



Renewable Energy Development in Cambodia

Institute of Technology of Cambodia

BACKGROUND

- Cambodia, situated in Southeast Asia, shares borders with Vietnam, Laos and Thailand. Land area : 181 035 sq. km
- Population: 13.3 million (83% in rural areas)
- GDP: US\$280 per capita
- Electrification rate : 17% (urban~54% and rural~13%)
- Energy consumption: 55 kWh per capita
- Electricity cost, ranging from about US\$ 0.14/kWh in EDC's grid ,to US\$ 0.30 – US\$ 0.92 per kWh in rural areas served by REE
- Generation in 2007 : 200 MW and 1,071 GWh
- Projection in 2020 : 3,502 MW and 18,597 GWh
- Main generation source: Diesel Oil & Heavy Fuel Oil
- High potential of hydro source : more than 10,000 MW

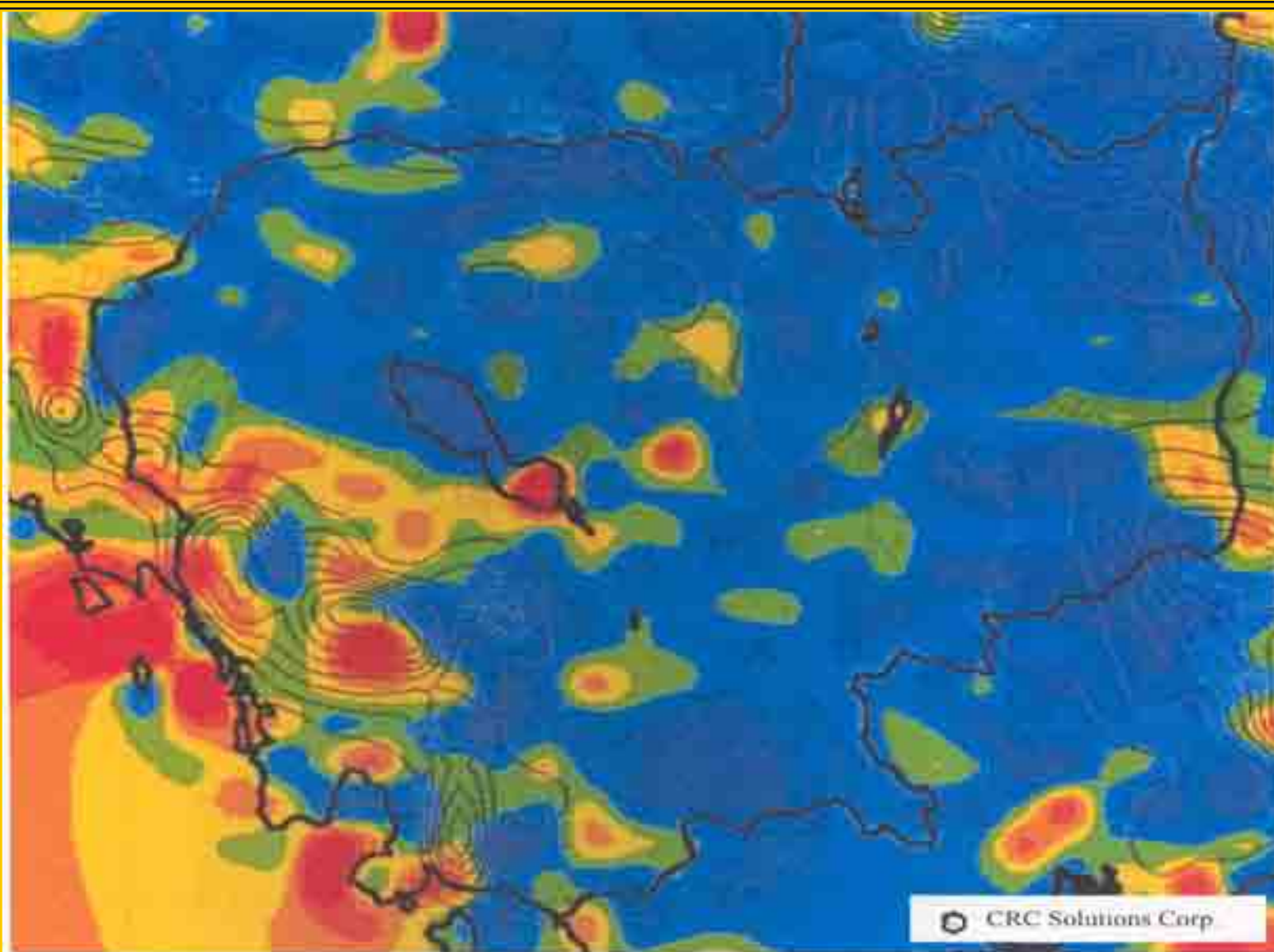


POTENTIAL RENEWABLES RESOURCES

- **Solar Energy**: the average sunshine duration of 6-9 hours per day, giving an average of 5kWh/day. thus, considerable potential of solar energy. Total installed capacity is around 3,000 kWp.
- **Wind Energy**: The southern part of the great lake Tonle Sap, the mountainous districts in the southwest and the coastal regions, such as Sihanoukville, Kampot, Kep and Koh Kong have the annual average wind speed of 5m/s or greater. The total area around 5%.
- **Hydro**: The potentiality (10.000MW, but current contribution to electricity production less than 20MW).

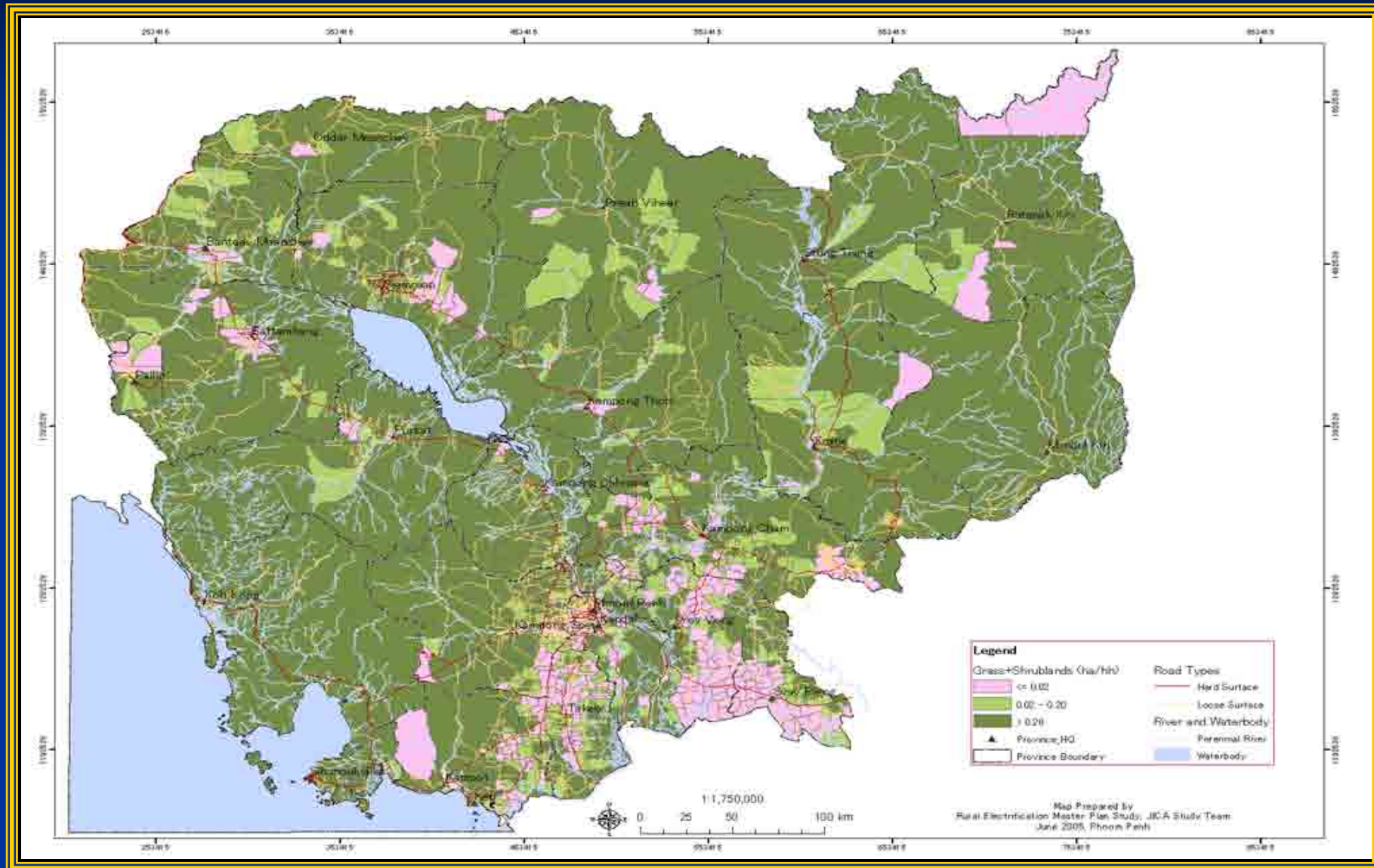
POTENTIAL ENERGY RESOURCES (Con't)

