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i-REFO

Increase in the REduction and REcovery of EXpired FOod

Coordinatore: **UNIVERSITA' DI PERUGIA -
Dipartimento di Ingegneria
Francesco Fantozzi**

www.irexfo.eu

26 Marzo 2019

Politecnico di Milano, RIFIUTI E LIFE CYCLE THINKING, 4° EDIZIONE



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Why is i-REXFO needed?

ALMOST A BILLION PEOPLE
are going hungry, while we waste
1/3 OF THE FOOD WE PRODUCE.



Source: FAO, 2013



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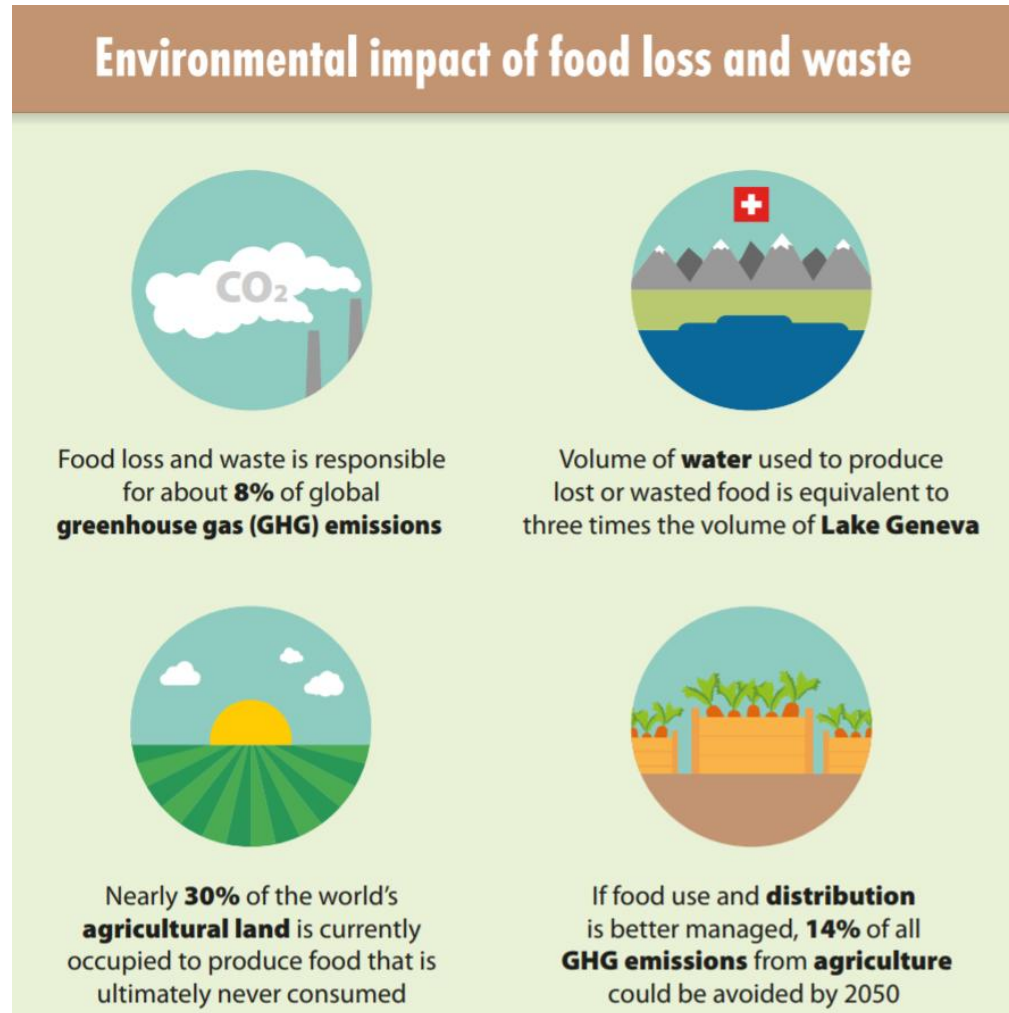
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Why is i-REXFO needed?

Each year 28% of available land and 250 km³ of water are used to produce food which is wasted. Waste food produced and landfilled emits the equivalent of 3.3 Gtons of CO₂.





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Why is i-REXFO needed?

IN THE EU (Estimates, 2012)

