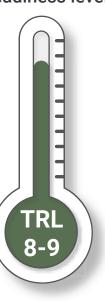


PRACTICE ABSTRACT Biorefinery process and methodology



Technology readiness level:



Target group

This is especially interesting for the stakeholders that want to replicate or seek inspiration in the Danish demonstration site to establish and operate green biorefineries. The main stakeholders are farming cooperatives and the farmers that deliver the grass. Larger renewable energy consortia and new food product developers also show interest.

Benefits and impact

The technology and processing methodology is already being implemented in commercial facilities around Denmark. The past three years two commercial sites have been attempting to adopt the technology and are constantly improving. New commercial activities will be started through a new Danish subsidy scheme. Aarhus University is helping with these activities to assure that the experiences and results are considered in the commercial implementation.

The intensive testing, optimisation, analysis and experience at scale (Demonstration scale- 10 ton/hr input) has moved the technology significantly towards commercial sustainability. The result provides significant de-risking of commercial implementation as commercial activities can build directly on the processing methodology, analysis and experiences.





Challenges

The green biorefinery process and the products that it produces makes an economic incentive for farmers to grow perennial grassland and get all the environmental benefits associated with this (reduced nutrient leaching, sustainable nitrogen fixation, reduced pesticide use, increased soil carbon and increased biomass production per area). The process yields local protein feed that substitutes soya meal import and reduces the environmental impact of animal feed. The process co-produces biogas or biomethane that converts into heat and power or substitutes natural gas.

Solution

The production process has been tested and validated at demo-scale for the production of grass/legume leaf protein concentrates for monogastric animal feed. The GO-GRASS Danish demo Green Biorefinery has optimised and demonstrated the processing and methodology for the production of a local protein concentrate, to substitute soya meal in monogastric feed formulations and valorisation of fibre press cake and brown juice for ruminant feed and biogas production.



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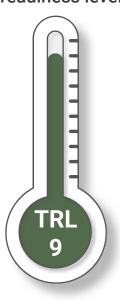




Business Plan Writer Tool



Technology readiness level:



Target group

Entrepreneurs, coaches, managers and company owners.

Benefits and impact

The G2G Business Plan Writer Tool is designed to provide an easy-to-follow structure that covers all relevant parts of a business model. By going through all the different parts of the tool, an entrepreneur can turn a conceptual business idea into a detailed and comprehensive business plan and assess the feasibility and credibility of their business strategy.

The budget module and the written business plan together can be used to steer a company's strategy and create a compelling narrative about the business perspective for meetings with business associates, investors, banks, or other financial organisations. This can significantly increase the chance of securing funding or receiving attractive investment opportunities.

We plan to continue using this tool in future EU projects and keep it open to all entrepreneurs who might benefit from it. Our goal is to help partners in future projects to better understand their business model and potentially grow their business.

The tool is open to the public upon registration at

g2g-tool.investornet.dk/

After the log-in page, the user will be greeted with an overview of business plans and their progress. The tool is self-guided, meaning that the user can go through the different sections and fill in the required details without external help or guidance.

The user has full control over who can get access to the information being uploaded. In this way, business-sensitive information can be kept confidential. To share the business plan offline, the user can save the data from the Writing Module as a PDF and the Budget Module in an Excel file.





Challenges

When entrepreneurs write a business plan, one of their main challenges is to ensure that they include all relevant elements in a structured and convincing way. It is important to describe all relevant issues connected to the elements in a business plan, address potential challenges, and substantiate key assumptions. However, this task can be complicated. Often, existing resources offer theoretical insights but lack practical guidelines and actionable steps to support the entrepreneur in converting their innovative idea into reality. Additionally, lack of "business history or lack of track record" is often an issue that young or recently founded companies must overcome, and a well-written, comprehensive business plan can potentially be a solution to that challenge.

Solution

The G2G Business Plan Writer Tool is an online platform that provides a comprehensive solution to business owners of all levels of expertise. It caters to both seasoned entrepreneurs as well as those with little to no prior experience in business plan writing. The tool is designed to help connect the various elements involved in starting a new business and offers quality feedback to users. By doing so, it provides basic support for the business plan writing process, helping entrepreneurs put their plans into action and turn their innovative ideas into reality. The tool offers three distinct components:

- Writing module: The module consists of 5 main areas divided into 25 elements. The writing element is essentially a field, where the user can add text. Each element has a short description, outlining what is needed to address, supporting illustration on the right and writing space on the left.
- Budget module: This module will allow the user to forecast 24 months + 5 years of cost and revenue, helping companies see potential liquidity challenges. Associated Profits and Loss, Balance Sheets and liquidity analysis are automatically calculated.
- Evaluation: Although it is an online tool, the evaluation process requires an evaluation by dedicated G2G consultants with relevant experience and qualifications. The evaluator scores the "completeness & quality" of each of the elements in the business plan.

