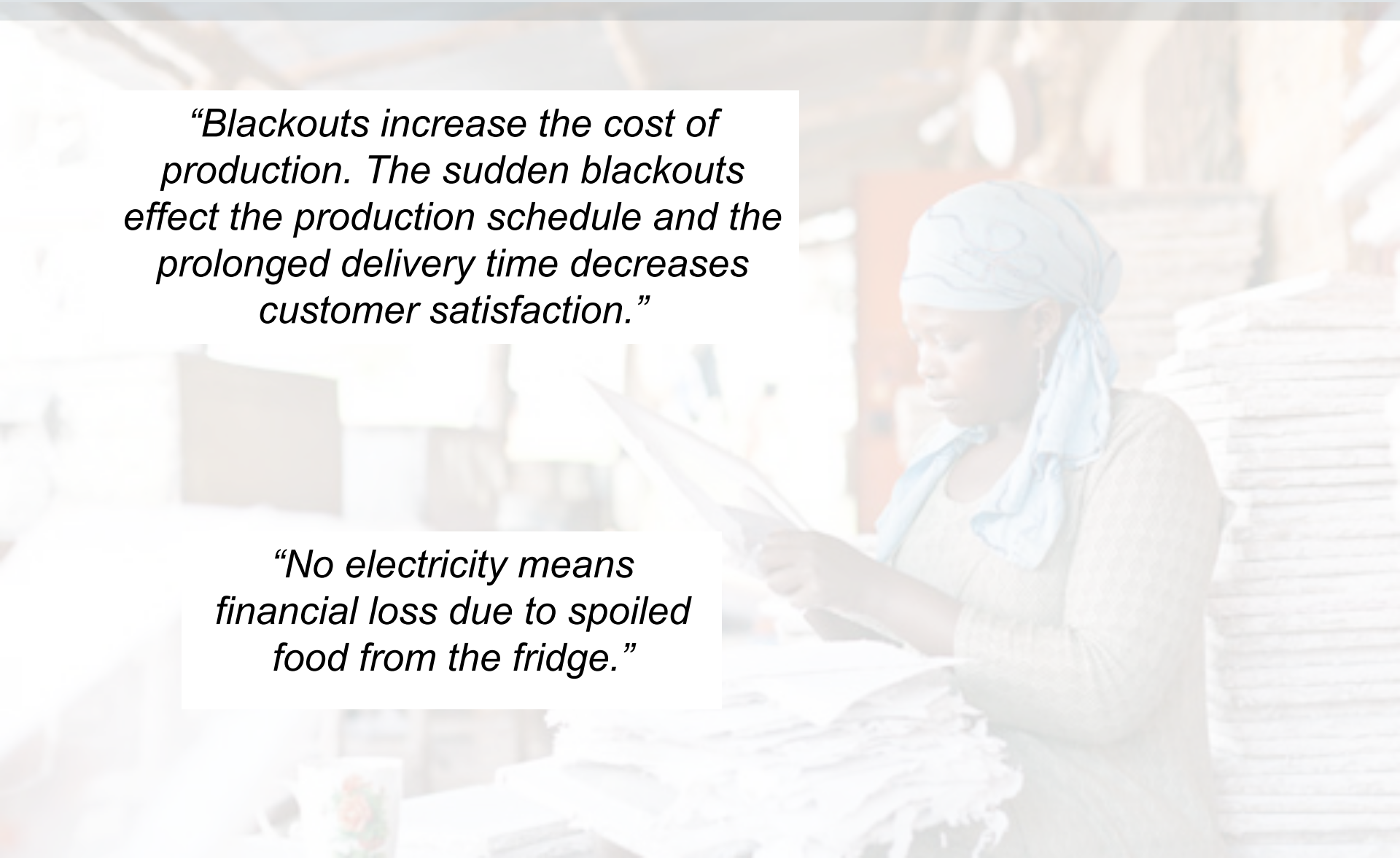
"With electricity I could have a side business in my community, such as welding or ground nut grinding."

"No blackouts and constant power could increase production and eventually we could employ more people"

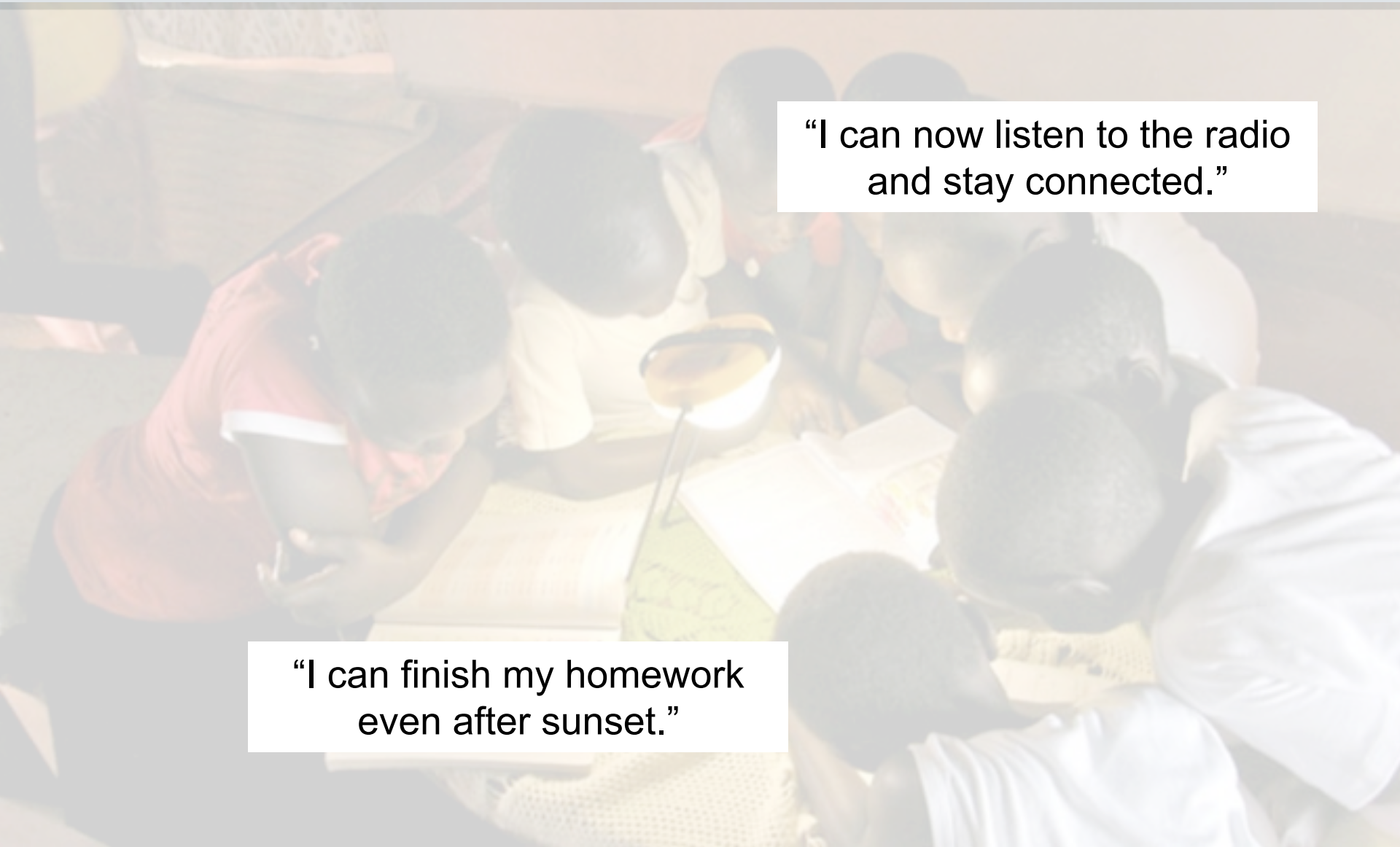
Economic Impact: save costs

“Blackouts increase the cost of production. The sudden blackouts effect the production schedule and the prolonged delivery time decreases customer satisfaction.”

