BIOENERGY EUROPE

STATISTICAL REPORT 2022

REPORT PELLETS

Bioenergy EUROPE

EUROPEAN PELLET COUNCIL

A NETWORK OF BIOENERGY EUROPE

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PELLETS

FORWARD

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A short summary of the pellet sector in 2021 could be this: the "boom" before the storm.

In many regards, 2021 was a year of records for the pellet industry, with both production and consumption experiencing significant growths. The short-lived recovery after the COVID-19 induced lockdowns contributed to increased energy in general, including pellets. In addition, the heating season of 2020-2021 was longer than normal due to a longer period of cold temperatures, increasing the demand on the residential pellet market. Finally, national initiatives to phase out heating oil and for promotion of renewable heating sources, have contributed to impressive growth rates, both in emerging markets, such as Poland, as well as in established ones, such as Austria. And on the global level, new players in Latin America, Asia and elsewhere have started the process of establishing vibrant pellet markets – both for domestic consumption and for export.

Then came late summer 2021 and the first rumblings of instability began to appear. Foreshadowing Russia's war in Ukraine, new hurdles in the supply of Russian fossil energy to Europe started to emerge and the energy market entered an extend period of constant price growth that impacted every sector of the economy. Naturally, the pellet sector was not immune to this situation, and pellet prices also increased due to higher costs for raw materials, electricity and transportation.

Despite these increases, pellets managed to maintain or even improve their competitive position versus most other energy carriers, which saw sharper price increases. In the industrial market, wood pellets have emerged as the most competitive fuel source for thermal power generation, cheaper than both coal and natural gas. In the residential and commercial sector, fears of disruptions in the natural gas flows, as well as extraordinary natural gas prices, are prompting more and more consumers to switch to locally available, renewable, and cheaper heating sources – which obviously include pellets. This increased interest in pellets – coupled with the financial support offered by the aforementioned national fuel switching initiatives – are also stimulating the market for pellet heating appliances, both boilers and stoves, with numerous producers reporting large increases in production capacities.

However, things are far from rosy. Russia's invasion of Ukraine in February 2022 turned the energy market upside down, sending energy prices skyrocketing. The European Pellet Council reacted swiftly to condemn the invasion by suspending ENplus certificates for pellet producers located in Russia and Belarus in April 2022. By the summer in 2022, wood products - including wood pellets – have been included in the list of EU sanctions over Russia. Three main factors are contributing to an unprecedent situation of market tightness: increased pellet demand (which also includes overstocking driven by fears of future pellet shortages), reduced pellet supply due to the cutting-off of Russian and Belarusian markets, and to a lesser extent, years of slower pellet production capacity growth compared to the growth of pellet consumption restricting the ability of existing producers to absorb/adjust to/respond to this shock.

The pellet sector proved its resilience during the COVID-19 crisis and the pellet value chain managed to avoid any significant negative impacts. The current energy crisis is a more fundamental threat and in anticipation of the 2022 – 2023 heating season, the whole of Europe enters very murky waters. To add insult to injury, trends in European policy developments – the European Parliament's introduction of the term "primary woody biomass" and potential restrictions on its use in REDIII along with the very low priority for bioenergy in REPowerEU – are not helpful at all in establishing framework conditions that foster the development of the sector.

What can the pellet sector do in the face of all these challenges? The answer is still in the making, but several of its key components have always been there have been constantly improving trend throughout the years. Pellets will always be a sustainable, cost-effective solution providing benefits not only to end-users but also to all the local & regional actors involved in their value chain. By increasing the cooperation among the various actors of the pellet sector, not only will the pellet markets mature and improve, but also a clearer message can be delivered to policy makers regarding the sector's contribution to European decarbonization targets.

ABOUT

THE STATISTICAL REPORT

Every year since its debut release in 2007, Bioenergy Europe's Statistical Report has provided an in-depth overview of the bioenergy sector in the EU-27 Member States.

Bioenergy Europe's Statistical Report has been enriched each year with new figures and information, collecting unique data on the developments of the European bioenergy market from a growing number of international contributors.

Bioenergy Europe develops detailed reports that aid industry leaders, decision makers, investors and all bioenergy professionals to understand the situation of bioenergy in Europe.

With more than 150 graphs and figures, readers of Bioenergy Europe´s Statistical Report can get accurate and up-to-date information on the EU-27 energy system such as the final energy consumption of biomass for heat and electricity, the number of biogas plants in Europe, the consumption and trade of pellets, the production capacity of biofuels and other key information to help break down and clarify the complexity of a sector in constant evolution.

In 2017, the Report was rewarded by the European Association Awards for being the 'best Provision of Industry Information and Intelligence', a recognition after a decade of collective work.

THE EUROPEAN ASSOCIATION AWARDS 2017

ABOUT

BIOENERGY EUROPE

A bit of history

Bioenergy Europe is the voice of European bioenergy.

It aims to develop a sustainable bioenergy market based on fair business conditions. Founded in 1990, Bioenergy Europe is a non-profit, Brussels-based international organisation bringing together more than 40 associations and 90 companies, as well as academia and research institutes from across Europe.

Our vision

Bioenergy Europe will be the leading player in ensuring that sustainable bioenergy is a key pillar in delivering a carbon neutral Europe.

Our mission

Bioenergy Europe facilitates the development of a sustainable, strong, and competitive bioenergy sector through:

- Promotion towards European policymakers and stakeholders for awareness, acceptance, and reputation of bioenergy.
- Promote the development of consistent, realistic, and sustainable bioenergy scenarios in the heat, electricity, and transport sectors.
- Pro-active proposals to develop more favourable European legislation.
- Market intelligence to support decision making.
- Services to members, including support to advocacy at a national level.
- Tools, including certification schemes, to sustain market growth and credibility.
- Industry collaboration throughout the entire supply chain.
- Promotion of efficient and innovative technologies within the bioeconomy.

2007 First Statistical Report published

2009 + analysis on the National Renewable Energy Action Plan + (108 pages)

2010 89 pages

2011 + pellet chapter + (108 pages)

2012 + statistics on ENplus® + 2700 downloads + (124 pages)

2013 + socio-economic indicators + 2600 downloads

2014 + EPC European Wood Pellet + Overview + expert's view + 3000 downloads + 158 pages

2015 + statistics on wood chip consumption + 200 page report on bioenergy support scheme in Europe + key findings report + 3500 downloads

2016 + chapter on environmental impact of bioenergy + projections on bioheat & bioelectricity + awarded as 'the Best Provision of Industry Information & Intelligence'by the European Association Award + 4000 downloads

2017 + updated information on bioelectricity / bioheat market & support schemes in all EU28 Member States + a seperate report on ENplus®

2018 + report available to the public, free of charge + emphasis on providing transparent data & sharing knowledge to support private & public initiatives to promote bioenergy + 300 pages

2019 / 2020 / 2021 + Bioenergy Europe publishes 7 focussed reports published throughout the year

2022

OUR

ACTIVITIES

Bioenergy Europe carries a wide range of activities aimed at supporting its members on the latest EU and national policy developments. Bioenergy Europe works to voice their concerns to EU and other authorities, including, advocacy activities in key policy areas as well as the organisation of dedicated working groups.

Working Groups

Bioenergy Europe's working groups act as a platform for members to discuss common issues and exchange information on the state of play of bioenergy.

There are currently 8 active working groups:

- Agro-biomass;
- Competitiveness;
- Domestic Heating;
- Pellets;
- Sustainability;
- Wood Supply;
- Task Force Carbon Removal;
- Task Force National Advocacy.

Certification Schemes

Thanks to the experience and authority acquired over the last 20 years, Bioenergy Europe has successfully established two international certification schemes to guarantee high quality standard for fuels, namely, ENplus®, as well as the latest edition in the certification for sustainable bioenergy: SURE.

Networks

Bioenergy Europe is the umbrella organisation of both the European Pellet Council (EPC) and the International Biomass Torrefaction Council (IBTC). These networks have been created thanks to the dynamics of Bioenergy

EUROPEAN PELLET COUNCIL
A NETWORK OF BIOENERGY EUROPE

INTERNATIONAL BIOMASS TORREFACTION COUNCIL
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Europe members. Today, these networks bring together bioenergy experts and company representatives from all over Europe and beyond.

The European Pellet Council (EPC), founded in 2010, represents the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from over 17 countries.

EPC is a platform for the pellet sector to discuss issues relating to the transition from a niche product to a major energy commodity. Issues include the standardisation and certification of pellet quality, safety, security of supply, education and training, and the quality of pellet-using devices. EPC manages the ENplus® quality certification.

Launched in 2012, the International Biomass Torrefaction Council (IBTC), aims to build the first platform for companies that have common interests in the development of torrefied Biomass markets. Currently, the IBTC initiative is supported by more than 20 companies worldwide.

IBTC's objective is to promote the use of torrefied biomass as an energy carrier and to assist the development of the torrefaction industry. In this respect, IBTC's key activities are to undertake studies or projects, and to commonly voice its members' concerns to third parties to help to overcome barriers of market deployment.

For further information on Bioenergy Europe's Networks & Certification Schemes visit www.bioenergyeurope.org

OUR
MEMBERS*

As the common voice of the bioenergy sector, Bioenergy Europe, aims to develop a sustainable bioenergy market based on fair business conditions and does so by bringing together national associations and companies from all over Europe – thus representing more than 4000 indirect members, including companies and research centres.

Associations

Academia

*Members as of November 2022

Companies

ENHANCED VISIBILITY & SPONSORSHIP OPPORTUNITIES

Enhanced Visibility

(Exclusive to Bioenergy Europe Members)

This opportunity entails a free of charge promotion for Bioenergy Europe members only. This offer includes the chance to display your organisation's logo as well as a featured 100-word description, placed in 1 of the 7 annual statistical reports of your choice.

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You can find more information in regard to the sponsorship on our website or get in touch with our Team at info@bioenergyeurope.org

*Bioenergy Europe Members receive a 50% discount on this sponsorship package

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- Minor Elements (Trace)
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- Biomass content
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- Particle size distribution
- Ash melting behavior (AFT's)
- DNA (Rice husk)

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- Draft survey
- Hold inspection
- Cargo superintendence
- Stockpile survey
- Volumetric assessments
- Bias testing
- Mechanical Sampling System (MSS) design and installation
- Fumigation
- Gas free

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- Chain of custody certification (CoC)
- ENplus® certification
- ISCC Plus
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SUSTAINABLE RESOURCES Verification Scheme (SURE) is a voluntary certification scheme that aims at ensuring the sustainable and responsible use of biomass within the energy sector. SURE's set of criteria is in accordance with the principles of the European Energy Directive (RED II) and enables all economic operators within the bioenergy sector to demonstrate compliance with RED II requirements.

Interested to learn more? Visit our website:
www.sure-system.eu

HAWKINS WRIGHT

Hawkins Wright Ltd. is a privately-owned consulting company headquartered in London, UK. With 40 years of experience, we are a trusted source of information for international pulp, paper and biomass industries. Hawkins Wright provides a range of market intelligence and analytical services to the biomass and bioenergy industries. These services include private consultancy assignments covering a full range of marketing and strategic subjects as well as regular multi-client reports and newsletters. Our expertise covers the entire biomass supply chain, from forest resources, to logistics, pellet production, contracting and biomass power plant development.

https://www.hawkinswright.com/biomass

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At Yemmak, we produce machines tailored to your needs and build turnkey factories as Turkey's largest manufacturer since 1965. Leveraging our strength as the first feed machine manufacturer in the Turkish private sector, we create solutions for a variety of industries such as Feed (Poultry, Ruminant, Pet Food, Aquatic, Flake), Biomass, Rendering, Chemical, Material Handling and Storage. We provide services for project consulting and engineering, special-purpose projects, automation, modernization, steel construction and after-sales support with a 300-strong staff of leaded by specialist engineers. We export more than 70 percent of our production to four continents.

www.yemmak.com

EN*plus*® is the world-leading quality certification scheme for wood pellets that systematically certifies the entire supply chain, from the early stages of production to the delivery process. The EN*plus*® requirements go beyond those of the international standard ISO 17225-2 to guarantee optimum efficiency. In addition, all actors along the supply chain follow detailed guidelines to ensure consistent quality. In more than ten years of existence, the EN*plus*® scheme has certified more than 1200 companies in 47 countries and has become a widely recognized brand trusted by professionals and consumers alike.

https://enplus-pellets.eu/

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BIOenergy EUROPE

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www.aielenergia.it

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CPM Europe is a globally trusted supplier of premium biomass grinding, pelleting and briquetting systems and solutions. We are a preferred supplier of equipment to a continuously growing number of customers in Europe, America and Asia. When matched together with a global sales and service network there is no better partner for your biomass grinding and pelleting needs worldwide.

www.cpmeurope.nl

ANDRITZ

The materials involved in biomass, biofuel, and waste pelleting are some of the harshest and most challenging to pelletize. Because of this, annual expenses related to consumable parts are approximately 77% higher for bio and waste producers than any other pelleting industry.

ANDRITZ process experts go the extra mile every day to provide the most durable, efficient, and cost-effective technology, maintenance plans, and spare and wear parts programs - allowing for the production of high-quality pellets capable of meeting the most rigorous certification standards and ultimately contributing to a greener European economy.

www.andritz.com/feed-and-biofuel-en/industries/biomass-pelleting

CENER

NATIONAL RENEWABLE ENERGY CENTRE

ADItech

CENER (National Renewable Energy Centre of Spain) operates the Pre-treatment Unit integrated in its Biorefinery and Bioenergy Centre (BIO2C) for production of batches of pre-treated biomass. It consists of a pilot plant with a production capacity of 150-350 kg/h including chipping, chopping, drying, torrefaction, and pelletization. The Torrefaction Unit consists of an indirectly heated cylindrical reactor using thermal fuid at temperatures between 220 and 300 °C to convert raw biomass into thermally treated product. The pilot plant is very fexible regarding bulk density and particle size, being able to process difficult fuels with very low bulk density and very high fines content.

www.bio2c.es

BioEnergy EUROPE

0 Methodology and disclaimer

All the data that is presented in this report comes from multiple sources, indicated below each table and figure. Wherever possible, this data has been sourced from contributors who are active and relevant in the pellet industry in their respective countries. This data collection method allows for accurate information at the national level, but is dependent on the participation of our contacts. In the absence of participation, the consolidated data for 2020 is replicated for 2021, but this is indicated where appropriate.

For pellet trading data, only one source was used this year: the United Nations trading data site, UNcomtrade.

A particularly important point for this report is the absence of Russia, Ukraine and Belarus in the "Other Europe" aggregates. Indeed, the current geopolitical situation has not allowed us to collect data in these countries for 2021. In order to keep growth rates plausible, data for these 3 countries have also been deducted from the totals for previous years. However, the most recent data (2020) for these three countries can be found at the bottom of the detailed tables (but are not counted in the aggregates for the reason given above). Depending on how the situation will evolve in the future, the next year's aggregates for 2021 might be different than this same data for this year. Additionally, Russia is still displayed in the trade section because of its position as an exporter towards the rest of Europe in 2021 (Table 15).

1 Overview of World Pellet Sector

As was the case in the previous edition of this report, world pellet production is steadily increasing. Indeed, the year 2021 reveals a global production that is approximately 6,8% higher than in 2020. The countries with the greatest production growth are Lithuania, Poland and Canada, all of which are characterised by an increase of approximately 500.000 tonnes, while their relative growth rates as compared to 2020 are 32%, 38% and 15% respectively.

1.1 World pellet production

In 2021, the **EU27** saw once again its total pellet production increase significantly, i.e. by about 9%. This relative increase corresponds to an absolute increase of 1.636.119 tonnes. Within the **EU27**, Germany remains by far the largest producer, with 3.355.000 tonnes, well ahead of the second largest producer in the Union, Latvia, with 2.108.400 tonnes. When looking at the world's top producers, 7 of the top 10 countries are from the EU. Besides Germany and Latvia, countries such as Sweden, France, Poland, Austria and Estonia are among the biggest producers worldwide.

The **rest of Europe** (outside the EU27) also saw a significant increase of around 15% between 2020 and 2021, corresponding to an absolute increase of around 200.000 tonnes. This figure may seem relatively low, but this is due to the absence of Russia, Belarus and Ukraine from the data in this edition of the report.

North American production between 2020 and 2021 increased by about 4%, which represents an absolute increase of just over 500.000 tonnes. An important point to note is that this increase is almost exclusively due to production growth in Canada, where production increased by 15% or 490.000 tonnes. As for the other country included in this aggregate, the USA, its production only increased slightly by less than 1%. However, the US still leads the global production of pellets, with approximately 9,3 million tonnes produced in 2021.

South American collected data is unfortunately limited to Brazil and Chile, but these are the two largest South American pellet producers. Thus, the conclusions drawn under the aggregate of South America must take this into account. Regrettably, no contribution could be obtained from Chile this year. As compared to the 2020 production, the 2021 production is 17% greater, which corresponds to an absolute increase of 190.000 tonnes, but this increase is exclusively due to an increase in Brazilian production. Due to the lack of reported data, it is likely that the South American increase in production is greater than 17%.

As far as **Oceania** is concerned, unfortunately it is not possible to confirm the planned increase in production capacity in Australia, as announced last year, since no contribution was received from them this year. The data is therefore replicated from 2020. We can, however, note an increase in actual production in New Zealand even though the number of production sites remained constant.

Production in **Asia** (mainly Southeast Asia + Japan, South Korea and China) cannot be accurately calculated due to difficulties in obtaining data. Thus, 2021 production is similar to 2020 production. However, as consumption on the continent increased by about 33% between 2020 and 2021, it is likely that production also increased.

In this report, no data is displayed for **China** due to uncertainty surrounding the Chinese pellet market. The size of the country, and the fact that its market comprises mainly of small producers, generates difficulties in obtaining accurate statistics. Moreover, there is ambiguity about the type of pellet that is being produced in China (whether wood pellets or agropellets). In any case, the Chinese market appears to be exclusively local (nearly no imports or exports) which has almost no impact on the global supply and demand.

Africa currently remains an untapped market for pellets. Although the continent is a big wood supplier, the pellet industry is not very developed. Nevertheless, investment in producing wood pellets in Africa (Mainly South Africa and Gabon) has recently led to a significant increase in pellet production which will be shown in the coming years.

Chilean Biomass Association (AChBIOM)

EXPERT COMMENT

Since several years now, the Chilean pellet market has entered a very dynamic phase. Demand for pellets for the last 3 years has increased by an average rate of about 20%. The current production capacity is about 400.000 tons/year and production in 2022 is expected to reach about 200.000 tons/year – with a reduction of around 10% compared to the 2021 levels. The Chilean pellet market is mostly driven by domestic consumption which represents around 90% of the production. Investments for new production capacity are expected to materialize in 2023, and next year's output is expected to reach 370,000.

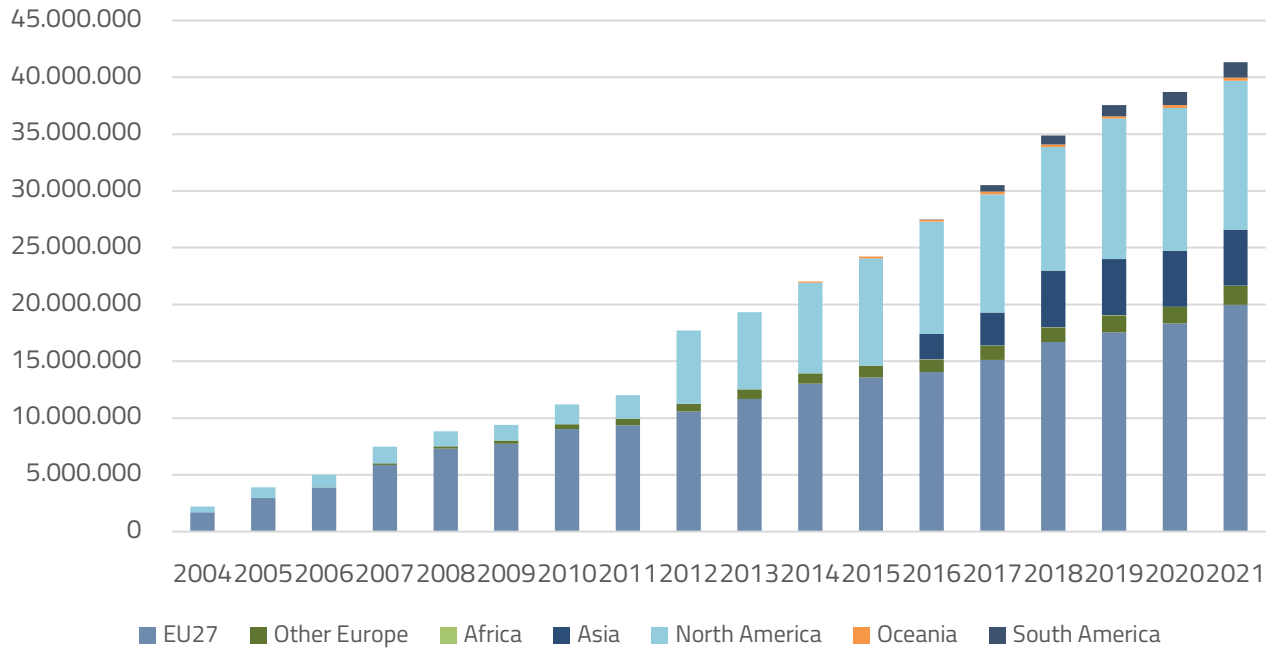
Even though bioenergy is the second largest energy source in Chile (about 25% of primary energy supply comes from biomass, very close to petroleum), it is only recently that, after decades of procrastination, the parliament has approved the law that recognizes solid biofuels as fuels. This is good news for the Chilean bioenergy market and will open new opportunities, but also create new challenges.

In the past months, the Chilean pellet market has also experienced stresses and market tightness. Several factors are responsible: increases in the prices of natural gas - and therefore of electricity – between June 2021-2022, reduction in lumber production and increased used for wood as a co-firing fuel in power plants. On a positive note, this has promoted increased collaboration between market actors and a multisector work group composed by government ministries, companies, financial institutions, and associations among others. All these stakeholders started working together to prevent this situation from happening again in the future, as well as address any other relevant challenges defined.

In 2021, a network called "Red Futuro Madera" (www.futuromadera.cl) was established, bringing together associations from different sectors of the forest value chain: pulp & paper, timber, boards, bio packaging, natural forest; forestry services companies and bioenergy. The network aims to transmit information to the general public, authorities, NGOs and companies about the potential of the forestry sector to develop a circular bioeconomy model through multiple natural based solutions, allowing massive and multisectoral actions related to increase the number and impact of ESG initiatives.

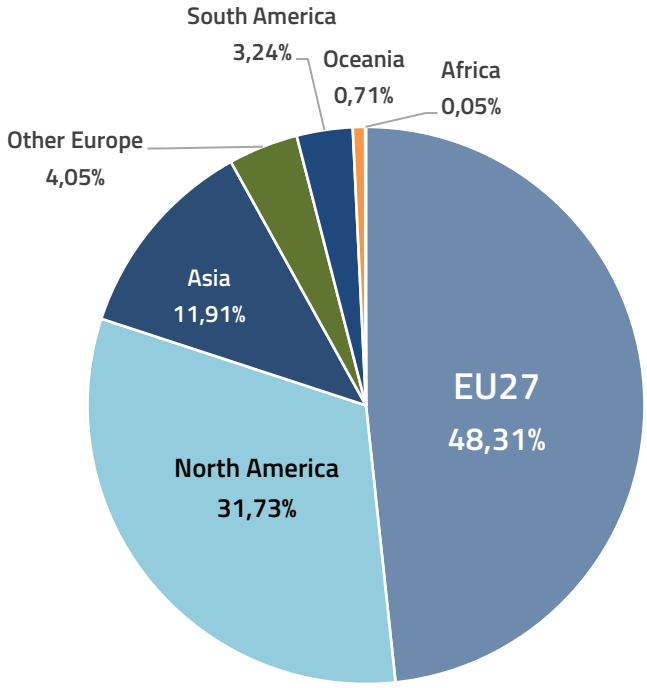
Rodrido O'Ryan Blaitt
President of AChBIOM

Figure 1 Evolution of global pellet production (tonnes)



Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, EG have their production data replicated from 2020.
Source: EPC survey 2022; FAO; Bioenergy International

Figure 2 Distribution of the world pellet production in 2021 (%)



Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, EG have their production data replicated from 2020.
Source: EPC survey 2022; FAO; Bioenergy International

Table 1 Evolution of pellet production in the world by region (tonnes)

	2016	2017	2018	2019	2020	2021	Growth (2020-2021)
EU27	14.032.689	15.106.568	16.703.841	17.546.956	18.327.099	19.963.218	**9%**
Other Europe	1.104.148	1.244.890	1.258.654	1.474.551	1.457.736	1.674.981	**15%**
North America	9.900.000	10.400.000	10.900.000	12.371.845	12.583.039	13.112.984	**4%**
South America	30.000	548.900	801.000	971.000	1.151.000	1.341.000	**17%**
Asia	2.231.000	2.926.000	4.985.000	4.935.400	4.920.000	4.920.000	**N/A**
Oceania	160.000	250.000	205.000	220.000	245.000	295.000	**20%**
Africa	25.000	25.000	25.000	28.000	19.000	19.000	**N/A**
World	27.482.837	30.501.358	34.878.495	37.547.752	38.702.874	41.326.183	**7%**

Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, ES have their production data replicated from 2020.
Source: EPC survey 2022, FAO, Bioenergy International

Figure 3 Evolution of pellet production of the TOP 10 producing countries in 2021 (tonnes)

(a) Top 3 producing countries

(b) Remaining 7 countries in the top 10

Note: SE, VN have their production data replicated from 2020.
Source: EPC survey 2022, FAO, Bioenergy International

Figure 4 Growth in pellet production by country between 2020-2021 (tonnes and %)

(a) Top 3 countries of absolute growth in pellet production

(b) Rest of the world

Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, ES have their production data replicated from 2020.
Source: EPC survey 2022, FAO, Bioenergy International

Table 1 World pellet production in 2020 and 2021

	2020			2021		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	753	24.162.000	18.327.099	774	25.662.140	19.963.218
Other Europe	168	1.793.939	1.457.736	181	1.951.174	1.674.981
Total Europe	921	25.955.939	19.784.835	955	27.613.314	21.638.199
North America	130	17.022.814	12.583.039	127	18.022.469	13.112.984
South America	47	1.597.126	1.151.000	49	1.697.126	1.341.000
Asia	82	7.029.000	4.920.000	82	7.029.000	4.920.000
Oceania	13	530.000	245.000	13	530.000	295.000
Africa	4	50.000	19.000	4	50.000	19.000
Total	1.197	52.184.879	38.702.874	1.230	54.941.909	41.326.183

Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, ES have their production data replicated from 2020.
Source: EPC survey 2022, FAO, Bioenergy International

Table 3 Detailed world pellet production by country in 2020 and 2021

	2020			2021		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	**753**	**24.162.000**	**18.327.099**	**774**	**25.662.140**	**19.963.218**
AT	41	1.745.000	1.500.000	41	1.817.000	1.607.500
BE	12	820.000	740.000	12	850.000	820.000
BG	63	320.000	171.800	65	324.000	172.700
CY	0	0	0	0	0	0
CZ	37	560.000	486.000	41	650.000	526.000
DE	56	3.400.000	3.101.000	57	3.675.000	3.355.000
DK	3	300.000	116.000	3	300.000	140.000
EE	23	1.612.000	1.426.320	23	1.689.000	1.500.000
EL*	25	140.000	44.000	25	140.000	44.000
ES	85	2.040.000	616.000	75	1.984.800	641.710
FI	26	630.000	322.000	26	630.000	365.000
FR	55	2.100.000	1.700.000	58	2.300.000	1.800.000
HR*	18	350.000	270.000	18	350.000	270.000
HU	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IE*	1	40.000	27.500	1	40.000	27.500
IT	31	420.000	380.000	35	420.000	420.000
LT	23	575.000	440.000	23	575.000	450.000
LU*	1	50.000	42.479	1	50.000	42.479
LV	28	2.000.000	1.600.000	29	2.319.240	2.108.400
MT	0	0	0	0	0	0
NL*	4	350.000	290.000	4	350.000	290.000
PL	70	1.600.000	1.300.000	90	2.100.000	1.800.000
PT	28	1.530.000	850.000	25	1.508.100	758.929
RO	20	900.000	700.000	20	900.000	600.000
SE*	64	2.300.000	1.900.000	64	2.300.000	1.900.000
SI*	22	160.000	134.000	22	160.000	134.000
SK	17	240.000	170.000	16	230.000	210.000
Other Europe	**168**	**1.793.939**	**1.457.736**	**181**	**1.851.174**	**1.674.981**
AL	14	90.000	64.000	16	120.000	90.000
BA	38	420.000	340.000	41	430.000	403.000
CH	24	300.000	270.000	25	340.000	324.000
ME	10	110.000	80.000	12	142.000	101.200

NO	0	0	0	0	0	0
RS	76	560.000	439.924	80	570.000	470.438
UK	6	333.939	263.812	7	349.174	286.323
North America	130	17.022.814	12.583.039	127	18.022.469	13.112.984
CA	47	4.653.000	3.310.000	47	5.054.000	3.800.000
US	83	12.369.814	9.273.039	80	12.968.469	9.312.984
South America	47	1.597.126	1.151.000	48	1.697.126	1.341.000
BR	27	1.400.000	1.030.000	29	1.500.000	1.220.000
CL*	20	197.126	121.000	20	197.126	121.000
Asia	82	7.029.000	4.920.000	82	7.029.000	4.920.000
ID*	8	682.000	340.000	8	682.000	340.000
JP*	6	138.000	125.000	6	138.000	125.000
KR*	15	802.000	240.000	15	802.000	240.000
MY*	22	1.045.000	795.000	22	1.045.000	795.000
TH*	16	862.000	317.000	16	862.000	317.000
VN*	15	3.500.000	3.100.000	15	3.500.000	3.100.000
Oceania	13	530.000	240.000	13	530.000	295.000
AU*	9	335.000	135.000	9	335.000	135.000
NZ	4	195.000	110.000	4	195.000	160.000
Africa	4	50.000	19.000	4	50.000	19.000
EG*	4	50.000	19.000	4	50.000	19.000
World	1.197	52.184.879	38.702.874	1.230	54.941.909	41.326.183
BY	31	621.000	446.000	N.A.	N.A.	N.A.
RU	300	2.500.000	2.200.000	N.A.	N.A.	N.A.
UA	22	545.000	519.000	N.A.	N.A.	N.A.

