AUSTRIAN ENERGY AGENCY

Wood Flow Model in Austria

drawing the bigger picture

Dietmar Hagauer

AUSTRIAN ENERGY AGENCY

Content

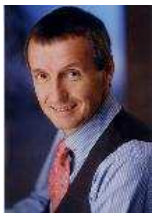
- Austrian Energy Agency – who we are
- Klima:Aktiv
- Key information on energy supply and demand in Austria
- Calculation of wood fuel parameters
- Conversion factors for wood fuels
- Wood flow model

Austrian Energy Agency – in a Nutshell

- Austria´s national energy agency (*1977)
- 80 employees, 7 million € annual turnover
- independent think tank: from basic decision-making to implementation

President:
Minister of Environment
Josef Pröll

Vice -President:
Minister of Economy
Martin Bartenstein



Vice-President:
Governor of Styria
Franz Voves

klima:aktiv

The core element of the climate protection initiative launched by the Federal Ministry of the Environment and managed by the Austrian Energy Agency

23 programmes provide and aim at

- **information and awareness raising**
- **consultancy and training**
- **market transformation**
- **introduction of quality standards**

in close co-operation with market actors and regions

Volume: 10 million Euro

klima:aktiv program „timber for energetic use“

- lasting 4 years
- goal: support in mobilisation of not yet used resources of timber for energetic use
  (goal + 2 mio. m³ per year from 2007/2008)
- workpackages:
  - WP1: building an strengthen networks
  - WP2: improvement of transparency on the market
  - WP3: improvement of services
  - WP4: steps for increasing energy efficiency
  - WP5: improvement of education
  - WP6: strengthen R&D activities
  - WP7: political lobbying
- resources:
  - 1 program manager, 3 assistances

Situation in Austria

- **Austria: 83.871 km²**
- **of which 47% covered forest**
- **steep alpine region**
- **22 million m³ annual cut, 7.6 million m³ additional potential for forest biomass**
- **13.7 million m³ import, 9.9 million m³ export**
- **long tradition in forestry -> high expertise, but complex structures**

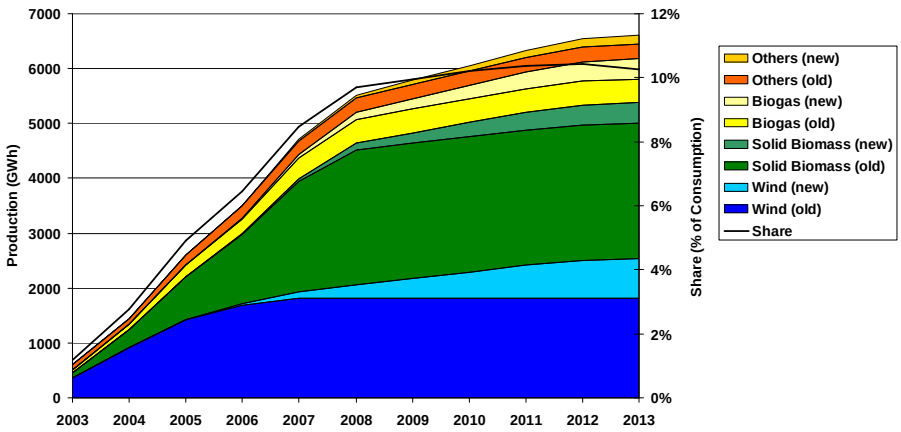
General information

- shortage of ressources
- rising prices
- rising energyconsumtion

thus we know we need

- mobilisation of timber in the forests
- improving energy efficiency for the timber sector
- Short Rotation Forestry

