



# **Nuclear Energy After Fukushima**

Wednesday, May 4, 2011; 2:30 – 3:45 PM

## **Moderator:**

**Joel Kurtzman**, Senior Fellow; Executive Director, Center for a Sustainable Energy Future, Milken Institute

## **Speakers:**

**Spencer Abraham**, Chairman and CEO, The Abraham Group; former U.S. Secretary of Energy

**Amir Adnani**, President and CEO, Uranium Energy Corp.

**Christopher Paine**, Director, Nuclear Program, Natural Resources Defense Council

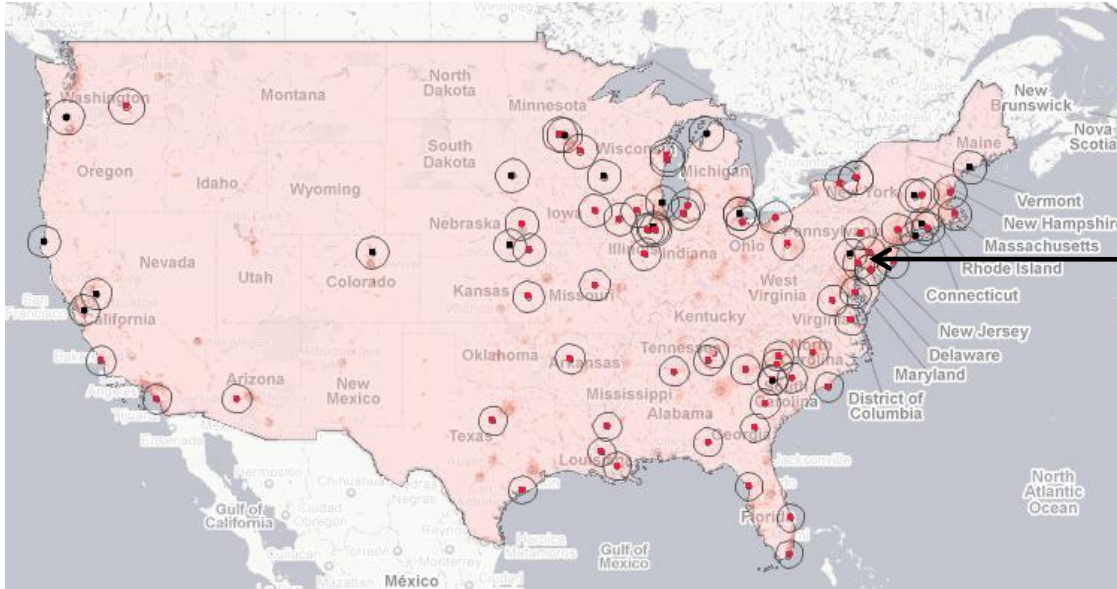
**Andrew Shapiro**, Founder and President, GreenOrder

