

Nuclear Fleet Strategies



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These slides do not provide a complete record of the presentation and discussion.

The views expressed in this presentation are mine; these views may not be the same as those held by my clients or by my colleagues.

Introduction

- **Nuclear fleet strategy was (is) successful in France**
- **But, world has changed since French fleet was built**
- **Is the nuclear fleet concept relevant (or even possible) today?**
- **Yes - a 21st Century virtual nuclear fleet approach is evolving**

Agenda

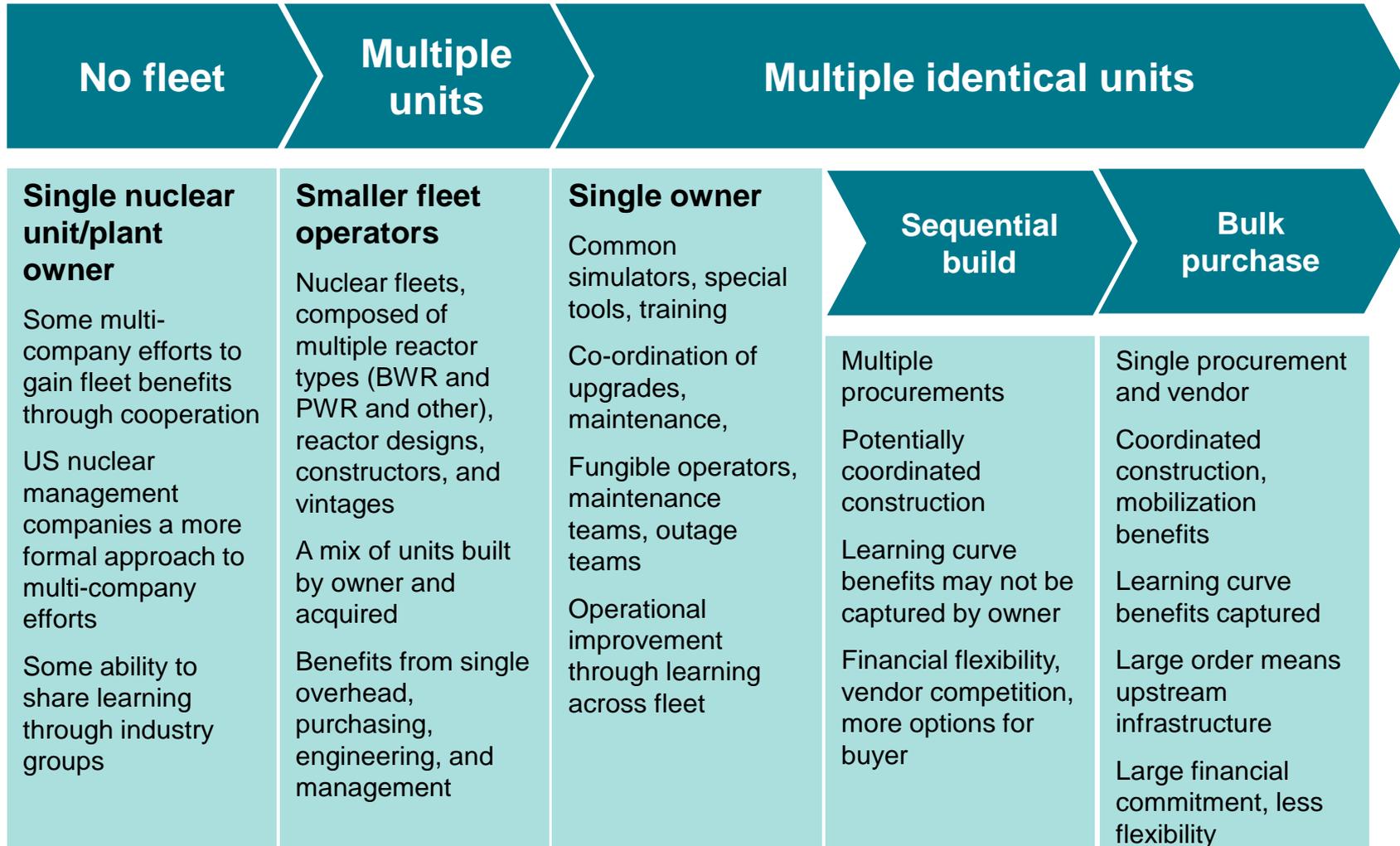
- **Eskom's nuclear fleet aspirations**
- **Nuclear fleet concept**
 - Review of the French nuclear fleet
 - Fleet benefits
- **Feasibility of the French nuclear fleet approach today**
- **Virtual fleets**

