STÉPHANIE LIMONGY/DÉPARTEMENT DE L'AUDE.

The 2-MW Limoux wood-fired plant (Occitania) started up in March 2023. The Upper Aude Valley's wood sector will provide about 2 000 tonnes of wood waste annually for heat recovery by the boiler plant to heat a whole string of public buildings, multi-occupancy and single-family homes along a three-kilometre long district heating network.

-4.1%

The decrease of inland consumption from solid biofuels in the EU27 between 2021 and 2022

SOLID BIOFUELS BAROMETER 2023

A study carried out by EurObserv'ER.

According to EurObserv'ER, solid biofuel energy consumption, in all its forms (from roundwood to wood pellets, wood waste and by-products, residue, plant and other renewable industrial waste) in the European Union of 27 should settle at about 100.3 Mtoe. This is the second highest annual consumption figure ever recorded in the EU, following 2021 when a new record was made. The slide from the 2021 peak can be attributed first and foremost to the year's milder average temperatures, which reduced heating needs across the European Union. Furthermore, wood pellet supply circuit pressures hit industrial users, exacerbated by the backdrop of tighter biomass sustainability criteria monitoring, international tensions with Russia and record energy market prices.

87.6 TWh

The electricity production from solid biofuels in the EU27 in 2022

81.4 Mtoe

The heat consumption from solid biofuels in the EU27 in 2022

Solid biofuel persists as the main renewable energy used in the European Union. EurObserv'ER reckons that European Union consumption of solid biofuel-sourced primary energy should exceed 100 Mtoe in 2022 (100.3 Mtoe based on the provisional data to hand). This is less than the 2021 consumption level that hit a 104.5-Mtoe peak that can be mainly ascribed to below-normal temperatures leading to a much longer heating season than recently experienced. The European Union's heating needs contracted sharply in 2022. Eurostat has set up a technical indicator known as Heating degree days (HDD), based on weather forecasts to make an approximate estimate of energy consumption requirements for space heating, from one year or month to the next. The higher the season's HDD, the higher the heating requirement. According to the Eurostat database, the annual number of HDDs fell by 8.6% in the EU-27 between 2021 and 2022, from 3 126 to 2 858 HDD. The number of HDDs for 2022 is one of the lowest in the last decade, with the exception of 2020 and 2015 which were even lower (2 759 and 2 901 respectively). Almost all of the EU countries heating needs fell in 2022 compared to 2021 with exception of Cyprus (696 HDD, a 14.1% increase), Malta (544 HDD, a 16.7% increase) and Greece (1 538 HDD, a 0.1% increase). The two countries with the highest heating needs experienced year-on-year drops of 6.2% for Finland (i.e., 5 277 HDD) and 5.4% for Sweden (i.e., 4 919 HDD). Further south, the drops were 18.4% in France (2 036 HDD), 12.1% in Germany (2 736 HDD), 11.1% in Spain (1 478 HDD), 9.5% in Italy (1 735 HDD) and further east, Poland had an 8.3% drop (3 200 HDD).

The solid biofuel energy consumption trend played out in a different context from that of 2021, leaving aside climate variations. The main event was the geopolitical crisis unleashed by Russia's invasion of Ukraine at the end of February 2022, which led to the most serious energy crisis since the oil price shock of the early 70s. Record energy prices ensued, triggered by Russia's natural gas exports extortion strategy. The crisis had specific implications for solid biofuel trading. As early as April 2022, the European authorities pronounced an embargo on forest product imports (including wood pellets) to the European Union from Russia and Belarus. It immediately revoked the FSC (Forest Stewardship Council) and SBP (Sustainable Biomass Program) sustainability and traceability certificates for these countries, while a total ban on wood pellet imports came into effect on 10 July 2022. These sanctions disrupted the traditional flow of Russian and Belarusian wood pellets to Europe's markets (amounting to about 2 million tonnes from Russia alone). The upshot took the form of supply shortages in the main wood pellet importing countries, namely Denmark, the Netherlands, Belgium and Italy. The latter were forced to diversify their wood pellet supply sources and draw up emergency plans to mitigate the impact of the crisis. Another limitation that major heat and/or power plant operators (with ≥20 MWth boilers) had to deal with was the implementation of certificates demonstrating that their biofuel feedstocks meet the Renewable Energy Directive 2018/2001 sustainability criteria (and more particularly the sustainability and GHG emission reduction criteria or low risk of indirect change of land use criteria), which are essential for eligibility for the production incentives and for inclusion in the Member States's national target calculations. The Commission's Implementing Regulation (EU/ 2022/96) of 14 June 2022 on the criteria verification rules provides for their effective application from 30 December 2023. The scheduled end of production subsidies may lead some operators to wind up operations. A case in point is Belgium's biggest biomass plant, the Rodenhuize plant (which shut down in April 2023), whose wood pellet feedstock was sourced in Canada. EurObserv'ER considers that the vast majority of the final energy consumption announced for 2022 by the Member States complies with the Renewable Energy Directive criteria. However, as the biomass certification mechanisms of some countries have yet to roll out and the approaches are inconsistent, the situation is prone to change. Certain countries consider

Tabl. n° 1

Primary energy production and gross inland consumption of solid biofuels in the European Union in 2021 and 2022** (in Mtoe)*

