

Energy Policy, Enterprise and IT

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Talk given on 1 April 2026 in the context of a roundtable
discussion on the energy sector: How IT supports grid flexibility.

Event organized by NRB.



PART 1

Energy policy

Between 2000 and 2022, European energy policy was driven by two priorities:

- (i) the phase-out of nuclear power;
- (ii) the reduction of CO₂ emissions.

In some cases, the overly ideological implementation of these priorities has led to two consequences:

1. energy becoming scarcer and more expensive, weakening European industrial competitiveness;
2. increased dependence on energy imports.

These issues have increased Europe's vulnerability to certain foreign regimes that may use energy as a means of exerting pressure.

The shock of 2022

In 2022, Russia invaded Ukraine while simultaneously using gas as a weapon to prevent an overly strong reaction from the Europeans. As early as 2021, Russia had restricted its gas supplies, preventing Europe from filling its storage facilities and forcing it to enter the winter with unusually low reserve levels.

This strategy, based on exploiting Europe's energy dependence as a means of exerting pressure, was openly acknowledged, as illustrated by certain communications from Gazprom.

Excerpts from a Gazprom promotional video explicitly depicting the interruption of gas supplies to Europe. A Gazprom operator closes a valve, followed by the appearance of the EU flag.



Indirect funding of the Russian military-industrial complex

In addition to energy dependence, massive purchases of Russian gas and oil have contributed to finance the country's military-industrial complex.

These financial flows have strengthened Moscow and contributed to the belief that Europe would respond only weakly in the event of aggression, a belief that was confirmed at the beginning of the conflict.

“Vladimir Putin is able to fund his war machine thanks to EU payments for Russian gas and oil.”

Josep Borrell, 2022.



The whole of Europe has paid the price

The crisis sent gas prices soaring, threatening a large part of European industry and putting many households in a precarious situation.

The sabotage of the Nord Stream gas pipelines on 26 September 2022 marked a further turning point.

Some investigations point to the hypothesis of a Ukrainian operation, potentially carried out with the approval of the United States. The aim would have been to prevent certain European countries from maintaining privileged energy relations with Russia.

Gas price trends on the Dutch TTF, the European market benchmark.



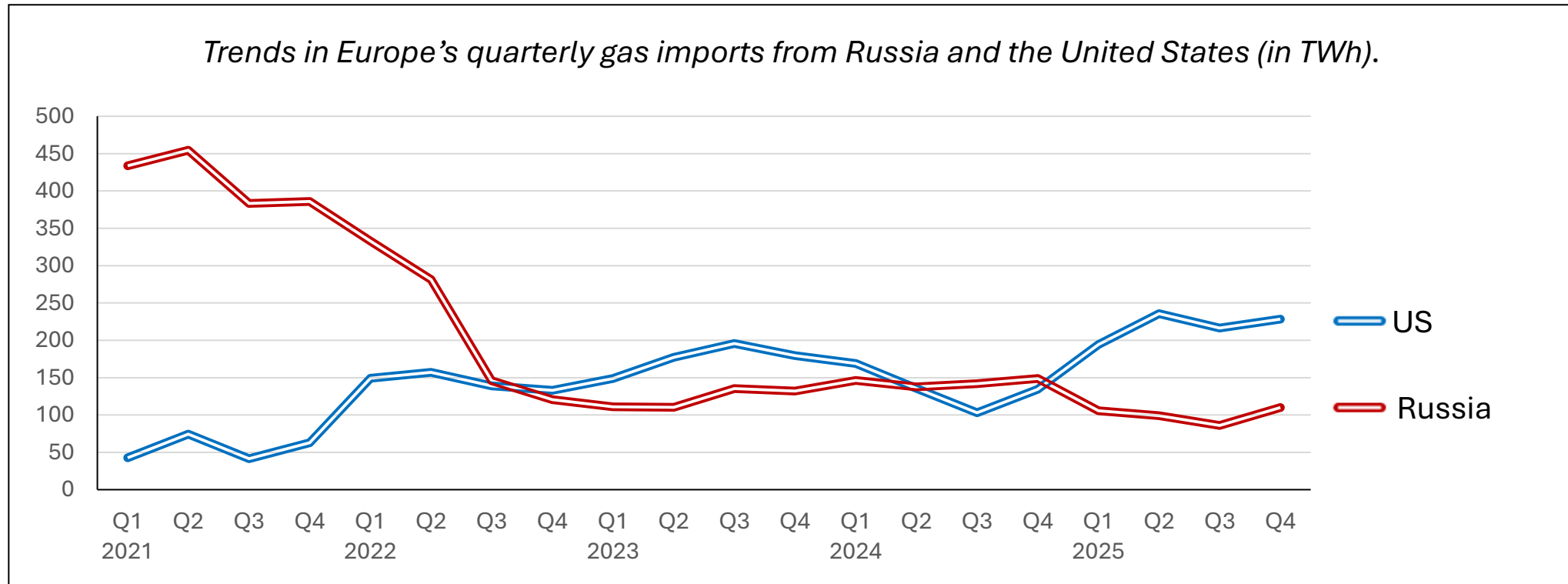
*Gas leak on Nord Stream 2.
Gas prices rise to €186/MWh.*

