

The demand of electricity power supply engineering essay



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According to (The Journal of Cambodia Energy Sector Strategy, 2010) "

Cambodia's power supply facilities were heavily damaged by war. Cambodia has started its process of rehabilitation under support from the World Bank, ADB, Japan, USA and European Countries. At present, the electricity supply in Cambodia is fragmented into 24 isolated power systems centred in provincial towns and cities. All are fully reliant on diesel power stations. Per capita consumption is only about 48 kWh / year and less than 15% of households have access to electricity (urban 53.6%, rural 8.6%) and the amount of electricity consumption is as follows: Private sector 0.5%, Service sector 40%, Industrial sector 14%. The supply requirements are projected to increase in average by 12.1% per year, and the peak load is expected to reach up to 1,000 MW in 2020. The largest system is Phnom Penh, which has a population of 11.4 million and more than 12,000 electricity customers. It accounts for 70 per cent of the country's electricity consumption, with a peak demand of 80 MW, and an available capacity of 129.2 MW (EDC 74.5 MW, IPPs 54.7 MW), the peak demand will increase to 170 MW in 2004 and in 2020 to 649 MW. As of 2000, the total energy generation was 415.14 GWh, including CUPL 208.28 and Jupiter 13.25. The total installed capacity for provincial towns is estimated about 50 MW with the size ranging from 300kW to 5 MW, and the peak demand is expected to increase to 173 MW in 2010 and to 342 MW in 2020. Due to the small size of generation dependent on high cost imported oil, the lack of a high voltage transmission system and the big losses in distribution, the electricity price is the high in the region. According to data from 2000, the average tariff is about 14.6 US Cents / kWh in Phnom Penh, and 25 to 50 US cents / kWh in remote areas. Currently there are 7 MV cross-border connections with

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Thailand, by local private sector investors: Koh Kong provincial town: 2 MW; O - Smach of Oddor Meanchey: 2 MW; Kamrieng of Battambang: 1 MW; Phnom Proeuk of Battambang: 2 MW ; Sampeov Loun of Battambang: 1 MW; Poipet of Banteay Meanchey: 5.6 MW; Pailin: 2.5 MW, and in addition 4 MV connections with Viet Nam by EDC: Bavet of Svay Rieng: 0.6 MW; Memut of Kampong Cham: 1.9 MW; Ponhea Krek of Kampong Cham: 0.9 MW; Kampong Trach of Kampot: 1 MW . Electricity play as the important part of developing this country. The electricity make the people life easy to live and brilliant, the electricity make many industry work and make the country modern. The electricity can save environment in Cambodia. Cambodia people used electricity instead of using woods, charcoal to cooks or burn for their industries. But unfortunately the electricity is not enough to supply for Cambodia people in the whole country and the price of electricity in Cambodia still expensive. Most of Cambodian people and industries still used woods and charcoal to cook, to work their machines. These are the one reasons that amount of forests in Cambodia decrease because of the people cut down the trees for firewoods to served a lot amount of Cambodia people. According to (REPORT ON POWER SECTOR OF THE KINGDOM OF CAMBODIA, 2010) by end of 2010, about 55% of total villages in the Kingdom of Cambodia had access to electricity

Supply. So 45% of total villages in the Cambodia had not access to electricity. Cambodia has substantial hydropower resources and indications of oil, gas and coal deposits; there is an urgent needs to assess the extent of these energy resources. Other renewable energy sources are available and their use is being started, such as biomass, solar and mini-hydro. The

problem is to diversify the sources of supply, and intensify the exploration for natural gas and the development of renewable energy resources. Cambodia has indication of deposits of energy natural resources such as fossil fuels, natural gas and coal, and over 84% of the primary energy consumption is contributed by fuel wood. Less than 9% of rural households have access to a grid-quality electricity services. Those who depend mainly on rechargeable batteries and small diesel-fueled isolated generation have paid with very high unit prices for electricity. Rural electrification in Cambodia is increasing at a surprising rate in many districts and provinces serviced by Government coordinated electrification program. The basis for this progress is a ready market for the sale of electricity by the local entrepreneurs. But the state electricity companies alone can not meet the increasing electricity demand especially for the rural population almost poor in the near future. This situation encourages the provision of rural electricity by other appropriate solutions.

