

TAPYR

Thermochemical apparatus for
thermal weeding and disinfection
powered by biomass.



TAPYR

For applications in horticultural extensive crops, orchards, organic farming.

The business idea for the TAPYRO project consists of the engineering and commercialisation of a cost-effective technology able to kill spontaneous weeds by heat, thus avoiding the use of toxic chemical herbicides.

REDUCTION OF GREENHOUSE GAS EMISSION UP TO 90 %



GPL Thermal weeding

TAPYRO

REDUCTION OF OPERATIVE COSTS UP TO 75 %



GPL Thermal weeding



TAPYRO

-75 %



WATER SAVING

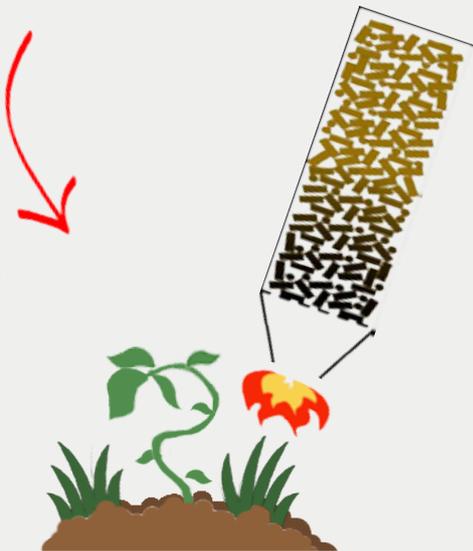


MORE SECURITY

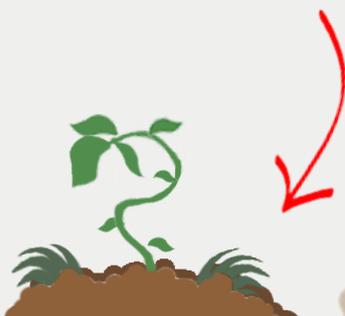
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TAPYRO

TAPYRO has been conceived both for **thermal weeding** and **pyro-disinfection** applications. Concerning weed control, the technology can be set up for applications in **horticultural extensive crops, orchards**, in particular in **organic farming**, as well as **green management and gardening**.

THE DEVICE

TAPYRO basic unit consists in a pyro-gasifier **fuelled by renewable biomass**, such as commercial pellet and forestry/agricultural residues, which produce heat through the oxidation of pellet fuel.

Weeds are killed by the exposure to hot gases generated **during pyro-gasification, an unconventional oxidation process** led with lack of oxygen .

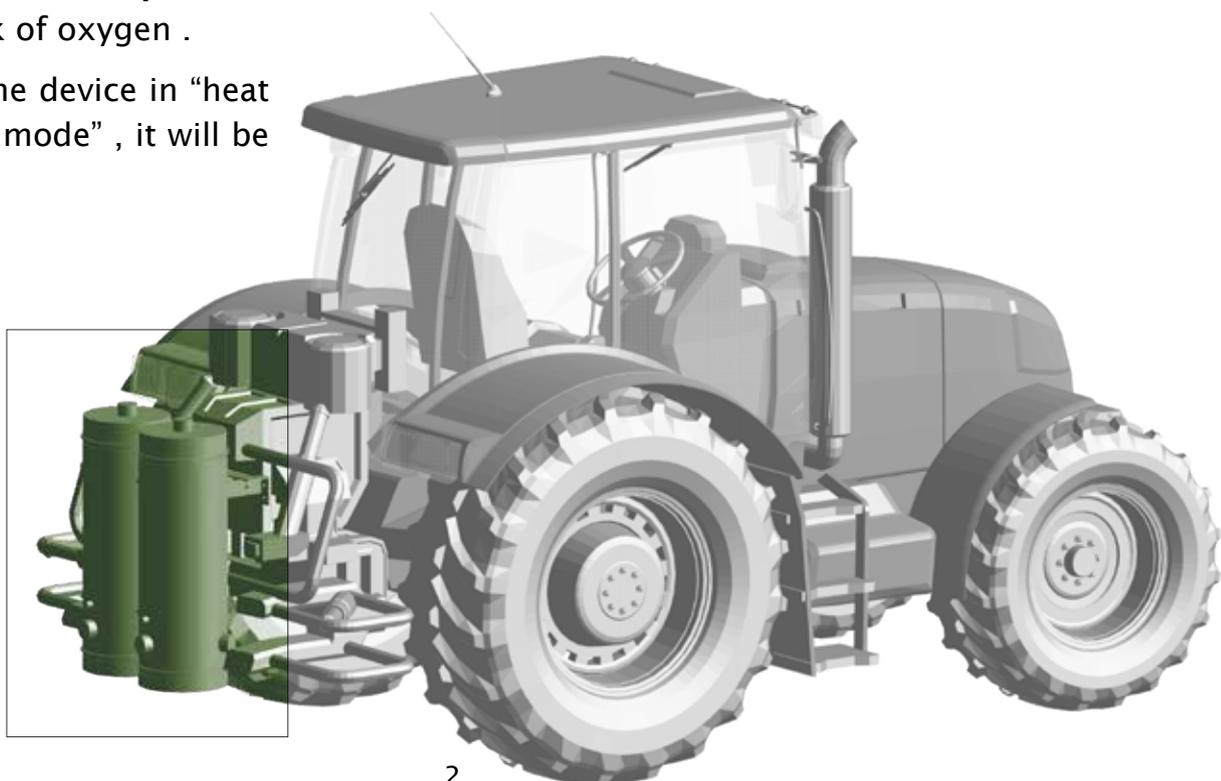
Running the device in “heat and biochar mode” , it will be