Note: Countries with an * have their 2021 data replicated from 2020. BY, RU, UA data provided for information purposes only, it is not included in the aggregates nor the graphs.
Source: EPC survey 2022, FAO, Bioenergy International

1.1.1 Global pellet production future estimation

Globally, there is still significant room for further expansion of sustainable pellet production, provided that some barriers are overcome (investment, logistics, etc.). Unfortunately, data on the overall potential of pellet production is only available for a few areas.

Africa: For 2021's report, Egypt has been included while most of the other African countries have no consolidated data currently available. Africa remains a continent with great potential and, despite 2020's announcement of investment in pellet producing plants, Africa remains at the beginning of its pellet journey. Regardless, Africa is currently the continent with the largest share of bioenergy in its final energy mix – albeit with a majority of biomass being used in the form of firewood or charcoal which is unsustainably produced and used with limited efficiency. According to the FAO, production of firewood and charcoal contributed to the deforestation observed between 2010 and 2020. The ability to increase both sustainable production and efficient use of biomass means there is massive potential for pellet production on the continent.

Recent investments in the production of wood pellets in Africa (including South Africa and Gabon) have led to a significant expected increase in African pellet production for 2021, but unfortunately, due to data production and collection issues, there is none to demonstrate the expected outcome. If development of the pellet market in Africa is to continue, many barriers (mainly logistics and product quality) will need to be overcome first.

Europe: see section "European pellet production future estimation"

North America – US: pellet production can sustainably expand by at least 20 million tonnes per year if the pulp and paper industry remains on the current declining trajectory.

South America – Brazil: Brazil has tremendous potential to produce large quantities of wood pellets. Indeed, according to IBGE (Brazilian Institute of Geography and Statistics), there is great potential for the use of forest residues from the Brazilian forest sector (extraction and silviculture) to produce pellets. In 2019, the generation of waste from the forest value chain in Brazil was equivalent to over 85 million cubic meters (85.514.484,76 m^3). Another area in which Brazil could increase its production is agropellets, mainly from sugarcane bagasse. According to the latest data, the number of production sites for non-woody pellets has dropped from 3 to 1, which drastically reduced production (from 252.000 tonnes to 150.000).

2 World pellet consumption

Worldwide, pellet consumption has been growing considerably for several years. Between 2020 and 2021, consumption increased by 16%, which represents approximately 6,5 million tonnes. Besides the global increase, it is important to note that all regions of the world for which there was new data (all regions except Africa and Oceania) have seen an increase in consumption (see Table 4). While the degree of this growth has varied, the largest growth was experienced in Asia and EU27.

The **EU27** remains the largest pellet consumer globally and in 2021 consumed 24,5 million tonnes. The increase from 2020's consumption of 20,6 million tonnes marks one of the biggest increases in consumption ever recorded. The increase of 3,9 million tonnes corresponds to approximately 18%. As was the case last year, one of the biggest drivers of this growth was increased consumption in the Netherlands (+40%, or 940.000 tonnes), mainly for industrial purposes (power generation). Many other countries also recorded strong growth, including Denmark (+25%, nearly 700.000 tonnes), Germany (+29%, 660.000 tonnes) and France (+23%, 530.000 tonnes). In terms of relative growth, the most striking increase is Poland, where consumption increased by 76%. This is mostly due to government incentives for residential users (like the Clean Air Programme) which doubled residential consumption (from 350.000 to 700.000 tonnes).

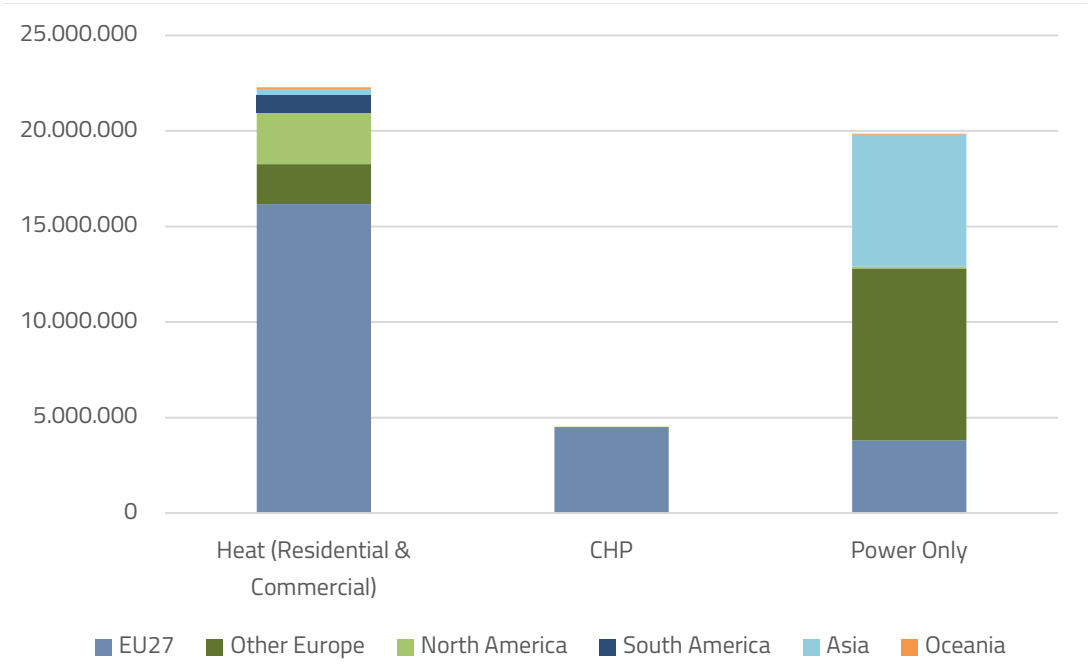
European countries outside of the EU27 also displayed steady growth in consumption (+6%), mostly driven by an increase in residential consumption, except for the UK where industrial consumption is the biggest driver (+300.000 tonnes).

In **North America**, pellet consumption has remained stable in recent years despite various initiatives to expand the market in both the US and Canada.

In **South America**, the forecast on the use of pellets, mostly for residential and mid-scale heat production, is more growth, even if the continent is likely to become the next big exporting hub. In Brazil, there is good potential for pellet consumption in both commercial and industrial applications.

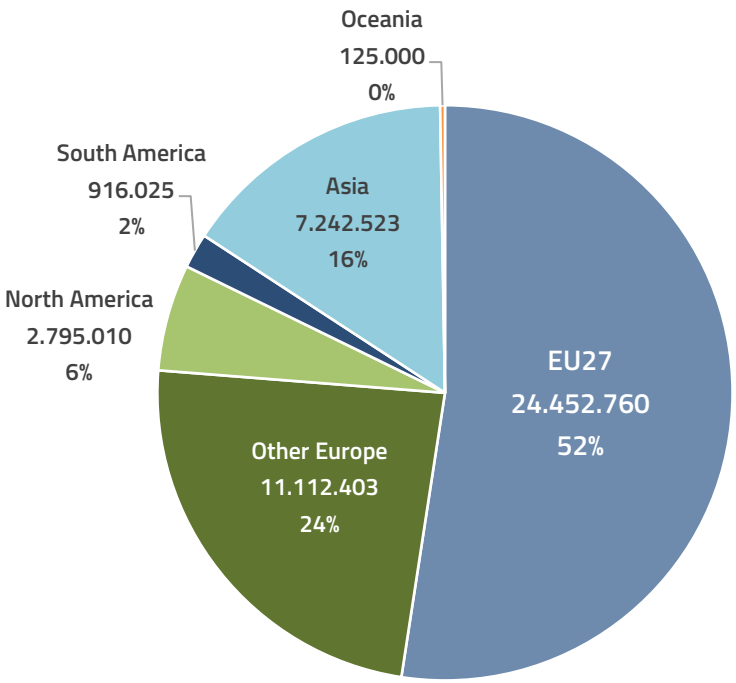
Pellet consumption in **Asia** is concentrated in two countries: South Korea and Japan. Both of these two industrial pellet users experienced substantial growth in consumption, with some of the highest growth rates in the world. Japan experienced a staggering 50% growth, corresponding to more than 1 million tonne of additional consumption in the power sector. South Korea showed an impressive 21% increase, second only to Japan and the Netherlands, translating into 700.000 additional tonnes, in the industrial sector.

Figure 5 World pellet consumption in 2021 by type of end-use (tonnes)



Note: LV, PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ. Power Only consumption is from 2020.
Source: EPC survey 2022; Hawkins Wright

Figure 6 Distribution of world pellet consumption in 2021 (tonnes and %)



Note: LV, PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ. Power Only consumption is from 2020.
Source: EPC survey 2022; Hawkins Wright

Figure 7 World pellet consumption by type of end use in 2021 (tonnes and %)

Note: Lit. PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, Lit. PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ. Power Only consumption is from 2020.
Source: EPC survey 2022, Hawkins Wright

Table 4 Evolution of pellet consumption in the world by region (tonnes)

	2016	2017	2018	2019	2020	2021	Growth 2020-2021
EU27	14.501.741	16.372.491	17.641.138	18.591.534	20.696.681	24.452.760	18%
Other Europe	7.569.389	8.342.727	9.426.996	10.152.682	10.515.340	11.112.403	6%
Total Europe	22.071.130	24.715.218	27.068.134	28.744.216	31.212.021	35.565.163	14%
North America	335.000	350.000	380.010	2.669.010	2.705.010	2.795.010	3%
South America	N.A.	N.A.	336.000	527.826	682.025	916.025	34%
Asia	346.860	506.353	1.059.542	5.040.000	5.454.230	7.242.523	33%
Oceania	N.A.	N.A.	N.A.	30.000	125.000	125.000	N.A.
Total	22.752.990	25.571.571	28.843.686	37.091.052	40.178.286	46.643.721	16%

Note: Lit. PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, Lit. PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ. Power Only consumption is from 2020.
Source: EPC survey 2022, Hawkins Wright

Figure 8 Top 10 pellet consuming countries by end-use in 2021 (tonnes)

Note: US, JP, KR residential consumption is from 2020. FR, US commercial consumption is from 2020.
Source: EPC survey 2022, Hawkins Wright

Figure 9 Growth in pellet consumption by country between 2020- 2021 (tonnes and %)

(a) Top 3 countries in absolute terms

(b) All countries with available data excluding the top 3

Note: LV, PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ Power Only consumption is from 2020.
Source: EPC survey 2022; Hawkins Wright

Figure 10 World industrial pellet consumption by country in 2021 (tonnes)

BE, SI, CA CHP consumption is from 2020. CA, NZ Power Only consumption is from 2020.
Source: EPC survey 2022; Hawkins Wright

Figure 11 Evolution of industrial pellet consumption in top 5 countries in the world (tonnes)

Source: EPC survey 2022, Hawkins Wright

Table 5 Detailled world pellet consumption by aggregates in 2020 and 2021 (tonnes)

	2020					2021				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU27	10.623.758	2.921.223	3.720.000	3.131.700	20.696.681	12.862.993	3.312.267	4.477.500	3.800.000	24.452.760
Other Europe	1.017.881	775.107	22.352	8.700.000	10.515.340	1.244.717	845.103	22.583	9.000.000	11.112.403
Total Europe	11.941.639	3.696.330	3.742.352	11.831.700	31.212.021	14.107.709	4.157.370	4.500.083	12.800.000	35.565.163
North America	2.520.000	90.000	10	95.000	2.705.010	2.605.000	95.000	10	95.000	2.795.010
South America	183.762	498.263	N.A.	N.A.	682.025	187.762	688.263	N.A.	N.A.	876.025
Asia	326.000	N.A.	N.A.	5.128.230	5.454.230	326.000	N.A.	N.A.	6.916.523	7.242.523
Oceania	35.000	40.000	N.A.	50.000	125.000	35.000	40.000	N.A.	50.000	125.000
Africa	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Total	15.006.401	4.324.593	3.742.362	17.104.930	40.176.286	17.271.471	5.010.633	4.500.093	19.861.523	46.643.721

Note: LV, PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020. FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is from 2020. BE, PL, SI, CA CHP consumption is from 2020. PT, CA, NZ Power Only consumption is from 2020.Source: EPC survey 2022, Hawkins Wright

Table 6 Detailed world pellet consumption by country in 2020 and 2021 (tonnes)

	2020					2021				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU27	10.923.758	2.921.223	3.720.000	3.131.700	20.696.681	12.862.993	3.312.267	4.477.500	3.800.000	24.452.760
AT	840.000	160.000	0	0	1.000.000	980.000	210.000	0	0	1.190.000
BE	427.859	10.866	20.000	980.000	1.438.725	332.500	31.667	20.000	750.000	1.134.167
BG	185.485	1.823	N.A.	N.A.	187.308	240.446	3.117	N.A.	N.A.	243.563
CY	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CZ	110.000	40.000	N.A.	N.A.	150.000	116.000	44.000	N.A.	N.A.	162.000
DE	1.690.000	480.000	70.000	0	2.240.000	2.245.000	562.500	72.500	0	2.900.000
DK	863.000	152.000	1.710.000	N.A.	2.725.000	804.765	150.644	2.450.000	N.A.	3.405.408
EE	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
EL	80.000	20.000	N.A.	N.A.	100.000	85.000	25.000	N.A.	N.A.	110.000
ES	456.000	245.000	0	1.700	704.700	520.000	260.000	0	0	780.000
FI	49.000	367.000	275.000	0	691.000	61.000	457.000	260.000	0	778.000
FR	1.790.000	210.000	300.000	0	2.300.000	2.190.000	210.000	430.000	0	2.830.000
HR	25.000	15.000	N.A.	N.A.	40.000	28.000	18.000	N.A.	N.A.	46.000
HU	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IE	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IT	2.964.667	168.437	N.A.	N.A.	3.133.104	3.173.186	178.547	N.A.	N.A.	3.351.733
LT	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
LU	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
LV	140.000	17.000	0	0	157.000	140.000	17.000	0	0	157.000
MT	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
NL	80.000	160.000	0	2.100.000	2.340.000	100.000	180.000	0	3.000.000	3.280.000
PL	350.000	70.000	30.000	50.000	500.000	700.000	100.000	30.000	50.000	880.000
PT	170.000	160.000	0	N.A.	330.000	170.000	160.000	0	N.A.	330.000
RO	N.A.	N.A.	N.A.	N.A.	N.A.	250.000	20.000	0	N.A.	270.000
SE	556.747	575.097	1.300.000	N.A.	2.431.844	557.096	595.793	1.200.000	N.A.	2.352.889
SI	90.000	37.000	15.000	N.A.	150.000	120.000	37.000	15.000	N.A.	172.000
SK	48.000	32.000	0	0	78.000	48.000	32.000	0	0	80.000

Other Europe	1.017.861	775.107	22.352	8.700.000	10.515.340	1.244.717	845.103	22.583	9.000.000	11.112.403
AL	55.000	5.000	0	0	60.000	68.000	7.000	0	0	75.000
BA	230.000	42.000	0	0	272.000	285.500	53.000	0	0	338.500
CH	227.500	122.500	0	0	350.000	250.000	168.000	0	0	418.000
ME	27.000	4.000	0	0	31.000	35.770	4.905	0	0	40.675
NO	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
RS	344.268	13.000	0	0	357.268	469.946	17.500	0	0	487.446
UK	134.113	588.607	22.352	8.700.000	9.445.072	135.501	594.698	22.583	9.000.000	9.752.782
North America	2.520.000	90.000	10	95.000	2.705.010	2.605.000	95.000	10	95.000	2.795.010
CA	225.000	40.000	10	95.000	360.010	310.000	45.000	10	95.000	450.010
US	2.295.000	50.000	N.A.	N.A.	2.345.000	2.295.000	50.000	N.A.	N.A.	2.345.000
South America	183.762	498.263	0	0	682.025	197.762	718.263	0	0	916.025
BR	36.000	480.000	0	0	516.000	50.000	700.000	0	0	750.000
CL	147.762	18.263	N.A.	N.A.	166.025	147.762	18.263	N.A.	N.A.	166.025
Asia	326.000	N.A.	N.A.	5.128.230	5.454.230	326.000	N.A.	N.A.	6.916.523	7.242.523
ID	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
JP	136.000	N.A.	N.A.	2.028.230	2.164.230	136.000	N.A.	N.A.	3.116.523	3.252.523
KR	190.000	N.A.	N.A.	3.100.000	3.290.000	190.000	N.A.	N.A.	3.800.000	3.990.000
MY	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
TH	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
VN	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Oceania	35.000	40.000	N.A.	50.000	125.000	35.000	40.000	N.A.	50.000	125.000
AU	15.000	0	N.A.	0	15.000	15.000	0	N.A.	0	15.000
NZ	20.000	40.000	N.A.	50.000	110.000	20.000	40.000	N.A.	50.000	110.000
Africa	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
EG	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
World	15.006.401	4.324.593	3.742.362	17.104.930	40.178.286	17.271.471	5.010.633	4.500.093	19.861.523	46.643.721
BY	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
RU	50.000	27.000	33.000	N.A.	110.000	N.A.	N.A.	N.A.	N.A.	N.A.
UA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note: LV, PT, US, CL, JP, KR, AU, NZ residential consumption is replicated from 2020. FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is replicated from 2020. BE, PL, SI, CA CHP consumption is replicated from 2020. PT, CA, NZ Power Only consumption is replicated from 2020. BY, RU, UA data provided for information purposes only, it is not included in the aggregates nor the graphs. Source: EPC survey 2022, Hawkins Wright

2.1 World pellet trade

As was the case last year, **Europe** and **Asia** are net importers of pellets. Indeed, in 2021, pellet consumption exceeded production by 4,5 million tonnes in the **EU27**, 9,4 million tonnes in the **rest of Europe** and 2,3 million tonnes in **Asia**. The gap between consumption and production is widening in Asia, mainly due to an increase in industrial consumption in both Japan and South Korea.

The majority of **EU27** pellet imports in 2021 came from the US, Canada and Russia. However, the current geopolitical context is having a huge impact on imports from Russia, due to sanctions imposed by the EU in July 2022. This situation is responsible for great tension on the European market in 2022, as it is now necessary for trade partners to find alternatives to the several million tonnes of Russian pellets that were previously circulating in the EU in 2021 (Displayed in Table 16).

Imports from **other European countries** (outside the EU) are mainly driven by industrial consumption in the **UK** for electricity generation, which accounts for the majority of imports. The bulk of these pellets comes **from North America (USA and Canada)**.

Looking in more detail at **Asia**, we see that its imports are mainly due to **Japan** and **South Korea**. As compared to 2020, production levels have remained the same (around 5 million tonnes produced in Asia) while consumption has increased by almost 2 million tonnes (from 5,5 to 7,2 million), mainly for power generation. As far as **Japan** is concerned, the main trading partners for imports are **Vietnam**, the **United States** and **Malaysia**. **South Korea** also imports from **Vietnam** and **Malaysia**, but trades preferentially with **Canada** rather than with the United States.

The biggest exporting areas, namely **North America** (US and Canada) and **Southeast Asia** (Vietnam, Malaysia, Thailand, Indonesia) and **Russia**, are witnessing very limited growth in local consumption and are unlikely to see their status as net exporters change in the near future. However, following the sanctions imposed on Russia after its invasion of Ukraine, Russia's status as an exporting region will drastically change; the full impact of this change; however, will only be illustrated in the next edition of the report which will cover data from the year 2022.

Figure 12 World pellet map of production and consumption in 2020 and 2021 (million tonnes)

Note: EL, HR, IE, LU, NL, SE, SI, CL, ID, JP, KR, MY, TH, VN, AU, EG production is from 2020; LV, PT, US, CL, JP, KR, AU, NZ residential consumption is from 2020; FR, LV, PT, SI, SK, US, CL, NZ commercial consumption is from 2020; BE, PL, SI, CA CHP consumption is from 2020; PT, CA, NZ Power Only consumption is from 2020.
Source: EPC Survey 2022; Hawkins Wright

3 Situation in Europe

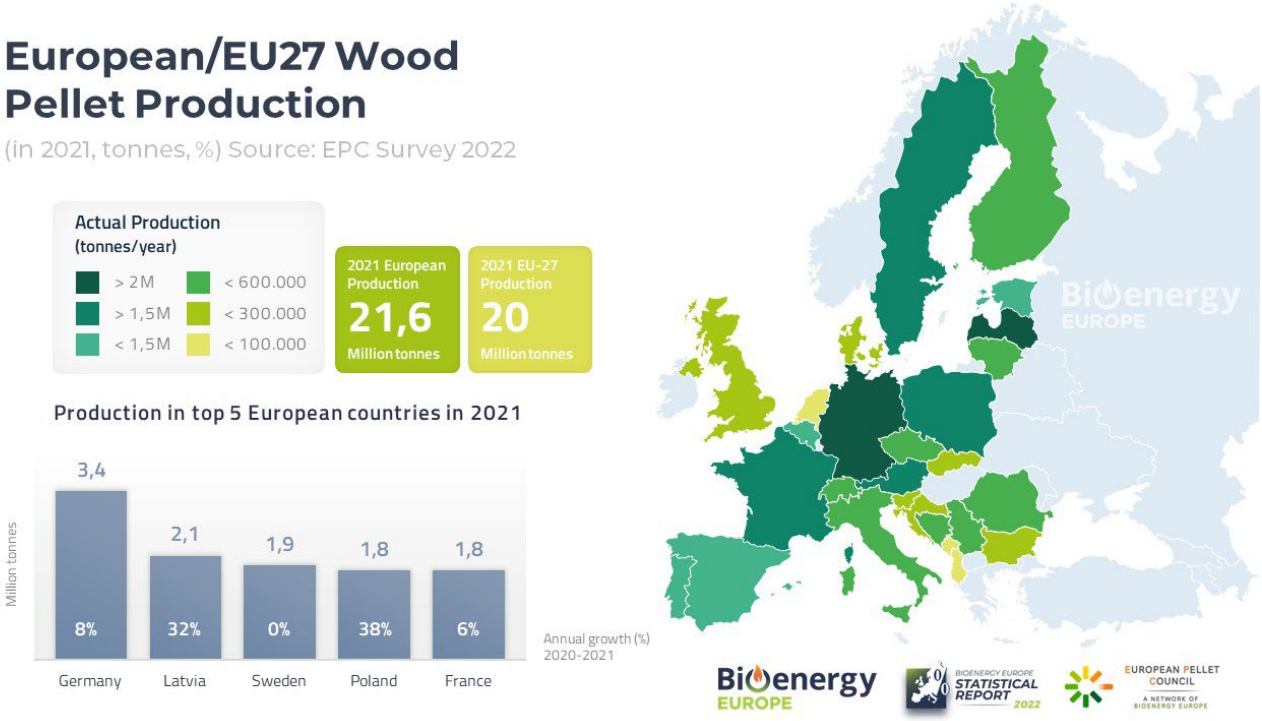
3.1 European pellet production

As compared to 2020, total production capacity in the **EU27** increased by 6,2% – from 24,1 million tonnes to 25,6 million tonnes. This increase in production capacity is due to the net opening of 21 new production sites, from 753 in 2020 to 774 locations in 2021. Actual production increased by 8,9% – from 18,3 million tonnes to almost 20 million tonnes.

The other European countries ("**Other Europe**", excluding the EU27) saw their production capacity increase by 8,7% between 2020 and 2021, with their actual production increasing by almost 15%. This increase is evenly distributed between all the countries in this aggregate.

Although not yet reflected in the data presented in the report (2021), the Russian invasion of Ukraine has severely disrupted the pellet market in Europe, and most countries are currently developing new strategies to increase production in an effort to make up for the pellets no longer available from Russia, Ukraine and Belarus. In addition, the consequences of the invasion on fossil fuel prices are increasingly being felt, especially in countries with a high proportion of Russian gas in their energy mix.

Figure 13 Map of European pellet production in 2021



Note: HR, NL, SE, SI have their production data replicated from 2020.
Countries in grey have no reliable data for 2021 or uncertainties around 2020 data.
Source: EPC survey 2022; Bioenergy International

Figure 14 Evolution of European pellet production by region (tonnes)

Note: EL, HR, IE, LU, NL, SE, SI production is from 2020.
Source: EPC survey 2022, Bioenergy International

Figure 15 Evolution of pellet production in the top 10 largest European producers (tonnes)

Note: SE production is from 2020.
Source: EPC survey 2022, Bioenergy International

Austria: Pellet production in Austria has been steadily increasing for several years, and 2021 is no exception. Production has increased by 7.2% between 2020 and 2021, mainly due to the large amount of damaged wood from bark beetle infestations that created a significant stream of cheap raw material for wood pellet production.

Belgium: Actual production in Belgium grew by nearly 11% between 2020 and 2021, mostly driven by commercial demand (>50kw).

Estonia: Estonia also experienced growth between 2020 and 2021, but relatively limited. Production capacity increased by 4.8% and actual production by 5.2% in this time period.

France: Between 2016 and 2020, there was little new production capacity being installed because market growth was possible without it, and there was no real positive political signal to incentivise it (prices were not attractive to investors). Beginning in mid-2020 things changed, and we witnessed a regular increase in capacity – new plants or increased capacity at existing ones. According to ProPellets France, we can expect an increase of around 1 million tonnes of capacity between 2021 and 2023.

Germany: Germany remains the biggest pellet producer within the EU, mainly due to a strong domestic heating market. The German production capacity increased by 8.1% between 2020 and 2021, and the actual production grew by approximately the same amount.

Latvia: Latvia experienced quite an impressive growth in production last year, reaching more than 2.3 million tonnes of production capacity in 2021 (an increase of more than 16%). This can partly be explained by the Latvian government passing new legislation that led to an increase in raw material availability. There were also some measures, such as financial support for households for pellet purchasing, that led to an increase in pellet demand.

Poland: The Polish pellet production experienced a massive increase from 2020 to 2021, driven mostly by internal consumption and incentivised by the Clean Air Programme, a governmental project for the replacement of old heating appliances with modern ones. Twenty new production sites were opened in Poland, allowing for an increase in production capacity by more than 30%, the result was half a million tonnes of actual production growth in 2021.

Portugal: For Portugal, the available data shows a decrease in production of about 10%. However, the small sample size of the Portuguese data makes it impossible to state with certainty that this trend is taking place at the national level.

Spain: In 2021 the production rhythm in Spain was slower due to weak demand. The heating season was short and, with the exception of a couple of very cold weeks (Storm Filomena), the weather was mild. The COVID-19 lockdown was still present at the beginning of 2021 and affected Spanish producers in different ways, depending on their specific location. The producers located in regions with more holidays homes and rental properties were the most affected, due to the reduction in tourism given COVID-19. By the end of autumn, following an increase in sales of pellet appliances as a result of the increase in fossil fuel prices, demand was reactivated, and stocks started to decrease.

Figure 16 Evolution of pellet production in the top 11-20 European producers (tonnes)

Note: NL have their production data replicated from 2020.
Source: EPC survey 2022

Bosnia and Herzegovina: The pellet production increase in Bosnia and Herzegovina from 2020 to 2021 was around 63.000 tonnes or 19% in relative terms. This growth follows the opening of 3 new production sites in the country, bringing the total up to 41 facilities.

Czechia: Pellet production in the Czechia has been increasing strongly for several years, and 2021 was the year with the highest increase to date. The opening of 4 new production sites has increased the production capacity by 16,1% and the actual production by 8,2%.

Lithuania: Although relatively minor (+2%), Lithuania still experienced a growth in pellet production from 2020 to 2021.

Italy: Italy remains, as of 2021, the world's biggest residential pellet user. Its production grew slightly from 2020 to 2021 and returned to the production level of the 2015-2019 period. Despite Italy having an abundance of forests, production is constricted by complicated extraction and limited accessibility of this wood. Although 36% of the land area is covered by forests, the harvesting rate of the annual increment is only between 18% and 34% while Europe's average is 62%. These low extraction figures make any future growth in pellet production unlikely in Italy in the short-term.

Finland: In Finland, wood pellets as a source of energy are of minor importance, but the production data still displayed growth from 2020 to 2021 by around 13%, mostly driven by bigger producers. Indeed, during the last few years, the number of small pellet producers has decreased, while a few large producers have increased their share of the total production.

Romania: The country witnessed a small decrease in pellet production starting in 2020 and only produced 600.000 tonnes in 2021 (a decrease of around 14%). This trend is due mostly to a lack of raw material which slowed down pellet production.

Serbia: Pellet production in Serbia increased by 7% from 2020 to 2021, reaching 470 485 tonnes. This increase is due to the opening of 4 new production sites in the country.

Switzerland: Swiss pellet production increased by 20% between 2020 and 2021, thanks to one new production site, bringing the total number of plants to 25.

United Kingdom: Production in the UK grew by approximately 10%, due mainly to the opening of a new production site. This trend is also likely to accelerate in the coming years, with several new production lines in commission.

