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Infrastructure Report Austria

Activity A.T2.2: Infrastructure analysis

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

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CONTENT

1. METHODOLOGY

In Austria different types of renewable energy plants exist and publicly available data for wind, photovoltaic, hydropower, biomass and biogas/biomethane plants have been included in the infrastructure database. Industry has a big share in the Austrian economy and such hard-to-abate industries like steel and chemical production are included in the database, however lack on publicly available data on energy needed makes it harder to develop specific P2G Hub ideas and use cases. As transport hubs ports and railway will play a significant role in the P2G Hub development, possible transport hubs are identified, however much more possibilities and alternative transport ways exist. Power grid is represented in the database with the substations and gas network with Entry-/Exit Points of distribution area and transmission system. All data included in the database e.g. in the Renewable Energy Atlas are publicly available data.

Data inputs for Optimization Tool on tariffs and fees in power network as well as for gas production and consumption etc. are based also on publicly available data and own estimations based, for example, on average numbers of data available. However, it should be noted, that for exact use case calculations with Optimization Tool specific input parameters should be taken into account, which may vary from the »baseline scenario«, which is included as default in the Tool.

Call for feedback on collected data was initiated in Austria in 2021 during the overall feedback round and thereupon adjustments of parameters needed were made by work package leader (PP4).

2. BRIEF DESCRIPTION OF INFRASTRUCTURE LANDSCAPE IN AUSTRIA

Austria produces the majority (approx. 80%) of the electricity using renewable energy sources, and electricity imports account for a quarter of the total electricity consumption[1]. By 2030, the electricity demand should be completely covered by renewables[2]. For this purpose and also for the electrification of industry, further expansion of the power grid is necessary. The expansion of storage capacities (short-term, seasonal) will also be essential. Austria has a well-developed gas network, which can also potentially be used for hydrogen transport in the future and respective gas network developments are planned (European Hydrogen Backbone Initiative), which will allow to further develop hydrogen economy in Austria[3]. Decarbonisation strategies of hard-to-abate industries, which are represented in Austria, such as steel production, chemical, refineries, will be big hydrogen and renewable gases consumer in the future. Thus, Power-to-gas projects are in operation already like electrolysis plant at Voestalpine Stahl GmbH in Linz (H2FUTURE[4]) or under construction in refinery Schwechat (UpHy[5]), using local renewables potential in Styria (Renewable Gasfield[6]) and at semi-conductor production site in Carinthia (H2Pioneer[7]) only to name just a few.

[1] https://de.statista.com/statistik/daten/studie/325080/umfrage/stromimport-oesterreichs/
[2] *Republic of Austria*, Government Programme 2020-2024 (2020) p. 79 (available under: https://www.bundeskanzleramt.gv.at/dam/jcr:7b9e6755-2115-440c-b2ec-cbf64a931aa8/RegProgramm-lang.pdf).
[3] European Hydrogen backbone. A European Hydrogen Infrastructure Vision Covering 28 Countries. April 2022 (2022) p.19 (available under: https://ehb.eu/files/downloads/ehb-report-220428-17h00-interactive-1.pdf)
[4] https://www.h2future-project.eu/ (accessed on 10 December)
[5] https://www.wiva.at/project/uphy/ (accessed on 10 December)
[6] https://www.wiva.at/project/renewable-gasfield/ (accessed on 10 December)
[7] https://www.wiva.at/project/h2pioneer/ (accesssed on 10 December)

2.1 ELECTRICAL ENERGY SECTION

Share of renewables on the Austrian electricity market

Austrian government aims at covering its national electric power supply from 100% renewable sources (nationally balanced) by 2030 (EC 2020). According to the energy balance for the electricity sector published by national statistics institution *Statistik Austria* (2021), the share of renewables in the electricity sector shows a positive development towards government ambitions. Table 1 displays 2020 data for electricity production, imports, exports and consumption in Tj for Austria.

