

7.2.8 Power Supply

(1) General Consideration

1) Current Situation of Power Supply System in Sihanoukville

Generating Facilities

The electricity supply in Sihanoukville is managed by EDC through an isolated distribution network supplied by diesel generators at the EDC power station in Sihanoukville, as shown in **Table 7.2-19**.

Table 7.2-19 Generator Capacity of EDC Sihanoukville

Sl. No	Name of Manufacturer of Gen	Rated capacity (MW)	Available capacity (MW)
1	Wartsila-1	2.5	2.5
2	Wartsila-2	2.5	2.5
3	Russian Generator-1	0.8	0.6
4	Russian Generator-2	0.8	0.6
5	Russian Generator-3	0.8	0.6
Total		7.4	6.8

The available output of this power station is 6.8 MW. Two sets of new generators, installed in 1998 under an ADB loan, are normally operated at present for the peak power demand of 4 MW, and old Russian-made generators are on standby for emergency or during maintenance.

Distribution Network

The distribution network of EDC Sihanoukville consists of 22 kV distribution lines and low voltage networks (400/230 Volt, 3 phase and 4 wire system). The current distribution network was rehabilitated in 1999 with the financial assistance of ADB. An existing 22kV distribution line passes through the SPFZ, as part of the 22kV network shown in **Figure 7.2-23**.

Electricity Tariff

The electricity tariff of EDC is established for the EDC's power system, as shown in **Table 4-36** in Chapter 4 of the Main Report. The tariff in Sihanoukville is slightly higher than that of Phnom Penh; for instance the tariff of an industrial consumer is 0.13 – 0.17 US\$/kWh in Sihanoukville while it is 0.12 – 0.15 US\$/kWh in Phnom Penh.

Transmission Line to Sihanoukville

There was no transmission line connection in Sihanoukville as of February 2003.

2) *Power Demand Forecast of Sihanoukville*

Table 7.2.-20 shows the power demand forecast for all of Sihanoukville including the power demand of the Sihanoukville Port Free Zone (SPFZ) and industrial areas proposed by the Study.

Table 7.2-20 Power Demand Forecast for Sihanoukville

(Unit: MW)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
General demand	4.1	4.4	4.8	5.1	5.5	5.9	6.3	6.8	7.3	7.6	8.0	9.0	10.0	10.5
Free Zone and Industrial Area														
SPFZ				2.5	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
SPIA												3.1	4.3	4.3
SIA-4							5.8	8.7	11.6	11.6	11.6	11.6	11.6	11.6
SIA-6												6.3	9.4	12.5
Total of Power Demand	4.1	4.4	4.8	7.6	8.8	9.2	15.4	18.8	22.2	22.5	22.9	33.3	38.6	42.2

3) *Development Plan for Power Supply in Sihanoukville*Establishment of Transmission Line to Sihanoukville

MIME and EDC plan to establish a 230 kV interconnection transmission line between Phnom Penh and Viet Num to import power from the Viet Num grid in 2006. In addition, a branch transmission line from Takev to Kampt, and continuing on to Sihanoukville is planned to be installed by 2007 or 2008. When Sihanoukville is connected to this national power grid, sufficient power will be available.

Expansion of the Existing Power Station

By the time the power will be available from the new transmission line, EDC plans to rapidly expand the generation capacity to meet the growing demand in Sihanoukville. At the moment, MIME and EDC are repairing a French made generator (1.8MW) to resume operation in February 2003. Furthermore, EDC plans to shift one or two sets of diesel generators (2.5MW, each) from C3 Power Station in Phnom Penh to make up for the shortage of generation capacity in Sihanoukville in 2004 or 2005. Consequently the available generation capacity will be 12.4 MW up to 2007 as shown in **Table 7.2-21**. This is in excess of the forecasted demand of 9.2 MW inclusive of the demand for the SPFZ.

Thus, EDC will be able to secure their generation capacity to supply the required electricity to the SPFZ as well as to the general consumers based on EDC's plan for generation expansion.

Table 7.2-21 Planned Generator Capacity of Sihanoukville Power Station

Sl. No	Name of Manufacturer of Gen	No. of Units x Capacity (MW)	Commencement Year	Available Capacity
Current Generators				
1	Wartsila	2 x 2.5	1998	5.0
2	Russian Gen.	1 x 0.6	-	0.6
Subtotal				5.6
Generators to be installed in the future				
3	SMCA (French)	1 x 1.8	2003-3	1.8
4	Caterpillar	1 x 2.5	2004	2.5
5	Caterpillar-2	1 x 2.5	2004	2.5
Subtotal				6.8
Total				12.4

Source : EDC

Development Plan for Large-Scale Generation around Sihanoukville

There are only small diesel generators in the current Sihanoukville system. MIME and EDC plan to develop a stable, indigenous and economical source of electricity, such as hydropower and/or gas combined cycle operating on the natural gas resource in Siam Bay as shown in **Table 7.2-22**. Utilization of available local energy resources could contribute to substantially reduce the generation cost.

