

Compact Nuclear Energy: Capturing the Manufacturing and Supply Chain Opportunity

Joint CDT Fission-Fusion Event on Compact Nuclear

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Matthew Blake, Chief Engineer – UK SMR

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Overview

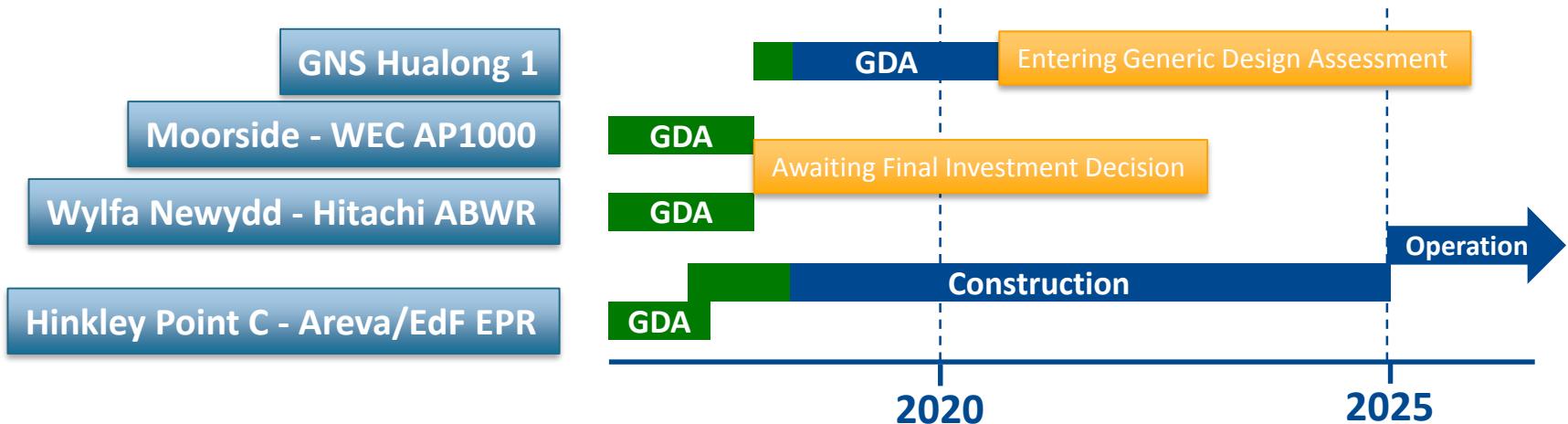
- **Recent Experiences**
 - Commencement of large reactor new build
 - Success and failure
- **The scale of the challenge to UK supply chain**
 - Capability and Capacity
- **Small Modular Renaissance**
 - Meeting the challenge of SMR



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Recent Experiences - Timeline

- The UK is attracting multiple international reactor vendors to build new large nuclear plants
 - Financing is the key challenge – to date only EPR at Hinkley Point C is financed

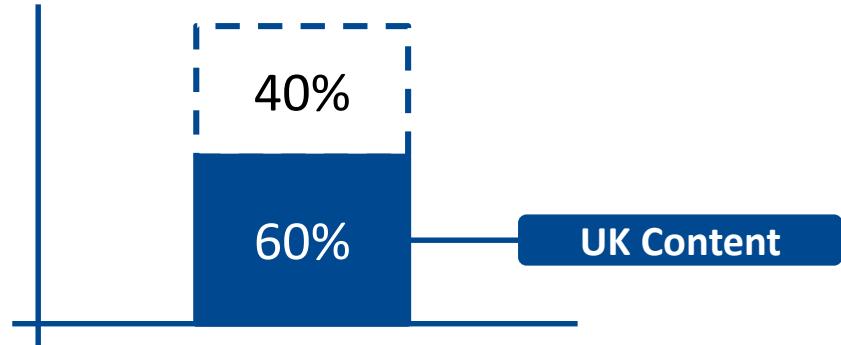


Large Reactors – UK Content

- There is a significant amount of UK content
- Around 50% of the UK content relates to Civil Engineering, Earthworks and Construction – things that have to be done on site in the UK
- UK must strive towards increasing share of higher technology / IP items



