



Rural Electrification Planning

Private led Rural Electrification: Status and Perspective for Rural Electrification by Renewable Energy Sources



Theng Marith
Director of Electricity Regulation
Electricity Authority of Cambodia

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Past Situation of Energy Use for Lighting in Rural Area

Based on the survey of 2000 the energy sources for lighting in rural area can be classified as below:

- Batteries 55%
- Dry Cell Batteries 24%
- Candles 11%
- REE **04%**
- Small Genset 03%
- EDC Grid **02%**

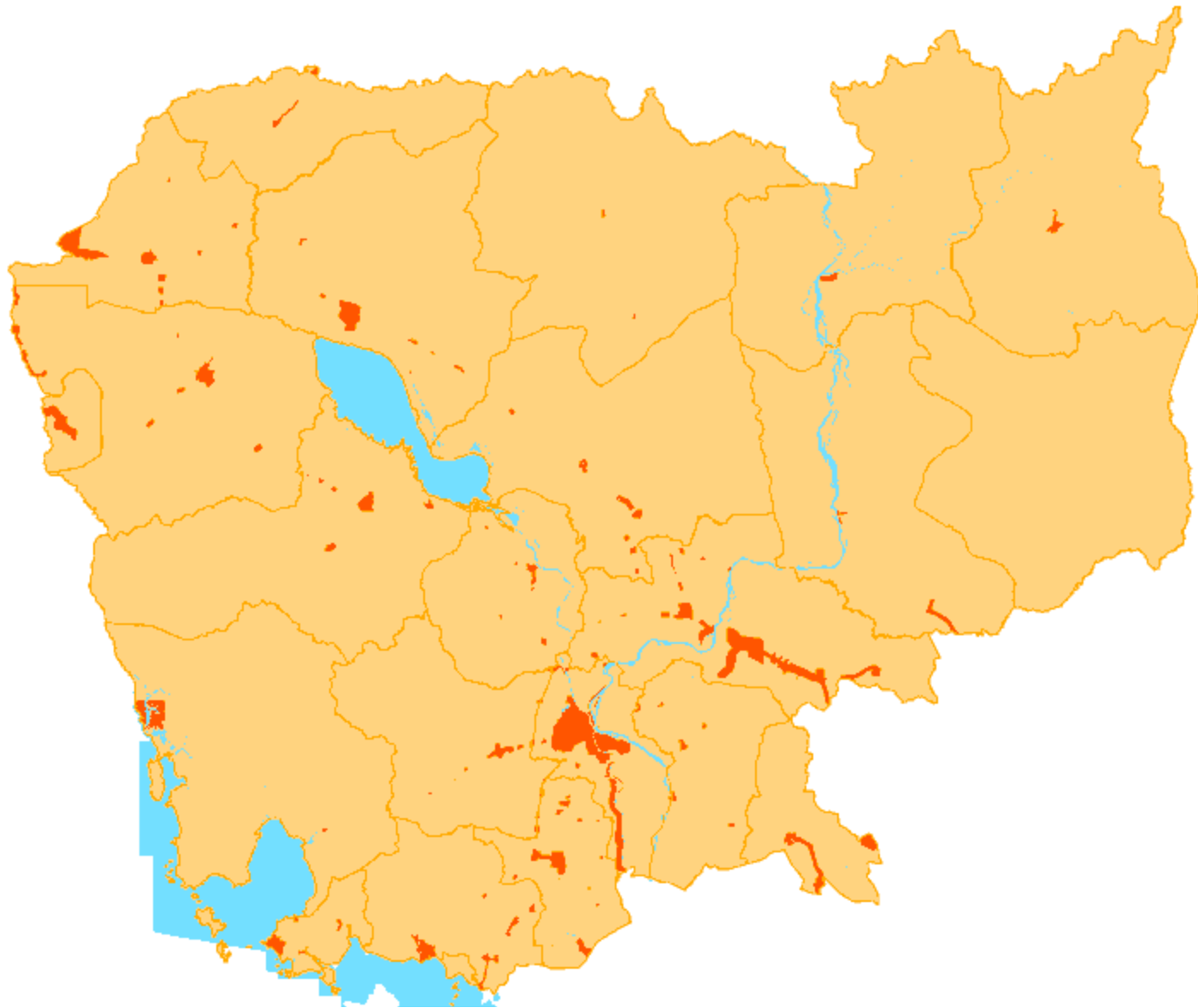
NOTE: In most of the cases, kerosene is used as a standby means for lighting.

Source: MIME

BACKGROUND

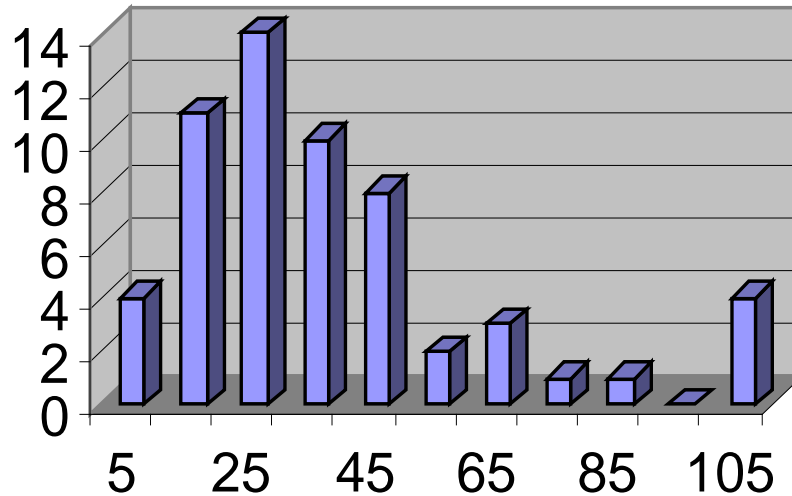
- From 2002 to 2006
- Gather REE to apply for license and recommend them to upgrade their infrastructure
- Technical Standard in Power system in 2007
- Electrification rate increase from 15% to 22% (non official assessment, definition?)
- Energy consumption: 55 to 75 kWh per capita (rough assessment)
- Number of connections in rural area $76,600 + 25,800 = 102,400$ connections in 2006 with consumption of 93,587 MWh.
- Electricity cost, ranging from about US\$ 0.12/kWh in EDC's grid to US\$ 0.30 – US\$ 0.92 per kWh in rural areas served by REE
- Generation in 2006 : 300 MW and 1,090 GWh
- Projection in 2015 : 750 MW and 3,000 GWh
- Main generation source: Diesel Oil & Heavy Fuel Oil
- Some generation based on renewable energy: Anlong Tamei

