# Role of Nuclear Power for a Sustainable Future

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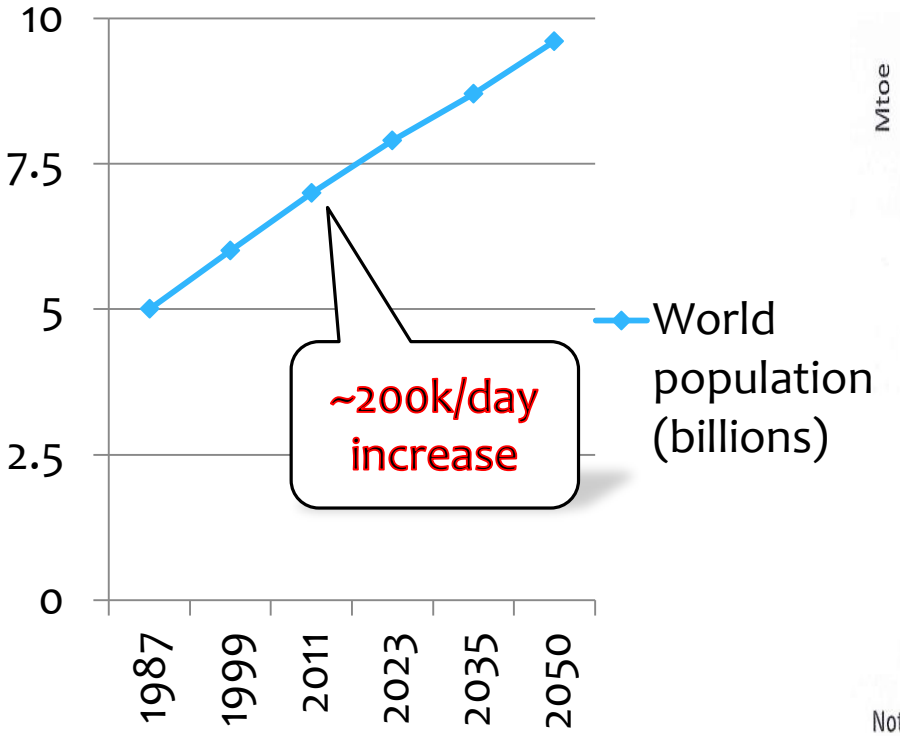
# Global Challenges

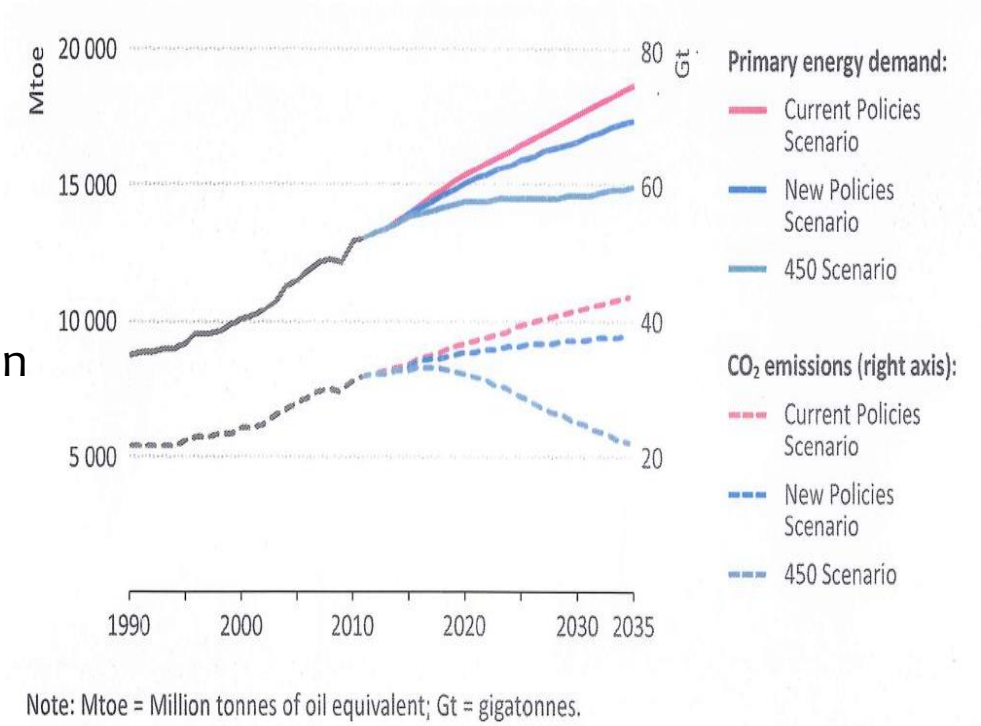
- Environmental Pollution
- Climate Change
- Economic growth, Population explosion
- Water shortage, Drought
- Food crisis, Hunger
- Poverty
- Energy shortage
- Infection, etc.

