IEA Bioenergy

Task 42 Biorefining

Country Report Austria

September/2014

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JOANNEUM RESEARCH

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- Biomass use for energy and non-energetic applications
- Biomass related (national) policy issues
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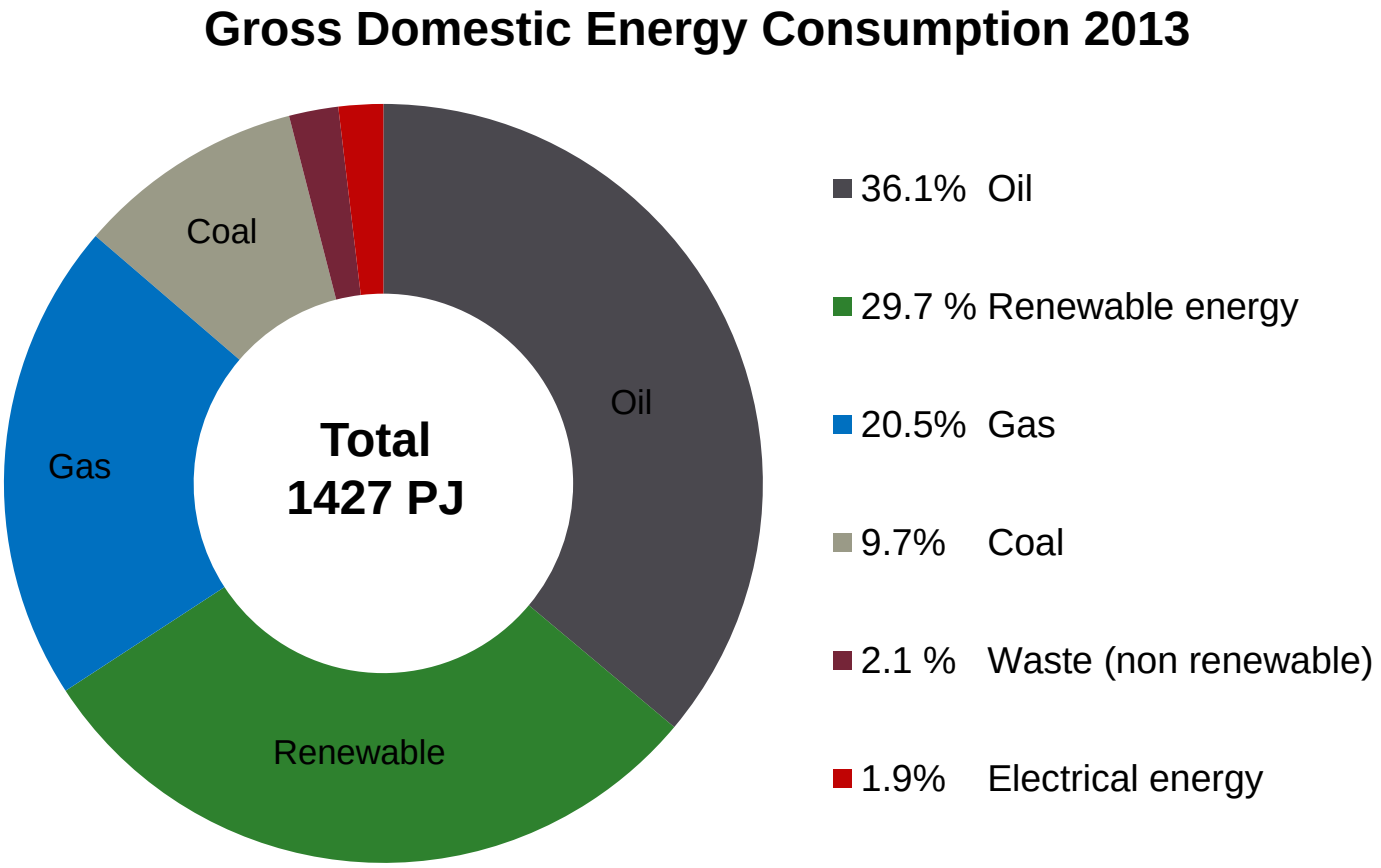
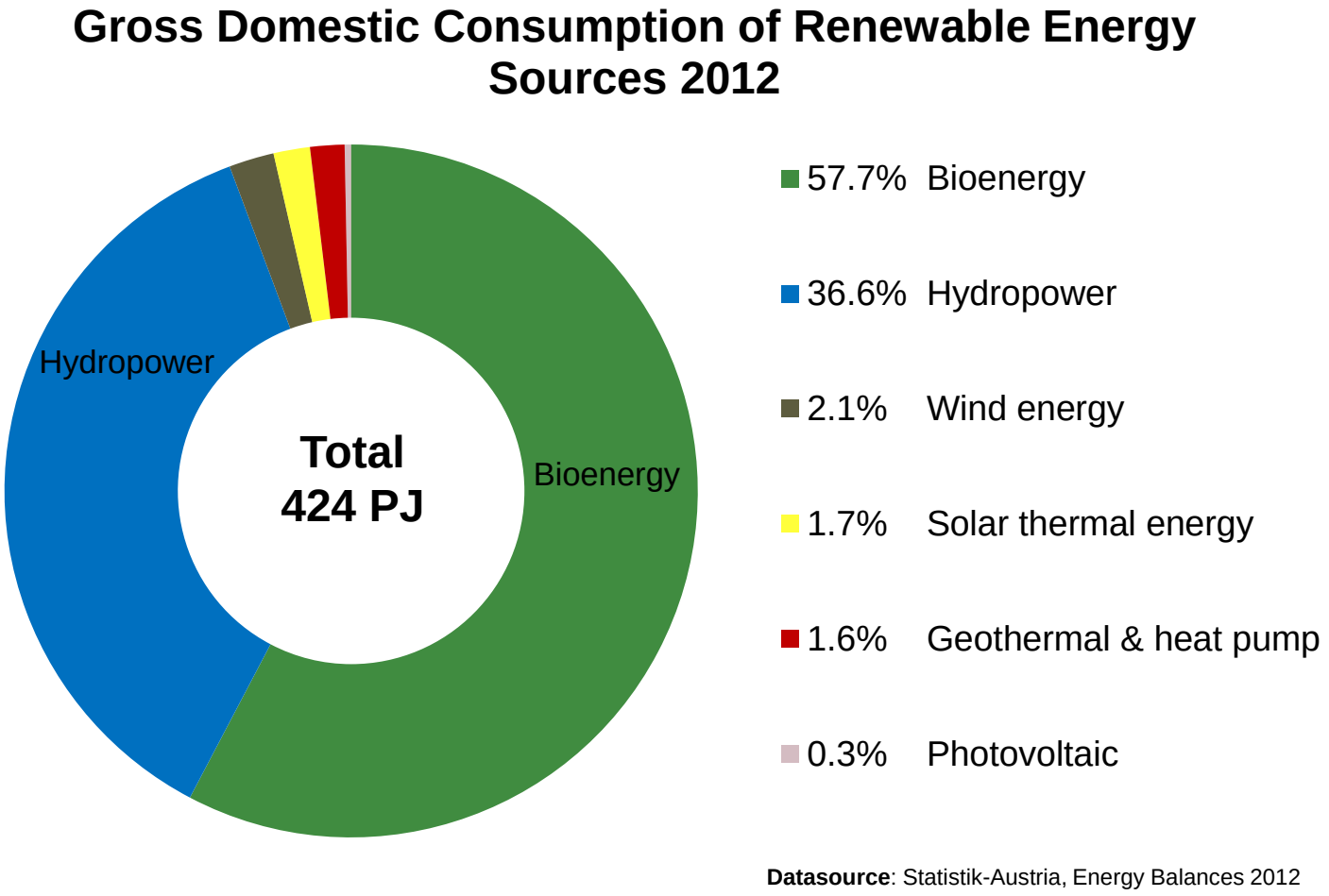
- Biorefinery demonstration and pilot plants
- Major R&D projects
- Major national stakeholders involved in the field of biorefining
- Other issues

Country specific energy consumption (1)



Datasource: Statistik-Austria, Energy Balances 2013

Country specific energy consumption (2)



Datasource: Statistik-Austria, Energy Balances 2012

Country specific energy consumption (3)

Energy balance 2013 for Austria in Petajoule (1)

Energy Carriers	Gross inland consumption	Final energy consumption	Imports	Indigenious production
Hard Coal	98.8	4.9	97.9	0
Lignite	1.9	1.9	1.9	4
Coke	37.7	9.7	37.3	0
Crude oil and NGL	36.8	0	332.7	37.1
Refinery feedstocks	15.6	0	1.9	0
Gasoline	2.0	65.9	32.7	0
Bioethanol	0.1	2.3	1.1	0
Kerosene	-0.5	28.6	4.3	0
Diesel	126.2	253.5	158.0	0
Biodiesel	8.2	17.6	10.2	0
Gasoil	17.7	52.5	27.5	0
Fuel oil	-16.2	6.5	2.4	0
LPG	1.8	4.6	2.9	0
Other oil products	0.9	1.9	18.7	0

Datasource: Statistic-Austria, Energy Balances 2013

Country specific energy consumption (4)

Energy balance 2013 for Austria in Petajoule (2)

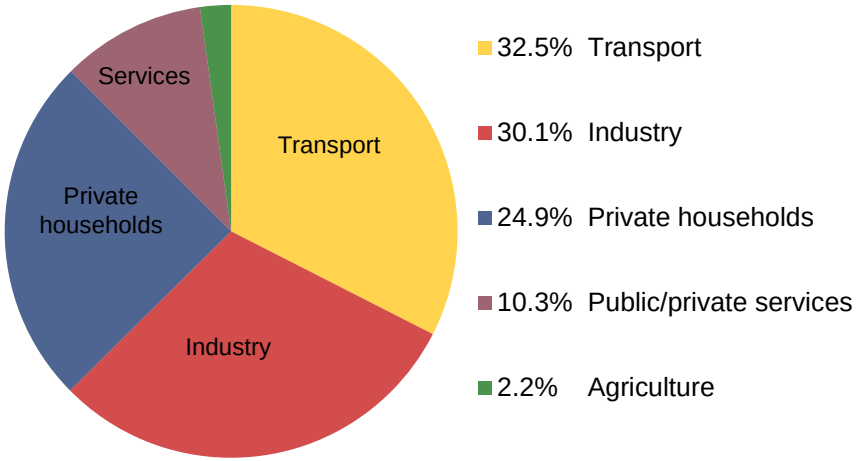
Energy Carriers	Gross inland consumption	Final energy consumption	Imports	Indigenious production
Raffinery gas	0	0.1	0	0
Natural gas	293.1	190.1	357.7	47.1
Blast furnace gas	0	1.4	0	0
Coke oven gas	0	2.3	0	0
Waste non renewable	28.9	11.7	0	28.9
Fuel wood	62.0	61.9	11.3	51.4
Biofuels	174.1	80.1	26.7	170.2
Ambient heat	14.8	14.2	0	14.8
Heat for district heating	0	77.9	0	0
Hydropower	150.9	0	0	150.9
Wind and PV	13.8	0	0	13.9
Electricity	26.2	226.9	89.9	0
TOTAL	**1426.4 PJ**	**1116.6 PJ**	**1215.1 PJ**	**514.3 PJ**

