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)

Sorted waste collection
66%
52%
42%

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

- Municipal organic waste
- Biological sludge
- Zootechnical waste
- Compost

Waste-to-Fuel Technology

- Bio-methane
- Eni proprietary technology
- Water

- Bio-oil
- Bio-methane

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Waste to Fuel (W2F) Technology – Process

ORGANIC WASTE ➔ PRETREATMENT ➔ REACTION ➔ SOLIDS FILTRATION ➔ SEPARATION ➔ PRODUCTS

- **Grinding**
- **Homogenization**
- **Inert removal**
- **250-350°C 50-160 bar**
- **Reaction**
- **Heat Recovery**
- **Heat**
- **Heat**
- **RESIDUE**
- **BIO-OIL**
- **WATER**
- **CO2**
- **BIO-OIL**
- **MARINE BUNKER FUEL**
- **REFINERY**
- **BIO-METHANE**
- **WATER TREAT.**
- **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!'”
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.

Bio oil

Anaerobic digestion of water may produce bio-methane. Low CO₂ emissions. No waste burning but thermo-liquefaction.

WASTE TO FUEL (7 Eni patents)

Soil usage

Low CO₂ emissions. No waste burning but thermo-liquefaction.

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.

Reduced soil usage (<0.3 m²/t) compared to biogas and composting. Re-use of industrial sites after soil remediation, avoiding virgin soil usage.

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

Water

Bio methane

Stakeholders

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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

**FEASIBILITY STUDY**
- 2-3 months
- Economic evaluation
- Preliminary commercial agreements

**BASIC - FEED**
- 6 months
- Finalization of request for Authorities approval
- Finalized commercial agreements

**PERMITTING**
- Submission of request for Authorities approval: 12-18 months
- Civil works for site preparation (in parallel)

**SITE PREPARATION**
- Execution: 12-15 months
- Commissioning: 3 months

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

INVESTMENTS (M€)
≈70

PERSONNEL INVOLVED IN THE PLANT CONSTRUCTION
≈80
Average effort considering 1.5 years of building activities

PERSONNEL INVOLVED IN PLANT PRODUCTION OPERATIONS
≈40
Average value for 25 years of design life (direct and indirect personnel)

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

≈20.000 MILLION CUBIC METER OF BIO-METHANE PER YEAR
As maritime bunker fuel with reduces sulphur presence

≈2,5 M€
Preliminary CAPEX estimate

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

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