Source: Valio

The solution

The CANMILK project is developing an innovative technology based on non-thermal plasma which will help farms to cut down methane emissions.

The CANMILK system will be simple, safe and low maintenance, with a feasible overall cost. Its design considers the ventilation system and overall operating conditions of barns, so that it will be easily integrated to existing barn infrastructures.

Overall, the project will raise awareness of environmental solutions available for the reduction of non-CO_2 greenhouse gas emissions from dairy and meat farms.

Consortium partners

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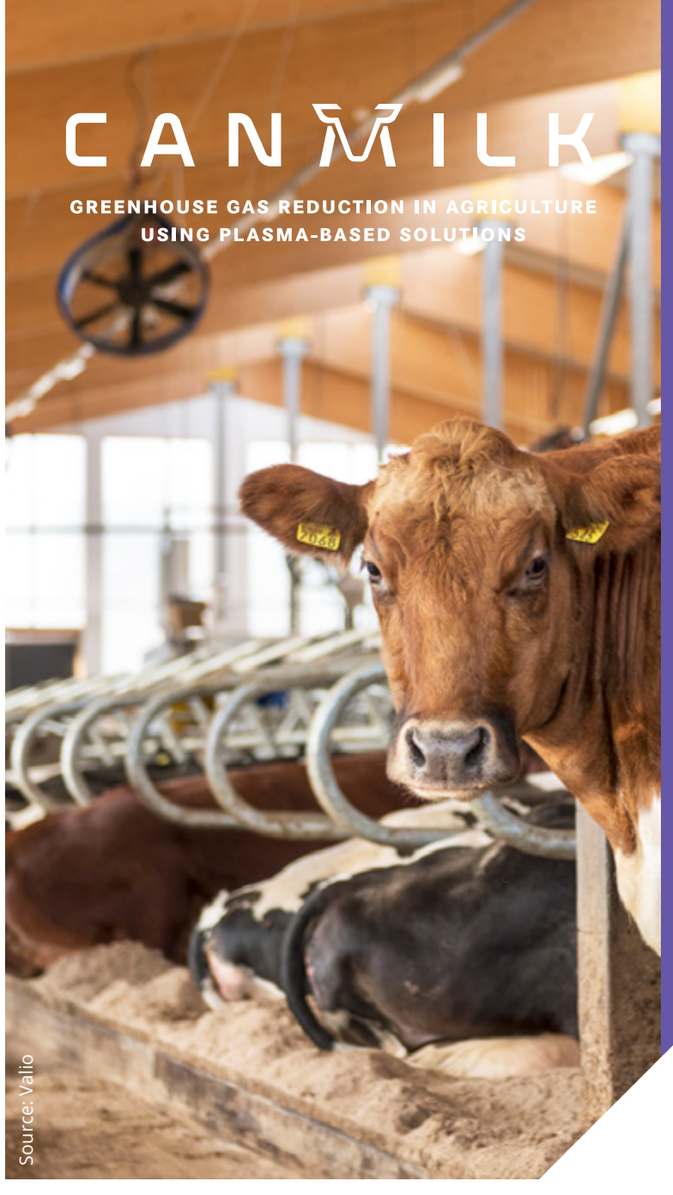
CANMILK Project

@CANMILK_project

CANMILK

GREENHOUSE GAS REDUCTION IN AGRICULTURE USING PLASMA-BASED SOLUTIONS



Source: Valio

Funded by the European Union

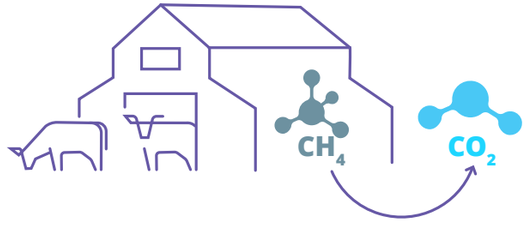
About CANMILK

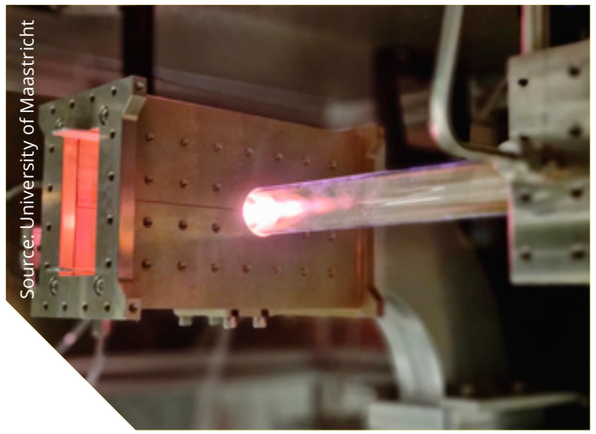
Background

Agriculture accounts for about 10% of total greenhouse gas emissions at European level. A significant proportion of these (around 54%) is methane, most of which is produced by rumination and belching by cattle. In the EU there are around 77 million cows on 1.8 million cattle farms. Each of these is a tiny point source of highly dilute methane, but the combined contribution reaches to total 158 MT CO_2 equivalent of methane emissions annually.

