European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Nigerian Energy Support Programme (NESP)

Profitability of mini-grids in Nigeria

The environment of the Mini-Grid Acceleration Scheme (MAS) and the MAS‘ intended impact

Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Agenda

1. Mini-grid market potential in Nigeria
2. Profitability of Nigerian mini-grids
3. Challenges in profitability and main operational risks
4. Access to finance options
5. Available grant funding opportunities and their characteristics (MAS vs. NEP)

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Mini-grid market potential in Nigeria

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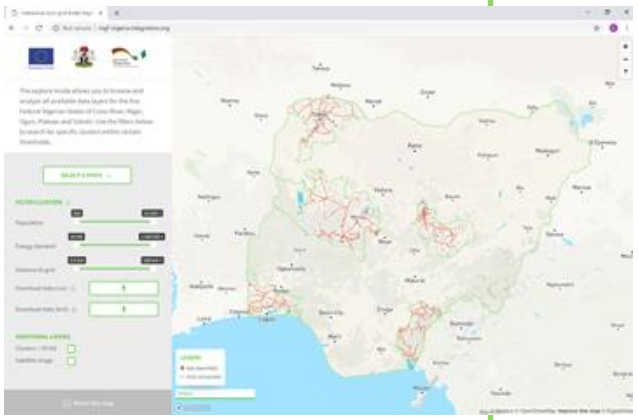
Results of geospatial analysis

NESP I – Focus on Modelling

- Identified potential in five states via GIS modelling
- Published results online
- http://mgf-nigeria.integration.org/



NESP II – Focus on Data Collection

- Central Data Management System
- Map and survey off-grid settlements
- Status of the grid (mobile mapping)

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Profitability of mini-grids in Nigeria

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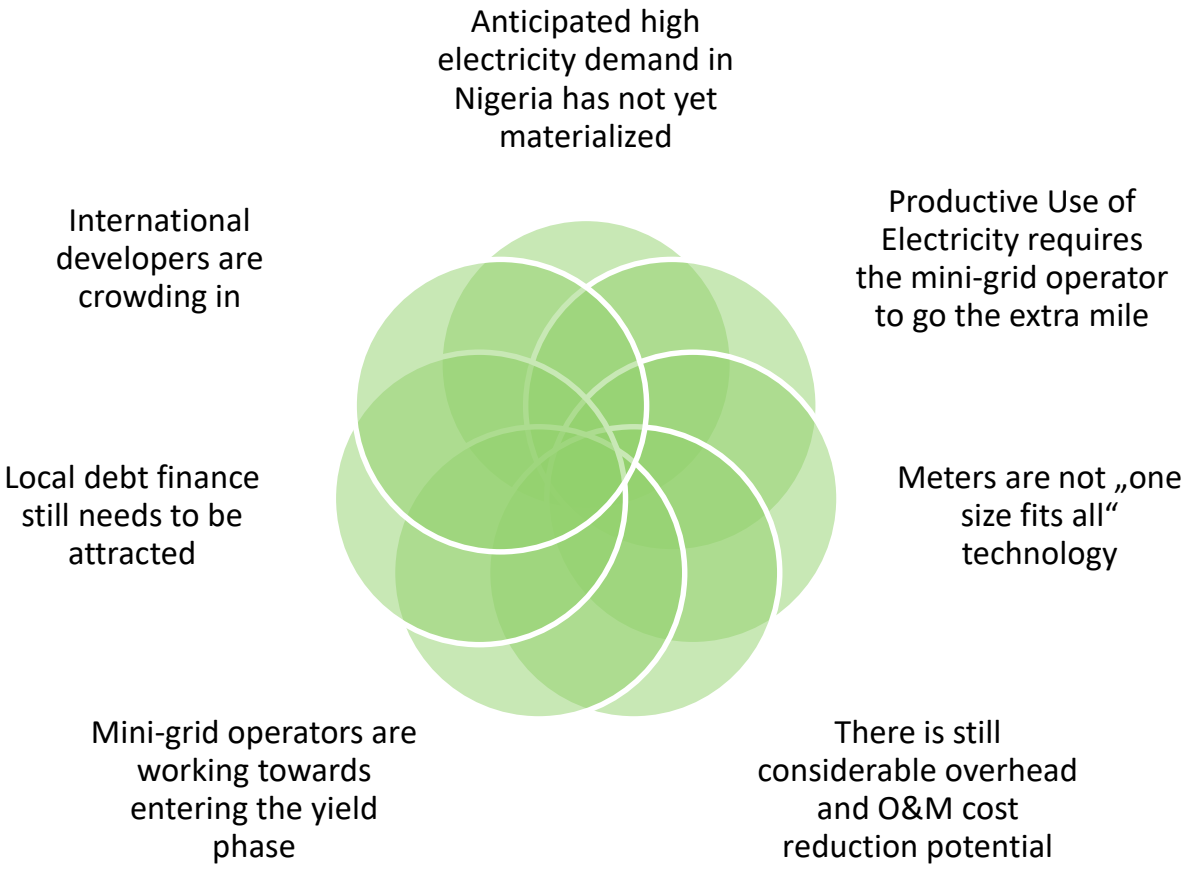
Current stage of mini-grid development in Nigeria



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Challenges in mini-grid profitability and operational risks

-

Approaches to improve mini-grid profitability

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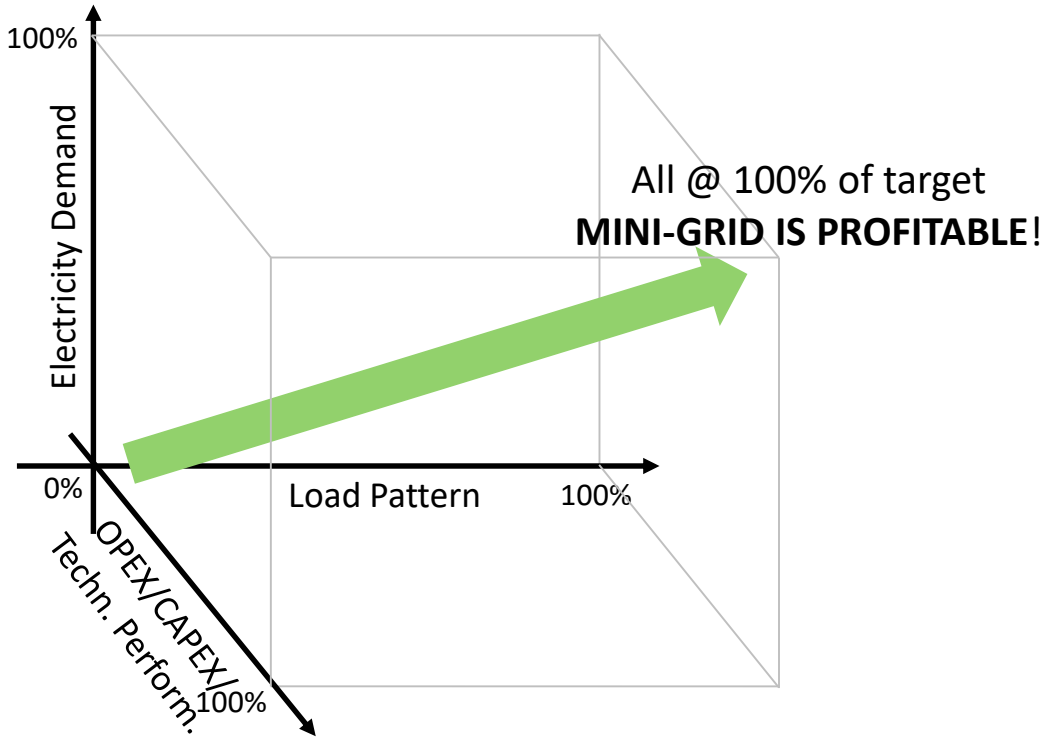
Factors of profitable mini-grid operation

