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Three Puzzles of 3/11

Lawrence Axelrod
Axelrod Energy Projects

2011 Energy Conference

October 23-25, 2011

Miami Beach



Introduction

- Past (FY2006 - FY2010)
- Present (April - July FY2011)
- Future (through FY2013)

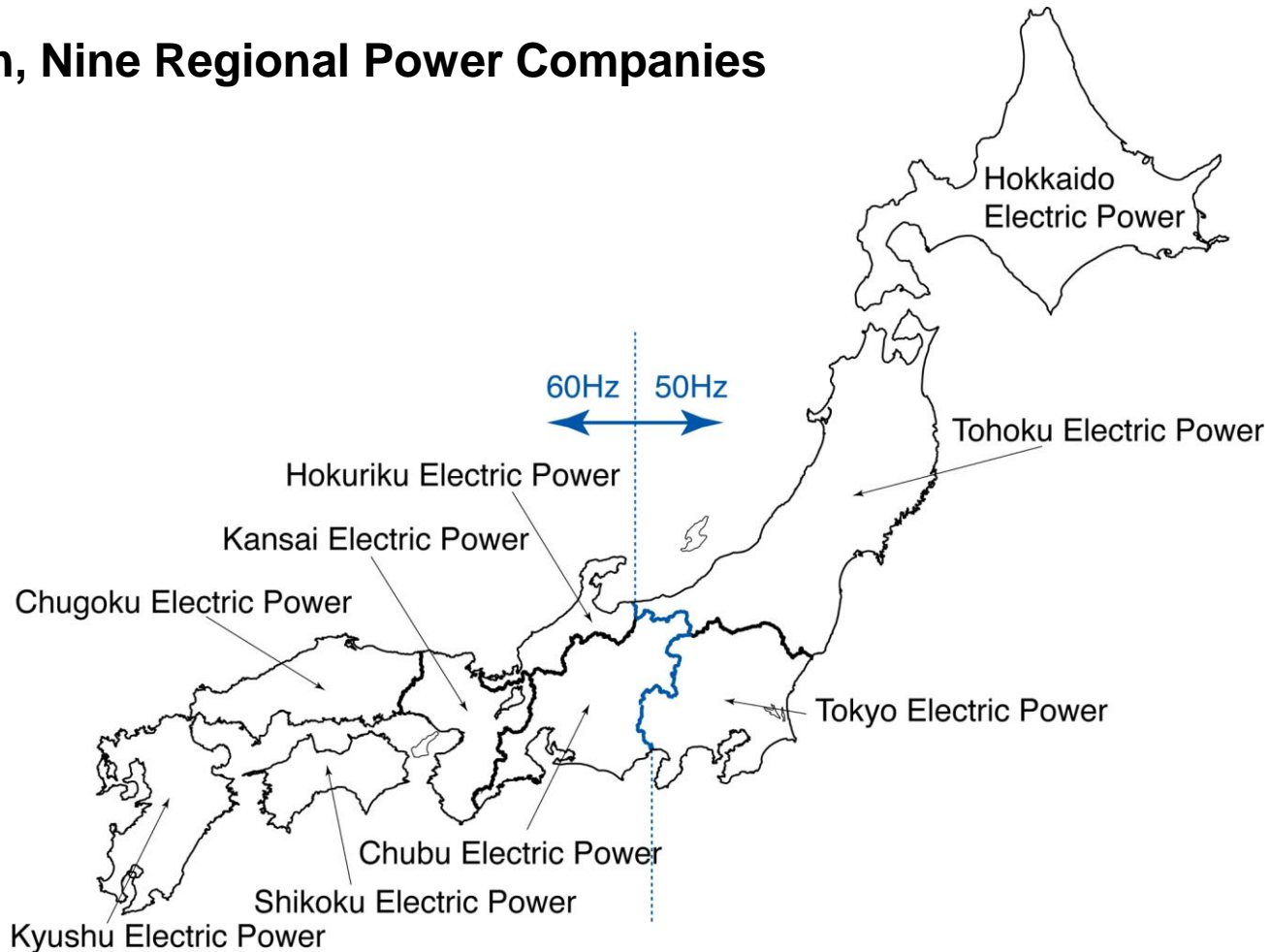


Introduction

- Power Generation in Japan
 - Nuclear
 - Hydro
 - Thermal
- Fossil Fuel Usage in Japan
 - Coal
 - LNG
 - Crude
 - Fuel Oil

