



Myanmar: Towards Universal Access to Electricity by 2030

World Bank, October 1, 2014

Country and Sector Overview

Country Overview

Land Area: 261,319 sq mile (678,500 sq km)

Population: 53 million

States/Regions: 15

GDP per capita: US\$1,100

Triple transitions since 2011:

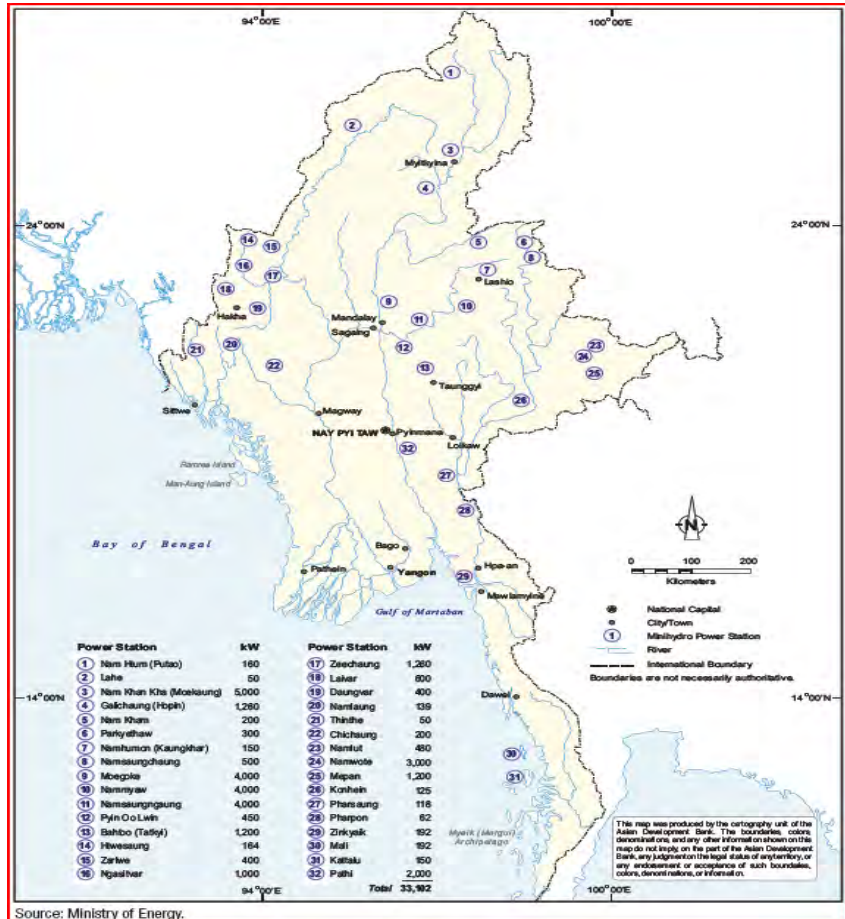
- from an authoritarian military system to democratic governance;
- from a centrally directed economy to market oriented reforms;
- from 60 years of conflict to peace in the border areas.



Energy Resources

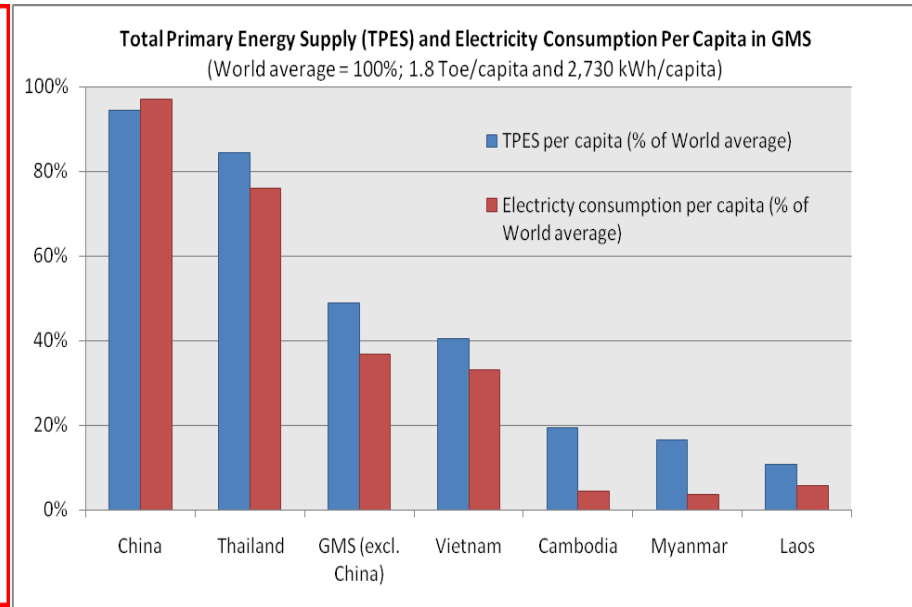
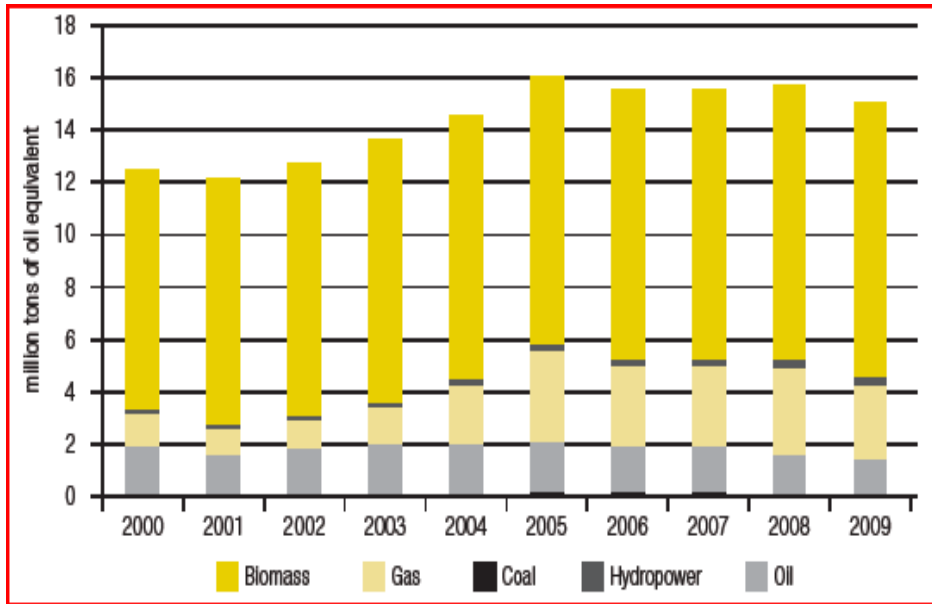


Oil and gas fields (11.8 tcf gas reserves)



Hydropower potential about 100 GW

Total Primary Energy Supply and Electrification



- Solid fuels (biomass) represent about two thirds of the total primary energy supply
- Electricity consumption per capita is one of the lowest in the world (141 kWh/year)
- Electrification ratio increased from 16% in 2006 to 33% in 2014
- Average electrification ratio in rural areas is about 16%

Generation Mix and Development (2013-2014)

Total Generation Capacity by Plant Type
(as of Dec, 2013)

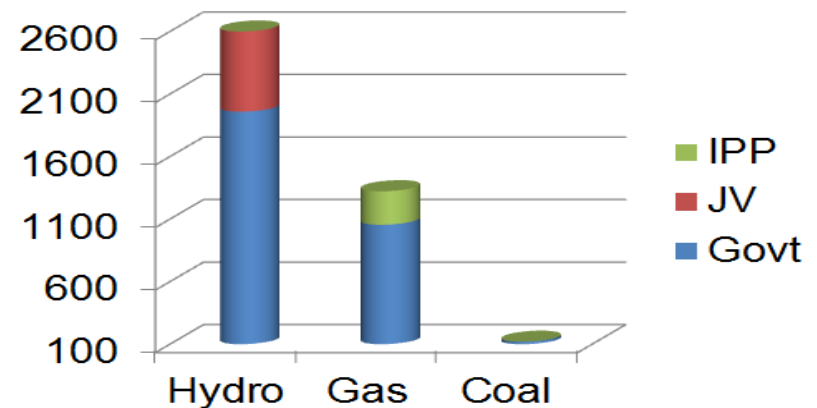
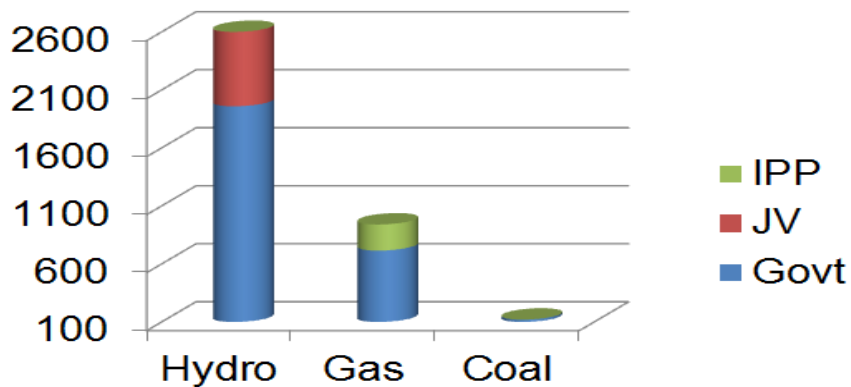
(MW)

