CX Collaborative Decarbonization in Transport and Logistics Systems

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REthinking and FOstering Competence and skills for sUstainable transport, Shipping, and logistics





What do I do as EU Climate Pact Ambassador?

Online Course on Decarbonizing Transport Systems

MO OC International Task Force + Roadmap for Net Zero Ports



Webinar Series on Decarbonizing Ports and Shipping



Interested? Scan the code!





Plan for Today

- Introduction
- Course Overview
- Collaborative Decarbonization Game
- Roadmap Exercise

11-07- 11:30 -2024 15:15

Collaboration and sharing in decarbonizing transport and logistics systems

Aims of the course







Build Fundamental Understanding: Provide participants with a foundational understanding of necessary steps to achieve decarbonization and climate across multiple transportation modalities. Explore Conceptual Applications: Explore research and practical applications of collaboration and sharing as means to decarbonize transport and logistics systems. Promote Awareness, Discussion, Real-World Implementations: Encourage participants to reflect on transport and logistics systems in their context and discuss actual steps that are required to implement effective decarbonization measures for these systems.



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Language	English
Hours	4.5 hours
Keywords	Collaborative Transport and Logistics, Collaboration, Sharing, Decarbonization, Net Zero, Sustainability, Climate Targets.
Syllabus	This course aims to provide participants with a comprehensive understanding of the fundamental steps required to achieve decarbonization and enhance climate resilience across various transportation modalities. Exploring both theoretical concepts and practical applications, participants will gain insights into collaborative approaches and sharing mechanisms as effective means to address decarbonization challenges in transport and logistics systems.
 **** Funded by **** the European Union 	



	Lecture	X
	Case study	
Teaching methods	Hands on/games	
	Exercises	
	Other (describe)	
	Homework	
Evaluation methods	Class project	
	Other (describe)	

Lecture content

1	Introduction collaboration and sharing for decarbonizing transport systems
2	Defining decarbonization targets for transport and logistics systems
3	Overview on technological options
4	Modelling and digital twinning
5	Policy and climate scenarios
6	Collaborative decarbonization transport game
7	Case studies



1: Collaborative Decarbonization





NWO Perspectief – 17 companies 1.3M Co-Financing

Decarbonization strategies are typically distinguished as **efficiency improvement** and **technological switch approaches**. In this project, we can consider both types of strategies to decarbonize the port call process. In practical terms the **three main aims of the project** are consequently:

- 1. Port call optimization to **minimize waiting emissions** ("efficiency improvement").
- 2. Port call optimization for **port calls that are optimized for shore power and alternative fuel usage** ("technological switch").
- 3. Create a virtual port call environment for net zero port call scenario evaluation.

Port Authority: How will EU ETS effect our port calls? How to make our port call systems smarter? How can we improve inhouse ETA predictions? **City of Rotterdam:** How do we reduce emissions in our area?





by 2030 from a 2019 base year.* Port of Rotterdam Authority commits to reduce absolute scope 3 employee commuting and business travel GHG emissions 60% over the same target timeframe. Port of Rotterdam Authority commits to reduce absolute scope 3 purchased goods and services GHG emissions 45% over the same target timeframe. Port of Rotterdam Authority commits to reduce absolute scope 3 use of sold products and services GHG emissions 20% over the same target timeframe.

*The target boundary includes land-related emissions and removals from bioenergy



Source: Port of Rotterdam

4: Why building Twins for Decarbonization?



The Iron Law of Project Management

Big projects come in 'over budget, over time, under benefits, over and over again.'

Percentage of studied projects that came in...





We can "Pixar Plan" That is, building reliable models that are key to the success of large-scale projects

- Simulation
- Digital Twinning
- Optimization
- Machine Learning
- Al

3/4: Reviewing Disruptions

Methanol to lead low-carbon bunker demand by 2030



Graph 1. Range Of Hydrogen Demand Assessment By 2050



BP Energy Outlook 2020 - Rapid

World Energy Council - Unfinished Symphony

Hydrogen Council - 2DS

Opportunity: Creating the <u>most efficient and</u> <u>sustainable port call process</u> considering detailed technology and policy scenarios.

