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# "*Biogas use as fuel in waste collector captive fleet: the experience in the city of Rome, future plans*"

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# Who is AMA Rome

- **Public company** for the solid waste management of the Municipality of Rome
- Established in **1985**
- **100%** owned by Municipality of Rome
- Exclusive concessionary for the Integrated Municipal Solid Waste (MSW) management

# What AMA Rome does?

- Collection, transport and disposal of MSW;
- MSW selected collection (20% in weight);
- Medical wastes incineration;
- City cleaning (sweeping,special events, emergency operations);
- MSW intermodal transport (by urban Railway)

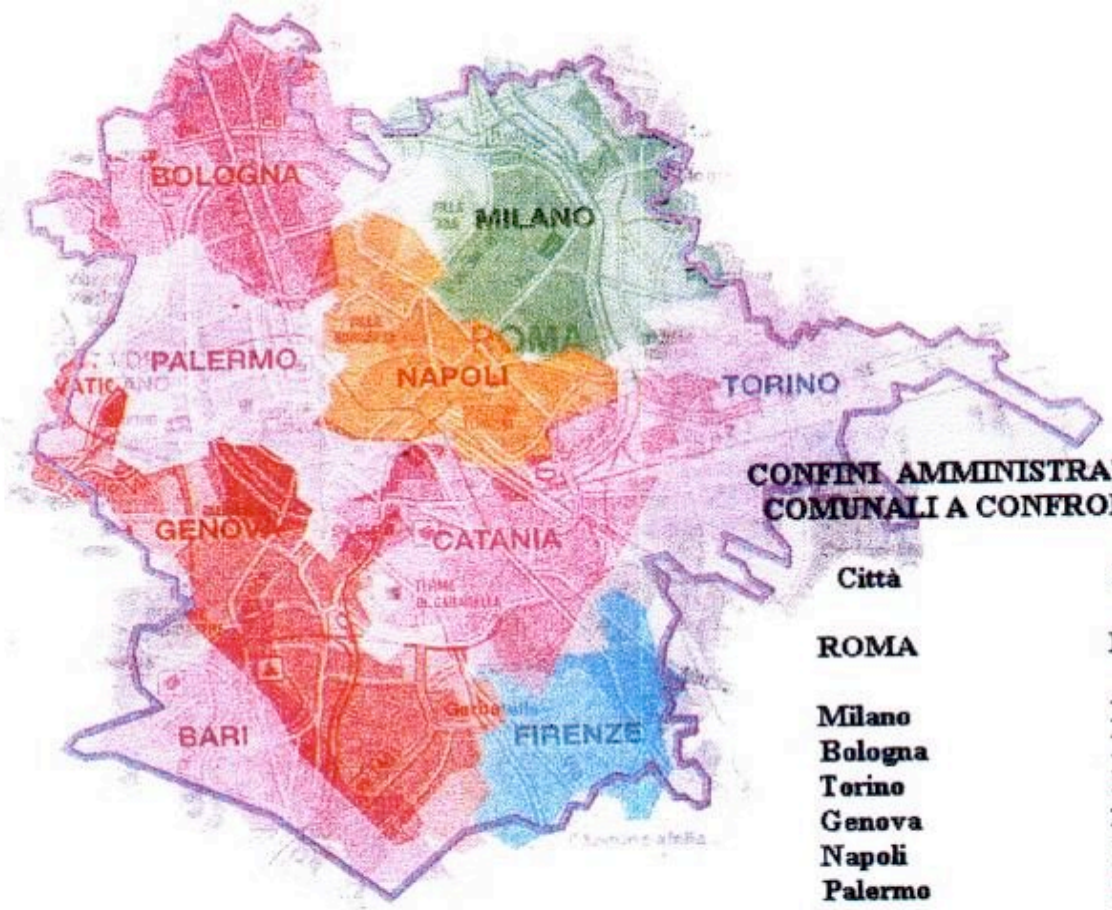
# AMA Rome figures (1)

