

Hull Vane® submerged wing

Stern-mounted submerged wing vs the same 500 GT superyacht without the wing (BAU)

1 INTRODUCTION

Hull Vane is a patented submerged wing mounted at the stern of a yacht. It is a structural element that adds comfort and improves ship efficiency. The wing is made of SJ355 steel, weighs 3.1 t and lasts 20 years, the same as the yacht.

2 METHODOLOGY

Functional unit. 1 hour of use. Use profile: 630 h of use (30 h fast cruise, 600 h slow cruise); 12,600 h over the 20-year yacht life (PCR).

System boundaries. Only processes that differ between scenarios; processes common to the yacht are excluded. BAU: propulsion diesel in the use phase only. Hull Vane: full wing life cycle. *Upstream*: steel, coating and antifouling paint, paint packaging. *Core*: transport, plasma cutting, cold forming, welding, sandblasting, painting, distribution (average 755.74 km to 17 shipyards). *Downstream*: assembly, use, repainting every 2 years, disassembly, end of life (100% recycling).

Standards. ISO 14040; ISO 14044 (incl. Amd 2, 2020); PCR Yachts and small crafts (2015, v1.01).

Impact methods: CML 2001 (GWP100, AP, POCP, EP, ODP, NOx, SOx, PM10); AWARE (water); ReCiPe 2016 (H) endpoint single score, Ecopoint (Pt).

The study compares a 500 GT yacht with the wing (Scenario 2) and without it (Scenario 1, BAU). The goal is to check whether installing the wing is the more sustainable choice, for Water Revolution Foundation's Hub of Verified Solution.

Data sources. Mainly primary data from Hull Vane (bills of materials, invoices, direct measurements, counters). Ecoinvent v3.5 for raw materials, fuels and electricity (Dutch grid mix in manufacturing). SimaPro 9.0. No allocation.

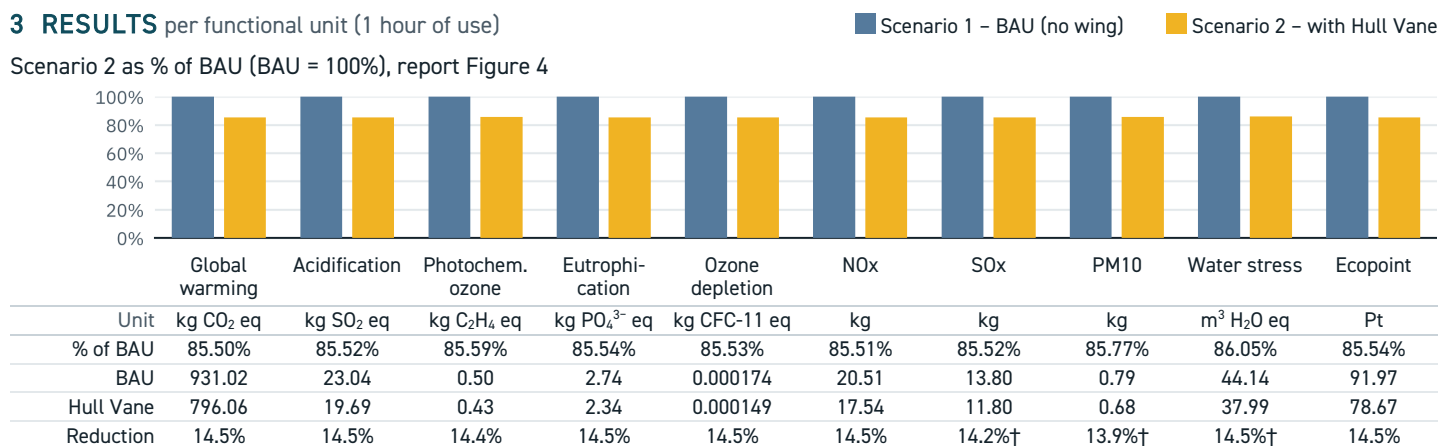
Use phase. Diesel use, BAU vs Hull Vane: fast cruise 618.80 vs 563.10 l/h; slow cruise 303.33 vs 257.66 l/h (10,966.58 vs 9,376.76 MJ per hour of use). Hotel-load electricity excluded in both.

Key assumptions. Paint amounts calculated from wing area (19.60 m²), 0.15 mm layers and 1.2 kg/l density. Paint supplier 50 km away. Sandblasting diesel 0.023 kg/m² (literature). Disassembly energy 5% of cutting energy (company advice). Paint packaging included, although the PCR excludes it.

BAU reference. The same yacht without the wing. Only its propulsion diesel is modelled.

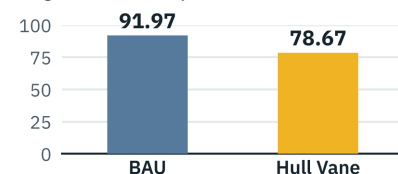
3 RESULTS per functional unit (1 hour of use)

Scenario 2 as % of BAU (BAU = 100%), report Figure 4



Bars and % of BAU row: Figure 4 chart data stored in the report file (§4).

Single score, Ecopoint (Pt)



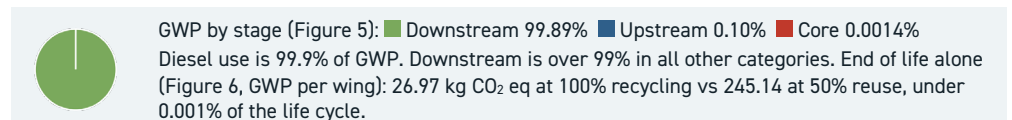
Damage (Pt)	BAU	H. Vane	Red.
Human health	85.49	73.13	14.5%
Ecosystem quality	5.48	4.69	14.5%
Resources	1.01	0.86	14.5%

Chart: report Figure 1. Table: report Table 12.

Sensitivity analysis (report §4.1, Figure 7 data; Table 13)

Case (result as % of BAU)	GWP	Ecopoint	Range, all 10
Scenario 2: 100% recycling at end of life	85.50%	85.54%	85.50–86.05%
Scenario 2a: 50% recycling, 50% reuse	85.58%	85.54%	85.51–86.06%
Scenario 2b: 5% less diesel use	81.30%	81.27%	81.24–81.78%

Table 13 reports an 18.2–18.8% reduction for scenario 2b.



4 KEY FINDINGS

Lower in all 10 indicators. Per the report, impacts are around 14–15% lower with the wing (std 0.12). Global warming: 931.02 → 796.06 kg CO₂ eq per hour of use. Ecopoint: 91.97 → 78.67 Pt.

Lower fuel use drives the result. Diesel use falls from 618.80 to 563.10 l/h at fast cruise and from 303.33 to 257.66 l/h at slow cruise. Downstream, mainly diesel use, causes over 99% of the impact.

Keep in mind: the result rests on the fuel figures with and without the wing and the 630 h use profile. Only propulsion diesel is compared.

Sensitivity. 5% less diesel use raises the reduction to about 19%. A 50% recycling, 50% reuse end of life raises end-of-life GWP about 9 times, but changes the total by under 1%.

Trade-offs. No indicator is worse with the wing. Producing it (3.44 t of virgin steel, paints, transport) adds under 1% of the impact; the report calls the other downstream contributions irrelevant.