



GALILEO Flexcon

24/09/2026

GALILEO 

Why did we start **GALILEO**?

Industrial flexibility as a lever for competitiveness, electrification and system efficiency



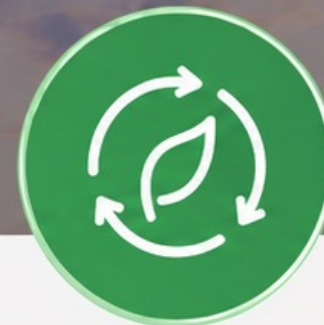
Industrial electrification is accelerating

Decarbonisation, electrification and new industrial loads are driving power demand up.



Competitiveness is under pressure

Industry must stay resilient amid volatile energy costs and major investment needs.



Flexibility creates dual value

It supports security of supply and unlocks new value streams for industry.



Industrial flexibility is no longer optional –
it is becoming a strategic asset for Belgian industry.



GALILEO at a glance

Unlocking industrial flexibility for a more competitive Belgian industry

With support from  **economie**



Objective

- Explore the **flexibility potential** of industrial processes
- Identify solutions to unlock flexibility and overcome **technical, operational, economic and regulatory barriers**
- Combine academic models with **5 industrial cases** from energy-intensive industries



Partners



Industrial use cases

	 Steel	 Metallurgy	 Chemical, Food, Agro, Metallurgy	 Food	 Data Centers
 Flexibility assessment	✓	✓	✓	✓	✓
 Portfolio management	✓		✓	✓	
 RES investment				✓	✓
 Long-term flexibility valorization (CRM)		✓	✓		
 Short-term flexibility valorization	✓	✓	✓	✓	✓



From demonstration to impact:

combining academic and applied research with large-scale industrial use cases.



01/09/2024 – 28/02/2027 | 30 months



Panel



**Joppe
Schildermans**



**Thomas
Verbruggen**



**Benny
Holemans**

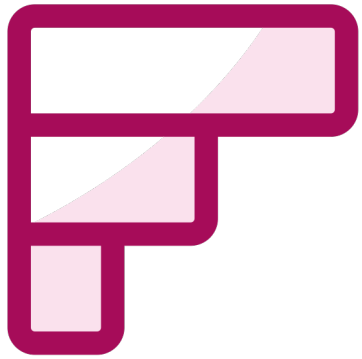


**Adeline
Wantiez**



**Matthias
Debyser**





What is the biggest barrier for providing industrial flexibility?



What is holding back industrial flexibility?

Industry in focus

Industrial flexibility barriers are multi-dimensional, but three barriers appear again and again.



Seven barrier dimensions

Technological · Economic · Regulatory · Organisational · Behavioural · Informational · Competence



Top 3 barriers in literature

1

Business case is not positive

Revenues and savings often do not compensate for costs, effort and uncertainty.

2

Product quality at risk

Flexibility must not compromise production output, quality or service commitments.

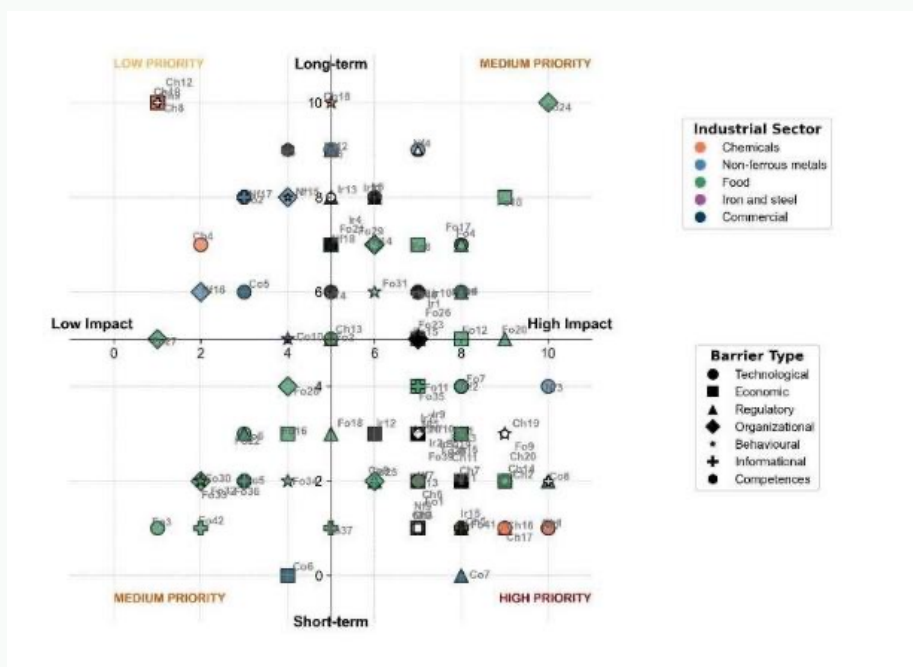
3

IT implementation risks

Digital systems, automation and secure data exchange can become barriers in practice.