- Area served ……**1,290** km²
- Population served…… **3,2** millions
- Daily MSW collection…… **4,300** tons
- Annual MSW collection…… **1,800,000** tons
- Annual AMA turnover …… **500** millions €

# AMA Rome figures (2)

- Personnel ..... **6,800**
- Heavy/medium duty trucks..... **1,200**
- Light duty trucks ..... **800**
- MSW sorting and treating plant (180,000 tons/y) ..... n. **3**
- Aerobic compost plant (30,000 tons/y)..... n. **1**
- Medical incinerator plant (20,000 tons/y)... n. **1**
- Treatment plant C&D debris (5,000 tons/y) n. **1**
- MSW railway transport (180,000 tons/y)

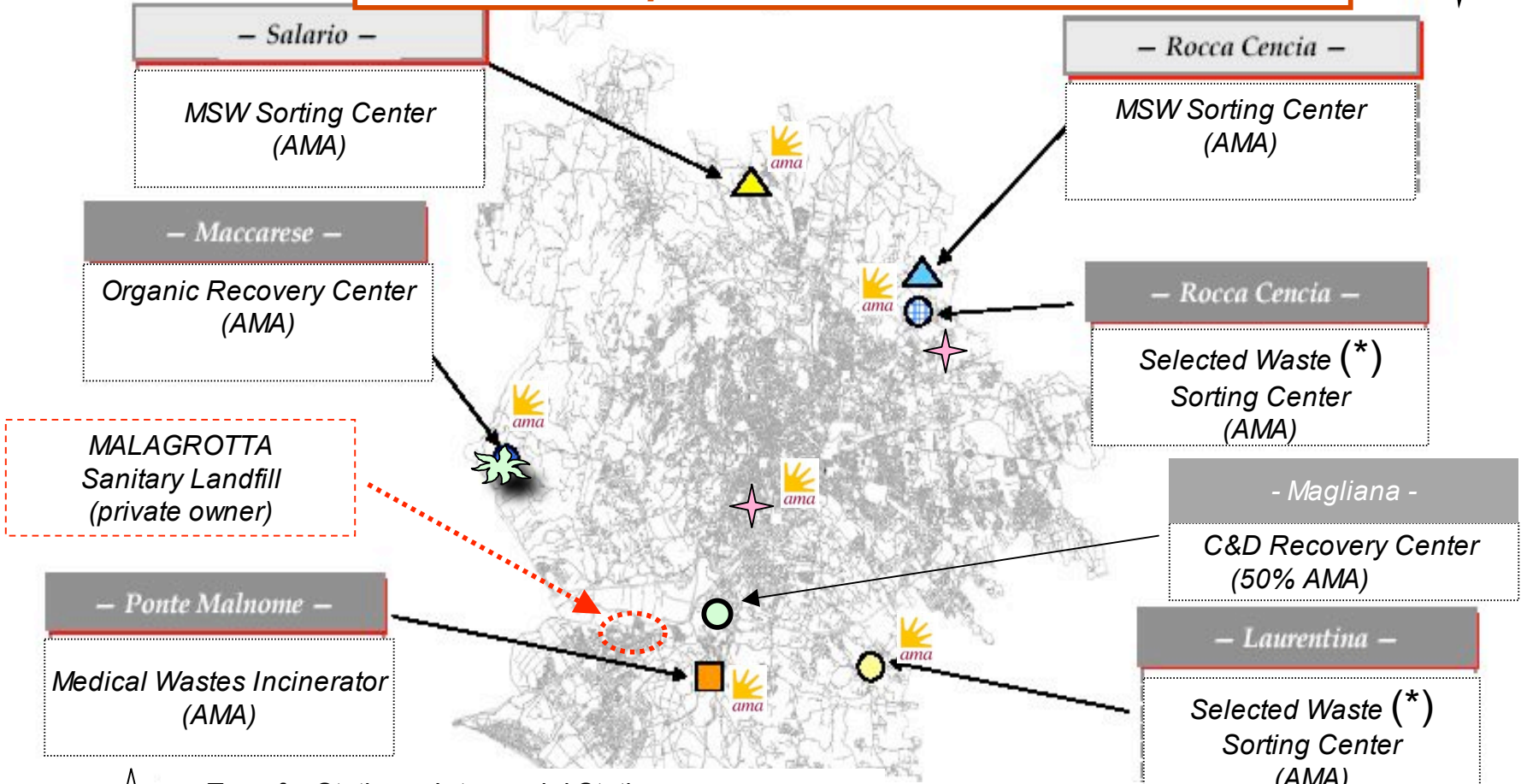
# Rome boundaries - municipal surfaces at comparison in Italy




