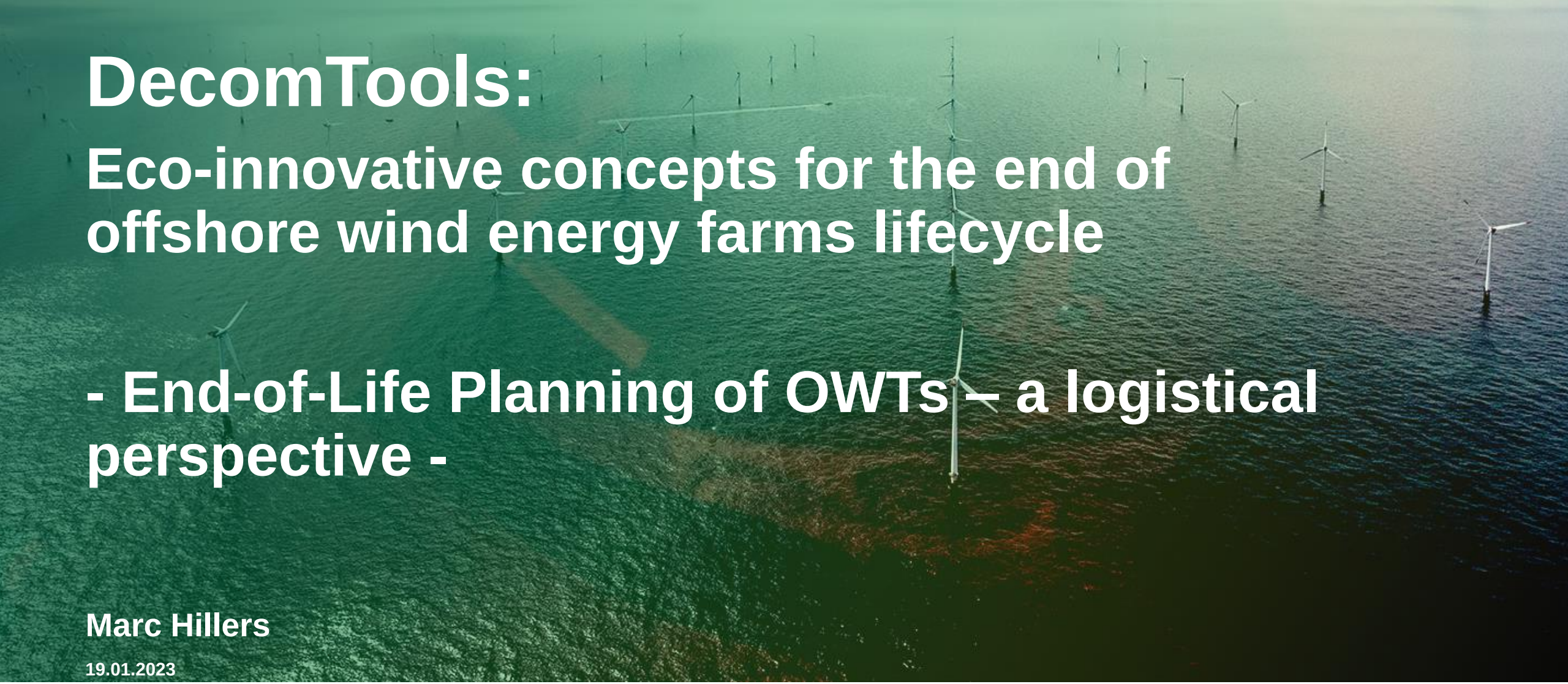

DecomTools:

Eco-innovative concepts for the end of offshore wind energy farms lifecycle

- End-of-Life Planning of OWTs – a logistical perspective -

Marc Hillers

19.01.2023

HOCHSCHUL INSTITUT LOGISTIK

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HOCHSCHULE EMDEN·LEER

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Introduction

- „2 decommissioning cycles“
  - 1st Cycle: Already ongoing, with a relatively low volume of OWTs → „Test case“ for decommissioning strategies and methods
  - 2nd Cycle: Expected to begin ~2030 corresponds to large volumes in the NSR
    - Requirements: Fully developed solutions and decommissioning strategies

