

The impact of additional weather limitations on weather windows for floating offshore wind

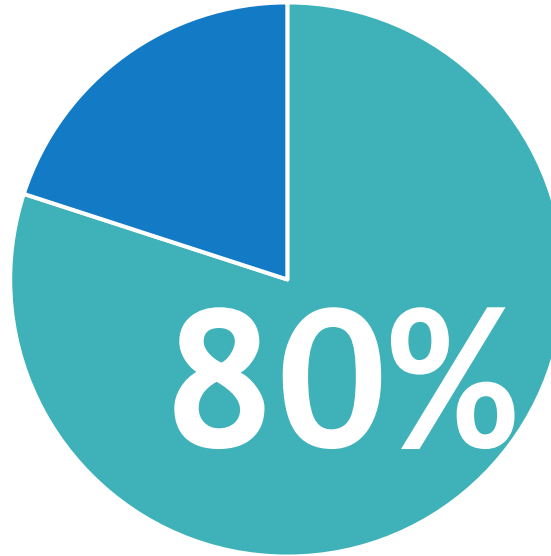
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Wind and Marine Energy Systems and Structures, Centre for Doctoral Training,
University of Strathclyde

<https://www.wamss-cdt.co.uk/>

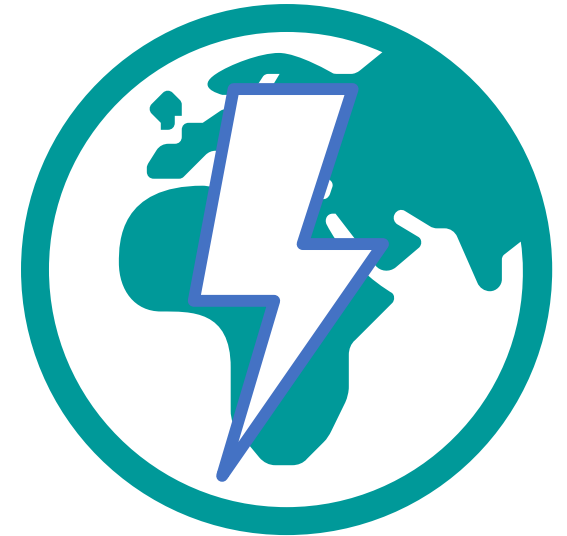
Floating Wind Overview

At present, fixed offshore wind sites are limited to
~50m water depth



of all the offshore wind resource is located in waters 60 m and deeper in European seas

14 GW of floating wind installed or in construction by 2030



Wind Europe, "Floating Offshore Vision Statement", 2017

O&M Challenges

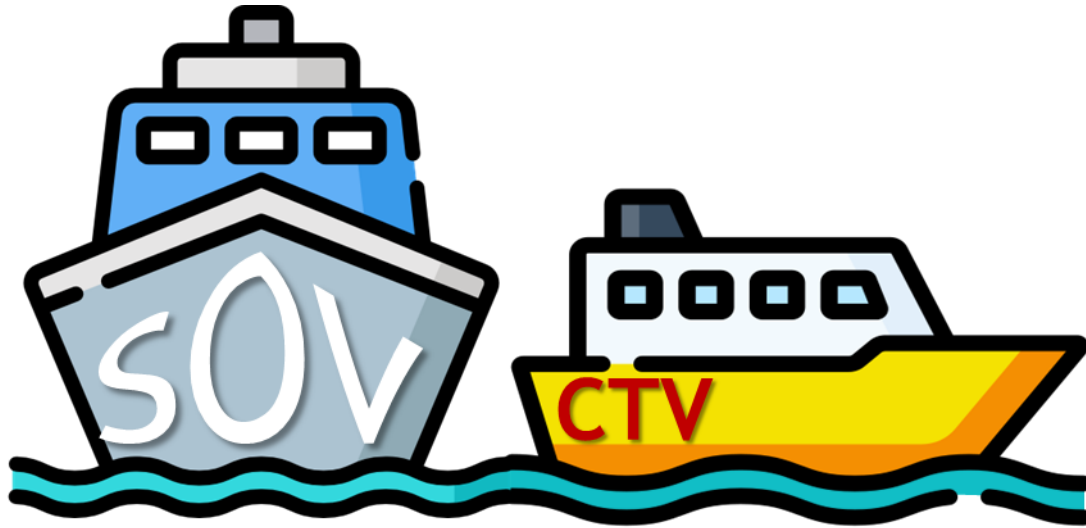


Harsher conditions and increased distance means weather windows are more critical