FOOD IS LOST OR WASTED THROUGHOUT THE ENTIRE SUPPLY CHAIN



from **agricultural production** to final **household consumption**



million tonnes

of food are wasted per year

or



kg per person



million tonnes of CO₂

emitted from production and disposal of EU food waste



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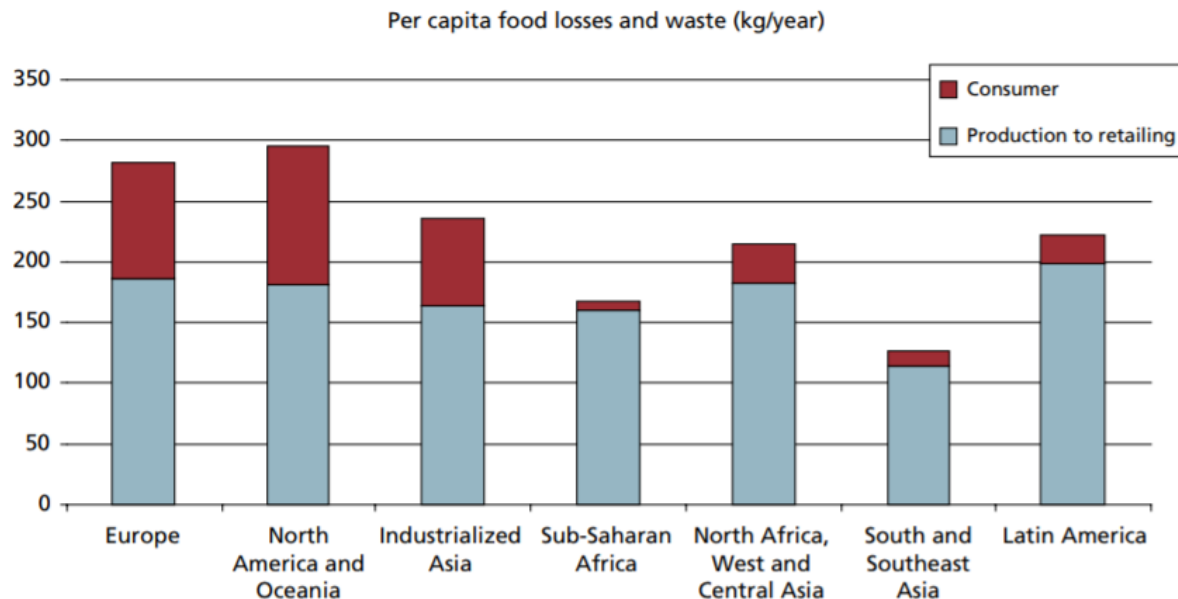


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Why is i-REXFO needed?

Food waste in industrial countries are caused by a combination of factors:

- Inadequate level of communication in the food supply chain (from the supply of raw materials to the distribution) → no donation in time;
- In the HORECA sector and at home: portions are too big, poor use of doggy bags, poor use of food remaining from previous meals;





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Why is i-REXFO needed?

-Consumer behavior (food shopping badly planned or not planned, excessive food quantities acquired, difficulties in the interpretation of the instructions on expiring date, reported on the labels);





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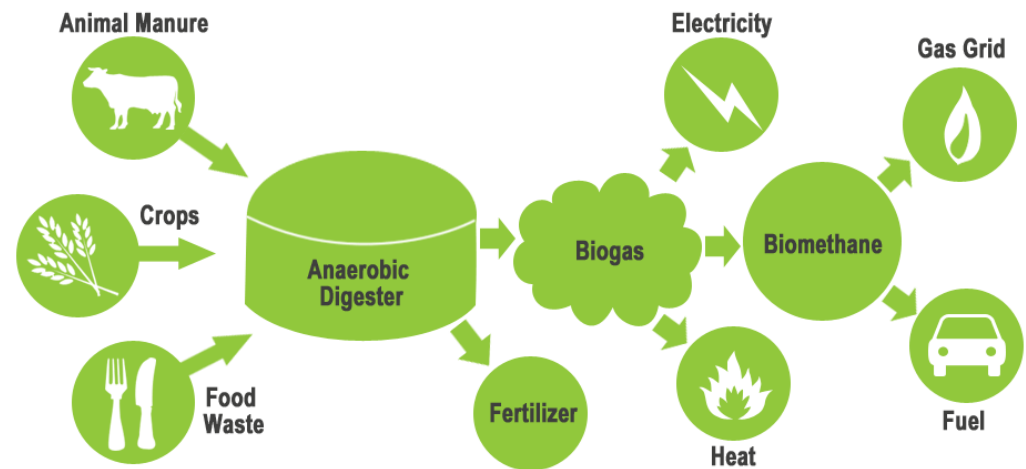
Why is i-REXFO needed?

-When the food becomes not suitable for human consumption, there are economic, logistic, legal and last but not the least cultural barriers, which prevent its reuse:

-In the animal feed sector;



-In the energy sector





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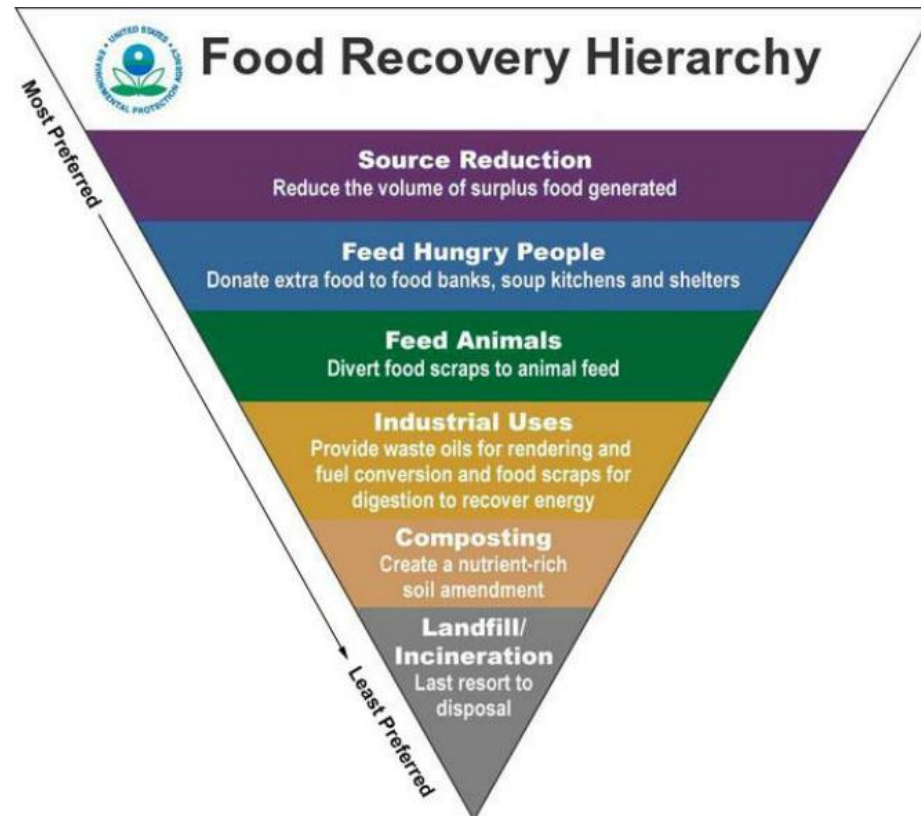