“No electricity means financial loss due to spoiled food from the fridge.”



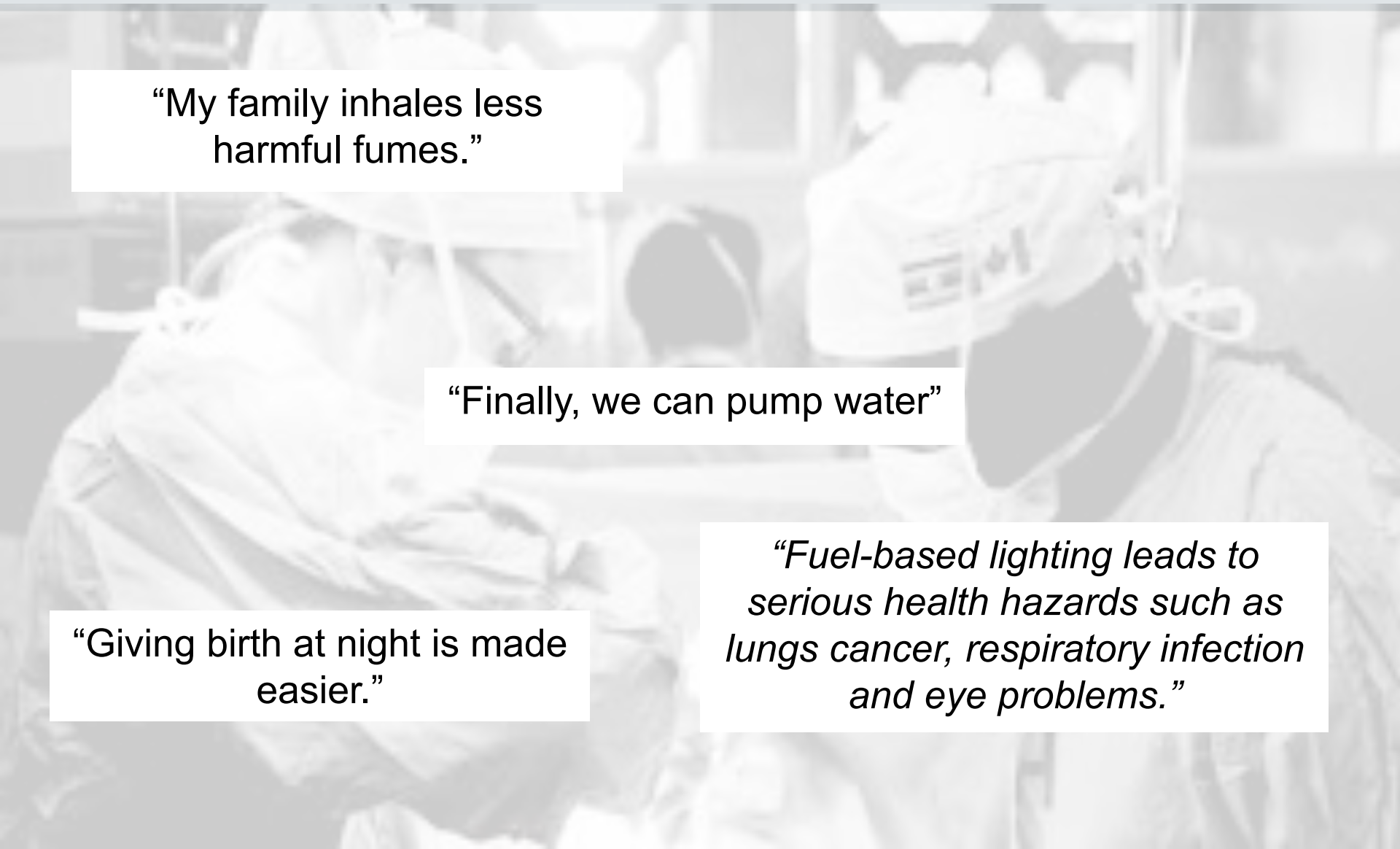
Social Impact: improve education



"I can now listen to the radio and stay connected."

"I can finish my homework even after sunset."

Social impact: improve health



"My family inhales less harmful fumes."

"Finally, we can pump water"

"Fuel-based lighting leads to serious health hazards such as lungs cancer, respiratory infection and eye problems."

"Giving birth at night is made easier."

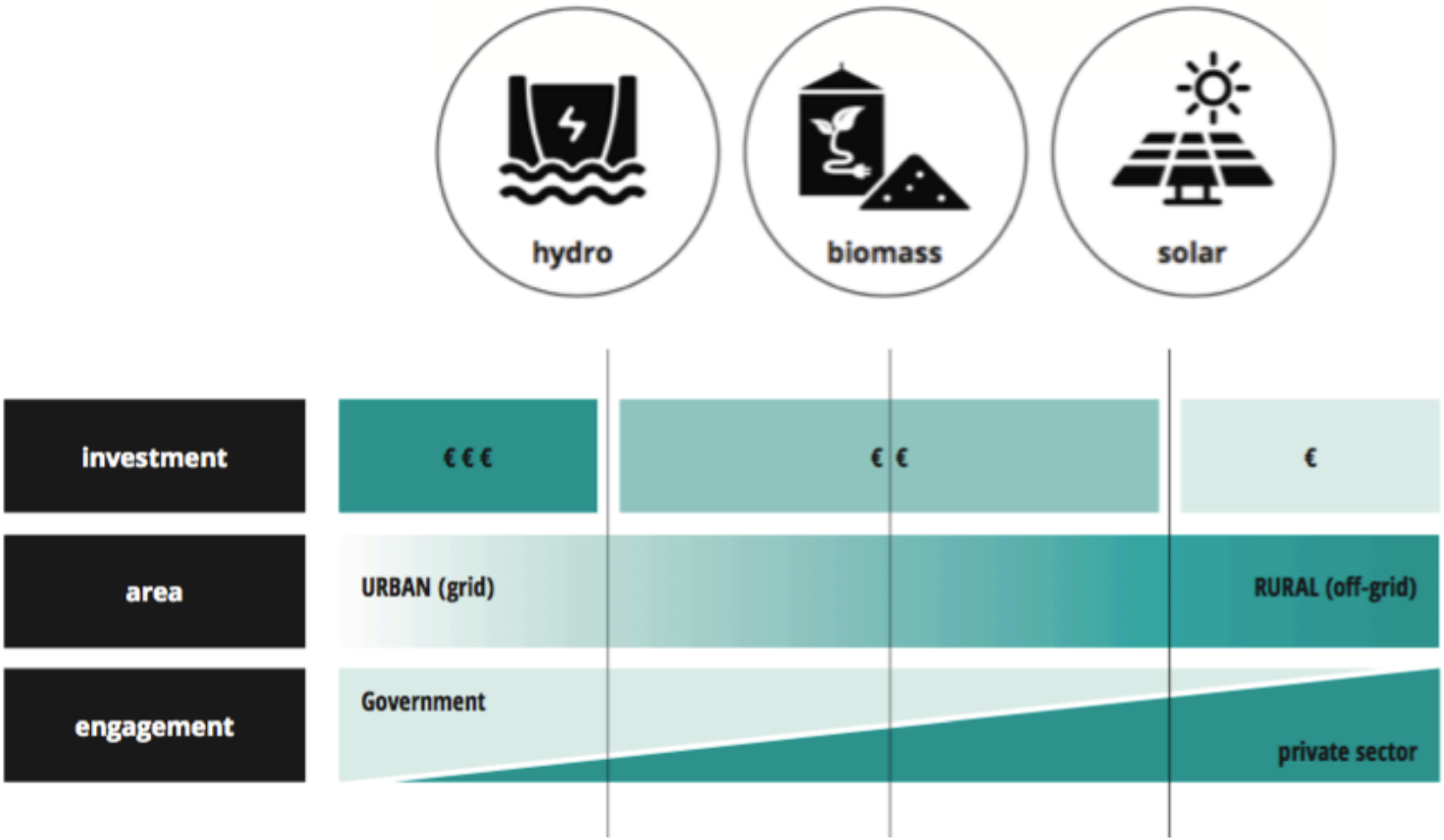
Environmental Impact

"Biomass is main energy supply – deforestation has lead to an increase in prize of charcoal."

