Asian Low Carbon Society Research Network

04-July 2011, Malaysia

Low Carbon Development in Cambodia

Hak Mao

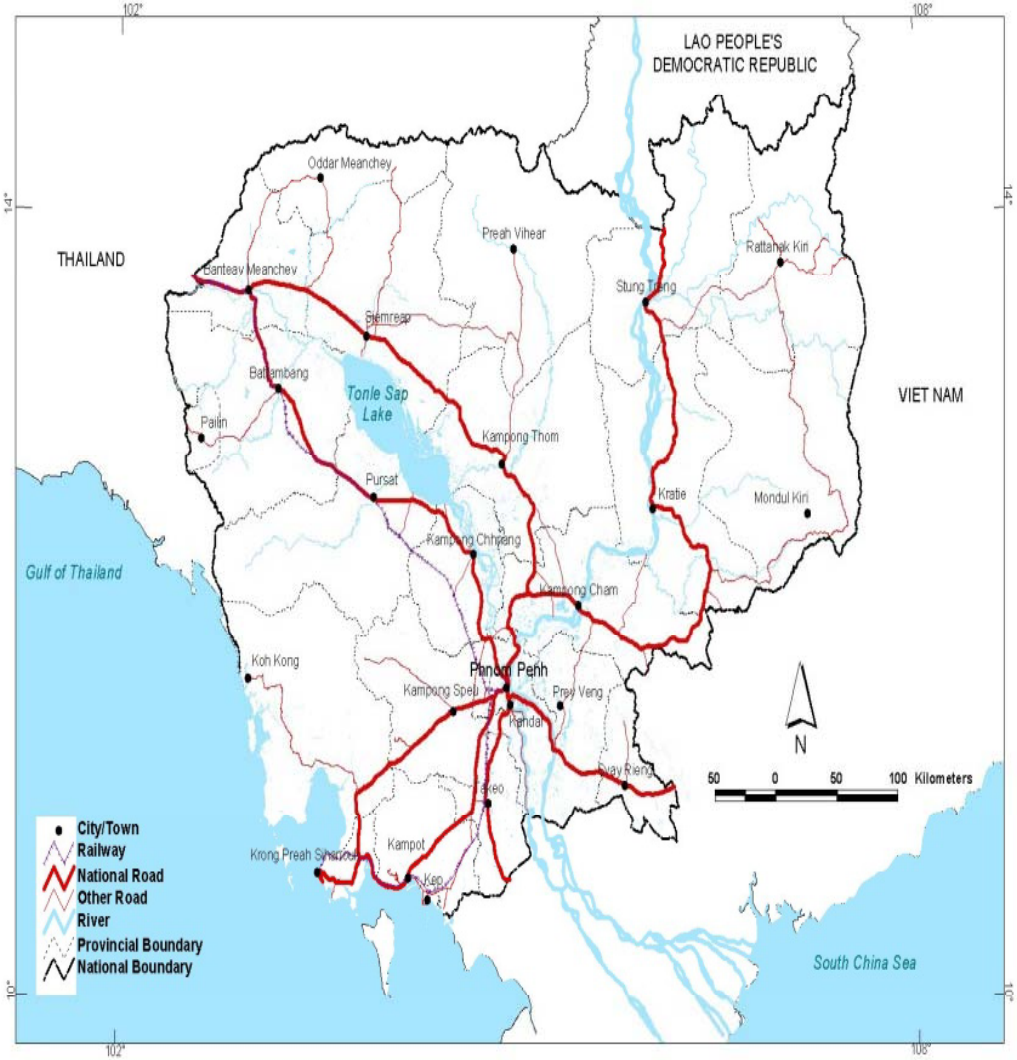
Head of Office, Climate Change Department,

Ministry of Environment ,

Cambodia

I. Country Background

- Total area: 181,035 km^2.
- Population: 13,388,910 (2008)
- Growth rate: 1.54%
- The country borders to:
  - Thailand, the West
  - Lao PDR, the North
  - Vietnam, the East:
  - Golf of Thailand, the South-west
- It is an agricultural country with 80.25% living in rural areas



