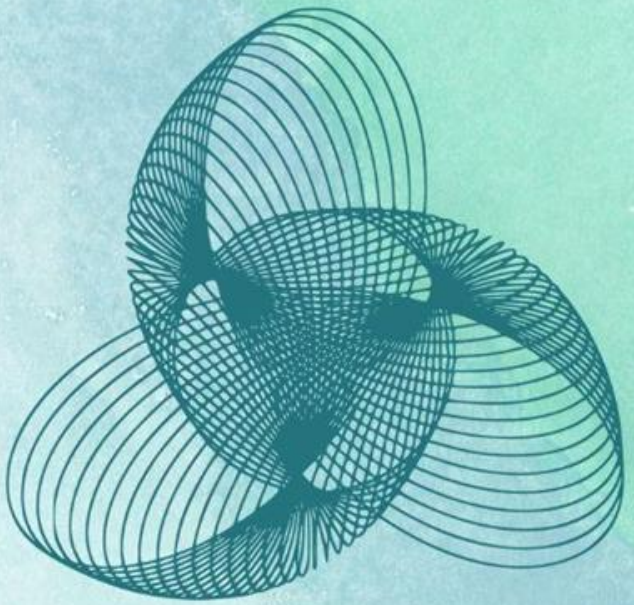

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the Sustainability EducationAI programme for greeNER fuels and enerGY on ports

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Module #2: Overview of present key tools and Certifications for ports energy transition in Europe

Course coordinator:

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Learning objectives of the course

On completion of this course, the participants will be able to:

i. Understand key tools for ports' green transition: Gain basic knowledge of the present key tools and frameworks driving energy transitioning in European ports.

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Table of Content

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1- Introduction to the ports' energy transition

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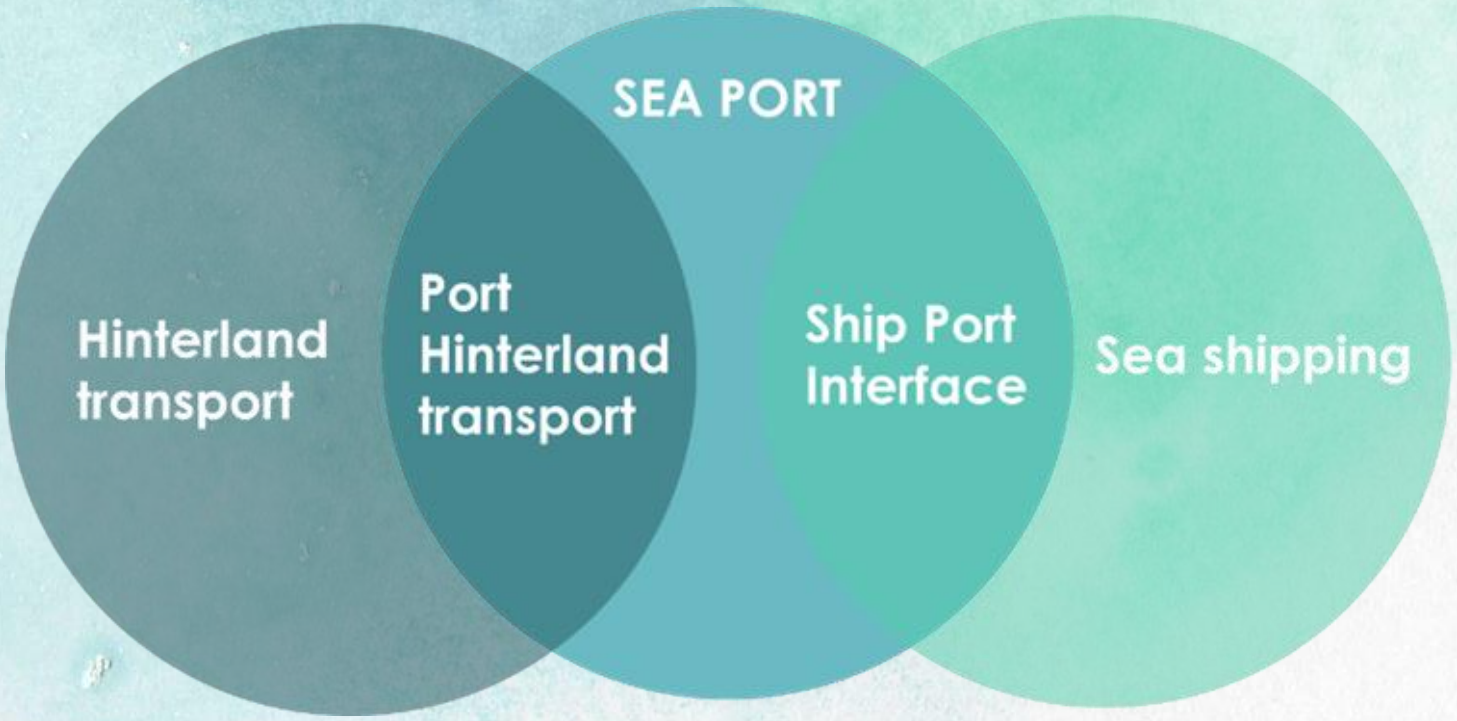

Scope for ports for energy transition

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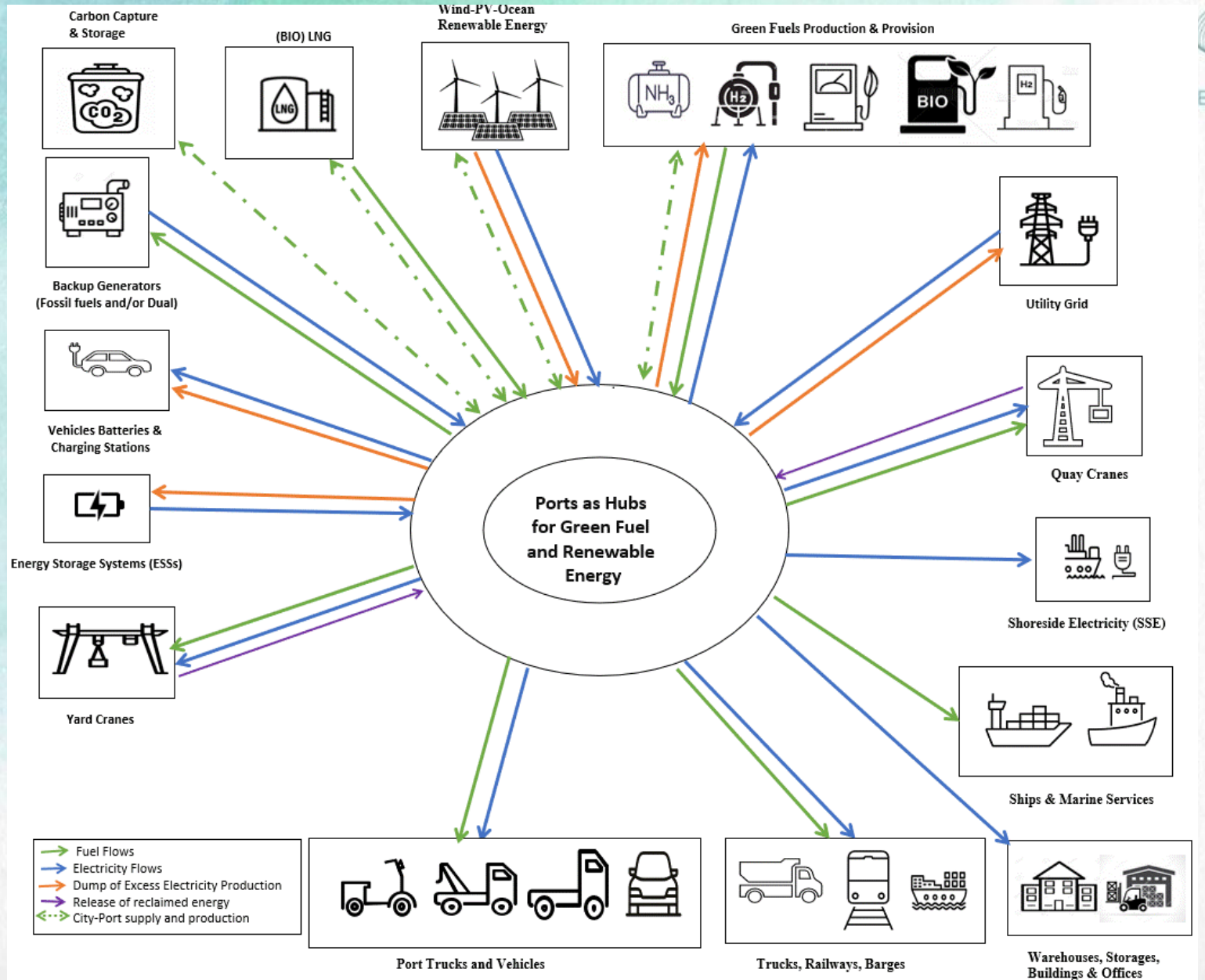
1- Introduction to the ports' energy transition

Energy transition :

Energy Framework at Ports



1- Introduction to the ports' energy transition

Energy transition - context

At global level, the section on COP28 emphasizes the need for global action to significantly increase renewable energy capacity and enhance energy efficiency by 2030. It also highlights the importance of setting ambitious emission reduction targets across all sectors. The long-term goal remains achieving carbon neutrality by 2050, which entails reducing greenhouse gas (GHG) emissions as much as possible and offsetting the remainder through carbon credits.