Development of eco-electricity in Austria

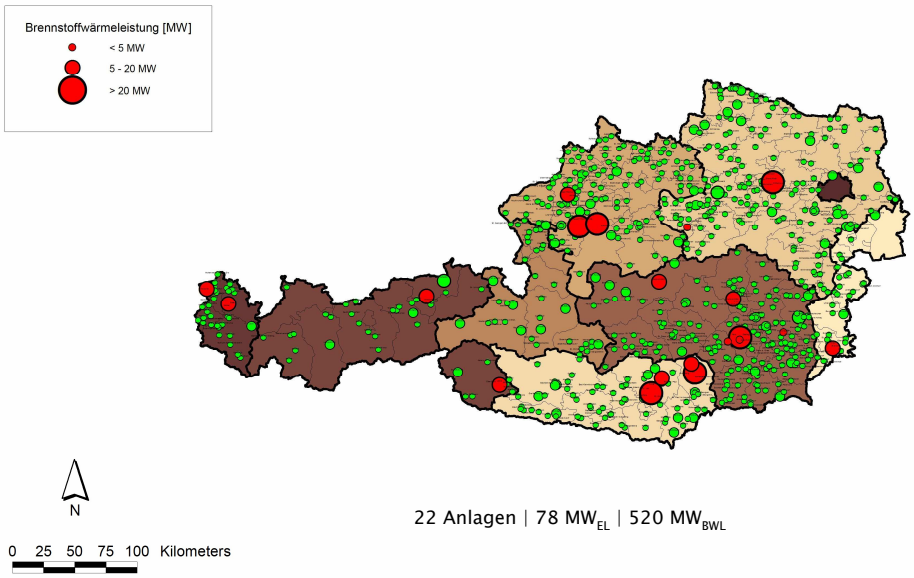


Source: own calculations

Eco-electricity biomass power plant Example of Wien Energie

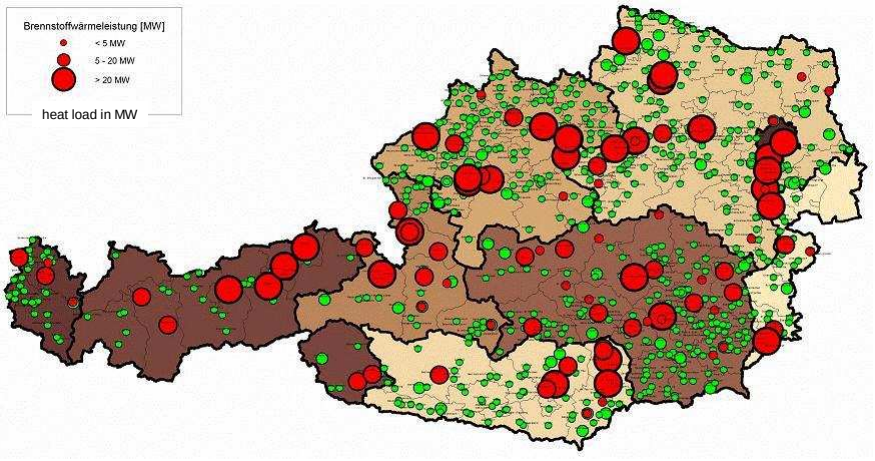
- investment
  52 Mio. €;
  66 MW heat load,
  15 MW/25 MW_{el}
- Fuel demand
  600.000 m3/year
  190.000 t/year resp.