Distribution Map in 2006



Consumption per connection in 2006

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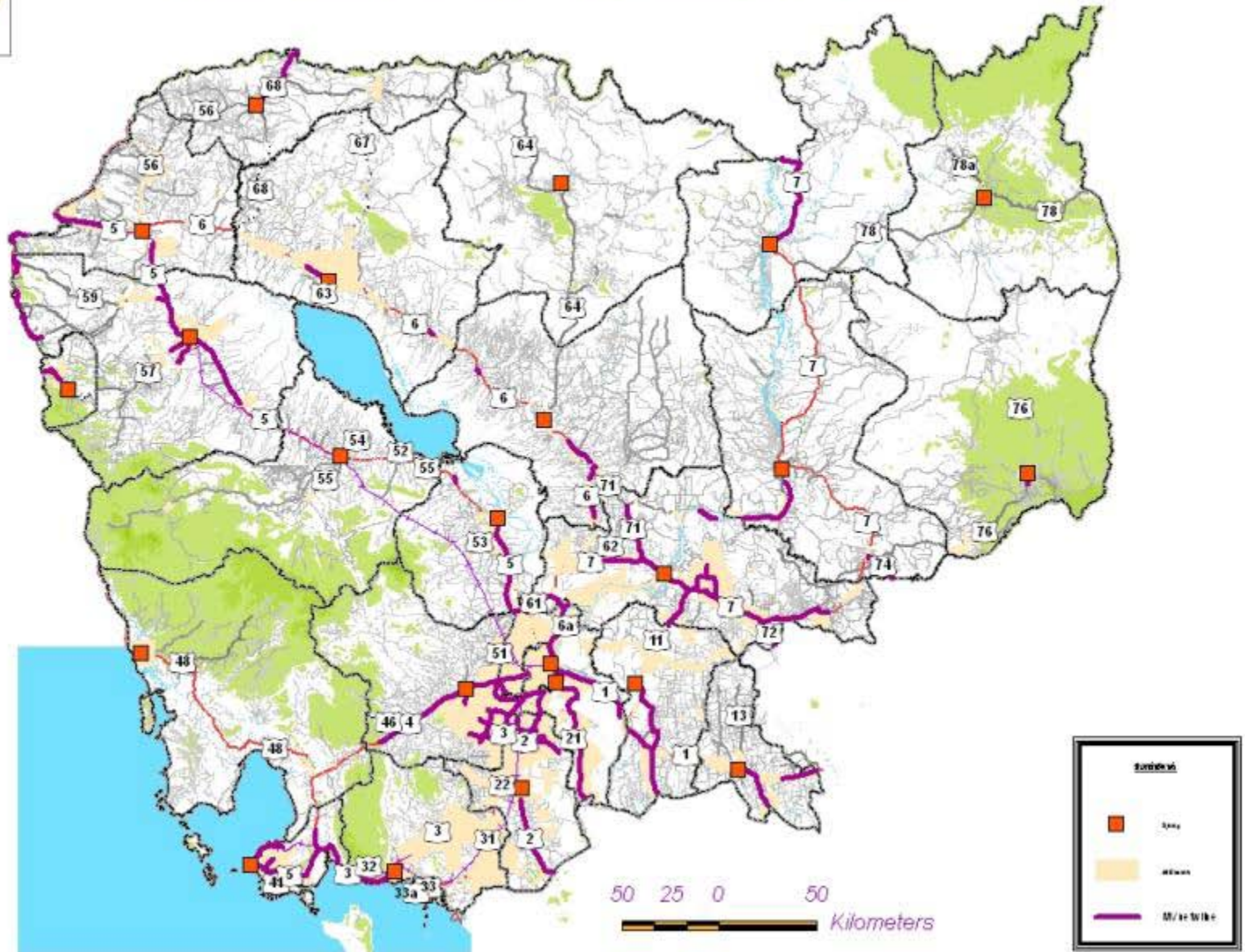
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BACKGROUND

