

The 406th Forum on Research Work

# Short-Term Energy Supply/Demand Outlook

-- Forecast through FY2011 and Analysis on Effects of Crude Oil Price, Economic Growth and Ambient Temperature Changes –

December 22, 2010

Shigeru Suehiro, Senior Researcher  
Energy Demand, Supply and Forecast Analysis Group  
Energy Data and Modelling Center  
Institute of Energy Economics, Japan  
Toshiaki Hachiuma, Researcher  
Masayuki Kako, Researcher  
Manabu Sofukuwaki, Researcher  
Kenji Sugii, Researcher

- ◆ **Outline of research** Background, analysis procedure, model flow
- ◆ **Economic and energy demand trends**
- ◆ **Economic and production outlook**
- ◆ **Energy demand outlook**
- ◆ **Analysis** on effects of crude oil, economic growth and ambient temperature changes
- ◆ **Conclusion**

## ◆ Background

The world economy is on a recovery track after the worst period following the financial crisis. In the Japanese economy, production and consumption have recovered rapidly on an export rebound and economic stimulus measures. Based on such situation, we forecast energy supply and demand through FY2011. We put forward the base case forecast and an analysis on effects of uncertain factors.

## ◆ Projection method

Quantitative model (macroeconomic conditions, energy supply and demand)  
→ See next page

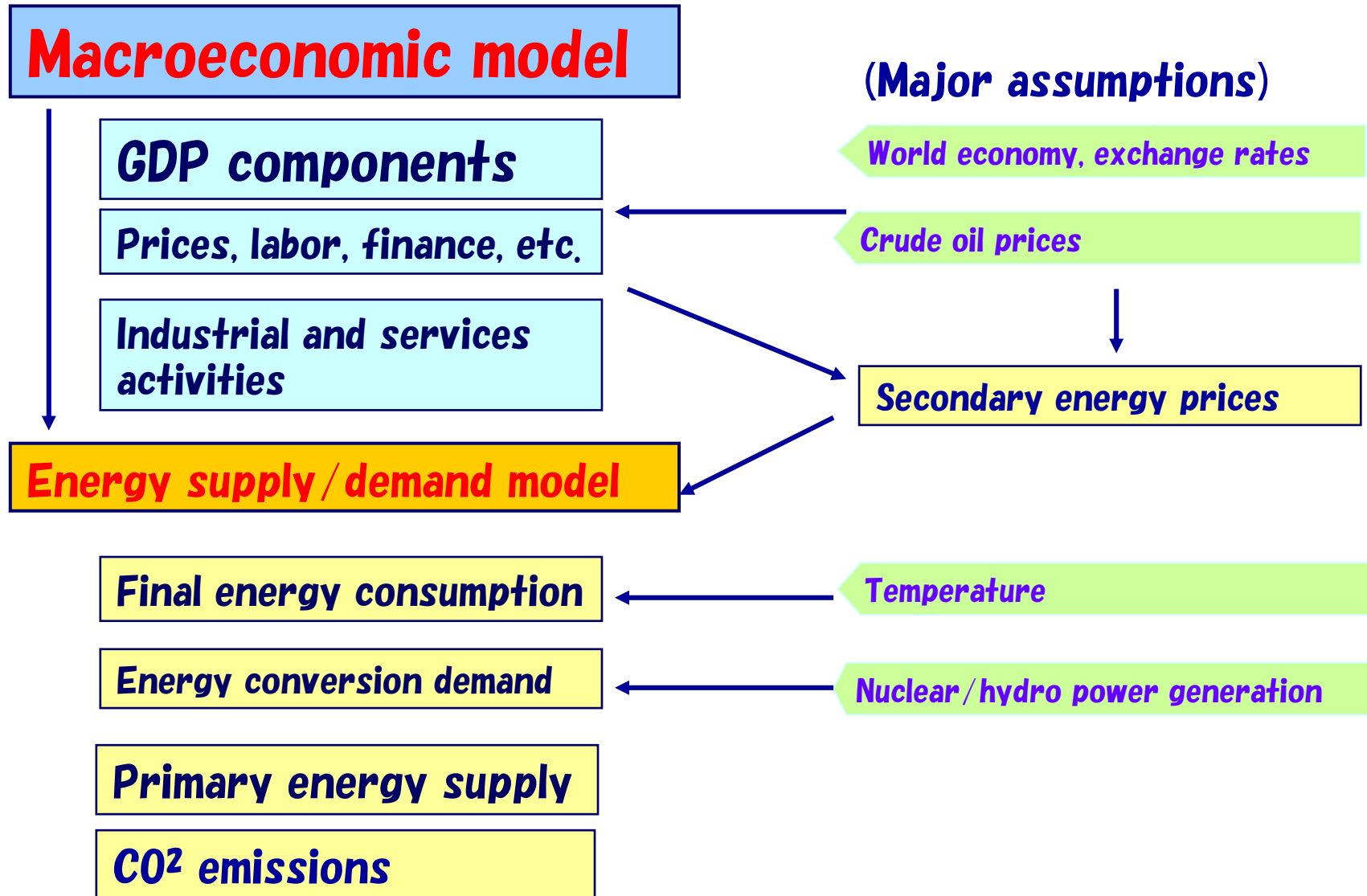
## ◆ Case

Base case

Analysis on effects of changes (FY2011)

- ◇ Crude oil price: Higher price (+\$10)/Lower price (-\$10)
- ◇ Economic growth: Higher growth (+1%)/Lower growth (-1%)
- ◇ Ambient temperature: (Summer (+1°C)/Winter(-1°C))

# Flow of Model Analysis



To gain a consistent understanding of the key elements which define future supply and demand and a variety of causal relations in econometric terms.

# Economic and Energy Demand Trends

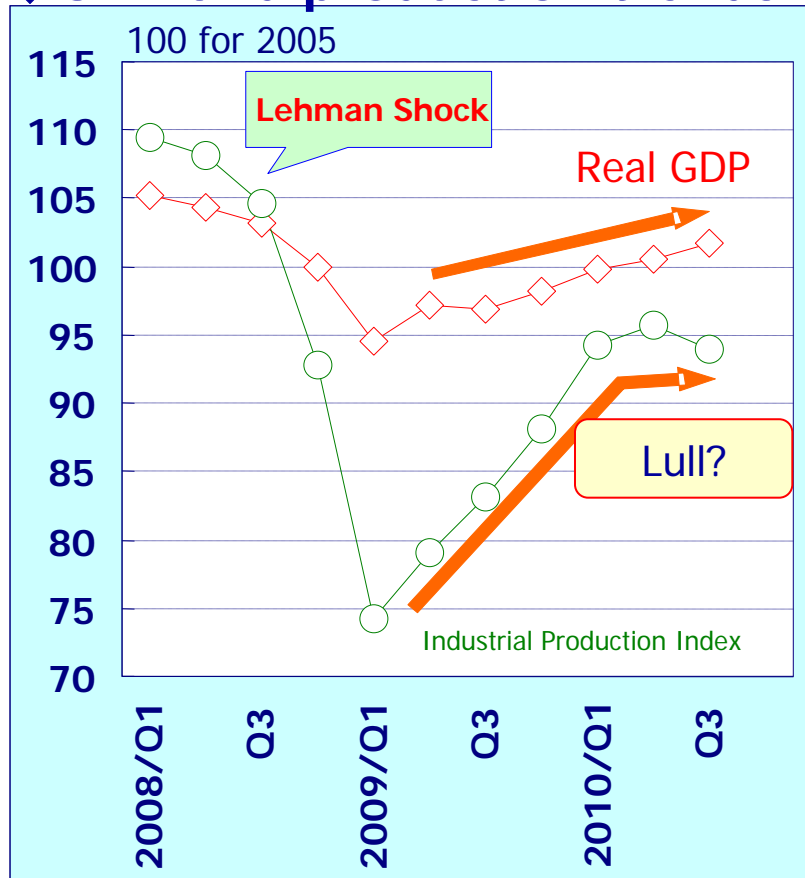
- ◆ Economy and energy prices
- ◆ Electricity sales
- ◆ Town gas sales
- ◆ Fuel oil sales
- ◆ Sector-by-sector breakdown
  - Industrial sector
  - Residential sector
  - Commercial sector
  - Transportation sector

# Macroeconomic Trends

IEEJ: February 2011



## ◆ GDP and production trends



## ◆ Crude oil import price (CIF)



Sources: Cabinet Office, *Preliminary National Income Statistics*; Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes*; Institute of Energy Economics, Japan

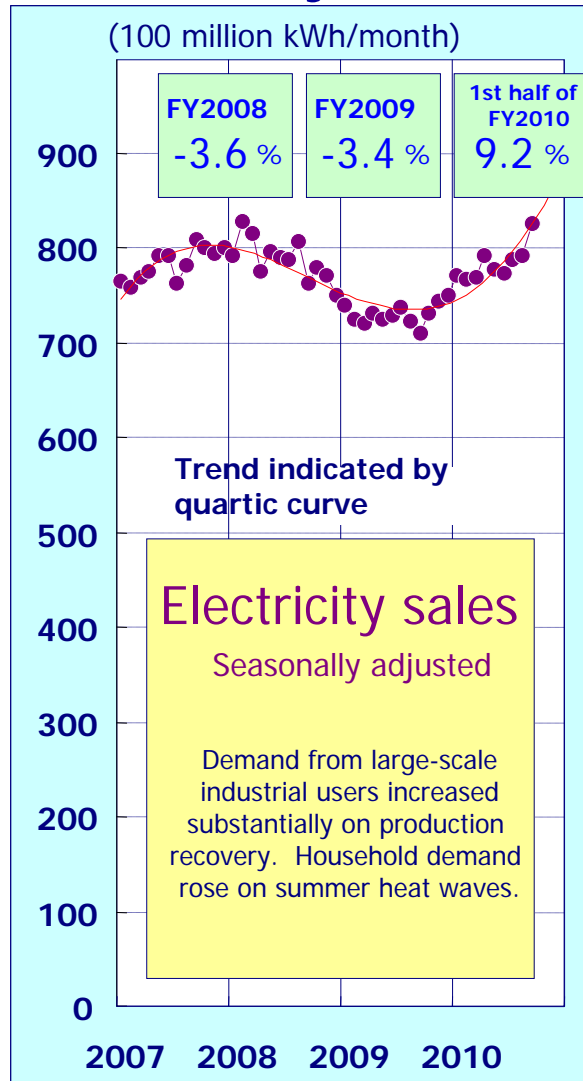
The Japanese economy is on a firm recovery path. But a decline could come in reaction to the expiration of consumption stimuli. The benchmark crude oil price remains around \$80/barrel.

