

Sustainable Networks for the Energetic Use of Lignocellulosic Biomass in South East Europe

Description of Joint Pilot application 6: Storage properties of slash

**to be implemented in
Styria, Austria and
Graubünden, Switzerland**

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1. Pilot factsheet

Pilot title: Improving storage properties of slash		Acronym: STORES
Lead partner: Holzcluster Steiermark GmbH	Other partners: Holzforschung Austria, BIOMA AG, BOKU Wien, Waldverband Steiermark, Naturwärme St. Lambrecht, Komptech GmbH, Graubünden Holz, Biomass Energy Graubünden	Area of intervention: Styria
Pilot focus: process oriented, upgrading of biomass	Start of implementation: 03/2014	Pilot duration: 03/2014 – 11/2014
Budget:	Target group: harvesting companies, biomass processors, biomass traders, heating plants, lobbying organisations	

2. Executive summary

Slash, also referred to as logging residues is a byproduct of wood harvesting consisting of branches, needles and tree tops. This material is of relatively poor quality and is used for heat and/or power generation in medium to large scale biomass heating and CHP plants in the form of wood chips. Most of the slash usually occurs in the warmer seasons of the year when the demand of heating/CHP plants is typically low. Therefore, different treatments of slash shall be tested to improve storage properties and increase the possible storage period. Additionally, storage tests over longer periods will be carried out to compare and evaluate the effects different pre-treatment measures have on slash and how they influence its behavior over longer storage periods.

Key words: slash, storage properties, harvesting residues, pre-treatment

3. Objectives

The main objective of the pilot application is to find a way to increase the possible storage duration of slash by improving its storage properties. Therefore, different treatments of the slash will be tested and storage tests will be conducted.

In various expert interviews conducted during the analyses phase (WP 3) of the project, it became evident that there is a need to store slash over a longer period, since it occurs mainly in warmer seasons when the demand for heating is low. Since only relatively little literature exists on the topic while the demand for a solution in this field is high, this problem was chosen to be analysed in detail via a pilot project.

If it would be possible to store slash without high energy and mass losses in a cost effective way, this would broaden the resource base for biomass heating and power plants and could help to reduce the current competition between energetic and material use of biomass in Styria.

The main problem is the high content of green material (needles/branches) alongside with a high moisture content which leads to significant loss of dry matter and as a result to a loss of energy content during storage over longer periods caused by natural decomposition processes. Further problems are mold growth which can cause health risks for users as well as heat generation caused by micro-biotic activities which might even lead to self-ignition. Another problem is the content of impurities in form of soil/dust caused by harvesting and skidding of the trees.

A main goal is to overcome these shortcomings and improve the characteristics of slash and therefore its quality along with the economic value.

4. Description of pilot application

4.1 Description of core application and country/region specific extension

The pilot application will feature different pre-treatment measures of slash followed by storage tests of the treated samples in order to capture, measure and compare the effects of the different treatments on the storage properties and the mass and energy loss of slash.

Processing and pre-treatment measures

The following processing, treatment and conditioning measures will be applied to the slash samples:

1. Chipped slash (untreated): this is the most common form in which slash is handled and used in Styria. The chips will be stored in a pile. This sample will serve as a reference for the other tests.
 - a. Green slash is chipped – open-air storage – thermal utilization
2. Chipped and screened slash: in order to decrease the content of needles/leaves and therefore moisture content and potential microorganism activities in the material, the chipped slash will be screened to remove the needles before storage in a pile. The removed needles/green material could ideally be used for the production of compost. Three different variants will be examined:
 - a. Green slash is chipped – roofed storage – screened-thermal utilization
 - b. Green slash is chipped - screened - roofed storage – thermal utilization
 - c. Green slash is chipped - screened – open-air storage – thermal utilization
3. Chipped and dried slash: technically pre-dried slash, stored in piles
 - a. Green slash is chipped - dried / roofed storage– thermal utilization
 - b. Green slash is chipped – dried / roofed storage– screened – thermal utilization
 - c. Green slash is chipped - screened – dried / roofed storage– thermal utilization
4. Chipped slash, biologically pre-treated before storage
 - a. Chipped slash treated with microorganisms: slash is treated with active microorganisms (also used for ensiling) before storage to delay the biological decomposition process
 - b. Chipped slash treated with acid: slash is treated with propanoic acid (also used for ensiling) before storage to delay the biological decomposition process
5. Unchipped/untreated slash: slash is stored as it is obtained during tree harvesting (branches and treetops) to compare the storage behaviour to chipped slash. One part is left to dry for 2 months (to simulate storage in the forest) before further processing.
 - a. Unchipped/untreated slash – open-air storage – chipping – thermal utilization

