390th Regular Research Session

Short-Term Energy Demand/Supply Outlook

Forecast through FY 2005 and Analysis of the Impact of Oil Prices, Economic Growth and Temperatures

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The Institute of Energy Economics, Japan

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Outline of Research

◆ Research Objective

This report attempts to forecast energy demand and supply in Japan through FY 2005, based on the present uncertainties about the economy and oil prices. In addition to a standard forecast, this report gives an analysis of the impact of uncertain factors.

◆ Prediction Methodology

Econometric model (Macro-economy, energy demand and supply)

->See Next Page

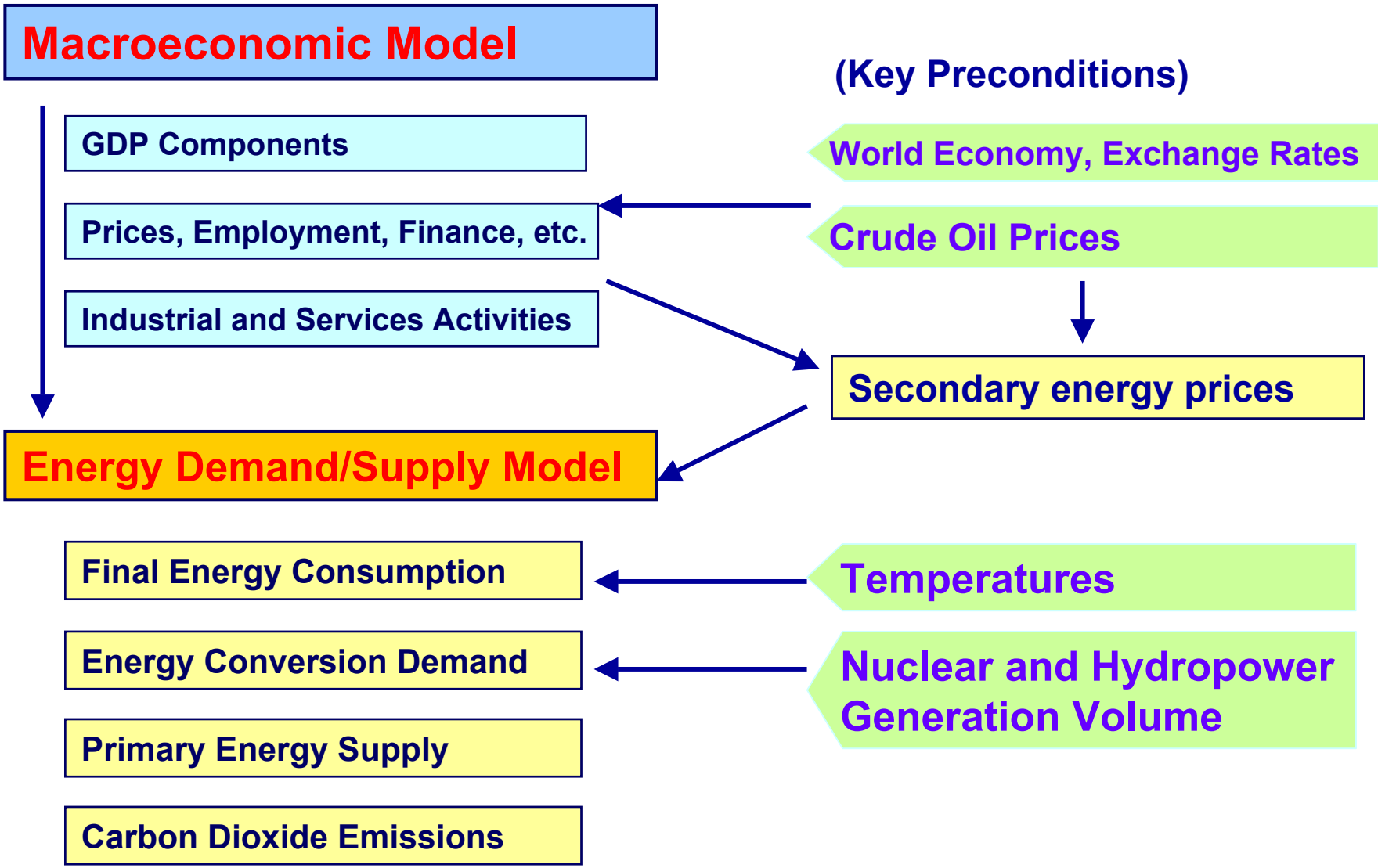
◆ Case:

Standard Case

Sensitivity Analysis (FY 2005)

- ◆ Oil price: Higher/Lower
- ◆ Economic growth: Higher/Lower
- ◆ Impact of temperatures (Summer/Winter)

Model Analysis Flow



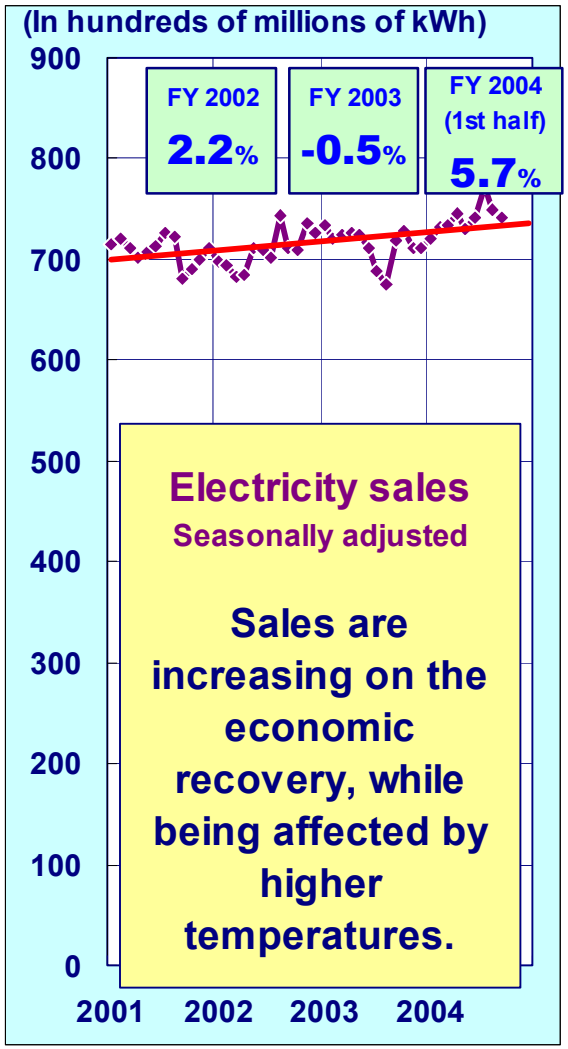
Future demand/supply-defining factors and various cause-to-effect relations are interpreted econometrically and consistently.

Present State of Energy Demand

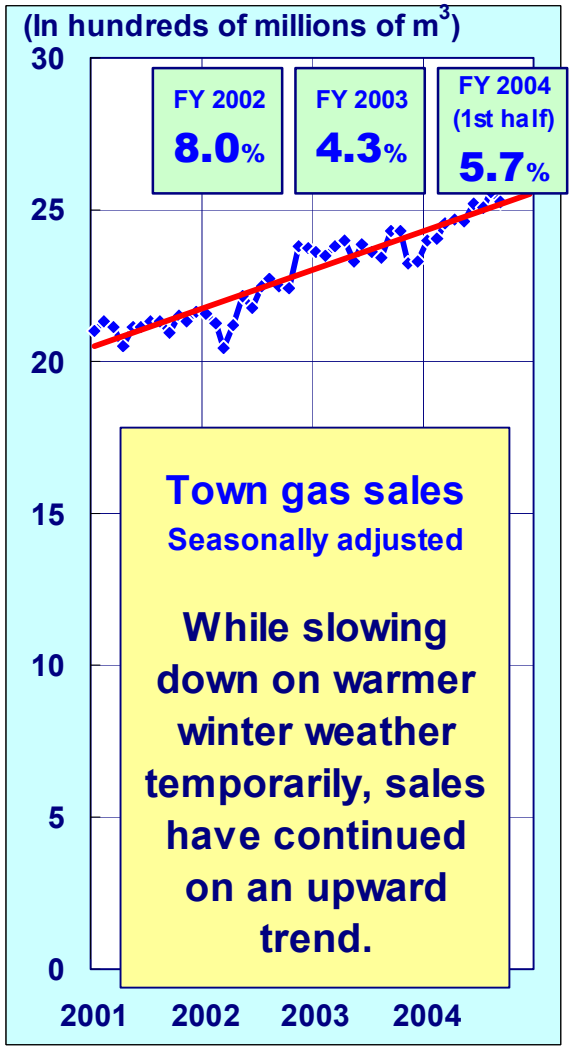
- Electricity Sales Volume
- Town Gas Sales Volume
- Fuel Oil Sales Volume

Energy Sales

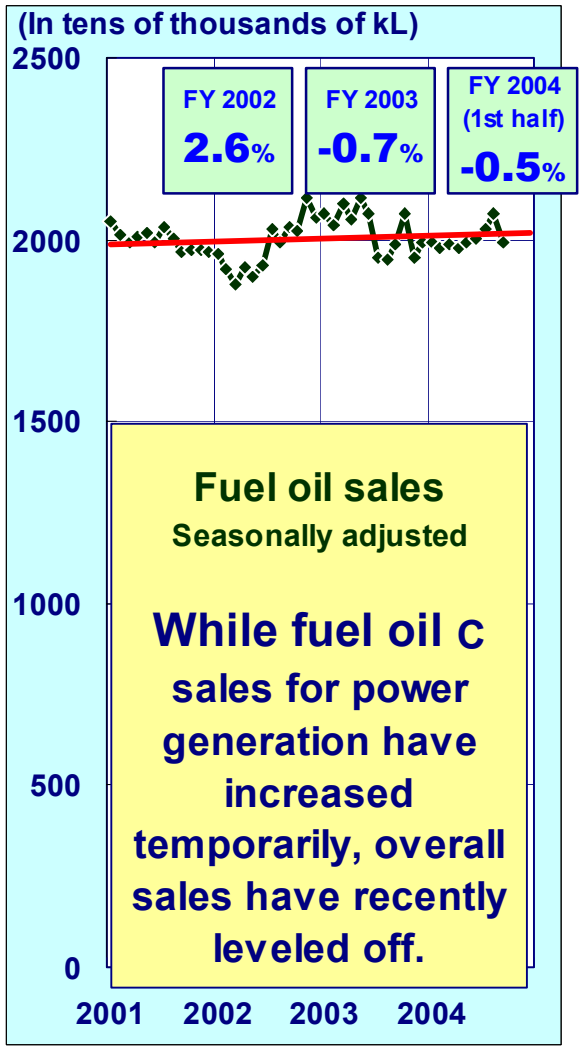
◆Electricity



◆Town Gas



◆Fuel Oils

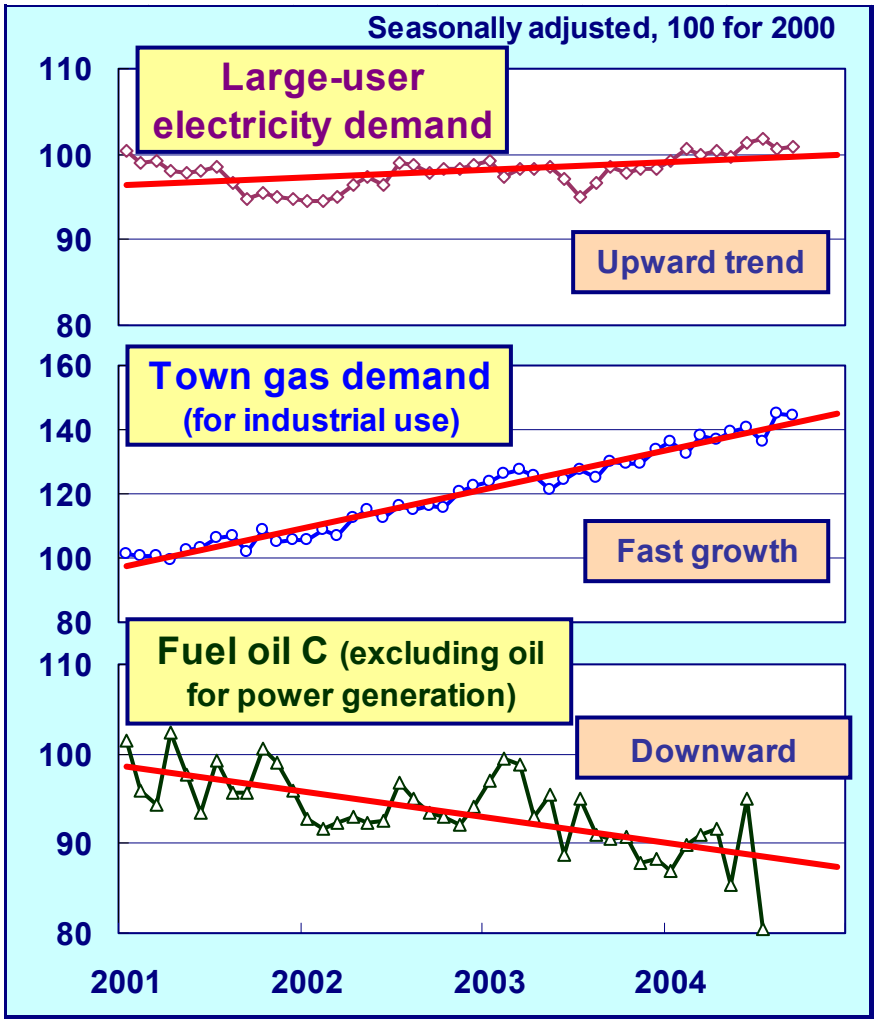


Sources: Ministry of Economy, Trade and Industry, *Monthly Electricity Survey and Statistics, Monthly Gas Industry Statistics, Monthly Resources and Energy Statistics*

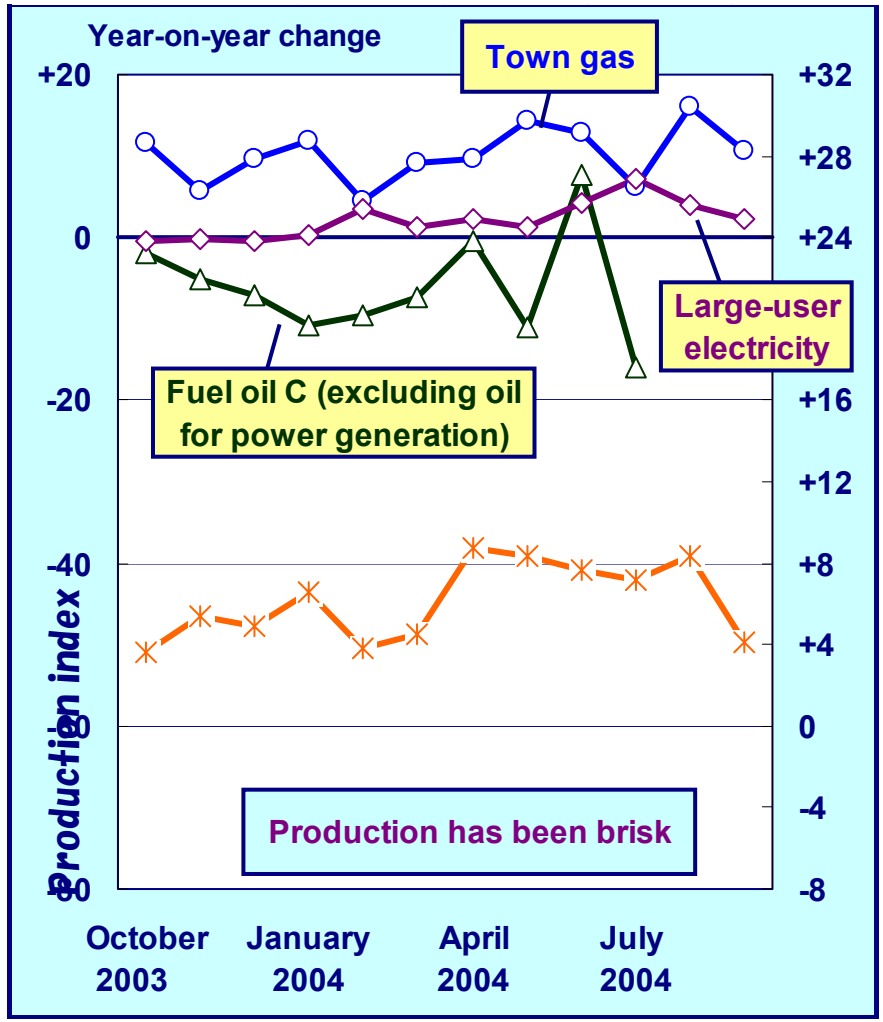
[Industrial Demand]