Sr	Owner/ Fuel	Hydro	Gas	Coal	Total
1	Govt	1959	715	120	2794
2	JV	840	0	0	840
3	IPP	120	225	0	345
Total		2919	940	120	3979

Total Generation Capacity by Plant Type
(as of April, 2014)

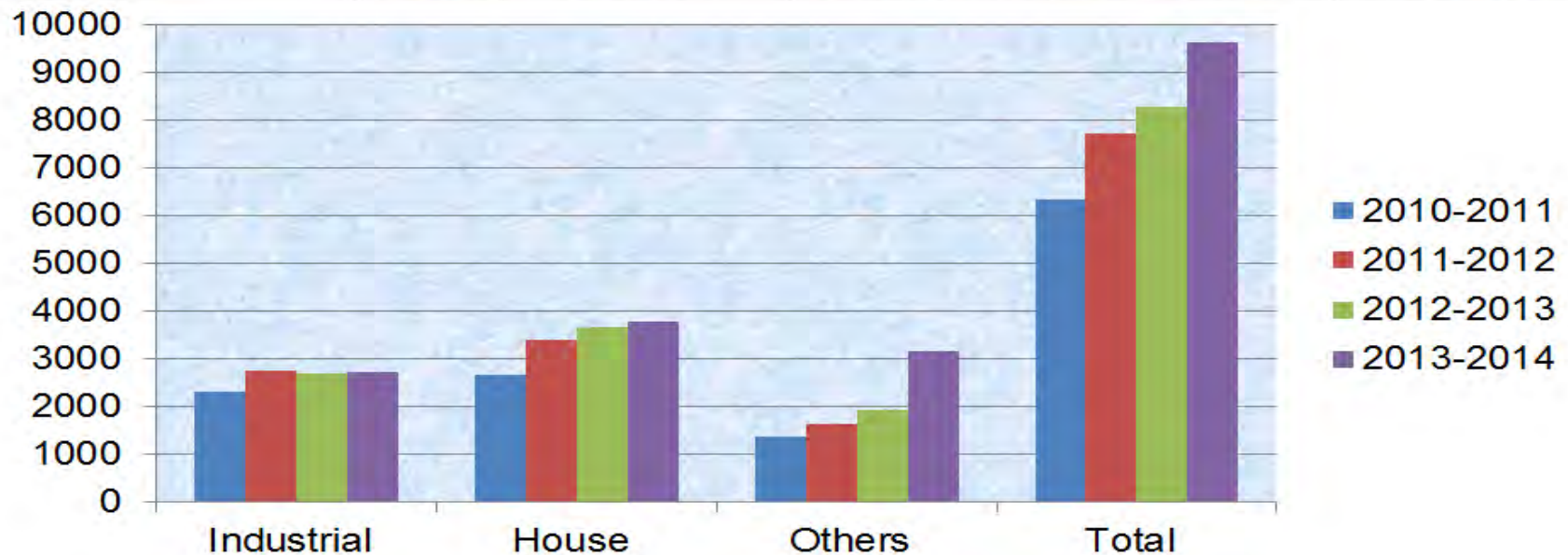
(MW)

Sr	Owner/ Fuel	Hydro	Gas	Coal	Total
1	Govt	1959	1055	120	3134
2	JV	840	0	0	840
3	IPP	172	268	0	440
Total		2971	1323	120	4414

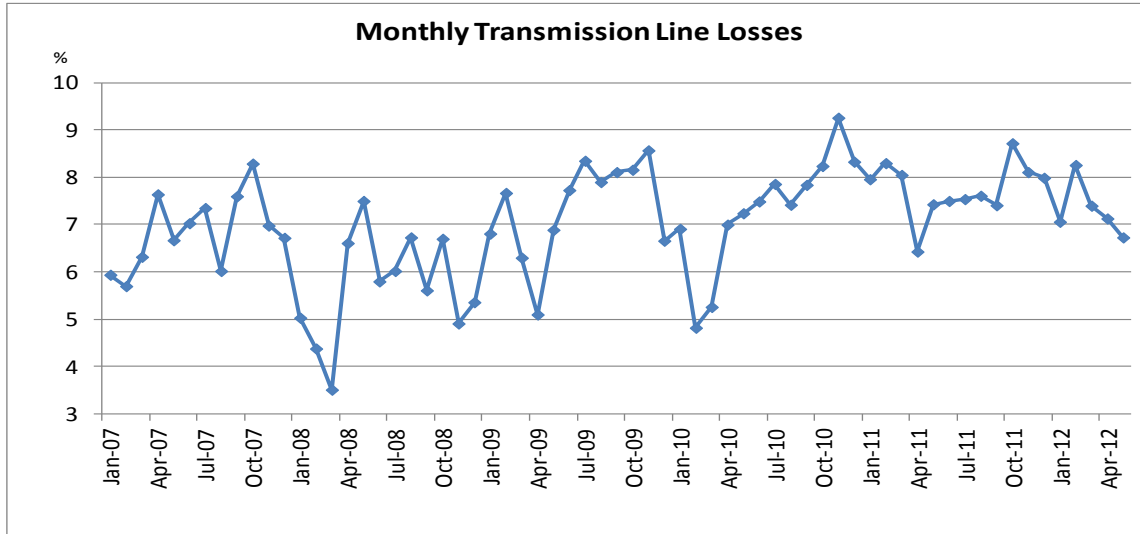


Electricity Demand (GWh) 2010-2014

Type of Consumption	Unit	2010-2011 Year	2011-2012 Year	2012-2013 Year	2013-2014 Year
Industrial	GWh	2286.7	2727.3	2690.5	2698.9
Household	GWh	2653.5	3380.9	3649.7	3763.8
Others	GWh	1371.88	1608.579	1913.668	3149.9
Total	GWh	6312.08	7716.779	8253.868	9612.6



Transmission and Distribution Losses



- Transmission losses hovers around 6-7%
- Distribution losses declined from 22% in 2009 to around 18% in 2012, but remain high due to overloading and commercial losses (estimated at 8% in YESB)



Key Issues and Challenges

1. Strategic Vision for Power Sector Development

- Optimal fuel mix for secure and cost effective electricity supply in the domestic market
- Private sector participation model attractive for investors and affordable for consumers

2. Reform of Legal and Regulatory Environment

- Transparent and stable regulatory regime (following the adoption of new Electricity Law)
- Financially sustainable power industry (cost recovery tariff for efficient power services)

3. Implementation of Investment Program

- Least-Cost Investment Program
- Mobilization of long term capital

4. Institutional Development and Capacity Building

- Coordination with National Energy Management Committee & Energy Development Committee
- Technical assistance to MOEP and MOE for EITI application
- Policy dialog with development partners

5. Sponsor & Legacy Issues

- Particularly relevant to private sector projects (e.g. IPPs with early MOAs)



The World Bank Group Energy Program for Myanmar

Objective: Alleviate acute electricity shortages and set the power sector on a sustainable path.