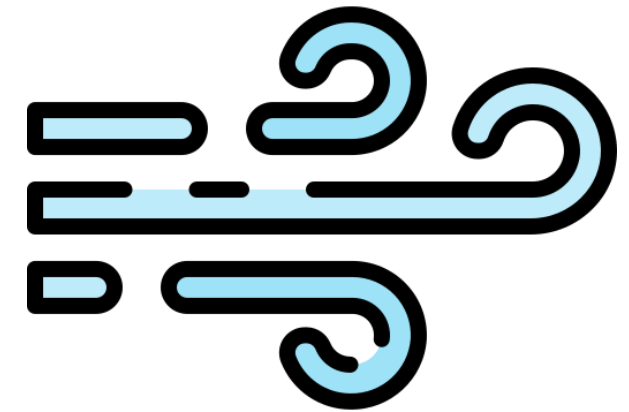


LCOE - Levelised Cost of Energy

Fixed Bottom Offshore Wind Limitations



Significant Wave Height
 H_s

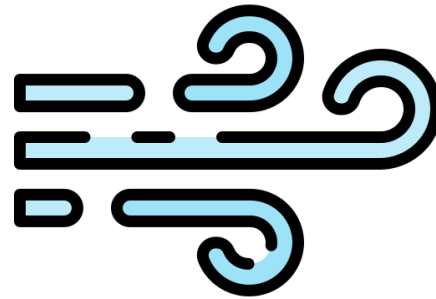


Wind Speed

Floating Wind Limitations



H_s



Wind Speed

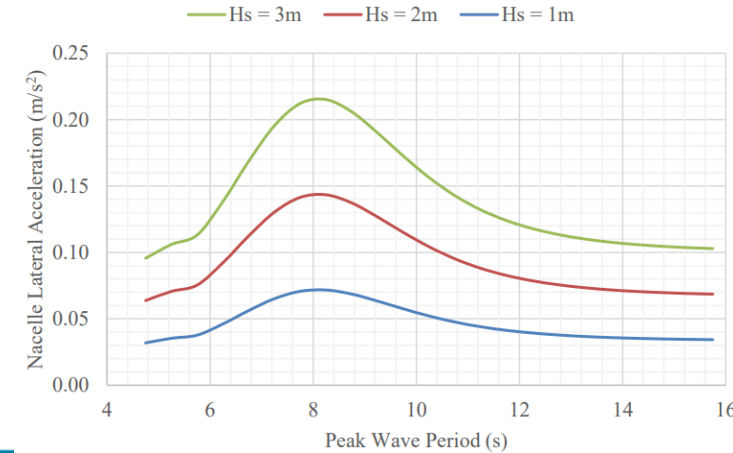
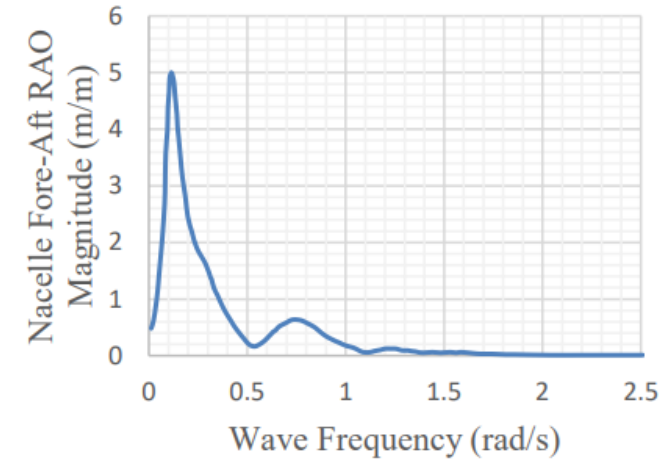
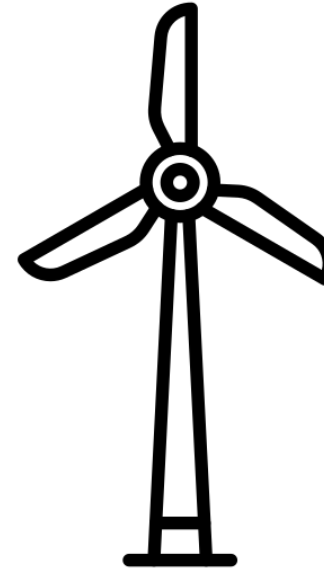


Workability

Workability



Peak Wave Period
(T_p)



Scheu, M. 2018, June. Workability on Offshore Wind Turbines-a Comparative Study of Fixed-Bottom and Floating Applications. In The 28th International Ocean and Polar Engineering Conference. OnePetro.

