

India's Economic Development, Environmental Conservation and Energy Security

Kazuya Fujime, Managing Director, IEEJ

Over the nearly two decades from 1980 through 1999, India has developed at a pace that GDP grew an average 5.6%/year in real terms. Of the GDP growth, 2%/year resulted from the country's population growth. And yet, few, including many economists, imagined 20 years ago that India in South Asia, once counted as symbolic lands of economic stagnation, would achieve as amazing economic development as it did.

But, because the rapid economic development was paired with progress in industrialization, urbanization and motorization, energy demand (primary basis) soared at a higher pitch than the real GDP growth, or up 6.0%/year in 1980 – 1999. Generated output increased 8.1%/year and elasticity to GDP stood at 1.5, which proved India's economic growth was electricity-intensive. In the background, however, there are such peculiarities as cheaper-than-cost electricity prices and poor efficiency, notably transmission losses (including stolen electricity) as much as 40%. It is abundant indigenous coal that covered surging electricity needs. With its share in total generated output jumping from 55% (1980) to 75% (1999), coal-fired power generation increased nearly 10% per annum.

Significantly growing coal consumption at power plants aggravated environmental problems, typically air pollution.

Though a shrinking share is likely, it remains unchanged that coal-fired power still forms the mainstream. The share of gas-fired power is expected to rise, but far short of meeting the requirement. In pursuit of clean coal use, much expectations are entertained for clean technology transfer-based CDM (clean development mechanism), etc. Among other causes of air pollution, advancing motorization resulted in rapidly swelling automotive petroleum consumption, up 5.9%/year in two decades on a primary supply basis. Shifts from non-commercial energies, like

firewood, charcoal and cattle excrements, to highly convenient oil contributed to worsening air quality as well. Natural gas use in an effort to alleviate air pollution is under way in such forms as introduction of CNG (compressed natural gas) vehicles, but its share is still very limited. Among the efforts to purify polluted air and environment, the most essential one is to improve poor efficiency of energy use. To that end, extremely important is to adopt a policy to help the formation of price levels that can fairly cover incurred costs.

From energy security perspectives, rapidly expanding energy use as a result of economic development is found subject to many challenges common to environmental conservation. Due to such factors as inefficiency and underpricing, energy demand outgrew GDP and could no longer be met with indigenous resources-based supply alone. Accordingly, in recent years, coal imports have rapidly ballooned. Oil imports have expanded as well. Over the last two decades, energy imports increased 6.8%/year, with oil imports up from 400,000 B/D in 1980 to 1.20 million B/D in 1999. Most of the imports came from the neighboring Middle Eastern countries. Dependence on energy imports rose from 21% in 1980 to 26% in 1999.

According to IEEJ's economic and energy forecast for 2020, GDP growth is likely to remain strong, though slowing down a little to 4.5%/year (including 1.4% attributable to a population growth). Both primary energy supply and generated output will keep growing, though at a bit slower pace of 5.2%/year and 5.4% (with transmission losses assumed to shrink), respectively. Particularly net energy imports will accelerate to an annual growth of 8.2%. With import dependence rising to 39% in 2020 and further to 44% by 2020, energy supply mix will become vulnerable as much as pressing the balance of payments. Thus, energy can pose a restraint on economic development. Coal imports will grow by 12%-short a year. Oil imports, projected to increase to 2.50 million B/D in 2010 and to 4.20 million B/D in 2020, will approach Japan's present levels and thus have a massive impact on Asia's oil supply and demand. Meanwhile, if the share of coal-fired power is reduced from 75% in 1999 to 70% in 2020 and the natural-gas share is raised

from 6% in 1999 to 10% in 2020 for environmental reasons, resultant reliance on LNG/pipeline gas imports would send import dependency rising. Economic growth, environmental conservation and energy security are closely interwoven. The key to getting them harmonize will be economic and technical cooperation from Japan, the U.S. and others.

