

**SESSION 3: CHALLENGES AND SOLUTIONS FOR LOW CARBON FUTURE**

**Electricity is Key to a Sustainable and  
competitive Future**

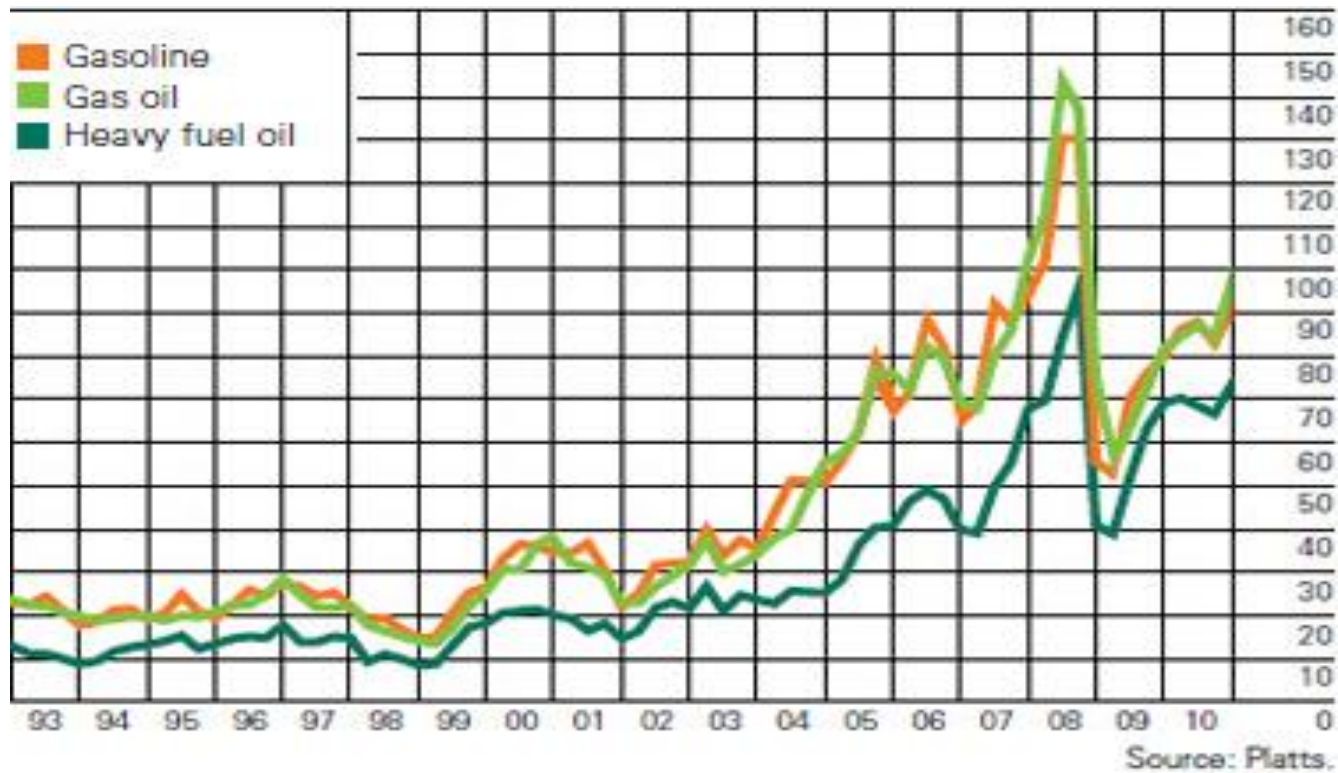
Mitsuho Uchida

2012 HAWAII ASIA PACIFIC INSTITUTE / NEAEF  
12TH EXPERT WORKING GROUP MEETING ON  
ENERGY AND ENVIRONMENT

# **Global Energy Risks in 21<sup>st</sup> Century**

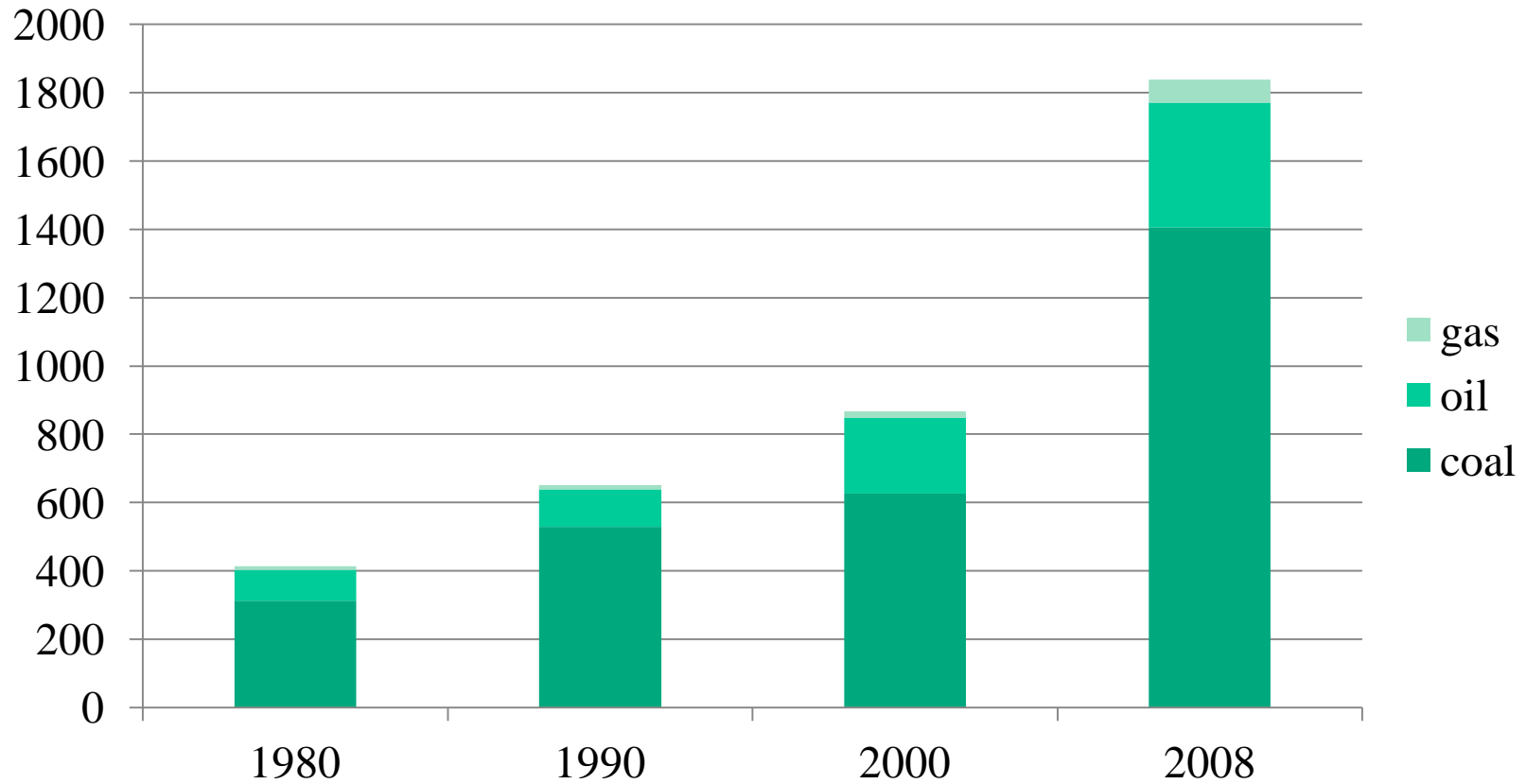
- 1. World energy demand will be expanding at higher speed. Most of emerging countries have great population.**
- 2. China : no.2 energy consumption and no.1 CO2 emissions, India:no.4 energy consumption and no.3 CO2 emissions**
- 3. Higher fossil fuel dependency in Asia may cause another oil shocks in near future.**
- 4. The effects of Fukushima**