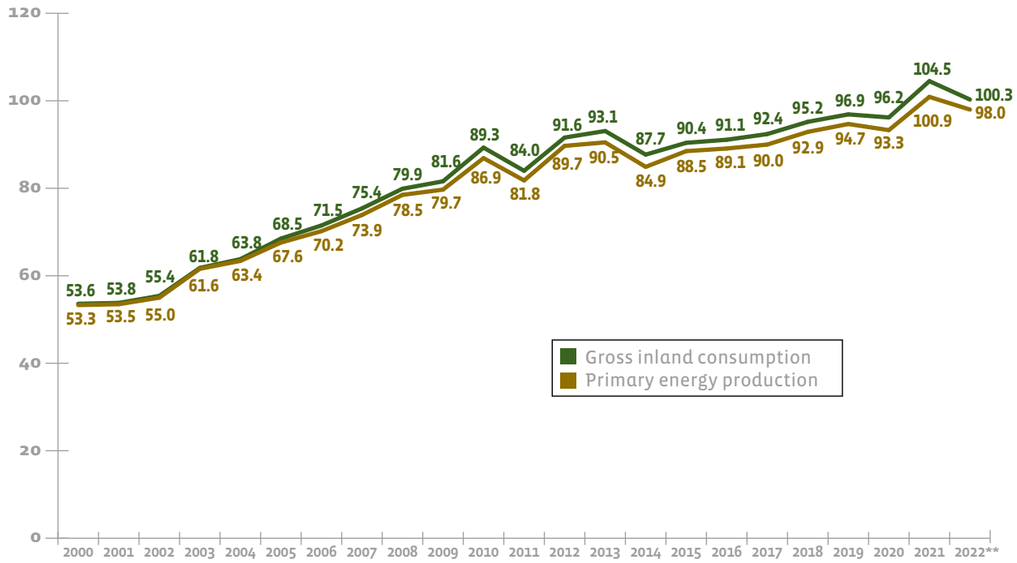
	2021		2022**	
	Production	Consumption	Production	Consumption
Germany	13.901	13.972	14.379	14.546
France	10.788	10.931	10.120	10.271
Sweden	10.264	10.199	10.082	10.052
Poland	8.881	9.082	8.675	8.745
Finland	9.037	9.538	8.462	8.704
Italy	7.834	9.118	7.109	8.247
Spain	5.278	5.278	5.297	5.297
Austria	5.294	5.210	4.944	4.833
Czechia	3.913	3.689	3.727	3.512
Romania	3.625	3.639	3.471	3.419
Denmark	1.526	3.644	1.554	3.128
Portugal	2.922	2.700	2.971	2.800
Netherlands	1.752	2.760	1.742	2.481
Hungary	2.194	2.193	2.073	2.073
Belgium	1.320	1.895	1.302	1.881
Bulgaria	1.812	1.783	1.586	1.602
Latvia	2.312	1.505	2.515	1.535
Slovakia	1.496	1.484	1.505	1.505
Croatia	1.669	1.437	1.656	1.378
Lithuania	1.396	1.419	1.297	1.292
Estonia	1.810	1.138	1.766	1.143
Greece	0.787	0.816	0.797	0.824
Slovenia	0.604	0.604	0.525	0.525
Ireland	0.232	0.267	0.251	0.273
Luxembourg	0.183	0.180	0.177	0.168
Cyprus	0.024	0.028	0.028	0.032
Malta	0.000	0.002	0.000	0.001
Total EU 27	100.854	104.512	98.012	100.267

Excluding charcoal. ** Estimate.* ***Source: EurObserv'ER 2023.*

Wood pellet consumption in dwellings and the commercial sector continued to rise buoyed by craze for wood pellet burning heating appliances in 2021. The residential and commercial sectors concentrated 56% of European Union wood pellet consumption in 2022 (compared to 51% in 2021).

Graph. n° 1

Solid biofuels primary energy production and inland consumption growth figures for the EU27 since 2000 (in Mtoe)*



Excluding charcoal. **Estimate.* ***Sources: years 2000-2020 Eurostat, years 2021 and 2022 EurObserv'ER.* *Note: Eurostat data presented for the years 2000 to 2020 are those updated on July 11, 2023 and do not take into account possible statistical revisions at the end of the year 2023*

that their final energy production meets the sustainability criteria by default, while others will not factor them in until the certification mechanisms have been effectively implemented. These statistical decisions have a direct impact on the Renewable Energy Directive target calculations that are proportional to the volumes of biomass used in the major plants that operate ≥20 MWth boilers.
The implementation of these control measures is a result of a drawn-out debate on the role allocated to solid biofuel energy in the European Union decarbonisation targets and the resilience capacity of its forest resources to maintain ecosystem services (such as oxygen and air production) and preserve biodiversity. Under particular scrutiny are the fuel-guzzling needs of very high capacity biomass power plants. On further reflection, the use of solid biofuels to meet energy requirements has clearly increased over the last two decades. Their consumption in the EU-27 that has practically doubled since 2000 (53.6 Mtoe in 2000, 89.3 Mtoe in 2010 and 100.3 Mtoe in 2022) (Graph.1). The trade associations remind us that this rise coincided with the increase in the potential supply of biomass energy. The Bioenergy Europe Statistical Report 2023 on biomass supply comments that Europe's forests have developed over the last three decades not only in forested areas but also that the forest carbon stock has increased through better management. In 1990, the average forest stock was 133 m3/ha while in 2020, this figure had increased by more than 30% to 173 m3/ha.

Tabl. n° 2

Gross electricity production from solid biofuels in the European Union in 2021 and 2022** (in TWh)*

	2021				2022			
	Electricity only plants	CHP plants	Total	Compliant*** (%)	Electricity only plants	CHP plants	Total	Compliant*** (%)
Finland	0,000	12,668	12,668	87,2 %	0,000	11,908	11,908	100,0 %
Sweden	0,000	11,174	11,174	100,0 %	0,000	11,257	11,257	100,0 %
Germany	5,000	5,750	10,750	100,0 %	4,800	5,450	10,250	100,0 %
Netherlands	2,385	5,457	7,842	93,7 %	1,882	4,838	6,720	85,4 %
Poland	1,713	4,686	6,398	100,0 %	1,526	4,174	5,700	100,0 %
Denmark	0,000	7,133	7,133	100,0 %	0,000	5,679	5,679	99,0 %
Spain	4,116	0,979	5,095	96,2 %	4,125	0,807	4,932	93,5 %
France	0,691	3,732	4,423	100,0 %	0,889	3,785	4,674	100,0 %
Italy	2,385	2,144	4,529	100,0 %	2,266	2,092	4,358	100,0 %
Austria	0,709	2,815	3,523	60,8 %	0,764	2,979	3,743	21,9 %
Portugal	1,346	2,046	3,392	100,0 %	1,473	2,071	3,544	100,0 %
Belgium	1,458	1,306	2,763	100,0 %	1,464	1,379	2,843	100,0 %
Czechia	0,001	2,663	2,665	100,0 %	0,001	2,658	2,659	100,0 %
Bulgaria	0,372	2,001	2,373	0,3 %	0,322	1,731	2,053	0,3 %
Hungary	0,610	1,165	1,775	93,2 %	0,582	1,111	1,693	93,2 %
Estonia	0,609	1,085	1,694	100,0 %	0,548	0,975	1,523	100,0 %
Slovakia	0,000	1,325	1,325	100,0 %	0,000	0,956	0,956	100,0 %
Croatia	0,000	0,660	0,660	100,0 %	0,000	0,716	0,716	100,0 %
Latvia	0,000	0,570	0,570	100,0 %	0,000	0,552	0,552	100,0 %
Romania	0,032	0,548	0,580	100,0 %	0,029	0,491	0,520	100,0 %
Ireland	0,447	0,024	0,471	4,5 %	0,482	0,026	0,508	4,5 %
Lithuania	0,000	0,387	0,387	100,0 %	0,000	0,394	0,394	100,0 %
Luxembourg	0,000	0,285	0,285	100,0 %	0,000	0,268	0,268	100,0 %
Slovenia	0,000	0,169	0,169	100,0 %	0,000	0,142	0,142	100,0 %
Greece	0,016	0,026	0,042	100,0 %	0,009	0,043	0,052	100,0 %
Total EU 27	21,889	70,796	92,685	92,9 %	21,160	66,483	87,643	92,1 %