The energy transition is key to this, focusing on shifting from fossil fuels to renewable energy sources. Electrification of consumption, particularly in sectors like transportation, along with digitalization of grids, are critical strategies for improving energy efficiency and supporting this transition.

Concerning the EU ports, particularly the focus on green transition tools and certifications in European ports, this aligns with the broader objectives of reducing GHG emissions and enhancing energy efficiency as outlined in COP28. The emphasis on certifications, such as ISO standards for energy management and environmental management, further underscores the commitment to measurable, standardised approaches to achieving these goals.

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1- Introduction to the ports' energy transition

Overview of related EU initiatives, regulations, and key frameworks for port energy transition

At European level, the energy transition within European ports is a critical component of the broader European Green Deal, which aims to make Europe the first climate-neutral continent by 2050. The maritime sector, responsible for around 13% of the EU's transport greenhouse gas (GHG) emissions, is under significant pressure to reduce its environmental footprint. As such, the transition to greener fuels and renewable energy within ports is not only necessary but also a key strategic priority for the European Union (EU).

Key initiatives and regulatory frameworks guiding this transition include the European Green Deal, which sets ambitious targets for reducing GHG emissions by at least 55% by 2030 and achieving net-zero emissions by 2050.

In conjunction with the Green Deal, the European Climate Law enshrines these targets into binding legislation, requiring member states to adopt national strategies to achieve these goals.

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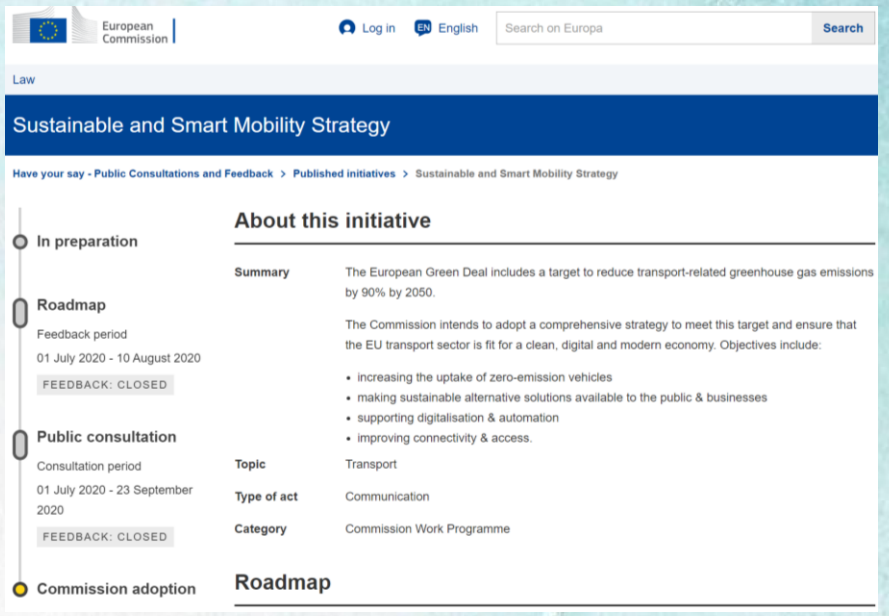
1- Introduction to the ports' energy transition

Overview of related EU initiatives, regulations, and key frameworks for port energy transition



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1- Introduction to the ports' energy transition

Overview of related EU initiatives, regulations, and key frameworks for port energy transition

Another critical framework is the Sustainable and Smart Mobility Strategy, which prioritizes the development of zero-emission ports. This strategy emphasizes ports' roles as clean energy hubs that integrate electricity systems, hydrogen, and other low-carbon fuels. It also promotes the use of ports as testbeds for innovative energy solutions, such as waste reuse and the circular economy.

To support the decarbonization of maritime transport, the EU has also introduced the FuelEU Maritime Initiative, which aims to increase the uptake of sustainable alternative fuels by setting limits on the greenhouse gas intensity of energy used by ships.

Additionally, the Alternative Fuels Infrastructure Directive (AFID) mandates the deployment of sufficient alternative fuels infrastructure, including onshore power supply systems, to support the maritime sector's energy transition.

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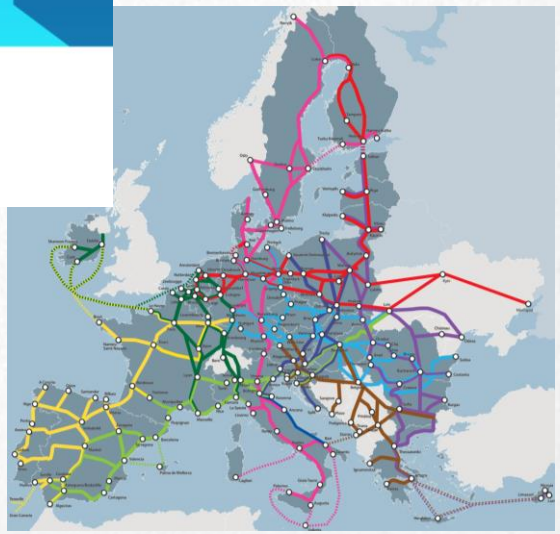
1- Introduction to the ports' energy transition

Overview of related EU initiatives, regulations, and key frameworks for port energy transition

Moreover, initiatives like PORTS 2030 explore the potential for energy transition in ports, encouraging collaboration among stakeholders to develop and implement sustainable energy solutions. These initiatives are supported by funding programs such as Horizon Europe, which finances research and innovation projects focused on green and renewable energy in the maritime sector.

Read more here:
https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/brochures_images/ports2013_brochure_lowres.pdf



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1- Introduction to the ports' energy transition

Importance of Adopting Tools for Transitioning to Greener Fuel and Energy

Adopting greener fuels and technologies is vital for reducing GHG emissions in the maritime sector, aligning with EU climate goals. Transitioning to renewable energy sources like hydrogen, ammonia, and biofuels helps decarbonize port operations and maritime transport. This shift also enhances port sustainability by reducing reliance on fossil fuels, mitigating energy price volatility, and improving energy security, as seen with Onshore Power Supply (OPS) systems that cut CO2 emissions.

Furthermore, embracing greener energy boosts ports' long-term competitiveness and opens opportunities to become renewable energy hubs. Digital tools like smart grids and energy management systems further optimize energy use, reduce costs, and support sustainable port operations.

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2- Eenergy management in ports

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Tools for energy monitoring, management, and energy audits

Effective energy management in ports is essential to reduce operational costs, decrease greenhouse gas emissions, and enhance sustainability. To achieve this, ports are increasingly adopting advanced tools for energy monitoring, management, and audits.

- **Energy Monitoring Systems (EMS):** These systems play a crucial role in collecting real-time data on energy consumption across various port operations. EMS can track electricity usage, fuel consumption, and emissions, providing a comprehensive view of the port's energy footprint. Such systems often include features like automated data collection, energy usage dashboards, and alerts for abnormal consumption patterns. For instance, the integration of smart meters and sensors allows for detailed monitoring of energy use in lighting, heating, cooling, and equipment operation.

- **Energy Management Systems (EnMS):** EnMS are software platforms that help ports optimize their energy usage by analyzing data from EMS. These systems can automate energy-saving measures, such as adjusting lighting or HVAC systems based on occupancy or time of day. They also assist in demand response, where the port can reduce or shift its energy use during peak periods to avoid high energy costs or to participate in grid-balancing activities. Advanced EnMS may incorporate predictive analytics to forecast energy needs .

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2- Eenergy management in ports

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Tools for energy monitoring, management, and energy audits

- **Energy Audits**: Regular energy audits are a critical tool for identifying inefficiencies and potential energy-saving opportunities in port operations. These audits assess the energy performance of various systems and processes, including lighting, HVAC, equipment, and buildings. They provide a detailed analysis of energy flows and identify areas where energy losses occur. Audits typically result in recommendations for improving energy efficiency, such as upgrading to more efficient equipment, optimizing operational procedures, or enhancing insulation in buildings.

- **Renewable Energy Integration Tools**: To facilitate the integration of renewable energy sources, ports use specific tools that manage the production and storage of renewable energy, such as solar or wind power. These tools are essential for balancing energy supply and demand within the port, ensuring that renewable energy is effectively utilized and stored when production exceeds consumption. This can include the use of microgrids that integrate multiple renewable energy sources and provide resilience against grid outages.

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2- Eenergy management in ports

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Tools for energy monitoring, management, and energy audits

- **Carbon Footprint Calculators**: These tools help ports measure and manage their greenhouse gas emissions. By accounting for emissions from various sources, such as shipping, cargo handling, and on-site energy generation, ports can identify the most significant contributors to their carbon footprint. This information is crucial for developing strategies to reduce emissions, such as transitioning to cleaner fuels or implementing carbon offset programs.