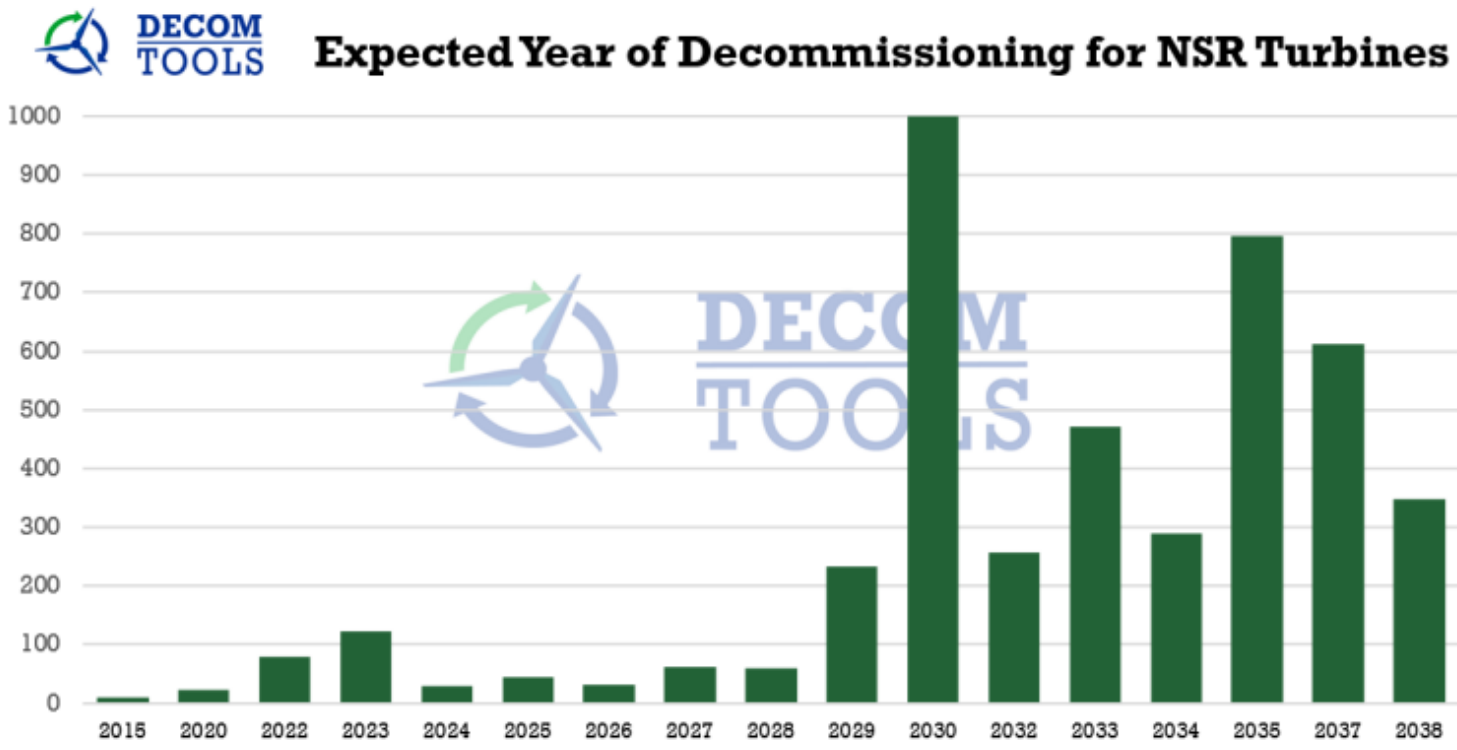

Figure 1: Expected Year of Decommissioning for Offshore Wind Turbines in the NSR

Kruse, M. (2019): Market Analysis Decom Tools 2019, [online], available at: https://northsearegion.eu/media/11753/market-analysis_decomtools.pdf

