Oct 2nd , 2014

Project Overview

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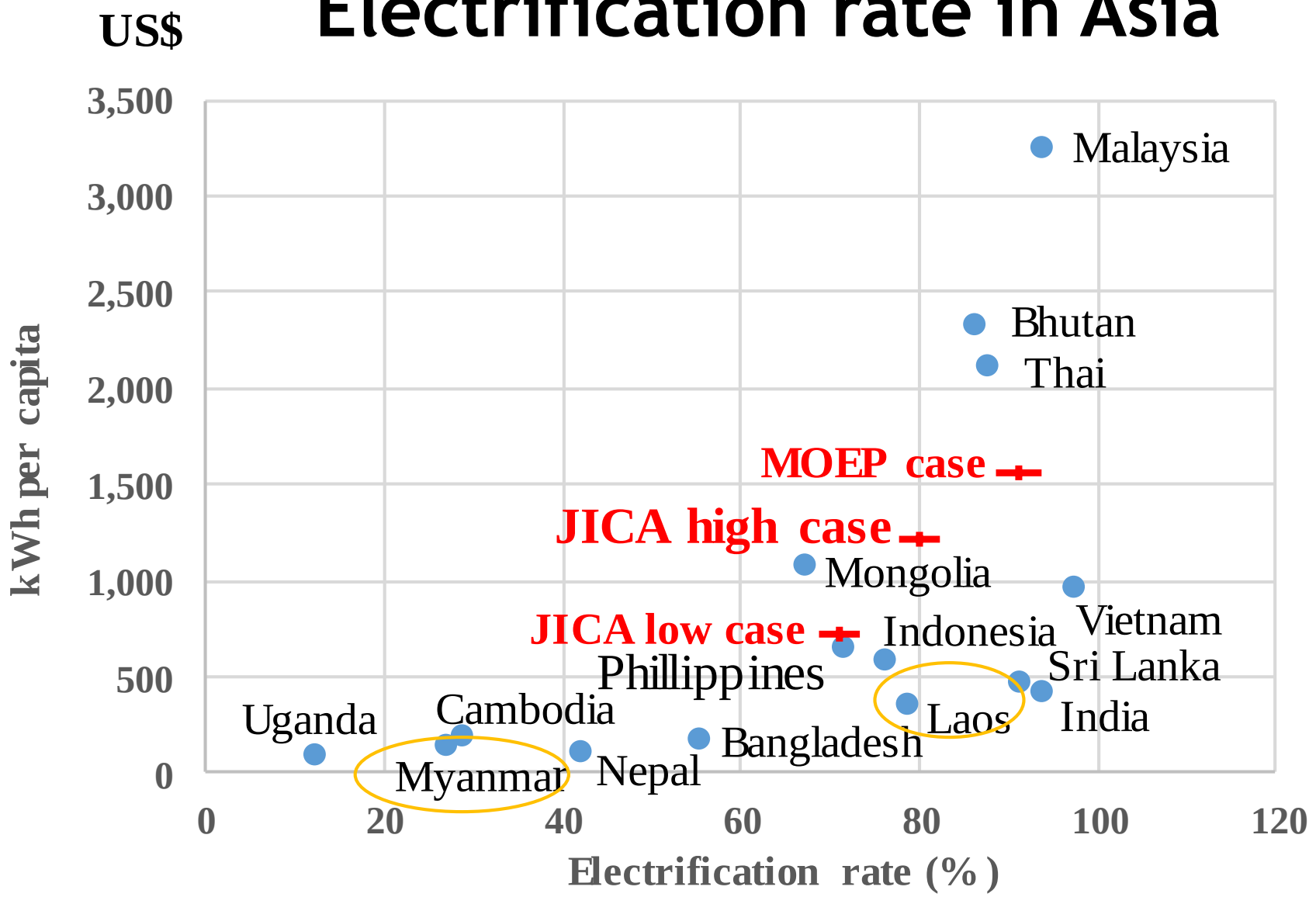
The University of Tokyo