Biomasse-KWK-Projekte in Österreich | Stand 2002

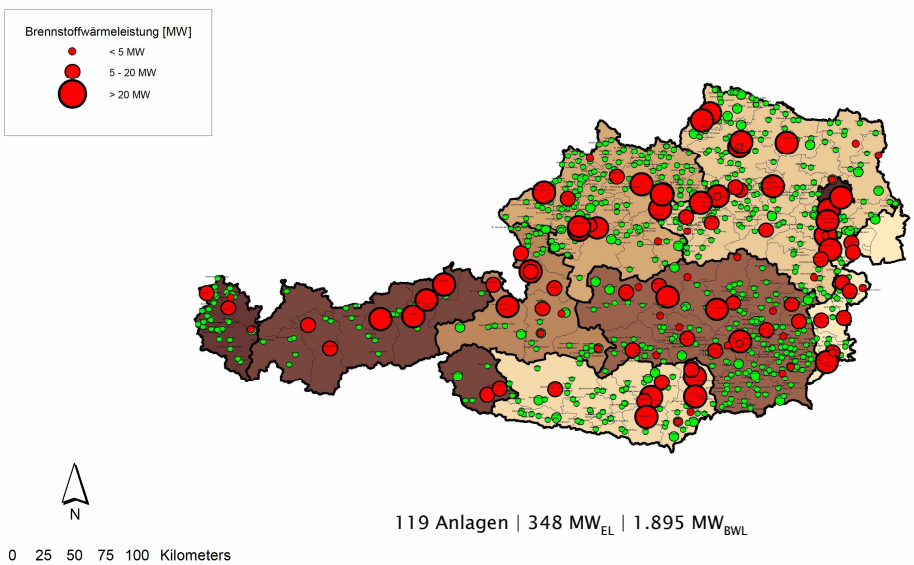


22 Anlagen | 78 MW_{EL} | 520 MW_{BWL}

Location of biomass CHPs (2006)



Biomasse-KWK-Projekte in Österreich | Prognose 2008

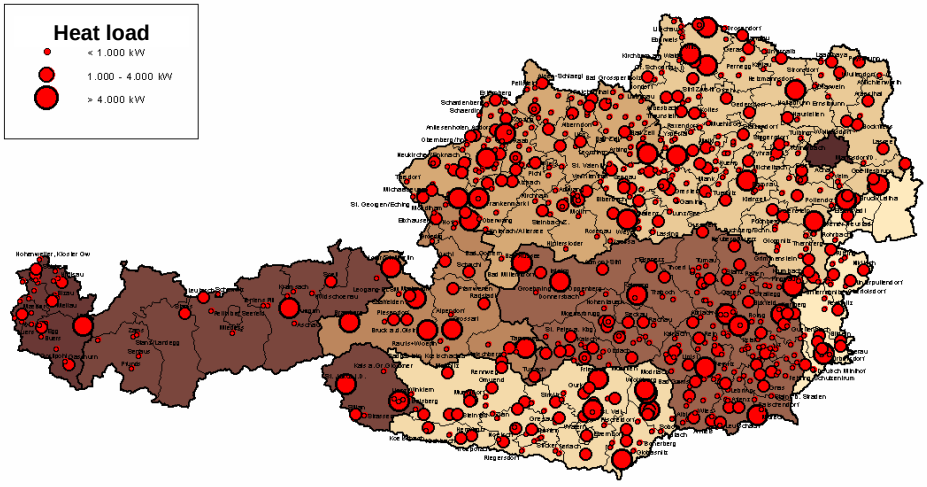


119 Anlagen | 348 MW_{EL} | 1.895 MW_{BWL}

Heat production with biomass: District heating

- 500 kW - 30 MW
- distribution with hot water pipes
- modern flue gas cleaning
- since 1980 more than 1.000 plants, 1.000 MW heat load
- mostly based on local initiatives
- Investment subsidies 30 % (in specific cases up to 50%)

Location of biomass heating plants (2005)

