AgroBioHeat

Promoting the penetration of agrobiomass heating in European rural areas

Introduction to AgroBioHeat / European experiences on using vineyard prunings for heat production

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Workshop: Using vineyard prunings for heat

Vilafranca del Penedès, Spain

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AgroBioHeat project background

The AgroBioHeat project

- Background
- Summary information: funding, consortium, geographical scope
- Strategy and Approach

Using vineyard prunings for heat

- Vineyards in Europe
- Biomass potential from vineyard prunings
- Fuel properties
- Field productivity & harvesting methods
- Success cases, demos & new projects

Working together with AgroBioHeat & Conclusions

- Call for icebreakers
- Take home messages & actions

The AgroBioHeat project

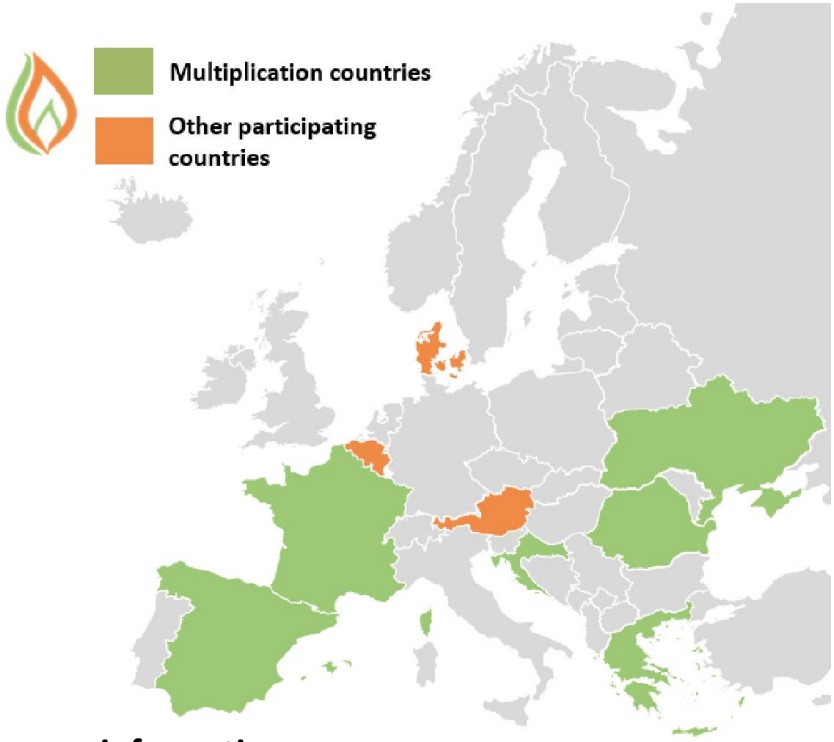
AgroBioHeat project background

Yes	… but
Huge agrobiomass potential in Europe[1]	Extremely underutilized for bioenergy production, chicken and egg problem
Rural areas often have higher heat demands than urban ones	Energy poverty, no natural gas grid
Market availability of modern heating for agrobiomass with high efficiency systems and low emissions	Limited awareness of technology options, solutions should be tailored to peculiarities of agrobiomass fuels
Agrobiomass can be cost-effective fuel compared to fossil fuels and even wood biomass fuels!	Organizational efforts to collect it, capital investment required, no support schemes or policy recognition

The effective promotion of modern agrobiomass heating solutions can contribute to the decarbonization of the rural heating sector!

[1] Herbaceous agricultural residues: 123.5 Mt dry sustainable potential (Scarlat et al., 2019)
Agricultural prunings: 12.5 Mt dry, technical potential (Dyjakon & García-Galindo, 2019)
Agro-industrial residues: not insignificant quantities available on the market, e.g. 1.2 Mt of exhausted olive cake just in Spain (Manzanares et al., 2017)
Energy crops: 117,401 hectares already cultivated, primarily with miscanthus, poplar and willow (Bioenergy Europe, 2019). scenarios for 9 to 29 Mha by 2050 (GLOBIOM)

