



**GOWLING WLG**



# ADVANTAGES AND DRAWBACKS OF SMALL MODULAR REACTOR PROJECTS

ROBERT ARMOUR

# GLOBAL REACH



Gowling WLG is an international law firm which consists of independent and autonomous entities providing services around the world. Our structure is explained in more detail at [gowlingwlg.com/legal](https://www.gowlingwlg.com/legal)



# CONCERNS AND RISKS FOR LARGE NUCLEAR POWER PROJECTS

- Long Development/Construction Timescales
- Design Complexity of Gen III
- First of a Kind Technology Risks
- Huge Capital Commitments
- Time to Market/ Long Payback Periods
- Economies of Scale?
- Grid Impacts



# CONCERNS AND RISKS OF LARGE NUCLEAR POWER PROJECTS

- High Hazard, Low Probability
- Environmental & Operational
- Proliferation/Security
- Fuel Cycle
- Political and Legal Challenge
- Surrounding Infrastructure
- Skills and Nuclear Culture

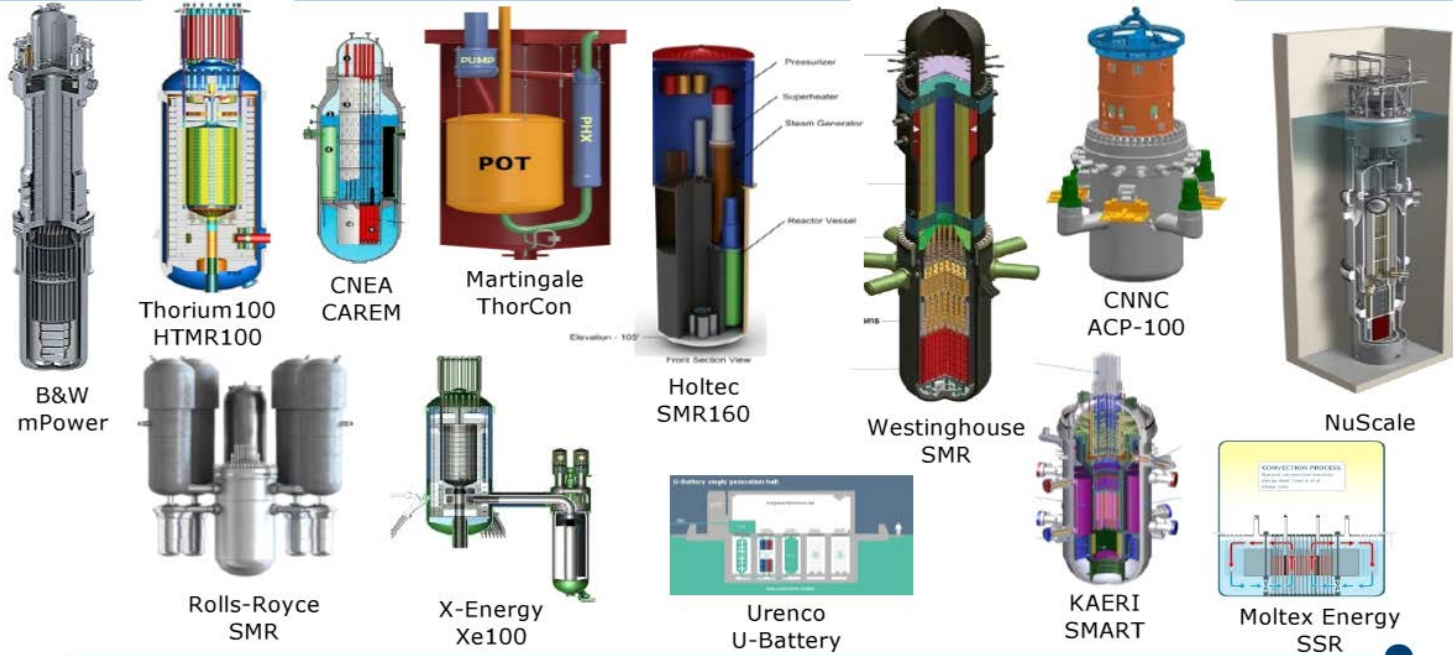


# WHY CHOOSE NUCLEAR AT ALL?

- Zero /Low Carbon Economy Imperative
- Reliability of Power Supplies
- Security of Fuel Source
- Diversity of Generation
- National Kudos
- Predictability of Power Prices
- Export and Economic Potential



# SMALL MODULAR REACTOR DESIGNS



(Not to scale)