Table 1: Energy balance for the electricity sector in Austria 2020 in Tj

2020	Electricity in TJ
1. Production	
2. Import	88 281
3. Stocks	
4. Export	80 376
5. Gross available energy (1+2+3-4)	7 905
6. Conversion loss	49
7. Conversion output (= production)	249 157
8. Consumption of energy sector	25 188
9. Transport loss	11 491
10. Nonenergy consumption	
11. Available for final consumption (5+7-(6+8+9+10))	220 334
Agriculture	4 298
Private households	64 822
Industry	98 093
Transport	11 136
Public and private services	41 985

Data source: Statistik Austria (2021).

Gross domestic electricity generation in Austria in 2020 was 249,157.3 TJ. During the last decade, electricity production has fluctuated to certain degree as shown in figure 1, having its lowest share of 221,804.96 TJ in 2014. Share of renewables shows a positive trend acquiring greater importance for the Austrian electricity generation.

Development of the Gross Domestic Electricity Production in Austria by source in TJ

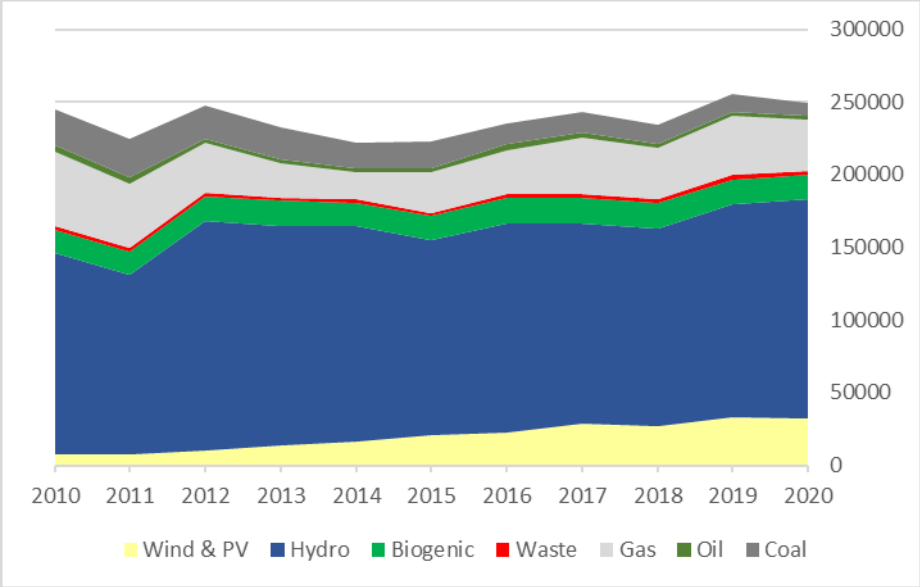

Figure 1: Gross Domestic Electricity Production by source in Tj, 2010-2020. Data source: Statistik Austria (2021).

In 2020, hydropower accounted for around 61% of all electricity generation in Austria, with the rest largely coming from renewable energies from wind and sun (13%) and from biogenic sources (7%). Share of electricity generated from renewable sources showed its highest level in 2020 reaching 81% of the total electricity production (see figure 2), which represents an increase of 4 points compared to 2019 levels.

