

Trust must be earned

Amundi Energy Transition – EU Infrastructure Investment Outlook

October 2025

ExecSumm

Infrastructure Investment Outlook

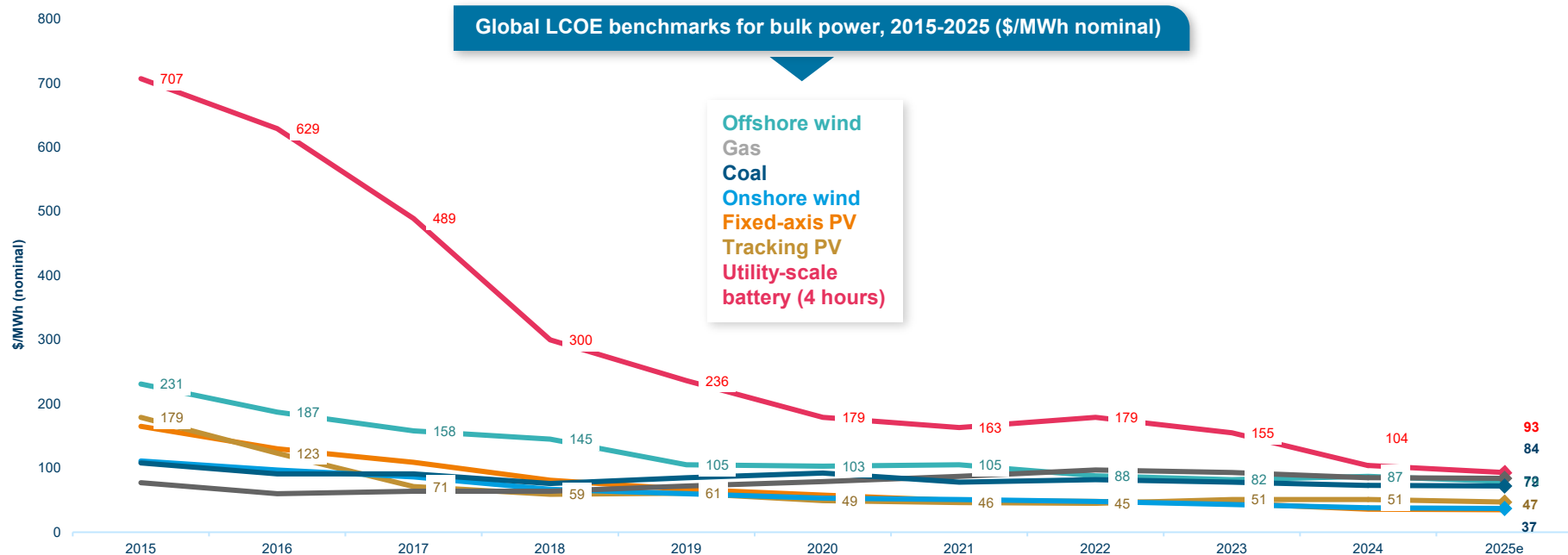
Executive Summary

Addressing the investment outlook universe with a clear infrastructure lens (with heavy focus on cashflows certainty and revenues contractualization) can be done via a 3-categories approach



Executive Summary

Sector dynamics still underpinned by strong cost momentum



Source: BloombergNEF

Note: The LCOE is the long-term breakeven price a power project needs to recoup all costs and meet the required rate of return. The global benchmarks are capacity-weighted averages using the latest country estimates, and capacity forecasts from BNEF sector teams' Market Outlooks for 2025. Offshore wind includes offshore transmission costs. Coal- and gas-fired power include carbon pricing where policies are already active. LCOEs do not include subsidies or tax credits. LCOEs shown by financing date. Data for 2025 are estimates.

Executive Summary

Watershed moment for mid market developers across technologies

2015-2023 : Easy money → happy times

- Burn cash now ... IPO later on GW multiples : capital raising every 18 months
- Grow at all cost
- Everlasting and infinite gvt support
- No barrier to entry or track record need (100 EV charger developer in France alone), subsidy vulture
- Paper developer / 0 technical know how (BESS, curtailment, ...)
- IPP : I am replacing EDF in 24 months
- Sell RtB or die
- Every TE as reliable as regulated solar : risk mispricing
- “Mgt BP” or nothing



2024-... : music has stopped → survival of the fittest

- Equity drought in mid market
- Very large pipelines are stranded at RtB or pre RtB stage
- Substantial political wobble (bangs for our bucks) : do your homework
- Very substantial death rate to be expected over the next 24 months creating ground for healthy consolidation
- Pricing is much more favorable to buyers
- Project finance remains abundant
- Subsidy/Money crazed business cases are now apparent (merchant BESS, hydrogen, ...)
- Lack of industrial depth is going to be costly

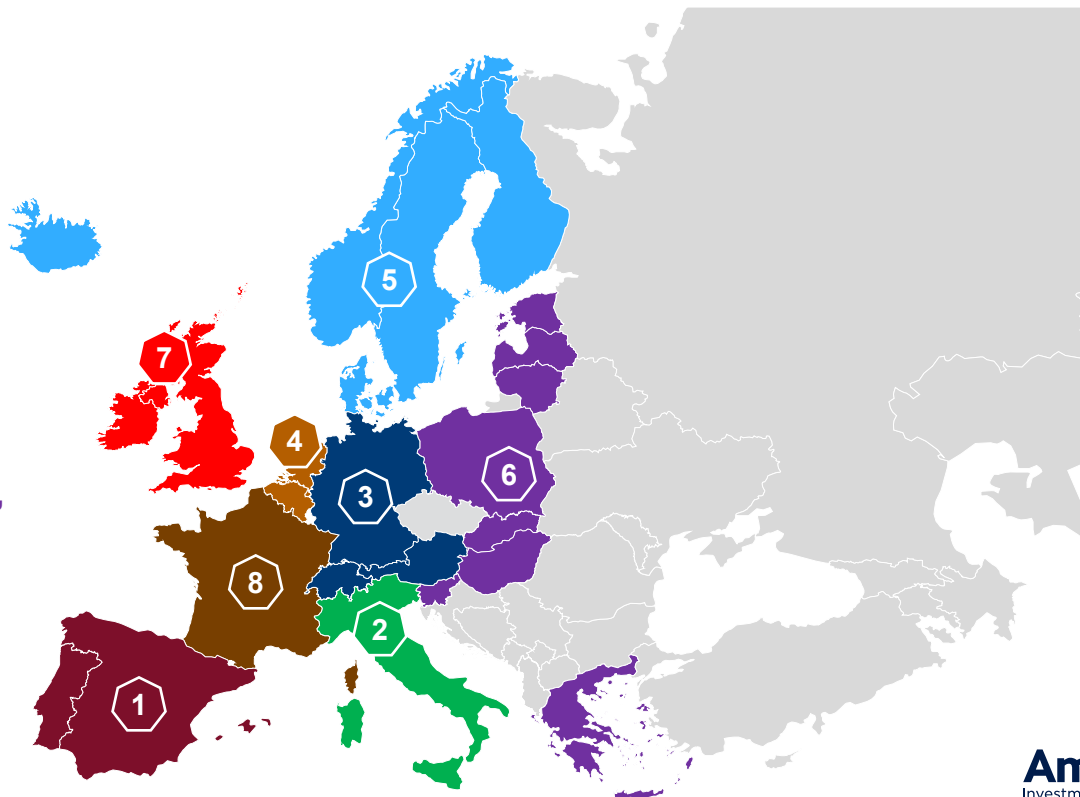
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Geographical Segmentation

EU OECD markets split in 8 key regions

- 1 Iberia: Spain, Portugal**
- 2 Italy**
- 3 DACH: Germany, Austria, Switzerland**
- 4 Benelux: Belgium, Netherlands**
- 5 Nordics: Sweden, Finland, Norway, Denmark, Iceland**
- 6 CEE: Poland, Hungary, Slovenia, Greece, Estonia, Latvia, Lithuania, Slovak Republic**
- 7 UK & Ireland**
- 8 France**



Glossary

- **Bcm:** Billion cubic meters
- **BESS:** Battery Energy Storage Systems
- **BEV:** Battery Electric Vehicles
- **CAGR:** Compounded Annual Growth rate
- **CCUS:** Carbon Capture Utilization and Storage
- **CfD:** Contracts for Difference
- **CMA:** Capacity Market Auction
- **COD:** Commercial Operations Date
- **cPPA:** Corporate Power Purchase Agreement
- **EfW:** Energy from Waste
- **ET:** Energy Transition
- **EU27:** European Union 27 members
- **EV:** Electric Vehicles
- **EVCS:** Electric Vehicles Charging Stations
- **FiT:** Feed in Tariff
- **GHG:** Greenhouse Gas
- **GM:** Ground-Mounted
- **GW:** Gigawatt
- **HPA:** Heat Purchase Agreement
- **HVO:** Hydrogenated Vegetable Oils
- **ICE:** Internal Combustion Engine
- **IPP:** Independent Power Producer
- **IRA:** Inflation Reduction Act
- **IRR:** Internal Rate of Return
- **LCOE:** Levelized Cost of Energy
- **Li-ion:** Lithium-ion
- **MACSE:** *Meccanismo di Assegnazione Centralizzata per la Sostenibilità Energetica*
- **MJ:** Megajoules
- **MSW:** Municipal Solid Waste
- **MW:** Megawatt
- **MWh:** Megawatt-hour
- **NIMBY:** *"Not In My Backyard"*
- **O&G:** Oli & Gas
- **PPA:** Power Purchase Agreement
- **PV:** Photovoltaic
- **RES:** Renewable Energy Source
- **ROFO:** Right Of First Offer
- **ROSCO:** Rolling Stock Company
- **SAF:** Sustainable Aviation Fuel
- **TES:** Thermal Energy Storage
- **TSOs:** Transmission System Operators
- **UK:** United Kingdom
- **VE:** Véhicules Electriques
- **WtE:** Waste to Energy

Section 1

Renewable Energy Production

1.a

Solar

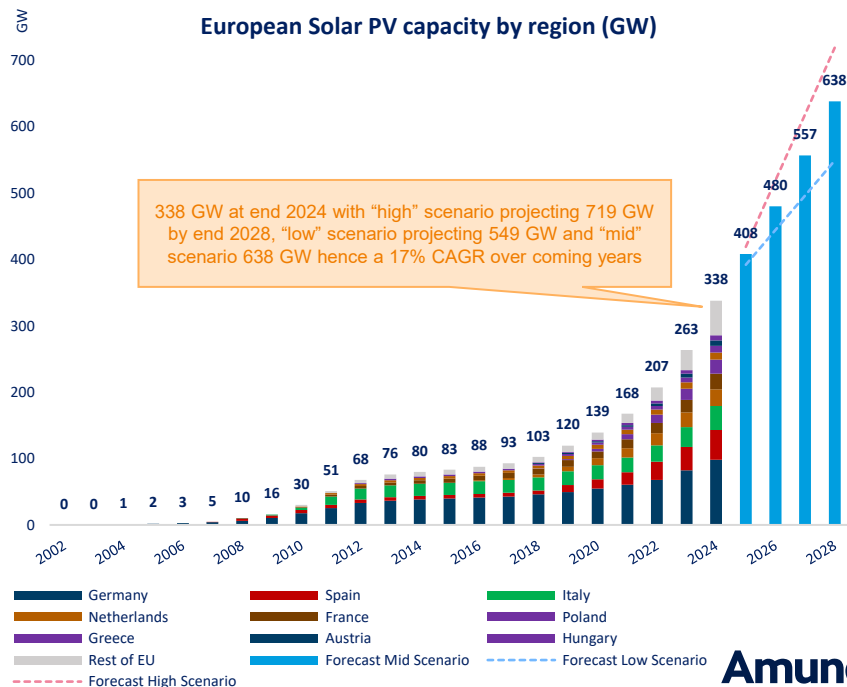
1.a Solar – EU-wide Snapshot



Solar is the fastest-growing Renewable Energy Source (« RES ») benefiting from substantial and sustainable tailwinds, with 338 GW end 2024 cumulated capacity across the EU27 and a 638 GW projected capacity by end 2028, for a 17% annual CAGR

Technology Overview

- Solar power is now unequivocally recognized as the quickest, most cost-effective environmentally-friendly technology to reduce dependency to fossil fuels (and Russian supply), and contribute to reaching the EU' 45% RES target by 2030 (RePowerEU plan)
- The solar sector has seen double digit growth since 2016 and has matured as a proven infrastructure asset class throughout the last decade, with substantial infrastructure dry power chasing developers / IPPs and fierce competition for quality assets (with operational bases and credible growth plans)
- End 2024 EU solar capacity is 338 GW, projected to grow to 638 GW by '28 – see graph), generating a steady stream of investment opportunities
- Key EU-wide sector challenges revolve around permitting and grid connection delays, as well as grid stability / negative prices / cannibalization (mitigated to some extent by BESS rise - see section 2)
- The 9 most dynamic markets are Germany, Spain, Italy, Poland, the Netherlands, France, Austria, Belgium, Greece and Hungary
 - This section focuses on these markets with the exception of Austria and Hungary, and adding Sweden



1.a Solar – Regional Snapshots

Spain



Market Overview & Recent Deals

- With a 45 GW end 2024 capacity, Spain is aiming to grow to 76 GW by 2030 leveraging on its landscape of well-established market players (Utilities, O&G majors, IPPs, equity investors) and proven PPAs framework
 - all 2020-'22 deployments were done via PPAs or merchant projects (including at times complex PPAs for solar + BESS), proof of a high degree of market sophistication
 - the Spanish solar sector has been particularly impacted in recent years by curtailment and cannibalization with heavily negative prices driven by the country's high solar power density and irradiation
 - BESS therefore attracts significant focus in Spain with hybrid solar + storage PPAs gaining in importance
- Key growth challenges are around construction permits delays and growing NIMBY mentality with local resistances, as well as lack of skilled labor driving up capex