Datasource: Statistik-Austria, Energy Balances 2013

Country specific energy consumption (5)

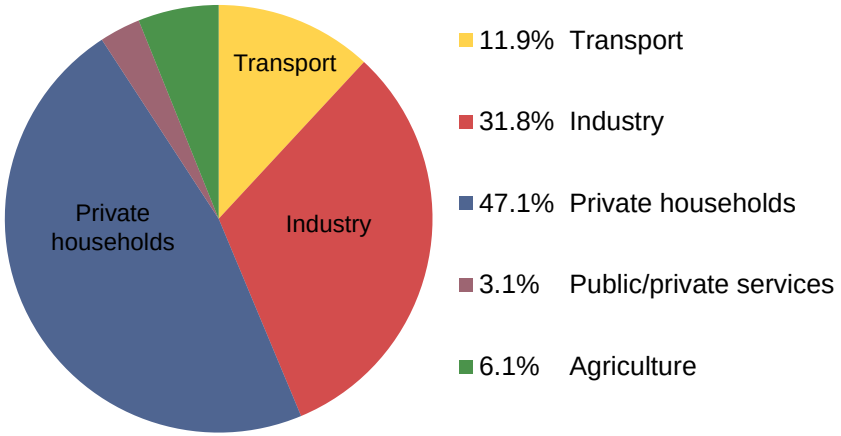
Final energy consumption by sector 2013

Final total energy consumption by sector



Total: 1117 PJ

Final energy consumption of Renewables by sector



Total: 176 PJ

Datasource: Statistik-Austria, Energy Balances 2013

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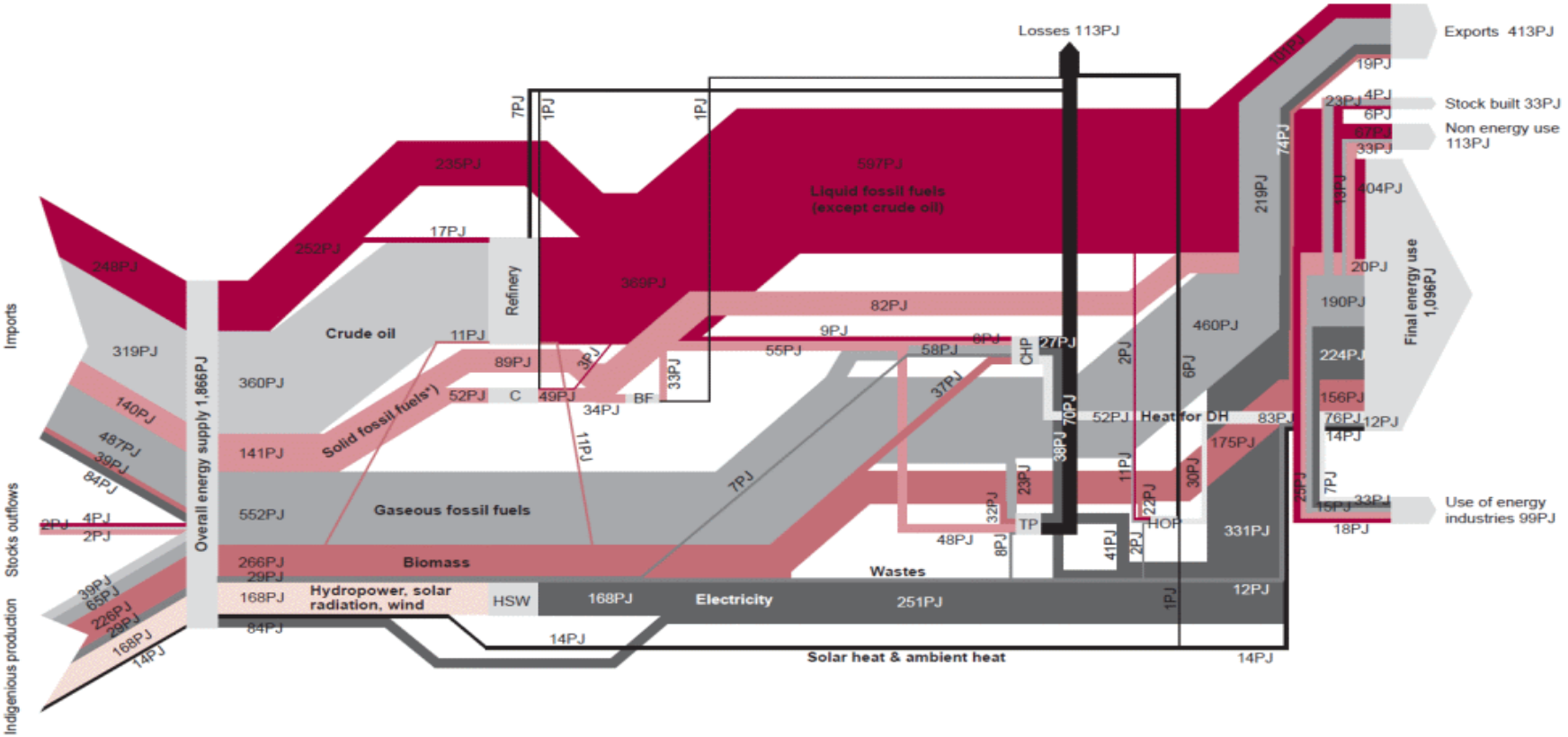
Country specific energy consumption (6)

Energy flow Chart for Austria 2012



Rounding differences not equalized.
C ... Coke oven; BF ... Blast furnace; HSW ... Hydropower, PV, Windpower plant; TP ... Thermal power plants; HOP ... Heat only production; CHP ... Combined heat and power ; Production of charcoal is not shown because of the low energy flows (< 0,5PJ).
*) including coke oven gas and blast furnace gas, DH ... District heating

S: STATISTICS AUSTRIA, Energy statistics. Compiled on 28. January 2014.

Source: Statistic-Austria, Energy Balances 2013

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Biomass use for energy and non-energetic applications (1)

Consumption of Bioenergy in Austria- Development & Potential (1)

Heat from Biomass (in Petajoule) 2005, 2011, 2020

Energy sources	2005 (PJ)	2011 (PJ)	Potential 2020 (PJ)
Wood-based	106.1	127.7	149.6
Black liquor	15.6	20.7	22.4
Landfill gas	0.3	0.2	0.2
Biogas	0.7	0.8	6.2
Liquid biomass	0.3	0.0	0.0
Domestic waste (bio-shares)	1.2	2.2	2.2
Other solid biomass	2.8	8.8	11.4
Total	**127 PJ**	**160.4 PJ**	**192 PJ**

Datasource: Bioenergie- Basisdaten, 2013

Biomass use for energy and non-energetic applications (2)

Consumption of Bioenergy in Austria- Development & Potential (2)

Electricity from Biomass (in Petajoule) 2005, 2011, 2020

Energy sources	2005 (PJ)	2011 (PJ)	Potential 2020 (PJ)
Domestic waste (bio-shares)	1.0	0.8	0.8
Wood- based	2.6	7.6	9.3
Biogas	1.1	2.3	4.6
Liquid biomass	0.2	0.0	0.0
Black liquor	4.0	4.6	5.4
Other solid biomass	0.3	1.0	1.2
Total	**9.2 PJ**	**16.3 PJ**	**21.3 PJ**

Biofuels (in Petajoule) 2005, 2011, 2020

Energy sources	2005 (PJ)	2011 (PJ)	Potential 2020 (PJ)
Pure biofuel	0.9	5.0	8.0
Bioethanol- admixture	0.0	2.7	5.3
Biodiesel admixture	1.4	14.9	22.3
Total	**2.3 PJ**	**22.6 PJ**	**35.6 PJ**

Datasource: Bioenergie- Basisdaten, 2013

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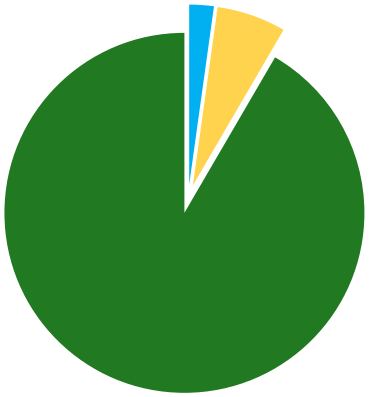
Biomass use for energy and non-energetic applications (3)

Share of Farmland for Biogas and Biofuel Production 2012

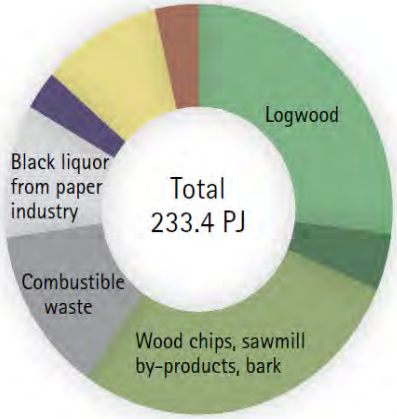


- **8.4 %** (115.000 ha) of total domestic farmland in Austria are used for bioenergy cultivation

→ Cover about **0.7 %** of Austria`s gross domestic energy consumption

Datasource: Landesumweltanwaltschaften,2013

Gross Domestic Consumption of Bioenergy 2009



27.0% Logwood
4.3% Pellets
28.5% Wood chips, sawmill by-products, bark
13.1% Combustible waste
10.7% Black liquor from paper industry
3.0% Bio-, landfill-, and sewage gas
9.9% Bioethanol, biodiesel, vegetable oils
3.7% Meat- and bone meal, sewage sludge, straw, various biogenics

Source: Statistics Austria, Energy Balances 1970-2009, Austrian Energy Agency

- Biomass consumption has increased by **44%** since 2005
- Share of wood: **79%** → most important ressource for the bioenergy market in Austria