Financing: Up to US\$1 billion 2014-2016

Three Pronged Approach:

1. Scale-up access to reliable electricity supply

- Increase generating capacity through support to public and private projects
- Expand grid and off-grid electrification

2. Improve efficiency across the electricity value chain

- Increase efficiency of gas-fired power generation
- Reduce losses in distribution

3. Financial viability and sustainability

- Develop a financial viability action plan including a tariff review
- Poverty and social impact assessment and design of electricity subsidies




Cooperation with Donor Partners

Sector Planning	Legal and Regulatory	Financial Sustainability	Transmission & Distribution	Generation	Rural Energy
Analytical Basis for Strategic Decisions	EITI Application Support	Financial Viability Action Plan	Distribution Improvement in Yangon	New CCGT for MEPE & IPPs; PPP Transactions	Off-grid power program
Energy Master Plan for NEMC (ADB/Japan (JFPR))	Electricity Law & Electricity Regulation (ADB/Norway)	Strengthening Financial Management (Multi-donor)	4-region distribution system improvement	Donated GT and generators (GOT, Japan/JICA)	Rural Electrification Project
National Electricity Plan (Power Sector Master Plan)			National Power Transmission Network (ADB-JICA-Korea)	Urgent Rehab and Upgrade (Yangon, Thilawa, Baluchaung, Hlaingthaya)	Rural Power Infrastructure (electrification in 14 regions/states)
National Electrification Plan	Rural Electrification Law	Economic Valuation of Natural Gas in domestic mkt.	Advisor for Yangon Electricity Supply System	PPP bidding and contracting support (ADB/DFID)	Studies on Off-grid Small Scale Hydro
Energy Efficiency Policy and Renewable Energy Devel. Plan	Environmental and Social Safeguard and Conservation		YESB Corporatization Support through Investment and Advisory Support	Institutional development for sector management of PPPs	

 = ADB

 = JICA

 = WBG

 = Others/Joint

Myanmar and Sustainable Energy for ALL (SE4ALL)

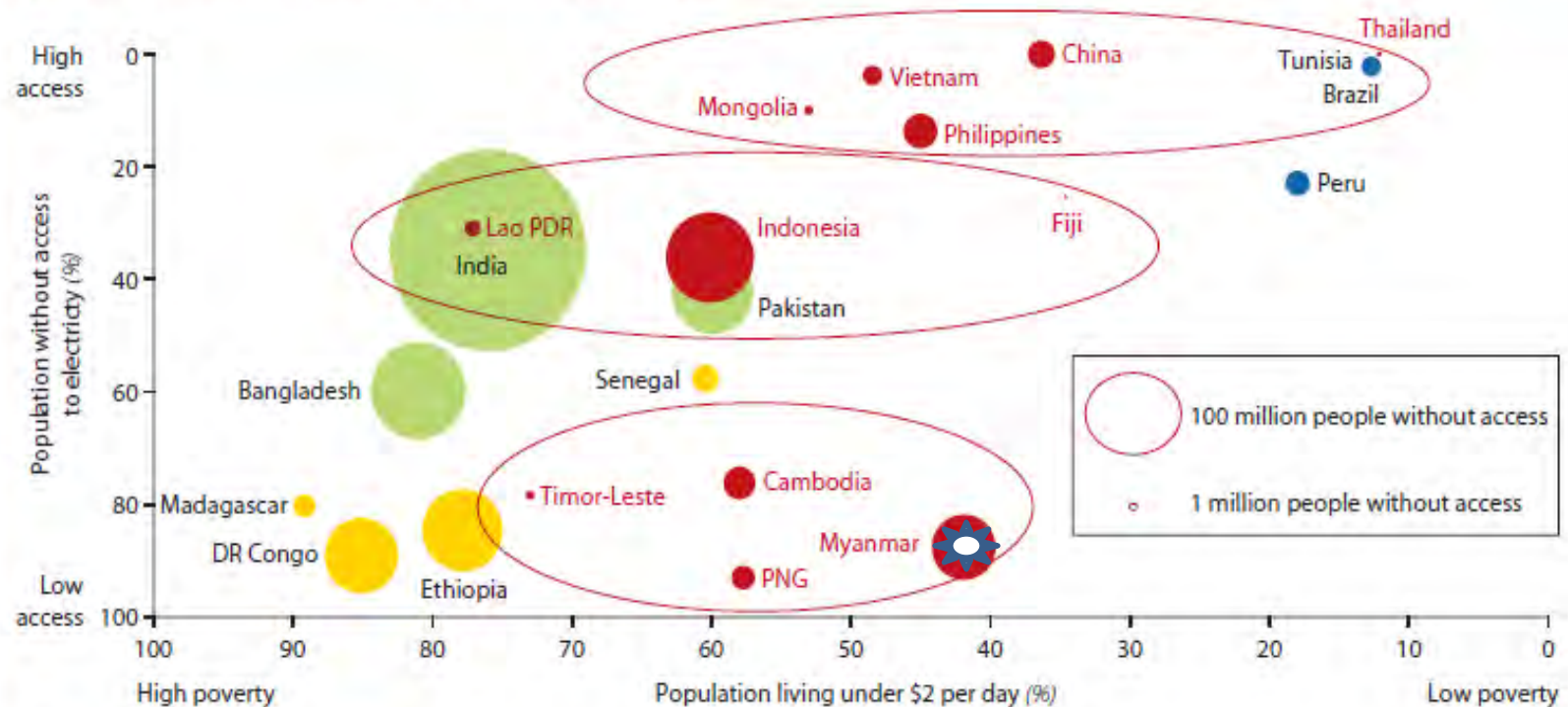
- **SE4LL Endorsement-** Myanmar endorsed the UN SE4ALL Initiative.
- **An high impact country** - Myanmar is identified as one of the high impact countries that offer the most potential to make rapid progress by SE4ALL.
- Myanmar is one of the first countries, and currently the only country in the East Asia and Pacific Region, that receive significant grant support from the World Bank/ESMAP SE4ALL Technical Assistance Program.



Towards universal access to electricity in Myanmar

Electrification and Socioeconomic Development

Figure 1.4 Poverty and Lack of Access to Electricity by Country, 2008



Sources: IEA 2010; World Bank 2010e; authors' estimates.

Government of Myanmar is Strongly Committed to Achieving Universal Access to Electricity

- **Goal to achieve > 50% coverage in 2016** - The Government is developing an implementation plan to increase electricity coverage in 2016.
- The President's office has established a dedicated **National Electrification Executive Committee (NEEC)** under the patronage of the Vice President, and with union ministers of MOEP and MLFRD as chair and co-chair.
- **Renewable Energy for Rural Electrification** - A Rural Electrification and Potable Water Resource Committee was established through a Presidential Decree where one of the mandates is to promote renewable energy for rural electrification.

But Myanmar's electrification challenge is immense...

The electrification rate is estimated at **33%...**

Need to connect over **2x** as many households per year to reach universal electrification by 2030...



New household connections per year

189,000

130,000

59,000

2012

440,000

For universal electrification by 2030



Source: MOEP (2011-2012), ESE, YESB data and Castalia estimations
Assumes 6.5 people in a household

It is impossible to meet this challenge without a programmatic, sector-wide approach...

Countries that have achieved rapid electrification have relied on **Programmatic, Sector-wide approach**

Key Features :

- ▶ Coordinated least-cost technical and investment planning
- ▶ Sustainable financing policy
- ▶ Stable flow of funds
- ▶ Results focused



Need of Myanmar National Electrification Plan (NEP) 2015-30

- NEP should be a **comprehensive action plan** for developing, financing, and implementing electricity access scale-up program nationwide, with the target of achieving universal access by 2030.
- NEP would **align support from different stakeholders** with the implementation program for achieving national access targets and syndicates financing on a timely, ongoing and programmatic basis.

Component I: Geospatial Least Cost Electrification Rollout Plan



A high level geospatial rollout plan comprising:

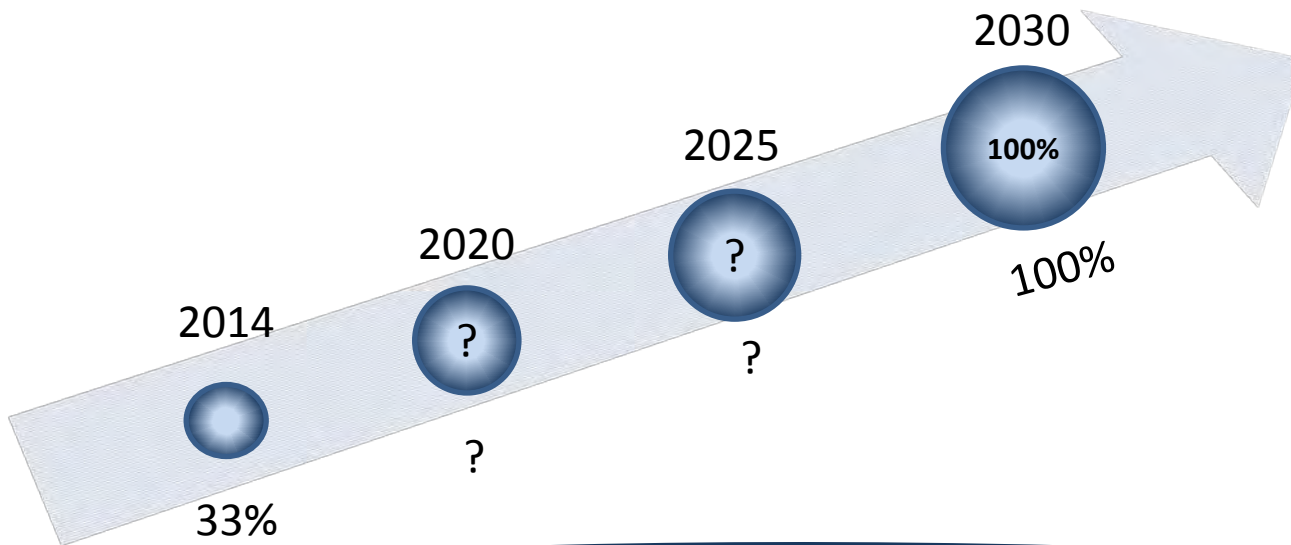
- **Systematic grid network rollout connection plan**

