CURRENT DIRECT™

CCNR Shore Power at Berths Workshop

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Context

- Research and innovation project funded by the European Commission's Horizon 2020
  - H2020-EU.3.4. - SOCIETAL CHALLENGES - Smart, Green and Integrated Transport (€ 6,339.40 million)
  - LC-BAT-11-2020 - Reducing the cost of large batteries for waterborne transport (€ 21.50 million)
  - Current Direct - Swappable Container Waterborne Transport Battery (€ 11.98 million)
- Swappable containerized batteries connected to an Energy as a Service Platform
- **Significantly reduce the total lifetime cost of waterborne transport batteries**
- **Cut GHG emissions of the marine transport sector**
- **Increase the installed energy of containerized energy storage systems**
- **Trigger investments for innovation, employment, and knowledge creation**

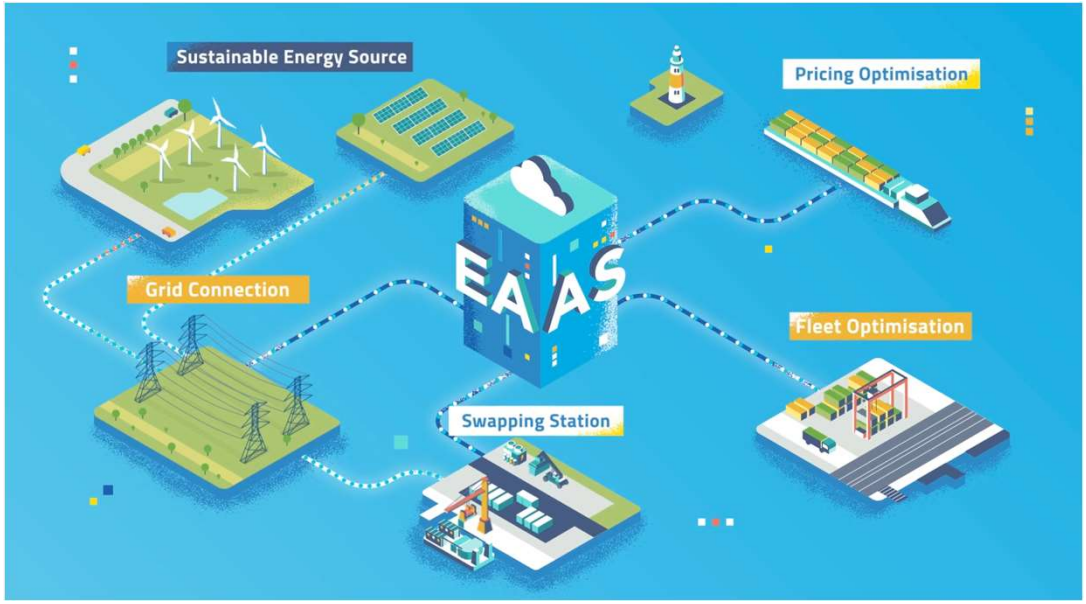
Strategic Objectives

Innovative Waterborne Transport Cell SO1 	Certified Battery System SO2 	Certified Integration Standards SO3 	Standardized Shore Infrastructure SO4 
Energy-as-a-Service Business and Financing Model SO5 	Standard Marine Battery Certification Methodology SO6 	Operational Demonstrator SO7 	Dissemination and Stakeholder Management SO8 

