# Nuclear Power after Fukushima

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# Introduction

- ~1200 days passed since March 11, 2011
- ~130000 local people are still suffering difficult time as evacuee
- Japanese Government decided new Energy Policy in April, 2014
- No nuclear power plant operation since Sept., 2013
- Most serious effect of Fukushima accident is “loss of confidence on nuclear”
- The 1st priority in Japan is “to rebuild public trust on nuclear”

# Fukushima Daiichi NPS Accident

**Chronology**

**14:46 on March 11, 2011**

**earthquake / tsunami** → **Rx scram**

↓

**station blackout (SBO) by inundation**

↓

**core melt / hydrogen generation**

↓

**hydrogen explosion in Reactor Building**

↓

**release of radioactive material**

# Effects of Fukushima accident

**UNSCEAR report 2013**

- **No acute health effects (i.e. acute radiation syndrome or other deterministic effects) had been observed among the workers and the general public that could be attributed to radiation exposure from the accident.**
- **The most important health effects observed so far among the general public and among workers were considered to be on mental health and social well-being, relating to the enormous impact of the earthquake and tsunami, causing loss of family and friends and loss of livelihood and necessitating evacuation ; and the impacts of the nuclear accident, including not only further evacuation and loss of livelihood, but also fear and stigma related to real and perceived health risks associated with ionizing radiation.**

**UNSCEAR : United Nations Scientific Committee on the Effects of Atomic Radiations**

# New Safety Construct

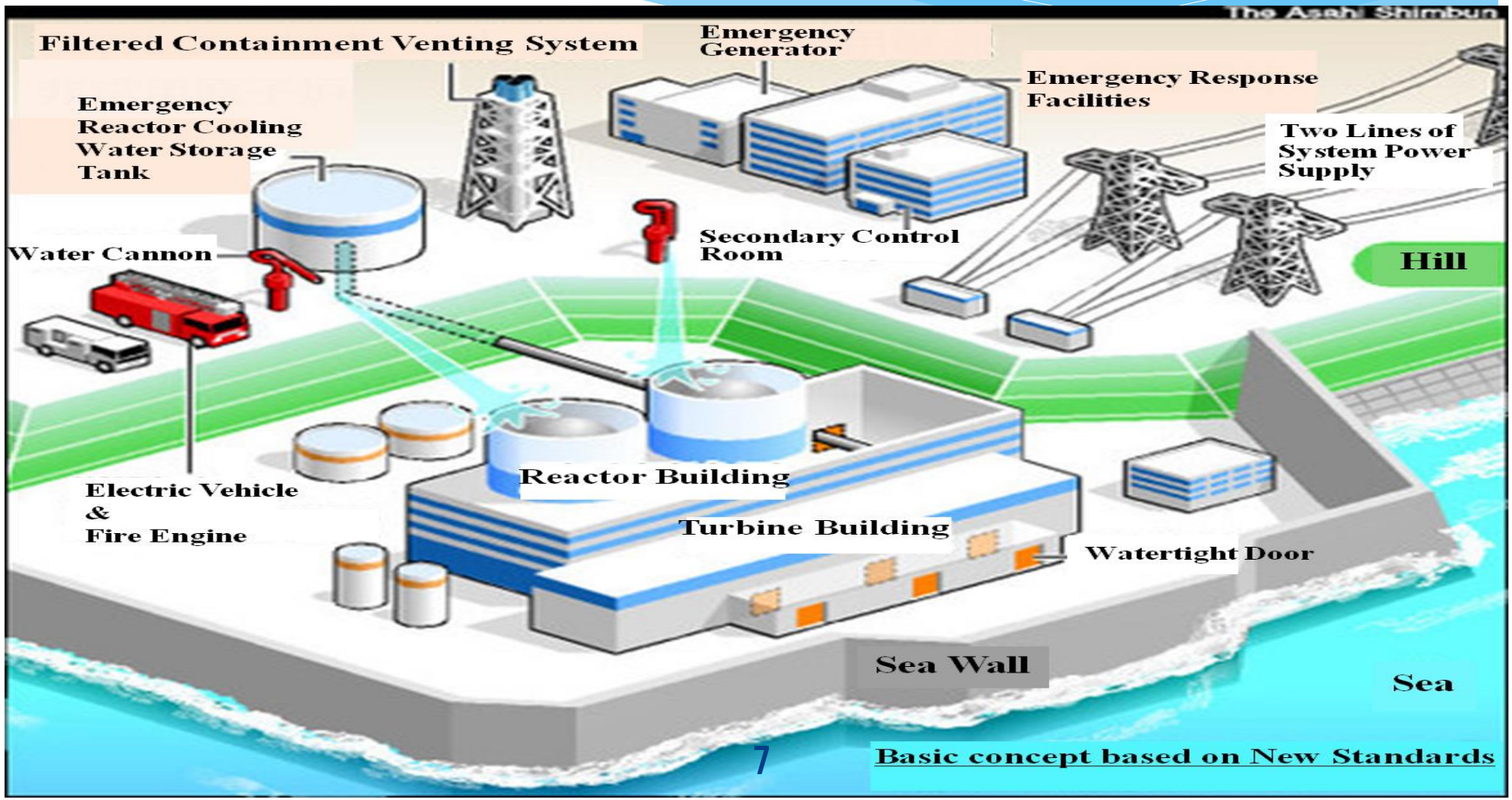
- **Most serious effects of Fukushima accident**
  - **disruption of local community**
  - **loss of confidence on nuclear**

