IEA Bioenergy

Task42 Biorefining in a Future BioEconomy

Country Report Austria

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Michael Mandl[1], Franziska Hesser[3], Johannes Lindorfer[2], Miriam Lettner[3], Stefanie Wong[1]

tbw RESEARCH 1

ENERGIE INSTITUT an der Johannes Kepler Universität Linz 2

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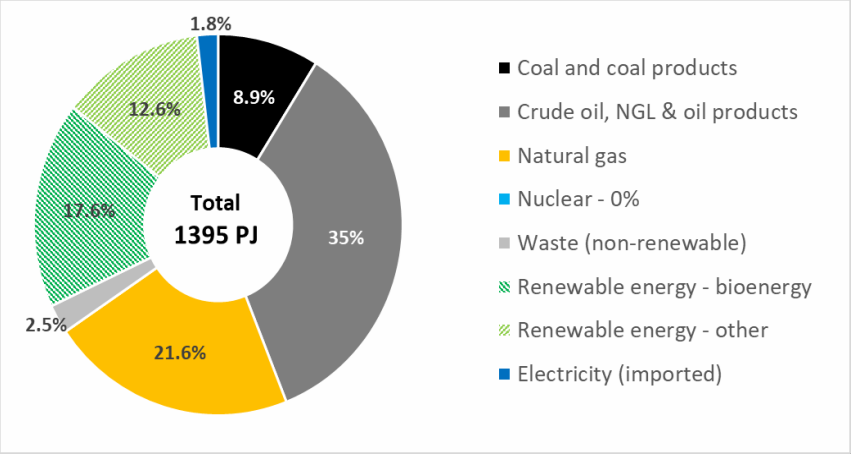
1. Total primary energy supply (TPES) and contribution bioenergy: current status and expected evolution

1.1 TPES -Total primary energy supply in Austria 2016

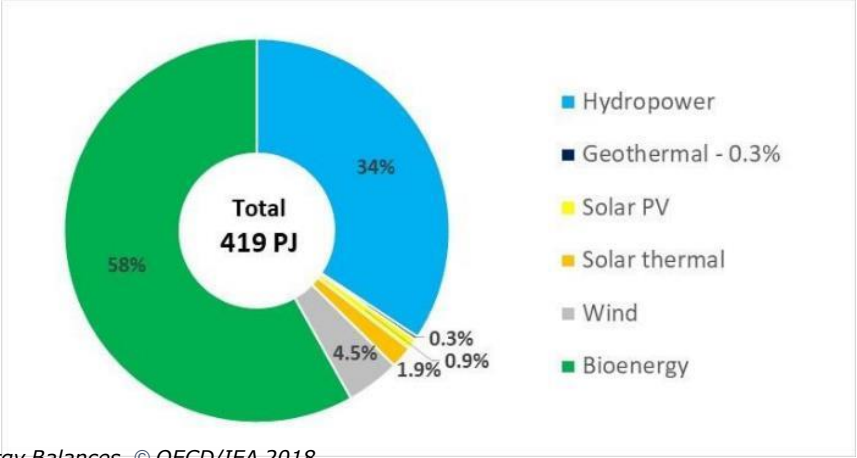
TPES AT (2016): 1,395 PJ

- 65.8% is fossil based energy; natural gas, oil, coal (914 PJ)
- 30.2% RES - Renewable energy supply (420 PJ)
  - 17.6% bioenergy (245 PJ)
  - 12.6% other RES (175 PJ)
- 2.5% Non-renewable from waste
- 1.8% power import



Renewable energy distribution

58% bioenergy (245 PJ)
34% hydropower (143 PJ)
4.5% wind (19 PJ)
1.9% sun_{thm}, 0.9% PV (12 PJ)
0.3% geothermal energy (1.3 PJ)

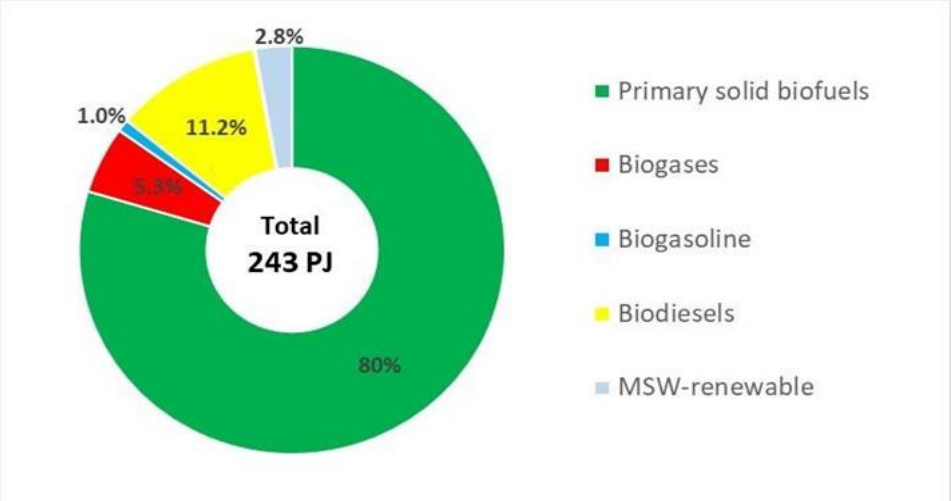


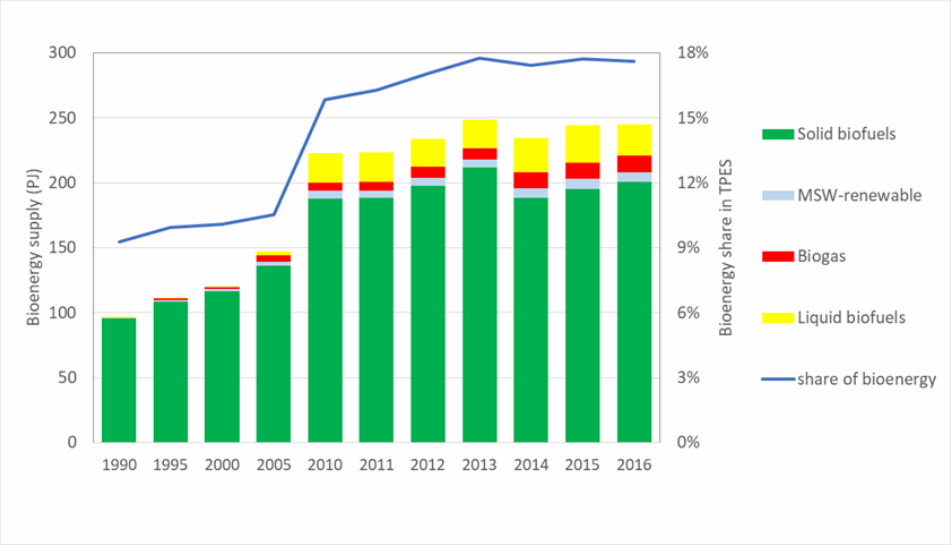
Source: World Energy Balances, © OECD/IEA 2018