Hinkley Point C - Areva/EdF EPR



UK Supply Chain - Capability

	Major Companies	Support Companies	Skills	Experience	Facilities
Reactor Pressure Vessel					
RPV Internals	Red	Grey	Grey	Orange	Orange
Reactor Integrated Head Package		Orange	Red	Orange	Orange
Steam Generator		Orange	Orange	Orange	
Pressuriser	Orange	Orange	Grey	Orange	Orange
Control Rods Drive Mechanism (CRDM)	Red	Grey	Orange	Orange	Orange
Reactor Containment Liner/Vessel	Orange	Orange	Orange		Dark Grey
Primary Circuit Auxiliaries	Orange				
Tanks, Vessels, Heat Exchangers*	Dark Grey				
Reactor Coolant Loop Pumps					
Pumps & Valves	Orange				
Mechanical Equipment Modules					Orange
Reactor Polar Crane	Red	Grey	Grey	Red	Red
Cranes (Excluding Polar)	Dark Grey	Dark Grey	Dark Grey	Dark Grey	Dark Grey
Primary Loop Pipework	Red	Orange	Red	Red	Orange
Safety Related Pipework	Orange	Orange	Orange	Orange	Dark Grey
Non-Safety Related Pipework					
Safety Related EC&I	Orange	Orange			
Non-safety Related EC&I	Dark Grey				
HVAC	Orange				
Nuclear Island Installation	Orange		Orange		
Turbine/Generators					
Emergency Diesels					
Transmission & Distribution	Orange				
Radwaste Plant	Orange				
Water Treatment Package					
General Site Electrics					
Security Equipment	Dark Grey				
Forgings (Excluding Ultra-large)	Red				
Mechanical Installation	Orange				
Electrical Installation	Orange				

*May be less capacity for safety related tanks etc

- The UK has the capability to manufacture most of the components, systems and sub-systems for large reactors
- Several of the components that are constrained (red) become orange or green when size is reduced for SMR

KEY	Major Companies	→ 5 Companies	3 ↔ 5 Companies	↔ 2 Companies
Support Companies	→ 5 Companies	3 ↔ 5 Companies	↔ 2 Companies	
Skills	Sufficient available skills capacity	Capacity available with some investment	Skills shortages, need special attention	
Experience	Current experience of nuclear markets	Some experience of nuclear or related markets	Lack of experience, needs special attention	
Facilities	Sufficient current capacity	Capacity available with some investment	Shortage of capacity without significant new investment	

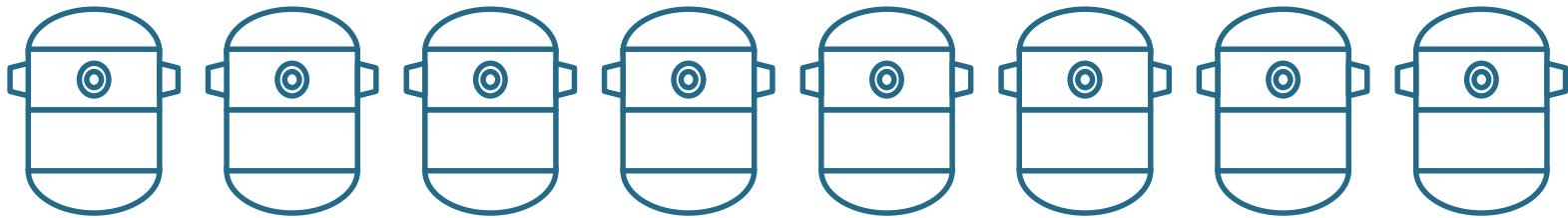
Taken from 'Capability of the UK Nuclear New Build Supply Chain', (NIA, 2012)