# Active and inactive U.S. nuclear reactors

*10 and 50 mile evacuation zones contain significant populations*



MILKEN INSTITUTE



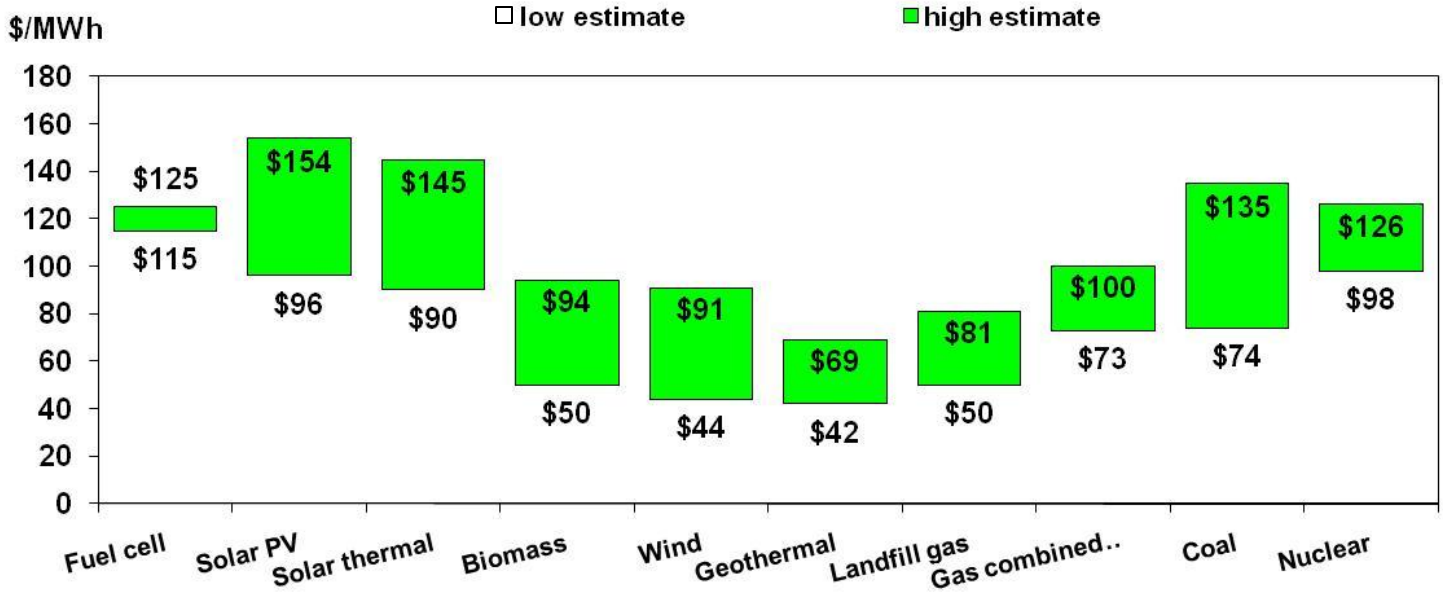
20 million people live within 50 miles of Indian Point alone.

