DecomDSS
An Overview

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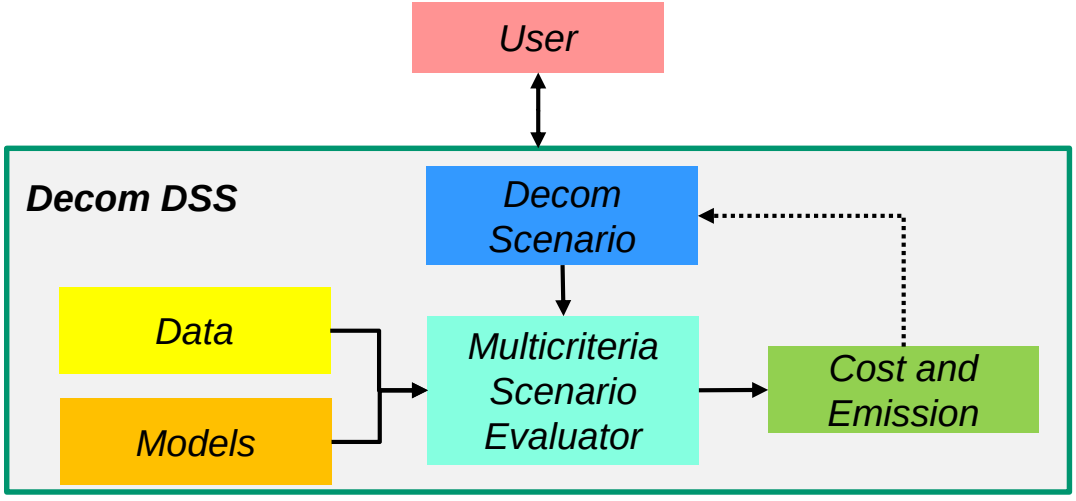
Decommissioning phases & the DecomDSS focus

Project Management	Project Preparation	Offshore Preparation	WTG Removal	Substation Removal	Anemometry Mast Removal	Cable Removal / Leave in Situ	Seabed Clearance	Recycle and Waste Management	Monitoring
Code = 1	Code = 2	Code = 3	Code = 4	Code = 5	Code = 6	Code = 7	Code = 8	Code = 9	Code = 10
Project Management costs throughout PMT Team Responsible for DP development, approval, execution and close out Contract Management Stakeholder engagement Regulatory Authority approvals etc	Engineering Procurement Surveys - Topsides - Foundation seabed area - Souring protection - Cable routing and status Pre Lifting Plan Approval Facilities inspection of lifting points, identify remedial work Preparation / identification of cables to be cut / removed	WTG, Substation, Mast - De-energise and isolate - Spin blades to required position (WTG) - Final Inspections and remedial work - Installation / certification of lifting points - Removal of loose items - Hot bolting - cutting - Preparation for removal	Wind Turbine Generator - Set up Jack-up or HLV in place - Unbolt or final cut for removal - Single lift, per blade, two blade + nacelle, or piece by piece removal Foundation (monopile, tripod or jacket) - Set up/adjust Jack-up or HLV in place - Unbolt or cut TP and lift to lifting or transportation barge - Excavate around seabed cutting level (if required) - Deploy ROV and cut at seabed desired level - Single Lift to lifting vessel or transport barge	Substation - Set up Jack-up or HLV in place - Unbolt or final cut for removal - Single Lift Jacket - Set up/adjust same Jack-up or HLV in place - Excavate around seabed cutting level (if required) - Deploy ROV and cut at seabed desired level - Single Lift Jacket to lifting vessel or transport barge	Mast - Can use smaller lift vessel - Unbolt or final cut for removal - Single lift Foundation - Monopile similar to WTG - Set up Jack-up or HLV - Excavate around seabed cutting level (if required) - Deploy ROV and cut at seabed desired level - Single Lift monopile to lifting vessel or transport barge	Removal - Peel method and either cut in pieces or put on reel. - Requires cable installation type vessel Leave In Situ - Cables to be buried - ROV support vessel plus ROV equipped with cable burial equipment	Either removal of, or additional, scour protection Post survey	Scrap or re-use material Onshore dismantling Disposal or delivery for re-use	Ongoing monitoring of sea-bed post decommissioning

DecomDSS Functions

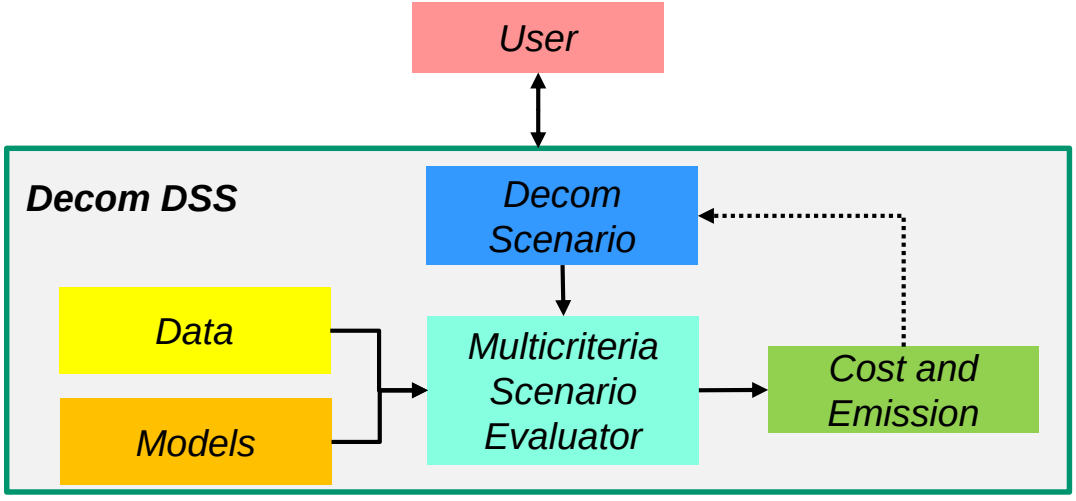
The decision support system allows to

- Define an offshore windfarm
- Define/Set available resources
- Define different removal scenarios
- Evaluate a removal scenario for its Cost and Emission



