Methanation plant that injects biomethane into the grid at the Arcy Farm in Seine-et-Marne.

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+ 0,7 %

Biogas primary energy production growth in the EU 28 between 2018 and 2019.

BIOGAS BAROMETER

A study carried out by EurObserv'ER.

EurObserv'ER

Primary energy production from biogas in the EU28 countries has increased only slightly since 2017. According to EurObserv'ER, output reached 16.6 Mtoe in 2019, which is marginally higher than in 2018, but around the same level as in 2017. The rollout of regulations less supportive of using food-type energy crops for producing biogas has fuelled this general trend and has been compounded by the limitation on the capacity allocated to biogas tenders and less attractive biogas electricity payment terms. Nonetheless some member countries have posted positive output growth, thanks to their determination to both encourage biomethane injection and recover energy from fermentable waste.

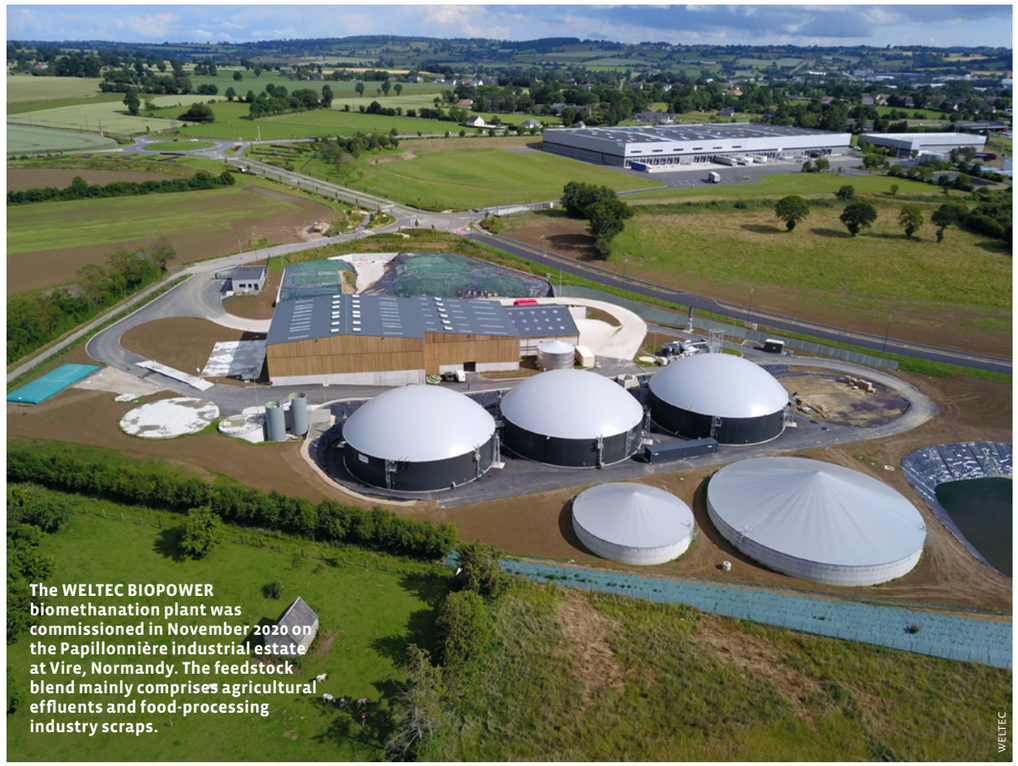
16.6 Mtoe

of biogas primary energy produced in 2019 in the EU 28

62.5 TWh

of biogas electricity produced in 2019 in the EU 28

BIOGAS BAROMETER – **EUROBSERV'ER** – DECEMBER 2020



The WELTEC BIOPOWER biomethanation plant was commissioned in November 2020 on the Papillonnière industrial estate at Vire, Normandy. The feedstock blend mainly comprises agricultural effluents and food-processing industry scraps.

Most of current biogas production across the European Union comes from methanation plants purpose-designed for energy recovery grouped under the term "Other biogas from anaerobic fermentation" (see box). These plants vary in type and capacity and include small farm methanation plants, higher-capacity plants such as co-digestion (or multi-product) sites, large industrial food-processing plants (mainly single feedstock), and some household waste methanation plants. They use different types of feedstocks (raw materials) such as manure, farm crop waste, green waste, food-processing industry waste and household waste, and may also use intermediate crops (crucifers, grasses, etc.) and energy crops (maize, etc.). Energy crops are added to optimise the methanation reaction by contributing carbon, which facilitates the methanogenic production of the digestate. Their use in the Member States for producing renewable energy is highly regulated. The maximum input varies in line with domestic legislation for those facilities that seek payment for their biogas output.

16.6 MILLION TOE OF BIOGAS PRODUCED IN THE EUROPEAN UNION OF 28

In 2019, primary energy production from biogas (from anaerobic fermentation and thermal processes) across the European Union of 28 remained stable, upholding the trend reported since 2017. According to EurObserv'ER, output increased slightly in 2019 to 16.6 Mtoe (up 0.7% on its 2018 level). This figure integrates the official statistical revisions of the production series of Germany, the UK and Denmark that reflect improved sector monitoring.

The UK's departure from the European Union – it officially left on 31 January 2020 – will have a significant impact on the European Union's statistics, as the UK is the second largest European biogas producer after Germany. The 2019 output of the EU27 came to 13.9 Mtoe (13.8 Mtoe in 2018), which equates also to 0.7% year-on-year growth.

Most of this lacklustre growth since 2017 can be ascribed to the implementation of more stringent regulations on the use of food crops for producing biogas (such as maize), the reduction in the capacity allocated to biomass electricity tenders (and thus biogas) and less attractive payment terms for biogas electricity than in the past. The two biggest biogas producer countries, namely Germany and the UK, saw their output stagnate leading to annual growth of -0.1% and +0.7% respectively in 2019.

Some other member countries posted significant growth – the outcome of their policies to develop the sector. A strong case in point is France whose output enjoyed double-digit growth in 2019 (11% compared to its 2018 performance) and is not far off one million toe (976.6 ktoe in 2019). Biogas production in Denmark, another key player, also grew strongly for the second year running. It reached 396.6 ktoe in 2019 – 24.3% or 77.6 ktoe more than in 2018 and as much as 132.6 ktoe more than in 2017. At 125 ktoe, Greek primary biogas energy output also clearly increased, albeit to a lesser extent (10.8% up on the previous year's output).