Aim is to align the following with their design values:

1. **Electricity Demand**
2. **Load Pattern**
3. **OPEX / CAPEX / technical performance**



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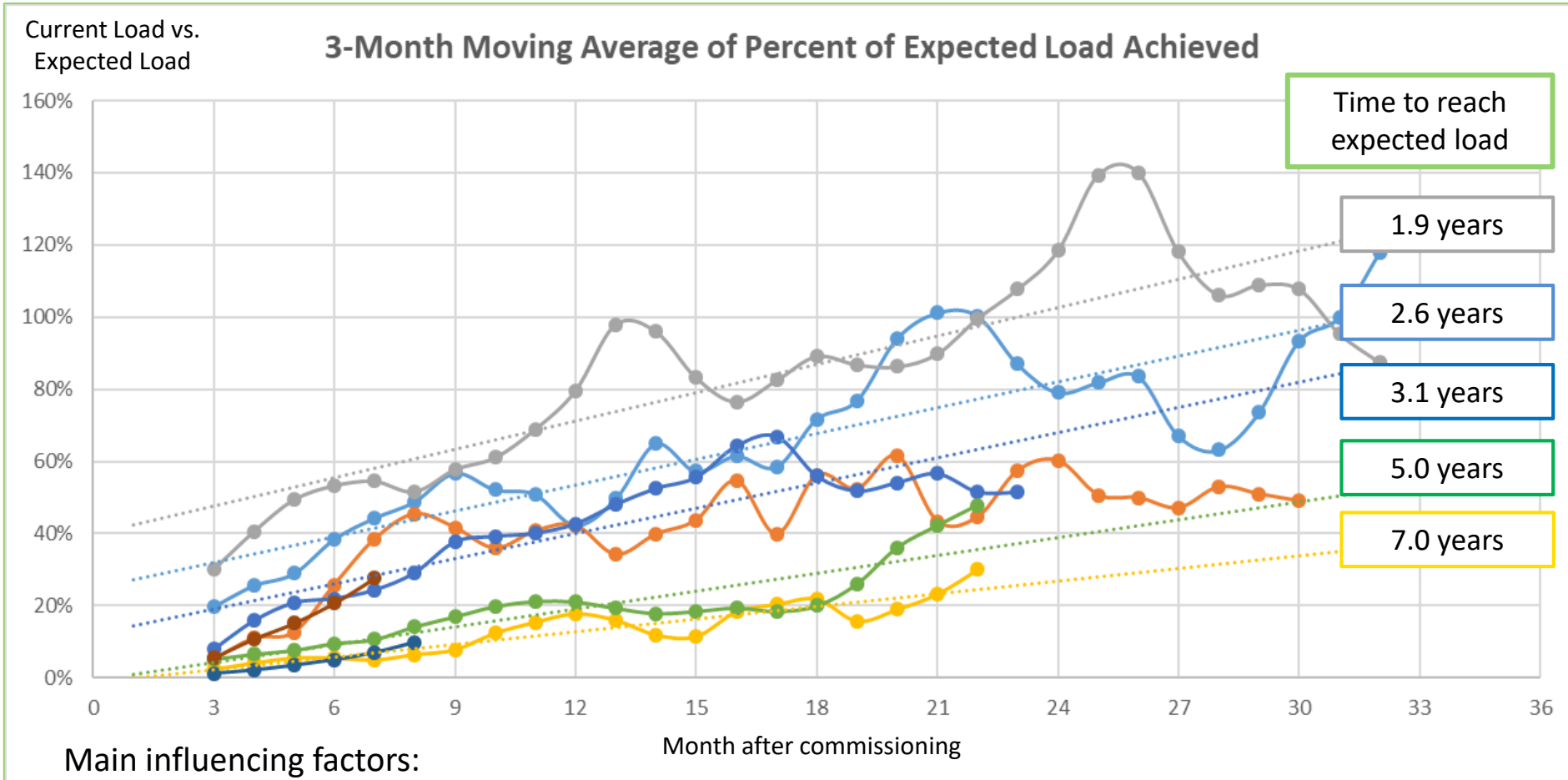
Demand development of mini-grids in Bangladesh



Main influencing factors:

- Trust relationship between operator and community
- Success of households and businesses in raising funds (banks, MFIs, family and friends)

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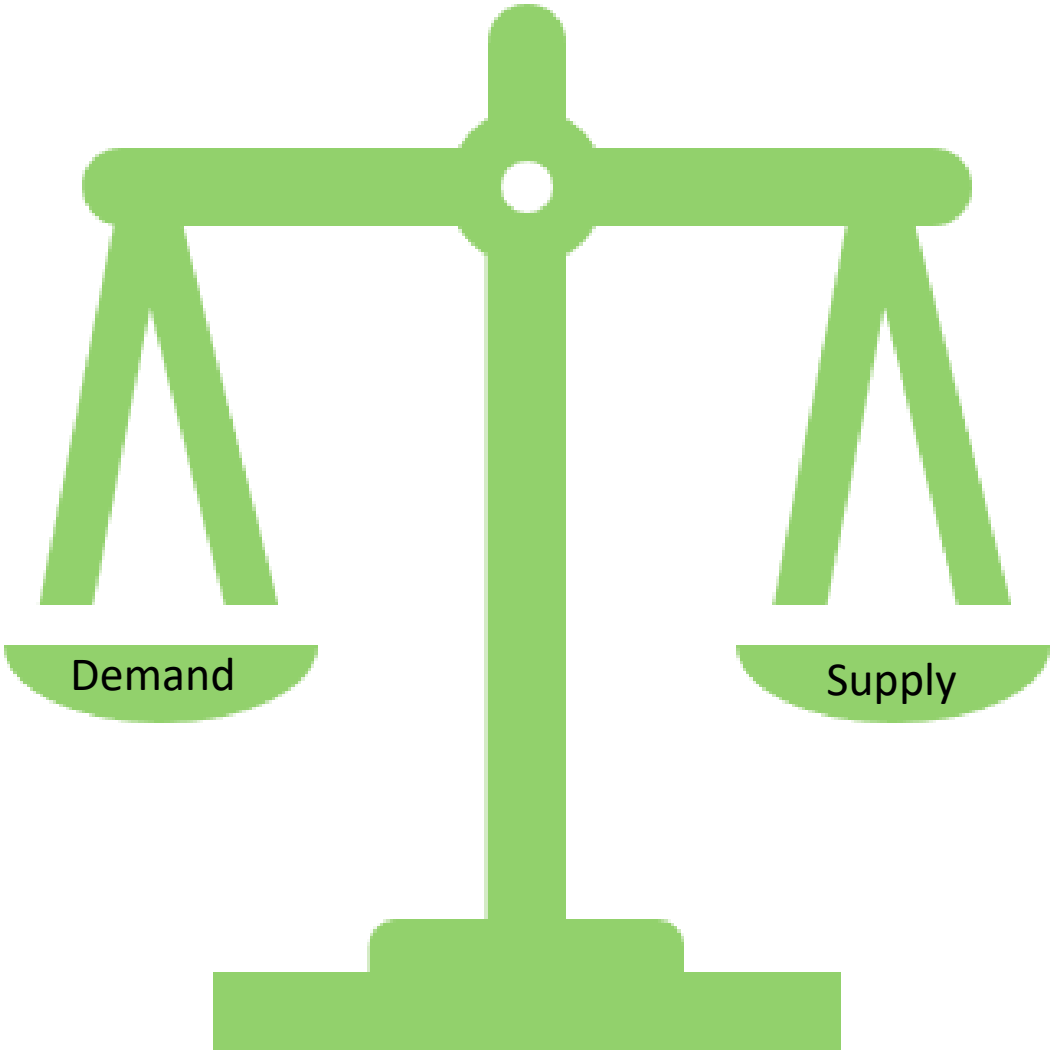
The Demand Supply Equilibrium