Figure 17 Evolution of pellet production in the Baltic countries (tonnes)

Source: EPC survey 2022, Bioenergy International

Figure 18 Evolution of pellet production in the Balkan countries (tonnes)

Note: HR, SI production from 2020.
Source: EPC survey 2022

Overall, the Balkan countries have seen a large increase in production since 2010, but the intensity varies by country. One notable increase is Serbian production, which is growing strongly, placing the country in thirteenth position in terms of European production. Another interesting trend is the decrease and subsequent stabilisation of Croatian production after 2019. This decrease is a result of the shutdown of 3 production sites, reducing total production by 16%. At the aggregate (Balkan) level, production rose from 1.327.924 in 2020 to 1.468.658 in 2021, an increase of 11%.

Figure 19 Wood pellet production evolution of Europe's top 10 largest growing markets (in absolute terms) for pellet production (between 2013-2021) (tonnes)

Note: SE production from 2020.
Source: EPC survey 2022, Bioenergy International

Table 7 Detailed European pellet production in 2020 and 2021

	2020			2021		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	**753**	**24.162.000**	**18.327.099**	**774**	**25.662.140**	**19.963.218**
AT	41	1.745.000	1.500.000	41	1.817.000	1.627.500
BE	12	820.000	740.000	12	850.000	820.000
BG	63	320.000	171.800	65	324.000	172.700
CY	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
CZ	37	560.000	486.000	41	650.000	526.000
DE	56	3.400.000	3.101.000	57	3.675.000	3.355.000
DK	3	300.000	116.000	3	300.000	140.000
EE	23	1.612.000	1.426.320	23	1.689.000	1.500.000
EL*	25	140.000	44.000	25	140.000	44.000
ES	85	2.040.000	616.000	75	1.984.800	641.710
FI	26	630.000	322.000	26	630.000	365.000
FR	55	2.100.000	1.700.000	58	2.300.000	1.800.000
HR*	18	350.000	270.000	18	350.000	270.000
HU	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IE*	1	40.000	27.500	1	40.000	27.500
IT	31	420.000	380.000	35	420.000	420.000
LT	23	575.000	440.000	23	575.000	450.000
LU*	1	50.000	42.479	1	50.000	42.479
LV	28	2.000.000	1.600.000	29	2.319.240	2.108.400
MT	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
NL*	4	350.000	290.000	4	350.000	290.000
PL	70	1.600.000	1.300.000	90	2.100.000	1.800.000
PT	28	1.530.000	850.000	25	1.508.100	758.929
RO	20	900.000	700.000	20	900.000	600.000
SE*	64	2.300.000	1.900.000	64	2.300.000	1.900.000
SI*	22	160.000	134.000	22	160.000	134.000
SK	17	240.000	170.000	16	230.000	210.000
Other Europe	**168**	**1.793.939**	**1.457.736**	**181**	**1.851.174**	**1.674.981**
AL	14	90.000	64.000	16	120.000	90.000
BA	38	420.000	340.000	41	430.000	403.000
CH	24	300.000	270.000	25	340.000	324.000
ME	10	110.000	80.000	12	142.000	101.200
NO	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
RS	76	560.000	439.924	80	570.000	470.458
UK	6	333.939	263.812	7	249.174	286.323
BY	31	621.000	446.000	N.A.	N.A.	N.A.
RU	300	2.500.000	2.200.000	N.A.	N.A.	N.A.
UA	22	545.000	519.000	N.A.	N.A.	N.A.

Note: Countries with an * have their 2021 data replicated from 2020. BY, RU, UA data provided for information purposes only, it is not included in the aggregates nor the graphs.

Source: EPC survey 2022, FAO, Bioenergy International

3.1.1 European pellet production future estimation

At the European level, there is still significant room for further expansion of sustainable pellet production, provided that some barriers are overcome (investment, logistics, etc.) Unfortunately, this data is only available for a few areas.

The general sense is that production is strongly impacted by the current geopolitical situation in Europe. All countries that provided feedback on the situation confirm that production in 2022 will be much higher than in 2021, due mainly to the sanctions imposed on Russia that drastically reduced the supply of fossil fuels. Although this has resulted in an increase in pellet demand (with consumers looking for alternatives to oil, gas and electricity), the sanctions imposed on the trade of wood products from Russia and Belarus have led to a reduction in pellet imports, which only increases market tension.

Albania: Production could reach 150.000 tonnes in the next five years.

Austria: The total wood pellet production could reach 3 million tonnes based on the availability of sawmill residues. Further increase could come from the extracted wood following the bark beetle outbreak. In 2022, 8 new plants with a total of 300.000 tonnes capacity are expected to be operational. Sawmills are currently using all their sawdust and a small portion of wood chips for pellet production. Since about twice as many chips are produced as sawdust, a doubling of the current production would already be feasible by just using the resources in the sawmills.

Bosnia and Herzegovina: Production could reach 500.000 tonnes in the next five years.

Bulgaria: There is significant potential for pellet production in Bulgaria given that in the upcoming years the number of pellet plants is expected to increase. Moreover, funding schemes exist that help support and subsidise pellet production.

Czechia: In the short term, producing one million tonnes of agglomerated wood fuel (pellets and briquettes) is achievable. Doubling the production and reaching two million tonnes seems achievable only by halving log exports.

Estonia: The competition for resources in the wood market is relatively high in Estonia, with a well-developed wood processing sector (excluding paper mills) and (local) energy sector demand (CHP, co-firing, pellet production, small-scale stoves). It therefore does not make sense to assume a hypothetical production capacity. Due to aforementioned competition for resources and shifting regulations, it is likely that pellet production in Estonia is close to peak production.

Finland: Alternative use of wood residues currently prevents large-scale wood pellet production, which could unleash a potential of 1.5 million tonnes per year. Domestic agro-residues could add an extra 0.1 million tonnes per year.

France: Currently, France is one of the highest pellets producing countries in the EU, with an actual production of 1,8 million tonnes and an installed capacity of 2,2 million tonnes. Investments are currently being made to increase the production capacity by around 1 million tonnes by 2025.

Germany: Between 20-25 million tonnes of raw material could be used for pellet production per year. 6,5 million tonnes of this are sawmill residues and around 17 million tonnes are roundwood residues (saw timber production). Further increase in raw material could come from the extracted wood after the bark beetle outbreak. The potential raw material supply for pellet production per year is about 6.5 Mt sawmill residues and around 17 Mt roundwood that is not suitable for board production.

Montenegro: Production could reach 100.000 tonnes in the next two years.

Slovakia: The usable potential of biomass for wood pellet production is approximately 1 million tonnes per year.

Spain: Several reports look at the amount of biomass that can be mobilised for energy purposes, taking into consideration the constraints that make its extraction relatively difficult (slope of the land, forested mountain areas, etc.) The latest available data shows a potential of 3.3 million tonnes of additional dry matter from various sources (broadleaves, mixed forests, shrubs, wooded pastures, etc.)

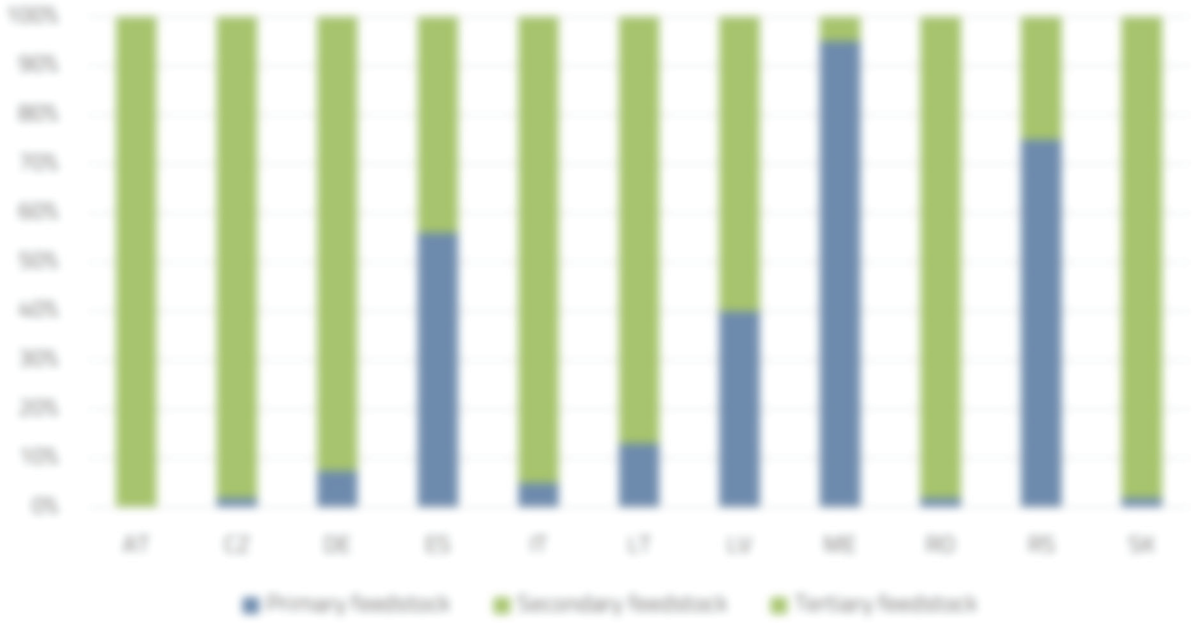
3.1.2 Qualitative analysis for European wood pellet production

Within the data collection run by EPC, our partners[1] have identified the main raw materials used for pellet production in Europe.

Three categories have been defined:

- Primary feedstock = roundwood and harvesting residues (i.e. wood extracted for pellet production)
- Secondary feedstock = any by-products from wood industry (e.g. sawdust, shavings, etc.)
- Tertiary feedstock = any used wood (reclaimed wood, waste wood)

Figure 20 Estimate of the shares of raw materials used in local pellet production in Europe in 2021 (%)

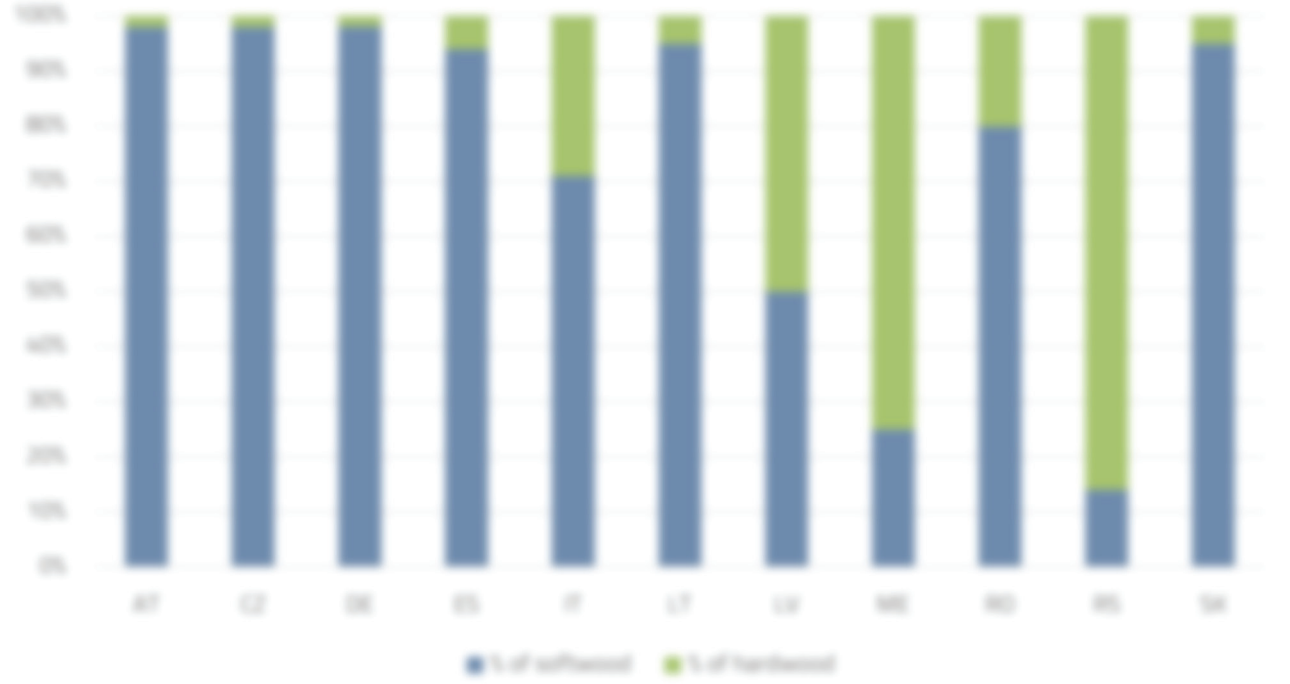


Source: EPC survey 2022

Our partners have also reported on the use of hardwood and softwood as the chosen material for their local pellet production.

[1] For this survey, mainly the pellet associations were consulted. Not all of them have consulted their local producers.

Figure 21 Estimate of the shares of hardwood and softwood as raw material for local pellet production in Europe in 2021 (%)

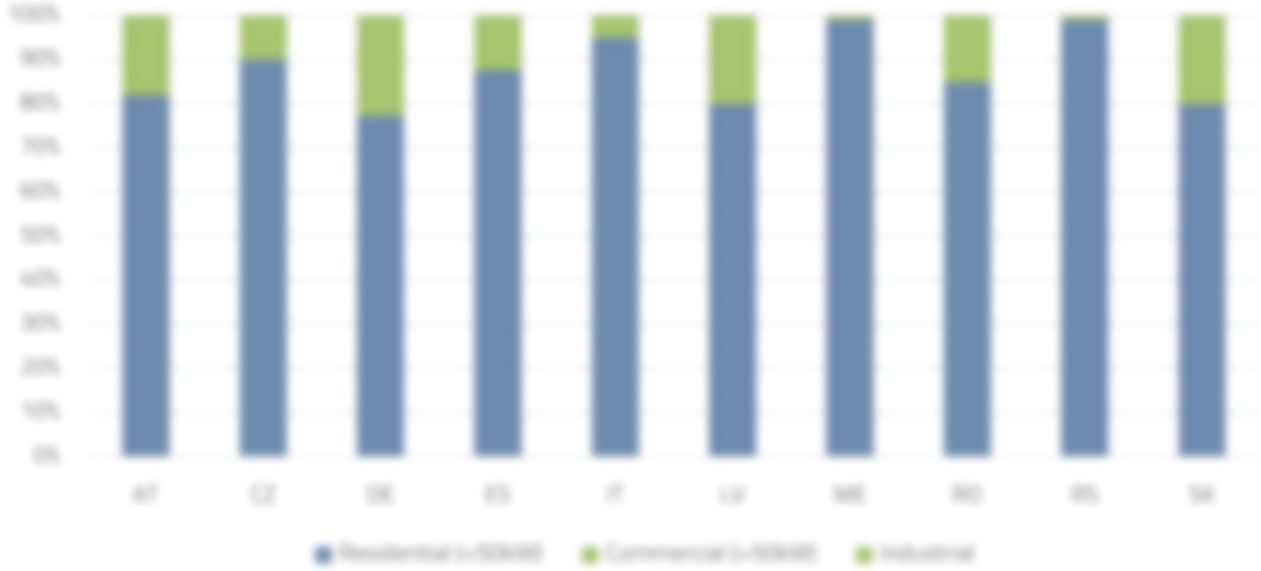


Source EPC survey 2022

A consultation was carried out with our partners[7] to identify the main markets for pellets produced in each European country. Two main categories have been identified: (1) countries that mainly produce pellets for the heating market (residential and commercial) and (2) countries that mainly produce pellets for industrial use.

[7] For this survey, mainly the pellet associations were consulted. Not all of them have consulted their local producers.

Figure 22 Estimate of European pellet producers' main markets by end-use in 2021 (%)



Source: EPC survey 2022

For this edition of the report, we note that none of the respondents to the "market share" section of the EPC 2022 survey indicated that the industrial market was one of the "main markets". This observation is consistent with the generally noted trend that pellets produced in Europe are predominantly destined for the premium market and that industrial pellets consumed are generally imported.

Table 8 European pellet producers' perception of the main difficulties in 2021 (1- least preoccupying to 5- most preoccupying)

	Lack of raw material	Price of raw material	Lack of demand	Competition with importers	Pellet stock management
AL	5	5	3	1	2
AT	1	3	1	1	3
BA	5	5	1	2	2
CZ	3	4	3	2	2
ES	5	4	1	1	5
LV	4	4	1	1	1
ME	5	5	1	4	2
RO	5	4	1	1	5
RS	5	4	1	2	1
SK	5	4	2	3	2

Source: EPC survey 2022

Warmeston

EXPERT COMMENT

Supply-demand outlook remains uncertain

2022 has clearly been a year of extremes in the energy markets across the Europe. At the start of last heating season, we experienced increasing energy prices in the Baltics. Chipped wood export to European markets, which saw very little activity for a while, picked up rapidly in Q4 and brought up biomass prices for local utilities and pellet producers in kind. After the Russian attack on Ukraine and the subsequent sanctions on Russian goods, we have seen further increase in biomass cost all through the summer of 2022. It is now evident that EU biomass markets are experiencing the largest supply-demand imbalance ever with previous historic record prices doubled.

Demand has skyrocketed as consumers are searching ways to move away from the uncertainty of Russian fossil gas. Biomass, especially pellets, are a close alternative for many applications and can often be sourced locally within EU countries. Therefore, high numbers of new residential pellet boilers are currently being installed and many industries across Europe are seriously considering pellets as alternative to fossil gas for industrial heat input for their production needs. Furthermore, existing residential pellet users are stocking-up more than usual, to mitigate the risk of price increase in the upcoming heating season.

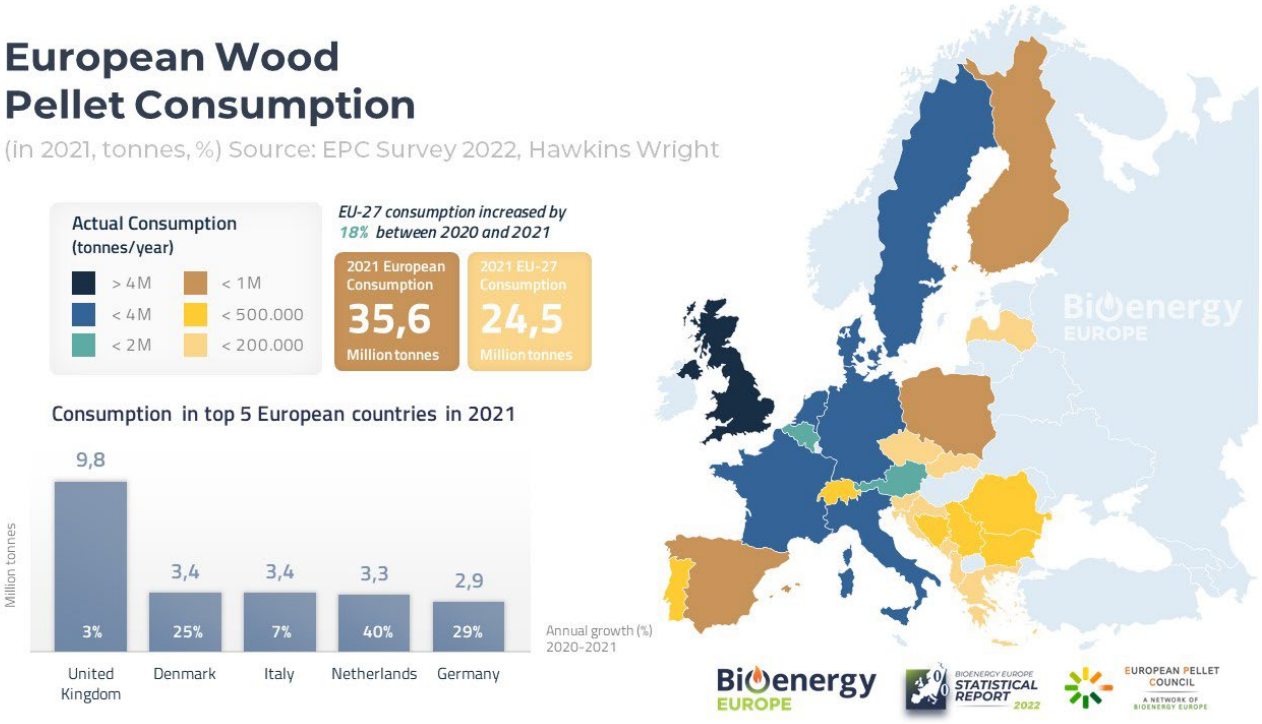
However, the supply is struggling to keep up. Imports from Russia and Belarus have been cut off by sanctions implemented as a response to Russian attack on Ukraine. As a result of ongoing war, Ukrainian trade flows to EU markets have been decreased. At the same time European pellet producers are facing limited feedstock availability due to various reasons and are therefore struggling to produce at nameplate capacity. Any investments to increase production face a lot of uncertainty as the outlook on payback times remains highly uncertain and is by large dependent on political decisions.

Mait Kaup
CEO of Warmeston
Estonia

3.2 European pellet consumption

3.2.1 Total European pellet consumption

Figure 23 Map of pellet consumption in Europe in 2021



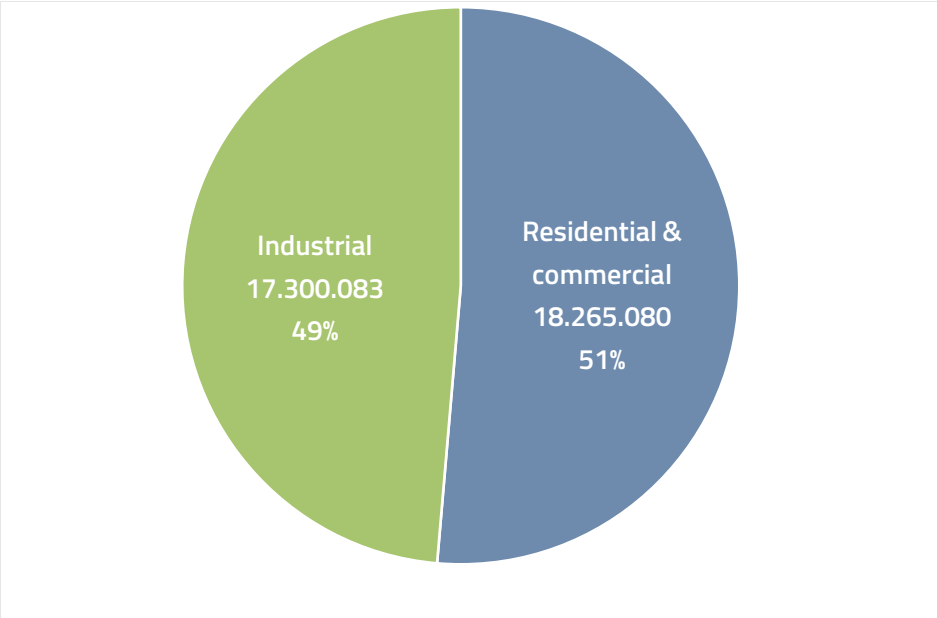
Note: LV, PT residential consumption is from 2020. FR, LV, PT, SI, SK commercial consumption is from 2020. BE, PL, SI CHP consumption is from 2020. PT Power Only consumption is from 2020.
Source: EPC survey 2022; Hawkins Wright

Between 2020 and 2021, the growth in pellet consumption has been quite impressive, mainly driven by the EU27. Indeed, **EU27** consumption increased by more than 18% (an additional 3,8 million tonnes), while consumption in **non-EU countries** increased by 5,7% (which is still higher than last year's growth).

Historically, an increase in industrial consumption was the main driver of an increase in pellet consumption at the European level. However, between 2020 and 2021, residential and commercial consumption increased by about 17% (+2,65 million tonnes) while industrial consumption was 11% (+1,7 million tonnes).

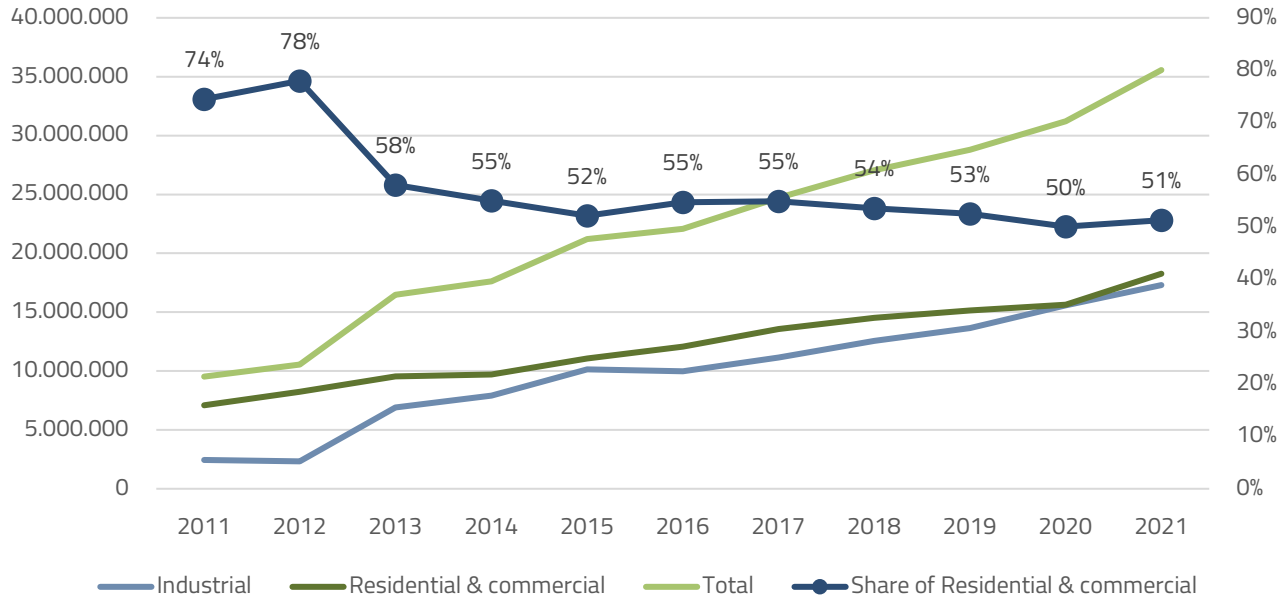
Residential consumption is already rising sharply, and it is more than likely that this trend will continue in the years to come. Indeed, the extremely high prices of fossil fuels are pushing consumers to diversify their energy supply, and the competitiveness and effectiveness of pellets makes them a much sought-after alternative. However, as explained above, the sanctions imposed on Russia are significantly reducing the amount of pellets available for the European residential market, which is limiting growth in consumption. A more precise analysis of the consequences of this geopolitical and energy crisis will be found in the next edition of this report, for data covering 2022.

