Renewable Energy Based Mini-grids in Myanmar:
- Barriers and their role for sustainable development and peace -

Masako Numata, Masahiro Sugiyama

This research is supported by ERIA

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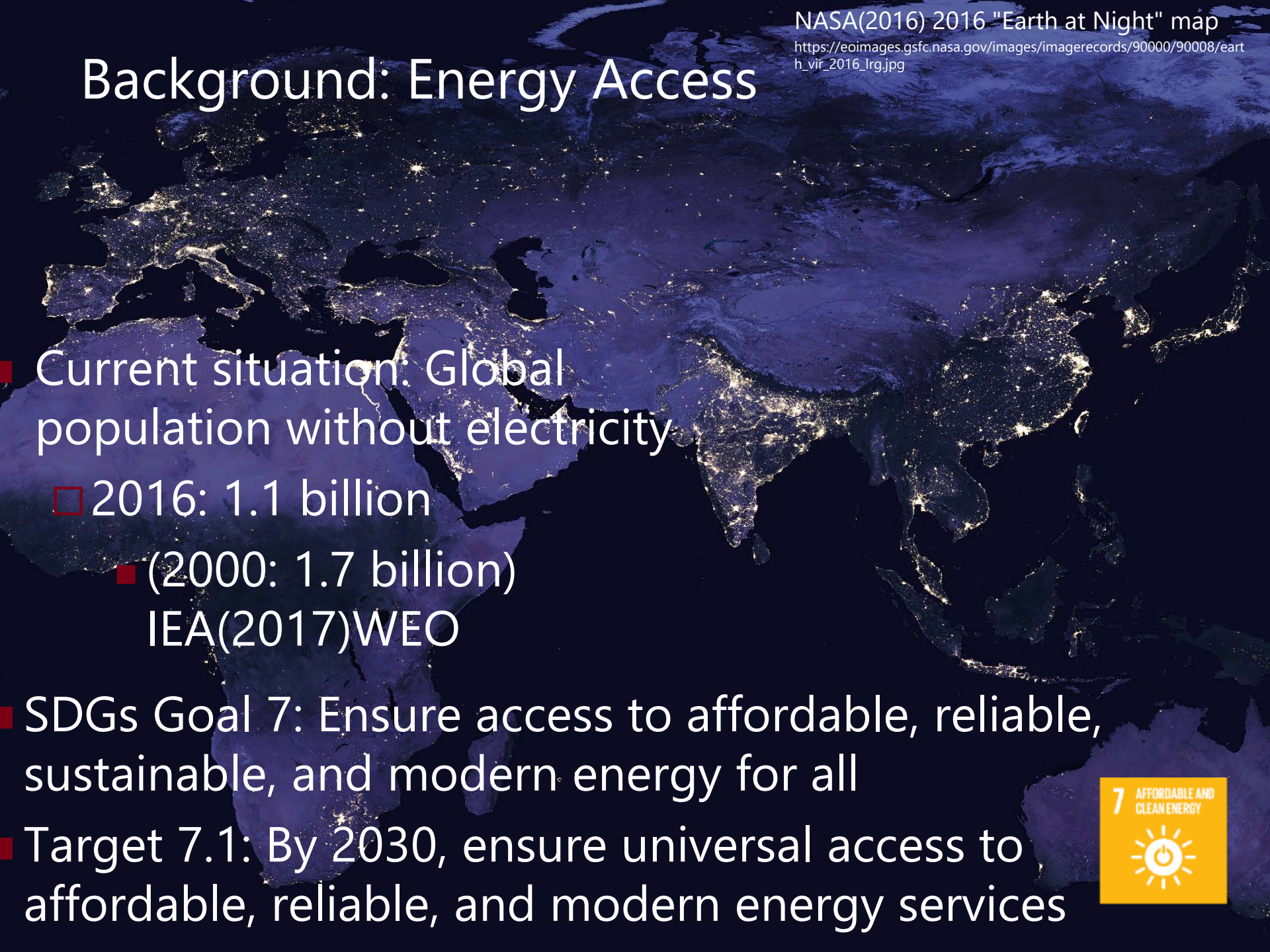
  - Introduction
  - Comments and Discussion

Background: Energy Access



NASA(2016) 2016 "Earth at Night" map
https://eoimages.gsfc.nasa.gov/images/imagerecords/90000/90008/earth_vir_2016_lrg.jpg

- Current situation: Global population without electricity
  - 2016: 1.1 billion
    - (2000: 1.7 billion)
      IEA(2017)WEO
- SDGs Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all
- Target 7.1: By 2030, ensure universal access to affordable, reliable, and modern energy services

