

ENERGY
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**From myth to reality: Asia's nuclear
energy prospect in the post-
Fukushima era
Moscow, 6 June 2011**

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I. The Impact of the Fukushima Accident on People

A. Raising a global concern about the safety of nuclear energy - People equate nuclear energy with accidents / disasters



Sources: 1. : On 20 March, 2011, 1500 people marched in Tokyo opposing nuclear <http://img.yidaba.com/photo/20110321/201103211102426378.jpg>
2. On 26 March, 2011. anti-nuclear demonstrators march in Cologne, Germany
<http://makanaka.wordpress.com/japan-nuclear-emergency-fukushima/>

I. The Impact of the Fukushima Accident on People

B. Encouraging debates about scaling down or phasing out nuclear energy sector



Source: 1. The Hamaoka Nuclear Facility, “the most dangerous power plant in Japan” was completely shut down on 14 May 2011

<http://blogs.wsj.com/japanrealtime/tag/hamaoka/>

2. On 29 March 2011, the president of opposition party in Taiwan proposed phasing out the industry when the operating license of the Ma-anshan Nuclear Power Plant in Pingtung County, the youngest operating facility, comes up for review in 2025.

<http://www.taipeitimes.com/News/taiwan/archives/2011/03/30/2003499468>

I. The Impact of the Fukushima Accident on People

C. Contributing Factors

1. Exaggerated reporting by the media
2. Prevailing poor knowledge about nuclear energy worldwide



Sources: 1. On 26 April 2011, the Philippine chapter of the International League of Peoples' Struggles (ILPS) led a program in Quezon City to remind the public of the devastation of Chernobyl. <http://bulatlat.com/main/2011/04/28/global-day-of-action-against-nuclear-power-reactors-held/>
2. Indians participate in a candle light vigil in Ahmadabad, India, to protest the country's plans to increase its nuclear power by 600 percent. <http://hereandnow.wbur.org/2011/04/13/india-nuclear-power>

I. The Impact of the Fukushima Accident on People

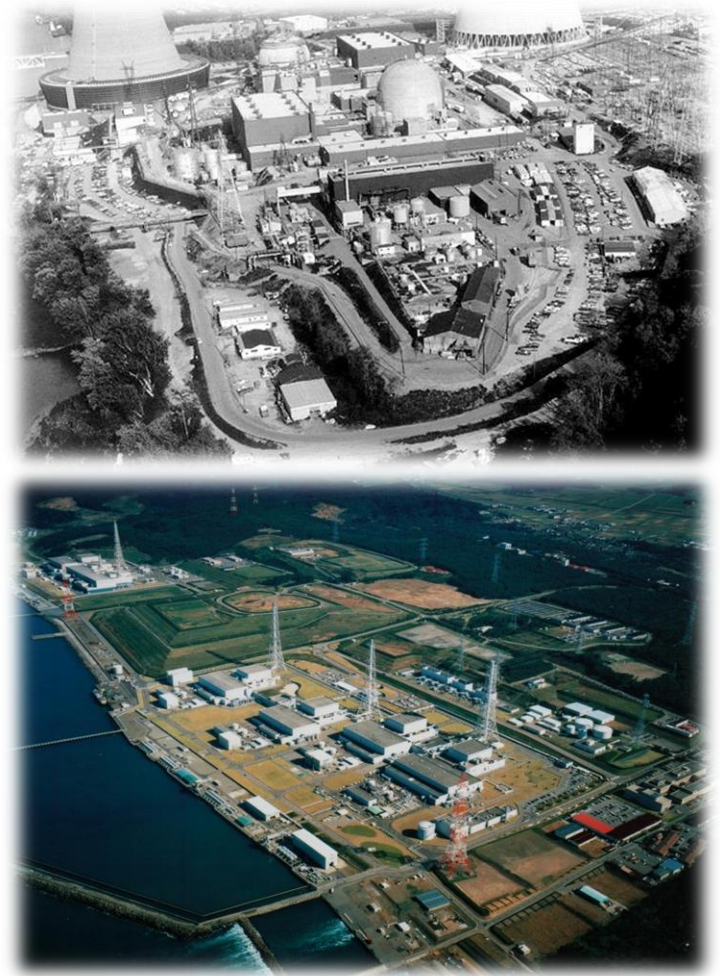
D. Whether the facts supports the prevailing public concern

