



European Energy Policy Conference Maritime Ports and Shipping: Gateways for the Energy Transition (Or, "Why Ports as Energy Transition Hubs Fascinates Me")

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A world of many ports

Fun facts

- About 4,700 commercial/cargo ports in 170 countries enable global and local trade and fulfil a variety of functions for the economy (> 1,100 ports in China; 360 in the USA; 62 in Denmark)
- 99% of global sea-borne trade goes through approx. 850 ports
- Most of the things we buy have passed through at least two ports
- Ports provide jobs, facilitate trade (connectivity), and accommodate industries
- Port capacity disruptions have ripple effects in logistics and trade (e.g., energy, food, raw materials, semi-finished and finished products)

(Many) dimensions in port conceptualization

- *Location*: Seaports; Dry ports/Inland container depots; Inland (canal/lake/river) ports; Arctic ports; Warm water ports (e.g., Murmansk); Small island ports
- *Specialization*: Container ports; Dry bulk ports; Oil and gas terminals; Transshipment ports, Cruise and ferry ports; Fishing ports; Offshore energy ports
- *Service scope*: Feeder ports; Gateway ports; Hub ports; Multi-modal ports
- *Size*: Mega ports (e.g., Shanghai, Singapore, Los Angeles); Medium-sized ports (Gothenburg); Small ports (Halifax, Napier, Aarhus)
- *Ownership*: Public ports (owned & managed by state entities); private ports (eg., DP World); Corporatized/privatized ports (e.g., ABP); Industrial (private) ports
- *Governance*: Landlord ports; Service ports; Tool ports
- *Other*: Free ports; Naval ports; Marinas



Traditional perspectives on the role of ports: Infrastructure, operations, and logistics optimization

Focus on *the port per se*, conceptualized as

- A place that handles ships and cargo
- ... with operational efficiency
- ... within an economic efficiency framework
- ... and within efficient administrative and policy frameworks

Performance matrix

- Cargo throughput
- Ship turnaround times
- Cost efficiency

The port as a 'production function' and port management a 'black box'

- The port is a single entity that transforms input (land, labor and capital) into outputs (ship and cargo handling)
- No examination of what is inside the port management entity or how it creates value





Some problems with the traditional views on the role of ports, and why we need a New Perspective

What are?

- They assume that ports are homogeneous and have the same resources and capabilities (which is not true in reality)
- They do not explain why some ports are more successful than others (even if they have the same inputs)
- They do not take into account the role of technology, innovation, and knowledge in value creation
- They do not adequately consider the importance of external factors (e.g., market conditions, regulations, and social and environmental factors)

A changing port governance landscape

Four decades of worldwide port governance reforms (towards commercialized and corporatized governance structures)

- *Privatization*: Government transfers asset ownership (including land) to a privately owned company, which remains under government regulation (mainly in the UK and New Zealand).
- *Commercialization*: Governments withdraw from the operation of transportation infrastructure while retaining ownership
- *Decentralization*: Shifting the responsibility to oversee the economic public interest from the national to the local level increases local responsiveness and flexibility, and often accompanies commercialization
- *Corporatization*: A particular form of commercialization involves creating a separate legal corporate entity (with shares)

Changing environmental priorities of (European) ports

- Extend beyond the traditional port perimeter
- Require cross-sector collaboration and broader stakeholder involvement

