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Scaling Off-Grid Solar Solutions: Techno-Economic Assessment and PPP Models for a Just Energy Transition

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AMPERES' Contribution to Inclusive Electrification

Established in 2015, AMPERES is a mission-driven enterprise with offices in Vietnam and Australia.

Since 2017, AMPERES has supported villages and communities in Vietnam, Myanmar, Cambodia, and Lao to improve livelihoods through access and ownership of distributed energy and water resources.

We are currently active in 11 countries throughout the Asia - Pacific

- **We support governments** improve the sustainability of policy & planning processes.
- **We empower communities** to improve livelihoods through affordable and reliable access to distributed energy & water resources.
- **We work with companies** & industry to decarbonise business, promote energy independence & reduce operating costs.
- **We collaborate with universities** & researchers to prototype & scale innovative technology towards commercialisation.



Community solar, Myanmar


Solar Home Systems, Vietnam




Community solar, Australia


Community recycled battery manufacturing, Myanmar


Community Consultations, Myanmar

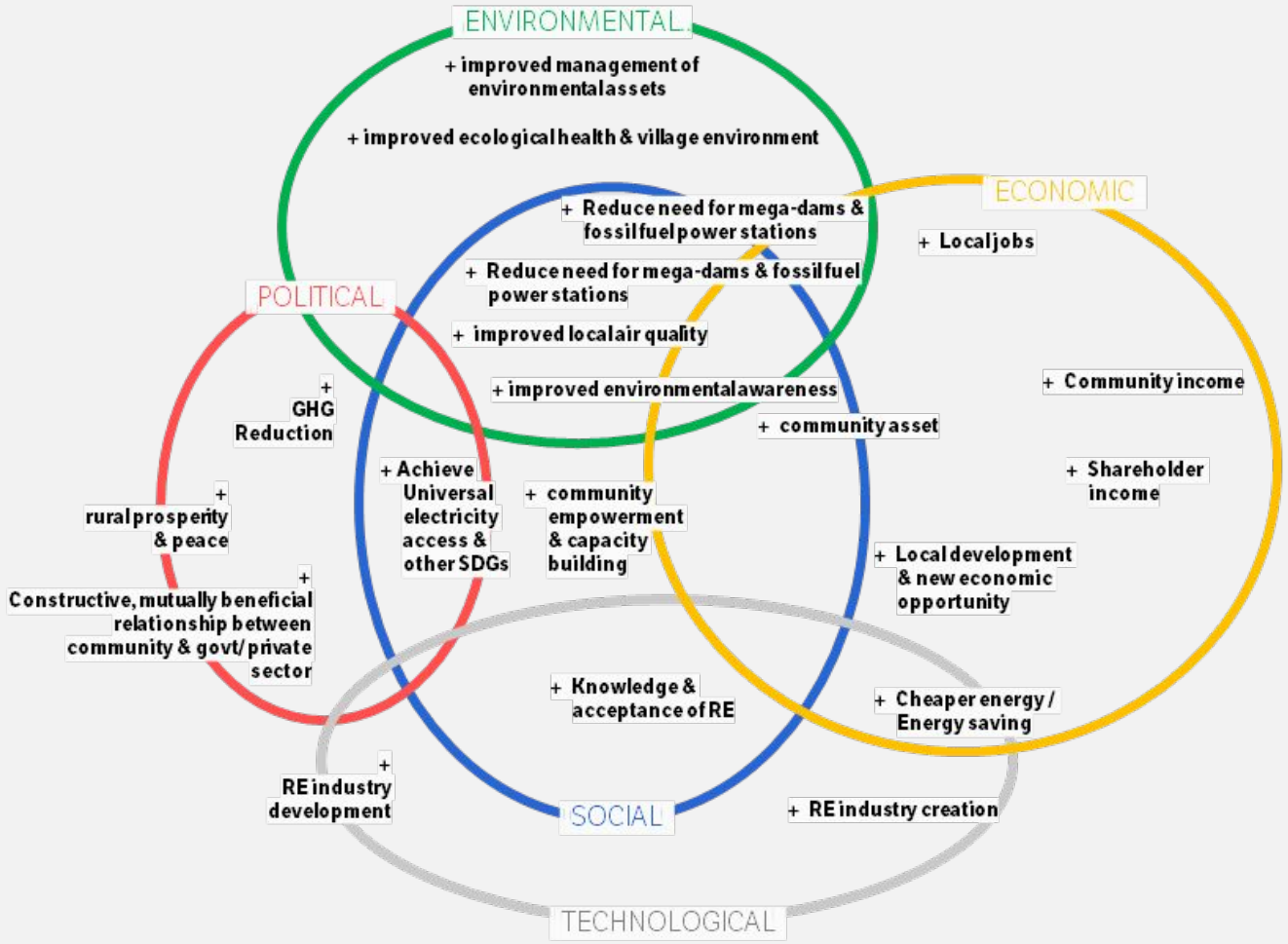

Community solar microgrid, Cambodia


Community solar microgrid, Vietnam

The Rural Energy Gap - Why It Matters?