26/09/22



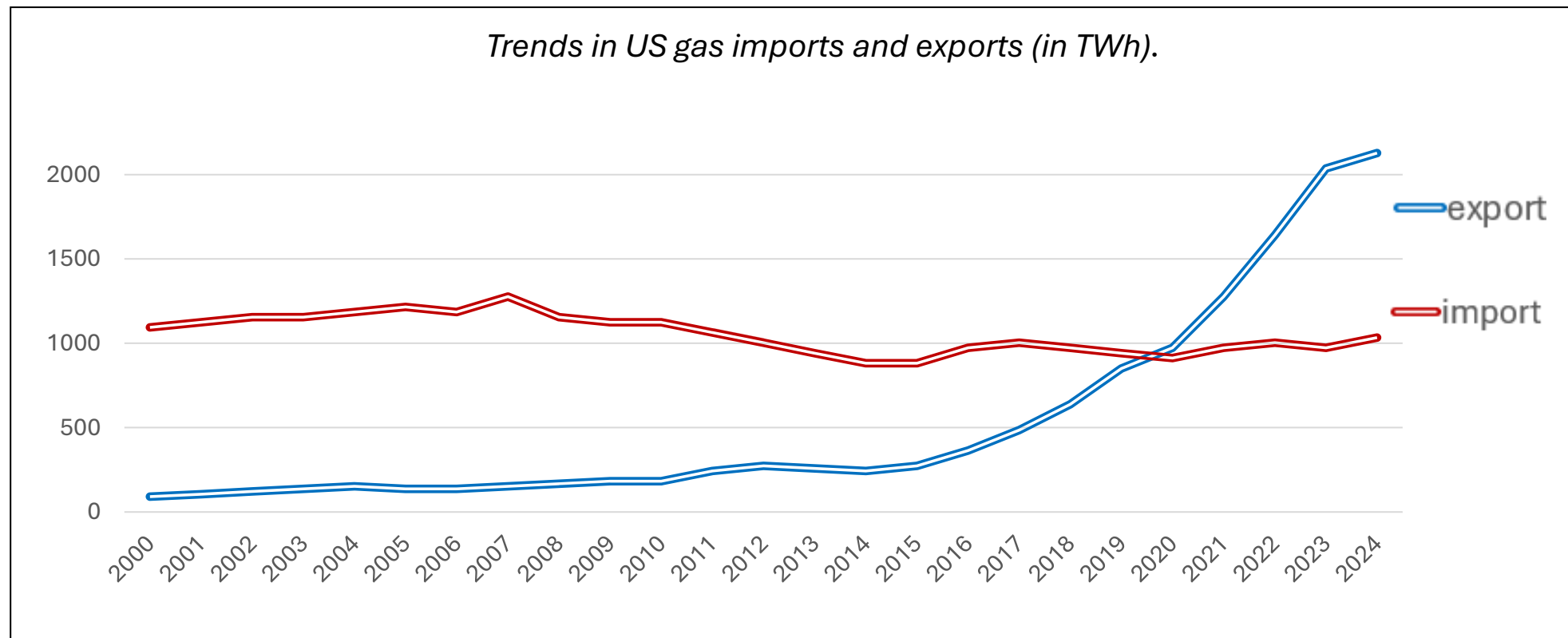
From one dependency to another

The reduction in Russian supplies has been offset by increased imports of liquefied natural gas (LNG) from the United States, which has become Europe's main supplier.



The effectiveness of US Realpolitik in the energy sector

In just ten years, the United States has gone from being a net importer to becoming the world's leading exporter of LNG, thanks to the rapid expansion of its shale gas industry and the accelerated development of liquefaction capacity.¹



¹ Several LNG terminals originally built to import gas into the United States were converted into export terminals during the 2010s.

This new dependence is dangerous for two reasons

- 1 The United States could use gas as a weapon against Europe.

POLITICO

The EU aims to reduce its dependance on American gas following Trump's threats over Greenland

The European Commissioner for Energy stated that the US president's threats were a "wake-up call", highlighting the need to find new sources of gas supply.

► LISTEN

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- 2 During the 1973 oil embargo, the United States prioritised its domestic market and restricted exports.

Public Law 93-159

AN ACT

November 27, 1973
[S. 1570]

To authorize and require the President of the United States to allocate crude oil, residual fuel oil, and refined petroleum products to deal with existing or imminent shortages and dislocations in the national distribution system which jeopardize the public health, safety, or welfare; to provide for the delegation of authority; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Emergency Petroleum Allocation Act of 1973".

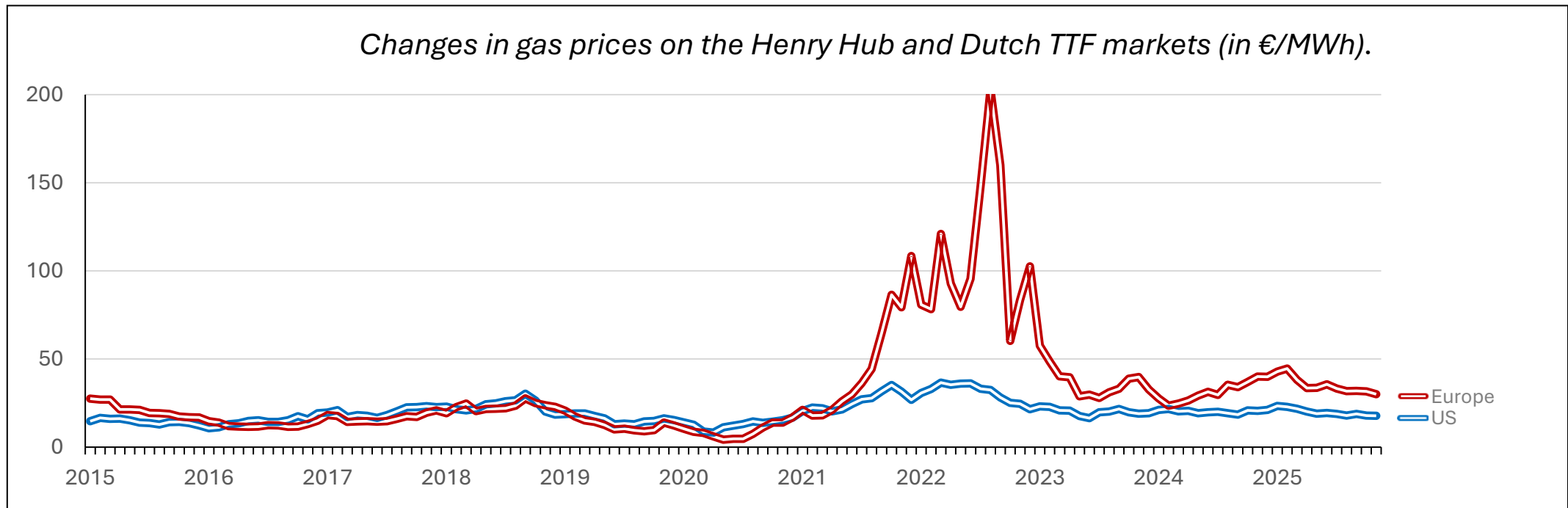
Emergency
Petroleum Allo-
cation Act of
1973.

In 1973, Washington passed the Emergency Petroleum Allocation Act. This law gave the federal government extensive powers to regulate the domestic oil market, while exports of petroleum products were subject to a system of licences granted by Congress.

European gas prices are about three times higher than in the US

On 4 March 2026, the price of gas stood at around €9/MWh on the Henry Hub (United States) compared with €55/MWh on the Dutch TTF (Europe). Since January 2023, average prices have been around €15/MWh in the United States and €35/MWh in Europe.

For Europe, this price gap poses an existential threat to the competitiveness of several industrial sectors, particularly the chemical industry.



Two examples illustrating this existential threat in Belgium

BASF to cut 600 jobs in Antwerp, a symbol of Europe's excessively high energy costs



For several years, BASF has been heavily affected by the crisis impacting the entire chemical sector.

BASF has confirmed its intention to cut 600 jobs at its Antwerp plant by 2028. The sector is under pressure due to high energy costs.

L'Echo

Another blow for the Port of Antwerp: Envalior closes its Kallo site



Envalior will shut down its glass fibre plant in Kallo by the end of 2026, eliminating 220 jobs in the Port of Antwerp.

Envalior is set to close its fibreglass plant in Kallo by the end of the year, resulting in the loss of a further 220 jobs in the Port of Antwerp.