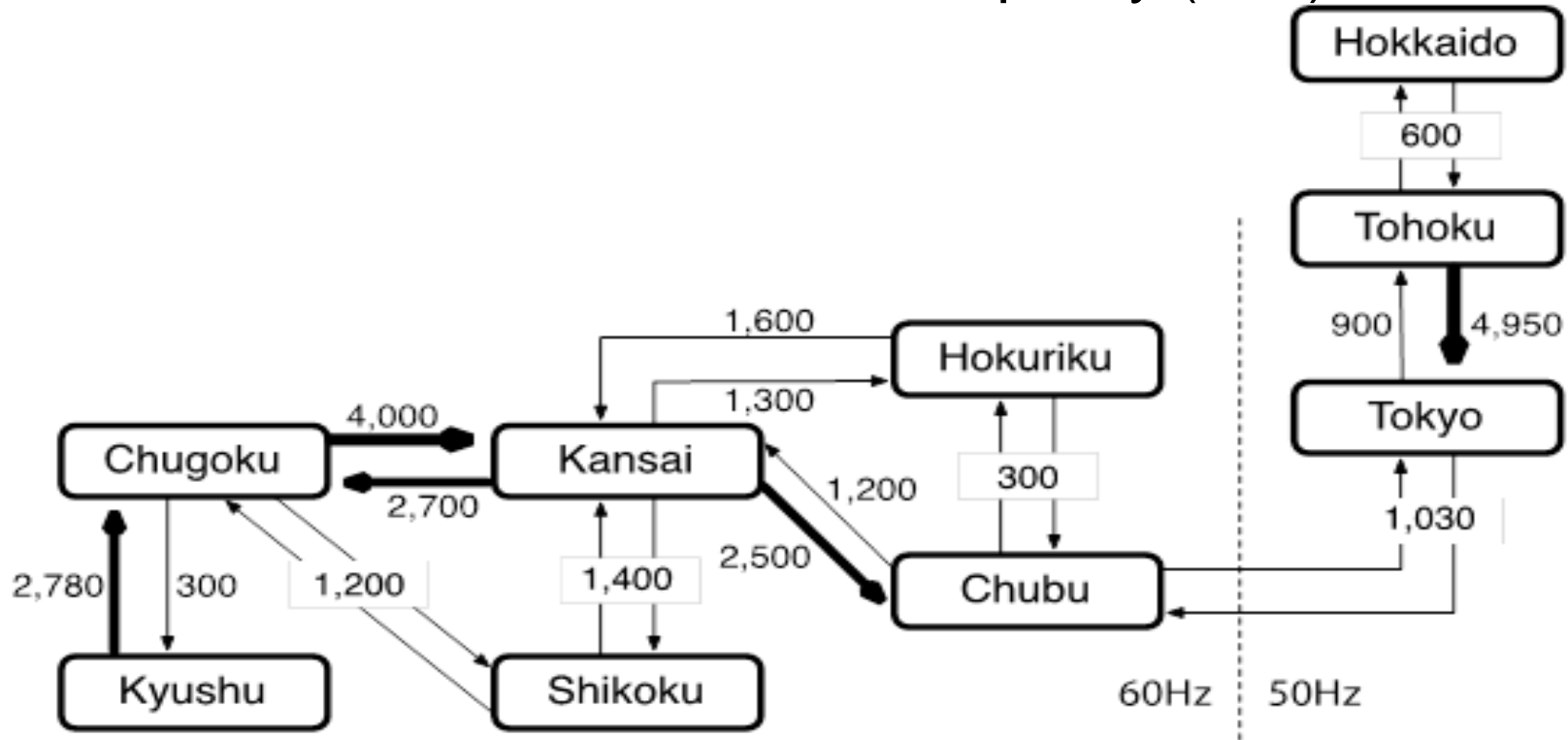
Introduction

Japan, Nine Regional Power Companies



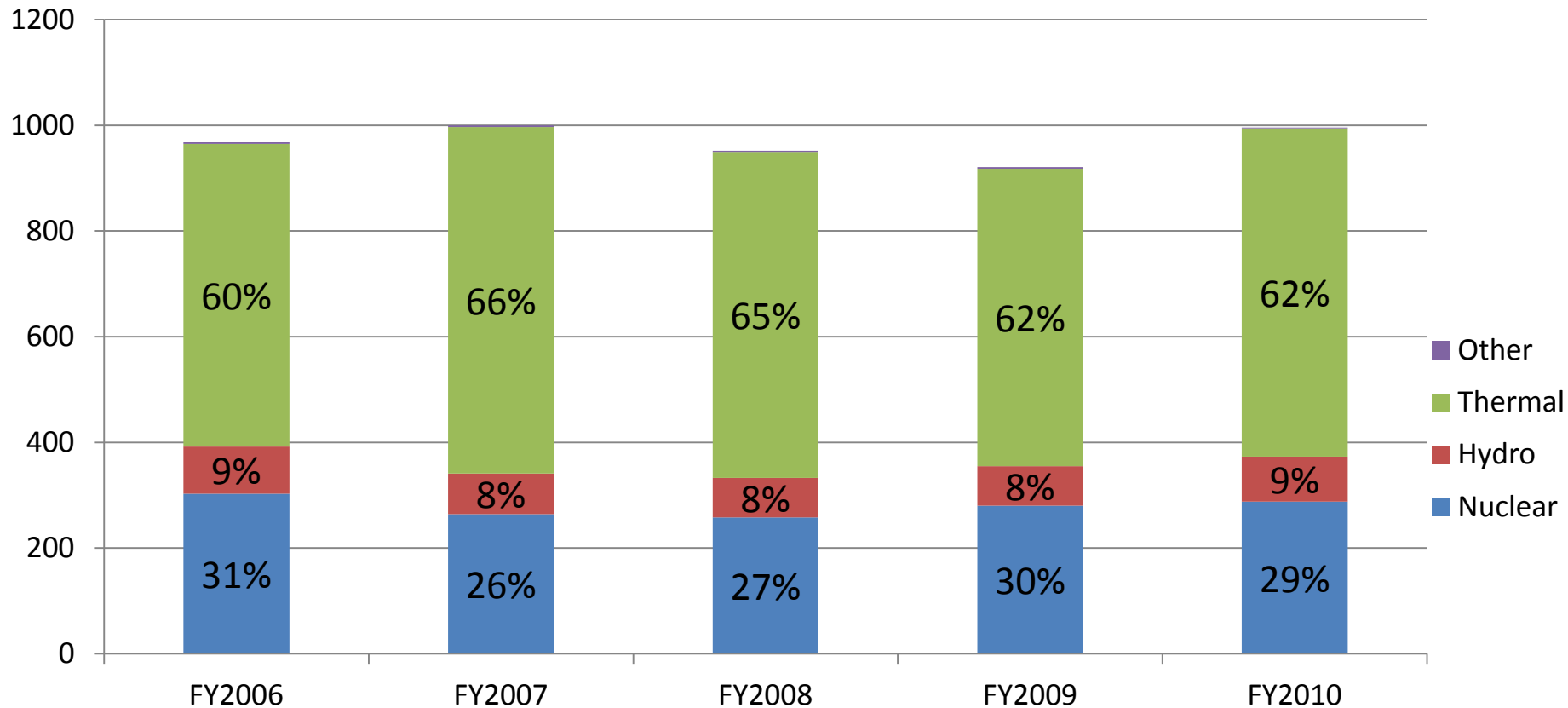
Introduction

Japan, Nine Regional Power Companies,
Cross Transmission Capacity (MW)



