BIOENERGY EUROPE

STATISTICAL REPORT 2021

REPORT PELLETS

Bioenergy EUROPE

EUROPEAN PELLET COUNCIL

A NETWORK OF BIOENERGY EUROPE

Bioenergy Europe

Place du Champ de Mars 2A
1050 Brussels
T : +32 2 318 40 34
info@bioenergyeurope.org
www.bioenergyeurope.org

Authors

Gilles Gauthier (lead author)
Ioannis Avagianos

Content and Technical Guidance

Jean-Marc Jossart
Cristina Calderón

Policy Guidance

Giulia Cancian
Irene Di Padua
Claudio Caferri

Visuals & Promotion

Corinna Sala (statistical report promotion)
Gaia Weber (statistical report visuals)
Claudio Caferri (policy Brief visuals & promotion)

Supported by:

Européenne de Biomasse

AXIS Tech

CONTRIBUTORS

BRAS PELL BIOENERGIA
LITBIOMA LITHUANIAN BIOMASS ENERGY ASSOCIATION
POLISH PELLET COUNCIL
AIEL ASSOCIAZIONE ITALIANA ENERGIE AGROFORESTALI
ACHBIOM Asociación Chilena de Biomasa
Универзитет у Београду Шумарски факултет
pro»pellets Austria
LATbio
Propellet
Luke NATURAL RESOURCES INSTITUTE FINLAND
BIOENERGY AUSTRALIA FUEL | GAS | HEAT | POWER
WOOD PELLET ASSOCIATION OF CANADA
SVEBIO
Bioenergia
Sumitomo Corporation
UNITED GROUP
LABEE GROUP
DEPI DEUTSCHES PELLETINSTITUT
FEBHEL
RUSSIAN PELLET COUNCIL
Belarus by
Eesti Taastuvenergia Koda
HellaBiom Hellenic Biomass Association
aveBiom
BIOPEL®
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FORWARD

Pablo Rodero Masdemont
President
EPC

Gilles Gauthier
General Manager
EPC

2020 was an average if not satisfactory year for the European pellet industry both on the supply and the demand side, despite some hurdles.

The COVID-19 pandemic hit all parts of our society, including the pellet sector. Luckily, it appeared that, beyond being a mainly local, sustainable, and affordable industry, our sector is also very resilient. Indeed, besides having had a limited influence on pellet use for electricity production after the drop of electricity demand in Europe, the COVID-19 pandemic had no dramatic impact on the industry. Thanks to the automated nature of pellet production, and the fact that several countries considered it to be an essential industrial activity, the industry was able to continue operating with the necessary COVID-19 safety measures. Down the value chain, construction and installation of appliances were only slightly impacted in Europe. All in all, the pellet industry keeps contributing to the survival of local (rural) economies, while other sectors saw a decline in their activities. Thankfully, as we are writing these lines, the COVID-19 situation is somehow easing, and we hope that this means the beginning of the end for this dramatic pandemic.

Unfortunately, 2020 was also the year of bark beetle outbreaks, which brought about the need for removing dead wood from forests and a finding a use for it. Once again, the bioenergy sector showed its essential role. Fortunately, autumn 2021 was rather wet in Europe, slowing down significantly, if not stopping, the parasite reproduction cycle.

On a more positive note, the sales of residential pellets heating appliances showed very encouraging trends in countries like Germany, France and Austria, proving that, when the governments actively invest in phasing out fossil fuels, pellet systems directly appear as a credible, affordable and sustainable solution. In 2021 we have been recording even more encouraging sales in those countries.

Despite the encouraging sales of pellet systems, 2020's demand for pellet was average. This average demand, together with a supply curve that did not experience any major shifts, led to a rather depressed market. But, as always with the pellet industry, a certain situation does not last for long. Indeed, 2021 has brought about a complete change in market trends. First, the 2020-2021 heating season lasted much longer than usual, which, together with homeworking requirements in many countries, led to an increased pellet use in the residential market. Secondly, this long heating season, coupled with high electricity prices, encouraged many industrial operators to use more pellets than usual. Such a sustained demand allowed most of the market players to empty their stock at the end of the 2020-2021 heating season. Today, all market conditions are favourably pushing the demand while the stocks levels are rather low, leading to a market tightening. Still, even if the market is tightening, it is incredibly impressive to see how pellet prices compare to fossil fuel prices, which are currently hitting historical record highs. Together with increasing appliance sales, this shows again how bioenergy can help to fight energy poverty in Europe.

All in all, despite the 2020 hurdles, the pellet industry continues its expansion and shows all its qualities. Still, we hope that the market tightening will lead to structural projects that may help the industry to better anticipate and handle market fluctuations.

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-28 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-28 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

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 + 300 pages

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 + Bioenergy Europe publishes 7 focussed reports published throughout the year

2021

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 a support to advocacy at 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.

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 7 active working groups:

- Agrobiomass & Energy Crops;
- Biopower & CHP;
- Competitiveness;
- Domestic Heating;
- Sustainability;
- Pellets;
- Wood Chips.

Certification Schemes

Thanks to the experience and authority acquired over the last 20 years, Bioenergy Europe has successfully established three international certification schemes to guarantee high quality standard for fuels, namely, ENplus®, GoodChips® 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 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 18 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 23 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 2021

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.

This enhanced visibility opportunity is limited and interested members are required to contact the team via info@bioenergyeurope.org

You can find further information about this opportunity on the Bioenergy Europe website.

Sponsorship

Bioenergy Europe offers a sponsorship opportunity for the Statistical Report where you will have the opportunity to have the highest level of visibility. In addition to having full page adverts in all 7 statistical reports, you will also have your logos placed on publications, policy briefs, and enjoy content-driven tweets, as well as Linkedin posts, amongst a variety of additional advantages.

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

Bioenergy Europe
Place du Champ de Mars 2A
1050 Brussels
T : +32 2 318 40 34
info@bioenergyeurope.org

www.bioenergyeurope.org

ANDRITZ Feed and Biofuel is one of the world's leading suppliers of technology and services for the biofuel industries.

We offer an extensive line of equipment for the production of high-quality biomass products. We pair our equipment with our state of the art automation solutions to ensure full process traceability.

We have decades of experience designing and building biomass plants; including engineering, installation, start-up, and commissioning, as well as aftermarket parts and service. This experience has resulted in hundreds of successful biomass installation all over the world.

However, ANDRITZ is not just passionate about our machines - We are passionate about people, and we have the best in the industry. When you choose ANDRITZ Feed and Biofuel as your partner, you get a dedicated team of professionals who are there with you, every step of the way.

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

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, torrefacction, 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.

More info: www.bio2c.es

Russian Pellet Council (RPC) is an authorized industry association of all pellet market participants: producers, traders, consumers, service providers, etc. By now, more than 40 organizations from different countries have joined RPC, including governmental organizations and media. The association contributes to the progress in the industry and growth of its members by different ways. Some of the examples of RPC's work are the events that take place regularly and multi-page news bulletins published every month.

To know more, see the website:
www.ruspellet.com

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

ENplus® 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 ENplus® 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 ten years of existence, the ENplus® scheme has certified more than 1100 companies in 47 countries and has become a widely recognized brand, trusted by professionals and consumers alike.

https://enplus-pellets.eu/

YEMMAK

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.

https://enplus-pellets.eu/

SGS

SGS is the world's leading inspection, verification, testing and certification company. We are recognized as the global benchmark for quality and integrity. With more than 89,000 employees, we operate a network of more than 2,600 offices and laboratories around the world.

Our core services are Inspection, Testing, Certification and Verification.

www.sgs.com

BATHAN®
swiss made lubricants

As a competent partner, BATHAN AG has been advising well-known companies worldwide for the use of high-performance lubricants and additives, supporting maintenance planning and offering OEM-quality plant maintenance.

We are a full-service provider to wood pellet producers, offering service & repairs, spare parts, consulting and training.

www.bathan.ch

SURE
SUSTAINABLE RESOURCES
Verification Scheme GmbH

SURE enables all economic operators along the supply chain, including the producers of wood pellets, to prove sustainable use of biomass in electricity and heat production

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

*after recognition by the European Commission

Congo Basin Pellets

Sustainable, certified and providing African employment.

Congo Basin Pellets is beginning its operations in Gabon, using only wood waste and sawdust from the multiple wood transformation companies installed in Gabon's special economic zone at Nkok.

Our Nkok plant, producing 45,000 tons of wood pellets per year, will be fully operational by September 2021, creating approximately 100 new direct jobs, whilst also finally eliminating the burn-off of countless tons of unused sawdust, veneer waste and log cutoffs.

Our pellets, made mostly from Okoume and Azobe wood species, will be shipped in bulk to European customers at first.

www.congobasinpellets.com

Bioenergy EUROPE

Européenne de Biomasse

Speed up your decarbonization with the HPCI Green Pellet®

Européenne de Biomasse's edb-HPCI® technology is now an industrial reality: the **FICA-HPCI** plant started the **HPCI Green Pellet®** production. (125 kt, Reims, France)

www.ebiomass.eu

Européenne de Biomasse
HPCI Green Pellet®

Easier to use and competitive due to its advanced properties

- All biomasses
- Standardized, high energy density
- Highly stable, water-resistant, low dust, no CO
- Outdoor storage and transportation
- Grindable at any co-firing mix ratio
- Limited supply chain and conversion costs

AXIS Tech

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‹PEC Suwalki, Poland

OUR SOLUTIONS:

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- Saturated head boiler units (8 - 30 t/h)
- Superheated boiler units (15 - 100 t/h)
- CHP (2.5 - 20 MWe; 10 - 80 MW heat)
- Thermal oil boiler units (10 - 50 MW)
- Fuel handling equipment and systems
- Ash removal equipment and systems
- Flue gas cleaning equipment and systems
- Heat recovery equipment and systems

Forest Investment, Lithuania ›

‹Rigas BioEnergija, Latvia

VISIT

www.axt.eu

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AXIS Tech

EXPERT COMMENT

AXIS Tech

Dear readers,

Even though the COVID-19 pandemic has become a challenge for all production sectors across the world, Bioenergy Europe's statistical Pellet report shows that, fortunately, the pellet production did not experience a major downturn and has increased globally. One of the main reasons for this success was the automatization of the pellet production process that allowed most of the production to continue despite the COVID measures. Furthermore, we are currently facing a deficiency in raw materials in most industries, but the high level of pellet stock allowed the industry players not to experience any supply shortage, although this had an impact on prices.

The breakdown of energy sources by fuel type in the HVAC sector, to be found in the present report, helps to identify which European pellet markets are the most favourable for pellet systems. Indeed, the countries where the households mostly rely on coal and heating oil are offering the best potential for the sales of pellet units. Even if we see positive signs of renewable energy expansion, the whole world has to do better to ensure the future of the humanity. Indeed, all around the globe, we must improve the energy efficiency of all processes along with air quality improvement and greenhouse gas reduction. To support this transition, some support programmes are available on national and European levels. To further transition, the private sector should also take its part of social responsibility and further encourage the phasing out of fossil fuel and embrace biomass.

The AXIS Tech team is pleased to be able to offer to the market what it needs the most in these difficult times. We see a growing customer interest in AXIS Tech technologies that can provide solutions such as biomass equipment for the combustion of various fuels and carbon-neutral energy production, and conveyor systems that allow automation of various production and transportation processes. By caring about our partners' success and the future of environment, we can help them solve problems that may arise during their journey towards the world of clean energy.

Greetings from Evaldas Margis

AXIS Tech Director of Commerce

1 Overview of World Pellet Sector

The **global** pellet production is continuously growing since its beginning, showing a growth of 5% from 2019 to 2020. The three highest production growth figures in absolute volumes came from Europe, Germany with 280.000 tonnes, Latvia with 193.291 tonnes and Russia with 150.000 tonnes.

1.1 World pellet production

In 2020, the production within the **EU27** countries has been healthy but not exceptional. In absolute terms, the EU27 registered a fair 4% increase in production between 2019 and 2020. Within the EU27, Czech Republic had a significant growth of 22%. Besides the EU27, Russia should be mentioned, as it recorded a remarkable increase of 7,3% with significant potential to even record further growth in the coming years.

In **North America**, growth stagnated (+2%) in 2020. Canadian production increased by 410.000 tonnes (+14%) which is consolidating Canada as the second largest country producer in the world. In comparison, the US has shown a stagnated decrease (-2%).

In **South America**, two countries are showing an interesting development in pellet production, namely Brazil and Chile. The production records of Brazil show 1.030.000 t in 2020 with a great increase of production capacity expected to appear from 2023 onwards. Chile, with a much modest actual production reaching 176.217 t in 2020 is witnessing a growth of the production capacity already from 2021 with the addition of 3 plants (total of 340.000 tonnes/year of capacity).

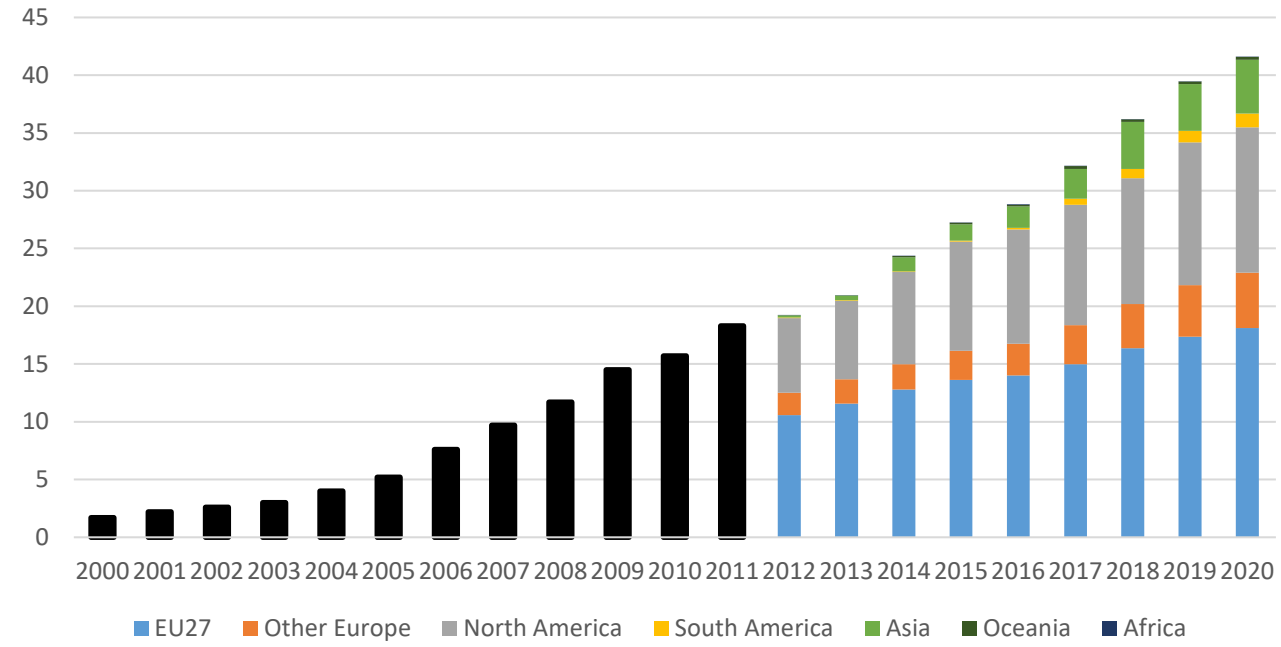
Oceania witnessed a noticeable increase (+11%) in 2020 compared to 2019, compensating for the operating problems and subsequently the closure of the largest producing plant in Australia (250.000 tonnes/year of capacity) at the beginning of 2019. Despite this, New Zealand's production stabilised during 2020 but new projects are expected in the coming years that could augment the production capacity mainly in Australia but also to a smaller extent in New Zealand.

The production in **South East Asia** (Vietnam, Malaysia, Thailand, and Indonesia) grew dramatically in the recent years. In 2020, a noticeable increase can be observed.

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

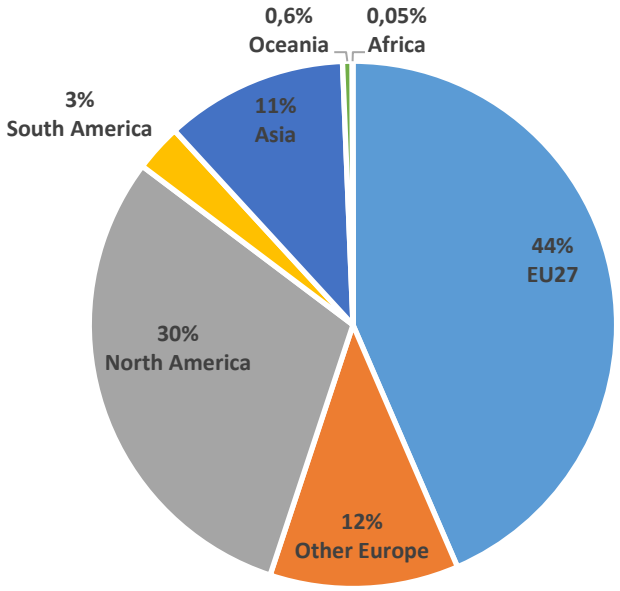
In this report, **Africa** is part of the picture as the continent remains a very big wood supplier and at the same time it is an uncharted area regarding the pellet industry. Still, investments have recently been made to produce wood pellets in Africa (among others South Africa and Gabon) leading to a significant increase of pellets production to be seen in Africa in 2021.

Figure 1 Evolution of global pellet production (million tonnes)



Note: LU: 2020 production is a replication of 2019.
Source: EPC survey 2021; FAO; Future Metrics; Bioenergy International

Figure 2 Distribution of world pellet production in 2020 (%)



Note: LU: 2020 production is a replication of 2019.
Source: EPC survey 2021; FAO; Future Metrics; Bioenergy International

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

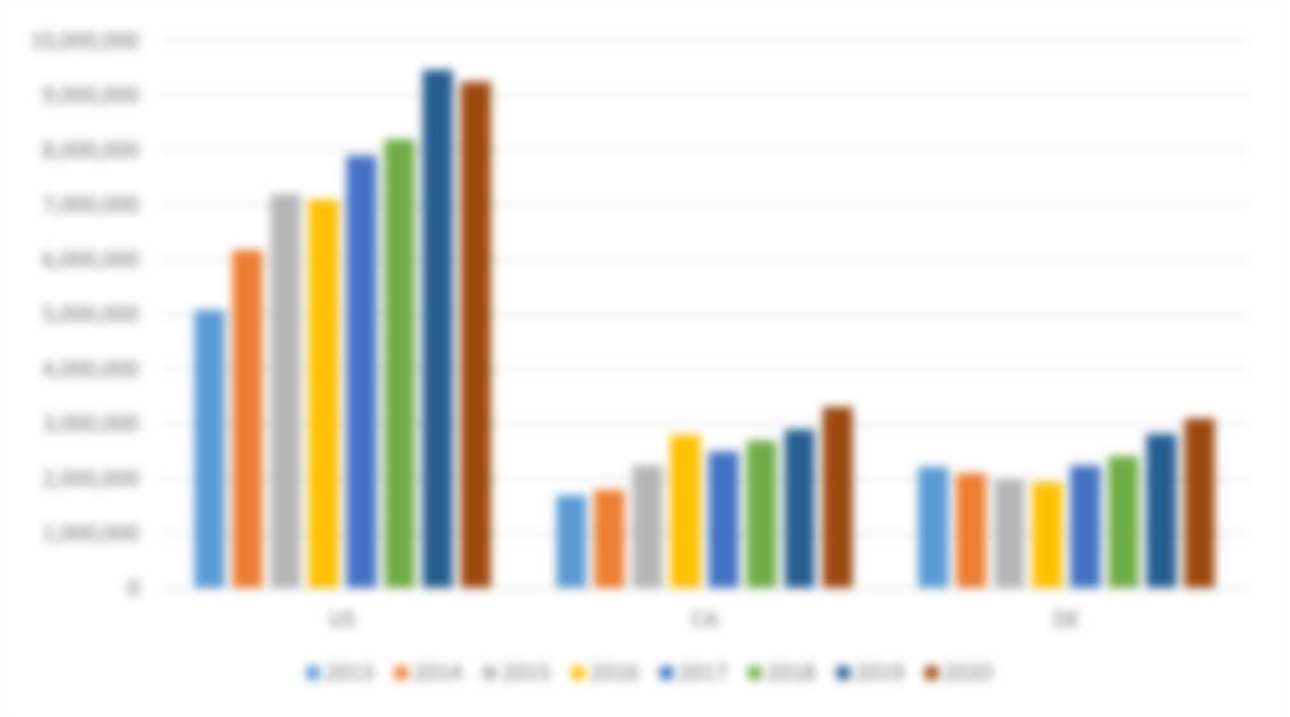
	2014	2015	2016	2017	2018	2019	2020	Growth (2019-2020)
EU27	12.802.482	13.613.817	14.007.689	14.989.568	16.366.841	17.364.636	18.101.489	4%
Other Europe	2.186.590	2.535.634	2.748.352	3.383.890	3.816.654	4.455.551	4.816.620	8%
North America	7.878.000	9.450.000	9.900.000	10.400.000	10.900.000	12.364.000	12.557.962	2%
South America	49.390	75.000	135.350	548.618	801.412	985.740	1.206.217	22%
Asia	1.226.010	1.408.739	1.839.996	2.567.969	4.088.383	4.055.000	4.655.000	15%
Oceania	105.000	153.000	160.000	250.000	205.000	235.000	245.000	11%
Africa	30.000	35.000	38.000	18.000	31.000	28.000	19.000	-32%
World	24.377.482	27.271.190	28.830.388	32.158.044	36.209.290	39.476.927	41.601.308	5%

Note: (1): 2020 production is a replication of 2019.

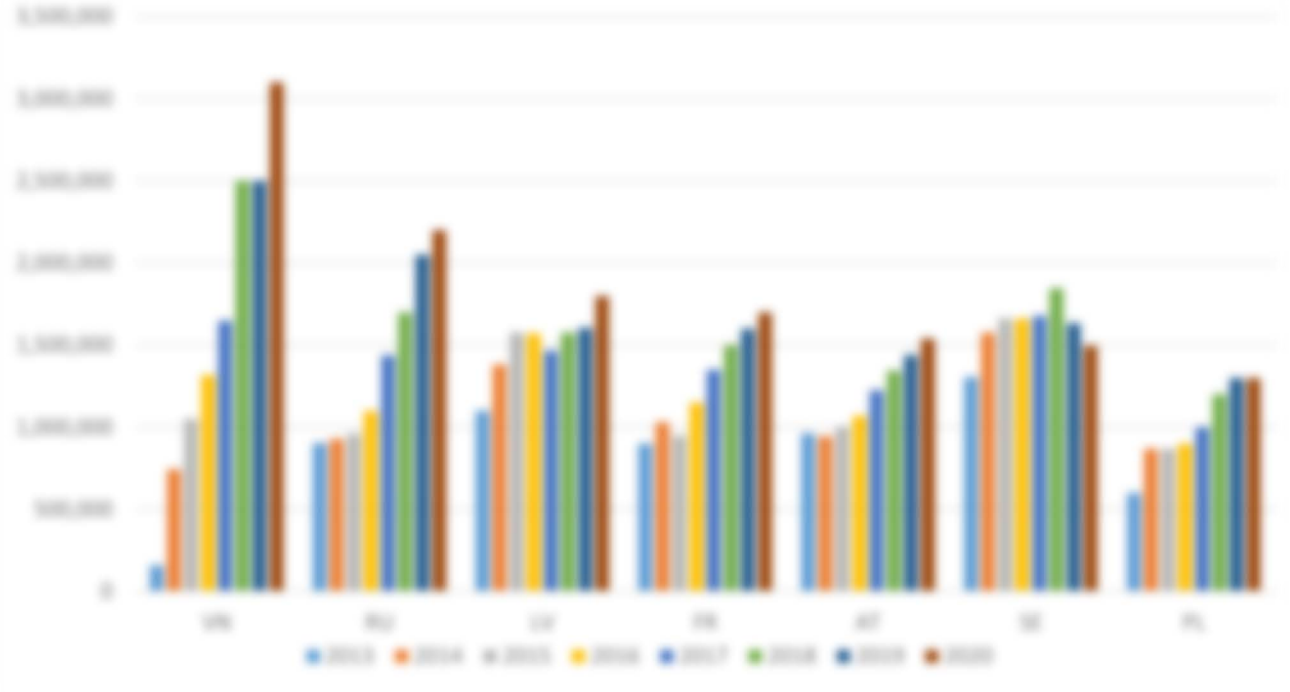
Source: EPC survey 2021; FAO; Future Metrics; Bioenergy International

Figure 3 Evolution of pellet production of the TOP 10 producing countries in 2020 (tonnes)

(a) Top 3 producing countries with adapted scale



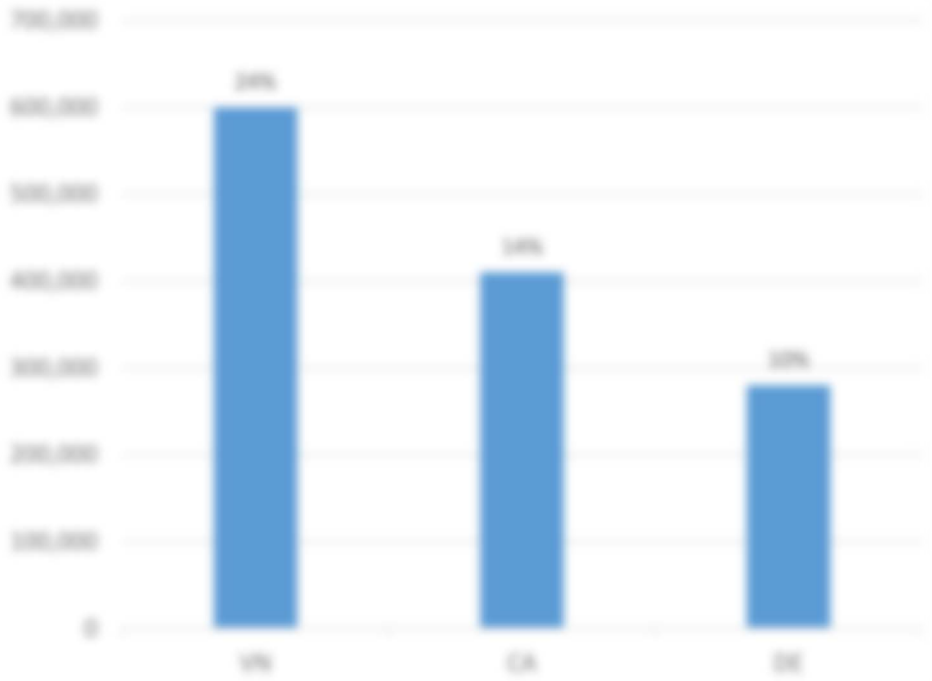
(b) Rest of the 7 countries from the top 10



Source: EPC survey 2021, FAO, Future Metrics, Bioenergy International

Figure 4 Growth in pellet production by country between 2019-2020 (tonnes and %)

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



(b) Rest of the world

Note: LU: 2020 production is a replication of 2019.

Source: EPC survey 2021, FAO, Future Metrics, Bioenergy International

Table 1 World pellet production in 2019 and 2020

	2019			2020		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	725	24.043.480	17.364.636	743	25.325.000	18.101.489
Other Europe	509	5.180.629	4.455.551	540	5.366.000	4.816.620
Total Europe	1.234	29.224.029	21.820.187	1.283	30.691.000	22.918.109
North America	130	16.344.834	12.364.000	131	16.667.864	12.337.982
South America	43	1.374.182	989.740	47	1.597.126	1.206.217
Asia	72	4.833.000	4.055.000	82	6.629.000	4.655.000
Oceania	13	465.000	235.000	13	530.000	245.000
Africa	5	56.000	28.000	4	50.000	19.000
Total	1.497	52.297.045	39.476.927	1.560	56.164.990	41.021.308

Note: LU: 2020 production is a replication of 2019.

Source: EPC survey 2021, FAO, Future Metrics, Bioenergy International

Table 3 Detailed world pellet production by country in 2019 and 2020

	2019			2020		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	725	24.043.400	17.364.636	742	25.525.000	18.101.489
AT	42	1.665.000	1.441.000	41	1.745.000	1.540.000
BE	12	760.000	660.000	12	835.000	740.000
BG	62	215.000	171.000	63	335.000	171.800
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	34	530.000	400.000	39	560.000	486.000
DE	53	3.905.000	2.821.000	56	4.269.000	3.101.000
DK	3	300.000	140.000	4	300.000	150.000
EE	23	1.612.000	1.244.000	23	1.612.000	1.269.000
EL	23	130.000	38.000	25	140.000	44.000
ES	82	1.878.400	714.000	85	2.040.000	816.000
FI	29	630.000	363.000	26	630.000	322.000
FR	52	2.000.000	1.600.000	55	2.100.000	1.700.000
HR	21	380.000	335.000	19	543.000	374.600
HU	7	184.000	11.480	7	168.000	11.480
IE	1	40.000	28.000	1	40.000	27.500
IT	29	450.000	400.000	31	480.000	380.000
LT	22	550.000	490.000	23	575.000	440.000
LU	1	50.000	42.479	1	50.000	42.479
LV	27	1.950.000	1.606.709	28	2.000.000	1.800.000
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	4	350.000	290.000	5	348.000	225.000
PL	65	1.500.000	1.300.000	70	1.600.000	1.300.000
PT	27	1.270.000	830.000	23	1.484.000	859.000
RO	20	800.000	600.000	20	900.000	700.000
SE	64	2.300.000	1.633.958	64	2.300.000	1.497.620
SI	n.a.	150.000	120.000	5	160.000	134.000
SK	20	290.000	190.000	17	240.000	170.000
Other Europe	509	5.180.629	4.455.551	540	5.366.000	4.816.620
AL	14	90.000	70.000	14	100.000	92.000
BA	38	400.000	352.000	39	420.000	395.000
BY	8	412.000	412.000	31	601.000	446.000
CH	24	280.000	257.000	24	300.000	270.000
ME	10	110.000	84.500	11	110.000	91.000
NO	4	105.000	57.368	4	105.000	57.368
RS	74	547.000	383.051	83	560.000	445.000
RU	300	2.175.000	2.050.000	300	2.500.000	2.200.000
UA	21	515.000	515.000	22	545.000	515.000
UK	16	542.629	270.632	12	425.000	301.252

Note: LU: 2020 production is a replication of 2019.

Source: EPC survey 2021, FAO, Future Metrics, Bioenergy International

	2019			2020		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
North America	130	16.344.834	12.364.000	131	16.667.864	12.557.982
CA	46	4.330.000	2.900.000	47	4.653.000	3.310.000
US	84	12.014.834	9.464.000	84	12.014.864	9.247.982
South America	43	1.374.182	985.740	47	1.597.126	1.206.217
BR	24	1.200.000	850.000	27	1.400.000	1.030.000
CL	19	174.182	135.740	20	197.126	176.217
Asia	72	4.833.000	4.055.000	82	5.629.000	4.855.000
ID	6	355.000	160.000	8	682.000	160.000
JP	6	138.000	125.000	6	138.000	125.000
KR	13	243.000	243.000	15	802.000	243.000
MY	19	735.000	710.000	22	1.045.000	710.000
TH	16	862.000	317.000	16	862.000	317.000
VN	12	2.500.000	2.500.000	15	3.500.000	3.100.000
Oceania	13	465.000	235.000	13	530.000	245.000
AU	9	310.000	110.000	9	335.000	135.000
NZ	4	155.000	110.000	4	195.000	110.000
Africa	5	56.000	28.000	4	50.000	19.000
EG	5	56.000	28.000	4	50.000	19.000
Total	**1.457**	**52.297.043**	**39.476.927**	**1.560**	**56.164.990**	**41.601.308**

Source: EPC survey 2021, FAO, Future Metrics, Bioenergy International

1.1.1 Global pellet production future estimations

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

Africa: This year Egypt is included in the report but for the majority of African countries no consolidated data is currently available. Africa remains a continent with great potential and, despite the recent announcement pellet producing plants in 2020, the impression that Africa is not even at the beginning of its biomass journey remains. Still, investments have recently been made to produce wood pellets in Africa (among others in South Africa and Gabon) leading to a significant increase of pellets production to be seen in Africa in 2021.