1.2.1 Contribution bioenergy

- Bioenergy AT (2016): 245 PJ
- 80% solid biofuels
- 11.2% biodiesel
- 5.3% biogas
- 2.8% RE from waste (MSW)
- 1.0% biogasoline

- Bioenergy almost doubled in period 2000 and 2010
- Since 2010 bioenergy share stabilized at about 17.5%





Source: World Energy Balances, © OECD/IEA 2018

1.2.2 Contribution bioenergy in different sectors (2016)

- Power production (235 PJ)
  -> 78% RES, (61% hydro, 7.1% bioenergy)
- Transport (358 PJ)
  -> 8.7% RES, (6.2% bioenergy)
- Fuel and heat production (515 PJ)
  -> 35.1% RES, (33.5% bioenergy)

Sector	Share of bioenergy	Share of renewable energy	Overall production/ consumption
Electricity production	7.1%	78% *(61% hydro)*	65.3 TWh (235 PPJ)
Transport energy (final consumption)	6.2%	8.7%	358 PJ
Overall fuel and heat consumption[5]	Direct biomass: 27.0% Biobased heat: 6.5%	35.1%	515 PJ

Source: World Energy Balances, ©OECD/IEA 2018

Eurostat data RES for AT (2016):

- Overall share: 33.5%
- Heating/cooling: 33.3%
- Electricity: 72.6%
- Transport: 10.6%

1.3 Development renewable energy (incl. bioenergy) in Austria

- Main increase expected in renewable energy consumption until 2020: hydro, wind, solar and biomass/-gas
- Increase RES by 2030 to 45-50% from current level of 33.5%
- By 2020, 8.45% of diesel and petrol in the transport sector have to be substituted by RES

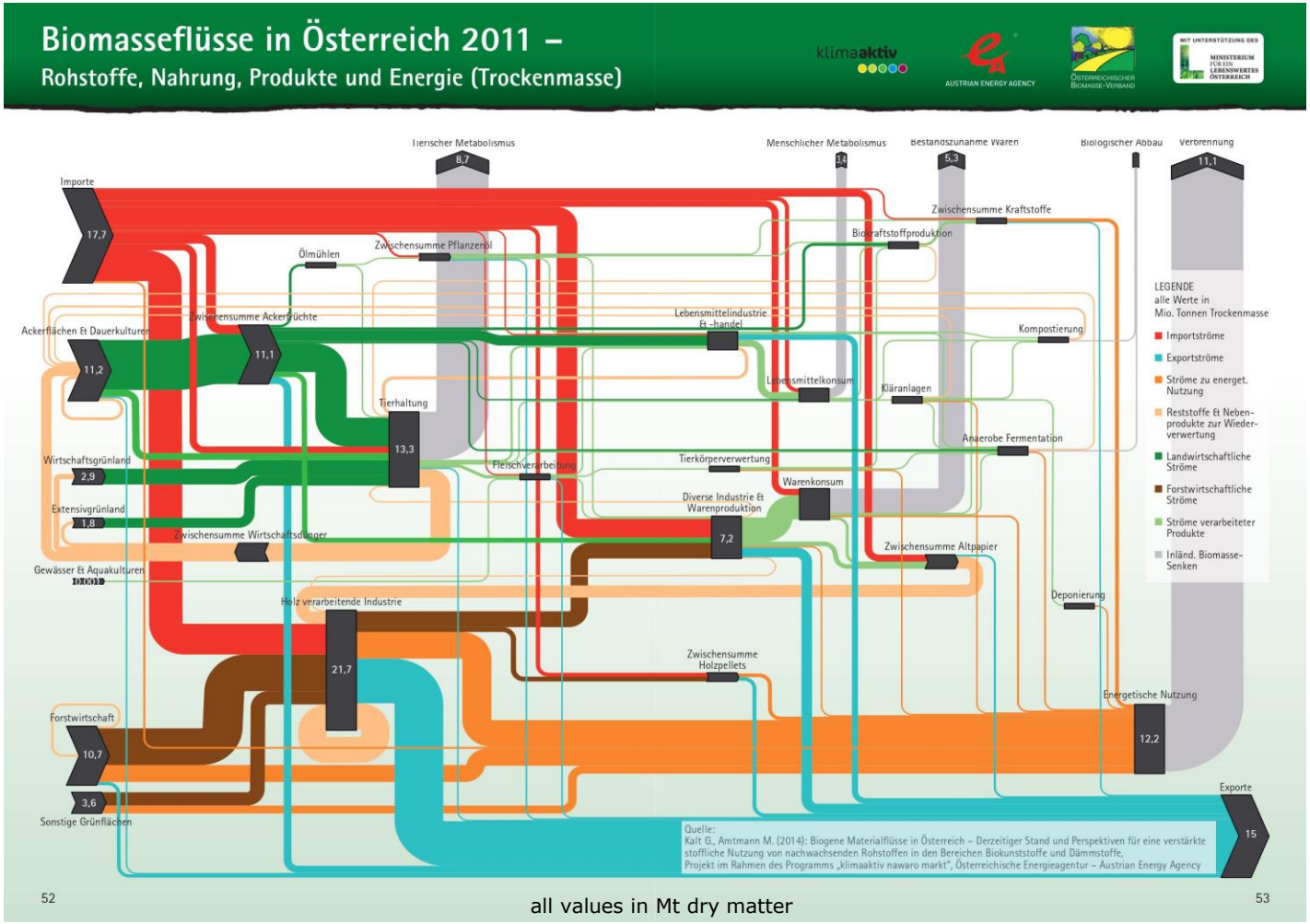
Table: *Austria´s 2020 renewable energy targets.*