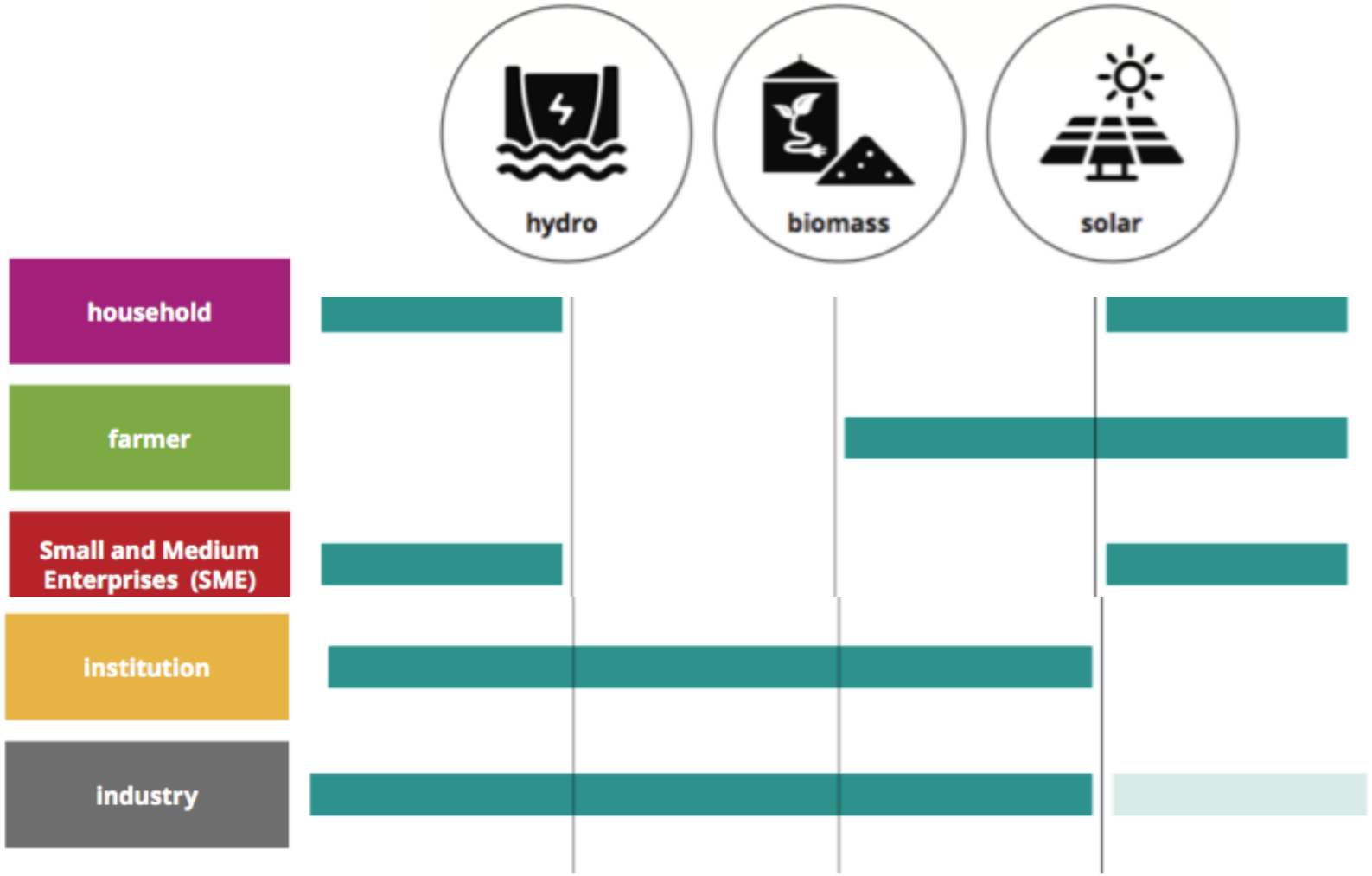
"Kerosene lamps are a significant source of carbon emissions"

„The biggest issue is deforestation. Forests have been greatly reduced. A lot of unlawful tree cutting is happening"

General insights



General insights



Solar

HMW increase productivity in rural areas through solar?

Subchallenge Owner Statement

Solar – Xaver Kitzinger
LittleSun GmbH

- **THIS IS OUR FOCUS, BECAUSE…**
- Access to electricity and in specific light is the key for increasing productivity when the sun goes down.What do people do in villages after sunset? They go to bed.
- Access to light improves health & safety, education, productivity and family well being and above all economics: Saving from switching from Kerosene, torches, candles
- => Solar is the most cost effective way to bring energy access especially to rural areas:

Subchallenge Owner Statement

Solar – Xaver Kitzinger
LittleSun GmbH

- **WE SEE CHALLENGES IN...**
- Last mile distribution, sub standard products spoiling the market and low purchasing power in rural communities
- Furthermore UNHCR announced this week: Uganda is about to become the country in Africa which is hosting the most refugees. Integration 1,000,000 + refugees arriving to Uganda who have lost everything and to make them productive is also a huge challenge for the energy sector.

Subchallenge Owner Statement

Solar – Xaver Kitzinger
LittleSun GmbH

- **WE SEE OPPORTUNITIES IN...**
- Uganda is a young society, with a good education system and very business driven. Entrepreneurship is rooted in society.
- We therefore also see opportunities to use entrepreneurship as part of the solution to integrate refugees into the economic system of Uganda