- **Biomass:** The report prepared by NEDO on “the Assistance Project for the Establishment of an Energy Master Plan” identified significant biomass energy resources from a variety of agricultural residues such as rice husk., Cassia, Cassava, Luscenia, Mulberry, Coconut, SEM, Pro.....
- **Biogas:** The effectiveness of small scale biogas has been demonstrated in Cambodia by a number of different projects. The use of animal wastes to generate high quality gas for cooking has significant economic, health, social and environment benefits for poor rural households.
- **Biofuel:** Jatropha – 200 ha (Fencing), Palm Oil – 4,000 ha (recently) and can be 10, 000 ha and sugar cane 20,000 ha.

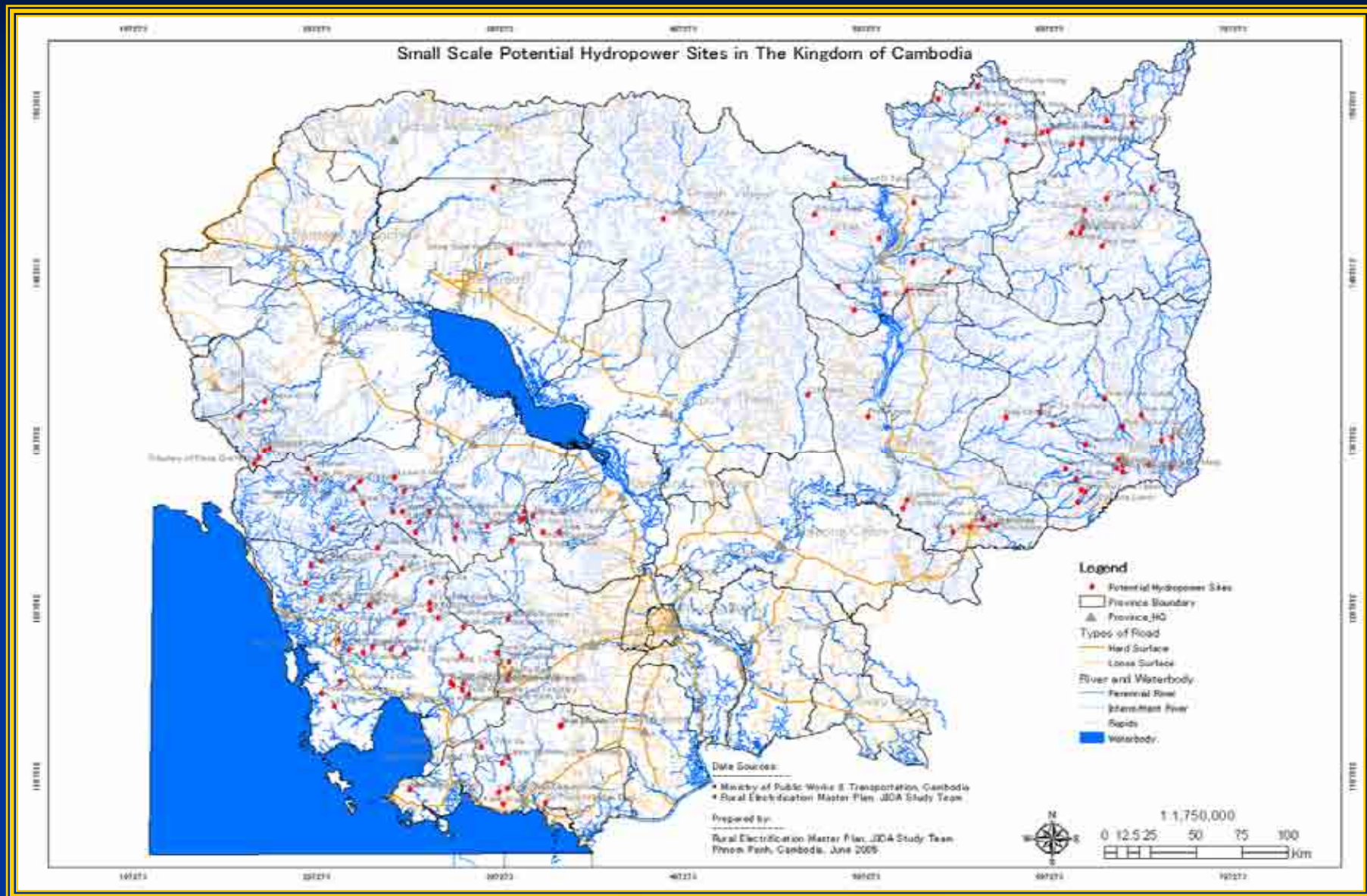


wind condition simulation results (annual wind condition map)