Recent Deals (*midcap, platform-level*)

- Acquisition by Visalia of a stake in Barter, with Asterion seller – *May 2025*
- Greening Group fundraising (minority stake) - *Ongoing*

Investment Landscape

A dynamic and high-growth investment environment with substantial remaining potential thanks to experienced market players and a well-established cPPAs market

- Government support for solar in Spain has recently shifted focus from large-scale projects towards <5MW installations with a “local community” focus
 - This follows the pressure the country's transmission network was put under in 2023/2024 after it added 4 GW of renewables incl. 2.8 GW of GM solar and 596 MW of distributed solar, as small-scale projects require less network infrastructure
 - Such high growth was historically supported by the government's Contract for Difference (“CfD”) scheme - a “partially symmetric” or “one-way” CfD - where the generator delivers to the grid electricity at a given bid price, but with the risk of being penalized if it does not produce a required minimum
 - This left potential for upside during times of high electricity prices via selling on open markets the surplus above such minimum
- This recent lack of government support for large-scale solar also finds its roots into the **well-established PPA framework** the country enjoys, with all large-scale solar projects since '20 structured with PPAs rather than government's CfDs
 - While Germany has led the charge in PV capacity growth over the last decade, Spain is by far the first solar PPAs market with 14.2 GW signed since '18 (versus 3.6 GW for Germany),
 - The move is also explained by the relatively low Levelized Cost of Energy (“LCOE”) characteristic of Spain, with the country **gradually moving outside the need for subsidies**

1.a Solar – Regional Snapshots

Italy



Market Overview & Recent Deals

- Italy has experienced sluggish growth between 2015 and 2021 with the need to now install 8 GW of PV capacity p.a. until '30 to meet its 80 GW target, from a current 36 GW '24 base
 - Key growth challenges have historically revolved around permitting delays (for large scale projects), grid congestion (especially due to driving energy production in the South to energy consumption in the North), and lack of national PPAs frameworks
- On 13 Aug. 2024 the Italian government issued the long-awaited « Fer-X » legislation, governing the next 4 years of auctions across Italy's renewable technologies including solar – *see next slide*
- PPAs are expected to remain an integral part of the country's solar revenues story, although PPAs advocates are concerned that the Fer-X legislation will outprice current levels (€85MWh Fer-X auction starting price versus current ~ € 70/MWh PPAs pricing)

Recent Deals (*midcap*)

- Sale of a minority stake in Chiron Energy (Unicredit sellside advisor) – 105 MW deployed with 1 GW target – *May 2025*
- Sale by Susi Partners of ReFeel New Energy (50% or 100%) – mix of BESS and PV – *May 2025*
- Investment by Mirova into a JV with Qualitas Energy (IRP), circa €90m – *April 2025*
- Acquisition by Contour Global (KKR-backed) of a portfolio of solar development from Limes Renewable Energy – *April 2025*

1.a Solar – Regional Snapshots

Italy



Investment Landscape

A proven and stable PV market with substantial growth ahead thanks to new and favorable government support

- Although a relatively dynamic PV market historically, Italy's solar capacity has so far largely been rooted in small scale / residential PV, due to government incentives such as the « Superbonus 110 » (110% tax rebate to individuals buying solar panels)
- Large-scale PV has historically proven difficult to develop due to slow and complex permitting processes and grid inefficiencies, jeopardizing projects in Southern Italy designed to bring power to consumption centers in the North. Recent Spring '24 laws granting a degree of power to regional governments (versus national guidelines) often resulted in a ban on PV on certain agricultural land and raised concerns in the investment community
- This said, the recent Fer X (effective August '24) legislation has now clarified the government support to solar – among other renewables sources – by precisising the shape and extent of 2-ways CfDs levels to be paid over projects useful lives for solar plants above 1MW:

RES		Power	Operating price (€/MWh)	Higher operating price (€/MWh)	Lower operating price (€/MWh)
PV	2- ways CfD received over a project's useful life	<= 1MW	93	-	-
		> 1MW	85	95	70
Wind		<= 1MW	93	-	-
		> 1MW	85	95	70
Hydro		<= 1MW	130	-	-
		> 1MW	90	105	80

- New solar plants are to reach COD within 21 months of the auction results

1.a Solar – Regional Snapshots

Germany



Market Overview & Recent Deals

- **Germany** has been a PV leader for long, and remained so in 2024 with the highest annual growth of 16,1 GW installed capacity, cumulating to a 98 GW capacity base
 - Growth is projected to remain strong with an estimate 20GW per annum until '30, enabling to meet a 215GW capacity target
 - The German government has built on its previous support schemes (*Renewable Energy Act REE*) to finalize in April 2024 the **Solarpaket 1**, streamlining permitting and increasing the maximum tender volumes (per GM farm) from 20 MW to 50 MW – *see right hand side*

Recent Deals (midcap)

- Investment by Clearwise of a 16,75 MW project in Germany developed by Feldwerke Solar – *ongoing*
- Infravia shortlisted against Ardian Infrastructure and Partners Group for the Enerparc acquisition – *ongoing*
- Sale by AXA of 60% of ILOS Project from Omnes Capital – *April 2025*

Investment Landscape

A historically dynamic market with continually supportive regulation

- Germany's *Solarpaket 1* intends to further boost the country's already strong growth in solar capacity, focusing solely on this technology (versus most EU countries publishing government support schemes across all RES)
 - *Solarpaket 1*'s main consequence is to increase the max capacity to access government tenders to 50 MW (from 20 MW), benefiting GM plants, following the trend of increasingly large installations
 - The package also introduces an obligation for grid operators to connect renewable energy projects in priority, and for public landowners to allow for cables to pass on their land, as well as expedites the permitting process
- *Solarpaket* (and the REE legislation generally) works as a one-way CfD, with price in the last auction of max €52.4/MWh (no indexation)

CfD Auction Rounds	March '23	Jul '23	Dec '23	March '24	Jul '24
Capacity awarded (GW)	1.9	1.67	1.61	2.23	2.15
Highest tariff (€/MWh)	73.0	66.5	54.7	54.9	52.4
Average tariff (€/MWh)	70.3	64.7	51.7	51.5	50.5

- *Solarpaket 2* is still expected to be published to date, with no fundamental change expected by the market
- The cPPAs market benefits from a well-established and proven framework with Germany considered the largest cPPA market in EU after Spain

1.a Solar – Regional Snapshots

The Netherlands and Belgium



Market Overview & Recent Deals

- **The Netherlands** enjoy a 2024 solar installed capacity of 26 GW, thanks to a clear government support scheme (*Sustainable ET scheme « SDE++ »*) which has proven flexible in the high inflation environment of these past years
 - SDE++ is available to various energy transition technologies, and grants a 15 years CfD to solar projects (with varying reference prices, e.g. €66.7/MWh for GM solar)
 - Key attention areas are political support, administrative bandwidth to approve projects, and land availability for GM projects
 - The country is gradually converging to no-subsidy environment thanks to high competition
- **Belgium** is home to a 11GW 2024 base but disproportionately located in Flanders
 - Complexity results from the 3 different support schemes in Flanders, Wallonia and Brussels – *see next slide*

Recent Deals (midcap)

- Infranity invests €125m in ESG – May 2025

Investment Landscape

Netherlands a dynamic market with a proven framework, uncertainty/caution in Belgium

- **Netherlands'** SDE++ framework has historically succeeded in boosting RE projects investments in the country, acting as a one-way CfD over 12 to 15 years dependent on the technology (15 years for solar)
 - The 2023 SDE++ scheme benefited from a €8bn total budget across technologies, with a subsidy intensity calculation and a phased bidding mechanism designed to ensure lowest subsidies granted to the most competitive projects (*see Appendix Sources for detailed scheme overview*)
- Recent concerns over the lack of compensation to the government in case of high market prices are expected to make for a transition towards 2-ways CfDs starting from 2027 (non-retroactively)
 - This has recently created a surge of interest into cPPAs, building on the country's experience structuring these for wind projects
- **Belgium's** solar sector has historically been centered on residential small-scale, and while large-scale could benefit from similar support incentives as the wind sector – which is well developed both for onshore and offshore – and from its countercyclicality, corresponding regulations remain to be implemented to date
 - 3 regions each have separate authority over their territory and only Brussels has so far implemented a green certificates support mechanism, effectively acting like a CfD over 10 years
 - Regulation is still expected both in Flanders and Wallonia

1.a Solar – Regional Snapshots

Sweden



Market Overview & Recent Deals

- **Sweden** is expected to take the lead in Nordics' highest solar capacity growth in the coming years from a base of 5.1 GW in 2024, as Denmark's capacity growth is expected to weaken due to higher grid connection fees.
 - Sweden has however only set itself a modest 7.7 GW 2030 target, and doubts exist to date on the extent of the political support to promote the sector with no clear government incentivization / revenues support programs to date
 - Attention must be paid to upcoming government incentivization programs, which have been slow to materialize and in some cases

Recent Deals (*midcap*)

- Acquisition by Renewable Power Capital (RPC, CPPI-backed) of the solar development subsidiary of Njordr – *March 2025*

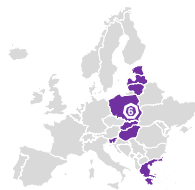
Investment Landscape

Investors concerns exist regarding Nordics RES projects on the back of significant difficulties in onshore wind over the past years. Revenues certainty is difficult to guarantee

- Sweden is yet to publish clear governmental revenues support schemes to boost solar growth, and has only set itself a very low 2030 capacity target raising doubts on actual political willingness to promote the sector
- Recent changes of government posed doubts on the capacity to reach the already modest targets noting decisions taken such as lowering fuel taxes or removing the carbon tax for district heating which constrain PV promotion. To date, Sweden lacks a clear roadmap and strategy on solar PV

1.a Solar – Regional Snapshots

CEE: Poland and Greece



Market Overview

- While **Poland** shows a circa 21 GW solar capacity in 2024, a large share of this is from rooftop residential installs
 - Government regulations are now designed to unlock larger GM / industrial-scale developments → the national plan is expecting a modest 29.3 GW capacity by '30
 - With onshore wind suffering regulatory backlash, solar is expected to be the lead RES in coming years and the government has designed an auction process to support growth
 - The 2023 auction was heavily undersubscribed, given ceiling prices being considered too low by market participants and the growing development of cPPAs, however the 2024 results paved the way for better alignment between government incentives and investors/developers interest, attracting better subscriptions
 - Constraints however revolve around the need for grid modernization and clarity required on upcoming subsidy schemes, as well as Ukraine war-related instability. The impact of the recent election results remains to be assessed for the Polish renewable energy landscape's future
- **With 10 GW solar capacity to date**, Greece's government has set itself a modest 13.4GW 2030 target
 - Gov't auctions have been run for a number of years with a 2023 ceiling price of €70/MWh and a new Jan. '24 law now promotes solar + BESS projects so as to tackle the country's curtailment issues

Investment Landscape

- Governments willingness to promote solar make for potentially interesting business cases via revenues support schemes, however platform investments should be assessed on a case by case basis and grid modernization is key**
- Favorable regulations have seen light in both Poland and Greece and the market is evolving from small-residential scale installations to larger industrial projects benefiting from revenues support
 - Both countries however face issues relative to need for grid modernization and continued development of their PPA market in order to fully transition from residential to utility-scale solar markets
 - The lack of historical investments to date and the relative lack of market understanding from the bulk of investors in these countries make for relatively immature markets, set to evolve in coming years.

1.a Solar – Regional Snapshots

France



Market Overview & Recent Deals

- With 23.4 GW of solar capacity installed by the end of 2024 and an announced target of 60 GW in 2030 (despite a potential estimated by consensus in the industry of at least 68 GW), France remains a dynamic solar market benefiting from a dense network of developers and abundant capital (in particular infrastructure capital)
- Government support in recent years has helped streamlining access to feed-in tariffs or CfDs, notably through an "open window" system through which any project <1 MW in size can subscribe in a simplified and accelerated manner to government support at a fixed price over 20 years, while larger projects are subject to competitive calls for tenders organized by the Energy Regulatory Commission (CRE)
 - Recent legislative updates have weakened support mechanisms for small-scale solar (100-500kW), without reducing the attractiveness for developers to focus on industrial-scale projects and in particular ground-mounted plants
 - Grid connection and permitting timelines remain a bottleneck, in the context of an ecosystem of developers in which the differentiating factor becomes the ability to plan for and navigate administrative processes to ensure development speed

Investment Landscape

A proven, dynamic market, composed of numerous developers with strong expertise in the sector, in a geography with high potential (irradiation, land including agrivoltaics) and benefiting from a favorable legislative framework

- With a large number of solar developers and an influx of infrastructure capital towards quality players, competition is fierce when development teams / management teams can prove their quality by demonstrating an established track record.