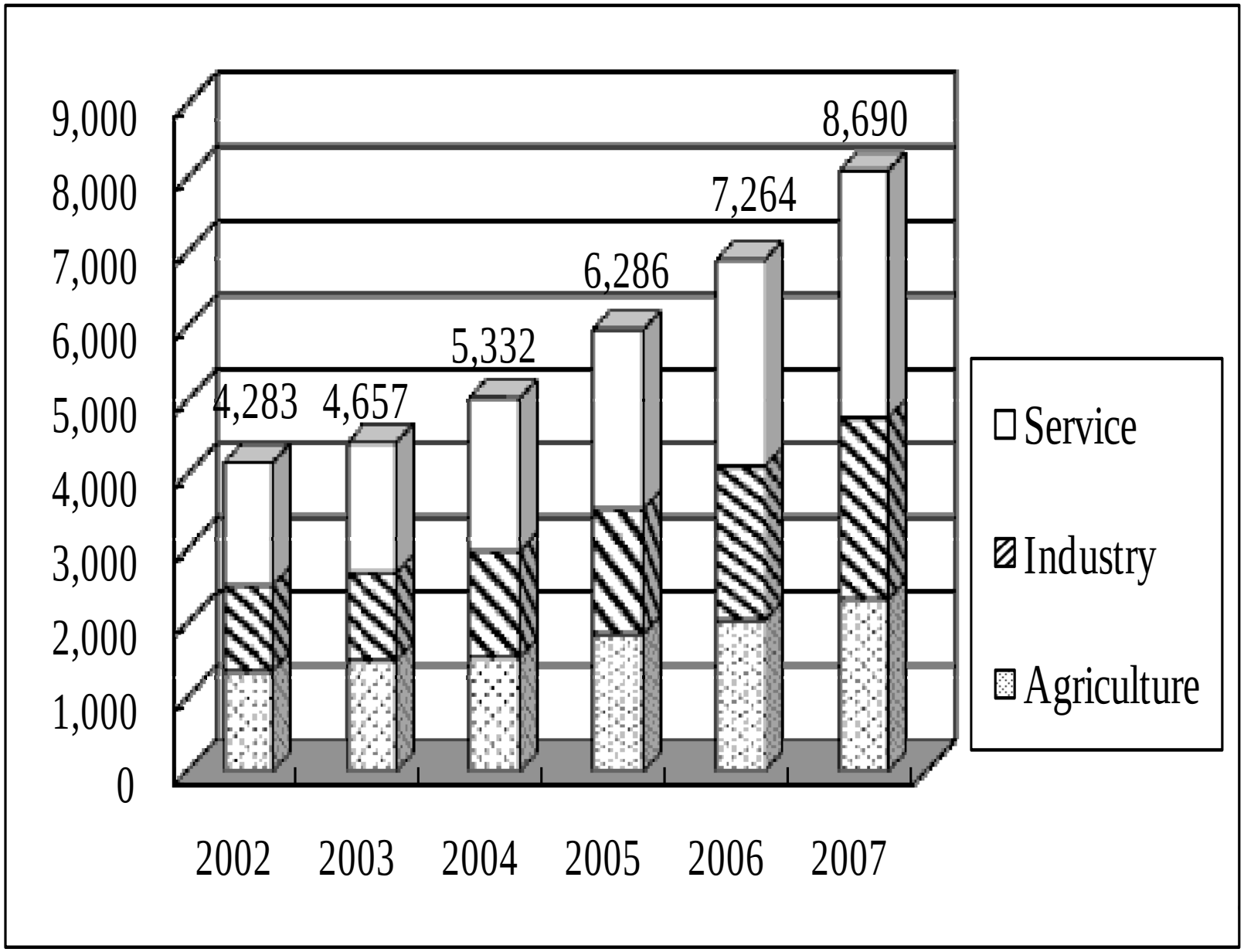
II. Climate Information

- Cambodia's climate is dominated by the tropical monsoon with distinct rainy/wet and dry seasons;
- Rainy season (May to Oct.), while dry season (Nov. to April);
- Average max. temp. is around 28^{o}C and average min. temp. around 22^{o}C;
- Max. temp. exceeding 38^{o}C;
- 1994 to 2006, the average annual rainfall has fluctuated between 1,400 mm and 1,926 mm and in the coastal areas may reach 5,000 mm;
- Floods affected 1.6 million Cambodians in 1996, 3.4 million in 2000 and 1.7 million in 2001;
- Floods in 2000, 2001 and 2002 were the worst that hit Cambodia and resulted the death toll at 347 fatalities (80% were children), 317,975 houses damaged. Total direct physical damages to infrastructures, properties and crops were estimated at US $150 million; and
- 1990-2000 records suggested that floods resulted in average annual losses of 100 lives and financial losses in the range of $100 to 170 million.