DecomDSS Features

- Expandable to different levels of detail
- Can be used for different scenarios
- Generic; can be used for different windfarms, types of wind turbines, etc
- Expandable to include new set of data (as new technologies emerge)
- User friendly



Data

Windfarm Product Model
for
Decommissioning and Recycling

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A Decision Support System for Decommissioning of Offshore Windfarms: The Data Platform

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***Abstract*—This paper presents a data protocol for storing the information which are required for the planning of windfarms decommissioning. The data protocol is the base of a decision support system software tool which allows its user to define various decommissioning scenarios and to evaluate them against** them against CRE (Cost, Risk, and Environmental impact) measures. This paper elaborates on the first phase of the development of the system and is focused on the data required for decision making and optimisation of the process.

Maheri, A., Jalili Dargalusani, S. (2021) 'A Decision Support System for Decommissioning of Offshore Windfarms: The Data Platform', IEEE Xplore, DOI: https://doi.org/10.1109/EFEA49713.2021.9406248

Models

Sustainable Energy Technologies and Assessments 48 (2021) 101628

Contents lists available at ScienceDirect

Sustainable Energy Technologies and Assessments

journal homepage: www.elsevier.com/locate/seta

Decommissioning cost modelling for offshore wind farms: A bottom-up approach

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ARTICLE INFO

Keywords:
Offshore wind farm
Offshore decommissioning
Cost modelling
Bottom-up approach

ABST

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Economic and environmental assessments to support the decision-making process in the offshore wind farm decommissioning projects

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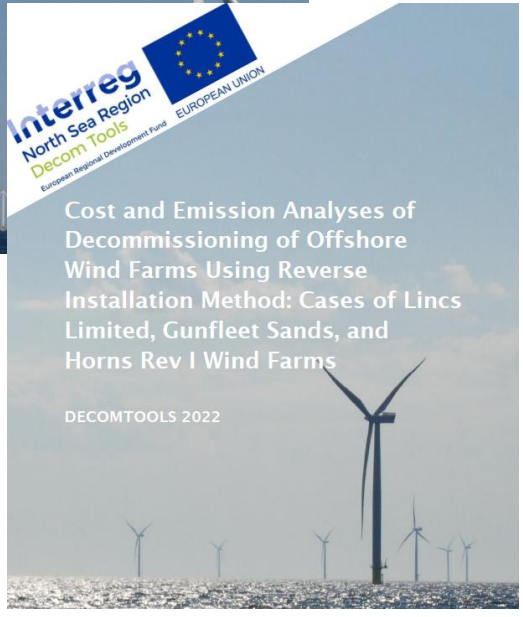
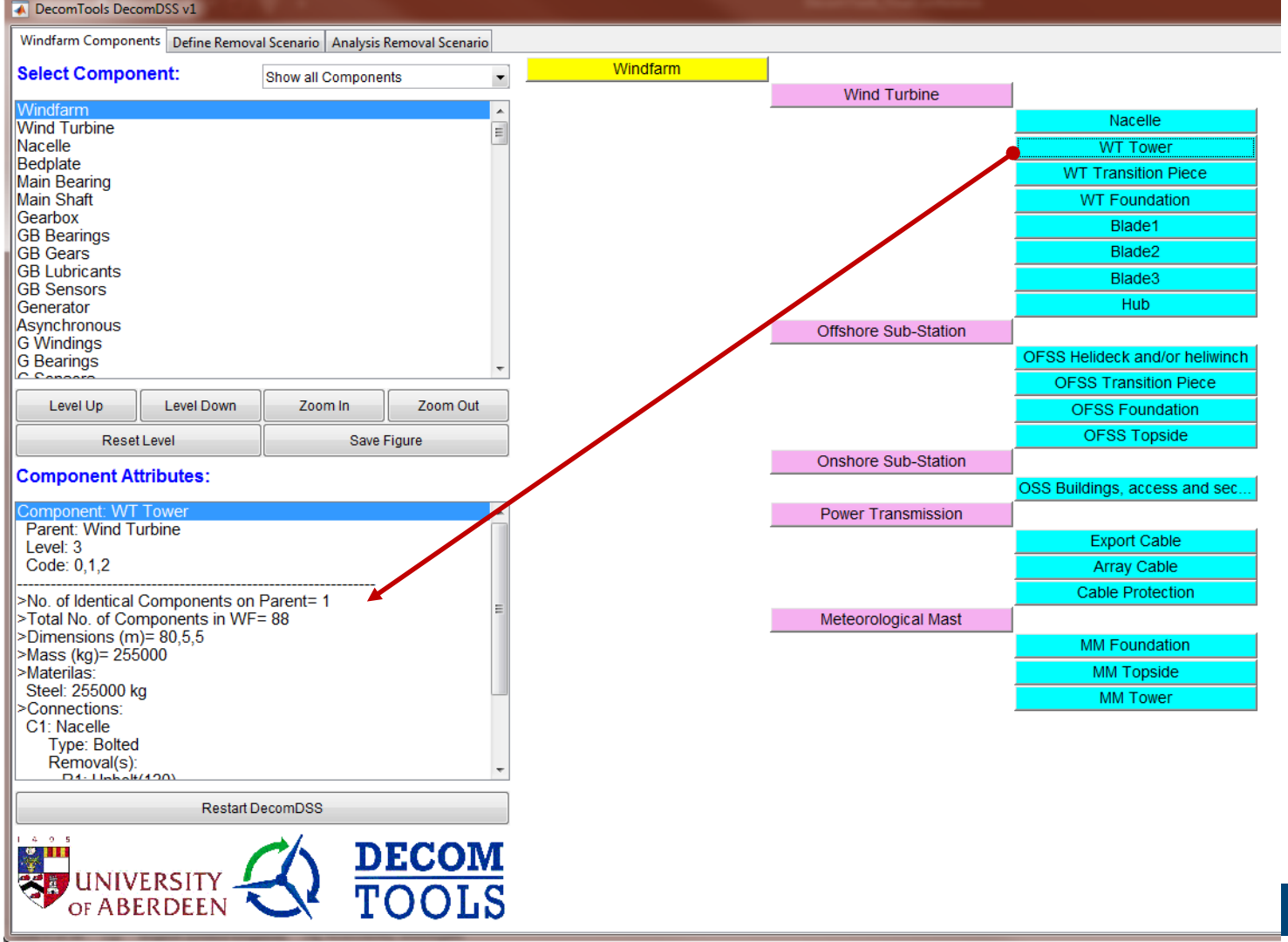
Abstract