Industry in focus - *what industry tells us*

Prioritised barriers across sectors



Priority barriers from industry

Business case is **uncertain**

Product and **service quality** at risk

Adapting **internal processes**

Menu of options: what to choose?

Uncertainty on grid infrastructure



Behavioural barriers seem underestimated but should not be ignored

Panel



**Joppe
Schildermans**



**Thomas
Verbruggen**



**Benny
Holemans**



**Adeline
Wantiez**



**Matthias
Debyser**



Industry in focus: menu of solutions

Unlocking flexibility requires a portfolio of actions which must reinforce each other.

1 BUSINESS CASE 2.0



New markets



New financial instruments

2 ENGAGEMENT

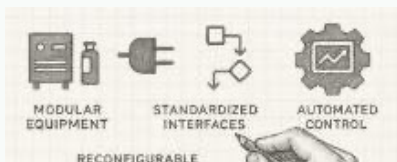


Ownership in a culture of change



Structure and incentives

3 ANTICIPATION

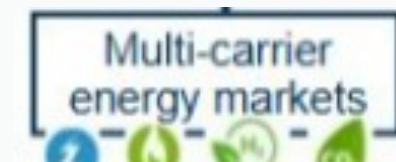


Investments



Communication with system operator

4 COLLABORATION



New multi-carrier markets



Towards industrial symbiosis

From industrial flexibility to market value

GALILEO industrial reference cases



Five industrial partners | one shared question: how to turn real process flexibility into value?

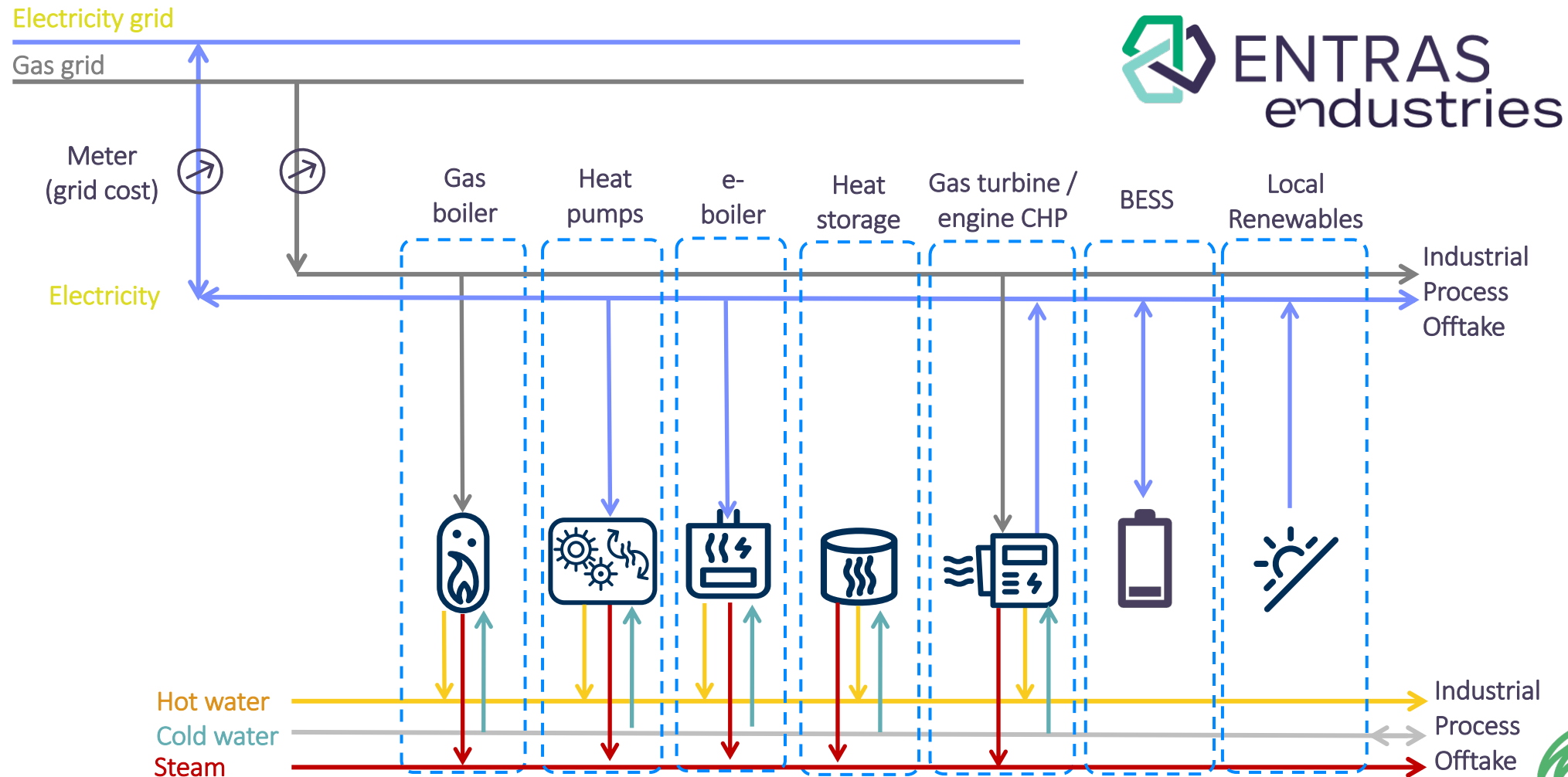
Company	Sector	GALILEO Focus		
 Aperam Stainless Steel Belgium	STEEL	Waste heat valorisation	WASTE HEAT	THERMAL BUFFER ORC / E-BOILER
 Nyrstar	NON-FERROUS	Electrolysis as a virtual battery	ELECTROLYSIS	LIQUID BUFFER
 Tessenderlo Group EVERY MOLECULE COUNTS	CHEMICALS	Steam system flexibility	STEAM	TURBINE / BYPASS
 Tiense Suiker	FOOD	Seasonal steam-network flexibility	SEASONAL SITE	STEAM NETWORK CHP / E-BOILERS
 LCL Data Centers	DATA CENTRES	Storage and flexible connection	PV & WIND	BESS DATA CENTRE

