Interreg
EUROPEAN UNION
Danube Transnational Programme
DanuP-2-Gas

Deliverable D.T2.1.1

Biomass Report Austria

Activity A.T2.1: Biomass potential analysis

June, 2022

Project co-funded by the European Union funds (ERDF, IPA)
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DOCUMENT CONTROL SHEET

Project reference	
Full title of the project	Innovative model to drive energy security and diversity in the Danube Region via combination of bioenergy with surplus renewable energy
Acronym	DanuP-2-Gas
Programme priority	Priority 3
Programme priority specific objective	SO 3.2 Improve energy security and energy efficiency
Duration	01.07.2020 – 31.12.2022
Project website	www.interreg-danube.eu/danup-2-gas
Project coordinator	TZE

Short Description
The potential for exploitable organic residue for each participating country listing key aspects such as location, amount, transport options and costs.

Document Details	
Title of document	Biomass Report (Austria)
Action	WP T2 Transnational Infrastructure and Biomass assessment & Pre-feasibility Studies
Deliverable	D.T2.1.1
Delivery date	June 2022

Version	Date	Author	Organization	Description
V1	28.03.2022	Francisco Villagarcia, Karin Fazeni	EI-JKU	1st version
V2	03.06.2022	Francisco Villagarcia, Darja Markova	EI-JKU	2nd version

IMPRINT

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Responsible Partner for the compilation of this document

ERDF PP3 Energy Institute at the Johannes Kepler University Linz (AT)

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Version	Date	Author	Organization	Description
v1	*26.10.2020*	*Kiril Raytchev*	*BSERC*	*Initial version*
v2	*05.11.2020*	*Kiril Raytchev*	*BSERC*	*Suggestions from the Supervisory board meeting (03.11.2020)*
v3	*21.12.2020*	*Kiril Raytchev*	*BSERC*	*Suggestions from PP12*
v4	*21.01.2021*	*Kiril Raytchev*	*BSERC*	*Internal call for feedback. See Meeting-minutes-20210127_V2 and Meeting-minutes-20210121*

1. METHODOLOGY

This *Biomass Report Austria* was prepared by the *Energieinstitut an der Johannes Kepler Universität Linz* as a deliverable for the *DanuP-2-Gas* project. This report complements the *DanuP-2-Gas Biomass Database Austria* and includes public information on biomass from Statistik Austria, the national statistic institution, as well as data and information from selected reports available at a national level. The report is divided into three main sections concerning (i) wood and wood biomass, (ii) herbaceaus biomass, and (iii) animal and human waste biomass.

In addition, we rely on the IEA Bioenergy report on Implementation of bioenergy in Austria (2021 update) for the present biomass report, together with a series of reports on regional developments of biomass energy sources. This includes the Energy Barge (a compendium of national market reports), Austrian Biomass Association reports, further expert reports of the Austrian Energy Agency, as well as Austria related independent scientific publications on bioenergy.

The *Energieinstitut an der Johannes Kepler Universität Linz* is a well known interdisciplinary research organisation with 20 years of experience in the energy field. Its energy technology department is involved in several bioenergy projects on national and international levels. This report has thus condensed the latest reliable sources of knowledge relevant to depict the current status of bioenergy sources in Austria.

2. WOOD AND WOOD BIOMASS

The following types of wood and woody biomass are encompassed in the analysis:

- Wood chips
- Saw mill residues
- Short rotation biomass (wood chips)
- Logs, firewood
- Wood pellets

The data was assessed based on available statistics, market reports and own estimations based on market reports, statistics and literature. Additionally, the data sources used in the Energy Barge project[1] were used and the data has been updated for the current country report.

[1] Kaufmann, A.-K. (2017) *Energy Barge. Building a Green and Energy Logistics Belt. Compendium of national market reports. Deliverable 3.1*, 2017.

2.1 WOOD PELLETS

The amount of wood pellets produced and the location of Austrian pellets producers have been derived from Biermayr and colleagues (2020)[2]. Another source concerning the location of Austrian pellets producers is proPellets Austria (https://www.propellets.at/) – the association of the pellets sector in Austria. In total currently 42 sites for pellets production are reported in Austria.

shows the Austrian pellets production sites. Eleven companies (red dots) produce between 60,000 and 150,000 t/a , 20 between 20,000 and 60,000 t/a (green dots) and twelve companies produce below 20,000 t/a (yellow dots). In total in the year 2019 1.4 Mio. t of pellets was produced in Austria. The total wood pellets production amounts 1.6 Mio. t in the year 2019 and it has to be assumed that these amounts are in use at the moment. More details on the pellets production at each site are available on the *DanuP-to-Gas Biomass Database Austria*.

