

Flexible, Energy-Responsive Aluminium Smelting

Noda Technologies AB | October 21, 2025

Why flexibility in aluminium smelting?

- Aluminium electrolysis is among the most energy-intensive industrial processes.
- Québec's smelters benefit from stable hydropower, yet the landscape is shifting:
 - Growing interconnections and evolving grid dynamics.
 - New large baseload competitors (AI datacentres, semiconductor fabs).
 - Rising expectations around ESG, digitalization, and resilience.
- **Thesis:** Observability → predictability → **safe flexibility**.



Our innovation: real-time observability for the HH cell

Maintenance-free anodic current-sensor platform

- Synchronous sampling of current distribution in the Hall-Héroult cell.
- Real-time proxy for the kinetic & thermodynamic state of the electrolyte.
- Enables predictive control and safe current modulation for demand flexibility.

Scope now & roadmap

- **TRL 3** (current) → **TRL 4** (short, paid PoC, Q3 2026) → **TRL 5** (pilot 2027).
- Control algorithms & digital twin (multi-GPU) follow sensor validation.



Context & insights (Europe → Québec)

- European markets show how volatility rewards controlled flexibility in smelting.
- Nordic results (hydropower context) are particularly strong — relevant to Québec.
- Takeaway: flexibility builds predictability, safety, and future optionality even where power is cheap today.



Evidence from European case study

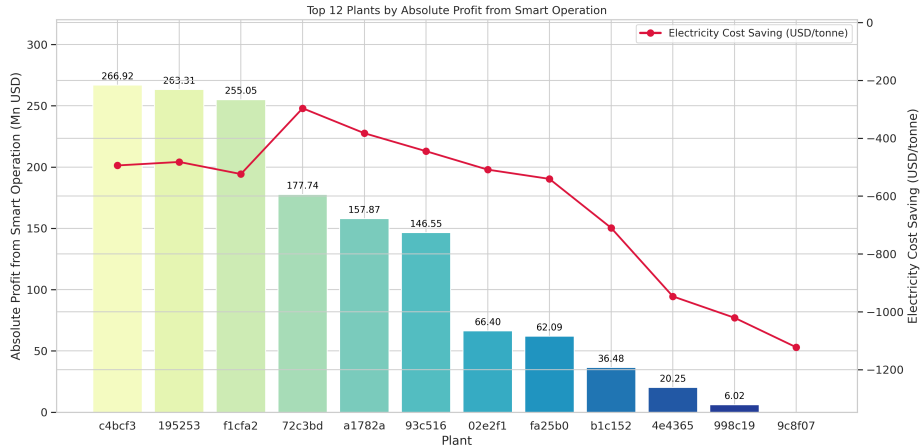
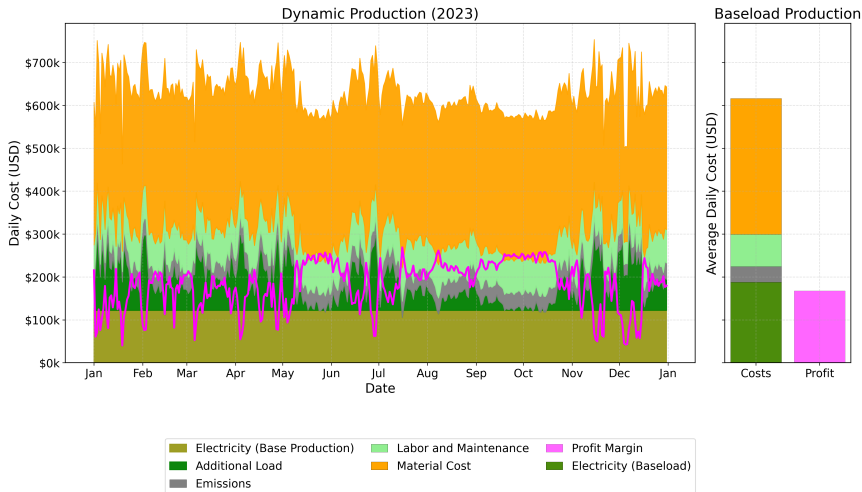


Figure 1. Top-12 smelters by absolute profit & electricity-cost saving under flexible vs. baseload operation (Europe 2021–2024).

Evidence from European sample smelter

Dynamic vs. Baseload Production: Daily Financial Overview



Collaboration we seek (2025–2027)

2026 — Short, paid PoC (2–3 months)

- Co-create the **business case**: ROI model using partner data; define KPIs.
- Technical feasibility via busbar emulator + sensor platform in the loop; multi-GPU simulation.

2027 — Funded pilot (TRL 5)

- Industrial host deployment; requirements for flexible operation (both monitoring, remote supervision, grid integration).



Partner roles

Industrial (smelters)

- Define PoC scope & KPIs; provide process data/sim parameters; participate in PoC; prepare to host pilot.

Energy / grid (Hydro-Québec ecosystem)

- Integration insights, balancing mechanisms, future market-design inputs.

Applied R&I & clusters

- Validation support, analytics, and access to joint non-dilutive funding (NRC IRAP, Vinnova bilateral, EUREKA, SDTC).



Funding path & presence

- Internal R&D in Sweden via national non-dilutive funding (pending; alternatives identified).
- PoC: joint non-dilutive capital (target PoC budget ~\$80k).
- Open to establishing a local presence in Canada as collaborations mature.

Contact

Email: `claro@noda.technology`

Web: <https://www.noda.technology>

