



**mixBioPells**

# AGROPELLETS – CHALLENGING FUEL FOR THE FUTURE

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# IEE MixBioPells -project



The **Intelligent Energy Programme (IEE)** is financing a European project called **MixBioPells**, duration two years 2010 – 2012.

**The main aim of the project is to study and enhance the markets of alternative and mixed pellets in the regions.**

The local situations of the alternative pellets are analysed in

- Central Finland,
- Eastern Sweden,
- Jutland in Denmark,
- Rhineland-Palatinate in Germany,
- Lower Austria,
- Lombardy in Italy and
- Asturias in Spain.

- Much more information you can find from [www.mixbiopells.eu](http://www.mixbiopells.eu)

# INTRODUCTION



## WHY ALTERNATIVE PELLETS

- There is a lack of wood-based raw materials for pellet production, or wood is expensive.
- In many European countries more straw and grass material available than wood.
- Commonly used raw materials are **pruning of vineyard, miscanthus, straw, reed canary grass and peat.**
- Markets of alternative biomass pellets are still blocked by various constraints.
- Activities in industrial and public sectors have started for alternative solid biofuels.

# RAW MATERIALS

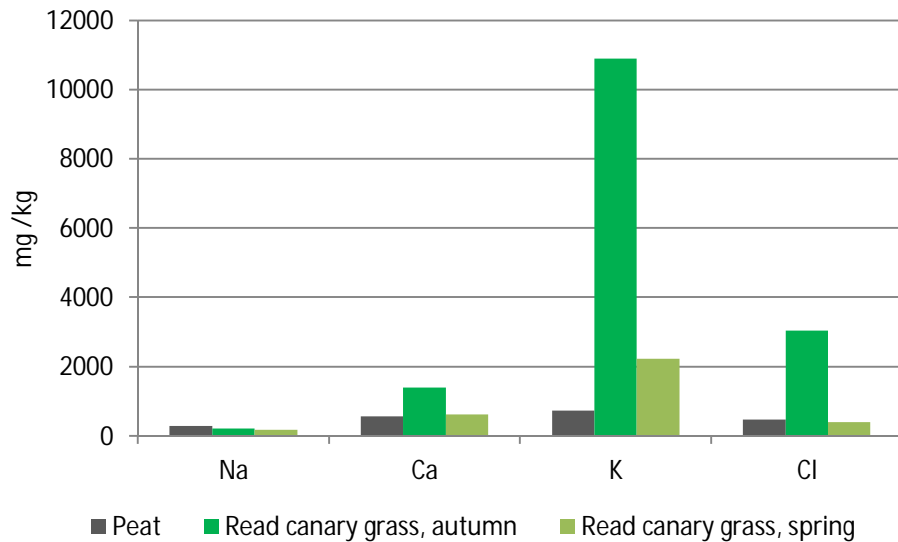


- **Alternative pellets**, **straw**, **grass**, different kind byproducts, waste... other than wood, one rawmaterial,
- **Mixed pellets**, two or more raw materials,
- (**Blended**, two or more raw materials, precise mixtures).

## Differences to the wood raw material

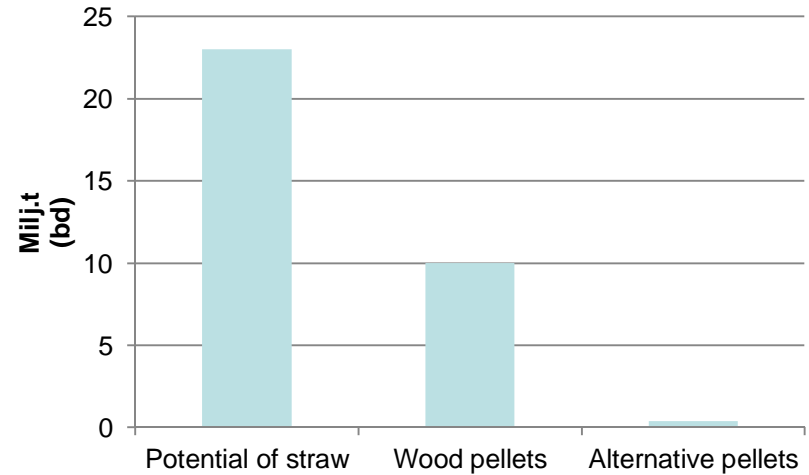
- **ash** amount bigger, 2 – 10%,
- in the plant **harmful components**, K, Cl, S...
- straw, grass light **bulk density**, 80 – 150 kg/m<sup>3</sup>,
- **moisture** is usually low 10 – 20%, (bales surface/core)
- **fiber** -form.