- **Energy Performance Indicators (EPIs):** Ports use EPIs to track their energy efficiency progress over time. These indicators provide a clear picture of energy performance by comparing current energy usage against historical data or industry benchmarks. EPIs help ports set realistic energy-saving targets and measure the effectiveness of implemented energy efficiency measures.

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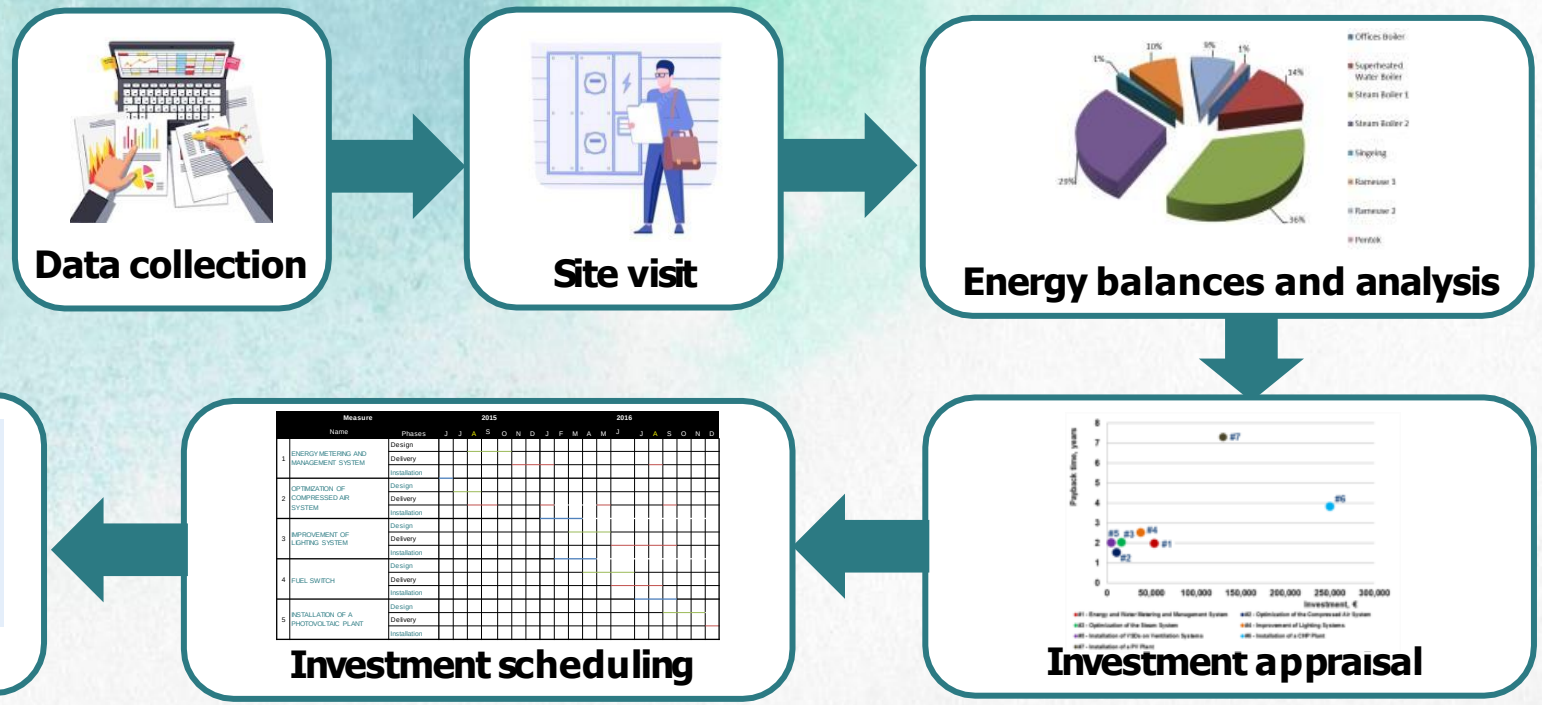
EN 16247 – Energy audit

An energy audit is an inspection survey and an analysis of energy flows for energy conservation. It may include a process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense and carbon footprint.

Energy audit procedure according to the EN 16247



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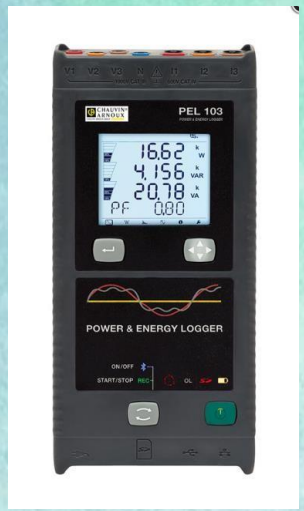
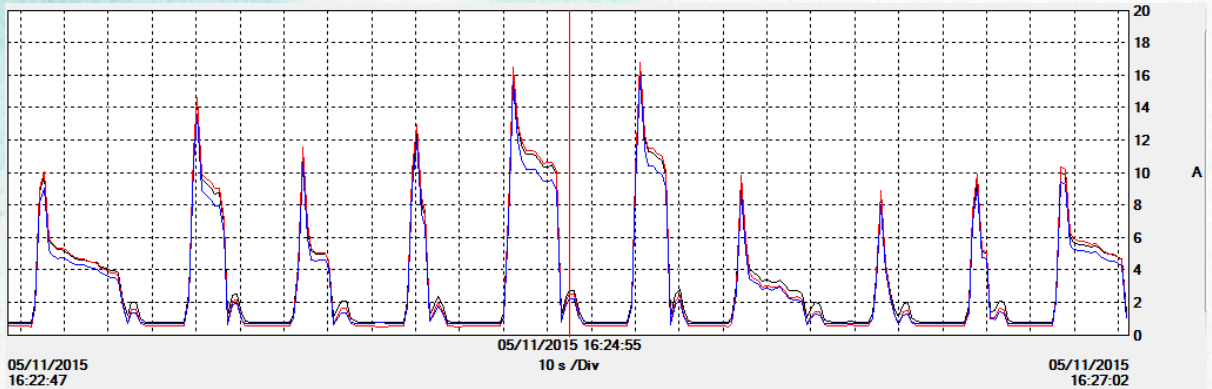
EN 16247 – Energy audit: monitoring campaign





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2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning in Ports

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To enhance energy efficiency, ports are implementing a range of best practices that address both operational and infrastructural aspects. These practices not only reduce energy consumption but also contribute to the overall sustainability goals of the port.

1. Electrification of Port Equipment
2. Onshore Power Supply (OPS) Systems
3. Energy-Efficient Lighting
4. Energy Recovery Systems
5. Building Energy Efficiency
6. Optimized Cargo Handling Operations
7. Employee Training and Awareness
8. Continuous Improvement through Energy Audits and Monitoring

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2- Eenergy management in ports

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Best Practices in Energy Efficiency and Energy Transitioning

- **Electrification of Port Equipment:** One of the most effective strategies for improving energy efficiency is the electrification of port equipment, such as cranes, forklifts, and trucks. Electrification reduces reliance on diesel-powered equipment, leading to significant reductions in fuel consumption and emissions. Additionally, electric equipment often has lower maintenance costs and longer lifespans, contributing to overall cost savings.

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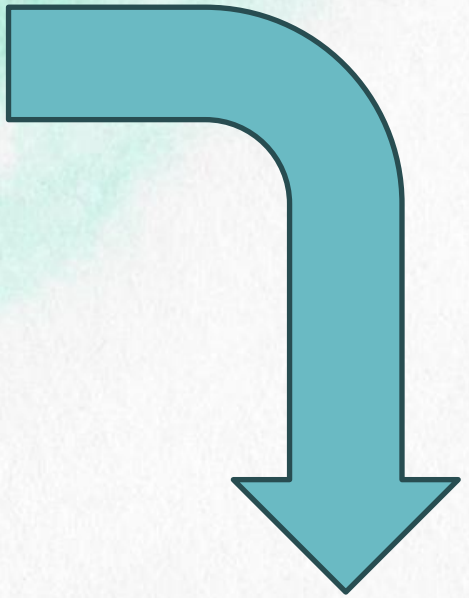
2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning

- **ShoreSide Electricity (SSE):** SSE systems, also known as cold ironing, allow ships to plug into the local electricity grid while docked, enabling them to shut down their auxiliary engines. This practice significantly reduces emissions of CO2, NOx, SOx, and particulate matter, improving air quality in and around port areas. Best practices involve ensuring the availability of OPS for a wide range of vessel types and integrating renewable energy sources into the power supply.



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Best Practices in Energy Efficiency and Energy Transitioning

Onshore Power Supply (OPS)

- Key technology to mitigate ship's emissions at berth.
- Availability of OPS is increasing as part of ports sustainability initiatives.
- Supply of high voltage electricity is a key enabler for OPS of higher power demanding ships.
- OPS projects require involvement from many stakeholders.
- Architecture of OPS systems is increasingly automated to allow for efficient operation.

