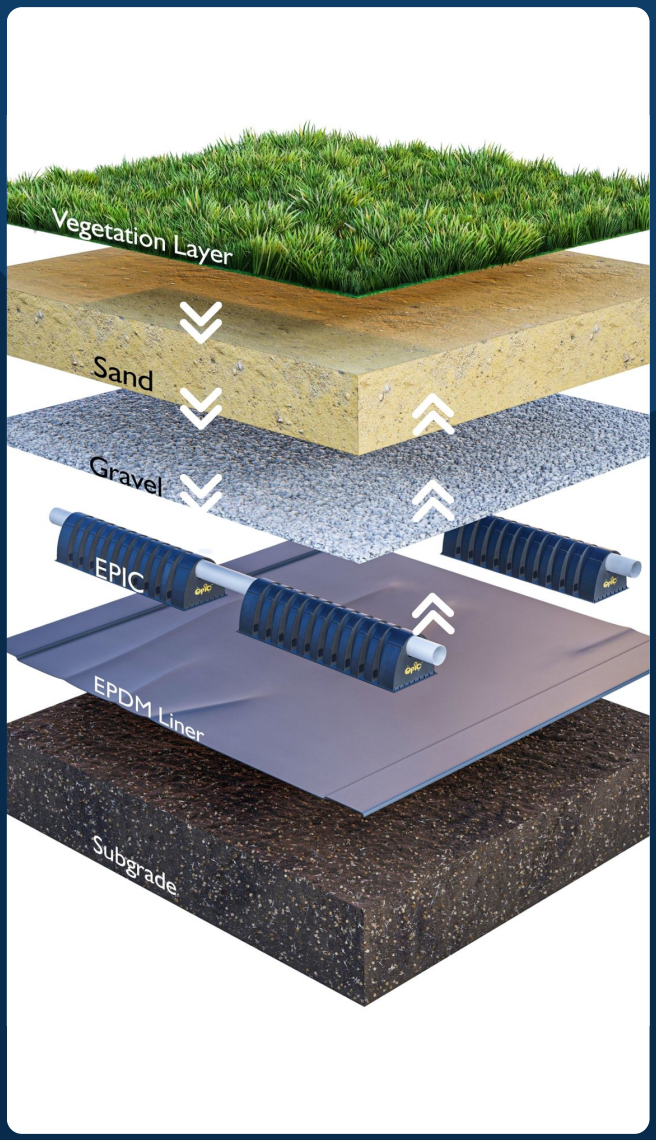
EPIC TOTAL WATER SOLUTIONS · POSITION PAPER

THE CARBON ACCOUNT

Not neutral. Negative.

Carbon neutrality is a claim that has to survive an audit, and a high proportion of natural material is not one. So here is the account. Every kilogram of resin, every square metre of membrane, every tonne of aggregate and every litre of diesel on one side. Every cubic metre of water neither treated nor pressurised on the other. **A 1,000 m² EPIC cell carries 16.8 tonnes of embodied CO_2 once, and returns 1.03 tonnes every year for fifty.** It does not need to be neutral.

01 What the system is made of
02 The debit — one 1,000 m² cell, itemised
03 The credit — two mechanisms, both electrical
04 Omissions, and end of life
05 At national scale



Vegetation, sand, gravel, chamber, membrane, subgrade. Every layer of an EPIC cell appears on the account inside.

16.8t
EMBODIED, ONCE
CO_2e per 1,000 m², all-in, for a 50-year asset

1.03t
AVOIDED, EVERY YEAR
CO_2e per 1,000 m², managed 80% water case

3.1×
NET NEGATIVE
Lifetime credit over lifetime debit, 50 years

PASSIVE. · INTEGRATED. · SUSTAINABLE.

★ Made in the USA · Reno, Nevada

THE HONEST STARTING POINT

Mass share is not a carbon claim

By weight, an EPIC installation is less than 0.5% plastic components and more than 99.5% natural materials. That is true. On its own it proves nothing.