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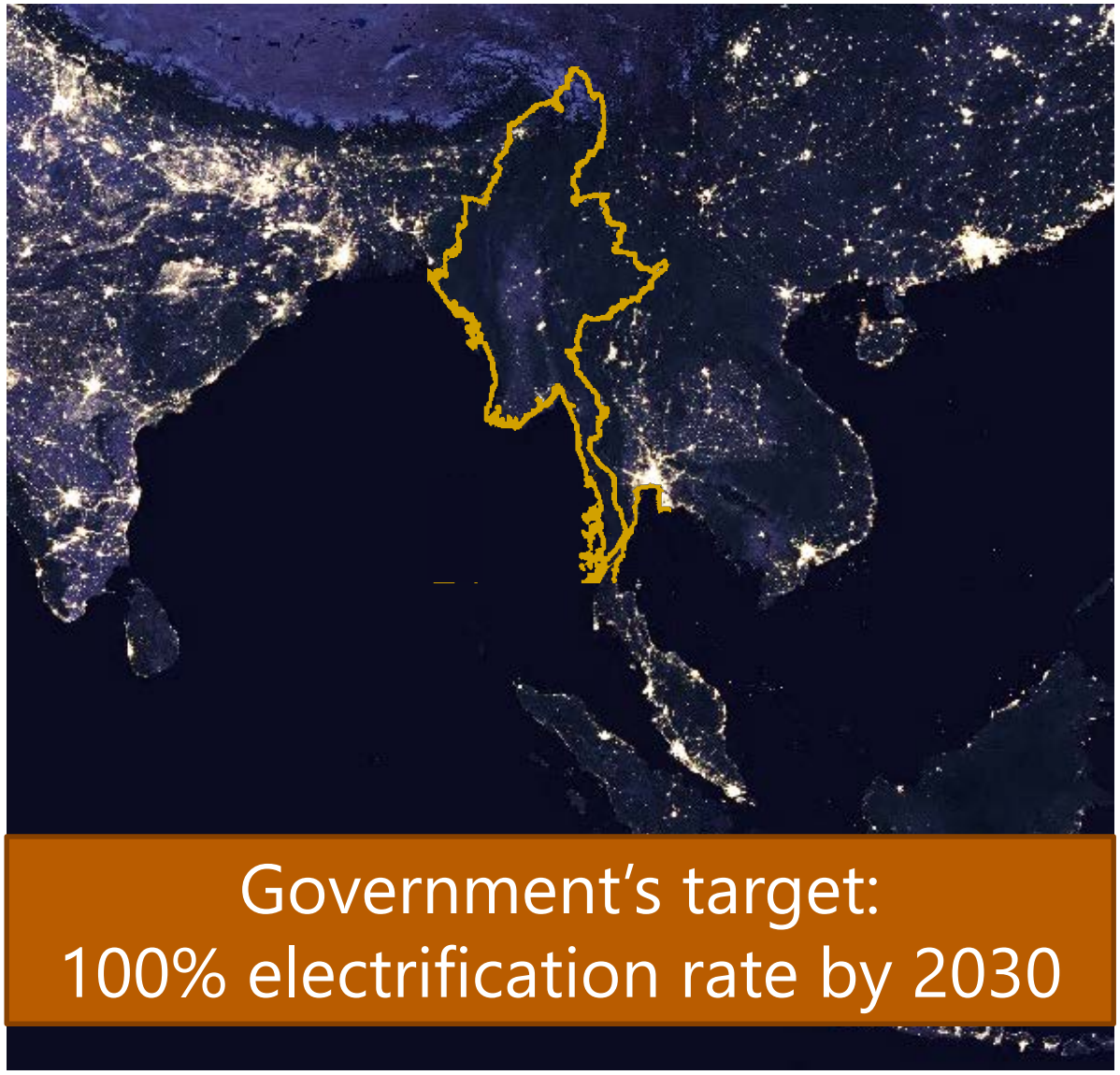
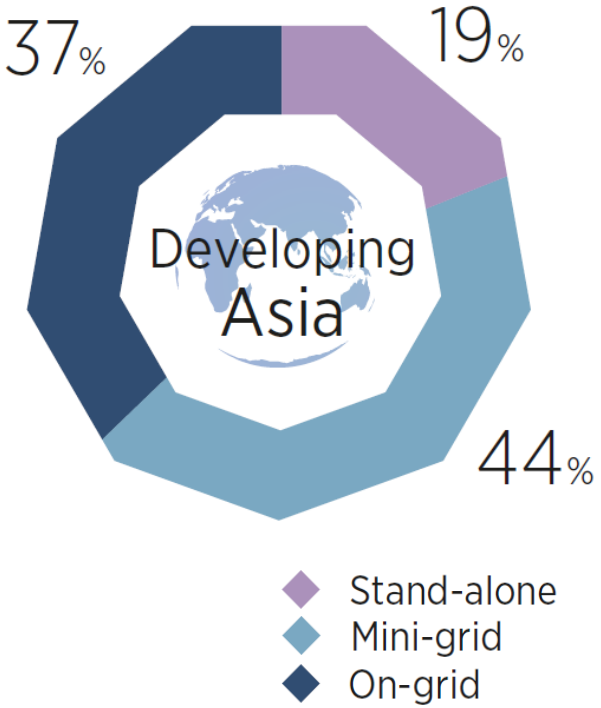
Current situation of electrification in Myanmar