Electricity, town gas, fuel oil C

Demand for Each Energy Source



Trend in Past Year

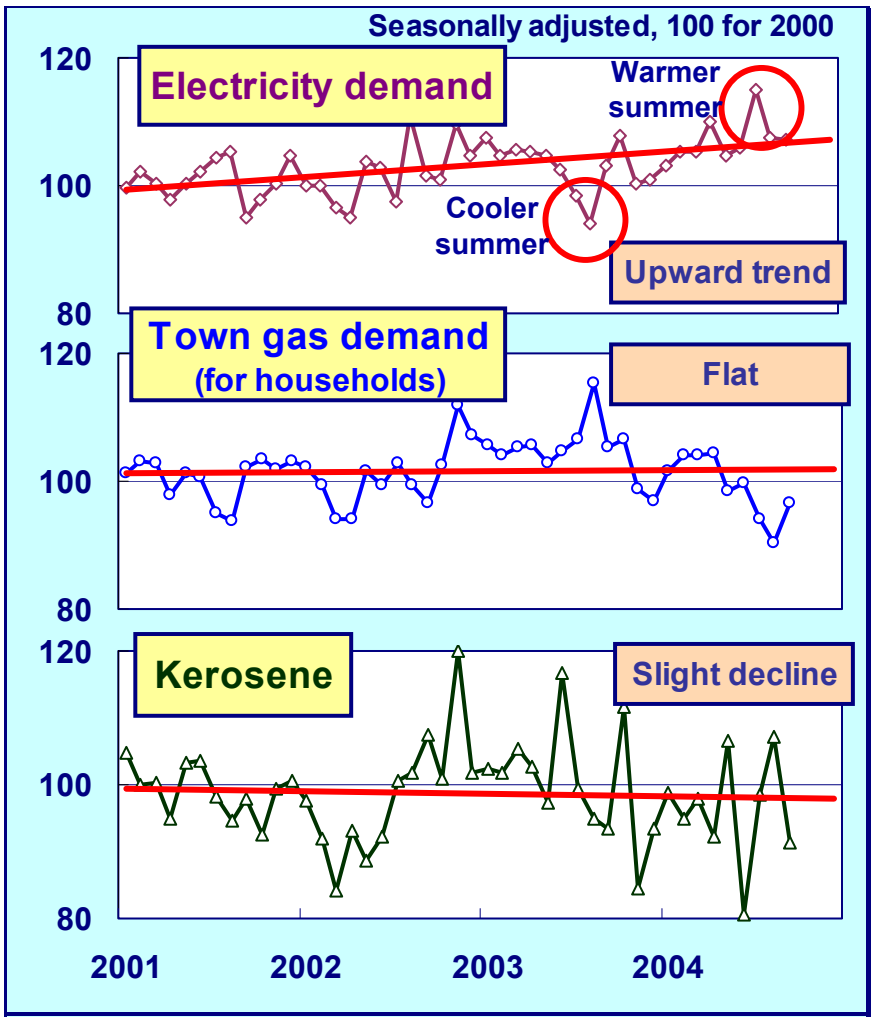


Sources: Above-listed sources, and Petroleum Association of Japan, *Monthly Oil Statistics* for energy demand.
Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes* for the production index.

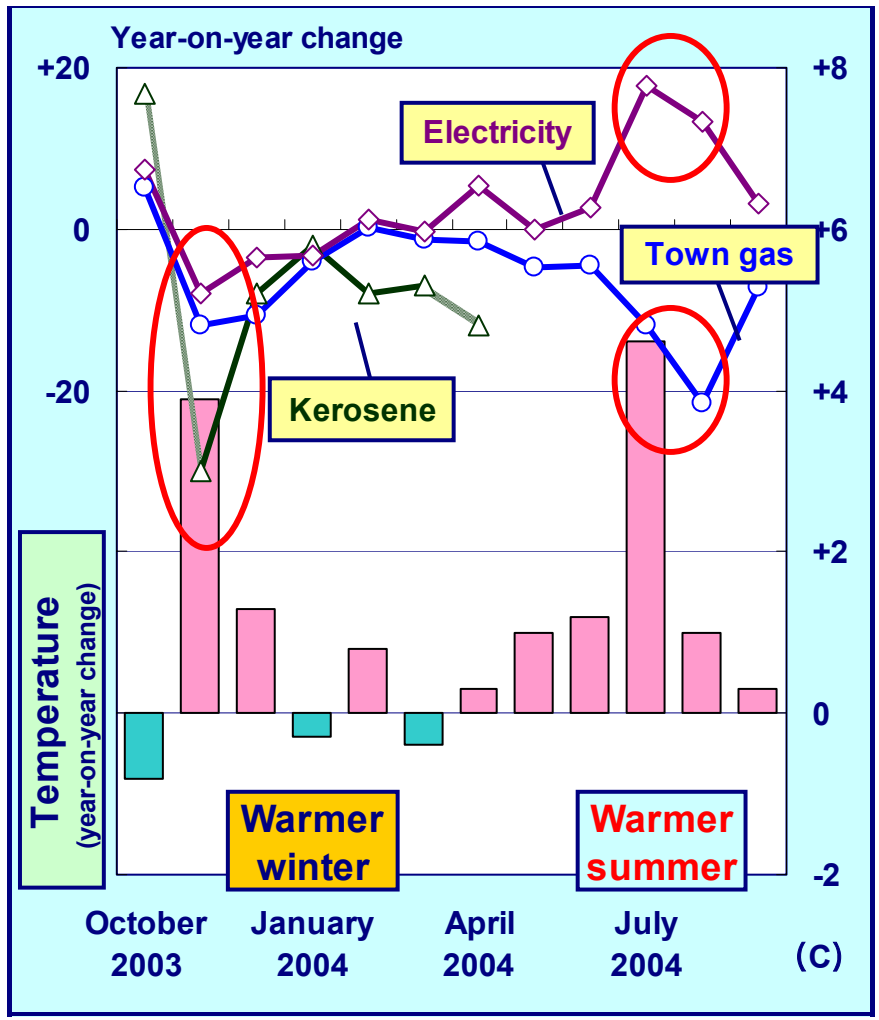
[Household Demand]

Electricity, town gas, kerosene

Demand for Each Energy Source



Trend in Past Year

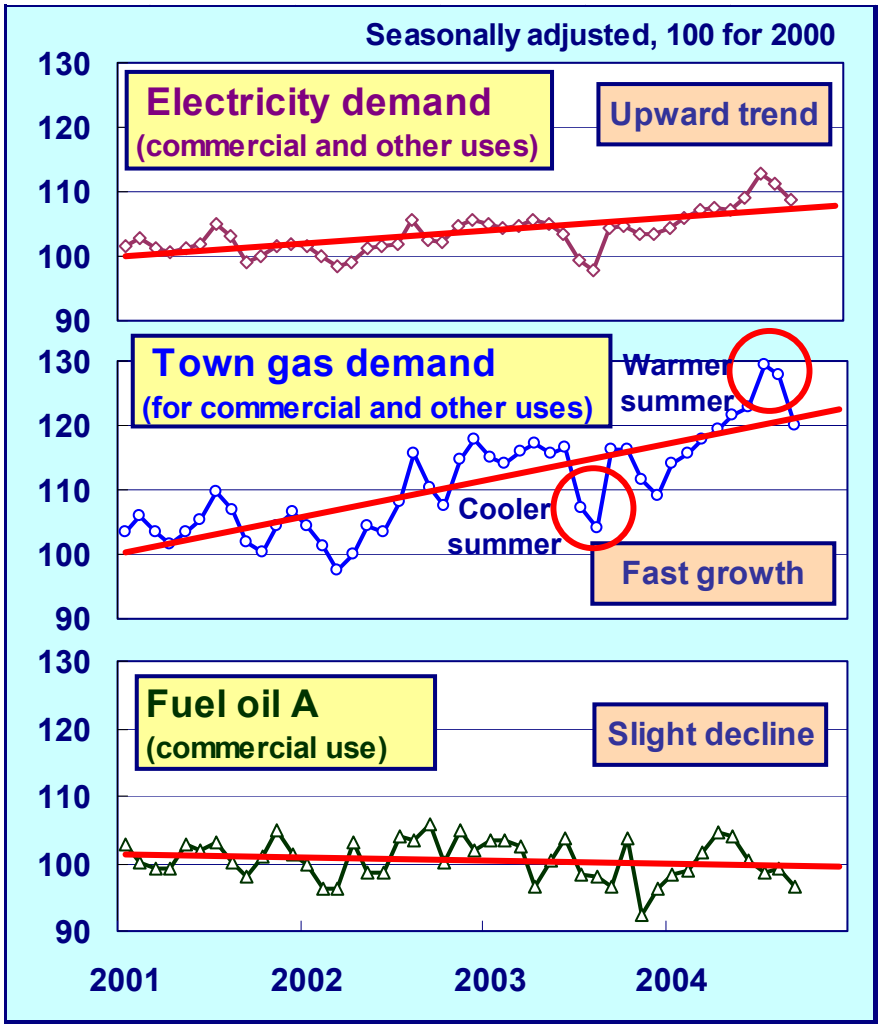


Sources: Above-listed sources for energy demand. Japan Meteorological Agency for temperatures.

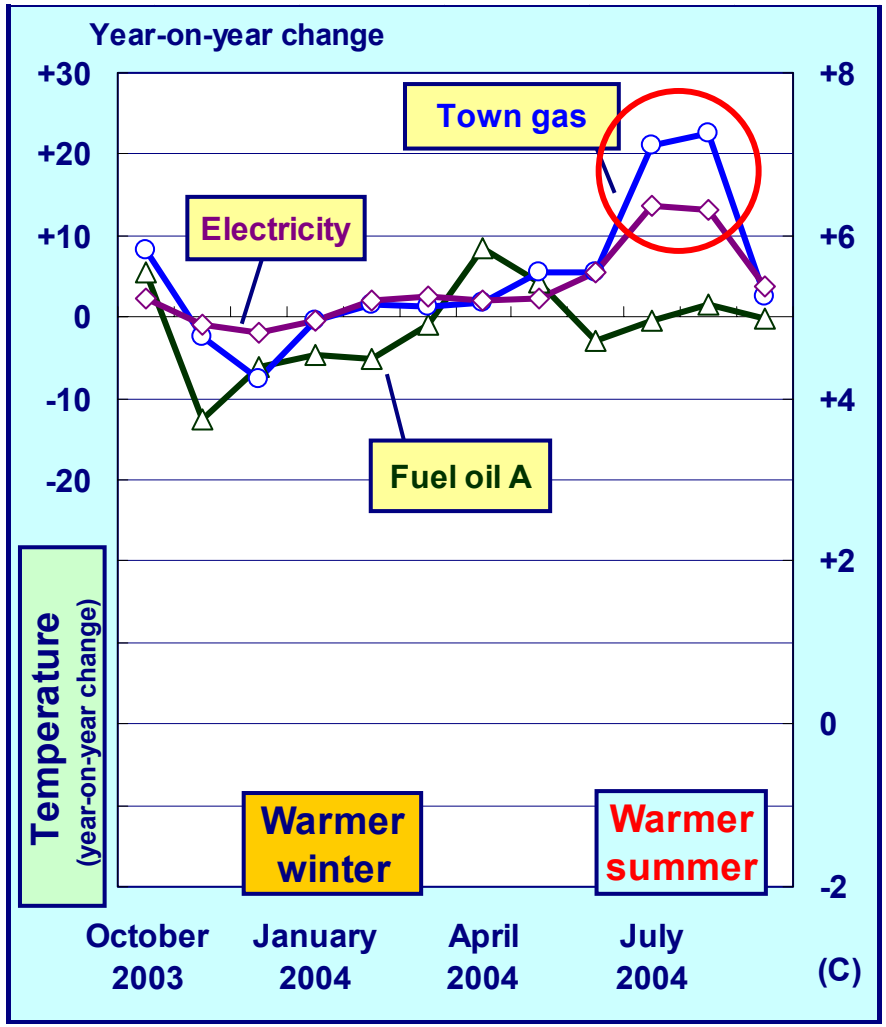
[Commercial Demand]

Electricity, town gas, fuel oil A

Demand for each energy source

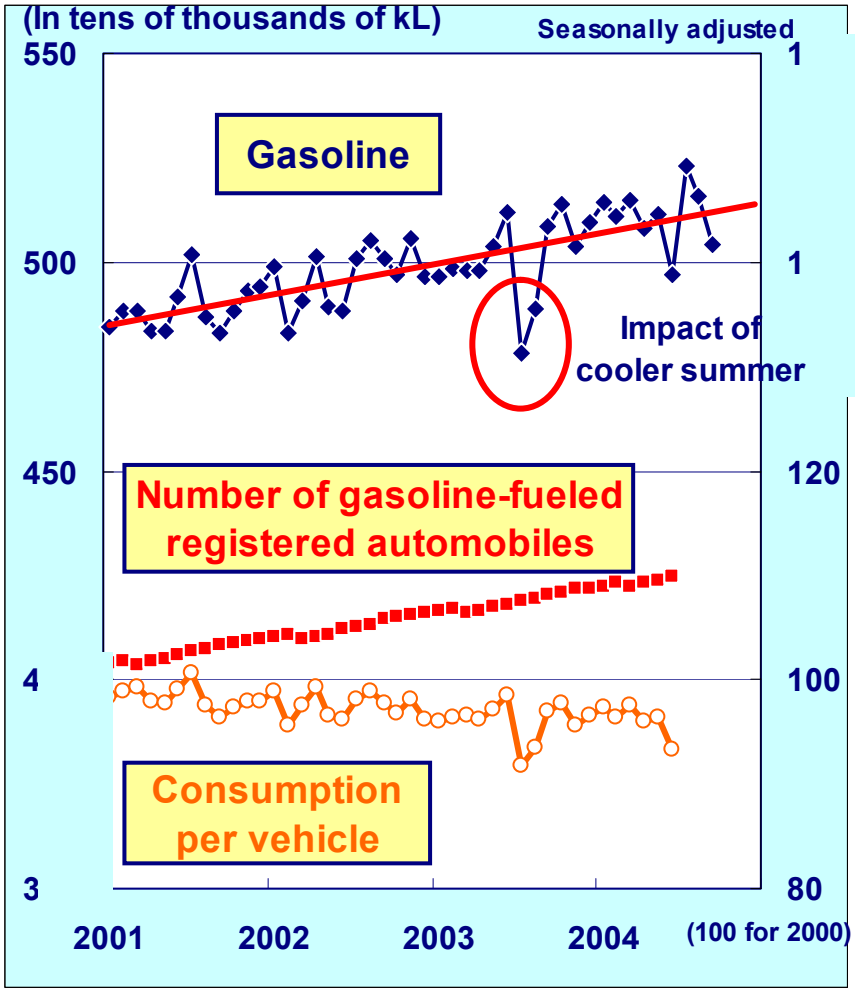


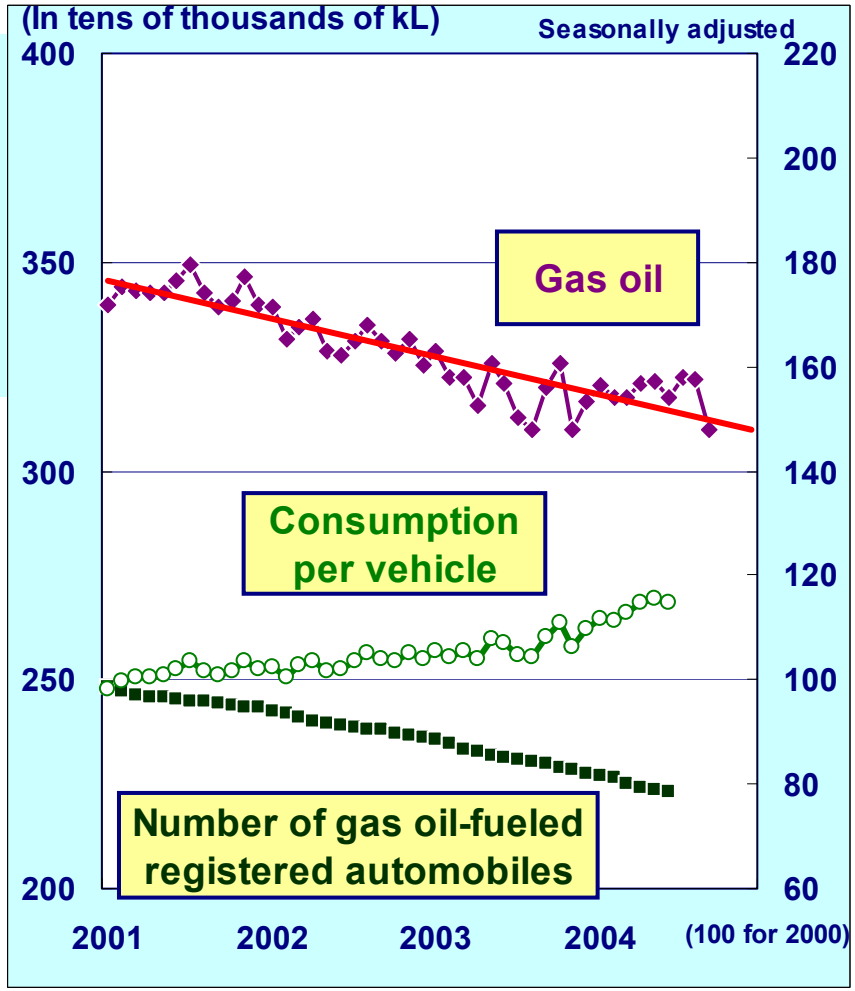
Trend in Past Year



Sources: Above-listed sources EDMC estimates for energy demand. Note: Electricity includes demand subject to liberalization.