Source: PwC

Shell - Sky Scenario Powerfuels in a Renewables World Hydrogen Economy Outlook - Strong Policy

BP Energy Outlook 2020 - Net Zero

IEA Energy Technology Perspectives 2020 - SDS

Acil Allen Report - Low World Energy Council - Modern Jazz Hydrogen Economy Outlook - Weak Policy

Annual total UK port electricity demand under an ambitious decarbonisation scenario



5: Emissions in Ports – An Important and Urgent Problem



- → International emissions from waiting during the port call estimated to be 160 million tonnes (which is about the same amount as the CO2 emissions in the Netherlands in 2022).
- Shore power becomes mandatory: As of 1 January 2030, any ship at berth in a port of call under the jurisdiction of a Member State must therefore be connected to the on-shore power supply and use it for all its energy needs while at berth.
- → EU ETS started and will increase quickly: On 1 January 2024, the EU extended the coverage of its ETS to incorporate the maritime sector, as part of the broader EU ETS reform that came into force in June 2023.

7: Case Studies

Example "Waiting Times" illustrated for Terminals (ETA vs. ETB)





Robust zero-emission port terminal operations (RZEPTO)



Optimizing STS efficiency by peak power management to enable large-scale electrification







6: Collaborative Decarbonization Game: Achieving 100 % Shore Power by 2030





Vertical Collaboration

Decarb Game: 2 Games with each 3 Groups

2 Parallel Games

Game 1: 3 Groups

Game 2: 3 Groups





Role #1: Shipping Company Goal:

- Max. earnings
- 100% shore power port calls by 2030

Role #2: Terminal/Grid Operator Goal:

- Max. earnings
- 100% shore power port calls by 2030

Role #3: EU Goal:

- Min. budget use
- 100% shore power port calls by 2030

	Tonnes of CO ₂ emitted	Year	Carbon cos in USD*
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Intra-EU vovage		2023	12 000
		2024	27 000
Le Havre - Riga-	700	2025	42 000
Amsterdam	700	2026	60 000



Decarb Game: Roles and Objective (Years 2025-2029)

Role #1: Shipping Company Goal:

- Max. earnings
- 100% shore power port calls by 2030

Facts:

- 800 vessels
- Earnings 1 Billion per year
- Cost for shore power onboard 1 Million per vessel
- Microgrid expansion costs of 2,5 Billion

Decisions each year:

- How many vessels (in %) to equip with shore power?
- How much support capacity
 add to the grid (in %)?

Role #2: Terminal/Grid Operator

<u>Goal:</u>

- Max. earnings
- 100% shore power port calls by 2030

Facts:

- 200 berths
- Earnings 800 million per year
- Cost for shore power onshore 4 Million per berth
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<u>Goal:</u>

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"The CO ₂ cost per tonne cargo is based on th soot European Emission Allowances (EUR 7)	e last settlement price of the 2.90), 1 EUR = 1.12 USD.		
			Sig)ar



Calculations – Year 2025

Role #1: Shipping Company Facts:

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- Microgrid expansion costs of 2,5 Billion

Decisions each year:

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 add to the grid (in %)?

Updated Earnings = earnings – (invests - EU subsidies)

Role #2: Terminal/Grid Operator

Facts:

- 200 berths
- Earnings 800 million per year
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Decisions each year:

- How many berths (in %) to equip with shore power?
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Role #3: EU

<u>Goal:</u>

- Min. budget use
- 100% shore power port calls by 2030

Facts:

- 10 Billion budget
- Decisions each year:
- How many vessels and berths (in %) to subsidize with shore power?
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Updated Balance = budget subsidies





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Decarb Game: Roles and Objective (Year 2026)

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Role #2: Terminal/Grid Operator

Goal:

- Max. earnings
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Goal:

- Min. budget use
- 100% shore power port calls by 2030

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Calculations – Year 2026

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Decisions each year:

- How many vessels (in %) to equip with shore power?
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Updated Earnings = earnings – (invests - EU subsidies) + 2% increased earnings shore power port calls

Role #2: Terminal/Grid Operator

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<u>Goal:</u>

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			Sio)ar



Decarb Game: Roles and Objective (Year 2027)

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			Sig)ar



Calculations – Year 2027

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Decisions each year:

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 add to the grid (in %)?