# Energy Demand Trends

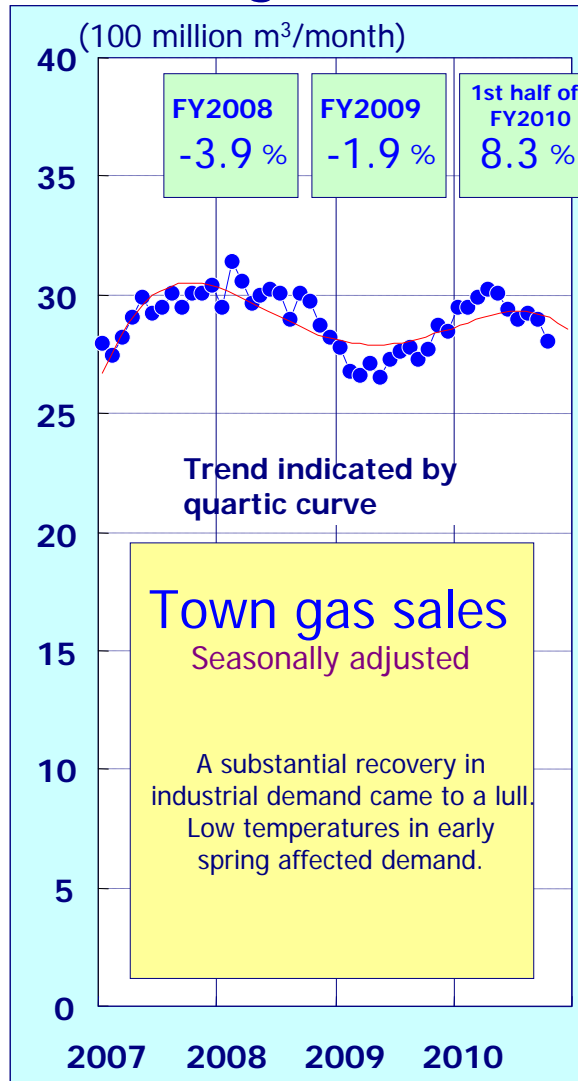
IEEJ: February 2011



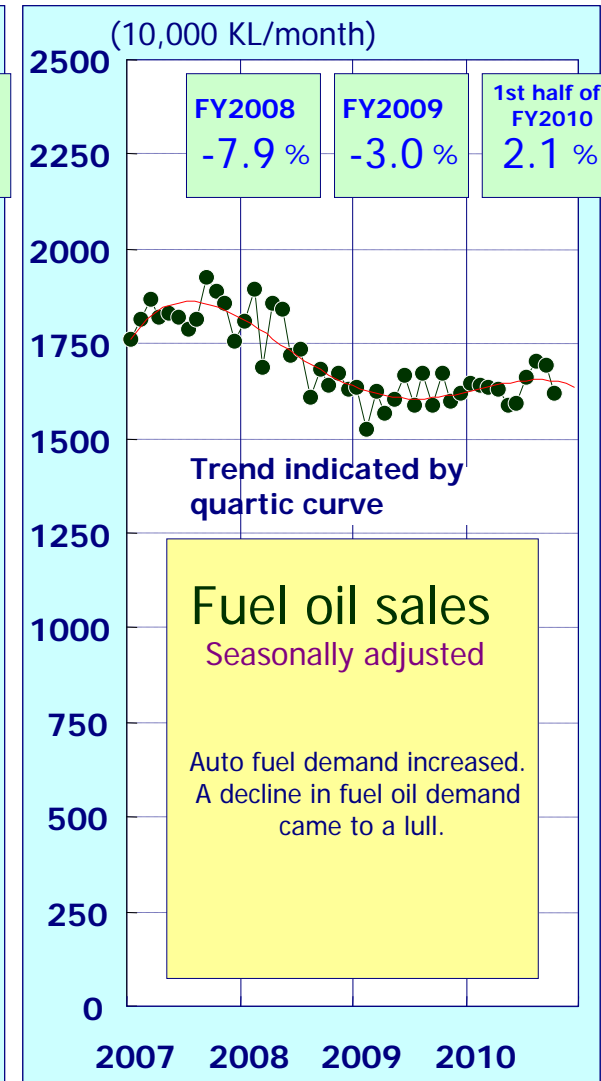
## ◆ Electricity



## ◆ Town gas



## ◆ Oil (fuel oil)

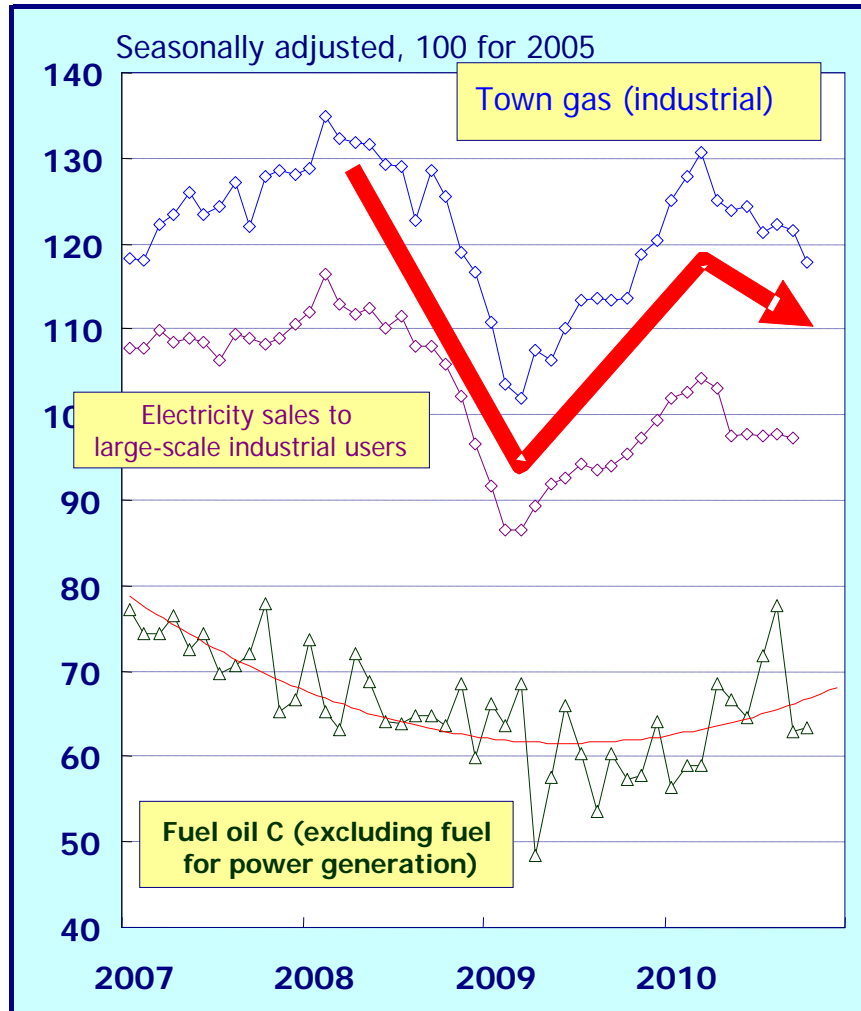


Sources: Ministry of Economy, Trade and Industry, *Monthly Electricity Survey and Statistics* (estimates based on statistics before April 2010 revisions), *Monthly Gas Industry Statistics*, *Monthly Resources and Energy Statistics*

# 【Industrial Sector】Electricity

demand from large-scale industrial users, town gas, fuel oil C

## Demand Trends for Each Energy Category



## Correlation between Production Trends and Electricity Demand



Sources: Earlier-listed sources; 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. Electricity sales to large-scale industrial users have been estimated by EDMC based on data before April 2010 revisions.

**Industrial energy demand has been largely affected by economic fluctuations. A sharp recovery in town gas and electricity demand has come to a lull. Oil demand is bottoming out. A switch from oil to town gas and electricity seems to be continuing.**



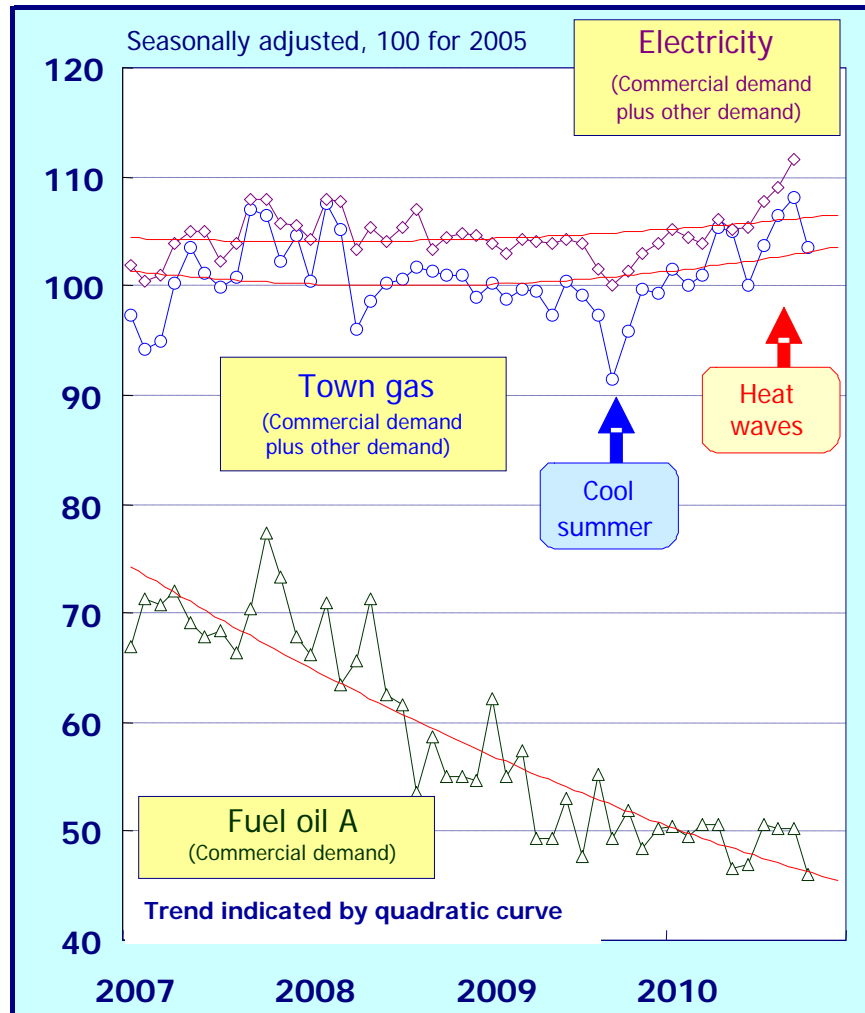
# 【Commercial Sector】

IEEJ: February 2011

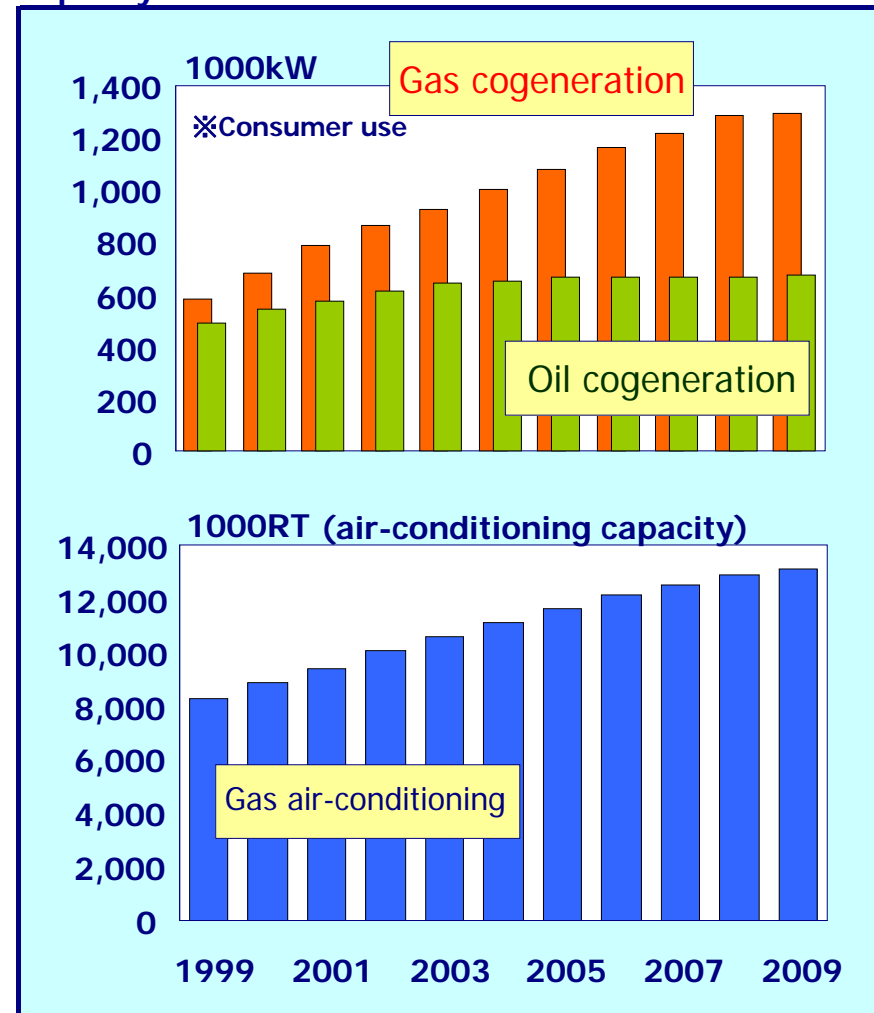
Electricity, town gas, fuel oil A



Demand Trends for Each Energy Category



Gas Cogeneration Capacity and Gas Air-conditioning Capacity



Sources: Earlier-listed sources and EDMC estimates for energy demand; Center for Promotion of Natural Gas; Japan Gas Association. Note: Electricity includes power subject to deregulation.