Workability



Eliminate motion induced sickness in technicians

$$WI = \frac{\textit{Workable Time}}{\textit{Total Duration}}$$

RAMBOLL



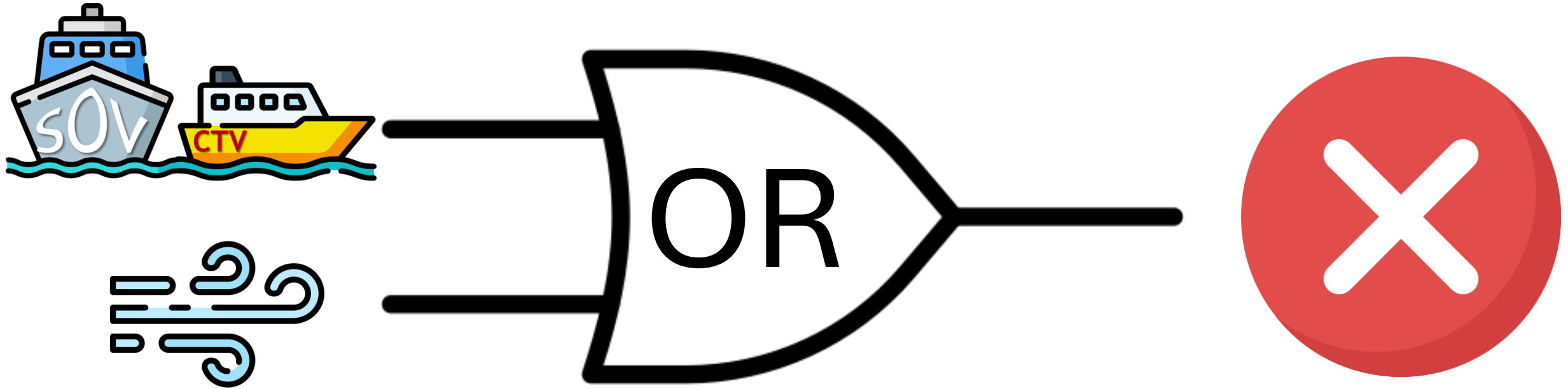
Workability vs Accessibility - “Design D”

Hs \ Tp	4	5	6	7	8	9	10	11	12	13	14
1	0.033	0.064	0.075	0.025	0.030	0.026	0.024	0.019	0.010	0.008	0.003
1.5	0.002	0.040	0.060	0.026	0.029	0.013	0.016	0.015	0.009	0.006	0.003
2	0.000	0.006	0.056	0.031	0.024	0.013	0.008	0.009	0.009	0.003	0.002
2.5	0.000	0.000	0.016	0.039	0.022	0.013	0.005	0.004	0.004	0.002	0.001
3	0.000	0.000	0.002	0.020	0.026	0.011	0.006	0.002	0.002	0.001	0.001
3.5	0.000	0.000	0.000	0.004	0.023	0.010	0.006	0.002	0.001	0.001	0.000
4	0.000	0.000	0.000	0.000	0.010	0.011	0.005	0.002	0.001	0.000	0.000
4.5	0.000	0.000	0.000	0.000	0.002	0.007	0.004	0.001	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.004	0.003	0.002	0.000	0.000	0.000
5.5	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.001	0.000	0.000	0.000