When this barometer was produced, it was too soon to calculate the full distribution of primary energy production between the various biogas stocks for the whole of the European Union, but the data gathered from the main producer countries confirms the recent years' trend. If we consider the EU28, methanation biogas from non-hazardous waste and raw plant matter (the "other biogas" category) still accounts for just over three-quarters of total biogas production and is rising (from 75.3% in 2018 to 75.8% in 2019). Although the landfill biogas share is declining (from 14.5% in 2018 to 13.6%) it still provides the second biggest input. The sewage sludge biogas share inched up from 9.3% in 2018 to 9.6% in 2019, while biogas from thermal processes stabilized at 1% between 2018 and 2019. In the new EU27, i.e. without the UK, the distribution between the biogas stocks differs slightly, because of the size of the UK's landfill biogas stock. The "other biogas" share rises to 81.9% in 2019 (81.6% in 2018), the landfill biogas figure is 8.5% (8.9% in 2018), followed by 8.4% for sewage sludge biogas (8.3% in 2018) and 1.2% for biogases from thermal processes (1.1% in 2018).

Biogas in its various guises

Methanation is a natural biological process in which many micro-organisms (bacteria) break down organic matter in an oxygen-free environment. This may occur naturally in certain environments such as marshes. It may also be deliberately engineered for energy production and/or waste treatment purposes in anaerobic (in the absence of oxygen) fermentation plants using industrial equipment called "digesters" or alternatively may occur naturally in non-hazardous waste storage centres (engineered landfills).

The international nomenclature used by Eurostat and the International Energy Agency, divides biogas (from anaerobic fermentation) into three sub-sectors, segmented by waste origin and treatment (the official names are given in inverted commas):

- methanation of wastewater treatment plant sludge ("sewage sludge gas")

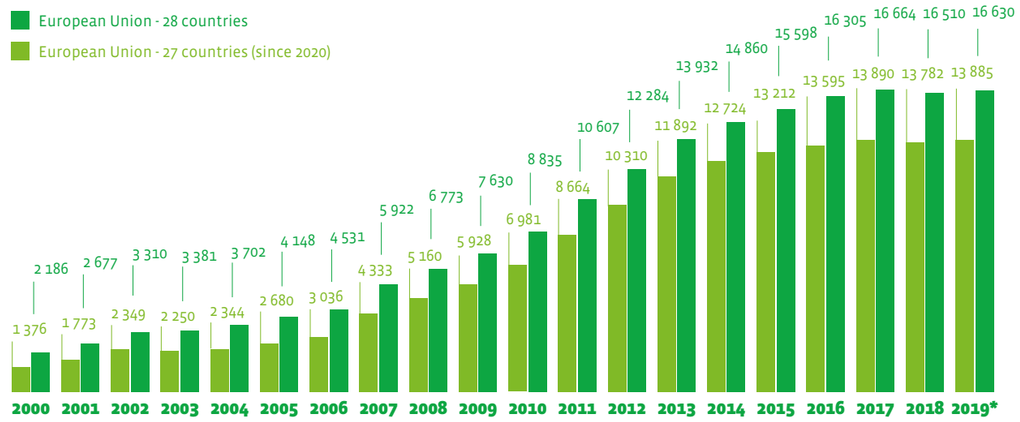
- non-hazardous waste storage facility biogas ("landfill gas")

- methanation of non-hazardous waste or raw plant matter ("other biogas")

These international institutions also monitor a fourth segment, whose biogas is the product of a heat treatment process ("biogases from thermal processes") by pyrolysis or gasification of solid biomass (wood, forest residue, solid and fermentable household waste). These processes produce hydrogen (H_2) and carbon monoxide (CO), which when combined can be transformed into syngas to substitute natural gas (CH_4).

Graph. n° 1

Evolution of primary biogas energy production in EU28 and EU 27 since 2000 (in ktoe)



Source: EurObserv'ER 2020

BIOGAS BAROMETER – **EUROBSERV'ER** – DECEMBER 2020

The "other biogas" category's growth in output has slackened considerably from its previous pace. In the EU28, it increased by 1.5% between 2018 and 2019 (from 12 424.6 to 12 612.1 ktoe). Landfill biogas output continued to falter, falling by 5.8% (from 2 397.8 to 2 259.5 ktoe) and sewage sludge biogas output increased by 4.2% (from 1 529.2 to 1 593.5 ktoe). Similar trends are observed with the UK out of the equation – the "other biogas" category increased by 1.1% to 11 375.1 ktoe, landfill biogas fell by 4.3% to 1 177.4 ktoe and sewage sludge biogas increased by 2.2% to 1 167.4 ktoe. The drop in landfill biogas production comes as no surprise and is expected on sites already operated, as the stock of biogas tapped directly in landfills tends to fall and peter out over time. Likewise, the development of composting and fermentable waste-to-energy sectors in active methanation units (that use digesters), reduces the methanogenic inputs in engineered landfill facilities. The only way to increase landfill biogas production will be to equip existing facilities with new engineering, as the creation of new landfills is no longer permitted.