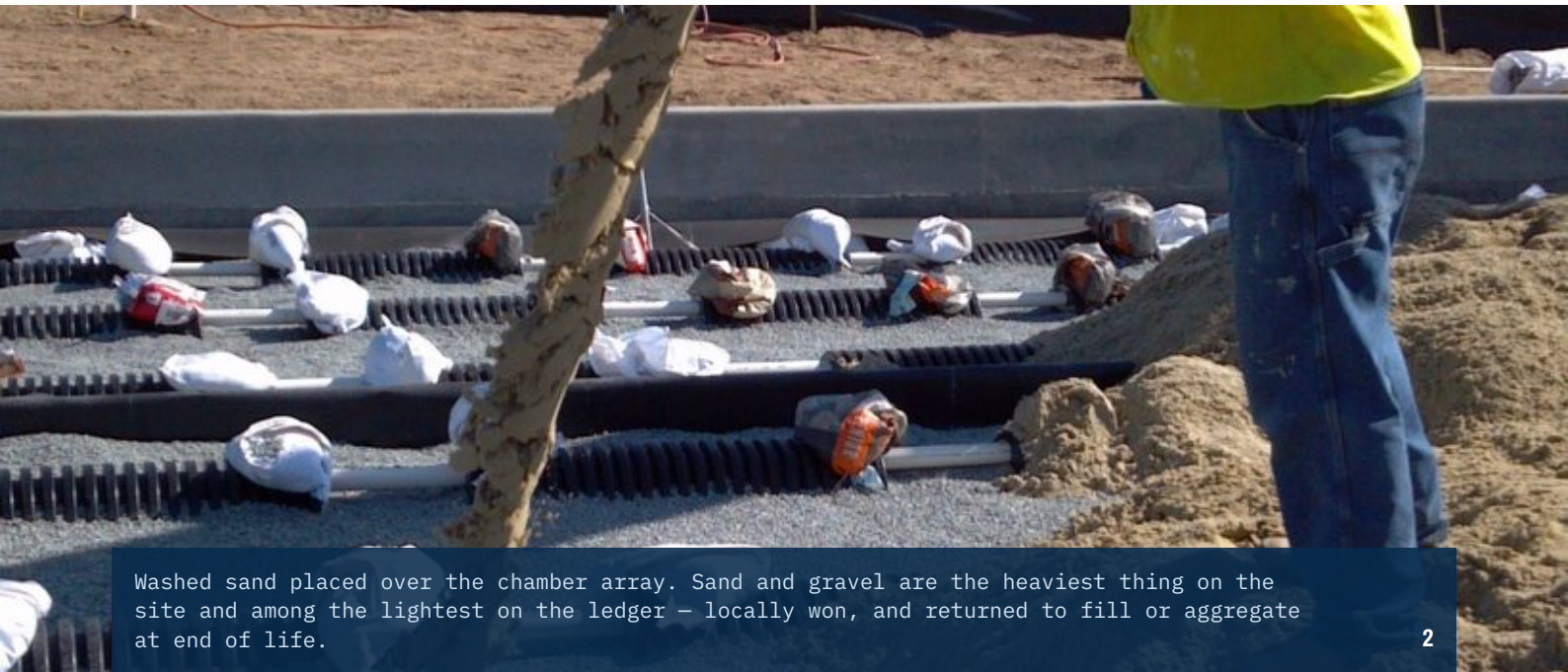
The plastic controls the fluid dynamics. The natural materials — sand, gravel, root mass and the living community of plants and micro-organisms held in the profile — perform the environmental service, cleaning and reusing water through physical uptake and biological breakdown of pollutants. The two must work in synergy for the system to function as a water management solution at all.

Polypropylene is the primary chemical component of the EPIC chambers and pans. It is essentially a polymer of carbon and hydrogen, the same commodity plastic used in bottles, car fenders and food packaging. A small chamber weighs 0.77 kg; a large one 2.50 kg. Both are moulded in a single piece, in Reno, Nevada.

But a tonne of resin does not become carbon-free because it lies beneath six hundred tonnes of sand. A carbon claim has to be built the other way round: from published emission factors, applied to a specified quantity of material, and set against a measured saving. That is what the next four pages do, for one 1,000 m^2 cell.