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UK Supply Chain - Capacity

- However, the most significant challenge is not capability...
... but capacity



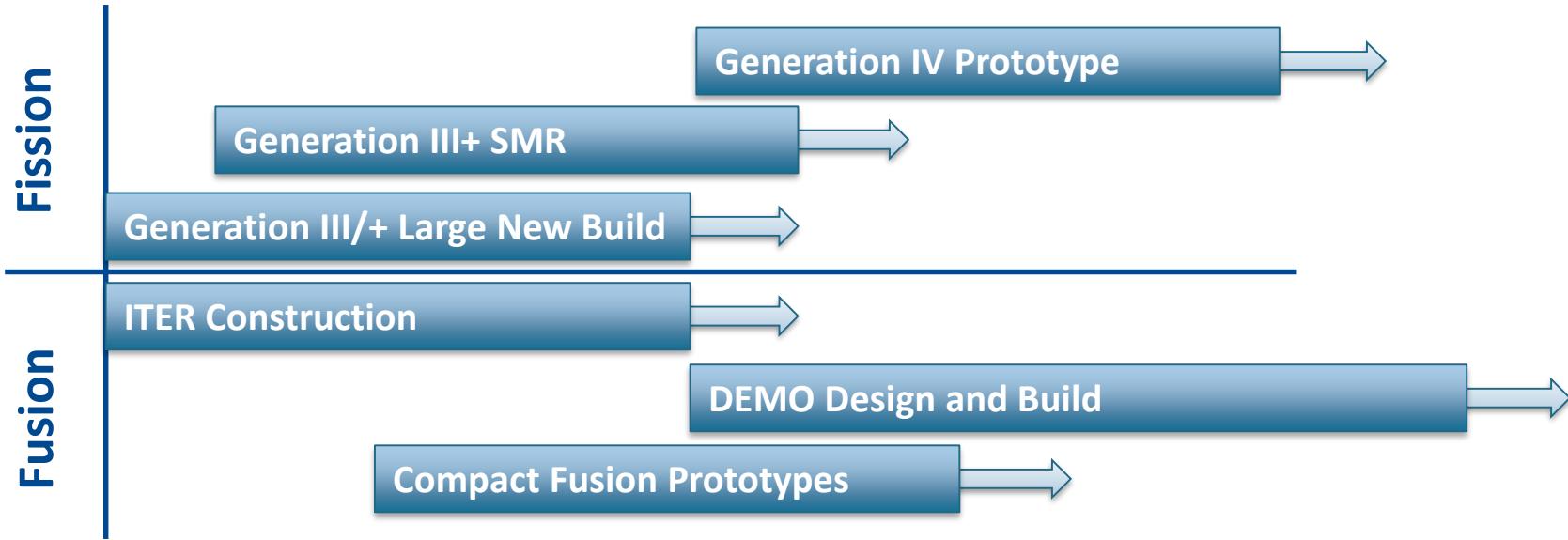
- The UK nuclear supply chain is focussed on engineering services, decommissioning and defence applications



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Forward timeline

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SMR – Future Fission

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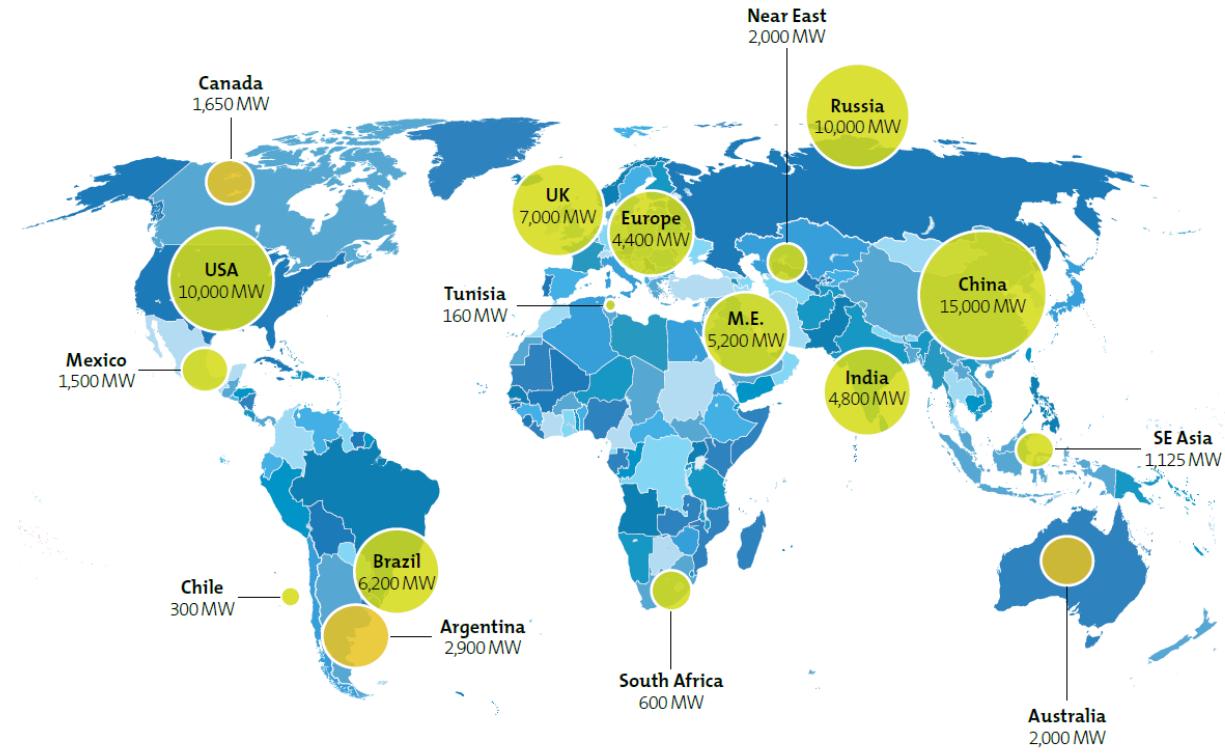
Large Reactors	Category	SMR
1200 - 1700 Mwe	Plant Power Output	Less challenging to grid infrastructure
£4 Bn - £8 Bn	Capital Cost	Able to access project financing
8 – 12 Years	Construction Duration	Designed for build certainty
60 Years	Intended Lifetime	Similar operational lifespan
Under Construction	Current Maturity	Designs require regulatory approval
~ 16 GWe planned	UK Energy Policy	Government support always key to nuclear



