Utilization of Renewable Energy for Off-grid Rural Electrification in National Electrification Project

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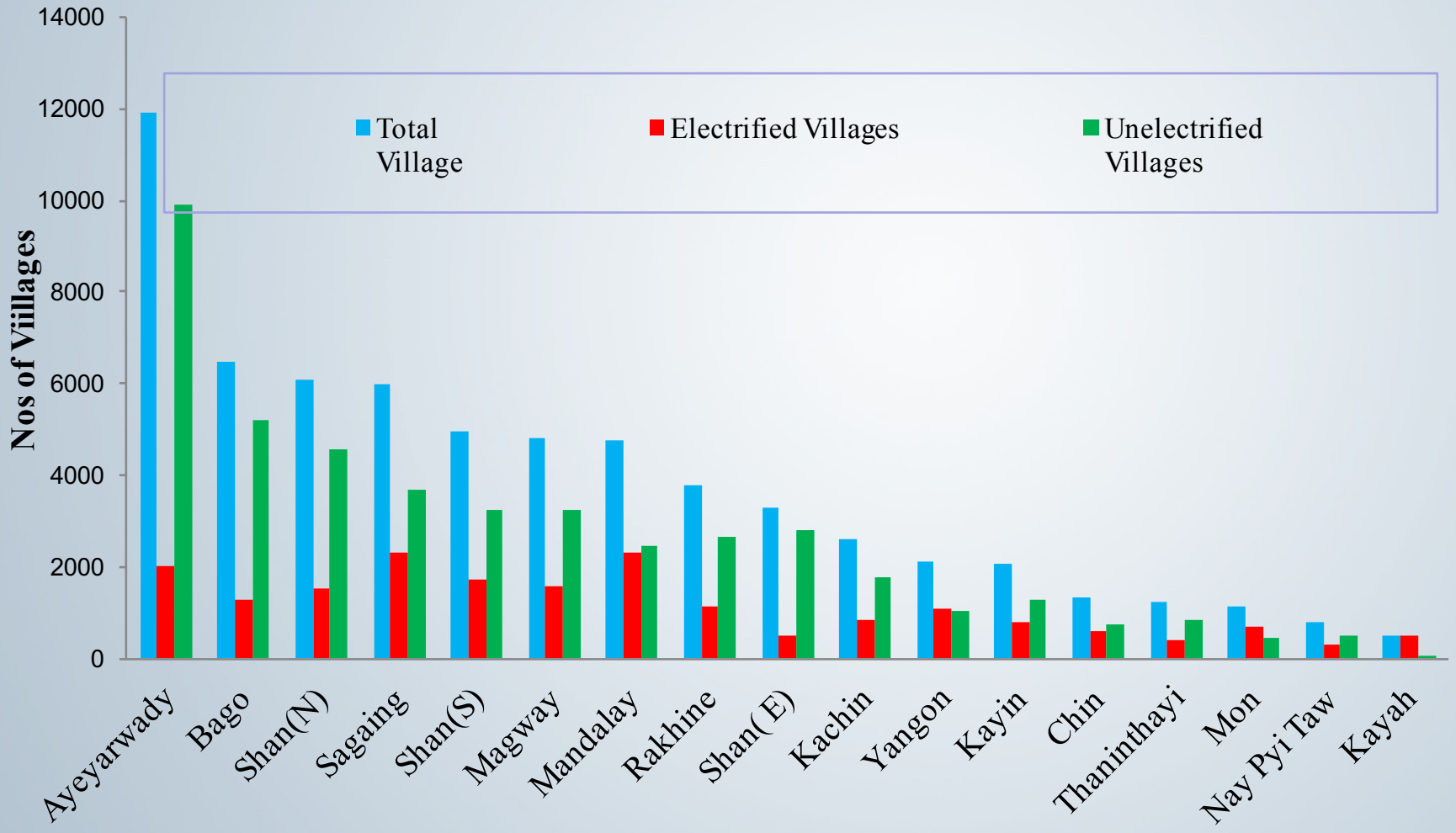
Current Situation of Rural Electrification



Total villages - 63899

Electrified villages - 22908 **(Based on 70% electrified HH in Villages)**

Non-electrified villages - 40991

Electricity installed capacity

Sr.	Resource	Installed Capacity
1.	Hydro Power	3033 MW
2.	Gas	1236 MW
3.	Coal	120 MW
4.	Renewable (Mini-hydro, solar, Bio)	5 MW
Total		4394 MW

