

## Post Fukushima potential technical solutions with regard to isolated locations

sea THE FUTURE

DCNS

Bertrand Aubriot, Deputy Director, Strategy and Development,  
DCNS, Paris, France®

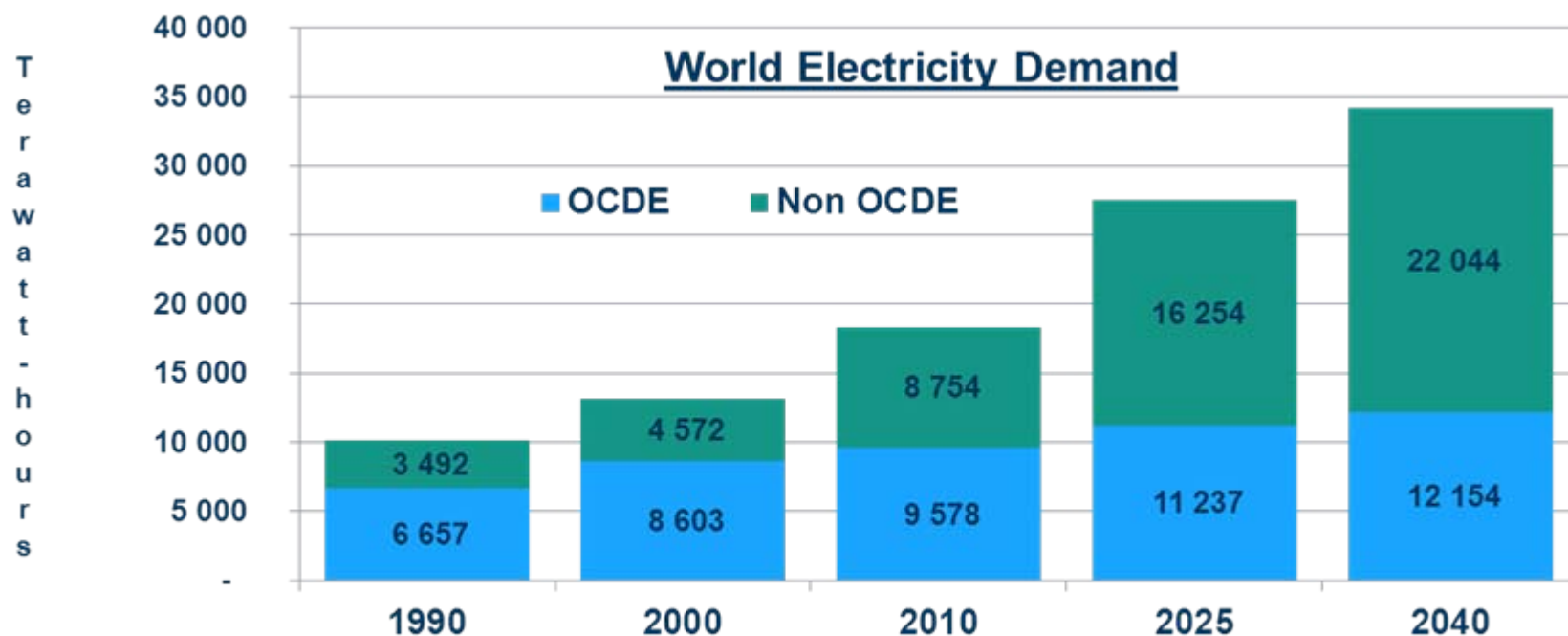
# DCNS Experience



- Designer, builder and maintainer of Nuclear Powered Ships (SSN, SSBN, CVN) : 18 reactors built over the last 40 years.
- Integrator of complex and major projects.
- Developing into civil energy :
  - BU “Marine Renewable Energy”
  - BU “Civil Nuclear”
  - ➔ Services and EPC contracts for EDF and the French Nuclear Energy Commissioner (CEA)
  - ➔ Flexblue for the long term development

# Electricity need growth is a global issue

Strong growth of electricity demand is expected in the 20 coming years, mainly for emerging markets