\*Source: NNL

# ARE SMRS A SENSIBLE WAY FORWARD?

- Lower Cost of Development
  - Modular
  - Factory Build
  - Transportable
- Lower Programme Costs
- Shorter Construction Period
- Smaller Site Profile
- Enhanced Safety/Passive Systems
- Reduced Protection Zone
- Lower LCOE



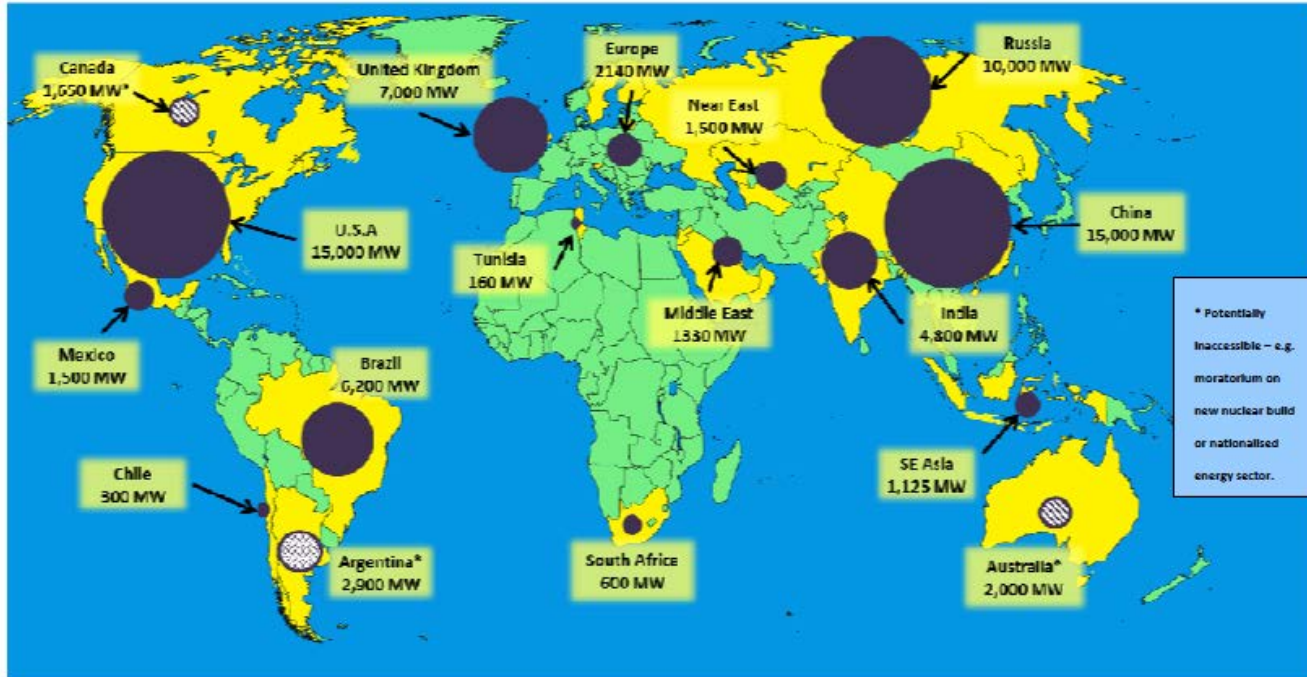


# ARE SMRS A SENSIBLE WAY FORWARD?

- Grid Compatibility
- Load Following Capability
- Fit with Particular Uses
  - Remote communities
  - Desalination
  - Mining/Extraction
  - Hydrogen
  - District Heating
- Wider Attributes of Large NPPs
- Potential Market



# POTENTIAL GLOBAL MARKET FOR SMRS

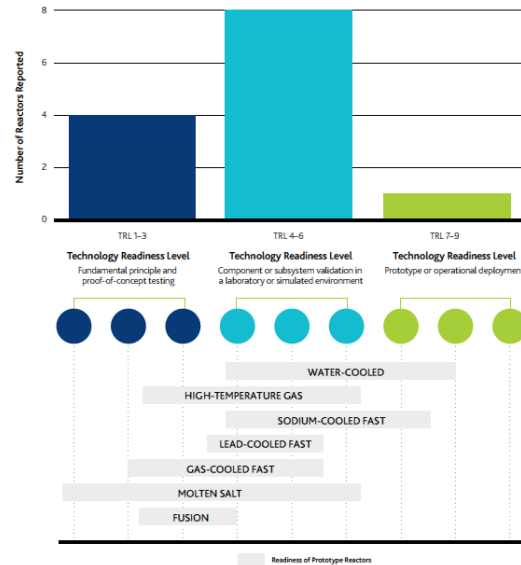


# BUT SMRS HAVE CHALLENGES TOO

- First of a Kind
- Development Risk and Cost
- Deployability Timescales
- Maturity of Designs
- Reference Plant requirement