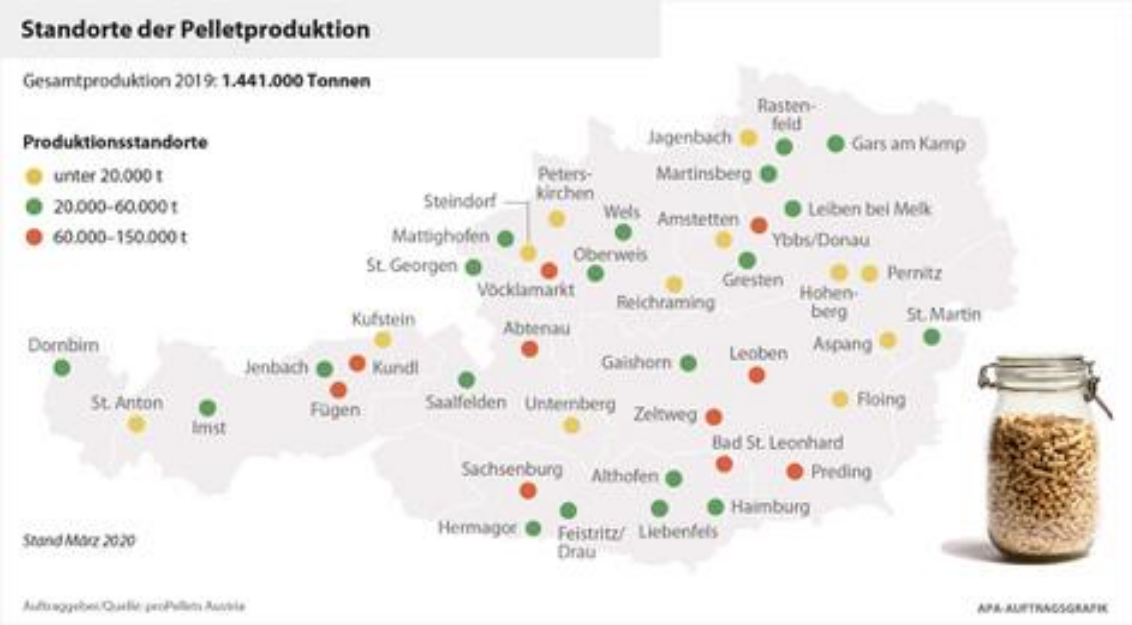

Figure 1: Pellets production sites in Austria (proPellets Austria, 2021)[3]

Concerning the composition of wood pellets, it is assumed that most of the wood pellets in Austria are made from softwood. The LHV, ash content and contaminant content as well as the bulk density refers to the EN plus 2015 on the quality standard of wood pellets. The accepted ranges for the contaminant S are >0,04 - >0,05 m-%, for Cl >0,02 – 0,03 m-%. Additionally, the boundaries for the accepted content of Hg and

[2] Biermayr, P.; Dißauer, C.; Eberl, M.; Enigl, M.; Fechner, H.; Fürnsinn, B.; Jaksch-Fliegenschnee, M.; Leonhartsberger, K.; Moidl, S.; Prem, E.; Schmidl, C.; Strasser, C.; Weiss, W.; Wittmann, M.; Wonisch, P. & Wopienka, E. (2020) [Ger] *Innovative Energietechnologien in Österreich: Marktentwicklung 2019*, BMK, Wien.
[3] proPellets Austria (2021) [Ger] *Herstellung österreichischer Holzpellets*, Online: https://www.propellets.at/herstellung

Cd very low as well: Hg = max. 0,1 mg/$kg_{pellets;}$ Cd = max. 0.5 mg/$kg_{pellets}$.[4] The chemical composition was drawn by Frodeson (2019)[5].

Table 1: Average composition of wood pellets

LHV	Bulk density	Moisture	Hemicellulose	Lignin	Cellulose	Ash Content	Contaminants
[MJ/t]	[t/m3]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]
17 280	0.65	max. 10%	28-33%	27-32%	39-42%	0.7-2%	<0.02%

Source: own table based on EN plus (2015) and Frodeson, F. (2019).

The current pellets price in Austria is around 323 €/t (April/Mai 2022).[6]

2.2 WOOD CHIPS AND SAW MILL RESIDUES

The Austrian wood chips production was estimated based on the cut wood produced in Austrian biggest saw mills in the year 2020. In total, the biggest saw mills in Austria produce 14 million solid meters in the year 2020, which is an increase of about 6 % in comparison to the year 2019. The biggest site in Austria is *Holzindustrie Maresch in Retz*, Lower Austria, reporting a wood cut of 1.29 million fm in total. The second biggest saw mill in Austria are *Mayr-Melnhof Holz* in Leoben, Styria, and *Stora Ensso* in Ybbs, Lower Austria, with a wood cut of 1.15 million fm each. *Binderholz* in Fügen, Tyrol, is another saw mill showing a wood cut of more than 1 million fm in 2020.[7] The amount of wood chips and other saw mill residues was then estimated assuming average factors for saw mill by-products (see Table 2).

Table 2: Factors for by-products in saw mills

by-product	[%]
shavings	*10%*
wood chips	*25%*
cap timber	*2.50%*
spruce	*12%*
wood shavings	*4%*

Source: own table based on Zipusch, et al (2011)[8].