Electricity and gas demand has increased on an economic recovery (and last summer's heat wave). Fuel oil A demand has continued to fall on a growing switch to electricity and gas.

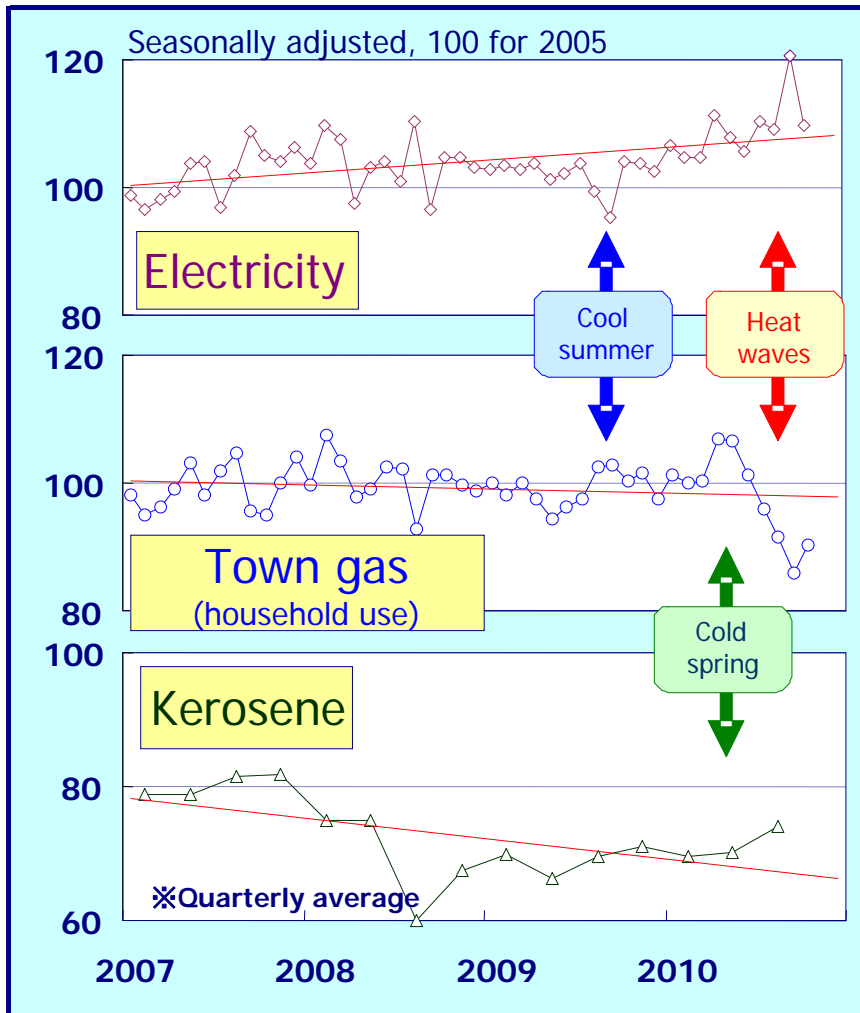
# 【Residential Sector】

IEEJ: February 2011

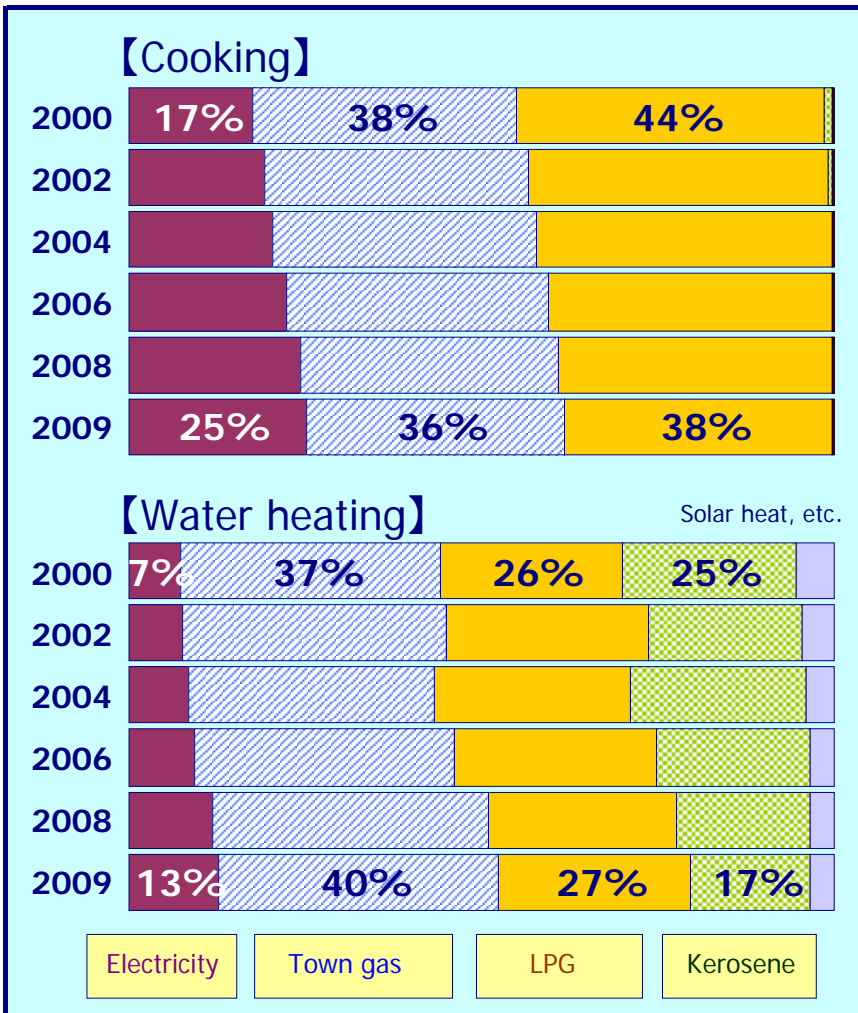
Electricity, town gas, kerosene



## Demand Trend for Each Energy Category



## Energy Mix by Use

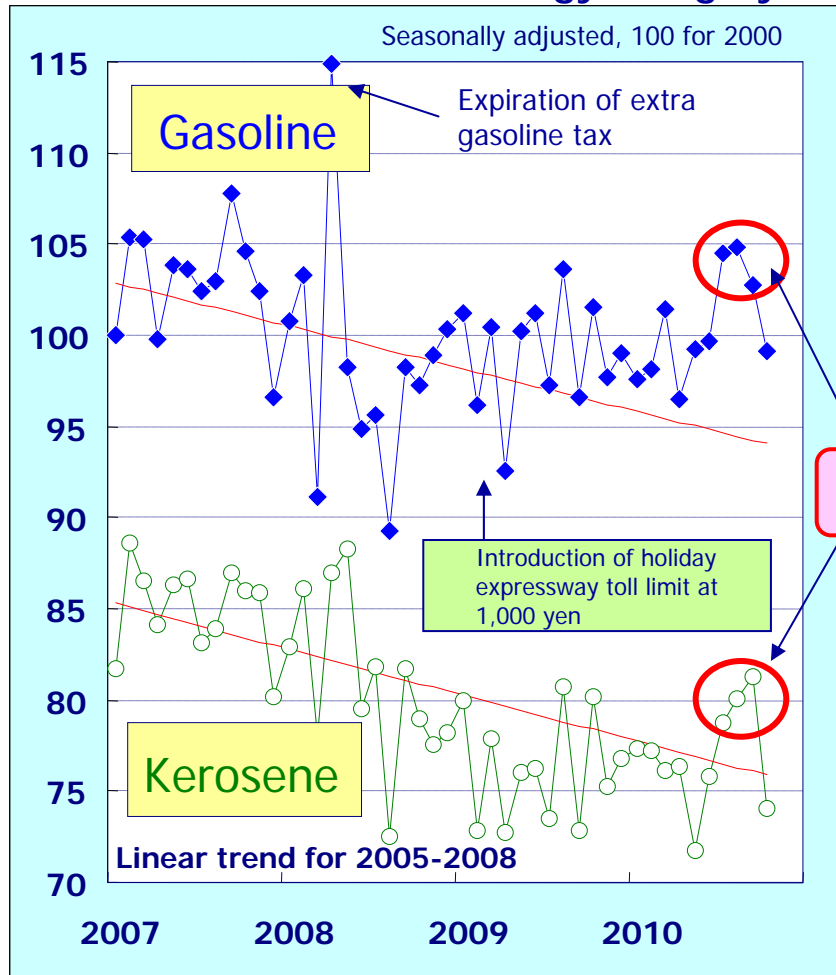


Sources: Earlier-listed sources for energy demand; EDMC estimates for energy mix by use.

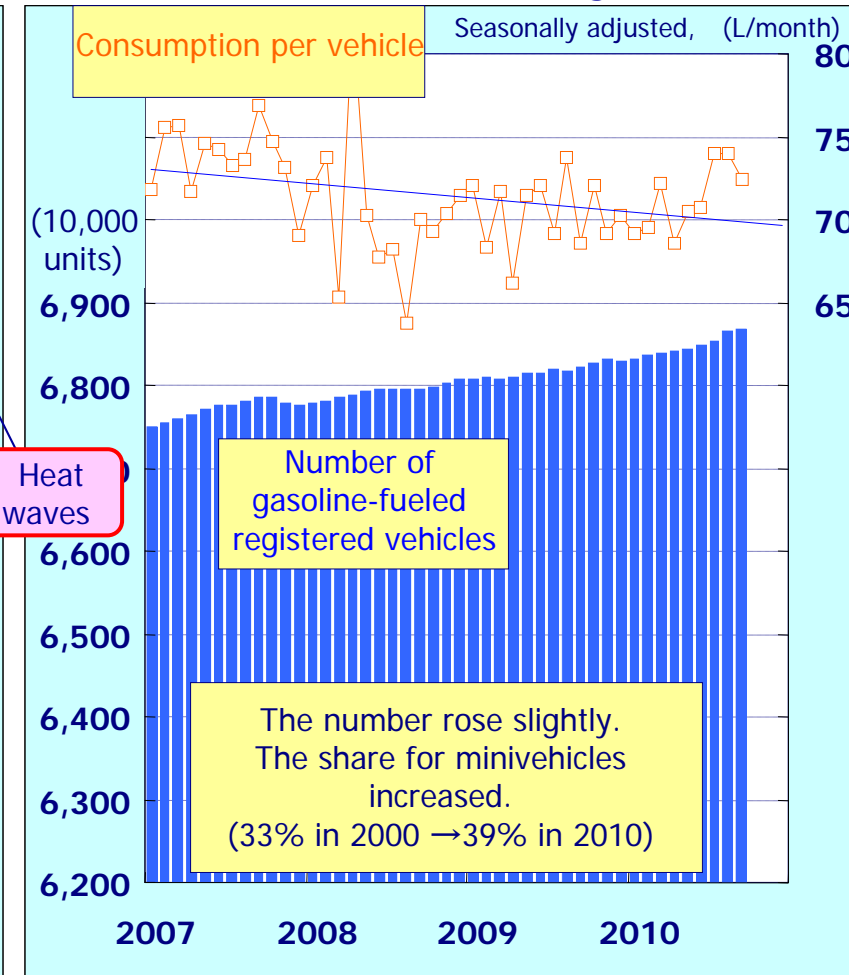
Temperature changes have great influences on household energy demand. Effects of all-electric houses are gradually spreading.