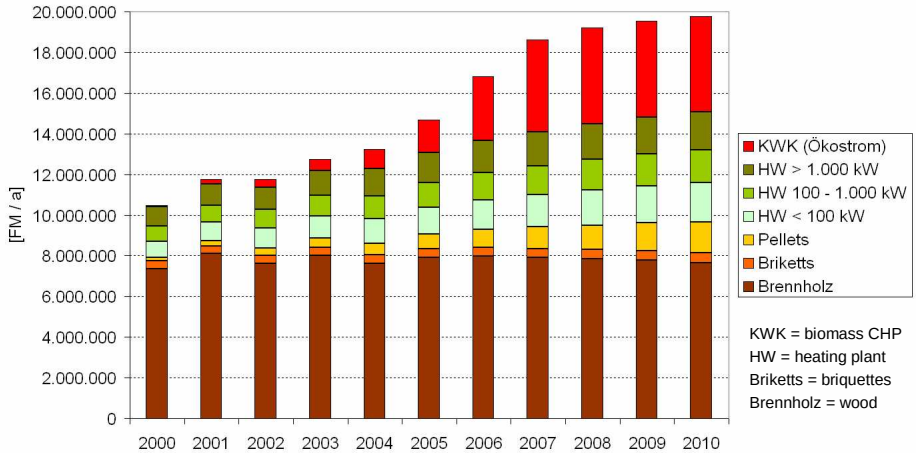


1.002 Anlagen mit insgesamt 1.132 MW (über > 100 kW)

Heat production with wood chips

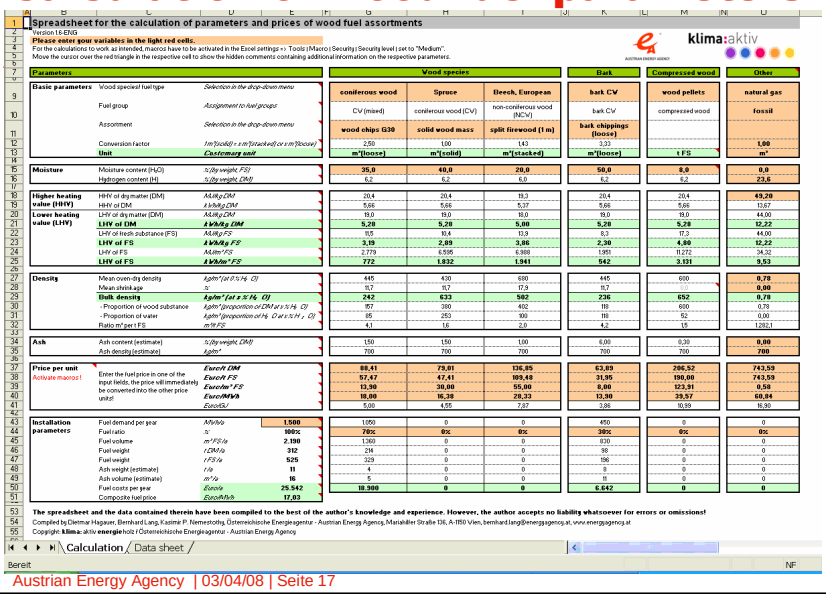
fully automatic, competitive

Biomass: High demand for fuel



KWK = biomass CHP
HW = heating plant
Briketts = briquettes
Brennholz = wood

calculation of wood fuel parameters



Spreadsheet for the calculation of parameters and prices of wood fuel assortments

Version 16-ENG

Please enter your variables in the light red cells.

For the calculations to work as intended, macros have to be activated in the Excel settings => Tools | Macro | Security | Security level | set to "Medium".
Move the cursor over the red triangle in the respective cell to show the hidden comments containing additional information on the respective parameters.