AgroBioHeat – summary information



Summary information

- Funding: Horizon 2020, Grant Agreement 818369
- Topic: LC-SC3-RES-28-2018-2019-2020 - Market Uptake support
- Duration: 1st January 2019 – 31st December 2021
- Total budget / EU funding: 2,998,043.75 €
- Project Coordinator: Centre for Research and Technology Hellas (Greece)
- Website: http://www.agrobioheat.eu

Technical partners (GR, ES, AT)

CERTH · circe · BIOS BIOENERGIESYSTEME GmbH

European association (BE)

Bioenergy Europe

National multipliers (RO, UA, FR, ES, GR, HR)

GREEN ENERGY Romanian Innovative Biomass CLUSTER · LABIO Bioenergy Association of Ukraine · Aile initiatives énergie environnement · AVEBIOM · INASO-PASEGES · Zelena Energetska Zadruga

Straw & network expertise (DK)

AGRO BUSINESS PARK

Social sciences expertise (BE)

WhiteResearch

Agrobiomass facility operator (FR)

Agronergy

AgroBioHeat – Approach & Strategy

Our approach

Providing Support

Targeted actions for specific stakeholders and policy makers to assist early adopters and create a level playing field

Generating Vision

Roadmap / vision for agrobiomass heating: inclusion in political agenda, business strategies, local and regional development priorities

Developing Trust

Proof that agrobiomass heating works, that it is economically, environmentally, socially sustainable and that other adopters have succeeded

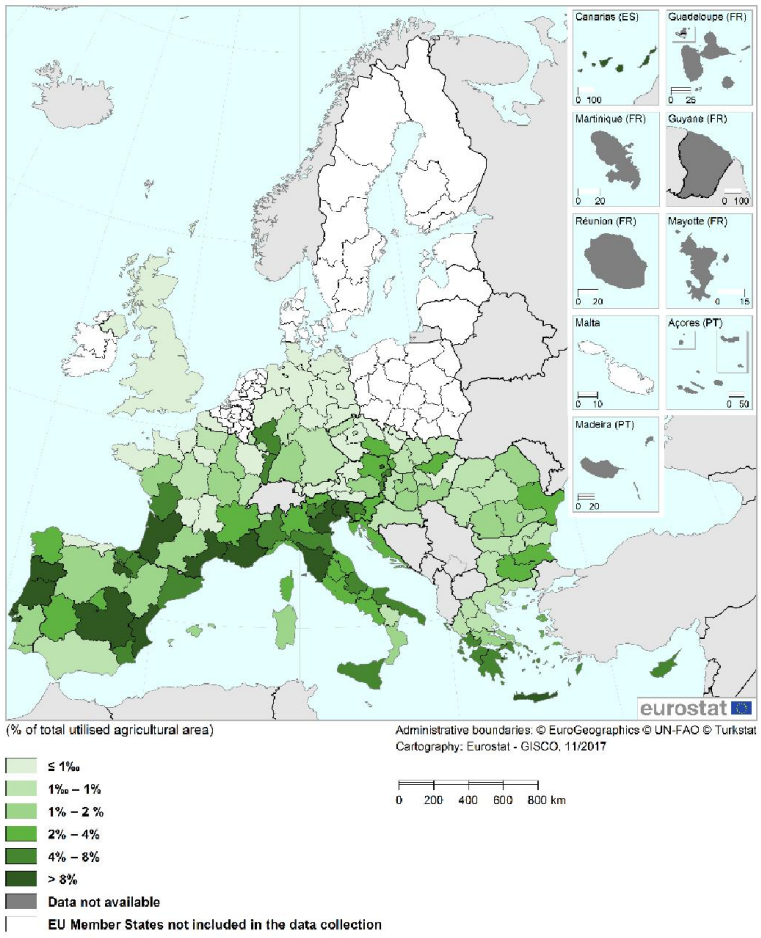
Our strategy for change

- ✓ Accompaniment of new "icebreaker" initiatives
- ✓ Policy recommendations for revision of Ecodesign Regulation based on combustion tests
- ✓ Trainings to installers
- ✓ Policy roadmaps / recommendations & advocacy actions
- ✓ Increased sector visibility in fairs & expos
- ✓ Social surveys & local / regional workshops & community hearings
- ✓ Agrobiomass Heating Observatory
- ✓ Visualization and promotion of success cases
- ✓ Organization of site-visits
- ✓ Targeted dissemination actions & workshops
- ✓ Performance testing of modern agrobiomass heating devices (lab-scale & operating facilities)