**CONFINI AMMINISTRATIVI COMUNALI A CONFRONTO**

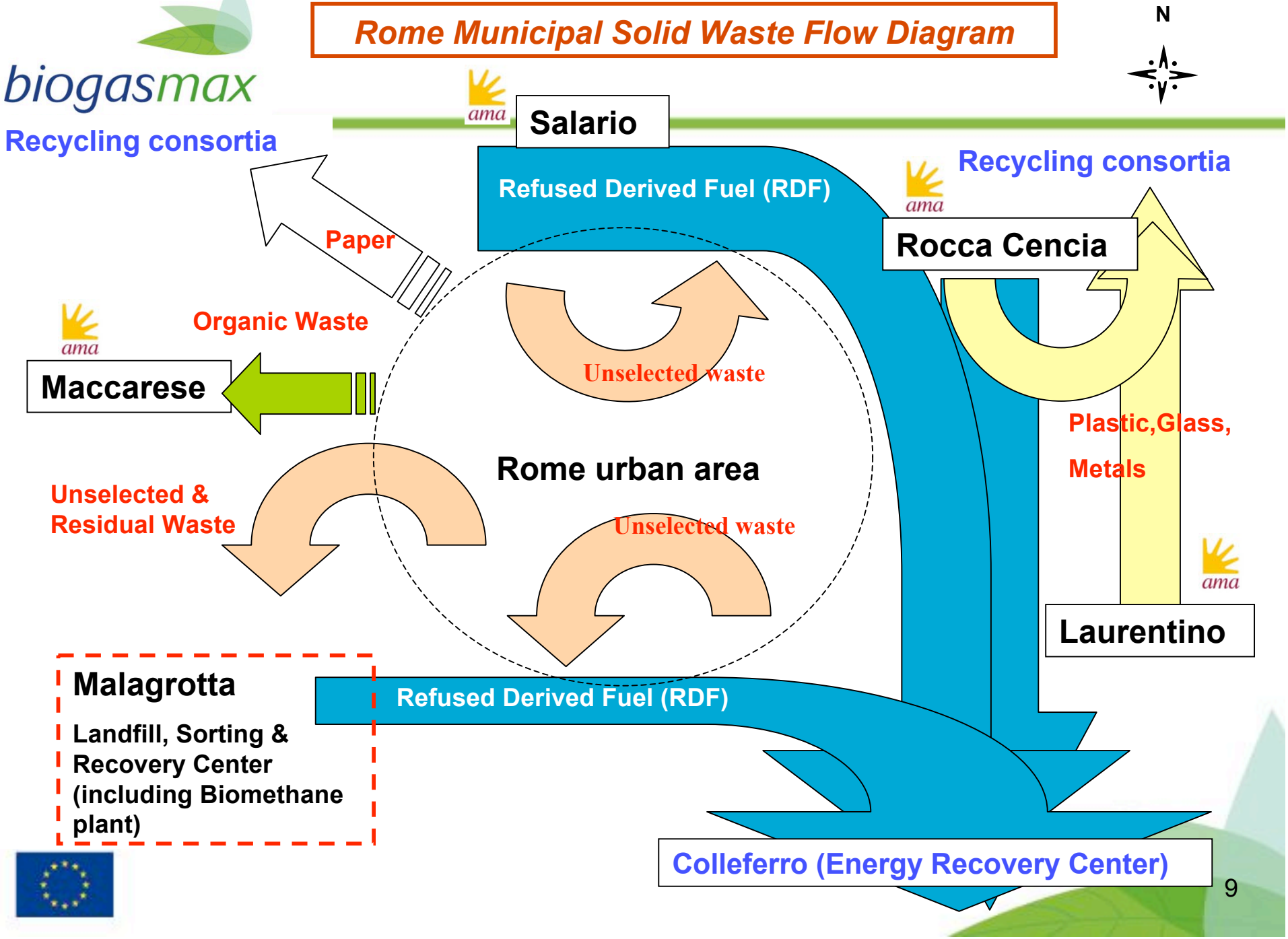
| Città | Kmq |
|---|---|
| ROMA | 1.290 |
| Milano | 181,6 |
| Bologna | 140,7 |
| Torino | 130,2 |
| Genova | 240,5 |
| Napoli | 117,3 |
| Palermo | 158,9 |
| Catania | 180,9 |
| Firenze | 102,4 |
| Bari | 116,2 |