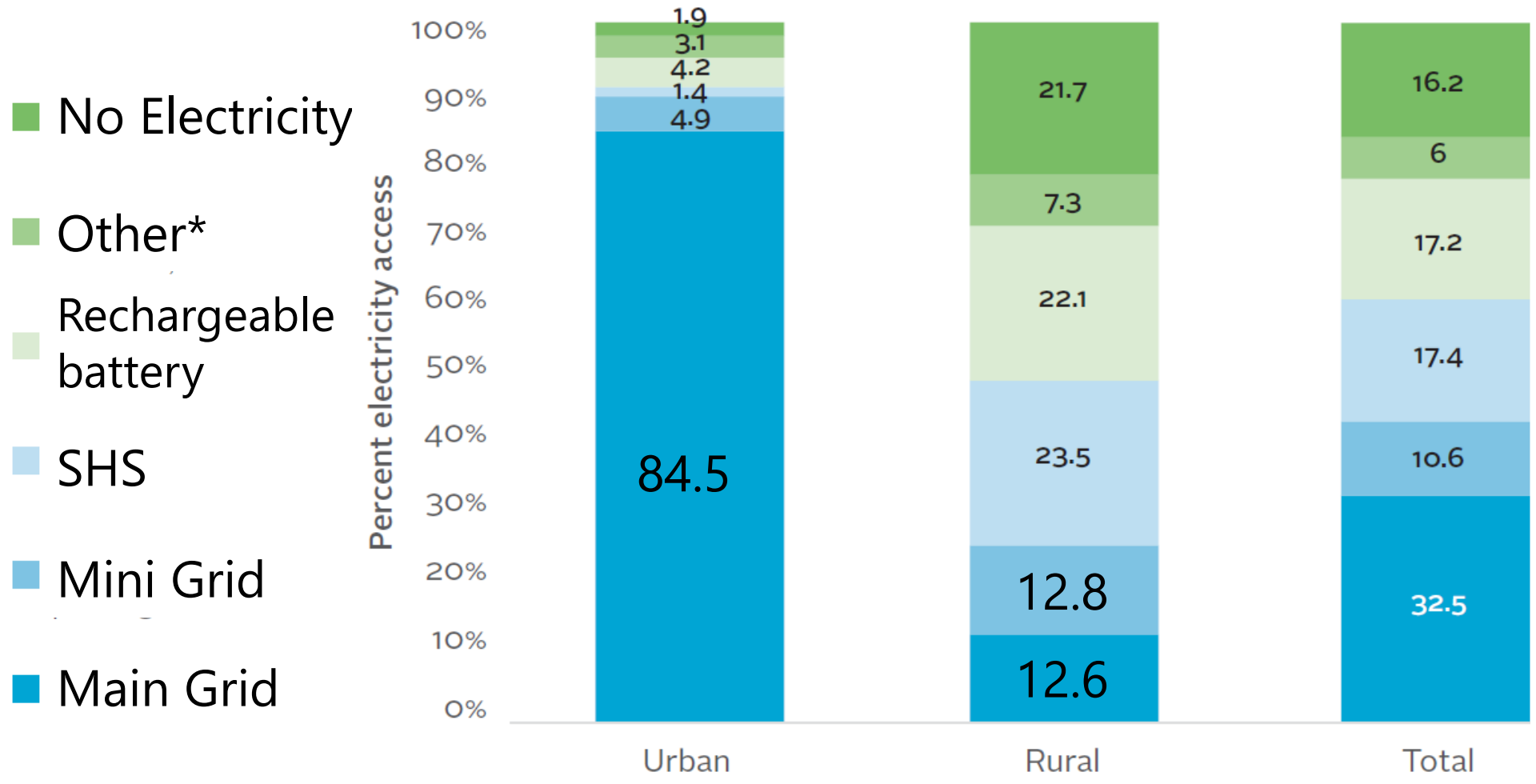


Government's target:
100% electrification rate by 2030



Estimated source of additional generation required to achieve universal electricity access (IRENA, 2017)

Source of electricity in Myanmar



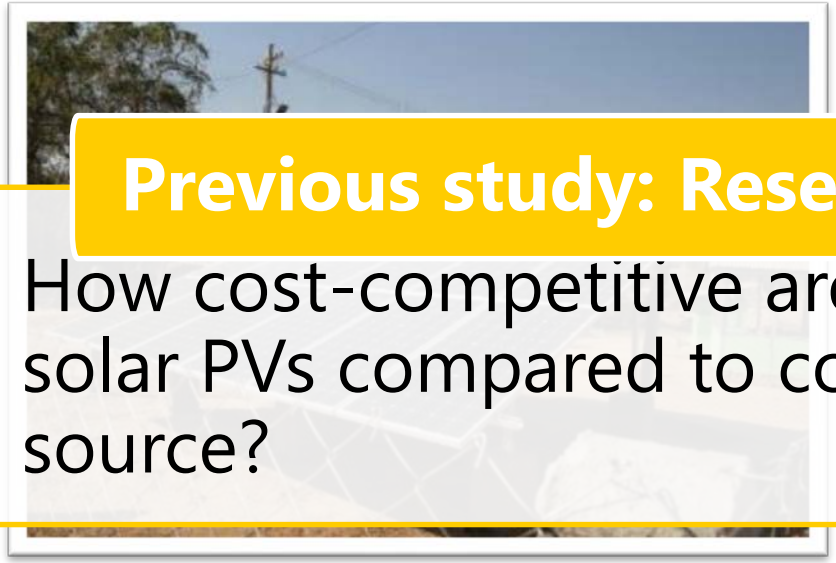
* Mill, Generator, Solar Lantern

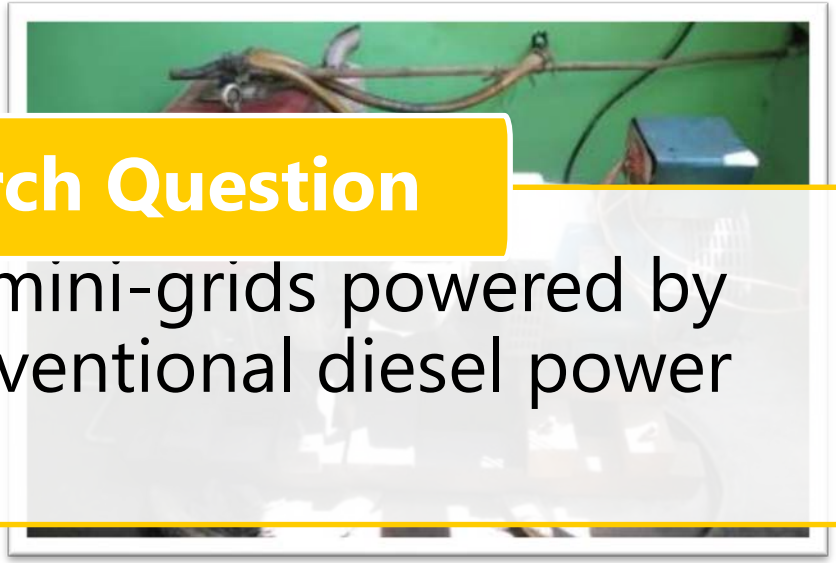
Ministry of Plannning and Finance, Myanmar and World Bank (2017)

Mini-grids in Myanmar

	No. of villages
Diesel generator	13,000
Mini hydropower	2,400
Biomass gasifier	1,200
Solar PV	150

Greacen (2017). Myanmar Mini-Grid Overview (p. 24). Nay Pyi Taw.





