"Transitioning the South Asian Energy Market: Advancing Low Carbon Growth Through Regional Cooperation and Cross-Border Energy Trade"

Clean Energy Development in Bangladesh

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Bangladesh Power Sector Overview

- **Growth:**10% in FY 2010, (avg 7.0 % since 1990)
- **Installed** Generation capacity: 6361 MW
  (Public: 56%, Private: 44%)
- Total demand (Grid connected): 6,000 MW (with DSM)
- Average generation (Grid connected): 4,300-4,700 MW
- Highest generation: 4,890 MW (13th June, 2011)
- Per capita generation: 220 kWh (grid); 236kWh (including captive and renewable)
- Access to electricity: 49%
- Total consumers: 12 Million
- Distribution line: 270,000 km
- Distribution loss: 13.1%
- Total Generation From RE 50MW

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Key Considerations

- Per capita consumption among lowest in the world
- Average GDP Growth 6% implies efficient use of electricity
- Energy efficiency program, DSM, supply side management ongoing
- Electricity viewed as a public goods as opposed to private goods
- Share of liquid fuel to **continue to** increase in short and medium term plan
- Share of coal to increase **under** long term plan
- Share of Renewable Energy to substantially increase after 2013

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Steep Towards RE & EE

- Policy adopted in 2008
- Conservation Act Under Way
- Formation of SEDA Under Way
- No Feed in Tariff Policy **in view yet.**
- 5% of total power generation from renewable sources by 2015, 10% of total power generation from renewable sources by 2020
- Govt. Steep EE, CFL 15 Million Distributed, 10 Million Under Way
- Training for Energy Auditing and Leveling

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Entities involved in RE Development

- Power Division as Nodal Agency
- Government Agencies:
- Utilities: BPDB, REB
- LGED
- IDCOL
- Others:
- Private Sector Agencies
- NGOs
- Public Universities in R&D

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Initiatives in Renewable Energy Development

- IDCOL's program a success story in off-grid SHS in the world
- Private sector also developed a lot
- Provisions created in the policy and legislation for RE
- Need financial support for carry forward the RE program

Institutional Framework

- Establishment of SEDA as the Nodal agency underway
- Dedicated Wing set up in Power Division to carry out the RED activities until the establishment of SEDA
- A new Wing on "Sustainable Energy" set up at Power Cell, the Technical Wing of Power Division
- Individual Directorates set up at utilities to carry forward Renewable Energy development activities

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RE Potential

- Solar **Potential**: Enormous, average daily solar radiation of 4–6.5 kWh/m^2
- Wind: Mainly in coastal areas and offshore islands, Resource mapping required
- Hydro: Approx. 500 MW Limited potential **through** micro or mini hydro (max. 5 MW).
- Biomass **Energy**: 300 MW, Biomass resources rice husk, crop residue, wood, jute stick, animal waste, municipal waste, sugarcane bagasse etc.
- Biogas: 350 MW, 8.6 Million Cubic Meter of Domestic Biogas from animal, kitchen and municipal wastes

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Achievement

- SHS: 45 MW (900,000 Units)
- Other Solar PV Applications: 1MW
- Wind Energy: 2MW
- Biomass based electricity: 1MW
- Biogas based electricity: 1MW
- Total: 50MW

Impact of Solar Home System

- Improve rural People's standard of living, income level, health, education, infant mortality etc.
- Demand for more SHS opened up opportunities for backward linkages
- Needs to scale up capacity
- Created investment opportunity

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Vision of Solar Power Development

- 16,000 MW Generation Capacity by 2015
- 800 MW power from renewable sources (5% of total Generation)
- Needs at least 1000 MW installed capacity
- Considering available dependable renewable sources, Solar power could be most dominant intervention
- Vision: 500 MW power from renewable sources by 2015

Renewable Energy Development Vision

- **Public Sector Participation**
- Solar: 25MW
- Wind: 235MW
- Total: 260MW

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Public Sector Participation	
Category	**Total Capacity**
Solar	25 MW
Wind	235 MW
Total	**260 MW**

Private Sector Participation (through IDCOL)			
	Unit Capacity	**Target**	**Total Capacity**
Solar Home System	50 W	3 million	150 MW
Biogas Plant for cooking gas	2.6 m3	100,000	40 MW
Solar Mini Grid	50 -100KW	10	1 MW
Solar Irrigation Pump	8 KW	750	6 MW
Biogas based Power Plant	20 KW	300	6 MW
Biomass Based Power Plant	200 KW	15	3 MW
Total			**206 MW**

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Solar Power Development
through ADB's intervention

- ADB's vision of developing 3000 MW solar power in Asia Pacific region by 2013
- Bangladesh envision to have 500 MW solar power by 2013 **and intend** to be an active partner of ADB's venture
- Bangladesh has proven capability, need finance

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Bangladesh 500 MW Solar Power Development through ADB's intervention

- Salient Features of Bangladesh 500 MW Solar Power Development Program
- A concerted effort of a number of government ministries and their affiliated agencies
- Strong involvement of private sector
- Two types of programs:

  # Investment involving contribution from beneficiaries and private sector

  # Social Service aiming to fulfill the government's social commitment

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Investment Program 450MW

Installation of Solar Irrigation Pumps Total 190MW

- Average capacity of each solar pump 8 kW (Total Pump1.2M, 25000)

Installation of Mini Grid Solar Power System 50 MW

- 1000 Solar Mini Grids be installed in growth centers and cluster villages
- Average capacity of each solar mini grid 25 kW
- Each system will cover 65-75 households

Installation of Roof Top Solar Solutions 50 MW

- Sponsoring Ministry: Power Division, Ministry of PEMR
- 5000 Solar systems be installed with 10Wp Sys

Installation of Roof Top Solar Solutions Industry 20MW

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Investment Program 450MW Con….

Installation of Solar PV System in Government/ Semi-government offices 40 MW

Solar electrification in rural health centers 50MW

- 18000 rural community clinics in remote villages

Solar electrification in Remote Educational Institute 13MW

- Total No. educational institutions: 1,12,756 (7000)

Solar electrification at Union Information Services Centers 13MW

- About 4501 Information Services Centers at Union level

Installation of SHS in Religious Establishments 7MW

Solar LED Street Lighting 10MW

Solar Electrification at Railway Stations 30MW

- Total no. Railway Stations: 450

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Financing Arrangement

- Total Investment requirement: 3.0 b USD
- Investment Program: 1.9 b
- Social Sector: 1.1 b
- ADB Finance: 2.5 b USD
  - Grant: 1.8 b (60%)
  - Credit: 0.7 b (22%)
- GOB and Private Sector Participation : 0.5 b (18%)
- support for CDM project development

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Capacity Development

- Requires capacity development program both in public and private sector.
- A strong R&D support **required** for the effective adoption of technology.
- Capacity enhancement program and financial support **required** for the R&D institutions
- Capacity development support **required** for CDM project development

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- Regional Cooperation for RE & EE
- Adopting Sri Lankan model for efficient lighting
- Following India's Energy Auditing, Conservation & Product Labeling
- Green Built adopted in National Housing Policy
- Cooperation from Germany for one decade
- Recent cooperation from USAID
- Talks with India, Bhutan and Nepal for water sharing for hydro-power
- Talks underway for smart grid
- Large ICS Pprogram (Grameen Shakti & GIZ)

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Conclusion

- *500 MW clean power by 2012, fulfilling the GOB's commitment as per policy*
- *Empowerment of rural poor people and improvement of their living condition in terms of health, nutrition, education, income level, infant mortality etc.*
- Carbon emission reduction: 1.6 million MT/yr
- Reduction in imported diesel: 1.0 million MT/yr
- Reduction in imported kerosene: 0.6 million MT/yr
- Reduction in natural gas consumption: 1.0 MMCFT
- Fulfillment of constitutional obligation and social responsibility; and commercialization of renewable energy as a viable product
- Creating job jobs

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Thanks

Clean Energy Development in Bhutan

July 11 – 13, 2011
Male, Maldives

Tashi Dorjee, Chief Engineer
Department of Energy, MoEA

Outline of the Presentation

- Introduction to energy sector
- Hydropower potential and development status
- Energy supply & demand situation
- Policy Initiative
- RE development initiative
- Challenges and Constraints

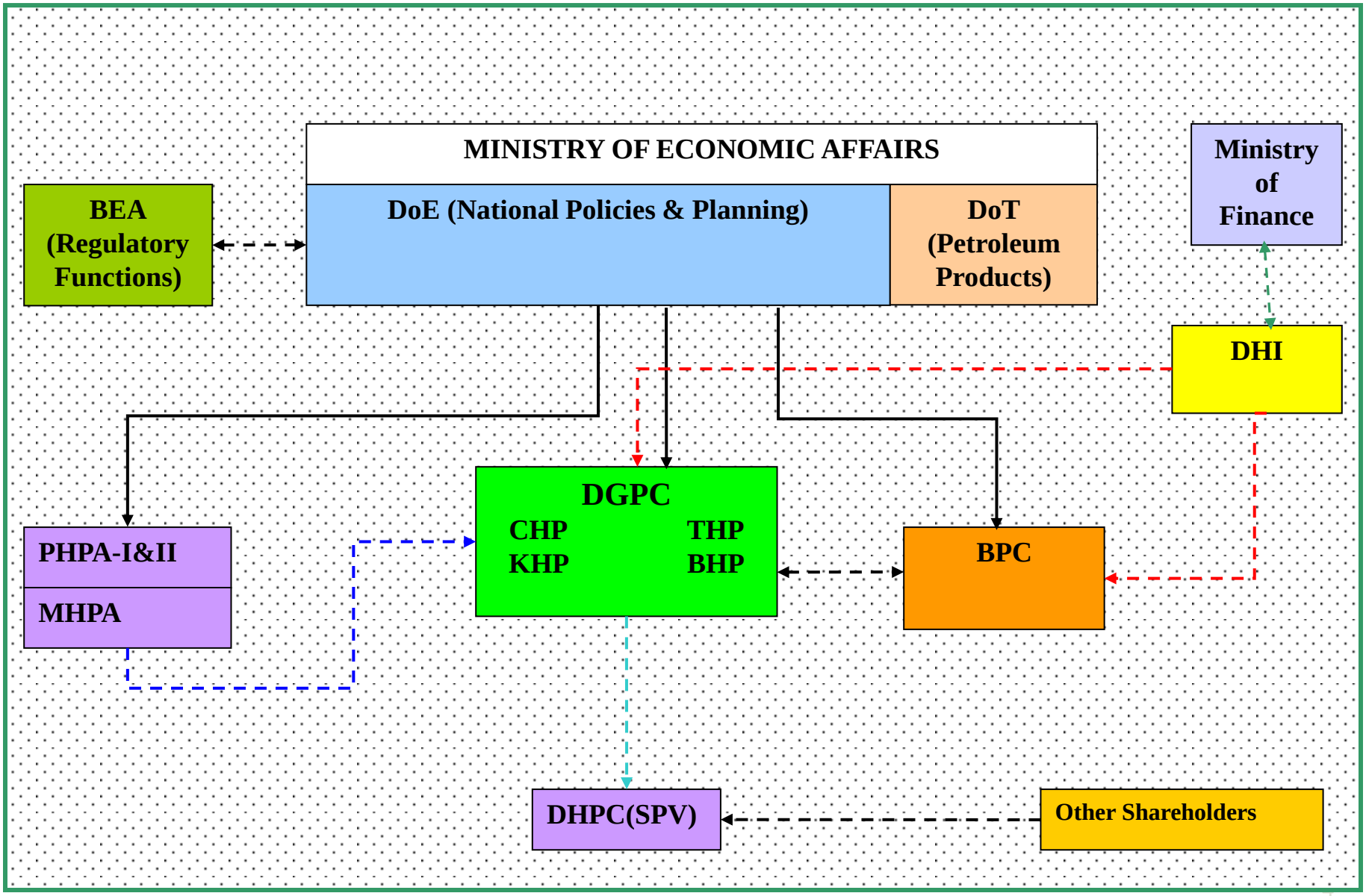
Energy Sector

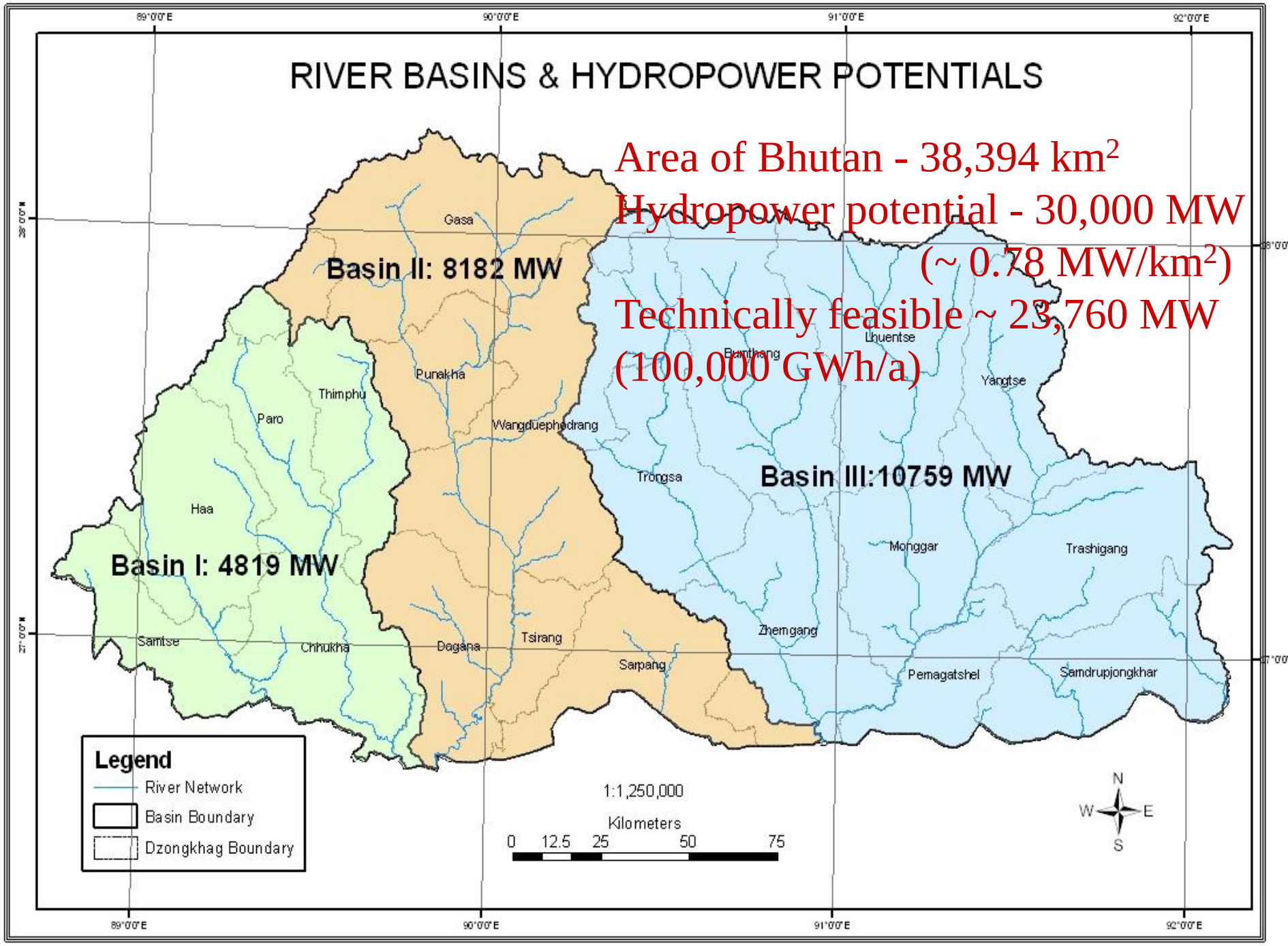
Electricity Act passed by the 79th Section of the NA in July 2001

Unbundling of power sector in 2003:

- ✓ DoE- National Policy and Planning
- ✓ BPC- Transmission and distribution
- ✓ BEA – Regulation (fully autonomous in Jan. 2010)
- ✓ DGPC (Jan. 2008) – O&M of all existing hydropower plants owned by RGoB and development of HPPs.

Structure of Energy Sector




RIVER BASINS & HYDROPOWER POTENTIALS
Area of Bhutan - 38,394 km2
Hydropower potential - 30,000 MW
(~ 0.78 MW/km2)
Technically feasible ~ 23,760 MW
(100,000 GWh/a)
Basin II: 8182 MW
Basin III:10759 MW
Basin I: 4819 MW
Gasa
Punakha
Thimphu
Paro
Haa
Wangduephodrang
Trongsa
Bumthang
Lhuentse
Yangtse
Monggar
Trashigang
Zhemgang
Pemagatshel
Samdrupjongkhar
Samtse
Chhukha
Dagana
Tsirang
Sarpang
Legend
River Network
Basin Boundary
Dzongkhag Boundary
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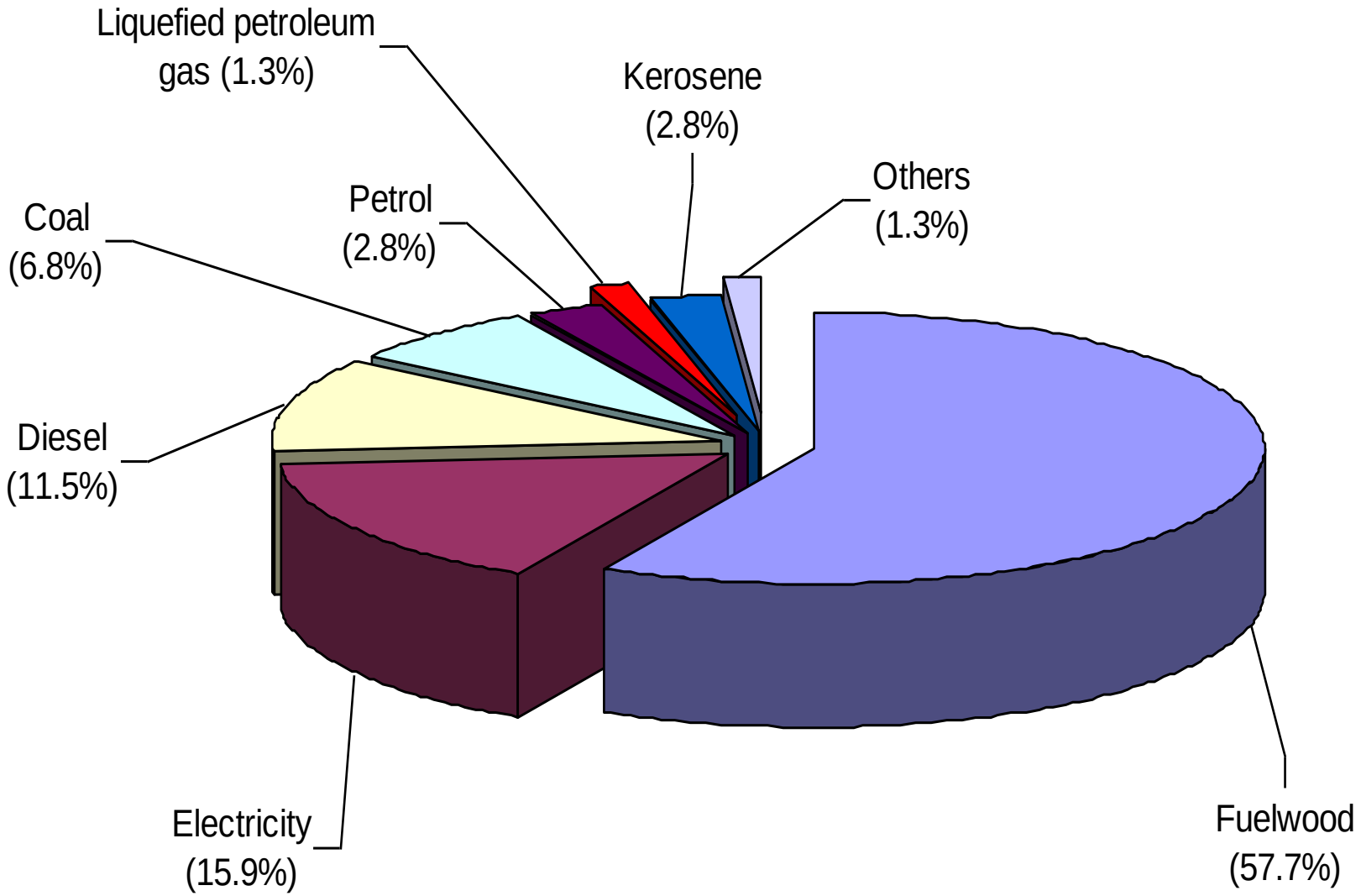
Development Status