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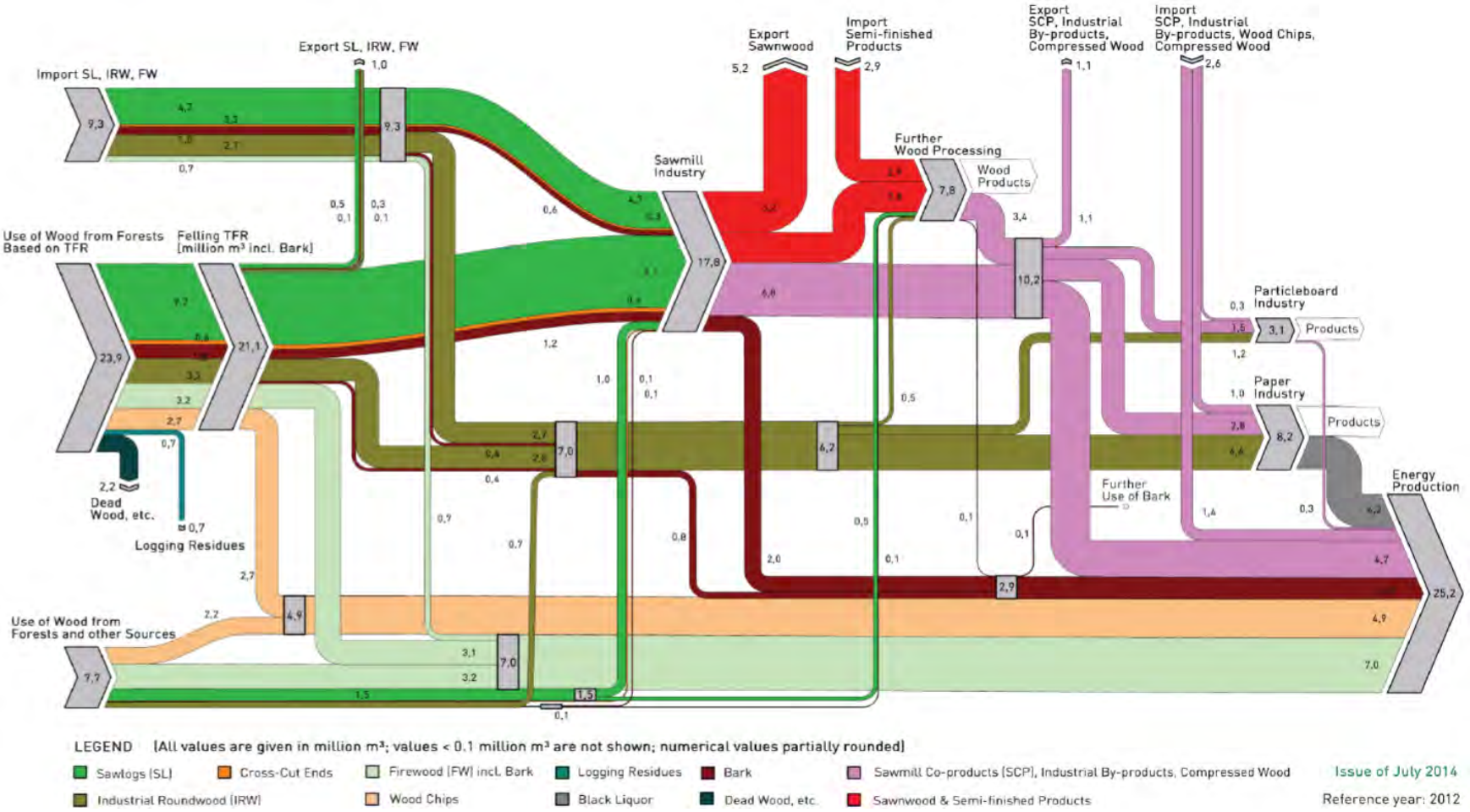
Biomass use for energy and non-energetic applications (4)

Woodflows in Austria 2012



Source: AEA,klimaaktiv,FHP,2012

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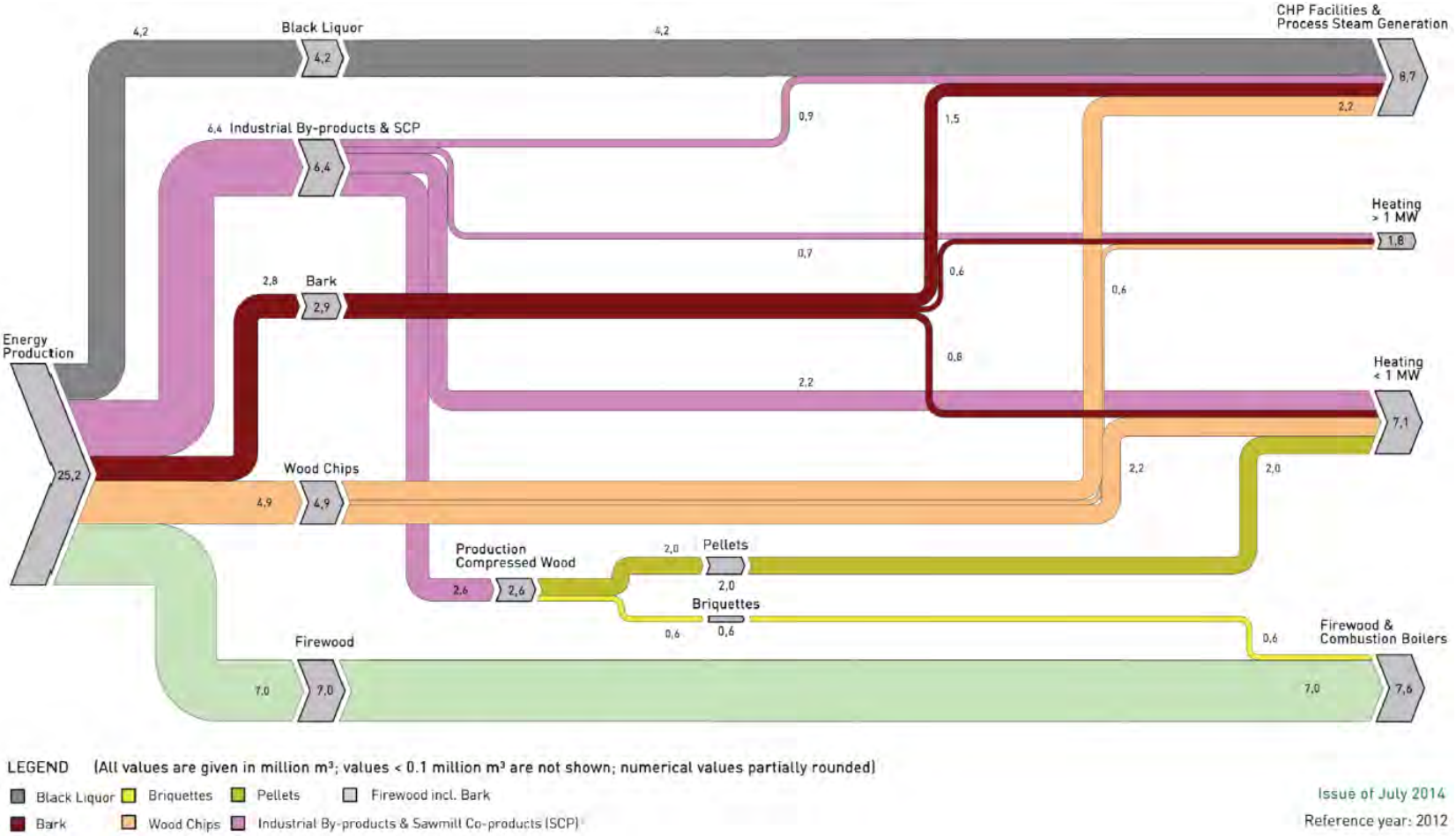
Biomass use for energy and non-energetic applications (5)

Woodflows for Austria- Energy Production 2012



Source: AEA,klimaaktiv,FHP,2012

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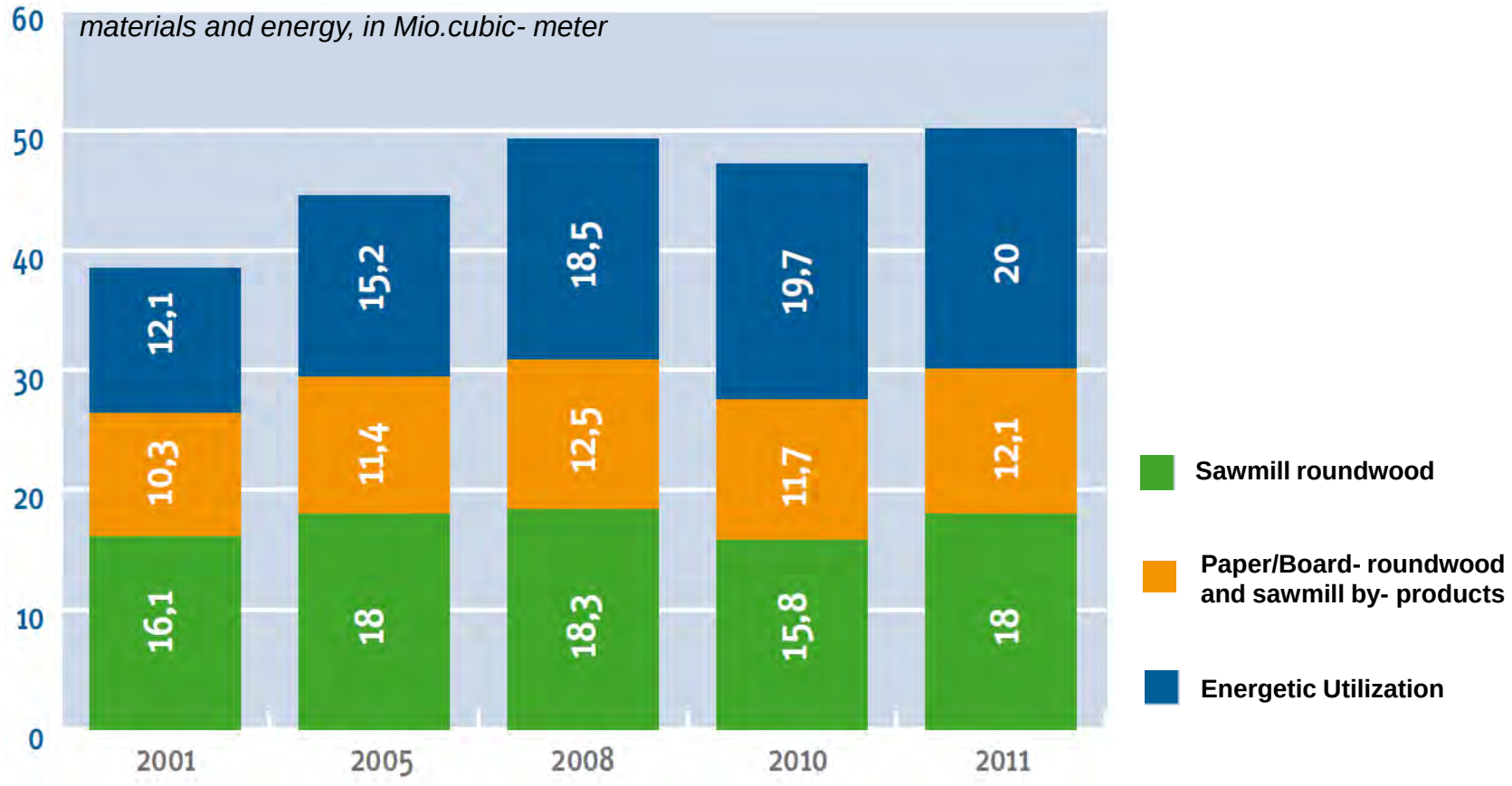
Biomass use for energy and non-energetic applications (6)