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What is i-REXFO?

i- REXFO objective the reduction of the quantity of food which is disposed in landfill.

i-REXFO follows an innovative approach which incentives actions for the reduction of food waste (DEMO REF chain) and the energy valorization of the food which is not edible anymore (EFE DEMO chain)





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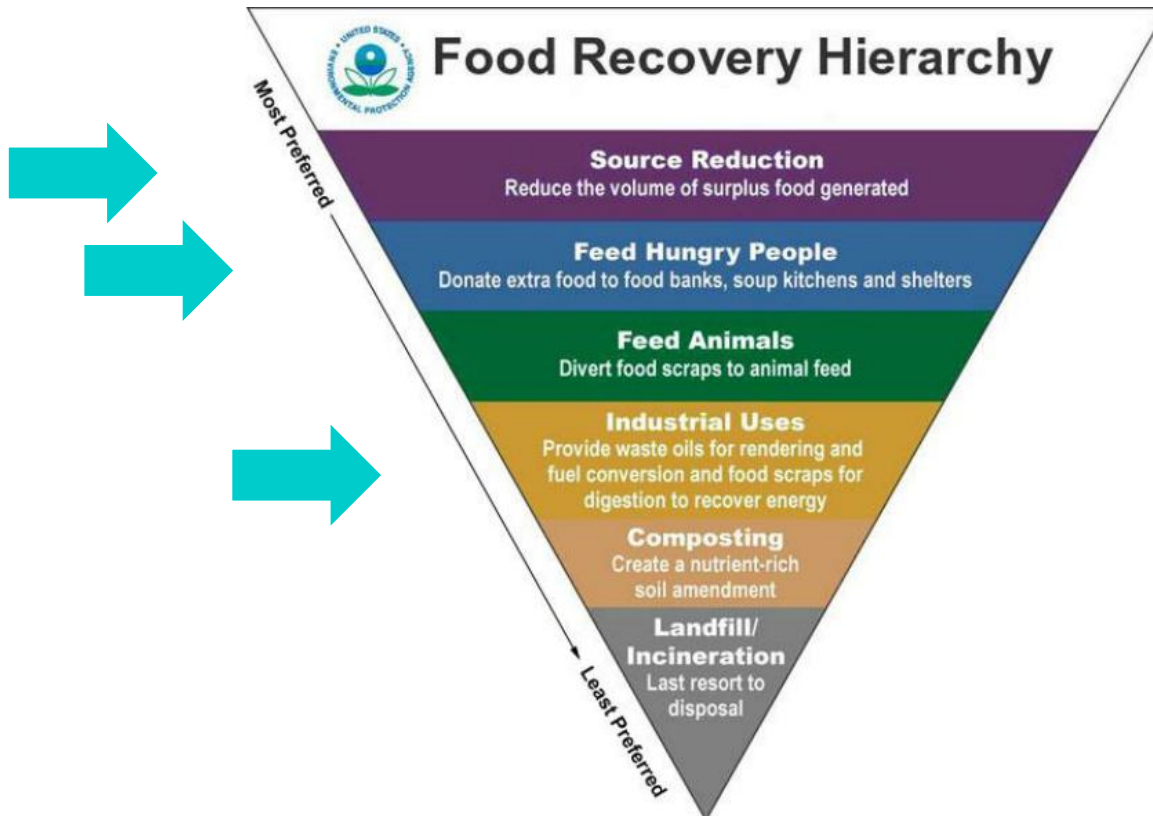


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What is i-REXFO?

i-REXFO is a **BUSINESS MODEL** to reduce waste food through a holistic approach;

It finances actions to reduce food waste

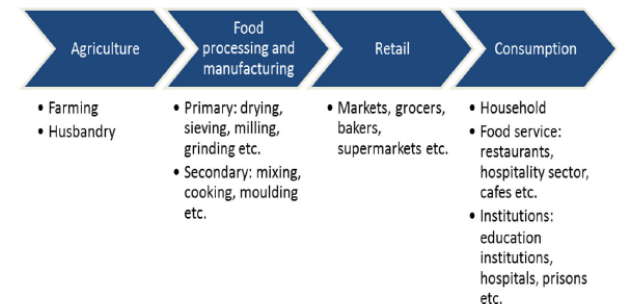
- ➔ consumer awareness
- ➔ donation to charities
- ➔ last minute market & doggy bags

by selling bioenergy produced by food waste.

