BIOENERGY EUROPE

STATISTICAL REPORT 2019

PELLET REPORT

Bioenergy EUROPE

EUROPEAN PELLET COUNCIL

A NETWORK OF BIOENERGY EUROPE

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FOREWORD

Let's continue to invest in our sector!

The global pellet demand recorded a sustained growth, for both the industrial and heating markets in 2018 and similarly at the beginning of 2019. Unfortunately, investment in production capacity in areas showing high raw material availability, is lacking behind and is creating tension on the global market. Let's continue to invest in our ever-expanding sector!

Sadly, the global pellet use is difficult to predict. Changes in support schemes can dramatically affect the industrial use whilst the intensity of the heating season is a game changer for the heating markets. These uncertainties have encouraged investors to be careful, which in turn, has led to a rather tempestuous state of affairs on the market.

In order to cover the extra needs of the market, some additional investment in production and improving raw material procurement is required. Thankfully, an increase of capacity is foreseen; mainly centred in North America and North East Asia but also Europe, although this most likely won't be enough to bring enough liquidity in the market. Maybe in the future, some more volumes could come from underexploited areas such as South America and Africa.

Europe, the historical frontrunner of pellet use, remains the unchallenged champion of consumption but for the last few years as Asia, namely, Japan and South Korea, appear to be much more of a dynamic market. This aside, Europe remains a rather dynamic market, whereby industrial use grew extensively in 2018 and again at the beginning of 2019, with this growth being boosted by both the UK and the Netherlands. Looking to the future, perhaps Germany and possibly Poland, have the potential to use significant volumes of pellets in the context of phasing out coal power plants.

The European heating sector is growing too but showing a rather different picture from one country to another. France should be mentioned as it witnesses record stove sales, challenging the Italian champion. The case of France reinforces the fact that with proper market conditions in place (partly allowed by a political project) it will naturally allow for pellets to be recognised for what they are, that being, a performant, comfortable, credible, sustainable and profitable solution.

However, the domestic market is just one part of this ever-expanding heating market, as the mid-scale or commercial market is most likely the sleeping giant that would require much more care and attention if the sector is to make full use of its great potential.

We hope that you'll draw similar conclusions as we have when reading our report but, more than that, we hope that you'll find what you need in there! With our We hope you'll like the newly added sections dedicated to the Heating Degree Days and a first attempt of analysing the market penetration of pellet domestic appliances. We would love to hear your thoughts so please don't hesitate to contact us for any comment you might have

We take the opportunity of writing this foreword to thank all our contributors for their precious information and a special thanks to our colleague, Martin Colla, for having put this report together.

Let's hope for a wonderful heating season to all of us!

We wish you a good read!

Pablo Rodero Masdemont
President
EPC

Gilles Gauthier
General Manager
EPC

STATISTICAL REPORT

TIMELINE

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 is therefore able to develop a detailed report that helps 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

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2019

ABOUT

OUR ACTIVITIES

Bioenergy Europe carries a wide range of activities aimed at supporting its members by informing them about latest EU and national policy developments, and by voicing their concerns to EU and other authorities. These include advocacy activities in key policy areas as well as the organisation of dedicated working groups acting as platforms where members can 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

In addition, Bioenergy Europe conceives and deploys targeted publications and communication campaigns to inform and educate about the potential of bioenergy for a decarbonised Europe.

Most notably, the association has several years of experience in data collection on the evolution of the bioenergy market and produce unique and tailored analyses along the year.

Thanks to the experience and authority acquired over the last 19 years, Bioenergy Europe successfully established two international certification schemes to guarantee high quality standard for fuels.

Bioenergy Europe is also the umbrella organisation of 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.

EUROPEAN PELLET COUNCIL
A NETWORK OF BIOENERGY EUROPE

The European Pellet Council (EPC) is an umbrella organisation of Bioenergy Europe founded in 2010, representing the interests of the European wood pellet sector. Its members are national pellet associations or related organisations from 18 countries.

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

EPC is managing the EN*plus*® quality certification.

www.pelletcouncil.eu
www.enplus-pellets.eu

INTERNATIONAL BIOMASS TORREFACTION COUNCIL
A NETWORK OF BIOENERGY EUROPE

The International Biomass Torrefaction Council (IBTC) is an umbrella organisation of Bioenergy Europe launched in 2012 and aims to building the first platform for companies having common interests in the development of torrefied Biomass markets. Currently, the IBTC initiative is supported by more than 23 companies active 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.

www.ibtc.bioenergyeurope.org

ABOUT

BIOENERGY EUROPE

BIOENERGY EUROPE is the common voice of the bioenergy sector with the aim to develop a sustainable bioenergy market based on fair business conditions.

BIOENERGY EUROPE is a non-profit Brussels-based international organisation founded in 1990 which brings together national associations and companies from all over Europe – thus representing more than 4000 indirect members, including mainly companies and research centers.

www.bioenergyeurope.org

ASSOCIATIONS

ACADEMIA

ABOUT

BIOENERGY EUROPE

Companies

Members as of October 2019.

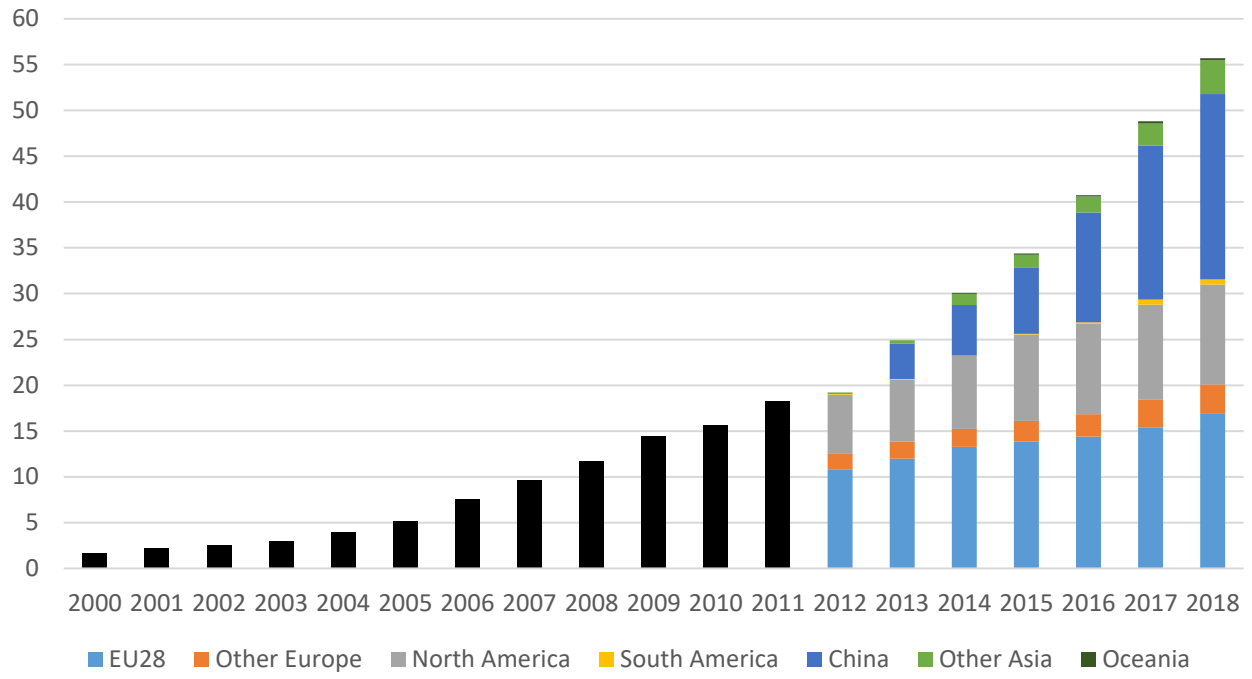
1 Overview of World Pellet Sector

Table 1 displays worldwide pellet production statistics. As shown within this table, production is continuously growing, with the global pellet production growing by 14% from 2017 to 2018. Asia is expanding rapidly. Indeed, beside China, pellet production volume has increased by 54% in 2018, led by Vietnam, Malaysia and Thailand.

In this report, the word '*pellet*' is always in reference to '*wood pellet*' unless otherwise stated in cases where '*agro-pellet*' is specified.

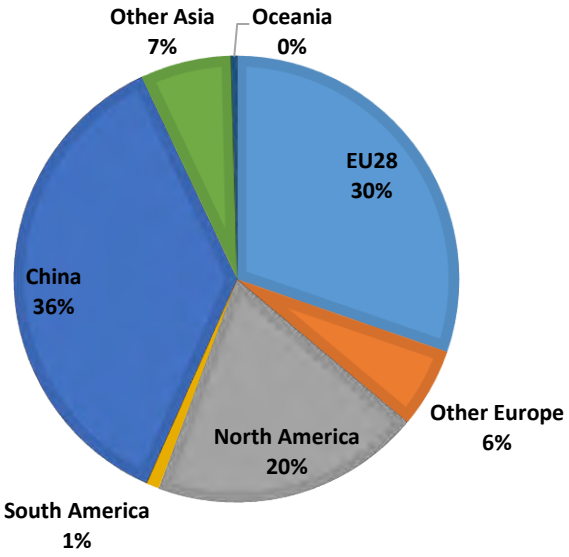
1.1 World pellet production

Figure 1 Evolution of global pellet production (million tonnes)



Note: BY, HU, NO & UA: 2018 production is a replication of 2017.
Source: EPC survey 2019; FAO; FutureMetrics

Figure 2 Distribution of world pellet production in 2018 (%)



Note: BY, EE, HU, NO & UA: 2018 production is a replication of 2017.
Source: EPC survey 2019; FAO; FutureMetrics

The data for China are estimations taken from Great Resources Co Ltd, however, this is not official data. Considering the size of the country and the fact that it is a country of mainly small producers, it is therefore, very complicated to obtain accurate statistics. Moreover, there is great uncertainty on the type of pellet produced in China, being wood pellets or agro-pellets. The general estimation highlights that 80% of the total pellets produced are wood pellets while the remaining 20% are agro-based pellets. This proportion is likely to evolve to roughly 70-30% in the following years as the total pellet production is expected to increase and limitations on wood raw materials take effect. China exports an insignificant quantity of pellets to Japan and South Korea and as a result of this it is an independent market for now. This situation could change as it has the potential to become a large net importer due to the government wanting to promote pellets on an industrial scale.

Oceania witnessed a noticeable decrease (-18%) in 2018 compared with 2017, the largest producing plants in Australia (250.000 tonnes / year of capacity) have experienced operating problems and closed at the beginning of 2019. Despite this, new projects are expected in the coming years that could increase the production capacity mainly in Australia but also to a smaller extent in New Zealand.

In North America, growth remained relatively weak in 2018 due to delays in projects and bad weather conditions that affected the production (hurricane, forest fire, floods). Although Canadian production increased by 200.000 tonnes (+8%) recovering a large part of the decline in production that was observed in 2017 in comparison to 2016. Canada remains the third largest country producer in the world. In comparison, the US has shown an increase twice lower in percentage (+4%) than that of its Canadian neighbour. In both countries there is an increase expected as prospective projects should come into operation in the coming years with the hope of strongly growing production capacity.

Production within the EU28 countries has been healthy but not exceptional. In absolute terms, the EU28 registered the second most significant increase in production (or the most significant excluding China). Beside the EU28, Russia should be mentioned, as it recorded an increase of 12% with significant potential to record a dramatic growth in the coming years.

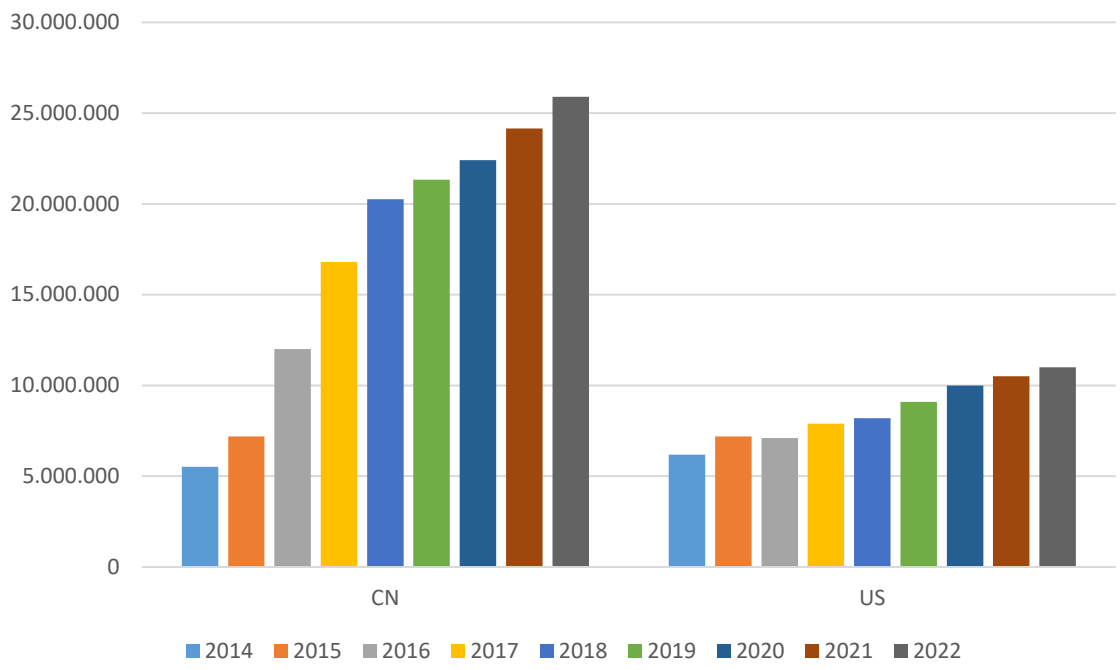
Table 1 Evolution of pellet production in the world by regions (tonnes)

	2013	2014	2015	2016	2017	2018	Growth 2017-2018
EU28	11.974.154	13.287.316	13.855.927	14.383.274	15.401.127	16.879.382	**10%**
Other Europe	1.853.128	1.934.366	2.234.124	2.439.352	3.005.933	3.222.889	**7%**
North America	6.781.000	7.978.000	9.450.000	9.900.000	10.400.000	10.900.000	**5%**
South America	61.500	49.390	75.000	135.350	548.618	549.412	**0%**
China	3.864.000	5.520.000	7.200.000	12.000.000	16.800.000	20.250.000	**21%**
Other Asia	394.524	1.215.844	1.419.533	1.735.761	2.401.763	3.697.257	**54%**
Oceania	0	105.000	153.000	160.000	250.000	205.000	**-18%**
Total	24.928.306	30.089.916	34.387.583	40.753.738	48.807.441	55.703.939	**14%**

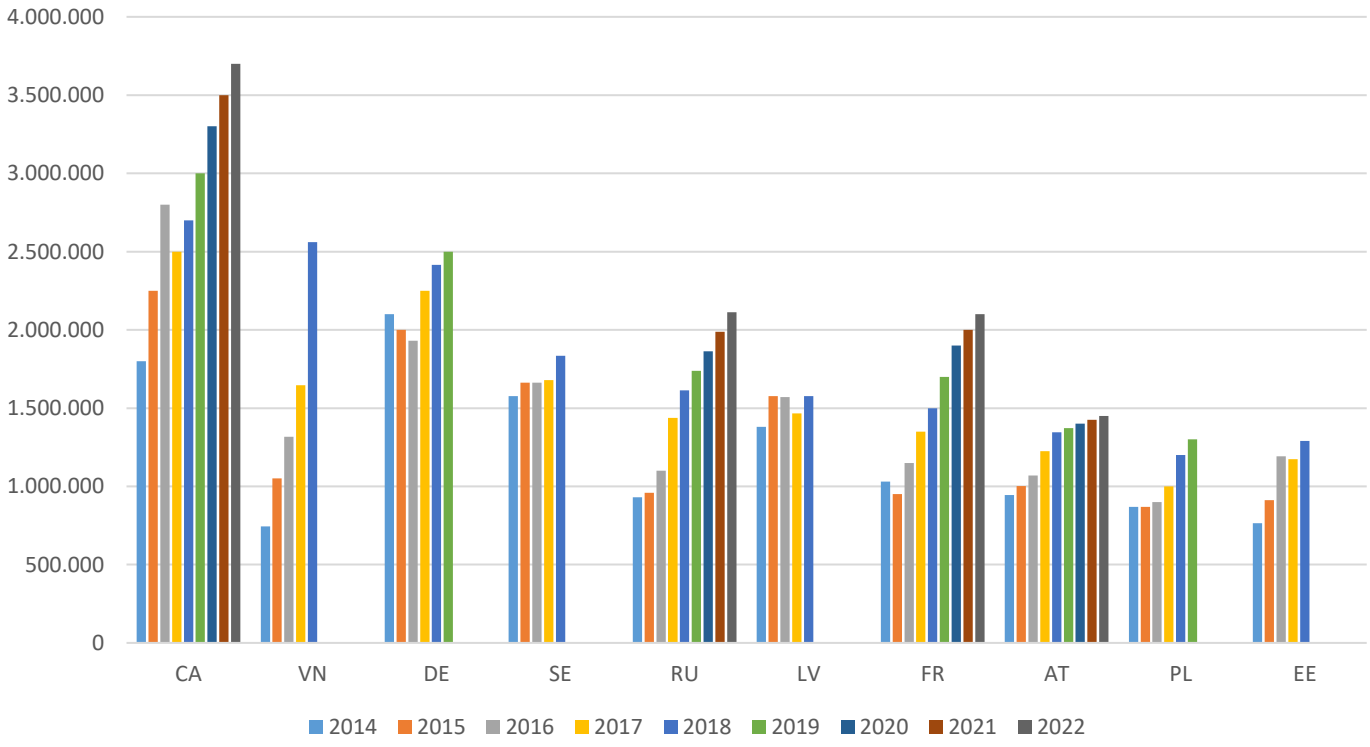
Note: BY, HU, NO & UA: 2018 production is a replication of 2017.
Source: EPC survey 2019; FAO; FutureMetrics

Figure 3 Evolution of pellet production of the TOP 10 of 2018 producing countries (tonnes)

(a) Top 2 producing countries with adapted scale



(b) Rest of the 8 countries from the top 10

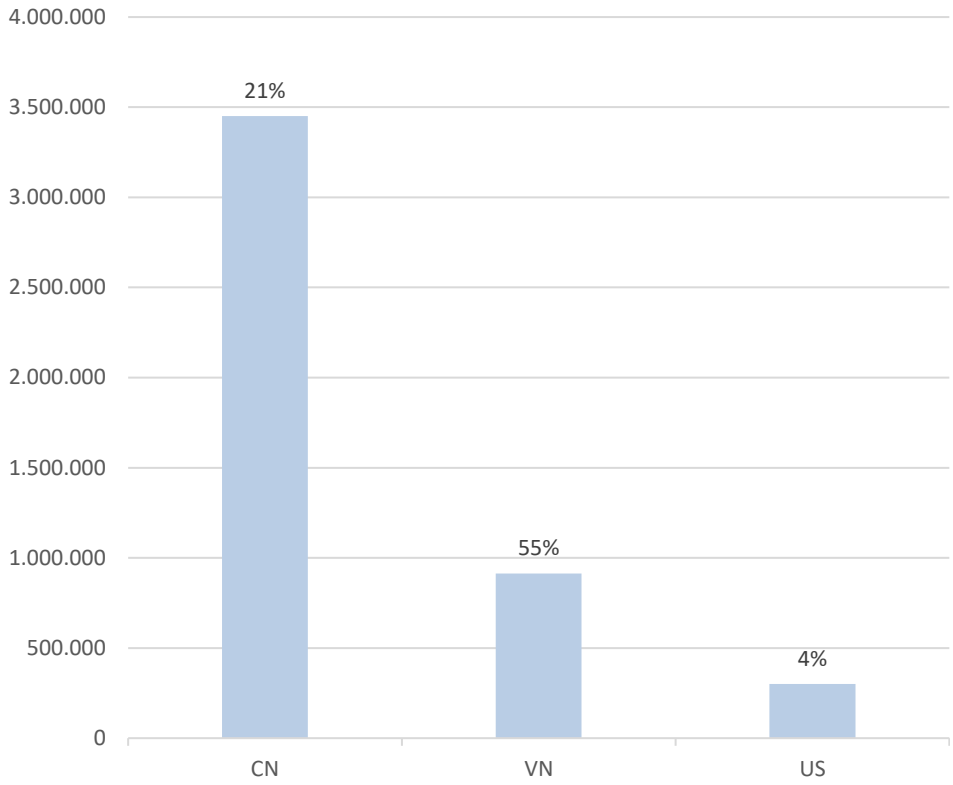


Note: 2019 and 2021 data were obtained by using linear regression with 2018 historical data and the 2020 and 2022 forecast estimations received. Except for DE and PL where the estimations received were only for 2019. Forecasts were not available for all countries.

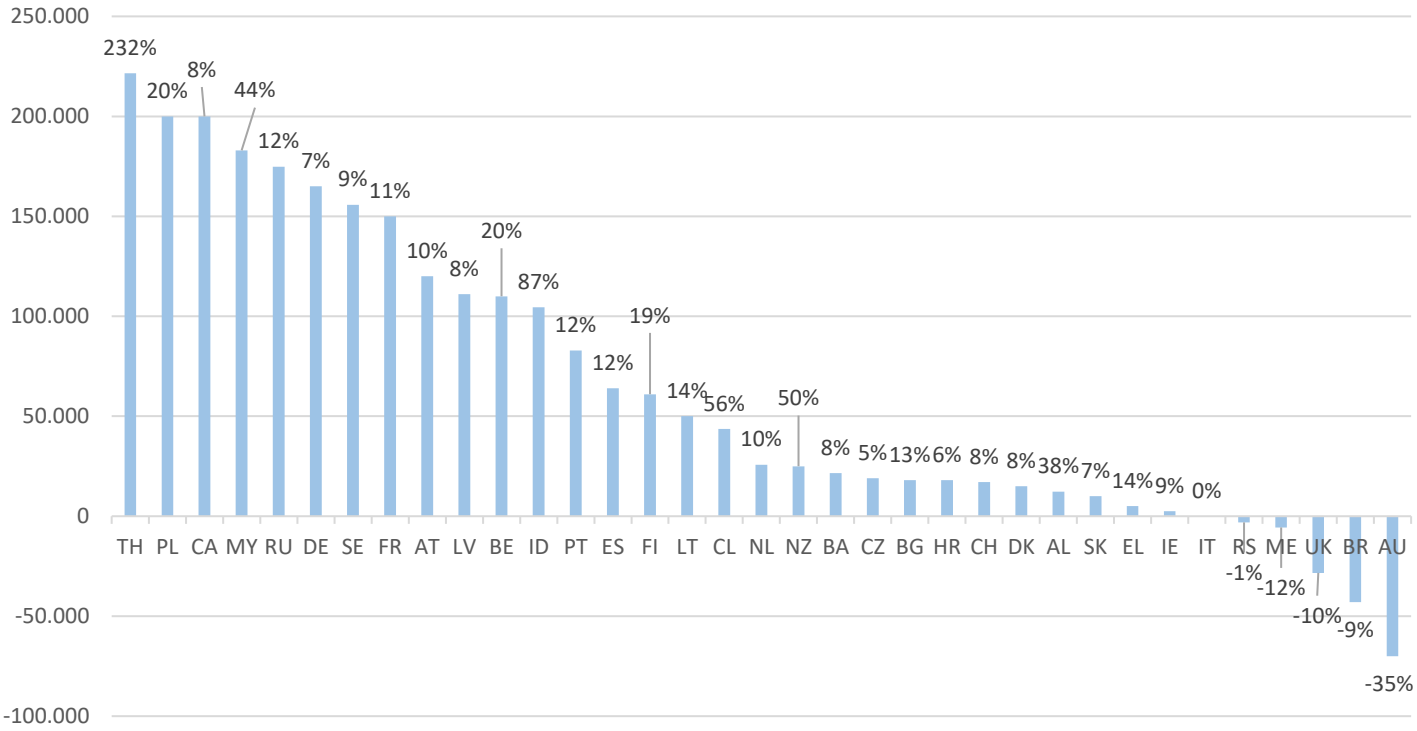
Source: EPC survey 2019; FAO; FutureMetrics

Figure 4 Growth in pellet production by countries between 2017-2018 (tonnes and %)

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



(b) Rest of the world



Note: BY, HU, NO & UA: 2018 production is a replication of 2017.

Source: EPC survey 2019; FAO; FutureMetrics

Table 2 World pellet production in 2017 and 2018

	2017			2018		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU28	707	22.860.771	15.401.127	719	23.352.903	16.879.382
Other Europe	538	3.555.000	3.005.933	547	3.578.000	3.222.889
Total Europe	1.245	26.415.771	18.407.060	1.266	26.930.903	20.102.271
North America	185	15.638.864	10.400.000	126	16.163.034	10.900.000
South America	33	959.200	548.618	39	1.348.600	549.412
China	2.089	31.343.283	16.800.000	2.240	34.502.394	20.250.000
Other Asia	196	2.037.000	2.401.763	n.a.	n.a.	3.697.257
Oceania	12	570.000	250.000	13	555.000	205.000
Total	3.760	76.964.118	48.807.441	3.684	79.499.931	55.703.939

Note: BY, HU, NO & UA: 2018 production is a replication of 2017.

The drop observed for North America in the number of operating production plants is due to a change in the accounting methodology in the US which is more accurate now.

Source: EPC survey 2019; FAO; FutureMetrics

Table 3 Detailed world pellet production by country in 2017 and 2018

	2017			2018		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU28	**707**	**22.860.771**	**15.401.127**	**719**	**23.352.903**	**16.879.382**
AT	43	1.600.000	1.225.000	42	1.630.000	1.345.000
BE	12	760.000	550.000	12	760.000	660.000
BG	56	285.000	144.000	59	302.000	162.000
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	26	450.000	366.000	28	480.000	385.000
DE	55	3.400.000	2.250.000	55	3.750.000	2.415.000
DK	5	300.000	180.000	5	300.000	195.000
EE	23	1.612.000	1.173.000	23	1.612.000	1.290.300
EL	18	130.000	35.000	24	135.000	40.000
ES	89	1.747.000	529.000	80	1.760.000	593.000
FI	29	630.000	324.000	28	630.000	385.000
FR	52	1.800.000	1.350.000	52	1.800.000	1.500.000
HR	18	352.000	287.000	21	370.000	305.000
HU	3	122.000	5.191	n.a.	n.a.	11.490
IE	1	40.000	28.100	1	40.000	30.600
IT	30	450.000	400.000	30	450.000	400.000
LT	17	400.000	350.000	19	480.000	400.000
LU	1	50.000	n.a.	1	50.000	n.a.
LV	27	1.950.000	1.466.000	27	1.950.000	1.577.100
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	4	350.000	264.300	4	350.000	290.000
PL	55	1.200.000	1.000.000	63	1.400.000	1.200.000
PT	23	1.159.000	700.000	26	1.300.000	782.906
RO	22	1.030.150	500.000	20	800.000	500.000
SE	64	2.300.000	1.678.929	64	2.300.000	1.834.736
SI	17	145.000	110.000	18	150.000	110.000
SK	10	250.000	150.000	11	250.000	160.000
UK	7	348.621	286.957	6	303.903	258.600
Other Europe	**538**	**3.555.000**	**3.005.933**	**547**	**3.578.000**	**3.222.889**
AL	10	45.000	32.000	11	52.000	44.200
BA	32	360.000	283.400	32	360.000	305.000
BY	n.a.	n.a.	220.000	n.a.	n.a.	220.000
CH	24	280.000	210.000	24	280.000	227.000
ME	7	65.000	48.000	7	65.000	42.400
NO	4	105.000	57.368	4	105.000	57.368
RS	61	525.000	327.165	69	541.000	324.086
RU	87	2.175.000	1.438.000	87	2.175.000	1.612.835
UA	313	n.a.	390.000	313	n.a.	390.000

Note: BY, HU, NO & UA: 2018 production is a replication of 2017.

Source: EPC survey 2019; FAO; FutureMetrics

	2017			2018		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
North America	**185**	**15.638.864**	**10.400.000**	**126**	**16.163.034**	**10.900.000**
CA	40	3.800.000	2.500.000	44	4.168.000	2.700.000
US	145	11.838.864	7.900.000	82	11.995.034	8.200.000
South America	**33**	**959.200**	**548.618**	**39**	**1.348.600**	**549.412**
BR	16	846.800	470.900	19	1.210.000	428.000
CL	17	112.400	77.718	20	138.600	121.412
China	**2.089**	**31.343.283**	**16.800.000**	**2.240**	**34.502.394**	**20.250.000**
CN	2.089	31.343.283	16.800.000	2.240	34.502.394	20.250.000
Other Asia	**196**	**2.037.000**	**2.401.763**	**n.a.**	**n.a.**	**3.697.257**
ID	8	355.000	119.730	n.a.	n.a.	224.167
JP	147	n.a.	126.532	n.a.	n.a.	n.a.
KR	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MY	25	850.000	413.035	n.a.	n.a.	596.025
TH	16	832.000	95.548	n.a.	n.a.	317.029
VN	n.a.	n.a.	1.646.918	n.a.	n.a.	2.560.036
Oceania	**12**	**570.000**	**250.000**	**13**	**555.000**	**205.000**
AU	9	300.000	200.000	10	400.000	130.000
NZ	3	270.000	50.000	3	155.000	75.000

Note: The drop observed for US in the number of operating production plants is due to a change in the accounting methodology which is now more accurate.
Source: EPC survey 2019; FAO; FutureMetrics

New-Zealand: Production capacity dropped in 2018 compared with that of 2017, it is due to the sale and revised downward output of the largest producing plant in the country. The increase of actual production is explained by an increase in production of the second largest plants. A new producing plant is forecasted in the coming years.

1.2 World pellet consumption

World pellet consumption has increased to 35.146.706 tonnes (excluding China although including China it is totalled to 52.746.706 tonnes) in 2018 or +14% compared to its level of 2017.

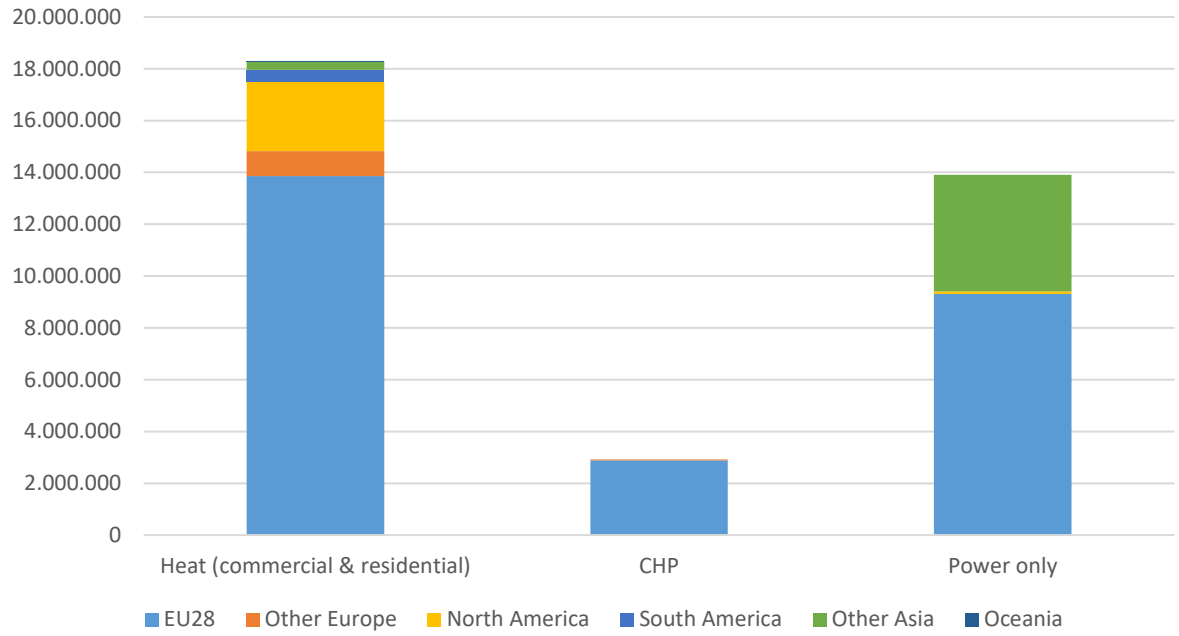
On a global level, industrial pellet consumption has increased by nearly 3 million tonnes, whilst residential & commercial consumption increased by 1.349.039 tonnes (China not included – no consumption details available).

Besides the EU28, which remains globally the largest pellet user, Asia recorded a continuous growth in recent years. Besides China, the most significant growth occurred in East Asia, more specifically in South Korea and Japan. Indeed, those countries respectively showed an increase of 39% and 86%, taken from industrial consumption.

The EU28 remains by far the largest consumer in the world. The EU28 consumption has grown by around 2 million tonnes in 2018 with the industrial use of pellets being led by the UK. With this, the UK consumption continued to increase in 2018, reaching around 8,5 million tonnes with a significant part of this growth due to the conversion of the fourth unit of Drax and additional power plants converted and put online to biomass (e.g. Czech utility EPH's Lynemouth; MGT Power's Teesside). The residential and commercial use of pellets is led by Denmark, with the country boasting the highest rate of pellet consumption per inhabitant for the residential sector mainly through district heating.

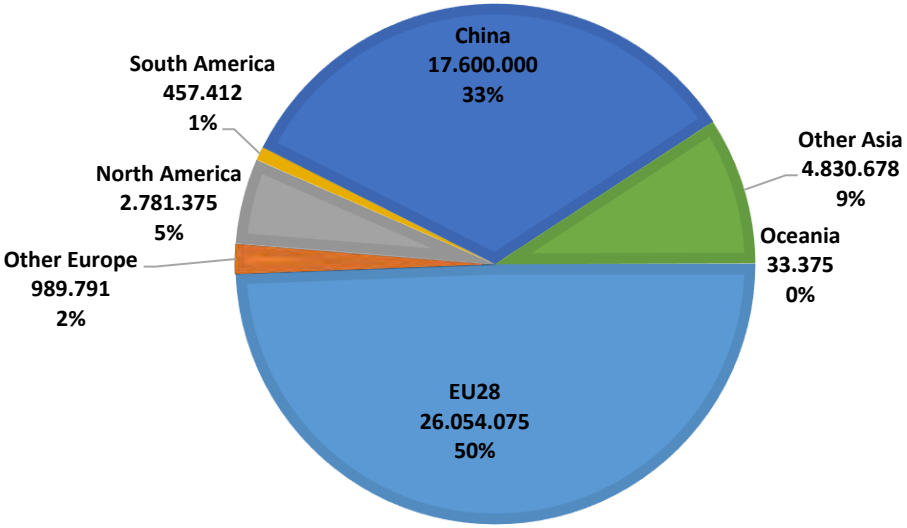
European countries outside of the EU28 also displayed robust growth in consumption, although total consumption volume remains relatively small.