Figure 24 European pellet consumption by type of end use in 2021 (tonnes and %)



Note: LV, PT residential consumption is from 2020. FR, LV, PT, SI, SK commercial consumption is from 2020. BE, PL, SI CHP consumption is from 2020. PT Power Only consumption is from 2020.
Source: EPC survey 2022; Bioenergy International, Hawkins Wright

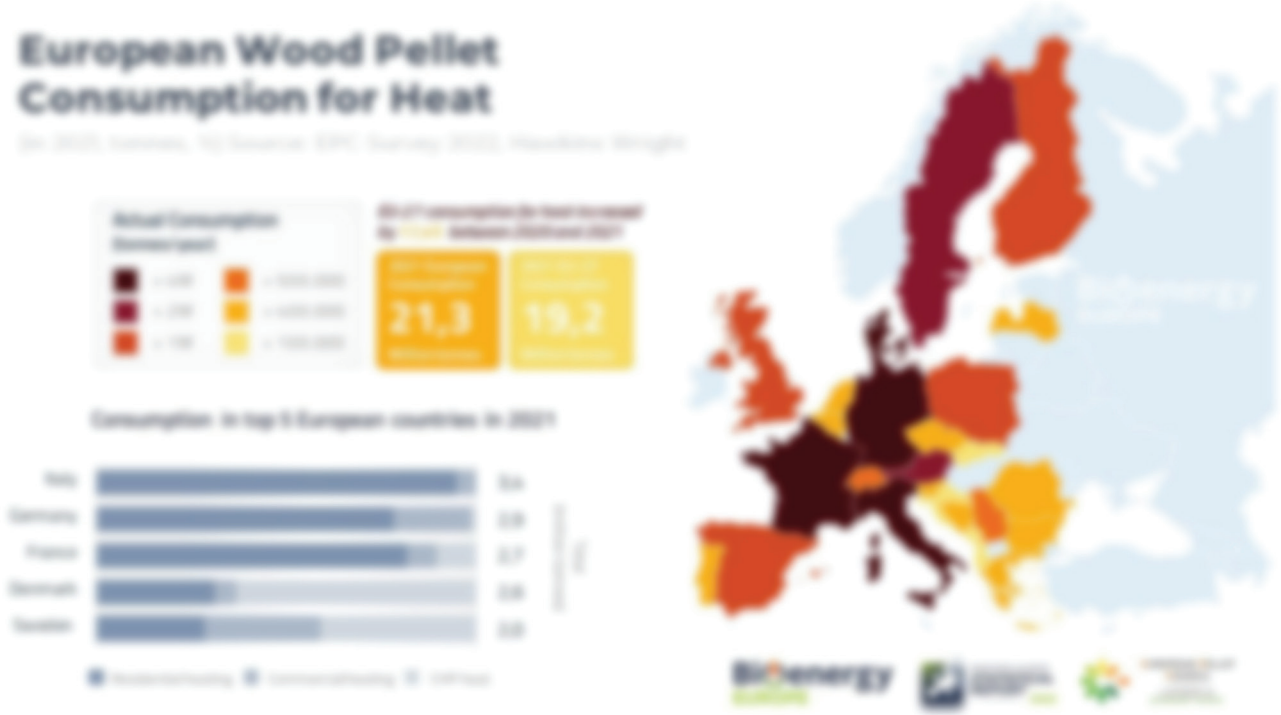
Figure 25 Evolution of pellet consumption in Europe by type (tonnes and %)



Note: LV, PT residential consumption is from 2020. FR, LV, PT, SI, SK commercial consumption is from 2020. BE, PL, SI CHP consumption is from 2020. PT Power Only consumption is from 2020.
Source: EPC survey 2022; Bioenergy International, Hawkins Wright

3.2.2 European pellet consumption for heating

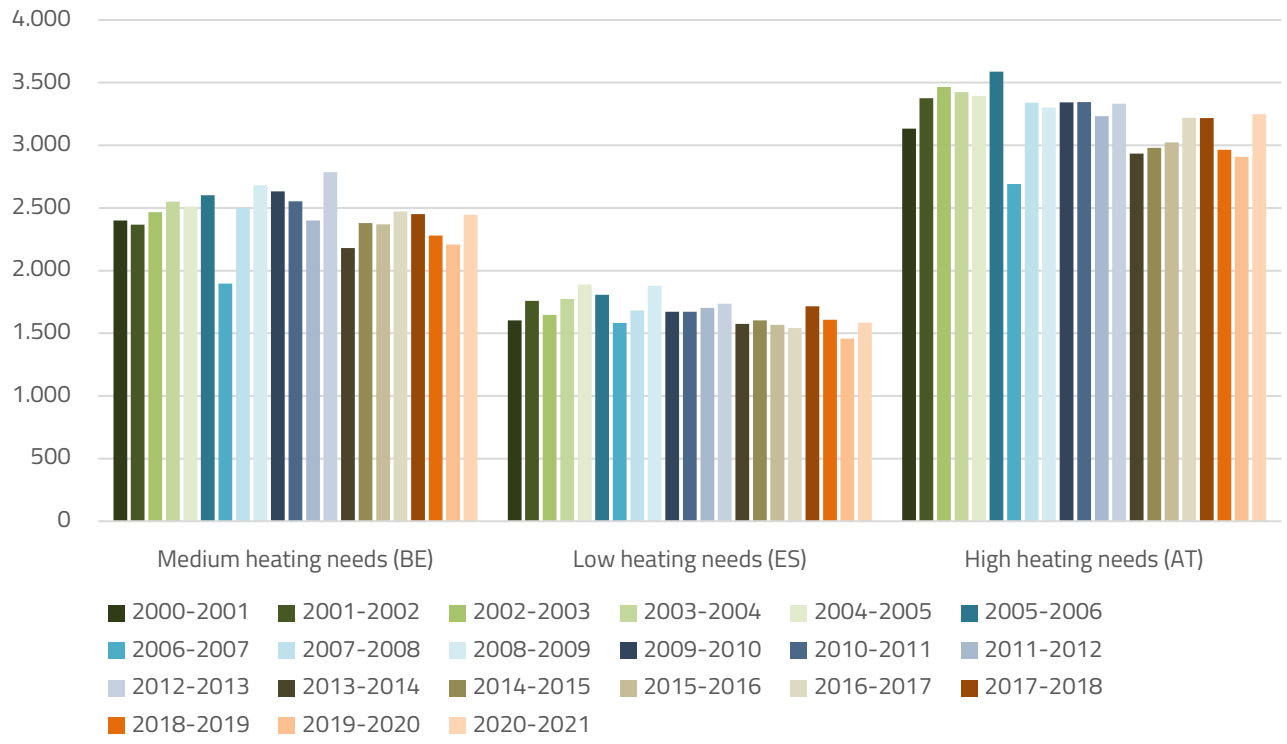
Figure 26 Map of pellet consumption for heating in Europe in 2021



Note: LV, PT residential consumption is from 2020. FR, LV, PT, SI, SK commercial consumption is from 2020. BE, PL, SI CHP consumption is from 2020.
Source: EPC survey 2022, Hawkins Wright

The demand for pellets for heating (residential, commercial and partly CHP) increased by 17.4% between 2020 and 2021 at the EU27 level. The largest European consumer is still Italy, but most of the other top 5 countries exhibited a higher growth rate in consumption than the Italian market did. Thus, we can note an increase of 7% in Italian consumption, 30% for Germany, 22% for France and 20% for Denmark. We also note a slight decrease (less than 2%) in Swedish consumption.

Figure 27 Heating Degree Days (HDD)[3] per heating season (from September to April) for different years for the three climatic zones considered* (in HDD)



*Climatic zones defined by Tsikaloudaki, Laskos and Bikas (2011), 'On the Establishment of Climatic Zones in Europe with regard to the Energy Performance of Buildings'

Source: Eurostat

Figure 27 shows the fluctuation of energy demand for heating between heating seasons since 2000. Indeed, Heating Degree Days (HDD) is used as a proxy to estimate the heating energy needs - the higher the HDD for a season, the higher the need for heating. Therefore, we can see that the heating season of 2012-2013 was generally characterised by colder temperatures (i.e. higher HDD), that created some disruption on the pellet market which it was not fully prepared for, and then led to market tension and even some shortage. For this reason, pellet market players then tried to organise themselves to prevent this situation from repeating itself by increasing their production and stock. From 2013 to 2016, Europe experienced three consecutive mild winters, leading to rather disappointing growth in pellet consumption in the heat market and inducing an accumulation of pellet stock in some regions. The following heating seasons were colder, resulting in higher pellet use for heat, and revealing a growth of around 12% over the 2016-2017 period. This sudden rise in consumption generated again some tension in the supply, leading to shortage in some areas and generating a price increase in 2018. The heating season of 2018-2019 was slightly milder than the previous

[3] Heating Degree Days (HDD) depict the severity of the cold in a specific time period taking into consideration outdoor temperature and average room temperature (in other words the need for heating). The calculation of HDD relies on the base temperature, defined as the lowest daily mean air temperature not leading to indoor heating. The value of the base temperature depends in principle on several factors associated with the building and the surrounding environment. By using a general climatological approach, the base temperature is set to a constant value of 15°C in the HDD calculation.

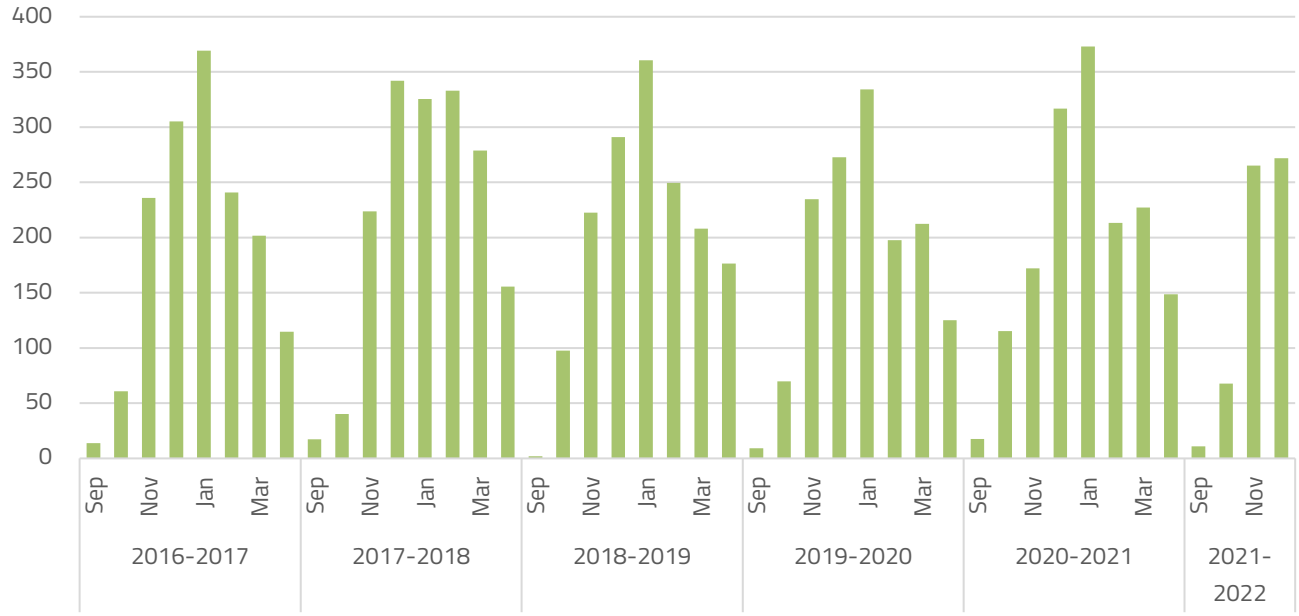
If $T_m \leq 15°C$ Then $[HDD = \sum_i(18°C - T^i_m)]$ Else $[HDD = 0]$ where T^i_m is the mean air temperature of day i.

Examples: If the daily mean air temperature is 12°C, for that day the value of the HDD index is 6 (18°C-12°C). If the daily mean air temperature is 16°C, for that day the HDD index is 0. *Definition and explanations from Eurostat.*

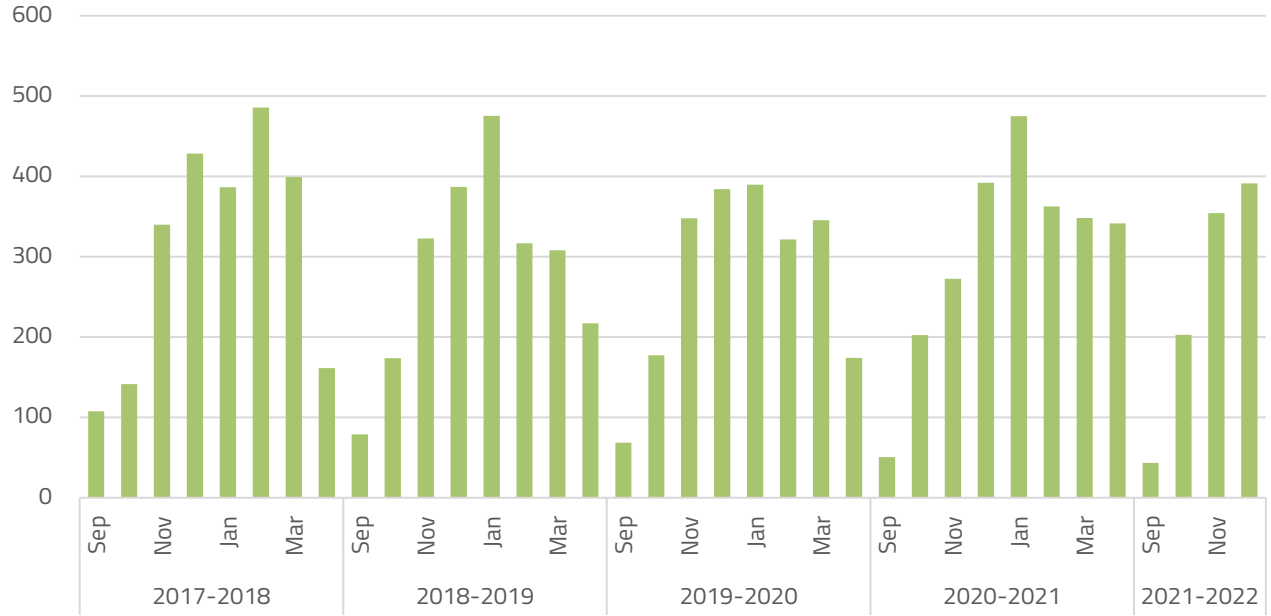
ones but only marginally colder than 2013-2016, leading to a modest growth in the pellet consumption for heating. The 2019-2020 season followed the same pattern as the previous season and a reduction in consumption also appeared. The 2020-2021 season began similar to the previous but then lasted for much longer. Indeed, in many areas, energy demand was still rather high in March and April, which unexpectedly bolstered pellet demand, allowing most of the market players to empty their stock. Focusing on Figure 28, it is clear that the start of the 2021-2022 season looks very interesting, to say the least. Indeed, in the current context of market tension, we can see on the graphs that, for the three regions concerned, the need in November is generally higher than that of the 2020-2021 period (93 HDD higher in Spain, 82 in Belgium and 23 in Austria).

Figure 28 Heating Degree Days for different heating seasons per month for three main EU climatic regions since 2013 (in HDD)*

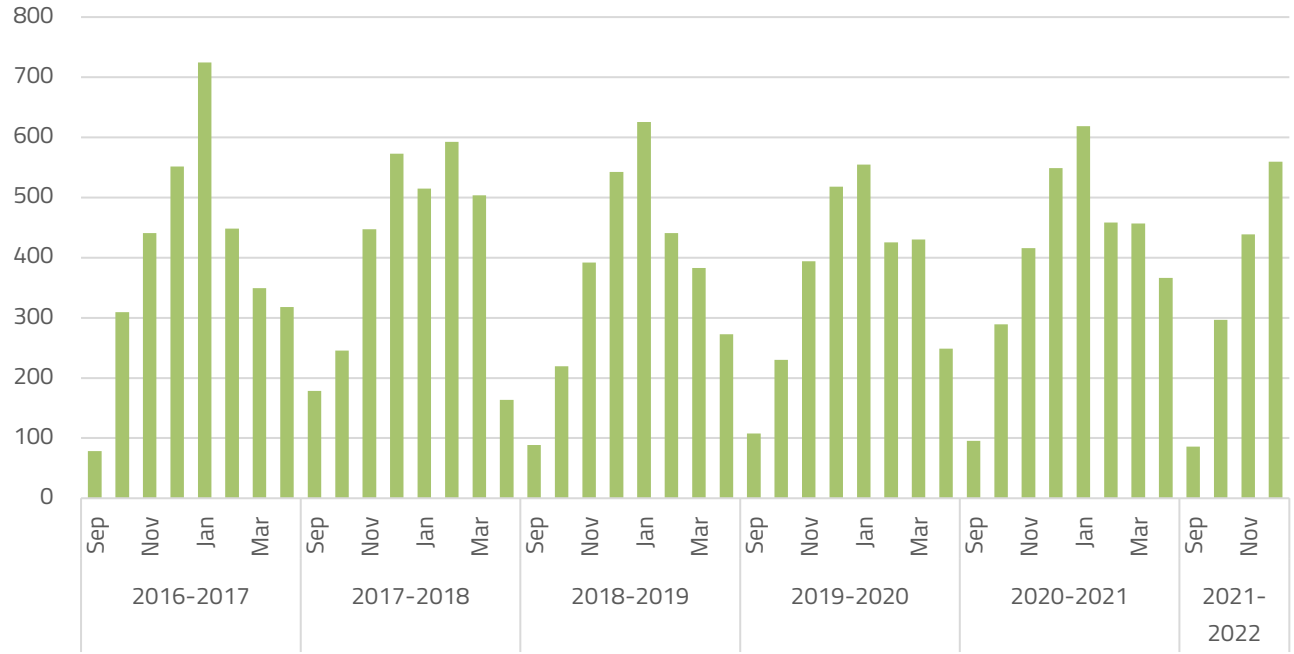
(a) HDD for Spain – Low heating needs region



(b) HDD for Belgium – Medium heating needs region



(c) HDD for Austria – High heating needs region



*Climatic zones defined by Tsikaloudaki, Laskos and Bikas (2011), 'On the Establishment of Climatic Zones in Europe with regard to the Energy Performance of Buildings'

Source: Eurostat

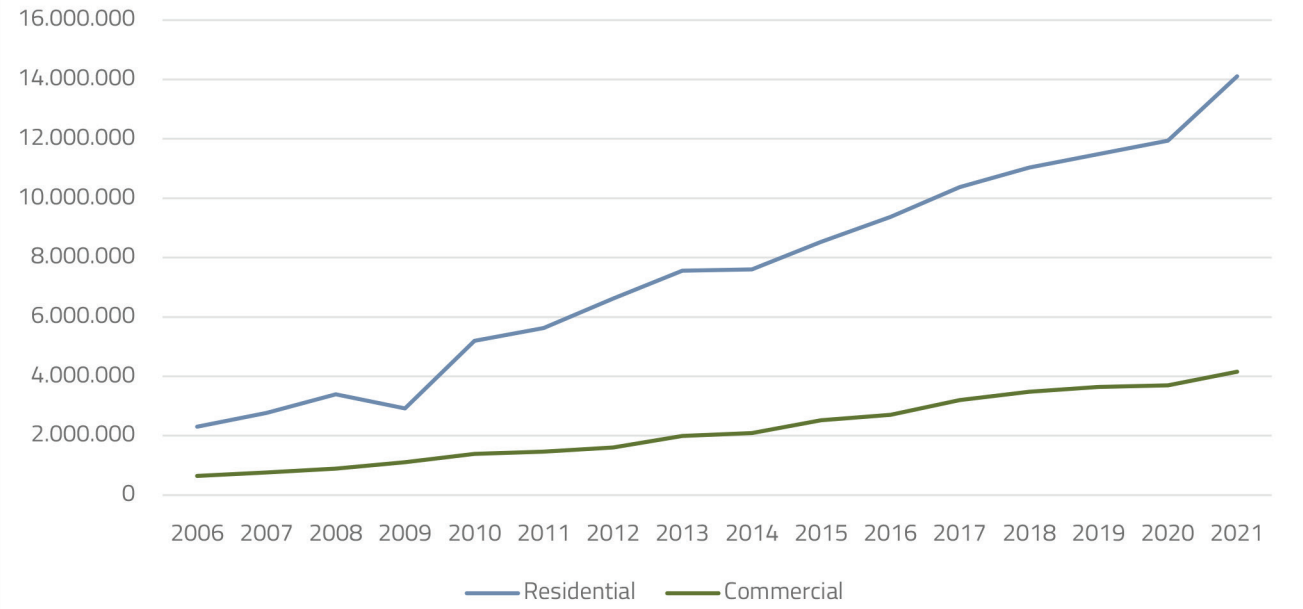
Table 9 Detailed European pellet consumption for heating in 2020 and 2021 (tonnes)

	2020				2021			
	Residential	Commercial	2/3 CHP	Total	Residential	Commercial	2/3 CHP	Total
EU27	**10.623.758**	**2.821.223**	**2.480.000**	**16.324.981**	**12.862.993**	**3.312.267**	**2.985.000**	**19.160.260**
AT	840.000	160.000	0	1.000.000	980.000	210.000	0	1.190.000
BE	427.859	10.866	13.333	452.058	332.500	31.667	13.333	377.500
BG	185.485	1.823	N.A	187.308	240.446	3.117	N.A	243.563
CY	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
CZ	110.000	40.000	N.A	150.000	116.000	44.000	N.A	162.000
DE	1.690.000	480.000	46.667	2.216.667	2.245.000	582.500	48.333	2.875.833
DK	863.000	152.000	1.140.000	2.155.000	804.765	150.644	1.633.333	2.588.741
EE	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
EL	80.000	20.000	N.A	100.000	85.000	25.000	N.A	110.000
ES	458.000	245.000	0	703.000	520.000	260.000	0	780.000
FI	46.000	367.000	183.333	596.333	61.000	457.000	173.333	691.333
FR	1.790.000	210.000	200.000	2.200.000	2.190.000	210.000	286.667	2.686.667
HR	25.000	15.000	N.A	40.000	28.000	18.000	N.A	46.000
HU	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
IE	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
IT	2.964.667	168.437	N.A	3.133.104	3.173.186	178.547	N.A	3.351.733
LT	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
LU	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
LV	140.000	17.000	N.A	157.000	140.000	17.000	N.A	157.000
MT	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A
NL	80.000	160.000	N.A	240.000	100.000	180.000	N.A	280.000
PL	350.000	70.000	20.000	440.000	700.000	100.000	20.000	820.000
PT	170.000	160.000	0	330.000	170.000	160.000	0	330.000
RO	N.A	N.A	0	N.A	250.000	20.000	0	270.000
SE	556.747	575.097	866.667	1.998.511	557.096	595.793	800.000	1.952.889

SI	98.000	37.000	10.000	145.000	120.000	37.000	10.000	167.000
SK	46.000	32.000	0	78.000	48.000	32.000	0	80.000
Other Europe	1.017.881	775.107	14.901	1.807.889	1.244.717	845.103	15.056	2.104.875
AL	55.000	5.000	0	60.000	68.000	7.000	0	75.000
BA	230.000	42.000	0	272.000	285.500	53.000	0	338.500
CH	227.500	122.500	0	350.000	250.000	168.000	0	418.000
ME	27.000	4.000	0	31.000	35.770	4.905	0	40.675
NO	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
RS	344.268	13.000	0	357.268	469.946	17.500	0	487.446
UK	134.113	588.607	14.901	737.621	135.501	594.698	15.056	745.254
BY	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
RU	50.000	27.000	22.000	99.000	N.A.	N.A.	N.A.	N.A.
UA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

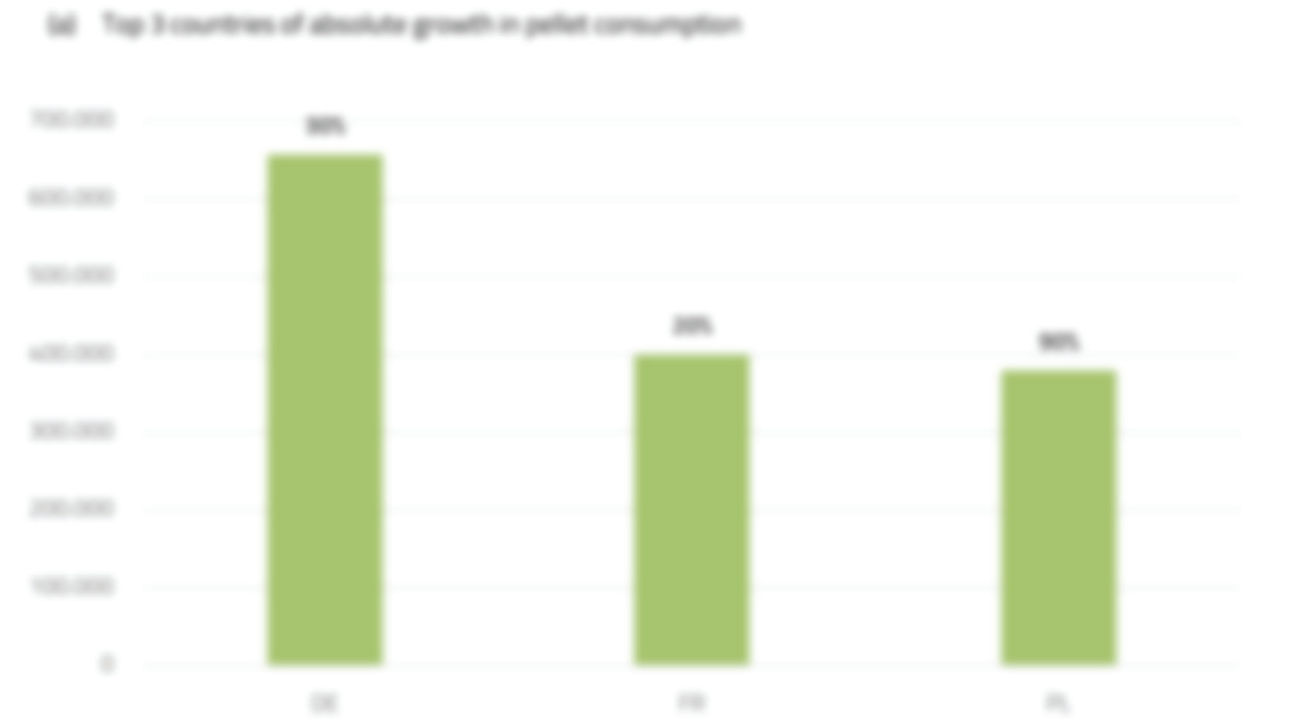
Note: LV, PT residential consumption is from 2020. FR, LV, PT, SI, SK commercial consumption is from2020. BE, PL, SI CHP consumption is from 2020. BY, RU, UA data provided for information purposes only, it is not included in the aggregates nor the graphs.
Source: EPC survey 2022; FAO; Hawkins Wright

Figure 29 Evolution of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP (tonnes)



Note: LV, PT residential consumption is replicated from 2020. FR, LV, PT, SI, SK commercial consumption is replicated from 2020.
Source: EPC survey 2022

Figure 30 Growth of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP by country between 2020-2021 (tonnes & %)



(b) Rest of the world

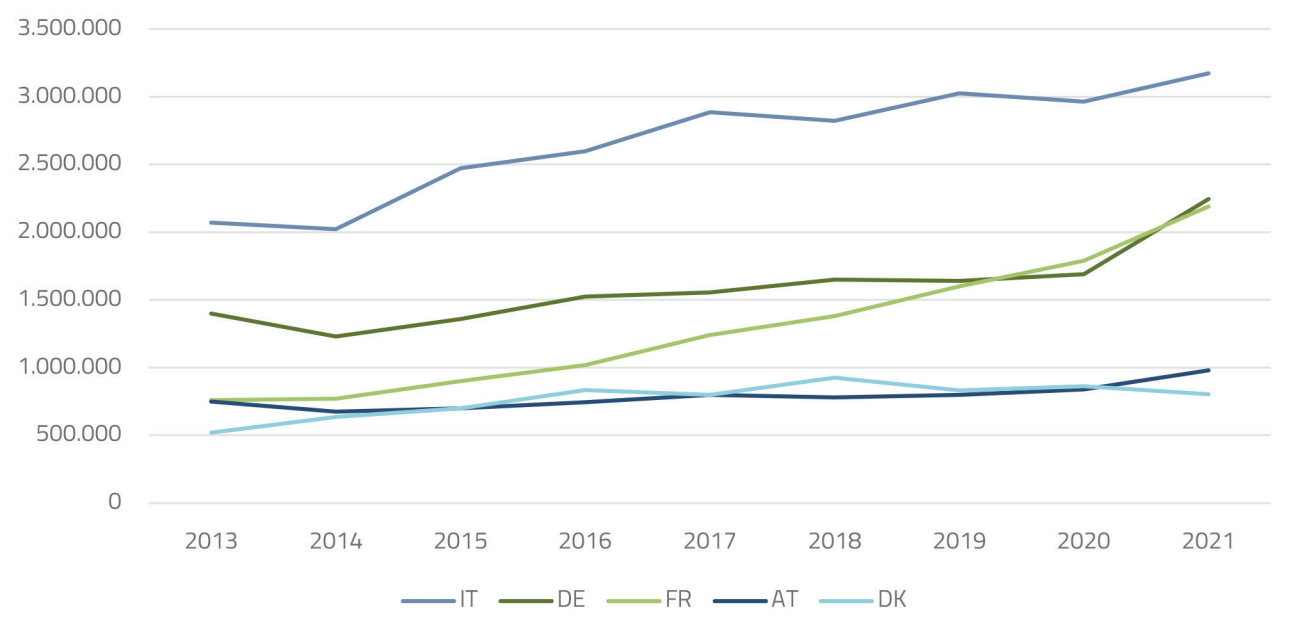
Note: LV, PT residential consumption is replicated from 2020. FR, LV, PT, SI, SK commercial consumption is replicated from 2020.
Source: EPC survey 2022

Figure 31 European pellet consumption for residential (< 50kW) and commercial (> 50kW) heat in 2021 (tonnes)

Note: LV, PT residential consumption is replicated from 2020. FR, LV, PT, SI, SK commercial consumption is replicated from 2020.
Source: EPC survey 2022

3.2.2.1 RESIDENTIAL PELLET CONSUMPTION

Figure 32 Evolution of Europe's top 5 countries for residential (<50kW) pellet consumption in Europe (tonnes)



Source: EPC survey 2022

Austria: The period 2020-2021 saw the largest increase in residential consumption in recent years, rising by almost 17%. In absolute terms, this represents an increase of almost 150.000 tonnes.

Denmark: Denmark is the only country on this list showing signs of a slowdown in residential consumption. Indeed, the country has reduced its consumption by almost 7%, representing about 60.000 tonnes.

France: The figures are impressive to say the least, with an increase of over 1 million tonnes consumed between 2016 (1.020.000 tonnes) and 2021 (2.190.000 tonnes). The period 2020-2021 is characterised by an increase of almost 23% in consumption. If the plans to increase production capacity in France become a reality, and if the country continues on its current consumption trend, it is likely that it will become the leading European consumer in the next few years.

Germany: After moderate growth over the period 2016-2020, Germany saw its residential consumption explode between 2020 and 2021, with an increase in consumption of almost 33%. In absolute terms, this represents more than half a million additional tonnes of consumption.

Italy: After a minor decrease from 2019 to 2020, Italian residential pellet consumption showed an increase in residential consumption of around 7%. Italy remains the largest residential consumer in Europe, with almost one million tonnes more than the second largest, Germany.

Figure 33 Evolution of Europe's top 6- 10 countries for residential (<50kW) pellet consumption in Europe (tonnes)

Source: EPC survey 2022

Belgium: Belgium is the only country in the top 6- 10 to see its residential consumption decreasing. This 23% drop translates into a reduction in consumption of almost 100.000 tonnes. However, the figures for Belgium in 2021 are based on estimates and this trend should be treated with caution.

Poland: The situation in Poland is remarkable, to say the least, with a residential increase reaching the 100% threshold. This doubling of consumption (from 350.000 to 700.000 tonnes) is motivated by the Clean Air Programme being implemented in Poland, which has led to an explosion in the sale of residential heating installations (subsidised by the state for the replacement of old systems) and consequently residential consumption as well.

Serbia: After significant reduction in consumption between 2017 and 2018, Serbia has seen a steady increase in residential consumption. The period 2020-2021 is no exception to this trend, with an impressive growth of 36,51%, corresponding to 125.678 tonnes.