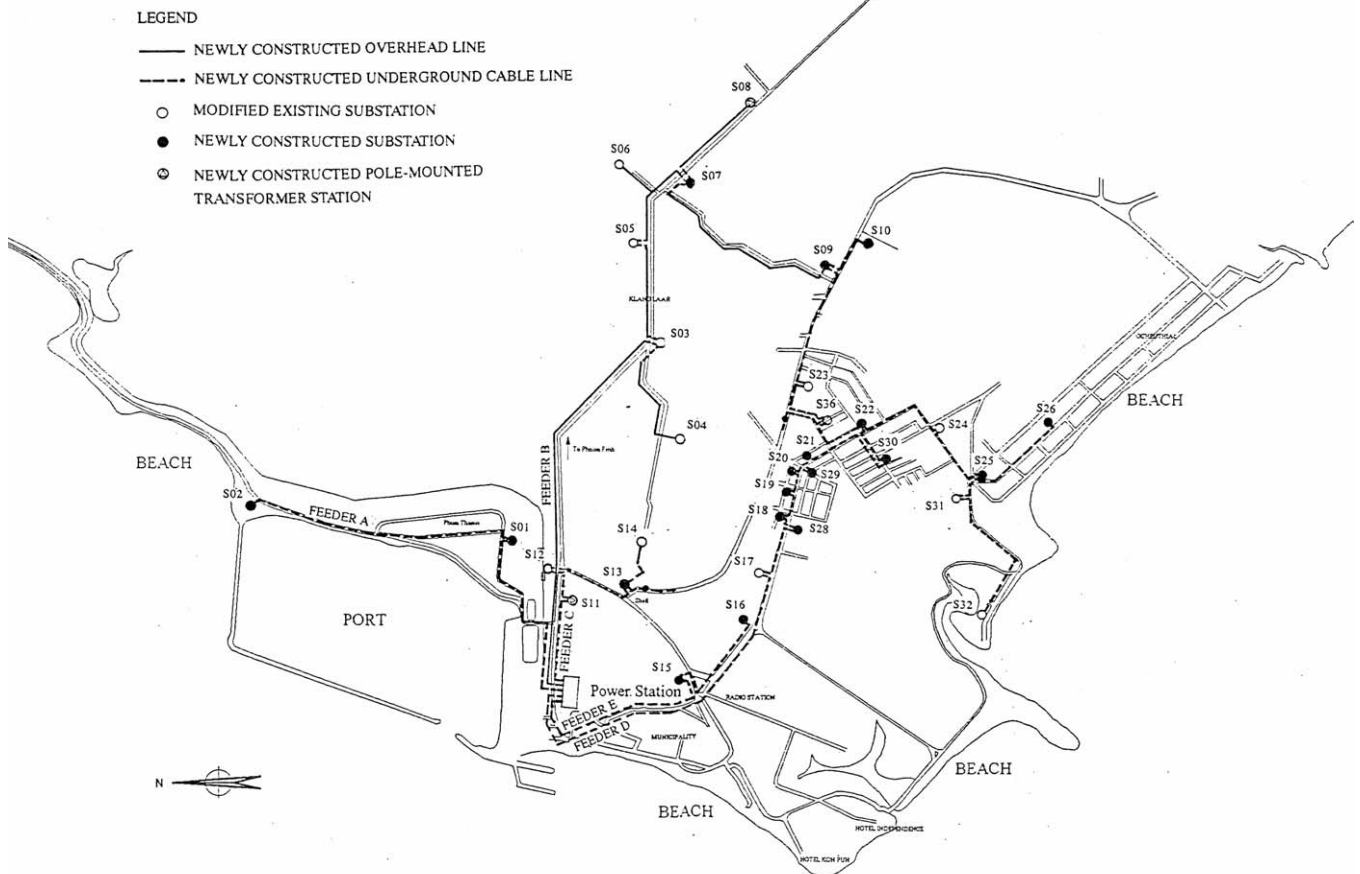
Table 7.2-22 Potential of Large-Scale Generation around Sihanoukville

(Unit: MW)

Sl. No	Power Station	Estimated Capacity (MW)	Expected Commencement Year	Remark
Hydro Power				
1	Kamcay	120	2010	F/S was completed in 2002.
2	Steung Atay	110	2012	No study has been done so far.
3	Steung Russei Chrum	125	2013	No study has been done so far.
4	Steung Metoek	90	-	No study has been done so far.
Power Generation other than Hydro				
5	Sihanoukville Combined Cycle	3 x 90	2007-2016	F/S was completed in 2002.
6	Coal Plant Kampot	200~300	-	Some private company proposed.