- 99,47% electrification in Vietnam—but ~911.400 people still lack reliable power access
- Remote, mountainous, and island areas remain off-grid or diesel-reliant
- Energy poverty impacts education, health, economic equity

An Tức Commune people – photo by Việt Nam News



Social, Technological, Environmental, Economic and Political Benefits of Community Renewable Energy

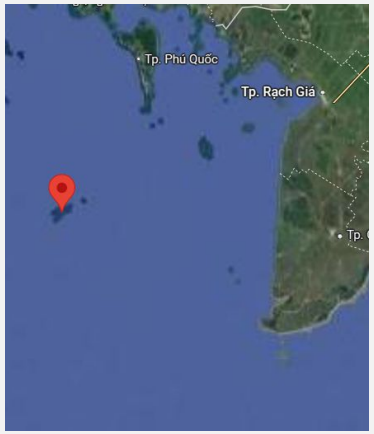
Research Objective & Scope

What We Explore?

Assess off-grid solar technologies:

- Solar Home Systems (SHS)
- Hybrid Solar (PV + Diesel)
- Mini-Grids

Where We Test It?



Case study: Thổ Châu Island

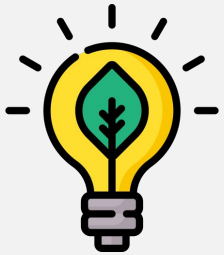
1,912 people

474 electricity customers

4 diesel power generators with a capacity of 2,468 MW

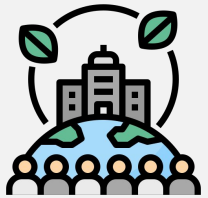
Remote, diesel-reliant, and a national energy equity priority

Why It Matters?



Recommend **scalable, just solutions** aligned with:

- **PDP8** – Vietnam's energy roadmap
- **JETP** – Just Energy Transition Partnership



Case Study: Thổ Châu Island Snapshot

Overview & Demographics

- **Location:** Offshore island, part of Kiên Giang Province (~220 km from mainland)
- **Population:** 1,912 residents
- **Households connected to power:** 474
- **Community profile:**
  - Predominantly **fishing village households**
  - Presence of **civil administration units and security posts** (strategic border location)
- Strategic in national **maritime sovereignty and economic zoning** plans

Photo: Sokoyo solar light project on Tho Chau Island, Phu Quoc, Vietnam by DAT solar

Energy Landscape

- **Current supply:**
  - Diesel generators (4 units) with total capacity of **2.468 MW**
  - Operated since 2014, heavily fuel-dependent
- **Annual demand:**
  - **~1.72 million kWh/year** (2024 estimate), increasing at 25% YoY
- **Challenges:**
  - **High fuel costs**, frequent refueling trips
  - Limited reliability for 24/7 power

Feasibility Comparison: Off-Grid vs. Grid Extension

Option	Tech Fit	Cost (CAPEX)	Social Impacts	Environmental Impacts
Solar Home System	Basic Needs Only	Low	Uneven Coverage	Low Emissions
Hybrid PV/Diesel	Medium	Medium	Good for Services	Partial Emissions
Solar Mini-Grids	Full Fit	Moderate	Inclusive	Clean & Scalable
Submarine Cable	Full Fit	Very High	High	Clean (Grid mix)

Mini-Grid strikes the best balance of cost, impact, and sustainability.