# Energy demand growth is inevitable

## Population explosion



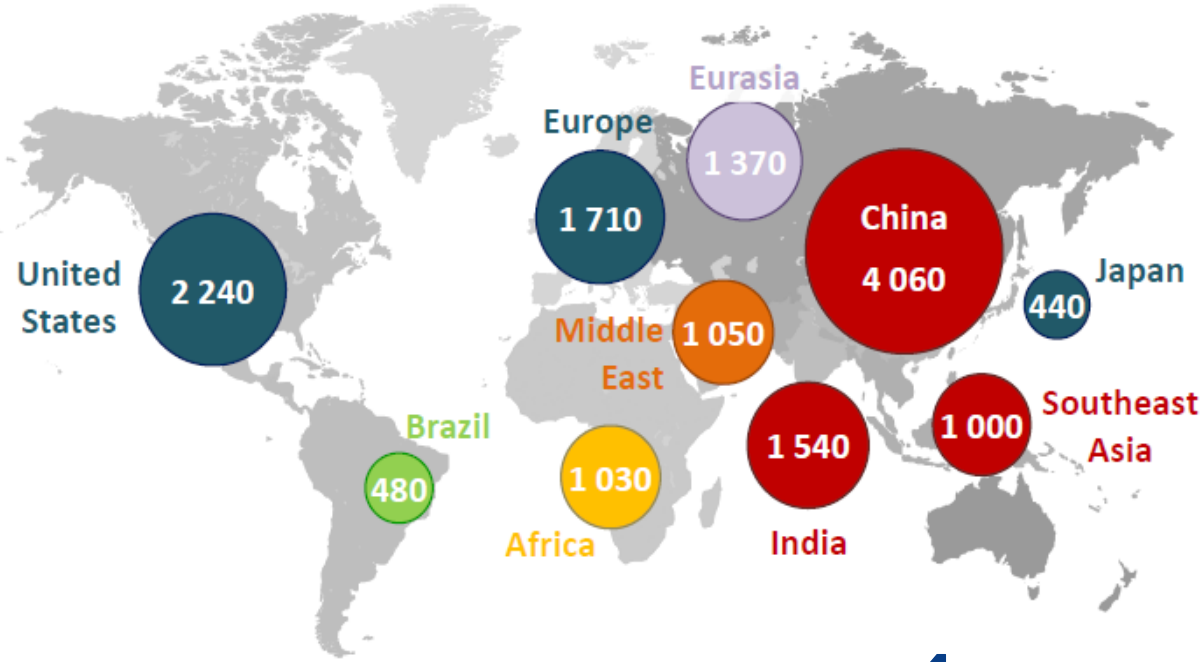

## Energy demand & CO2 Emission



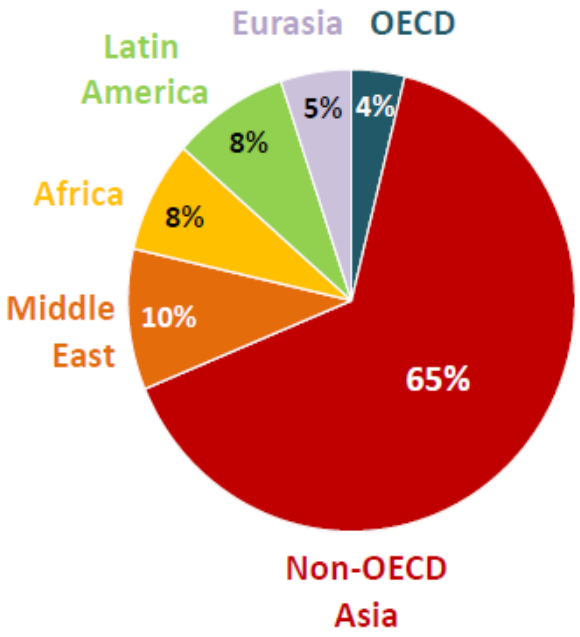

source: IEA-WEO 2013

# Asia :
# Main Driver of Energy Demand Growth

**Primary energy demand, 2035** (Mtoe)




**Share of global growth 2012-2035**

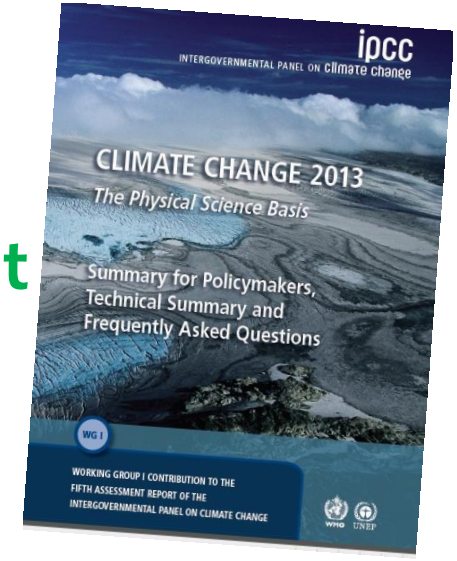



source: IEA-WEO 2013

# Increase of $CO_2$ emission and Climate Change

**IPCC AR-5 WG1 report (Sep. 2013)**

- Warming of the climate system is unequivocal.
- Human influence on the climate system is clear.
- Continued emissions of GHG will cause further warming.
- Most aspects of climate change will persist for many centuries even if emissions are stopped.