The wind energy sector has experienced a significant expansion during the past two decades. With the current global appetite for the further expansion of Offshore Wind Farms (OWFs) as one of the main renewable energy resources, a vast number of OWFs are expected to enter the decommissioning stage in the near future which may potentially create serious environmental and economic challenges to different countries. Hence, effective decision-making procedures are required to protect the environment, taxpayers, and local communities against the potential economic and environmental impacts of OWF assets at the end of their lifetime. This study presents a new approach for economic and environmental assessments of OWF decommissioning projects based on a bottom-up model. The approach formulates the costs and emissions based on the available data and experience in the field and tries to provide appropriate assumptions to predict the costs and emissions caused by the different decommissioning activities. In order to validate and show the applicability of the approach, the cost and emission analyses of two OWF



Interreg North Sea Region European Regional Development Fund | EUROPEAN UNION | DECOM TOOLS | UNIVERSITY OF ABERDEEN

Windfarm in 3 levels of detail



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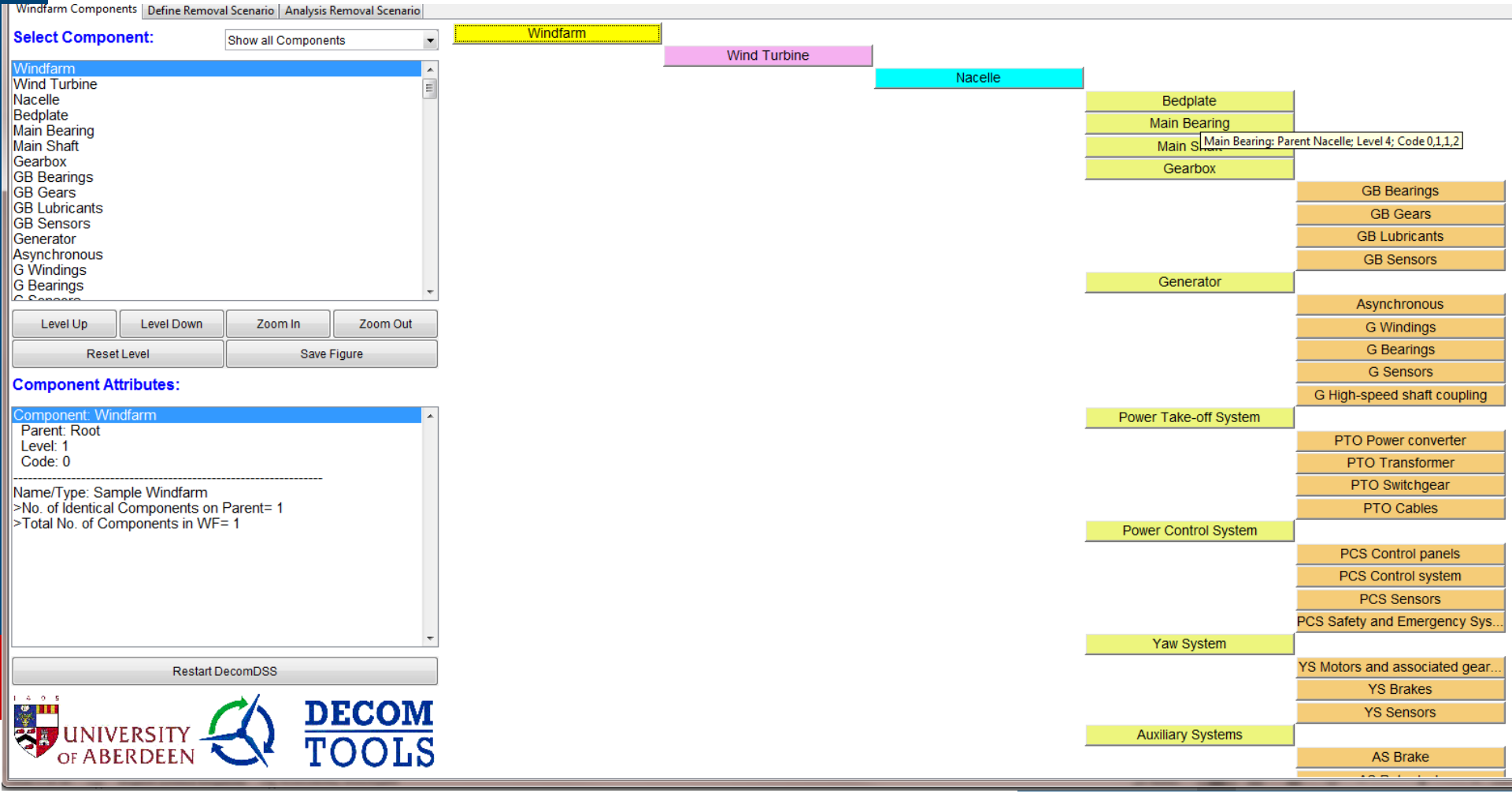
Windfarm in 5 levels