Excluding charcoal. **Estimate. ***Compliant with the criteria of Article 29 of Directive (EU) 2018/2001* ***Source: EurObserv'ER 2023.*


JOHAN GUNSÉUS

The Dåva 2 biomass cogeneration plant at Umeå, Sweden. The two major forestry countries, Finland and Sweden, monopolize the top EU rankings with solid biofuel electricity outputs of 11.9 TWh and 11.3 TWh.

IMPORTS FROM OUTSIDE THE EU PLUMMET

EurObserv'ER reckons that solid biofuel output in 2022, namely the inputs taken from European soil, stood at about 98 Mtoe, which is a 2.8% YoY decline on 2021 (EU output fell by 2.8 Mtoe). The difference between the national output data and gross domestic consumption equates to the import-export balance, as well as stock variations. Net solid biofuel imports across the European Union, were fairly low and below the 2021 level (3.7 Mtoe in 2021 and 2.3 Mtoe in 2022). Most can be ascribed to biomass fuel imports (wood and wood pellets) from non-EU countries and North America. As explained earlier, the Russian and Belarusian wood pellet embargo is partly responsible for the 2022 slump in imports and European legislation on biomass sustainability, that is being phased in, is most probably hitting certain supply flows outside the European Union, and North America in particular.
The breakdown of the various biofuels in European Union countries' national solid biofuel production reveals a very clear heavyweight player – the "wood, wood residue and by-products" category, which includes wood pellet production. According to Eurostat data, the breakdown for 2021 (last available annual data) was, in descending order of importance, 80% for "wood, wood residue and by-products" (incl. 5.9% of wood pellets), 13.5% for black liquor (a by-product of the paper pulp industry), 4.2% for other materials and plant residue, 1.8% for renewable industrial waste, 0.6% for bagasse and 0.2% for animal waste.

EUROPEAN WOOD PELLET PRODUCTION RISING

Wood pellet consumption in recent years has been one of the main drivers of European Union solid biofuel energy growth, both in the domestic sector with wood pellet heating appliances (boilers and stoves) very much in vogue, and industrial uses to replace coal. The Bioenergy Europe Statistical Report 2023 produced in conjunction with the European Pellet Council asserts that wood pellet consumption growth in the European Union of 27 slipped by about 1.6% between 2021 and 2022, from 24.5 to 24.2 million tonnes. The main reason for this contraction is the drop in wood pellet consumption in industry, primarily in the cogeneration and power production sectors, with the main culprit being the highly volatile price of wood pellets. In contrast, wood pellet consumption in dwellings and the commercial sector continued to rise buoyed by wood pellet burning heating appliances being all the rage in 2021. The residential and commercial sectors concentrated 56% of European Union wood pellet consumption in 2022 (compared to 51% in 2021), which is the highest share since 2014. However, the geopolitical consequences of Russia's aggression and resulting energy crisis, together with uncertainties surrounding Russian gas supplies, led to a sharp hike in the price of wood pellet fuel. It soared to new highs at the end of 2022 with prices of over 700 euros per tonne, whereas prices hovered around the 300-euro mark until 2021. They finally fell after the 2022-2023 winter, but are still higher than they were in 2021, primarily because of the hike in the electricity and gas prices used for their production. Naturally, high price volatility has had an impact on the purchasing decisions of industrial users, which has led to falling consumption. The report notes that wood pellet consumption in industry has been slashed in Dutch power plants (by about 300 000 tonnes in 2022) and in Danish cogeneration plants (by about 550 000 tonnes in 2022).
European Union wood pellet output is increasing. It rose from 19.8 million tonnes in 2021 to 20.4 million tonnes in 2022 (by 3.2%), while production capacity rose

from 25.6 to 27 million tonnes (by 5.6%). The report claims that the opening of 63 new production sites is responsible for this increase. Weaker growth in output compared to production capacities can be explained by the sharp rise in production costs owing to energy price rises and also to reduced supplies of Russian and Belarusian timber (due to the European embargo) earmarked for processing into wood pellets on European Union soil.

FALLING SOLID BIOFUEL ELECTRICITY AND HEAT OUTPUT

Primary energy is the energy contained in natural resources prior to any processing. Final energy is the energy used by the consumer, after being transformed and transported, used and invoiced at the point of use. EurObserv'ER distinguishes two types of use of solid biofuel-sourced final energy, namely electricity (table 2) and heat (or cooling). Solid biofuel heat is differentiated according to whether it comes from the processing sector transformation, i.e., is distributed via heating networks (table 3) or used directly by the end users (in the residential, industrial and agricultural sectors), excluding the transport sector (table 4). In the European Union of 27, solid biofuel electricity output was measured at 87.6 TWh in 2022, 75.9% of which was produced by CHP plants. This output is below the 2021 record production level of 92.7 TWh (meaning output fell by 5.4% between 2021 and 2022), yet it is higher than its 2020 level (83 TWh). The top three European Union solid biofuel electricity producer countries remain unchanged. The two major forestry countries, Finland and Sweden, monopolise the top rankings with solid biofuel electricity outputs of 11.9 TWh (6% less than in 2021) and 11.3 TWh (0.7% more than in 2021) respectively. All of this output was generated in cogeneration plants. Germany lies in third place with 10.3 TWh and 4.7% less output. The sharpest drops in solid biofuel electricity output were felt in the two highest wood pellet importing countries, namely Denmark whose output fell by 20.4% to 5.7 TWh (a YoY drop of 1.5 TWh) and the Netherlands whose output fell by 14.3% to 6.7 TWh (a YoY drop of 1.1 TWh). Their reduced wood pellet consumption is directly responsible for the drops in output, be it in the Dutch power plants or Danish CHP plants. Turning to the main producer countries, Poland's solid biofuel electricity output also logged a double-digit fall (of 10.9%, to 5.7 TWh, i.e., an annual contraction of 0.7 TWh). Solid biofuel electricity output rose in France (by 5.7% to 4.7 TWh), Austria (by 6.2% to 3.7 TWh) and Portugal (by 4.5% to 3.5 TWh), as if to confound the main European producers.

