CORE POWER

New Nuclear Technology and its Potential Effects on Global Maritime

Scott Edwards | VP, Regulatory Development, Core Power

AIMU Marine Insurance Issues – May 8, 2025

Introduction to CORE POWER

Who?	A private company with 65+ strategic shareholders from shipping, energy, trading and banking.
What?	Building the '*Liberty*' Program – the world's first Maritime Civil Nuclear Program.
Why?	A $5.6 trillion addressable market in maritime, improving the way nuclear is delivered and, global trade is powered.
How?	Mass-assembly in shipyards, of Floating Nuclear Power Plants and nuclear-powered ships.
When?	Orderbook opens 2028. Full commercialisation by mid-2030s.

The complete end-to-end Maritime Civil Nuclear Program for deployment at sea.

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Maritime Nuclear Background

Maritime Nuclear History

- 70+ years of maritime nuclear
  - Nuclear Navies primarily
  - Nuclear Icebreakers
  - State-supported Floating Nuclear Power Plants (FNPPs)
- In these cases, National Governments have operated the assets

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NS *Savannah*

- Initial nuclear-powered merchant ship, built as part of US President Eisenhower's "Atoms for Peace" initiative
- Launched in 1959 and delivered in 1962
- Served as a passenger liner from 1962-65, and as a cargo vessel until 1971, when she was deactivated
- Visited 32 domestic and 45 foreign ports, transited the Panama Canal, although excluded from several countries
- Currently owned by the US Marine Administration (MARAD) and located in Baltimore Harbor, USA

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Otto Hahn

- West German nuclear cargo ship, launched in 1963 and delivered in 1968
- Configured as a passenger and cargo vessel until deactivated in 1979
- Visited 33 ports in 22 countries, but never given permission to visit the USA or transit the Panama Canal
- Converted to conventional diesel engine and operated until scrapping in 2009

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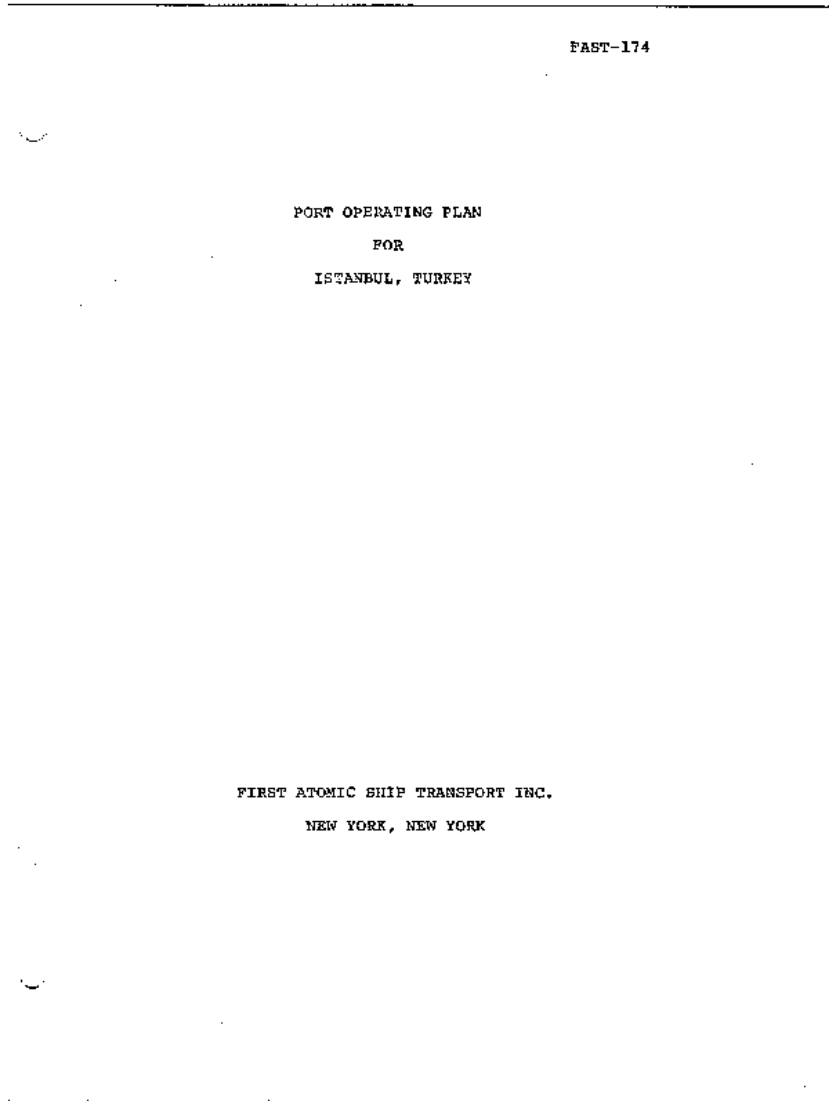
Specific Port Entry Plans

- Prior to entry of a nuclear-powered merchant ship into a port, Port Entry Plans were developed for each port and specific vessel
- Each Port Entry Plan was subject of extensive negotiations between the State being entered and the State that owned and operated the ship
- One example is that negotiations took 15 months before the *Otto Hahn* was allowed to enter the Port of Buenos Aires, Argentina
- Some of those Port Entry and Port Operating Plans are still available, such as the *Savannah* Port Operating Plan for Istanbul, Turkey



FAST-174

PORT OPERATING PLAN

FOR

ISTANBUL, TURKEY

FIRST ATOMIC SHIP TRANSPORT INC.