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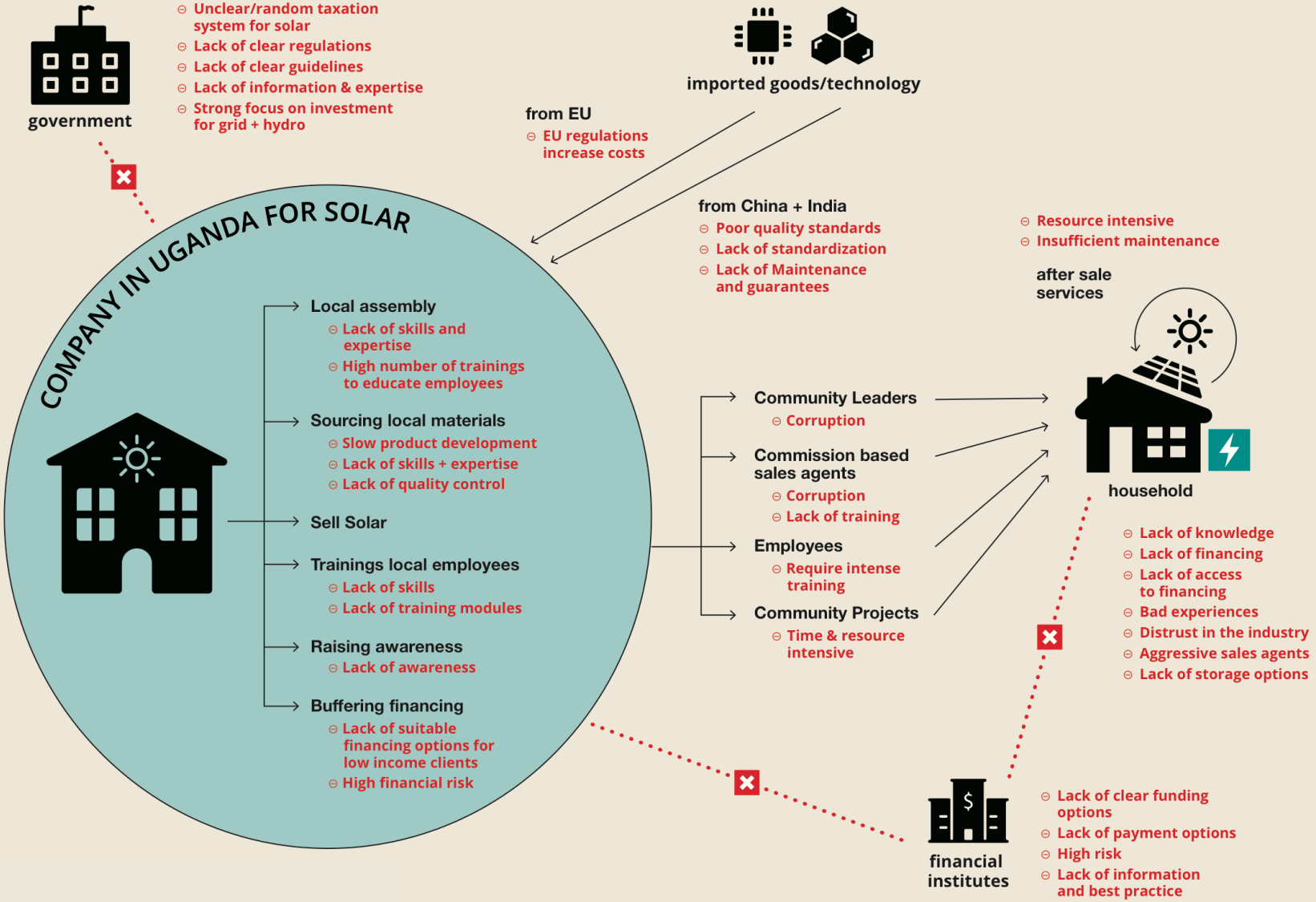
Subchallenge Owner Statement

Solar – Xaver Kitzinger
LittleSun GmbH

- **WHAT WE BRING…**
- High quality German engineered solar products.
- Existing distribution network in Uganda and experienced in building up entrepreneurial sales systems in refugee contexts.

Overview
Solar



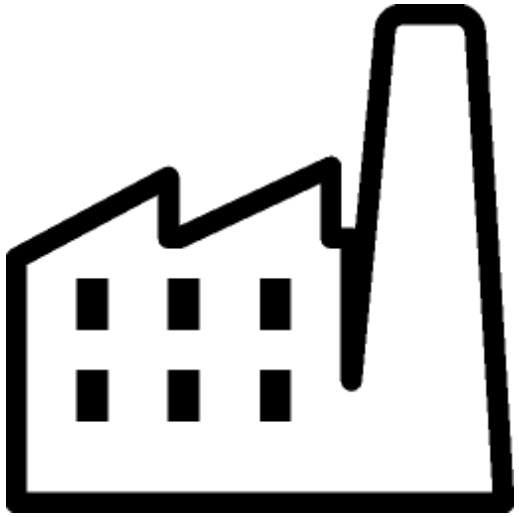
National level

„The focus is on hydro. But we wish for better policies & standardizations that support the solar industry. The potential of solar is critical to electrify Uganda.“
(solar industry)

Industry level

„Many solar companies sell products with a poor quality. Imported good‘s often are damaged or don‘t fit to our standards. This makes it hard to develop good products + build trust.“

(solar industry)



Community level

„Do you have electricity? – No. I have solar.“

(Individual)

Key Challenges
Solar

- Lack of awareness from communities
- Distrust of agents
- Lack of capacity & skills
- Lack of financial resources
- Lack of standardization
- Lack of collaboration between private & public sector

Biomass

HMW increase productivity in rural areas through biomass?

Subchallenge Owner Statement

Biomass – PlanET Biogastechnik GmbH

Dip. Eng. Christof Langguth

- ***THIS IS OUR FOCUS, BECAUSE****…..* more than 80% of Ugandans live in rural areas. 89% of the population use fuelwood as source of energy. A more efficient use of biomass will reduce the pressure on natural resources, as well as providing cleaner energy to benefit people's health and the environment.

Subchallenge Owner Statement

Biomass – PlanET Biogastechnik GmbH

Dip. Eng. Christof Langguth

- **WE SEE CHALLENGES IN**... the initial costs for more efficient biomass applications and the expensive investment in infrastructure for electricity, accompanied by a sustainable system of service and maintenance.

Subchallenge Owner Statement

Biomass – PlanET Biogastechnik GmbH

Dip. Eng. Christof Langguth

- **WE SEE OPPORTUNITIES IN**... a young, motivated population and abundant natural bio resources. Creating jobs in rural areas will decrease the migration into cities and foreign countries.

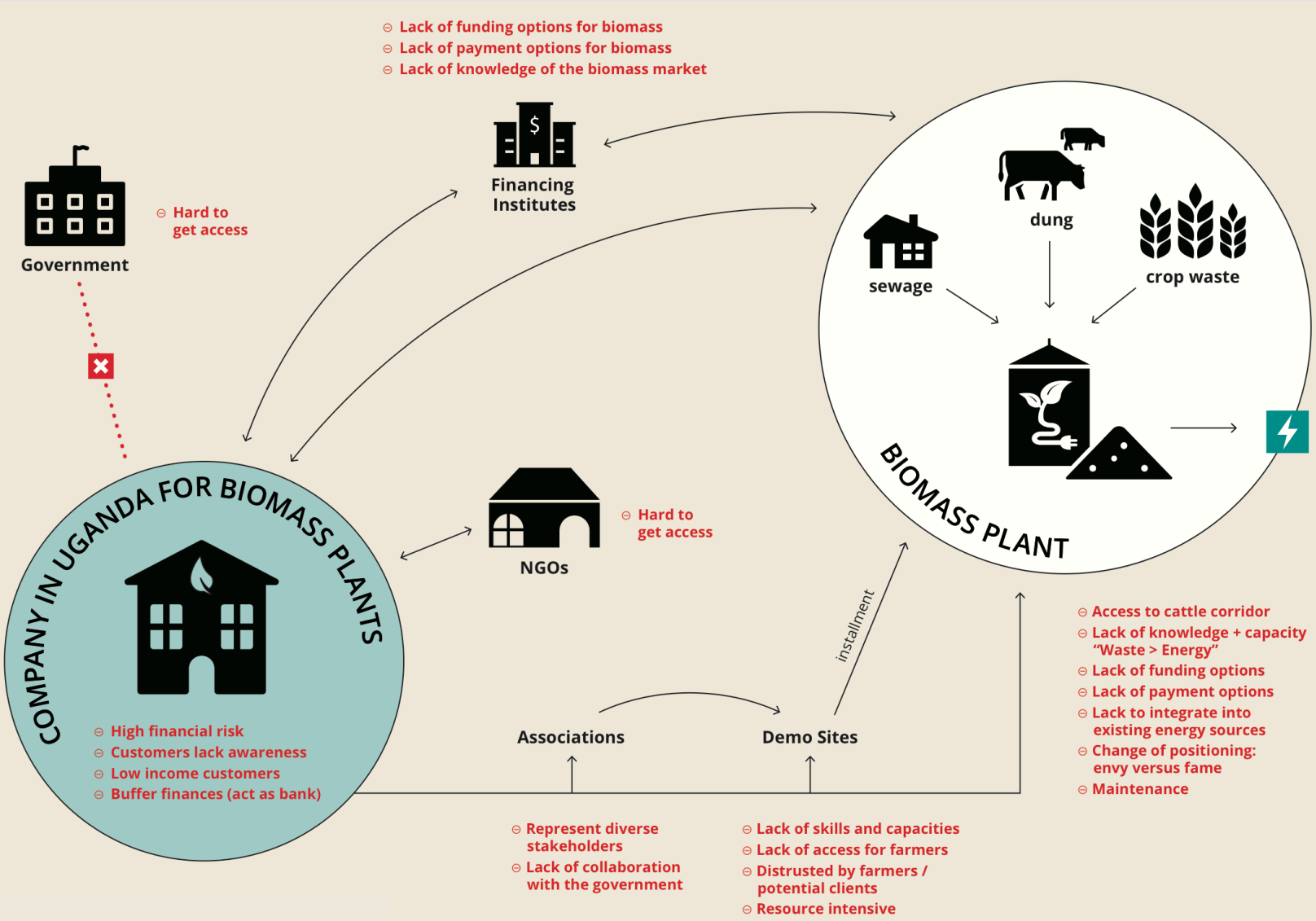
Subchallenge Owner Statement

Biomass – PlanET Biogastechnik GmbH

Dip. Eng. Christof Langguth

- **WHAT WE BRING**…a technical solution that respects the local circumstances and offers a long term approach for the production of energy. We see the need to coordinate GOs, NGOs, private companies and local communities targeting maximum acceptance and coverage.