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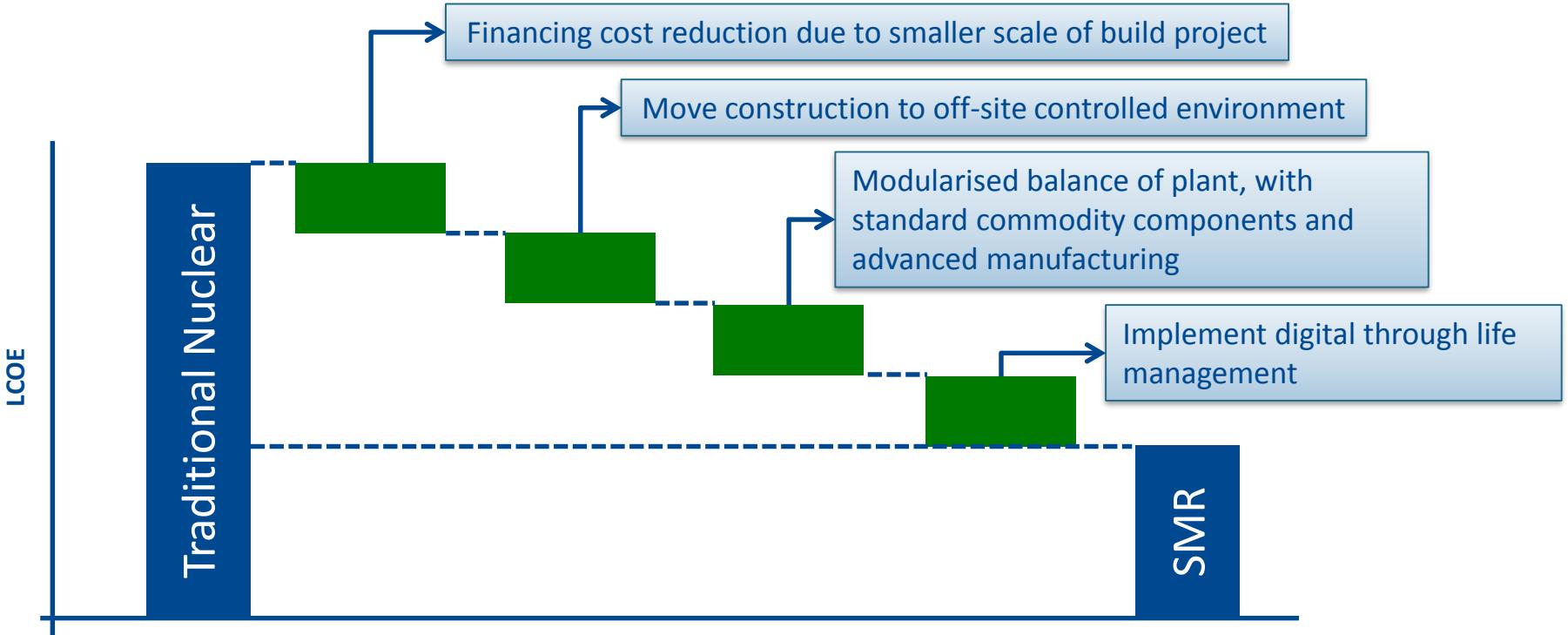
SMR – A Substantial Reward

- UK SMR market estimated at around 7 GWe by 2035
- Global SMR market estimated to be around 65-80 GWe by 2035



SMR – Why SMR?