Previous study: Research Question

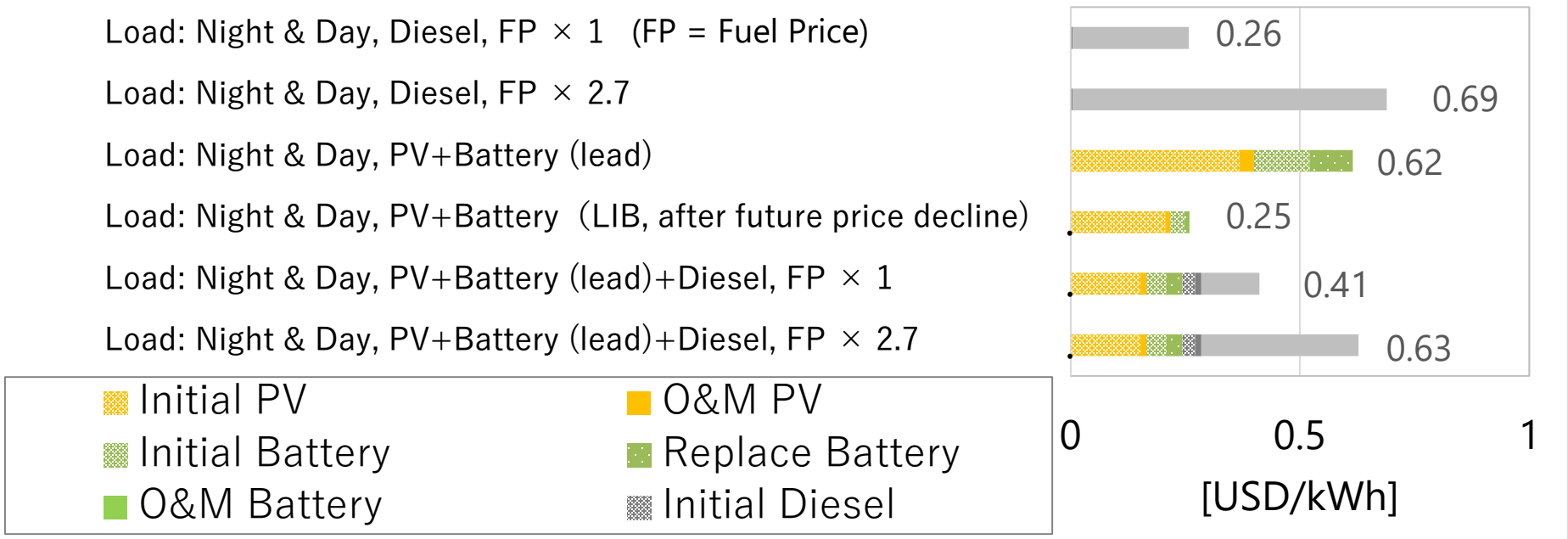
How cost-competitive are mini-grids powered by solar PVs compared to conventional diesel power source?

Previous study: Cost competitiveness of PV mini-grids

- Calculated LCOE (Levelized Cost of Electricity) based on interview and questionnaire survey data

Survey 1	
Date	February 2–3, 2017
Venue	Yangon Technological University
Method	Semi-structured interview Interview protocol (Comello et al., 2017)
Number of interviewees (companies)	7
Survey 2	
Date	April to July 2017
Method	Questionnaire
Number of interviewees (companies)	2
Survey 3	
Date	October 19–24, 2017
Method	Open interview
Number of interviewees (companies)	4

Comparison of LCOE



Numata et al., (2018) ERIA Discussion paper series. Forthcoming.

Research Question

In rural areas, where the fuel cost is high, what is the barriers to deployment of solar- and battery-powered mini-grids?

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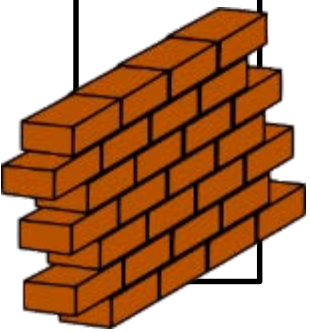
Barrier typology

Barriers

- Financial
- Economic
- Social/Cultural
- Technical
- Regulatory



Painuly (2001) "Barriers to renewable energy penetration: A framework for analysis".

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Barrier typology

Comello et al., (2017). "Enabling Mini-Grid Development in Rural India,",. Greacen (2017). "Role of Mini-grids for Electrification in Myanmar - SWOT Analysis and Roadmap for Scale up."