Eskom's nuclear fleet aspirations

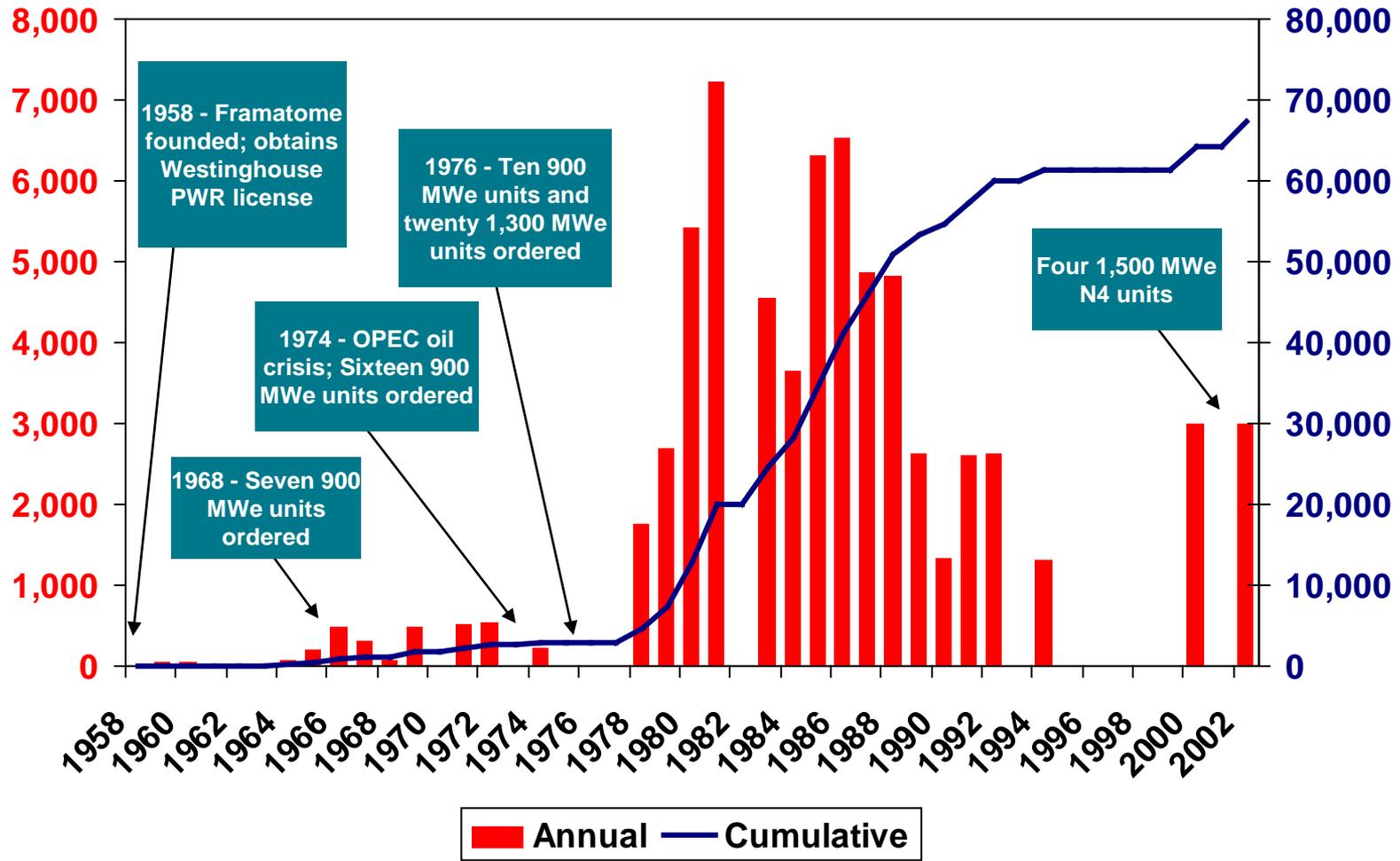
- **Large capacity build**
 - 40,000 MW of new capacity planned by 2025
 - 20,000 MW in new nuclear fleet
- **Nuclear fleet strategy**
 - 10 EPR units or 15 AP1000 units, plus PBMR units in later years
- **Eskom faces several issues**
 - Large CapEx investment, even with single nuclear plant
 - Nuclear fleet purchase requires large financial commitment
 - Rating agency action in August reduced funding ability
- **Examined costs, benefits, and approaches to nuclear fleets**