The heat production sector across the EU-27 contracted in 2022 after rising sharply in 2021, mainly because of lower heating needs. Nonetheless they were above their 2020 level. According to EurObserv'ER, solid biofuel heat used directly by end users fell by 3.2% between 2021 and 2022 to 69.2 Mtoe, which is 2.3 Mtoe less than in 2021. Germany, one of the European countries most exposed to dependency on Russian gas, is the only country to have recorded a clear increase in its solid biofuel final energy consumption – from 0.8 Mtoe to 11.5 Mtoe – as consumers have sought to substitute as much gas as possible. Final energy consumption also grew slightly in Spain (by 0.1 Mtoe to 3.8 Mtoe in 2022) and was stable in Sweden (57 ktoe added to reach 5.5 Mtoe). Steady final biomass energy consumption in Sweden can be put down to the growing need for solid biofuel process heat (2.3% more to 4.6 Mtoe). Gross solid biofuel heat output sold to heating networks (and so produced by the processing sector) fell by 0.9 Mtoe between 2021 and 2022 to 12.2 Mtoe (a drop of 7.1%). This can mainly be ascribed to CHP plants, which garnered a 61.0% share in 2022 (61.2% in 2021). It should be borne in mind that this drop followed the unusually long heating season in 2021. The three countries with the densest solid biofuel heating networks, (Sweden, Finland, and Denmark), all saw their output contract. The sharpest fall was recorded in Denmark (10.3%, for a total of 1.5 Mtoe in 2022). We estimate total solid biofuel heat consumption by adding the processing sector's heat output to the output directly used by end-users (final process and "other sectors" energy consumption excluding transport). Across the European Union it should stand at about 81.4 Mtoe in 2022 compared to 84.6 Mtoe in 2021, denoting a 3.8% fall (table 4).

Tabl. n° 3

Gross heat production in the transformation sector from solid biofuels in the European Union in 2021 and in 2022** (in Mtoe)*

	2021				2022			
	heat only plants	CHP plants	Total	Compliant*** %	heat only plants	CHP plants	Total	Compliant*** %
Sweden	0.761	1.982	2.743	100.0 %	0.709	1.902	2.611	100.0 %
Finland	1.024	1.056	2.080	87.2 %	0.961	1.013	1.975	100.0 %
Denmark	0.534	1.181	1.716	98.0 %	0.504	1.036	1.540	99.0 %
France	0.682	0.615	1.297	100.0 %	0.659	0.622	1.281	100.0 %
Austria	0.661	0.368	1.029	60.8 %	0.601	0.355	0.956	21.9 %
Germany	0.192	0.467	0.659	100.0 %	0.148	0.474	0.622	100.0 %
Lithuania	0.413	0.149	0.562	100.0 %	0.393	0.149	0.543	100.0 %
Poland	0.148	0.352	0.500	100.0 %	0.143	0.347	0.489	100.0 %
Latvia	0.184	0.218	0.402	100.0 %	0.192	0.216	0.408	100.0 %
Netherlands	0.120	0.280	0.400	77.6 %	0.113	0.222	0.335	59.9 %
Estonia	0.099	0.237	0.335	100.0 %	0.090	0.215	0.305	100.0 %
Czechia	0.051	0.200	0.251	100.0 %	0.044	0.178	0.222	100.0 %
Italy	0.089	0.295	0.385	100.0 %	0.087	0.121	0.208	100.0 %
Bulgaria	0.013	0.185	0.198	6.3 %	0.010	0.137	0.147	6.3 %
Slovakia	0.053	0.099	0.152	100.0 %	0.044	0.082	0.126	100.0 %
Croatia	0.000	0.095	0.096	100.0 %	0.001	0.106	0.107	100.0 %
Luxembourg	0.005	0.099	0.104	100.0 %	0.005	0.094	0.099	100.0 %
Hungary	0.036	0.059	0.094	87.5 %	0.035	0.057	0.092	87.5 %
Romania	0.018	0.067	0.085	100.0 %	0.018	0.067	0.085	100.0 %
Slovenia	0.013	0.030	0.044	100.0 %	0.013	0.029	0.042	100.0 %
Belgium	0.000	0.021	0.021	100.0 %	0.000	0.024	0.024	100.0 %
Total EU 27	5.097	8.055	13.152	92.5 %	4.768	7.449	12.217	91.4 %

Excluding charcoal. **Estimate. ***Compliant with the criteria of Article 29 of Directive (EU) 2018/2001.* ***Source: EurObserv'ER 2023.*

Tabl. n° 4

Final energy consumption from solid biofuels** in the countries of the European Union in 2021 and 2022*** (in Mtoe)*

	2021	Compliant**** 2021 %	2022	Compliant**** 2022 %
Germany	10.653	100.0 %	11.465	100.0 %
France	8.458	100.0 %	7.673	100.0 %
Poland	7.287	100.0 %	7.083	100.0 %
Italy	7.324	100.0 %	6.701	100.0 %
Sweden	5.476	100.0 %	5.533	100.0 %
Finland	5.491	87.3 %	4.910	98.5 %
Spain	3.709	98.4 %	3.816	98.7 %
Romania	3.551	100.0 %	3.366	100.0 %
Austria	3.522	98.2 %	3.176	97.4 %
Czechia	2.830	100.0 %	2.663	100.0 %
Portugal	1.766	100.0 %	1.821	100.0 %
Hungary	1.629	99.3 %	1.540	99.3 %
Belgium	1.320	100.0 %	1.267	100.0 %
Croatia	1.146	100.0 %	1.098	100.0 %
Slovakia	1.024	100.0 %	1.038	100.0 %
Latvia	0.922	100.0 %	0.953	100.0 %
Denmark	1.011	100.0 %	0.843	100.0 %
Greece	0.789	100.0 %	0.804	100.0 %
Bulgaria	1.049	80.2 %	0.998	80.2 %
Netherlands	0.710	96.3 %	0.686	92.4 %
Lithuania	0.637	100.0 %	0.610	100.0 %
Slovenia	0.533	100.0 %	0.454	100.0 %
Estonia	0.422	100.0 %	0.445	100.0 %
Ireland	0.170	66.4 %	0.175	66.4 %
Cyprus	0.026	100.0 %	0.030	100.0 %
Luxembourg	0.029	100.0 %	0.028	100.0 %
Malta	0.002	100.0 %	0.001	100.0 %
Total EU 27	71.484	98.4 %	69.176	99.2 %