Figure 5 World pellet consumption in 2018 by type of end-use (tonnes)



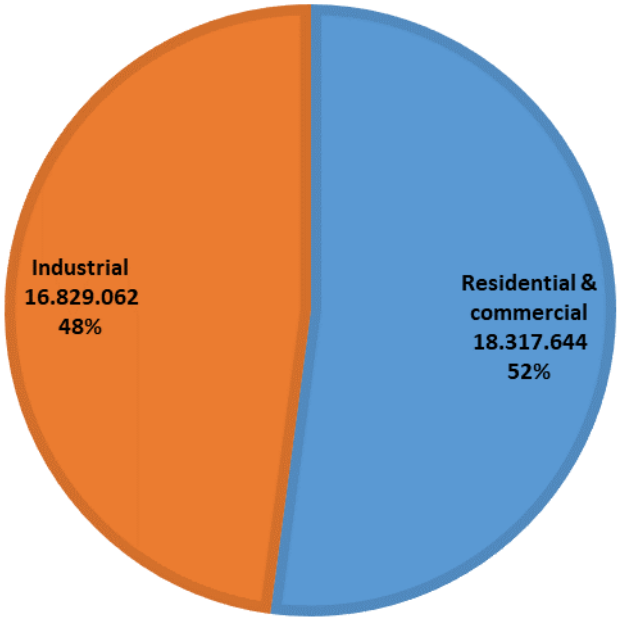
Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
China not included because the consumption details was not available.
Source: EPC survey 2019; FutureMetrics; FAO; Hawkins Wright

Figure 6 Distribution of world pellet consumption in 2018 (%)



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

Figure 7 World pellet consumption by type of end use in 2018 (tonnes and %)



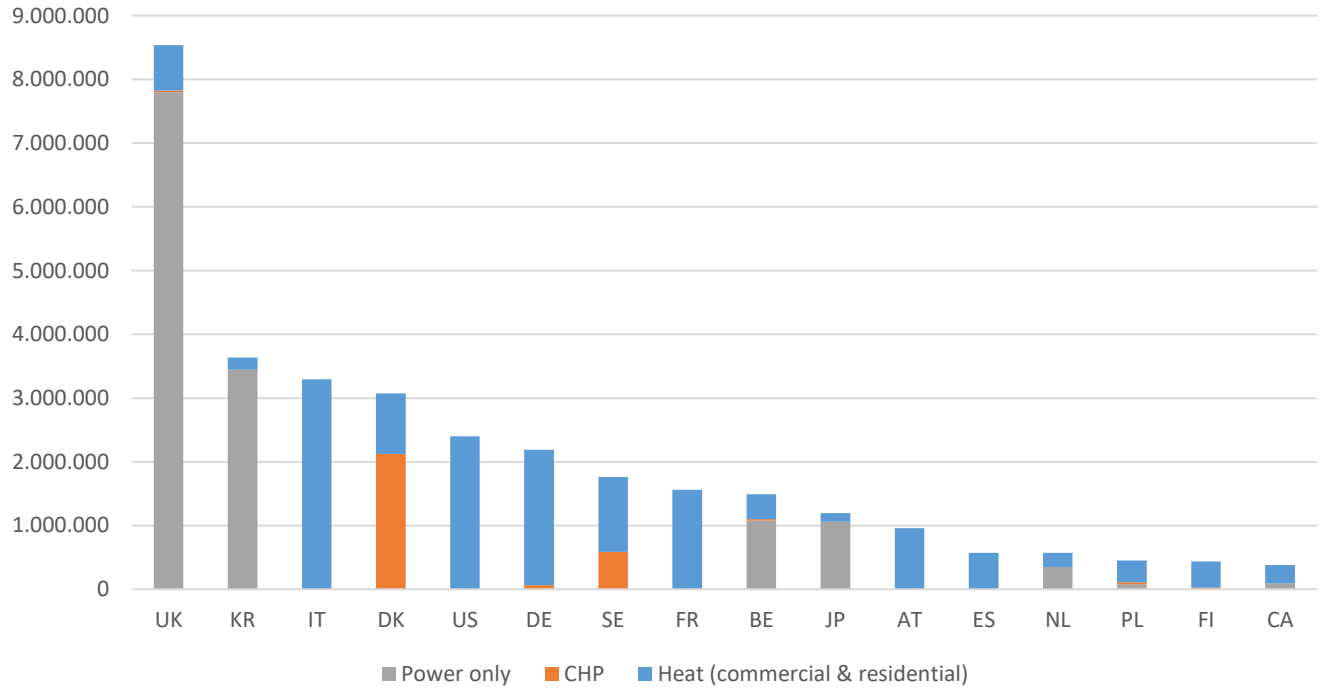
Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017.
China not included because the consumption details was not available.
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

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

	2013	2014	2015	2016	2017	2018	Growth 2017-2018
EU28	17.019.804	18.058.077	21.106.161	21.703.645	24.035.765	26.054.075	8%
Other Europe	325.079	569.134	598.730	704.194	907.727	989.791	9%
Total Europe	17.344.883	18.627.211	21.704.891	22.407.839	24.943.492	27.043.866	8%
North America	2.506.000	2.875.000	2.232.005	2.432.360	2.550.410	2.781.375	9%
South America	n.a.	58.000	90.000	n.a.	82.409	457.412	n.a.
China	3.200.000	4.800.000	6.400.000	9.600.000	12.800.000	17.600.000	38%
Other Asia	168.941	218.551	1.846.684	2.389.496	3.263.518	4.830.678	48%
Oceania	n.a.	n.a.	22.500	27.500	29.500	33.375	13%
Total	23.219.824	26.578.762	32.296.080	36.857.195	43.669.329	52.746.706	21%

Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
Brazil consumption in 2017 was not reported.
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

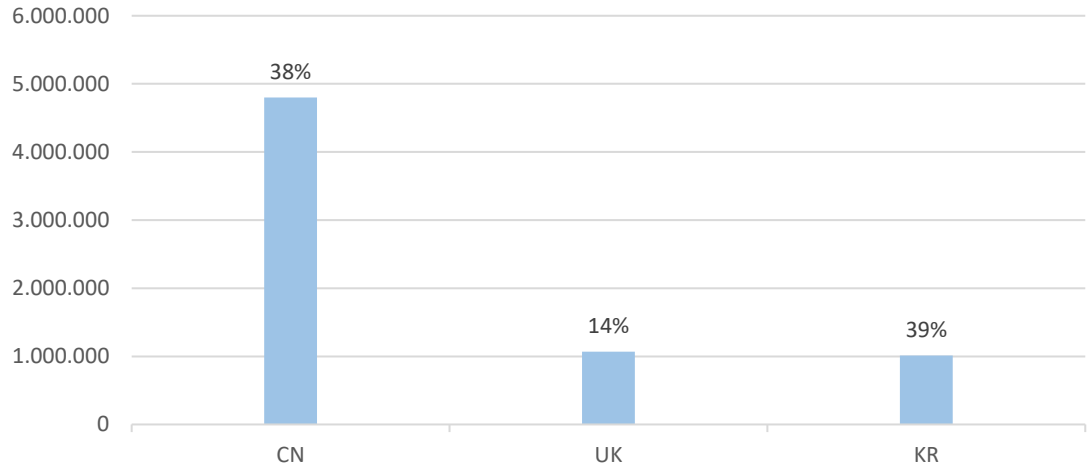
Figure 8 Top 10 pellet consuming countries by end-use in 2018 (tonnes)



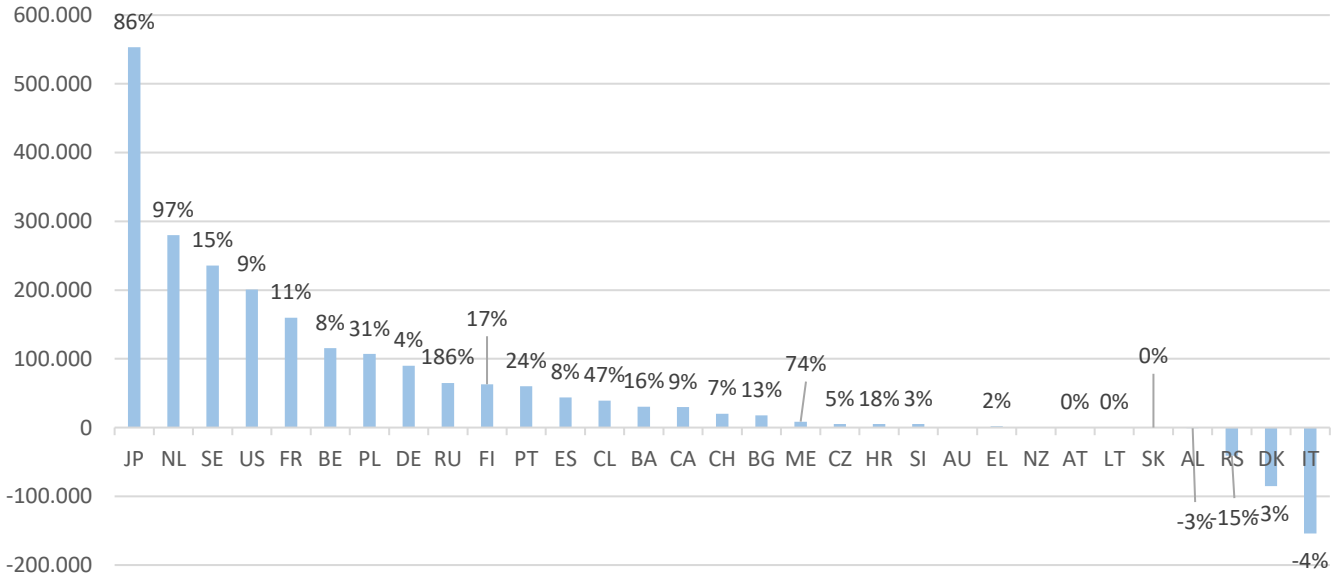
Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
China not included because the consumption details was not available.
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

Figure 9 Growth in pellet consumption by countries between 2017-2018 (tonnes and %)

(a) Top 3 countries in absolute terms

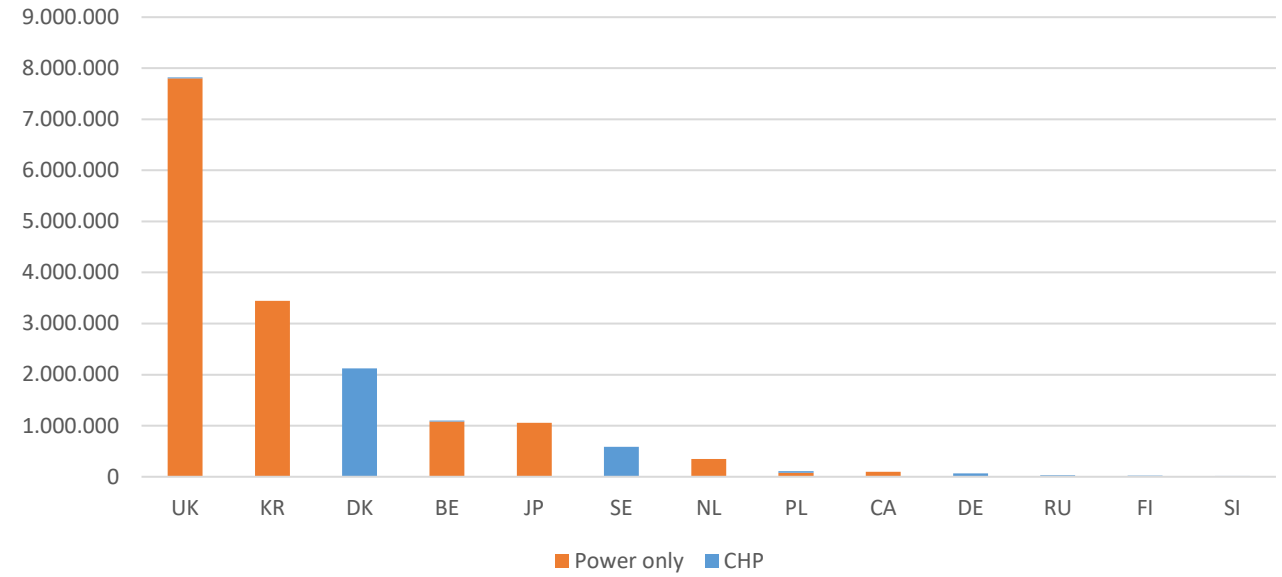


(b) Rest of the countries with available data



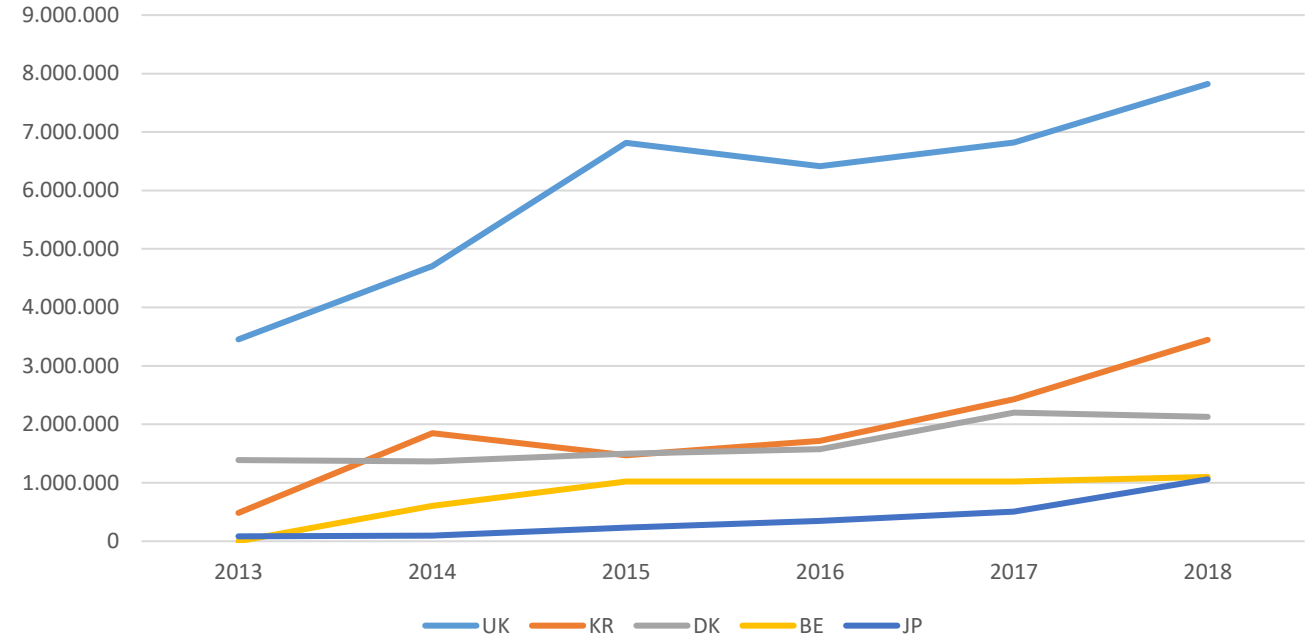
Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

Figure 10 World industrial pellet consumption by country in 2018 (tonnes)



Sources: EPC survey 2019, Hawkins Wright, FutureMetrics

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



Sources: EPC survey 2019, Hawkins Wright, FutureMetrics

Table 5 World pellet consumption (detailed) in 2017 and 2018 (tonnes)

	2017					2018				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU28	9.840.520	3.327.039	2.938.206	7.930.000	24.035.765	10.297.645	3.557.046	2.889.384	9.310.000	26.054.075
Other Europe	726.441	181.286	0	0	907.727	755.151	204.640	30.000	0	989.791
Total Europe	10.566.961	3.508.325	2.938.206	7.930.000	24.943.492	11.052.796	3.761.686	2.919.384	9.310.000	27.043.866
North America	2.390.410	65.000	0	95.000	2.550.410	2.616.375	70.000	0	95.000	2.781.375
South America	57.686	24.723	0	0	82.409	117.059	340.353	0	0	457.412
CN	n.a.	n.a.	n.a.	n.a.	12.800.000	n.a.	n.a.	n.a.	n.a.	17.600.000
Other Asia	326.000	0	0	2.937.518	3.263.518	326.000	0	0	4.504.678	4.830.678
Oceania	29.500	0	0	0	29.500	33.375	0	0	0	33.375
Total	13.370.557	3.598.048	2.938.206	10.962.518	43.669.329	14.145.605	4.172.039	2.919.384	13.909.678	52.746.706

Note: EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
Brazil consumption in 2017 was not reported.
Source: EPC survey 2019; FutureMetrics; Hawkins Wright

Table 6 Detailed world pellet consumption by country in 2017 and 2018 (tonnes)

	2017					2018				
	Residential	Commercial	CHP	Power Only	Total	Residential	Commercial	CHP	Power Only	Total
EU28	**9.840.520**	**3.327.039**	**2.938.206**	**7.930.000**	**24.035.765**	**10.297.645**	**3.557.046**	**2.889.384**	**9.310.000**	**26.054.075**
AT	800.000	160.000	0	0	960.000	790.000	170.000	0	0	960.000
BE	346.500	8.800	20.000	1.000.000	1.375.300	381.150	9.680	20.000	1.080.000	1.490.830
BG	140.071	1.227	n.a.	n.a.	141.298	157.775	1.384	0	0	159.159
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	65.000	32.000	0	0	97.000	68.000	34.000	0	0	102.000
DE	1.425.000	615.000	60.000	0	2.100.000	1.485.000	640.000	65.000	0	2.190.000
DK	800.000	160.000	2.200.000	0	3.160.000	800.000	150.000	2.125.000	0	3.075.000
EE	30.000	10.000	0	0	40.000	30.000	10.000	0	0	40.000
EL	73.000	15.000	0	0	88.000	75.000	15.000	0	0	90.000
ES	326.000	203.000	0	0	529.000	355.000	218.000	0	0	573.000
FI	62.000	247.000	64.000	0	373.000	62.000	351.000	23.000	0	436.000
FR	1.240.000	160.000	0	0	1.400.000	1.380.000	180.000	0	0	1.560.000
HR	19.000	9.000	0	0	28.000	22.000	11.000	0	0	33.000
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	3.150.000	300.000	0	0	3.450.000	3.042.749	253.256	n.a.	n.a.	3.296.005
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	129.000	9.000	0	0	138.000	129.000	9.000	0	0	138.000
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	60.000	130.000	0	100.000	290.000	70.000	150.000	0	350.000	570.000
PL	233.000	50.000	30.000	30.000	343.000	280.000	60.000	30.000	80.000	450.000
PT	100.000	150.000	0	0	250.000	160.000	150.000	0	0	310.000
RO	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SE	538.849	455.212	534.106	0	1.528.167	691.774	482.834	589.268	0	1.763.876
SI	95.000	40.000	10.000	0	145.000	98.000	37.000	15.000	0	150.000
SK	40.000	30.000	0	0	70.000	40.000	30.000	0	0	70.000
UK	120.600	529.300	20.100	6.800.000	7.470.000	132.697	582.392	22.116	7.800.000	8.537.205
Other Europe	**726.441**	**181.286**	**n.a.**	**n.a.**	**907.727**	**755.151**	**204.640**	**30.000**	**n.a.**	**989.791**
AL	27.700	2.800	0	0	30.500	26.200	3.300	0	0	29.500
BA	169.090	23.000	0	0	192.090	188.340	34.200	0	0	222.540
BY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CH	185.250	99.750	0	0	285.000	198.250	106.750	0	0	305.000
ME	10.200	1.550	0	0	11.750	18.200	2.200	0	0	20.400
NO	46.180	24.866	0	0	71.046	46.180	24.866	0	0	71.046
RS	277.521	4.820	0	0	282.341	232.481	8.824	0	0	241.305
RU	10.500	24.500	0	0	35.000	45.500	24.500	30.000	0	100.000
UA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

	2017					2018				
	Residential	**Commercial**	**CHP**	**Power Only**	**Total**	**Residential**	**Commercial**	**CHP**	**Power Only**	**Total**
North America	**2.390.410**	**65.000**	**0**	**95.000**	**2.550.410**	**2.616.375**	**70.000**	**0**	**95.000**	**2.781.375**
CA	225.000	30.000	0	95.000	350.000	250.000	35.000	0	95.000	380.000
US	2.165.410	35.000	0	0	2.200.410	2.366.375	35.000	0	0	2.401.375
South America	**57.686**	**24.723**	**0**	**0**	**82.409**	**117.059**	**340.353**	**0**	**0**	**457.412**
BR	n.a.	n.a.	n.a.	n.a.	n.a.	26.000	310.000	0	0	336.000
CL	57.686	24.723	0	0	82.409	91.059	30.353	0	0	121.412
China	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**12.800.000**	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**17.600.000**
CN	n.a.	n.a.	n.a.	n.a.	12.800.000	n.a.	n.a.	n.a.	n.a.	17.600.000
Other Asia	**326.000**	**n.a.**	**n.a.**	**2.937.518**	**3.263.518**	**326.000**	**n.a.**	**n.a.**	**4.504.678**	**4.830.678**
ID	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
JP	136.000	0	0	506.353	642.353	136.000	0	0	1.059.542	1.195.542
KR	190.000	0	0	2.431.165	2.621.165	190.000	0	0	3.445.136	3.635.136
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	**29.500**	**0**	**0**	**0**	**29.500**	**33.375**	**0**	**0**	**0**	**33.375**
AU	12.000	0	0	0	12.000	15.000	0	0	0	15.000
NZ	17.500	0	0	0	17.500	18.375	0	0	0	18.375

Note: EE, LT & NO: 2018 consumption is a replication of 2017.

JP; KR: 2018 residential consumption is a replication of 2017

Source: EPC survey 2019; FutureMetrics; Hawkins Wright

1.3 World pellet trade

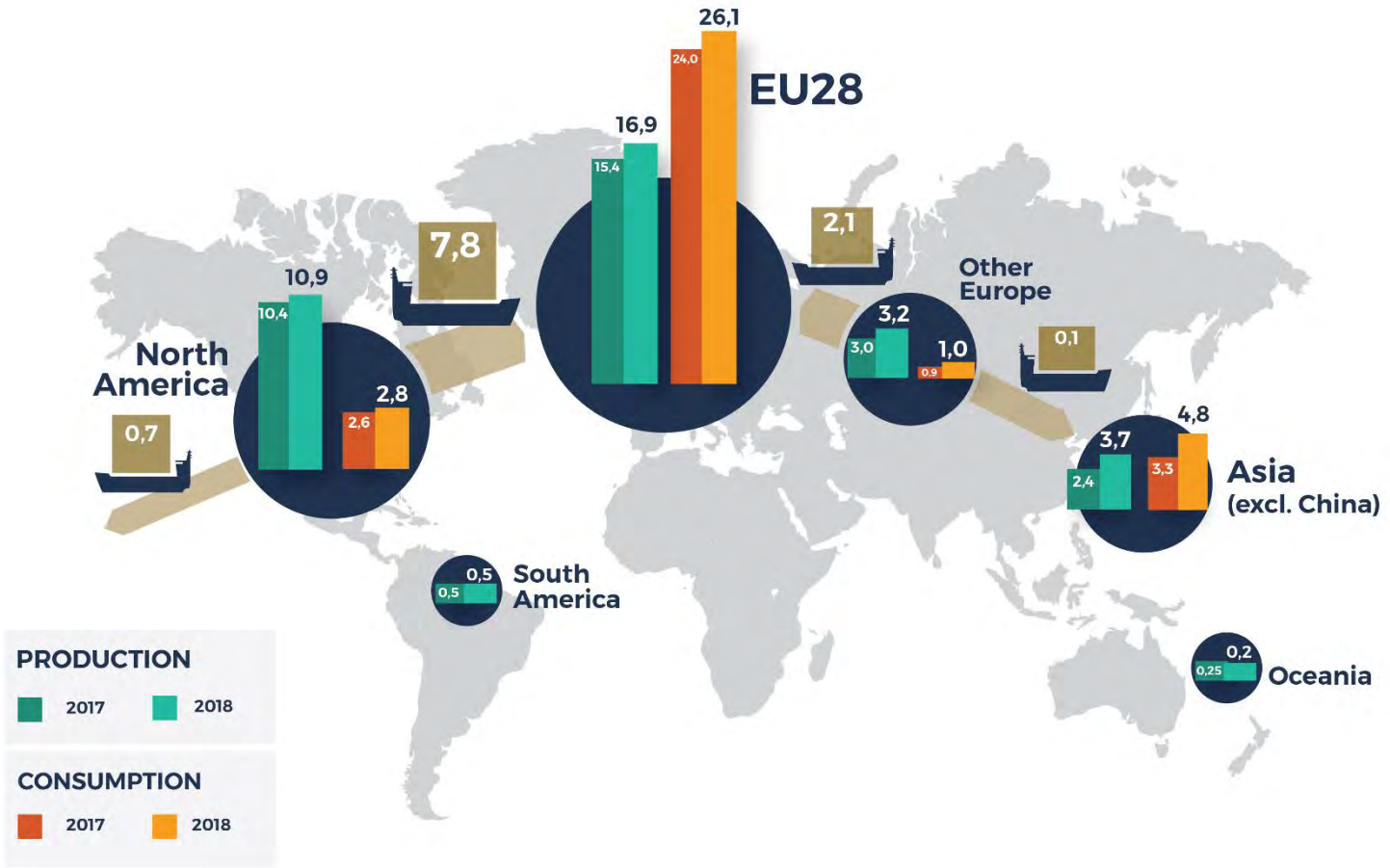
Two regions are net importers of pellet in the world: the EU28 and Asia. Figure12 confirms the current hegemony of the EU28 concerning pellet consumption but Asia is growing fast and is becoming alongside with Europe the driving force of the pellet market development.

With EU 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 the UK, Denmark and Belgium. 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 2,2 million tonnes or 63 % of its imports in 2018) and Malaysia (around 0,6 million tonnes or 17% of its imports in 2018). Japan, setting stronger requirements in term of sustainability, quality and reliability of supply, is sourcing its pellet principally from Canada (around 0,67 million tonnes or 63% of its import in 2018).

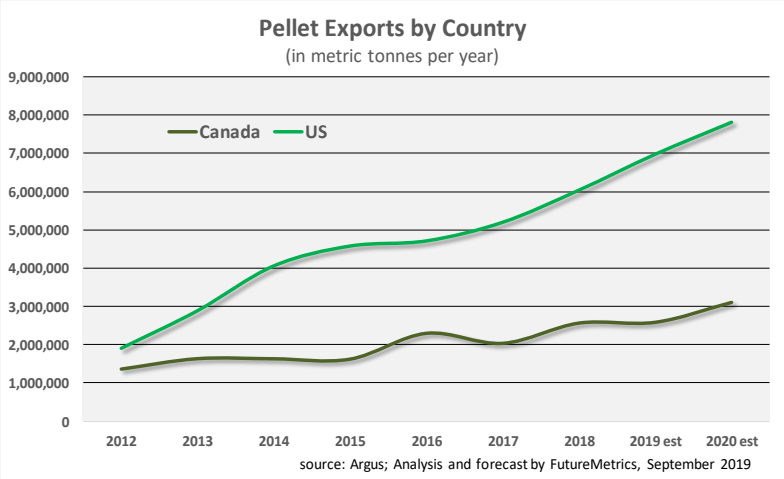
Canada, the US and Russia do not show any sign of strengthening their internal consumption, even though some initiatives are taken in order to grow the local demand. Therefore in the future these countries are likely to remain net exporters.

Figure 12 World pellet map and trade flow in 2018 (million tonnes)



Note: BY, HU, LU, NO & UA: 2018 production is a replication of 2017. EE, LT & NO: 2018 consumption is a replication of 2017.
JP; KR: 2018 residential consumption is a replication of 2017
Source: EPC survey 2019; FAO; FutureMetrics; Hawkins Wright; UNComtrade

William Strauss, PhD
FutureMetrics
President



North America development and Asia perspective - the latest trends

"FutureMetrics expects continued growth in production levels in North America and other major and emerging pellet producing regions as market demand continues to grow. Growth in the EU and UK in the demand for industrial wood pellets, under current policy, is expected to plateau in 2022 at about 20,3 million tonnes per year. However, growth in the northeast Asian markets is expected to continue well into the 2020's.

As the Japanese market for industrial wood pellets grows, an increasing proportion of pellets produced in British Columbia and Alberta - Canada - will ship to Japan rather than to the UK and Western Europe. Currently, most exports from western Canada go the UK. In 2018 about 1,5 million tonnes were shipped from western Canada to the UK. Approximately 190.000 tonnes were shipped to the Netherlands, Denmark, Belgium, and Italy. Canada also exported about 217.000 tonnes of bagged pellets into the US heating markets, however, shipments from western Canada to Japan more than doubled from 2017 to 2018 to about 623.000 tonnes.

If western Canadian production shifts to Japan (and possibly South Korea) then demand from the UK and the major importing nations of the EU may be satisfied by new production capacity in the US and eastern Canada.

FutureMetrics expects Japanese demand to exceed 4,5 million tonnes per year by 2024. Based on FutureMetrics primary research, there are 70 independent power plant projects in Japan that will be starting between 2020 and 2024 totaling 3.104 megawatts. A reasonable assumption is that 40% or more of the fuel for these projects will be pellets.

Some of that new Japanese demand will be supplied by emerging production countries such as Vietnam, Australia, Thailand, and Chile, however, western Canada and potentially the western states in the US will supply a significant portion of that demand. Some pellets may be shipped to Japan from the US southeast until the major eastern US producers with contracts to supply Japan develop production capacity in regions with more competitive logistics, strong sustainability credentials, and well-developed rules of law.

The future of South Korean demand is less certain due to the unknown future values of renewable energy certificates (RECs). Demand in S. Korea has fallen in recent months as REC prices have collapsed. Most pellet imports into S. Korea are on very short-term contracts. FutureMetrics does not foresee that new production capacity will be built in north America for the S. Korean market if current S. Korean policy persists.

Finally, FutureMetrics does not anticipate that feedstock supply and cost fundamentals will impede the potential growth of new production capacity in the US and in Canada when matched to the expected growth in global demand. "

2 Situation in Europe

2.1 European pellet production

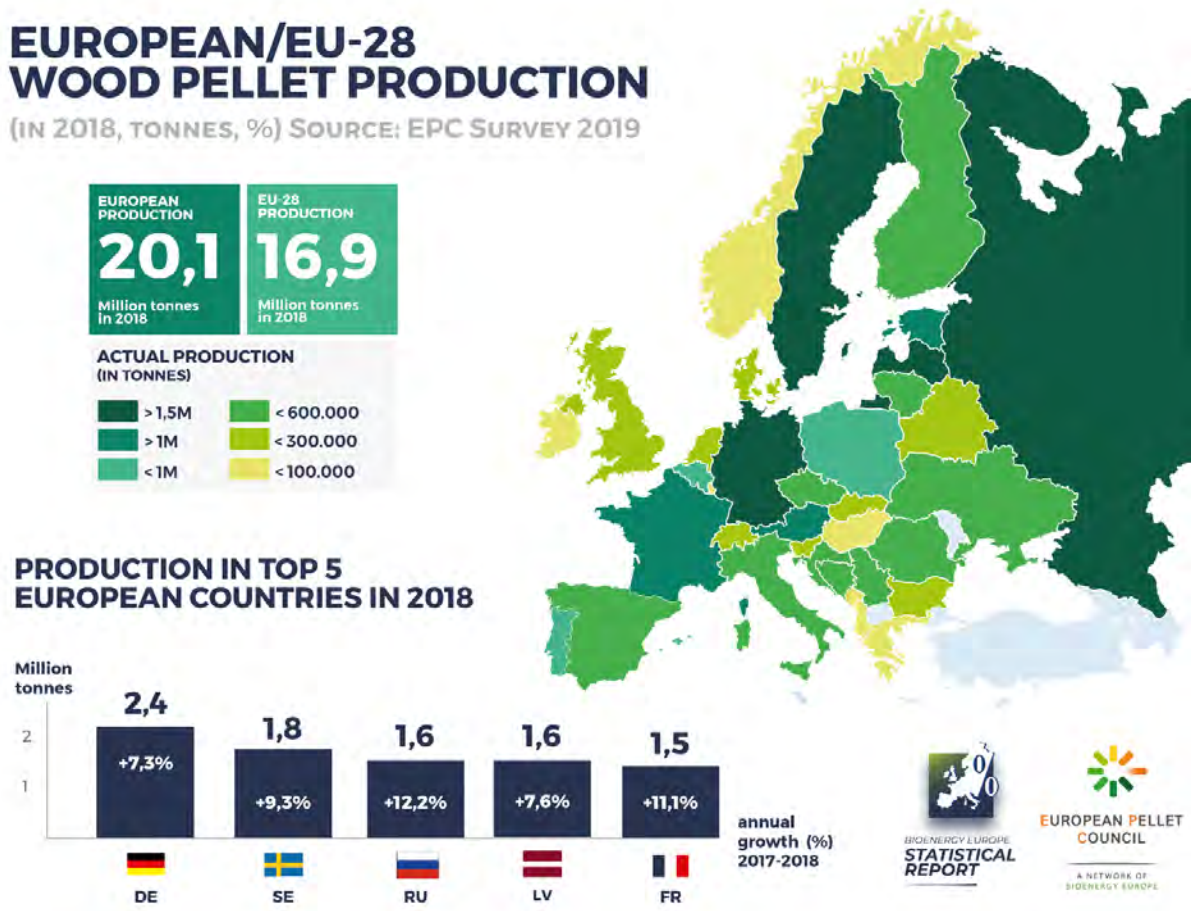
In 2018 Europe as a whole recorded a 9,2% growth reaching 20,1 million tonnes of production, with a continued growth in production from 2017 to 2018 following on from a disappointing year in 2016 (4,6% growth in 2016).

Weather during the summer and autumn of 2017 adversely affected the pellet industry in north-eastern Europe, specifically Estonia and Latvia and in August 2017, extreme flooding occurred in the Baltic region. Furthermore, the winter came late leaving the ground dampened for an extended period, delaying the access to the forest for harvesting. This significantly impacted the supply of wood products. The result was a sharp rise in the price of raw materials and a diminished supply of wood for pellet producers. In 2018, the situation surrounding raw material for pellet production began to stabilise itself and by the second half of 2018 all pellet producers had access to the raw material. Despite the accessibility of the raw material the prices remained drastically high (the highest ever recorded) and at the very end of 2018 it appeared that the raw material prices started to decrease by the beginning of 2019. These market tensions naturally had an impact on pellet price, both for the industrial and domestic pellets.

In Portugal, a significant EU net pellet exporter, the industry was also disrupted by the forest fires that ravaged Portugal the last summers. In 2017, the fires not only destroyed around 520.000 hectares of forest but also several wood processing mills, including two pellet plants. In 2018, the production increased but still lower than the one million tonnes produced in 2014.

On the other hand, other significant European producers registered solid growth between 2017 and 2018, namely, Belgium, Finland, Hungary and Poland all registering growth rates above 18%. Although Europe remained unchallenged as the world leader for pellet production and despite its robust growth, the demand for pellets continued to grow faster than the production in 2018 (in absolute terms).

Figure 13 Map of European pellet production in 2018



Note: BY, HU, NO & UA: 2018 production is a replication of 2017.
Source: EPC survey 2019; FAO

Didzis Palejs
CM Biomass
LATbio - President

The Baltic countries situation

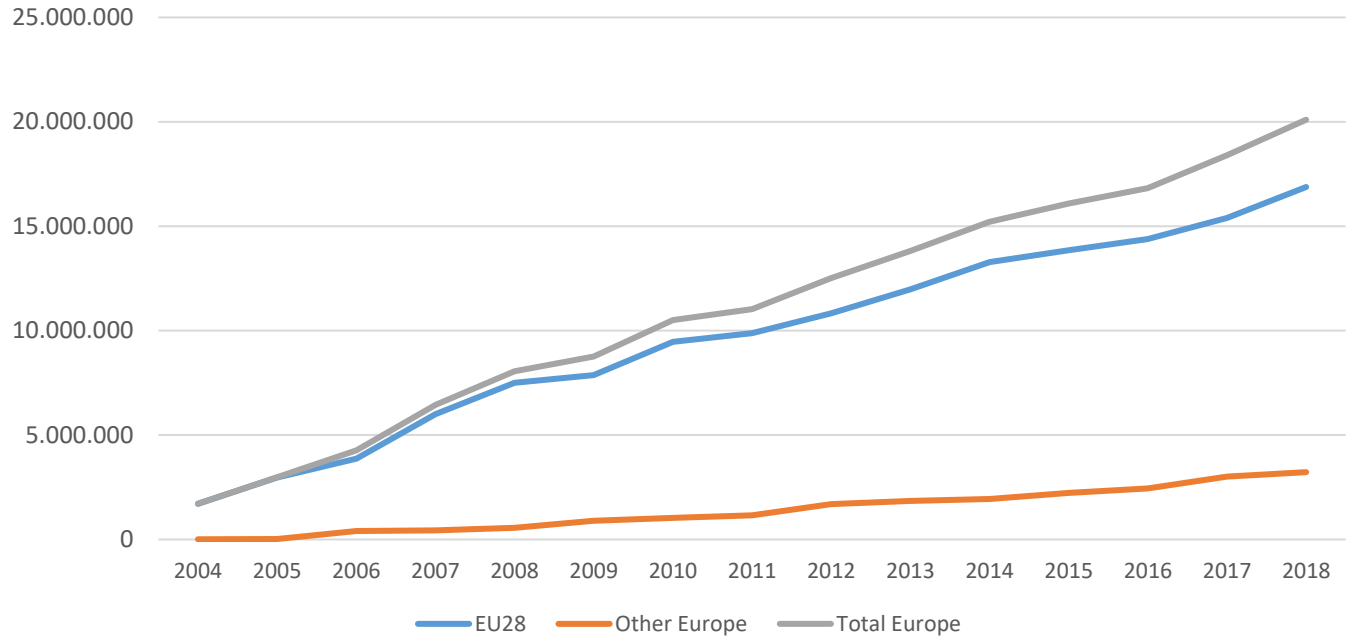
"Baltic countries are one of the wood pellet production pioneers, starting to produce significant amount of wood pellets already back in 1990s. Since then the wood pellet production in all three Baltic countries (Latvia, Estonia and Lithuania) has been rapidly developing.

The previous year 2018 was quite difficult for pellet producers as the raw material availability was a major issue. The raw material shortage started already in 2017, when extreme weather conditions hampered proper forestry operations. Due to the shortage of the raw material, prices spiked at the all-time high levels. This year 2019, on the contrary, has been good from the perspective of the raw material sourcing. There was plenty of raw material available and the prices dropped. Currently most of the pellet producers have high levels of the raw material stocks and are well prepared for the coming season.

Within next few years it is expected that the wood pellet production level in Baltic countries will slightly increase as few new production capacities will be commissioned. For example, Stora Enso is currently building a pellet plant about 100 km east from Riga at their Launkalne sawmill. In general – the production capacity in Baltics has reached high level and likely not many new plants are going to build.