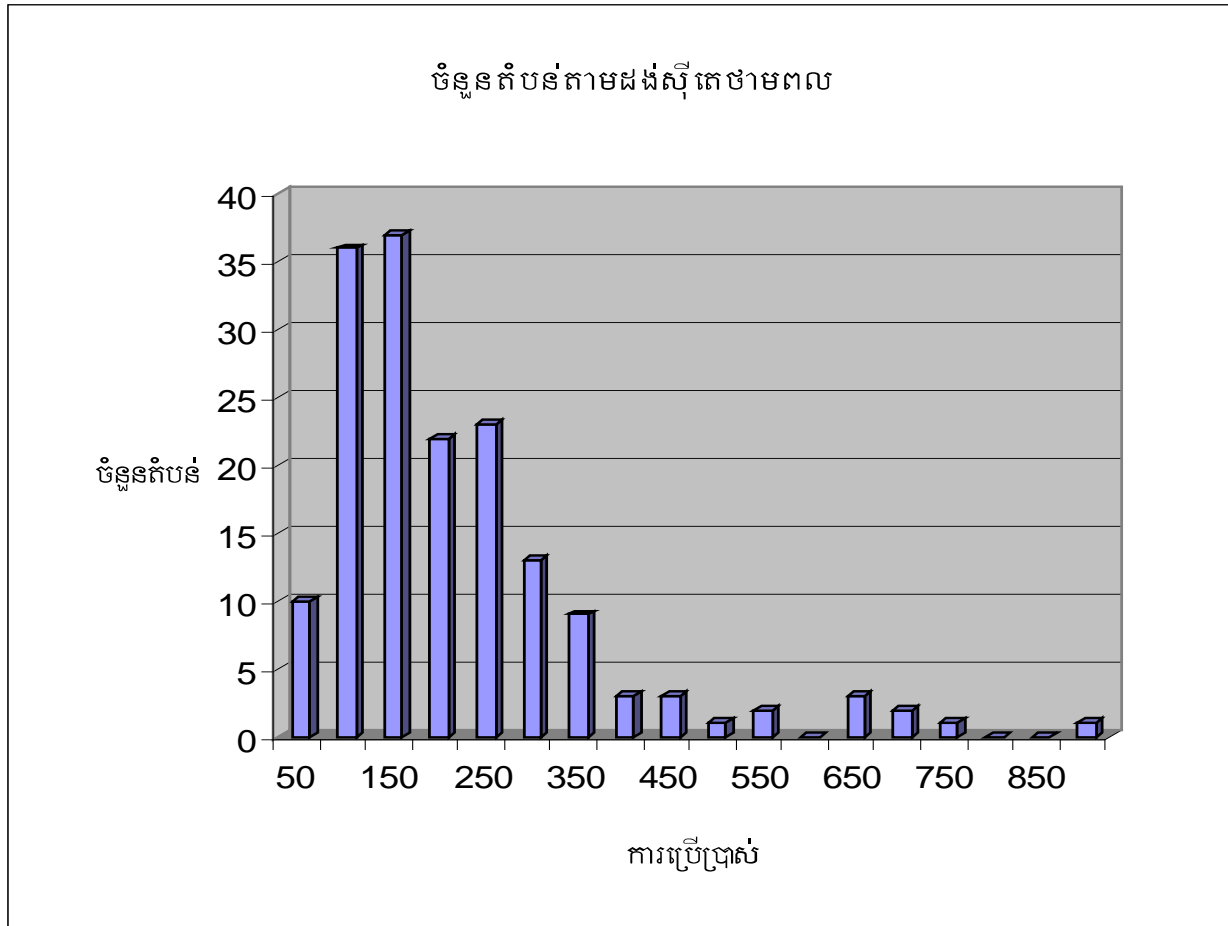
- From 2007 to 2008: Challenge in petroleum crisis period
- REE shall apply themselves for license and recommend to have good infrastructure before issuing license. Special cases are considered for remote area.
- Electrification rate increase fast but difficult to assess.
- 13% of villages are electrified (partly)
- Number of connections in rural area $117,500 + 54,500 = 172,000$ connections in 2008 with consumption 168,177 MWh.
- Energy consumption: from 75 to 115 kWh per capita (rough assessment)
- Electricity cost, ranging from about US\$ 0.12/kWh in EDC's grid to US\$ 0.30 – US\$ 0.92 per kWh in rural areas served by REE
- Generation in 2008 : 384 MW and 1,450 GWh
- Projection in 2015 : 750 MW and 3,000 GWh
- Main generation source: Diesel Oil & Heavy Fuel Oil
- Many temptations in renewable technology (biomass) but not successful in rural electrification.
- There has been project of biomass power plant (4.8MW) in Kg Cham that never started.



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Consumption per connection in 2008