[4]European Pellet Council (2015) [ed.] [Ger] *En plus. Qualitätszertifizierung für Holzpellets. ENplus Handbuch für Deutschland, Österreich und die Schweiz*. Teil 1-6, version 3.0.
[5] Frodeson, F. (2019) *Towards understanding the Pelletizing process of biomass. Perspective on Energy Efficiency and Pelletability of Pure Substances*. Doctoral Thesis, Karlstad University, series 2019:32
[6] proPellets Austria (2022) [Ger] *Aktuelle Pelletpreise, Preisentwicklungen und Vergleiche*, Online: https://www.propellets.at/aktuelle-pelletpreise (dl: 02.05.2022).
[7] Holzkurier (2021) [Ger] *Die größten Sägewerke Österreichs*. Online: https://www.holzkurier.com/blog/groesste-saegewerke-oesterreich.html# (dl: 05.07.2021)
[8] Zipusch, et al. (2011) [Ger] *Wirtschaftlichkeitsanalyse der Sägenebenprodukteverwertung in der österreichischen Holzindustrie*. Schriftenreihe des Instituts für Marketing und Innovation. Band 6, Wien.

In the *DanuP-2-Gas Biomass Database Austria,* wood chips are mentioned separately. In contrast, the saw mill residues shavings, cap timber, spruce and wood shavings are summarized together.

Based on these assumptions the biggest saw mills in Austria produce approx. 1.4 million BM tonnes wood chips per year and 1.6 million BM tonnes saw mill residues per year. According to the market in Austria it has to be assumed that today these saw mill products are already in use. Table 3 summarizes the main composition of wood chips as by-product from saw mills.

Table 3: Average composition of wood chips as a by-product from saw mills and other saw mill by-products

LHV	Bulk density	Moisture	Hemicellulose	Lignin	Cellulose	Ash Content	Contaminants
[MJ/t]	[t/m3]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]
18 500	0.23	15-25%	28-33%	27-32%	39-42%	0.7-2%	n.a.

Source: own table based on Biomass Association Upper Austria (n.a.)[9] and Frodeson, F. (2019)

The price for saw mill products other than wood chips is estimated to be around 100 €/t according to the latest market price documented for saw dust.[10] The transport costs are assumed to be similar to those reported for wood chips in the range from 30 – 60 €/BD tonnes. These transport costs encompass the costs from the forest to the final plant, whereby the transport distances from forest to saw mill is assumed to range between 15 km and 50 km, the transport distance from the saw mill to the final plant is assumed to range from 5 km to 250 km.[11]

In addition to the wood chips available as a residue from saw mills, there are also wood chips produced from thinning work, damaged wood or wood of low quality. In these cases wood chips are a by-product of wood harvesting.[12] For Austria a total wood chips amount of 3.3 Mio. solid meters from wood harvesting is reported for 2019, assuming a density of 0.43 BD tonnes/solid meter[13] this corresponds to approx. 1.4 million bone dry tonnes wood chips.[14] The composition of these wood chips is assumed to be equal to those shown in Table 3.

In case of wood chips as a by-product from wood harvest the detailed site location, respectively the biomass owner cannot be determined. This is mainly due to the small structure of the forestry sector in Austria. There are many small farmers owning a small forest area. Some of them use the wood and wood

[9] Biomass Association Upper Austria (n.a) [Ger] *Masse und Energiegehalt von Hackgut in Abhängigkeit vom Wassergehalt*.
[10] Burger Sägewerk Holzhandel (2021) *Hacksschnitzel/Sägespäne*. URL: https://www.burgerholz.at/produkte/holz-zum-wohnen/hackschnitzel-saegespaene/ (dl: 05.07.2021)
[11] Austrian Biomass Association (n.a.) [Ger] *Hackgut – der Alleskönner. Von der Ernte bis zum Brennstoff*. URL: https://www.biomasseverband.at/wp-content/uploads/FolderHackgutAlleskoennerv3.pdf (dl: 05.07.2021)
[12] Austrian Biomass Association (n.a.) [Ger] *Hackgut – der Alleskönner. Von der Ernte bis zum Brennstoff*. URL: https://www.biomasseverband.at/wp-content/uploads/FolderHackgutAlleskoennerv3.pdf (dl: 05.07.2021)
[13] Hagauer, D. (2009) [Ger] *Empfohlene Umrechnungsfaktoren für Energieholzsortimente bei Holz- bzw. Energiebilanzberechnungen*. Bundesministerium für Land- und Forstwirtschaft.
[14] Klimaaktiv (2020) [Ger] *Holzströme in Österreich*. URL: https://www.klimaaktiv.at/erneuerbare/energieholz/holzstr_oesterr.html (dl: 06.07.2021)

chips for their own purposes, other sell it to companies which do the chipping or directly sell it to the energy production plants. Accordingly, the ownership of the wood chips cannot be determined. Nevertheless Table 4 gives a non-exhaustive overview of companies offering wood chipping in Austria, which could potentially be a central contact point for wood chip availability. The companies shown in Table 4 do not publish their current or planned capacities.