Electricity Generation In Cambodia

2. 1. Generation by Type of Generation Facilities

According to (REPORT ON POWER SECTOR OF THE KINGDOM OF CAMBODIA, 2010) Electricity generation facilities in the Kingdom of Cambodia for the year 2010 can be divided into 4 types: 1 - Hydropower Plants, 2 - Diesel power Plants, 3- Thermal Power Plants using coal and 4 - Plants using wood and other biomass. During 2010 the following three Hydropower Plants were in operation. 1. Kirirom connected to Phnom Penh power system, 2. Ratanakiri connected to Ratanakiri power system of EDC, and 3. Mondulkiri, supplying electricity to provincial town of Mondulkiri. Apart from these three

hydro power plants, Kamchay hydro power plant generated electricity on trial basis. Mr. Dung Ly, supplying electricity at Ang Long Tamey (Battambang Province), SL Garment Processing (Cambodia) Ltd, supplying part of its generation to EDC Phnom Penh, and Tai Seng Import Export & Construction co., Ltd supplying power to EDC Rattanakiri use wood, agricultural products or waste as fuel for generation of electricity. Sovanna Phum Investment Co., Ltd, an IPP, having License No. 213L, uses coal to generate electricity and supplies to EDC Phnom Penh. All other power plants of the licensees are diesel power plants using Heavy Fuel Oil (HFO) and/or Light Diesel Oil (LDO).

2. 2 Energy Imported from Neighboring Countries

Cambodia imports electricity from Thailand, Vietnam and Laos. The import from Vietnam is at 22 kV through a number of connections and at 230 kV through Vietnam - Takeo - Phnom Penh 230 kV line. Similarly import from Thailand is at 22 kV through a number of connections and at 115 kV through Thailand - Banteay Meanchey - Battambang and Siem Reap line. The import from Laos is at 22 kV to Steung Treng area.

Based on the Electricity Trade Agreement between Ministry of Industry, Mines and Energy of Cambodia with the Ministry of Industry of Vietnam, government companies/organization such as EDC and Electricity of Kratie have signed Power Purchase Agreements with Vietnam Power No. 2 for import of electricity at a number of points for supply of electricity to areas located near the Cambodia - Vietnam border either by themselves or through other licensees. Vietnam Power No. 2 charges a fixed tariff of 6.9 US Cents per kWh for supply to Cambodia at MV. The tariff for import by EDC at 230 kV <https://assignbuster.com/the-demand-of-electricity-power-supply-engineering-essay/>

is a time of use tariff in USD/kWh being different during rainy season and rest of the year. Some private companies have received the right from MIME to purchase electricity from Provincial Electricity Authority of Thailand for supply to areas near Cambodia -Thai border. Cost of electricity imported from Thailand at 22 kV is based on two part - time of use tariff of Provincial Electricity Authority applicable for the category of consumer. The tariff has demand charges (Baht per kilowatt of maximum demand), energy charges (Baht per kWh with different rates for energy drawn during peak and off-peak hours), service charges (fixed charge as Baht per month), power factor penalty (Baht per excess KVAR) and Ft (change in expenses charge in Baht/kWh). Because of such tariff structure, the cost of electricity varies in different months due to different use conditions. The tariff for import by EDC at 115 kV from Thailand consists of energy charge as Baht per kWh and Ft (change in expenses charge in Baht/kWh). EDC has started import from Laos in 2010 only. The Tariff for this import is 7. 02 US Cents/kWh.

