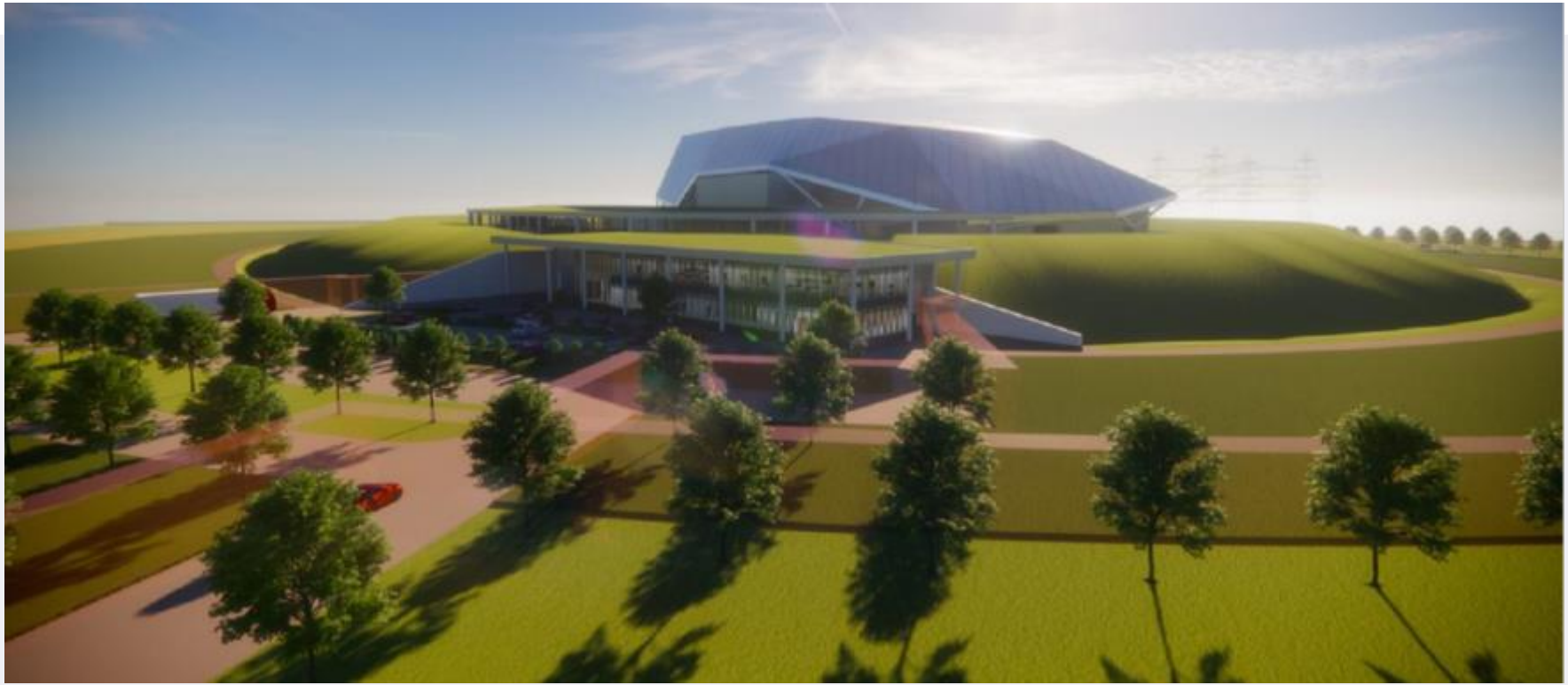
Rolls-Royce SMR

Nuclear Academics Meeting

8th September 2021

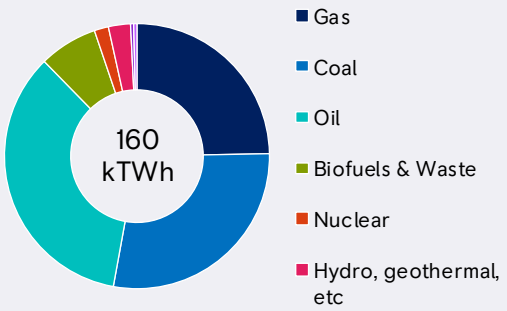
Sophie Macfarlane-Smith – Head of Customer Business