# Levelized costs of electricity

*\$/MWh by fuel type*

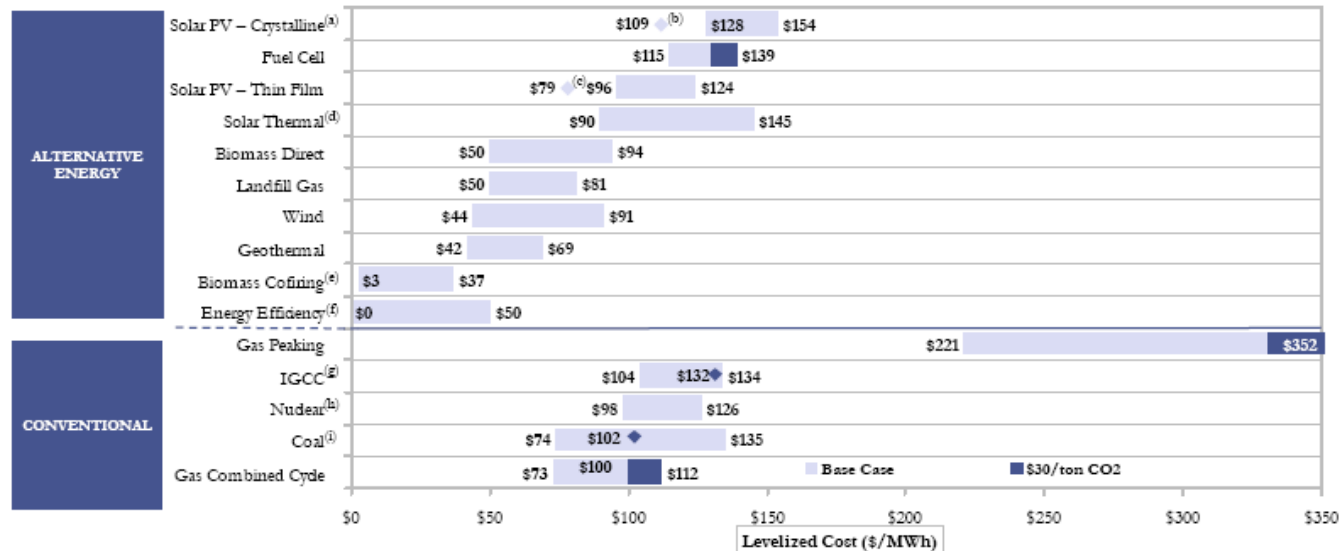


MILKEN INSTITUTE



# Levelized generation costs

*\$/MWh, with sensitivity to carbon emission costs*

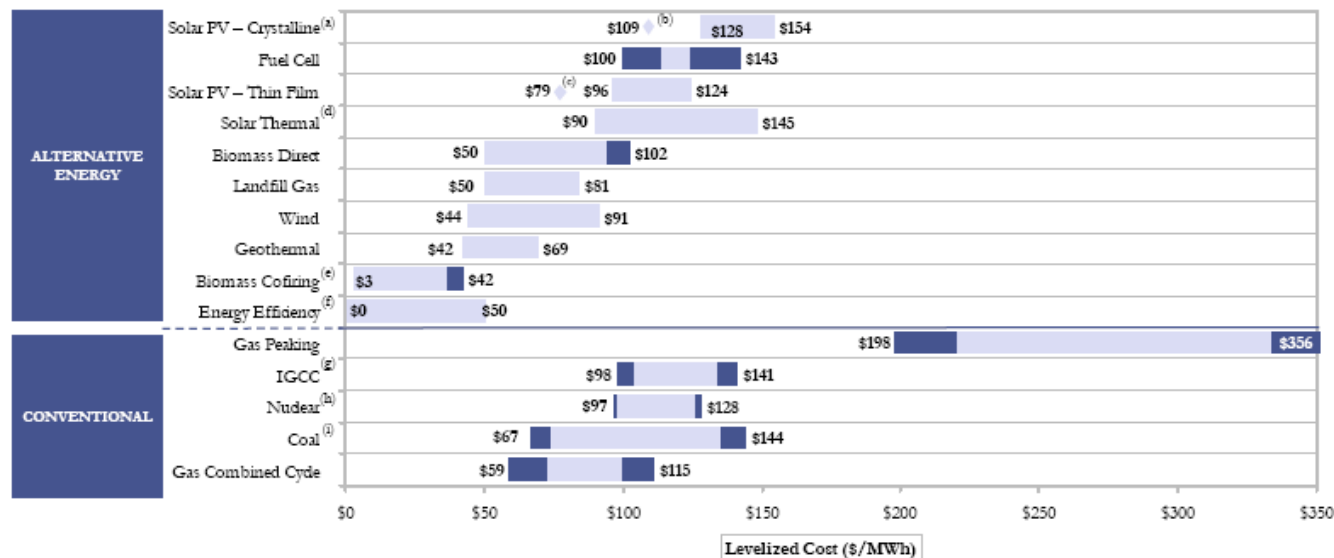


# Levelized generation costs

*\$/MWh, with sensitivity to fuel prices*



MILKEN INSTITUTE

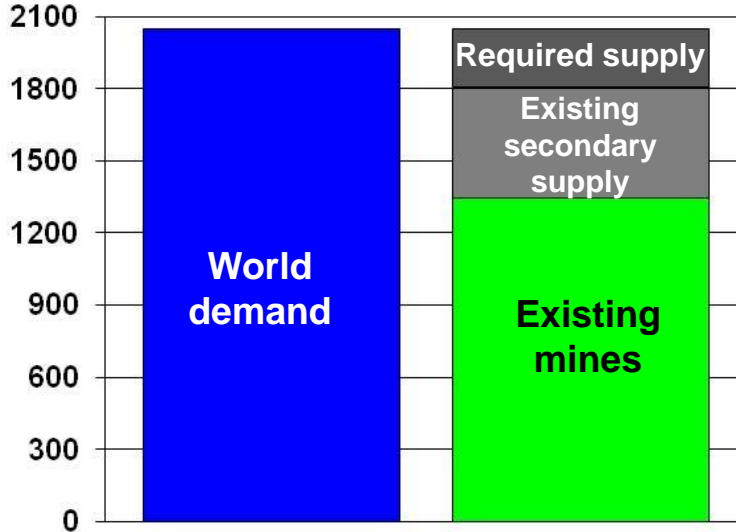


# Uranium market 2010-2019

*million lbs  $U_3O_8$*



MILKEN INSTITUTE

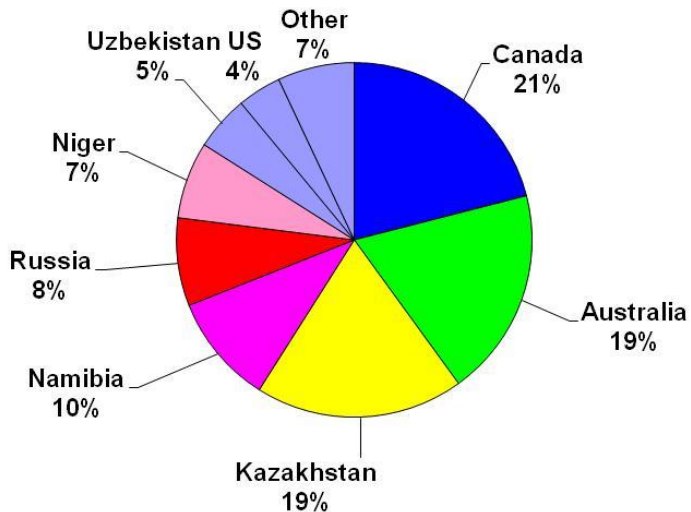


# World Uranium production

2008