Table 4: Wood chipping companies

company	location
KRAMER HACKGUTERZEUGUNG GmbH	5521 Niedernfritz
Hackgut Möslinger GmbH	4674 Gaspoltshofen
Lener Hackgut GmbH	6116 Weer
Hackguterzeugung Resch GmbH	5621 St. Veit / Pongau
Hackguterzeugung Kals GmbH	4594 Grünburg
Hattinger Oskar Hackguterzeugung-Maschinenhandel	4676 Aistersheim
Berthold	2153 Stronsdorf
Mayrhofer Hackguterzeugung	4772 Lambrechten
Winkler Hackgut GmbH	9782 Nikolsdorf
Hackguterzeugung Andreas Schernthaner	6361 Salvenberg
Hackguterzeugung Schwarzenlander	4852 Weyregg am Attersee
Hackguterzeugung Aigner	6345 Kössen
Eibl - Hackguterzeugung & Handel	4574 Vordertambergau
Hackschnitzel-Erzeugung Josef Knapp	6068 Mils
Hackguterzeugung Gerald Freitag	8076 Vasoldsberg
Günther Fauland Hackguterzeugung	8503 Stainztal
Hackgut Hahn	8301 Eggersdorf bei Graz
Hackguterzeugung Grebenz	8452 Großklein
Winkler Hackgut GmbH	9782 Nikolsdorf
Hackgut Graf	3281 Schachau
Papst HACKK EXPRESS	8742 Obdach
Reinisch Hackgut	6142 Mieders

Source: own table based on Google Maps' data.

Fehler! Verweisquelle konnte nicht gefunden werden. shows the site location of wood chipping companies in Austria (non-exhaustive). In total 22 companies have been identified. Thereof six are located in Upper Austria, five in Styria and three in Tyrol. Upper Austria, Styria and Tyrol are the »hotspots« of wood chipping in Austria.

Figure 2: Location of wood chipping companies in Austria Source: Google Maps (2021)[15]

As the attribution of wood chips directly from forestry is not possible due to the data issues, the overall amount of wood chips is attributed to the Austrian Federal States according to the Federal State´s share on total Austria forest area (see also figure 3). The estimated wood chips production on Federal State level is shown in *DanuP-2-Gas Biomass Database Austria.*

Table 5: Wood chips directly from forest

location	value	unit
Austria	**1 419 000**	**t**
Burgenland	66 000	t
Carinthia	165 000	t
Lower Austria	313 500	t
Upper Austria	198 000	t
Salzburg	148 500	t
Styria	264 000	t
Tyrol	214 500	t
Vorarlberg	49 500	t

Source: own table and estimation

[15] Google Maps (2021) *Search by: Hachgut Erzeugung Österreich*, Online: https://www.google.com/search?client=firefox-b-d&tbs=lf:1,lf_ui:2&tbm=lcl&q=hackgut+erzeugung+%C3%96sterreich&rflfq=1&num=10&ved=2ahUKEwj33-Ghys7xAhUlsaQKHfw4AnEQtgN6BAgFEAQ#rlfi=hd:;si:;mv:[[49.205533429804355,18.210763473437503],[45.8695039744437,8.762521285937503],null,[47.56406653150557,13.486642379687503],7] (dl: 06.07.2021)

This amount of wood chips is already in use according to the Austrian Wood Flow Chart[16] and Wood Flow Chart on energetic usage. The biggest share of wood chips is currently used for heating facilities < 1 MW (approx. 57 %), approx. 35 % are used in CHP facilities and a smaller share goes into heating facilities > 1 MW.[17]

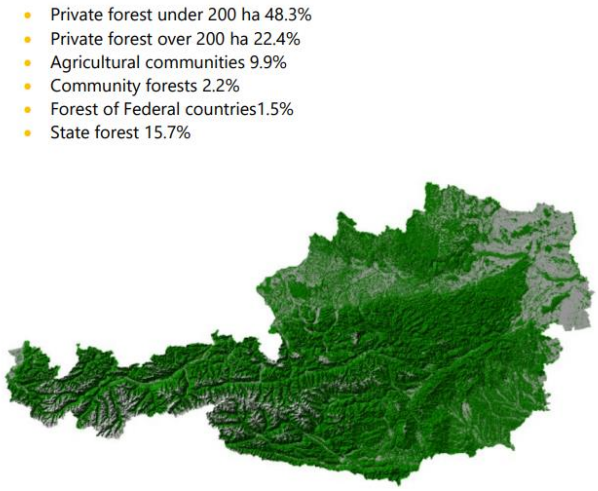

Figure 3: Private and public forest ownership in Austria. Source: Böhling (2021)18

2.3SHORT ROTATION WOOD

Wood from short rotation is usually chipped and used for energetic purposes in Austria. Due to the small-sized agricultural structure in Austria, no bigger companies have been identified who manage the short rotation wood plantations. This happens on farm level and therefore is organized on small scale level. Accordingly, it is not possible to figure out the owner of short rotation biomass as this is subject to confidentiality in Austria statistics.

Accordingly, the potential of short rotation wood – which is mainly utilized for chipping in Austria – is shown in

Table 6 on Federal state level. The area used for short rotation plantations is according to the Austrian statistical report on agriculture.[19] The average yield of short rotation plantations is assumed to be 11 t/ha according to Biermayr et al (2019)[20].

[16] Austrian Energy Agency (2020) *Holzströme in Österreich*, Online: https://www.klimaaktiv.at/erneuerbare/energieholz/holzstr_oesterr.html (dl: 08.07.2021)
[17] Austrian Energy Agency (2020) *Wood Flows in Austria – Energy Production*, Online: https://www.klimaaktiv.at/erneuerbare/energieholz/holzstr_oesterr.html (dl: 08.07.2021)
[18] Böhling, K. (2021) *Report on current situation and position of women in forestry in Danube Region*, Deliverable D.T1.1.1, Online: https://www.researchgate.net/publication/351048741_Report_on_current_situation_and_position_of_women_in_forestry_in_Danube_region_Deliverable_DT111_Project_number_DTP3-500-12_Fem4Forest/link/60811160881fa114b41b8814/download
[19] Statistik Austria [ed.] (2020) [Ger] *Statistik der Landwirtschaft*. Wien.
[20] Biermayr et al. (2020) [Ger] *Innovative Energietechnologien in Österreich: Marktentwicklung 2019*, Berichte aus der Energie- und Umweltforschung 14/2020.