Development of wood-utilization in Austria 2001- 2011



Source: Industriellenvereinigung, 2012

Biomass use for energy and non-energetic applications (7)

Biomass use for non-energetic applications 2009/2010

Utilization of biomass for feed, materials and chemicals

Use	Year	Amount in Mio. tons
Wood for particle boards	2009	1.2
Wood for pulp and paper	2009	2.3
Wastes from pulp and paper	2008	1.5
Chemicals from biomass	2009	0.78
Cereal production	2009 / 2010	5.1 / 4.5
Sugar production	2009	0.44
Starch production	2009	0.3
Oilseed production	2009	0.3

Datasource: Agrana,Lebensministerium, Statistik-Austria, Trading Economics, UnData, 2009- 2010

Biomass related (national) policy issues

Austrian activities towards a national BioEconomy strategy

Currently 2 ministries involved

- Transport, Innovation and Technology (BMVIT)
- Agriculture, Forestry, Environment and Water Management (BMLFUW)

2 strategy papers published

- „Research, Technology and Innovation Strategy for Biobased Industries in Austria“ (BMVIT, 2014)
  - Sector focus on food, pharma, chemical and wood processing industries
  - R&D focus on biomass conversion technologies, integrated concepts for cascading use of biomass, biorefineries
  - Position of bioenergy: focus on concepts of integrated energy and material use of biomass
- „Position and Background Paper Bioeconomy“ (BMLFUW, 2013)
  - Identification of essential research areas for Austria: biomass production, conversion technologies, cross-cutting issues (LCA, (i)LUC)

Biomass related sustainability aspects (1)

Current framework for a „sustainable“ biomass use in Austria

- **Forestry:**
  - The *National Forestry Law* regulates a sustainable forest management

  → *PEFC certification system* (completed 2,6 million hectares of forest certification)

- **Agriculture:**
  - *Cross Compliance Regulations* for the observance of legal standards regarding the environment, food safety and animal welfare

  → Basic requirements for farm management and use of agricultural areas

  - Natural protection regulations of the federal states

Biofuels:
All biofuels which are to be counted towards the substitution objectives must comply with the sustainability criteria set out

→ Evidence of sustainability is handled in Austria through the electronic system *"Elna"*, which is operationally managed by the Federal Environment Agency

Biomass related sustainability aspects (2)

Demands on decision-makers at federal- and state level, in terms of a sustainable use of bioenergy

(Position- paper of the environmental authorities)

1) **Efficient land- use for Bioenergy**

- Utilizing agricultural residues (straw, agricultural fertilizer, biomass from agricultural management)
- Use of waste (food waste, biomass from Community management)
- Utilization of biomass from contaminated or degraded areas
- Cascading use of renewable resources

2) **Sustainable biomass- cropping- systems**

- Use of humus-building cover crops, locally adapted crops and cultivation methods
- Use of mixed cultures, flower strips and integrated crop rotations
- Energy utilization of extensively used short-rotation plantations, which enhance the cultural landscapes as wood structures

→ **Contribution to the conservation of biodiversity and soil fertility**

Source: Umweltanwaltschaften Positionspapier, 2013

Running commercial biorefineries (1)

Biorefinery Pischelsdorf in Austria

State-of-the-art: Commercial Scale

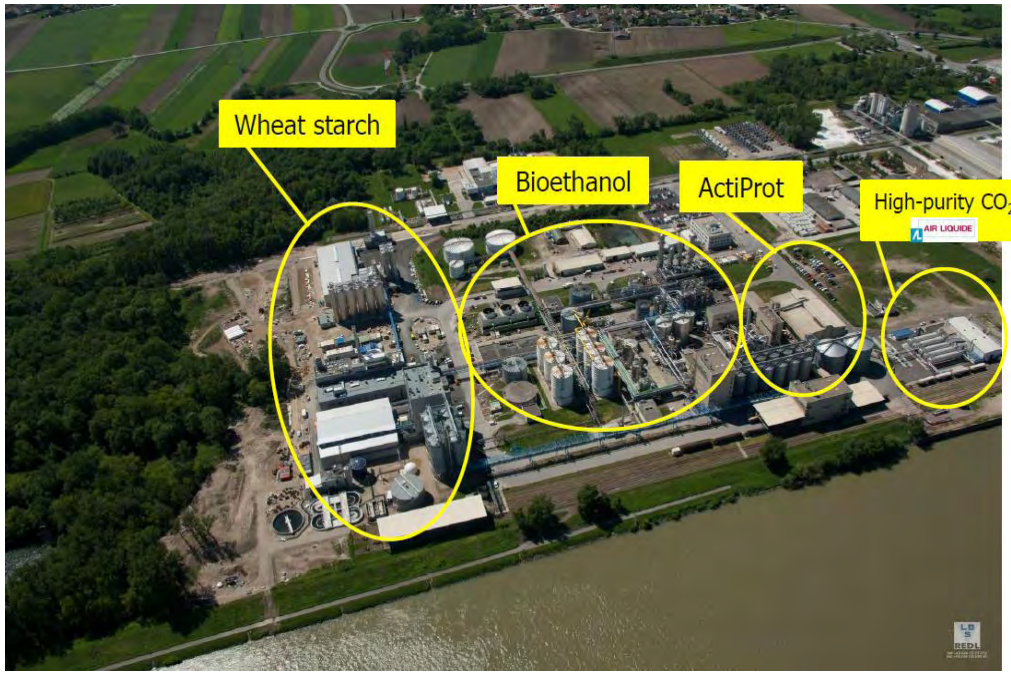
Type of biorefinery: Two platform (starch, C5/C6 sugars) biorefinery for the production of bioethanol, wheat starch and gluten, and CO2 from agrarian raw materials by integration wheat starch processing into existing bioethanol facility

Location: Pischelsdorf, Austria

Owner: AGRANA Bioethanol GmbH

Feedstocks: Agrarian raw materials

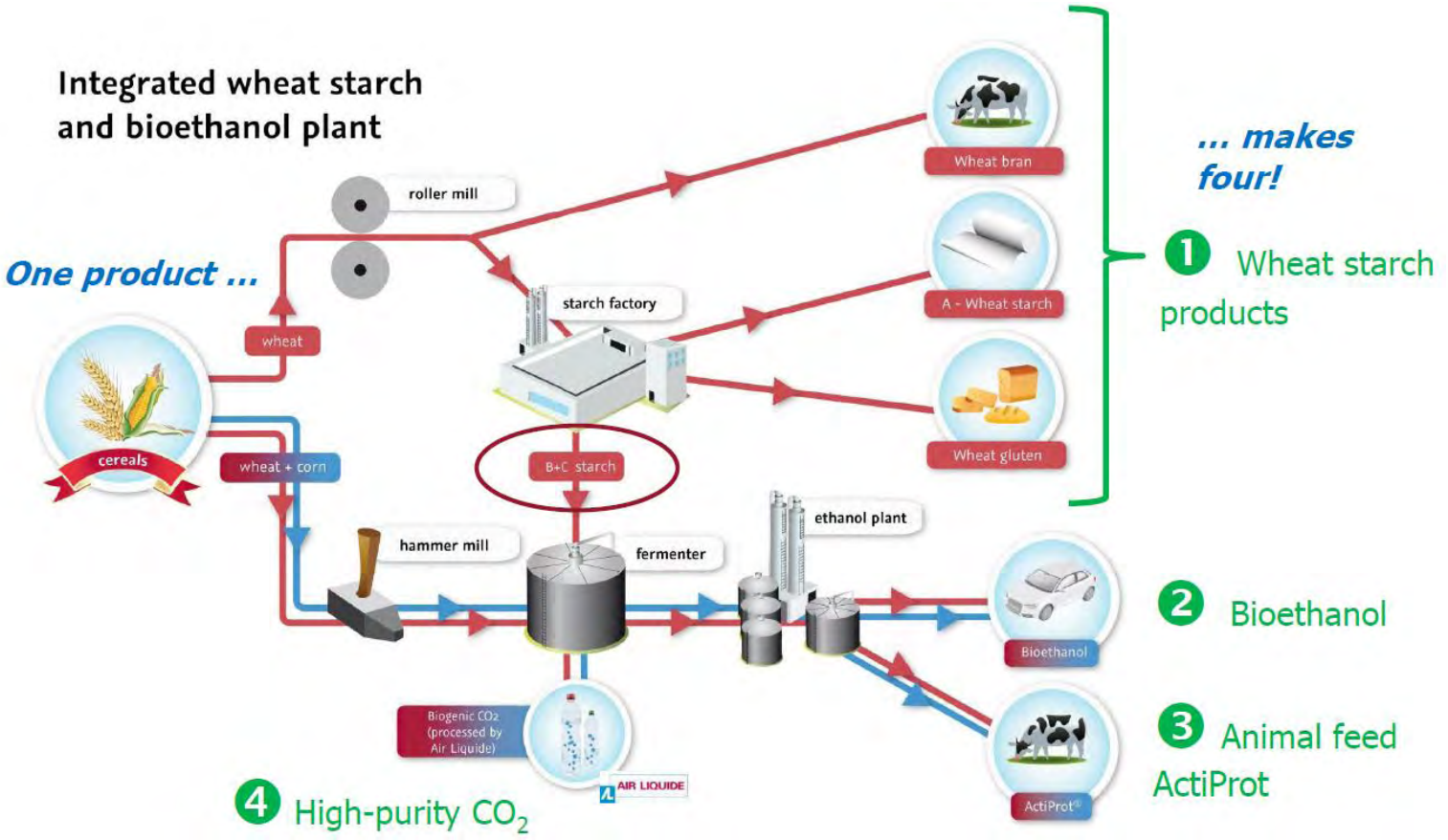
Outputs: Bioethanol, wheat starch and gluten, CO2



Source: Agrana, 2013

Running commercial biorefineries (2)