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SMR – The Challenge



x2 SMR per year



x2 reactor plant sets



- 2 x RPV
- 6 x Steam Generator
- 2 x Pressuriser
- 9 x RCP



x1,000 MEP modules



- 2 sets of '500' (?) plant modules?



x4,000 Civils 'building block modules'



- 2 sets of '2000' modular building blocks?

SMR – A step-change in manufacture

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Link to Video



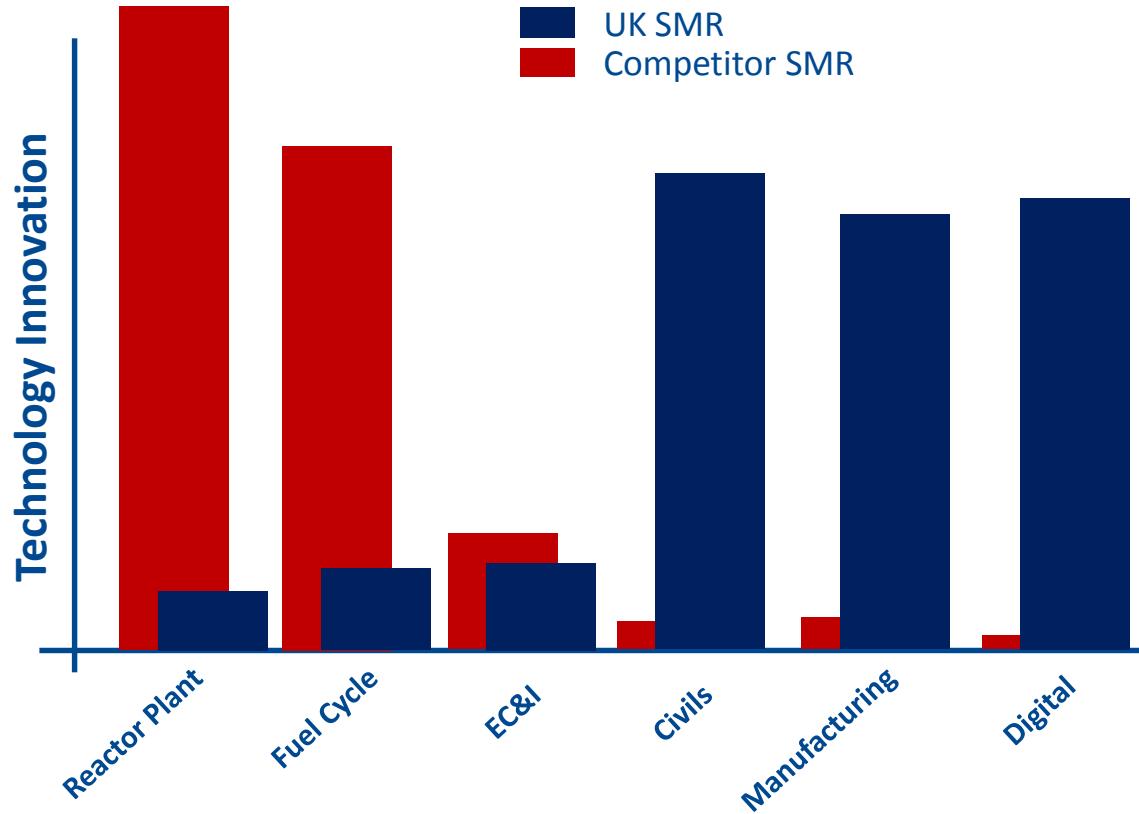
- Safe, reliable and affordable low carbon energy; on grid by 2030
- £100 Bn boost to the UK economy through life
- Access to a £400 Bn export market
- Revitalisation and sustainment of the UK nuclear supply chain to 2050
- Creation of 40,000 skilled and sustainable jobs



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UK SMR – Research & Technology

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- UK SMR targets build certainty, affordability and through-life product quality
- This will be achieved through innovative approaches to civil engineering / construction, manufacturing and digital technology adoption