Spain: Residential consumption in Spain continues to grow steadily since 2014, with the period 2020-2021 characterised by an increase of 13,5% or 62.000 tonnes, thus recovering pre-pandemic growth. The increase was not higher due to mild weather (except for a couple of very cold weeks) for most of that heating season. Since December 21- January 22 we are observing an increase in the sale of pellet appliances (mainly stoves) due to the high increase of fossil fuel prices. 2022 will maintain the same trend if the weather, as it is foreseen, remains mild at the beginning of winter. Another interesting observation is the tendency of consumers to buy more, in order to accumulate a large stock of pellets. There is a sense of panic and a kind of hoarding effect with pellets. As of beginning of 2022, producers are fulfilling demand without problems, but there is a need to raise consumer awareness of the fact that there is no need to accumulate pellets, in order to avoid negative market effects.

Sweden: The level of residential pellet consumption in Sweden has not changed since 2020, with very moderate growth of 0,06% after a substantial decrease in consumption between 2018 and 2019 (-22%).

Figure 34 Evolution of Europe's top 5 largest growing markets (between 2014- 2021in absolute terms) residential (<50kW) pellet consumption in Europe (tonnes)

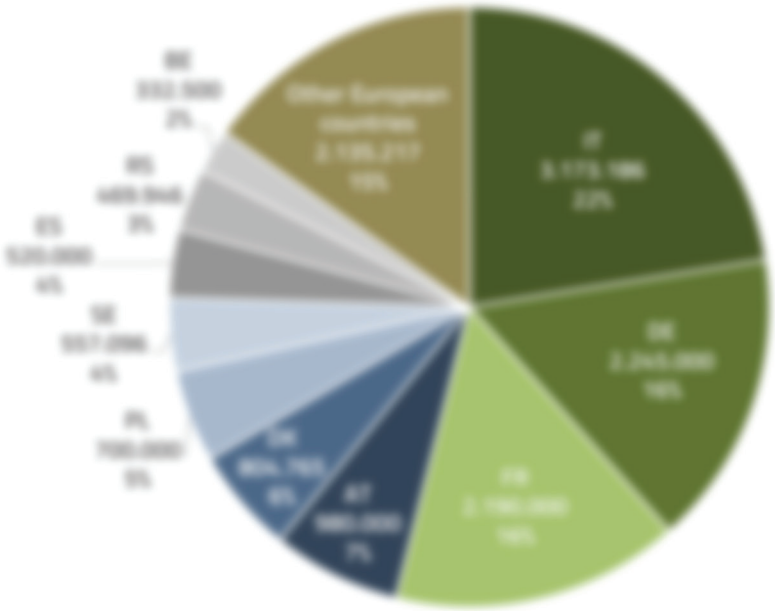
Note: the order of the legend follows the decreasing order of the absolute increase of production (in tonnes) between 2014 and 2021
Source: EPC survey 2022

Figure 35 Evolution of Europe's top 5 fastest growing markets (between 2014- 2021 in relative terms) residential (<50kW) pellet consumption in Europe (tonnes)

Note: the order of the legend follows the decreasing order of the absolute increase of production (in tonnes) between 2014 and 2021
Source: EPC survey 2022

The Balkan countries constitute a net-exporting region, but they have displayed increasing strength in their domestic markets that is driven by residential pellet consumption. This may affect their role as suppliers of the EU27 in the future.

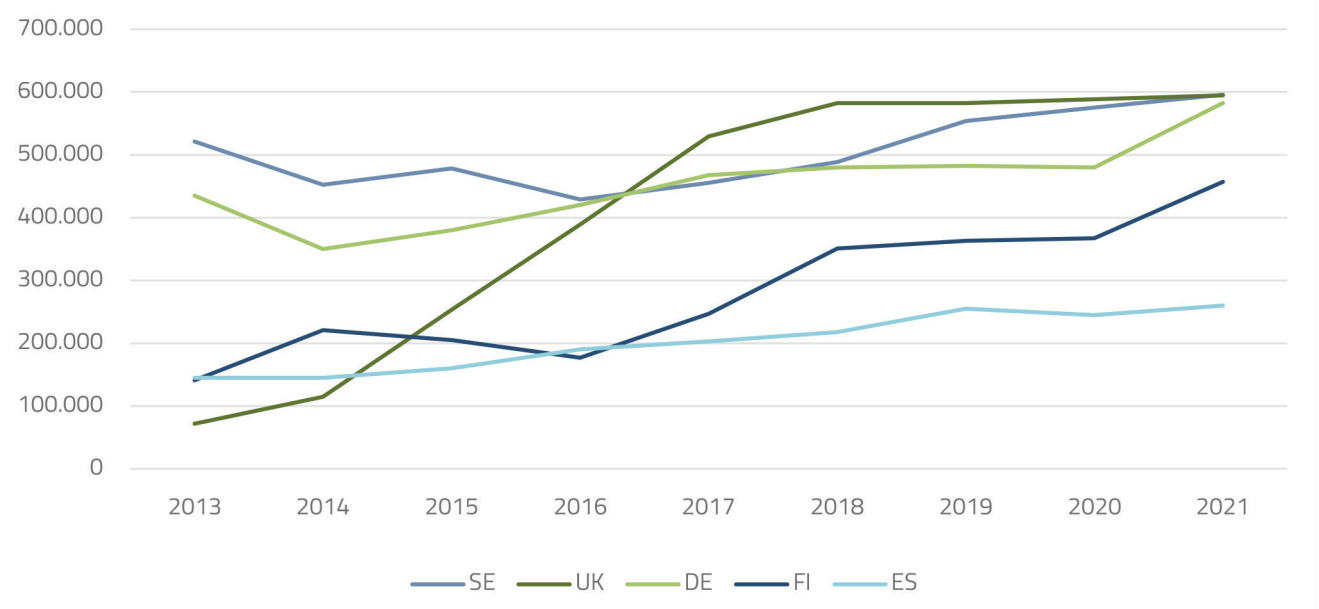
Figure 36 Share of European residential (<50kW) pellet consumption by country in 2021 (tonnes)



Note: LU, PT residential consumption is replicated from 2020.
Source: EPC survey 2022

3.2.2.2 COMMERCIAL PELLET CONSUMPTION

Figure 37 Evolution of Europe's top 5 countries commercial (>50kW) pellet consumption in EU (tonnes)



Source: EPC survey 2022

All major commercial pellet consumers (>50 kw but excluding industrial consumption) follow an increasing trend in consumption between 2020 and 2021, but with varying intensity depending on the country. **Germany** and **Finland** are the two countries with the highest increase (21% and 25% respectively, corresponding to 102 500 tonnes and 90 000 tonnes respectively), followed by **Spain** (+/- 15 000 tonnes) and **Sweden** (+/- 20 000 tonnes). The **United Kingdom** completes the top 5 with a small increase of 1%, corresponding to about 6 000 tonnes.

Figure 38 Evolution of Europe's top 6- 10 countries commercial (>50kW) pellet consumption in EU (tonnes)

Note: FR commercial consumption is replicated from 2020.
Source: EPC survey 2022

Among the top 6- 10 commercial consumers, the most significant growth occurred in **Switzerland** and **Austria**, with 37.14% and 31.25% respectively, corresponding to 45.500 and 50.000 tonnes. The **Netherlands** saw its consumption increase by 12.50% (20.000 tonnes), followed by **Italy** (6%, 10.000 tonnes). **France**, whose 2021 consumption level was matched by Austria's, has not changed as compared to 2020.

Figure 39 Share of European commercial (>50kW) pellet consumption by country in 2021 (tonnes)

Note: FR, LV, PT, SI, SK commercial consumption are replicated from 2020.
Source: EPC survey 2022

ProPellets Switzerland

EXPERT COMMENT

Pellets Market in Switzerland 2021

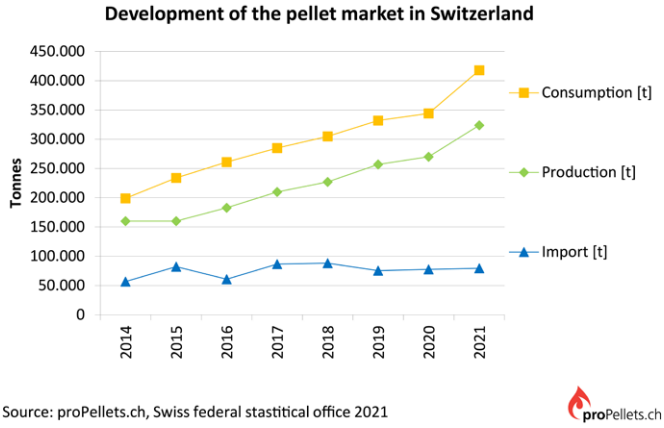
Sabine L'Eplattenier-Burri
Managing Director
ProPellets.ch

In the year 2021 a great increase in pellets use was registered. ProPellets.ch estimates a sale of 418.000 tonnes, an increase of 22% compared to 2020. 198.000 tonnes were EN*plus* certified, an increase of 20% compared to the previous year. ProPellets.ch estimates the total production in Switzerland at 324.000 tons (+20%) of which 271.000 tonne (+16%) were EN*plus* certified. Import remains a the same low level as in 2020, with 80.000 tonnes there was only a minor increase of 2% compared to 2020. With 43.500 tonnes, more than half of the imported pellets were EN*plus* certified, an increase of 0.8% compared to 2020. Overall, the production, trade and import of EN*plus* certified pellets did not increase in the same volume as the total volume.

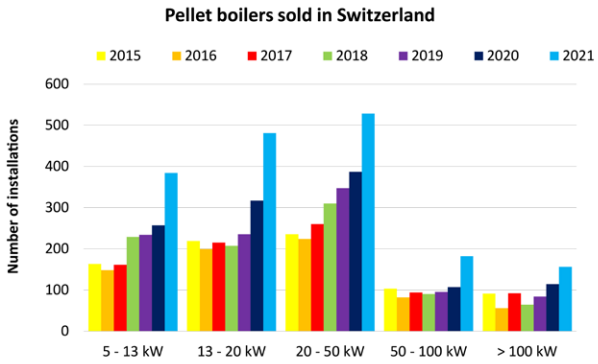
These figures are collected by ProPellets.ch durin the monthly production and trade survey and the customs statistics of the Swiss federation. The production of about 10 small producers of pellets which do not participate in the surveys of ProPellets.ch are estimated at 35.000 tonnes and are included in the statistics.

The whole market around pellets registered in 2021 a much larger increase than the previous years. Pellet boiler sales increased by 46% compared to 2021 and many producers invested in expanding their production. Still, the higher demand could be covered by the increased production, even if it was a close call. To minimize the risk of a pellet shortage and ensure supplies in short and long term, ProPellets.ch increased the market analysis and is in close contact with the federal office for national economic supply.

2021 was a tense year and we expect the next few years to be at least as demanding.



Source: proPellets.ch, Swiss federal stastitical office 2021

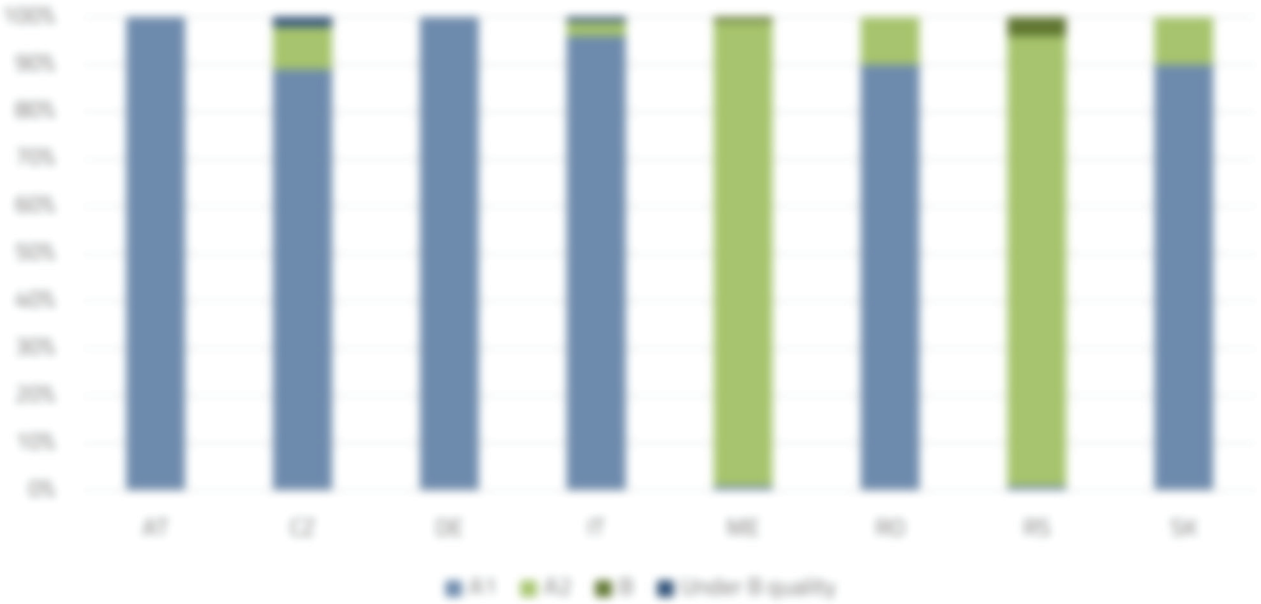


Source: Holzfeuerungen Schweiz 2021

3.2.2.3 QUALITATIVE ANALYSIS

EPC held a consultation with pellet industry stakeholders* to identify pellet quality classes that are often used within both the residential and commercial heating markets for each European country (the results are shown in figures 40 and 41 below). The consultation demonstrated that, while some countries are mainly or even exclusively using premium quality – both for the residential and commercial markets – many other countries use lower quality pellets in the commercial sector, with some countries even using lower quality pellets in the residential market.

Figure 40 Estimate of pellet quality class shares for residential heat market in European countries in 2021(%)



Source: EPC survey 2022

* For this survey, mainly pellet associations were consulted. Not all of them have consulted the local producers.

Figure 41 Estimate of pellet quality class shares for commercial heat market in European countries in 2021 (%)

Source EPC survey 2022

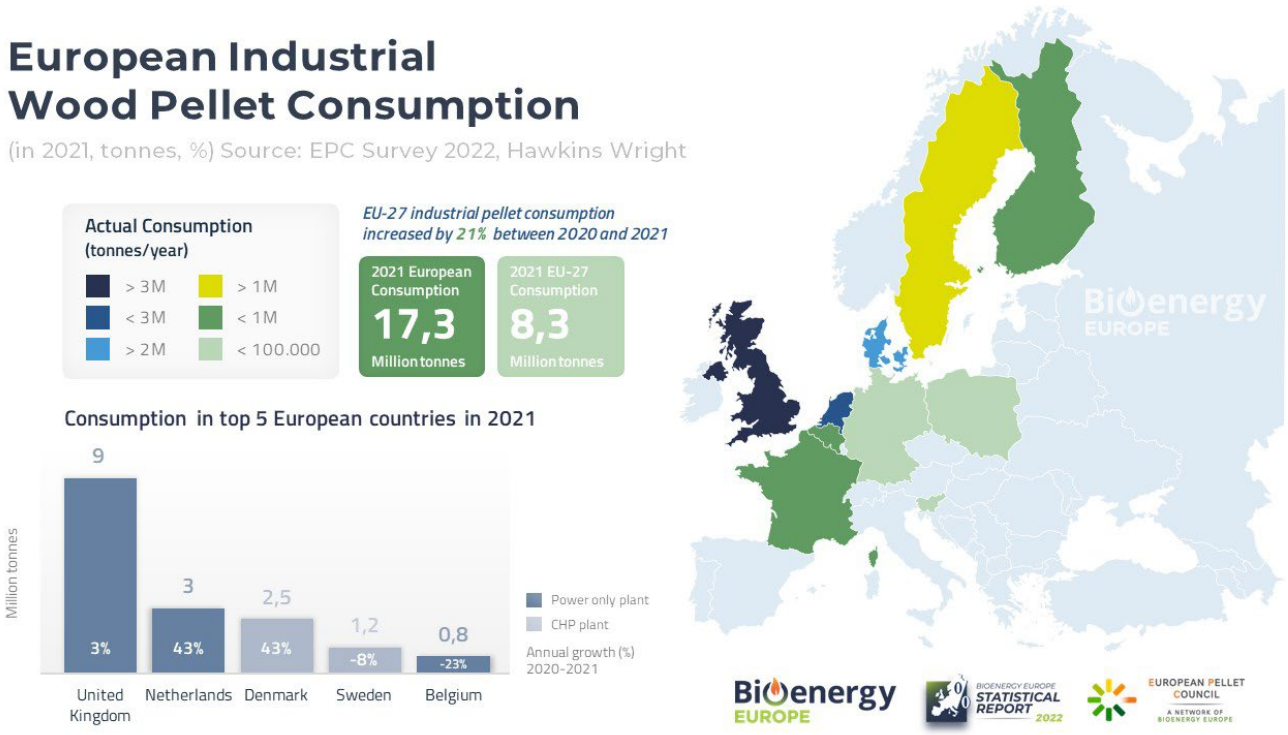
Another consultation was carried out to identify how pellets are delivered to users within the residential heat market of each European country. Germany, Austria and Latvia each have heat markets where around half of the consumers operate boilers fed from a silo that has a multi-tonne capacity. This explains why these markets are mainly consuming bulk pellets. This is also the case for a smaller number of consumers in Czechia and Spain, and even more rarely in Italy and Slovakia. Outside of these countries, consumers mainly buy bagged pellets, either because residential appliances are typically stoves with lower power output (e.g. Italy) or because the boiler operators are not fed from a dedicated high-capacity storage room. As far as big bags (around a ton) are concerned, we can see from the graph that they are used in most countries for which data is available, but much less than 15kg bags.

Figure 42 Forms of delivery used in the residential heat market in European countries in 2021 (%)

Source EPC survey 2022

3.2.3 European industrial pellet consumption

Figure 43 European map of industrial pellet consumption in 2021



Source: EPC survey 2022, Hawkins Wright

The trend of increasing pellet consumption that we have noticed in other sectors is also observed in the industrial sector. Indeed, when all European countries (EU27 + Other Europe) are included, industrial consumption increased from 15.572.352 tonnes to 17.300.083 tonnes, an increase of about 11%. If we focus on the EU27 alone, this increase in consumption is even greater, rising from 6.850.000 tonnes in 2020 to 8.277.500 tonnes in 2021, an increase of 21%.

The current energy price situation, the effects of which could already be seen at the end of 2021, is largely responsible for the increase in industrial pellet consumption. Indeed, with electricity and other fossil fuel prices as high as they are, the use of pellets for industrial processes and electricity generation is highly advantageous, especially in 2021, for which the increase in pellet prices was not yet as drastic as in 2022. However, this increase in industrial consumption has also impacted other sectors, such as the residential sector, by reducing the amount of available pellets for other types of users. Although in general the quality level of the pellets used is very different between industrial and premium residential users, the recent increase in electricity prices and market tension are such that they have pushed power plants to acquire premium pellets, creating a kind of loop that adds further tension to an already tight market.

Belgium: Following the end of green certificate support, the biopower plant of ENGIE les Awirs stopped operating in September 2020. This cessation led to a drop of industrial pellet usage of about 250.000 tonnes per year in Belgium. However, the second and last unit of ENGIE that operates on pellets, the Rodenhuize plant, continues to function.

Denmark: After two consecutive reductions in industrial consumption (-5% between 2018 and 2019, and -14,5% between 2019 and 2020), the trend was completely reversed between 2020 and 2021 with an increase in consumption of almost 45%, or 740.000 tonnes.

The Netherlands: Industrial consumption in the Netherlands is following the same trend as in Denmark, i.e. an increase of 43% in consumption, representing an additional 900.000 tonnes in this case.

United Kingdom: The UK continues its historical momentum in industrial consumption, reaching a new record in 2021 with an increase of just under 5%. With 9.000.000 tonnes consumed in 2021 (mostly by the four units at the Drax site), the UK remains the world's largest industrial pellet consumer.

Figure 45 Evolution of industrial pellet consumption of Europe's biggest consumers (tonnes)

Source: EPC survey 2022, Hawkins Wright

ProPellets Austria

EXPERT COMMENT

pro»pellets
Austria

Looking back, 2021 was a year in which market development was ramping up towards 2022. Obviously as a preparation for the war, gas supplies were tightening over the course of the year. As coal as well as emission allowances also hit record prices, electricity prices were starting to get out of control and pellets became a more economic fuel that coal for power generation. Consumers were worried over high fossil fuel prices and climate change. As a consequence, demand for pellet stoves increased significantly and demand for pellet boilers increased massively. After a sluggish market in spring time pellet markets gradually tightened up and concerns regarding sufficient supply emerged in fall among market participants. After years of accelerating market growth the pellet market entered a situation of structural undersupply. Underinvestment due to questions regarding the future of subsidies for the largest industrial pellet user may be one root cause for this.

In any case 2021 became the preparation for a perfect storm in 2022 when record heating equipment sales and high demand for power production coincided with supply curtailment as a consequence of economic sanctions against Russia and Belarus. Unprecedented volatility has since characterized the pellet market leaving puzzled market actors wondering about what to expect next.

Christian Rakos
CEO
ProPellets Austria

3.3 European heating appliances market

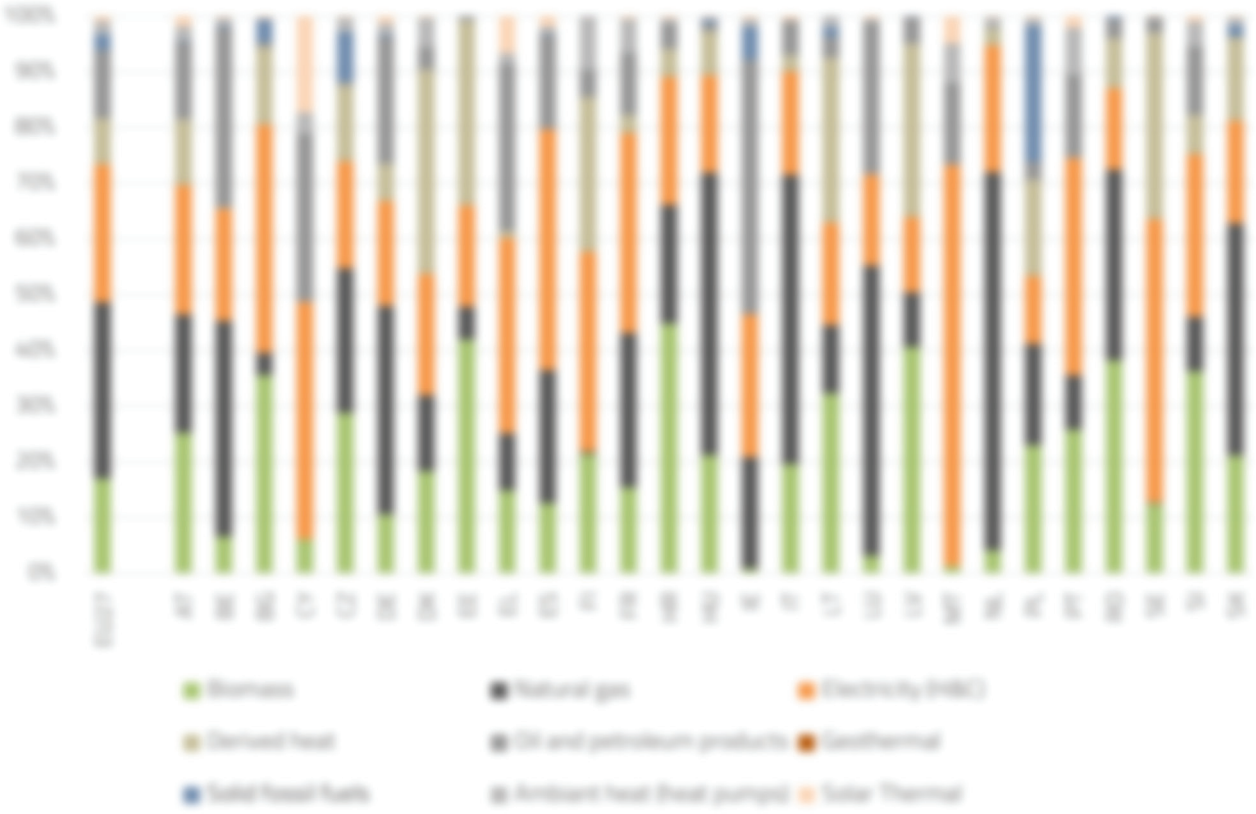
Generally, the European heating appliances market shows great development year after year, even if the trends vary among the different countries. The recent initiative in several countries to phase out the use of heating oil is hope for even further market expansion, despite the fierce competition from heat pumps that affects this growth.

More recently, the COVID- 19 lockdowns had some impact on heating appliance sales since many businesses had to pause their activities. However, this impact appears to have been rather limited. COVID- 19 also had some positive impact since homeworking incentivised individuals to invest in their homes, such as through buying a pellet stove.

The crisis affecting today's households is of course that of rising fossil fuel and electricity prices, which is another reason for European households to opt for renewable solutions. However, as reflected in pellet prices, a forced and overly rapid transition is not necessarily ideal, as we are now seeing shortages and other tensions across the continent.

Figure 46 presents the breakdown of energy sources by fuel type in the heating and cooling residential sector across the various European countries. The purpose of this graph is to understand the market share of each of the heating technologies within the residential sector. The graph can help to identify which European markets are the most promising in terms of pellets. As well as replacing old biomass heating appliances, the replacement of heating oil and coal (solid fossil fuel) appliances represents significant potential for growth in the European pellet market.

Figure 46 Share of energy used for heating and cooling in the residential sector by EU27 countries in 2020 (%)



Source: Eurostat

Austria: Substantial budgets for subsidies will be available for the purpose of changing the existing non-renewable heating systems with renewable ones, as the declared target is to phase out oil heating systems by 2035 and gas heating systems by 2040. Additionally, phase-out laws are expected to prohibit the replacement of old fossil fuel heating systems with new fossil fuel systems, forcing the old stock of fossil appliances to be replaced with alternative appliances. The federal government has secured the highest ever budget for subsidising the switch to renewable heat. Households can receive up to 5000€ from the federal budget and another 3000-6000€ from provincial subsidies for changing their heating system.

Czechia: In Czechia, a subsidy programme for the replacement of old boilers of the 1st and 2nd emission classes (mainly coal-fired boilers) with modern, ecological sources has been running already for 5 years, it has now been extended until 2027. Pellet boilers and heat pumps are generally subsidised, with the maximum subsidy being 4.900€.

Denmark: The implementation of the GHG emissions reduction law by 2030 will include the phase-out of fossil fuels across many sectors and will boost renewables.

Finland: Under Prime Minister Sanna Marin, the government will work to ensure that Finland is carbon neutral by 2035 and carbon-negative soon after that. The energy use of coal will phase out, in line with existing decisions, by May 2029 at the latest. According to the current forecasts, the use of peat as a primary energy source will be discontinued during the 2030s, although it will remain in use to ensure security of supply. The use of fossil fuel oil in heating will phase out by the beginning of the 2030s.

Germany: Oil heating systems will be banned from 2024 onwards and only hybrid heating systems (fossil and renewable fuels) will be permitted. Additionally, owners of oil heating appliances which are older than 30 years are obliged to replace them.

Greece: The phase-out of oil heating appliances is planned by using natural gas. Biomass fuels, especially in rural areas, would play a secondary role.

Latvia: The state currently pays subsidies to incentivise households to phase out fossil fuels and switch to renewables.

Poland: The year 2021 is a record year for pellet consumption and appliance sales. The government's Clean Air Programme offers subsidies for the replacement of old coal-fired installations with gas, pellet or heat pump installations. Thanks to this programme, Poland has reported sales of up to 3.500 new pellet appliances (mostly boilers) per month, and this trend is likely to continue in the future since only 10% of the 10-year budget has been used so far.

Slovakia: The country is currently addressing the phasing out of fossil fuels for heating purposes in its National Recovery Plan.

Spain: The Ecological Transition Ministry has established ambitious objectives to reach carbon neutrality by 2050 and it's expected that funds from Europe (recuperation & resilience funds), together with those of the Green Deal, will strongly support renewable energy to achieve these objectives. First details on the support schemes for installing biomass appliances with recovery funds have been published: RD411/2021 for residential appliances, RD1124/2021 for non-residential appliances, RD707/2022 for District Heatings, RD706/2022 for biogas.

3.3.1 European stove market

Table 10 Average percentage of households with pellet stoves in 2021 in select European countries (%)

IT	7,11%
FR	4,62%
ES	2,31%
AT	1,44%
DE	0,57%
SE	0,47%
EL	0,38%
HR	0,26%
LV	0,26%
CZ	0,20%
SK	0,04%

Note: considering maximum one appliance per household
Source: Eurostat and EPC survey 2022

In general, we see an increase in the percentage of households equipped with pellet stoves (with some exceptions) between 2020 and 2021. Factors such as government subsidies and fossil fuel phase-out plans work hand-in-hand to increase this number. Furthermore, with the recent crisis in gas and electricity prices, it is more than likely that these figures will increase considerably in the coming years.

Austria: As compared to last year, the average percentage of households with stoves increased, thanks to phase out plans and subsidies.

Croatia: Stoves and fireplaces have increased in number, especially low-cost products imported from neighbouring countries Bosnia and Herzegovina, North Macedonia as well as Turkey and China.

Czechia: The number of stoves sold in Czechia increased substantially in the past year, peaking at 1.600 units in 2021.

