

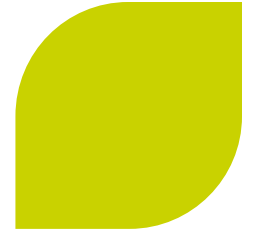
# **Commercial Decommissioning... a Vendors Global Perspective**

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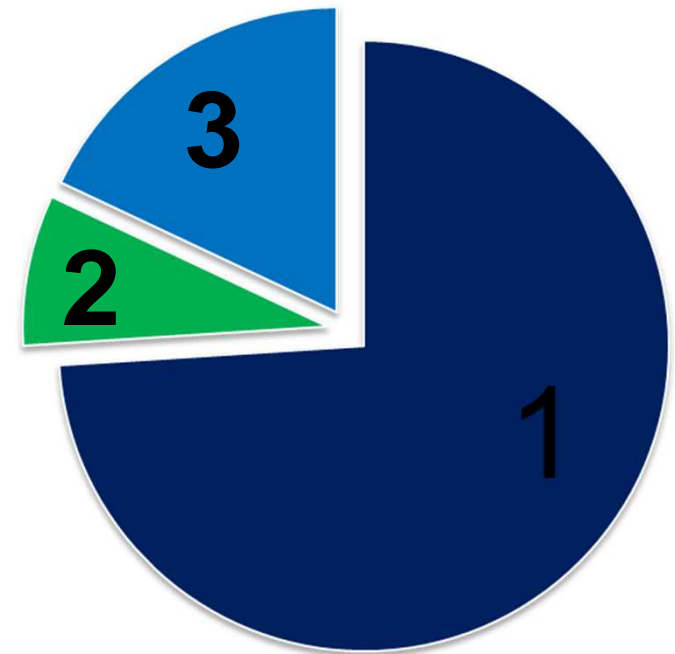
# Key Statistics



