

Sustainable Energy Access in Humanitarian Situations

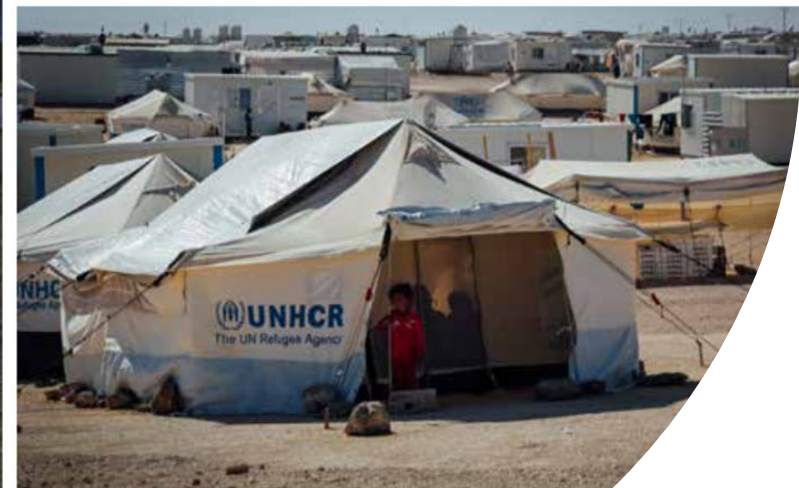
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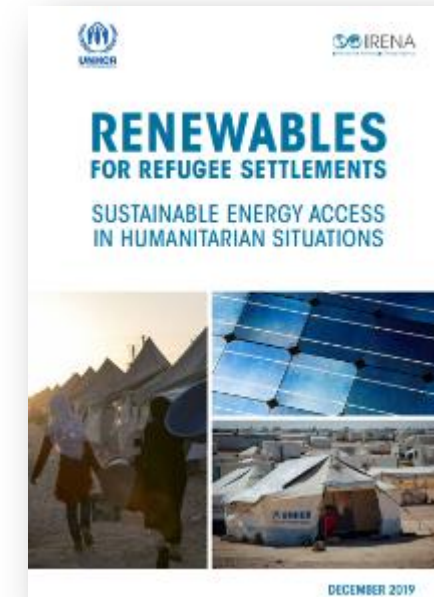
5th International Hybrid Power Systems Workshop
Session 2A – Hybrid Power Case Studies I
11:30-13:00 CEST - Tuesday, May 18, 2021



- » Introduction and background
- » Solutions considered for clean electricity and cooking
- » Business models
- » Overview of refugee settlements
- » Key findings
- » Recommendations for settlements in Iraq
- » Recommendations for settlements in Ethiopia
- » Examples of proposed solutions
- » Conclusions

Introduction and background

- 70.8 million displaced people (25.9 million refugees and over half < 18 years of age)
- Most refugees depend on unsustainable energy resources that pose risks to their security and safety
- Access to clean and sustainable energy can deliver quick returns
- IRENA and UNHCR entered into an MoU
- Under this framework, IRENA – jointly with UNHCR – released a study at the Global Refugee Forum in December 2019 to assess energy usage in four refugee camps in Iraq and Ethiopia
- Missions to the camps in Ethiopia and Iraq took place in September 2019



Technology options considered for electricity

- **Solar lighting kits**



Solar lanterns charging at a school in Chuuk, Federated States of Micronesia

- **Standalone solutions /SHS**



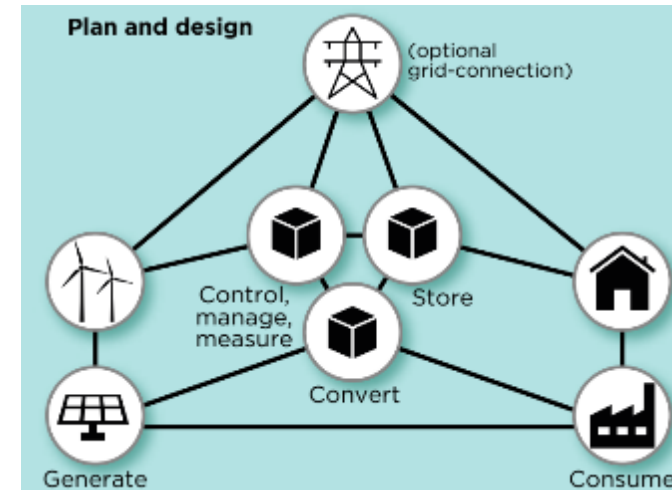
School in Chuuk using standalone solar PV with battery storage