Recent Deals (*midcap*)

- Solveo Energy raised €98m from Mirova – *May 2025*
- Melvan fundraised from IDIA, BPI France and OCCTE – *May 2025*
- Marguerite increased its investment into Nexun, eyeing an European expansion – *Mai 2025*

1.b

Onshore Wind

1.b Onshore wind – EU-wide Snapshot

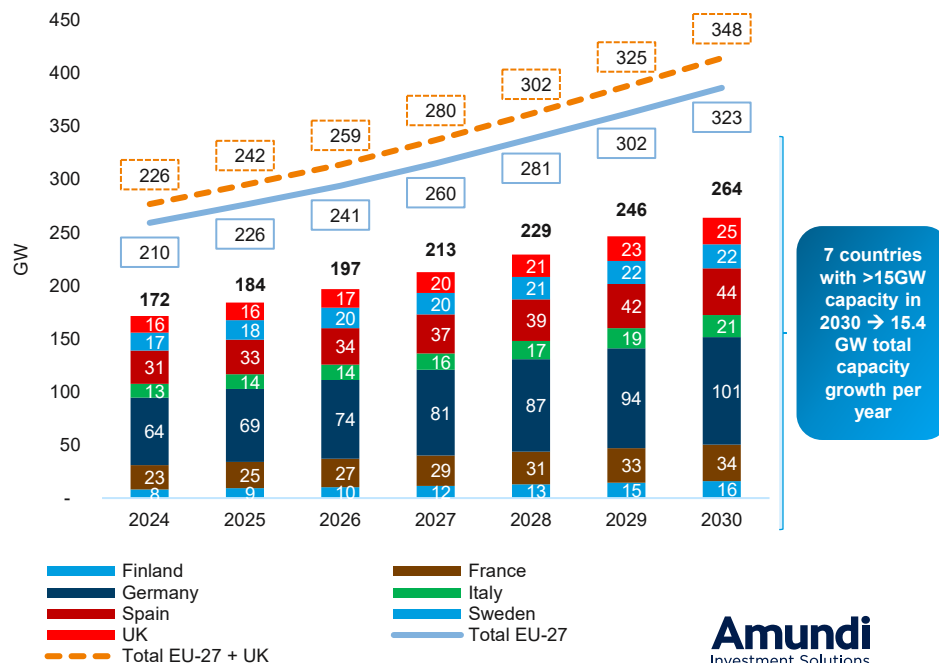


A central pillar of the global energy transition, onshore wind has reached at end 2024 a 210 GW capacity across the EU27 (226 GW incl. the UK), with an expected c. 20 GW '25-'30 annual growth

Technology Overview

- Wind power is a mature technology continuing to benefit from clear EU governments support and backed by a well-established and dynamic supply chain ecosystem
 - 2024 saw 11.5 GW of new onshore wind installation, with Germany the continent leader
 - While grid bottlenecks, permitting delays in many EU countries (incl. due to local adversity/NIMBY) and challenging financial conditions have been recent bottlenecks, the pace of onshore wind deployment has continuously grown and the market now expects 17GW built across the EU27 annually, up to a 323 GW capacity by 2030
 - This would still fall short of the c. 360 GW EU Commission target
- Auctions and tenders are still set to play a major role in the build-out of onshore wind with c. 60% of new capacity to be awarded in gov't auctions, consistent with the last few years.
 - Remaining capacity to either be supported by the expanding corporate PPA market, or on an entirely merchant basis in certain markets (consensus expects a total capacity of 51 GW to be developed on a merchant/PPA basis between 2025 and 2030)

Forecast cumulated onshore wind capacity across 7 countries



1.b Onshore wind – Regional Snapshots

Spain



Market Overview

- With 31.1 GW onshore wind capacity at end 2024 and a forecast c. 2 GW per year until 2030, Spain is one of the most dynamic EU markets enjoying favorable natural conditions for wind power
- Government support schemes have however experienced a suite of bumps last few years, with a '22 auction heavily undersubscribed
 - This was the result of the government's refusal to acknowledge higher commodities and supply chain prices in an inflationary '22 environment, keeping the auction cap low (estimated around €47/MWh), resulting in significantly lower than expected market interest and thus awarded capacity (46MW only)
 - 2023 and '24 auctions were expected to correct the trend, however have yet not taken place to date, with the government instead preparing a '25 auction process embedding the latest EU Net-Zero Industry Act provisions
 - Developers therefore remain in expectation of upcoming auctions
- Outside these recent regulatory shortcomings, the Spanish support model is a proven 2-ways CfD subsidy mechanism clearly understood by the market and providing high revenues certainty

Recent Deals (midcap)

- Acquisition by Greencoat Schroders of 49% of a portfolio alongside Repsol (JV) with a 300 MW / 8 onshore wind farms base – *March 2025*

Investment Landscape

A proven and high-growth market which, upon resolution of the past few years regulatory uncertainty on tenders cap prices, will continue to deliver investment opportunities in coming years

- Favorable regulations and high investors interest in the Spanish market is expected to continue promoting a high volume of transactions, with grid stability / negative prices remaining top of investors minds (similar to solar PV)

1.b Onshore wind – Regional Snapshots

Italy



Market Overview & Recent Deals

- With 12.9 GW 2024 onshore wind capacity and a forecast 1,5 GW per annum until 2030, Italy is a reasonably dynamic market with clear government support
- The FER-X legislation – *see section 1.a* – applies to onshore wind with a 2-ways CfD at strike price circa €72/MWh, paid over a project's useful life
- Currently at c. 2% of total EU PPA signed capacity, the Italian PPA market lags in dynamism and CfDs / the FER-X legislation are expected to remain the main source of revenues certainty for renewable energy generation

Recent Deals (*midcap*)

- Acquisition by Equitix-backed Gruppo Dolomiti Energia of stakes in JVs with Italia Vento Power Corporation (IVPC) - *Dec. 2024*
 - c. 1 GW wind capacity at various development stages

Investment Landscape

A promising market essentially thanks to new revenues support legislation expected to generate a steady stream of investment opportunities

- FER-X is expected to continue backing Italian onshore wind growth among a dynamic ecosystem of investors, industrials and IPPs comfortable with the Italian RES market

1.b Onshore wind – Regional Snapshots

Germany



Market Overview & Recent Deals

- Germany is the onshore wind EU leader, with 63.5 GW capacity, a long-established regulatory framework, and a forecast c. 6 GW incremental capacity per year until 2030
- Government support materializes via a one-way CfD over 20 years, with approximate strike price €74/MWh
 - With the 2025 budget adopted with a transfer of the renewables subsidies from a climate fund into the federal budget, there are risks that reforms of the support scheme could occur in the medium term (possibly from CfDs into a capacity auction mechanism) – to be monitored
- The PPA market lacks dynamism with regards to onshore wind and is in comparison much more widely used for solar power and offshore wind

Recent Deals (*midcap*)

- Development by Qair (CVC DIF-backed) of 61 MW of onshore wind in Baden-Württemberg – *February 2025*
- Energy Infrastructure Partners (EIP)-backed BayWa r.e. sold a 56 MW wind portfolio under development in Germany to three different buyers (EEF, Omnes Capital-backed Enova Value and KGAL) – *Oct. '24*

Investment Landscape

A historically dynamic market with continually supportive regulation

- With a long history of stable and flexible government support towards onshore wind (similarly to other RES), investors interest is expected to remain strong and valuations high in coming years for German wind platforms
- Recent auction results confirm, despite concerns on the offshore wind sector, that onshore wind remains so far on a high-growth trajectory

1.b Onshore wind – Regional Snapshots

Nordics: Sweden and Finland



Market Overview & Recent Deals

- With a 17 GW 2024 installed base and a projected 900MW annual growth until 2030, Sweden is, on paper, an onshore wind EU market of significant interest
- Finland accounts for a c. 8.3 GW 2024 installed base and is forecast to grow at c. 1.3 GW per year until 2030
- Both markets are however outliers in the EU in that they do not benefit from any government support scheme in any fashion, with all projects structured via cPPAs
 - Sweden has recently witnessed several large bankruptcies as a result of 2022/'23 high electricity prices creating difficulties to deliver production obligations under large cPPAs signed in 2017 / '18, with some of them in the process of being terminated with significant penalties owed to the offtakers
 - In comparison Finland's PPA market appears more stable and able to structure more resilient contractual arrangements with a number of mid-size (30-50MW) PPAs signed in recent months

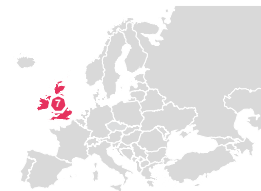
Investment Landscape

A market where governments decided not to support the sector hence relying entirely on cPPAs which has created difficulties and bankruptcies over the past few years

- The lack of government support schemes in the Nordics force investors to rely on corporate PPAs, which have historically been ill-structured with merchant exposure retained in times of high electricity prices and difficulty for wind farms to produce
- This has resulted in resounding bankruptcies such as the Markbygden Ett wind farm (accumulating 220 m€ losses before defaulting with 530m€ debts) when wind farms had difficulties delivering the stated energy volumes to PPA offtakers and had to buy electricity on open markets at times of high prices
- Market perception is therefore negative on these jurisdictions despite Finland intending to demonstrate a better ability to structure more adequate PPAs

1.b Onshore wind – Regional Snapshots

UK



Market Overview & Recent Deals

- With a 15.7 GW onshore wind installed base at end 2024 and a wind power industry active since the 1990's, the UK has been a pioneer in spearheading the technology growth over the past decades
- The UK market is forecast to grow 1.7GW per year until 2030
 - the recently elected Labor government reaffirmed clear support to these targets by lifting certain permitting constraints which were effectively acting as a ban on new developments
- The government's support scheme is a standard, proven 2-ways CfD attributed via an auction mechanism, the «Allocation Rounds, AR»
- The Labor government also extended CfDs to repowering projects, enabling revenues certainty across longer projects lives in a positive move indicating continued government support
- AR6 recently resulted in 990MW of onshore wind allocation across 22 wind farms predominantly in Scotland, with a strike price £50.9/MWh – a favorable result versus the previous AR which saw modest interest due to an insufficient cap price

Recent Deals (midcap)

- MEAG sold to Engie a 102 MW portfolio of UK wind farms – *March '25*
- OTPP and PSP Investments-backed Cubico Sustainable Investments invested into a 100MW farm in Northwest England (largest in England) – *Dec. '24*

Investment Landscape

A proven jurisdiction which historically spearheaded the sector growth and benefits from long-dated reliable government support schemes as well as strong political backing

- Benefitting from a long history of stable and flexible government support and a dynamic ecosystem of developers and IPPs, investors interest is expected to remain strong and valuations high in coming years for UK wind platforms

1.b Onshore wind – Regional Snapshots

France



Market Overview & Recent Deals

- With 22.8 GW of onshore wind power capacity installed in 2024, wind power represents approximately 11% of electricity production in France. The market remains buoyant with ambitious objectives (*PPE Programmation Pluriannuelle de l'Energie* 2019-23 targets 34.7 GW in 2028)
- The market remains highly dependent on CRE tenders. The latest tenders for the 2023-2025 period target an average of 2.2 GW per year, and the last two tenders (2 x 950 MW) were oversubscribed despite some non-compliant applications.
- However, the market often suffers from local and political oppositions which can result in appeals and projects cancellations:
 - Recently in April 2025, the Nancy administrative court cancelled a French wind farm project at Mont des Quatre Faux, even though carried out by EDF Renouvelable
 - Discussions on the 2025-2030 *PPE* are stalling and its adoption is delayed with criticism from parliamentarians despite less ambitious objectives than the previous *PPE* (33 GW in 2030) and a slowdown in calls for tender (c. 1.5 GW/year)

Investment Landscape

A mature market with a dense ecosystem of developers and well-established government support, suffering however from a lack of short-term visibility

- Short-term political deadlines (municipal elections in 2026 and presidential elections in 2027) create a degree of uncertainty and call for a degree of caution – in that vein a number of wind power players are diversifying, and pure players are becoming more rare.

Recent Deals (*midcap*)

- H2Air capital raise from iCON Infrastructure.
 - H2AIR is one of the main French onshore wind developer with a 243 MW operational base and a mid-term pipeline of more than 1 GW

1.c

Offshore Wind – fixed & floating

1.c Offshore wind – EU-wide Snapshot



Alongside onshore wind, fixed and floating offshore wind is a key component to reaching the EU 2030 targets with an end 2024 installed base of 36.6 GW (incl. UK, 20.5 GW in EU-27) and forecast 8 GW annual growth

Technology Overview

- Now well-established with clear governments' support schemes and large stable supply chains, the offshore wind industry is a central component of numerous European countries' renewables strategies
 - The UK was a clear pioneer since 2012, closely followed by Germany
 - Belgium, Denmark, France (a laggard due to long-dated appeal processes eventually solved around 2022 and now catching up), and the Netherlands form the rest of the EU industry
 - France is pioneering the floating offshore wind industry with the first auction in H1 2024, the technology also is on the UK's radar to achieve its 2030 offshore wind targets
- Sweden, Spain, Portugal, Ireland, Italy, Greece, Finland and Poland on the other hand have chosen not to prioritize the technology: they do not account for any capacity to date, even though some of these countries are active onshore wind markets and benefit from adequate natural conditions
- All countries supporting the technology do so via CfDs (most often 2-ways and typically 15 years) - this is expected to continue being the bedrock of the sector's growth in coming years
- Bottlenecks to the technology's growth have been around permitting/grid connection and historically supply chains issues. Europe also faces certain shortcomings in the offshore wind value chain such as port capacity not expanding fast enough and availability of installation vessels

Investment Landscape

- While offshore wind projects' revenue certainty and well-understood construction / O&M risks (in the case of fixed offshore) make for appealing infrastructure characteristics, the projects' size and funding needs make for minimum several hundred-m€ tickets in order to acquire sizeable equity stakes
 - Illustrating this, the Dec. '24 Brookfield 12.5% stake acquisition in four UK offshore wind farms totaling 3.5 GW from Ørsted is disclosed to have traded for £1.75bn EV, implying a €600m EV for 12.5% of one 1 GW farm
- Offshore wind investment is therefore to be assessed on a case by case by investors able to invest significant tickets / having raised dedicated investment vehicles