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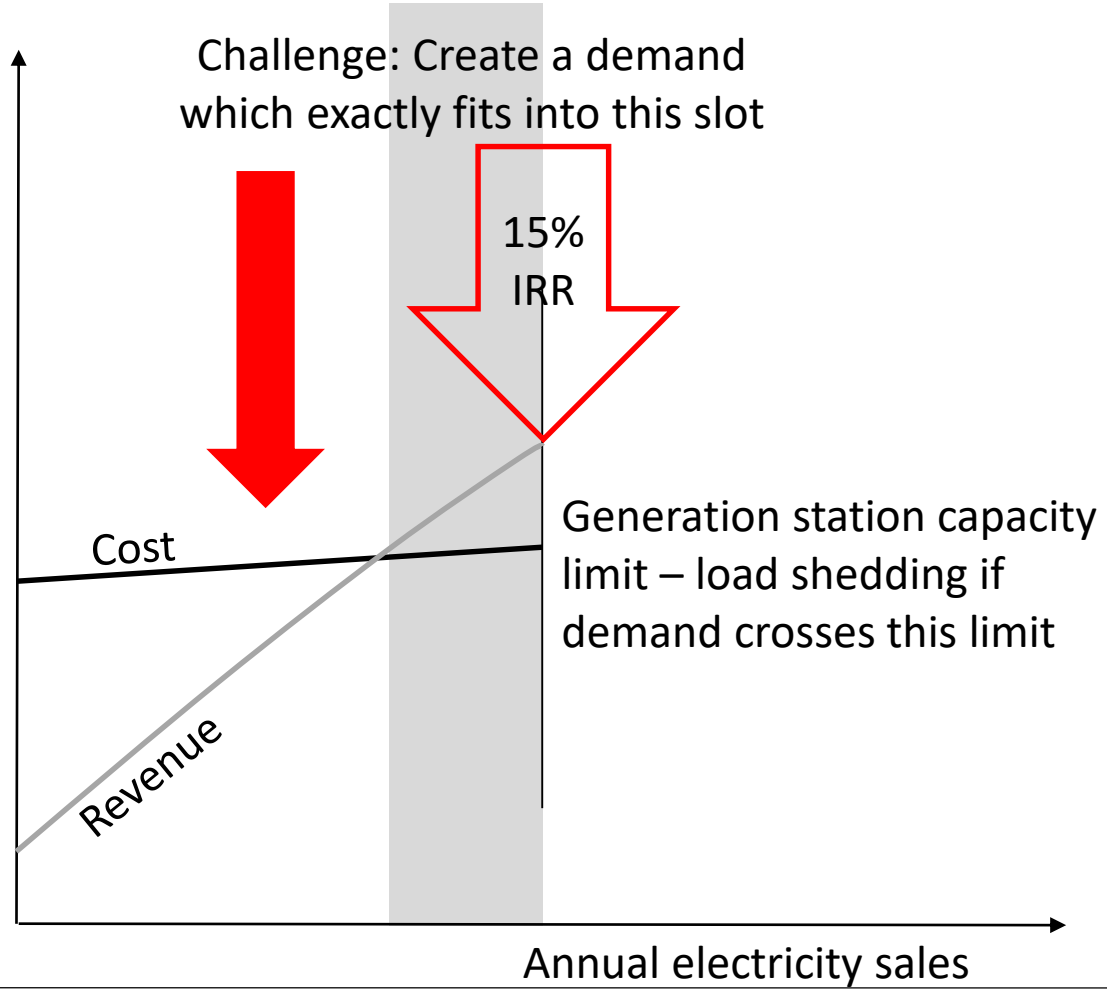
Solar Battery - only



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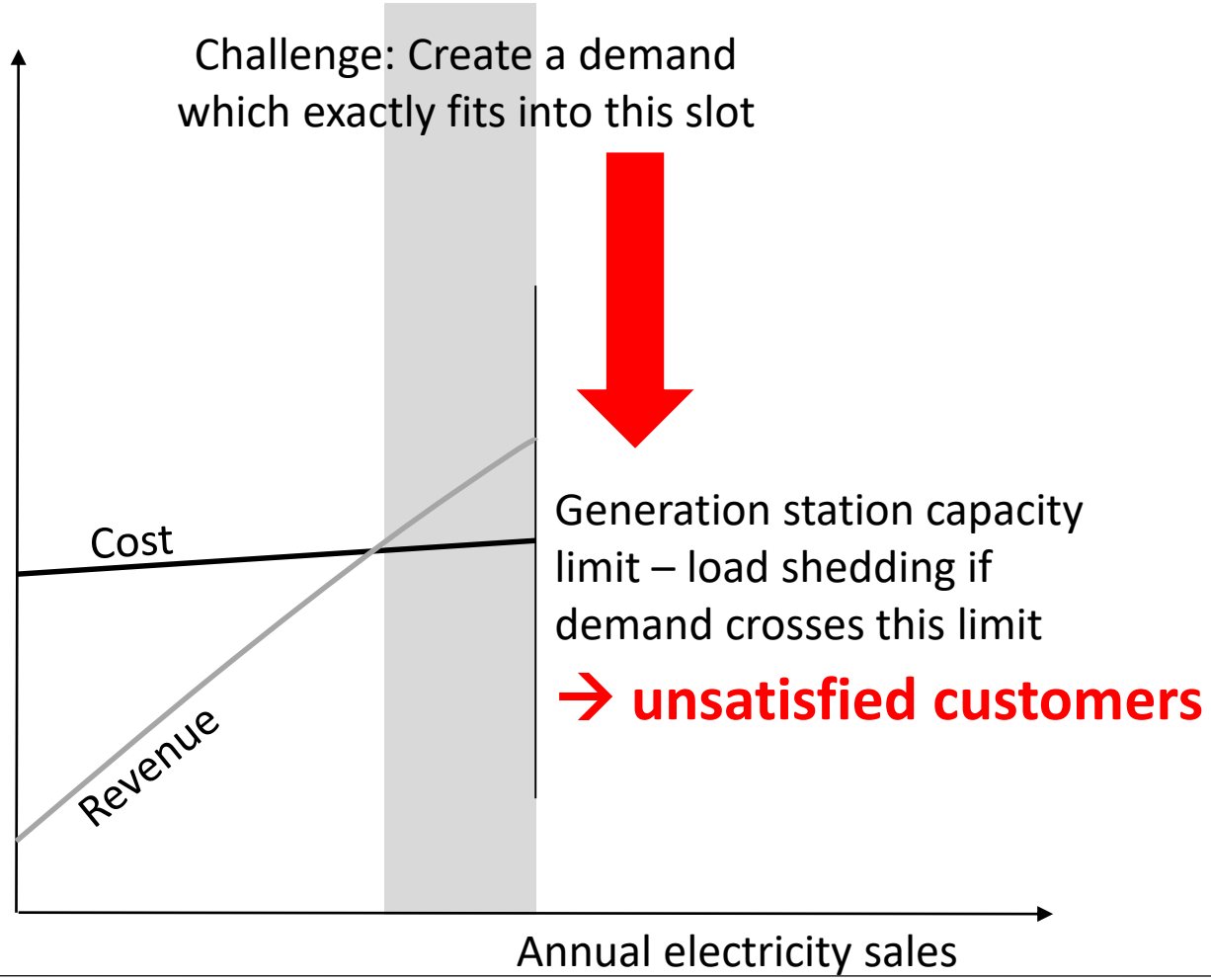