NEW YORK, NEW YORK

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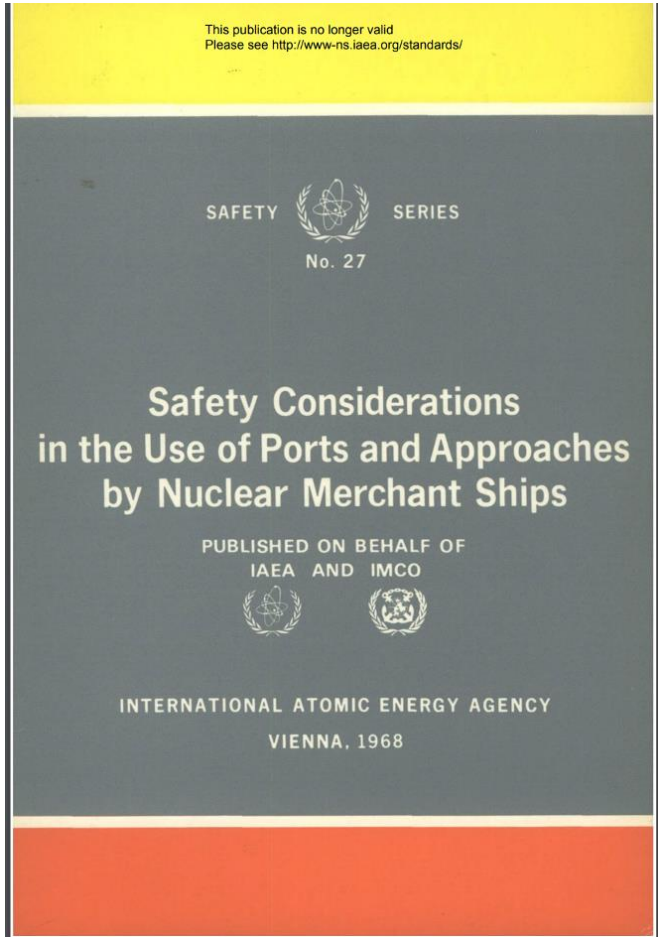
Joint IAEA and IMO Document, *Safety Considerations in the Use of Ports and Approaches by Nuclear Merchant Ships*

- Published in 1968, it was the first (of 2) joint IAEA and IMO documents – the second is the INF Code
- Intent of the document was to provide guidance to Governments and Port Authorities on various procedures and precautions that can be employed during visits
- Document did not preclude development of specific documents, similar to the Istanbul agreement discussed previously
- Lack of use of this document over time has led to it having a designation of “no longer valid”
- NEMO early in effort to update this document as part of the IAEA ATLAS Project



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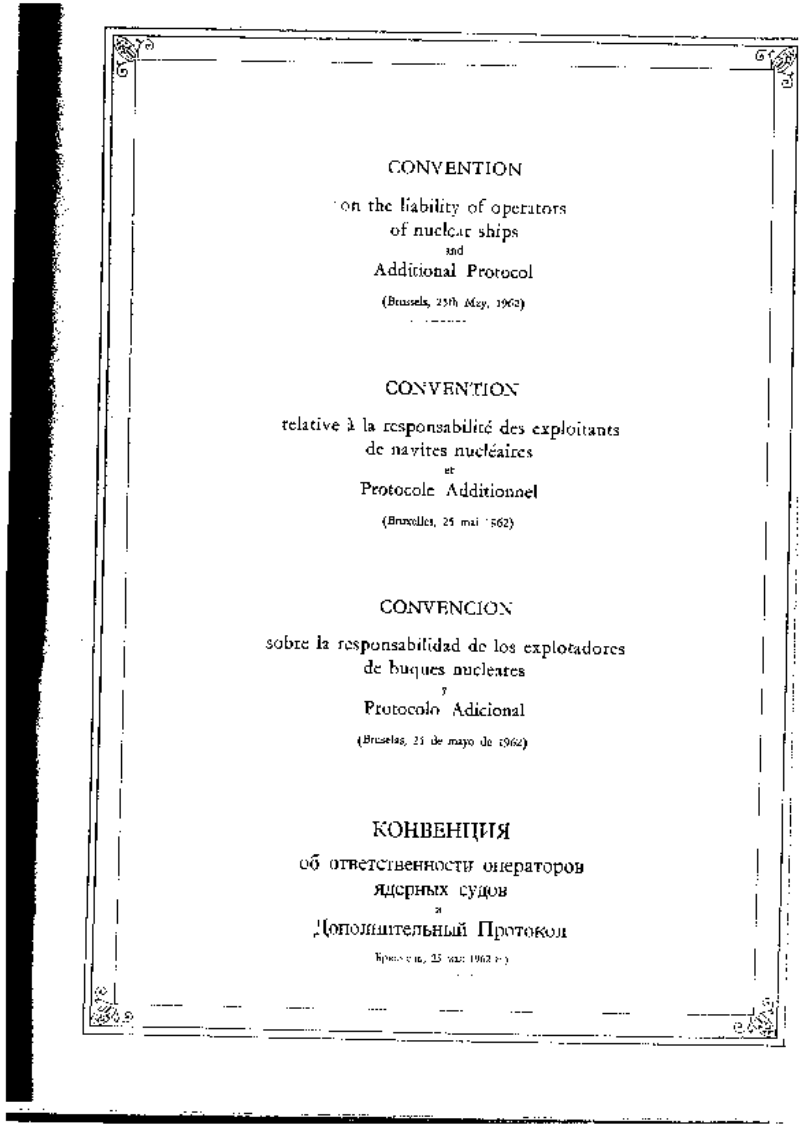
Brussels Convention of 1962 (not ratified)

- Paris and Vienna Conventions are international treaties that establish a framework for civil nuclear liability and compensation for nuclear damage
- Convention on Supplementary Compensation (CSC) also exists for other States, including the USA, Japan, India and Canada, that have their own liability laws that meet certain standards
- These Conventions cover terrestrial nuclear as well as transport of radioactive and nuclear materials, but do not cover maritime nuclear power
- Brussels Convention was negotiated in 1962, but was never ratified due to a disagreement over the applicability to military ships



CONVENTION

on the liability of operators
of nuclear ships
and
Additional Protocol

(Brussels, 25th May, 1962)

CONVENTION

relative à la responsabilité des exploitants
de navires nucléaires
et
Protocole Additionnel

(Bruxelles, 25 mai 1962)

CONVENCION

sobre la responsabilidad de los explotadores
de buques nucleares
y
Protocolo Adicional

(Bruselas, 25 de mayo de 1962)

КОНВЕНЦИЯ

об ответственности операторов
ядерных судов
и
Дополнительный Протокол

(Брюссель, 25 мая 1962 г.)

