



GREENPORT
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Sustainable Maritime Operations and Green Port Technologies

Module number 4

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Operational strategies for energy saving and emission reduction

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Operational strategies for energy saving and emission reduction in ports

SESSION OBJECTIVES

- ❑ **Analysis of established operational strategies** aimed at optimizing energy consumption and reducing emissions, with a focus on practical and measurable solutions.
- ❑ **Practical application in port operations**, taking into account daily challenges and the typical operational variables of ports.
- ❑ **A multi-stakeholder approach** that promotes coordination among ships, pilotage services, tug operators, terminal planners, and port authorities.
- ❑ **Real-world cases and concrete data** to demonstrate the tangible benefits of the strategies implemented.
- ❑ **Scenario-based exercises** that allow participants to apply the strategies in realistic port conditions

Techniques using existing resources

OPERATIONAL STRATEGIES FOR ENERGY EFFICIENCY AND EMISSION REDUCTION

Eco-speed: adjust approach speed based on berth availability.

Optimised tug deployment: use the right tug, minimise idle time.

Tidal windows: schedule movements with favourable currents.

Real-time monitoring: PPUs, sensors, drones.

Behavioural change: pre-briefings and debriefings for crews.

TECHNIQUE	EXAMPLE PORT	RESULT
Eco-speed adjustments	Rotterdam	Less idle time; reduced approach fuel use
Tug use optimisation	Antwerp-Bruges	Fewer high-power tug minutes
Tidal window scheduling	Gothenburg	Up to 15% tug fuel saving
Real-time monitoring	Barcelona	Live feedback improved operational choices
Behavioural change	Los Angeles/Long Beach	Participation rate >90% in speed program

Eco-speed steaming

SAFE MINIMUM SPEED STRATEGY

Concept: Maintaining a safe minimum speed during approach and transit can lead to 10–30% fuel savings.

Benefits: Enables smoother manoeuvres, reduces idle time, and helps alleviate port congestion.

Real-World examples: Successfully implemented in major ports such as Los Angeles/Long Beach, Rotterdam, and Gothenburg.

Key Principle: Align vessel arrival with berth availability through Just-in-Time (JIT) Arrival.

STAKEHOLDER GROUP	BENEFITS OF ECO SPEED STEAMING
Pilots	• Smoother handling during approach. • Reduced need for last-minute speed changes.
Tug masters	• Easier and safer engagement. • Less idle or holding time awaiting vessel.
Pilot vessel crews	• Safer, more fuel-efficient boarding operations. • Reduced high-speed runs.
Terminal planners	• Improved berth utilisation and reduced congestion.
VTS	• Better traffic flow management and less anchorage congestion.

Scheduling with tidal windows

Tidal conditions strongly affect **fuel use, emissions, and manoeuvring safety** during approaches, berthing, and unberthing.

By aligning ship movements with **favourable tidal windows**, ports can reduce propulsion demands and achieve safer, more efficient operations.

PRINCIPLES

Favourable currents → assist propulsion, cut fuel use.

Slack water → precise manoeuvring, safer pilot boarding.

Adverse currents → higher fuel demand, greater tug support.

Tidal height → ensures under-keel clearance.

STAKEHOLDER GROUP	BENEFITS OF TIDAL WINDOW SCHEDULING
Pilots	Shorter duration of pilotage due to favourable current from the stern.
Tug masters	There is potential for lower bollard pull requirements when currents are favourable
Pilot vessel crews	Reduced high-speed running and improved safety
Terminal planners	Optimised berth utilisation
VTS	Smoother traffic flow and reduced congestion

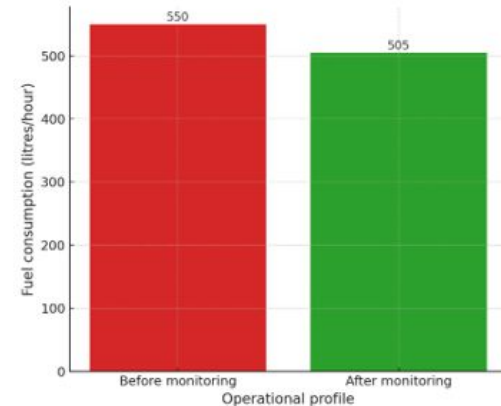
Real-time fuel consumption visualisation

A system for **live monitoring of fuel consumption** across tugs, pilot boats, and other harbour craft.

Data is continuously collected and presented in real time, allowing **crews, pilots, VTS operators, and port managers** to make informed decisions immediately, rather than waiting for post-operation reports.

HOW IT WORKS

- **Data capture:** Sensors measure fuel flow, engine load, and RPM in real time.
- **Data display:** Information is visualised on onboard screens for crews and on shore dashboards for managers.
- **Decision support:** Crews receive actionable insights to adjust speed, power, and manoeuvres instantly.
- **Performance analysis:** Historical data supports post-job reviews to identify efficiency improvements and optimise fuel use over time.



Encouraging behavioural change through data-driven feedback

Leveraging data to drive behavioural change is key to achieving lasting fuel efficiency and emissions reduction.

- Data alone cannot reduce fuel use and emissions; **behavioural change is essential.**
- Operators adopt efficient practices when they **see the impact of their actions.**
- Feedback must be **visible, relevant, timely, and positively reinforced.**
- Stakeholders benefit by **aligning operations, optimizing fuel, adjusting speeds, reducing idle time, and improving traffic flow.**
- Implementation involves **defining metrics, collecting data, providing feedback, and recognising achievements.**

Tug energy saving, before and after a job

Tug operations are highly fuel-intensive, not only during active assistance but also in transit and idle time.

Significant savings possible by optimising pre-job preparation and post-job return.

- ☐ Synchronise tug departure with pilot boarding ETA
- ☐ Select the most efficient tug (bollard pull & location)
- ☐ Plan approach to minimise high-RPM manoeuvres.

**BEFORE
THE JOB**

- ☐ Use intermittent thrust/drift assist where safe
- ☐ Coordinate with pilot to avoid unnecessary power changes
- ☐ Optimise towline length

**DURING
THE JOB**

- ☐ Depart at eco-speed back to the station.
- ☐ Avoid unnecessary loitering near the berth or in fairways.
- ☐ Shut down auxiliary engines not needed for immediate readiness

**AFTER
THE JOB**



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