# Rome Municipal Solid Waste treatment facilities




(*) Selected Waste = plastic, glass, metals from separated collection

# Rome Municipal Solid Waste Flow Diagram



# AMA experience in using biogas as fuel

- Since 1997 AMA tested landfill biogas as fuel in n. **10** HDV (waste compactors);
- Biogas fleet progressively increased up to**15** units;
- IVECO engine modified to CBG fuel.

# Experienced performance on biogas fleet

- **Low** air pollutant released;
- **Low** noise emissions (night service);
- **Low** cost of fuelling compared to diesel due to biogas available in landfill;
- **Residual problems** in engine performances (only on old converted engines);
- **Logistic problems** (biogas available **only** in landfill).

# Drivers for a new biomethane project

- Landfill biogas production is going to be **exausted** in the medium term (and landfill to be **closed**) due to EC environmental directives;
- Continuing the **biomethane experience**;
- Strategy of increasing the **selected collection** (in particular **door-to-door** one, with emphasis on **organic waste**);
- Investigating the building of a new anaerobic plant in the Maccarese Organic Waste Centre (beside the existing composting plant) for **energy use** and also for **use in vehicles**.

# Reference logistic scenario -national

Distribution of natural gas filling facilities in main regions of Italy (*)

**ITALY**

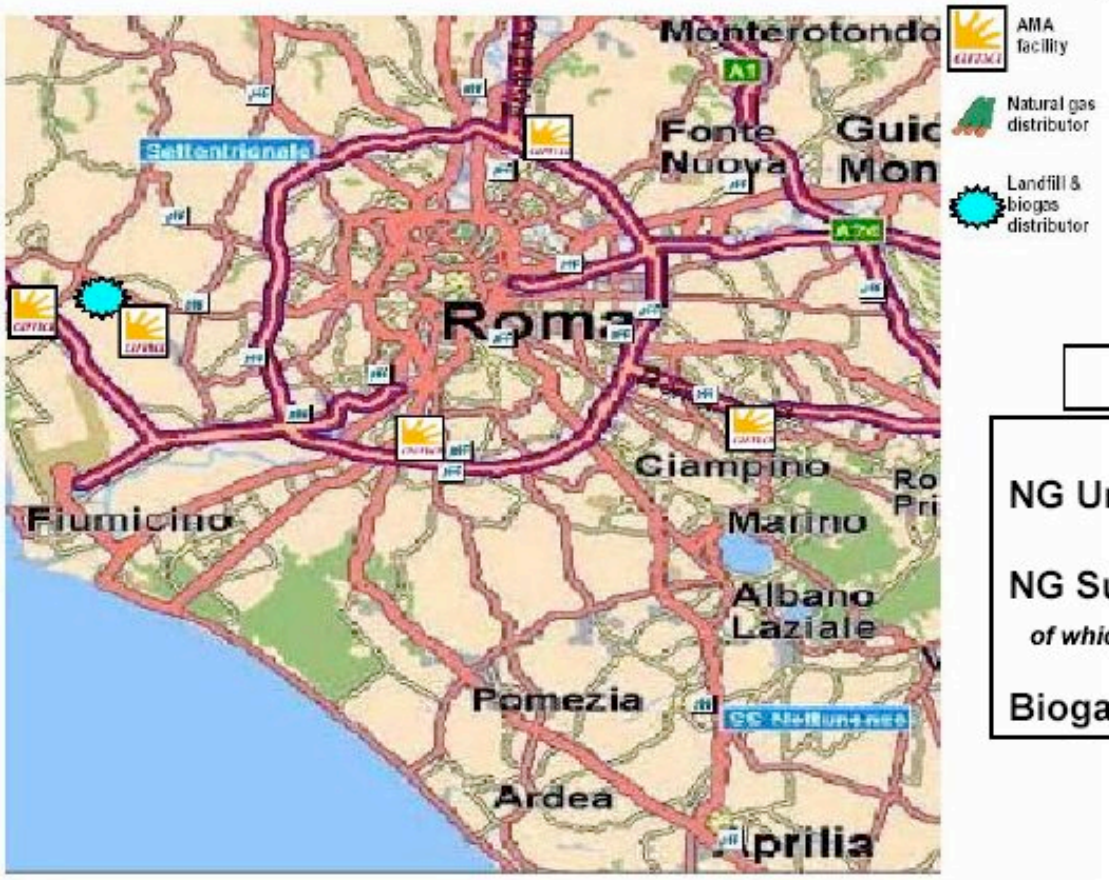
| In operation | |
|---|---|
| North: | 373 |
| Centre: | 231 |
| South: | 114 |
| **Total:** | **718** |
| **In opening:** | **49** |
| **In building:** | **77** |
| **In designing:** | **113** |