Grass and Shrub Lands (ha/hh) for Biomass and Biofuel



Potential of Small Hydropower





Micro and Medium hydro Power Plant



Pico-hydro power plant



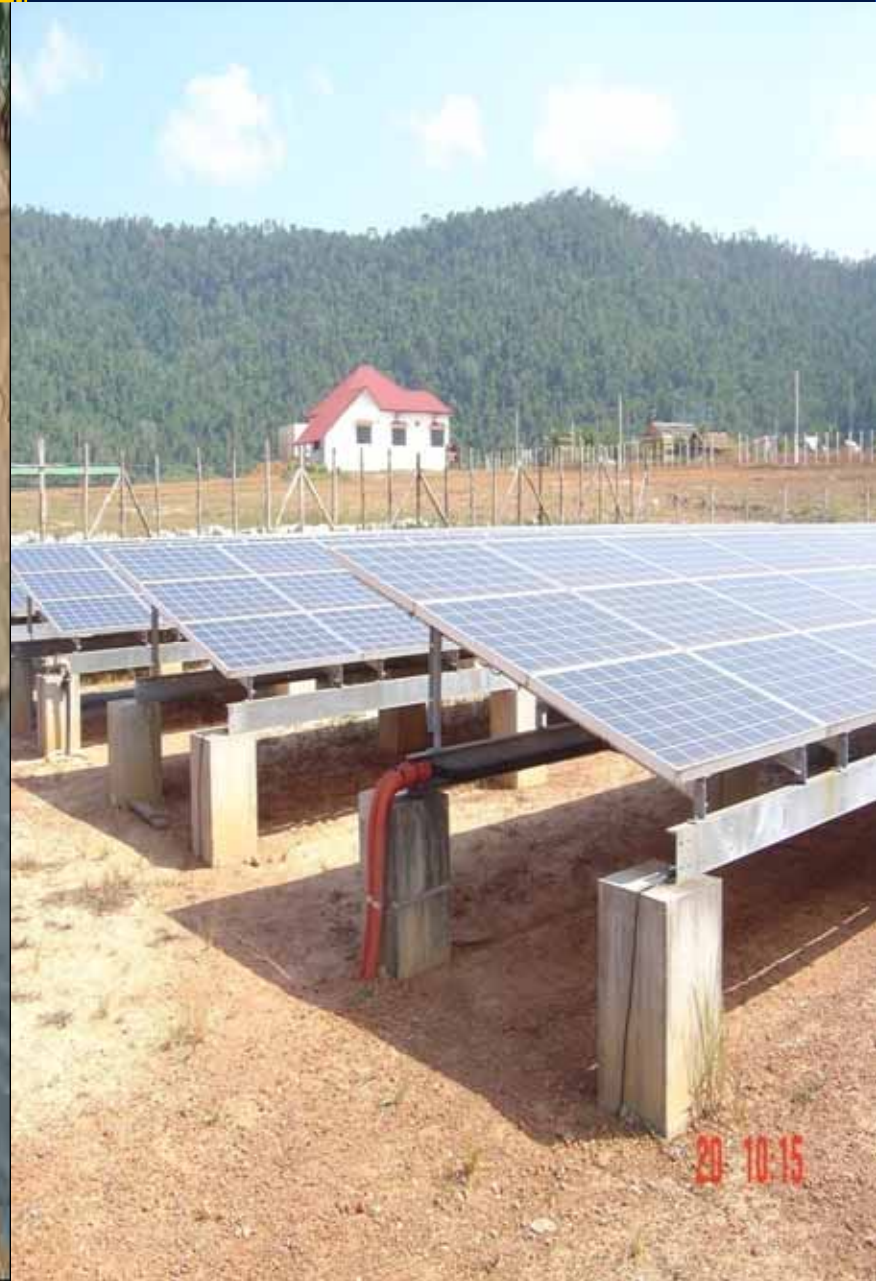
Popularization of Biomass Power



Luciana Plant for Biomass Gasification in Rokar Ar, Kompong Cham Province



PV-Research Cooperation Project (MIME-NEDO)



