

Electrolyser technology wars.

Four technologies. One €275B market. The bet your organisation makes today defines its cost base for 20 years — and the data rarely matches the hype.

ALKALINE · PEM

AEM · SOEC

€275B

global green H₂ market
size by 2030

~8%

annual cost-reduction
target the sector
chases

20 yr

the horizon your
technology choice
locks in

The spec sheet is *not* the decision.

Every technology here has a defensible technical story. **What decides the winner is fit** — which market, which power profile, which site, which decade you are buying for.

Efficiency is the number everyone is comfortable comparing.

It is almost never the number that decides the project.

 These verdicts come from technical due-diligence and R&D scale-up work — not from vendor datasheets or press releases.

Four technologies, four bets

Two are commercial today. Two are wagers on the next decade. Each carries a different risk-and-reward profile.

ALK

TRL 9

The Veteran

Decades-proven, lowest CAPEX, industrial workhorse. Slow to follow variable power.

PEM

TRL 8–9

The Challenger

Fast, efficient, pairs with renewables. Higher CAPEX; platinum & iridium exposure.

AEM

TRL 5–7

The Dark Horse

No precious metals, strong cost path — but durability is unproven at scale.

SOEC

TRL 6–8

The Specialist

Exceptional efficiency with waste heat. Complex, high-temperature operation.

What actually separates them

Three axes decide the choice — and none of them is peak efficiency.

Read down the column that matches your project.

COMMERCIAL TODAY · PROVEN

WAGERS ON THE DECADE · UNPROVEN

01 Durability

ALK 80–100k hrs — built for 20-year asset lives

05 Cost trajectory

AEM best long-run curve — no precious metals

02 Dynamic response

PEM follows variable renewables; ALK cannot

06 Membrane life

AEM 20–50k hrs — the gate that decides it

03 CAPEX today

ALK lowest system cost; PEM higher on metals

07 Heat integration

SOEC needs >150°C steam to win on cost

04 Supply chain

ALK mature & de-risked; PEM exposed to Pt/Ir

08 Peak efficiency

SOEC 80–90% — only with that waste heat

The cheapest hydrogen is not the obvious one

INDICATIVE LCOH — €/KG H₂ · AVG EU POWER ~€55/MWH · PRODUCTION ONLY

SOEC + waste heat



€3.8

lowest — heat replaces power

Alkaline (ALK)



€4.8

AEM

**indicative*



€5.0

PEM



€5.4

THE FLIP SOEC has the highest system CAPEX — yet the lowest LCOH where steam is free. Cost lives in electricity, not the stack.

EU / IEA TARGET ~€1.5–2.0/kg by 2030. Not there yet — but the trajectory is real and closing faster than headlines suggest.



The risks nobody prices in

Each looks like a technical footnote. Each can decide the project.

PEM

Platinum & iridium

THE RISK

A supply chain concentrated in a handful of geographies — a price and geopolitics risk, not just a materials line.

MITIGATION

Lower catalyst loading, recycling, supplier diversification — all active R&D.

AEM

Membrane durability

THE RISK

Life unproven beyond ~20–50k hrs. The whole cost case rests on a number no one has confirmed at scale.

MITIGATION

Stage it. Pilot-first, R&D spend — not infrastructure spend.

SOEC

Thermal cycling

THE RISK

High temperatures and cycling fatigue degrade stacks; the cost case needs a co-located heat source that may not exist.

MITIGATION

Industrial co-location, heat recovery, advanced materials.



Where each one wins

There is no single winner. There is a right answer for each job.

Large baseload >100 MW

ALKALINE

Scale-ready, lowest cost, proven at industrial volume today.

Variable renewables coupling

PEM

Only technology that follows wind and solar load curves cleanly.

Decentralised / distributed

PEM · AEM

Compact and modular; AEM transformative here if it matures.

Industrial waste-heat sites

SOEC

Home turf — nothing else touches its efficiency with steam.

Long-term cost leadership

AEM

The standout if durability delivers — it could reset the curve.

What the data tells us

Four verdicts, one strategy — and none of them is “pick a winner.”

1

Lead with Alkaline at scale

For most organisations entering hydrogen through 2028 — lowest risk, lowest CAPEX, mature supply chain.

2

Build PEM capability in parallel

The choice for variable renewables. Cost parity expected 2027–28 — the positioning window is now.

3

Watch AEM closely

Best long-run cost potential. If membranes clear 40,000 hrs at scale, the landscape shifts.

4

Treat SOEC as a niche play

Exceptional where high-temperature waste heat exists. Evaluate seriously — don't force it.

THE PATTERN No single technology wins everything. The organisations that win build a **portfolio** — not a single bet.

LISTEN NOW

Projects don't fail. The bet does.

The technology is rarely the problem. Every wrong turn in this episode was a choice — made by capable people, for good reasons. Which is exactly what makes it avoidable.



The full breakdown is in Episode 1

Listen on chadehydrogen.com — link in the comments.

Which technology does your current roadmap assume — and is that assumption still valid? Tell me before you listen.