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ENERGY RESEARCH / SYSTEM INNOVATION

NORTHSTAR

Coordinating flexible energy at the industrial edge

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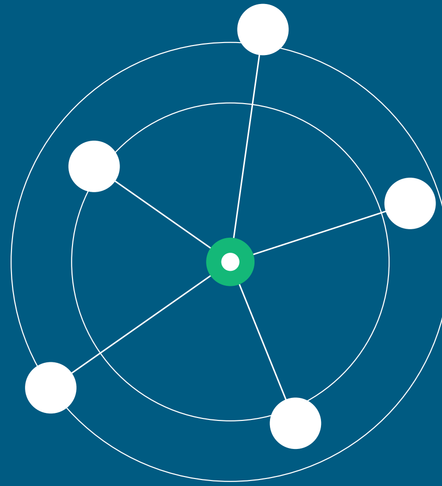
SINTEF Energy Research

Strategy review / August 2026



The opportunity in one minute

DECISION BRIEF

18% lower peak demand

2.4 MW flexibil made dispatchab

11 mo. modelled payback period

Industrial sites already own the flexibility.

NORTHSTAR turns thermal storage, batteries, compressors, and process buffers into one auditable operating resource.

Decision requested

Approve a 12-month, three-site scale-up with a single control-room interface.

Flexible assets are abundant.
Coordination is scarce.

Value leaks between planning and operations

Day-ahead plan fixed schedules

Market signal prices + grid needs

coordination gap

Plant reality constraints + drift

Manual intervention value arrives too late

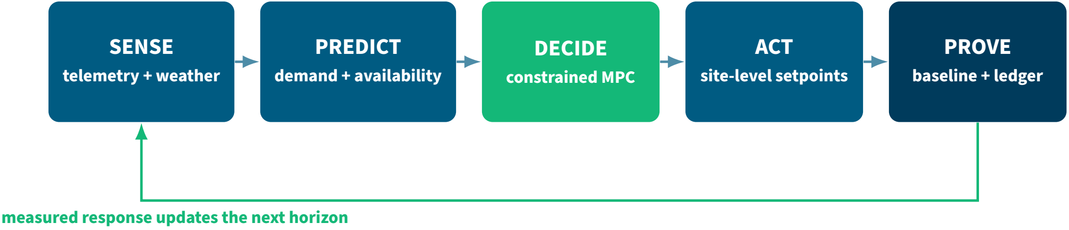
WHAT OPERATORS TOLD US

- Models do not reflect the latest plant state.
- Asset controls are fragmented by vendor.
- Flexibility bids lack a defensible audit trail.

Design principle

Optimise the portfolio, but protect every local process constraint.

NORTHSTAR closes the loop every five minutes



EDGE FIRST

Site safety logic remains local and retains final authority.

PORTFOLIO AWARE

Assets are dispatched against a shared flexibility envelope.

EVIDENCE NATIVE

Every bid, limit, setpoint, and response is time-stamped.

Optimising flexibility within production limits

ROLLING-HORIZON OBJECTIVE

$$\min_{u_{1:H}} \sum_{t=1}^{H} \underbrace{p_t P_t}_{\text{energy}} + \underbrace{c_t^{\text{peak}} z_t}_{\text{capacity}} + \underbrace{\lambda \|\Delta u_t\|_1}_{\text{wear}}$$

$$\begin{aligned} x_{t+1} &= A x_t + B u_t + E w_t, \\ x_t \in \mathcal{X}_{\text{safe}}, &\qquad u_t \in \mathcal{U}_{\text{asset}}. \end{aligned}$$

Forecast uncertainty tightens the safe envelope before dispatch.

Hard constraints

Process temperature, pressure, state-of-charge, ramp rate, and operator lockouts.

Soft objectives

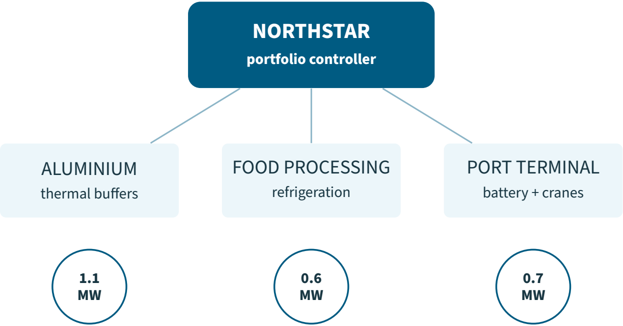
Cost, emissions, reserve value, asset wear, and schedule preference.

