

**Secondo meeting di progetto PRIN
BIO-CHEAPER**
***BIOMasses Circular Holistic Economy APproach to
EneRgy equipments***

Meeting online – 17 Aprile 2020

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**Freie Universität Bozen
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Free University of Bolzano**

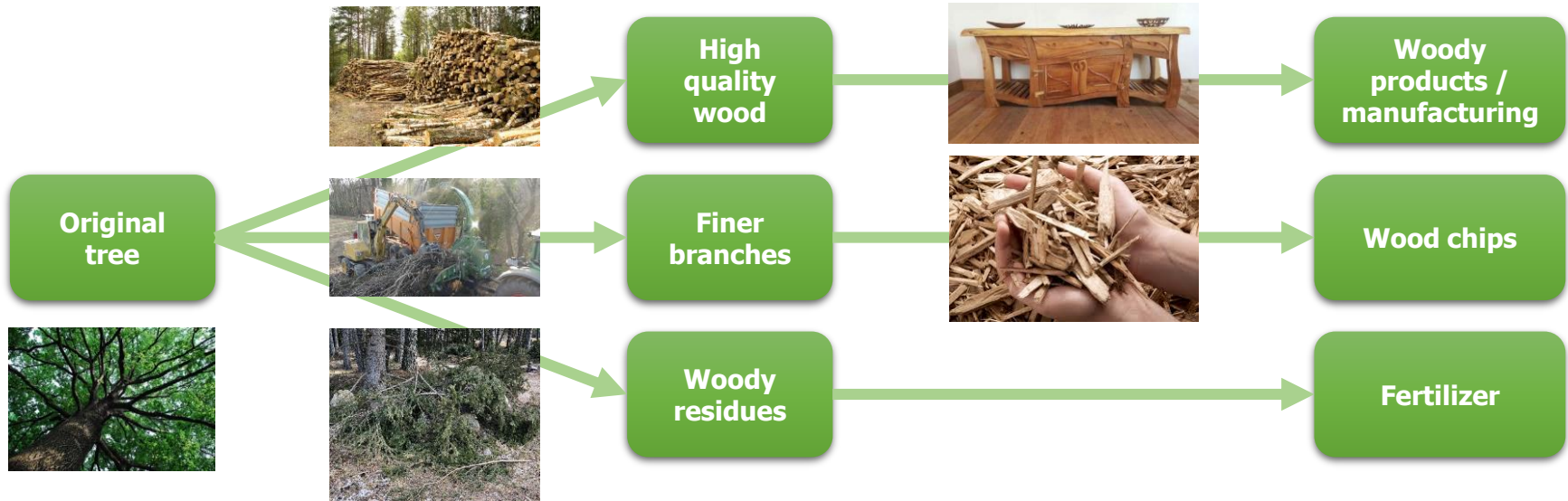


2.1) Selection of the biomass products

Woody residues in South-Tyrol

Analysis of:

- *current management strategies & methodologies*
- *energy potential*



2.1) Selection of the biomass products

Selected categories of woody residues



R1. Hard or brittle branches – twigs of diameter above 5 mm



R2. Flexible branches – twigs of diameter below 5 mm



R3. Needles – the green leaves of the branch



R4. Cones – pine cones of various sizes

2.2) Lab thermal, physical and chemical characterization

2.2.3) Gasification Feedstock and Residual char

Characterisation of the selected woody residues

Parametro di misura	Strumento	Normativa di riferimento	
Potere calorifico	Calorimetro IKA C200	UNI EN ISO 18125:2018	Biocombustibili solidi - Determinazione del potere calorifico
Contenuto di Umidità	Stufa	UNI EN ISO 18134-2:2015	Biocombustibili solidi - Determinazione dell'umidità - Metodo di essiccazione in stufa - Parte 2: Umidità totale - Metodo semplificato
Contenuto di Ceneri	Muffola	UNI EN ISO 18122:2016	Biocombustibili solidi - Determinazione del contenuto di ceneri
Contenuto di Sostanze Volatili	Analizzatore Termogravimetrico Netzsch STA 449 F3	UNI EN 15148:2010	Biocombustibili solidi - Determinazione del contenuto di sostanze volatili
Contenuto di Carbonio, Idrogeno e Azoto	Analizzatore Elementare Vario MACRO Cube Elementar	UNI EN ISO 16948:2015	Biocombustibili solidi - Determinazione del contenuto totale di carbonio, idrogeno e azoto - Metodi strumentali

2.2) Lab thermal, physical and chemical characterization

2.2.3) Gasification Feedstock and Residual char

Characterisation of the selected woody residues

Residue type	Moisture (%)	Ash (%)	HHV (MJ/kg)
R1: Hard branches	11.51 ± 0.85	3.19 ± 1.34	19.76 ± 0.21
R2: Flexible branches	21.02 ± 1.60	2.51 ± 0.07	20.46 ± 0.04
R3: Needles	46.07 ± 0.86	1.74 ± 0.23	21.14 ± 0.20
R4: Cones	10.72 ± 2.53	0.93 ± 0.27	20.81 ± 0.09

Residue type	C (%)	H (%)	N (%)	S (%)	O (%)*
R1: Hard branches	56.95 ± 0.25	5.88 ± 0.08	0.40 ± 0.03	0.14 ± 0.01	33.44 ± 0.32
R2: Flexible branches	66.10 ± 0.35	5.55 ± 0.24	0.89 ± 0.09	0.16 ± 0.02	24.79 ± 0.51
R3: Needles	52.36 ± 0.56	6.85 ± 0.08	1.36 ± 0.06	0.30 ± 0.04	37.39 ± 0.65
R4: Cones	57.70 ± 0.47	5.96 ± 0.16	1.26 ± 0.08	0.49 ± 0.05	33.66 ± 0.50