Difference between Rural and Urban Area

Category comparison	Urban	Rural
Poverty gap	0.047	0.023
Access to water ratio	65.2%	81.4%
Malnutrition	33.7%	25.4%
Food poverty	2.5%	5.6%
Poverty index	15%	29%
Electrification rate	89%	16-18%

Relevant Ministries on Electrification in Myanmar

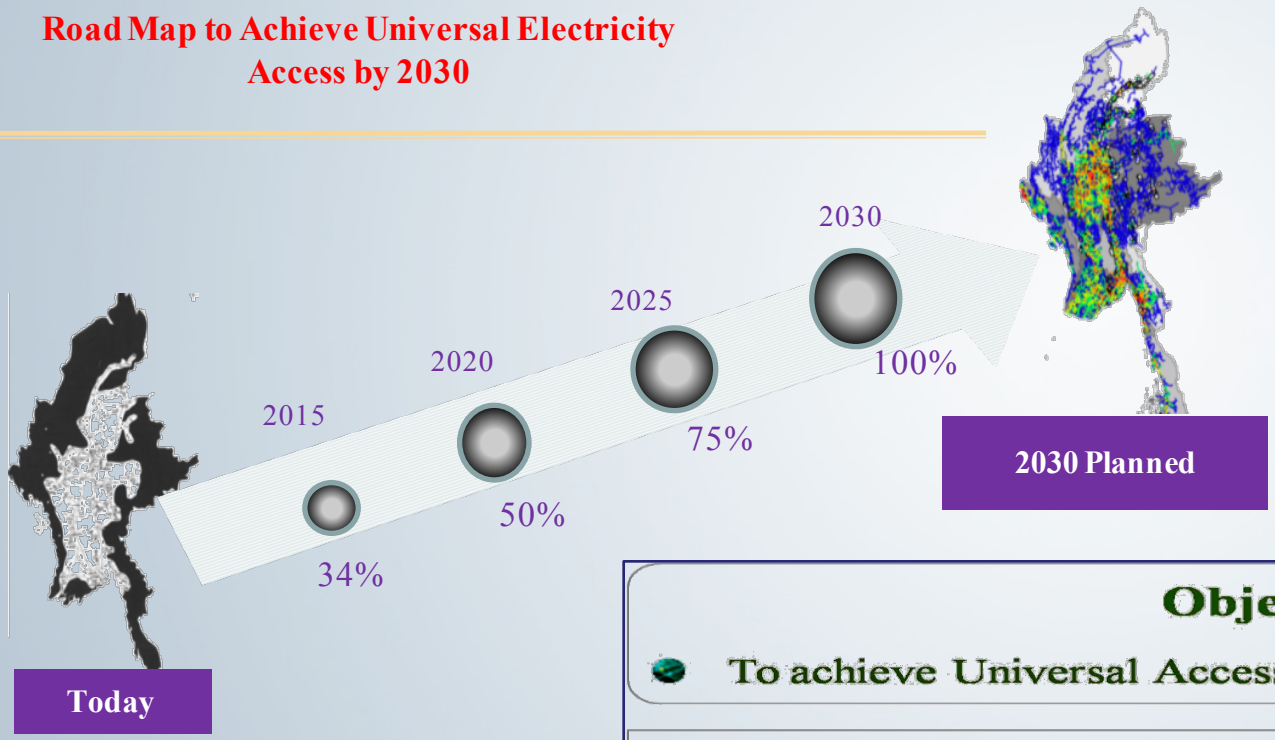
- Ministry of Electricity and Energy - Urban and Rural Area (Grid-Extension)
- Ministry of Agriculture, Livestock and Irrigation (Department of Rural Development) - Rural Area (Off- Grid)
- Ministry of Border Affairs - Border Area (Off- Grid)

Energy Status in Myanmar

Sr.	Energy Status	
1	Total Energy Production	27.5 mtoe (2015)
2	Total Energy Production (Renewable Energy)	8.5 mtoe (biomass)
3	Total Energy Production (Solar)	~ 0 mtoe
4	Total Energy Production (Micro Hydro, Hydro)	761 ktoe (2014)
5	Total Biogas plant installation (household size and big size)	About 190
6	Total Energy Consumption	14.2 mtoe (2015)
7	Potential Energy Production (Solar)	51973.8 TWH per year
8	Potential Energy Production (Hydro) and (Micro-Hydro)	100,000 MW
9	Potential Biogas plant installation	103 million head of livestock generating animal waste which could be used for biogas
10	Total Energy Need	up to ~ 21 mtoe