- **Solar water pumping**



A solar plant installed at a borehole in Darashakran refugee camp (Iraq)

- **Mini-grids**



Source: Based on IRENA (2016) Innovation Outlook: Renewable Mini-Grids

- **Grid connected renewables**

Technology options considered for cooking

■ Ethanol

- Produced from crops with high starch and sugar content
- More efficient and less polluting
- Faster cooking and do not produce smoke or soot

■ Briquettes

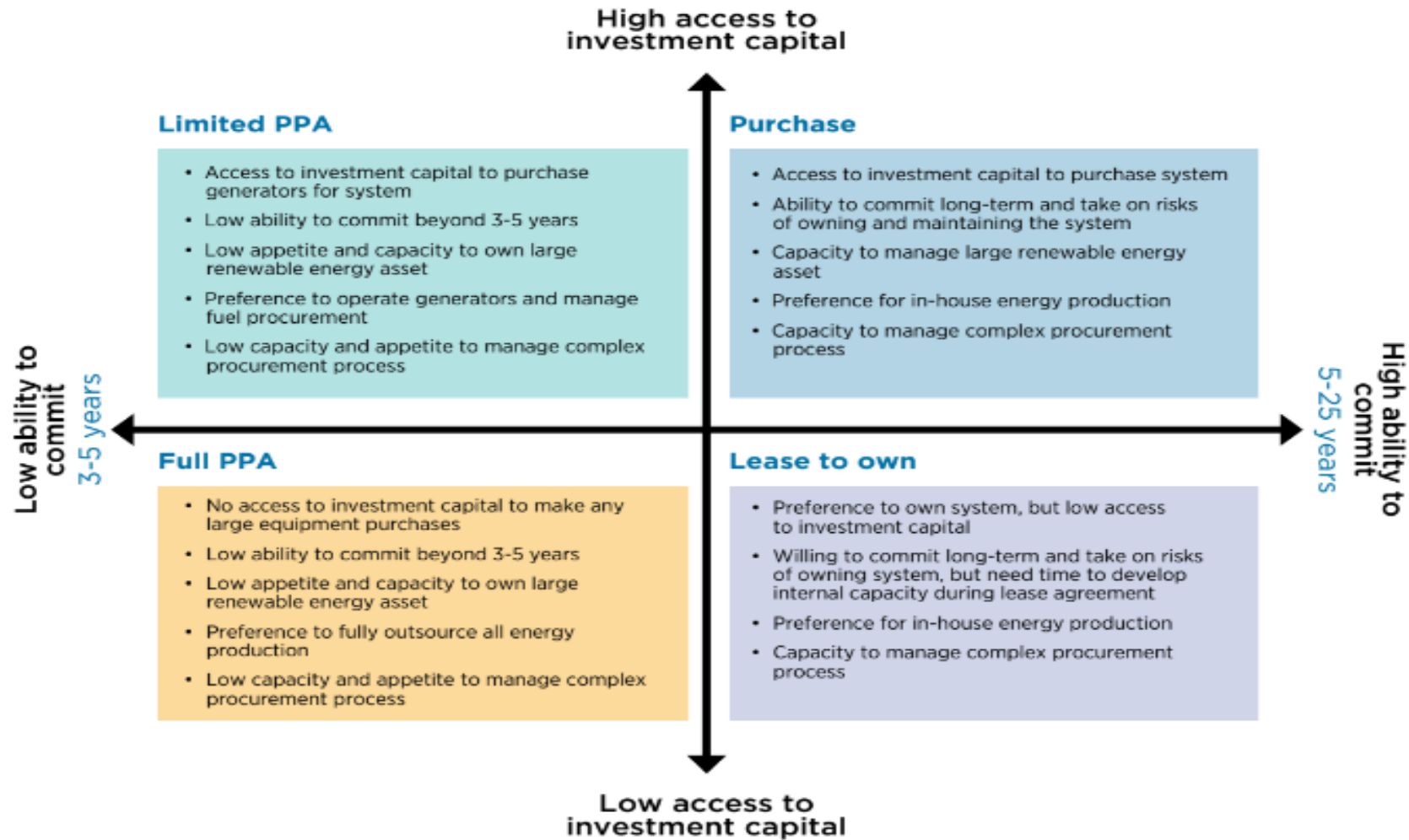
- Made by compressing dried woody biomass
- Low moisture content and high energy density
- Burn for a longer time and significantly reduce smoke
- Considered a renewable fuel source when produced from sustainable biomass resources