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 a 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 forest chain for Brazil was equivalent to 85.514.464,76 m^3.

Russian Pellet Union

EXPERT COMMENT

Russia - Future growth and challenges of Russian production

Russia is on track to double pellet production to 5.5 million tons within 5 years. To date, more wood residues remain unused than are pelletized. Moreover, the wood industry is growing, and more and more residues need to be marketed. 80 new pellet plants have been announced; 25 are currently under construction.

80-90% of Russian pellets get exported. The main challenges are related to insufficient railway and port capacity. Railway tariffs for wood pellets have risen by 40% in 2021. Additionally, SBP proposes very challenging changes to its requirements for producers working in conformity with FSC (all Russian and Belarus SBP producers).

Currently, 86 pellet plants are ENplus and/or SBP certified in Russia. Practically all pellets originate from high-quality wood residues. The prospects are excellent for further growth of ENplus and the introduction of SURE certification.

Bioenergy Europe and the Russian Pellet Union (RPU) cooperate on informing Russian producers on pressing topics, such as the REDII implementation. The RPU has achieved the status of Self-Regulatory Organisation and is a member of Russia's government and railways' workgroups.

Rens Hartkamp
Russian Pellet Union

Russian Pellet Union

2 World pellet consumption

The **World** pellet consumption has increased to reach 39.767.541 tonnes in 2020, or +7% compared to its level of 2019. On a global level, the industrial pellet consumption has increased by nearly 2,3 million tonnes, whilst residential & commercial consumption increased by 0,3 million tonnes.

The **EU27** remains globally the largest pellet user. Its consumption has grown by around 0,8 million tonnes in 2020 with the industrial use of pellets being led by the NL. With this, the NL consumption continued to increase in 2020, reaching 2,0 million tonnes. The residential and commercial use of pellets is led by Italy with a consumption of 3,4 million tonnes and stabilising its previous year's annual growth in 2020.

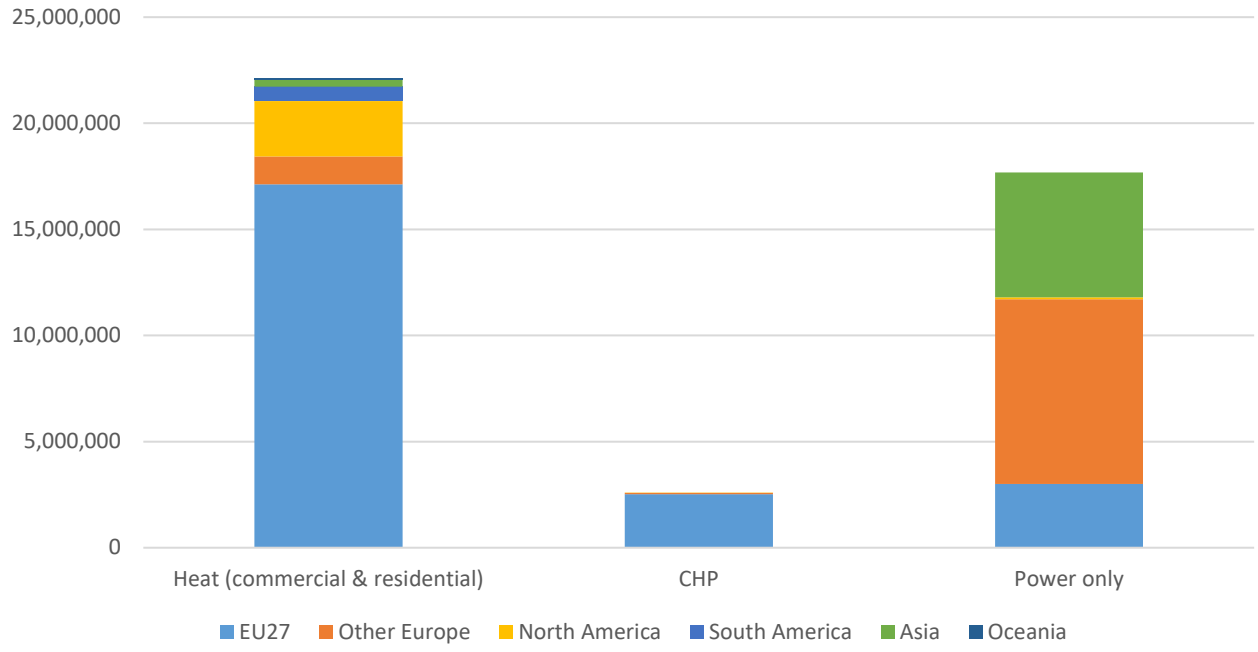
European countries outside of the EU27 also displayed robust growth in consumption (+5%), and, with the addition of UK, their total consumption volume changed to a relatively big figure of 10,8 million tonnes in 2020.

In **North America**, the use of pellet has not witnessed a dramatic growth in the recent years despite different initiatives to grow the market both in US and Canada. Still, a niche market is consolidating its expansion: the pellet barbecues. The increasing sales of these barbecues lead to increasing sales of high margin pellets (e.g. 3 producers of 10.000 tonnes in Canada).

In **South America**, the use of pellet, mostly for residential and mid-scale heat production, is expected to grow in the future even if the continent will also increasingly become a next exporting area. In Brazil, there is good growth potential for pellet consumption in commercial and industrial applications.

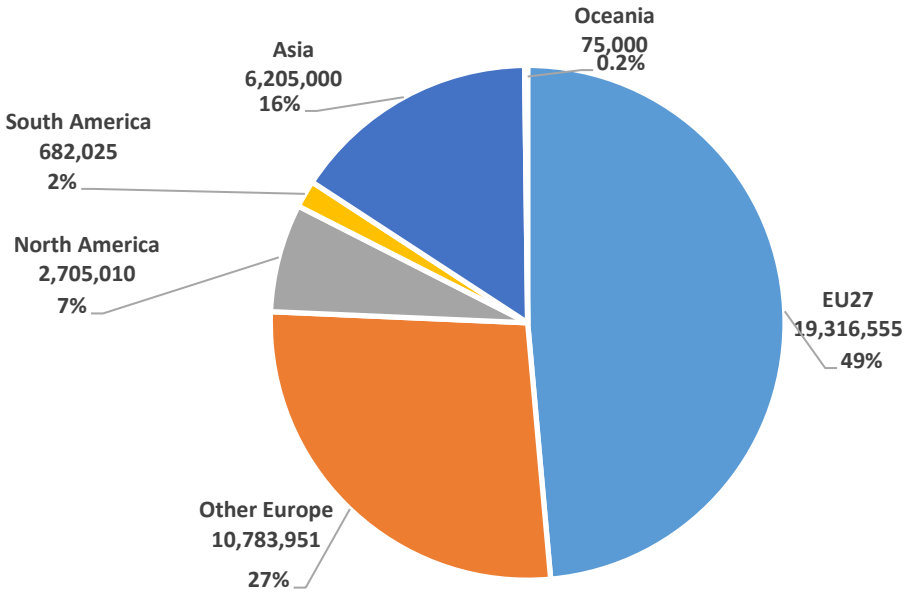
The pellet consumption in **Asia** concentrates in two countries, South Korea, and Japan. Those two industrial pellet users show very different trends in 2020. Indeed, the REC (Renewable Energy Certified) price dropped in South Korea, which directly impacted the use and hence the import of pellets. The future growth of industrial use of pellets in South Korea remains uncertain. Contrary to South Korea, Japan owns a much more stable support scheme, allowing a solid growth of industrial pellet usage (sourced from Southeast Asia and Canada). Based on the current growth, Japan could reach 10 million tonnes of industrial pellet usage by 2030.

Figure 5 World pellet consumption in 2020 by type of end-use (tonnes)



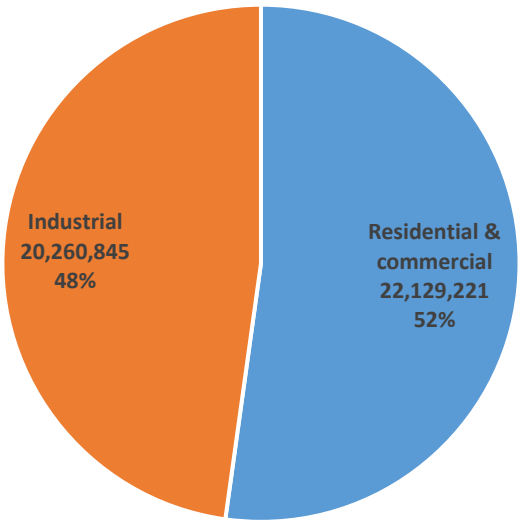
Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU, JP; KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

Figure 6 Distribution of world pellet consumption in 2020 (tonnes and %)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU, JP; KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

Figure 7 World pellet consumption by type of end use in 2020 (tonnes and %)



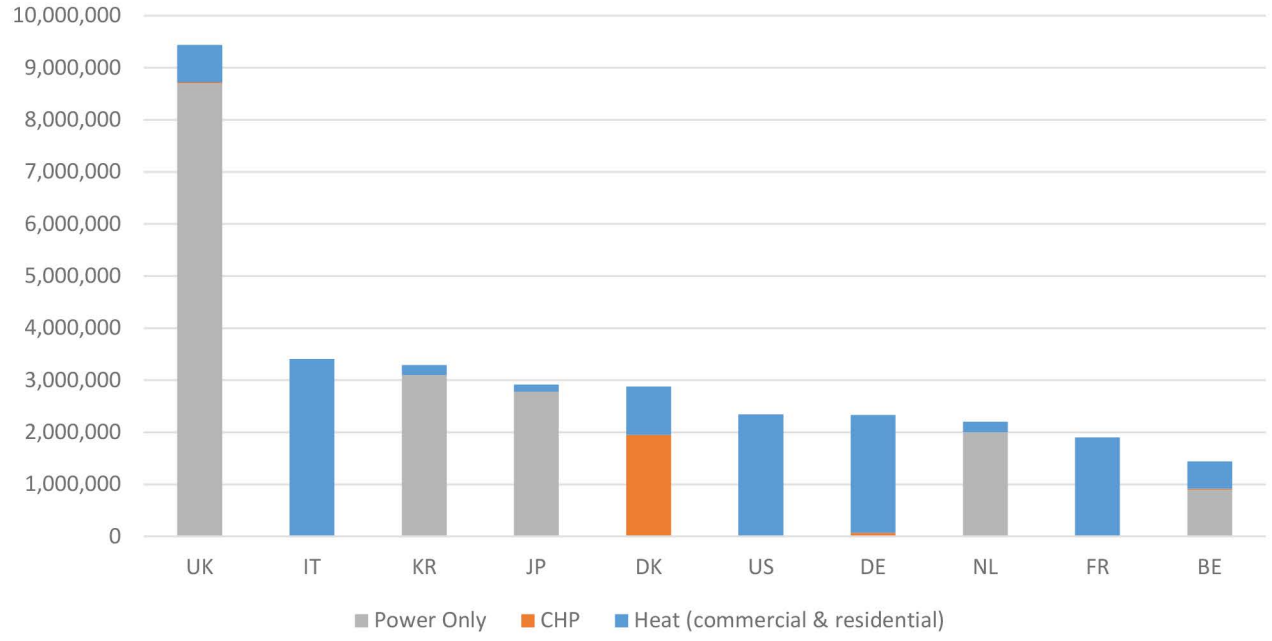
Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU, JP; KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

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

	2015	2016	2017	2018	2019	2020	Growth 2019-2020
EU27	13.574.321	14.365.333	16.275.725	17.409.712	18.489.424	19.216.555	4%
Other Europe	7.724.730	7.096.737	8.371.727	9.526.996	10.273.728	10.783.851	5%
Total Europe	21.299.051	21.962.071	24.653.452	26.936.708	28.763.152	30.100.506	5%
North America	2.402.000	2.440.000	2.499.000	2.612.010	2.669.010	2.705.010	1%
South America	90.000	n.a.	82.409	457.412	527.826	682.025	29%
Asia	1.845.184	2.378.851	3.331.996	4.685.230	5.039.780	6.205.000	23%
Oceania	22.500	27.500	29.500	33.375	70.000	75.000	7%
Total	25.658.735	26.808.422	30.596.357	34.724.735	37.069.773	39.767.541	7%

Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU, JP; KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

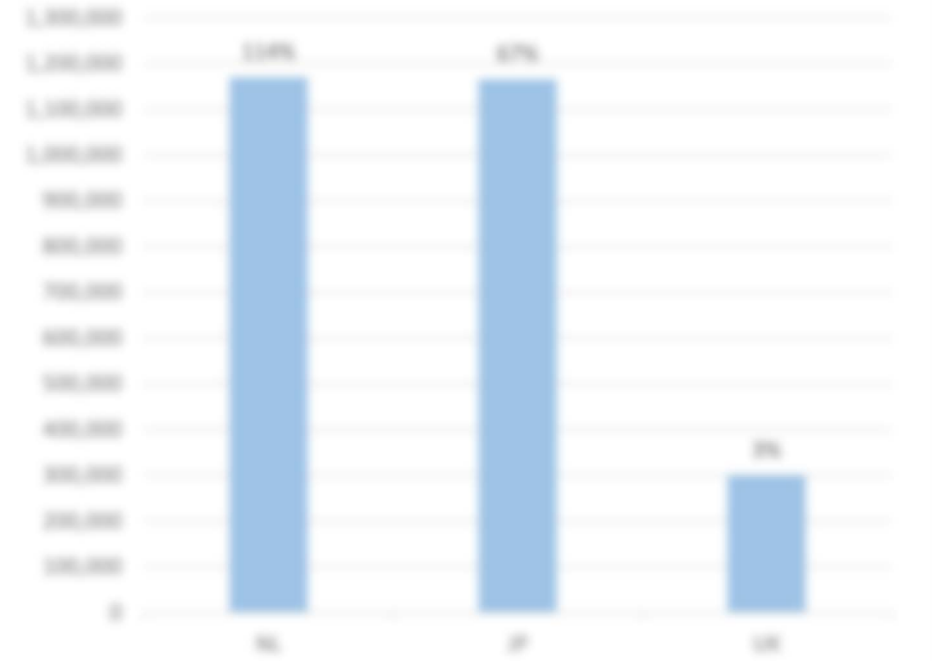
Figure 8 Top 10 pellet consuming countries by end-use in 2020 (tonnes)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU, JP; KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

Figure 9 Growth in pellet consumption by country between 2019- 2020 (tonnes and %)

(a) Top 3 countries in absolute terms



(b) Rest of the countries with available data

Note: EE, LT, NL, UK &ND: 2020 consumption is a replication of 2019.
JP, KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021, Future Metrics, FAO, Hawkins Wright

Figure 10 World industrial pellet consumption by country in 2020 (tonnes)

Sources: EPC survey 2021, Hawkins Wright, Future Metrics

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

Sources: EPC survey 2021, Hawkins Wright, Future Metrics

Table 5 World pellet consumption (detailed) in 2019 and 2020 (tonnes)

	2019					2020				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU27	10.752.918	3.084.775	2.767.788	1.880.000	18.485.424	10.900.395	2.879.474	2.530.019	3.021.700	19.316.333
Other Europe	1.012.768	805.844	55.116	8.400.000	10.273.728	1.154.877	873.858	55.116	8.700.000	10.783.851
Total Europe	11.765.686	3.890.619	2.822.904	10.280.000	28.763.152	12.055.272	3.753.332	2.585.135	11.721.700	30.100.184
North America	2.409.000	75.000	10	95.000	2.669.010	2.535.000	90.000	10	95.000	2.705.010
South America	132.461	395.365	n.a.	n.a.	527.826	183.762	498.263	n.a.	n.a.	682.025
Asia	326.000	n.a.	n.a.	4.713.785	5.039.785	326.000	n.a.	n.a.	5.879.000	6.205.000
Oceania	35.000	35.000	n.a.	n.a.	70.000	35.000	40.000	n.a.	n.a.	75.000
Africa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	14.758.147	4.395.984	2.822.914	15.088.785	37.069.773	15.135.034	4.381.595	2.585.145	17.675.700	39.767.041

Note: EE, LT, NL, UK &ND: 2020 consumption is a replication of 2019.
JP, KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

Table 6 Detailed world pellet consumption by country in 2019 and 2020 (tonnes)

	2019					2020				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU27	10.752.818	3.084.775	2.767.788	1.880.000	18.489.424	10.900.355	2.879.474	2.530.019	3.001.700	19.310.333
AT	800.000	150.000	n.a.	n.a.	950.000	860.000	155.000	n.a.	n.a.	1.015.000
BE	427.859	10.866	20.000	980.000	1.438.725	509.000	11.000	20.000	900.000	1.440.000
BG	183.400	1.482	n.a.	n.a.	183.882	185.485	1.823	n.a.	n.a.	187.308
CY	n.a.	n.a.	n.a.	n.a.	3.275	n.a.	n.a.	n.a.	n.a.	4.299
CZ	72.000	37.000	n.a.	n.a.	109.000	78.000	41.000	n.a.	n.a.	119.000
DE	1.343.000	669.500	47.500	n.a.	2.300.000	1.394.000	667.000	70.000	n.a.	2.331.000
DK	833.000	147.000	1.986.288	n.a.	2.966.288	780.000	150.000	1.950.000	n.a.	2.880.000
EE	30.000	10.000	n.a.	n.a.	40.000	30.000	10.000	n.a.	n.a.	40.000
EL	78.000	18.000	n.a.	n.a.	96.000	79.500	18.200	n.a.	n.a.	97.700
ES	420.000	255.000	n.a.	n.a.	675.000	458.000	245.000	n.a.	1.700	704.700
FI	91.000	362.000	20.000	n.a.	433.000	48.000	367.000	11.000	n.a.	427.000
FR	1.600.000	200.000	n.a.	n.a.	1.800.000	1.700.000	200.000	n.a.	n.a.	1.900.000
HR	28.000	18.000	n.a.	n.a.	46.000	25.000	15.000	n.a.	n.a.	40.000
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	3.233.159	176.427	n.a.	n.a.	3.409.586	3.243.226	163.569	n.a.	n.a.	3.406.796
LT	47.500	12.500	n.a.	n.a.	60.000	47.500	12.500	n.a.	n.a.	60.000
LU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LV	130.000	15.000	n.a.	n.a.	145.000	140.000	17.000	n.a.	n.a.	157.000
MT	n.a.	n.a.	n.a.	n.a.	668	n.a.	n.a.	n.a.	n.a.	668
NL	80.000	150.000	n.a.	800.000	1.030.000	80.000	120.000	n.a.	2.000.000	2.200.000
PL	220.000	70.000	30.000	100.000	420.000	250.000	70.000	30.000	100.000	550.000
PT	170.000	160.000	n.a.	n.a.	330.000	131.197	123.480	n.a.	n.a.	254.677
RO	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SE	546.000	934.000	629.000	n.a.	1.729.000	994.487	422.902	434.019	n.a.	1.251.408
SI	98.000	27.000	15.000	n.a.	150.000	120.000	27.000	15.000	n.a.	172.000
SK	43.000	31.000	n.a.	n.a.	74.000	46.000	32.000	n.a.	n.a.	78.000
Other Europe	1.012.768	805.844	55.116	8.400.000	10.273.728	1.154.977	873.858	55.116	8.700.000	10.783.951
AL	48.000	4.000	n.a.	n.a.	52.000	56.000	8.000	n.a.	n.a.	64.000
BA	210.000	38.000	n.a.	n.a.	248.000	276.500	55.000	n.a.	n.a.	334.500
BY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CH	215.800	116.200	n.a.	n.a.	332.000	223.600	120.400	n.a.	n.a.	344.000
ME	24.500	2.900	n.a.	n.a.	27.400	28.500	4.200	n.a.	n.a.	30.700
NO	46.180	24.866	n.a.	n.a.	71.046	46.180	24.866	n.a.	n.a.	71.046
RS	285.591	10.486	n.a.	n.a.	296.077	940.500	52.000	n.a.	n.a.	992.500
RU	50.000	27.000	33.000	n.a.	110.000	50.000	27.000	33.000	n.a.	110.000
UA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
UK	132.697	582.392	22.116	8.400.000	9.137.205	132.697	582.392	22.116	8.700.000	9.437.205

	2019					2020				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
North America	2.499.000	75.000	10	95.000	2.669.010	2.535.000	90.000	10	95.000	2.705.010
CA	240.000	35.000	10	95.000	370.010	225.000	40.000	10	95.000	360.010
US	2.259.000	40.000	n.a.	n.a.	2.299.000	2.295.000	50.000	n.a.	n.a.	2.345.000
South America	132.461	395.363	n.a.	n.a.	527.826	183.762	698.263	n.a.	n.a.	882.025
BR	31.000	370.000	n.a.	n.a.	401.000	36.000	480.000	n.a.	n.a.	516.000
CL	101.461	25.363	n.a.	n.a.	126.826	147.762	18.263	n.a.	n.a.	166.025
Asia	326.000	n.a.	n.a.	4.713.785	5.039.785	326.000	n.a.	n.a.	5.879.000	6.205.000
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.	1.613.785	1.749.785	136.000	n.a.	n.a.	2.779.000	2.915.000
KR	190.000	n.a.	n.a.	3.100.000	3.290.000	190.000	n.a.	n.a.	3.100.000	3.290.000
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	35.000	n.a.	n.a.	70.000	35.000	40.000	n.a.	n.a.	75.000
AU	15.000	n.a.	n.a.	n.a.	15.000	15.000	n.a.	n.a.	n.a.	15.000
NZ	20.000	35.000	n.a.	n.a.	55.000	20.000	40.000	n.a.	n.a.	60.000
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.

Note: EE, LT, NL, UK &ND: 2020 consumption is a replication of 2019.
JP, KR: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright

2.1 World pellet trade

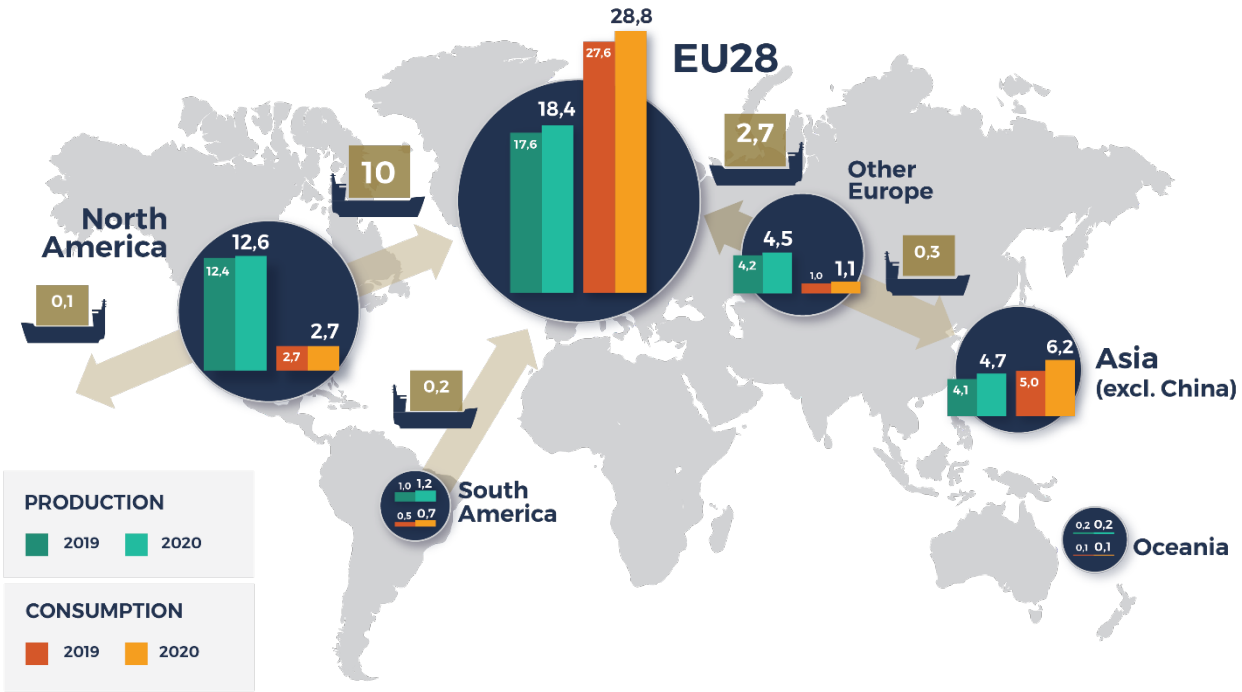
Two regions are net importers of pellets in the world: the **EU28** and **Asia**. The Figure 12 confirms the current hegemony of the **EU28** concerning pellet consumption, nevertheless Asia is growing fast and is becoming alongside with Europe the driving force of the pellet market development.

With **EU28** pellet imports being sourced mostly from the US and Canada, as well as from bordering European countries (mainly Russia), demand for pellets has been driven, in large, by the industrial consumption within UK, the Netherlands, Denmark and Belgium and the residential consumption in Italy. The trade within Europe (import and export) is detailed later in this report.

South Korea and **Japan** are almost exclusively importing their pellets. While South Korea is mainly sourcing its pellets from Vietnam (around 1,9 million tonnes or 64% of its imports in 2020) and Malaysia (around 0,5 million tonnes or 17% of its imports in 2020), Japan is sourcing its pellet principally from Vietnam (around 1,2 million tonnes or 57% of its import in 2020) with Canada covering 30% of their import (with a volume of 0,6 million tonnes).

The biggest exporting areas, namely **North America** (US and Canada), **South East Asia** (Vietnam, Malaysia, Thailand, Indonesia) and **Russia**, are witnessing a very limited growth of local consumption, and will not see their net exporting status changing in the near future.

Figure 12 World pellet map and trade flow in 2020 (million tonnes)



Note: LU: 2020 production is a replication of 2019, EE, LT, NL, UK &NO: 2020 consumption is a replication of 2019. JP; KR: 2020 residential consumption is a replication of 2019. The EU28 aggregation is used since UNcomtrade doesn't use yet the EU27 one.
Source: EPC survey 2021; Future Metrics; FAO; Hawkins Wright, UNcomtrade; Bioenergy International

3 Situation in Europe

3.1 European pellet production

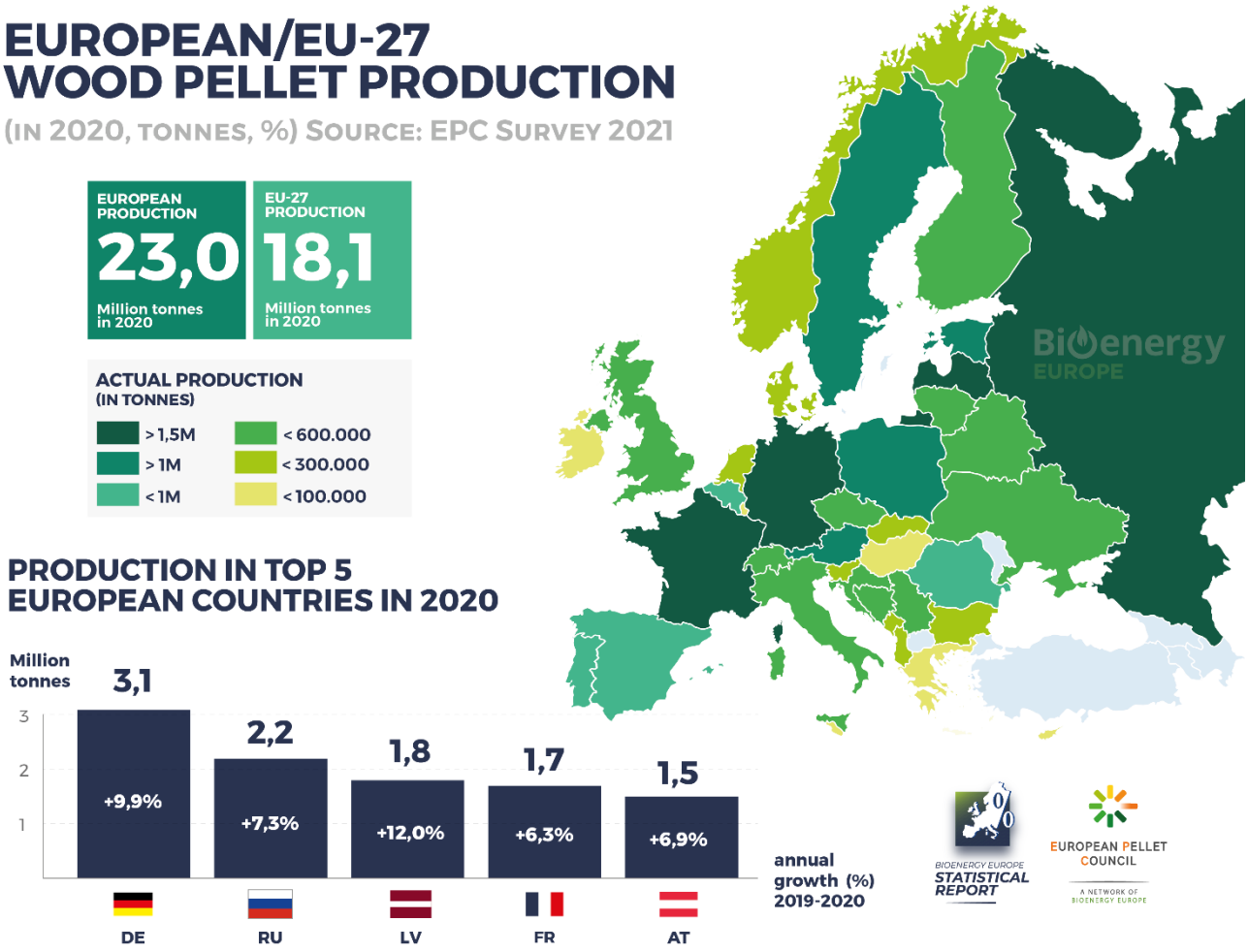
In 2020, **Europe** as a whole recorded a 5,0% growth (compared to 2019) reaching nearly 23 million tonnes of production. Although Europe remains unchallenged as the world largest pellet producer, production has ceased to grow faster than the consumption since 2016 (in absolute terms).

The European pellet production faced various situations since 2017.

After the difficult times of 2017-2018, flooding in the **Baltic States** and forest fires in **Portugal**, the European pellet production has not faced any critical issue in 2019 nor in 2020, allowing a sustainable growth of the industry.

Some countries even witnessed a solid growth of production, with the **German** production growing by 0,28 million tonnes and the **Latvian** production growing by 0,19 million tonnes.

Figure 13 Map of European pellet production in 2020



Note: LU: 2020 production is a replication of 2019.

Source: EPC survey 2021; FAO; Future Metrics; Bioenergy International

ProPellets Austria

EXPERT COMMENT

pro»pellets Austria

Increase of pellet production in western Europe

At present, a wave of investments in new pellet production plants is taking place in Austria, Germany and France. In Austria, 8 plants with a combined capacity of 350.000 tonnes are being completed. The German Pellet Institute expects an increase of German pellet production capacity within the next two years of 800.000 tonnes. ProPellets France is expecting around 1 million tons of additional pellet production capacity within the next 3-4 years.