Financial barriers	Economic Barriers	Social/Cultural Barriers	Regulatory Barriers	Technical Barriers
Access to finance	Small market size	Negative externalities by international organizations	Lack of regulatory framework	Technology gap
High cost of capital	Low demand	Ethnic/ language difference	Lack of technical standards	Lack of inter-connectivity with main grid
Insufficient customers' capital	Cost-revenue gap: tariff structure	Education gap	Institutional capacity	Intermittency
Currency risk	Fee collection	Perception of inferior quality	Threat of grid extension	Operation and maintenance (O&M)

Financial Barriers

Access to finance	Difficulty in access to finance due to the immaturity of Myanmar financial sector.
High cost of capital	Even if funds can be procured, costs of capital (interest rates, loan fees) are high.
Insufficient customers' capital	Customers' access to finance is also limited.
Currency risk	When funds are procured in a foreign currency, businesses take a currency risk with the revenue in Myanmar Kyat.

Economic Barriers

Small market size	The scale of Myanmar's renewable energy market is still small.
Low demand	Creation of demand beyond basic use for lighting and charging cell phones is necessary to make business sustainable.
Cost-revenue gap: Tariff structure	Difficulty of balance between the customers' ability to pay and the costs.
Fee collection	Fee collection risk should be reduced.

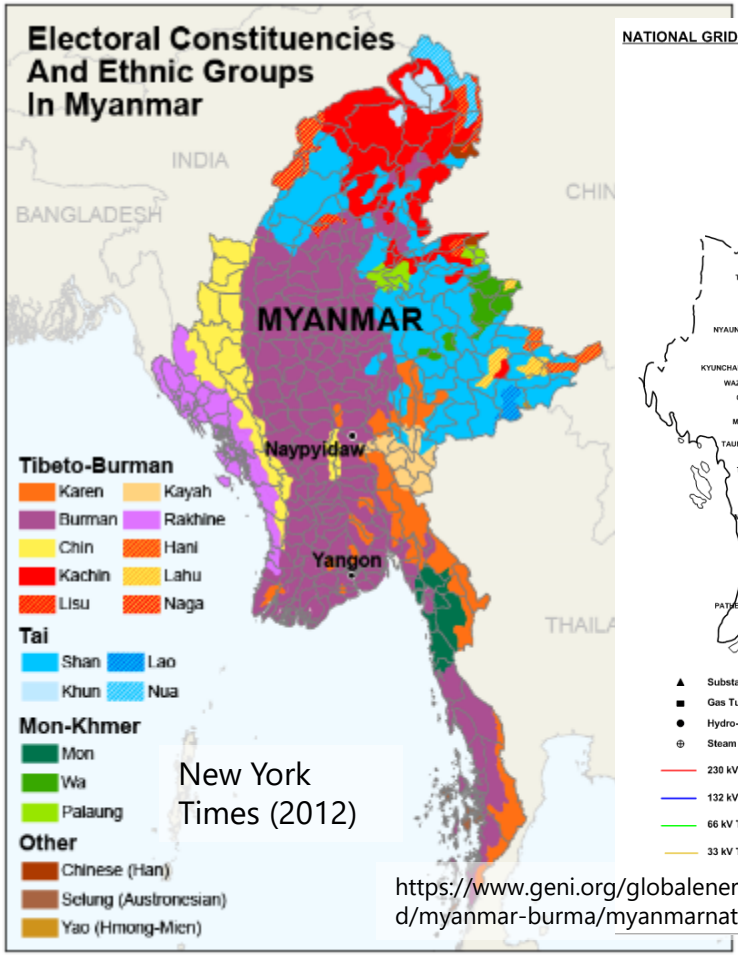
Social/Cultural Barriers


Greacen (2017)

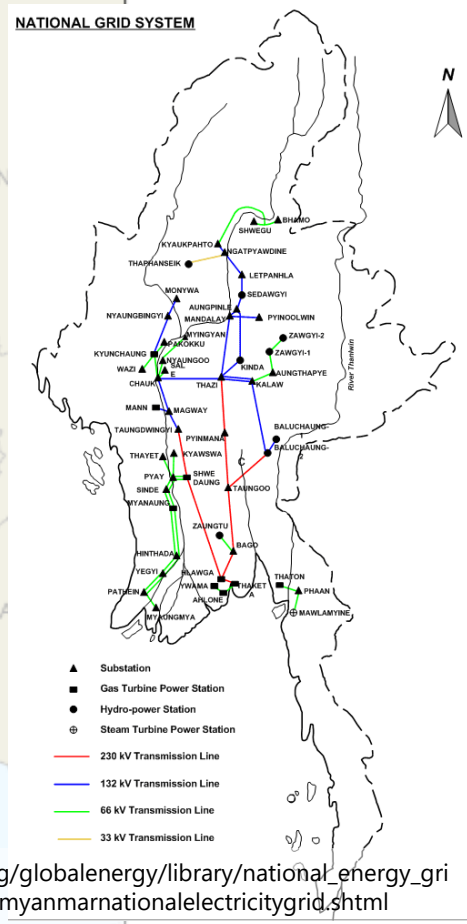
Negative externalities caused by international organizations	The business environment of existing spontaneous mini-grid has changed before/after the mini-grid projects subsidized by international organizations.
Education gap	It is sometimes difficult for local developers/operators to meet credit standards of international soft loan providers not because of creditability but because of education gap

Social/Cultural Barriers (cont.)

Ethnic/ language difference	Unelectrified regions overlap with areas inhabited by ethnic minorities.
Perception of inferior quality	It is difficult to achieve 24hours 7days supply. Customers' perception is needed.



New York Times (2012)



https://www.geni.org/globalenergy/library/national_energy_grid/myanmar-burma/myanmarnationalelectricitygrid.shtml

Technical Barriers


Photo: Greacen (2017)

Technology gap	Local indigenous technology sometimes differs from international current practice (e.g., design policy.)
Lack of inter-connectivity with main grid	The risk of an unplanned extension of the main grid will increase without interconnectivity with the main grid.

Technical Barriers (cont.)