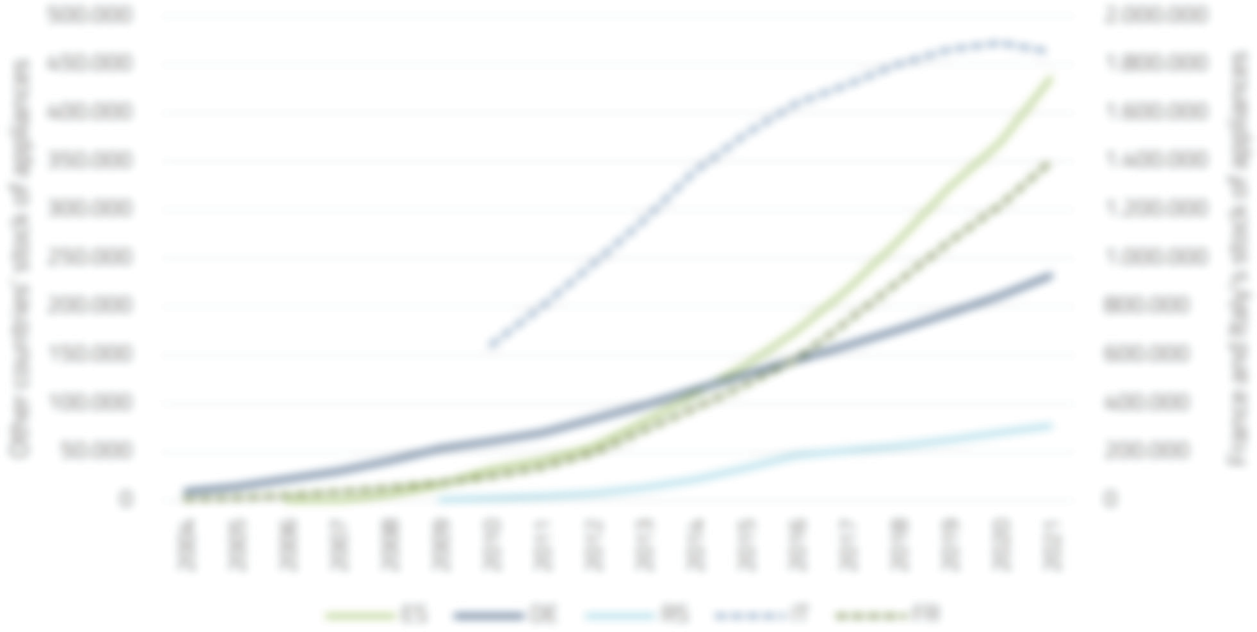
France: The country is on a rather impressive trajectory with regard to the pellet stove market segment. Indeed, 2021 is shaping up to be a record year in terms of sales, with around 180.000 new units, making France the European leader in terms of annual sales.

Germany: The German market is constantly growing for all types of pellet appliances. As compared to annual sales in 2020, the year 2021 stands out with an increase of 17% for stoves.

Italy: The Italian pellet stove market was slowing down considerably between 2014 and 2020, with 2020 being the worst ever measured in terms of sales of new appliances. Despite this fall in sales, Italy remains the country with the highest number of installed pellet stoves in Europe. The figures for 2021 are more optimistic, with the market starting to grow again (+24,4%).

Spain: The slowdown in appliance sales due to COVID-19, which was experienced especially in 2020 and early 2021, has now been overcome. Since December 2021-January 2022, Spain is now witnessing an increase in the sales of pellet appliances (mainly stoves) due to the high increase in fossil fuel prices.

Figure 47 Evolution of the installed stock of pellet stoves in some major European markets (n° of units; Italy and France in secondary axis)



Source: EPC survey 2022

Figure 48 Evolution of the installed stock of pellet stoves in some minor European markets (n° of units)

Note: SE, HR, EL installed stock of pellet stoves from 2020.
Source: EPC survey 2022

Figure 49 Evolution of the annual sales of pellet stoves in some European markets (in ^{nr} of units)

(a) Top 3 countries for pellet stoves sales

(b) Top 4-8 countries for pellet stoves sales

Source: EPC survey 2022

3.3.2 European residential boiler market

Table 11 Average percentage of households with pellet boilers in 2021 in select European countries (%)

AT	3,89%
LV	1,61%
SE	1,28%
PL	0,82%
DE	0,81%
CZ	0,81%
IT	0,53%
FR	0,41%
SK	0,35%
ES	0,32%
EL	0,15%
HR	0,06%

Note: considering maximum one appliance per household.
Source: Eurostat and EPC survey 2022

The pellet boiler segment is the one with the highest growth in 2021 among all types of installations, driven mainly by sales in the three leading countries, i.e. Germany, France and Poland. The number of sales from these three countries combined almost reaches the total number of residential pellet boilers installed in Austria (which is the second largest stock) for 2021.

Austria: After a fall in sales between 2014 and 2018, boiler sales are growing strongly with around 8.000 new units sold in 2021.

Czechia: The year 2021 proved to be extremely beneficial for the sale of pellet boilers in Czechia, going from 2.200 units sold in 2020 to 4.500 in 2021 (doubling in sales).

France: As was the case for Czechia, France doubled its pellet boiler sales between 2020 and 2021, from 16.000 to 32.000 units sold. This increase is mainly due to the replacement of old heating oil boilers, support for which was stopped in 2018, as well as to subsidies for the installation of renewable heating systems.

Germany: This country continues to lead Europe in terms of the number of pellet boilers installed. Its number of units sold per year rose from 40.500 in 2020 to 61.325 in 2021, representing an increase of more than 50%. The energy policy implications of the Ukraine war and the move away from gas are leading to a unpredictable situation that will probably continue to significantly increase demand for pellet boilers.

Poland: This country has the most impressive growth in annual pellet boiler sales in all of Europe. Indeed, the country has gone from about 8.000 units sold in 2020 to 42.000 units sold in 2021, which represents a growth of 425%. This sales boom is driven by the Clean Air Programme, a government intervention that allows Polish households to replace their old coal or heating oil boilers with new biomass boilers that are much more efficient in all respects.

ÖkoFEN

EXPERT COMMENT

Extraordinary times for the residential pellet boiler market

In 2021, the momentum of recent years continued. Pellet heating is now considered an established solution in most regions of Europe. To follow the demand, all manufacturers of boilers have greatly expanded their production capacities. In our case, the production volume was even tripled within two years.

Until now, the main target group was clearly the 18 million oil-fired heating systems still in operation in Europe.

Since the war in Ukraine, however, the target group of gas heaters is gaining strongly in importance. Many customers are extremely insecure and also want to get away from gas for moral reasons. Above all, however, the prices for gas have risen sharply in many countries and heating is often no longer affordable for homeowners.

This customer segment is more difficult for the pellet heating market because these customers are not used to needing space for fuel storage, but on the other hand the market is several dimensions larger and even a few percent shift has a big impact. In Germany, Austria and France alone, 1.4 million gas heating systems were sold last year. That is 69% of all heating systems sold! By comparison, pellet boilers were sold 101,000 units in these countries in 2021.

Unfortunately, however, the market for pellets has not been spared the effects of the war and the associated energy crisis in Europe. Sharply increased prices and, in some cases, poor availability cost us a lot of confidence among end customers.

Trust is also being lost with the discussion about REDIII. It is completely incomprehensible how EU politicians, in the midst of the biggest energy crisis in post-war history, question the only year-round renewable energy source, stainable forest products. Even more so when pellets for the heating market are predominantly produced from sawmill residues and are therefore a prime example of circular economy.

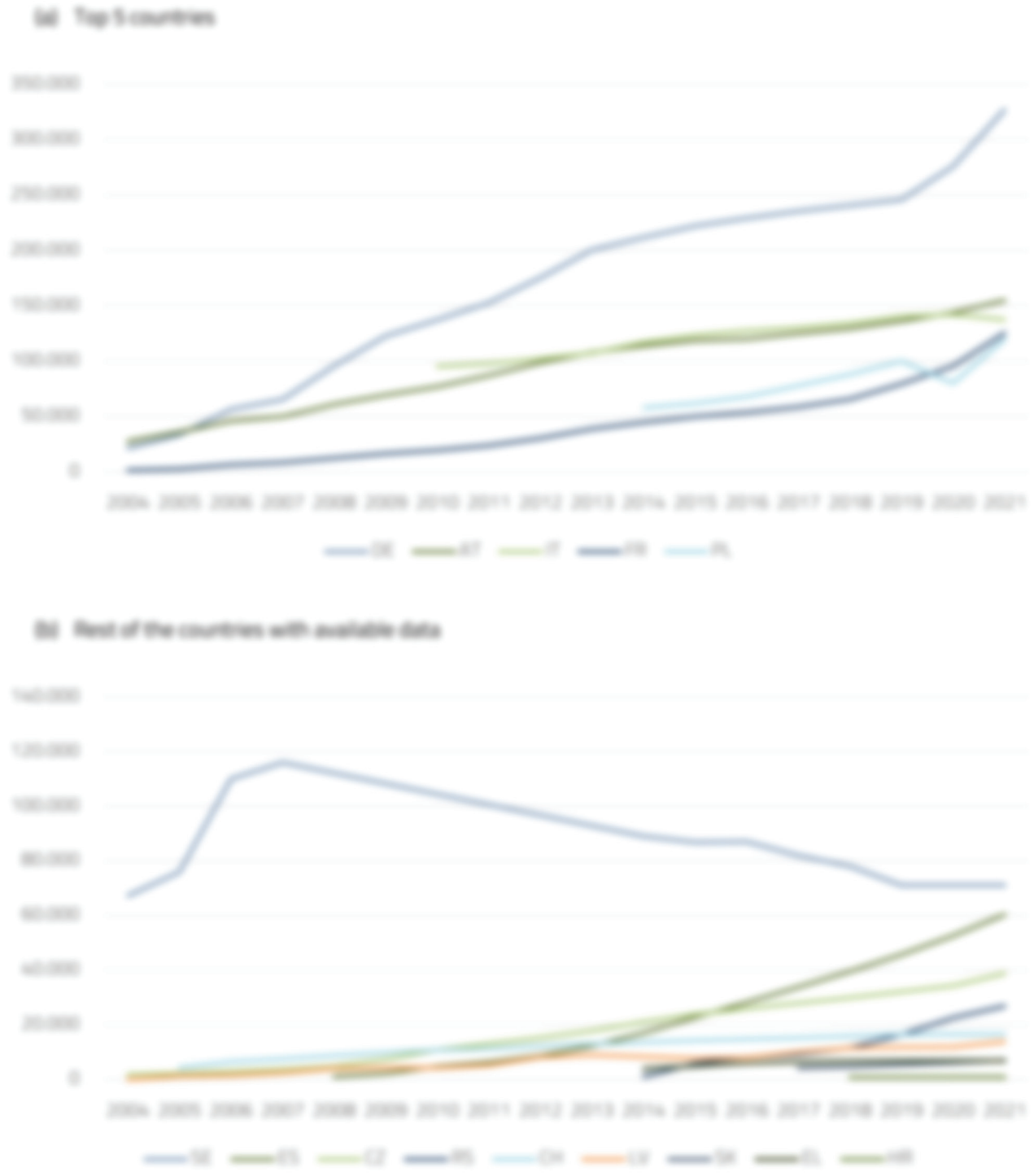
Despite the negative headlines surrounding these issues, however, more and more people want to switch to green heat from pellets. Technologically, a lot has happened in recent years. Today, there are devices that are ultra-clean and highly efficient. And the most important thing: the switch can be made NOW and immediately brings independence and climate protection.

Therefore, we are still firmly convinced that pellets will play a major role in the heating market of the future. In addition to good and affordable products, this requires above all reliability in the supply and prices of pellets. We are all hopeful to get this back in the course of the next months.

Stefan Ortner
CEO
ÖkoFEN

ÖkoFEN

Figure 50 Evolution of the installed stock of residential pellet boilers (<50kW) in some European markets (n° of units)



Source: EPC survey 2022

Figure 51 Evolution of the annual sales of residential pellet boilers (<50kW) in some European markets (n° of units)

Source: EPC survey 2022

3.3.3 European commercial boiler market

Pellets for commercial heating (defined as dedicated-heat boilers with at least 50 kilowatts of output used in residential buildings, public buildings, services, industry, etc.) remain a niche market in most of Europe but have been identified by several observers as key to establishing pellet use in the long term.

Figure 52 Evolution of the installed stock of commercial pellet boilers (>50kW) in some European countries (n° of units)

Note: Commercial boilers in Spain includes multi-fuel boilers.
Source: EPC survey 2022.

Austria: An increase in installations is expected due to political pressure for phasing out heating oil.

Spain: Data on Spanish commercial boilers include multi-fuel boilers capable of using pellets. While these boilers tend to use cheaper biomass sources like olive stones, pine nut shells and almond shells, they are capable of consuming pellets when cheaper biomass is not available. After a drop in sales between 2019 and 2020 (from 1.052 units sold to 922, a loss of 12%), the trend is now upwards, with 1.177 new commercial boilers sold, representing an increase of 27,6%. With those new sales, as well as the drop in Italy, Spain now leads Europe when talking about the installed stock of >50kW commercial boilers. With the increase in fossil fuel prices and subsidies for the replacement of old boilers, it is likely that these numbers will increase again by 2022.

Figure 53 Evolution of the installed stock of commercial pellet boilers (<500kW) in some European countries (in ' of units)

Source EPC survey 2022

Most of the countries shown in the figure above have sustained steady growth in installed stocks of pellet boilers in recent years. As is the case for other types of installations, the main drivers of this increase are national subsidies, fossil fuel phase-out plans and rising fossil fuel prices.

Serbia: The big boom in the number of installed pellet boilers is the result of a significant number of schools (over 200), kindergartens, health care centres and other public and commercial buildings which have started to use pellets instead of coal and heating oil. In 2019, the Serbian government supported a vast number of public buildings in replacing heating oil and coal with wood pellets. 2021 is no exception to this trend, and it is highly likely that 2022 will follow the same pattern.

Switzerland: Unfortunately, no sales data for the Swiss market is available, but from the installed stock data the situation following the growth of the last few years has stabilised, with a similar number of installed appliances for 2020 and 2021. However, according to the forecasts, it is expected that sales will increase for the period 2021/2022 and that this will be reflected in the installed stock for 2022.

Figure 54 Evolution of the annual sales of commercial pellet boilers (>50kW) in some European countries (n° of units)

Source: EPC survey 2022

Table 12 Annual sales of boilers and stoves in Europe in 2020 and 2021 (n° of units)

	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2020	2021	2020	2021	2020	2021
AT	2.000	2.000	7.500	8.000	800	800
CZ	1.500	1.600	2.200	4.500	N.A.	N.A.
DE	20.500	24.000	40.500	61.325	850	1.175
ES	46.946	66.856	6.875	7.799	922	1.177
FR	150.000	180.000	16.000	32.000	0	650
HR	1.500	N.A.	330	N.A.	60	N.A.
IT	134.688	167.554	8.749	10.944	307	384
LV	416	430	1.820	1.910	520	560
PL	500	1.000	8.000	42.000	500	500
SK	100	100	750	800	30	20
RS	7.500	7.085	6.200	4.288	400	344

Note: Commercial boilers in Spain includes multi-fuel boilers.
Source: EPC survey 2022

Table 13 Installed stock of pellet boilers and stoves in Europe in 2020 and 2021 (n° of units)

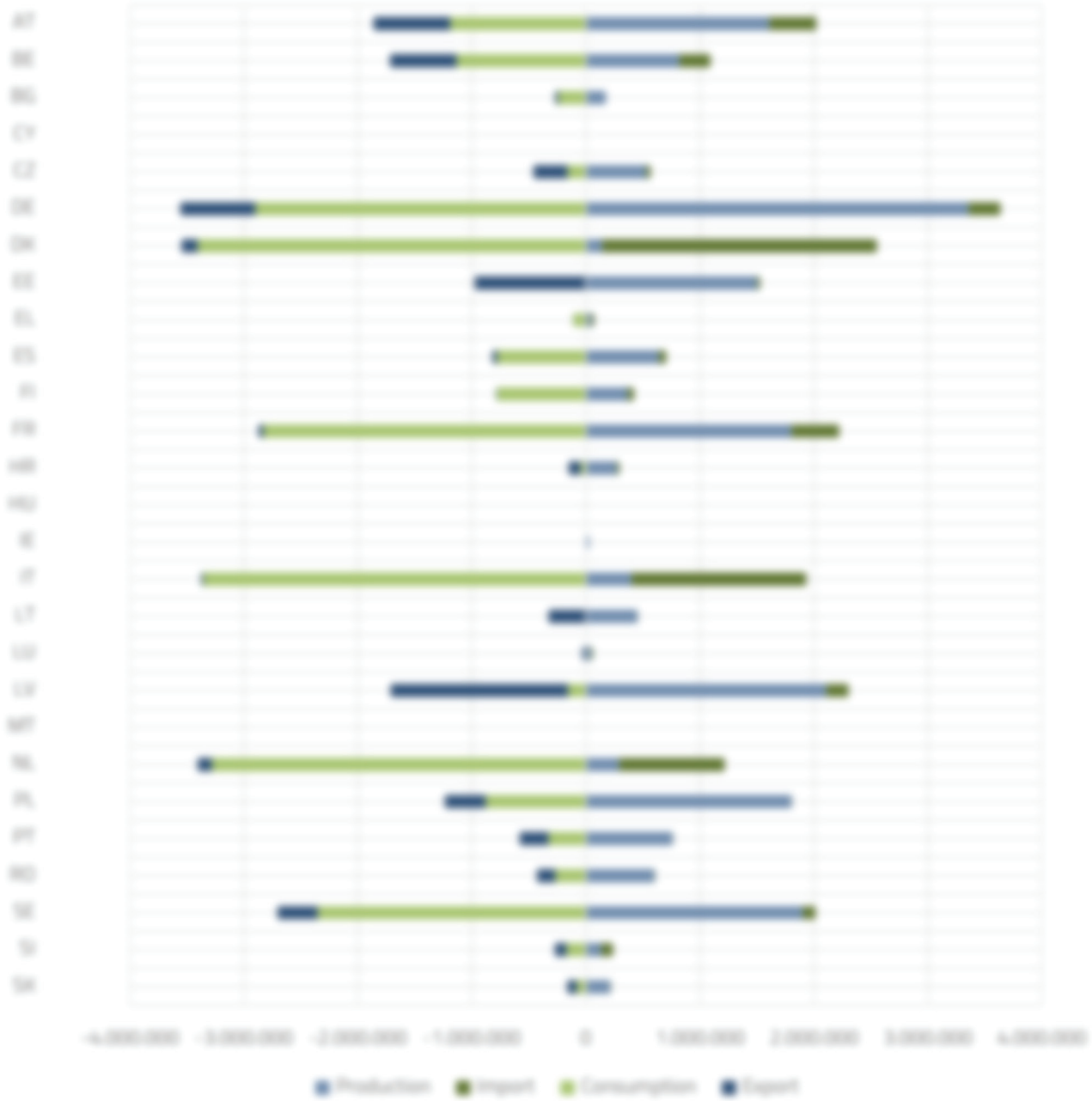
	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2020	2021	2020	2021	2020	2021
AT	55.300	57.500	143.700	155.000	6.250	7.050
CZ	7.900	9.500	34.300	38.800	N.A.	N.A.
DE	211.400	232.400	276.100	327.200	10.300	11.100
EL	17.700	17.700	6.900	6.900	1.740	1.740
ES	369.429	436.265	52.593	60.392	14.326	15.503
FR	1.216.000	1.400.000	95.600	125.500	0	2.100
HR	3.830	3.830	900	900	135	135
IT	1.889.387	1.853.144	142.129	137.326	14.436	13.793
LV	2.180	2.210	11.950	13.860	2.350	2.400
PL	N.A.	N.A.	80.000	120.000	3.000	3.000
SE	26.400	26.400	71.100	71.100	2.000	2.000
SK	800	900	6.250	7.050	530	550
CH	11.036	11.036	16.550	16.550	2.300	2.300
RS	70.220	77.305	22.611	26.899	1.040	1.384

Note: Commercial boilers in Spain includes multi-fuel boilers.
Source: EPC survey 2022

3.4 Intra-European trade of pellets

The data provided in this section has been provided by Ufkcomtrade. Unfortunately, the accuracy varies between countries, the data does not have the same level of accuracy for imports as for exports, leading to some mismatches. However, these numbers still reflect the big trends in trade across Europe. For a more "global" approach and visual/interactive tool, this link developed by Future Metrics provides an up-to-date map where that provides precise pellet flows that can be filtered based on the importer/exporter.

Figure 55 EU27 Member States pellet balance by country in 2021 - production, consumption, export, import (tonnes)



Source: EPC survey 2022, Hawkins Wright, Ufkcomtrade

Table 14 Intra EU27 pellet trade in 2021 (ktonnes)

Exporter → Importer ↓	AT	BE	BG	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK
AT		0	0	0	191.072	122.007	0	50	0	2	0	3	474	2	0	7.851	1.243	0	23	0	139	211	0	114.474	0	9.086	3.230
BE	212		0	0	29	33.712	40.241	3.747	0	44	0	1.120	0	0	0	80	10.969	6.312	76.241	0	93.722	1.060	161	0	0	0	2
BG	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CY	0	3	0,01		0	0,07	0	0	152	0	0	0	0	0	0	3	3.250	0	0	0	31	0	0	0	0	0	11
CZ	1.478	54	4	0		2.049	0	74	0	0,4	0	22	0	38	0	1	0	0	0,18	0	435	28.568	639	0	2	0	4.884
DE	21.723	31.197	7	3.681	13.216		94.744	0	0	5	0	1.027	209	0	0	4	969	22.869	0	0	10.766	63.851	0	4	1.019	4.987	225
DK	0	152.323	0	0	0	117.068		152.785	0	5.385	5.332	0	0	0	0	0	34.648	0	762.351	0	13	104.784	167.817	0	226.389	0	0
EE	0	0	0	0	0	248	0		0	0	48	0	0	0	0	1	268	0	23.802	0	19	11	0	0	0,25	0	0
EL	417	0	18.617	1.841	0	4	0	0		0	0	0,22	286	0	0	1	27	0	0	0	183	1	0	2.080	0	0	139
ES	5,04	4	0	0	0	132	1	47	0		0	455	0	0	0	224	0	0	0	0	131	23	59.784	2	2	0	0
FI	0	0	0	0	0	0	0	53.834	0	0		0	0	0	0	0	0	0	0	0	196	0,21	0	0	0	0	0
FR	8.413	231.073	84	0	2.762	92.734	0	16.181	0	25.730	0		421	0	3	581	16.282	3.126	7.043	0	5.854	11.942	422	3	0	0	0
HR	4.884	0,74	0	0	0	389	0	0	0	0	0	0		0	0	19.445	0	0	0	0	6	1	0	0	0	3.099	126
HU	226	0	0	0	29	989	0	0	0	0	0	58	139		0	0,03	0	0	0	0	0,31	49	0	485	0	221	74
IE	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0
IT	596.673	93	926	1	123.082	224.712	3.559	65.980	0,15	5.999	1	36.764	54.479	4.536	1		59.140	1	71.412	1	9.105	89.137	33	3.609	49	79.872	59.431
LT	0	0	0	0	80	280	0	201	0	0	1	0	0	0	0	25		0	1.582	0	1	111	0	0	0	0	0
LU	0	10.850	0	0	11	2.269	0	0	0	0,02	0	0	0	0	0	5	0		0	0	42	529	0	0	2	0	0
LV	15	21	0	0	0	120	58	10.942	0	2	0,1	0	0	0	0	0	181.785	0		46	0,06	103	0	0	0	0	0
MT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
NL	1.897	149.656	4.852	0,43	48	48.485	559	30.887	50	166	14	602	7	36	96	743	15.826	25	375.817	1		52.423	21.791	567	23.034	98	1.185
PL	0	0	0	0	72	2.337	0	0	0	8	0	2	380	0	0	411	956	0	0	0	0		0	0	237	0	26
PT	0	8	0	0	0	70	0	0	0	1.286	0	1.070	0	0	0	0,35	0	0	0	0	26	8		0	15	0	0
RO	139	0	19a	27	557	840	0	0	449	0	0	25	48	66	0	12	0	0	79	0	5	237	0		0	401	408
SE	0	0	0	0	1	1.455	169	93.756	0	3	1.099	1	0	0	0	3	0	0	8.242	0	4.485	2.809	3	0		0	0
SI	33.701	0	0	0	1.424	5.851	0	0	0	0	0	0,43	8.038	1.861	0	255	59	0	4	0	0,04	2	0	36.439	0		14.242
SK	26	23	3	0	4.158	57	0	19a	0	1	0	3	37	163	0	374	0	0	0	0	0,03	502	0	0	0,26	0	

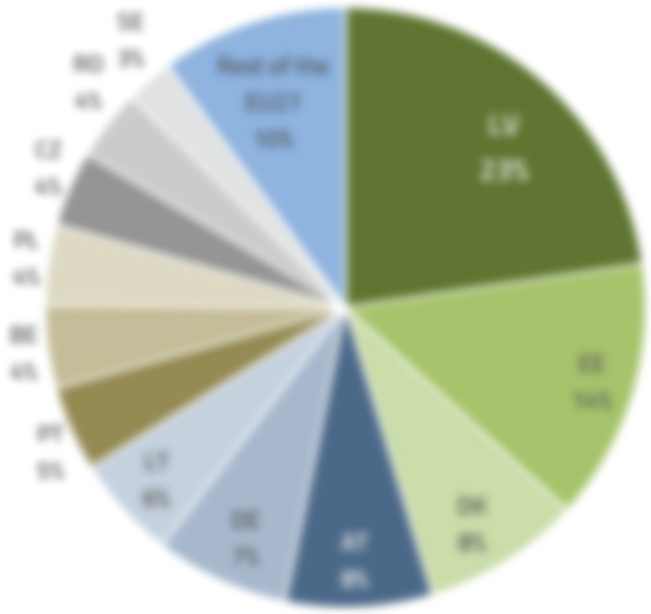
Source: UNcomtrade

3.4.1 EU27 exporting countries

Figure 56 Evolution of the exports of pellets in the top 10 EU27 exporting countries (tonnes)

Source: UNcomtrade

Figure 57 Share of total EU27 pellet exports in 2021 (%)



Source: UNcomtrade

Table 15 Top 5 EU27 pellet exporting countries to the top 5 destination countries in 2021 (tonnes)

Exporting country	Trade destination	Tonnes of pellets
LV	UK	1.430.740
	DK	696.275
	NL	120.509
	IT	99.505
	BE	36.662
	Rest of the world	125.053
EE	DK	913.823
	UK	310.185
	SE	101.368
	NL	73.793
	FI	58.746
	Rest of the world	101.297
DK	LV	485.532
	BE	139.295
	NL	101.161
	DE	67.877
	IT	67.366
	Rest of the world	82.768
AT	IT	756.127
	DE	36.391
	SI	29.436
	CH	26.156
	CZ	11.114
	Rest of the world	14.512
DE	IT	281.261
	AT	155.680
	FR	110.763
	DK	102.285
	NL	48.693
	Rest of the world	103.216

Source: Uncomtrade

3.4.2 EU27 importing countries

Belgium: Over the period 2017-2020, pellet imports into Belgium have followed a steady increase, peaking at 1,21 million tonnes in 2020. However, the closure of the "Les Awirs" power plant has reduced Belgian industrial consumption, and this has also been reflected in imports, with a drop of about 21,6%. The main supplier of pellets in 2021 for Belgium was Russia, with 430.048 tonnes traded. The current crisis therefore represents a significant problem for the Belgian pellet supply, as this affects almost half of its imports for the year.

Denmark: As was the case last year, Denmark is the most important country for pellet imports in the EU27, with 3,2 million tonnes imported. This represents an increase of 24% as compared to 2020 imports, but that specific year's imports were the lowest for the period 2017-2021. The main driver of imports into Denmark is industrial consumption.

France: French imports were increasing substantially between 2020 and 2021, reaching just over 650.000 tonnes (60% increase). This increase may seem impressive in relative terms, but it corresponds to only about 250.000 tonnes, or only 8% of French consumption for 2021.

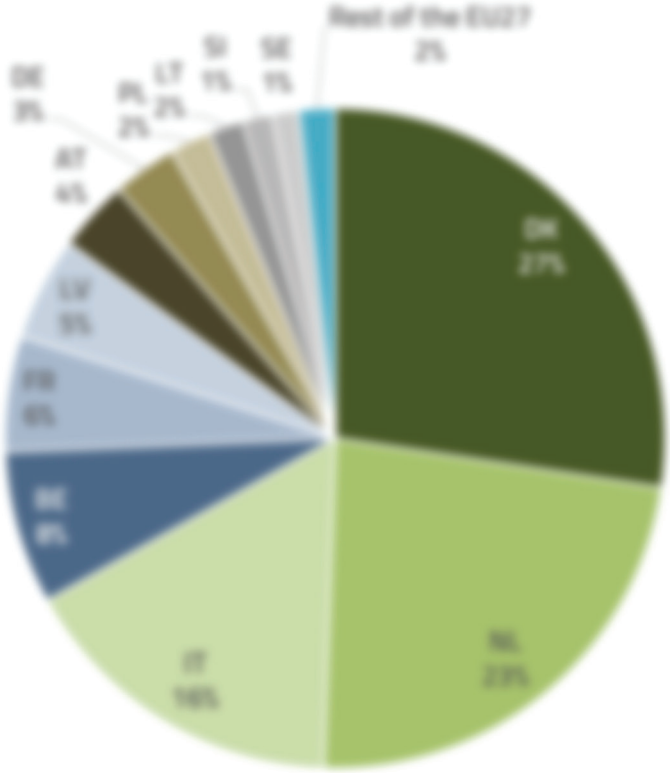
Italy: Italy is the third largest importer of pellets in the EU27, with an import level of around 1,9 million tonnes in 2021 according to the UNcomtrade website. This level of imports follows the downward trend observed since 2019, with a fall in imports of around 9,5% between 2019 and 2020. The 2020-2021 period shows a more significant drop, corresponding to 14,6%.