Research and system
partners



GALILEO combines academic models with real industrial use cases from energy-intensive sectors.

Advanced process modeling – *building a digital twin*



ENTRAS
industries



Master optimizer coordinates all steerable assets BTM

An additional decision layer mastering all flex actions – forecasting, nomination, steering

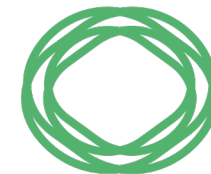
Markets, grid signals, tariffs, contracts, PPAs, CO₂

MASTER OPTIMISER

Technical + economic + multi-market decision layer

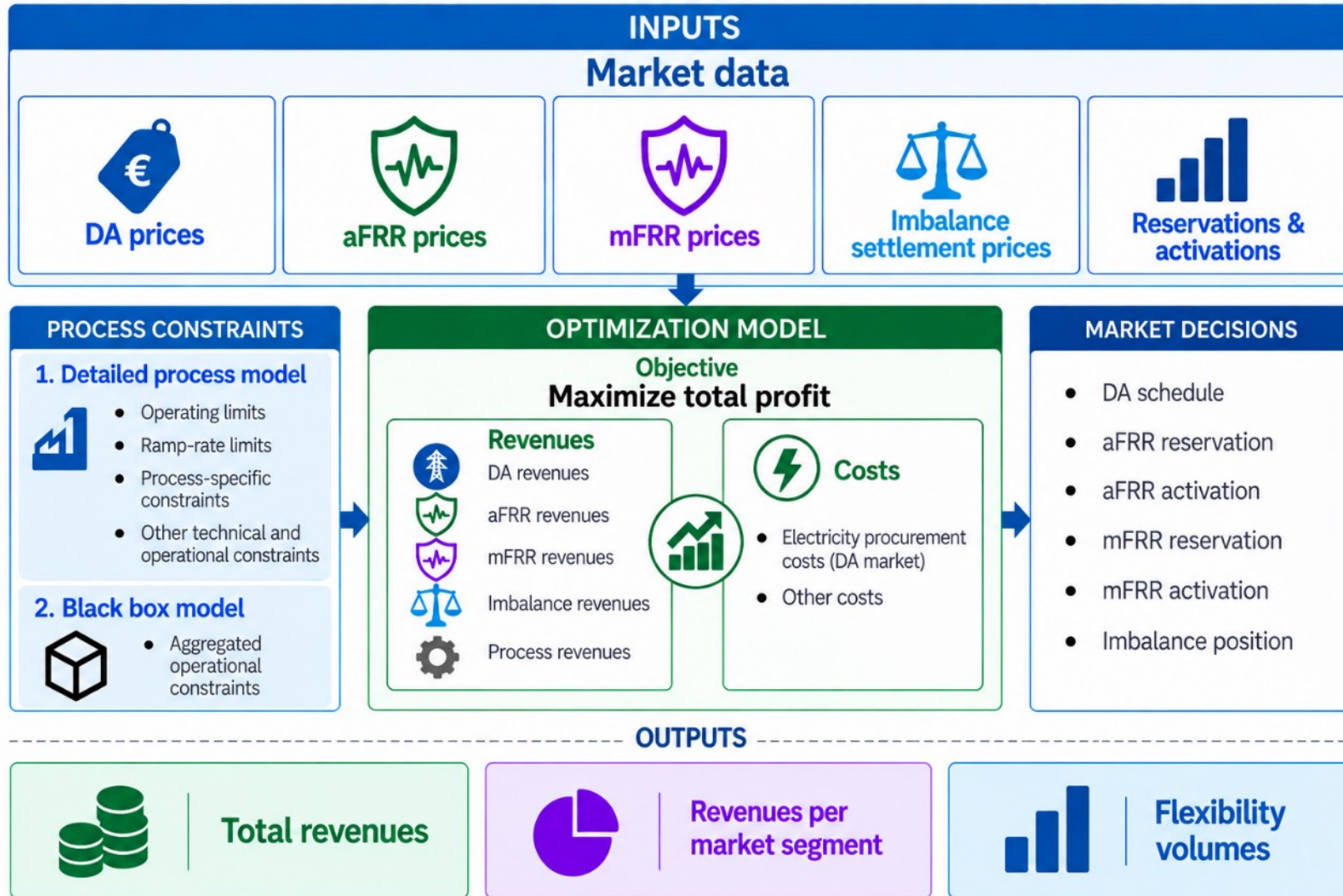
Existing EMS / SCADA / DCS / PLC / local controls

