Biomass potential in CZ and AT

Evaluation of the efficiency of biomass supporting policies for households in CZ and AT

(Czech-Austrian Winter and Summer School)

Jakob Aichinger
Alp Arslan Suleymanli

Co-operating Universities

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CONTENT

1. ABSTRACT

Biomass was the first energy carrier of mankind. After it was strongly substituted by fossil fuels during the last decades, its importance as a renewable energy carrier now rises continuously again. To be able to compare the two countries and to get a picture of the current situation, the current biomass use and the estimated potential were evaluated from several sources.

In order to enforce the energy system to include more RES and especially biomass, governments apply incentive programmes, which mainly are subsidies on biomass burning units. However, the two countries' systems differ significantly: While Austria supports pellet- and wood-burning units for all sizes directly, Czechia supports bigger plants monetary and controls the new burners in the households by restricting laws for example for exhaust gas.

In conclusion, both the countries show efforts to enforce biomass utilization – especially technically advanced, such as second-generation biomass – and in both countries biomass contributes a significant share of the renewable energy generation.

2. INTRODUCTION

According to EU's 20-20-20 targets, all countries are obliged to reduce their greenhouse gas emissions, to raise the share on renewable energy and to raise energy efficiency. These Targets were replaced in 2015 by the new 2030 Energy Strategy, which include EU-wide targets and policy objectives for the period between 2020 and 2030. These targets aim to help achieving the long-term target of greenhouse gas reduction by 2050. The goals are phrased similar, however the extent is different. Biomass as a sustainable and renewable energy carrier will play an important part to fulfil the first two requirements. Since it is able to substitute liquid and solid fossil fuels such as gasoline, diesel and coal, it will gain importance in transport sector and in the sector of domestic heating but also in the decentralized coal firing power plants.

However, although it is a renewable energy carrier, the land that is needed to produce it, is limited. Especially the use of so-called first generation biofuels require additional land in order to increase production, however, these resources are usually easier and cheaper exploitable. Therefore a sustainable use of resources, increased use of second generation biomass and well-planned political enforcement to drive developments in a sensible direction is necessary.

Czech Republic and Austria, both members of the EU, have similar goals, since the EU is directing them, however, the countries differ in their approach to face and force necessary changes. The core objectives of this work are to compare the policy practice of these two countries and to draw a picture of the direction, the policy is heading, statistics of biomass use and potential in the countries are compared.

The work is based on literature, such as scientific papers, and statistical data which was obtained from the statistical offices of the countries and the European commission.

3. CURRENT SITUATION OF THE ENERGY SUPPLY AND POTENTIAL OF BIOMASS EXPLOITATION

The following chapters describe the current situation of biomass utilization and energy supply in Austria, Czechia and the the EU.

3.1. Austria compared to EU-28

Due to advantageous conditions in terms of renewable energy production (especially wood biomass and electric energy from hydropower) in Austria, their share is significantly higher than EU average: Considering the gross energy consumption in 2013, EU28 had a share of 11.8% compared to 31.6% Austria (BMLFUW, 2015).

The following Figure 1 shows the gross energy consumption split up into different energy carriers. The green highlighted ones can be considered as renewable (BMLFUW, 2015). With 12.8% biofuels and biogenic combustibles are the largest share, followed by wood and combustible waste (6.2%).

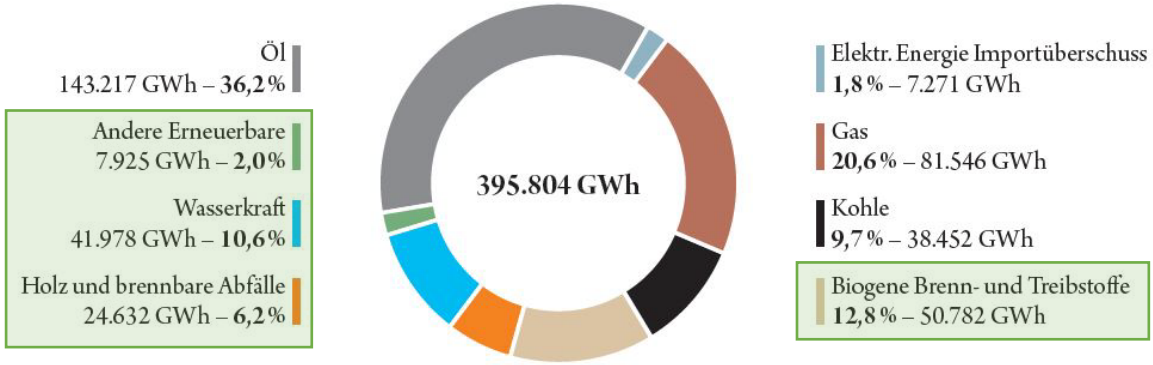

Figure 1: Share of energy carriers in Austria (gross domestic consumption) (BMLFUW, 2015).

Figure 2 shows in which parts the renewable share of gross energy consumption in the EU 28 can be split up (BMLFUW, 2015). The largest part is wood combustibles (5.5%) followed by hydropower (1.9%) and windpower (1.2%). The percentages relate to the total gross energy consumption of the EU28.

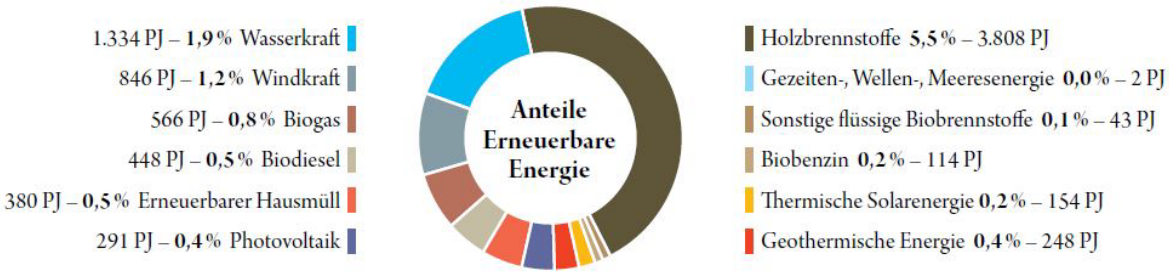

Figure 2: Shares of renewable energy carriers in the EU28 in 2013 (gross domestic consumption) (BMLFUW, 2015).

