Electric Shipping – an opportunity for Finland and Europe

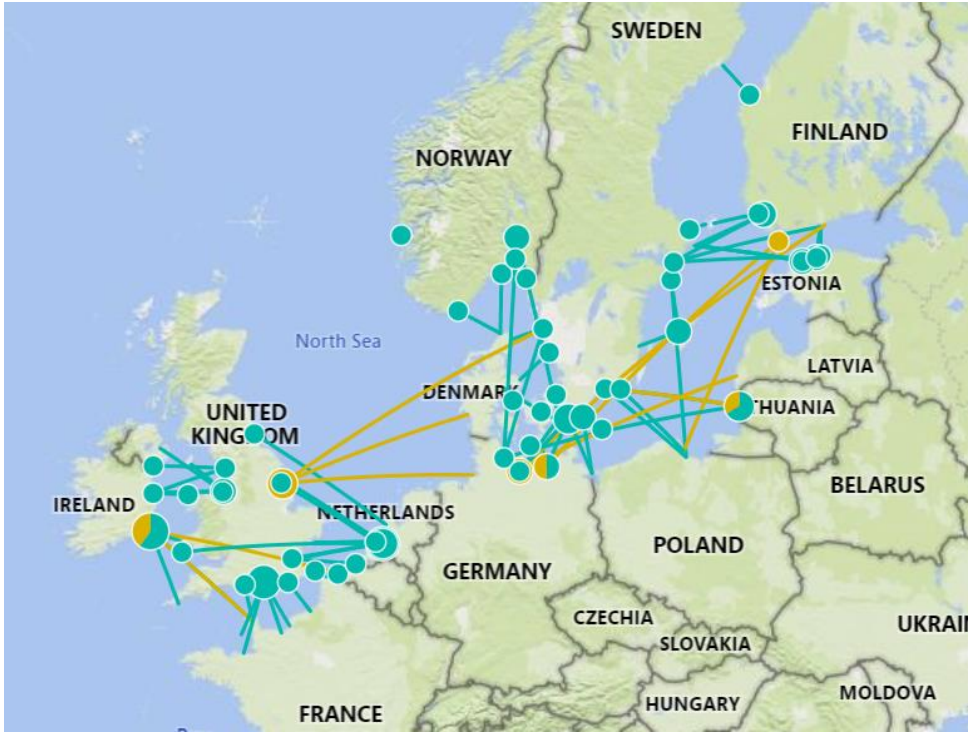
Magnus Gustafsson

Head of Research Industrial Management – Åbo Akademi University

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Electric ships are Competitive

- Analysis of competitiveness of battery-electric propulsion on RoPax routes in Northern Europe according to present speed on majority of RoPax and RoRo routes
- As batteries become cheaper and lighter the electric ships will become even more competitive and the number of feasible routes will increase.
- EU regulations (Fuel EU Maritime) favor electric ships and provides a significant source of revenue.
- By mid 2030's electricity will be the most competitive alternative in intra-European Short-Sea Shipping.



Feasibility of battery electric ships (2025 prices)