Table 6: Potential of short rotation wood in Austria

Federal State	*short rotation wood area 2018 [ha]*	*short rotation wood [t]*
Austria total	**2 422**	**26 642**
Burgenland	15	165
Carinthia	171	1 881
Lower Austria	948	10 428
Upper Austria	569	6 259
Salzburg	59	649
Steiermark	604	6 644
Tyrol	55	605
Vorarlberg	0	0
Vienna	1	11

Source: own table and estimations based on Statistik Austria (2020)[21] and Biermayr et al (2020).

In total the potential of wood chips from short rotation is estimated to be around 27.000 t in Austria. Most of this potential is located in Lower Austria, Upper Austria and Styria. For further considerations it should be assumed that this biomass potential is already in use.

Table 7 summarizes the average composition for wood chips from short rotation wood. Ash and carbon content were derived from Whittaker et al (2018)[22], the moisture, hemicellulose, lignin and cellulose content was derived from Kacik et al. (2012)[23] and the LHV

was taken from Eisenbies et al. (2016) [24].

Table 7: Average composition of wood chips from short rotation

LHV	**Bulk density**	**Moisture**	**Hemicellulose**	**Lignin**	**Cellulose**	**Ash Content**	**Contaminants**
[MJ/t]	[t/m3]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]
8.600-11.700	0.29	44%	30%	20%	20%	1.50%	n.a

[21] Statistik Austria [ed.] (2020) [Ger] *Statistik der Landwirtschaft*. Wien.
[22] Carly Whittaker, Nicola E. Yates, Stephen J. Powers, Tom Misselbrook, Ian Shield, (2018) Dry matter losses and quality changes during short rotation coppice willow storage in chip or rod form, *Biomass and Bioenergy*, Volume 112,, Pages 29-36, https://doi.org/10.1016/j.biombioe.2018.02.005.
[23] Kacik, F. et al (2012) Chemical Profiles of Wood Components of Poplar Clones for their Energy Utilization. *Energies*, Vol. 5, pp. 5243-5256
[24] Mark H. Eisenbies, Timothy A. Volk, Aayushi Patel, (2016) Changes in feedstock quality in willow chip piles created in winter from a commercial scale harvest, *Biomass and Bioenergy*, Volume 86, Pages 180-190.

Source: own table based on Whittaker, C. et al (2018), Kacik, F. Et al (2012) and Eisenbies, M.H. et al (2016).

As reported for example by Eisenbies, M.H. et al (2016) or Whittaker, C. et al (2018) the properties of wood chips derived from short rotation biomass changes over time and is therefore for example dependent on the duration of storage but also on harvesting time.[25][26]

3. HERBACEAUS BIOMASS

3.1 MISCANTHUS

The potential for miscanthus in Austria has been derived based on Austrian agricultural statistics and the area which is used for miscanthus cultivation. Similar to short rotation wood potential, it is not possible to figure out the owner of the biomass as the Austrian agriculture is very small-sized. Accordingly, a number of individual farmers are the owners of the biomass and those cannot be mentioned due to confidentiality issues regarding agricultural statistics. In the following the potential of miscanthus is shown based on Federal State level (see

Table 8). Table 9 summarises the average composition of miscanthus reported in the literature.

Table 8: Average composition of wood chips from short rotation wood

	miscanthus [ha]	*miscanthus [t]*
Austria total	**1 118**	**15 652**
Upper Austria	447	6 258
Lower Austria	469	6 566
Styria	109	1 526
Carinthia	35	490
Burgenland	40	560
Salzburg	5	70
Tyrol	6	84
Vorarlberg	7	98
Vienna	-	-

Scource: Own estimations based on Statistik Austria (2020)[27] and Biermayr et al. (2020).

[25] Mark H. Eisenbies, Timothy A. Volk, Aayushi Patel,
Changes in feedstock quality in willow chip piles created in winter from a commercial scale harvest, Biomass and Bioenergy, Volume 86, 2016, Pages 180-190, https://doi.org/10.1016/j.biombioe.2016.02.004.
[26] Carly Whittaker, Nicola E. Yates, Stephen J. Powers, Tom Misselbrook, Ian Shield, (2018) Dry matter losses and quality changes during short rotation coppice willow storage in chip or rod form, *Biomass and Bioenergy*, Volume 112,, Pages 29-36, https://doi.org/10.1016/j.biombioe.2018.02.005.
[27] Statistik Austria [Ed.] (2020) [Ger] *Statistik der Landwirtschaft*. Wien.

Table 9: Average composition of miscanthus

LHV	Bulk density	Moisture	Hemicellulose	Lignin	Cellulose	Ash Content	Contaminants
[MJ/t]	[t/m3]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]	[% dry]
16 200	0.13	<15%	27%	19%	48%	3.00%	n.a

Source: Own table based on Falano, T. Et al (2014)[28].