CHP • boilers • e-boilers • heat pumps • batteries • buffers
cooling • steam • biogas • flexible production loads



Example of dispatched industrial process





Optimal Strategy

Find the most profitable and feasible way to participate in electricity markets.



Maximize value

Optimal schedule and bids across markets.



Respect real constraints

Technically feasible and practical for industrial operations.

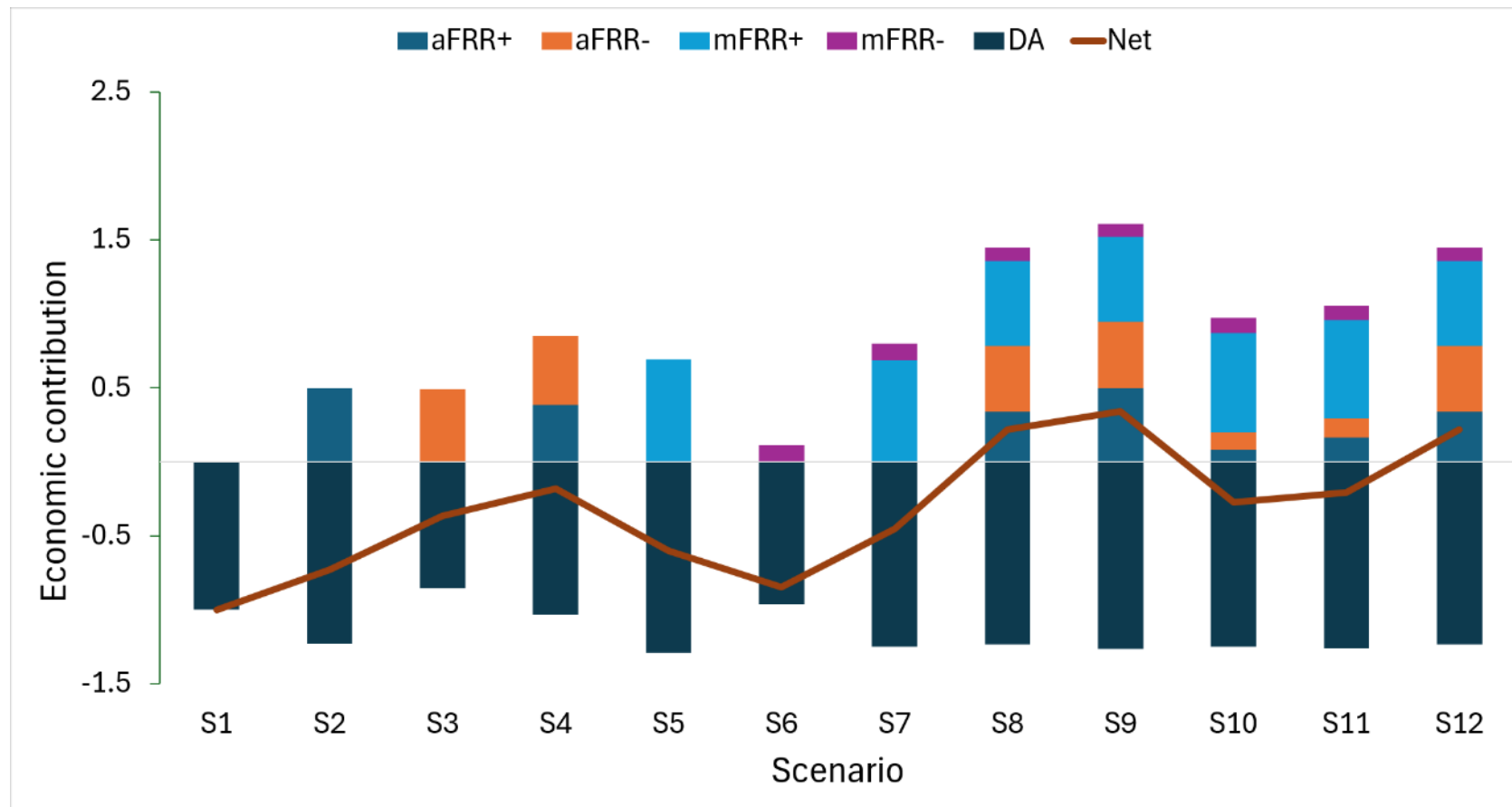


Turn flexibility into opportunity

Generate additional revenues while meeting process and market requirements.



Combining markets creates value ...



Scenario	Market participation
S1	DA only
S2	DA + aFRR ⁺
S3	DA + aFRR ⁻
S4	DA + aFRR
S5	DA + mFRR ⁺
S6	DA + mFRR ⁻
S7	DA + mFRR
S8	DA + aFRR + mFRR
S9	DA + aFRR + mFRR (relaxed activation constraints)
S10	DA + 1.0 mFRR + 0.3 aFRR
S11	DA + 1.0 mFRR + 0.3 aFRR (relaxed activation constraints)
S12	DA + aFRR + mFRR (conservative high-risk flexibility)

Important to outweigh the operational cost against additional revenue

From Flexibility to Value: Key Takeaways



**Higher revenues
through value stacking**

10–30%

higher revenues compared to
participation in a single market



**Lower electricity
procurement costs**

5–15%

reduction through optimized
scheduling of flexible demand



**Better utilization
of flexible assets**

10–25%

increase in asset value realization



**Faster investment
decisions**

Days instead of weeks

business cases prepared in
days instead of weeks



**Smarter planning
and analysis**

More accurate insights

automated data handling and
standardized workflows reduce
manual scenario analysis



**Higher investment
confidence**

Lower risk

more accurate valuation reduces
the risk of over- or under-investing
in flexibility assets



Industrial flexibility creates real value when process capabilities
are combined with the right market strategy.