[Transportation Demand] Gasoline, gas oil





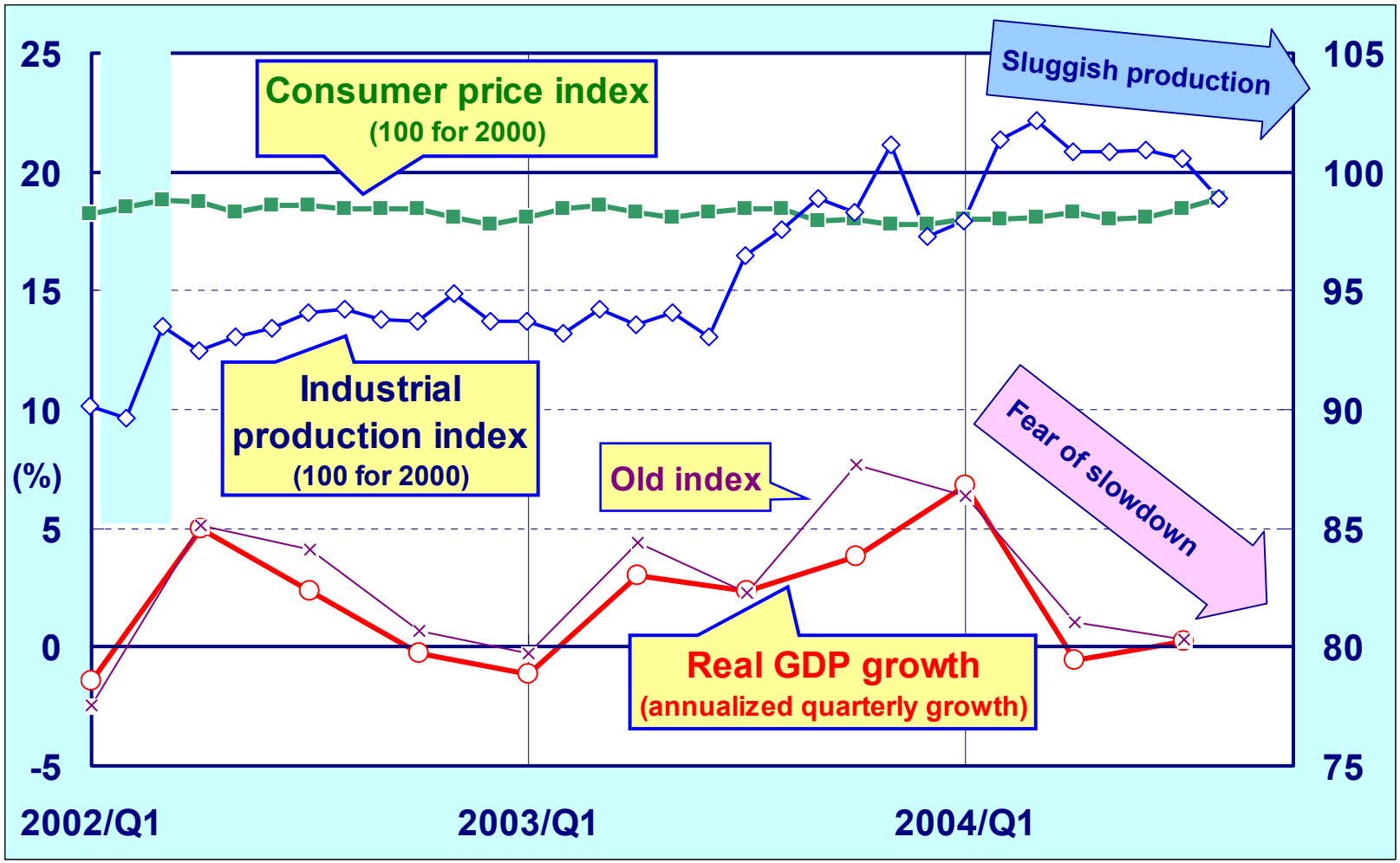
Sources: Ministry of Economy, Trade and Industry, *Monthly Resources and Energy Statistics.* Automobile Inspection & Registration Association, *Number of Registered Automobiles*

Demand for gasoline and gas oil for automobiles has changed in line with changes in the number of registered automobiles. In terms of consumption per vehicle, gasoline has been declining and gas oil has been increasing.

Present State of Macroeconomy

- GDP, Prices and Other Macroeconomic Indicators
- Industrial Material Production, Other Production Activities, Etc.

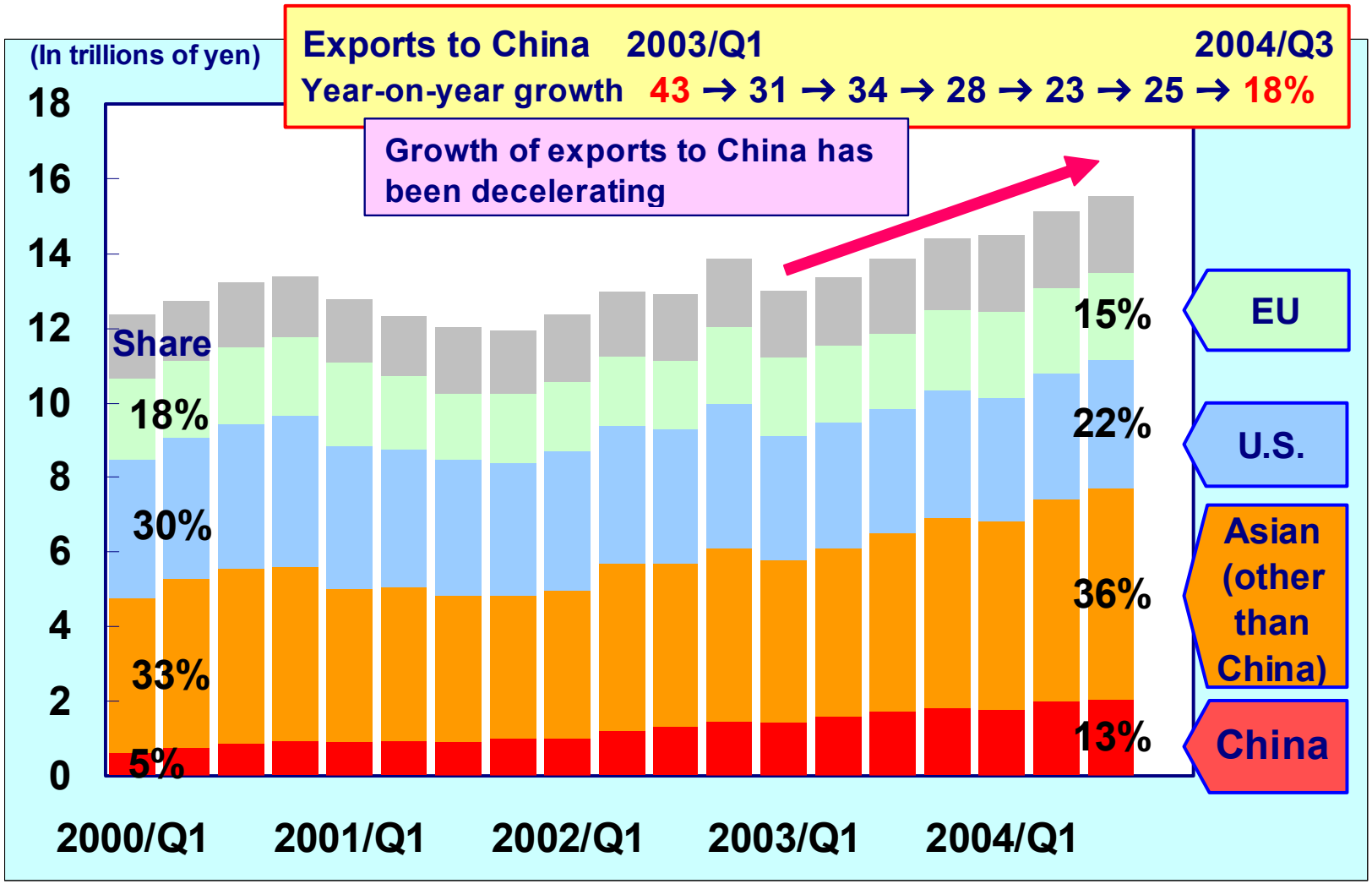
Key Economic Indicators



Sources: Cabinet Office, *Preliminary National Income Statistics.* Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes.* Ministry of Internal Affairs and Communications, *Consumer Price Index.*

The Japanese economy signals a slowdown after recovery.

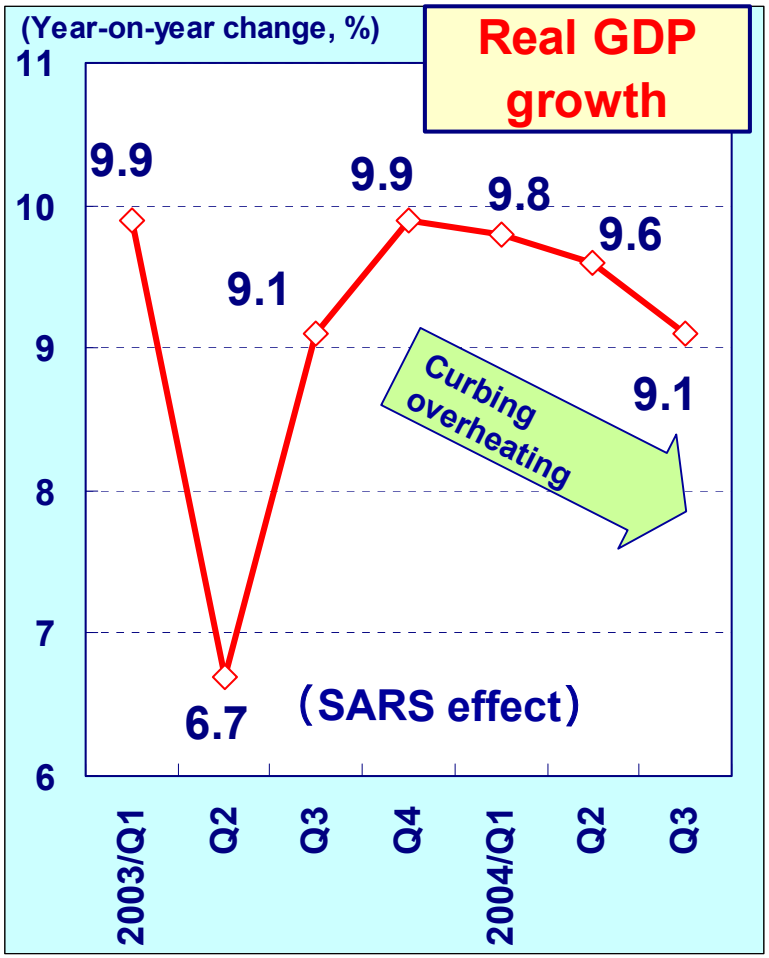
Exports by Destination (on an F.O.B. basis)



Source: Ministry of Finance, *Trade Statistics*

Japan's exports to Asia, including China, have been increasing, accounting for a half of total exports.

Chinese Economic Trend



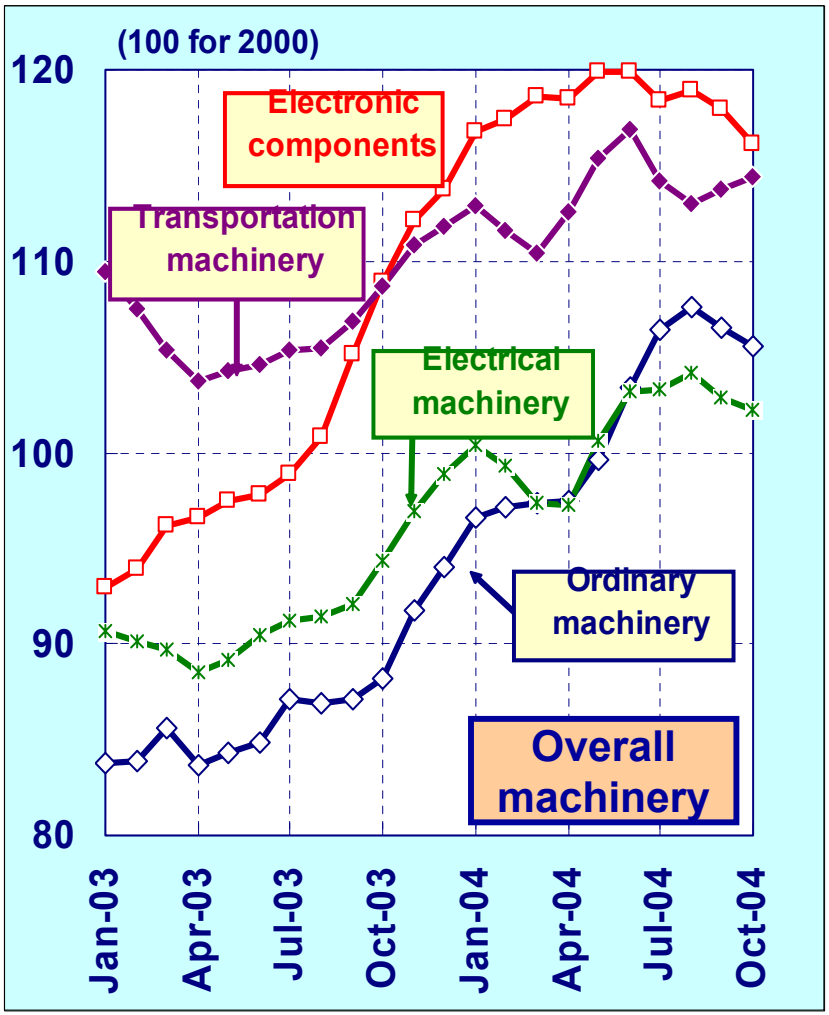
Year-on-year change, %	Industrial production value added	Retail sales value	Value of completed investment in fixed assets	Exports value	Import value	Consumer prices
2003/Q1	17.2	9.2	31.6	33.5	52.4	0.5
Q2	15.4	6.8	33.3	34.4	38.2	0.7
Q3	17.0	9.8	29.6	29.6	34.4	0.8
Q4	18.2	10.4	23.8	40.3	38.4	2.7
2004/Q1	17.7	10.7	43.0	38.2	42.3	2.8
Q2	17.7	15.1	22.3	40.4	43.6	4.4
Q3	15.8	13.4	26.5	29.1	30.3	5.3

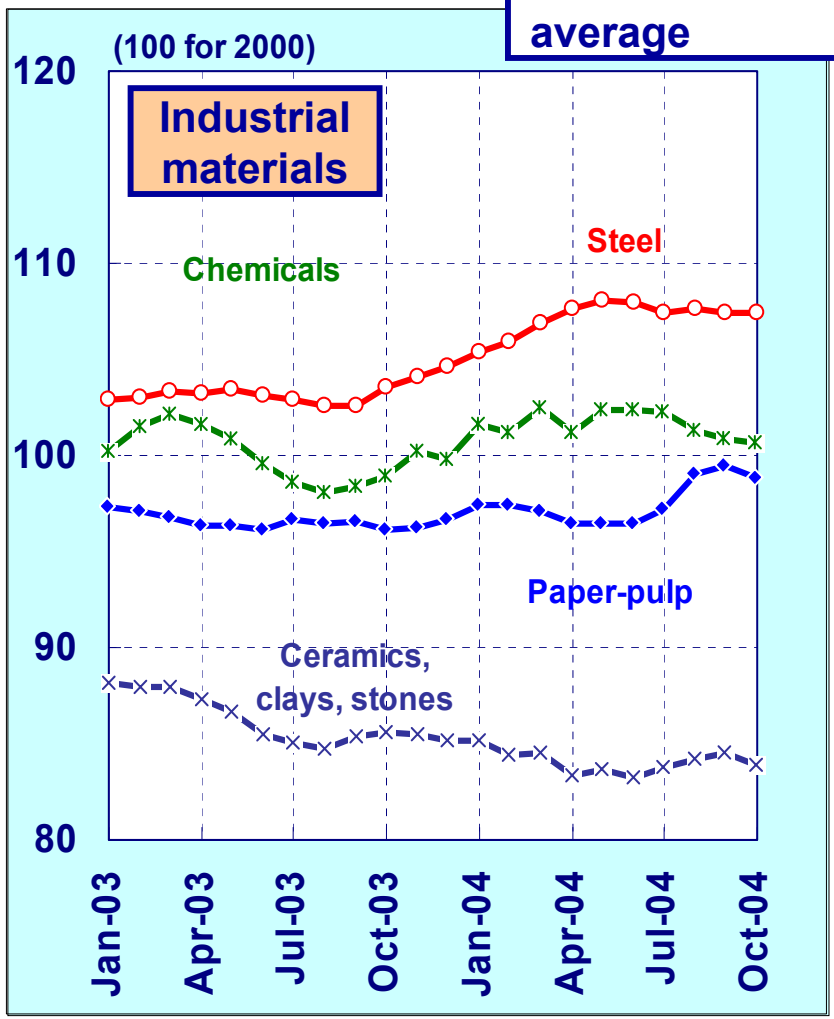
Source: Japan External Trade Organization, *Chinese Economy.*

China has curbed fixed asset investment that had been overheated, making readjustments for a soft landing.