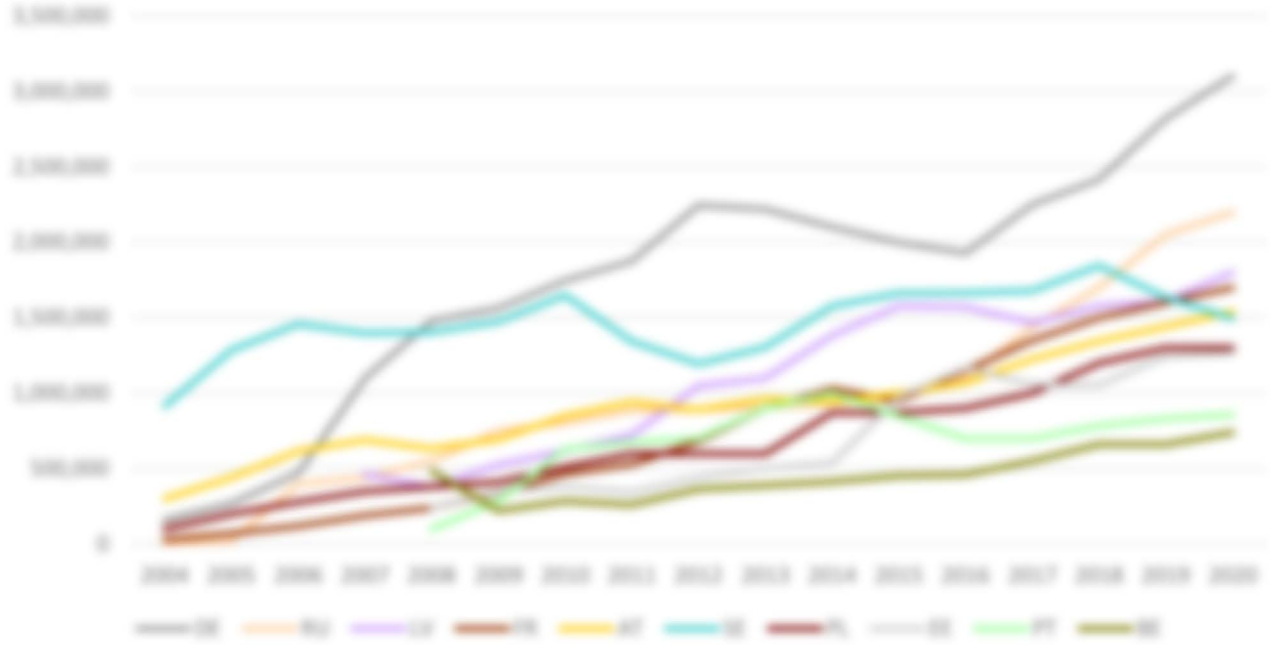
While this sounds like a very substantial increase, it should be kept in mind that demand has accelerated enormously and will probably continue to increase. In Austria, pellet boiler sales will reach 12.000 and could increase further to up to 20.000 units a year, creating an additional demand of 100.000 tonnes per year. In Germany, 60.000 boilers and 30.000 stoves will be installed, twice as much as last year and numbers could increase further creating an increase of annual demand beyond 500.000 tonnes. In France, pellet stove sales will reach 190.000 units and boiler sales are expected to reach 25.000 units adding at least 300.000 tonnes of demand in 2021.

Christian Rakos
CEO
ProPellets Austria

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

Note: LU: 2020 production is a replication of 2019.
Source: EPC survey 2021, FAO, Bioenergy International

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



Source: EPC survey 2021, FAO, Bioenergy International

Austria: Production has grown by 6,9% in 2020, driven by demand from Italy, resulting in plentiful supplies of raw materials, mainly in the form of timber industry residue. Spoliation due to bark beetle infestation and dry summer created a significant stream of cheap raw material for wood pellets.

Belgium: Production capacity in Belgium, which had grown well in the period from 2007 to 2012, has since showed a second period of growth from 2016 to 2020 mainly due to the increase of residential demand in Belgium and in the neighbouring countries.

Estonia: The production increased by 2% in 2020, at optimal use of capacity, overpassing the losses from 2017 and reaching its highest recorded level.

France: In 2020, production grew by 6,3%, while the production capacity has remained the same since 2017. With the great increase of local residential demand, some investments have been made to further increase the pellets production that will lead to a production growth in 2022.

Germany: Germany has grown to be the biggest pellet producer within the EU mainly due to a strong domestic heating market. The German production decreased beginning 2012 due to a disappointing internal consumption and was disrupted in 2016 by the bankruptcy of the biggest producer, German Pellets. Despite this, there was a strong recovery in 2017 allowing the country to exceed its previous production record, set in 2012. This growth continued through 2020 (17%) and was led by reasonable prices set for raw material and a growing demand from the heating market.

Latvia: The production increased by 12% in 2020 showing a persistent growth rate and reaching its highest recorded level, leaving behind the drop in pellets production witnessed in 2017.

Poland: production stagnated in 2020 at 1,3 million tonnes, mainly due to feedstock limitations.

Portugal: Portuguese production grew continuously from 2010 to 2014 but then contracted due to limited availability of raw material. Still, 2020 saw a limited increase of 3,5% in production compared to 2019.

Russia: Production has grown by 7,3% in 2020, up to 2,3 million tonnes total production. The production in Russia has shown a sustained growth in 2020 and is expected to grow even further in the future. The pellet production has increased mainly because of the wood processing industry, which produces increasing volumes of sawdust, together with the growing EU demand.

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

Source: EPC survey 2021, FAO, Bioenergy International

Czech Republic: Production showed a remarkable increase of 21.5% in 2020, mainly driven by the great availability of raw material after the bark beetle outbreak.

Finland: Production showed a small drop of 6% for 2020. Domestic wood pellet production has had an upward trend during the last years, although it might be probable that domestic pellets will be replaced or, at least, the expected growth in pellet consumption will be covered by cheaper imported pellets from Russia and the Baltic States.

Greece: The initial concentration of pellet production in a few big units (set for exports mainly) is gradually shifting towards a decentralised production with more smaller producers dedicating their production to the local market. Those small producers show a capacity of 1.000-2.000 tonnes/annum and only a few have more advanced, automated facilities with an annual capacity of over 10.000 tonnes. Despite the improving economics, the rather low demand is not allowing the full exploitation of raw materials and equipment. Therefore, this low equipment utilisation rates force producers to shift their activities towards the production of secondary products, such as wood briquettes, agrofuels, granulated animal feed and pelletised organic fertilisers.

Italy: Italy remains the world's biggest residential pellet user. Although Italian pellet production figures are estimations, it seems that production has reached its peak, due to insufficient access to raw material. Despite Italy having an abundance of forests, extraction is complicated by the limited accessibility of this wood, making any future growth in pellet production unlikely. Some regions in Italy have banned the use of A2 pellets for air emission reasons which precipitated a conversion of pellet plants to be exclusively A1 production. Traders are progressively specializing their sales on A1 quality too.

Spain: the combination of a rather low energy demand during the 2019-2020 heating season together with a high level of stock for the market players have reduced the need for pellet production. With the pandemic having greatly impacted staff availability, pellet production has been further reduced. Besides, producers that mainly rely on exporting their pellets have also been impacted by the difficulties faced by the transport sector.

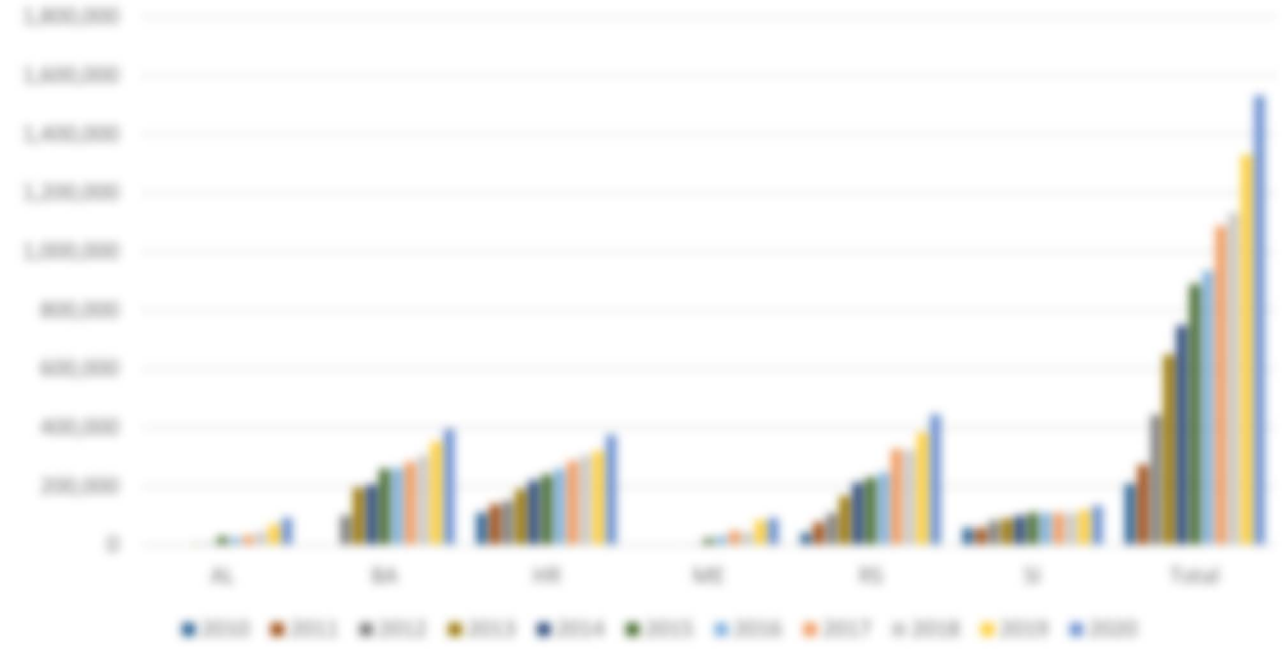
Slovak Republic: the production has decreased by 10.5% due to stoppage of production of three plants. A big production plant started operating in 2020 but didn't counterbalance the loss.

Montenegro: During 2019, two existing factories significantly increased their capacity and production of wood pellets by installing new pellet presses while three new plants started production. With these investments, Montenegro has significantly increased its pellet production in 2020 compared to the previous years. Almost 65% of total production was exported in 2020, mostly to Kosovo, Albania, and Italy.

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

Source: EPC survey 2021, FAO, Bioenergy International

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



Source: EPC survey 2021, FAO, Bioenergy International

Croatia: Since 2010, Croatia has registered sustained growth in pellet production, with all market conditions becoming favourable (raw material availability and foreign demand), allowing the production to thrive. This growing trend is expected to continue in the coming years.

Serbia: The number of pellet producers and their production has rapidly increased in the last 10 years, from 2 producers in 2006 to 83 in 2020 albeit smaller-scale producers. This rapid increase was precipitated by demand for pellets both domestically and for export and was led mostly by medium and small capacity pellet plants.

By the end of 2020, there was a fair increase of 16% compared to 2019 production. This increase was provoked by the high demand mainly form the public sector where many new pellet heating appliances have replaced old coal and oil heating appliances. In 2020, the import of wood pellets increased by 73% compared to 2019, reaching 40.000 tonnes. Export of wood pellets decreased in 2020 by 12.4%, reaching 78.000 tonnes.

Figure 19 Wood pellet production evolution of Europe's top 10 largest growing markets (in absolute terms) for pellet production (between 2012-2020) (tonnes)

Note: The order of the legend is following the decreasing order of the absolute increase of production (in tonnes) between 2012 and 2020.
Source: EPC survey 2021, FAO, Bioenergy International

Table 7 European pellet production in 2020 compared to 2019

	2019			2020		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU27	729	24.043.400	17.364.636	743	25.325.000	18.101.489
AT	42	1.665.000	1.441.000	41	1.745.000	1.540.000
BE	12	760.000	660.000	12	820.000	740.000
BG	62	319.000	171.000	63	320.000	171.800
CY	n.a	n.a	n.a	n.a	n.a	n.a
CZ	34	590.000	420.000	39	560.000	486.000
DE	55	3.905.000	2.821.000	56	4.269.000	3.101.000
DK	3	300.000	140.000	4	300.000	150.000
EE	23	1.612.000	1.244.000	23	1.612.000	1.269.000
EL	23	130.000	38.000	25	140.000	44.000
ES	82	1.878.400	714.000	85	2.040.000	816.000
FI	29	630.000	363.000	26	630.000	323.000
FR	52	2.000.000	1.600.000	55	2.100.000	1.700.000
HR	21	380.000	320.000	19	543.000	374.600
HU	7	164.000	11.490	7	168.000	11.490
IE	1	40.000	28.000	1	40.000	27.500
IT	29	450.000	420.000	31	420.000	380.000
LT	22	550.000	420.000	23	575.000	640.000
LU	1	50.000	42.479	1	50.000	42.479
LV	27	1.950.000	1.606.709	28	2.000.000	1.800.000
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	6	350.000	290.000	5	349.000	225.000
PL	65	1.500.000	1.300.000	70	1.600.000	1.300.000
PT	27	1.210.000	830.000	23	1.484.000	859.000
RO	20	800.000	600.000	20	900.000	700.000
SE	84	2.300.000	1.633.958	84	2.300.000	1.497.620
SI	n.a.	150.000	120.000	5	160.000	134.000
SK	20	290.000	190.000	17	240.000	170.000
Other Europe	509	5.180.629	4.455.551	540	5.366.000	4.816.620
AL	14	90.000	70.000	14	100.000	92.000
BA	38	400.000	352.000	39	420.000	395.000
BY	8	612.000	612.000	31	601.000	646.000
CH	24	280.000	257.000	24	300.000	270.000
ME	10	110.000	84.500	11	110.000	91.000
NO	4	105.000	57.368	4	105.000	57.368
RS	74	547.000	383.051	83	560.000	445.000
RU	800	2.175.000	2.050.000	800	2.200.000	2.200.000
UA	21	519.000	519.000	22	545.000	519.000
UK	16	542.629	270.632	12	425.000	301.252

Note: LU: 2020 production is a replication of 2019.

Source: EPC survey 2021, FAO, Bioenergy International

3.1.1 European pellet production future estimations

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

Albania: The 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. Some further increase could come from the wood extracted 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 part of chips for pellet production. Since about twice as many chips are produced as sawdust, a doubling of the current production would already be achievable by using just the resources in the sawmills.

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

Bulgaria: There is a significant potential for pellet production in Bulgaria as in the next years the number of pellet plants is expected to increase. Moreover, there are subsidizing funding schemes supporting pellet production.

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

Estonia: As the optimal level of capacity utilization has been reached, surpassing 1.5 million tonnes of production is very unlikely.

Finland: Alternative uses of wood residues currently prevent the large 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: France is currently producing 1,7 million tonnes of pellets and for 2023 estimates fall within 2,3-2,5 million tonnes.

Germany: In Germany there are between 20-25 million tonnes of raw material per year that could possibly be used for pellet production. The raw material is made of 6,5 million tonnes that are sawmill residues and around 17 million tonnes that are roundwood residues – saw timber production. Some further increase of raw material could come from the wood extracted 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.

Greece: The available feedstock from tree pruning corresponds to around 1.5 million metric tons of dry matter/year and forestry residues: around 0.4 million metric tons of dry matter could provide the base for producing up to 0.5 million metric tons of wood pellets, mainly A2 and B class.

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

Russia: The annual output of wood processing residues and non-saw-able wood in Russia has reached 80 million m³ from which around 9 million could still be used as feedstock for wood pellets production.

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

Spain: The potential raw material for pellet production could reach 3.5 million tonnes (DM) of wood/year.

Sweden: There is a 2,3 Mt potential of raw material for wood pellet production.

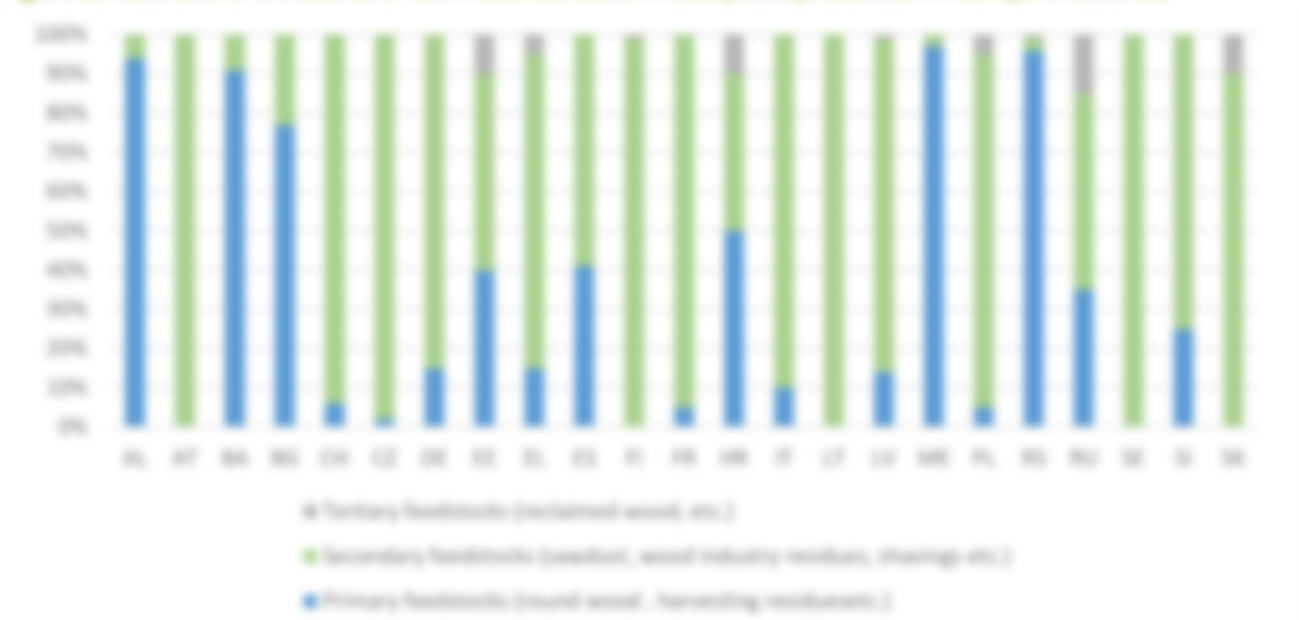
3.1.2 Qualitative analysis for European wood pellet production

Within the data collection run by EPC, our partners[1] have identified the main raw materials used for pellets 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 2020 (%)

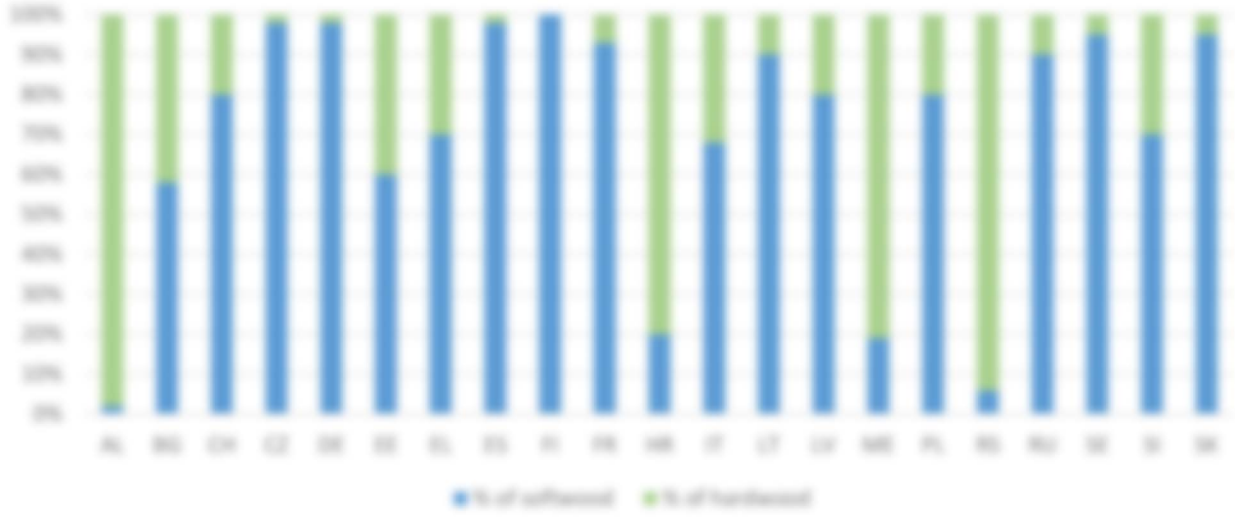


Source: EPC survey 2021

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.

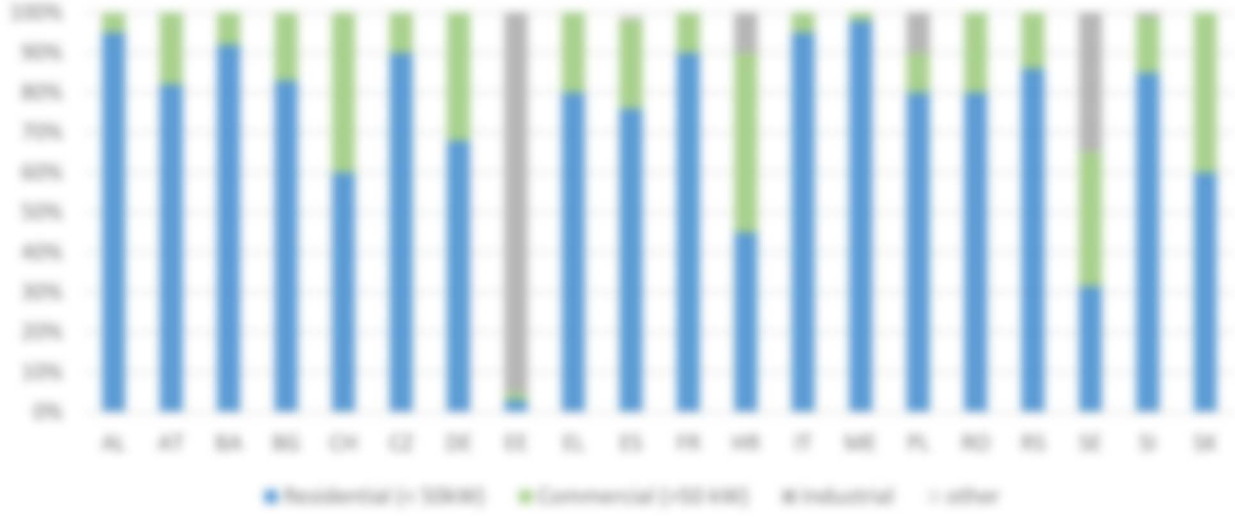
Figure 21 Estimate of the shares of hardwood and softwood as raw material for local pellet production in Europe in 2020 (%)



Source: EPC survey 2021

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

Figure 22 Estimate of European pellet producers' main markets by end-use in 2020 (%)



Source: EPC survey 2021

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

In 2020, European pellet production grew by 1,1 million tonnes while consumption increased by 1,3 million tonnes. This is reflected in the responses of pellet producers about their main preoccupations, whose concerns about 'demand' decreased while 'availability and prices of raw materials' registered a rise.

Table 6 European pellet producers' perception of the main difficulties in 2020 (1: least preoccupying to 5: most preoccupying)

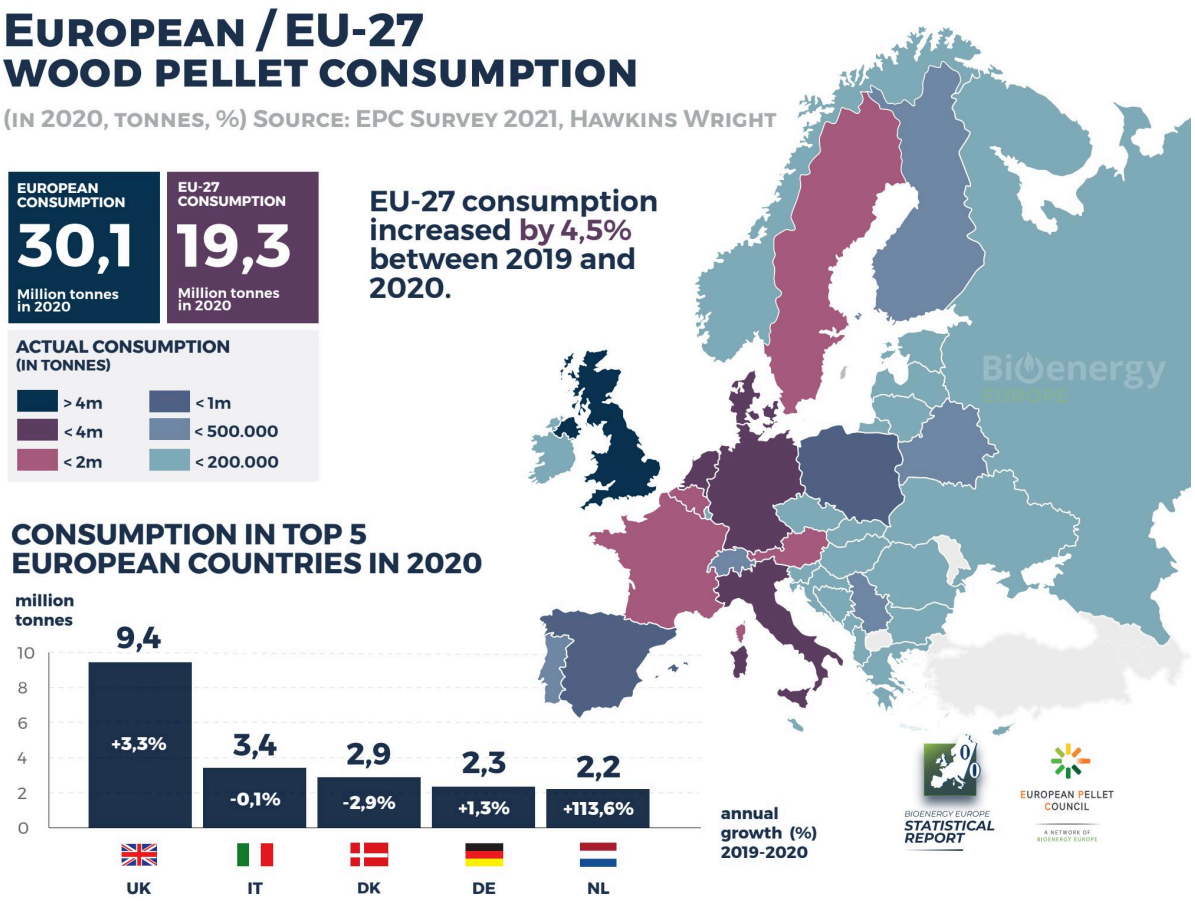
	Lack of raw material	Price of raw material	Lack of demand	Competition with importers	Pellet stock management	Other
AL	5	5	3	3	1	1
AT	1	1	1	2	1	n.a.
BA	5	5	3	2	1	n.a.
BG	4	5	3	1	2	n.a.
CH	1	3	4	4	4	n.a.
CZ	1	2	4	2	2	2
EE	5	4	n.a.	1	2	3
EL	5	4	2	4	2	5
ES	3	4	4	3	5	n.a.
FI	2	1	4	2	1	n.a.
FR	3	2	4	1	5	n.a.
HR	5	4	4	3	5	n.a.
LT	1	4	5	5	1	n.a.
LV	1	2	3	5	4	n.a.
ME	5	4	3	1	1	n.a.
MD	2	2	3	4	3	n.a.
RS	5	4	4	4	2	n.a.
RU	3	3	2	n.a.	4	n.a.
SE	1	3	4	2	2	2
SI	4	4	1	3	2	n.a.
SK	4	5	3	3	2	n.a.

Source: EPC survey 2021

3.2 European pellet consumption

3.2.1 Total European pellet consumption

Figure 23 Map of pellet consumption in Europe in 2020



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

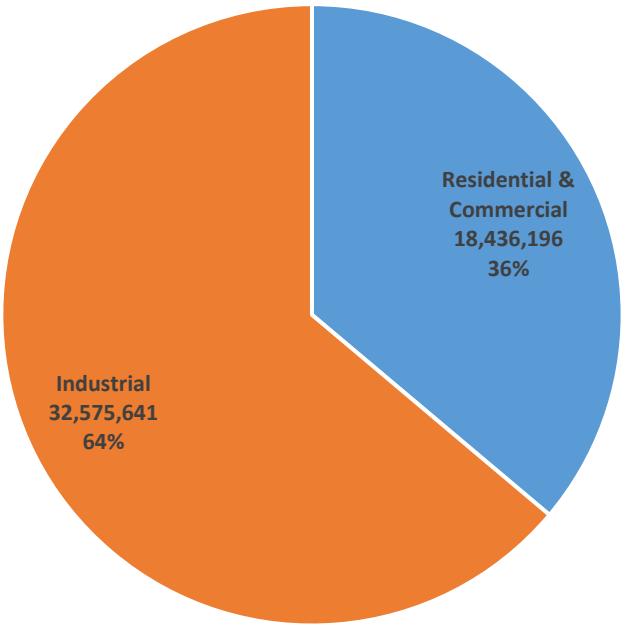
In 2020, **European** pellet demand experienced an increase of 1,3 million tonnes in comparison to 2019, representing a growth of 5%, below the 7% growth that was observed in 2019.

The **industrial growth** was responsible for 89% of the total pellet consumption increase (from 2019 to 2020) in Europe, while actually the total pellet consumption increase for the same period for United Kingdom (UK) and Netherlands was due to a consumption increase for power only (4% increase for UK, 150% increase for Netherlands).

The **residential/commercial market** realised modest growth in most European countries in 2020 compared to 2019. This can be explained by two main (correlated) factors. Firstly, the 2019-2020 heating season showed a rather similar energy demand as for 2018-2019 in most European climate zones. Nonetheless, the 2020-2021 heating season has witnessed a low energy demand during 2020's final months. Secondly, the heating appliance sales in Europe did not show a dramatic increase during that period. However, despite this, France and Serbia are highlighted as growing examples, as they have both registered the biggest increase (in absolute terms) in residential/commercial pellet consumption.

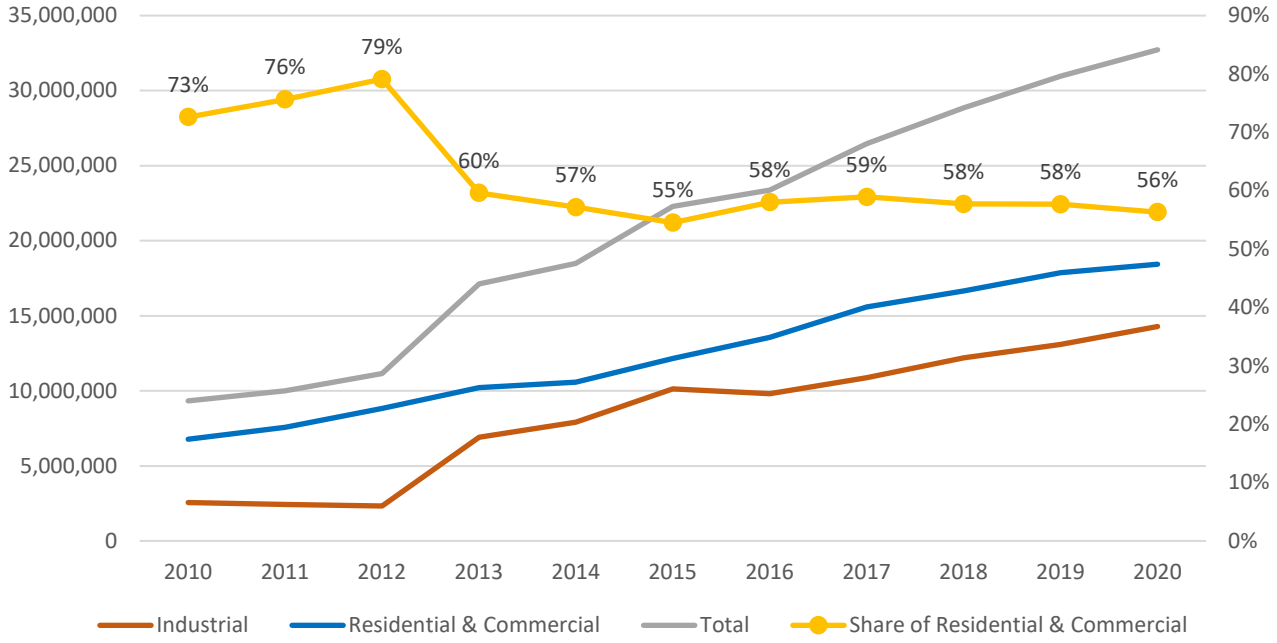
More recently, the **COVID-19** which was initially seen as a great risk for the pellet demand, finally appeared to have very limited impact, much less than the low 2019-2020 heating season.