In the year 2012, Austria was the 7th biggest producer of renewable energy within the EU28. While it only produced 1.6% of the total energy, it was responsible for 5.4% of renewable energy production (BMWFW, 2015).

3.2. EU 2020 and 2030 targets

In order to fulfill the EU targets concerning reduction of greenhouse gases and reduction of dependence of the import of primary energy, the member states follow different leads to reach the goal. In the heating and cooling sector, every country has set national targets of the share on renewable energy sources until 2020. Table 1 shows the percentages for each year. 2005 is the base year, on which the following goals were set (CANSINO et al., 2011). As depicted in 3.3, Austria fulfilled the 2020 targets already in 2014.

Table 1: National targets of renewable energy in heating and cooling in 2005, 2010, 2020 (CANSINO et al., 2011).

	2005 (%)[b]	2010 (%)[b]	2020 (%)[b]
Austria	24.3	30.5	32.6
Belgium	2.3	3.5	11.9
Bulgaria	15.28	16.50	23.8
Cyprus	9.1	16.2	23.5
Czech Republic	8.4	10.2	14.1
Denmark	23.2	30.8	39.8
Estonia	16.3	19.2	17.6
Finland	40	37	47
France	13.6	17	33
Germany	6.6	9	15.5
Greece	12.76	14.7	19.7
Hungary	5.4	9.0	18.9
Ireland	3.5	4.3	12
Italy	2.8	6.53	17.09
Latvia	42.7	45.3	53.4
Lithuania	27	28	39
Luxembourg	1.7	2.1	8.5
Malta ([a])	—	7.9	6.2
The Netherlands	2.5	3.7	8.7
Poland ([a])	—	12.29	17.05
Portugal	31.9	30.7	30.6
Romania	18.72	17.86	22.05
Slovak Republic	6.1	7.6	14.06
Republic of Slovenia	20	22.3	30.8
Spain	8.8	11.3	18.9
Sweden	53.7	57	62.1
United Kingdom	0.7	1	12

[a] No data for 2005.
[b] These data represent the percentage of renewable heat generation as a proportion of total heating and cooling energy demand.

Table 2 shows the targets of the 2030 directive in relation to the 2020 targets. The four colored columns show the different EU targets. The individual targets are GDP adjusted, therefore the more ambitious scenarios are mainly carried by the former EU-15 (RESCH et al., 2014).

Table 2: National 2030 RES targets with different EU targets (RESCH et al., 2014).

		2020	2030	2030	2030	2030
EU target	%	20	30	35	40	45
Results on national RES targets						
			Flatrate + GDP adjusted			
Austria	AT	34	44	49	54	59
Belgium	BE	13	23	27	32	37
Bulgaria	BG	16	23	26	29	32
Cyprus	CY	13	22	26	30	35
Czech Republic	CZ	13	20	24	27	31
Denmark	DK	30	42	48	53	59
Estonia	EE	25	32	36	39	42
Finland	FI	38	47	51	55	59
France	FR	23	34	39	45	50
Germany	DE	18	29	34	40	45
Greece	GR	18	28	33	38	43
Hungary	HU	13	21	24	28	32
Ireland	IE	16	27	33	38	44
Italy	IT	17	27	32	37	42
Latvia	LA	42	49	52	55	59
Lithuania	LT	23	30	34	38	41
Luxembourg	LU	11	20	25	29	34
Malta	MT	10	20	24	29	34
Netherlands	NL	14	25	30	36	41
Poland	PL	15	23	26	30	34
Portugal	PT	31	40	45	49	54
Romania	RO	24	31	35	38	42
Slovakia	SK	14	22	25	29	33
Slovenia	SI	25	35	40	45	51
Spain	ES	20	30	34	39	44
Sweden	SE	49	59	64	69	75
United Kingdom	UK	15	27	33	39	46

3.3. Heat supply in Austria

Heat supply is responsible for almost a third of final energy use in Austria and can mainly be split up in two branches: decentralized domestic heating and district heating (BMWFW, 2015). In 2014, 35.6% of the final energy in the heating sector was generated from renewable resources (BMLFUW, 2015).

3.3.1. District heating

In 2013, district heating covered about 21% of total heat supply (24 380 GWh). Of this energy, 58.4% were provided by CHP-plants. The other part comes from heating plants. Although the CHP-process is more efficient and therefore emits less CO_2, its share is decreasing due to economic reasons (low price for electricity and high price for natural gas and other fuels) (BMWFW, 2015). In Figure 3 and Figure 4 the produced heat from 1990 to 2013 and the share of the energy carriers are shown. The green part is biomass and the blue part combustible waste.

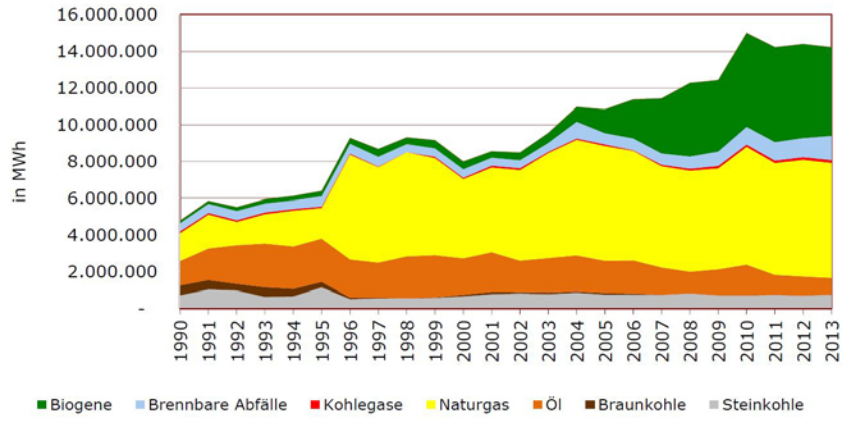

Figure 3: Heat supply from CHP from 1990 to 2013 (BMWFW, 2015)