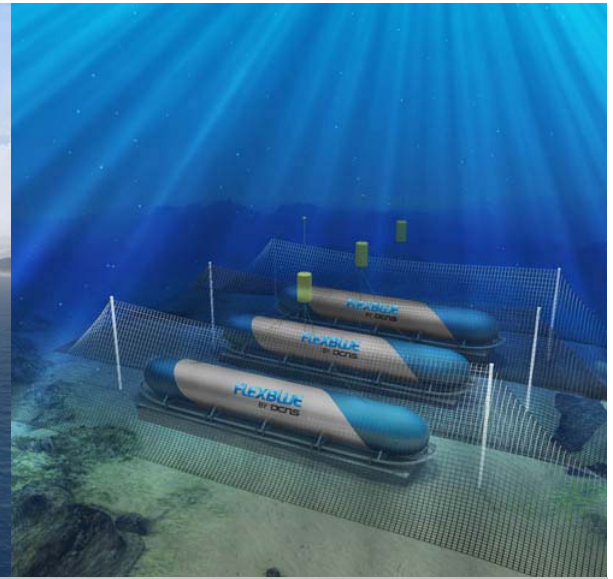
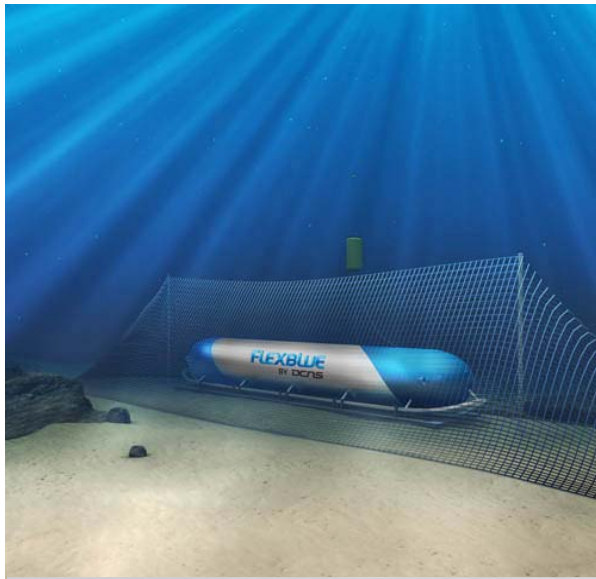


Source: Exxon Mobil Energy Outlook 2012

# Small and Modular Reactor (SMR) Market analysis

- High power nuclear energy production units usually need a high initial investment because they are unique and built on the place where they will produce energy.
- Small power units like the SMR can be built in modules in a production unit, that make them more competitive.
- SMR market is made of :
  - Small grids in fast developing countries ;
  - Non interconnected grids in large countries.
- Market size is estimated to hundreds of SMR over the next 20 years.