Sector	Share in gross final consumption per sector
Overall target	34.2 %
Heating and cooling	32.6 %
Electricity	70.6 %
Transport	11.4 %

Source: National Renewable Energy Action Plan of Austria (2010)

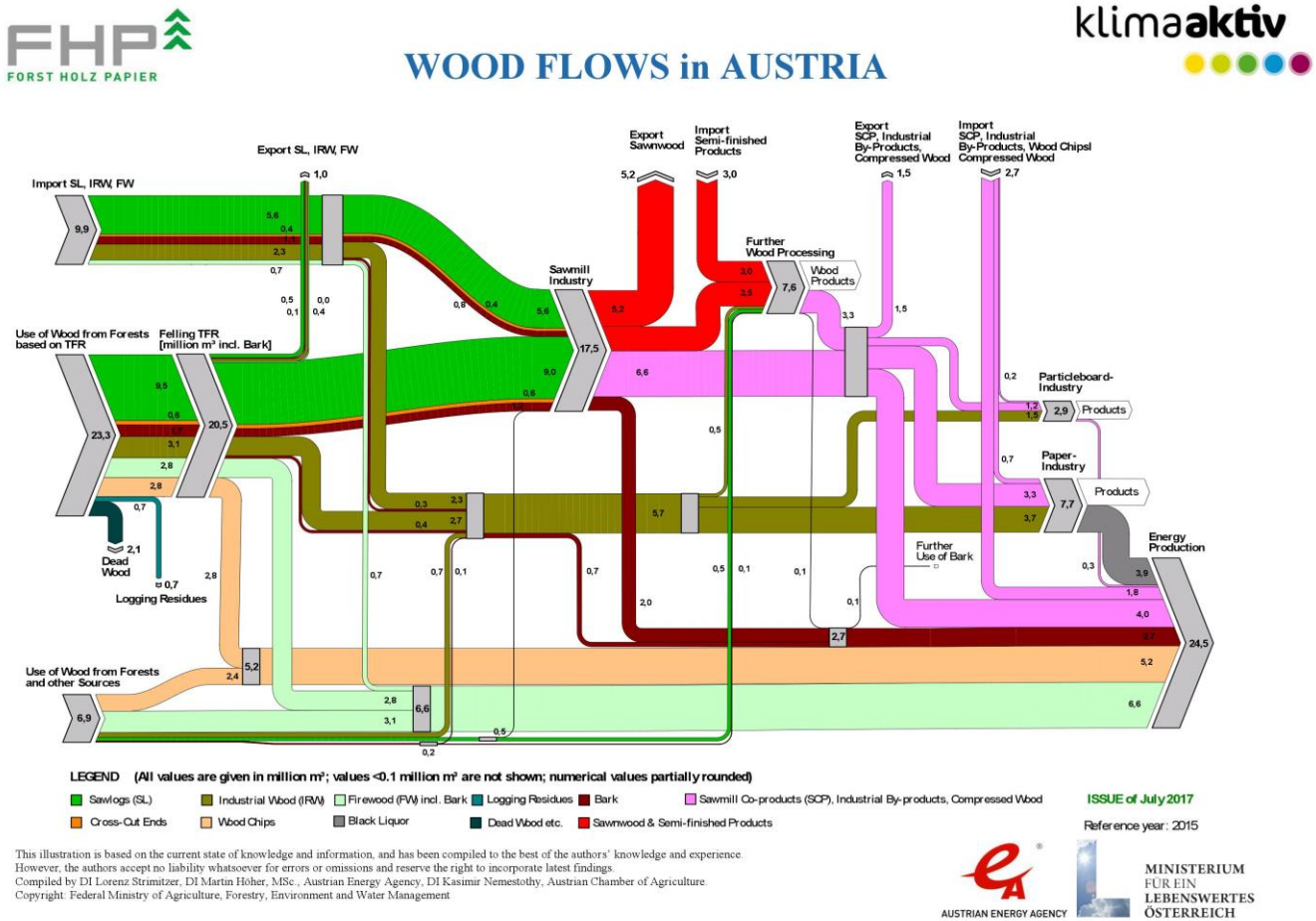
2. Biomass use for non-energetic purposes

