



GREENPORT
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Sustainable Maritime Operations and Green Port Technologies

Module number 3

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Lecturer contact info

Industry ecosystem and technological landscape

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Shaping the Future of Port Operations

SESSION OBJECTIVES

- ❑ **Gain a clear understanding of how decarbonisation, technological innovations, and evolving client expectations are shaping modern port operations.**
- ❑ **Examine real-life scenarios** to see how these trends directly influence ship manoeuvring, tug assistance, and day-to-day operational decision-making.
- ❑ **Learn how emerging technologies and operational practices can be applied** to improve coordination, efficiency, and adaptability in port operations.
- ❑ **Discuss strategies** to maintain high safety standards, optimize operational efficiency, and reduce environmental impact through informed decision-making.

Industry ecosystem & technological landscape

RAPID TRANSFORMATION OF PORTS

Decarbonisation, technological innovation, evolving customer expectations.

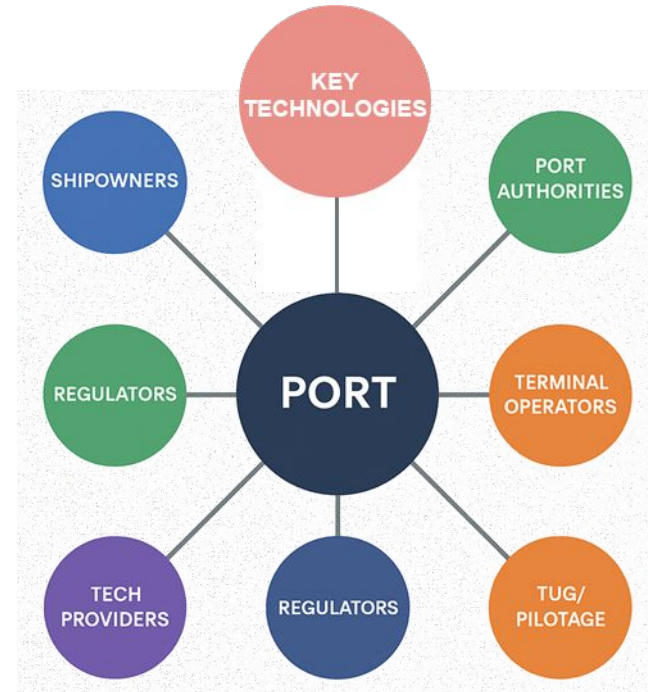
ECOSYSTEM

Shipowners, charterers, terminal operators, port authorities, tug and pilotage companies, regulators, technology providers.

DIRECT IMPACT ON PILOTS AND TUG MASTERS

Safety, efficiency, environmental performance.

Key technologies: Onshore Power Supply (OPS), LNG/methanol/ammonia propulsion, ShaPoLi systems, emissions monitoring tools.



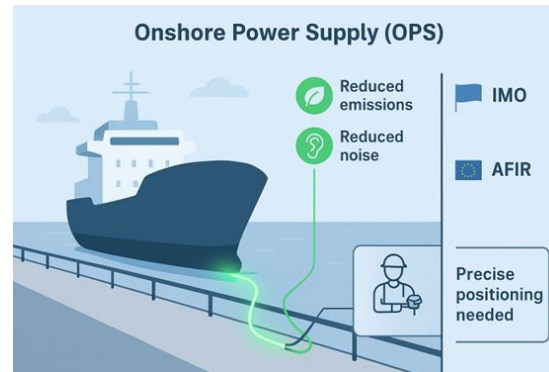
Onshore Power Supply (OPS)

OPERATIONAL IMPLICATIONS

- Requires highly accurate berthing to align vessels with onshore power connection points.
- Demands careful coordination between pilots, tug masters, mooring teams, and shore power technicians.

BENEFITS

- Significant reduction of CO₂, NO_x, SO_x, and particulate matter emissions.
- Quieter port environment, improving local air quality and community wellbeing.



REGULATORY CONTEXT

- **IMO:** Voluntary guidelines for shore power adoption.
- **EU (AFIR):** Mandatory implementation by 2030 for TEN-T core ports.

CONSEQUENCE

New operational routines and collaboration protocols are necessary to ensure safe, efficient, and compliant shore power usage.

Alternative fuel vessels



- Helps reduce greenhouse gas emissions and air pollutants.



- It requires cryogenic storage, careful handling, and the establishment of strict safety zones around vessels and infrastructure.

LNG

- Provides dual-fuel flexibility for engines, supporting smoother transition from conventional fuels.

- Its main challenges are toxicity and flammability, which demand rigorous safety measures.

METHANOL

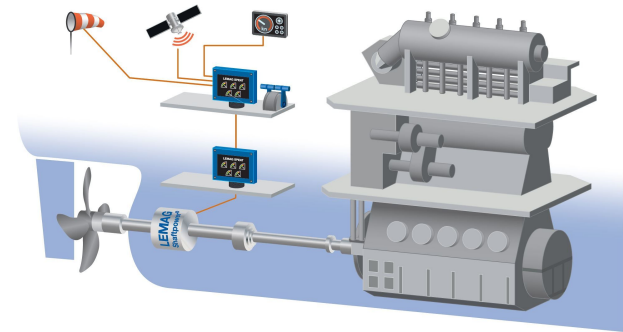
- Produces zero CO₂ emissions during use.

- It is highly toxic and corrosive, requiring specialized handling and equipment to ensure crew and environmental safety.

AMMONIA

ShaPoLi systems

- **PURPOSE:** Limits or monitors maximum shaft output to ensure compliance with EEXI (Energy Efficiency Existing Ship Index) and CII (Carbon Intensity Indicator) regulations.
- **BENEFITS:**
 - ☐ Reduces fuel consumption and greenhouse gas emissions.
 - ☐ Provides improved operational data to support port planning and scheduling.
- **CHALLENGES:**
 - ☐ Slower engine responsiveness during critical manoeuvres.
 - ☐ Reduced availability of “engine kicks” for fine control.
- **OPERATIONAL IMPACT:** Early communication of power limitation data through pilot cards, VTS systems, and tug allocation planning to ensure safe and efficient port operations.



Emission monitoring tools

- **Modern ports are increasingly adopting advanced monitoring solutions** such as EMSA drones, onboard systems, fixed quayside sensors, and networked detectors.
- These technologies generate real-time environmental data that can be shared among stakeholders **to improve both efficiency and compliance.**

BENEFITS FOR STAKEHOLDERS

- ☐ **Pilots** receive direct feedback on their manoeuvring choices, supporting safer and more fuel-efficient navigation.
- ☐ **Tug masters** can optimise power use, reducing unnecessary fuel burn and emissions.
- ☐ **Terminal operators** gain accurate data for berth scheduling, helping to avoid emission peaks during busy periods.
- ☐ **Port Authorities** can rely on evidence-based insights to ensure regulatory compliance and monitor overall environmental performance



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