

KINGDOM OF CAMBODIA
NATION KING RELIGION

PRINCIPLES AND CONDITIONS
FOR ISSUING THE SPECIAL PURPOSE TRANSMISSION
LICENSE IN THE KINGDOM OF CAMBODIA

- (1)- PROKAS OF MINISTRY OF INDUSTRY, MINES AND
ENERGY ON PRINCIPLES AND CONDITIONS FOR
ISSUING THE SPECIAL PURPOSE TRANSMISSION
LICENSE IN THE KINGDOM OF CAMBODIA**
- (2)- EXPLANATION PAPER ON SPECIAL PURPOSE
TRANSMISSION LICENSE**

PRINTED BY ELECTRICITY AUTHORITY OF CAMBODIA

MAY 2007

PROKAS
ON PRINCIPLES AND CONDITIONS FOR ISSUING THE SPECIAL
PURPOSE TRANSMISSION LICENSE
IN THE KINGDOM OF CAMBODIA

MINISTRY OF INDUSTRY, MINES AND ENERGY

- Seen the Constitution of the Kingdom of Cambodia;
- Seen the Royal KRET No. NS/RKT/0704/124 Dated July 15, 2004 on the appointment of the Royal Government;
- Seen the Royal KRAM No. NS/RKM/0196/05 Dated January 24, 1996 promulgating the law on establishment of the Ministry of Industry, Mines and Energy;
- Seen the Royal KRAM No. NS/RKM/0201/ 03 Dated February 02, 2001 promulgating the Electricity Law of the Kingdom of Cambodia;
- Seen the request of Electricity Authority of Cambodia No. 336-LT-06-EAC Dated 31 March, 2006;

DECIDES

Article 1

In accordance with the provisions of Electricity Law, to define the main principles and conditions for issuing special purpose transmission license, according to which, the Electricity Authority of Cambodia shall evaluate and decide to issue the special purpose transmission license for service providers according to the provisions of the Electricity Law of the Kingdom of Cambodia.

Article 2

The full contents of principles and conditions for issuing the special purpose transmission license are attached here with.

Article 3

Electricity Authority of Cambodia shall ensures that all special purpose transmission licenses for service providers in the Kingdom of Cambodia are issued according to the principles and conditions set out in Article 2.

Article 4

The term and conditions of the special purpose transmission license to be issued to service providers shall be determined by the Electricity Authority of Cambodia according to the provisions of the Electricity Law of the Kingdom of Cambodia.

Article 5

Existing Prokas or other decisions contrary to this Prokas shall be considered null and void.

Article 6

This Prokas shall come into force from the date of signing.

Minister of Industry Mines and Energy

Sign and Seal

SUY SEM

**PRINCIPLES AND CONDITIONS
FOR ISSUING THE SPECIAL PURPOSE TRANSMISSION
LICENSE IN THE KINGDOM OF CAMBODIA**

**CHAPTER 1
GENERAL PRINCIPLES**

PRINCIPLE 1 - TRANSMISSION AND SUB-TRANSMISSION FACILITY

Electric Facilities used for transfer of bulk power over long distances are called **Transmission Facilities**. In accordance with the real situation of development of electric system in the Kingdom of Cambodia, in the first stage, Transmission Facilities are classified in two categories: **Transmission Facilities and Sub-Transmission Facilities**.

The HV transmission lines including the HV/MV substations, associated control, protection, metering and communication facilities used for proper transmission of electricity constitute the Transmission Facility.

The MV lines and associated facilities used for supply of electricity to other licensees or bulk consumers constitute **Sub-Transmission Facility**.

**PRINCIPLE 2 – LICENSE FOR OPERATION OF THE TRANSMISSION AND
SUB-TRANSMISSION FACILITY**

Electric Power Transmission service providers require transmission license issued by EAC. There are two types of transmission license; the National Transmission License and the Special Purpose Transmission License.

The National Transmission Licensee shall have the right to construct, own and operate Transmission Facilities and Sub-transmission Facilities throughout the Kingdom of Cambodia.

The Special Purpose Transmission Licensee shall have the right to construct, own and operate only those Transmission Facilities and/or Sub-transmission Facilities, which are specifically identified in its license. Special Purpose Transmission License can be issued for **radial feeders** as well as **feeders in parallel** to other feeders.

Radial Feeder – The only transmission line or sub-transmission line to transfer electricity in bulk between two points.

Parallel Feeders – More than one transmission line or sub-transmission line to transfer electricity in bulk between two points.

**PRINCIPLE 3 – EXEMPTION FROM REQUIREMENT OF TRANSMISSION
LICENSE FOR OPERATION OF CERTAIN FACILITIES**

HV lines up to a length of 50 kilometers or MV lines up to a length of 20 kilometers, owned and operated by a Generation Licensee and used only for connecting its generation plant to the grid system is considered as connection facility, and can be operated under the generation license.

HV lines up to a length of 30 kilometers or MV lines up to a length of 10 kilometers, owned and operated by a bulk or MV consumer and used only for getting power supply to meet its load is considered as part of the consumer's installation and no license will be required to operate the facility.

The MV lines owned by a distribution licensee situated within its authorized area of supply, and the MV lines owned by a distribution licensee but situated outside its authorized area of supply used for getting power supply to its area of supply for distribution and permitted by EAC under the distribution license are considered part of distribution system and no transmission license will be required to operate the facility.

CHAPTER 2

**PRINCIPLES FOR ISSUE OF SPECIAL PURPOSE TRANSMISSION
LICENSE FOR TRANSMISSION FACILITY**

**PRINCIPLE 4 – RIGHT TO CONSTRUCT AND OPERATE A TRANSMISSION
FACILITY**

The National Transmission Licensee has the first right to construct and operate a proposed transmission facility within the time the facility is needed. If the National Transmission License is not in a position to construct a transmission facility within the time the facility is needed, then the right to construct and operate the transmission facility can be provided to an eligible company and to whom a Special Purpose Transmission Licensee can be issued.