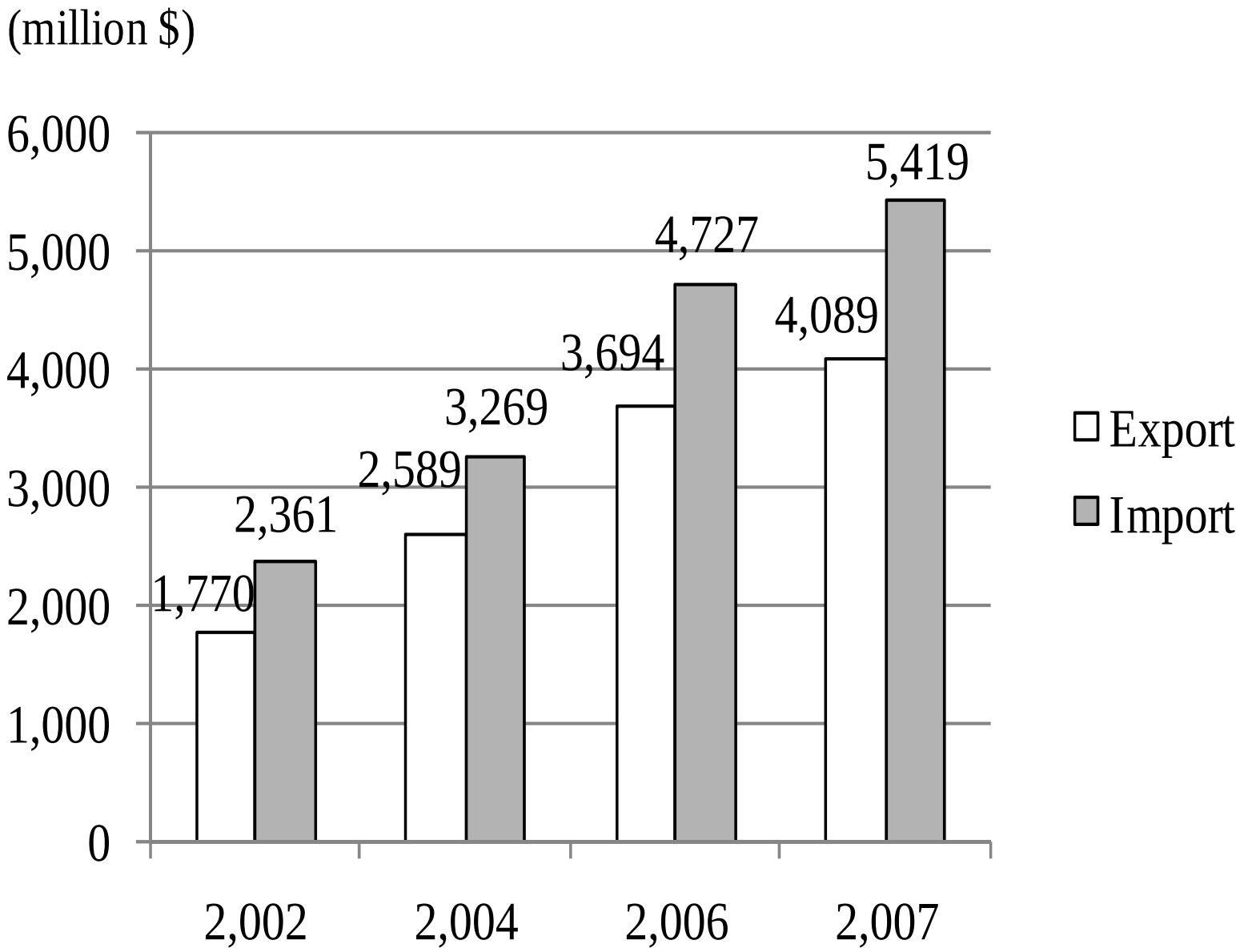
III. Cambodia's Current Economic condition

- Cambodia's economic base is shifting away from the agriculture, forestry and fisheries sector to the industrial sector;
- The services sector is one of the largest sectors in the economic development accounting for 36% of GDP and is largely driven by the tourism industry;
- However, agriculture is still important in rural areas, where most of people depends on paddy cultivation for subsistence;
- Per capita GDP rose from 1.86 million Riels in 2005 to 2.42 million Riels in 2007;
- The spread of financial crisis and increasing food price has adversely impacted the Cambodian economy; and
- RGC set RS, NPRS and NSDP is for economic growth and poverty reduction to ensure sustainable development.