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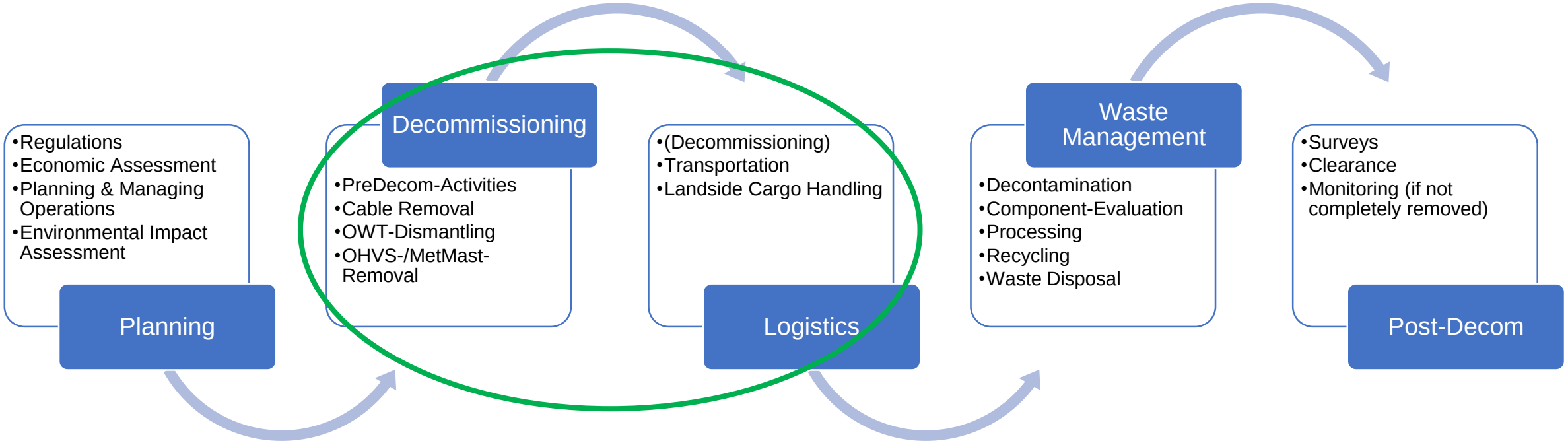
“Decommissioning Process”



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Uncertainties along the entire Supply Chain

Regulations	Technology	Processes	Recycling	Reusability
• Ambiguity of legislative conditions	• Decommissioning Techniques and Equipment	• Procedural uncertainties	• Especially for blades	• Which components and materials can be re-used and sold?

Finances	Timing	Vessel Availability	Environmental Impacts	Ports
• Sufficient budgets for decommissioning?	• What/When is the right timing for decommissioning?	• Will there be enough sufficient vessels to do the decommissioning?	• Legislatations • Impacts • …	• Crucial hubs (Operational, Distributional, Processing, Storing, Recycling, ….)

Weather	…
• Wind • Seastate	• …..

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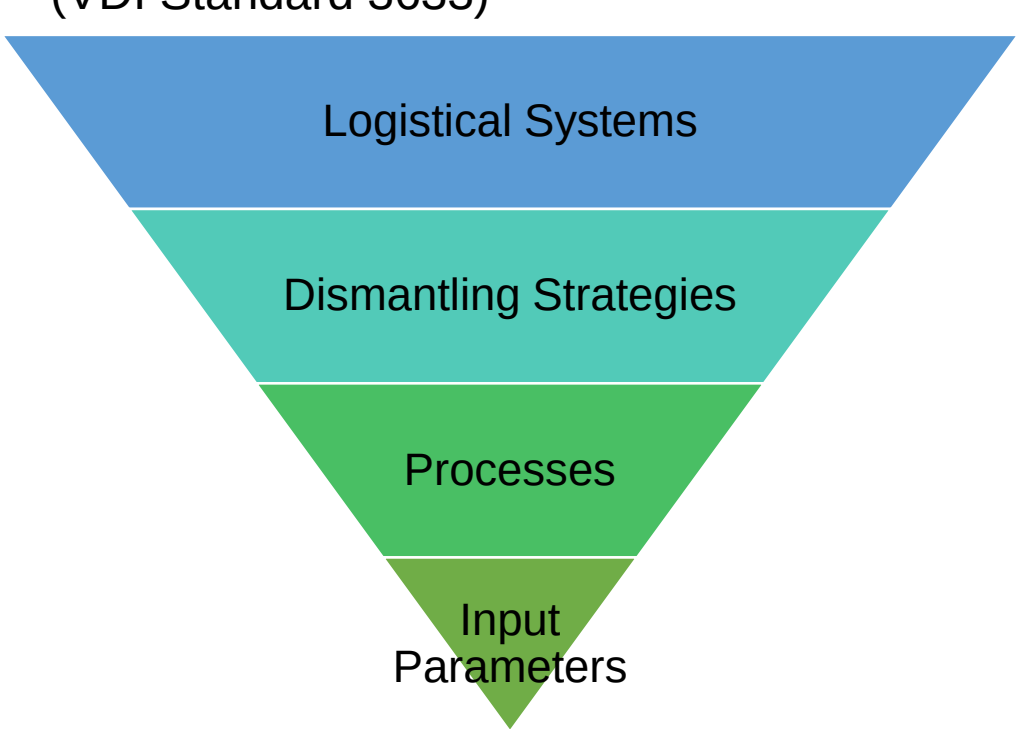
Logistical Simulation

Simulation is a method of replicating a real system with all dynamic processes in a model that can be experimented with, in order to derive findings that can be applied to reality.