Electricity Transmission

3. 1 High Voltage System in Cambodia

By end of the year 2010, nine high voltage grid substations (GS), as detailed in the following table, were used to provide power supply to the MV system to supply power to the consumers in Cambodia. The Grid Substations at serial 1 to 5 are owned and operated by EDC and those at serial 7 to 9 are owned and operated by (Cambodia) Power Transmission Lines Co. Ltd (CPTL)

3. 2 Grid Supply Systems

The high voltage grid-substations in operation by end of 2010 are Phnom Penh (GS 1, GS 2, GS 3, and GS 4), Takeo, Kampong Speu, Banteay Meanchey, Siem Reap and Battambang. Medium Voltage lines from these grid-substations supply electricity to different licensees. Apart from the supply from these grid-substations, MV supply is made available at a number of areas along the border with Vietnam, Thailand and Laos by extension of 22 kV lines from Vietnam Grid, Thai Grid and Laos Grid. This has resulted in the development of seven grid systems in Cambodia as described below;

1. Phnom Penh Grid: This grid consists of grid-substations GS 1, GS 2, GS 3, GS 4 in Phnom Penh, grid-substations at Kampong Speu, Takeo and 230 kV supply system from Vietnam. The power sources connected to this grid include 230 kV supply from Vietnam and generation plants of Cambodia Utilities Pte Limited, CETIC International Hydropower Development co. Ltd, Khmer Electric Power Co. Ltd, City Power Group Corporation, Colben Energy (Cambodia) Ltd, (Cambodia) Electricity Private Co. Ltd, SL Garment Processing (Cambodia) Ltd, Sovanna Phum Investment Co, Ltd and generation plants of EDC at Phnom Penh and Takeo. By end of 2010, this grid supplied electricity to 53 licensees in the provinces of Phnom Penh, Kandal, Kampong Speu, Takeo and Kampong Chhanang.

2. Banteay Meanchey Grid: This grid consists of grid-substations at Banteay Meanchey, Siem Reap, Battambang and 115 kV supply system from Thailand. The power sources connected to this grid include 115 kV supply from Thailand and generation plants of EDC at Banteay Meanchey, Siem Reap, Battambang. By end of 2010, this grid supplied electricity to 15

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licensees in the provinces of Banteay Meanchey, Siem Reap and Battambang.

3. Kampong Cham MV Grid: This MV grid consists of Generation plant of G. T. S. Power Ltd at Kampong Cham and the connected 22 kV system in and around Kampong Cham. By end of 2010, this grid supplied electricity to 9 licensees in the provinces of Kampong Cham and Prey Veng.

4. Sihanouk MV Grid: This MV grid consists of Generation plant of Colben Energy (Cambodia) Ltd and of EDC at Sihanoukville and the connected 22 kV system in and around Sihanoukville. By end of 2010, this grid supplied electricity to 7 licensees in the province of Sihanoukville.

5. MV Grid connected to Vietnam system: Cambodia imports electricity from Vietnam through 22 kV connections at 13 locations in the provinces of Kampong Cham, Svay Rieng, Kampot, Mondulhiri, Kandal, Takeo, Kratie and Prey Veng. The supply is then extended to other licensees. By end of 2010, 29 licensees got supply from the Vietnam grid.

6. MV Grid connected to Thailand system: Cambodia imports electricity from Thailand through 22 kV connections at 8 locations in the provinces of Battambang, Pailin, Banteay Meanchey, Koh Kong and Oddor Meanchey. The supply is then extended to other licensees. By end of 2010, 7 licensees got supply from the Thai grid

7. MV Grid connected to Lao system: In 2010, EDC started importing power from Laos to supply to Steung Treng area. By end of 2010, only EDC availed the supply from Laos.

3.3 Electricity Tariff

The cost of electricity either from own generation or from purchase from IPP, neighboring country or other licensee is the single largest component of the cost of electric supply by licensees to the consumers. About 93% of the electricity generated by licensees in Cambodia use Diesel/ HFO as fuel. Hence for the licensees generating electricity using Diesel/HFO or purchasing electricity from IPPs with cost of purchase linked to the price of fuel, the cost of electric supply is related to the cost of Diesel/HFO.