1. Economic Trend

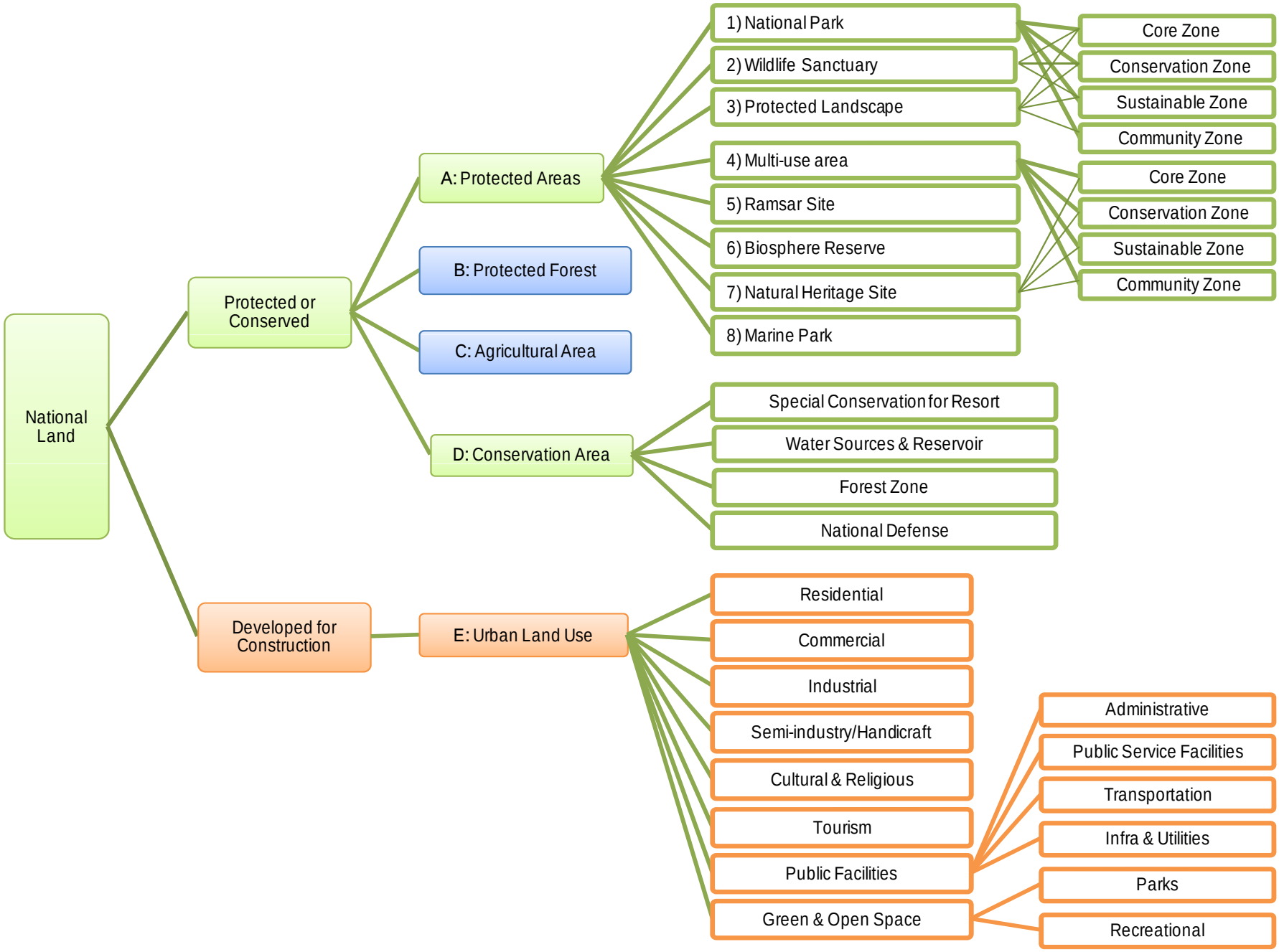


2. Export and Import Trend



IV. Land Use

- The land use plan, which has been legally defined by Law of Land Management, Urban Planning and Construction (1994) and Land Law 2001, and other sub-decrees;
- Related Laws: Law of Environmental Protection and natural Resource Management, Law of Forestry and Law of Fishery and others; and
- Once the land use plan is authorized, the monitoring of the implementation and effectiveness of the plan is another important task by DLMUPCC as well as MLMUPC