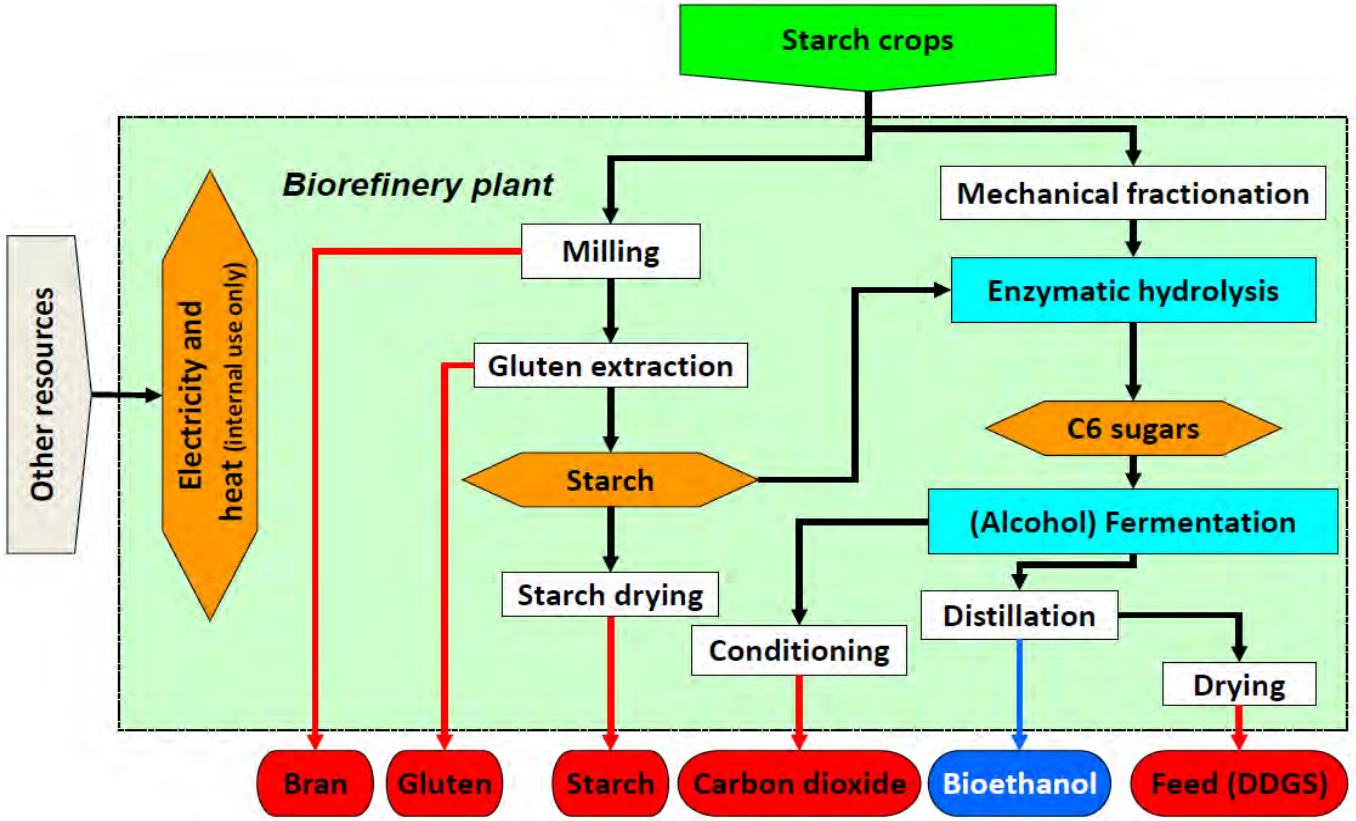
The Concept of the Biorefinery Pischelsdorf



Source: Agrana, 2013

Running commercial biorefineries (3)

The Concept of the Biorefinery Pischelsdorf

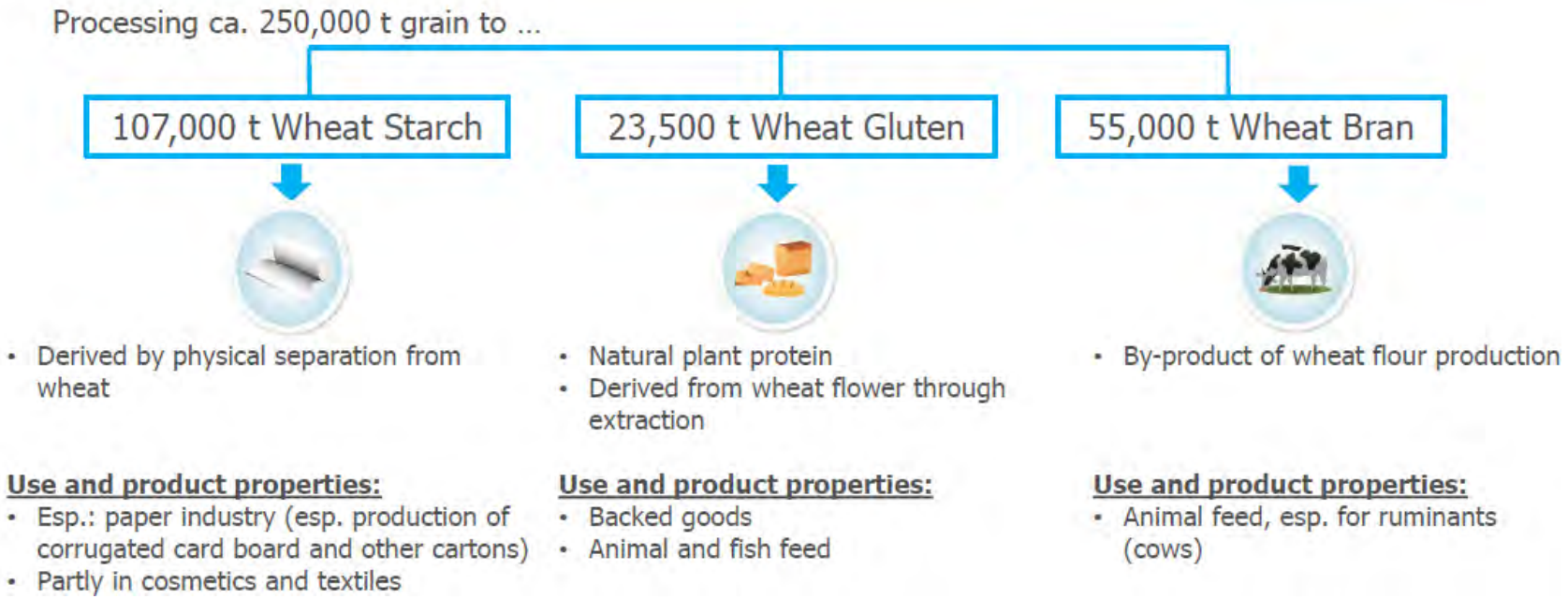


Source: Agrana, 2013

Running commercial biorefineries (4)

The Production Cycles of the Biorefinery Pischelsdorf

Cycle 1: Wheat starch facility



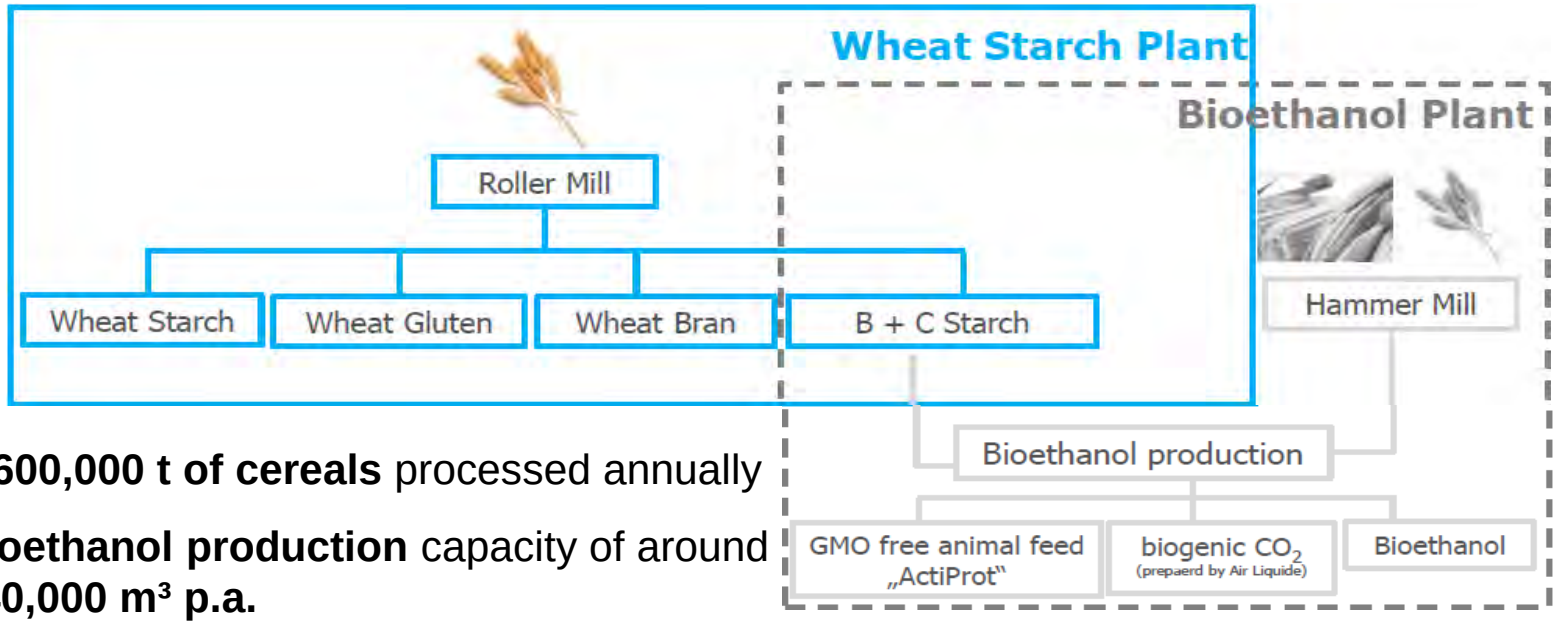
→ *Pischelsdorf uses regional grain surpluses (between 5 and 9 mln. tons per year)*

Source: Agrana, 2013

Running commercial biorefineries (5)

The Production Cycles of the Biorefinery Pischelsdorf

Cycle 2: Bioethanol production and its By-Products



- **~ 600,000 t of cereals** processed annually
- **Bioethanol production** capacity of around **240,000 m³ p.a.**
- Approx. **175,000 t of GMO-free protein-rich animal feed (ActiProt)** processed annually (By-Product of ethanol production)
- CO2- recuperation plant captures **100,000 tons of CO2 per year** (By-Product of ethanol production)

Source: Agrana, 2013

Running commercial biorefineries (6)

Pöls- Biorefinery in Austria

State-of-the-art: Commercial Scale

Type of biorefinery: 3-platform biorefinery producing pulp, paper, tall oil, turpentine, bark and electricity & heat from wood