The iRexfo model requires environmental sustainability on the entire Life Cycle.

The project is focused on the food waste generated by:

- Food industry;
- Farms;
- Big retailers;
- HORECA sector;
- Consumers.





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The i-REXFO model

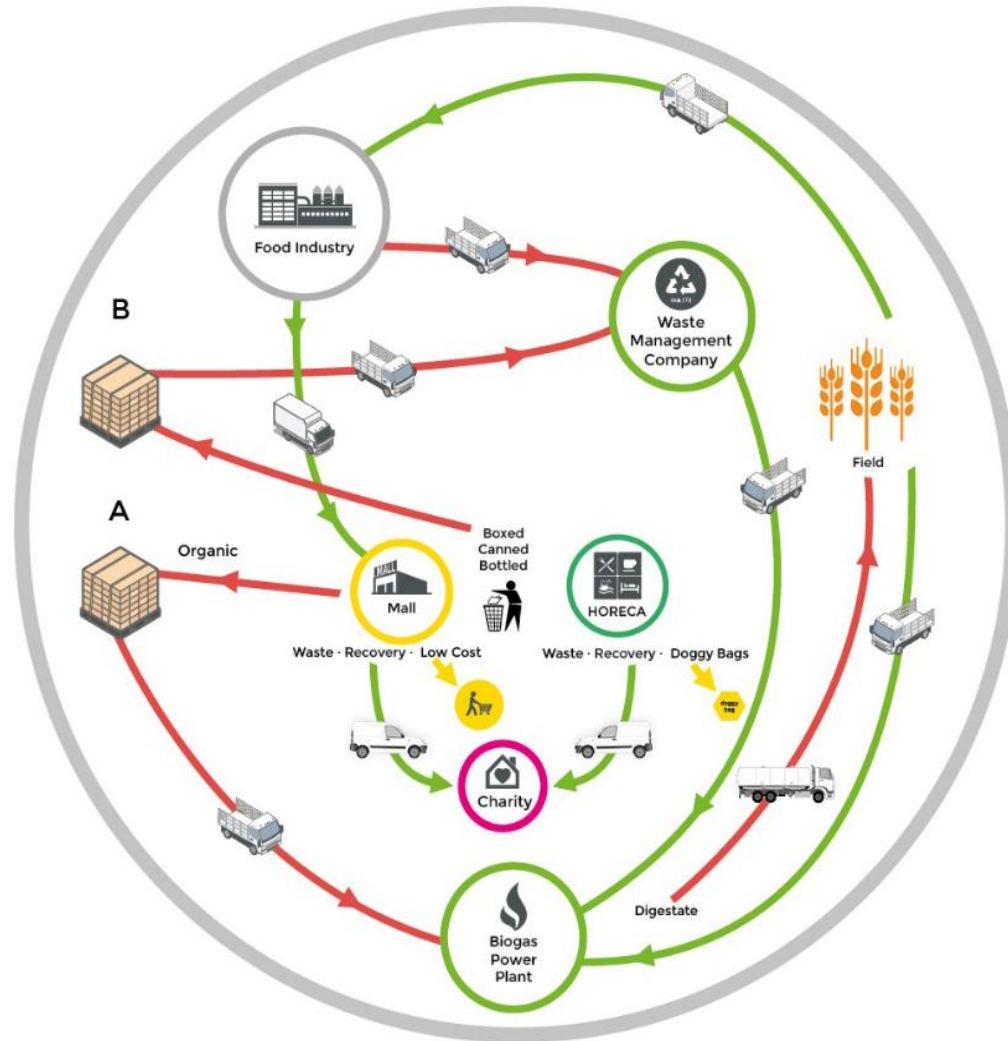
Circular diagram of the i-REXFO approach