# The Third Oil Crisis?



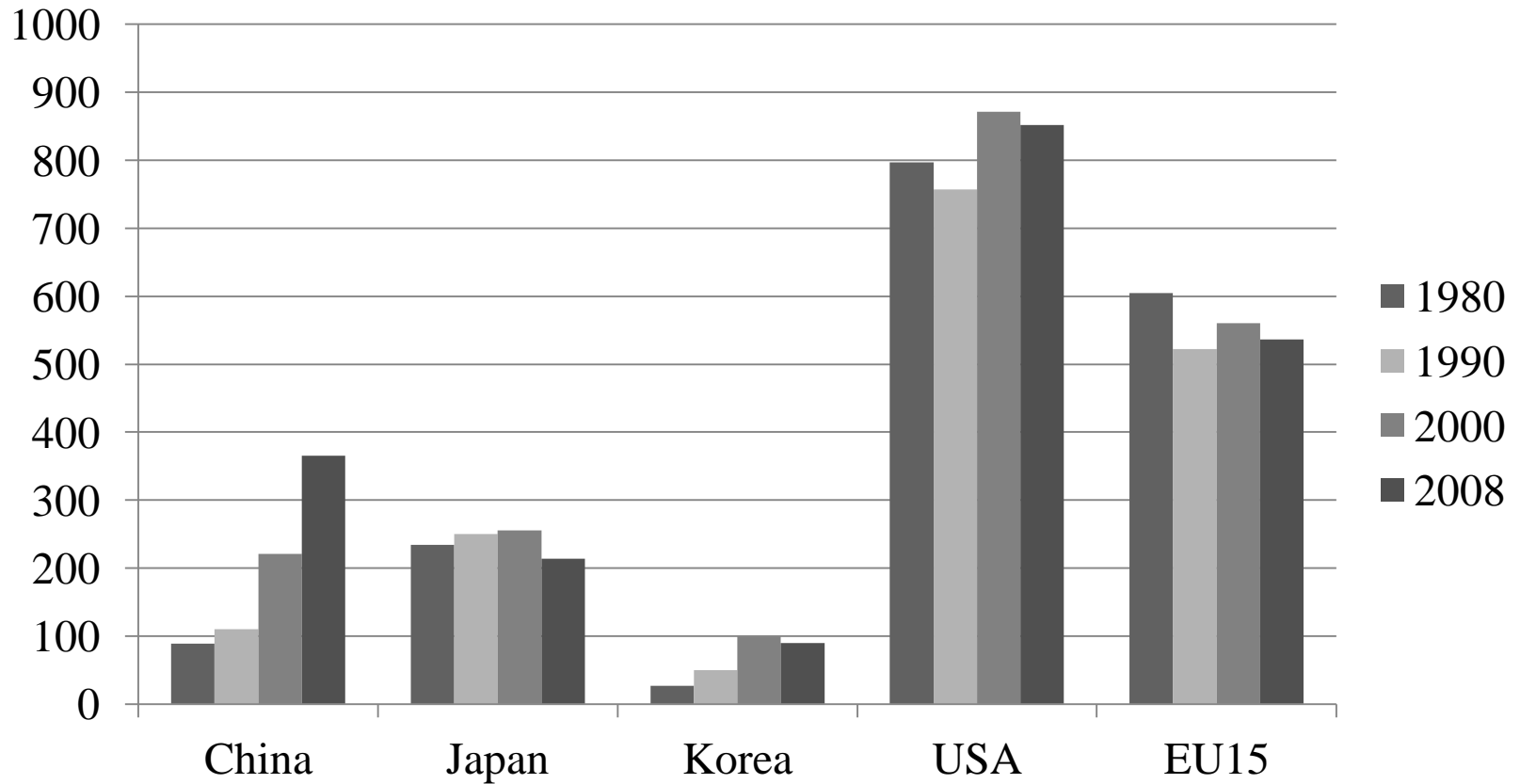
# Chinese Demand for Fossil Fuels

(million toe)



# Oil consumption

(million ton)



## Basic Stats of Energy/Economy in NEA(2008)

	Area (10000k m**2)	Populat ion(mill ion)	Energy consum ption(m illion t)	GDP (billion \$)	Per capita GDP(\$)	CO2 (million t)	Per capita CO2(t)
China	960	1325	1914	6586	4970	6510	4.9
Japan	38	128	496	3579	27960	1186	9.3
Korea	10	49	227	1140	23460	489	10.1
USA	963	304	2284	11532	37888	5646	18.6