- (VDI Standard 3633)



(Main) Simulation Outputs

- Project Duration
- Project Costs
- Overall CO2-Emission

- Data of > 1k Simulation Runs per Scenario
- Possibility to extract more detailed information on different stages

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WTIV shuttles between OWF & Port

WTIV remains at site while FV shuttle between OWF & Port

Pendulum System

Part-by-Part-Configuration

Bunny-Ear-Configuration

Star-Configuration

Part-by-Part-Configuration

Bunny-Ear-Configuration

Star-Configuration

Feeder System

Logistical Systems and Dismantling Strategies

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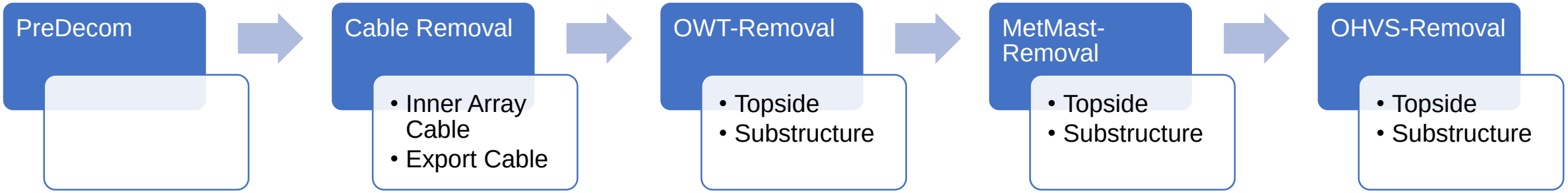
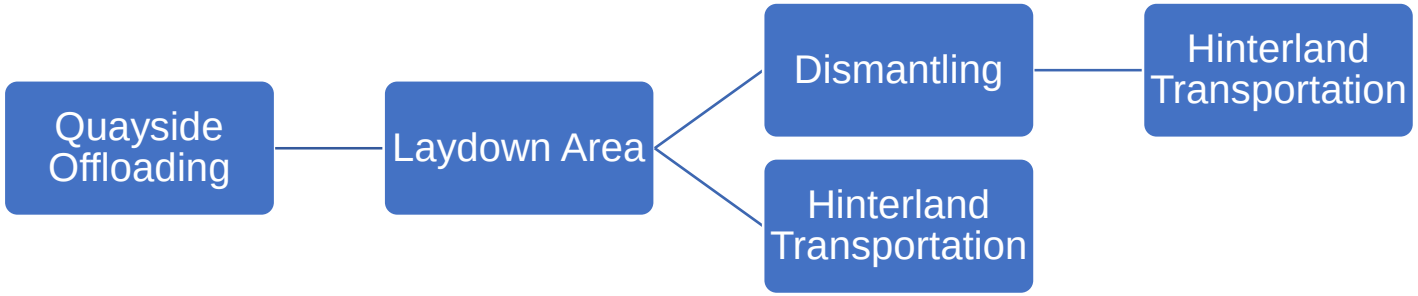
Process Overview