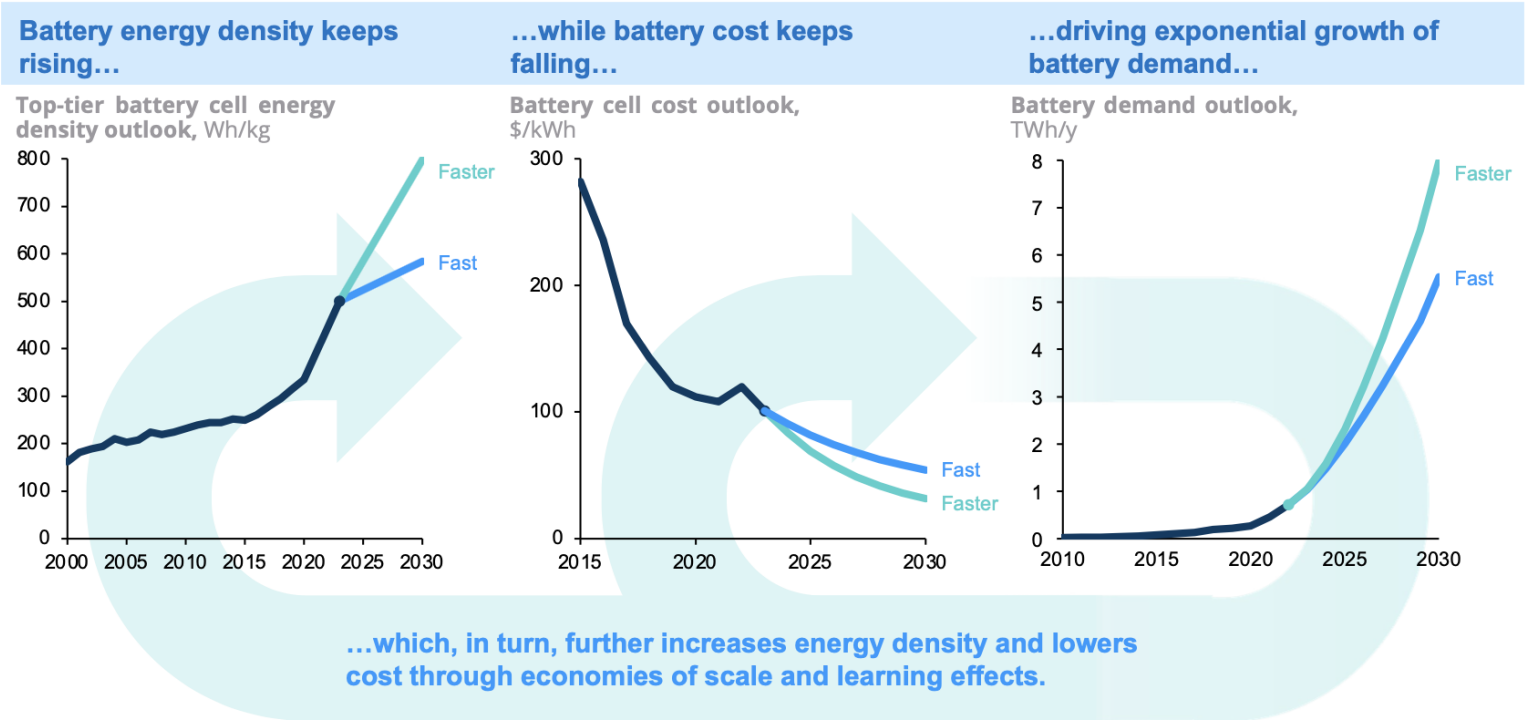
- Green: electric competitive with conventional fuels
- Yellow: Electric competitive with biofuels
- In all cases competitive with synfuels

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Battery cost and weight decrease 50% every 5-7 years

- In 2019 a marine battery solution cost over 1000 €/kWh in 2019, in 2023 496 €/kWh (Corvus), in 2025 they cost 350 €/kWh (Corvus) – this drives down investment and operating costs.



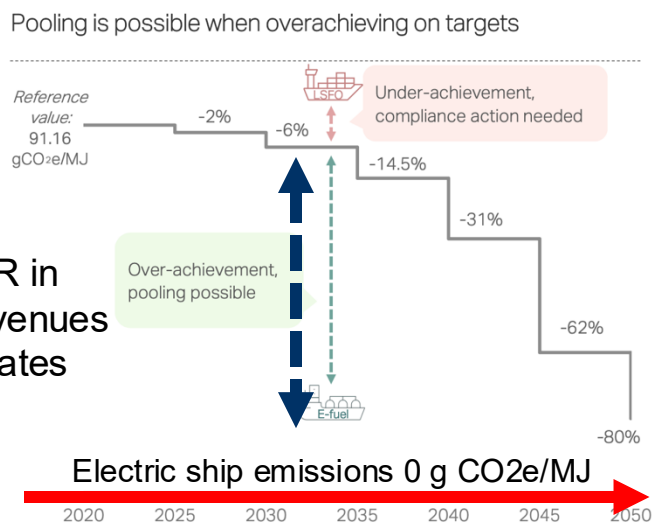
Source: Walter et al., X-Change: Batteries: The Battery Domino Effect, RMI 2023