# Economic Growth Rate (%)

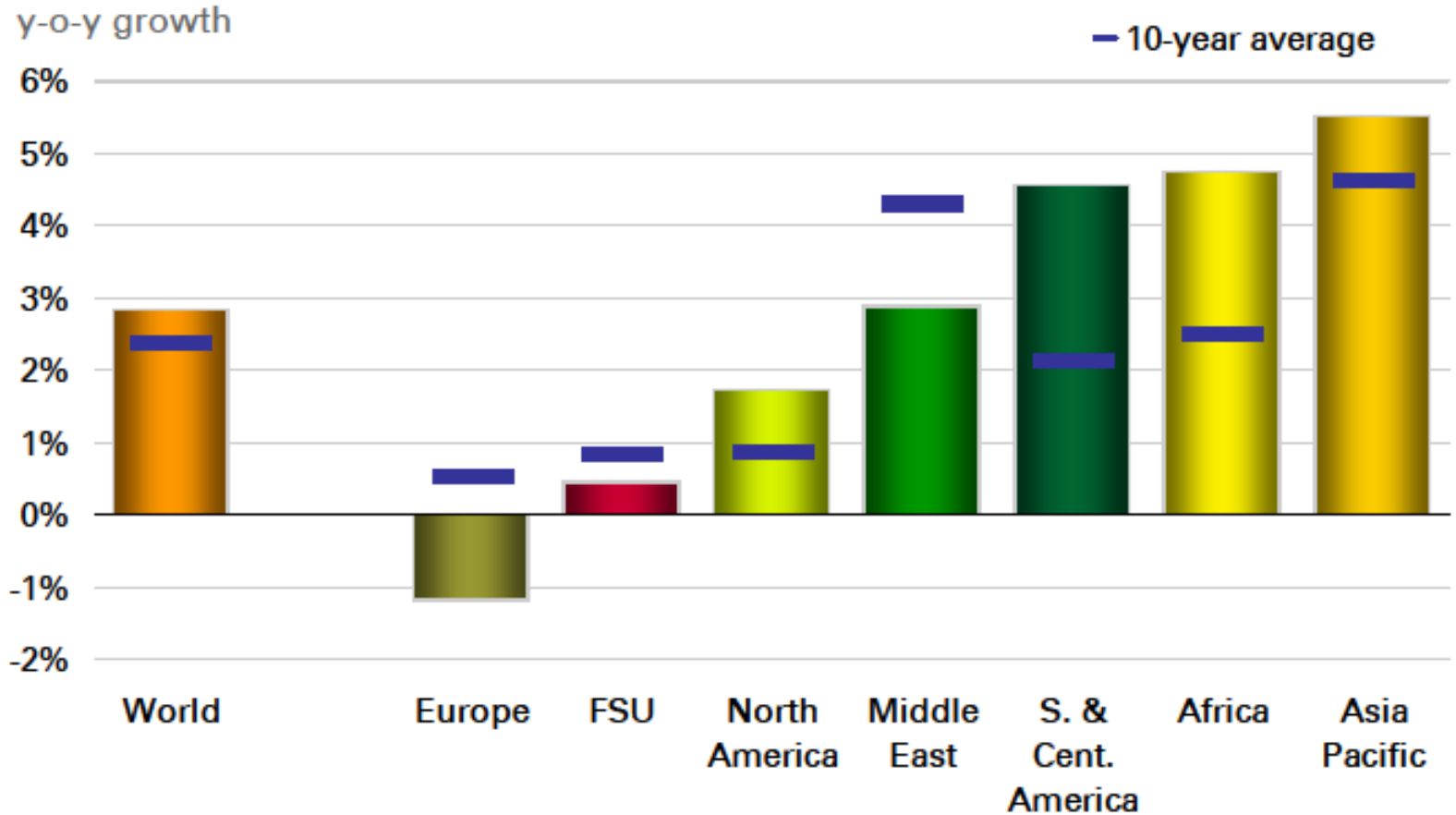
	2006	2007	2008	2009	2010
China	12.7	14.2	9.6	9.2	10.3
Japan	2.0	2.4	-1.2	-6.3	3.9
Korea	5.2	5.1	2.3	0.2	6.1
USA	2.7	2.1	2.8	-2.8	0.0

# **Global Environmental Risks in 21<sup>st</sup> Century**

- 1. World CO<sub>2</sub> emission will increase more than double by 2050.**
