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USING GRANULATION (PELLETIZING) TO INCREASE THE USAGE OF SLAGS

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Background



- Fertilisation with fly ash is increasing now rapidly
- There is long history of testing materials to this use
- For about 35 % of forest area fly ash is seen as usefull itself
- Symbiosis products are seen as a solution to increase usage of the the by-product materials, especially those with fine particle size
- Fine particles are high with calciumoxide in slag products
- Vital components nitrogen and phosporous can be taken from water in the best case



One solution

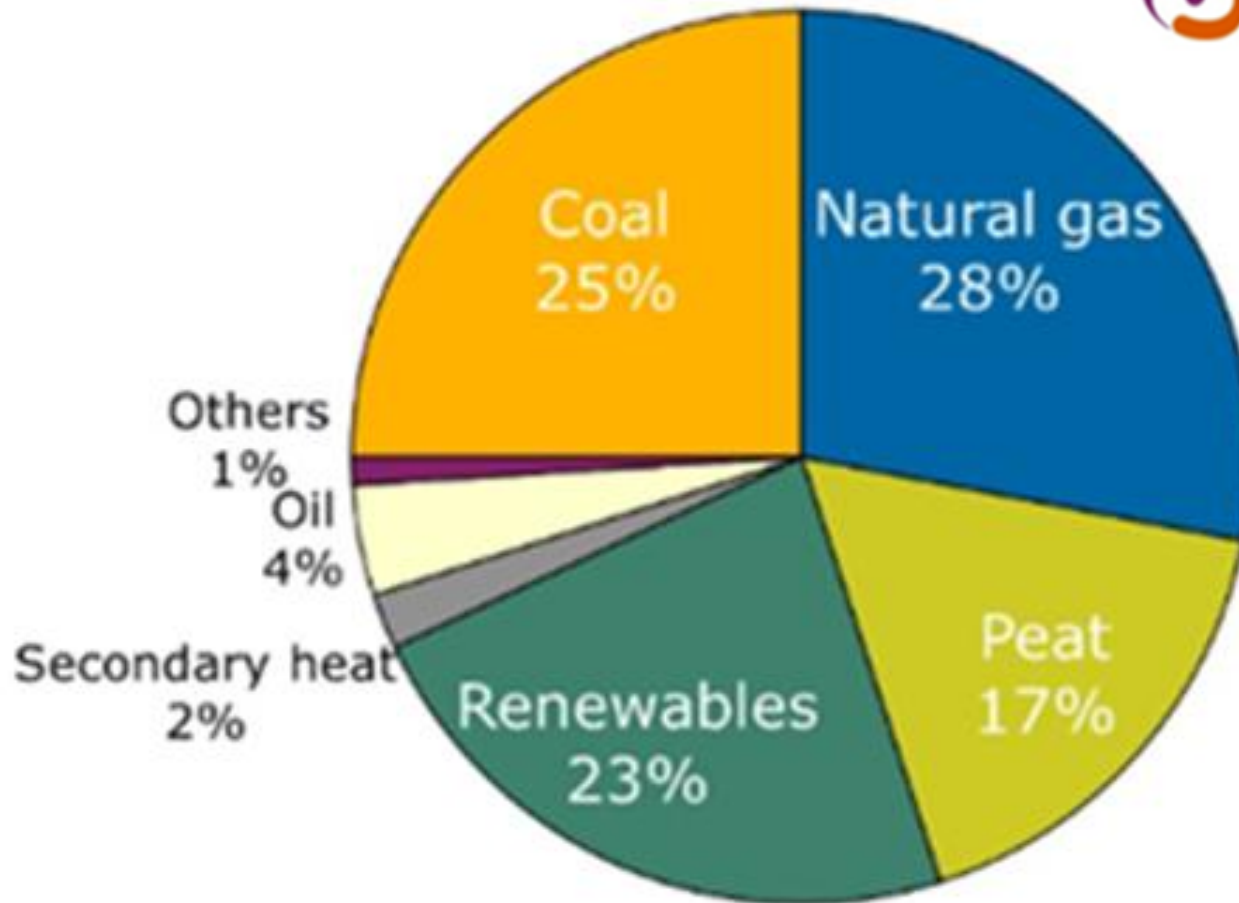


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Fuel consumption in production of district heat and CHP 2012