Austrian Gross Domestic Electricity Production 2020 by source in %

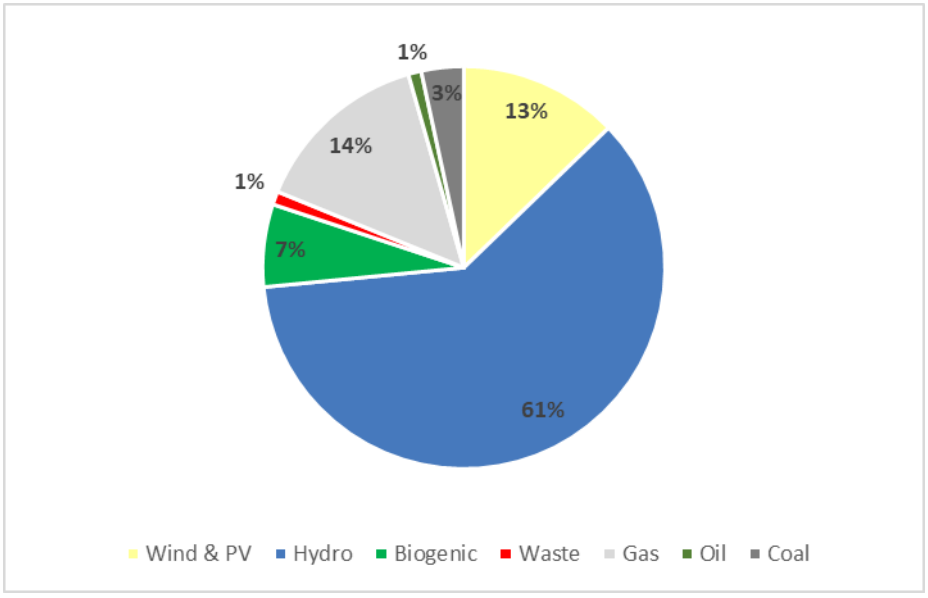

Figure 2: Gross Domestic Electricity Production by source in %, 2020. Data source: Statistik Austria (2021) and own calculations.

Austrian Final Electricity Consumption 2020 by sector in %

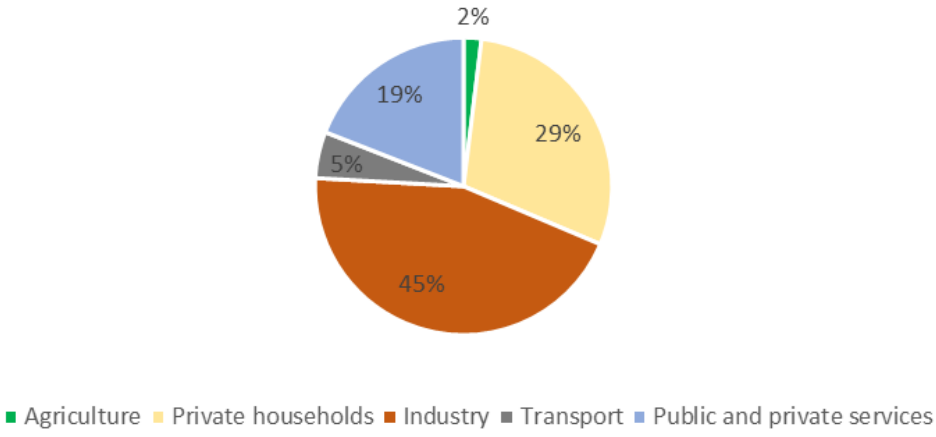

Figure 3: Final Electricity Consumption by sector in %, 2020. Data source: Statistik Austria (2021) and own calculations.

Industrial sector has the highest share (45 %) in the gross final electricity consumption in Austria. Private households consume 29 %, while public and private services represent 19 % of gross final electricity consumption as figure 3 shows.

2.2 NATURAL GAS ENERGY SECTION

Gas grid in Austria

The total length of the Austrian transmission grid is approx. 2,000 km, and that of the distribution networks approx. 44,000 km[8] (see figure 4). The Austrian gas grid developed over time and because of Austria's central location in Europe, the gas grid has an important function to transport natural gas imports to the southern and western parts of Europe. Also gas flows in the opposite direction takes place more and more intensively (E-Control 2022).

