CONSOLIDATED LIFE CYCLE ASSESSMENT (LCA) REPORT

Project: LIFE17 ENV/LV/000318 – LIFE-ALFIO

Portfolio: Paints For Life water-borne decorative coatings

Scope of this report: cradle-to-gate (A1–A3), functional unit = 1 litre of paint

Date: 16 March 2026

This revised version is intended to make the environmental outcome of the assessed formulations clear, concise and usable for decision-making.

This project has received funding from the LIFE Programme of the European Union.
The contents of this publication are the sole responsibility of the beneficiaries and do not necessarily reflect the opinion of the European Union.

Executive summary

This revised LCA report focuses on environmental conclusions rather than methodology. It identifies the lowest- and highest-impact formulations in the LIFE-ALFIO portfolio, explains the main environmental drivers, and states clearly what the project products achieve and what should be improved next.

Point	Result	Interpretation
Portfolio assessed	21 formulations	Consistent cradle-to-gate A1–A3 comparison across the project portfolio.
GWP range	1.372 to 4.195 kg CO_2e/L	Low/no-TiO_2 systems are at the lower end; TiO_2-rich white/base-A systems are at the upper end.
CED range	12.50 to 43.04 MJ/L	The energy pattern follows the same logic as GWP.
Main environmental driver	Titanium dioxide where present	In pigmented recipes, TiO_2 is the clearest first-order hotspot.
Second environmental driver	Binder system	Binders materially influence both GWP and CED across the portfolio.
Contribution of ALINA organoclay	~0.026 to 0.034 kg CO_2e/L	Measured contribution is small relative to pigment and binder contributions.

Overall conclusion. The revised interpretation shows that the environmental profile of the assessed paints is determined primarily by white pigment loading and binder selection. The project therefore delivers environmental value by enabling lower-biocide water-borne coatings, while the next reductions in carbon and energy footprint should focus mainly on pigment and binder optimisation rather than on the organoclay additive itself.

1. Purpose and scope

This report evaluates the environmental outcome of the assessed Paints For Life formulations using a cradle-to-gate scope (A1–A3) and a declared functional unit of 1 litre of paint.

Included stages are raw materials, inbound transport and manufacturing electricity. Packaging, outbound distribution, application, use phase and end-of-life are outside this declared scope.

The results are suitable for internal portfolio comparison, eco-design prioritisation and product guidance within the project platform. They are not presented as audited public comparative claims.

2. What the LCA shows about the project products

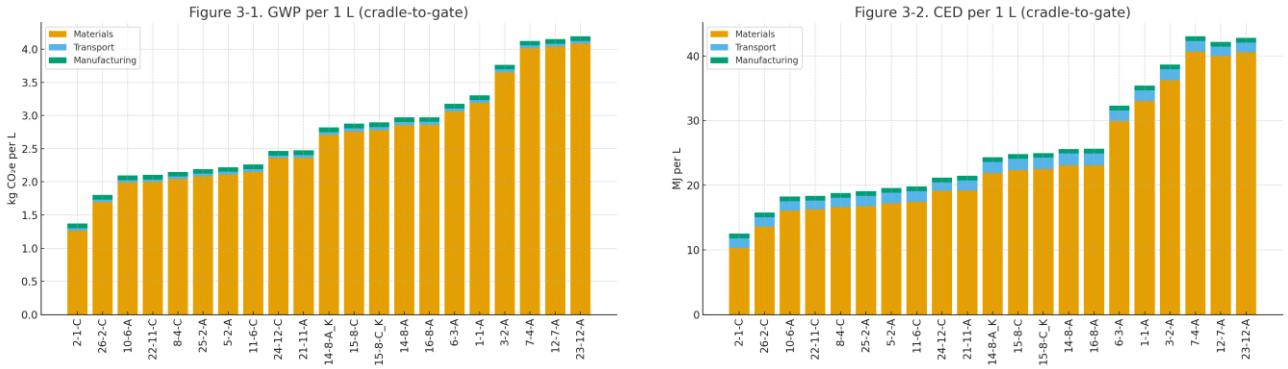


Figure 1. Portfolio GWP and CED totals per litre (cradle-to-gate A1–A3).

