EPD OPTIMIZATION REPORT

LEED Credit: LEED v4.1 MRc2 — Environmental Product Declarations, Option 2 (Optimization Assessment)

Product:	Manufacturer:
Oil Well Cement (API HSR)	Union Cement Company
Issue Date:	**Expiry Date:**
26-Mar-2026	25-Mar-2031

EPD Reference and Optimization Basis

شركة أسمنت الاتحاد(ش.م.خ.)
UNION CEMENT COMPANY (Pr.J.S.C)

Product: Oil Well Cement (API HSR)
Declared Unit: 1 metric ton
System Boundary: Cradle-to-gate with options (A1-A4, C1-D)
Manufacturer: Union Cement Company (Pr.J.S.C), UAE
Program Operator: International Climate Intelligence System (ICIS)
EPD Number: ICIS-202603-128
Issue Date: 26-Mar-2026
Expiry Date: 25-Mar-2031

Basis of Assessment

- Baseline EPD: Oil Well Cement (API HSR) EPD (ICIS-202603-128).
- Same product optimization; no third-party manufacturer EPDs used.
- System boundary: cradle-to-gate (A1–A3); declared unit: 1 metric ton.
- Modeled optimization scenario corresponding to an indicative 8-10% reduction in A1–A3 GWP.
- Improvements limited to manufacturer-controlled parameters in A1 and A3 with unchanged production technology.

Purpose

The purpose of this report is to assess potential cradle-to-gate (A1–A3) environmental impact reduction opportunities for Union Cement Company's Oil Well Cement (API HSR) through a modeled optimization scenario, in accordance with the requirements of LEED v4.1 MRc2 – Environmental Product Declarations (Option 2).

Methodology

The optimization assessment was conducted using a life cycle assessment-based approach consistent with EN 15804+A2 and ISO 14025 principles, aligned with the requirements of LEED v4.1 MRc2 Option 2.

The current Oil Well Cement (API HSR) EPD (ICIS-202603-128) was used as the baseline. A modeled optimization scenario was developed for the same product by adjusting selected, manufacturer-controlled parameters within the cradle-to-gate (A1–A3) system boundary, while keeping the declared unit, production route, and system boundaries unchanged.

The methodology focuses on identifying realistic improvement levers within the A1 (raw material supply) and A3 (manufacturing) stages, including raw material system control and kiln energy efficiency improvements. No changes were made to product classification, functional performance, or downstream life cycle stages.

Environmental impacts were evaluated using the same impact assessment method applied in the baseline EPD to ensure consistency and comparability between the baseline and modeled optimization scenario.

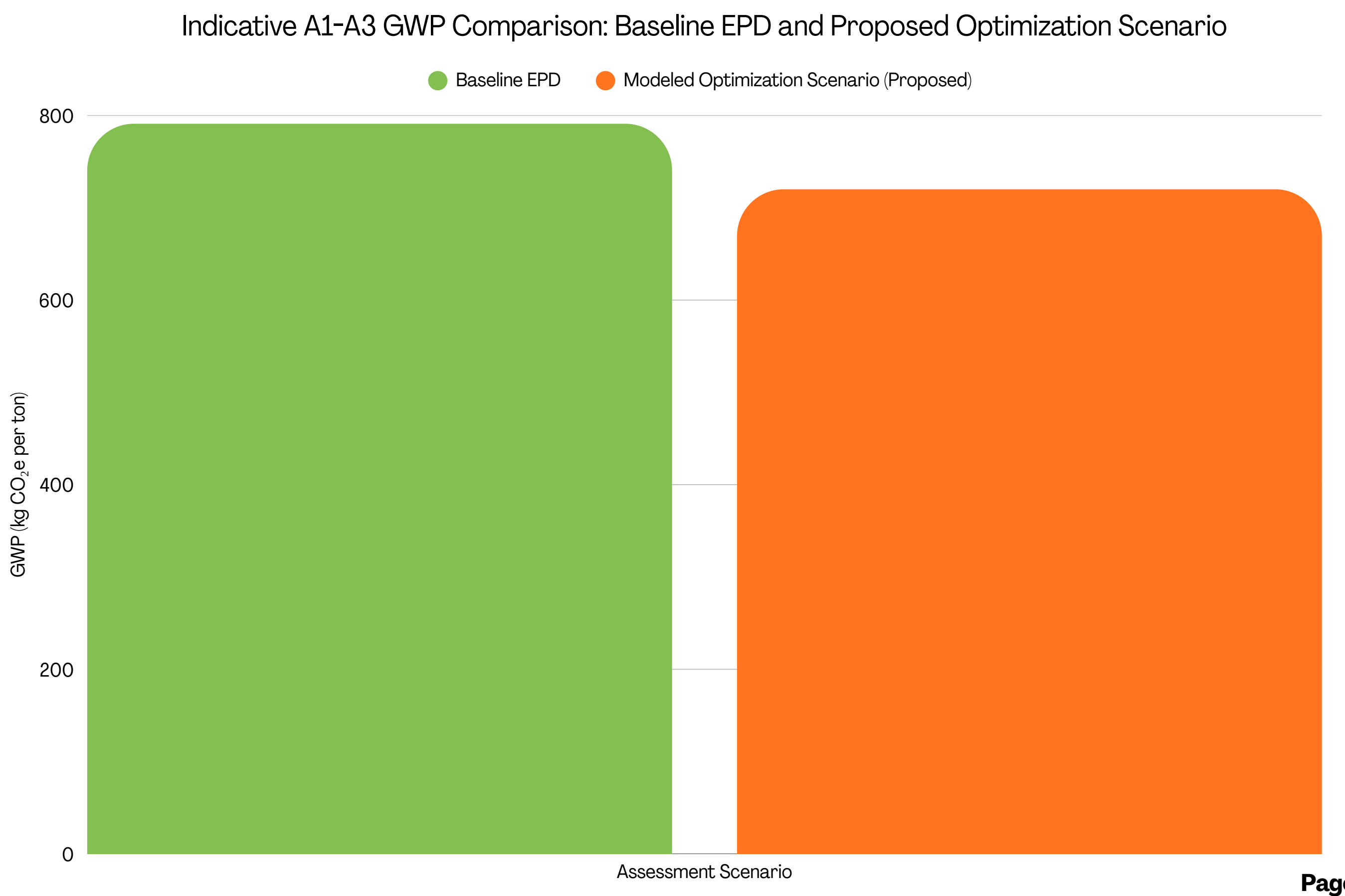
As the optimization scenario is modeled for the same product and manufacturer using identical declared unit, system boundaries, and impact assessment method, the baseline and optimization results are directly comparable.