L'Echo

Still, there is reason for optimism in Europe

Despite current volatility, LNG prices are expected to fall sharply in the coming years. A wave of new liquefaction terminals is set to enter the market and massively increase global supply.¹

LNG project	Country	Capacity (Mt/year)	Energy (TWh/year)
Golden Pass LNG	USA	20	≈ 270
Plaquemines LNG	USA	13	≈ 170
North Field East & South	Qatar	48	≈ 620
LNG Canada (Phase 1)	Canada	14	≈ 180
Coral South + Rovuma	Mozambique	20	≈ 260



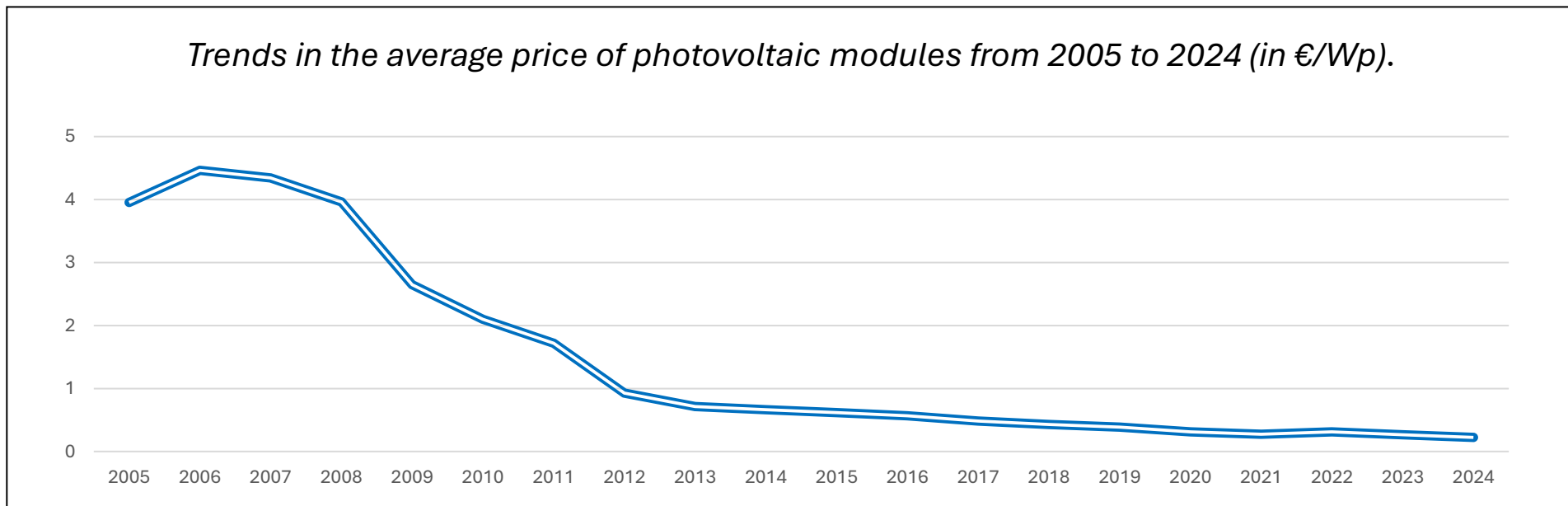
These few projects currently under construction already represent nearly 1,500 TWh/year of additional capacity. By comparison, Belgium consumes around 180 TWh/year of natural gas, and before 2022, Europe imported an average of 160 TWh/year of Russian gas via pipelines.

¹ This projection assumes that the geopolitical situation in the Middle East does not deteriorate further and that a degree of stability returns to the region.

Another source of hope: clean-techs are becoming cheap-techs

Clean-techs refer to all technologies, energy solutions and industrial processes designed to produce, store and transport energy with very low carbon emissions.

In recent years, the large-scale industrialisation of clean-techs, particularly in China, has made them inexpensive, and even competitive with conventional fossil fuel technologies.



Example 1: photovoltaic (PV) panels

China has brought about a collapse in PV prices through three key factors:

- (i) technological excellence;
- (ii) massive industrial capacity;
- (iii) fierce competition in its domestic market.

Global prices for mainstream PV modules have fallen to as low as €0.10/Wp.

Module class	Global PV module prices (€/Wp)	
	October 2016	October 2025
High efficiency	0.60	0.12 (-400%)
Standard	0.46	0.10 (-360%)
Low cost	0.34	0.05 (-580%)

China alone produced more than 650 GWp of PV in 2024, equivalent to nearly a third of the world's installed PV capacity (2.2 TWp in 2024).

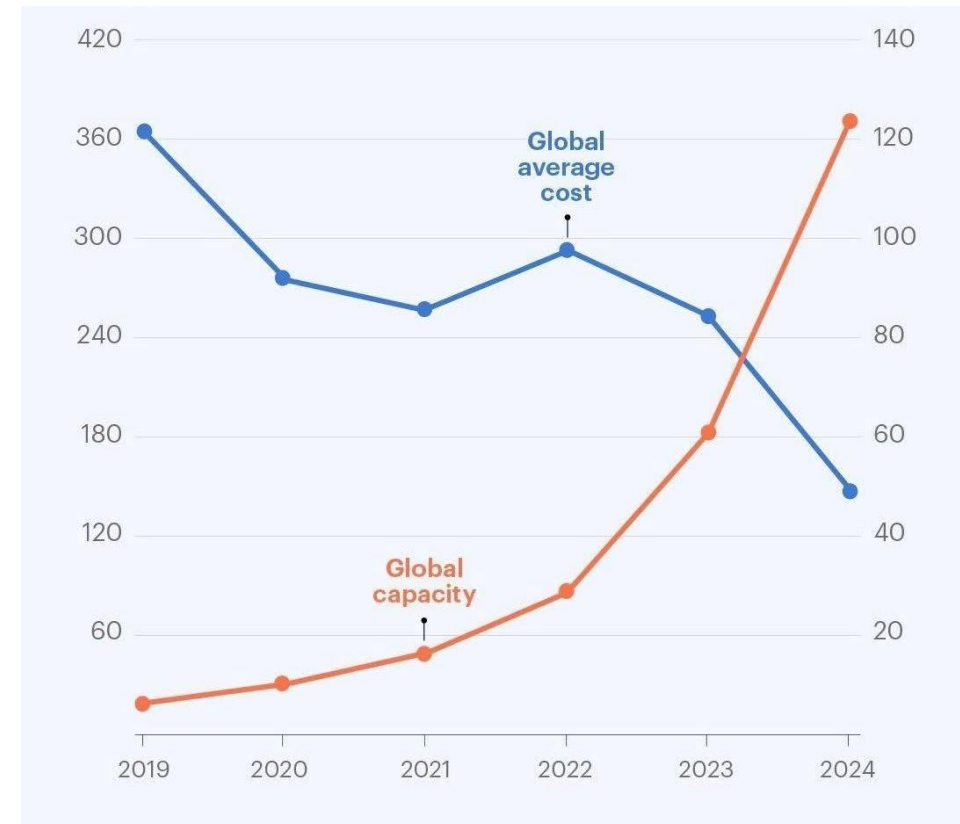
Example 2: Batteries (1/2)

China also leads the way in battery manufacturing. CATL, BYD, CAL and other manufacturers produce battery packs on a massive scale for both electric vehicles (EVs) and stationary storage.

In 2024, the global average price of a battery pack was around \$140/kWh.

Chinese manufacturers had managed to drop below the \$100/kWh mark by the end of the year.

Trends in installation costs (in \$/kWh –left-hand axis) and capacity (in GW –right-hand axis) of batteries at the level of electricity grids.



Example 2: Batteries (2/2)

The fall in battery prices is making EVs more affordable.

In 2024, BYD's Qin Plus EV, with a range of 500 km, was selling for around €15,000. By way of comparison, in 2015, an EV with a range of 300 km cost at least €30,000.

BYD's Qin Plus EV.



At BYD, a new EV rolls off the production line every 51 seconds.