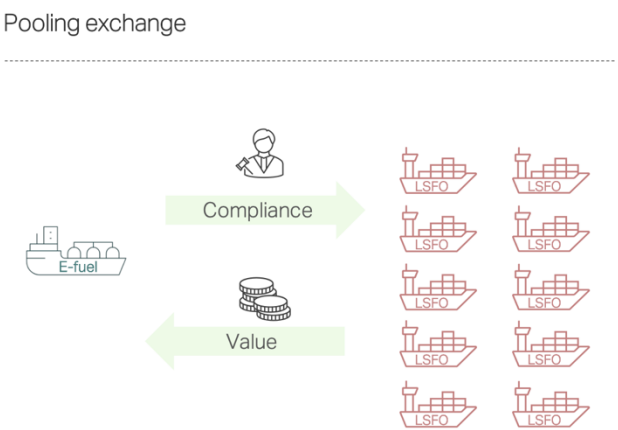
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Additional revenues from low emissions

- Starting 2025 Fuel EU Maritime (FEUM) penalises ships that exceed the emission threshold – 640 € for every ton above the limit.
- To avoid penalties shipowners can buy renewable fuel or they can buy compliance points from low-emission ships – demand for renewable fuels is 7 times greater than supply.
- Because an electric ship is zero emission it can earn additional revenues from surplus compliance points – the marginal cost for producing the certificate is zero.
- Fuel EU Maritime covers 13.000 ships – 98% run on fuel oil, they all need emission certificates.
- The cheapest way for a conventional ship to compensate emissions is to buy certificates from and electric ship

10-15 MEUR in potential revenues from certificates



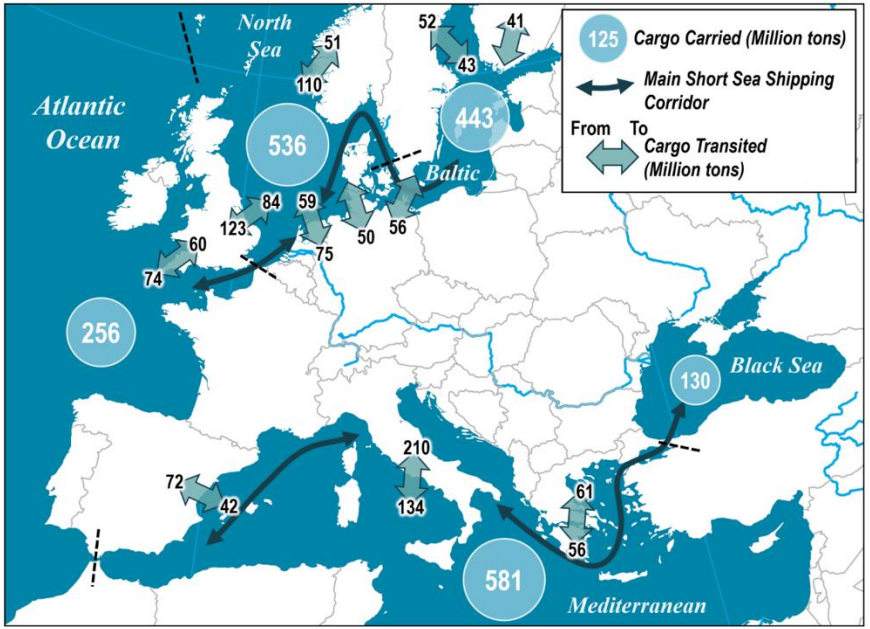


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Opportunity– Electrify European Short Sea Shipping

- Short Sea shipping includes about 40% of the world shipping.
- In the EU 57% of maritime freight, 1.6 billion tonnes, 870 billion euros is Short Sea Shipping.
- Short Sea Shipping emits 54 Million tonnes CO_{2e}, 40% of total shipping emissions (140 Million tonnes CO_{2e})
- Short Sea Shipping consumes 17 million tonnes fuel (300.000 barrels per day) → over 8,5 BEUR/year
- The Short Sea fleet consists of 2.600 bulk carriers (average age 18 years), 800 container feeders, 300 RoRo/RoPax vessels and 1.100 tankers - altogether 4.800 ships.
- Short-sea shipping is a key part of the European transportation system.
- 90% of Finnish sea freight is short-sea.
- Proximity to the market and the geopolitical situation makes electrification of European short sea shipping an opportunity for Finnish marine industry.