Figure 24 European pellet consumption by type of end use in 2020 (tonnes and %)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

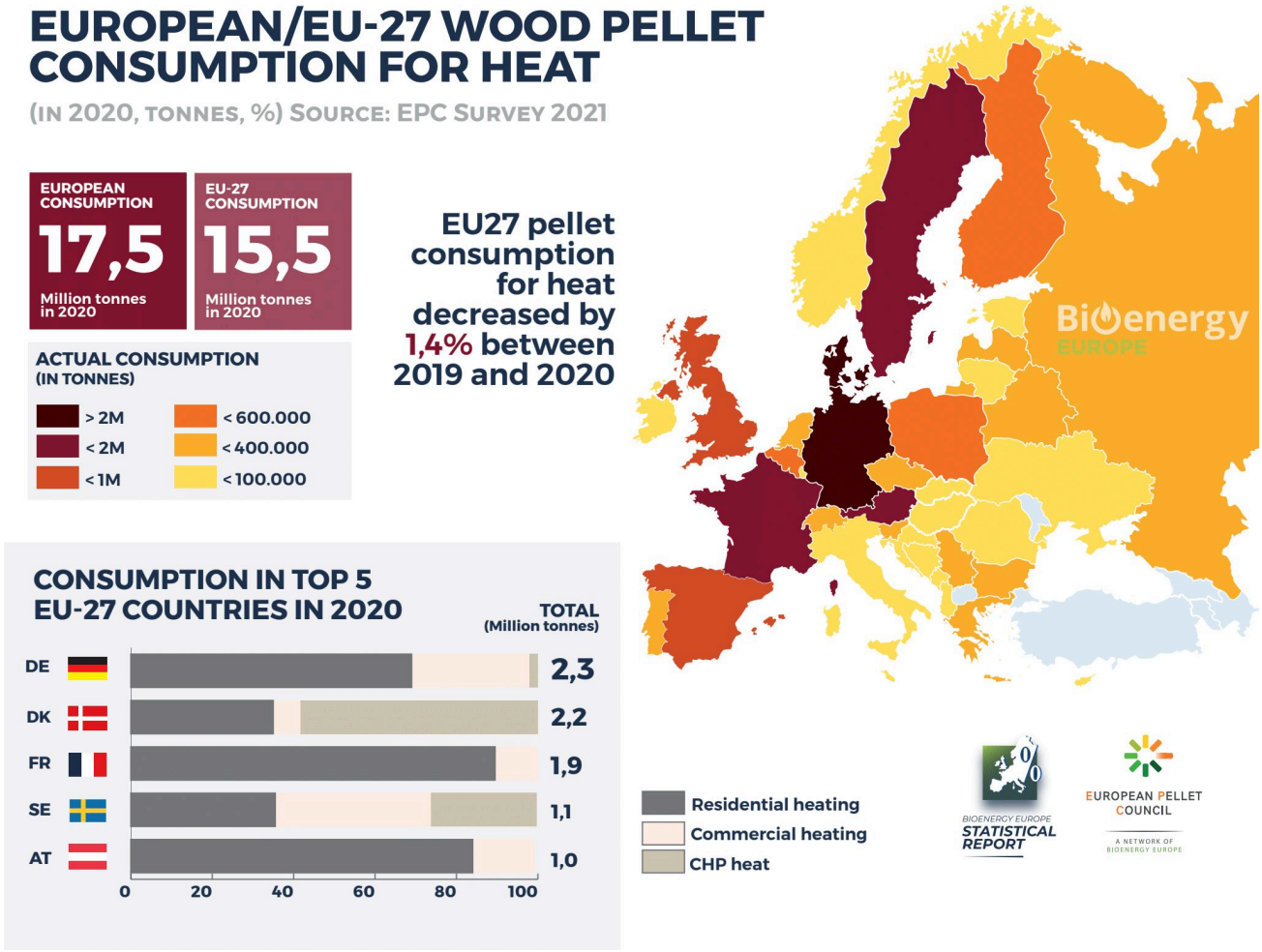
Figure 25 Evolution of pellet consumption in Europe by type (tonnes and %)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

3.2.2 European pellet consumption for heating

Figure 26 Map of pellet consumption for heating in Europe in 2020

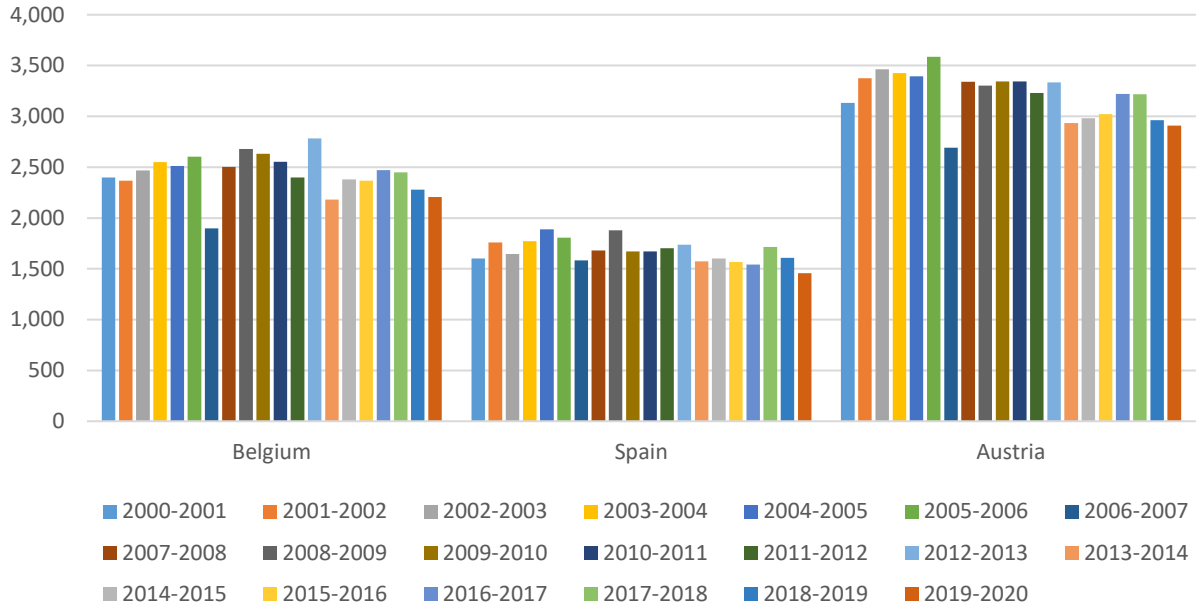


Note: Include residential, commercial and 2/3 of CHP consumption; EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019. RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

The annual increase of the pellet demand in the **residential/commercial** sector was smaller in 2020 than in 2019: +3,8% in 2020 (vs 2019) and +5% in 2019 (vs 2018). It can be explained by the fact that 2018 has benefited from fairly good heating seasons while 2019 was deeply impacted by the low 2019-2020 heating season and a low start of 2020-2021 heating season. Furthermore, the not so strong increase in sales of heating appliances did not compensate for this low demand. Despite this, France and Serbia are highlighted as growing examples, as they have both registered the biggest increase (in absolute terms) in residential/commercial pellet consumption.

Still, in 2020, the **residential and commercial** consumption increased together by 152.339 tonnes. Commercial pellet demand decreased in 2020 (-4%) while the residential showed a weak growth (+2%) and in absolute terms: + 289.686 tonnes for residential use and -137.287 tonnes for commercial use.

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)



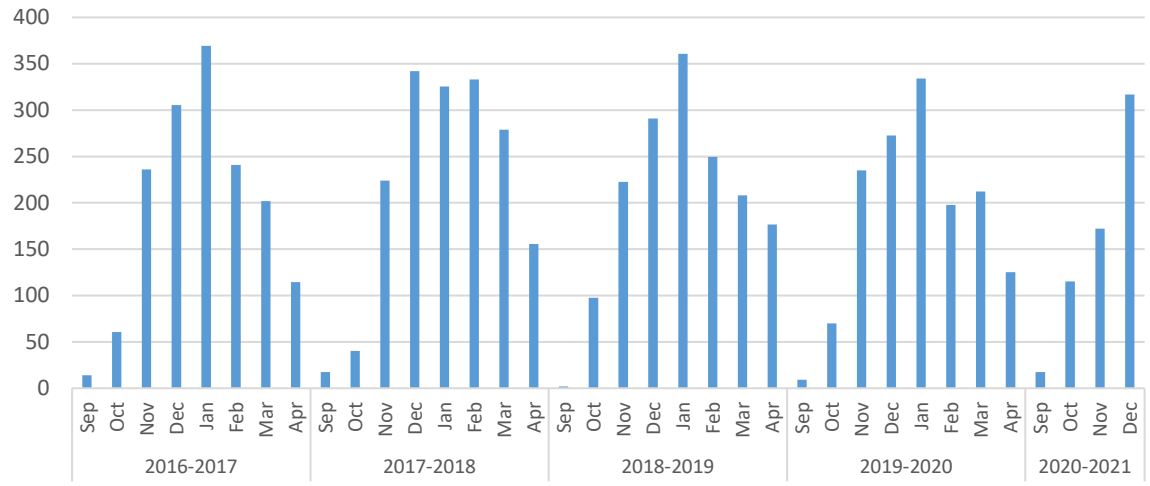
*Climatic zones defined by Tsikaloudaki, Laskos and Bikas (2011), 'On the Establishment of Climatic Zones in Europe with regard to the Energy Performance of Buildings'
Source: Eurostat

Figure 27 shows the fluctuation of energy demand for heating between heating seasons since 2000. Indeed, 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), creating some disruption on the pellet market that was not fully prepared, leading to market tensions and even small shortages. For this reason, pellet market players then tried to organise themselves to prevent this situation from repeating itself by increasing their production and stock. Unfortunately, from 2013 to 2016, Europe experienced three consecutive mild winters, leading to a rather disappointing growth of pellet consumption in the heat market inducing the accumulation of pellet stock in some regions. Thankfully, the following heating seasons were colder, resulting in better pellet use for heat showing a growth of around 12% over the 2016-2017 period. This sudden rise in consumption generated again some tensions 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 ones but only marginally colder than the ones from 2013 to 2016, leading to a modest growth of 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 started very similarly to the previous but then lasted for much longer. Indeed, in many areas, the energy demand was still rather high in March and April, which unexpectedly supported the pellet demand, allowing most of the market players to empty their stock.

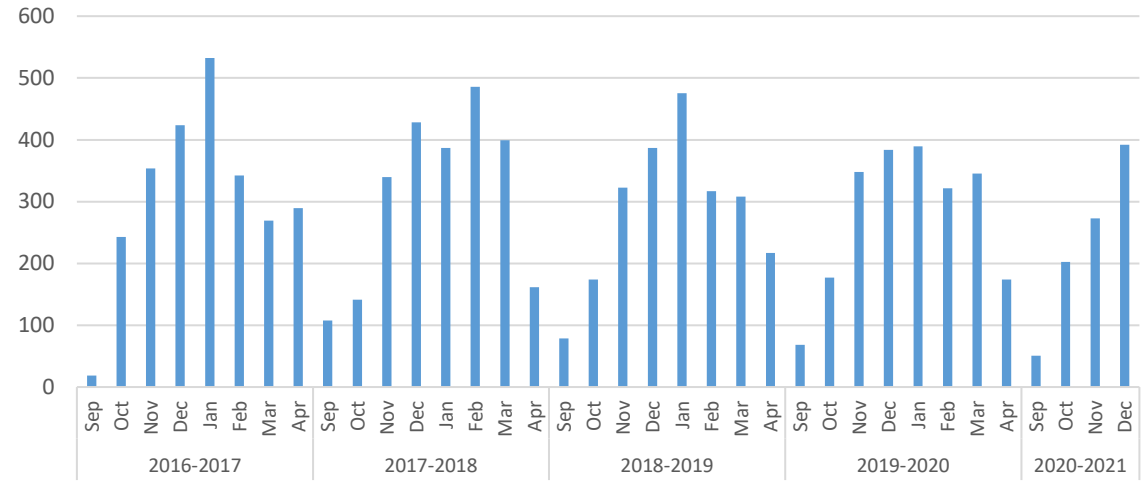
[3] Heating Degree Days (HDD) depict the severity of the cold in a specific time period taking into consideration outdoor temperature and average room temperature (in other words the need for heating). The calculation of HDD relies on the base temperature, defined as the lowest daily mean air temperature 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.*

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

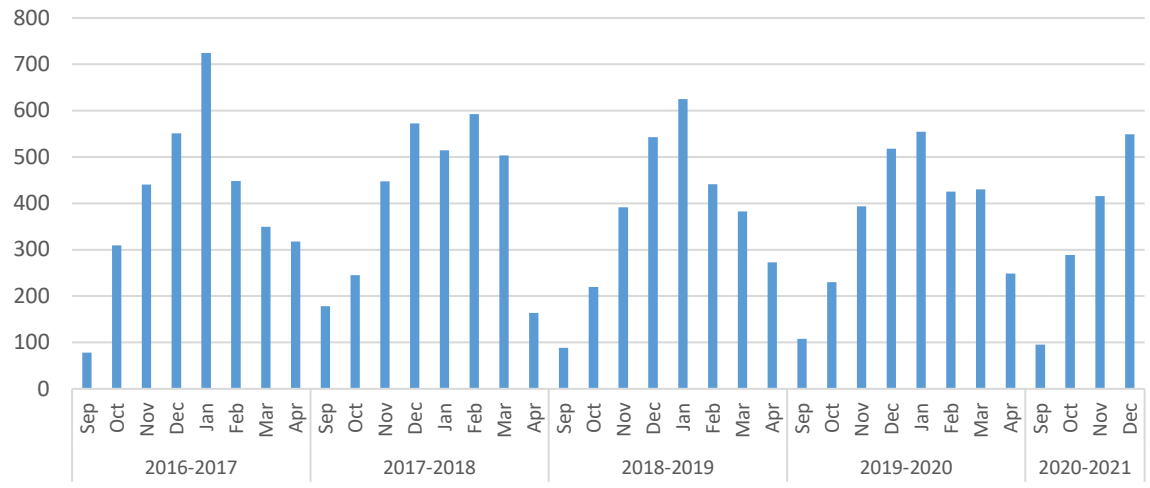
(a) HDD for Spain – Low heating needs region



(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 European pellet consumption for heating in 2020 compared to 2019 (tonnes)

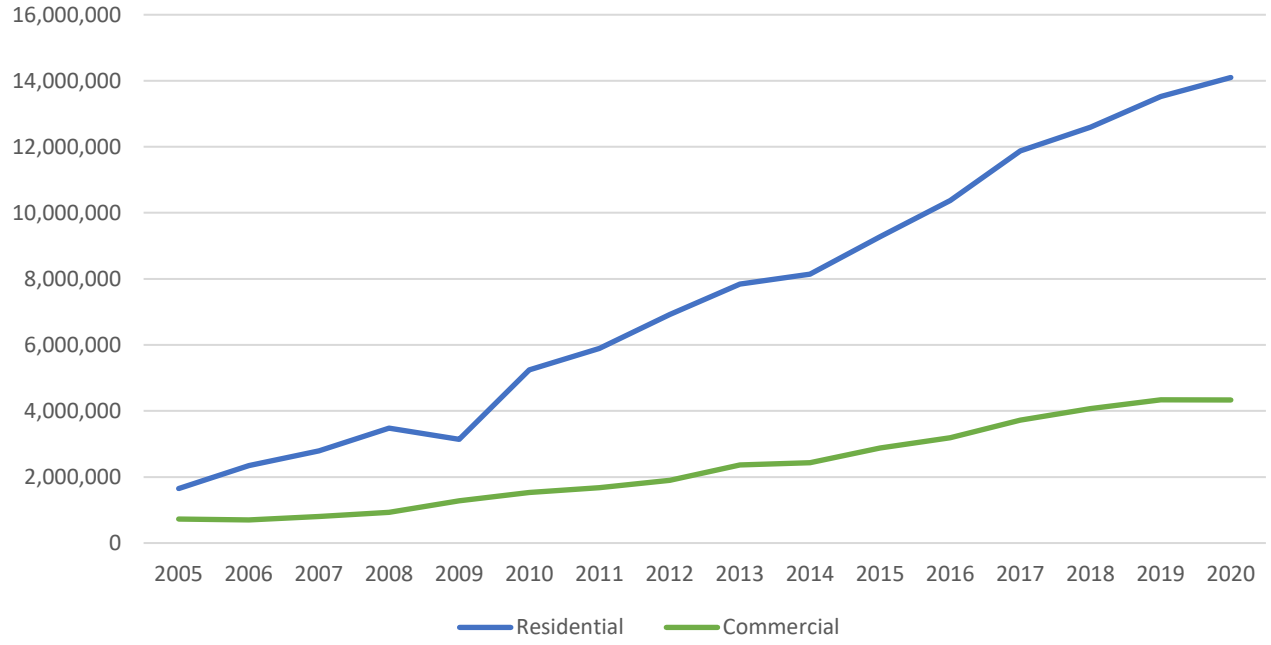
	2019				2020			
	Residential	Commercial	2/3 CHP	Total	Residential	Commercial	2/3 CHP	Total
EU27	10.752.818	3.084.715	1.845.152	15.682.685	10.900.395	2.879.474	1.686.679	15.466.548
AT	800.000	150.000	n.a.	950.000	860.000	155.000	n.a.	1.015.000
BE	427.859	10.866	13.333	452.058	509.000	11.000	13.333	533.333
BG	182.400	1.482	n.a.	183.882	185.485	1.823	n.a.	187.308
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	72.000	37.000	n.a.	109.000	78.000	41.000	n.a.	119.000
DE	1.563.000	669.500	45.000	2.277.500	1.594.000	667.000	46.667	2.307.667
DK	833.000	147.000	1.324.192	2.304.192	780.000	150.000	1.300.000	2.230.000
EE	30.000	10.000	n.a.	40.000	30.000	10.000	n.a.	40.000
EL	78.000	18.000	n.a.	96.000	79.500	18.200	n.a.	97.700
ES	420.000	255.000	n.a.	675.000	458.000	245.000	n.a.	703.000
FI	51.000	362.000	13.333	426.333	48.000	367.000	7.333	422.333
FR	1.600.000	200.000	n.a.	1.800.000	1.700.000	200.000	n.a.	1.900.000
HR	28.000	18.000	n.a.	46.000	25.000	15.000	n.a.	40.000
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	3.233.159	176.427	n.a.	3.409.586	3.243.226	163.569	n.a.	3.406.796
LT	47.500	12.500	n.a.	60.000	47.500	12.500	n.a.	60.000
LU	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
LV	130.000	15.000	n.a.	145.000	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	150.000	n.a.	230.000	80.000	120.000	n.a.	200.000
PL	320.000	70.000	20.000	410.000	350.000	70.000	20.000	440.000
PT	170.000	160.000	n.a.	330.000	131.197	123.480	n.a.	254.677
RO	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SE	540.000	554.000	419.333	1.519.333	594.487	422.902	289.346	1.106.735
SI	98.000	27.000	10.000	145.000	120.000	27.000	10.000	167.000
SK	43.000	21.000	n.a.	74.000	46.000	32.000	n.a.	78.000
Other Europe	1.012.768	805.844	36.744	1.855.356	1.154.977	873.858	36.744	2.065.579
AL	48.000	4.000	n.a.	52.000	56.000	8.000	n.a.	64.000
BA	210.000	38.000	n.a.	248.000	279.500	55.000	n.a.	334.500
BY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CH	215.800	116.200	n.a.	332.000	223.600	120.400	n.a.	344.000
ME	24.500	2.900	n.a.	27.400	26.500	4.200	n.a.	30.700
NO	46.180	24.866	n.a.	71.046	46.180	24.866	n.a.	71.046
RS	285.591	10.486	n.a.	296.077	340.500	52.000	n.a.	392.500
RU	50.000	27.000	22.000	99.000	50.000	27.000	22.000	99.000
UR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
UK	132.697	582.392	14.744	729.833	132.697	582.392	14.744	729.833

Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.

RU: 2020 residential consumption is a replication of 2019

Source: EPC survey 2021

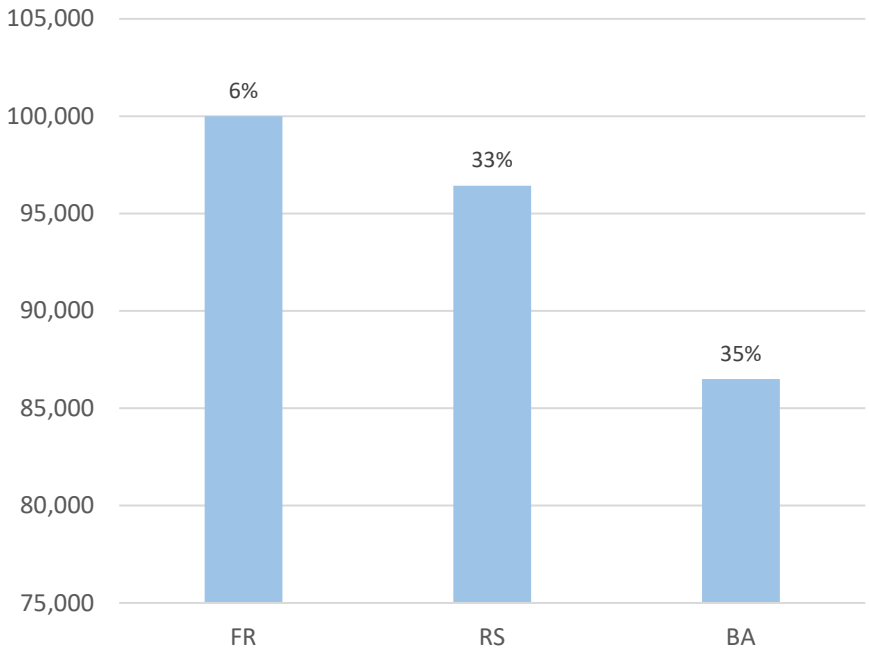
Figure 29 Evolution of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP (tonnes)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

Figure 30 Growth of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP by country between 2019-2020 (tonnes & %)

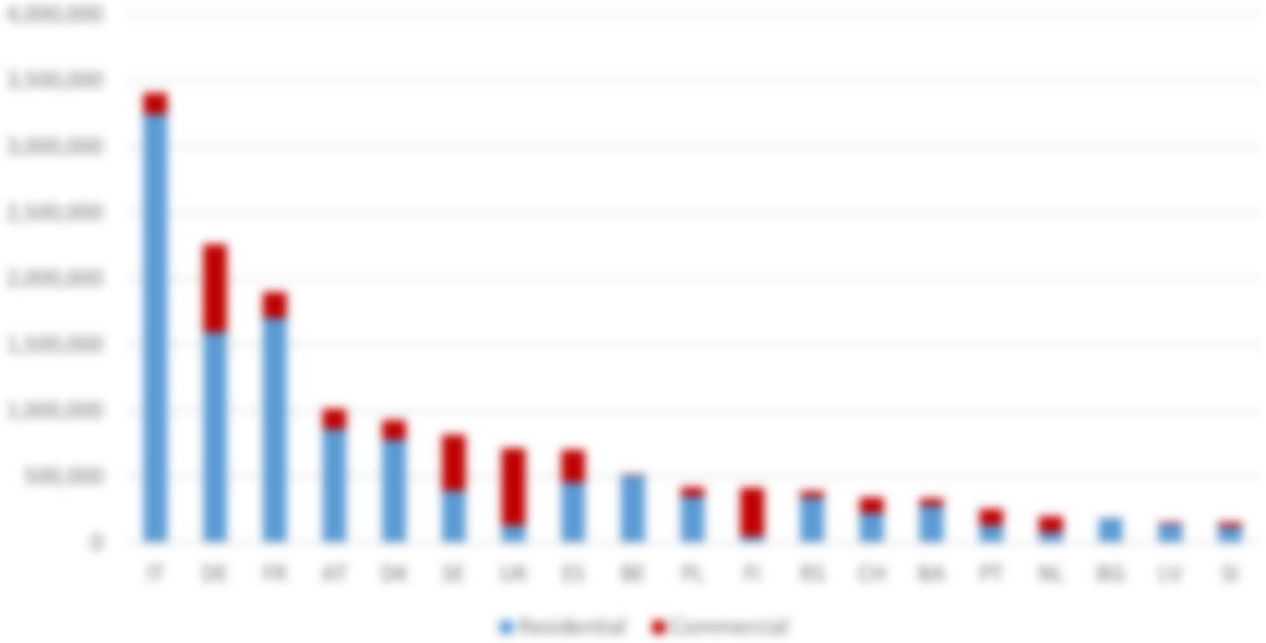
(a) Top 3 countries of absolute growth in pellet consumption



(b) Rest of the world

Source: EPC survey 2021

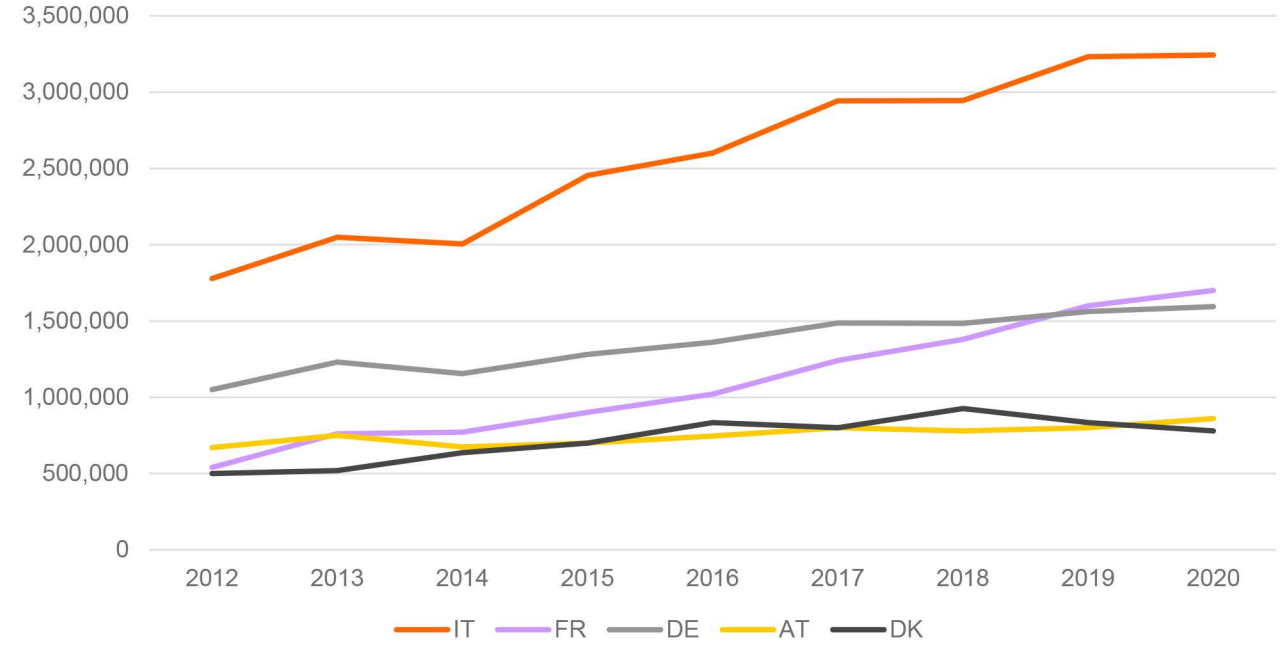
Figure 31 European pellet consumption for residential (< 50kW) and commercial (> 50kW) heat in 2020 (tonnes)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021, Hawkins Wright

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 2021

Austria: A fair increase of the pellet consumption within the residential sector (+7.5%) was observed in 2020 overpassing the small increase (+2.6%) that was observed in 2019.

France: The country's consumption of pellets resulted in an 6.3% increase with an additional 100.000 tonnes from 2019 to 2020, with residential consumption being totally responsible of this growth.

Italy: In 2020 the consumption in Italy stagnated, showing a minor decrease of -0.3%.

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

Source: EPC survey 2021

Finland: in the future, pellet consumption in small-sized heating plants as well as in small-sized dwellings will be approximately on the same level as today, but it may be possible that the consumption will increase in large-sized dwellings, such as schools, industrial halls, retirement homes, etc.

Greece: Almost 80-85% of wood pellet consumption is by small-to-medium scale residential heating units (stoves, boilers). The consumption was further supported in 2020 by incentives on income and geographic location criteria imposed by the government.

Spain: In Spain, the residential consumption increased mainly due to the pandemic and the amount of time spent in households. The increase, though, is not remarkable due to low use of second homes for holidays.

Russia: while the figures are and remain low on residential pellet use, the reality might be very different given that this information has proved to be challenging to collect.

Figure 34 Evolution of Europe's top 5 largest growing markets (between 2013-2020 in absolute terms) residential (<50kW) pellet consumption in Europe (tonnes)

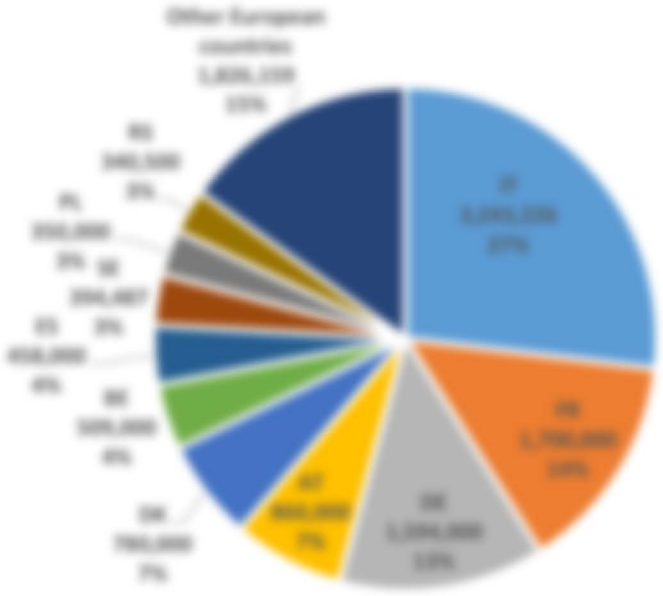
Note: the order of the legend is following the decreasing order of the absolute increase of production (in tonnes) between 2013 and 2020.
Source: EPC survey 2021

Figure 35 Evolution of Europe's top 5 fastest growing markets (between 2013-2020 in relative terms) residential (<50kW) pellet consumption in Europe (tonnes)

Note: the order of the legend is following the decreasing order of the absolute increase of production (in tonnes) between 2013 and 2020.
Source: EPC survey 2021

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

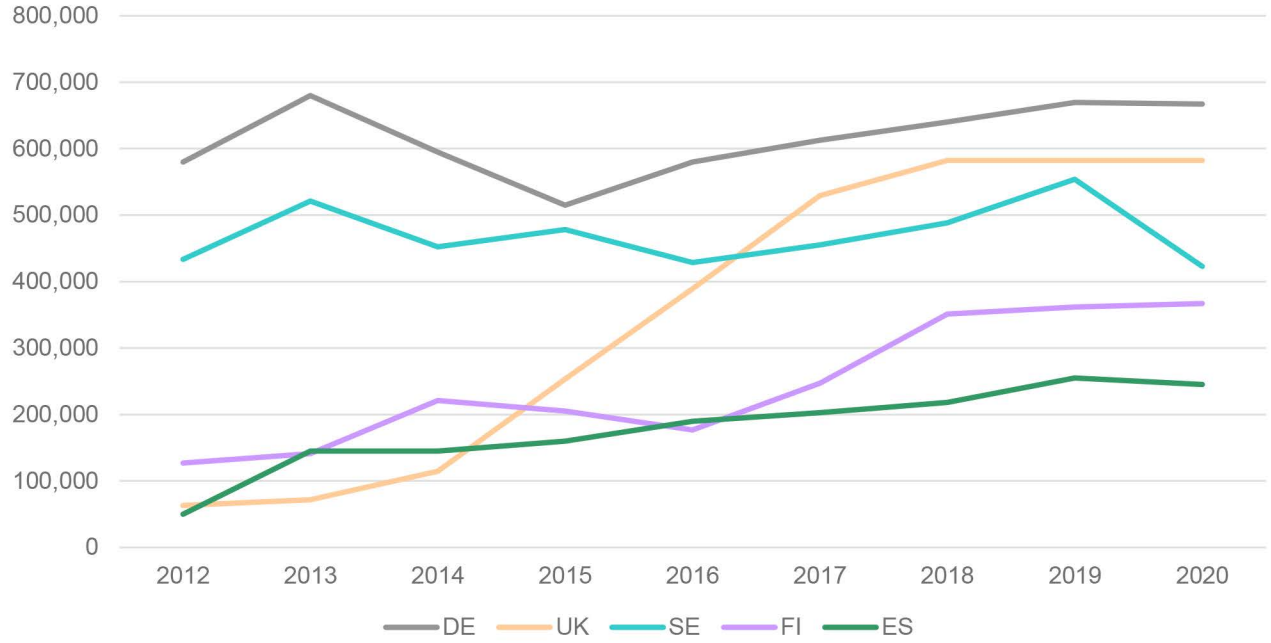
Figure 36 Share of European residential (<50kW) pellet consumption by country in 2020 (tonnes)



Note: EE, LT, UK, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

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 2021

[redacted]

[redacted]

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

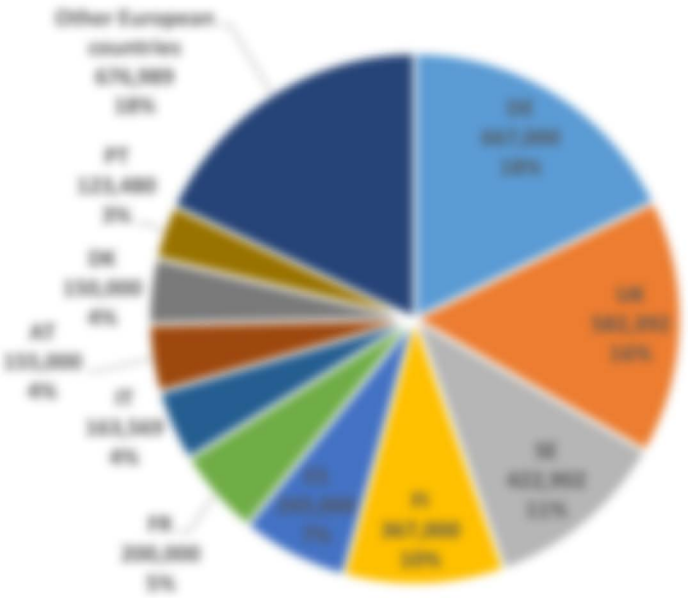
Source: EPC survey 2021

Greece: Wood pellet penetration in the professional and industrial bioheat generation sectors is still slow. Due to the large quantities required by industrial plants, factory owners tend to seek feedstock mainly through low-cost imports at larger quantities rather than higher cost local production at smaller quantities (e.g. sunflower husk pellet imports from neighbouring Balkan countries and Ukraine are quite common).