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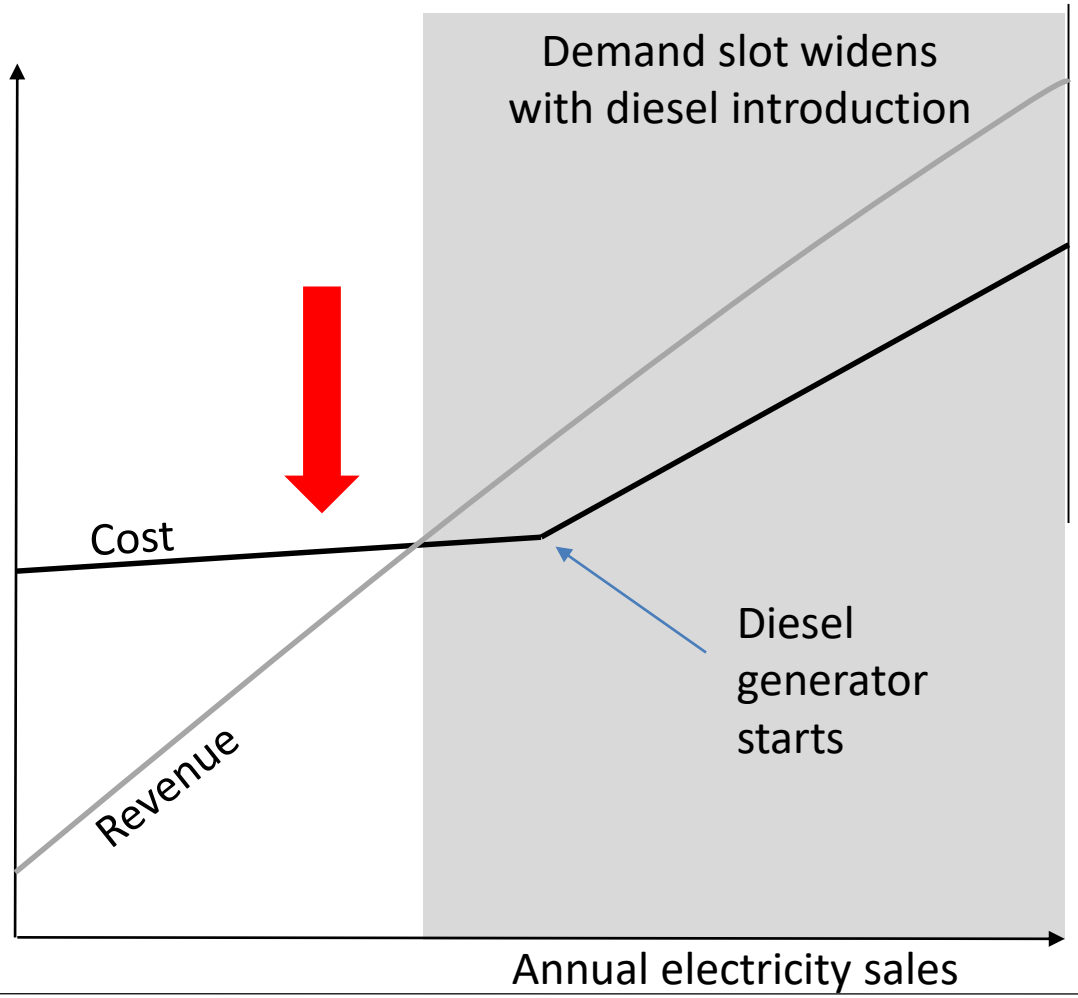
Solar battery diesel - cycle charge



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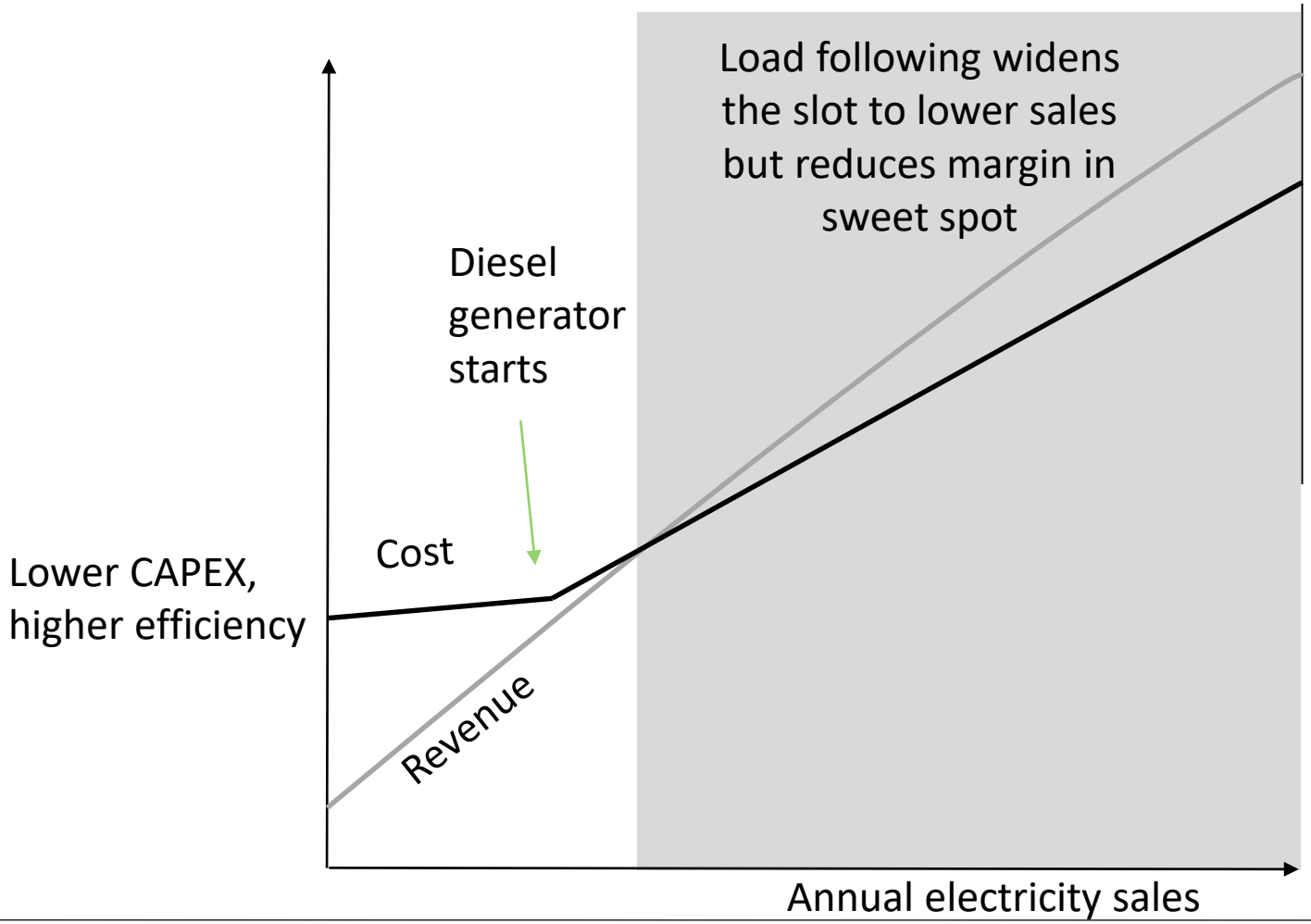
Solar battery diesel – load following