# Measures to reduce $CO_2$ emission(1)

## Dr. Kaya's Formula (RITE Japan)

**$CO_2$ / Capita**


=GDP / Capita

: economic growth

X energy consumption / GDP

: energy efficiency

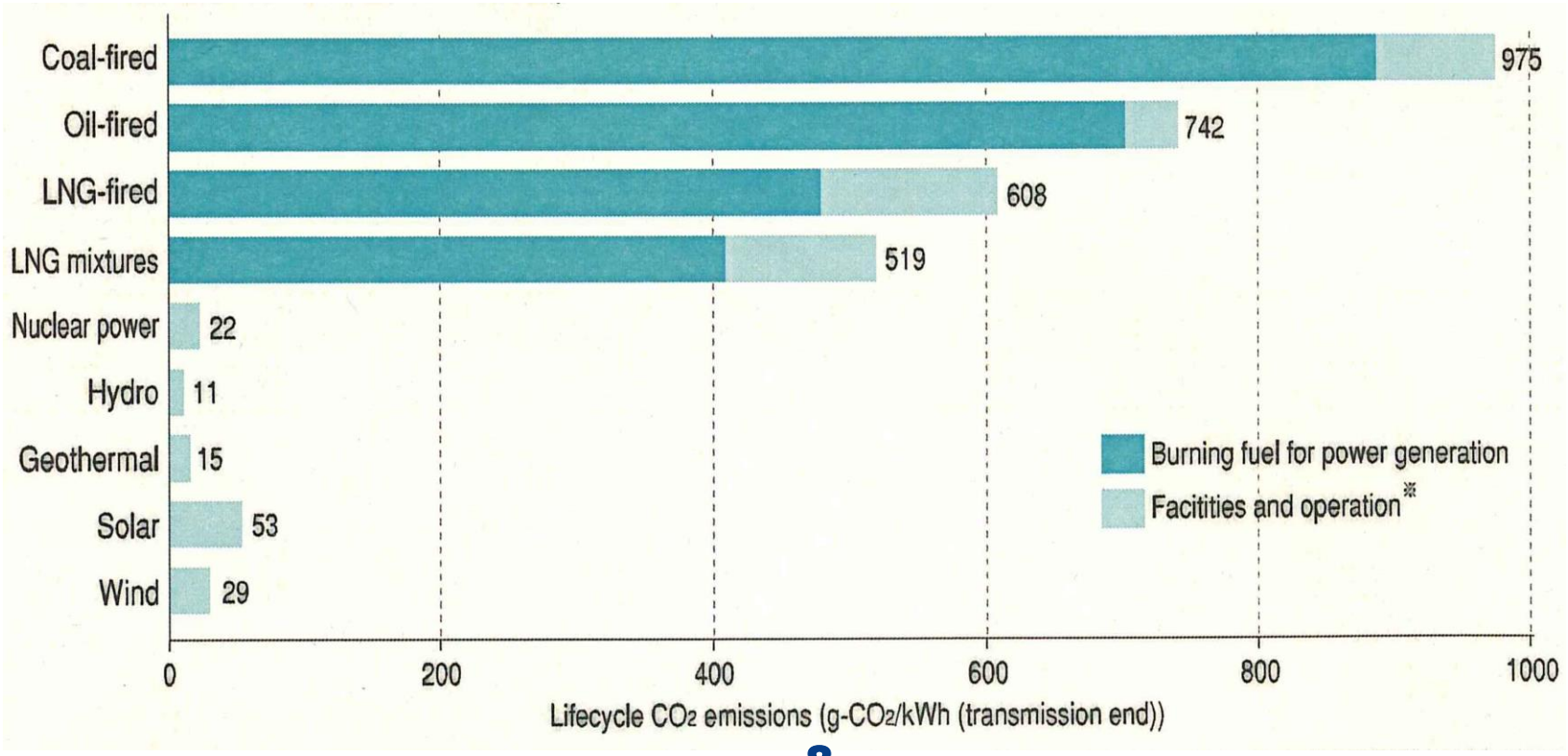
X $CO_2$ / energy consumption

: cleanliness of energy

# Measures to reduce $CO_2$ emission(2)

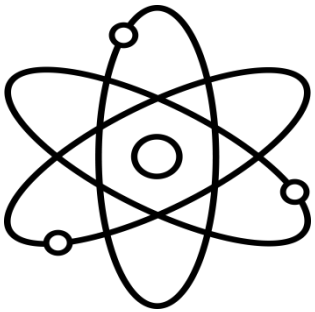
- Economic growth is inevitable
- Measures to reduce $CO_2$ emission are limited as follows ;
  - to improve energy efficiency
  - to introduce clean energy sources
- Power sector's decarbonisation is particularly critical
- Clean energy power sources :
  - Renewable(solar, wind, biomass, geothermal, hydro)
  - Clean coal with CCS
  - Nuclear

# $CO_2$ emission (g-$CO_2$/kwh) by electricity generation



# Measures to reduce $CO_2$ emission(3)

- **Nuclear power** is one of the key **clean energy** power sources.



- There is **no silver bullet** to realize **low carbon society**, but there would be **no solution without nuclear.**

# Role of nuclear power in reduction of $CO_2$ emission

**Nuclear Power**

- **Zero emission energy source during operation**
- **Estimated effect of reduction of $CO_2$ emission by 1Gw capacity NPP compared with coal fired plant**

  **~6 Mt/y of $CO_2$**

  **assumption : 1Gw NPP generates 7 Twh/y of electricity when capacity factor is 80%**

- **Globally nuclear power currently avoids release of more than 2Gt/y of $CO_2$, compared with coal fired plant**

# Nuclear Power in the world

## now and future prospect

- 2013 372.8 Gw (435 units in operation)
  68.4 Gw ( 72 units under construction)

| | IAEA | WEO |
|---|---|---|
| 2020 | L 390 / H 463 Gw | 460/488 Gw |
| 2030 | L 400 / H 699 Gw | 513/682 Gw |
| 2035 | | 527/792 Gw |
| 2050 | L 413 / H 1092 Gw | |

source : IAEA-RDS-1 2014
IEA-WEO 2013

# Nuclear Future in Japan(1)

**Basic Energy Plan of Japan (April, 2014)**

- nuclear power is an important base load power as a low carbon and quasi-domestic energy source