Methane (CH_4) is 84 times more potent than carbon dioxide (CO_2) in heating up the Earth on a 20-year timescale. Policies and technologies aiming to reduce CH_4 emissions will deliver benefits in terms of climate mitigation rapidly and in the short term. Turning methane into carbon dioxide therefore helps to slow down global warming.

The challenge in the methane reduction from barns is the highly diluted concentration of the methane, which is far too low for traditional combustion technologies to be feasible.




Source: University of Maastricht

CANMILK concepts and approach

CANMILK will convert low concentration of methane into less harmful products, by means of plasma technology.

Plasma activation

CH_4 conversion will be studied by a combination of plasma experiments and modeling. Oxygen (O_2) plasma produces reactive oxygen species (O atoms, oxygen excited species and various ions). Hydrogen (H_2) plasma produces H atoms and ions.

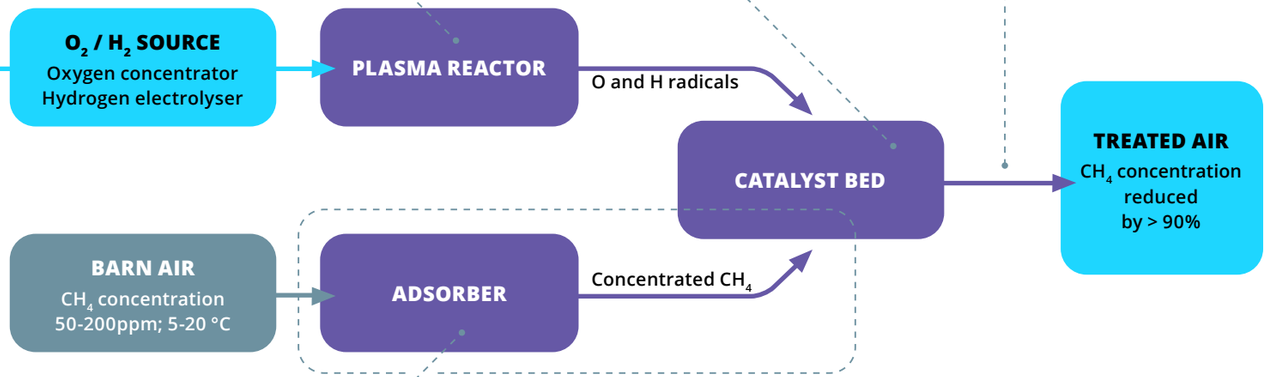
A chemical kinetics model and computation fluid dynamics model will be developed to study the gas flow behaviour in the oxygen and hydrogen plasma reactor.

Catalysis

The reactive oxygen species and hydrogen atoms/ions come in contact with the air and methane mixture, creating reactive CH_x species, which in turn will react on a catalyst and be converted to CO_2.

Monitoring and proof of concept tests

The full system will be tested in an experimental setting, and its performance monitored. A proof of concept test in real-barn conditions will follow.



Adsorption

Advanced sorbent materials will be used to concentrate the methane from the barn air, creating an enriched methane feed to the plasma process. A higher concentration of methane in a reduced volume of gas results in increased efficiency and size and energy savings. This process will also minimize unwanted reactions, such as the formation of NOx (nitric oxide and nitrogen dioxide), harmful gases which should be avoided.

The CANMILK concept will be tested with and without the use of methane adsorbers.

Operation in barns, techno-economic and environmental assessment

The placement of the systems in the barn operational environment will be carefully studied, including ventilation design, needs and structure of barns. Three different integration case studies will be made for Finland, UK and south European conditions.

Modelling software will study the modes of operation, layouts and strategies of ventilation as well as simulate the dairy barn adsorber technology. The capital and operating costs of the proposed approach over its operational life cycle will be evaluated. Analysis will be performed to compare the techno-economics to alternative technologies for methane abatement.

CANMILK objectives

Objective 1
Develop a simple, modular and efficient concept for methane abatement in cattle barns

Objective 2
Develop materials for methane concentration

Objective 3
Develop catalysts for methane treatment in plasma

Objective 4
Increase understanding of plasma chemistry in dilute methane abatement

Objective 5
Increase public awareness on the effects of methane on global warming and methods to overcome it

Objective 6
Investigate barn environment and techno-economic aspects of technology

CANMILK in numbers

- Targeted overall cost below 80€/T CO_2eq.
- Targeted methane conversion of 90%
- Targeted technology readiness level 3 at the end of the project (proof-of-concept in the lab scale)

CANMILK expected impacts

- Increase knowledge of feasibility and processes for removing non-CO_2 greenhouse gases from the atmosphere, particularly methane.
- Investigate techno-economic and environmental feasibility of plasma-based technologies for methane abatement.
- Raise awareness on the effects of methane and other non CO_2 greenhouse gases on earth warming.


Source: Valio


Source: Valio