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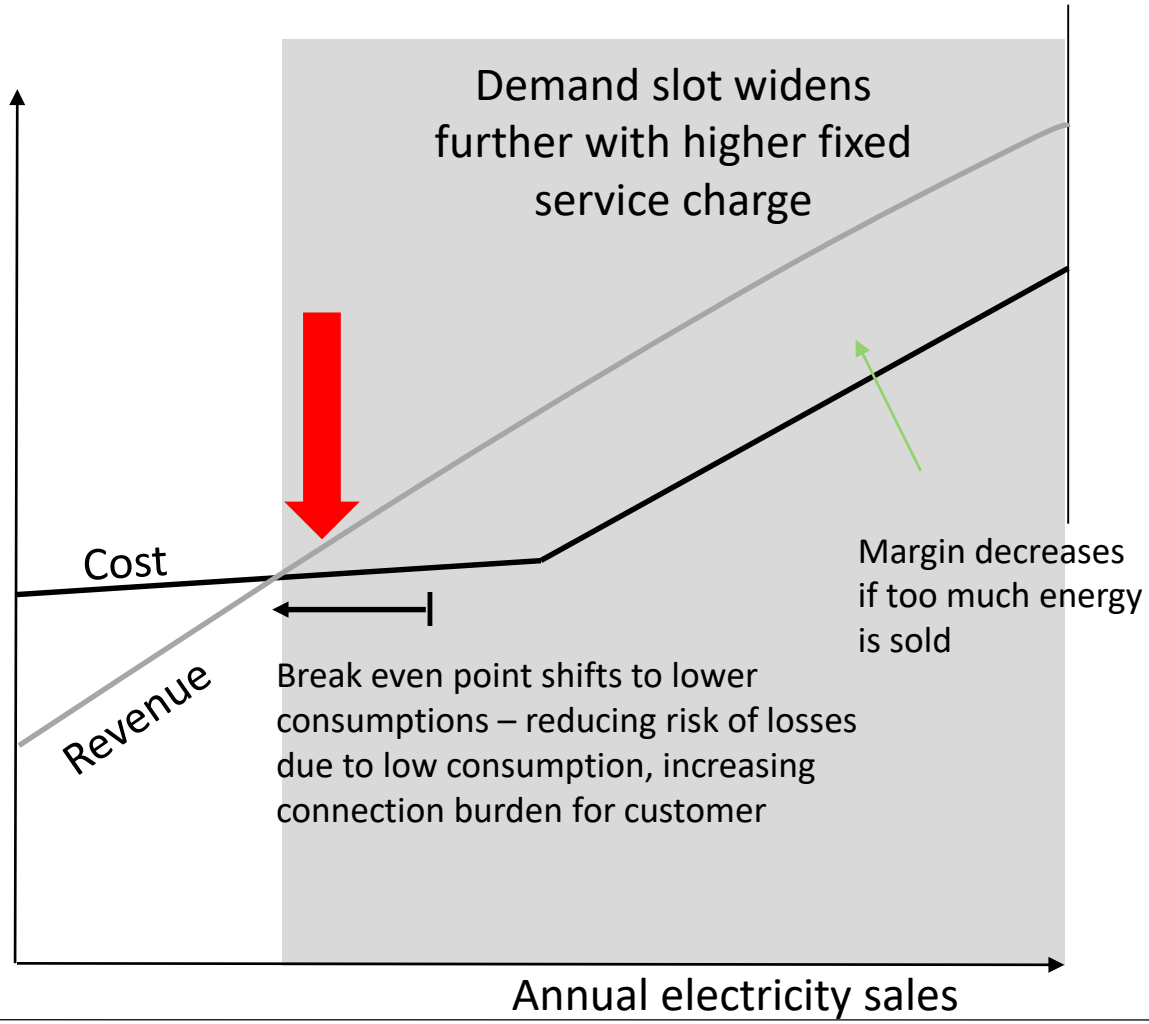
Fixed tariff components



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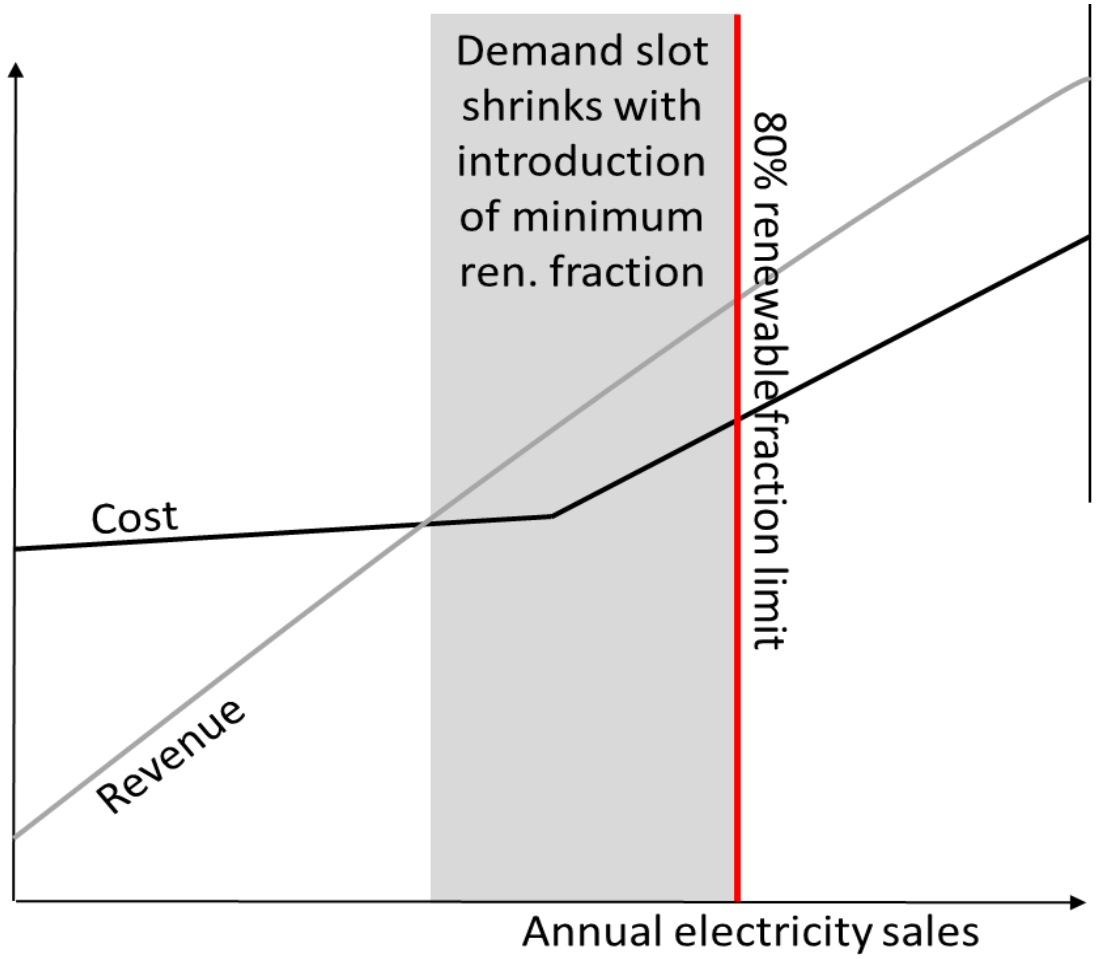
Minimum renewable fraction requirement