1.d

Biomethane

1.d Biomethane – EU-wide Snapshot



As a sustainable alternative to fossil gas, biogas and biomethane in particular is expected to play a significant role towards reaching the EU's 2030 emissions targets. From a 22 bn m³ (bcm) biogas production capacity in 2024 (of which 4.9 bcm is biomethane), EU objectives are to reach 35 bcm biomethane capacity by 2030

Technology Overview

- Biogas is a mixture of methane, CO₂ and small quantities of other gases produced by anaerobic digestion of organic matter (crop residues from harvest of wheat, maize or rice; animal manure; organic fraction of municipal solid waste or wastewater sludge)
 - Biogas can be used directly to produce electricity and heat or as an energy source for cooking, but cannot be transported by traditional gas network infrastructure
 - The methane content of biogas typically ranges from 45% to 75% by volume, with most of the remainder being CO₂ – hence its energy content can vary from circa 16 megajoules (“MJ”) per m³ up to 28 MJ/m³
- **Biomethane** is produced either by (i) “upgrading” biogas so as to remove the CO₂ and certain other contaminants resulting in a truly “renewable energy gas” (90% of biomethane production today), or (ii) by the gasification of solid biomass followed by a methanation process (less common)
 - Biomethane offers an energy content around 36 MJ/m³ and is indistinguishable from natural gas → it can be used without alterations in transmission / distribution infrastructure or end-user equipment, and is fully compatible with natural gas vehicles
- As a sustainably-produced alternative to fossil gas, biomethane is recognized by the EU as an important pillar of the 2030 RePowerEU targets with a 35 bn m³ annual production target by 2030, from a 4.9 bn m³ base to date
 - Largest biomethane producers in Europe today are (in order) Germany, the UK, Denmark, France, the Netherlands, Italy
- *See appendix for further biogas / biomethane production details*

1.d Biomethane – Regional Snapshots

Italy



Market Overview & Recent Deals

- While it lags behind the other 4 EU leaders to date, Italy's potential lies in its governmental incentive program (Biomethane Decree) published in Sept. 2022
 - Despite a c. 1 bcm capacity at end 2024, this most recent legislation aims to incentivize biomethane plants developments in the context of the country's post-Covid National Recovery and Resilience Plan, which allocated €2bn to the technology
- The Biomethane Decree ensures 2 benefits
 - A capex contribution of up to 40% of eligible capex (inc. connection and design costs)
 - A 15 years FiT from COD depending on the plant's capacity per the below levels

Type of biomethane plant	Biomethane production capacity	Reference tariff (€/MWh) for new agricultural and waste-powered plants + revamping of agricultural plants
Small agricultural	< 100 sm ³ (standard cubic meter) per hour	115
Other agricultural	> 100 sm ³ per hour	110
Organic waste-powered	No capacity threshold	62

Recent Deals (midcap)

- Investment by Plenium Partners in a biomethane development project led by Aragorn Value Leadership in the Emilia-Romagna region with 250 standard m³ per hour capacity – *May 2025*
- Acquisition by Tages Capital of two greenfield biomethane plants in the Foggia and Potenza regions – *May 2025*
- Acquisition by KKR of a 25% stake in the €3bn EV company Enilive, Eni's subsidiary specialized in biorefinery, biomethane and smart mobilities – *April '25*
- Investment by Eren Group into Retina Biometano, backed by Macquarie Capital – *March 2025*
- Investment by Eiffel into biogas developer BTS Biogas, for €50m, to develop a portfolio of CHP units to be transformed into biomethane plants – *Nov '24*

Investment Landscape

A promising market benefiting from dedicated governmental regulation and an active investment environment

- Notwithstanding the technically-complex nature of the biomethane production industry, government support and regulatory clarity boxes are ticked in the Italian market and the recent set of transactions demonstrate a dynamic investment environment expected to remain in coming years

1.d Biomethane – Regional Snapshots

Germany



Market Overview & Recent Deals

- Historically the EU leader with a 2024 base around 1.3 bcm (c. 30% of total EU production), the German market recently suffered from a shift in government focus from biomethane support into biofuels
 - The government's Renewable Energy Act (*EEG*) only provided revenues support to « flexible » combined heat and power plants in Southern Germany using biomethane for electricity production, of capacity is between 200 and 600 MW, until July 2024 which significantly slowed down investment into the sector these recent years
 - In June 2025 the Renewable Energy Directive (RED III)'s released draft proposed removing certain double-counting mechanisms leading the industry to expect increased output prices and triggering a level of investors uncertainty

Recent Deals (midcap)

- Investment by Biogen (Partners Group-backed) of 2 biomethane plants in Germany from Steinbeis Holding et ABEL Gruppe, for a total capacity of 80 GWh per year – *May '25*
- German gas business VNG - majority-owned by EnBW - in talks to acquire 5 biogas plants from E.ON (after infrastructure funds and strategics such as Igneo and Engie also looked into the portfolio but did not proceed) – *latest news April '24*
- Macquarie's VORN Bioenergy platform, based in Germany (but aiming to develop biomethane plants continent-wide) – *launched Feb. '23*

Investment Landscape

A historically dynamic market which experienced an abrupt slowdown in 2024 – developments to be monitored

- Regulatory developments must be monitored with regards to the German biomethane industry, with the results of the latest auction and RED III important to recalibrate the extent of the government biomethane-dedicated support and thereby reignite investors interest in German platforms

1.d Biomethane – Regional Snapshots

Netherlands



Market Overview & Recent Deals

- From a circa 0.3 bcm 2024 base, the Netherlands' government has set itself a 2bcm 2030 target
- SDE++ scheme, referred to in section 1.a, also encompasses biomethane production and allocates a 12 years CfD for the technology set at levels sufficient to cover standardly non-profitable portions of a plant costs - circa €79.7/MWh

Recent Deals (midcap)

- VTTI (IFM-backed) launched a Biomethane platform in the Netherlands, VIDA Bioenergy, with EU expansion ambitions – Jan. '25
- Asterion Industrial Partners investment into Dutch biogas producer Byont (seed investment are 2 CHP plants in Belgium which will be upgraded to produce biomethane -) – Oct. '24

Investment Landscape

A dynamic market benefiting from the SDE++ regulation covering biomethane among other technologies (i.e. non-specific)

- Feedstock and industrial / operational risks remain top of mind when assessing business plans however a steady stream of opportunities is expected from the Netherlands in the coming years and numerous investors have positioned themselves adequately in anticipation

1.d Biomethane – Regional Snapshots

Nordics: Denmark



Market Overview & Recent Deals

- With a significant 0.5 bcm 2024 base, Denmark is experiencing strong growth since the government's FiT introduction in 2012
 - National target to substitute 100% of natural gas consumption with biomethane before 2030
- The support scheme for biomethane is a combination of a fixed and variable premium which the beneficiary receives on top of the price from selling the gas, so that the aid covers the cost difference between fossil gas and biomethane.
 - Tendered capped to a level around €50/MWh

Recent Deals (*midcap*)

- Copenhagen Infrastructure Partners backing Sindal Biogas (founded in 2017) developing a plant with an intended production of upgraded biogas of up to 34 million cm – *May 2024*
- Infranode investment (minority stakes) in two plants owned by Danish biogas platform Renegas A/S currently operating a 1.5mcm (million cubic meter) capacity – *Jan. 2024*

Investment Landscape

Unlike onshore wind and solar, biomethane benefits from dedicated support in Denmark enabling to bridge the gap with fossil gas economics

- Active investors interest in Denmark with the government support as the cornerstone of infrastructure investment
- Expectation of a steady flow of opportunities, which should be assessed based on management teams credibility, operational expertise and feedstock securisation.

1.d Biomethane – Regional Snapshots

CEE: Poland



Market Overview & Recent Deals

- While there are no biomethane plants in Poland, the Polish regulatory environment is increasingly favoring the expansion of biomethane production (several measures to support biomethane production are pending but not adopted), confirming Poland's sustainable biomethane potential of 3.3 bcm by 2030*
- Currently, a feed-in-premium support system provides additional payments to the market price received, up to the guaranteed level of the electricity price for 20 years from the first day of sale of biomethane covered by the support scheme, but no later than 30 June 2048. Obtaining support requires a certificate from the President of the Energy Regulatory Office (the regulatory authority for the energy market in Poland)
- The most recent regulation** (still to be approved) proposes a feed-in-premium for plants with capacity over 1 MW. The reference price for RES installations for the production of biomethane was set at the level of:
 - 538 PLN/MWh: generation from biogas other than agricultural
 - 545 PLN/MWh: generation from agricultural biogas

Recent Deals (midcap)

- Meridiam, GIP and Suez investment (51% controlling stake) into Ara Cursus, a Polish developer and operator of anaerobic digestion plants. Eiffel's Gaz Vert fund is also buying a 24.5% stake – *Preferred Proponents Jul. '24*

Investment Landscape

Positive signals both from the Polish government adopting a feed-in-premium/CfD policy as well as from recent infrastructure investors entry

- Polish market should remain on infrastructure investors radar providing geographical diversification under a favorable government support regime

Sources: [Dentons](#), [Roedl](#)

*Guidehouse: Gas for Climate Report, 2022

**September 25, 2024 draft amendment to the Act of May 20, 2016

1.d Biomethane – Regional Snapshots

UK



Market Overview & Recent Deals

- With a circa 0.8 bcm 2024 installed base the UK is the second biomethane market in Europe behind Germany, thanks to various support mechanisms including the Green Gas Support Scheme (GGSS) established in 2021
- The GGSS provides tariff support for plants producing biomethane via anaerobic digestion which is injected into the gas grid - it is funded by a dedicated levy (Green Gas Levy) applied to all licensed fossil fuel gas suppliers
- The GGSS has been confirmed until 2028, although with a yearly reduction mechanism designed to prevent over-compensation where biomethane deployment would be greater than anticipated

Recent Deals (midcap)

- Acquisition by Asterion Industrial Partners alongside Swen Capital Partners of a biomethane plant in Charlton Park with capacity sufficient to deliver the energy needs of circa 5,000 households – *March '25*
- 3i Infrastructure's acquisition of biogas plant operator Future Biogas Group, owning multiple biogas plants in the UK with a green gas combined capacity of 489 GWh per annum– *Aug. '24*
- Lazard Asset Management acquiring a majority stake in DBE Energy owning an anaerobic digestion facility in Cranleigh in Surrey - *Dec. '22*
- Spanish manager Q-Energy investment (controlling stake) into bioenergy company Acorn Bioenergy planning to develop 15 anaerobic digestion facilities across the UK – *June '23*

Investment Landscape

A dynamic market with clear dedicated government support and political willpower to promote the sector

- A dedicated tax voted to finance biomethane and positive political signals make for a favorable investment environment for UK biomethane, as evidenced by numerous recent infrastructure investors transactions and continued activity

1.d Biomethane – Regional Snapshots

France



Market Overview

- With 1.4 billion m3 in 2024, growing steadily in recent years, France demonstrates a unique biomethane production potential in Europe thanks to sustained agricultural activity and proven technical expertise
 - Although representing only about 2.3% of primary natural gas production, the quantities of biomethane injected on national networks increased by 31% between 2023 and 2024
- In July 2024, the European Commission validated a French government support mechanism for the sector based on “2-way” CfDs, granted under strict conditions of production volume and forecast budgets

Investment Landscape

A sector in continuous growth with largely untapped potential and positive signals in terms of government support

- With significant potential thanks to a large agricultural sector and recent government support mechanisms, biomethane in France continues its rapid growth
- Although complex to operate hence requiring solid technical expertise, the subsector is expected to generate a significant flow of opportunities for infrastructure investors in the coming years.