Inter-mittency	Renewable energy is often intermittent; day/night and dry/rainy seasons for solar power, and rainy/dry seasons for hydropower. A system to compensate is needed.
O&M	Without local expertise, Operation and maintenance (O&M) become more difficult and it affects durability and keeping the quality.

Regulatory Barriers

Lack of regulatory framework	There is currently no legislation covering mini-grids.
Lack of technical standards	Since there are no technical standards or codes, it is difficult to ensure the quality of mini-grids.

Regulatory Barriers (cont.)

Institutional capacity	Coordination across ministries is time-consuming. On-grid systems fall under the jurisdiction of the Ministry of Electricity and Energy, while off-grid systems fall under the Department of Rural Development, the Ministry of Agriculture, Livestock and Irrigation.
Threat of grid extension	When there is unplanned grid extension, there haven't been settled any compensation or guarantee of business for existing mini-grids

Barrier analysis using AHP

Sub Research Question

Which is the main barrier to deployment of renewable based mini-grid?

- Methodology
  - AHP: Analytic Hierarchy Process
    - A decision making method
    - Pair-wise comparison
    - Prioritization
  - Questionnaire survey to stakeholders

Sample questionnaire

Regulatory Barriers	Extremely important	Very strongly important	Strongly important	Moderately important	Equally important	Moderately important	Strongly important	Very strongly important	Extremely important	
	9	7	5	3	1	3	5	7	9	
Lack of regulatory framework										Lack of technical standards
Lack of regulatory framework										Institutional capacity
Lack of regulatory framework										Threat of grid extension
Lack of technical standards										Institutional capacity
Lack of technical standards										Threat of grid extension
Institutional capacity										Threat of grid extension

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Comments and questionnaire

- Request for filling out the questionnaire
  - 15 minutes
  - Difficulty: collection of answer…
- Any comments or questions are welcome!
- Further study
  - Based on prioritization, derive policy recommendations to overcome main barriers

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Renewable energy for sustainable development and peace

Overview of the book

Editors	Dr. Daniel M. Kammen (Professor, University of California, Berkeley)
	Mr. Hisashi Yoshikawa (Project Professor, the University of Tokyo)
Publisher	Elsevier
Date of publication	early 2020 (planned)
Theme	How clean/renewable energy can contribute to sustainable development and peace in **Myanmar**, Colombia, South Sudan and Balkan?

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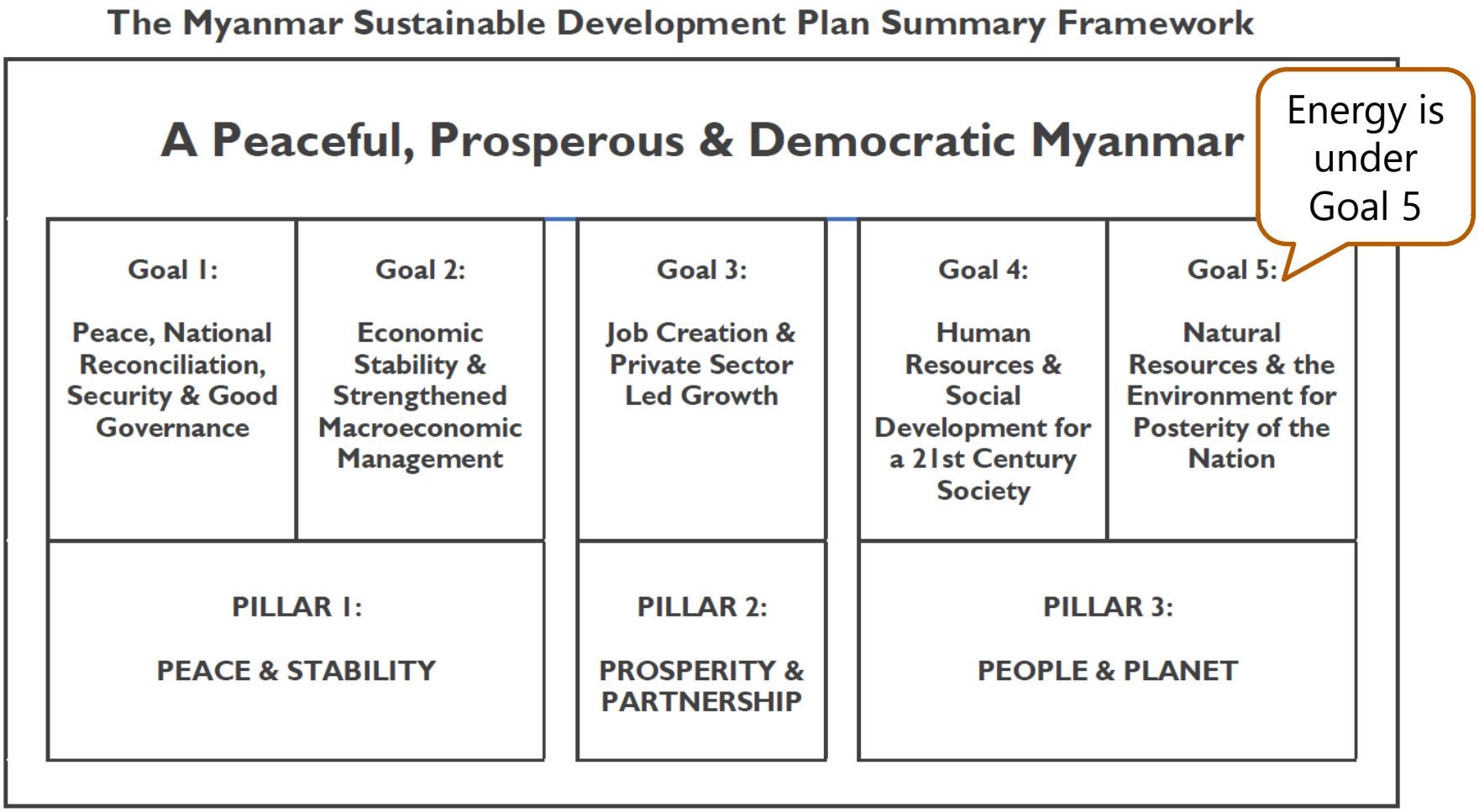
Clean/renewable energy can contribute to sustainable development

