

Power System And Technical Issues In South Korea

Presented by

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Presentation Topics

1. Statistics of electric power
in South Korea

2. Electricity transmission
network of South Korea

3. Technical issues

1. Statistics of electric power in South Korea

1.1 History of Power System

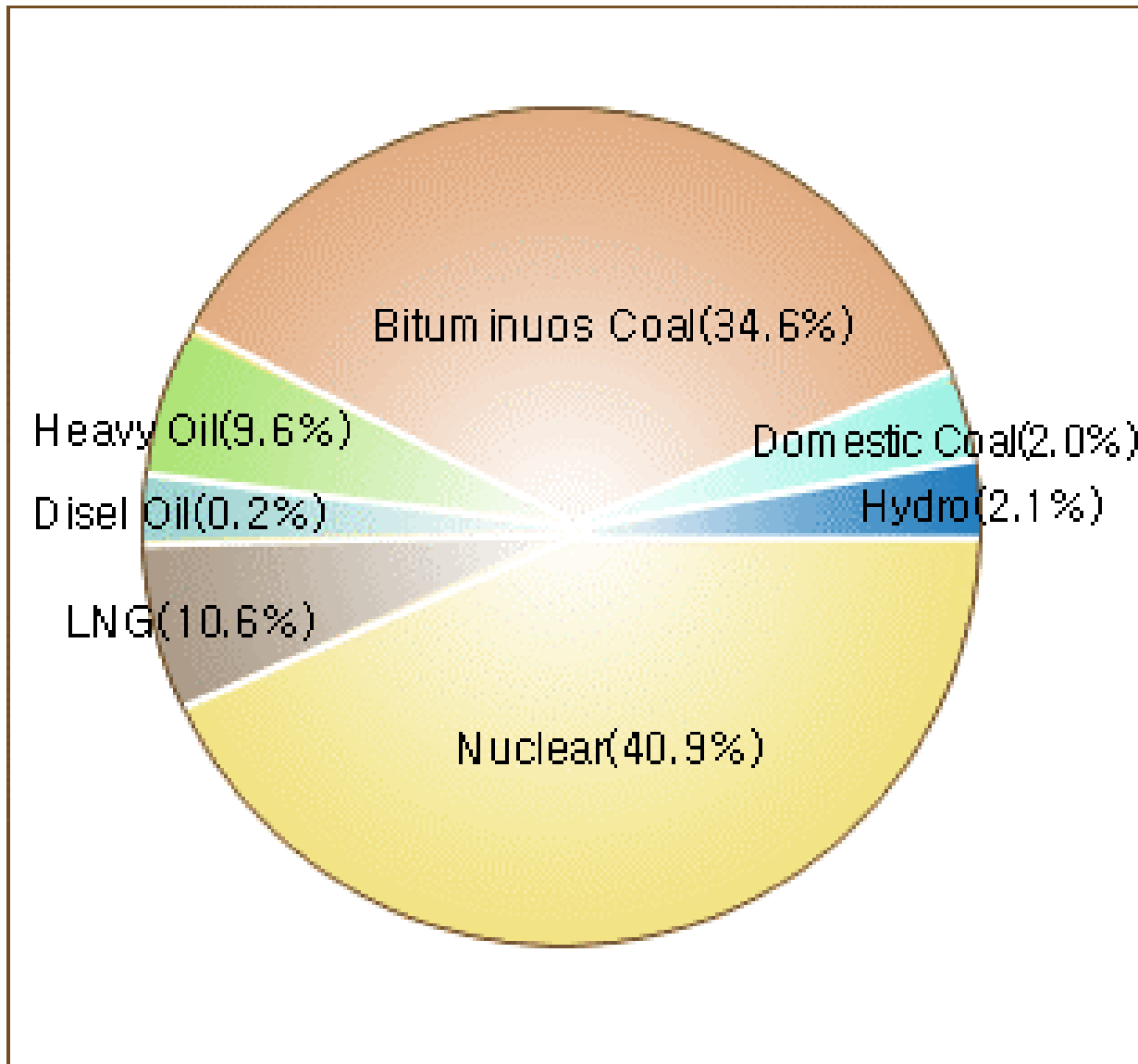
1961 Foundation of Korea Electric Power Company

1975 Construction of the first 345kV Sin Yoe Soo transmission line running 93km between Yoe soo Power Plant and Sin Nam Won substation