**PRINCIPLE 5 – POINTS THAT EAC SHALL CONSIDER BEFORE DECIDING
TO ISSUE A SPECIAL PURPOSE TRANSMISSION LICENSE**

Before deciding to issue a Special Purpose Transmission License for a proposed transmission facility, EAC should be satisfied about the usefulness (public interest) of the

transmission facility, the time when the facility is required to be put in operation and its effect on the operation of other transmission facilities. For this, EAC can rely on the plan approved by Ministry of Industry, Mines and Energy for the facilities included in the plan. For the facility not included in the approved plan, EAC may require the applicant for Special Purpose Transmission License to furnish justification and result of studies specified by EAC to assess the usefulness of the proposed transmission facility.

PRINCIPLE 6 – OPEN ACCESS FOR USE OF TRANSMISSION FACILITIES OF SPECIAL PURPOSE TRANSMISSION LICENSEE

The Special Purpose Transmission Licensee shall provide non-discriminatory open access for use of its transmission facilities subject to technical limitation as per the regulations framed by EAC. In cases, where the National Transmission Licensee has transmission agreement contracting the entire capacity of the facility or the transmission agreement restricts the Special Purpose Transmission Licensee from allowing the use of the facility by third parties, the provision of open access, for use of the facility of the Special Purpose Transmission Licensee, will be provided by the National Transmission Licensee.

PRINCIPLE 7 – PLAN FOR EXPANSION OF CONTROL OF NATIONAL TRANSMISSION LICENSEE

In cases, where the National Transmission Licensee has transmission agreement contracting the entire capacity of the transmission facility of the Special Purpose Transmission Licensee, the transmission agreement should provide for the option of the National Transmission Licensee to buy out the facility in future.

PRINCIPLE 8 – PLAN FOR INCREASING EFFICIENCY IN THE OPERATION OF TRANSMISSION FACILITY

The Special Purpose Transmission Licensee should connect the facilities of other licensees to its facility in accordance with regulations/codes approved by EAC. To facilitate such connection, the Special Purpose Transmission Licensee should keep adequate space in the control room and yard to house equipments for future expansion/ connection of other transmission/sub transmission facilities.

PRINCIPLE 9 – MAIN CONDITIONS WHICH EAC SHOULD INCLUDE IN SPECIAL PURPOSE TRANSMISSION LICENSE

Electricity Authority of Cambodia shall ensure that the contents of the special purpose transmission license issued for service providers include the following main conditions.

- 1-The Special Purpose Transmission Licensee shall comply with the regulations and the Grid Code in force.
- 2-The Special Purpose Transmission Licensee shall operate its facility as per instructions of the Control Center. The schedule of planned outages and emergency outages for the facility shall be approved by the Control Center.
- 3-The Special Purpose Transmission Licensee shall, at all times, provide suitable communication facilities compatible with the facilities provided in the Control Center to have instant communication with and transfer of operating data to the Control Center.
- 4-The Special Purpose Transmission Licensee shall provide suitable meters and metering equipment to measure electrical quantities imported and exported by the transmission facility of the Licensee.

CHAPTER 3

PRINCIPLES FOR ISSUE OF SPECIAL PURPOSE TRANSMISSION LICENSE FOR SUB-TRANSMISSION FACILITY

PRINCIPLE 10 – RIGHT TO CONSTRUCT AND OPERATE A SUB- TRANSMISSION FACILITY

A sub-transmission facility can be built and operated by either the National Transmission Licensee or a Special Purpose Transmission Licensee. The Special Purpose Transmission License for sub-transmission facilities will be issued by EAC in the best public interest.

PRINCIPLE 11 – OPEN ACCESS FOR USE OF SUB-TRANSMISSION FACILITY OF THE SPECIAL PURPOSE TRANSMISSION LICENSEE

The Special Purpose Transmission Licensee shall provide non-discriminatory open access for use of its sub-transmission facilities subject to technical limitation as per the regulations/codes approved by EAC. In cases, where the National Transmission Licensee has transmission agreement contracting the entire capacity of the facility or the transmission agreement restricts the Special Purpose Transmission Licensee from allowing the use of the facility by third parties, the provision of open access, for use of the facility of the Special Purpose Transmission Licensee, will be provided by the National Transmission Licensee.

PRINCIPLE 12 – PLAN FOR INCREASING EFFICIENCY IN THE OPERATION OF SUB-TRANSMISSION FACILITY

The Special Purpose Transmission Licensee should connect the facilities of other licensees to its facility in accordance with regulations/codes approved by EAC.

PRINCIPLE 13 – MAIN CONDITIONS WHICH EAC SHOULD INCLUDE IN THE SPECIAL PURPOSE TRANSMISSION LICENSE FOR SUB-TRANSMISSION FACILITY

Electricity Authority of Cambodia shall ensure that the contents of the special purpose transmission license issued for electric suppliers for sub-transmission facility include the following main conditions.

- 1-The Special Purpose Transmission Licensee shall comply with the provisions of the Grid Code and Distribution Code.
- 2-The Special Purpose Transmission Licensee shall operate its facility as per instructions of the Control Center, when such instructions are issued, otherwise the licensee shall follow best utility practices.
- 3-The Special Purpose Transmission Licensee shall provide suitable meters to measure electrical quantities imported and exported by the sub-transmission facility of the Licensee.

Explanation Paper on Special Purpose Transmission License

A. TRANSMISSION SYSTEM AND TRANSMISSION GRID

Transfer of bulk power over long distances is done at high voltage, as it is economical and efficient. The high voltage lines used for transfer of bulk power are called “Transmission Lines” or “Transmission Circuits”. A transmission line connects a generating station or a sub-station with another generating station or sub-station. Power transformers are used in generating stations to raise the voltage of the produced power from the generation voltage to transmission voltage. Power transformers are used in substations to raise or lower the voltage to connect together transmission lines designed for different voltages, sub-transmission system and/or distribution system. The Transmission System consists of the interconnected transmission lines and sub-stations. Most transmission systems use overhead alternating current (AC) lines. However, use of some overhead direct current transmission lines and underground and submarine cable exist as well.

The voltage of transmission is selected depending on the quantum of power and distance of transfer. More the quantity of power and longer the distance, higher is the selected voltage. Generally a transmission system uses more than one voltage. Table 1 gives some of the main voltages used in the transmission system of different countries.