klima:aktiv

Parameters				Wood species			Bark	Compressed wood	Other
Basic parameters	Wood species/ fuel type	*Selection in the drop-down menu*		coniferous wood	Spruce	Beech, European	bark CW	wood pellets	natural gas
	Fuel group	*Assignment to fuel groups*		CV (mixed)	coniferous wood (CV)	non-coniferous wood (NCV)	bark CV	compressed wood	fossil
	Assortment	*Selection in the drop-down menu*		wood chips G30	solid wood mass	split firewood (1 m)	bark chippings (loose)		
	Conversion factor	*1 m³(solid) = x m³(stacked) or x m³(loose)*		2,50	1,00	1,43	3,33		1,00
	Unit	*Customary unit*		m³(loose)	m³(solid)	m³(stacked)	m³(loose)	t FS	m³
Moisture	Moisture content (H_2O)	*% (by weight, FS)*		35,0	40,0	20,0	50,0	8,0	0,0
	Hydrogen content (H)	*% (by weight, DM)*		6,2	6,2	6,0	6,2	6,2	23,6
Higher heating value (HHV)	HHV of dry matter (DM)	*MJ/kg DM*		20,4	20,4	19,3	20,4	20,4	49,28
	HHV of DM	*kWh/kg DM*		5,66	5,66	5,37	5,66	5,66	13,67
Lower heating value (LHV)	LHV of dry matter (DM)	*MJ/kg DM*		19,0	19,0	18,0	19,0	19,0	44,00
	LHV of DM	***kWh/kg DM***		**5,28**	**5,28**	**5,00**	**5,28**	**5,28**	**12,22**
	LHV of fresh substance (FS)	*MJ/kg FS*		10,5	10,4	13,9	8,3	17,3	44,00
	LHV of FS	***kWh/kg FS***		**2,89**	**2,89**	**3,86**	**2,30**	**4,80**	**12,22**
	LHV of FS	*MJ/m³ FS*		2.779	6.595	6.988	1.993	11.272	34,32
	LHV of FS	***kWh/m³ FS***		**772**	**1.832**	**1.941**	**542**	**3.131**	**9,53**
Density	Mean oven-dry density	*kg/m³ (at 0 % H_2 O)*		445	430	680	445	600	0,78
	Mean shrink age	*%*		11,7	11,7	17,9	11,7	100	0,00
	Bulk density	***kg/m³ (at x % H_2 O)***		**242**	**633**	**582**	**236**	**652**	**0,78**
	- Proportion of wood substance	*kg/m³ (proportion of DM at x % H_2 O)*		157	380	402	118	600	0,78
	- Proportion of water	*kg/m³ (proportion of H_2 O at x % H $_2$ O)*		85	253	100	118	52	0,00
	Ratio m³ per t FS	*m³/t FS*		4,1	1,6	2,0	4,2	1,5	1.282,1
Ash	Ash content (estimate)	*% (by weight, DM)*		1,50	1,50	1,00	6,00	0,30	0,00
	Ash density (estimate)	*kg/m³*		700	700	700	700	700	700
Price per unit	Activate macros !	Enter the fuel price in one of the input fields, the price will immediately be converted into the other price units!	*Euro/t DM*	88,41	79,01	136,85	63,89	206,52	743,59
			Euro/t FS	57,47	47,41	103,48	31,95	190,00	743,59
			Euro/m³ FS	13,30	30,00	55,00	8,00	123,31	0,58
			Euro/MWh	18,00	16,38	28,33	13,30	39,57	60,84
			Euro/GJ	5,00	4,55	7,87	3,86	10,99	16,90
Installation parameters	Fuel demand per year	*MWh/a*	1.500	1.050	0	0	450	0	0
	Fuel ratio	*%*	100%	70%	0%	0%	30%	0%	0%
	Fuel volume	*m³ FS/a*	2.190	1.360	0	0	830	0	0
	Fuel weight	*t DM/a*	312	216	0	0	98	0	0
	Fuel weight	*t FS/a*	525	329	0	0	196	0	0
	Ash weight (estimate)	*t/a*	11	4	0	0	8	0	0
	Ash volume (estimate)	*m³/a*	16	5	0	0	11	0	0
	Fuel costs per year	*Euro/a*	25.542	18.300	0	0	6.642	0	0
	Composite fuel price	*Euro/MWh*	17,03						

The spreadsheet and the data contained therein have been compiled to the best of the author's knowledge and experience. However, the author accepts no liability whatsoever for errors or omissions!