- **A New Nuclear Safety Construct**

***"The set of planned, coordinated, and implemented systems ensuring that nuclear plants are designed, constructed, operated, and managed to prevent extensive societal disruption caused by radioactive releases from accidents, using an all-risk approach."***

**proposal by ASME Task Force (June 2012)**

# Safety enhancement after Fukushima accident



# Current Status of Fukushima

- Preventive measures of groundwater leakage into the buildings are in progress
- Contaminated water is being purified and stored in the storage tanks
- Defueling and decommissioning of damaged reactors have been deployed based on mid. & long term road map
- Decontamination of the surrounded environment is in progress

# Current Status of NPP in Japan

- All the NPPs (48plants, 44Gw) have been shut down since Sept. 2013

- 19 plants out of 48 plants are in the process of safety assessment by the regulatory body (NRA) based on the new regulation

- Restart of NPPs is expected later this year, but it is not clear when and how many units will restart

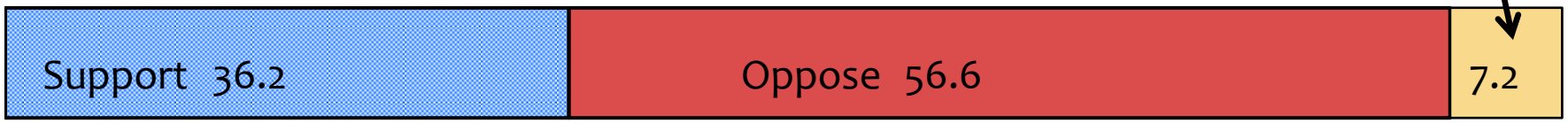
# Effects by Suspension of All NPPs Operation

- Power supply has been assured by restarting aged fossil plants
- Import of crude oil and natural gas sharply increased
- Dependency of fossil fuel on middle East increased up to ~88%
- Additional cost to purchase oil and gas : ~3.6T-JY (35bn $US)/FY2013
- CO2 emission increased : ~9%
- Electricity rate change : ~20%

# Opinion poll on Nuclear Restart

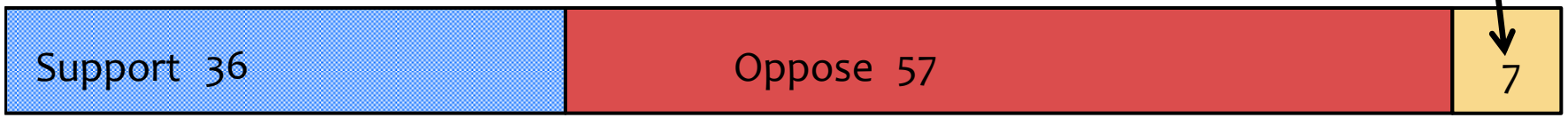
## "What do you think about restart of Nuclear Power Station after review by NRA ?"