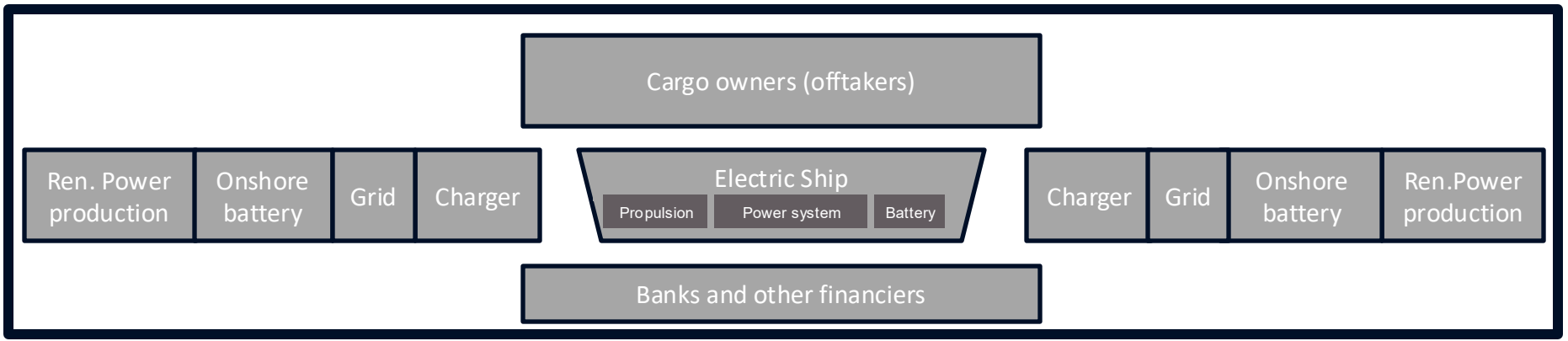


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Electric ships are different

- An electric ship must be charged at every port call.
- An electric ship requires onshore investments, offtakers and financers – this forms an electric maritime corridor
- Electrification of shipping should be done One Electric Maritime Corridor at a Time



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Two types of electric ships

- An electric ship requires charging at each port call.
- This can be done by charging an onboard battery or by exchanging battery containers that are charged in port.
- Ships with fixed batteries are connected to a charger that is backed up by an onshore battery.
- Both solutions have advantages and drawbacks.
- In both cases batteries in port are operated as part of the energy system while charging.
- There will be a new type of port operator

Fixed batteries



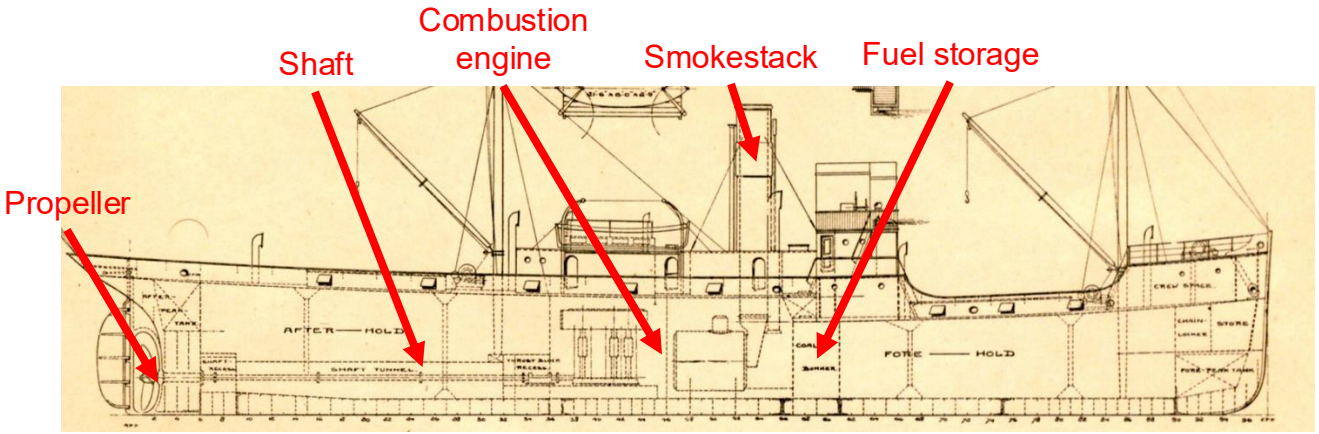


Replacable batteries.