Tabl. n° 1

Primary production from biogas in the European Union in 2018 and 2019 (in ktoe)*

	2018					2019*				
	Landfill gas	Sewage sludge gas	Other biogases from anaerobic fermentation	Biogases from thermal processes	Total	Landfill gas	Sewage sludge gas	Other biogases from anaerobic fermentation	Biogases from thermal processes	Total
Germany	115.8	492.0	6 950.4	0.0	7 558.3	102.7	487.2	6 957.6	0.0	7 547.5
United Kingdom	1 168.1	387.1	1 171.9	0.0	2 727.1	1 082.0	426.1	1 237.0	0.0	2 745.1
Italy	333.5	51.7	1 500.0	6.8	1 892.2	322.2	50.0	1 449.1	6.6	1 828.0
France	298.9	36.7	543.9	0.0	879.5	284.2	44.6	647.8	0.0	976.6
Czechia	21.3	44.0	538.5	0.0	603.8	20.4	43.6	517.1	0.0	581.2
Denmark	4.0	23.9	291.0	0.0	319.0	5.0	29.8	361.8	0.0	396.6
Netherlands	12.7	58.2	255.3	0.0	326.2	10.4	62.7	282.8	0.0	356.0
Poland	38.9	116.1	133.4	0.0	288.3	40.2	120.2	138.1	0.0	298.5
Spain**	149.3	66.3	24.2	25.2	264.9	145.0	64.4	23.5	27.4	260.3
Belgium	18.9	25.5	176.4	7.4	228.2	17.5	26.4	183.3	4.7	231.9
Austria	1.9	25.0	200.1	0.0	227.0	1.2	33.7	179.4	0.0	214.4
Finland	17.9	17.5	32.6	118.4	186.4	15.5	17.8	30.4	126.0	189.7
Sweden	4.0	78.0	93.8	0.0	175.8	5.9	77.8	97.8	0.0	181.5
Slovakia	6.8	13.3	128.7	0.0	148.8	6.5	12.8	124.0	0.0	143.3
Greece	64.8	17.0	31.1	0.0	112.8	67.0	20.0	38.0	0.0	125.0
Hungary	12.7	28.5	50.8	0.0	92.0	11.4	25.8	45.9	0.0	83.1
Latvia	7.6	2.0	77.4	0.0	87.0	7.5	2.1	70.9	0.0	80.6
Croatia	5.0	3.2	65.4	0.0	73.6	5.5	3.5	71.2	0.0	80.2
Portugal	67.8	5.9	8.8	0.0	82.5	65.1	6.4	8.6	0.0	80.1
Bulgaria	0.0	8.8	44.9	0.0	53.6	0.0	8.3	42.7	0.0	51.0
Ireland	33.5	9.0	7.8	0.0	50.4	31.1	11.2	7.6	0.0	50.0
Lithuania	10.0	6.9	20.2	0.0	37.1	8.7	6.8	23.4	0.0	39.0
Slovenia	2.0	2.0	20.4	0.0	24.3	1.5	1.2	19.5	0.0	22.2
Romania	0.0	0.0	20.7	0.0	20.7	0.0	0.0	20.7	0.0	20.7
Luxembourg	0.0	1.6	20.2	0.0	21.9	0.0	1.8	16.2	0.0	18.0
Cyprus	1.1	0.7	11.4	0.0	13.2	1.2	0.7	12.0	0.0	14.0
Estonia	1.4	7.5	4.8	0.0	13.6	1.4	7.6	4.8	0.0	13.9
Malta	0.0	0.9	0.8	0.0	1.6	0.0	1.0	0.6	0.0	1.6
Total EU 28	2 397.8	1 529.2	12 424.6	157.8	16 509.5	2 259.5	1 593.5	12 612.1	164.7	16 629.8
Total EU 27 (from 2020)	1 229.8	1 142.1	11 252.7	157.8	13 782.4	1 177.4	1 167.4	11 375.1	164.7	13 884.7

**Estimate. ** For Spain, the official data on biogas deposits are being revised with retroactive statistical revisions to be expected in 2020 and 2021.*
Note : when the information was not yet available, the distribution between the different types of biogas was estimated by EurObserv'ER for the year 2019 according to the distribution of the year 2018. ***Source: EurObserv'ER 2020***

AN ALL-ROUND ENERGY SOURCE

Biogas energy has a number of qualities that mean it can cater for various needs. The main method of taking up biogas energy is producing electricity however it is generated... in CHP or other plants. EurObserv'ER reports that all in all, biogas electricity plant output was in very slight decrease. The variations in Member States' outputs cancelled each other out and are quantified as 62.5 TWh for the EU28 in 2019 (62.7 TWh in 2018) and 54.9 TWh for the EU27 (55 TWh in 2018). The drop in German output, for instance, was broadly offset by the build-up in biogas electricity production in France.

When there are outlets for heat in the vicinity of methanation plants, biogas can be fully used with maximum energy efficiency to produce heat. EurObserv'ER puts the EU28 output of biogas heat from the processing sector at 893.4 ktoe in 2019, equating to 4.0% growth. Final energy consumption (used directly on site and not produced by the processing sector) should be added to this figure. For the EU28, it is put at about 2 561.9 ktoe in 2019 (2.9% more than in 2018). For the EU27, it is put at about 2 414.4 ktoe in 2019 (2.8% more than in 2019).

Another avenue that is gaining ground is biogas purification. This entails extracting the CO_2 and other compounds to leave methane only. Biomethane produced in this way has 99% methane content offering similar qualities to those of natural gas. Biomethane can be stored and distributed as biofuel for vehicles that run on VNG or be directly injected into natural gas grids provided the grids are close enough to the production unit. Injection offers several advantages, such as higher energy yield than that of cogeneration because it can be used directly for heat applications (heating, cooking, hot water production, etc.). It also enables the biomethane output to be stored in the natural gas grids, which means that its use can be postponed until times when its energy recovery is most relevant, for example using it in thermal power plants to respond better to grid balancing needs.

This solution is increasingly popular in countries that see an interesting alternative to the existing biogas units, to

decarbonize their natural gas grids and/or the VNG fuel used in transport. Italy published a highly ambitious "biomethane" decree on 2 March 2018 along these lines that aims to promote its use, to increase the country's green fuel share in its transport sector. Going into detail, the decree allocated 4.7 billion euros to facilities (new and existing), that usher in biogas-to-biomethane conversion systems to be in service by 2022. The funds cover annual production to a maximum of 1.1 billion Nm3 and will be encouraged by a green certificate mechanism. Investors, such as TerraX srl and Swen Capital Partners, have already announced more than ten injection and bioLNG biofuel production projects for heavy vehicles (see further on).

Biomethane injection also provides gas distributors with the opportunity to offer greener gas and propose full or partial "renewable" gas supplies to consumers using traceability mechanisms based on Guarantees of Origin (GO). When biomethane is injected into the grid, it blends with the natural gas, making it impossible to tell them apart. These Guarantees of Origin can trace the biomethane, as an identified Guarantee of Origin (production location and types of input used) is issued for every injected megawatt-hour. The European biomethane market is gradually taking shape. Several major producer countries have established certification mechanisms, and the AIB (Association of Issuing Bodies) is working on their harmonization, in the same way as it did for electricity-related GOs. According to the German Energy Agency, DENA, the main driving force behind European biomethane is currently Switzerland. Swiss imports of biomethane certificates total more than 500 GWh in 2019, mainly served by certificates originating from the UK, Denmark, and Germany. DENA says that the certificates originating from Great Britain, the Netherlands and Denmark could be much cheaper, because biomethane has already received funding to supply natural gas to those countries' grids. The French plan to ban natural gas for heating new buildings by 2024 could also provide biomethane GO with a major opening.