The Netherlands: The Netherlands continues its impressive momentum in pellet imports since 2017. With a record import level reached in 2020, 2021 saw an increase in imports of 12,4%, bringing total Dutch imports to 2,7 million tonnes. The main trading partner of the Netherlands is the US, with more than one million tonnes imported (1,13 million), making the Netherlands the largest importer of US pellets in the EU27.

Figure 58 Evolution of the imports of pellets in the top 10 EU27 importing countries (tonnes, UK with secondary axis)

Source: UNcomtrade

Figure 59 Share of total EU27 pellet imports in 2021 [1]



Source: UNcomtrade

The five largest importers in the EU27 (Denmark, Netherlands, Italy, Belgium, France) alone account for 80% of total pellet imports.

Table 16 Top 5 EU27 pellet importing countries from the top 5 countries of origin in 2021 (tonnes)

Importing country	Origin of the import	Tonnes of pellets
DK	LV	792.350
	EE	702.785
	US	328.723
	SE	324.331
	RU	316.647
	Rest of the world	734.670
NL	US	1.131.520
	LV	575.017
	RU	448.544
	CA	193.881
	BE	149.656
	Rest of the world	208.142
IT	AT	598.073
	DE	224.712
	BR	194.655
	CZ	123.582
	RU	102.860
	Rest of the world	657.766
BE	RU	430.048
	US	162.227
	NL	93.722
	LV	76.241
	DK	40.241
	Rest of the world	76.535
FR	BE	231.573
	US	153.560
	DE	92.734
	RU	86.337
	ES	25.730
	Rest of the world	68.897

Source: Ufficomtrade

3.5 European pellets price

Limitation of liability - Under no circumstance shall EPC and its contributors be liable for the exactitude, or the use made of the price information available in this section. Moreover, the high unpredictability of today's market makes it difficult to provide any kind of forecast on its development.

Table 17 VAT rate for pellets compared with general VAT rate applied in select European countries in 2021 (%)

	2021 VAT rate for wood pellets (in %)	2021 General VAT rate (in %)
AL	20	20
AT	13	20
BA	17	17
CZ	15	21
DE	7	19
EL	24	24
ES	21	21
IT	22	22
LV	12	21
ME	21	21
PT	23	23
RO	19	19
RS	10	20
SK	20	20

Source: EPC survey 2022

Austria: A 7% VAT reduction was offered in Austria for the purchase of pellets in 2021.

Czech Republic: A VAT rate reduction of 6% was proposed for wood fuels (wood, pellets, briquettes).

Germany: From July 2020 until the end of December 2020, the federal government of Germany decided to reduce the VAT rate. From 19% to 16% in general and from 7% to 5% for pellets. However, in 2021, VAT rates reverted to previous values.

Latvia: The VAT rate for wood pellets is reduced by half, going from 21 to 12%.

Serbia: A 10% reduction was offered in Serbia for the purchase of wood pellets, with the VAT set to 10% (instead of 20%).

3.5.1 European price development of residential pellets

3.5.1.1 BAGGED PELLET PRICES

Figure 60 Estimation of bagged pellet prices in European countries with highest prices between January 2017 and July 2022 (retail price, 1 pallet in €/tonne VAT incl.)

Source EPC survey 2022

Figure 61 Estimation of bagged pellet prices in European countries with lowest prices between January 2017 and July 2022 (retail price, 1 pallet in €/tonne VAT incl.)

Source EPC survey 2022

Figure 62 Variation and average of bagged pellet prices between January 2021 and December 2021 by country (retail price, 1 pallet in €/tonne VAT incl.)

Source EPC survey 2022

Table 18 Estimation of bagged pellet prices between January 2021 to July 2022 in Europe (retail price, 1 pallet in €/tonne VAT incl.)

	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22
AL	220	220	220	220	220	225	230	230	235	242	250	270	272	272	272	275	281	292	295
AT	270	269	269	261	258	258	260	263	266	271	277	284	302	307	308	339	N.A.	N.A.	N.A.
BA	197	190	184	180	180	180	180	183	183	186	212	222	232	242	254	268	306	317	320
BE	250	250	250	250	250	240	240	240	240	263	263	286	307	336	343	348	352	408	464
CZ	304	316	330	332	317	295	276	276	280	280	285	294	299	321	348	385	413	421	N.A.
DE	291	291	292	281	278	288	287	295	299	308	318	347	389	410	402	423	439	473	554
EL	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	295	300	305	280	260	260	270
ES	282	282	282	277	277	277	279	279	279	291	291	291	310	310	310	379	379	379	N.A.
FI	N.A.	279	N.A.	N.A.	278	N.A.	N.A.	278	N.A.	N.A.	278	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
FR	290	290	290	294	294	294	306	306	306	326	326	326	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
HR	260	270	260	240	240	230	230	230	240	250	270	270	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IT	285	285	285	288	270	270	295	276	300	311	311	311	343	362	362	384	N.A.	N.A.	N.A.
LT	177	169	169	174	174	178	180	191	196	196	207	218	218	229	283	327	338	N.A.	N.A.
LV	280	280	260	260	240	240	180	200	260	270	270	280	230	300	300	320	380	380	380
ME	220	220	215	205	205	205	205	210	215	230	230	230	252	280	285	285	301	315	320
NL	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	365	375	385	N.A.	N.A.	N.A.	N.A.
PL	210	210	210	210	210	210	210	210	220	230	260	280	300	320	320	320	N.A.	N.A.	N.A.
RO	281	281	270	260	255	227	227	227	307	335	361	361	320	340	360	370	380	400	430
RS	212	212	210	205	205	215	215	220	230	278	285	288	285	285	300	305	325	365	370
SI	268	268	268	268	270	270	270	270	290	295	310	310	353	353	353	N.A.	N.A.	N.A.	N.A.
SK	240	240	240	213	213	213	229	247	247	252	260	280	306	306	306	324	390	448	N.A.

Source EPC survey 2022

3.5.1.2 BULK PELLET PRICES

Figure 63 Estimation of bulk pellet prices in European countries with highest prices between January 2017 and July 2022 (delivered-tbl, distance 100 km, delivery fees included. In €/tonne VAT incl.)

Source EPC survey 2022

Figure 64 Estimation of bulk pellet prices in European countries with lowest prices between January 2017 and July 2022 (delivered-tbl, distance 100 km, delivery fees included. In €/tonne VAT incl.)

Source EPC survey 2022

Figure 65 Variation and average of bulk pellet prices between January 2021 and December 2021 by country (delivered 6t, distance 100 km, delivery fees included, in €/tonne VAT incl.)

Source EPC survey 2022

Table 19 Estimation of bulk pellet prices between January 2021 and December 2021 (delivered 6t, distance 100 km, delivery fees included, in €/tonne VAT incl.)

	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21	Aug 21	Sep 21	Oct 21	Nov 21	Dec 21	Jan 22	Feb 22	Mar 22	Apr 22	May 22	Jun 22	Jul 22
AL	218	218	218	218	218	222	227	227	232	240	248	268	270	270	270	273	279	290	293
AT	231	233	232	220	219	221	223	225	229	236	249	265	300	309	306	319	336	367	440
BA	165	167	180	176	176	176	177	180	180	184	210	220	230	240	252	266	304	315	318
BE	250	250	250	250	250	240	240	240	240	263	263	286	307	336	343	348	352	438	484
CH	353	356	356	346	330	331	331	336	340	346	357	395	429	460	474	486	489	484	N.A.
CZ	302	305	310	314	293	275	261	261	270	270	274	288	293	305	321	376	396	402	N.A.
DE	238	236	240	227	217	221	225	232	237	248	267	303	367	374	369	377	393	432	508
ES	275	275	275	271	271	271	272	272	272	297	297	297	315	315	315	387	387	387	N.A.
FR	284	284	284	271	271	271	282	282	282	304	304	304	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
HR	270	280	280	250	250	250	250	250	260	270	280	280	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
IT	296	311	311	295	308	308	308	308	318	331	330	330	368	391	390	421	N.A.	N.A.	N.A.
LT	138	142	137	131	122	125	126	146	176	172	188	225	258	261	357	295	304	504	N.A.
LV	120	118	119	115	116	115	120	121	133	141	147	155	220	280	280	300	360	380	370
ME	218	218	213	213	203	203	203	208	213	228	228	228	250	278	283	283	299	313	318
NL	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	320	330	340	N.A.	N.A.	N.A.	N.A.
PL	210	210	210	210	210	210	210	210	220	230	260	280	300	320	320	320	N.A.	N.A.	N.A.
RS	210	210	208	200	200	212	212	219	230	278	285	288	283	283	287	303	322	362	367
SI	277	277	277	265	265	265	265	265	265	299	299	299	332	332	332	N.A.	N.A.	N.A.	N.A.
SK	243	243	243	224	224	224	236	248	248	248	257	273	300	300	300	320	340	380	N.A.

Source EPC survey 2022

3.5.2 European price development of industrial pellets

Figure 66 Development of Argus wood pellets index cif NWE USD/t

Source: Argus Media

Source: Argus Media

Argus Media's expert comments on the industrial market and price developments :

Industrial wood pellet prices for deliveries to northwest Europe (NWE) have reached record highs in 2021-2022 supported by supply bottlenecks and strong demand.

The Argus 90-days spot index averaged $168/t cif NWE in 2021, up $32/t on the year, seeing record highs – at the time – towards the yearend.

Most European utilities had entered 2021 well-stocked, as a milder than usual winter season and plants going offline in 2020 pared demand, which combined with the abundant supply of raw materials from the bark beetle infestation in Germany and elsewhere in central Europe in late 2020. These resulted in spot prices during the 2020-21 heating season dropping to a four-year low of $134/t cif NWE.

But colder than usual weather in April-May 2021 prompted stronger demand for heating. And rising power prices from May 2021, as the overall global commodity complex firmed, bolstered power sector demand. Some pellet-fired utilities – particularly in Denmark and the UK – were able to generate power at strong margins even outside state supported schemes. And the break-even power price for pellet-fired generation switching to a discount to that for coal-fired units – after accounting for emissions – gave pellets a competitive advantage over coal at co-fired plants, particularly in the Netherlands (see chart).

Pellet burn for power rose to a historic high in 2021, to a combined hourly average of 4.5GW for the UK, Denmark, Belgium, Netherlands and France which was also well above 3.9GW a year earlier. Power sector consumption therefore rose by an equivalent of 2.4 million tonnes of wood pellets – assuming an average 40pc efficiency rate at plants – to 20.7 million tonnes in 2021, Argus calculates. Mostly because of stronger output in the summer season, with many utilities entering the 2021-22 heating season with stocks below recent-year averages.

By contrast, pellet production dropped in the second half of 2021, partly because most plants produced more in the first six months as raw material supplies got bolstered from bark-beetle infested trees and strong construction activity. But raw material availability tightened significantly later in 2021, particularly in the last quarter of the year, with most producers in the Baltics operating on supplies fresh from forests rather than allowing material to undergo the full-year cycle of drying.

Wood pellet prices continued to increase sharply in 2022, with the Argus spot cif NWE averaging $291/t on 1 January – 23 August and the index at a fresh high of $369/t on 23 August.

Delays in deliveries from key supply regions – the US, the Baltics, and Portugal –mostly because of Covid-19 related disruptions in the global supply chain, further exacerbated the supply tightness in the first quarter of 2022, supporting prices. Disruptions in Europe's trade with Russia and Belarus following the start of the conflict in Ukraine from late February 2022 adding to the pressure on the supply side.

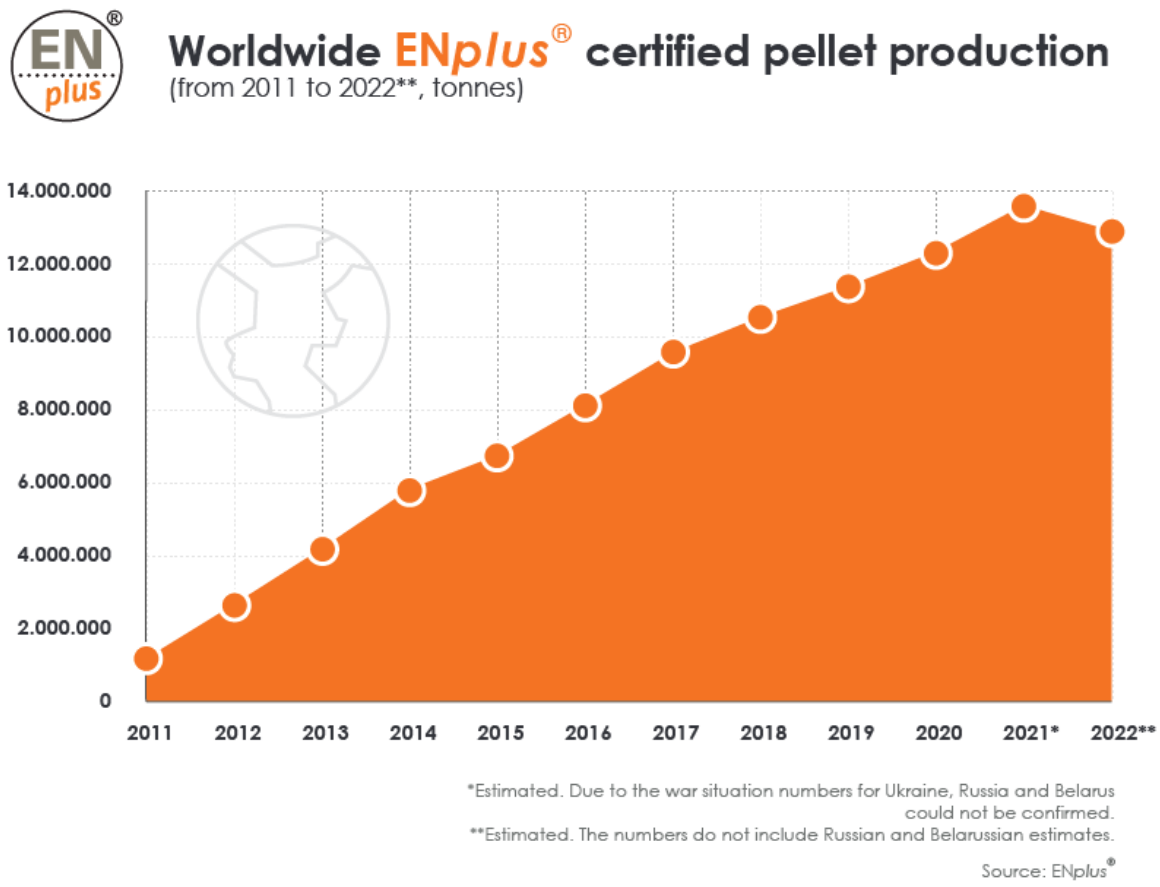
Many utilities in northwest Europe went on planned or unplanned maintenance in the second quarter of 2022, while some switched fuels, even though power, coal and emission prices provided with a strong incentive to burn pellets for most of 2022. This was partly to manage delays in deliveries and prevent sharp increases in pellet prices, as well as replenish inventories to healthy levels ahead of the next heating season.

The incentive for burning pellets to generate power or heat remains strong for the remainder of 2022 and 2023, although European buyers are yet to close the deficit from the ban on trade of wood products – including wood pellets and chips – after sanctions kicked in on 11 July.

Signs of a slowdown in construction activity have given some hope that more raw material could become available for pellet production, particularly in the Baltics which have been hit the hardest from the halt in trade of wood products with Russia. That said, demand in Europe is expected to continue to exceed supply in the near future and prices to hold firm, as long as power, coal, emissions prices also hold current firm levels.

4 Focus on EN*plus*®

Figure 67 Worldwide EN*plus*® certified production from 2011 to 2022 (tonnes)



The EN*plus*® certification scheme ensures wood pellet quality for the customer by guaranteeing the quality of the pellets over the entire supply chain (i.e. from production to end-user delivery). This certification is governed and managed by the European Pellet Council (network of Bioenergy Europe) outside Germany. In Germany the Deutsches Pelletinstitut DEPI is the governing body, with the support of National Associations, and it manages the certification on a national level. Since its introduction, the number of countries with certified EN*plus*® producers has rapidly grown, reaching 46 countries with a total volume of over 12,4 million tonnes of certified pellets produced in 2020 and nearly 14 million tons in 2021. The 2022 drop in ENplus pellets production can be explained by the current geopolitical situation and the suspension of russian companies from the ENplus scheme.

The number of EN*plus*® certified producers worldwide shows once again a sizeable growth, reaching 618 producers and 568 traders in 2021. With these results, EN*plus*® is well on its way to reaching its aim of harmonising pellet quality at the global level.

Figure 68 Worldwide EN*plus*® certified pellet production plants in 2021

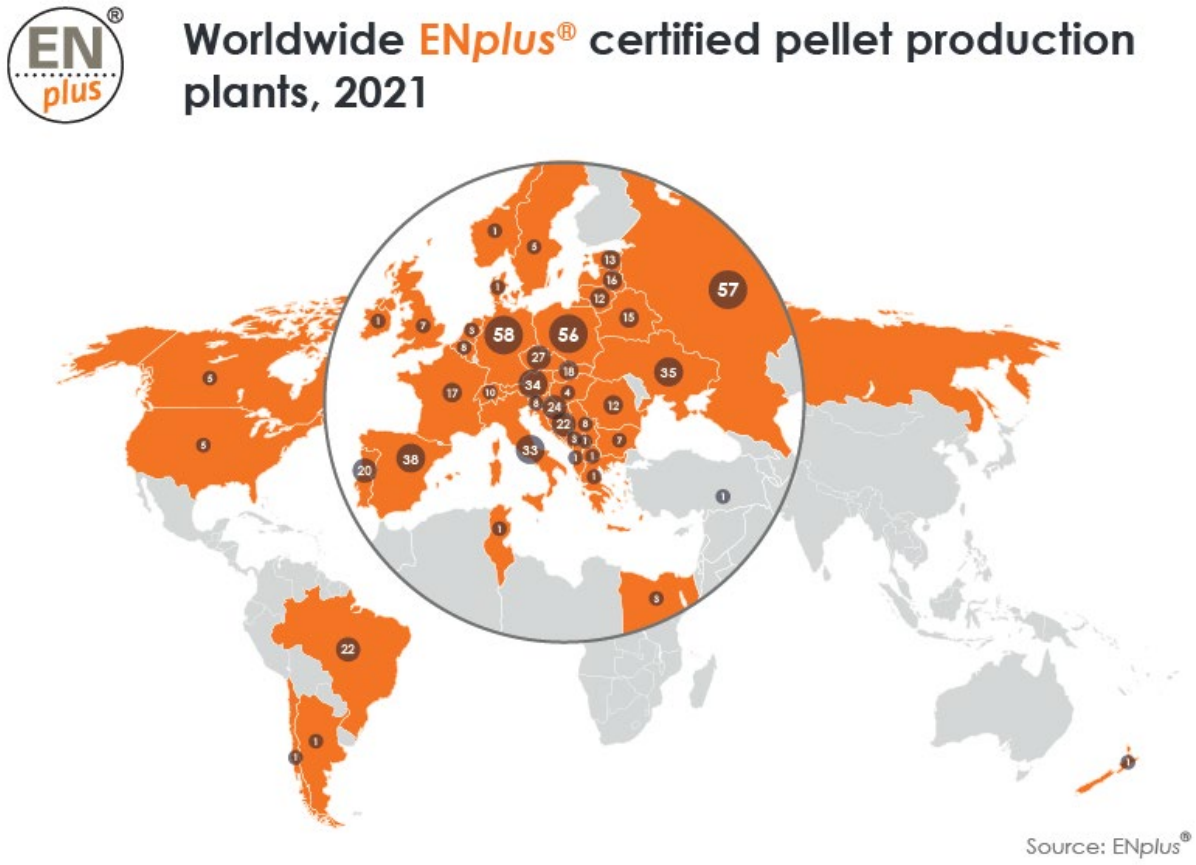


Figure 69 Amount of countries with EN*plus*® certified producers

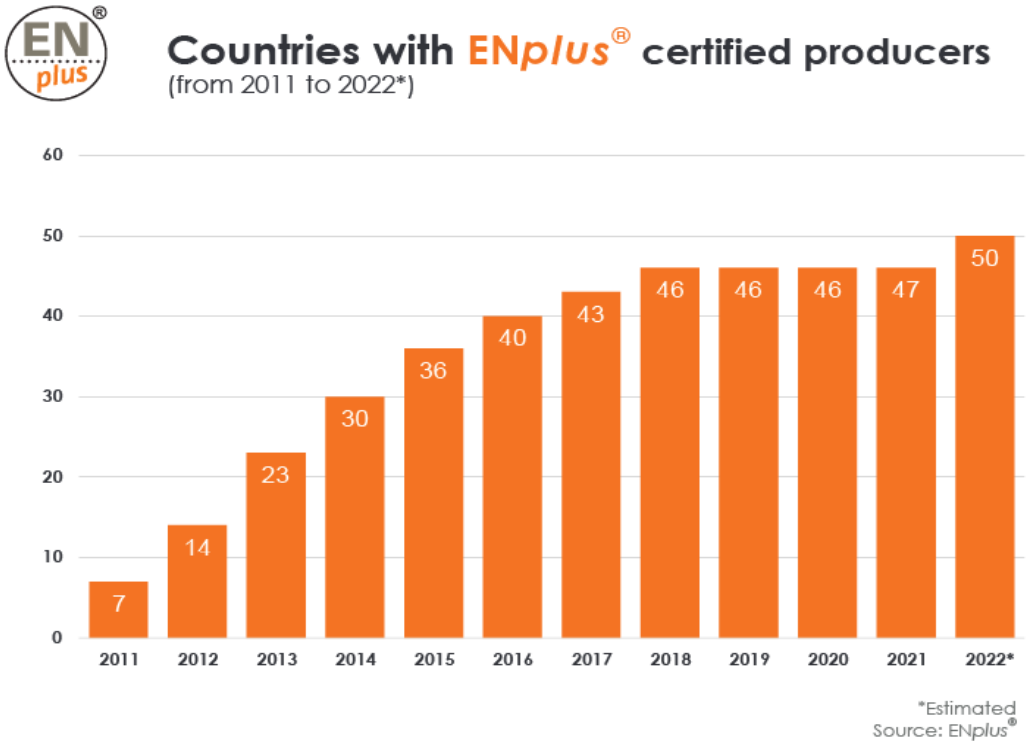


Figure 70 Total number of EN*plus*® certified producers/traders in 2021

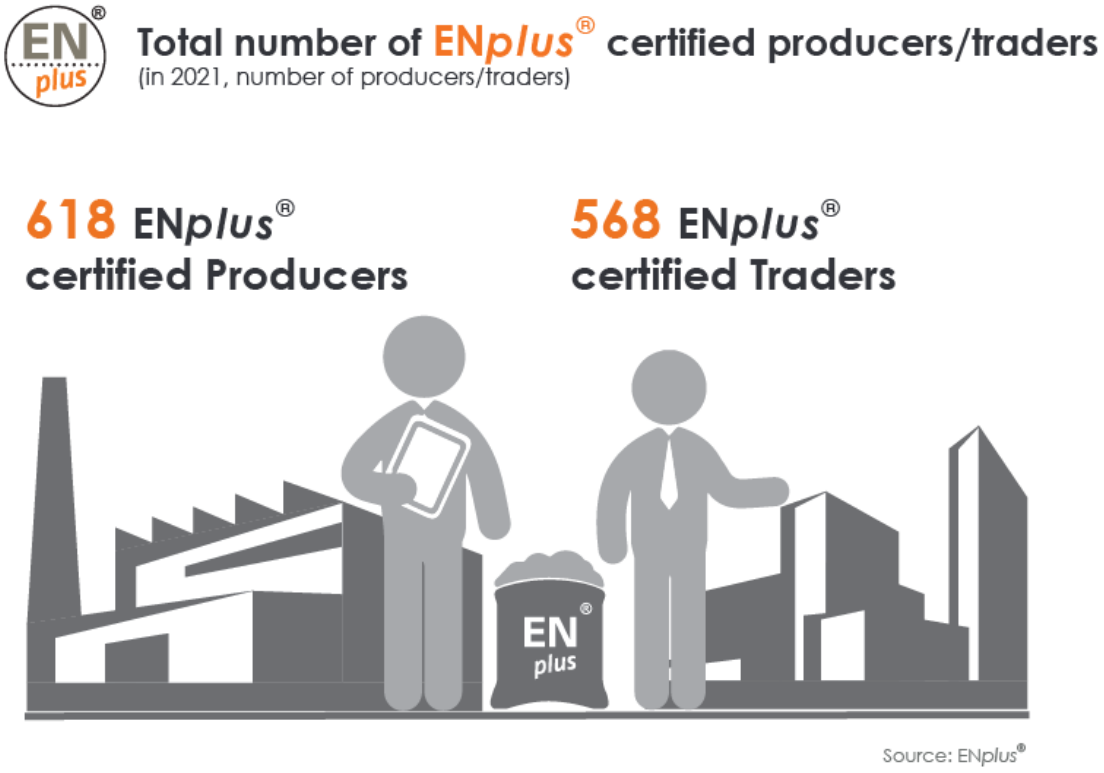


Figure 71 Volumes of EN*plus*® certified pellet produced by the top 5 countries from 2018 to 2022 (tonnes)

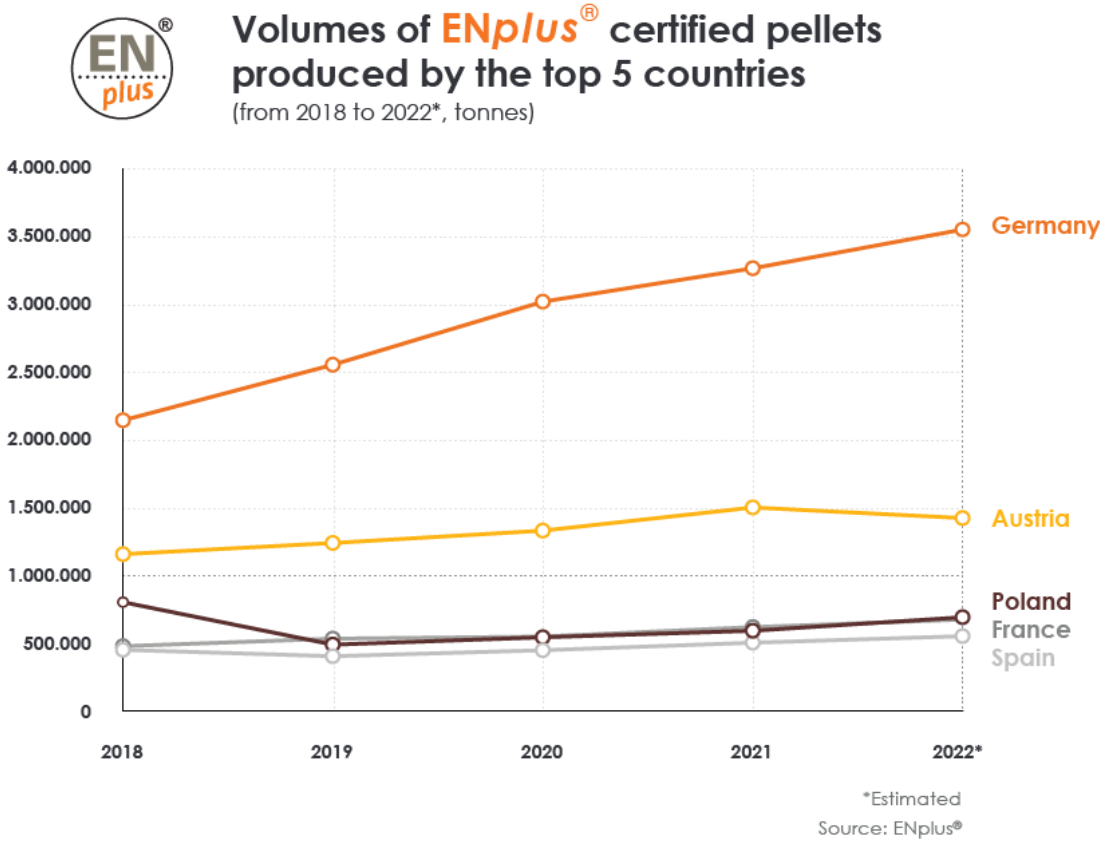


Figure 72 Total active EN*plus*® certified pellet producers in the Balkans

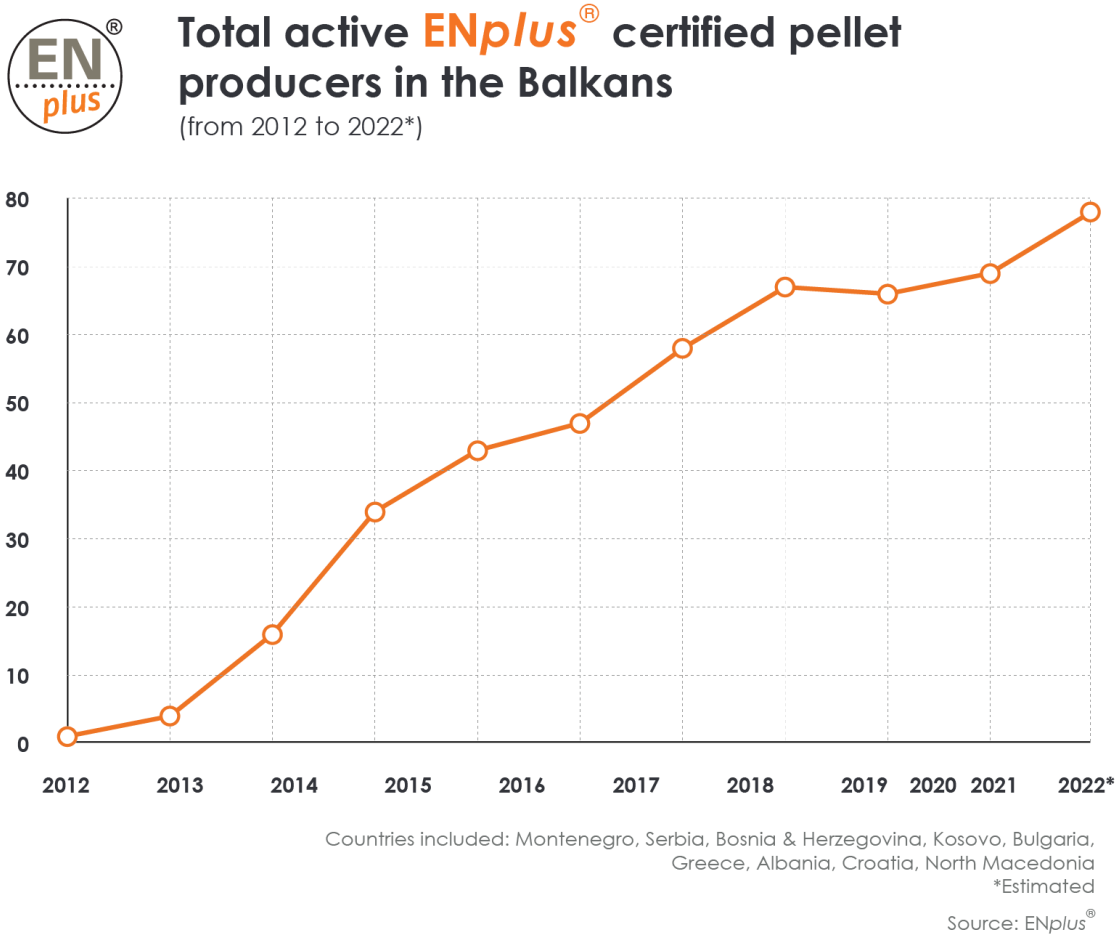


Figure 73 Volumes of EN*plus*® certified pellets produced by the top 20 countries in 2021 (tonnes)