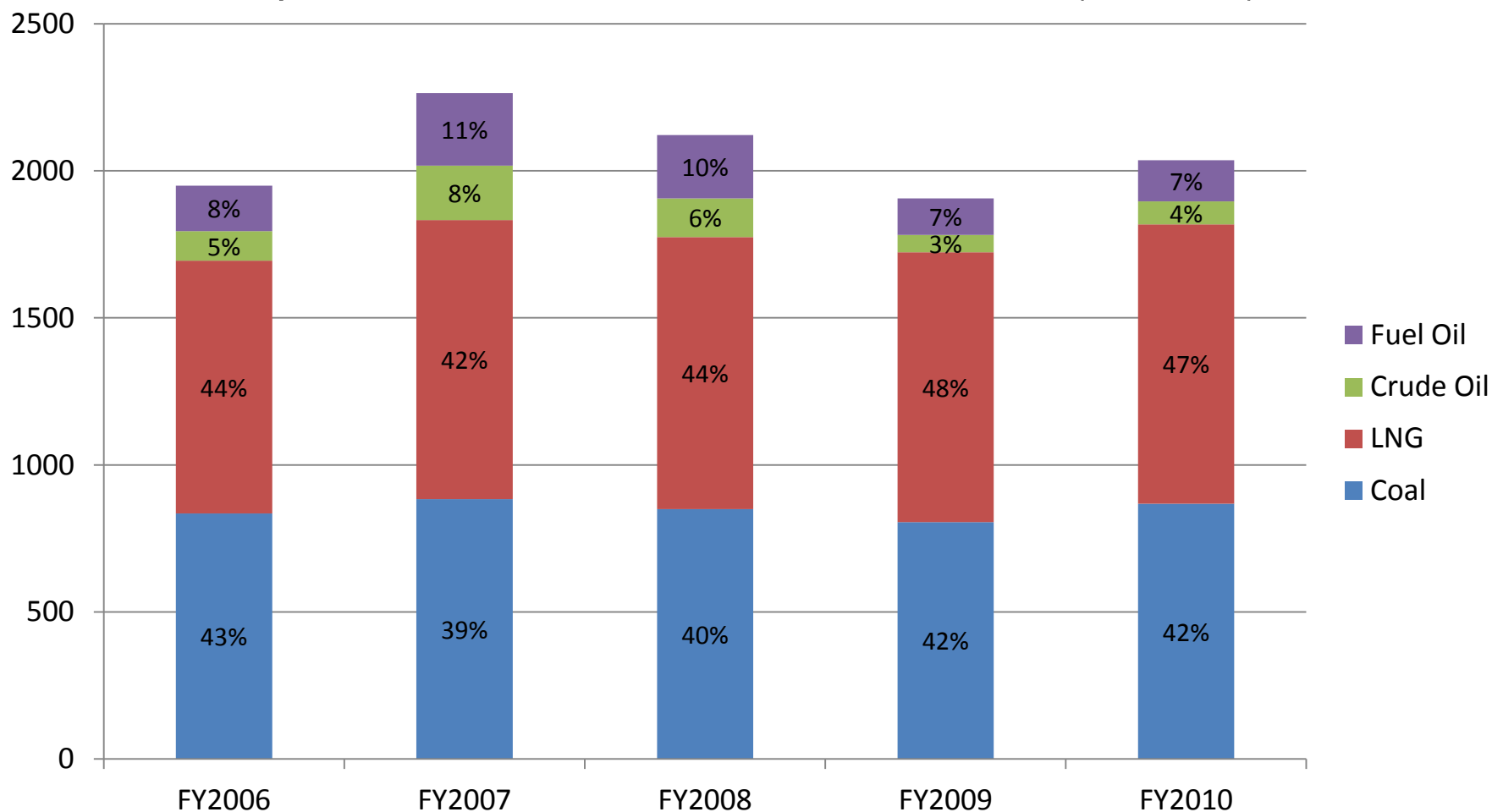
Past – Overview

Japan, Power Generation by Energy Source (TWh)



Past – Fossil Fuels

Japan, Fossil Fuels for Power Generation (kb/d foe)

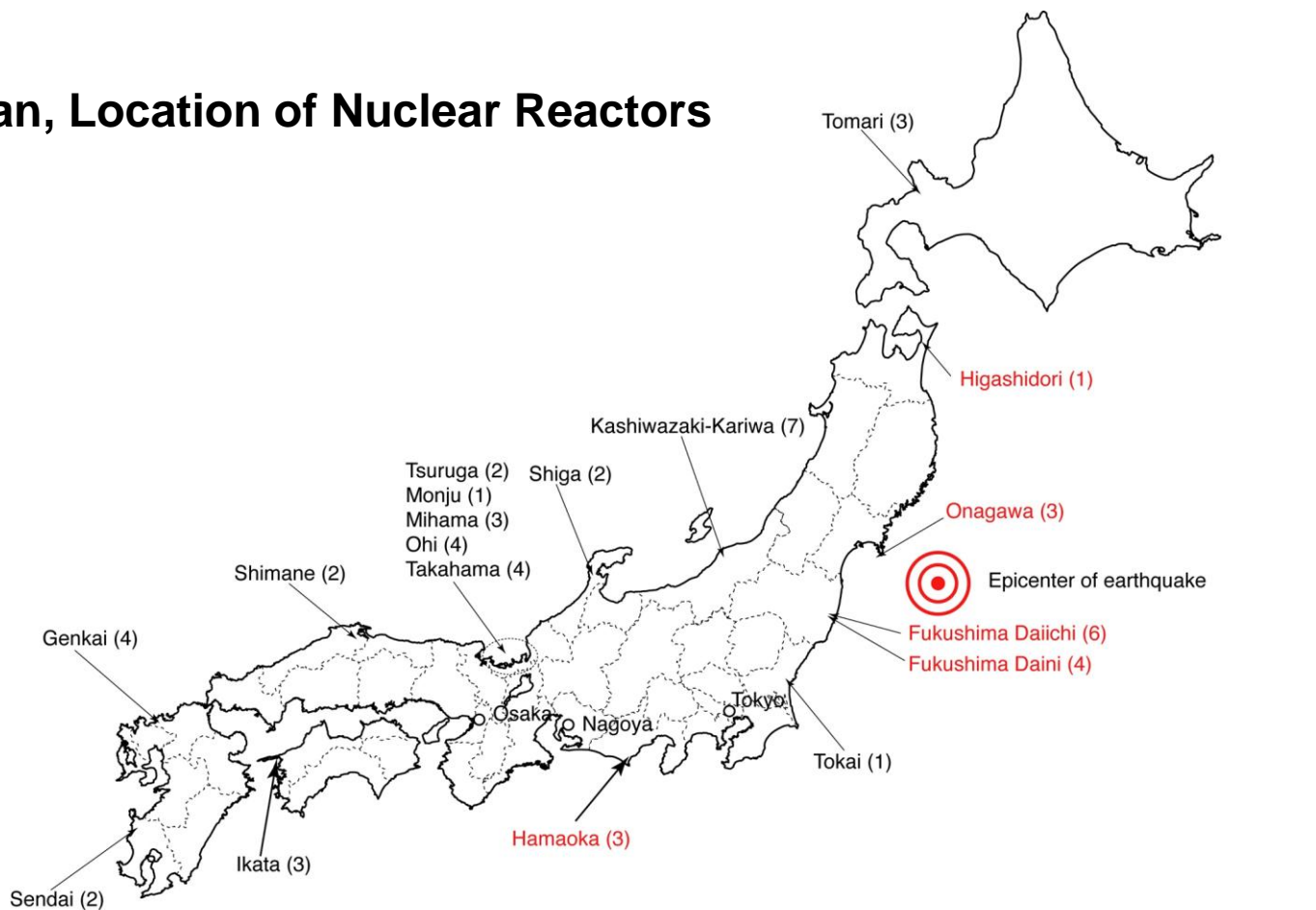


Present – Nuclear

- Nuclear power plants before March 11, 2011
 - 55 reactors with aggregate capacity of 49.1 GW
- Earthquake / tsunami on March 11, 2011
 - Aggregate loss due to damage: 2,812 MW
 - “Collateral” loss: 6,284 MW
- Nuclear reactors that were planned or under construction on March 11, 2011
 - 11 reactors with aggregate 14.8 GW capacity
 - All but one reactor will likely undergo review/revision