# RAW MATERIALS



Salo, R., 2000

**Reed canary grass** is harvested in spring and it has been noted that water soluble chlorine (Cl) and potassium (K) leaches away during the winter, even over 80%.



**Straw, cereals** is the most important alternative material. Estimate in Europe nearly 23 million tons of dry biomass.

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# PELLETISING



## Pellets, wood and alternative, favorable features

- Pellets have high energy content per volume unit, 4 – 5 MWh/t
- Increased bulk density (500-700 kg/m<sup>3</sup>)
- Low moisture content, about 10%
- Small variations in fuel quality
- Homogeneous composition
- High energy density in combustion



# PELLETISING



- Pelletizing of wood and alternative materials is almost equal
- 
- The bulk density of straw and grass is low, difficulties in transport and pelletizing
- **Bales** should be first de-baled and chopped, a problem **fiber**
- In most cases artificial drying is not necessary
- Mixpellets it is needed two units to feed in the press, alternative pellets one.
- The agropellets tolerate less moisture than wood pellets during the storage.
- Additives; combustion appliances are  $\text{CaO}$ ,  $\text{Ca}(\text{OH})_2$ ,  $\text{CaCO}_3$ ,  $\text{MgCO}_3$ ,  $\text{Al}_2\text{O}_3$  and **kaolin** ( $\text{H}_2\text{Al}_2\text{Si}_2\text{O}_8 \cdot \text{H}_2\text{O}$  or  $\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ ).



Bale braker in the factory in Neusiedl/Zaya.

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# NEW PELLETISING METHODS



**A mobile pelleting plant;** if it is difficult to transport raw material to the plant, the plant goes to the source.

The Finnish mobile pelletizer ([www.louhetar.fi/biobotnia](http://www.louhetar.fi/biobotnia)) grinds whole bales. Straw and reed canary grass are the usual pelletized raw materials of the machine.

A mobile pelletizer has also been developed for square bales in Germany ([www.energievomland.de](http://www.energievomland.de)).

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# NEW PELLETISING METHODS



In Germany a **twin-screw extruder** for breaking and compressing agricultural materials before pelletizing. The material is fed by two rotating screws through the barrel and compacted against a die.

German **PUSCH Ag** has developed a hydraulic press with a cost intensive pre-treatment of the raw materials. The production of different mixed biomass pellets can be done without changing the press die ([www.pusch.ag/](http://www.pusch.ag/)).

**Torrefaction**, the minimum plant capacity should be 5 – 15 t/h after Kiel.



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# CEN-Standards



- When **CEN-Standards** become into force national standards are not valid any more.
- Additional standards will follow (other fuels: e.g. torrefied pellets).
- Revision time of **CEN-standards** is 3 years after coming into force.
- National standards in Austria are continuously updated (ÖNORM C 4000, C 4002, M 7139).
- Estimated publication of **EN 14961**- 2 to 5 in the mid of 2011