Sector-by-Sector Industrial Production Index

3-month moving average



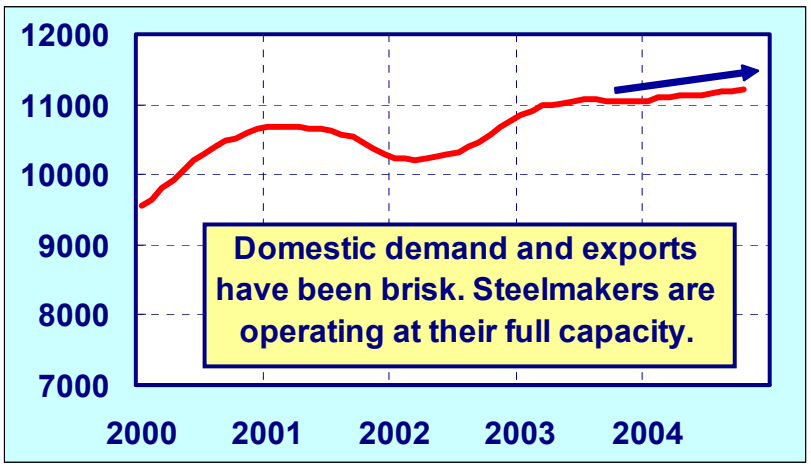


Source: Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes*

Steel and machinery production for exports has been brisk. But some slowdown has emerged.

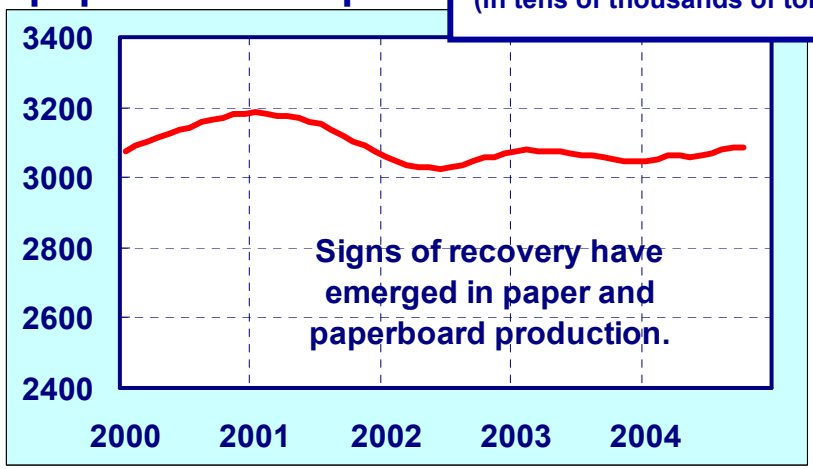
Industrial Material Production

1) Crude steel output

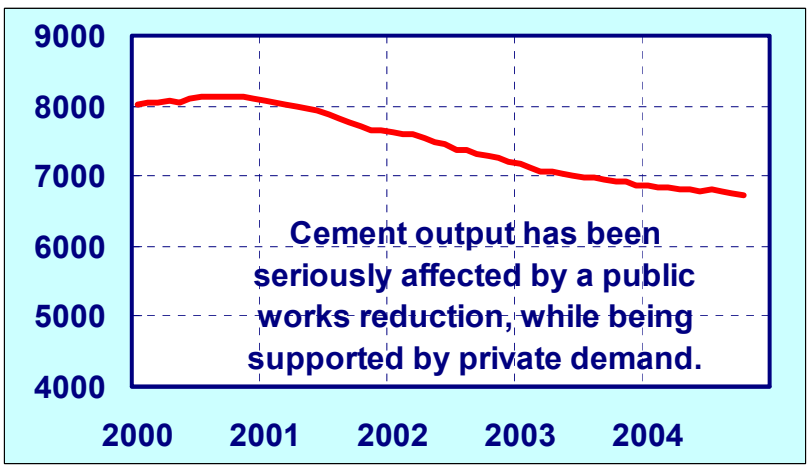


2) Paper and paperboard output

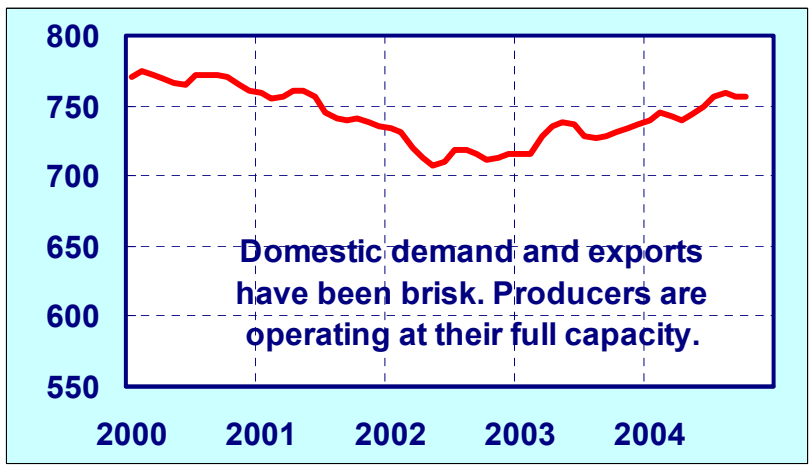
12-month moving total
(in tens of thousands of tons)



3) Cement output



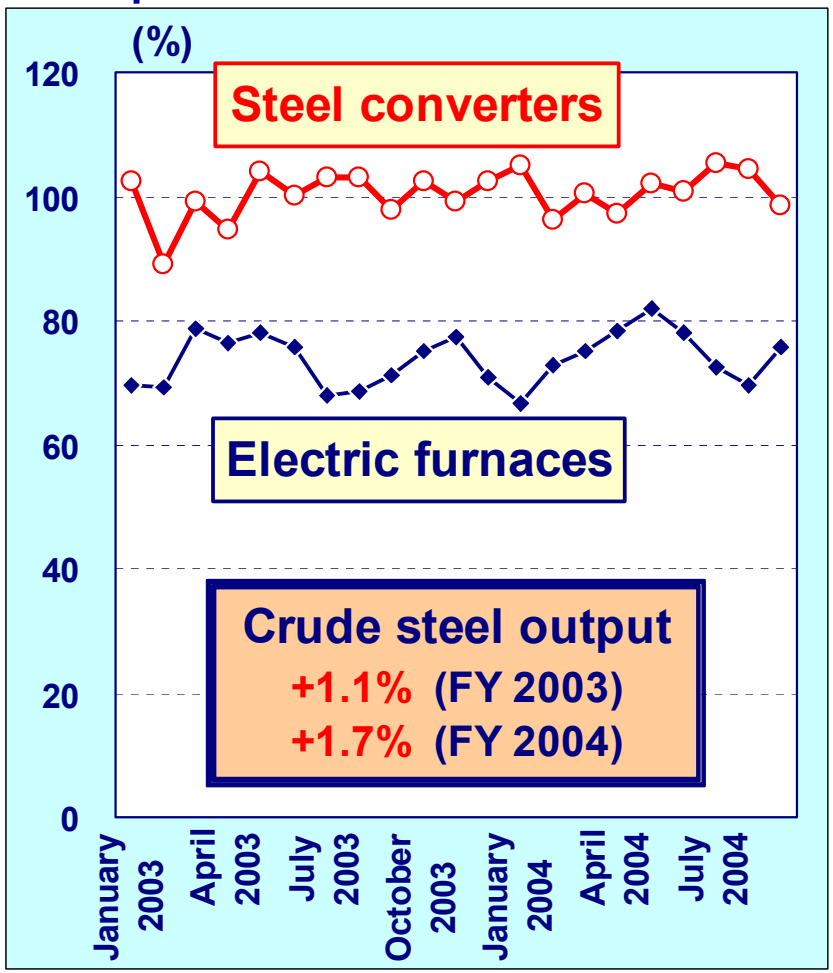
4) Ethylene output



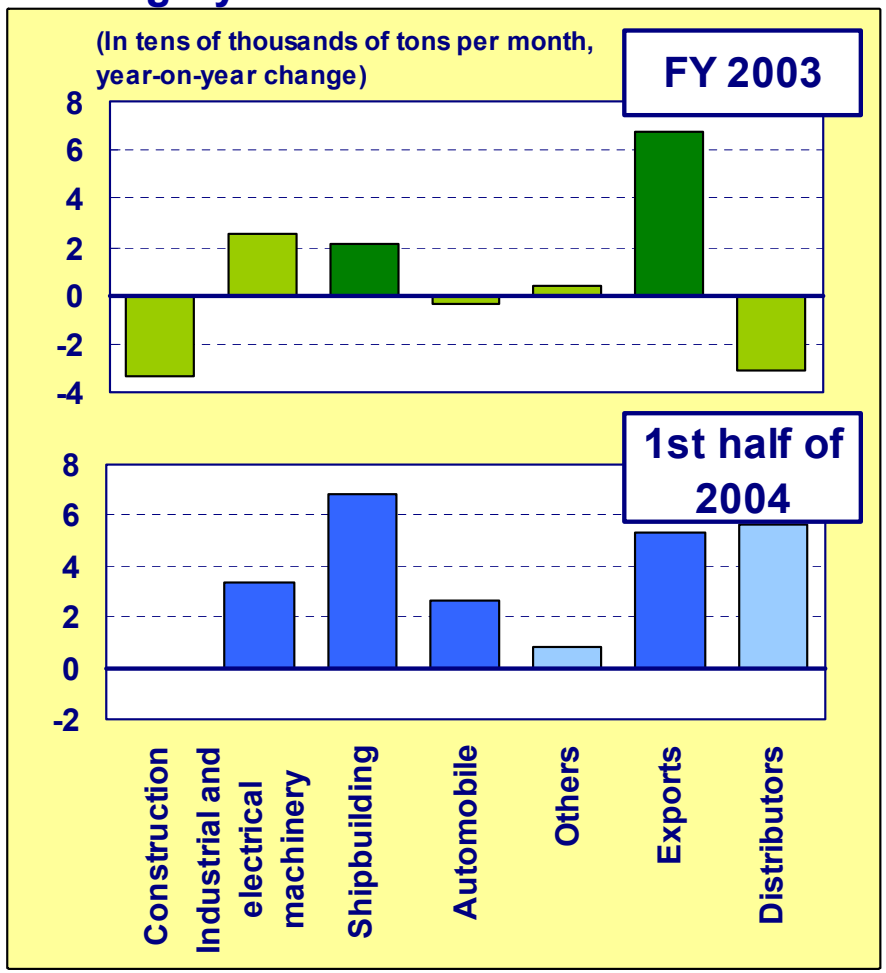
Sources: Ministry of Economy, Trade and Industry, *Steel, Nonferrous Metals and Metal Products Statistics; Ceramics and Construction Materials Statistics; Chemical Industry Statistics; Paper, Printing, Plastics and Rubber Products Statistics.*

[Steel] Production and Demand

Capacity utilization rate for crude steel production



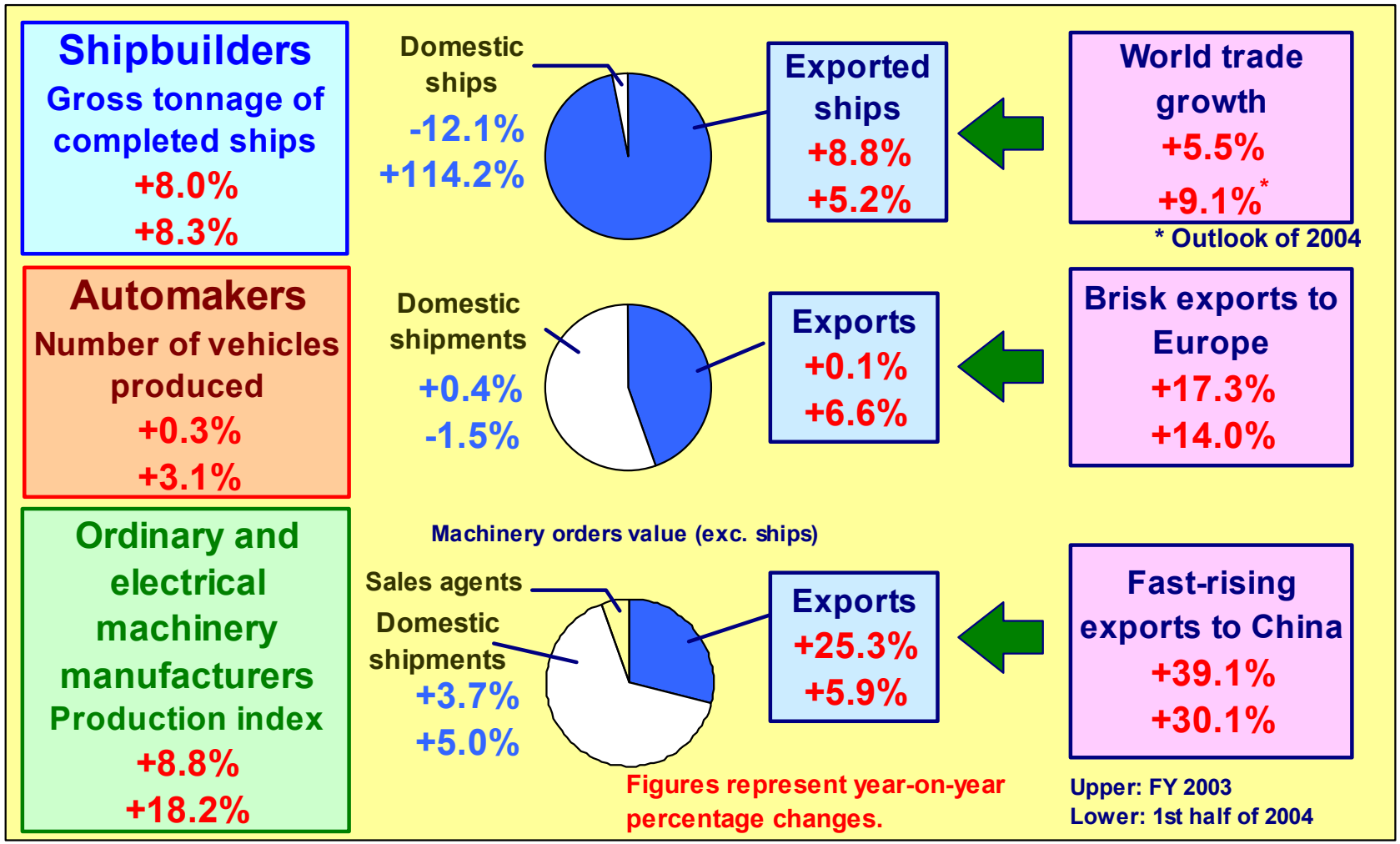
Common rolled steel orders by user category



Source: Ministry of Economy, Trade and Industry, *Steel, Nonferrous Metals and Metal Products Statistics*

Steelmakers are operating at their full capacity. Notable growth is seen in demand for steel for shipbuilders and exports to China.

[Steel] Users' Trends



Sources: Japan Automobile Manufacturers' Association; Ministry of Land, Infrastructure and Transport; Ministry of Economy, Trade and Industry; Cabinet Office; International Monetary Fund.

Shipbuilders, automakers and machinery manufacturers, as steel users, depend heavily on exports for growth.

Macroeconomic Outlook

- GDP and Demand Items, Price Index
- Industrial Materials Output
- Production Index, Service Activity Index, Transportation Indicators

Macroeconomic Indicator Outlook

[Standard Case]

	Actual	Forecast		Year-on-year change (%)		
	FY 2003	FY 2004	FY 2005	FY 2003	FY 2004	FY 2005
Nominal GDP (in trillions of yen)	501.3	506.1	509.3	0.8	1.0	0.6
Real GDP (in trillions of yen)	523.1	534.8	542.0	1.9	2.2	1.3
Private sector demand	392.7	402.9	408.0	(1.6)	(2.0)	(1.0)
Public sector demand	118.5	117.4	118.2	(-0.4)	(-0.2)	(0.2)
Overseas demand	12.0	14.9	16.0	(0.8)	(0.5)	(0.2)
Production index (100 for 2000)	96.6	101.9	104.7	3.5	5.5	2.7
Consumer price index (100 for 2000)	98.1	98.0	97.8	-0.2	-0.1	-0.1
Crude oil price ($/bbl)	29.5	38.5	34.0	8.0	30.4	-11.7
Exchange rate (yen/dollar)	113.0	107.7	105.0	-7.3	-4.7	-2.5

Sources: Actual figures from Cabinet Office, *Preliminary National Income Statistics,* and others. Forecasts from IEEJ.

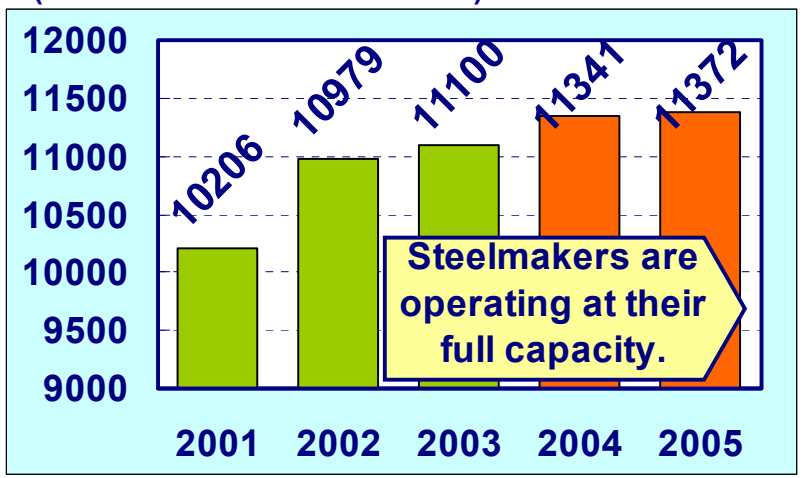
Note: In parentheses are GDP growth contribution rates. A combination of rates does not match the total growth rate due to percentage deviation.