The use of biomethane as a biofuel was specifically covered in the Observ'ER Biofuel Barometer published in September 2020. Use in the EU28 is surging, having increased from 186.8 ktoe in 2018 to 269.6 ktoe in 2019. The main reason for this significant growth (of 44.3%) is the increase in the biogas fuel consumption level identified in Italy, which has risen from 0.4 to 40.9 ktoe according to the GSE. We should point out that the electricity and heat output from biomethane injected into the grid and thus blended with fossil-sourced natural gas is not included in the biogas electricity and heat production statistics, save for some exceptions. This electricity and heat production is estimated from the amount of biomethane injected into the grid out of the total use of gas intended for their production, in order to include this production in the member countries' renewable energy targets. This estimate appears in the Eurostat Shares tool used to harmonize calculation of the share of energy produced from renewable sources. According to EurObserv'ER, the electricity and heat output share produced from injected biomethane is growing, as biomethane injection spreads. Electricity output was estimated at 1 356 GWh in the EU28 (monitored in 10 countries), implying 19.5% growth. In the EU27, it was put at 539 GWh, indicating 27.4% growth. Biogas heat produced from biomethane also makes quite a substantial contribution. It is put at 403.2 ktoe in the EU28 for 2019 (20.7% more than in 2018) and 127.8 ktoe in the EU27 (40.2% more than in 2018). These figures do not include the German electricity and heat output from biogas injected into the grid. Germany's development of biomethane injection is the greatest of all European Union countries, as it has integrated this production directly into its biogas production indicators (included in the indicators of tables 2 and 3). According to AGEE-Stat, electricity production from injected biomethane was 2 620 GWh in 2019 (2 600 GWh in 2018) and heat production 174.4 ktoe (169.6 ktoe in 2018).

FRANCE SETS NEW SIGHTS FOR BIOMETHANE

The French biogas sector showed the strongest momentum of all the European Union countries in 2019. According to the Monitoring and Statistics Directorate (SDES) of the Ministry of Ecological Transition, primary biogas output, all sources taken together, increased by 11% between 2018 and 2019 to reach 976.6 ktoe.

Biogas electricity production rose to 2 587 GWh in 2019 (including 2 249 GWh from cogeneration plants), equating to 9.2% growth over 2018. Biogas indirectly contributed to the production of about one hundred additional GWh (99.8 GWh in 2019 compared to 45.8 GWh in 2018), through biomethane injection into the natural gas grid and used in gas turbine combined-cycle power plants. The biogas thus directly and indirectly produced 2 687.3 GWh of electricity in 2019.

According to the SDES biogas scoreboard data, France had 776 biogas electricity-producing plants connected to the grid in 2019, amounting to total installed capacity of 493 MW. In 2019, a further 39 MW were connected, distributed across 151 new plants. The SDES points out that plants with >1 MW of capacity account for 64% of the newly-installed capacity, with methanation plants comprising three-quarters of the installed base for 41% of the total capacity. At the end of December, projects in the pipeline represented a further 61 MW of capacity.

France is also one of the most active countries involved in injecting biomethane into the grid. The reason for this is that an "on tap" system has been in place since 2011, that gives any grid-connected biomethane project access to a guaranteed feed-in tariff that varies in line with the feedstocks used and the project size. In the case of methanation

According to the European Biomethane Map published by the European Biogas Association (EBA) and Gas Infrastructure Europe (GIE), the number of biomethane plants is burgeoning in Europe. It increased by 51% in the two years between 2018 and 2020, rising from 483 plants in 2018 to 729 in 2020. The publication reports that 18 European countries are producing biomethane. The EBA puts the combined output of these plants at about 23 TWh, i.e. almost 2 Mtoe and reckons that sector output could increase to 370 TWh (equating to 31.8 Mtoe) by 2030 and to 1 170 TWh (100.6 Mtoe) from 2050 onwards.

The number of biogas plants producing electricity is much higher. According to the EBA, Europe had 18 202 installations in 2018 amounting to 11 082 MW of electrical capacity. The newly-commissioned biogas plant figure for 2019 has yet to be released but is likely to be down to fewer than 300. According to the Ministry of Ecological Transition scoreboard, France, which is spearheading the drive to construct new biogas plants, installed 151 new plants in 2019 (39 MW for electricity generation), while Germany only installed 83 new plants in 2019 (out of a base of 9 527).

Tabl. n° 2

Gross electricity production from biogas in the European Union in 2018 and 2019 (in GWh)*

	2018			2019*		
	Electricity only plant	CHP plant	Total	Electricity only plant	CHP plant	Total
Germany	7 100.0	26 000.0	33 100.0	6 900.0	26 000.0	32 900.0
Italy	2 895.7	5 403.9	8 299.6	2 862.9	5 413.9	8 276.8
United Kingdom	5 458.5	2 234.9	7 693.4	5 169.6	2 399.6	7 569.2
France	370.1	1 999.7	2 369.8	338.8	2 248.6	2 587.5
Czechia	41.8	2 565.4	2 607.2	37.8	2 486.5	2 524.3
Poland	0.0	1 127.6	1 127.6	0.0	1 123.0	1 123.0
Belgium	70.5	874.2	944.7	77.3	869.5	946.8
Spain	740.0	183.0	923.0	699.0	205.0	904.0
Netherlands	23.3	863.6	886.9	21.3	873.6	894.9
Denmark	0.8	612.1	613.0	0.9	635.3	636.2
Austria	562.1	66.2	628.3	569.8	42.1	611.9
Slovakia	81.0	458.0	539.0	80.0	460.0	540.0
Croatia	27.8	327.1	354.9	30.6	359.7	390.3
Greece	55.8	260.5	316.3	46.8	330.7	377.5
Finland	234.9	184.7	419.7	161.7	201.5	363.2
Latvia	0.0	374.1	374.1	0.0	353.0	353.0
Hungary	111.0	220.0	331.0	102.3	202.7	305.0
Portugal	253.3	18.1	271.4	246.1	18.3	264.5
Bulgaria	85.0	127.2	212.3	78.9	118.0	196.9
Ireland	139.2	44.9	184.1	130.1	55.2	185.3
Lithuania	0.0	139.9	139.9	0.0	155.0	155.0
Slovenia	1.2	117.7	118.8	1.2	93.1	94.4
Luxembourg	0.0	75.5	75.5	0.0	70.9	70.9
Romania	40.0	30.2	70.2	40.0	30.2	70.2
Cyprus	0.0	56.9	56.9	0.0	60.2	60.2
Estonia	0.0	38.0	38.0	0.0	39.0	39.0
Sweden	0.0	10.0	10.0	0.0	17.0	17.0
Malta	0.0	9.0	9.0	0.0	6.4	6.4
Total EU 28	18 292.1	44 422.3	62 714.4	17 595.0	44 868.1	62 463.1
Total EU 27 (from 2020)	12 833.6	42 187.4	55 021.0	12 425.4	42 468.5	54 893.9