Swappable Waterborne Transport Battery

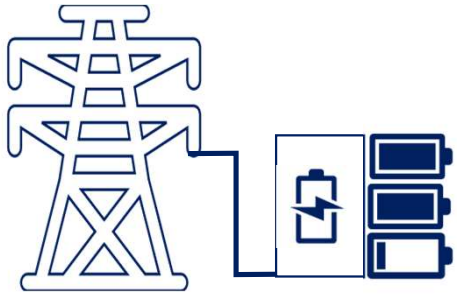
20ft Container

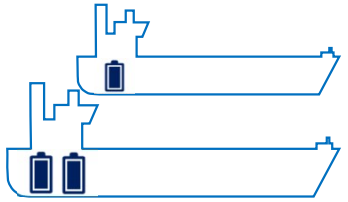
1MW, 3MWh



Energy-as-a-Service Platform

Interfaces and Topology





Shore Side

Swapping Infrastructure

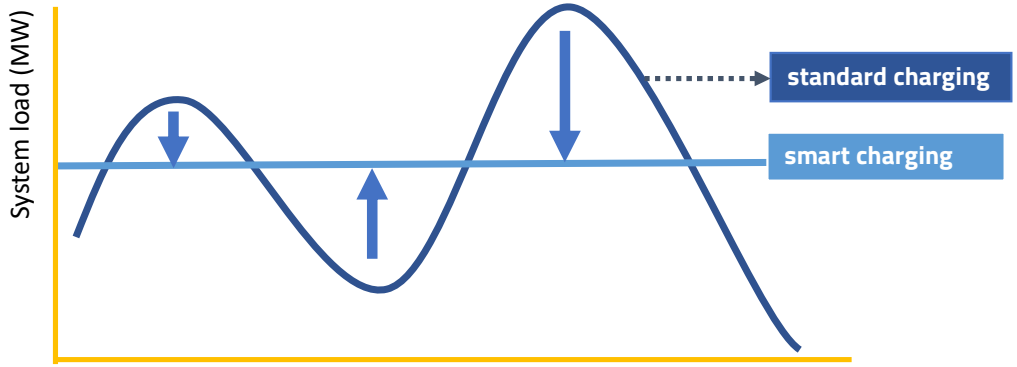
Vessel Side

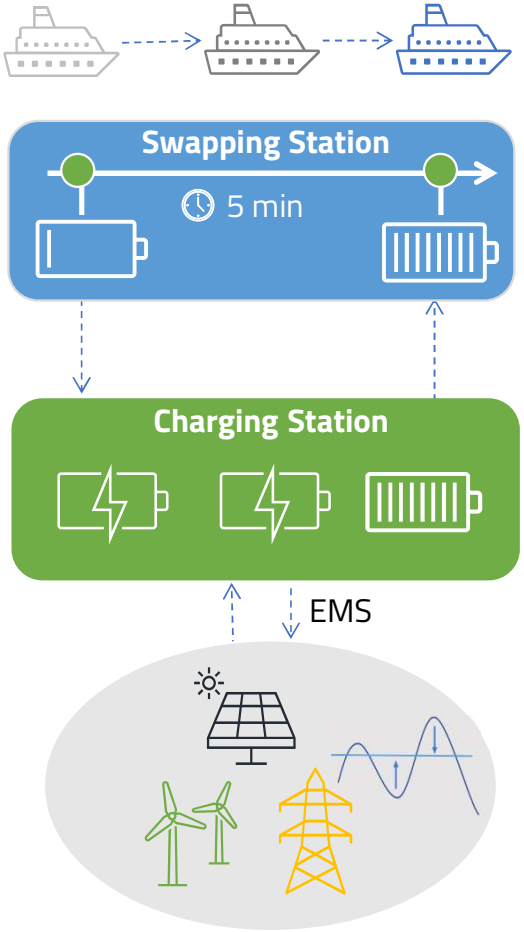
- National grid standards
- Supporting Infrastructure Grid Connection
- - Fire Safety, regulatory
  - IEC/ISO
- Mechanical and Structural Considerations
- Swapping Movement and Reach
- Human Interface
- Safety, Redundancy, and Regulatory
- Electrical and Machinery Interfaces
- Vessel Retrofit
- Mechanical and Structural Considerations

Scheduling

Grid Management – CD Benefits

- Decoupling of battery swapping station (BSS) from battery charging station (BCS) for improved time management.
  - Slow charging for increased battery life cycle enabling lower investment on port's grid infrastructure (lower power capacity)
  - Smart charging for reduced grid congestion.
- Batteries coupled with renewables to avoid curtailment.
- Battery to grid (B2G) – Enables bidirectional energy flows providing greater flexibility during charging and remunerated ancillary services to the grid.