possible to control pellet pyro-gasification **in order to stop** heat generation **producing biochar** instead of ashes as process residue (as in the “heat” mode), **to be used as soil improver**.

Setting up in parallel 50kWt or 100kWt TAPYRO basic units, it is possible to reach 200÷300 kW thermal power, the usual standard value for LPG-fuelled weeding competing solutions.

A prototype of about 50 kW thermal power has been set up in order to carry out both bench scale tests and a preliminary field trial; **the patent application “Weed control device powered by solid fuel”**, which has been successfully filed for Italy, **is going to be extended abroad** through a Patent Cooperation Treaty (PCT) procedure.

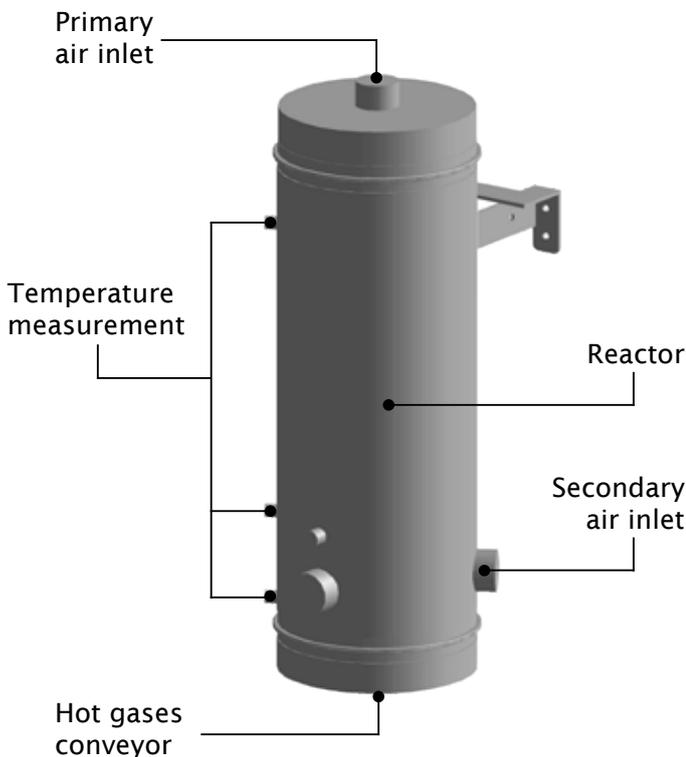
TAPYRO DEVICE



OBJECTIVES

Project main objectives are:

- Promoting **eco-friendly cropping techniques** which may drive to a **chemical-free sustainable agriculture**, considering in particular the key challenge of water saving
- Supporting a **systemic involvement** of the different potential stakeholders, from the whole farming chain of production to final consumers
- Establishing a business agreement with interested partners to **engineer and commercialize TAPYRO in targeted potential markets** (this entails technological validation of the device performance against standards or commercial benchmark).



RESULTS

TAPYRO business model has been validated through getting feedbacks of

the proposed solution from experts and stakeholders (Cesac Company, ApoFruit Company), which were also involved in the carried out bench and field test evaluation.