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Status Today

Current Regulations

- Currently there are no specific regulations governing the use of FNPP's at an international level.
- Russian nuclear icebreakers and FNPPs, including the AKADEMIK LOMONOSOV, are built and operate solely under national regulations.
- IAEA about to issue a Technical Report on the Design Safety and Security Considerations for Floating Nuclear Power Plants
- The IMO has existing rules for nuclear powered ships, but they have not been updated since the 1980s

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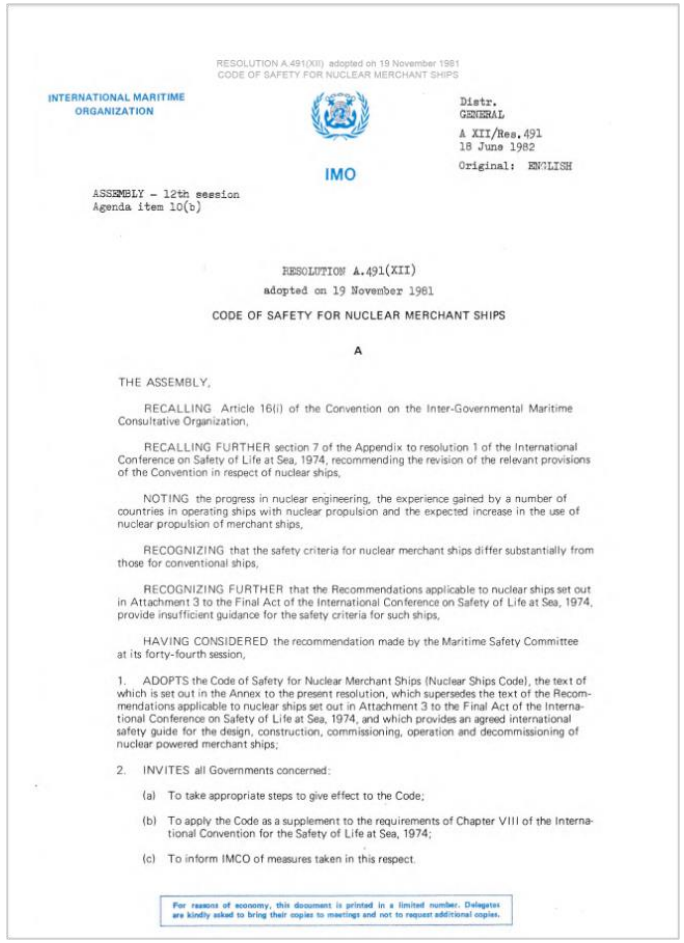
The Code of Safety for Nuclear Merchant Ships Assembly Resolution A.491

- Supplement to SOLAS Chapter VIII
- Written in 1970s, adopted as Resolution A.491 in 1981
- Prescriptive definition of safety requirements
- Limited to prescribing requirements for ships using early designs of PWRs and a direct steam cycle propulsion system
  – Requires periodic updates as technology progresses – **this has not occurred**
- Represents a barrier to positive technology developments which can offer reduced EPZ
- Needs revision to align with most recent IAEA standards
- Two proposals to update Code submitted in advance of June 2025 IMO MSC 110 meeting (USA/Republic of Korea and Russia)



RESOLUTION A.491(XII) adopted on 19 November 1981
CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS

INTERNATIONAL MARITIME ORGANIZATION

IMO

Distr.
GENERAL
A XII/Res.491
18 June 1982
Original: ENGLISH

ASSEMBLY – 12th session
Agenda item 10(b)

RESOLUTION A.491(XII)
adopted on 19 November 1981
CODE OF SAFETY FOR NUCLEAR MERCHANT SHIPS

A

THE ASSEMBLY,

RECALLING Article 16(i) of the Convention on the Inter-Governmental Maritime Consultative Organization,

RECALLING FURTHER section 7 of the Appendix to resolution 1 of the International Conference on Safety of Life at Sea, 1974, recommending the revision of the relevant provisions of the Convention in respect of nuclear ships,

NOTING the progress in nuclear engineering, the experience gained by a number of countries in operating ships with nuclear propulsion and the expected increase in the use of nuclear propulsion of merchant ships,

RECOGNIZING that the safety criteria for nuclear merchant ships differ substantially from those for conventional ships,

RECOGNIZING FURTHER that the Recommendations applicable to nuclear ships set out in Attachment 3 to the Final Act of the International Conference on Safety of Life at Sea, 1974, provide insufficient guidance for the safety criteria for such ships,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its forty-fourth session,

1. ADOPTS the Code of Safety for Nuclear Merchant Ships (Nuclear Ships Code), the text of which is set out in the Annex to the present resolution, which supersedes the text of the Recommendations applicable to nuclear ships set out in Attachment 3 to the Final Act of the International Conference on Safety of Life at Sea, 1974, and which provides an agreed international safety guide for the design, construction, commissioning, operation and decommissioning of nuclear powered merchant ships;

2. INVITES all Governments concerned:

(a) To take appropriate steps to give effect to the Code;

(b) To apply the Code as a supplement to the requirements of Chapter VIII of the International Convention for the Safety of Life at Sea, 1974;

(c) To inform IMCO of measures taken in this respect.

For reasons of economy, this document is printed in a limited number. Delegates are kindly asked to bring their copies to meetings and not to request additional copies.