- b. Unchipped/untreated slash – open-air storage (rotting) – chipping – screening -
roofed storage - thermal utilization

Storage tests

The storage of the pre-treated samples described above will be carried out over duration of six to eight months, starting in May 2014. This time span and season represents the time of the year when slash actually occurs but the demand is usually low since the heating period is over. Therefore, this storage period corresponds with the time of the year when storage of slash is necessary.

Storage tests will be carried out in three different locations:

- Biomassehof Naturwärme St. Lambrecht: storage variants 1, 2 and 3 will be carried out in the roofed storage space of the biomass heating plant St. Lambrecht in Styria. 2 different variants will be examined:

Raw material: Green slash

1 ref.	chipping	open-air storage		thermal utilization
2	chipping	covered open-air storage		thermal utilization
3a / 3b	chipping	technical drying / roofed storage	screening	thermal utilization
3c	chipping	screening	technical drying / roofed storage	thermal utilization

- Bioma AG - CHP Gmünd: variants 1 and 4 will be stored open-air at the storage area of the Bioma heating plant in Gmünd, Lower Austria.

Raw material: Green slash

1 ref.	chipping	open-air storage		thermal utilization
4a	chipping	microorganisms treatment	open-air storage	thermal utilization
4b	chipping	acid treatment	open-air storage	thermal utilization

- Biomass trade center Leoben: variants 1, 2 and 5 – the different storage behavior of chipped and unchipped slash will be examined as well as the effect that screening has on the storage behavior. The slash will be stored open air.

Raw material: Green slash

1a ref.	chipping	open-air storage			thermal utilization
5a / 5b	open-air storage		chipping	screening	chipping
			chipping	open-air storage	thermal utilization
2c	chipping	screening	open-air storage		thermal utilization

This makes for 12 different storage piles in total, which leads to 24 samples to be analysed since they have to be taken before and after the storage tests.

Each pile should be made up of approx. 250 m³ wood chips but will depend on the usual pile size as well as the available storage space at the different sites.

Sample taking and analysis

The taking and preparation of samples will be carried out according to EN 14778 and EN 14780, respectively. Samples will be taken at the beginning and the end of the storage tests. From each truck delivery of material that is used for the storage tests, a total of 15 to 20 liters will be taken from at least 10 different points in order to represent the whole delivery. Since one pile will consist of 3 to 4 truckloads, between 30 and 40 individual samples will be taken from each storage pile. Samples will be taken by the project partners after instruction and training by science partner Holzforschung Austria (HFA), which will also carry out the preparation and analysis of the samples in the laboratory.

The following characteristics will be determined:

- Moisture content
- Dry matter/weight loss
- Energy content/energy loss (LHV)
- Ash content
- Particle size distribution/screening analysis
- Chemical composition (C/H/N and S/Cl Analysis)
- Volatile matter

Moisture content

The moisture content will be determined through drying of slash samples according to EN 14774-2.

Loss of mass/dry matter

The mass loss will be determined by weighing the samples at the beginning and the end of the storage tests. Alongside with the measured moisture content, the loss of dry matter will be determined.

Energy content

The energy content of the slash samples will be determined as net calorific value on “dry basis” and “as received” according to EN 14918. Through comparison of the net calorific value at the beginning and the end of the storage tests, the energy loss/increase (through lower moisture content) will be determined as well.

Ash content

The amount of ash contained in the slash will be determined according to EN 14775.

Particle size distribution & content of fine particles

The classification of the particle size will be determined through a screening analysis according to EN 15149-1.