Estimate. Note: The gross electricity production from biomethane injected into the network and therefore mixed with natural gas of fossil origin is not included in the statistical indicators of biogas gross electricity production (excepted for Germany).* ***Source: EurObserv'ER 2020*

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plants, the feed-in tariff consists of a baseline tariff and a feedstock premium. The former ranges from € 64 to € 95 per MWh depending on the production type and project size (biogas production flow) and the latter ranges from € 5 to € 39 per MWh depending on the type of feedstock and project size. The feedstock premium is € 5 per MWh for institutional and household waste, € 20-30 per MWh for farming and food-processing waste, and € 10-39 per MWh for sewage plant residue.
According to a Biomethane Observatory report published by SiaPartners in May 2020, the number of plants rose sharply in 2019, with 49 new injection sites, which is a 62% rise on its 2018 level, making the French sector the fastest growing in Europe. The Biomethane Observatory puts the total number of plants injecting biomethane at 139 with 2.5 TWh of injection capacity. The sector's growth prospects are also very promising as 1 134 projects that have reserved injection capacities for a combined capacity of 25 TWh. However, the new multi-annual energy plan (PPE), published on 23 April 2020 scaled down the biomethane sector's development ambitions to 14-22 TWh injected in 2028. The stated target is still ambitious. Its intention is that biogas (both injected and directly used) should account for 6-8% of gas consumption in 2028. The PPE plans for the current injection feed-in tariffs to give way to a tendering system with target purchase prices of € 75 per MWh in 2023 then € 60 per MWh in 2028. The PPE intends to publish a tendering schedule for injected biomethane at the rate of two tenders per year each targeting 350 GWh of annual output, so that the sector can plan ahead. As for renewable heat, the 2020 biogas target (including injected biogas) ranges from 12 TWh (low assumption) to 18 TWh (high assumption).

Tableau n° 3

Gross heat production from biogas in the European Union in 2018 and in 2019 (in ktoe) in the transformation sector

	2018			2019		
	Heat only plant	CHP plant	Total	Heat only plant	CHP plant	Total
Germany	8.6	358.3	366.9	10.5	382.2	392.7
Italy	0.1	213.7	213.8	0.2	211.1	211.3
France	9.4	60.2	69.6	8.3	68.8	77.1
Denmark	1.9	45.2	47.1	1.9	46.8	48.7
Poland	0.4	21.7	22.0	0.5	22.0	22.5
Finland	4.9	13.8	18.7	5.4	15.5	20.9
Latvia	0.1	21.2	21.4	0.0	19.3	19.3
Czechia	0.0	17.5	17.5	0.0	17.0	17.0
Slovakia	0.1	14.1	14.2	0.1	14.1	14.2
Croatia	0.0	11.5	11.5	0.0	11.9	11.9
Sweden	4.5	3.1	7.6	6.0	5.2	11.2
Belgium	0.0	9.1	9.1	0.0	10.7	10.7
Netherlands	0.0	8.5	8.5	0.0	8.9	8.9
Austria	1.1	6.0	7.1	0.7	3.8	4.5
Slovenia	0.0	5.3	5.3	0.0	4.4	4.4
Bulgaria	0.0	4.1	4.1	0.0	4.1	4.1
Romania	2.2	1.9	4.0	2.2	1.9	4.0
Luxembourg	0.0	2.4	2.4	0.0	2.5	2.5
Lithuania	0.0	2.8	2.8	0.0	2.5	2.5
Hungary	0.0	2.6	2.6	0.0	2.4	2.4
Estonia	0.0	1.8	1.8	0.0	1.4	1.4
Cyprus	0.0	1.3	1.3	0.0	1.3	1.3
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.0
Total EU 28	33.3	825.8	859.0	35.8	857.6	893.4
Total EU 27 (from 2020)	33.3	825.8	859.0	35.8	857.6	893.4

Estimate. Note: The gross heat production from biomethane injected into the network and therefore mixed with natural gas of fossil origin is not included in the statistical indicators of biogas heat production (excepted for Germany).* ***Source: EurObserv'ER 2020*