BACKGROUND

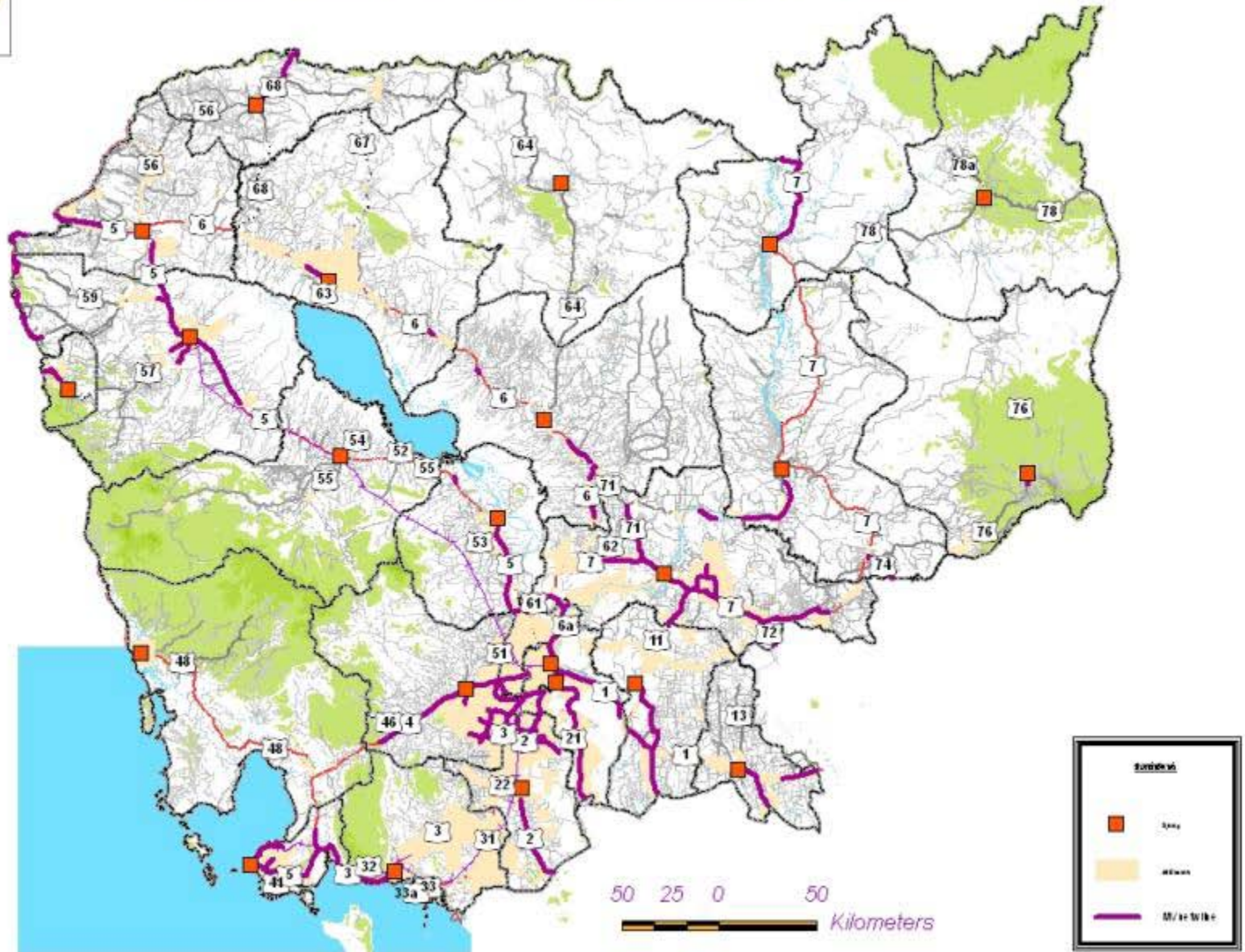
- From 2009 to 2010(?): Challenge in world economic crisis period
- High requirement for new application for license.
- Electrification rate increase fast but difficult to assess.
- >15% of villages are electrified (partly)
- Energy consumption: from >125 kWh per capita (rough assessment)
- Electricity cost, ranging from about US\$ 0.12/kWh in EDC's grid to US\$ 0.30 – US\$ 0.92 per kWh in rural areas served by REE
- Generation in 2008 : 384 MW and 1,450 GWh
- Projection in 2015 : 750 MW and 3,000 GWh
- Main generation source: Diesel Oil & Heavy Fuel Oil
- About 94 zones connected to provincial grid or national grid (expected until end of 2010).

NEW CONTEXT IN RURAL AREA

- EAC start consider the consolidation process of small licensees
- More than 30% of licensees has MV infrastructure
- MV lines connecting from zone to zone are building
- Electricity cost, ranging from about US\$ 0.12/kWh in EDC's grid to US\$ 0.30 – US\$ 0.92 per kWh in rural areas served by REE, but in 50 zones the price is less than 2000 Riels/kWh and about 30 zones the price will be about 1200 Riels/kWh in 2011
- The TL from Battambang to Phnom Penh, from Phnom Penh to Kg Cham and from Tai Ninh to Kg Cham will reinforced the rural electrification process
- Grid expansion goes: 22 kV line connect from Phnom Penh to Krek, to Chrey Thom, to Neak Loeung, to Phnom Den to Kg Som, to Banteay Meanchey, may be to Poy Pet(?) and Thmor Puok(?) and to Kg Thom in 2011?
- What about Preah Vihear, North of Siemreap, Uddor Meanchey?



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National Policy in RENEWABLE TECHNOLOGY

- Encourage the most efficient systems for generation, transmission and distribution of electricity from clean and renewable energy sources, to enable a **rational electricity tariff policy** through promotion of differentiated tariffs based on cost recovery principles;
- **Promote renewable electricity systems for rural applications, as part of a national portfolio of grid and off-grid technologies, provided they are the least-cost option for the national communities;**

RURAL ELECTRIFICATION COMPONENTS

- **Goals:** by *2020*, all villages will have access to electricity of different forms; and the year *2030* -70% of all rural H'holds will have access grid quality electricity.
- **Main components of the Rural Electrification Strategy:**
 1. Grid expansion from the existing
 2. Diesel stand-alone, Mini-Utility Systems (to avoid small system)
 3. Cross-border Power Supply from neighboring countries (Thailand, Vietnam and Lao PDR)
 4. Renewable Energy (Solar, Wind, Mini-micro hydro, Biomass, Biogas, Bio-fuel, etc...)

Bad factor of Renewable energy

- **From 2006 to 2008**, some REE have try to use biomass, base on wood, agriculture waste or rice husk, but not successful.
- **Some organization (SME) try to promote this technology but no success history in rural electrification, (success history in cogeneration)**
- **Why? difficult to answer but there are simple reasons:**
 1. Investment cost is very high for rural investor, so not attractive to other investor,
 2. REE use self made gazeifier, so the gaz is not good for their engines, => maintenance cost is very high
 3. Some project: Anlong Tamei, Angkor Biocogen, OMO. But the investment process very slow, so until now, no demonstation
 4. **Project FondEM, Jica (Mondulkiri, successful, but with limitations), Some companies in Kg Cham, Kg Chhnaing and Kg Thom (but without project documents)**

Anlong Tamei community

- 15kW genset and 3 km of LV line
- Upgrade to 20 kW but not registered
- In Anlong Tamei, the capacity is small. The solution is for a small community on the road near Battambang. The price is about 2000 Riels/kWh (first proposed 1200 Riels/kWh): lack of reserve for further development and further demand growth. The network is not standardized