Let us do a quick calculation

Let us see just how cost-effective the combination of PV and batteries can be, particularly in regions close to the equator.

Let us take a 1 MWp solar power plant equipped with a battery system. Let's assume:

- (a) a load factor of 25%;
- (b) a production profile that is identical every day;
- (c) a battery capable of storing half of the daily output to ensure a constant supply;
- (d) a cost of €0.10/Wp for the PV and €100/kWh for the battery system.

The daily output of the PV plant is:

$$1 \text{ MW} \times 0.25 \times 24 \text{ h} = 6 \text{ MWh/day.}$$

According to assumption (c), a 3 MWh battery is therefore required.

The total capital expenditure (CAPEX) for the PV + battery system is therefore:

$$(0.10 \times 1,000,000) + (100 \times 3 \times 1,000) = \text{€}400,000.$$

Over 20 years, the total output is:

$$1 \text{ MW} \times 8,760 \text{ h} \times 20 \text{ years} \times 0.25 = 43,800 \text{ MWh (assuming no losses in the battery).}$$

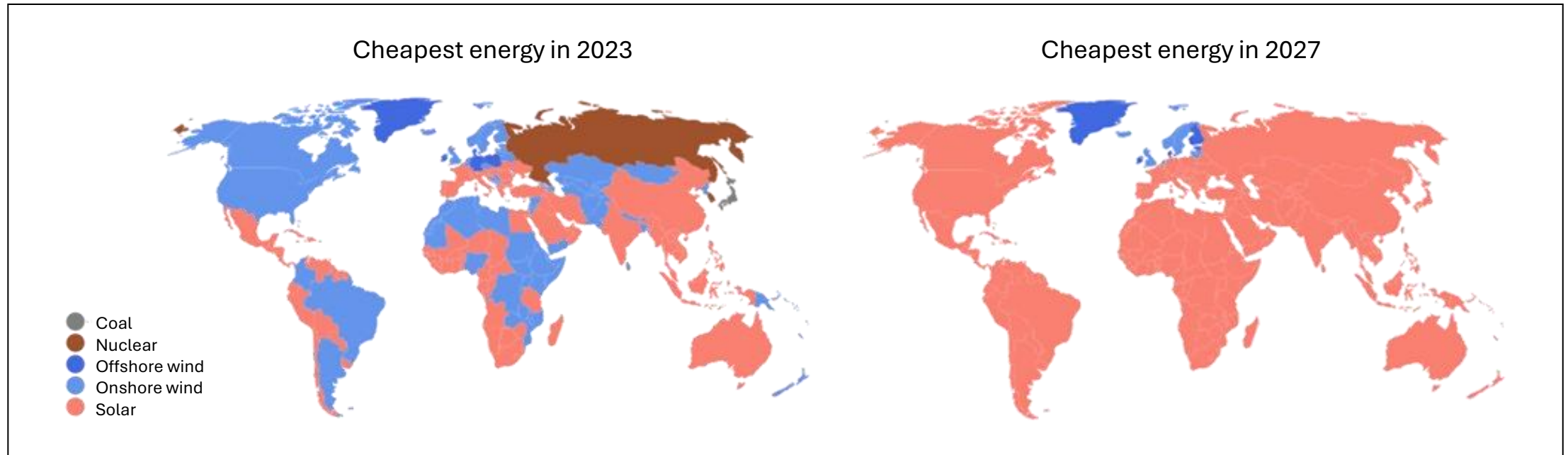
The average cost of investment is therefore: $400,000 / 43,800 \approx \text{€}9/\text{MWh}$

A CAPEX of €9/MWh for a PV + battery installation in a very sunny area is extremely competitive compared to energy prices observed on the markets.

Energy	Price	Source	Date
Natural gas (Dutch TTF)	€55/MWh	ICE Endex	04/03/2026
Natural gas (Henry Hub)	€9/MWh	Business Insider	04/03/2026
Crude oil (US Brent)	€33/MWh	oilprice	08/12/2025
Electricity (CAL-26)	€76/MWh	elexys	08/12/2025

PV will soon dominate global electricity generation

A recent study published in *Nature Communications*¹ concludes that solar power is set to become the cheapest source of electricity in most parts of the world, even when battery storage is factored into the system cost.

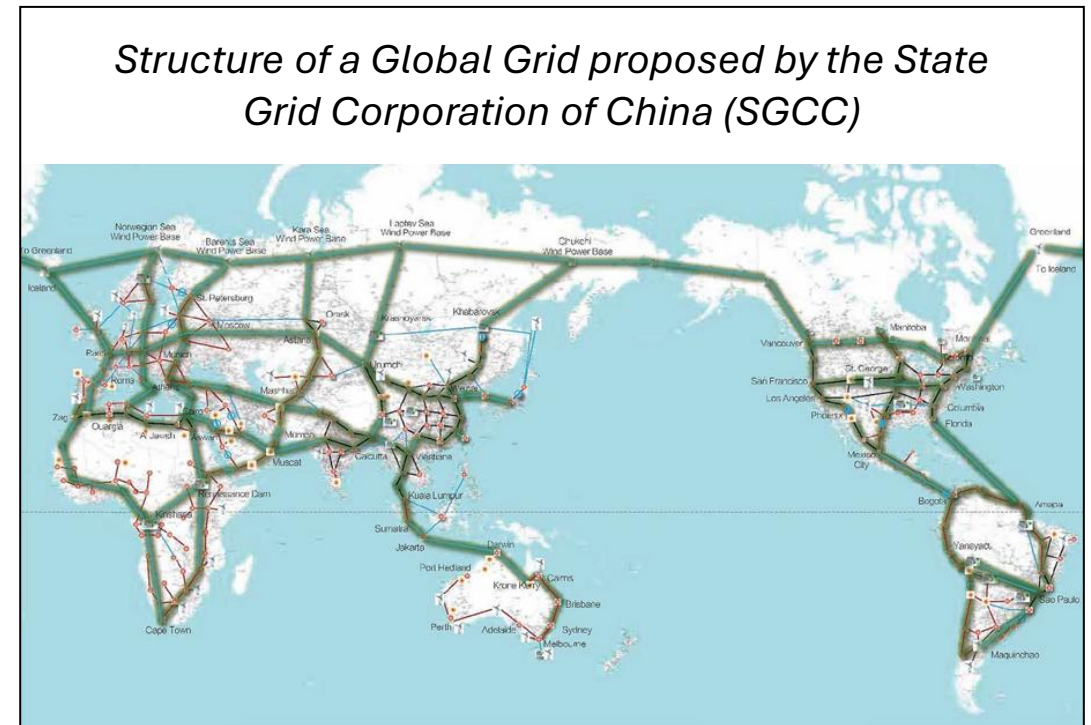


¹ Paper reference: [Nijssse, F.J.M.M., Mercure, JF., Ameli, N. et al. \(2023\). The Momentum of the Solar Energy Transition. Nature Communications, 14, 6542.](#)

An electricity grid to connect all regions of the world

One could envisage transporting this cheap electricity to major consumption centers, such as Europe, via long-distance overland and undersea power links.