Overview
Biomass



National level

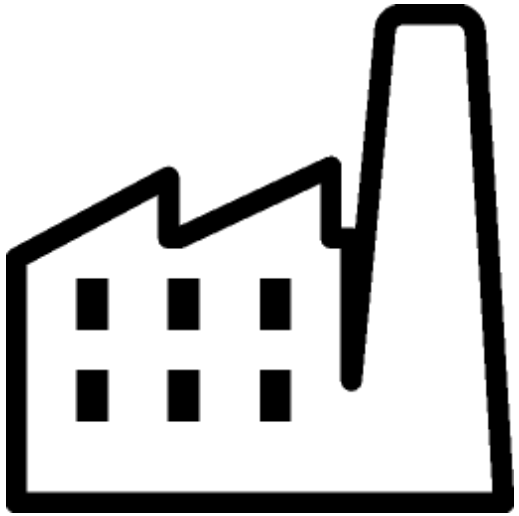
„The government needs more data, case studies and awareness to support endeavour of the private sector in biomass.“

(private sector)

Industry level

„We need more support from the government in terms of subsidies and standardization.“

(private sector)



Farmer‘s level

„You can turn cow dung into electricity? – I had no idea.“

(Farmer)

„What is ROI (return on investment) – I can‘t afford it today, so why bother?!“

(Farmer)

Key Challenges
Biomass

- Lack of awareness
- Distrust of agents
- Lack of financial resources
- Lack of capacity and skills
- Lack of subsidies

Agriculture

HMW use energy solutions to empower agriculture?

Subchallenge Owner Statement

Agriculture – Katharina Meder,
GIZ, Powering Agriculture

- **THIS IS OUR FOCUS, BECAUSE…**
- You need energy for agriculture!
- 30% of the global energy is consumed in agricultural value chains which makes the sector one of the biggest GHG emitter.

Subchallenge Owner Statement

Agriculture – Katharina Meder,
GIZ, Powering Agriculture

- **WE SEE CHALLENGES IN...**
- No access to energy (equals low productivity of food value chains, can lead to migration)
- Outdated technology that is energy hungry (high GHG emissions, high costs, inefficient use of energy)

Subchallenge Owner Statement

Agriculture – Katharina Meder,
GIZ, Powering Agriculture

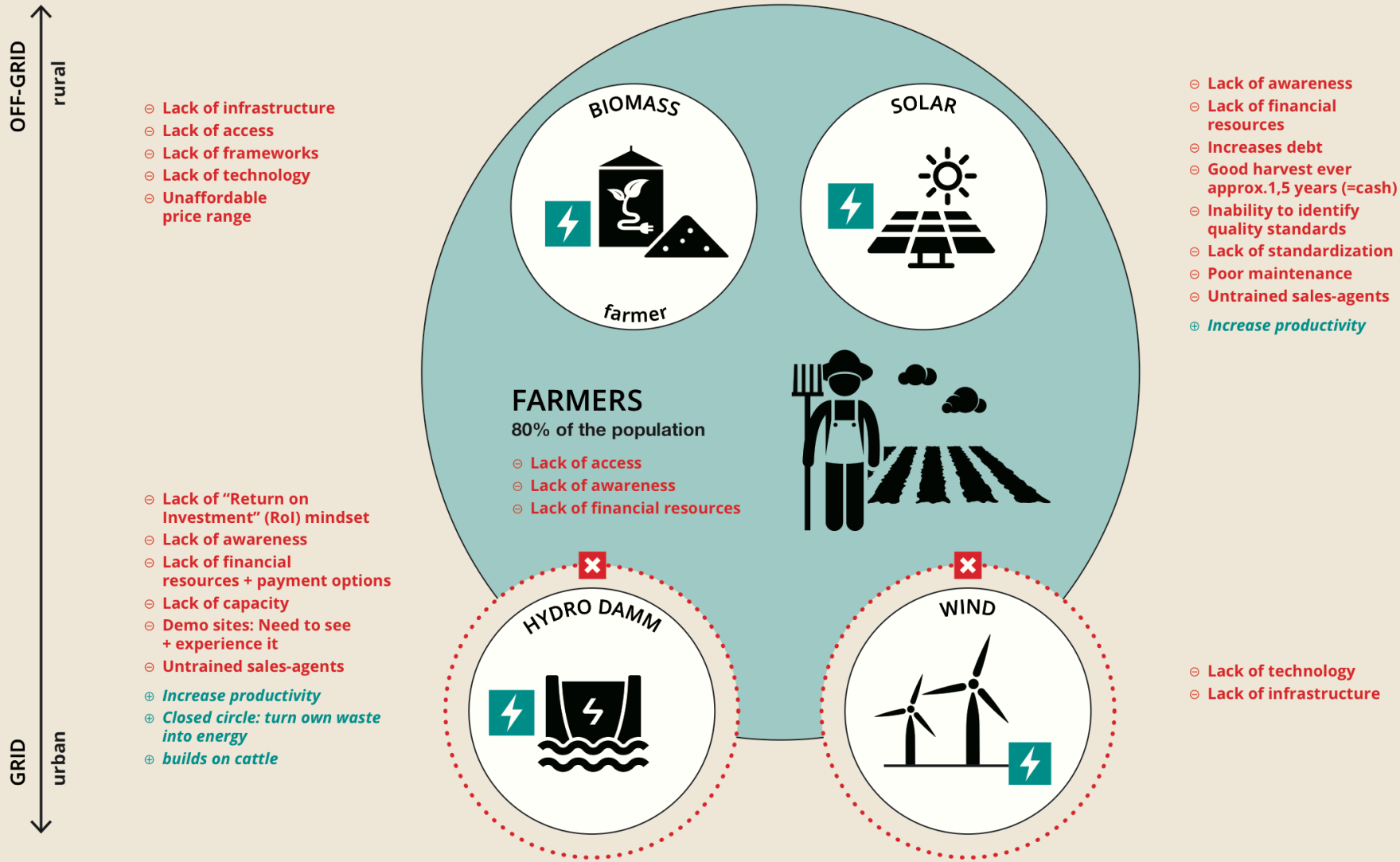
- **WE SEE OPPORTUNITIES IN...**
- Promising food value chains exist
- Sustainable use of energy along food value chains can increase productivity and decrease costs (winwin!)
- Appropriate and affordable technology is available
- Increased level of awareness amongst policy makers

Subchallenge Owner Statement

Agriculture – Katharina Meder,
GIZ, Powering Agriculture

- **WHAT WE BRING…**
- We have a profound understanding of this “web” and have been working on all kinds of knots in it
- Field experiences in East Africa and globally, facilitating knowledge exchange between regions
- Examples include energy efficiency in the Kenyan tea sector, solar powered irrigation in East Africa, India and North Africa, solar powered milk cooling in East Africa and North Africa, rice processing in South East Asia