With the unique combination of the Writing, Budgeting and Evaluation components, the G2G Business Plan Writer Tool offers a solution to develop a detailed business plan relevant to future partnerships, investors or soft funding.



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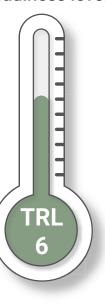




Roadside grass cleaning technology



Technology readiness level:



Target group

Owners of roadside grass, National- regional governmental organisations like Rijkswaterstaat and municipalities. Other key stakeholders are contractors who do the actual harvesting of the roadside grass and process it, organisations that will produce the grass cellulose based on roadside grass.

Benefits and impact

The technology is cleaning the roadside grass in such a way that it can be used to produce grass paper. There was no technology that can realise this good enough until now. It makes high value application of roadside grass possible.

Step 1: Preventing collecting roadside pollution during harvesting. An external company developed a machine with a mowing head for clean harvesting. The mowing head deposits the grass into a bin and from there it is sucked into a loading trolley. In this way sand and lower pollution is not harvested.

Step 2: The harvested grass is spread on a conveyor band. A vision camera is used and an algorithm that is trained, from a large database with pictures of pollution, to recognise the pollution and giving a signal to the mechanical removal device to separate it from the grass that enters the digester.

The cleaning technology is extensively tested by ACRRES. The resulting grass will be used in the production technology. The produced cellulose fibres will be tested in grass paper production.



Challenges

The main problem is the waste status of roadside grass in the Netherlands. It is important to make a waste product fit as raw material to produce grass cellulose fibres to substitute wood cellulose in paper production. Current solutions are to pick manually the pollution from the grass at a conveyor band.

Solution

The cleaning of roadside grass entails 2 steps: Step 1 is done during the harvesting. The road-side grass is mowed and directly separated from the soil. A suction wagon collects the road-side grass without collecting sand and deep laying pollution. Step 2 is implemented just before the digestion. Pollution is recognised by vision cameras and removed mechanically from the grass. The waste status of roadside grass will be lifted to the status 'Extended use'.



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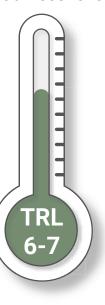




Grass cellulose fibres



Technology readiness level:



Target group

Schut papier, other paper factories, users of fibre material (pots for growing flowers, vegetables etc). Sustainability-minded customers, most likely for graphical and packaging applications.

Benefits and impact

Together with Schut papier, HB and ACRRES are conducting large scale tests to produce paper with different percentages of substitution of wood cellulose, turning a low/waste quality grass product into a high value paper or carton product.

The goal is to make paper from grass sourced fibres with as much as possible substitution of wood-based cellulose. The Dutch demonstration site aims to produce a more sustainable fibre to be used as ingredient for paper by using a low-quality feedstock as a fibre source, such as roadside grass.





Challenges

Currently, almost all paper is produced from either virgin wood-based cellulose or recycled paper. The Dutch demo site aims to source raw materials locally by sourcing cellulose from grass, thus reducing the need to import cellulose and cutting of trees. While dry grass particles are already used as a raw material occasionally at Schut Papier, it is merely added as a decorative 'filler' to the paper pulp. It does not 'bond' with the other fibres like cellulose and is still coloured.

Solution

The demonstration site developed cellulose fibres that have enough strength and a good dewatering capacity at the same time allowing an economic feasible large scale paper production. When this is not feasible still niche markets remain. Preferably the produced bio-based paper and packaging products should allow a high appeal to buyers and a reduced carbon footprint.



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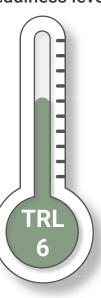




Process for manufacturing grass cellulose to substitute wood cellulose in paper products



Technology readiness level:



Target group

- Manufacturers of production technology for the bio-based sector.
- Companies in the business of collecting and processing biomass.
- Clients of <u>Schut papier</u> or other paper companies that want to strengthen sustainability by using biobased material in their product like printing companies, designers of packaging material.
- Local/regional authorities, rural communities and nature organisations that want to keep in charge of collecting and treating their own biomass

Benefits and impact

Paper made with wood fibres has more environmental impact. By replacing part of it with grass fibres we help reduce the environmental impact of the paper industry, we reduce the cost of producing paper and it has a high versatility to develop different kind of paper products (tissue paper, carboard and newsprint.) The innovative process developed for utilising grass fibres in papermaking may have applications beyond the paper industry.