Using vineyard prunings for heat

Vineyards in Europe

Map1: Area under vines, by NUTS 2 regions, 2015
(% of total utilised agricultural area)



Note: Structural statistics on vineyards cover the EU Member States having a minimum planted area of 500 hectares of vineyards. Therefore Belgium, Denmark, Estonia, Ireland, Latvia, Lithuania, Malta, the Netherlands, Poland, Finland and Sweden are not included in the data collection Germany: NUTS level 1. Cyprus, Luxembourg and the United Kingdom: national data.
Source: Eurostat (online data code: vit_t1 and agr_r_acs)

Areas under vines in the EU-28 (EUROSTAT, 2015)

- 3.2 million hectares (45 % of world total)
- Main producers: Spain (29.1%), France (24.9%), Italy (20.1%), Portugal (6.1%), Romania (5.7%), Greece (3.2%), Germany (3.2%), others 7.7%)
- 2.5 million agricultural holdings
- Average vineyard area per holding: from 0.2 ha (Romania) to 10.5 ha (France) / EU-average 1.3 ha/holding
- 52.7 % red wines / 42.7% white wines
- 83 % of the area corresponds to PDO and PGI production
- Mostly older vineyards: < 3 years: 6.5 %, 3 – 9 years: 15.7 %, 10 – 29 years: 40.7 % , > 30 years: 37.1 %
- Decreasing trend from 1999 to 2009

Beyond the EU-28 (OIV Statistical Report on World Vitiviniculture, 2016 data)

- Turkey: 468,000 ha, Moldova; 140,000 ha (2018) / highest density of vineyards in the world, Russia: 88,000 ha, Georgia: 48,000 ha, Ukraine: 45,000 ha (2018)

What to do with vineyard prunings?

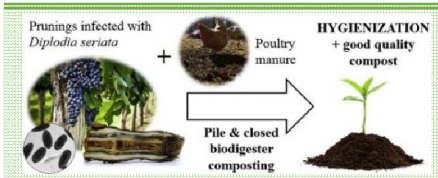
		☺	☹
	**(Manual) collection and burning on-site**	Fairly quick and easy to implement	Air pollution Waste of biomass resource Fire hazard
	**Mechanical chopping / mulching in the vineyard**	Return of (some) nutrients to the field	Risk of disease, fungi, insect propagation Requires some expenses and investments (e.g. mulchers, chippers)
	**Removal of prunings for compost production**	Return of nutrients to the field Mixing with livestock manure may improve fertilizer properties Reduced env. footprint of vine cultivation	Requires expenses and investments Value of compost?
	**Removal of prunings for energy production**	Controlled combustion & emissions Avoids disease propagation Substitutes fossil fuels and reduces CO_2 emissions Job creation Reduced env. footprint of vine cultivation	Requires expenses and investments (e.g. harvesting system, boiler, etc.) Requires careful planning to succeed
	**Traditional use (e.g. barbeques, cooking)**	Delicious	Dioxins / PAHs? Niche market / Seasonal & small demand

Image sources: (La Maison d'Olivier Leflaive, Matei et al. (2016), Yealands Wine, Clayhill Vineyard, Hanwell Wine