Key Findings: Mini-Grids Lead the Way for Remote Electrification

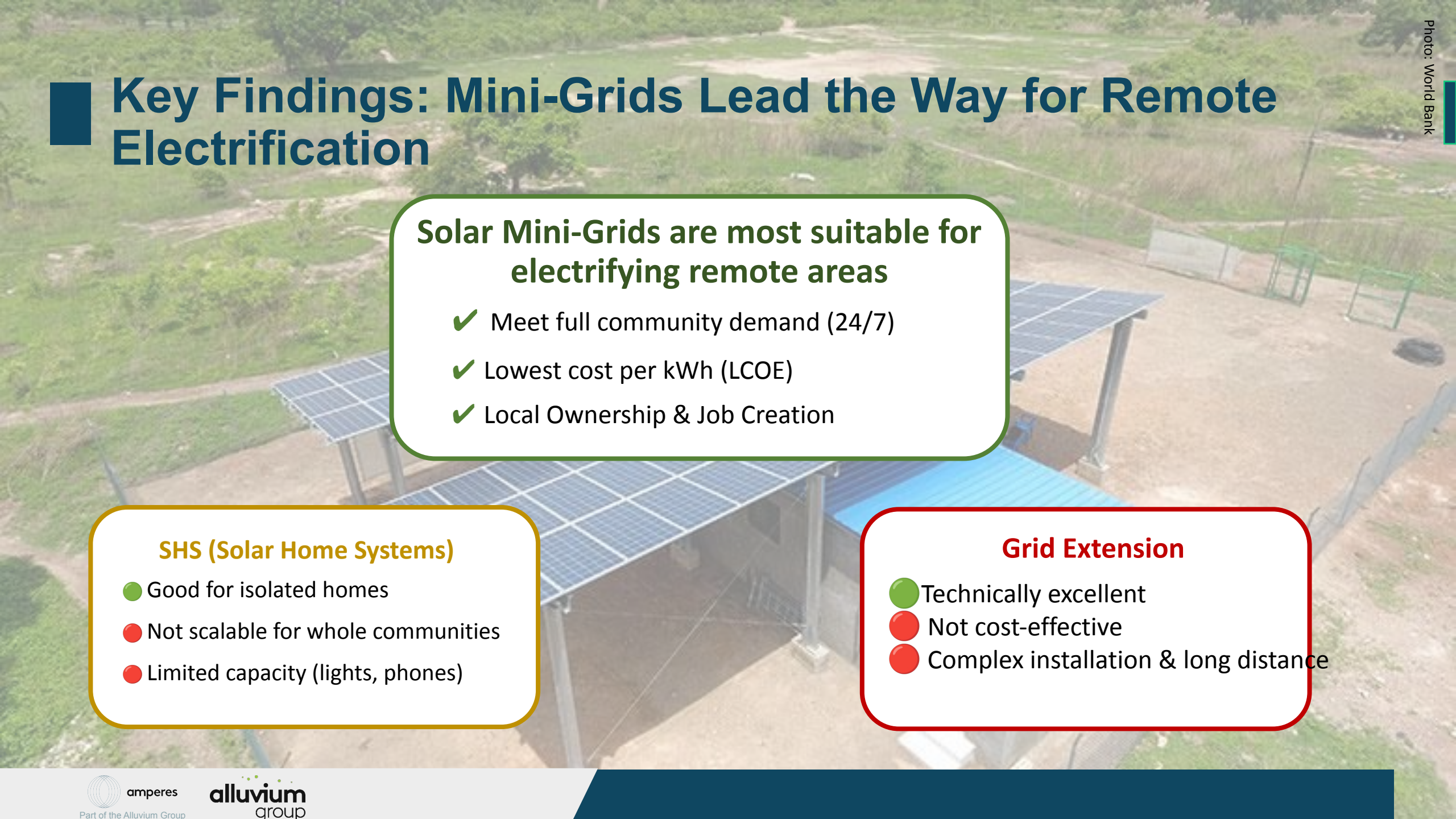


Photo: World Bank

Solar Mini-Grids are most suitable for electrifying remote areas

- ✔ Meet full community demand (24/7)
- ✔ Lowest cost per kWh (LCOE)
- ✔ Local Ownership & Job Creation

SHS (Solar Home Systems)

- 🟢 Good for isolated homes
- 🔴 Not scalable for whole communities
- 🔴 Limited capacity (lights, phones)

Grid Extension

- 🟢 Technically excellent
- 🔴 Not cost-effective
- 🔴 Complex installation & long distance

What Makes Mini-Grids Work

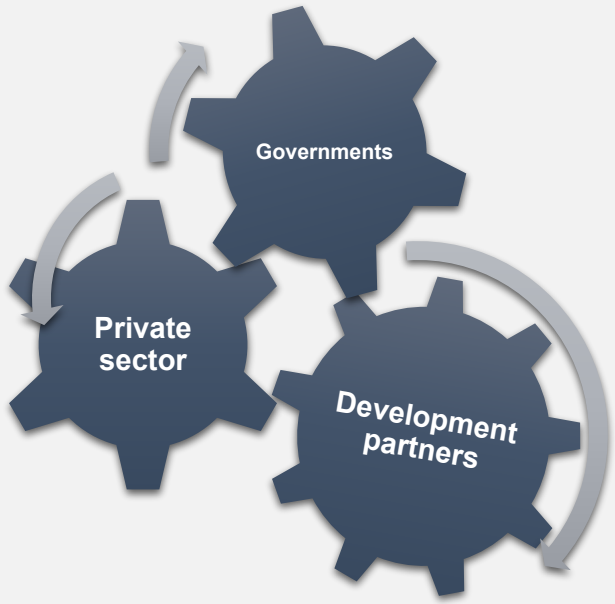
Technological Enablers

- Falling PV and Battery Price (from 1,400USD per kilowatt-hour in 2010 to less than 140 USD per kilowatt-hour in 2023)
- Smart inverter & Control systems
- Modular, scalable systems

Institutional Frameworks

- Public-Private Partnerships
- Distributed Renewable Energy Certificates (D-RECs) for private finance
- Legal & regulatory support via 2024 Electricity Law

Policy Recommendations



Policy & Legal Support

- Integrate mini-grids into PDP8 rural access goals
- Legally recognize Community-Owned Renewable Energy (CORE) models

Financial Innovation

- Enable blended finance (donor + private capital)
- Pilot D-REC schemes to monetize carbon reductions

Capacity Building

- Train local O&M teams
- Support creation of rural energy cooperatives
- Behavior change campaigns to promote acceptance of new technologies. Participatory planning processes that ensure community voices & need are heard

Photo courtesy of Basile Morin.

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Thank you!

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