2.1 Biomass flows Austria 2011

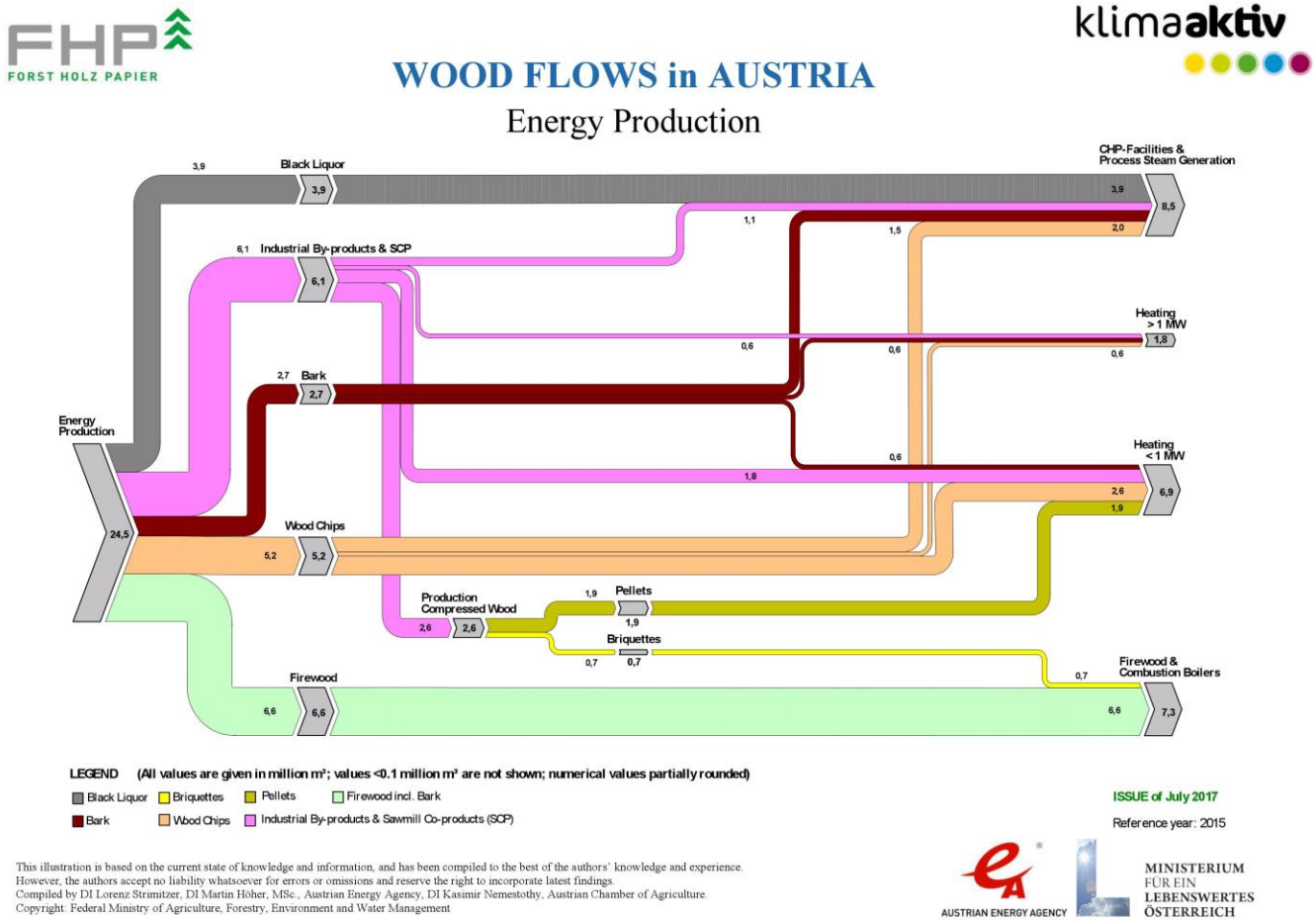


all values in Mt dry matter

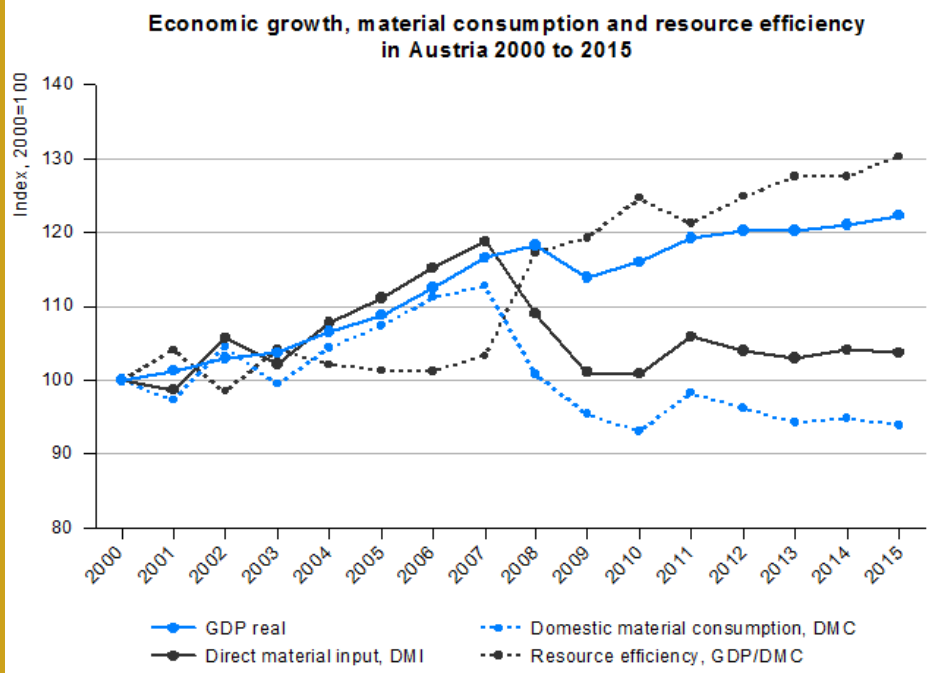
2.2 Wood flows Austria



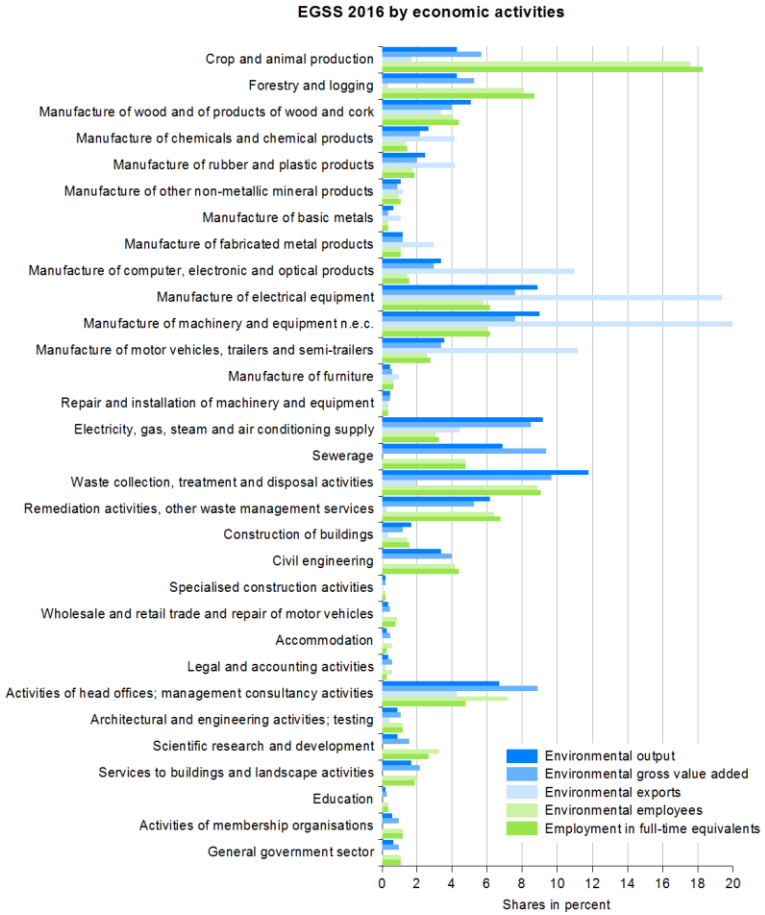
2.3 Energy production wood



2.4 Resource efficiency & EGSS



S: STATISTICS AUSTRIA, Material flow accounts, on behalf of Federal Ministry of Agriculture, Forestry, Environment and Water Management. Compiled on 23 October 2017.