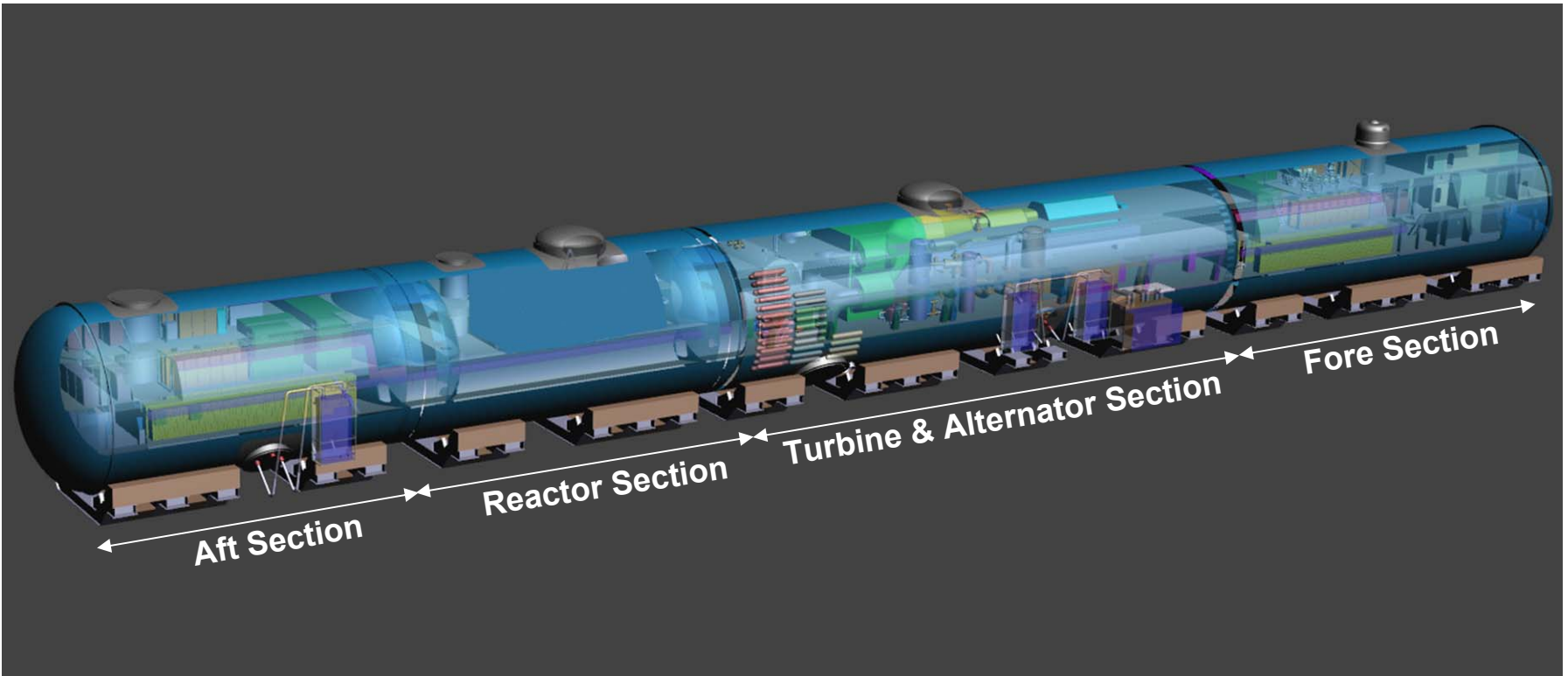




# Flexblue® Concept

VIDEO

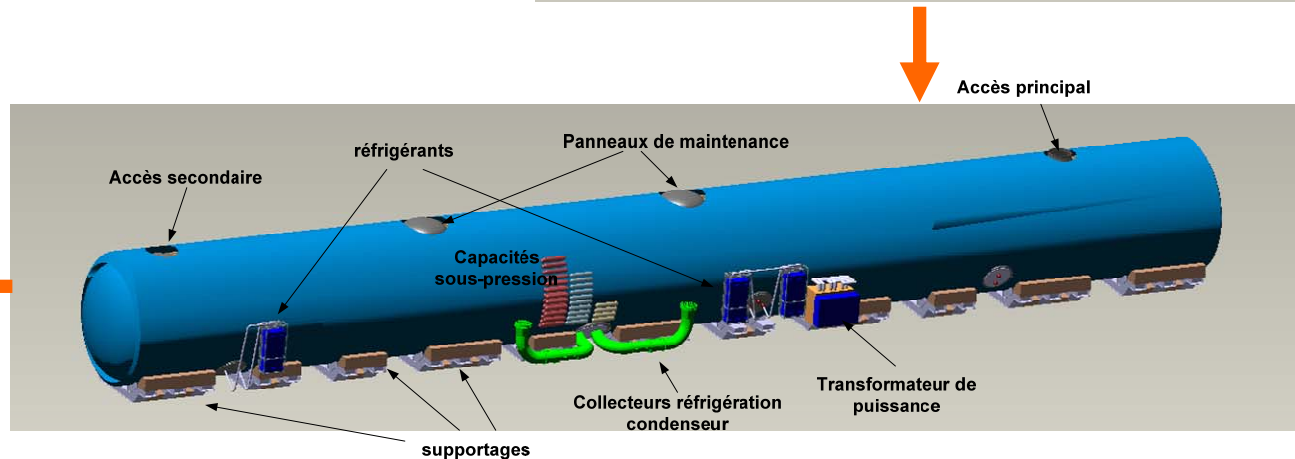
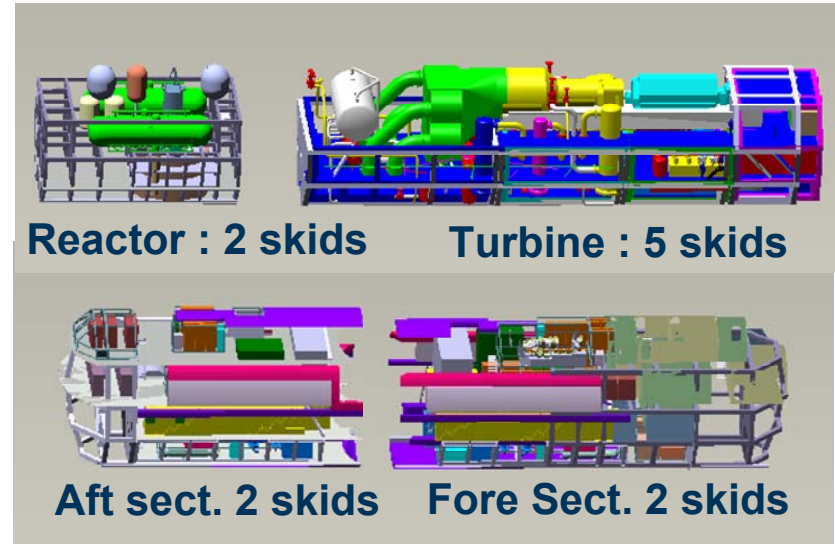
# Flexblue® : Sub Sea System