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New Nuclear for Maritime Approaches

Inherent passive safety and operational simplicity

Long fuel cycles

Minimal Emergency Planning Zones

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Siting Flexibility and redeployability

Complete safety from geological events

Immediate and easy access to the world's largest heat sink

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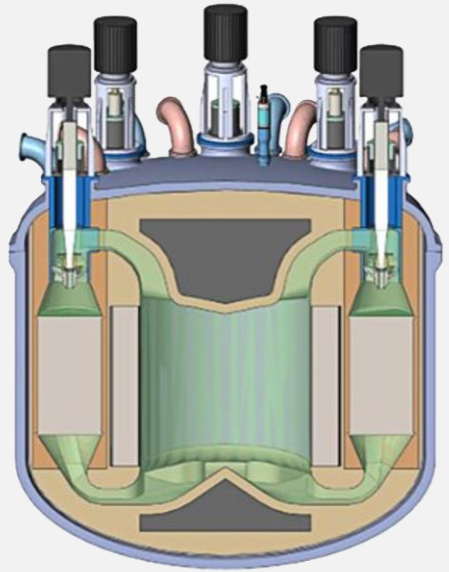
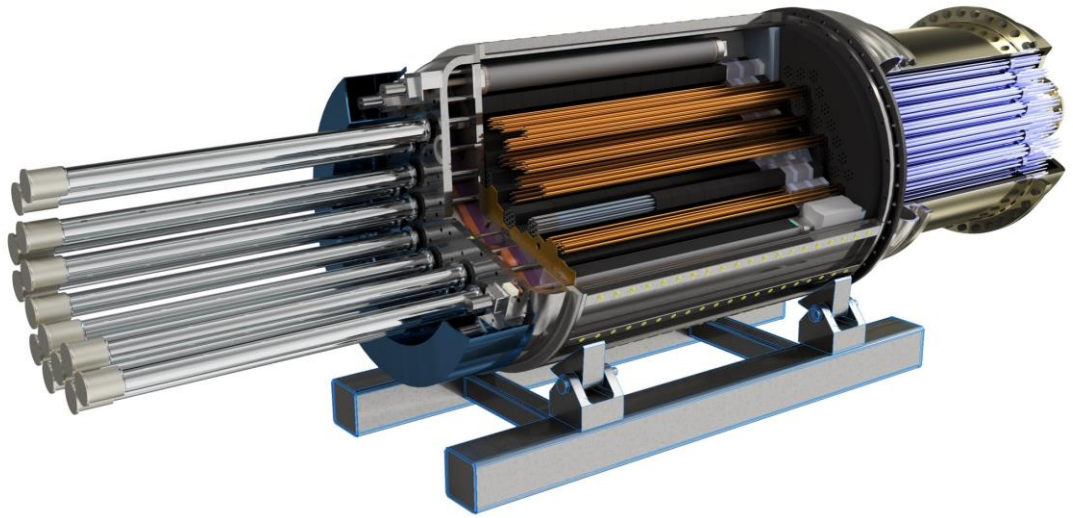
Molten Salt Reactors

- Use a liquid molten salt that contains both the fuel and coolant
- Passive safety features requiring minimal intervention
- Ambient pressure so minimal risk of material expulsion



Heat Pipe Reactors

- Solid State Reactor with minimum moving parts
- Low pressure reactor with 8–15 year refuelling cycle
- Fully factory built and able to be mounted on barges



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The benefits of shipyard construction

- The key benefit of maritime nuclear is the ability to move to full factory construction.
- Repeated builds will allow the nuclear industry to achieve full nth of a kind production
- Experience of the US Navy has already shown that this is possible through the deployment of SMR powered submarines

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Deployment Opportunities

Reducing GHG Pollution from Maritime Industry

International Maritime Industry responsible for ~3% global GHG emissions, or ~ 1 billion tons CO2

Global fleet is ~ 100,000 vessels.

< 7,300 ships consume > 50% of global marine fuels market.

IMO GHG Strategy is Net-Zero by 2050

‘New Nuclear’ can produce green fuels and power ships.