	1996	2004	2009	2013	2016	2020	2022
1 Port development (water)		Garbage/port waste	Noise	Air quality	Air quality	Air quality	Climate change
2 Water quality		Dredging: operations	Air quality	Garbage/port waste	Energy consumption	Climate change	Air quality
3 Dredging: disposal		Dredging: disposal	Garbage/port waste	Energy consumption	Noise	Energy efficiency	Energy efficiency
4 Dredging: operations		Dust	Dredging: operations	Noise	Community relationship	Noise	Noise
5 Dust		Noise	Dredging: disposal	Ship waste	Garbage/port waste	Relationship with local community	Water quality
6 Port development (land)		Air quality	Community relationship	Community relationship	Ship waste	Ship waste	Community relationship
7 Contaminated land		Hazardous cargo	Energy consumption	Dredging: operations	Port development (land)	Water quality	Ship waste
8 Habitat loss		Bunkering	Dust	Dust	Water quality	Garbage/port waste	Garbage/port waste
9 Traffic volume		Port development (land)	Port development (water)	Port development (land)	Dust	Dredging operations	Port development (land)
10 Industrial effluent		Ship discharge (bilge)	Port development (land)	Water quality	Dredging operations	Port development (land)	Dredging operations



Reconceptualizing the 'Port Authority'

Ports as elements in value-driven chain structures (Robinson, 2002)

- Reframing ports as integrated nodes in global value chains, emphasizing their role in facilitating value-creation rather than simply acting as transportation hubs
- Ports are no longer seen as standalone entities but as entities deeply embedded in supply chain networks
- Instead of only charging fees for traditional port services, ports (should) aim to provide value-added services to port users

Renaissance port authority (Verhoeven, 2010)

- Re-envisioning port authorities as dynamic entities playing a broader role in regional and global value chains and business ecosystems
- Renaissance port authorities embrace innovation and technology, integrate sustainability into their core strategies, and foster closer relationships with local communities, businesses and policymakers

Port development company (van der Lugt, 2017; de Langen and van der Lugt, 2017; de Langen and Saragiotis, 2018)

- Describing how port authorities move away from their traditional role as public administrators of port infrastructure to become commercially focused port development companies (PDCs) that actively invest in port facilities, real estate, and innovation to attract businesses and industries looking for prime locations to integrate production and logistics
- PDCs focus on financial autonomy and profit-driven strategies



Charles Haskell
Lloyd's Register's Decarbonisation
Programme Manager

Ports are uniquely positioned to become catalysts for decarbonisation in a multitude of sectors, ranging from maritime, energy, logistics and transport

Ports and the clean energy transition

Transition goals

- Renewable energy production
- Renewable energy trade and logistics
- Green fuel bunkering infrastructure
- Decarbonizing port operations
- Decarbonization beyond the port perimeter

The role of ports

- Hubs: energy hubs, circular economy clusters (incl. technology and infrastructure development)
- Anchors for regional economic development and industrial transformation
- Facilitation and coordination
- Knowledge exchange and capacity building, cross-sector stakeholder collaboration, network formation and brokerage
- Governance, policy and power dynamics
- Overcoming (technological, economic, human, and institutional) challenges and barriers
- Commercial, market and strategy thinking

Ports as locations

Locational attributes

- Land and space availability
- Deep-water and tidal conditions
- Hinterland connections (access to transportation and logistics networks)

Proximity to major energy consumers

- Industry: e.g., petrochemical, steel & metals, cement & construction, fertilizer production, food, textiles & apparel, transport & logistics
- City: e.g., residential heating & cooling, appliances & lightning, public infrastructure, transportation & mobility, hot water systems

Proximity to renewable energy resources and green fuel production

- Offshore & onshore wind; solar energy; wave and tidal energy; biomass & waste-to-energy
- Hydrogen production