1. Six decades of power generation by nuclear energy starting in the 1950s

2. Hundreds of nuclear power reactors in operation globally since the 1950s

Sources: 1. **Pennsylvania's Shippingport facility** was the first full-scale commercial nuclear power plant in the United States. It shipped its first power into the Pittsburgh grid on 18 December 1957. Photo courtesy Federation of American Scientists
2. **Japan's Kashiwazaki nuclear plant**, with 7 total capacity of 8,212 MW is the largest nuclear power plant of the world.

<http://pcgladiator.blogspot.com/2009/01/nuclear-power-plants.html>



I. The Impact of the Fukushima Accident on People

3. **440** nuclear power reactors in use in 2011

4. Only three significant accidents leading to the release of radioactive materials since the 1950s

-February 1979 **Three Mile Island** (USA): no harm to humans and the environment

-April 1986 **Chernobyl** (USSR): causing harm to humans & environmental contamination

-March 2011 **Fukushima** (Japan): no harm to humans and the environment



Source: The Chernobyl after the accident, <http://library.thinkquest.org/04oct/01020/chernobyl.htm>

II. The Impact of the Fukushima Accident on Governments: Continuation of Two Pre-Fukushima Trends

A. Americas and Europe: no major interest in nuclear energy “traditionally” for various reasons, including availability of alternatives & popular opposition, a trend to continue, with a few exception having ongoing projects:

1. Russia (11)
2. Bulgaria, the Slovakian Republic and Ukraine (each 2)
3. Finland and France (each 1)
4. Argentina and Brazil (each 1)
5. The United States: possibly two with guaranteed financing

II. The Impact of the Fukushima Accident on Governments: Continuation of Two Pre-Fukushima Trends

- B. Asia, particularly, Asia-Pacific:** the main arena for nuclear energy expansion since 1970s but especially 1990s owing to various energy, financial, environmental and political/security reasons
1. Currently, about **100** projects have been considered, negotiated and signed
 2. Ongoing projects:
 - China (24)
 - South Korea (6)
 - India (4)
 - Taiwan (2)
 - Pakistan (1)
 - Japan (1)
 - Iran (1)
 - Vietnam (1)
 3. China will remain number 1 having about 100 projects on its list of which many will be realized

II. The Impact of the Fukushima Accident on Governments: Continuation of Two Pre-Fukushima Trends

C. All the Asian countries with an active nuclear program or a serious plan towards it, **including Japan**, have reiterated their commitment to its continuity in the post-Fukushima era



Sources: 1. Westinghouse is about halfway to completion of one of the plants at Sanmen in China's Zhejiang province. 28 March 2011

http://www.msnbc.msn.com/id/42258191/ns/business-world_business/t/new-nuclear-plants-designed-be-safest-ever/

2. Vietnam PM Dung receives Russian Deputy Foreign Minister A. Borodavkin. Both side discussed orientations and measures to enhance bilateral cooperation to accelerate the implementation of strategic cooperation projects, especially the project on construction of the first nuclear-power plant in Vietnam. 26 April 2011

<http://english.vietnamnet.vn/en/politics/7549/government-in-brief-26-4.html>

II. The Impact of the Fukushima Accident on Governments: Continuation of Two Pre-Fukushima Trends

D. Those Asian countries uncommitted to nuclear energy in the pre-Fukushima era have declared a pause in their nuclear programs (Thailand and Philippines)



Source: On 30 June 2010, Greenpeace activists placed a huge barrel bearing the nuclear symbol in front of the Energy Ministry to highlight the economic risks of Thailand building the five nuclear power plants proposed in the nation's Power Development Plan. Their protest is now supported by the accident of Fukushima.
<http://www.greenpeace.org/international/en/news/Blogs/nuclear-reaction/thailands-future-nuclear-plans/blog/12852>