Household kitchen in the Sherkole refugee settlement (Ethiopia)



Traditional cook stove in the Sherkole refugee settlement (Ethiopia)



PPA= Power purchase agreement

Note: For the limited PPA, organisations will need access to investment capital to procure generators

Source: Kube Energy

Overview of refugee settlements

- **Darashakran, Iraq**
 - 40km north of Erbil (Kurdish region of Iraq)
 - 2013, largest settlement in Erbil region (≈ 11,608)

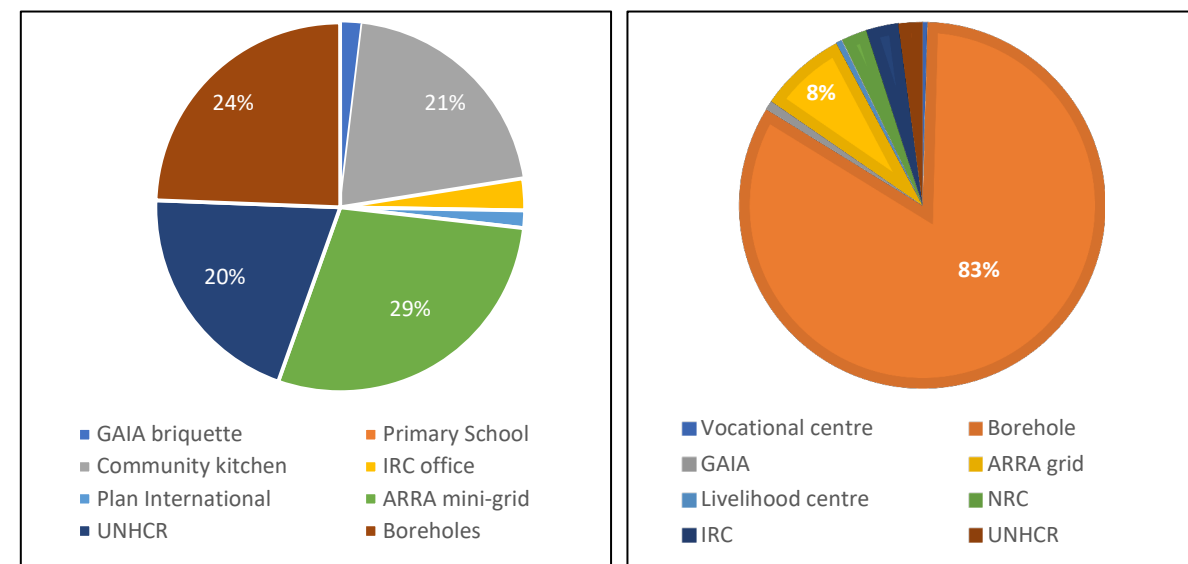
- **Domiz 1 & 2, Iraq**
 - Adjacent to each other, 10 km outside Duhok (Kurdish region of Iraq)
 - 2012, combined population of 44,000 (largest in Iraq)

- **Sherkole, Ethiopia**
 - 42 km north of Assosa on the border with Sudan
 - 1997, currently hosts ≈10,619 refugees

- **Tsore, Ethiopia**
 - 20 km north of Assosa on the border with Sudan
 - 2015, currently hosts ≈14,153 refugees