Location: Pöls, Austria

Owner: Zellstoff Pöls AG, Heinzel Holding GmbH, EMACS Foundation

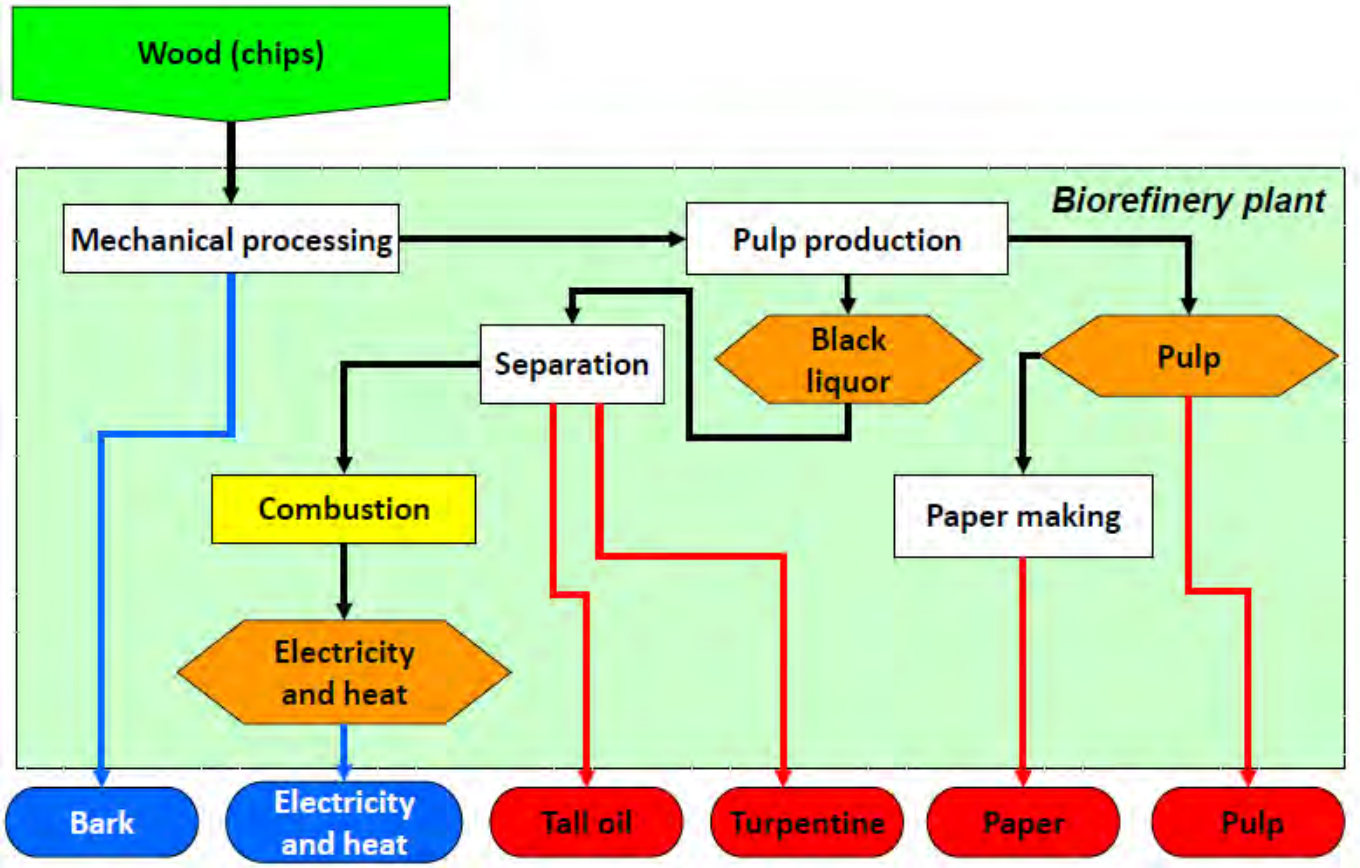
Feedstocks: Wood

Outputs: Pulp, paper, tall oil, turpentine, bark and electricity & heat

Source: Agrana, 2013

Running commercial biorefineries (7)

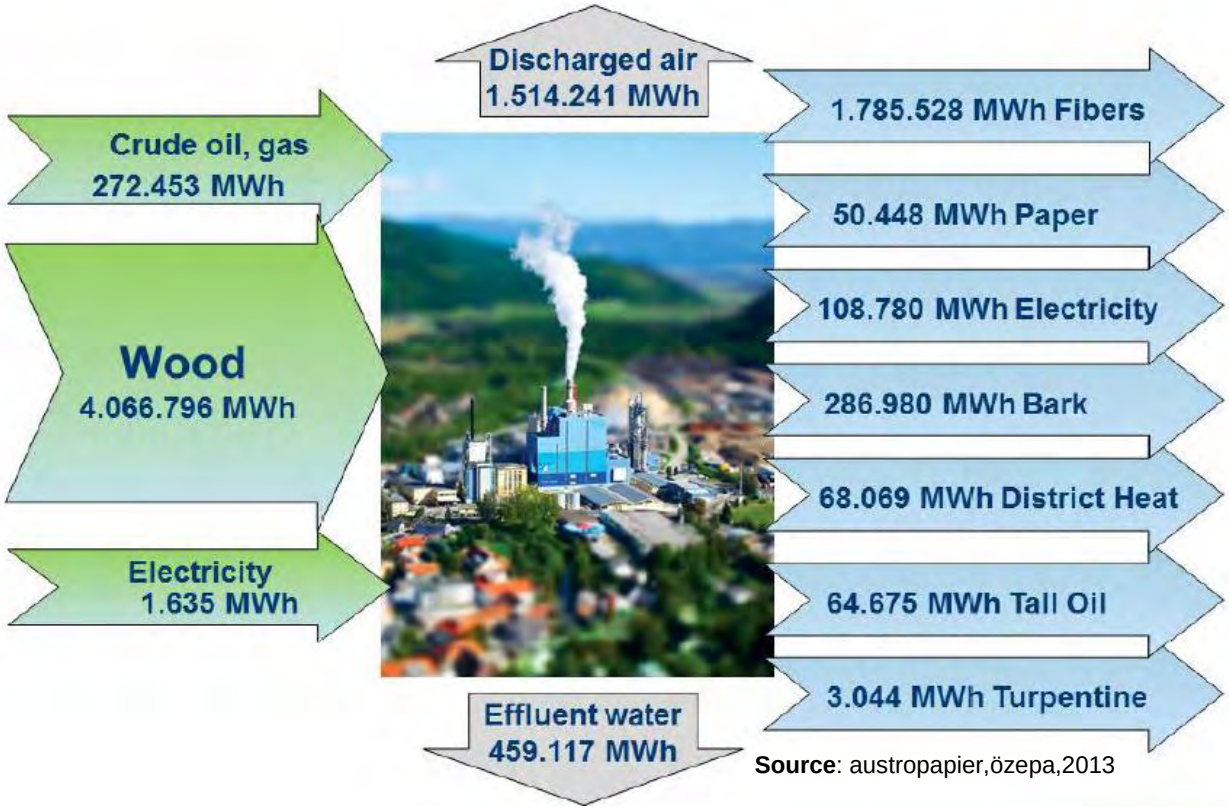
The Concept of the Biorefinery Pöls



Source: Agrana, 2013

Running commercial biorefineries (8)

Input- Output ratio of the Biorefinery Pöls



Source: austropapier,özepa,2013

→ Pöls supplies **15000 households with heat** in the local area and is able to supply **35000 households with electricity**

Biorefinery pilot plants (1)

BDI bioCRACK Pilot Plant in Schwechat/Vienna

State-of-the-art: Pilot Plant

Type of biorefinery: A one-platform (pyrolysis oil) refinery for the production of diesel fuel, pyrolysis-oil and bio-char from solid biomass

Location: OMV refinery Schwechat/Vienna, Austria

Owner: BDI – Bioenergy International AG

Feedstocks: Lignocellulosic biomass (wood chips, straw)

Outputs: Raw diesel fuel, pyrolysis-oil, char

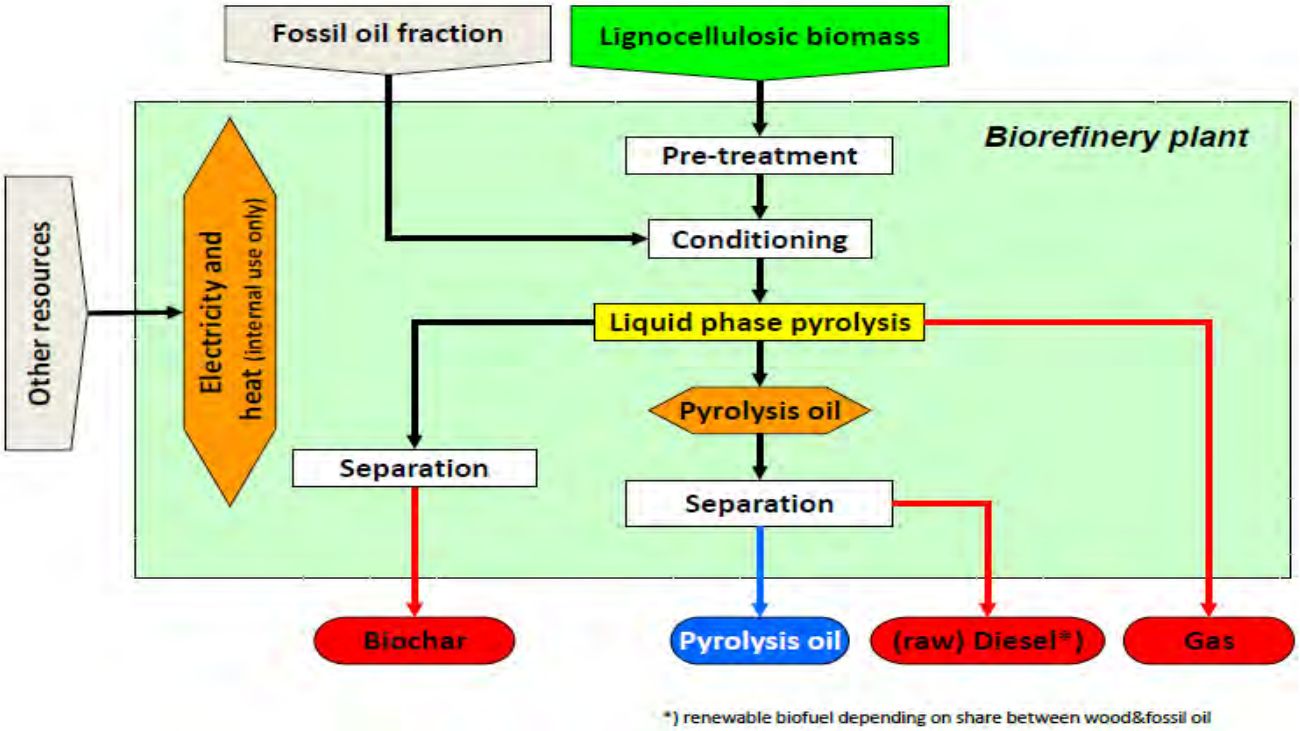
→ The **bioCRACK pilot –plant** in Schwechat is the **first of its kind worldwide**

→ **Converts solid biomass** (2.4 t/d input capacity) directly **into raw diesel fuel** (5 t/a)

Source: Agrana, 2013

Biorefinery pilot plants (2)