The whole embodied debit of a 1,000 m^2 cell is 16.8 tonnes. The average GCC resident emits 18 tonnes in a year.

<0.5%	99.5%	50+ yr	0%
PLASTIC BY WEIGHT	NATURAL MATERIAL BY WEIGHT	DESIGN LIFE, NO GLUE, NO PRESSURE	OF IT DISCARDED AT END OF LIFE



Washed sand placed over the chamber array. Sand and gravel are the heaviest thing on the site and among the lightest on the ledger — locally won, and returned to fill or aggregate at end of life.

ONE 1,000 M² CELL, ITEMISED

The debit

ITEM	QUANTITY AS SPECIFIED	T CO_2E
EPIC chambers	269 × LG46 at the published 3.72 m² per chamber = 672 kg polypropylene	2.47
EPDM membrane	1,290 m² at 1.14 mm — 1.29 × cell area, the measured overlap factor	6.99
Freight to site	0.67 t · 14,000 km sea from Reno, plus 850 km road at each end	0.21
Sand and gravel	680 t — 350 mm washed sand, 75 mm bridging gravel, local supply, 30 km haul	4.42
Installation plant	17 machine-days at 60 m² per day with equipment, 60 L diesel per day	2.68
Total embodied carbon — paid once, for an asset rated at 50 years		**16.77**

THE FACTORS, AND WHERE THEY COME FROM

`1.548 kg CO₂e/kg` — polypropylene resin, cradle-to-gate. Franklin Associates for the American Chemistry Council, 2021.

`2.13 kg CO₂/kg` — injection moulding, electric machine. ARBURG to EUROMAP 60.2, 2022. Published range 1.07–4.43; this is mid-range, not best case.

`5.42 kg CO₂e/m²` — reinforced EPDM membrane, 45 mil. ASTM International EPD, 2022.

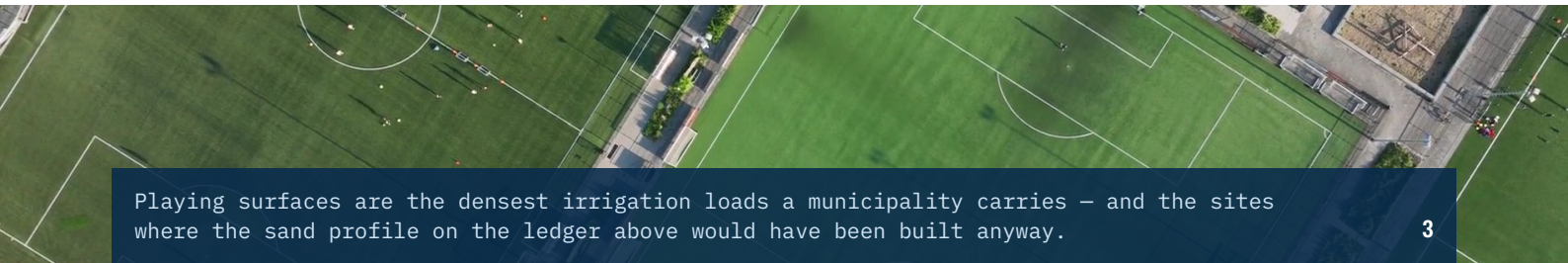
`0.40 kg CO₂/kWh` — grid emission factor, GCC generation mix. EPIC cost-benefit model.

- Specify the **SM24** chamber at a typical landscape density and the chamber line falls to **0.87 t**.
- A sand-based sports field or a golf green carries that profile with or without EPIC. On those sites, **deduct 4.42 t**.
- **9.67 t** of the total is EPIC hardware and its freight. The remaining 7.10 t is site work common to most landscape construction.
- The **membrane** is the single largest line — nearly three times the chambers. That is where design attention belongs.
- Transport is **1.3%** of the total. Chambers nest 1,080–3,456 to a forty-foot container.