2.2) Lab thermal, physical and chemical characterization

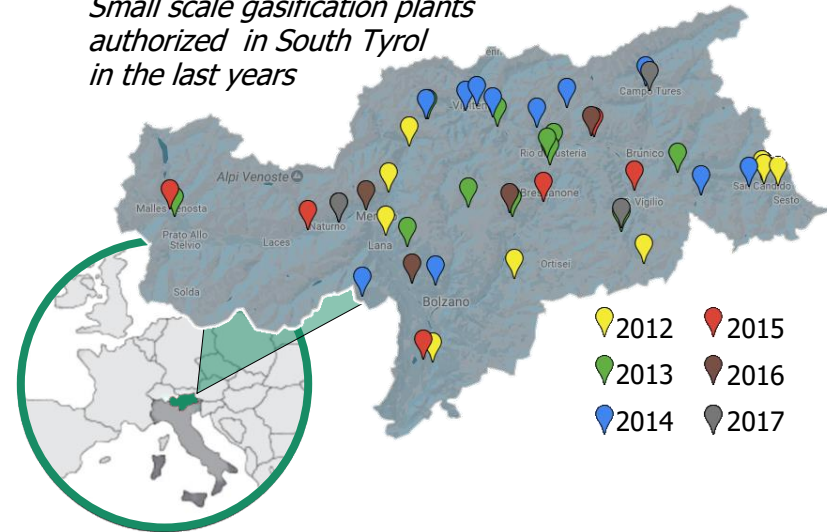
2.2.3) Gasification Feedstock and Residual char

Technology	Reactor	Biomass	Electric power [kW]	Thermal power [kW]
Burkhardt GmbH	Rising co-current	Pellet	180	270
Entrade Energiesysteme GmbH	Downdraft Fixed bed	Pellet A1	25	60
Future Green Srl (Wubi)	Downdraft Fixed bed	Wood chips	100	200
Hans Gräbner	Downdraft Fixed bed	Wood chips	30	60
Holzenergie Wegscheid GmbH	Downdraft Fixed bed	Wood chips and briquette	140	270
Kuntschar Energieerzeugung GmbH	Downdraft Fixed bed	Wood chips	150	260
Spanner Re² GmbH	Downdraft Fixed bed	Wood chips	45	105
Stadtwärke Rosenheim	Double stage Fixed bed	Wood chips	50	110
Syncraft Engineering GmbH	Double stage Fixed bed	Wood chips	250	990
Urbas Maschinenfabrik GmbH	Downdraft Fixed bed	Wood chips	296	550
Xylogas & EAF	Downdraft Fixed bed	Wood chips	440	880

Installed technologies

Characterisation of representative chars from commercial plants

Small scale gasification plants authorized in South Tyrol in the last years



2.2) Lab thermal, physical and chemical characterization

2.2.3) Gasification Feedstock and Residual char

Characterisation of representative chars from commercial plants

Technology	Ash	C	H	N	S	O	HHV	LHV	Moisture (ar)	Surf. area
	(%)	(%)	(%)	(%)	(%)	(%)	(MJ/kg)	(MJ/kg)	(%)	(m ² /g)
A	27.84	68.63	0.33	0.83	n.d.	2.37	23.11	23.04	n.d.	352
B	16.08	80.23	0.49	0.23	0.28	2.69	26.74	26.64	1.04	128
C	49.52	48.03	0.89	0.25	n.d.	1.31	14.52	14.33	n.d.	78
D	31.50	66.96	0.18	0.16	0.63	0.57	19.69	19.65	81.73	281
E	13.34	78.97	0.68	0.20	0.31	6.50	25.53	25.38	2.58	587
F	6.49	91.59	0.52	0.25	0.56	0.60	30.92	30.81	1.59	272
G	29.17	69.46	0.11	0.12	0.27	0.87	22.87	22.84	0.23	320
H	25.64	69.49	0.20	0.46	0.33	3.88	24.17	24.12	2.02	306

3) Small scale Prototypes and Innovative solutions: testing and monitoring

3.6) Gasification of wood-cellulosic waste biomasses and use in CHP systems

Preliminary gasification tests on "model" woody residues

Study case	Moisture average	Ash	C	H	N	S	O (by difference)	LHV
[-]	[%w] w.b.	[%w] d.b.	[%w] d.b.	[%w] d.b.	[%w] d.b.	[%w] d.b.	[%w] d.b.	[MJ/kg] d.b.
bark 08 (wood chips)	10.9±0.48	0.7±0.03	49.2±0.27	6.2±0.07	0.1±0.01	0.2±0.01	43.6±0.28	18.2±0.02
bark 30	10.7±0.31	1.5±0.02	49.5±0.19	6.15±0.09	0.25±0.01	0.25±0.02	42.65±0.18	18.25±0.05
bark 80	7.8±0.23	3.3±0.02	50.1±0.20	5.8±0.19	0.3±0.01	0.2±0.02	40.3±0.16	18.3±0.11
bark 100	7.2±0.25	4.0±0.02	50.3±0.23	5.6±0.22	0.4±0.01	0.2±0.02	39.5±0.18	18.5±0.13



bark 08
(wood chips)



bark 30



bark 80

3) Small scale Prototypes and Innovative solutions: testing and monitoring

3.6) Gasification of wood-cellulosic waste biomasses and use in CHP systems

Preliminary gasification tests on "model" woody residues

Open-top gasification system



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Preliminary gasification tests on "model" woody residues