Final energy consumption in «Industry» and «Other sectors», excluding «Transport» ** Excluding charcoal * Estimation **** Compliant with the criteria of Article 29 of Directive (EU) 2018/2001.*
Source: EurObserv'ER 2023.

NEWS FROM AROUND THE MAIN COUNTRIES

Solid biofuel consumption was nothing to write home about in 2022, yet it still displayed some of the highest consumption levels ever recorded. The policy to develop the thermal and cogeneration uses of biomass in the framework of the renewable energy directives turned out to be very timely in the current directives' context of fossil gas supply tensions, and even more astute for the major forestry countries and those that offer potential. Locally produced biomass is one of the options that will enable us to wean ourselves off our dependency on fossil energies given the uncertain natural gas supply environment and wild fluctuations in fossil energy prices.

SOLID BIOFUELS SERVICING ENERGY TRANSITION AND SECURITY IN FINLAND

Finland is an industrialised country whose energy mix is one of the least dependent on fossil fuels. The exploitation of its forestry resources (70% of Finnish soil is timberland) plays an important hand in this. According to Statistics Finland, wood fuels in 2022 accounted for up to 28.5% of the country's energy consumption, which is slightly less than in 2021 (29.6%), but more than in 2020 (27.8%). Solid biofuels taken together accounted for 8.7 Mtoe of primary energy consumption in 2022, which is an 8.7% YoY decline. Finland is the European Union's 5th biggest biomass consumer but more importantly, has the highest per capita biomass consumption at 1.569 toe, ahead of Sweden with 0.962 toe per capita (graph 2).

All in all, renewable energies accounted for 41.8% of its energy consumption in 2022 (42.1% in 2021 and 39.3% in 2020), far outstripping oil (20.3%), nuclear energy (20.4%), coal (6.4%), natural gas (3.0%) and peat (3.0%). The country's wood cogeneration plants also supplied 13.9% of its electricity in 2022 (the same as in 2021) compared to 44.6% for the renewable total and 29.7% for nuclear power. Finland's forestry industry wields considerable economic weight with its 5.5 million inhabitants. It includes timber processing (structural wood, furniture) and the chemicals industry (paper and pulp). The country has increased the availability of biomass for energy purposes by developing exports of its forestry activity. While solid biofuel output varies from year to year, it is on course to increase. It rose from 6.4 Mtoe in 2000, to 7.7 Mtoe in 2010 and to 8.5 Mtoe in 2022. Of the 8.5 Mtoe of solid biofuels produced on Finnish soil in 2022, 59.3% was categorised as wood, wood residue and by-products, 40.2% as black liquor and 0.5% as other plant materials and residue. Forestry industry by-products and wood residue are mainly used for producing electricity and heat in CHP plants and have been more recently converted into advanced biofuels (primarily tall oil production). Incidentally, Finland is the top European Union solid biofuel electricity producer with 11.9 TWh of output in 2022 and lies in second place for solid biofuel heat sales (2 Mtoe in 2022).

Tabl. n° 5

Heat consumption from solid biofuels** in the countries of the European Union in 2021 and 2022*** (in Mtoe)*

	2021	Compliant**** 2021 %	2022	Compliant**** 2022 %
Germany	11.312	100.0 %	12.087	100.0 %
France	9.755	100.0 %	8.954	100.0 %
Sweden	8.218	100.0 %	8.144	100.0 %
Poland	7.787	100.0 %	7.572	100.0 %
Italy	7.708	100.0 %	6.909	100.0 %
Finland	7.571	87.2 %	6.884	99.0 %
Austria	4.551	89.8 %	4.133	80.0 %
Spain	3.709	98.4 %	3.816	98.7 %
Romania	3.636	100.0 %	3.451	100.0 %
Czechia	3.080	100.0 %	2.885	100.0 %
Denmark	2.727	98.7 %	2.383	99.4 %
Portugal	1.766	100.0 %	1.821	100.0 %
Hungary	1.723	98.6 %	1.631	98.6 %
Latvia	1.324	100.0 %	1.361	100.0 %
Belgium	1.341	100.0 %	1.291	100.0 %
Croatia	1.242	100.0 %	1.205	100.0 %
Slovakia	1.176	100.0 %	1.164	100.0 %
Lithuania	1.199	100.0 %	1.153	100.0 %
Bulgaria	1.248	68.4 %	1.145	70.7 %
Netherlands	1.110	89.6 %	1.022	81.7 %
Greece	0.789	100.0 %	0.804	100.0 %
Estonia	0.757	100.0 %	0.750	100.0 %
Slovenia	0.577	100.0 %	0.496	100.0 %
Ireland	0.170	66.4 %	0.175	66.4 %
Luxembourg	0.133	100.0 %	0.127	100.0 %
Cyprus	0.026	100.0 %	0.030	100.0 %
Malta	0.002	100.0 %	0.001	100.0 %
Total EU 27	84.636	97.5 %	81.393	98.1 %

** Gross heat production in the transformation sector and final energy consumption in Industry and «Other sectors» (excluding Transport) ** Excluding charcoal *** Estimation **** Compliant with the criteria of Article 29 of Directive (EU) 2018/2001.* ***Source: EurObserv'ER 2023.***

CONSUMPTION RISING IN GERMANY

AGEE-Stat, the Working Group on Renewable Energy Statistics mandated by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), claims that primary biomass energy consumption exceeded 14.5 Mtoe in 2022, namely YoY growth of 4.1%, which equates to 573 ktoe of additional consumption. This increase, like the previous year's, was exclusively allocated to heating directly used by end users that rose from 10.7 Mtoe in 2021 to almost 11.5 Mtoe 2022 (an 812-ktoe rise). The main source of this increased consumption is the industrial sector followed by a smaller increase in household consumption.