Table 1 – Voltages used in Transmission

	Country	Main Voltages of Transmission
1	Thailand	500 kV, 230 kV, 115 kV
2	Vietnam	500 kV, 220 kV, 110 kV
3	Laos	230 kV, 115 kV
4	Malaysia	500 kV, 275 kV, 132 kV
5	Myanmar	230 kV, 132 kV, 66 kV
6	China (Yunnan Province)	500 kV, 220 kV, 110 kV
7	Philippines	500 kV, 350 kV, 230 kV, 138 kV, 115 kV, 69 kV
8	India	400 kV, 220 kV, 132 kV
9	United States of America	765 kV, 500 kV, 345 kV, 230 kV
10	Cambodia	115 kV, 230 kV

The transmission system connects generating plants to each other and carries electric energy from the generation plants to the distribution system. The sub-transmission system is the part of the system between transmission system and distribution system. The distribution system carries the electricity to the residential, commercial and other customers. The customers receiving power at high voltage are connected to the transmission system.

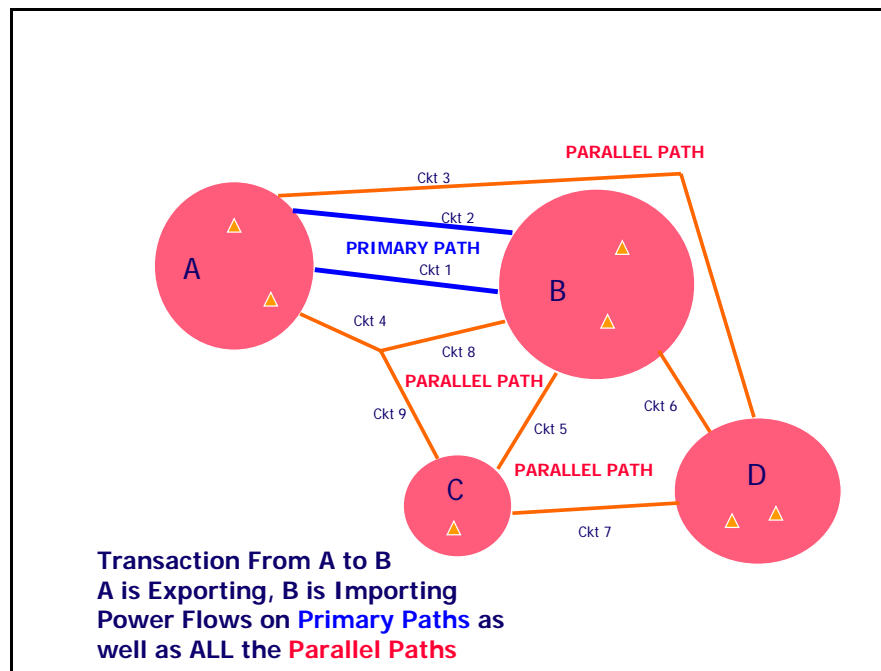
A Transmission Grid or Bulk Power System is a network of generating stations, transmission circuits, and substations.

B. POWER FLOW IN TRANSMISSION SYSTEM

Electricity flowing between a generator and a customer moves through all lines connecting the two, not only along the shortest distance between the two points. Electricity cannot be easily directed in one particular way or its flow controlled. There are no “valves” engineers can open or close to control the flow of electricity down a particular line, short of cutting off the flow on the line completely by opening a circuit breaker. The flow of electricity does not recognize the contract path or the ownership of the facilities. The flow of electricity in a network simply follows the laws of physics.

For a given transmission circuit, three key parameters determine power flow: terminal bus voltages, line impedance, and the relative phase angle between the sending and receiving end. The impedance of a transmission circuit depends on the line's length and design details for the line. A low impedance path attracts a greater part of the total transfer than a path with high impedance. In a transmission circuit of a network, electricity may flow in either direction.

Figure 1 – Flow in Transmission System



In the simplified example shown above, electricity dispatched from the generator to the customer can flow through all the lines connecting the two. When electricity flows along several paths to a given destination this is called “Parallel Flow.” As the power transfer increases, flows on primary path as well as the parallel paths increase. A contingency on any one circuit will affect the flow on all the remaining circuits. A change in the generation or load at any point of the Grid System will also result in change in the flow in different

circuits. These may result in current in a circuit crossing the limiting value and affecting the stability of the system. Hence proper studies for the whole system are required to be done before allowing any addition of new generation capacity or new load or new transmission circuits. The studies are to be updated regularly to know the possible overloading, voltage at different locations and other operating constraints. The studies and planning, therefore, is required to be done by one organization for the whole system even though different elements may be owned by different operators.

Electricity moves from generators through transmission and distribution systems to customers at nearly the speed of light. Since today there is no way to realistically store bulk quantities of electricity, the total amount of electricity generated must be continually matched to the total amount of electricity being used. In other words, total outputs of all the generators must be matched continuously with the total load and loss in the system.

The protection and its settings provided for different elements of the grid need proper coordination so that in case of a fault occurring in one of the elements, the protection should be able to act to isolate the faulty element from the grid quickly. The decision regarding protection is generally taken by a technical committee with members from different licensees operating generation or transmission assets.

C. CONTROL CENTERS

Satisfactory operation of the Grid requires direct coordination and proactive monitoring of the Grid system. This work is done by the Control Centers. A control center coordinates the operation of the grid components and is responsible for operating the power system within a geographic region called a control area irrespective of the ownerships of the generation and/or transmission facilities in the area. Very large power systems have more than one control centre. A system operated by one control center is connected to systems operated by other control centers with transmission Tie Lines.

In Thailand, EGAT has 6 Control Centers. The Central Control Center, situated at the EGAT headquarters in Nonthaburi Province, is responsible for the control of 230 kV and higher transmission system throughout Thailand as well as transmission lines between EGAT and Lao Electricity Enterprise and Malaysian Electricity Authority, and the control of power generation with generating capacity of 100 megawatts or more. The five regional control centers, described below, are responsible for the control of 115 kV and lower transmission system and the control of power generation with generating capacity lower than 100 megawatts in their respective areas.

1. Metropolitan Control Center, situated in the EGAT headquarters in Nonthaburi Province, is responsible for the area of Bangkok and its outlying provinces, totaling 4 provinces.