Range 500 nautical miles, same as Hanko-Rostock

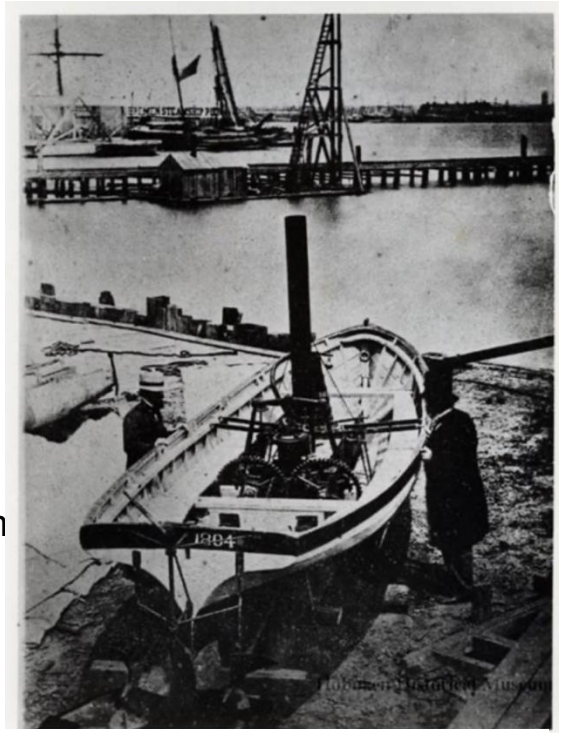
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The maritime industry of today is based on a 200-year old technical configuration



- For the last 200 years, since the invention of the propeller, the design of the ship has been dominated by the combustion engine powertrain (steam or diesel)

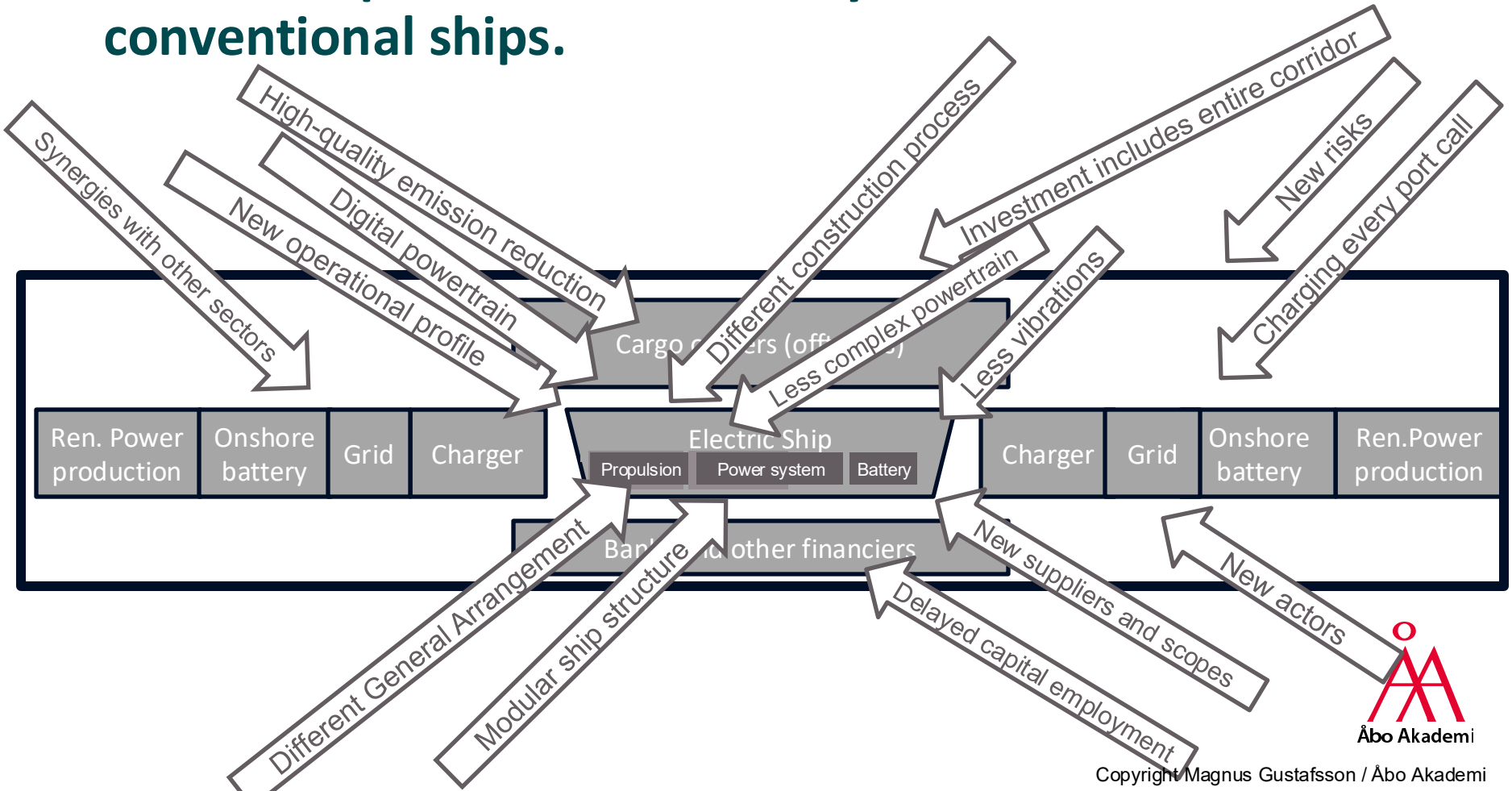
- Battery-electric propulsion challenges this regime.