- Offshore Process Overview



- Onshore Process Overview



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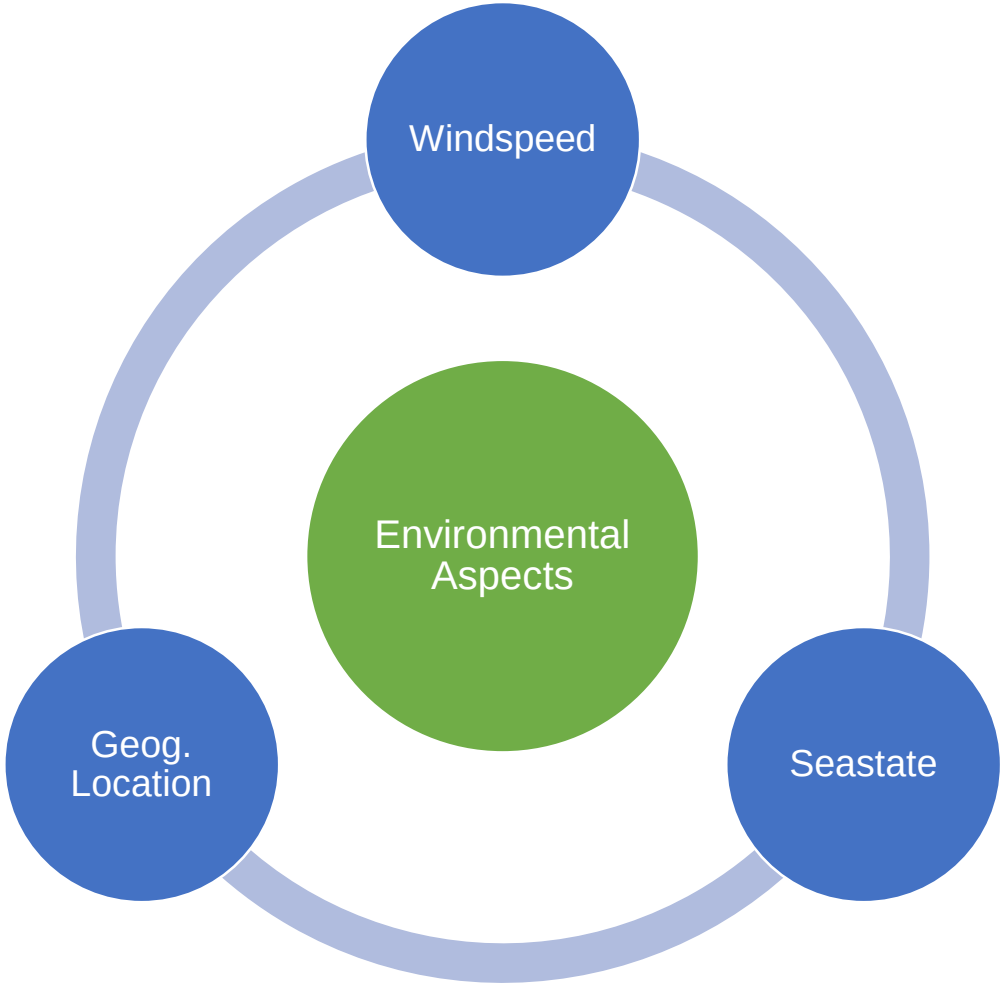
Environmental Aspects and Simulation Parameters



Parameters to consider:

- Amount of OWT
- Dismantling Strategy
- Dismantling Process Times
- Available Vesseltypes and –characteristics in different stages
- Ports and their capacities
- Component-Handling
- Onshore Supplychain
- ….

Basestudy:

- 80 OWT
- 1x MetMast
- 1x OHVS
- HR1-Location: ~20km of the Danish coast

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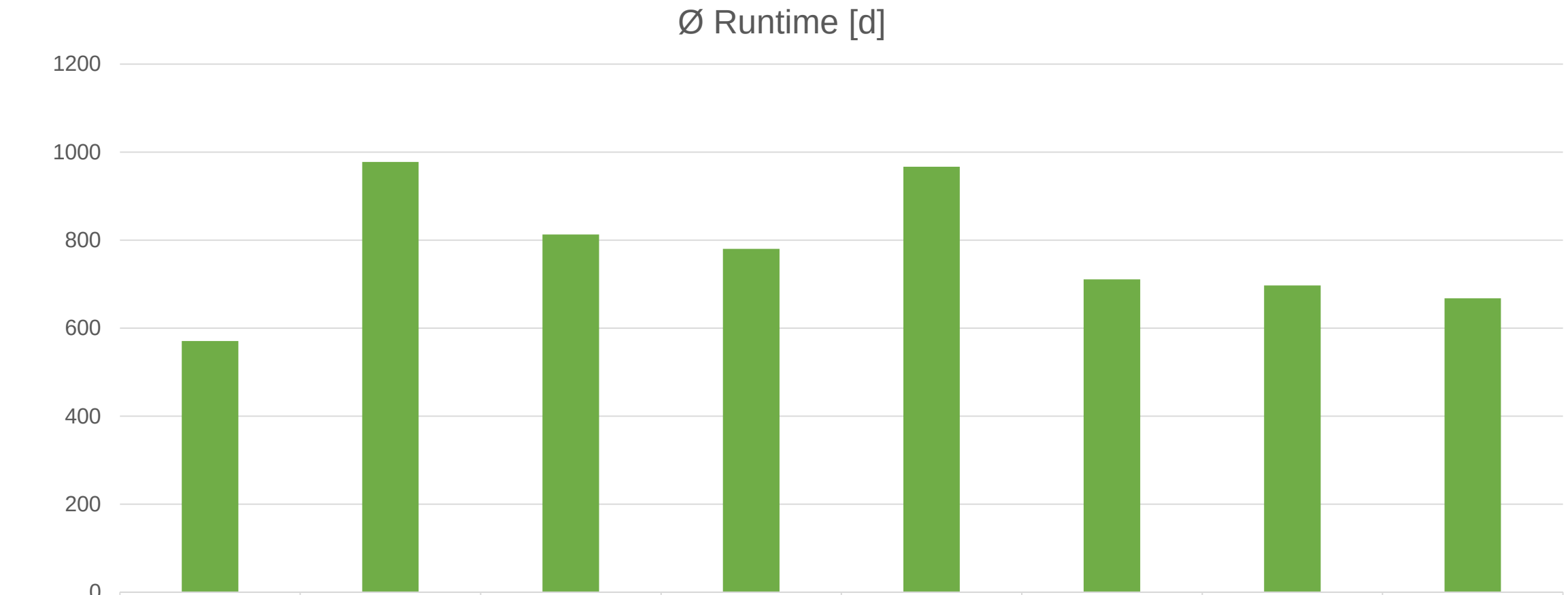
Simulation Outputs – Offshore– Ø Runtime