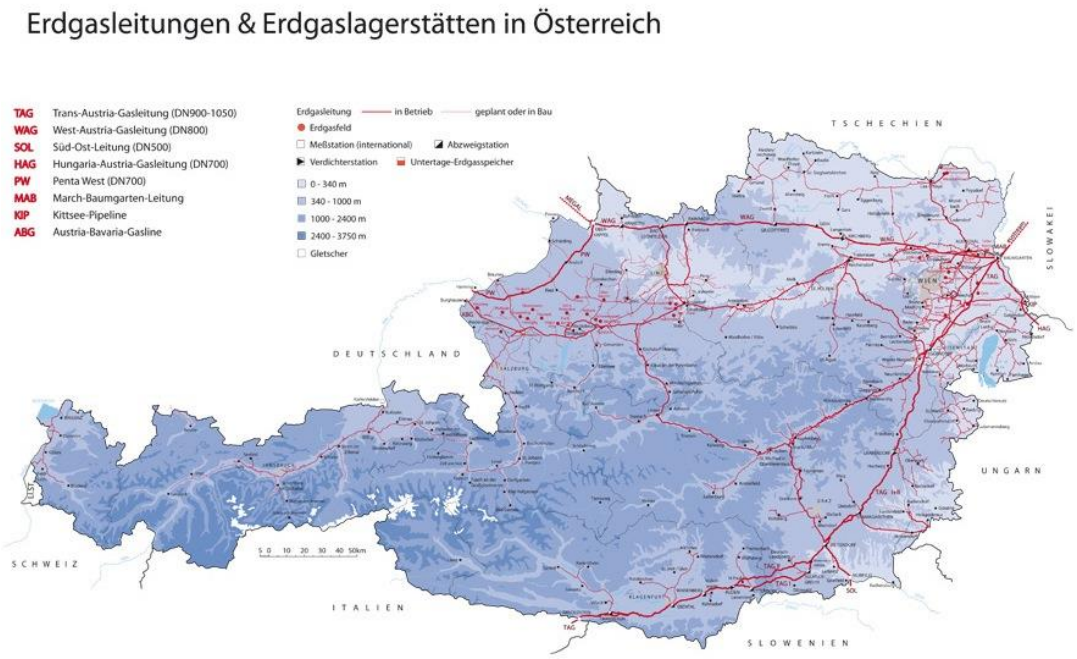

Figure 4. Gas pipelines and storage facilities in Austria; source: E-Control

[8] https://www.e-control.at/en/industrie/gas/gasnetz (accessed 28 November 2022)

Regarding development of hydrogen economy in Austria, the European Hydrogen Backbone Initiative foresees the development of pan-european hydrogen transport infrastructure and according to the plans Austrian gas grid will be further developed and serve mainly as a transit country. East-west corridor (Ukraine–Slovakia – Austria – Germany) and north-south corridors (North Africa – Italy – Austria –Germany) will be developed during the next years. However, the network would also serve the residential customers as well as for industry, such as steel production facility in Linz and refinery near Vienna[9].

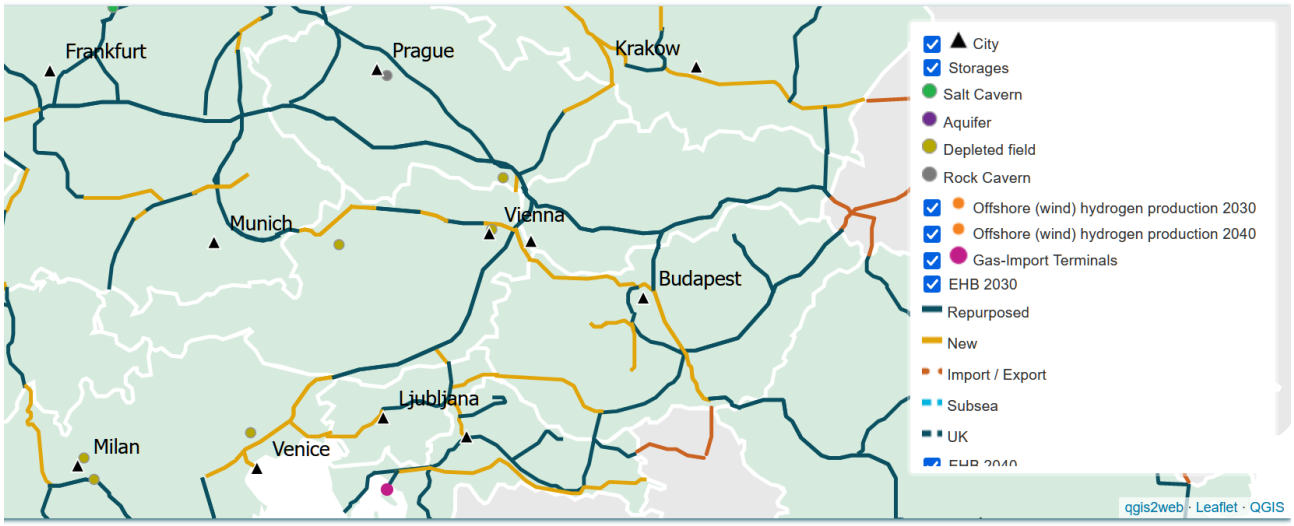

Figure 5. Future (hydrogen) gas grid developments in Austria[10]

However, it is important to mention that the development of infrastructure will be dependent on future hydrogen supply routes and European demand centres.