Scheduling

Grid Management – CD Benefits

Barriers on IWT electrification

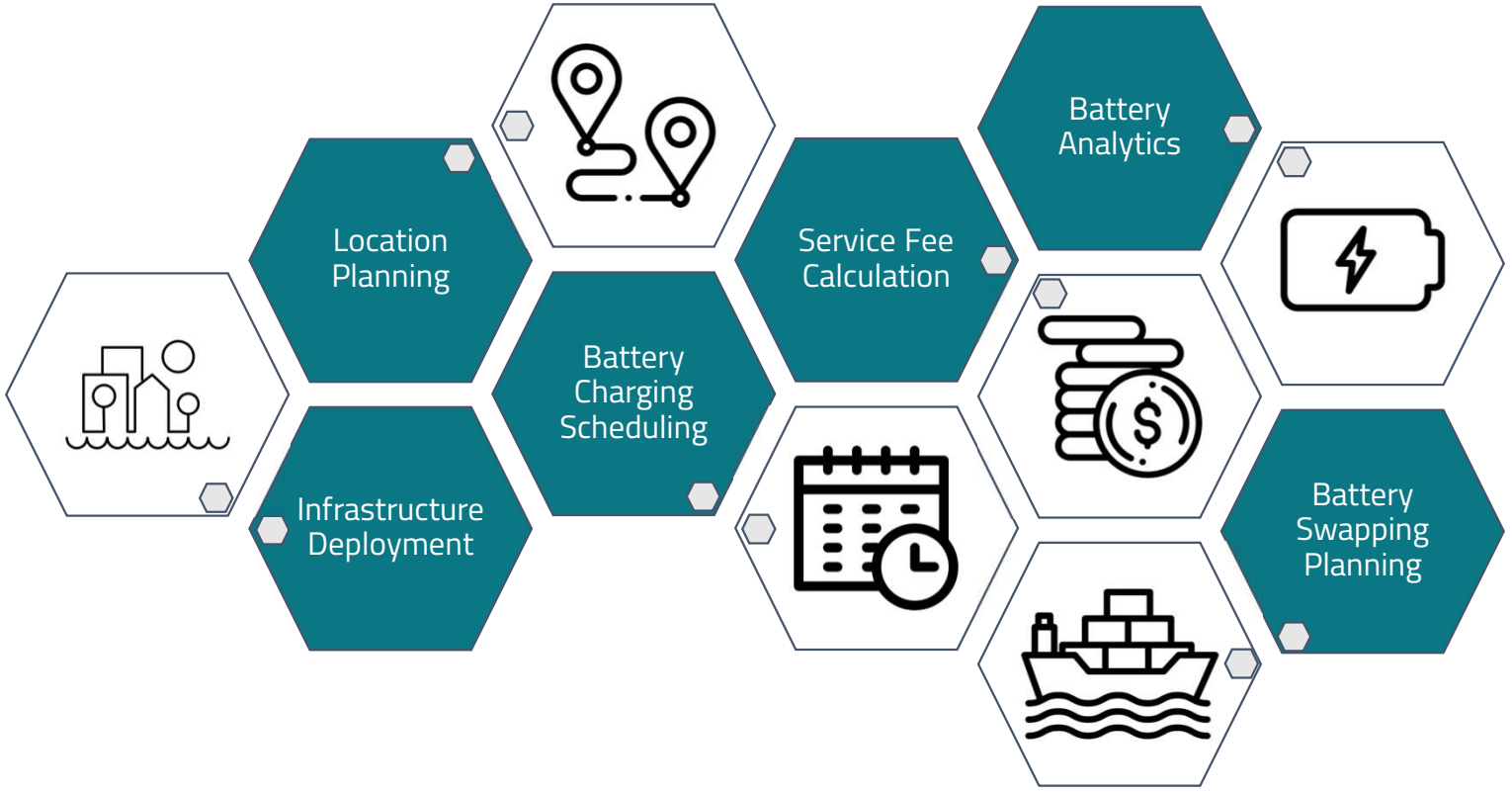
- Insufficient power capacity and connections at the port
- Lack of renewable energy generation at the port
- Reduced information on grid infrastructure
- Lack of support for battery systems as a grid management mechanism.