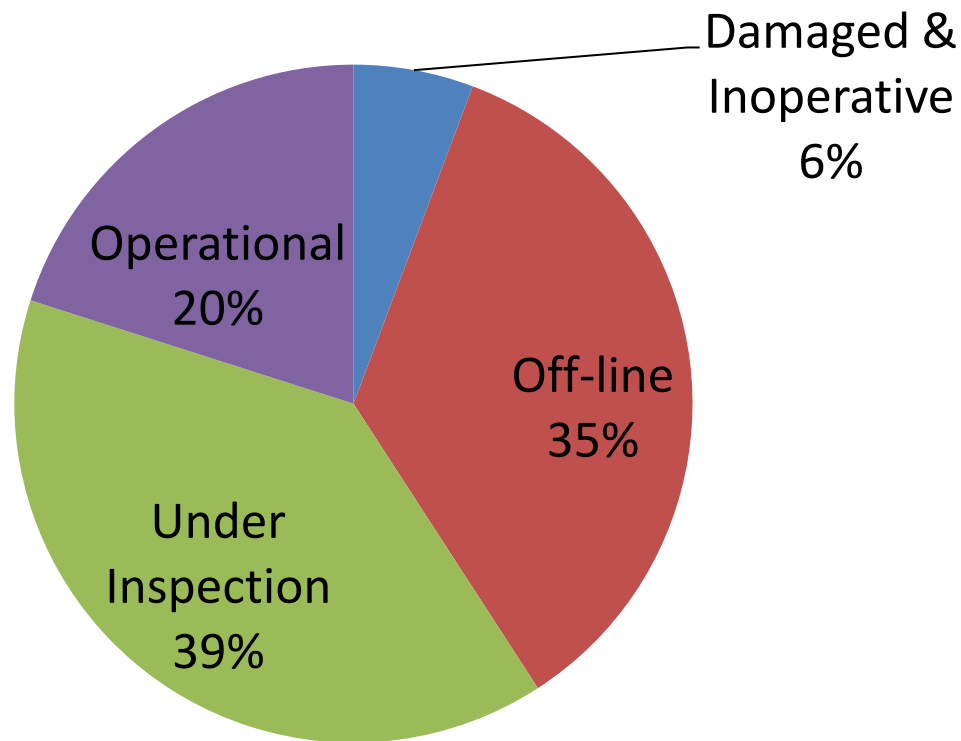
Present – Nuclear

Japan, Location of Nuclear Reactors



Numbers indicate number of active nuclear reactors
Red text indicates reactors shut down as a result of the Tohoku Earthquake