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

A. Nuclear energy is still considered safe despite the Fukushima incident

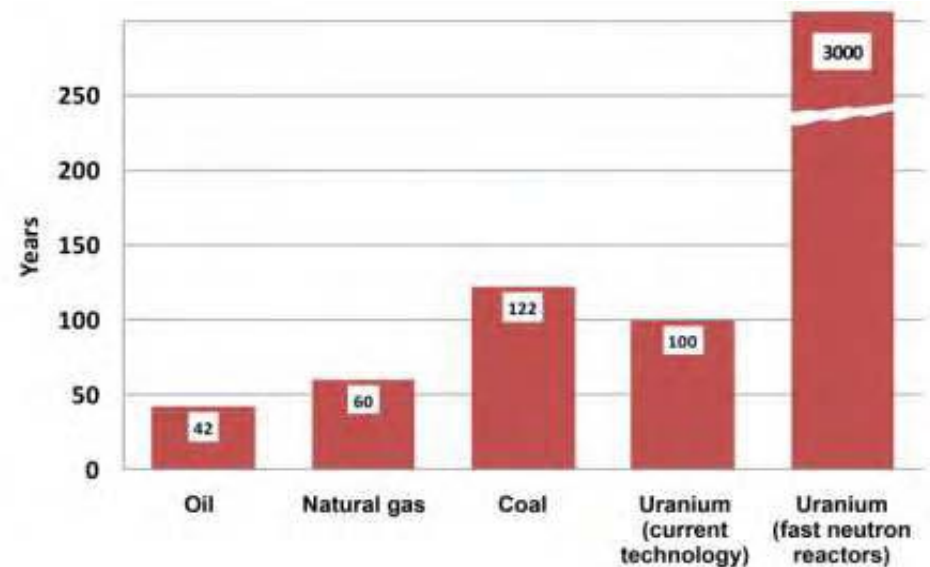
1. The Fukushima accident is not a proof of nuclear energy being unsafe
2. It actually showed how containment structures could prevent disasters like Chernobyl
3. Today's containment structures are more resistant than that of Fukushima; some are even capable of tolerating a direct hit by a passenger airplane
4. The Fukushima accident's main cause (vulnerability of its cooling system to tsunami) can be easily fixed by installing reactor cooling systems at an elevated platform in countries prone to tsunamis

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

B. Factors justifying the use of nuclear energy in the pre-Fukushima era are still valid

1. Decreasing reliance on imported fossil fuel having financial, political and security implications for the importers
2. Depletion of oil/gas/coal reserves in fossil-energy-rich countries

Figure 1.3: Reserve/production ratios of key energy resources (Global proved reserves in 2008, uranium in 2007)

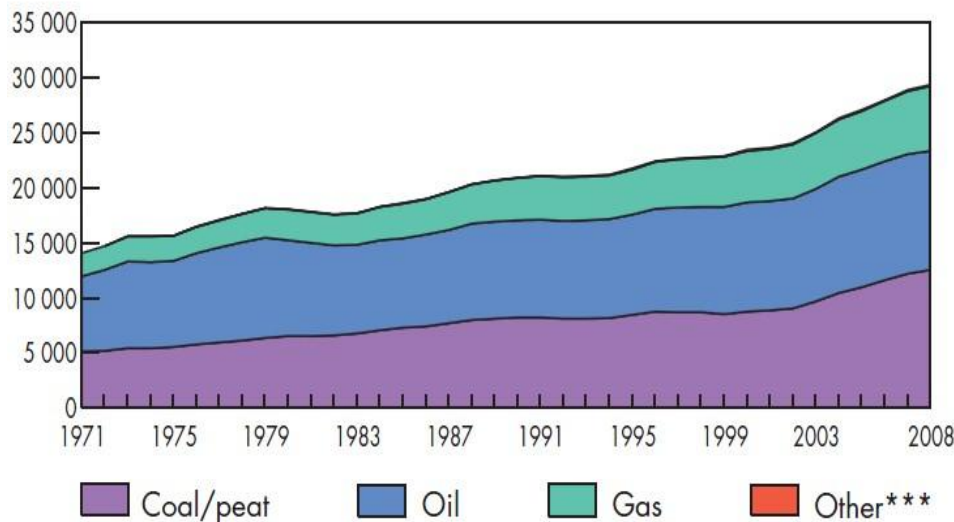


Source: The Security of Energy Supply and the Contribution of Nuclear Energy, Nuclear Development 2010, P. 37.