DecomTools DecomDSS v1

Windfarm Components | Define Removal Scenario | Analysis Removal Scenario

Connections (click to combine)

C1:Blade1 * Hub
C2:Blade2 * Hub
C3:Blade3 * Hub
C4:Hub * Nacelle
C5:Nacelle * WT Tower
C6:OFSS Foundation * Seabed OFSS
C7:OFSS Topside * OFSS Transition Piece
C8:OFSS Transition Piece * OFSS Foundation
C9:WT Foundation * Seabed WT
C10:WT Tower * WT Transition Piece
C11:WT Transition Piece * WT Foundation

Cut Method (click >> to select one method)

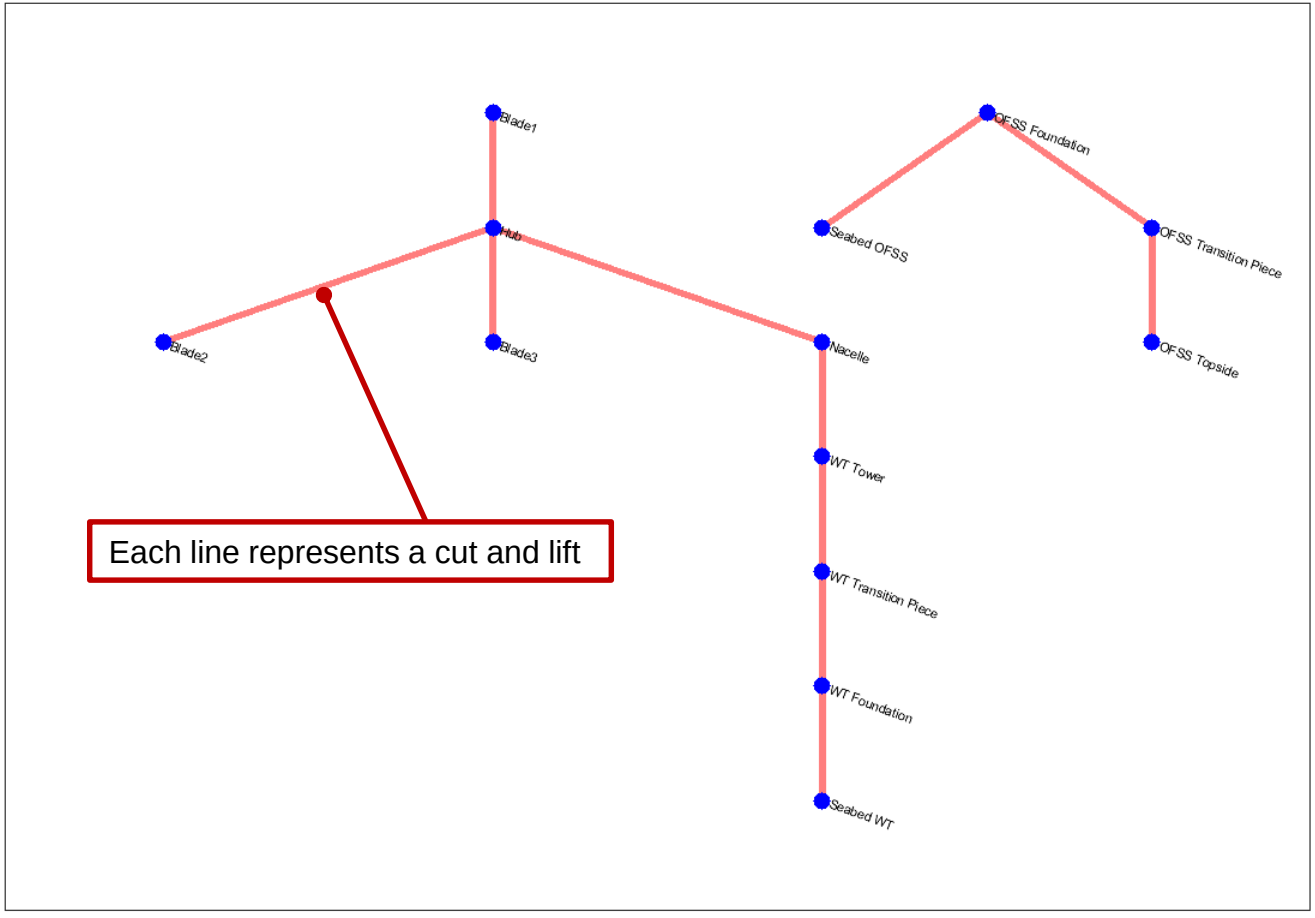
C1: Unbolt(64)
C2: Unbolt(64)
C3: Unbolt(64)
C4: Unbolt(24)
C5: Unbolt(120)
C6: AWJ(5.7,0.06)
C7: Plasma(5,0.05)
C8: Plasma(5.7,0.06)
C9: AWJ(3.4,0.05)
>> C10: Unbolt(100) ; Plasma(5,0.04)
C11: Plasma(3.4,0.05)