2. Central Plain Control Center, situated in the EGAT headquarters in Nonthaburi Province, is responsible for area consisting of 23 provinces in the central plains except Bangkok and its outlying provinces.
3. Northeastern Control Center, situated in Khon Kaen 1 High-Voltage Station in Khon Kaen Province's Mueang District, is responsible for the area consisting of 19 provinces in the north-east.
4. Southern Control Center, situated in Lamphura High-Voltage Station in Trang Province's Huai Yot District, is responsible for the area consisting of 16 provinces in the south.
5. Northern Control Center, situated in Phitsanulok High-Voltage Station in Phitsanulok Province's Mueang District, is responsible for the area consisting of 14 provinces in the north.

Vietnam has one National Load Dispatch Centre (NLDC) situated in Hanoi which controls the Vietnamese power system by directly controlling the 500 kV transmission network and major power plants, and indirectly controlling the 220kV transmission network through the three regional load dispatch centres (RLDCs), (northern, central and southern regional centres).

In vertically integrated utilities, the Control Centre is owned by the utility. In many countries where the function of transmission is separated from other functions, the main transmission company, owned by the State, owns and operates the Control Centre. Examples are United Kingdom and India. In these two countries the transmission company operating the control center is not allowed to own generation or trade in power. This is done to avoid conflict of interest and create confidence in the operation by the Control Center. In many other countries like USA, the control Centers are operated by Independent System Operators (ISO).

The duties performed by the control centers generally include the following:

1. Monitoring and Operational control of the power system to ensure continuity and adequacy of supply with satisfactory level of quality
2. Exchanges of electric energy with neighboring power utilities
3. Maintenance scheduling on high-voltage generation and transmission capacities
4. Making of daily, weekly/ monthly programs of power system operation.
5. Keep historical data

For continuous monitoring of the power system, the control center has to receive the system data from the generating stations and substations. Through proper communications (metering and telemetry), the control center is constantly informed of generating plant output, flows in transmission lines and ties to neighboring systems, and system conditions. A control center uses this information to ensure reliability by following reliability criteria and to maintain its interchange schedule with other control centers.

With advancement of technology, control center systems can now acquire the electric system data through communications with hardwired or programmable equipment in the field. For this purpose Remote Terminal Units (RTUs) or Intelligent Electronic Devices (IEDs) are used in the field. The information is transmitted to the control center over the Supervisory Control and Data Acquisition (SCADA) system.

Main purposes of the power system control are:

1. Continuous supply of electric energy to the consumers
2. Satisfactory level of quality of supplied electricity (including frequency and voltage)
3. Secure operation of the power system
4. Economic operation of the power system.

For the bulk power system to operate reliably, it must be designed and operated based on the following principles:

- The total generation at any moment must be kept equal to total electricity consumption and losses on the system including transmission and distribution.
- The electricity flows through the transmission system in accordance with physical laws and cannot be directed to flow through specific lines.
- The system must be designed with reserve capacity in generation and transmission to allow for uninterrupted service when contingencies occur.

D. SUB-TRANSMISSION SYSTEM AND POWER FLOW IN SUB-TRANSMISSION SYSTEM

The Sub-transmission system is the system connecting the Transmission System with the distribution system supplying power to the consumers. The voltages of the Sub-transmission system are lower than the voltages of the Transmission System. Some of the sub-transmission system voltages used in different countries are 66 kV, 33 kV, 22 kV, 11 kV etc. The sub-transmission system has generally radial power flow with very few parallel paths. The quantum of power flow and the area being fed by a Sub-transmission

line is smaller compared to a Transmission line. Because of these reasons, a contingency on a Sub-transmission line does not affect the performance of other parts of the system. In most of the countries, one Sub-transmission line supplies power to the area of one distribution licensee. The planning or operation of the Sub-transmission System does not warrant the level of coordination that is required for a transmission system.

E. THE TRANSMISSION GRID SYSTEM IN CAMBODIA (IN 2006)

The power supply system in Cambodia is dispersed and isolated, except for the Phnom Penh system. Only the Phnom Penh system has high voltage (115 kV) lines. The Phnom Penh transmission system consists of the 115 kV line around Phnom Penh and the 115 kV line from Kirirom Hydropower station to Phnom Penh. This system interconnects the three substations in Phnom Penh, the generating stations owned by EDC, generating stations owned by IPPs in Phnom Penh and Kirirom and the substation at Kampong Speu. This system is controlled by the Control Station situated in Phnom Penh. The transmission lines and the control station are owned by EDC. EDC has been issued the National Transmission License which provides it the right for transmission throughout Cambodia.

Cambodia has ambitious plan to develop the high voltage system in Cambodia to interconnect all major towns and areas of Cambodia to provide grid supply to its population. At present efforts are under way to construct the following:

1. 230 kV line from Vietnam to Phnom Penh with substations at Takeo and Phnom Penh
2. 230 kV line from Takeo to Kampot with substation at Kampot
3. 115 kV line from Thailand to Siem Reap and Battambang with substations at Banteay Meanchey, Siem Reap and Battambang.
4. 230 kV line from Kampot to Sihanoukville with substations at Veal Renh and Sihanoukville.

The facilities at 1, 2 and 4, to be owned by EDC, together with the existing grid system of Phnom Penh will constitute the southern grid or Phnom Penh grid and will be controlled by the control centre at Phnom Penh. The facilities at 3 will be owned by a private entrepreneur having agreement with EDC to provide the transmission service and will constitute the western grid and will be controlled by the control center, located in the area and to be owned by EDC.

F. THE DEVELOPMENT OF TRANSMISSION SYSTEM IN CAMBODIA

The transmission system in Cambodia is evolving. To implement the Government plan to cover more areas by grid supply, more transmission lines and substations will have to be

constructed. Interconnection of the transmission systems of the countries in the Greater Mekong Sub-region is also being considered. The new transmission lines and substations may be constructed by the following:

1. By EDC, the holder of National Transmission License: EDC has not been able to generate sufficient funds to be able to fund new transmission lines from its own resources and hence it is dependent on external funding. It will be able to construct only those facilities for which it has been able to arrange external funding.
2. By owner of new large generation plant: The transmission line required to connect the generating plant with the grid to deliver the generated power may be constructed by the owner of the generating plant as a part of the generation project.
3. By owner of a large industry: A large industry or a consumer needing large quantities of power may construct a direct line from the grid to his load to take power supply from the grid.
4. By a transmission service provider: An entrepreneur may construct a line to provide transmission service either to a particular licensee/consumer or a number of licensees/consumers.
5. By an multi-country transmission service provider: Transmission lines extending beyond the boundaries of Cambodia may be constructed (i) to import electricity from neighboring countries (ii) to export electricity from Cambodia (iii) to interconnect the system in Cambodia with the systems of other countries and (iv) to interconnect the system of other countries without having an interconnection with the system in Cambodia.