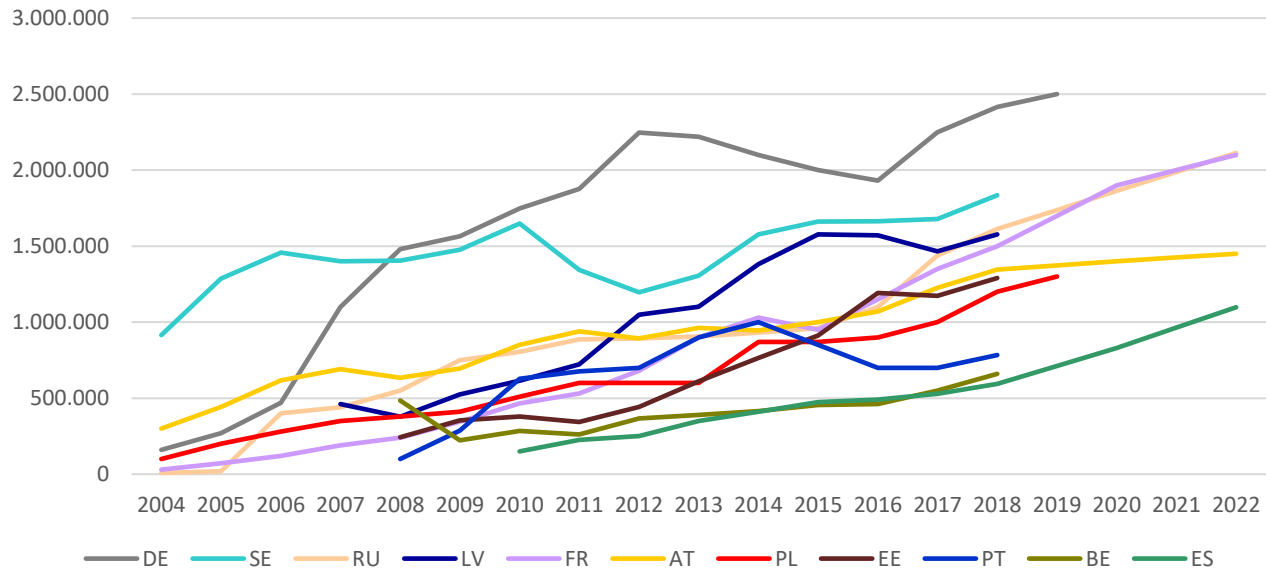
Historically Baltic countries have been one of the largest wood pellet exporters in the world, but a new and positive development has started. In recent years, consumption of premium wood pellets in the Baltic region has started to grow rapidly, pushing the consumption towards around half a million tonnes per year (which will be confirmed soon by official data). This has likely been caused by multiple factors (growing wealth of the population, high gas prices, wood pellet advertising campaigns, etc.). It is expected that the local consumption of the premium wood pellets will continue to grow in the coming years. "

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



Note: BY, HU, NO & UA: 2018 production is a replication of 2017.
Source: EPC survey 2019; FAO

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



Source: EPC survey 2019

Austria: Production has grown by 10 %, driven by demand from Italy and across Europe with plentiful supplies of raw materials. 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 remained relatively constant. Currently, Belgian industrial users rely almost exclusively on imported pellets. Domestic production is therefore principally for the local heating market and for exports. The residential heating demand is growing due to the increase of pellet appliances that are cheaper and promoted in new buildings. Despite large

quantities of raw material being available, due to bark beetle infestation, a decrease might be observed in the coming years that could create a change to different sub products as raw material for wood pellet production.
A reform of the green certificate mechanism is currently under way in Belgium, which could put at risk the profitability of the pellet producers as most of them use biomass cogeneration.

Estonia: Suffered less than Latvia from the unfavourable climate conditions of 2017 (with a mere production decrease of 20.000 tonnes in 2017) with the production increasing by +10% in 2018 reaching its highest recorded level.

France: In 2018 production grew by 11% in 2018 significantly less than in 2017 with the production mainly being that of A1 quality class (around 99%).

Germany: Germany has grown to be the biggest pellet producer within the EU with this reflection being based mainly on a strong domestic heating market. The German market was disrupted in 2016 by the bankruptcy of the biggest producer 'German Pellets' and a disappointing internal consumption. Despite this, there was a strong recovery in 2017 which continued through in to 2018 allowing the country to exceed its previous production record, set in 2012.

Latvia: Due to raw material shortages, the total pellet production was lower in 2017 than in the two previous years. Warm winter weather meant that the ground did not freeze and as a result forestry equipment could not cross the boggy terrain to harvest wood. In the summer of 2018, both pellet producers and raw material traders still reported raw material shortages. However, the market finally recovered and increased to nearly 1,6 million of tonnes in 2018 (a similar level as seen in 2015).

Poland: 2018 followed the same trend as in 2017, amid growing demand for pellets, mainly for export to Italy and Denmark. Some pellet plants had problems sourcing a sufficient supply of raw materials with the situation still occurring in 2019. Prices of raw material have rapidly increased. The season 2017/2018 was additionally influenced by local demand which is rapidly growing due to subsidies for modern boiler investments in addition to a new power plant in Elbląg (200,000 tonnes/year) which opened in October 2018.

Portugal: Portuguese production grew continuously from 2010 to 2014 but then contracted due to limited availability of raw material. The industry was also disrupted by the forest fires that ravaged Portugal the last summers. In 2017, the fires not only destroyed around 520.000 hectares of forest but also several wood processing mills, including two pellet plants. The future of the forest industry remains uncertain, although pellet mills may be more resilient than other wood processing industries due to their ability to process a wider variety of raw materials. In 2018, a 12% increase in production was observed compared to that of 2017 alongside with three more operating plants reaching a total of twenty-six.

Russia: Production has grown by 12% in 2018, up to 1.600.000 tonnes total production, likely mainly in response to strong demand in Europe, as well as because of subsidies for pellet exports. Domestic demand for pellets remains uninspiring, with leading export destinations for Russian wood being Denmark, Belgium, Sweden, the United Kingdom and South Korea. 2019 and 2020 could show significant growth.

Spain: Since 2010 Spain has registered solid and steady growth. However, despite this, in recent times the Spanish pellet market has been hindered by diminished Portuguese pellet imports and additionally by the closure of several plants due to financial problems. Additionally, there are relatively few new producers but some of the existing producers increased their capacity. Nonetheless, the Spanish pellet market continues to grow, and several large plants are expected to begin operating in 2019 and will be fully operating by 2020 (3 x 80.000-140.000 tonnes/year). This will inevitably affect the internal market even if a large percentage of their production will be exported. Nevertheless, it is expected that the next season will not be as complicated as the previous one, as the heating season came to a close by mid-March (earlier than the previous year) producers were able to start stocking mid-May. As a result of this along with the increase in production of new projects and or the increased capacity in some plants, expectations to have stock tensions for the next heating season even if a cold winter is coming are not predicted to be high.

Most of the pellet plants are producing domestic pellet A1 and from a capacity of about 10.000 tonnes almost all the plants are certified.

Sweden: Despite a drop in production in 2011 and 2012, Sweden has seen a gradual recovery, exceeding its 2010 production level by nearly 200.000 tonnes in 2018. To note Swedish production is almost exclusively high-quality A1-class pellets.

Rens Hartkamp, PhD

BiomassConsult

The Russian situation

"The Russian pellet sector is going strong. The pellet market is developing stably and has plenty of growth potential. One sees an increase in pellet producers, traders, and companies with bagging lines. Ever more ports are handling wood pellets, for example, in Novorossiysk on the Black Sea.

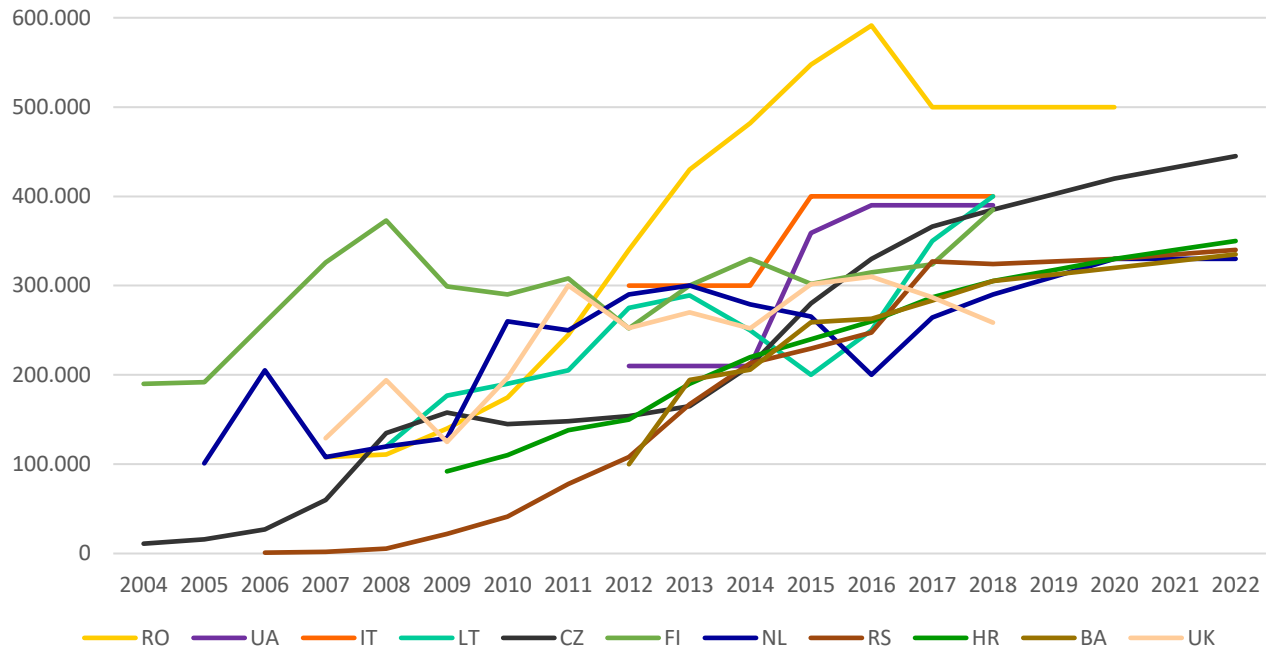
By far most pellets are made of high-quality secondary wood residues. It is worth mentioning that the use of only 5% Siberian larch tremendously increases the mechanical durability of any kind of wood pellets.

Russia and Belarus together have more FSC certified forests, than any country in the world. Moreover, Russia is one of the few countries that still has considerable growth in FSC Forest Management certification. Considering wood pellets specifically, ENplus® is the most popular system, followed by SBP.

Over the last 10 years, BiomassConsult predicted a 10% average annual growth rate in Russian pellet production, which would result in 2 million tons in 2020. This has proven to be accurate. Because the price for wood pellets has increased worldwide a few years ago, BiomassConsult assumes that Russian wood pellet production will continue to grow at the same pace for several years to come. This would result in 5 million tons of wood pellet production a year in 2030. Russia entered the top three of ENplus® pellet producing countries this year and could become the world leader in the future.

The accuracy of government data on the Russian export of pellets has improved greatly. However, the picture on domestic consumption is still blurry. BiomassConsult estimates domestic consumption to be over 10% of total production. In many regions of the vast country, the domestic market for pellets is viable (without subsidies). Considering the delivery costs to, for example, Germany, Italy or the UK, for some small producers it makes sense to market most of their pellets domestically already today. As soon as wholesales will start professionalizing the domestic sales market, ENplus® certified pellets could become in demand in Russia also. "

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



Source: EPC survey 2019; FAO

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 the following year.

Czech Republic: Steady annual growth in pellet production without major fluctuations since 2013. The largest pellet plants are associated with large foreign-owned sawmills. In 2020, the country expects to record a large increase in production, as Pfeifer plans to triple its production capacity in the Czech Republic by over 120,000 tons of pellets per year.

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. In spite of 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.

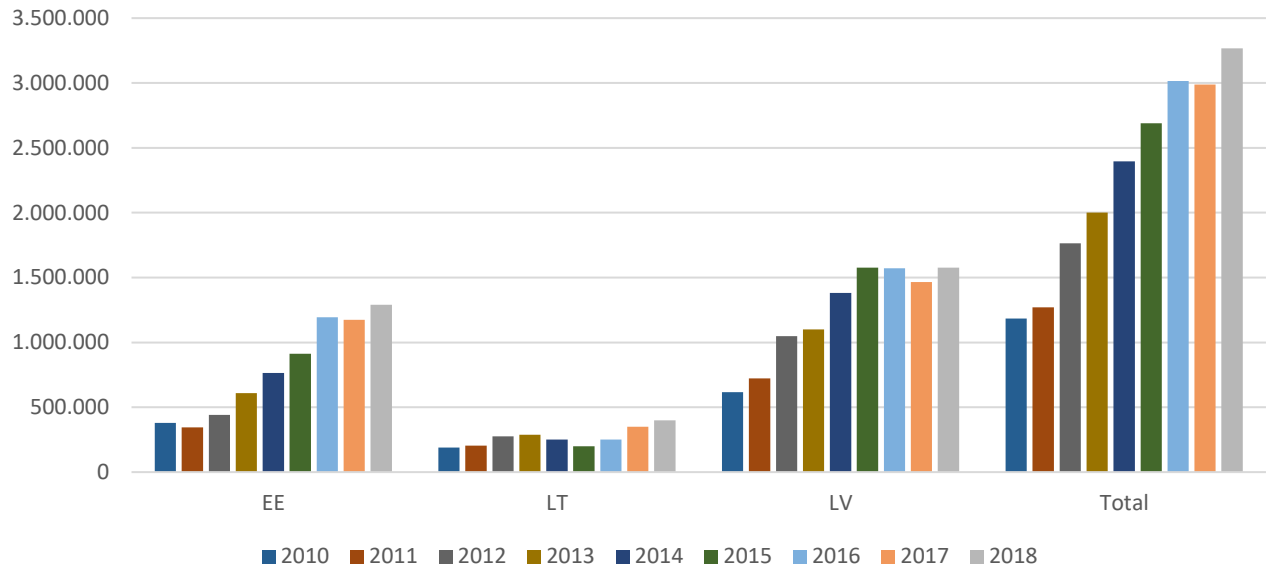
The Netherlands: The capacity production and the actual production is not foreseen to increase due to the lack of raw material available.

Serbia: The number of pellet producers and their production has rapidly increased in the last ten years, from two producers in 2006 to sixty-nine in 2018 albeit smaller-scale producers. This rapid increase was precipitated by demand for pellets both domestically and for export. Raw material shortages have prevented Serbian producers from operating at full capacity, with pressure on forest resources being significant as well as increasing competition among the participants on the woody biomass market.
By the end of 2018, total installed capacity for pellet production in Serbia had reached 541.000 tonnes with the actual production being 324.000 tonnes – this was a small decrease compared to 2017 production. This minor decrease is a consequence of the sudden import of mostly Ukrainian wood pellets in 2017, which were some 15% to 20% cheaper than domestically produced ones. In 2018 this led to a huge market share of the imported pellets within the Serbian market and to increase in wood pellet stocks for domestic production facilities, therefore, the leading five producers

stopped the production in January and February of 2018. Decrease in their total wood pellets production in 2018 was in range from 8% to 27% comparing to 2017. The adverse effect on the total production level was mitigated by a newly expansive factory which was established in September 2017, as well as by eight new small pellet units, which started their production activities in 2018. It was small sawmills that bought the wood pellet production lines and started producing pellets from their own sawdust from log processing.

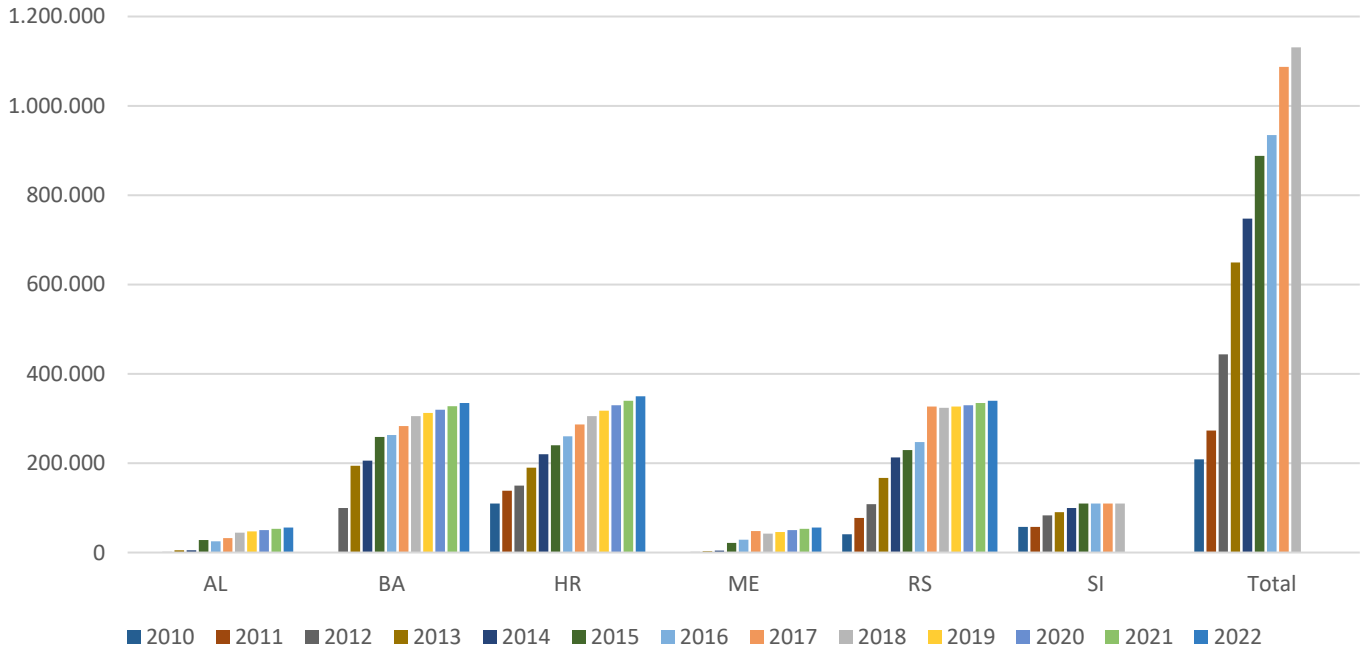
In 2018 the import of wood pellets decreased to some 64% in comparison to the previous year with the beginning of 2019 showing signs of market recovery.

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



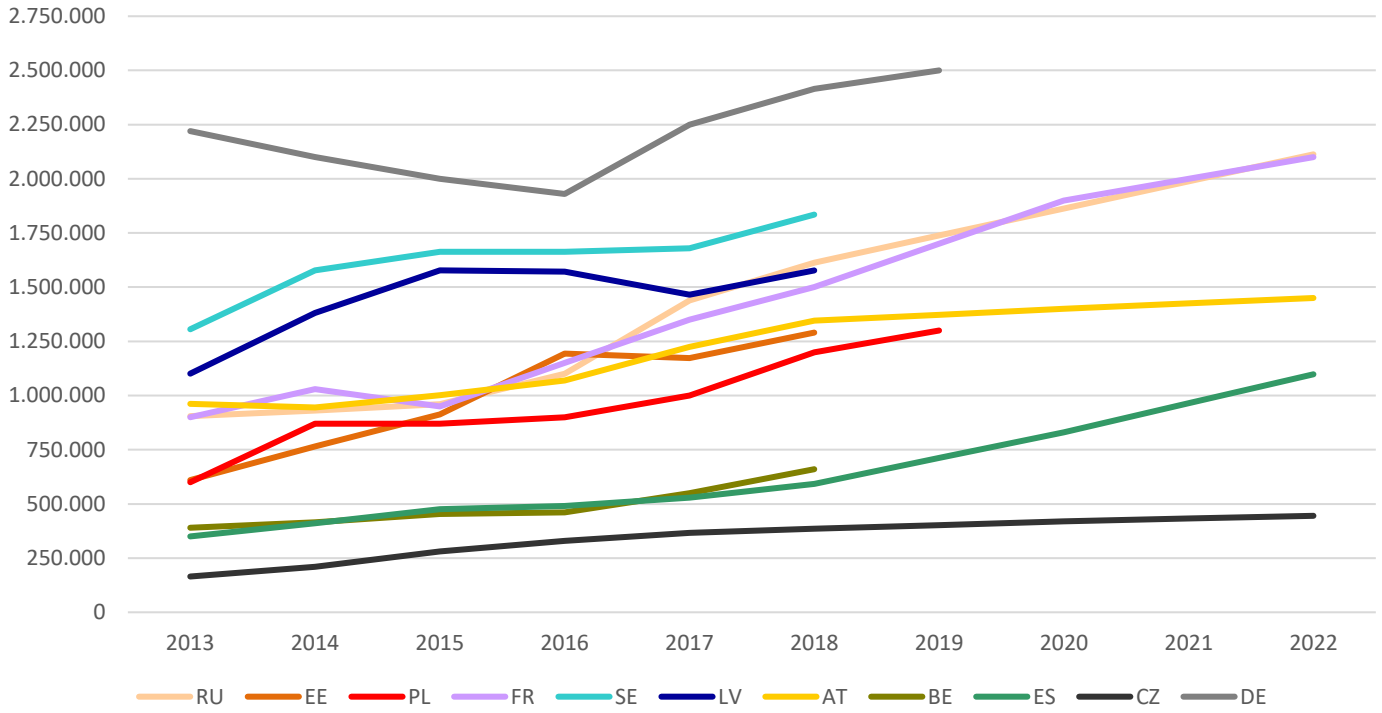
Source: EPC survey 2019

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



Source: EPC survey 2019

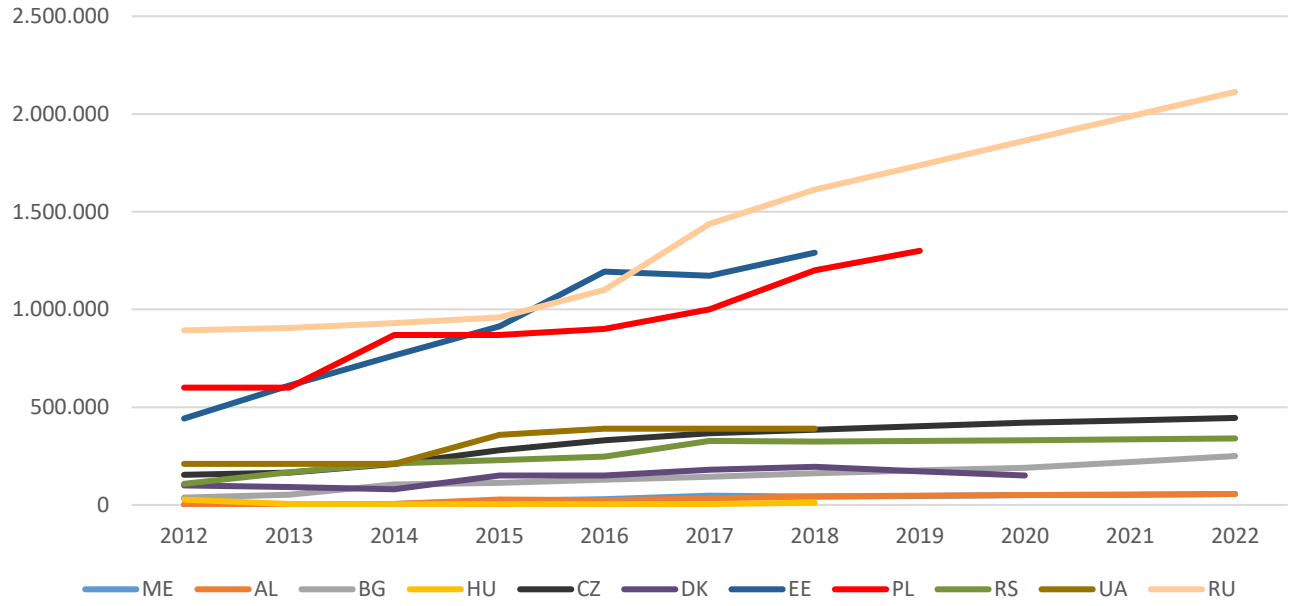
Figure 19 Wood Pellet Production Evolution of Europe's top 10 largest growing markets (in absolute terms) for pellet production (between 2013-2018) (tonnes)



The order of the legend is following the decreasing order of the absolute increase of production (in tonnes) between 2013 and 2018.

Source: EPC survey 2019; FAO

Figure 20 Wood Pellet Production Evolution of Europe's top 10 fastest growing markets (in relative terms) for pellet production (between 2013-2018) (tonnes)



The order of the legend is following the decreasing order of the relative increase of production between 2013 and 2018.

Source: EPC survey 2019; FAO

Table 7 European pellet production in 2018 compared to 2017

	2017			2018		
	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)	Number of operating production plants	Production capacity (tonnes)	Actual production (tonnes)
EU28	**707**	**22.860.771**	**15.401.127**	**719**	**23.352.903**	**16.879.382**
AT	43	1.600.000	1.225.000	42	1.630.000	1.345.000
BE	12	760.000	550.000	12	760.000	660.000
BG	56	285.000	144.000	59	302.000	162.000
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	26	450.000	366.000	28	480.000	385.000
DE	55	3.400.000	2.250.000	55	3.750.000	2.415.000
DK	5	300.000	180.000	5	300.000	195.000
EE	23	1.612.000	1.173.000	23	1.612.000	1.290.300
EL	18	130.000	35.000	24	135.000	40.000
ES	89	1.747.000	529.000	80	1.760.000	593.000
FI	29	630.000	324.000	28	630.000	385.000
FR	52	1.800.000	1.350.000	52	1.800.000	1.500.000
HR	18	352.000	287.000	21	370.000	305.000
HU	3	122.000	5.191	n.a.	n.a.	11.490
IE	1	40.000	28.100	1	40.000	30.600
IT	30	450.000	400.000	30	450.000	400.000
LT	17	400.000	350.000	19	480.000	400.000
LU	1	50.000	n.a.	1	50.000	n.a.
LV	27	1.950.000	1.466.000	27	1.950.000	1.577.100
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	4	350.000	264.300	4	350.000	290.000
PL	55	1.200.000	1.000.000	63	1.400.000	1.200.000
PT	23	1.159.000	700.000	26	1.300.000	782.906
RO	22	1.030.150	500.000	20	800.000	500.000
SE	64	2.300.000	1.678.929	64	2.300.000	1.834.736
SI	17	145.000	110.000	18	150.000	110.000
SK	10	250.000	150.000	11	250.000	160.000
UK	7	348.621	286.957	6	303.903	258.600
Other Europe	**538**	**3.555.000**	**3.005.933**	**547**	**3.578.000**	**3.222.889**
AL	10	45.000	32.000	11	52.000	44.200
BA	32	360.000	283.400	32	360.000	305.000
BY	0	0	220.000	0	0	220.000
CH	24	280.000	210.000	24	280.000	227.000
ME	7	65.000	48.000	7	65.000	42.400
NO	4	105.000	57.368	4	105.000	57.368
RS	61	525.000	327.165	69	541.000	324.086
RU	87	2.175.000	1.438.000	87	2.175.000	1.612.835
UA	313	n.a.	390.000	313	n.a.	390.000

Note: BY, HU, NO & UA: 2018 production is a replication of 2017.

Source: EPC survey 2019; FAO

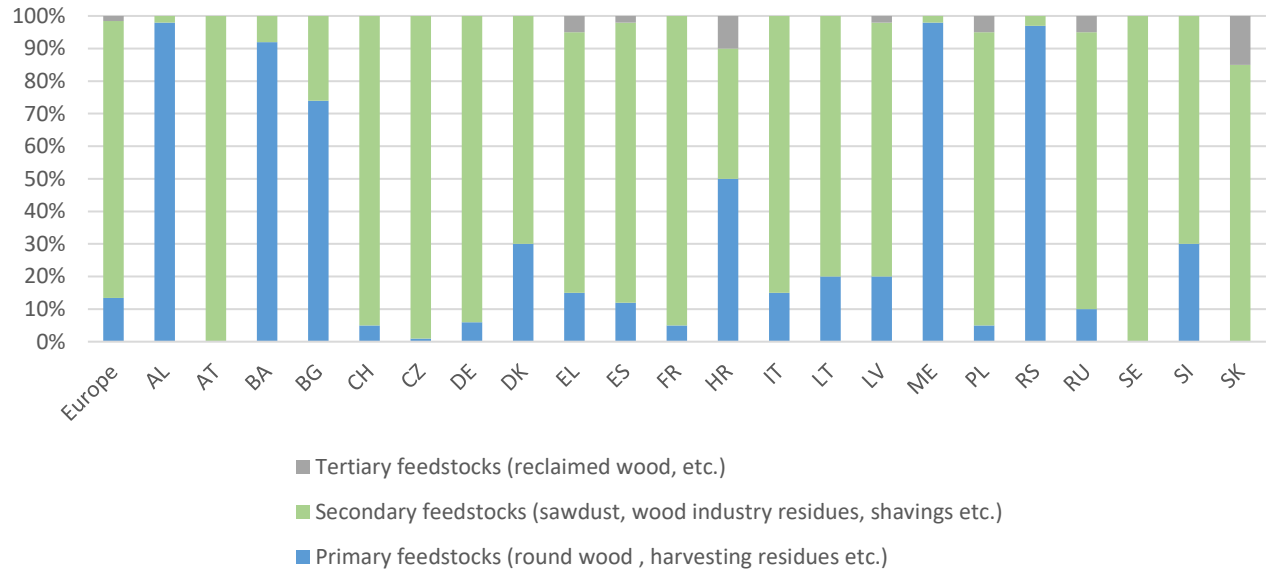
2.1.1 Qualitative analysis for European wood pellet production

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

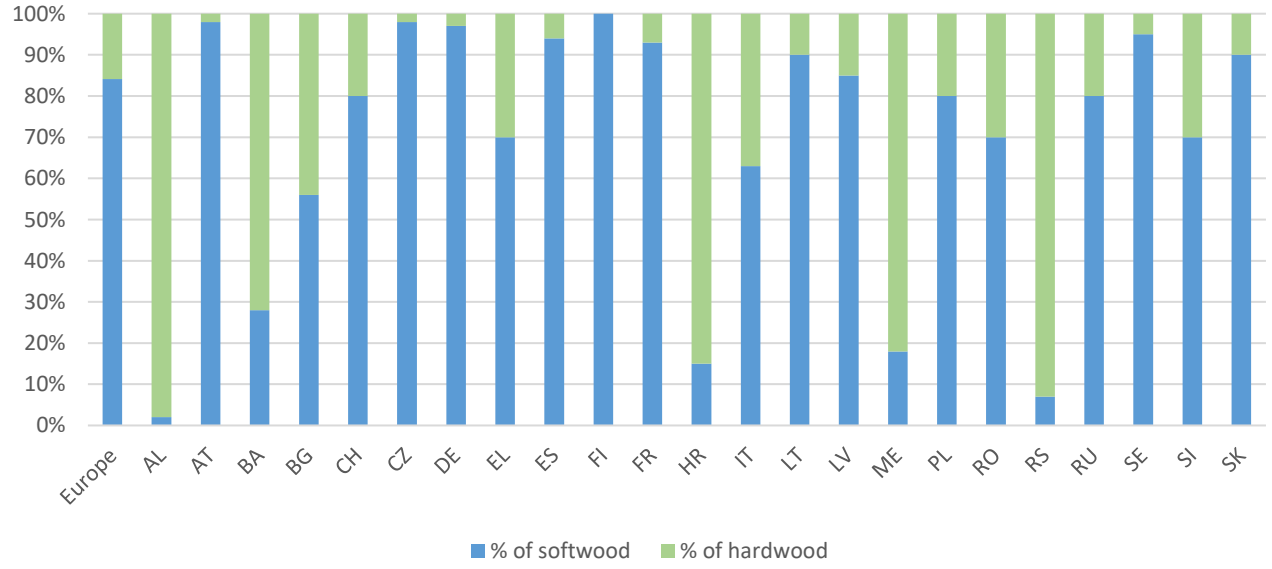
Figure 21 Estimate of the shares of raw materials used in local pellet production in Europe in 2018 (%)



Source: EPC survey 2019

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

Figure 22 Estimate of the shares of hardwood and softwood as raw material for local pellet production in Europe in 2018 (%)

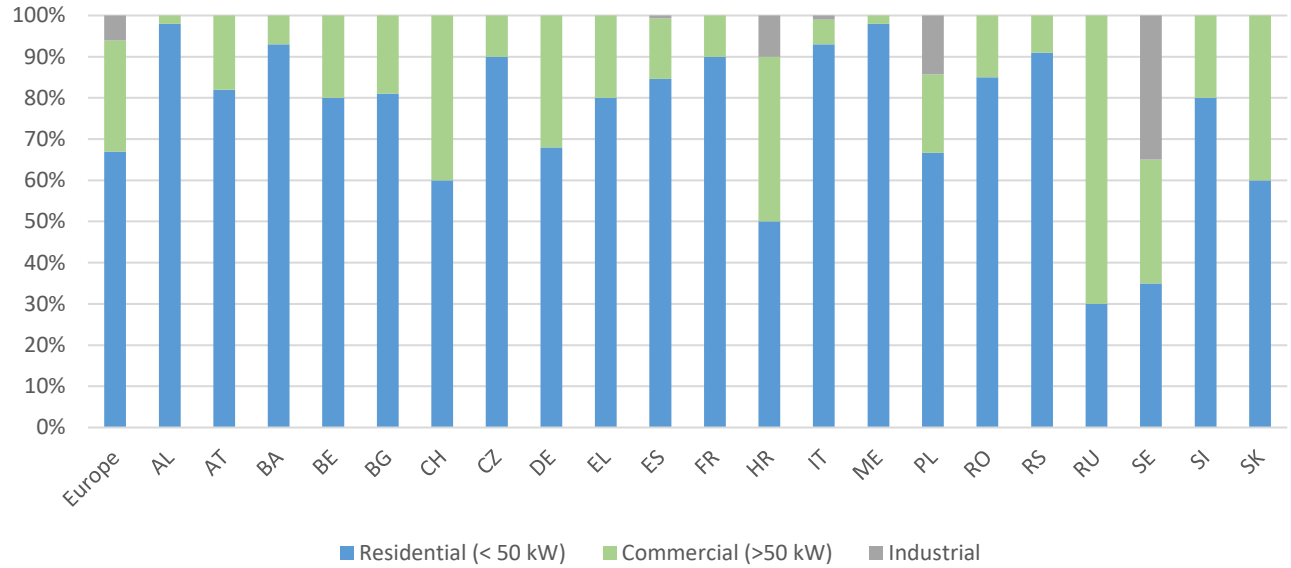


Source: EPC survey 2019

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

A consultation was carried out with our partners[2] 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 23 Estimate of European pellet producers' main markets by end-use in 2018 (%)



Source: EPC survey 2019

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

In 2018, European pellet production grew by 1,6 million tonnes while consumption increased by 2,1 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 (cf. table 8).

The lack of demand may remain a problem in some markets, such as those markets in Finland and or Sweden, where the other residential RES are competitive heating options and/or electricity registers low prices (Sweden).