This idea of a global electricity grid connecting electricity producers and consumers across continents was introduced in 2013 by Spyros Chatzivasileiadis, Damien Ernst and Göran Andersson under the name *Global Grid*.¹

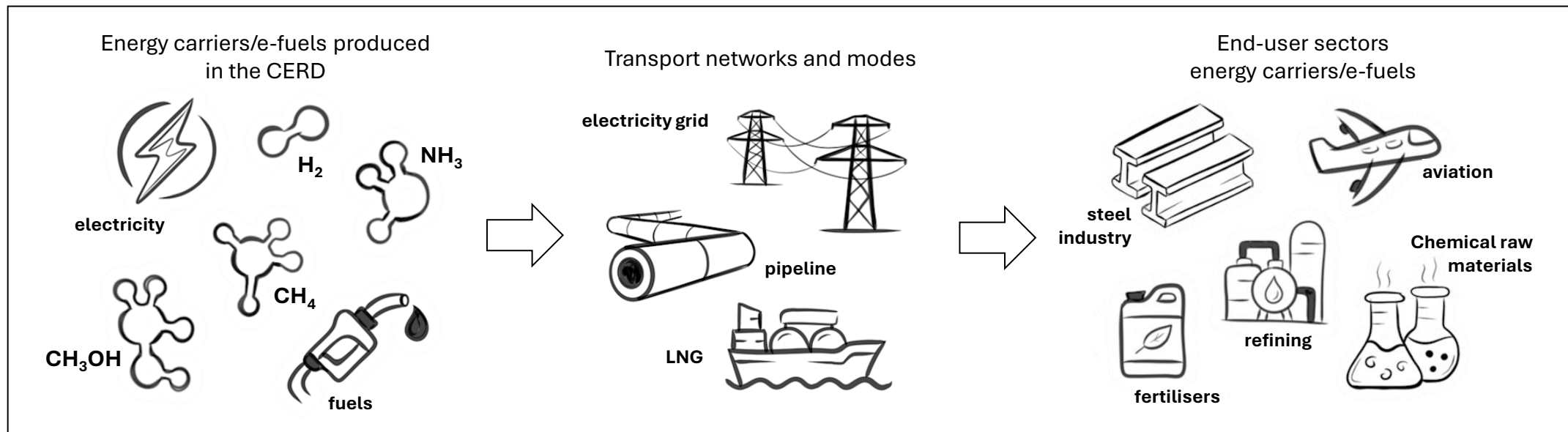


¹ Paper reference: [Chatzivasileiadis, S., Ernst, D., & Andersson, G. \(2013\). *The global grid*. Renewable Energy, 57, 372–383.](#)

A promising alternative already gaining momentum

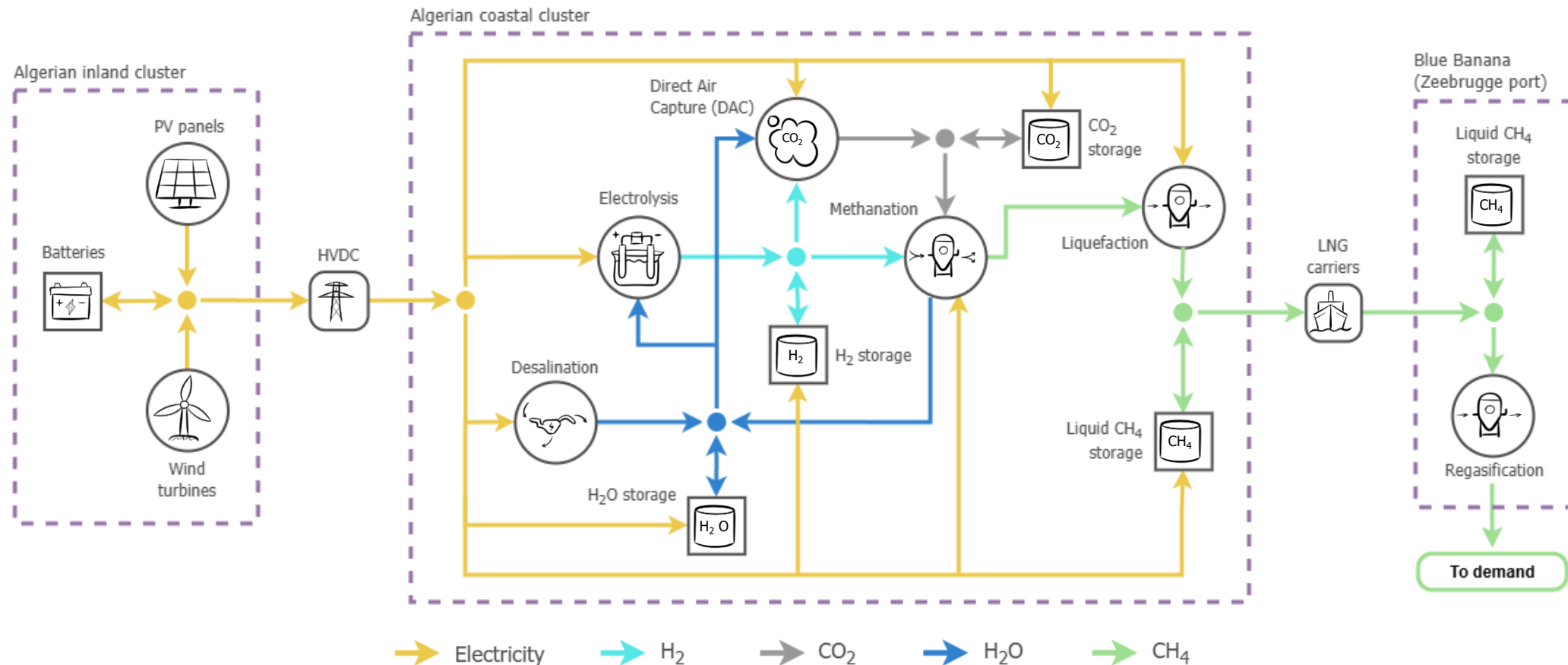
Cheap solar energy can also be transported to Europe in the form of molecules that are easy to store and transport over long distances, known as e-fuels.

These are produced directly in regions of the world that have renewable resources of exceptional abundance and quality. These are known as Remote Renewable Energy Hubs (RREH). They can directly replace fossil hydrocarbons as they possess the same physical and chemical properties.



Schematic diagram of e-methane production using clean-tech in an RREH

Solar and wind energy are captured in the Algerian desert and transported to the coast via an HVDC transmission line. There, it is used to produce e-methane, which is then shipped to Belgium for consumption.



PART 2

Enterprise in this new energy context

Energy policies directly influence the choices made by companies to ensure their energy supply and competitiveness.

We will discuss three key points of the current energy context:

Point 1 – The choice of the level of electrification of processes and energy uses

Point 2 – The integration of local renewable generation

Point 3 – Grid congestion and its implications for companies

Point 1 – The choice of the level of electrification of processes and energy uses

Today, the trend for company sites and industrial facilities is clearly towards the electrification of energy uses, particularly through heat pumps, electric boilers, electric furnaces, and other power-based technologies.

Looking ahead, energy-rich molecules produced in RREHs may become available at low cost in the coming years,

This perspective raises a relevant question:

Could the remaining non-electrified industrial processes be decarbonized using e-fuels in the coming years?