- 2. More than 80% of the incremental energy demand will occur in emerging countries.**
- 3. NEA share of CO<sub>2</sub> emissions will be more than half of the world.**



# 2007 Carbon Emissions Growth



# The Road to Reduce CO2 Emissions

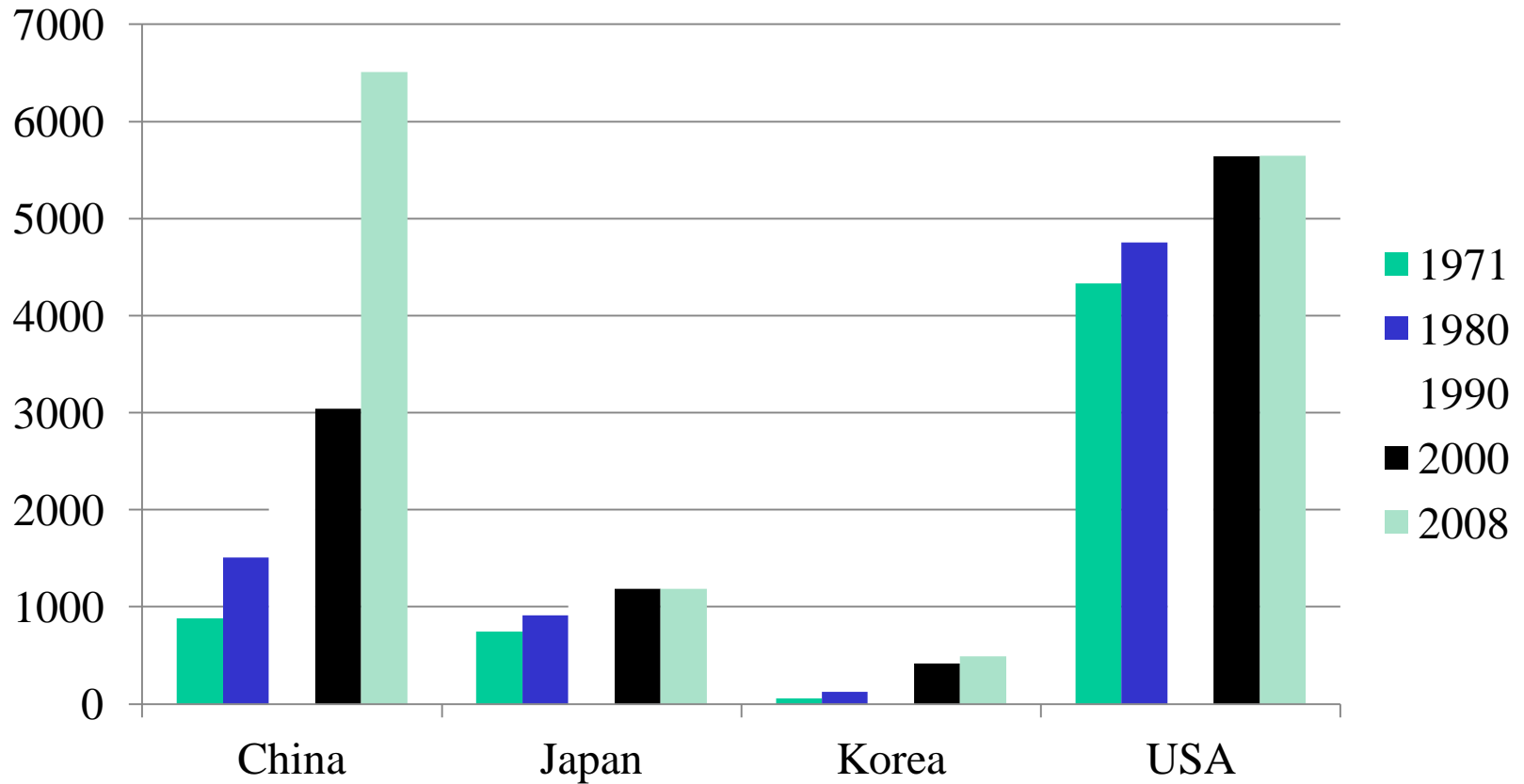
$$\text{CO2} = (\text{CO2/ENERGY})(\text{ENERGY/GDP})(\text{GDP})$$