MILKEN INSTITUTE

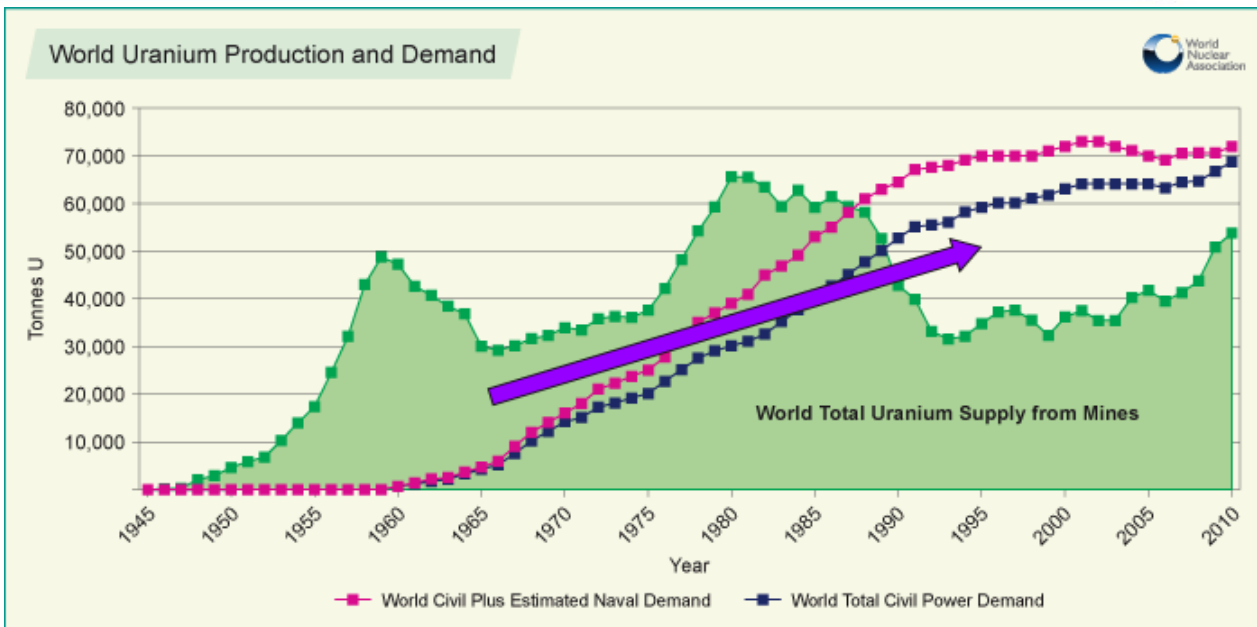


# World Uranium Production and Demand



MILKEN INSTITUTE

2010



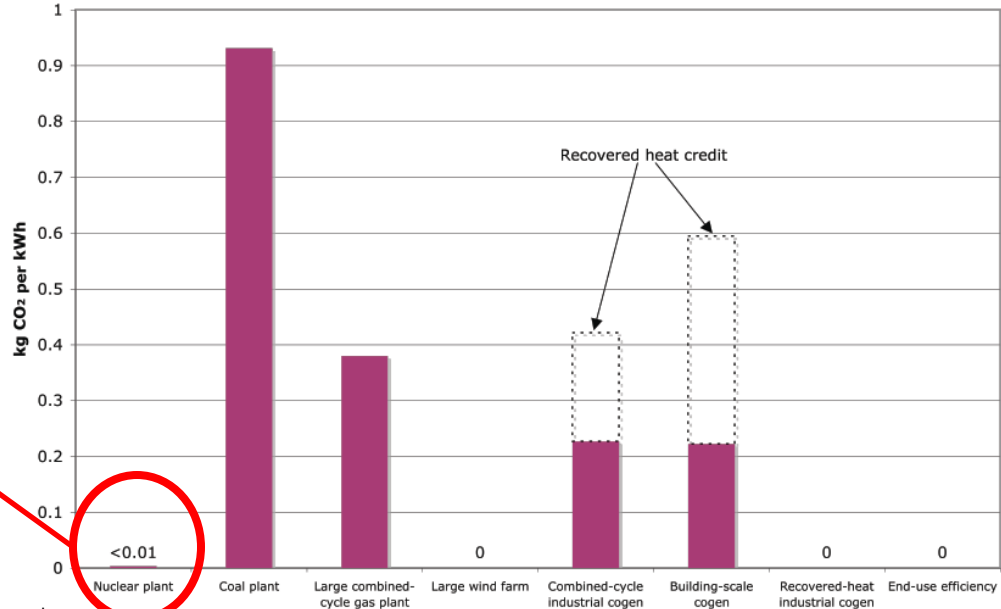


# Operating CO<sub>2</sub> emitted per delivered kWh

kg CO<sub>2</sub>



MILKEN INSTITUTE



**Nuclear**

# Nuclear - the Fuel of The 21<sup>st</sup> Century



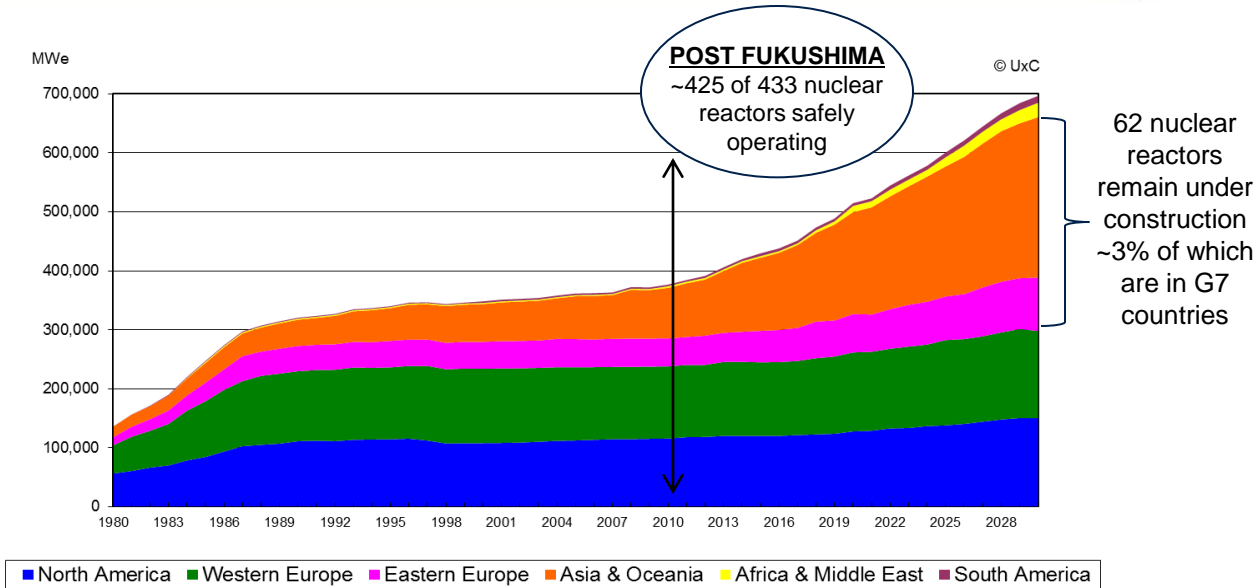
MILKEN INSTITUTE

## *Today's Drivers for Increased Nuclear Capacity*

- **Increasing Energy Demand**  
Global population growth and industrial development will lead to a doubling of electricity consumption by 2030
- **Climate Change**  
Fossil fuels must be reduced and replaced by low-emission sources of energy
- **Security of Supply**  
Reduce vulnerability to interrupted deliveries of oil and gas
- **Economics**  
Increasing fossil fuel prices have greatly improved the economics of nuclear power for electricity
- **Insurance Against Future Price Exposure**  
A longer-term advantage of uranium over fossil fuels is the low impact that increased fuel prices will have on the final electricity production costs