- ✓ Large hydro ~ 1480 MW
- ✓ Mini/micro hydro ~ 8.168 MW (23 nos.)
- ✓ Total hydro developed ~ 1488.168 MW (5% of potential)
- ✓ Solar PV installed ~ 0.045 MW
- ✓ Diesel power installed ~ 17.39 MW
- ✓ Total installed cap. ~ 1505.60 MW

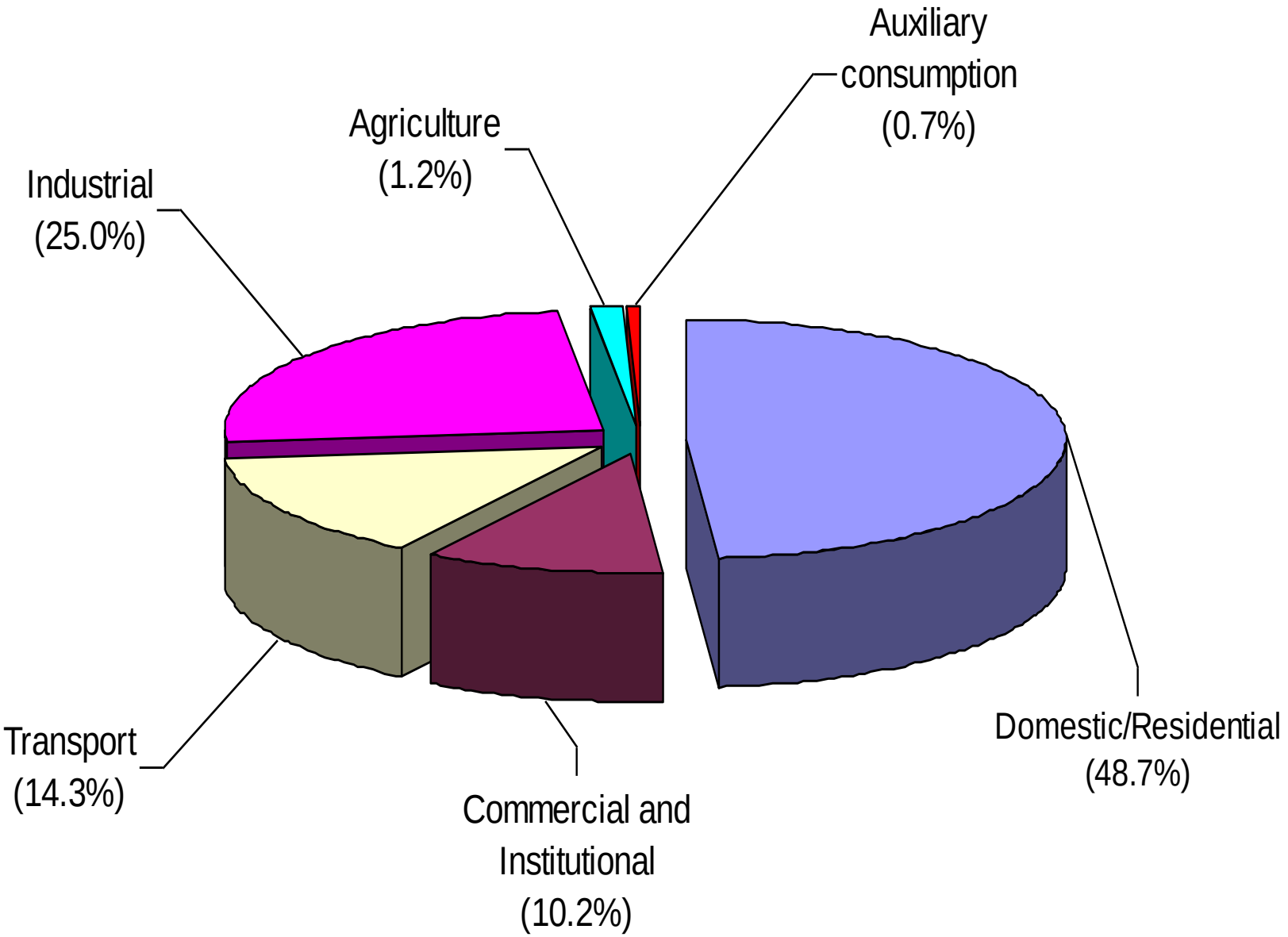
Power Supply & Demand Situation (2009-10)

- Total generation = 1505.60 MW, 6972.40 GWh (~ 100% hydro based)
- Total export ~ 5353 GWh (~77%)
- Total import ~ 19.55 GWh
- Total domestic consumption ~ 1665 GWh
- Power system demand ~ 194 MW
- Per capita energy consumption ~ 2200 kWh

Energy Supply Mix (2005)



Sector-Wise Energy Consumption



Domestic & Export Tariff

Customer Category		1st August 2010 to 30th June 2011	1st July 2011 to 30th June 2012	1st July 2012 to 30th June 2013
Wheeling (Nu./kWh)		0.111	0.111	0.111
LV	0-100 kWh per month (Nu./kWh)	0.85	0.85	0.85
	101-300 kWh per month (Nu./kWh)	1.47	1.54	1.62
	Above 300 kWh per month (Nu./kWh)	1.94	2.04	2.14
	LV bulk consumers (Nu./kWh)	1.94	2.04	2.14
MV	Energy charge (Nu./kWh)	1.63	1.71	1.79
	Demand charge (Nu./kWh) /month	95	105	115
HV	Energy charge (Nu./kWh)	1.51	1.54	1.54
	Demand charge (Nu./kWh) /month	85	105	105

Export Tariff:

Chukha: Nu. 2.0/unit

Kurichu: Nu. 1.8/unit

Tala: Nu. 1.8/unit

Policy Initiative

- Bhutan Sustainable Hydropower Development Policy 2008
- Economic Development Policy 2010
- Renewable Energy Policy (final draft)
- Captive Power Development Policy (Under formulation)

Bhutan Sustainable Hydropower Development Policy 2008

Key objectives of the Policy:

- Mobilize funds and attract investments for accelerated hydropower development.
- Enhance revenue contribution to the Govt.
- Contribute to socio-economic development.
- Ensure domestic electricity supply security and reliability
- Ensure that the hydropower development is in accordance with the sustainable development policy of the Govt.
- Contribute towards development of clean energy to mitigate problems related to global warming and climate change.

Economic Development Policy 2010

Apex Policy for the country to stimulate economic development.

Following provisions are stipulated with respect to energy sector:

- ✓ Electricity to all households by the year 2013.
- ✓ Essential public institutions and services shall receive highest priority for supply of electricity.
- ✓ Development of hydropower shall be accelerated to achieve a minimum power generation of 10,000 MW by 2020.
- ✓ Inter-linking of transmission grids to ensure energy security and reliability.
- ✓ While hydropower development shall be one of the main thrust of the government; an integrated approach shall be pursued to meet different energy needs in the most efficient manner

Renewable Energy Policy

Key Policy Objectives:

- Initiate exploration and development of RE resources.
- Institutionalize development of national and local capabilities for enhanced use of RE systems.
- Promote efficient and cost-effective RE based commercial application by providing fiscal and non-fiscal incentives.
- Mobilize funds and attract investments, especially private sector, for RE development.
- Contribute to socio-economic development
- Enhance energy security.
- Establish necessary infrastructure and institutional mechanism to carry out the mandates specified under various Acts and policies having an impact on RE.

Captive Power Generation Policy (under formulation)

Key Policy Objectives:

- To reduce the gap between supply and demand for electricity, and to make best use of energy resources particularly in the lean generation/peak consumption period.
- To ensure energy security for industries and encourage sustainable industrial development

Hydropower Development Initiative

Sl. #	Projects	Capacity (MW/GWh)	Constr. Schedule
1	Punatsangchhu-I	1200 / 5700	2008 – 2015
2	Mangdechhu	720 / 2900	2011 – 2017
3	Punatsangchhu-II	990 / 4200	2010 - 2017
4	Sankosh Storage	4060 / 7100	2013 – 2020
5	Kuri-Gongri	1800 / 6800	2014 – 2020
6	Amochhu Storage	620 / 3375	2012 – 2018
7	Bunakha Storage	180 / 688	2012 – 2017
8	Kholongchu	600 / 2500	2012 – 2018
9	Chamkharchu-I	720 / 3208	2012 – 2018
10	Wangchhu	600 / 2415	2012 – 2018
11	Dagachhu (CDM)	126 / 500	2009 – 2013
12	Nikachhu	210 / 920	2012 – 2016
	Total:	**11,826 / 40,306**	

Other Renewable Energy Initiative and Plan

Rural Renewable Energy Development Project (ADB):

- Solar energy - Solar electrification of 672 house holds and establishment of institutional mechanism for O&M
- Pilot wind project - Construction and commissioning of two 180 kW wind plant
- Biogas - Construction of 1,600 biogas plants in rural areas for cooking
- Biomass - 20,000 improved stoves through GEF/others

- Energy conservation and efficiency improvement (UNESCAP). Govt. directives to formulate EE Policy by Dec. 2011.
- Development of integrated master plan for RE incl. hydro upto 25 MW
- Institutional capacity development

Hydropower Development

Opportunities

- Renewable, Clean form of Energy
- CDM & Substitution to fossil fuels/reduction in GHG emission
- Export /Market demand in India and South Asia (peaking energy)
- Benign environment (political, social & physical/techno-economic).

& Challenges

- Resources constraints (capital intensive & skills & technology !)
- Conservative Environment laws !
- Risks (long gestation, weather, geology, seismology)
- Market (pricing, competition)
- Transport cost (land locked !)

Challenges & Constraints in other RE development

- Capital intensive
- Difficult accessibility due to rugged mountain terrain
- Difficult to provide O&M services - economy of scale and affordability
- Lack of private sector for RE initiative
- Institutional and human resource capacity constraint

Thank You !

Transitioning the South Asian Energy Market:
Advancing Low Carbon Growth Through Regional Cooperation and Cross-Border Energy Trade

11-13 July 2011

Energy Efficiency Programmes, Policies in India & Technology Case Studies

12 July 2011

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Why AEEE ?

To integrate highly fragmented EE business in India

Support Policies & Regulations: To work closely with BEE, MNRE & Regulatory Commissions and others **to help evolve regulatory frameworks** (effective implementation of EC Act 2001, Electricity Act 2003 & the NAPCC- National Mission on Enhanced Energy Efficiency)

Assessment of Policies Across Sectors: To address cross-sectoral projects and issues & assess the *energy-impact* of policies

Networking Platform: Platform to share and learn about global best practices, enable industry benchmarking and access to CleanTech financing & incubation programmes

Market Transformation: For partnership and co-ordination with Multilateral & Bilateral agencies (Market & Technology Transformation)

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Our Partners

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Partnerships & Alliances

USAID ECO-III Project Team & Partners

- International Resources Group (*AEEE Policy Framework)*
- Alliance to Save Energy – Charter, Vision & Mission

Affiliate of Efficiency Valuation Organization – M&V Training, CMVP Certification

Lawrence Berkeley National Laboratory (LBNL) - (1)Capacity Building for Implementation of DSM Programmes. (2) Data Centers

Institute of Sustainable Communities in partnership with ORNL in capacity building of Energy Auditors in India

Climate Work-SSEF support for Report on State of Energy Efficiency in India

ASSIST Asia – working with AEEE to take M&V Capacity Building to Philippines

India's Response to Climate Change

Focus on increasing End Use Energy Efficiency

Each kW saved at the end-use side is equivalent to about 1.8 kW saved on the generation side

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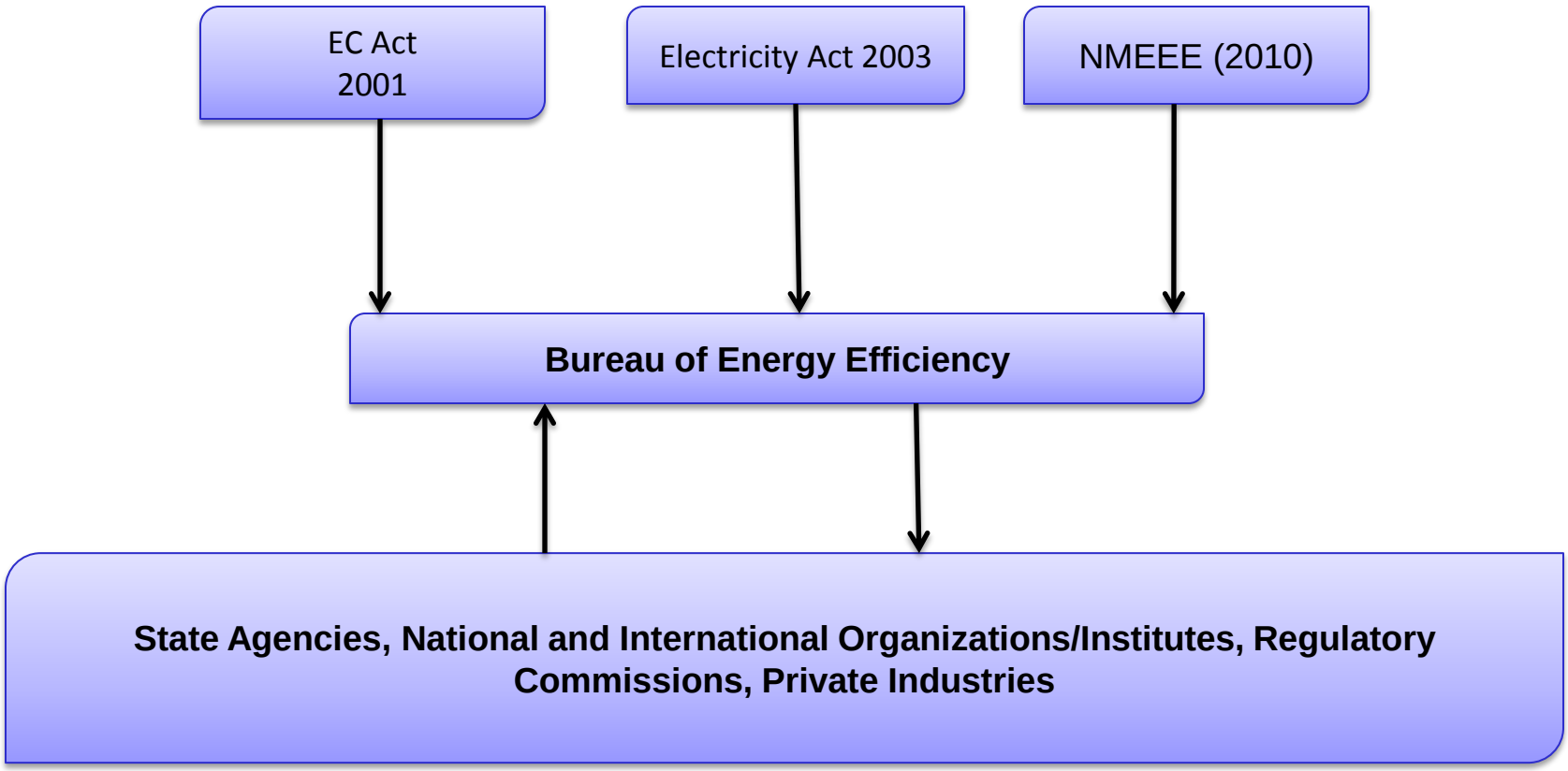
Policy Stimuli for EE in India



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1. The Energy Conservation Act 2001

Key Directives of EC Act:

- Minimum energy consumption standards for appliances and labeling
- Energy intensive industries identified to be known as Designated Consumers (DCs)
- EE improvement in unorganized sectors (SMEs)
- Energy Conservation Codes for Buildings
- Central and State Energy Conservation Fund
- The EC Act identified Bureau of Energy Efficiency (BEE) as the statutory body under the Ministry of Power

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2. The Electricity Act 2003

- Mandates efficiency for Generation, Transmission and Distribution
- Formed the National Electricity Policy for optimum utilization of resources
- High emphasis on efficiency levels of generating plants, boosting renewable and non-conventional energy sources
- Demand Side Management (DSM) accorded high priority, periodic energy audits were made compulsory for power intensive industries

3. National Mission for Enhanced Energy Efficiency (NMEEE)

- The National Action Plan on Climate Change was approved in India in June 2010
- The Action Plan Outlines 8 Missions
- National Mission on Enhanced Energy Efficiency (NMEEE)
- Status Report on Energy Efficiency in India – in print
- NMEEE aims to boost the programmes under the EC Act through 4 major initiatives