Waste



Matter





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During the Life Project



Food Industry Waste





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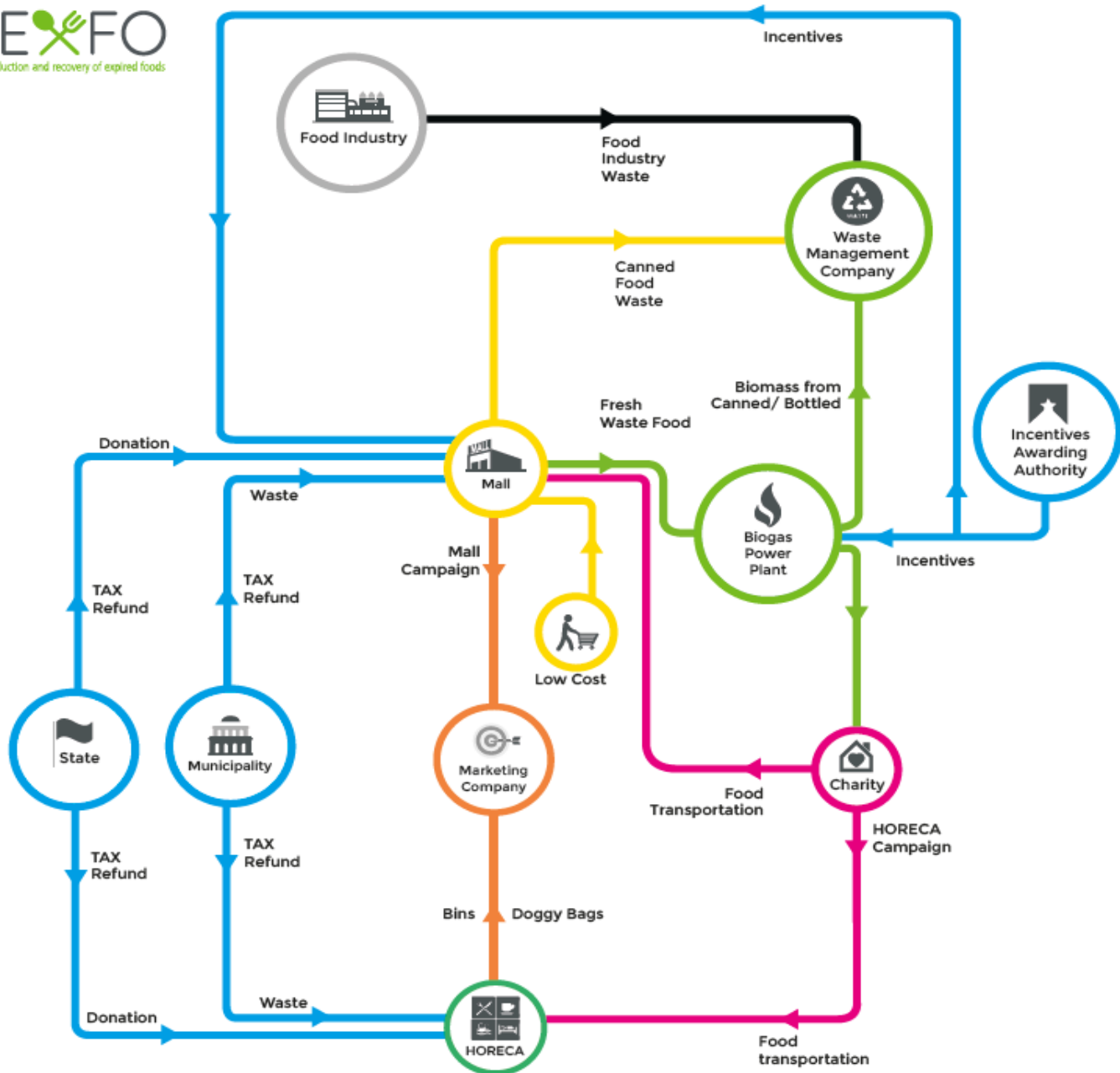


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After the Life Project





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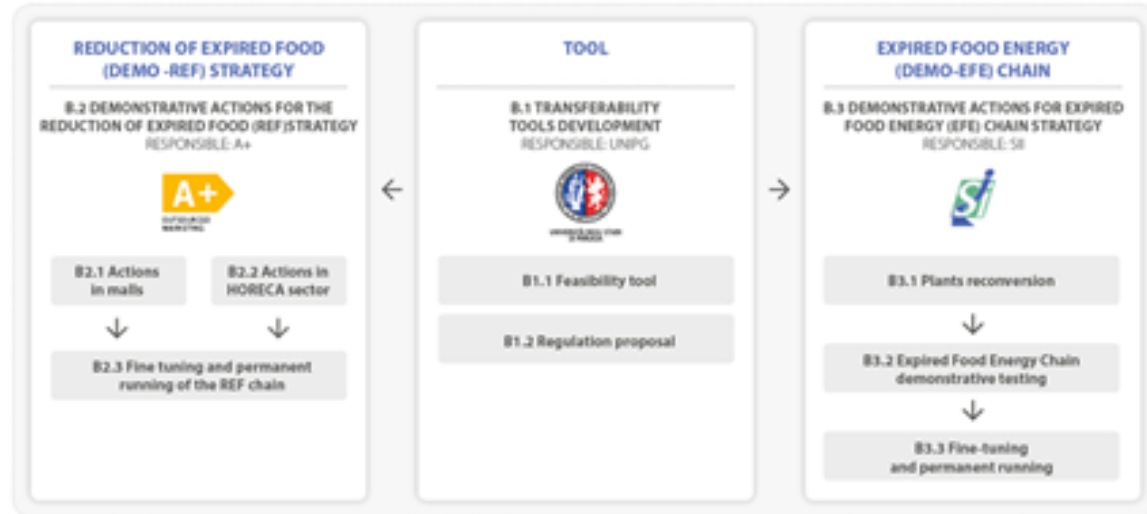


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PRELIMINARY ACTIONS





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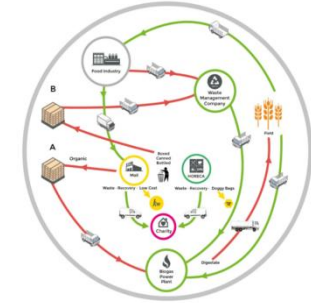
How does i-REXFO work?