S: STATISTICS AUSTRIA, Environmental Accounts, Environmental Goods and Services Sector (EGSS), 2016, on behalf of BMNT. Compiled on 13 December 2018. – Only activities are shown with an environmental share of at least 0.2% or which are not confidential.

EGSS…Environmental Goods and Services Sector

3. Bioenergy policies and status of implementation

3. Bioenergy policies and status of implementation

- In 2018 four Austrian Federal Ministries presented a working document on the bioeconomy and the respective roles and fields of research[1]. The **"National Bioeconomy - RTD Strategy"** will underpin innovation and R&D to move towards circular economy and regional development.
- Research and innovation is seen as the basis for a structural change from fossil energy to sustainable economy.
- In May 2018 the **climate and energy strategy**[2] (Mission 2030) was decided by the Austrian Federal Government.
- Bioeconomy is a flagship project to boost growth for bio-based products, energy, processes and services.
- To emerge bioeconomy further stimulus is needed in bioenergy, efficiency measures, biorefining of materials from agriculture & forestry, moving toward circular economy
- In March 2019 the **National Bioeconomy Strategy**[3] Austria was decided by the Austrian cabinet

© BMVIT

1 https://nachhaltigwirtschaften.at/resources/nw_pdf/biooekonomie-fti-strategie-ag2-2018.pdf

2 https://mission2030.info/

3 https://www.bmvit.gv.at/innovation/publikationen/energieumwelttechnologie/biooekonomiestrategie.html

4. Research focus related to bioenergy and biorefining

- The largest potential is seen in wood, waste and residues are another important feedstock
- Austrian bioenergy technologies are based on long-lasting R&D policy
- Government supports participation in IEA Bioenergy Agreement
- In 2018 the government presented a bioeconomy research strategy[3]
- The Austrian Competence Centre for Excellent Technologies program supports collaborative research between universities and companies
- Austria's industry is involved in R&D through large companies (e.g. Siemens, Andritz, GE Jenbacher…) and innovative SMEs
- Various industries in the biobased product sector such as Lenzing, Mondi, Heinzl, Sappi and Agrana… are currently exploring and have been implementing integrated biorefining pathways

[3] https://www.bmvit.gv.at/innovation/downloads/energieforschungsstrategie.pdf

5. Biorefinery related funding programmes

Austrian Research Promotion Agency (FFG)

https://www.ffg.at/en

https://www.ffg.at/produktionderzukunft

https://www.ffg.at/content/energie-der-zukunft

Federal Ministry for Transport, Innovation and Technology

https://www.bmvit.gv.at/innovation/produktion/fabrik_der_zukunft.html

Austrian Climate and Energy Fund

https://www.klimafonds.gv.at/ausschreibungen/

Kommunalkredit Public Consulting

https://www.publicconsulting.at/

6. Projects – national

Acronym	Project name	Funding source	Duration	Weblink
BioREg	Etablierung einer dezentralen rohstoffflexiblen Reststoffbioraffinerie	FFG	2017-2020	https://www.wood-kplus.at/de/aktuelles/wood-k-plus-startet-neues-projekt-bioreg-_n52
PowderExteriorWood	Entwicklung eines Verfahrens zur witterungsbeständigen Beschichtung von Holz- und Holzfaserverbundwerkstoffen	FFG	2016-2019	https://projekte.ffg.at/projekt/1723551
3D-CFRP	Additive Manufacturing of Continuous Fibers Reinforced Polymer Materials for High Performance Structural Applications	FFG	2017-2020	https://projekte.ffg.at/projekt/1848274
BioForS	Bio-based form sheets for aircraft applications	FFG	2018-2020	https://projekte.ffg.at/projekt/2758311
Natural3D	Natural reinforcement for 3D printing from Nano to Continuous for bioinspired applications	FFG	2017-2020	https://projekte.ffg.at/projekt/2728576
RSBC	Reliable and Sustainable composite production for Biobased Components	FFG	2017-2020	https://nachhaltigwirtschaften.at/de/projekte/reliable-and-sustainable-composite-production-for-biobased-components.php
FLIPPR + FLIPPR²	Future Lignin and Pulp Processing Research	FFG	2017-2020	http://www.flippr.at/jart/prj3/flippr/main.jart
Wood C.A.R.	Computer Aided Research	FFG	2016-2019	http://www.woodcar.eu/
Bioraffinerie	Entwicklung mikrobiologischer Bioraffineriekonzepte	FFG	2016-2019	https://projekte.ffg.at/projekt/1415445

6. Projects – national

Acronym	Project name	Funding source	Duration	Weblink
Nutricoal	A biobased fertilizer with metered nutrient release	FFG	2018-2021	https://projekte.ffg.at/projekt/2920188
InduZymes	Enzymproduktion aus industriellen Reststoffen	FFG	2017-2020	https://projekte.ffg.at/projekt/1817334
CareForParis	Adaptation for carbon efficient forests and the entire wood value chain (including a policy decision support tool) - Evaluating pathways supporting the Paris Agreement	ACRP	2017-2019	http://eficeec.boku.ac.at/local/portal/projects/careforparis/index.html
ReNOx	Recovery of ammonium from liquid digestates for industrial NOx-removal	FFG	2015-2021	http://vtiu.unileoben.ac.at/media/2017_10_13_ReNOx_-_english.pdf
Bio-ABC	Development of a two-step biological CO_2-fixing process for the production of fuel chemicals	FFG	2017-2020	https://www.vt.tuwien.ac.at/biochemical_engineering/bioprocess_technology/projekte/aktuelle_projekte/bio_abc_development_of_a_two_step_biological_co2_fixing_process_for_the_production_of_fuel_chemicals/DE/
CAFB	Combined Agro-Forest Biorefinery	IWB2020	2015-2020	
Bio-Reduce	Kombinierte Produktion von Biomethan und Bio-Aromaten als Strategie zur CO2 Reduktion in den Bereichen Transport und chemische Industrie	IWB2020	2019-2020	