Point 2 – The integration of local renewable generation

Grid electricity prices:

Based on Belgian wholesale electricity indices for early 2026 (e.g., EBlm, Endex, eSpot), electricity prices are around €80–90/MWh, excluding network tariffs, taxes, and supplier margins.

Cost of PV electricity:

One kWp of PV generates an average of 900 kWh/year in Wallonia (standard orientation and tilt). Assuming an installation cost of €0.80/Wp for a residential system, the cost of self-generated MWh over a typical 25-year lifespan is:

$$(0.80 \times 10^3) / (900 \times 25) \approx \text{€}0.036/\text{kWh} = \text{€}36/\text{MWh}.$$

PV electricity therefore costs significantly less than grid electricity.
When self-consumption is high, **photovoltaics is a ‘no-brainer’**. Even when the self-consumption rate is limited, it can typically be increased by adding battery storage.

Point 3 – Grid congestion and its implications for companies

The Belgian electricity grid is currently operating at or near capacity in many areas, preventing new loads from being connected. This congestion is occurring at a time when electricity demand is increasing rapidly, driven by electrification and the emergence of new applications.

**The collapse of the electricity grid, heavily saturated:
“If we do nothing, Wallonia will go bankrupt”**

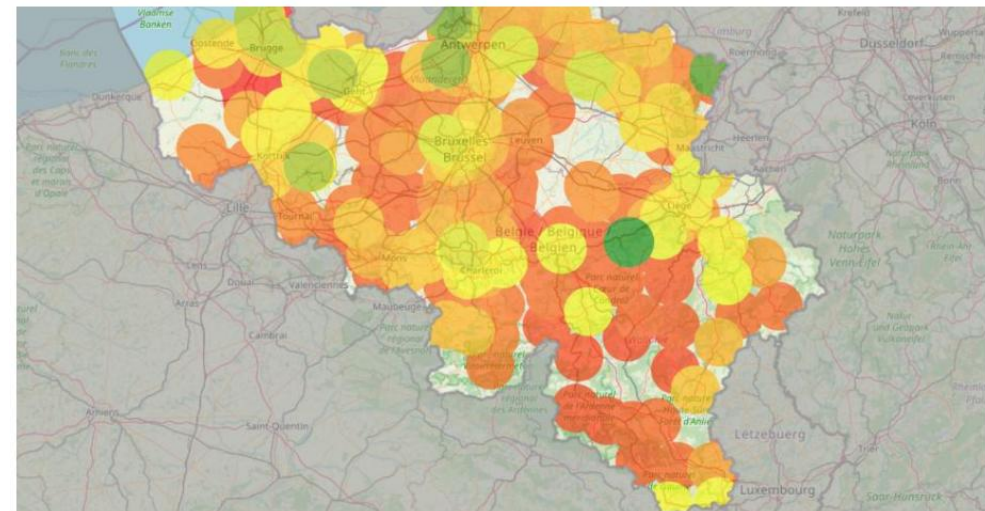


Christophe Leroy

Journaliste au Vif • 23-10-2025, 16:58 • Mise à jour le: 23-10-2025, 17:49 •

🕒 5 min. de lecture

Le Vif



The remaining hosting capacity of the electricity grid shows a Wallonia that is already strongly saturated today (initially expected for 2027).

Alarming examples for the Belgian economy

In Belgium, numerous industrial projects (such as business park expansions, industrial processes electrification, and data centers) cannot be connected to the grid within a reasonable timeframe. Connection delays of 5 to 10 years can be expected.

Libin: the future Van der Valk hotel cannot be supplied with electricity

David Pierson

Published Wednesday 1 October 2025 at 15:55 – Updated Wednesday 1 October 2025 at 16:42

In Libin, the project to build a new Van der Valk hotel next to the Euro Space Center cannot be connected to the grid despite having obtained planning permission and the site being prepared.

tvLux

Hundreds of companies blocked at the gates of the Walloon electricity grid

MAXIME VANDE WEYER, NICOLAS BAUDOUX

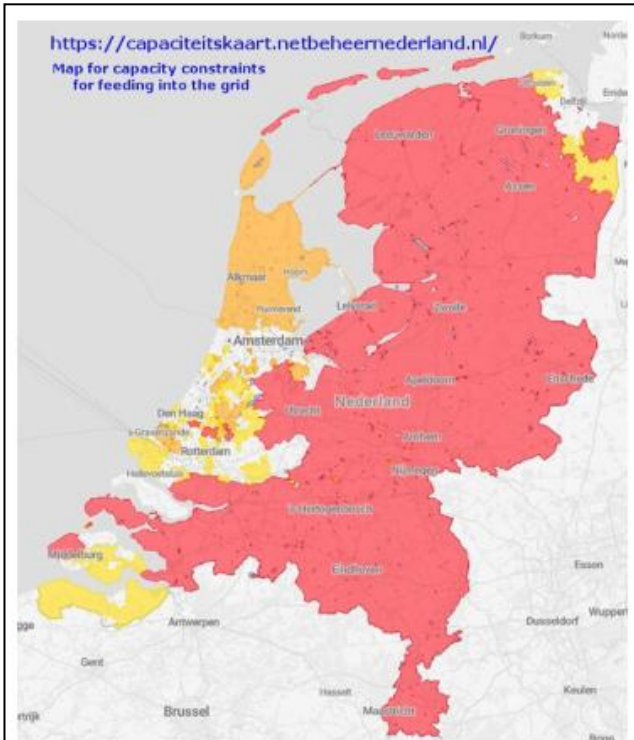
11 December 2025, 00:05

Applications relating to industrial electrification projects, batteries or fast-charging stations are piling up in the queue.

Even less energy-intensive initiatives, such as the installation of solar panels by an SME or the expansion of an industrial estate, are also being held up.

L'Echo

These problems are encountered throughout all Europe



Map of grid congestion in the Netherlands.
Image: Netbeheer Nederland

In the Netherlands, nearly 12,000 businesses are waiting to be connected.



A street in Barcelona plunged into darkness during the Iberian blackout of 28 April 2025.
© AFP

*In Spain, the grid is struggling to absorb all the energy produced locally.
On 28 April 2025, this led to a blackout lasting several hours that affected essential services.*

What should you do if you don't have enough connection capacity?

When the grid is overloaded and the distribution system operator (DSO) refuses to increase your power supply, the only solution is to reduce your reliance on the grid by using local storage and generation solutions, such as:

Gas-fired generator: Based on TTF gas indices for early 2026 ($\approx$ €30/MWh), and assuming a typical electrical efficiency of 35%, the cost of electricity produced by a gas generator is approximately €85/MWh.

- ☒ Provides dispatchable and controllable power;
- ☒ Ensures continuity of operations;
- ☒ Can complement intermittent renewable generation.

Photovoltaics: As shown above, the cost of self-generated electricity is approximately €36/MWh.

- ☒ Very competitive energy cost;
- ☐ Not controllable;
- ☐ Does not necessarily generate power when required.

Battery: It is not necessarily very expensive. When congestion occurs only during limited periods, a battery can be sufficient to remain within the capacity limits imposed by the DSO. In addition, batteries increase self-consumption by storing surplus PV generation.