Latvia: Due to concerns about the air quality (PM particles) in 3 biggest cities in Latvia, it has been decided to limit the combustion of biomass.

Serbia: In the past two years over 300 public buildings have replaced their old heating systems (based on coal and heating oil) with new modern and efficient heating appliances using wood pellets and wood chips.

Figure 39 Share of European commercial (>50kW) pellet consumption by country in 2020 (tonnes)



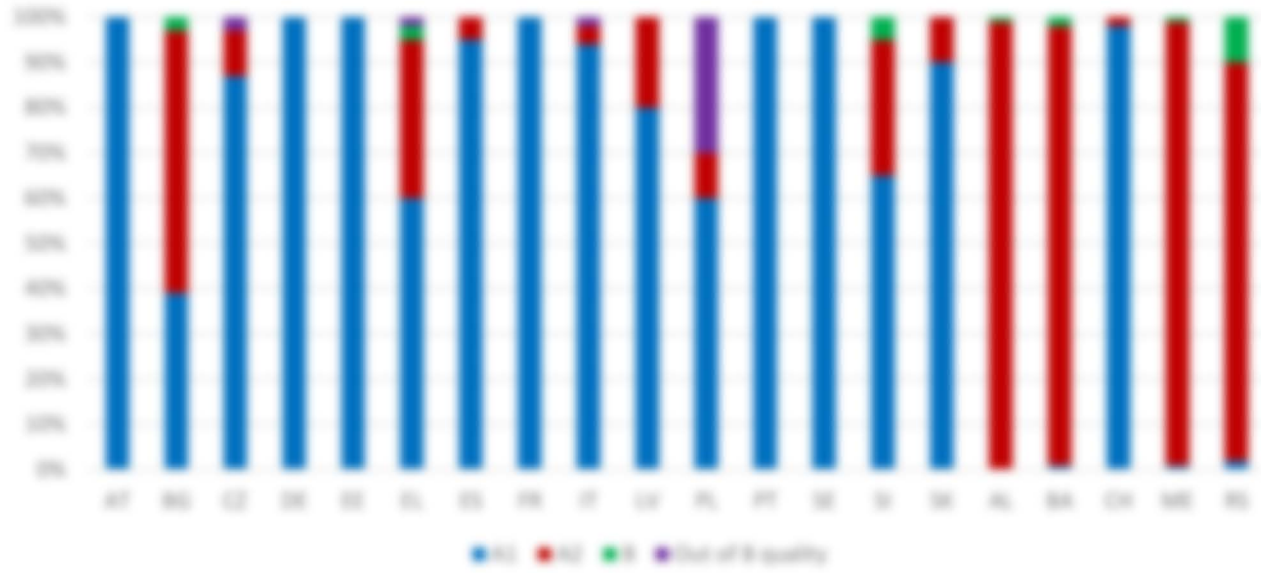
Note: EE, LT, LV, NO & RU: 2020 consumption is a replication of 2019.
RU: 2020 residential consumption is a replication of 2019
Source: EPC survey 2021; Hawkins Wright

3.2.2.3 QUALITATIVE ANALYSIS

EPC held a consultation with pellet industry stakeholders[4] to identify pellet quality classes that are often used within both the residential and commercial heating market for each European country (these 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.

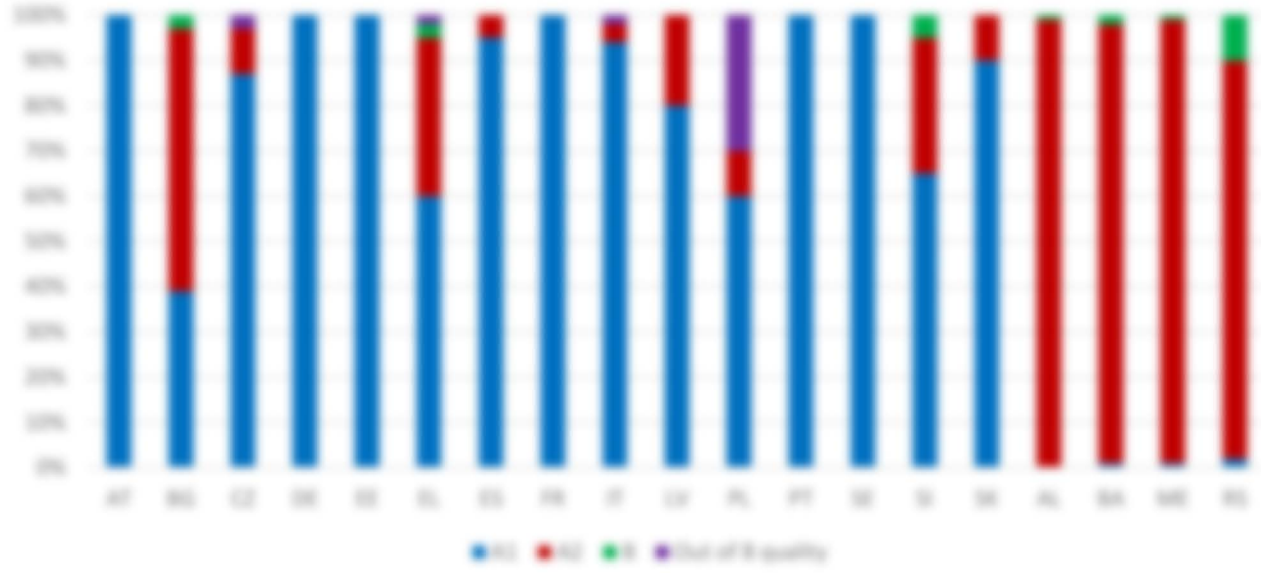
[4] For this survey, mainly pellet associations were consulted. Not all of them have consulted the local producers.

Figure 40 Estimate of pellet quality class shares for residential heat market in European countries in 2020(%)



Source: EPC survey 2021

Figure 41 Estimate of pellet quality class shares for commercial heat market in European countries in 2019 (%)

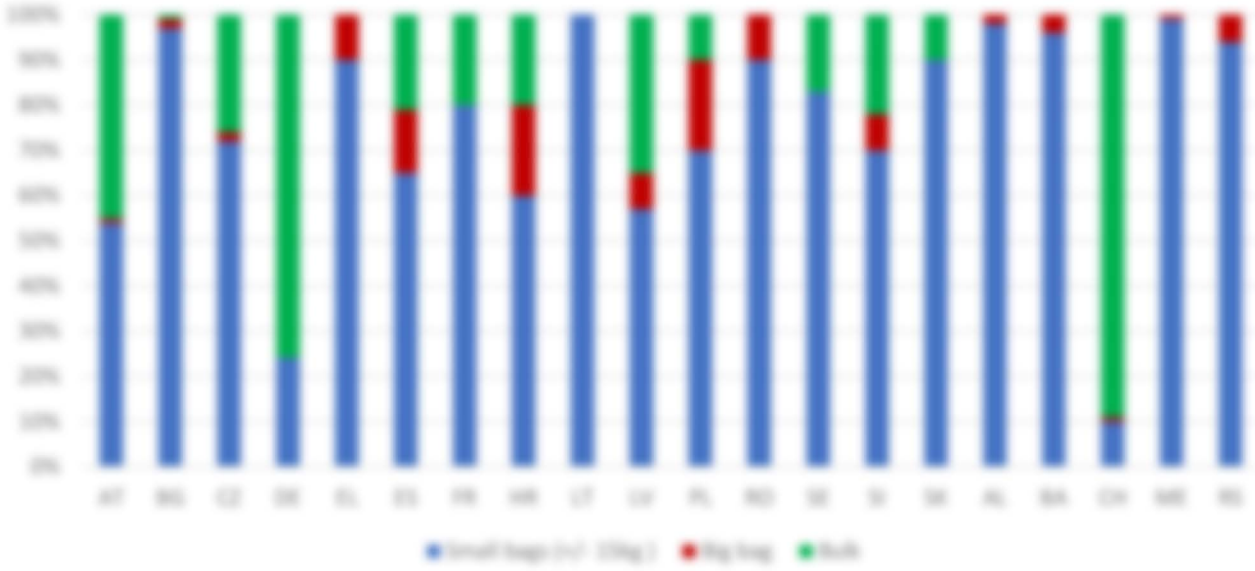


Source: EPC survey 2021

Another consultation was carried out to identify how pellets are delivered to users within the residential heat markets of each European country.

Germany, Austria, and Switzerland each have heat markets where consumers operate boilers fed from a silo having a multi-tonne capacity. This explains why these markets are mainly consuming bulk pellets. 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. It can also be noted that big bags are rather commonly used in some countries.

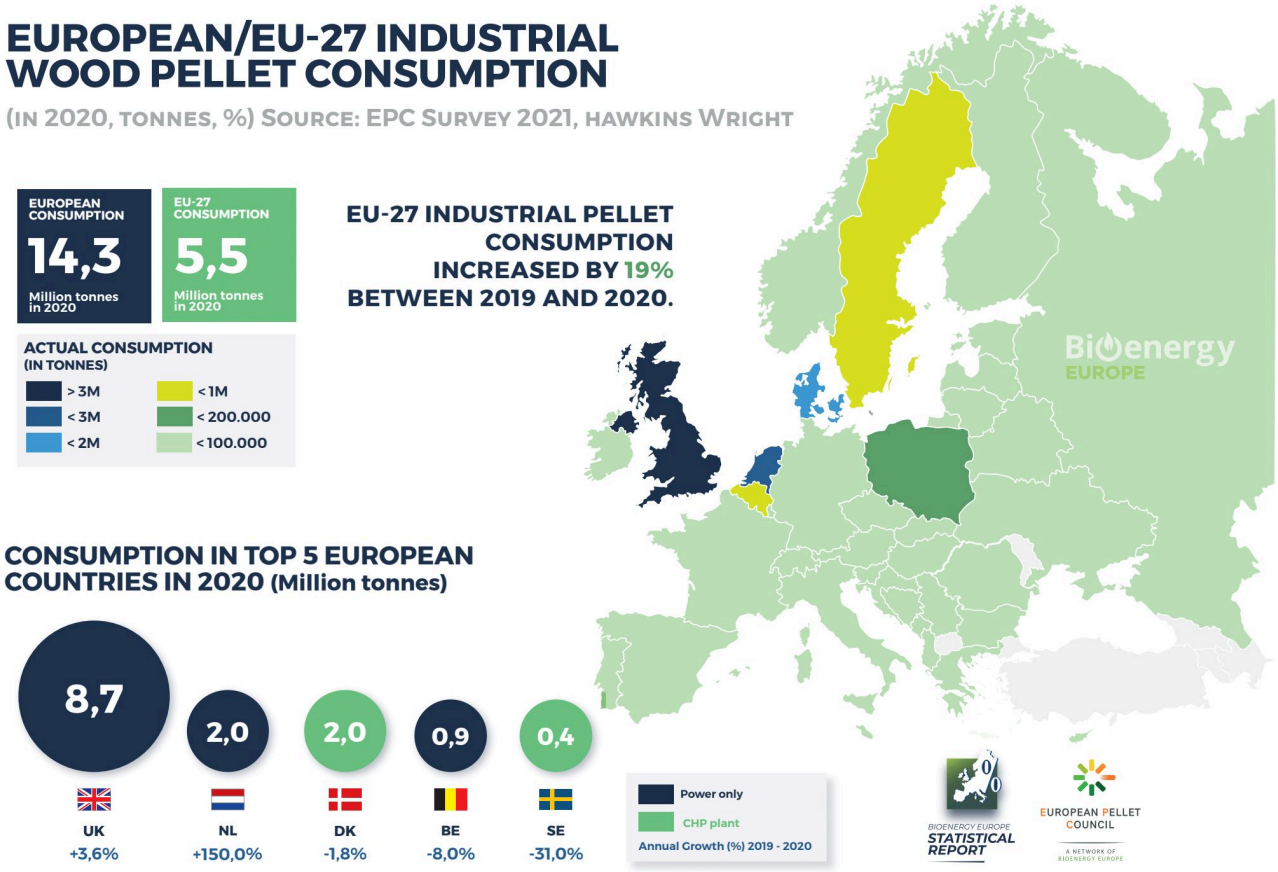
Figure 42 Forms of delivery used in the residential heat market in European countries in 2020 (%)



Source: EPC survey 2021

3.2.3 European industrial pellet consumption

Figure 43 European map of industrial pellet consumption in 2020



Source: EPC survey 2021, Hawkins Wright

Q1-Q2 2020 showed great tensions on the industrial pellet market. Indeed, the supply was very tight, leading to spot price records, increased use of coal (for the co-firing plants) but enhanced interest and use of agropellets.

Following great supply tightness that occurred in Q1-Q2 2019, the rest of 2019 and 2020 completely reversed the trend. To avoid the 2019 hurdle, the utilities took strong positions and entered the 2019-2020 very well stocked while the demand actually slowed down. Indeed, the 2019-2020 heating season has been rather low, impacting the need of industrial pellets. In March 2020, the COVID-19 pandemic did reduce the electricity demand, which impacted the industrial pellet users having their costs exposed. On top of that, the supply is strong, and some utilities did plan outages or even faced technical problems, beside ENGIE Les Awirs closure. The 2020-2021 heating season has started slowly but in many areas the heating season did last longer than usual, leading all in all to a significant energy demand. Moreover, later on in 2021, the high electricity price and fossil fuel price led in some areas to an enhanced use of pellet for electricity production, tightening further the market situation.

Belgium: Following the end of green certificate support, the biopower plant of ENGIE les Awirs stopped operating in September 2020. This cessation will lead to a drop of industrial pellet usage of about 300.000 tonnes per year in Belgium. Still, Rodenhuize plant, the second and last unit of ENGIE running on pellets, continues to operate.

Denmark: The industrial pellet consumption in Denmark witnesses a drop for three consecutive periods with a decrease of -1,8% in 2020, following a drop of -5% in 2019 compared to the previous year. The retrofitting success of coal plants to biomass, that initially focused on wood pellets, indeed resulted in a peak consumption of pellets in 2017. However, the recent retrofitting programmes have been diverted from pellets to wood chips. 2021 will show higher numbers due to the high operating rates of some units during the long 2020-2021 heating season but also due to favourable market conditions (high electricity price and high fossil fuel price).

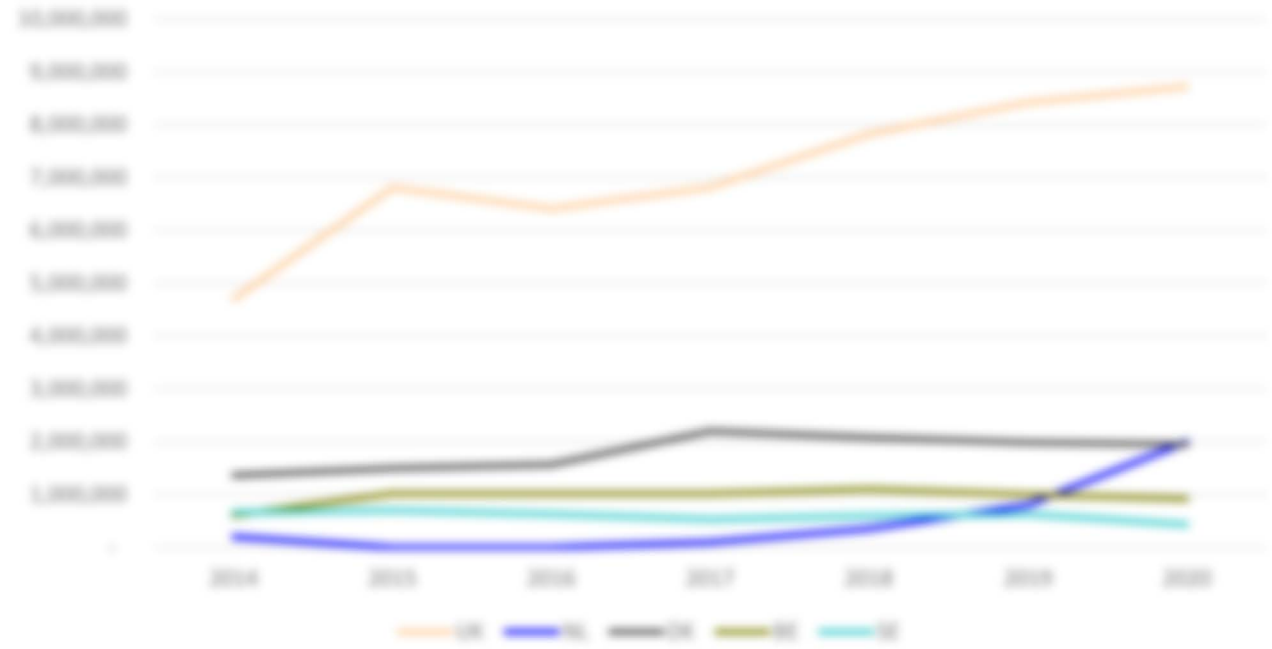
Sweden: 2020 low consumption rates are the result of an energy demand variation. 2021 will show higher numbers due to the high operating rates of some units during the long 2020-2021 heating season but also due to favourable market conditions (high electricity price and high fossil fuel price).

The Netherlands: in 2020, the ramping up of industrial pellet usage perdured in the Netherlands, thanks to the SDE+ subsidy. Indeed, RWE Amers 9 hit a record high in pellet consumption for electricity production, while RWE Eemshaven plant's 2020 consumption was impacted by the consequences of a storage fire. Uniper MPP3 recorded its highest pellet consumption rate (co-firing with coal) in 2020.

United Kingdom: The industrial pellet consumption increased again in 2020 to reach its record. This is mainly due to 2020 having been the first full year of operation both for the 4 units of Drax (the 4th unit conversion was finalized in Q3 2019) and the fully biomass converted EP Lynemouth plant. More use is expected at the very end of 2021 as the MGT Teesside unit should be put online after having experienced some delay in the plant commissioning

For the coming years, no further investment in industrial pellet usage is foreseen in any of the countries that are listed above. Still, all the eyes are now turning to Germany and Poland. Indeed, both countries have committed to phase out coal usage for electricity production but it is still very unclear at this stage whether pellet will indeed partly replace coal.

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



Source: EPC survey 2021, Hawkins Wright

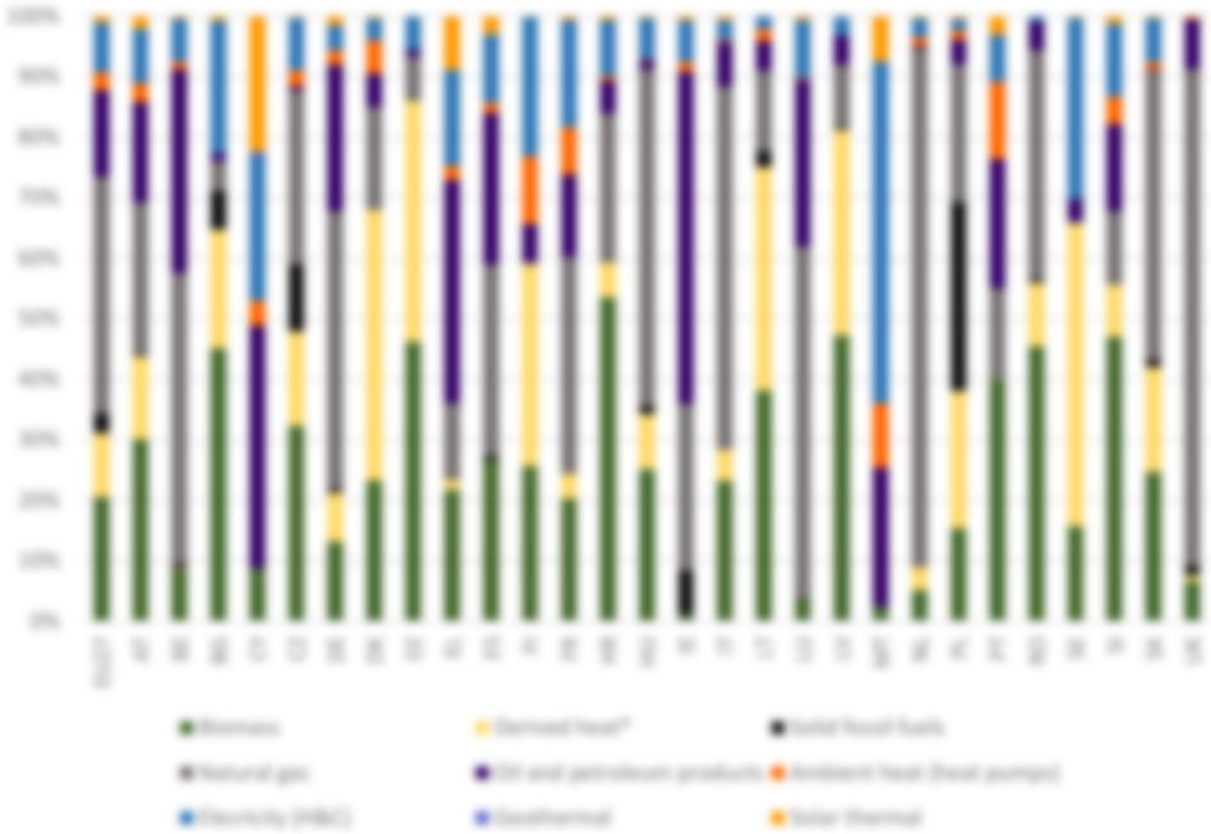
3.3 European heating appliances market

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

More recently, the COVID- 19 lockdown had some impact on the heating appliances sales as many businesses had to pause their activities. But this impact finally appeared to be rather limited. Actually, the COVID- 19 also had some positive impact as the homeworking enhanced people to invest in their home, among others, by buying a pellet stove.

Figure 46 presents the breakdown of energy sources by fuel type in the heating and cooling residential sector within the different 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 regarding pellets. As well as replacing old biomass heating appliances, the replacement of heating oil and coal (solid fossil fuel) appliances represents significant potential of growth for the European pellet market.

Figure 46 Share of energy used for heating and cooling in the residential sector by European countries in 2019 (%)



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 fossil stock of appliances to be replaced with alternative appliances.

Bulgaria: Until 2024, there are two significant EU subsidising programs for boosting biomass heating appliances installation in households, while new funding opportunities for phasing out fossil fuel use in residential and public sectors (coal, oil) are expected until 2030.

Czech Republic: In the Czech Republic, a subsidy program for the replacement of old boilers of the 1st and 2nd emission class (mainly coal-fired boilers) for modern ecological sources has been running for 5 years and has now been extended until 2027. Pellet boilers and heat pumps are mostly subsidized, with the maximum subsidy being 4.900 €.

Denmark: The implementation of GHG emissions reduction law by 70% by 2030 will include the phase-out of fossil fuels across many sectors and will boost the renewables.

Finland: The use of fossil fuel oil in heating will be phased out by the start of the 2030s.

France: Since 2019, the government's heating oil phase-out action has reinforced the support for renewables. In 2020, an income tax credit and an additional support program for renewables was launched. From mid-2022 installations in buildings, new or used ones, must comply with the maximum emission limit of 250 CO_2eq/kWh.

Germany: Oil heating systems will be banned from 2026 onwards and only hybrid heating systems (fossil and renewable fuels) will be permitted. Additionally, owners of oil heating appliances older than 30 years have the obligation to replace them.

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

Poland: Biomass, and pellets in particular, are recognised as an alternative to coal, but no decisions have been taken so far to support schemes on a governmental level. On local authorities' level, the pellet is embedded with coal under the solid fuels label, enhancing confusion about biomass and coal.

Slovak Republic: The ministry of the environment has implemented a renewables support program, called "green for households", where biomass use is included.

Spain: Ecological Transition Ministry is in the preparatory phase (collecting expressions of interest), as funds are expected under the declared target of reaching carbon neutrality by 2050.

Sweden: In the residential and industrial sector, there is a national carbon tax of around 120 €/tonne CO_2, along with a subsidiary program, "Climate Step", pushing for a switch to renewables.

Switzerland: Authorities are preparing a new CO_2 legislation which includes taxes on petrol/diesel, replacement for heating systems, etc. With the referendum of 13 June 2021, the revised CO_2 Act was rejected. In the cantons, the cantonal regulations now come into play, and they are just as strict, at least in the short term. Furthermore, since summer 2021, financial support for appliances is available if a fossil heating system (gas, heating oil) is being replaced.

3.3.1 European stove market

Table 10 Average percentage of households with pellet stoves in 2020 in some European countries (%)

IT	8,12%
BG	4,97%
FR	3,94%
ES	1,97%
AT	1,38%
DE	0,52%
SE	0,47%
EL	0,40%
LV	0,29%
HR	0,26%
CZ	0,14%
SK	0,04%

Note: considering maximum one appliance per household
Source: Eurostat and EPC survey 2021

Bulgaria: To improve air quality, along with the need to improve energy efficiency and reduce greenhouse gas emissions, there has been a positive trend for pellet appliances within the country. This was promoted by support programmes from the EU, the Bulgarian government, as well as the private sector, all encouraging users to switch from fossil fuels to pellets as an alternative fuel source.

Croatia: Stoves and fireplaces have increased, especially low-cost products imported from neighbouring countries (Bosnia and Herzegovina, Macedonia), Turkey and China.

Czech Republic: About 800 pellet stoves are sold in the Czech Republic every year. The only major domestic producer of pellet stoves and several importers of pellet stoves from Italy are involved in these sales.

Finland: The market for pellet appliances has been relatively unsuccessful for years. However, increased oil prices may now bring some interest to the market in the coming years.

Greece: The development of the pellet appliances market depends to a great degree on available incentives by subsidised programmes in the sector of energy savings (e.g. subsidy scheme under the auspices of Department of Energy and Environment ""Savings at Home II"").

Ireland: Domestic stoves are gaining popularity but there is no market data available on the uptake.

Italy: The market has been slowing down since 2014 and a decrease was seen in 2020 with the drop of sales from 181.410 to 170.325 units per year. Despite this fall in sales, Italy remains the country with the highest number of installed pellet stoves in Europe, boasting 2.2 million pellet unit installations, almost 2 times as many appliances as the next-largest market, France.

Poland: A drastic drop in appliances sales is recorded due to the suspension of "Clean Air 0/4" programme in the beginning of 2020. The program is expected to be relaunched with new requirements in the future.

Portugal: The installation of pellet boilers and stoves reached a peak in the winter of 2019-2020. The producers consider that, in the upcoming years, the number of installations will be steady with tendency to decrease in 2025 due to the competition with heat pumps.

Serbia: A huge increase of pellet stoves and boilers is the result of a huge number of schools (over 200), kindergartens, health care centres and other public and commercial buildings that have switched from coal and heating to pellets. Since 2019, the government of Serbia has supported a vast number of public buildings in replacing heating oil and coal with wood pellets leading to sales increase.

Spain: The market trends in 2020 were worse than in 2019 with a 16% decrease in the annual sales of pellets stoves. During the pandemic, the installations of stoves have been impacted due to the limited availability of installers, while sales greatly recovered in the second part of the year. 2021 should be rather similar while 2022 and beyond should be more favorable as Renewable Energies supports, and recovery funds will be put into place.

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

Source: EPC survey 2021

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

Source: EPC survey 2021

Figure 49 Evolution of the annual sales of pellet stoves in some European markets (n° of units)

Source: EPC survey 2021

3.3.2 European residential boiler market

Table 11 Average percentage of households with pellet boilers in 2020 in some European countries (%)

BG	5,44%
AT	3,60%
LV	1,55%
SE	1,26%
DE	0,79%
CZ	0,71%
PL	0,68%
IT	0,55%
SK	0,33%
FR	0,31%
ES	0,19%
EL	0,16%
HR	0,06%

Note: considering maximum one appliance per household
Source: Eurostat and EPC survey 2021

Austria: Residential pellet boilers have long been popular in Austria, although sales have slowed down since 2014. In 2017, sales increased substantially (27% from 2016) and in May through to June 2018, two support programs were launched to replace existing fossil fuel appliances. The increased sales of 2019 have been followed by 2020's further increase of up to 7.500 sold boilers. Sales of pellet boilers in Austria 2021 are expected to double compared to 2020 and reach an all-time high of 12.000 units. Also, exports of Austrian pellet boiler industry show massive growth, especially on German and French markets, which are growing very rapidly. It should be noted that important advances have also been made regarding further reducing the already very low emissions, while several companies are now testing near zero emission boilers.

Bulgaria: Bulgaria holds the highest sales rate and highest ratio (table 11) in Europe due to the generous incentive to switch from fossil fuel-based appliances to highly efficient wood pellet appliances. Governmental support in air quality and energy efficiency measures in the residential sector is expected to boost pellet appliances accompanied by funding measures. Additionally, there are six strong Bulgarian producers of boilers, stoves and burners that use wood pellets as fuel. All six manufacturers also export their products within Europe. Similarly, other popular producers of pellet appliances from other European countries (e.g. Austria, Spain, Switzerland, and Italy) operate in Bulgaria.

Czech Republic: There are 14 producers of pellet boilers in the Czech Republic and another 10 importers from abroad, creating a large and highly competitive market environment. Due to state support of up to 4.300 euros, the number of pellet boilers is growing. In recent years, more pellet boiler installations have been built with an all-season pellet hopper for bulk pellets. The number of customers of bulk pellets is growing faster than for bagged pellets.

Denmark: According to estimates, 5- 10.000 pellet boilers are sold per year.

France: The support for heating oil has been removed in 2018 inducing a rise by more than 40% in boilers' sales. In 2019, sales of pellet boilers simply doubled and significant support was given in 2020 for the replacement of heating oil boilers, to the extent that some market actors were able to offer a 1€ installation. Consequently, 2020 growth rates should have been high but, due to pandemic, only a 1.5% increase was registered. But the current situation is very promising for 2021.

Germany: Germany owns the biggest stock of installed residential pellet boilers in Europe. The number of boilers is higher than the number of pellet stoves, which shows the specificity of this market. Rising prices for heating oil along with improved subsidies of up to 45% for oil heating installation replacement with renewable energy sources have driven the increase in pellet appliances' sales (replacement of other heating appliances is subsidized up to 35%).