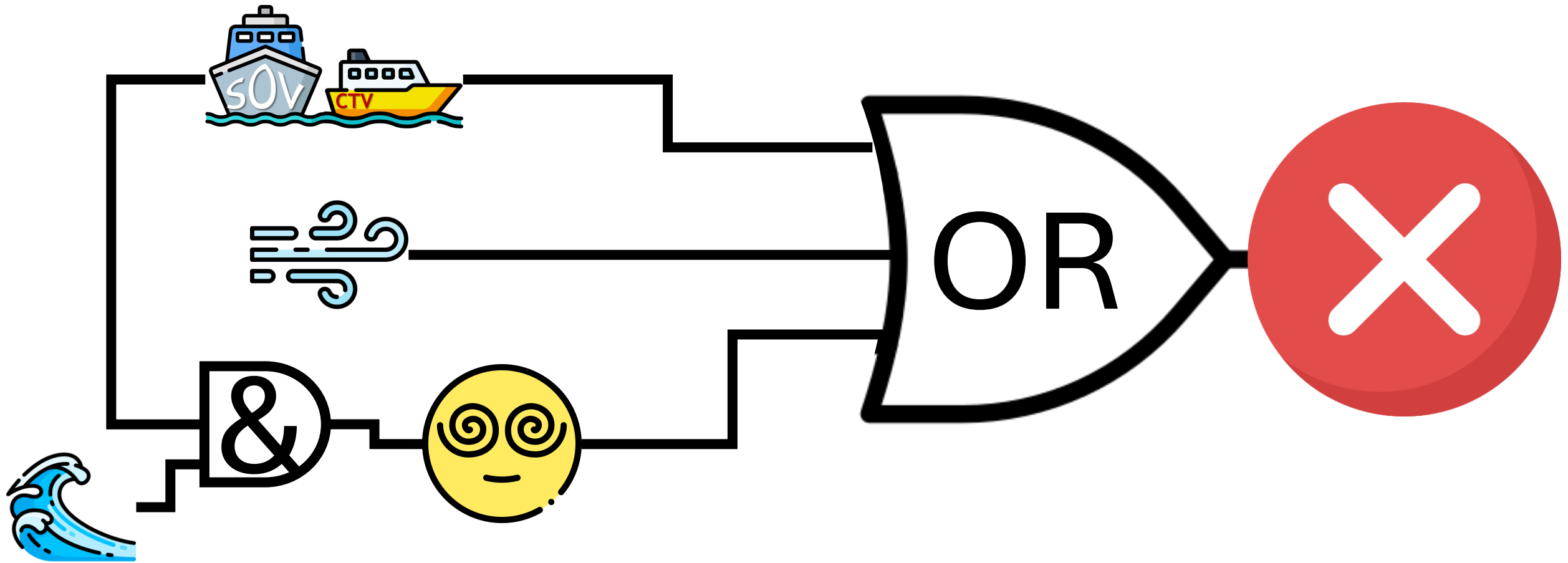
SOV Limitations

WI Limitations

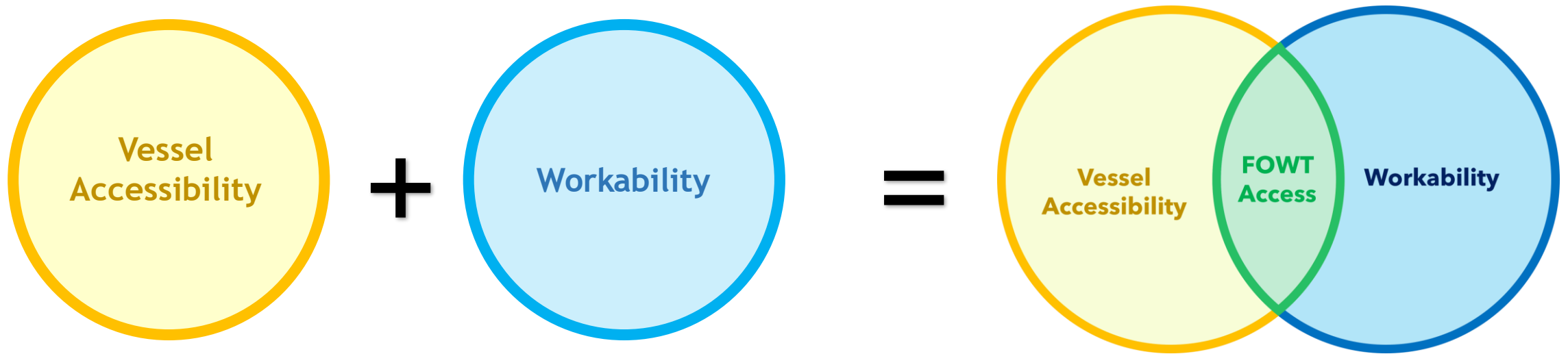
Access Limitations



Access Limitations + Workability



Workability vs Accessibility



Impact



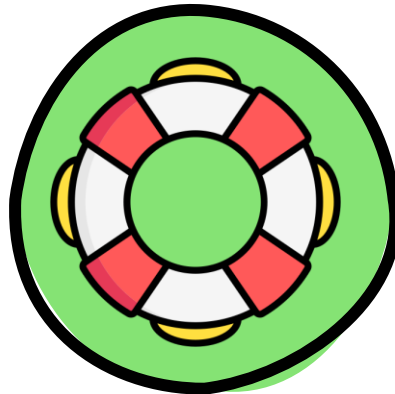


HOW?

WHEN?

WHAT?