Fail-safe behaviour

If data quality drops, the site returns to its last verified local policy.

A pilot designed around operational credibility

Three sites, one coordinated flexibility envelope



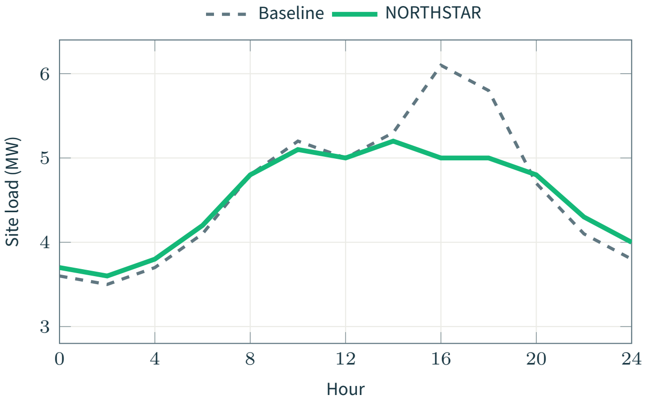
PILOT PROTOCOL

1. Six-week baseline period
2. Twelve-week shadow dispatch
3. Eight-week live operation
4. Independent settlement review

Evidence base

38,400 control intervals across winter and shoulder-season conditions.

Coordination removes the peak—not production



1.1 MW verified peak reduction

96.8% dispatch completion

Shaded interval denotes the

capacity-charge window.

Performance holds across operating modes

Asset group	Available flex (MW)	Delivered share	Response time	Process events attributable
Thermal buffers	1.10	97.4%	4.8 min	0
Refrigeration	0.62	95.9%	3.1 min	0
Battery system	0.48	99.2%	8 sec	0
Crane schedule	0.23	91.7%	6.0 min	0
Portfolio	**2.43**	**96.8%**	**3.4 min**	**0**

RELIABILITY

99.94% platform availability during live operation.

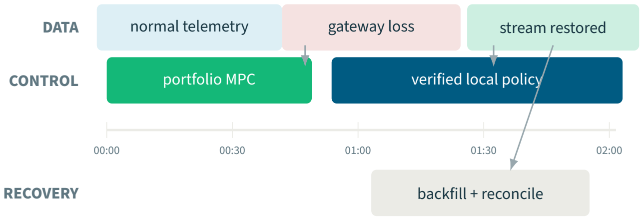
ECONOMICS

21.6% reduction in energy and capacity cost.

ASSURANCE

All dispatches reconciled to meter and operator logs.

Graceful degradation is a designed operating mode



OBSERVED GATEWAY OUTAGE

- Local constraints remained enforced.
- No operator action was required.
- Meter data reconciled automatically after recovery.

Result

Zero unsafe setpoints and only 0.6% of scheduled flexibility deferred.

Standardise the core.
Localise the constraints.

Scale depends on clear layers of authority

Site safety

Owns the boundary

- PLC interlocks
- operator lockouts
- safe-state policies

Portfolio control

Owns the dispatch

- forecasts
- optimisation
- setpoint allocation

Assurance

Owns the evidence

- model versions
- event ledger
- settlement trace

The optimiser may request. The site controller decides.

A staged path from pilot to portfolio service

Q4 2026
Harden pilot
cyber review + operator UX

Q1 2027
Three-site scale
shared control-room service

Q3 2027
Market integration
capacity + balancing bids

2028
Portfolio product
repeatable site onboarding

GATE TO PROCEED

Independent cyber assessment and signed operating envelopes for all sites.

GATE TO COMMERCIALISE

Twelve months of auditable availability above 95% across the portfolio.

Recommendation: fund the control layer

Launch a 12-month scale-up with three explicit outcomes.

1. **Operational:** one interface for site and portfolio control.
2. **Commercial:** verified delivery into two flexibility products.
3. **Repeatable:** onboarding kit proven on a fourth asset class.

SCALE-UP ENVELOPE

NOK 6.8m

12 months / 3 sites

Decision: August 2026

Expected outcome

A field-proven, assurance-ready flexibility service with a modelled 11-month customer payback.

SINTEF

Flexible energy. Industrial confidence.

Questions & discussion

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