Heat production by the processing sector, dropped by tens of ktoe (37 ktoe between 2021 and 2022), resulting in a total of 622 ktoe in 2022. Solid biofuel power output from CHP or other plants also fell by 0.5 TWh to 10.25 TWh. AGEE-Stat points out that final energy consumption for renewable energy-sourced heat in 2022 (mainly solid biofuels) showed a modest increase over the year. This progress was made against the backdrop of declining fossil energy use, due to the mild weather and also industry's and households' efforts to make savings in the wake of Russia's war of aggression against Ukraine. The renewable energy share of final energy consumption for heat and cooling has clearly increased. It is projected at 18.2%, which is 2.4 points of a percentage higher than in 2021. Growth of Germany's solid biofuel energy consumption is partly driven by the demand for wood pellet fuel. According to the Bioenergy Europe report, Germany increased its consumption by 10% over the year to 3.2 million tonnes in 2022, almost all of which was used for heat production.

THE FRENCH CONSUMPTION FIGURE STAYS ABOVE THE 10-MTOE MARK

The SDES (Sustainable Development Ministerial Statistical Department) of the French Ministry of Ecological Transition quantified solid biofuel primary energy consumption at 10.3 Mtoe in 2022, which is below the 2021 level of 10.9 Mtoe (a 6.0% annual loss). Like the rest of Europe, this fall can be attributed to the mild autumn and winter temperatures of 2022 that reduced residential and tertiary space heating needs. Primary wood energy output slipped to 10.1 Mtoe and can be ascribed to a positive contribution from imports, mainly of wood pellets (775 196 tonnes imported and 89 490 tonnes exported in 2022).

Solid biofuel electricity output grew by 5.7% to 4.7 TWh (251 GWh more than in 2021), illustrating more positive momentum, which may be explained by increased demand from conventional thermal power plants to cope with the drop in nuclear and hydropower electricity output to balance supply and demand, even though solid biofuel plants make a minor contribution. The SDES assessed the net maximum electrical capacity of solid biofuel plants at 911.5 MW at the end of 2022, compared to the 2021 year-end figure of 898.8 MW. Despite the mild winter temperatures, at 1.3 Mtoe, gross heat output from the processing sector, was almost stable between 2021 and 2022 and can be attributed to the country's policy to develop biomass heating networks. End users were responsible for most of the fall in solid biofuel energy consumption from 8.5 Mtoe in 2021 to 7.7 Mtoe in 2022. To break this down further, the residential sector is answerable for most of the fall (from 6.7 to 5.9 Mtoe), as industrial consumption remained stable at 1.3 Mtoe.

BIOMASS, A DECARBONISATION OPTION FOR INDUSTRY

Rocketing fossil energy prices in the aftermath of Russia's 2022 invasion of Ukraine forced manufacturers to refocus on the need to decarbonise their sectors and accelerate their energy transition. Solid biofuel consumption in industry was boosted in those countries whose gas

Graph. 2

Gross inland consumption of solid biofuels by toe per inhabitant in the European Union in 2022***

Excluding charcoal ** Estimate* ***Source: EurObserv'ER 2023.*

BIOMASS IN THE RENEWABLE ENERGY DIRECTIVE

To count towards the renewables targets, or to be eligible for subsidies by EU countries, renewable energy sourced from biomass needs to fulfil sustainability criteria. The recast Renewable Energy Directive 2018/2001 extends sustainability criteria to cover also large-scale biomass for heat and power, in addition to biofuels and bioliquids for transport.

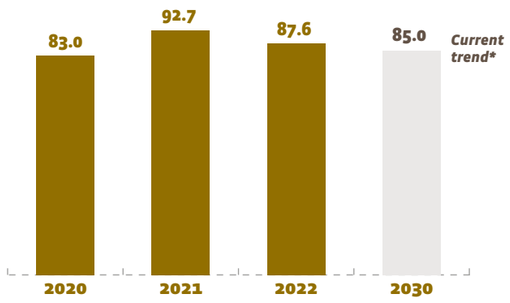
In the particular case of solid biofuels, it adds new criteria for agriculture waste and residues, requiring evidence of the protection of soil quality and soil carbon, and for agriculture biomass, requiring evidence that the raw material is not sourced from highly biodiverse forests. As for forest biomass, bioenergy generators must demonstrate that the country of origin has laws in place avoiding the risk of unsustainable harvesting and accounting of emissions from forest harvesting. If such evidence cannot be provided, bioenergy generators need to demonstrate sustainability compliance at the level of the biomass sourcing area. New biofuels plants need to deliver at least 65% fewer direct greenhouse gas (GHG) emissions than the fossil fuel alternative. New biomass-based heat and power plants need to deliver at least 70% (80% in 2026) fewer GHG emissions than the fossil fuel alternative. Bioelectricity, requiring that large scale plants (above 50 MW) apply highly efficient cogeneration technology, or apply Best Available Techniques (BAT) or achieve 36% efficiency (for plants above 100 MW), or use carbon capture and storage technology

The recast of the Renewable Energy Directive (RED III) includes a further targeted strengthening of the biomass sustainability criteria and will take up recommendations of the report "The use of woody biomass for energy production in the EU", by the Commission's Joint Research Centre. The revised directive includes the extension of no-go areas for forest biomass to protect in particular primary and old-grown forests, as well as wet- and peatland. It also requires avoiding the use of roots and stumps and to minimise large clear-cuts. The proposed rules introduce an obligation on EU countries to design their national support schemes in accordance with the biomass cascading principle whereby woody biomass is used according to its highest economic and environmental added value.

https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/biomass_en

Graph. n° 3

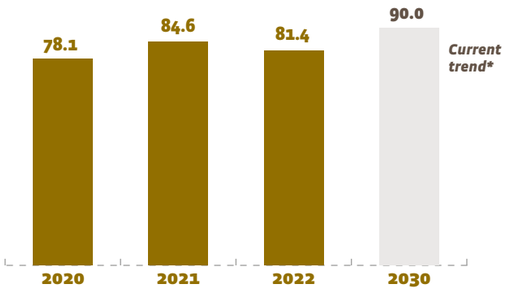
Projection EurObserv'ER de la production d'électricité issue de biomasse solide dans l'Union européenne à 27 (en TWh)*