1.e

Energy from Waste (“EfW”) / Waste Management

1.e EfW / Waste Management – EU-wide Snapshot



Having concluded that EfW solutions risk harming efforts to reduce and recycle waste, the EU commission has chosen not to support the technology nor to set 2030 targets → cPPAs or HPAs* are expected to be the cornerstone of investment opportunities rather than regulatory revenues support schemes. More opportunities might also exist for investors in the wider waste management space

Technology Overview

EfW

- An EfW facility generates electricity by burning household, retail or offices waste that cannot be recycled or repurposed – referred to as Municipal Solid Waste (“MSW”)
 - Output can also consist of hot water - directed to nearby heating networks - or steam usable by industrial plants.
- EfW plants also contribute to reducing the amount of landfilled MSW, and to reach the EU Landfill Directive’s targets of a maximum of 10% of MSW to be landfilled by 2035 (the EU Waste Framework Directive sets the MSW handling prioritization as (i) avoidance, (ii) recycling, (iii) EfW, and all else failing (iv) landfilling)
- The EU commission has however decided not to prioritize EfW on the back of the “Do No Significant Harm” (“DNSH”) principle (by which an economic activity is only deemed environmentally sustainable if it not only contributes to one or more of the 6 environmental objectives of the EU’s Taxonomy Regulation but also does not significantly harm any of the others), as the commission opined that EfW use might jeopardize recycling efforts
 - As such no FiT or CfD revenues support schemes should be expected for EfW-generated power across the EU

Waste Management

- Recent years saw infrastructure funding backing corporates holding municipal concession contracts for waste management, and at times operating EfW facilities (e.g. Vauban’s Paprec, Meridiam’s Suez)

Investment Landscape

- With the UE stance on waste avoidance & recycling versus EfW plants, no regulatory revenues support schemes are to be expected in the EU
 - however EfW projects remain financeable via cPPAs or HPAs
 - Due attention must be given to construction and operational expertise noting the high technicity of EfW plants – credibility of developers and operational teams is key
- Investments in corporates with secured long-term concession contracts and clear feedstock securitisation could be investigated for investors opportunities in the space

Section 2

Storage, Mobility & Grid Efficiency

2.a

Battery Energy Storage Systems (BESS)

2.a BESS – EU-wide Snapshot



A promising emerging infra class with potential to solve RES's intermittency shortcomings. The UK is a historical technology leader, but only Italy has developed an infra-compatible support scheme

Technology Overview

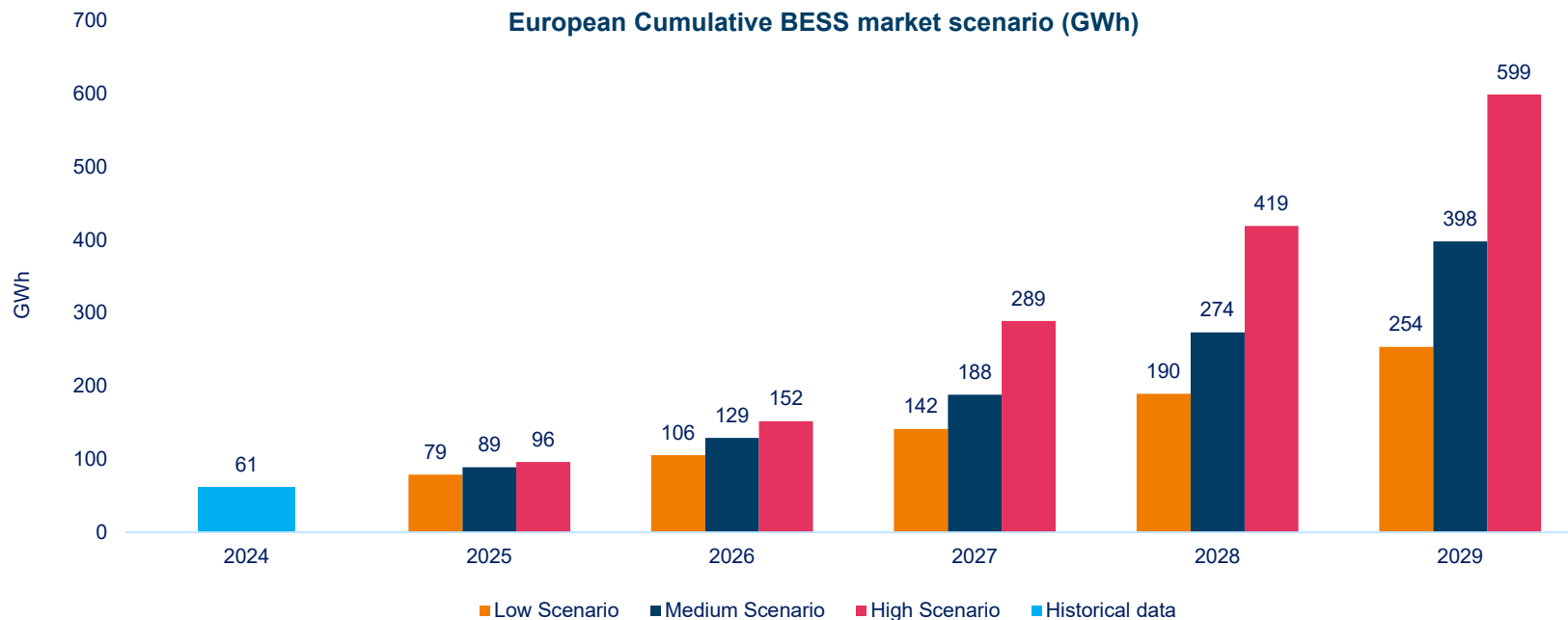
- The intermittent nature of renewables energy production - solar and wind in particular - creates undue pressure on national grids and windows of negative prices (each year a record both in terms of the total number of negative prices hours and cumulative value of negative prices)
 - In a quest to both reach the EU's emissions reductions targets and optimize IPPs revenues, it is now widely accepted that storage systems will be the path to ensuring grid stability
- With growing investor confidence in the technology, an influx of funding has poured into Li-ion BESS
 - With 49.1 GWh BESS capacity (small and large scale) installed in the EU27 in 2024, the existing base is projected to grow to reach 398 GWh capacity by 2029
 - Fundamental trends of decreasing capex (from technological advancements, economies of scale and cheaper raw materials), are expected to continue establishing BESS as a pillar of the ET
- The asset class' characterization as infrastructure, however, is yet to materialize
 - The UK has been a historical leader but revenue models only relied on capacity markets, leaving large exposure to merchant revenues
 - While the '22/'23 energy crisis resulted in a particularly profitable time window, UK investments have since vanished
 - Clear government support is required to provide revenues certainty, and Italy is the first country to develop an availability-based scheme specifically designed to attract infra funding - *see next sl.*

Investment Landscape

- With a business model largely centered around frequency management or wholesale trading – *see next slides* –, infrastructure investment opportunities are only to be found in countries which have set up availability-based compensation mechanisms ensuring revenues certainty
 - To date Italy is the only market having done so – *see dedicated slide* – however investors monitor other European opportunities expected to emerge in coming years

2.a BESS – EU-wide Snapshot

A 61 GWh energy storage capacity base at end 2024, expected to grow in Europe to circa 398 GWh by 2029

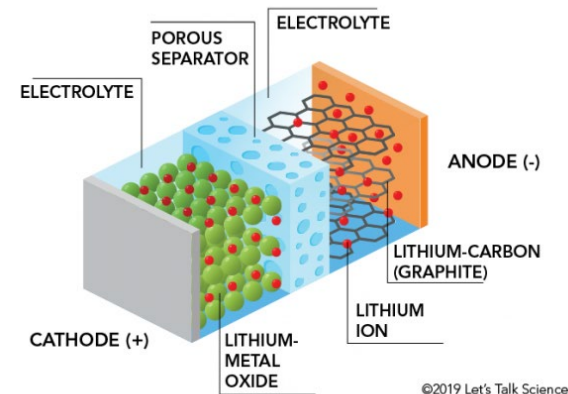


2.a BESS – Technology Overview

While other batteries than Li-ion exist, Lithium remains the most proven technology and the target of most government support schemes to date. Li-ion BESS typically offer 2-4 hours average capacity duration (although expected to increase up to 8 hours in coming years), and enable to alleviate grid constraints

Technology Overview

- Most BESS to date use Lithium-ion (Li-ion) batteries given their relatively small size, light weight, high capacity/energy density, modest maintenance needs and low self-discharge rate
 - Lead-Acid (PbA) batteries, Sodium-Sulphur (Na-S), Flow Batteries and Zinc Bromine (cerium-zinc) are however competing technologies which, while not preferred to date, can offer lower cost, lower inflammability and better tolerance to extreme temperatures
- There are 4 key components of a conventional lithium-ion battery: Cathode, Anode, Electrolyte and Separator – *see right hand side*
- When a battery is discharging, lithium ions move from the anode to the cathode (vice versa when charging) with the electrolyte carrying ions between the anode and the cathode through the separator
- Within the 2024 European installed capacity, the majority remains residential scale however forecasts consensus is on a growth of the industrial scale projects to reach the 398 GWh expected 2029 capacity
- The ability to store energy allows BESS operators to generate revenues by (i) arbitraging wholesale prices, (ii) responding to “balancing mechanism” and frequency management services requests from grid operators and (iii) depending on the country benefiting from government support remuneration - *see next slide on business model*
- Average BESS capex expressed in €/MWh is around 200 (including balance of plant and grid connection) and has been steadily decreasing over the past years thanks to economies of scale with the trend expected to continue albeit stabilize



2.a BESS – Business Model

A BESS revenue stack is typically derived from 3 streams mixed and optimized to maximize profit: (i) energy arbitrage, (ii) ancillary services and (iii) government-support schemes remunerating capacity availability

1

Energy arbitrage (in wholesale market)

- **Context:** energy price volatility from rising renewable share → opportunity to buy and sell electricity by charging / discharging within adequate windows
- **Revenue:** Arbitrating between lower purchase prices (when supply is high or demand is low, or a factor of cost such as fuel prices, carbon prices or environmental conditions vary) and higher sale prices, i.e. buying and storing energy in times of low demand, and releasing it in times of high demand.
 - Typically purchasing and charging at times of high solar irradiation, and selling / discharging at night
- These services occur during the day-ahead market and intraday markets

% within revenue stack highly dependent on volatility → varies every year (24% average estimated in 2024 in the UK)

2

Ancillary & Balancing Mechanism

- **Context:** With growing constraints from RES, grid operators (TSOs) reward players able to support stability and balance, for instance via frequency management services (maintaining frequency at 50Hz)
- **Revenue:**
 - o Frequency response services: Maintaining the grid frequency via discharging or absorbing energy within seconds/minutes, helping stabilize frequency fluctuations → BESS receive a €/MWh remuneration. Like arbitrage, these services can occur all along the market opening period
 - o Balancing mechanism: Balancing electricity supply and demand close to real time by submitting bids a half hour before market closure → BESS participate via “bids” or “offers” and receive a €/MWh remuneration on a pay-as-bid basis
 - o Other services include stability payments, reactive power, congestion management and restoration (autonomous start-up in absence of supply)

3

Government Support – focus of next slides

- **Context:** With BESS now recognized as a necessary source of grid stability, governments are setting up regulatory frameworks to encourage replacement of older storage units and getting capacity contracted for future requirements → allows BESS operators to attain a level of certainty in investment returns/avoid merchant exposure
- **Revenue:** Government-support schemes can either be (i) capacity market auctions which allow BESS operators to add a premium on top of market revenues, or (ii) other forms such as “MACSE scheme” in Italy which remunerates a large part of the income relating to a capacity made available (in a bid to attract infrastructure funding) – see next sl.

% in revenue stack varies based on grid needs, e.g. 84% of UK BESS revenues in 2022 but expected only 20% in 2024

2.a BESS – Regional Snapshots



The UK has been a historical large-scale BESS leader driven by a dynamic ecosystem of developers operating on merchant risk and boosted by the recent energy crisis. With investment levels having now dropped, gov't support not being BESS-specific / not providing revenues certainty struggles to boost the sector back

UK Government Support: Capacity Market Auction

- The Capacity Market Auction (CMA) was introduced in 2014 as part of the electricity market reform in an effort to ensure better planning of available energy supply across energy sources
- **It is technology-agnostic**, with “de-rating factors” applied to technologies based on an assessment of their use to the grid in cases of unusual stress
- Awardees receive a fixed premium in £/kW/year, which they can add to their merchant revenues, **as such doesn't secure fixed revenues levels**
- Descending clock auction “pay as clear”, where bidders submit capacity and then withdraw as the clearing price drops:
 - i. auction starts at a price cap and price is reduced in each round by a set decrement (e.g. £5/kW/year in the last auction run)
 - ii. participants must submit an exit bid to leave the auction: the minimum price at which they accept the capacity market premium
 - iii. auction clears when the capacity that remains in the auction is less than capacity available for award in the round

BESS in Latest CMA (T-1 (2024/25) & T-4 (2027/28) Auctions)

- The CMA runs 2 auctions to procure capacity for each delivery year:
 - the first is held 4 years ahead of the delivery year (T-4 auction), to allow enough time to build any new capacity needed, and
 - a year before delivery, a ‘top-up’ auction is run (T-1 auction) allowing for last-minute adjustments

2023/24 Auctions Results - T-1 Auction (DY 2024/25)

- The auction cleared in round 8 → £35.79/kW/year clearing price
- Total capacity which entered the auction: 9,457.1 MW (de-rated), aggregate capacity awarded 7,639.6 MW
- BESS was awarded 655.1MW, a 8.6% share of total awarded capacity, the highest capacity awarded to clean technologies in this auction round

2023/24 Auctions Results - T-4 Auction (DY: 2027/28)

- Auction cleared in Round 2 → £65/kW/year clearing price (not far off the £75/kW/year cap, reflecting a constrained UK market capacity balance)
- Aggregate capacity awarded 42.8GMW of which 1GW in BESS (2.4%)

Recent Deals

- SAE, in partnership with Ecoenergy, develops a 250 MW / 1,250 MWh BESS project in Uskmouth – May '25
- Sale by CIP of a 50% stake in a 500 MW BESS project in Scotland to AXA IM – April '25

2.a BESS – Regional Snapshots



Italy is the first market offering a government support scheme designed to attract infrastructure funding: the MACSE subsidy, while remaining complex, is generating significant investors interest

Italy's Capacity Market (CM)

- Contrary to the UK, two government support mechanisms exist in Italy (but are not stackable)
 - the Capacity Market (similar to the UK but with a strike price requirement); and
 - MACSE: BESS-specific and most infrastructure-friendly support scheme in Europe

1. Capacity Market

- Auctions: technology-agnostic (similar to the UK), with BESS eligible however short duration batteries are impacted by high derating factors, and longer durations are currently undervalued
- Difference with UK CMA are that awardees must:
 - repay grid operator Terna the difference, if positive, between the price of the electricity realized on the energy and services markets and a defined strike price; and
 - offer capacity on energy and services markets.
- Latest CMA in Italy (results published 31 Oct. 2024) resulted in 174 MW total allocated capacity, including 89 MW for BESS

