

# Commercial Decommissioning... a Vendor's Global Perspective

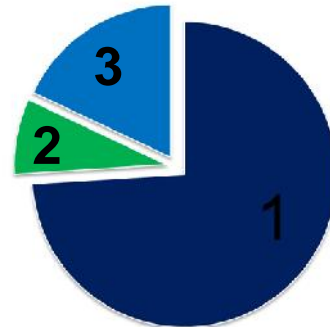
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## Key Statistics

- ▶ In the next 20 years more than 200 nuclear power plants are expected to be closed, primed for or begin decommissioning worldwide – more than half currently in operation
- ▶ Main drivers for plant shutdown:
  - ◆ 1. Units that have lived out their lifetime, fulfilled their purpose, or are no longer economically justifiable to run (74%)
  - ◆ 2. Units that close following an accident or serious incident (8%)
  - ◆ 3. Units which are closed prematurely by political decision or due to regulatory reasons (18%)



## Europe

- ▶ **On track to decommission 150 reactors in the next 20 years**
  - ◆ Contains 69% of projected nuclear power related closures by 2030 (as of 2012 estimates)
  - ◆ Market values of these decommissioning efforts stands at \$81.5 billion (2012 estimates)
- ▶ **France**
  - ◆ \$21.5 billion in market value over the next 20 years
  - ◆ EdF to pursue its D&D program (Chooz, Superphénix, Bugey ...)
  - ◆ Main driver: Completion of expected reactor lifetime in the long term




## Europe

- ▶ **Russia**
  - ◆ \$13.5 billion in market value over the next 20 years
  - ◆ Main driver: completion of reactor lifetime
- ▶ **UK**
  - ◆ \$18.7 billion in market value over the next 20 years
  - ◆ 3 units shut down since 2011
  - ◆ Main driver: completion of reactor lifetime
- ▶ **Germany**
  - ◆ 8 Units closed down prematurely that could be dismantled in the medium term (due to German immediate phase out)
  - ◆ Final costs may exceed \$32.5 billion considering long term fuel storage costs
  - ◆ Currently dismantling 4 units
  - ◆ Eventual shutdown of remaining 9 plants (12.7 GW)
  - ◆ Main driver: political decisions




## Asia Pacific

- ▶ Market value of Asia Pacific region in the next 20 years estimated to be \$20.3 billion
- ▶ Second highest market projection globally following Europe
- ▶ Japan
  - ◆ Fukushima will continue to generate strong needs for D&D work on-site (remediation, fuel retrieval and D&D, soil decontamination)
  - ◆ Accident expected to generate additional need for D&D support of other Japanese reactors
  - ◆ Difficulty for foreign players to support D&D market in Japan
  - ◆ Main drivers: Fukushima accident and political decisions

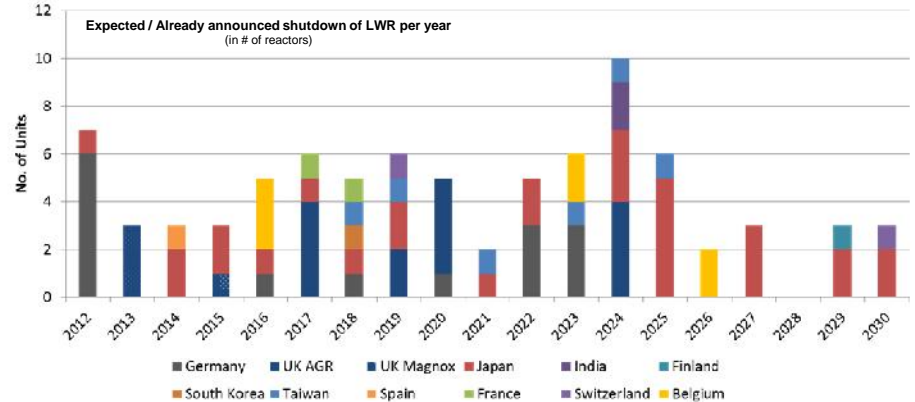


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## End of Operating Licenses Globally


Expected / Already announced shutdown of LWR per year  
(in # of reactors)





Year	Germany	UK AGR	UK Magnox	Japan	India	Finland	South Korea	Taiwan	Spain	France	Switzerland	Belgium
2012	7	0	0	0	0	0	0	0	0	0	0	0
2013	0	3	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	2	0	0	0	0	0	0	0	0
2015	0	0	0	2	0	0	0	0	0	0	0	0
2016	0	0	0	1	0	0	3	0	0	0	0	0
2017	0	0	0	1	0	0	0	0	0	1	0	0
2018	0	0	0	1	0	0	0	0	0	1	0	0
2019	0	0	0	1	0	0	0	0	0	0	1	0
2020	0	0	0	1	0	0	0	0	0	0	0	0
2021	0	0	0	1	0	0	0	0	0	0	0	0
2022	0	0	0	1	0	0	0	0	0	0	0	0
2023	0	0	0	1	0	0	0	0	0	0	0	0
2024	0	0	0	1	0	0	0	0	0	0	0	0
2025	0	0	0	1	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0	0	0	0
2027	0	0	0	1	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0	0	0	0
2029	0	0	0	1	0	0	0	0	0	0	0	0
2030	0	0	0	1	0	0	0	0	0	0	0	0