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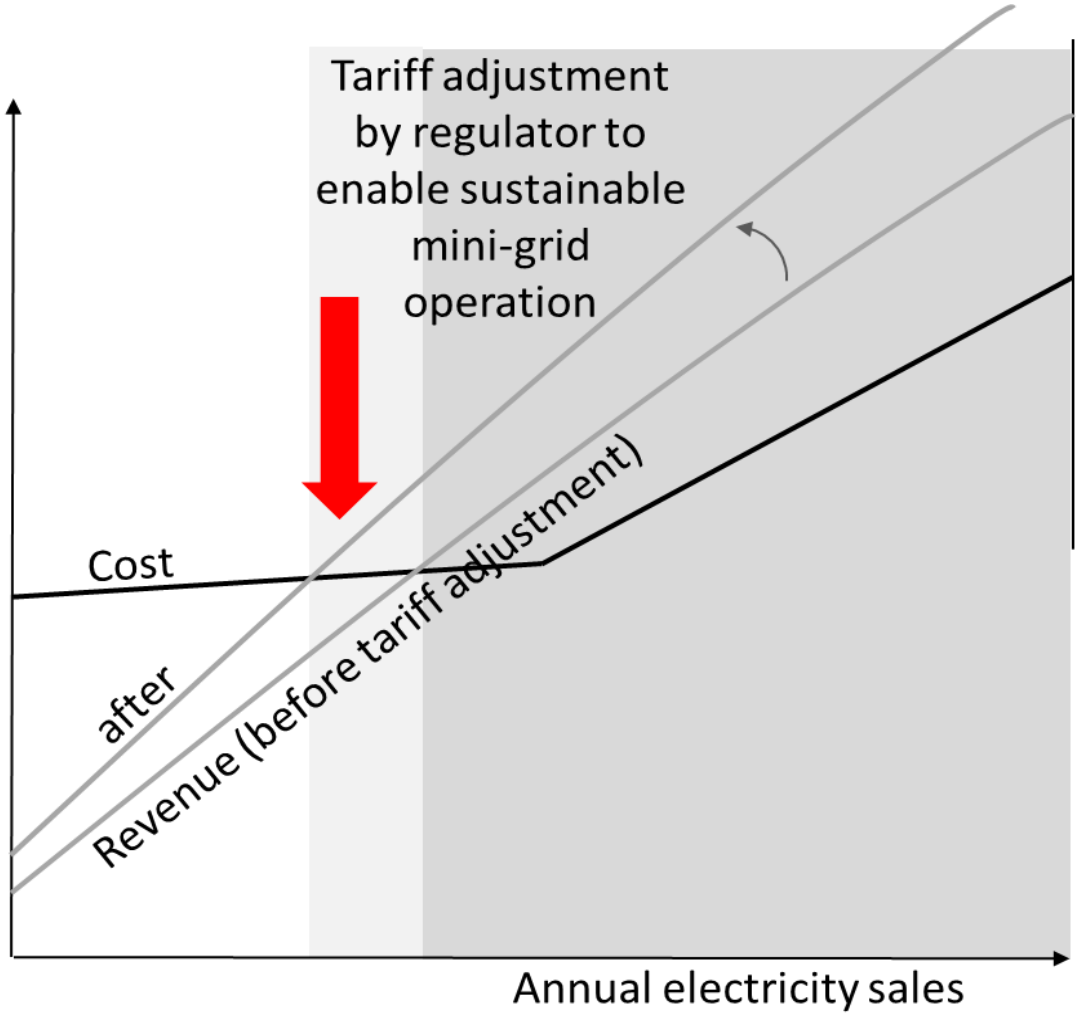
Tariff adjustment



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Productive Use fostering

- Deferred payments and consumer loans
- Engineering support
- Technical Assistance during operation

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Staged implementation

- Load Following with lower renewable fraction
- Conversion to Cycle Charging with higher renewable fraction

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Load pattern risk management

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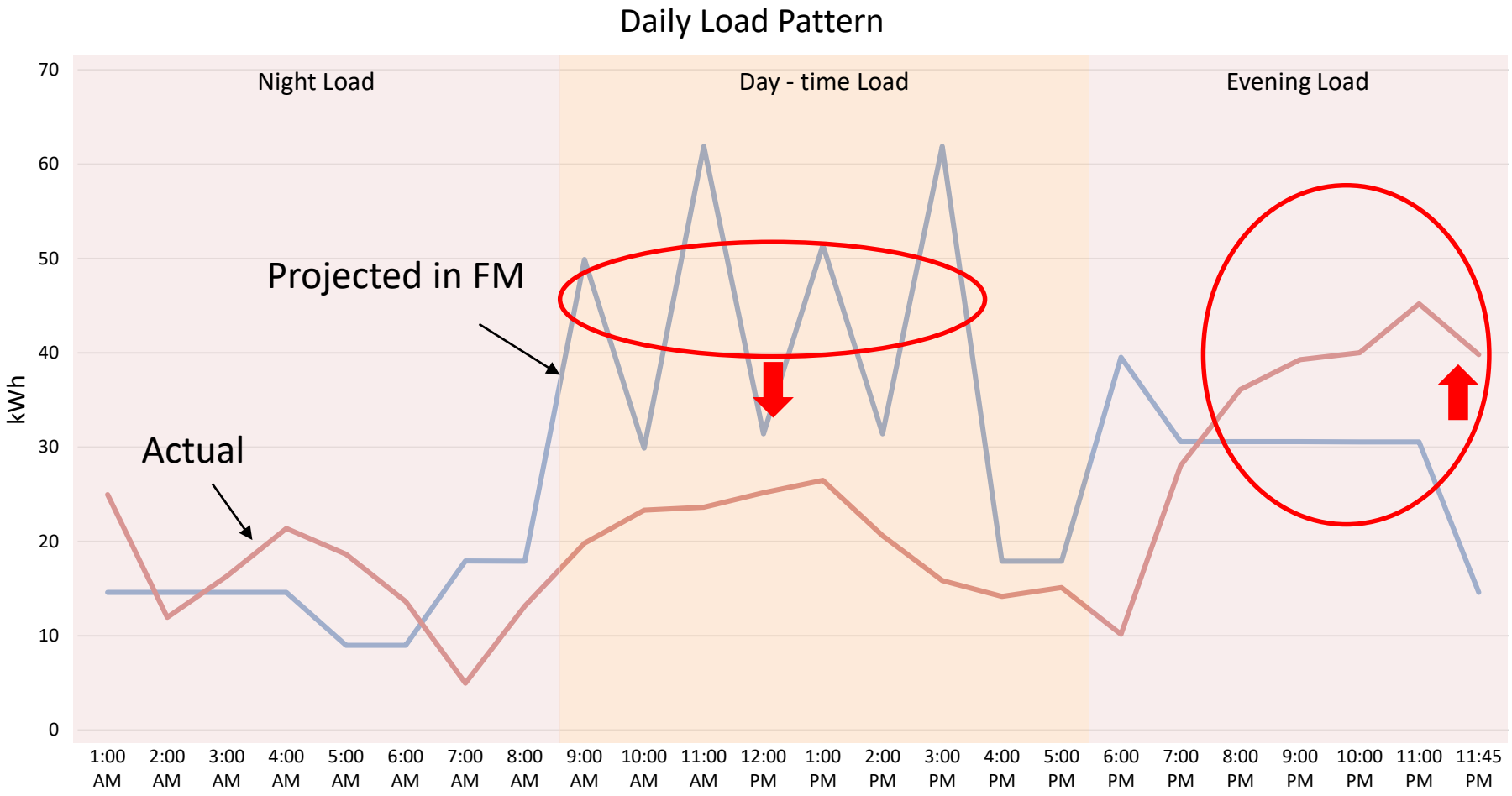
Load pattern planned vs. actual in Bangladesh