MACSE – first auction results in September 2025

2. MACSE

- MACSE (*Meccanismo di Assegnazione Centralizzata per la Sostenibilità Energetica*) is a unique subsidies plan by the Italian government to boost RES integration and support up to 50GWh of energy storage by 2030
- MACSE offers BESS operators to swap a share of their merchant revenues (which they have flexibility to define) for 15-years fixed inflation-linked contracts with Terna, thereby ensuring an availability-based payment with a highly creditworthy offtaker (Terna, backed by the IT government)
 - Premium is awarded via a competitive auction process (pay-as-bid auction for authorized projects), with first one in early 2025 (although the gov't hasn't disclosed the upcoming auction capacity, nor the reference price below which bids must be)
- In exchange to the premium received from Terna:
 - Operators must allocate the corresponding storage capacity for the provision of time-shifting products* which enable market operators to trade in the market as a virtual storage product
 - Operators will be able to participate in the ancillary services market (MSD) but will only retain 20% of the revenues earned on this market**
- Key difference with the CMA: MACSE allows investors to flexibly select the level of contracted capacity included in the MACSE scheme so as to retain merchant exposure to the degree of their choice

2.a BESS – Regional Snapshots



Germany's industrial-scale battery market is in its very early stages with only circa 1.5 GWh (12% of total BESS capacity in the country) and no standalone BESS-specific regulation

Bundesnetzagentur's Innovation Tender (CfD)

- Only one technology-agnostic gov't support scheme available in Germany: the innovation tender
- A capacity market which could benefit large-scale standalone BESS is yet to be launched – it is expected in 2028

Innovation Tender

- Not available to standalone BESS but to RES coupled with storage assets
- Historically significantly undersubscribed, mainly due to restrictive rules applied to winning projects, in that BESS must forego ancillary services revenues and stacking to participate
- Initially offering a fixed feed-in premium over 20 years, however to prevent overcompensating producers when prices are high, the fixed premium has been replaced with a sliding market premium so that no remuneration will be paid when prices exceed a reference value

Latest Innovation Tender results

Latest innovation tender results (Closed for bids on 01 May 2025)

- The German Federal Network Agency (*Bundesnetzagentur*) has received a record number of subscriptions with 158 bids totaling 2GW, more than 4x the procurable amount
- The agency awarded 29 contracts of solar-plus-storage with prices for successful bids ranging between €50.0/MWh and €63.9/MWh and an average volume-weighted price of €61.5/MWh, in continuing decline since the Autumn 2024 tender
- These results, well below the €90.0/MWh ceiling price, reflect the growing investors and developers' interest in the asset class and the robustness of Germany's support mechanisms

2.b

EV Charging Stations (EVCS)

2.b EVCS – EU-wide Snapshot



After a flurry of transactions throughout 2021-'23, the EVCS sector is currently experiencing a slowdown on the back of reduced EVs demand post reduction of EV subsidies by most EU governments → careful deals selectivity is required for infrastructure investors with focus on downside protection

Technology Overview

- With battery electric vehicles (« BEVs ») sales growing by a factor of 18x between 2017 and '23 and the EU ban on Internal Combustion Engines (« ICE ») vehicles sales by '35, EVCS infrastructure deployment has emerged as a necessity in all EU countries and a number of transactions backed by infrastructure capital saw light starting ~2021, both for public and private charging (see below examples)
- Business models in the EU typically do not include partnerships with corporates granting exclusivity on fleets, nor any governmental revenues support, and therefore little revenues contractualization
 - Instead most business models are exposed to traffic risk which is combined with mitigating factors such as partnerships with retailers attracting vehicles on their real estate (Meridiam's Allego with Ikea, Driveco with Carrefour, EDF's Izivia with McDonalds) in a strategy called "destination charging", or focus on locations with some sort of "capture" potential such as highway gas stations or private charging (ICG's investment into Zepplu)
- Business models are also frequently exposed to electricity price volatility, with a margin charged on the pass-through of power cost upon customers charging their vehicles (and, at times in a destination charging model, a mix of fixed rent + electricity margin to be paid to the retailer)
 - Few business models fully fix power prices towards customers, ensuring exposure to power prices remains limited and the infrastructure thesis assessment to be narrowed to traffic risk mitigation
- With many governments re-prioritizing their subsidies allocations away from EVs, driving a reduction in short-term sales, infrastructure funding towards EVCS is currently experiencing a slowdown

Investment Landscape

- Current sector slowdown is impacting projects on full traffic risk the most, as EVs sales and traffic forecasts are being re-adjusted
- With no governmental support on revenues (regulations instead boost the sector by setting EVs targets / gradually banning ICEs), downside protection is the cornerstone to infrastructure investment into public EVCS
- No EU countries stand out in particular in terms of de-risking traffic risk exposure
- As such infrastructure investors are currently re-assessing exposure to the sector and awaiting clarity on updated traffic curves, thereby creating a 'wait and see' momentum expected to continue in the coming months before the sector picks up pace

2.c

Transport Fleets Decarbonization

2.c Transport Fleets Decarbonization – EU-wide Snapshot



Leasing / ‘sale and lease-back’ transactions have established as clear infrastructure opportunities over the past years, with transactions in the rail, last-mile delivery and refrigerated transport spaces adding to the previously existing shipping and aviation sectors. In most portfolios, fleets are now on the path to decarbonization with infrastructure investors targeting full transition to “green” by the end of their hold period

Opportunity Overview & Recent Deals

- While shipping and aviation fleets financing has historically been the focus of either specialist/dedicated equity funds or lending divisions (Macquarie AirFinance, Vmo aircraft leasing backed by Ares, Mitsui’s Navigare Capital Partners), recent years have seen an increasing number of fleets equity financing transactions with infrastructure investors acquiring portfolios leased under 7-10 years contracts with either a limited number of creditworthy counterparts or a wide stable pool of customers
 - The large majority of investment theses include decarbonization of such fleets over time, so as to build a future-proof exit equity story

Recent Deals

- Infravia acquisition of an 80% stake in Louis Dreyfus Armateurs, a group specialized in sea shipping services, so as to double the fleet size and accelerate the fleet’s energy transition to less carbonated solutions – *Feb. 2025*
- Infranity acquiring an 80% stake in Swedish Nordic Re-finance locomotive lessor with clear plans to modernize/‘greenify’ the fleet – *Jan. 2025*
- Wren House 43% stake acquisition in Petit Forestier, a refrigerated trucks family-owned lessor, with fleet electrification a pivotal element of the investment thesis – *April 2024*

Investment Landscape

- A now well-established investment thesis coupling investment into capital-hungry fleets portfolios with a transition strategy away from fossil fuels, diesel engines or outdated assets generating suboptimal levels of GHG
- Such strategy is now well active across the rail (ROSCOs), containers & shipping, trucking (refrigerated or not), or ferries sectors
- Typically benefitting from an established stable base of counterparts willing to enter into 7-10 years contracts with high renewal probability, or from a monopolistic position (ferries), fleets financing offers suitable predictable inflation-linked cashflows and is expected to continue on a steep growth path in coming years
- High barriers-to-entry stable fleet portfolios, especially when offering IRR rerates via ‘greenification’ over the hold period, should fully remain on investors radars and are expected to constitute sizable portions of managers portfolios

2.d

Grid / Interconnection

2.d Grid / Interconnection



With expansion needs and EU grids interconnectivity an important factor of grid stability - a central challenge give RES growth and intermittencies –, investment in grid infrastructure has the potential to generate a steady stream of greenfield or brownfield opportunities for infrastructure investors

Technology Overview

- Power grid infrastructure, initially government-owned, has seen a wave of privatization or semi-privatization starting around the mid 1980s
 - While remaining heavily regulated, most grid operators are now private or listed: Tennet in the Netherlands (and in parts of Belgium and Germany), National Grid in the UK, Elia in Belgium, Terna in Italy (~30% owned by CDP, the *Caisse Des Dépôts* equivalent), 50Hertz, Amprion, and TransnetBW in Germany, Red Electrica in Spain (20% gov't owned), RTE in France (50.1% EDF)
- In continuation of this trend, a number of government tenders for stakes into publicly-owned grid infrastructure have come to market in recent years, with infrastructure funds now eager to participate (*see Recent Deals below*)
- In some instances, infrastructure investors have directly acquired stakes in Utilities (e.g. Meridiam's stake into Suez) which then bid for grid infrastructure extension projects

Recent Deals

- Igneo Infrastructure Partner's energy grid company Nordion (formed by merging in 2021 three gas distribution companies owned by Igneo since 2018) has secured a majority stake acquisition into Swedish regional electricity grid operator Dala Energi – *Dec. '24*
- Norway's municipality of Fredrikstad's 51% stake sell into Fredrikstad Energi, an electricity grid operator, could attract infrastructure funding alongside Utilities – *process launched Sept '24*
- Controlling stake sale into Electricity North West, the power network operator for the North West of England, attracting interest from KKR, APG, CDPQ along Engie – *KKR and APG exited process end July '24*

Investment landscape

- With the Nordics generating a steady flow of investment opportunities (often joint sales of full or parts of electricity and gas/heating networks), the sector is expected to remain on infrastructure investors' radars
- Significant investment tickets are to be expected for “platform” positions in large power grid operators

Section 3

Industrial Decarbonization, Heat and Energy Efficiency

3.a

Hydrogen (H₂) / Electrolysers

3.a H₂ – EU-wide Snapshot



The 2030 REpowerEU targets of 10 mt H₂ production in the EU is focused on renewable (« green ») hydrogen produced with electrolyzers powered by renewable energy sources (unlike grey or blue H₂)

Technology Overview

- H₂ is a clean fuel which, when consumed in a fuel cell, only produces water (unlike fossil fuels producing GHGs), making it an attractive fuel option for transportation and electricity generation applications, as well as an energy carrier that can be used to store, move, and deliver energy produced from other sources
- It can be produced from a variety of domestic resources, such as natural gas, nuclear power, biomass, or renewable power
- Several methods allow for H₂ production with the most common being natural gas reforming (a thermal process), and electrolysis
 - Thermal processes account for 95% of all H₂ production to date and are highly polluting as they involve steam reforming, a high-temperature process in which steam reacts with methane in the presence of a catalyst to produce H₂ but also carbon monoxide, and a relatively small amount of carbon dioxide
 - **Electrolytic processes**, albeit a small share of today's H₂ production, have the potential to be more sustainable : water is separated into oxygen and hydrogen through a process called electrolysis taking place in an electrolyser which functions much like a fuel cell in reverse - instead of using the energy of a hydrogen molecule, like a fuel cell does, an electrolyser creates hydrogen from water molecules

The Shades of H₂

- H₂ production is routinely given a color, reflective of its environmental footprint
 - Green H₂ is derived from electrolyzers powered exclusively by RES – it is the only renewable energy and the focus of the EU production targets
 - Grey H₂ is derived from steam reforming whereby CO₂, extracted through the process, is released into the atmosphere
 - Blue H₂ is a variant of grey H₂ whereby the CO₂ is captured using CCUS technology
 - Anecdotally, pink H₂ refers to H₂ electrolyzers production powered by nuclear energy, and yellow H₂ by solar (only, vs green H₂ which can be solar, wind or else)
 - Since early 2023, the EU recognizes pink H₂ as “low-carbon” but a consultation is in train to validate the inclusion of pink H₂ into European Hydrogen Bank auction support – see next slide

0.05 mt green H₂
capacity at June '24



10 mt '30 target
green H₂ capacity

3.a H₂ – EU-wide Snapshot



As the translation of EU directives into national laws is yet to materialize, momentum is lacking and the sector is currently facing a slowdown despite a number of infrastructure projects having emerged these past years

EU Support schemes

- As both a feedstock and a fuel with storage ability, H₂'s potential is significant: a fully functional H₂ industry could balance fluctuating electricity supply and demand (solving for RES's intermittency) and provide inter-seasonal energy storage, both of which are needed in a net-zero energy system
- At EU level, the “European H₂ Bank” is the most tangible support scheme in place to date, being a financing instrument reaching up to €3 bn total and run by the EU commission via subsidies auctions → the most recent round was launched in Dec. '24 and closed in May '25, awarding nearly €1 bn to 15 renewable H₂ projects
 - CIP, Hy24, IFM Investors, GIP, CVC were among the awarded projects investors
 - All projects must start producing green H₂ within 5yrs following their award, at which point they receive a fixed premium (in €/kg, non-indexed) over 10yrs (ceiling price of €4.5/kg)
 - Producers must submit regular proof of the GHGs emissions reduction, and the subsidy is cancelled if production is <70% of a bid volume for 3 consecutive years
 - Going forward: a new auction round is ongoing, with a €1bn EU budget and max ceiling price €4 / kg – *results expected end H1 2025*
- At national levels, H₂ national plans translating the EU directives are yet to be published (initial deadline set March '25 however experts expect a delay), thereby creating investors uncertainty and delaying capex / electrolyzers build plans

Investment Landscape

- While certain infrastructure investors have committed to the technology (Ardian's Hy24, Andara's Lhyfe - *see left-hand side*), the business case / economics for competitive sustainable green H₂ are yet hard to grasp due to lack of visibility on EU support
 - To date the production cost gap between grey (c. €3/kg) and green H₂ (8-12€/kg) remains difficult to bridge without subsidies
- Green ammonia, either for usual industrial uses (production of agricultural fertilizers, nitric acid, synthetic fibers, explosives, dyes, pharmaceuticals) or as an energy storage fuel, is produced from green H₂ and also has potential for long term offtakes
- SAF derived from H₂ are another outputs option, however struggling to demonstrate tangible commercial potential - *see next section* -
- The business case for H₂-fuelled vehicles and charging stations is difficult to stand behind to date
- Since unlike in the US (where the IRA, before the November '24 election, granted significant capex subsidies) the EU directives supporting revenues are yet to be published into national laws, the sector is generally in “wait and see” mode which H₂ companies are using to perfect their operational expertise, which will prove valuable when the situation and market will unlock