- Power : 160 MW Electric
- Length  $\approx$  146 meters
- Hull  $\varnothing \approx$  14 meters
- Displacement  $\approx$  20 000 tons
- Moored up to a 100 meters depth
- Unmanned Operation, permanent accessibility

# Flexblue® : Maximum use of modularity

- 11 skids
- 80 sub-skids
- Hull & skids factory assembled
- Full completed module shipped on site
- Very limited civil works on site

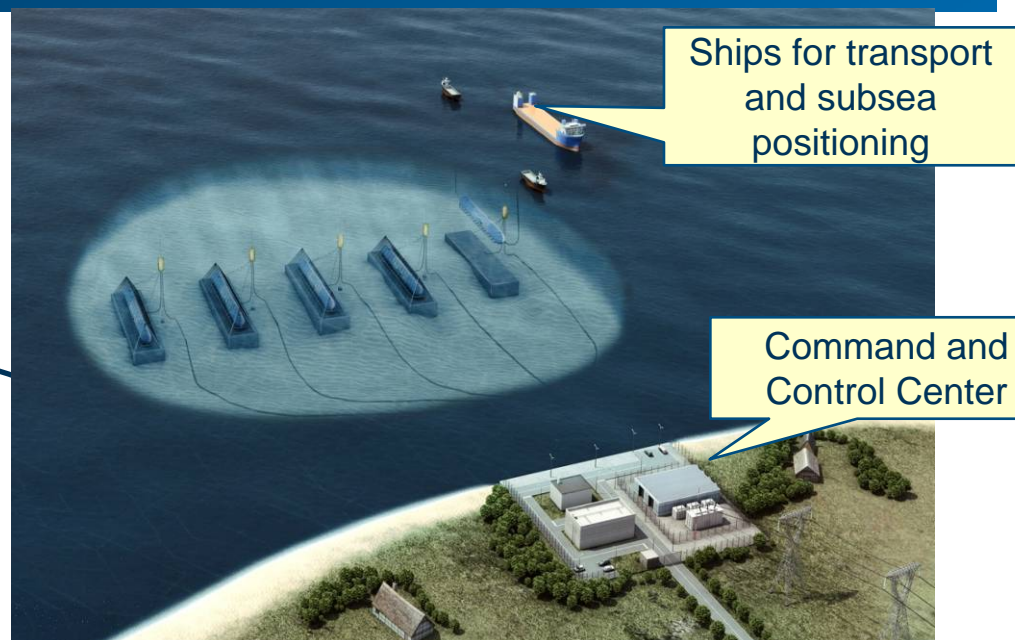




# Flexblue® : Life Cycle

## Modules :

- Positioned in territorial waters, at less than 12 Miles from coast.
- Moored down to 100 meters deep