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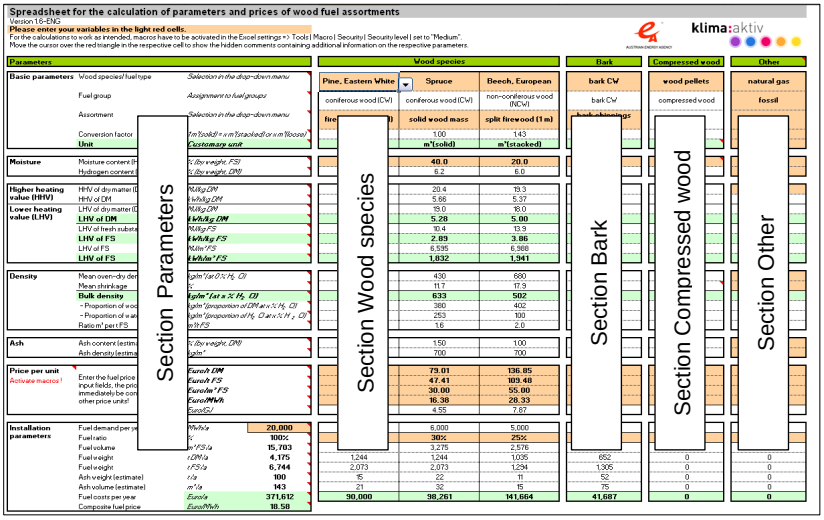
Calculation | Data sheet

Bereit NF

structure



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Parameters				Wood species			Bark	Compressed wood	Other
Basic parameters	Wood species/ fuel type	*Selection in the drop-down menu*		Pine, Eastern White	Spruce	Beech, European	bark CW	wood pellets	natural gas
	Fuel group	*Assignment to fuel groups*		coniferous wood (CV)	coniferous wood (CV)	non-coniferous wood (NCV)	bark CV	compressed wood	fossil
	Assortment	*Selection in the drop-down menu*		fire	solid wood mass	split firewood (1 m)	bark chippings		
	Conversion factor	*1 m³(solid) = x m³(stacked) or x m³(loose)*			1,00	1,43			
	Unit	*Customary unit*			m³(solid)	m³(stacked)			
Moisture	Moisture content (H_2O)	*% (by weight, FS)*			40.0	20.0			
	Hydrogen content (H)	*% (by weight, DM)*			6.2	6.0			
Higher heating value (HHV)	HHV of dry matter (DM)	*MJ/kg DM*			20.4	19.3			
	HHV of DM	*kWh/kg DM*			5.66	5.37			
Lower heating value (LHV)	LHV of dry matter (DM)	*MJ/kg DM*			19.0	18.0			
	LHV of DM	***kWh/kg DM***			**5.28**	**5.00**			
	LHV of fresh substance (FS)	*MJ/kg FS*			10.4	13.9			
	LHV of FS	***kWh/kg FS***			**2.89**	**3.86**			
	LHV of FS	*MJ/m³ FS*			6,595	6,988			
	LHV of FS	***kWh/m³ FS***			**1,832**	**1,941**			
Density	Mean oven-dry density	*kg/m³ (at 0 % H_2 O)*			430	680			
	Mean shrink age	*%*			11.7	17.9			
	Bulk density	***kg/m³ (at x % H_2 O)***			**633**	**582**			
	- Proportion of wood	*kg/m³ (proportion of DM at x % H_2 O)*			380	402			
	- Proportion of wat	*kg/m³ (proportion of H_2 O at x % H $_2$ O)*			253	100			
	Ratio m³ per t FS	*m³/t FS*			1.6	2.0			
Ash	Ash content (estim	*% (by weight, DM)*			1.50	1.00			
	Ash density (estima	*kg/m³*			700	700			
Price per unit	Activate macros !	Enter the fuel price in one of the input fields, the price will immediately be conv other price units!	*Euro/t DM*		79.01	136.85			
			Euro/t FS		47.41	103.48			
			Euro/m³ FS		30.00	55.00			
			Euro/MWh		16.38	28.33			
			Euro/GJ		4.55	7.87			
Installation parameters	Fuel demand per ye	*MWh/a*	20,000		6,000	5,000			
	Fuel ratio	*%*	100%		30%	25%			
	Fuel volume	*m³ FS/a*	15,703		3,275	2,576			
	Fuel weight	*t DM/a*	4,175	1,244	1,244	1,035	652	0	0
	Fuel weight	*t FS/a*	6,744	2,073	2,073	1,294	1,305	0	0
	Ash weight (estimate)	*t/a*	100	15	22	11	52	0	0
	Ash volume (estimate)	*m³/a*	143	21	32	15	75	0	0
	Fuel costs per year	*Euro/a*	371,612	30,000	98,261	141,664	41,687	0	0
	Composite fuel price	*Euro/MWh*	18.58						