G. THE DEVELOPMENT OF SUB-TRANSMISSION SYSTEM IN CAMBODIA

To enable grid supply to reach the consumers, MV lines are needed to take the power from the substation to the distribution system. In Cambodia, the present distribution system is disbursed with each village/ town having its isolated distribution system, which is owned by a different service provider. This situation in Cambodia is different then in most other countries where one service provider provides distribution service to a large area having a large number of villages/ towns. In Cambodia, the owner of the Sub-transmission system and the distribution system may be different. One sub-transmission line may supply power to more than one distribution licensee. Hence EAC has to ensure that there is no discrimination in the operation of the sub-transmission system. Because of these reasons, it becomes necessary to treat the sub-transmission system on a different footing, to treat it like a transmission line but with less sensitivity for planning and operation.

In Cambodia, the new sub-transmission lines at MV may be constructed by the following:

1. The MV lines may be owned by EDC. In the present situation this seems more likely. The government also plans that EDC should own the MV lines to transmit the power from the substation to the distribution system of the village/town. EDC

may arrange external funding by including these facilities within the project for transmission expansion or as separate projects or may provide funds from own source.

2. The owner of a generating plant may construct the MV lines to deliver the generated power to the grid at MV or to sell power to the distribution licensees in different villages/towns.
3. The MV line may be drawn by a large consumer to avail power supply at MV from the substation. In some rare cases, the line may also be used to supply power to the distribution licensee of a village or other consumers on the way either by wheeling of power or by sale of power.
4. The MV lines may be drawn by a distribution licensee to get electricity from the substation/ generation plant. The distribution licensee may also use the MV lines to supply power to other distribution licensees either by wheeling of power or by sale of power.
5. The MV lines may be drawn by an independent service provider to supply power to the distribution licensees either by wheeling of power or by sale of power.

H. THE DEVELOPMENT OF CONTROL CENTER IN CAMBODIA

EDC has a Control Centre in Phnom Penh to control the only Grid System now existing. EDC is planning to construct the National Control Center in West Phnom Penh Substation along with the construction of the 230kV line from Vietnam to Phnom Penh. A control center will have to be established at Banteay Meanchey or Siem Reap to control the grid system proposed to be developed by constructing transmission line from Thailand. Similar control centers will have to be established for each such isolated grid system developed. With the inter connection of the isolated grid systems, the existing control centers may either be abolished or continued so that finally a system with a National Control Center and a number of Regional Control Centers is developed. The location and number of regional control centers will depend on the size of the grid system and convenience of control operations.

I. LICENSES AND ELECTRICITY LAW

Article 38 of the Electricity Law states that the Government policy is

1. To reduce long run marginal cost of supply of electricity to consumers
2. Establish a national grid and progressively expand this grid throughout Kingdom of Cambodia.

Article 5 of the electricity Law provides that while taking decision on issuing licenses EAC should consider:

1. Government policies, strategies and planning in power sector to reduce long and short run marginal cost
2. Ensure public interest
3. Decisions of Ministry of Industry, Mines and Energy on subjects set out in Article 4.

ARTICLE 38

In issuing consolidate licenses, the Authority shall consider long term planning and the objectives of Government policy to reduce long run marginal cost in the long term supply of electricity to consumers, establish a national grid and progressively expand this grid throughout Kingdom of Cambodia.

ARTICLE 5

Each electric power service provider is required to have a license issued by the Electricity Authority of Cambodia, and shall abide by the provisions of this law and those of its license, regulations and procedures of Electricity Authority of Cambodia, and the requirements of the laws of the Kingdom of Cambodia.

While making decision on issuing licenses, the Authority shall take into consideration the government policies, strategies and planning in power sector which aim to reduce the long and short run marginal cost of supplying electricity throughout the Kingdom of Cambodia, and decisions set out in Article 4 of this law, and shall ensure the public interest.

The Electricity Authority of Cambodia shall ensure that the licensees shall use the standard related to technical operation, safety and environment, which is issued and published by the Ministry of industry, Mines and Energy.

License in this law shall mean a license for the provision of an electric power service.

Licensee in this law shall mean a person to whom the Authority has granted a legal and valid license under this law.

Article 41 of the Electricity Law provides that without a license the following acts can not be performed:

1. Operate as an electric power utility
2. Provide electric power service
3. Licenses shall be issued only to competent persons.

This means that no license is required for a consumer or for operation of electrical facilities only for own use. Before issuing license to a person, EAC has to be satisfied that the person is competent to fulfill the service obligation and conditions of the license.

ARTICLE 41

No person may operate as an electric power utility or provide electric power services unless he/she has performed under and in accordance with the terms of a valid license issued by the Authority.

Licenses shall be issued only to persons whose competence satisfies the requirement of Authority to operate as an electric power utility and to fulfill the service obligations and conditions included in the license. Licensees shall not be required to provide electric power services, the cost of which can not be recovered through electricity tariffs, except to the extent specific funds are provided to subsidize consumers and the licensee is agreeable to this arrangement.

Article 35 of the Electricity Law states that “Consolidate License” may be the combination of some or all licenses (Generation, Transmission, Dispatch, Distribution, Bulk Sale, Retail and Subcontract License). Articles 35 and 38, both deal about cases where Consolidated License can be issued and do not have any restrictive provisions i.e. do not state cases where Consolidated License can not be issued. As per these two Articles Consolidated Licenses can be issued to:

1. EDC
2. Isolated systems
3. For establishing a national grid and its progressive extension.
4. To reduce long run marginal cost in the supply of electricity to consumers
5. In public interest.

ARTICLE 35:

The Consolidate License is the type of license, which may be the combination of some or all licenses stated at serial numbers 1 to 7 of Article 29 of this Law.