7. Commercial biorefineries

AustroCel Hallein

Location	Hallein, Austria
Type/ Size	Lignocellulosic biorefinery; Commercial Plant; 160,000 tons of pulp/year
Processing & Products	Environmentally friendly, completely chlorine free (TCF) manufacturing process 100,000 solid cubic metres of energy wood 110 GWh district heating; 100 GWh green energy; 86 GWh biogas

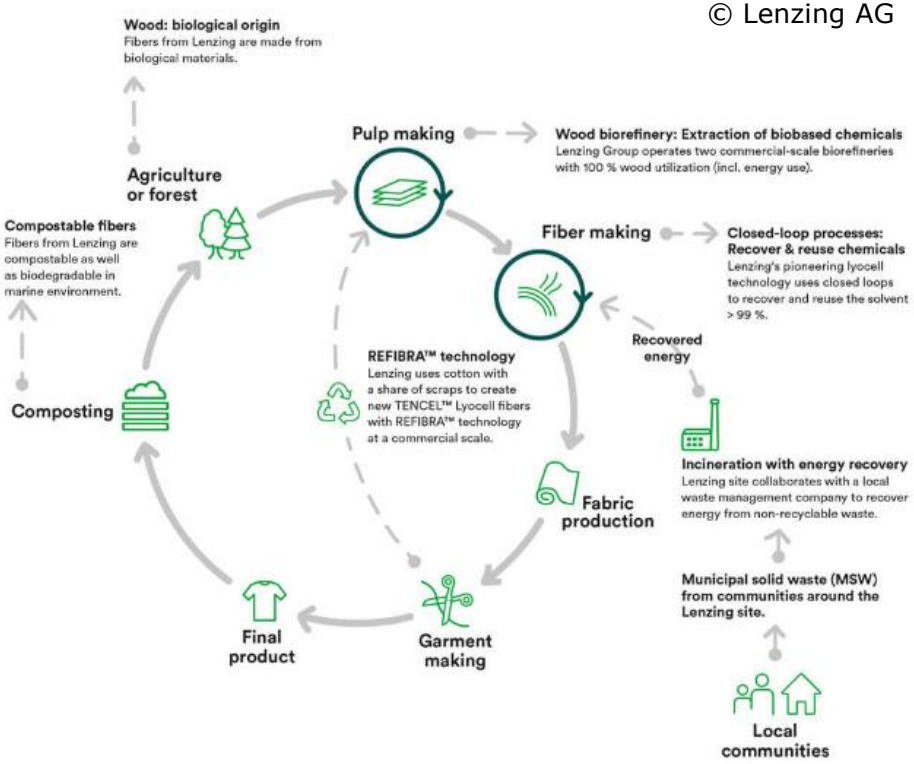
© Marco Riebler

webpage	https://austrocel.com/

Lenzing AG

© Lenzing AG

Location	Lenzing, Austria
Type/ Size	Lignocellulosic biorefinery; Commercial Plant; 300,000 tons of pulp/year
Processing & Products	Viscose, Modal and Lyocell process 40% pulp 50% bioenergy 10% biobased materials: Acetic acid, Furfural, Magnesium-Lingosulphonate, Soda Ash, Sodium Sulphate, Xylose (in cooperation with DuPont)
webpage	https://www.lenzing.com/de/



© Lenzing AG

Agrana

Location	Pischelsdorf, Austria
Type/ Size	Commercial plant 250,000m³ bioethanol/a
Processing & Products	Processing of agrarian raw material (600,000 t/a wheat/maize) Bioethanol, animal feed, wheat starch and wheat gluten, high-purity CO_2
webpage	https://www.agrana.com/en/products/bioethanol/

© APA-PictureDesk/Agrana/Schedl

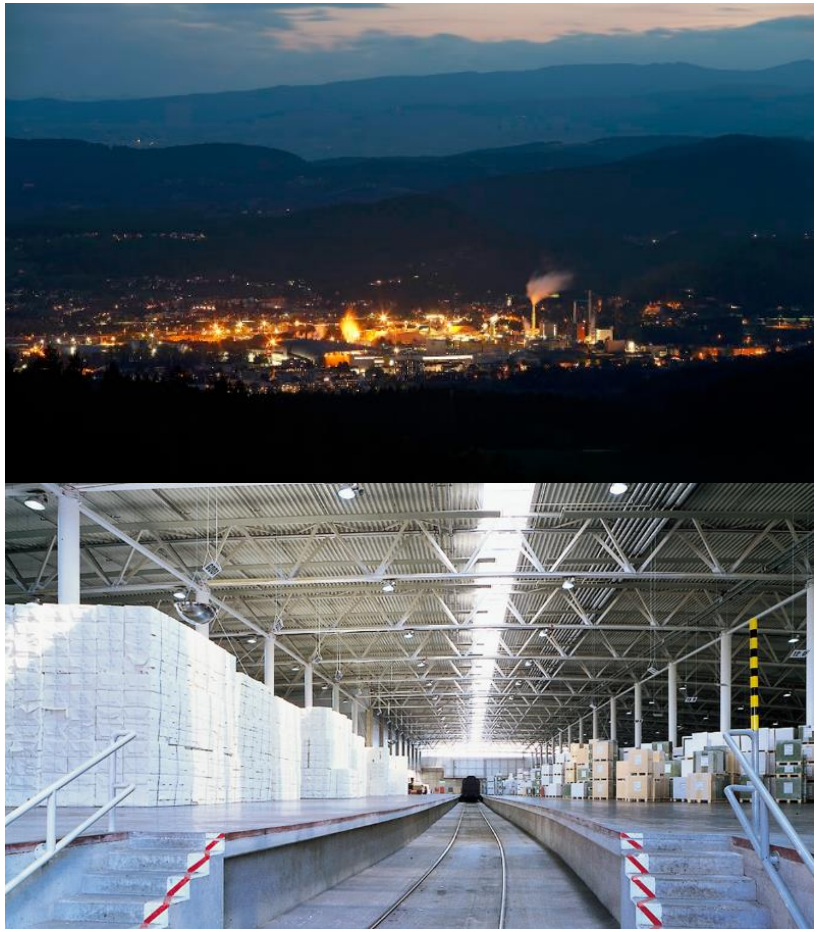
Zellstoff Pöls

Location	Pöls, Austria
Type/ Size	Lignocellulosic biorefinery Commercial plant 450,000 tons pulp 90,000 tons paper
Processing & Products	Production of Pulp and Paper, Use of black liquor to cover fuel energy need; Use of vapor for power generation. Additional power generation District heating supply currently is 18,0 MW
webpage	https://www.zellstoff-poels.at/en/