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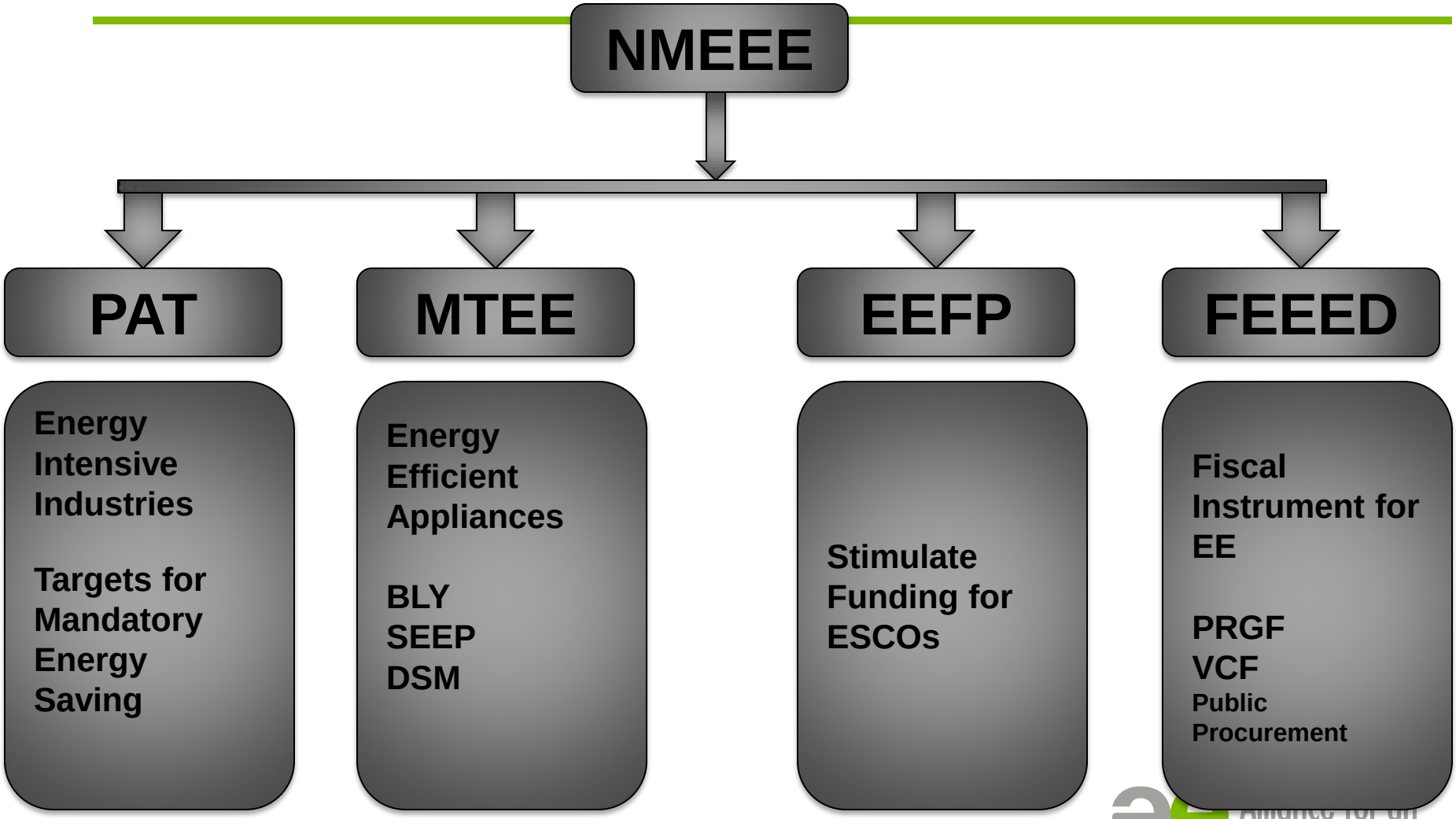
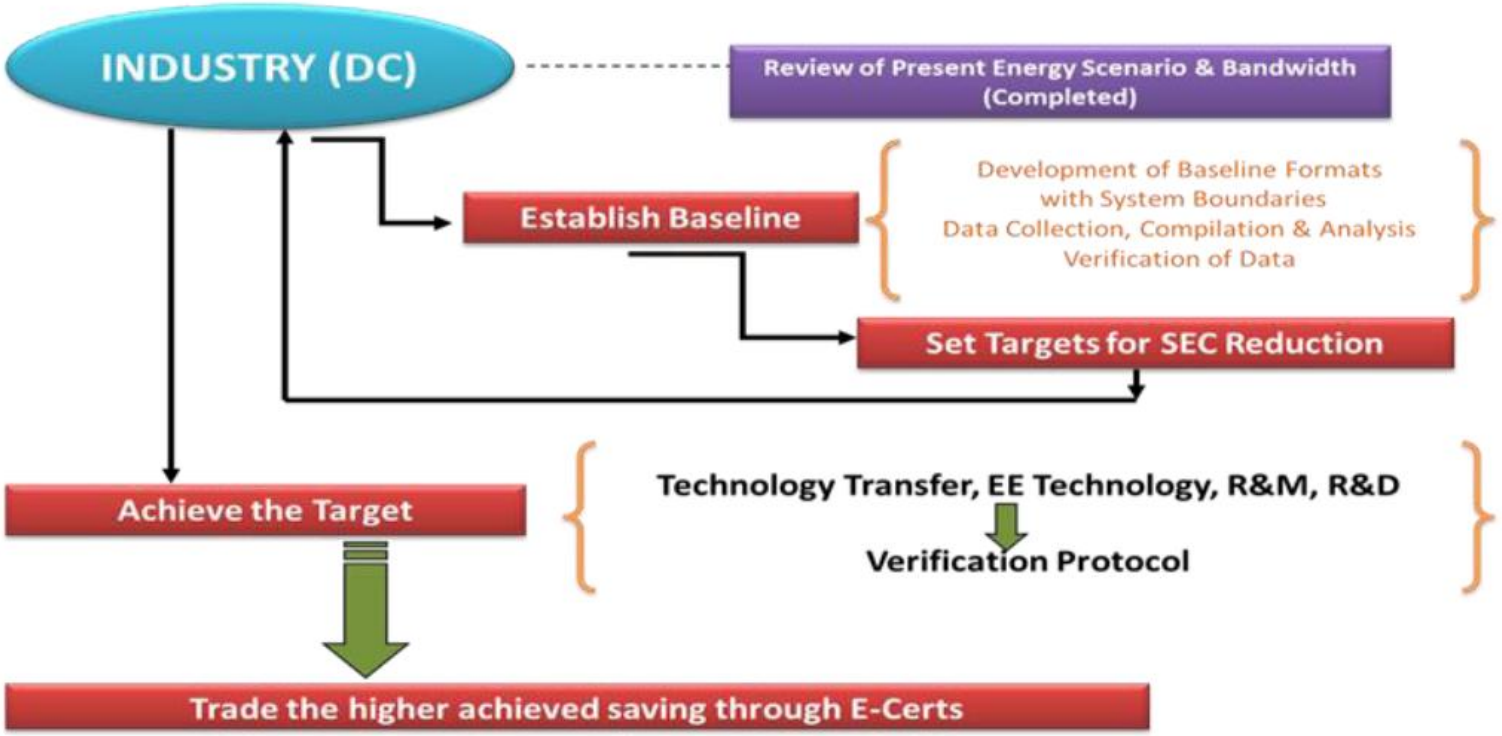
NMEEE – Four Initiatives



NMEEE-1: Perform, Achieve & Trade (PAT) Scheme

PAT aims to create business transactions worth INR 7,500 billion through savings of about 10 Mtoe, over its first compliance 2011-14

(avoided capacity of 5623 MW, about 3.5% of total installed capacity)



NMEEE-2: Market Transformation for Energy Efficiency (MTEE)

Lighting CDM Project (Bachat Lamp Yojana)

- 20 million CFLs distributed; aims replacement of 400 million lighting points by CFLs by 2012(40 million tonne reduction)
- Largest CDM project by UNFCCC

Super Efficient Equipment Program (SEEP)

- Reduce energy consumption and enable DSM
- Reduce cost of EE Equipment through accelerated market stimulation
- Encourage domestic manufacturing

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NMEEE-3: Energy Efficiency Financing Platform (EEFP)

- **Stimulate necessary funding for ESCOs based on delivery mechanism**
- **MoU with PTC India, SIDBI & HSBC bank signed by BEE**
  - **PTC India has started financing in several building energy efficiency projects**
  - **SIDBI has taken up projects for 25 SME clusters**

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NMEEE-4: Framework For Energy Efficient Economic Development (FEEED)

Fiscal instruments to promote energy efficiency

- Partial Risk Guarantee Fund (PRGF) and Venture Capital Fund (VCF) INR 6,662 million allocated for both in 2010-1 to be in operation by March 2011
- Proposal on "Energy Efficiency in Public Procurement" approved in principle by CoS
- Detailed proposal on "Tax/Duty concessions for energy efficiency"

The BEE is also the legal entity for executing the initiatives under NMEEE and engages in public-private partnership in implementing various EE programmes

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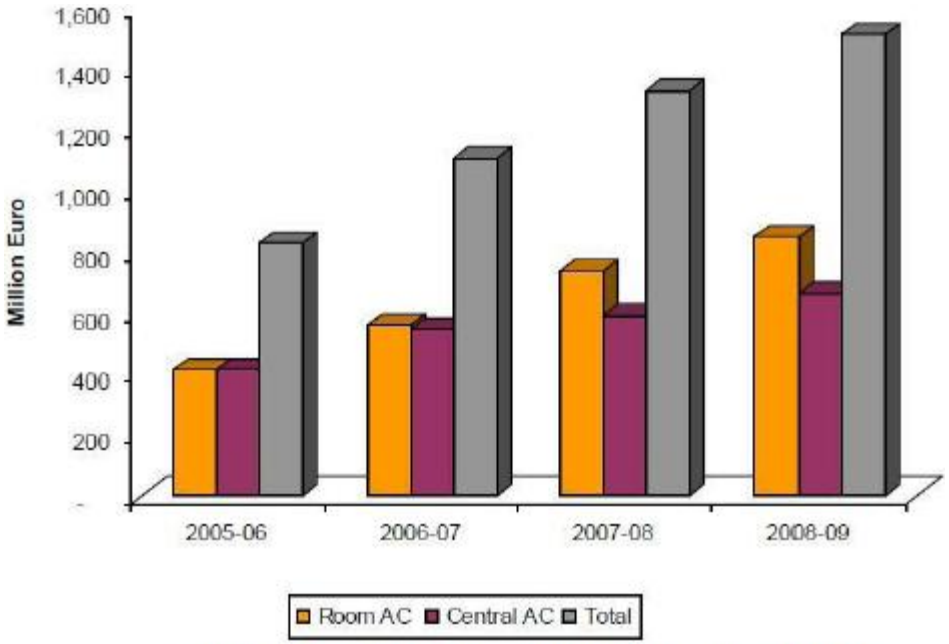
Energy Efficiency in Buildings

- By 2011, 1000 registered green building projects
- India has the third largest green building footprint in the world (56 million sq m)
- LEED India, GRIHA, Star Rating of Buildings
- Surge in demand for Building Management Solutions



Growth of Air conditioner Markets in India (Source: GTZ 2010)

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Energy Service Companies (ESCOs) for EE in India

- **USAID ECO-1 & 2 Projects helped create the first ESCOs in India**
- **In 2008, ADB: India ESCO market potential USD 10 billion to create annual energy savings of 183.5 billion kWh**
- **ESCO implementation through Performance Contracting**
- **BEE has accredited 89 ESCOs, evolving an EE Financing platform**
- **Capacity building of ESCOs to address diverse EE demands (Building, Mu EE, Ag EE, SMEs, DCs)**
- **The Energy Efficiency Services Limited (EESL) was formed by INR 1.9 billion in 2010 by the Government**
- **EESL to serve as *a super ESCO* for the public sector (including municipalities, government buildings, etc.)**

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Impact of Standards & Labeling Programme in India

- By 2030, 70% buildings will be newly built, use of appliance and equipment to rise sharply
- Household energy in India to grow to 1300 TWh in 2030, where 30-40% energy saving can be through using EE appliances
- In 2011-12, India will have 20 million pumps; replacing 45-50% by EE pumps will give 62.1 billion units savings annually

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AEEE Activities Reflect India's Clean Energy & EE Priorities

- Support the implementation of PAT Scheme
- M&V Training & CMVP Certification – to strengthen EE project implementation
- Energy Efficiency in Rotating Equipments (motors, pumps, fans). Launched 21 April 2011, National Workshop on 5 Aug. 2011
- Partnering with Forum of Regulators, Utilities & DisComs to support DSM & EE programmes
- DSM programme parterns – North Delhi Power Ltd and BESCom, Bangalore (as members) and MERC, MSCDCL, Tata Power, Reliance Infra

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AEEE Concept of EE Expertise Implementation & Financing

Energy Efficiency: "From Boiler Room to Board Room"

(Enhance the pool of Energy Auditors & M&V professionals)

Level 1 - Energy Audit – Certified Energy Auditors / Managers

- Identifies opportunities, does not achieve Energy Efficiency *per se*

Level 2 - Investment Grade Audits & develops projects/ DPRs that can attract Banks/ Institutional funding

Level 3 – Certified M&V Professional (CMVP) – **India has 55 now**

- Equipped to use reliable, International M&V protocols to COMPUTE energy savings
- Expertise in EE Financing to ensure/ keep track of payback, strengthen ESCO business model by validating savings

Level 4 – Carbon Reduction Manager, **E.M.V.** Expertise for DSM programme evaluation

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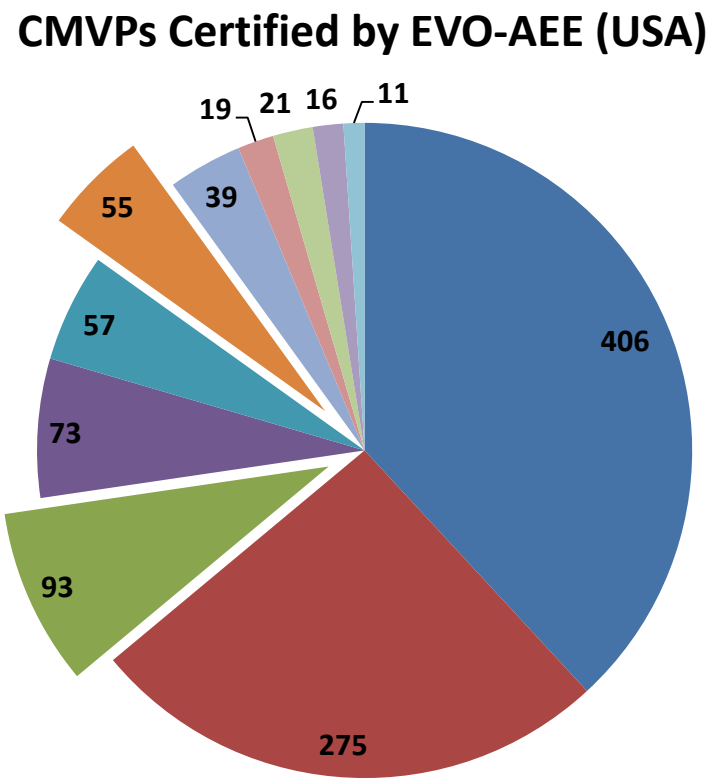
M&V Training & CMVP Certification

- First M&V Seminar Delhi 2005, PCRA hosted for EVO
- M&V Fundamentals trainings in Delhi-Apr'08, Mumbai-May'09 and Bangalore Nov'09 & M&V Familiarisation Workshops in Delhi & Chennai - Mar'11 and Pune April '11
- CMVP Certification Training & Exams in Delhi Nov 2009, July 2010, Bangalore March 2011, Jun 2011
- EVO has Certified 5 Indian Trainers as CMVP Trainers
- AEEE invited under USAID/ SARI/Energy to train & certify CMVPs in South Asian countries (excluding India)
- AEEE to conduct M&V Training in Manila, August 2011

India has 55 CMVPs
Out of 1065 worldwide

Global Distribution of CMVPs	
Country	No-s
USA	406
Canada	275
China	93
South Africa	73
Spain	57
INDIA	55
Taiwan (28), Hong Kong	39
France	19
Belgium (11), Swiss, UK	21
Portugal	16
Others	11
TOTAL	1065



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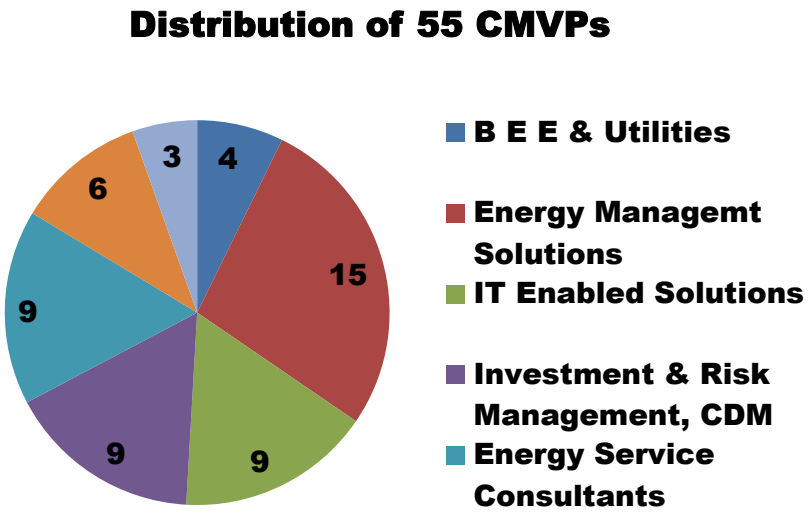
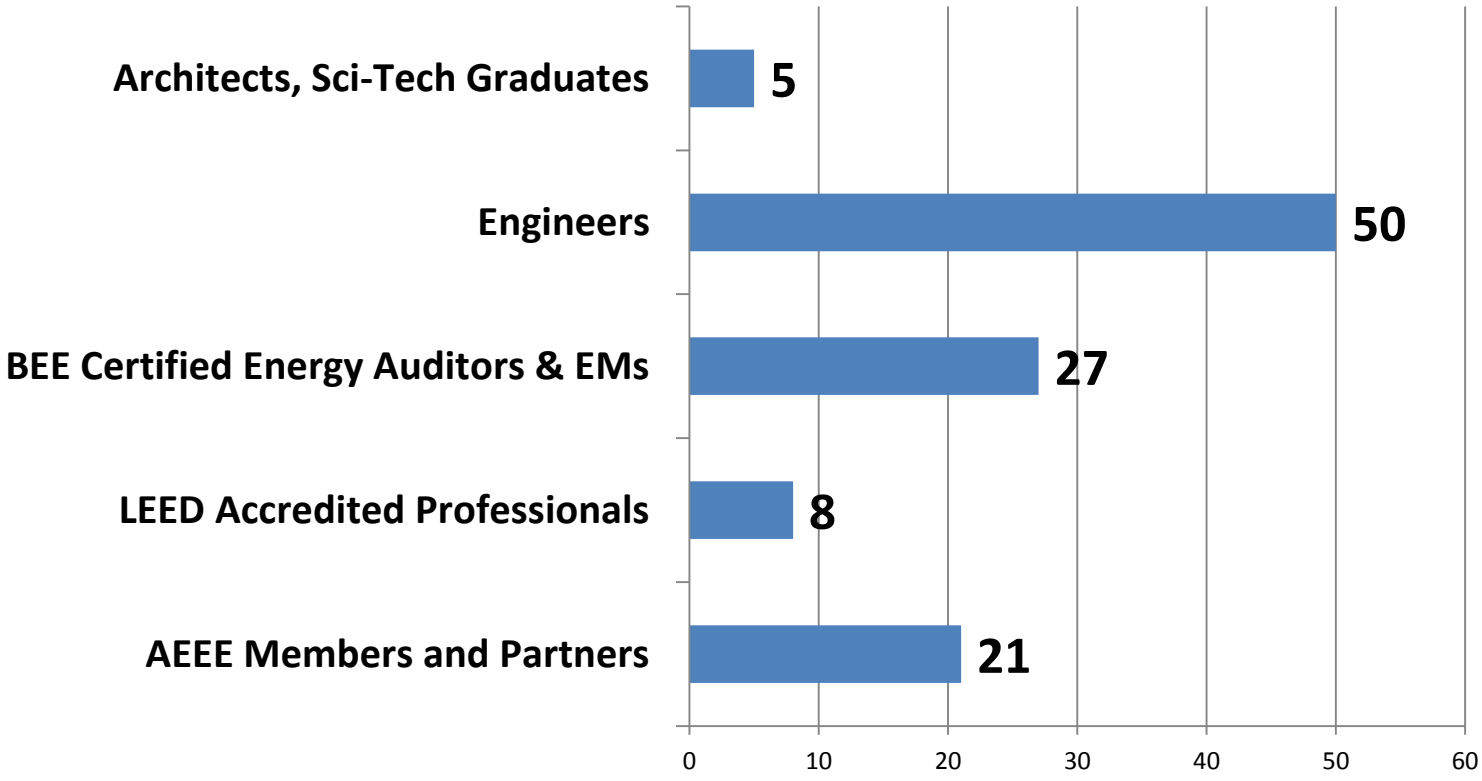
Company-wise Distribution of 55 CMVPs

Sectors	Companies	No-s
B E E & Utilities	BEE, Tata Power, Reliance Infra, MSEDCL (1 each)	4
Energy Managemt Solutions	Schneider-Electric(9), Johnson Controls(2), Honeywell(4)	15
IT Enabled Solutions	Cisco Systems(3),Infosys(2), Wipro Eco Energy(2), Intel(2)	9
Investment & Risk Management, CDM	Aditya Birla Mngt Services (2) \PWC(2), Darashaw &Co(4), Morgan Stanley Capital Intl(1)	9
Energy Service Consultants	SeeTech, AlienEnrgy, Invensys, Custmsd Energy Solutns, SGS India, KLG, UVKA (1 each)	9
Building Services	Paharpur BusnsCentre, BlueStar, GreenTree, Spectral/M&V Svs	6
Associations/ NGOs	IRG, ASE & AEEE	3



Alliance for an Energy Efficient Economy

Professional Background of 55 CMVPs



Alliance for an Energy Efficient Economy™

Information & Resources

Integrate Resources and Reports on Energy Efficiency

- Status Report on Energy Efficiency in India – in print
- USAID ECO-III project reports and documents: Projects, Workshops, Surveys and Benchmarking of various sectors
- Fortnightly AEEE Webinars – knowledge sharing platforms on policies, technologies, regulatory measures, markets and international EE developments
- Technology updates and reports on Low Carbon Technologies
- A dynamic Website for updates with resources for Members and non-members and Newsletters
- **Workshops & Reports on EE in Hospitals, Waste Heat Recovery and Energy Efficiency in Data Centers**

Alliance for an Energy Efficient Economy™

The Way Forward

- Welcome to join AEEE as a networking platform
- Information & resources sharing on all clean energy & energy efficiency technologies & experiences the region and globally
- Access information on national policies, bilateral and multilateral programmes
- S. Asian countries have a long history of sustainable inter-dependence with nature and natural resources
- Let us together to build South Asia as clean energy ‘model region’

Thank you

Large Corporate Members

Members

SEE-Tech

Cosmos Ignite

CMAI

Alternative Futures

Specific Project Partners:

Energy Efficiency Programs in Nepal

T. M. Shakya
General Manager
Transmission and System Operation
Project Coordinator
Energy Access and Efficiency Improvement Project

Presentation Outline

- Need for Energy Efficiency
- Ongoing Energy Efficiency Programs
- Energy Access and Efficiency Improvement Project
- Transmission and Distribution Reinforcement Programs
- Power Factor Improvement Program
- Loss Reduction Program
- Energy Efficiency in Lighting
- Renewable Street Lighting
- Conclusion

Why Energy Efficiency?