1. Energy Efficiency Up → Fuel Efficiency & Industrial Structure
2. Fossil Fuel Dependence Down → Fuel Choice → Natural Gas & Nuclear & RES
3. Economic Growth Down

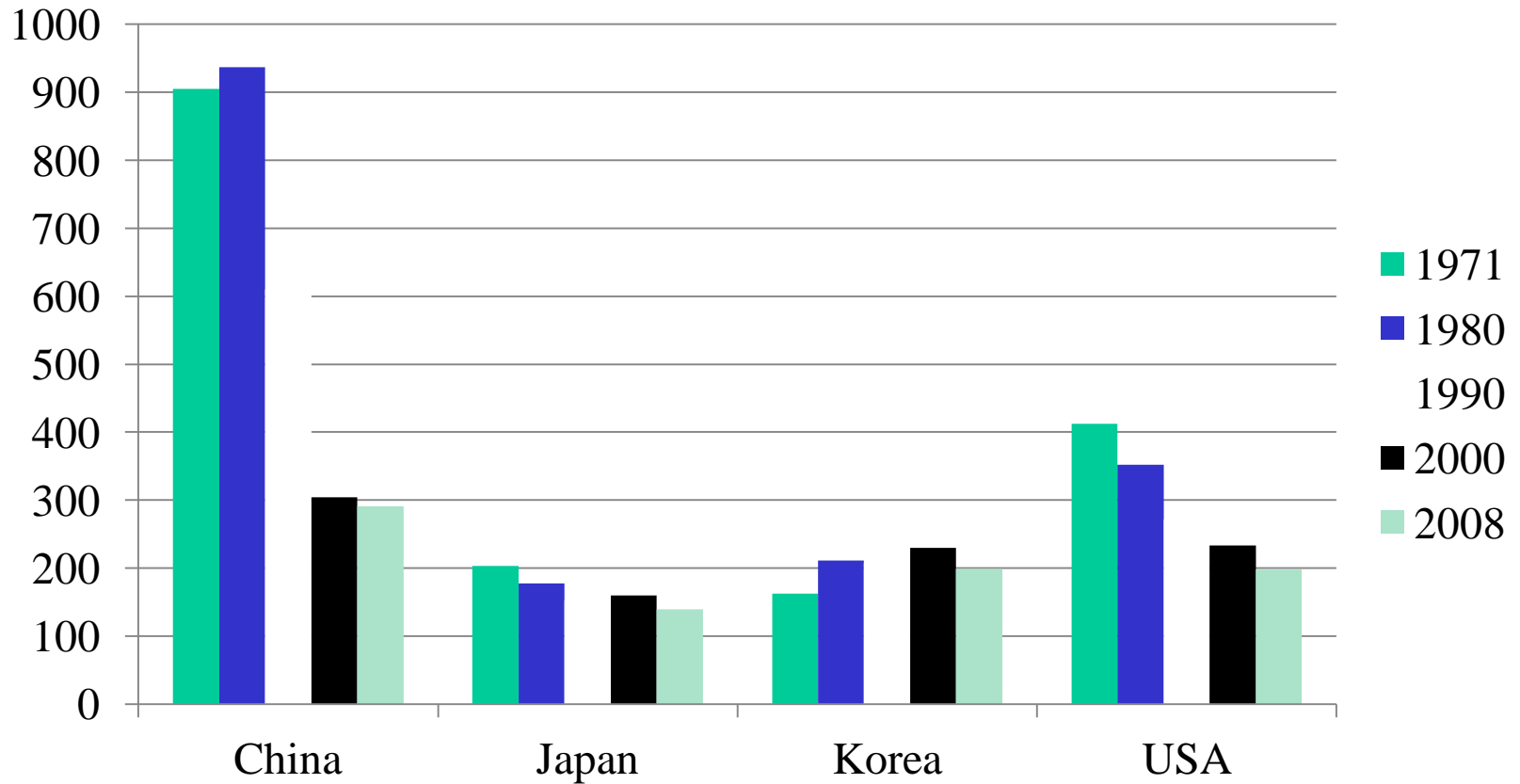
# CO2 Emissions

(million ton)



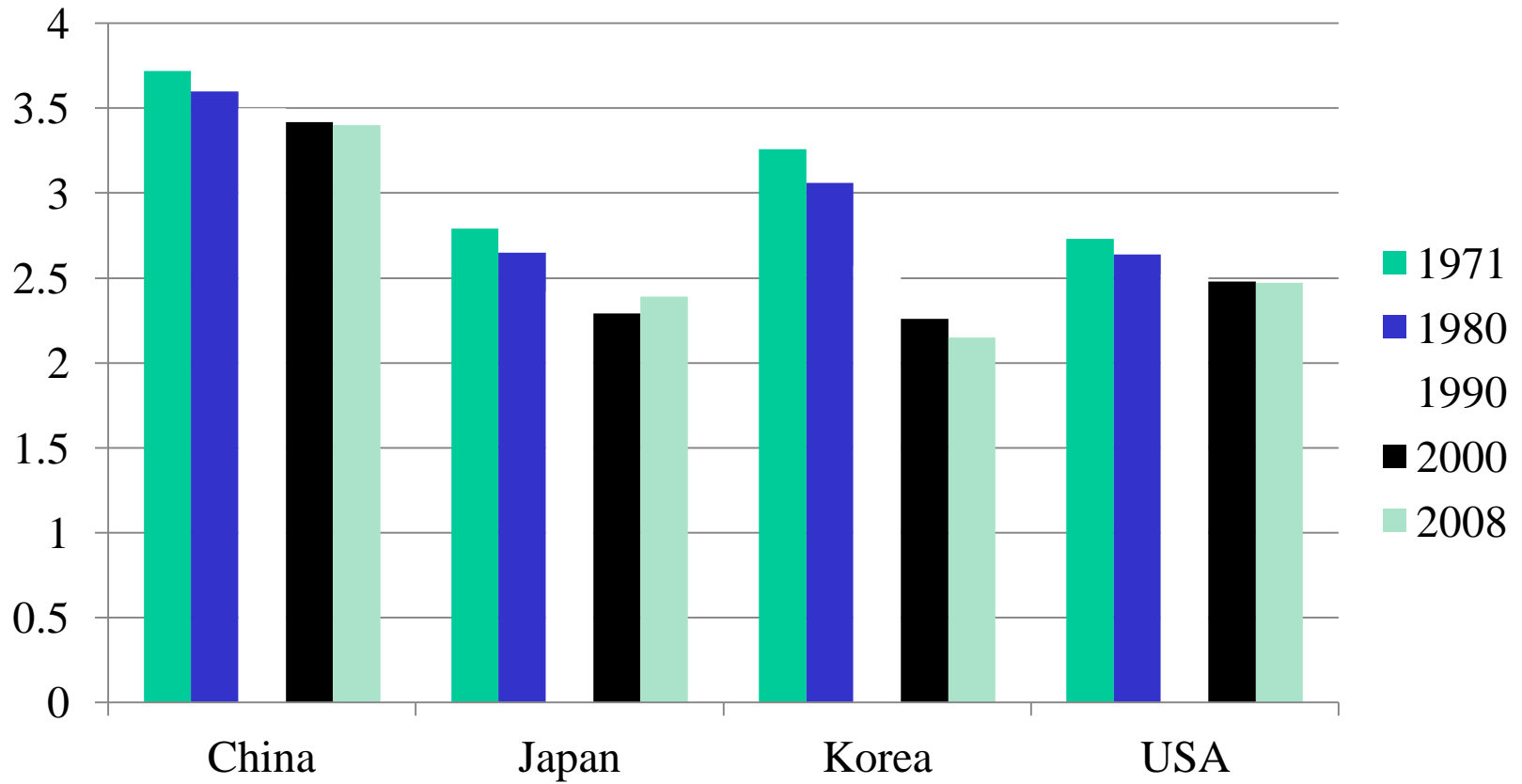
# Energy/GDP

(toe/mil\$)



