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# Eni Waste to Fuel Technology

## Industrial Deployment Plan

*Bruxelles - November 19th, 2019*

# Organic waste in Italy

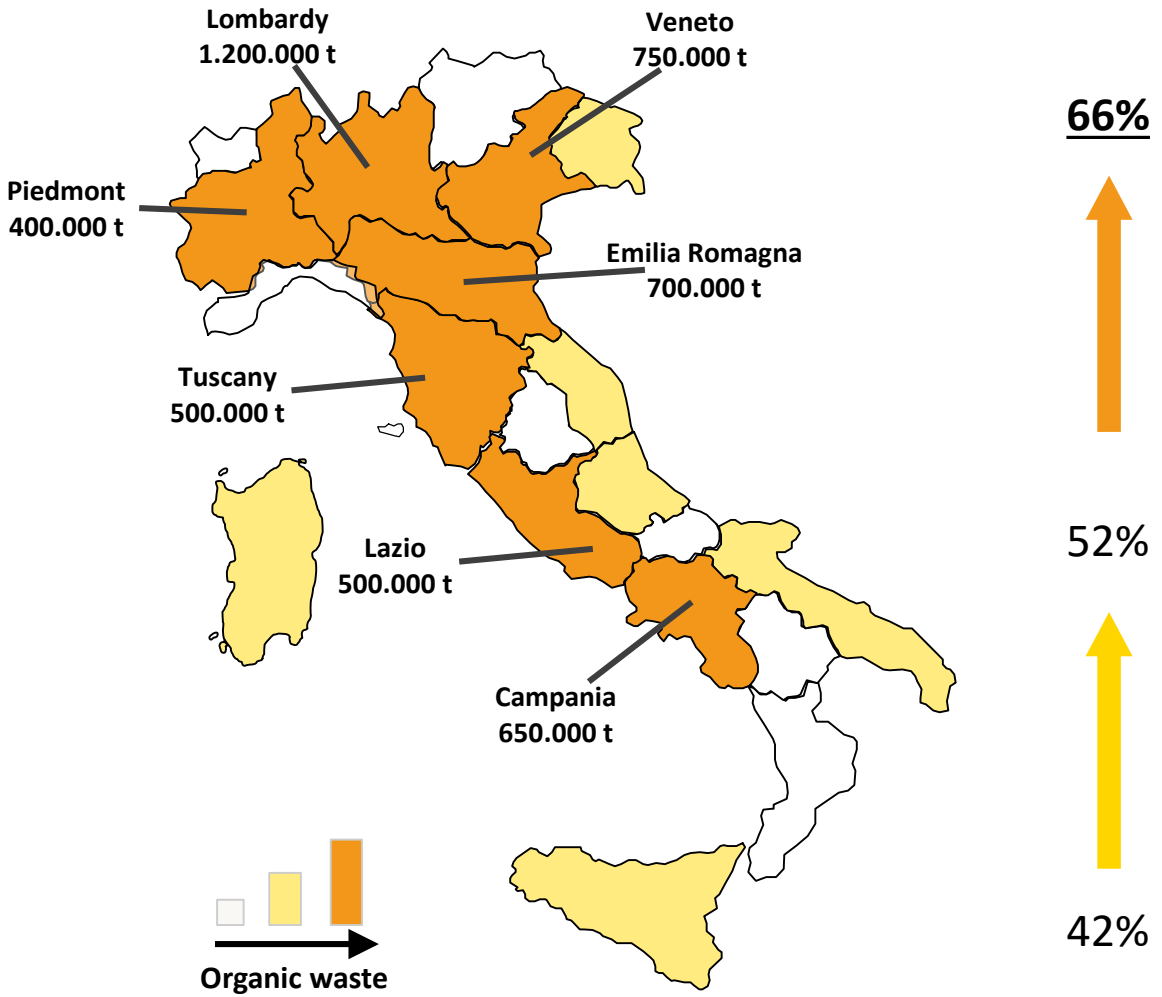
**Sorted waste collection in 2017**

**56%**

**Organic waste in 2017**

**6.600.000 t**

***(110 kg/inhabitant)***

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# Organic waste valorization: Waste to Fuel Technology, an Eni solution