Updated Earnings = earnings – (invests - EU subsidies) + 2% increased earnings shore power port calls

Role #2: Terminal/Grid Operator

Facts:

- 200 berths
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Role #3: EU

<u>Goal:</u>

- Min. budget use
- 100% shore power port calls by 2030

Facts:

- 10 Billion budget
- Decisions each year:
- How many vessels and berths (in %) to subsidize with shore power?
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Updated Balance = budget subsidies





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Le Havre - Riga-	700	2025	42 000
Amsterdam	700	2026	



Decarb Game: Roles and Objective (Years 2028)

Role #1: Shipping Company Goal:

- Max. earnings
- 100% shore power port calls by 2030

Facts:

- 800 vessels
- Earnings 1 Billion per year
- Cost for shore power onboard 1 Million per vessel
- Microgrid expansion costs of 2,5 Billion

Decisions each year:

- How many vessels (in %) to equip with shore power?
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 add to the grid (in %)?

Role #2: Terminal/Grid Operator

<u>Goal:</u>

- Max. earnings
- 100% shore power port calls by 2030

Facts:

- 200 berths
- Earnings 800 million per year
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Decisions each year:

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Role #3: EU

<u>Goal:</u>

- Min. budget use
- 100% shore power port calls by 2030

Decisions each year:

- How many vessels and berths (in %) to subsidize with shore power?
- How high to set the interest rate for shore power projects (in %)?







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NY - Antwerp - NY		2025	50 500
		2026	72 500
Intra-EU vovage		2023	12 000
		2024	27 000
Le Havre - Riga-	700	2025	42 000
Amsterdam	700	2026	



Calculations – Year 2028

Role #1: Shipping Company Facts:

- 800 vessels
- Earnings 1 Billion per year
- Cost for shore power onboard 1 Million per vessel
- Microgrid expansion costs of 2,5 Billion

Decisions each year:

- How many vessels (in %) to equip with shore power?
- How much support capacity
 add to the grid (in %)?

Updated Earnings = earnings – (invests - EU subsidies) + 2% increased earnings shore power port calls

Role #2: Terminal/Grid Operator

Facts:

- 200 berths
- Earnings 800 million per year
- Cost for shore power onshore 4 Million per berth
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Decisions each year:

- How many berths (in %) to equip with shore power?
- How much capacity add to the grid (in %)?

Updated Earnings = earnings – (invests - EU subsidies) + 2% increased earnings shore power port calls

Role #3: EU

<u>Goal:</u>

- Min. budget use
- 100% shore power port calls by 2030

Facts:

- 10 Billion budget
- Decisions each year:
- How many vessels and berths (in %) to subsidize with shore power?
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Updated Balance = budget subsidies





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Decarb Game: Roles and Objective (Year 2029)

Role #1: Shipping Company Goal:

- Max. earnings
- 100% shore power port calls by 2030

Facts:

- 800 vessel
- Earnings 1 Billion per year
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Decisions each year:

- How many vessels (in %) to equip with shore power?
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Role #2: Terminal/Grid Operator

Goal:

- Max. earnings
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Facts:

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Decisions each year:

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Role #3: EU

Goal:

- Min. budget use
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Decisions each year:

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Le Havre - Riga-		2025	
Amsterdam		2026	



Calculations – Year 2029 \rightarrow 2030 goal achieved?

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Decisions each year:

- How many vessels (in %) to equip with shore power?
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Role #2: Terminal/Grid Operator

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Reflect on Lessons Learned and Draft a Roadmap

Discuss lessons learned from the game and decide on which key actions need to be taken for your organization to succeed in the transition to shore power:

- 1. What lessons did you learn for your organization?
 - Were your decisions successful why/why not?
 - What would you change if you were to play again?
 - What changes would you require from other players?
- 2. Prepare a shore power draft roadmap for your organization (ppt/drawing)
 - What actions need to be taken when?
 - Are all the elements included?
 - How do you validate your assumptions and make sure you stay on track in later years?
 - Send to <u>f.schulte@tudelft.nl</u>

• Work in groups as defined earlier



30'



Roadmap Example

Addressing climate change

Over a decade of regulatory action to cut GHG emissions from shipping







THANK YOU FOR YOUR ATTENTION



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