The world's first double propeller driven steamboat Little Juliana built in 1804

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Electric ships are fundamentally different from conventional ships.



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Electrification enables a disruption in shipbuilding

- The maritime industry is burdened by legacy business models that lowers productivity.
- Because electric ships are so different technically, operationally and in business terms they enable introduction of new more productive business models.

- New knowledge in ship design, construction, investment and operations will be needed.
- It also enables platform-based shipbuilding that shorten delivery times, lower costs and increases quality.
  - Increased modularisation
  - Delayed capital employment
  - Designs that enable industrialisation of shipbuilding (Configure to Order)
  - Simpler solutions especially below main deck and in engine-room
  - Lighter modules as batteries can be installed just before sea trials
  - Retrofits that minimise ship downtime
  - Digitalisation to gather data from all stages of the ship lifecycle

- Whoever takes the lead will shape the market.

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Electrification of shipping is possible

- Reducing shipping emissions at no extra cost
- Set path towards lower freight costs from cheaper batteries
- Locally produced renewable energy
- Resilient and autonomous shipping industry
- Take lead in marine industry

Finland has all the knowledge needed.

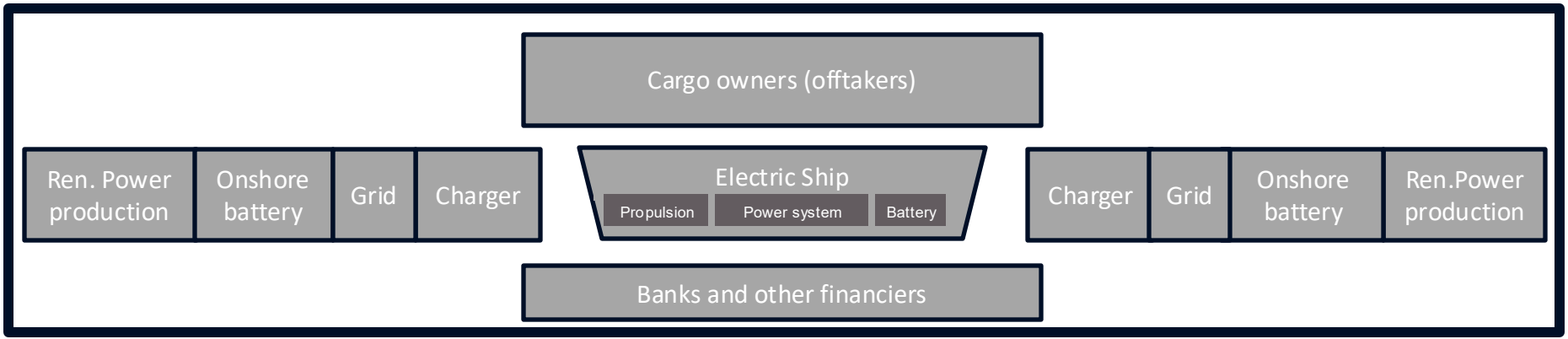
How do we capture the opportunity?