The Concept of the bioCRACK Pilot Plant

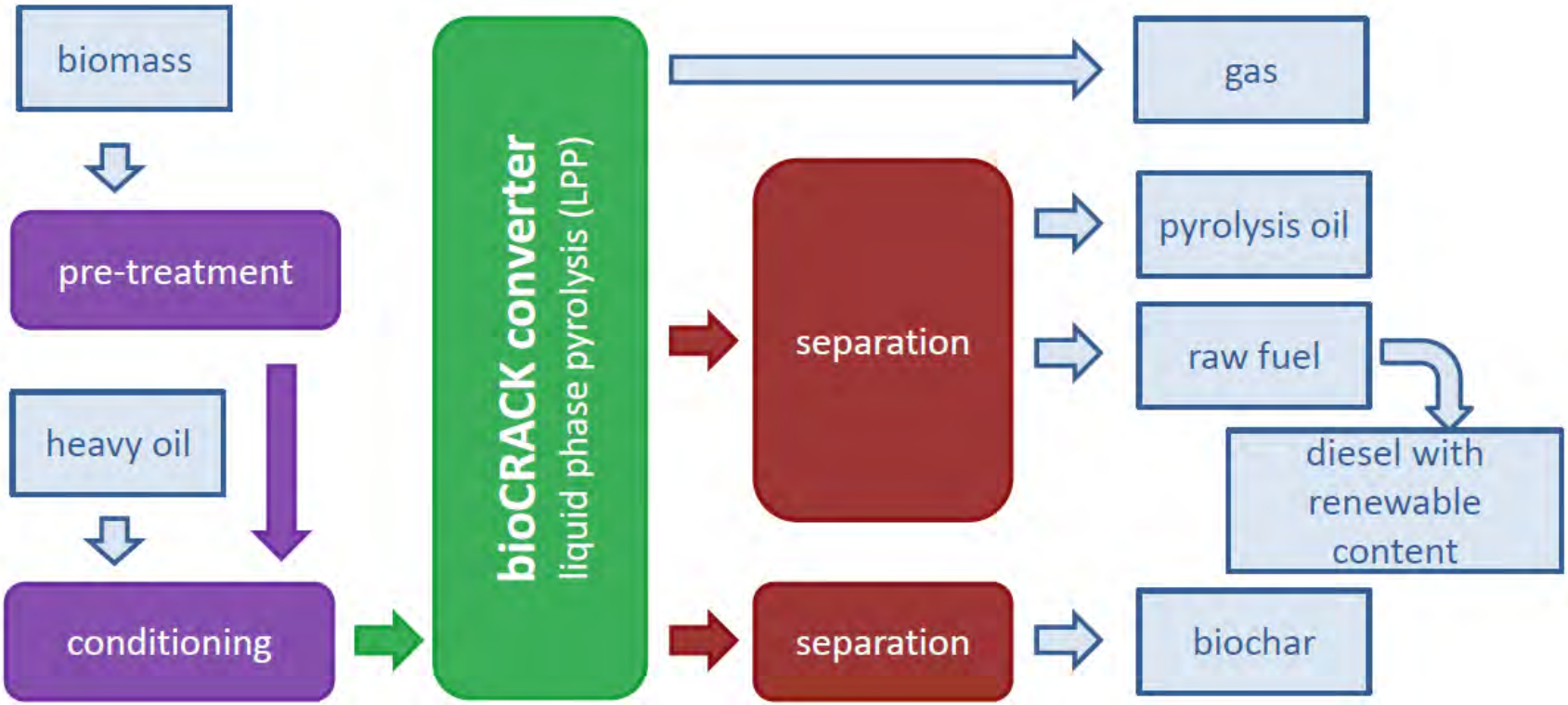


→ **bioCRACK technology** produces mineral diesel with renewable shares that can be easily upgraded to EN590 quaility **within existing refinery units**

Source: Agrana, 2013

Biorefinery pilot plants (3)

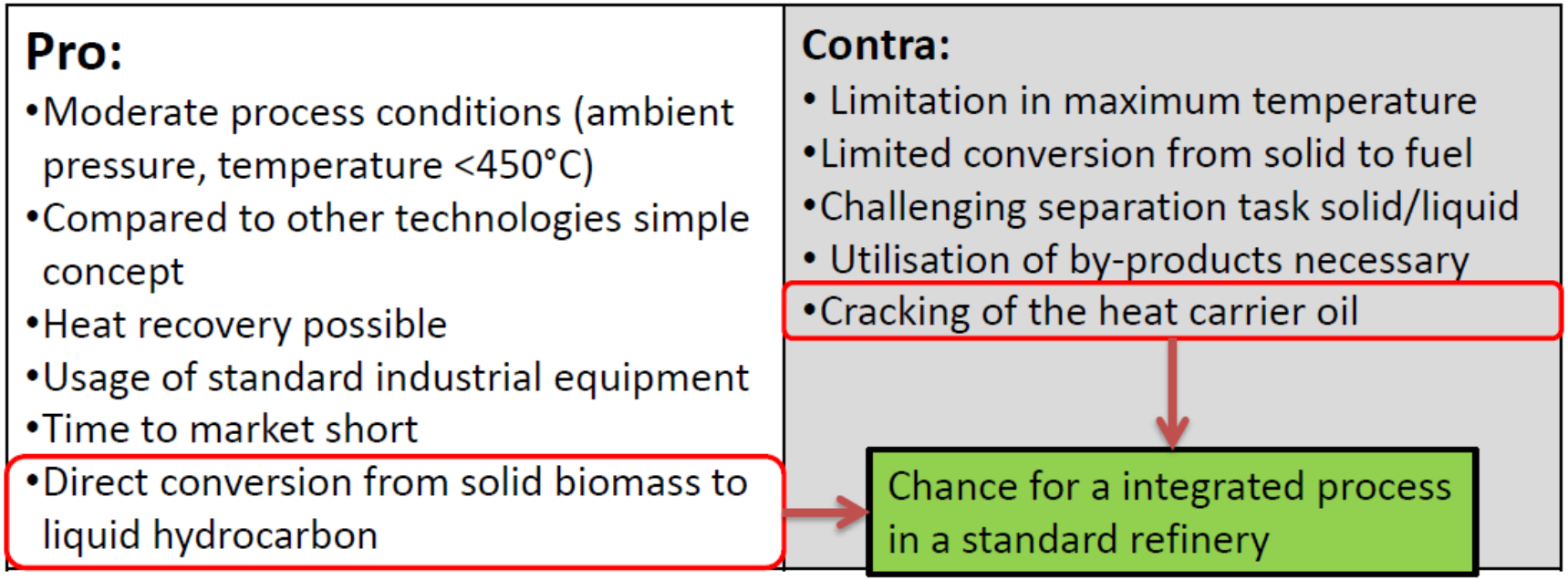
bioCRACK Process Scheme



Source: BDI, bioCRACK, 2013

Biorefinery pilot plants (4)

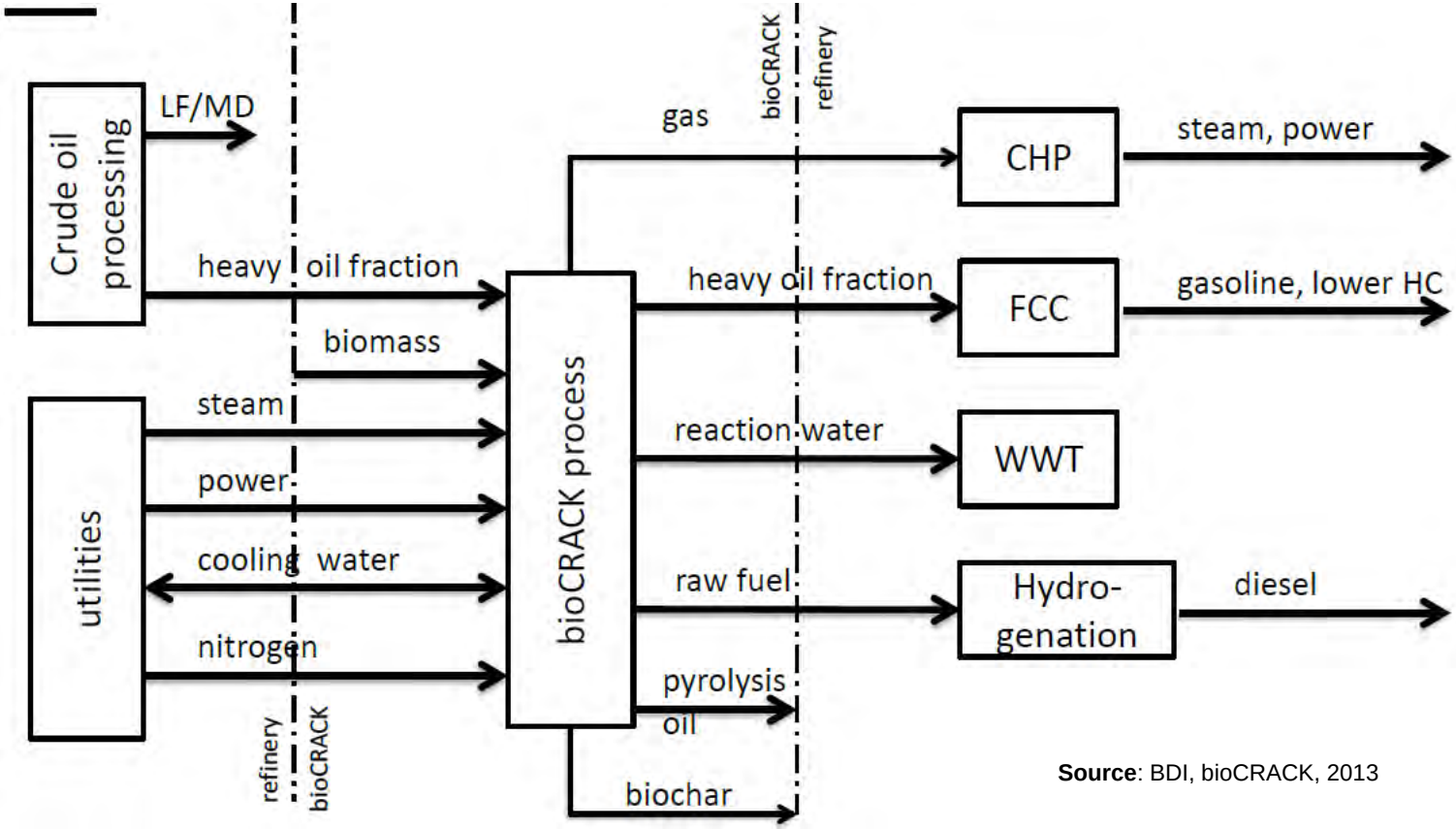
Pro and Contra of the bioCRACK technology



Source: BDI, bioCRACK, 2013

Biorefinery pilot plants (5)

Integration of bioCRACK technology into existing refineries



Source: BDI, bioCRACK, 2013

Biorefinery demonstration plants (1)