1979 Installation of Dual On Line Real Time Computer in head office for Automatic Frequency Control(A.F.C)and Economic Load Dispatch(E.L.D)

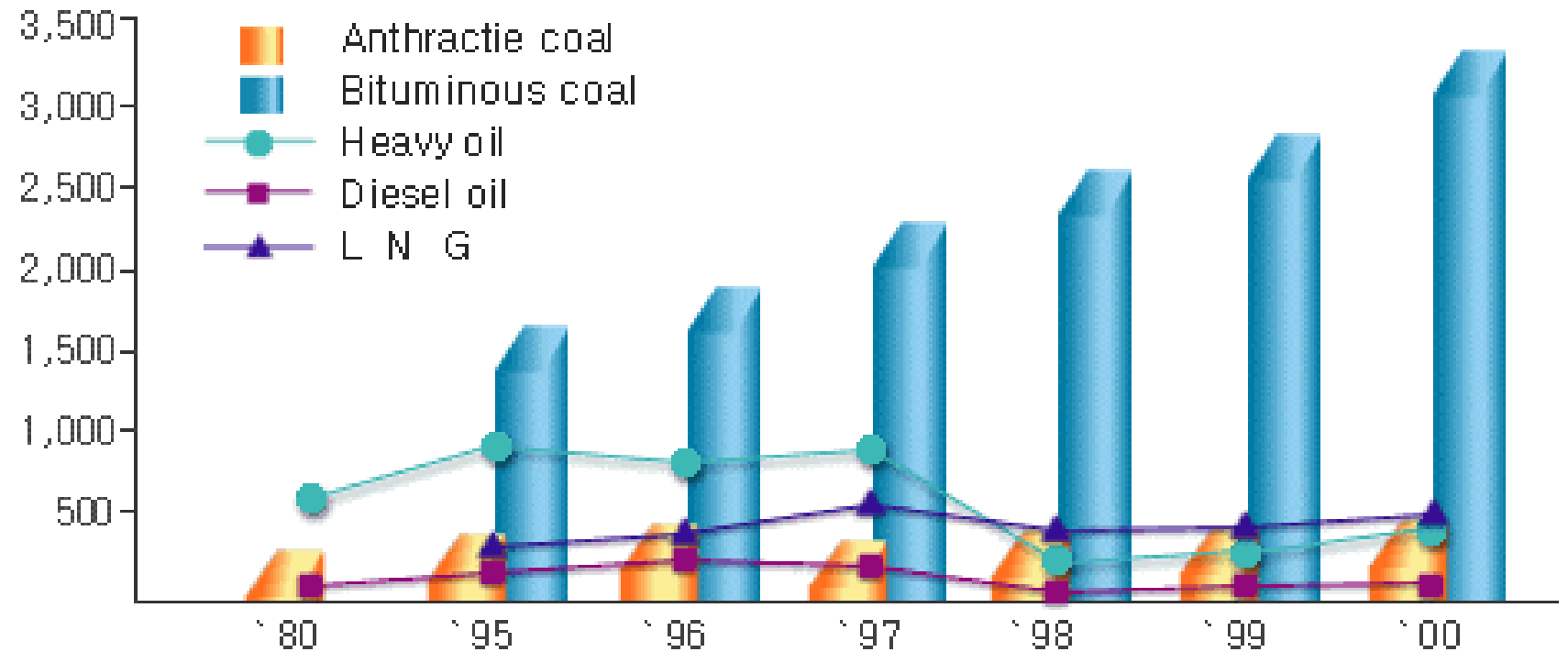
- 1981 Start up of the first SCADA system in Seoul Power Transmission Department
- 1988 Department establishment of Energy Management System(E.M.S)
- 1993 Construction of the first 345kV underground Transmission Line running between Mi Geum and Seong Dong in the Eastern area of Seoul
- 1997 300MW High Voltage Direct Current Link between Cheju Island and Mainland
- 2001 The first 765kV transmission line planned to be energized