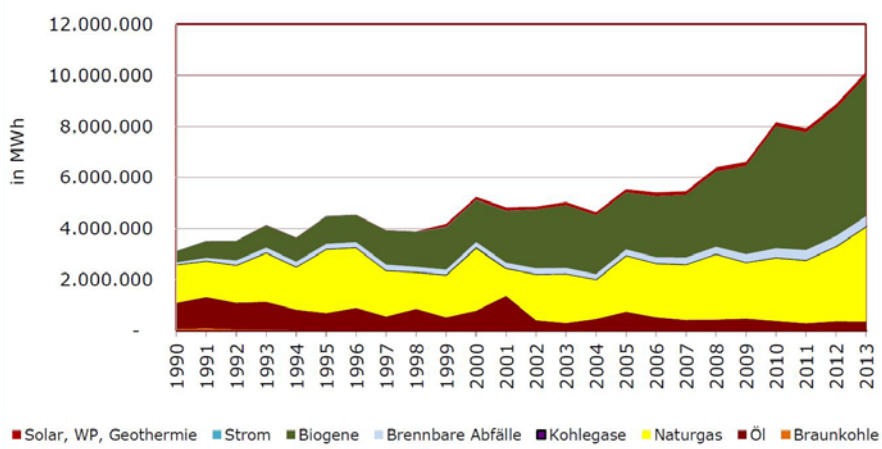

Figure 4: Heat supply from heating plants from 1990 to 2013 (BMWFW, 2015)

The renewable share in district heating was slightly risen since 2012 (44.2%) – after a drop in 2013 (43.2%) – to 45.3% in 2014 (BMLFUW, 2015).

3.4. Heat supply from biomass in Czechia

In Czechia, biomass is still traditional solid fuel in households heating systems mainly in rural areas, mostly as a chopped timber wood. But also furnaces equipped with automatic dosing machine for pellets (in single households) and woodchips or saw dust (in central district heating systems) are in use. New project for co-generation heat and electricity in municipal heating plant are being lay out.

3.4.1. Household heating systems

In the countryside households, there is not sufficient overview how many furnaces for wood are in use. In the countryside, it is estimated that 17 % of households have furnace for wood. However, taking into account that some part of coal furnace owners uses wood as fuel (wood from local forest is often cheaper than coal, thus wood is used even in households equipped with coal furnaces) this estimation can be increase till 30%.

Table 3: Household equipped with furnace for wood (Czech Biomass Assosiation)

Cities		**Countryside**	
Furnace for central household heating	Combination of central heating and warm water	Furnace for central household heating	Combination of central heating and warm water
2.78%	1.1%	21.2%	8.8%

3.4.2. Centralized heating system

There is approximately 40 district heating systems for biomass in Czech Republic. There is existing systematic support for renewable electricity and heat generation from biomass. District heating systems tends to include electricity co-generation. One of the successful example is district heating system in Trebic city, managed by company TTS. There was installed new turbine in May 2005. Turbine is now in a testing phase. Company runs two boilers for biomass with power of 7 and 3 MW.

In addition to the co-generation, co-combustion is also the way of biomass utilization. Co-combustion of biomass with brown coal or lignite is done in four power plants of company CEZ (Power plant Tisová, Poříčí, Ledvice and Hodonín). In Hodonin, highest amount of biomass is used. In 2009, CEZ replaced one unit of Hodonin to pure biomass combustion. In 2014, CEZ produced 274 GWh energy from biomass, 152 of it produced in Hodonin Power Plant.(CEZ GROUP)

3.5. Biomass utilization in Austria

In the following statistics (BMLFUW, 2015) the term “wood fuels” covers the use of firewood, wood chips, pellets, briquettes, waste wood, wood charcoal and biogenic waste.

In 2014, 28 650 GWh of heat in final energy were supplied by wood fuels, which is more than 98% of the heat obtained from biomass (BMLFUW, 2015).

In Austria solid biomass is a traditional energy carrier in decentralized domestic heating. However also biomass-CHP and biomass heating plants are established applications. Therefore the market of biomass firing devices is on a relatively high level. After a pellet shortage in 2006 and the rise of prices, in 2007 the market dropped significantly, but developed high numbers in 2008 again. As an effect of the world economic crises, the number of sold units dropped again. After an all-time-high in 2012 numbers kept decreasing until 2014 (**Fehler! Verweisquelle konnte nicht gefunden werden.**), which can be partly explained by the low oil prices, private subsidies of oil burners and the high numbers of investments in the past years.

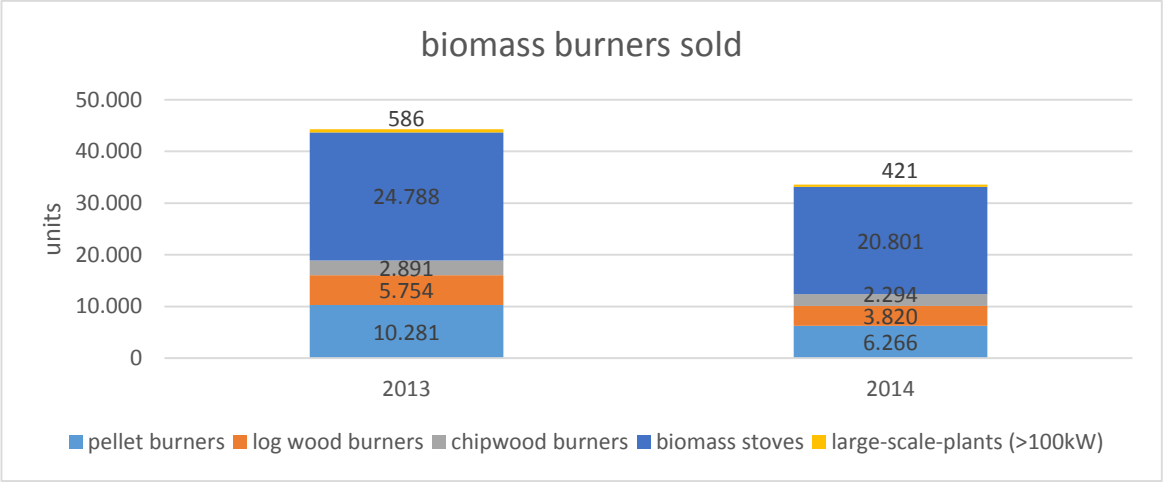

Figure 5: Sold biomass burners in 2013 and 2014 (BMLFUW, 2015).