Mondulkiri mini HPP

- Capacity 2 x 185 kW
- 28 km MV line and 33 km LV line
- Can supply the provincial town, with some limitations in dry season.
- The solution is considered as hybrid system with 300 kW Diesel Genset, then the cost is not cheap as forecasting.
- Issues in growing demand in the near future.
- tariff 1500 Riels/kWh for household



Paoychar community

- Now in Paoychar, under grant from Gtz, the project is based on jatrophar. Gtz help community in building a good LV line with option for upgrading to a system with MV line in the future by REE. The generation is based on jatrophar oil and D.O. The capacity of generation should be increased to adapt to future demand.
- under construction

Veal Veng REE, Pursat

- Generation based on biomass (wood).
- For Ice making machine and supply to the district town area
- under assessment

FondEM project

- The first implementation has a small capacity (11 kW) to supply to 100 families in a town with 200 families. So some conflict for the community and may cause discrimination from the first time. The total project cost is estimated to about 5 millions US\$.
- In the project, there are solar components.

OMO

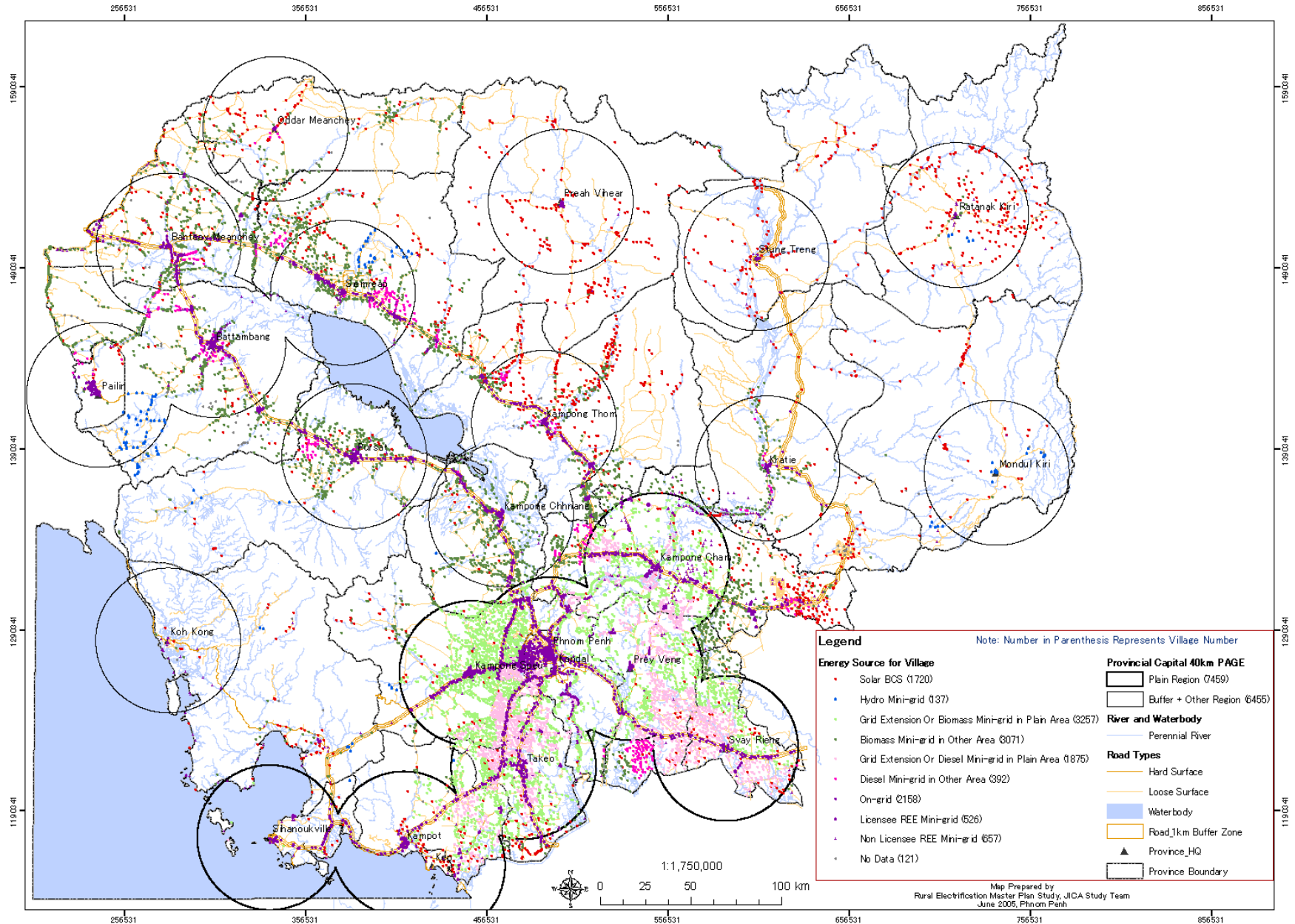
- Generation based on rice husk
- For rice mill in Skun, Cheung Prey district, Kg Cham.
- But the project is not complete because of unwilling of the investor.