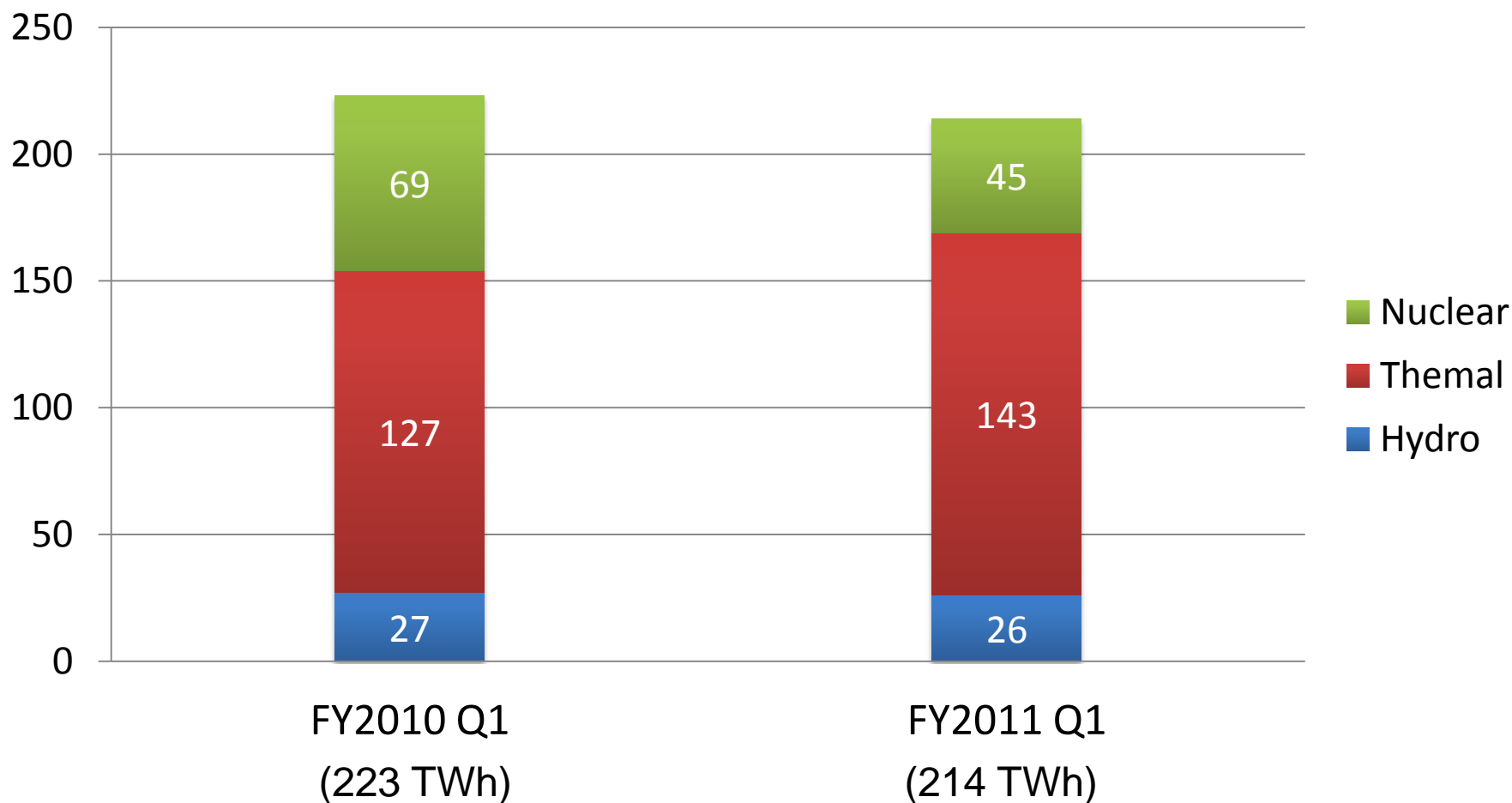
Japan, Nuclear Generation Capacity, Current Status