4. Generation Projects under implementation and planning

Because of the electricity are not enough for supply to the whole country the government have plant to develop the electricity field. Following Generation Projects are under construction and their position at the end of 2010 is stated below:

- i. Kamchay Hydroelectric Project: The project consists of PH 1 with capacity of 3x60 MW, PH 2 with capacity of 4 x 2. 5 MW and PH 3 with capacity of 1 x 3. 2 MW. The project is being implemented by Sinohydro Kamchay Hydroelectric Project Co. Ltd. PPA has been signed with EDC. Generation License No. 177L has been granted by EAC. Work is in progress and is likely to be operational in 2011.
- ii. Kirirom Extension Phase II Hydroelectric Project: The project consists of PH with capacity of 2 x 9 MW. The project is being implemented by CETIC Hydrop ower

Development Co. Ltd. PPA has been signed with EDC. Work is in progress and is

likely to be operational in 2012.

iii. Stung Atay Hydroelectric Project: The project consists of PH 1 with capacity of 4 x 5 MW, PH 2 with capacity of 4 x 25 MW and 115 kV line from hydroelectric plant to Ou Saom Substation and 230 kV line from Ou Saom substation to Pursat Grid

substation. The project is being implemented by C. H. D. (Cambodia) Hydropower

Development Co. Ltd. PPA has been signed with EDC. Generation License No. 290L has been granted by EAC. Work is in progress and is likely to be operational in 2014

iv. Stung Tatay Hydroelectric Project: The project consists of PH with capacity of 3 x 82 MW and 230 kV line from hydroelectric plant to Ou Saom Substation. The project is being implemented by Cambodian Tatay Hydropower Limited. PPA has been signed with EDC. Generation License No. 293L has been granted by EAC.

Work is in progress and is likely to be operational in 2015.

v. Lower Stung Russei Chrum Hydroelectric Project: The project consists of PH 1

with capacity of 2 x 103 MW, PH 2 with capacity of 2 x 66 MW and 230 kV line

from hydroelectric plant to Ou Saom Substation. The project is being implemented

by China Huadian Lower Stung Russei Chrum Hydroelectric Project (Cambodia)

Company Limited. PPA has been signed with EDC. Work is in progress and is likely to be operational in 2015

vi. 100 MW Coal Fired Power Plant in Sihanoukville: The Project consists of 2x50

MW (net) coal fired electric power generating facility at Sihanoukville. The project

is being implemented by Leader Universal Holdings Be rhad. PPA has been signed

with EDC. Construction has started and is likely to be commissioned in 2013.

vii. 240 MW Coal Fired Power Plant in Sihanoukville: The Project consists of 2x120 MW (net) coal fired electric power generating facility at Sihanoukville. The project is being implemented by Cambodia International Investment Development Group

Co. Ltd. PPA has been signed with EDC. Construction has not yet started and the

project is scheduled to be commissioned in 2015.

viii. 135 MW Coal Fired Power Plant in Sihanoukville: The Project consists of 1x135 MW coal fired electric power generating facility at Sihanoukville. The project is

being implemented by Cambodia International Investment Development Group

Co. Ltd. PPA has been signed with EDC. Construction has not yet started and the

project is scheduled to be commissioned in 2017.

ix. Sesan Hydroelectric Project: Feasibility study has been done. Negotiations are going on to finalize construction program. The proposed capacity of the plant is 400 MW.

x. Prek Laang Hydroelectric Project: Pre-feasibility study has been done. The proposed capacity of the plant is 90 MW

The electricity sector is at an important stage of development. As already outlined, it

presently provides only very limited services, and per capita consumption in Cambodia is the lowest in the region. The sector should be developed

rapidly to contribute to a balanced and sustainable growth. Cambodia's main requirement is to identify alternative resources of energy, at a reasonable price. The main problem is that the economy of scale necessary to deliver least cost energy are greater than Cambodia's level of consumption, but investment in large scale power station, both thermal and hydro, could be considered for energy export projects which would also contribute to reducing costs for domestic uses.

In summary, to achieve profitability, efficiency, innovation and social objectives, then a commitment and flexibility is necessary, and private participation is inevitable. The least cost suppliers will win the market and the national economy as a whole will grow rapidly.