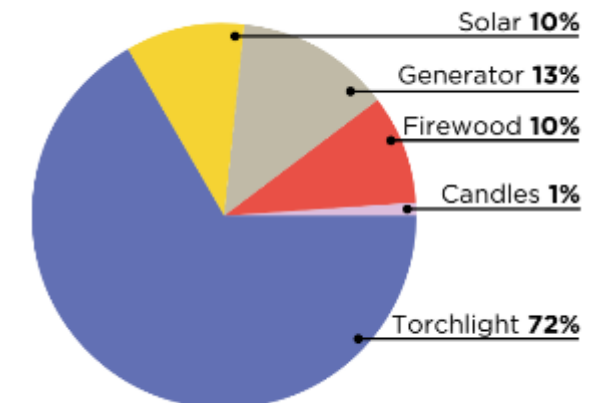
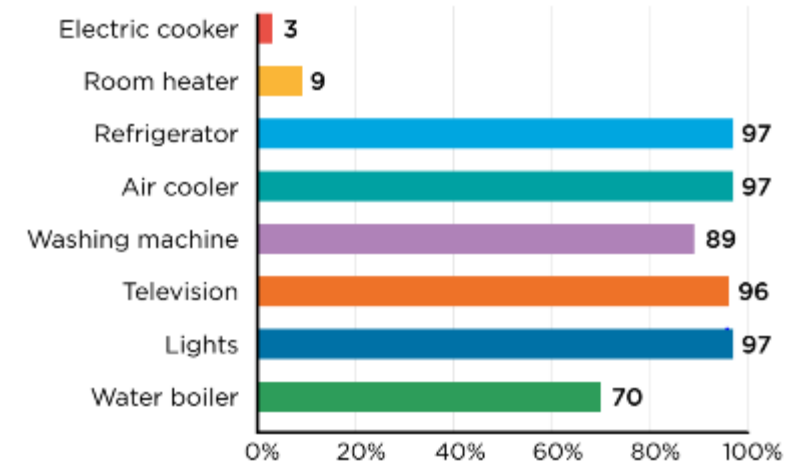
UNHCR refugee settlements in Iraq



Pie charts of the electricity use in Sherkole (left) and in Tsore (right)

Key findings

- 1. The energy situation for refugees reflects the development level of the host community**
- 2. Brownouts and blackouts lead to over-reliance on expensive backup diesel generators in Iraq**
- 3. The lack of access to energy for cooking for refugees poses a risk for conflict with host community in Ethiopia**
- 4. Large potential benefits arise from increasing the use of renewable energy in refugee settings**
- 5. The lack of data limits the efficiency of electricity supply and is a barrier for moving to renewables**



Distribution of appliances in Domiz, Iraq (top) and main lighting source in Sherkole, Ethiopia (bottom)

Recommendations for settlements in Iraq

1. Improve energy efficiency at the settlements
2. Continue to install renewables at community/facilities
3. Increase transformer capacity (10 MW to 16 MW)
4. Install renewable power plants on the feeder lines to the settlements to compensate for the lack of electricity supply
5. Facilitate for any investments in infrastructure for the refugee settlement to take place in ways that reduces UNHCR's technical and financial risk
6. Push for meters to be installed at households in the Domiz settlements and for refugees to pay on a kWh basis



6.6 MW solar PV installation in Domiz 1 (left) and a 2.5 MW solar PV installation in Domiz 2 (right)



Birdseye view of the powerhouse (in red) and available space (in blue)

Recommendations for settlements in Ethiopia

1. Promote and support the use of fuel-efficient stoves
2. Consider a transition to a market-based approach for providing sustainable biomass for cooking in the settlements – for example, improved cook stoves that use briquettes or ethanol
3. Scale-up forest plantations and rehabilitate land near settlements
4. Establish a mini-grid in the settlements
5. Initiate market-based solar lamps access initiatives
6. Increase the use of solar street lights to improve the lighting situation in the settlements
7. Apply for a grid connection for the settlements from Ethiopian Electric Power