Overview
Agriculture



- ⊖ Lack of infrastructure
- ⊖ Lack of access
- ⊖ Lack of frameworks
- ⊖ Lack of technology
- ⊖ Unaffordable price range

- ⊖ Lack of awareness
- ⊖ Lack of financial resources
- ⊖ Increases debt
- ⊖ Good harvest ever approx.1,5 years (=cash)
- ⊖ Inability to identify quality standards
- ⊖ Lack of standardization
- ⊖ Poor maintenance
- ⊖ Untrained sales-agents
- ⊕ *Increase productivity*

- ⊖ Lack of access
- ⊖ Lack of awareness
- ⊖ Lack of financial resources

- ⊖ Lack of "Return on Investment" (RoI) mindset
- ⊖ Lack of awareness
- ⊖ Lack of financial resources + payment options
- ⊖ Lack of capacity
- ⊖ Demo sites: Need to see + experience it
- ⊖ Untrained sales-agents
- ⊕ *Increase productivity*
- ⊕ *Closed circle: turn own waste into energy*
- ⊕ *builds on cattle*

- ⊖ Lack of technology
- ⊖ Lack of infrastructure

National level

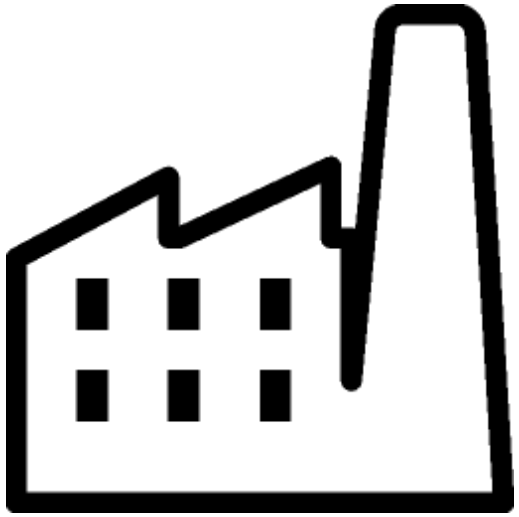
„They need to think more holistically and see the bigger picture.“

(private sector)

Industry level

„We sell solar / bio digesters, but actually we‘ve become experts in: awareness raising and financing.“

(private sector)



Community level

„First I want light... then a fridge...then a TV...

I‘m only slowly starting to think about increasing my productivity to benefit my community. Only problem is:

I can‘t afford it.

(Individual)

Key Challenges
Agriculture

- Lack of awareness
- Lack of financial resources
- Lack of access to the grid
- Lack of training and capacity
- Lack of clear guidelines & frameworks
- Lack of integration
- Dilemma: urgent versus important

Integration

HMW integrate different energy sources to increase the productivity of Mini Grids / Off-Grids?

Subchallenge Owner Statement

Integration – Elizabeth Nyeko
MANDULIS ENERGY

- **THIS IS OUR FOCUS, BECAUSE…**
- Lack of access to electricity in rural off-grid areas (SDG7)
- Productive, quality, modern energy is key to achieving all the SDGs
- Over 70% of population engaged in Agriculture, which contributes to over 30% of GDP. Small holder farmers produce most of this output, but lack of access to agricultural value addition services (drying, milling, packaging, storage, logistics, market access), therefore farmers are kept to minimum percentage of the value chain

Subchallenge Owner Statement

Integration – Elizabeth Nyeko
MANDULIS ENERGY

- **WE SEE CHALLENGES IN...**
- Energy access trilemma (affordability, sustainability, reliability)
- Clean affordable cooking fuel
- Island microgrid using renewable energy requires a robust digital solution for power evacuation and distribution
- Productive power required for agricultural value addition (electricity, processing, drying, storage) therefore solar alone is not productive, and wind alone is not reliable

Subchallenge Owner Statement

Integration – Elizabeth Nyeko
MANDULIS ENERGY

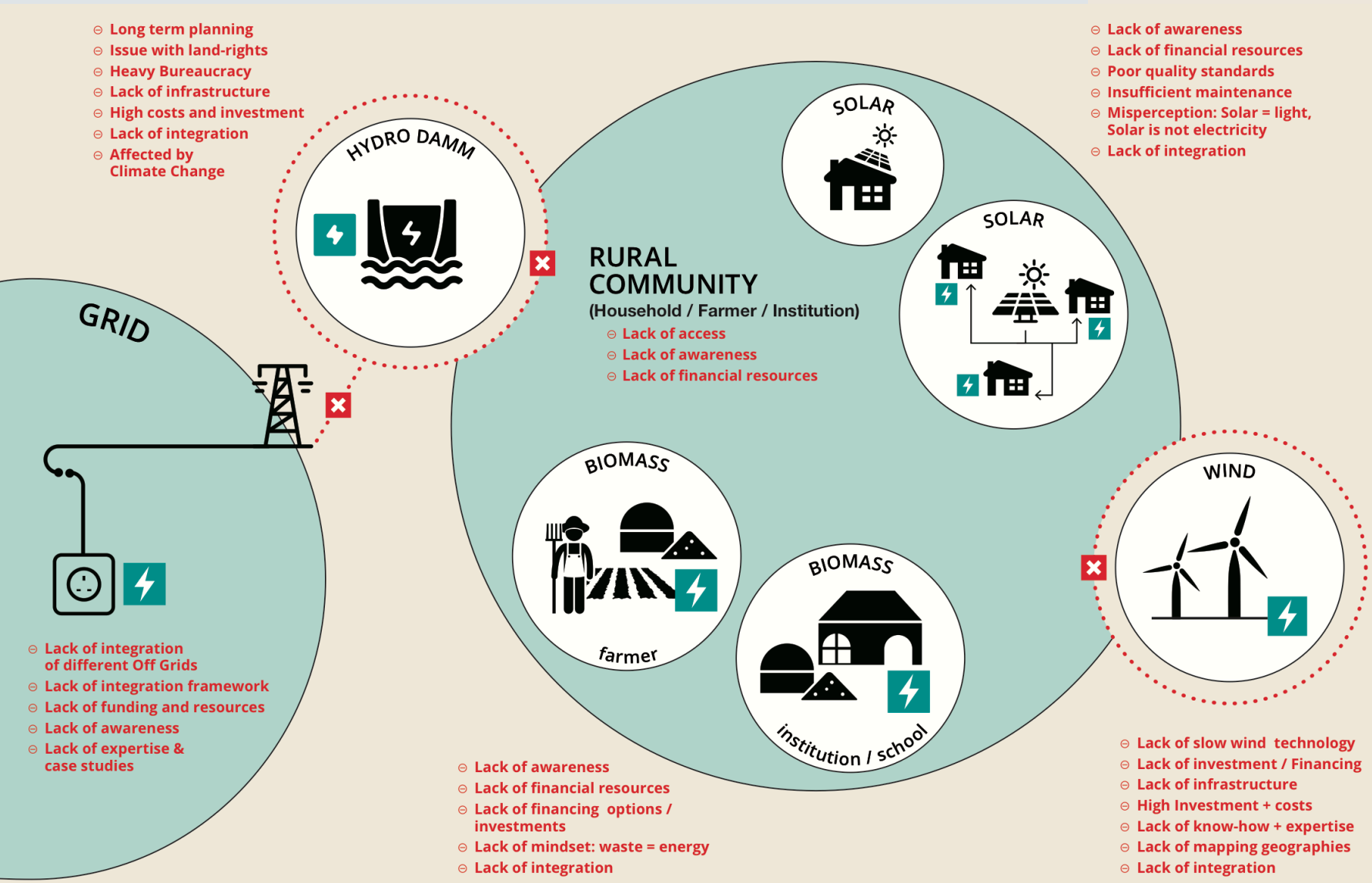
- **WE SEE OPPORTUNITIES IN...**
- Integrated approach
- Hybrid microgrids
- Digital solutions
- Capacity building and training, of farmers and local entrepreneurs
- Electricity improves quality of life in rural areas, enabling youth to improve their status within their environment