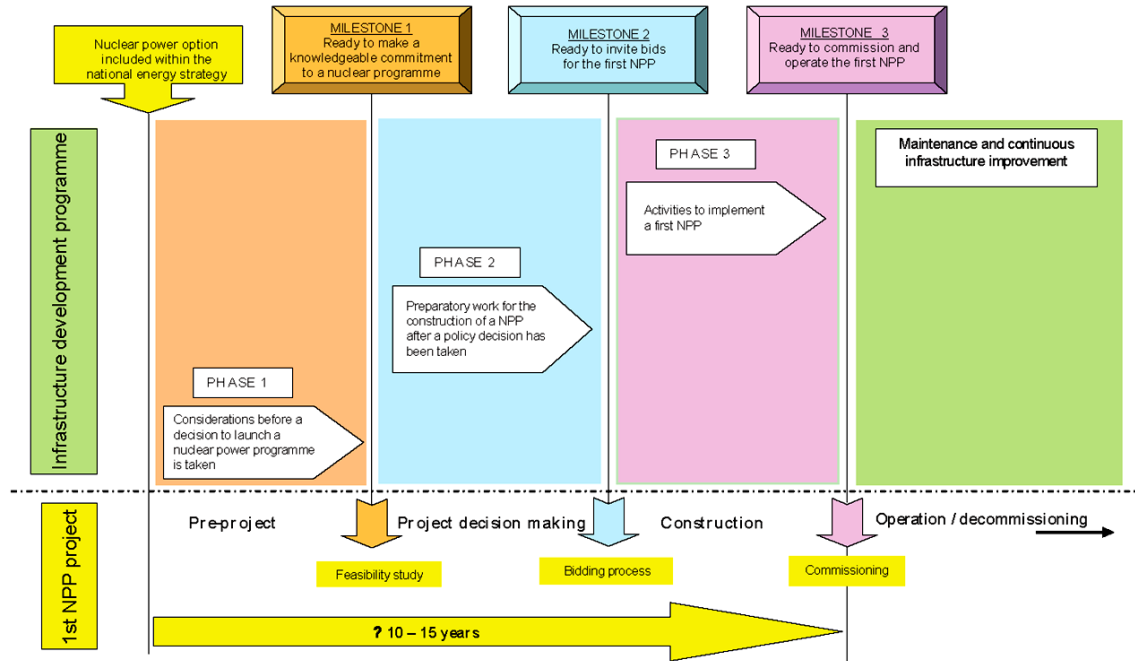
# TIMESCALES AND MATURITY

## Minimum TRL reported by Reactor Vendors and Technology Developers



Source: Canadian Nuclear Laboratories - "Perspectives on Canada's SMR Opportunity" Report issued 17 October 2017

# NATIONAL NUCLEAR INFRASTRUCTURE - MILESTONES



Source: Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1, IAEA, Vienna (2007)

# NATIONAL NUCLEAR INFRASTRUCTURE - MILESTONES

Issues	Milestone 1	Milestone 2	Milestone 3
National position			
Nuclear safety			
Management			
Funding and financing	Conditions	Conditions	Conditions
Legislative framework			
Safeguards			
Regulatory framework			
Radiation protection			
Electrical grid			
Human resources development			
Stakeholder involvement			
Site and supporting facilities			
Environmental protection			
Emergency planning			
Security and physical protection			
Nuclear fuel cycle			
Radioactive waste			
Industrial involvement			
Procurement			

Source: Milestones in the Development of a National Infrastructure for Nuclear Power, IAEA Nuclear Energy Series No. NG-G-3.1, IAEA, Vienna (2007)

# HOST COUNTRY CORE COMPETENCIES

- Site Selection
- Licensing
- Legal and Regulatory Framework
- International Treaty Commitments
- Safety
- Security
- Safeguards
- Spent Fuel and Nuclear Waste
- Decommissioning
- Audit Regime

# KEY ENABLERS OR ATTRIBUTES

- Low Lifetime Costs
- Competitive and affordable
- Is there a market?
- Proving the Business Case
- Programme Cost





# KEY ENABLERS OR ATTRIBUTES

- Low Waste Production
- Community Acceptance
- Safety
- Availability and Reliability
- Long Term Political Support

**THANK YOU**





**GOWLING WLG**

# CONTACTS

ROBERT ARMOUR

*UK Nuclear Practice Group Chair*

 +44 (0)20 7759 6410

 [robert.armour@gowlingwlg.com](mailto:robert.armour@gowlingwlg.com)





**GOWLING WLG**