© Zellstoff Pöls AG

Sappi - Gratkorn Mill

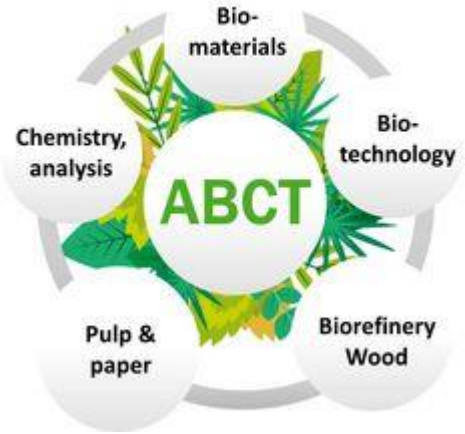
Location	Gratkorn, Austria
Type/ Size	Lignocellulosic Biorefinery Commercial plant 980,000 t/a paper
Processing & Products	250,000 t/a totally chlorine free (TCF) chemical pulp District heating for 55,000 households
webpage	https://www.sappi.com/gratkorn-mill



8. R&D initiative

There is a regional initiative with strong focus on biorefining activities:

- **Austrian Biorefinery Center - Tulln (ABCT)**
  - **University of Natural Resources and Life Sciences, Vienna**



© BOKU ABCT

Webpage:
https://forschung.boku.ac.at/fis/suchen.projekt_uebersicht?sprache_in=de&menue_id_in=300&id_in=1872

9. Biorefinery Education

Biorefinery Engineering - factsheet

- English taught **master program** with an engineering focus at **TUGraz**
- **Credits:** 120 ECTS
- **Duration:** 4 semesters, full-time
- **Admission criteria:** an undergraduate degree in a subject relevant to biorefinery engineering (e.g. chemistry, environmental sciences)
- For more information see:

https://www.tugraz.at/en/studying-and-teaching/degree-and-certificate-programmes/masters-degree-programmes/biorefinery-engineering/

9. Biorefinery Education

BioEnergyTrain Student Camp on

"Biorefineries and Biobased Industrial Products"

at the Competence Center for Wood Composites and Wood Chemistry (Wood K Plus), in Linz Austria

For more information see:

http://www.bioenergytrain.eu/student-camp-2019-on-biorefineries-and-biobased-industrial-products/

10. Demo und pilot plants

10. Demo plant

ecoduna AG – eparella GmbH

Location	Bruck/ Leitha, Lower Austria
Type/ Size	Demonstration Plant, Industrial Pilot since 2018 Goal: 100 t_{dm} algae/a
Processing & Products	• Production of microalgae from nutrients, $C0_2$ and sunlight. • Production of omega-3 fatty acids from algae for high value applications (food) • Valorisation of residues for other product applications • Integration with biogas optional
webpage	www.ecoduna.com

© ecoduna

10. Pilot plant

Lignozellulose-Biorefinery (LCF Biorefinery) @ ICEBE-TU-Wien

- LC-Feedstock (cereal residues, forest biomass and residues, paper, cellulosic, MSW)
- 10L Organosolv Extractor, 220°/30bar,
- Downstreaming: Thin film evaporator, membranes
- Products:

  Nanolignin

  Bioactives

  Organic acids

  Erythritol

  Fibres

11. Major innovation activities and EU projects with Austrian input

Acronym	Project name	Funding source	Duration	Weblink
ERIFORE	European Research Infrastructure for Circular Forest Bioeconomy	H2020	2016-2018	http://erifore.eu/
SmartLi	Smart Technologies for the Conversion of Industrial Lignins into Sustainable Materials	H2020	2015-2018	https://clicinnovation.fi/projects/smartli/
SUSBIND	Development and pilot production of SUStainable bio-BINDer systems for wood-based panels	H2020	2018-2022	https://susbind.eu/
D4EU	Dendromass4Europe	H2020	2017-2022	https://www.dendromass4europe.eu/
BioEnergyTrain	European cooperation for higher education	H2020	2015-2019	http://www.bioenergytrain.eu/
Percal	Chemical building blocks from versatile MSW biorefinery	H2020	2017-2020	http://www.percal-project.eu/index.php
Wast!UP	Value chains for disruptive transformation of urban biowaste into biobased products in the city context	H2020	2019-2022	
START CIRCLES	Supporting TrAnsition from lineaR To CIRCuLar valuE chainS	Interreg	2018-2021	http://www.si-at.eu/en2/
OPTISOCHEM	OPTimized conversion of residual wheat straw to bio-ISObutene for bio based CHEMicals	BBI-JU / H2020	2017-2021	http://optisochem.eu/
REWOFUEL	REsidual soft WOod conversion to high characteristics drop-in bioFUELs	H2020	2018-2021	http://www.rewofuel.eu/