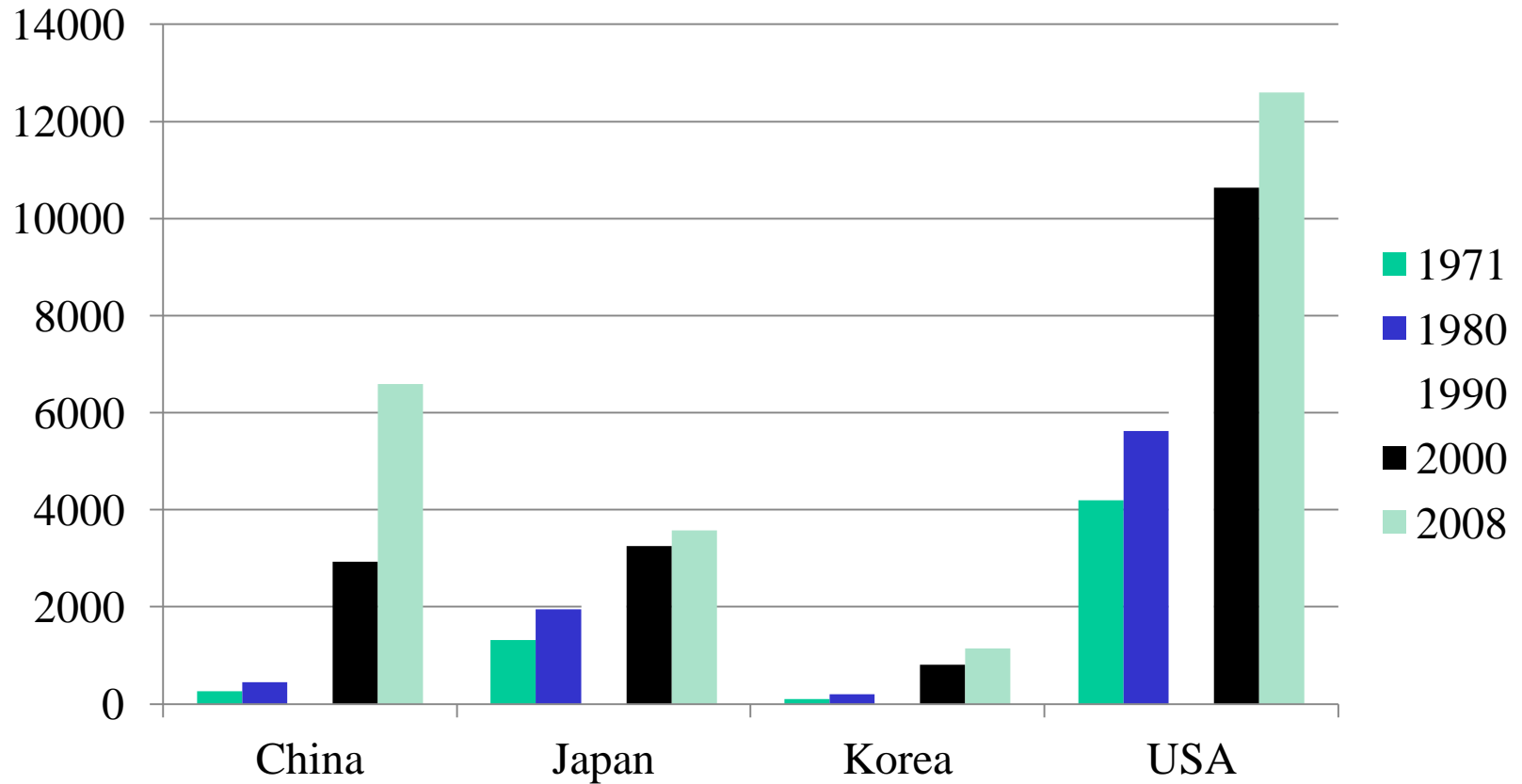
# CO2/Energy

(CO2t/toe)



# Real GDP

( ppp base, 2000 price)



## **Energy policy in 21<sup>st</sup> Century will be driven by the triple challenges of**

- making substantial reduction in emissions of greenhouse gases, such as CO<sub>2</sub>
- while ensuring a secure supply of energy
- all at reasonable cost to the economy for promoting economic competitiveness in the globalizing world

## Electricity is expected to play very important role to tackle the triple challenges

- on the supply side, potential advances in power generation technology and CCS
- on the demand side, advances in efficient electro-technologies such as heat pumps and the potential of electricity in transport, such as shinkansen, light rail, EV etc
- both will help to reduce carbon emissions and boost energy supply security



# Electricity is Key to a sustainable future (1)

- Electricity drives modern society providing light, heat & power to our homes, hospitals, schools, businesses.
- Electricity generation accounts for about a third of the world's CO<sub>2</sub> from energy use.
- With its ability to become carbon-neutral, electricity can lead the drive to decarbonise economy & society and ensure reliable and economical energy supply.
- The technologies for producing electricity without emitting carbon dioxide are either in use or close to deployment.