Table 8 European pellet producers' perception of the main difficulties 2018 (1: least preoccupying to 5: most preoccupying)

	Lack of raw material	Price of raw material	Lack of demand	Competition with importers	Pellet stock management
AL	5	5	4	4	1
AT	1	2	1	3	2
BA	5	5	4	2	1
BG	2	5	3	4	2
CH	4	3	1	4	4
CZ	3	5	1	2	3
DE	3	4	1	2	2
DK	5	4	2	3	1
EL	5	4	2	4	2
ES	3	4	1	2	4
FI	2	0	4	2	1
FR	3	4	2	1	4
HR	5	4	4	3	5
IT	4	2	1	4	3
LT	1	5	1	4	1
LV	2	5	1	2	3
ME	5	5	3	1	1
PL	5	5	1	2	2
RO	4	5	0	0	2
RS	5	5	3	3	1
RU	3	3	1	1	2
SE	2	3	4	1	0
SI	4	5	1	4	2
SK	3	3	3	3	3
UK	4	5	2	3	3

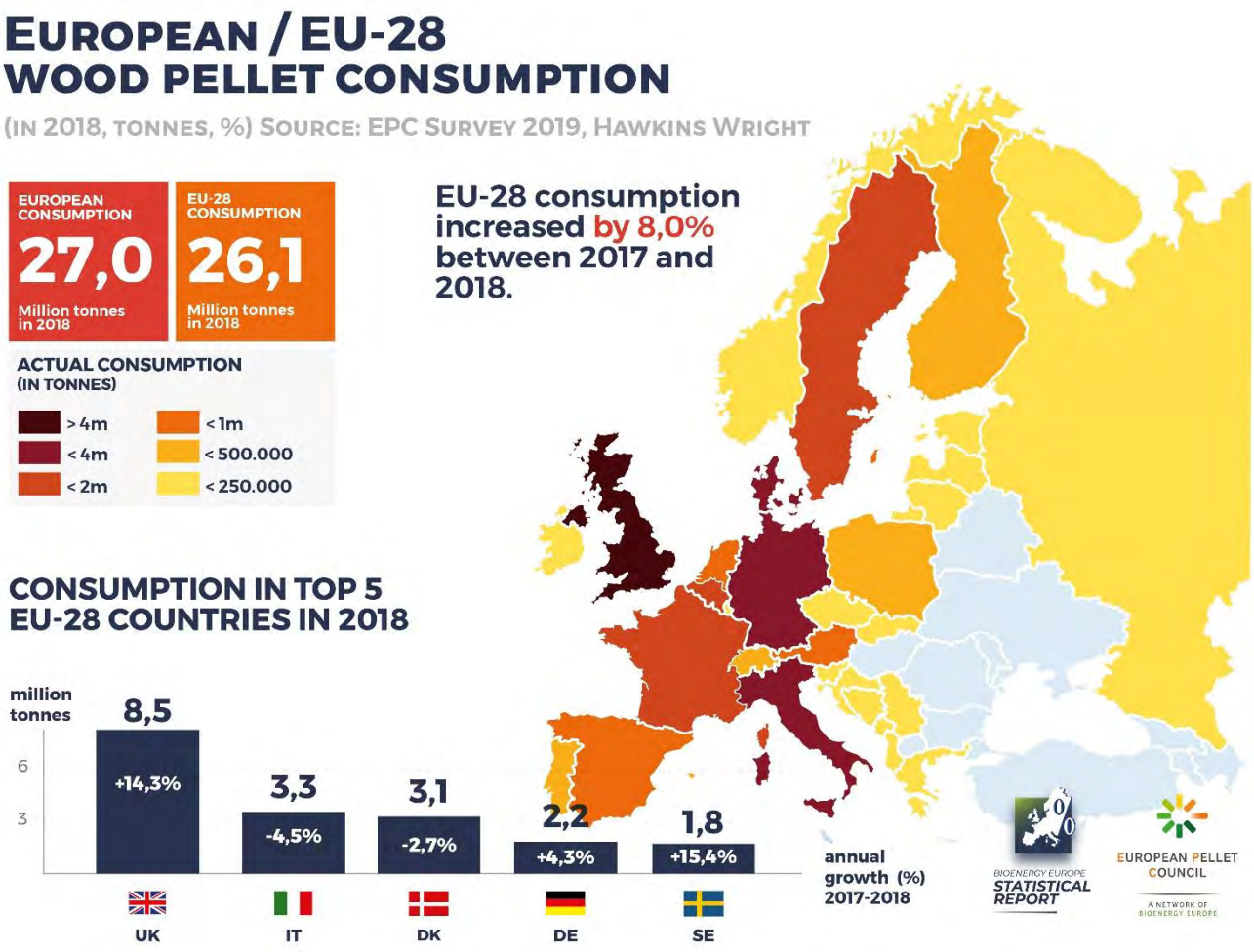
Note: Other difficulties perceived as one of the most difficult for SE: low prices for electricity.

Source: EPC survey 2019

2.2 European pellet consumption

2.2.1 Total European pellet consumption

Figure 24 Map of pellet consumption in Europe in 2018



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019, Hawkins Wright

In 2018, European pellet demand experienced an increase of 2,1 million tonnes in comparison to 2017, representing a growth of 8%, below the 11% growth that was observed in 2017 where the heating seasons 2016-2017 and 2017-2018 were colder than previous years in most EU countries.

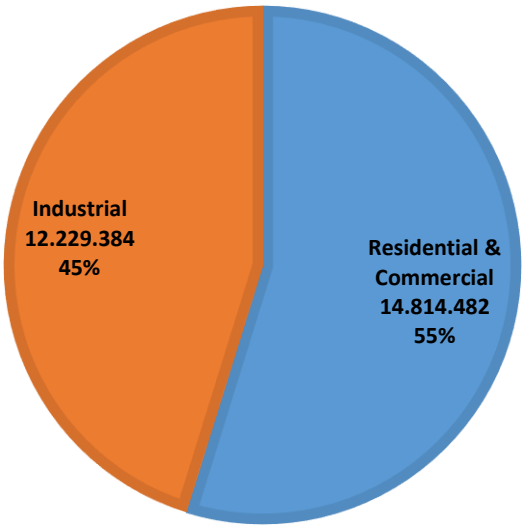
In 2018 the demand increased in both the residential/commercial sectors as well as the industrial markets, with a rise of around 5% and 13% respectively.

The industrial growth was responsible for 65% of the total pellet consumption increase (from 2017 to 2018) in Europe and it was almost exclusively (~92%) due to a consumption increase for power only in the United Kingdom (73,5% of the increase) as well as in the Netherlands (18,4% of the increase).

The residential/commercial market realised modest growth in most European countries in 2018 compared to 2017. This can be explained by two main (correlated) factors. Firstly, the 2017-2018 heating season showed a rather similar energy demand as for 2016-2017 in most European climate zones. Additionally, the 2018-2019 heating season has, however, witnessed a slow take off. Secondly, the heating appliance sales in Europe did not show a dramatic increase during that period. However, despite this, Sweden and France are highlighted as growing examples, as they have both registered the biggest increase (in absolute terms) in residential/commercial pellet consumption.

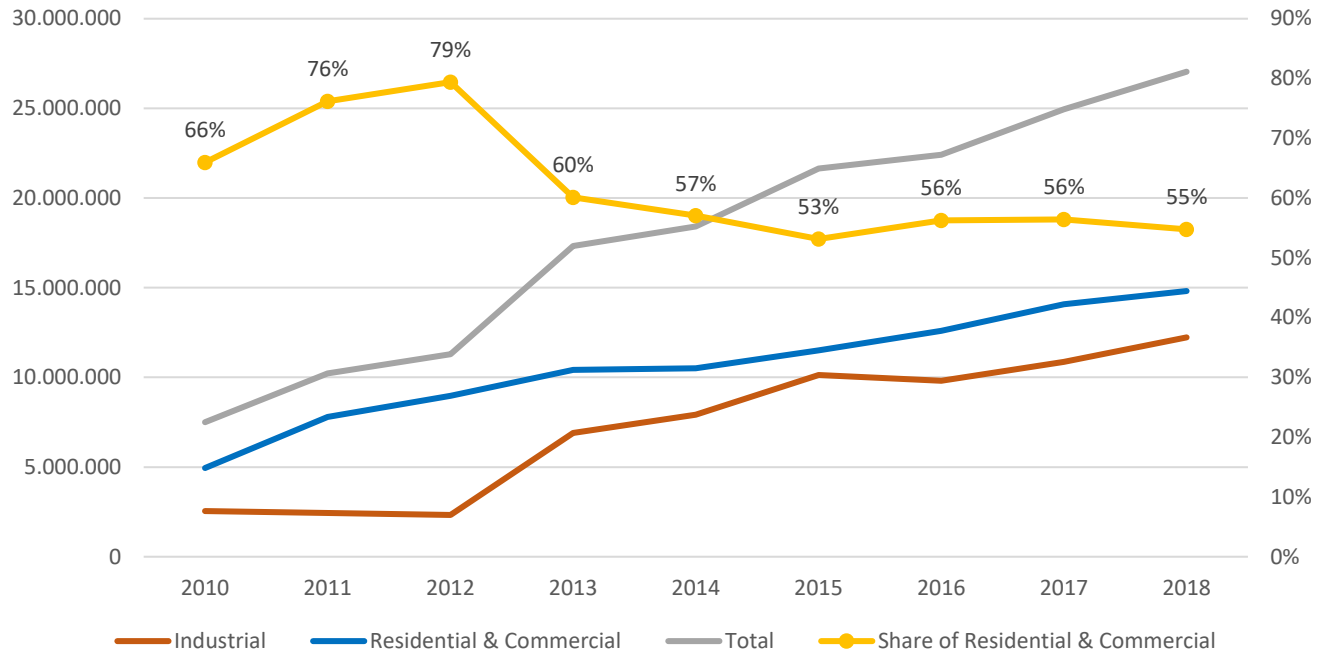
France will very likely show an even stronger growth in the coming year, thanks to the sustained sales of pellet appliances. Italy has experienced a small decrease of -4,5% of pellet use but it is still the biggest consumer of residential pellets in Europe. It must be noted that in 2018 Italy changed the methodology for collecting consumption data and as such the comparison with previous years in terms of statistical data is not as accurate.

Figure 25 European pellet consumption by type of end use in 2018 (tonnes and %)



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019, Hawkins Wright

Figure 26 Evolution of pellet consumption in Europe by type (tonne and %)



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019, Hawkins Wright

Fiona Matthews
Hawkins Wright
Associate Director (Bioenergy)

Market tightness: the latest trends on the European market

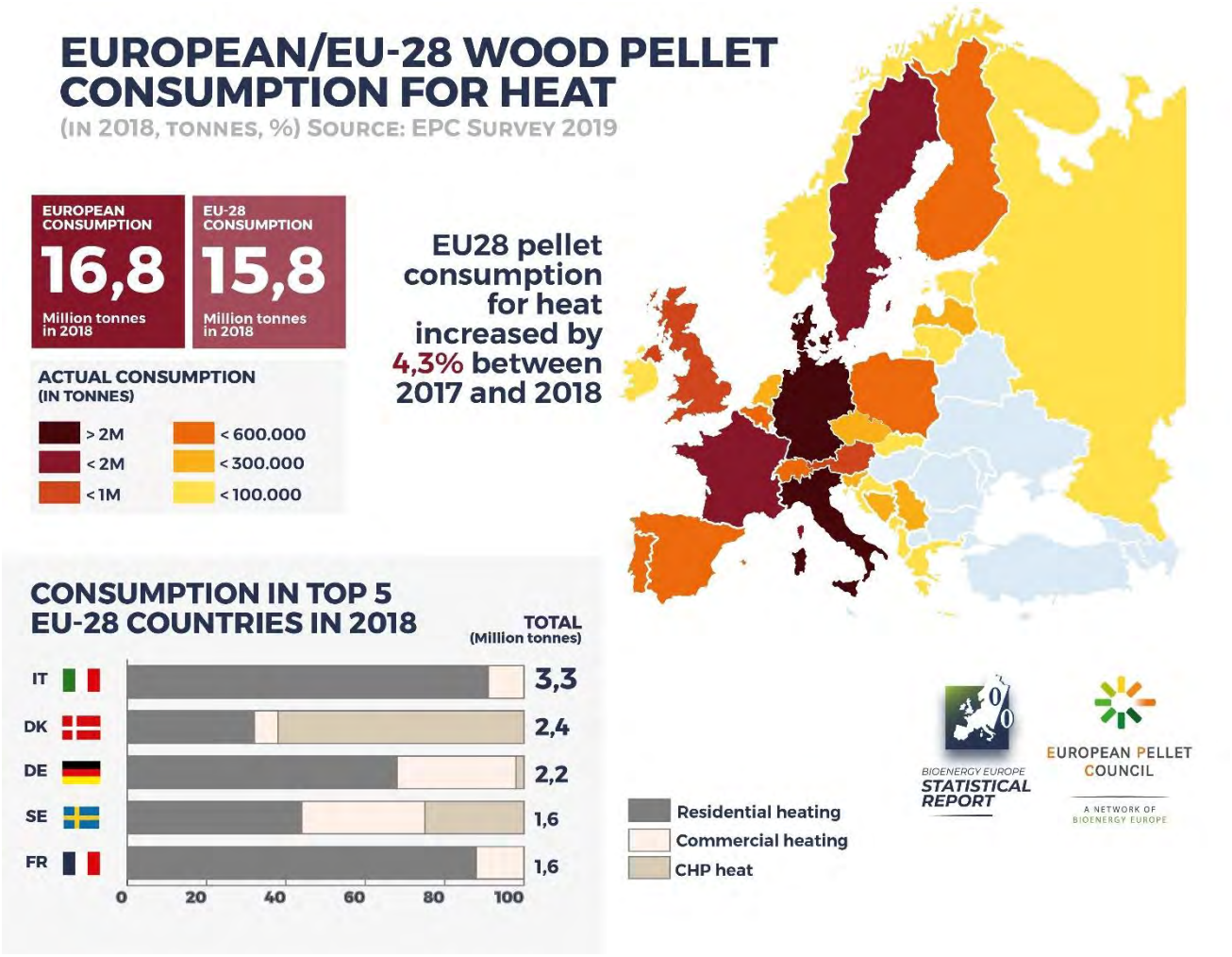
" The 2018/19 winter season was characterised by shortages in the supply of industrial pellets to Europe. Numerous utilities were unable to secure the volumes of pellets which they wished to purchase, and some were forced to reduce their operations or use coal instead. The situation was caused by a combination of operational problems at well-established pellet mills and a lack of investment in new pellet manufacturing capacity, which in recent years has failed to keep pace with demand growth.

However the European heating sector was protected from the shortages by its greater reliance on local supply, and the fact that suppliers had built up good stock levels ahead of the season. This meant that some surplus volumes were even available to sell into the industrial market, partly easing the shortages there. Heating pellet production volumes have reached record levels in important European markets in 2019, which should ensure that the premium sector is well supplied again through 2019/20.

As we approach the end of 2019 it seems that the supply issues in the industrial market may have been temporarily alleviated by technical issues at some key power plants. Consumption in 2019 has been lower than expected in both the UK and the Netherlands. Delays (of an unknown duration) in the construction of MGT's Teesside plant may also serve to rebalance supply-demand in 2020."

2.2.2 European pellet consumption for heating

Figure 27 Map of pellet consumption for heating in Europe in 2018

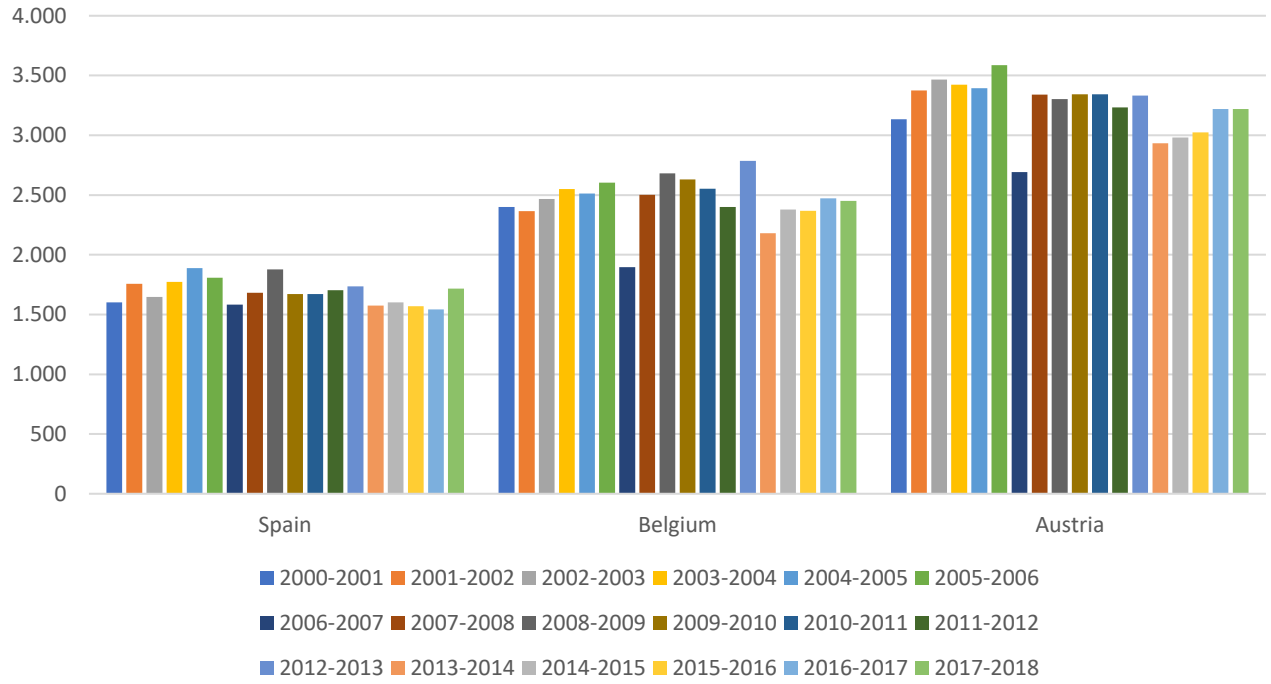


Note: Include residential, commercial and 2/3 of CHP consumption
Note 2: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019

The annual increase of the pellet demand in the residential/commercial sector was smaller in 2018 compared with that of 2017: +5% from 2017-2018 versus +12% from 2016-2017. It can be explained by the fact that 2017 has been a good year for pellet demand due to the relatively good heating season for period 2016-2017 and 2017-2018 in most EU regions (after three relatively disappointing heating seasons from 2013 to 2016). As the heating season 2018-2019 was slow to take off and that the year of comparison (2017) recorded a nice consumption, 2018 recorded a slightly lower growth in terms of annual consumption with this growth not being supported by tremendous sales of heating appliances.

Still, in 2018, the residential and commercial consumption increased by 739.196 tonnes. 75% of pellets used in these two segments are consumed by residential users. Commercial pellet demand grew at a faster rate (+7% in 2018) than the residential one (+5% in 2018). The opposite is true in absolute terms: +485.835 tonnes for residential use, +253.361 tonnes for commercial use.

Figure 28 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 28 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. Pellet market players then tried to organise themselves to prevent this situation from happening again 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 2018-2019 seems to be slightly milder than the previous one but still colder than the ones from 2013 to 2016 leading to a modest growth of the pellet consumption for heating.

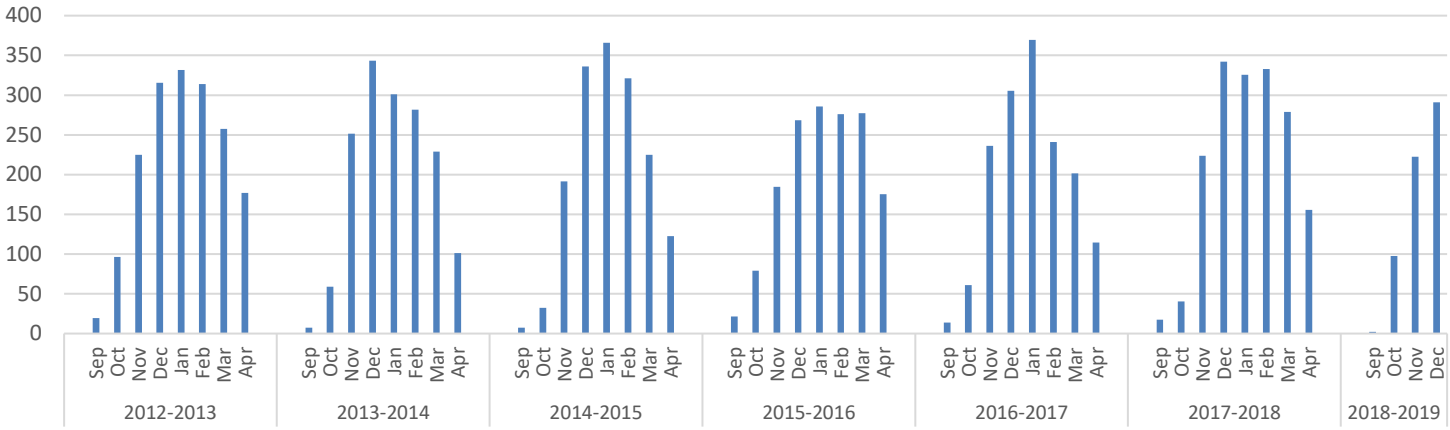
[3] Heating Degree Days (HDD) depict the severity of the cold in a specific time period taking into consideration outdoor temperature and average room temperature (in other words the need for heating). The calculation of HDD relies on the base temperature, defined as the lowest daily mean air temperature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

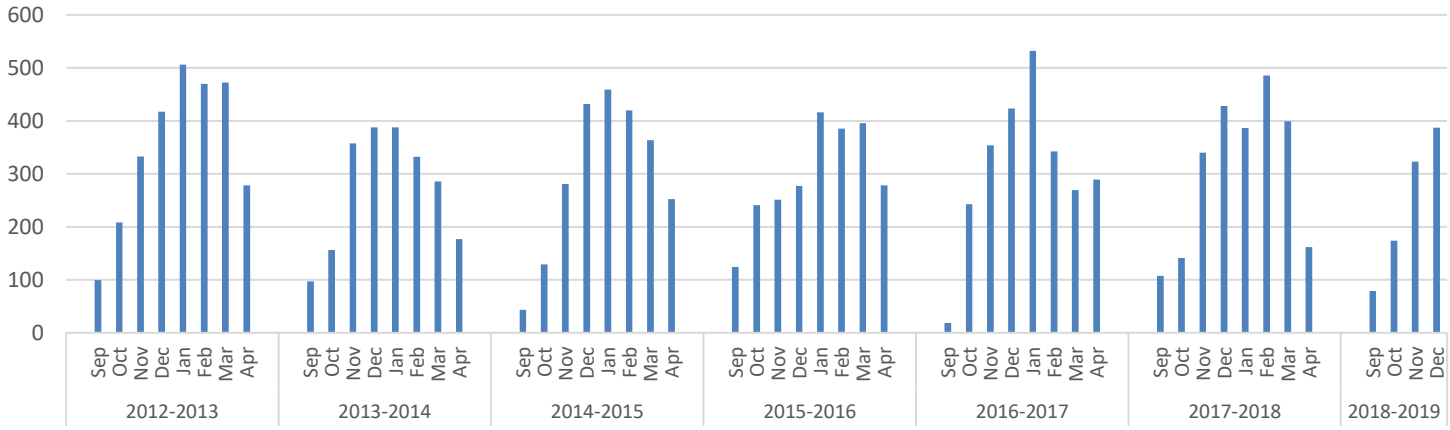
Examples: If the daily mean air temperature is 12°C, for that day the value of the HDD index is 6 (18°C-12°C). If the daily mean air temperature is 16°C, for that day the HDD index is 0. *Definition and explanations from Eurostat.*

Figure 29 Heating degree days for different heating seasons per months for three main EU climatic regions since 2012 (in HDD)*

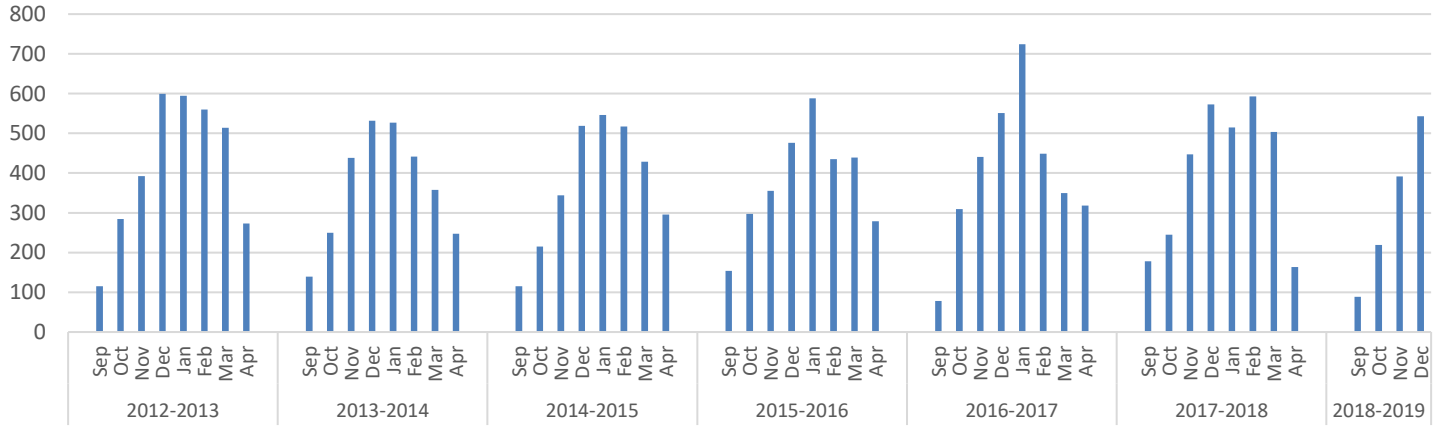
(a) HDD for Spain – Low heating needs region



(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

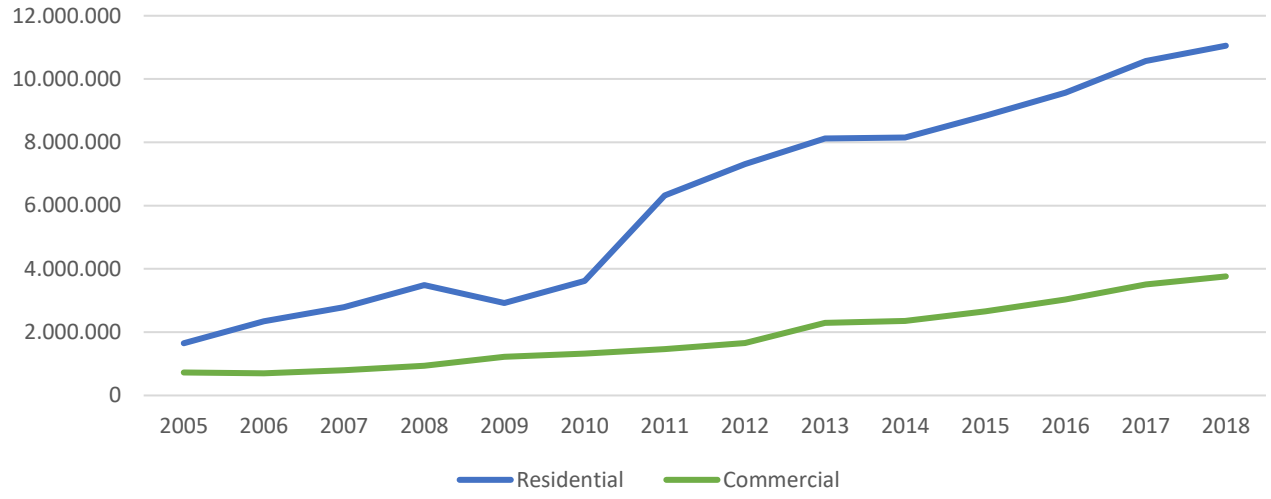
Table 9 European pellet consumption for heating in 2018 compared to 2017 (tonnes)

	2017				2018			
	Residential	Commercial	2/3 CHP	Total	Residential	Commercial	2/3 CHP	Total
EU28	**9.840.520**	**3.327.039**	**1.958.804**	**15.126.363**	**10.297.645**	**3.557.046**	**1.926.256**	**15.780.947**
AT	800.000	160.000	0	960.000	790.000	170.000	0	960.000
BE	346.500	8.800	13.333	368.633	381.150	9.680	13.333	404.163
BG	140.071	1.227	n.a.	n.a.	157.775	1.384	0	159.159
CY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CZ	65.000	32.000	0	97.000	68.000	34.000	0	102.000
DE	1.425.000	615.000	40.000	2.080.000	1.485.000	640.000	43.333	2.168.333
DK	800.000	160.000	1.466.667	2.426.667	800.000	150.000	1.416.667	2.366.667
EE	30.000	10.000	0	40.000	30.000	10.000	0	40.000
EL	73.000	15.000	0	88.000	75.000	15.000	0	90.000
ES	326.000	203.000	0	529.000	355.000	218.000	0	573.000
FI	62.000	247.000	42.667	351.667	62.000	351.000	15.333	428.333
FR	1.240.000	160.000	0	1.400.000	1.380.000	180.000	0	1.560.000
HR	19.000	9.000	0	28.000	22.000	11.000	0	33.000
HU	n.a.	n.a.	n.a.	n.a.	0	0	0	0
IE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
IT	3.150.000	300.000	0	3.450.000	3.042.749	253.256	n.a.	3.296.005
LT	47.500	12.500	n.a.	n.a.	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	129.000	9.000	0	138.000	129.000	9.000	0	138.000
MT	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
NL	60.000	130.000	0	190.000	70.000	150.000	0	220.000
PL	233.000	50.000	20.000	303.000	280.000	60.000	20.000	360.000
PT	100.000	150.000	0	250.000	160.000	150.000	0	310.000
RO	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
SE	538.849	455.212	356.071	1.350.132	691.774	482.834	392.845	1.567.453
SI	95.000	40.000	6.667	141.667	98.000	37.000	10.000	145.000
SK	40.000	30.000	0	70.000	40.000	30.000	0	70.000
UK	120.600	529.300	13.400	663.300	132.697	582.392	14.744	729.833
Other Europe	**726.441**	**181.286**	**0**	**907.727**	**755.151**	**204.640**	**20.000**	**979.791**
AL	27.700	2.800	0	30.500	26.200	3.300	0	29.500
BA	169.090	23.000	0	192.090	188.340	34.200	0	222.540
BY	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
CH	185.250	99.750	0	285.000	198.250	106.750	0	305.000
ME	10.200	1.550	0	11.750	18.200	2.200	0	20.400
NO	46.180	24.866	0	71.046	46.180	24.866	0	71.046
RS	277.521	4.820	0	282.341	232.481	8.824	0	241.305
RU	10.500	24.500	0	35.000	45.500	24.500	20.000	90.000
UA	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

Note: EE, LT & NO: 2018 consumption is a replication of 2017.

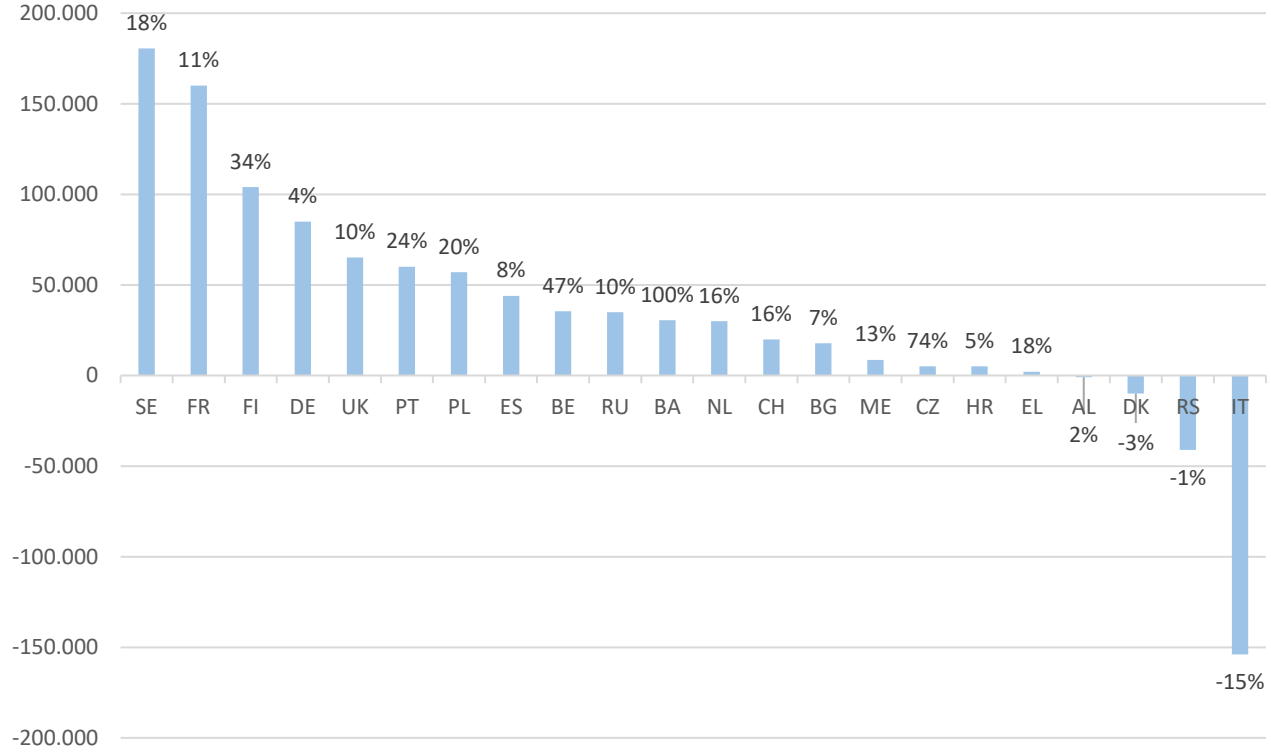
Source: EPC survey 2019

Figure 30 Evolution of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP (tonnes)



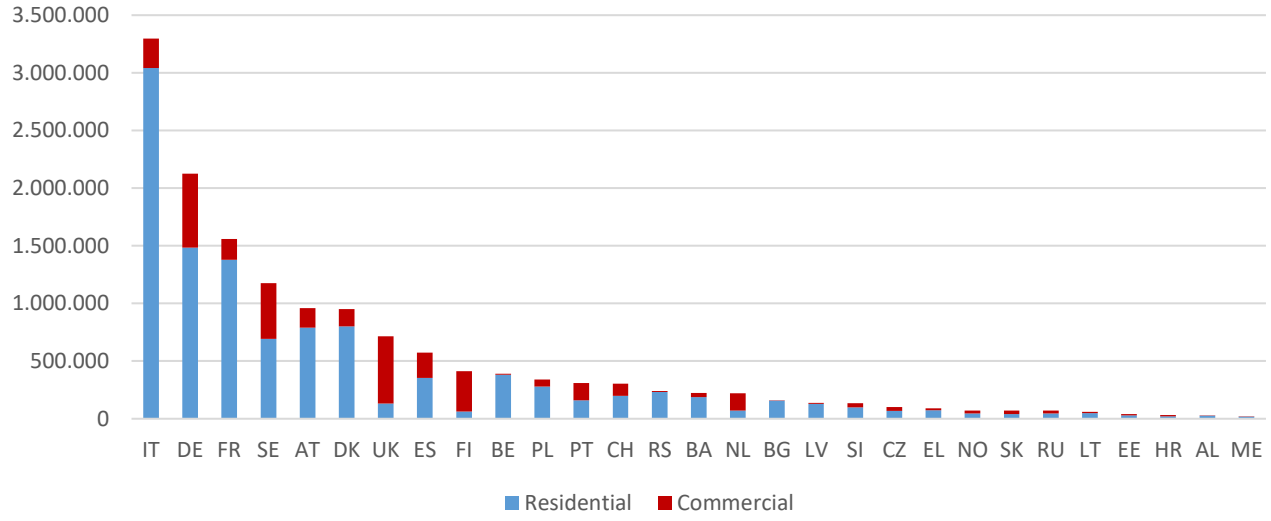
Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019

Figure 31 Growth of European pellet consumption for residential (<50kW) and commercial (>50kW) heat excluding CHP by countries between 2017-2018 (tonnes & %)



Source: EPC survey 2019

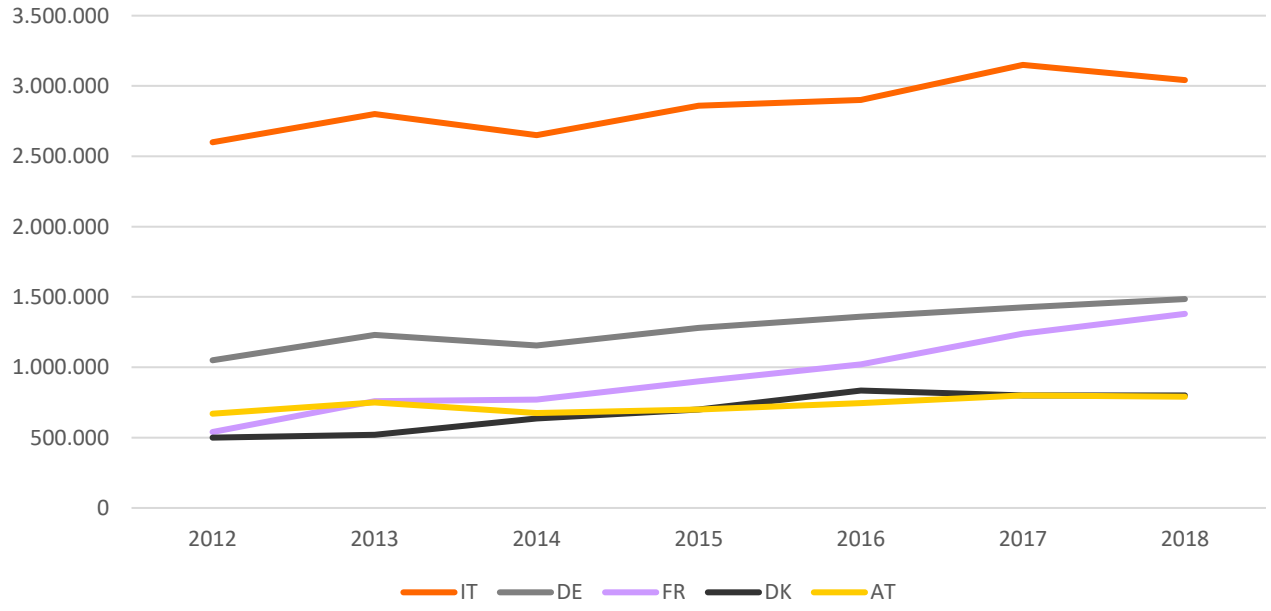
Figure 32 European pellet consumption for residential (< 50kW) and commercial (> 50kW) heat in 2018 (tonnes)



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019

2.2.2.1 RESIDENTIAL PELLET CONSUMPTION

Figure 33 Evolution of Europe's top 5 countries for residential (<50kW) pellet consumption in Europe (tonnes)



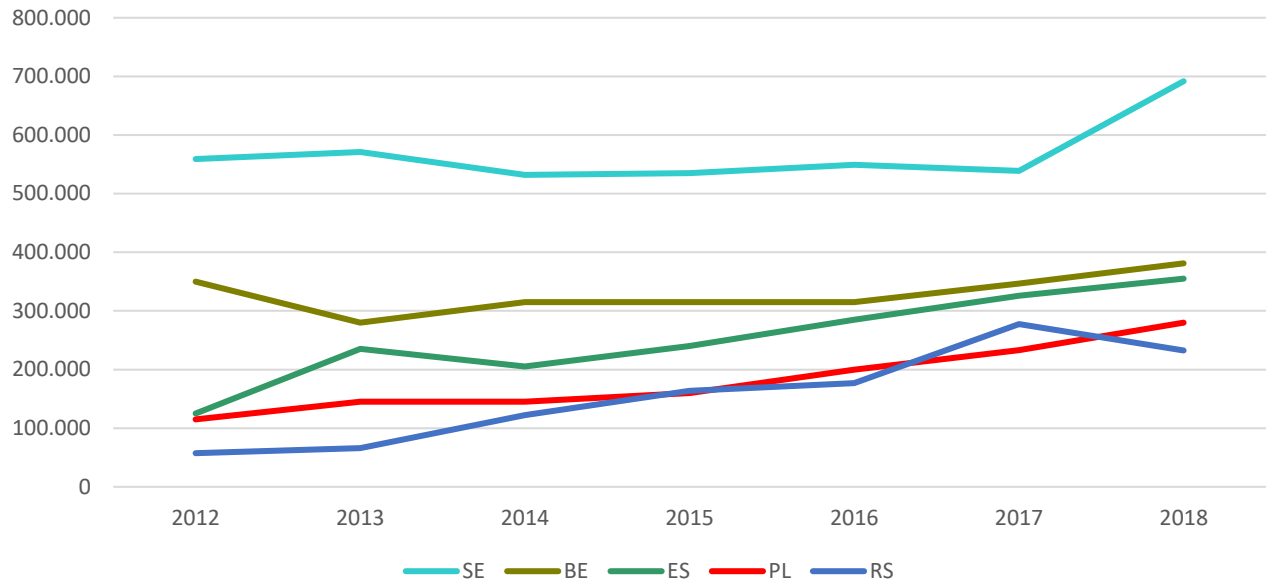
Source: EPC survey 2019

Austria: A very small decrease of the pellet consumption within the residential sector (-1,25%) was observed in 2018, it could be related to the climate slightly milder in the heating season 2017-2018.