Nuclear fleet concept



French nuclear fleet build-out (MWe)

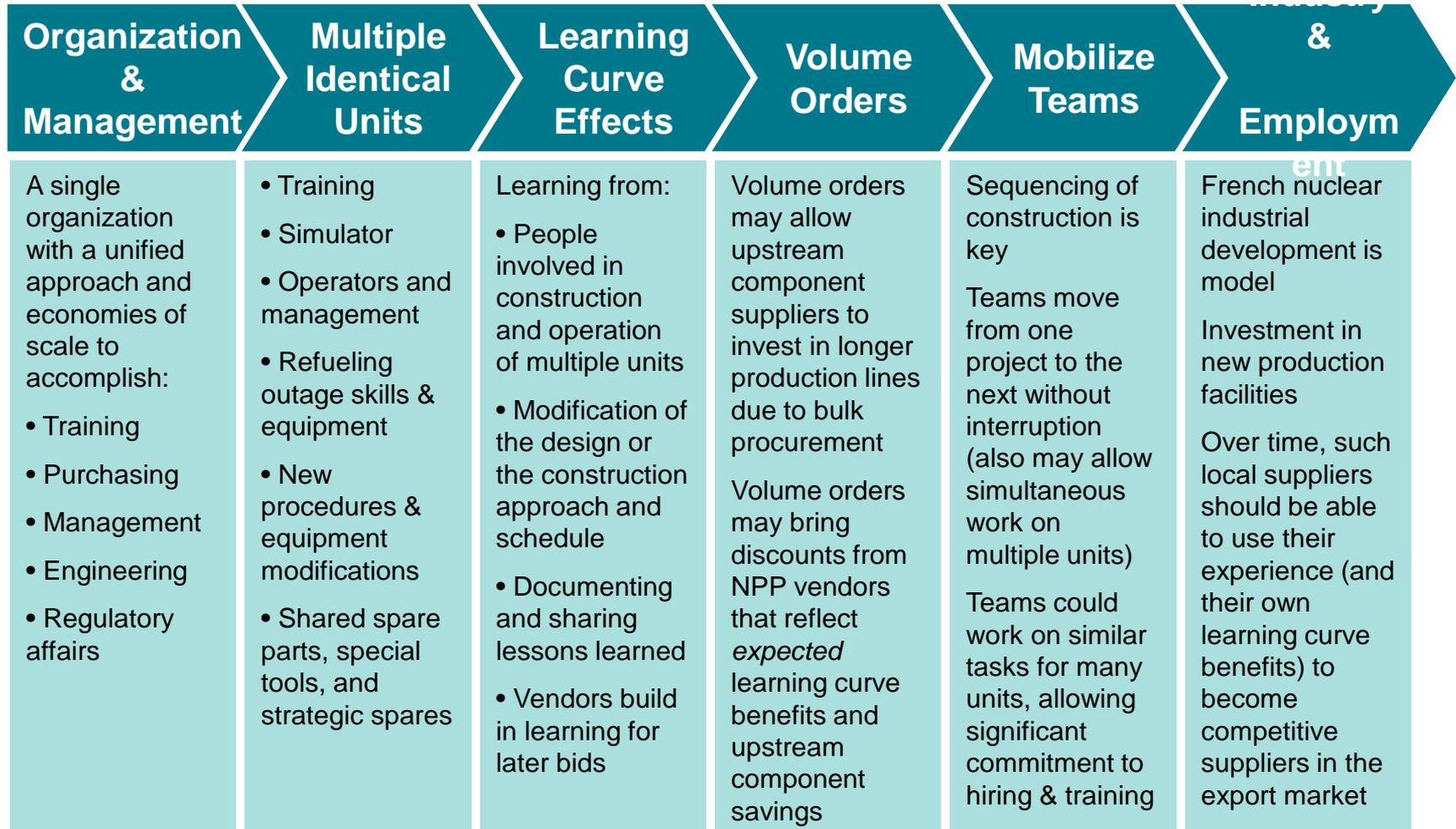


Source: EDK analysis

French nuclear fleet strategy

- **OPEC oil crisis was primary motivation for French government**
 - EdF nuclear fleet strategy was the French national nuclear strategy
 - Resources of French government were committed to nuclear
 - French government influenced other sectors of the economy
 - French government controlled the electricity industry
- **France made a national investment in nuclear value chain - supported by bulk reactor purchases**
 - Uranium mining, milling and processing
 - Uranium enrichment; starting with diffusion and moving to centrifuge
 - Fuel design and fabrication
 - Forging facilities for reactor pressure vessels and other forged components
 - Various components, systems and engineering for nuclear plants
 - Spent fuel reprocessing and MOX fuel fabrication
- **The French nuclear supply chain is now largely consolidated into Areva**

Nuclear fleet benefits



Is the French approach feasible today?

- **Role of Government**

- French fleet based on Government sponsorship, investment, and control
- Only China and Russia have a nuclear fleet strategy today
- Smaller fleets in Japan and Korea have strong government involvement