1.2 Gross Power Generation

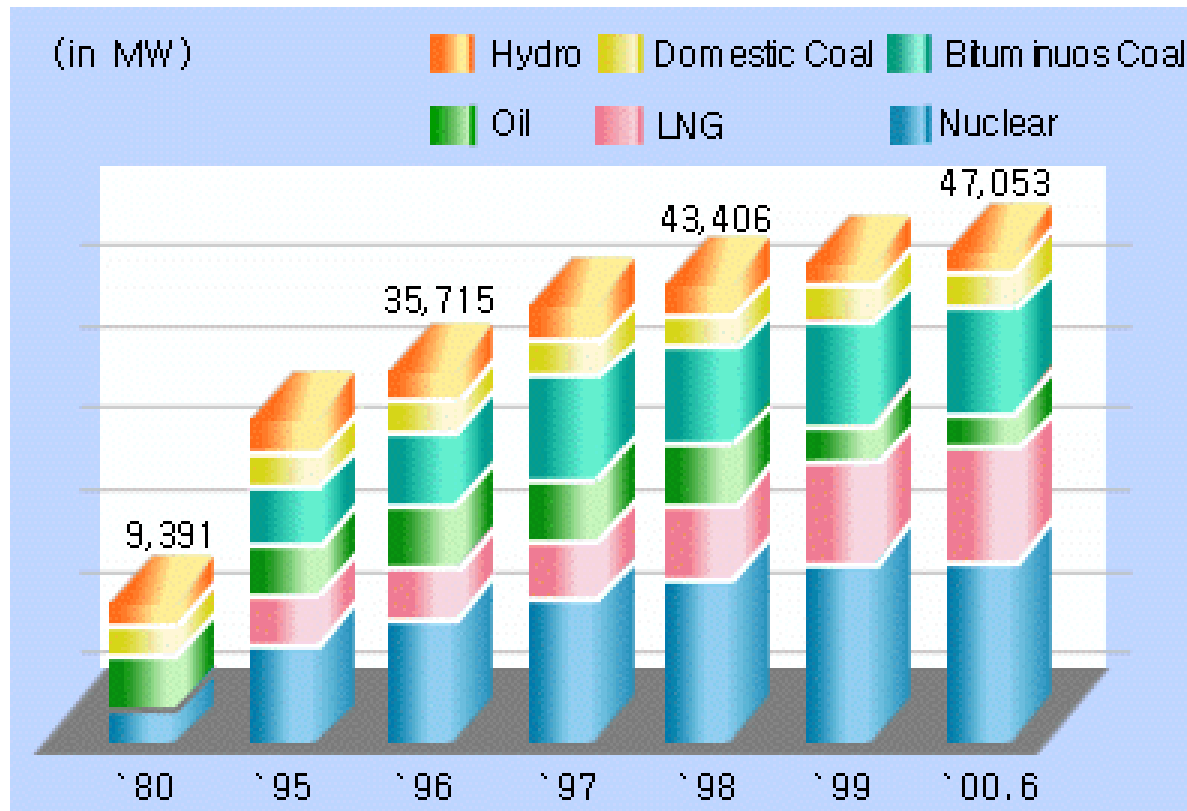


1.3 Fuel Consumption for Generation

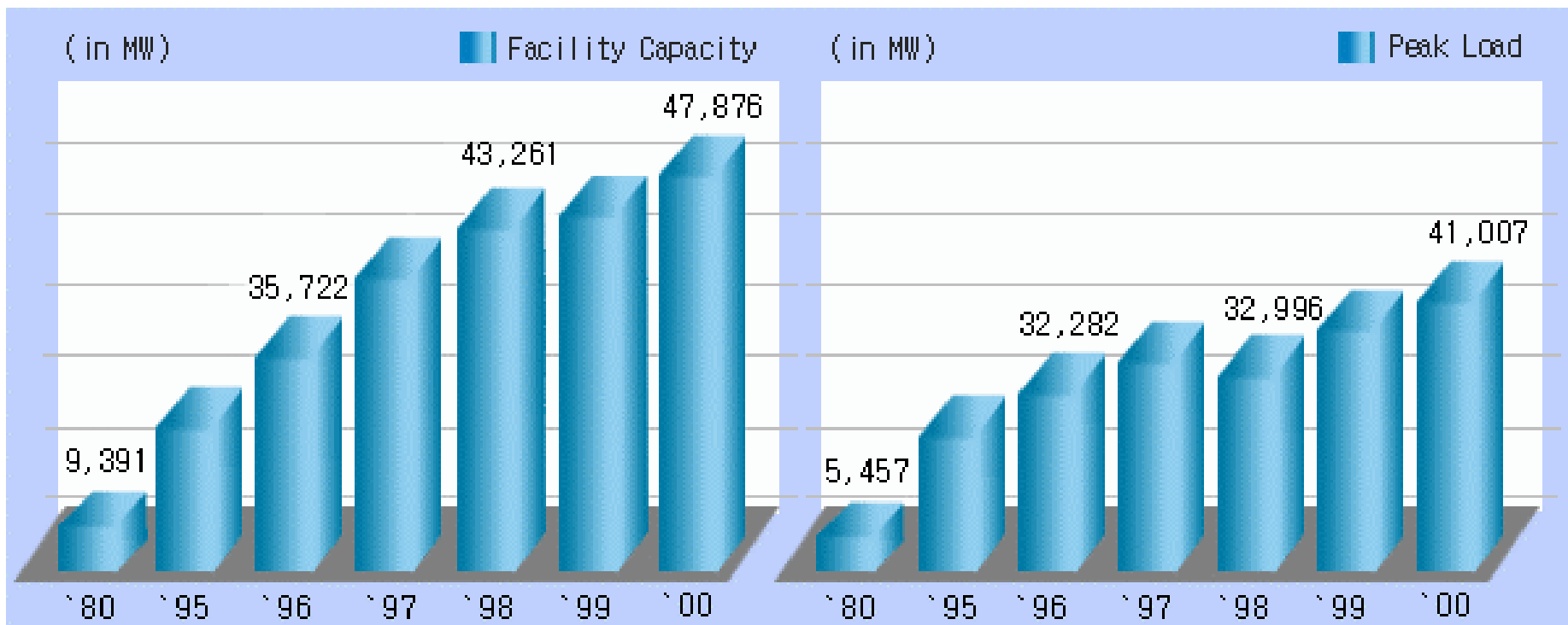
(10,000ton, 10,000kl)