National Land
Protected or Conserved
A: Protected Areas
1) National Park
2) Wildlife Sanctuary
3) Protected Landscape
Core Zone
Conservation Zone
Sustainable Zone
Community Zone
4) Multi-use area
5) Ramsar Site
6) Biosphere Reserve
7) Natural Heritage Site
Core Zone
Conservation Zone
Sustainable Zone
Community Zone
8) Marine Park
B: Protected Forest
C: Agricultural Area
D: Conservation Area
Special Conservation for Resort
Water Sources & Reservoir
Forest Zone
National Defense
Developed for Construction
E: Urban Land Use
Residential
Commercial
Industrial
Semi-industry/Handicraft
Cultural & Religious
Tourism
Public Facilities
Green & Open Space
Administrative
Public Service Facilities
Transportation
Infra & Utilities
Parks
Recreational

V. Current Population Circumstance and Projection

1. Current Population Data in Cambodia

Year	Population (in million)			Average annual growth	Sources of data
	Both sexes	Male	Female		
1962*	5.7	2.9	2.8		
1970	6.8	-	-		
1981	6.7	3.1	3.6		
1988	8.1	3.7	4.4	2.8	
1989	8.3	3.8	4.5		
1990	8.6	4.0	4.6		
1991	8.8	4.1	4.7	2.5	
1992	9.0	4.1	4.9		
1993	9.3	4.3	5.0		Provincial Reports
1994	9.9	4.7	5.2	6.1	SESC93-194
1995	10.9	5.2	5.6		DSC 1996 1/
1996	10.3	5.0	5.4		SESC96
1996	10.7	5.1	5.6		DSC96
1997	10.4	4.9	5.4		CSES97
1998*	11.4	5.5	5.9	2.5	GPCC98
2004**	12.8	6.2	6.6	1.81	CIPS 2004
2008*	13.4	6.5	6.9	1.54	GPCC 2008

2. Population Trend

1950	4 346
1955	4 840
1960	5 433
1965	6 141
1970	6 938
1975	7 098
1980	6 748
1985	8 099
1990	9 690
1995	11 380
2000	12 760
2005	13 866
2010	15 053
2015	16 357
2020	17 707
2025	18 973
2030	20 100
2035	21 121
2040	22 086
2045	22 997
2050	23 795

VI. Energy Circumstance in Cambodia

- Demand for Electricity in Cambodia
  - 70% Rural population lack access to electricity
  - Kerosene is predominantly used for domestic lighting
  - Some use car batteries for lighting and TV
- Grid electricity will not be available to majority of the Cambodia for many years to come
- Need alternatives to supply electricity to this population
- Solar Photovoltaics (PV) is a mature technology with a range of possible applications in Cambodia