- **Few utilities could commit to nuclear bulk purchase today**

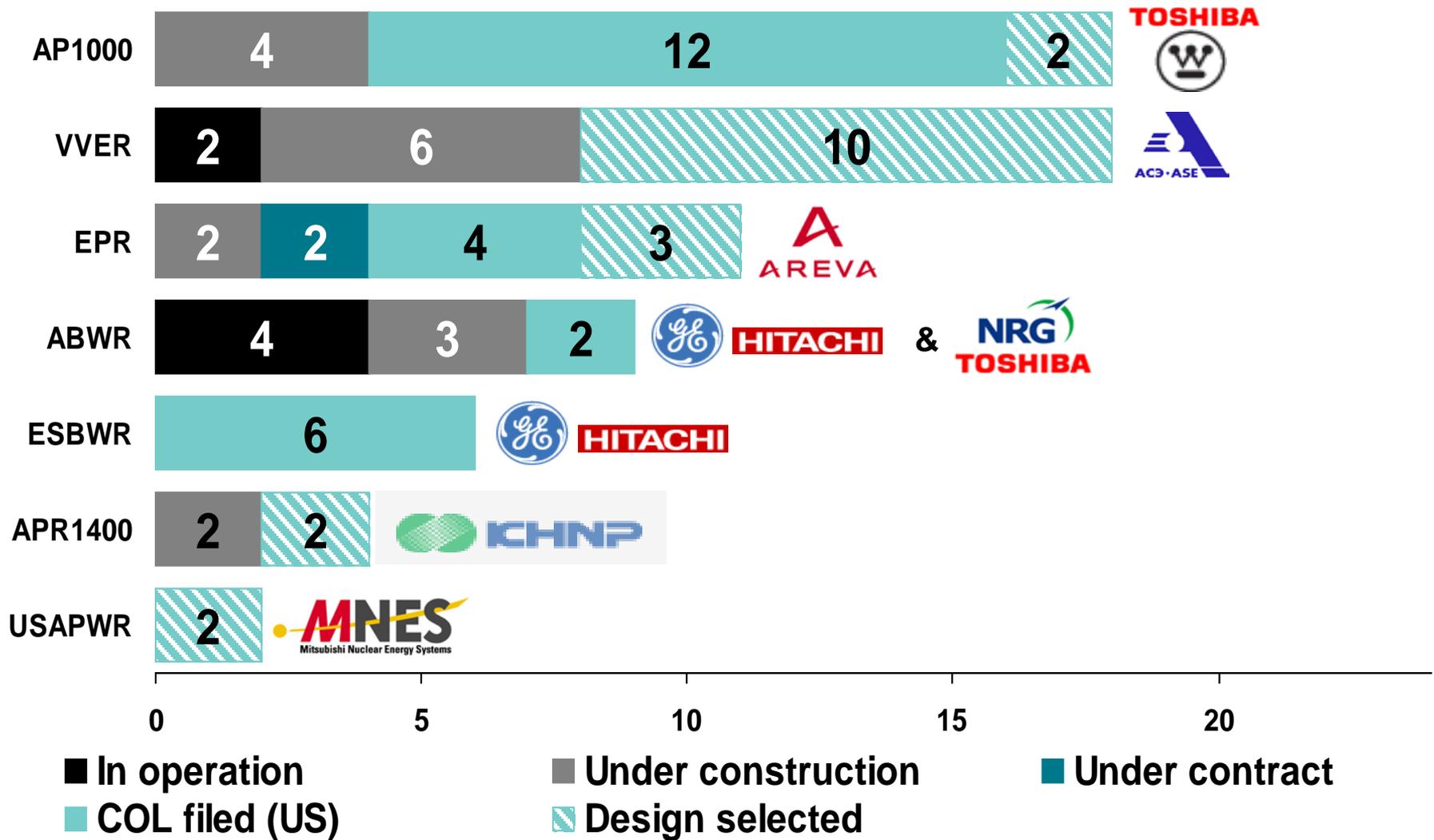
- High cost and high perceived risk
- Few new nuclear plans involve bulk purchases

- **Bulk reactor procurement has risks**

- Little buyer bargaining power after initial decisions
- May be little competition for on-going costs (e.g., outage services)