Anaerobic digestion of sewage plant sludge – Herning-Studsgård site in Denmark

GERMANY — EUROPE'S BIOGAS HEAVYWEIGHT

Germany has invested more in its biogas sector than any other European Union country. Its output amounts to more than half of the biogas output of the EU27 (54.4% in 2019). Updated data released by the Working Group on Renewable Energy Statistics of the German Environment Ministry, AGEE-stat, biogas primary energy production was quantified at just over 7.5 Mtoe in 2019, which is almost identical to its 2018 level. The explanation for this high production level is the rollout of a renewable energy law (EEG) throughout the 2000 decade that particularly promoted the production of renewable electricity using energy crops. On-farm biogas, whose development was given a boost until 2011, is the reason for the high share of the "other biogas" segment that generates 92.2% of output. On-farm methanation plants dominate the German sector, accounting for about 95% of the methanation plants that produce electricity on site. The figures released by the German biogas association (Fachverband Biogas), show that the area devoted to producing biogas was about 1.4 million hectares in 2019, including 1 241 615 hectares of farming land set aside for producing maize, cereals, and other crops and 169 311 hectares of meadows.
However, since 2011, the number of new biogas plants being built has plummeted in Germany (from 1 526 additional plants in 2011 to 456 in 2012), as a result of increasingly less attractive legislation. The slowdown was further exacerbated by the implementation of the EEG 2014 law, which initiated direct electricity sales on the market for electricity produced by >500-kW methanation plants the same year, then for >100-kW plants starting on 1 January 2016. This amendment to the EEG 2014 law, slashed the feed-in tariff for biomass electricity, which drove down the number of new biogas plants. Since then, bioenergy's contribution to the electricity and heat sectors, has been mainly driven by existing plants. The German biogas association reports that only 83 new plants dedicated to electricity production were commissioned in 2019 (122 plants in 2017, 113 plants in 2018) taking the total number to about 10 000 (9 527 plants in service in 2019).
The association puts the electrical capacity of these biogas plants at 5 000 MW in 2019 (5 030 MW expected in 2020) but only 3 810 MW of the capacity was used (3 794 MW expected in 2020). The difference between total and used capacity derives from the flexibility premium introduced as part of the 2012 renewable energy law (EEG 2012) to provide the electricity grid with a balancing service. This flexibility premium (initially set at € 130 per kW for 10 years, then reduced to € 40 per kW over 20 years under the EEG 2014 law) was introduced to increase the useable electrical capacity during peak consumption periods. Plant operators are obliged to reduce their electrical capacity injected into the grid the remainder of the time to be eligible for the premium.
In 2019, AGEE-Stat assessed biogas electricity output at 32.9 TWh, which is slightly lower than the 2018 figure (33.1 TWh). AGEE-Stat points out that this data has been updated, to integrate new information on the distribution of electricity production between solid and

gaseous biomass. It also points out that the biogas electricity output injected into the natural gas grid is included in its biogas electricity output statistics, put at 2 620 GWh in 2019 (2 600 GWh in 2018).
Germany is also Europe's biggest biomethane producer. As stated by the DENA Biomethane Barometer published in April 2020, about 10 TWh of biogas was grid-injected (10 093 GWh in 2018 and 9 826 GWh in 2019). The barometer reports that three new biomethane injection plants went on stream in 2019 taking the total number to 219 with 133 734 Nm3 (normalized m3) per hour of injection capacity between them. Injected biomethane accounts for just over 1% of the country's gas consumption.

EUROPE'S INDUSTRY LOOKS EAST

Many digester manufacturers have developed the downstream side of the value chain and started operating their own plants to diversify economically and consolidate their offers. So, several European firms are focussing on the methanation plant construction business. A case in point is the German firm EnviTec Biogas, which earned 52% of its H1 earnings for 2020 from operating biogas sites (55.9 million euros out of a total of 107.6 million euros), while its initial core business, construction, only accounted for 17% of its earnings. The rest of its business comes from a division that the firm has developed in the last few years, by taking a plunge into the downstream side with services. The division posted total business worth 18.4 million euros in H1 2020. The company works in Europe but also in Asia where it is currently involved in two projects in China with another five already to its credit. The first of the new projects will be constructed near the city of Lankao, in Henan Province. EnviTec Biogas will deliver eight digesters to the prime contractor, the PowerChina Group, a Chinese state enterprise. The site is designed to produce about 50 000 Nm³ of biogas daily. EnviTec is responsible for all the engineering and providing the main components, while supporting its partner in the construction and commissioning works. The second new project will be constructed near Qin Xian City in Shaanxi Province. Once completed, the biogas plant's four digesters will generate about 37 000 Nm³ of biogas daily from farm residue such as maize stalks.
Asia is a prospect eyed by a growing number of European firms, such as Germany's WELTEC BIOPOWER. It originally specialized in stainless steel plants and claims to have constructed over 300 biogas plants all over the world to date. Its customers range from waste management companies, the agri-food business, farming through to water treatment. WELTEC BIOPOWER was commissioned for a project in South Korea, in Gyeonggi-do Province, 60 kilometres north of Seoul this summer. The seven-megawatt plant is due to be commissioned as early as spring 2021. The plant will digest up to 93 000 tonnes of food waste annually converting it into heat. Closer to home, WELTEC BIOPOWER has built a biomethane plant that was commissioned in November 2020 in the town of Vire, Normandy (France). AGRIGAS VIRE is the owner of this 11 million euro project, which brings together about 40 farms and local businesses. The unit will process about 70 000 tonnes of substrates for conversion into biogas and biomethane. The site will inject about 270 m3 of green gas per hour into the grid, which will be used as the equivalent of natural gas to cover about 20% of the town's gas needs (18 500 inhabitants). Air Liquide, another industrial group to diversify into biogas in recent years, has announced the forthcoming construction of its first two biomethane plants in Italy in conjunction with its local partner Dentro il Sole. The two plants will be built at Truccazzano (Milan) and Fontanella (Bergamo), and will recycle organic matter into biomethane from agricultural and cattle farming activities. The total annual production capacity of these two new plants will be 3 200 tonnes of liquified biomethane, or the equivalent of about 50 GWh per annum. Commitment to biogas by the Air Liquide Group has made it a player with recognized know-how, as it has 20 biomethane plants across the globe.