Reset Connections

Cut & Lift Order (click on C&L items to change order)

C1:Blade1 * Hub
C2:Blade2 * Hub
C3:Blade3 * Hub
C4:Hub * Nacelle
C5:Nacelle * WT Tower
C6:OFSS Foundation * Seabed OFSS
C7:OFSS Topside * OFSS Transition Piece
C8:OFSS Transition Piece * OFSS Foundation
C9:WT Foundation * Seabed WT
C10:WT Tower * WT Transition Piece
C11:WT Transition Piece * WT Foundation

Check Removal Scenario



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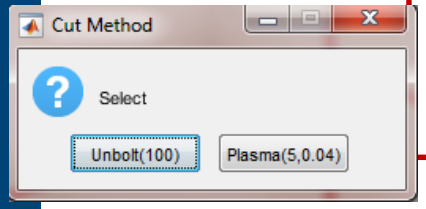
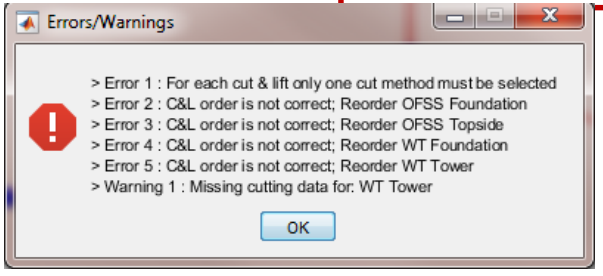
DECOM TOOLS

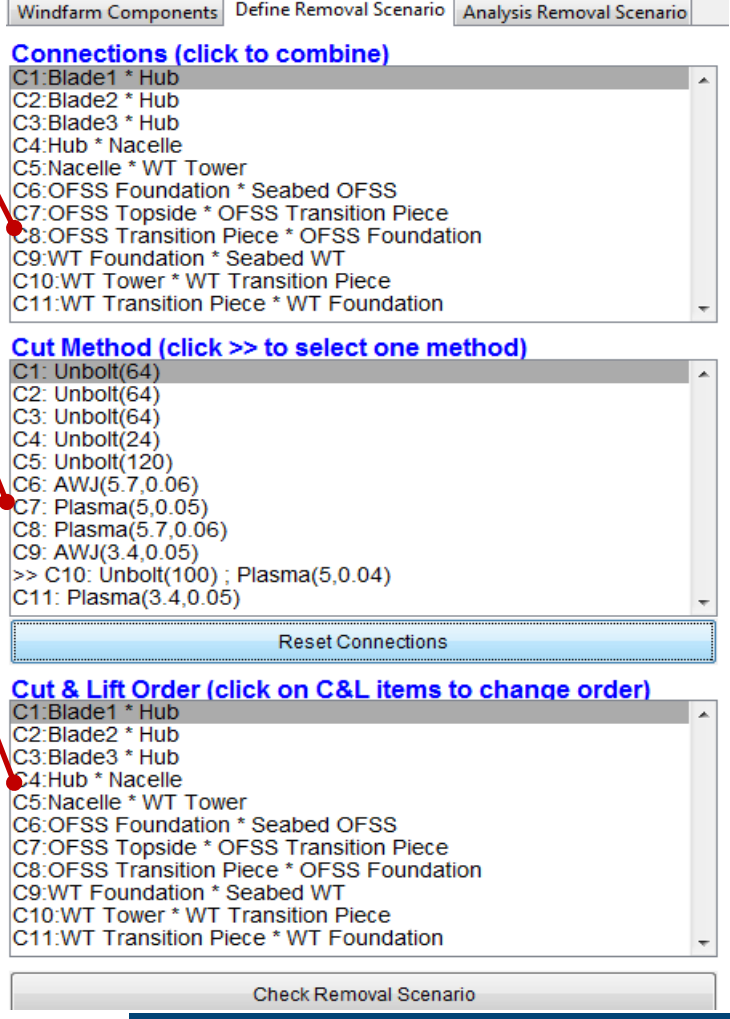
- List all available connections
- Allows for combining components, hence defining different scenarios

- Data required for estimating the cutting time
- In case of '>>' there are more than one option. The user needs to select one

Checks for the
- Right order → error if not
- Cut data → warning editable in the next step
- Capacities