**Municipal organic waste**

**Biological sludge**

**zootechnical waste**

Bio - methane

Compost

**WASTE-TO-FUEL**

**Eni proprietary technology**

**BIO-OIL**

**BIO-METHANE**

**WATER**

# Waste to Fuel (W2F) Technology – Process

**ORGANIC WASTE** → **PRETREATMENT** → **REACTION** → **SOLIDS FILTRATION** → **SEPARATION** → **PRODUCTS**

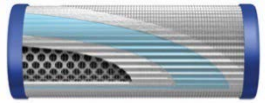
Inert removal

Grinding

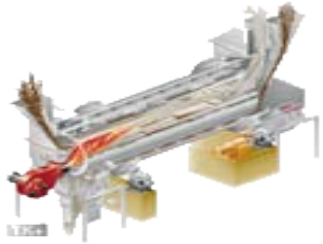
Homogenization

*250-350°C*
*50-160 bar*

**HEAT**



**HEAT RECOVERY**



**RESIDUE**

**GAS**
**BIO-OIL**
**WATER**

**WATER TREAT.**

**CO2**

**BIO-OIL**

a *MARINE BUNKER FUEL*

b *REFINERY*

**BIO-METHANE**

**WATER**

*''The Waste to Fuel technology replicates in few hours what Nature takes thousands of years to carry out; a low-impact environmental process capable of producing bio-oil, bio-gas and water from urban waste!''*

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# Waste to Fuel (W2F) Technology: bio-oil and water from organic waste

## ORGANIC WASTE

**Dry solid content:** 15 - 35%

of which fatty substances and proteins 5-20%

**Water:** 60 - 80%

*Organic waste composition may vary based on seasonality and consume habits*

## REACTION

**THERMAL CONVERSION 300 C 90 bar**

## BIO-OIL

**Yield: 3 - 16%**

*Bunker fuel (BTZ) or semi-finished product for refineries to produce advanced bio-fuels*