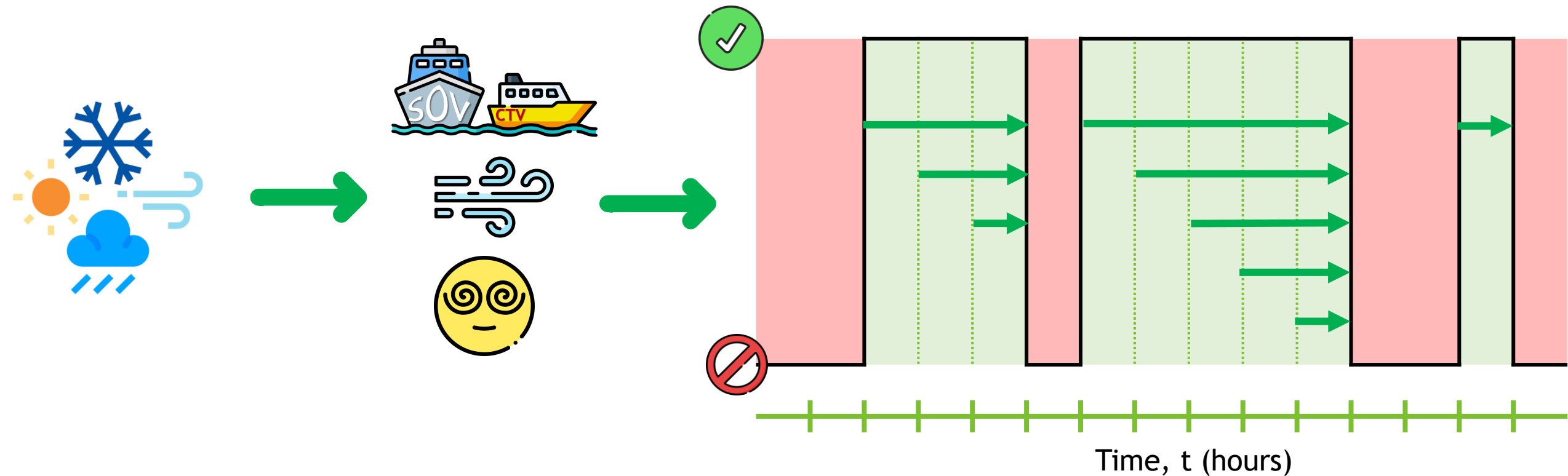
Case Study



RAMBOLL

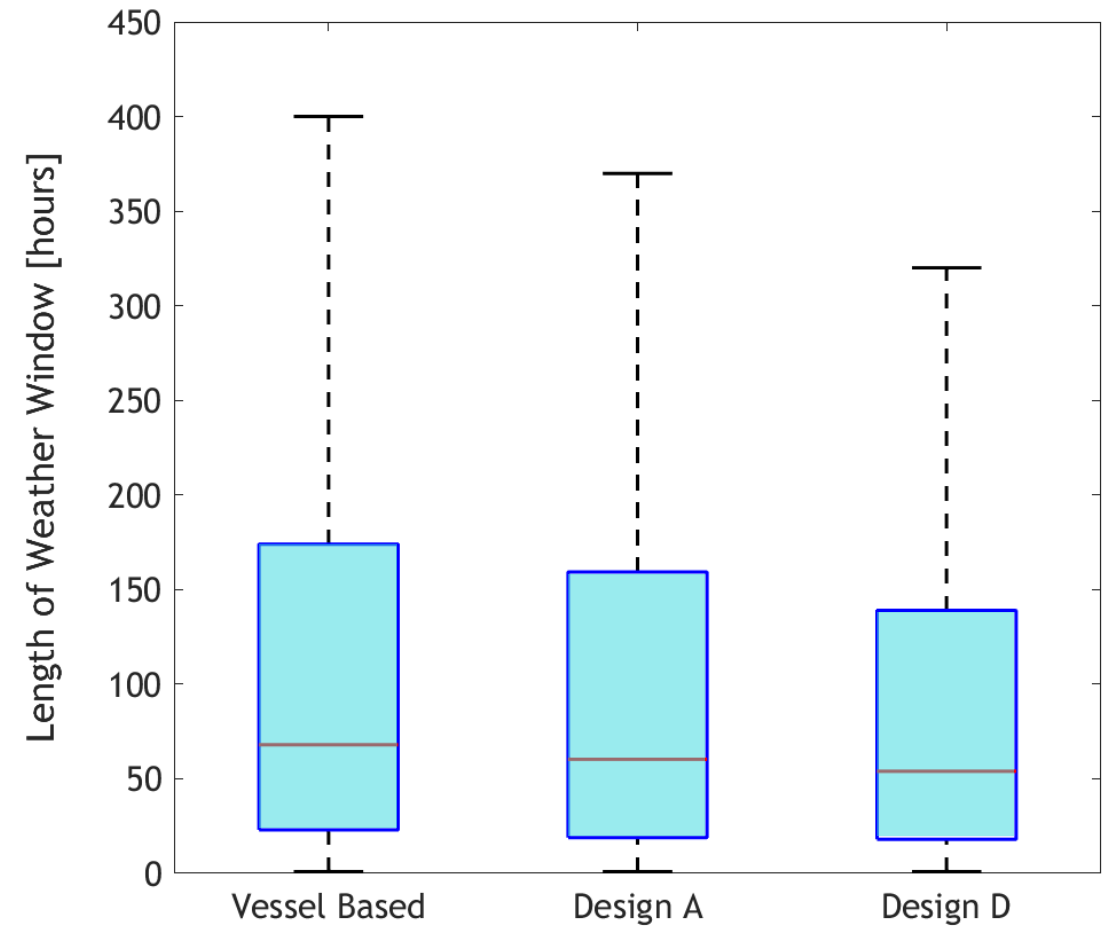
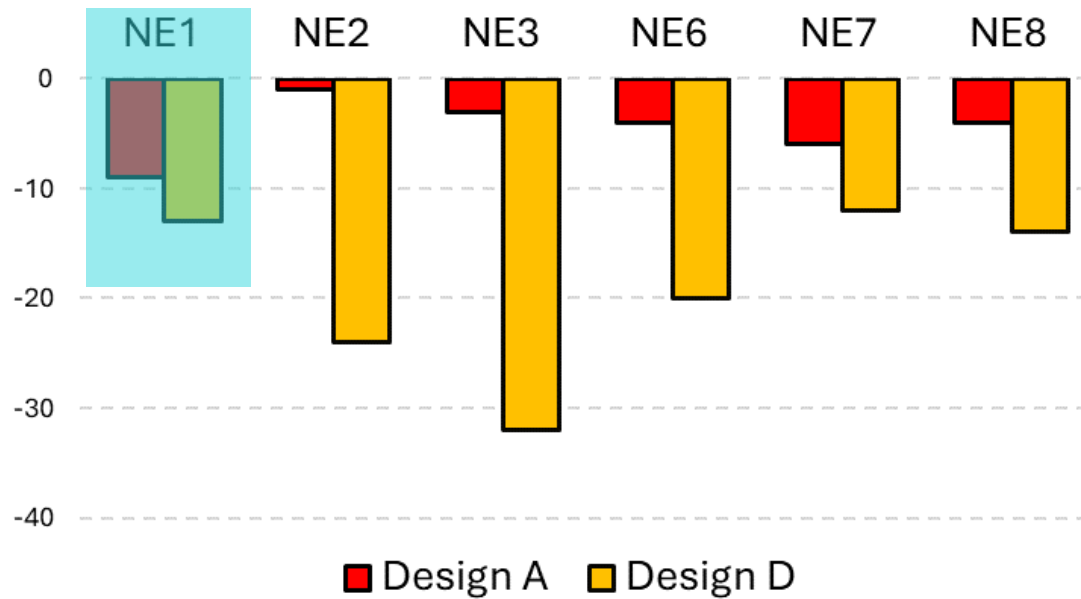