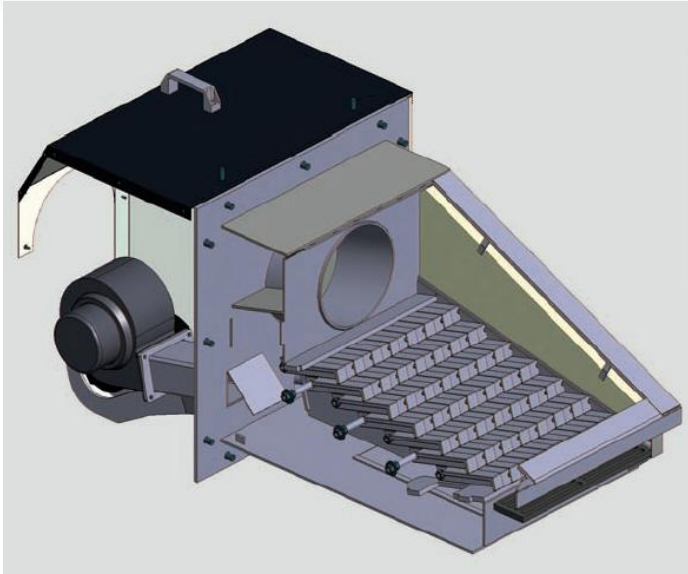
# SMALL SCALE COMBUSTION



- Usually difficult or impossible to burn alternative biopellets in a small-scale boiler with a static grate.
- In many experiences with alternative pellets
  - the **melting of ash**,
  - the **large amount of ash** (2-10%, wood <0,5%
  - **emissions** have been problems.
- New innovative solutions are needed for small-scale combustion.
  - A 60 kW burner with a moving grate was used in the tests of the project, (**MultiJet**, Ariterm Oy).
  - **Successful experiments** were carried out with the burner mixes of peat/straw; 50%/50% (with and without kaolin) and reed canary grass/wood; 20%/80% and 50%/50%.



# SMALL SCALE COMBUSTION



MultiJet-burner with a moving grate



Termocabi AGRIPELLETS  
For mixed pellets

The burner is a blown air type, with the horizontal flame in a monoblock structure.



Veto Flisomat for briquettes

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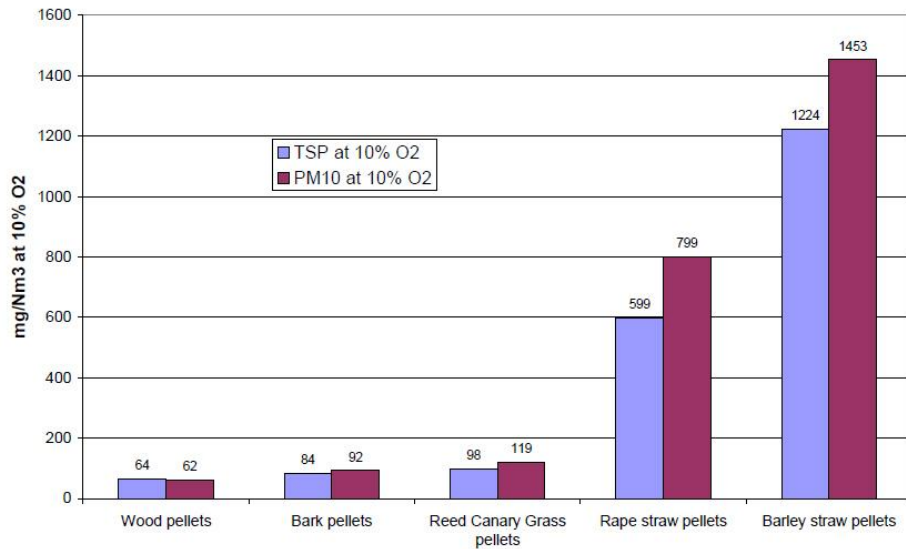
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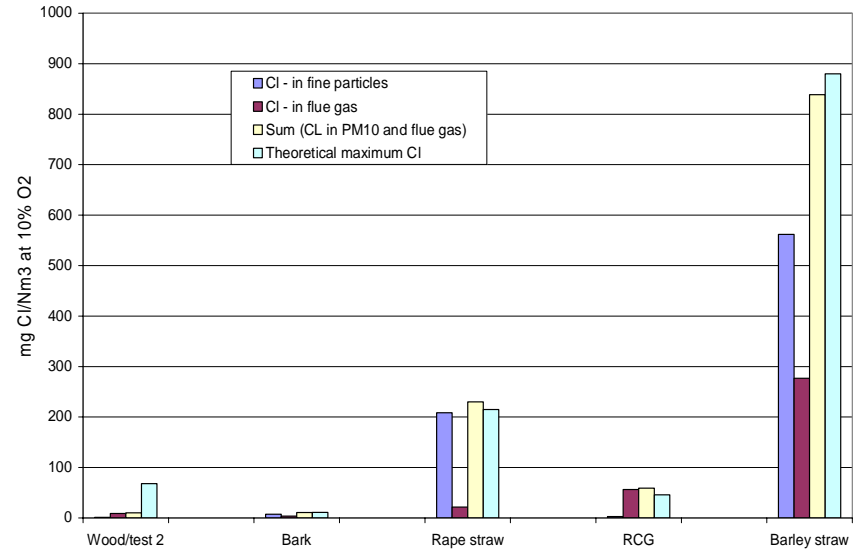
# SMALL SCALE COMBUSTION