	BaseStudy	P_PbP	P_BunnyEar	P_Star	F_PbP	F_BunnyEar	F_Star	DecomToolV
Runtime	571	978	813	780	967	711	697	668
▲%	x	+71%	+42%	+36%	+69%	+24%	+21%	+17%

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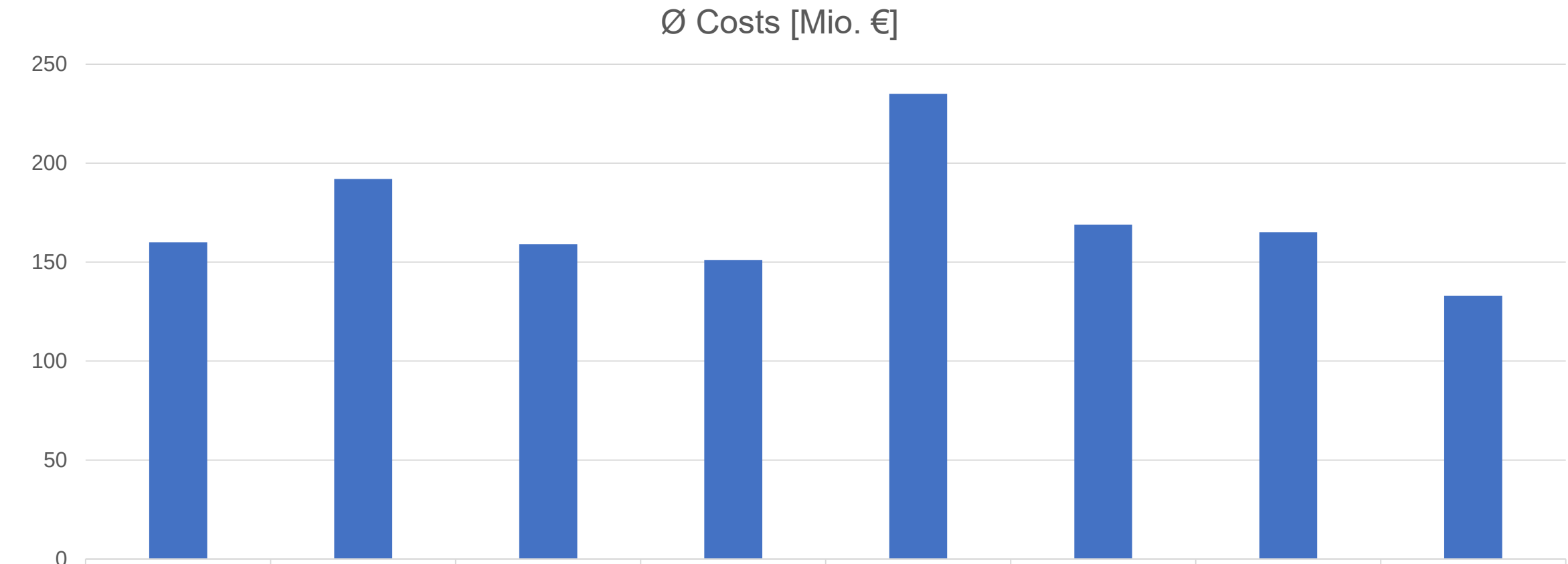
Simulation Outputs – Offshore – Ø Costs



	BaseStudy	P_PbP	P_BunnyEar	P_Star	F_PbP	F_BunnyEar	F_Star	DecomToolV
Costs	160	192	159	151	235	169	165	133
▲%	x	+20%	-1%	-5%	+47%	+6%	+4%	-17%