Section Parameters

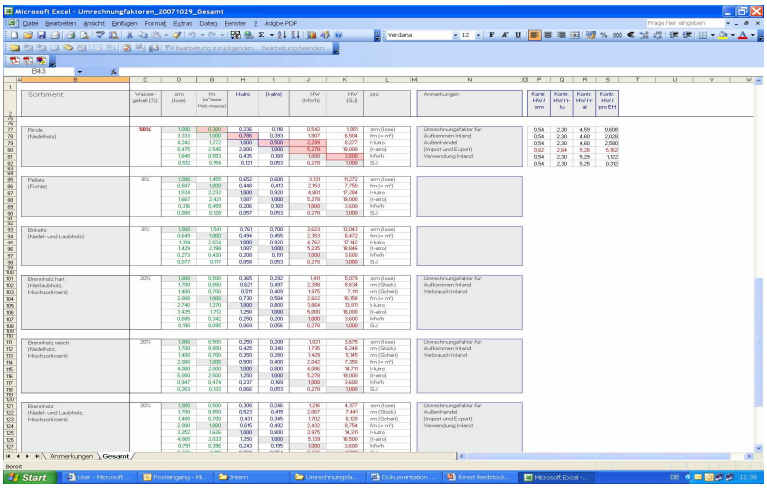
Section Wood species

Section Bark

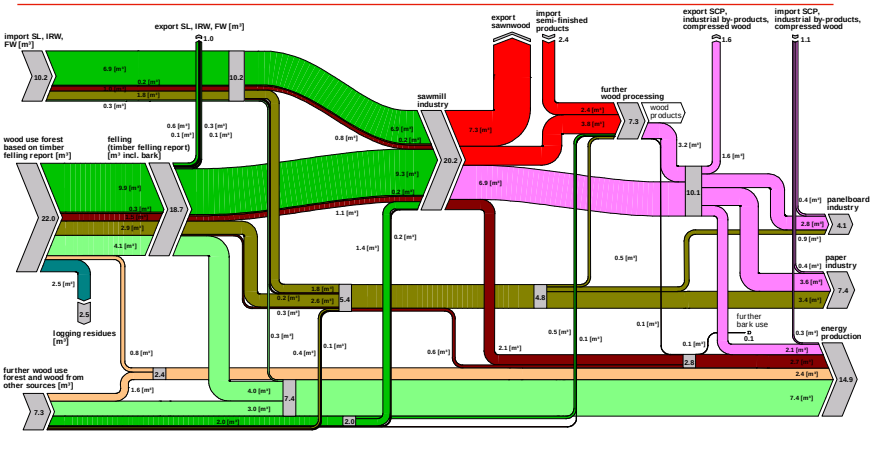
Section Compressed wood

Section Other

Conversion factors for wood fuels (volume – weight – energy content)

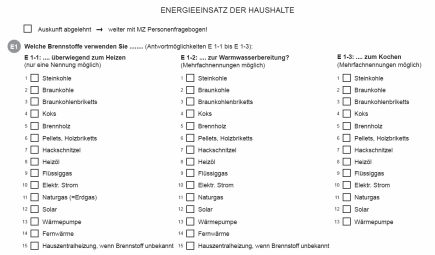


Woodflow Austria 2005



Problems in drawing the wood flow - example firewood (1)