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Become the integrator and lifecycle supplier

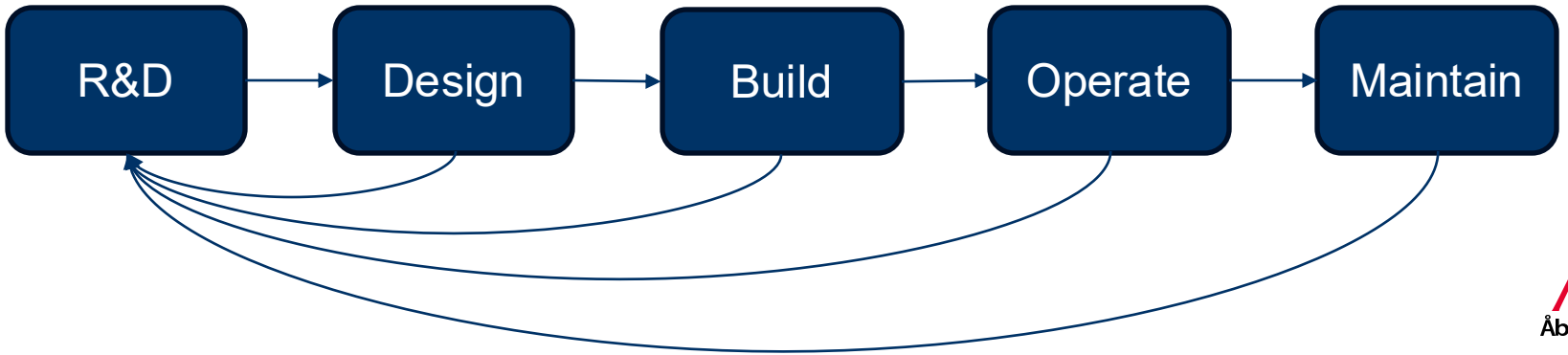
- To capture the opportunity Finland must become the supplier that integrates and provides the lifecycle of electric shipping.
- Electric ships require charging at each port call. The ship investment will require onshore investments – this forms an Electric Maritime Corridor.
- **Together, Finnish companies can provide the Electric Maritime Corridor as a lifecycle solution.**



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What does being an integrator mean?

- A business partner that combines hardware and software from different vendors to create a cohesive system, enhancing performance and functionality
- As integrator you put together the solution, you know how it was designed and why. By monitoring and digitalising each step of the process you can then gather data that can be used for R&D, innovation and improving the performance of the installation.
- If you are not the integrator then you do not get the data, you do not learn and do not build the knowledge.



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China does not control all rare earths – it dominates the refinement process – The Knowledge is the Asset

China puts new restrictions on EV battery technology in latest move to consolidate dominance

By John Liu, CNN
5 min read · Updated 10:05 PM EDT, Thu July 17, 2025

Liz Lee, an associate director at Counterpoint Research, said the move "deepens the emerging geopolitical tech decoupling beyond materials to process IP

EU to tighten investment rules to stand up to China

Commission wants greater benefits for local workers and technology transfers when foreign companies set up in bloc

A wave of Chinese industrial projects in Europe is also stoking concern that Beijing is fostering European dependence on its high-end manufacturing in order to boost its geopolitical leverage, a stated goal of Chinese President Xi Jinping. It is also seen as a way for Chinese companies to circumvent any further EU tariffs on Chinese goods.

The Chinese government has said it will restrict sharing of knowhow and equipment on highly advanced lithium iron phosphate batteries with foreign companies. However, implementation of these restrictions remains unclear.

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Why Viking Line's investment is important for Finland

- Viking Line's planned investment into two fully electric ferries on the Helsinki-Tallinn route are crucial for Finland to take the lead in the new electric ship segment.
- It would enable Finnish companies to:
  - Get insight into how an electric ship and the electric corridor should be built
  - Gather data on how the ships and the electric corridor performs
  - Establish proof of concept on the next generation of shipping



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To take a leading role in electric ships Finland needs a Program to Electrify Short Sea Shipping and Industrialise Shipbuilding

- Develop modular electric ship concept to lower cost and shorten delivery time.
- Modular charging and port-infra solutions including smart grid.
- New financing models for Electric Maritime Corridors that capitalize on strengths of electric ships.
- Digital electric ship lifecycle model to gather data
- Center of excellence for electric shipping to develop new concepts

- Establish pilots: Helsinki-Tallinn, Naantali-Kapellskär, Hanko-Rostock, Container feeder routes
- Engage other EU countries, EU commission and EU Maritime Industrial Strategy (eg. Horizon Europe program, Framework Program 10, Sustainable Transport Investment Plan)