Natural gas prices in Austria

According to the Austrian regulatory authority for the natural gas market (better known as *E-Control*), prices for 1 KWh natural gas in Austria, including network costs and taxes, vary between ca. 5,4 and 30 Cent depending on (i) the level of consumption, (ii) the natural gas supplier and (iii) place of residence as the grid fees and charges may differ depending on the grid area. According to this a kilowatt hour of gas in the Upper Austria network area costs an average household with an annual consumption of 15,000 kWh 35.58 cents from the most expensive supplier, 6.96 cents from the local supplier for existing consumer with long-term agreement and 10.95 cents from the cheapest alternative provider (E-Control 2022).

Natural gas prices in Austria are based on the wholesale natural gas prices. These wholesale prices result primarily from gas trading on so called gas hubs and gas exchange markets. In this context, the import index represents a referencing indicator for gas traders. Table 2 displays the import prices for natural gas, which end-use will take place in Austrian territory (excluding the natural gas import of transitory nature).

[9] European Hydrogen backbone. A European Hydrogen Infrastructure Vision Covering 28 Countries. April 2022 (2022) p.19 (available under: https://ehb.eu/files/downloads/ehb-report-220428-17h00-interactive-1.pdf)
[10] https://ehb.eu/page/european-hydrogen-backbone-maps (accessed on 05 December)

Table 2: Statistics on natural gas import prices[11]

Year	Month	Import price
	Unit	Cent/kWh
2021	January	1,470
	February	1,613
	March	1,497
	April	1,707
	May	1,973
	June	2,250
	July	2,827
	August	3,245
	September	3,868
	October	5,789
	November	6,814
	December	7,989
2022	January	8,204
	February	6,845
	March	8,385
	April	10,022
	May	8,742
	June	9,361
	July	14,538
	August	23,694
	September	17,683
	October	11,150

In this section also the production and injection of biomethane in the gas grid should be mentioned. According to the data of Austrian Biomethane register there are 16 biomethane producers in Austria[12]. Total injected amount of biomethane in the year 2021 was 136,41 GWh[13].

There are 301 biogas plants in Austria[14] with total installed capacity of 83.553 kW in year 2021[15].

[11] https://www.e-control.at/industrie/gas/gaspreis/grosshandelspreise (accessed November 28 November 2022)
[12] https://www.biomethanregister.at/de/register/teilnehmer/biomethanproduzent (accessed 16 August 2022)
[13] https://www.biomethanregister.at/de/statistik/2021 (accessed 16 August 2022)
[14] https://www.kompost-biogas.info/biogas/statistik-biogas/ (accessed 16 August 2022)
[15] https://www.e-control.at/documents/1785851/1811582/E-Control_Oekostrombericht_2021_Final.pdf/d04142ba-cd89-5422-2972-fe721f90cd2a?t=1635952429306 (accessed 16 August 2022)

2.3 BIOCHAR SUPPLY SECTION

Biochar can be obtained in Austria from Sonnenerde GmbH, a company, specialising in production of different types of soils, including biochar. The commercially available biochar[16] can be obtained as pure product or adjusted for other applications. The production of biochar takes place in the company-own biochar plant with Pyreg-reactor, producing about 350 tons of biochar yearly[17]. Biochar costs are around 610 € per ton.

2.4 WATER SUPPLY SECTION

The water supply network is well developed in Austria. The price for drinking water for the population vary from region to region and can be assumed to be around 1,70 €/m3. The one-time charge for water grid connection for citizens in Upper Austria is 2.137,00 €[18].

Costs for building a drilled water well also depends on several conditions, for example, how deep the water well should be e.g. ground-water levels etc. The costs vary accordingly and start at around 2.000 €.