READ THIS AS A SPECIFICATION, NOT A BROCHURE

The boundary is stated so it can be argued with. Included: resin production, moulding, ocean and road freight, membrane manufacture, aggregate extraction and haulage, and installation plant. Excluded: the tooling amortised across a hundred million mouldings, the office, and the end-of-life stage — which for EPIC is a credit rather than a cost, and is described on page 5. Every factor is public and every quantity is drawn from an issued bill.

The result is **16.8 kg of CO_2e per square metre, once**. Substitute your own chamber density, membrane specification, haul distance and grid factor and the account re-runs in a spreadsheet. It is meant to.



Playing surfaces are the densest irrigation loads a municipality carries — and the sites where the sand profile on the ledger above would have been built anyway.

WHAT THE SYSTEM STOPS DOING

Two mechanisms, both electrical

Water not treated. Every cubic metre of treated sewage effluent delivered to a landscape has been through a plant first. EPIC's own cost-benefit model puts that at 0.80 kWh per cubic metre, on a grid emitting 0.40 kg CO_2 per kWh — **0.32 kg of CO_2 for every cubic metre called for**. Water that is never called for is treatment energy never spent.

Water not pressurised. A spray system has to arrive at the head at roughly 3.5 bar; at a realistic wire-to-water efficiency of 65% that is 0.147 kWh per cubic metre pumped. EPIC floods its chambers to the connector invert and lets capillarity carry water up into the root zone, so the transfer duty is around 0.5 bar, or 0.021 kWh per cubic metre. **EPIC's published model omits this saving entirely. It is counted here.**

SAME 1,000 M² CELL, AGAINST A LAWN AT 9 L/M²/DAY	INSTANT 50%	UNMANAGED 65%	MANAGED 80%
Water saved, m^3 per year	1,642	2,135	2,628
Treatment energy avoided, t CO_2/yr	0.53	0.68	0.84
Pumping energy avoided, t CO_2/yr	0.18	0.18	0.19
Total avoided, t CO_2 per year	**0.70**	**0.87**	**1.03**
Carbon payback — EPIC hardware only	13.7 yr	11.2 yr	9.4 yr
Carbon payback — all-in, including site works	23.8 yr	19.4 yr	16.3 yr
Net position at 50 years, t CO_2e	−18	−27	−35

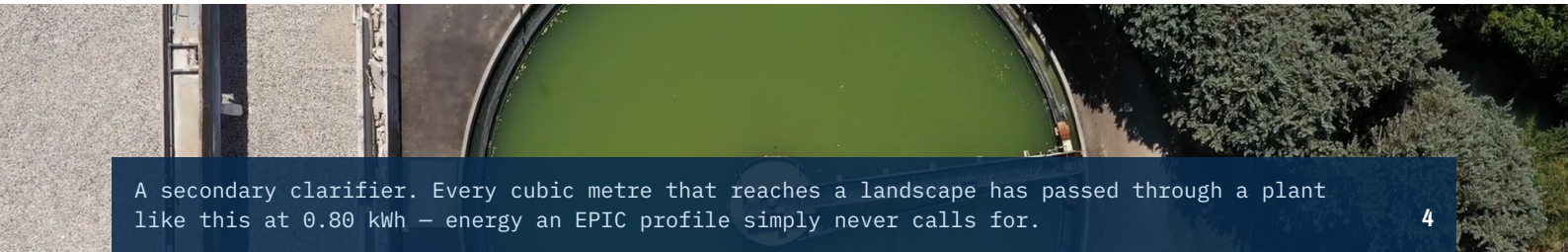
THE SAME FIGURES ON A MUNICIPAL LANDSCAPE

Take EPIC's own published 100,000 m^2 case at the managed rate: **262,800 m^3 of water and 84.1 tonnes of CO_2 avoided every year** on treatment energy alone — the annual footprint of nearly five Gulf residents, from one landscape, without changing anything a visitor can see.

AND IF THE TRANSFER PUMP RUNS ON SOLAR

EPIC requires very little pressure and will run on a few panels. Where the transfer duty is met by on-site PV, the pumping credit becomes the incumbent's **full 0.147 kWh/m³** rather than the difference, and the payback shortens again. The table above does not assume it.