(FY 2005) Production and investment will slow down on deceleration of export growth.

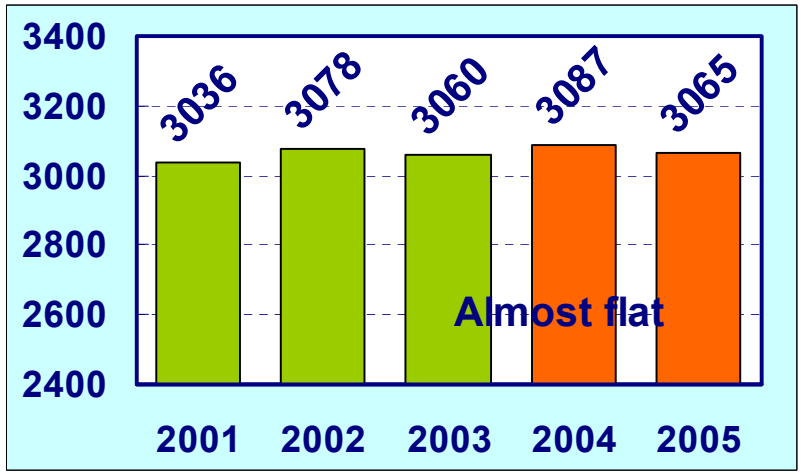
Industrial Materials Production Outlook

[Standard Case]

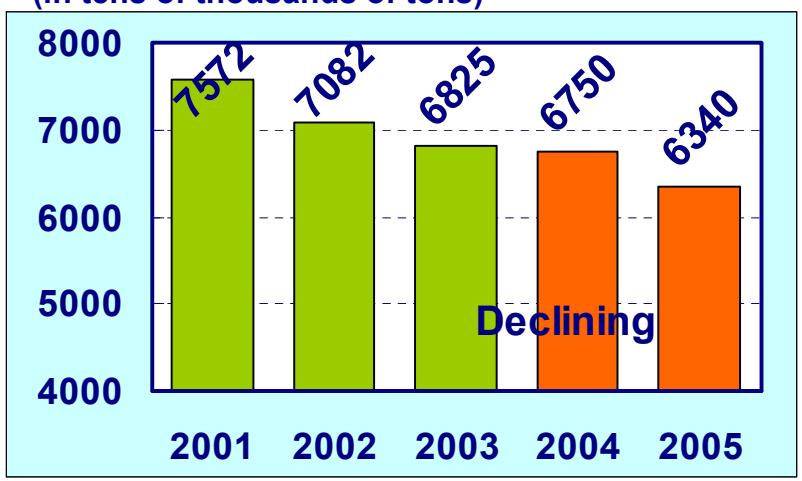
1) Crude steel output
(in tens of thousands of tons)



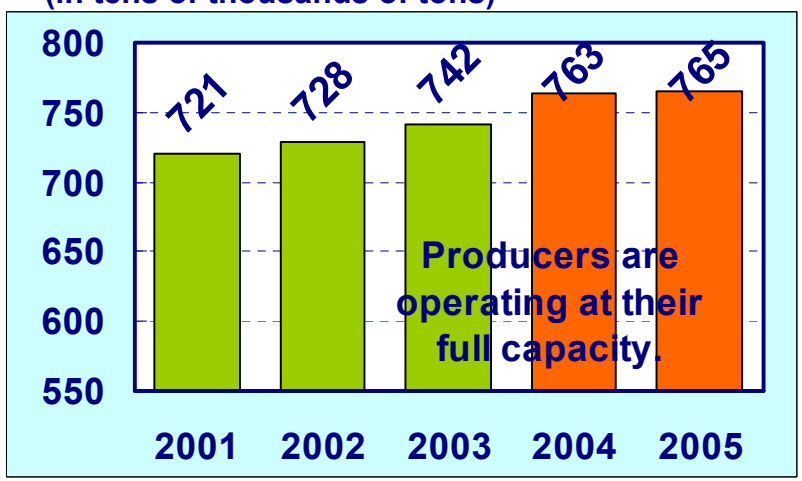
2) Paper and paperboard output
(in tens of thousands of tons)



3) Cement output
(in tens of thousands of tons)



4) Ethylene output
(in tens of thousands of tons)



Sources: Actual figures from above-listed sources. Forecasts from IEEJ.
Note: Fiscal year figures.

Production, Services and Transportation Outlook

[Standard Case]

(100 for 2000)	Actual	Forecast		Year-on-year change (%)		
	FY 2003	FY 2004	FY 2005	FY 2003	FY 2004	FY 2005
Foods	97.4	96.8	97.0	-0.4	-0.6	0.2
Nonferrous metals	97.4	98.1	98.2	-1.1	0.7	0.2
Metals and machinery	95.2	104.0	108.8	8.0	9.2	4.7
Industrial production index	96.6	101.9	104.7	3.5	5.5	2.7
Tertiary industry activity index	102.5	104.0	105.4	1.3	1.5	1.4
Passenger car person kilometers	101.9	102.2	102.7	-0.2	0.3	0.4
Truck ton kilometers	102.8	106.0	105.7	3.2	3.1	-0.3

Sources: Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes,* and others. Forecasts from IEEJ.

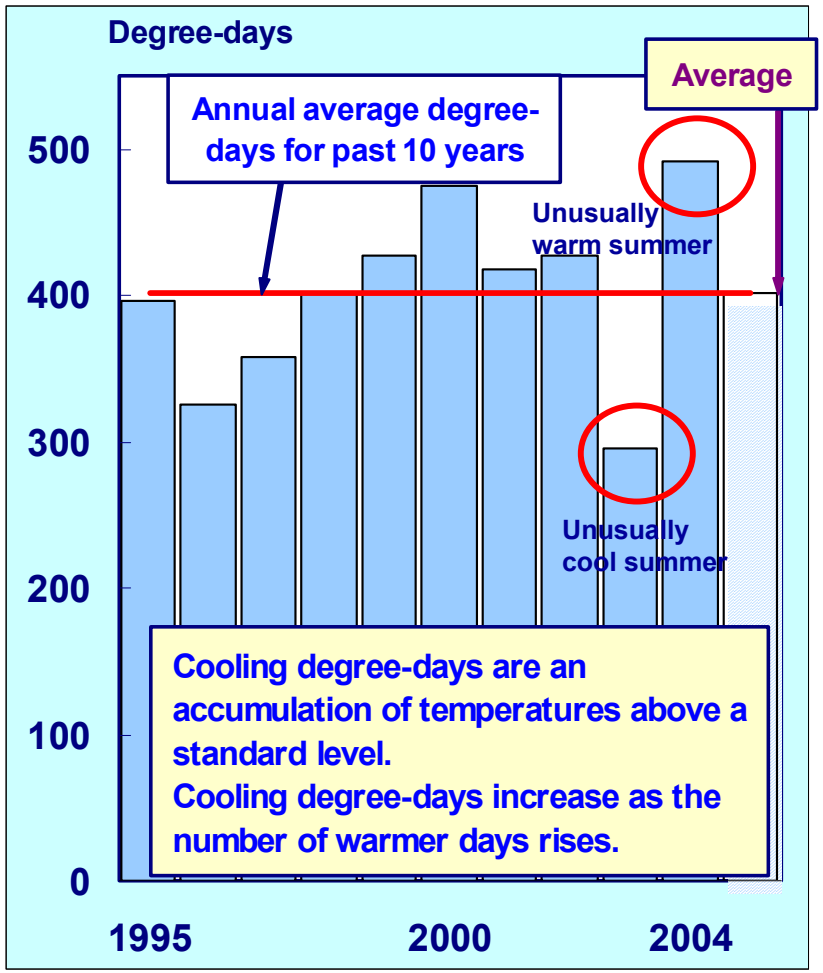
(FY 2005) Ordinary and electrical machinery production will slow down after leading the economic recovery. Transportation will turn down after increasing on production expansion.

Energy Demand/Supply Outlook

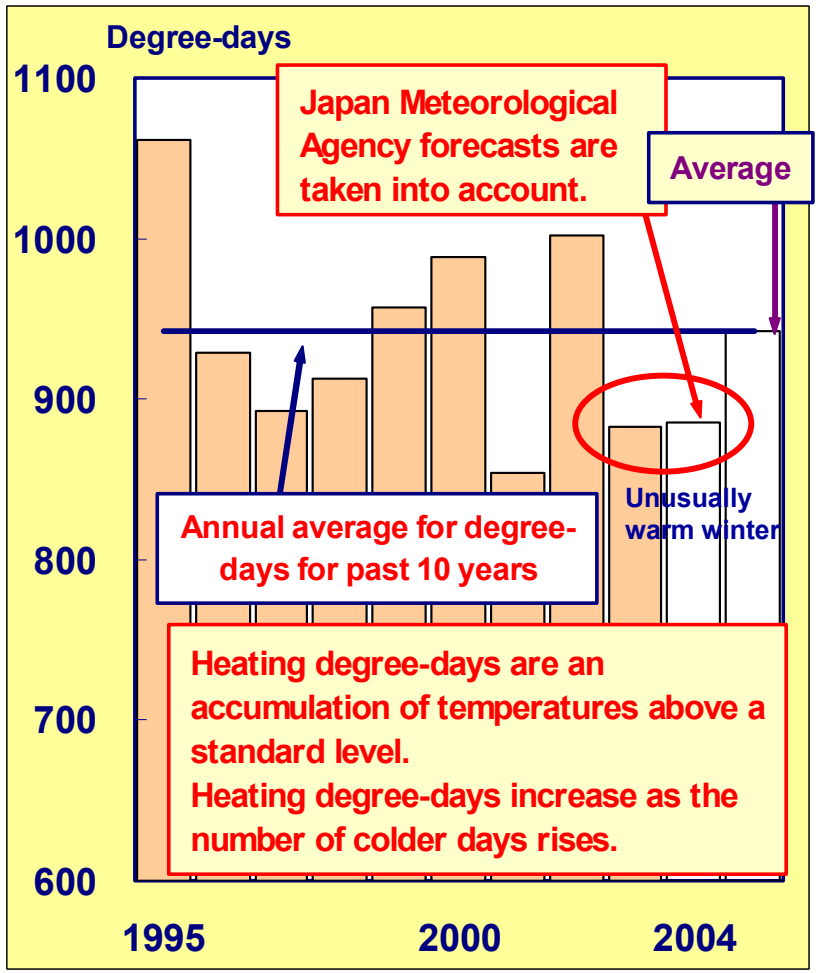
- Primary Energy Supply, Final Consumption, Carbon Dioxide
- Electricity, Town Gas and Fuel Oil Sales

Temperature (Cooling and Heating Degree Day) Assumptions

1st Half (April-September) Cooling Degree-Days and Temperatures



2nd Half (October-March) Heating Degree-Days and Temperature



Source: Japan Meteorological Agency and EDMC estimates. Real data before December 2004.

Note: Cooling degree-days: Accumulation of gaps between average temperatures for days when the temperature was above 24 C and the standard temperature of 22 C.
Heating degree-days: Accumulation of gaps between average temperatures for days when the temperature was below 14 C and the standard temperature of 14 C.

Nuclear Power Generation Assumptions

Operation has resumed gradually at nuclear power plants whose operation was suspended in or after FY 2002.

[New Nuclear Power Plants Planned to Launch Operation]

January 2005: No. 5 Hamaoka (1.38 million kW)

July 2005: No. 1 Totsu (1.10 million kW)

March 2006: No. 2 Shiga (1.36 million kW)

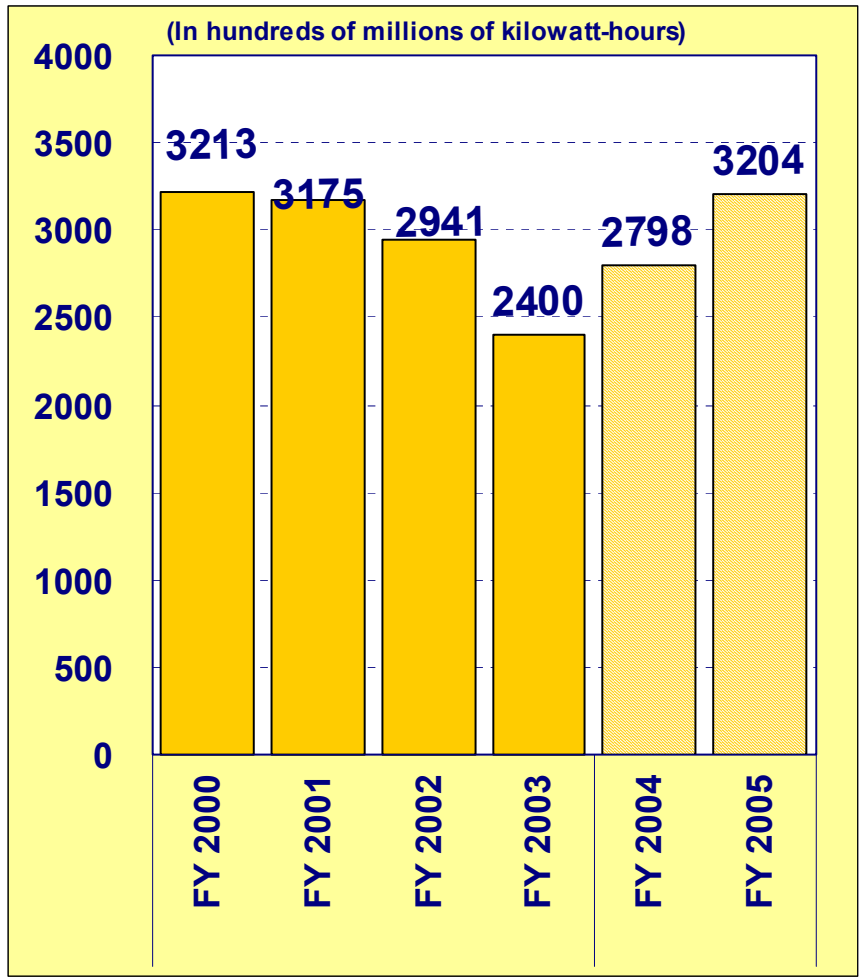
[Nuclear power generation growth rate]

FY 2003: - 18.7%

FY 2004: + 16.6%

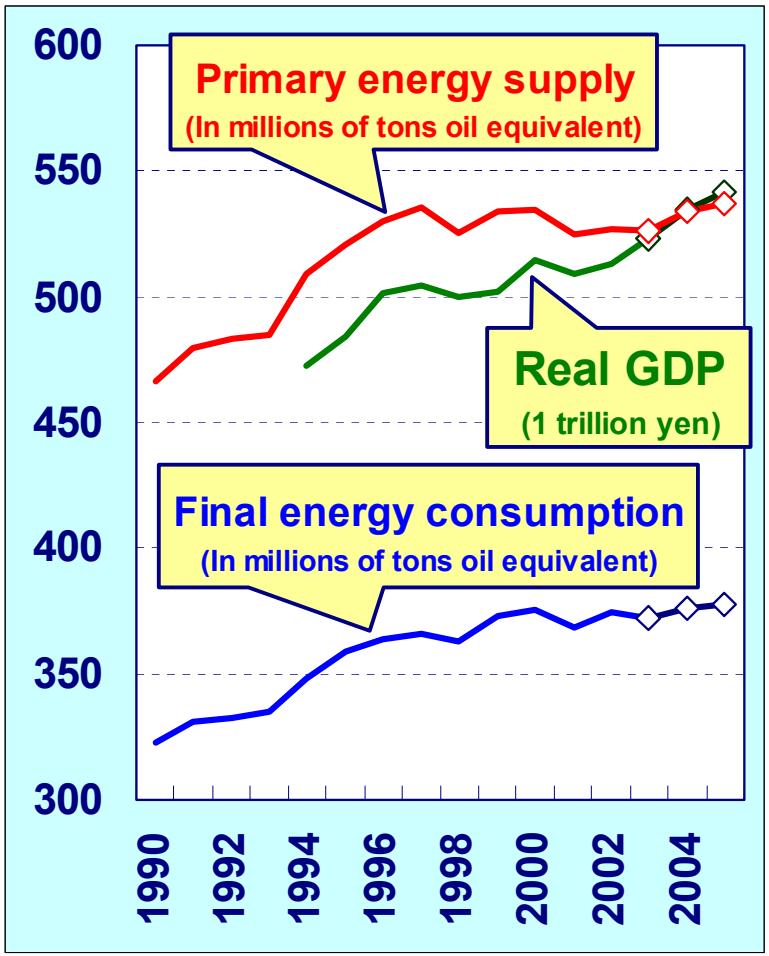
FY 2005: + 14.5%

Nuclear Power Generation Results and Assumptions



Final Energy Consumption and Primary Energy Supply Outlook

[Standard Case]



		Results		Forecasts	
	(FY)	2002	2003	2004	2005
Real GDP	1 trillion yen	513.2	523.1	534.8	542
	(Change from previous year)	(0.8)	(1.9)	(2.2)	(1.3)
Primary energy supply	1 million TOE	527	527	534	537
	(Change form previous year)	(0.5)	(-0.1)	(1.4)	(0.7)
Final energy consumption	1 million TOE	374.5	372	376.3	377.8
	(Change form previous year)	(1.7)	(-0.7)	(1.2)	(0.4)

Source: Cabinet Office and EDMC estimates. Forecasts from IEEJ.