The knowledge, techniques, and technology can potentially be transferred to other markets, such as packaging, textiles, or biodegradable materials, thereby expanding the impact and commercial potential of the project. The carbon footprint is at least 10 times lower than wood cellulose.



Grass paper products

Description

The digestion technology used in the Dutch demonstration site is well-known. The process variables for the digester have been developed, and the process for extracting the grass fibres from the digestate is new. The different process steps need further upscaling and development to increase the fibre production. This is also necessary to realise a positive business case.





Challenges

The process is creating a high value for a low quality/waste product, fostering the substitution of wood cellulose in the paper industry, diminishing cutting of trees, and improving the carbon footprint of paper. Until now digesting of grass in Europe has not focused on producing grass-based cellulose for the papermaking industry. The focus was mainly on biogas production.

The current challenge in utilising grass fibres for papermaking lies in achieving the necessary removal of lignin while ensuring that the resulting fibres possess the desired fibrillating properties and exhibit effective dewatering behaviour. It is crucial to achieve these outcomes without the presence of sugars and protein in the fibres. The project aims to overcome the limitations associated with the lignin of grass fibres, allowing their effective utilisation in the papermaking process. The successful lignin removal, combined with desired fibrillating and dewatering characteristics, is essential for producing high-quality paper products from grass cellulose fibres.

Solution

The production technology for grass cellulose is a batch process. It starts with a dry digester and deploys several following steps to isolate and upgrade the grass fibres. The main innovation is the production process represented by the following order of the different process steps and the relevant process variables. The main innovations in the project lie in its scalable process, the use of grass fibres as a novel material, the potential for transferability to other markets, and the tailored applications for specific conditions. Grass-based paper products can offer comparable or superior properties in terms of strength, printability, and recyclability compared to conventional paper products.



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How to get started and succeed abstract manual



Technology readiness level:



Target group

Entrepreneurial sector, advisory and coaching sector, and regional representatives.

Benefits and impact

The purpose of the manual is not to provide detail, but rather to give a comprehensive overview of the different elements and their connection in converting ideas to successful businesses. After the description of each main category, actionable items are listed, summarising the key learnings and listing specific steps to be done. In the last chapter further information is provided about different tools which will be available within the GO-GRASS project. It can be a useful addition to the toolbox of rural entrepreneurs and coaches or advisors and thus help improve the quality of business plans in the future. The manual can also be used as a supplementary document in using the Business Plan Writer Tool, as they follow the same five elements around business planning.

This document aims to provide an easily accessible guide to start converting your innovative ideas into a successful business with or without an adviser. The tool is available **here (PDF)**.

Challenges

There are various resources detailing the elements and complexity of business modelling. The "How to get started and succeed manual" aims to collect the most relevant sections for business planning and provide an easy-to-navigate document for entrepreneurs and advisors, making sure that the most relevant and important aspects of a business plan are covered.

Solution

The origins of business ideas vary but the actions and efforts to convert the ideas into concrete business ventures still have a lot of common denominators. Common elements have been identified in how business ideas come to life and which resources are needed to convert the idea into a business. The key elements can be summarised into the five pillars of creating a business plan. These are:

- Business model, Sales and Marketing partners
- Customers, Customer needs, Markets
- Product, Competition, Production and Key Resources
- Make it all work, Management
- Budget, Funding and Investors

The structure of the manual aims to first provide the right knowledge, secondly, describe actionable steps to do and lastly to give an overview to additional tools to be developed in the project which could help the reader to turn the business idea into reality.

www.go-grass.eu in ②

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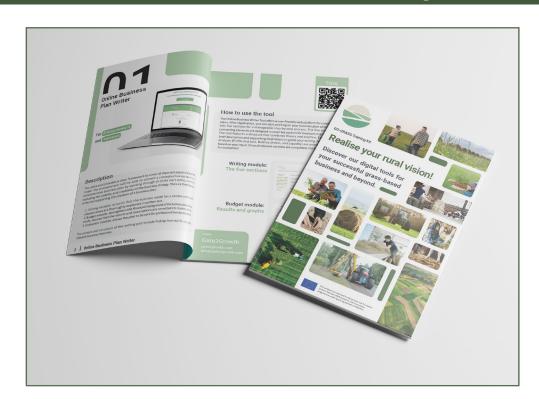
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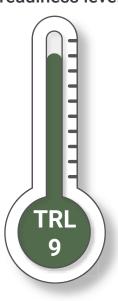




GO-GRASS Training Kit



Technology readiness level:



Target group

Entrepreneurs, multipliers, advisors, and stakeholders in the bioeconomy sector.