** Excluding charcoal.* ***Source: EurObserv'ER 2023.***

Graph. n° 4

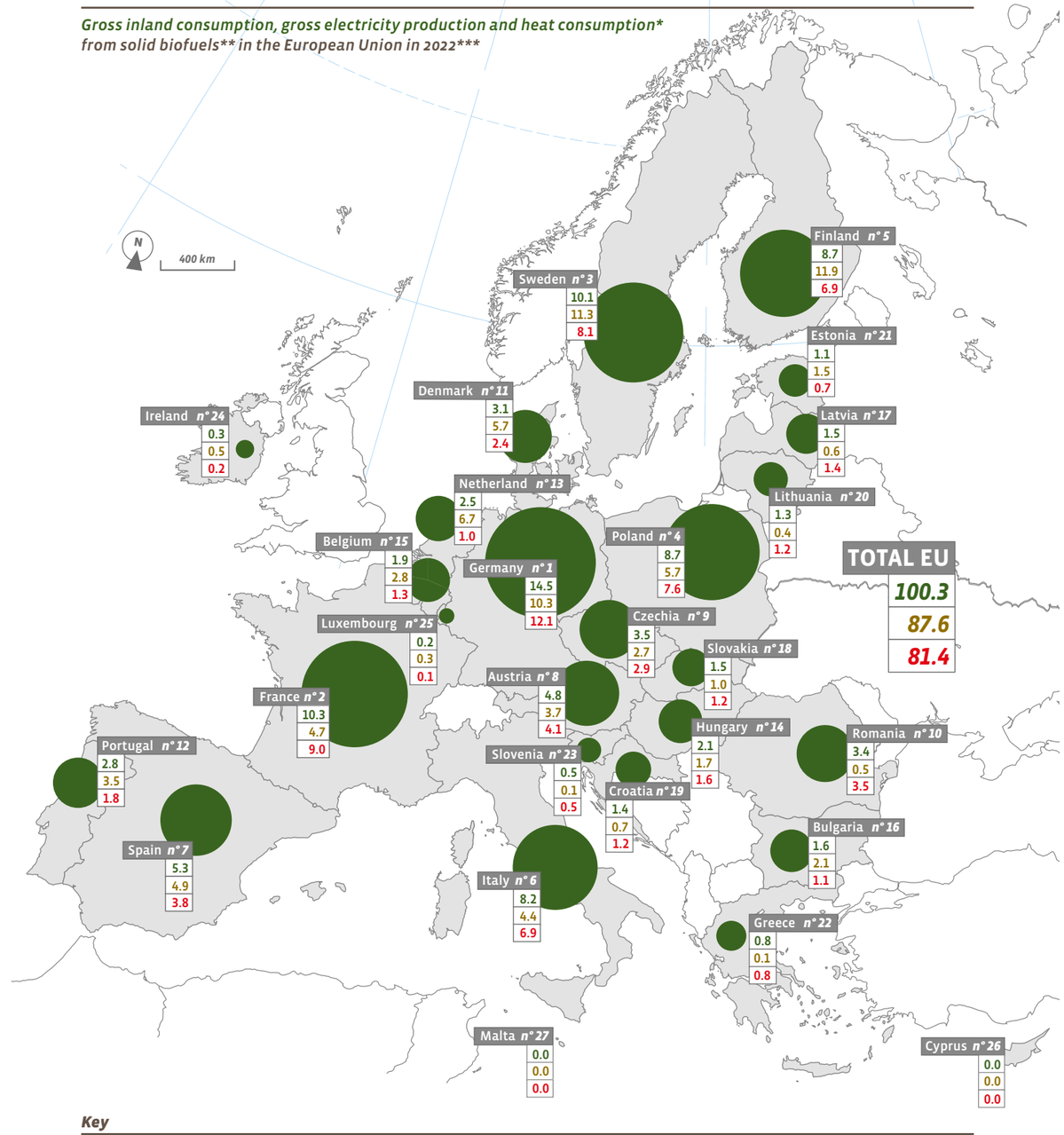
EurObserv'ER projection of heat consumption from solid biofuels** in the EU 27 (in Mtoe)*



** Gross heat production in the transformation sector and final energy consumption in Industry and «Other sectors» (excluding Transport). ** Excluding charcoal.* ***Source: EurObserv'ER 2023.***

supplies were most at risk, not to mention several major power plant operators whose procurement circuits came under pressure, or whose activity came under scrutiny from the European legislators for biofuel feedstock sustainability. There are several investment options open to medium-sized industrialists, who seek to reduce their CO_2 emissions without affecting their competitiveness. Examples are electrifying their processes, using industrial heat pumps, increasing energy efficiency, investing in renewable gas production plants (biomethane, hydrogen) and also investing in biomass heat projects... ideally projects based on the procurement of local wood and other feedstocks, that avoid conflicts of usage, whose prices are less volatile than those of fossil fuels. Initiatives have been rolled out across the Member States to speed up this transition. In France, for example, the government launched a call for "Zero-Fossil Industry" (IZF) projects on 29 April 2022 in response to the war in Ukraine. Its aim was to quickly deploy GHG emission-curbing projects by reducing fossil energy use. The selected projects, which have received almost 225 million euros in aid, will enable industrial sites to cut their emissions, making them more resilient in the long term. In particular, they will limit their exposure to fossil energy prices and that of carbon, which has been boosted in the short term as a consequence of Russia's war on Ukraine, and in the medium term through the adop-

Gross inland consumption, gross electricity production and heat consumption from solid biofuels** in the European Union in 2022****



Key

100.3 Inland consumption of solid biofuels** in the European Union in 2022*** (in Mtoe)

87.6 Gross electricity production from solid biofuels** in the European Union in 2022*** (in TWh).

81.4 Heat consumption* from solid biofuels** in the European Union in 2022*** (in Mtoe).

Gross heat production in the transformation sector and final energy consumption in Industry and «other sectors» (excluding transport). ** Excluding charcoal. * Estimation.*
Source : EurObserv'ER 2023.