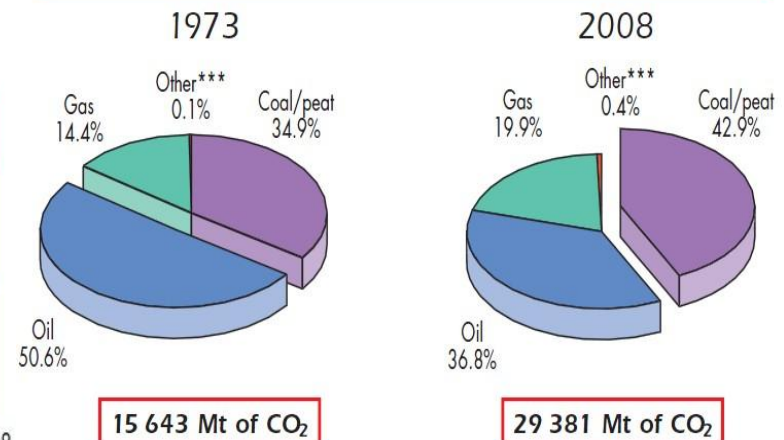
III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

- 3. Energy-mix diversification to improve energy security
- 4. Mitigation of global warming: decreasing greenhouse gas emissions

Evolution from 1971 to 2008 of world* CO₂ emissions** by fuel (Mt of CO₂)



1973 and 2008 fuel shares of CO₂ emissions**



*World includes international aviation and international marine bunkers.
 **Calculated using the IEA's energy balances and the Revised 1996 IPCC Guidelines.
 CO₂ emissions are from fuel combustion only. ***Other includes industrial waste and non-renewable municipal waste.

Source: 2010 Key World Energy Statistics, IEA, P. 44.

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

C. Unsustainable nature of the global energy mix

1. Domination of the global energy mix by fossil energy (oil, gas, coal) to continue in the foreseeable future
2. Insignificant contribution of non-fossil energy (renewables and nuclear) to the global energy mix

| | Energy demand (Mtoe) | | | | | | | Shares (%) | | CAAGR (%) |
|-------------------|----------------------|---------------|---------------|---------------|---------------|---------------|---------------|------------|------------|------------|
| | 1990 | 2008 | 2015 | 2020 | 2025 | 2030 | 2035 | 2008 | 2035 | 2008-2035 |
| TPED | 8 779 | 12 271 | 13 776 | 14 556 | 15 263 | 16 014 | 16 748 | 100 | 100 | 1.2 |
| Coal | 2 233 | 3 315 | 3 892 | 3 966 | 3 986 | 3 984 | 3 934 | 27 | 23 | 0.6 |
| Oil | 3 222 | 4 059 | 4 252 | 4 346 | 4 440 | 4 550 | 4 662 | 33 | 28 | 0.5 |
| Gas | 1 674 | 2 596 | 2 919 | 3 132 | 3 331 | 3 550 | 3 748 | 21 | 22 | 1.4 |
| Nuclear | 526 | 712 | 818 | 968 | 1 078 | 1 178 | 1 273 | 6 | 8 | 2.2 |
| Hydro | 184 | 276 | 331 | 376 | 417 | 450 | 476 | 2 | 3 | 2.0 |
| Biomass and waste | 904 | 1 225 | 1 385 | 1 501 | 1 627 | 1 780 | 1 957 | 10 | 12 | 1.7 |
| Other renewables | 36 | 89 | 178 | 268 | 384 | 521 | 699 | 1 | 4 | 7.9 |

Source: New Policies Scenario, IEA, World Energy Outlook 2010, p. 620.