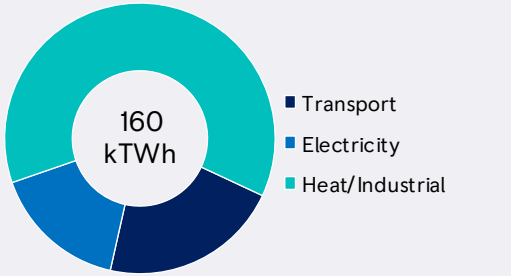
SMR Video https://vimeo.com/551457837/0735106fb6



Tomorrow's energy market will look fundamentally different as the world transitions to a low carbon environment

Only 13% global energy is low carbon

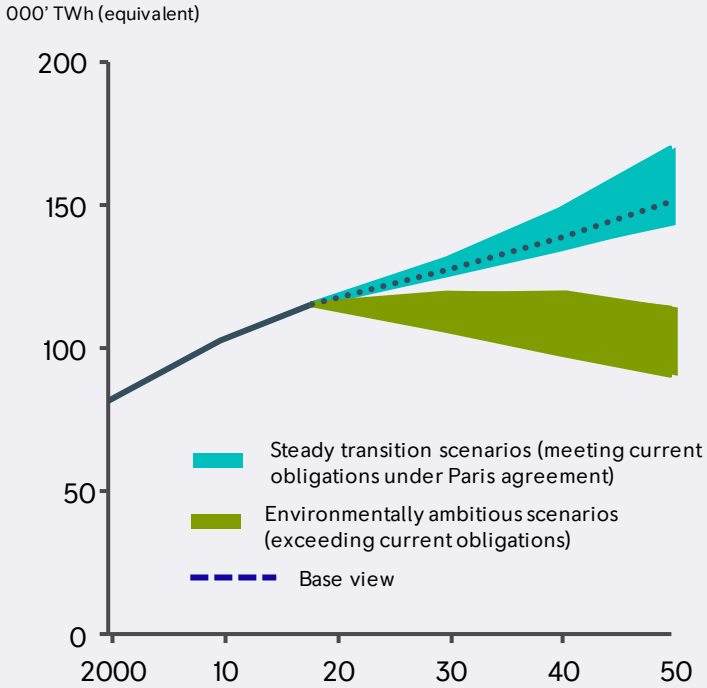




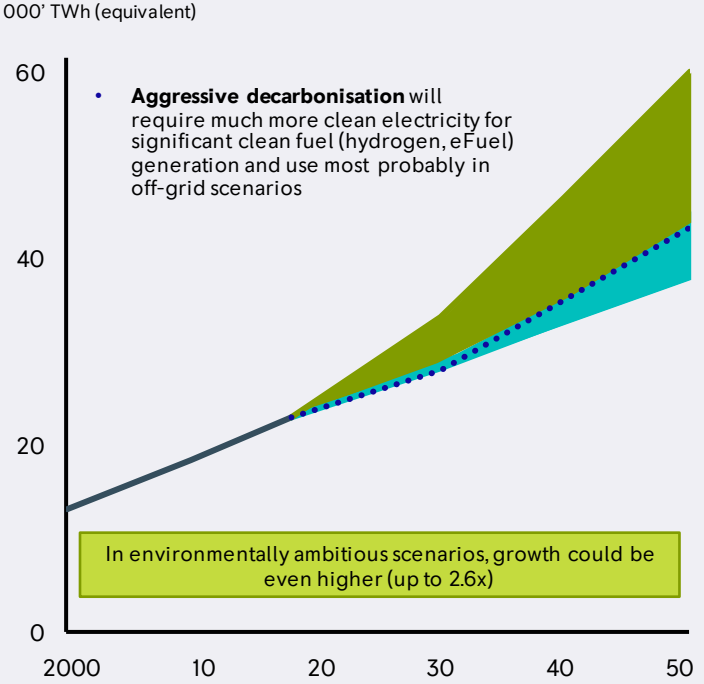
- The challenge is huge, covering transport and heat as well as grid electricity
- Decarbonisation obligations are having a material impact on energy policies
- There are a limited number of solutions to decarbonising many sectors. Most need more clean electricity
- The demand for clean electricity is set to grow considerably in any scenario
- Industrial companies are seeking to decarbonise production quickly and economically
- Our SMR provides a low cost, investible, and deliverable solution to predictable clean electricity at a scale unmatched by other clean sources

Energy forecasts may vary but electricity growth is substantial in any future energy system scenario

Consensus[1] outlook on final energy consumption (2000-2050F)