- fuel consumption 58,0 TWh



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Forestry is an important part of the solution to the climate problem

- Carbon storage can be increased, if especially fertilisation materials with lower carbon footprint are used to enhance fertilisation and that way increased the growth of the forest
- Sustainable production of renewable material and energy are achieved to increase with correct actions with the use of by-products
- Symbiotic materials to be used as affordable fertilisation material are needed to increase forest growth
- Some nutrients can be vital in longer perspective, even the ones now seen problematic (molybdenum)



Need

- Larger and in some cases mobile units are needed in order to get by-products into pelletized form in amounts required by the Directive 2006/12/EC
- More flexibility to production units and security for the investments done by SMEs on service business
- More flexibility to product variety
- Increased material usage in the new utilization model
- Fertilizers with better properties
- Nutrients removal from water and wastewater is needed
- Light stone material needed for several purposes and to combine materials sufficient properties are achieved



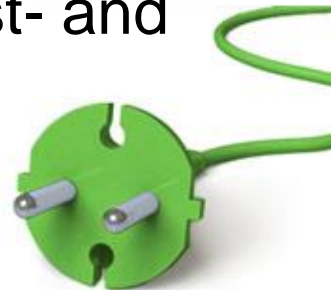
Approach

- Application of mobile, flexible (more silos and dosing equipment) and larger production units, with more variation possibilities in the products
- Utilizing the results of long-time studies concerning this research area, conducted by local and international research institutes and universities
- Several laboratories are participating in this multidisciplinary study, field testing will also be conducted
- Marketing benefits will be shown by LCA analysis
- Second generation products with added value will be developed, harnessing the principles of eco-, cost- and material efficiency



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Benefits

- The products are clearly more affordable than competing products made from primary raw materials
- Production unit sizes will be sufficient after this project, and there will be no further necessary need for enlargement in the future
- Logistics costs will decrease as production is available next to the raw materials
- Larger production units mean more R&D professionals working at the SMEs (the experts used are usually from outside the SMEs), and therefore, in the future, SMEs must hire more own R&D people to handle several difficult details
- A partial solution to the sustainable usage of phosphorus