A negative net position is net removal. The 50 / 65 / 80% band and the 9 L/m^2/day lawn benchmark are EPIC's own published cost-benefit assumptions, and the treatment-energy row reproduces the CO_2 figures in that model exactly. Field-recorded savings across the installed base run 50–85% against traditional sprinkler irrigation (University of New Mexico study, 2004).



A secondary clarifier. Every cubic metre that reaches a landscape has passed through a plant like this at 0.80 kWh — energy an EPIC profile simply never calls for.

THE ACCOUNT IS CONSERVATIVE BY CONSTRUCTION

What is left out

FOUR CREDITS EPIC COULD CLAIM AND DOES NOT

1. **The carbon in the system EPIC replaces.** A spray installation carries its own mainlines, laterals, valves, heads, controller, pump and pump house — and renews its surface hardware every five to ten years, with major overhaul at ten. That embodied carbon recurs four or five times across fifty years. EPIC's is paid once. It is set at zero here.
2. **Vegetation.** Neither system is credited with the carbon its planting sequesters, although in an arid climate it is EPIC's water budget that makes the planting viable in the first place.
3. **Fertiliser.** Subsurface delivery cut fertiliser use by 45% against drip in the Al Dahra greenhouse trial at Al Ain. Nitrogen fertiliser is carbon-intensive to manufacture. Not counted.
4. **Water quality.** The natural components remove over 80% of total suspended solids, 85% of total phosphorus and over 60% of nitrates (Rice Creek Watershed District research). No carbon value assigned.

One further asymmetry. Every credit above is priced at a grid emitting 0.40 kg CO_2 per kWh. As GCC generation decarbonises the credit shrinks — but so does the argument for spending that electricity on water no plant needed. The debit, once paid, never returns.

NOTHING HERE IS CONSUMED

EPIC reaches the objective most recycling only approximates: the components are wholly reusable with no intermediate process. Nothing is glued, nothing is pressurised, and the plastic is shielded from UV degradation below grade. Complete installations more than ten years old — plastic and natural components together — have been lifted and re-established on another site.

Where a system is not relocated, the chambers can be extracted and reused, or shredded and ground through conventional polypropylene recycling. Sand and gravel return to service as fill, grading material or aggregate. Surface vegetation and root mass compost by ordinary methods. The environmental equation of a recycling process is rarely examined as a whole: in an efficient one the energy total serves the environmental goal, in an inefficient one more energy is lost than gain is won. **Reuse without reprocessing sidesteps the question entirely.**



Capillary rise through washed sand — the mechanism that replaces pump pressure, and the reason the credit column exists.

THE SAME ARITHMETIC, OVER A PROGRAMME

One hundred million trees

Run the account over a national programme rather than a park and it becomes the case put to Saudi Arabia's Green Initiative: 100 million Ghaf saplings irrigated from reverse-osmosis reject water through EPIC pods. On that proposal's sequestration model — 17.3 kg of CO_2 per tree per year across the first ten years of growth — the planting removes **1.73 million tonnes of CO_2 every year**, on water a desalination plant currently pays to dispose of.

100M	1.73 Mt	$25.95M	2.5M m³
GHAF SAPLINGS AT 6 × 6 M	CO_2 REMOVED PER YEAR	ANNUAL CREDIT VALUE AT $15 CORSIA	REJECT WATER PUT TO WORK DAILY

WHERE THE CREDIT CAN BE REGISTERED

Water savings achieved through irrigation are eligible under several established programmes. The **Verified Carbon Standard** carries a water-conservation methodology applicable to irrigation projects, and the **Climate, Community and Biodiversity Standards** include a Water Benefit Standard covering the measurement and verification of conservation benefit. Voluntary offset markets commonly admit water-conservation projects as an eligible type. Requirements vary by jurisdiction; qualify any specific project with the relevant registry before booking value. Nothing here requires a credit to be sold for the technology to pay — the carbon position is a by-product of a water decision that already stands on its own economics.



Trees established in the dunes of the United Arab Emirates. The Green Initiative case runs the same account 100 million times, on water a desalination plant currently pays to throw away.

Because water is too precious to waste.

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