Solar system at School



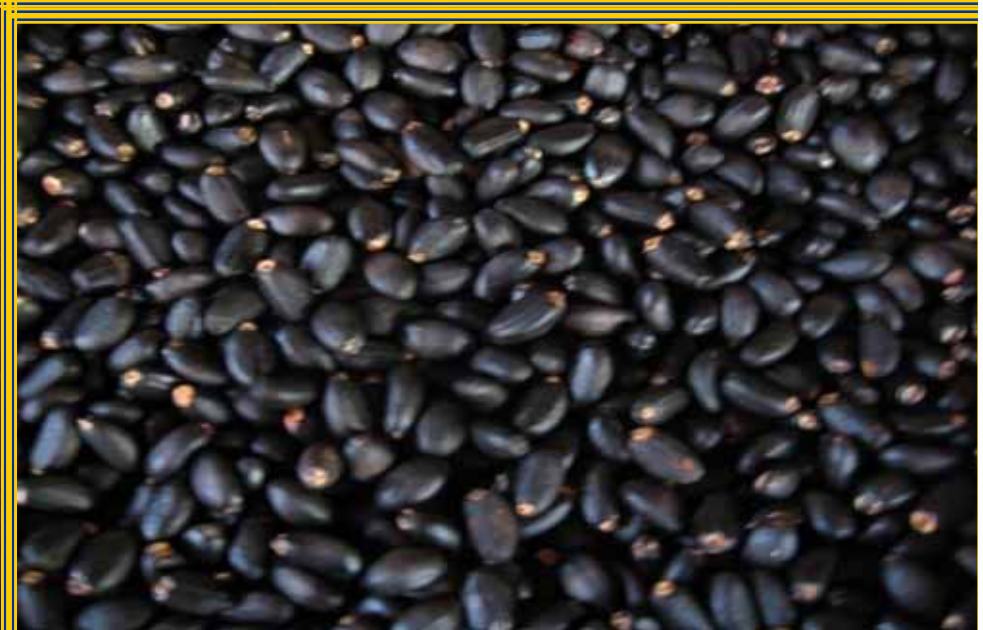


Solar System at Health Center



Solar Home System in Rural Household

Biofuel experiment







**ADAPTIVE
RESEARCH
PROGRAM**



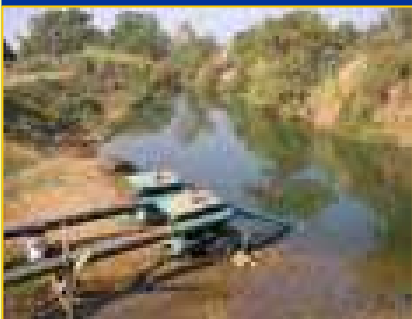
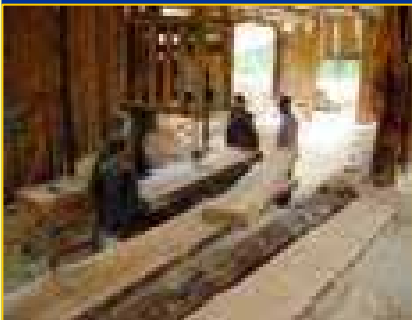
RURAL ELECTRIFICATION STRATEGY COMPONENTS

- **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
 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...)

MASTER PLAN STUDY ON RURAL ELECTRIFICATION BY RENEWABLE ENERGY BY JICA, JAPAN

- **GOAL** To improve the current level of electrification and for the poverty reduction as well as enhancing education and medical treatment in the rural areas.
- **PURPOSES**
 - Study of policies to promote electrification in those areas not yet serviced
 - Introduction and development of Renewable Energy Technologies
 - Study of institution and organization for sustainable operation and maintenance supported by the appropriate business model, including the financial procurement plan.
- **TARGET** To achieve 100% Electrification of Rural Villages by the year 2020.

Framework Goals and Targets



Goal

- Reduce poverty level
- Improve living standard
- Foster rural economic development

Effects of RE

Targets of Rural Electrification Sector

- (1) 100% village electrification by 2020
- (2) 70% household electrification with grid-quality electricity by 2030

Levels of Rural Electrification

- **Three levels of electrification**

Level 3: National Grid (grid electrification)