## WATER

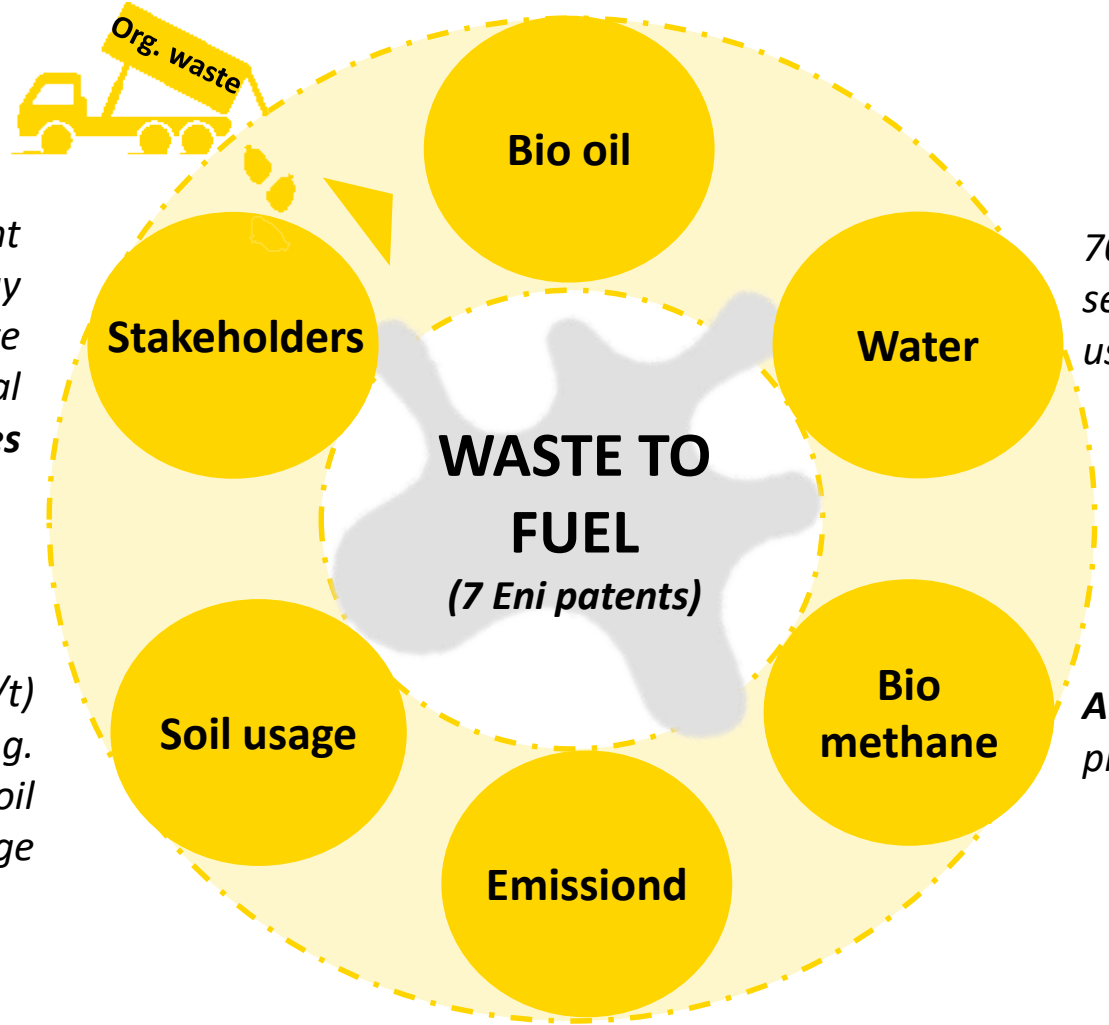
**Yield: 60 - 80%**

*Water for irrigation or industrial usage*

# Waste to Fuel Technology - Innovation and main characteristics

*Low sulphur content (<0,1%), it can be used as **marine bunker fuel** or as input for refineries to produce biofuels*

*Optimal plant **size 150 kt/y** (equivalent to 1.5 million citizens). This plant may **reduce** the treatment and waste transportation **costs**, **re-use** industrial **sites** and promote **job opportunities***




*70% of organic waste is **water**. After separation and treatment, it can be used for **irrigation** or **industrial** usage*

***Reduced soil usage** (<0,3 $m^2/t$) compared to biogas and composting. Re-use of industrial sites after soil remediation, avoiding virgin soil usage*