| In operation | |
|---|---|
| **Lazio:** | **33** |
| *of which:* | |
| Rome : | 16 |


(*) Source: data and graphics elaborated from www. Federmetano. it

# Reference logistic scenario - local

Natural gas and biogas distributors facilities in the city of Rome (*)




| Rome | |
|---|---|
| NG Urban : | 9 |
| NG Suburban: | 7 |
| *of which highway fac.* | *3* |
| Biogas: | 1 |

*(*)source:data and graphics elaboration from www. metanauto.it and www.comune.roma.it*

# Rome biomethane upgrading and distribution plant close to the landfill

# Types of vehicles monitored



- Chassis: IVECO EUROTECH mod. MP 240 E 26/PS CNG (purchased in 2004, equipped and put in operation in 2006)
- Waste compacting equipment: side loader 26 m3
- n.2 storage tanks 140 l
- n.2 storage tanks 80 l (left side)
- n.3 storage tanks 140 l on the cabin back (optional) for more operation range

# Rome landfill biomethane refuelling plant

Technicals:

- n. 8 fuel pumps
- Average filling time:

  15 min (fast loading)

Obstacles:

- limited operating hours
- operator presence needed

  (no self-service filler available)

# AMA Rome use in captive vehicles: data from the close monitoring

**HDV waste compactors average consumption** :

biomethane: **1.33** km/kg

diesel : **1.8** km/l

**HDV waste compactors operating range:**

biomethane : **170 km** (s. tank capacity 130 kg)

diesel: **540 km** (s. tank capacity 300 l )

*note: **1 kg** methane = **1.33 litres** diesel*

# AMA Rome use in captive vehicles: data from the monitoring (1)

**Maintenance (chassis) :**

☺ Less breakdowns due to chassis failures;

☺ Wider gap between **motor oil** changes;