Subchallenge Owner Statement

Integration – Elizabeth Nyeko
MANDULIS ENERGY

- **WHAT WE BRING…**
- We are technology agnostic, our goal is to maximize kWh per person/household per year and minimize LCOE
- Access to abundant, renewable, cheap, resources for energy generation, agricultural waste, solar and wind
- Partnership with French NGO, ACTED which has a network of 24,000 farmers engaged in production of rice, maize, groundnuts
- Off-grid, pilot 32kW biomass gasification site
- On-grid, permit to develop 20MW biomass power project for PPA to the grid in Gulu

Overview
Off-Grid Integration



National level

„Balancing rural and urban electrification is tricky.“

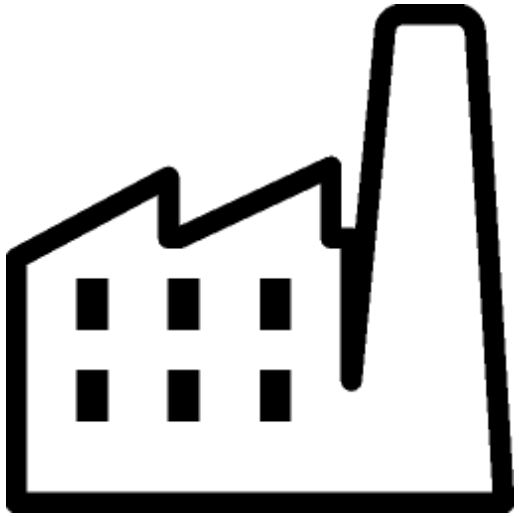
(Private Sector)

Industry level

„We need a license to create a medium-size grid – it‘s a very bureaucratic process.“

„It‘s a big risk, we never know when the grid will be expanded where.“

(private sector)



Community level

„I don‘t understand what solar and biomass is and how it will change the life of my family.“

(Individual)

Key Challenges
Off-Grid Integration

- Lack of awareness
- Lack of expertise
- Lack of financial ressources
- Lack of access to the grid
- Lack of collaboration: private & public sector
- Mental model of individuals:
  - UMEME = power = productivity
  - SOLAR = light
  - Biogass = farmers
  - Hydro = always under construction

Hydro

HMW increase productivity in rural areas through hydro?

Subchallenge Owner Statement

Hydro – MBA Heike Bruch
Voith

- **This is our focus, because Hydro Power ...**
- Is renewable, reliable, independent of day time
- It brings developments infrastructure in rural areas, agricultural irrigation, flood control, drinking water.
- It works on low operational and maintenance costs, very efficient, long life time of 50-100 years

Subchallenge Owner Statement

Hydro – MBA Heike Bruch
Voith

- **We see challenges in Uganda ...**
- Access to electricity in rural areas 7 %
- energy costs are high
- transportation and infrastructure is inadequate
- Financing or infrastructure projects is an issue as budget is needed for improving health and education system

Subchallenge Owner Statement

Hydro – MBA Heike Bruch
Voith

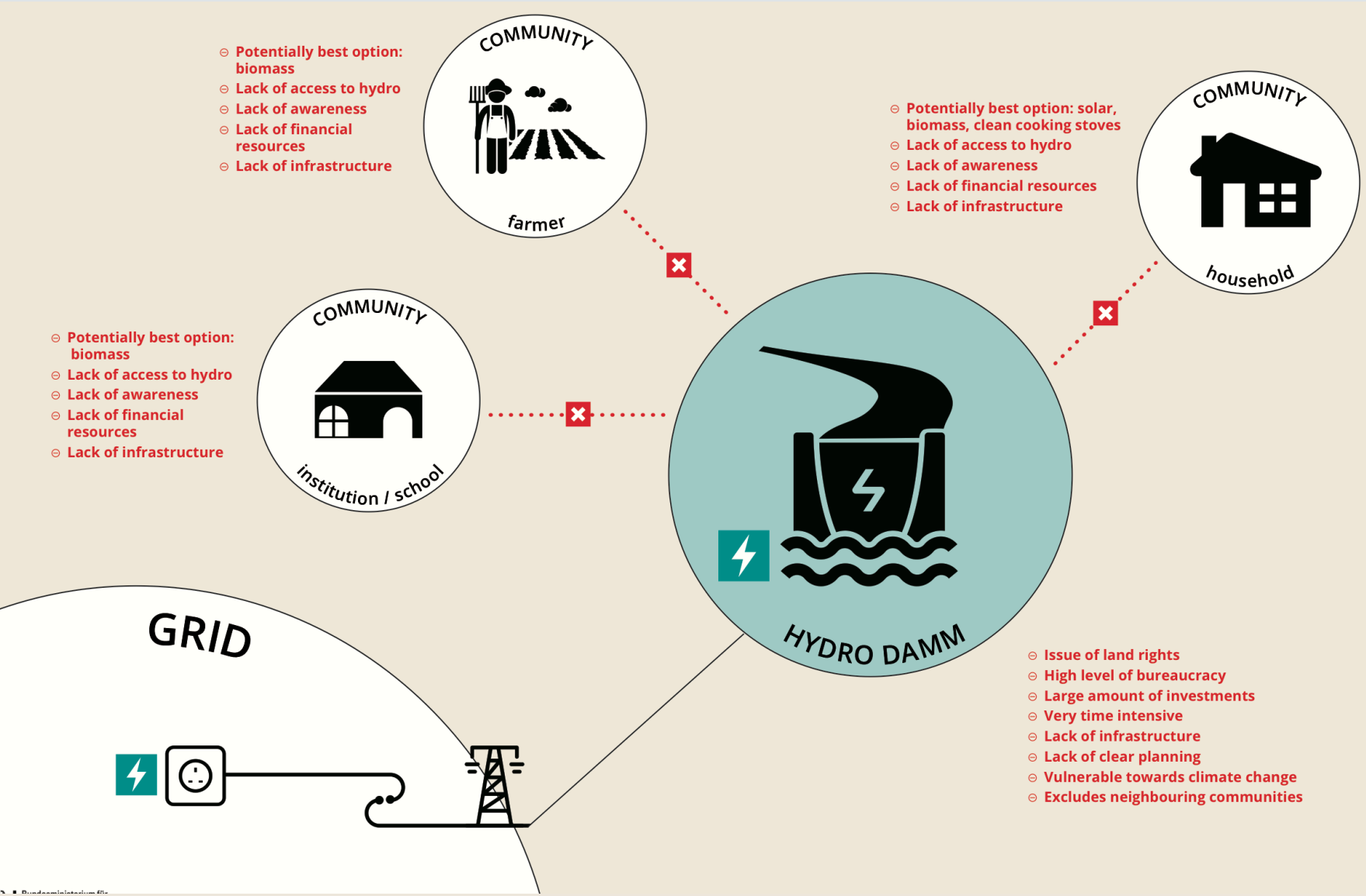
- **We see opportunities in Uganda ...**
- Large water resources and Hydro Power potential
- it's technical feasible: 5 500 – 6 000 MW and already exploited: 1 475 MW (~25%), 80% of total generated electricity by Hydro Power
- Small Hydro Power Projects are already planned

Subchallenge Owner Statement

Hydro – MBA Heike Bruch
Voith

- **What we bring ...**
- 150 years Voith means 150 years proven technology and experience in Hydro Power worldwide.
- Developing full-line solutions with keen sense responsibility, environmentally and socially
- Voith Hydro’s Footprint in Africa amounts ~25% of installed capacity