## Electricity is Key to a sustainable future (2)

- Electrification also offers cutting emissions from other sectors: EV and Electric heat pumps
- Low-carbon power is expensive and requires huge investments in infrastructure and improvement in energy efficiency.
- Entirely new type of electricity grid is required
- Trinity of generation : nuclear, renewables and fossil fuel plants with CCS

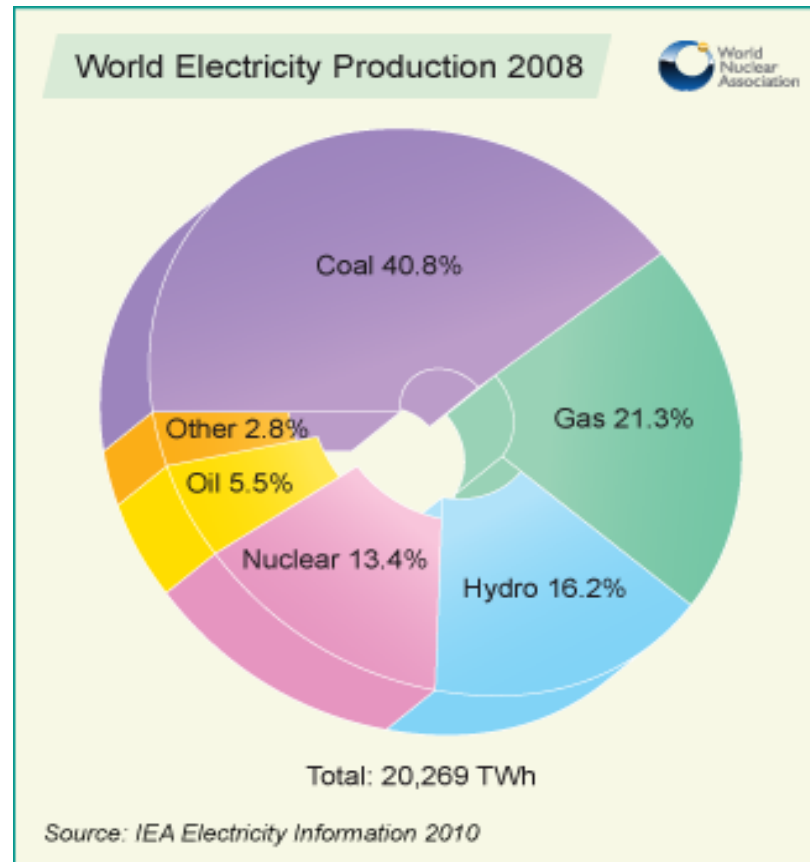
## Building up a mix of renewable energy

- Renewable energy technologies will make growing contributions to the world's energy supply and demand mix in coming decades and expected the main source of power generation in NEA.
- However, there remains a big gap between available sources and ones that currently can be harnessed in economically, environmentally, and socially acceptable ways. Solar and wind power is unstable energy and should be separate from existing power grids.
- Need to develop a mix of renewables with flexible back-up generation and adapted grids. Technical progress is critical to fill this gap.

# Nuclear Power

- Nuclear power generation is an essential part of portfolio of carbon-free generation
- High capital costs but low running costs: suited for stable base-load power generation
- At present, 16 % of world's electricity is produced by nuclear power stations in 30 countries with 377 GW and projected to rise to 433 GW by 2030, mainly in Asia.
- Large risks and uncertainties in both licensing and subsequent construction, operation waste management and decommissioning. Controlling costs is a key and difficult objective.

- 1. Now over 440 commercial nuclear power plants operating in 30 countries, with 377,000 MWe of total capacity.**
- 2. They provide about 14% of the world's electricity as continuous, reliable base-load power.**



# Thermal Power Generation

- Coal-fired generation will remain an indispensable part of a well-balanced and diverse supply of power resources.
- The advanced clean coal technologies should be used wherever possible
- Demonstration of carbon capture and storage technology should be accelerated.

## Natural gas

- More use of natural gas is quick way to cut CO<sub>2</sub> emissions
- Huge gas fields are close by NEA
- Conventional coal-fired to be replaced by latest CCGT to cut CO<sub>2</sub> emissions by more than half.
- Gas system can be easily installed in inland areas or factory premises, if gas pipeline is close by
- Fuel-cell cogeneration systems using natural gas installed in commercial complexes, homes and other facilities, energy efficiency would dramatically rise while CO<sub>2</sub> emissions would drop.
- Clean natural gas is a good choice for back-up generation system for solar and wind power.

# **Market integration will contribute to building a secure and sustainable future**

- Market integration is the only way we can reach our overarching policy objectives. We will never be able to deliver our ambitious energy efficiency or greenhouse gas emission targets without fully utilizing the opportunities that large and integrated markets offer.
- We would not be able to reap the full benefits of liberalized markets, if competition was only to happen within national borders.