# 【Transportation Sector】

Demand Trend for Each Energy Category



Number of Gasoline-fueled Registered Vehicles



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

Gasoline demand has turned upward on such factors as the introduction of the holiday expressway toll limit at 1,000 yen. A kerosene demand fall might have come to a lull on growing cargo traffic.

# Estimation of Policy Effects (FY2009)

	Effects on energy demand	Degree of effects
Electrical appliance eco-point system	Electricity down 270 million kWh	Residential electricity consumption down 0.1%
Tax cuts and subsidies for eco-friendly vehicles	Gasoline down 300,000 KL	Gasoline demand down 0.6%
1,000 yen limit on holiday expressway toll	Gasoline up 800,000 KL	Gasoline demand up 1.3%

Source: IEEJ

Momoko Aoshima, "Analysis of Effects of Electrical Appliance Eco-point System Introduction on Energy Consumption"

<http://eneken.ieej.or.jp/data/3459.pdf>

Shigeru Suehiro, "Energy-saving Effects of Tax Cuts and Subsidies for Eco-friendly Vehicles"

<http://eneken.ieej.or.jp/data/3499.pdf>

Akira Yanagisawa, "Analysis of Effects of Expressway Toll Reduction/Elimination and Extra Gasoline Tax Expiration"

<http://eneken.ieej.or.jp/data/2856.pdf>

# Major Assumption and Economic Outlook

- ◆ GDP, prices and other economic indicators
- ◆ Industrial material production and other production activities
- ◆ Temperature, nuclear/hydro power generation

# Macroeconomic Indicator Outlook **[Base case]**

IEEJ: February 2011



	Actual FY2009	Forecast		Change from previous year (%)		
		FY2010	FY2011	FY2009	FY2010	FY2011
Nominal GDP (in trillions of yen)	<b>474.0</b>	<b>481.4</b>	<b>485.2</b>	-3.7	1.6	0.8
<b>Real GDP (in trillions of yen)</b>	<b>526.7</b>	<b>543.8</b>	<b>551.4</b>	<b>-2.4</b>	<b>3.2</b>	<b>1.4</b>
Private consumption	<b>304.0</b>	<b>309.0</b>	<b>310.0</b>	0.0	1.6	0.3
Nonresidential investment	<b>70.6</b>	<b>73.5</b>	<b>75.6</b>	-13.6	4.1	2.8
Public demand	<b>121.9</b>	<b>122.2</b>	<b>121.9</b>	5.1	0.2	-0.2
Exports	<b>72.7</b>	<b>85.3</b>	<b>89.7</b>	-9.6	17.4	5.1
Industrial production index (100 for 2005)	<b>86.0</b>	<b>93.3</b>	<b>95.5</b>	-9.0	8.5	2.4
Consumer price index (100 for 2005)	<b>100.0</b>	<b>99.2</b>	<b>98.6</b>	-1.6	-0.8	-0.7
Crude oil import price (\$/barrel)	<b>69.1</b>	<b>80.9</b>	<b>85.0</b>	-23.2	17.1	5.1
Exchange rate (yen/dollar)	<b>92.8</b>	<b>86.0</b>	<b>85.0</b>	-7.6	-7.4	-1.1

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

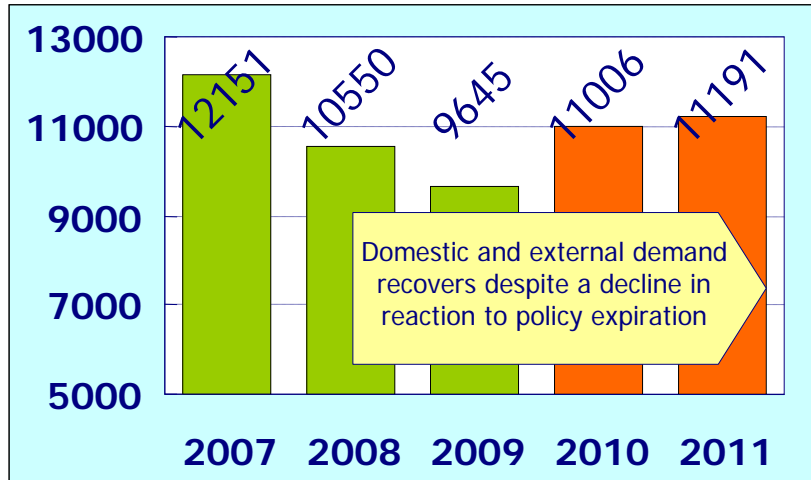
**(FY2011) The economic growth driver will gradually shift from exports to domestic demand. The Japanese economy will grow for the second straight year.**

# Industrial Material Production Outlook **【Base case】**

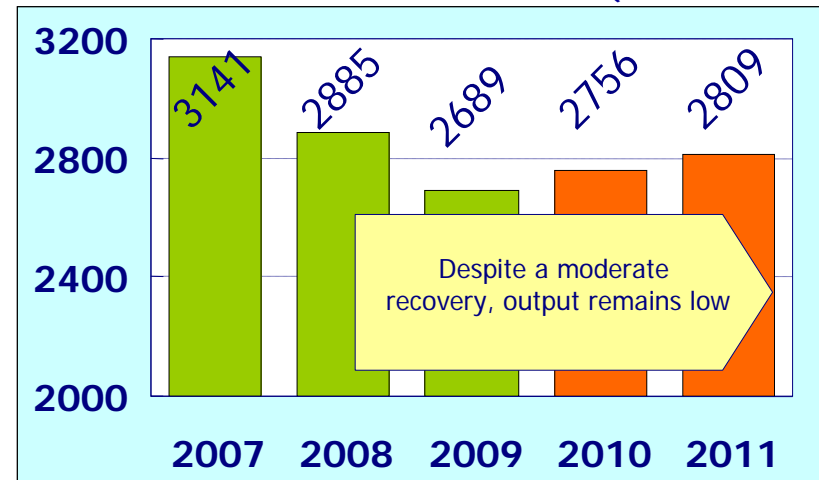
IEEJ: February 2011



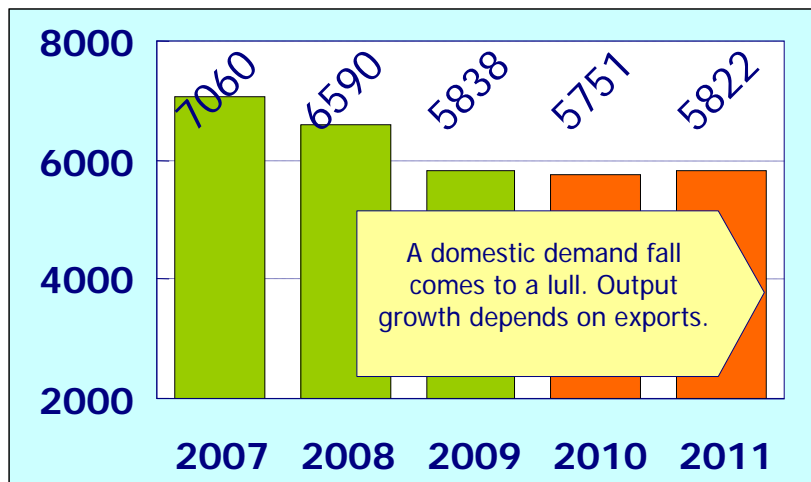
(1) Crude steel output (in tens of thousands of tons)



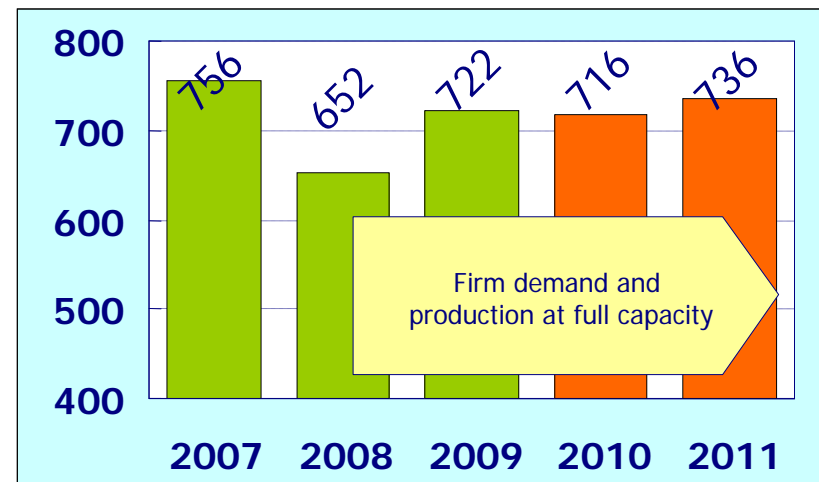
(2) Paper and paperboard output (in tens of thousands of tons)  
(12-month moving total)



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



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



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*; Japan Cement Association, *Cement Supply/Demand*; Forecasts from IEEJ

# Production, Services and Registered Vehicle Outlook

**【Base case】**

(100 for 2005)	Actual FY2009	Forecast		Change from previous year (%)		
		FY2010	FY2011	FY2009	FY2010	FY2011
Nonferrous metals	<b>84.0</b>	<b>89.0</b>	<b>91.6</b>	-5.3	6.0	2.9
Ordinary/electrical machinery, etc. ※	<b>82.5</b>	<b>96.5</b>	<b>99.5</b>	-13.0	17.1	3.0
Industrial production index	<b>86.0</b>	<b>93.3</b>	<b>95.5</b>	-9.0	8.5	2.4
Vehicle output (in tens of thousands of units)	<b>887</b>	<b>925</b>	<b>953</b>	-11.4	4.3	3.0
Tertiary industry activity index	<b>96.7</b>	<b>98.8</b>	<b>100.3</b>	-3.4	2.2	1.6
Number of gasoline-fueled registered vehicles (in tens of thousands)	<b>6,823</b>	<b>6,867</b>	<b>6,883</b>	0.4	0.6	0.2
Number of diesel-fueled registered vehicles (in tens of thousands)	<b>676</b>	<b>632</b>	<b>586</b>	-6.4	-6.5	-7.3

Sources: Ministry of Economy, Trade and Industry, *Industrial Production, Shipment and Inventory Indexes, and others* for actual data; Forecasts from IEEJ