- More ports are today offering OPS services, allowing ships to reduce emissions at berth, with benefits for local air quality, reduction of GHG emissions and noise.
- Ships at berth have significantly different operating profiles, imposing different requirements for power supply.
- High voltage supply (>1 kV AC) enables more efficient connection.
- Matching AC frequency 50/60 Hz is an aspect to consider for transoceanic ships.
- Standardisation achieved by complete IEC/IEEE 8005 series.
- IMO Interim Guidelines for Safe OPS operation have been finalised.

Source: German News Agency

2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning

SSE in a Nutshell - OPS opportunities & challenges

Onshore Power Supply (OPS)

- Key technology to mitiga ship's emissions at berth
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- Supply of high voltage electricity is a key enabl for OPS of higher power demanding ships.
- OPS projects require involvement from many stakeholders.
- Architecture of OPS systems is increasingly automated to allow for efficient operation.

Table i: OPS for shipping in a nutshell - advantages/opportunities and challenges.

Advantages/opportunities	Challenges
- **Environment:** local impact from OPS is immediately positive in terms of SO_x, NO_x and Particulate Matter (PM) emissions. GHG impact would depend on the specific CO_2 emission factor associated to the available electricity supply. - **Noise reduction**: with connection to energy from the shore there would be no need to have the auxiliary engines running, leading to an immediate noise reduction onboard and in the port area. - **Working conditions**: significantly improved working conditions, allowing for a more comfortable working environment onboard. - **IMO Guidelines for OPS:** having been finalised in SSE sub-committee in 2020, the IMO Interim Guidelines for safe OPS operation, once published, will constitute a global-reaching instrument for the development of shore-side electricity.	- **GHG impact**: in countries with high CO_2 emission factors for the electricity supply, the use of SSE from the national electricity grid would lead to more emissions than using the standard diesel generator on-board. - **Frequency**: the incompatibility 50/60 Hz would have to be resolved by the installation of a frequency converter. This would immediately lead to an increase in the investment cost associated to SSE infrastructure. - **Connectors:** standardisation of OPS equipment can be a challenge, at global level. Through Directive 2014/94 the standard enforce is IEC/IEEE 80051/1 (2019) – High Voltage Shore Connection (HVSC). - **Black-out**: some onboard shore-power arrangements in the main switchboard may lead to black-out during transfer of the energy from ship to shore supply. Gradually, with the introduction of synchronization capability this challenge has been overcome.

Agency

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Best Practices in Energy Efficiency and Energy Transitioning

Shore-side Battery Charging (SBC)

- Shore-side battery charging has developed at the pace of increasing numbers in hybrid/electric ships
- Charging from port-side infrastructure, through onshore transformers, is key.

- Growing number of electric/hybrid ships has driven the development of shore-side battery charging options, typically automated and associated with dedicated mooring systems.
- SBC with shore-side transformer saves significant space onboard the receiving ship.
- Typical specification in the order of multi-MWh charger for fast charging during short periods at berth.

Source: Cavotec SA

SBC Battery Swapping (SBC-BS)

- Battery swapping may allow electric/plug-in vessels to have reduced turnaround times at berth, without having to “wait-to-charge”.
- Modularity and standardisation are key aspects to ensure.

- Battery swapping provide for flexibility, reduced charging periods at berth and operational gains for waterborne trade in fixed routes.
- High demand for standardised solutions and to mitigate the risk of multiple proprietary solutions.
- Ship-shore interface infrastructure to be designed for swift and safe handling of battery module units.

Source: Wärtsilä Corporation

2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning

Shore-side Power Banks (SPB)

- Power banks, or shore side Electrical Energy Storage (ESS) units are technology enablers for the storage of on-site renewable electricity.
- Batteries are the central technology in power bank stations.

- Power banks are used currently in many applications, for temporary storage of renewable electricity production.
- Important technology enabler for implementation of solar/wind projects in the port area.
- Current battery technology has low energy density, leading to a large footprint area per installed MWh energy unit.

Source: Stena Line

Port generators

- Electricity supply where SSE infrastructure is not yet in place can be provided by port generators.
- For actual environmental gains, electricity production should be based on cleaners low-to-zero carbon fuels.

- Port Generators may be shore or waterborne, either in containerized units or power barge units.
- Solution already deployed and implemented in practical commercial applications.
- Allows for flexibility, with electricity production possible in different port locations.
- Actual environmental benefits depend on fuel used for power generation.

Source: Becker Marine Systems

2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning

- **Energy-Efficient Lighting:** Upgrading to energy-efficient lighting, such as LED systems, is a common practice in ports. LED lighting consumes less energy, has a longer lifespan, and provides better illumination compared to traditional lighting solutions. Implementing smart lighting systems that adjust based on occupancy or daylight availability further enhances energy savings.

The Power of LED: Reduced Emissions, Lower Costs, Longer Life | Port of Seattle

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2- Eenergy management in ports

Best Practices in Energy Efficiency and Energy Transitioning

- **Energy Recovery Systems:** Ports are increasingly adopting energy recovery systems that capture and reuse energy that would otherwise be wasted. For example, regenerative braking systems in cranes can capture energy during braking and feed it back into the electrical system. Similarly, waste heat recovery systems can capture heat from equipment or processes and use it for space heating or water heating.

Danieli Centro Cranes is the use of Regenerative Converters, able to send back to the grid the electric energy generated during braking

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2- Eenergy management in ports

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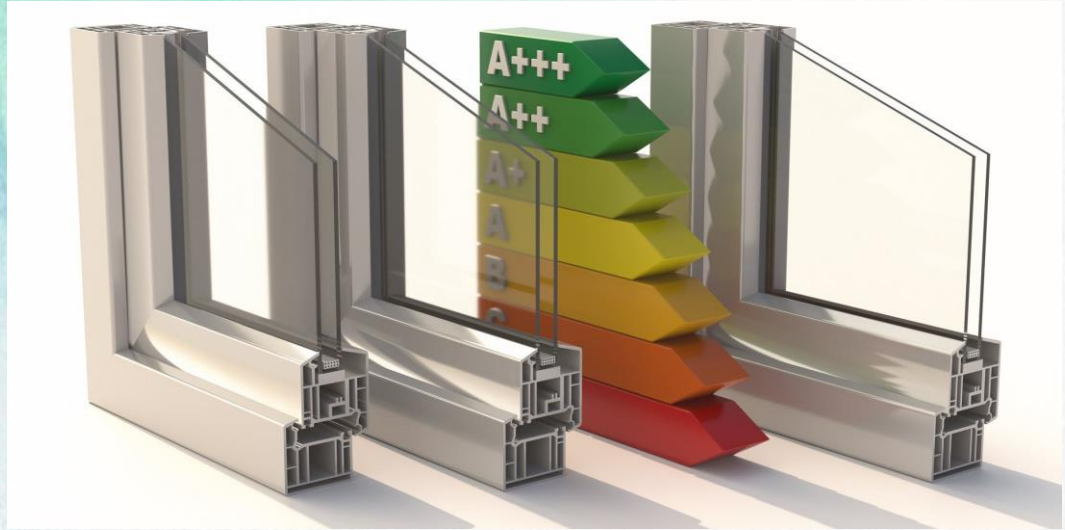
Best Practices in Energy Efficiency and Energy Transitioning

- **Building Energy Efficiency:** Ports often have extensive building infrastructure, including offices, warehouses, and maintenance facilities. Implementing energy efficiency measures in these buildings, such as improved insulation, energy-efficient windows, and advanced HVAC systems, can lead to significant energy savings. Additionally, adopting smart building technologies that automate energy use based on real-time data can further optimize energy consumption.



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2- Eenergy management in ports

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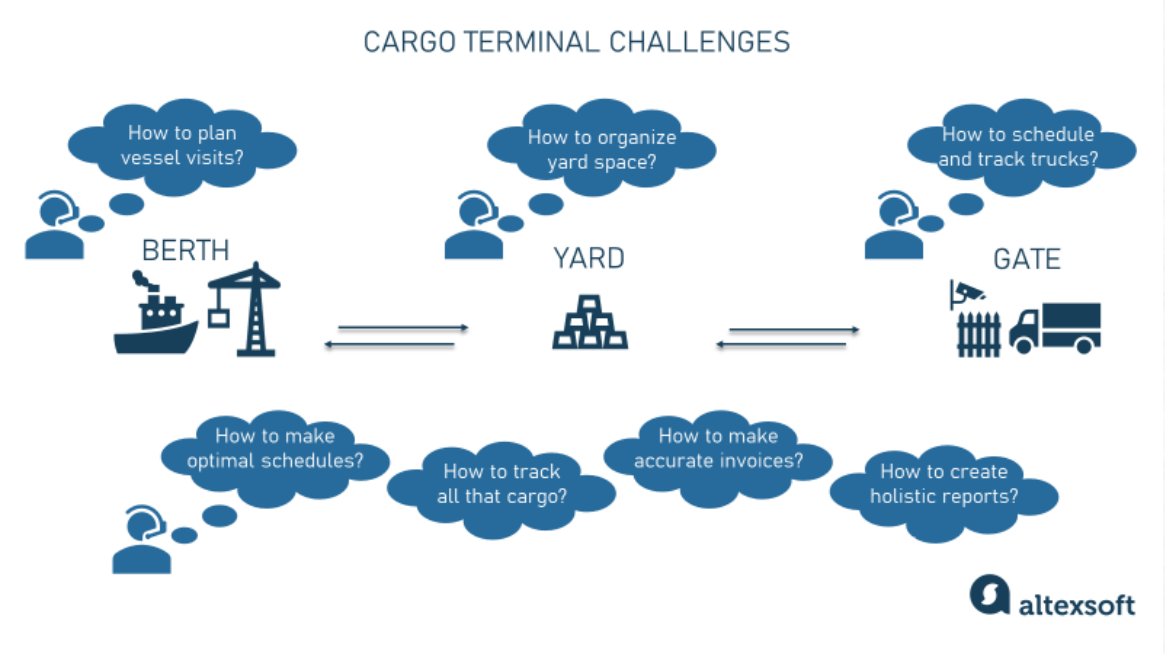
Best Practices in Energy Efficiency and Energy Transitioning