Transferability tool

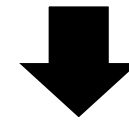


Design REF + EFE

Circular diagram of the i-REXFO approach



Transfer - Hungary



Demonstration - Umbria





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Increase in Reduction and recovery of expired foods



- 1. FEASIBILITY and TRANSFERABILITY TOOL**
- 2. DEMONSTRATIVE ACTIONS IN UMBRIA REGION FOR WASTE FOOD REDUCTION**
- 3. DEMONSTRATIVE ACTIONS IN UMBRIA REGION FOR WASTE FOOD TO ENERGY CHAIN**
- 4. TRANSFER OF THE I-REXFO BUSINESS MODEL TO OTHER REGIONS IN ITALY & HUNGARY**

Project overview: the B actions



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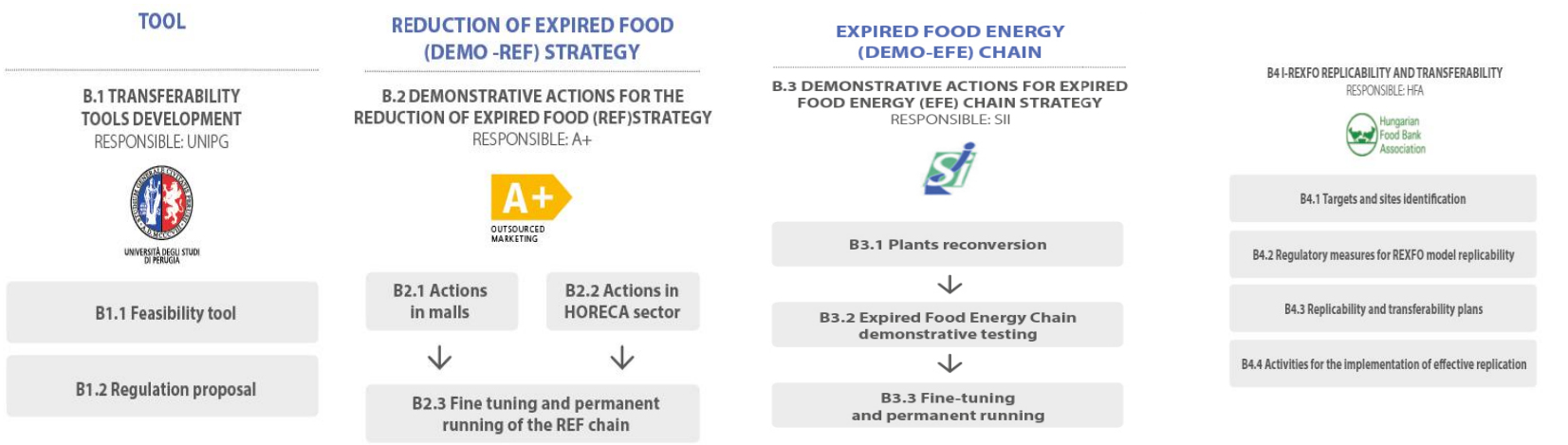
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B1. Practical tool to design and optimise an integrated business model for FW reduction and energy use

B2. Sustainability of a REF strategy through demonstrative actions in Umbria Region in malls and Horeca.

B3. Sustainability of an EFE strategy through demonstrative actions in Umbria Region for biogas from FW

B4. Transferability of the iREXFO approach to other Regions and Countries (2 in Italy and 2 in Hungary)





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Project overview: the B1 action

B1. Development of instruments for the evaluation of the feasibility of the approach

- A technical–economical- environmental optimization tool based on:
 - methanation potential of waste food;
 - availability and localization;
 - incentives and detaxation;
- A manual with guidelines and norms to:
 - facilitate the authorization path of both the donated food and that used for energy purposes;
 - to promote the activation of fiscal incentives.



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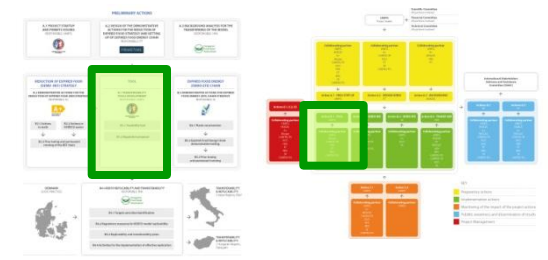
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B.1 Transferability tools development