Such experimental trials have been planned in order to prove functionality and effectiveness of the weeding device, as well as to monitor and evaluate environmental emission of the current demonstrative prototype. The trials and environmental evaluation were conducted together with CIRSA - Interdepartmental Center of research for Environmental Science - University of Bologna, Ravenna Campus.

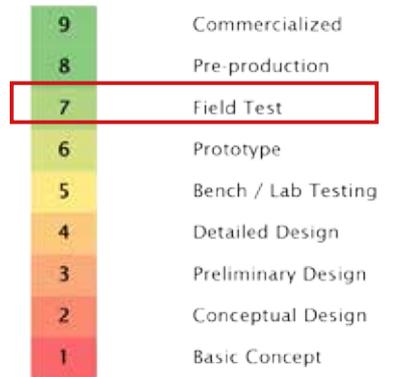
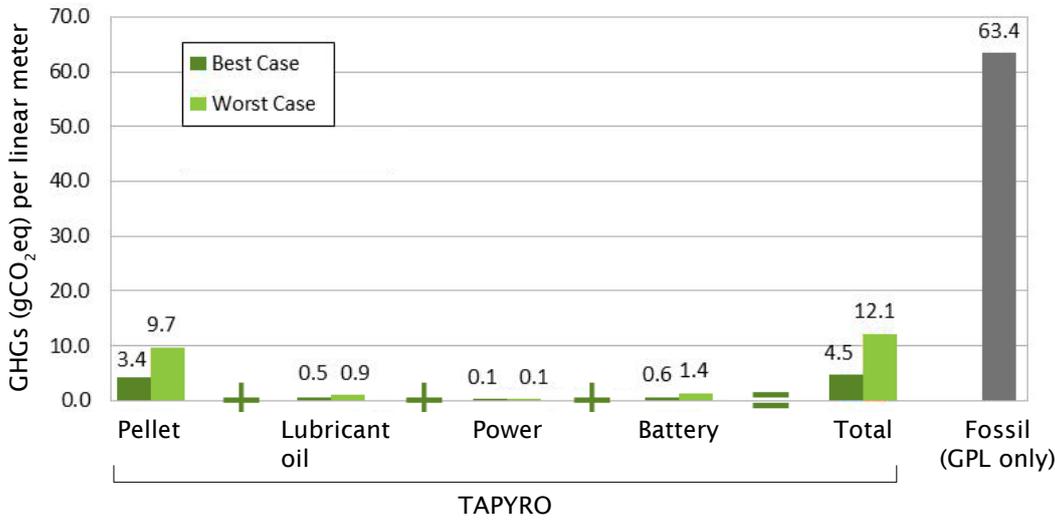
Field tests enabled to measure and record data about process air and temperature of hot gases generated for the thermal weeding effect; during the steady-state operation phase, the mean temperature of the produced hot gases was about 900°C, with a maximum value of about 1000°C estimating a fuel consumption mean rate of about 12 kg/h of pellet.

This achievement will be useful for further demonstrative trials with a tractor-mounted device, in order to estimate economic operative costs.