1.4 Installed Generating Capacity

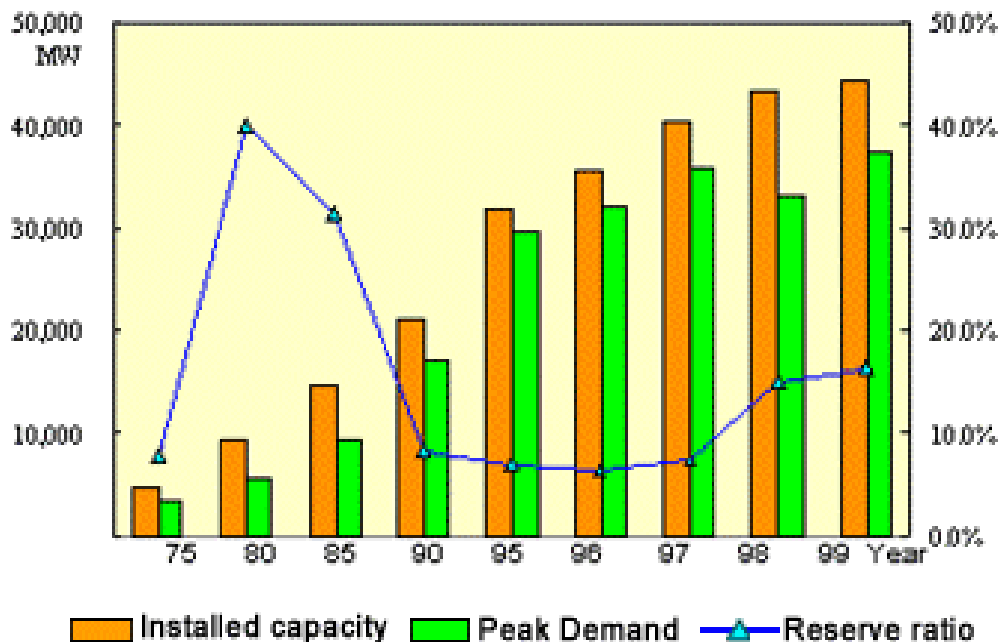


1.5 Power Supply and Demand

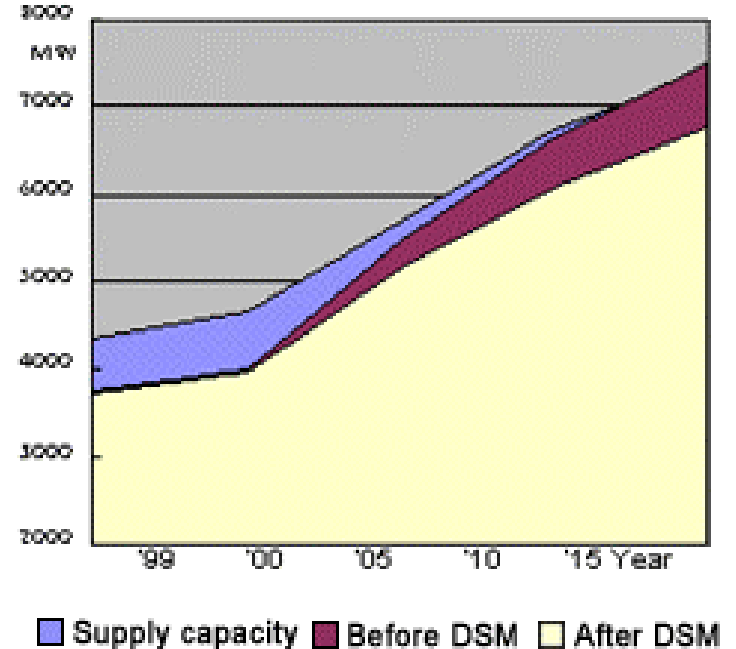


1.6 Power capacity & reserve ratio and long term load forecast

Power capacity & reserve ratio



Long-term load forecast



2. Electricity transmission network of South Korea

- 345kV lines
 - major network
- 154kV or 66kV lines
 - local systems
 - most 66kV lines
 - being removed or replaced
- Constructing 765kV

2.1 KEPCO Substation and Underground Transmission

- 345kV Indoor Substation and
Underground Transmission Line
 - other 345kV indoor Substations are
under construction
 - operation of two 345kV indoor GIS
Substations, in April 1997

2.2 KEPCO RCC SCADA(as of '98 data)

■ SCADA Major Function

- Supervisory
- Remote Control
- Telemetry
- Event Logging
- Report Generation
- Dispatcher Training Function
- Data Link