- dependency on nuclear power generation will be lowered to the extent possible
- a volume of electricity to be secured by nuclear power generation will be carefully examined, taking Japan's energy constraints into consideration from the view point of stable energy supply, cost reduction, global warming and maintaining nuclear technologies and human resources

# Nuclear Future in Japan(2)

## --- my personal view ---

**Electricity Demand of Japan ~ 1000Twh/y**

| | | Before Fukushima (2010) | Now | Future (2030) |
|---|---|---|---|---|
| Nuclear | | 30% | 0% | 15%~20% |
| Fossil | Gas | 30% | 45% | 40% |
| | Coal | 20% | 25% | 15% |
| | Oil | 10% | 20% | 5% |
| Renewable | | 10% | 10% | 25%~20% |

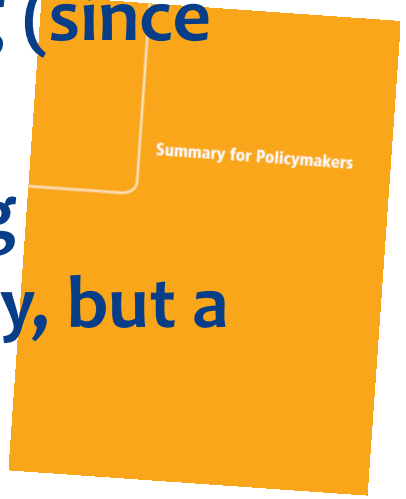
# Light and Shadow of Nuclear Power

- Light
  - reliable : superiority in stable supply
  - affordable : low and stable operational cost
  - clean : free from GHG emissions during operation
- Shadow
  - safety : risk of severe accident
  - waste management : siting of final repository
  - proliferation/security : threat of terrorist attack

# Evaluation on Nuclear Power as low carbon energy supply

**IPCC AR-5 WG3 report SPM4.2.2 (Apr. 2014)**

- Nuclear energy is a mature low-GHG emission source of base load power, but its share of global electricity generation has been declining (since 1993).
- Nuclear energy could make an increasing contribution to low carbon energy supply, but a variety of barriers and risks exist



# For the Steady Development of Nuclear Power

- Nuclear Safety
- Waste Management
- Public Support

# For the Sustainable Nuclear Future

**Areas to be considered for international collaboration :**

- **Harmonization of safety regulation**
- **Waste Management**
- **R&D of future innovative technology**
- **HRD (Human Resources Development)**

# Thank you for your attention!

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