4) *Power Demand and Supply Balance*

Figure 7.2-24 summarizes the scenario of generation capacity expansion and the power demand forecast in Sihanoukville showing the power demand and supply balance.



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Figure 7.2-23
Electricity Distribution Network of EDC Sihanoukville as of December 2002

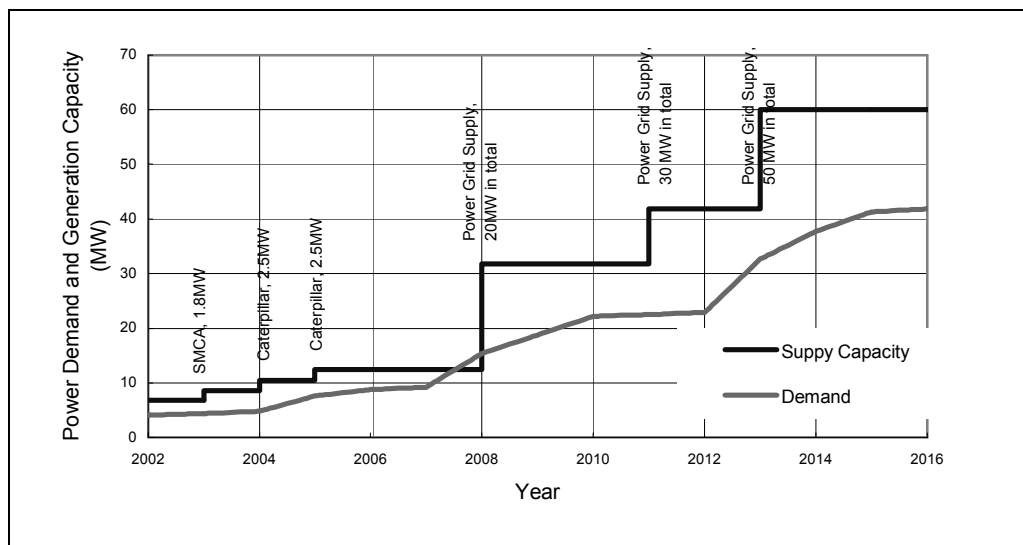


Figure 7.2-24 Power Demand and Supply Balance in SNV

5) Outline of Power Supply to the Sihanoukville Port Free Zone (SPFZ)

The outline of the power supply scheme to the SPFZ is illustrated in **Figure 7.2-25**.

Considering that the power demand forecast for the SPFZ is 3.3 MW and the power station is located at only 2 km away, the electricity should best be supplied directly from EDC power station through a distribution line of 22kV.

The Study Team recommends that two (2) special feeders of 22kV underground cable line be set up to feed power specifically to the SPFZ, considering the reliability of the power supply. These distribution lines shall not be used for any purpose other than to supply the SPFZ.

(2) Design Conditions and Criteria

The following basic design conditions and criteria are adopted.

1) Design Conditions

- (a) Sufficient power supply to the potential users
- (b) Highly reliable power supply to the users
- (c) Low fluctuation (high stability) of supply voltage

2) Basic Design Criteria

- (a) Voltage regulation: : $\pm 5\%$ of rated voltage of 400/230V, to enhance distribution line reliability
- (b) Power interruption : No long term power interruption

to enhance reliability of supply

- (c) Regulations and standards : EDC Design Standard, March 1996
IEC standards

Since the distribution networks in the Sihanoukville Port Free Zone (SPFZ) connect to the EDC power station and its network, EDC Design Standard March 1996 and the specifications of equipment under EDC's recent projects should be adopted in designing. Moreover, this will be beneficial in operation as EDC staff and/or in-house engineers and skilled laborers can easily maintain and operate the distribution facilities.

(3) Specifications

The basic design for the following facilities is proposed in the following items.

- (a) A transmission line between the power station and the switching station
- (b) A switching station in the industrial area
- (c) Distribution facilities in the industrial area

In addition to these, some auxiliary works for EDC facilities, such as an increase of switchgears in the power station, shifting the existing distribution lines to the SPFZ, etc. may be necessary.

1) *Transmission Line to the SPFZ*

The power to the SPFZ will be transmitted from the EDC power station through 22kV underground cables, of which the proposed cable route is shown in **Figure 7.2-25**. Two (2) circuits are proposed for securing high reliability of the power supply.