THE ENVIRONMENTAL ADVANTAGES OF TAPYRO TECHNOLOGY

I. GHGs Cradle-to-Grave TAPYRO* vs. Fossil thermal weeding

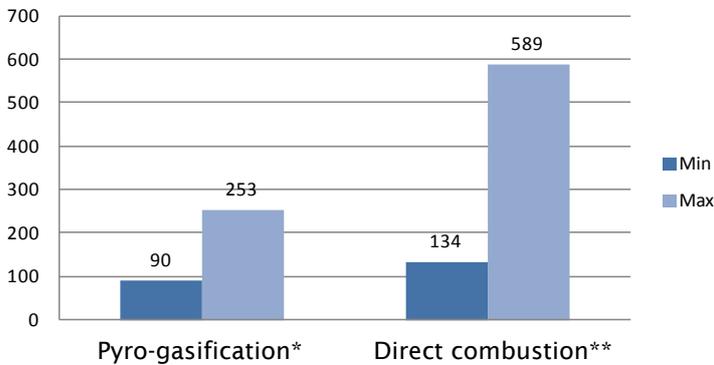
Technology Readiness Level



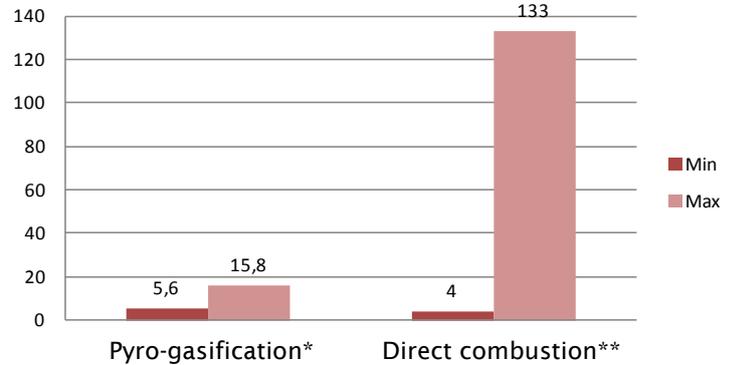
* TAPYRO running in biochar production mode

II. Pyro-gasification* vs. Direct combustion**

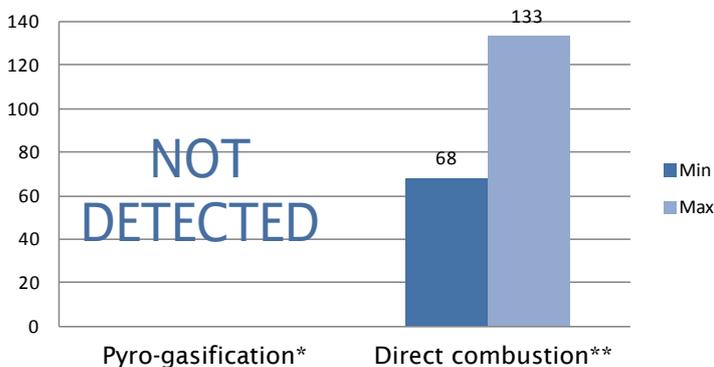
CO emission (ppm)



VOC emission (ppm)



NO_x emission (ppm)***



Indoor emissions measured at 2.5m from the hot gases exit bottom section.

Concerning to measured particulate emission, they are lower than background level of 80 µg/m³ (quantified as very poor according to the air quality standard).

* TAPYRO running in biochar production mode

** Typical pellet stove emissions

*** Not detected during trials when producing biochar

EMISSIONS

Regarding the above-mentioned bench scale tests, they have been performed in order to monitor and analyze the following pollutant emissions: CO (carbon monoxide), Particulate, VOC (Volatile Organic Compounds), NO_x.

Bench scale tests reveal that VOC, CO, and Particulate are low running TAPYRO in “heat and biochar” mode; nevertheless running the device in “heat” mode, during the final phase of oxidation of biochar to ashes, the emission parameters increase, giving so a precious insight on pyro-gasification conditions inside TAPYRO reactor and new directions on how to achieve a cleaner and more complete combustion of gases when the device is not running in “heat and biochar” mode.

NEXT STEPS

Currently the work team is looking for funding opportunities in order to **support the manufacturing and setting up** of a tractor-mounted new demo version of TAPYRO, according to feedbacks and recommendations received from some potential users previously involved.