Ecoduna Algae Biorefinery in Bruck/Leitha

State-of-the-art: Demonstration Plant

Type of biorefinery: 3-platform biorefinery producing biofuels, electricity & heat, omega-3/6 fatty acids and fertilizer from microalgae

Location: Bruck an der Leitha, Austria

Owner: Ecoduna produktions-GmbH

Feedstocks: Microalgae

Outputs: Biofuels, electricity & heat, omega-3/6 fatty acids and fertilizer

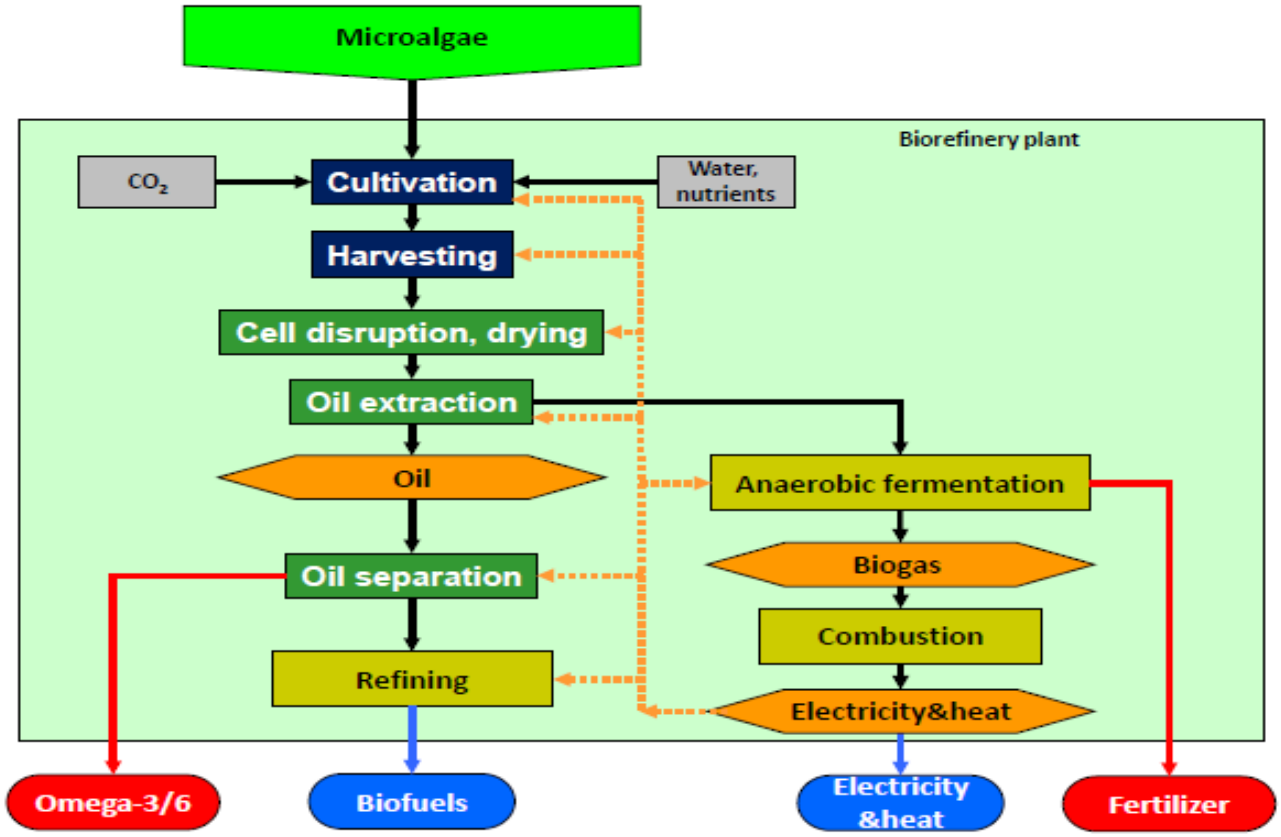
→ Approximately **17 tons of biomass**, with an **oil content of about 40%** are produced annually

→ **4-5 tons of oil** and **2-3 tons of fuel/year** are obtained from this

Source: Agrana, 2013

Biorefinery demonstration plants (2)

The Concept of the Ecoduna Algae Biorefinery



Source: Agrana, 2013

Biorefinery demonstration plants (3)

Advantages of the „Hanging Garden“ technology

- **Highest yield per hectare of any type of biomass with over 200 tonnes per hectare per year.**
- **High degree of purity – highest product quality through a closed production system** (no contamination or mixing of different species)
- **Economic continuous production process 365 days per year**
- **Short amortisation period** (return on investment within 6 to 7 years)
- **Closed system makes possible the recycling and recirculation of resources**
- **Low running costs for personnel and materials** (minimal energy costs through use of hydrostatic transport without pumps, recycling of resources in a closed system)

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Major R&D projects (1)

Selection (1)

Name of Project	Type of Project	National Coordinator	Description	Duration
Fuel4me	EU	Joanneum Research	The overall aim of FUEL4ME is to establish a sustainable chain for continuous biofuel production using microalgae as a production platform, thereby making 2nd generation biofuels competitive alternatives to fossil fuels	12/2012-05/2017
Drive4EU	EU	Joanneum Research	The Drive4EU-project focuses on the development of a production chain of natural rubber and inulin from Russian dandelion.The objective of the project is to set up a new European chain for the production and processing of natural rubber	02/2014-01/2018
ChiBio	EU	Energy Institute at Johannes Kepler University Linz	The aim of this project is based on an integrated biorefinery concept, realizing a diverse array of novel conversion strategies for chitin rich waste to high value specialty chemicals for the polymer industries. All biological by-products accumulating in the process-chain e.g. proteins and lipids will be investigated for their potential as feed for biogas production	11/2011 - 10/2014
All-gas	EU	BDI Bio Energy International	The All-gas project seeks to demonstrate the sustainable large-scale production of biofuels based on the low-cost cultivation of microalgae	2012- 2017

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Major R&D projects (2)

Selection (2)

Name of Project	Type of Project	National Coordinator	Description	Duration
CO2-use CO2:use	National	EVN AG	Carbon dioxide, which is purified from flue gas, is used for the cultivation of phototrophic microorganisms (e.g.microalgae). From the produced biomass, the product (e.g. PHB to replace fossile plastics) will be isolated and the residual biomass will enter a biogas process. Via anaerobic digestion, energy (biogas) is produced and the nutrients will be made available. These nutrients are recirculated for algae cultivation	03/2012 - 02/2015
Aminomax	National	Energy Institute at Johannes Kepler University Linz	The main objective of the project is to increase the economic viability of the concept "Green Biorefinery" in order to further reduce the cost price of the product amino acids and thus to allow bulk- applications with low revenue potential	02/2014 - 02/2015
FABbiogas	EU	University of Natural Ressources and Life Sciences in Vienna	FABbiogas project aspires to change the mindsets of all stakeholders in the waste-to-energy chain by promoting residues from Food and Beverage (FaB) industry as a new and renewable energy source for biogas production. Project outputs will support the diversification of energy sources within FaB companies, leading to wide-spread valorization and efficient integration of FaB residues into energy systems	04/2013-09/2015

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Major national stakeholders involved in the field of biorefining (1)

Industry – Stakeholder (1)

Names	Websites
Lenzing Ag	www.lenzing.com
OMV	www.omv.at
AGRANA	www.agrana.at
Energie AG Oberösterreich	www.energieag.at
New Energy Capital Investment	www.energyinvest.at
Biodiesel Mureck - Seeg reg. Gen.m.b.H.	http://www.seeg.at/biodiesel.php
Biodiesel Kärnten GmbH	www.biodiesel-kaernten.com
Die Südsteirische Energie- und Eiweiß-erzeugungsgenossenschaft (SEEG)	http://www.seeg.at/seeg.php
EuroBioFuels AG	www.eurobiofuels.ag
Energy Holding	http://www.energyholding.at/cms/website.php
HPF Biokraft Hirtl GmbH	http://www.hpf-biokraft.at/
Biodiesel Enns GmbH	http://www.biodiesel-enns.at
PPM-Energie aus nachwachsenden Rohstoffen GmbH	http://www.ppm-biodiesel.com/kontakt_de.php
BIO-Diesel Krems GmbH	http://www.biodieselkrems.at/

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Major national stakeholders involved in the field of biorefining (2)

Industry – Stakeholder (2)

Names	Websites
Bio Oil Development GmbH	http://www.bio-oil.biz/de/
Münzer Bioindustrie- Division Biodiesel	http://www.muenzer-gruppe.at/bdv/
Sappi	*www.sappi.com*
BDI- Bioenergy	*www.bdi-bioenergy.com*
Andritz	*www.andritz.com/de*
Vogelbusch GmbH	*www.vogelbusch-biocommodities.com*
Anniki	*www.annikki.at*
Austropapier	*www.austropapier.at*
Schweighofer Fiber GmbH	*www.schweighofer-fibre.at*
Wood k plus	*www.wood-kplus.at*
EVN	*https://www.evn.at*
Jungbunzlauer	*www.jungbunzlauer.com*
Sustainable Innovation	*www.sustainovation.at*

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Major national stakeholders involved in the field of biorefining (3)

Research and Development - Stakeholder

Names	Websites
Joanneum Research	www.joanneum.at
Institute of Industrial Ecology	www.indoek.noe-lak.at
Bioenergy 2020+	www.bioenergy2020.eu
ExCO Bioenergy	*www.ieabioenergy.com*
IFA Tulln	*www.ifa-tulln.ac.at*
IFZ- Institute of Science/Technology and Society	www.ifz.tugraz.at/
BIOS- Bioenergysystems GmbH	*www.bios-bioenergy.at*
FHP- Kooperationsplattform Forst Holz Papier	*www.forstholzpapier.at*
IIASA	www.iiasa.ac.at/
Vienna University of Technology	*www.tuwien.ac.at*
Graz University of Technology	*www.tugraz.at*
Johannes Kepler University Linz	*www.jku.at*
Karl- Franzens University Graz	*www.uni-graz.at*
BOKU- Vienna	*www.boku.ac.at*
University of Applied Sciences in Wels	www-en.fh-ooe.at/wels-campus

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Major national stakeholders involved in the field of biorefining (4)

Administration/Organizations - Stakeholder

Names	Websites
Ministry of Innovation and Technology	www.bmvit.gv.at
ECO plus (Bleier)	*www.ecoplus.at*
ARGE Biokraft	*www.biokraft-austria.at*
Chamber of Agriculture	http://www.lko.at/
Austrian Biomass Association	http://www.biomasseverband.at/home/
Austrian Energy Agency	*www.energyagency.at*
FFG - Austrian Research Promotion Agency	https://www.ffg.at/en
Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)	http://www.bmlfuw.gv.at/en.html
Federal Ministry of Science, Research and Economy (BMWFW)	http://www.bmwfw.gv.at/Seiten/default.aspx
FJ-BLT Wieselburg	http://www.josephinum.at/blt/die-blt.html

More info

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