# Nuclear the Fuel of The 21<sup>st</sup> Century

## Nuclear Capacity Forecast by Region 1980-2030

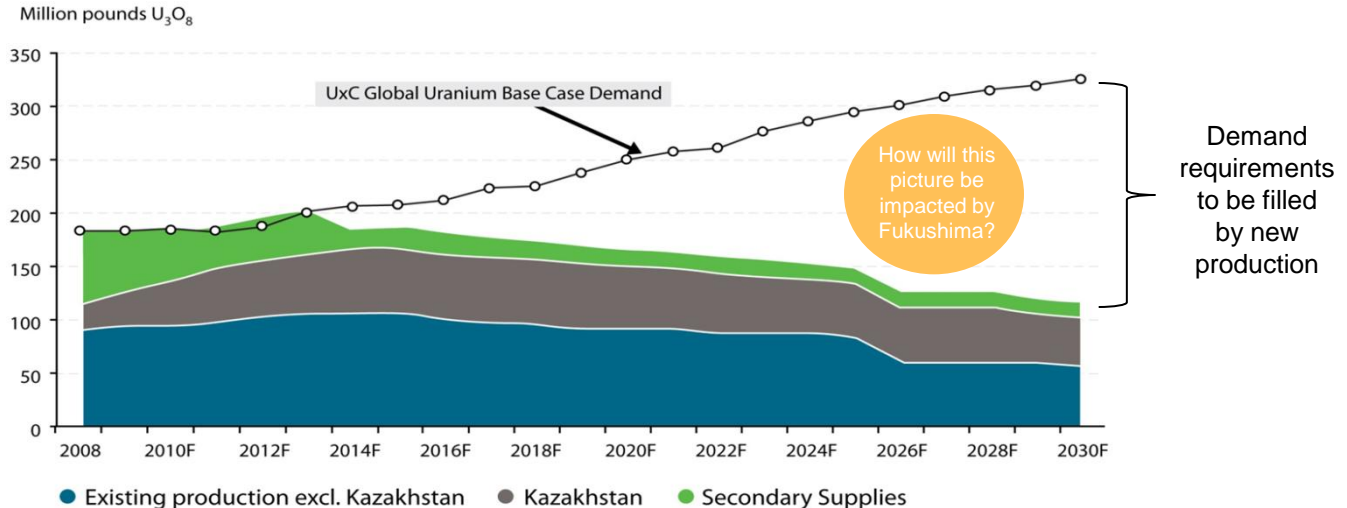


Source: UxC Base Case Nuclear Capacity Forecast by Region, 1980-2030

# Post Fukushima

## The Uranium Sector Continues to Face a Supply/Demand Imbalance

### Production from Existing Mines and Secondary Supply



# Post Fukushima



MILKEN INSTITUTE

## *The Uranium Sector Continues to Face a Supply/Demand Imbalance*

MINE SUPPLY (~130 MM LBS. U<sub>3</sub>O<sub>8</sub> IN 2010)  
CANNOT MEET CURRENT DEMAND (182 MM LBS. U<sub>3</sub>O<sub>8</sub> IN 2010)  
NOR IS IT EXPECTED TO GROW AT THE SAME PACE AS FUTURE DEMAND

### ***WHAT HAS CHANGED SINCE FUKUSHIMA?***

#### Uranium Demand

- 425 nuclear reactors safely operating
- 11 down in Japan, 7 down in Germany
- 62 nuclear reactors under construction
- Only ~3% of reactors under construction are in G7 countries

#### Uranium Supply

- Analysts view \$80/lb. uranium as necessary to support new mine development
- Uranium spot prices are well below these levels
- Will lead to constrained supply through project delays and cancellation
- HEU expires in 2013

# Post Fukushima

## *The U.S. Picture*



MILKEN INSTITUTE

- U.S. holds the **fourth position** globally for recoverable resources of U3O8
  - 104 U.S. nuclear reactors **consume 55mm lbs. of U3O8/year** to generate 20% of US electricity grid
  - Currently, the U.S. **produces approximately 4mm lbs. of U3O8/year**
  - Secondary supplies are declining and **most new sources of uranium are mined in politically unstable countries** which are prone to supply disruption
- **Post Fukushima** - The Obama administration will apply lessons learned but will continue to speed reactor construction with \$36 billion in federal loan guarantees for as many as eight new reactors