The French Report

French Environment and Energy Management Agency
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AD plants in operation (E&Young study for ADEME, 2010):

- On-farm: arr. 20
- Centralised: 2
- Industrial: 88
- Sewage sludge: 74
- Municipal: 6 (3 biowaste & 3 grey waste)
- Landfill: 301 inc. 65 with energy valorisation
Biogas Plant Inventory

Up-grading plants in operation:

• 1 landfill: 200 m³/h (R&D - PSA and membranes)

• 1 biowaste (Lille): 1,200 m³/h (water scrubber)

• 1 municipal sludge (Lille-Marquette): 100 m³/h (water scrubber)
**Biogas Plant Inventory**

**Trends of AD plants** (E&Young study for ADEME, 2010):

Trend of MSW AD plants since 2000:

Trends in numbers of others AD plants in 2020:
- + 60 industrial (88 to 150)
- + 60 municipal sludge (74 to 134)

Trends in numbers of up-grading plants: arr. 20 (landfill & on-farm)
**Biogas Plant Inventory**

**Gas production 2008** (French Ministry for Environment and Energy, 2009):

- Raw biogas production: 3,300 GWh
- Energy production: 1,290 GWh
- Electricity production: 660 GWh inc. 77 GWh CHP
- Amount of heat recovered: 630 GWh inc. 70 GWh CHP
- Up-graded to biomethane
  - Amount injected to natural gas pipeline: 0
  - Amount used as vehicle fuel: arr. 0
Performance data (French Ministry for Environment and Energy, 2009):

- electrical efficiency: 15.0%
- total energy efficiency: 39.1%
- emissions: nd
Economic Data (if available):

- **Investment costs**

- AD plant
  - on-farm AD: 5,000 to 8,500 €/kWe dep. of P
  - biowaste AD: 80 €/treated ton

- **Up-grading**

- **Operating Costs**
Biogas Plant Inventory

**Economic Support Data:**

- **Feed-in tariffs (act. 2010)**

<table>
<thead>
<tr>
<th>feed-in tariff (in c€/kWhe)</th>
<th>P ≤ 150 kW</th>
<th>150 kW &lt; P ≤ 2 MW</th>
<th>P &gt; 2 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD bonus</td>
<td>2,100</td>
<td>2,100</td>
<td>2,100</td>
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</table>

<table>
<thead>
<tr>
<th>Energy efficiency (V)</th>
<th>V ≤ 40 %</th>
<th>40 &lt; V &lt; 75 %</th>
<th>V ≥ 75 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE bonus</td>
<td>0</td>
<td>Linear interpolation</td>
<td>3,150</td>
</tr>
</tbody>
</table>

| Min.                        | 11,551  | Linear interpolation | 9,975   |
| Max.                        | 14,701  | Linear interpolation | 13,125  |

\[ V = \frac{\text{total heat and electricity sell or consumed by process}}{\text{raw energy from biogas}} \times 0.97 \]

- **Investment grants**
  - Environment agency: until 30% of the investment limited to 10 M€, namely 3 M€
  - Agricultural ministry: until 375 k€/project on-farm AD
  - European funds
**Biogas Plant Inventory**

**National Strategy/Support for Exploitation of Biogas:**

- **Renewable Heat Fund** managed by ADEME to promote the use of heat, biogas transport and grid injection
  
  **5 projects in 2009:**
  3 large AD (organic waste and sludge)  
  1 transport of raw biogas from landfill to a furnace  
  1 landfill biogas valorisation (in operation)

- **Waste fund** managed by ADEME to promote new technologies, and the use of digestate
  
  **3 projects in 2009:**
  AD animal by-products and organic waste

- **national WG** on up-grading and grid injection: definition of technical specifications to inject biomethane into the grid and feed-in tariff
Challenges:

- AD plant permitting
- Environmental licenses
- Grid connections (electricity, heat, gas pipeline)
- Digestate utilisation
Research Activities:

- Biogasmax with Lille City
- Up-grading by PSA and membranes: test for low and high capacities (landfill, on-farm), different kinds of membranes
- Technologies to remove siloxanes from landfill gas