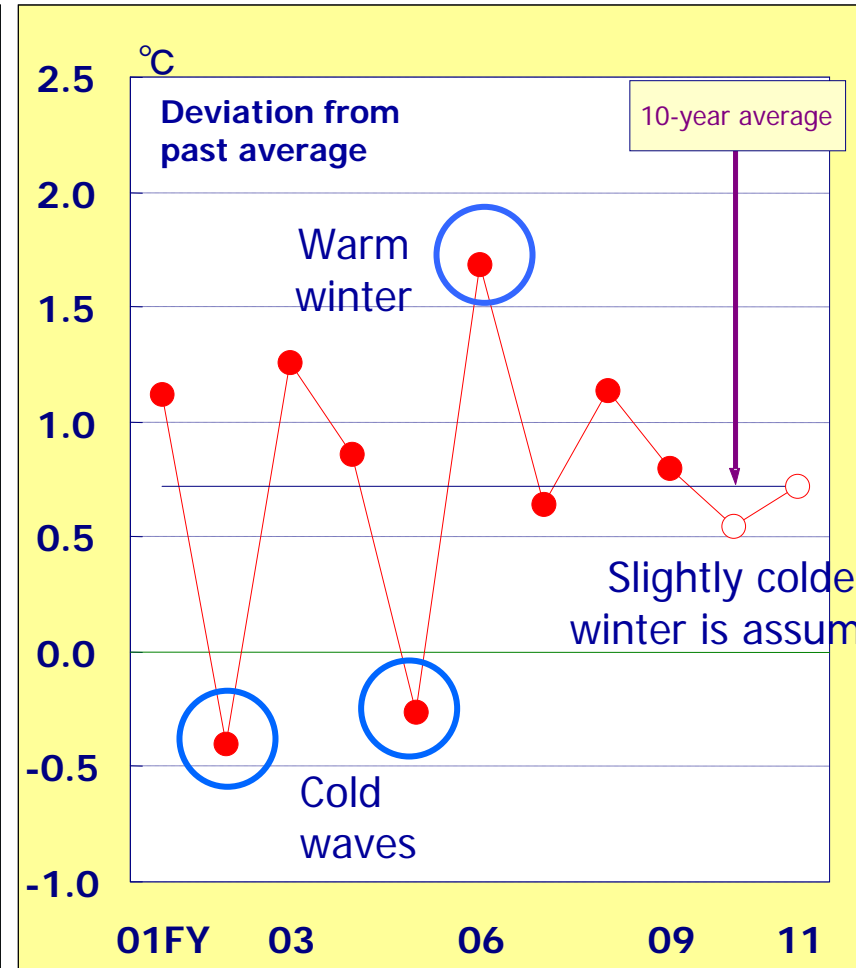
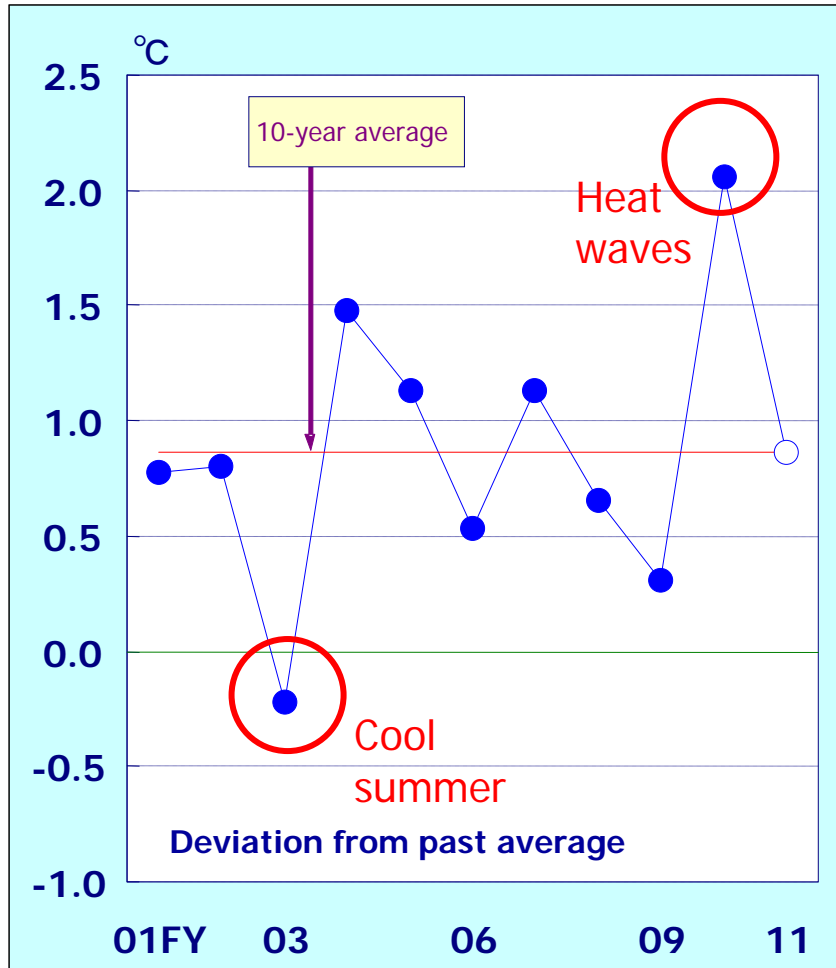
Note: Ordinary/electrical machinery, etc. includes ordinary machines, electrical machines, information and communications machines, electronic components/devices, precision machines and metallic products.)

**(FY2011) Growth in machinery (electrical appliances, vehicles and others) production will slow down on the expiration of relevant policies. The number of gasoline-fueled registered vehicles will increase slightly, with the share for minivehicles increasing.**



# Temperature Assumptions

Summer (June-September) temperature assumption    Winter (November-March) temperature assumptions

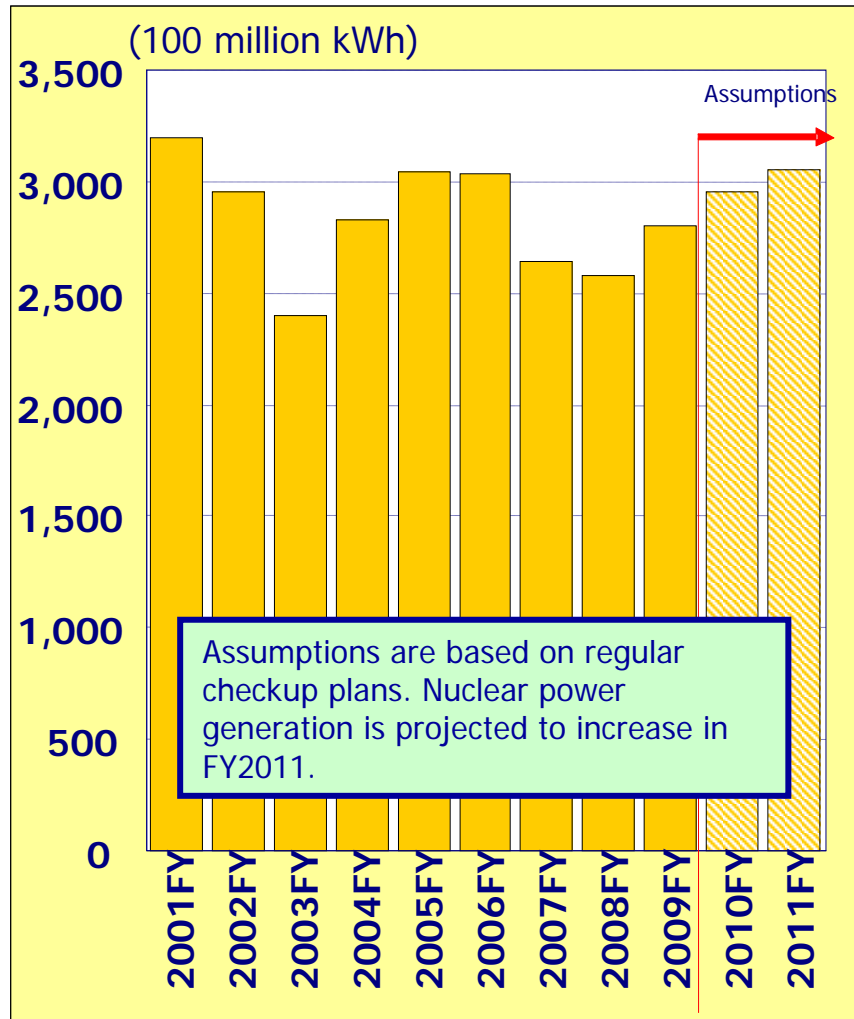


Sources: Japan Meteorological Agency and EDMC estimates. Actual data before December 2010. The past average represents the 1971-2000 average.

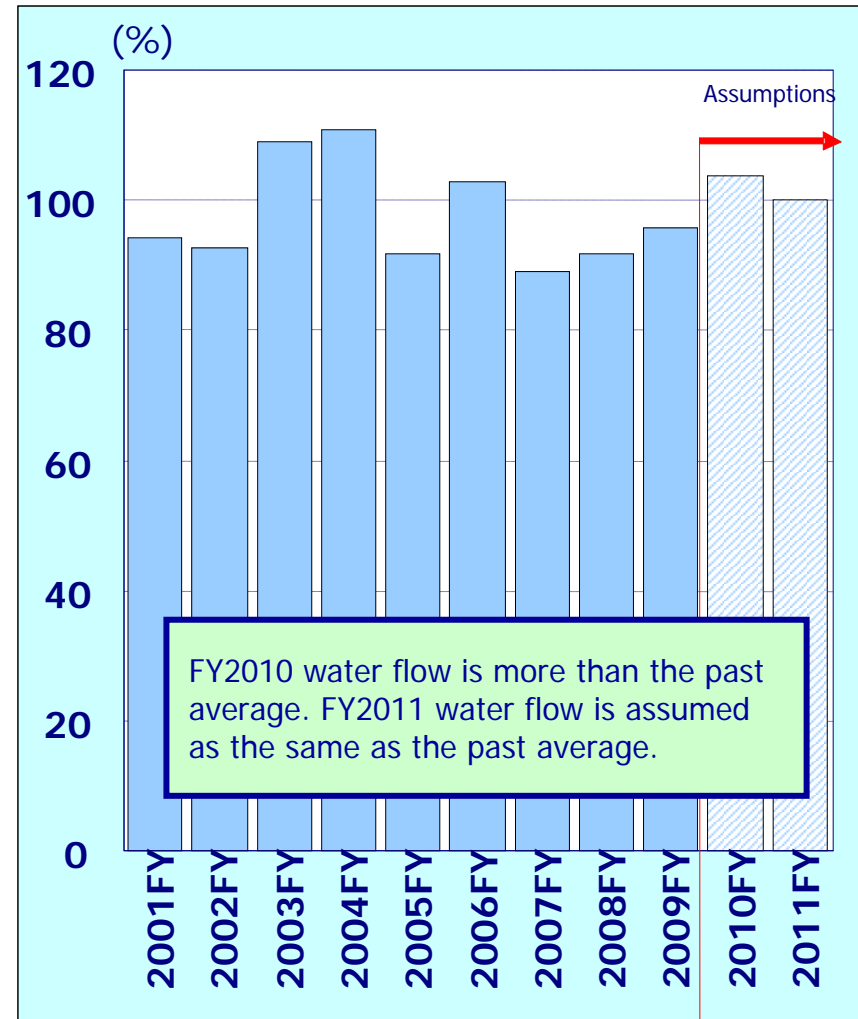
Note: The Japan Meteorological Agency's seasonal forecast is reflected for the FY2010 winter.

# Nuclear/Hydro Power Generation Assumptions

Nuclear Power Generation Results and Assumptions



Water Flow Rate Results and Assumptions



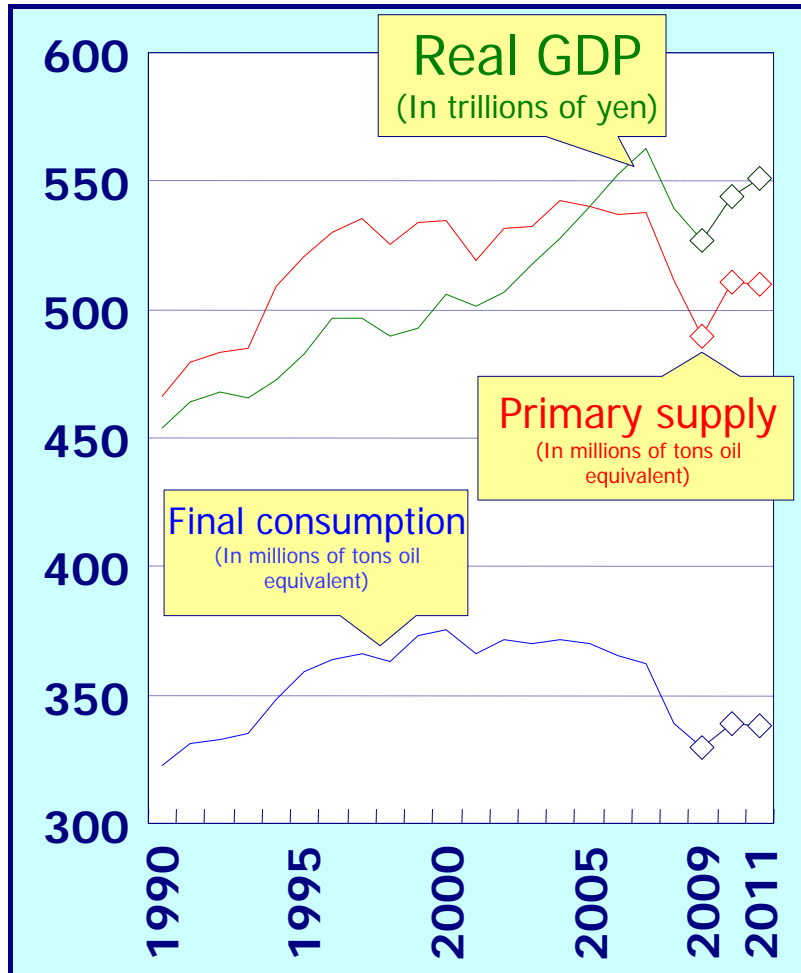
Note: Actual data before December 2010 for both nuclear power generation and water flow

# Energy Supply/Demand Outlook

- ◆ Final energy consumption and primary energy supply outlook
- ◆ Electricity, town gas and fuel oil sales

# Energy Demand Outlook

【Base case】



		Actual		Forecast	
		2008	2009	2010	2011
	(FY)				
Real GDP	Trillion yen	539	527	544	551
	(Year-on-year change)	(-4.1)	(-2.4)	(3.2)	(1.4)
Final energy consumption	In millions of tons oil equivalent	339	329	339	338
	(Year-on-year change)	(-6.4)	(-2.8)	(2.8)	(-0.2)
Primary energy supply	In millions of tons oil equivalent	511	490	510	510
	(Year-on-year change)	(-4.9)	(-4.2)	(4.1)	(-0.1)

Source: Results from Cabinet Office and IEEJ; Forecasts from IEEJ

(FY2011) While economic growth will continue, energy demand will decline slightly in reaction to heavy year-before air-conditioning demand.