Basic design of the transmission system is proposed as follows:

- (a) Line Voltage : 22 kV
- (b) No. of circuits : 2 circuits
- (c) Line Length : Approximately 2 km
- (d) Cable type : XLPE 240 mm² triplex, Al. conductor
- (e) Cable depth : 0.8 m depth by direct burying (Protection pipe shall be used, burying under the roads.)
- (f) Details of cable burying : EDC Design Standards shall be applied.

2) *Switching Station*

For the purpose of receiving power from the 22kV transmission line from the power station, a switching station will be constructed at the receiving end in the SPFZ, as shown in **Figure 7.2-25**. The switching station will also have the functions of switching 22kV lines (feeders) and measuring the energy consumption in the entire free zone. **Figure 7.2-26** shows a single line diagram and equipment layout image

of the switching station. The proposed basic design of the switching station is summarized below:

- (a) Line Voltage : 22 kV
- (b) Rated current of bus-bar : 630 A
- (c) Type : Indoor cubicle type
- (d) Arrangement of 22 kV Switchgear
 - 22 kV incoming cubicle : 2 sets
 - 22 kV outgoing cubicle with circuit breaker : 2 sets
 - 22kV metering unit : 2 sets

3) *Distribution Network in the SPFZ*

The route of the 22kV distribution line in the Sihanoukville Port Free Zone (SPFZ) is as shown in **Figure 7.2-25**. The distribution network is formed in a ring-circuit with a branch line.

A ring main unit (RMU) is placed on the 22kV distribution line at the boarder of every two consumers, and will distribute electricity to one or two customer(s) at this point. Besides, these units will function as on/off switching on the 22kV feeder circuit.

The 22kV underground cable lines and RMU will be set up in the SPFZ in the early stage. Other necessary facilities to consumers, such as step-down transformers, energy meters, low voltage facilities, etc. will be provided by the consumers.

The basic design of the 22kV distribution line is as follows:

- (a) Line Voltage : 22 kV
- (b) No. of circuits : One (1) line in ring formation and one (1) branch line
- (c) Line length : Approximately 4.5 km
- (d) Cable type : Rated voltage 24kV (50Hz)
XLPE 240 mm² triplex, Al. conductor
- (e) Burying method : 0.8 m depth by direct burying
(Protection pipe shall be used when burying under the roads.)
- (f) Ring main unit : Outdoor cubicle type or indoor type
(If the indoor type is used, a small building shall be constructed.)
- (g) Operation system : Manual Operation

4) *Electricity Supply for Public Street Lighting*

A public street lighting system will be set up on the both sides of the main roads and on one side of the other roads in the SPFZ for security purposes. The power for the lighting will be supplied from transformers to be put on the 22kV lines through low voltage underground cables 2 x 25 mm² (Al).

The power from the transformer stations can not only be used for street lighting but also for public purposes such as for the one-stop service center, well pumping, water pumping, etc.