End of Presentation

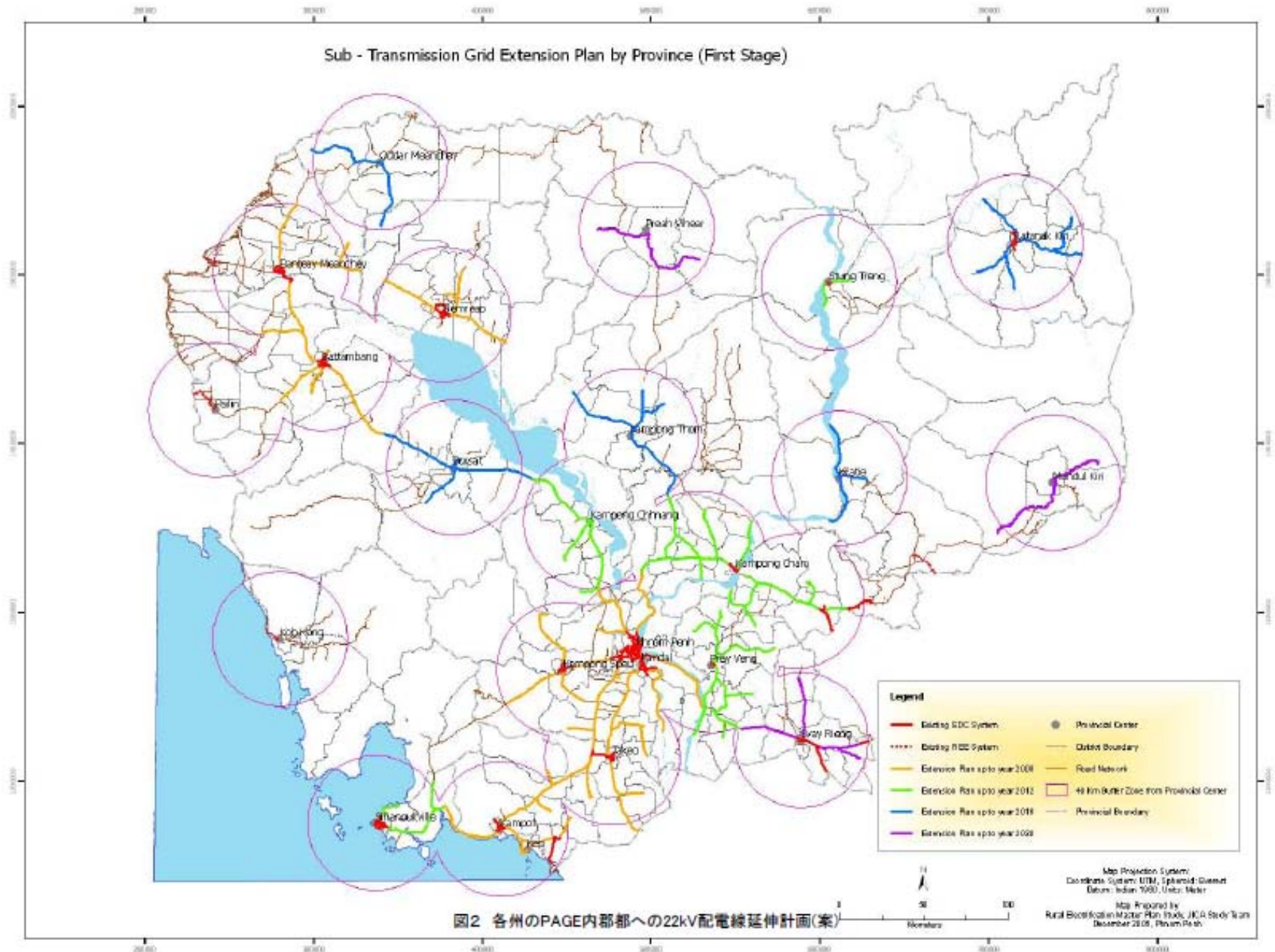


Thank you for your attention.