1. Estimated Energy Demand

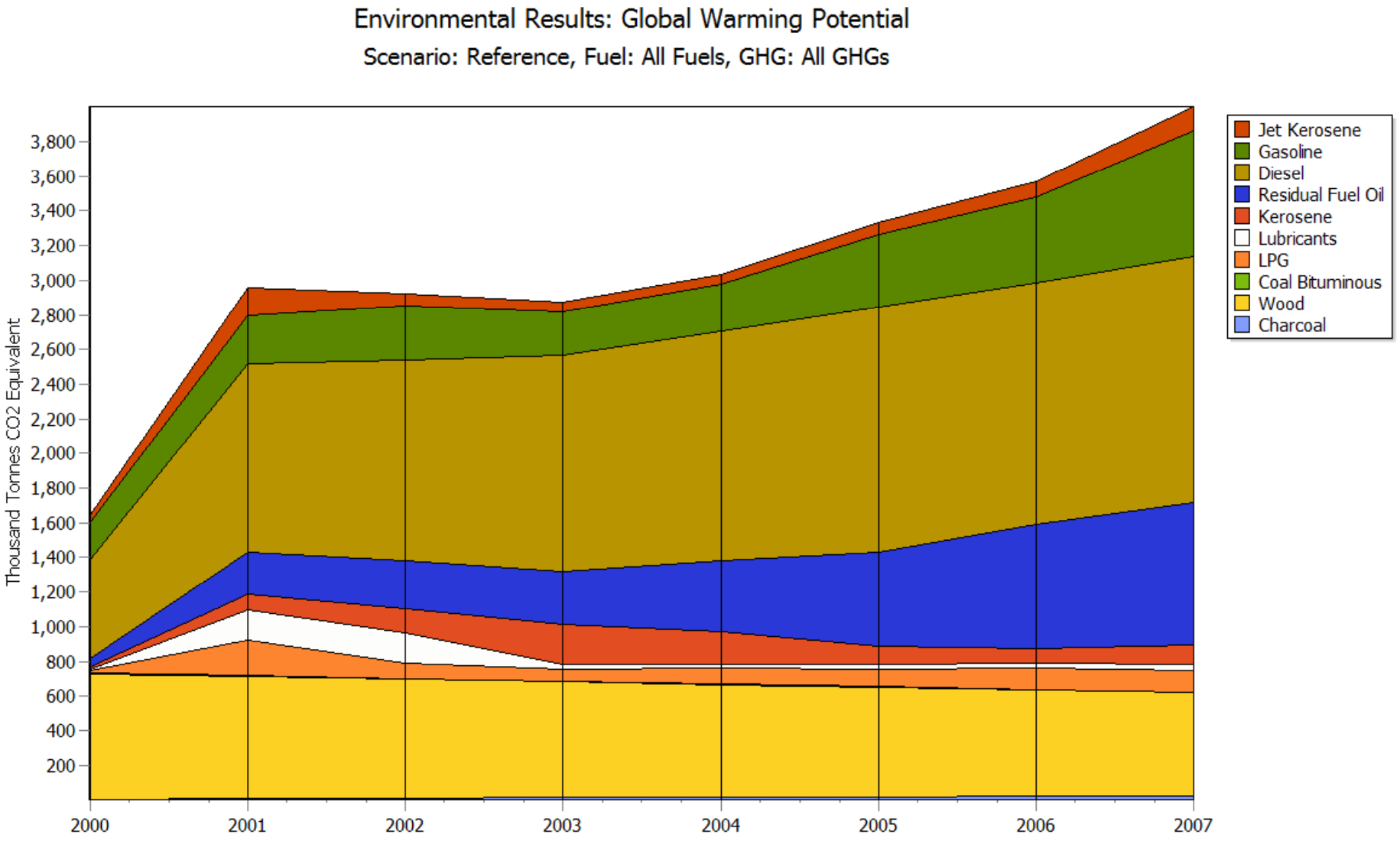
Table 20 *Estimated rural energy demand in Cambodia (TJ)*

	2007	2010	2012	2015	2017	2020	2022	2025	2027	2030
Total electricity	1,787	2,155	2,493	2,790	3,118	3,476	3,777	4,328	4,636	5,095
Total charcoal	5,107	6,796	8,532	12,323	12,441	12,156	12,153	11,998	12,137	13,112
Total firewood	73,637	67,920	62,785	54,742	54,038	49,749	45,866	42,355	40,178	35,522
Total LPG	1,885	2,313	2,512	3,135	3,591	4,671	5,570	7,020	7,763	8,964
Total kerosene	1,108	1,166	978	843	735	673	674	731	767	717
Total candle	139	144	140	148	154	164	171	186	194	203
Total animal dung	683	4,117	5,945	3,030	1,763	1,821	2,915	4,026	2,703	1,068
Total	**84345.5**	**84610.5**	**83383**	**77009**	**75838.5**	**72707**	**71125**	**70642**	**68376.5**	**64679.5**