National Electrification Project

Road Map to Achieve Universal Electricity Access by 2030



Objective

- To achieve Universal Access to electricity by 2030

Objectives of Off-Grid Electrification in NEP

- To increase electricity access in rural areas
- To implement the pre-electrification system in the remote villages
- To make better electrification system by the public contribution
- To improve the public-private-people partnership

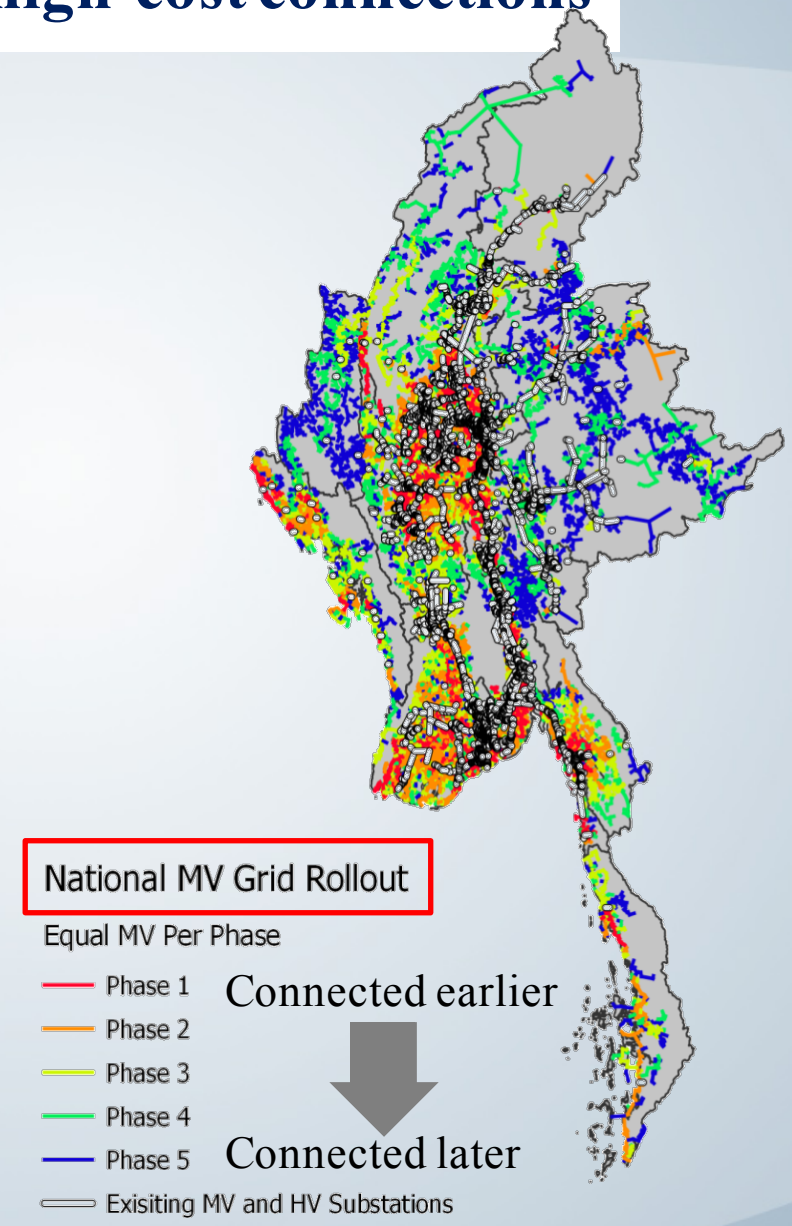
Grid Roll-out Plan from low-cost to high-cost connections

Phase 1, 2 & 3

- Dense areas require shorter distribution lines and lower cost per connection and will be connected first
- Remote communities require longer lines and higher cost and will be connected later

Phase 4 & 5

- Chin, Shan, Kachin and Kayah have highest cost per connection, thus to be connected in the final phases



National Electification Program for 5 Years (2016~2021)