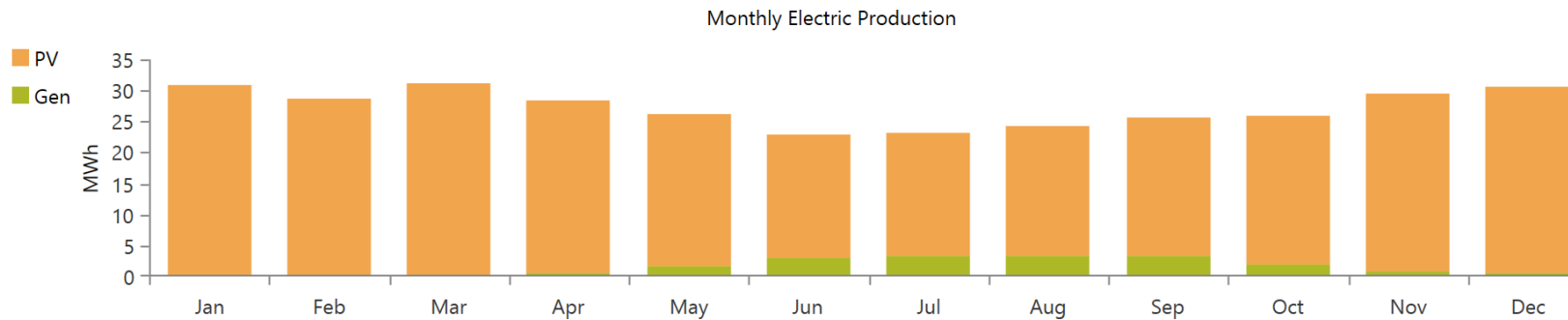
A refugee tending a eucalyptus plantation in the Sherkole refugee settlement



Standalone solar system with containerised battery bank

Examples of proposed solutions

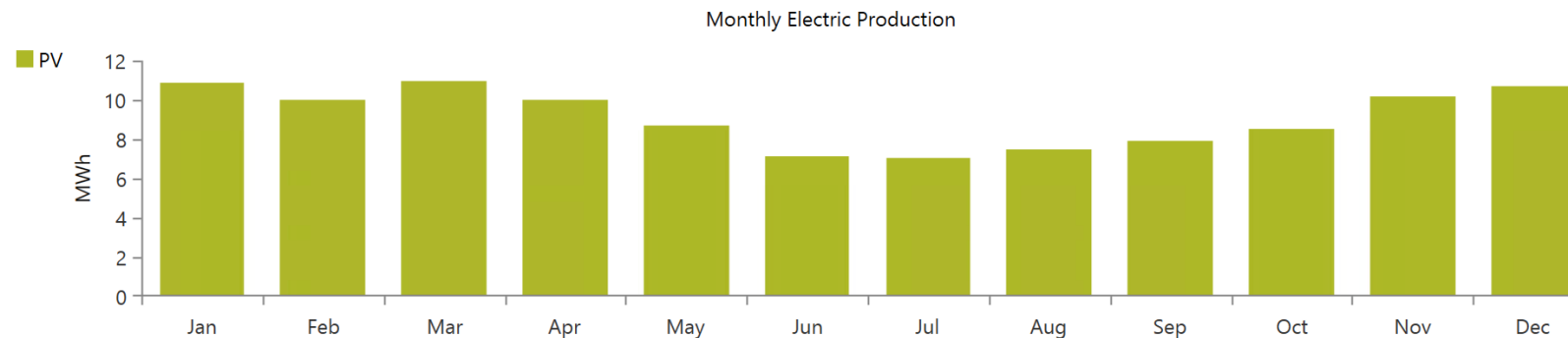
Sherkole settlement mini-grid



Monthly electricity generation of proposed mini-grid in Sherkole settlement, Ethiopia

PV: 183kW
Storage: 433kWh
Diesel: 80kVA
COE: 0.16 USD/kWh
RE Share: 91%
Investment: 480,000-550,000 USD

Tsore settlement mini-grid



Monthly electricity generation of proposed mini-grid in Tsore settlement, Ethiopia

PV: 65kW
Storage: 108kWh
Diesel: None
COE: 0.2 USD/kWh
RE Share: 100%
Investment: 160,000 USD

Conclusions

- More data needs to be collected
- Energy loggers are crucial to properly measure and size appropriate renewable energy systems
- In Iraq, transitioning to a meter-based payment system for HH in the settlements could improve the availability and quality of electricity supply
- In Ethiopia, collecting data on HH income would be central in moving towards market-based cash assistance
- Considerable synergies can be gained from collaboration between humanitarian organisations (e.g. UNHCR) and specialised RE agencies (e.g. IRENA)

Renewables are key for affordable, reliable, climate-safe access to modern energy services



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