Panel



**Joppe
Schildermans**



**Thomas
Verbruggen**



**Benny
Holemans**



**Adeline
Wantiez**



**Matthias
Debyser**



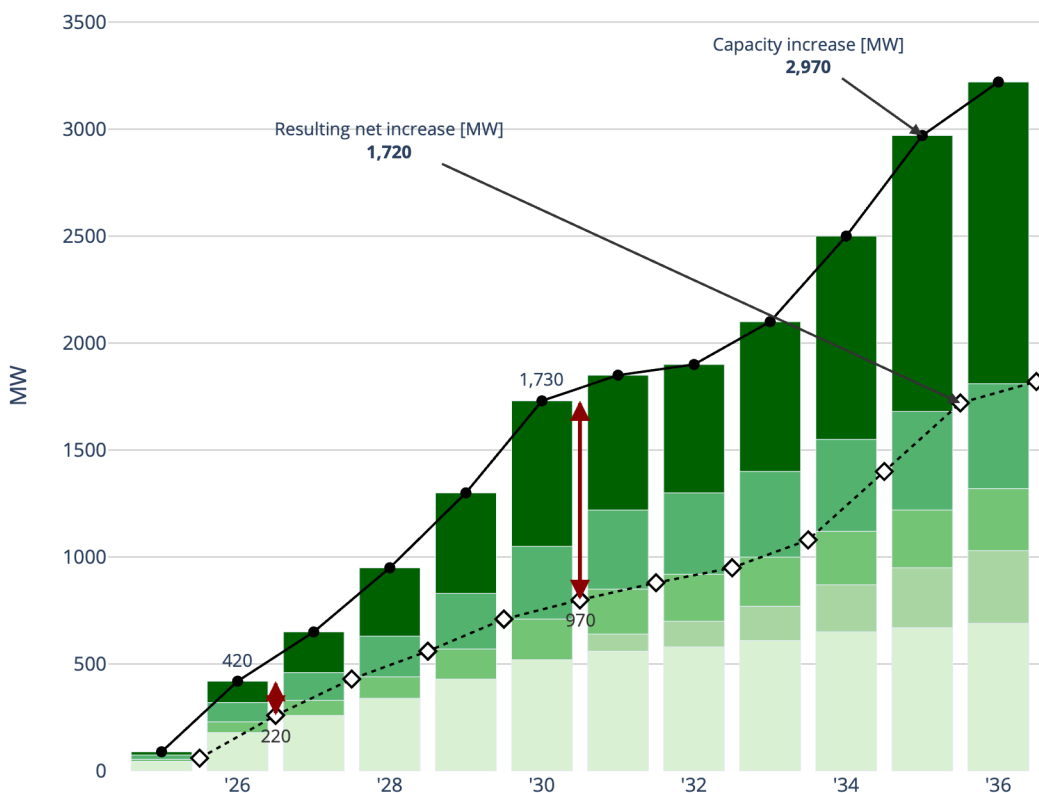


What is most important for turning identified flexibility into a viable market strategy?

Towards System impact/upscaling