- **Leading Ministries**

➢ **MOEE Grid Extension (310 Mil USD)**

➢ **MoALI Off-grid (90 Mil USD)**

Off- Grid Electrification Program

Sr	Programme	Village	Household	Remark
1	Mini-grid System	364	35049	Public Contribution-20%~50%
2	Solar Home System	5184	468186	Public Contribution-10%~20%
3	Community Building (School, Clinic, Religious Building, Streetlight)	5548	40232	100% Subsidized by Project Fund

➢ **Electrification System**

➢ **Solar Home System**

➢ **Mini-Grid System (Solar, Hydro,**

➢ **Bio-mass , Bio-gas System)**

➢ **Electrification Item (9 items)**

➢ **House-hold Electrification (small, medium Large)**

➢ **Rural Health Centre**

➢ **School (Primary, Middle, High)**

➢ **Religious Building**

➢ **Rural Street Light**

Yearly Plan of Off- Grid Electrification for 5 Years (2016-2021)

Sr.	Fiscal Year	SHS		Mini-Grid		Total		Estimated Cost (Million $)	Remark
		Village	HH	Village	HH	Village	HH		
1	2016-2017	2708	141465	10	1081	2718	142546	34.910	Complete
2	2017-2018	1367	87958	34	5184	1401	93142	24.954	On Going
3	2018-2019	1500	133275	100	11050	1600	144325	50.508	Plan
4	2019-2020	1500	122950	100	9095	1600	132045	46.355	Plan
5	2020-2021	1500	128550	100	7380	1600	135930	46.394	Plan
	Total	8575	614198	344	33790	**8919**	**647988**	203.121	

Implementations under NEP in (2016-2017) FY

- Solar Home System
  - (7) State & Regions, (95) Townships
  - (2708) Villages , (141465) Households
- Mini-Grid System
  - (4) States, (5) Townships
  - (8) Project Sites, (10) Villages, (1539) Connections {1081 HH, 103 PF, 320 SL, 35 Productive End Uses}
- Developer's Operation Period - 6~10 years (based on tariff rate)
- Tariff Rate - 350 Kyat ~ 500 Kyat

Financing and Subsidy Policy

- 2012-2013 FY~ 2015-2016 FY -100% Government's Subsidy in cooperation with International Organizations

- 2016-2017 FY (NEP)
  - Solar Home System
    - (85%~90%) (NEP Budget)
    - 10%~15% (Public Contribution)
  - Mini-Grid System
    - 60% by NEP Budget
    - 20% by Developers
    - 20% by Community

    } 100%

Funding Resources

- World Bank's IDA Loan - USD (90) Million (2016~2021)
- Government's Yearly Budget - USD (15) Million (Average)
- KfW's Grant - Euro (9) Million (2016~2019)
- GIZ's Grant - Euro (2) Million for TA (2016~2018)
- Italy Soft Loan - Euro (30) Million (2018~2021)
- ADB's Grant - USD (2) Million (2015~2017) (Complete)
- JICS's Grant - JPY (994) Million (2014~2017) (Complete)

Technical Changes in Off-Grid Electrification Myanmar

SHS Before 2016

- 80Watt Solar Module -1Pc (5yrs Warranty).
- Battery (12V/65AH) -1Pc (1.5yrs Warranty)
- Controller (10A/12V) -1Pc (3yrs Warranty).
- Inverter (12V/ 300W) - 1Pc (3yrs Warranty).
- LED Bulb (3W) - 2Pcs
- LED Tube Lamp (10W) - 1Pcs
- Cable (8m, Length) -4 Sets
- **Service Level**
  - **LED Bulbs, Phone Charging, TV (25W)(3hr)**

SHS After 2016

- 60Watt Solar Module -1Pc (10yrs Warranty)
- Battery (12V/40AH) (Lead Acid)/-1Pc (3yrs Warranty)
  (12V/23Ah) (Li-ion)
- Controller (5A/12V) -1Pc (3yrs Warranty)
- LED Bulb (12V/3W) - 5Pcs (3yrs Warranty)
- Cable (8m, Length) -4Sets (3yrs Warranty)
- **Service Level**
  - **LED Bulbs (5hr), Phone Charging (2.5hr),**
  15W DC TV (3hr), Fan (3hr)

Service Level by Mini-Grid under NEP

- Lighting
- TV, Sound Box , Mobile Phone Charger, AC Fan
- Refrigerator
- Productive Uses(up to 1KW)

Technological Development of Solar Home System (Before 2016 Vs After 2016)