Consensus[1] outlook on total electricity production (2000-2050F)

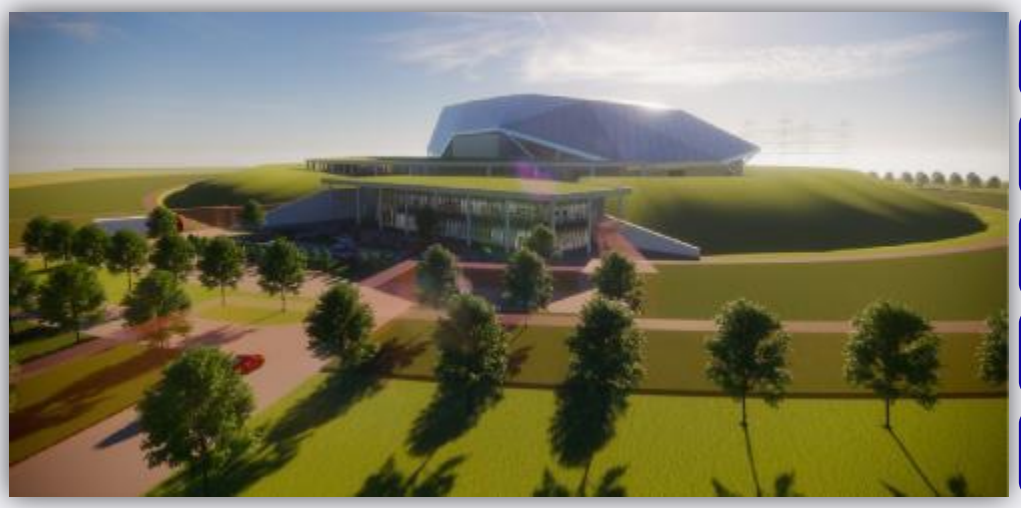


Source: LEK
Note:
1. Consensus forecasters of energy and electricity growth include Bloomberg, BP, DNV-GL, EIA, Exxon Mobil, IEA and IRENA

Rolls-Royce SMR is a revolutionary nuclear product; factory fabricated, road transported and site assembled.

The RR SMR approach is a holistic, integrated power station and not just a nuclear reactor design.

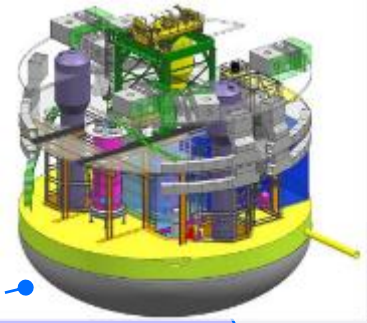
- ~470 MWe output
- 50 Hz design
- Proven PWR Technology & Standard Fuel
- Power station delivery as a turnkey project
- 4 yr Construction (Nth unit)



- Enhanced Gen III+ levels of safety and security
- 1st unit on grid early 2030s
- Capital cost under £1.8 Bn*
- Adaptable, multi-use power & heat output
- LCOE £35-£50 per MWh*

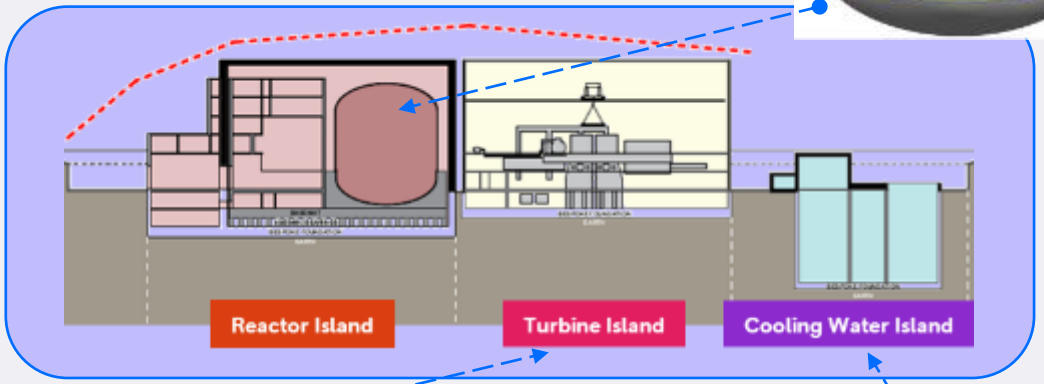
Rolls Royce SMRs – Low cost, Deliverable, Investable Low Carbon Power