Weather Window Modelling

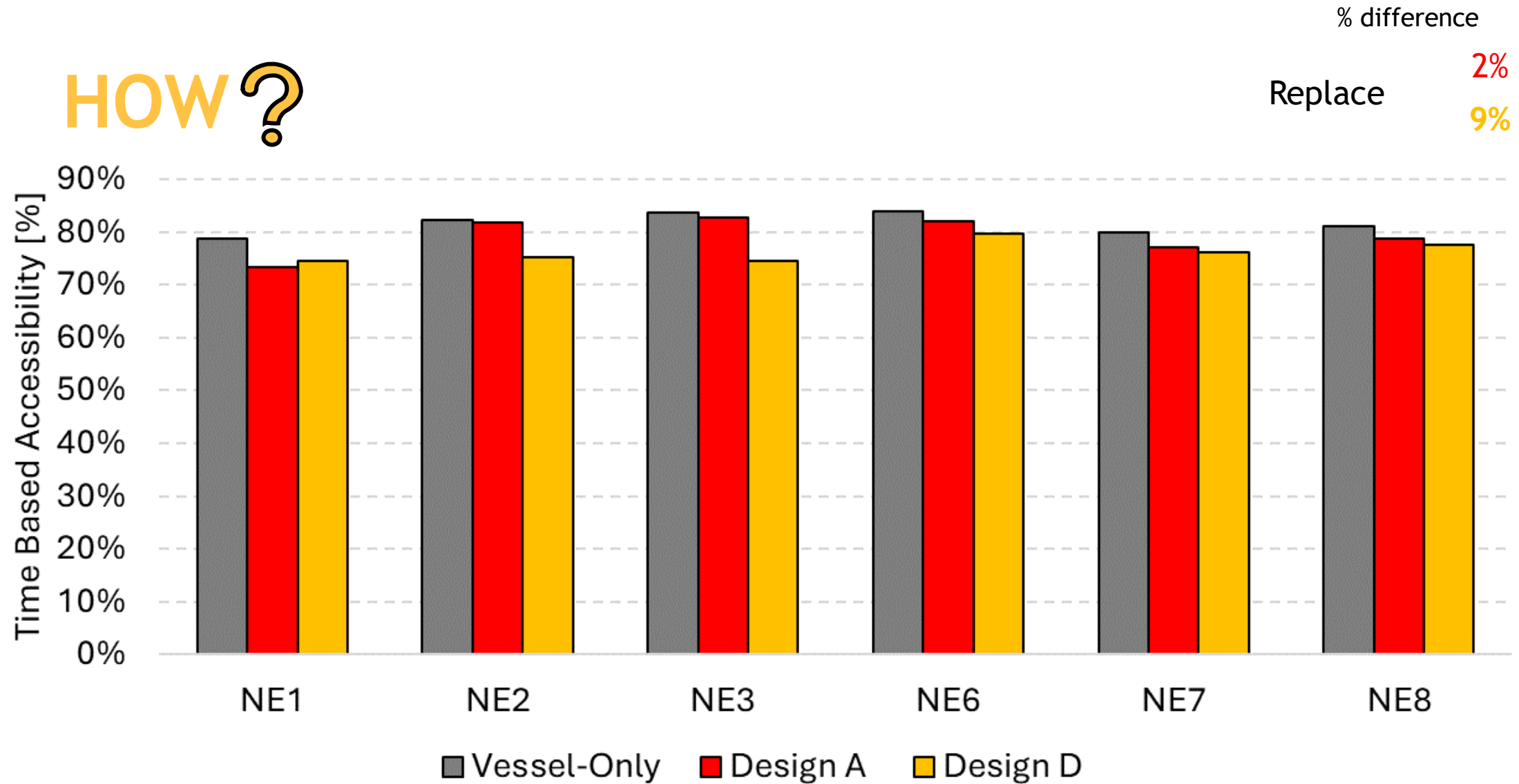


HOW?