Since biogas and biofuels have little relevance in heat supply, but rather in transport sector (biofuels) or domestic heating and electric energy generation (biogas), these energy carrier are not taken further into account of this work.

3.6. Biomass utilization in Czechia

As mentioned before, biomass plays a significant role in energy mix of Czechia and has the biggest share among renewable energy resources, thanks to less favourable conditions for wind, solar and hydropower.

RES contribution to the consumption of primary energy sources (PES) in the Czechia has reached approximately 154 PJ in 2013 (8.7% of total PES). Biomass plays by far the most important role in the Res portfolio-solid biomas is 59%, biomass used for biogas productions is 15.6% and liquid biofules is 7.4%. Total biomass consumption in Czechia is approximately 8.4 million tonnes. (2013). The following table gives detailed information about biomass utilization on energy purposes.

Table 4: Biomass consumption for energy purposes in the Czechia, 2013 (HAAS, KNAPEK)

Biomass type	Electricity (mil tonnes)	Heat (mil tonnes)	Total (mill tonnes)
Wood waste	0.868	1.252	2.120
Firewood	0	0.052	0.052
Plant materials	0.097	0.061	0.158
Briquettes and pellets	0.096	0.075	0.171
Pulp extracts	0.334	0.996	1.330
Households			3.897
Biomass (energy) export			0.750
Biomass energy total			**8.478**

A great majority of biomass used for energy purposes is currently coming from waste and residual biomass-paper production and the wood processing industry. Biomass used by household (either bought or self-collected from forests) is roughly 50% of total biomass consumption for energy purposes.Biomass has also important contribution in power generation-the electricity produced by burning of solid biomass is 22.6% of RES power generation and biogas plants contribute another 18.1 %.

The Czech Energy Policy assumes further growth of RES production up to 300 PJ until 2040 which, 224 PJ of this estimated to come from solid biomass, biogas and biofuels. Biomass growth expected to show itself also in power sector. It's estimated to occupy 44% of RES power generation in 2040.

3.7. Biomass potential in Austria

3.7.1. Wood biomass

Although Austria has wide areas of forest (3.96 million hectares) and is only using about 60% of the annual growth, wood fuel is a limited resource. Sample calculation: The entire timber stock in the forests could supply Austria only for 6 years with the primary energy needed. If every year only the amount of the growth rate is used for energy purposes, it could cover a fifth of Austria's annual primary energy consumption HIRSCHBERGER, P (2006). These examples show how important an efficient use of biomass is.

In 2005 4.3 million tons of wood fuel (62 PJ/a) were used energetically which equals 24% of the harvested wood. According to the Austrian ministry for agriculture and forestry the use of wood biomass will be increased to an amount of 137 PJ in 2020 (SINABELL et al., 2008). KRANZL and HAAS (2008) published a similar number for current (2004) use of wood fuel: 70 PJ/a. Also to be mentioned are byproducts of the sawmill industry (31 PJ in 2004) and paper industry (24 PJ of black liquor) KRANZL, HAAS (2008).

HIRSCHBERGER (2006) divides the additional potential of wood biomass as follows:

- Unused additional growth: can only be used partially as wide parts in Austria cannot be harvested economically.
- Forestry reserves: Reserves due to lower harvest rate in the past years.
- Treetops and branches: rather small potential, also causes relatively high nutrition runoff.
- Deadwood: It is ecologically critical to take these parts and usually can't be harvested economically

Concluding can be said: There is some potential of increase of additional 27% to the current state of use. Nevertheless, as the majority of this potential is in small private forests, with its mobilization come difficulties. (HIRSCHBERGER, 2006)

3.7.2. Agricultural biomass

KRANZL and HAAS (2008) worked out three potentials of agricultural biomass until 2050: "Low", "Baseline" and "High. They represent the upper and lower bandwidth of the potential, amongst others caused by differently assumed crop mixes. Another important influence is the progress in breeding of energy crops which is expected in (VAN DAM et al., 2006) to be 1% per year. On the short term, 100PJ of biomass can be supplied, until 2050 the production can be risen to 200PJ/a (Figure 6). This however would require significant changes in the current agriculture. (More than 30% of arable land would be needed for the energy production).

In Figure 6 the following categories are mentioned (from top to bottom): manure, other plant residue, cereal straw, catch crops, grass (extensive grassland), grass (intensive), sugar beet, sunflower, rape, corn, corn silage, miscanthus, short rotation wood, grain.

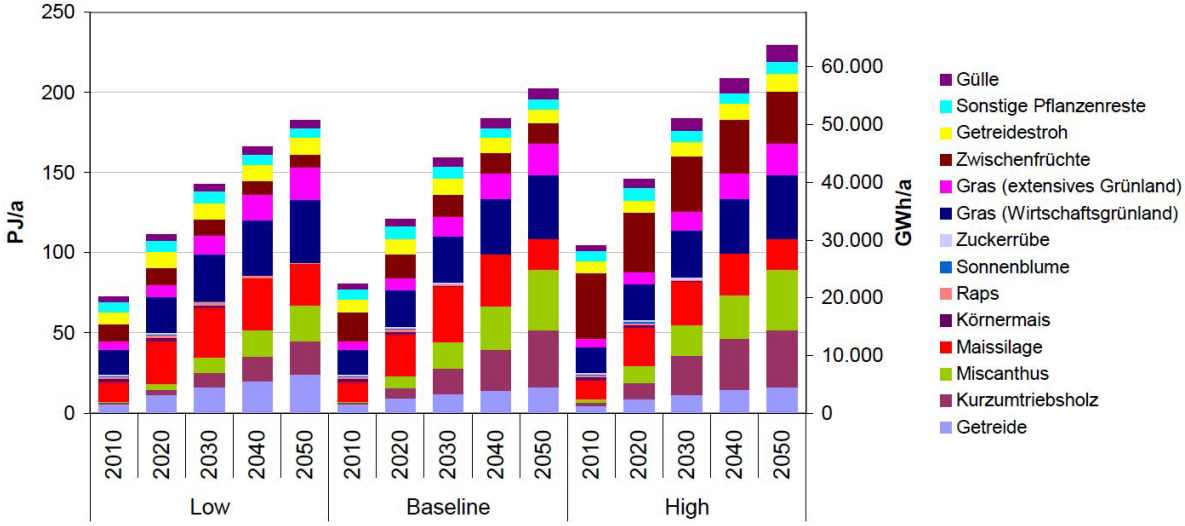

Figure 6: Potential of agricultural biomass in Austria (KRANZL, HAAS, 2008).