Off-grid and weak grid Areas and our road mapping projects

Off Grid : 1.3Billion
Weak Grid : 2 Billion

Electrification rate in Asia



(Source) Japan Electric Power Information Center (JEPIC)
(Note) The cases are estimated rate for Myanmar as of 2030 by JICA and MOEP

Challenges and concerns led by off and weak grid

Poverty

Sustainability

Social Division

Resilience

Our experience in Lao PDR

Stakeholder's Meeting

Techno Changes

Society Changes

Vision

Poverty Reduction

New-Industry Creation

Regional Integration

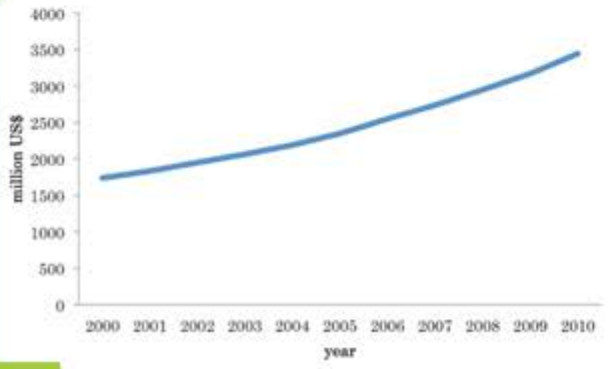
Policy Tools ↔ Technology Tools

Policy Tools ↔ Technology Tools

Policy Tools ↔ Technology Tools

Stakeholder's Meeting

Policy Recommendation



Economic Growth

Major Visible Challenges of Myanmar in the Energy/Electricity Field

Short term:

- Stable supply of electricity
- Electricity tariff structure

Medium/Long term:

- Energy access/Electrification, particularly in rural area
- Investment environment
- Energy policy integration
- Human resource development

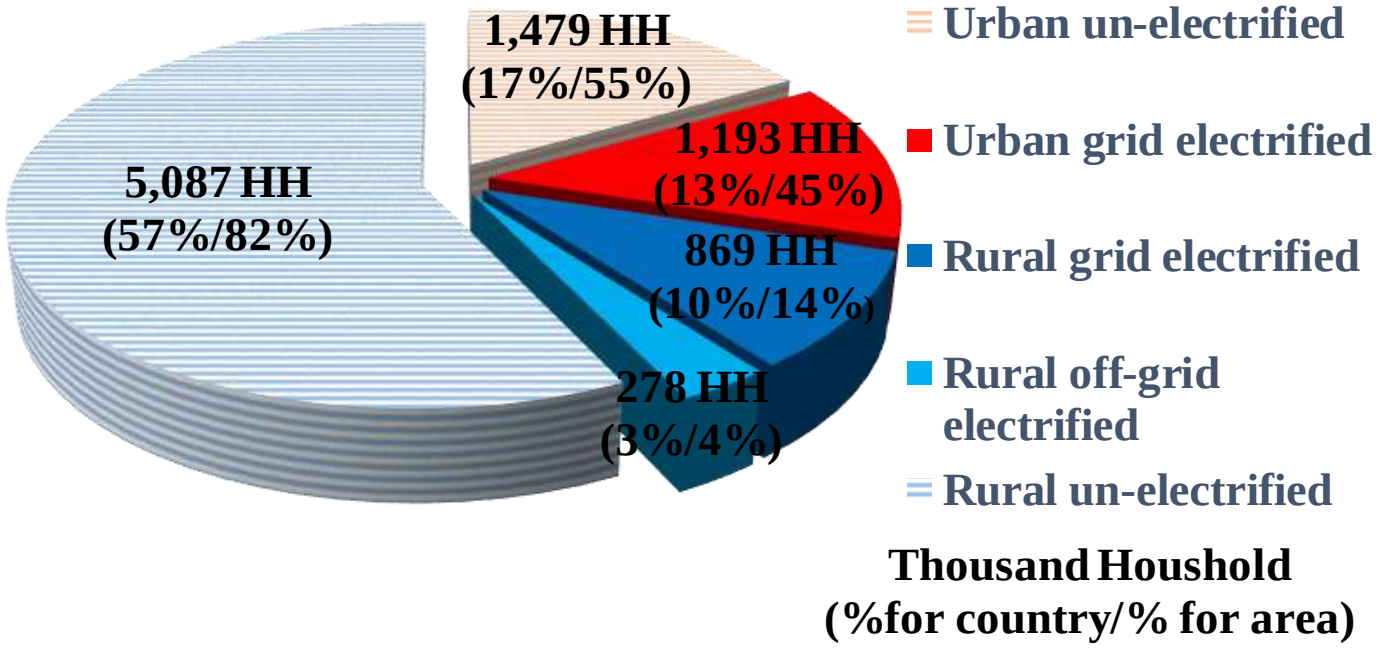
Demand projection for rural electrification