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

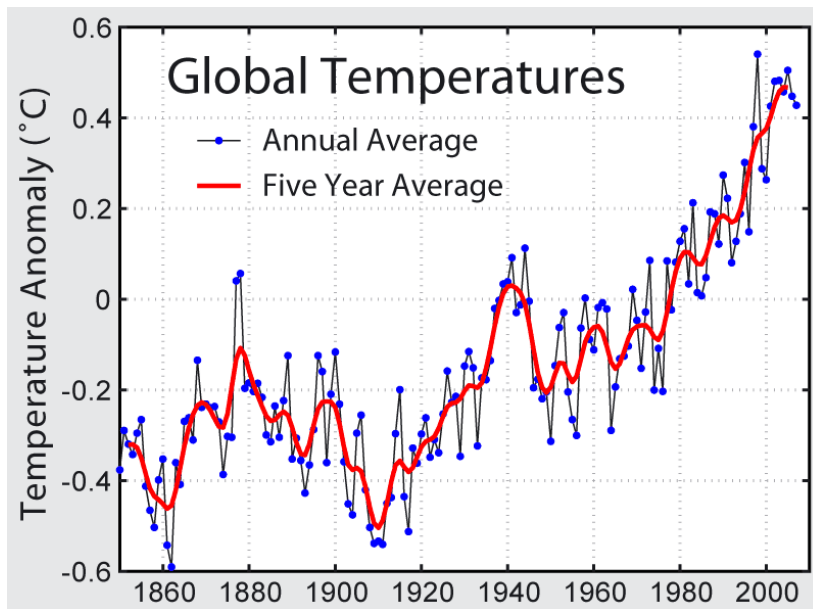
3. Heavy consumption of fossil energy: the major contributor to global warming
4. Continuation of this trend based on projections

| | CO ₂ emissions (Mt) | | | | | | | Shares (%) | | CAAGR (%) |
|-----------------------------|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|------------|------------|------------|
| | 1990 | 2008 | 2015 | 2020 | 2025 | 2030 | 2035 | 2008 | 2035 | 2008-2035 |
| Total CO₂ | 20 924 | 29 260 | 32 741 | 33 739 | 34 395 | 35 053 | 35 442 | 100 | 100 | 0.7 |
| Coal | 8 296 | 12 579 | 14 865 | 15 084 | 14 999 | 14 818 | 14 416 | 43 | 41 | 0.5 |
| Oil | 8 805 | 10 805 | 11 289 | 11 580 | 11 886 | 12 257 | 12 624 | 37 | 36 | 0.6 |
| Gas | 3 823 | 5 875 | 6 586 | 7 075 | 7 510 | 7 979 | 8 402 | 20 | 24 | 1.3 |
| Power generation | 7 476 | 11 918 | 13 364 | 13 668 | 13 831 | 13 908 | 13 756 | 100 | 100 | 0.5 |
| Coal | 4 927 | 8 670 | 10 058 | 10 175 | 10 190 | 10 083 | 9 767 | 73 | 71 | 0.4 |
| Oil | 1 192 | 864 | 638 | 561 | 495 | 435 | 397 | 7 | 3 | -2.8 |
| Gas | 1 357 | 2 384 | 2 668 | 2 933 | 3 146 | 3 391 | 3 593 | 20 | 26 | 1.5 |
| TFC | 12 435 | 15 852 | 17 752 | 18 368 | 18 826 | 19 359 | 19 851 | 100 | 100 | 0.8 |
| Coal | 3 231 | 3 629 | 4 498 | 4 583 | 4 510 | 4 440 | 4 362 | 23 | 22 | 0.7 |
| Oil | 7 053 | 9 266 | 9 958 | 10 309 | 10 663 | 11 076 | 11 460 | 58 | 58 | 0.8 |
| <i>Transport</i> | <i>4 393</i> | <i>6 403</i> | <i>6 911</i> | <i>7 262</i> | <i>7 633</i> | <i>8 089</i> | <i>8 539</i> | <i>40</i> | <i>43</i> | <i>1.1</i> |
| <i>Bunkers</i> | <i>613</i> | <i>1 033</i> | <i>1 096</i> | <i>1 172</i> | <i>1 245</i> | <i>1 332</i> | <i>1 422</i> | <i>7</i> | <i>7</i> | <i>1.2</i> |
| Gas | 2 152 | 2 958 | 3 295 | 3 476 | 3 653 | 3 842 | 4 029 | 19 | 20 | 1.2 |