3.7.3. Organic waste

The most important types of biogenic waste for energetic use are (according to KRANZL and HAAS, 2008):

- mixed domestic waste
- waste wood
- organic waste
- residues from kitchen or canteen
- green cuttings
- waste oil
- sludge
- slaughterhouse waste
- waste from food industries

The total capacity of waste incineration plants and sludge treatment plants in 2008 was expected to be 22PJ/a. Additional 6PJ/a were obtained from waste wood. To calculate a future potential, it was expected that the amount of waste will remain constant, only waste wood is expected to rise up to 8.6PJ/a. The biogenic residues are expected to be 3.8PJ/a (KRANZL, HAAS, 2008).

3.7.4. Economic point view

The costs of biomass represent the growing difficulties to exploit additional biomass sources and to redirect currently used sources, such as food production, to energetic use. In order to reduce costs and avoid rivalry with food production, an increased use of residues and waste has to be forced. Figure 7 shows the biomass potential (bars: green: silvicultural; yellow: agricultural; left axis in PJ) at a certain amount of subsidies (EUR/t). The line shows the necessary volume of subsidies (SINABELL et al., 2008).

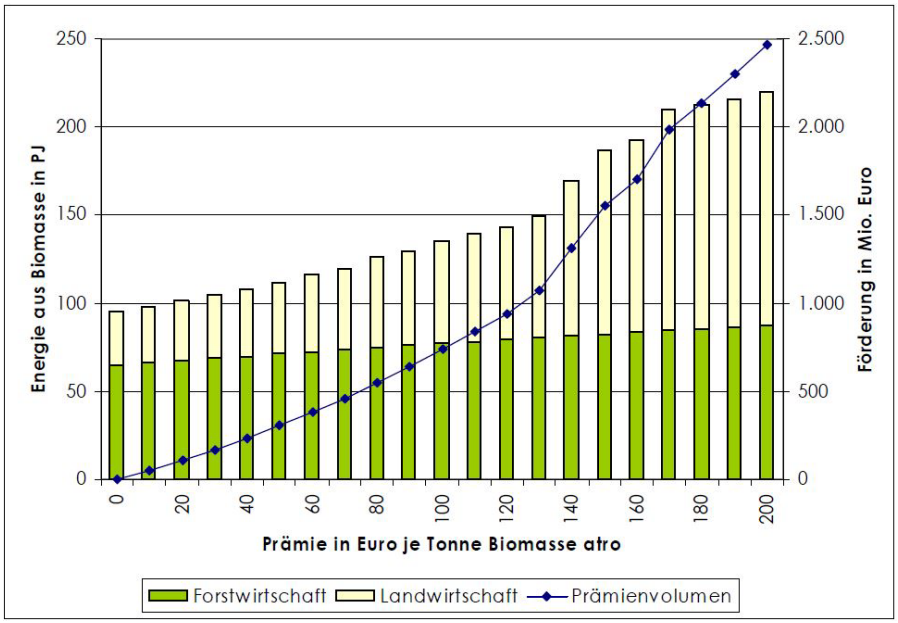

Figure 7: Available agricultural and silvicultural biomass depending on the output-subsidies in EUR/t (SINABELL et al., 2008).

Figure 8 shows the production costs (green bars) of different energy crops in comparison to the specific yields (blue bars). The datasets are listed as follows: main products: grain, cereal whole-plants, short rotation wood, miscanthus, corn silage, corn, rape, sunflower, potato, sugar root, grass silage (intensive), grass silage (extensive), byproducts: cereal straw, corn straw, rape straw, sunflower straw, leftovers potato, leftovers sugar root. The figure shows a wide variety of production costs per GJ. In order to rise amount of produced biomass economically, especially different varieties of corn and energy crops – such as miscanthus and short rotation wood – will be increasingly planted.

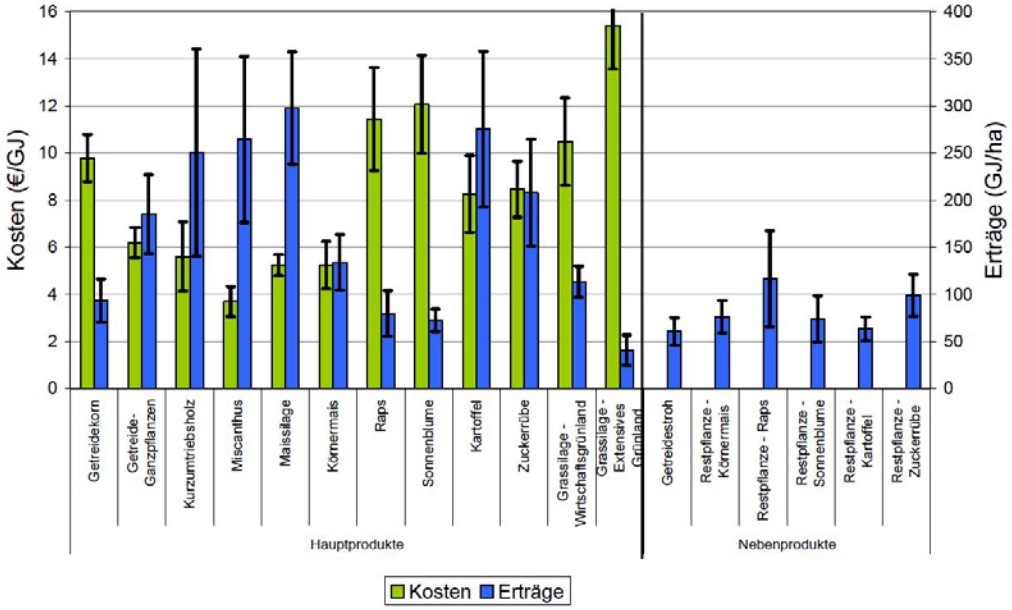

Figure 8: Production costs of energy crops (gross-energy-yields) Data from 2006 (KRANZL, HAAS 2008).