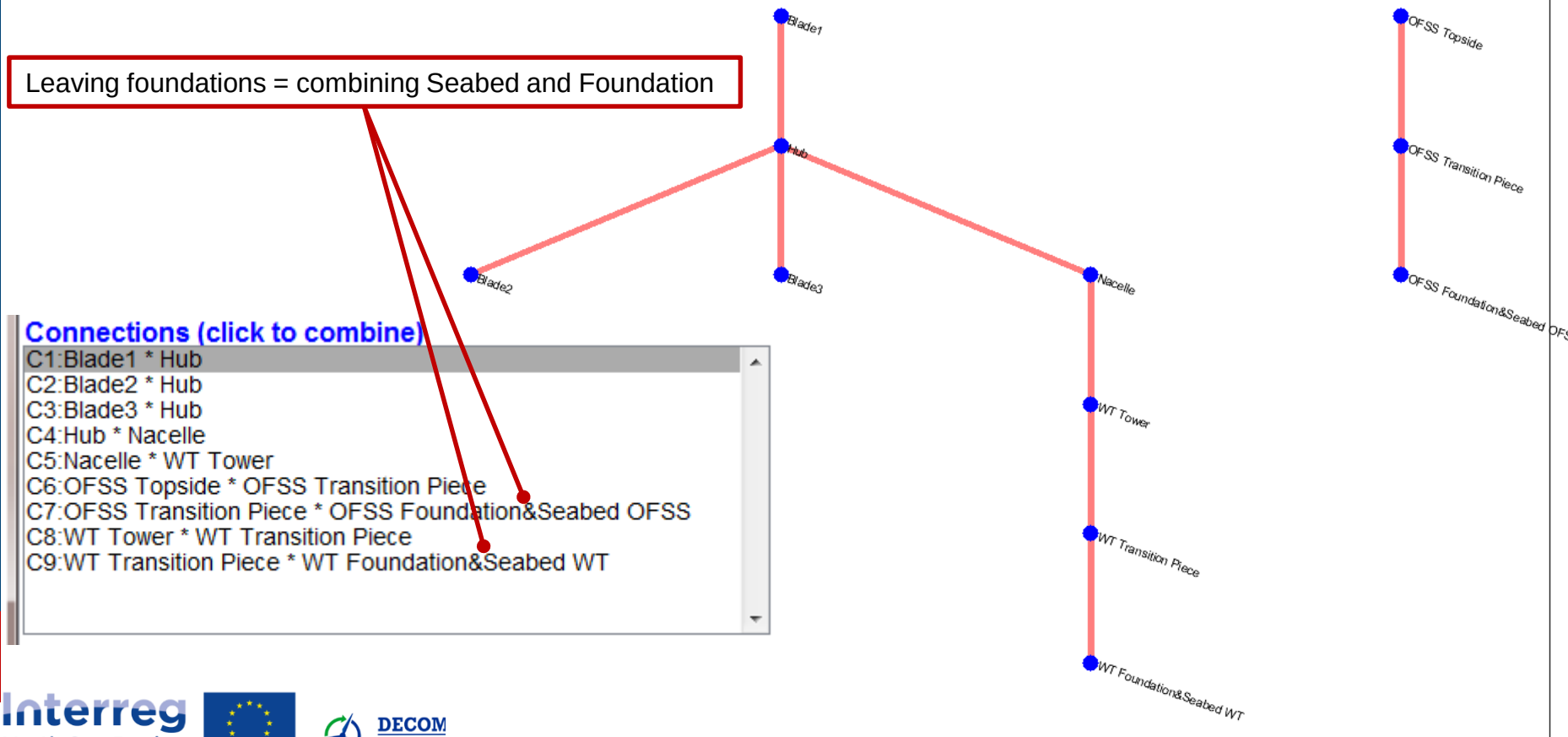






Leaving Foundations

Leaving foundations = combining Seabed and Foundation

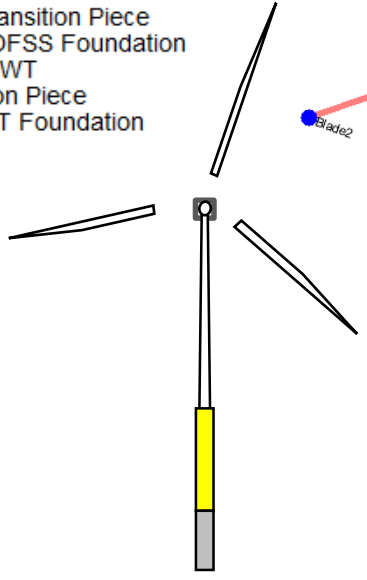


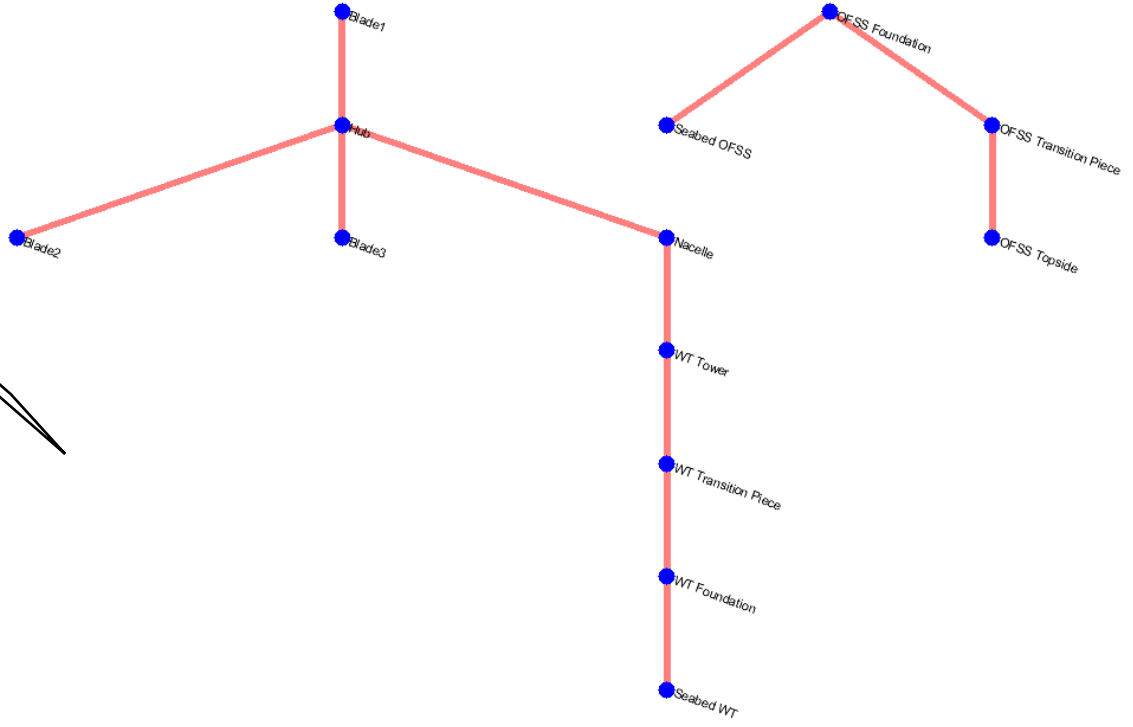
Cut and lift blade by blade, then reverse installation