- **Optimized Cargo Handling Operations:** Efficient cargo handling operations can significantly reduce energy use. This includes optimizing the routing and scheduling of cargo movements to minimize idle times and reduce the number of unnecessary movements. Automation and the use of advanced software systems to plan and execute cargo handling can lead to more efficient operations.



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2- Eenergy management in ports

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Best Practices in Energy Efficiency and Energy Transitioning

- **Employee Training and Awareness:** Engaging port employees in energy efficiency initiatives is crucial for their success. Training programs that educate staff on energy-saving practices, such as turning off equipment when not in use or reporting energy inefficiencies, can lead to behavioural changes that significantly reduce energy consumption.

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2- Eenergy management in ports

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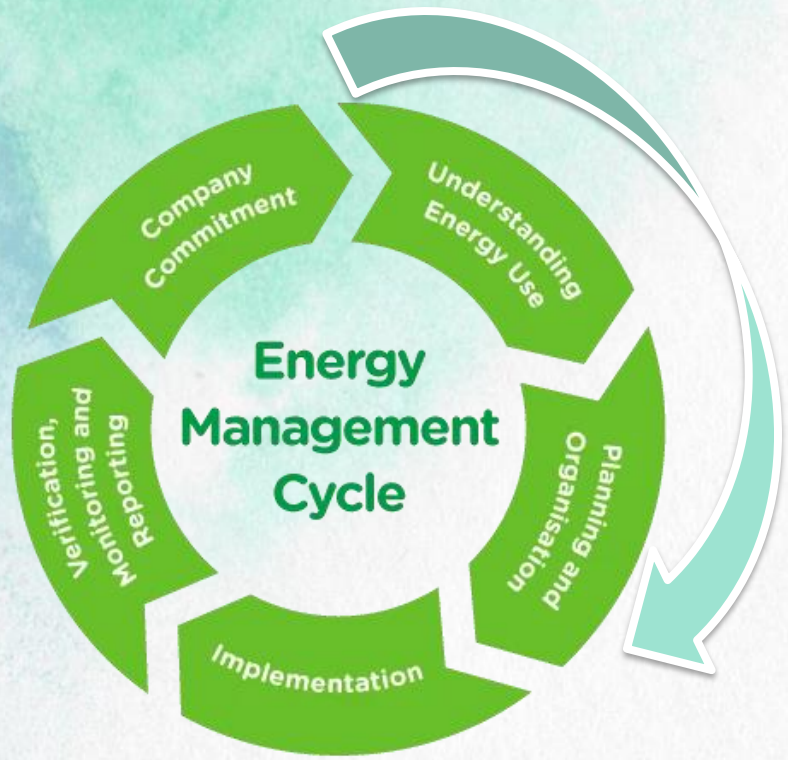
Best Practices in Energy Efficiency and Energy Transitioning

- Continuous Improvement through Energy Audits and Monitoring: Regular energy audits, combined with continuous monitoring, ensure that ports are constantly improving their energy efficiency. This process helps identify new opportunities for energy savings and verifies the effectiveness of implemented measures. By adopting a culture of continuous improvement, ports can stay at the forefront of energy efficiency in the maritime industry.



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2- Eenergy management in ports

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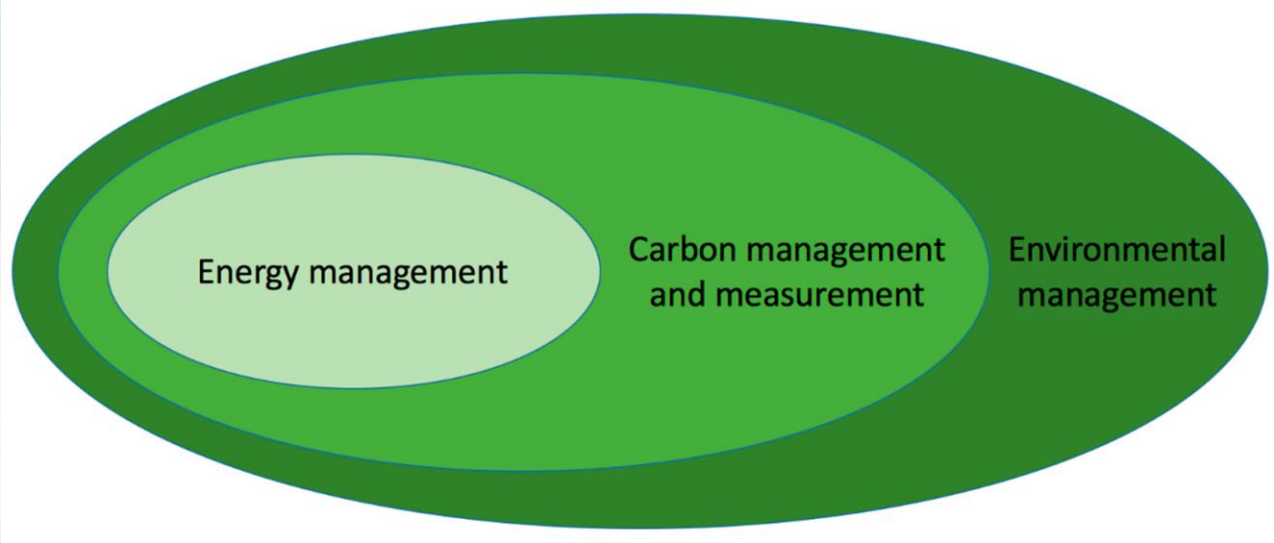
Best Practices in Energy Efficiency and Energy Transitioning

… Energy management and efficiency in ports require a combination of advanced tools, strategic planning, and the adoption of best practices. By leveraging these approaches, ports can achieve significant energy savings, reduce emissions, and contribute to environmental and sustainability goals .



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3- Ports' certifications and labels

Overview of relevant certifications

Ports around the world are increasingly adopting certifications and labels that emphasize sustainability, energy efficiency, and environmental responsibility. These certifications not only help ports align with global environmental standards but also demonstrate a commitment to sustainable practices, which can enhance their reputation and competitiveness.

Key certifications relevant to ports include:

ISO 50001 (Energy Management Systems): ISO 50001 is an international standard that provides a framework for establishing, implementing, maintaining, and improving an energy management system (EnMS). The standard helps ports and other organizations improve energy performance, including energy efficiency, energy use, and consumption. By adopting ISO 50001, ports can systematically manage their energy resources, leading to reduced energy costs, lower greenhouse gas emissions, and a more sustainable operation. The certification involves continuous monitoring and optimization of energy use, which is crucial for ports aiming to reduce their carbon footprint.