[16] https://www.sonnenerde.at/de/produkt/bio-pflanzenkohle (accessed 16 August 2022)
[17] https://www.sonnenerde.at/de/pflanzenkohle/produktion (accessed 16 August 2022
[18] https://www.land-oberoesterreich.gv.at/215948.htm (accessed 16 August 2022)

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E-Control (2021) Was kostet eine kWh Gas?, Online: https://www.e-control.at/konsumenten/strom/strompreis/was-kostet-eine-kwh-gas

E-Control (2022) Gasnetz, Online: https://www.e-control.at/industrie/gas/gasnetz

EC (2020) *Integrated National Energy and Climate Plan for Austria*, Online: https://ec.europa.eu/energy/sites/ener/files/documents/at_final_necp_main_en.pdf

Statistik Austria (2021)[DE] *Energiebilanzen*, Online: http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/energie_und_umwelt/energie/energiebilanzen/index.html

4. APPENDIX

ATLAS DATA SETUP

In the following tables data for Optimization Tool for business case calculations for Austria are explained in detail. In case no exact explanation is given, own estimations have been used. Respective normative documents[19] [20] were used to define specific parameters.

	Grid investment prices	
Electrical grid	Unit cost for electrical transmission grid connection [€/(kW km)]	5,40
	Unit cost for electrical distribution grid connection [€/(kW km)]	15,60
	Capacity cost for electrical transmission grid connection [€/kW]	150,00
	Capacity cost for electrical distribution grid connection [€/kW]	150,00
Gas grid	Unit cost for gas transmission grid connection [€/(kW km)]	80,00
	Unit cost for gas distribution grid connection [€/(kW km)]	80,00
	Capacity cost for gas transmission grid connection [€/kW]	400,00
	Capacity cost for gas distribution grid connection [€/kW]	150,00
Water grid	Unit cost for water grid connection [€/(m^3/h)/km]	4,00
	Capacity cost for water grid connection [€/(m^3/h)]	0,00
	Electricity prices	
	Start time of day tariff [hour]	0
	End time of day tariff [hour]	24
	Start time of weekend tariff [hour]	
	End time of weekend tariff [hour]	
Day tariff	Electricity price without grid or operator fees, including taxes [€/kWh]	0,10
	Grid/operator fees of the transmission system, including taxes [€/kWh]	0,03
	Grid/operator fees of the distribution system, including taxes [€/kWh]	0,05
Night tariff	Electricity price without grid or operator fees, including taxes [€/kWh]	0,10
	Grid/operator fees of the transmission system, including taxes [€/kWh]	0,03
	Grid/operator fees of the distribution system, including taxes [€/kWh]	0,05
Weekend tariff	Electricity price without grid or operator fees, including taxes [€/kWh]	0,10
	Grid/operator fees of the transmission system, including taxes [€/kWh]	0,03
	Grid/operator fees of the distribution system, including taxes [€/kWh]	0,05
	Monthly peak power price [€/kW]	5,00
	VAT percentage applicable to electricity business [%]	20

[19] Systemnutzungsentgelte-Verordnung https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20010107&FassungVom=2022-01-01 (accessed 10 November)

[20] Gas-Systemnutzungsentgelte-Verordnung https://www.e-control.at/bereich-recht/verordnungen-zu-gas/-/asset_publisher/2MiC2HIOnKeH/content/gas-systemnutzungsentgelte-verordnung%25C2%25A0 (accessed 10 November)

Grid investment prices

Capacity cost for electrical transmission grid connection [€/kW] – 150 €/kW
System provision charge for Grid level 6 (Netzbereitstellungsentgelt für Netzebene 6)

Capacity cost for electrical distribution grid connection [€/kW] – 150 €/kW
System provision charge for Grid level 6 (Netzbereitstellungsentgelt für Netzebene 6)

Unit cost for gas distribution grid connection [€/(kW km)] – 80 €/kW km
Estimation for use in Optimization Tool. However, 4.790,00 € for 30 meters of gas pipeline max 60 kW for households (Netzzutrittsentgelt. Für erstmalige Herstellung eines Erdgashausanschlusses bis zu 60 kW (Ho), bei 30 Meter Anschlusslänge = 4.790,00 €)[21]

Electricity prices

Electricity price without grid or operator fees, including taxes [€/kWh] - 0,10 €/kWh
Energy price for industrial consumer in Upper Austria with 80 000 kWh/a, according to the best offer of tariff calculator of e-control[22]