The consolidated license can be issued to EDC and to the isolated systems to grant the right to generate, transmit, dispatch, distribute and sale the electric power to consumers. If a consolidated licensee intends to add new generation facilities, then he must apply for generation license for each new generation facility.

For the purposes of encouraging efficiency and competition and where this will contribute to the least long run marginal cost of electricity, the Authority shall include the provision in this license for disaggregating the generation, transmission and distribution services in the service coverage territory of licensee.

Article 40 of the Electricity Law provides for issue of Subcontract License to provide electric power services according to the subcontract agreement with the existing licensee. So, according to this Article, there will be two licensees having right to provide the same electric power service, one the existing or main licensee and two the Subcontract Licensee having a subcontract agreement with the main licensee to provide the service. The subcontract agreement may cover all or a part of the services being performed by the main licensee under its license. By only executing the subcontract agreement, the second person can not provide the service. It has also to get a Subcontract License. Article 45 provides that the licensee can assign or transfer its license to any other person only with the special approval of EAC. In the Subcontract agreement, the main licensee is not transferring the license; it keeps its right under its license, but allows another person to provide the services it has the right to provide. And the second person can provide the service only if it has executed the subcontract agreement and has obtained the Subcontract License. The implications of issuing license and giving right for providing the same service to two persons are as follows:

- (i) By issue of Subcontract license, the rights and obligation of the main licensee are not taken away, the rights are temporarily, as per the provision of the subcontract agreement, are allowed to be performed by the second person. After the subcontract agreement expires or is terminated or the Subcontract License expires or is revoked or due to any reason the subcontract licensee is not able to provide the services, the main licensee has to provide the services. And if he is not able to provide the services, it will construe violation of his license conditions.
- (ii) To make the above possible, the facilities for providing the services should be available to the main licensee. If the main licensee owns the facilities, and the subcontract licensee was allowed to operate the same, the facilities will be available to the main licensee for operation. If the facilities are partly or wholly owned by the subcontract licensee, then either there should be provision in the

subcontract agreement for main licensee to be able to operate the existing facilities or the main licensee will have to construct the required facilities. This means the subcontract agreement should have provisions such that the services are provided without any undue interruption in the event of the subcontract licensee not being able to provide the services due to what ever reason. While approving the subcontract agreement and issuing subcontract license, EAC has to ensure this.

ARTICLE 40:

The Subcontract Licensee shall have the right to provide electric power services according to the subcontract agreement with existing licensee.

Subcontract Licenses under this Article shall include all applicable conditions, and such additional license conditions as the Authority may consider in the public interest.

The Authority may issue the regulations regarding the activities and operation of subcontract agreement when the Authority concludes that is in the public interest.

J. TRANSMISSION LICENSES

Articles 31, 32 and 33 of the Electricity Law deal with transmission license. Article 31 provides that the transmission licensee shall have the following rights:

- (i) Own, operate and manage the transmission facility,
- (ii) Wheel electricity – receive electricity owned by another licensee, transmit it over its facility and deliver the same.
- (iii) Sell electricity in bulk – generate or purchase electricity, transmit it over its transmission facility and sell it in bulk to another licensee or bulk consumer.

Article 31 provides for two types of Transmission License (i) National Transmission License (NTL) and (ii) Special Purpose Transmission License (SPTL). Article 32 deals with National Transmission License and Article 33 deals with Special Purpose Transmission License. Both licenses provide the same rights described above under Article 31 to the licensees. But the two licenses have different provisions for the following aspects:

- (i) Licensee – The National Transmission License can be issued to the state power transmission company (EDC at present) only. Hence there can be only one National Transmission Licensee. The Special Purpose Transmission License can be issued to any eligible company (State owned, joint venture or private) other

than the state power transmission company. Hence there can be more than one Special Purpose Transmission Licensee.

- (ii) Authorized area of operation – The National Transmission Licensee has the right to provide the transmission service throughout the Kingdom of Cambodia (subject to the rights of Special Purpose Transmission Licensee), whereas the Special Purpose Transmission Licensee has the right to provide the transmission service only by facilities specifically identified in the license. The National Transmission license specifies the **area of operation** and hence the licensee can construct and operate all transmission facilities required within the authorized area. But the Special Purpose Transmission License specifies the **transmission facilities** and hence the operation under this license is limited only to the specified facilities and can not operate any other facility not identified in the license.
- (iii) Term of the License – The National Transmission License may be of an indefinite term where as the Special Purpose Transmission License may be for an indefinite term or the useful life of the transmission facility covered by the license.

As the National Transmission Licensee has been given the rights to provide transmission service throughout Cambodia and there is also provision for issue of Special Purpose Transmission License, it is expected that the National Transmission Licensee will be the main provider of transmission service but not the sole provider. There may be instances when the National Transmission Licensee may not construct certain transmission facilities either due to lack of funds or lower priority for the National Transmission Licensee but higher priority for some other entrepreneur. Some possible examples of lower priority could be:

- (i) A multi country transmission line passing through Cambodia, but not connected to facilities in Cambodia.
- (ii) A transmission facility to transmit electricity from a big generation plant in Cambodia to a neighboring country.
- (iii) A transmission facility not connected to the main grid.
- (iv) In some cases it may be easier for another entrepreneur to arrange funds and operate certain transmission facilities.

ARTICLE 31

The Transmission Licensee shall have the right to provide the transmission service. The right of the transmission licensee in this law is to own operate and manage the power transmission facilities for transferring and delivering or selling the electricity in bulk.

There shall be two types of transmission license: National Transmission License and Special Purpose Transmission License.

ARTICLE 32

The National Transmission License shall be issued to the state power transmission company that has the right to provide the transmission service for delivering the electric power to the distribution companies and bulk power consumers throughout the Kingdom of Cambodia, except in the territory served by the isolated systems as stipulated in Article 35 paragraph 1 and subject to the rights of special purpose licensees under Article 33 of this Law.

The license issued under this Article may be of an indefinite term, subject to revocation under this Law.

ARTICLE 33

The Special Purpose Transmission Licensee shall have the right to construct, own and/or operate the specifically fixed identified transmission facilities in Cambodia that have the specified purpose and ensure the public interest. The principles and conditions for issuing the Special Purpose Transmission Licenses shall be determined by the government regulation.