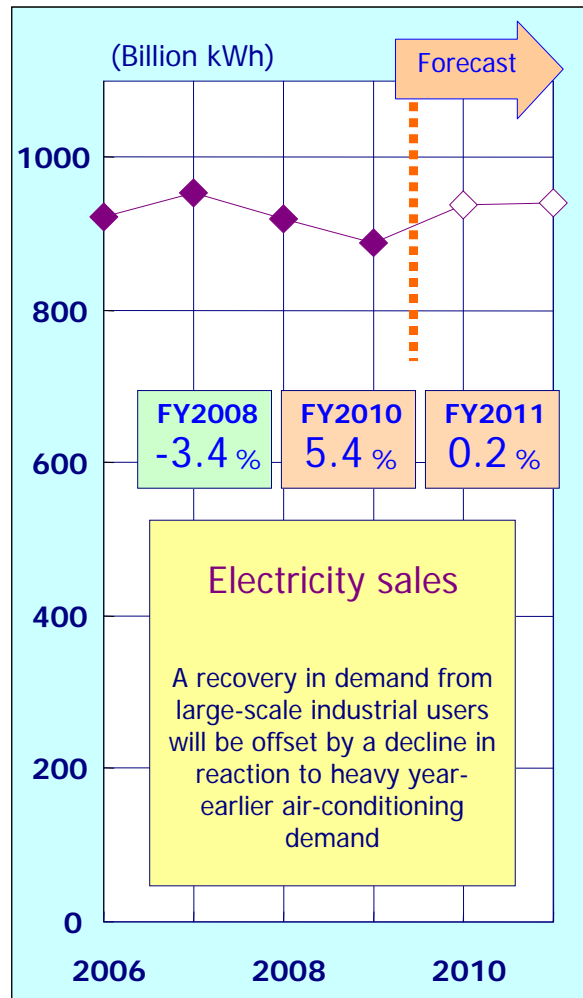
# Energy Sales Outlook

IEEJ: February 2011

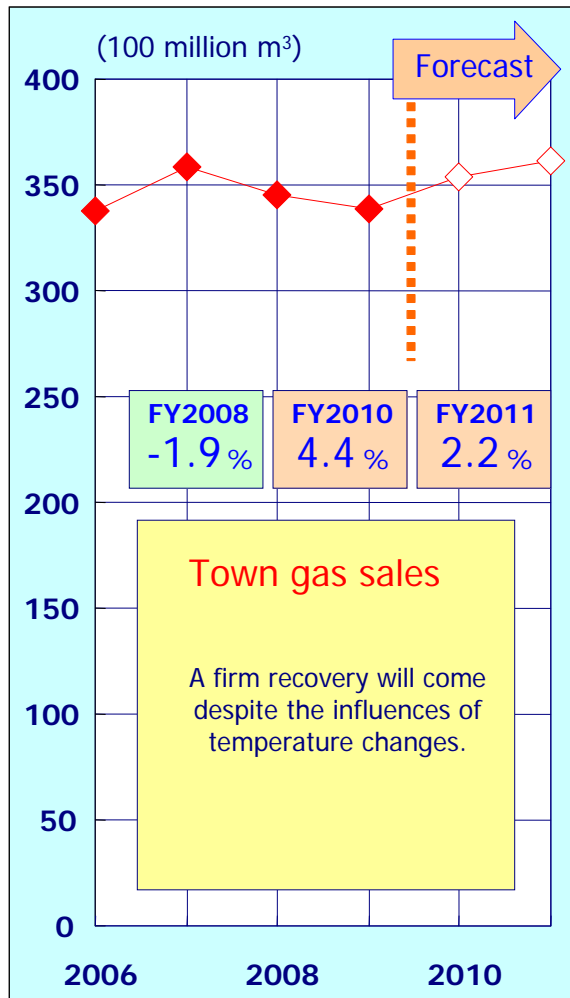


【Base case】

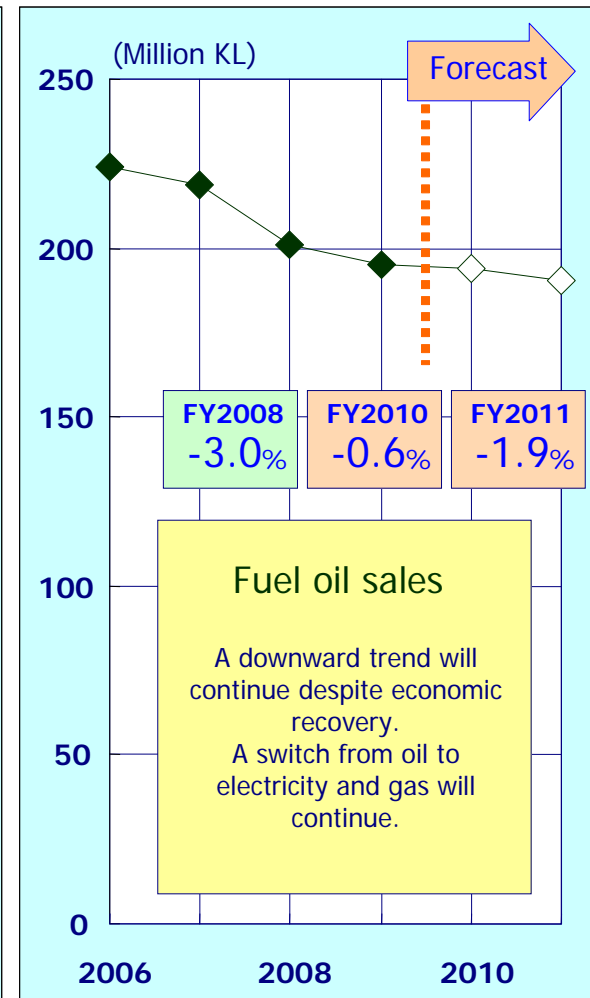
## ◆ Electricity



## ◆ Town gas



## ◆ Oil (fuel oil)



Sources: Actual data from 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 **【Base case】**

IEEJ: February 2011



(Billion kWh)	Results	Forecasts		Change from previous year (%)		
	FY2009	FY2010	FY2011	FY2009	FY2010	FY2011
Residential	<b>285.0</b>	<b>299.9</b>	<b>295.5</b>	-0.1	5.2	-1.5
Non-residential*	<b>604.4</b>	<b>637.6</b>	<b>643.9</b>	-4.9	5.5	1.0
<b>Total</b>	<b>889.4</b>	<b>937.5</b>	<b>939.4</b>	-3.4	5.4	0.2
Large-scale industrial user demand	<b>280.9</b>	<b>300.6</b>	<b>305.2</b>	-6.3	7.0	1.5
Chemical	<b>26.7</b>	<b>28.1</b>	<b>28.5</b>	-10.9	5.4	1.2
Steel	<b>46.3</b>	<b>52.8</b>	<b>53.1</b>	-9.7	14.1	0.6
Machinery/instruments	<b>69.5</b>	<b>76.4</b>	<b>78.6</b>	-8.8	9.9	2.9

Sources: Results from Ministry of Economy, Trade and Industry, *Monthly Electricity Survey and Statistics*; forecasts from IEEJ.

Note: Non-residential demand includes liberalized-segment demand. Although statistical categories were revised in April 2010, we used categories before revisions in a bid to give priority to continuity of data.

**(FY2011)**

**Residential:** Despite households' growing switch to electricity, residential demand will fall substantially in reaction to heavy year-before air-conditioning demand.

**Large-scale industrial user demand:** Demand growth will be limited on a slowdown in production recovery.

# Town Gas Sales by User Category **【Base case】**

IEEJ: February 2011



(100 million m <sup>3</sup> )	Results	Forecasts		Change from previous year (%)		
	FY2009	FY2010	FY2011	FY2009	FY2010	FY2011
Residential	<b>96.3</b>	<b>97.2</b>	<b>98.1</b>	-0.2	1.0	0.9
Commercial	<b>46.2</b>	<b>47.7</b>	<b>48.4</b>	-3.0	3.2	1.5
Industrial	<b>167.1</b>	<b>177.6</b>	<b>183.8</b>	-3.1	6.3	3.5
Other	<b>28.9</b>	<b>30.9</b>	<b>30.7</b>	1.2	7.0	-0.7
<b>Total</b>	<b>338.4</b>	<b>353.3</b>	<b>361.0</b>	-1.9	4.4	2.2

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

(FY2011)

**Residential:** Despite an increase in the number of contracts, per-contract demand will follow a downward trend.

**Commercial and other:** Services activities will recover, while air-conditioning demand will fall in reaction to heavy year-before demand.

**Industrial:** Demand will increase on production recovery.

Town gas demand has become more sensitive to production trends than to temperature trends.

# Fuel Oil Sales Breakdown

IEEJ: February 2011



**【Base case】**

(Million KL)	Results	Forecast		Change from previous year (%)		
	FY2009	FY2010	FY2011	FY2009	FY2010	FY2011
Gasoline	57.6	57.6	55.9	0.1	0.1	-3.0
Naphtha	47.3	47.2	48.2	10.4	-0.2	2.1
Kerosene	20.0	19.8	18.9	-1.0	-1.5	-4.3
Diesel oil	32.3	32.4	31.6	-4.4	0.3	-2.4
Fuel oil A	16.0	15.3	14.7	-10.3	-4.7	-3.7
Fuel oil B/C	16.4	16.0	15.3	-29.2	-2.6	-4.4
For power generation	7.2	6.5	6.2	-43.7	-10.0	-4.6
<b>Total</b>	<b>194.9</b>	<b>193.7</b>	<b>190.0</b>	<b>-3.0</b>	<b>-0.6</b>	<b>-1.9</b>
LPG sales (million t)	16.4	16.4	16.4	-5.5	-0.2	0.3

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

(FY2011)

**Gasoline/diesel:** Demand will fall on fuel and transportation efficiency improvements as well as a reaction to year-before heat waves.

**Kerosene:** Households will growingly switch to electricity and gas.

**Fuel oil:** A switch from fuel oil to electricity and gas will continue, while industrial production will recover. Demand for fuel oil for power generation will decline on an increase in nuclear power generation.