Current electrification situation

Household electrification rate is 26%

Rural household electrification rate is 18%

Urban household electrification rate is 45%



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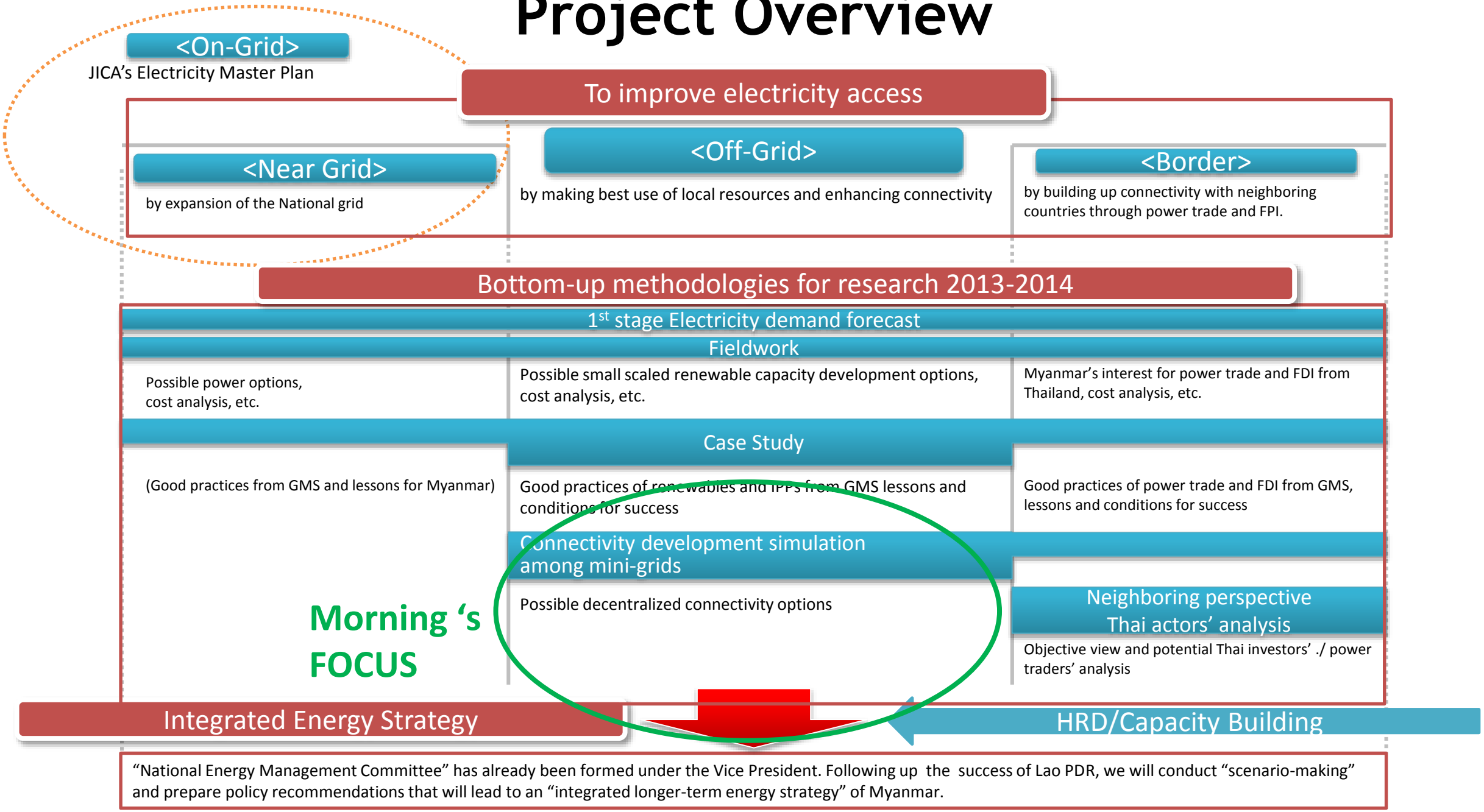