France: The country's consumption of pellets resulted in an 11% increase with an additional 160.000 tonnes from 2017 to 2018, with residential consumption being responsible for 87,5% of this growth.

Italy: In 2018 Italy altered the methodology for collecting consumption data and therefore the comparison with previous years is not as accurate. The decrease in pellet consumption in 2018 could also be linked with the milder winter 2018-2019 than the previous one.

Figure 34 Evolution of Europe's top 6-10 countries for residential (<50kW) pellet consumption in Europe (tonnes)

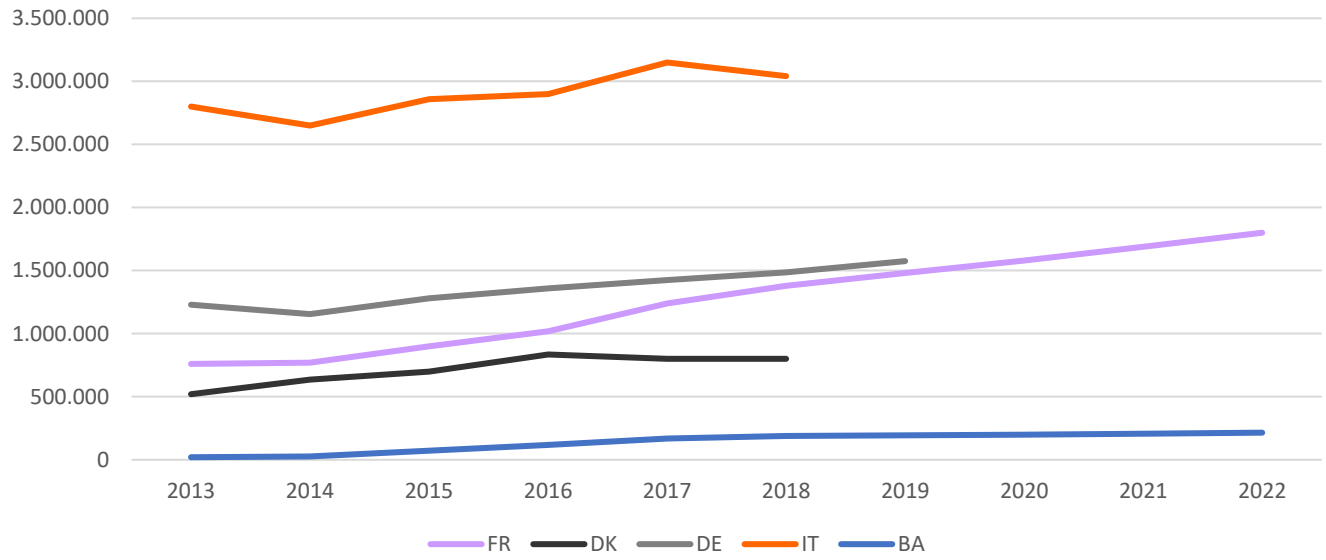


Source: EPC survey 2019

Poland: Consumption of pellets in Poland has grown since 2014. Government subsidies drove an increase in new appliances, which in turn precipitated an increase in pellet consumption. The effect of these subsidies should continue to be felt for years to come.

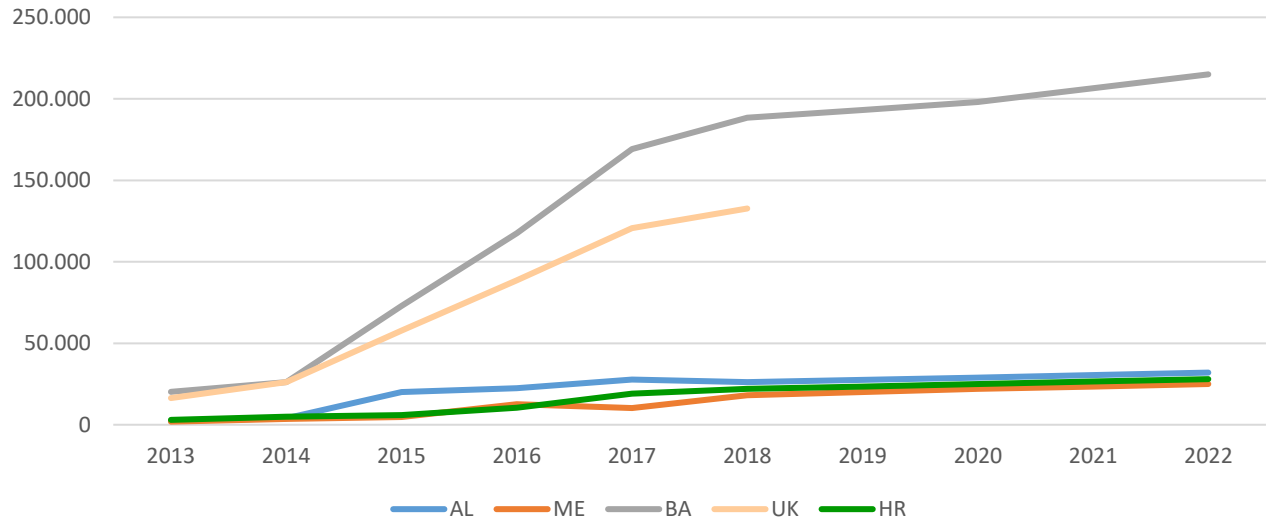
Spain: In Spain consumption increased, roughly matching domestic production levels. The demand was bigger than in the previous year mainly due to the number of new installations and to what could be referred to as a standard winter 2018-2019 (this despite a couple of weeks which saw a reduced demand due to the high temperatures in February 2019). There were some stock tensions at the beginning of the season (December – January 2018) but with the rise in temperature during February the tension was reduced. Consumption is still expected to rise over the course of next year as a result of the appliance installation trend in conjunction with a support scheme for heating devices that was foreseen for April 2019 (however the delay in the formation of the government caused a delay in the approval).

Figure 35 Evolution of Europe's top 5 largest growing markets (between 2013-2018 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 2018.
Source: EPC survey 2019

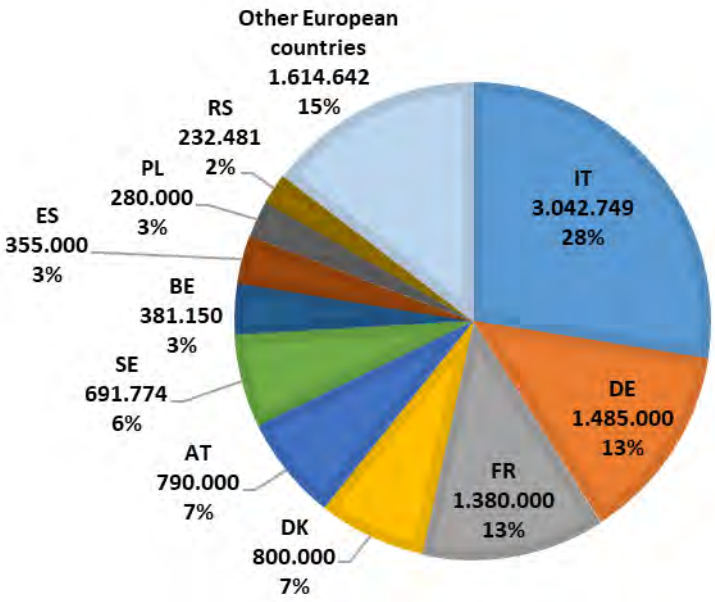
Figure 36 Evolution of Europe's top 5 fastest growing markets (between 2013-2018 in relative terms) residential (<50kW) pellet consumption in Europe (tonnes)



Note: the order of the legend is following the decreasing order of the absolute increase of production (in tonnes) between 2013 and 2018.
Source: EPC survey 2019

The Balkans countries constitute a net exporting region, but they have displayed an increasing strength in their domestic markets being driven by the residential pellet consumption. This may disturb their role as suppliers of the EU28 in the future.

Figure 37 Share of European residential (<50kW) pellet consumption by country in 2018 (tonnes)



Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019

Matteo Favero, PhD

AIEL - Italian Agroforestry Energy Association

ENplus® and ariaPulita® certification specialist

The Italian situation

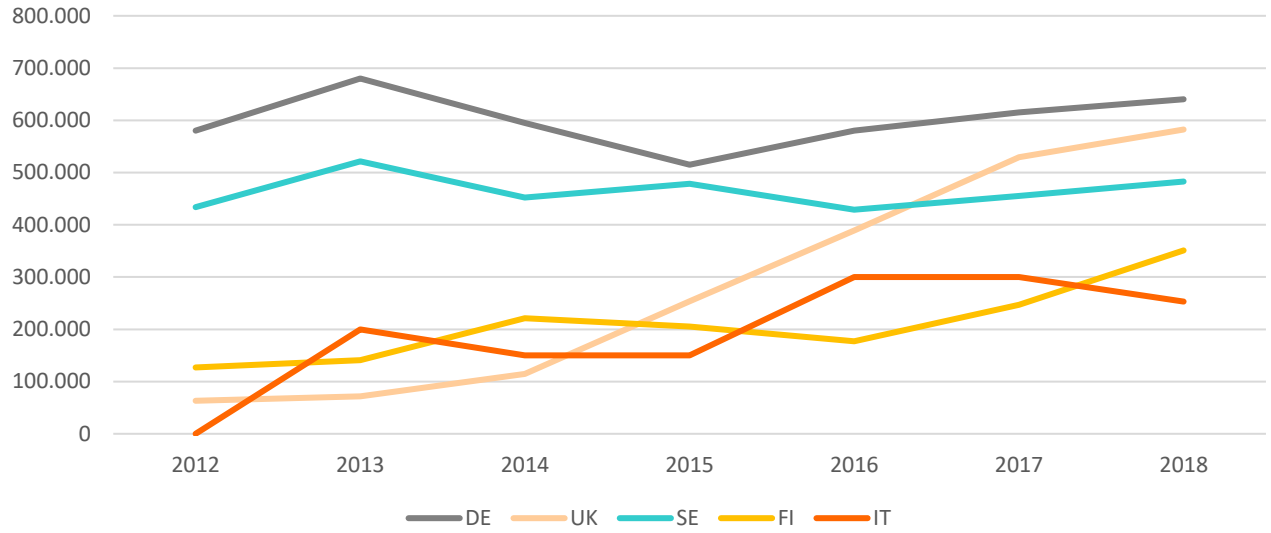
"AIEL systematically collects sale figures of Italian stove and boiler manufacturers, analysing them on a bi-monthly basis. The associated Companies account for more than 70% of the Italian market of pellet stoves (incl. inserts and kitchens, excl. boilers). In 2019, domestic sale patterns revealed progressively decreasing trends, shifting from 49.570 units sold in 2018 (January-June) to 41.357 appliances this year (January-June). It's not easy to outline comprehensive and unambiguous reason(s) behind these figures. Recently, Italy experienced warm winters, and unusual wintery springs could not fully counterbalance them because of both market dynamics (main sale season) and consumers' purchase behaviours. On the other side, sales dramatically concentrate during the winter cold spikes (severe but generally short), causing some difficulties to the traditional business models.

Several policy actions targeting the air quality issue, as well as related media campaigns, also contributed to reduce market sales, either influencing consumers and/or calling some manufacturers to focus more on quality products rather than maximizing quantities. Additionally, the national Energy Services Management Body (GSE) began verifying more carefully the rightful implementation of relevant incentive schemes such as "Conto Termico", then rejecting many received applications.

These patterns also mirror pellet market dynamics, with no shortages currently predicted – nor predictable, and declining prices. Last year a chilly spring partially mitigated a negative winter season; pellet consumption slightly declined, but it should be noted that some changes occurred in the way data are gathered and analysed. So, all eyes are on the next winter season, as it could imprint a turning point to the market – either positive or negative. The Italian domestic market needs to overall reorganize itself in order to recovery to the skyrocketing figures experienced in the past; it's a challenging and stimulating path, definitely worth being covered together. "

2.2.2.2 COMMERCIAL PELLET CONSUMPTION

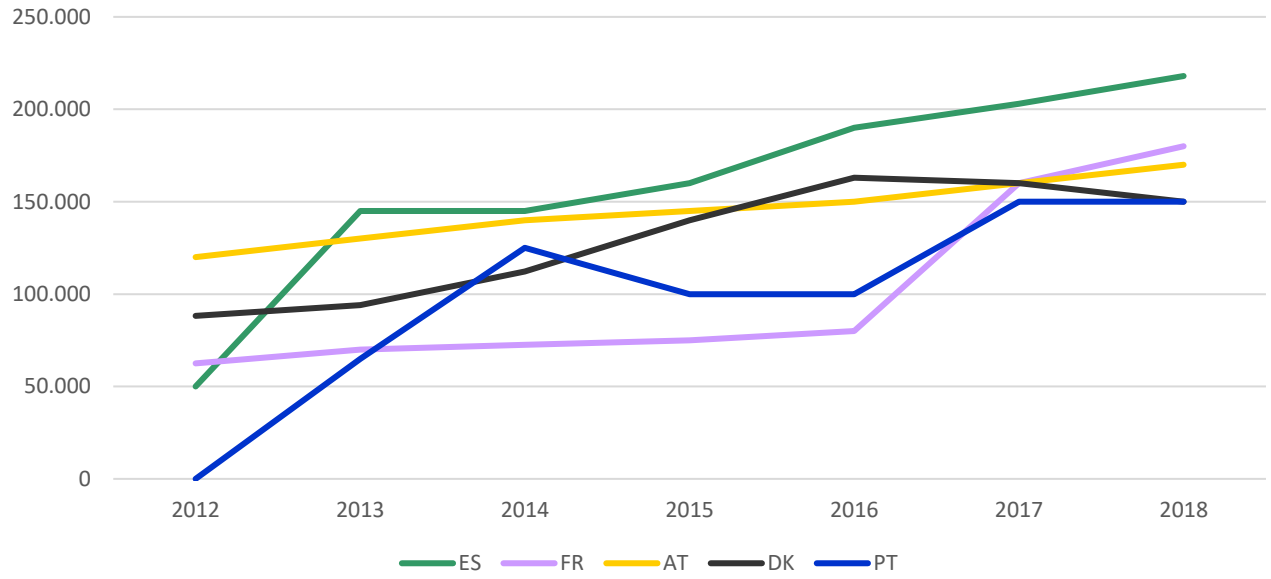
Figure 38 Evolution of Europe's top 5 countries commercial (>50kW) pellet consumption in EU (tonnes)



Source: EPC survey 2019

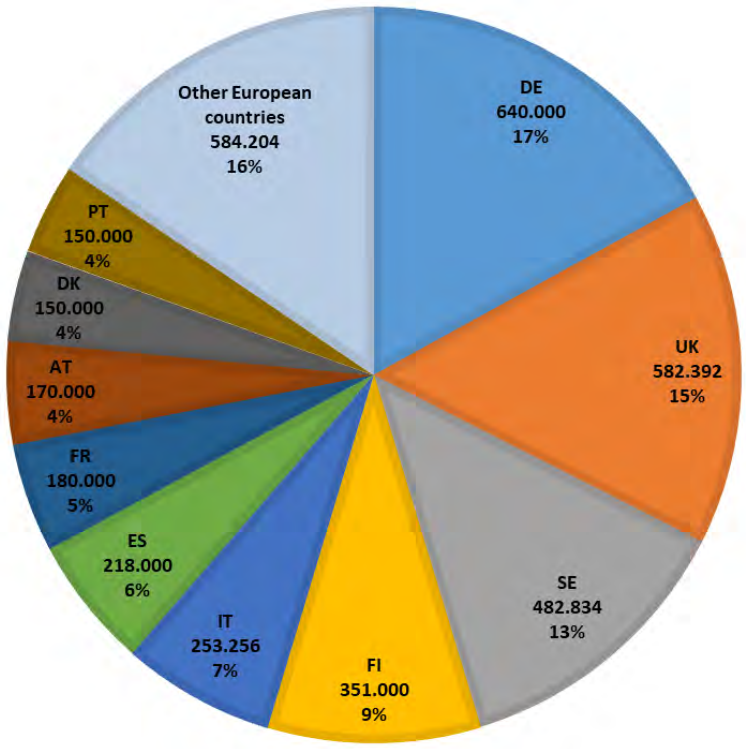
Finland: Pellet consumption is expected to continually rise in the coming years with several 100.000 tonnes due to mid to large scale energy plants. Domestic pellet production will cover a good part of the additional demand, yet further imports will probably also be needed.

Figure 39 Evolution of Europe's top 6-10 countries commercial (>50kW) pellet consumption in EU (tonnes)



Source: EPC survey 2019

Figure 40 Share of European commercial (>50kW) pellet consumption by country in 2018 (tonnes)

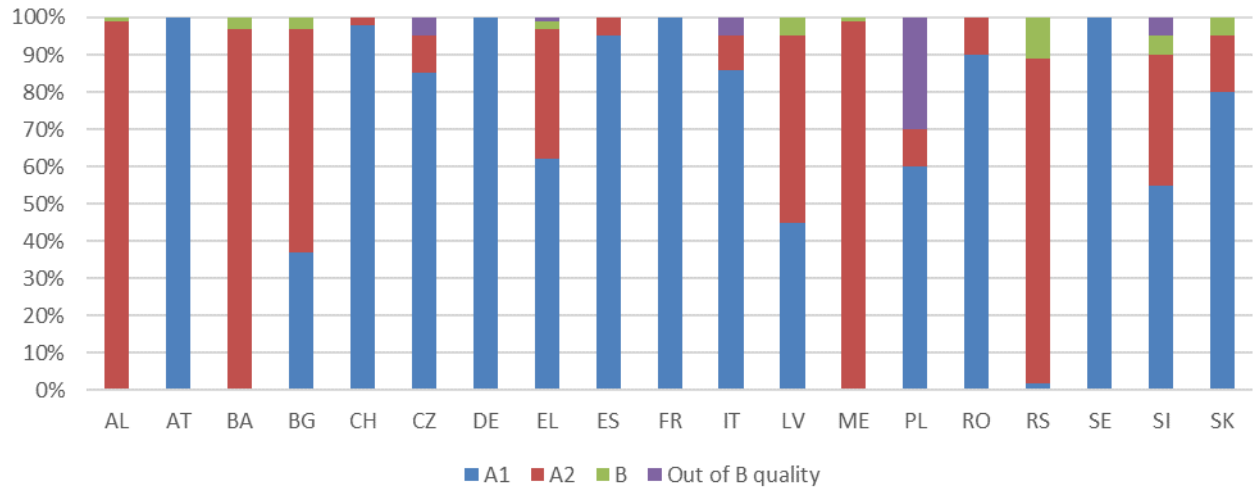


Note: EE, LT & NO: 2018 consumption is a replication of 2017.
Source: EPC survey 2019

2.2.2.3 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 41 and 42 below). The consultation demonstrated that while some countries are mainly or even exclusively using premium quality, both for the residential and commercial markets, many other countries use lower quality pellets in the commercial sector with some countries even using lower quality pellets in the residential market.

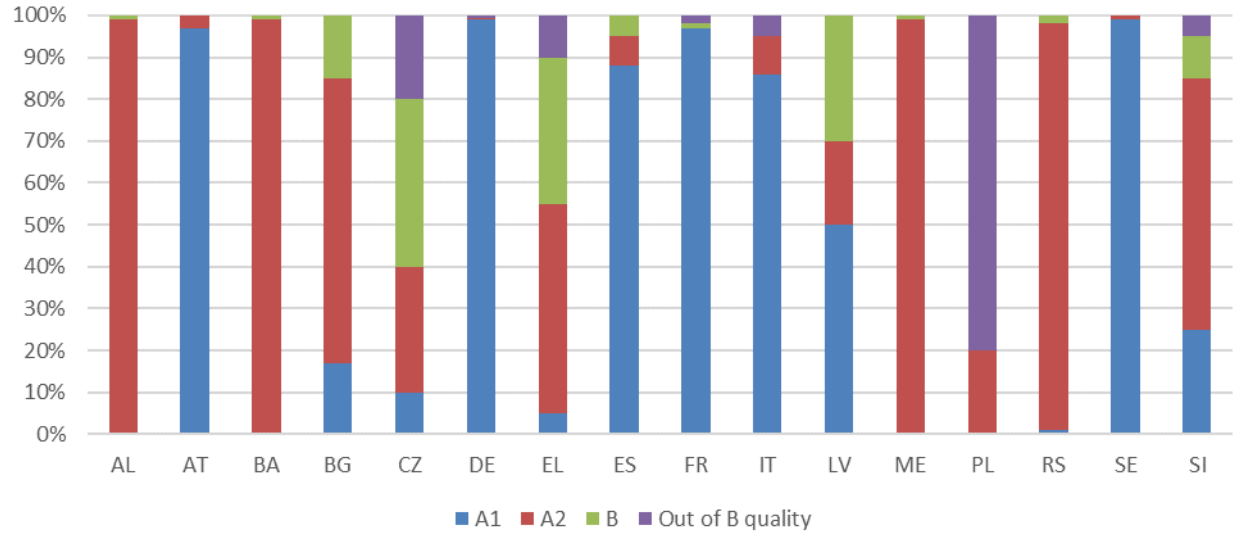
Figure 41 Estimate of pellet quality class shares for residential heat market in European countries in 2018(%)



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

Source: EPC survey 2019

Figure 42 Estimate of pellet quality class shares for commercial heat market in European countries in 2018 (%)

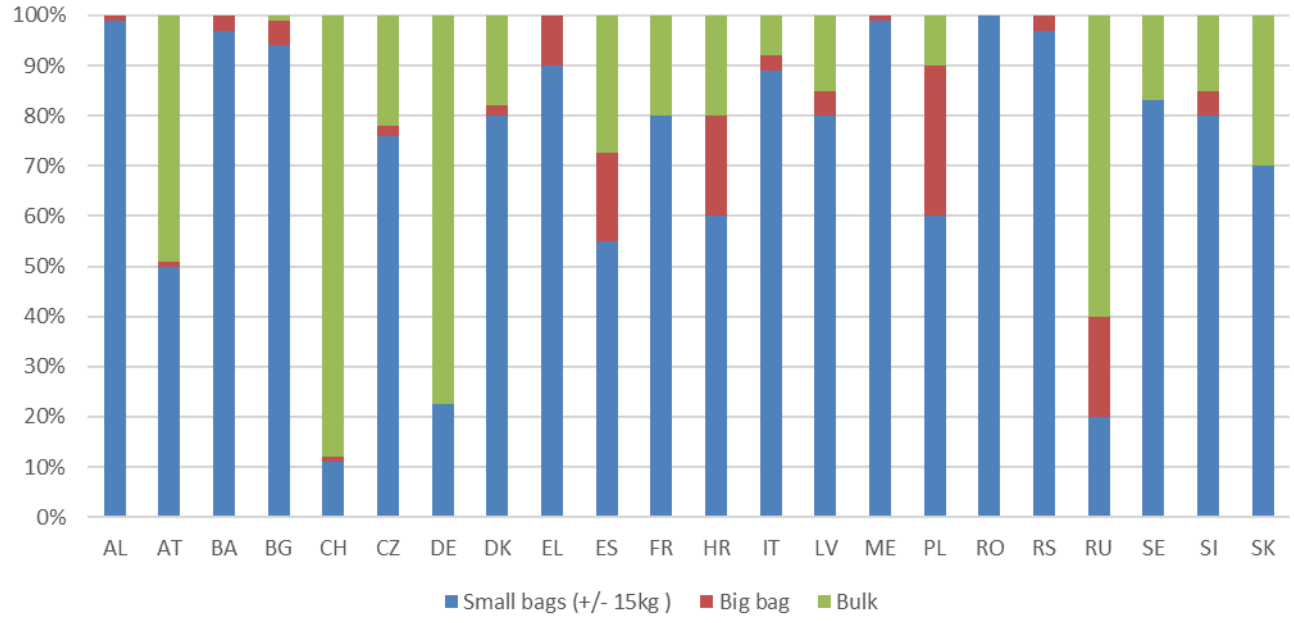


Source: EPC survey 2019

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 43 Forms of delivery used in the residential heat market in European countries in 2018 (%)

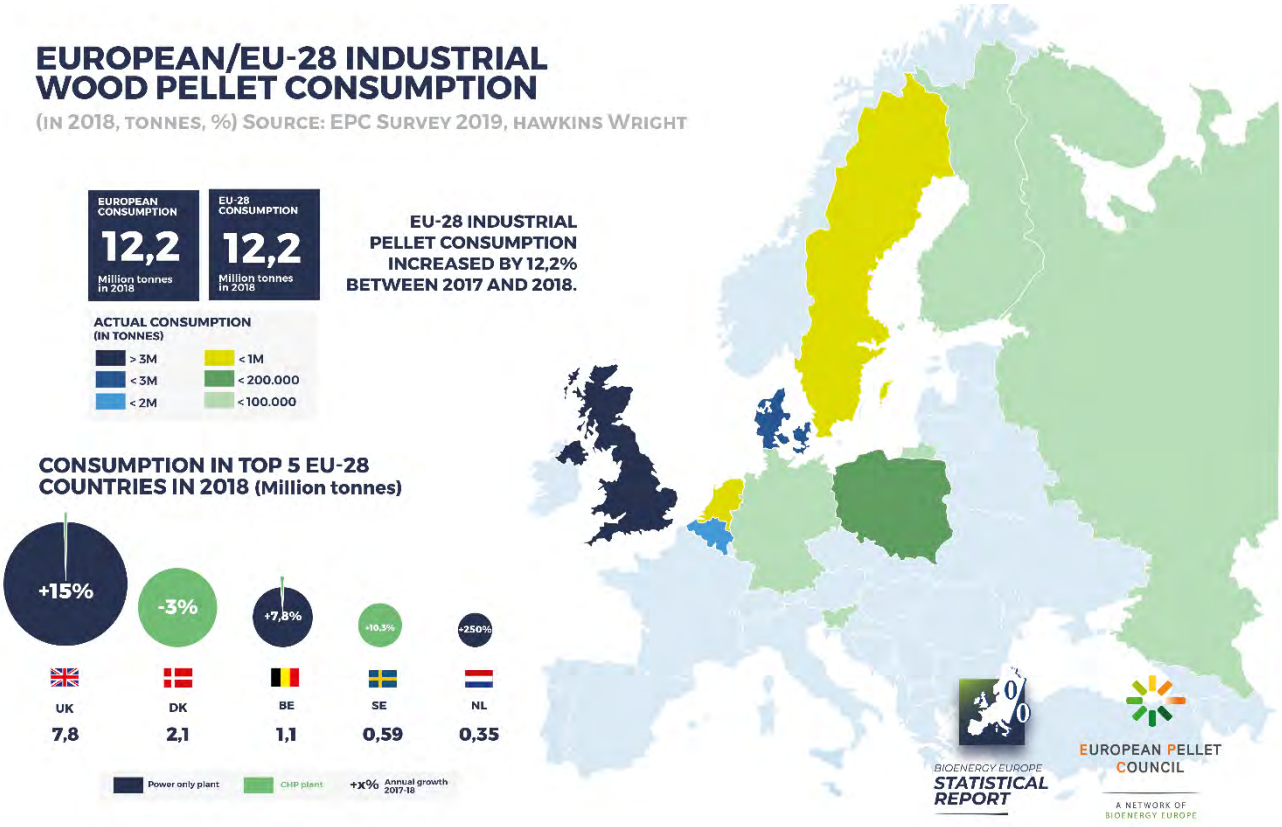


Source: EPC survey 2019

2.2.3 European industrial pellet consumption

Europe's installed industrial wood-fired power capacity rose throughout 2018. And further developments will put the market balance to the test again this winter. Europe will enter the winter period with even more biomass-fired power capacity. *Comments from April Poore- Argus Media acting editor.*

Figure 44 European map of industrial pellet consumption in 2018



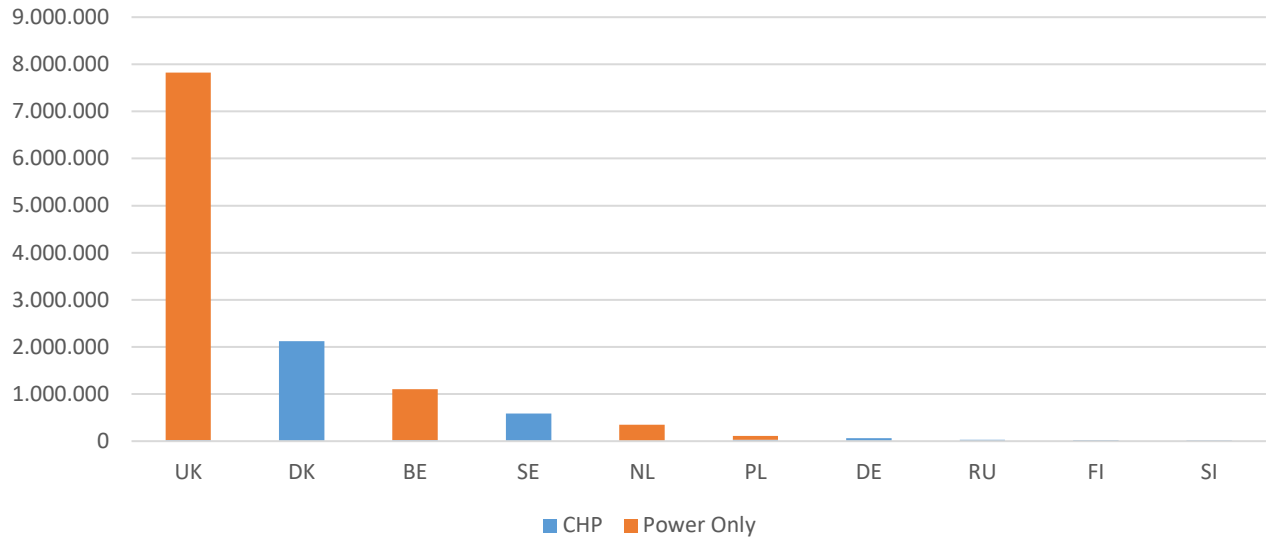
Source: EPC survey 2019, Hawkins Wright

The Netherlands: Demand growth will stem from the Netherlands, where a handful of coal-fired plants are in the commissioning stages of wood pellet co-firing. Uniper's 1.1GW Maasvlakte (MPP3) plant — where co-firing has been delayed until September 2019 — Engie's 731MW Rotterdam plant and RWE's 777MW Eemshaven A and B units are all expected to begin commercial co-firing of 10-15% later this year. And RWE's 630MW Amer 9 plant continues to ramp up to 80% wood pellet co-firing in 2020, having reached 50% this March. *Comments from April Poore- Argus Media acting editor.*

Poland: A new power plant in Elbląg (200.000 tonnes/year) was built and started operating in October 2018.

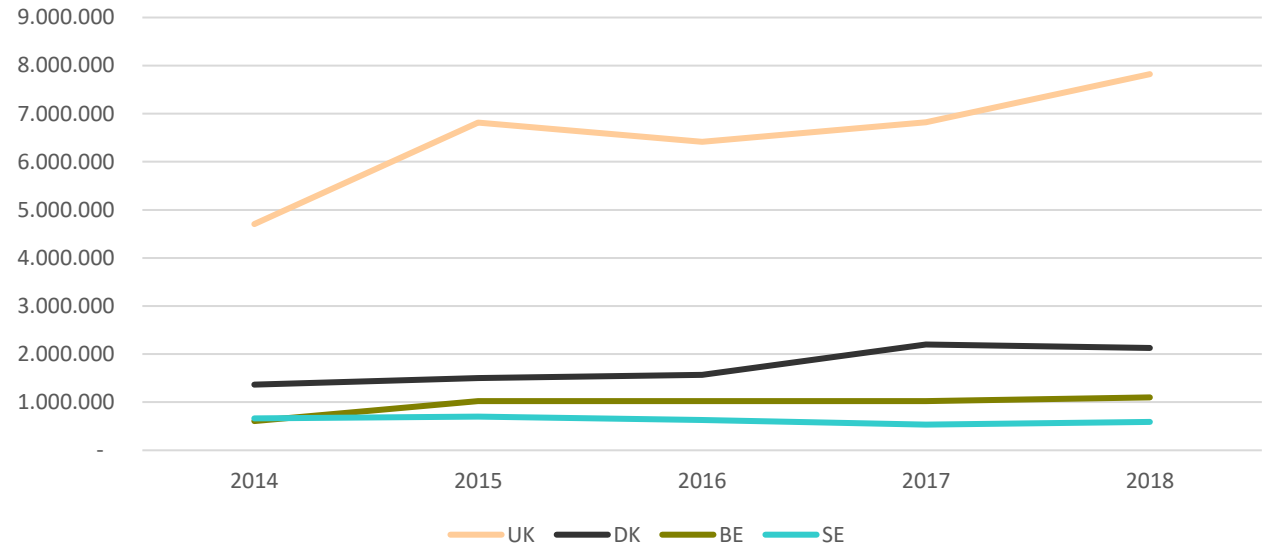
United-Kingdom: A fourth Drax unit (645MW peak-load) and Czech utility EPH's 396MW Lynemouth plant were converted to biomass (wood pellets) in 2018 and other power plants that were to be put online, e.g. MGT Power's Teesside 299MW dedicated biomass combined heat and power plant is due to come online in 2020. *Information from April Poore- Argus Media acting editor.*

Figure 45 European industrial pellet consumption by country in 2018 (tonnes)



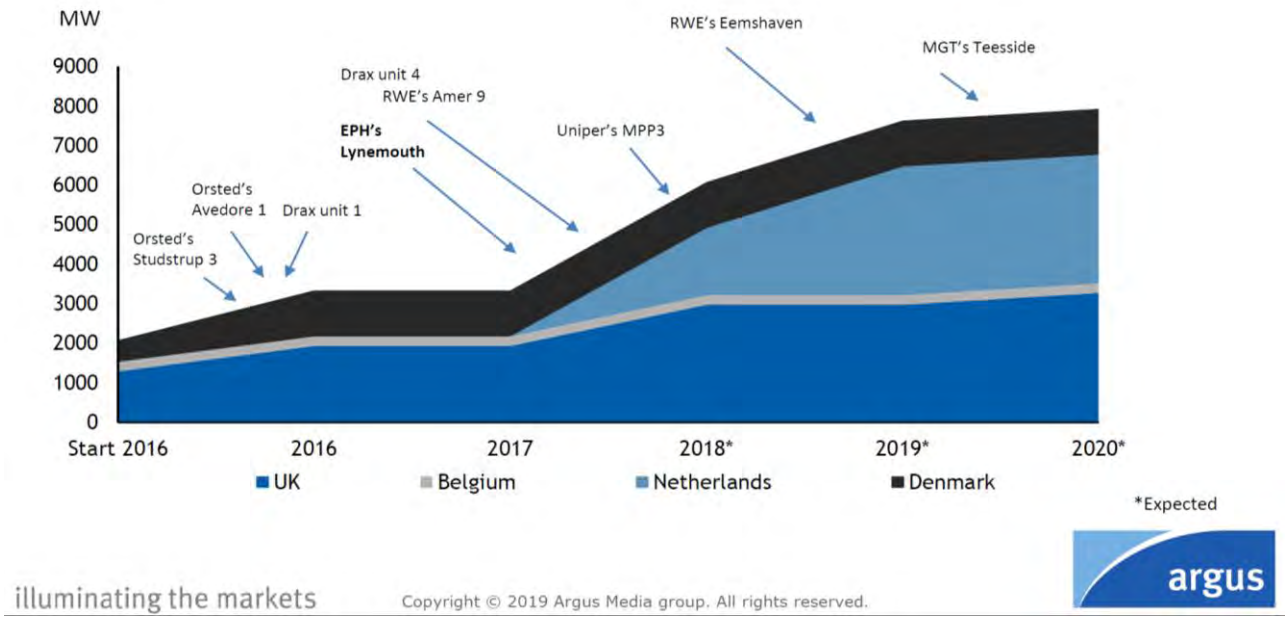
Source: EPC survey 2019, Hawkins Wright

Figure 46 Evolution of industrial pellet consumption of Europe's biggest consumers (tonnes)



Source: EPC survey 2019, Hawkins Wright

Figure 47 European wood pellet power plant capacity growth



Robert Seehawer
European Energy Exchange AG
Senior Business Developer

Will Germany be the next big user of industrial wood pellets in Europe?