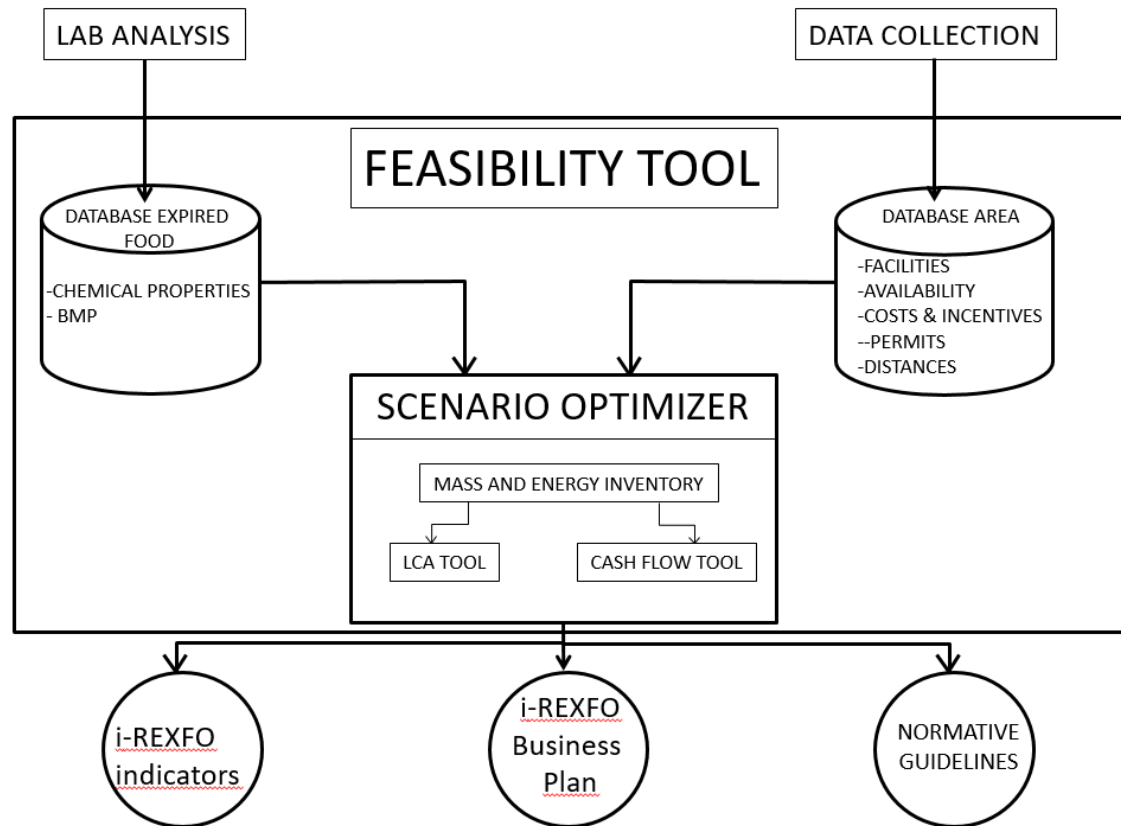
Duration: (01/10/2017- 31/08/2019)

Responsible: UNIPG

Partner: UNIPG, Biogaz, CARITAS TR, HFA, PT, REG, CARITAS PG



Task B.1.1 Feasibility Tool (01/10/2017- 31/08/2019)





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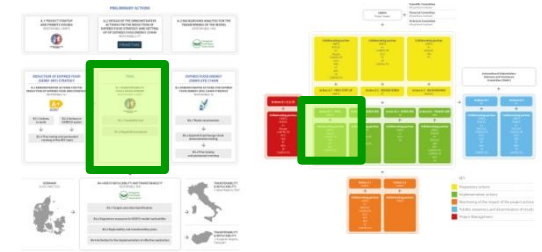
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B.1 Transferability tools development

Duration: (01/10/2017- 31/08/2019)

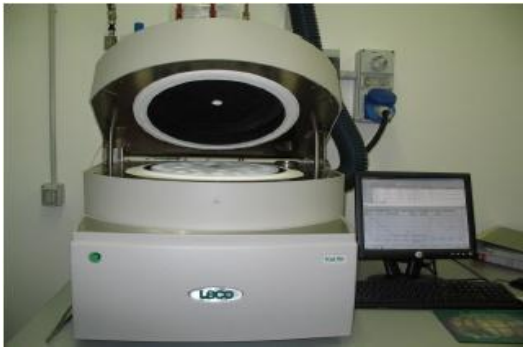
Responsible: UNIPG

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Task B.1.1 Feasibility Tool (01/10/2017- 31/08/2019)

CHEMICAL AND PHYSICAL CHARACTERIZATION



Thermogravimetric Analysis (TGA)



pH Meter



Ultimate Analysis (CHN)

BIOMETHANE POTENTIAL TEST (BMP)



BMP test



GAS Cromatography (GC)



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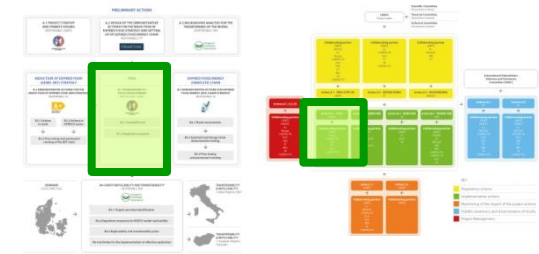
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Duration: (01/10/2017- 31/08/2019)

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Task B.1.1 Feasibility Tool (01/10/2017- 31/08/2019)

Chemical and physical characterization - RESULTS

	Lettuce	Onion	Apple skin & flesh	White bread	Inoculum
Moisture (%)	92,47	89,67	72,35	10,66	94,18
Volatile Solids (%wb)	6,19	8,01	21,53	71,25	5,58
Ash (%)	1,19	1,62	0,75	0,53	0,09
Fixed Carbon (%)	0,15	0,70	5,37	17,56	0,15
Starting pH	7,44	7,50	5,47	5,8	7,49
C (%)	41,70	38,4	47,60	47,00	41,16
H (%)	5,20	4,95	6,24	6,18	4,44
N (%)	2,53	5,14	0,49	2,20	2,31
C/N	16,48	7,47	97,14	21,36	17,82