▶ 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



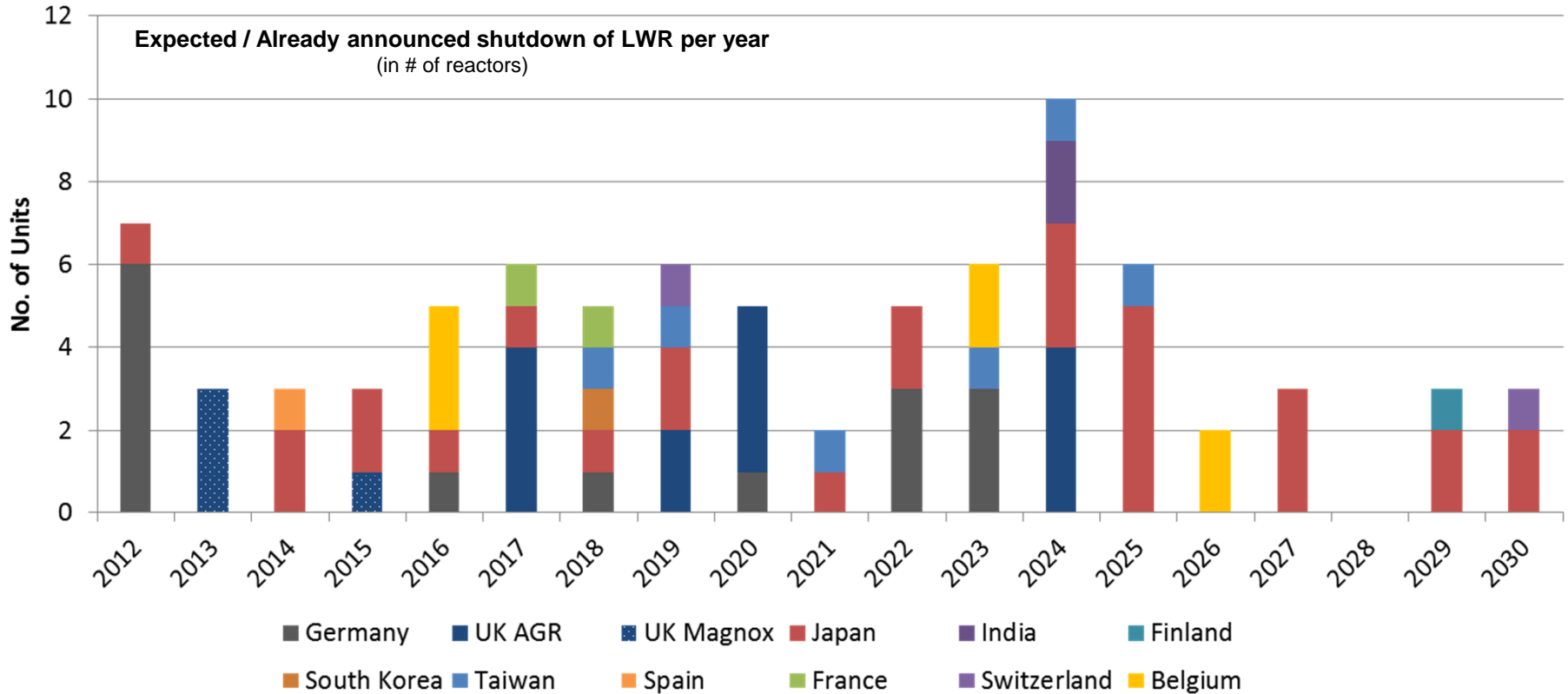
# Asia Pacific



- ▶ **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**



# End of Operating Licenses Globally



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

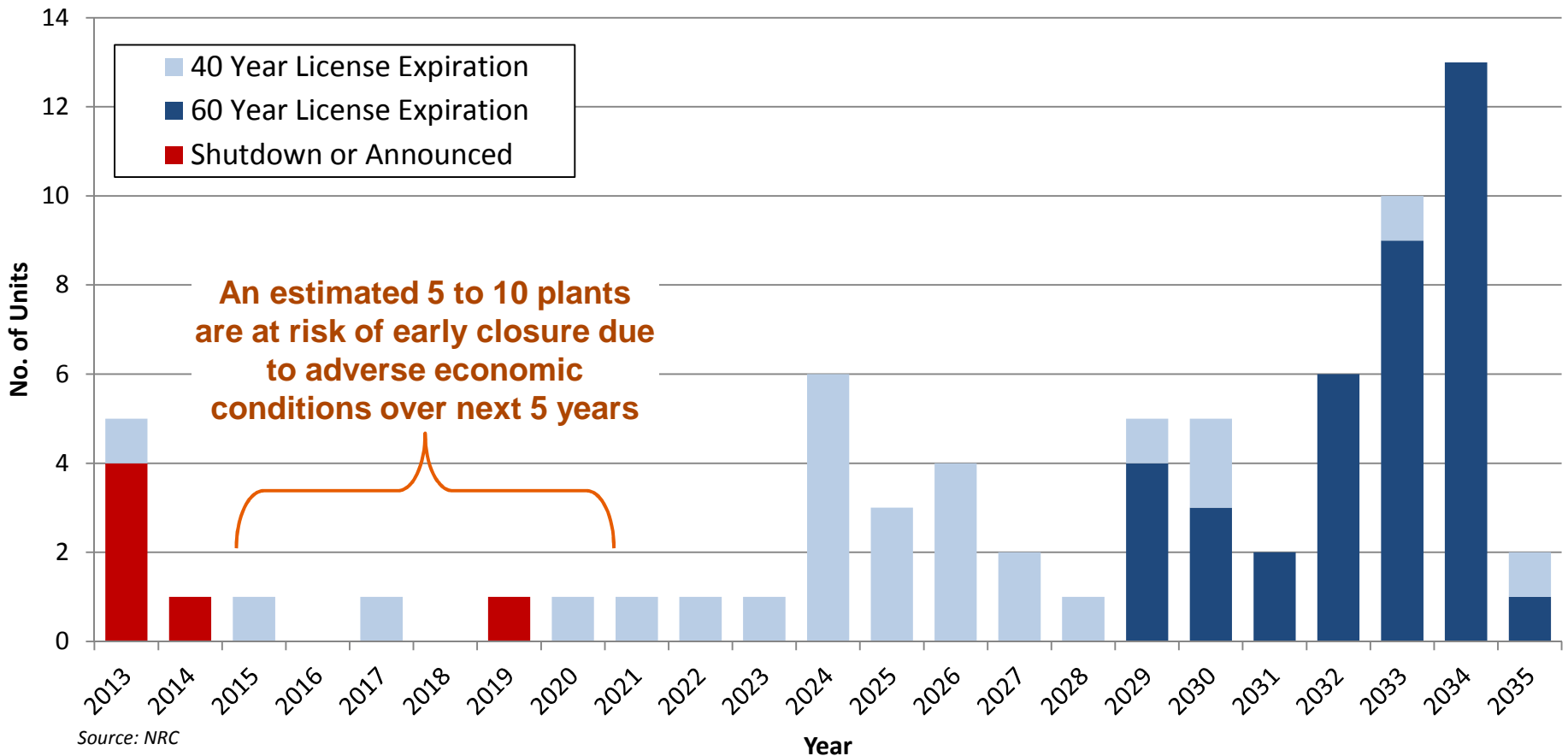


- ▶ **A number of nuclear plants running low or negative economic projections are in danger of premature shutdown if market conditions do not change**
- ▶ **Political implications and site specific situations have also influenced decisions to shut down plants**
- ▶ **Analysts reaffirm recent closures 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**



40 Year Licenses expected to be extended by 20 years – all still are running

# Future US Market Reactor Shutdown to 2035

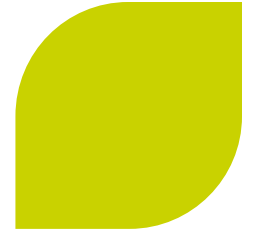


An estimated 5 to 10 plants are at risk of early closure due to adverse economic conditions over next 5 years



Plants most at risk are small, single unit sites in deregulated electrical markets (most economically stressed), but technical issues are responsible for half of all of those recently shutdown.

# 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 is 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

# 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**