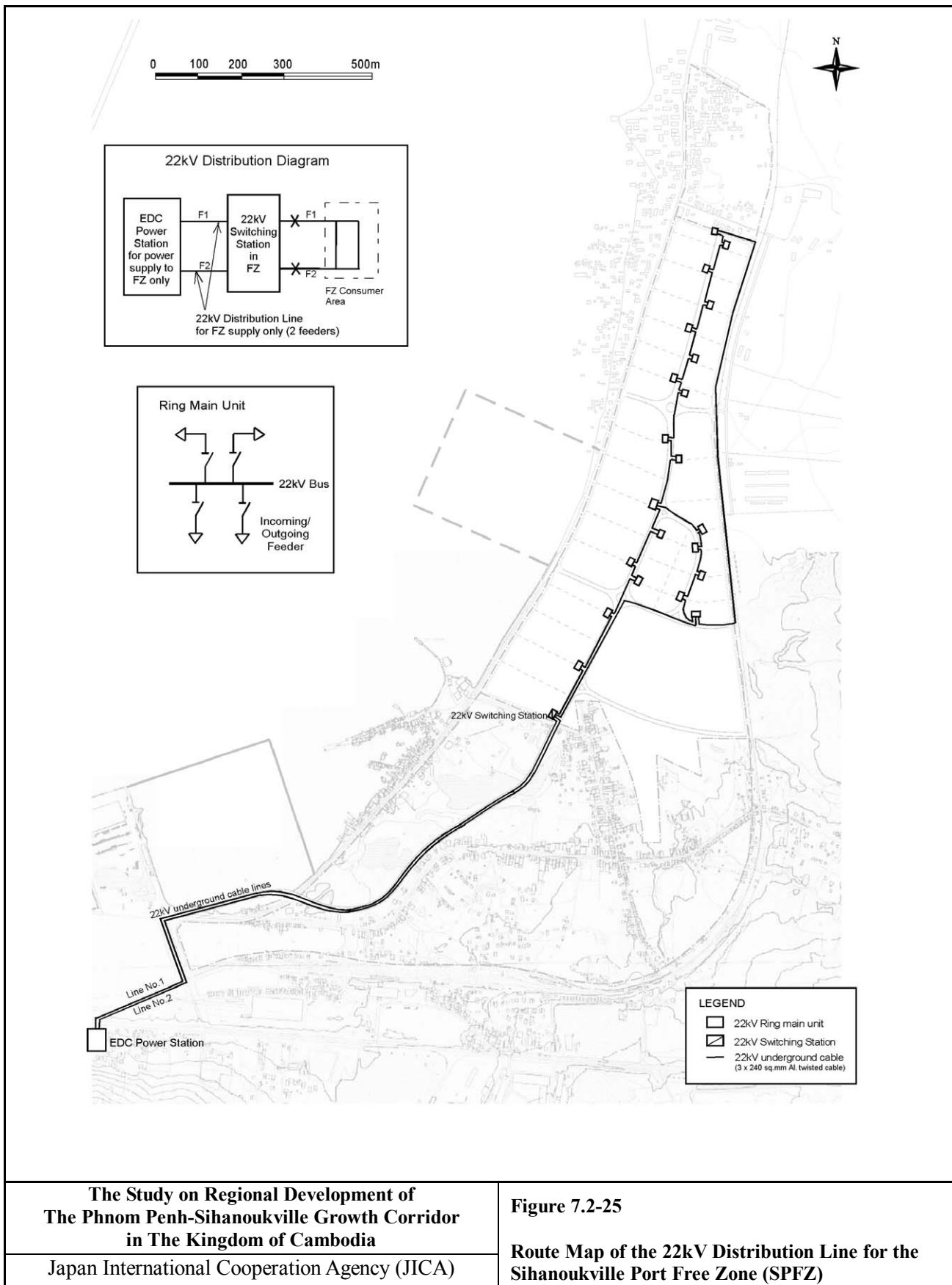
The proposed basic design of the electricity supply facilities for the street lighting system is as follows:

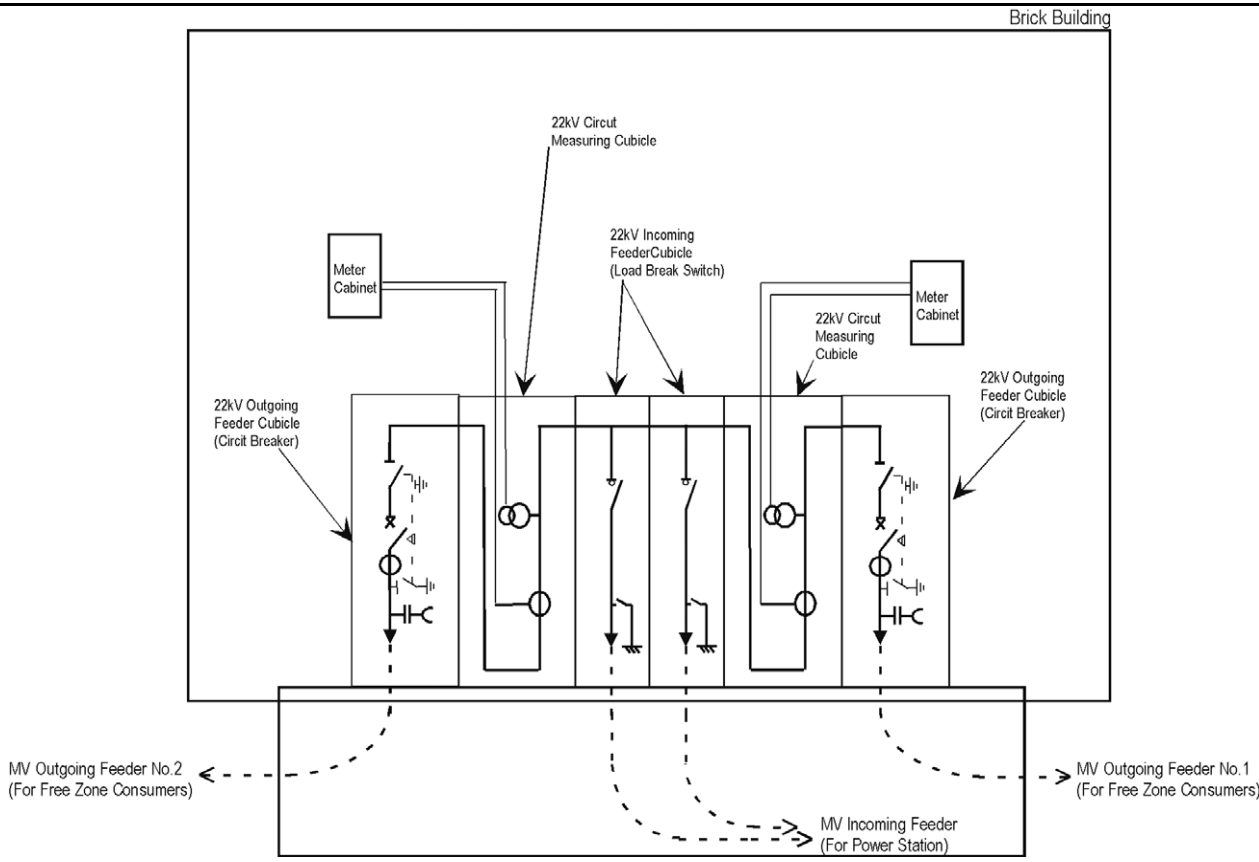
Transformer Station

- | | |
|---------------------------------|---|
| (a) Transformer | : 22/0.4 kV, 100 kVA |
| (b) No. of Transformer Stations | : 2 stations |
| (c) Auxiliary equipment | : -Low voltage distribution board
-Street lighting distribution board
-Watt-hour meter
-On/off switching timer for lighting
-Circuit breakers |
| (d) Type of substation | : Pole mounted type, or
In door substation type |
| (e) Other design | : EDC Design Standards are applied. |

Street Lighting Cable

- | | |
|------------------|---|
| (a) Line voltage | : 230 V (Single phase) |
| (b) Cable type | : Rated Voltage 0.6/1.0 kV
XLPE 2 x 25 mm ² Al. conductor |
| (c) Cable length | : Approximately 7 km |





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Figure 7.2-26
**22kV Switching Station in the Sihanoukville Port
Free Zone (SPFZ)**

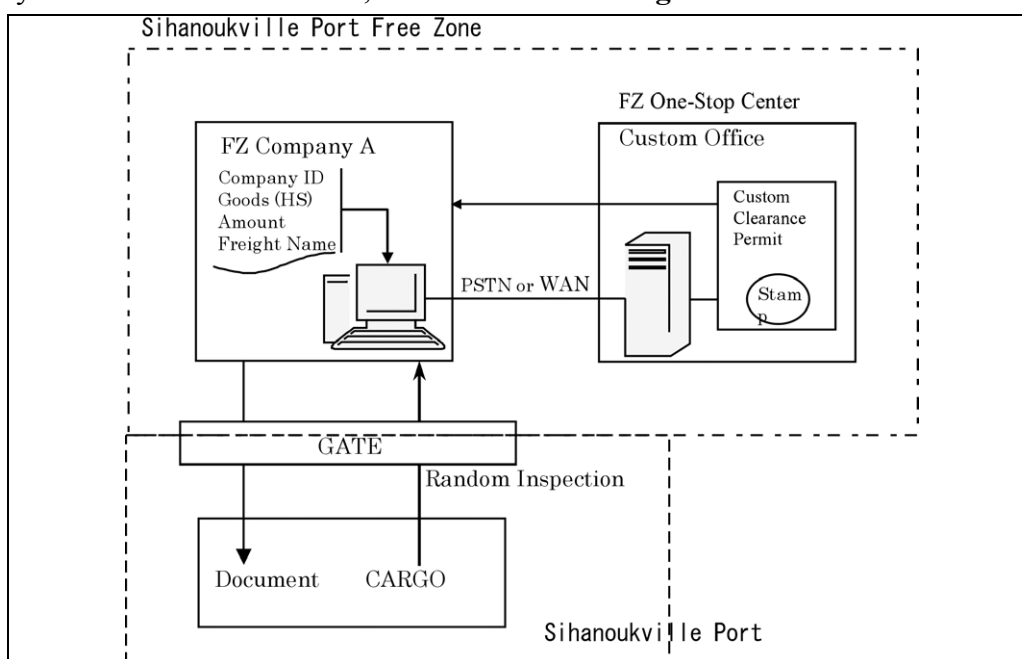
7.2.9 Telecommunication

The fixed phone services in Sihanoukville are provided by CAMSHIN and CAMINTEL.

The MPTC planned to lay down an optical fiber cable from Phnom Penh to Sihanoukville with STM-4 (622 Mbps) and to establish an LS (3,000 lines) in Sihanoukville. According to the Plan, the optical fiber cable and a switching facility will be completed in late 2004.