- Depleting Fossil Fuel Reserves (Coal, Oil and Gas)
- Increasing Cost of Hydropower Development
- Growing Public Sentiments against Nuclear Power
- High Cost of Renewable Energy
- Rising Concern for Environmental Protection
- Need for Reducing Global Warming / Climate Change

Ongoing Energy Efficiency Programs in Nepal

- Transmission and Distribution System Reinforcement Programs
- Loss Reduction Programs
- Installation of HV and LV Capacitors To Improve Power Factor
- Use of Electronic Energy Meters
- Energy Access and Efficiency Improvement Project

Energy Access and Efficiency Improvement Project

- **ADB Financed Project**

  - ADF Loan: USD 65 million
  - Clean Energy Fund: USD 4.2 million
  - Climate Change Fund: USD 0.3 million

- **Scope of Project**

  - Rehabilitation of Generation Plants
  - Expansion and Strengthening of Power Transmission System
  - Distribution System Reinforcement

Energy Access and Efficiency Improvement Project

- **Transmission and Distribution System Reinforcement Programs**
  - **Construction of 132 kV Double Circuit Transmission Lines**
  - **Construction of Transmission Substations**
  - **Construction of Distribution Substations**

Energy Access and Efficiency Improvement Project

- **Power Factor Improvement Program**
  - **Installation of Capacitor Banks at 10 Grid Substations**

- **Supply Side Energy Efficiency Programs**
  - **In Kathmandu Valley**
  - **Simara – Birgunj Industrial Corridor**

- **Energy Efficiency in Lighting**
  - **Distribution of 1 million CFL Lamps**
  - **Waste Management**

Energy Access and Efficiency Improvement Project

- **Renewable Street Lighting Program**

  - **Installation of 1000 Nos. Solar Street Lights (50 Nos. Solar / Wind Hybrid)**
  - **Covering Municipal Areas of Kathmandu Valley**
  - **Primary Locations: Temples / Monasteries/ Monumental Zones / Market Places**
  - **Steering Committee: Representatives from NEA / Local Development Ministry / Municipalities / Alternative Energy Promotion Center (AEPC)**
  - **Use Of LED Lamps**

Conclusion

- Energy Saved is As Good As Energy Generated
- Energy Efficiency Measures are Cost Effective
- Need for Promotion of Energy Efficient Lamps and Appliances
- Need for Public Awareness Programs
- Energy Efficiency Measures Benefit Consumers, Society, Utility, Nation and World as Well

Thank You

Transitioning the South Asian Energy Market

July 11-13,2011, Male

Energy Management Program of Sri Lanka

Upali Daranagama

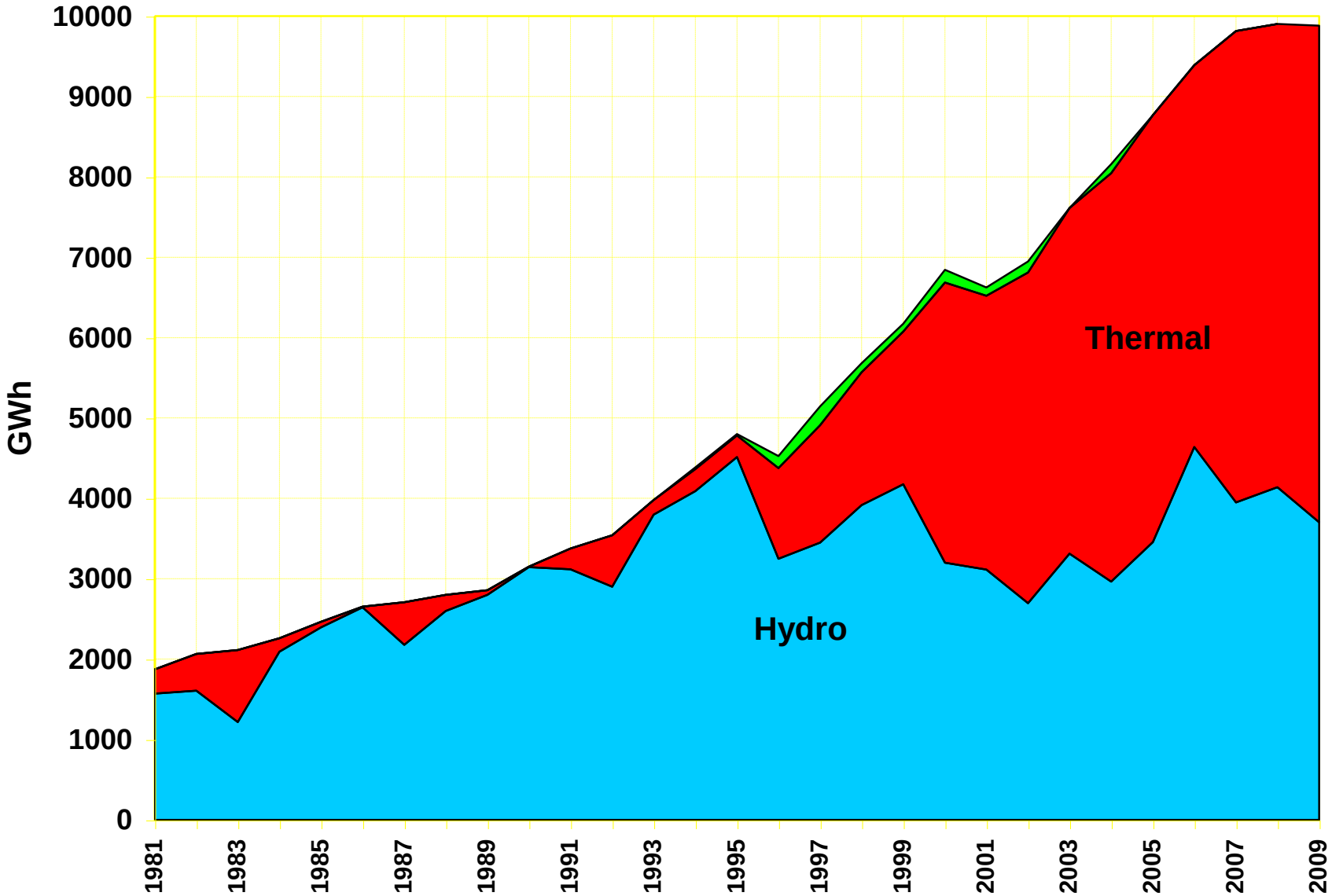
Additional Secretary (Planning and Development)

Ministry of Power and Energy

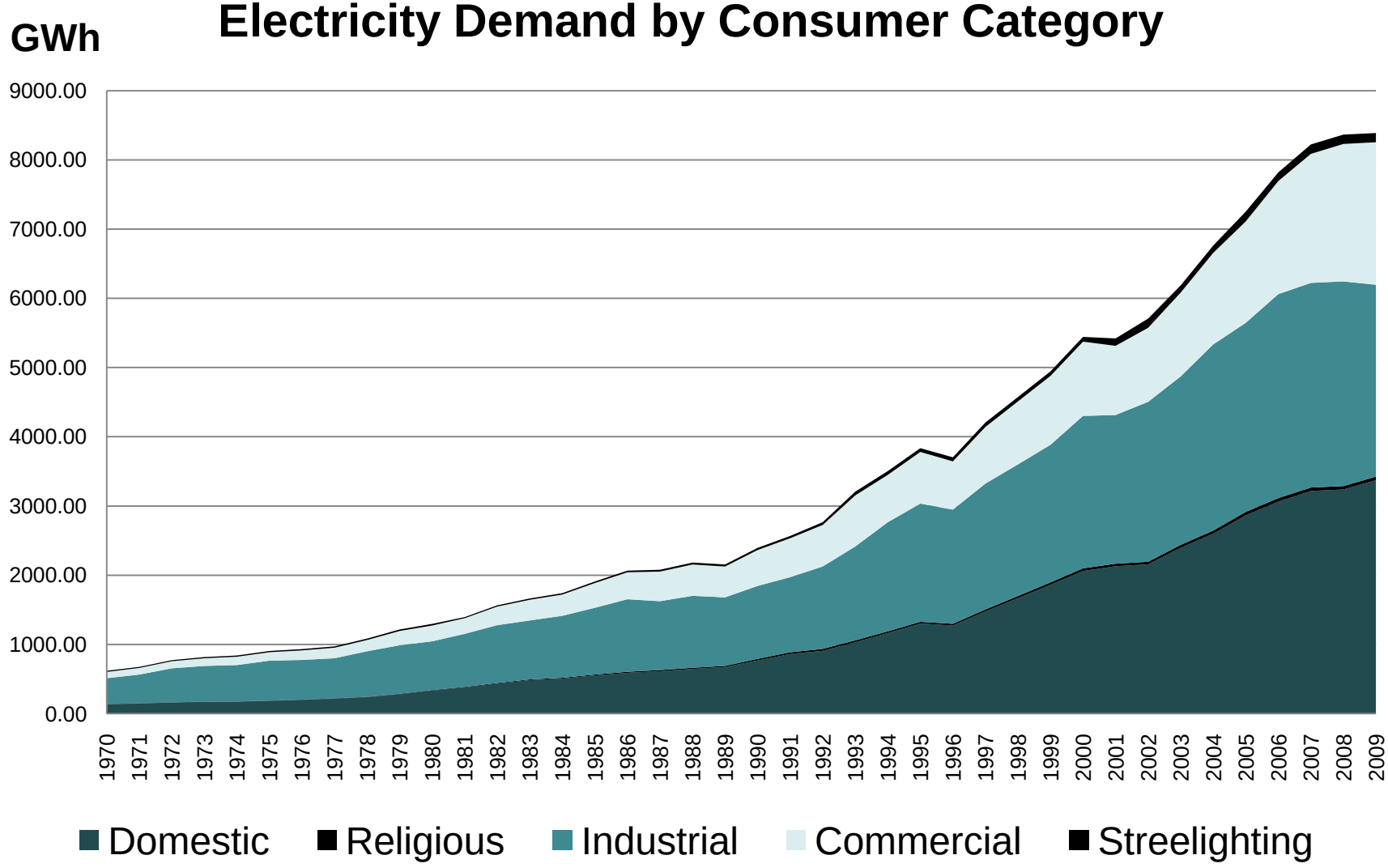
Outline of the Presentation

- Energy Supply and Consumption Pattern
- National Policy
- Interventions on Energy Management

Hydro – Thermal Share

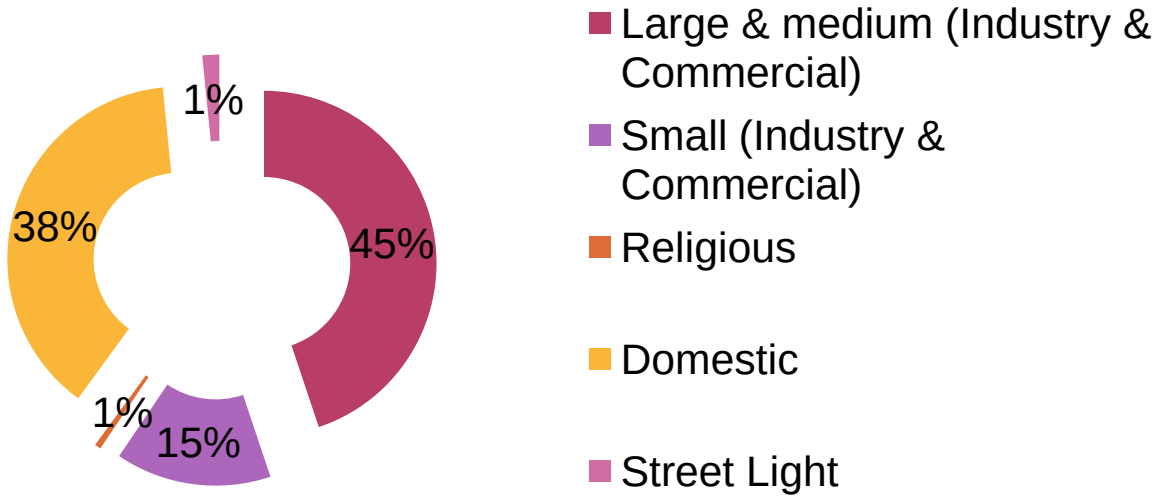


Electricity Demand by Consumer Category



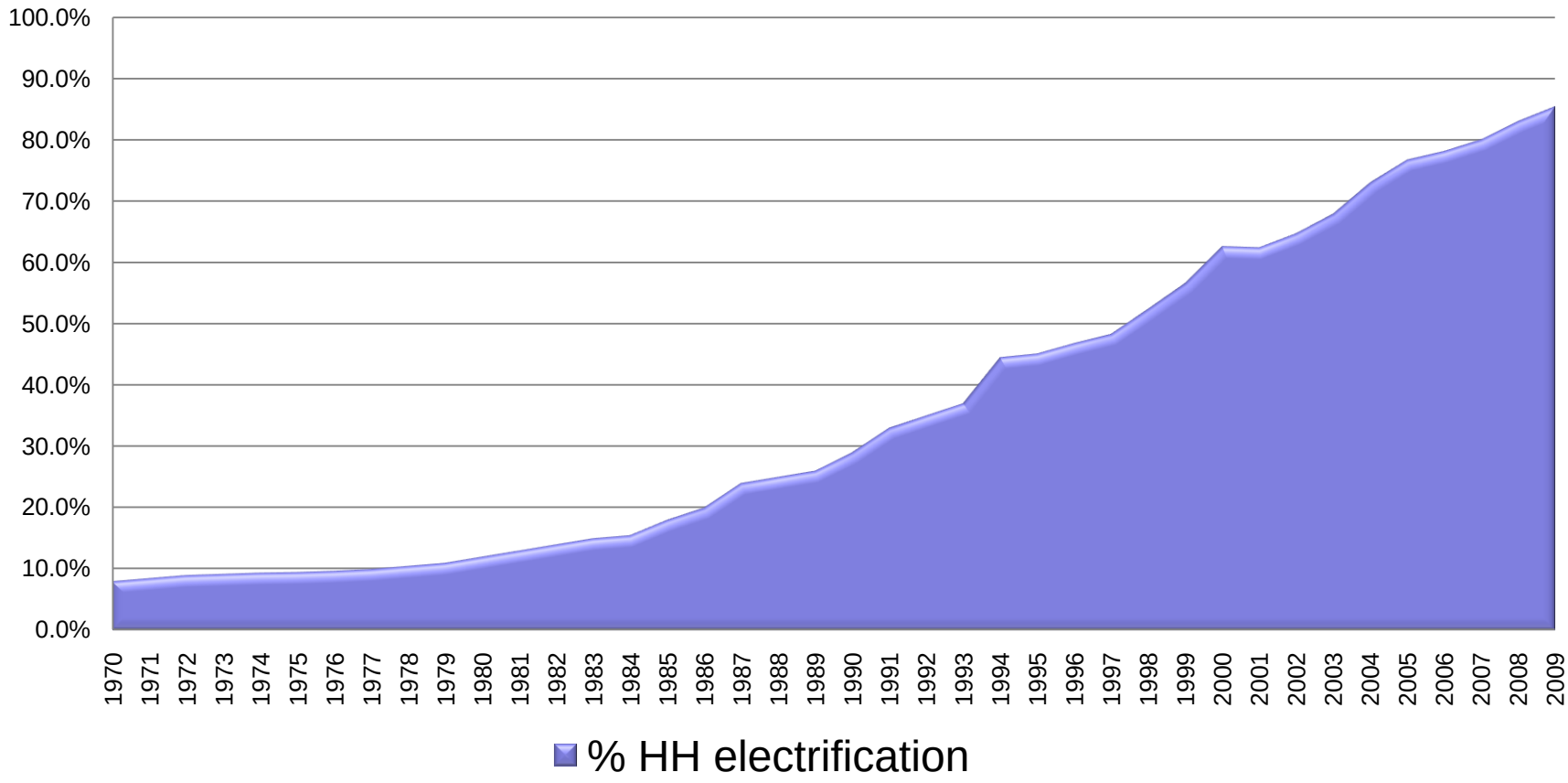
Energy Scenario

Electricity Consumption by Sectors



Sector	Annual Consumption (2008) GWh
Large & medium (Industry & Commercial)	3775
Small (Industry & Commercial)	1229
Religious	49
Domestic	3230
Street Light	133
Total	**8416**

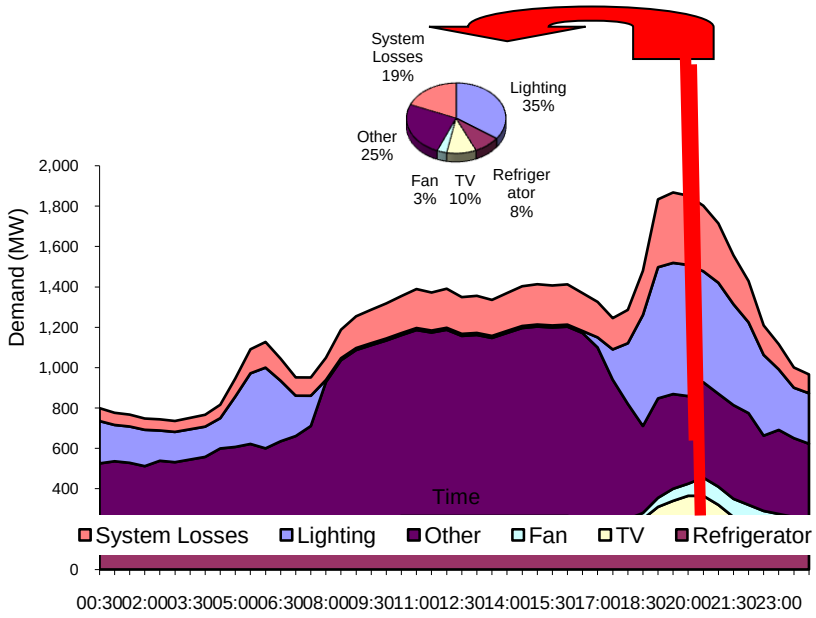
Percentage of HH Electrification in Sri Lanka



