



Life-MEGA

Smart computing system to monitor and abate the indoor concentrations of NH₃, CH₄ and PM in pig farms



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Project

The LIFE MEGA project, funded by the LIFE program of the European Union, aims to improve air quality in pig farms through the adoption of two different air treatment technologies: a dry filter and a wet acid scrubber.

At the moment, the systems were tested in an Italian and a Spanish pig farm. Currently in Italy, the trials are continuing in a second pig farm to test the abatement efficiency of the two air treatment technologies in different environmental and management conditions. Air quality is constantly monitored in real time by Nuvap microclimatic devices. These tools have been equipped with an algorithm that, based on the concentration of indoor airborne pollutants, will activate the dry and/or the wet scrubber so as to maintain air quality in respect of the health of the animals and operators, and at the same minimizing the energy consumption of the two abatement systems.

Installation in Spain

In October 2020, the wet scrubber was installed in the first Spanish host farm. The scrubber was moved to the second host farm in April 2022.



Fig. 1 Wet scrubber installation in Spain

In February 2021, also the dry scrubber was installed in the first host farm.



Fig. 2 Dry scrubber installation in Spain

In the same month, Nuvap tools were installed in the wet scrubber, dry scrubber, and control rooms to monitor the air quality inside the barn where piglets are housed during the weaning phase (from 4 to 15 kg).



Fig. 3 Microclimatic tools installation in Spain

Installation in Italy

In October 2021, the wet scrubber was moved to the second Italian host farm, located in the province of Pavia.



Fig. 4 Wet scrubber installation in Italy

At the same time also the dry scrubber was installed.



Fig. 5 Wet scrubber installation in Italy

Finally, in November, Nuvap tools were installed in the wet scrubber, dry scrubber and control rooms to monitor the air quality inside the barn where animals are housed during the fattening phase (from 60 to 170 kg).



Fig. 6 Microclimatic tools installation in Italy

Online technical event

An online conference was held on June 18, 2021 to present the LIFE-MEGA project, whose aim is to test two technologies (i.e. dry and wet scrubber) to reduce emissions in pig farming, and to demonstrate the potential effects of improved air quality on animal welfare.

The meeting was organized by partner IRTA.

The conference was attended by a representative of the Recovery Plan (DARP), an expert in emissions deriving from livestock farms, and an expert in animal welfare.

Control d'emissions en granja per reduir l'impacte ambiental i millorar el benestar animal. Projecte Life Mega

Jornada tècnica en línia
Divendres 18 de juny de 2021

Presentació

La reducció de l'impacte ambiental que poden tenir els sistemes de producció intensiva com el de porcí es pot enmarcar de manera clara entre els objectius de desenvolupament sostenible de les Nacions Unides. Així mateix, la millora del benestar animal ha estat una petició creixent d'una part de la societat. En el Projecte LIFE MEGA (LIFE18 ENV/IT/000200) es treballa en la millora de la qualitat ambiental a l'interior de les granges de porcí, per tal que la reducció en la concentració de gasos interior i en aquells que s'emeten a l'exterior, es redueixi. Els efectes directes d'aquesta reducció es farien notar no sols en l'impacte ambiental, si no també en el benestar, en paràmetres com els respiratoris o l'estress que pot conduir a conductes com la caudofòbia. En aquesta jornada es farà una presentació inicial sobre les millors tècniques disponibles (MTD) en el sector porcí i es presentarà el projecte LIFE MEGA i algun dels seus resultats preliminars.

Programa

09.55 h Benvinguda i presentació de la jornada

10.00 h Millors tècniques disponibles (MTD) en el sector porcí
Sr. Juanjo Esquerda, DACC.

10.30 h Control d'emissions en granja. Projecte LIFE MEGA
Sr. August Bonmati, Gestió Integral Residus Orgànics de IRTA.

11.00 h Efectes de la millora de la qualitat ambiental en el benestar animal en garrins de transició
Sra. Emma Fàbrega Romera, Benestar Animal de IRTA.

11.30 h Torn de preguntes

11.45 h Cloenda de la jornada

Aquesta jornada es realitza en línia. Us hi podeu inscriure mitjançant l'enllaç que trobareu a l'apartat d'inscripcions. El dia abans de la jornada rebreu l'enllaç d'accés a l'aula virtual des d'on podreu seguir-la.

Organització

Departament d'Acció Climàtica, Alimentació i Agenda Rural

IRTA⁹

Life-MEGA

Disputació Barcelona

#PATT2021

Generalitat de Catalunya
Departament d'Acció Climàtica, Alimentació i Agenda Rural

PLAANUAL 2021
DE TRANSFERÈNCIA TECNOLÒGICA

210107/175

Fig. 7 Leaflet of the technical event

Webinar with stakeholder

On May 27, 2021, a roundtable was organized by UMIL with a group of stakeholders to define the ammonia (NH₃) and particulate matter (PM₁₀) threshold values to be set on the NUVAP tools for the activation of the wet and dry scrubber operational functioning.