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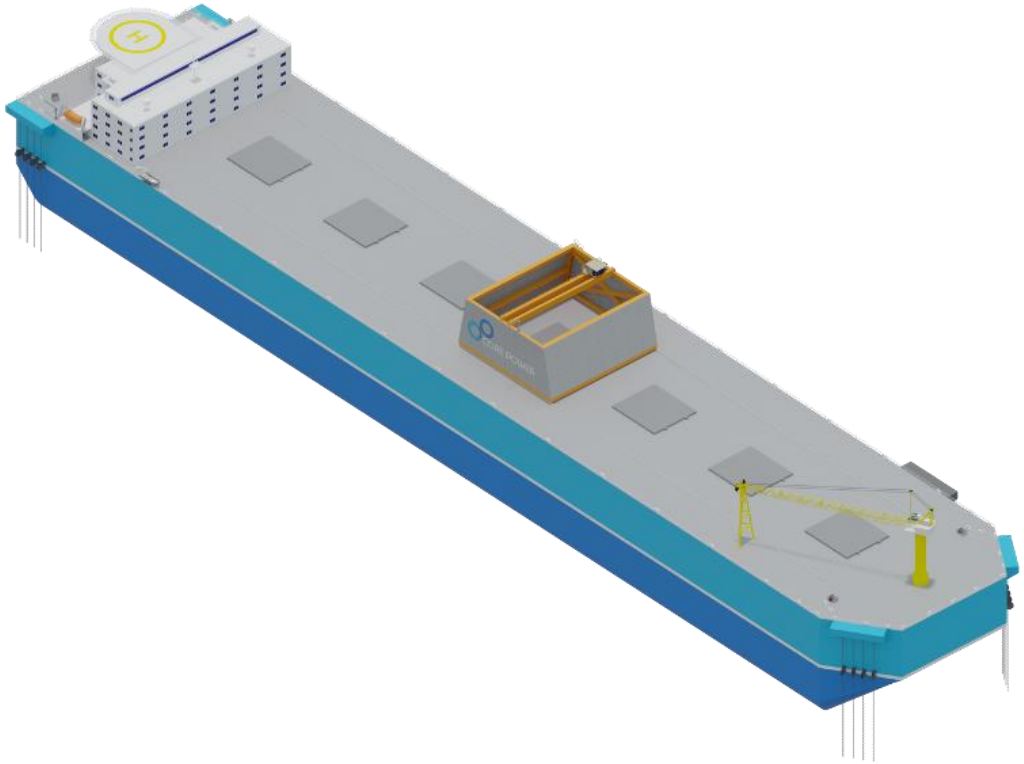
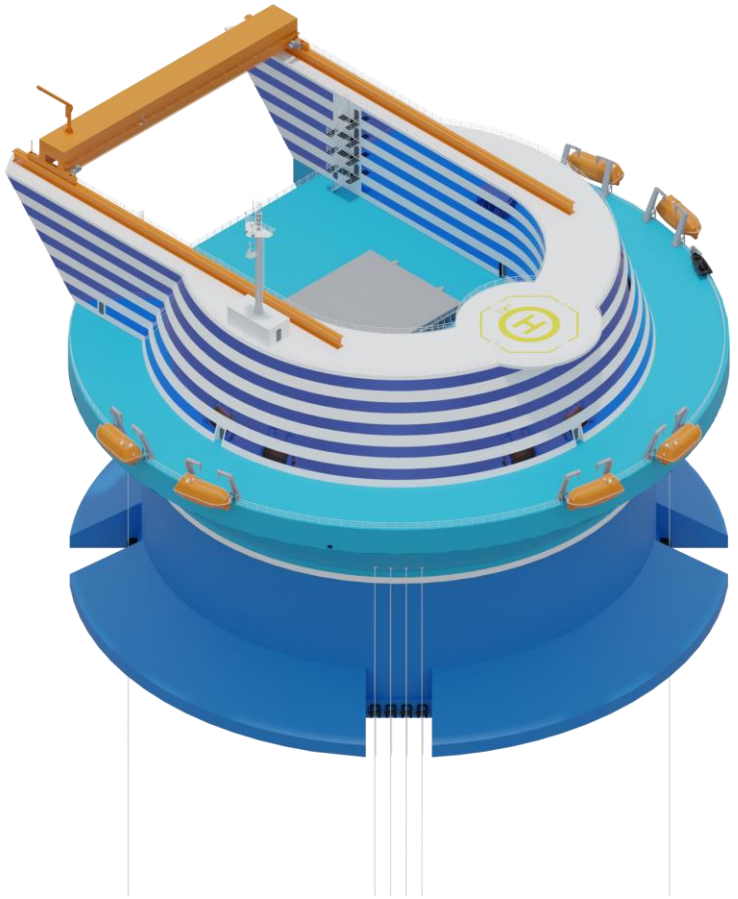
FNPPs for Port Electrification, Process Heat, Microgrids…





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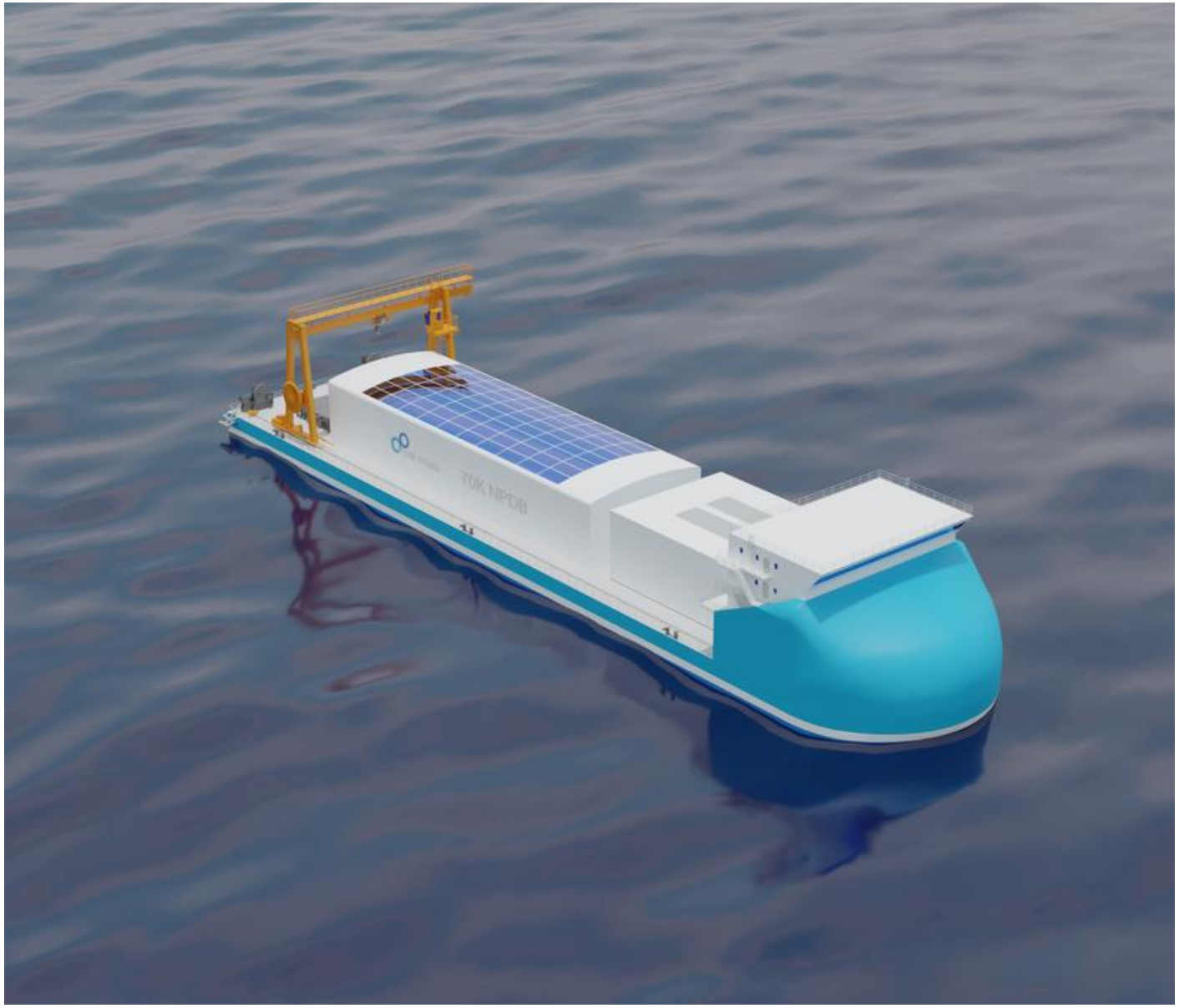
Desalination

- Global water demand is expected to grow by ~30% by 2050 aggravating already existing water shortages.
- Current desalination plants can suffer from low utilisation rates when water Is abundant making them expensive to run.
- Nuclear powered floating desalination plants could alleviate this issue.
- Able to provide power and water they offer a more attractive economic proposition for deployment.