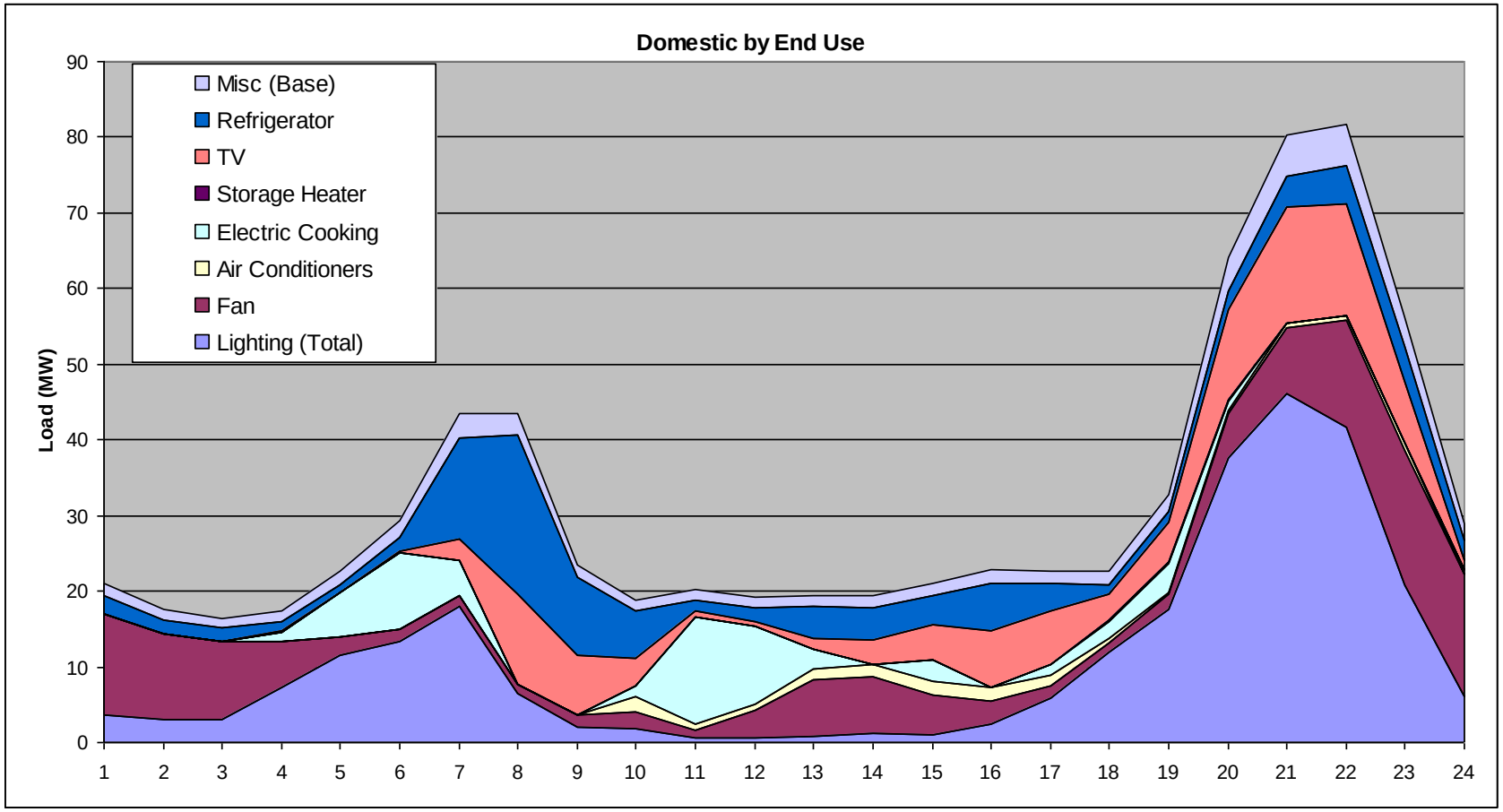
Lighting – Principal Contributor to Electricity Demand

Lighting, especially residential, major user of electricity and principal contributor to peak load

- Evening demand for lighting contributes to ~35% of peak demand
- 1/3 of South Asia electricity used by residential and commercial sectors (234 TWh/year in 2008)
- 40% CEB (Sri Lanka) electricity consumed by residential sector, mainly for lighting

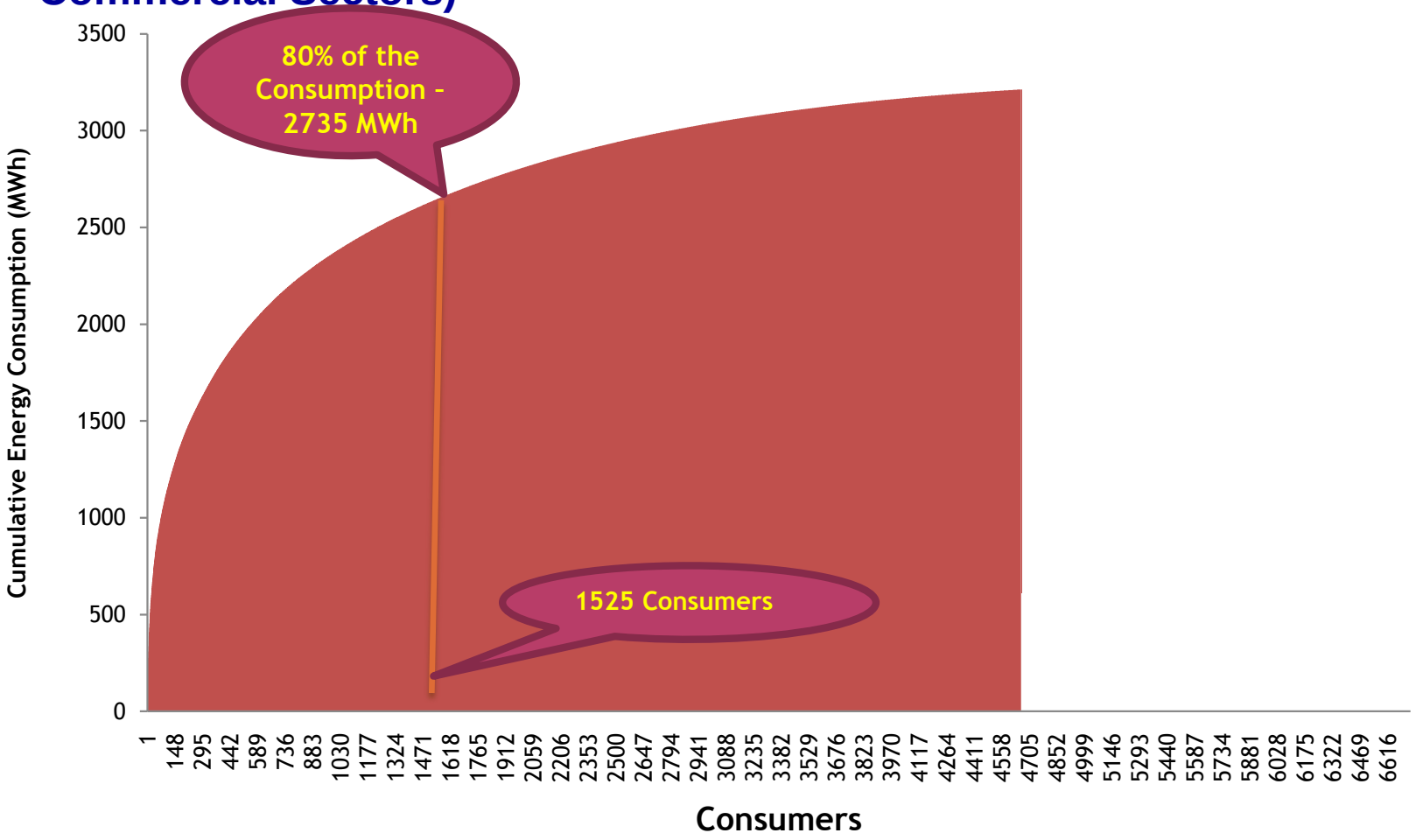


Domestic end-use profiles



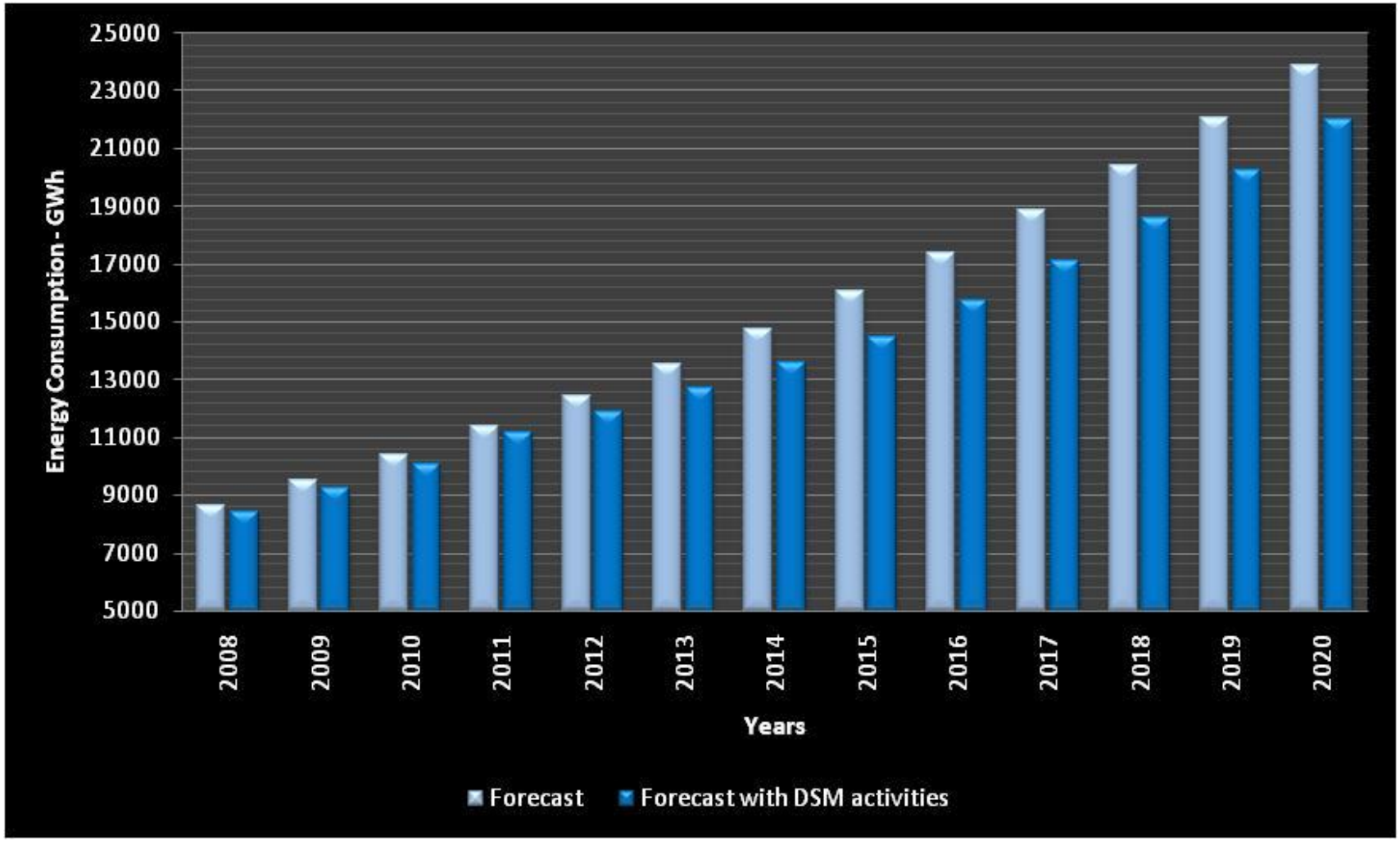
Energy Scenario Industrial and Commercial

- **Cumulative Consumption of Large & Medium (Industrial & Commercial Sectors)**

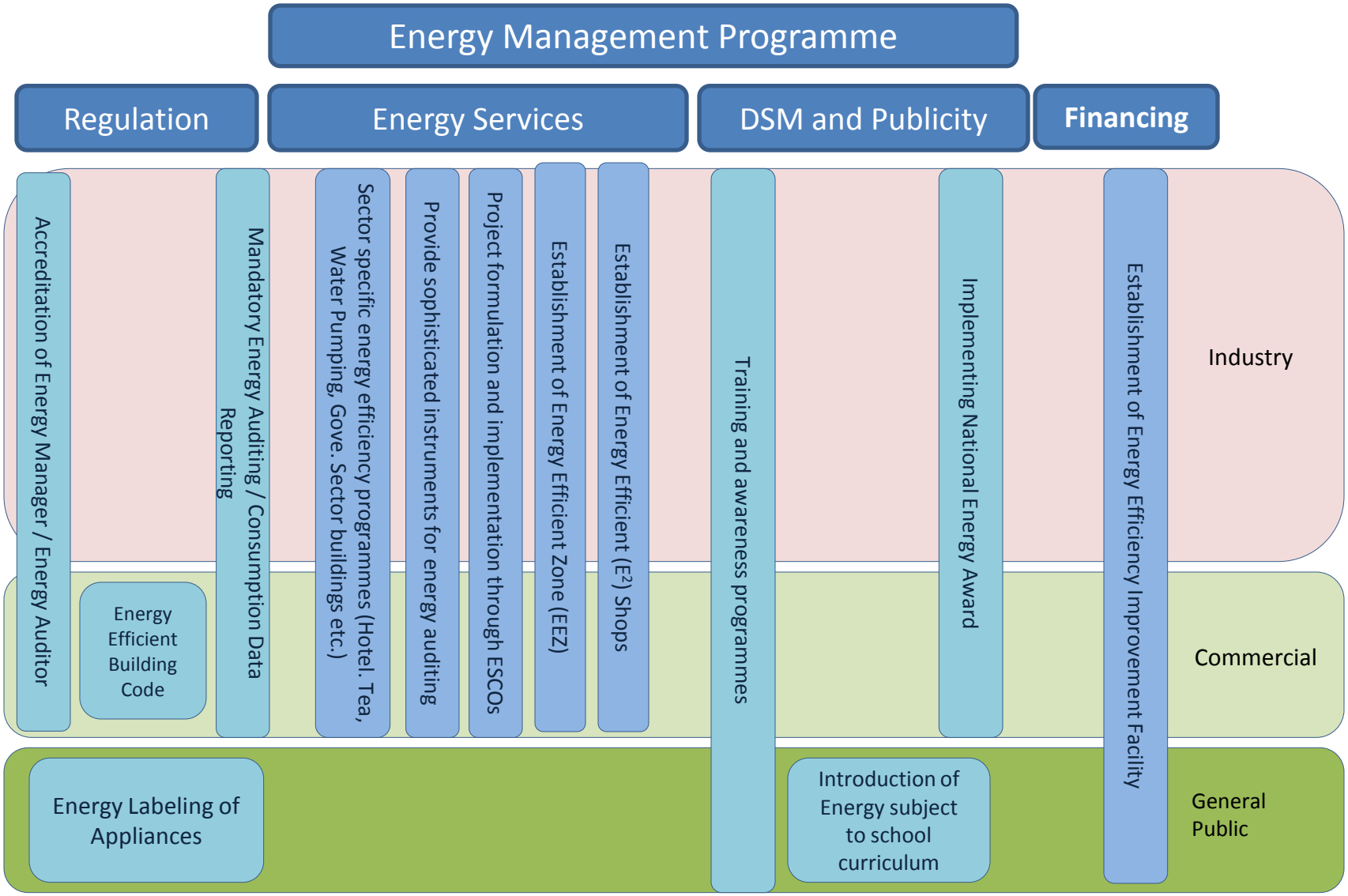


Targets

- Saving of 20% of 2010 energy consumption by 2020



Interventions

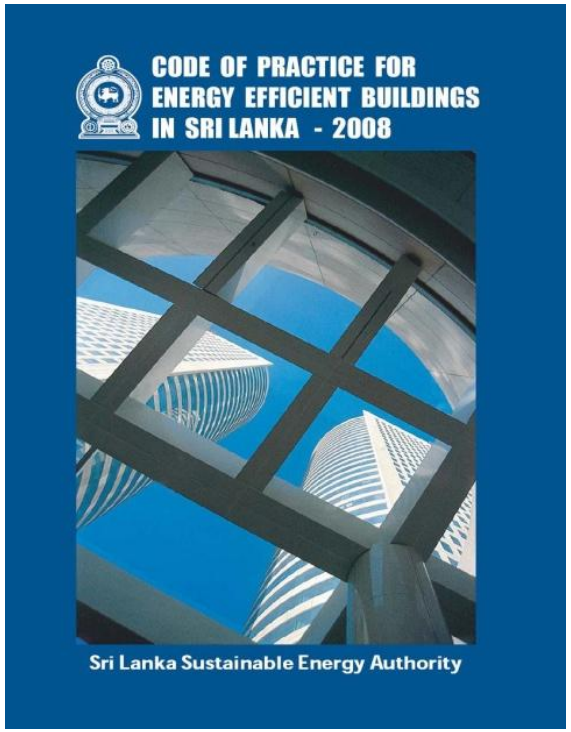


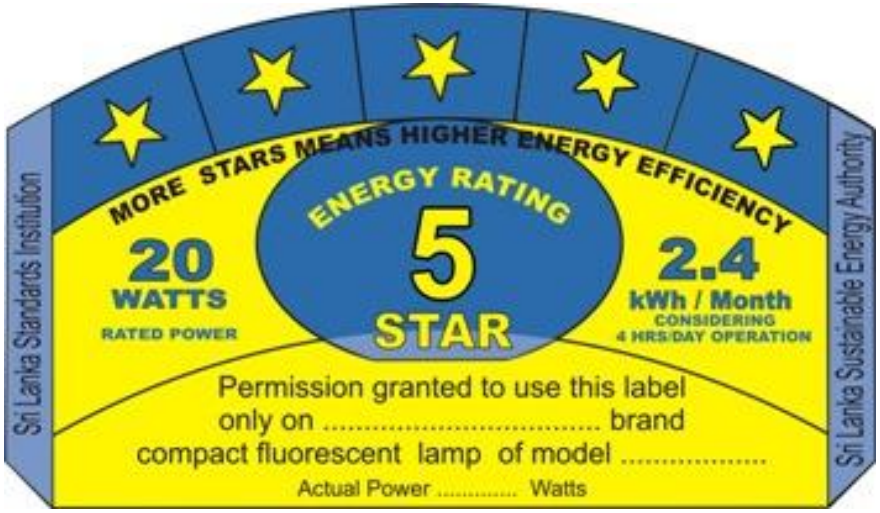
Interventions

- ✓ **Energy Manager & Energy Auditor Regulation** **About 1525 industries and establishments (consume 80% electricity)**
- ✓ **240 GWh annual saving potential**
- ✓ **Main Elements:**
  - ➢ **Energy consumption reporting**
  - ➢ **Appointment of certified energy managers/auditors**
  - ➢ **Implementation of plans of action on energy conservation**
- ✓ **Applicable for Any Industry and Commercial Establishments**
- ✓ **1st Phase of Implementation:**
  - ➢ **Annual Electricity Consumption > 600,000 kWh or**
  - ➢ **Annual Thermal Energy Consumption > 4,500 TOE**