Grid/operator fees of the distribution system, including taxes [€/kWh] – 0,05 €/kWh
System utilization charge and system losses charge without measuring fee (Entgelt für Messleistungen, 28,56 €/a) and without electricity levy (Elektrizitätsabgabe, 80 €/a) for Industry with 80.000 kWh/a power consumption in Upper Austria[16]

[21] https://www.netzooe.at/Richtlinien-und-Netzzutrittsentgelt.pdf?ch=KS4qwYtW&:hp=3;2;de (accessed 01 October 2022)
[22] https://www.e-control.at/industrie/service-beratung/gewerbetarifkalkulator#/product-details/ (accessed 01 October 2022)

	Gas prices	
	Start of winter period	October
	End of winter period	April
Winter period	Gas price without grid/operators fees, including taxes [€/kWh]	0,0468
	Gas supply fee, including taxes [€/kWh]	0,014386
	Transmission system fee for consumption, including taxes [€/(kWh/day)]	0,0002125
	Transmission system fee for injection, including taxes [€/(kWh/day)]	0,0001458
	Distribution system fee for consumption, including taxes [€/kWh]	0,014386
	Distribution system fee for injection, including taxes [€/kWh/h/a]	0,12
Summer period	Gas price without grid/operators fees, including taxes [€/kWh]	0,0468
	Gas supply fee, including taxes [€/kWh]	0,014386
	Transmission system fee for consumption, including taxes [€/(kWh/day)]	0,0002125
	Transmission system fee for injection, including taxes [€/(kWh/day)]	0,0001458
	Distribution system fee for consumption, including taxes [€/kWh]	0,014386
	Distribution system fee for injection, including taxes [€/kWh/h/a]	0,12
	VAT percentage applicable to gas business [%]	20

Water price	
Price for water supply, excluding sewerage and wastewater cleaning costs, including operators/grid fees and taxes [€/m3]	1,70

Biochar transport prices	
Unit transport cost via waterway [€/(t km)]	0,10
Unit transport cost via railroad [€/(t km)]	0,10
Unit transport cost via road [€/(t km)]	0,10

Gas prices

Gas price without grid/operators fees, including taxes [€/kWh] - 0,0468 €/kWh

Energy price for Industry with 40.000 kWh/a in Linz/Upper Austria[23]

Gas supply fee, including taxes [€/kWh] - 0,014386 €/kWh

System utilization charge without measuring fee (Entgelt für Messleistungen, 21 €/a) and without gas levy (Erdgasabgabe, 6.60 cent/normal cubic metre/a) for Industry with 40.000 kWh/a gas consumption in Upper Austria[17]

Transmission system fee for consumption, including taxes [€/(kWh/day)] - 0,0002125 €/(kWh/day)

Transmission costs (Baumgarten Exit)[24,25]

[23] https://www.e-control.at/industrie/service-beratung/gewerbe-tarifkalkulator#/ (accessed 01 October 2022)
[24] https://www.gasconnect.at/en/network-access/transmission-network/tariffs (accessed 01 October 2022)
[25] https://www.gasconnect.at/fileadmin/Fachabteilungen/ST/EN/TARIFFS-4-TRADERS-EN-v-04062020.pdf (accessed 01 October 2022)

Transmission system fee for injection, including taxes [€/(kWh/day)] - 0,0001458 €/(kWh/day)
Transmission costs (Baumgarten Entry)[18,19]

Distribution system fee for consumption, including taxes [€/kWh] - 0,014386 €/kWh
System utilization charge without measuring fee (Entgelt für Messleistungen, 21 €) and without gas levy (Erdgasabgabe, 6.60 cent/normal cubic metre) for Industry with 40.000 kWh/a gas consumption in Upper Austria[26]

Distribution system fee for injection, including taxes [€/kWh/h/a] - 0,12 €/kWh/h/a
System utilization charge in the distribution grid for feed in of produced renewable gases.
The parameter is highlighted, because the Optimization tool is using different measuring units - €/kWh/h.

[26] https://www.e-control.at/industrie/service-beratung/gewerbe-tarifkalkulator#/ (accessed 01 October 2022)