- **Complementary spatial plans for mini-grids and individual systems**

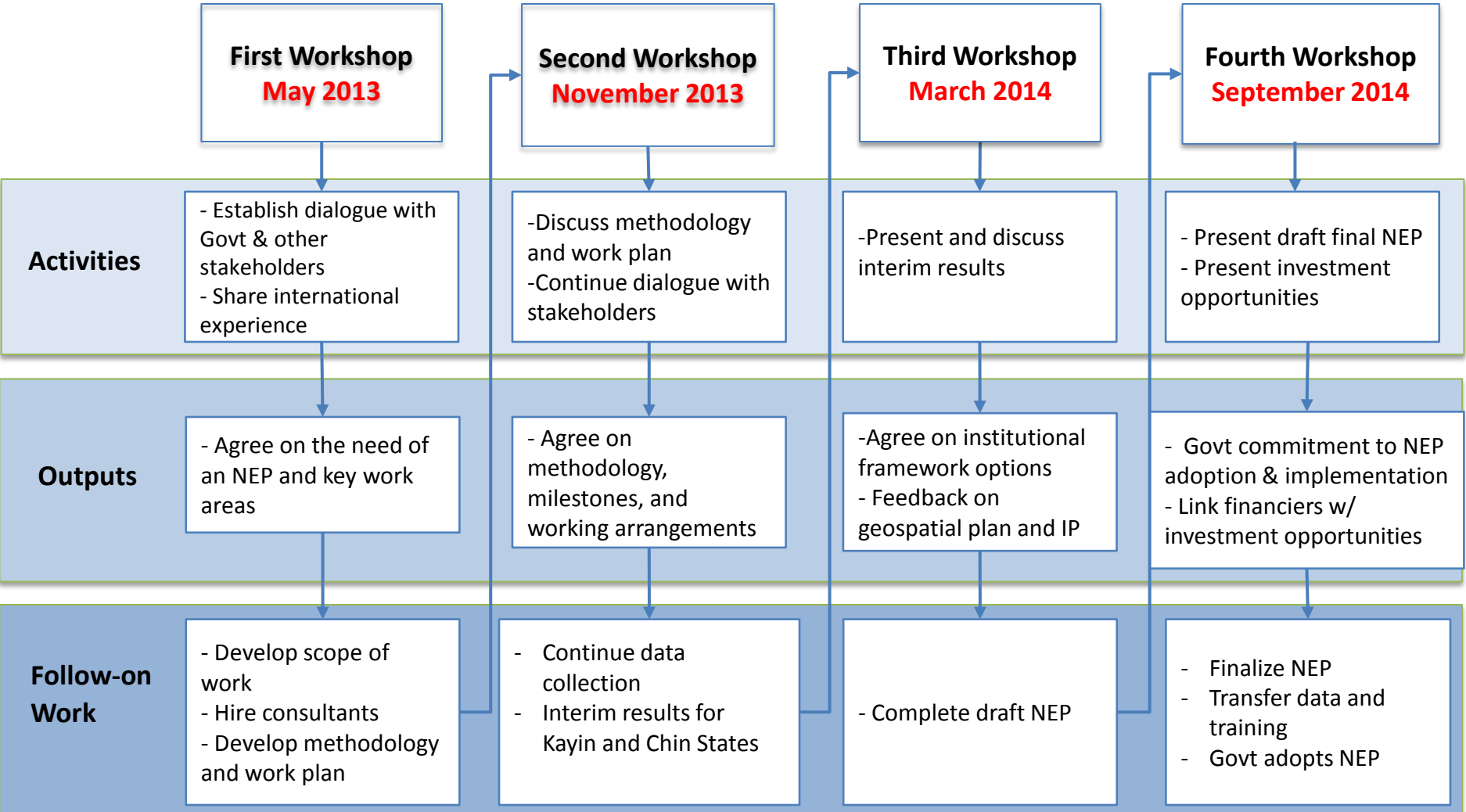


Component II: Road Map and Investment Prospectus

- Long-term and intermediate targets for 2015-2030
- Investment financing framework for the first 5 years
- Action plan to address enabling policy and institutional framework
- Capacity strengthening initiatives for key institutions and agencies



Processes and Milestones



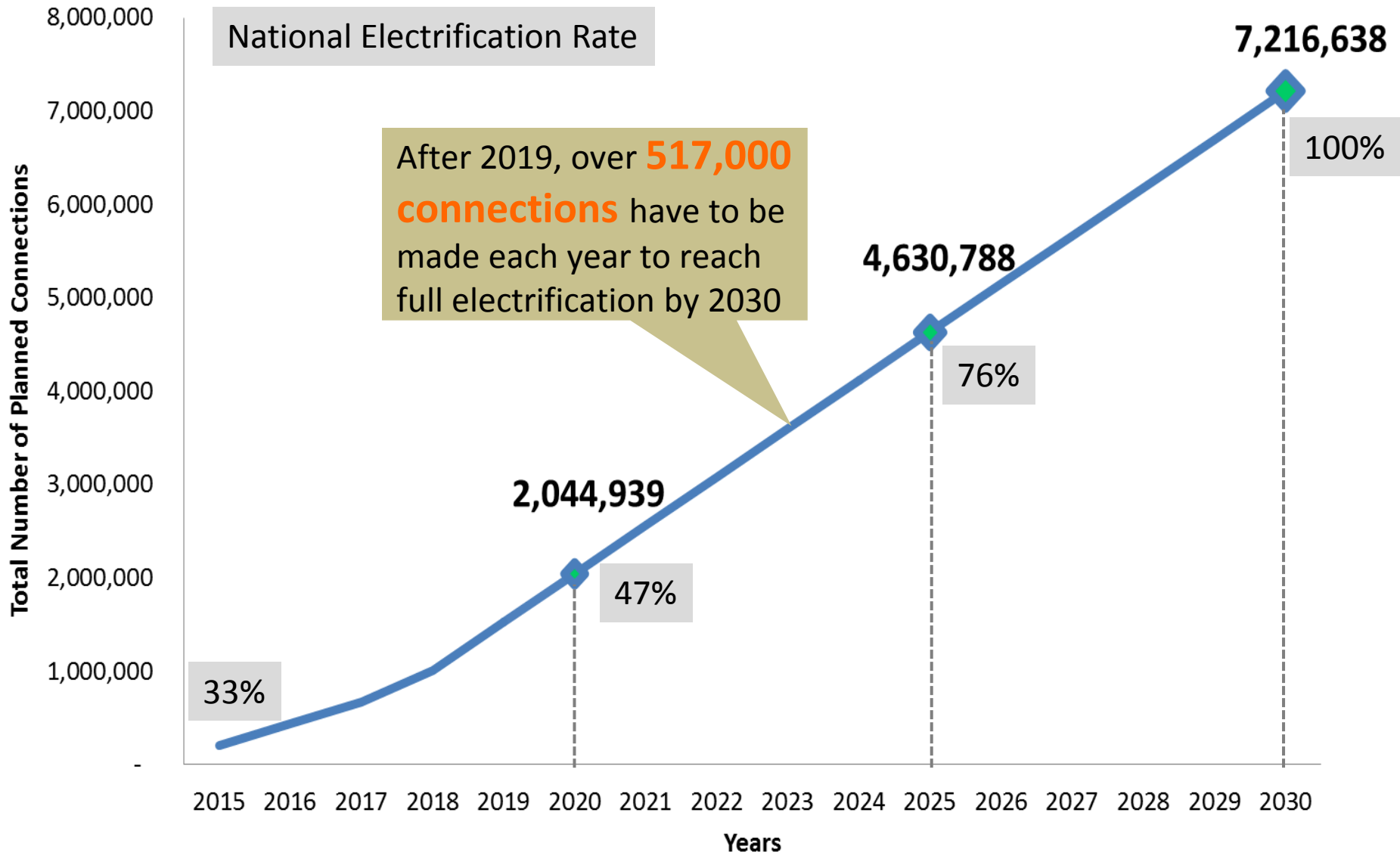
Ownership of the Government and Collaboration

- Ministry of Electric Power (MOEP) and Ministry of Livestock, Fisheries and Rural Development (MLFRD) jointly lead the NEP preparation with participation from other member agencies of NEMC and REPWSC and assistance from the World Bank.
- MOEP and MLFRD co-manage consultants together with World Bank. This includes strategic guidance to data collection, review of key deliverables, and organization of workshops .
- Consultants work closely with the government teams throughout the NEP preparation process
- Close coordination with US, ADB, JICA and other respective, related initiatives.