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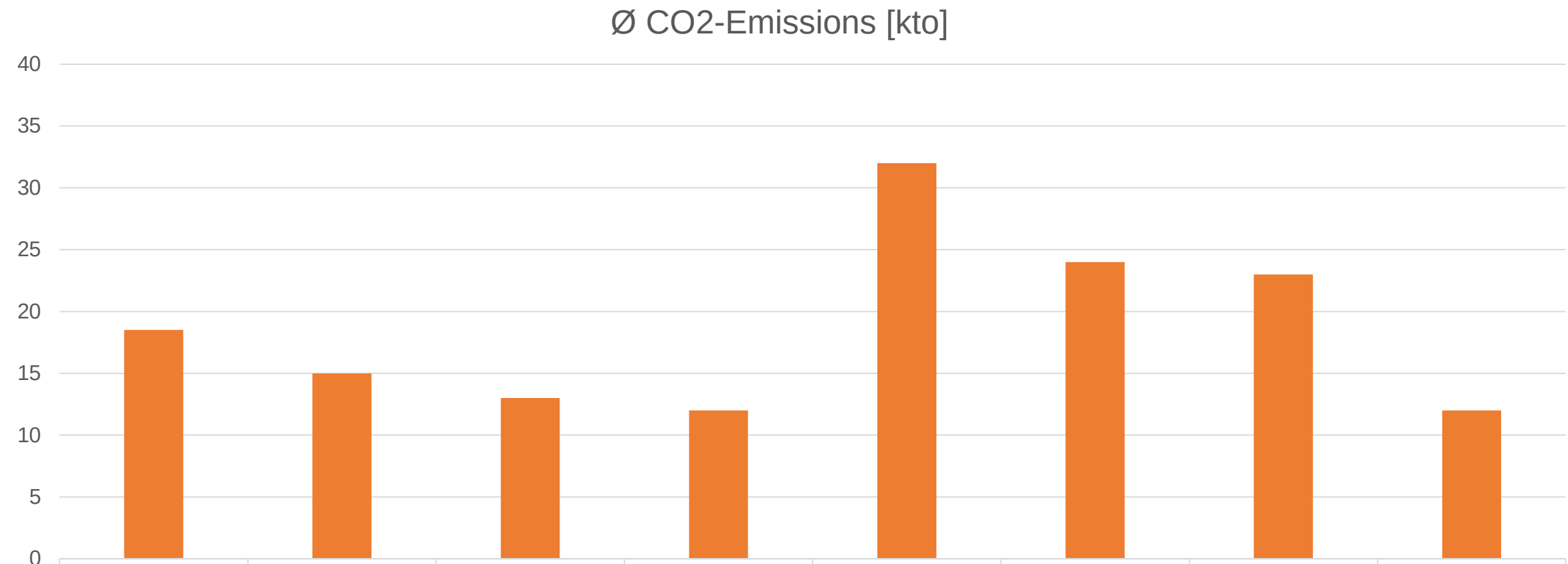
Simulation Outputs – Offshore – Ø CO2-Emissions



	BaseStudy	P_PbP	P_BunnyEar	P_Star	F_PbP	F_BunnyEar	F_Star	DecomToolV
kto	18,5	15	13	12	32	24	23	12
▲%	x	-18%	-30%	-32%	+76%	+31%	+29%	-35%

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- Logistical Simulations can give a good overview about the supply chain or logistics strategy and may even offer new perspectives
  - The base of data is crucial! → „The more realistic the data basis, the more realistic are the results”

- Nearly Impossible to create „one solution fitting all“
  - Appropriate Logistic arrangements are essential!