Benefits and impact

Looking ahead, we believe that this Training Kit holds significant potential for post-project training and capacity-building activities. Stakeholders, trainers, entrepreneurs, and regions engaging and further disseminating this material contribute to a more sustainable and resilient future for grassland regions in Europe.

The <u>Training Kit</u> is available on the GO-GRASS website. Contact information about the tool developers is presented under each section, together with a QR code navigating the reader to the location of the tools.

Challenges

Significant effort has been directed towards the development of various support tools in the GO-GRASS project. However, interested entrepreneurs, coaches or regional representatives could have a difficult time finding an overview and selecting relevant resources and tools to use. The Training Kit introduces nine tools developed in the GO-GRASS project as factsheets, supporting rural entrepreneurs and stakeholders in the grass-based bioeconomy.

Solution

The Training Kit is thought of as a collection of the tools and resources developed in the project in a reduced form to help entrepreneurs, multipliers, or advisors with the training activities towards potential replication of project results. Whether the user is a rural entrepreneur, municipality representative, stakeholder, or trainer, these tools are tailored to guide you through exploring, understanding, and replicating the circular grass-based business models developed by the GO-GRASS consortium. The goal is to help understand how to make the most of grasslands in a way that benefits both the environment and local economies. The Training Kit is designed as a booklet, each tool is presented as a spread. It can be used in a digital or printed format.



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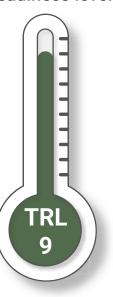




Online platform and interactive maps



Technology readiness level:



Target group

Grass-based businesses, researchers, rural development agencies, planning authorities, rural advisors.

Benefits and impact

The knowledge centre and the interactive maps provide diverse resources regarding favourable conditions to exploit the untapped potential of grasslands in different countries and regions. Researchers and rural entrepreneurs will be reusing the GO-GRASS good practices, training resources and interactive maps of Europe, displaying key stakeholders, relevant data related to grassland and the replication of innovative business models.

The user-friendly interactive maps of Europe are displaying data and GO-GRASS resources about grassland type and availability. Users can explore the state of development of the biobased sectors in their countries, find partners and be visible on the stakeholder map. On the stakeholder map, users can find their next partners and discover innovative grass-based businesses. Through a short form, grass-based businesses and entrepreneurs can upload their data (address, name of the company, website, services and products, type of grass/raw materials) and be visible on the **stakeholders' map**. The maps are available on the knowledge centre.

The **knowledge centre** provides diverse resources regarding favourable conditions to exploit the untapped potential of grasslands in Europe. It provides good practices, multimedia materials, infographics, training resources and interactive maps of Europe, displaying key stakeholders, relevant data related to grassland and the replication of innovative business models.

Challenges

The uniqueness of the tool lies in transforming complex grassland data in an easy-to-use way and thus helping business assess their viability with grass-based ideas.

Solution

On the online interactive maps, users can get access to data about grassland type and availability, socio-economic conditions, and livestock across Europe and explore the potential of grass-based business models in different regions and countries. On the stakeholder map, users can find their next partners and discover innovative grass-based businesses. The type of stakeholders is colour-coded and placed on the map. By clicking on the stakeholder, users can see additional information, such as website, service and address.



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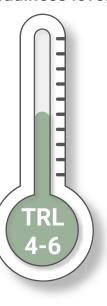




Biochar from grass



Technology readiness level:



Target group

Rural farmers, agricultural industry, policymakers, feed industry, rural communities, entrepreneurs, machinery company, and local authorities could be interested. Biochar is a high value product with a multitude of applications. Its potential to provide a carbon sink will make biochar of interest for all entities with the goal to achieve climate neutrality.

Benefits and impact

The process generates substantial amounts of heat which can be used on the farm. When applied to soil it can generate a carbon sink and carbon credits on the voluntary market. Biochar from grass can be registered as an EU fertilising product.