Candidate Energy Sources by Village



Proposed Extension of Sub-transmission Lines



Proposed Extension of National Grid

- a plan proposed to achieve grid electrification -

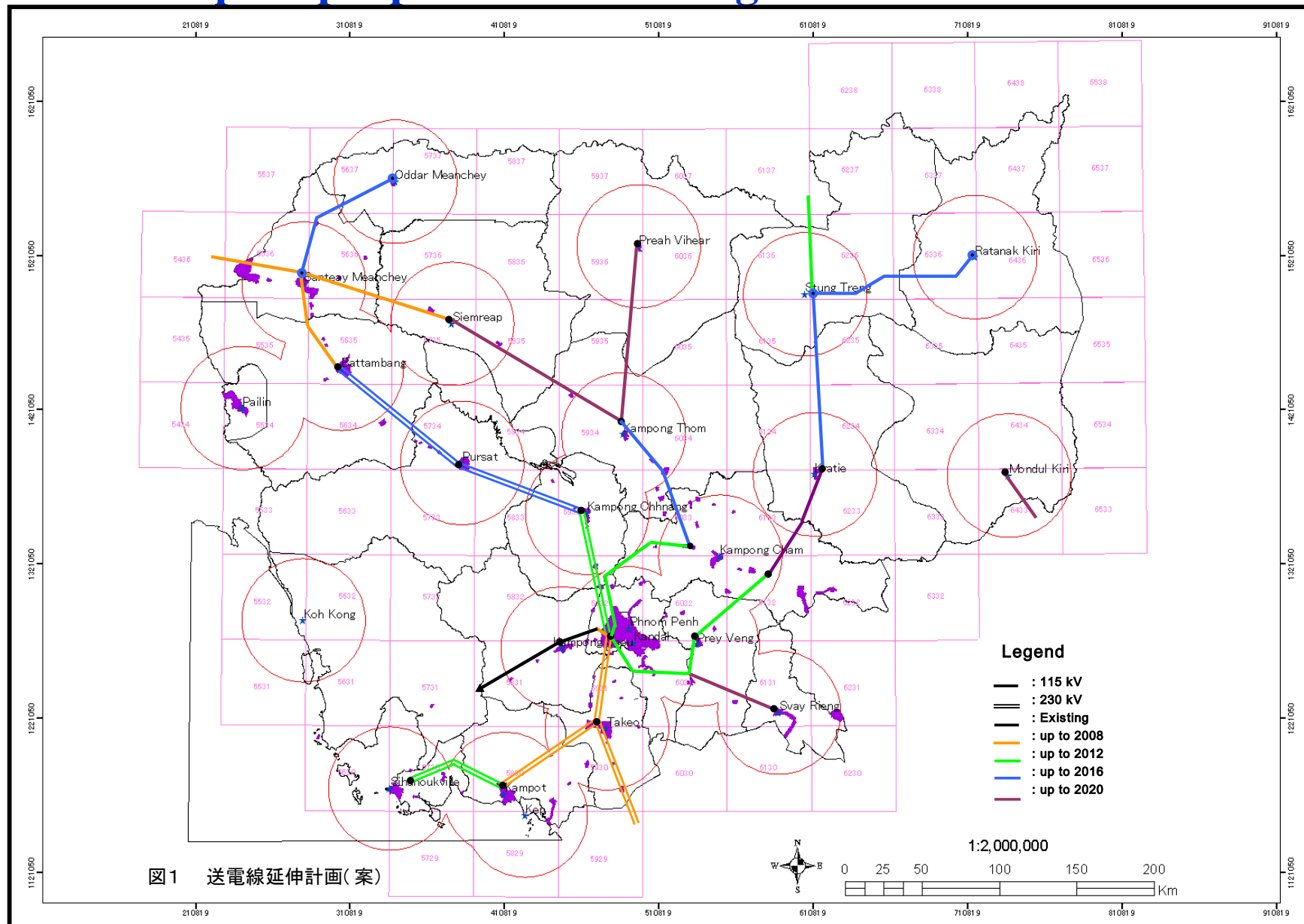
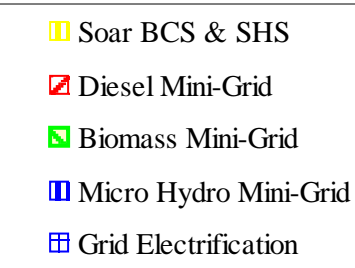
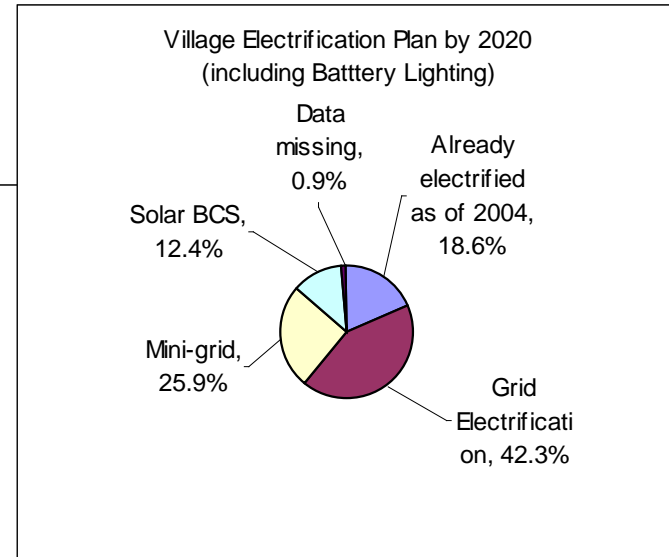
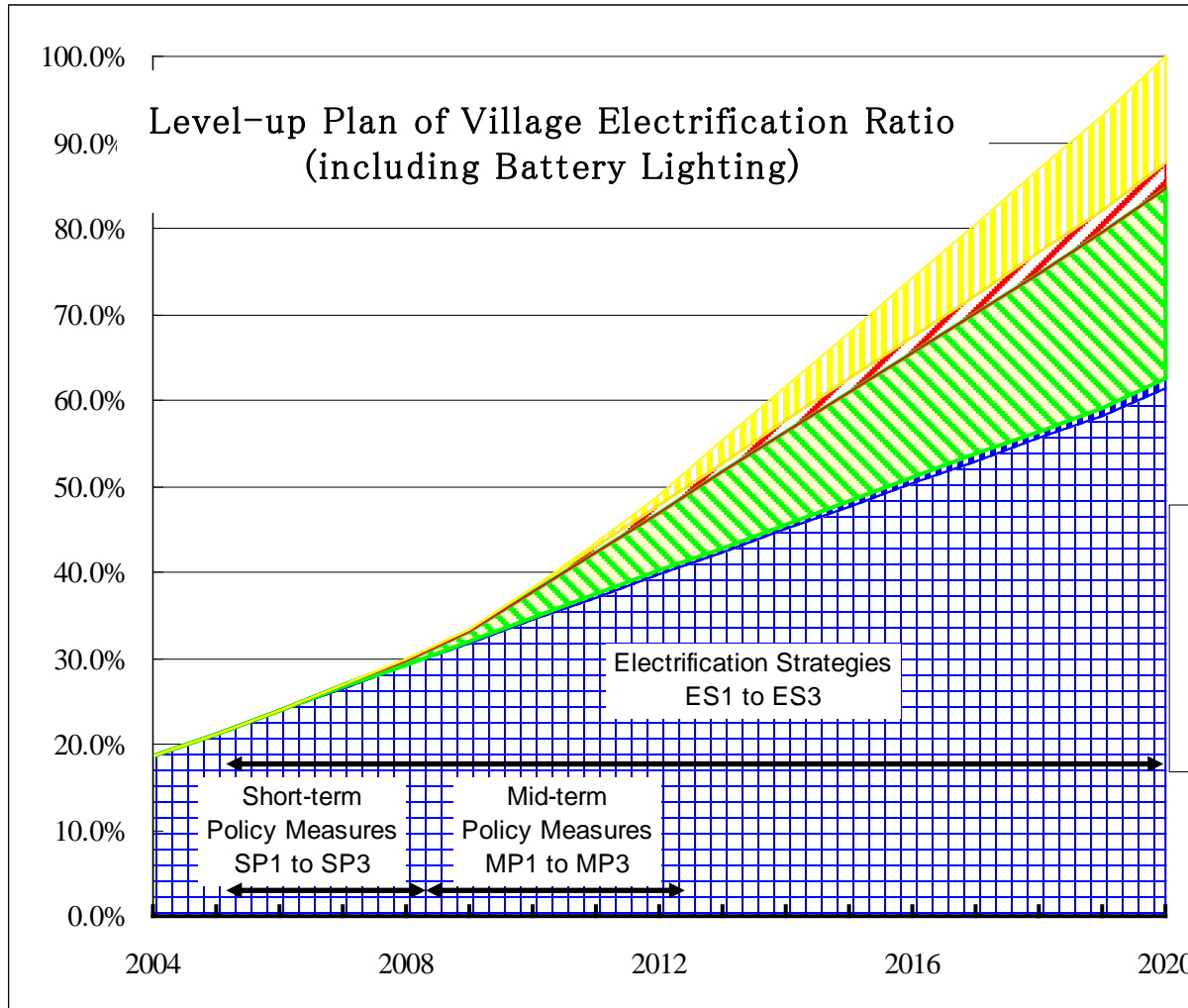
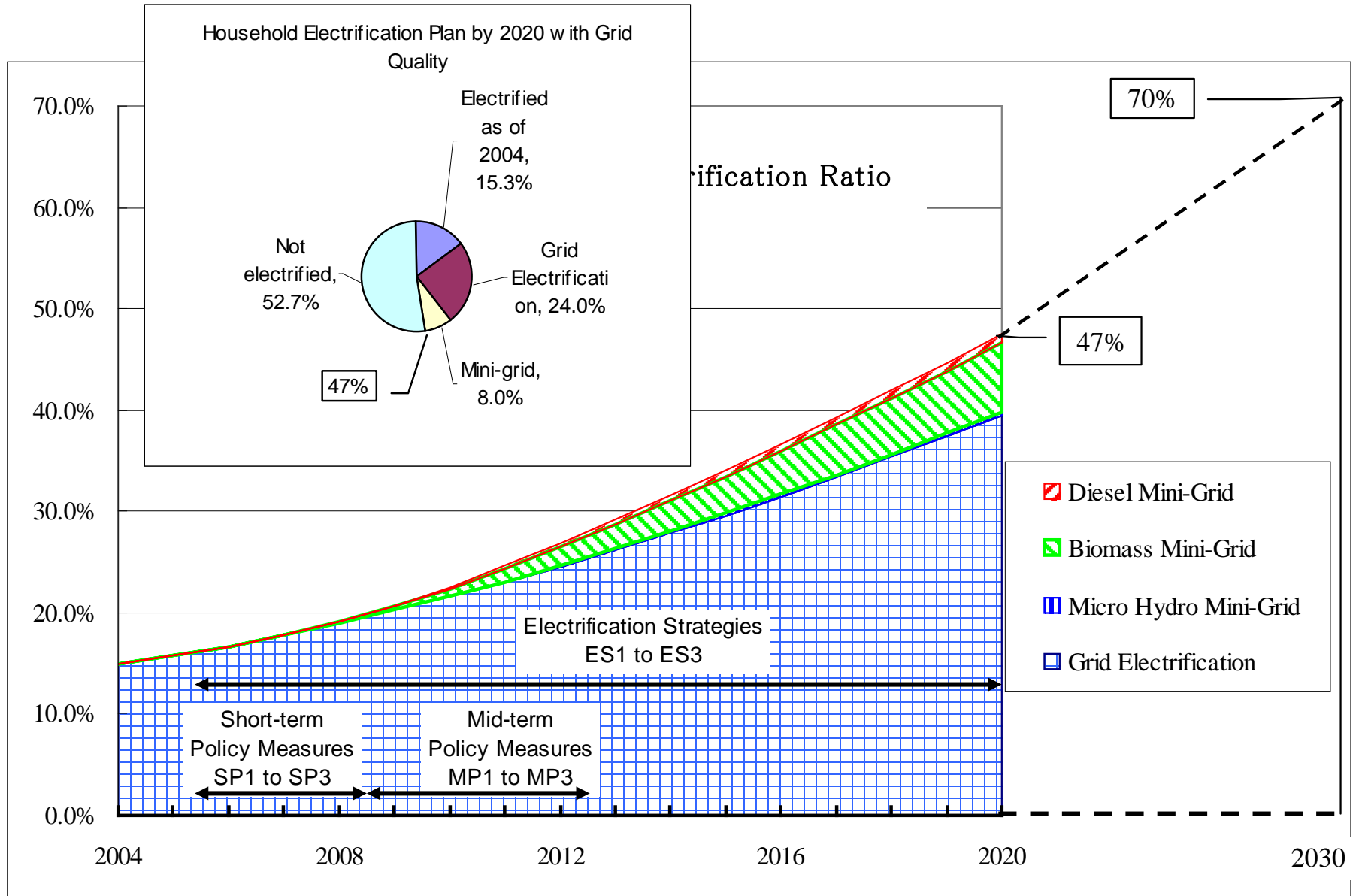


图1 送電線延伸計画(案)

Village Electrification Plan



Household Electrification Plan



Summary of Off-grid Electrification

Name of Representative Regions	Energy Sources	Number of Villages	Number of Households	Target Number of Households for Electrification by the Year 2020
Off-grid Area (2020)				
Northeast, Southwest and mountainous areas	Micro hydro, hybrid	137	18,541	9,000 (50% of left)
Tonle Sap coastal region, etc.	Biomass gasification	3,071	501,636	168,000 (33%)
	Diesel	392	69,390	23,000 (33%)
Sub-total of mini-grids		3,600	589,567	200,000
Northeast or North provinces	Solar BCS/SHS	1,720	237,570	60,000 12,000