

Success Stories of Advanced Biofuels for Transport

LANTMÄNNEN AGROETANOL

Year of plant start-up:	2001, updated 2008
Location:	Norrköping, Sweden
Technology:	Lantmännen Agroetanol is one of the largest biorefineries in the Nordic region and part of Lantmännen. We mainly refine grain at our plant, but also other raw materials such as residuals from the food industry.
Plant capacity:	<p>Ethanol: Agroetanol has capacity for over 200,000 m³ ethanol annually. Part of it becomes biofuel and some of this volume is used in other applications.</p> <ul style="list-style-type: none">• Agro Cleanpower ED95: 90% CO₂ reduction makes Agro Cleanpower ED95 one of the world's most sustainable fuels. We supply Agro Cleanpower 95 as a ready-to-use fuel to bus operators and truck haulage companies.• Agro Cleanpower E85: Using E85 instead of petrol is by far the easiest way to reduce your carbon footprint – up to 70% carbon dioxide reduction with Agro Cleanpower E85. There are currently over 200,000 registered cars in Sweden that can run on E85, known as 'flex-fuel' cars and 1,700 public E85 pumps.• E10 for low-blend: Almost all petrol sold in Sweden now has 5% ethanol added. The blend should be increased to 10% (E10) in a few year time, just like it has been done in e.g. Belgium and Finland. <p>Feed/Protein: Our refining process converts the starch portion of grain into ethanol. We separate the protein into stillage, which is used to produce DDGS, an animal protein feed. That means that we cycle back some of the raw material back to the farms and the food chain and finally the plant nutrients to the fields in the manure. Our protein feed has a high protein content, is GMO-free, has high climate performance and the raw materials are locally produced, avoiding the need for imports from far-away countries such as soy. This is positive for the EU, because there is a massive shortage of protein in the EU and a heavy-reliance on protein imports.</p> <ul style="list-style-type: none">• Agrow Feed 90: Our main product is Agrow Feed™ 90, a tasty protein feed containing 30-35% protein depending on seasonal variations. The product is dried and pelleted (6 mm). <p>Carbon dioxide: the grain fermented in our biorefinery releases a carbon dioxide. Still, since carbon dioxide is part of the natural cycle, nothing is added to atmosphere. In our case, however, we capture it and deliver it directly via pipes to our next-door neighbour, AGA-Linde, who liquefy it into carbonic acid. In this way,</p>

	<p>we are not only the largest producer of ethanol and protein animal feed, but also the largest supplier of green CO₂/carbonic acid in Sweden. That's enough bubbles to fill every carbonated beverage sold throughout the country.</p> <ul style="list-style-type: none"> • Carbonic acid for foods: In addition to all the regular bottled carbonated beverages found in stores, carbonic acid is also often added directly to drinks in restaurants and bars. • Industrial applications for carbon dioxide: Carbon dioxide is also common as a refrigerant in the food industry, both in the packaging of goods and for transport. It is also used in fire extinguishers and in the paper pulp production process. <p>Replacing all fossil carbon dioxide currently in use with clean, green carbon dioxide is an important part of the transition to a sustainable society.</p>
Operational experience achieved:	More than 3,700 million m ³ ethanol produced.
Total Capital Expenditure:	More than € 200 million.
Principle feedstocks:	We mainly refine grain (wheat) at our plant, but also other raw materials such as residuals from the food industry and bread returns from food retailers.
Feedstock Capacity:	About 80 ton/h. The raw materials are mainly domestic. The majority is wheat and other grains, but recycled products and industrial residues from the food industry are also used.
Products/markets:	<p>Our refining process yields three main products – ethanol, protein and carbon dioxide. We process each of these into sustainable products such as transport fuel, animal feed and carbonic acid. Our ethanol for example reduces the GHG emissions by more than 90% compared to fossil fuels, making it one of the most sustainable fuels in the world.</p> <p>See the below image for a full overview of the by-products.</p>
Technology Readiness Level (TRL):	TRL 9 – actual system proven in operational environment