Chemical composition

C/H/N-Analysis according to EN 15104 will be carried out as well as S/Cl-Analysis according to EN 15289 to determine the most relevant chemical parameters of the samples.

Volatile matter

The content of volatile matter will be determined according to EN 15148.

Cost recording

Since slash is a biomass resource of low quality and therefore very low market value, costs for treatment and storage play a crucial role in its utilization. It is important to measure the costs of each treatment step and compare them to the achieved benefits to determine possible financial profits. Therefore, costs for every step in the pre-treatment and storage activities will be evaluated and a treatment cost-benefit analysis will be carried out. This task will be carried out by science partner BOKU.

4.2 Innovative capacity

So far, relatively little research has been done in the field of pre-treatment and storage of slash and only a few publications on this topic exist. Furthermore, if storage tests were conducted in the frame of a certain study, they span over longer periods (1 year or longer) which is not necessary in the Styrian case and might lead to different results than the shorter storage periods applicable in Styria. Also, no storage tests that compare screened material with chipped as well as untreated slash have been carried out so far.

4.3 Involved parties

Holzcluster Steiermark GmbH:	Planning of pilot, coordination of partners and activities
Waldverband Steiermark:	Coordination and planning of pilot
Biomassehof Steiermark:	Acquisition, pre-treatment and storage of slash
Holzforschung Austria:	Scientific supervision, research design, analysis of samples, training of project partners
BOKU Wien	Economic evaluation and cost recording
Bioma AG	Acquisition, processing, pre-treatment and storage of slash
Naturgut GmbH:	Pre-treatment of slash (screening)
Graubünden Holz:	Observer, receivers of data (unrestricted access to results)
Biomass Energy Graubünden:	Observer, receivers of data (unrestricted access to results)

4.4 Time schedule

03/2014-05/2014	Planning and coordination of partner activities, setup of research design, Training of project partners on sample taking and handling at the HFA
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06/2014	Processing and preparation of slash samples; Beginning of storage tests, first sample taking
06/2014-10/2014	Storage tests with continuous measurements
10/2014	End of storage tests, second sample taking
11/2014	Capitalization of results, dissemination & workshops

4.5 Financial scheme

Factor	Cost [€]	
	HCS	WVS
FOROPA personnel	15.000	10.000
External expertise (scientific partner +sample analysis)	9.300	9.300
Equipment	-	-
Total	24.300	19.300
Grand total	43.600	

5. Expected outcomes and impact

The main outcome to be expected is a clear view on what is the most efficient method for treating and storing slash over longer periods and if this is possible in a cost-effective way.

If it is possible to treat slash in a cost effective way and improve the storage properties, this would increase the availability of higher quality fuel for larger biomass heating plants and CHP plants and therefore broaden the resource base and increase supply security. Since there would be more biomass available which is not suited for material use, this would also ease the current competition between material and energetic biomass use in Styria.

If the quality of slash can be raised through pre-treatment and storage, demand and therefore market value is likely to increase as well, allowing forest owners, harvesting companies and biomass traders for more cost effective harvesting, processing and transport of harvesting residues. Therefore, every actor in the regional biomass supply chain will profit from improved storage characteristics of slash and the created added value resulting from the increased quality of the material.

6. Communication and dissemination plan

Technical report on slash treatment

After the storage tests have been finished, captured results will be summarized and published with all requirements and corresponding costs. The report will be distributed to biomass processors, traders as well as biomass heating plant operators in the project countries and beyond and will be available on the websites of the partner organizations for download.

Stakeholder workshop

Additionally, a workshop for involved stakeholders on the results and main findings of the pilot projects will be held as well, alongside an online publication of the technical report. Target group for the workshop are forest owners, biomass processors and traders, harvesting and logging companies as well as transport companies and lobbying organizations.

Publications

1. Publication in relevant business magazine (Ökoenergie, Holzkurier, Forstzeitung etc.) contributed by Holzcluster Steiermark (HCS) or Waldverband Steiermark (WVS)
2. Scientific publication (contributed by science partner, to be published after the end of project)