Research Questions and Method

- Research Questions
  - How much does it cost to electrify rural area in whole country.
  - Explore implications of the national electrification rate target of 70% by 2030

- Methodology:
  - Demand Projection (Tentative)
  - Cost Estimation & Development of Preliminary Scenarios

Framework of research: Rural Electrification Scenario

(1)Demand Projection of Rural Area

Estimate
(a) On-grid demand.
(b) Off-grid demand(micro-grid).
(Consistent with JICA master plan.)

(2)Cost Estimation

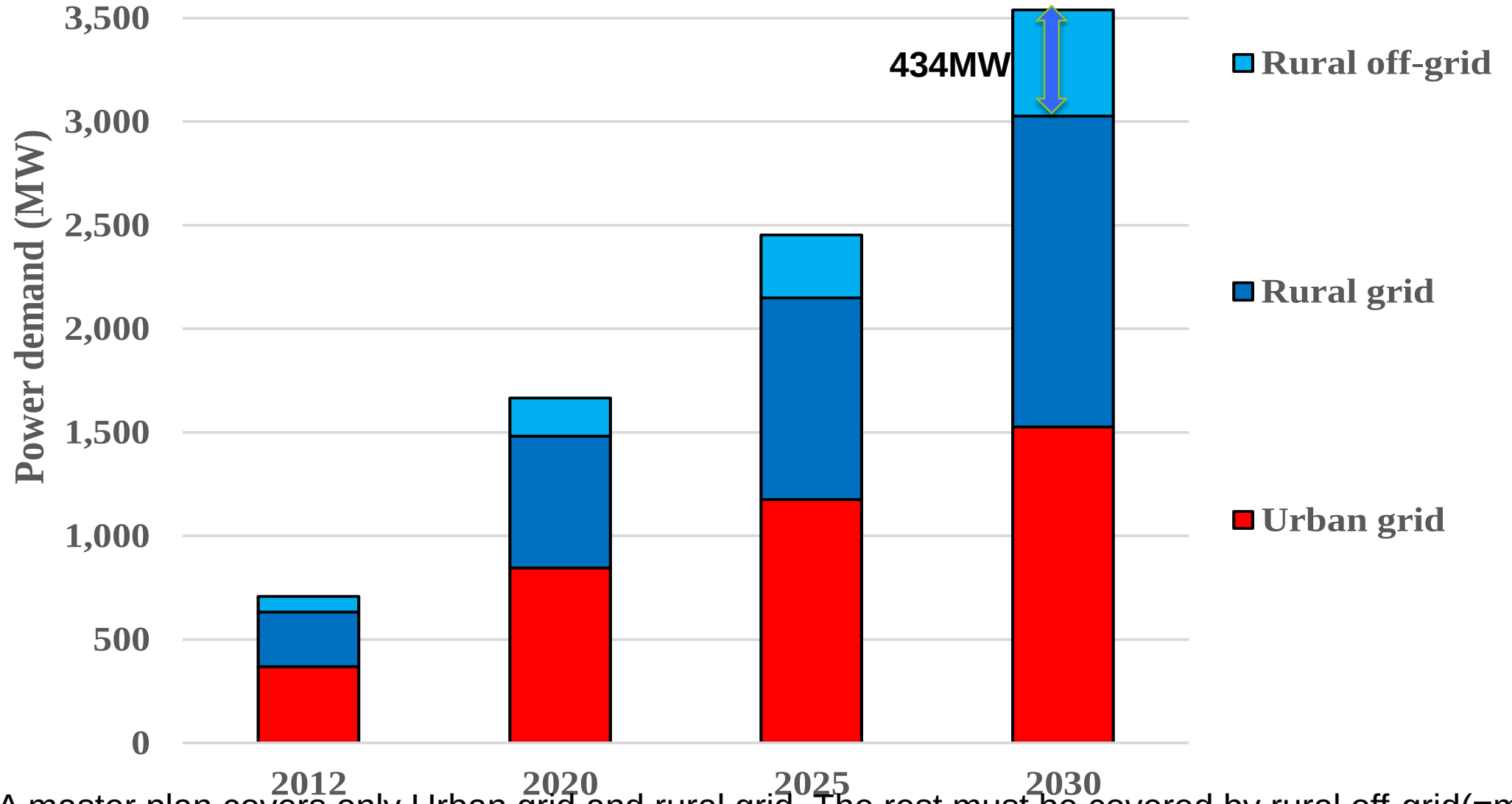
Cost Simulation of unit micro-grid
With “HOMER©” Software.