## Small particles in the flue gas



## Chlorine content in the flue gas



Oravainen, H., 2008

# LARGE SCALE PRODUCTION & COMBUSTION



Bigger amounts of alternative pellets is produced and combusted already in Nordic countries:

- 80,000 t/a of straw pellets have been made in Denmark for several years (since 2003) for the Amager power plant.
  - There have been some problems to burn straw, but they have been solved.
- The Perä-Seinäjoki pellet factory of Vapo Oy produces annually 30,000 – 60,000 t of peat pellets.
- In Sweden bark pellets are produced in Norrköping.

# Existing emission threshold values for combustion plants



Country	Range	CO	OGC	NO <sub>x</sub>	SO <sub>2</sub>	HCl	Particles	Dioxine / Furanes
Austria <sup>3)</sup>	<100kW	loose	no	strict	no	no	loose	no
	100kW - 1MW	loose	no	strict	no	no	loose	no
	> 1MW	no	no	no	no	no	no	no
Denmark	<100kW	no	no	no	no	no	no	no
	100kW - 1MW	loose	no	loose	no	no	loose	no
	> 1MW	no	no	loose	no	no	loose	no
Finland	<100kW	no	no	no	no	no	no	no
	100kW - 1MW	no	no	loose	no	no	loose	no
	> 1MW	no	no	loose	no	no	loose	no
Germany	<100kW	loose	no	loose	loose	loose	loose	strict
	100kW - 1MW	strict	no	loose	loose	strict	strict	strict
	> 1MW	strict	no	loose	loose	strict	strict	strict
Italy	<100kW	no	no	no	no	no	loose	no
	100kW - 1MW	strict	loose	no	strict	no	loose	no
	> 1MW	strict	loose	no	strict	no	strict	no
Sweden	<100kW <sup>1)</sup>	no	loose	loose	no	no	no	no
	100kW - 1MW <sup>2)</sup>	no	loose	strict	loose	no	loose	no
	> 1MW	no	no	strict	loose	no	loose	no
Spain	<100kW	no	no	no	no	no	no	no
	100kW - 1MW	no	no	no	no	no	no	no
	> 1MW	no	no	no	no	no	no	no

1) Threshold values valid up to 300 kW

2) Threshold values valid from 300 kW to 1MW

3) Threshold values valid for Lower Austria and combustion systems up to 400 kW

Original Zeng, T.,  
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# GASIFICATION



Gasification might be one option to utilise pelletized biomass and biomass mixtures.

- Experiments of **Jalasjärvi Lämpö Oy** were done with a 62/38% mix of sod peat and reed canary grass pellets, respectively.
- The heat value of RCG was 2.35 MWh/m<sup>3</sup> (4.2 MWh/t) double the value for sod peat (1.0 MWh/m<sup>3</sup>).
- 100 t of RCG pellets was produced and used in a month for heating.
- The emission very close the values of Government act 445/2010 (5 - 50 MW). In the gasifier there is no precipitator at the moment.
- The type is the fixed-bed updraft gasifier.



# CONCLUSION



- It is possible to produce mixed pellets and also to combust them.
- The partial substitution of wood by controlled mixtures of straw or grass opens up the possibility to broaden the fuel base.
- It is possible to influence fuel properties by making mixtures of raw materials.
- The European market for mixed pellets is at an early stage of its development.
- A fundamental understanding of the behaviour of mixed biofuels and further studies with systematic variation of process parameters and other mixture compositions are needed.
- Inclusion of other biomass obtained from the region will lead to expansion of the biomass assortment and thus to more flexibility in the production and use of mixed pellets.



**Thank you for your attention!**  
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