Sources: Source: New Policies Scenario, IEA, World Energy Outlook 2010, p. 622

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

5. Necessity of Decreasing Greenhouse Gas Emissions: Mitigation of Global Warming

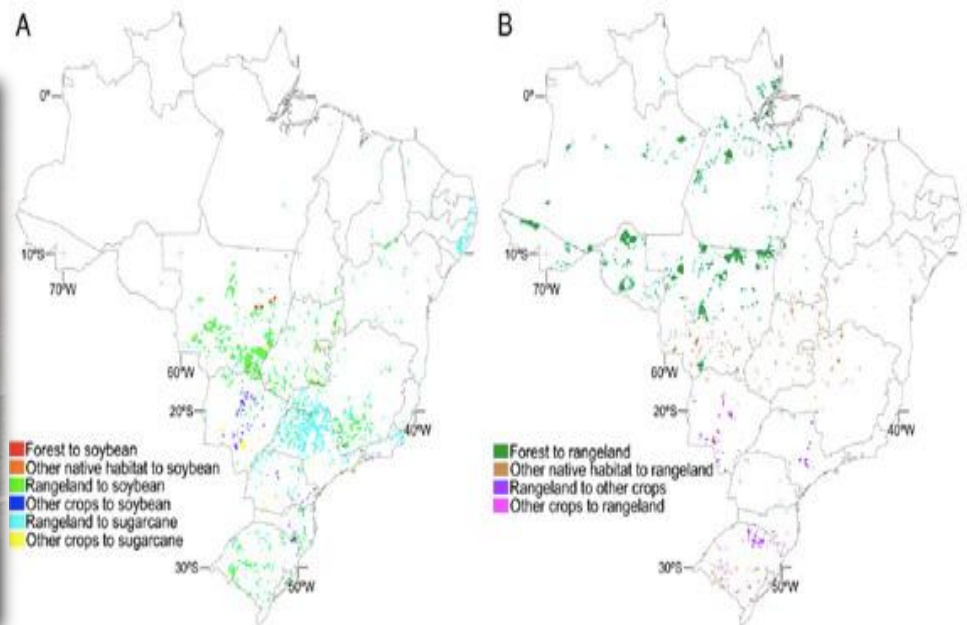


Sources: Bone dry Lake Pejar, one of the main water sources for Goulburn., Australia

<http://www.smh.com.au/news/National/Emergency-water-arrives-for-the-towns-running-dry/2005/06/08/1118123901295.html>

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

6. Yet, not all available “green replacements” (renewables) are environmentally-clean: e.g., bio-fuel is more pollutive than gasoline/ diesel fuel because of its highly pollutive production process



Sources: 1. Photo of the Year in Sweden award, a **bio-fuel factory in Brazil** making “**environmentally-friendly fuel**” for the European market
2. Modeled direct (A) and indirect (B) LUC caused by the fulfillment of Brazil’s biofuel (sugarcane ethanol and soybean biodiesel) production targets for 2020. Image and caption from Lapola et al. 2010

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

7. Environmentally-clean renewables: currently not a viable substitute for fossil energy due to their **limited energy generation**
8. Nuclear energy: a major environmentally-clean source of large-scale power generation
9. Nuclear energy as a necessity for energy generation and mitigating global warming being a clean source of energy, along with certain renewables
10. Necessity of its inclusion, along with environmentally-clean renewables, in the global energy mix



Source: **Koeberg nuclear power station**, the only nuclear power station in South Africa and the entire African continent. <http://www.todaysafricannews.com/?p=281>

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

D. New factors: Political Developments of 2011 in the oil/gas-exporting countries

1. Instability, change of governments and armed conflicts in many Arab countries, including oil/gas exporters (Algeria, Egypt, Libya, Oman and Yemen)