(3) Development of Preliminary Scenarios

Estimate total cost to satisfy off-grid demand using unit micro-grid cost

Demand projection for rural electrification

To achieve the target electrification rate of 70% for all of Myanmar by 2030, approximately 434 MW of off-grid electrification will be required



JICA master plan covers only Urban grid and rural grid. The rest must be covered by rural off-grid(=micro grid)

Unit cost for micro-grid installation in off-grid Electrification

Case	Component of micro-grid	Unit cost per micro-grid (US$/micro-grid)□Total	Micro-grid number (Electrified villages)	Electrification cost (MUS$) Total
1	PV+Dies+Biog+Bat+Con	212,258	9,989	2,120
2	PV+Dies+Biog+Bat+Con	212,258	1,110	236
3	PV+Dies+Biog+Bat+Con	766,061	2,854	2,187
4	Hydro+Bat +Con	640,603	317	203
5	PV+Dies+Biog+Bat+Con	1,943,341	1,427	2,773
6	Hydro+Dies+ Biog+Bat+Con	736,526	159	117
Total			15,856	7,636
US$ per micro-grid			—	481,584
US$ per kW			—	14,827

Total Electrification (Rural) Cost: 7,636 M USD (Tentative)

Caveats: the results depend on: hydro availability, technology costs (e.g., PV), rather large demand, coarse data resolution

Summary and Future work

- Summary
- (1) Demand Projection of Rural Area
  - To achieve 70% electrification, 434MW should be provided by micro-grid.
- (2) Cost Estimation
  - Unit micro grid cost is estimated at 0.2M USD - 2M USD depending on configurations.
- (3) Development of Preliminary Scenarios
  - We tentatively estimated total cost(inc. capital and operation costs) at 7.6 Billion USD for rural electrification for approx.16,000 micro-grids.

- Future work
  - Improve population data.
  - Improve data for hydro power potential.
  - Consider SHS(Solar Home System) in addition to micro-grid.
  - Produce multiple scenarios that take priorities into account.

Project Overview

<On-Grid>
JICA's Electricity Master Plan

To improve electricity access

<Near Grid>
by expansion of the National grid

<Off-Grid>
by making best use of local resources and enhancing connectivity

<Border>
by building up connectivity with neighboring countries through power trade and FPI.

Bottom-up methodologies for research 2013-2014

1st stage Electricity demand forecast

Fieldwork

Possible power options, cost analysis, etc.

Possible small scaled renewable capacity development options, cost analysis, etc.

Myanmar's interest for power trade and FDI from Thailand, cost analysis, etc.