These elements must be controlled by an EMS

The Energy Management System (EMS) is a software layer that monitors in real time:

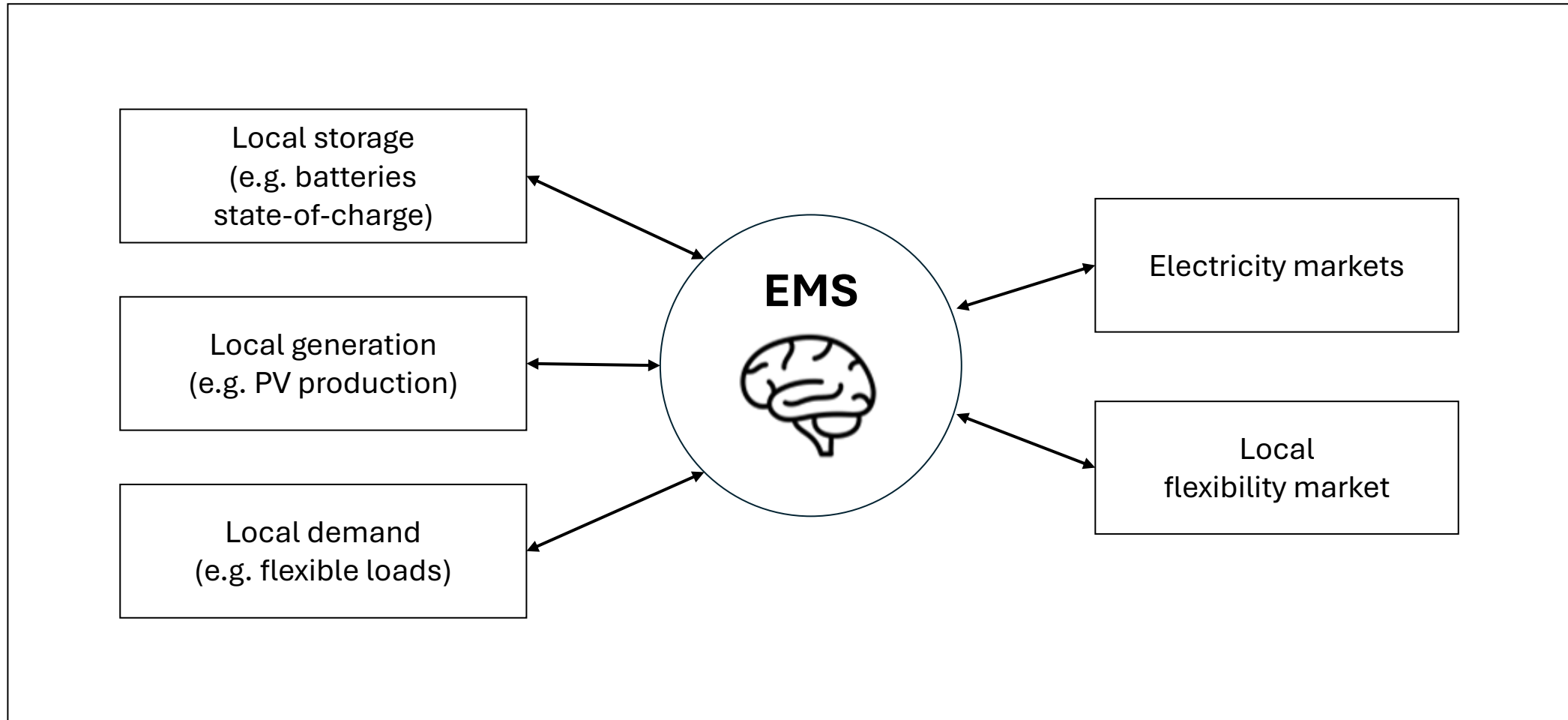
- (i) the state of the company's energy assets (PV production, batteries state-of-charge, flexible loads, EV charging/discharging, industrial processes consumption)
- (ii) grid constraints and connection limits;
- (iii) electricity prices and market signals.

For example, the EMS automatically decides:

- when to charge or discharge the battery;
- when to activate backup generation;
- when to adjust the PV output;
- when to shift or shed flexible loads (demand-side management).

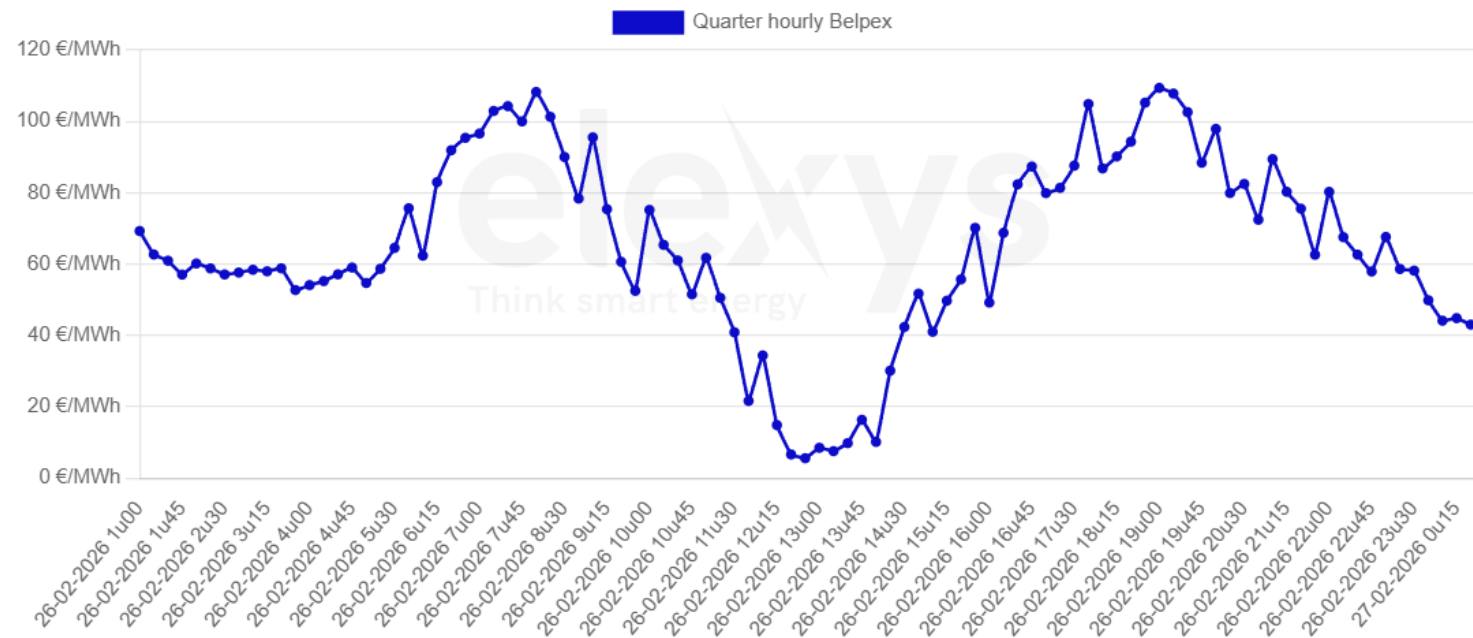
Objective of the EMS: Supply energy at minimum cost while respecting technical constraints, in particular the connection capacity limit imposed by the DSO.