Total 49,147 MW

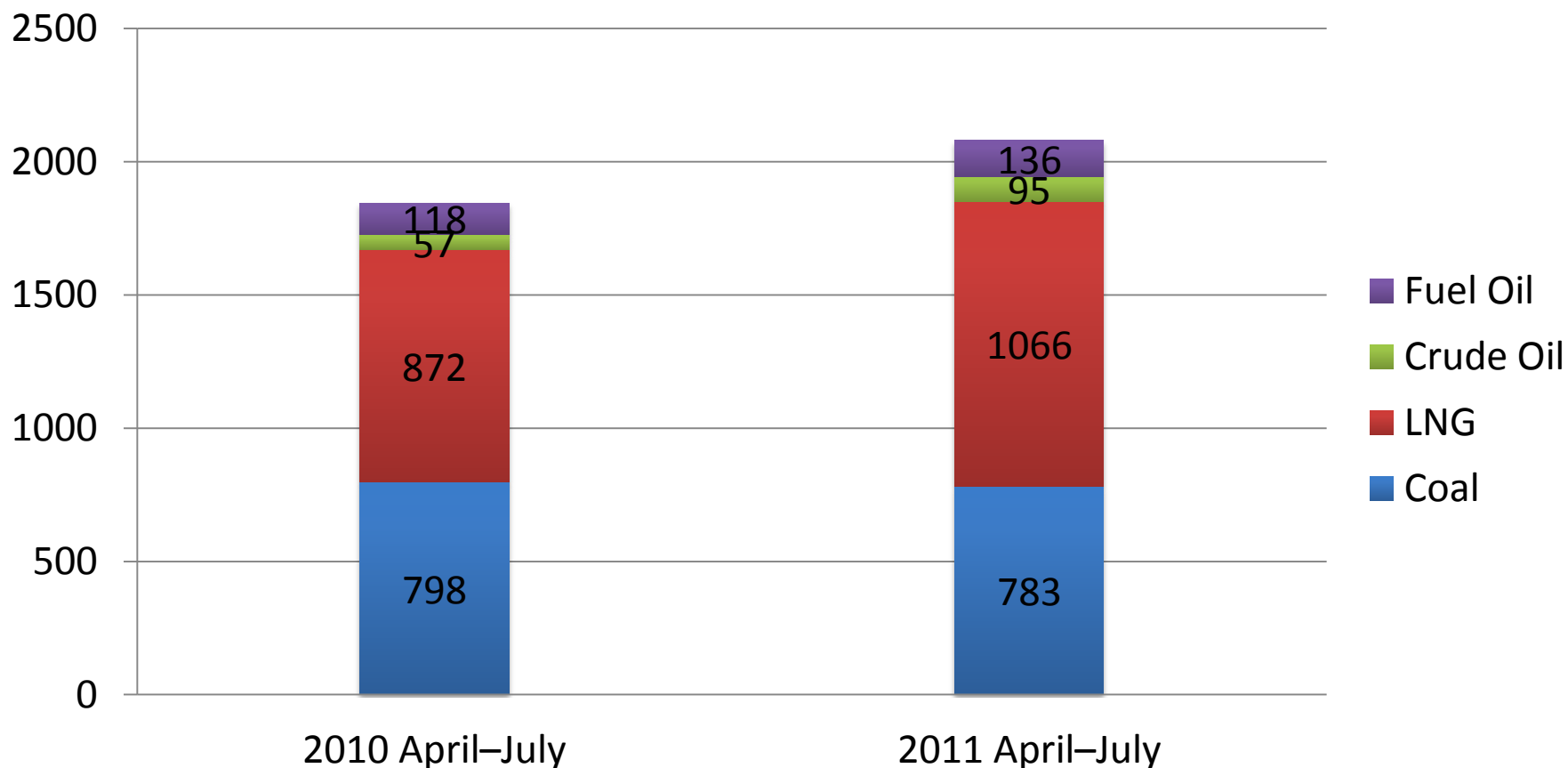
Present – Power Generation

Japan, Power Generation by Source (TWh)



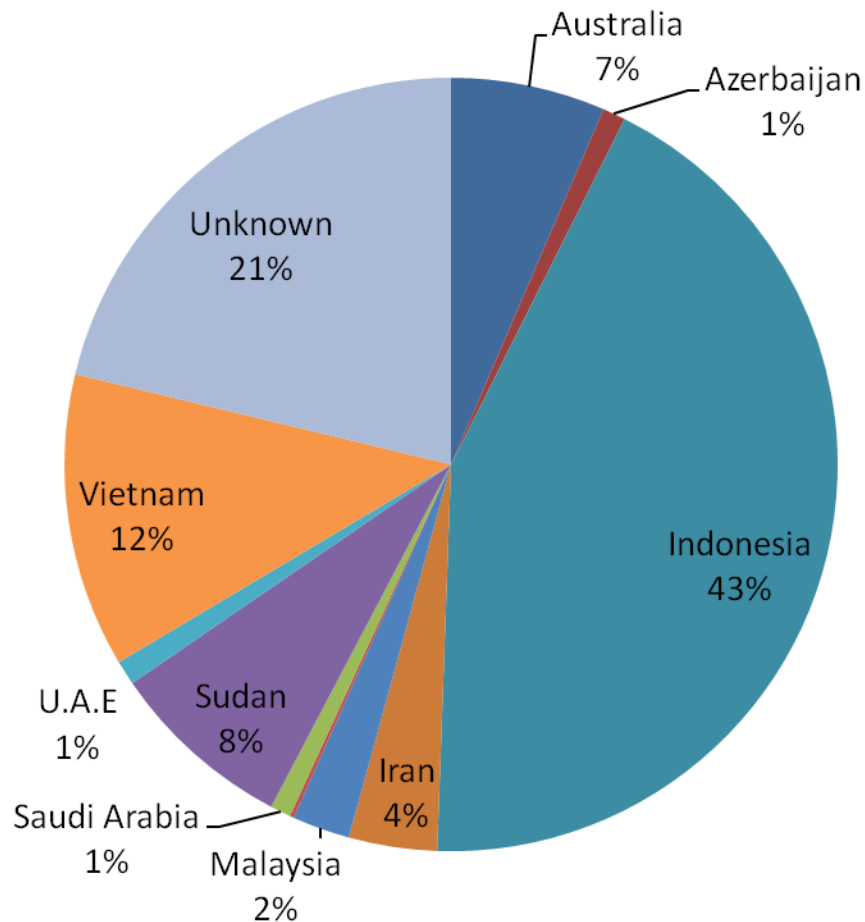
Present – Fossil Fuels

Japan, Fossil Fuel Use for Power Generation (KB/D FOE)