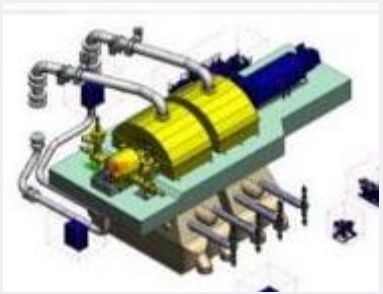
Rolls-Royce SMR plant: Key Features



Reactor Systems

- A robust and licensable design incorporating:
  - A 3-loop PWR
  - 3 reactor coolant pumps (one in each loop)
  - 3 vertical **u-tube** steam generators
  - Steam pressurised using a **pressuriser**
- Nuclear fuel is industry standard 17x17 assembly **UO_2 enriched up to 4.95%**,
- **Boron free design** to enable a **low environmental impact and eliminate handling hazards.**





Turbine Island

- Comprises a commercially available turbine and generator set

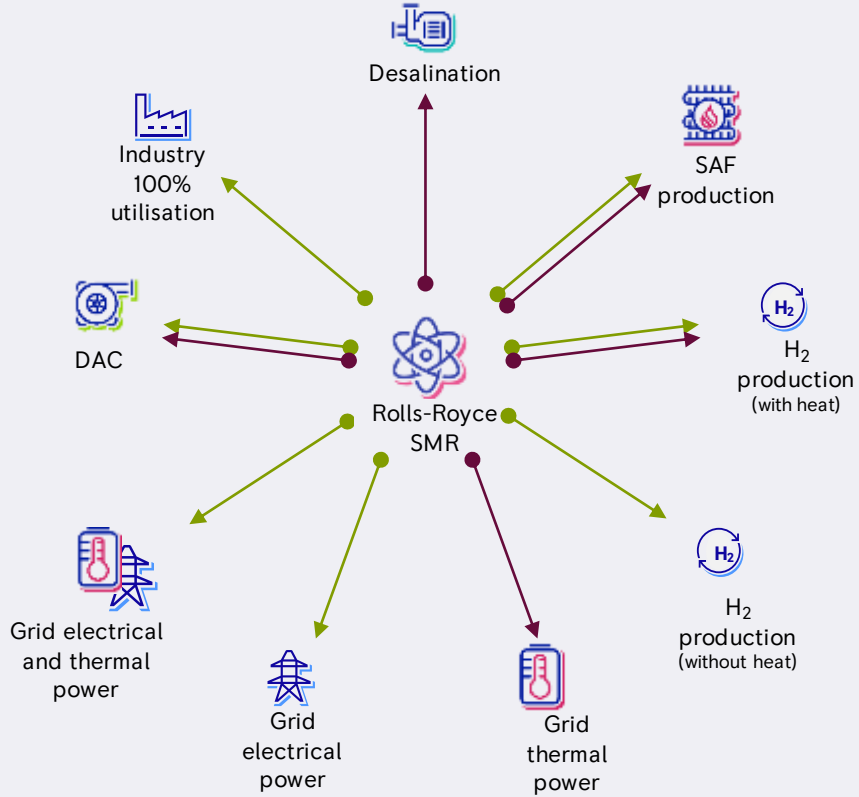
Cooling Water Island

- Indirect cooling system utilises modular cooling towers to remove heat from the turbine island

The heat and power from SMRs supports a range of industrial uses. Shared usage minimises the cost of plant ownership and maximises the economic efficiency of the low carbon energy.

One Rolls-Royce SMR and associated plant can. . . .

- Power a million homes
- Produce 170 tonnes of H_2 per day
- Produce 280 tonnes of net zero synthetic fuel per day
- Heat or cool a city the size of Sheffield (pop c580,000)



Efficiency does not necessarily equate to economical value

Innovations that focus on delivering ultimate market value are important

Engineering efficiency is the ratio between the energy needed to power a process vs the energy the process creates

Economic efficiency is the ratio between a company's ability to invest in and use its assets vs the income they generate