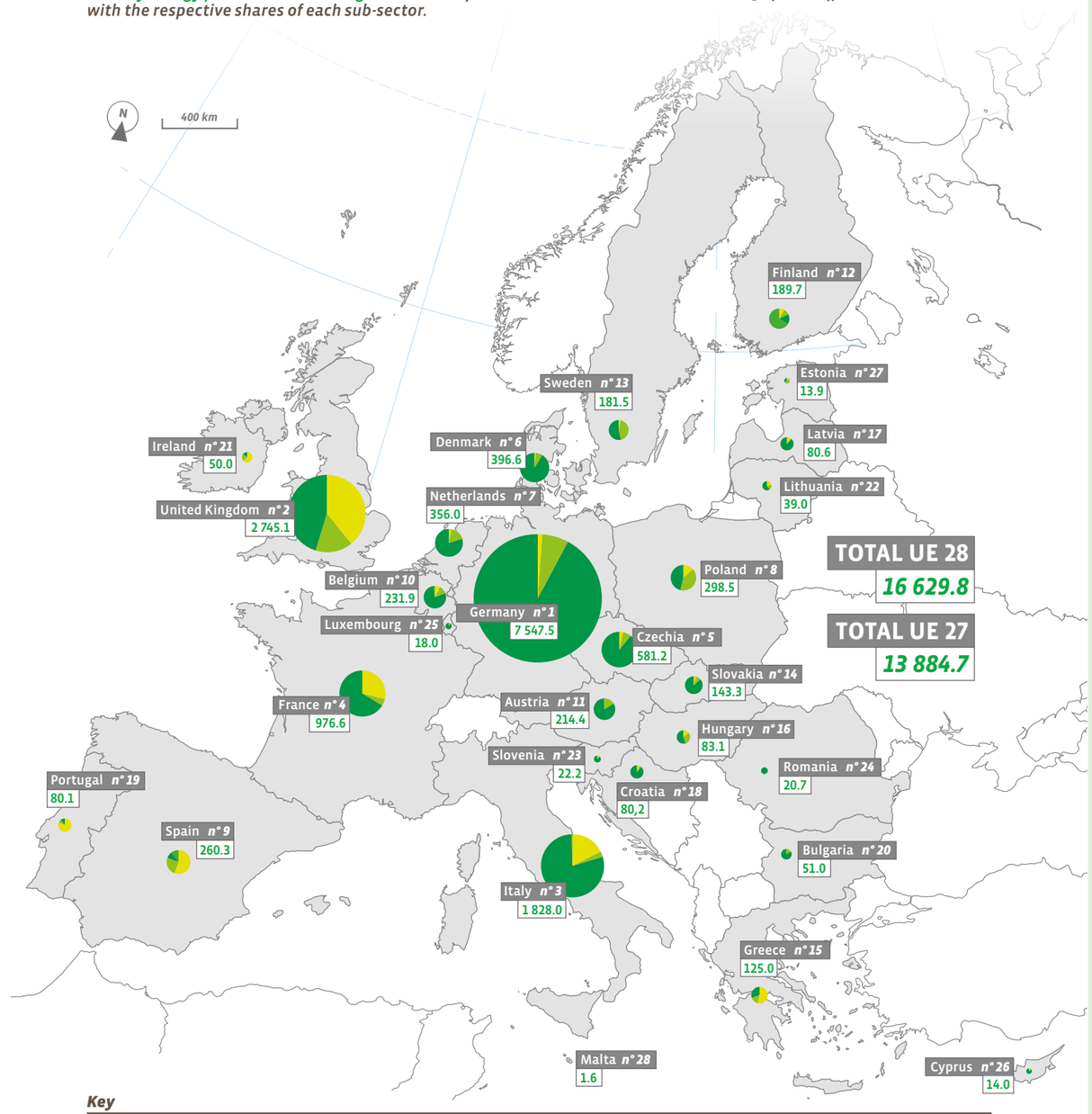
Tabl. n° 4

Representative firms of the methanisation sector in Europe as of 2020

Company	Activty sector	Country	Number of references	Employees
AB Energie Holding	Manufacturer	Italy	980	1 115
EnviTec Biogas	Manufacturer, developper and operator	Germany	660	433
PlanET Biogas Global	Manufacturer and developper	Germany	482	200
Schmack Biogas (Viessmann Group)	Developper and operator	Germany	450	51
Weltec Biopower	Manufacturer	Germany	300	113
Nature Energy	Developper and operator	Denmark	60	n.a
Air Liquide	Developper and operator	France	25	75
Scandinavian Biogas Fuels International	Manufacturer, developper and operator	Sweden	25	55
Gasum	Developper and operator	Finland	16	373

Sources : Eurobserv'ER 2020 *based on companies' communication*

Primary energy production from biogas in the European Union countries at the end of 2019 (in ktoe), with the respective shares of each sub-sector.*



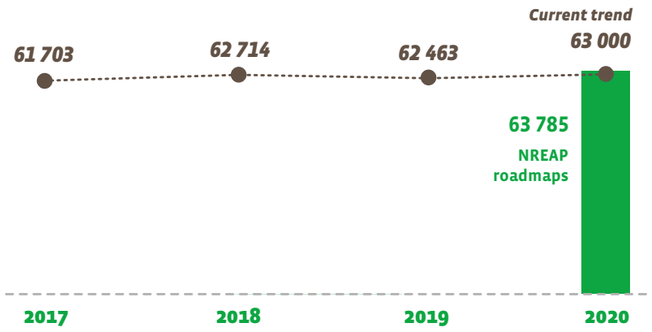
Estimates. Note : When the information was not yet available, the distribution between the different types of biogas was estimated by EurObserv'ER for the year 2019 according to the distribution of the year 2018.* ***Source: EurObserv'ER 2020*

Biogas fuel is one possible solution being mooted alongside other extremely promising new mobility technologies such as electric vehicles equipped with electrochemical batteries (lithium-ion or other) or fuel cells. Biogas has genuine assets. It is CO_2-emission neutral, effective at not polluting the air, it has high potential for very short term deployment, and last but not least, uses tried and tested motorizations. It can be used as fuel (once purified into biomethane) in natural gas vehicles (running on vehicular natural gas) in two forms: CNG, compressed natural gas (at 20 MPa, or 200 bar) or LNG natural gas (at -163°C). Incidentally, natural gas vehicles (NGVs) should not be mistaken for liquefied petroleum gas (LPG) vehicles that run on a liquid petroleum product made from butane and propane. For technical reasons, LPG vehicles cannot run on LNG and vice-versa.

One of the hardest-driving companies in this area is the Finnish group Gasum whose activities range from biodegradable waste processing, to biogas production, biogas fuel distribution and producing fertilizers. Gasum has 15 biogas plants in Finland and Sweden, which makes the company one of the Nordic countries' biggest biogas producers. As for biogas fuel, Gasum intends to develop a network of 50 filling stations across the Nordic countries for heavy vehicles by 2024, with a biogas distribution target of 4 TWh. The first such station in Sweden has opened at Mariestad. It is Gasum's seventh liquified gas filling station for heavy vehicles. We have already touched on the French Air Liquide Group, another active player in the biogas for vehicles, which has more than 80 bio-NGV stations in Europe. The company has consolidated its biogas fuel position in recent years by acquiring two Nordic companies. The first, FordonsGas, distributes bio-NGV for Sweden's transport market, operating about fifty bio-NGV distribution stations, which makes it one of the largest bio-NGV distribution networks on Swedish soil. The second is the Norway's Skagerak Naturgass, part of the Statkraft Group, one of Europe's biggest renewable energy producers. Skagerak Naturgass has a distribution network that delivers natural gas for industry, and biomethane for the Norwegian transport market through four bio-NGV filling stations in the Oslo region.