CD solution

EaaS Platform

- Regular communication with stakeholders
- Route planning and optimization
- Charging scheduling and optimization
- Guarantee enough batteries in the system
- Data Communication through smart meter gateways (SMG) and control boxes
- Comply with Standards

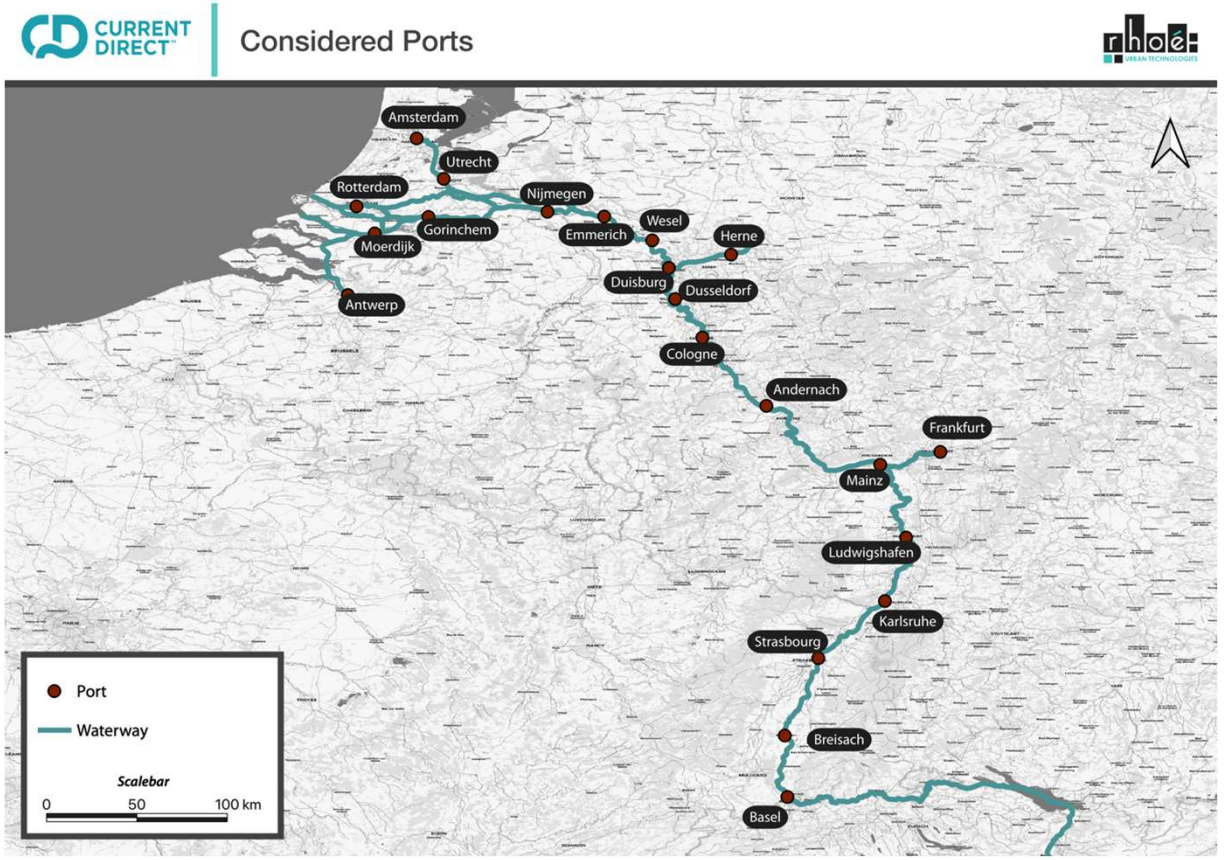
The EaaS Platform Design



Infrastructure Study

- Research and communication with the Ports with highest throughput on important Inland Waterway Networks (Rhine, Danube)
- Assessment of their existing infrastructure equipment (container bridges, container cranes, mobile cranes)
- Highlight of the port investments priorities and needs for the future
- Presentation of the Inland Waterway Transport traffic in Rhine and Danube Basin