2.3 765kV project

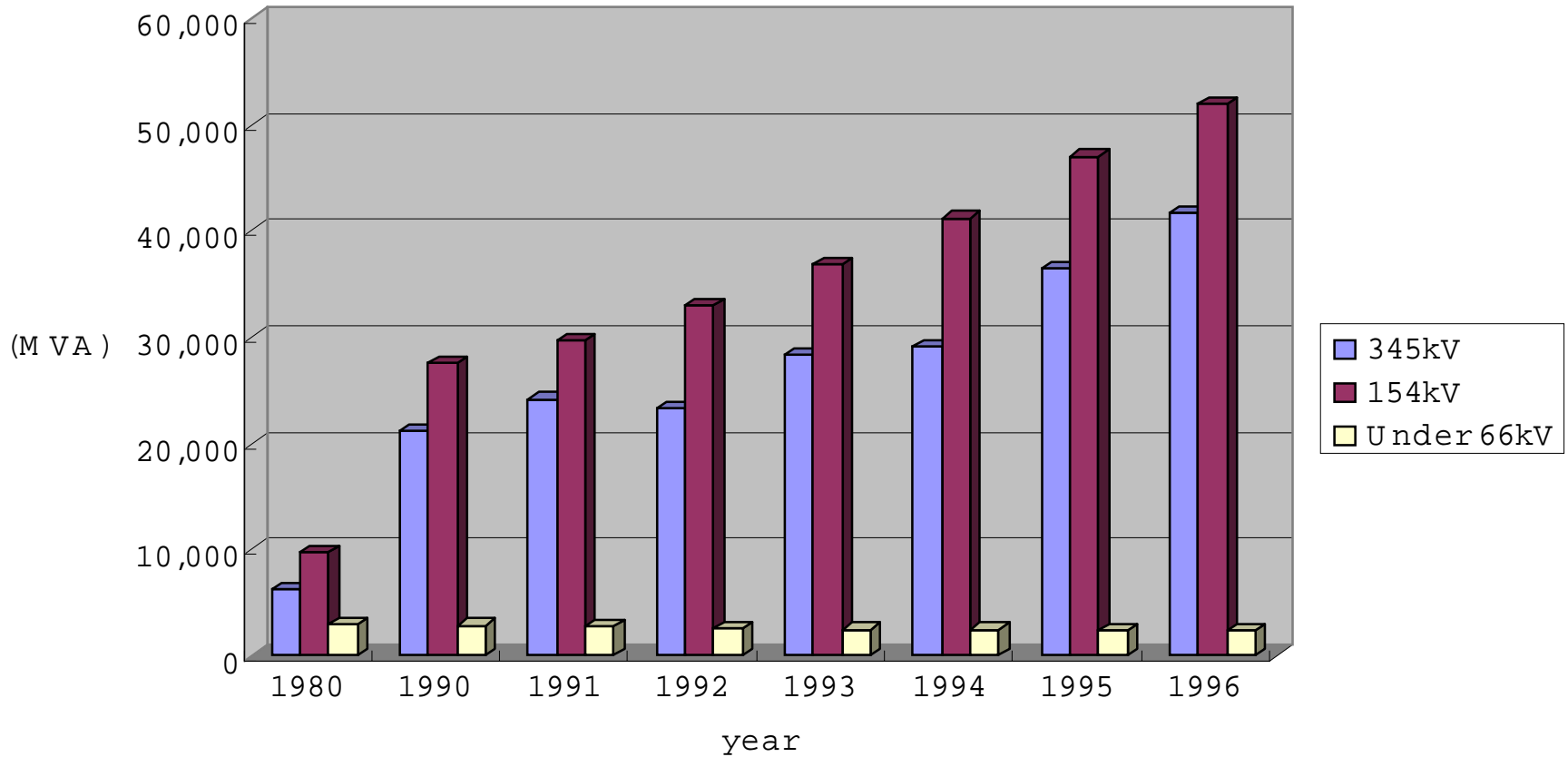
Construction of 765kV facilities

- to meet the rapidly increasing power demand in and around the capital area
- 3 transmission lines, 2 substations

Construction Plan				
	Transmission Line	Length (km)	Completion (year)	765kV Operating (year)
Step I	Tangjin T/P ~ Sin Sosan S/S	40	1998	2001
	Sin Sosan S/S ~ Sin Ansong S/S	137	1999	2001
	Sin Taebaek S/S ~ Sin Gapyong S/S	157	1999	2004
Step II	Sin Ansong S/S ~ Sin Gapyong S/S	75	2005	2005
	Sin Namwon S/S ~ Sin Jincheon S/S	200	@ 2003	@ 2010

2.4 Substation Capacity

Substation capacity (MVA)



3. Technical issues

3.1 Technical issues in KEPCO system

■ Fault Current

- large scale power plant + multiple connection

 - large fault current

 - bus separation

 - reliability getting worse

- present condition

 - 345kV : bus separation - 6 places

■ Circuit breaker capacity

	765 kV	345 kV	154 kV
Capacity	50 (kA)	63/40 (kA)	50/31.5 (kA)

■ Fault current calculation result

year	2001		2005		2010	
	avg.(kA)	excess bus	avg.(kA)	excess bus	avg.(kA)	excess bus
345kV bus	30	-	31	6	33	7
154kV bus	23	8	24	25	25	27

limit : 345kV(40kA), 154kV(50kA)

Countermeasure

- install larger capacity circuit breaker
345kV(63kA), 154kV(50kA)
- considering series reactor installation
Hwaseong, Pukpusan S/S, Yongheong TP etc.

Metropolitan area security problem

- present condition
 - load concentrated in metropolitan area (42% of total load)
 - reactive power loss increased for large power transfer in long-distance line
- investigating the upper limit of northward flow 43,465 MW (average power factor:91%)

Case	Northward flow limit	
Normal operation	10,886 MW	0.95 p.u.
Asan T/L tripped	9,926 MW	

Transient Stability

- load composition

	Constant power	Constant power	Constant impedance
Real power	52.05 %	12.73 %	35.22 %
Reactive power	35.51 %	8.27 %	56.22 %

- contingency condition

- 3 phase fault, major 345 kV T/L 2 line tripped
- fault duration : 6 cycle
- simulation time : 5 sec

Characteristics of AC or DC interconnection

■ AC interconnection

- less expensive than DC interconnection
- limitation of interconnection between different frequencies
- disadvantage of system protection

■ DC interconnection

- construction cost is much higher than the one of AC interconnection
- advantage of system protection
- advantage of long distance

3.2 Electric power system interconnection between South and North Korea

■ Advantages of interconnection

- plant capacity savings
- emergency power interchange
- spinning reserve savings
- interchange due to diversity

■ Problems of interconnection

- trouble in stability problem
- difficulty in power flow control, frequency

control