The telecommunication demand of the Sihanoukville Port Free Zone (SPFZ) is projected to be 200 lines in 2005. To cope with the demand, an RSU will be installed in the one stop service center and to connect the newly established LS with an optical fiber cable.

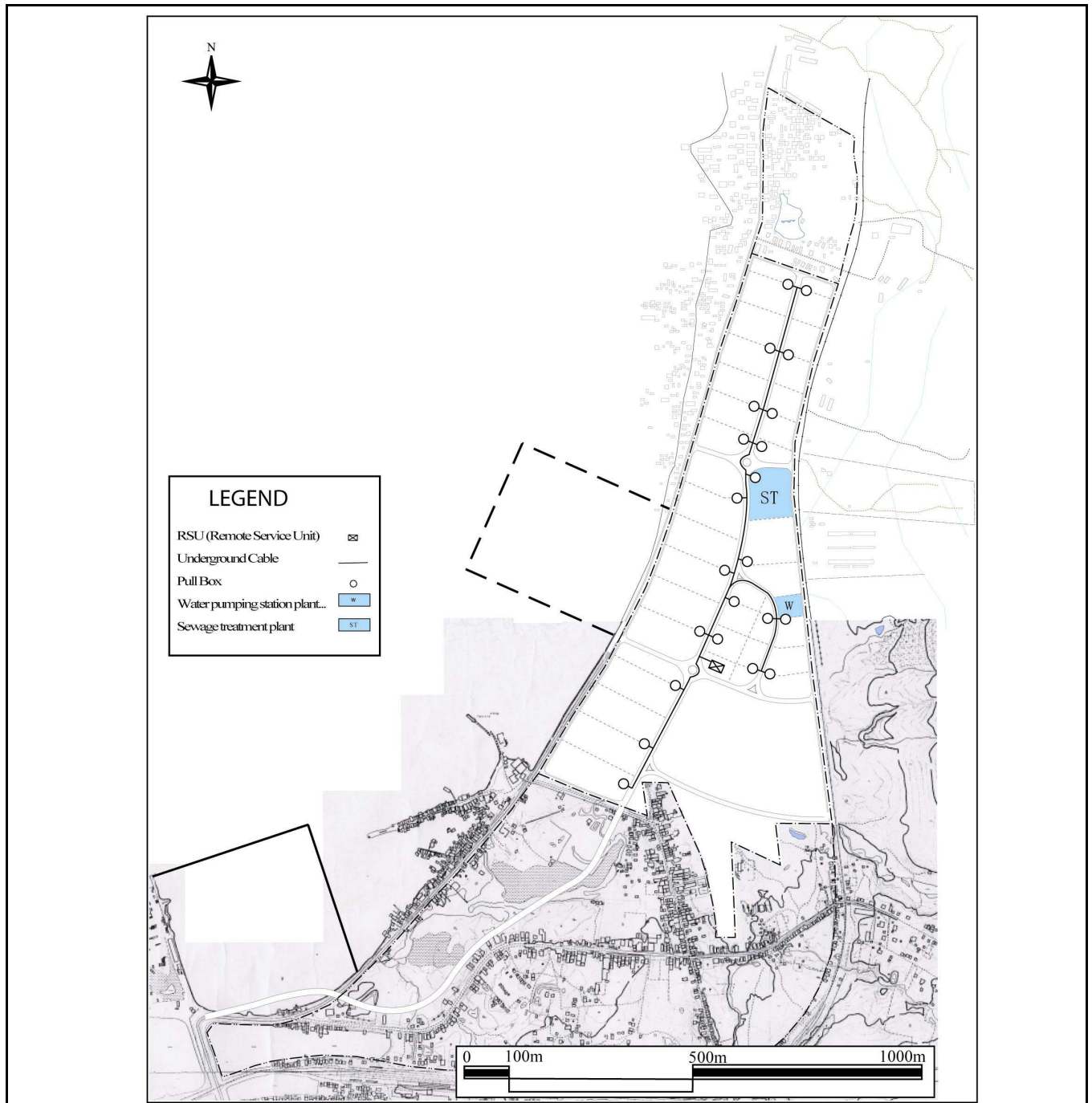
For the network plan in the SPFZ, since the export-oriented companies to be located in SPFZ may adopt a computerized system for shipping and accepting orders for products, parts and components, sufficient capacity for data communication should be provided. Additionally, to enhance the convenience of the customs clearance procedure, it is imperative that each company should have the ability to be connected with the customs office established in the SPFZ One-Stop Center though a proposed system for custom clearance, as illustrated in the **Figure 7.2-27**.