IRENA. (2017). REthinking Energy 2017

Affordable and clean energy supports all of the Sustainable Development Goals

Sustainable development in Myanmar



Ministry of Planning and Finance, Myanmar (2018). Myanmar Sustainable Development Plan (2018 - 2030).

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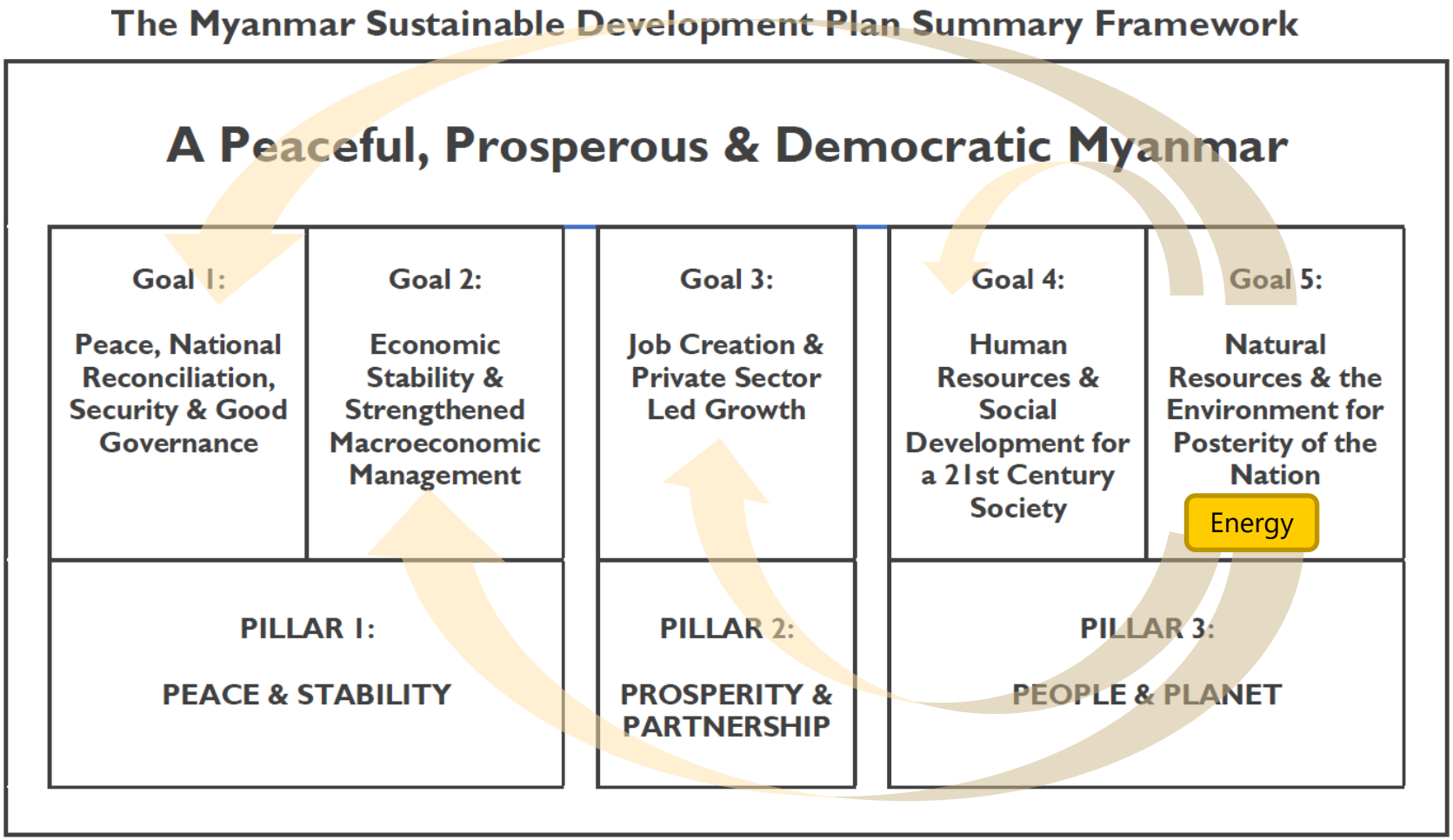
Goal 5: Natural Resources & the Environment for Posterity of the Nation

Strategy 5.1	Ensure a clean environment together with healthy and functioning ecosystems
Strategy 5.2	Increase climate change resilience, reduce exposure to hile protecting livelihoods, and facilitate growth pathway
Strategy 5.3	ble access to water and sanitation in onmental sustainability
Strategy 5.4	**Provide affordable and reliable energy to populations and industries via an appropriate energy generation mix**
Strategy 5.5	Improve land governance and sustainable management of resource-based industries ensuring our natural resources dividend benefits all our people
Strategy 5.6	Manage cities, towns, historical and cultural centers efficiently and sustainably

Energy is mentioned only in Strategy 5.4.

Energy can play more role



Ministry of Planning and Finance, Myanmar (2018). Myanmar Sustainable Development Plan (2018 - 2030).