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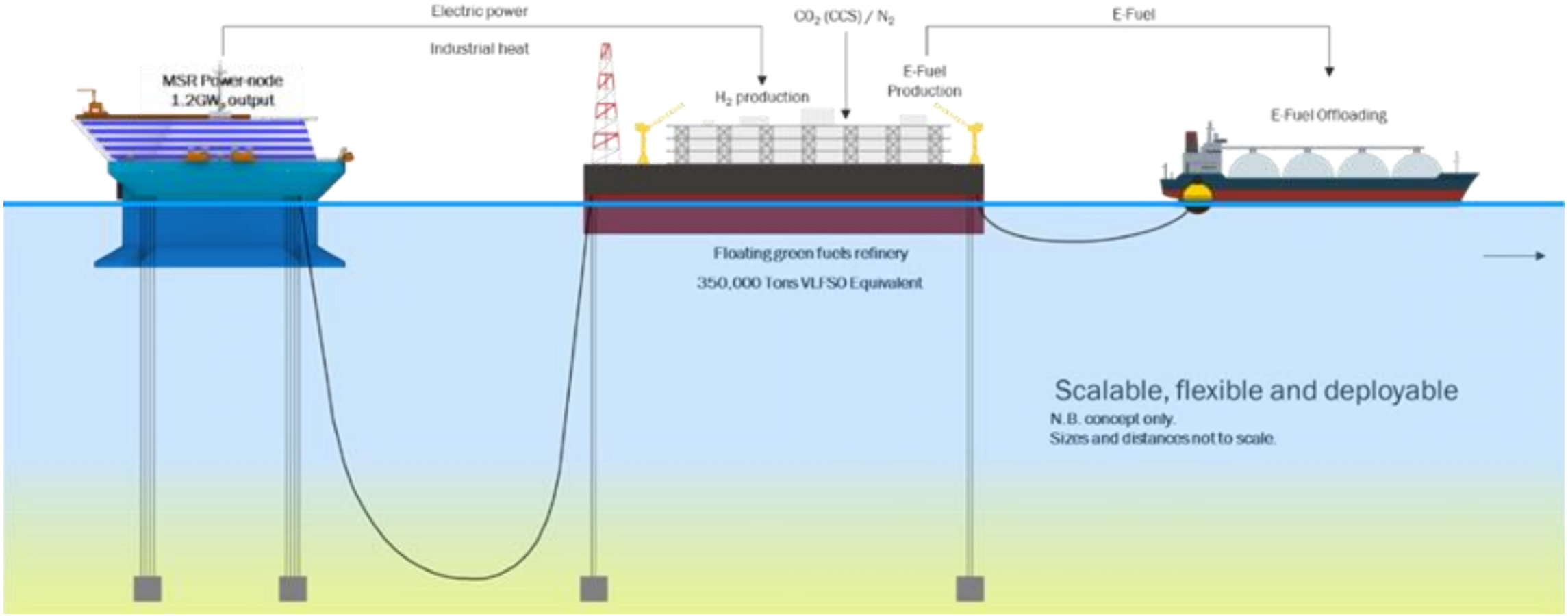
Production of Efuels



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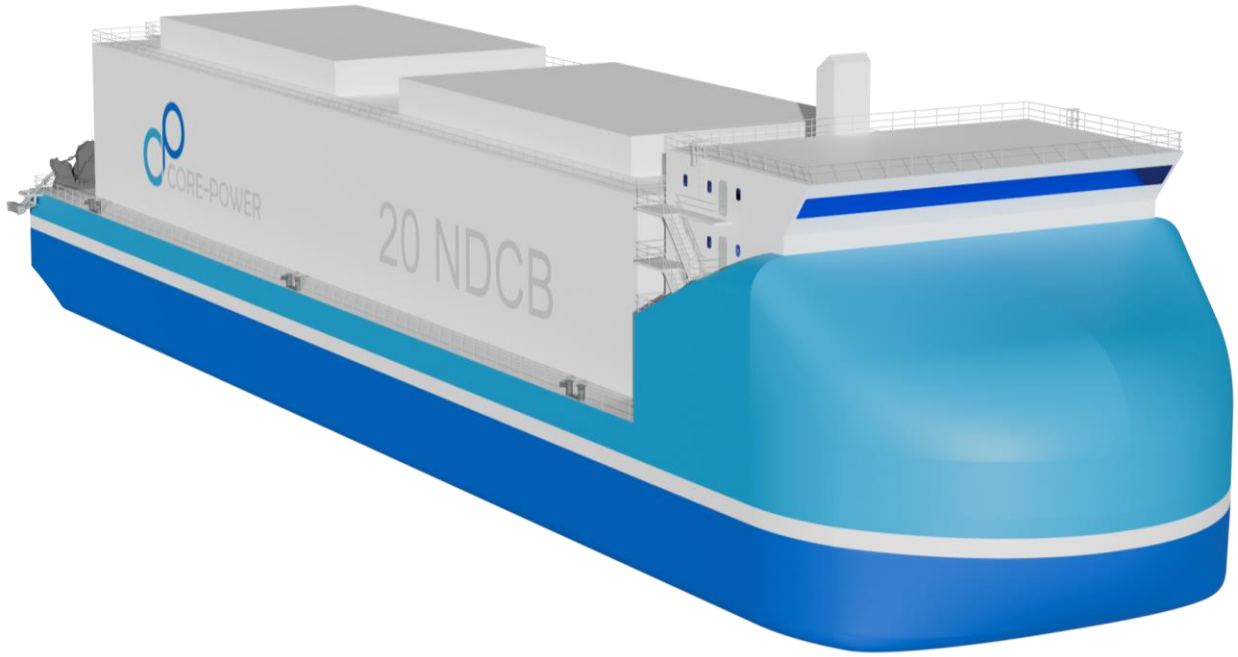
Floating Data Centres

- Data centres are one of the fasting growing loads on the electricity grid. Demand is predicted to reach 2600 TWh by 2024.
- This is expected to accelerate with the further digitalisation and the increasing prevalence of AI technologies.
- Floating Data Centres powered by SMRs could speed up deployment without putting strain on constrained local grids.