3.b

Biofuels

3.b Biofuels – EU-wide Snapshot



The only biofuels (outside biomethane and green H₂ previously covered) with potential for infrastructure funding identified are Sustainable Aviation Fuels (“SAF”)

Technology & Regulatory Overview

- SAFs are “drop-in” (ready to be used in current infrastructure and engines) aviation fuels which can be either derived from (i) waste like used cooking oils, agricultural residues, landfill trash, or made from crops grown specifically for fuel, (corn, palm trees to switchgrass); or (ii) from hydrogen (which can be green) and CO₂; classifying them as more sustainable than traditional fossil fuels
- **Regulatory developments in the EU**
 - The RePowerEU plan sets binding targets for the share of RE in the transport sector (including maritime and aviation): by 2030, EU countries are required to either achieve a share of 29% of renewable energy in transport or to reduce the emissions intensity of transport fuels by 14.5%, as well as a combined sub-target for renewable hydrogen and advanced biofuels of 5.5%
 - In this context, the ReFuelEU Aviation directive was adopted in October '23, setting minimum obligations for all fuel suppliers to gradually increase the share of advanced biofuels and synthetic aviation fuels in the fuel supplied to operators at EU airports, starting with a minimum volume of SAF at 2% in '25, increasing to 70% by '50
- With the aviation sector accounting for c. 2% of global energy-related CO₂ emissions (in '22) and air travel demand expected to double by '40, SAF is considered the only feasible near-term commercially-available solution to cutting aviation emissions
 - The International Air Transport Association (IATA) estimates that SAF could contribute around 65% of the reduction in emissions needed by aviation to reach net zero CO₂ emissions by 2050

SAF Strengths & Weaknesses

- + More sustainably-produced fuels immediately available to be used in air transport without changing the existing storage and distribution infrastructure, aircraft or engines
- Difficulty at this point to assess clear economics and ROI, still costs more than kerosene
- Numerous small producers with different pathways leading to difficulty to target one specific approach / have conviction backing one company. Institutional investors, major oil and gas companies, and largest insurance companies are not yet invested in the sector
- Lack of visibility on scalability
- Lack of visibility on offtake agreements, and airlines counterparty risks for cPPAs

3.b Biofuels – EU-wide Snapshot



Most SAF transactions currently active are suffering from severe delays / BPs scale-downs, or going fully bankrupt

Recent Deals (midcap)

- Aside from Macquarie Asset Management's SkyNRG platform, very few SAF-only business cases have been backed by infrastructure investors to date
 - Most often business cases mix green H₂, green ammonia or SAF together (Hy24's Elyse Energy, Octopus' Norwegian developer Deep Wind Offshore)
 - SkyNRG aims to develop 2 facilities in the Netherlands, each targeting 100k tons of SAF per year and 35k tons of sustainable by-products, such as LPG and naphtha, using feedstocks such as locally produced H₂ and use waste and residue (e.g. cooking oil)
 - SkyNRG – in which KLM is a MAM co-shareholder - disclosed having partnerships with strategic offtakers such as KLM and Boeing with long-term agreements "worth up to €4bn to buy SAF"
 - Latest understanding is that the business case is suffering and developments being slowed down
- Foresight Group has invested in a German green H₂ developer HH2E initially aiming to supply "at least 200k t p.a.", now going into bankruptcy - Nov. 2024

Investment Landscape

- Despite SAF being recognized as a credible H₂ – based output, the sector faces the double challenge of
 - i. lack of visibility on EU directives' translation into national law to provide subsidies bridging the competitiveness gap between grey and green H₂ – *see previous section –*; and
 - ii. lack of visibility on SAF use (despite certain EU targets such as ReFuelEU) compounded by the creditworthiness of airlines expected to enter into the production offtake contracts

The combination of these challenges leaves the SAF industry in a similar state as the H₂ sector with a "wait and see" dynamic until the EU H₂ directives clearly translate into national law and subsidies programs, with SAF expected to evolve in parallel to the wider H₂ industry in coming years.

3.C

Heat: industrial heat / heat capture & heat networks

3.c Heat – EU-wide Snapshot



While heating networks have historically been government-procured (often by local municipalities) under PPP/concession models, upcoming decarbonized heat delivery solutions should be monitored

Technology / Regulatory Overview & Recent Deals

- Local heating networks / district heating concessions have long been on infrastructure investors radars with a flurry of contracts signed over the past decade
 - Investors have set up dedicated financing vehicles such as CVC DIF's HEMIKO developing, financing and operating heating networks across the UK; Partners Group setting up Gren, a company owning EfW and CHP plants but also operating district heating networks across Finland, Estonia, Latvia, Lithuania, and the UK; and Antin's investment into IDEX in France
- Outside of these established schemes, heat-related investment opportunities can exist in the spaces of heat capture and decarbonized heat delivery towards industrial uses
 - Industrial heat consumption accounts for two-thirds of industrial energy demand and almost 1/5th of global energy consumption. Most industrial heat is still generated through combustion of fossil fuels and fossil gas.
 - Decarbonization of such heat can typically occur via direct electrification (when electricity is sourced sustainably), H₂, CCUS or biomass/biomethane – *all covered in previous sections of this paper*. However new technologies to deliver decarbonized heat are emerging, such as Thermal Energy Storage (TES) which refers to the technology allowing for the storage and transfer of heat energy for later use, initially fueled by (green) power to generate heat. It encompasses 2 primary categories – *see appendix slide for breakdown*:
 - Sensible - storing thermal energy by heating or cooling a storage medium (liquid or solid) without changing its phase
 - Latent - using latent heat to store thermal energy, meaning the energy required to change the phase of the medium used

Recent Deals

- Andera Partners' investment into Kyotherm allows the company to develop its molten salts technology which stores heat for later use by an industrial partner directly on site – *Feb. '22*
- InfraVia invested in Kyotherm in *Oct' 24*

Investment Landscape

- The heat use sector has seen recent interest from infrastructure investors but (apart from district heating networks) remains a relatively nascent sector where infrastructure fundamentals are to be assessed on a case by case basis, and where a degree of exposure to operational performance of management teams is to be expected.
 - General market positioning is to await sector developments / further transactions

3.d

Energy Efficiency

3.d Energy Efficiency – EU-wide Snapshot



With industrial and buildings emissions still accounting for 11% and 6% respectively of all GHG emissions, numerous countries are imposing energy efficiency / consumption constraints (e.g. French rules requiring large buildings to reduce energy consumption by 60% by 2050), creating potential investment opportunities

Technology & Regulatory Overview

- Energy losses heavily contribute to GHG emissions with binding targets imposed in many EU countries
 - While a nascent sector of infrastructure investment, the works required to reach industrial or buildings targeted efficiencies all require significant capex while delivering energy savings over the long term
 - As such infrastructure investors have begun to turn their attention towards structuring projects generating long-term downside protected returns
- In the buildings efficiency space these can take the form of “energy efficiency as a service solutions” whereby a dedicated vehicle finances and performs required works to optimize energy consumption, receiving over the long term a share of energy savings
- In the industrial space, capture of heat otherwise lost (fatal or waste heat) is expected to grow in importance with, among other sectors, the data centres space growing over the coming decade

Recent Deals

- White Summit has invested into the Powesco vehicle, delivery energy efficiency services to clients in the tertiary sector – *Dec. 2024*
- DWS investment into EDF's Perfesco providing energy efficiency solutions to industrial groups – *Oct. 2024*

Investment Landscape

- With necessary capex to be spent to optimize buildings efficiency, and energy savings materializing as a consequence over the long term, the cashflows profiles of the sector adequately suit infrastructure investors mandates
 - With an uptick in the number of infrastructure transactions in the sector seen in 2024, the thesis is expected to grow in importance on infrastructure investors radars in coming years

Section 4

Cautious Stance – Lessons Learned in Infrastructure

4.a

Gigafactories

4.a Case Study: Northvolt



Northvolt, once Europe's green EV batteries production pioneer backed by more than \$13 billion in debt and equity funding (most funded EU start-up in 2023), has now reached bankruptcy due to increasing costs and production delays leading to withdrawal of its key offtakers

Northvolt Genesis and Funding

- Founded in 2016, Northvolt aimed to spearhead a sustainable European lithium-ion EV batteries supply chain with a target 150 GWh annual batteries production capacity by 2030, thereby mitigating European reliance on Asian manufacturers (CATL, LG, Panasonic, etc)
- Through various fundraisings it built a shareholders base including Volkswagen, Goldman Sachs, BMW as well as IMCO, CPP, Omers and BlackRock, and its first gigafactory (operations start in 2021, first cells deliveries in 2022) with plans for three more (incl. one in the US benefitting from IRA)
 - Business model was based on long term offtake contracts from Volkswagen, Volvo and BMW with fixed price on delivered production volumes
 - Northvolt also diversified into battery recycling with a facility aiming to process 125,000 tons of end-of-life batteries and production waste p.a.
- Northvolt was considering an IPO in 2023

Bankruptcy

- Northvolt's rapid expansion and focus diversification across multiple gigafactories in parallel, without solidifying production capacity in its initial factory in Skellefteå (initially 16GWh per year quickly upped to 32 GWh/yr) , led to significant production delays
 - EV batteries manufacturing remains a highly complex / chemistry-based industrial process which is very difficult to stabilize and to reach production scalability on, despite hiring of experts from Asian manufacturers leading operations
- The company's overdiversification into areas such as recycling, or disorganized M&A strategy, further constrained resources and diverted focus from robust quality production
 - 2019 saw the launch of a recycling program, Revolt, targeting 50% recycled materials
 - In 2021, Northvolt acquired a San Francisco-based battery technology company (Cuberg) expected to develop next-generation battery cells with a lower price point
- After admitting production delays in 2022, confirmed in 2023 (**0.5%** of planned annual capacity was delivered), BMW cancelled a €2bn offtake contract in 2024
- Coupled with a global slowdown in EV demand contrary to initial forecasts, and in a continued context of stiff competition from Asian manufacturers (China controls 85% of global battery-cell production and fluctuating raw material prices, leading to pricing pressures), Northvolt's lack of self-sustained profitability for too long left it vulnerable when investor sentiment shifted amid broader economic uncertainty
- Northvolt filed for bankruptcy in Q4 '24 after several setbacks and contracts termination from key offtakers – *all details not available / confidential* – and c. \$5bn debt – Goldman Sachs understood to have lost c. \$900m and Blackrock fund performance severely impacted

4.a Case Study: Automotive Cells Company

ACC, a joint venture between Stellantis, Mercedes-Benz and Total Energies, has suspended work on two gigafactories plants, after raising \$4.7 billion in debt funding

ACC Initial Thesis and Funding

- Founded in 2020 by Stellantis and TotalEnergies, ACC's first Gigafactory in Northern France started operations in May 2023 after having raised c. \$1.2bn equity funding having brought Mercedes-Benz into the shareholders base and circa \$4.7bn debt
- Similarly to Northvolt and a number of other European EV batteries manufacturing companies, ACC focused its technological plan on the Nickel-Manganese-Cobalt Li-ion battery technology, aiming to reach a 120 GWh / 2 million batteries annual production capacity by 2030
 - Similarly relying on long term offtake contracts with automotive heavyweights, ACC's profitability cornerstone is rooted in the Mercedes-Benz involvement
- Initial ACC plans were for 2 further gigafactories beyond the French one, in Italy and Germany

Challenges and Slowdown

- Similarly to Northvolt, ACC has had to acknowledge a higher manufacturing complexity than initially envisioned with difficulties to stabilize production / mitigate scrap and losses
- Further, the emergence of Lithium-Ferrophosphate batteries, circa 40% cheaper than Nickel-Manganese-Cobalt (albeit offering lower efficiency) jeopardizes the ACC technological plan and demand forecasts, noting production lines entirely vary between the two technologies
- In 2023 Italy's government decided to cut an initially-promised €200m funding grant to ACC after it faced delays building a Gigafactory in Termoli
 - That same year construction began for the German gigafactory but ACC quickly faced logistical issues, needing to clearing existing factory sites, delaying progress.
 - Amid production difficulties on the French Gigafactory (understanding as high as **50% production scrap**), the Italian and German construction plans were cancelled
- Supply chain bottlenecks were also cited as challenges, with sourcing of the numerous raw materials for battery production not locally available despite being centralized
- While the company has not announced liquidity issues nor bankruptcy risks, investors remain in "wait and see" mode in a sector once attracting heavy enthusiasm now tainted by the Northvolt resounding failure

4.a Case Study: BritishVolt



A £3.8 billion UK government-backed venture to build a battery plant in Northumberland failed after difficulties to secure offtake and secure public funding

Genesis

- Founded in 2019 with the ambitious plan of building a £3.8bn gigafactory in Northumberland of target capacity 38 GWh/year (serving approximately 300k cars and vans per year)
- Unlike Northvolt, ACC or the Verkor Gigafactory (another EV batteries manufacturing start-up in France), Britishvolt never secured offtake support from an automotive heavyweight prior to construction
 - Britishvolt founders instead aimed to solely capitalize on political support and investors enthusiasm in the nascent sector

Challenges and Bankruptcy

- With no long term offtake, Brexit consequences on UK finances and a lengthy fundraising process eventually unsuccessful, even the public funding initially promised did not materialise and Britishvolt went bankrupt in early 2023 without having produced a battery



4.a Solar Panels Gigafactories

A number of solar panels gigafactories projects have been in fundraising for a number of years and are to date still struggling to secure commitments and initiate construction on the back of Asian competition and production process challenges