Case Study

(Good practices from GMS and lessons for Myanmar)

Good practices of renewables and IPPs from GMS lessons and conditions for success

Good practices of power trade and FDI from GMS, lessons and conditions for success

Afternoon's FOCUS

Connectivity development simulation among mini-grids

Possible decentralized connectivity options

Neighboring perspective Thai actors' analysis

Objective view and potential Thai investors' ./ power traders' analysis

Integrated Energy Strategy

HRD/Capacity Building

"National Energy Management Committee" has already been formed under the Vice President. Following up the success of Lao PDR, we will conduct "scenario-making" and prepare policy recommendations that will lead to an "integrated longer-term energy strategy" of Myanmar.

Overview of our ERI/PARI research initiative

- Research counter-part
  - Energy Research Institute (ERI), Chulalongkorn University
  - ERIA, member of Energy Research Institute Network
- Research period

Necessity of power development for enhancing the rural electrification in Myanmar

  - 1st phase: October 1st 2013 – June 30th 2014
  - 2nd phase: July 1st 2014- June 30th 2015 (expected)

- Rationale
  - Necessity of power development for enhancing the rural electrification in Myanmar
  - How to benefit from "left-over" of capital flows from the neighboring countries who aim to fuel own power demand?
  - Win-win bilateral trade between Myanmar and Thailand in IPP business?

Neighboring Perspective

Investment

Generation Project
Coal / Hydro

IPPs Investor
EGATi, EGCO, GPSC

Concerns

Power Trade

Civil / Local Society

Left over

EGAT
Off-take Purchase

MEPE
Domestic Supply

Finance

Lender
Public/Private Bank

Stakeholder Meeting

2013			2014					
OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
⇒⇒⇒ Literature Surveys		● WS1 BKK	⇒⇒⇒ (Un)Structured Hearing		● WS2 BKK	⇒⇒⇒ Structured Hearing		● WS3 NPT
Step 1: Identify the barriers on each case study			Step 2: Analyze the socio-economic factors in identified barriers			Step 3: Seek for how to remove the identified barriers		

Framework for barrier analysis

- Current status of literatures
  - Previous study of IPP mostly focuses on the political and institutional barriers
  - Contrary, major literatures on barriers in FDI discusses wider range of barriers including social aspect
  - UN DESA (2005) indicates the typological approach to analyse barriers multi-dimensionally; (1) Technical, (2) Economic, (3) Political, (4) Legal, (5) Social and (6) Environmental aspects