Source: JST

Figure 7.2-27 Customs Clearance Procedure in the Sihanoukville Port Free Zone (SPFZ)

The network in the zone is as shown in **Figure 7.2-28**.



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Figure 7.2-28

**Plan of the Telecommunication Network for the
Sihanoukville Port Free Zone (SPFZ)**

7.2.10. One Stop Service Center

For integrated and robust operation and control of the Sihanoukville Port Free Zone (SPFZ), a one stop service center is proposed in the center area. All relevant organization as shown in Figure 7.2-29 shall be established in the one stop service center.

The necessary total area is designed to be 600 m² and the site area is 3,000m².

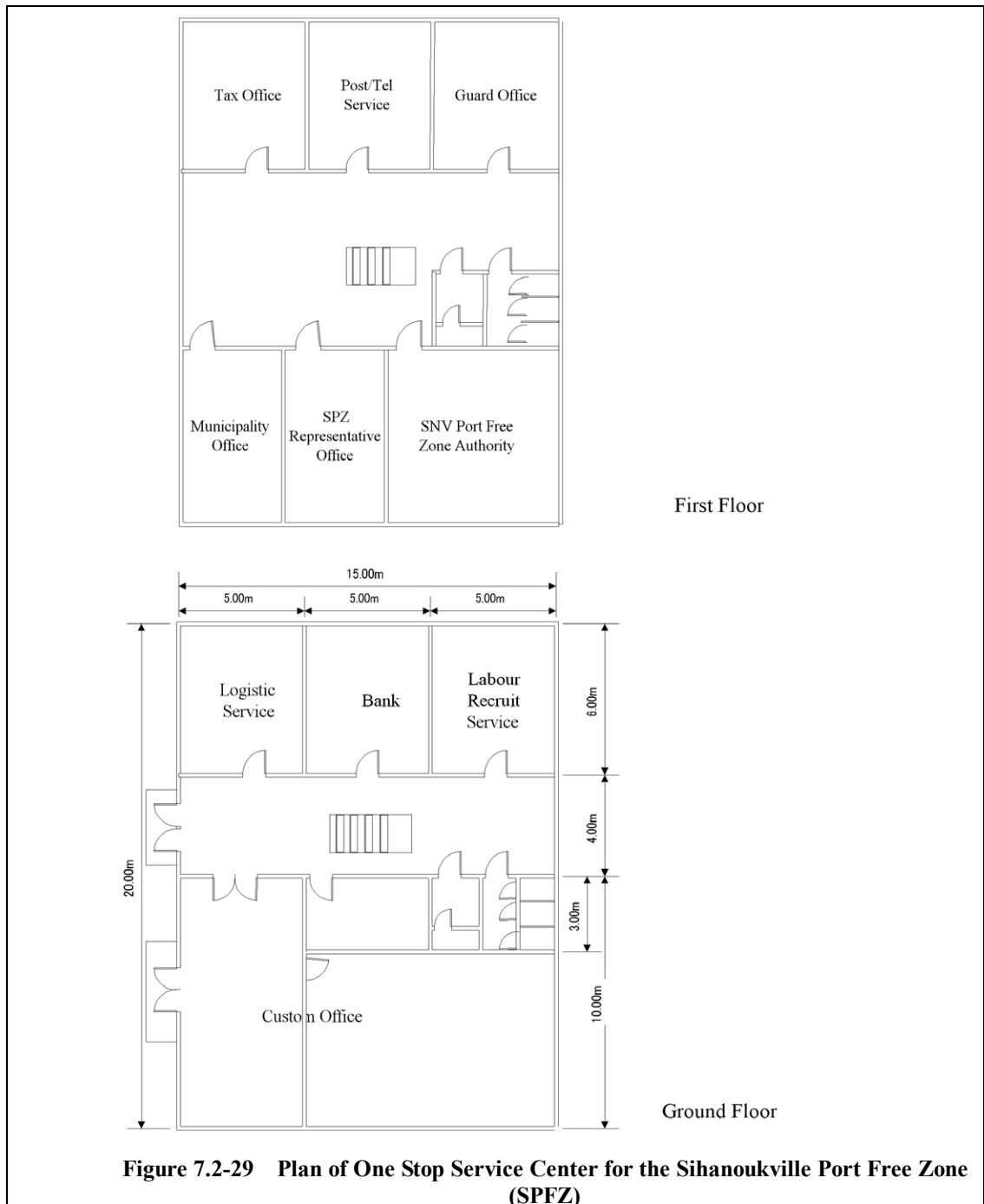


Figure 7.2-29 Plan of One Stop Service Center for the Sihanoukville Port Free Zone (SPFZ)