Present – Crude Oil

Japan, Imports of Direct-Burn Crudes by Country of Origin,
July 2010-July 2011

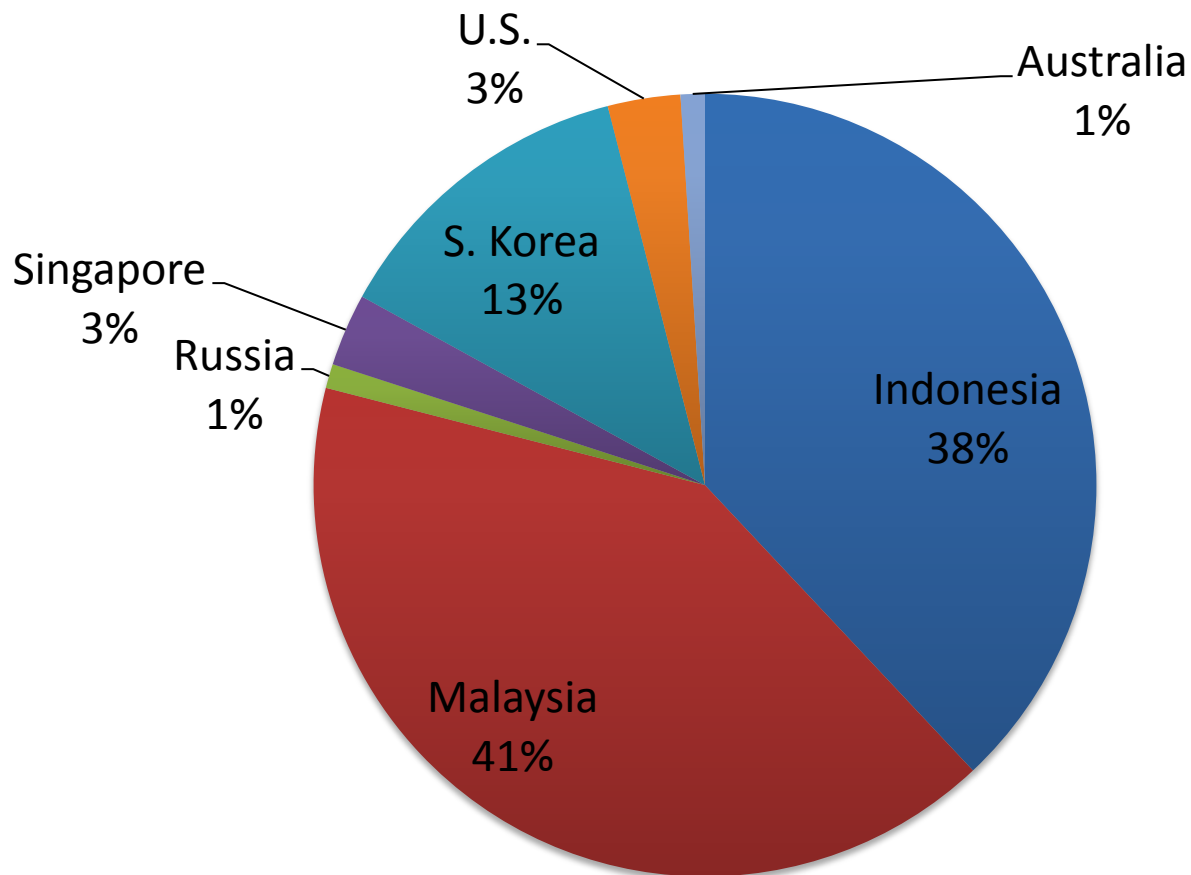


Total: 7,207,000 kl

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Present – Fuel Oil

Fuel Oil Imports, By Country of Origin, May 2010-June 2011



Total: 24,721,000 barrels

Future

- Growth in Electricity Demand
 - Exceptional demand management through aggressive conservation and load shifting efforts averted disaster for peak summer season FY2011.
 - Industrial output already back to 99% of pre-quake levels
 - Resumed economic growth for FY2012-FY2013
 - Sustainability of aggressive load-shifting and conservation efforts over the long term is questionable.
 - Return to roughly pre-quake electricity demand for FY2012, incremental demand growth for FY2013

Future — Nuclear Puzzle

- Nuclear
 - Aggregate loss of 14.5 GW of capacity (Fukushima + Hamaoka)
 - By May 2012, all but one of the currently operational reactors will be offline for inspections and maintenance
 - Japanese government set target date of “summer 2012” for restart of the nuclear sector
 - But may take 6 months to restart the 39 remaining reactors.
 - Owing to increased public scrutiny and regulatory caution, there will be a significant drop in nuclear utilization



Future

- Hydro is capacity constrained and lacks flexibility
- Reliance on fossil fuels to fill the nuclear gap
 - Coal
 - LNG
 - Crude Oil
 - Fuel Oil

Future – Mix Puzzle

- Coal
 - Will continue in base-load generation role
 - Incremental increases through greater utilization
- LNG
 - Significant new capacity available in last two years.
 - Will fill the bulk of base and mid-peak gap left by nuclear
- Oil
 - The gap in mid-peak to peak load generation will be met by increases in crude- and fuel oil-fired generation.

Future – Fuel Oil Puzzle

- VLSFO Use
 - Regional utilities and independent power producers
- VLSFO Production
 - Japan's refiners can produce 85-90 kb/d of VLSFO.

Future – Fuel Oil Puzzle

- VLSFO imports look to be in range of 100 kb/d or more
- VLSFO Import Sources
 - Far East / AG / USAC
- VLSFO Blending
 - LCO / VGO / Crude Oil

Conclusion

- Japan's nuclear generation will be significantly lower than pre-3/11/2011 levels because of lost generation capacity and lower utilization rates of surviving capacity.
- Japan will rely on a mix of fossil fuels to fill the nuclear gap, with particular emphasis on LNG
- To meet the jump in fuel oil requirements, Japan will need to significantly boost VLSFO imports

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