"If you look at the fundamentals, you could easily come to the conclusion that Germany must surely be the next big user of industrial pellets in Europe. Firstly, Germany has a huge operational hard coal/ lignite power plant fleet which could convert to biomass quickly. Secondly, the German energy transition has nearly come to a standstill in the recent years. The national climate targets for CO_2 emission reduction in 2020 (a 40% decrease of CO_2 emissions compared to 1990) will not be met. Germany is one of the biggest users of coal in the EU with a hard coal/ lignite capacity of more than 42 GW in 2018 with the German power production amounting to around 40% of coal as fossil fuel in the same period. In addition, the nuclear phase-out until 2022, with a shutdown of 9.5 GW capacity will put additional pressure on the transmission grid through missing baseload power production. Last but not least, Germany's climate targets for 2030 (55% reduction of CO_2 emissions compared to 1990) are very ambitious considering the limited success of the "Energiewende" so far. How does Germany want to meet all these challenges without a bigger use of biomass?

Obviously, a huge drop in CO_2 emissions will happen once the coal phase-out is completed. Current planning reveals it will be done in several steps with the capacity aim of 30 GW (15 GW hard coal/ 15 GW lignite) by 2022. A further reduction to 17 GW (9 GW lignite/ 8 GW hard coal) will follow by 2030. The complete coal phase-out is due to be completed by 2038 with the option to prepone to 2035. "A substitution of coal with natural gas can only be a part of the solution" is the most often heard step forward currently. Natural gas as a storable commodity fits through its flexible usage perfectly into the power market requirements, but in the end, it is still a fossil fuel. Germany has to put more emphasis on power and heat from renewable energy sources and overcome obstacles on expanding all RE-capacities. For example, the targeted offshore wind capacity extension to 20 GW by 2030 is slowed down by the required transmission grid extension. On-shore wind capacity growth is limited due to tougher allowance policies. Indeed, just a few days ago, the German government lifted the solar capacity extension cap fixed at 52 GW. Unfortunately, this cap has been an obstacle over the most recent years with an installed solar capacity of more than 45 GW in 2019.

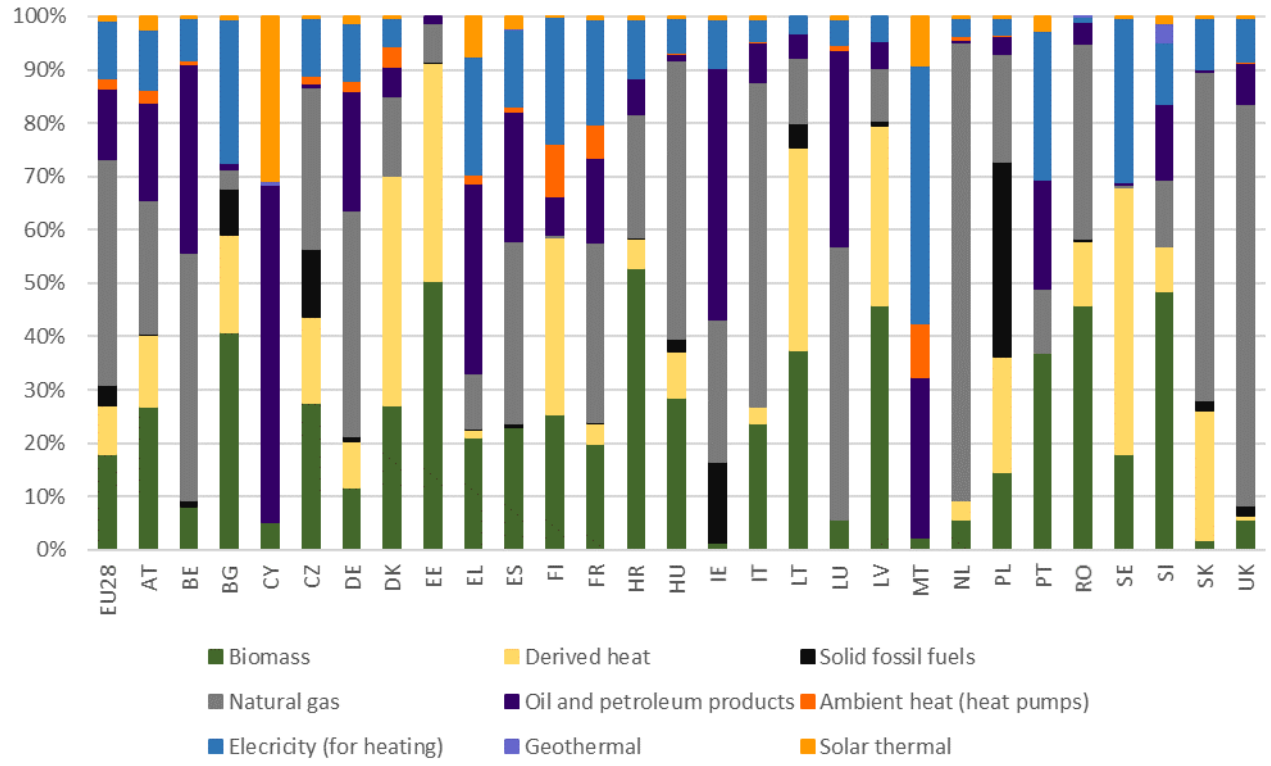
The power and heat market must be dominated by renewables to create a successful energy transition in Germany. The political will and the underlying social mandate are there. However, the instruction – Germans like plans and agendas – the "how to do it" is still missing and may not even be available in the near future. It is widely agreed by industry and analysts that solid biomass is most efficiently used in combined heat and power (CHP) plants. When in winter, heat is required, and Germany still uses predominantly fossil fuels. Less than 14 % of the energy used for heating came from renewables (of which 86 % is provided by biomass) in 2018. That shows the huge upside potential for renewables. We also know that wind and solar power production is heavily fluctuating throughout the day sometimes from up to 90 % down to 10 %. That is one explanation for growing intraday power trading activity at EPEX which is the power spot exchange at EEX. Here EPEX offers to buy and sell power until 5 min before delivery to optimize the fluctuating power production from wind and solar. Therefore, EEX supports the integration of renewables into the exiting power wholesale market and is an active part of the energy transition.

Germany can be the next big champion of industrial pellets with biomass fuelled CHP plants which produce heat and power in such periods of "Dunkelflauten" with low sunshine and less wind. However, who tells biomass when to step in? That integration into the mix of renewables requires a functioning short-term market for biomass. Every CHP plant is profitable when income is higher than cost. Income is defined by the price for heat and the price for power. The latter is traded in highly liquid markets, originating a strong and credible price signal. Costs are defined by the biomass feedstock, potential temporary subsidies and the supply chain. Market prices in both power and biomass allow each operator the individual decision to operate the biomass plant to produce heat and furthermore sell the power or not to do so. Obviously in times of high electricity prices with potentially low wind and solar power production, biomass can fulfil the "swing producer role" based on market prices. The integration of biomass can only be done transparently through market-based mechanisms. Furthermore, a flexible supply chain, including short-term trading will enable Biomass its usage when it is most effective and economic.
Biomass is no obscure construct in the distant future. It has a proven track record and accounts to a huge chunk of renewable energy consumed today already. The appliance of biomass in CHP plants is a proven success story to be seen in other countries. Biomass can enable Germany to reach the climate goals quicker and support the energy transition away from fossil fuels. Furthermore, Germany can diversify its mix of renewables and could also be a role model as the fourth biggest economy worldwide for an effective energy transition. Biomass in Germany is going to play a bigger role compared to today, if transparency through price signals as well as flexibility in the supply chain support the operation of CHP plants. Both transparency and a flexible supply chain are created through exchange products to enable Germany to credibly be the next big champion of industrial pellets in Europe. "

2.3 European heating appliances market

Figure 48 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 in regard to 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. Based on this criterion, the following countries (among others) demonstrate a significant potential (to be analysed with the absolute demand for heating in term of energy Cf. Bioenergy Europe's report on biomass for heat): Belgium, France, Germany, Poland or Spain.

Figure 48 Share of energy used for heating and cooling in the residential sector by European countries in 2017 (%)



Source: Eurostat

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2.3.1 European stove market

In 2014, 2015 and early 2016 sales of stoves were slow through most EU28 countries. This was mainly due to mild winters and the low price of heating oil. However, in the mind of the customer, the purchase of a stove is seen as much less of an investment, having to rapidly pay off, than in comparison to that of a boiler. As a consequence of this, the better heating season of 2016-2017, allowed for the market to recover in a few countries (Italy not included in those). In 2018, the sales kept on the same trend as in 2017.

Table 10 Average percentage of household with pellet stoves in 2018 in some European countries (%)

IT	9,18%
BG	4,28%
FR	3,03%
ES	1,44%
AT	1,32%
SE	0,63%
DE	0,43%
EL	0,40%
HR	0,24%
LV	0,24%
CZ	0,10%
FI	0,09%
SK	0,01%

Note: considering maximum one appliance per household
Source: Eurostat and EPC survey 2019

Bulgaria: In order 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, government as well as the private sector to get users to switch from fossil to pellets as an alternative fuel source.

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.

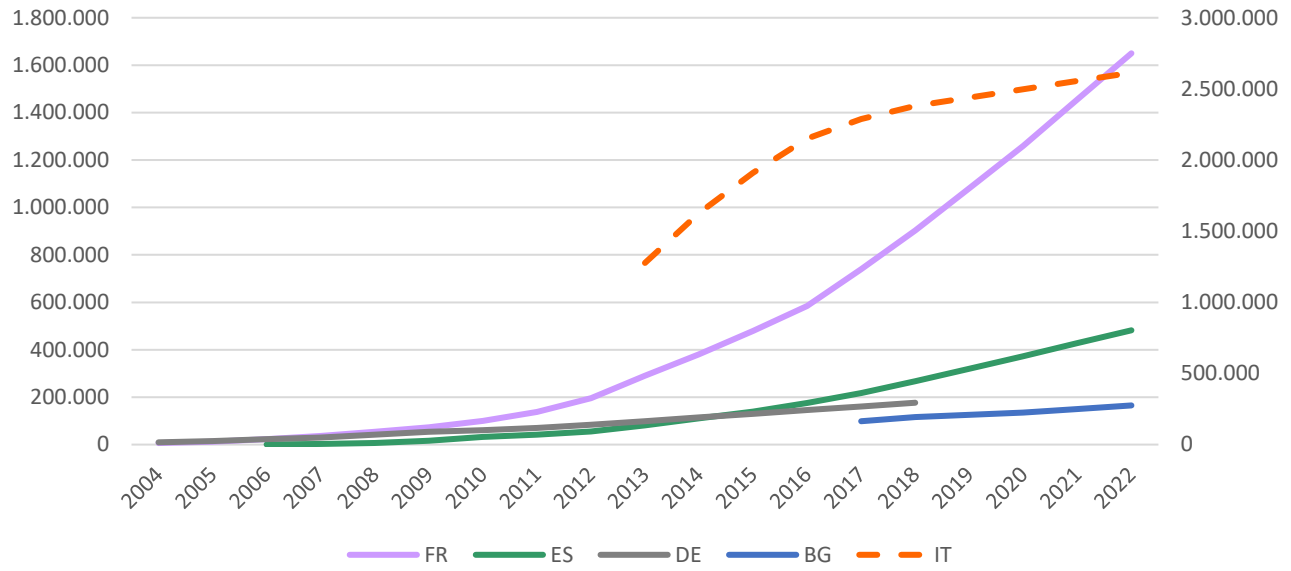
France: Since 2014, stove sales have increased steadily and have exceeded the rate of sales in comparison to that of the Italian market. Since 2017 the growth of sales has settled and is now estimated around 13%. The carbon tax has been stopped at the level of 2018 i.e. 44,6 € / tonnes of CO_2, but the support for heating oil has been removed, thus increasing pellet competitiveness.

Germany: Rising prices for heating oil along with improved subsidies for new pellet installations have finally led to a small growth in sales, although, despite new policy framework renewable heat still lacks political support.

Italy: The market has been slowing down since 2014 with a drastic decrease being seen in 2018 with sales dropping from 233.471 to 130.732 units per year. Despite this fall in sales, Italy remains the country with the highest number of installed pellet stoves in Europe, boasting 2,4 million pellet unit installations, more than 2,5 times as many appliances as the next-largest market, France.

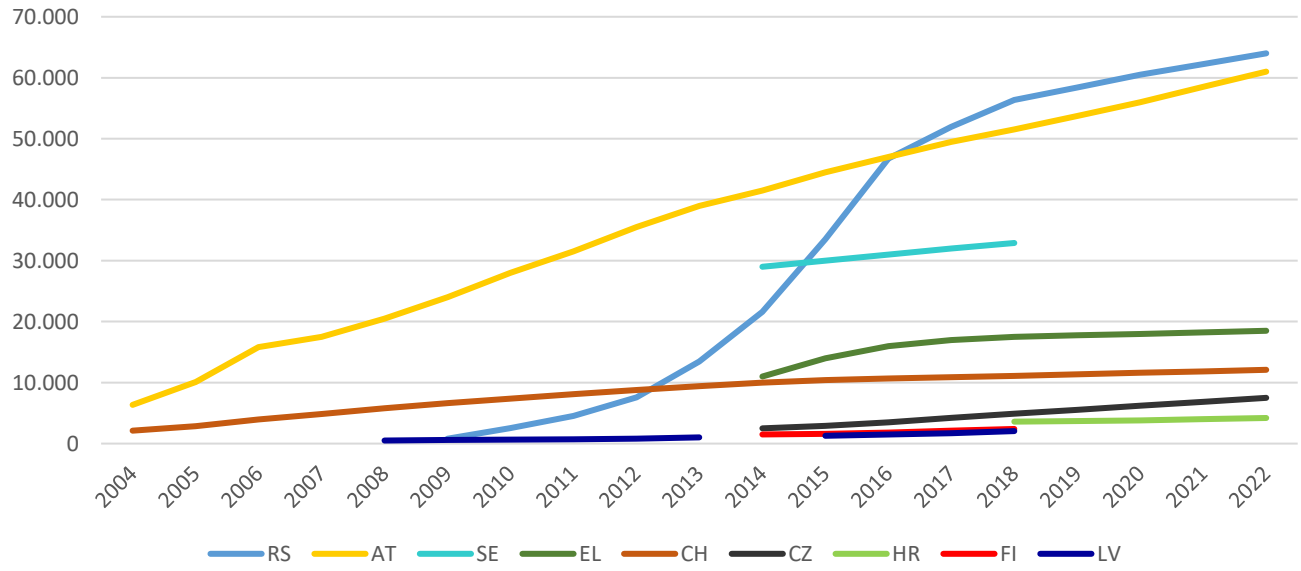
Serbia: As a result of a pellet shortage during January 2017 in conjunction with a steep increase in prices, consumers have lost trust in pellets within the residential sector. Consequently, there was an evident sharp drop in the sales of pellet appliances.

Figure 49 Evolution of the installed stock of pellet stoves in some major European markets (n° of units; Italy in secondary axis)



Source: EPC survey 2019

Figure 50 Evolution of the installed stock of pellet stoves in some minor European markets (n° of units)



Source: EPC survey 2019

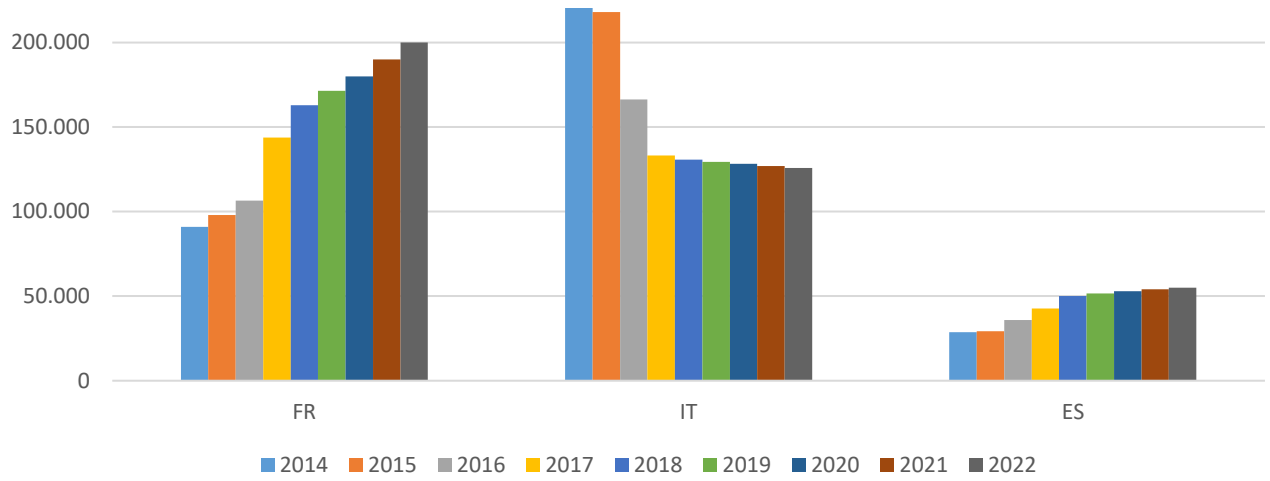
Marco Palazzetti
Palazzetti Group
CEO

The latest trends (2019 and 2020) of pellet stoves sales in Europe

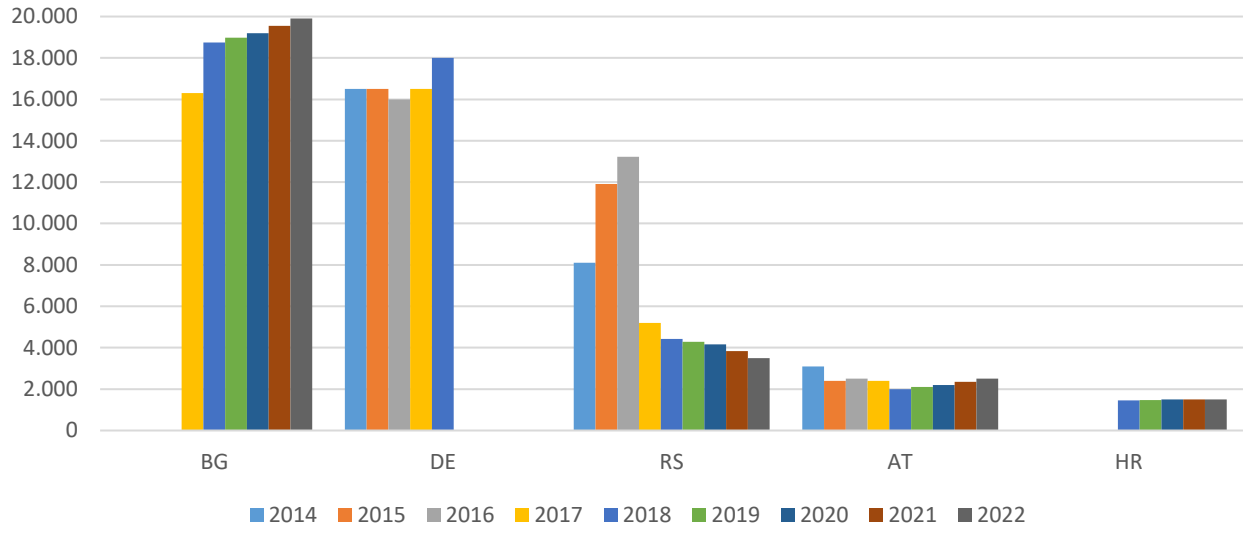
"With the overall growing market continuing to rise at variable speeds among countries, there is still the underlying potential for the market to flourish. This increase can be characterised by various factors.
Firstly, the specific categories of products available on the marketplace display a different kind of market penetration from country to country within Europe. Secondly, legislative restrictions will encourage this product category to gain a market share despite other corresponding products. On the other hand, there are difficulties being faced by the sector. Misinformation certainly has a negative effect on public opinion regarding the real benefits that biomass brings to the economy and to the environment in a more specific way. "

Figure 51 Evolution of the annual sales of pellet stoves in some European markets (n° of units)

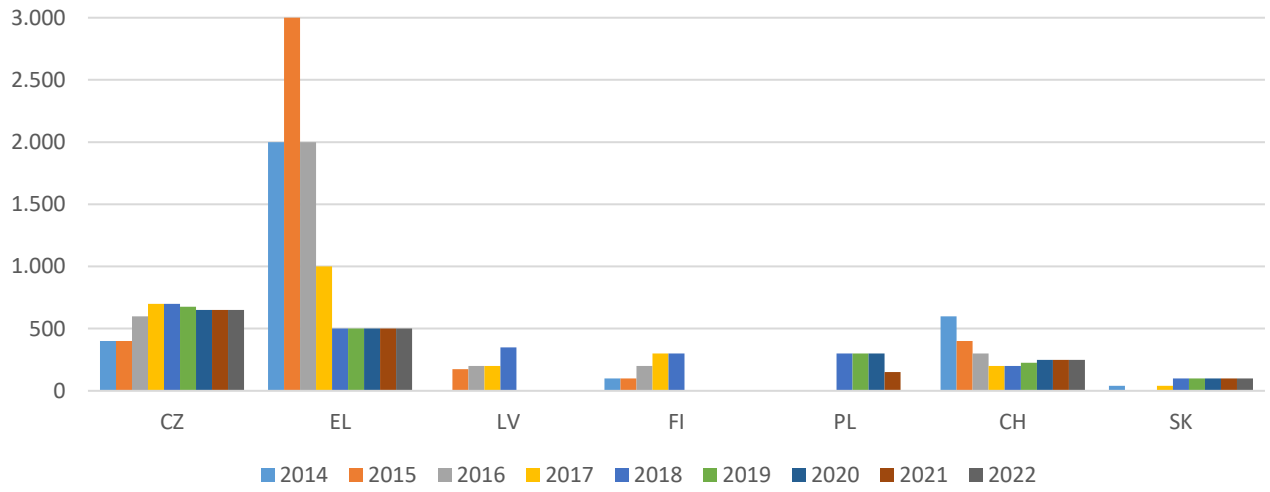
(a) Top 3



(b) Top 4-8



(c) Rest of the countries (with available data)



Source: EPC survey 2019

2.3.2 European residential boiler market

Table 11 Average percentage of household with pellet boilers in 2018 in some European countries (%)

BG	5,1%
AT	3,3%
SE	1,6%
LV	1,3%
FI	1,0%
PL	0,7%
DE	0,7%
CZ	0,6%
IT	0,4%
FR	0,2%
EL	0,2%
ES	0,1%
HR	0,06%
UK	0,04%
SK	0,03%

Note: considering maximum one appliance per household
Source: Eurostat and EPC survey 2019

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. Despite this, sales recorded a small decrease in 2018 but are expected to reach a sale of 5.000 units per year in 2020.

Bulgaria: 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. 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, Germany or Italy) operate in Bulgaria.

Czech Republic: The situation on the pellet boiler market is double-edged. On the one hand, the country has generous state subsidies (4.900€ for pellet boilers). On the other hand, the Czech Republic has a large number of manufacturers of these boilers and together with the import of many other brands has caused high competition within the market resulting in low sales of individual home players, this will create issues for Czech boiler manufacturers without a high export share.

France: The support for heating oil has been removed and significant support has been given for the replacement of heating oil boilers so that some market actors are able to offer a 1 € installation inducing a rise by more than 40% in the 2018 boilers sales. In 2019, with additional aid, sales are expected to experience high growth, with a particularity amongst boilers to 1 € bringing customers who would otherwise not have access to these pellet boilers.

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.

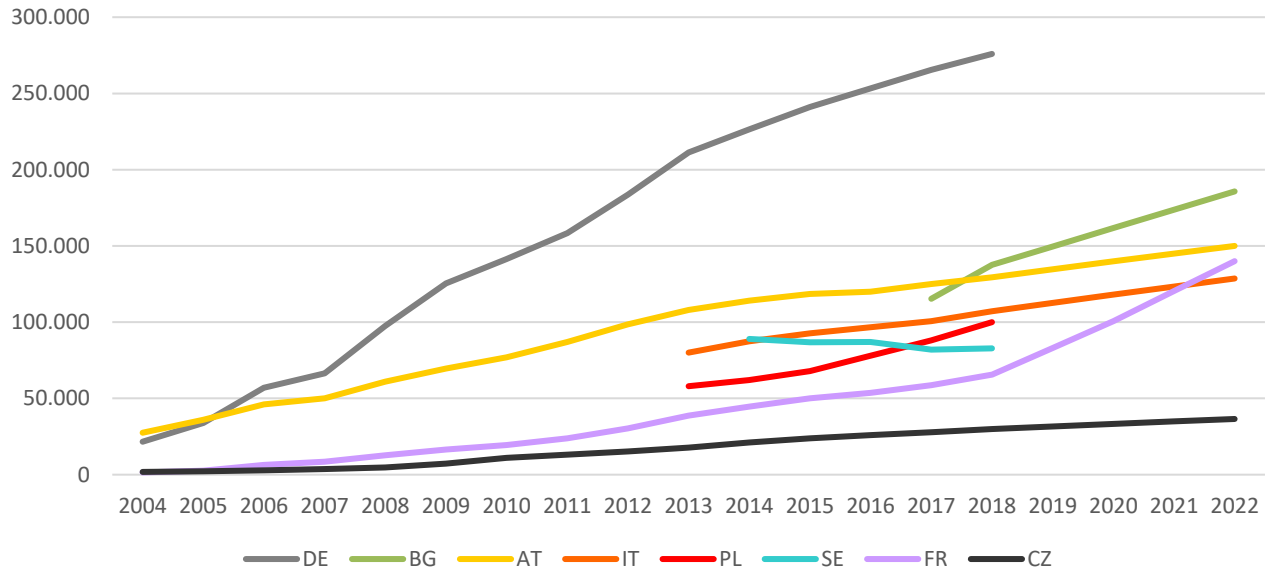
Italy: Although the market is dominated by pellet stoves, sales of residential pellet boilers are the fourth highest in Europe.

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 2018 boiler sales experienced an increase of 20%.

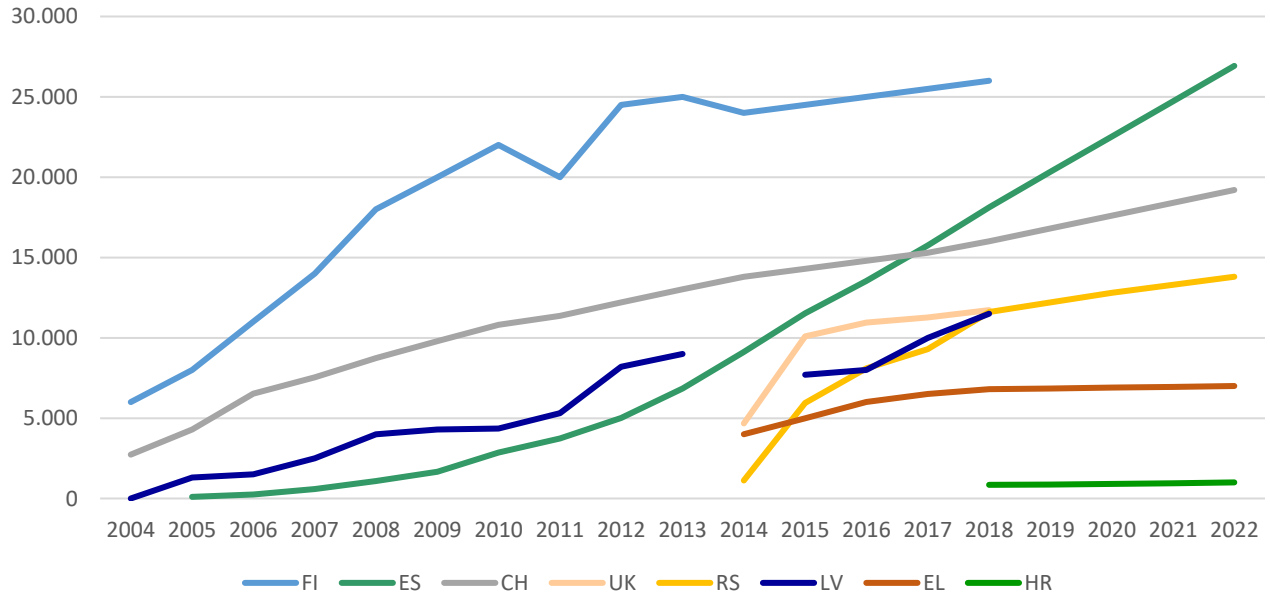
United Kingdom: The Renewable Heat Incentive (RHI) scheme has helped residential pellet boiler sales to skyrocket within the UK. However, the program is a victim of its own success and the government has now decided to significantly reduce tariff payments to the owners of biomass installations. In 2015, 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.

Figure 52 Evolution of the installed stock of residential pellet boilers (<50kW) in some European markets <50kW (n° of units)

(a) Top 8 countries

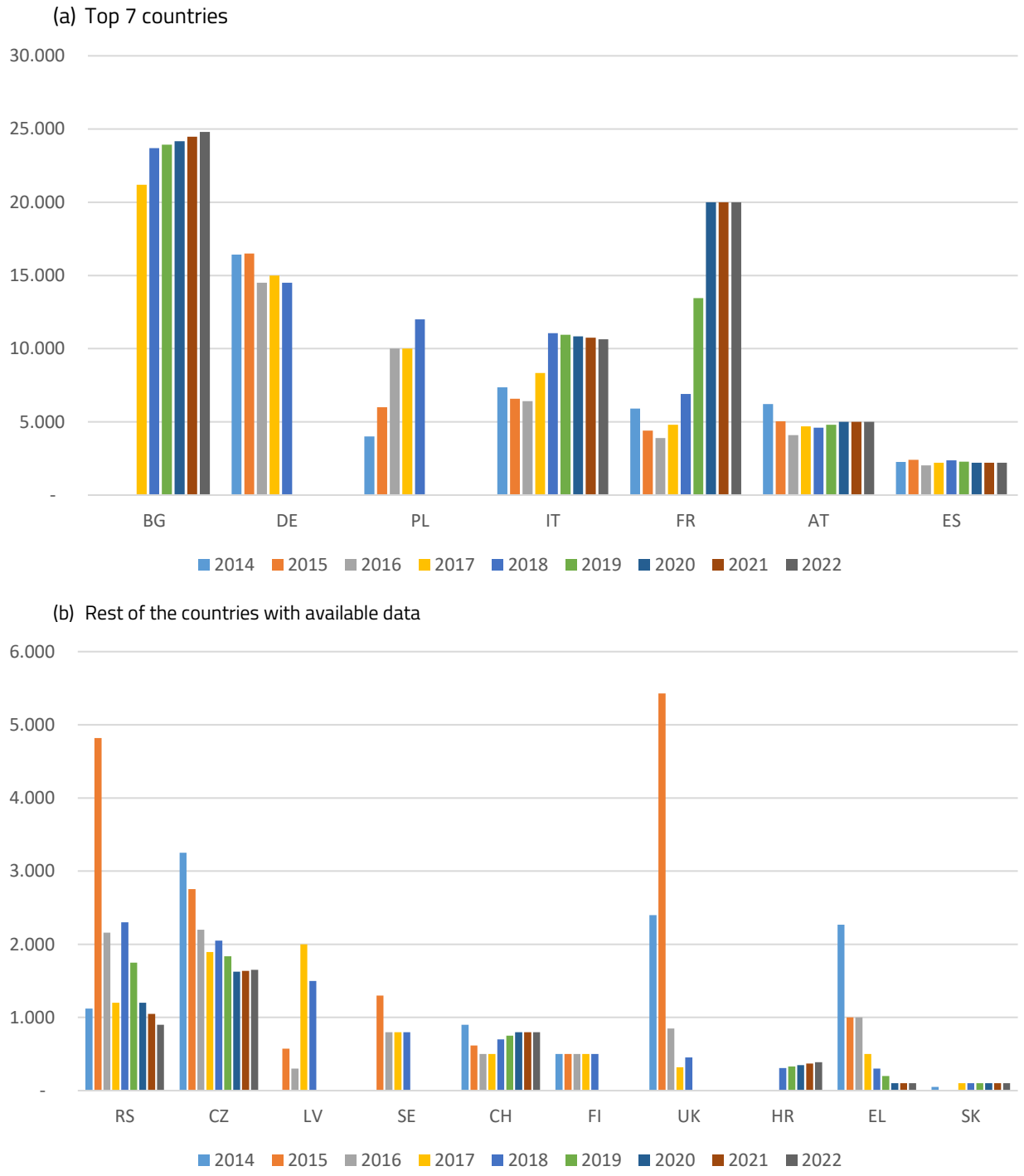


(b) Rest of the countries with available data



Source: EPC survey 2019

Figure 53 Evolution of the annual sales of residential pellet boilers (<50kW) in some European markets (n° of units)



Source: EPC survey 2019

2.3.3 European commercial boiler market

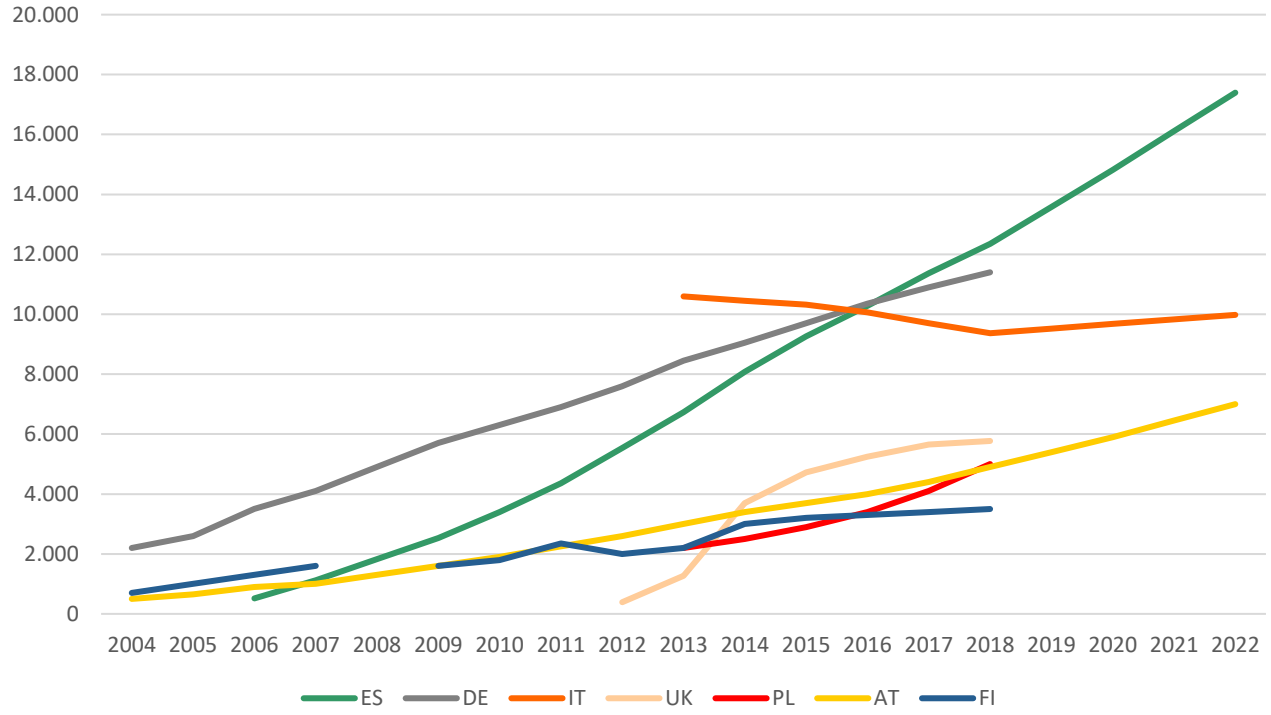
Pellets for commercial heating (defined as dedicated-heat boilers with at least 50 kilowatts of output used in residential buildings, public buildings, services, industry, etc.) remains a niche market in most of Europe, but has been identified by several observers as the key for establishing pellet use in the long term. Indeed, the commercial heating market is today growing at a faster growth rate than the residential sector.