2. Greenhouse Gas Emissions Cambodia based on imported fuels and wood and charcoal

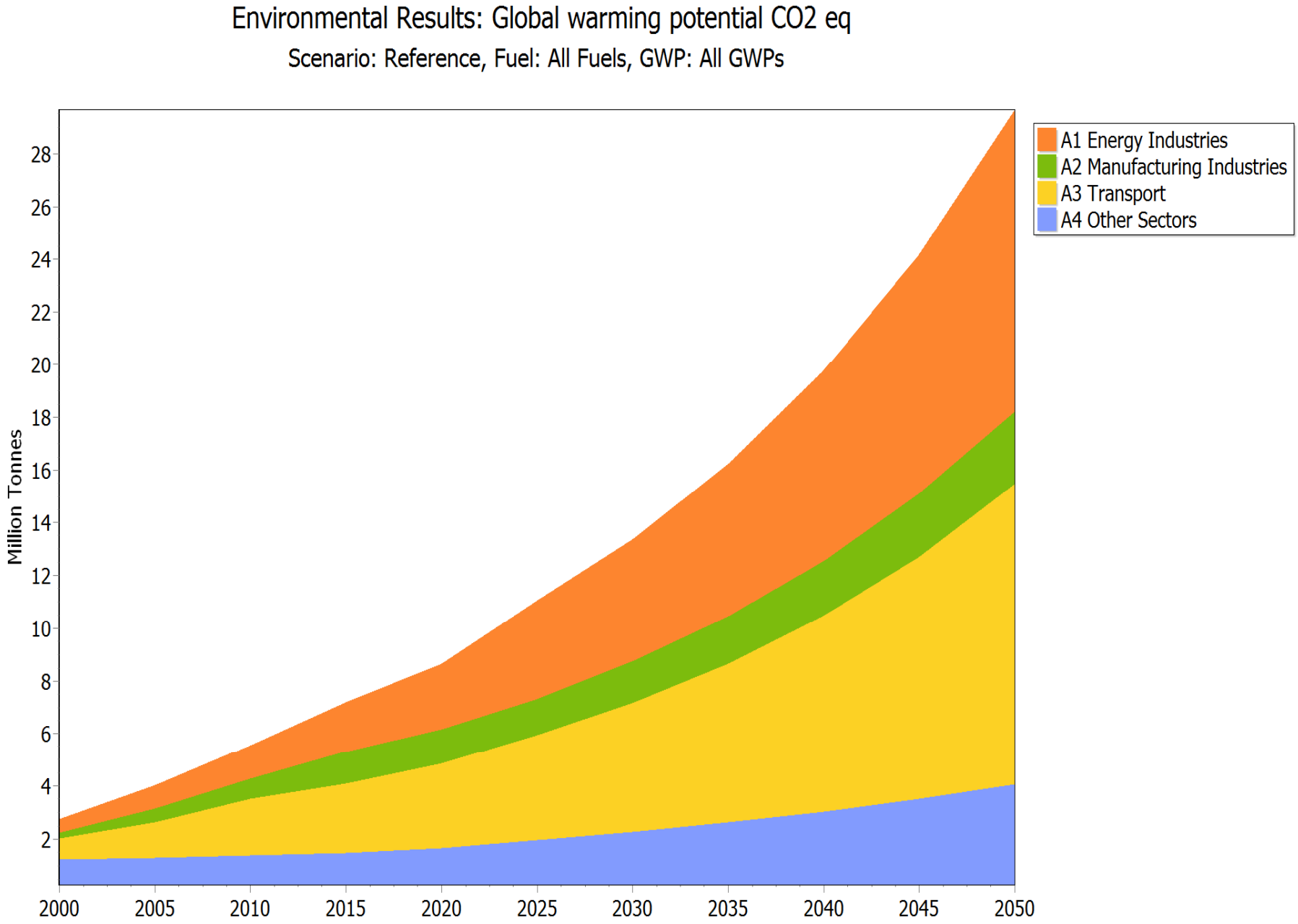
	2000	2001	2002	2003	2004	2005	2006	2007
Jet Kerosene	38.06	163.27	72.15	55.59	56.50	65.15	91.53	141.37
Gasoline	215.88	280.08	311.40	251.03	269.75	418.13	497.24	723.62
Diesel	572.88	1,085.58	1,158.07	1,245.75	1,323.34	1,416.38	1,393.20	1,419.03
Residual Fuel Oil	49.00	243.48	280.27	308.36	417.27	546.24	713.99	825.39
Kerosene	12.89	92.76	135.32	227.88	186.41	100.23	84.92	108.11
Lubricants	12.29	168.58	176.47	31.18	22.70	29.92	28.12	37.08
LPG	12.59	207.55	87.36	67.65	88.71	100.27	122.95	123.85
Coal Bituminous	2.81	2.92	3.03	3.16	3.28	3.41	3.55	3.69
Wood	724.46	706.00	687.55	669.10	650.64	632.19	613.73	595.28
Charcoal	5.94	8.66	11.39	14.11	16.83	19.56	22.28	25.00
Total	1,646.79	2,958.88	2,923.02	2,873.80	3,035.42	3,331.47	3,571.51	4,002.43