TABLE1 TREND AND OUTLOOK OF ECONOMY/ENERGY SUPPLY/DEMAND-IN INDIA (1)								%/Year
	UNIT	1980	1990	1999	2010	2020	1999/1980	2020/1999
PRIMARY ENERGY SUPPLY	MTOE	93.9	183.3	282.4	515.1	818.4	6	5.2
COAL	MTOE	56.3	106.5	157.2	284.2	469.3	5.6	5.3
OIL	MTOE	31.5	58.7	93.9	161	244.7	5.9	4.7
NATURAL GAS	MTOE	1.2	10.1	20.8	48.5	70.7	16.2	6
NUCLEAR	MTOE	0.8	1.6	3.4	5.9	9.9	7.9	5.2
HYDRO	MTOE	4	6.2	7	15	23.3	3	5.9
RENEWABLE	MTOE		0.1	0.1	0.6	0.6		
FINAL ENERGY CONSUMPTION	MTOE	59.3	113.1	162.9	324.6	504.3	5.5	5.5
INDUSTRY	MTOE	28	62	97.9	175.2	270.2	6.8	5
TRANSPORT	MTOE	18.4	26.4	44.5	76.3	118.9	4.8	4.8
OTHERS	MTOE	12.9	24.7	20.5	73.1	115.2	2.5	8.6
NET ENERGY IMPORT	MTOE	20.1	29.5	70	201.6	362.9	6.8	8.2
COAL	MTOE	-1.8	3.1	10.8	53.5	111.1	14.9(90~99)	11.7
OIL	MTOE	21.9	26.3	59.2	124	209.8	5.4	6.2
NATURAL GAS	MTOE	0	0	0	23.6	41.5		
OTHERS	MTOE	0	0.1	0.1	0.5	0.5		
POWER GENERATION TOTAL	TWh	119.3	289.4	527.3	938.8	1,584.3	8.1	5.4
COAL THERMAL	TWh	65.6	195.7	396.7	685.3	1109	9.9	5
OIL THERMAL	TWh	5.8	6.6	5.8	9.4	15.8	0	4.9
GAS THERMAL	TWh	1	9.3	29.2	47.4	151.1	19.4	8.1
THERMAL TOTAL	TWh	69.7	211.6	357.5	742.1	1275.9	9	6.2
NUCLAR	TWh	3	6.1	8.4	22.5	38	5.6	6.7
HYDRO	TWh	46.6	71.7	69.1	174.1	270.4	2.1	6.7
RENEWABLE	TWh	0	0	0.1	0.1	0.1		
CO <sub>2</sub> EMISSIONS	MT-C	88.1	171.4	276.5	473.3	757.7	6.2	4.9
GDP 1995 PRICE	\$US Billion	158.7	275.1	449.1	732.6	1,137.7	5.6	4.5
POPULATION	MILLION	687.3	849.5	997.5	1,182.7	1,319.4	2	1.4
PRIMARY ENERGY/CAPITA	TOE/CAPITA	0.14	0.22	0.28	0.44	0.62	3.7	3.9
GDP ELASTIRITY							1.1	1.16