Source: IDCOL

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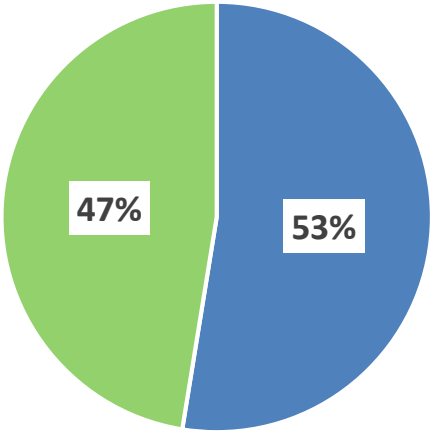
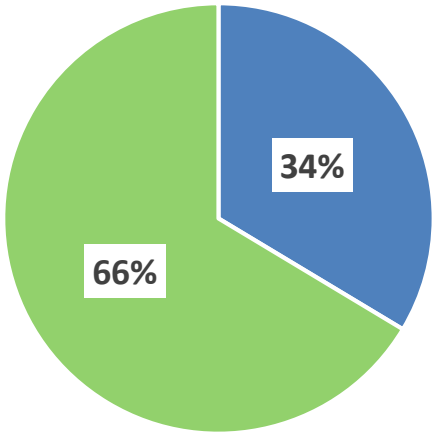
Daytime vs. Nighttime load

Assumption



- Day-time Load (9 am - 5 pm)
- Evening Load (5 pm - 9 am)

Actual



- Day-time Load (9 am - 5 pm)
- Evening Load (5 pm - 9 am)

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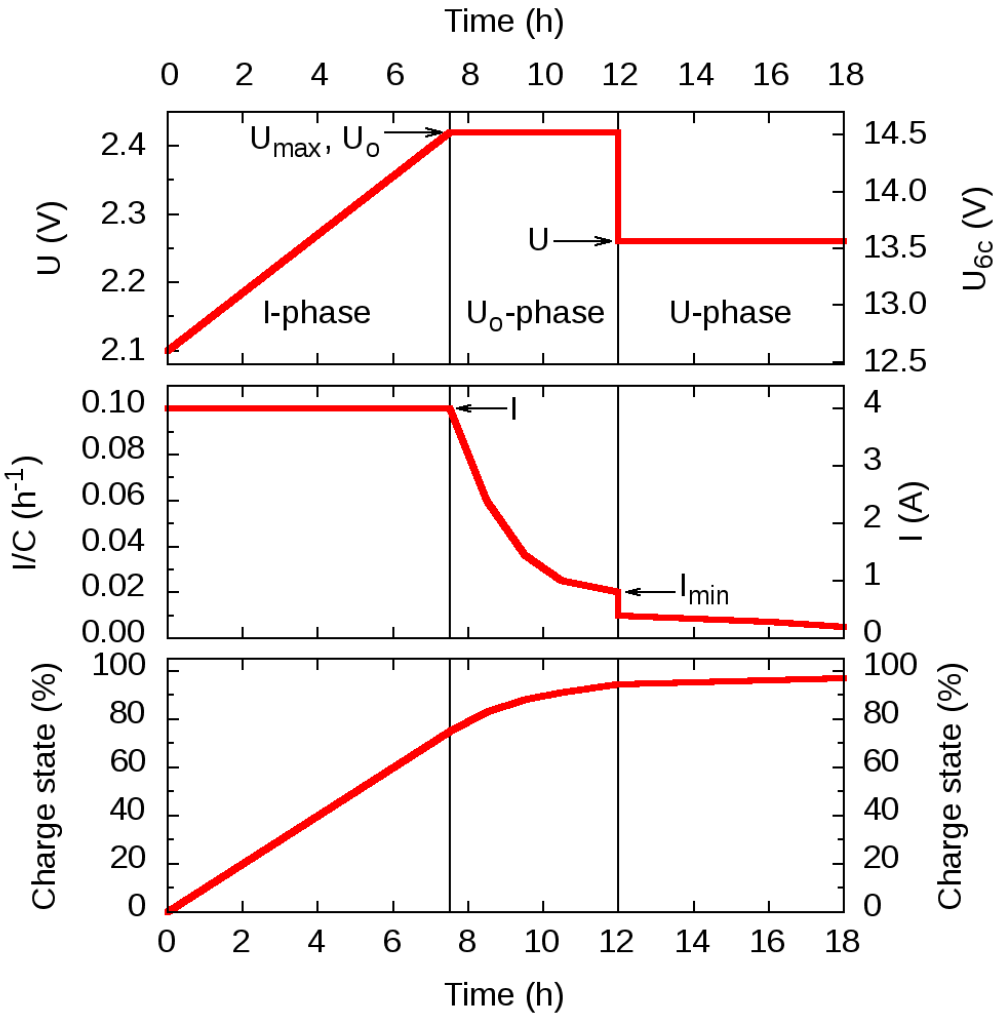
IUoU charging



Source: Wikipedia

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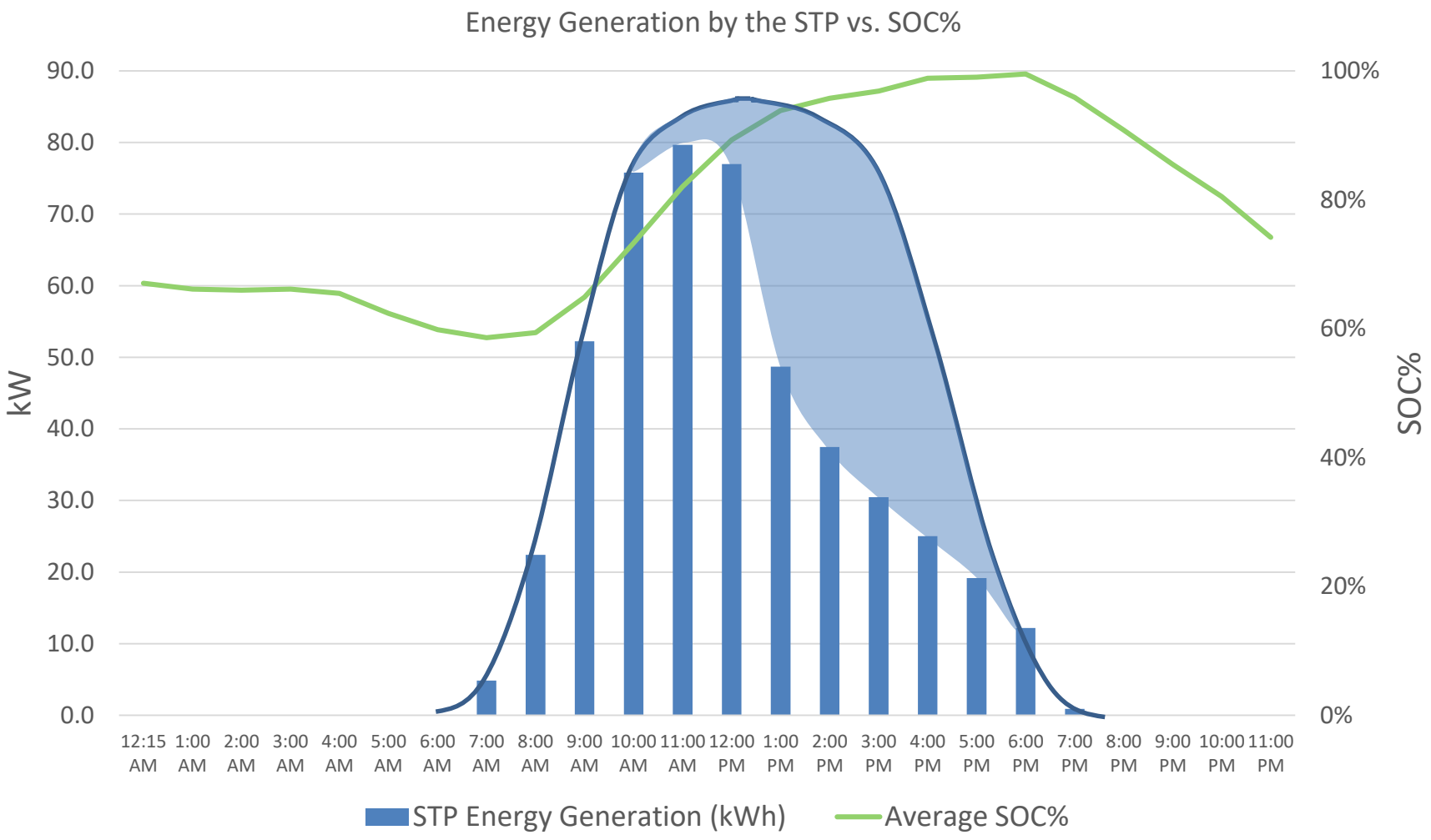
Derating of PV inverters with battery full charge