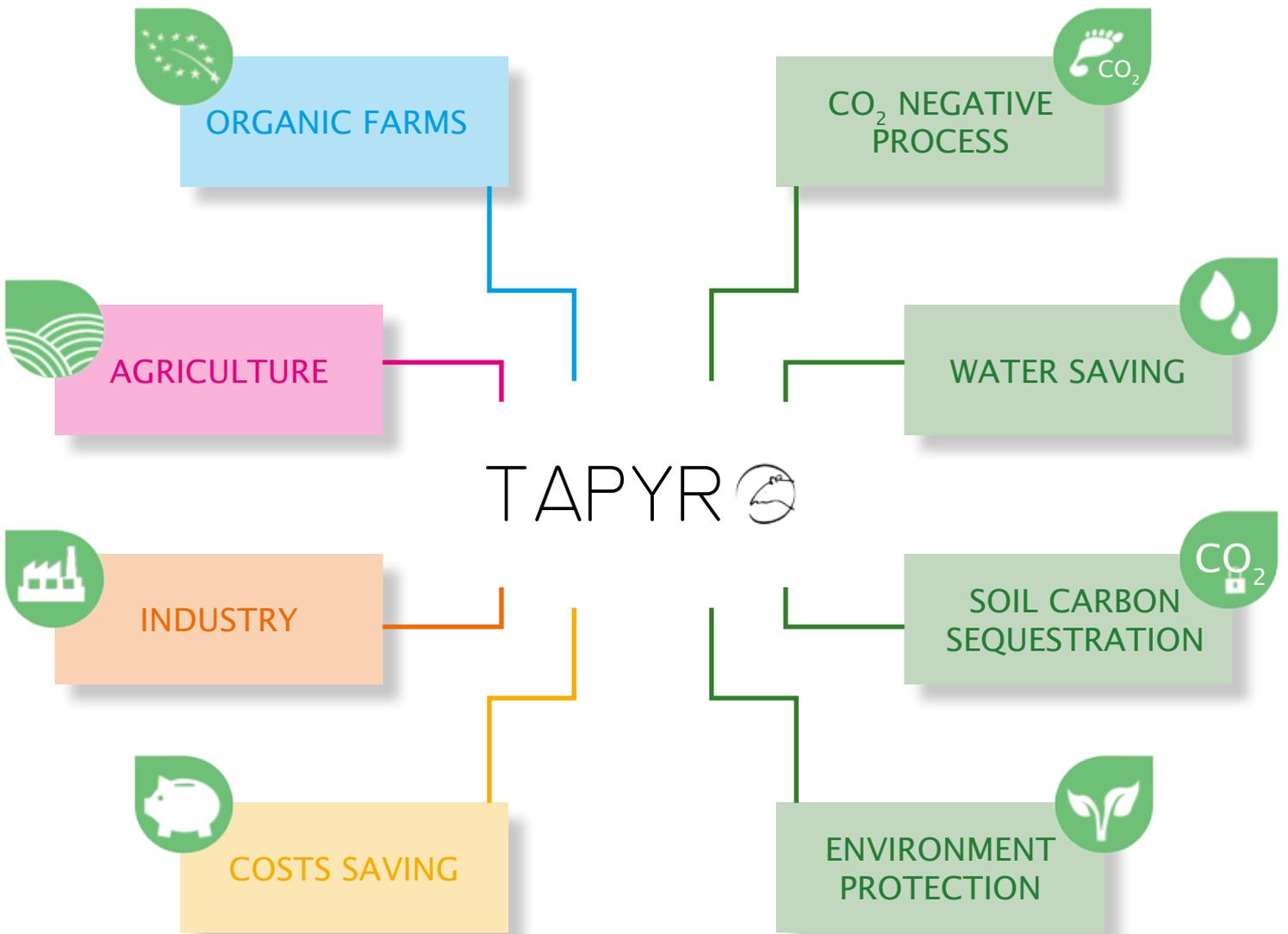


A new pre-commercial prototype will enable field trials in **real operation environment**, making possible either a better engagement of potential customers either a further development of TAPYRO business. Moreover, concerning demo trials in different targeted farming sectors, a lasting **collaboration with agronomists** is needed due to evaluate and validate the related achievements.



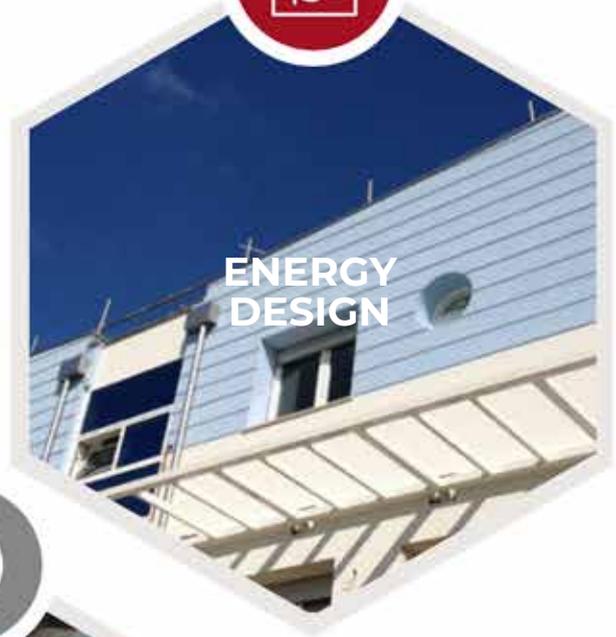
Finally, fundraising is needed to boost the extension of the patent application “Weed control device powered by solid fuel”, which is going to be implemented through Patent Cooperation Treaty (PCT) procedure.







**BIOGAS -
ANAEROBIC
DIGESTION**



**ENERGY
DESIGN**



BIOCHAR



**THE DEVELOPMENT
OF TECHNOLOGICAL
SOLUTIONS**



TRAINING