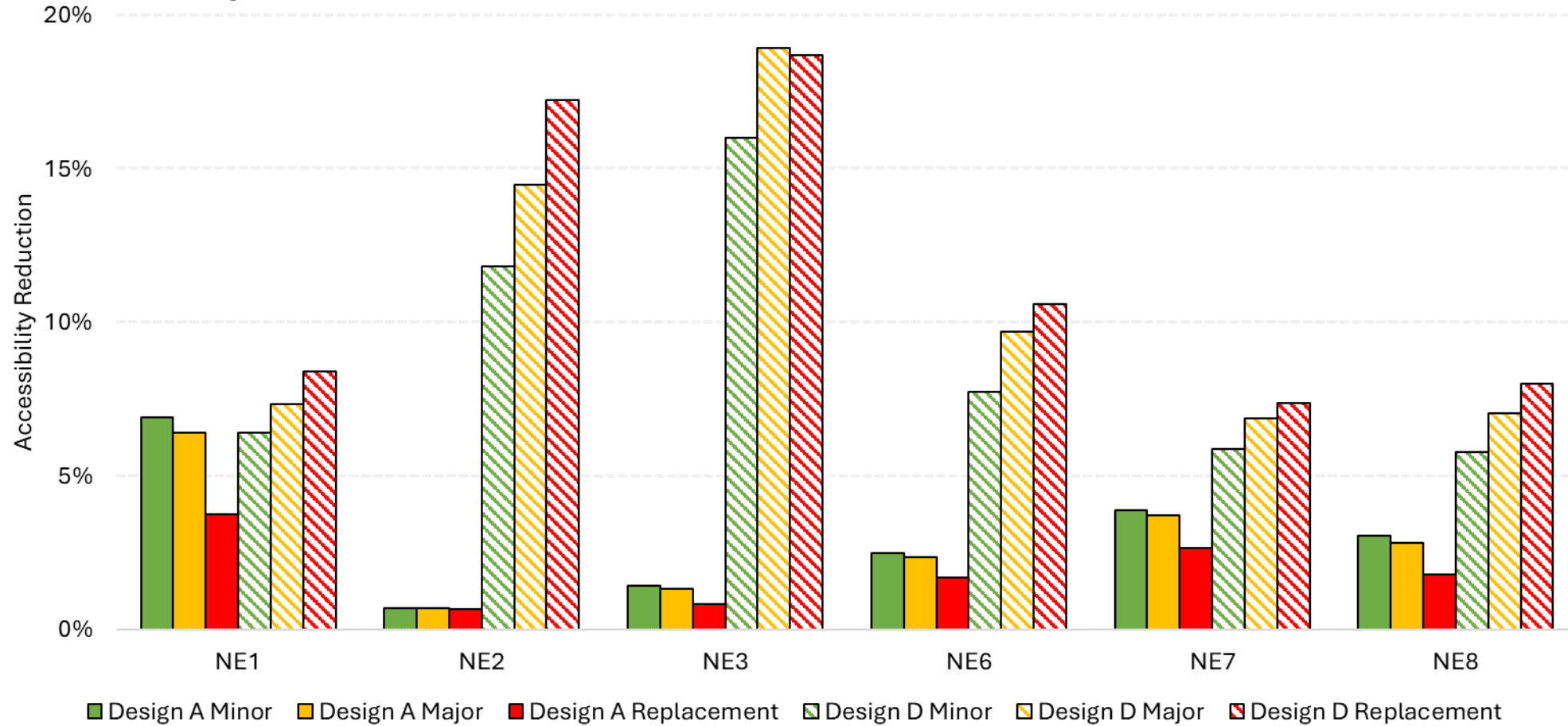
P50 Weather Window Length Reduction



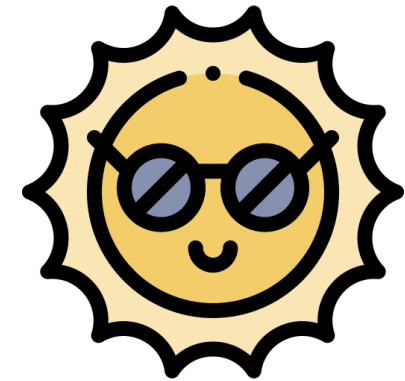
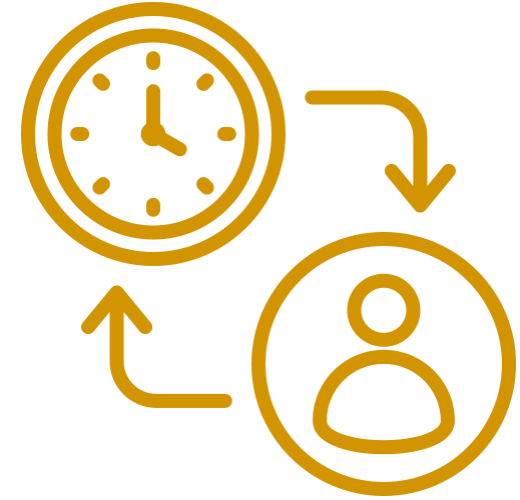
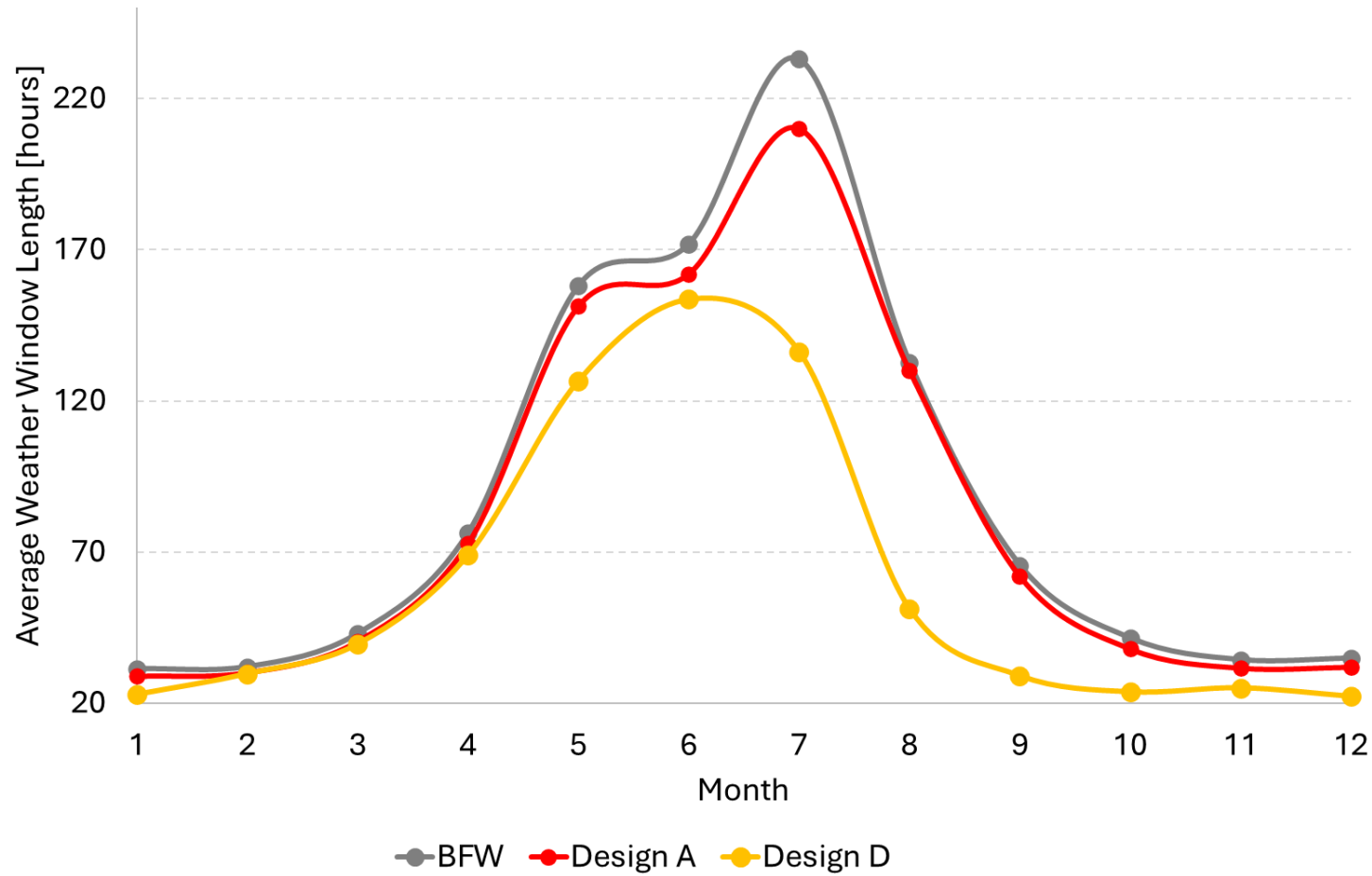
HOW?



HOW?



WHEN ?



WHAT?

15%

Average increase
in OpEx for
on-replacement
operations

Conclusions



Unique results for
each substructure
design



SOV strategy sites
will see a more
significant impact



What is an
acceptable WI?



Effective
scheduling
Required



Strathclyde Floating
Wind Research Group



LinkedIn



Publications



WAMSS CDT