2: Mini-grids

1: Battery lighting

} off-grid areas

- **Use of renewable energy**

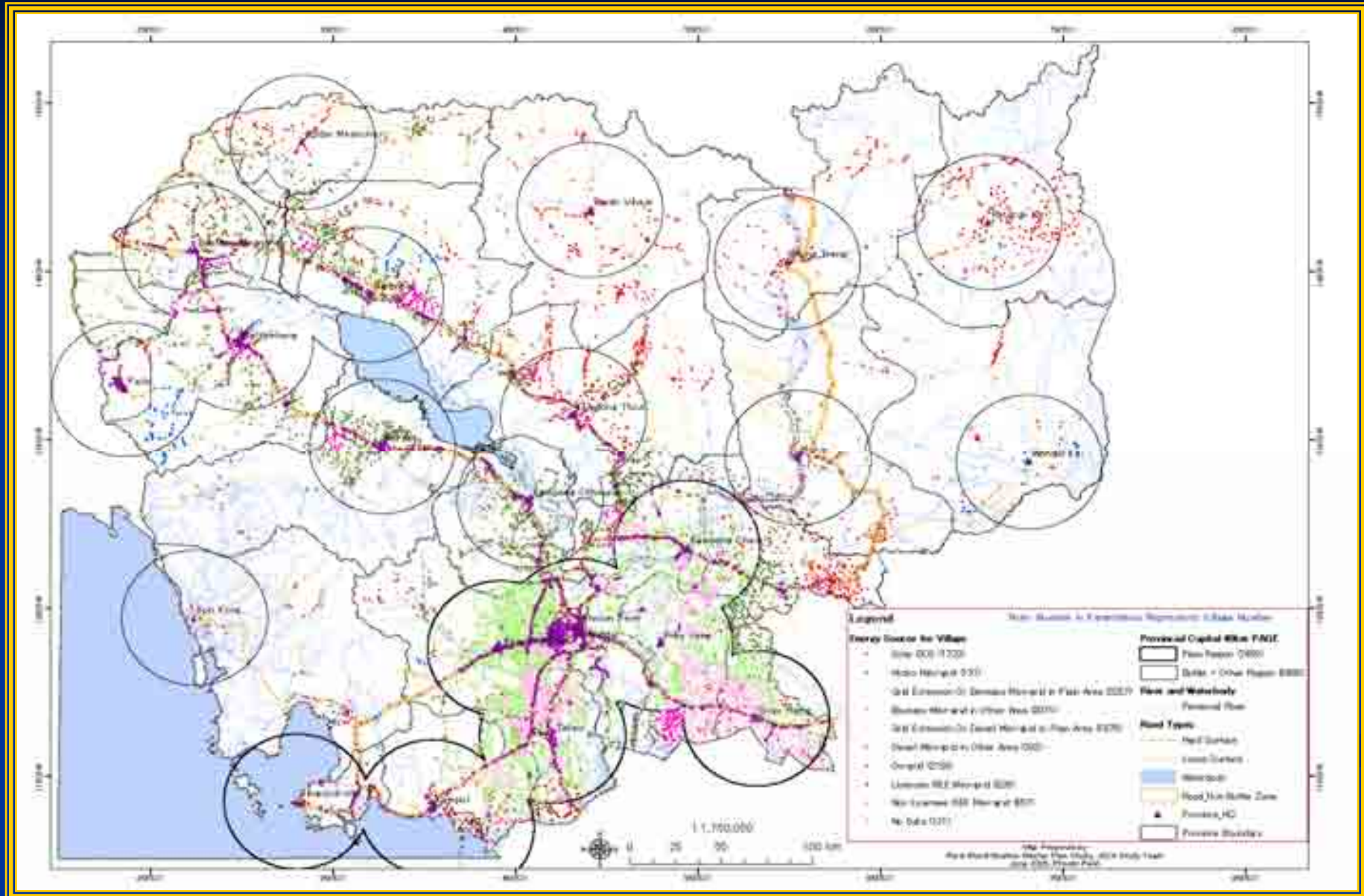
Mini-grids: biomass and micro hydro

BCS: solar, (locally wind)



BCS

Candidate Energy Sources by Village



THE PROJECT INCENTIVE

Type	Grant proposed, US\$ per household connected	Estimated total cost/unit in US\$
New household connected (diesel)	45 \$	150 \$
Mini hydro from 0.5 MW up to 5 MW	400\$/kW installed	1744\$/kW installed
Micro hydro From 50 kW up to 500 kW	400\$/kW installed	2700\$/kW installed
Solar Home System	100\$/set	400\$/set of 40 Wp