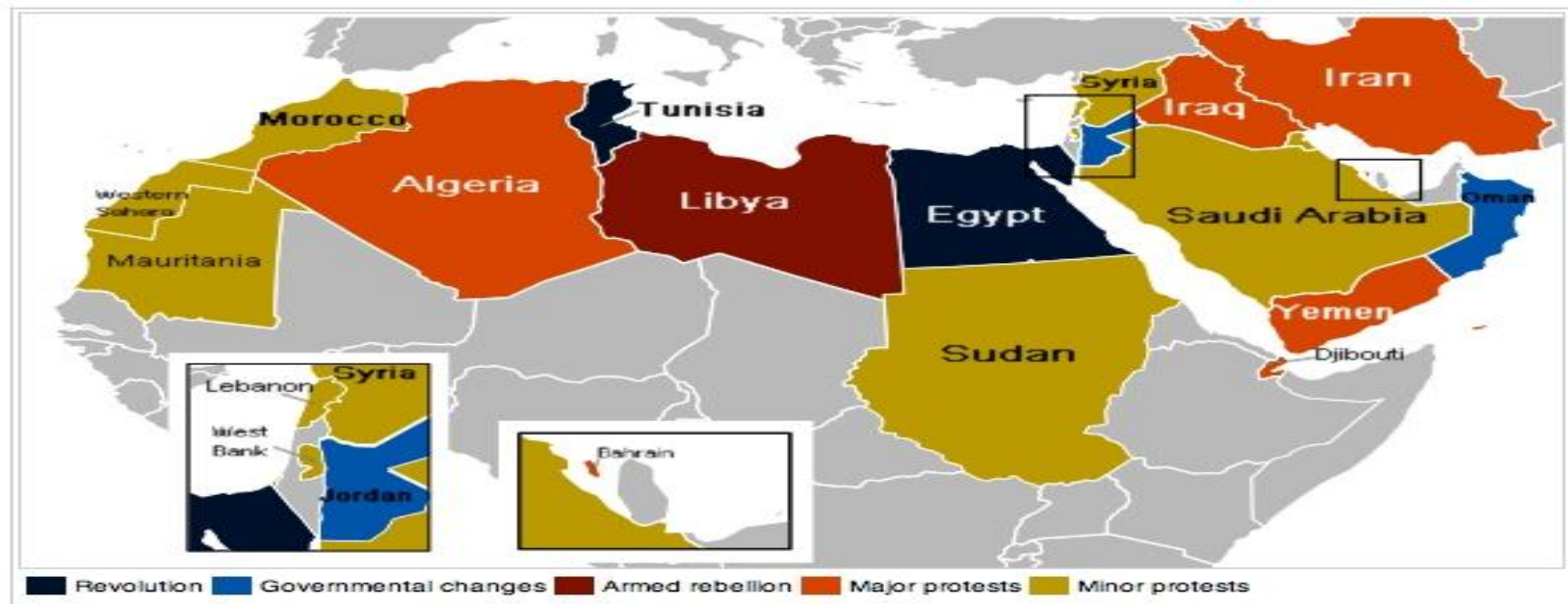


Source: 1. Fierce fighting has erupted in the Yemeni capital, Sanaa, AFP, Ahmad Gharabli, 31 May 2011.

2. Libyan rebels gather on the frontline as smoke from a burning oil facility darkens the sky on 11 March, 2011. Photo by John Moore/Getty Images

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

2. Potential of expansion of instability to major Arab oil/gas exporters of the Persian Gulf (Kuwait, UAE, Qatar and Saudi Arabia) all of which have experienced a limited degree of popular dissatisfaction/unrest



Sources: Author's created based on the 2011 Middle East and North Africa protest map

III. Major Reasons for the Continued Interest in Nuclear Energy in the Post-Fukushima Era

3. Oil price hikes and continued high oil prices in the foreseeable future
4. Predictable growing competition among the major oil/gas consumers over supplies with energy, financial and political/military implications
5. Uncertainty about oil/gas supply availability at an affordable price
- 6. All these factors have created another incentive for decreasing reliance on imported oil/gas and thus retaining, expanding or adding nuclear energy to one's energy mix**

IV. The future of Nuclear Energy in the Post-Fukushima Era

- A.** Those countries uncommitted to nuclear energy in the pre-Fukushima era (European and American) will largely remain so mainly because of having alternatives
- B.** The factors encouraged and demanded opting for nuclear energy in the pre-Fukushima era are still strong/valid and will remain so for those committed to the nuclear energy for a range of reasons

IV. The future of Nuclear Energy in the Post-Fukushima Era

C. Asia, particularly, Asia-Pacific will be the main arena for rapid nuclear energy expansion



Thank you for paying attention!