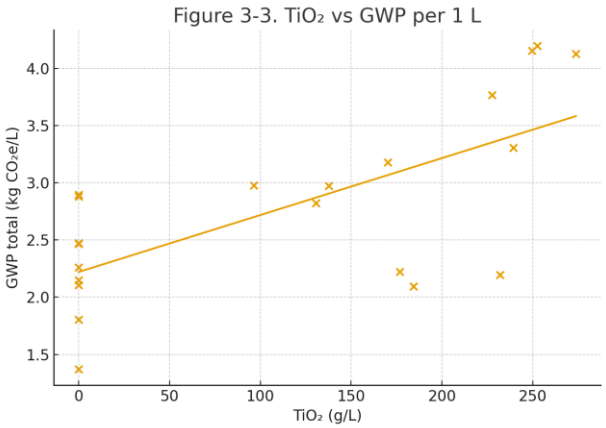
The portfolio results are clear. The lowest GWP and CED values are observed for 2-1-C (1.372 kg CO_2e/L; 12.50 MJ/L). The highest GWP value is observed for 23-12-A (4.195 kg CO_2e/L), while the highest CED value is observed for 7-4-A (43.04 MJ/L).

What this means environmentally. The project does not produce one single environmental result; it produces a portfolio. Within that portfolio, the lower-impact formulations are mainly those with little or no TiO_2, whereas the upper end of the range is occupied by white or highly pigmented formulations. The environmental outcome is therefore not uniform across all formulations.

Main findings supported by the portfolio data

- The materials stage dominates total impact across the portfolio. Under the declared assumptions, inbound transport is small and manufacturing electricity is fixed and secondary.
- Where present, TiO_2 is the most important carbon and energy hotspot. In the detailed formulation tables, TiO_2 contributes approximately 0.241 to 2.217 kg CO_2e/L.
- Binders are the second major driver. In the detailed tables, binder contributions range approximately from 0.368 to 1.932 kg CO_2e/L depending on recipe and binder system.
- ALINA organoclay remains a minor share of the total footprint in the assessed recipes. In the detailed formulation tables, its contribution is approximately 0.026 to 0.034 kg CO_2e/L.
- This means that a low-biocide formulation can still have a higher cradle-to-gate carbon footprint if it relies heavily on TiO_2 and/or high-impact binders.

3. Interpreting the result: what determines the footprint



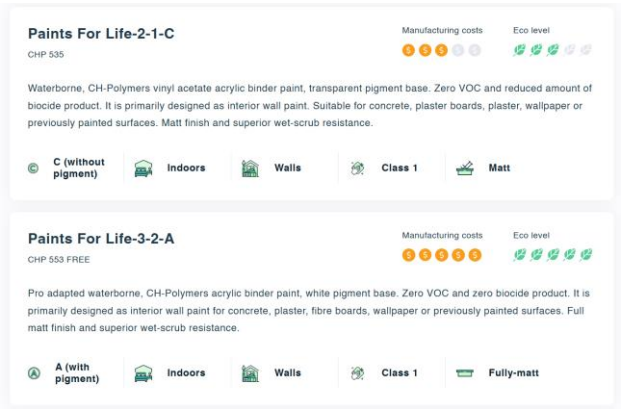


Figure 2. Left: higher TiO_2 loading is associated with higher GWP within the portfolio. Right: the project translated the LCA logic into an eco-level view on the Paints For Life platform.

The scatter plot confirms the core interpretation: higher TiO_2 loading tends to move a formulation upward in GWP. The relationship is not perfect, because binder type, filler package and additives also matter, but TiO_2 is still the clearest first-order driver.

The platform screenshot illustrates how the project made the LCA usable in practice. The eco-level shown on the platform is a portfolio guidance tool that helps users identify lower-footprint formulations within the project portfolio. It should be read as an internal comparative aid, not as a third-party verified environmental claim or product declaration.

This is an important practical outcome of the project: the LCA did not remain an isolated technical file, but was turned into a decision-support feature that can steer users towards environmentally preferable formulations inside the platform.