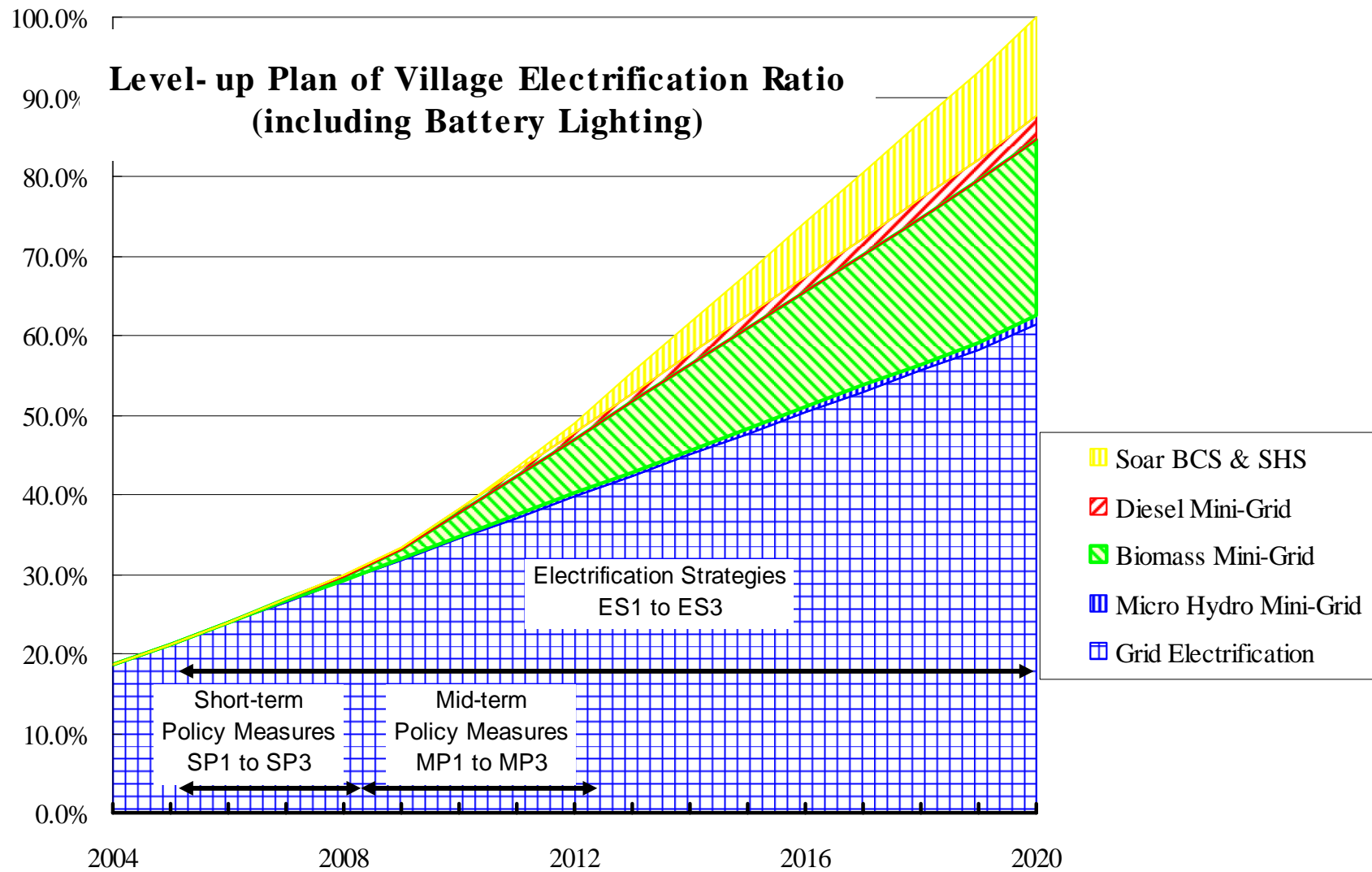
Needs to RE (JICA)

(Unit: \$ million)