2. Greenhouse Gas Emissions Cambodia based on imported fuels and wood and charcoal



3. Emissions in '000 Gg CO_2 eq. by sector 2000-2050

	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
A1 Energy Industries	0.512	0.887	1.27	1.875	2.492	3.738	4.642	5.789	7.247	9.098	11.45
A2 Manufacturing Industries	0.233	0.508	0.78	1.232	1.296	1.377	1.567	1.799	2.071	2.39	2.765
A3 Transport	0.785	1.341	2.116	2.607	3.213	3.961	4.886	6.031	7.448	9.202	11.376
A4 Other Sectors	1.229	1.304	1.392	1.482	1.658	1.977	2.285	2.623	3.025	3.505	4.079
Total	2.759	4.041	5.558	7.196	8.658	11.053	13.38	16.243	19.791	24.196	29.671


Environmental Results: Global warming potential CO2 eq
Scenario: Reference, Fuel: All Fuels, GWP: All GWPs
Million Tonnes
28
26
24
22
20
18
16
14
12
10
8
6
4
2
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
A1 Energy Industries
A2 Manufacturing Industries
A3 Transport
A4 Other Sectors

VII. GHG Inventory
GHG Inv. 1994 and 2000 (1)

GHGs by Source and Sink	Total CO_2eq. (Gg)	
	GHG Inventory 1994*	GHG Inventory 2000**
Energy	**1,881**	**3,444**
Agriculture	**10,560**	**21,112**
Land Use Change & Forestry	**-17,907**	**-24,565**
Waste	**273**	**229**
Industry (Cement)	**50**	**-**
TOTAL NAT'L CO2-eq.	**-5,142**	**220**

* Used a model adapted from the Philippines one (which was based on 1996 IPCC Guideline
** Used Revised 1966 IPCC Guidelines and UNFCCC Software Version 1.3.2 (2007)

GHG Inv. 1994 and 2000 (2)

VIII. GHG Mitigation Options

1. Energy Sector

- **Energy Industries**
  - Energy efficiency users
  - Energy efficiency buildings
  - Hydro dam CH4 mitigation
  - Small and Pico hydro
- **REEs**
  - Gasification imported Ankor technology
  - Gasification Cambodian made
  - Grid connection
- **Battery Charging Stations**
  - Grid connection
  - Biofuel
  - Solar charging
  - SHS

Cont’

2. Manufacturing Industry

- Rice milling efficiency/technology
- Brick works efficiency/technology
- Energy efficiency garment industry
- Ice plants efficiency/technology
- Garment sector efficiency/technology
- Waste water methane recovery
- Landfill gas recovery
- Ethanol production
- Bio-fuel from Jatropha

- Rice husk gasification imported Ankor tech
- Rice husk gasification locally produced
- Bier factories, biogas from waste water
- Efficient charcoal production
- Efficient cook-stove
- Ice plants using gasification
- Reduction private electricity generation
- Rice millers using gasification
- Rice husk briquettes
- Cement production heat recovery

Cont’

3. Transport Sector

- Electricity motobike
- Electricity bicycle
- Electricity cars
- Hybrid cars
- Special motor/bicycle lanes
- Car free zones
- Public city transport

Cont’

4. Commercial Industry

    - Air conditioning from diesel gen sets

5. Residential Sector
    - Efficient cookstove urban area
    - Efficient cookstove rural area
    - Biodigesters
    - Water filters
    - Solar lanterns
    - SHS
    - Energy efficiency

Cont’

6. Agriculture

- Wind water pumping
- Large biogas plants pigs and cows
- Agricultural waste briquettes
- Mining (aluminum mining)

IX. Cambodia policies and participation for LCS

- No commitment on GHG emission reduction so far;
- Ratified UNFCCC in 1995 and Kyoto protocol in 2002;
- Rectangular Strategy;
- National Strategic Development Plan;
- National Laws and Decrees related to Natural Resources Conservation and Management;
- Established National Climate Change Committee;
- National Forest Programme;
- REDD Roadmap;
- National Environmental Strategy and Action Plan;
- National Policies and Strategies on Renewable Energy and Efficient Transportation;
- National Green Growth Roadmap;
- Cambodia Climate Change Strategic Plan is developing;
- Continuous cooperate and participate with IGES for Low Carbon Development, LCS workshop held in Jan 2011; and
- Upgraded Climate Change Department in 2009.


Thanks for your attention!