

ESTONIA

Farm's performance, restructuring & modernisation

Location

Tsirgumäe, Valga county

Programming period

2014 – 2020

Priority

P2 – Competitiveness

Measure

M16 - Cooperation

Funding (EUR)

Total budget 387 295

EAFRD 287 088

National/Regional 61 318

Private 38 889

Project duration

2015 – 2018

Project promoter

KOIVAKONNU Ltd

Contact

innovatsioon@koivakonnu.ee

Website

<https://farmforfuture.com/en/>

A cooperative venture to develop a new generation energy efficient, thermo-regulated, shed for cattle housing.

Summary

In cattle breeding, the farmer usually keeps weaned young animals for more than one winter. In Estonia, due to the climatic conditions during the winter period, a significant part of the young calves feed is used to regulate their body temperature. This results in lower growth, whilst the animals release the same amount of greenhouse gases they would during normal growth.



A collaboration was set up between an organic cattle farm, a university and agricultural experts to look for possible solutions. During the project, various energy and resource efficient architectural and engineering options were combined with high-tech green technology and mechatronic systems, to find the best structural and technical solution. This included various analyses, simulations, computational models and tests.

Results

The outcome of this project was the concept 'TARK LAUT' which is a design for raising cattle in an optimal microclimate.

Thanks to the new design more kilos of beef are produced for each kilogram of methane produced by a bovine animal.

TARK LAUT has optimised the design and outside coating for the building, to capture plenty of daylight in wintertime and catches up to 80% of sunlight in the summer (850 W/m²).

In the winter, the 500 m² building keeps the animals warm, fed, hydrated and lit, while only using 700 kw/h of net energy (around EUR 70 per month). In the summer, the building dries 100 tonnes of hay within 48 hours by using 200 kw/h of net energy (around EUR 20 for 24 hours).

Context

In cattle breeding, the farmer usually keeps weaned young animals for more than one winter. In Estonia, due to the climatic conditions during the winter period, a significant part of the animal's feed is used to regulate its body temperature, causing sub-optimal growth. At the same time, the animals' digestive activity releases the same amount of greenhouse gases as they would during normal growth.

Aside from low temperatures, the second major problem with the typical cold barns (including walk-in barns) is the lack of direct sunlight. Sunlight is needed for the animals to produce vitamin D. Without sunlight animals often develop dermatological and metabolic disorders, aggravated by the rapid wetting of bedding and humid environment caused by condensation and inefficient air circulation.

Traditional cattle breeding barns have a structural design that do not take the welfare of the animals or caretakers into account. During the summer months, barns are underutilised when the animals are grazing outside.

Objectives

The objective of the project was to improve the winter housing conditions for beef cattle (especially weaned young animals) with an innovative design concept for cattle housing. The new concept would help to increase the economic performance, competitiveness and profitability of beef cattle farmers. This would happen through the increased mass gained by the animals in the winter, thereby making beef cattle farming more environmentally effective through increased productivity.

Activities

In the course of the project, the Koivakonnu organic cattle farm cooperated with the Intelligent Materials and Systems (IMS) Lab of the Institute of Technology of University of Tartu, and created an innovative energy-efficient thermo-regulated design concept for cattle housing, operating using renewable energy (TARK LAUT - Smart Livestock Housing).

The main problems to be solved were how to ensure the following for the animals, during the winter period in a sustainable and economically viable way:

- a. optimum temperature, so that the animals will use as little of the energy from their feed to regulate their body temperature;
- b. as much sunlight as possible to prevent animals from developing skin diseases and metabolic disorders;

- c. efficient air circulation to prevent condensation, which can spread of pathogens; and
- d. good working conditions for the farm workers, by increasing the convenience of changing the bedding, handling and feeding the animals.

During the project, various energy and resource efficient architectural and engineering options were combined with high-tech green technology and mechatronic systems to find the best structural-technical solution. This included various analyses, simulations, computational models, and tests. Different specialists and researchers from various universities in Estonia were consulted and reviewed the proposed solution.

Main results

TARK LAUT makes beef cattle farming more environmentally effective through increased productivity. More kilos of beef are produced for each kilogram of methane produced by a bovine animal. The airtight building is integrated with cost-efficient future smart ventilation solutions that would lower the greenhouse gas levels released from the building.

TARK LAUT optimised the shape and outer coating of the building, that enhances the well-being of the animals, by allowing them plenty of daylight in the wintertime and catches up to 80% of sunlight in the summer (that is 850 W/m²). This allows the farmer to earn additional income, since he can use the building for growing high value by-products, or for producing dry hay.

The energy efficient building makes full use of solar energy. In the winter, the 500 m² building keeps the animals warm, fed, hydrated, and lit, while only using 700 kw/h of net energy (around EUR 70 per month). In the summer, the building dries 100 tonnes of hay within 48 hours by using 200 kw/h of net energy (around EUR 20 for 24 hours). By optimising the production processes one can autonomously produce all the electricity and heat energy needed for the building.

The air in the building is always fresh. The smart ventilation system comes with a heat recovery unit and guarantees an optimal microclimate for the animals throughout winter. In the summer, the ventilation system breathes in more than 100 000 m³/h of air even in the dull Estonian climate conditions, while using almost only passive energy.

The farmer can raise the temperature above 60°C in the thermo-regulated building. This enables the manure to be handled in a novel way and to sterilise the building after emptying it. The combination of high temperature and UV-light effectively kills the dangerous pathogens in the building.