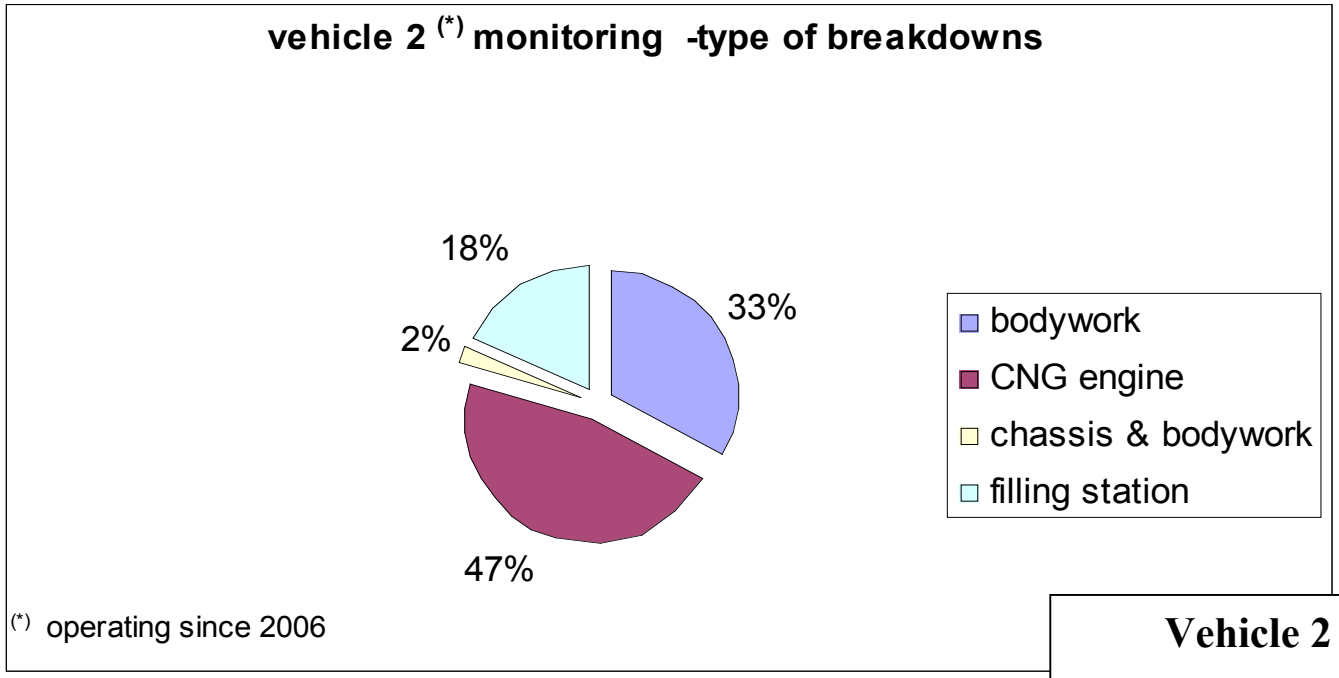

Frequent **electrical** problems on the chassis (ignition);

☹ Engine maintenance more difficult due to the rear location of gas storage tanks

☹ Need to change **storage tanks** each 4-5 years, and, anyway, in case of damages for accidents;

☹ Substitution of storage tanks (free of charge with a national “fund” partly financed from additional gas taxation): **vehicle not available**

# AMA Rome use in captive vehicles: data from the monitoring (2)




**Vehicle 2 - monitoring**

| | |
|---|---|
| Total breakdowns: | 10 |
| Total breakdown days: | 88 |
| Ave. breakd. duration: | 8.8 |

# AMA Rome use in captive vehicles: data from the monitoring (3)

Table 9. Vehicle availability

| | Vehicle 1 | Vehicle 2 |
|---|---|---|
| Planned driving hours | 3 840 | 3 864 |
| Actual driving hours | 1 218 | 2 628 |
| Total breakdowns (incidents) | 12 | 10 |
| Total breakdowns (days) | 198 | 88 |
| Total vehicle availability (%) | 31 | 69 |

# Average availability of vehicles monitored (1)

## Vehicle 1

- Operating since 2004
- The first new IVECO “pilot” model CNG/CBG with side loading waste compactor,
- Quite good availability in the first months of the period
- In the remaning period many stops due to electrical and mechanical failure of the compacting equipment (not related to biomethane)
- The average vehicle availability in the period was **31%**
- N. **12** breakdowns and an average breakdown duration of **16.5** days
- The distance covered was only **12,575** km.