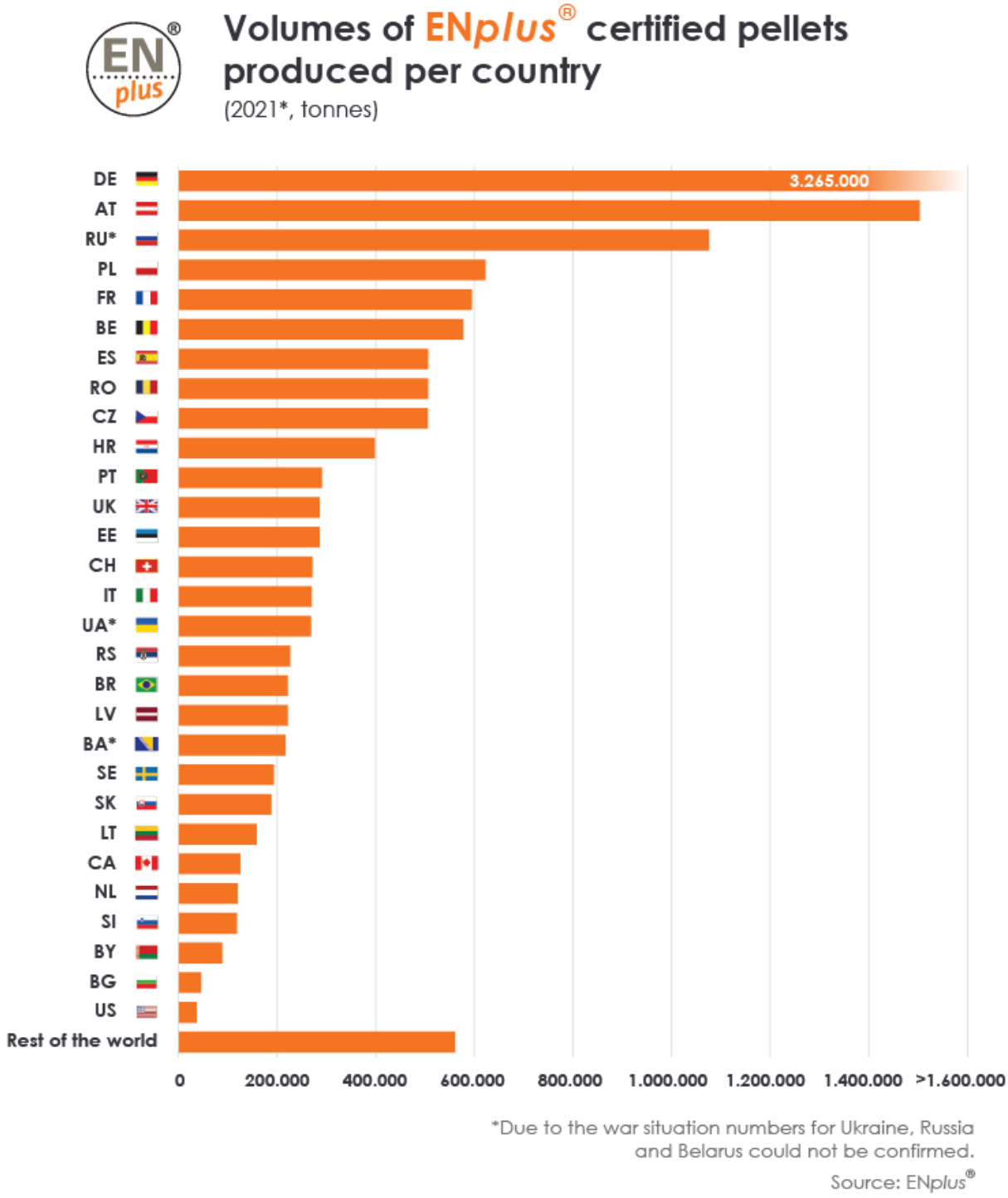
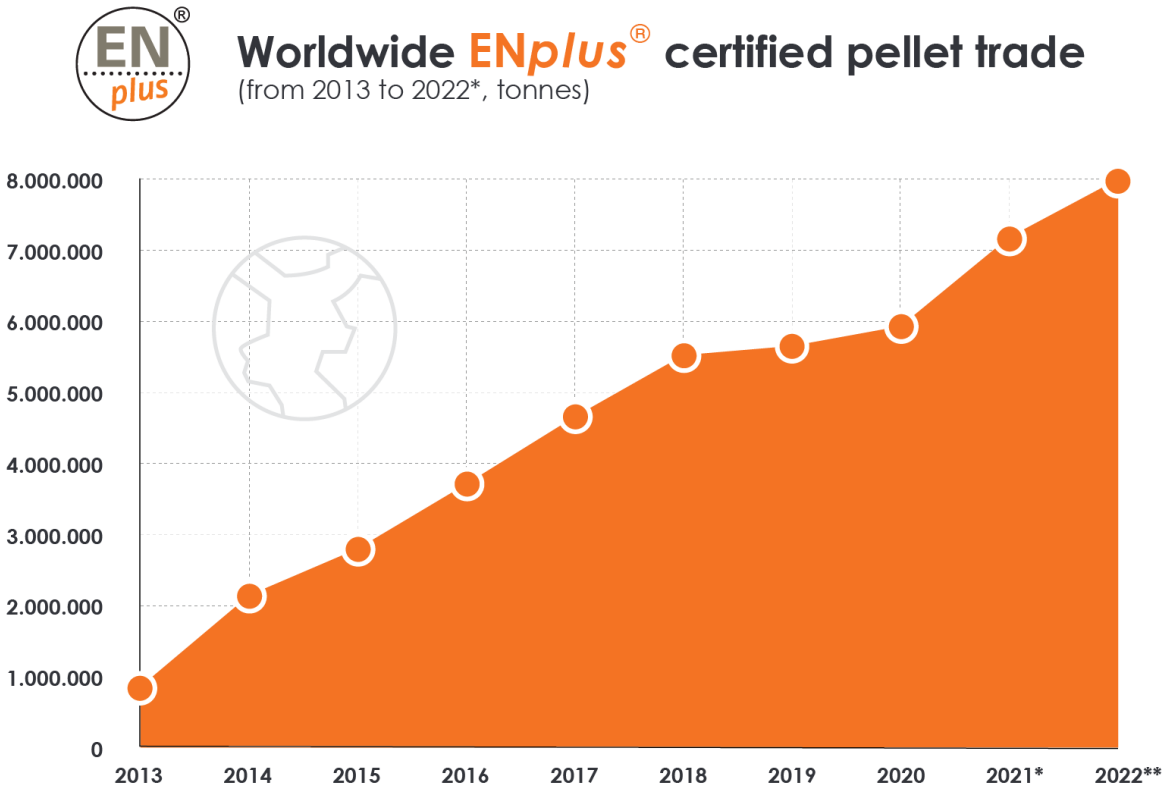


Figure 74 Worldwide EN*plus*® certified pellet trade (tonnes)



*Estimated. Due to the war situation numbers for Ukraine and Russia could not be confirmed.
**Estimated. The numbers do not include Russian estimates.

Source: EN*plus*®

AIEL

EXPERT COMMENT

Reasons behind the recent bull market trends in the European wood pellets sector are well-known and include direct and indirect war effects, as well as: EU sanctions hitting pellet imports from Russian Federation and Belarus; diminished Ukrainian export flows; increased competition in the supply chains, either between the domestic heating market and the industrial sector, and within the premium market too; protectionist behaviours of some national markets; energy price and supply shocks; inflation process; diminished availability of wood raw material; raising production costs; logistic constraints; high demand for heating solutions alternative to traditional fossil fuels and, lately, high levels of financial exposure and business risk taken by market players, and will to maximize profitability, too.

As a result, pellet prices reached noticeably higher levels compared to last year; only recently, tightness in the premium sector showed its early easing trends. Naturally, these market dynamics bring lights and shadow in the eyes of policy makers, final consumers, and market operators.

On the one hand, the wood pellet sector has not found itself fully prepared as a prompt substitute to the traditional fossil fuel supplies, and – even where this may actually happen – pellets may still not be of sure relief to household end-users' energy poverty, in the short term and in the face of energy price shock dynamics. These negative aspects, which in some countries also attracted the unprecedented interest of governmental competition and market Agencies, may have future effects on the sales of pellet appliances and on policy makers' and public perception about the reliability of the sector as a robust alternative to fossil fuels. This would be paradoxical, since many of the current tensions are still due to the slowness of the energy transition process toward a green and low-carbon economy. On the other hand, current prices are stimulating a widespread, significative interest in new production and bagging lines throughout Europe, even in countries typically dependent upon import flows, such as Italy. So, after some years of steady, progressive development of the market, the recent dynamics are likely to be powerful drivers to boost the sector and reach a new balance between steadily increased levels of supply and demand. New supply areas and trading flows are also expected to develop and pop up soon: among the others, Turkey and China are already well-spotted cases, sometimes accompanied by worries about possible dumping and "laundry" of Russian pellets in the European market.

Finally, the recurrence of low-quality pellets to compensate market tightness, shortages and price increase will probably be another challenge for the premium sector. Luckily, the world-leading certification scheme for wood pellets quality, EN*plus*®, has recently completed the revision of its standards and procedures and will keep serving the market at its best, focussing more than ever on product quality and traceability.

Matteo Favero

Wood Biofuels & Certifications Schemes Area Manager

AIEL

ENplus® Communication
Statistical Report

OCTOBER 2022

Fraud updates – General overview

Since mid-2022, the ENplus® Management has witnessed a sharp increase in the number of counterfeit certificates reported by both certified companies, scheme partners, and end-users, to its fraud management team, now representing 53% of all trademark fraud investigated and managed by ENplus®. The sudden rise in certificate falsifications could be explained by the growing demand for pellets, leading to a surge in such fraudulent practices. This wave of new reported fraud is particularly noticeable in Poland (15% share of all fraud cases received in 2022), Ukraine (9%), Germany (8%) and the Netherlands (6%). Additionally, 25% of new fraud has an unknown origin.

Bioenergy Europe and the National Licensers of ENplus® continue to place significant effort and resources into combating fraud. Practically, 130 fraud cases have been or are currently being handled by this network of partners since the beginning of 2022, of which more than a third (or 35%) is already solved, for a total of 832 fraud cases solved by ENplus® since 2014 (63% of all cases handled). Moreover, an additional 22 infringing companies were included this year on the ENplus® Blacklist, available on the ENplus® website (173 in total since 2014), making their actions known to the wider public, and thus safeguarding the pellet market as a whole.

The recent figures give an overview of the positive results of fraud fighting and highlight once again the importance of this activity. Last year, the total number of cases processed since 2014 reached the symbolic mark of 1000, and as of October 2022, more than 1300 cases have or are being dealt with, an all-time high. In 2022, marketing fraud (the unauthorised use of ENplus® in communication material) is the type of fraud with the second highest percentage (29%), followed by product misuses (the fraudulent use of the ENplus® seal on pellet bags) as the third most common type of fraud handled (13%). Finally, a small number of cases (5%) do not fit into any of those categories.

Eoin Stuckens
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Bioenergy Europe

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Figure 75 Number of reported fraud cases per country (absolute) from January 2022 until September 2022

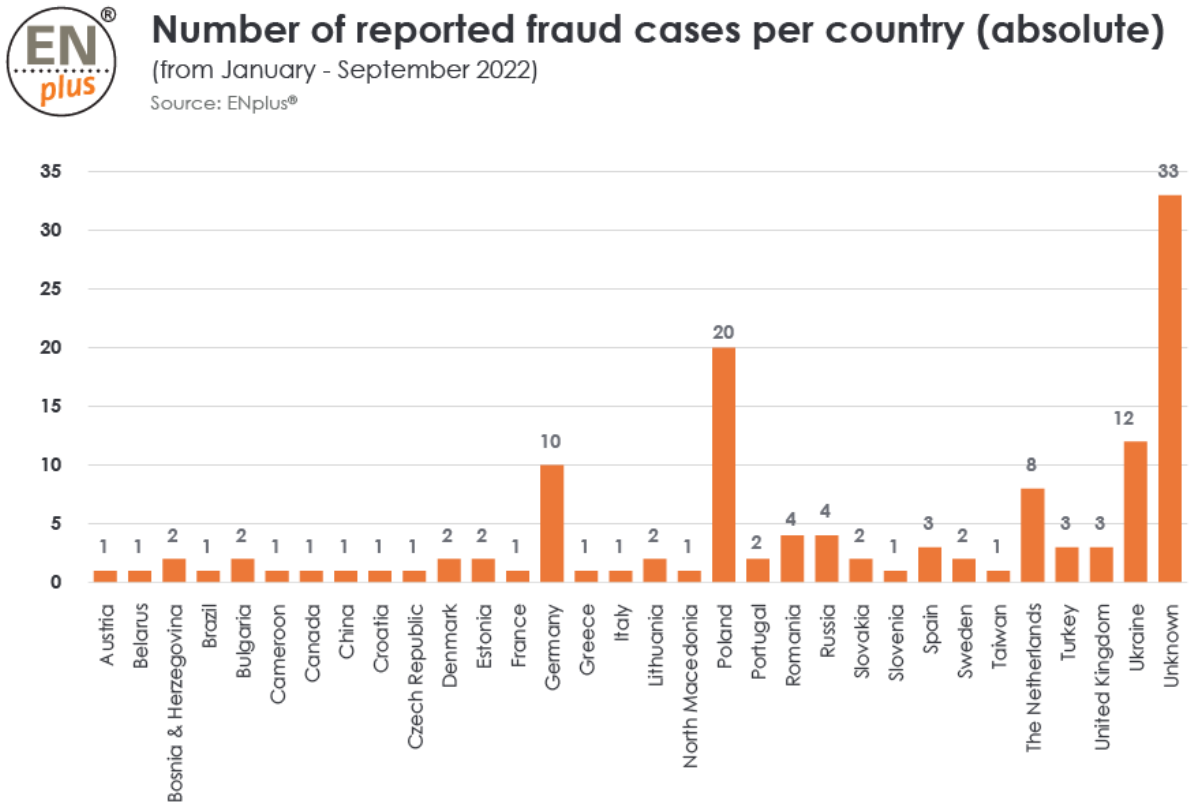


Figure 76 EN*plus*® fraud cases per type of fraud from January 2022 until September 2022

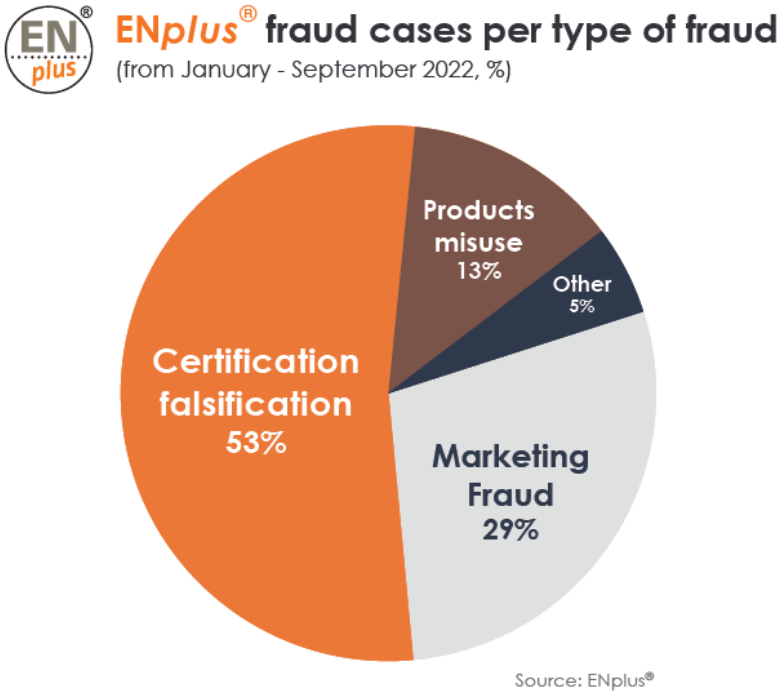
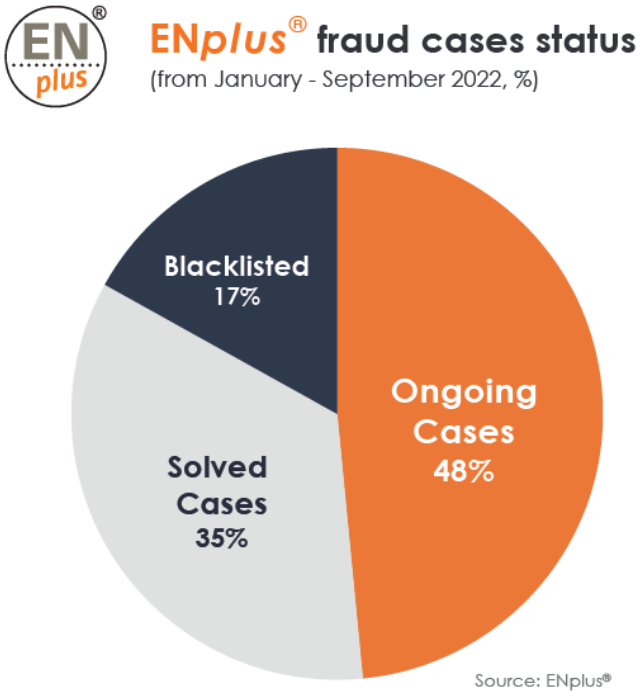


Figure 77 EN*plus*® fraud cases status from January 2022 until September 2022



5 Annexes

COUNTRY ABBREVIATIONS

EU27	European Union (27 members)
AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovak Republic

AL	Albania
AU	Australia
BA	Bosnia Herzegovina
BR	Brazil
BY	Belarus
CA	Canada
CH	Switzerland
CL	Chile
CN	China
ID	Indonesia
JP	Japan
KR	South Korea
ME	Montenegro
MY	Malaysia
NO	Norway
NZ	New Zealand
RS	Republic of Serbia
RU	Russia
TH	Thailand
UA	Ukraine
UK	United Kingdom
US	United states of America
VN	Vietnam

Conventions to geographic regions:

EU27: European Union member states. In the case when a new country has joined the EU, the country will be added also to previous years as a member of EU.

Other Europe: Albania, Belarus, Bosnia Herzegovina, Montenegro, Norway, Russia, Serbia, Switzerland Ukraine, United Kingdom

Europe: EU27+other European countries

Balkan countries: Albania, Bosnia Herzegovina, Croatia, Montenegro, Serbia, Slovenia

Baltic countries: Estonia, Latvia, Lithuania

SYMBOLS AND ABBREVIATIONS AND DECIMAL PREFIXES

Symbol	Meaning
,	Decimal separator
.	Thousand
N.A.	Data not available

GENERAL CONVERSION FACTORS FOR ENERGY

to from	1 MJ	1kWh	1 kg oe	Mcal
1 MJ	1	0.278	0.024	0.239
1 kWh	3.6	1	0.086	0.86
1 kg oe	41.868	11.63	1	10
1 Mcal	4.187	1.163	0.1	1

FUEL PROPERTIES OF SELECTED BIOMASS FUELS

Fuel	Net calorific value, dry content (kWh/kg) (moisture content 0%) ($q_{p,net,d}$)	Moisture content w-% (ar)	Net calorific value, as received=actual value (kWh/kg) ($q_{p,net,ar}$)	Bulk density (kg/loose m^3)	Energy density (MWh/loose m^3)	Ash content, dry (%)
Sawdust	5,28-5,33	45-60	0,60-2,77	250-350	0,45-0,70	0,4-0,5
Bark, birch	5,83-6,39	45-55	2,22-3,06	300-400	0,60-0,90	1-3
Bark, coniferous	5,14-5,56	50-65	1,38-2,50	250-350	0,50-0,70	1-3
Plywood chips	5,28-5,33	5-15	4,44-5,00	200-300	0,9-1,1	0,4-0,8
Wood pellets	5,26-5,42	7-8	4,60-4,90	550-650	2,6-3,3	0,2-0,5
Steam wood chips	5,14-5,56	40-55	1,94-3,06	250-350	0,7-0,9	0,5-2,0
Log wood (oven-ready)	5,14-5,28	20-25	3,72-4,03	240-320	1,35-1,95	
Logging residue chips	5,14-5,56	50-60	1,67-2,50	250-400	0,7-0,9	1,0-3,0
Whole tree chips	5,14-5,56	45-55	1,94-2,78	250-350	0,7-0,9	1,0-2,0
Reed canary grass (spring harvested)	4,78-5,17	8-20	3,70-4,70	70	0,3-0,4	1,0-10,0
Reed canary grass (autumn harvested)	4,64-4,92	20-30	3,06-3,81	80	0,2-0,3	5,1-7,1
Grain	4,8	11	4,30	600	2,6	2
Straw, chopped	4,83	12-20	3,80-4,20	80	0,3-0,4	5
Miscanthus, chopped	5,0	8-20	3,86-4,06	110-140	1,72-2,19	2,0-3,5
Straw pellets	4,83	8-10	4,30-4,40	550-650	2,4-2,8	5
Olive cake (olive pomace)	4,9-5,3	55-70	1,00-3,10	800-900	1,46-1,64	2-7
Olive cake (olive marc)	4,9-5,3	<10	4,30-4,70	600-650	2,6-2,9	2-7

1kWh/kg = 1 MWh/tonne = 3,6 GJ/tonne

Source: EUBIONET "Biomass fuel supply chains for solid biofuels"

Quality class	ENplus® A1	ENplus® A2	ENplus® B	Unit	Testing standard
Diameter (as received)	6 ± 1, 8 ± 1	6 ± 1, 8 ± 1	6 ± 1, 8 ± 1	mm	ISO 17829
Length (as received)	3,15 ≤ L ≤ 40 (a)	3,15 ≤ L ≤ 40 (a)	3,15 ≤ L ≤ 40 (a)	mm	ISO 17829
Share of pellets with a length < 10 mm (as received)	value & category to be stated	value & category to be stated	value & category to be stated	w-%	EN*plus*® Guidance Document (b)
- Category L < 20%, 20%≤ M ≤ 30%, S > 30%					
Moisture (as received)	≤ 10,0	≤ 10,0	≤ 10,0	w-%	ISO 18134
Ash (dry basis)	≤ 0,70	≤ 1,20	≤ 2,00	w-%	ISO 18122
Mechanical durability (as received) (c)	≥ 98,0	≥ 97,5	≥ 97,5	w-%	ISO 17831-1
Bulk density (as received)	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750	kg/m³	ISO 17828
Particle density (as received)	value to be stated	value to be stated	value to be stated	g/cm³	ISO18847
Coarse fines (3,15 mm ≤ FP < 5,6 mm) (as received)	value to be stated	value to be stated	value to be stated	w-%	analysis based on ISO 18846 (d, e, f, g)
Fines (< 3,15 mm) (bulk) (as received)	≤ 1,0	≤ 1,0	≤ 1,0	w-%	ISO 18846 (d, f, g)
Fines (< 3,15 mm) (bags) (as received)	≤ 0,5	≤ 0,5		w-%	ISO 18846 (e, f, g)
Net calorific value (as received)	≥ 4,6 (h)	≥ 4,6 (h)	≥ 4,6 (h)	kWh/kg	ISO 18125
Additives (as received)	≤ 2,0 (i)	≤ 2,0 (i)	≤ 2,0 (i)	w-%	
Nitrogen (dry basis)	≤ 0,3	≤ 0,5	≤ 1,0	w-%	ISO 16948
Sulfur (dry basis)	≤ 0,04	≤ 0,04	≤ 0,04	w-%	ISO 16994
Chlorine (dry basis)	≤ 0,02	≤ 0,02	≤ 0,03	w-%	ISO 16994
Arsenic (dry basis)	≤ 1	≤ 1	≤ 1	mg/kg	ISO 16968
Cadmium (dry basis)	≤ 0,5	≤ 0,5	≤ 0,5	mg/kg	ISO 16968
Chromium (dry basis)	≤ 10	≤ 10	≤ 10	mg/kg	ISO 16968
Copper (dry basis)	≤ 10	≤ 10	≤ 10	mg/kg	ISO 16968
Lead (dry basis)	≤ 10	≤ 10	≤ 10	mg/kg	ISO 16968
Mercury (dry basis)	≤ 0,1	≤ 0,1	≤ 0,1	mg/kg	ISO 16968
Nickel (dry basis)	≤ 10	≤ 10	≤ 10	mg/kg	ISO 16968
Zinc (dry basis)	≤ 100	≤ 100	≤ 100	mg/kg	ISO 16968
Ash deformation temperature	≥ 1200	≥ 1100	≥ 1100	°C	ISO 21404 (j)

(a) A maximum of 1% of the pellets may be longer than 40 mm. No pellets longer than 45 mm are allowed.

(b) 100 pellets should be measured (after sieving with a 5,6 mm sieve) for the length distribution mass where only 50 are recommended in the ISO 17829. The results shall be both expressed by the exact value and the category (L, M, S).

(c) At the loading point of the **transport vehicle** at the production site.

(d) At **company** gate or when loading **big bags** or truck for deliveries to end-users.

(e) At **company** gate, when filling bags (**bagged pellets**).

(f) The indication "3,15 mm" respective "5,6 mm" designates particles which pass through a round hole sieve with an aperture size of 3,15 mm, respective 5,6 mm, according to ISO 3310-2.

(g) ISO 18846 will be replaced by ISO 5370.

(h) Equal ≥ 16,5 MJ/kg as received.

(i) The amount of additives in production shall be limited to 1,8 w-% while the amount of post-production additives (e.g. coating oils) shall be limited to 0,2 w-% of the pellets.

(j) Ash is produced at 815 °C. All characteristic temperatures listed in ISO 21404 shall be stated in the report.

NOTE: The results are considered conforming if the value reported by the laboratory is within the specified limit.

Source: EN*plus*® Handbook

Pellet	In this report, the word '*pellet*' is always in reference to '*wood pellet*' unless otherwise stated in cases where '*agropellet*' is specified.
$CO2_{eq}$ (Carbon Dioxide Equivalent)	Carbon dioxide equivalent is the standard unit for comparing the global warming potential of any greenhouse gas over a specified period of time. In this way, the relative severity of all greenhouse gas emissions can be evaluated in terms of one agreed reference point.
CHP heat pellets consumption/use	Volume of pellets used for the heat production within a combined heat and power appliance (CHP) corresponding to 2/3 of the total volume of pellets used in the CHP.
CHP electricity pellets consumption/use	Volume of pellets used for electricity production within a combined heat and power appliance (CHP) corresponding to 1/3 of the total volume of pellets used in the CHP.
Commercial consumption/use	Volume of pellets used in dedicated heat boilers with a capacity greater than 50 kW. This class includes dedicated heat boilers used in residential buildings, public buildings, services, industry and excludes combined heat and power appliances (CHP).
Dedicated power pellets consumption/use	Volume of pellets used for electricity production in a plant only producing electricity without recovering the heat generated during the process.
Derived heat	According to Eurostat, derived heat covers the total heat production in heating plants and in combined heat and power plants. It includes the heat used by the auxiliaries of the installation which use hot fluid and losses in the installation/network heat exchanges. For auto-producing entities (= entities generating electricity and/or heat wholly or partially for their own use as an activity which supports their primary activity) the heat used by the undertaking for its own processes is not included.
Industrial pellet consumption	Pellet consumed in large scale CHP and power plants.
Pellet consumption for heat production	Unless otherwise stated, this corresponds to the volume of pellets used for residential, commercial use/consumption and 2/3 of the total volume of pellets used in combined heat and power plants (CHP).
Residential consumption/use	Volume of pellets used in domestic stoves and dedicated heat boilers with a capacity below 50 kW.

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