Greece: As the main consumers of heating appliance have been mainly, in the early stages, users of the residential sector, the commercial sector is also expected to grow at a faster rate in the coming years, especially in the rural areas where no natural gas alternative network exists, or where no plans for district heating are deployed.

Latvia: The amount of pellet appliances sales in the local market is growing and there is a high future potential, especially for replacement of old wood log boilers.

Poland: After a promising year in 2014, the Polish market stagnated between 2016 and 2017. Due to air quality issues, the country is working to replace inefficient solid fuel appliances, despite the country remaining Europe's biggest user of coal within the residential sector. Government incentives are expected to drive sales of modern pellet stoves and boilers. Indeed, in 2019 boiler sales experienced an increase of 20% but for 2020, the sales slowed due to the suspension of "Clean Air Gil" programme in the beginning of 2019. The program is expected to be relaunched with new requirements in the future.

Portugal: The installation of pellet boilers and stoves reached a peak in the winter of 2019-2020. The producers consider that, in the upcoming years, the number of installations will be steady with tendency to decrease in 2025 due to the competition with heat pumps.

United Kingdom: The Renewable Heat Incentive (RHI) scheme has helped residential pellet boiler sales to skyrocket within the UK. However, the program is a victim of its own success, and the government has now decided to significantly reduce tariff payments to the owners of biomass installations. In 2015, this led to a boom in sales, followed almost immediately by a steep drop-off in sales in both 2016 and 2017, creating much discrepancy on the market for the different stakeholders. Since then, the sales never recovered.

ÖkoFEN

EXPERT COMMENT

Current situation and future of residential pellets boiler in Europe

The market dynamics have clearly continued beyond the Covid-19 year into 2021. In the countries that have defined a clear goal to phase out oil heating, the market is growing very fast. It seems, once the government announces a clear target and deadline for the ban of fossil fuel heating systems sales, the market reacts quickly by focusing on renewables.

A factor that currently reduces the dynamic in some regions is the limited capacity of installers. But there is still a surprisingly high number of newly sold oil boilers across Europe that also block installation capacity - this could easily and quickly be used for renewable heat without the need for additional, new capacity. It remains to be seen if that happens in the near future.

Despite the booming market, we maintain a clear focus on innovation because we believe this is the key for keeping the position of pellets in the heating market of the future.

Our latest flagship project that contributes to this goal is a boiler that produces ultra-low real-life emissions. Taking upstream emissions into account, such a pellet boiler produces fewer particulate emissions than an existing oil boiler and is therefore of great benefit not only for climate and the local economy, but also for air quality. This is achieved through a special combustion chamber design and airflow that incurs very little extra costs and no additional maintenance requirements.

Innovations like these, which are simple, cost-effective and super-reliable, are leading the way to continue to be part of the revolution in the heating industry that is now taking place.

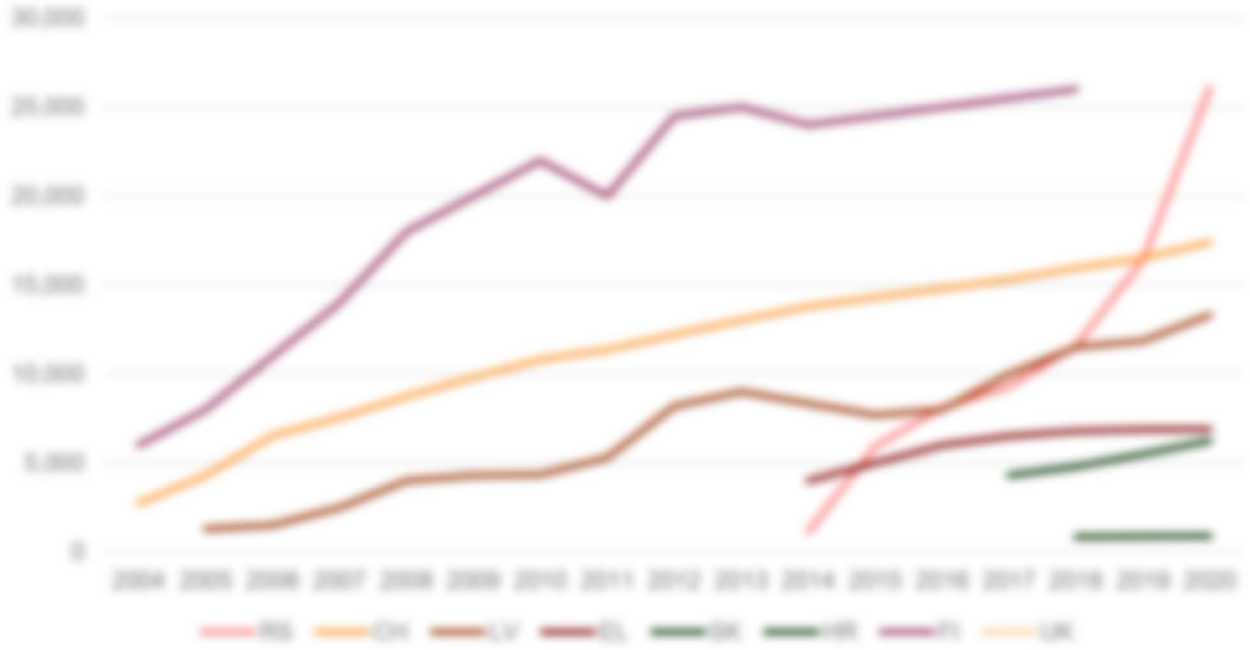
Stefan Ortner
CEO of ÖkoFEN

ÖkoFEN

Figure 50 Evolution of the installed stock of residential pellet boilers (<500kW) in some European markets <500kW (n° of units)

(a) Top 8 countries

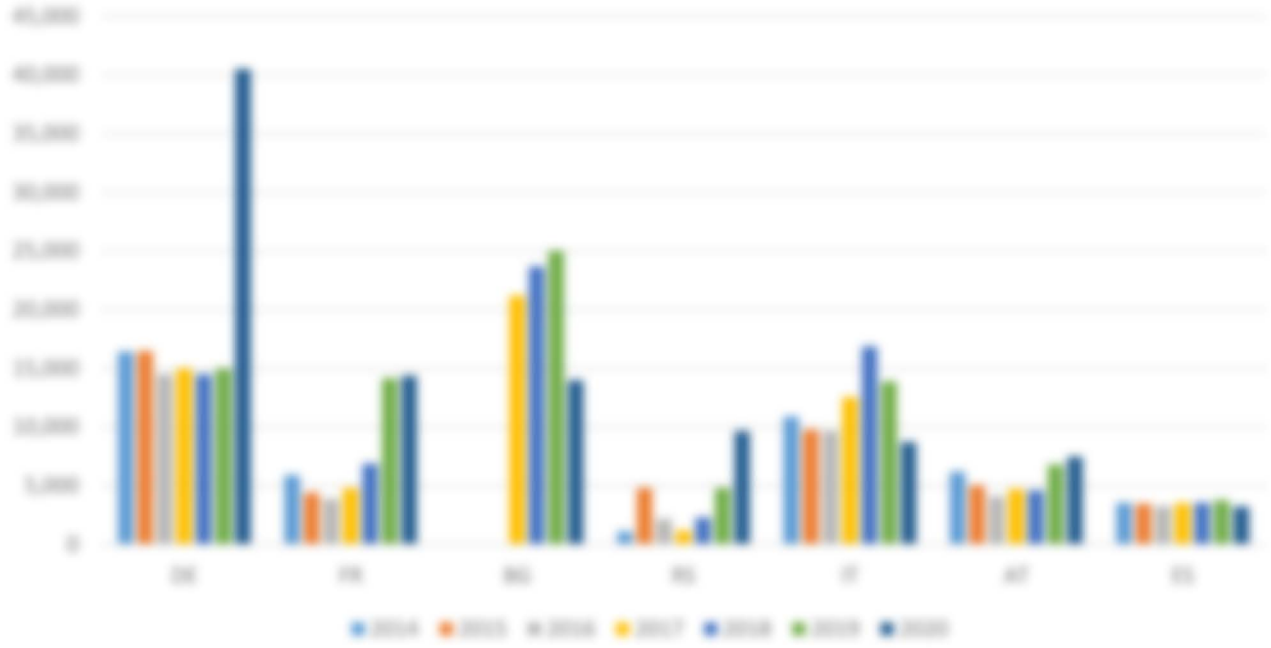
(b) Rest of the countries with available data



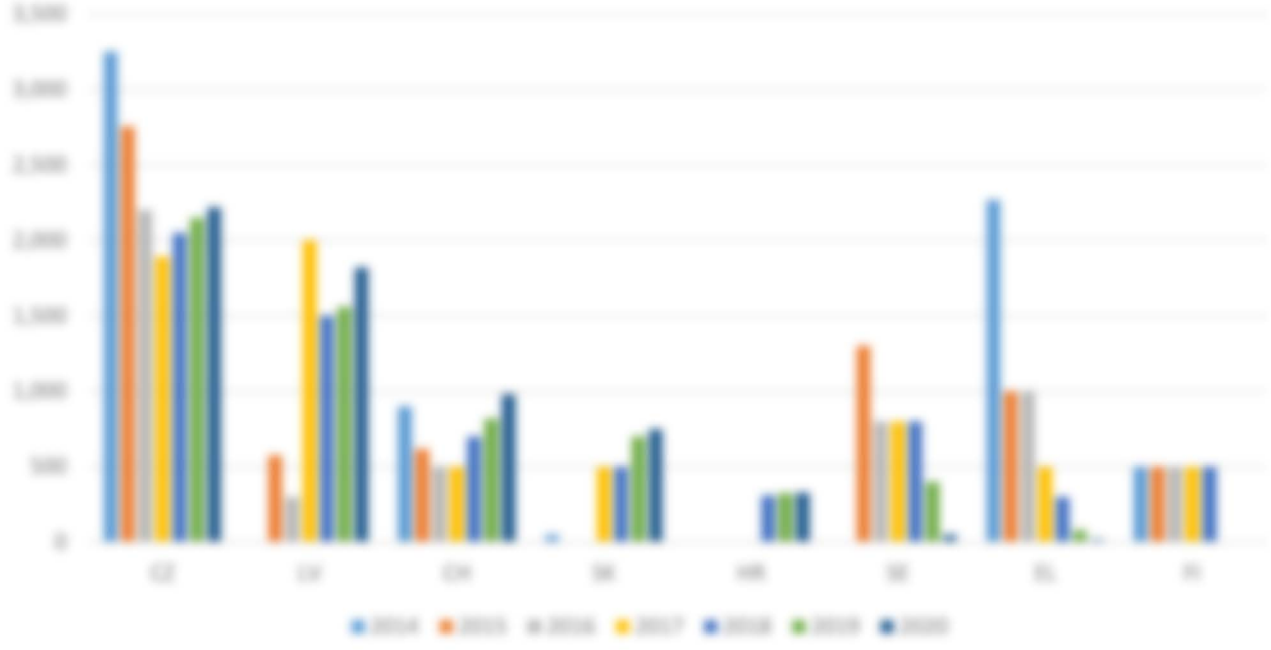
Source: EPC survey 2021

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

(a) Top 7 countries



(b) Rest of the countries with available data

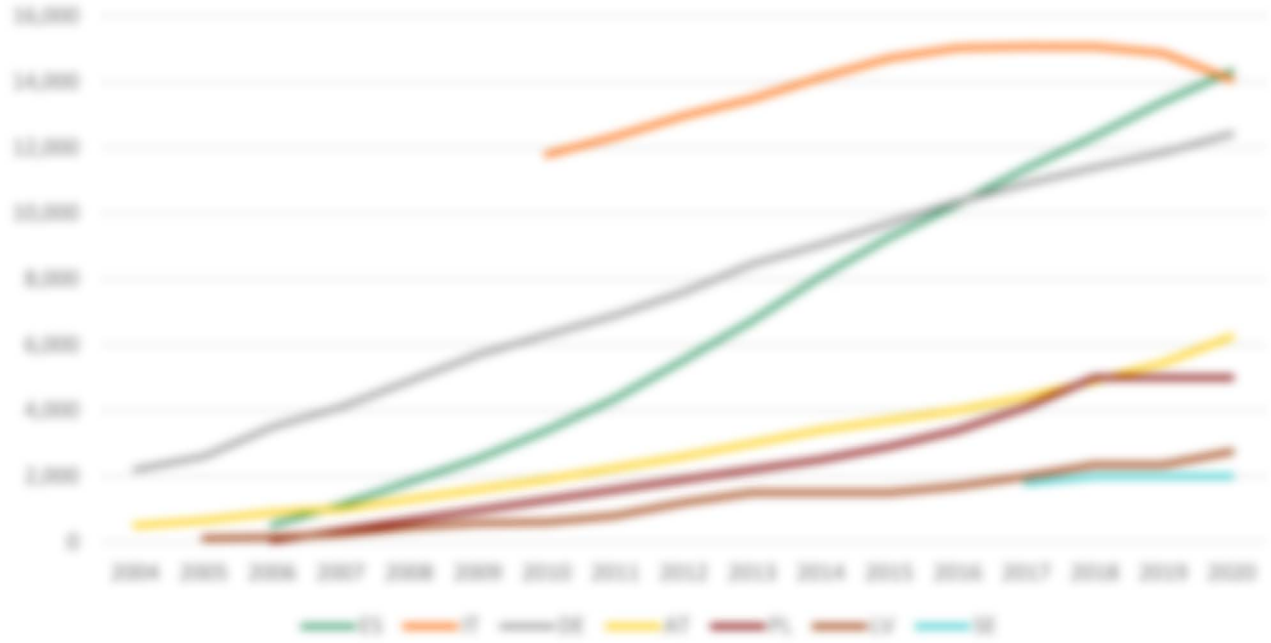


Source: EPC survey 2021

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.) remains a niche market in most of Europe but has been identified by several observers as the 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 2021.

Austria: An increase in installations is expected due to political pressure to phase 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 or almond shells, they are capable of consuming pellets when cheaper biomass is not available. The market trends in 2020 were worse than in 2019 with a 11,9% decrease in the annual sales of >50kW boilers. Due to the pandemic, in the first half of the year appliance installations decreased due to the impossibility of having systems installed but this was partly compensated by quite good number of new installations that were made during the second half of the year, mostly in autumn. 2021 should be rather similar to 2020, while 2022 and beyond should be more favorable as Renewable Energies supports, and recovery funds will be put into place.

Figure 53 Evolution of the installed stock of commercial pellet boilers (<50kW) in some European countries (n° of units)

Source: EPC survey 2021

Bulgaria: The price of natural gas in residential, public and industrial sectors has recently dropped, leading to the growth of natural gas boiler installations in those sectors.

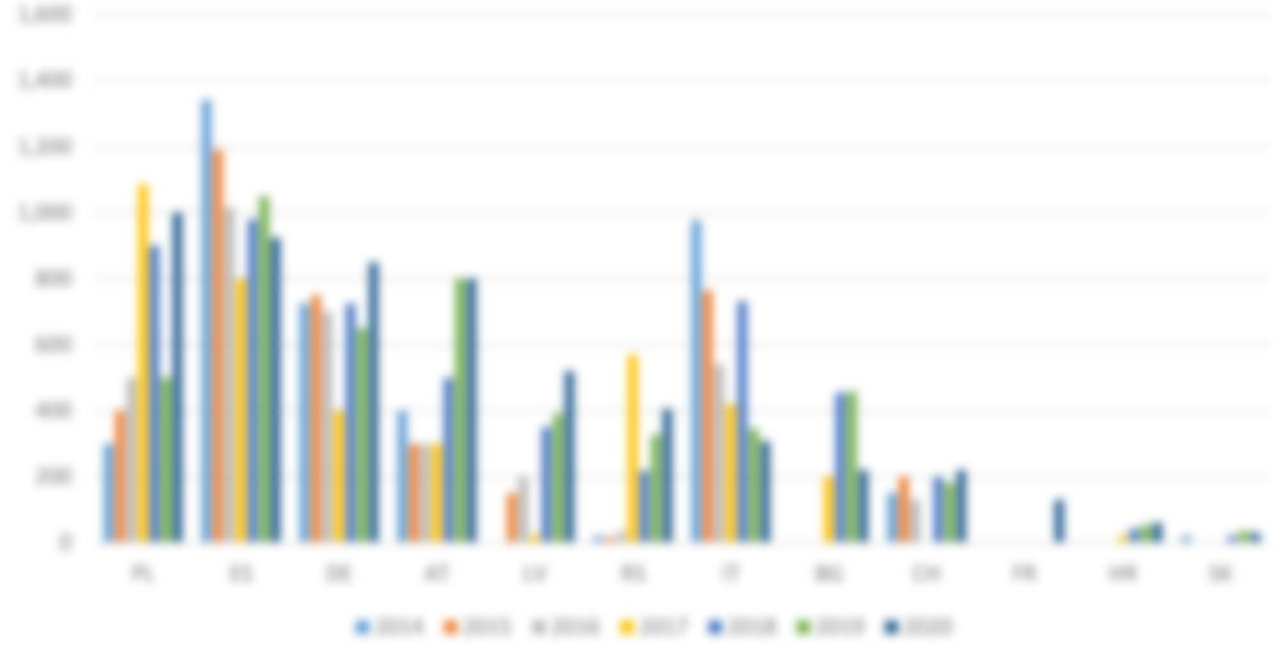
France: Boilers over 50 kW are sold but there is no data available. As a matter of fact, there is no pellet fuelled combined heat & power plant in the country.

Greece: Further development of wood pellet heating market and hot water generation appliances market in the commercial sector also depends on the availability of subsidy schemes for the public tertiary sector or private funding for the businesses. As the main consumers of heating appliance have been mainly, in the early stages, users of the residential sector, the commercial sector is also expected to grow at a faster rate in the coming years, especially in the rural areas where no natural gas alternative network exists, or where no plans for district heating are deployed.

Serbia: The big boom of the number of installed pellet boilers is the result of a huge number of schools (over 200), kindergardens, 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. As a result of these activities continuing in 2020, we can expect a new boom in 2021.

United Kingdom: As with the residential boilers, the Renewable Heat Incentive (RHI) has helped commercial pellet boiler sales to skyrocket in the UK in 2014 (nearly 2 500 units sold) but for the same reasons (tariff payment reduction) they fell sharply in the following years, reaching around 120 sales in 2019. Since then, the sales never recovered.

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



Source: EPC survey 2021

Table 12 Annual sales of boilers and stoves in Europe in 2019 and 2020 (n° of units)

	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2019	2020	2019	2020	2019	2020
AT	1.800	2.000	6.800	7.500	800	800
BG	19.820	10.200	25.027	14.020	458	220
CZ	900	1.000	2.150	2.220	n.a.	n.a.
DE	19.000	20.500	15.000	40.500	650	850
EL	100	100	80	20	20	20
ES	55.143	46.346	3.780	3.243	1.050	925
FR	157.600	127.500	14.180	14.400	n.a.	130
HR	1.440	1.500	225	230	52	60
IT	175.884	134.688	13.904	8.748	345	308
LV	390	416	1.560	1.820	390	520
PL	300	1.000	8.000	n.a.	500	1.000
SE	1.000	100	400	50	100	20
SI	70	n.a.	n.a.	n.a.	550	n.a.
SK	150	100	700	750	35	30
CH	200	200	820	980	180	220
RS	6.380	5.100	4.811	5.677	328	426

Note: Commercial boilers in Spain includes multi-fuel boilers.

Source: EPC survey 2021

Table 13 Installed stock of pellet boilers and stoves in Europe in 2019 and 2020 (n° of units)

	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2019	2020	2019	2020	2019	2020
AT	53.300	55.200	136.300	143.700	5.450	6.250
BG	124.100	134.800	145.800	147.400	1.823	500
CZ	5.800	6.800	32.100	34.320	n.a.	n.a.
DE	193.400	211.400	286.600	321.900	11.840	12.420
EL	17.600	17.700	6.880	6.900	1.720	1.740
ES	323.070	365.413	31.569	34.809	13.396	14.219
FR	1.068.000	1.195.000	79.600	92.700	n.a.	1.300
HR	3.700	3.800	880	900	127	135
IT	2.023.394	2.116.635	142.150	142.701	14.874	14.068
LV	2.140	2.466	11.860	13.320	2.350	2.750
PL	n.a.	n.a.	100.000	100.000	5.000	5.000
SE	26.400	26.400	71.100	70.000	2.000	2.000
SK	700	800	5.500	6.250	500	530
CH	10.990	11.050	16.500	17.400	1.600	1.800
RS	62.720	71.830	16.411	26.088	640	1.046

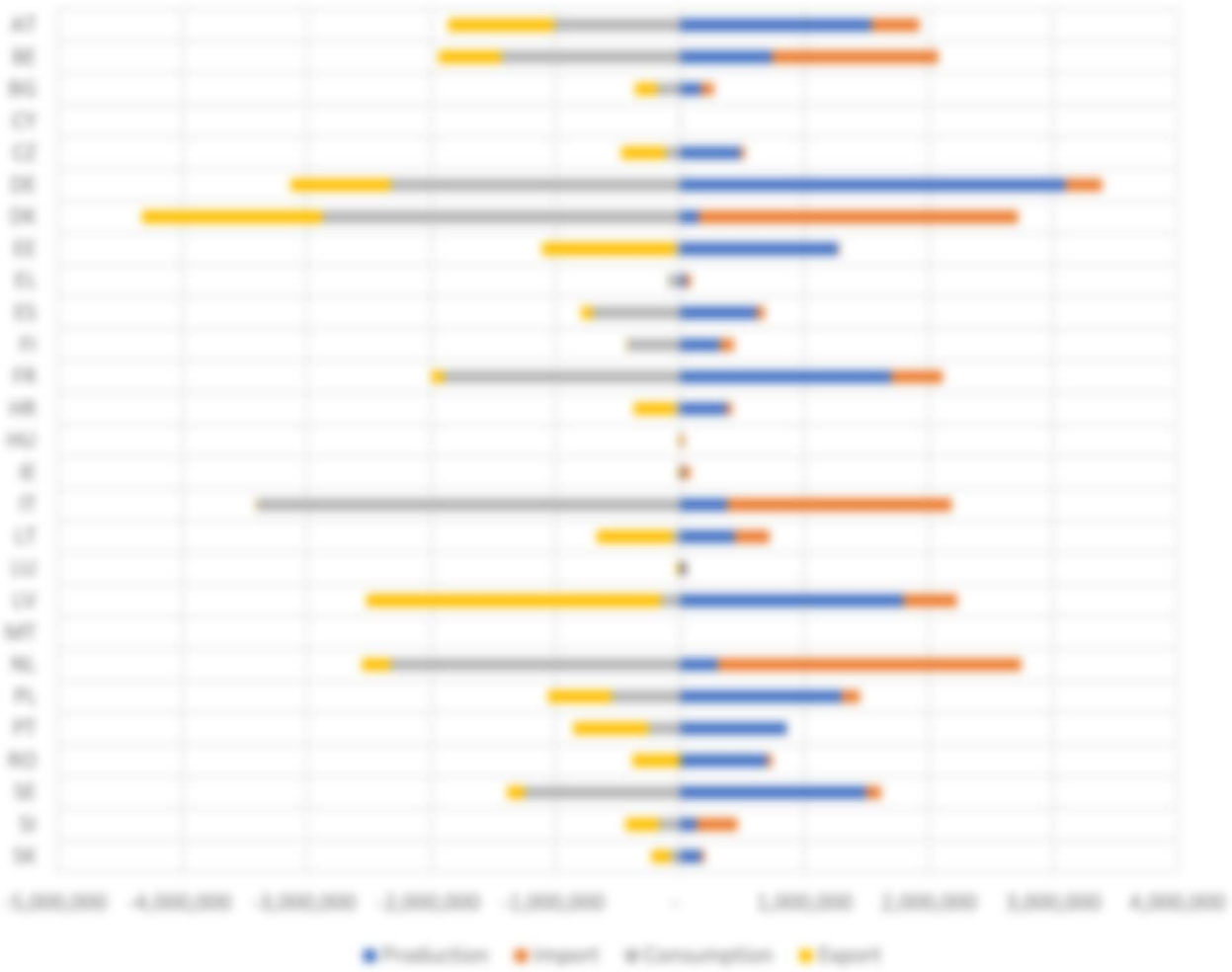
Note: Commercial boilers in Spain includes multi-fuel boilers.

Source: EPC survey 2021

3.4 European trade of pellets

The data provided in this section has been provided by Eurostat. Unfortunately, the accuracy varies between countries; the data does not present the same level of accuracy for import than for export creating some mismatches. However, these numbers still reflect the big trends within import/export across Europe.

Figure 55 EU27 Member States pellet balance by country in 2020 – production, consumption, export, import (tonnes)



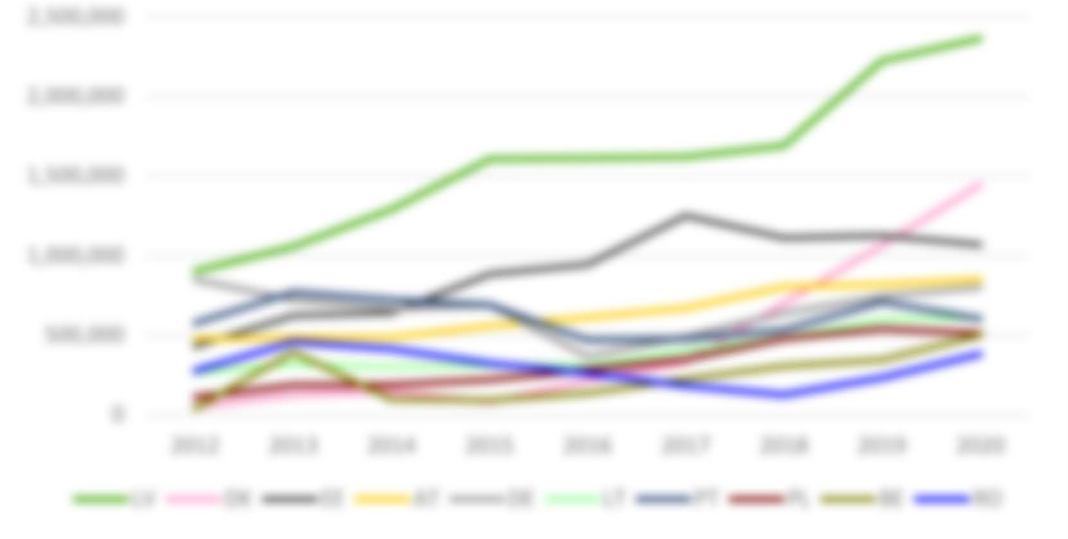
Source: EPC survey 2021, Hawkins Wright, Eurostat, FAO

Figure 56 Net European pellet trade stream and net North American export toward Europe in 2020 (> 100 ktonnes), (ktonnes)

Source: Eurostat

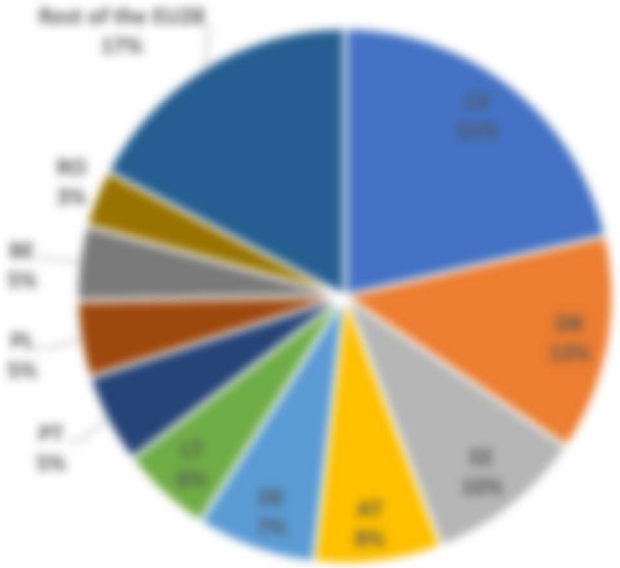
3.4.1 EU27 exporting countries

Figure 57 Evolution of the exports of pellets in the top 10 EU27 exporting countries (tonnes)



Source: Eurostat

Figure 58 Share of total EU28 pellet exports in 2020 (%)



Source: Eurostat

Table 14 Top 5 EU27 (EU28 until 2019) pellet exporting countries to the top 3 destination countries between 2017 and 2020 (tonnes)

	2017		2018		2019			2020	
UK	EE	715.596	EE	787.409	BY	181.328	UK	EE	1.129.597
	DK	604.498	DK	594.200	RU	66.731		DK	689.500
	UK	139.568	UK	141.436	LT	27.579		UK	148.439
	Rest of EU28	160.830	Rest of EU28	206.879	Rest of EU28	19.662		Rest of EU27	253.586
	Rest of the world	721	Rest of the world	1.155	Rest of the world	110		Rest of the world	542
EE	DK	725.472	DK	503.141	RU	6.755	DK	UK	521.576
	UK	215.188	UK	144.838	LV	2.387		BE	348.772
	SE	69.839	DE	262	LT	710		IT	57.839
	Rest of EU28	235.888	Rest of EU28	315.571	Rest of EU28	487		Rest of EU27	135.540
	Rest of the world	209	Rest of the world	6.213	Rest of the world	44		Rest of the world	804
DK	SE	89.802	UK	232.303	EE	690.127	EE	DK	697.634
	UK	69.754	SE	126.168	LV	550.736		BE	87.834
	DE	41.045	BE	123.205	US	505.992		NL	85.808
	Rest of EU28	127.846	Rest of EU28	211.295	Rest of EU28	898.877		Rest of EU27	101.575
	Rest of the world	215	Rest of the world	357	Rest of the world	549.814		Rest of the world	97.240
AT	IT	589.511	IT	713.975	CZ	111.743	IT	IT	711.855
	CH	23.552	SI	35.631	RO	103.161		SI	38.712
	DE	16.930	DE	16.050	DE	17.948	AT	DE	18.609
	Rest of EU28	31.673	Rest of EU28	5.072	Rest of EU28	31.111		Rest of EU27	12.009
	Rest of the world	3.606	Rest of the world	22.095	Rest of the world	2.999		Rest of the world	24.765
DE	IT	144.719	IT	222.969	IT	237.750	DE	IT	282.013
	FR	103.811	AT	118.782	FR	148.540		FR	121.036
	AT	99.943	FR	84.556	AT	102.278		AT	119.547
	Rest of EU28	94.106	Rest of EU28	157.622	Rest of EU28	208.691		Rest of EU27	208.015
	Rest of the world	47.299	Rest of the world	54.591	Rest of the world	44.950		Rest of the world	70.538

Source: Eurostat, DEPI

3.4.2 EU27 importing countries

Bulgaria: Pellets have been imported from Romania, Austria, Germany, Baltic countries, Turkey, and Ukraine in 2020.

Belgium: The imports of industrial pellets have decreased due to reduced consumption for electricity production, but total imports have slightly increased.