Results

The cradle-to-gate (A1–A3) Global Warming Potential (GWP) results for the baseline EPD and the modeled optimization scenario are summarized below.

Scenario	**A1-A3 GWP (kg CO_2e / ton)**
Baseline EPD	791
Modeled Optimization Scenario (proposed)	~712-728

The modeled optimization scenario represents a proposed potential reduction of approximately 8-10% in A1–A3 GWP relative to the baseline EPD, subject to implementation of the identified optimization measures.



Key Optimization Opportunities (A1 & A3)

A1 – Raw Material Supply (Clinker System & Inputs)

- Optimize raw material system to maintain controlled low C_3A clinker chemistry while improving input efficiency and reducing upstream emissions.
- Prioritize lower-carbon raw materials using supplier-specific emissions data for clinker, gypsum, and corrective inputs.
- Improve raw meal homogenization and feed control to ensure stable clinker phase formation and reduce process variability.
- Enhance material efficiency to achieve required API performance through optimized clinker phase composition and gypsum regulation.
- Optimize packaging and upstream inputs to reduce embodied impacts within the A1 boundary.

A3 – Manufacturing (Kiln & Grinding Operations)

- Improve kiln thermal efficiency through optimized preheater–precalciner operation and reduced specific heat consumption (GJ/ton clinker).
- Increase alternative fuel substitution (AFR) to reduce fossil CO_2 emissions while maintaining stable clinker phase development.
- Optimize clinker cooling and heat recovery to improve thermal integration and reduce energy losses.
- Enhance grinding efficiency by reducing specific electricity consumption (kWh/ton cement) through process optimization.
- Improve process stability and minimize losses across pyroprocessing and grinding operations.

Key Findings

- The optimization assessment indicates that measurable reductions in A1–A3 GWP are achievable for Oil Well Cement through targeted improvements in raw material system control and kiln energy performance within manufacturer-controlled processes.
- A3 remains the dominant contributor to total GWP, with reductions primarily driven by enhanced pyroprocessing efficiency, thermal energy optimization, and fuel-related emission reduction.
- A1 reductions are influenced by raw material efficiency and clinker system control, where optimization focuses on maintaining low C_3A chemistry while reducing upstream impacts.
- The identified measures focus on process and material efficiency improvements without altering product classification, API performance requirements, or underlying production technology.
- The reduction potential reflects realistic operational improvements aligned with current oil well cement manufacturing practices rather than fundamental process or composition changes.
- The optimization approach maintains full comparability with the baseline EPD through consistent system boundaries, declared unit, and impact assessment methodology.
- Overall, the results potentially demonstrate a credible and technically achievable pathway for 8–10% reduction in cradle-to-gate GWP through incremental, performance-aligned optimization measures.

Limitations & Assumptions

This optimization assessment is based on a modeled scenario and represents indicative reduction potential rather than verified or achieved performance. The assessment is limited to cradle-to-gate (A1–A3) life cycle stages and Global Warming Potential (GWP) only; other impact categories and downstream life cycle stages are not evaluated. The modeled optimization assumes implementation of the identified improvement measures, primarily related to raw material system control and kiln energy performance, without changes to product classification, API performance requirements, or declared unit. Results are intended solely for LEED v4.1 MRc2 Option 2 documentation purposes.

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