(NOTE) Actual:IEA Forecast:IEEJ

TABLE2 TREND AND OUTLOOK OF ECONOMY/ENERGY SUPPLY/DEMAND-IN INDIA (2)											
	UNIT	1980	MIX %	1990	MIX %	1999	MIX %	2010	MIX %	2020	MIX %
PRIMARY ENERGY SUPPLY	MTOE	93.9	100	183.3	100	282.4	100	515.1	100	818.4	100
COAL	MTOE	56.3	60.0	106.5	58.1	157.2	55.7	284.2	55.2	436.2	53.3
OIL	MTOE	31.5	33.6	58.7	32	93.9	33.3	161	31.3	253.7	31
NATURAL GAS	MTOE	1.2	1.3	10.1	5.5	20.8	7.4	48.5	9.4	94.1	11.5
NUCLEAR	MTOE	0.8	0.9	1.6	0.9	3.4	1.2	5.9	1.1	9.9	1.2
HYDRO	MTOE	4	4.20	6.2	3.5	7	2.4	15	2.9	23.3	2.8
RENEWABLE	MTOE	1.1		0.2		0.1		0.6	0.1	0.6	0.2
FINAL ENERGY CONSUMPTION	MTOE	59.3	100	113.1	100	162.9	100	324.6	100	504.3	100
INDUSTRY	MTOE	28	47.2	62	54.8	97.9	60	175.2	54	270.2	53.6
TRANSPORT	MTOE	18.4	31	26.4	23.3	44.5	27.3	76.3	23.5	118.9	23.6
OTHERS	MTOE	12.9	21.8	24.7	21.9	20.5	12.7	73.1	22.5	115.2	22.8
NET ENERGY IMPORT	MTOE	20.1	100	29.5	100	73	100	201.6	100	362.9	100
COAL	MTOE	-1.8	-9	3.1	10.5	10.8	14.8	53.5	26.5	111.1	30.6
OIL	MTOE	21.9	109	26.4	89.5	59.2	81.1	124	61.5	209.8	57.8
NATURAL GAS	MTOE	0	0	0	0	0	0	23.6	11.7	41.5	37.4
OTHERS	MTOE	0	0	0.1	0	0.1	0	0.5	0.3	0.5	0.2
OUTSIDE INTERDEPENDENCE RATIO	%	21.4		26.1		25.8		39.1		44.3	
POWER GENERATION TOTAL	TWh	119.3	100	289.4	100	527.3	100	938.8	100	1,584.3	100
COAL THERMAL	TWh	65.6	55	195.7	67.6	396.7	75.3	685.3	73	1109	70
OIL THERMAL	TWh	3.1	2.6	6.6	2.3	5.8	1.1	9.4	1	15.8	1
GAS THERMAL	TWh	1	0.8	9.3	3.2	29.2	5.6	47.4	5	151.1	9.5
THERMAL TOTAL	TWh	69.7	0	211.6	73.1	431.7		742.1	79	1,275.9	
NUCLAR	TWh	3	2.5	6.1	2.1	8.4	1.6	22.5	2.4	38	2.4
HYDRO	TWh	46.6	39.1	71.7	24.8	87.1	16.4	174.1	18.6	270.4	17.1
RENEWABLE	TWh	0	0	0	0	0.1		0.1		0.1	
CO <sub>2</sub> EMISSIONS	MT-C	88.1		171.4		276.5		473.3		757.7	
GDP 1995 PRICE	\$US Billion			275.1		449.1		732.6		1,137.7	
POPULATION	MILLION	687.3		849.5		997.5		1,182.7		1,319.4	
PRIMARY ENERGY/CAPITA	TOE/CAPITA	0.14		0.22		0.28		0.44		0.62	

(NOTE) Actual:IEA Forecast:IEEJ

Fig.1 Evolution and Outlook of Energy Mix in India

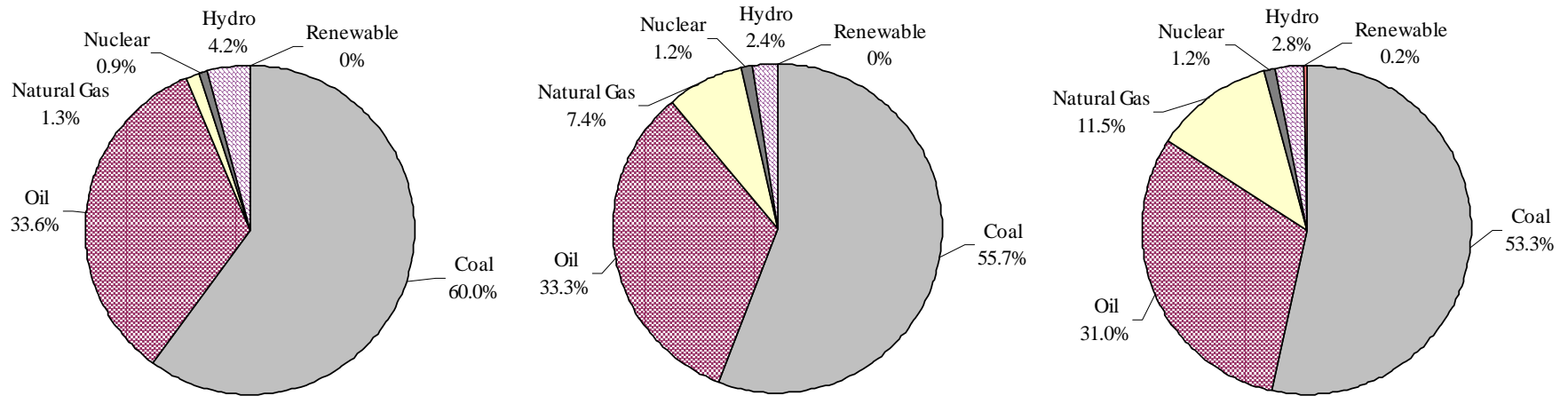


Fig.2 Evolution and Outlook of Power Mix in India