Windfarm Components | Define Removal Scenario | Analysis Removal Scenario

Connections (click to combine)

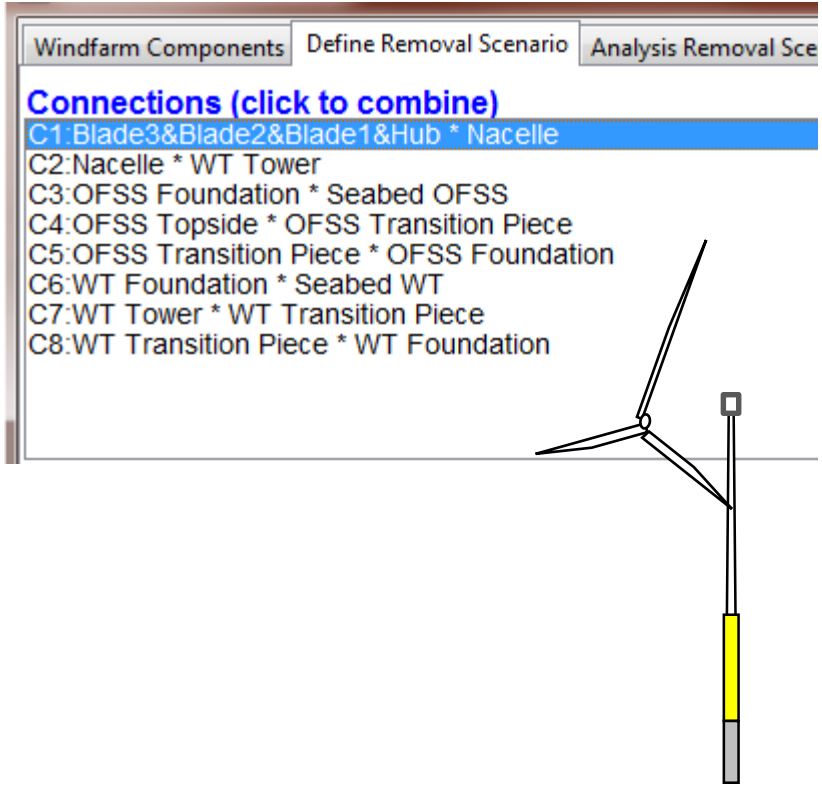
- C1:Blade1 * Hub
- C2:Blade2 * Hub
- C3:Blade3 * Hub
- C4:Hub * Nacelle
- C5:Nacelle * WT Tower
- C6:OFSS Foundation * Seabed OFSS
- C7:OFSS Topside * OFSS Transition Piece
- C8:OFSS Transition Piece * OFSS Foundation
- C9:WT Foundation * Seabed WT
- C10:WT Tower * WT Transition Piece
- C11:WT Transition Piece * WT Foundation