Following a literature review and extensive discussion with the stakeholders involved during the webinar, it was determined that air treatment systems will be activated when the following ranges are exceeded:

- 0.3-0.5 mg/m³ for PM₁₀
- 10-15 ppm for NH₃

Life-MEGA

UNIVERSITÀ DEGLI STUDI DI MILANO

LIFE-MEGA
definizione dei valori soglia per ammoniacca e particolato in allevamento suinicolo

27 maggio 2021 - ore 10:00
Webinar su ZOOM:
<https://us02web.zoom.us/j/82434824942?pwd=QzVRcFRnZVhMbVpsZlZlZk0JNOWxXZz09>

Meeting ID: 824 3482 4942
Passcode: 874490

Coordinatore:
UNIVERSITÀ DEGLI STUDI DI MILANO

Partner:
Nuvap IRTA ROTA GUIDO

Ore 10:00 inizio lavori e presentazione progetto

Ore 12:00 saluti e chiusura lavori

TAVOLA ROTONDA CON GLI STAKEHOLDER

Intervengono:
ANAS
CRPA Emilia Romagna
IZSLER
Life PrepAir
Regione Lombardia

f Instagram Twitter in

Fig. 8 Leaflet of the webinar

Preliminary results

Ammonia removal efficiency

To evaluate the average ammonia removal efficiency, the VERA Protocol was applied. Acid traps method was used to estimate the NH_3 retained by the scrubber.



Fig. 9 Acid traps installation

The acid traps consisted of two Dreschels containing 300 ml of 1% boric acid solution. Two traps were placed during the trials, one connected to the air inlet tube and one to outlet one (Fig 1 and 2), to estimate the amount of ammonia retained by the scrubber. The traps operated for 8 weeks for a period of 24 h. To determine the amount of ammonia collected by the traps a standard titration was performed .

Based on preliminary results, the average ammonia abatement efficiency was equal to:

- 61% in the first farm with natural ventilation and animals housed on solid floor with external outdoor run and a vacuum system for manure removal
- 22% in the second farm with natural ventilation and animals housed on a fully slatted floor and a vacuum system for manure removal



Fig. 10 Acid trap

Particulate matter removal efficiency

To evaluate PM_{10} abatement efficiency, data collected during monitoring campaigns with air treatment systems turned on and off were compared.

Particulate matter was continuously measured with the Haz Dust EPAM 5000 instrument, which determines PM_{10} concentration using a light scattering technology.



Fig. 11 Haz Dust to monitor PM_{10} concentration

Based on the data collected in the first host farm an average PM_{10} abatement efficiency equal to:

- 41% with the wet scrubber prototype
- 37% with the dry scrubber

was estimated.

In the second pig farm, PM_{10} data collection is ongoing.

Animal welfare

Based on behavioral evaluations results obtained in the first Italian farm no significant differences between the control room and the treatment rooms were observed, except for the number of aggression-related injuries, which was lower in the dry scrubber room ($p < 0.001$).

Animal welfare evaluations in the first Spanish farm and the second Italian farm are ongoing.

Monitoring visits

On February 2, 2021, the second monitoring visit was held with the project monitor to discuss about LIFE-MEGA developments and future activities.

The next monitoring visit was held on March 2, 2022.

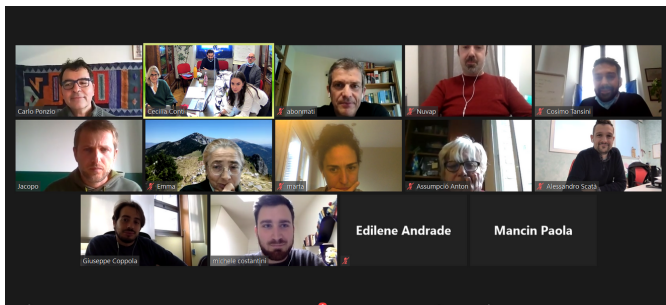


Fig. 12 Monitoring visit

Project video

In July 2021, the project video, available in Italian, English and Spanish, was posted on the website, social pages and YouTube channel.

Website and social media

For updates on project activities visit the website:

lifemega.unimi.it

or follow the project's social media channels:



Conferences

In 2021, the preliminary results were presented at the following conferences:

- MetroAgriFor 2021 IEEE International Workshop on Metrology for Agriculture and Forestry – “Ammonia concentration and recommended threshold values in pig farming: a review”. Trento-Bolzano, 3-5 November 2021. pp.162-166.
- Festival dello Sviluppo Sostenibile 2021 – Sistemi di Abbattimento delle Emissioni in Porcilaia. University of Milan, 14 October 2021, Webinar.
- X Convegno dell'Associazione Rete Italiana LCA. Innovazione e circolarità – Il contributo del Life Cycle Thinking nel Green Deal per la neutralità climatica – “Social Life Cycle Assessment degli allevamenti suinicoli intensivi in Italia: indicatori e scale di valutazione”. Reggio Calabria, 22-24 September 2021.
- 179th EAAE Seminar Food Policy Modelling as an effective and expeditious response to today's urgent issues – “Wet acid scrubber as abatement system of emission in pig barns: Life Cycle Assessment in the framework of Life MEGA project”. Chania, Greece, 9-10 September 2021.



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Nuvap



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