4. Coherent conclusions on environmental impact

Conclusion 1. The project portfolio contains clear lower- and higher-impact formulations, and these differences are large enough to be environmentally meaningful.

Conclusion 2. The most decisive environmental lever in the assessed formulas is white pigment loading, especially TiO_2. Formulations with no TiO_2 or with lower white-pigment loads consistently perform better on the declared cradle-to-gate basis.

Conclusion 3. Binder selection is the second most important lever. Lower-impact formulations cannot be explained by pigment alone; binder systems also materially affect the result.

Conclusion 4. ALINA organoclay is not the main environmental hotspot in the assessed products. Its contribution is measurable but small relative to the dominant pigment and binder contributions.

Conclusion 5. The portfolio therefore supports a precise environmental message: the project delivers lower-biocide water-borne paints and a platform that helps select environmentally better formulations, but the next major footprint reductions depend mostly on reformulation of pigment and binder systems.

5. Recommendations

- **Prioritise TiO_2 optimisation.** The first eco-design priority should be to reduce white pigment loading where performance allows, because this is the strongest and most consistent hotspot in the portfolio.
- **Optimise binder strategy in parallel.** The second priority should be binder selection and solids strategy, because binders materially affect both GWP and CED across low- and high-pigment products.

- **Treat additives and organoclay as secondary optimisation levers.** They should still be managed carefully, but the results do not support treating them as the main source of the product footprint.
- **Keep the eco-level tool on the platform, but explain it correctly.** It is useful for users to distinguish lower- and higher-footprint options inside the portfolio, but it should not be presented as a verified ecolabel or external comparative claim.
- **Upgrade the background data before any public comparative assertion.** Supplier-specific emission factors, measured plant energy and real logistics data would reduce uncertainty and strengthen the evidential basis of future disclosures.

6. Limitations and proper use of the revised report

- This assessment remains cradle-to-gate (A1–A3) and per litre of paint. It does not include packaging, distribution, use phase or end-of-life.
- Some background emission factors are screening-grade proxy data. The report is therefore suitable for internal portfolio interpretation and prioritisation, but not for unsupported public comparative marketing claims.
- For external comparative use, a critical review and stronger primary data would be required, together with performance normalisation where appropriate.

Appendix A. Portfolio result table

The table below consolidates the cradle-to-gate A1–A3 results per litre for all formulations assessed in the revised report.

Formulation	TiO_2 (g/L)	GWP total (kg CO_2e/L)	CED total (MJ/L)	Short reading
2-1-C	0	1.372	12.50	Lower-impact portfolio end
26-2-C	0	1.802	15.76	Lower-impact portfolio end
10-6-A	184	2.095	18.24	Lower-impact portfolio end
22-11-C	0	2.107	18.35	Lower-impact portfolio end
8-4-C	0	2.150	18.78	Lower-impact portfolio end
25-2-A	232	2.194	19.09	Mid-portfolio range
5-2-A	177	2.222	19.57	Mid-portfolio range
11-6-C	0	2.262	19.79	Mid-portfolio range
24-12-C	0	2.467	21.16	Mid-portfolio range
21-11-A	0	2.475	21.47	Mid-portfolio range
14-8-A_K	130	2.823	24.32	Mid-portfolio range
15-8-C	0	2.878	24.82	Mid-portfolio range
15-8-C_K	0	2.897	24.99	Mid-portfolio range
14-8-A	138	2.973	25.62	Mid-portfolio range
16-8-A	96	2.975	25.63	Mid-portfolio range
6-3-A	170	3.176	32.28	Mid-portfolio range
1-1-A	239	3.306	35.39	Mid-portfolio range
3-2-A	227	3.766	38.67	Upper-impact portfolio end

Formulation	TiO_2 (g/L)	GWP total (kg CO_2e/L)	CED total (MJ/L)	Short reading
7-4-A	274	4.126	43.04	Upper-impact portfolio end
12-7-A	250	4.152	42.17	Upper-impact portfolio end
23-12-A	252	4.195	42.78	Upper-impact portfolio end