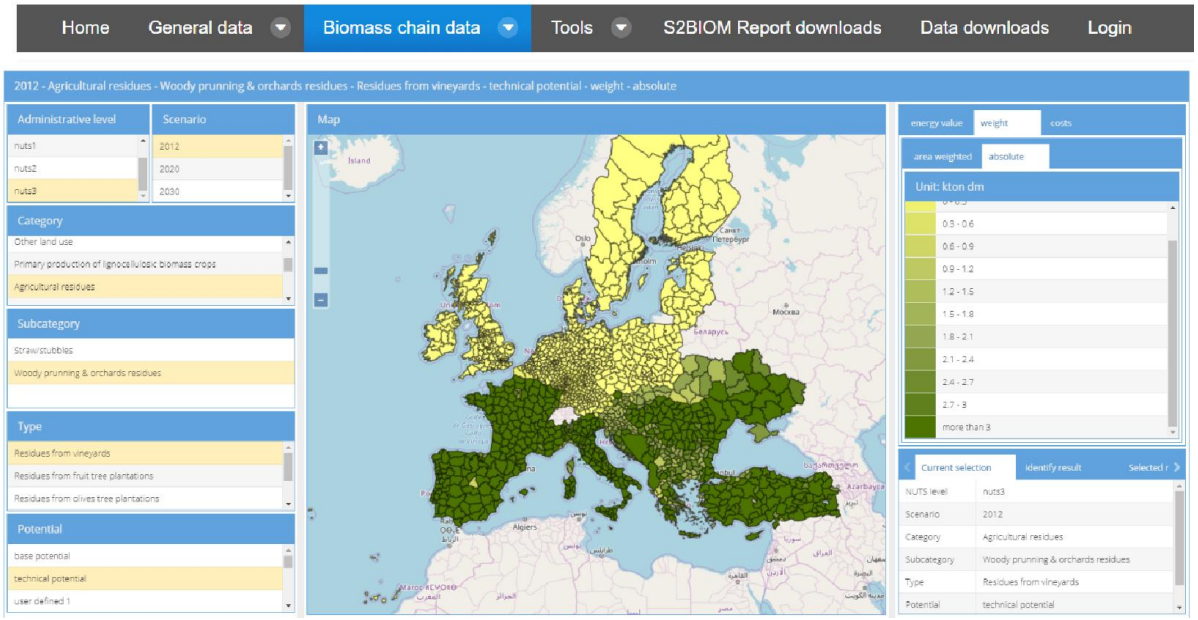
Vineyard prunings – technical potential

EU-28 member state	Pruning Biomass Technical Potential (tDM·yr−1)					
	Fruit	Nuts	Citrus	Olive	Vineyard	TOTAL
Austria	24,959	0	0	0	43,185	**68,144**
Belgium	31,758	0	0	0	0	**31,758**
Bulgaria	74,331	7075	0	0	48,496	**129,902**
Chyprus	8690	2658	10,621	15,588	7908	**45,465**
Czechia	33,040	0	0	0	13,251	**46,291**
Germany	100,935	319	0	0	89,866	**191,119**
Denmark	2968	5	0	0	0	**2972**
Estonia	1638	0	0	0	0	**1638**
Greece	161,708	20,252	68,605	895,521	94,138	**1,240,224**
Spain	429,624	295,291	489,292	2,625,290	825,392	**4,664,890**
Finland	831	0	0	0	0	**831**
France	314,016	25,055	12,167	20,031	772,348	**1,143,617**
Croatia	49,592	5859	2133	18,559	28,721	**104,863**
Hungary	170,668	5665	0	0	55,596	**231,929**
Ireland	860	0	0	0	0	**860**
Italy	493,707	113,912	198,223	1,360,483	682,719	**2,849,044**
Lithuania	18,766	66	0	0	0	**18,832**
Luxembourg	189	0	0	0	1177	**1366**
Latvia	8808	0	0	0	0	**8808**
Malta	865	0	374	193	820	**2252**
Netherlands	28,008	11	0	0	56	**28,075**
Poland	506,253	22,933	0	0	250	**529,436**
Portugal	76,237	68,341	24,882	281,677	174,348	**625,484**
Romania	306,050	1464	0	0	149,519	**457,032**
Sweden	2582	0	0	0	0	**2582**
Slovenia	18,017	507	0	948	15,206	**34,678**
Slovakia	13,898	159	0	0	10,191	**24,248**
United Kingdom	31,714	0	0	0	891	**32,606**
Mass (tDM·yr−1)	**2,910,710**	**569,572**	**806,297**	**5,218,291**	**3,014,077**	**12,518,946**

Source: Dyjakon A., García-Galindo D. (2019) Implementing Agricultural Pruning to Energy in Europe: Technical, Economic and Implementation Potentials. Energies 12(8), 1513; https://doi.org/10.3390/en12081513

Vineyard prunings – technical potential

S2Biom Tools for biomass chains



In every dark green NUTS3 area, there are more than 3,000 tons of vineyard prunings (dry matter) technically available

Source: S2Biom project tool set (https://s2biom.wenr.wur.nl/web/guest/home)
Calculation assumptions:

- Vineyard prunings / Moisture: 36 %w-% ar, LHV: 10.38 MJ/kg, ar
- Heating oil / LHV: 42.8 MJ/kg, Density: 0.85 kg/l, Emission factor: 73.78 tCO_2/TJ

Their energetic utilization for heat production in modern, efficient facilities heating oil corresponds to:

- **Fossil fuel substitution > 1,337,445 litres of heating oil per area**
- **Greenhouse gases avoidance > 3,590 tCO_2 per area**

Vineyard prunings – Fuel properties

Vineyard prunings – Fuel properties				
Property	Unit	Min	Max	Mean
Moisture	w-% ar	10	52	36
Ash	w-% db	2.3	4.9	3.4
Nitrogen, N	w-% db	0.48	1.50	0.74
Sulphur, S	w-% db	0.01	0.15	0.05
Chlorine, Cl	w-% db	< 0.01	0.11	0.02
Lower Heating Value	MJ/kg, ar	7.12	15.72	10.38
Arsenic, As *	mg/kg, db	0.02	0.27	--
Cadmium, Cd	mg/kg, db	< 0.01	1.1	--
Chromium, Cr	mg/kg, db	< 0.03	13	--
Copper, Cu	mg/kg, db	3.3	65	--
Mercury, Hg	mg/kg, db	0.001	0.017	--
Nickel, Ni	mg/kg, db	< 0.10	17	--
Lead, Pb	mg/kg, db	< 0.10	36	--
Zinc, Zn	mg/kg, db	10	260	--
Index (K+Na+Zn+Pb)	mg/kg, db	2,037	11,262	--

Data sources: Biomasud Plus project Deliverables 3.2 & 3.3, BIOS fuel database. Values correspond to analysis of 112 samples collected in Croatia, Greece, Italy, Portugal Slovenia, Spain and Turkey. * values for 88 samples

Generally lower fuel quality compared to forest wood fractions

- High ash, can be higher when harvested in mechanized way
- High nitrogen → NOx emissions
- High potassium content → particle emissions (can be controlled with ESPs, filters, etc.)
- Minor elements generally ok, but copper can be high
- **Particle size distribution also affects fuel feeding!!**

Energetic utilization requires:

- **Sophisticated combustion / feeding systems**
- **(and/or) appropriate biomass cleaning systems (e.g. before pellet production)**

Vineyard prunings: hog fuel / chips

Vineyard pruning / hog fuel from large shredder
Particle size: P45

Photo source: CIRCE, uP_running demo with Cooperativa Bodega San Juan Bautista

Vineyard pruning / hog fuel from integrated shredder / picker
Particle size: G50

Photo source: CIRCE, Vilafranca del Penedes

Vineyard pruning / chips
Particle size: P16

Photo source: CERTH, uP_running demo with VAENI Cooperative

Biomass productivity – vineyard prunings

Biomass productivity / vineyard prunings			
Source	# data	Biomass productivity (t/ha, dry)	
		Minimum	Maximum
uP_running field measurements: Croatia	10	0.44	1.63
uP_running field measurements: France	17	0.52	1.76
uP_running field measurements: Portugal	7	1.47	7.80*
uP_running field measurements: Spain	8	0.53	2.07
uP_running field measurements: Ukraine	3	1.43	2.42
uP_running field measurements: Italy	12	0.53	4.20
uP_running field measurements: Greece	15	0.07	2.60
Literature & EuroPruning	70	0.10	2.70

Data source: uP_running project Deliverable 6.2: Report on collected Observatory data: Year 3
All data available on up_running project Observatory: http://www.up-running-observatory.eu/en/
* Value from modern vineyard with density of 10,000 plants/ha

Spain "La Sardera": Garnacha, non-irrigated 0.56 t/ha (dry). Photo: CIRCE

Greece "Strantza': Xinomavro 2.31 t/ha (dry). Photo: CERTH

Biomass productivity from vineyard prunings generally lower than other pruning types.