tion of new European rules (the European "Fit for 55" package and the overhaul of Europe's carbon market). Stages 1 and 2 of this call for projects were revealed in April 2023. They cover support for heat production from biomass for Stage 1, involving 39 projects approved for 174.2M euros' worth of aid that will avoid the use of about 2 278 GWh of fossil-sourced primary energy per annum and 492 MtCO2e p.a. Stage 2 covers support to energy efficiency and process development projects ("DECARB IND"): sixteen projects have been approved for 51M euros and will avoid the use of about 735 GWh p.a of fossil-sourced primary energy and 170 MtCO2e p.a. Another call for biomass heat projects (AAP BCIAT) launched in April 2023 for a similar amount – € 125M – also hopes to expand the deployment of biomass solutions more broadly in industry. The BCIAT (Biomass Heat for Industry, Agriculture and Tertiary sector) call for projects is earmarked for biomass projects (boilers and hot air generators) whose thermal output exceeds 12 000 MWh p.a. The range of eligible fuels includes wood chips and similar wood waste, related waste and by-products of the primary wood processing industry, end-of-life wood and waste wood, wood pellets, industrial and agricultural by-products. These projects must be an element of an overall approach to optimise the site's use of energy (energy sobriety, efficiency, recovery of fatal heat, multi-RES design) and must fulfil procurement plan quality commitments.

RED III GIVES SUSTAINABILITY CRITERIA A BROADER SCOPE

For the European Commission, greater use of biomass in the EU may contribute to diversifying Europe's energy supply both in the heat production and electricity production segments, creating growth and jobs and reducing GHG emissions. However, if energy recovery from biomass is to be efficient in reducing GHG emissions and if it is to continue maintaining ecosystem services (such as oxygen and air production) and preserving biodiversity, the biomass must be sustainably produced and used. Biomass production involves a chain of activities, ranging from growing the raw materials to final energy conversion. Each stage of the process may pose various sustainability challenges that must be managed. To this end, the European Union has laid down tougher sustainability criteria firstly within the framework of the Renewable Energy Directive 2018/2001 (known as RED II), and subsequently "broadened" them within the framework of the recast Renewable Energy Directive 2023/2413 (known as RED III) on 18 October 2023 (see inset). RED III aims to extend the scope of the sustainability criteria further so that they apply to an even higher number of installations. It also aims to discourage the use of sawlogs, industrial quality timber for energy purposes, and similarly the use of biofuels exclusively for producing electricity. It also ensures that the Member States respect the cascading principle of using waste according to its hierarchy, the biomass energy must be produced so as to minimise the distortive effects on the raw materials market. The text of RED III came into force on 20 November 2023 giving the Member States 18 months (until 21/05/25) to transpose a specified number of the text's provisions into their national legislation, including those that amend articles 3, 29 and 30 that cover bioenergies and strengthening the sustainability criteria. Article 3 introduces restrictions on public aid for the exclusive production of electricity from forestry biomass. It stipulates that the Member States shall grant no new support or renew support to promote electricity production from forestry biomass in exclusively electrical facilities, with the exception of electricity produced in an outermost region (NB: an outermost region is a European Union territory situated outside the European continent) or if is produced by CO_2 capture and storage. The Member States must not award direct financial support for the use of sawlogs or veneer, industrial quality roundwood, stumps or roots for energy production. The same applies to the production of renewable energy through waste incineration, unless the separate collection obligations laid down in Directive 2008/98/EC have been met. As for Article 29 paragraph 1, the directive lowers the minimum application threshold of the sustainability criteria applicable to biomass-sourced fuels in installations that produce heat, electricity and cooling from the current 20 MW to 7.5 MW. It aims to guarantee greater environmental efficiency of the sustainability and GHG emission reduction criteria. Article 29-3 adds "subnatural forests" (namely, semi-natural ancient forests) and moors in areas where felling is forbidden to safeguard biodiversity. Lastly, Article 30, paragraphs 1 and 6, stipulate the obligations for conducting audits and setting up simplified national systems for electricity, heating and cooling producing installations whose total rated thermal input is between 7.5 and 20 MWth. □

Tabl. n° 6

Major European operators of biomass plants in 2023

Operator	Country	Operational capacity (MW)	Biomass and cofiring plants
Orsted	Denmark	Cofiring plants with biomass conversion 1 672 MWe 2032 MWth (only heat generation capacity based on biomass)	Avedøre 1(Den), Avedøre 2 (Den), Asnæs 6 (Den), Herning (Den), Skærbæk 3 (Den), Studstrup 3(Den)
Vattenfall	Sweden	CHP biomass plants and heat plants 65.9 MWe 2085.3 MWth	Lelystad (NL), Märkisches Viertel (GER) and in Sweden Gotland, Vänersborg, Motala, Askersund, Lyviksverket – Ludvika, Craboverket – Fagersta, Idbäcksverket – Nyköping, Jordbro, Ekobacken, Fisksätra, Knivsta, Uppsala, Storvreta, Bollmora
Pohjolan Voima	Finland	Multifuel (biomass, peat, fossil) CHP plant 596 MWe 1 169 MWth	Kymin Voima (Fin), Kaukaan Voima (Fin) (54 % ownership), Alholmens Kraft (Fin) (49,9 % ownership), Porin Prosessivoima (Fin), Rauman Biovoima (Fin) (72 % ownership)
Fortum	Finland	Multifuel (biomass-coal CHP) 399 MWe, 624 MWth	Multifuel (biomass -coal) CHP: Cz stochowa 5-(Pol), Zabrze (Pol), Naantali (Fin) jointly owned (Fortum' share 53.5 %)
RWE	Germany	CHP biomass plant and cofiring plant 655 MWe 350 MWth	Markinch CHP biomass plant (UK) Amer biomass and hard-coal fired power plant (80 % biomass (NL) RWE Eemshaven (15 % biomass) NL
Engie	France	Biomass plant 205 MWe (closed in april 2023)	Rodenhuize (Bel)

Sources : EurObserv'ER 2023 based on companies annual reports and communication

The main feedstocks of Sweden's Kalix wood-fired plant are wood chips and peat.

Sources : AGEE-Stat (Germany), 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, CRES (Greece), Central Statistical Bureau of Latvia, Statistics Estonia, DGEG (Portugal), NSI (Bulgaria), SEAI (Ireland Rep.), Statistics Lithuania, Statistical Office of the Republic of Slovenia, NSI (Romania), Republic of Slovenia Statistical office, Hungarian Central Statistical, NSO (Malta), EurObserv'ER, Eurostat early estimates.

The next barometer will be dedicated to wind power.

Funded by the European Commission

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