The validity of Special Purpose Transmission Licenses may be for indefinite term or limited to the useful life of the particular transmission facilities. The Special Purpose Transmission License is subject to revocation under this Law.

K. THE PRINCIPLES AND CONDITIONS FOR ISSUING SPECIAL PURPOSE TRANSMISSION LICENSES

The Electricity Law has not imposed any restriction on issue of Special Purpose Transmission Licenses, but Article 33 provides for determination of the principles and conditions for issuing the Special Purpose Transmission Licenses by government regulation.

The provision of the Law is that these principles and conditions shall be determined by **Government Regulation** and not by **Sub-Decree** as in the case of determination of License Fee stated in article 27 and as in the case of determination of Reasonable Cost in electricity business stated in Article 48. This means that this determination can be done by the Government Regulation, which is lower than Sub-Decree. Because these issues are technical issues, these principles and conditions can be determined by **Prokas of Ministry of Industry, Mines and Energy** as in the case of determination of Electric Power Technical Standard.

This provision allows flexibility and the ability to adapt to the changing situation in an evolving system. The principles and conditions for issuing Special Purpose Transmission License may be modified by the Government by modifying the Prokas as and when required.

As discussed in Section I above, the Electricity Law specifies the following principles for issuing a license, which are also applicable for the Special Purpose Transmission License:

1. To reduce the short run and long run marginal cost to supply electricity to consumers,
2. To establish a national grid and progressively expand this grid throughout the Kingdom of Cambodia.
3. To ensure public interest
4. Decisions of Ministry of Industry, Mines and Energy on subjects set out in Article 4.

Apart from the above principles, the additional principles required for issuing the Special Purpose Transmission License are discussed below:

1. **EAC should be satisfied about the utility of the transmission facility and the time when it is needed before issuing a Special Purpose Transmission License for proposed transmission facilities.**

The Sub-transmission system and the grid in its initial stage of development, consists of mostly radial feeders and even when parallel paths are available, the network is simple and hence the utility of new facilities and its effect on existing

network can be easily assessed. As the grid expands and more lines are added up, more parallel paths are created and detailed studies are needed to understand the utility of the new facilities and their effect on the existing network. The studies will also indicate the time when the new facilities are required, which will depend on the future load growth as per load forecast and the changes in the generation capacity and location. These studies are done by computers using suitable software. The studies may include some or all of the following studies:

- Load flow study
- Short circuit study
- Transient stability study
- Steady state stability analysis
- Voltage stability analysis
- Electromagnetic transient analysis
- Reliability analysis

Such studies are carried out for planning of the network. Hence if a facility is included in the plan, its utility and effect on the network will be available from the plan study. However, it has to be ensured that the plan study is based on the updated planning data. If the data, on which the earlier study was based, has changed, a fresh study may be required. For the study, the design data of existing and proposed components of the network, generation and load forecast details etc will be required. It may be convenient for EDC, the National Transmission Licensee to carry out these studies, as the studies are technical in nature, and the results of the study are utilized by MIME for the planning of the electricity sector. If the studies are required to be conducted for considering new facilities proposed to be constructed by a person other than the National Transmission Licensee, which are not included in the existing study, the cost of such additional studies may be borne by the interested party or as decided by MIME or EDC.

For EAC to be satisfied about the need for the proposed facilities, the application for the Special Purpose Transmission License should enclose a note explaining the utility of the proposed facilities. After the grid has developed and EAC feels that studies must be done to establish the utility of the HV facilities, EAC may require the application to enclose either the results of the study showing that the facilities are needed and the time when they are needed or the details and reference of the plan to show that the facilities are included in the plan.

2. National Transmission Licensee has the first right to construct a proposed transmission facility within the time it is needed.

EAC should satisfy itself that the National Transmission Licensee has no intention to construct a facility within the time period it is needed; before issuing

Special Purpose Transmission License. This can be done either by EAC writing to the National Transmission Licensee or the applicant getting necessary letters from the National Transmission Licensee and submitting it with the application for Special Purpose Transmission License. EAC may seek the opinion of the National Transmission Licensee on issue of Special Purpose Transmission License. If the National Transmission Licensee intimates that it has proposal to construct the proposed facilities within the period they are needed and the applicant disputes the same, then the applicant can complain to EAC and EAC will investigate the same.

As discussed earlier, the planning and operation of the grid system requires a high degree of co-ordination. To ensure this coordination, the Special Purpose Transmission License should have additional conditions of license in addition to the normal conditions of license being enforced by EAC for other types of licenses. The additional conditions are discussed below.

- 1. Compliance with Grid Code** – Grid Code is the most important code for proper operation of the Grid System. The Grid Code should cover System Planning, Connection Conditions, Operating Procedures, Scheduling and Dispatching, Outage Planning, Data registration and Information furnishing, etc. All generation licensees and transmission licensees must comply with the Grid Code.
- 2. Provision of Communication facilities** – The Licensee shall provide suitable communication facilities (such as SCADA) and measuring devices compatible with the facilities provided in the Control Center to provide on line data and communication from each substation to the Control Center.
- 3. Compliance with the instructions of the Control Center** - The Licensee shall comply with the instructions of Control Center for operation and planned outages of the facilities.
- 4. Obligation to provide connections to its facilities** – To meet the demand of the system it is necessary to connect new generation, transmission lines, sub-transmission lines and consumer installations to the network. In an evolving system like that of Cambodia, new lines will have to be connected to the existing system to gradually expand the Grid to more areas and provide interconnections. Hence it will be necessary that at least in the initial stages, provision is made in each substation (both in the yard and control room) for the space required to accommodate the future expansions and connections. Hence the License Condition may specifically provide for keeping space in each substation for adequate number (at least two) of future feeder connections at each voltage of operation. The bays need not be equipped till required but space has to be kept to house the equipment and control panels.