DESCRIPTION

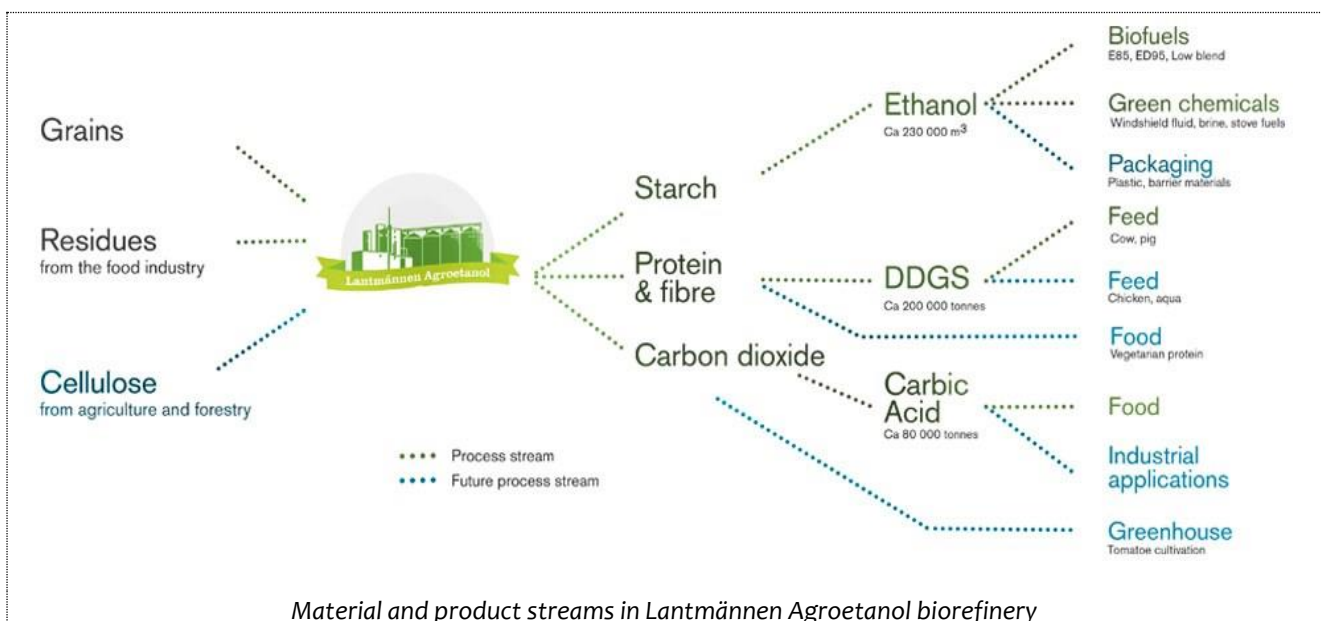
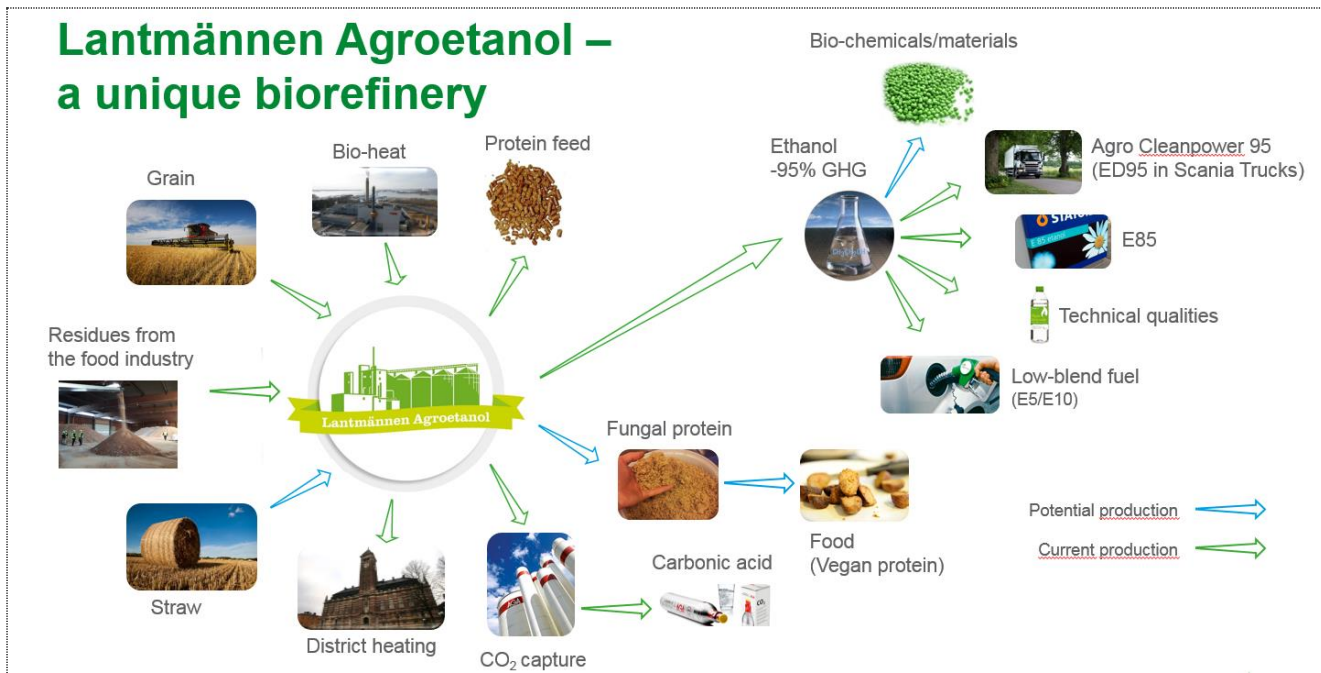
Lantmännen Agroetanol helps find solutions for a more sustainable society. We take care of nearly everything in our ingredients and create value at multiple levels. Our ethanol replaces fossil oil, whether in fuels, chemical products or in a future plastic.