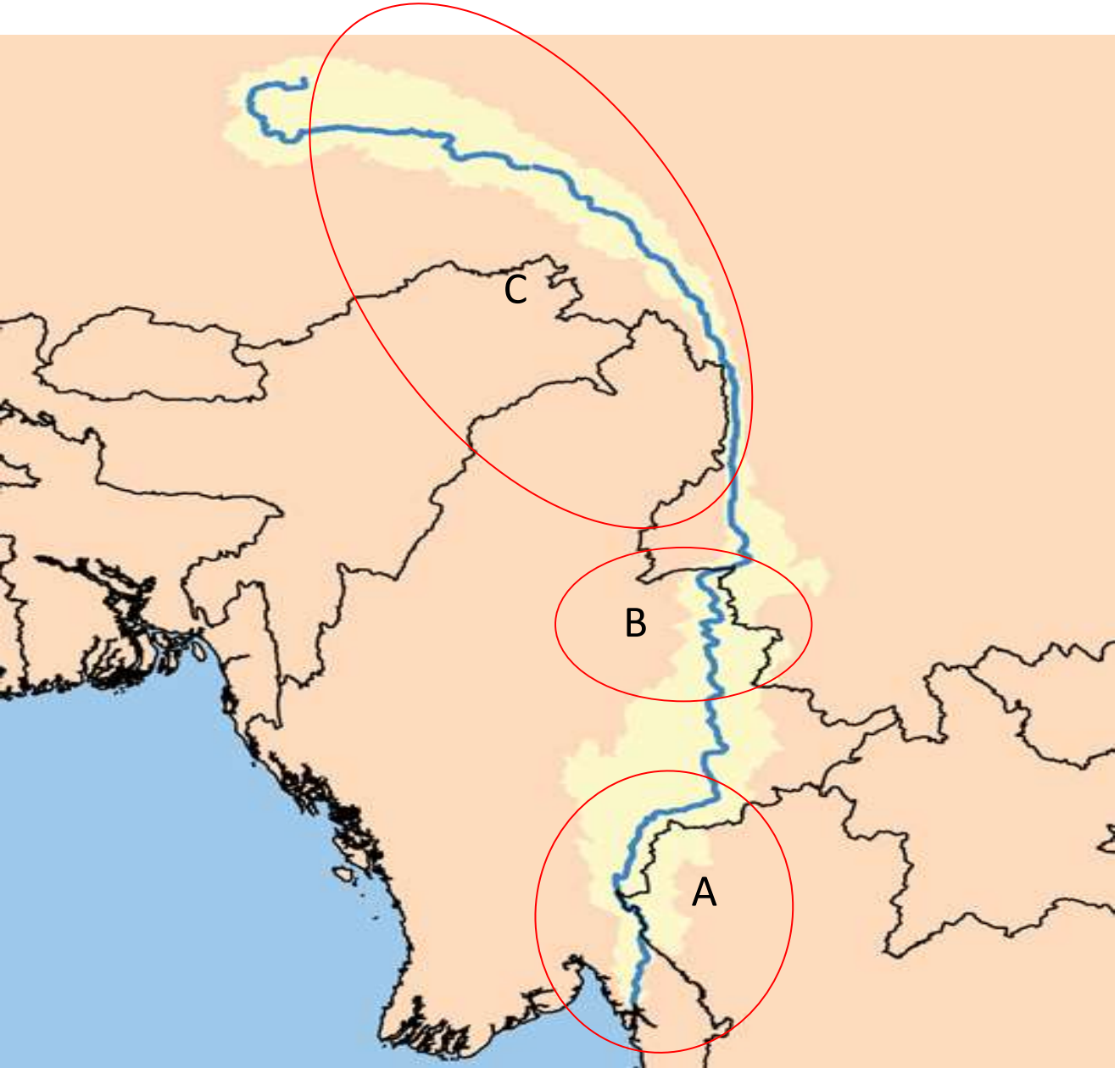
Findings

	Economic Barrier	Social Barrier
Coal-fired plant	•Due to the comparably high operational cost, it is difficult to make the project bankable. •Moreover, It is difficult to get lender such as World Bank and Asian Development Bank.	•Recent environmental NGOs movement should be severer in near future. •A compensation payment attached to its relocation is not so huge as mega hydro.
Hydro Plant	•Though its initial cost is huge, operational cost is low. •With the scale of economy, huge hydro (eg 7,000mw: Tasan) should be economically feasible.	•Larger and larger hydro plants are, severer and severer social/environmental impacts are. •Also, the dam location is mostly in armed conflict areas.

Economic barriers of coal-fired plant (Focus in 2013)

⇒ Social barriers of hydro plant (Focus in 2014)

Next step：Power development in Salween River



- Point A: down-stream of Salween; jointly Thai/Chinese and export to Thailand
  - Thai: Hutghi【1360MW】
  - Thai: Tasan【7000MW (Appx)】
  - Chinese: Wei Gyi 【5000MW (Appx)】
  - Chinese: Ywathit【4500MW】
- Point B: Upper Salween; led by Chinese to export to China
  - Gun Nong Dam(滚弄)【1400MW】
  - Nao Pa Dam (瑙帕)【1000MW】
- Point C: Chinese territory Nujiang (怒江); 13 dams are planned to be developed

- **What are the barrier and its removal in the Salween Development? An implication will be drawn for a further development in Zone “A” .**

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Cooperation for human resource development

The Energy Policy Workshop 2014 (Opening Ceremony)