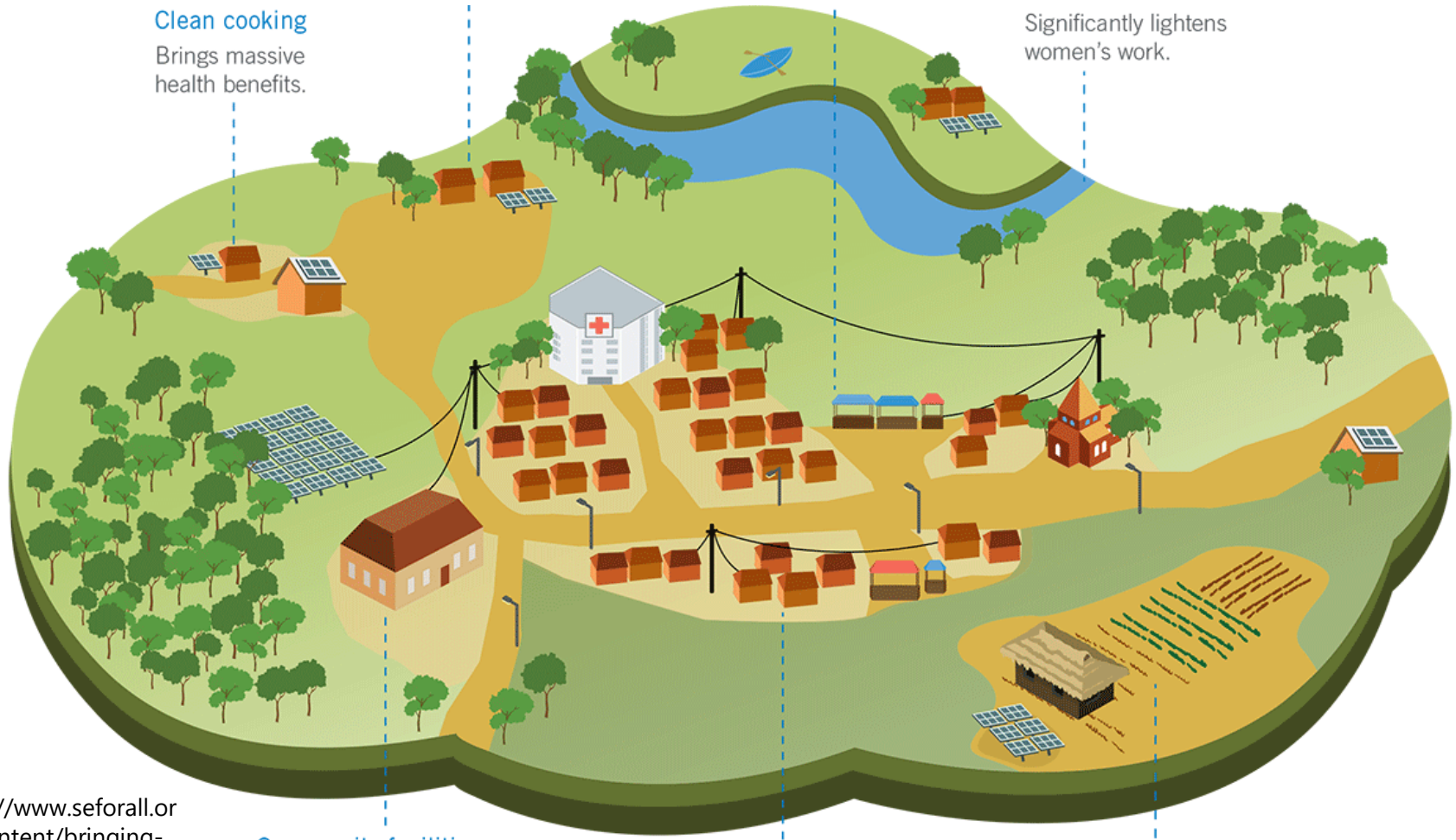
Decentralization is a key

Goal 1: Peace, National Reconciliation, Security & Good Governance

- Strategy 1.2: Promote equitable and conflict-sensitive socio-economic development throughout all States and Regions

- Action Plan 1.2.1: **Decentralize management of development activities**, **particularly in post-conflict and conflict-affected areas**, as a means of fostering greater social cohesion, including the development of IDP resettlement plans that facilitate safe, voluntary, and dignified returns

Decentralized mini-grids can be a good case



https://www.seforall.org/content/bringing-energy-all-least-cost-solutions-integrated-rural-energy-access

Features of development initiatives that can contribute to peace

Positive contribution to peace	Entrenching conflict
• Provides a local return • Strengthens subnational authorities • Builds common ground • Devolves decision making • Enables improved livelihoods • Recognizes multiple systems	• Does not offer local returns • Fails to consult, generates local tensions • Contravenes peace agreements • Exacerbates underlying causes • Supports security aims of conflict parties • Does not adapt national programs

Asia Foundation (2017). The Contested Areas of Myanmar: Subnational Conflict, Aid, and Development.

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Mini-grids have features that can potentially contribute to peace unlike previous large scale hydropower projects

Positive contribution to peace	Mini-grid
• Provides a local return • Strengthens subnational authorities • Builds common ground • Devolves decision making • Enables improved livelihoods • Recognizes multiple systems	☑ Electricity as a return ☑ Up to 30MW off-grid is under state/region authority ☑ Common understanding is necessary for installment ☑ Decision making by village committee ☑ Improve livelihoods ☑ Adjust systems to each villages

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Comments and discussion

- How can decentralized renewable energy contribute to peace process, or reduction of inequality?