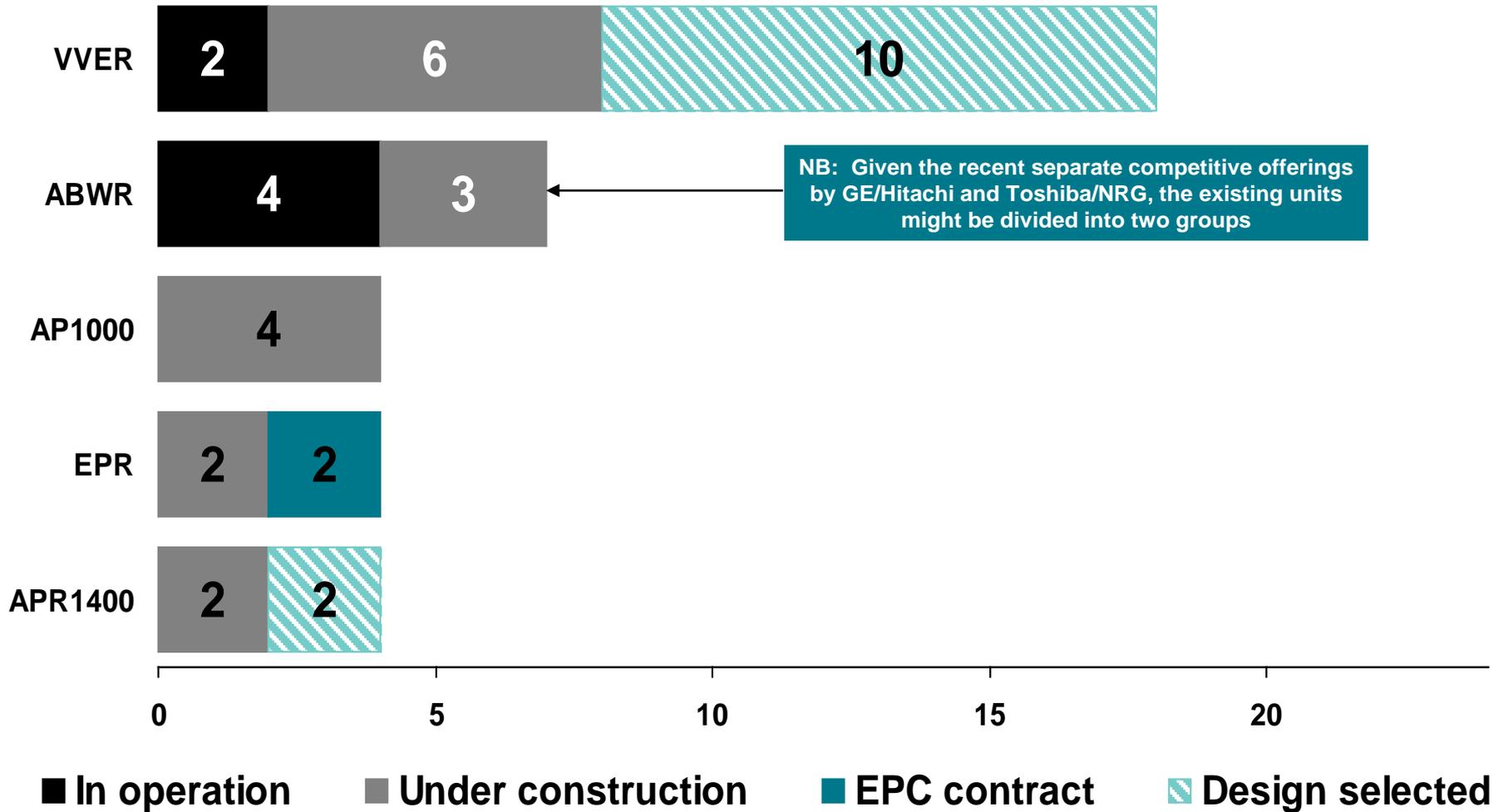
- **Hard to predict the *winning* world standard reactor design**

Global reactor design race



Source: EDK analysis; Updated 15 October 2008

Very different ranking without US units



Source: EDK analysis

Virtual global nuclear fleets

- **Multiple identical nuclear units, but different owners**
- **Nuclear fleet benefits through:**
 - Global vendor arrangements
 - Formal, member-only, users groups who share learning and investment in studies and special equipment
 - Vendors bring learning in early units to bids for later units
 - Public information about issues and problems
- **Owners of units gain benefits by sharing:**
 - Construction and design issues for new units
 - Safety, procedures, and equipment issues for operating units
 - Special tools, strategic spares, other items
 - Purchasing of services or other items

Virtual global nuclear fleets - issues

- **How will early adopters/buyers of new designs get benefits from learning that will accrue to later buyers?**
- **Which designs/vendors will win & stay in the game?**
- **How many world units are needed to get fleet benefits?**
- **Will formal owner/user groups (e.g., APOG in US) raise competition issues?**
- **Fleet benefits and competition in conflict**
 - Fewer designs/vendors – larger world fleets and more fleet benefits
 - More design/vendor competition – more competitive prices
 - Vendor business models may or may not support virtual fleets



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