Serbia: The big boom of the number of installed pellet boilers is the result of a huge number of schools (over 200), kinder gardens, health care centres and other public and commercial buildings which have started to use pellets instead of coal and heating oil. In 2018, the Serbian government supported a vast number of public buildings to replace heating oil and coal with wood pellets and as a result of these activities continuing in 2019, we can expect a new boom in 2019

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.

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 they fell sharply in the following years to reach around 120 sales in 2018.

Figure 54 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 2019

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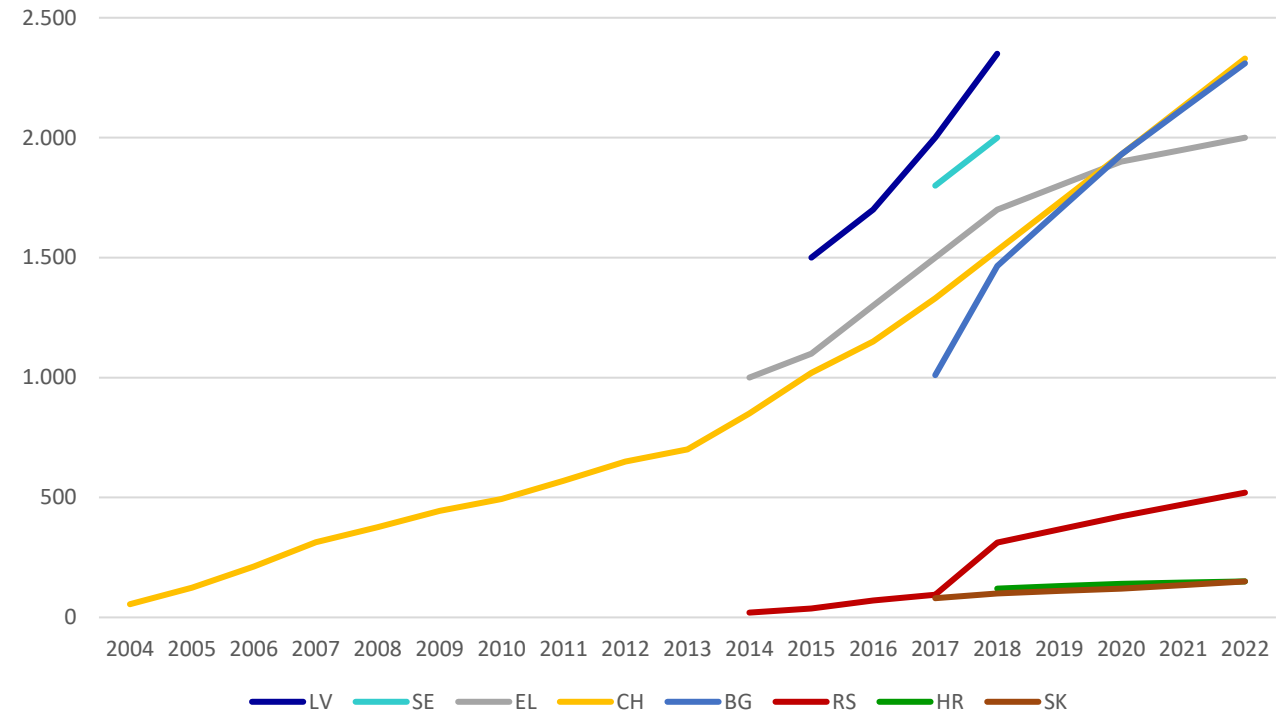
Figure 55 Evolution of the installed stock of commercial pellet boilers (>50kW) in some European countries (n° of units)



Source: EPC survey 2019

Fredrik Zetterlund

SVEBIO - Program Manager, BioPower and Heat Installations/Conversions

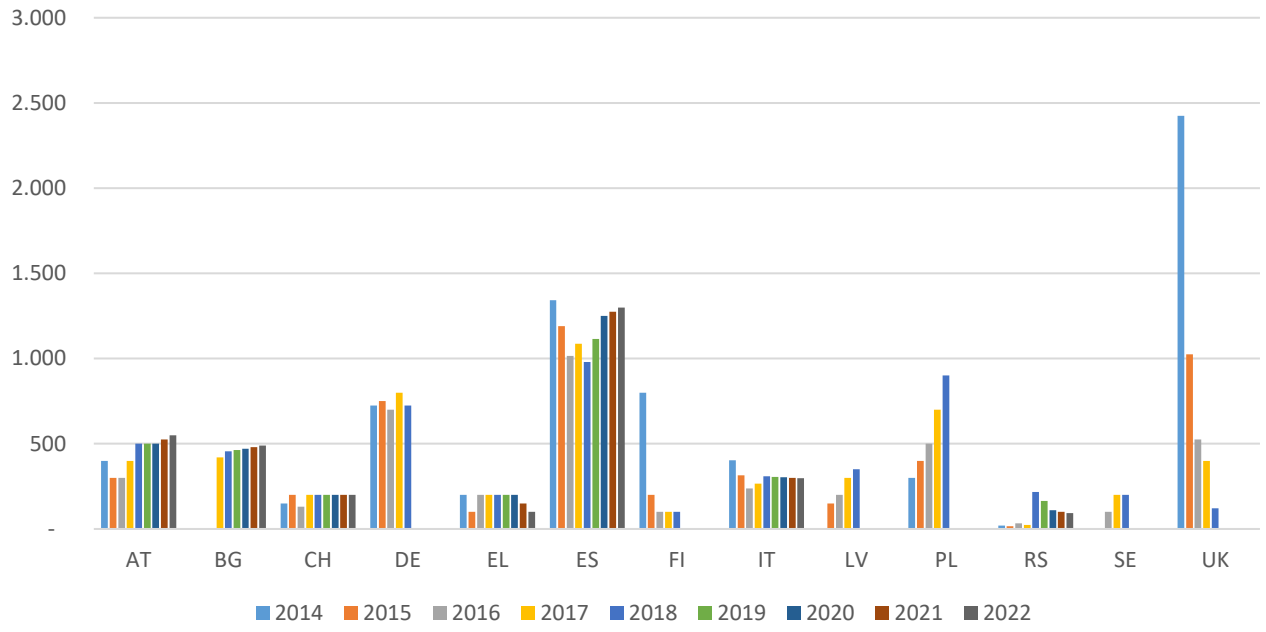
Swedish Pellet Association - Secretary General

Developments on the Swedish pellet market

"Growth in the market is mainly seen in middle size installations. Industry outside ETS with no requirements for emission allowances have had a steep increase in carbon taxation during the last years, from 2011 to 2018. From 1 January 2018 these companies pay a full Swedish carbon tax, around 130 €/tonne CO_2, as high as households and the service sector. This has caused many enterprises to switch from heating oil, propane or natural gas to biofuels, both bio oils and pellets. Many boilers have been retrofitted in food industry, breweries, asphalt preparation, greenhouses, and others. In farming, dryers for grains are converted from oil to pellets.

In the forest industry, some pulp mills are now using pellets for their lime kilns, and more similar investments may follow. In district heating, a couple of the biggest grid operators are investing in top load boilers using pellets. On the negative side, Stockholm Exergi has plans to shut down its large pellets fuelled CHP at Hässelby, Sweden's largest user of pellets, and replace it with a CHP using cheaper biomass fuels. "

Figure 56 Evolution of the annual sales of commercial pellet boilers (>50kW) in some European countries (n° of units)



Source: EPC survey 2019

Table 12 Annual sales of boilers and stoves in Europe in 2017 and 2018 (n° of units)

	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2017	2018	2017	2018	2017	2018
AT	2.400	2.000	4.700	4.600	400	500
CH	200	200	500	700	200	200
CZ	700	700	1.893	2.050	n.a.	n.a.
DE	16.500	18.000	15.000	14.500	800	725
EL	1.000	500	500	300	200	200
ES	42.732	50.130	2.212	2.370	1.086	980
FI	300	300	500	500	100	100
FR	143.900	163.000	4.800	6.900	n.a.	n.a.
IT	133.259	130.732	8.342	11.057	265	309
LV	200	350	2.000	1.500	300	350
PL	n.a.	300	10.000	12.000	700	900
RS	5.200	4.420	1.200	2.300	24	218
SE	900	900	800	800	200	200
UK	n.a.	n.a.	320	453	400	121

Note: Commercial boilers in Spain includes multi-fuel boilers.
Source: EPC survey 2019

Table 13 Installed stock of pellet boilers and stoves in Europe in 2017 and 2018 (n° of units)

	Stoves		Residential boilers (<50kW)		Commercial boilers (>50kW)	
	2017	2018	2017	2018	2017	2018
AT	49.500	51.500	125.000	129.500	4.400	4.900
CH	10.900	11.100	15.300	16.000	1.330	1.530
CZ	4.200	4.900	27.900	29.950	n.a.	n.a.
DE	160.300	176.500	265.500	275.900	10.900	11.400
EL	17.000	17.500	6.500	6.800	1.500	1.700
ES	217.797	267.927	15.754	18.124	11.366	12.346
FI	2.100	2.400	25.500	26.000	3.400	3.500
FR	740.000	903.000	58.700	65.600	n.a.	n.a.
IT	2.287.630	2.380.192	100.562	107.143	9.696	9.367
LV	1.700	2.050	10.000	11.500	2.000	2.350
PL	n.a.	n.a.	88.000	100.000	4.100	5.000
RS	51.920	56.340	9.300	11.600	94	312
SE	32.000	32.900	82.000	82.800	1.800	2.000
UK	72	72	11.270	11.723	5.650	5.771

Note: Commercial boilers in Spain includes multi-fuel boilers.
Source: EPC survey 2019

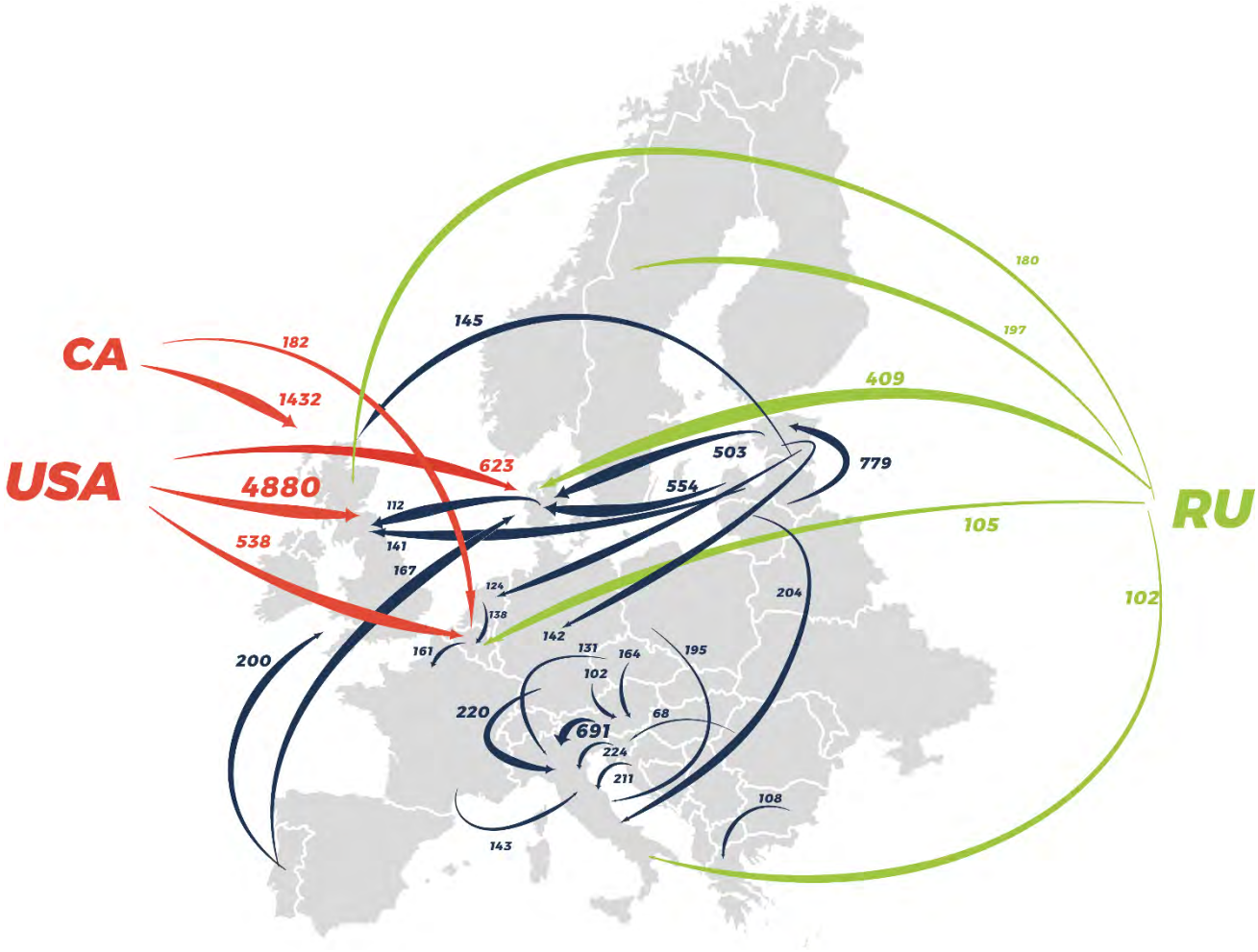
2.4 European trade of pellets

The data provided in this section has been provided by Eurostat. Please note that the accuracy varies between countries**,** the data do 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 57 EU28 Member States pellet balance by country in 2018 - production, consumption, export, import (tonnes)

Source: EPC survey 2019, Hawkins Wright, Eurostat, FAO

Figure 58 Net European pellet trade stream and net North American export toward Europe in 2018 (>100 ktonnes), (ktonnes)



Source: Eurostat

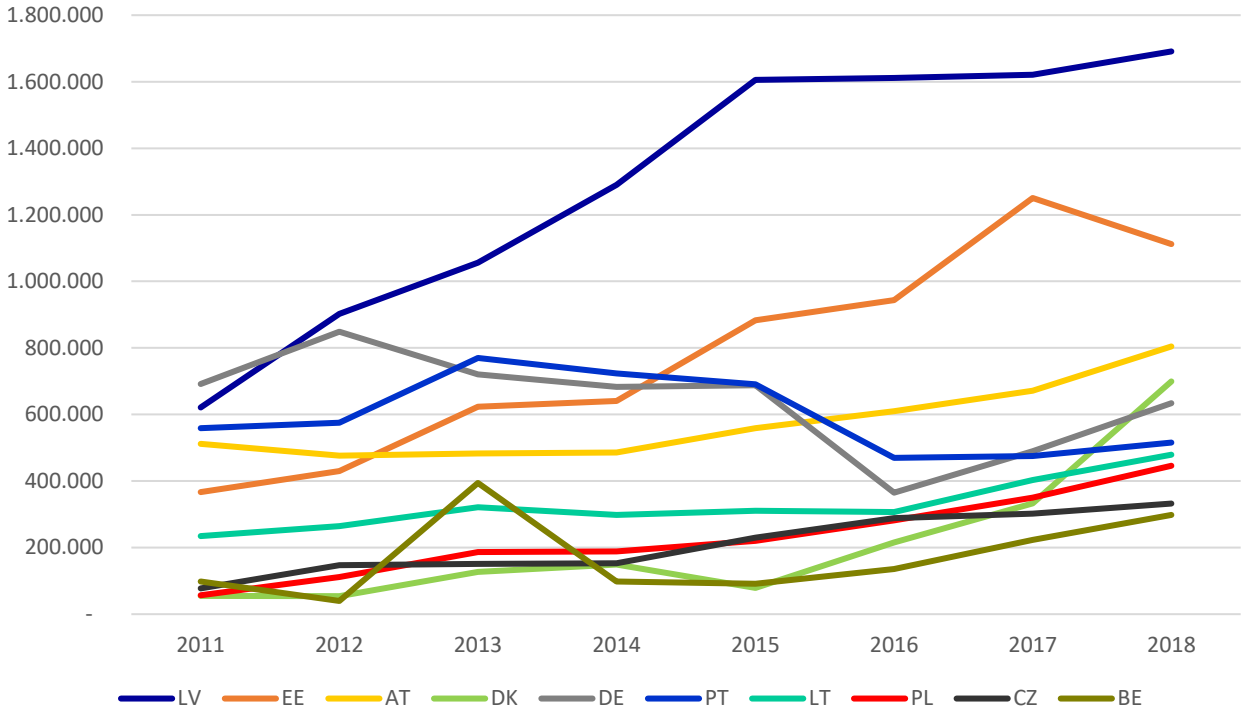
2.4.1 EU28 exporting countries

Austria: Austria remains a major exporter in Europe, with its main export being to the Italian market. Austrian production is principally A1 quality and is recognised as such abroad.

Latvia & Estonia: Both countries are major exporters of industrial pellets within Europe. Almost all of their production is exported due to weak internal consumption.
It can be noted that the data displayed for the last years for exports are unlikely to be exact for Latvia since they are stated to be higher than the production (Cf. Section 2.1).

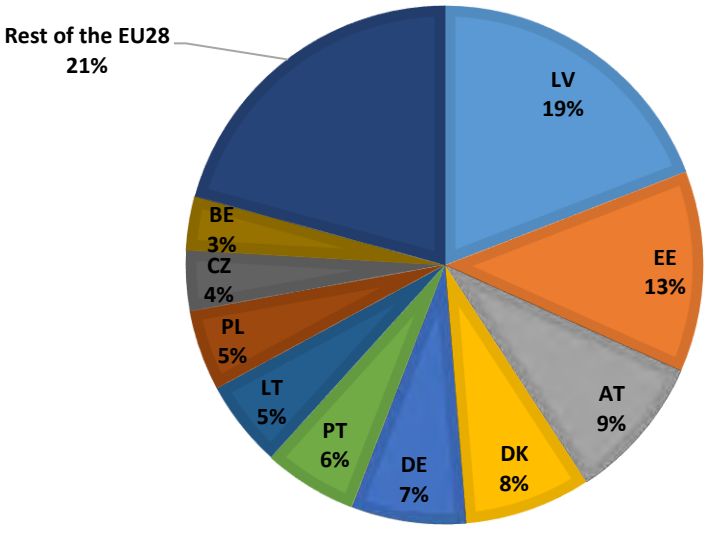
Portugal: Portugal is historically an exporter of industrial pellets; however, its exports have declined in the last year due to production problems as well as a growing internal consumption. Despite this the exports are now quite stable, having been so since 2016.

Figure 59 Evolution of the exports of pellets in the top 10 EU28 exporting countries (tonnes)



Source: Eurostat

Figure 60 Share of total EU28 pellet exports in 2018 (%)



Source: Eurostat

Table 14 Export to top 3 destinations of top 5 (of 2018) pellet exporting countries in EU28 between 2014 and 2018 (tonnes)

	2014		2015		2016		2017		2018	
LV	DK	493.195	DK	537.619	EE	634.803	EE	715.336	EE	787.409
	UK	308.086	EE	487.150	DK	572.750	DK	604.498	DK	554.200
	EE	306.500	UK	419.512	UK	294.369	UK	139.568	UK	141.436
	Rest of EU28	182.208	Rest of EU28	160.453	Rest of EU28	108.863	Rest of EU28	160.830	Rest of EU28	206.879
	Rest of the world	458	Rest of the world	621	Rest of the world	647	Rest of the world	721	Rest of the world	1.155
EE	DK	423.156	DK	506.484	DK	493.870	DK	725.472	DK	503.141
	IT	56.223	UK	234.417	UK	213.778	UK	219.188	UK	144.838
	SE	55.104	NL	59.178	NL	116.589	SE	69.839	DE	142.191
	Rest of EU28	106.284	Rest of EU28	83.227	Rest of EU28	118.288	Rest of EU28	235.888	Rest of EU28	315.571
	Rest of the world	72	Rest of the world	84	Rest of the world	115	Rest of the world	209	Rest of the world	6.213
AT	IT	440.114	IT	486.604	IT	550.796	IT	589.511	IT	713.975
	DE	28.575	DE	29.368	DE	21.584	CH	23.552	SI	35.631
	CH	7.266	CH	20.046	SI	17.102	DE	22.898	DE	27.660
	Rest of EU28	8.021	Rest of EU28	20.766	Rest of EU28	7.371	Rest of EU28	31.673	Rest of EU28	5.072
	Rest of the world	1.396	Rest of the world	2.344	Rest of the world	12.694	Rest of the world	3.606	Rest of the world	22.095
DK	DE	64.562	DE	56.004	UK	72.999	SE	89.802	UK	232.303
	UK	47.661	UK	7.893	BE	56.538	UK	69.754	SE	126.168
	SE	25.091	SE	7.648	DE	31.329	DE	44.971	BE	123.205
	Rest of EU28	11.984	Rest of EU28	7.090	Rest of EU28	53.791	Rest of EU28	127.846	Rest of EU28	217.295
	Rest of the world	197	Rest of the world	219	Rest of the world	329	Rest of the world	215	Rest of the world	357
DE	AT	212.409	AT	141.294	IT	120.113	IT	144.719	IT	219.752
	IT	170.714	IT	136.486	AT	83.812	FR	103.811	AT	118.208
	FR	90.181	FR	49.312	FR	57.501	AT	99.943	FR	84.556
	Rest of EU28	166.517	Rest of EU28	308.792	Rest of EU28	55.971	Rest of EU28	94.106	Rest of EU28	156.535
	Rest of the world	42.979	Rest of the world	52.400	Rest of the world	47.672	Rest of the world	47.299	Rest of the world	54.591

Source: Eurostat

2.4.2 EU28 importing countries

Belgium: The imports of industrial pellets have been relatively constant over the years due to internal consumption for electricity production.

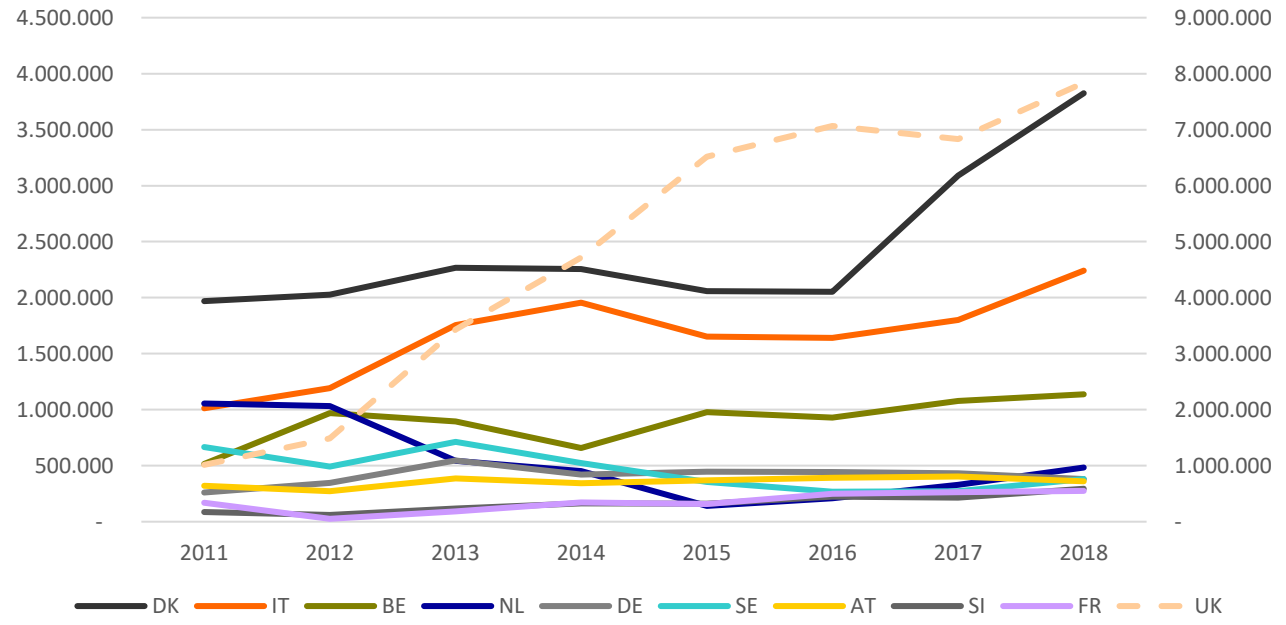
Denmark: Denmark is the second largest pellet importer, mainly sourcing pellets from Latvia, Estonia and from the US. The imported volumes increased by 24% in 2018.

Italy: Italy is the third largest importer of pellets. With a production of 400.000 tonnes and a consumption of 3.296.005 tonnes, the numbers delivered by Eurostat are likely to be ~700.000 tonnes too low. Italy is therefore probably closer to 3 million tonnes of import in 2018.

United Kingdom: The UK is the largest pellet importer in the EU, with most of its pellets being sourced from North America, due to the continuous increase of pellet use in its power plants coupled with limited local production.

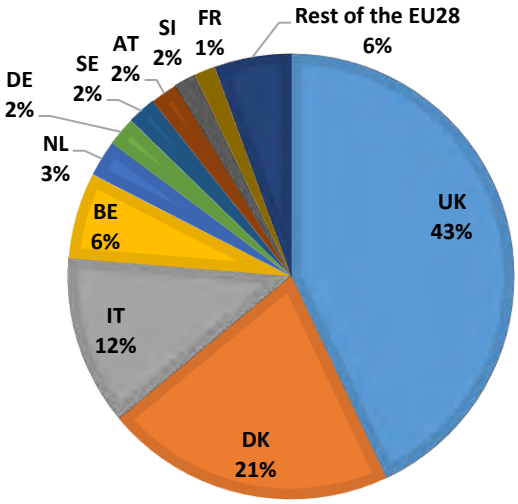
These four countries represent 82% of European imports. This number is likely to be higher due to Italy's imports having been underestimated as explained above.

Figure 61 Evolution of the imports of pellets in the top 10 EU28 importing countries (UK with secondary axis) (tonnes)



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

Figure 62 Share of total EU28 pellet imports in 2018 (%)



Source: Eurostat

Table 15 Import to top 3 destinations of top 5 pellet importing countries in EU28 between 2014 and 2018 (tonnes)

	2014		2015		2016		2017		2018	
EU28	US	3.889.833	US	4.277.626	US	4.901.682	US	5.205.453	US	6.138.500
	CA	1.258.832	CA	1.474.785	CA	1.685.203	CA	1.478.403	CA	1.762.253
	RU	826.184	RU	786.214	RU	833.596	RU	1.269.752	RU	1.364.471
	Other non EU28	571.865	Other non EU28	624.459	Other non EU28	674.238	Other non EU28	739.202	Other non EU28	1.089.324
UK	US	2.894.916	US	3.527.986	US	4.127.578	US	4.265.670	US	4.879.881
	CA	889.353	CA	1.161.425	CA	1.384.774	CA	1.256.756	CA	1.431.923
	LV	402.046	LV	995.125	LV	936.256	LV	737.190	LV	779.192
	Rest of EU28	524.315	Rest of EU28	789.599	Rest of EU28	461.449	Rest of EU28	398.814	Rest of EU28	466.097
	Rest of the world	4.460	Rest of the world	44.746	Rest of the world	158.595	Rest of the world	174.442	Rest of the world	279.562
DK	LV	612.466	LV	599.074	EE	595.199	EE	1.009.234	LV	940.415
	EE	464.212	EE	542.787	LV	548.760	LV	606.075	EE	719.070
	RU	388.704	RU	333.086	RU	257.655	RU	402.574	US	623.144
	Rest of EU28	662.240	Rest of EU28	546.877	Rest of EU28	522.023	Rest of EU28	715.201	Rest of EU28	1.007.268
	Rest of the world	104.211	Rest of the world	37.562	Rest of the world	128.260	Rest of the world	356.040	Rest of the world	535.559
IT	AT	400.299	AT	406.808	AT	449.627	AT	463.248	AT	704.928
	CA	229.180	HR	128.115	HR	144.113	HR	150.917	DE	186.457
	US	179.965	DE	108.882	SI	109.139	DE	116.993	HR	136.296
	Rest of EU28	837.930	Rest of EU28	591.863	Rest of EU28	617.279	Rest of EU28	715.686	Rest of EU28	693.027
	Rest of the world	308.902	Rest of the world	417.936	Rest of the world	321.477	Rest of the world	355.404	Rest of the world	520.833
BE	US	422.774	US	619.970	US	533.133	US	578.407	US	538.375
	CA	107.238	CA	227.940	CA	237.359	RU	205.057	CA	182.309
	NL	72.833	NL	63.251	RU	85.835	CA	168.552	NL	110.522
	Rest of EU28	49.005	Rest of EU28	24.980	Rest of EU28	71.320	Rest of EU28	108.718	Rest of EU28	186.683
	Rest of the world	4.590	Rest of the world	40.720	Rest of the world	1.035	Rest of the world	15.854	Rest of the world	119.467
NL	US	271.544	UK	56.803	UK	75.556	RU	61.480	LV	150.918
	UK	108.059	US	38.052	DE	42.305	PT	54.787	DE	62.345
	BE	29.093	BE	18.232	RU	27.405	LV	46.065	PT	54.693
	Rest of EU28	6.244	Rest of EU28	14.552	Rest of EU28	40.507	Rest of EU28	162.758	Rest of EU28	150.521
	Rest of the world	36.260	Rest of the world	13.318	Rest of the world	22.367	Rest of the world	3.474	Rest of the world	66.393

Source: Eurostat

2.5 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 2018 (%)

	VAT rate for wood pellets [in %]	General VAT rate [in %]
AL	20	20
AT	13	20
BA	17	17
BE	6	21
BG	20	20
CH	7,7	7,7
CZ	15	21
DE	7	19
DK	25	25
EL	24	24
ES	21	21
FI	24	24
FR	10	20
HR	25	25
IT	22	22
LT	21	21
LV	12	21
ME	21	21
PL	23	23
RO	19	19
RS	10	20
RU	20	20
SE	25	25
SI	22	22
SK	20	20
UK	5	20

Source: EPC survey 2019

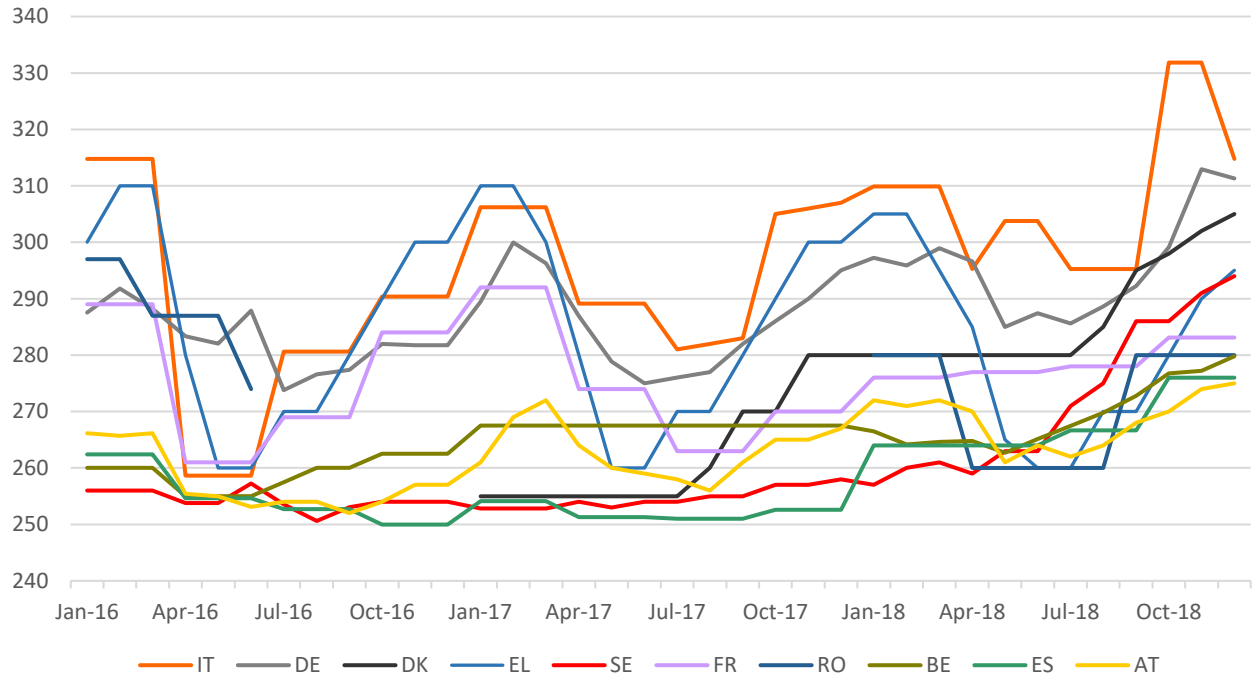
2.5.1 European price development of residential and commercial pellets

Despite the growing demand and supply difficulties in some European countries, pellet prices followed the same trend as previous years. Major differences in pellet prices occur in Europe with prices differences having the ability to simple double between countries. Some countries show a large seasonal price variation (e.g. the Balkans) whilst others are relatively stable (e.g. AT, FR, ES).

Bosnia-Herzegovina & Serbia: In 2017 a steep rise in pellet consumption could be seen across both countries. However, growth was hindered by a pellet shortage in the middle of January 2017. Pellets had been consumed at a faster rate than expected as a result of the number of days with temperatures below -15°C. The increase in heating demand led to premature exhaustion of winter stock in many households. The shortage lasted almost a month, during which prices peaked substantially, to over 290 €/tonne. Lower prices might now be linked to the new governmental 100% tax Bosnia-Herzegovina and Serbia for placing their products to Kosovo, leading to less pellet export to Kosovo, inducing an increase of wood pellet stocks in 2018 which resulted in lower prices.

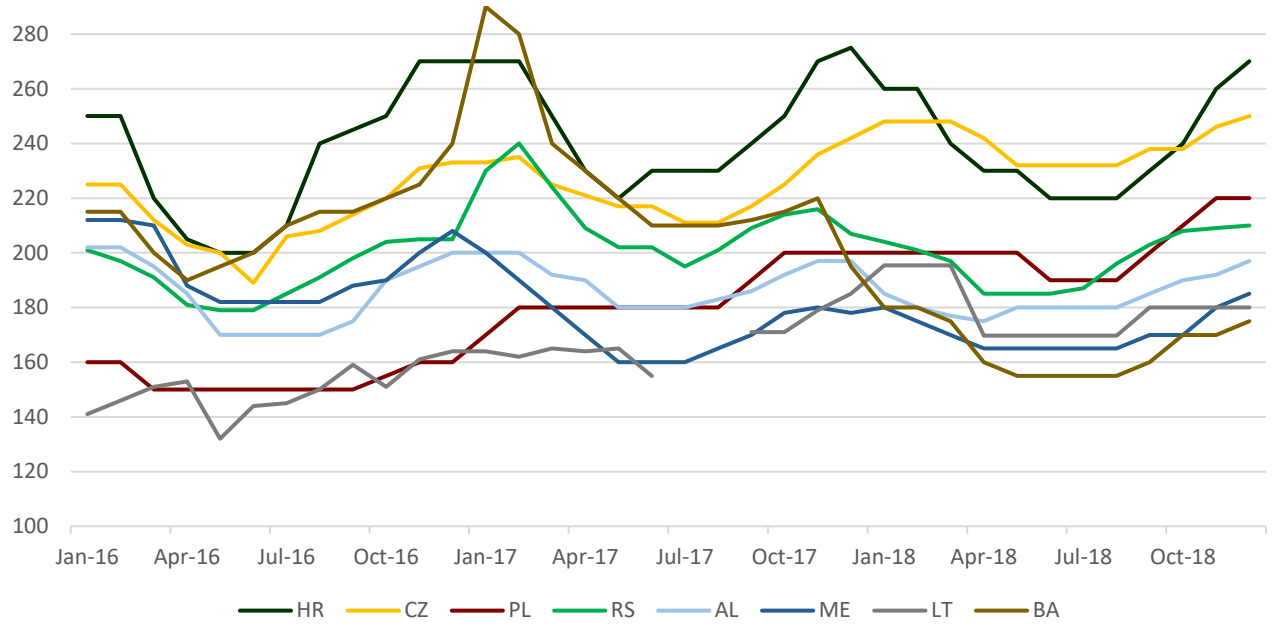
2.5.1.1 BAGGED PELLET PRICES

Figure 63 Estimation of bagged pellet prices in European countries with highest prices between January 2016 and December 2018 (retail price, 1 pallet in €/tonne VAT incl.)