There is a systemic need for (industrial) flexibility

Other industry CCS Data centres EAF Power-to-Heat Capacity increase [MW] Resulting net increase [MW]



Flex (central)

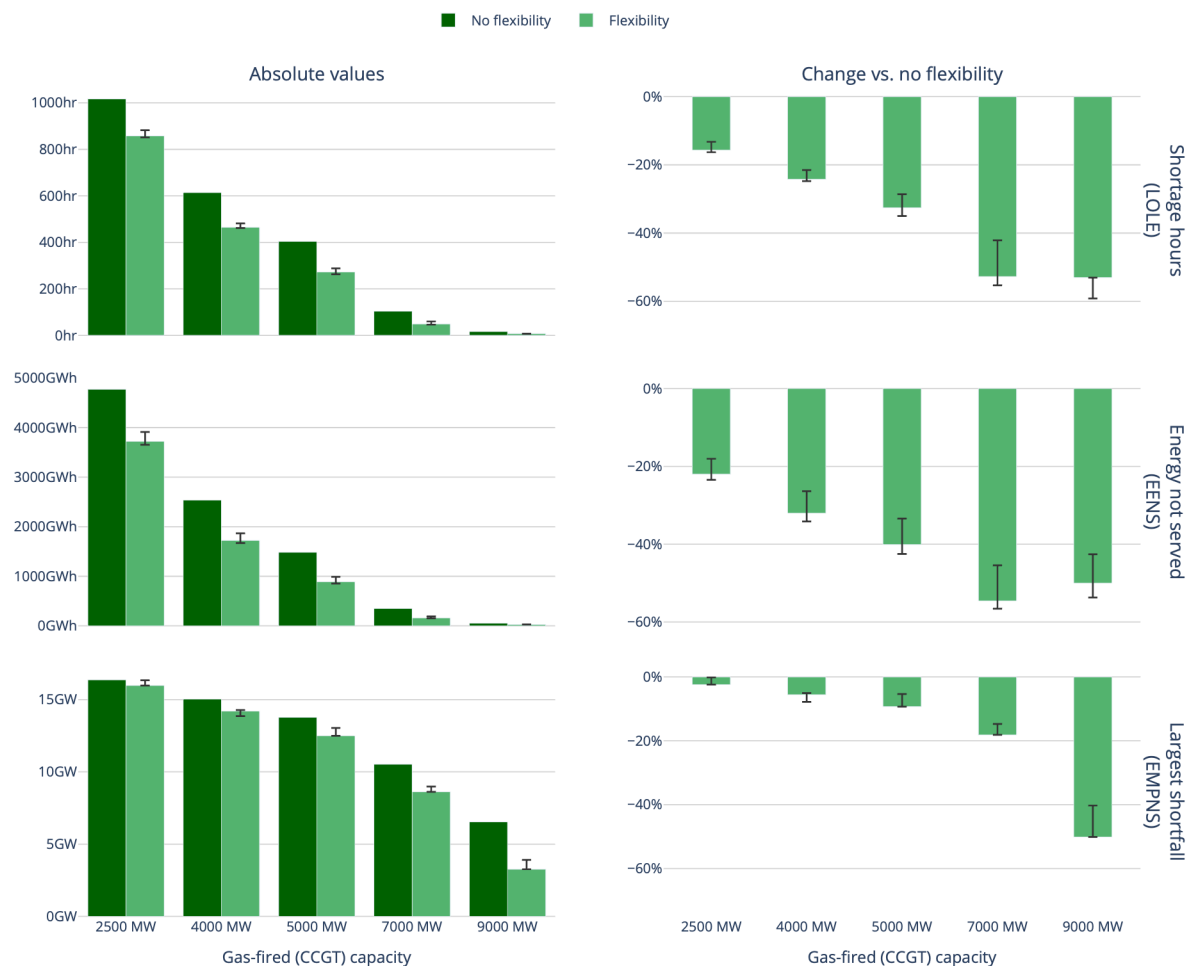
Process

40-80%	Power-to-Heat
75%	EAF
20%	Data centres
0%	CCS
5%	Other industry
45%	Weighted average