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3- Ports' certifications and labels

ISO 50001 (Energy Management Systems):

« Set of interrelated or interacting elements to establish an energy policy and energy objectives, as well as processes and procedures to achieve those objectives. »

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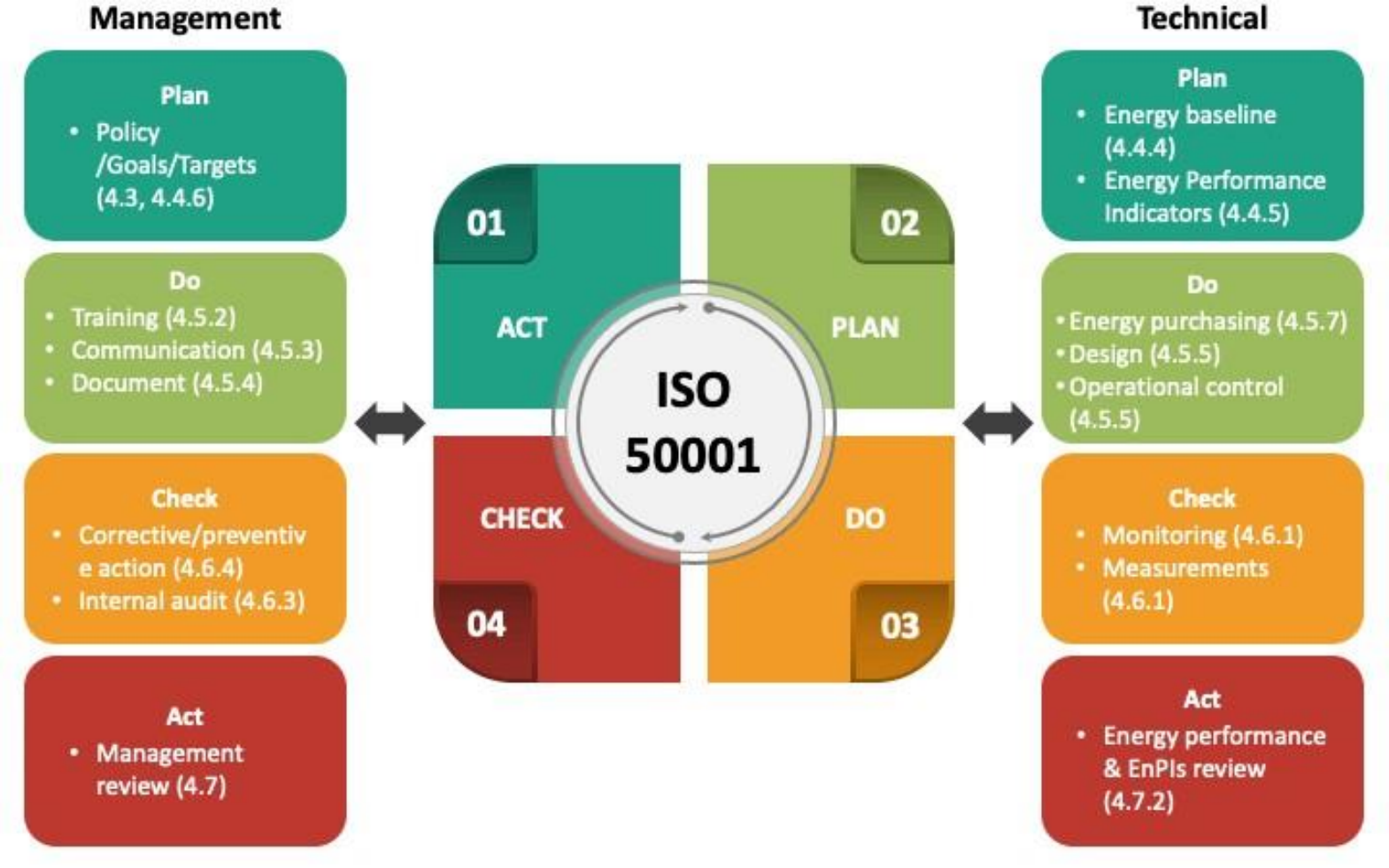
3- Ports' certifications and labels

ISO 50001 (Energy Management Systems): Principles



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3- Ports' certifications and labels

ISO 50001 (Energy Management Systems): Main definitions

- **ENERGY BASELINE (EnBs)**

Quantitative reference(s) providing a basis for comparison of energy performance

- **SIGNIFICANT ENERGY USE (SEU)**

An energy use that accounts for substantial energy consumption and/or offers considerable potential for energy performance improvement

- **ENERGY PERFORMANCE INDICATOR (EnPI)**

Quantitative value or measure of energy performance, as defined by the organization

NOTE: EnPIs could be expressed as a simple metric, ratio or a more complex model

- **ENERGY REVIEW**

Determination of the organization's energy performance based on data and other information, leading to identification of opportunities for improvement

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3- Ports' certifications and labels

ISO 50001 (Energy Management Systems):

Energy Eficiency Directive (EED) – Mandatory EMS (ISO 50001)

"The Article 1 of the EEC Treaty 11 of Directive (EU) 2023/1791 defines the obligation to adopt an energy management system (EMS) compliant with the ISO 50001 standard for all companies with an average annual energy consumption of more than 2030 toe, estimated over the previous 3 years…"

The EMS must be certified by third-party bodies by 11/10/2027.

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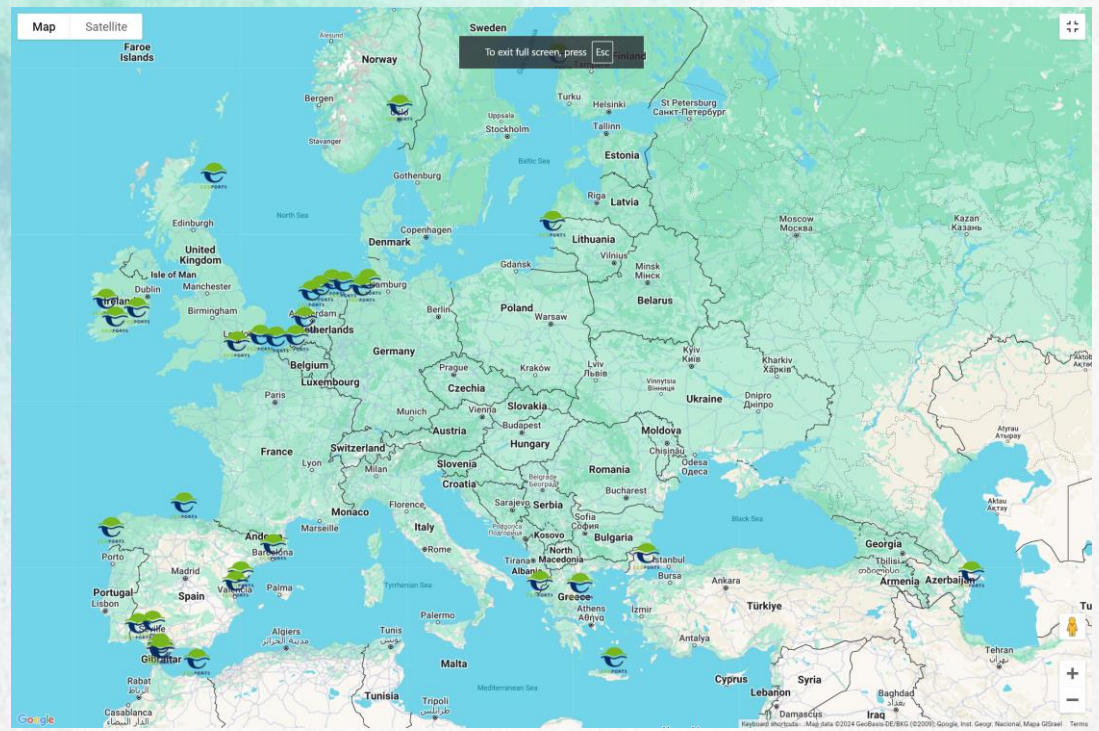
3- Ports' certifications and labels

Overview of relevant certifications

EcoPorts (Environmental Management System): EcoPorts is the leading environmental initiative for European ports, recognized by the European Sea Ports Organisation (ESPO). It aims to raise awareness and improve environmental management in the port sector. Ports meeting EcoPorts standards can achieve PERS certification, a recognized standard tailored to port authorities and aligned with ISO 14001. PERS-certified ports show a strong commitment to environmental sustainability, including pollution reduction, waste management, and ecosystem protection.



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3- Ports' certifications and labels

Overview of relevant certifications

ISO 14001 (Environmental Management Systems): ISO 14001 is an international standard for environmental management systems (EMS), offering a framework for organizations, including ports, to manage their environmental impact. Unlike ISO 50001, ISO 14001 has a broader scope, focusing on compliance with environmental laws and reducing environmental impact without setting specific performance requirements. For ports, it is crucial in addressing issues like waste management, air quality, and water pollution.

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3- Ports' certifications and labels

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Overview of relevant certifications

Green Marine Certification: The Green Marine certification is a voluntary environmental certification program for the North American maritime industry. It encourages ports to reduce their environmental footprint by meeting specific performance indicators that cover areas such as air emissions, spill prevention, waste management, and environmental leadership. Ports that achieve Green Marine certification are recognized for their proactive efforts to protect the environment through continuous improvement and the implementation of best practices.

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3- Ports' certifications and labels

Overview of relevant certifications

Environmental Ship Index (ESI): The ESI was initiated by World Port Climate Initiative (WPCI) and the International Organisation of Ports and Harbors (IAPH). Ports can register themselves as incentive providers to ships that have been cer- tified by registering their fuel consumption and air em issions (ESI, 2021). The index, thus, has a score ranging from 0 to 100. Based on the score, ports give incentives as percentage reductions in port dues, though the percentage calculations differ from port to port.