- **Kyodo News (Mar. 24, 2014)**




- **Asahi Newspaper (Mar. 15, 16, 2014)**


- **Yomiuri Newspaper (Mar. 14 - 16, 2014)**




(unit：%)

# New Energy Policy of Japan

## *The 4th Strategic Energy Plan of Japan*

*(Apr. 11, 2014)*

- **Basic view point of energy policies : 3E+S with global viewpoint and national economic growth**

  **3E ( Energy security, Economic efficiency, Environment)**

  **S (Safety)**

- **Building multi-layered, diversified & flexible energy demand-supply structure**
- **Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy demand- supply structure**

# Nuclear Policy in Japan

- **Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as improving the efficiency of thermal power generation**
- **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**

# Energy mix in the future

- **Energy mix** will be shown soon after this plan, taking into consideration factors including **restart of nuclear power plants** and expansion of renewable energies, and so on

**However, at present time**

- **Uncertainties** surrounding **Nuclear Power** in Japan
  - situation of **plant restart**
  - regulation on **40yrs lifetime**
  - possibility of **new construction**

# Rebuilding Public Confidence

- Rebuilding mutual trust
- Responsibility of each stakeholder
  - operator
  - regulatory body
  - expert/academia
  - government
  - general public/local people
  - mass media

# Responsibility of Operator

- prime responsibility for the safety of a nuclear installation rests with the holder of the relevant license

  (IAEA "Convention on Nuclear Safety")

- Safety enhancement by operator's voluntary action is crucial
- Oversight by third party's peer review is essential to assure operator's activity

# Responsibility of Regulatory Body

- **Independence :**

**to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy**

**(IAEA "Convention on Nuclear Safety")**

- **USNRC's Principle of Good Regulation (1991)**

**The Five Principle :**

**Independence, Openness, Efficiency, Clarity, Reliability**

# Responsibility of Experts(1)

**How to obtain the confidence/trust of experts from general public?**

**"Code of conduct for Scientist"**

**Science Council of Japan (Jan. 2013 )**

- **Responsibility of Scientists**
- **Research Integrity**
- **Science in Society**
  - *Dialogue with Society
  - *Scientific Advice
  - *Scientific Advice to Policy Planners and Decision Makers
- **Legal Compliance**

# Responsibility of Experts(2)

## --- for the welfare of humankind ---

***Noblesse oblige***

**Humanity**
**Modesty**
**Neutrality**
**Independency**
**Objectivity**

***Scientific approach***

**Technical competency/expertise**
**Technical rationality**
**Openness/Transparency**
**Communication/Dialogue**
**Trans-science communication**

# Rebuilding Public Confidence
## --- possible solutions ---

- Enhancement of safety by the voluntary action of the operator and oversight by the independent organization
- Risk communication is crucial to break with "myth of safety"
- Openness and transparency is the most important aspect for public relations
- Strict regulation by the independent regulatory body with high technical competency is the premise

# Revitalization of Nuclear Power

- 30 years after TMI in the case of USA
- 20 years after Chernobyl in the case of Russia
- ?? years after Fukushima in the case of Japan

# Role of Nuclear Power

- **Nuclear power is clean, safe, affordable, and reliable energy source.**

***Even after Fukushima accident :***

- **Role of Nuclear Power is unchanged.**
- **Speed of nuclear development in the world is slowing down but not stalling.**

# Japan's Role in the Global Nuclear Development

***Japan will***

- ***share*** **the lessons learned from the Fukushima accident and enhance safety of nuclear installations in the world**
- ***promote*** **decommissioning of damaged reactors of Fukushima in cooperation with international community**
- ***support*** **the nuclear development program of newcomer countries**
- ***contribute*** **to assure the international regime of nuclear nonproliferation and security**
- ***take the lead*** **in international R&D program of innovative nuclear technology**

# *Thank you for your attention!*

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