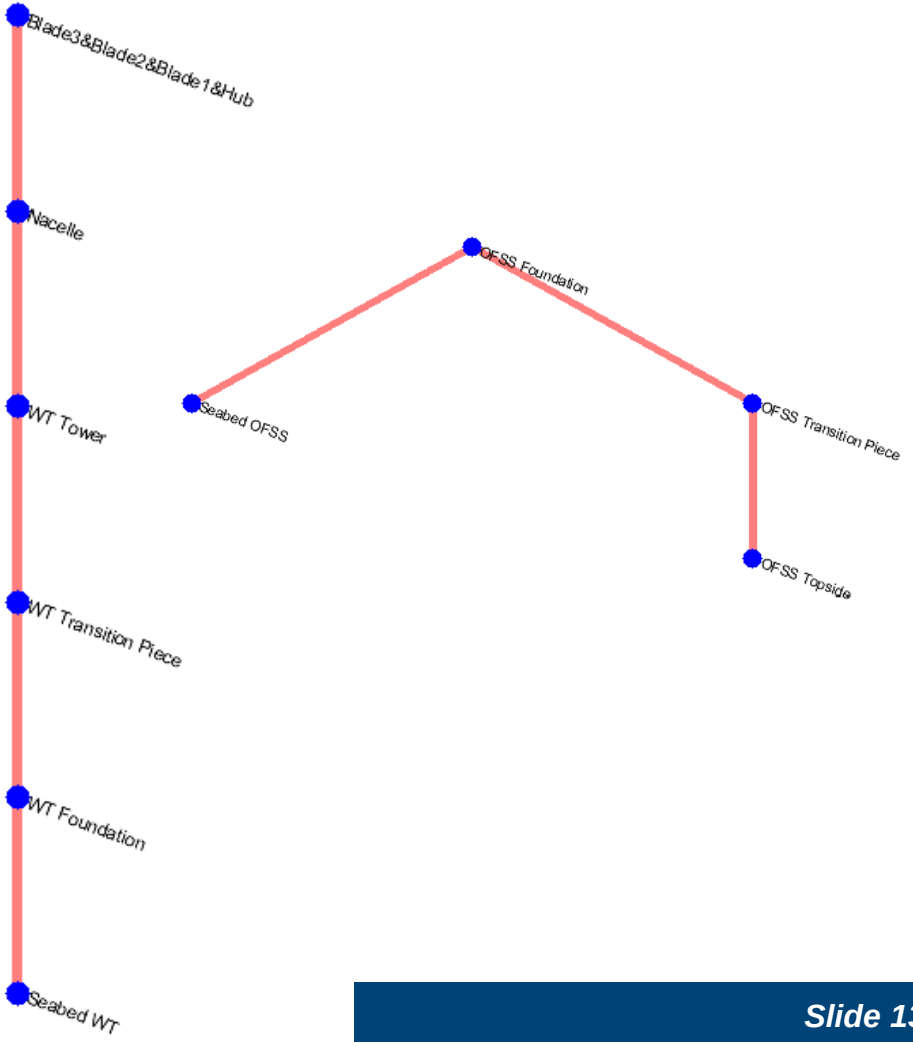




Rotor as a whole

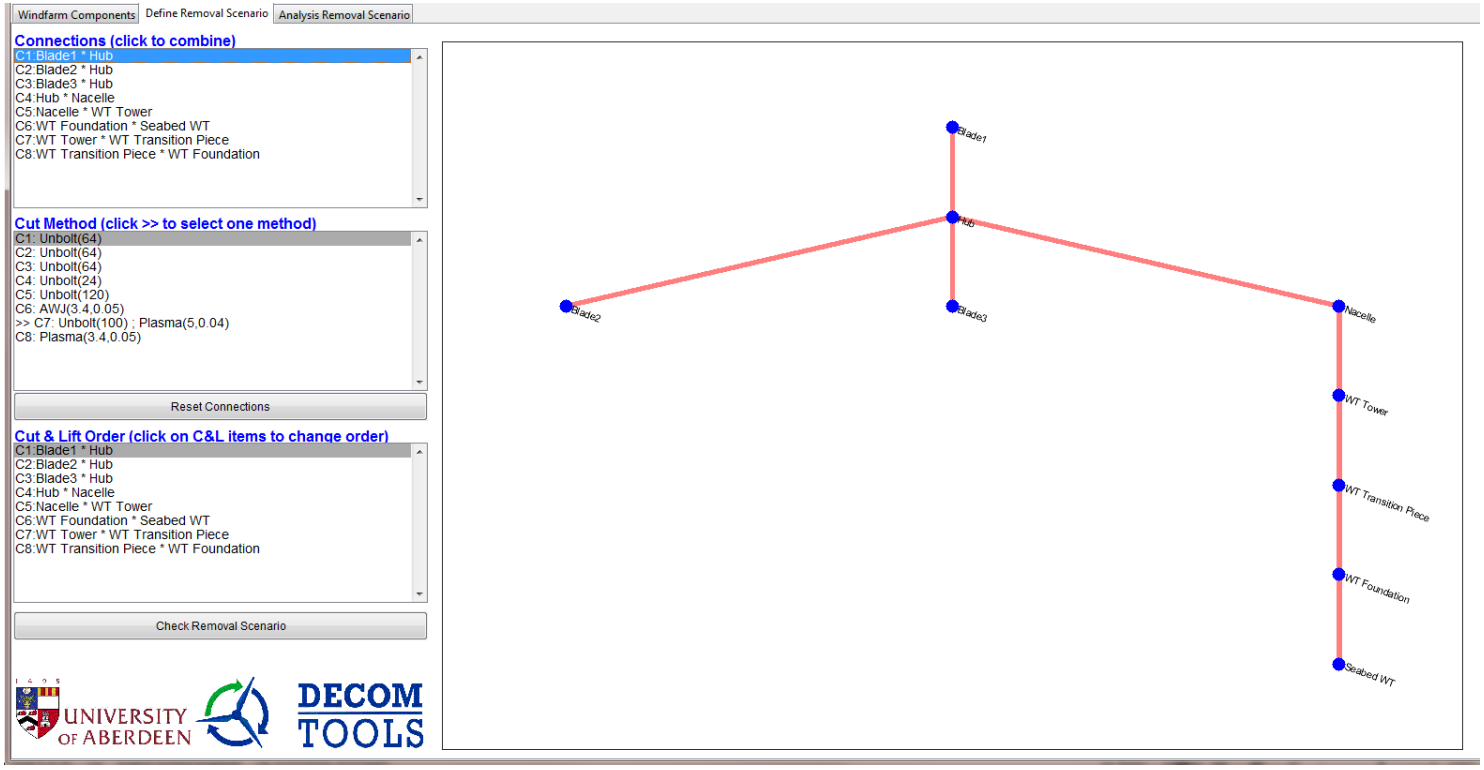
Rotor as a whole= combining all 3 blades and the hub





Excluding offshore substation from removal

Excluding offshore substation from removal= combining offshore substation seabed, foundation, transition piece and topside



Evaluation

Windfarm Components | Define Removal Scenario | Analysis Removal Scenario

Editable

Editable

Component	Mass (tone)	Cut Method	#bolts/D,tw (m,m)	Removal Speed (bolt/hr, mm/hr)	Positioning Time (hr)	Removal Time (hr)	No. in WF	BV Capacity
Blade1	12	Unbolt	64	30	3	5.1	88	90
Blade2	12	Unbolt	64	30	0.5	2.6	88	90
Blade3	12	Unbolt	64	30	0.5	2.6	88	90
Hub	4	Unbolt	24	30	0.5	1.3	88	1000
Nacelle	70	Unbolt	120	30	1	5	88	70
WT Tower	255	Plasma	5,0.04	41900	2	2.4	88	60
WT Transition Piece	260	Plasma	3.4,0.05	33500	1	1.3	88	20
WT Foundation	1200	AWJ	3.4,0.05	4800	3	5.2	88	20

Using built-in models and the data in the previous column; also editable

Default values, but editable

Deterministic Analysis

Total Removal Time (Days)

No. of TB/BV Trips

Cost (m£)

Emission (ton CO2)

Thank You!