3.8. THE SITUATION IN AUSTRIA

In Europe, according to CANSINO et al. (2011) four main types of incentive-instruments are applied by the public authorities: subsidies, tax incentives, financial support, feed-in tariffs. The most commonly subsidized technology in EU-27are: biomass (16 member states), solar-thermal (15 member states) and geothermal (9 member states). Also district heating covers an important share of the EU-27 heat generation. Its main advantage is the higher efficiency due to the possibility of CHP-plants. This fact would also justify more incentives to use RES in this type of heating system. It can only be applied in regions with high population density, though. Also thermal renovation of buildings has an even greater impact on the emissions than improvements in the boiler quality. In Austria incentives for building insulation and solar thermal systems are partially combined with federal boiler subsidies (Austrian Biomass Association, 2016). District heating and building insulation will not be considered further in this work.

Subsidies are the mostly applied incentives. They have the advantage to be easy to manage for the public authorities. In Austria, tax exemptions play a considerable role as an incentive on the supply side for biomass fuels. To rise its competitiveness, they are exempt from fossil fuel tax. Feed in tariffs for heat from CHP were first established in Austria in 2000 but are still only applied by a minority of the European countries. Feed in tariffs for renewable electrical production, however, are widely applied (CANSINO et al., 2011).

3.8.1. State funded investment subsidies on the supply side

For biofuel-producing facilities there are investment subsidies available. They are state funded and therefore apply the same way over the whole country. Projects for new plants and the conversion of existing plants that fulfill the following premises are supported:

Facilities to produce renewable combustibles and fuels (liquid and gaseous) that are not based on food crops:

- Biogas plants for the production of biomethane with technology to feed into the gas distribution system or use it as fuel.
- Thermal gasification unit to produce process gas from biomass including a unit to produce liquid and gaseous fuels.
- Production unit for second-generation-biofuels.

All parts of the plant that are relevant for the operation can be supported. The minimum investment has to be 10 000 Euro and at least 4 tons of CO_2 have to be saved per year. The used raw materials have to be provided locally (max. 100 km transport).

Amount of support

- Up to 25% of supportable investment volume
- Additional 5% for raw material within 50 km.
- Additional 5% for EMAS certificate
- Maximum of 675 Euro per saved ton of CO_2.

3.8.2. State funded feed-in-tariffs

“Electricity from renewable sources is supported mainly through a feed-in tariff.” (BANASIAK, 2014)

The biomass sector is split up into biogas, solid and liquid biomass.

Biogas (BANASIAK, 2014, Data from 2013)

- Biogas plants: depending on the maximum capacity: 0.1293 up to 0.195 Euro/kWh
- Sewage gas plants: 0.0594 Euro/kWh
- Landfill gas plants: 0.0495 Euro/kWh

Biomass (BANASIAK, 2014, Data from 2013)

- Solid biomass: 0.089 up to 0.2 Euro/kWh
- Liquid biomass: 0.0574 Euro/kWh

3.8.3. State funded boiler-subsidies

(source: Klima- und Energiefonds, 2016)

The Austrian climate and energy fund (Klima- und Energiefonds) supports the following new installations in private homes:

- Pellet- and wood chips central heating, which replace an existing fossil burner or electric heating.
- Pellet- and wood chips central heating, which replace an existing wood burner that is at least 15 years old.
- Pellet stoves that reduce the fossil fuel consumption of the existing burner or reduce the fuel consumption of an at least 15-year-old wood burner.

Not supported are the installation of used heaters, installations that do not replace an existing system (as above), new logwood heating systems.

The system has to be state of the art, have an automated fuel feeder, have at least 85% boiler efficiency, have a maximal power of 50 kW and the installation has to be carried out professionally.

Amount of support

The support is a non-repayable public funding of the following structure:

- 2000 Euro for a system, replacing a fossil fired boiler.
- 800 Euro for a system, replacing a wood boiler with an age more than 15 years.
- 500 Euro for a pellet stove.

The total value of the subsidies is 6 million Euro

3.8.4. Federally funded boiler-subsidies

(source: Austrian Biomass Association, 2016)

In Austria, every federal state has its own funding policy. These subsidies apply to private homes for up to two residential units.

Burgenland

- Only central heating system
- Max. 30% of the investment costs
- Max. 2600 Euro

Carinthia

- In combination with thermal renovation
- Max. 12600 Euro
- 35% of investment costs
- depending on square meters
- District heating: 30% of investment costs

Lower Austria

- 46% of renovation costs have to be obtained as a loan over at least 10 years
- 3% of that amount will be subsidized each year

Upper Austria

- Max. 50% of investment cost
- Max. 2800 Euro for pellet- and wood chips heating
- Max. 1700 Euro for log-wood heating
- Max. 3200 Euro for agricultural wood chips heating

Salzburg

- Pellet heating: 3000 Euro
- Wood chips heating: 4500 Euro
- Log-wood heating with buffer storage: 2600 Euro
- Biomass district heating: 2000 Euro
- Additionally 100 Euro for energy consulting

Styria

- Max. 25% of investment costs
- Max. 1300 Euro for log-wood boiler and pellet stove
- Max. 1600 Euro for pellet- and wood chips central heating

Tyrol

- 35% of the loan will be paid annually (40% for district heating)
- 25% of the investment costs as an initial subsidy (30% for district heating)