***Anaerobic digestion** of water may produce bio-methane.*

***Low $CO_2$** emissions. No waste burning but thermo-liquefaction*

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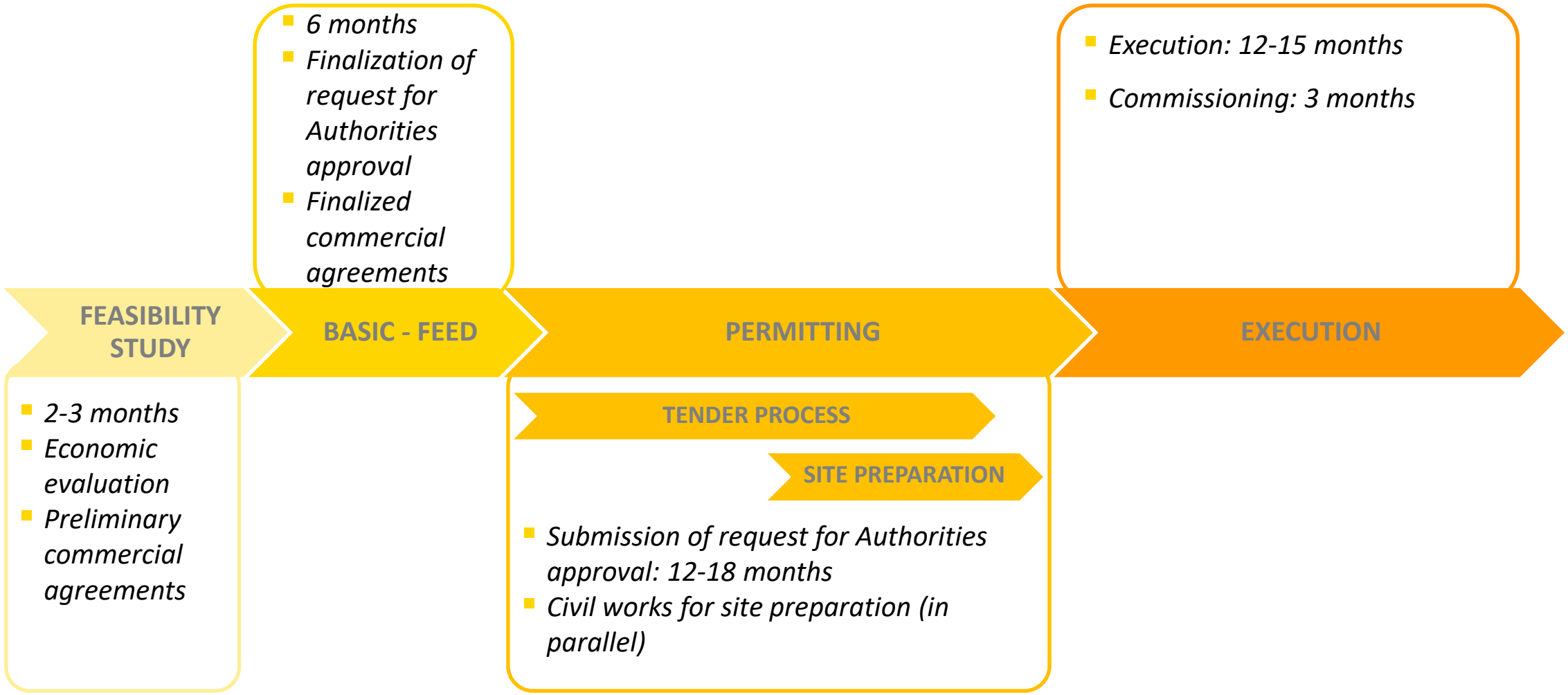
# Pilot plant in Gela

## TARGETS

- Bio-oil analysis, characterization and valorization
- Production test in continuous operation to verify the overall process (reaction and separation)
- design verification, reliability testing for production operations and maintenance routines feedback
- industrial scale plant design Lessons learnt collection

***0,7 t/d of organic waste***

# Typical schedule for industrial Waste to Fuel plant

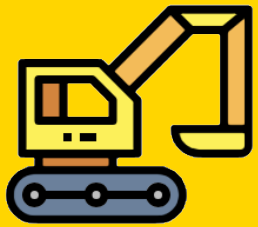


# Waste to Fuel industrial plant *(150 kt/y of organic waste)*: key numbers

*Preliminary CAPEX estimate*

**INVESTMENTS (M€)**

**≈70**



**≈80**

**PERSONNEL INVOLVED IN THE PLANT CONSTRUCTION**

*Average effort considering 1.5 years of building activities*

*Average value for 25 years of design life (direct and indirect personnel)*

**PERSONNEL INVOLVED IN PLANT PRODUCTION OPERATIONS**

**≈40**

**150.000**

**TONS OF ORGANIC WASTE PER YEAR**

*Organic waste treatment capacity. Spare philosophy and back up of critical machines to allow plant operation 24h per day, 365 days per year*

*As maritime bunker fuel with reduces sulphur presence*

**TONS OF BIO-OIL PER YEAR**

**≈20.000**

**≈2,5**

**MILLION CUBIC METER OF BIO-METHANE PER YEAR**

*It can be used as green fuel for trucks that collect waste*