Based on the miscanthus cultivation area and an assumed yield of 14 t/ha[29], the total miscanthus potential in Austria is estimated to be around 15,652 t, whereof ~40% are located in Upper Austria and Lower Austria each and 10 % in Styria. Accordingly, around 90 % are located in three of nine Federal States. For further considerations it should be assumed that this biomass potential is already in-use.

4. ANIMAL AND HUMAN WASTE BIOMASS

The data was assessed based on available statistics, market report and own estimations based on market reports, statistics and literature. Additionally, the data sources used in the Energy Barge project[30] were used and the data has been updated for the current country report.

Renewable municipality solid waste makes up 3% of the total bioenergy supply in Austria, having increased from 2 PJ in 2000 to its current amount of 8 PJ (IEA Bioenergy, 2021). Ever since the enactment of the Landfill Ordinance in 2004, banning any landfilling of recyclable or combustible waste, Austria pursues a straightforward strategy toward a circular reutilisation of municipal waste by enforcing recycling and energy recovery instead of landfilling (ÖWAW, 2020).

Figure 4 shows the development of municipal waste utilization in Austria from 1997 till 2017. According to most recent available data, municipal waste is utilized mainly for recycling or energy production by means of incineration. 60% of municipality waste gets recycled, where 11 waste incineration plants and 51 co-incineration plants process the remaining 40 % of municipality waste in Austria.

[28] Falano, T. Et al (2014) Assessing the environmental sustainability of ethanol from integrated biorefineries, *Biotechnology Journal*.

[29] Biermayr et al (2020) *I*[Ger] *nnovative Energietechnologien in Österreich. Marktentwicklung 2019*. Berichte aus der Energie- und Umweltforschung 14/2020.

[30] Kaufmann, A.-K. (2017). *Energy Barge. Building a Green and Energy Logistics Belt. Compendium of national market reports. Deliverable 3.1*, 2017.

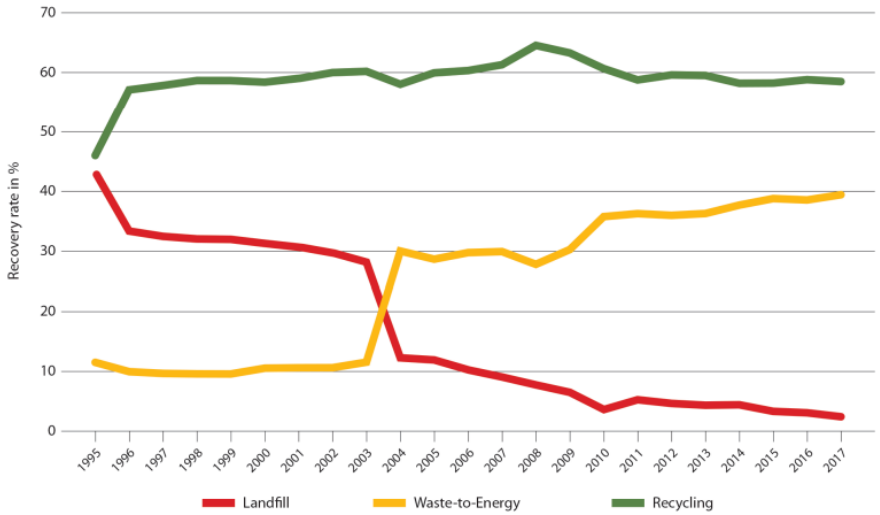

Figure 4: Development of Municipal Waste Utilisation in Austria 1995-2017. Source: ÖWAW (2020)[31].

[31] ÖWAW (2020) *The Role of Waste-to-Energy Technologies in the Circular Economy, by Example of Austria*, Online: file:///C:/Users/AK192354/Downloads/EP_Thermik_engl_20_final.pdf

5. BRIEF DESCRIPTION OF THE AUSTRIAN BIOMASS LANDSCAPE

Around 30% of Austria's energy supply comes from renewable sources, while 35% of the overall national consumption is based on renewables (based on 2019 data). Biomass accounts for 55% of renewable energy supply in Austria (as shown in figure 5).