ESI
ENVIRONMENTAL SHIP INDEX

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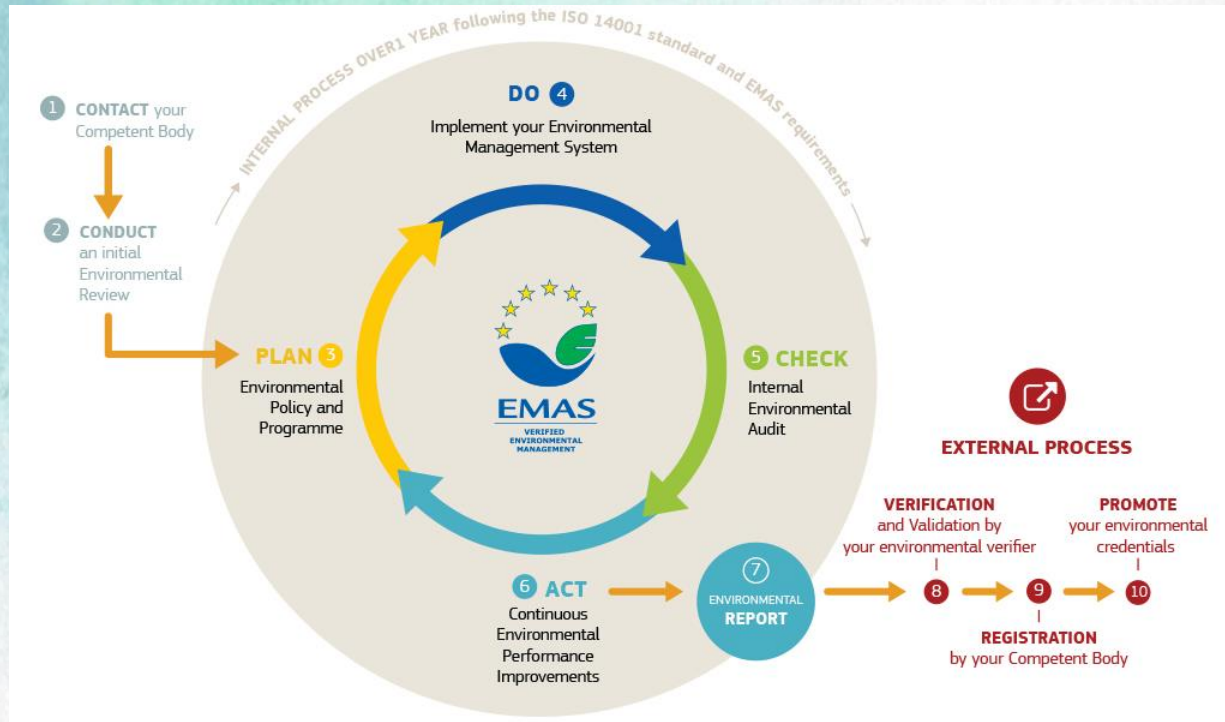
3- Ports' certifications and labels

Overview of relevant certifications

EMAS (Eco-Management and Audit Scheme): EMAS is a voluntary EU initiative designed to improve the environmental performance of organizations. It goes beyond ISO 14001 by requiring organizations to perform periodic environmental reviews, set performance goals, and publish environmental statements that are verified by independent auditors. Ports adopting EMAS demonstrate a strong commitment to transparency and continual improvement in their environmental performance.



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3- Ports' certifications and labels

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Overview of relevant certifications

ISO 14064 Carbon Footprint – GHG Certification of Operations: ISO 14064 is a set of standards for measuring, quantifying, and reporting greenhouse gas (GHG) emissions, helping organizations manage and reduce their carbon footprint. It includes ISO 14064-1 for organizational GHG inventories, ISO 14064-2 for project-level emissions, and ISO 14064-3 for certifying GHG reports. Ports can use ISO 14064 to measure and report their GHG emissions, demonstrating their commitment to climate change mitigation. Certification assures stakeholders that GHG reports are accurate and reliable..

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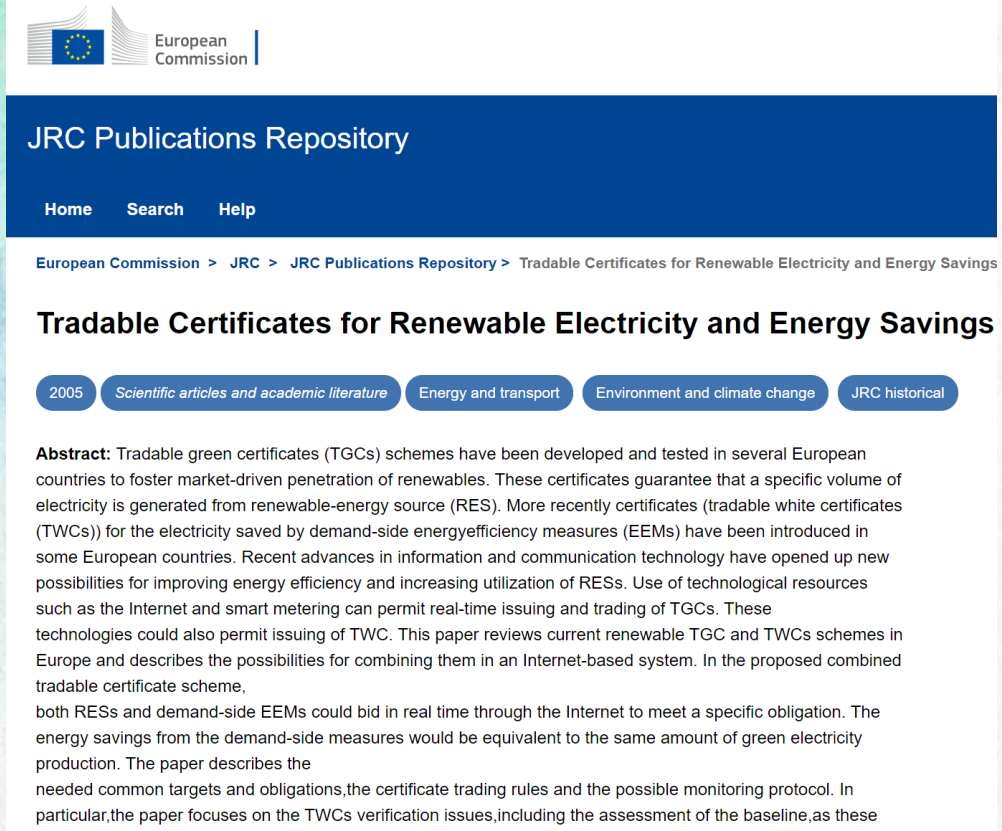
3- Ports' certifications and labels

Overview of relevant certifications

Tradable Green Certificates (CTs) for Renewable Electricity and Energy Savings:

Tradable Green Certificates (TGCs) represent proof of electricity generated from renewable sources or energy savings from efficiency measures. They enable trading to support renewable energy and efficiency projects. Ports can purchase TGCs to offset emissions when they can't generate renewable energy or achieve energy savings directly. TGC certification ensures authenticity and traceability, allowing ports to confidently contribute to sustainability.



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Tradable Certificates for Renewable Electricity and Energy Savings

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Abstract: Tradable green certificates (TGCs) schemes have been developed and tested in several European countries to foster market-driven penetration of renewables. These certificates guarantee that a specific volume of electricity is generated from renewable-energy source (RES). More recently certificates (tradable white certificates (TWCs)) for the electricity saved by demand-side energyefficiency measures (EEMs) have been introduced in some European countries. Recent advances in information and communication technology have opened up new possibilities for improving energy efficiency and increasing utilization of RESs. Use of technological resources such as the Internet and smart metering can permit real-time issuing and trading of TGCs. These technologies could also permit issuing of TWC. This paper reviews current renewable TGC and TWCs schemes in Europe and describes the possibilities for combining them in an Internet-based system. In the proposed combined tradable certificate scheme,
both RESs and demand-side EEMs could bid in real time through the Internet to meet a specific obligation. The energy savings from the demand-side measures would be equivalent to the same amount of green electricity production. The paper describes the
needed common targets and obligations,the certificate trading rules and the possible monitoring protocol. In particular,the paper focuses on the TWCs verification issues,including the assessment of the baseline,as these

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3- Ports' certifications and labels

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Overview of relevant certifications

PortCDM : PortCDM (Port Collaborative Decision Making) is a digital platform that improves communication and collaboration among port stakeholders, such as port authorities, shipping companies, and terminal operators. It facilitates real-time sharing of information on vessel traffic and cargo operations, optimizing traffic flow, reducing waiting times, and lowering emissions. By offering real-time data, PortCDM helps stakeholders make informed decisions, enhancing efficiency and reducing environmental impact. The platform, which is based on open standards, integrates with other port systems and is used in ports like Gothenburg and Rotterdam.

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3- Ports' certifications and labels

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Overview of relevant certifications

IEEE Certification in Artificial Intelligence and Machine Learning: The IEEE Certification in Artificial Intelligence and Machine Learning is designed for professionals in the ports and terminals industry to enhance their skills in AI and machine learning, particularly for optimizing energy systems. The program covers AI fundamentals, optimization, prediction, and ethics. This certification boosts professional development and job prospects, equipping individuals to improve the efficiency and sustainability of energy systems in ports through AI-driven solutions like optimizing energy consumption and predicting demand.