Overview of the EMS



Two factors contributing to the complexity of real-time control by the EMS to minimise the electricity bill (1/2)

1 Electricity markets allow electricity to be traded at quarter-hour intervals



Two factors contributing to the complexity of real-time control by the EMS to minimise the electricity bill (2/2)

2 The power allocated by the DSO may change dynamically over time, and local flexibility markets will emerge.

On 18 December 2025, the Walloon Parliament of Belgium adopted the decree on consumption flexibility, proposed by Energy Minister Cécile Neven. This measure allows DSOs to offer flexible connection contracts.

PARLEMENT WALLON

18 DÉCEMBRE 2025

TEXTE ADOPTÉ EN SÉANCE PLÉNIÈRE

PROJET DE DÉCRET

portant des dispositions diverses en matière d'énergie

EMS alone is not sufficient anymore: additional IT capabilities are needed

Managing energy in this context requires more than an EMS. It is increasingly becoming an IT and data problem. Companies need a broader IT architecture to monitor, forecast and optimise energy flows, interact with markets, and respect grid constraints in real time.

Examples include:

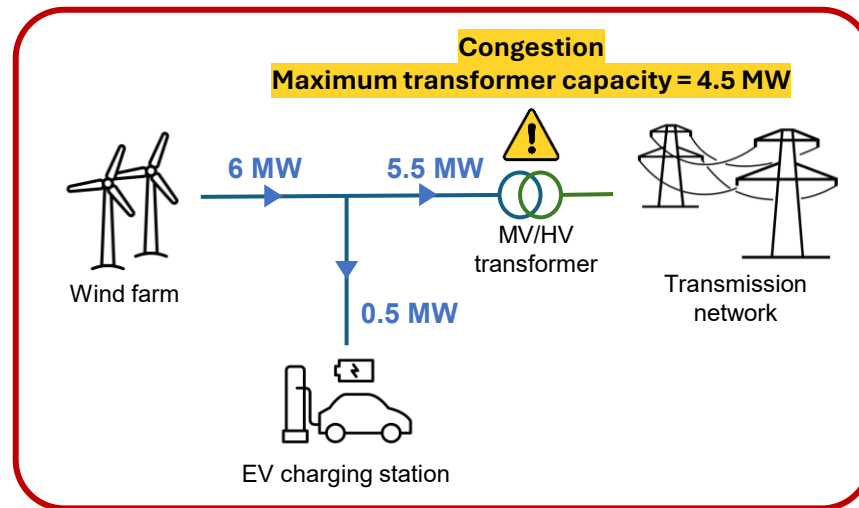
- Accurate metering and billing verification with strong privacy and cybersecurity;
- Advanced monitoring and control of on-site assets (e.g., SCADA¹ systems);
- Enabling data exchange with external energy stakeholders (grid operators, suppliers, aggregators)²;
- Automation and AI supporting complex operational decision-making in asset management;
- Interfacing with local flexibility markets that ensure proper settlement of flexibility service.

¹ Acronym for “Supervisory Control And Data Acquisition”.

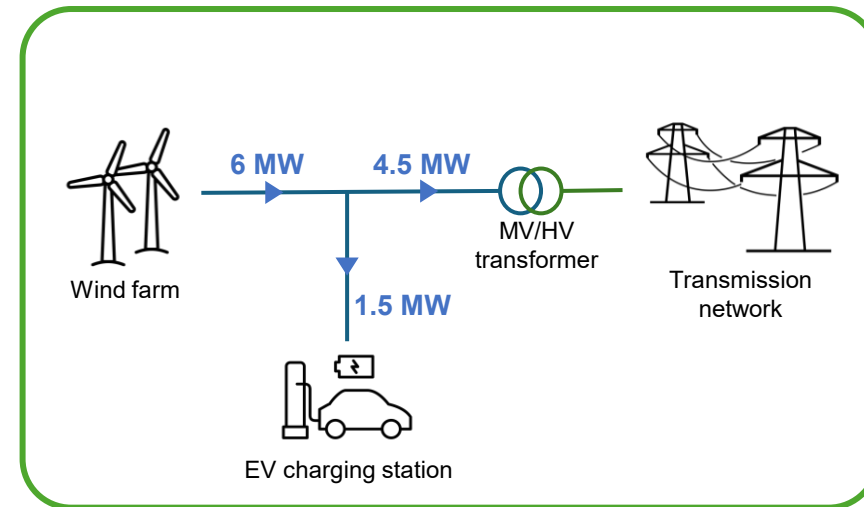
² Further information : [Bolland, A., Maio, A., Richard, T., Vassallo, M., Bahmanyar, A., & Ernst, D. \(26 October 2025\). *Breaking down the complexity of network operation* \[Paper presentation\]. Presentation at the TU Delft, Delft, Netherlands.](#)

Example of a local flexibility market¹

Congestion problem



Resolution of the congestion problem



A wind farm is generating too much electricity, causing congestion on the MV/HV transformer. The DSO asks the wind farm owner to reduce the output of its turbines by 1 MW.

The owner consults the local flexibility market platform and discovers that an EV charging station can consume an additional 1 MW. They decide to purchase this service to avoid reducing the output of their wind farm.

¹ Further information: [Buisseret, T., Vangulick, D., Ernst, D., Bahmanyar, A., Duchesne, L., Georges, E., & Avramidis, I.-I. \(June 2025\). SCOPE project: An innovative market-based solution to deal with injection congestion \[Paper presentation\]. 28th Conference and Exhibition on Electricity Distribution \(CIRED 2025\), Geneva, Switzerland.](#)

PART 3

New Technological Disruptions

The pace of technological progress is accelerating rapidly. Some infrastructure choices made today in companies could become obsolete sooner than expected.

We present three technological disruptions that could challenge current investment strategies. Infrastructure considered safe today could rapidly lose value and become stranded assets, creating significant financial risk.

Disruption 1: Obsolescence of slow EV charging infrastructure

New generations of electric vehicles are entering the market with the capability to handle extremely high charging power.

In 2025, CATL introduced the second generation of its Shenxing battery, capable of delivering up to 520 km of range after only five minutes of charging.

Such technological progress could render a significant share of slow-charging infrastructure in building car parks obsolete.

Presentation of the Shenxing Pro at IAA Mobility 2025.



Disruption 2: Obsolescence of car parks

Today, most buildings are designed with garages or parking spaces. However, this model could become less relevant in the coming decades.

With the development of autonomous electric vehicles, cars may no longer need to remain parked close to the building.

When not in use, vehicles could automatically move to locations where electricity is cheaper or more readily available for charging.

Will car parks soon be obsolete?



Disruption 3: Electricity transport via batteries

As battery costs continue to decline, many stakeholders are beginning to view batteries not only as storage assets, but also as an energy transport vector. This evolution could significantly change how electricity is delivered to buildings over the next decade. Electricity could be transported from low-cost generation hubs to consumption sites using mobile batteries, partially bypassing traditional distribution networks.

In such a context, certain investments in local generation assets, particularly gas or diesel generators, could lose part of their economic attractiveness.

Power Edison (USA) designs storage containers that can be transported by lorry.

TerraCharge, 2023.



Examples illustrating how mobile batteries could transform the energy sector