Variable and affected by many different factors, including:

- Agronomic practices during pruning
- Planting density, age, variety (vigorousness)
- Irrigation
- Others

Biomass productivity affects harvesting costs

- **More critical for biomass-to-power cases**
- **Less critical for biomass-to-heat (success cases with low productivities)**
- **Advised to perform field measurements instead of relying on literature data**

Harvesting (vineyard) prunings

Method 1. Hauling branches, making piles and shredding

Shredder Green Bull in Agrofirm Shabo (Source: Zerma-Ukraine)

- ✓ Easy to implement & relatively low investment
- × Forwarding with tractor → contamination with soil and stones
- × Manual handling / feeding → time required / personnel costs

Large shredder (Photo: CIRCE, uP_running demo)

Harvesting (vineyard) prunings

Method 2. Collection integrated with shredding OR baling

- ✓ Machinery derived from mulchers with biomass pick-up system (tilting bins, big bags, trailers)
- ✓ Multiple manufacturers and models
- × Hog fuel production → storage and feeding

- ✓ Pruning bales can be left on the field side to dry further
- × Requires handling of bales on the field
- × Unless using a bale boiler, bales need to be shredded / chipped before use

Method 3. Integrating pre-pruning and collection

Prototype developed in the Vineyards4Heat project

- ✓ Cost reduction
- ✓ Suitable for intensified crops with mechanical pruning (e.g. vineyards)
- × In development
- × Shredding of WET material (can result in degradation / fermentation of collected biomass)

Self-consumption - Domaine Xavier Muller (FR)

Domaine Xavier Muller

- Location: Marlenheim, France
- Use of vineyard prunings for farm heating
- Mostly self-consumption; vine stocks also from neighboring farms
- Initiated in 2010; from 2016, also vine stocks
- Biomass consumption: 12 t/y
- Harvesting method: baling
- Biomass sourcing radius: less than 2-3 km
- Total investment: 77,000 € (baler + chipper + boiler)
- Occasionally producing pellets from mobile pelletizing plant of H-énergie

For more information:
https://www.up-running.eu/wp-content/uploads/2017/10/uP_running_D6.3-Flagship-cases-report-v1_.pdf

Agro-industrial heating - ITC Shabo (UA)

SINCE 1822
SHABO

- Location: Odessa region, Ukraine
- Use of vineyard prunings for heat production in winery / distillery
- First successful case of industrial pruning use in Ukraine
- Initiated in 2015
- Biomass consumption: 1,000 – 1,500 t/y
- Harvesting method: forwarding + manually shredding
- Biomass sourcing radius: 10 km
- Total investment: Not disclosed. No public funds used
- 5 permanent jobs (boiler house operation), 7 part time jobs for logistics and 2 part time jobs at storage facilities

For more information:
https://www.up-running.eu/wp-content/uploads/2017/10/uP_running_D6.3-Flagship-cases-report-v

Pellet production - Pelets de la Mancha (ES)

el calor del campo pellet combustible de la mancha

ATHISA BIOGENERACIÓN

ATHISA SPAIN

- Location: Socuéllamos, Spain
- Large scale pellets and chips production from vineyard prunings
- Initiated in 2011
- Biomass consumption: up to 20,000 t/y
- Harvesting method: various, mostly forwarding and direct transport to plant or forwarding and shredding in large shredder
- Innovative, patented technology for removing contaminants (stones, sand, metal, etc.) from harvested agricultural prunings and plantation removal biomass
- Biomass sourcing radius: 30 km
- Total investment: 5.8 M€ (initial investment; does not include additional costs invested afterwards)
- Pellets marketed also for barbeques (pellet gourmet) and horse bedding

Image sources: Pelets de la Mancha / Athisa Group
For more information: https://www.youtube.com/watch?v=XNIWGZmWbYw&
https://www.up-running.eu/wp-content/uploads/2017/10/uP_running_D6.3-Flagship-cases-report-v1_.pdf

Public-private partnership for municipal buildings heating with vineyard prunings

AJUNTAMENT VILAFRANCA DEL PENEDÈS

VINYES XCALOR

Life

For more information:
http://vineyards4heat.eu/
https://www.up-running.eu/wp-content/uploads/2017/10/uP_running_D6.3-Flagship-cases-report-v1_.pdf

uP_running demo – VAENI (GR)

- Up-running project demo with VAENI cooperative + CERTH / INASO-PASEGES
- Harvesting method: manual piling and feeding of chipper
  - Chipper (Husmann H5) provided free of charge for the demo from the Municipality of Naoussa
- Final User: Andreou Greenhouses (fixed grate biomass boilers)
- In 1-2 days (+planning), full demonstration of value chain!
- Technical feasibility demonstration / economic requires finding new biomass end-users
- Next step? Heating of municipal buildings?