Home to industrial clusters/business ecosystems

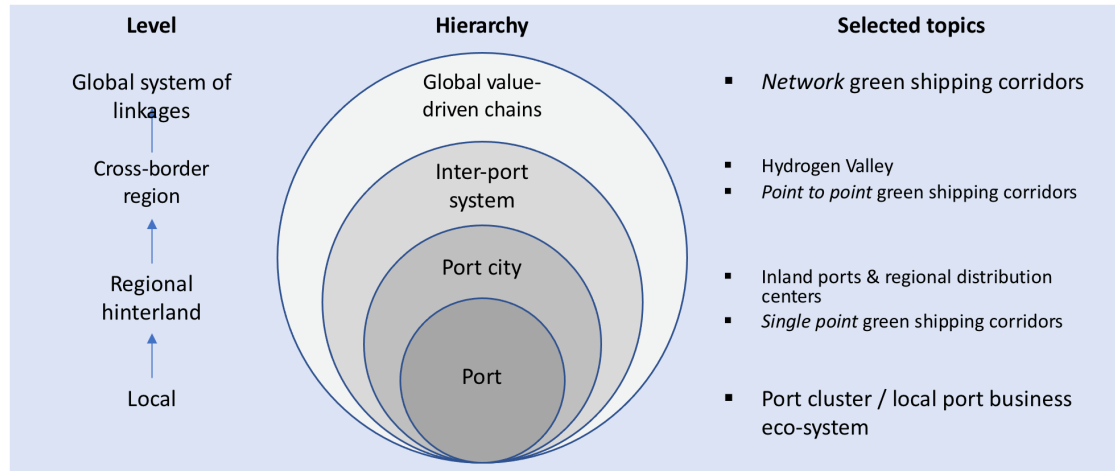
- The EU Union Strategy for Ports
- The Danish Port Partnership ("Havnepartnerskabet")



Ports as locations for the energy transition

Role of the port	Description
Clean energy products trade	<ul style="list-style-type: none">▪ Ports facilitate the import and export of renewable energy products, green fuels, captured CO2, and renewable energy system components (e.g., wind turbines, solar panels, biomass reactors, batteries)▪ Ports' locational attributes and infrastructure support efficient movement of these large and advanced components
Renewable energy manufacturing and logistics	<ul style="list-style-type: none">▪ Ports serve as logistical hubs for the operation and maintenance (O&M) of offshore wind parks and may attract significant investments from offshore wind developers, who become major port tenants and finance the building of O&M facilities that will create high-value jobs and contribute to the economic development in port regions▪ Ports may also serve as marshalling areas for renewable energy installations and as locations for manufacturing renewable energy components▪ Ports offer access to shipping routes and often also have land areas suitable for setting up large-scale manufacturing facilities for renewable energy components
Industrial symbiosis	<ul style="list-style-type: none">▪ Ports host maritime activities like shipbuilding, marine equipment supply, maritime services, and fisheries and accommodate non-maritime industries (e.g., chemical plants, power plants, steel plants, car assembly, and food production)▪ This creates opportunities for circular economy, waste-to-energy, etc. by facilitating recycling and energy and material reuse
Renewable energy generation and green fuel Production	<ul style="list-style-type: none">▪ Ports are becoming renewable energy producers by hosting solar farms, wind turbines, and green fuel production facilities (e.g., PtX plants for hydrogen or synthetic fuels).▪ This integration enhances energy efficiency, reduces carbon emissions, and supports cleaner energy systems.
Bunkering infrastructure	<ul style="list-style-type: none">▪ Ports are ideal locations for new fueling and bunkering infrastructure, including electric vehicle charging stations and green fuel distribution for ships and other mobile units.▪ These facilities support the frequent refueling needs during port stays, contributing to the overall sustainability and efficiency of transport and industrial operations.

A new maritime-energy ecology



Promising theoretical perspectives

- Supply chain management
- Global value chain
- Industrial clusters
- Institutional economics
- General systems theory
- Industrial ecology
- Business ecosystem
- Systems of innovation (national, technological...)
- Multilevel perspective (MLP)

The study of ports as complex organizations

Business and organizational challenges for PDCs in the clean energy transition

- Ports as commercial entities, balancing profit-making with public service and sustainability goals
- Need for strategic business models that integrate clean energy projects with core port operations
- Importance of engaging key stakeholders in value co-creation
- Adaptation of port services to new clean energy supply chains (e.g., hydrogen, renewable energy storage, green fuel production, CCSU)

A business model agenda for PDCs: Content of transactions

Definition

- Concerns the specifics of what services the PDC offers and encompasses the tangible and intangible assets the PDC must have to facilitate such transactions

Research question?