Myanmar National Electrification Plan

Roadmap to Achieve Universal Access by 2030



Two-pronged Approach: Grid and Off-grid Rollout Plan

- 1) Grid extension will reach some states later in grid roll-out, and these connections will cost substantially more per household**
- 2) For those areas where grid will arrive late, an off-grid “pre-electrification” option can provide non-grid electricity service in the short- and medium-term**
- 3) Over the long-term, grid extension is the most cost-effective option for the overwhelming majority of households**

Generation Capacity Needs

- 2.5-3.0 GW of new generation capacity will be needed only for modest, residential needs
- More will certainly be needed for commercial, industrial, other demands.
- This is approximately doubling current generation (~2.7 GW)

State	New Connections	Proposed Capacity (MW)
Ayeyarwady	1,082,000	395
Bago	688,000	251
Chin	112,000	41
Kachin	115,000	42
Kayah	27,000	10
Kayin	379,000	139
Magway	811,000	296
Mandalay	722,000	264
Mon	258,000	94
Nyapitaw	98,000	36
Rakhine	977,000	357
Sagaing	909,000	332
Shan	504,000	184
Tanintharyi	325,000	119
Yangon	208,000	76
Total	7,216,000	2,636

Recommended Sequencing of Grid Roll-out proceeds from low-cost to high-cost connections

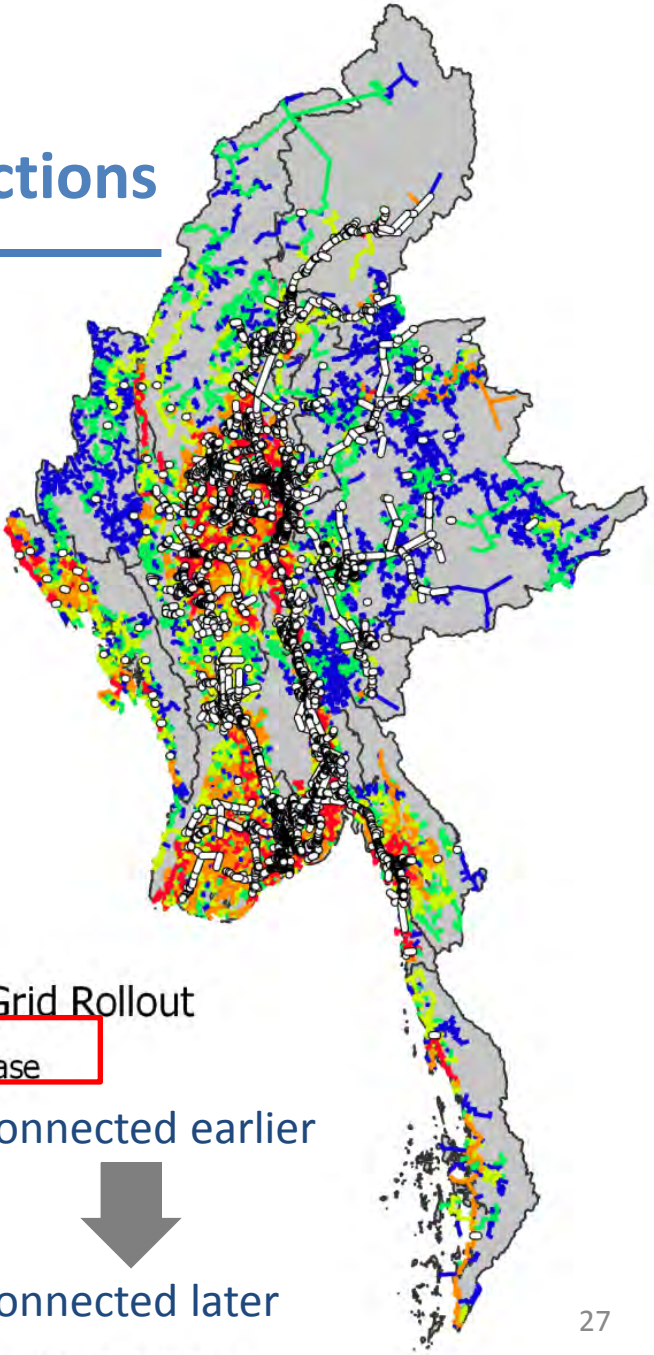
- **Dense areas** require less MV per connection and will be connected first
- **Remote communities** require more and will be connected later
- **Chin, Shan, Kachin and Kayah** have highest cost per connection, thus to be connected in the final phases

National MV Grid Rollout

Equal MV Per Phase

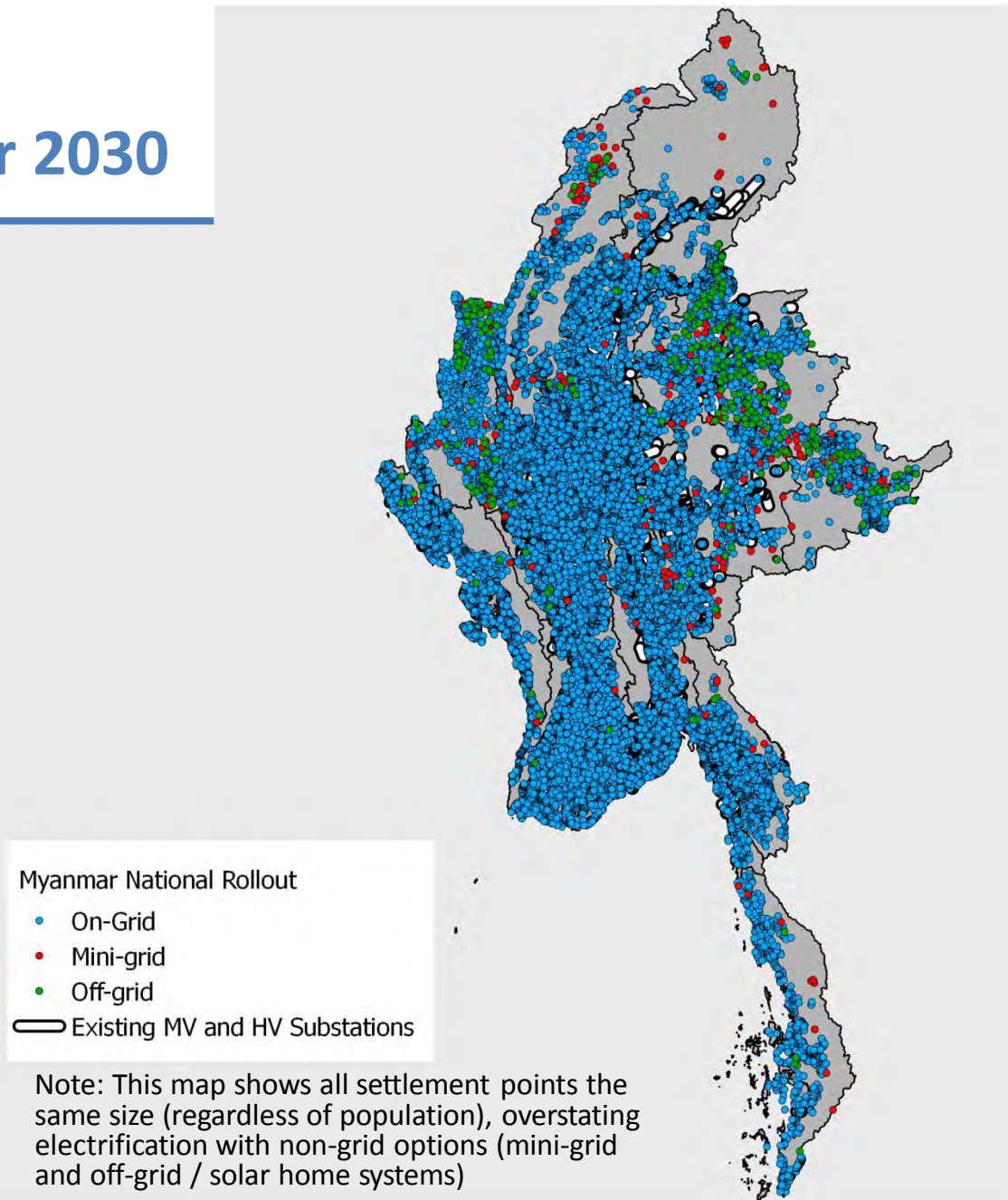
— Phase 1	Connected earlier
— Phase 2	
— Phase 3	
— Phase 4	
— Phase 5	Connected later
— Existing MV and HV Substations	