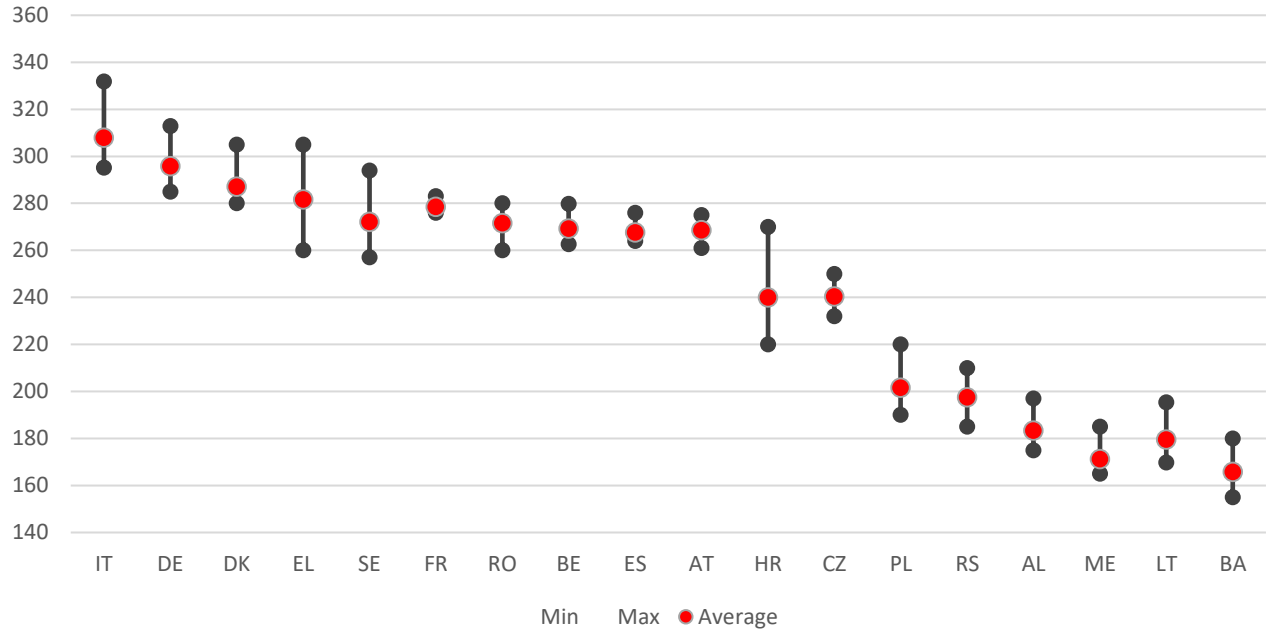
Source: EPC survey 2019

Figure 64 Estimation of bagged pellet prices in European countries with lowest prices between January 2016 and December 2018 (retail price, 1 pallet in €/tonne VAT incl.)



Source: EPC survey 2019

Figure 65 Variation and average of bagged pellet prices between January 2018 and December 2018 by country (retail price, 1 pallet in €/tonne VAT incl.)



Source: EPC survey 2019

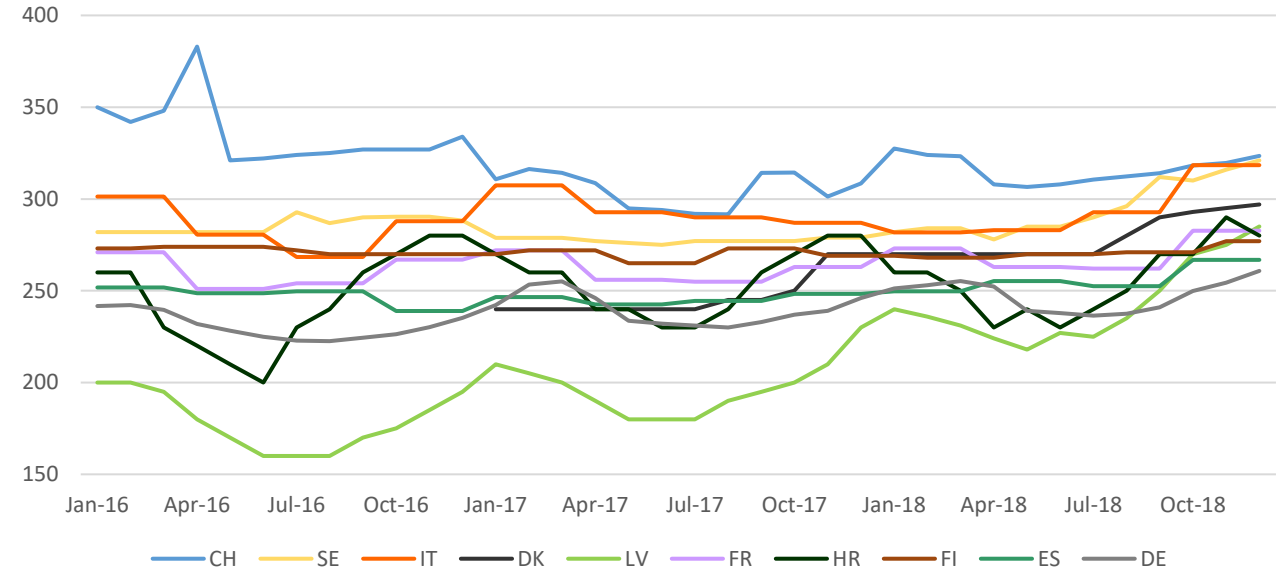
Table 17 Estimation of bagged pellet prices between January 2018 and December 2018 in Europe (retail price, 1 pallet in €/tonne VAT incl.)

	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
AL	185	180	177	175	180	180	180	180	185	190	192	197
AT	272	271	272	270	261	264	262	264	268	270	274	275
BA	180	180	175	160	155	155	155	155	160	170	170	175
BE	266	264	265	265	263	265	267	270	273	277	277	280
CZ	248	248	248	242	232	232	232	232	238	238	246	250
DE	297	296	299	297	285	287	286	289	292	299	313	311
DK	280	280	280	280	280	280	280	285	295	298	302	305
EL	305	305	295	285	265	260	260	270	270	280	290	295
ES	264	264	264	264	264	264	267	267	267	276	276	276
FR	276	276	276	277	277	277	278	278	278	283	283	283
HR	260	260	240	230	230	220	220	220	230	240	260	270
IT	310			295			295			332		315
LT	195	195	195	170	170	170	170	170	180	180	180	180
ME	180	175	170	165	165	165	165	165	170	170	180	185
PL	200	200	200	200	200	190	190	190	200	210	220	220
PT	270						230	230	250	250	270	270
RO	280	280	280	260	260	260	260	260	280	280	280	280
RS	204	201	197	185	185	185	187	196	203	208	209	210
SE	257	260	261	259	263	263	271	275	286	286	291	294

Source: EPC survey 2019

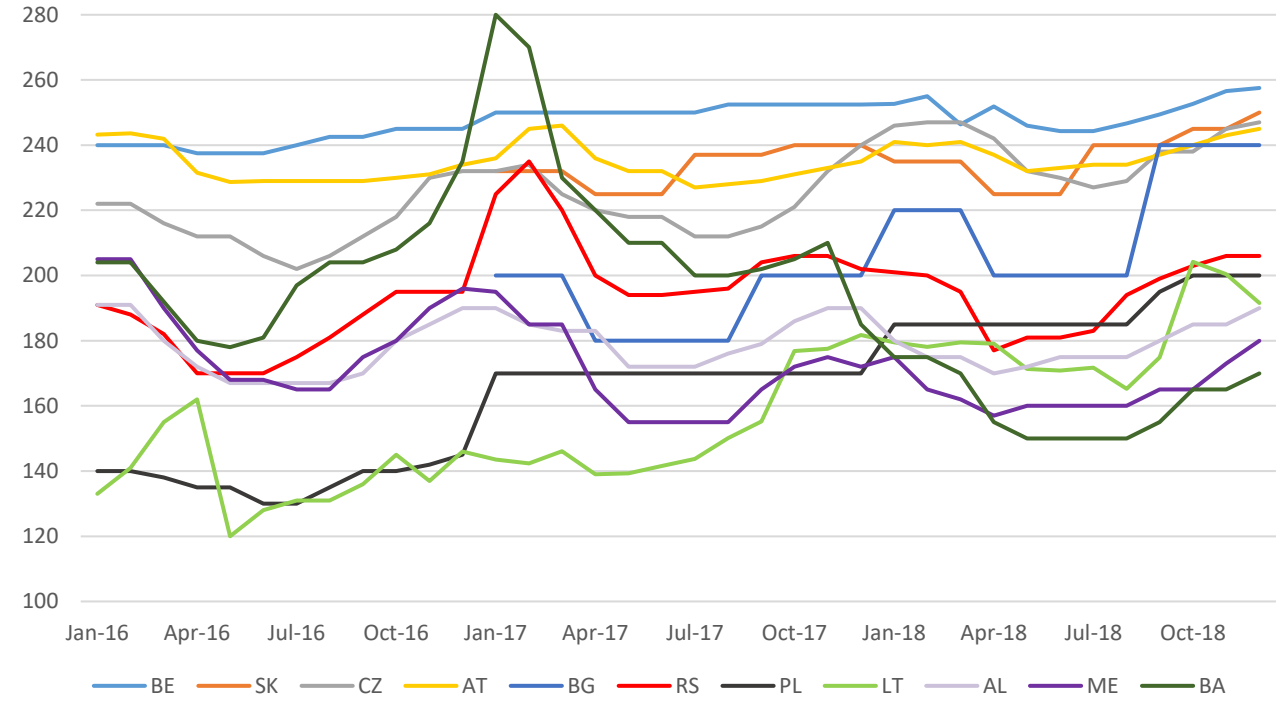
2.5.1.2 BULK PELLET PRICES

Figure 66 Estimation of bulk pellet prices in European countries with highest prices between January 2016 and December 2018 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)



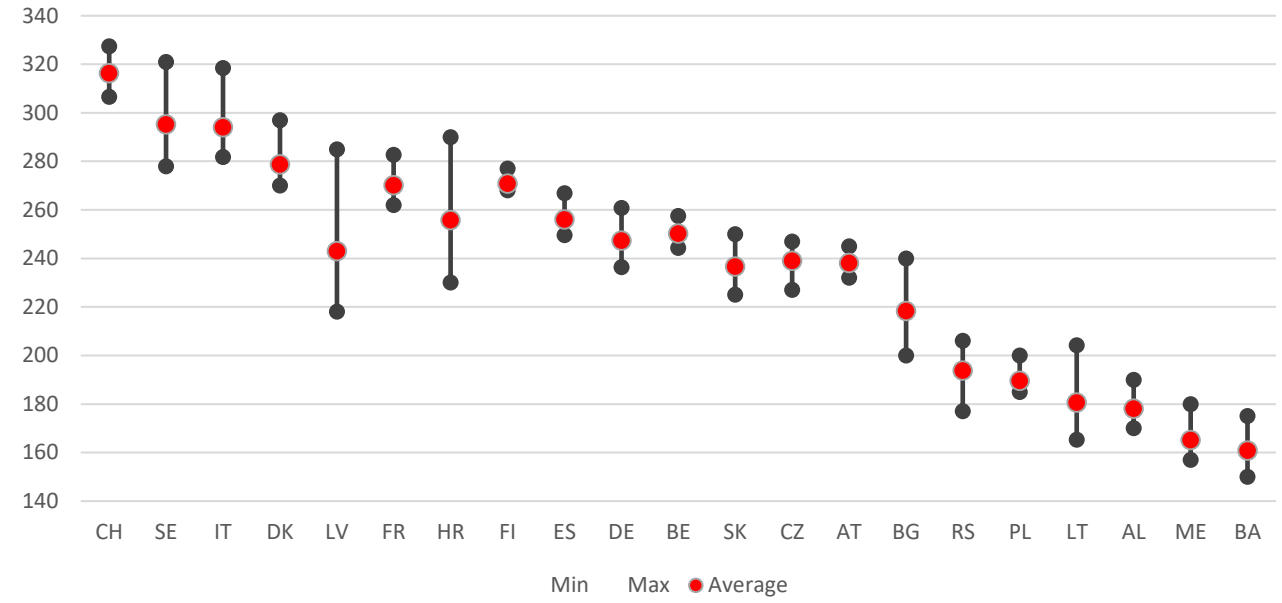
Source: EPC survey 2019

Figure 67 Estimation of bulk pellet prices in European countries with lowest prices between January 2016 and December 2018 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)



Source: EPC survey 2019

Figure 68 Variation and average of bulk pellet prices between January 2018 and December 2018 by country (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)



Source: EPC survey 2019

Table 18 Estimation of bulk pellet prices between January 2018 and December 2018 (delivered 6t, distance 100 km, delivery fees included. In €/tonne VAT incl.)

	Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18
AL	180	175	175	170	172	175	175	175	180	185	185	190
AT	241	240	241	237	232	233	234	234	237	240	243	245
BA	175	175	170	155	150	150	150	150	155	165	165	170
BE	253	255	246	252	246	244	244	247	249	253	257	258
BG	220	220	220	200	200	200	200	200	240	240	240	240
CH	327	324	323	308	307	308	310	312	314	318	320	323
CZ	246	247	247	242	232	230	227	229	238	238	245	247
DE	251	253	255	252	239	238	236	237	241	250	254	261
DK	270	270	270	270	270	270	270	280	290	293	295	297
ES	250	250	250	255	255	255	252	252	252	267	267	267
FI	269	268	268	268	270	270	270	271	271	271	277	277
FR	273	273	273	263	263	263	262	262	262	283	283	283
HR	260	260	250	230	240	230	240	250	270	270	290	280
IT	282			283			293			318		
LT	180	178	180	179	171	171	172	165	175	204	200	192
LV	240	236	231	224	218	227	225	235	250	270	275	285
ME	175	165	162	157	160	160	160	160	165	165	173	180
PL	185	185	185	185	185	185	185	185	195	200	200	200
PT	190					180						190
RS	201	200	195	177	181	181	183	194	199	203	206	206
SE	282	284	284	278	285	285	290	296	312	310	316	321
SK	235	235	235	225	225	225	240	240	240	245	245	250

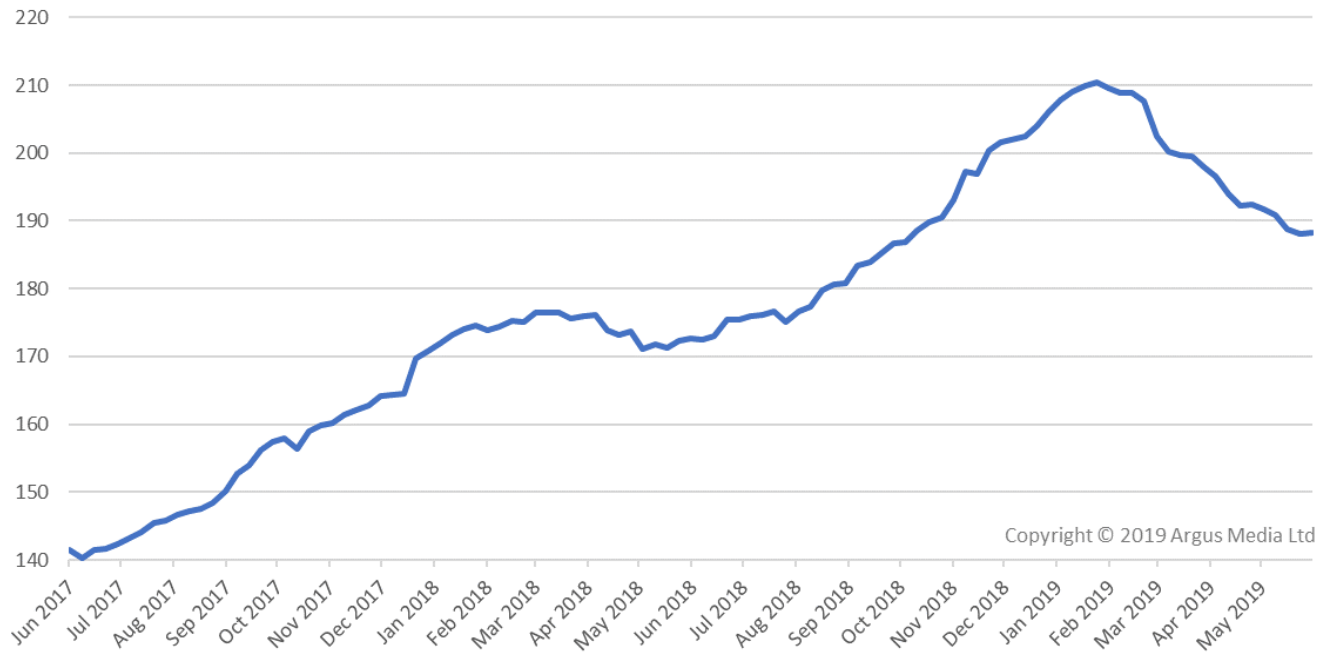
Source: EPC survey, 2019

Figure 69 Average and standard deviation of European prices of bulk pellets between January 2016 and December 2018 (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 taken into account: CH, SE, IT, DK, LV, 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 2019

2.5.2 European price development of industrial pellets

Figure 70 Development of Argus wood pellets 90 day Index cif NWE USD/t (Jun 2017 – May 2019)



Source: Argus Media

April Poore
Argus Media
Acting editor

Cif NWE wood pellet spot index overview 2019 so far

"The industrial wood pellet cif northwest Europe (NWE) index entered 2019 at a record high, as North American and European wood pellet deliveries struggled to keep pace with increased utility demand.

Europe's installed industrial wood-fired power capacity was significantly higher on the year in winter 2018/19. In the UK, utility Drax's 645MW peak-load unit 4 and Czech utility EPH's 396MW Lynemouth plant began firing wood pellets in 2019. While in the Netherlands RWE commenced co-firing at its 600MW Amer 9 plant, reaching 40pc by November.

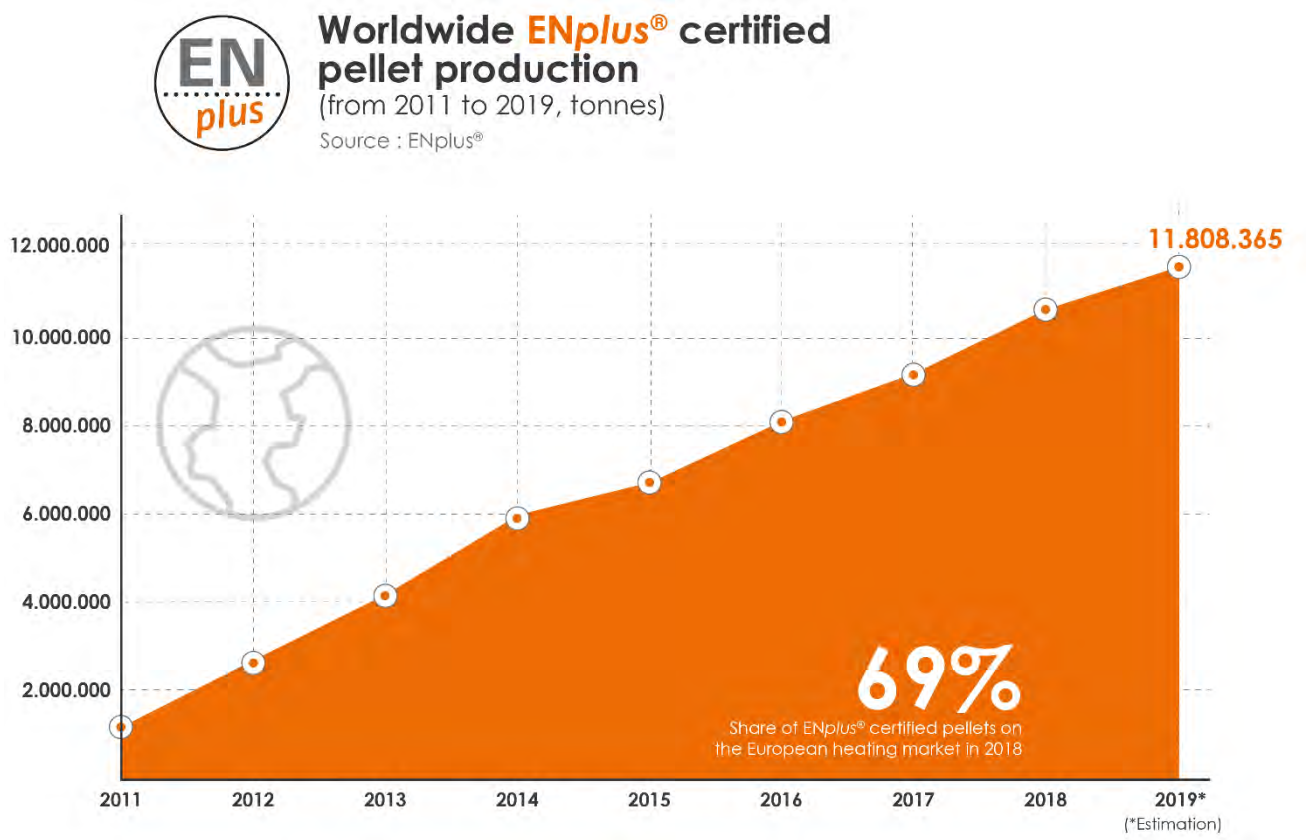
Meanwhile, on either side of the Atlantic, a torrid combination of hurricanes, forest fires, floods and new project delays limited the production and delivery of wood pellets. The coalescence left Europe's biomass market short on supply and lifted the Argus cif NWE wood pellet spot price to a record high of $210.36/t in mid-February.

Supply tightness eased throughout the second quarter. Utility wood pellet demand lowered as some turned to co-firing with coal or agriresidues, others extended or brought maintenance periods forward and warmer spring weather softened heating demand.

Moreover, many production troubles eased. Baltic forestry operations have recovered following floods that limited access to raw materials a year previous, and many producers globally have been able to catch up on long-term contract deliveries.

The spot index softened to an average of $187.97/t in June — but remained around 9pc or $16/t higher on the year."

3 ENplus® pellet production



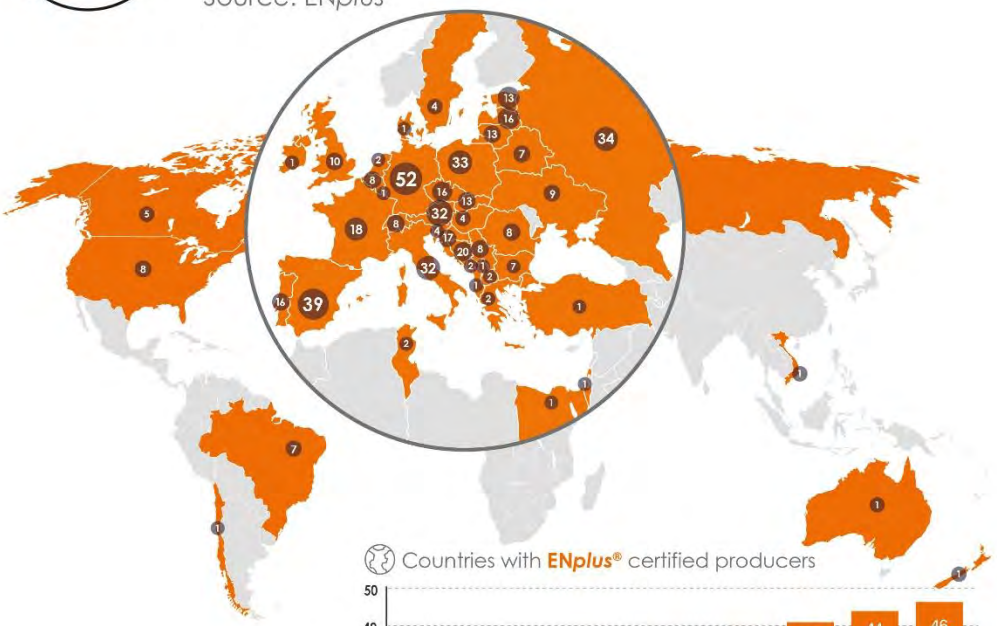
The ENplus® certification scheme ensures wood pellet quality for the customer by guaranteeing the quality of the pellets over the entire supply chain (i.e. from production to delivery). This certification is governed and managed by the European Pellet Council with the support of National Associations, 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 10,5 million tonnes of certified pellets produced in 2018. Continued growth is expected as in previous years, the production is expected to reach 12 million tonnes by the end of 2019.

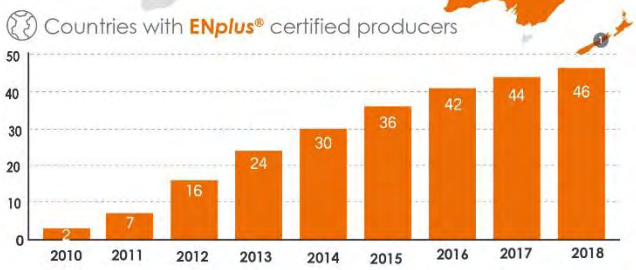
The number of ENplus® certified producers worldwide shows once again a sizeable growth, reaching 485 producers in 2018 and more than 500 now in 2019. The average annual growth of ENplus® pellet production for the last 5 years is around 21%. Since 2013 the production has more than doubled with an increase of more than 6 million tonnes of certified pellet produced. With these results, ENplus® is well on its way to reach its aim of harmonised pellet quality at a global level.

Worldwide ENplus® certified pellet production plants

(In 2018)

Source: ENplus®





Total number of ENplus® certified producers/traders

(in 2018, number of producers/traders)

Source: ENplus®

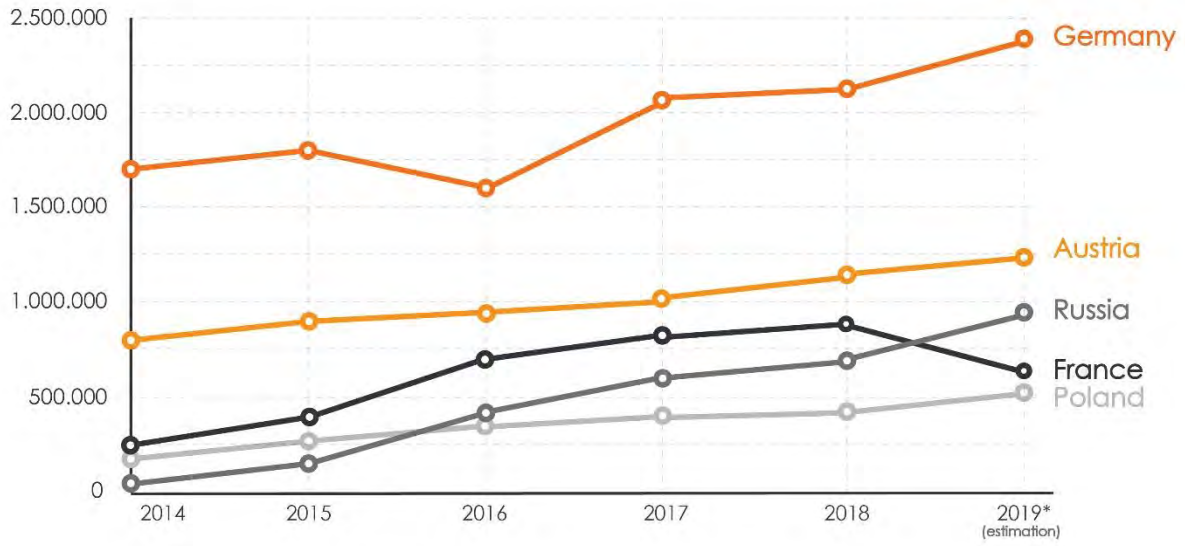
485 ENplus® certified Producers

412 ENplus® certified Traders

Volumes of ENplus® certified pellet produced in the top 5 countries

(from 2014 to 2019, tonnes)

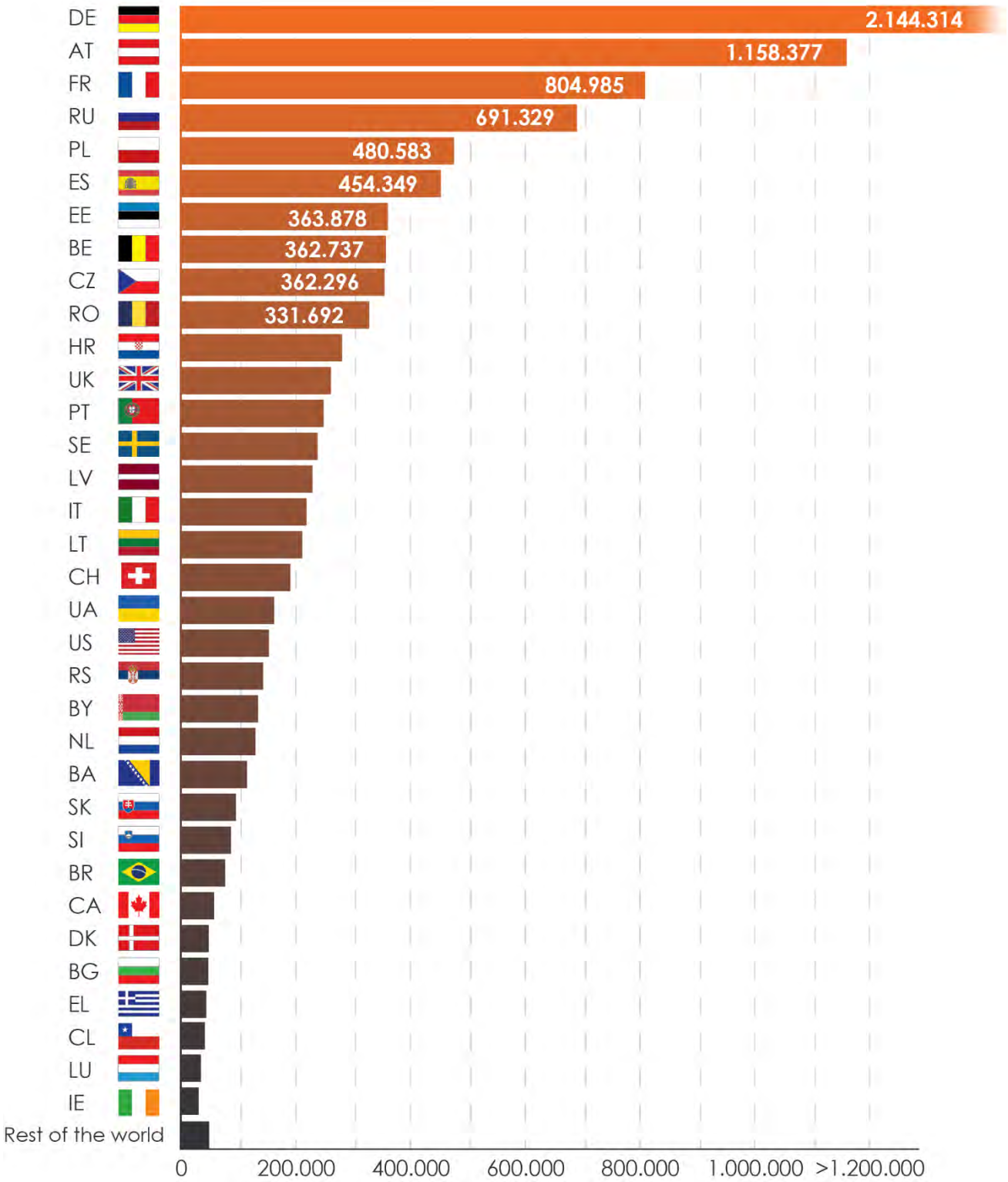
Source: ENplus®



Volumes of ENplus® certified pellets produced per country

(2018, tonnes)

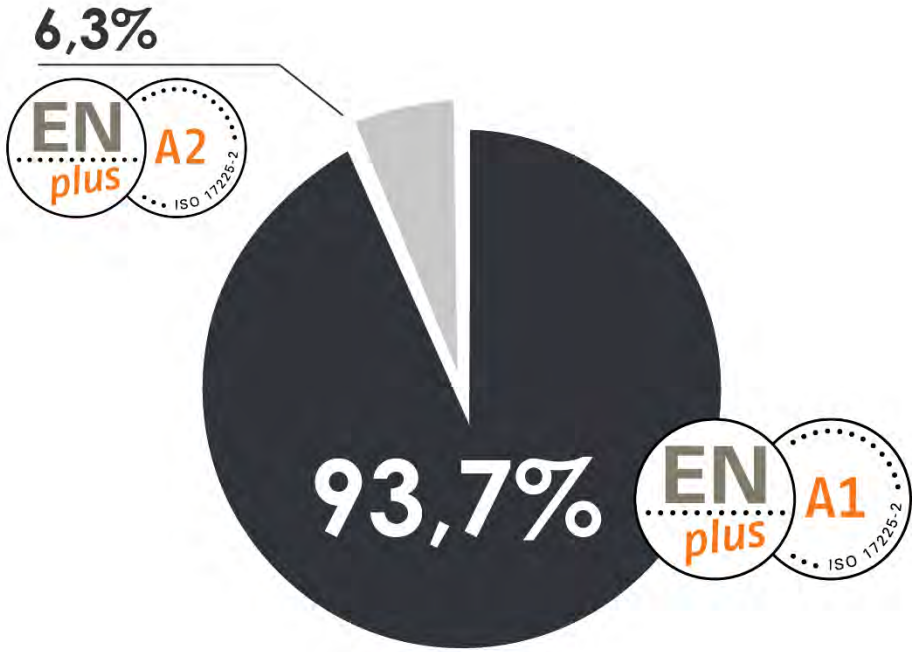
Source: ENplus®



ENplus® certified pellets producers per quality class

(September 2018)

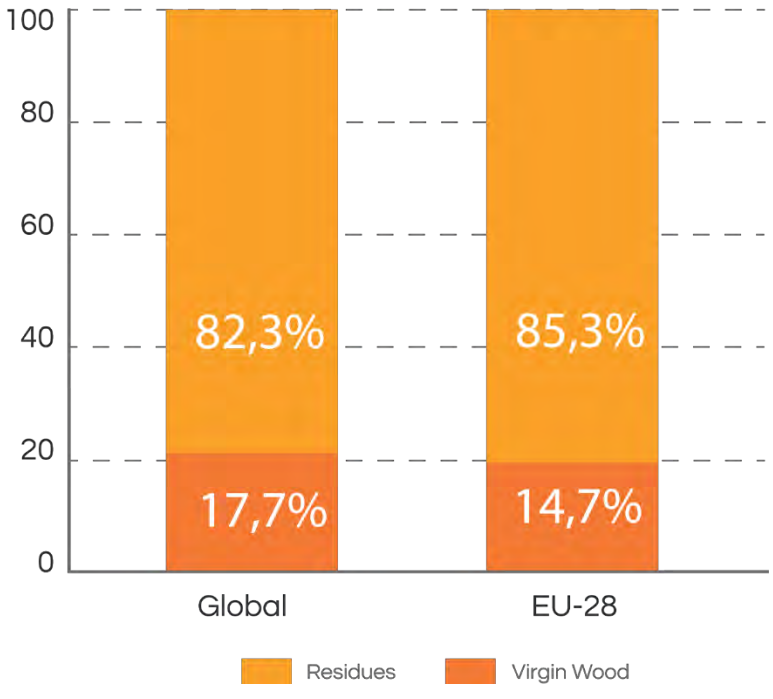
Source: ENplus®



Type of raw material for ENplus® certified pellets

(In 2018, %)

Source: ENplus®



4 Annexes

COUNTRY ABBREVIATIONS

EU28	**European Union (28 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
UK	United Kingdom

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
US	United states of America
VN	Vietnam

Conventions to geographic regions:

EU28: 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, Russia

Europe: EU28+other European countries

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

Baltic countries: Lithuania, Latvia, Estonia

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
Lof 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/ton = 3,6 GJ/ton

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

EN*plus*® REQUIREMENTS FOR WOOD PELLETS

Property	Unit	EN*plus*® A1	EN*plus*® A2	EN*plus*® 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/m^3 [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

GLOSSARY

$CO2_{eq}$ (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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