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Finland can provide a competitive European solution for reducing shipping emissions

- The EU Sustainable Transport Investment plan predicts that reducing shipping emissions 14,5% by 2035 will require additional investments between 35 and 47 BEUR (not including ship and infra investments) – this is primarily
- This plan is expected to mobilise at least EUR 2.9 billion until end of 2027, making particular use of the InvestEU, the Innovation Fund and Horizon Europe. It will be implemented in partnership with Member States and by triggering and activating market support from the European Investment Bank (EIB) Group and other financial institutions.
- The Commission will formally launch an "Early Movers Alliance" with interested Member States at high-political level by the end of the year, whilst also assessing the conditions for an EU-wide intermediary mechanism in the medium term that should support making full use of the power of the single market.

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The cheapest way to reduce EU shipping emissions is for deep-sea shipping to buy certificates from electric short-sea shipping

Company name	Annual C02eq ktonnes	Number of ships	Annual penalty - 2030 MEUR	Annual penalty 2030-34 MEUR
MSC Shipmanagement Ltd	8 941	374	-82	-312
Maersk A/S	6 056	146	-81	-236
MEDITERRANEAN SHIPPING CO SRL	3 591	116	-48	-140
CMA SHIPS SAS	2 702	61	-36	-105
Shanghai Ocean Shipping Co., Ltd.	2 460	40	-33	-96
GRIMALDI EUROMED S.p.A	2 051	57	-27	-80
EVERGREEN MARINE CORP. (TAIWAN) LTD	1 458	24	-19	-57
CMA CGM INTERNATIONAL SHIPPING COMPANY PTE LTD	1 397	36	-19	-54
Seaspan Ship Management Ltd.	1 674	56	-18	-61
CMA CGM SA	1 282	71	-17	-50
Anglo-Eastern (Germany) GmbH	1 248	37	-16	-48
DFDS A/S	1 114	31	-15	-43
TECHNOMAR SHIPPING INC-LIB	1 069	43	-14	-42
Zodiac Maritime Ltd	1 051	66	-14	-41
HL Crewmanagement GmbH	1 008	23	-13	-39
Orient Overseas Container Line Ltd	992	25	-13	-38
Sum of top emitters	38 094	1 206	-470	-1 446
Total EU shipping	137 000	13 000	-1 000	-4 800
EU Short Sea Shipping (not all in FEUM due to ship size)	54 000	4 800	-400	-1 900

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Center for Electric Shipping

Åbo Akademi, Aalto University, Tampere University and VTT are establishing a Center for Electric Shipping.

Mission:

- Drive electrification and renewal of shipping and shipbuilding industry using European knowledge, collaboration and technology to accelerate IMO goals

Vision:

- In 2035 the electrification of shipping is well underway using European knowledge, collaboration, technology and energy competitively

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Benefit

- Eliminate emissions in European Short Sea Shipping at no extra cost.
- Less import of fossil fuels (8,5 BEUR at present prices, 300.000 barrels per day, 3% of total EU imports).
- Lower freight costs in European Short Sea Shipping
- Increased use of locally produced renewable energy (85 TWh).
- Increased competitiveness for European marine industry from industrialisation of building of electric ships.
- Increased resilience from ship software integrated in Digital European Maritime Full Stack

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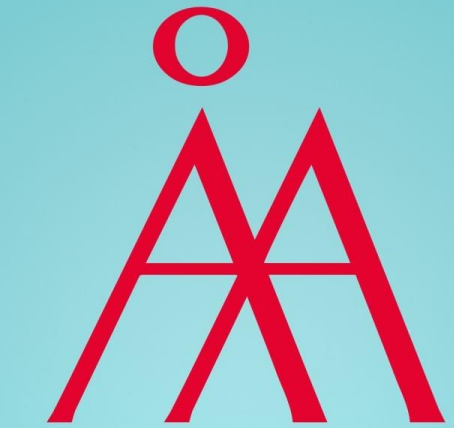
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Competition

- If we do not take the lead in electrifying shipping China will.
- Finnish and European companies will continue as system and component suppliers until supplanted by Chinese suppliers
- Ship software integrated in China or not integrated at all (present state) means European intra-European shipping is open to China or to hackers.

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