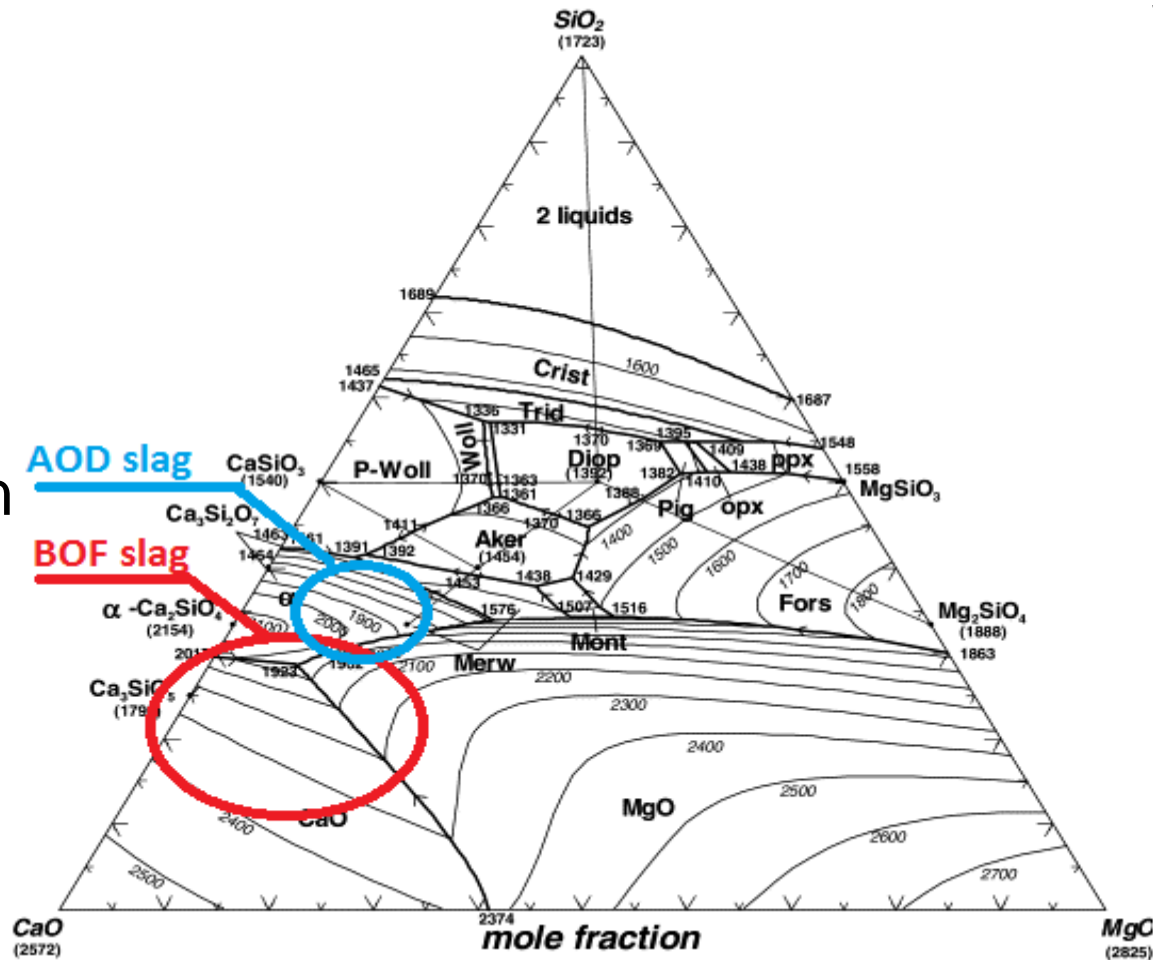
Competition

- Currently, there are no large and/or mobile granulation units available
- Larger size of production units are necessary from the economical point of view, and intensive research is required to point out the demand for this change
- There are similar needs across the whole Europe, and this Finnish project will demonstrate the benefits that could also be achieved with even larger production units
- Research will make the gap between the prices of by-product based products and primary raw material based products significant enough – markets will bloom



Slags usable for this need

- Also ladle slag from different producers
- Ladle slags are even more CaO rich to have benefits even more as considered for liming need