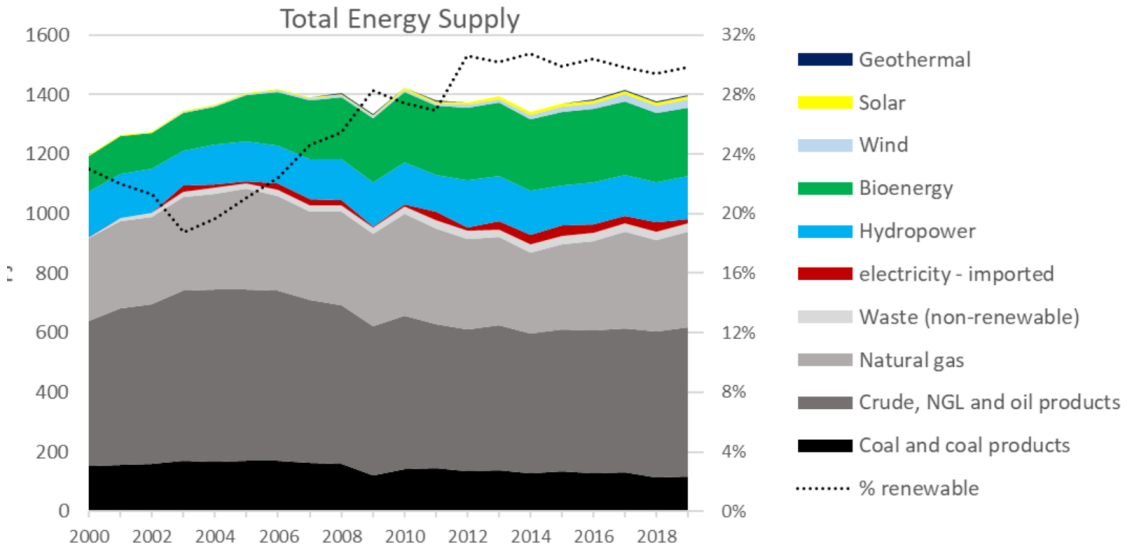

Figure 5: Biomass sources as part of total energy supply in Austria in PJ. Source: IEA Bioenergy (2021: 4)[32].

Biomass sources are used mainly for direct heating including residential heating and industrial applications as well as for district heating. In Austria district heating was traditionally based on bioenergy. Nowadays, it makes up to 50% of the energy supplied through the heat networks.

In 2019, the Total Energy Supply (TES) in Austria reached 1.398 PJ. Around a third of that total energy supply (i.e. 412 PJ) originated from renewable energy sources, 55% thereof were supplied by bioenergy (i.e.213 PJ). Regarding the types of bioenergy, Austria relies to a great extent on solid biofuels, which account for over 80% of the total bioenergy supply, comprising wood fuel, woodchips, wood pellets and bark, as well as sawmill by-products. Supply of solid biofuel is classified in three categories (see figure 6) (i) energy production (electricity and heat output), (ii) industry and (iii) residential sector. Energy supply of biodiesel, biogas, renewable municipality waste and bioethanol has increased steadily since 2004, reaching currently a share of around 16% of the total bioenergy supply.

[32] IEA Bioenergy (2021) *Implementation of bioenergy in Austria: 2021 update*, Online: https://www.ieabioenergy.com/wp-content/uploads/2021/11/CountryReport2021_Austria_final.pdf

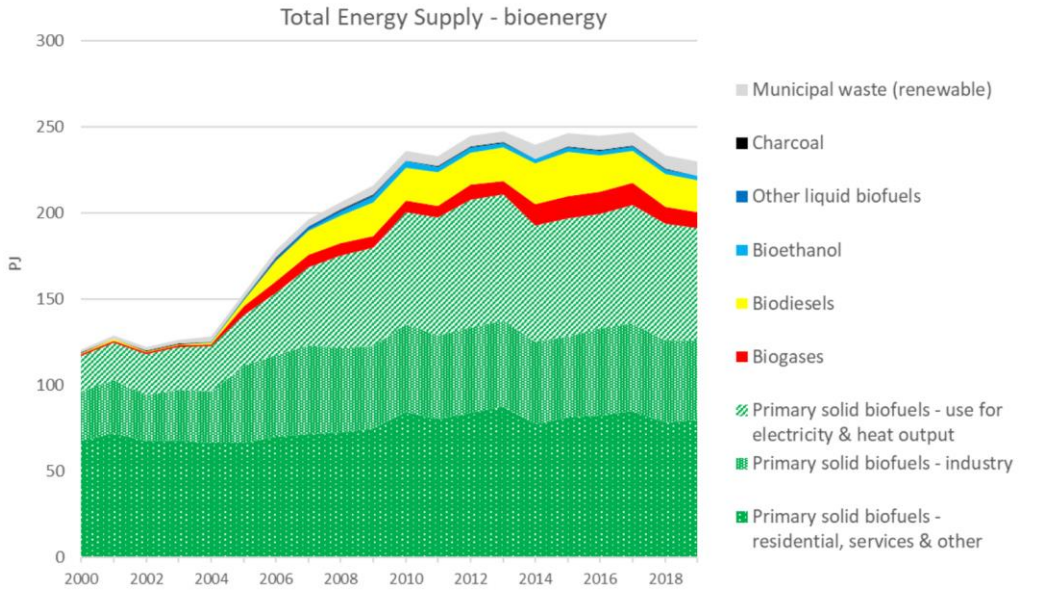

Figure 6: Composition of biomass sources in Austria in PJ. Source: IEA report on bioenergy in Austria (2021: 5).

According to the 2019 data, around 2,400 biomass heating plants with a total capacity of 2,100 MJ generate 6,100 GWh across Austria (see figure 7). Thus, around 200,000 households benefit from the national bioenergy heating supply (Austrian Biomass Association, 2019).