Photowatt

- Originally established as a research center for photovoltaic cells, Photowatt became a key player in the French solar industry after being acquired by EDF Renouvelables in 2012
- To date, the company continues struggling to compete with Chinese manufacturers, in particular due to a lack of sufficient research & development funding and advanced technological development.
- Despite a production process developed with a capacity of 200 MWp, the project wasn't able to be profitable.
- In September 2024, EDF Renouvelables announced the selling of Photowatt to Carbon

Carbon

- The Carbon gigafactory ambitions to produce solar panels on a 60ha zone in the industrial-port zone of Fos-sur-Mer, Marseilles
 - This gigafactory would integrate the entire production chain from production of silicon wafers, cells and photovoltaic modules to assembly of photovoltaic panels.
- With a an annual target production capacity of 5GW of solar cells and 3.5 GW of solar modules, Carbon expects to raise 1.7€ billion worth of funding
 - The fundraising was launched in 2023 and in a context of intense competition from Chinese manufacturers to date no commitments are secured, leading concerns on the project viability with or without governmental support
- The Photowatt acquisition by Carbon is the only tangible step taken by the company with an intention to 40m€ to revive and upgrade the existing facility and transform it into a production unit with a capacity of 500Mwp, equivalent to 1 million panels annually

4.b

Recycling

4.b Recycling: Batteries, Solar Panels

By nature complex and novel industrial processes requiring both feedstock streams (which can prove hard to guarantee over long periods) and adequate price points for outputs production, recycling ventures have struggled to attract infrastructure funding over the past years

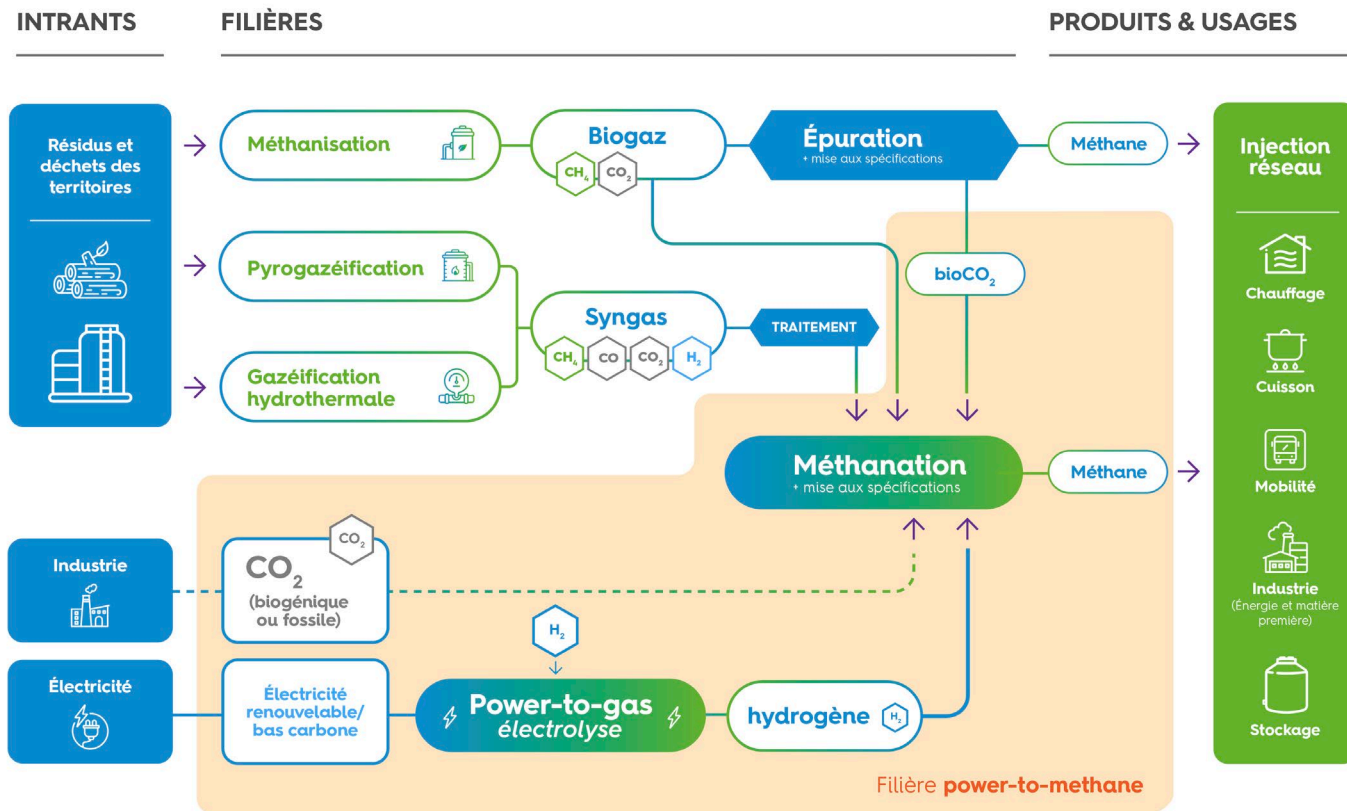
Recycling Ventures Challenges

- Infrastructure features mandate stable and contracted feedstock streams, as well as long term offtake contracts with fixed prices
- Most recycling projects are based on technological or industrial processes presenting some degree of innovation which, even patented, typically present an operational risk (or one in terms of reaching scale)
- In addition to this industrial risk, feedstock securitisation is not a given despite the typical abundance of the materials being recycled, as producers of such materials need to be incentivized (and/or forced) to recycle in the facilities / with the companies in question
- Lastly, recycled outputs – whilst typically re-usable - do not necessarily attract industrial companies enough to enter into long term offtake contract with fixed prices, in particular when outputs are commodities with varying prices on global markets
- For these reasons, the contractual and industrial certainty infrastructure investors require is typically difficult to find in recycling ventures

A

Appendices

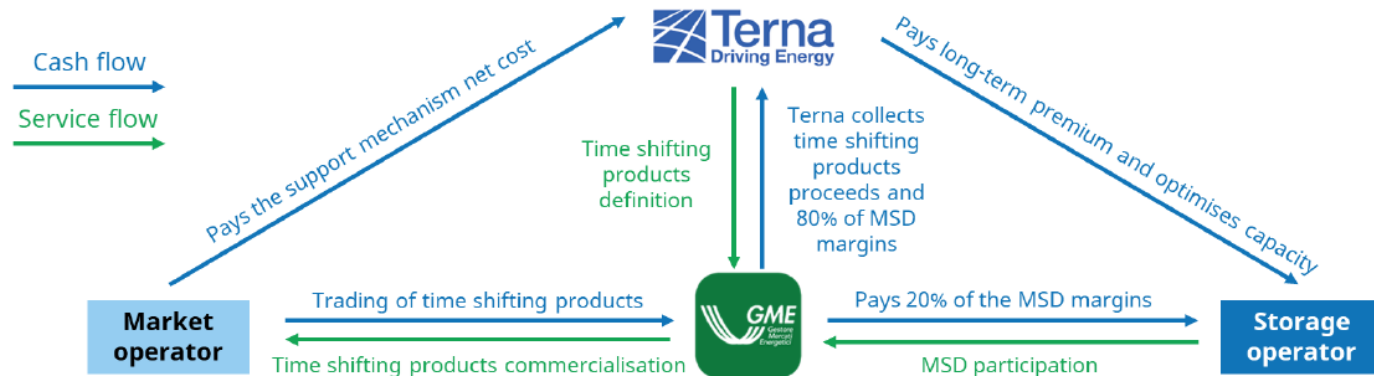
Biomass to Biogas to Biomethane



Volatility of business models in key BESS markets

Drivers		UK	US	Italy	Germany	Spain	Australia
Ancillary services	- Rise in BESS capacity/decline coal or gas - System inertia as RE1 rises - Quality of grid	Existing and saturating	Existing and saturating	Partially existing	Existing and mature	Partially existing	Existing and mature
		Increase in reliance on wholesale and balancing market mechanism due to saturation of ancillary service market	Market is diverse and less unified than Europe, with only some regions such as Pennsylvania, New Jersey, and Maryland offering better revenue opportunities	BESS participates in the MSD through pilot like for frequency regulation, with full access expected soon	The well- established ancillary services market presents significant revenue opportunities for BESS	BESS can access balancing markets. Non-frequency ancillary services are acquired via the TRM (Technical restriction market)	80%-90% of grid-scale energy storage's revenues in Australia come from FCAS services (Frequency Control Ancillary Services)
Energy arbitrage in wholesale market	- Supply volatility as RE increases - Market price volatility means higher spreads - Wholesale market access	Existing and mature	Existing and mature	Partially existing	Existing and mature	Partially existing	Partially existing
		- Liquid wholesale market with high price volatility - BESS arbitrage revenues surged due to increased RE output in last 2 years	- Less volatile market with lower wholesale prices, and varying state regulations - In 2021, 59% of battery capacity used for arbitrage	- Electricity spread grew by 35% CAGR in 5 years, boosting arbitrage revenue - Grid congestion in some areas can limit opportunities	- Liquid wholesale market with high price volatility - One-hour systems earn 40% through arbitrage; two-hour systems, over 70%	- Electricity spread grew by 25% CAGR in 5 years, boosting arbitrage revenue - Grid infrastructure limitations can restrict opportunities	- Deregulated electricity market with high price volatility - Energy arbitrage surged to 40% of BESS revenue in 2022 from 12% previously
Capacity market	- Power objectives set by the TSOs - Clarity of power market rules and policy - Certainty of positive returns	Existing and mature	Partially existing	Partially existing	Non existing	Under development	Under development
		UK's capacity market is increasingly favoring LDES, with around 60% of projects in the 2025-26 T-4 auction	BESS are eligible for capacity markets, rules vary by region	Capacity market is mature in Italy, however, new MACSE mechanism offering high revenue potential under development	There is no capacity mechanism in Germany	Spain is planning to implement the capacity market across the next two years, given EU approval timelines	Australia currently lacks a capacity mechanism but is exploring its implementation

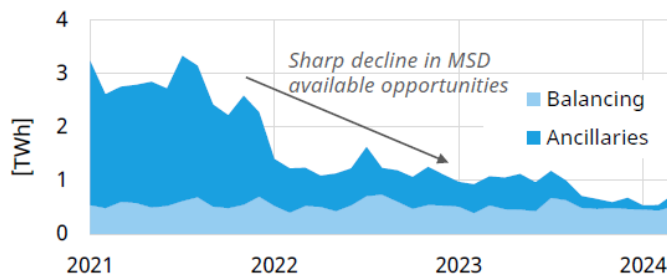
Italy BESS: MACSE



Impact on market operator

- Profile management on DA & WD markets via time shifting products
- MACSE cost passed on to consumers
- Terna physical optimisation of MACSE-backed storage drives stronger competition on MSD

MSD volumes



Impact on storage operator

- MACSE as a new business model – tolling on storage capacity for DA & WD margins with Terna as EMC
- Margin share on MSD – AssetCo keeping 20% of MSD margins
- MACSE set to further reduce MSD value but DA and WD value not expected to be distorted

TES

TYPE OF TES	TES TECHNOLOGY	T° RANGE COVERED	STORAGE DURATION
A  Sensible	1 Water tank TES	10°C-90°C	Hours to months
	2 Underground TES	5°C-100°C	Weeks to months
	3 Solid state	-160°C-1,300°C	Hours to months
	4 Molten salt	260°C-560°C	Hours to days
B  Latent	5 Eutectic phase-change material (PCM)	-115°C-0°C	Hours
	6 Salt hydrates PCM	0°C-120°C	Hours
	7 Organic materials PCM	0°C-160°C	Hours
	8 Solid-solid PCM	0°C-180°C	Hours

Additional Sources

— General

- LCOEs: <https://www.lazard.com/research-insights/levelized-cost-of-energyplus/>
- DNV ET Outlook: https://www.dnv.com/energy-transition-outlook/download/?utm_source=googlecpc&utm_medium=search&utm_campaign=eto_2024_download&qad_source=1&gclid=EAlaIqobChMltt2kmpXtiQMVL6hoCR0-0i0IEAAYASAAEgL_OvD_BwE

— RES

- Italy's FER-X Legislation: <https://www.wfw.com/articles/italys-new-fer-2-decree-incentives-for-renewable-energy-projects/>
- Germany's Solarpaket Overview: <https://greendealflow.com/solar-package-1-overview-of-the-main-new-solar-regulation-in-germany-2>
- Netherlands's SDE++ Overview: <https://english.rvo.nl/sites/default/files/2023-09/BrochureSDE2023English.pdf>
- Wind Outlook: <https://windeurope.org/intelligence-platform/product/wind-energy-in-europe-2023-statistics-and-the-outlook-for-2024-2030/>
- Biomass, Biomethane and Methanation: <https://presselib.com/article/terega-pau-bearn-landes-gaz-methanation-hydrogene-energie>
- Italy Biomethane Decree: https://www.twobirds.com/-/media/new-website-content/insights/pdfs/alert_biomethane-decree-2022_eng.pdf
- UK GGSS: <https://www.gov.uk/government/publications/green-gas-support-scheme-ggss>
- EU Biomethane Overview: <https://www.sia-partners.com/en/insights/publications/7th-european-biomethane-benchmark>
- Solar Power Outlook: <https://www.solarpowereurope.org/insights/outlooks/eu-market-outlook-for-solar-power-2024-2028/detail>

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- BESS Outlook: https://api.solarpowereurope.org/uploads/SPE_European_Battery_Outlook_2025_62b89db476.pdf
- Italy's MACSE: https://www.rse-web.it/wp-content/uploads/2024/05/08_MACSE-inglese.pdf

— SAF

- Investing in SAF Industry Interviews: <https://climatecatalyst.org/learning-hub/investing-in-sustainable-aviation-fuel/>