5. **Provision of Meters** – Meters of specified accuracy level will have to be provided at each interconnection point to record import and export of energy and other quantities for commercial purposes.
6. **Open Access** – In developed systems open access is enforced. In a system like that of Cambodia, particularly for facilities under Special Purpose Transmission License this aspect needs more close examination. In Cambodia, entrepreneurs in private sector are likely to construct the transmission facilities under specific transmission agreements, where the person using the facilities contracts for entire capacity. In such cases the licensee may not be free to provide the access to other persons. So, to allow free access to the extent spare capacity is available, the transmission agreement will have to keep the provision for suitable commercial arrangements to allow use of the facility by others. If the person using the facility is the National Transmission Licensee, then it can provide the transmission service even for the facilities of the Special purpose Transmission Licensee. However allowing free access in case of facilities for general use will not pose any problem.
7. **Protection Co-Ordination** – The licensee will have to provide protection for the facilities and keep its settings as per the procedures approved by EAC so that there will be proper co-ordination in isolating a faulty section quickly and effectively.
8. **Compliance with the Distribution Code** – The transmission and sub-transmission system will have connections to the distribution system. So, the licensee has to comply with the Distribution Code.
9. **Option to buy out by National Transmission Licensee** – Advocates of single transmission operator may desire to have provision for the National Transmission Licensee to buy out the facilities of Special Purpose Transmission Licensee after the facilities are connected to the National Grid and after some specified years of operation. Such a provision may deter the investment by private persons in transmission facilities, there by delaying the expansion of the Grid. The license conditions for Special Purpose Transmission License may not provide for compulsory transfer of transmission facilities to National Transmission Licensee. However, the National Transmission Licensee is free to contract for construction of transmission facilities by private persons on the basis of BOT or make provisions for buy out of transmission facility after the facilities are in operation for some years.

L. LICENSES FOR OPERATION OF HV TRANSMISSION FACILITIES

The issues relating to grant of license to Persons who may add transmission lines at HV as stated in Section F are examined below:

1. EDC: EDC is a state owned company and has already been granted the National Transmission License with the right to provide transmission service throughout Cambodia. So, EDC can operate the new lines under the existing license.
2. New Generation Plant: HV lines with short length (length up to 50 KM) and used only for connecting the generation plant to the grid may be considered as Connection Facility and part of the generation plant and hence can be covered by the Generation License granted for the operation of the generation plant. Longer lines will need a transmission License for its Operation. So, either the licensee should obtain a Consolidate License comprising of Generation License and Special Purpose Transmission License or the line should be transferred to a transmission licensee.
3. Large Industry/Consumer: HV lines with short length (length up to 30 KM) and used only for delivering power supply to the load of the owner of the line may be considered as Connection Facility and part of the consumers installation and no license will be required to operate the HV line. For Longer lines and if the lines are used to provide services to others, the large industry/ consumer owning the HV line should either obtain a special purpose transmission license or transfer the HV line to a transmission licensee.
4. Transmission service provider: The transmission service provider can operate the transmission lines under a special purpose transmission license.
5. Multi-country transmission service provider: The transmission service provider can operate the transmission lines under a special purpose transmission license.

In the above cases (except sl.5), a service provider may obtain a subcontract license in place of a special purpose transmission license in accordance with Article 40 of the Electricity Law. For this purpose, the service provider has to execute a subcontract agreement with the National Transmission Licensee or a Special Purpose Transmission Licensee (licensed to operate the said transmission facility).

M. LICENSES FOR THE OPERATION OF A MV SUB-TRANSMISSION FACILITY

MV lines can be part of a distribution system or sub-transmission system. This is more so in an evolving system like that of Cambodia. In an earlier decision, EAC has decided that “All MV and LV facility of a distribution licensee, in its area of supply, used for the purpose of supplying power to its consumers shall be treated as part of distribution system”. The license requirement for MV lines not covered by a distribution license and for the cases listed in Section G is examined below.

1. EDC: The MV facilities owned by EDC, outside its authorized area of supply, used for supply of power to other licensees or big consumers can be operated under the National Transmission License already issued to EDC.
2. New Generation Plant: MV lines with short length (length up to 20 KM) and used only for connecting the generation plant to the MV system may be considered as Connection Facility and part of the generation plant and hence can be covered by the Generation License granted for the operation of the generation plant. Longer lines will need a transmission License for its Operation. So, either the licensee should obtain a Consolidate License comprising of Generation License and Special Purpose Transmission License or the line should be transferred to a transmission licensee.
3. Large Industry/Consumer: MV lines with short length (length up to 10 KM) and used only for delivering power supply to the load of the owner of the line may be considered as Connection Facility and part of the consumers installation. No license will be required to operate the MV line. For Longer lines and if the lines are used to provide services to others, the large industry/ consumer owning the MV line should either obtain a special purpose transmission license or transfer the MV line to a transmission licensee or the distribution licensee of the area.
4. Distribution Licensee: The MV line, owned by a distribution licensee and situated outside its area of supply, used only to get power for supply to consumers in its area of supply may be operated under the distribution license with the specific provision that the licensee can own and operate the specific MV facility outside its area of supply. But if the MV facility is also used for supply of power to other licensees, the distribution licensee will also need a special purpose transmission license.
5. Independent service provider: The independent service provider, who owns MV facilities for wheeling of power to distribution licensees or consumers, will have to obtain a special purpose transmission license.

As stated in Section I, the service provider can obtain a sub-contract license in place of a special purpose transmission license.

N. LICENSES FOR THE OPERATION OF CONTROL CENTERS

As per the provisions of Article 36 of the Electricity Law, EAC may issue the Electricity Dispatch License only after the transmission system covers many important areas, the generation, transmission and distribution services have been separated and the electricity dispatch service is big enough to be reckoned as a separate service. It may take many years to fulfill the above conditions and till then the dispatch service can not be separated from the transmission service. This service will have to be provided by the National Transmission Licensee, who at present is the only transmission licensee and it is expected

that will continue to own and control (as provided in the PPA or transmission agreement) the major part of Transmission system.

ARTICLE 36:

The Electricity dispatch Licensee shall have the right to control, manage and operate the dispatch facilities for facilitating the delivery and receiving the electricity from the generation, transmission and distribution systems.

Electricity Dispatch License shall prescribe the condition to ensure that the operation of generation, transmission and distribution systems under its dispatch control is in safe, reliable and efficient condition.

Electricity Authority may issue the dispatch license to any person for providing dispatch service on a power system, provided that:

1. That power system has transmission lines connected to many important distribution areas,
2. The generation, transmission and distribution services have been separated from each other,
3. The electricity dispatch service is big enough that Authority can authorize to provide separate service.

The license issued under this Article may be of an indefinite term and subject to revocation under this Law.