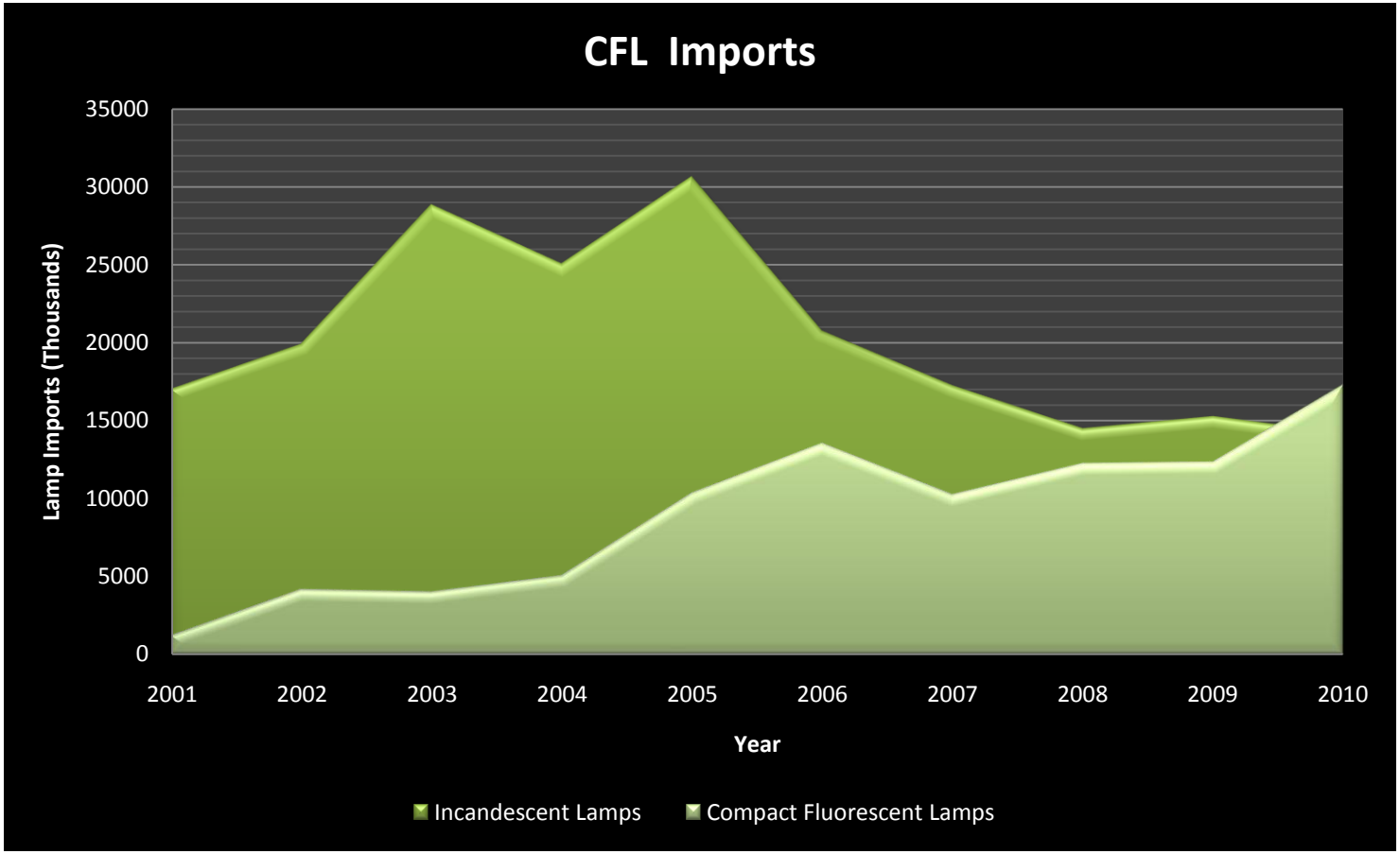
Interventions

- **Code of Practice / Green Certification of Buildings**
- **Energy Labeling Programme**

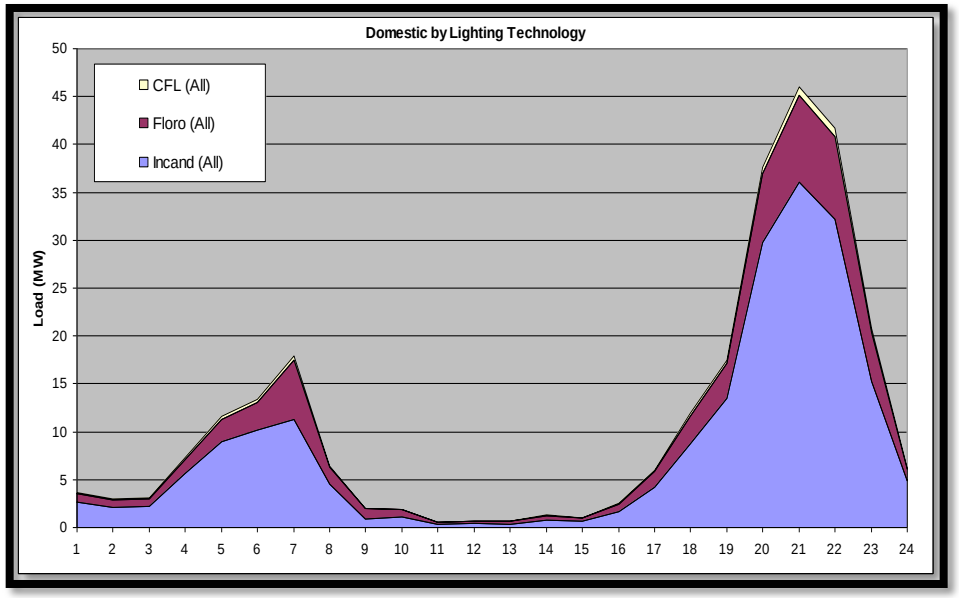




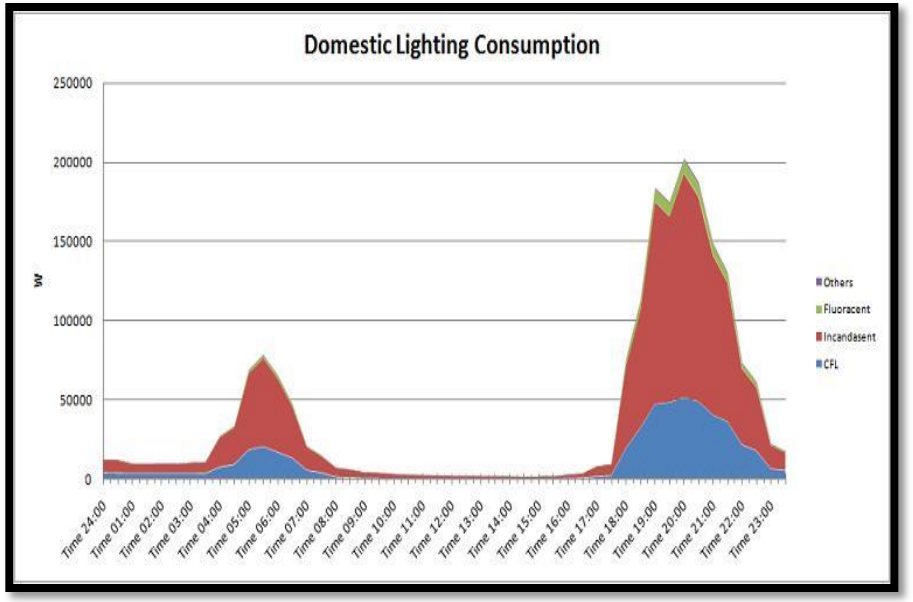
CFL Penetration in Sri Lanka



Impact of CFL on the Load Curve



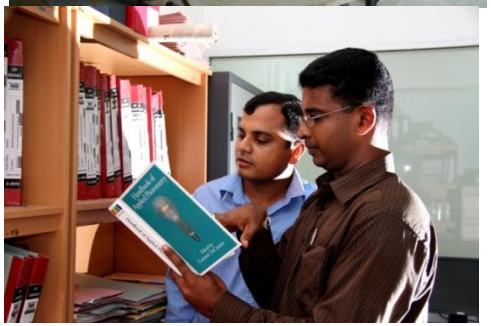
Year 2000



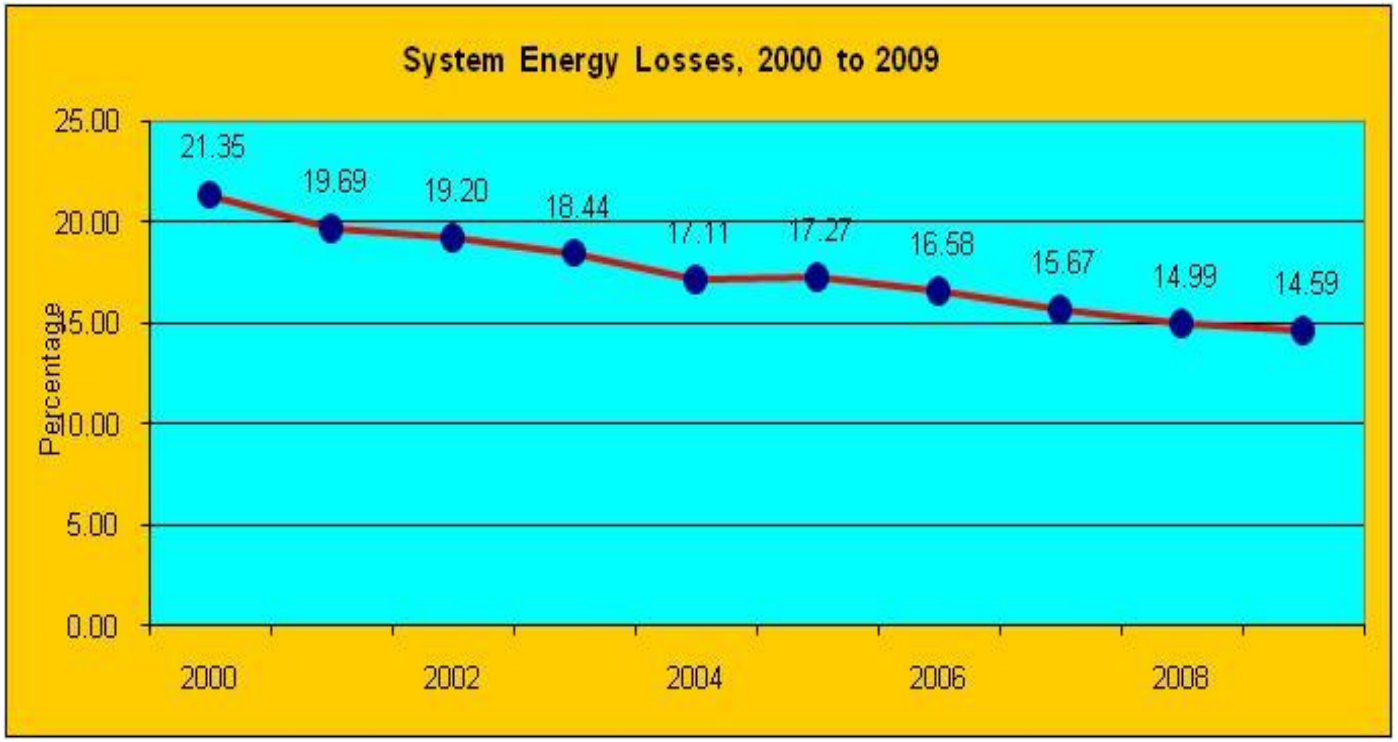
Year 2010

Regional Center for Lighting RCL

- University affiliated formal educational courses
  Short courses, seminars etc. and exposure for
  Academic staff with the support from
  knowledge partner, Lighting Research Centre (LRC)
  of Rensselaer Polytechnic Institute, New York
- State of the art Photometry Laboratory catering to the needs of manufacturers, dealers and users
- Library and Information Center



Supply Side - System Loss Reduction



Thank You

E-MAIL upali@energy.gov.lk

EXPLORE OUR SITE www.energy.gov.lk

Transitioning the South Asian Energy Market:
Advancing Low Carbon Growth Through Regional Cooperation and Cross-Border Energy Trade

11-13 July 2011

Clean Energy Development in India

12 July 2011

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E: info @ aeee.in

www.aeee.in

Alliance for an Energy Efficient Economy™

Alliance for an Energy Efficient Economy

AEEE is a member-driven industry association providing a common platform for energy efficiency stakeholders to collaborate with the Bureau of Energy Efficiency for implementing the Energy Conservation Act, and National Mission on Enhanced Energy Efficiency (NMEEE)

Vision

An Energy Efficient India

Alliance for an™ Energy Efficient Economy

AEEE Mission

AEEE addresses barriers to EE implementation through policy research; facilitating market transformation; fostering technology innovations; capacity building of energy professionals and stimulating financial investments

Alliance for an Energy Efficient Economy™

AEEE India

Large Corporate Members

Members

SEE-Tech

Cosmos Ignite

CMAI

Alternative Futures

Specific Project Partners:

AEEE Membership base

Leading equipment manufacturers & integrated EE solution providers
Contributed to the Corpus Fund of AEEE

- **Schneider Electric (India) Ltd**
- **Thermax Limited**
- **Conzerv Systems Pvt Ltd** (Now acquired by Schneider Electric)
- **Grundfos Pumps India Pvt Ltd**

Present Large Corporate Members include

- **Johnson Controls India**
- **SKF India Limited**

Specific Projects or Training Partners

- **Honeywell & CISCO, Infosys, Wipro, Tata Pwr, Reliance Infra/ REMI** (M&V Training/ CMVP Certification)
- **Forbes Marshall, FL Smidth** (for WHR initiative)

Alliance for an Energy Efficient Economy

AEEE 40 Members – July 2011

Utilities and DisComs

North Delhi Power Ltd, New Delhi

Bangalore Electricity Supply Co (BESCOM), Bangalore

EE Companies & Consultants

Dalkia Energy Services Limited

SEE-Tech Energy Solutions

A.T.E. Enterprises Pvt Ltd

CEPT University

Alien Energy Pvt Ltd

Beblec (India) Pvt Ltd

Invensys India Pvt Ltd

IRG Systems South Asia

KLG Systel Ltd

Wipro Eco Energy

Customised Energy Solutions

Paharpur Business Centre

Spectral Services Consults Pvt Ltd

Ecofirst Advisory Services

Marc Eco Lighting Pvt Ltd

Tide Technocrats Pvt Ltd

Data Matrix Infotech Pvt Ltd

Aqua MW

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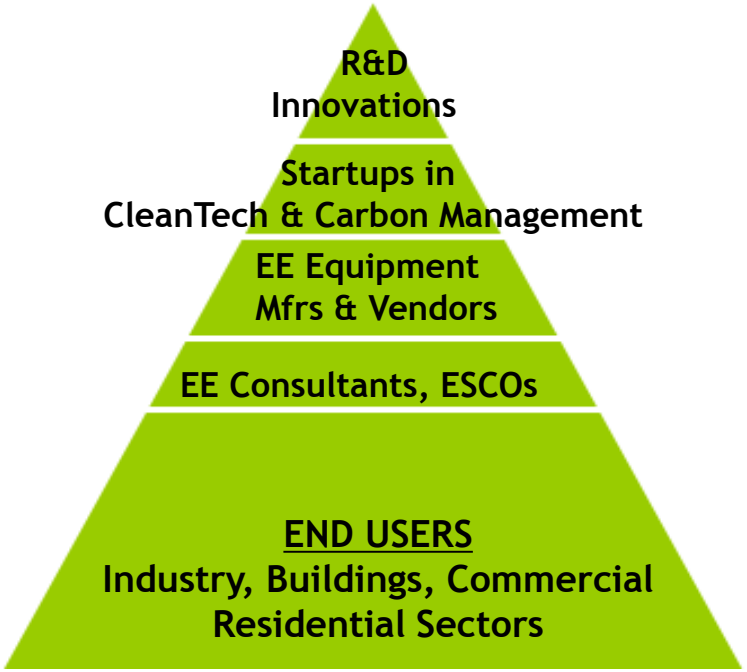
Integrate Clean Energy & EE in all Sectors

"Mainstreaming energy efficiency in investment operations by systematically integrating energy efficiency operations within the core energy practice by replicating the *business-as-usual* and proven energy sector project designs and instruments" - WB EE Action Plan for Sustainable Development (2007)



Key Stakeholder for Clean Energy Integration

AEEE's Support

- Interface on EE Policies & Regulations
- Participate & partner in EE implementation
- Identify Grants & Funding supports
- Access & dialogue with EE financing community (Banks & FIs)
- Interface between Start-ups & VC / Donors

Alliance for an Energy Efficient Economy™

Current Energy Scenario

- India's Economic Growth – around 7-8 % annual in recent years
- Need to meet economic and environmental goals – through Renewables and Energy Efficiency
- Quality & Access are key challenges
- Demand supply gap as reported by CEA for 2009-10 was 84 TWh 10% of total requirement
- Peak demand deficit was more that 15 GW – a shortage of 12.7%
- To meet the anticipated demand in 2017, we need to double the current capacity to 300 GW
- Oil demand for Transportation by 2015 would be 40% higher than that of 2007 and 150% higher for 2030
- Renewable Energy has a key role to play in meeting this demand

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Renewable Potential and Achievement in India – Grid Connected

Sl. No.	Source / System	Estimated potential (MW)	Assumed PLF (%)	Annual Generation (billion kWh)
1	Wind	**1,00,000**	**25**	**219**
2	Small Hydro (< 25MW)	**15,000**	**45**	**46**
3	Bagasse	**5,000**	**60**	**26**
4	Biomass	**17,000**	**60**	**88.72**
5	Large Hydro (Existing & Future)	**1,00,000**	**60**	**526**
6	Waste to Energy	**5,000**	**60**	**26.28**
7	Solar CSP Based	**2,00,000**	**35**	**613.2**
8	Solar PV	**2,00,000**	**20**	**350.4**
9	Geothermal	**10,000**	**80**	**70.1**
	Total	**6,52,000**	**-**	**1,966**

Source: World Institute for Sustainable Energy, Pune, India. 2010

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RE's Role in India's Energy Scenario-1

- India has abundant untapped natural resources
  - Vast landmass receiving highest Solar radiation in the world
  - Long coastline and high wind velocity for land-based and offshore windfarms
  - Significant annual biomass production
  - Numerous rivers and waterways for hydro power
- RE a buffer against energy security concerns, reducing dependence on imported fossil fuels
- RE offers hedge against hike and volatility of oil and gas prices
  - Oil prices expected to increase by 50% in 20 years from 2010, where as PV systems are expected to decrease less than half of 2007 prices in the same period

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RE's Role in India's Energy Scenario–2

- Off-grid RE power can meet demand in unserved rural areas
- RE can be supplied to both urban and rural poor – addressing India's GHG concerns & goals
- RE can support climate change goals set under NAPCC and recent Carbon intensity goals
- India aims to emerge into a global leader in RE
- Vast opportunities for collaboration at regional level

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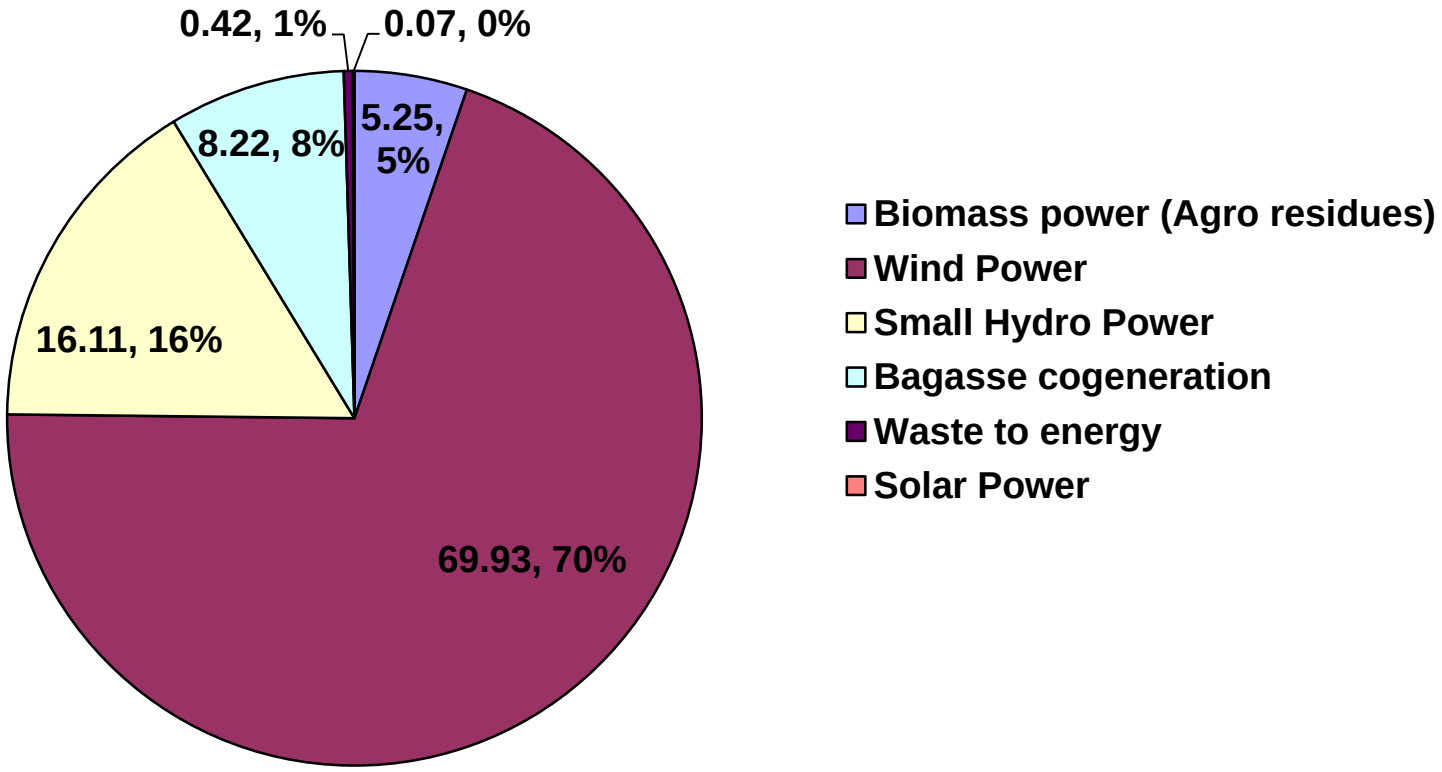
Contribution of RE Technologies to Grid-connected Power