- Investigation of data by Statistics Austria in „Microzensus Energy“ every 2 years
- 1% of Austria`s households = approx. 35.000 HH
- Model taking into account the heating days
- Longterm average approx. 65 PJ
- Suggestions for conversion in PJ:
  - Coniferous wood/non
  - 20 % water content
  - 660 kg lutro/m³
  - approx. 9,4 PJ/million m³

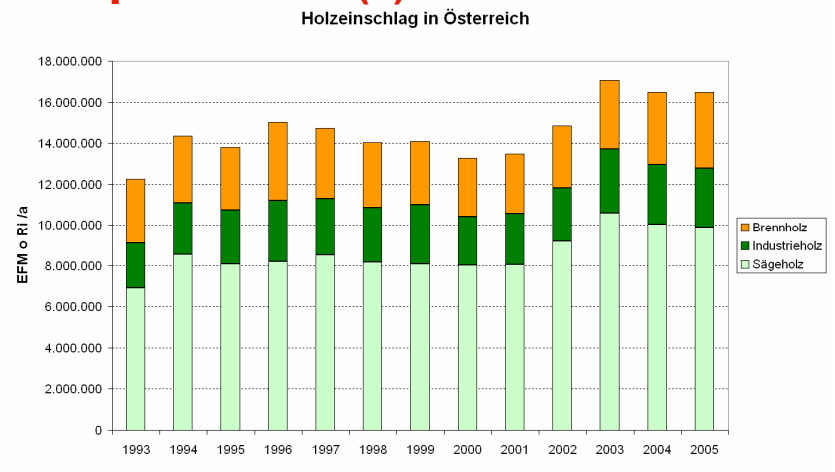

ENERGIEEINSATZ DER HAUSHALTE

Auskunft abgelehnt → weiter mit MZ Personenfragebogen!

E1 Welche Brennstoffe verwenden Sie ..... (Antwortmöglichkeiten E 1-1 bis E 1-3):

	E 1-1: ... überwiegend zum Heizen (nur eine Nennung möglich)	E 1-2: ... zur Warmwasserbereitung? (Mehrfachnennungen möglich)	E 1-3: ... zum Kochen (Mehrfachnennungen möglich)
1	Steinkohle	Steinkohle	Steinkohle
2	Braunkohle	Braunkohle	Braunkohle
3	Braunkohlenbriketts	Braunkohlenbriketts	Braunkohlenbriketts
4	Koks	Koks	Koks
5	Brennholz	Brennholz	Brennholz
6	Pellets, Holzbriketts	Pellets, Holzbriketts	Pellets, Holzbriketts
7	Hackschnitzel	Hackschnitzel	Hackschnitzel
8	Heizöl	Heizöl	Heizöl
9	Flüssiggas	Flüssiggas	Flüssiggas
10	Elektr. Strom	Elektr. Strom	Elektr. Strom
11	Naturgas (=Erdgas)	Naturgas	Naturgas
12	Solar	Solar	Solar
13	Wärmepumpe	Wärmepumpe	Wärmepumpe
14	Fernwärme	Fernwärme	
15	Hauszentralheizung, wenn Brennstoff unbekannt	Hauszentralheizung, wenn Brennstoff unbekannt	

Problems in drawing the wood flow - example firewood (2)



Source: BMLFUW

Big differences

Cutting of firewood by HEM: 3 - 4 million m³ without bark per year

Use of firewood by Statistics Austria: 7 – 8 million m³ / year

Explanations:
- **Too low estimation of cutting figures by HEM**
- **Use of firewood from non-forest-areas (parks, wine yards etc.)**
- **Use of recycling wood for firewood (especially in rural areas)**




Thank you for your attention!

Dietmar Hagauer
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