Since 2001, we have produced fuel ethanol at our plant in South-Eastern Sweden based on wheat and other grains as well as residues from the food industry. Thanks to efficient processes, the use of renewable process energy from adjacent biomass-fuelled CHP and important co-products in the form of protein-rich feed and biogas, the fuel ethanol produced reduces GHG emissions by more than 90% compared to fossil fuels.

Our feed products are high-grade protein to replace soya which otherwise would be imported, mainly from the

other side of the world. What we can offer instead is a viable protein locally grown and produced with only short transportation required as a result. Finally, the CO₂ formed during fermentation is captured and converted into clean and green carbonic acid to replace the fossil-produced version. Who would not prefer to drink mineral water with green bubbles rather than fossil fuel-produced?

Our innovation-driven organisation constantly seeks new solutions in order to lead the way into a green future. Free from all that is fossil fuel produced.



Stakeholders involved:

Lantmännen Agroetanol is part of Lantmännen, an agricultural cooperative owned by 25,000 Swedish farmers, with operations throughout the entire value chain from farm to fork. Thus, it involves a range of actors and stakeholders in the agriculture sector.

Agroetanol is part of Händelö Eco industrial park. Besides Agroetanol, E.ON, which has a combined heat and power plant delivering steam, electricity and heat from renewable raw materials is part of this, but also Svensk Biogas, a biomethane company and the city of Norrköping. Händelö Eco Industrial park is a part of the natural cycle of city, industry and agriculture.

Financing Support:

As an agriculture cooperative, we are owned by virtually all active farmers in Sweden. Our Agroetanol business has sales of around 1.7 billion Swedish kronor and approximately 90 employees.

All investments have been 100% financed by Lantmännen.

Blending mandates, especially GHG reduction quotas in European countries, and tax exemption for high blend biofuels.

Contribution to Sustainable Development Goals:

Our Agroetanol business contributes to a number of the UN's Sustainable Development Goals, namely:

- **SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.** By producing vital by-products like protein through our biorefinery operation, a scarce resource in Europe, we are helping achieve food security for Europeans.
- **SDG 7/ SDG 12/ 13: Ensure access to affordable, reliable, sustainable and modern energy for all. Ensure sustainable consumption and production patterns. Take urgent action to combat climate change and its impacts.** Our highly sustainable, crop-based bioethanol provides Europe with access to a green, available fuel which dramatically reduced CO₂ emissions compared to fossil fuels.
- **SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.** Our biorefinery is providing jobs for local people in Sweden, as well as supporting Europe's farmers who supply us with the grains, which in-turn provides them with stable income at a time when traditional farming costs lead to many farms closing across Europe.

Contribution to GHG emission reduction in transports:

In our biorefinery Lantmännen Agroetanol produces sustainable ethanol with over 90% GHG savings, we're not only contributing but beating the EU's GHG emission reductions targets for the Union as well as for transport.

The fossil diesel in heavy goods vehicles have so far been difficult to replace at any scale, but ED95 in Scania trucks can be used to reduce the GHG emissions significantly.

Employment:

Approximately 130 jobs directly plus the farming sector and downstream industries which largely depend on our products. We estimate the total employment in the whole value-chain (field to ethanol) to approximately 500 jobs.

Replicability and scale-up potential:

The scale-up potential at local and regional level is low, medium at national level and high at international level. However, the international trend in biofuel policy is to disincentive all crop-based fuels independent of life cycle environmental performance. This leads to significant political risk pertaining to replicability and scale-up. Still, we are about to scale-up the use of food industry residues and continuously increase the GHG savings per liter of ethanol.

Success factors:

Policy-driven market demand for biofuels with substantial GHG emission potential will help the EU meet its climate objectives, helping to protect our environment.

Constraints:

For more biorefineries to exist and be economically viable, we need long-term policies from the European Union and the member states that provide investor certainty and allow for market development. What's more, we want to see more policy actions which encourage the transition from fossil-fuels to greener energy alternatives like bioethanol – this could mean providing fiscal incentives (e.g. double counting for biofuel crops) to help create a level-playing field for sustainable, renewable fuels against cheap, dirtier fossil fuels.



Info provided by: Alarik Sandrup, Director Public and Regulatory Affairs

More information: <https://www.lantmannenagroetanol.se/en/>
<https://www.lantmannenagroetanol.se/en/produkter/etanol/ed95/>



The ART Fuels Forum brings together 100 experts and leaders representing the alternative transportation fuels Industry to facilitate discussions, elaborate common positions on policy issues and identify market penetration opportunities and barriers for these fuels. The Forum is established and financed by the European Commission under the project name “Support for alternative and renewable liquid and gaseous fuels forum (policy and market issues)”.

www.artfuelsforum.eu