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Emissions in Energy in Cambodia 2000

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Methodology

- **Tier 1** methodologies are used for Fuel Combustion. The IPCC Guidelines describes two approaches:
  - Reference Approach where emissions are estimated from the carbon content of fuels supplied to the country as a whole.
  - Source Categories Approach where emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.

Methodology

- **Reference Approach**
  - Estimate of Apparent Fuel Consumption
  - Annual imports of all fuels to Cambodia are recorded by CAMCONTROL Department.
  - In the year 2000, the following petroleum products were imported (statistics in tons): jet A1, gasoline, diesel oil, fuel oil, kerosene oil, lubricant oil, gas, and bitumen.
  - It is assumed that all imports are consumed the same year, and that no fuels are exported.

Methodology

Imports of petroleum products for Year 2000 (Tons)

Petroleum products	Amount (t)
Jet A1	17,607
Gasoline	101,572
Diesel Oil	366,956
Fuel Oil	96,200
Kerosene Oil	28,782
Lube Oil	4,490
Gas	13,237
Bitumen	1,033

Source: Ministry of Commerce, CAMCONTROL

Methodology

- Conversion to A Common Energy Unit (TJ)
  - The IPCC default values for conversion factors are used to estimate apparent consumption in terajoules:
    - 44.80 TJ/10^3 tonnes for gasoline,
    - 44.59 TJ/10^3 tonnes for jet kerosene,
    - 44.75 TJ/10^3 tonnes for other kerosene,
    - 43.33 TJ/10^3 tonnes for gas / diesel oil,
    - 40.19 TJ/10^3 tonnes for residual fuel oil,
    - 47.31 TJ/10^3 tonnes for LPG,
    - 40.19 TJ/10^3 tonnes for bitumen and lubricants.

Methodology

- Multiplication by Carbon Emission Factors
  - The following IPCC default values are used for Carbon Emission Factors (CEF):
    - 18.9 tC/TJ for gasoline,
    - 19.5 tC/TJ for jet kerosene,
    - 19.6 tC/TJ for other kerosene,
    - 20.2 tC/TJ for gas / diesel oil,
    - 21.1 tC/TJ for residual fuel oil,
    - 17.2 tC/TJ for LPG,
    - 22.0 tC/TJ for bitumen, and
    - 20.0 tC/TJ for lubricants.

Methodology

- Converting to CO2 Emissions
  - Multiply the Actual Carbon Emissions by 44/12 to find the total CO2 emission from fuel combustion
- Summary of results
  - In the year 2000, 630 kilotons of petroleum products with a value of US $162 million were imported (CAMCONTROL, MOC).
  - Total national emissions from fuel combustion amounted to **2050 Gg CO2 in the year 2000**.

Methodology

- **Source Categories Approach**
  - In the Source Categories Approach, emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.
    - Energy Industries
    - Manufacturing Industry and Construction
    - Transport
      - Road transportation
      - Railways
    - Others
      - Commercial/Institutional
      - Residential
      - Agriculture/Forestry/Fishing sector

Methodology

- **Source Categories Approach**
  - This approach requires data that are not currently available in Cambodia.
  - Gaps persist in estimating emissions from manufacturing industries and construction, transport, the commercial and institutional sector, the residential sector, and agriculture/forestry/fishing.
  - In energies industries, fuel consumption data is only available from the State electric utility, and large Independent Power Producers (IPP).

Methodology

- **Energy Industry**
  - Electricité du Cambodge (EDC), the state-owned electric utility, reports fuel consumption for the year 2000 as follow: 24.9 kt of diesel oil and 85.7 kt of fuel oil (EDC 2007).
  - In rural areas, households have access to electricity through Rural Electricity Enterprises (REEs) and battery charging services.

  - Energy Industries - 2000 GHG Emissions: **546 Gg CO2 eq**

Methodology

- Manufacturing Industries
  - Because of the unavailability or the lack of reliability of grid electricity, a large number of businesses and industries operate their own electric generators.
  - The installed autogeneration capacity amounted to some 87 MW in the year 2000, of which 32 MW in the manufacturing industries. Manufacturing industries produced and autoconsumed 90 GWh of electricity (NEDO 2001).
  - The diesel fuel consumption in the manufacturing industries is estimated at 24.3 kt for the year 2000.

  - Manufacturing Industries and Construction - 2000 GHG Emissions: **78 Gg CO2 eq**

Methodology

- Transport Sector
  - The consumption for domestic railroad transport amounted to 2.1 kt of fuel oil and 0.6 kt of gasoline in the year 2000 (RRC 2008).
  - Statistics for domestic aviation and national navigation are not available for the year 2000.
  - However, emissions from domestic aviation (Phnom Penh to Siem Reap) are assumed to be insignificant when compared to international aviation to neighbouring countries.
  - Thus the total imports of 17.6 kt of jet kerosene to Cambodia in the year 2000 are attributed to international bunkers.

Methodology

- Transport Sector
  - The transport sector consumption accounted for 92% of gasoline imported to Cambodia in 2005, 41% of diesel and 1% of residual fuel oil (IEA 2005).
  - Assuming the same proportions for the year 2000, a total of 93.5 kt of gasoline and 150.5 kt of diesel fuel were consumed in road transport.

  - Transport - 2000 GHG Emissions: **774 Gg CO2 eq**

Methodology

- Other Sector
  - The installed autogeneration capacity was estimated at 55 MW in the commercial/institutional sector in the year 2000 (NEDO 2001).
  - Total power generated and autoconsumed amounted to 72 GWh for a consumption of 19.4 kt of diesel fuel.
  - The residential sector is assumed to have accounted for the totality of Liquefied Petroleum Gases and other kerosene imported and 5% of diesel fuel.
  - The agriculture/forestry/fishing sector consumed 8% of motor gasoline and 16% of diesel oil imported (IEA 2007).

  - Other sectors - 2000 GHG Emissions: **464 Gg CO2 eq**

Summary of Results

- In the IPCC Source Categories Approach, emissions are estimated from the carbon content of fuels supplied to the main fuel combustion activities.
- This approach requires data that are not currently available in Cambodia.
- A number of gaps persist in estimating sectoral emissions with an estimated **188 Gg CO2** unallocated to specific sectors.
- In the year 2000, transport was the largest net contributor to national emissions from fuel combustion with 38%, followed by energy industries with 27%.

Summary of Results

Greenhouse Gas Emission from Energy Sector in 2000 (Gg)

ENERGY Fuel Combustion Greenhouse Gas Source Categories	CO2 Emissions (Gg)	CO2 Emissions (%)
Energy industries	546	27
Manufacturing industries and construction	78	4
Transport	774	38
Commercial/Institutional	62	3
Residential	189	9
Agriculture/Forestry/Fishery	212	10
Other	188	9
Total	2050	100

Thank you!