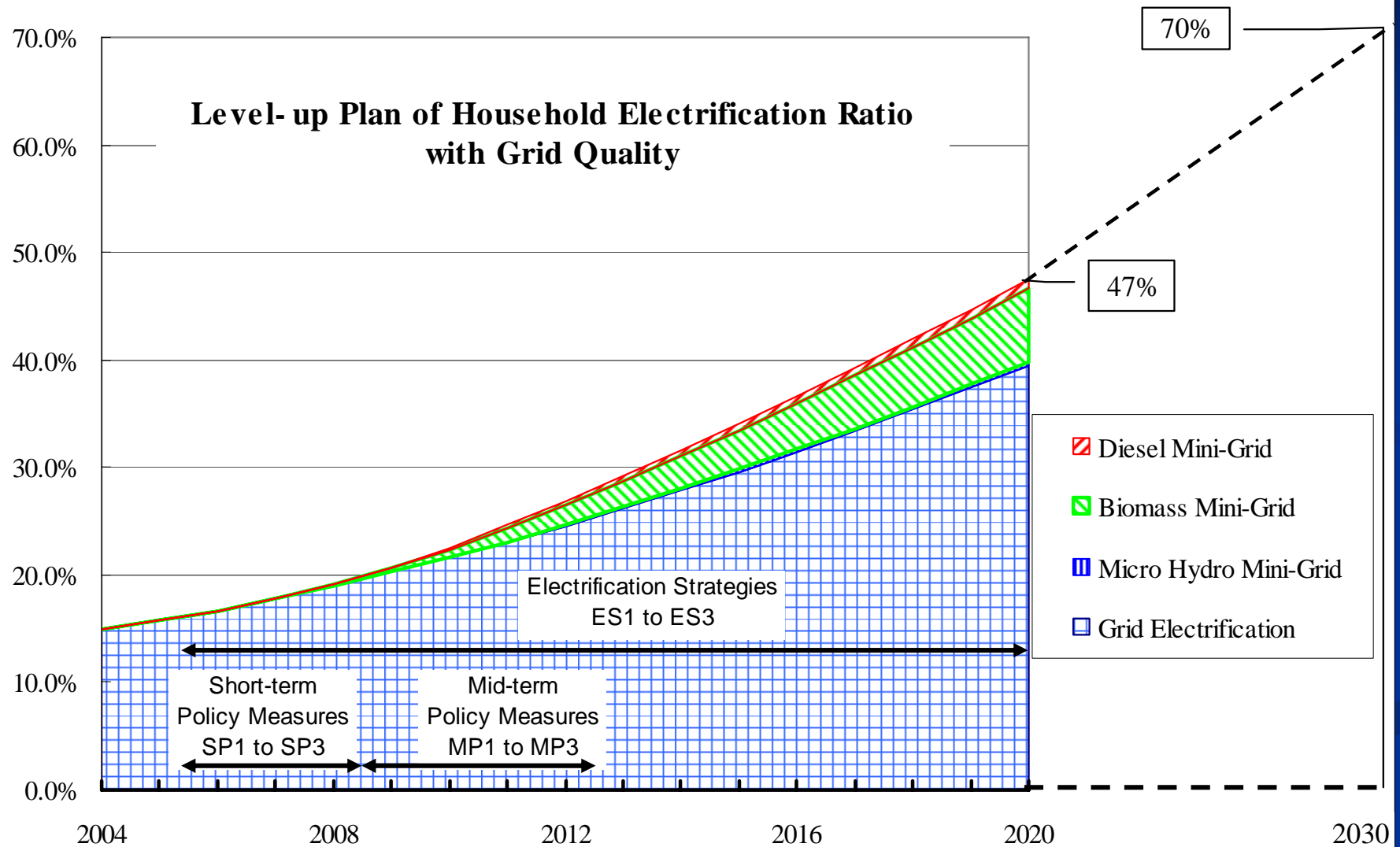
Type of Electrification	Nos. of Villages	Nos. of hh to be newly electrified by 2020	Total Costs	Per hh Costs (\$/h.h.)	Financing Sources		
					Subsidy	Equity	Loan
Grid electrification	6,411	600,000	280	467	70	42	168
Off-grid electrification	5,320	272,000	147	540	54	21	72
Total	11,731	872,000	427	490	124	63	240

- **272,000 households** awaiting RE by 2020
- In Cambodia, 880,000 hh using battery
- These have **ability to pay** for mini-grids (\$3-5 per hh per month)

Village Electrification Plan



Household Electrification Plan



Strategy for Promoting RE

Electrification Strategy (ES)

ES1 Formulation of National Electrification Program

**ES2 Grid electrification with government initiative and
Off-grid electrification with private sector initiative**

ES3 Establishment of implementation and supporting system

ES4 Financial arrangements for subsidy and soft loans

ES5 Supports to CEC/REE

Short-term Policy Measures

Short-term Policy Measures (SP) (2006-2008)

SP1 Financial arrangements

SP1-1 Creation of tax exemption system on imports
of renewable energy equipment

SP1-2 Creation of cross-subsidy system

SP2 Preparation for establishing non-profit SPC

SP2-1 Improvement of access to soft loans

SP2-2 Establishment of supporting system to CEC

SP3 Implementation of pilot projects

(micro hydro, biomass, solar BCS)

ANGKOR WAT

View from Balloon

Siem Reap

CAMBODIA

Thank for your kind attention !