Vorarlberg

- Max. 25% of investment costs
- Max. 3000 Euro for log-wood heating with buffer storage
- Max. 4000 Euro for pellet- and wood chips central heating
- Max. 3000 Euro for tile stoves as central heating
- Max. 3000 Euro for district heating
- Depending on the building, different categories apply

Vienna

- Max. 30% of investment costs

3.9. THE SITUATION IN CZECHIA (LEGAL SOURCES ON RENEWABLE ENERGY)

In Czechia, electricity produced by biomass is supported through either a guaranteed feed-in tariff or a green bonus paid on top of the market price. Plant operators are free to choose either option. Operators of biomass plants are entitled to priority connection to the grid such as other renewable energy plants. The use and the expansion of the grid are

subject to general legislation on energy. However, In August 2013, the Czech Parliament adopted an amendment to Act No. 165/2012 (Regulaton No. 310/2013) which de facto abolished the feed-in tariff and green bonus scheme for all technologies except small hydro by the end of 2013. New PV installations and biogas plants are only being supported if put into operation before 31 December 2013 (§4 par. 10 Act No. 165/2012). Wind, hydro, geothermal or biomass plants put into operation before 31 December 2015 are eligible for support only if the building permit was issued before 2 October 2013 (Transitional provisions no. 1 and 2 Act No. 165/2012).

The heat from biomass is supported through subsidies under two Operational Programmes funded by the ERDF (European Regional Development Fund). Furthermore, renewable heating plants are exempt from real estate tax. Unfortunately, the ordinary households cannot be benefited by this subsidies. The support mechanisms are eligible for companies, municipalities, universities and other public institutions.

3.9.1. Feed-in tariff

Feed-in tariff is the mechanism of support as fixed tariff that guarantees certain rate of return (in the case of Czechia is 6.3%) to the investors. Feed-in Tariff is eligible under following conditions:

- the electricity has to be generated in a CHP plant (§ 4 par. 5 b Act No. 165/2012).
- Only pure biomass firing in new electricity generating plants is eligible (number 1.7 Price Decision of the Energy Regulatory Office No. 4/2013).
- The maximum capacity must not exceed 100 kW (§ 4 par. 4 in conjunction with § 8 par. 2 Act No. 165/2012).
- The building permit must have been issued before 2 October 2013 (Transitional provisions No. 2 Act No. 165/2012).

The amount of the tariff varies according to the technology used:

- From 1 January – 31 December 2014: CZK 1.31 - 3.335 (approx. €ct 4.8-12.1) per kWh (number 1.7 Price Decision of the Energy Regulatory Office No. 4/2013)

3.9.2. Premium tariff: green bonus

Green bonus is support mechanism in way of adding to the market price of electricity. Both feed-in tariff and green bonus are differentiated by technology, type of fuel, installed capacity and etc. Green bonus is eligible under following conditions:

- The electricity has to be generated in a CHP plant (§ 4 par. 5 b Act No. 165/2012).
- Only pure biomass firing in new electricity generating plants is eligible (number 1.7 Price Decision of the Energy Regulatory Office No. 4/2013).
- The building permit must have been issued before 2 October 2013 (Transitional provisions No. 2 Act No. 165/2012).
- The amount of the annual bonus varies according to the technology used:

From 1 January – 31 December 2014: CZK 0.46 - 2.485 (approx. €ct 1.7-9.0) per kWh (number 1.7 Price Decision of the Energy Regulatory Office No. 4/2013)

3.9.3. Subsidy I (Operational Programme Business and Innovation for Competitiveness – OPPIK)

The Operational Programme "Business and Innovation for Competitiveness" allocates investment grants from the European Regional Development Fund (ERDF) for small, medium and large companies. Renewable energy projects are eligible under Priority Axis 3 “More Efficient Energy Management”, namely Investment Priority 1 “Supporting the production and distribution of energy from renewable sources”. The programme supports the construction or reconstruction of electricity or heat generating plants, for which the energy produced is primarily intended for distribution rather than own consumption

Companies may receive investment grants between CZK 1 million - 100 million (approx. € 36,000 – 3.6 million). The amount of the subsidy depends on the size of the company (Specific Target 3.1, 2.A.6.3 OPPIK):

- Small companies (up to 49 employees): 70% of eligible expenses
- Medium-sized companies (50 – 249 employees): 60% of eligible expenses
- Large companies (more than 250 employees): 50% of eligible expenses

3.9.4. Subsidy II: Operational Programme Environment

The Operational Programme "Environment" allocates investment grants from the European Regional Development Fund (ERDF). Renewable energy projects are eligible under Priority Axis 5 “Energy Savings”, namely Investment Priority 1 “Encouraging the transition to a low carbon economy in all sectors by promoting energy efficiency, smart energy management systems and the use of renewable energy in public infrastructures, including public buildings and the housing sector”. Those eligible for the programme are public institutions such as municipalities, regions, public research institutions, universities or associations. The Operational Programme Environment grants subsidies up to 85% of a project's total eligible expenditures (art. 4 no. 7 MŽP Directive No. 6/2014). Under target 5.1, only individual projects (up to € 50 million of total project costs) are eligible for support (2.5.3.2.4 OPŽP). Further terms and conditions will be set out in each call for applications.

4. EFFECTIVENESS OF THE SUPPORT AND INCENTIVE POLICY

4.1. NEW BIOMASS BOILER INSTALLATIONS IN AUSTRIA

To compare the effect of the incentive programmes by comparing the figures of newly installed power or sold boilers is rather difficult as the circumstances differ significantly in every federal state and several factors influence the willingness to invest in a biomass boiler. Between 2001 and 2014 in Lower Austria, Upper Austria and Styria, the highest capacities were installed (Figure 9). These states also have a high share on forested area (STRIMITZER, HÖHER, 2015a).