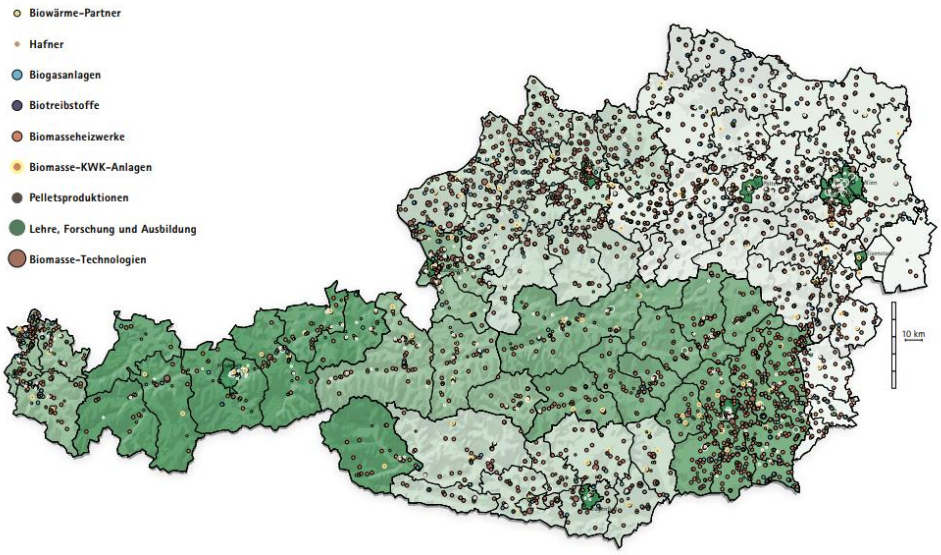

Figure 7: Location of biomass facilities in Austria. Source: Austrian Biomass Association (2019: 26)[33].

[33] Austrian Biomass Association (2019) [Ger] *Bioenergie Atlas Österreich*, Online: https://www.biomasseverband-ooe.at/uploads/media/Downloads/Publikationen/Bioenergie_Atlas/Bioenergie-Atlas_Oesterreich_2019_klein.pdf

In conclusion, data analysed for this report shows a clear trend for wide use of bioenergy in Austria. Different scenarios prospected by different private and public institutions see bioenergy as the most widespread energy source in a future climate neutral energy system.

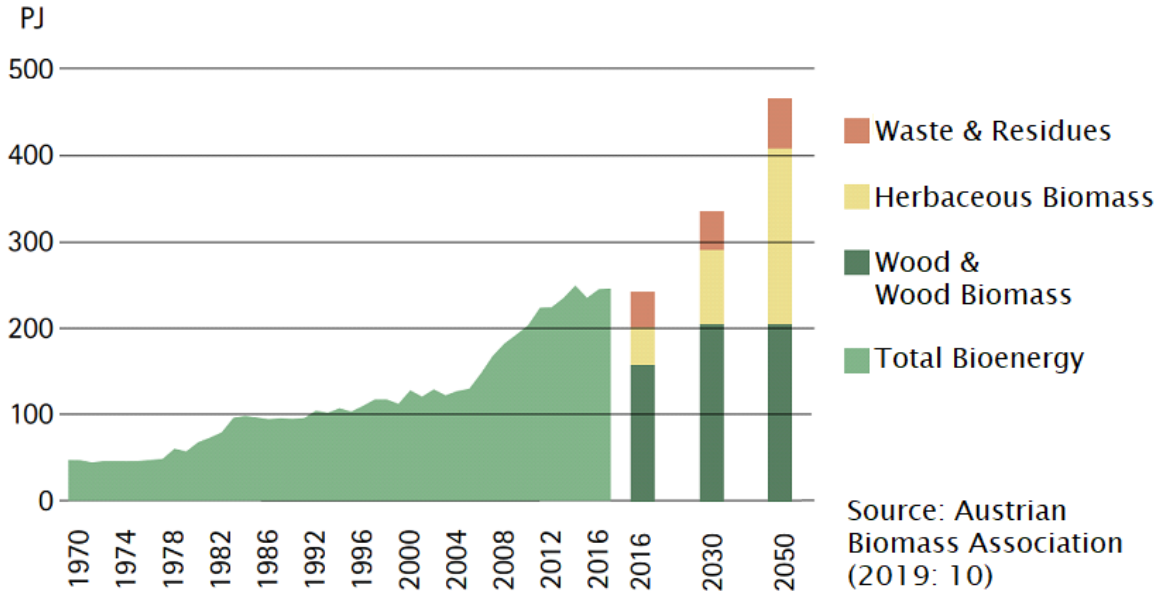

Figure 8: Evolution of gross domestic bioenergy consumption 1970-2016 and estimated unused biomass potential 2030 and 2050 in Austria. Source: Austrian Biomass Association (2019: 10)[34] with own translation.

Figure 8 displays the evolution of the domestic bioenergy consumption between 1970 and 2016 according to national statistics, together with the estimated unused biomass potential for 2030 and 2050. According to the *Austrian Biomass Association*, the current expansion of biomass utilisation is constrained by energy market receptivity, even though there is still a considerable biomass availability. The unused biomass potential is estimated to be between 25% and 50% of the total biomass available for energetic utilisation. As figure 8 shows, the largest biomass potential is located in the agricultural sector, followed by forestry and woody biomass (Austrian Biomass Association, 2019).

[34] Austrian Biomass Association(2019) [Ger] *Bioenergie Atlas Österreich*, Online: https://www.biomasseverband-ooe.at/uploads/media/Downloads/Publikationen/Bioenergie_Atlas/Bioenergie-Atlas_Oesterreich_2019_klein.pdf