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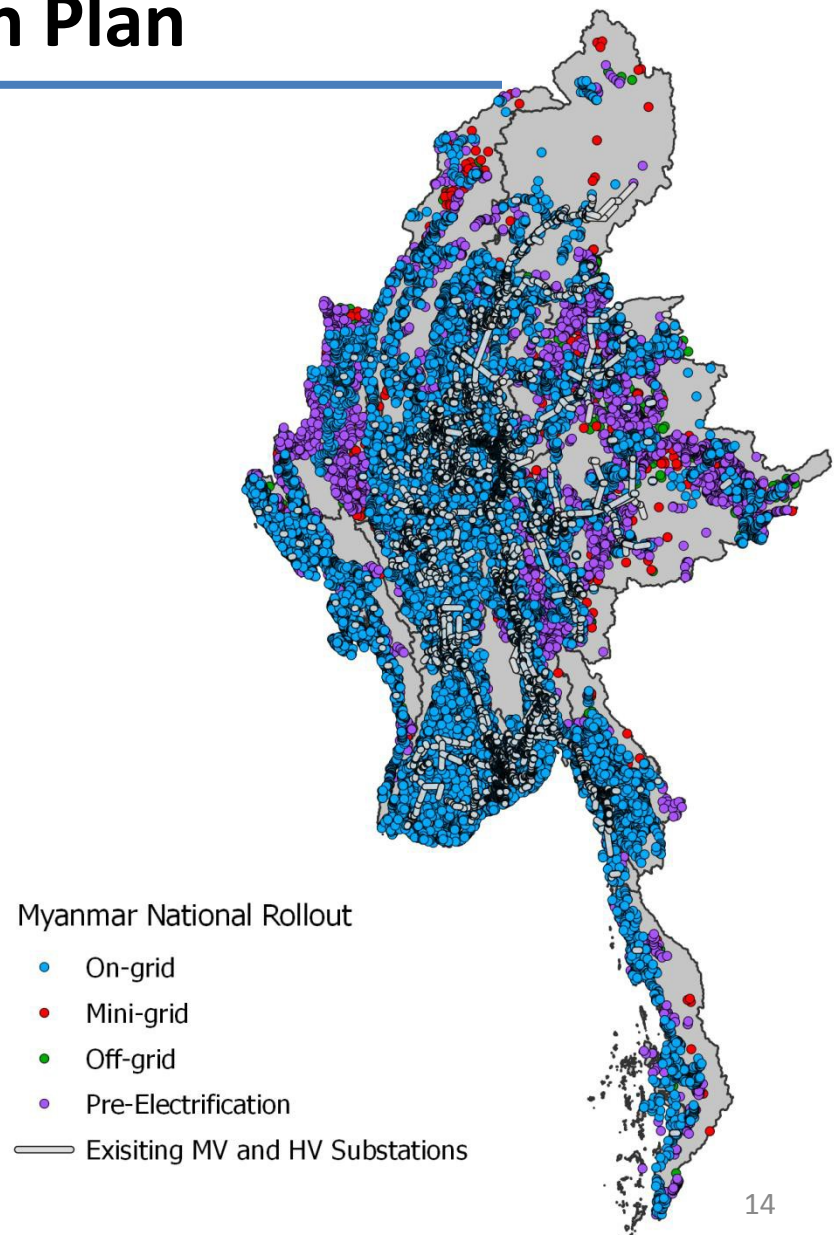
Least-Cost Recommendation for 2030

- By 2030, the majority is **grid connections**
- This will be **7.2 million households**
- Total cost is estimated at **US \$5.8 billion** (US\$800 per connection, average)
- This will be in addition to investments needed for generation & transmission



Recommendations for an Off-grid, Pre-electrification Plan

- 3-4% of the villages in the last phases of grid rollout are recommended for pre-electrification
- Pre-electrification villages shown in purple
- Shan, Chin, Kayah and Kachin States represent major areas for pre-electrification



Appropriate Pre-electrification Technology Options depend on the size of the village

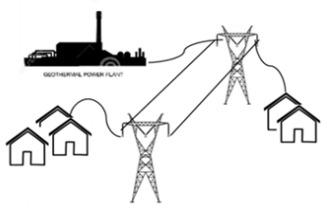
- **Solar home systems** - for smaller villages (<50 HHs)
 - may provide 75-175 kWh/yr for lighting/ICT/TV
 - **US \$400-500 / HH**
(These are international prices with good quality. Local prices may be lower, and quality can vary.)
- **Mini-grids-** for larger villages (>50 HHs)
 - solar, hybrid, diesel, or micro-hydro where available
 - 200-250 kWh/yr: lighting/ICT/TV & fan/small fridge
 - **US\$1,400/HH**
 - **Has potential to be integrated into grid and save on distribution investment later if built to grid standard**

How many connections are feasible in the first 5 years?

- Technically and physically feasible to implement about **1.7 million** additional connections from FY2015-19

Pace of ramp-up **limited by:**

- Institutional weaknesses
- Available skilled labor
- Procurement practices



	New Conns Required	2012 Actual	2015	2016	2017	2018	2019
ESE	6,993,539	59,000	75,000	150,000	225,000	337,500	517,170
YESB	207,752	130,000	130,000	77,752	0	0	0
Total			205,000	227,752	225,000	337,000	517,170



- Approximately **125,000** total mini-grid and off-grid household solution connections can be made. Includes both **permanent** and estimated **pre-electrification** connections

What is the financing need to achieve 1.7 million connections?

With national least-cost roll-out, **US\$670 million** of capital investments and **US\$24 million** of TA will be needed from FY 2015-19.

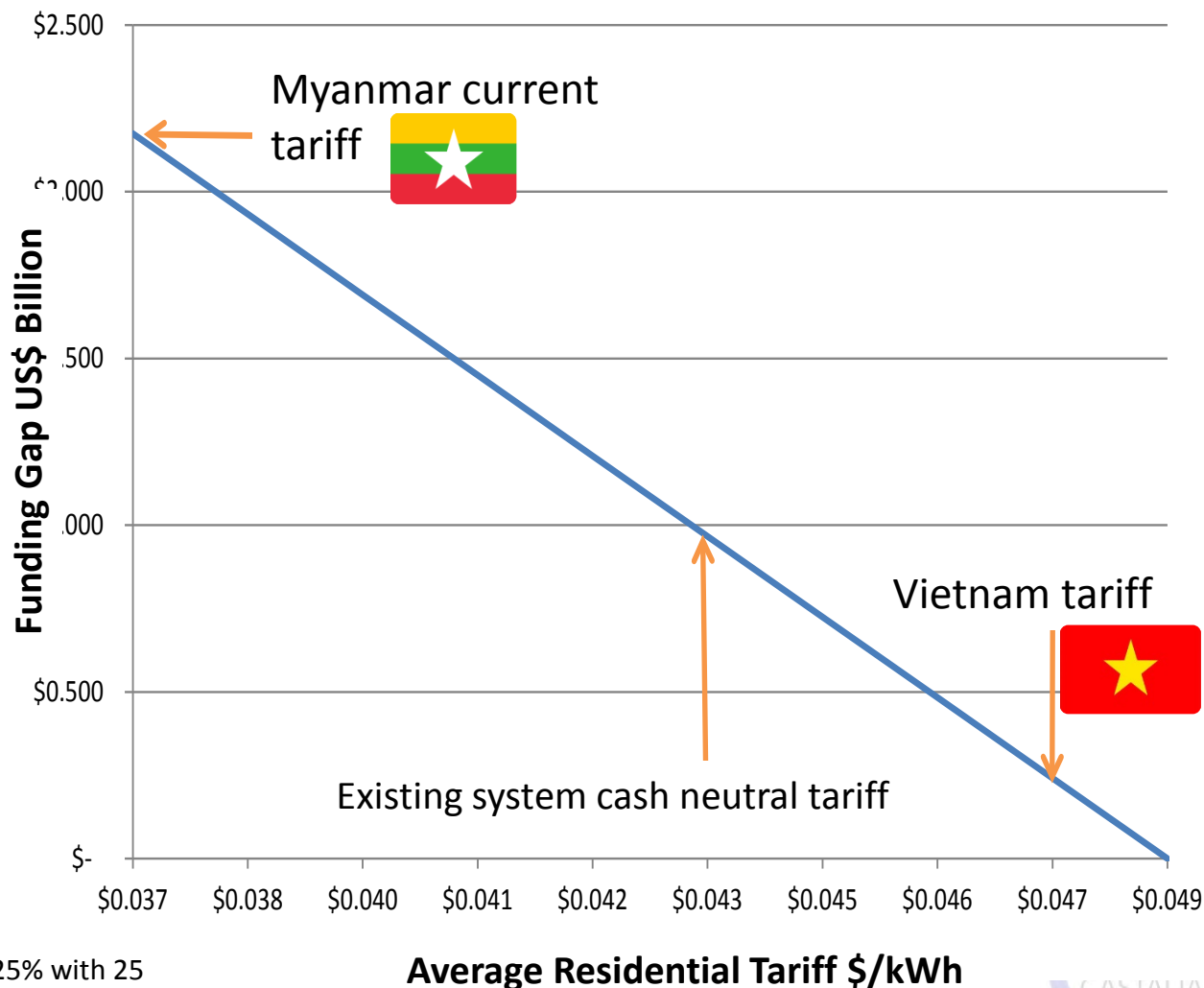
Type of investment	In US\$ Million				
	2015	2016	2017	2018	2019
Grid Investment	\$72.5	\$80.6	\$79.8	\$139.9	\$232.2
Mini-grid Investment	\$0.6	\$0.6	\$0.6	\$0.6	\$0.6
Pre-electrification Investment	\$2	\$3	\$4.5	\$6.5	\$8.5
Off-grid Investment	\$2.2	\$2.2	\$2.2	\$3.2	\$3.2
Annual Investment	\$77.3	\$86.4	\$87.1	\$150.2	\$244.5
Technical Assistance	\$10.3	\$6.8	\$2.2	\$3.1	\$1.4