# Average availability of vehicles monitored (2)

## Vehicle 2

- Operating since **2006**,
- Good average availability of **69 %** during the period,
- N. **10** breakdowns
- Average breakdown duration of 8.8 days.
- The distance covered was **27,065** km.
- The **47%** of breakdowns were related to the CNG engine, **33%** were related to bodywork, and **18%** to the filling station.
- From mid January 08 to mid March 08 availability was about **30%** first because of cold start problems
- Presence of water in the engine oil , which caused the need to change the part of the engine
- From March 08 to November 08 the availability was rather high (**70%** to **100%** in the main months)

# (Bio)methane use in captive vehicles Rome experience

## Maintenance (workshop):

- Executive plant design to be submitted to the approval of Fire Brigades (VVFF).

- Existent workshops to be adapted on safety requirements (no gas “bags” should be created on rooftops)

  for ex:

  additional gas automatic sensor system with automatic opening of motorised windows

  welding workspaces should be limited and provided with local air system

# Fire prevention on CNG/CBG waste collector trucks


Fire extinguisher automatic plant in the rear part of the cabin and in the hopper for improving safety work of drivers

(installation on AMA CNG/CBG HDT is ongoing)

# Investment costs and incentives for (bio)methane veicles – Italy

**Chassis purchasing cost comparison CNG/ diesel:**

3.5 tons: € 6,000 (+ **26,30%)** (price Italy IVECO febr. 09)

26 tons: € 45,200 (+ **29,97%)** (price Italy IVECO jul. 08*)

**Comparison foreseen optional automatic gearbox on diesel version price, originally manufactured on CNG models*

**(Bio)methane vehicles purchasing - (Incentives D.M. n. 5 - 10.02. 09 ):**

new commercial vehicles up to 3.5 tons gas fuelled (Euro 4/5):**€ 4.000**

plus up to **€ 2.500** with give back of old one (Euro 0/1/2)

**Old public incentive expired (D.M. 24/05/04):**

(Bio)methane monofuel HDV, LDV**: max € 4.131,66**

**state incentives only cover extra costs for ligh duty trucks**

# (Bio)methane use in captive vehicles Rome experience

## IMPACTS

**Refuelling plant**

Fillings management:

- **15-20** min filling duration;
- dedicated personnel to filling operations;
- different management of the filling plant (starting procedures and longer times for compressors),

Safety distance respect:

- property borderline
- internal, external buildings
- electric cabins, electrical cables, etc.

# Feedback from drivers and management

- Interviews to drivers and management of depot for biogas vehicles
- Driving and management of the vehicles **similar** to diesel vehicles
- **More comfort** on driving because of less noise
- Sensitiveness to danger of **fire/explosion**

# Coming actions in Rome regarding biomethane/methane

**7** new minibus are going to be operational in Rome by the municipal transport company;

model: IVECO Daily Urby, 6.5 tons , 100 kW, 8 m length);

fuelled by biomethane from Malagrotta landfill, up to 30 passengers,

equipped with mobile lifting platform for wheel chaired passengers

# Coming actions in Rome regarding biomethane/methane

133 new bi-fuel (gasoline/natural gas) city cars (Panda Natural power or equivalent) are going to be rented from AMA for next 48 months, old cars will be given back.
n.14 gas fuelled new sweepers

# AMA Organic Recovery Center located in Maccarese

# Type of waste delivered to Maccarese Organic Center




# Thank you!

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