- More Compactable
- Better Technical Assurance and Quality Assurance

Technological Development in Mini-Grid System

- Better Quality (Being Grid Ready Standard)
- More Systematically (Using Smart Meter and Pre-paid System)
- More effective and sustainable

RE Used in SHS Program by NEP Project for (2016-2017)

No.	State/Region	Solar Home System/ Public Solar System	
		No. of Site	Installed Capacity (MW)
1	Kayin	12536	0.71
2	Chin	13865	0.80
3	Sagaing	12059	0.69
4	Thanintharyi	20928	1.26
5	Rakhine	35403	1.81
6	Shan	32767	1.74
7	Ayeyarwaddy	33102	1.86
	Total	**160660**	**8.9**

RE Used in Mini-grid Program by NEP Project (2016-2017)

No.	State/Region	Solar Home System/ Public Solar System	
		No. of Site	Installed Capacity (MW)
1	Thanintharyi	1	0.063
2	Ayeyarwaddy	1	0.024
3	Magway	4	0.271
4	Bago	2	0.035
	Total		**0.393**

Mini-grid Program (NEP)

Overview

- clustered housing, presence of nearby stream of sufficient water flow and head in case of mini-hydropower, opportunities for productive-use loads
- 1% of households in the program will be served by mini-grids installed in the first year, rising to 10% in year 6.
- more specialized engineering skills to deploy and cohesive community with effective village committee

Technologies

Mini-hydro, solar, hybrid — < 1MW

Investment

Community	20%
Developer	20%
Government	60%

Improvement of Village-scale Productive Use in NEP (Mini-grid)

2016-2017 Fiscal Year

State/ Region	Effect House Hold	Public					Productive Energy User
		School	Clinic	Regilious Building	Street-light	Other	
4	1180	9	3	18	493	6	105

2017-2018 Fiscal Year

State/ Region	Effect House Hold	Public					Productive Energy User
		School	Clinic	Regilious Building	Street-light	Other	
6	3127	14	7	29	1138	2	561

Renewable Energy Target by NEP (2016-2021)

Unit	W/Unit or HH	Quantity	Total W
SHS	60	456500	27390000
School	375	3800	1425000
Rural Health Center	180	3800	684000
Religious Building	120	3800	456000
Street Light	70	19000	1330000
Mini-grid	200	35500	7100000
Total Watt Power			38385000
Total MW			38.39

Greenhouse Gas Reduction from NEP Project

- Replace candles, diesel/kerosene lighting, and diesel generators by renewable energy for village-scale mini-grids or hybrids or off-grid solar

Off-grid component		
Total household connection through village-scale mini grid	Number of households	35500
Emission reduction factor	t CO_2e/household/year	0.63
Total solar home systems	Number of households	456500
Emission reduction factor for 60Wp solar home system	t CO_2e/household/year	0.42
Greenhouse gas impact over project lifetime		
Emission reductions for mini-grid component (2016-2021)	Mt CO_2e	0.09
Emission reductions for SHS component (2016-2021)	Mt CO_2e	0.9

Renewable Energy Target by DRD (2030)

SHS

- Household per year - 160,000
- RE target per year - 10 MW

Mini-grid

- Village per year - 100
- RE target per year -15 MW

Total RE target by DRD at 2030

- 200-300 MW for Off-grid electrification; about 10% of total RE target by 2030

Positive Impacts on Local Communities

- Supporting to Promote Education and Health (Public Facilities: School, Health Center, Religious Building, Streetlight, etc.)
- Utilizing More Electrical Appliances (Mobile Phone, TV, Refrigerator, Sound Box, etc.) and Productive Uses (Water Pump, Forage Chopper, Mill, Welding and Lathe, etc.)
- Reducing the Expenditure and also Environmental Impacts



Investment Opportunities

- Submit International Competitive Bidding for SHS
- Propose the Proposal for Mini-Grid Project by proportionally contribution in line with Government's Program
- Propose the Proposal for Mini-Grid Project by 100% investment as for Developers

Challenges and Conclusion

Challenges

- Limited Capacity
- Community's knowledge and awareness
- Resource Allocation
- Development of Policy, rule and regulation
- Sustainable development

Conclusion

- RE Technologies Promising
- Improvement of capacity building for RE Technologies
- Incentive for Private Sector Participation
- Coordination of Public and Private Sector

Thank You For Your Attention