Central Fleet Operations Centre

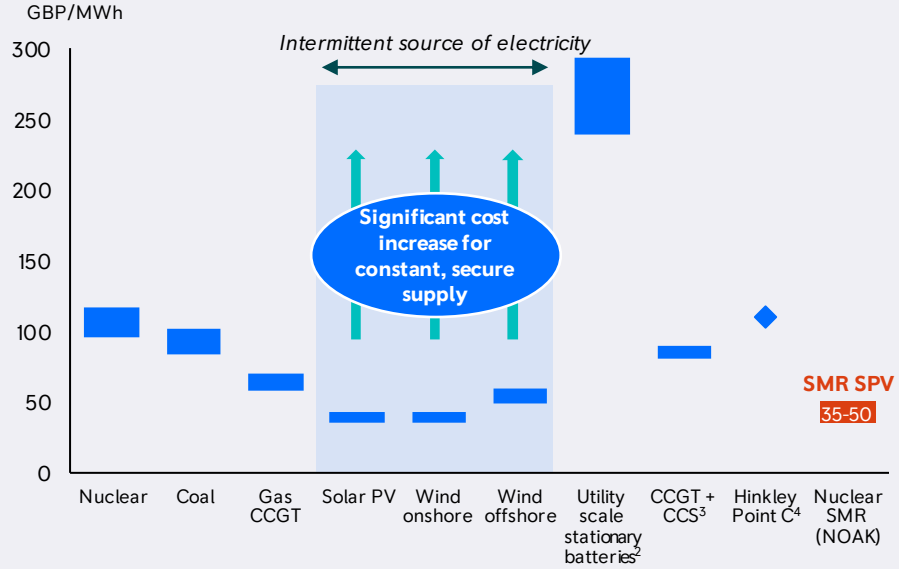
Digital Ecosystem

Objective: Reduce overall cost of ownership through:

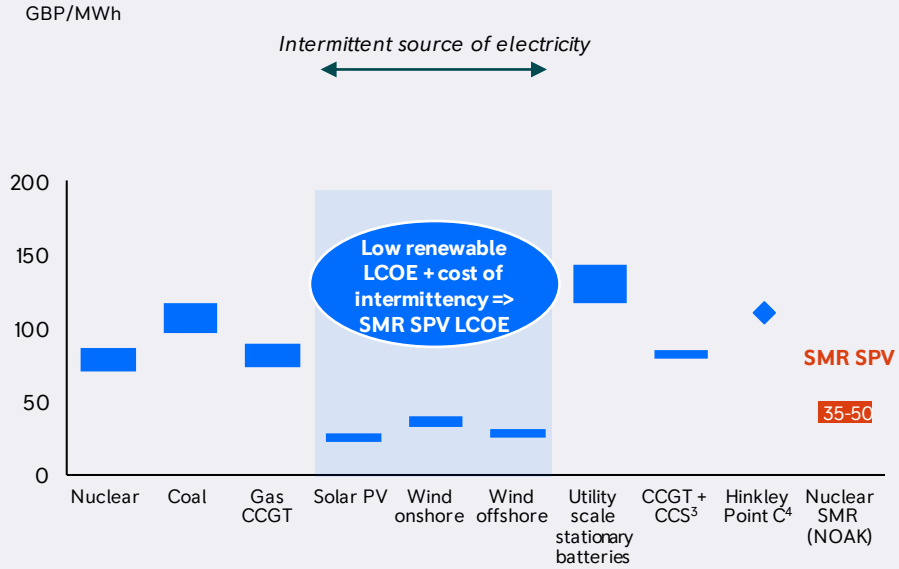
- **Total plant design integration / optimisation**
- **Maximise power output (for no further capital / op cost / risk)**
- **Maximising availability**
- **Maximising reliability**
- **Reduce outage periods**
- **Optimise predictive maintenance**
- **Reduce inventory & optimise spares planning**

The LCOE for SMRs is similar to renewable LCOEs and is significantly cheaper once storage costs for renewables are included

European LCOE / Levelised Cost of Storage ("LCOS"), by technology for indicative assets[1] commissioning in 2019



European LCOE / LCOS, by technology for indicative assets[1] commissioning in 2040



Sources: IEA WEO 2020, BEIS Electricity Generation Cost Report 2020
Notes: CCGT = Combined Cycle Gas Turbine; CCS = Carbon Capture and Storage; USD = United States Dollar

1. Data from IEA WEO 2020, converted from USD to GBP (0.7) with +/-10% range applied
2. IEA Data – 2020 base year
3. Data from BEIS Electricity Generation Cost Report 2020 – Refers to 2025 LCOE as this is the first estimated deployment date of this technology
4. GBP92.5 CFD agreed price, scaled by CPI to 2019, as per CFD agreement