# Final Energy Consumption by Sector

IEEJ: February 2011

**【Base case】**



(Million tons oil equivalent)		Results FY2009	Forecast		Change from previous year (%)		
			FY2010	FY2011	FY2009	FY2010	FY2011
Industrial		<b>154.9</b>	<b>161.0</b>	<b>163.0</b>	-3.5	3.9	1.3
Residential		<b>51.6</b>	<b>52.9</b>	<b>52.1</b>	-0.5	2.5	-1.5
Commercial		<b>40.5</b>	<b>41.6</b>	<b>41.5</b>	-4.3	2.7	-0.3
Transportation		<b>82.4</b>	<b>83.3</b>	<b>81.4</b>	-2.1	1.1	-2.4
Total		<b>329.4</b>	<b>338.8</b>	<b>338.0</b>	-2.8	2.8	-0.2

Source: Results and forecasts from IEEJ

(FY2011)

**Industrial sector: Production including machinery output will continue to recover.**

**Residential/commercial sector: Air-conditioning demand will fall in reaction to heavy year-before demand.**

**Commercial sector demand will decline slightly, despite recovery in services activities.**

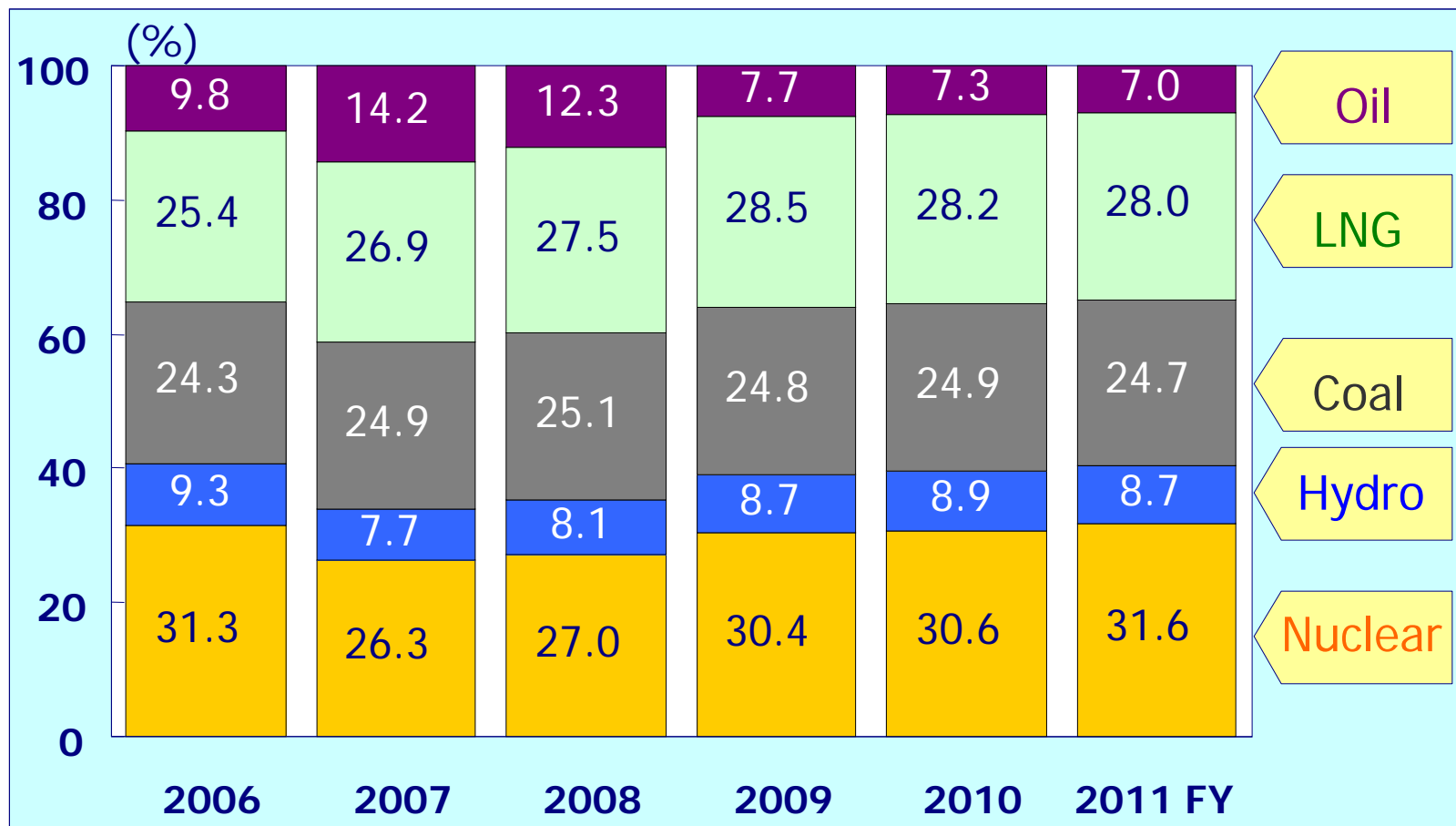
**Transportation sector: Demand will fall on fuel and transportation efficiency improvements as well as a reaction to year-before heat waves.**

# Power Mix (Power utilities, on an input basis) **【Base case】**

IEEJ: February 2011



**59% 66% 65% 61% 60% 60%** Thermal share



Source: Results and forecasts from IEEJ

**(FY2011) More new nuclear plants will start operation. Thermal power generation's share of total power generation will fall slightly.**

# Domestic Primary Energy Supply

IEEJ: February 2011

**【Base case】**



(Million tons oil equivalent)	Results	Forecast		Change from previous year (%)		
	FY2009	FY2010	FY2011	FY2009	FY2010	FY2011
Coal	<b>107.6</b>	<b>115.6</b>	<b>116.9</b>	-8.1	7.5	1.0
Oil	<b>209.6</b>	<b>209.2</b>	<b>205.2</b>	-6.2	-0.2	-1.9
Natural gas	<b>90.3</b>	<b>97.6</b>	<b>98.0</b>	-2.6	8.2	0.4
Hydro	<b>17.0</b>	<b>18.3</b>	<b>17.6</b>	1.0	7.6	-3.5
Nuclear	<b>58.9</b>	<b>62.2</b>	<b>64.3</b>	8.4	5.6	3.4
New energy	<b>6.7</b>	<b>7.3</b>	<b>7.6</b>	-5.0	9.9	3.1
Total	<b>490.0</b>	<b>510.3</b>	<b>509.6</b>	-4.2	4.1	-0.1
CO <sub>2</sub> (m. tons) ※ (100 for FY1990)	<b>1,075</b> <b>(101.5)</b>	<b>1,114</b> <b>(105.2)</b>	<b>1,106</b> <b>(104.4)</b>	-5.5	3.7	-0.8

Sources: Results from IEEJ and Ministry of the Environment; Forecasts from IEEJ ※ Energy-based CO<sub>2</sub>

(FY 2011) Although primary energy supply for power generation will decrease, coal supply will increase slightly on growth in industrial demand and natural gas supply on growth in town gas demand. Oil supply will continue to decline. CO<sub>2</sub> emissions will decrease slightly on temperature changes and more nuclear power generation.

# Sensitivity Analysis of Factors Affecting Energy Supply/Demand

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

# Analysis of Impact on Energy Supply/Demand

## Base case

FY2011 : GDP growth = 1.4%, C.I.F. crude oil price = about \$85/bbl

The crude oil price is based on Ken Koyama, *International Oil Situation and Oil Price Outlook for 2011*, December 22

### Impact of crude price changes

- Import price = about \$95/bbl (\$10 higher than in base case)
- Import price = about \$75/bbl (\$10 lower than in base case)

### Impact of economic changes

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

### Impact of temperature changes

- Temperature: Up 1°C (July-September) • • Hotter summer  
Down 1°C (January-March) • • Colder winter

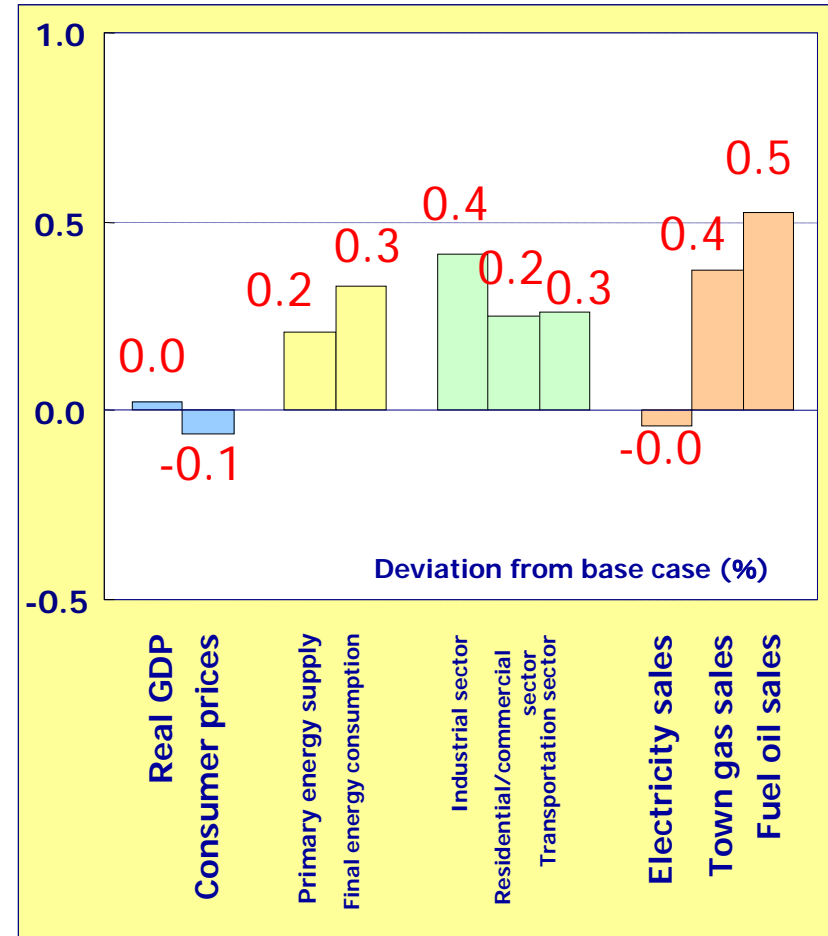
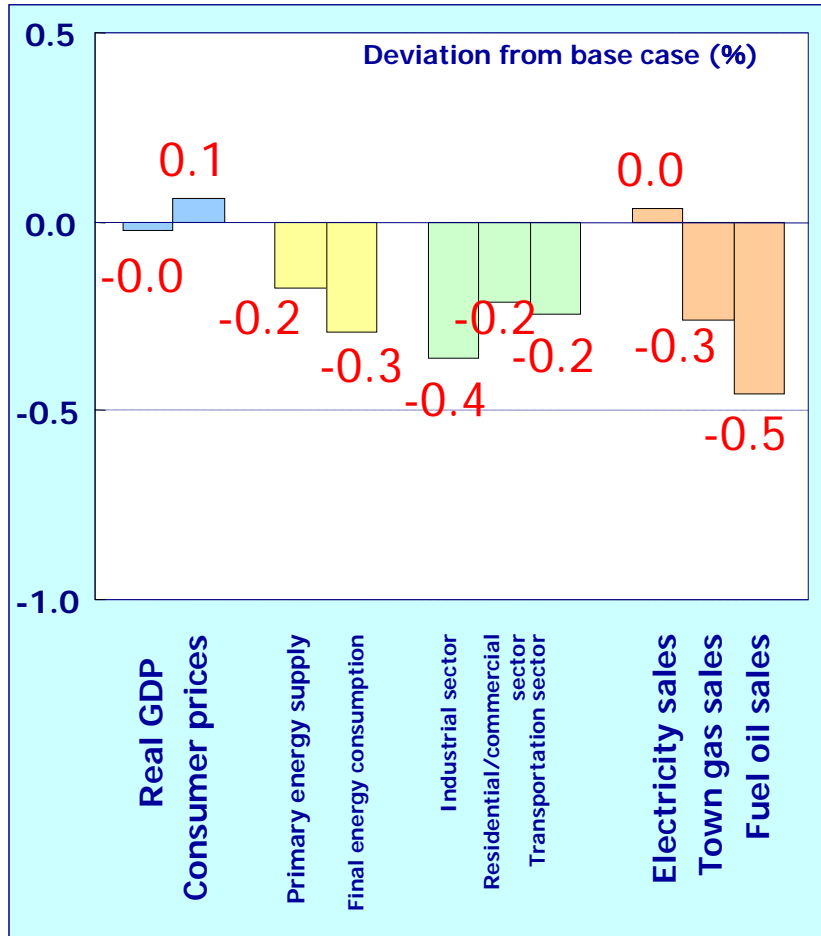
# Impact of Crude Oil Price Change