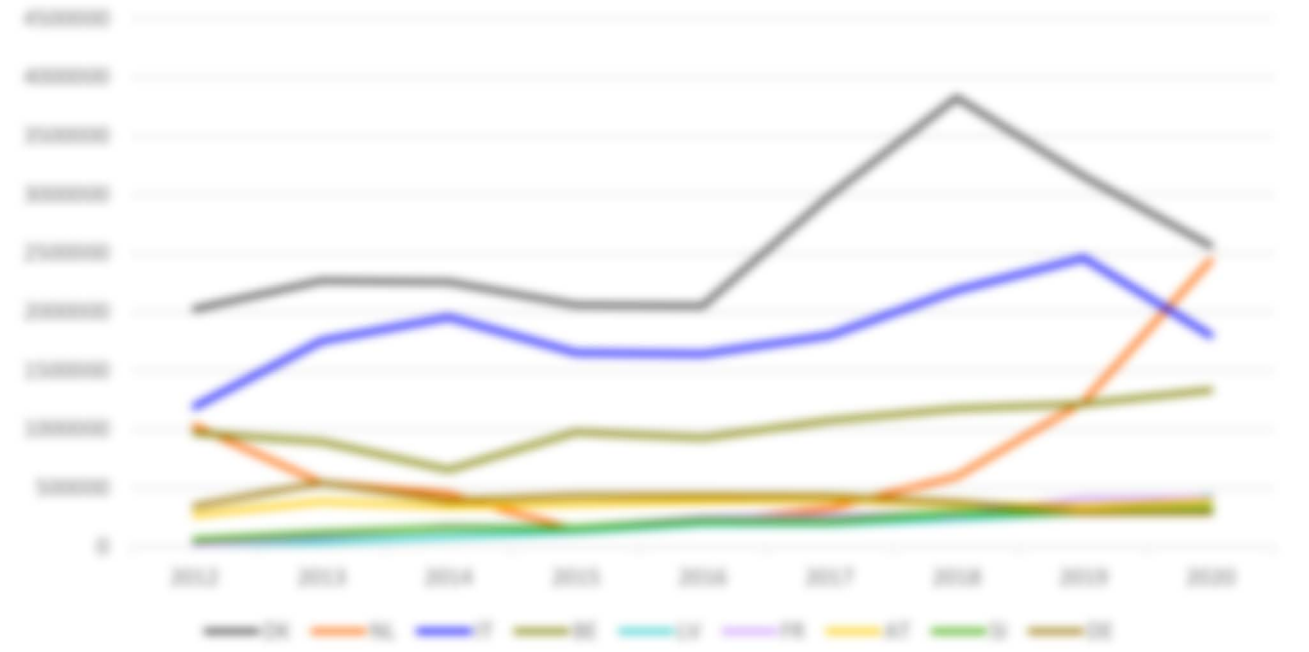
Denmark: Denmark is the first largest pellet importer, mainly sourcing pellets from the US, Portugal, Estonia and from Sweden. The imported volumes increased by 11% in 2020.

Italy: Italy is the third largest importer of pellets. With a production of 380.000 tonnes and a consumption of 3.406.796 tonnes, the numbers delivered by Eurostat are likely to be ~1.200.000 tonnes too low. Italy is therefore probably closer to 3 million tonnes of import in 2020.

The Netherlands: The imports for 2020 have recorded a growth that was almost double the growth experienced in 2019 (+97%). The Netherlands mainly imported from Latvia, the US and Russia due to the recovery of industrial pellet use.

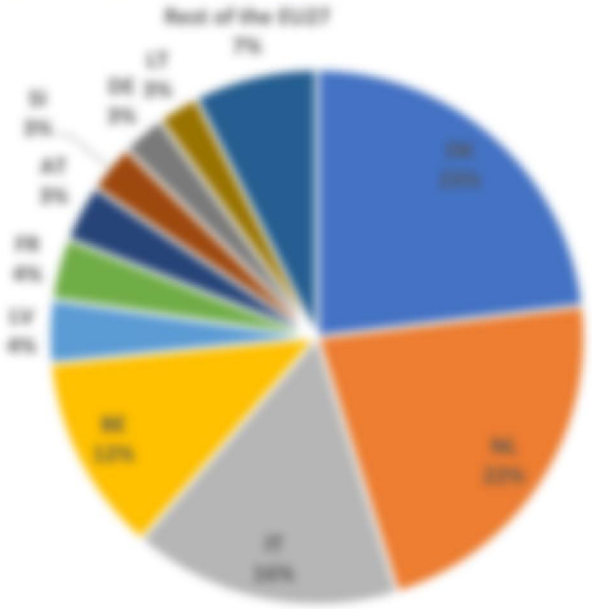
The top five countries (Denmark, the Netherlands, Italy, Belgium, and Latvia) represent 77% of European imports. This number is likely to be higher due to Italy's underestimated imports, as explained above.

Figure 59 Evolution of the imports of pellets in the top 10 EU27 importing countries (tonnes, UK with secondary axis)



Note: UK to be read with the secondary axis (right axis)
Source: Eurostat, DEPI

Figure 60 Share of total EU27 pellet imports in 2020 (%)



Source: Eurostat

Table 15 Top 5 EU27 (EU28 until 2019) pellet importing countries from the top 3 supplying countries between 2017 and 2020 (tonnes)

	2017		2018		2019			2020	
EU28	US	5.205.453	US	6.138.500	US	6.778.870	EU27	RU	1.505.724
	CA	1.478.403	CA	1.762.253	RU	1.688.791		LV	1.214.708
	RU	1.268.752	RU	1.364.471	CA	1.624.426		US	1.248.869
	Other non EU28	799.353	Other non EU28	1.089.334	Other non EU28	1.387.440		Other non EU27	1.912.431
UK	US	4.265.670	US	4.875.881	US	5.483.304	DK	EE	594.867
	CA	1.256.756	CA	1.431.923	CA	1.544.058		LV	491.452
	LV	737.190	LV	776.192	LV	767.683		RU	420.576
	Rest of EU28	398.814	Rest of EU28	466.097	Rest of EU28	572.386		Rest of EU27	711.054
	Rest of the world	174.442	Rest of the world	279.562	Rest of the world	329.849		Rest of the world	347.707
DK	EE	1.009.234	LV	940.415	EE	650.127	NL	LV	706.460
	LV	606.075	EE	719.070	LV	550.736		US	450.874
	RU	402.574	USA	623.144	USA	505.862		CA	430.495
	Rest of EU28	715.201	Rest of EU28	1.007.268	Rest of EU28	898.877		Rest of EU27	628.682
	Rest of the world	356.040	Rest of the world	535.559	Rest of the world	569.614		Rest of the world	223.290
IT	AT	463.248	AT	704.928	AT	593.421	IT	AT	593.421
	HR	150.917	DE	222.969	DE	237.750		DE	282.013
	DE	144.719	HR	136.296	BA	146.266		BA	146.266
	Rest of EU28	715.686	Rest of EU28	693.027	Rest of EU28	593.258		Rest of EU27	593.258
	Rest of the world	355.404	Rest of the world	535.833	Rest of the world	341.389		Rest of the world	341.389
NL	RU	61.480	LV	150.918	LV	255.230	BE	US	572.788
	PT	54.787	PT	54.693	RU	184.655		RU	297.727
	LV	46.063	DE	5.941	BE	183.511		EE	210.859
	Rest of EU28	162.758	Rest of EU28	150.521	Rest of EU28	444.288		Rest of EU27	217.230
	Rest of the world	3.474	Rest of the world	66.393	Rest of the world	170.703		Rest of the world	36.347
BE	US	578.407	US	538.375	US	591.710	LV	BY	288.622
	RU	205.057	CA	182.309	RU	136.398		RU	67.289
	CA	168.552	NL	110.522	EE	129.780		LT	43.543
	Rest of EU28	108.718	Rest of EU28	186.683	Rest of EU28	265.455		Rest of EU27	22.383
	Rest of the world	15.854	Rest of the world	115.467	Rest of the world	98.284		Rest of the world	3.987

Source: Eurostat, DEPI

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.

Note: Red values indicate that VAT rates have changed from the previous year.

Table 16 VAT rate for pellets compared with general VAT rate applied in European countries in 2020 (%)

	2020 VAT rate for wood pellets (in %)	2020 General VAT rate (in %)
AL	20	20
AT	13	20
BA	17	17
BG	20	20
CH	8	8
CZ	15	21
DE	7/5	19/16
EE	20	20
EL	24	24
ES	21	21
FI	24	24
FR	10	20
HR	25	25
IT	22	22
LT	9	21
LV	12	21
ME	21	21
PL	23	23
PT	23	23
RO	19	19
RS	10	20
RU	20	20
SE	25	25
SI	22	22
SK	20	20

Source: EPC survey 2021

Czech Republic: A VAT rate reduction for 10% was proposed for wood fuels (wood, pellets, briquettes) as a mitigation measure to bark beetle infestation which attacked most of the Czech forests.

Germany: From July 2020 onwards until 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.

Greece: With VAT rates at 24%, Greece has one of the highest VAT rates in Europe for renewable energy products. Yet, since last year there is a reduced VAT for natural gas, electricity, and district heating at consumer level. Hellenic Biomass Association has requested the tax authorities to include densified biomass products under the reduced VAT

levels, but the ministry classifies wood pellets with the less favourable firewood as "biomass fuels" and is reluctant to grant a reduced VAT status.

Italy: The rise of VAT rate occurred since January 2015 reduced profit margins to wholesalers and retailers, making it difficult to operate in this market. Fortunately, wood pellet price keep being competitive compared to fossil fuels.

Lithuania: Since January 2019, the VAT rate for wood fuel changed from 21% to 9% causing a reduction of pellet prices.

Latvia: The VAT rate for Business-to-Business trade with wood pellets is 0%.

Poland: Wood pellet show a VAT rate of 23% while straw pellets have an 8% VAT rate.

Slovenia: Despite multiple efforts and propositions to the government to include wood fuels under the products and services with reduced VAT (9%), the general VAT rate is applied for all the wood fuels.

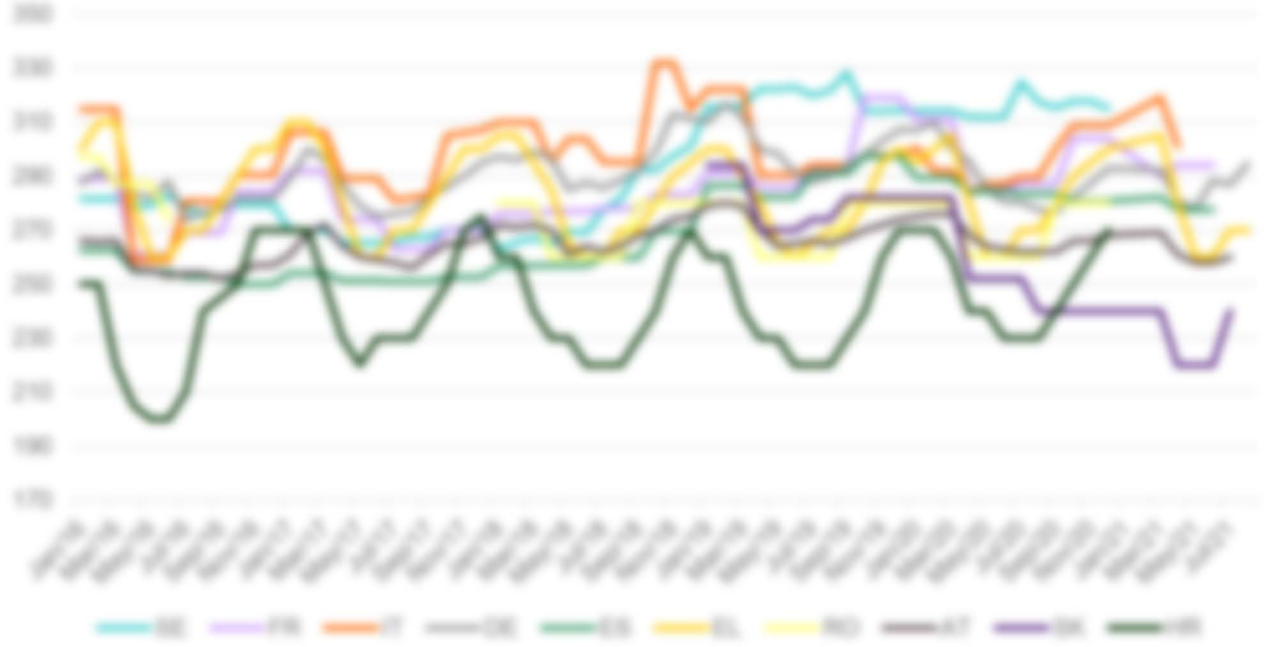
Spain: despite the willingness from some regional administrations to decrease the VAT rate for wood pellets, the central government stands its ground.

United Kingdom: Wood fuel sold directly to the end user attracts a reduced VAT rate of 5%. Companies that purchase fuel for commissioning purposes or to sell on to end users are required to pay a 20% VAT rate.

3.5.1 European price development of residential pellets

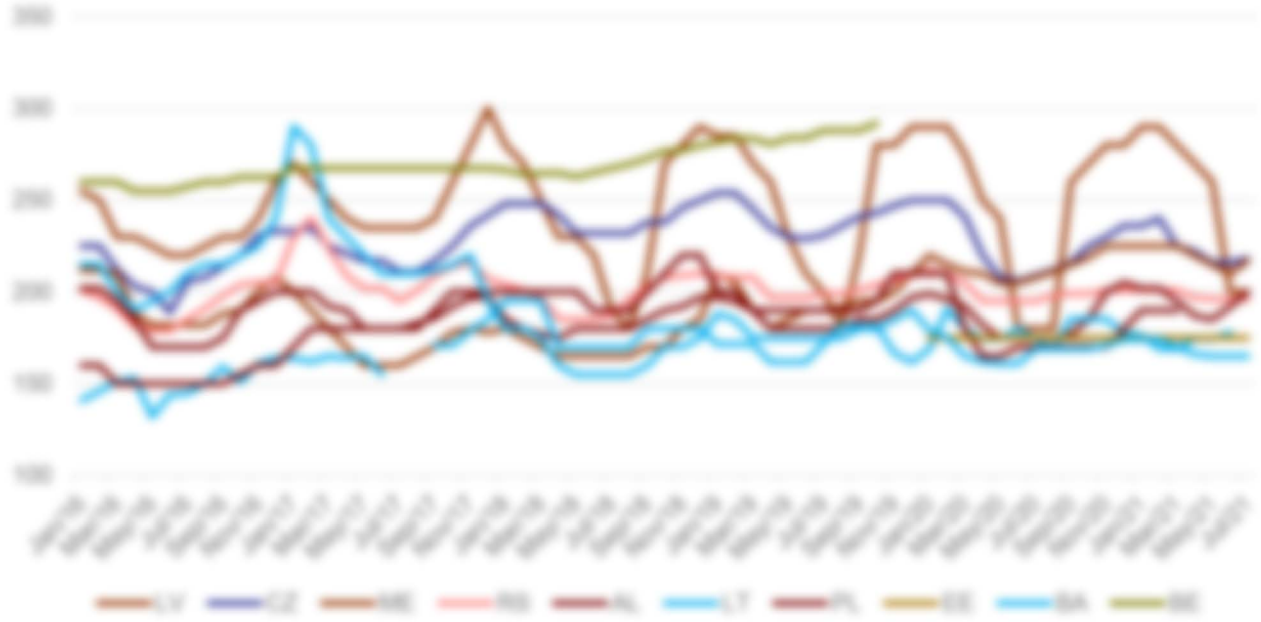
3.5.1.1 BAGGED PELLET PRICES

Figure 61 Estimation of bagged pellet prices in European countries with highest prices between January 2016 and July 2021 (retail price, 1 pallet in €/tonne VAT incl.)



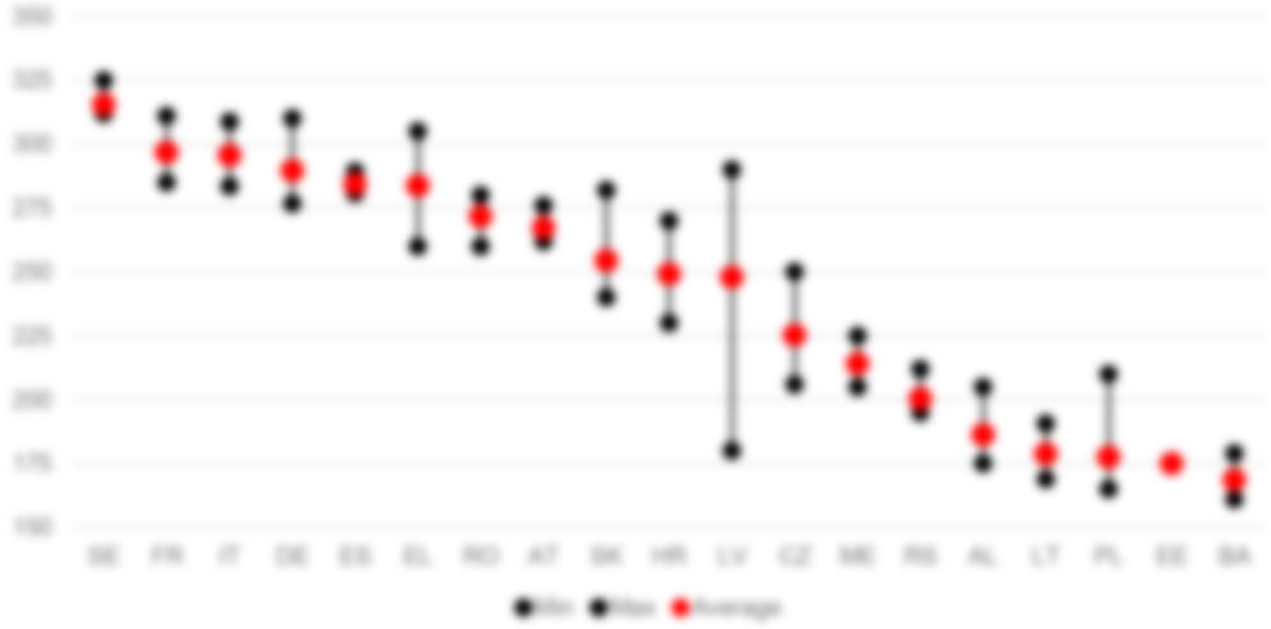
Source: EPC survey 2021

Figure 62 Estimation of bagged pellet prices in European countries with lowest prices between January 2016 and July 2021 (retail price, 1 pallet in €/tonne VAT incl.)



Source: EPC survey 2021

Figure 63 Variation and average of bagged pellet prices between January 2020 and December 2020 by country (retail price, 1 pallet in €/tonne VAT incl.)



Source: EPC survey 2021

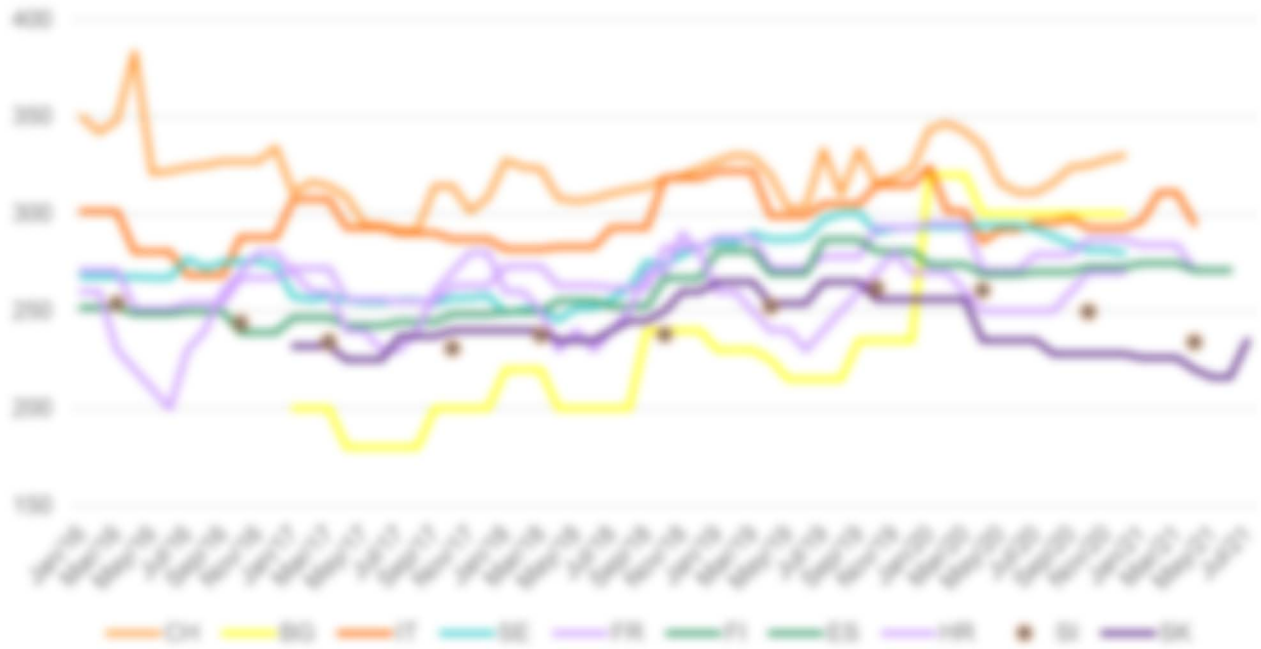
Table 17 Estimation of bagged pellet prices between January 2020 to July 2021 in Europe (retail price, 1 pallet in €/tonne VAT incl.)

	Jan 20	Feb 20	Mar 20	Apr 20	May 20	Jun 20	Jul 20	Aug 20	Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21
AL	199	196	192	182	175	175	175	175	177	185	200	205	202	202	195	187	185	192	200
AT	275	276	276	268	264	263	262	262	262	266	266	268	270	269	269	261	258	258	260
BA	178	175	165	162	161	161	168	168	168	169	171	174	174	174	170	166	165	165	165
CZ	250	250	241	220	208	206	209	212	216	225	230	236	236	240	225	222	216	216	218
DE	307	310	300	296	285	281	280	277	277	282	287	293	291	291	292	281	278	288	287
EE	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175	175
EL	295	300	305	280	260	260	270	270	280	290	295	300	295	300	305	280	260	260	270
ES	289	289	289	284	284	284	283	283	283	281	281	281	282	282	282	277	277	277	n.a.
FR	311	311	311	285	285	285	287	287	287	304	304	304	290	290	290	294	294	294	n.a.
HR	270	270	260	240	240	230	230	230	240	250	260	270	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IT	300	292	292	284	287	287	290	290	300	309	309	309	316	319	319	301	n.a.	n.a.	n.a.
LT	169	191	180	174	174	180	174	169	185	185	185	178	177	169	169	174	174	178	n.a.
LV	290	290	275	250	240	180	180	180	260	270	280	280	290	290	280	270	260	200	200
ME	220	215	211	210	205	205	208	211	215	219	225	225	225	225	225	220	215	210	217
PL	210	210	180	165	165	170	170	170	170	170	170	180	190	190	190	n.a.	n.a.	n.a.	n.a.
RO	280	280	280	260	260	260	260	260	280	280	280	280	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RS	212	210	205	195	195	195	195	198	199	199	201	201	201	201	201	197	196	196	196
SE	314	314	314	312	312	312	325	317	315	318	318	315	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SK	282	282	282	252	252	252	252	240	240	240	240	240	240	240	240	235	235	235	240

Source: EPC survey 2021

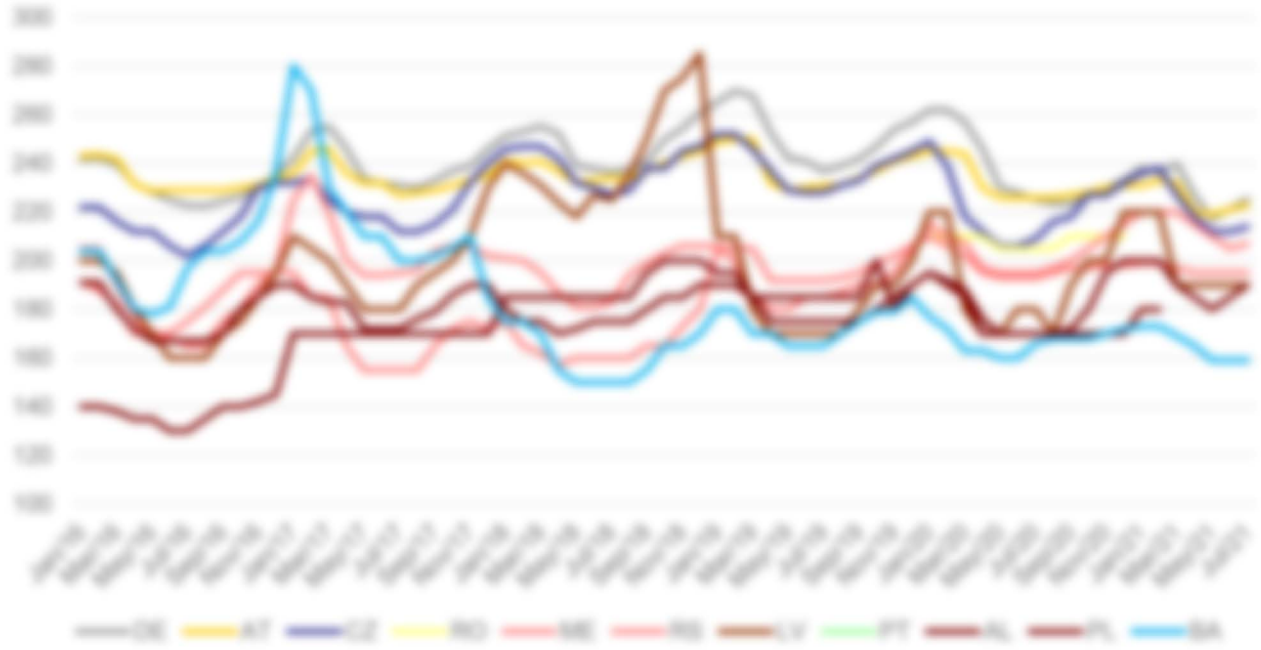
3.5.1.2 BULK PELLET PRICES

Figure 64 Estimation of bulk pellet prices in European countries with highest prices between January 2016 and July 2021 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)



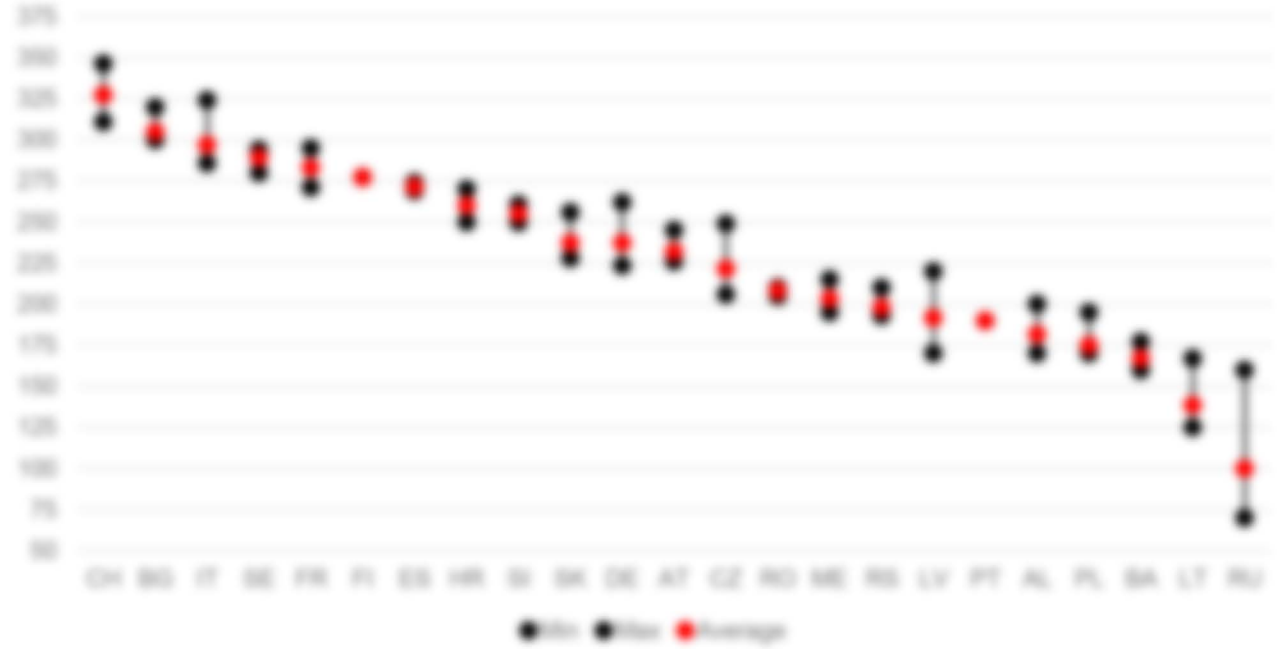
Source: EPC survey 2021

Figure 65 Estimation of bulk pellet prices in European countries with lowest prices between January 2016 and July 2021 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)



Source: EPC survey 2021

Figure 66 Variation and average of bulk pellet prices between January 2020 and December 2020 by country (delivered tit, distance 100 km, delivery fees included, in €/tonne VAT incl.)



Source EPC survey 2021

Table 18 Estimation of bulk pellet prices between January 2020 and December 2020 (delivered 40, distance 100 km, delivery fees included. In €/tonne VAT incl.)

	Jan 20	Feb 20	Mar 20	Apr 20	May 20	Jun 20	Jul 20	Aug 20	Sep 20	Oct 20	Nov 20	Dec 20	Jan 21	Feb 21	Mar 21	Apr 21	May 21	Jun 21	Jul 21
AL	165	162	168	176	170	170	170	170	172	180	195	200	200	200	190	185	180	185	190
AT	245	245	244	230	226	226	226	226	227	228	230	231	231	233	232	220	219	221	223
BA	177	172	163	163	160	160	166	168	168	168	170	172	173	173	169	163	159	159	159
BG	320	320	320	300	300	300	300	300	300	300	300	300	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CH	343	346	342	335	316	311	311	316	324	325	328	330	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	249	239	218	212	206	206	209	216	218	227	227	232	236	238	227	218	212	212	214
DE	262	262	257	246	230	228	225	224	223	227	230	233	238	236	240	227	217	221	225
ES	274	274	274	269	269	269	270	270	270	273	273	273	275	275	275	271	271	271	n.a.
FI	n.a.	277	n.a.	n.a.	277	n.a.	n.a.	277	n.a.	n.a.	277	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
FR	285	285	285	271	271	271	279	279	279	287	287	287	284	284	284	271	271	271	n.a.
HR	270	270	260	250	250	250	250	250	260	270	270	270	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IT	324	301	301	286	262	262	265	265	268	263	263	263	266	311	311	295	n.a.	n.a.	n.a.
LV	220	220	180	170	170	180	180	170	190	200	200	220	220	220	190	190	190	190	190
ME	215	210	207	197	195	195	195	197	200	205	210	215	220	220	220	215	210	205	207
PL	185	190	185	170	170	170	170	170	170	170	170	170	180	180	n.a.	n.a.	n.a.	n.a.	n.a.
PT	n.a.	190	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RO	210	210	210	210	205	205	205	205	210	210	210	210	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
RS	210	206	202	195	193	193	193	195	197	197	198	198	199	199	197	195	195	195	195
SE	293	293	293	294	294	294	292	288	284	281	281	280	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SI	n.a.	n.a.	n.a.	261	n.a.	n.a.	n.a.	n.a.	n.a.	250	n.a.	n.a.	n.a.	n.a.	n.a.	234	n.a.	n.a.	n.a.
SK	236	236	236	235	235	235	235	238	238	238	238	238	236	236	236	230	216	216	235

Source: EPC survey 2021

Figure 67 Average and standard deviation of European prices of bulk pellets between January 2016 and December 2020 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)

Note: Only the countries with complete data for the analysed period have been considered: CH, SE, IT, LU, FR, HR, FI, ES, DE, BE, SK, CZ, AT, BG, RS, PL, LT, AL, ME, BA. The weighted average was calculated considering the importance of the country pellet consumption in comparison with that of the total consumption of those countries in the corresponding year.

Note 2: The standard deviation is a measure that is used to quantify the amount of variation or dispersion of a set of data values.