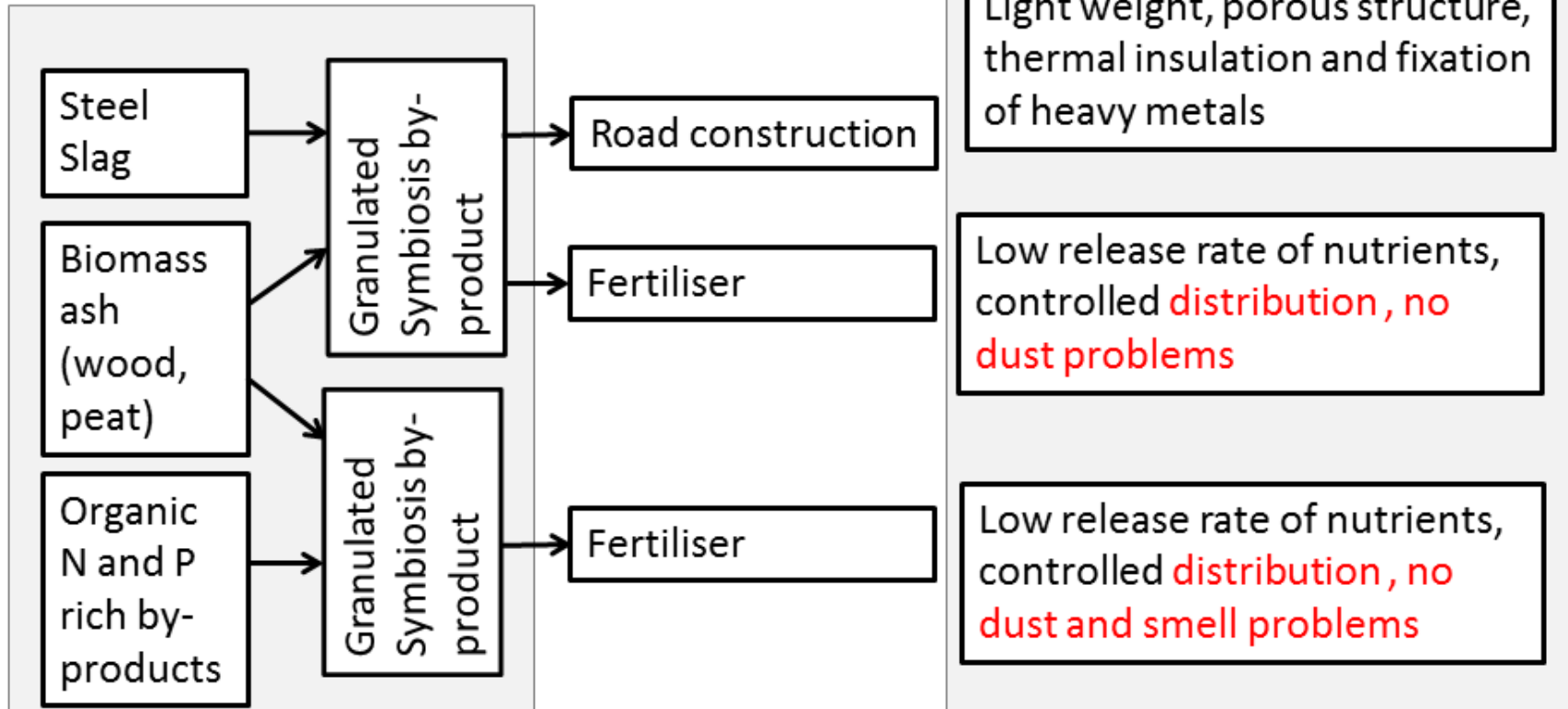


Symbiosis products

By-products

Intended
use

Advantage



Tested materials

For testing purposes pellets were made together with producer from Oulu region (Rakeistus Oy)

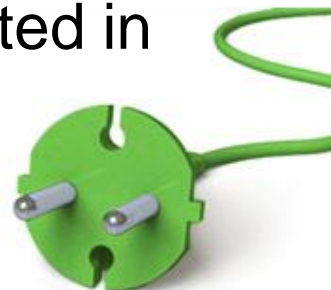


From left to right: bio-ash, steel slag and small- and large-sized symbiosis pellets containing bio-ash and slag.



1) Small-scale manufacturing tests of the symbiosis pellets

- The effect of the proportional composition (bio-ash/slag) of the symbiosis pellets
- The effect of granulation time
- The effect of certain additives (e.g. waste lime)
- The effect of water addition (volume added, method of addition) and its mixing efficiency
- Required drying time of the manufactured symbiosis pellets before use
- Results of these studies will be utilized and tested in pilot scale granulation



2) Properties of the symbiosis pellets

- Physicochemical properties such as:
 - pH, electrical conductivity, dry matter content, moisture content, total organic carbon (TOC), buffer capacity, liming capacity, specific surface area, particle size distribution, etc. These analytical methods are in common use in our research group and are described in detail in earlier publications
- Concentrations of easily soluble nutrients
 - Ca, Mg, Na, K, S, P, Mn, Cu, Zn, etc.
- Total concentrations of heavy metals
 - Cd, Cu, Pb, Cr, Zn, As, Ni, Hg, etc.



3) Application tests of the symbiosis pellets

- As a fertilizer material
- As an adsorbent material for water and wastewater treatment (and further usage as a fertilizer material)
- As a liming agent in soil remediation
- In road and building construction
- In concrete manufacture



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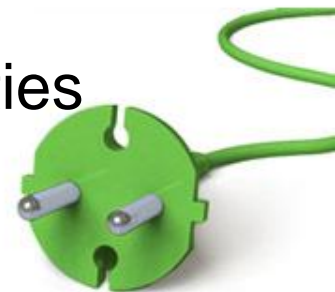


Conclusions

- Industrial symbiotic and pelletized products for fertilisation is preferred way to use by-products in forest cultivation
- SME companies are really needed to make this kind of utilisation reality as materials are needed from several producers
- Many times value chain and revenue generation model is preferring SME companies to serve several manufacturers of by-products
- First results seem to open new revenue possibilities



Picture: *Kaski* Eero Järnefelt year 1893



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Questions

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Picture: www.saminsavotta.fi & Nils-Olov Lindfors, Farmers Association of Norrbotten



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