IEEJ: February 2011



Higher price case (\$10 higher than in base case)

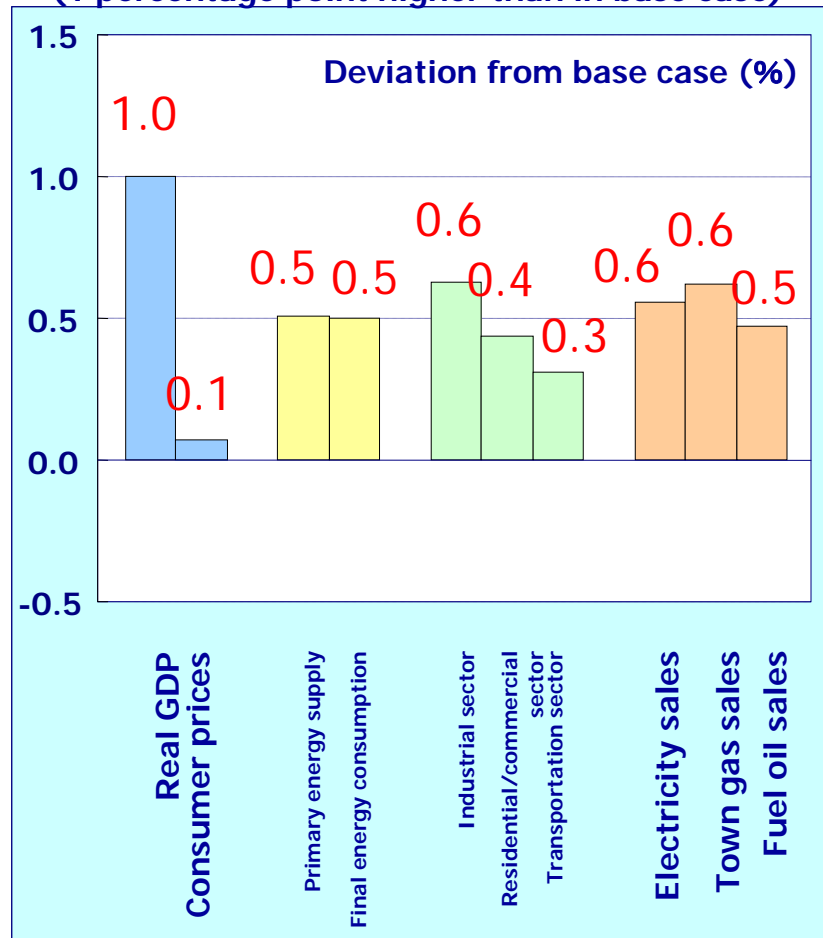
Lower price case (\$10 lower than in base case)



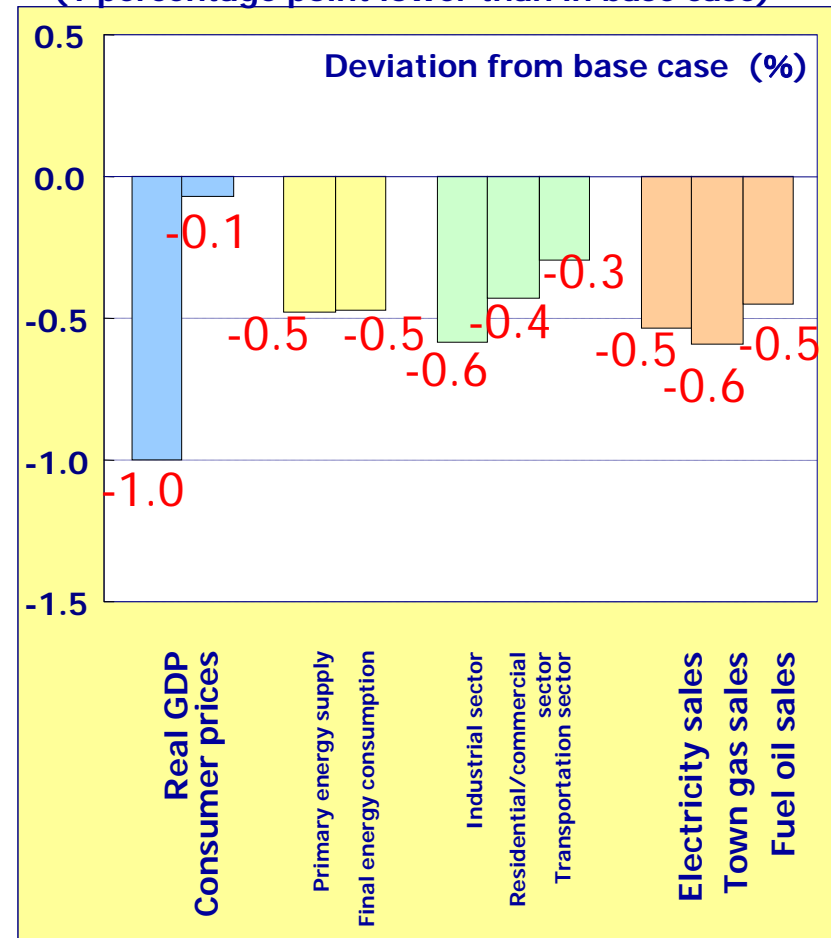
Energy demand changes have a greater impact on industries that are sensitive to economic conditions and price changes. The impact on electricity sales is opposite that on gas and oil sales because of relative price changes.

# Impact of Economic Growth Changes

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



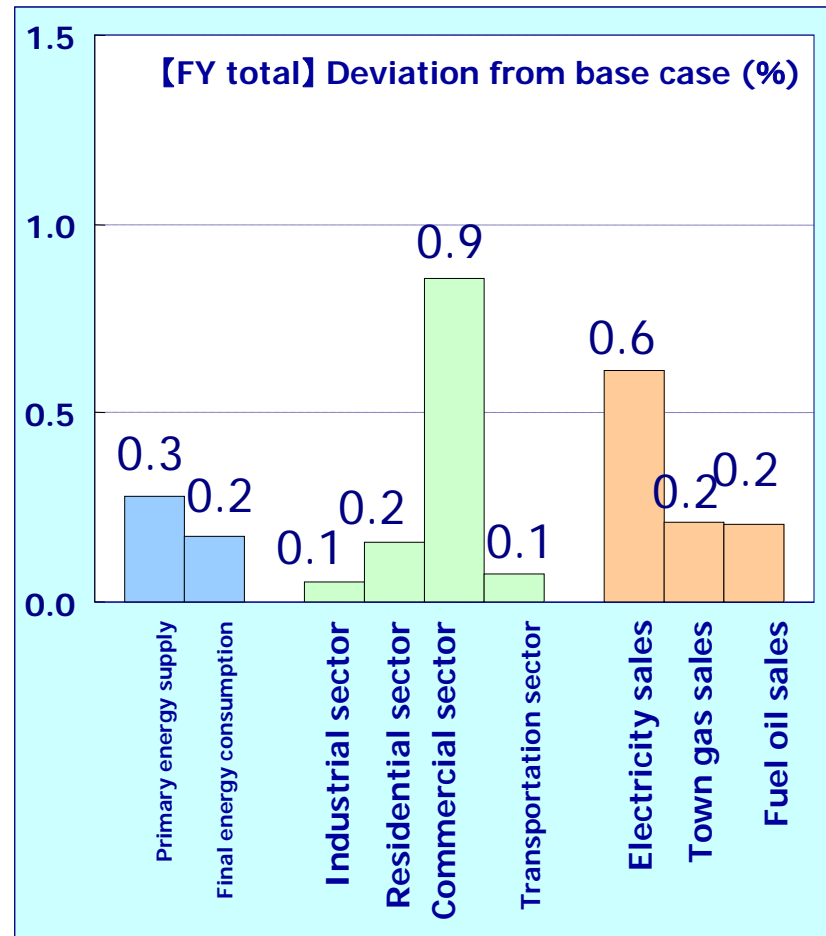
Lower growth case  
(1 percentage point lower than in base case)



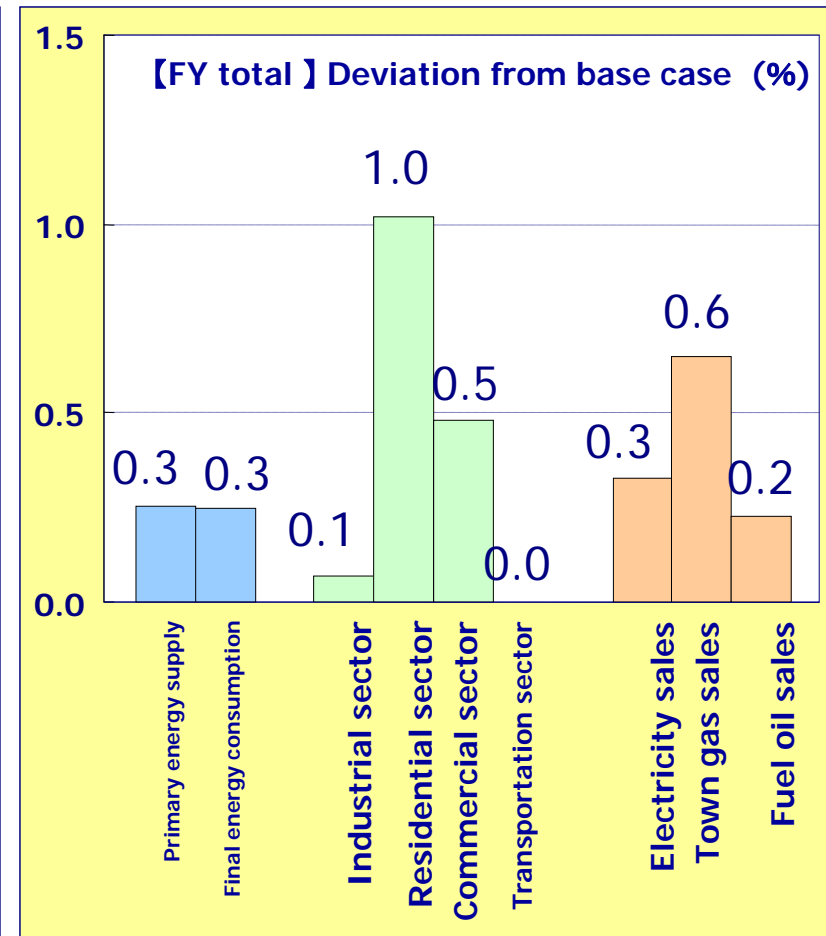
Energy consumption does not change as much as GDP growth changes.  
Among sectors, the industrial sector is sensitive to economic growth changes.

# Impact of Temperature Changes

## 1°C rise in July-September



## 1°C fall in January-March



Summer: Electricity demand rises sharply on an air-conditioning demand increase. An increase in demand for town gas for air-conditioning is offset by a decline in demand for gas for heating water.

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



- ◆ The Japanese economy will post **positive growth** for the second straight year. Recovery will slow down slightly on the expiration of economic stimuli. **Energy demand will decline on a temperature fall.**  
(FY 2011)  
Energy demand will rise in the industrial sector while falling in the residential/commercial and transportation sectors.  
Demand will level off for electricity, increase for town gas and decrease for oil.
  
- ◆ Economic recovery is still only half done. Energy consumption and **energy-based CO<sub>2</sub> emissions may increase.**
  - Projected falls in FY2011 are attributable to a reactionary temperature decline and greater nuclear power generation.
  
- ◆ While energy demand depends heavily on economic conditions, **energy demand in the transportation sector and oil demand are on a structural downward trend.**
  - Transportation sector: Falling population, fuel efficiency improvements, etc.
  - Oil: Falling demand for transportation fuel, a growing switch from oil to electricity and gas, etc.