Property	Value
Moisture (w-% ar)	36.2
Ash (w-% db)	4.7
Bulk density (kg/m^3 ar)	327
Particle size	P16S

For more information:
http://www.up-running.eu/wp-content/uploads/2016/10/uP_running_D3.3_Demonstrations_cases_study_analysis_submitted.pdf
https://www.youtube.com/watch?v=LiK9uJ9k7sc

New projects – Telavi, Georgia

EU4Energy

Covenant of Mayors for Climate & Energy CoM East

Demonstration Projects Eastern Partnership

Georgia tested equipment for collection and processing of vineyard prunings

EEC·336

On February 11, 2020 within the framework of the project funded under EU Covenant of Mayors Demonstration Projects (CoM-DeP) "Biomass Energy and Energy Efficient Technologies as Sustainable Energy Solutions for Georgian CoM signatories" in Telavi municipality village Gulgula vineyard, earlier supplied round-baler for vineyard prunings & trimmings and Balechipper were tested.

Project goal: heating of two municipal kindergartens with vineyard prunings

For more information:
https://com-dep.eu/georgia-tested-equipment-for-collection-and-processing-of-vineyard-prunings/?fbclid=IwAR0Xa0vUmZYZKJwGLuLNVzEiaNL-biPQc37ypI6EjoKXjNK5UUwRnK3wJ6k

Working together with AgroBioHeat & Conclusions

Take-home messages

Using vineyard prunings for heat is feasible!

- Several success cases from Europe (and beyond)
- Positive local and global impact

Setting up a vineyard pruning to heat project requires careful planning

- Evaluate local conditions: field measurements for biomass productivity, identify potential end-users
- Select appropriate harvesting method for local conditions and farmers' preferences
- Select suitable combustion equipment

Most initiatives are collaborative / cooperative

- Low average surface area of holdings & low biomass productivity means that many farmers will need to collaborate to mobilize meaningful quantities
- Other local actors: municipalities, agro-industries, greenhouses, etc.

Call for “icebreaker” initiatives

- Campaign launched to identify and support new pioneering initiatives on agrobiomass heating
- New agrobiomass heating initiatives using vineyard prunings can benefit from the project support (e.g. equipment selection and contacts with providers, techno-economic analysis, setting up and dimensioning of supply chain, etc.)

- Greece: https://agrobioheat.eu/el/call-icebreakers/
- Romania: https://agrobioheat.eu/ro/agrobioheat-va-sprijini-noi-initiative-icebreaker-de-utilizare-a-biomasei-agricole-pentru-incalzire/
- Spain: https://agrobioheat.eu/es/agrobioheat-busca-nuevas-iniciativas-bandera-de-consumo-de-agrobiomasa-para-brindar-su-apoyo/
- Ukraine: https://agrobioheat.eu/uk/agrobioheat-will-support-icebreaker-agrobiomass-consumption-initiatives/
- Croatia: https://agrobioheat.eu/hr/agrobioheat-trazi-inovativne-inicijative-koje-zele-koristiti-agrobiomasu-za-grijanje/

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CBC
Clúster Bioenergia Catalunya

FAMILIA TORRES
Desde 1870

Spread the word!

Participating organizations

Thanks to all the AgroBioHeat partners for making this a European event! And thanks to all the participating organizations:

Spain

- Termosun
- Energy Window SLU
- Faber 1900 SLP
- EMAVSA
- EVE
- Heizomat
- ATHISA BIOGENERACIÓN
- ISVED
- vanmander sl

Moldova

- Energy and Biomass Cluster

Croatia

- Dobra berba d.o.o.

Denmark

- Twinheat

France

- Vinea Energie

Greece

- KEOSOE, Central Cooperative Union of Wine Products
- VAENI Cooperative
- Tyrnavos Coop

Romania

- FNGAL, National Federation of Local Action Groups

AgroBioHeat

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Thank you for your attention!

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