The project focuses on the usage of late harvested grass from the Lower Oder Valley National Park. At harvest time the grown biomass is heterogeneous, highly lignified, and low in nutrients and has a low value as feed or substrate for biogas plants. Therefore, the focus is placed on the production of biochar from the late harvest grass. The aim is to produce biochar and use it as soil amendment. Before spreading, the char particles are charged with water and nutrients. The farmers can expect a higher or more stable yield with the help of a material that would have otherwise a low value.





Challenges

Extensively grown and ecologically beneficial harvested grasslands provide a large amount of biomass with very limited value and limited potential for agricultural utilisation. At the same time, the intensive utilisation of agricultural soils poses a multitude of challenges, including the reduction of soil organic matter, or leaching and loss of nutrients, particularly on low quality soils. Providing economic utilisation of high nature value grasslands while at the same time increasing soil quality, are the main challenges to be addressed.

Solution

The production of biochar from surplus grass and its utilisation in agricultural soils can provide economic incentives for the maintenance of high nature value grasslands and enhance agricultural soils through the addition of biochar. Before the addition to the soil biochar application in barns may reduce the pain of bad odour and increase animal welfare. When added to the composting process it can reduce greenhouse gas emissions. Subsequently, it acts as a supplement for organic fertilisation of adjacent agricultural fields, characterised by sandy soils, low nutrients content and water holding capacity. Biochar will increase the water holding capacity, the nutrient retention as well as soil microbial activity. The high content of inorganic material may have beneficial long-term effects. With the biochar carbon is fixed in soil, and carbon credits can be generated on the voluntary market. Additionally, the large amounts of energy released during the production process may substitute fossil fuels.

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Local, heat treated, quality assured reed canary grass animal bedding



Technology readiness level:



Target group

Customers are owners of stables, farms and animals such as horses, cattle, cows, pigs and poultry, schools of agriculture, greenhouses, soil producers and also some small pet keepers. Companies with greenhouses and production of soil are more and more interested in the material since they look for alternatives to peat. Tests have shown that reed canary grass can replace and decrease the use of peat and therefore benefit climate.

Benefits and impact

The cultivation of reed canary grass can contribute to achieving environmental and climate goals since this energy efficient crop harvested dry in springtime, can supply ecosystem services, store carbon in the big root system and thereby create carbon sinks. The processed bedding material mixed with manure will raise the value of the manure and increase circularity. In particular, horse manure is often not used due to the high content of wooden material which consumes nitrogen when decomposing. The use of Klimatströ to replace peat for climate reasons will involve new stakeholders such as greenhouses and soil producers. Also benefits such as new jobs, local self-support, strengthened preparedness at crisis and local economy are important.

A whole value chain suitable for small scale farm production has been developed. Reed canary grass is processed to a heat treated, quality secured and compressed product, suitable for multiple use for the local customers both as bedding material, peat substitution in soil, and as biofuel. The key equipment in the process is a screw press, a briquetting machine adapted for straw which is complemented with technique for shredding, dedusting, packaging, guidance and supervision. The product called "Klimatströ" in Sweden works well in stables and barns, and it can be ordered directly from the producer. Information about the product is available at **this Swedish website**.





Challenges

In Sweden large volumes of wood shavings and sawdust are used as animal bedding in stables and barns, which worsen the value of the manure and obstruct circularity. Wood shavings are less degradable, so they are a problem for digesting manure obtained from farms. The main pains at Swedish countryside are closure of farms due to unprofitability, lack of generation shifts (younger farmers and entrepreneurs), lack of local produced bedding material and abandoned arable land.

Solution

By replacing the wood materials with straw or reed canary grass in the form of shredded briquettes, there is a range of benefits, both for animal welfare, animal-keepers saving time and climate regarding carbon capture and recirculation of nutrients. The cultivation of reed canary grass and processing this grass into bedding material can create new incomes and add value to farms, ecosystem, countryside and municipalities. Reed canary grass bedding mixed with manure will result in higher efficiency in the biogas process, as fertiliser and contribute to increase circularity. The shredded straw briquette is easy to handle, it saves time and provides a soft, stable and dust free bed for animals like horses, pigs, poultry and cattle. It is heat treated which eliminates bacteria and mould spores, is delivered compressed and requires little storage space, and it benefits the nutrient supply, carbon capture and humus content in the field. Reed canary grass enables the use of abandoned land in combination with carbon sequestration. Continual efforts of cost reducing activities together with adapted marketing, sales and distribution will make the production profitable.



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