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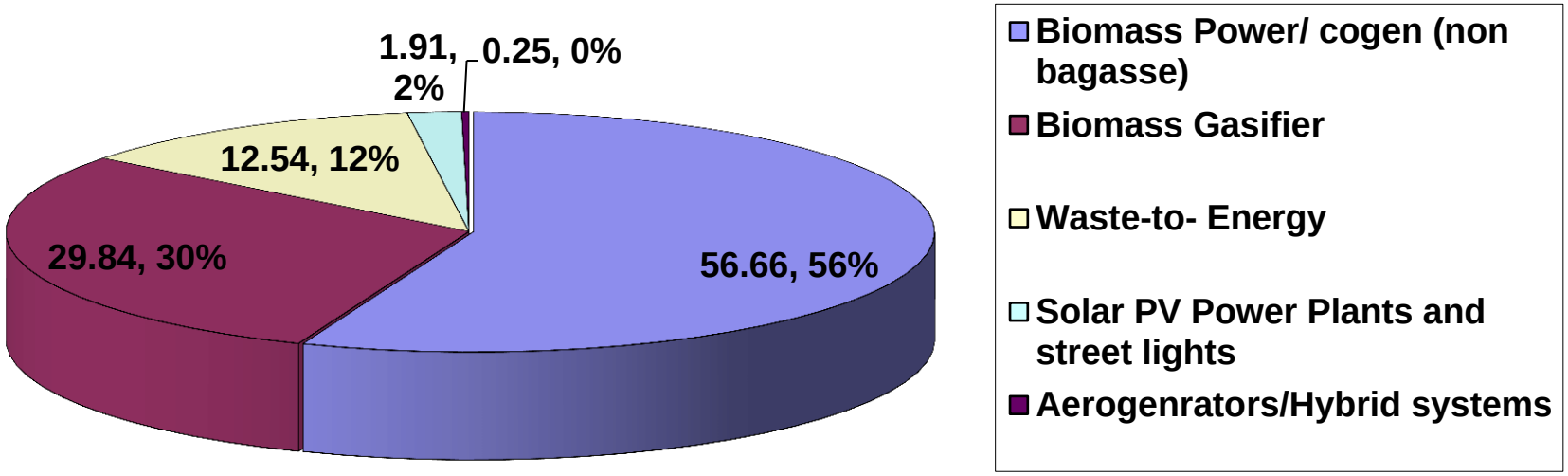
Contribution of RE Technologies to Decentralised Power



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RE and "*Bottom of the Pyramid*" Market

- **RE offers unique opportunity to meet the energy needs of the *bottom of the pyramid* population**
- **Micro Finance Institutions provide credit to individuval or local NGOs for purchase of RE systems: Solar lanterns, Solar cookers, small biogas plants in off-grid areas**
- **A few successful models of micro-hydels and water mills, managed by local community and cooperatives**

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Financing RE in India

- Clean energy investment worldwide Reached US$ 162 billion in 2009
- India has been a part of the boom in investment in RE
- Total financial investment in clean energy in India was $ 135 billion in 2009, ranking 8th in the world, according to UNEP study.
- E&Y ranks India the fourth most attractive country for RE investment in the world, only behind US, China & Germany

Initiatives toward Low Carbon Growth to address Climate Change

- CNG Based public transport in New Delhi and other cities
- Metro Rail Systems in major metros. Delhi has nearly 200 km network and growth
- Standards and Labeling Programme for Appliances driving our inefficient equipment
- Energy Conservation Building Codes – moving from Voluntary to Mandatory
- Information Technology growth and lower energy intensity of economy
- India's active participation in CDM process – over 500 – projects regd
- Promoting Green Entrepreneurship - WRI, CII – New Ventures India
- Voluntary Carbon Disclosure by Indian Companies

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Thank you

Large Corporate Members

Members

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Specific Project Partners:

Transitioning the South Asian Energy Market

July 11-13,2011, Male

Clean Energy Development in Sri Lanka

Upali Daranagama

Additional Secretary (Planning and Development)

Ministry of Power and Energy

Contents

- Sector overview
- National policy on renewables
- Renewable energy resources
- Development plan
- Business environment
- Development process
- Success factors

Power Sector Overview

Installed Capacity 2,878 MW

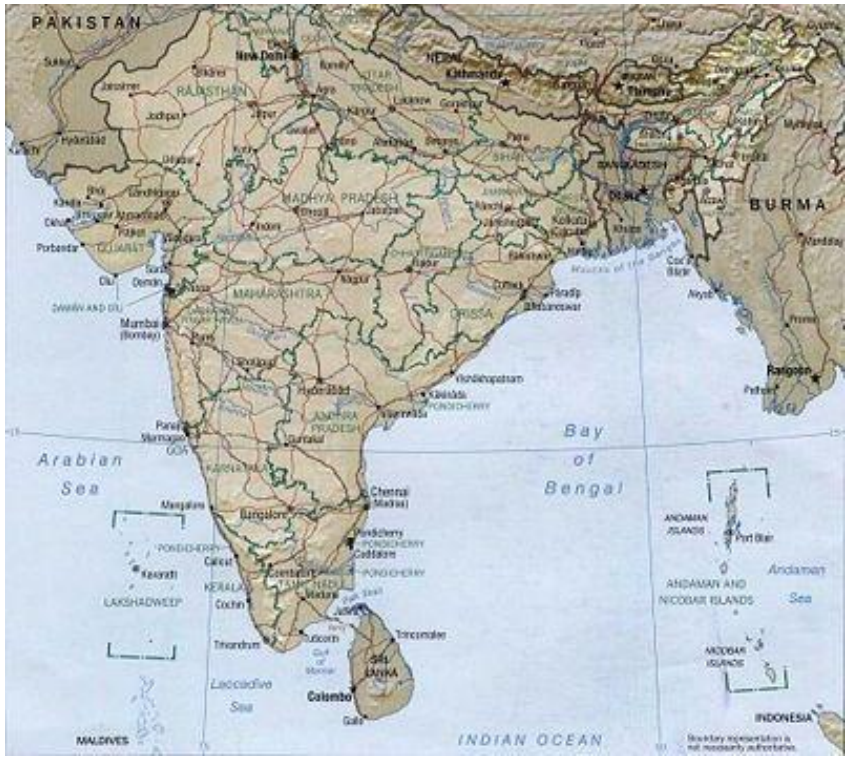
Hydro	1,205 MW
Thermal	1,560 MW
NCRE	213 MW

Generation

Hydro	40%
Thermal	60%

Electrification Level 89%

Grid Connected	87%
Off-Grid	02%



A brief history of Renewable Energy initiatives

- Plantation industry has benefited from Small Hydro Power (SHP) in either electrical or mechanical form from late 1880's
  - Capacity of these captive power plants reached almost 10MW by late 1950's
- With the availability of cheap grid electricity most of these installations went into disuse by 1960's
- Renewed interest from mid 1970's and a new enthusiasm in 1980's, due to oil shocks

Source : Sunith Fernando, An Assessment of Small Hydro Potential in Sri Lanka

National Policy on Renewables

The Government will Endeavour to reach a level of 10% of electricity generation using Non Conventional Renewable energy resources by 2015 (it is near 6% today)

- Availability of Standardized Power Purchase Agreement (SPPA) for less than 10 MW plants.

  Simple approach

  What ever produced will be purchased

  Acceptable to the Banks

  Low transaction costs

- Resource allocation

  First Come first served basis

  Devoid of cumbersome competitive processes

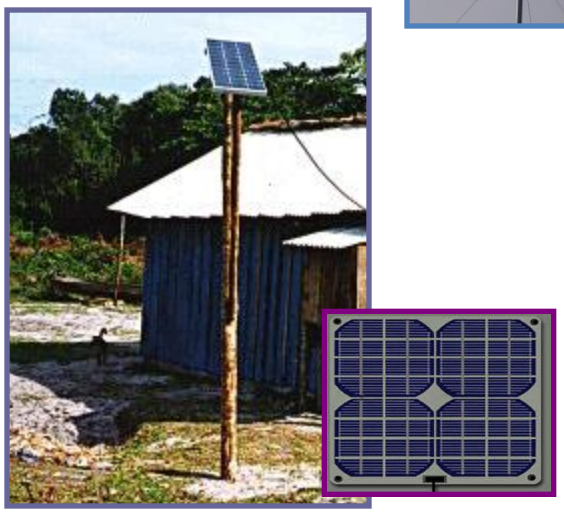
Renewable Energy Resources

Biomass

Wind

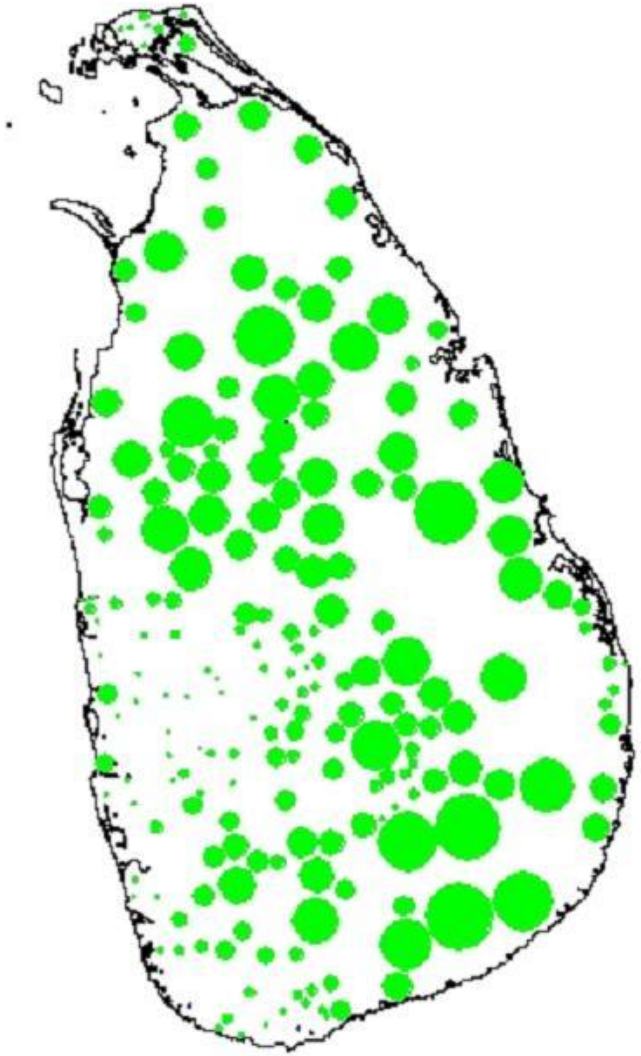
Hydro

Solar



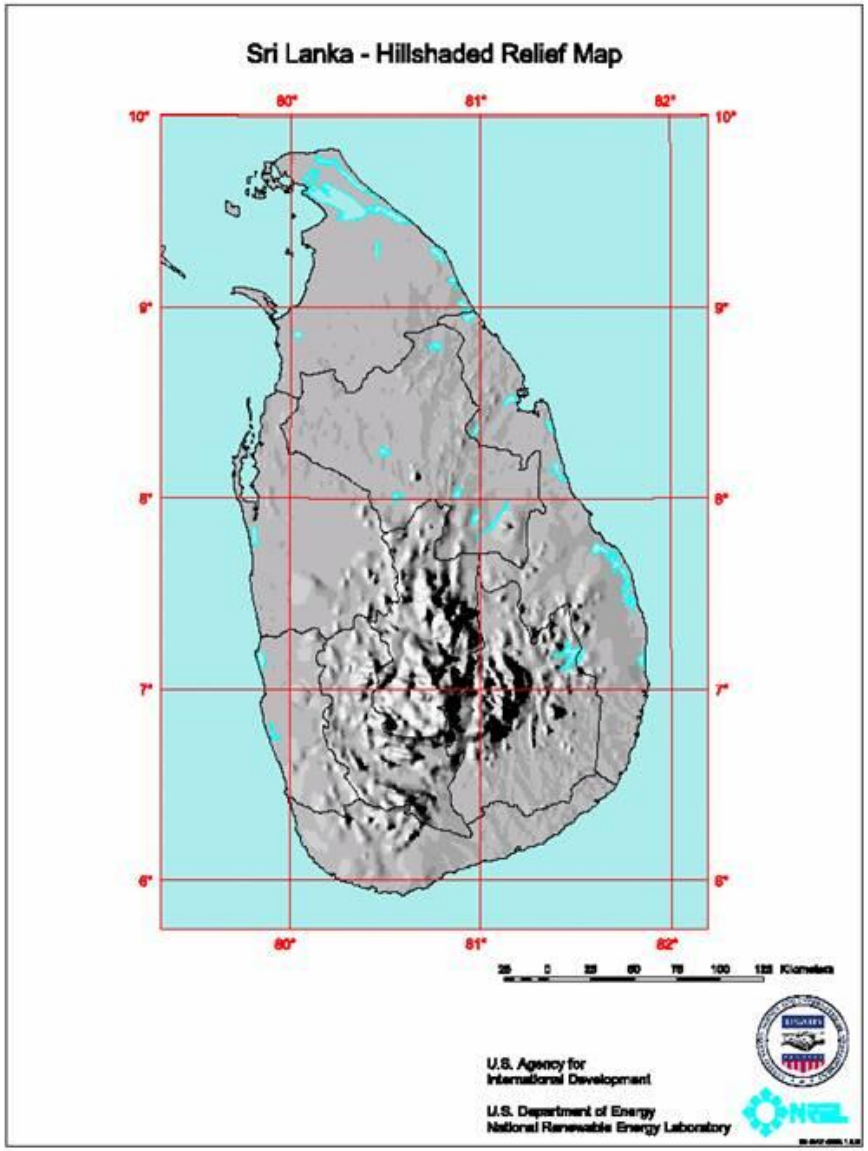
Biomass Resources

- 1,600,000 ha of marginal land available for utilisation
- 400,000 ha of coconut land available for underplanting
- Fuelwood yields range from 20-45 metric tonnes / year on a dry matter basis
- Green circles representative of fuelwood generation potential



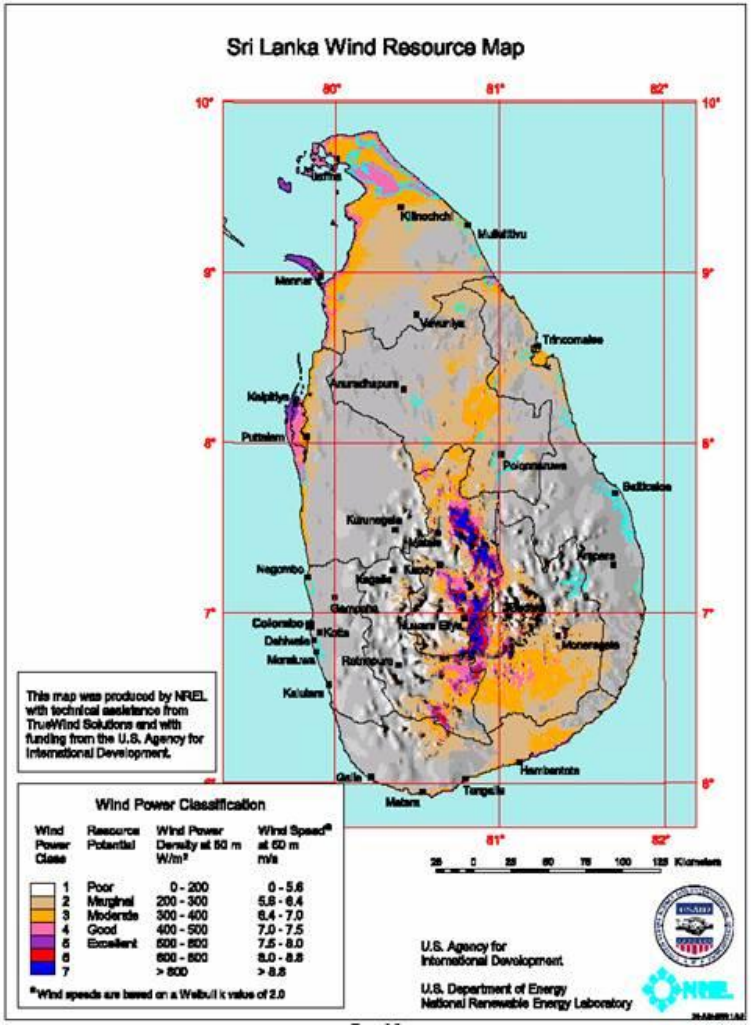
Hydro

- Central Hill Region
  - Peak of 2500m
- Good Rainfall
  - 2500-5000mm annual rainfall
  - Two monsoons



Wind Power Development

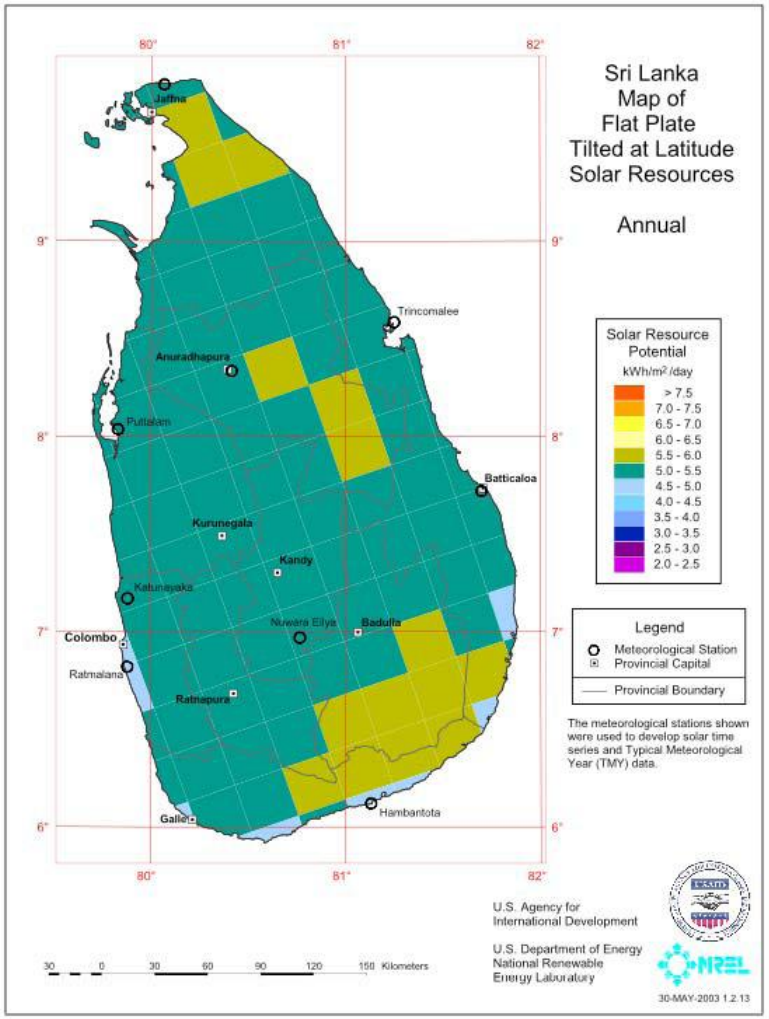
- Good Potential
  - Reliable monsoons
  - Long coastal belt
- West coast and central hills
  - 6-7 m/s mean annual wind speeds