- Elia's flexibility needs grow by ~2.5GW to 2036 driven by renewables
- The need is short and frequent, not long — errors rarely last beyond four hours, so demand response qualifies
- New industrial load is ~45% flexible

Figure 3-46 — Additional nominal capacity and flexibility from new loads, in industry and data centres (from Elia (2025) Adequacy and flexibility study for Belgium 2026-2036)

Industrial flexibility supports system adequacy



PATHS2050 REACTORS scenario, 2050 simulations. Average of three weather years (1995, 2008, 2009). Error bars: range across three ways of modelling industrial operation.

- More firm capacity leaves fewer shortages for industry to relieve

1 TWh → 0.03 TWh avoided

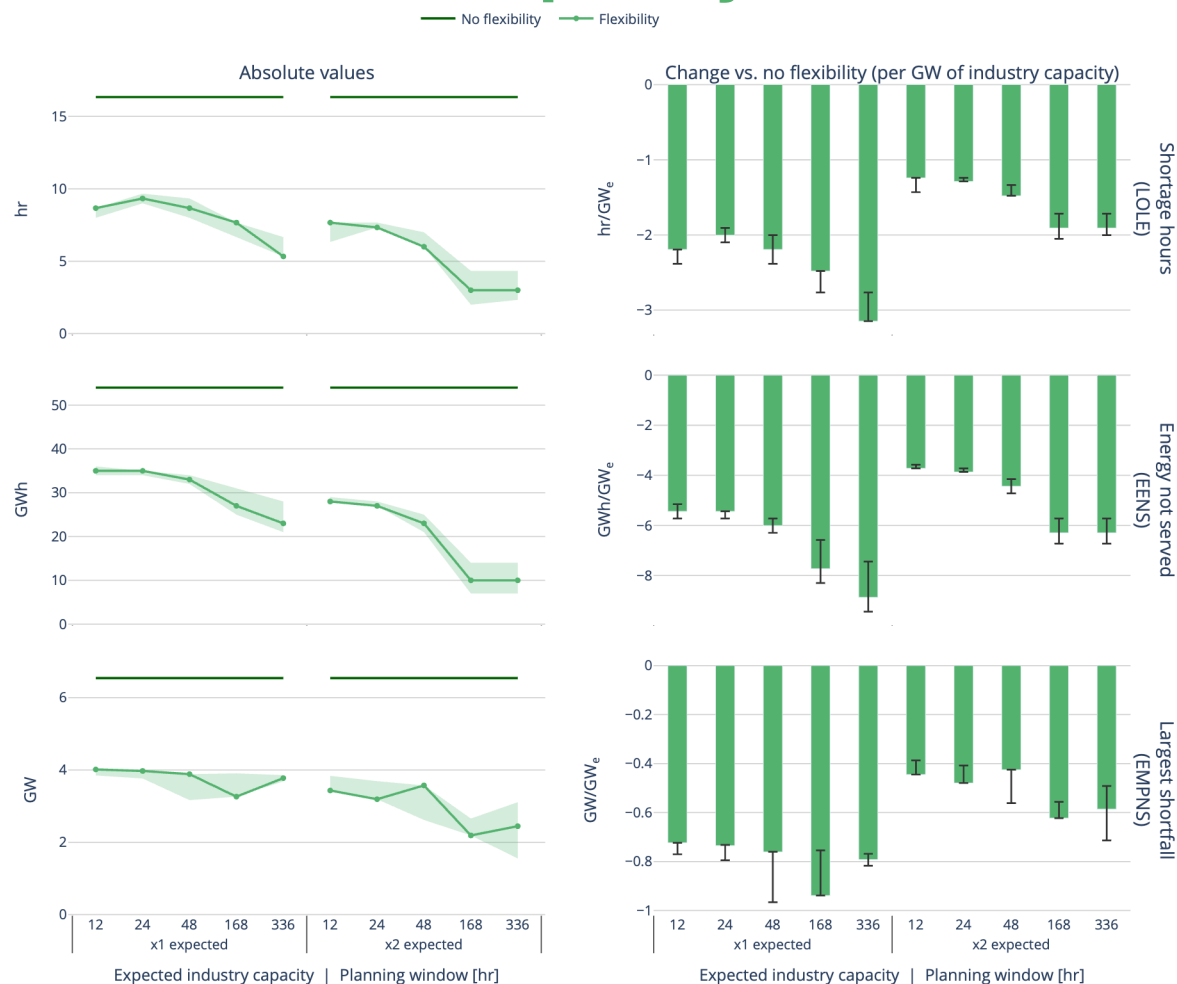
- ... yet industry covers a growing share of them

~20 % → ~50 %

- At peak, the two add up:

At 9 GW CCGT: 3.3 GW less shortage in the worst hour

Industrial capacity and scheduling horizon are partial substitutes



PATHS2050 REACTORS scenario, 2050 simulations. Average of three weather years (1995, 2008, 2009). Error bars: range across three ways of modelling industrial operation.