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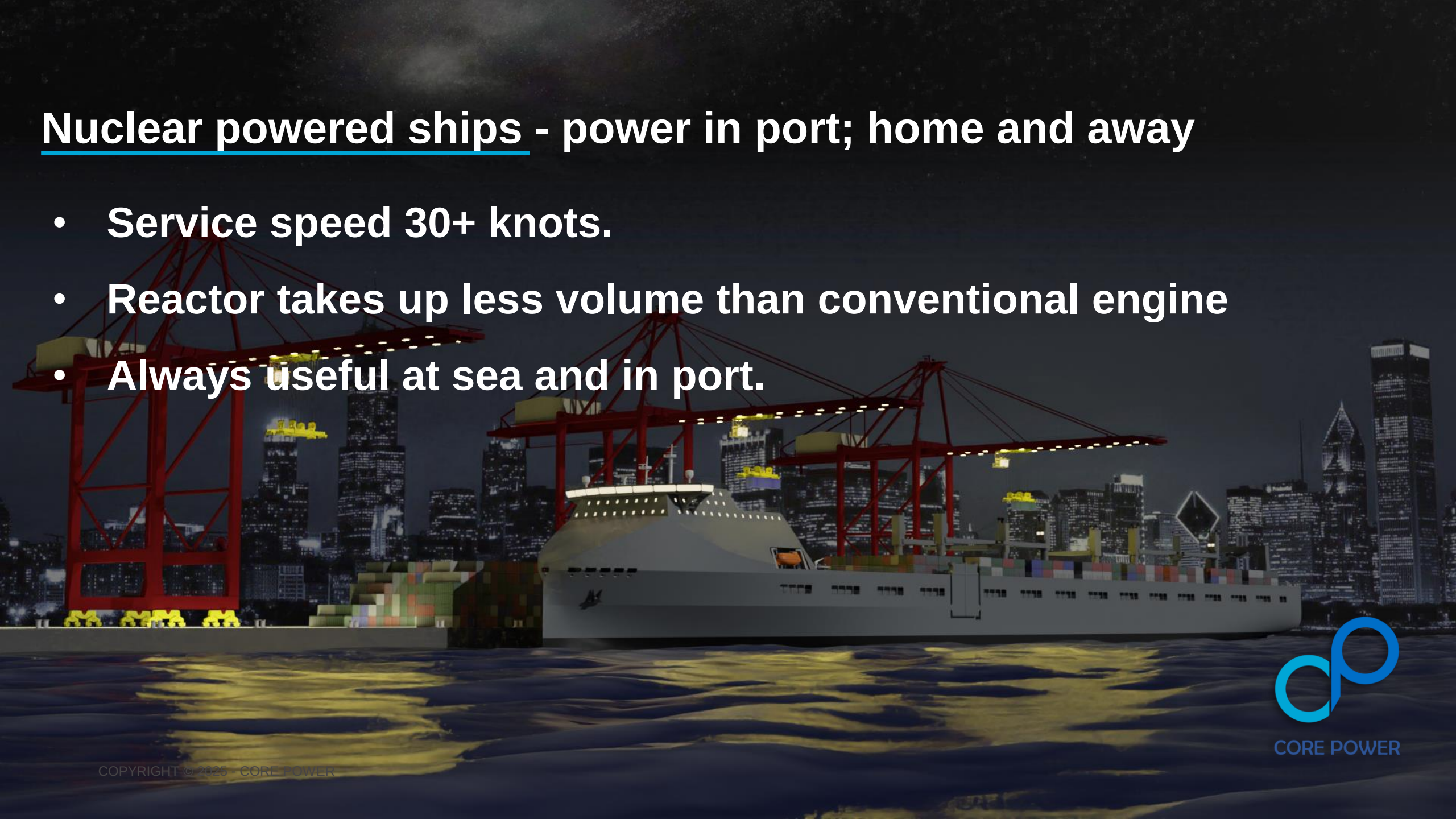
Nuclear powered ships - power in port; home and away

- Service speed 30+ knots.
- Reactor takes up less volume than conventional engine
- Always useful at sea and in port.