Graph. n° 2

Comparison of the current trend ofelectricity biogas generation of the EU 28 against the NREAP (National Renewable Energy Action Plans) roadmap (in GWh)



Source: EurObserv'ER 2020

NEW MOMENTUM IS OF THE ESSENCE

The biogas sector makes a full contribution to energy transition aims… firstly by reducing greenhouse gases, replacing fossil energies, and by reducing farming- and waste-related methane emissions into the air. It also contributes to the development of a circular economy by re-using digestates to enrich agricultural soils.

The new European regulations and the decision by the main European biogas producer countries to reduce incentives and regulate the use of food crops have affected the biogas sector's growth. To bounce back, the sector is reinventing a new growth model more closely linked to reclaiming resources from fermentable waste than to using culture crops. The new Renewable Energy Directive (2018 /2001), primarily Article 29, sets out a new legal framework on bioenergy development, by introducing sustainability and GHG reduction criteria for all fuels – liquid, solid or gaseous sourced from biomass – be they for use as biofuel, or to produce electricity and heat. Biomass energies and biogas must meet the sustainability requirements if they are to be included in the statistics as renewable under the directive's terms.

The European Commission has already analysed the biogas sector's potential in its "In-depth Analysis in Support of the Commission Communication COM (2018) 73" publication. The analyses demonstrate that the biogas contribution could rise from 16 Mtoe in 2015 to 30 Mtoe by 2030 (including a small amount of "thermal" biogas) and depending on the explored scenarios could vary from 45 Mtoe (EE scenario) to 79 Mtoe (P2X scenario) by 2050.

Thus, the growth potential is still high even if the implementation of a more attractive regulatory framework, with stronger political determination to substitute fossil gas and also stricter regulations to measure and control GHG emissions, will be required to revive production.

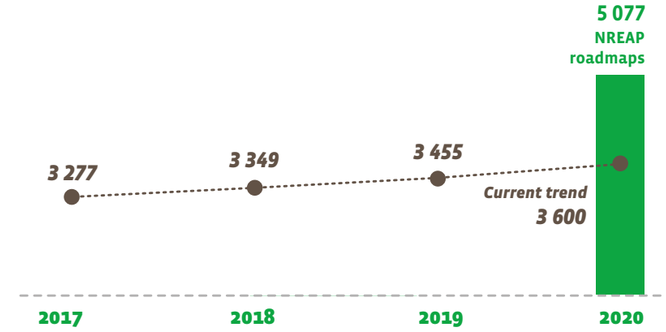
The EU Strategy for Energy System Integration published in July 2020 offers an insightful rundown of the challenges. Little by little, as the EU moves towards climate neutrality, the volume of natural gas used in Europe will gradually decline. According to the Strategy, the share of natural gas in gaseous fuels should fall to 20% and the remaining 80% of gaseous fuels should be mostly of renewable origin by 2050. Admittedly, it is still hard to forecast the future mix of these gaseous energy vectors – biogas, biomethane, hydrogen or syngas. Many questions remain about how regulatory framework of the European market will be implemented and which means will be deployed to make the wholesale uptake of renewable gases easier.

Biogas is also a crucial methane emission reduction weapon, for methane is the second biggest anthropogenic GHG gas after carbon dioxide (CO_2). Yet, its warming effect is 28 times greater per kilogramme than that of CO_2 over a 100-year timeline.

In **the European Commission's Methane Strategy**, presented in October 2020, the European body warns that European Union achievement of carbon neutrality in 2050, is contingent on dramatically reducing its anthropogenic methane emissions. The Commission claims that 53% of the methane emissions caused by humans come from agriculture, followed by waste at 26%. Controlled methanation in digesters in the farming sector is thus decisive in reducing GHG gases and so justifies the support for agricultural biogas production in the Commission's Methane Strategy. Biogas and biomethane also have an important role to play in reducing household waste emissions, which are the second anthropogenic methane emission source. The compulsory implementation of separate organic waste collection scheduled for 2023, will primarily offer new outlets to the anaerobic digestion stream. Waste reduction and the continuous reclamation of biomass resources are the core principals of an efficient circular economy and one of the main pillars of the European Green Deal. According to the European Biogas Association, the cross-sectoral perspective adopted by the Methane Strategy boosts the high potential of biogas and biomethane to reduce methane emissions in non-energy sectors. It provides a key opportunity to continue expanding the biogas and biomethane industries. Europe's biogas sector has undertaken to participate fully towards achieving the EU's climate neutrality target by 2050. Full EU-wide recognition of its potential is vital to help these industries develop and achieve the production shares planned of at least 39 billion cubic metres of natural gas equivalent (380 TWh) by 2030 and 120 billion m3 (1170 TWh) by 2050. □

Graph. n° 3

Comparison of the current trend of biogas heat consumption of the UE 28 against the NREAP (National Renewable Energy Action Plans) roadmap (in ktoe)



Source: EurObserv'ER 2020

Sources : AGEE-Stat (Germany), BEIS (United Kingdom), GSE (Italy), SDES (France), Ministry of Industry and Trade (Czech Rep.), Danish Energy Agency, Statistics Netherlands, GUS (Poland), Ministry for the Ecological Transition and the Demographical Challenge (Spain), Statistics Austria, SPF Economie (Belgium), Statistics Finland, Statistic Sweden, CRE (Greece), Central Statistical Bureau of Latvia, DGEG (Portugal), NSI (Bulgaria), SEAI (Ireland Rep.), Statistics Lithuania, Statistical Office of the Republic of Slovenia, STATEC (Luxembourg), MRA (Malta), EurObserv'ER, Eurostat early estimate.

The next barometer will cover solid biofuels.

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