 5 units at 4 sites announced shutdown in 2013

 8 units shutdown in 2011, 9 extra to shutdown by 2022

 Key question on post-Fukushima shutdown and D&D strategies, 28 units affected

 18 Units from the Magnox and AGR fleet



## United States

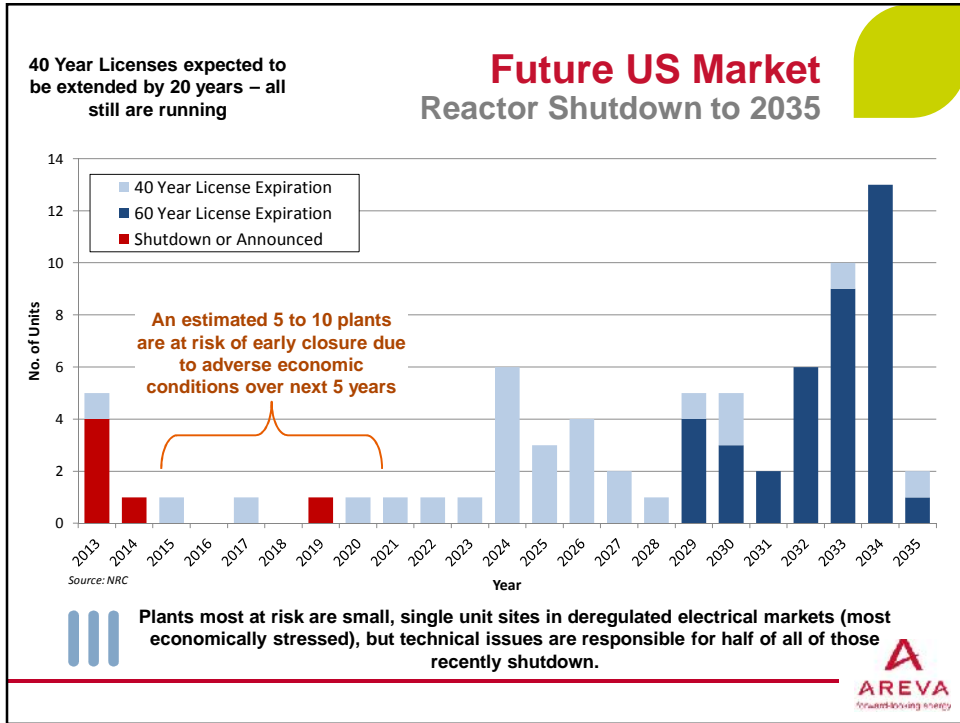


- ▶ Current forecasts for known U.S. D&D estimated at \$8 billion +/-
- ▶ 2012 lowest forecasted region globally
- ▶ 38 reactors will be shutdown by 2035 due only to end of license
- ▶ However, energy market conditions have driven several premature plant closings, including 5 in 2013 (SONGS 2&3, VY, Kewaunee, CR3)
- ▶ Current projection to expect potential additional early shutdowns due to economic performance pressures

## United States



- ▶ A number of nuclear plants running low or negative economic projections are in danger of premature shutdown if market conditions do not change
- ▶ Political implications and site specific situations have also influenced decisions to shut down plants
- ▶ Analysts reaffirm recent closures are not indicative of a wider trend (citing specific circumstances), but assert that decisions to shut down plants are more hastily done in this economic environment



### SAFSTOR vs. DECON

- ▶ **SAFSTOR vs. near term D&D influenced by:**
  - ◆ Status of and confidence in decommissioning fund (NDT) and cost estimate
  - ◆ Local and state politics
  - ◆ Public pressure
- ▶ **Most early shutdown plants tend to have underfunded decommissioning funds and opt for SAFSTOR**
- ▶ **SAFSTOR allows for fund growth through interest compounding; but...**
- ▶ **Must assume that cost increase less than fund growth**
  - ◆ May not be true across the board
  - ◆ Much uncertainty / risk in waste disposal costs, regulatory requirements, etc. when projected out several decades

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## SAFSTOR vs. DECON

- ▶ **Once initiated SAFSTOR decision is not easily changed to DECON**
  - ◆ Plant infrastructure equipment and components not readily available
  - ◆ RCS chemical decon can be very challenging
  - ◆ Key / knowledgeable plant personnel are gone
- ▶ **Consideration for phased approach to DECON**
  - ◆ Full System Decon
  - ◆ Removal of NSSS and DECON of the Containment Building
  - ◆ Removes >95% of the radiological source term under today's known regulations and cost
  - ◆ Improves risk profile in those areas most vulnerable to excessive cost growth
  - ◆ Can defer D&D of the remainder of the plant
- ▶ **Bottom line... it is incumbent on our industry (utilities and vendors) to responsibly, cost effectively and safely decommission our shutdown fleet.**

## Closing Comments

- ▶ **Globally and domestically, the number of shutdown units will grow dramatically over the next 20 years**
- ▶ **Early shutdown projections have tended to underestimate the actual rate of closures**
- ▶ **Phased approaches to D&D should be considered**  
and finally...
- ▶ **Our industry must safely and cost effectively deal with our retiring fleet to sustain the ability to build new plants**