		Container Bridges		Container Cranes		Mobile Cranes		Notes
Country	Port	Number	Lifting Capacity (tonnes)	Number	Lifting Capacity (tonnes)	Number	Lifting Capacity (tonnes)	
Germany	Duisburg			21	55	1	110	8 container terminals
Germany	Karlsruhe	19	4 to 25	2	50	-	20 to 250	
Germany	Ludwigshafen	2	62	1	52	1	104	9 crane systems (25 tonnes)
Germany	Manheim	4	-	1	50	52		2 trimodal container terminals
Germany	Kehl	3	For bulk cargo (22, 25, 50)			6	26.5	
		3	or container traffic (38, 42, 50)					
Germany	Weil am Rhein			1	-	1	-	
Germany	Hamburg			30	110	1	140	
Germany	Cologne			3	-			
France	Strasbourg			5	Gantry Cranes	4	Gantry Cranes	2 trimodal container terminals
France	Lauterbourg			1	Gantry Crane			trimodal container terminal
France	Colmar			1	40 Gantry Crane			
France	Mulhouse			3	40, 50, 60 Gantry Cranes			2 container terminals
Switzerland	Basel			2	34	1		
Belgium	Antwerp			2	41			5 container terminals
Romania	Constanța			5	Post-Panamax Cranes	3		



Distribution: Current Direct Consortium, Stakeholders, Advisory Board The Current Direct project is funded by the European Commission's Horizon 2020 program. Grant number 963603.

Vessel Integration

Demonstration

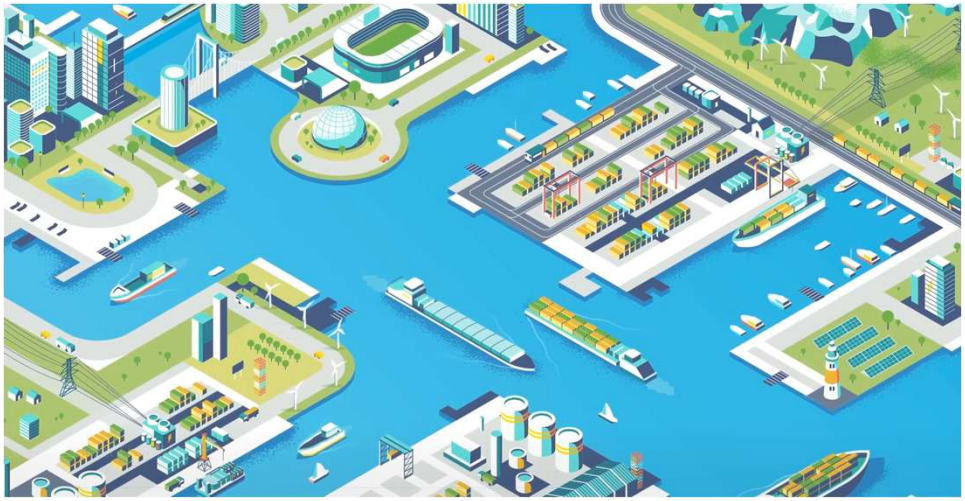
- 12-month Demonstration
- Major European Port
- Modular Hybrid Demonstration Vessel

Electrification

- Zero Emission Operation Mode – Battery
- Hybrid Operation Mode – Battery + ICE
- Hybrid+ Operation Mode- Battery + FC

Industry Collaboration

- Zero Emission Services
- Modular Vessel Design Concepts



We look forward to working with you!

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CURRENT DIRECT™ Revolutionize the way we move goods and people by water with the use of swappable containerized batteries connected to an Energy as a Service Platform

www.currentdirect.eu

www.linkedin.com/company/currentdirect