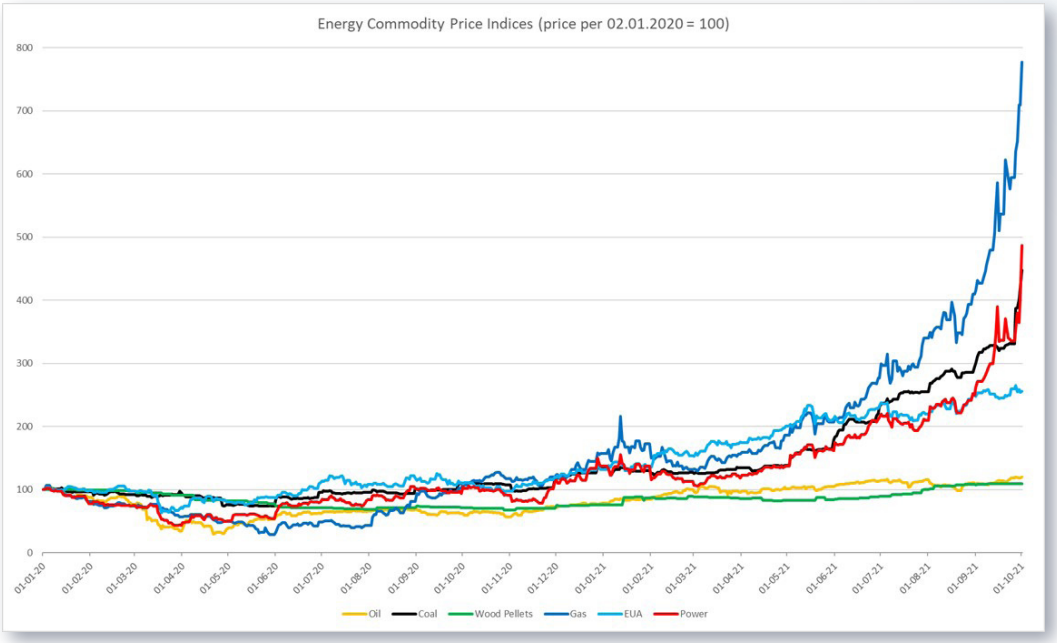
Source: EPC survey 2021

European Energy Exchange

EXPERT COMMENT

Current development of energy commodity prices and the spot market price for pellets

As shown in the chart below energy prices in 2021 are on the uptick for all energy commodities. In September 2021 we saw new all-time highs in the respective front month derivatives. That price trend did continue in October 2021.



Why is there no similar price movement in spot Wood Pellets as there is in Gas, EUA, Coal and Power prices? It remains obvious that the spot market for wood pellets follows different rules than spot markets of energy commodities. How can the wood pellets market become more professional?

With Argus we do have a price reporting agency which delivers a credible price signal. With EEX we do have an exchange platform which offers a hedging instrument to lay off the risks from spot price volatility. The EEX Wood Pellets futures are a flexible hedging instrument which can adjust quickly to market dynamics and external effects. At the same time active risk management offers price adjustments in positions by de-risking buyers and sellers at the same time. Therefore, a transition to a professional wood pellets market can be pursued as all ingredients are there.

Robert Seehawer

Senior Business Developer

European Energy Exchange

3.5.2 European price development of industrial pellets

Figure 68 Development of Argus wood pellets 90 day index cif NWE USD/t (Jun 2017 – SEP 2021)

Source: Argus Media

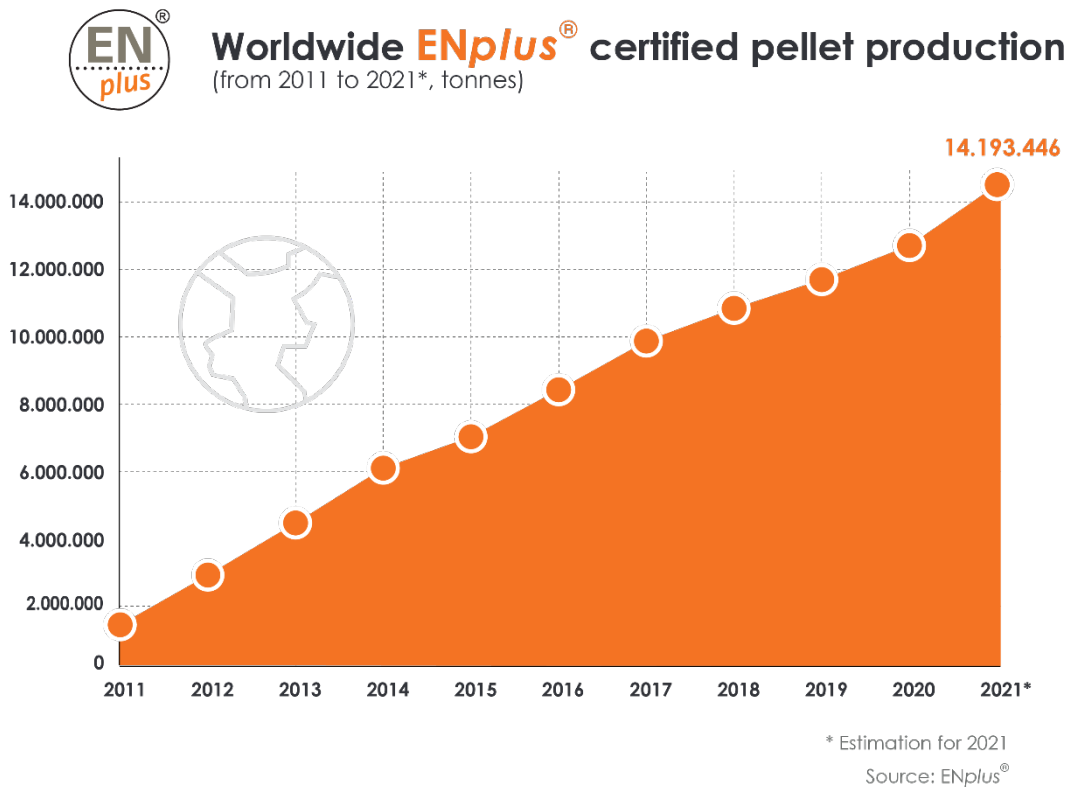
Source: Argus Media

After a great supply tightness in Q1-Q2 2019, the rest of 2019 and 2020 completely reversed the initial trend. To avoid the 2019 hurdle, utilities took strong positions and entered 2019-2020 very well stocked, while the demand actually slowed down. As a matter of fact, the 2019-2020 heating season was rather low, impacting the need for

industrial pellets. In March 2020, the COVID-19 pandemic did reduce the electricity demand, which impacted the industrial pellet users having their costs exposed. On top of that, the supply was strong, and some utilities did plan outages or even faced technical problems, besides ENGIE Les Awirs' closure. The 2020-2021 heating season started slowly but in many areas the heating season did last longer than usual, leading all in all to a significant energy demand. Moreover, later in 2021, the high electricity prices and fossil fuel prices led in some areas to an enhanced use of pellet for electricity production, tightening further the market situation. Today, many operators are anticipating high operation rates for the 2021-2022 heating season and thus, are ordering high volumes. This, together with the sustained residential demand, is tightening the market, leading to a sudden rise in pellet SPOT prices on the Argus index.

4 ENplus® pellet production

Figure 69 Worldwide ENplus® certified production from 2011 to 2021 (tonnes)



The ENplus® 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 Deutsches Pelletinstitut DEPI is the governing body, with the support of National Associations, managing the certification on a national level. Since its introduction, the number of countries with certified ENplus® producers has rapidly grown, reaching 46 countries with a total volume over 12,4 million tonnes of certified pellets produced in 2020 and 14,2 million tonnes in 2021(projection).

The number of ENplus® certified producers worldwide shows once again a sizeable growth, reaching 559 producers and 516 traders in 2020. With these results, ENplus® is well on its way to reach its aim of harmonised pellet quality at a global level.

Figure 70 Worldwide ENplus® certified pellet production plants in 2020

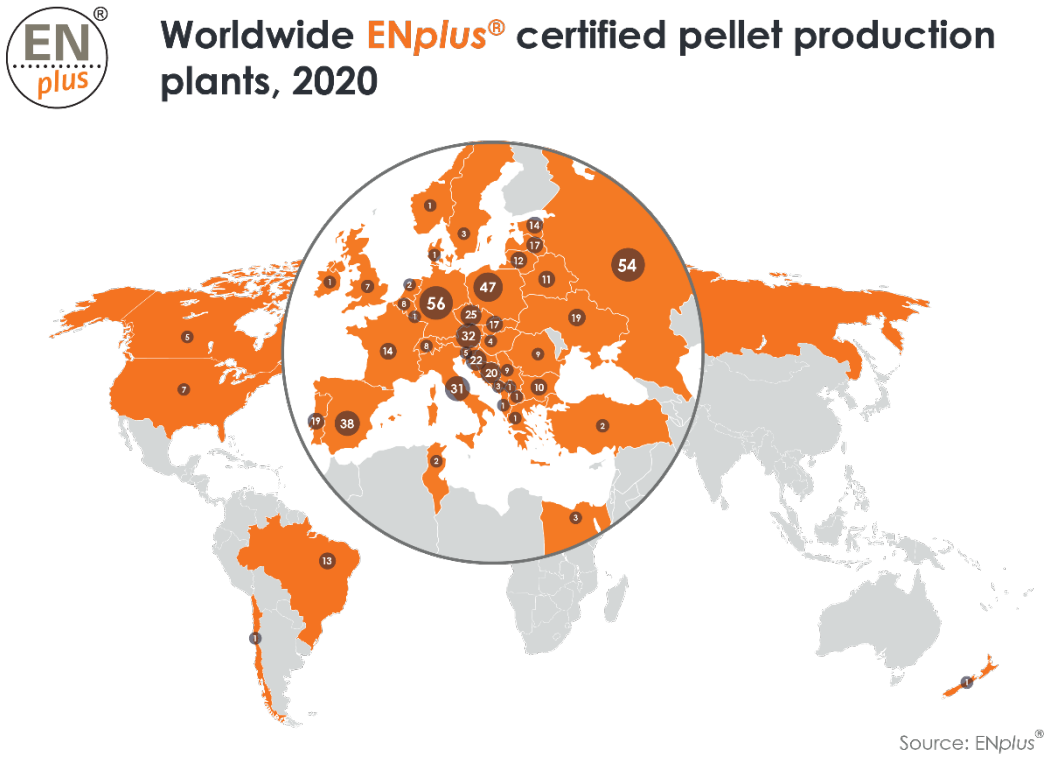


Figure 71 Amount of countries with ENplus® certified producers

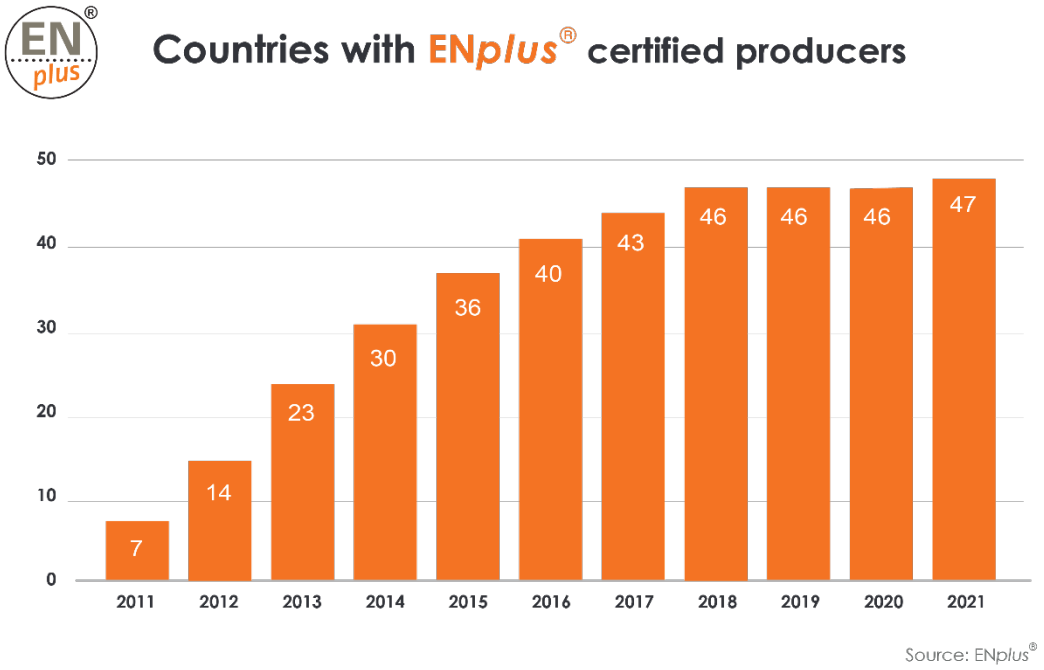


Figure 72 Total number of ENplus® certified producers/traders in 2020

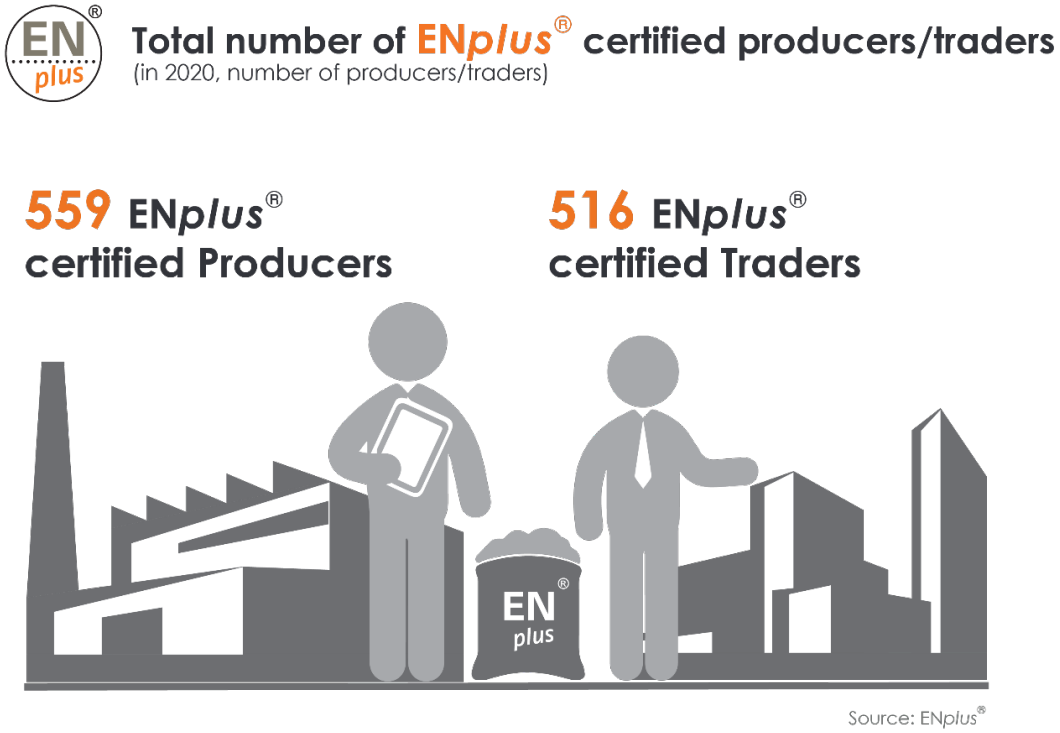


Figure 73 Volumes of ENplus® certified pellet produced by the top 5 countries from 2014 to 2021 (tonnes)

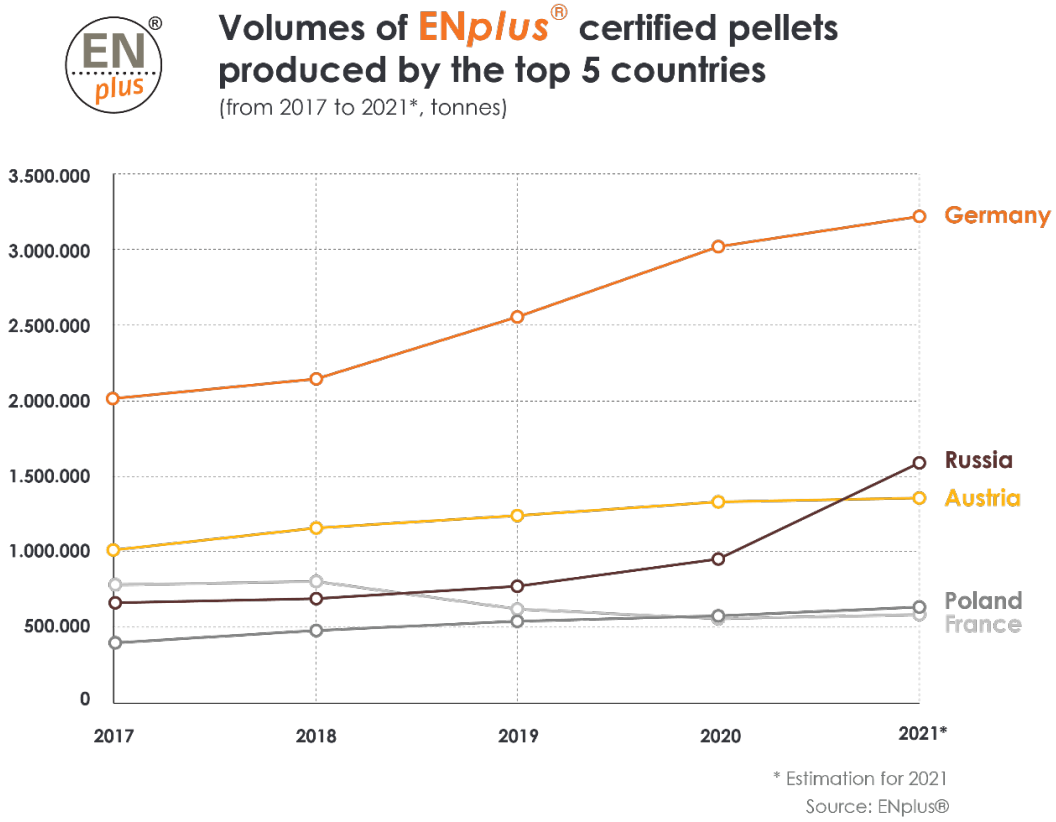
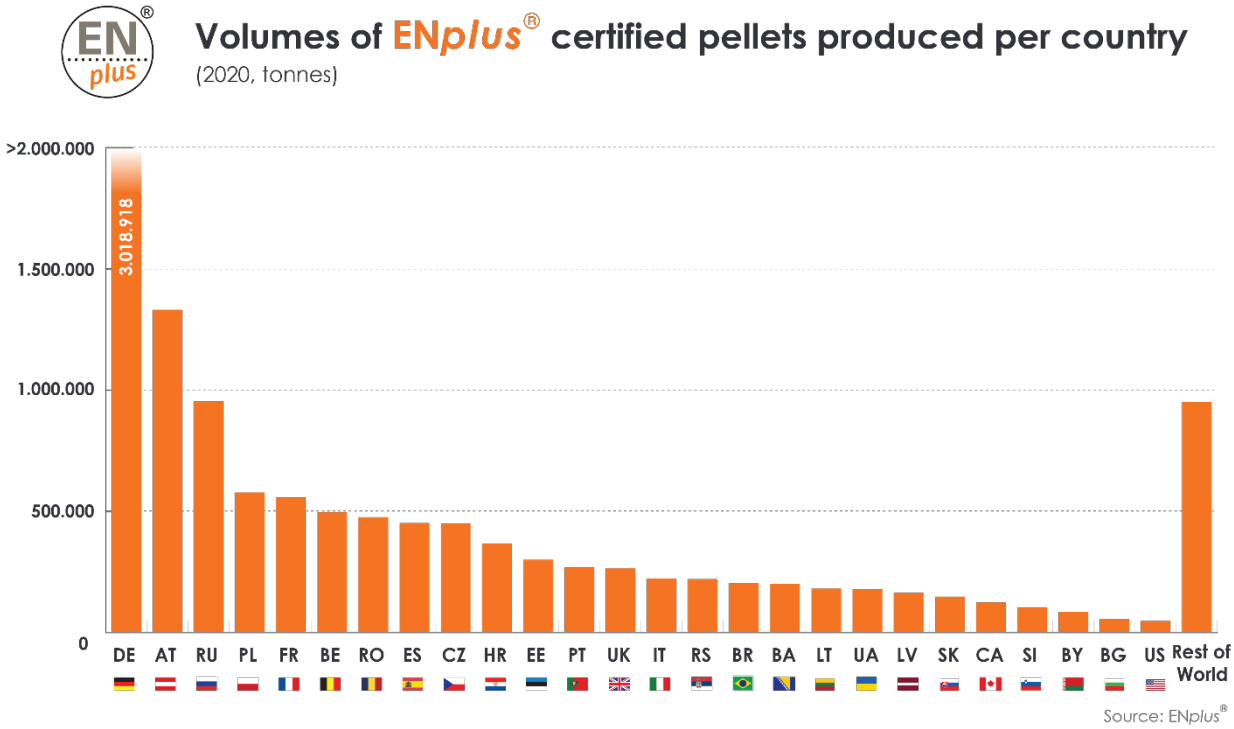


Figure 74 Volumes of EN*plus*® certified pellets produced by the top 20 countries in 2020 (tonnes)



IBTC

EXPERT COMMENT

INTERNATIONAL BIOMASS TORREFACTION COUNCIL

A NETWORK OF BIOENERGY EUROPE

For the torrefaction industry, what had already become apparent in recent years manifested itself very strongly in 2021. A significant expansion in the number of industrial sectors demanding torrefied biomass is going hand in hand with a significant broadening of the torrefied biomass product range. The flexibility of torrefaction processes in terms of product parameters, which has always been presented but was hardly demanded by potential power plant customers in the past, now presents itself for some industrial sectors as the most cost-effective and easiest way to sustainably replace fossil carbon in their production processes. Today, most torrefaction companies can offer in parallel with the standard torrefied biomass product for energy also high temperature torrefaction biomass with C content of 75% or more.

The torrefaction gas surpluses appearing in such production regimes enable operators to put their business models on an additional footing while increasing the overall process efficiency. Co-location or integration of torrefaction plants with other processes is one of the recent developments seen. The ability to process also ag by-products or other biomass fractions has additional positive impacts on sustainability of the supply chain and the system economics.

Thus, the torrefaction industry, aside of having reached TRL9 in recent years, sees the applications of torrefied biomass widen, the number of industrially operated sites increase and the demand from various industries constantly grow. This is a long aimed for situation and a bright outlook for the years to come.

Michael Wild

President

IBTC

5 Overview of advanced biomass pellet sector

Table 19 Advanced biomass plants

Location	Status	Commissioning	Name plate capacity	Intended NCV	Product form factor
Austria	Project in Operation	Since 2013	8.000 tonnes/year	22-23 MJ/kg	Briquette 70mm diameter
Belgium	Project in Operation	Pelletizing on industrial scale expected in 2022	powder 30.000 tons/year pellets 150 kg /hour	powder 22-28 MJ/kg pellets 21 MJ/kg	Powder (full production) Pellets (only for test purposes)
Croatia	Project in permitting phase	2020	4.500 tonnes/year 1.000 kW electricity	C_{fix} 90-98%	Charcoal 150mm
Estonia	Project in Operation		108.000 tonnes/year	21 GJ NCV Dry	Pellet
Finland	Project in final negotiation	2023	60.000 tonnes/year	22-23 MJ/kg	Briquette 70mm diameter
Germany	Project in Operation	Since 2016	3.000 tonnes/year	C_{fix} 90-98%	Charcoal 150mm
Ireland	Project in Operation		10.500 tonnes/year	n.a.	n.a.
Portugal	Project in Operation (not yet at full capacity)	Q4 2020	120.000 tonnes Black Pellets 80.000 tonnes White Pellets	18-22 MJ/kg	Pellet
Portugal	Project Under construction	2020	100.000 tonnes	22 GJ	Woodchips Pellet
UK	Project in Operation		30.000 tonnes/year	20,5-30 GJ NCV Dry	Pellet, char & powder
Russia	Project in permitting phase	Q4 2021	2 x 40.000 metric tonnes/year	21-25 MJ/kg	Pellet
Canada (BC)	Project in permitting phase	Q1 2021	100.000 tonnes	21 MJ/kg	Pellet
Canada (Qc)	Project in Operation	2016	15.000 tonnes	21 MJ/kg	Pellet
US	Project in Operation	2012	75.000 tonnes/year	25-50 GJ/MT	Pellet

Location	Status	Commissioning	Name plate capacity	Intended NCV	Product form factor
US	Project in permitting phase	2022	400.000 tonnes/year	25 - 30 GJ/MT	Pellet
US (Louisiana)	Project in Operation	2017	16.000 tonnes/year	19 MJ/kg	Pellet, briquette
US (Oregon)	Project in Operation	2019	90.000 tonnes/year	21- 22,5 MJ/kg	Pellet, briquette
US	Project Under construction	Q3 2021	125.000 tonnes/year	30 MJ/kg	Pellet, briquette
US (Oregon)	Project Under construction	n.a.	100.000 tonnes/year	n.a.	Softwood TorrB® torrefied biomass briquette
Indonesia	Project in final negotiation	Q1 2021	80.000 tonnes	21 MJ/kg	Pellet, briquette
Thailand	Project in developments	Q3 2020	15.000 tonnes	20 GJ	Pellet
Ethiopia	Project in final negotiation	2023	60.000 tonnes/year	22-23 MJ/kg	Briquette 70mm diameter

6 Overview of agropellets market

The agropellets market is rather unknown. Indeed, it appears to be very difficult to collect any precise statistics about this sector. A significant part of the agropellets demand is linked to the wood pellets market tension. Indeed, the market will only show a great interest for these products when the wood pellet market is scarce (as in early 2019). Even with that, this market deserves the industry attention as the raw material potential is extremely important but also because it might become a solution for several (industrial) market players in having their operational costs reach a sustainable level.

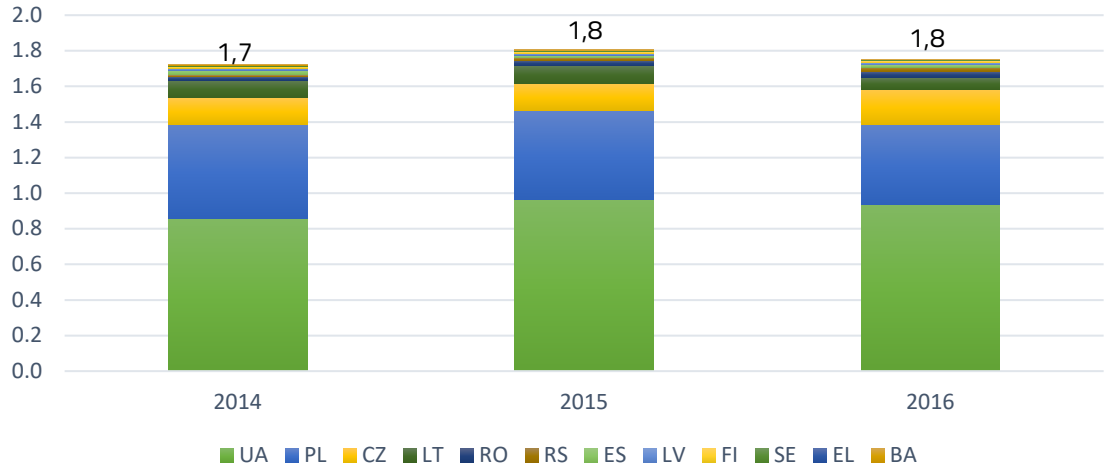
In this current section, the few elements that could be collected will be aggregated.

The below data was collected in 2017, while the verbal comments were collected in 2021.

Figure 75 European pellet production by raw material in 2016 (%)

Source: EPC survey, 2017

Figure 76 Evolution of the production of non-wood pellets in Europe (million tonnes)



Source: EPC surveys, 2017

France: agropellets will be used for the district heating plant Paris La Defense.

Greece: Should the sustainable forestry management practices, harvesting and logistics methods for agricultural residues improve in the future, then there might be serious opportunities to feed local factories from local agricultural by-products (agropellets) or mixed bio-pellets (woody and agro-based). Especially tree pruning (e.g. resulting from olive trees or vineyards) is expected to be a biomass source increasingly entering the feedstock mix with promising chances of becoming a suitable fuel both for commercial and industrial.

Poland: Before 2019, the green certificates in Poland were driving an important use of agropellets in power plants, mainly sourced from Ukraine and Poland. In 2016, the imported volume of sunflower husk pellets exceeded 300.000 tonnes. In 2019, the green certificates' price crashed, leading to a drastic reduction of agropellets use in Poland. Since then, most of the Polish agropellets producers have reduced their production, looked for other markets (e.g. animal bedding) or switched to wood pellet production.

Spain: The main agropellets in Spain are olive cake pellet (50.000 tonnes in 2020) and some undetermined quantities of straw (about 25.000 tonnes). A pellet plant for wood pellet has recently invested in a straw pelletizer.

Slovakia: The recent increase of straw price (30-80 €/t) has deeply impacted the production of straw pellet in Slovakia.

Switzerland: The production of agropellets is not expected to develop in Switzerland for two reasons. First, Switzerland requires that pellets be made of wood, and second, the emission limits are very restrictive. At the moment, the only work being done with agropellets is research.

Ukraine: Ukraine shows enormous potential for agropellets production (straw, sunflower husks, etc.). The sunflower husk is gaining popularity in the metal and cement production.

Brazil: There are three plants using sugarcane bagasse for pellets production, one very small plant that uses coffee husks, and that uses peanuts shell. There are no more significant projects for pellets from agriculture residues. The mains reasons for this are the competition with 2nd generation ethanol, the seasonality of the raw material and the difficulties to find a stable place in the market.

US: There is currently some interest in bagasse pellet production to be used in European power plants.

7 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, Bosnia Herzegovina, Belarus, Switzerland, Montenegro, Norway, Serbia, Ukraine, United Kingdom, Russia

Europe: EU27+other European countries

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

Baltic countries: Lithuania, Latvia, Estonia

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”

Property	Unit	EN*plus*® A1	EN*plus*® A2	ENplus® B	Testing standard [11]
Diameter	**mm**	**6 ± 1 or 8 ± 1**			**ISO 17829**
Length	**mm**	**3,15 < L ≤ 40 [4]**			**ISO 17829**
Moisture	**w-% [2]**	**≤ 10**			**ISO 18134**
Ash	**w-% [3]**	**≤ 0,7**	**≤ 1,2**	**≤ 2,0**	**ISO 18122**
Mechanical Durability	**w-% [2]**	**≥ 98,0 [5]**	**≥ 97,5 [5]**		**ISO 17831-1**
Fines (< 3,15 mm)	**w-% [2]**	**≤ 1,0 [6] (≤ 0,5 [7])**			**ISO 18846**
Temperature of pellets	**°C**	**≤ 40 [8]**			
Net Calorific Value	**kWh/kg [2]**	**≥ 4,6 [9]**			**ISO 18125**
Bulk Density	**kg/m³ [2]**	**600 ≤ BD ≤ 750**			**ISO 17828**
Additives	**w-% [2]**	**≤ 2 [10]**			**-**
Nitrogen	**w-% [3]**	**≤ 0,3**	**≤ 0,5**	**≤ 1,0**	**ISO 16948**
Sulfur	**w-% [3]**	**≤ 0,04**	**≤ 0,05**		**ISO 16994**
Chlorine	**w-% [3]**	**≤ 0,02**		**≤0,03**	**ISO 16994**
Ash Deformation Temperature[1]	**°C**	**≥ 1200**	**≥ 1100**		**CEN/TC 15370-1**
Arsenic	**mg/kg [3]**	**≤1**			**ISO 16968**
Cadmium	**mg/kg [3]**	**≤ 0,5**			**ISO 16968**
Chromium	**mg/kg [3]**	**≤10**			**ISO 16968**
Copper	**mg/kg [3]**	**≤10**			**ISO 16968**
Lead	**mg/kg [3]**	**≤10**			**ISO 16968**
Mercury	**mg/kg [3]**	**≤ 0,1**			**ISO 16968**
Nickel	**mg/kg [3]**	**≤10**			**ISO 16968**
Zinc	**mg/kg [3]**	**≤100**			**ISO 16968**

[1] ash is produced at 815 °C

[2] as received

[3] dry basis

[4] a maximum of 1% of the pellets may be longer than 40mm, no pellets longer than 45mm are allowed.

[5] at the loading point of the transport unit (truck, vessel) at the production site

[6] at factory gate or when loading truck for deliveries to end-users (*Part Load Delivery* and *Full Load Delivery*)

[7] at factory gate, when filling pellet bags or sealed *Big Bags*.

[8] at the last loading point for truck deliveries to end-users (*Part Load Delivery* and *Full Load Delivery*)

[9] equal ≥ 16,5 MJ/kg as received

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

[11] As long as the mentioned ISO standards are not published, analyses shall be performed according to related CEN standards

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 plant
Pellet consumption for heat production	Without a specific note 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's stoves and dedicated heat boilers with a capacity below 50 kW

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Européenne de Biomasse

AXIS Tech

Bioenergy Europe
Place du Champ de Mars 2A
1050 Brussels
T : +32 2 318 40 34
info@bioenergyeurope.org

www.bioenergyeurope.org