Overview
Hydro



National level

„Hydro is the future – we need more geographical & geological data.“

„We have to solve the issue of land rights.“

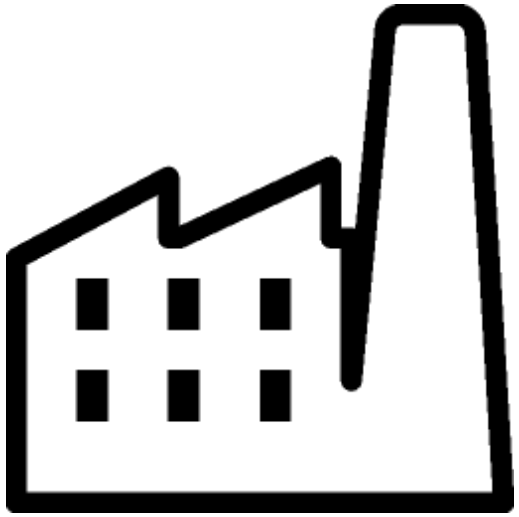
(Private sector)

Industry level

„Bureaucracy takes 2,5 years, construction would only take us 6 months.“

„We lack capacity and investment.“

(private sector)



Community level

„My ancestors married on this very land.“

„There is a cable above my house, but my community does not have access.“

(Individual)

Key Challenges
Hydro

- Lack of geographical and geological data
- Issues caused by negative effects of global warming
- Inadequate land rights
- Lack of financial resources
- Lack of access

Grid Connectivity

HMW improve the last-mile grid connectivity?

Subchallenge Owner Statement

Grid Connectivity –
Siemens

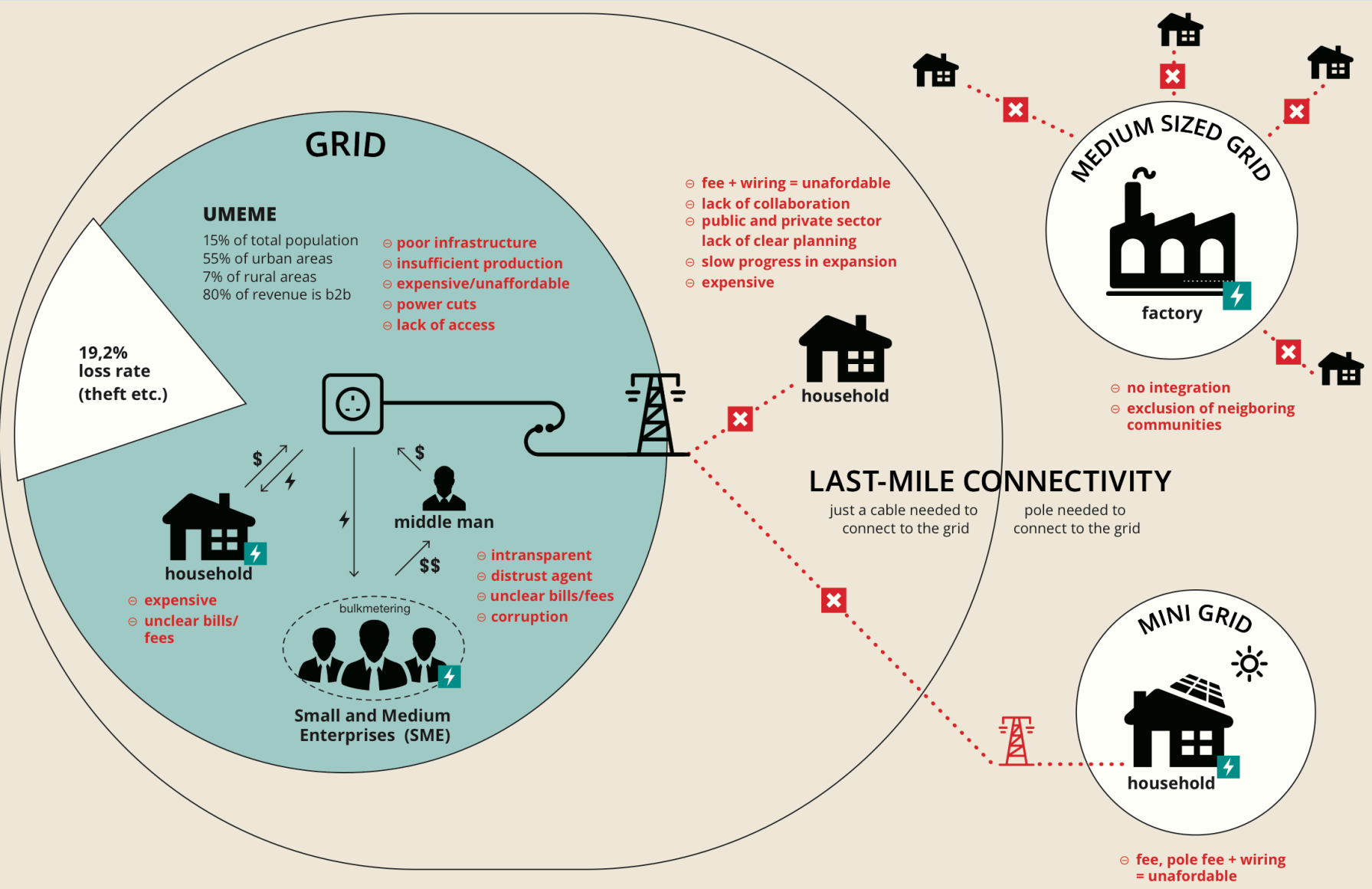
This is our focus, because…

Challenges we see...

Opportunities we see...

What we bring...

Overview
Grid Connectivity



National level

„Grid expansion is a priority, but progress is slow. It‘s unclear when & where it‘s planned.“

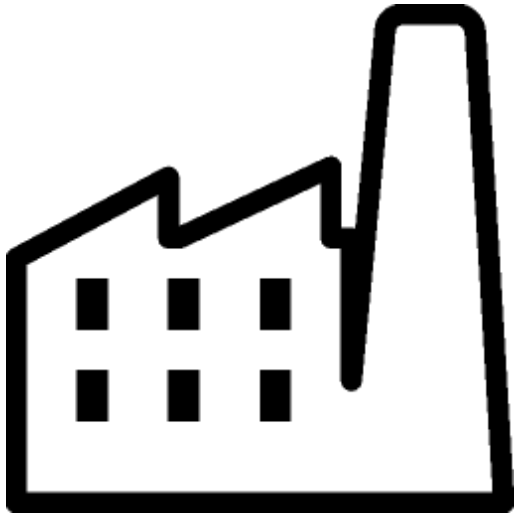
(private sector, individuals)

Industry level

„We need different solutions for low income customers.“

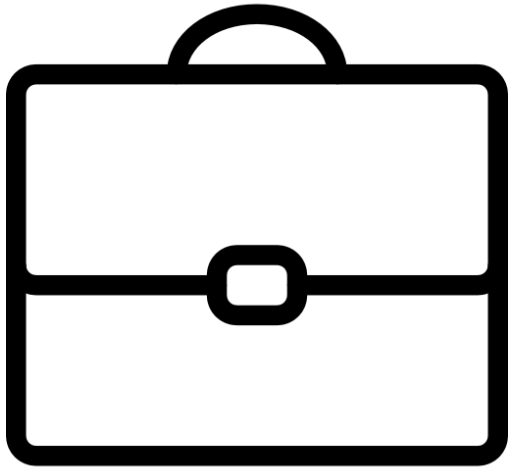
„We want more collaboration between private & public sector“

(private sector)



SME level

„Bulk-metering created tensions.“



Community level

„There is a pole right outside my house – but I can‘t afford the 160$ connection fee and getting my home wired.“

(individual)

Key Challenges
Grid-Connectivity

- *Generation*: Insufficient generation
- *Transmittions:* Poor infrastructure
- *Distribution*: lack of power-lines & unable to meet technical requirements
- *Demand:* unaffordable connection fee + house wiring cost
- Umeme = expensive / untransparent bills / corrupt middle men

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