Source: INENSUS

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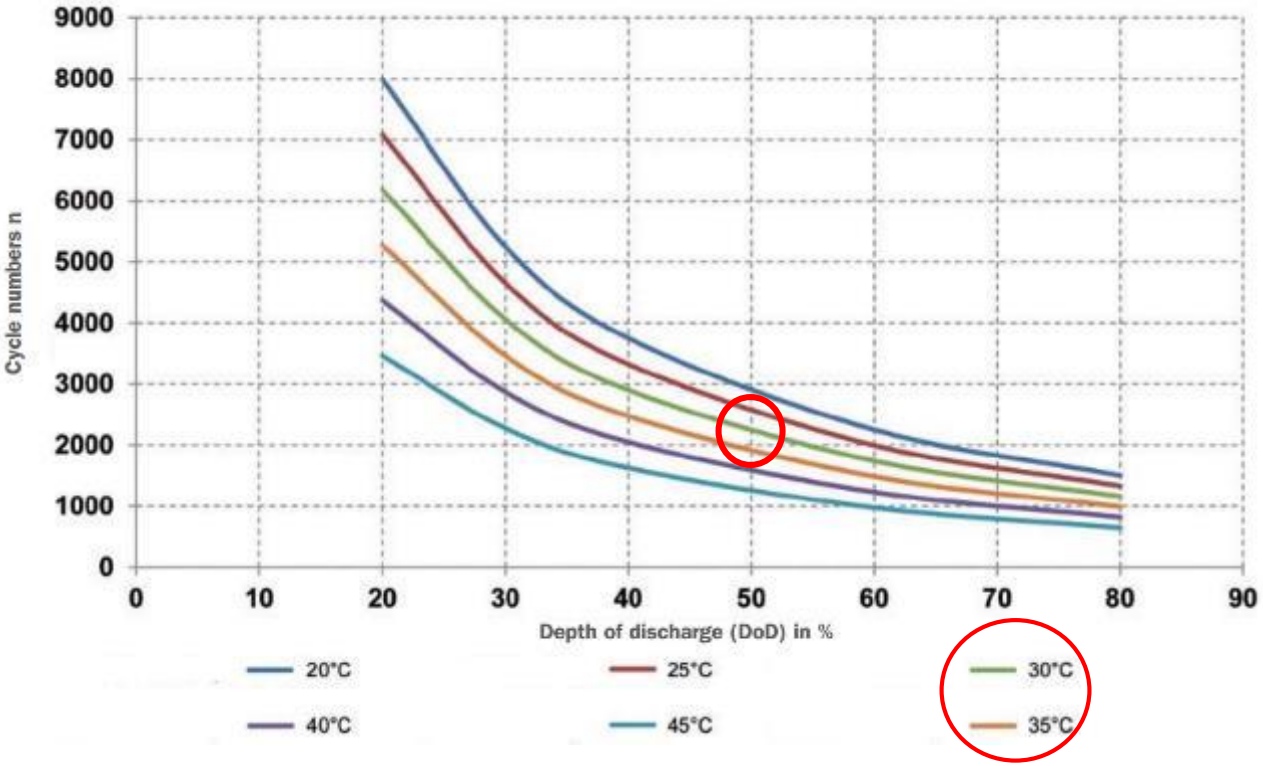
Battery lifetime with different ambient temperatures



Through high ambient temperature, batteries lose 33% of their cyclic lifetime resulting in a lifetime of approximately 5.5 years @35°C instead of 8.2 years @ 20°C

Source: Hoppecke

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Time of Use tariffs/ demand management

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Irrigation – load managed

- Control options
  - Through SI relays
  - Through droop mode and frequency switches
  - Timer controlled
- Limitations of load management and seasonality

Source: INENSUS

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Solar mini-grid cost over-run risk

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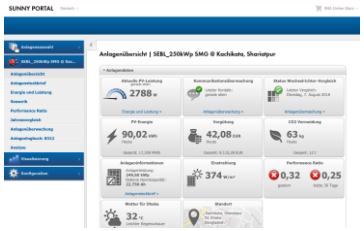
OPEX reduction through automation and IT

- Billing, cash transfer, meter charging with IT support (e.g, mobile money)
- CRM through call centers instead of on-site service
- Remote monitoring of technology
- Operation of diesel generator through autostart
- Security through CCTV and glas fiber theft protection

- Combination of on site management with KeyMaker activities



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Source: INENSUS

Access to finance for Nigerian mini-grids

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Equity

Own equity	• In cash • In kind
Specialized equity funds	• All-On • Etc.
Well-capitalized international mini-grid companies	• E.g. from East Africa • From the US
Multinationals from the power industry	• Equipment suppliers • IPPs • Utilities

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Debt

Specialized debt funds like	• ElectriFI • Fund for Energy Inclusion (FEI)
Nigerian banks	• CBN backed funding windows • DFI backed funding windows
Crowd financing	• Bettervest • Trine • Ecoligo • SunFunder

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Comparison of REA‘s grant funding windows

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Comparison of MAS and NEP

	Mini-grid Acceleration Scheme (MAS)	Nigeria Electrification Program (NEP) – 1st tender component
Total grant fund	EUR 6m	USD 70m in tender component (USD 150m in overall program)
Grant per lot	EUR 1m	Approx. USD 7m to USD 15m
Disbursement of grant	In-kind / distribution asset transfer	In cash on proof of connection of customers
Grant per connection	Ca. EUR 285	For bidder to define (bidding criterion)
TA in project development	ESIA, system design check, FM check	System check
TA in KeyMaker Model	Optimization of approach	None
Support in acquisition of finance	Transaction advisory with the specific aim to make mini-grids financable	Transaction advisory (probably broader than under MAS)
Target group	Local companies with local mini-grid experience	All mini-grid developers

Comparison of MAS and NEP

	Mini-grid Acceleration Scheme (MAS)	Nigeria Electrification Program (NEP) - tender component
Total grant fund	EUR 6m	USD 70m in tender component (USD 150m in overall program)
Grant per project	EUR 1m	Approx. USD 7m to USD 15m
Disbursement of grant	In-kind / distribution a… …er	In cash on proof of co… …of customers
Grant per connection	Ca. EUR 28…	For … …ding criterion)
TA in project development	ESI… …check, FM check	Systen… …ck
TA in KeyMaker Model	Optin… …ation of approach	None
Support in acquisition of finance	Transaction advisory with the specific aim to make mini-grids financable	Transaction advisory (probably broader than under MAS)
Target group	Local companies with local mini-grid experience	All mini-grid developers

Profitability through business model

Profitability through scaling

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Thank you!

Nigerian Energy Support Programme (NESP)

Sustainable Energy Access (Off-Grid)

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