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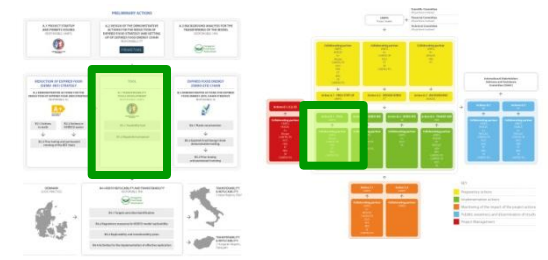
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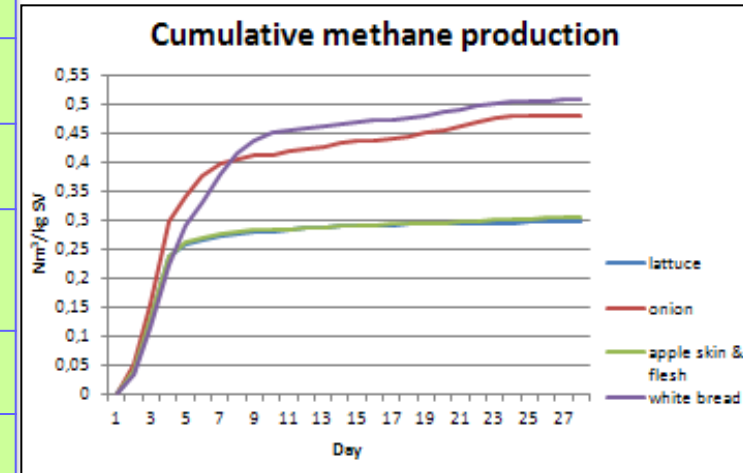
Partner: UNIPG, Biogaz, CARITAS TR, HFA, PT, REG, CARITAS PG



Task B.1.1 Feasibility Tool (01/10/2017- 31/08/2019)

Test BMP (Temperature range: mesophilic) - RESULTS

Vessel	Substrate		BMP** (Nm ³ _{CH₄} /KgSV)
1* (S:l _{VS} basis = 0,313)	lettuce	55 g	0,296
	inoculum	195 g	
2* (S:l _{VS} basis = 0,315)	onion	45 g	0,480
	inoculum	205 g	
3* (S:l _{VS} basis = 0,317)	apple skin & flesh	19 g	0,305
	inoculum	231 g	
4* (S:l _{VS} basis = 0,314)	white bread	6 g	0,507
	inoculum	244 g	
5 (blank assay)	inoculum	250 g	-



*all test was carried out in duplicate

**the BMP of the substrate was determined by subtracting the methane production of the blank from the gross methane production of the substrate



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Project overview: the B2 action

B2. Demonstrative actions for the reduction of expired food – REF chain

-Promotion of the sale and consumption of food which is approaching expiration date:

- In malls with dedicated spaces and particular discounts;
- In the HORECA sector by selling products at discounted prices when time is approaching to closing hour;

-Information campaigns for consumers on the correct understanding of the labels indicating the expiration date;

-Distribution of unsold food in canteens and solidarity markets;

-Distribution of containers with pleasant design (doggy bags) to promote the reuse of remaining food in restaurants.



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Project overview: the B3 action

B3. Demonstrative actions for the creation of a supply chain for the energy valorisation of waste food - EFE

- develop and demonstrate the sustainability of the supply chain for the energy valorisation of expired food in Umbria.
- Waste food is collected at the producer's site (Food industry, Farms, Retailers, HORECA);
- It is pretreated (separation of the packaging, milling, etc.), transported and used in an anaerobic digestion plant to produce energy;
- All the different phases are designed and monitored to grant the technical, economic and environmental sustainability



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Project overview: the B4 action

B4. Replicability and transfer of the i-REXFO approach

- The model tested in Umbria has to be replicable and transferable in other European contexts;
- i-REXFO approach will be transferred to other Regions and European Member States (2 regions in Italy and 2 in Hungary),;
- Using the transferability tool (B1) tuned with the experience gained in the demonstrative actions (B2 and B3).
- 4 new i-REXFO models will be designed and their feasibility will be demonstrated through business plans;



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i-REXFO RESULTS

- **CO2 reduction** **8.500 ton/year**
- **Waste Food Reduction** **3.400 ton/year**
- **Water Consumption Reduction** **480.000 m³/year**
- **Renewable Energy Production** **2.800 MWh/year**
- **Energy saving** **2.400 MWh/year;**
- **Land Occupation Reduction** **1.100 ha/year**



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i-REXFO Partners

 University of Perugia (CO)



 A + Srl. Outsourced marketing




Communication strategy in IT

 Biogáz Unió ZRT.



Transferability (EFE chain)

 Solidarietà Caritas Onlus



Pilot action on REF (charity)

 Associazione di Volontariato



Pilot action on REF (charity)


SAN MARTINO

 ECOPARTNER srl



Pilot action on EFE

Waste pre-treatment

 Hungarian Food Bank Association



Transferability (REF chain)

 Noesis snc



Reporting and administration

 Primetime Kommunikation A/S



Communication, good practice

 Regione Umbria



Legislation and permit

 Azienda Agricola Iraci Borgia

Pilot action on EFE (biogas plant)





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Feasibility study planned sites in Hungary



- Built-in electric power - 844 kW

Built-in electric power - 1,487 kW



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budget:

2,324,915 Euro

Durata

Settembre, 2017 - Febbraio, 2021

Coordinatore

Francesco Fantozzi

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