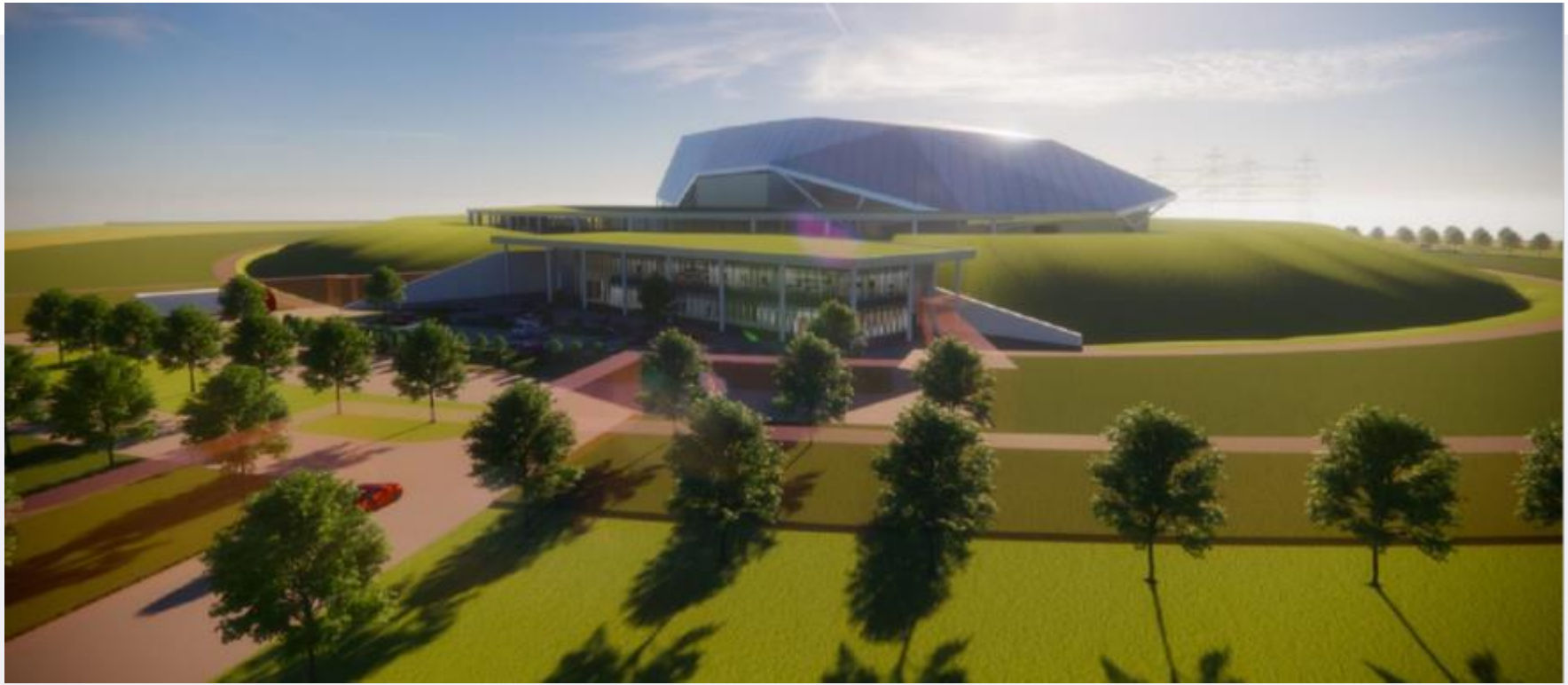
SMR Range determined by financing mechanism

Lessons from Aerospace?

There are many examples of high profile projects that have not delivered on expectations

- Dassault Mercure – 12 units built
  - Flying range of aircraft insufficient to meet **customer requirements**
- Tupolev TU-144 – 16 units built
  - **Pushed technology boundaries**, the aircraft was blighted by accidents leading to withdrawal from service
- Concorde – 20 units built
  - Sales suffered from **regulatory restrictions** imposed and **poor operational economics**
- Airbus A380
  - Required **expensive infrastructure changes** at airports. Ultimately too large and **economics poor**

Questions



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September 2021

Sophie Macfarlane-Smith

Head of Customer Business

Sophie.Macfarlane-Smith@rolls-royce.com

M +44 (0)7976193127