11. Major innovation activities and EU projects with Austrian input

Acronym	Project name	Funding source	Duration	Weblink
TFP-HyMat	Technology and Research Platform – Hybrid Materials	Interreg	2016-2019	https://www.jku.at/en/institute-for-chemical-technology-of-organic-materials/research/polymer-characterization/tfp-hymat/
NO WASTE	Verbesserte Biodiversität für abfallfreie wirtschaftliche Verwertung traditioneller Kulturpflanzen	Interreg	2017-2019	https://www.wood-kplus.at/de/partner/fordergeber-und-foerderprojekte/no-waste
Alplinkbioeco	Linking BioBased Industry Value Chains Across the Alpine Region	Interreg	2018-2021	https://tinyurl.com/Alplinkbioeco
WASTE2FUELS	Biobutanol from food waste	H2020	2016-2018	www.waste2fuels.eu
TORERO	TORrefying wood with Ethanol as a Renewable Output: large-scale demonstration	H2020	2017-	www.torero.eu
DanuBioValnet®	Interreg project, which is cross-clustering partnership to boost eco-innovation by developing a joint bio-based value-added network for the Danube Region	Interreg	2017-2019	http://www.interreg-danube.eu/approved-projects/danubiovalnet
CHIC	Chicory as a multipurpose crop for dietary fibre and medicinal terpenes	H2020	2018-	http://chicproject.eu
ICAWER	Interregional Concept for Advanced Wastewater Energy Reclamation	Interreg	2014-2020	https://icawer.syneco-group.com
LIGNOFLAG	Commercial flagship plant for bio-ethanol production involving a bio-based value chain built on lignocellulosic feedstock	BBI-JU / H2020	2017-2022	https://www.lignoflag-project.eu/

12. Major stakeholders

Governmental organisations

Name	Weblink
Ministry for Sustainability and Tourism	https://www.bmnt.gv.at/english/
Ministry for Transport, Innovation and Technology	https://www.bmvit.gv.at/en/index.html
Ministry for Digital and Economic Affairs	https://www.en.bmdw.gv.at/Seiten/default.aspx

Universities and Research Institutes

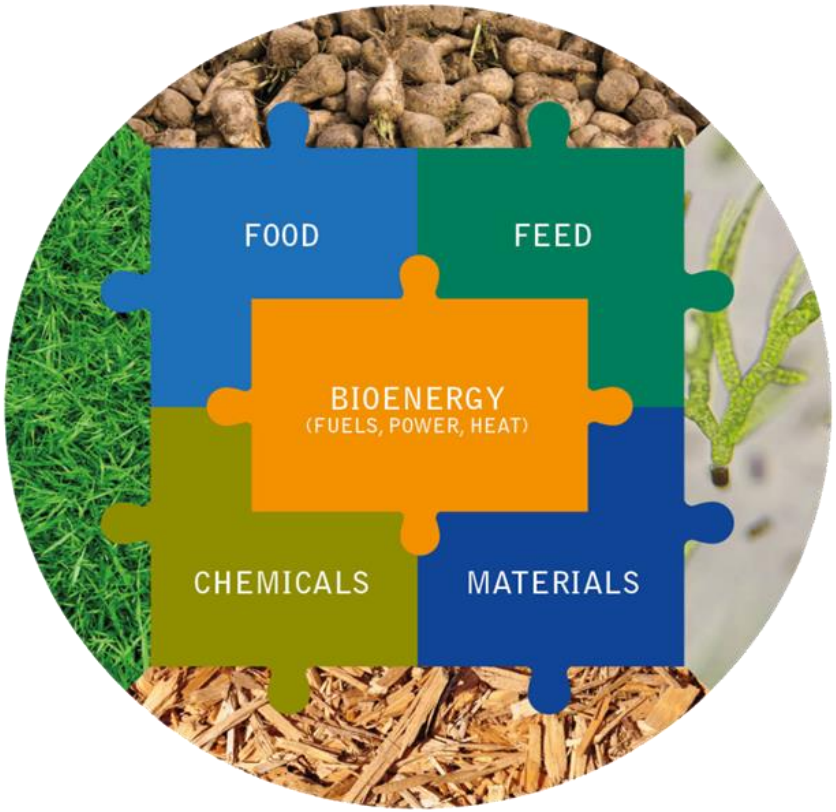
Name	Weblink
Technical University Vienna	https://www.tuwien.ac.at/en/
Vienna University of Natural Resources and Life Science	www.boku.ac.at
University of Graz	https://www.uni-graz.at/en/
Graz University of Technology	• Institute of Chemical Engineering and Environmental Technology • Institute of thermal engineering
University of Innsbruck	• Waste and Resource Management • Department of Microbiology
University of Applied Sciences Upper Austria	https://www.fh-ooe.at/en
Energy Institute at the University Linz	https://www.energieinstitut-linz.at
Bioenergy 2020+	www.bioenergy2020.eu
WOOD K plus	https://www.wood-kplus.at/en
Austrian Institute of Technology	www.ait.ac.at
AAE Intec	https://www.aee-intec.at
AEA – Austrian Energy Agency	https://en.energyagency.at
Joanneum Research	www.joanneum.at
International Insitute for Applied Systems Analysis (IIASA)	http://www.iiasa.ac.at/

12. Major stakeholders

Companies/industries

Name	Weblink
Siemens	https://new.siemens.com/at/de.html
Andritz	www.andritz.com
AustroCel Hallein	https://austrocel.com
Lenzing	www.lenzing.com
Mondi	https://www.mondigroup.com/en/home/
Heinzel	https://www.heinzel.com/en/
Sappi	www.sappi.com
Agrana	www.agrana.at
OMV	www.omv.at
Anniki	www.annikki.at

Name	Weblink
Austropapier	www.austropapier.at
Münzer Bioindustrie – Division Biodiesel	https://www.muenzer.at/en/home.html
BDI - Bioenergy	https://www.bdi-bioenergy.com/en/start
EVN	https://www.evn.at
PPM-Energie aus nachwachsenden Rohstoffen GmbH	http://www.ppm-biodiesel.com/
New Energy Capital Investment	http://www.energyinvest.at/about/
tbw research GesmbH	https://tbwresearch.org/
Wien Energie GmbH	https://www.wienenergie.at/eportal3/ep/channelView.do?channelId=-48494



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Contact Details

Michael Mandl
National Team Leader
tbw research GesmbH
m.mandl@tbwresearch.org

Franziska Hesser
Kompetenzzentrum Holz GmbH
f.hesser@wood-kplus.at

Johannes Lindorfer
Energieinstitut an der Johannes Kepler Universität Linz
lindorfer@energieinstitut-linz.at

IEA Bioenergy Website
www.ieabioenergy.com

IEA Bioenergy Task42 Website
www.task42.ieabioenergy.com