- What are the uncertainties regarding the future mix of green fuels offered by ports?
- How should PDCs innovate their offerings (products, services, and information) to align with the emerging roles of ports as clean energy transition hubs?
- What impact does such innovation in the content of transactions have on facilitating the integration of renewable energy systems, green fuels, and new industries within maritime and broader energy ecosystems?

A business model agenda for PDCs: Structure of transactions

Definition

- Concerns the network of entities participating in the exchange and defines their roles and relationships. Particularly, value creating activities can be performed both within and outside the boundaries of the PDC and include interactions with partners, suppliers, and port users and tenants, thereby emphasizing the networked nature of port business models.

Research questions

- How can PDCs redefine their value propositions and operational models to accommodate emerging customer segments and integrate the key resources needed, while developing their stakeholder relationships and optimizing port operations and strategic goals as energy transition hubs?
- Who are the right partners for the port in the transition, and how should the port collaborate?
- How can the port attract the right tenants and users to the port?

A business model agenda for PDCs: Governance of transactions

Definition

- The mechanisms and systems that regulate the conduct and terms of transactions, including legal and contractual frameworks (e.g., service agreements, land lease agreements, concession contracts, joint venture agreements), the informal norms and standards that guide behavior, and the formal rules that enforce compliance.
- It also covers decision-making processes, control measures, dispute resolution mechanisms, and how risks and rewards are shared among the parties.
- Is broader than but interlinked with 'corporate governance' (e.g., resource management, risk control, and maintaining external relationships). The role of the ports' Board of Directors is seen as custodial, ensuring that the business model is continuously adapted to meet strategic goals and stakeholder expectations.

Research questions

- How do port governance models (e.g., the landlord model) affect the efficiency and scalability of clean energy initiatives within ports?
- How can PDCs innovate their governance structures and mechanisms within existing regulatory frameworks to enhance their role as facilitators of the energy transition?
- How can PDCs effectively navigate the complexities of governance when board members, often appointed based on political considerations rather than sector-specific expertise, may lack the necessary understanding of port operations and the strategic imperatives of the clean energy transition?



A business model agenda for PDCs: Revenue model

Definition

- The traditional revenue models for ports may be challenged by the unique requirements that come with the clean energy transition, and ports must therefore innovate their revenue models to stay competitive and relevant.
- Offshore wind projects, for instance, require large areas in ports for short-term leases and typically involve only a few turbine installation vessels, which make infrequent port calls. This is very different from the typical high-volume, high-frequency operations associated with conventional port activities, such as, container shipping and ro-ro traffic.

Research questions

- Taking stock of the present: How is the ongoing energy transition already impacting the revenue generation of ports?
- What are the uncertainties regarding pricing of the fuels of the future?
- How can ports innovate their revenue models to capture a larger portion of the value created in the ecosystem of the clean energy transition and sustainable maritime operations?

Thank you for your attention!

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Maritime consultancy and advisory services

- Danish Maritime Authority (2002-2003)
- Contact Committee for Maritime Research (Denmark, Ministry of Economics and Business Affairs) (since 2018)
- Den Maritime Tænketank/The Maritime Think Tank (since 2020)
- Maritime Development Center (2016-2021)

Maritime research leadership

- Center for Shipping Economics and Innovation (CBS, 2006-2012)
- Director of CBS Maritime (since 2013)
- Co-director of the *Green Shipping Project* (2015-2023)
- Founder and Board member of Maritime Research Alliance (since 2020)

Maritime educational development

- M.Sc. Minor in Maritime Business
- B.Sc. in International Shipping and Trade
- HD2 Maritime

Maritime teaching

- Integrated Strategy Project (Executive MBA in Shipping and Logistics)
- Green Shipping and Ports (CBS, SMU, Kedge Business School)