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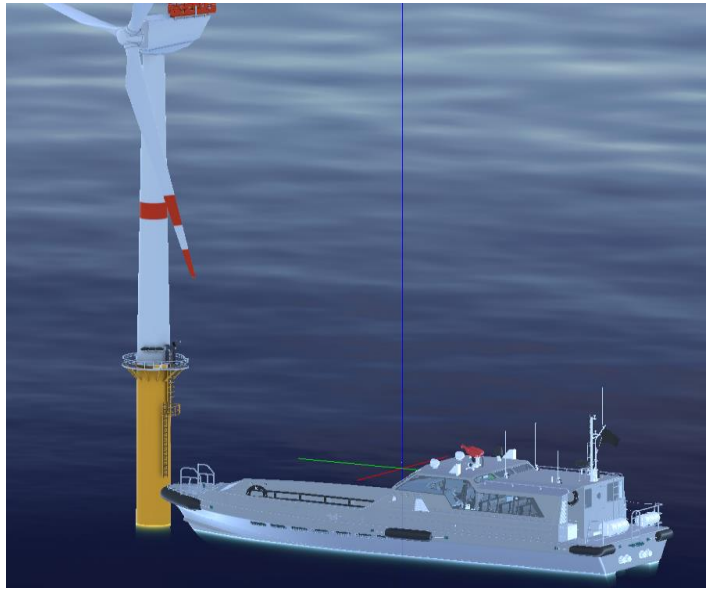
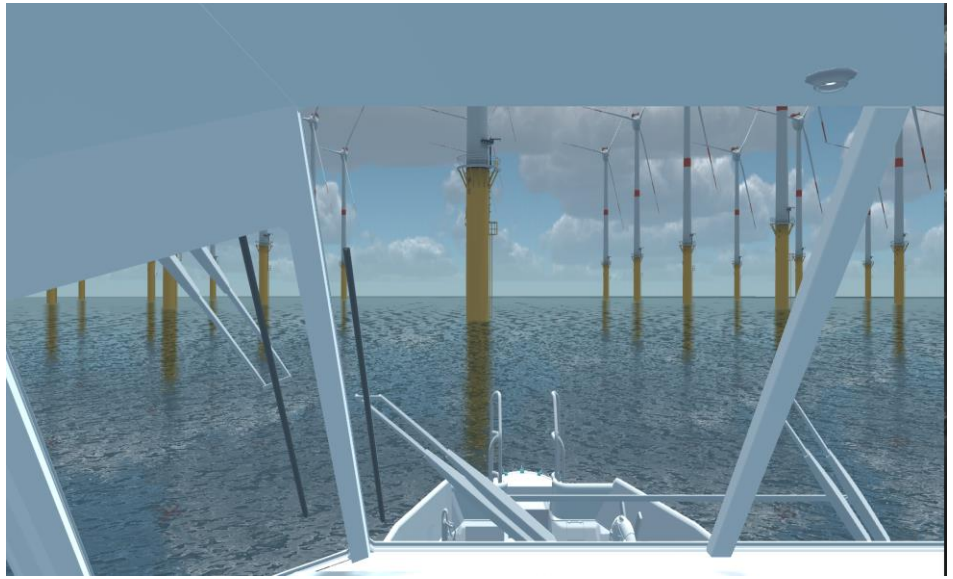
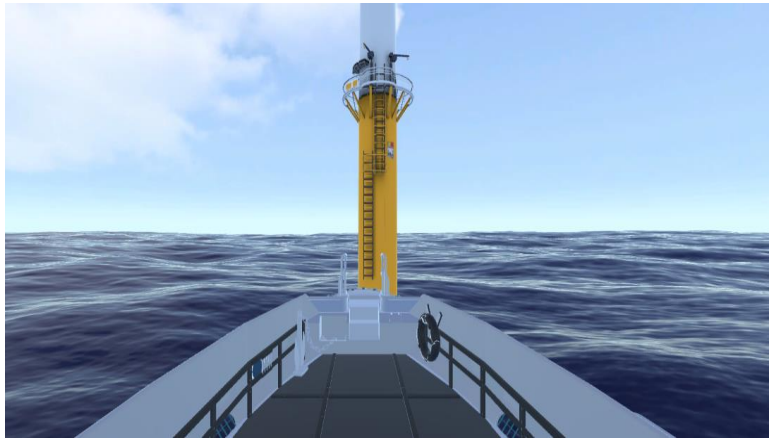
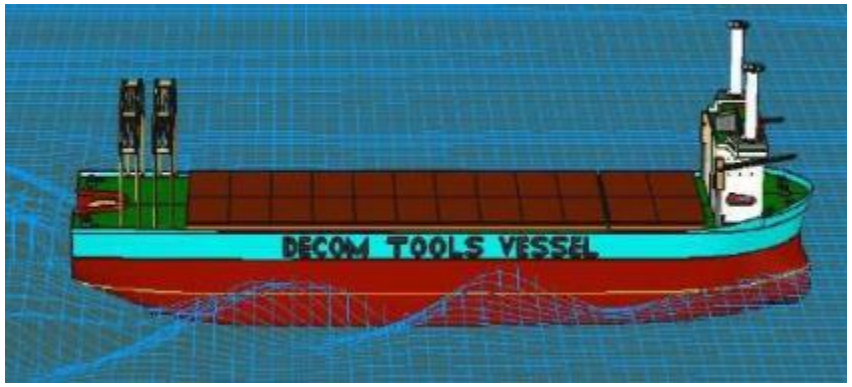
Want more? ;-)









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