Numbers are in constant US\$, does not include inflation

Size of funding gap depends on decisions about tariffs

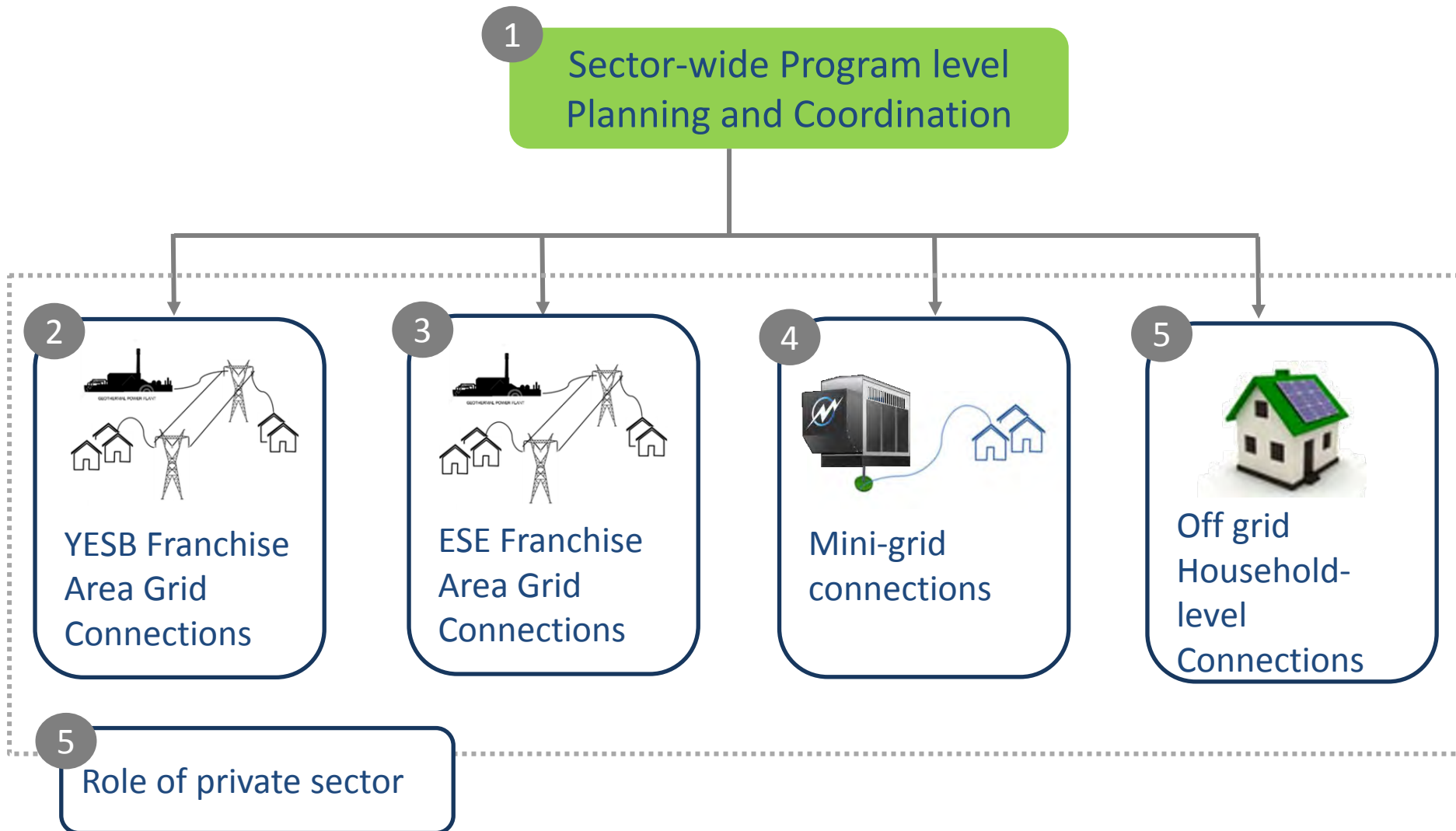
$$\text{Funding gap} = (\text{Revenue} + \text{Loan Amount Received}) - (\text{Capex} + \text{Opex} + \text{Loan Repayment})$$

- ▶ Funding gap is **\$2.2 billion** over a 40-yr period at the current tariff
- ▶ Reduced to **\$1.1 billion** with an existing system cash neutral tariff
- ▶ Reduced to **\$0.25 billion** with maintaining a residential tariff equivalent to Vietnam



Note: Assumes all loans are concessional, at 1.25% with 25 year repayment and 5 year grace period

Recommendations for Institutional Reform



To ensure NEP is well planned and coordinated

Establish well-resourced Executive Secretariat reporting to the Office of the Vice President or President

Establish Independent Regulator for tariff & standard setting

Permanent Functions:

- ▶ Maintain and update geospatial & financial plans for NEP
- ▶ Monitor achievement of targets
- ▶ Serve as main point of contact for development partners
- ▶ Advise on management of coherent financing program
- ▶ Provide advice and support to Ministries involved NEP program implementation.

Interim

Functions:

- ▶ Serve as acting regulator, until regulator formally established

Functions:

- ▶ Review & update estimates of total funding requirement
- ▶ Advise Govt on tariff options and implications for subsidy requirement
- ▶ Coordinate timely delivery of required subsidy



To accelerate connections in YESB franchise area

Under MOEP's leadership:

Short Term

Medium Term

Corporatize YESB, using IFC assistance

Develop Investment Program for YESB with IFC assistance

Enable YESB to access financing for distribution expansion.

Newly established Regulator (ER) should take over these functions from Secretariat