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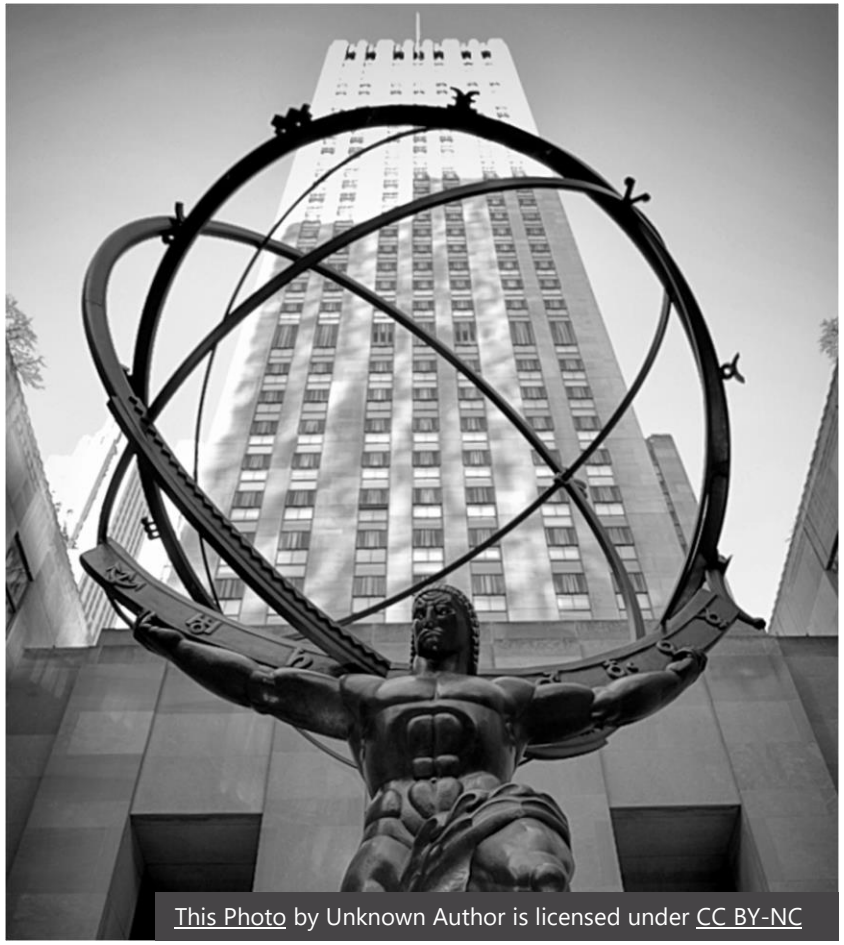
Making It Real

Introducing the IAEA's ATLAS project

Atomic Technology Licensed for Applications at Sea (ATLAS)

- IAEA organized a Global Symposium on FNPPs in late 2023. Over 200 member states, organizations, and developer companies attended.
- Kick-off of ATLAS initiative to establish a robust framework for the safe and secure deployment of peaceful civil nuclear applications at sea.
- IAEA Nuclear Safety Group started a Consultancy Group in 2023 to develop an IAEA Technical Report to assess the applicability of Nuclear Safety and Security Standards to FNPP.
- Future IAEA efforts will analyze, review, and refresh existing standards and guidelines, including the 1968 Safety Considerations in the use of Ports and Approaches.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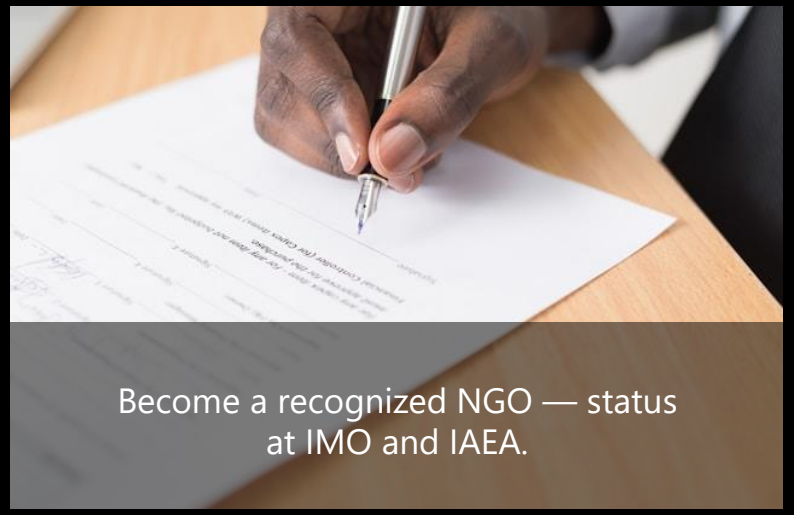
NEMO's Mission

NEMO NUCLEAR ENERGY MARITIME ORGANIZATION



NEMO Membership Summary

NEMO NUCLEAR ENERGY MARITIME ORGANIZATION

1. Nuclear tech developers and vendors / project managers
2. Shipowners/operators
3. Shipyards
4. Port Authorities
5. Class Societies
6. Insurance
7. Maritime & Energy Law
8. Power offtakers / end-users

NEMO Members

Steps in the Process

INTERNATIONAL MARITIME ORGANIZATION

SOLAS Ch. VIII
Res A.491(XII) 1981

IMO to revise current standards

IAEA confirm the applicability of current safety and security standards

IAEA

2025

Maritime:
IMO agrees to revise Nuclear Code in close dialogue with the IAEA

2024 – 2026

Nuclear:
IAEA completes gap analysis of **standards for floating nuclear.** 'ATLAS' initiative develops

2026 – 2028

Insurance:
Unified standards developed as a **foundation for Liability Convention**

2028 – 2030

Demonstration: Member states adopt rules for floating nuclear to enter and **operate in waterways and make port calls**

2030+

Delivery:
Fit-for-purpose technology is **deployed in early 2030s**

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International S, S & S standards for nuclear in maritime

+ 7 nations and 5 NGOs

IMO

Safety – MSC

IMO – SDC Sub committee

New SOLAS Ch. 8
Res. A.491Xii

2030

15+ nations and 7+ NGOs

ATLAS

IAEA

1. Roadmap
2. *A.491.Xii (IMO)*
3. Guidelines for port calls
4. Security and Safeguards recommendations
5. Classification (IACS)
6. *Civil liability Convention*

NEMO
NUCLEAR ENERGY MARITIME ORGANIZATION

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A civil liability convention for nuclear powered ships

- Marine insurers / P&I
- IUMI / IG
- Nuclear insurance pools
- Underwriters
- Reinsurers

NEMO
NUCLEAR ENERGY MARITIME ORGANIZATION

1. Modernised Structure / Suitable home
2. Wider heads of damage
3. Revised convention
4. Multilateral Nation state ratification

IMO

CMI 1897

Brussels Convention 1962

Key member states lead the work with NGOs at the IGOs to create a smaller multilateral Convention which others can join.

+ 7 nations and 5 NGOs

Revised Convention 20XX

2030

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