Transport



Construction



Refueling every 3 years  
Major Repairs every 10 years

Transport



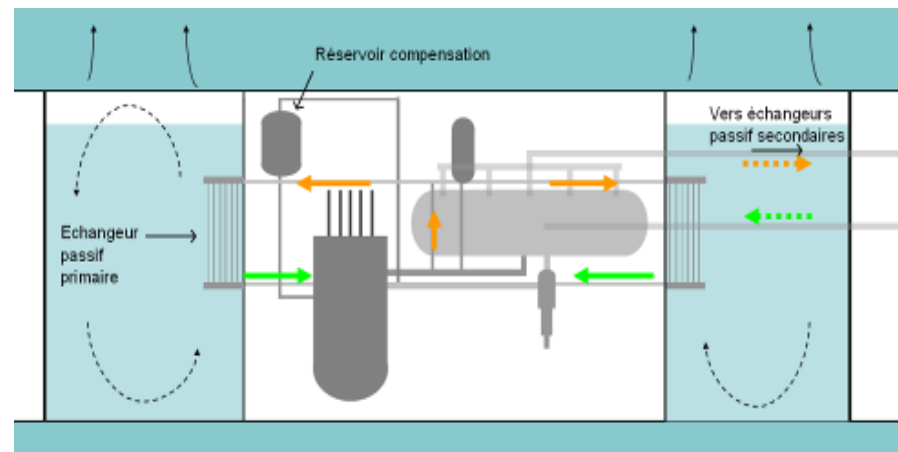


# Flexblue® : Economical energy ...

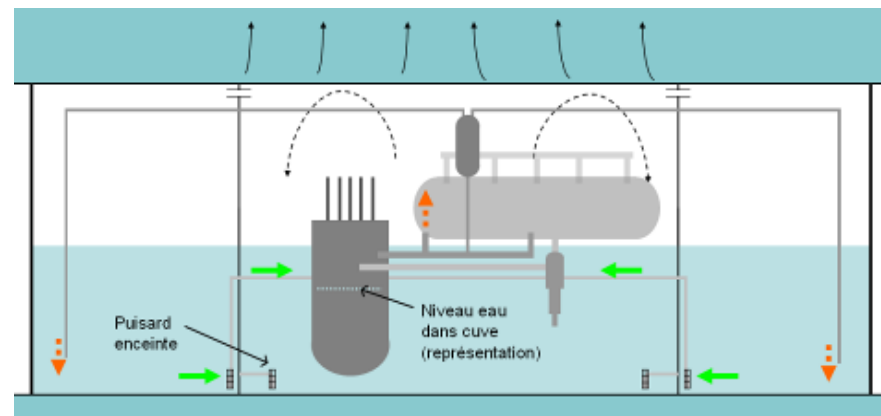
- **Reduced investment cost allowing a wide range of private and public financing schemes and due to :**
  - **Simple and fully standard design**
    - › Project risks controlled
    - › Project schedule reduced
    - › Quality and compliance controlled
  - **Modular shipyard construction technology**
  - **Passive systems - simplicity**
  - **Reduced civil engineering on site**
  - **Proven and Qualified technologies**
- **Maximum mutualization of maintenance facilities & manpower**
- **Easy decommissioning and dismantling**

# Flexblue® : ... with a high level of safety and security

- Unlimited cool water available
- Passive cooling and flooding systems
- Core, RPV and hull cooled in any situation => integrity maintained
- Natural stabilization in a safe state without human action required
- In an hypothetical case : reduced atmospheric releases and no emergency for populations (no sheltering, no evacuation)



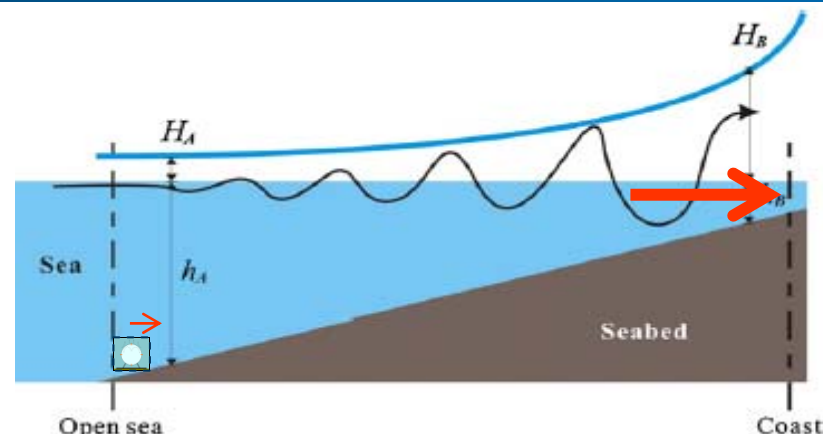
**Passive Cooling**



**Reactor Flooding**

# Flexblue® : ... with a high level of safety and security

- Immersion provides also a natural protection against most external events
  - No wind, no snow, ...
  - Significant attenuation :
    - Waves, tsunami
    - Earthquake : design margins, robustness of passive systems
  - Hostile acts and proliferation :
    - Limited accessibility
    - Monitoring devices above and under water
    - Intervention, according to specific country requirements



# The Flexblue® Concept ... Imagine...





**dcns**

sea THE FUTURE®