(FY 2005) Energy demand growth decelerates on slowdown of production and economic activities.

Domestic Primary Energy Supply

[Standard Case]

(In millions of tons oil equivalent)	Results FY 2003	Forecasts FY 2004	Forecasts FY 2005	Change from previous year (%) FY 2003	Change from previous year (%) FY 2004	Change from previous year (%) FY 2005
Coal	106.9	109.3	109.7	3.7	2.2	0.4
Oil	261.1	258.6	255.1	0.1	-0.9	-1.3
Natural gas	78.9	77.4	76.4	6.2	-1.9	-1.2
Hydro	20.9	21.0	20.0	15.1	0.6	-5.0
Nuclear	51.6	60.2	68.9	-18.7	16.6	14.5
New energy sources	7.2	7.2	7.2	0.6	0.9	-0.3
Total	526.5	533.7	537.3	-0.1	1.4	0.7
CO_2 (In millions of tons carbon equivalent)	325	324	321	2.1	-0.3	-0.9

Source: Results and forecasts from IEEJ.

(FY 2005) Oil and natural gas supply declines on the launch of new nuclear power plants.

CO_2 emissions decline, while energy supply increases.

Final Energy Consumption by Sector

[Standard Case]

(In millions of tons oil equivalent)	Results	Forecasts		Change from previous year (%)		
	FY 2003	FY 2004	FY 2005	FY 2003	FY 2004	FY 2005
Industry	175.2	176.8	177.3	0.3	0.9	0.3
Households	52.7	52.9	53.8	-2.8	0.4	1.8
Commerce	47.3	48.7	49.5	-1.4	3.1	1.5
Transportation	90.8	91.6	90.8	-0.3	0.9	-0.9
Total	372.0	376.3	377.8	-0.7	1.2	0.4

Source: Results and forecasts from IEEJ.

(FY 2005) Industry: Slowing production.

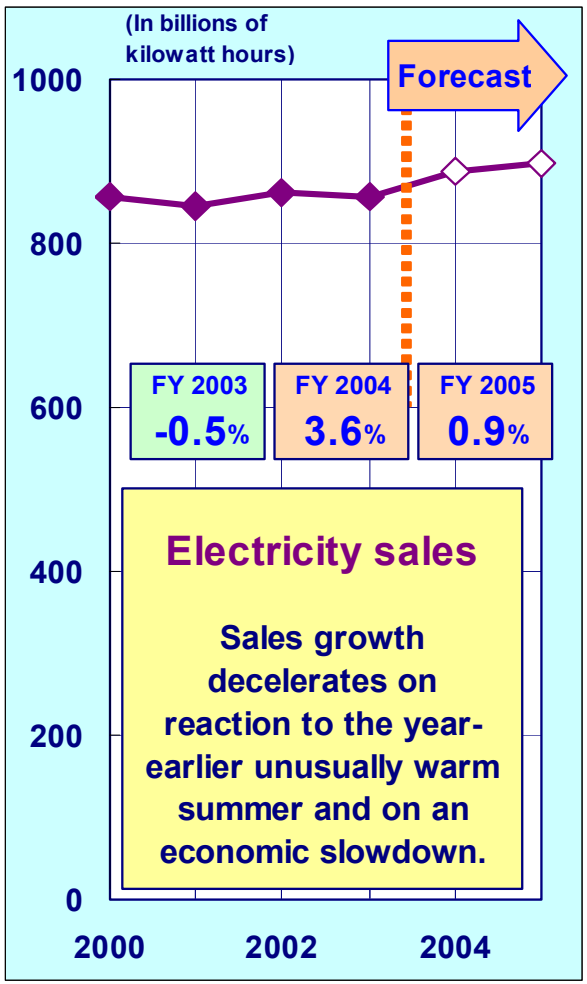
Households: A fall in cooling demand in reaction to the unusually warm summer a year earlier and a rise in heating demand in reaction to the unusually warm winter a year earlier.

Transportation: Decline in cargo transportation.

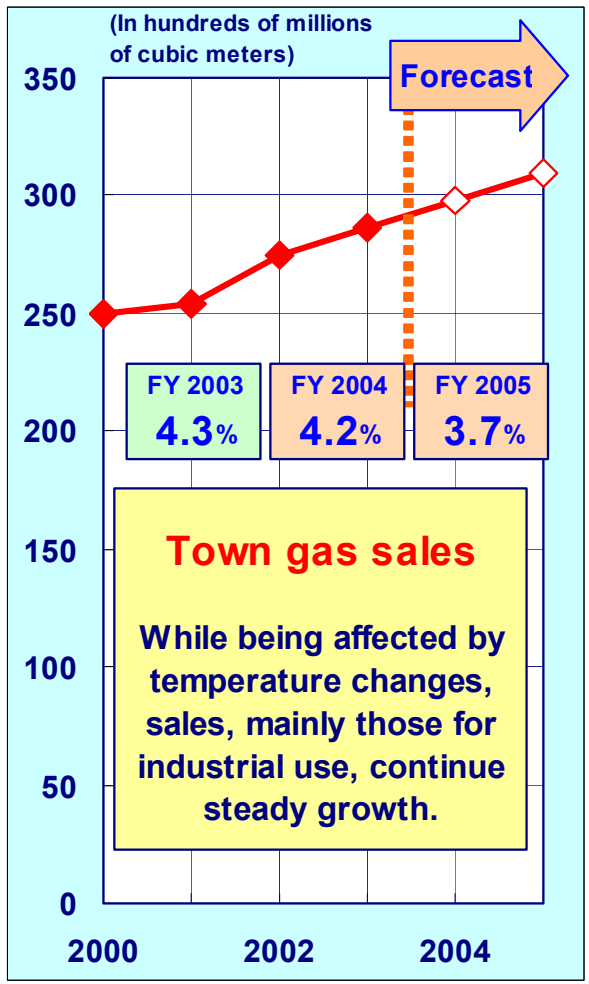
Energy Sales Outlook

[Standard Case]

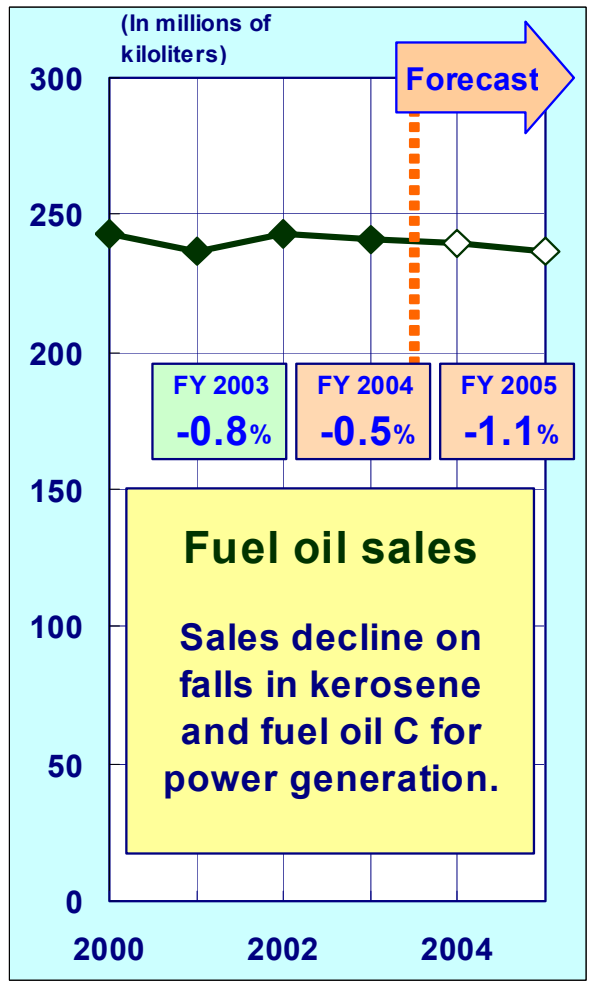
◆Electricity



◆ Town Gas



◆ Oil



Sources: Ministry of Economy, Trade and Industry, *Monthly Electricity Survey and Statistics, Monthly Gas Industry Statistics, Monthly Resources and Energy Statistics.*
Forecasts from IEEJ.

Electricity Demand by User Category

[Standard Case]

(In billions of kilowatt-hours)	Results	Forecasts		Change from previous year (%)		
	FY 2003	FY 2004	FY 2005	FY 2003	FY 2004	FY 2005
Households	259.7	268.8	271.4	-1.4	3.5	1.0
Non-household	598.6	620.5	625.9	-0.2	3.7	0.9
Total	858.2	889.3	897.3	-0.5	3.6	0.9
Industry	281.7	290.2	293.0	0.2	3.0	1.0
Chemical	27.6	28.7	29.3	1.3	4.2	1.9
Steel	52.7	54.1	54.2	0.7	2.5	0.3
Machinery/ instruments	68.5	72.5	73.9	1.7	5.8	1.9

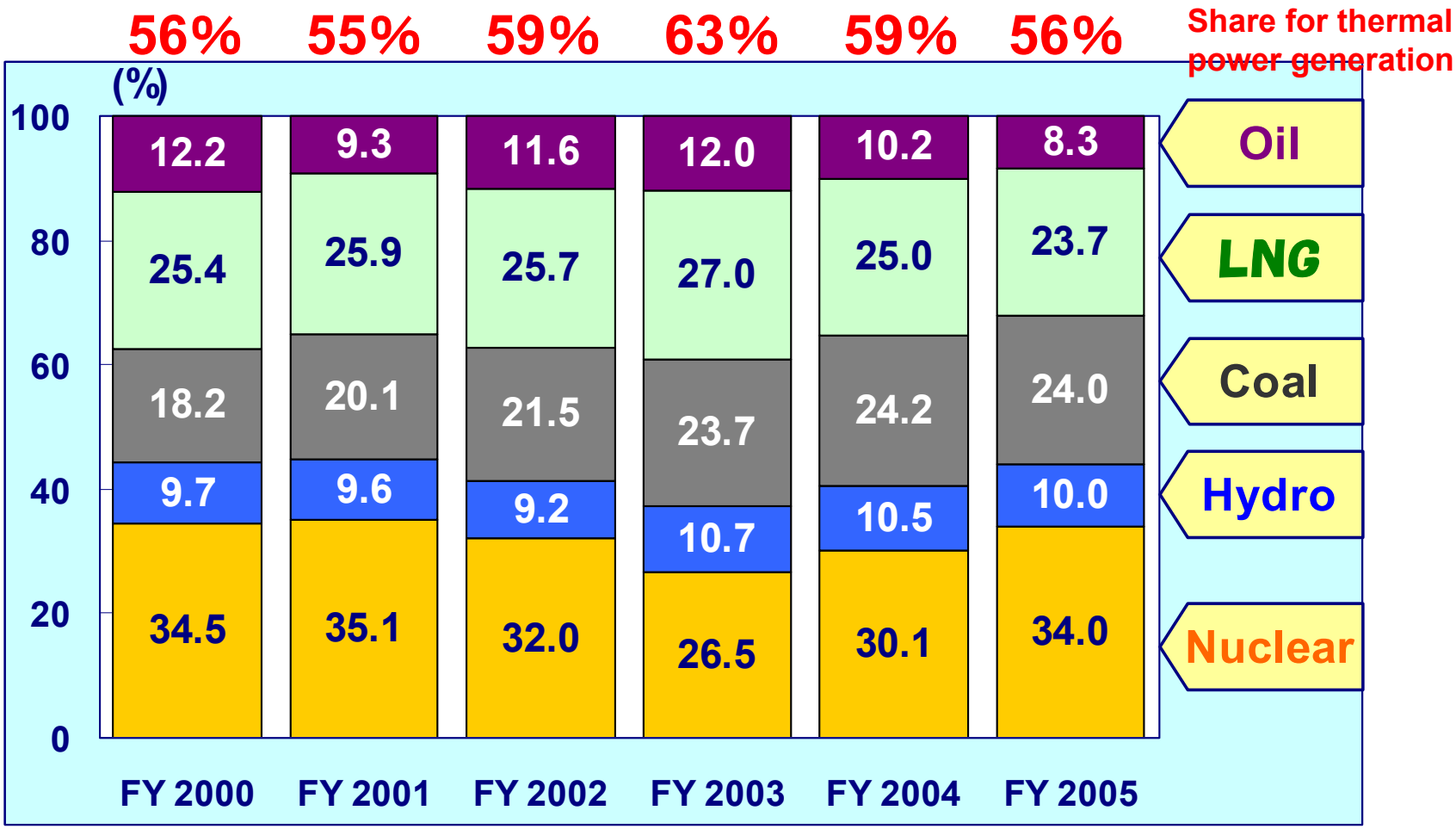
Source: Results from Ministry of Economy, Trade and Industry, *Monthly Electricity Survey and Statistics*. Forecasts from IEEJ.

(FY 2005) Households: A fall in cooling demand in reaction to the unusually warm summer a year earlier and a rise in heating demand in reaction to the unusually warm winter a year earlier.

Industry: Steelmakers and petrochemical products makers operate at their full capacity. Machinery and instrument makers reduce production.

Power Mix (Power utilities, on an input basis)

[Standard Case]



Sources: Results from Agency of Natural Resources and Energy, *Comprehensive Energy Statistics,* and EDMC estimates. Forecasts from IEEJ.

(FY 2005) The share for nuclear power generation increases as some plants resume operation after suspension and as new plants launch operation.

The share for thermal power generation slips below 60% as oil and LNG consumption for power generation is reduced.

Town Gas Sales by User Category

[Standard Case]

(In hundreds of million cubic meters)	Results	Forecasts		Change from previous year (%)		
	FY 2003	FY 2004	FY 2005	FY 2003	FY 2004	FY 2005
Households	97.1	94.2	97.6	0.3	-3.0	3.6
Commercial	44.3	47.1	47.4	1.9	6.3	0.7
Industry	120.3	130.5	137.6	9.1	8.4	5.4
Others	24.5	26.4	26.6	2.4	7.8	0.9
Total	286.1	298.1	309.2	4.3	4.2	3.7

Source: Results from Ministry of Economy, Trade and Industry, *Monthly Gas Industry Statistics.* Forecasts from IEEJ.

(FY 2005) Households: An increase in hot water and heating demand in reaction to the unusually warm winter a year earlier.

Commercial and others: An increase slows on a decline in cooling demand in reaction to the unusually warm summer a year earlier.

Industry: Growth decelerates on production and investment slowdown.

Fuel Oil Sales Breakdown

[Standard Case]

(In million kiloliters)	Results FY 2003	Forecasts FY 2004	Forecasts FY 2005	Change from previous year (%) FY 2003	Change from previous year (%) FY 2004	Change from previous year (%) FY 2005
Gasoline	60.6	61.3	61.5	1.2	1.3	0.2
Naphtha	48.7	49.5	49.7	0.1	1.7	0.5
Kerosene	29.1	28.7	29.0	-5.1	-1.2	1.0
Gas oil	38.1	37.9	36.6	-3.4	-0.5	-3.6
Fuel oil A	29.8	29.9	29.9	-1.3	0.4	0.3
Fuel oil B and C	30.2	27.6	25.6	2.3	-8.5	-7.4
For power generation	12.4	10.2	8.2	14.2	-17.9	-19.1
Total	240.9	239.8	237.0	-0.8	-0.5	-1.1

Sources: Results form Ministry of Economy, Trade and Industry, *Monthly Resources and Energy Statistics.* Forecasts from IEEJ.

(FY 2005) **Gasoline: An increase slows on a decline in cooling demand in reaction to the unusually warm summer a year earlier.**
Kerosene: Sales fall on slowdown in cargo transportation.
Fuel oil B and C: Sales for power generation decline sharply on an increase in nuclear power generation.

Sensitivity Analysis of Factors Affecting Energy Demand/Supply

- Impact of Oil Price Changes
- Impact of Economic Growth Changes
- Impact of Temperature Changes

Analysis of Impact on Energy Demand/Supply

Standard Case

FY 2005: GDP growth = 1.3%, C.I.F. crude price = about $34/bbl

The crude oil price is based on Ken Koyama, *International Oil Situation and Oil Price Outlook for 2005,* December 16, 2004.