- **Flexibility is limited by catch-up time** — shifted production still has to be recovered within the planning window
- **More time or more MW** — the two trade off, up to the point where the window stops paying

Not all market products are equally accessible for industrial flexibility

Use cases →	1	2	3	4	5	6	
Day-ahead	++	++	++	++	++	++	► BROADLY ACCESSIBLE
Intraday	++	++	++	++	++	++	
Imbalance	++	++	++	++	++	++	
aFRR ↑	+	++	++	+	++	++	► CONDITIONALLY ACCESSIBLE
aFRR ↓	++	+	++	++	++	++	
mFRR ↑	+	++	++	+	++	++	
mFRR ↓	++	+	++	++	++	++	
CRM	++	++	++	+	+	+	
FCR	-	+	+	-	-	++	► RESTRICTED
Congestion	-	-	-	-	-	-	

Scores: ++ good fit + moderate fit – poor fit. aFRR/mFRR = automatic/manual Frequency Restoration Reserve, CRM = Capacity Remuneration Mechanism, FCR = Frequency Containment Reserve

Process design enables market access and flexibility valorization

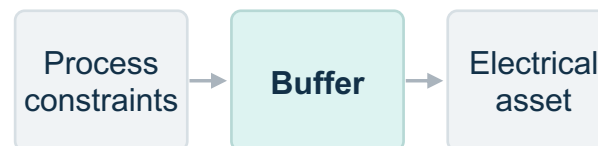
ELECTRIFICATION

Electrification creates more controllable power



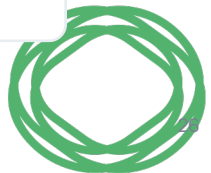
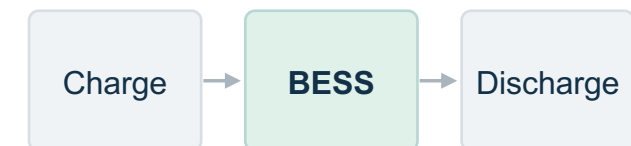
PROCESS BUFFERS

Buffers decouple process constraints



ELECTRICITY STORAGE

Storage enables fast bidirectional response



Industrial flexibility needs accessible markets that are compatible with industrial operating constraints

Balancing services and imbalance settlement

- Capacity reservation blocks shorter than 4 h
- Minimum bids below 1 MW
- New products matched to system needs (FFR)
- Real-time price (RTP)

Congestion management

- Open redispatch to smaller units and demand
- Flexible connection agreements

Capacity Remuneration Mechanism

- Proportionate participation rules
Lower operational burden, allow seasonality

Reduce unnecessary participation barriers while preserving technical power system requirements

● Modelled in GALILEO

● In use / under implementation

● Broader recommendation

Industrial flexibility needs accessible markets that are compatible with industrial operating constraints

Balancing services and imbalance settlement

● **aFRR/mFRR capacity reservation blocks < 4 h**

Match plant availability

● **Minimum bids < 1 MW**

Enable access for smaller flexible assets

● **New products matched to system needs (FFR)**

Only where the system needs fast response

● **Actionable real-time price (RTP) signals**

Support voluntary balancing responses

Congestion management

● **Open congestion management services to smaller assets**

E.g. 1 MW unit size Elia iCAROS roadmap

● **Flexible connection agreements**

Earlier access with restrictions

Capacity Remuneration Mechanism

● **Proportionate participation rules**

Lower operational burden, allow seasonality

Reduce unnecessary participation barriers while preserving technical power system requirements

● Modelled in GALILEO

● In use / under implementation

● Broader recommendation

Panel



**Joppe
Schildermans**



**Thomas
Verbruggen**



**Benny
Holemans**



**Adeline
Wantiez**



**Matthias
Debyser**





Will industrial flexibility take off?

Panel



**Joppe
Schildermans**



**Thomas
Verbruggen**



**Benny
Holemans**



**Adeline
Wantiez**



**Matthias
Debyser**





CLEAN
FLEXIBLE
COMPETITIVE
TOGETHER

FLEXIBLE
INDUSTRY
BRIGHTER
TOMORROW

Let's keep in touch!