IEEE Academy™
Artificial Intelligence

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3- Ports' certifications and labels

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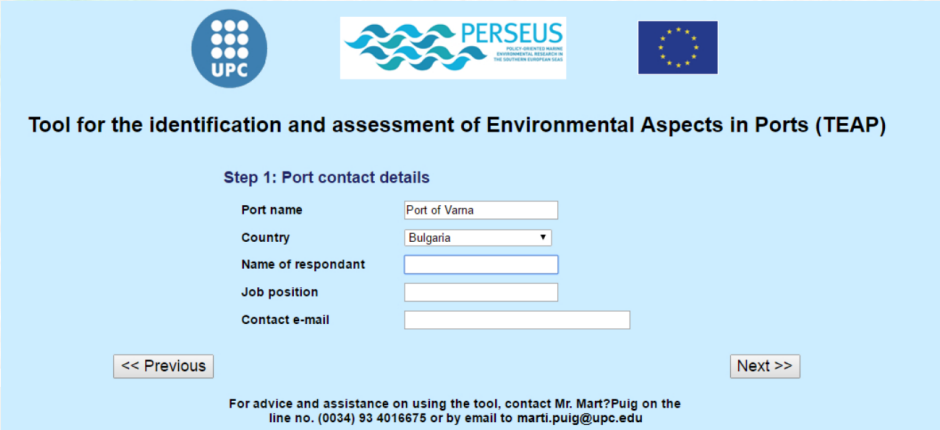
Overview of relevant certifications

Tool for identifying and implementing Environmental Indicators in Ports (TEIP) & Tool for the identification and assessment of Environmental Aspects in Ports (TEAP): TEIP and TEAP are tools designed to help port authorities improve environmental management.TEIP, from the Polytechnic University of Catalonia, is a 20-minute, five-step process that identifies and implements Environmental Performance Indicators (EPIs), offering tailored recommendations and guidelines.TEAP, developed under the European MSP Platform, is a 30-minute, five-step process for identifying and assessing Significant Environmental Aspects (SEAs). It aligns with standards like ISO 14001, aiding ports in meeting regulations and enhancing environmental quality. Both tools are confidential, user-friendly, and support unified environmental practices in ports.



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3- Ports' certifications and labels

Tools and Certificates	Example 1	Example 2
Energy Management Systems	Port of Gothenburg, Sweden	Port of Los Angeles, USA
Energy Efficiency Measures	Port of Hamburg, Germany	Port of Barcelona, Spain
Renewable Energy Sources	Port of Amsterdam, Netherlands	Port of Vancouver, Canada
Standardized tool to calculate Carbon Footprint in Ports	Port of Valencia, Spain	Port of Seattle, USA
Tool for the identification and implementation of Environmental Indicators in Ports (TEIP)	Port of Genoa, Italy	Port of Copenhagen, Denmark
Tool for the identification and assessment of Environmental Aspects in Ports (TEAP)	Port of Bremen, Germany	Port of Venice, Italy
IAPH World Ports Sustainability Program	Port of Felixstowe, UK	Port of Long Beach, USA
Carbon Foot Print Calculator for Ports (IAPH)	Port of Singapore	Port of Gdansk, Poland
EcoPorts	Port of Le Havre, France	Port of Piraeus, Greece
Clean Shipping Index (CSI)	Port of Helsinki, Finland	Port of Huelva, Spain
Green Award	Port of Antwerp, Belgium	Port of Dublin, Ireland
EU Eco-Management and Auditing Schemes (EMAS)	Port of London, UK	Port of Livorno, Italy
Self-Diagnosis Method (SDM)	Port of Trieste, Italy	Port of Malmö, Sweden
Strategic Overview Of Environmental Aspects (SOSEA)	Port of Tallinn, Estonia	Port of Dunkerque, France
World Port Sustainability Program(WPSP) Focused on UN Sustainable Development Goals	Port of Auckland, New Zealand	Port of Santander, Spain
Environmental Ship Index (ESI)	Port of Bremerhaven, Germany	Port of Los Angeles, USA
GHG Emissions Rating (GHG ER)	Port of Ghent, Belgium	Port of Marseilles, France
Green Marine (GM) environmental program	Port of Montreal, Canada	Port of Tacoma, USA

Tolls and Certificates	Example 1	Example 2
ISO 50001	Port of Bilbao, Spain	Port of Houston, USA
ISO 14001 Environmental Management	Port of Koper, Slovenia	Port of Yokohama, Japan
ISO 14064 Carbon Foot Print – GHG Certification of Operations	Port of Tarragona, Spain	Port of Melbourne, Australia
Tradable Green Certificates (CTs) for Renewable Electricity and Energy Savings	Port of Rotterdam, Netherlands	Port of Antwerp, Belgium
Green Marine Certification	Port of Quebec, Canada	Port of Seattle, USA
Sustainable Port Certification	Port of Durban, South Africa	Port of Odessa, Ukraine
PortCDM (in Digitalization and Artificial Intelligence knowledge and training)	Port of Valencia, Spain	Port of Baltimore, USA
Institute of Electrical and Electronics Engineers (IEEE) Certification in Artificial Intelligence and Machine Learning	Port of Marseille, France	Port of New York, USA

Institute of Electrical and Electronics Engineers (IEEE) Certification in Artificial Intelligence and Machine Learning refers to the application of AI and machine learning in port operations and not the certification of the port itself. Therefore, it would not be appropriate to provide examples of ports with this specific certification. However, there are examples of ports that have implemented AI and machine learning technologies in their operations:

- **Port of Rotterdam, Netherlands: The port has implemented AI and machine learning technologies in various aspects of its operations, including predictive maintenance, vessel traffic management, and smart infrastructure management.**
- **Port of Hamburg, Germany: The port utilizes AI and machine learning to optimize its logistics processes, improve traffic management, and enhance container terminal operations.**

3- Ports' certifications and labels

Benefits of Environmental and Energy Certifications for Ports

1. • **Enhanced Environmental Performance**:Certifications like ISO 14001 and EcoPorts require ports to systematically manage their environmental responsibilities, leading to reduced pollution, better waste management, and protection of local biodiversity. These certifications encourage continuous improvement in environmental performance, helping ports to identify and mitigate environmental risks.

2. • **Energy Efficiency and Cost Savings:**By implementing ISO 50001, ports can achieve significant energy savings through improved energy management practices. The standard helps ports to optimize their energy use, reduce waste, and lower operating costs. Energy audits and the adoption of energy-efficient technologies, as required by the certification, can lead to substantial reductions in energy consumption, directly impacting the bottom line.

3. • **Compliance and Risk Management**: Environmental and energy certifications ensure that ports are in compliance with national and international regulations. This reduces the risk of legal penalties and helps ports stay ahead of regulatory changes. Certifications also promote better risk management by identifying potential environmental hazards and implementing strategies to mitigate them.

4. • **Reputation and Competitive Advantage**:Achieving certifications such as EcoPorts or Green Marine enhances a port's reputation as a leader in sustainability. This can attract environmentally conscious customers, partners, and investors, providing a competitive advantage. Certified ports are often preferred by companies that prioritize sustainability in their supply chains.

5. • **Stakeholder Engagement and Social Responsibility:**Certifications encourage ports to engage with stakeholders, including local communities, regulators, and customers, to address environmental concerns. This engagement fosters transparency and trust, demonstrating the port's commitment to social responsibility and sustainable development. Publicly sharing certification achievements can enhance a port's image and strengthen its relationships with stakeholders.

6. • **Market Access and Investment Opportunities:**Many global companies and governments prefer to do business with ports that have recognized environmental and energy certifications. These certifications can open up new markets and attract investment by demonstrating that the port is committed to sustainable practices. Ports with certifications are also better positioned to receive funding and incentives for green projects from governments and international organizations.

Conclusions and take-home message

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The transition to sustainable energy practices within European ports is not just a regulatory requirement but a strategic necessity for long-term competitiveness and environmental stewardship.

By adopting key tools and certifications, ports can significantly reduce their carbon footprint, improve energy efficiency, and align with global/EU greening goals.

The integration of smart technologies, coupled with a commitment to continuous improvement through certifications like ISO 50001 and EcoPorts, will position European ports at the forefront of the green transition, ensuring they meet the challenges of tomorrow's energy landscape…

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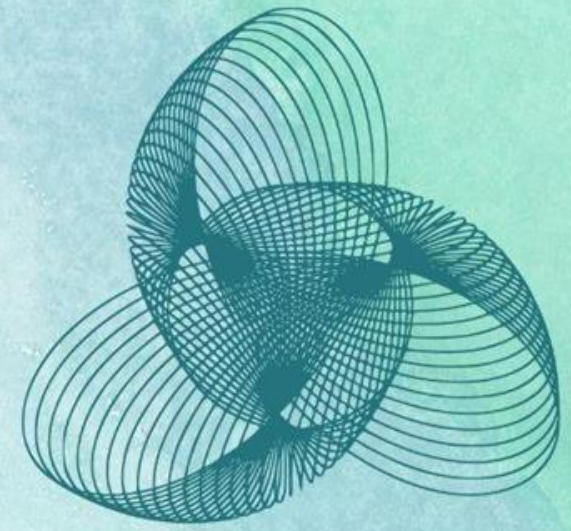

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FOR YOUR ATTENTION

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