Crude Price

- **Higher**
  - Crude price = about $43/bbl ($9 higher than in standard case)
- **Lower**
  - Crude price = about $28/bbl($6 lower than in standard case)

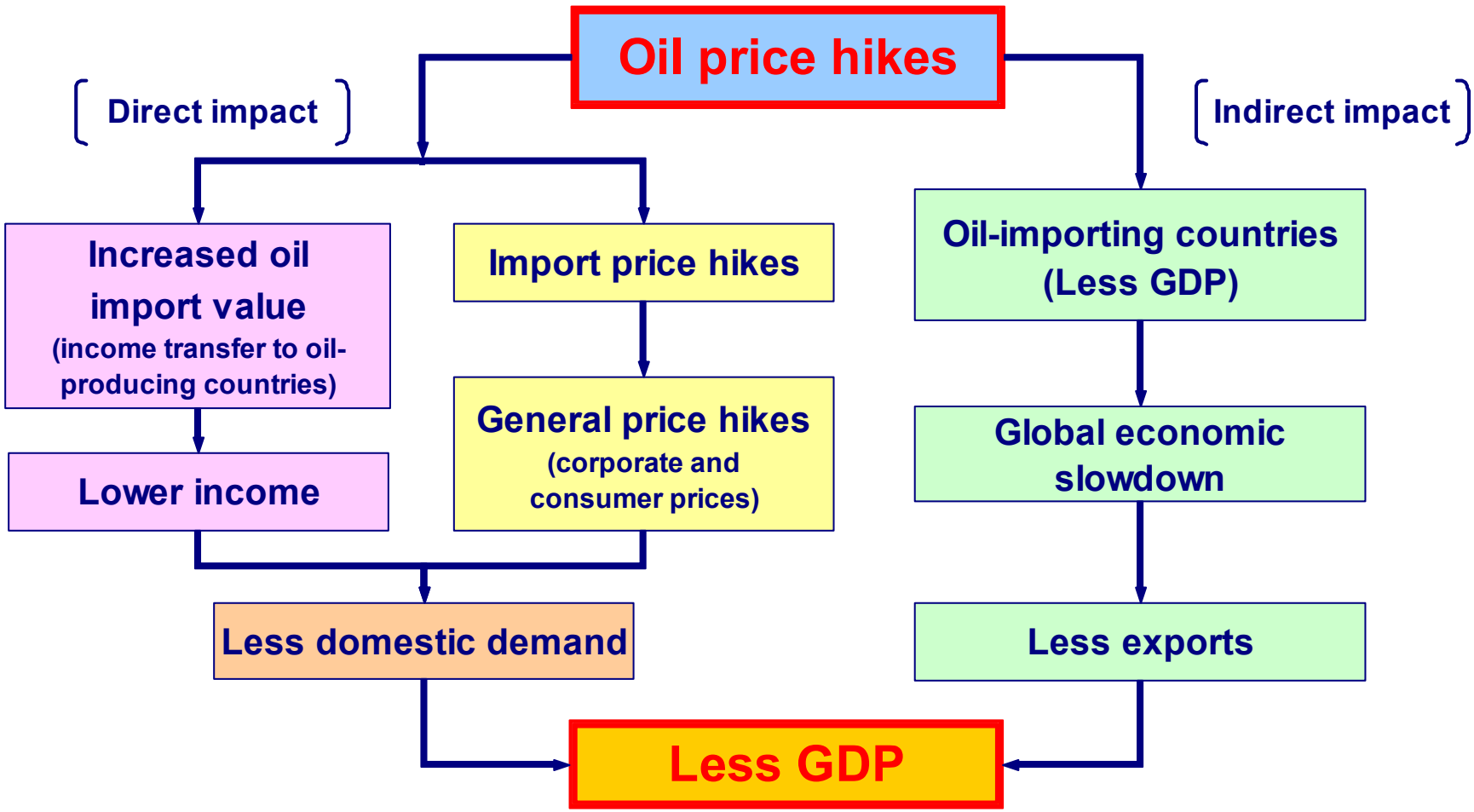
Impact of Economic Changes

- GDP growth change from standard case +1.0 percentage point
  - 1.0 percentage point

Impact of Temperature Changes

- Temperature: Up 1 C (July-September)
  Down 1 C (January-March)

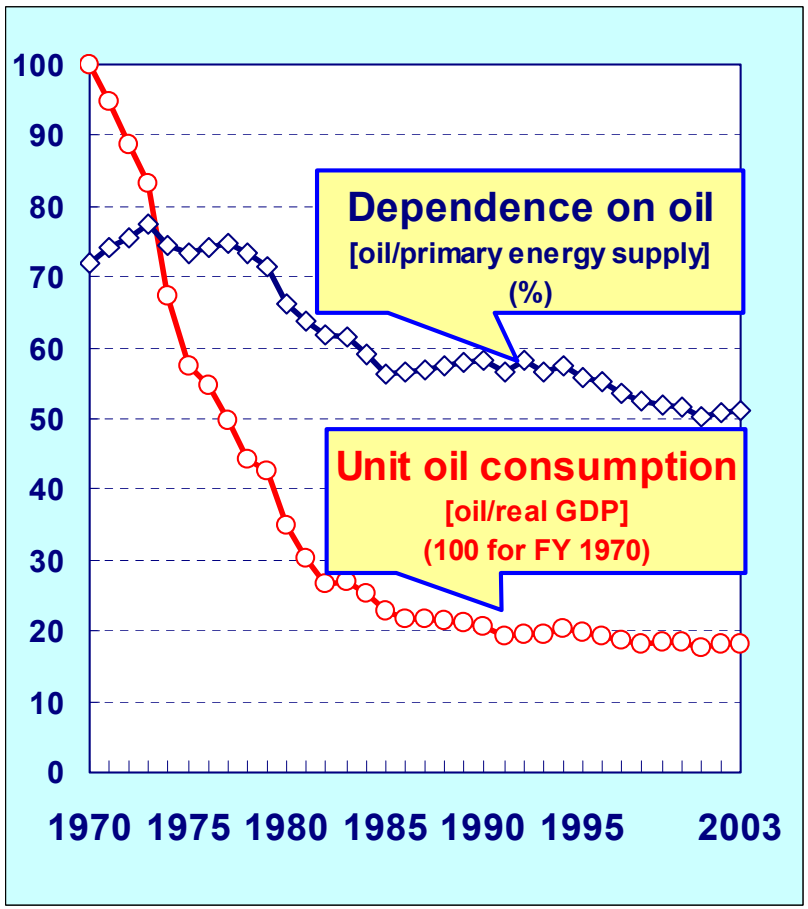
Impact of Oil Price Hikes on Economy



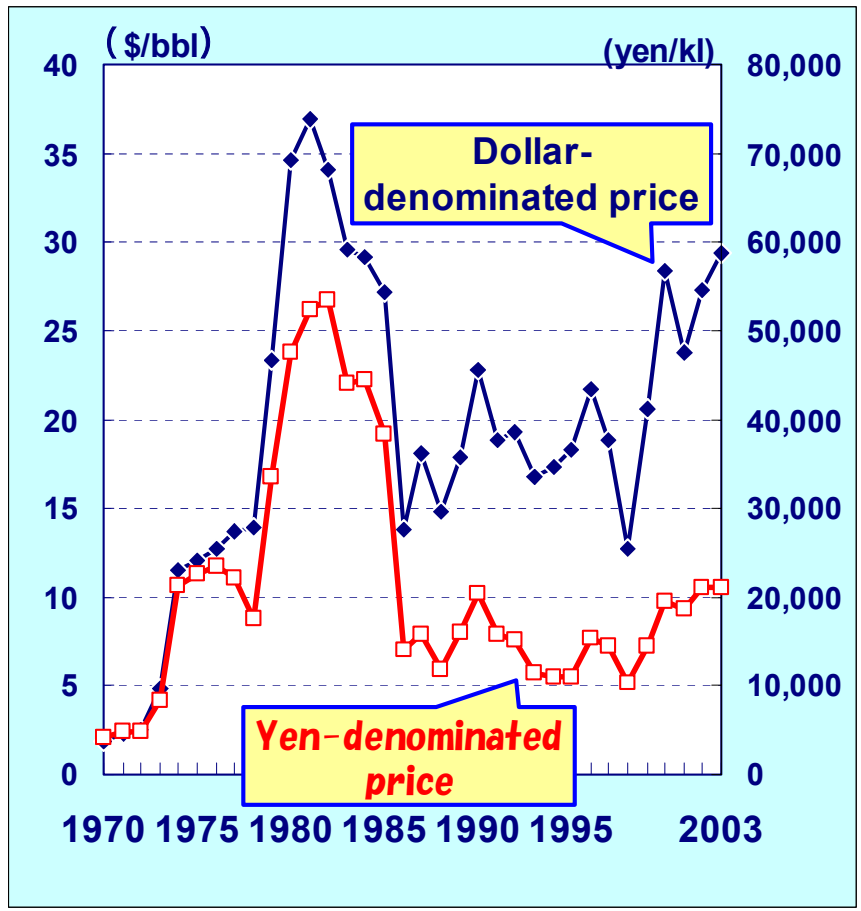
The impact on the Japanese economy is divided into two – 1) direct impact through income transfer to oil-producing countries and price hikes, and 2) indirect impact through global economic slowdown.

Changes in Dependence on Oil and Oil Import Prices

Changes in Dependence on Oil and Unit Oil Consumption



Changes in C.I.F. Crude Oil Import Price

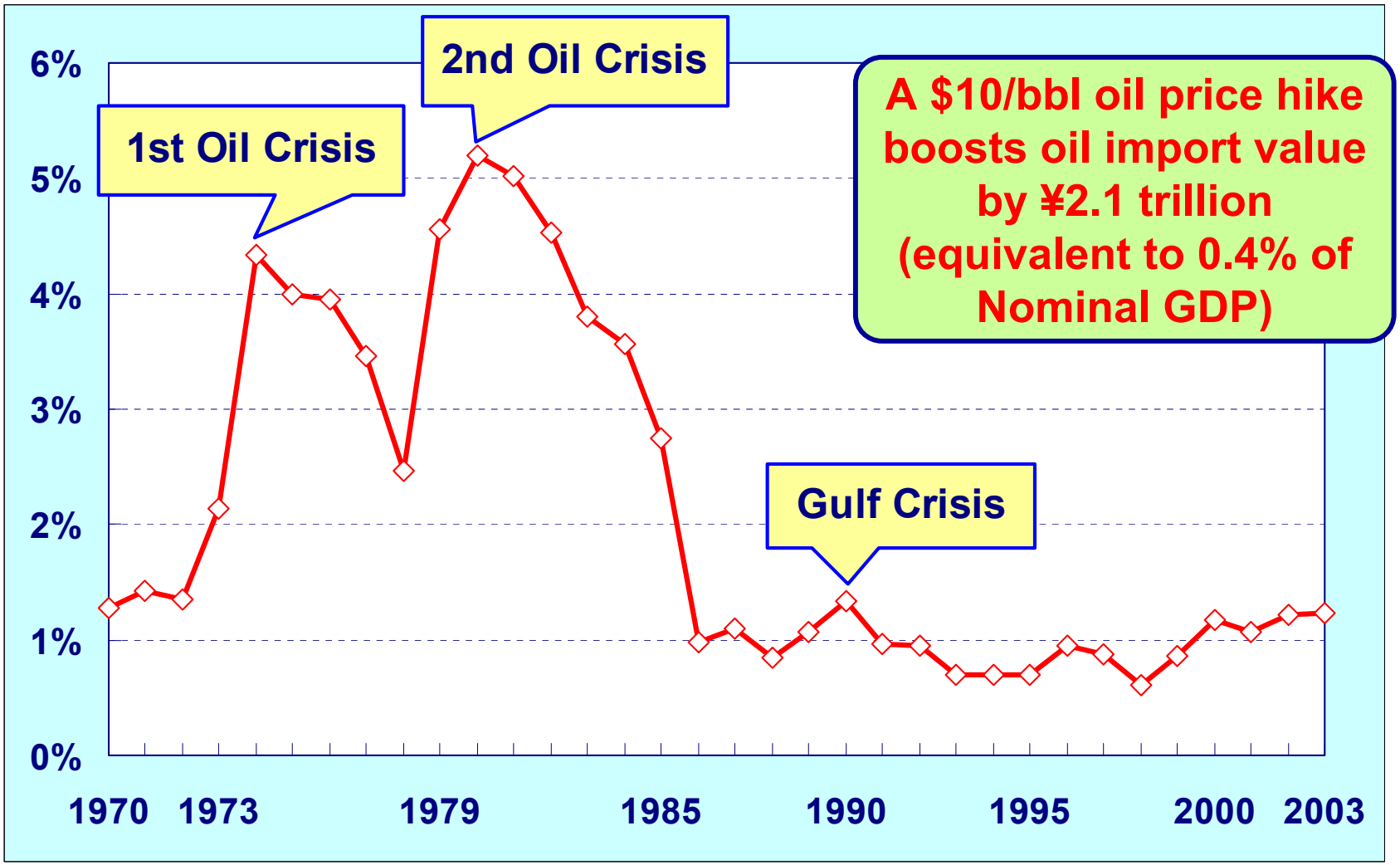


Sources: Ministry of Finance, *Monthly Trade Table;* Cabinet Office, *National Accounts*; EDMC, *Statistics Manual.*

Energy savings and departure from oil have made progress since the two oil crises.

Crude oil prices in yen have fallen on the yen's appreciation.

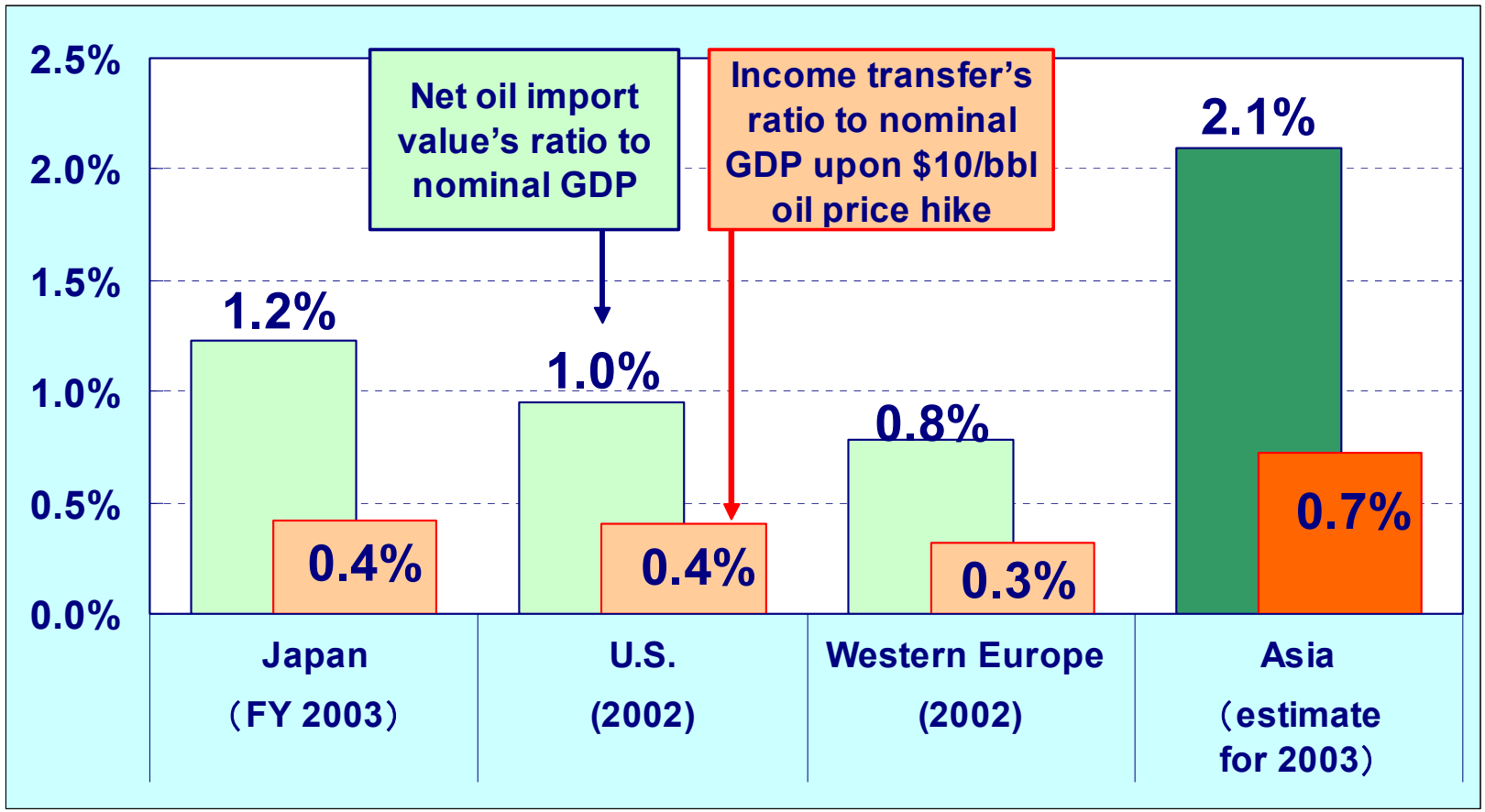
Oil Import Value's Ratio to Nominal GDP



Sources: Ministry of Finance, *Monthly Trade Table*; Cabinet Office, *National Accounts.*

Oil import value's ratio to nominal GDP has remained around 1% since the late 1980s.