Solar

Close to the equator

- In lower plains
  4.0 – 5.5 kWh/m^2/day
- 2.0 – 3.5 kWh/m^2/day in higher elevations



Development Plan

Cumulative Renewable Energy Capcity Additions MW					
Year	**Biomass**	**Hydro**	**Wind**	**Other**	**Total**
2007	1	119	3		123
2008	11	155	3		169
2009	15	165	14		194
2010	15	200	34	1	250
2011	20	225	34	1	280
2012	20	280	35	1	336
2013	20	295	85	2	402
2014	30	310	85	2	427
2015	40	330	85	5	460

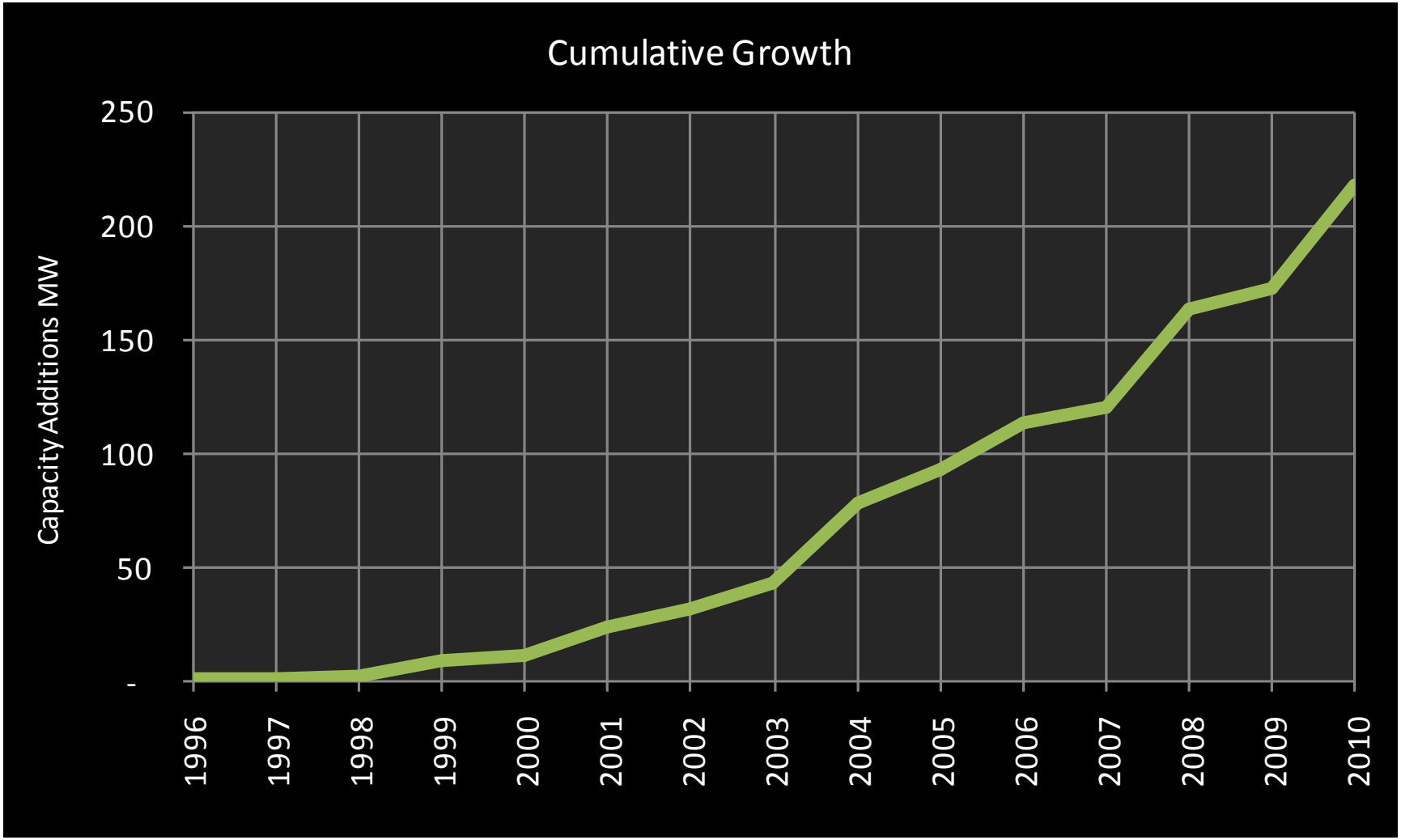
Steady growth of SHP sector

- The SHP sector grew at phenomenal phase due to the conducive environment
  - Acceptance of industrial norms – SPPA and procedure
  - Availability of attractive funding
    - First from ESDP*
    - Thereafter from REREDP**
  - Requirement of additional generation capacity

*Energy Services Delivery Project

** Renewable Energy for Rural Economic Development

Exponential growth of small renewable capacity



Wind - Past / Ongoing Activities

- Pilot Wind Power Project in 1999
  - **3 MW, 5 Turbines**
  - **in Southern region**
- Commercial Scale wind plants
  - **33 MW in operation**
  - **60 MW under construction**
  - **100 MW Wind Farm by 2015**

Business Environment

- Enthusiasm on renewable energy development is high among the local private sector
  - Relatively risk free investment
- World Bank is operating a special credit line for renewables.
  - More than 80 projects benefited
- Carbon trading policies are being developed.
  - pCDM instrument to be developed

A Growing Manufacturing Industry

few kW then…

Multi MW now…

Institutional Framework

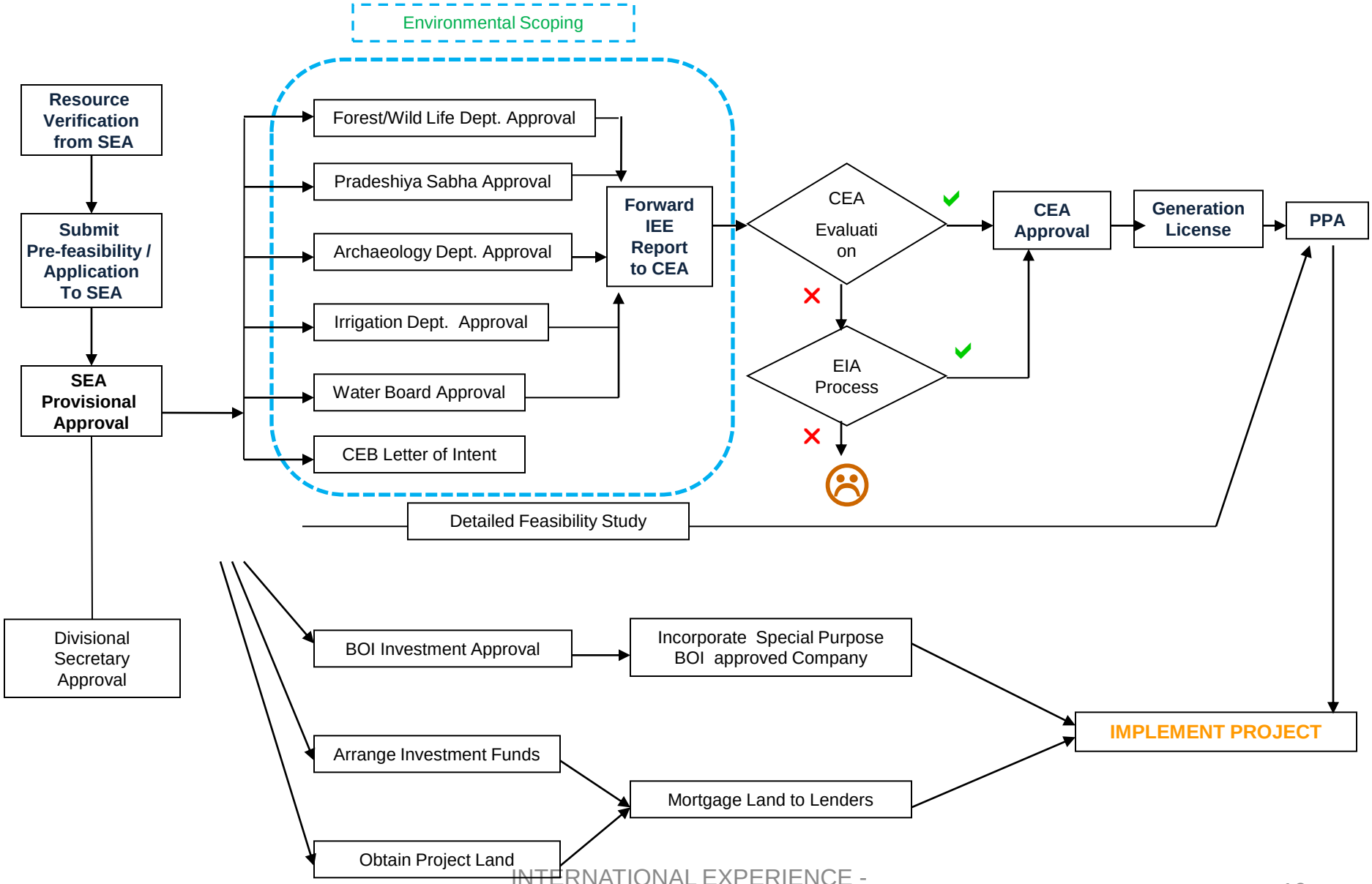
- Sustainable Energy Authority

(a) to identify, assess and develop renewable energy resources with a view to enhancing energy security and thereby derive economic and social benefits to the country;

Powers, Duties and Functions

- Assist the Minister in formulating national energy policy, including renewables
- Identify, conserve, inventorise and manage all renewable energy resources and technologies
    - Assess resource potential and prepare resource maps
    - Declare energy development areas
    - Render professional services in project formulation
- Develop a long term renewable energy plan
    - Interim targets for each resource
    - Prepare development guidelines
- Mobilise financing
    - Grants for pilots, Credit enhancement and concessionary funds
    - Technical services to DNA on CDM projects

RENEWABLE ENERGY DEVELOPMENT PROCESS IN SRI LANKA



Success factors

- Virtually free from market risks
  - What ever produced will be purchased
  - Guaranteed purchase price
- Availability of Standardized Power Purchase Agreement (SPPA)
  - Simple approach
  - Acceptable to banks
  - Low transaction costs
- Resource allocation
  - First come first served basis
  - Devoid of cumbersome competitive processes

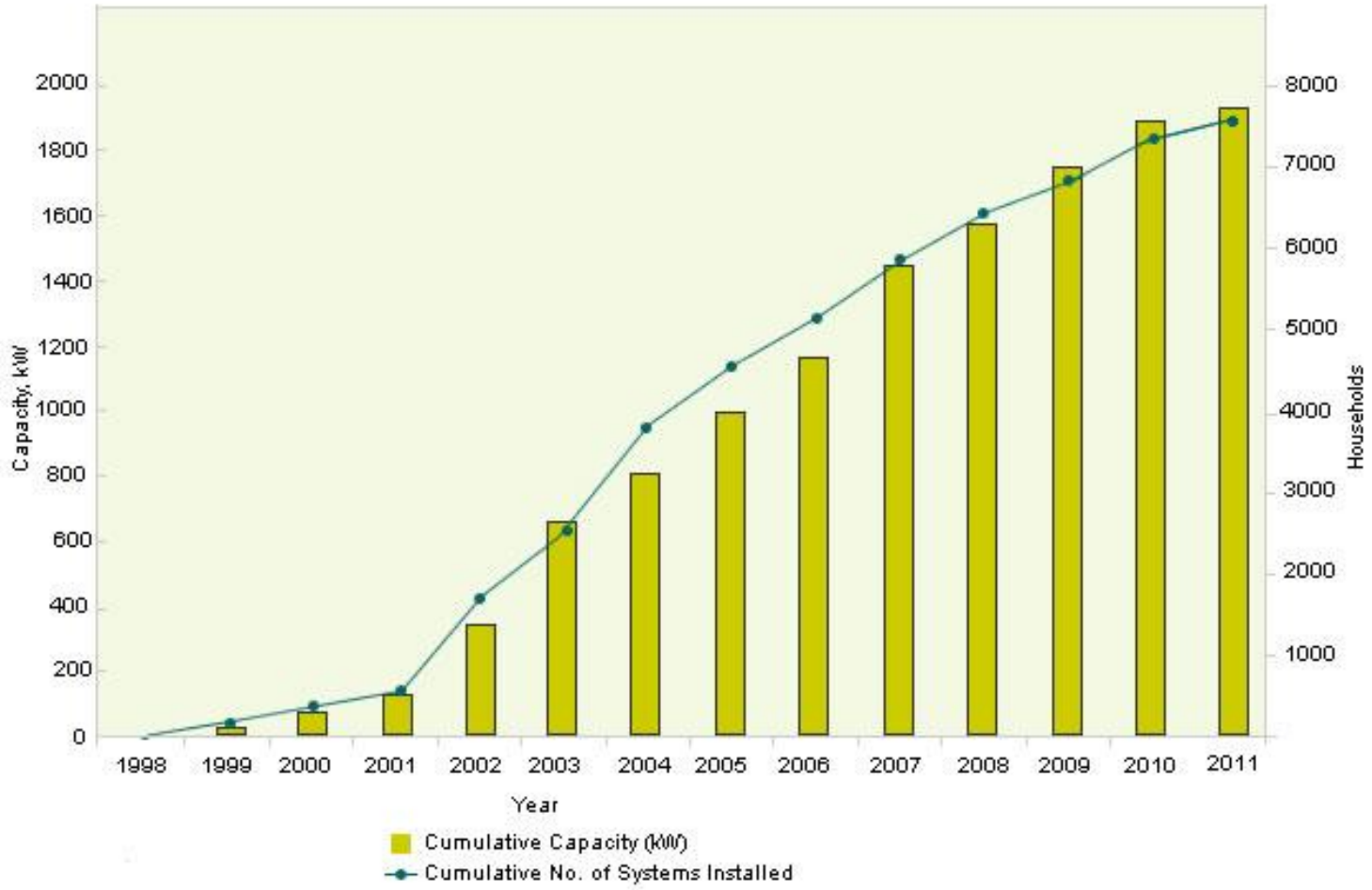
Success factors… contd.

- Financing mechanism in place
  - Two consecutive World Bank projects (ESDP and REREDP) with a sound disbursement procedure
- Technology development keeping pace
  - Local Engineering know how developed to commendable levels
  - Capacity of construction companies developed

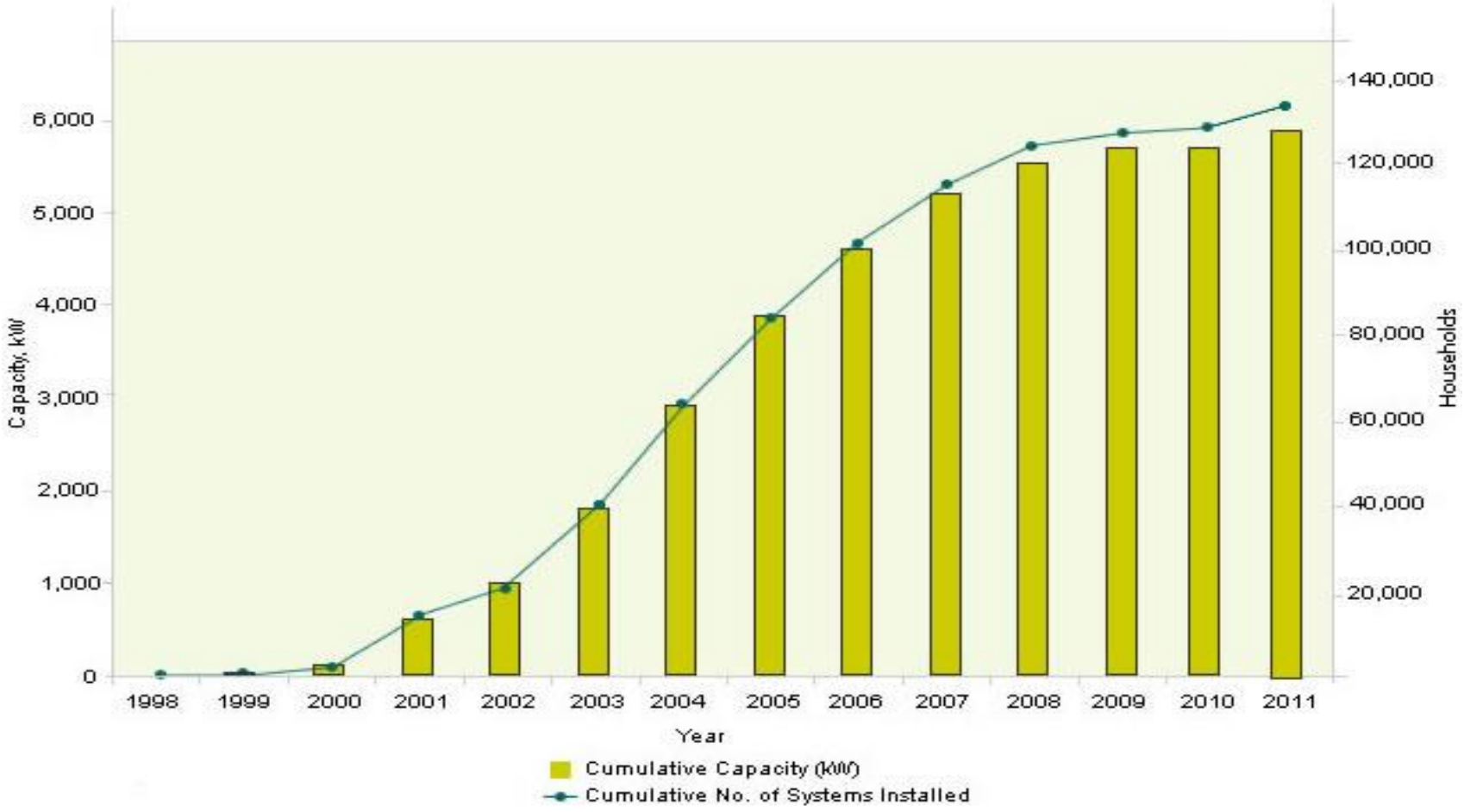
Off-grid Renewable Energy Development

- 1978 – Rural Energy Centre (REC), Model village at Pattiyapola (CEB) - UNEP asssisted
- 1980 – Grid assisted battery charging scheme
- 1983 – Pilot project on photovoltaic to electrify remote villages, Siriyagama and Bundala and solar home systems island wise. (CEB)
- 1985 – Pilot project on Efficient fuel wood stove (Hambantota and Ratnapura districts) (CEB)
- 1000 Solar Home Systems in a model village named Pansiyagama
- 1992 – First off grid village hydro project. (ITDG, CEB)
- 2002 – First Gliricidia wood based dendro power plant - Sapugaskanda. (Alternative Energy Division of Ministry of Science and Technology)
- 2004 – First off grid community based dendro plant .

ff-Grid Village Electrification Schemes Completed under ESD (1997-2002), RERED (2003-2007) & RERED Additional Financing (2008-2011) Projects



Solar Home Systems Installed under ESD (1997-2002), RERED (2003-2007) & RERED Additional Financing (2008-2011) Projects



Thank You

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