Country Case Studies

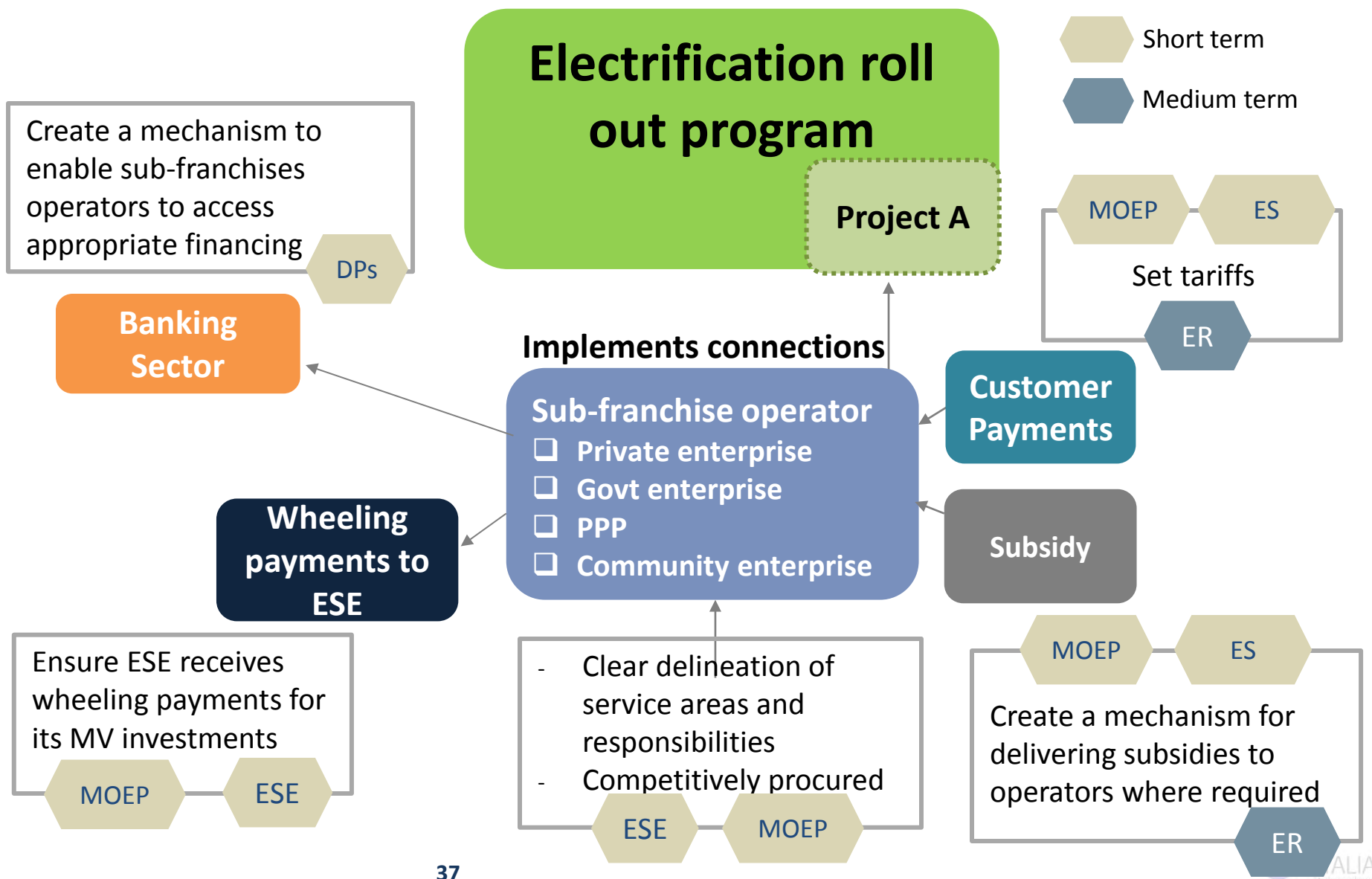


PUSO Subsidy to National Electricity Company (PLN)



State Govt. subsidies to DISCOs

ESE to follow same path as YESB...In addition, there are opportunities for private sector involvement in NEP implementation through sub-franchising



To implement mini-grids efficiently



- The process for the implementation of mini-grids should broadly **follow the process for sub-franchising of ESE grid areas:**
 - Decentralized “bottom-up” initiative but through standard processes
 - Access to finance by developers via two-step loans through banks: on-lending of donor financing
 - Least-cost subsidy mechanism
- **DRD should combine responsibility** for household-level off grid systems with responsibility for mini-grids (both permanent and pre-electrification)

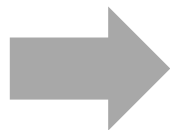
To ensure efficient and sustainable household and community level electrification solutions



DRD should:

- Provide financial incentives that promote cost-recovering business models to flourish
- Provide clear guidelines for entities that will benefit from incentives
- Encourage scaling up where SHS is economical
- Provide training support/incentives for technicians
- Closely monitor program's progress

Possible
SHS Models
to learn
from:



**Bangladesh: IDCOL
Model**



Lao PDR: OGS-PESCO-VEM Model

Summary of institutional recommendations

Independent Regulator

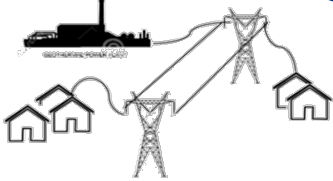
- Advise on tariffs, standards and subsidies needed

Executive Secretariat reporting to VP Office

- Overall management and coordination of geospatial plan
- Performance reporting
- Point source for donors

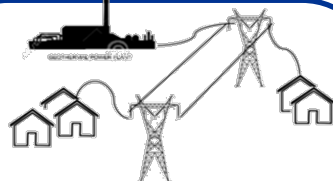
Donors

- TA for establishing and training new entities
- Concessional finance for entire program
- Establish 2-step loan program with banks



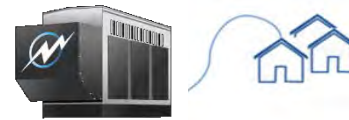
YESB Franchise Area

- Develop Investment Program with IFC
- Corporatize YESB



ESE Franchise Area

- ESE to follow YESB path
- Set up Sub-franchise concessions



Mini-grid Conns.

- Decentralized but standard approach modeled along ESE sub franchise concessions
- DRD manage & monitor



Off grid Conns

- DRD manage & monitor
- Re-orient program towards giving financial incentives rather than free SHS
- Support private sector SHS provision

Under MOEP leadership

Private Sector

- Participate in sub franchise concessions
- SHS provision

From Plan

To

Action

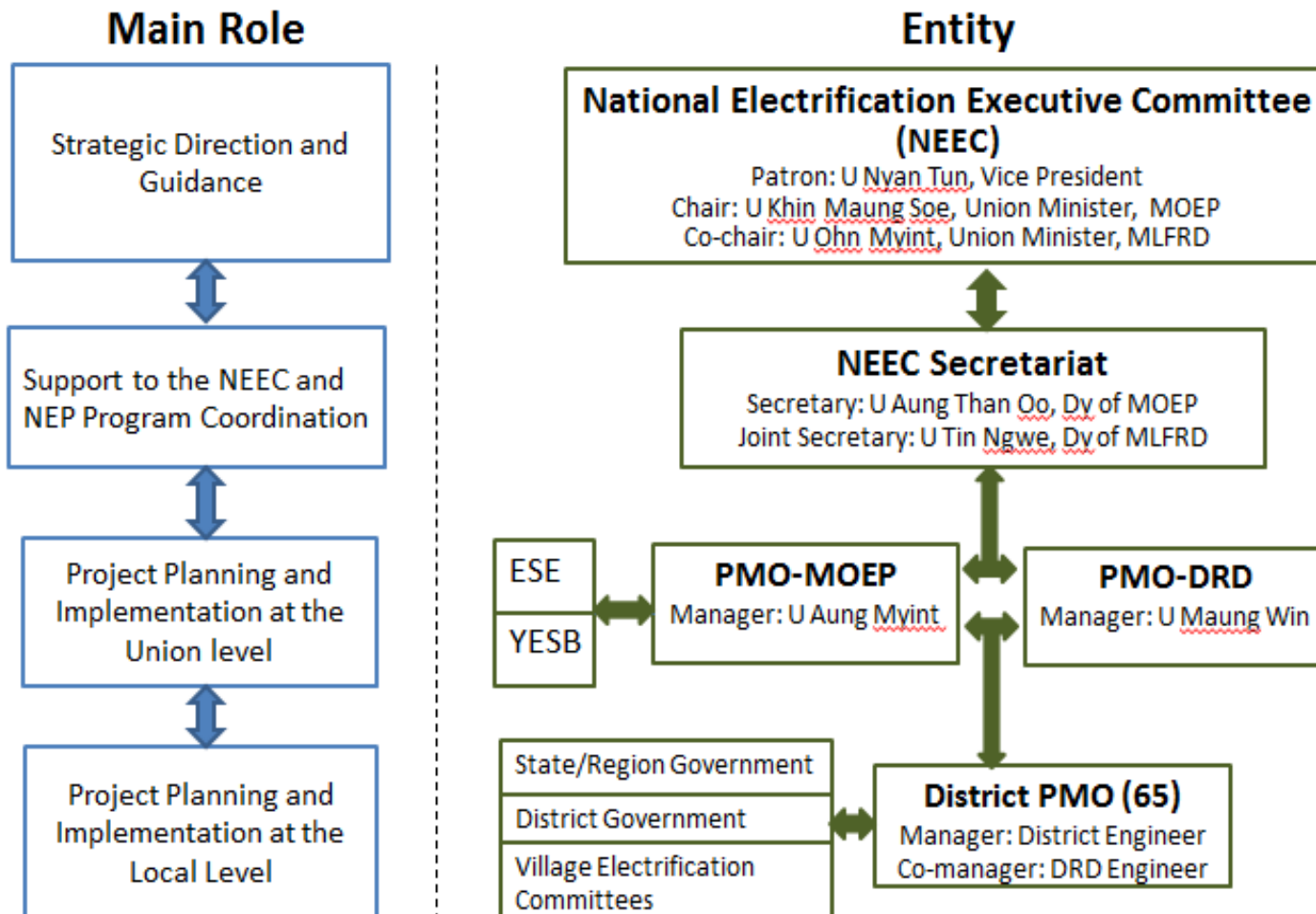


Draft NEP reports and workshop materials can be found at:

[https://energypedia.info/wiki/Achieving Universal Access to Electricity in Myanmar](https://energypedia.info/wiki/Achieving_Universal_Access_to_Electricity_in_Myanmar)
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Discussions and Q&As

Myanmar NEP Institutional Implementation Framework



WBG Engagement in NEP Implementation

-Accelerate the expansion of electricity services

- \$400 million National Electrification Project under preparation
- Develop results-based scheme and public –private partnership

-Increasing the generation capacity

- 106 MW CCGC plant under way (\$140 million IDA)
- Advising the government on IPP procurement
- Providing guarantee support to facilitate PS investments

-Improve system efficiency and financial viability

- IFC assessing corporatization of YESB
- IFC reviewing private sector investments in distribution