Foreign Economies' Dependence on Oil



Sources: Japanese Ministry of Finance, International Trade Center, World Bank/WDI, Asian Development Bank, Taiwan's International Trade Bureau

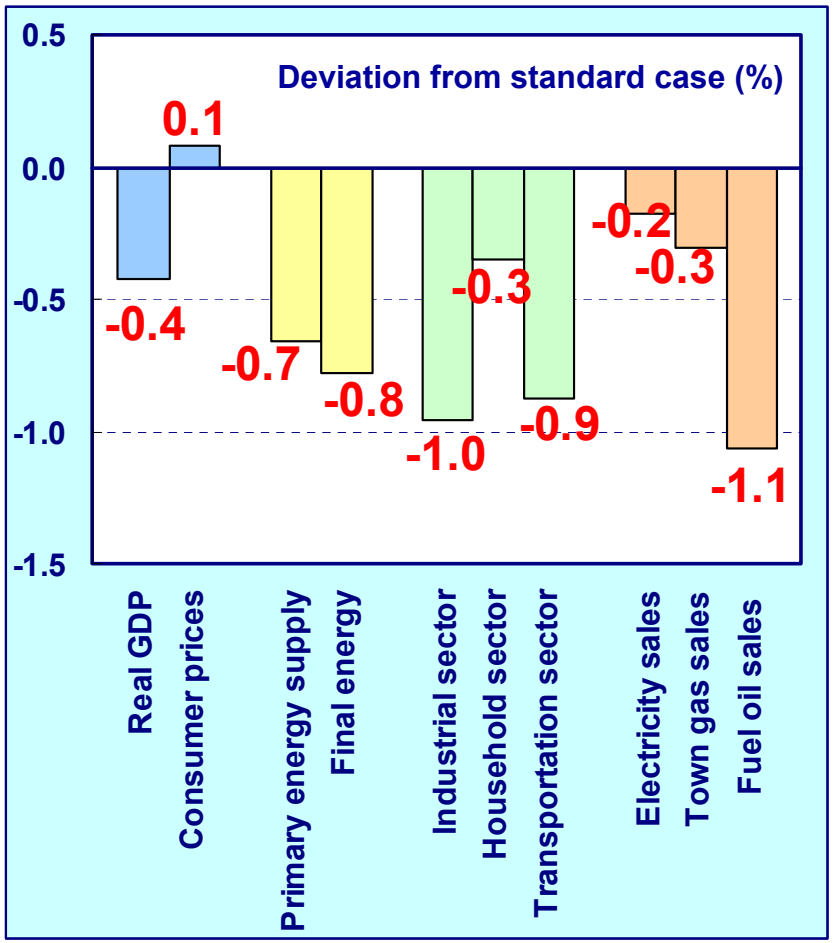
Notes: Western Europe: 7 countries – Germany, Britain, the Netherlands, France, Belgium, Italy and Spain

Asia: 9 economies – China, South Korea, Taiwan, Hong Kong, Singapore, Thailand, Indonesia, Malaysia, the Philippines

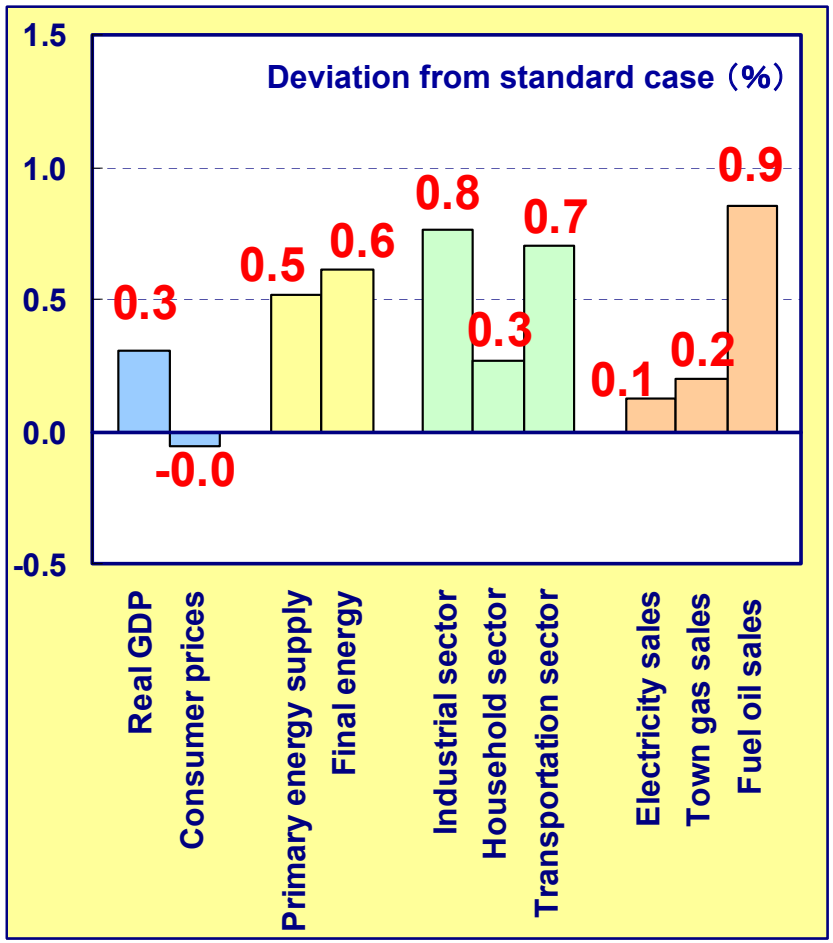
In Asia, which has rapidly increased oil imports in recent years, the impact of income transfer (ratio of an oil import value rise to GDP upon a $10/bbl oil price hike) is great.

Impact of Crude Oil Price Change

Higher price case ($9 higher than in standard case)



Lower price case ($6 lower than in standard case)

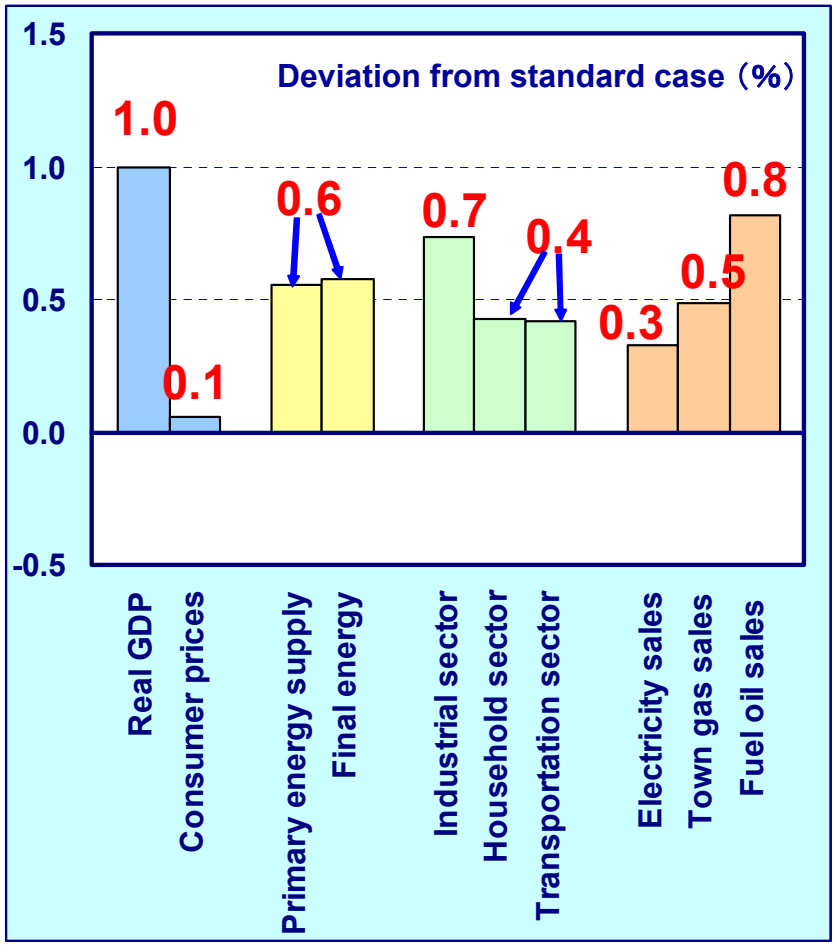


The impact is greater on industries and transportation (especially cargo transportation) that are sensitive to economic conditions and price changes.

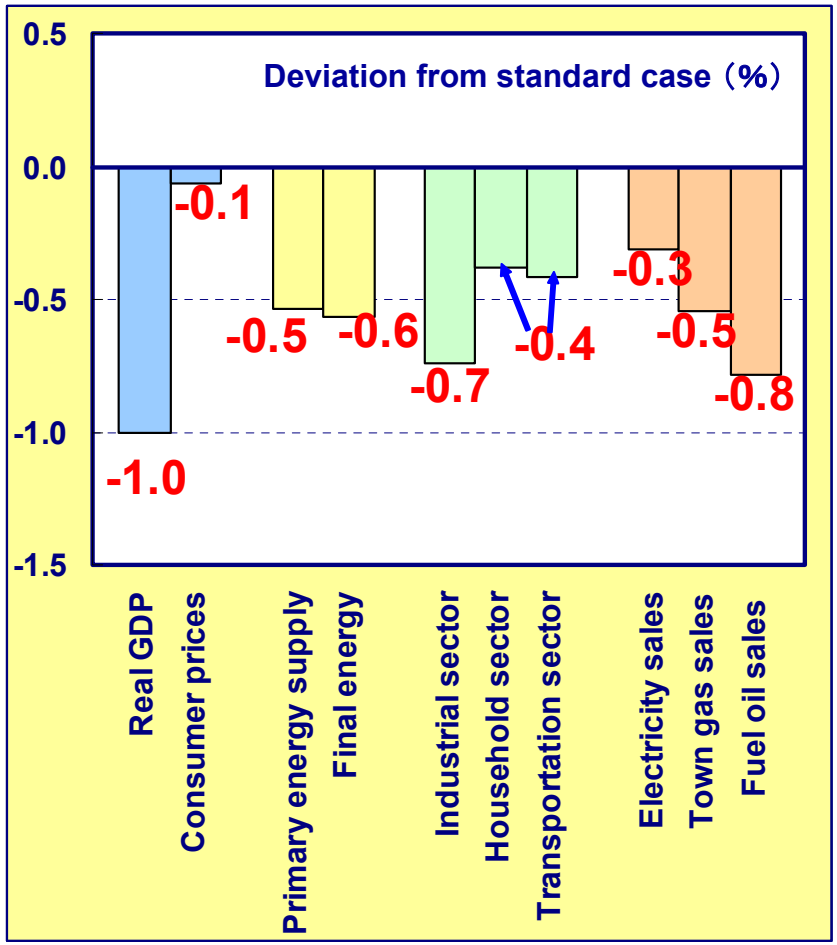
Wilder fluctuations are seen in fuel oil sales that are directly affected by oil price changes.

Impact of Economic Growth Changes

Higher growth case (1 percentage point higher than in standard case)



Lower growth case (1 percentage point lower than in standard case)

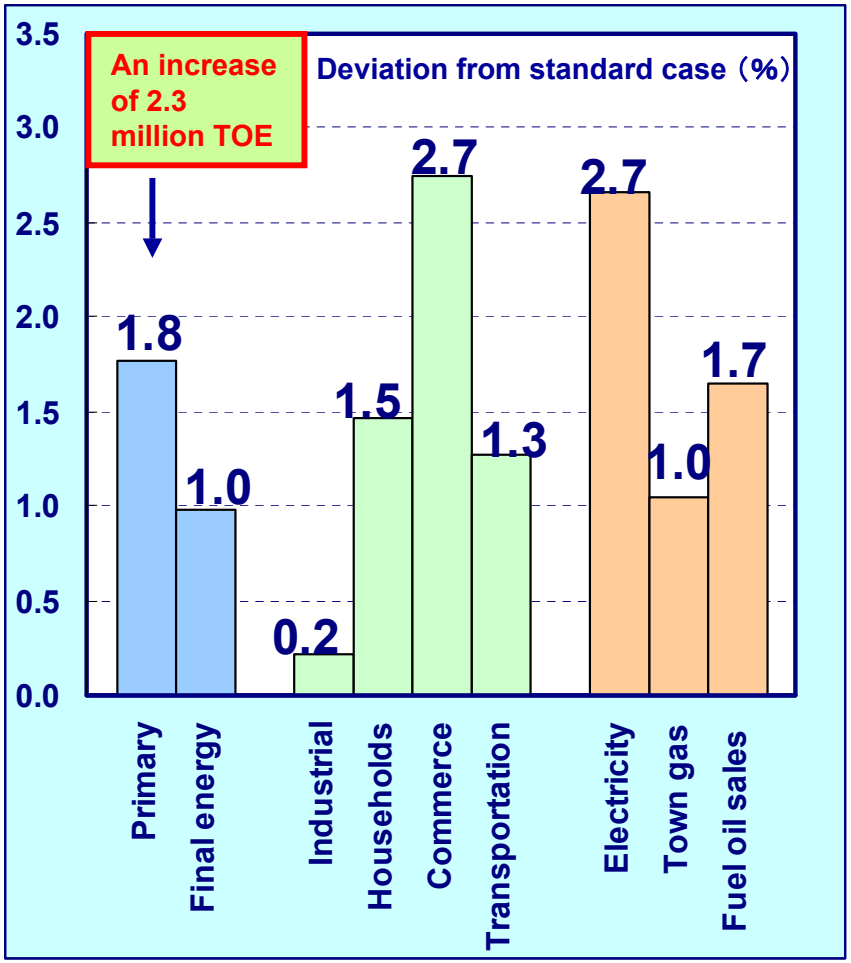


Energy consumption does not change as much as GDP changes.

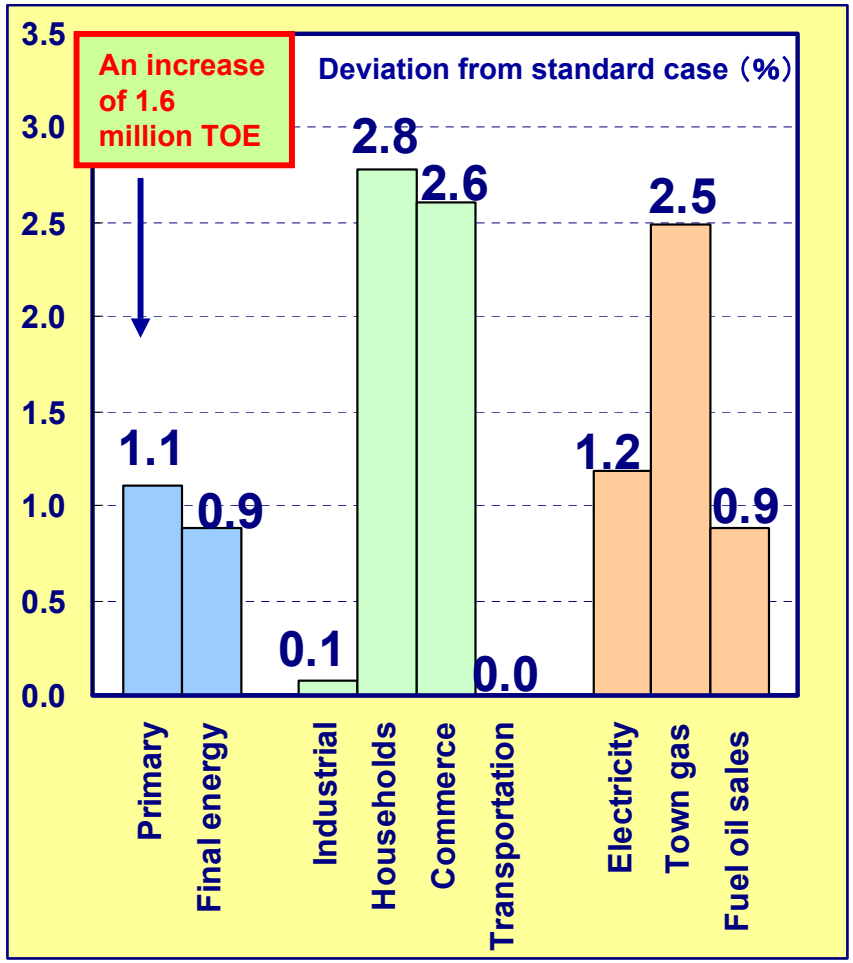
A change is greater in consumption of electricity as a necessary good and smaller in fuel oils for industrial and transportation use.

Impact of Temperature Changes

1 C rise in July-September



1 C fall in January-March



Summer: Electricity demand rises sharply on a cooling demand increase. In the household sector, a cooling demand rise is offset with a hot water demand fall.

Winter: Town gas demand rises sharply on heating and hot water demand increases.

Conclusion

- While the Japanese economy's growth will fall to 1.3% on the world economy's slowdown in FY 2005 and other factors, energy demand will increase slightly (a 0.7% rise in primary energy supply).
- While energy demand will increase, CO_2 emissions will decline on the launch of new nuclear power plants and other factors.
- Crude oil price and macroeconomic forecasts have uncertainty.

  - If the crude oil price remains high ($9 higher than in the standard case), economic growth and energy demand may fall. But the impact may be limited.

- Energy demand's long-term trend will depend on the advancement of energy-saving technologies and other factors. Over the short term, however, energy demand will be affected more by changes in economic conditions (including production) and in temperatures.