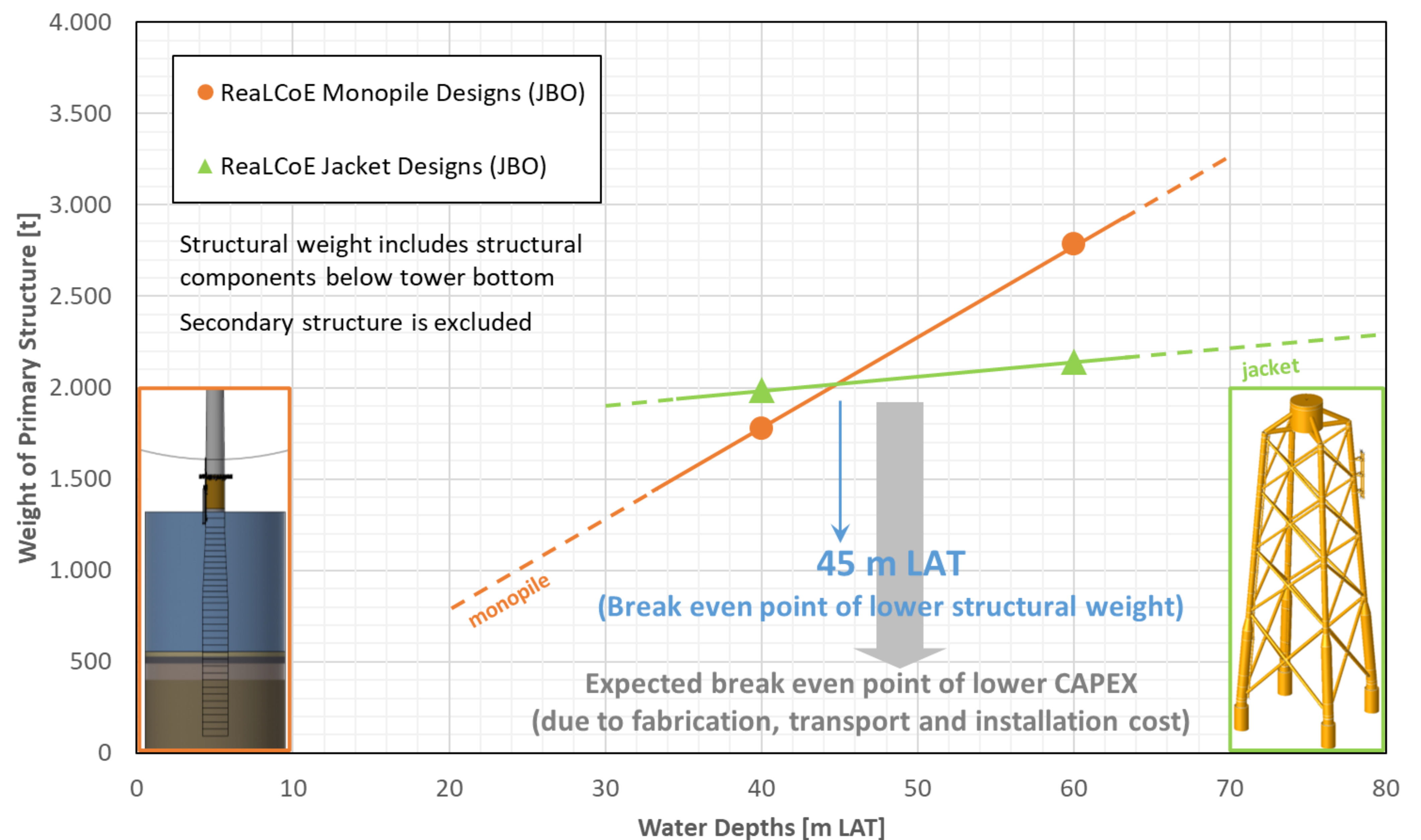


Water Depth Related Assessment of Bottom Fixed Foundation Types

As part of the ReaLCoE project different types of bottom-fixed foundations such as monopile, jacket and gravity base have been assessed and optimised. Monopile and jacket have also been compared for different water depths with site specific designs for 40m and 60m water depth and typical north sea soil conditions. Source 1 contains further details.



Comparison of monopile and jacket regarding substructure primary steel weight

Monopile design for deeper waters

Designing monopiles for 60m water depth primary steel weight increases by about 1,000 tons compared to 40m depth. Optimisation studies result in an increasing diameter from 9.5m to 11m.

The huge single piece weight affects the overall design and the necessity of interfaces. Mass limits are defined by fabrication and installation constrains. While monopiles at 40m depth might have a TP-less design, 50m depth will require a transition piece in the above water area. Higher water depth may require an interface even below water line.

Jacket design aspects

Although jacket structures are lighter than monopiles, necessary pile lengths and weights make the overall foundation even heavier for shallow conditions. Optimisation studies result in an increasing footprint from 23,25m to 30m going from 40m to 60m water depth.

Comparison of monopile and jacket

Comparing primary steel weights of monopile and jacket between 40m and 60m water depth shows a differentiated picture. While the monopile is the lighter type of foundation at 40m conditions, the jacket gets lighter for deeper conditions. A linear interpolation leads to the fact that 45m water depth is the break even point defining either monopile or jacket as steel weight optimised structure. All structural masses below tower bottom have been considered in the comparison except secondary steel components.

It is known that fabrication, transport and installation aspects are much more cost-intensive for jacket foundations compared to monopile. Thus, the break even point of lower CAPEX is expected at a much higher water depth leading to the fact that the monopile is a competitive foundation type up to 50m depth.

In any case, the 1st natural frequency of a monopile is about 20% lower compared to a jacket foundation.

Source

1. ReaLCoE consortium (JBO, PPI, DTU, DNV, GE). „Deliverable 1.3 - Reports opt. fixed/floating substructures (Conceptual Design Substructures)”, Report, , version 1.0, 29.02.2024

ReaLCoE's vision is to unleash the full potential of offshore wind energy
 €35/MWh LCoE Goal, +12MW WEC Capacity, ~32 mio € Total Budget, 42 month project duration



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