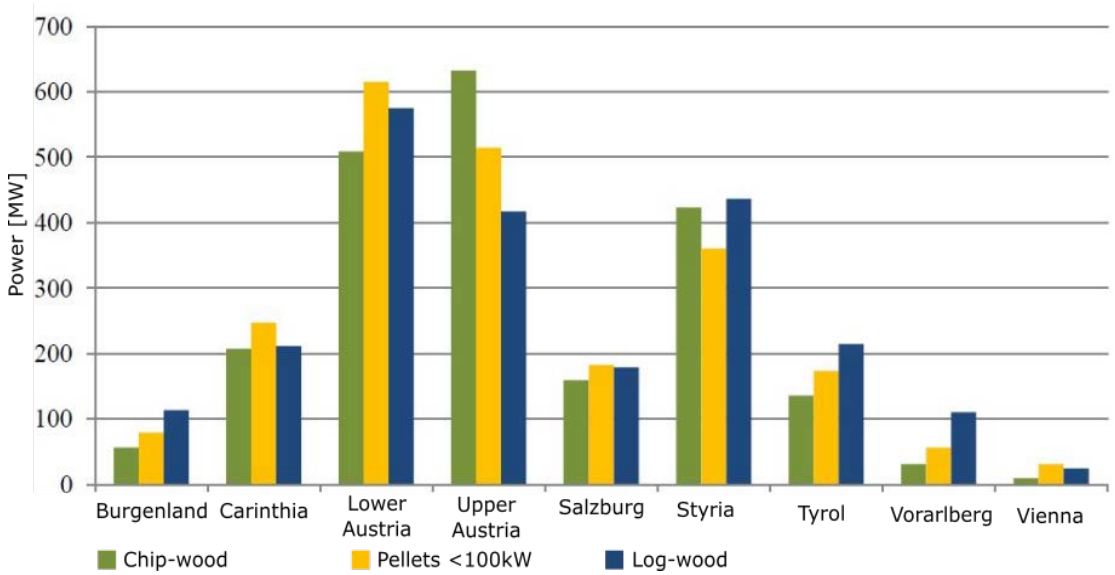

Figure 9: Newly installed power of biomass boilers from 2001-2014 (STRIMITZER, HÖHER, 2015a)

However, compared to the development of the number of households in the states, the installed power is rather equally distributed. Only in Vienna, the installed power is significantly lower than its population share and share on new households (Figure 10). Figure 10 also shows each state's share on the logged wood in Austria (red line). These numbers show that Styria harvests more wood biomass than Lower Austria and Upper Austria, however the installed capacity in Figure 9 is higher in these states, which could lead to the conclusion of further potential in biomass heating in Styria (STRIMITZER, HÖHER, 2015a). Chapter 0 also shows, compared with Upper Austria 0, a significantly lower cap of boiler subsidies in Styria. Thus it can be expected that there is a direct connection between newly installed capacity of biomass boilers and amount of federal subsidies.

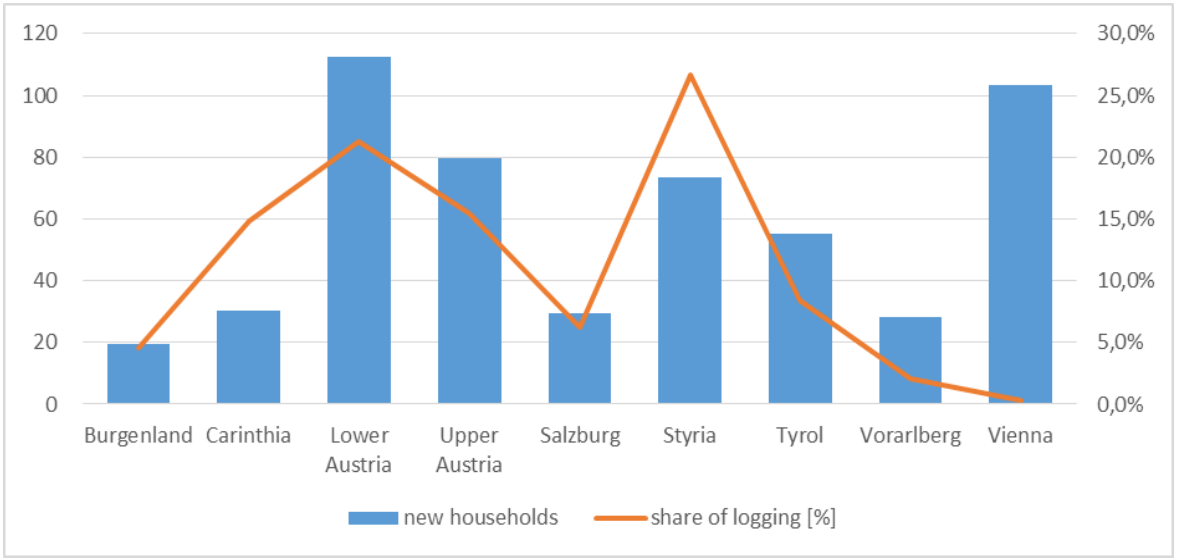

Figure 10: Development of the number of households from 2000 to 2014 (STATISTIK AUSTRIA, 2016). Share on total logging in Austria in 2014 (STRIMITZER, HÖHER, 2015a).

5. CONCLUSION

There are incentives for biomass as a renewable energy carrier on the supply and on the demand side in Austria. While the supply side is supported by tax exemptions, the demand side gets subsidies for the installation of new boilers and stoves or for the connection to the district heating grid.

The amounts and system of federal subsidies show high differences. There are two main categories: Some are paid as a support to pay off the loan (also in combination with renovation subsidies) and other states give direct monetary support (usually capped with a percentage of the total costs). While the state funded subsidies can only be obtained if a replacement of an existing system is carried out, the federal subsidies are also available for new buildings. If the requirements for both types of subsidies are fulfilled, the federal subsidy can be obtained additionally to the state funded subsidy. In some municipalities, there are also subsidies available, these, however differ again in height and preconditions. In some federal states, subsidies are also granted for district heating, which is not the case with state funded subsidies.

Even though, in Czechia there is no direct support for biomass (the support is eligible for companies and public institutions) there is obligatory standards that restricts inefficient and old boilers for household.

Concluding can be said, both countries do show efforts to strengthen their biomass-sector, however different approaches are chosen. Although attempted in this work, there could not be evaluated any significant statement concerning the efficiency of subsidies.

6. LIST OF FIGURES

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