Agriculture & Renewable energy / Biogas: contributions and opportunities for farms

Nicolas Tonnet
Energy / Biomass / Innovation / Ecoconception
Forest, Food & Bioeconomy entity
## Energy production from biogas (2017)

<table>
<thead>
<tr>
<th>Plant type</th>
<th>Number of plants</th>
<th>Electricity production (GWh/year)</th>
<th>Heat production incl. injection (GWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage sludge</td>
<td>88</td>
<td>40</td>
<td>470</td>
</tr>
<tr>
<td>Biowaste from MSW</td>
<td>16</td>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>Industrial</td>
<td>80</td>
<td>7</td>
<td>350</td>
</tr>
<tr>
<td>On-farm and centralized</td>
<td>390</td>
<td>820</td>
<td>780</td>
</tr>
<tr>
<td>Landfills with biogas recovery</td>
<td>113</td>
<td>950</td>
<td>330</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>687</strong></td>
<td><strong>1887</strong></td>
<td><strong>1950</strong></td>
</tr>
</tbody>
</table>
Objectives and scope

Renewable energy considered
- Biofuel
- Methanisation
- Onshore wind
- Photovoltaic power
- Heat pumps
- Solar thermal energy
- Combustion (bioenergy)

Agricultural production (ressources)
- Crops (cereal, oilseed, protein...)
- Market gardens
- Vineyards
- Orchards
- Farming (cattle, sheepe, poultry, swine...)
- Mix crops & breeding
Agriculture contribution for renewable energy production:
- 20% national renewable energy production
- 4,6 Mtep
- Mainly biofuel & onshore wind (cereal plain)
- 50,000 farm

Energy demand (agriculture): 4,5 Mtep
Economic component

- (gross) profit for renewable energy in agriculture: 1,4 milliards €
- 2% of the global profit for the agriculture (69 milliards €)

Income:
- Biomass sale: biofuel, combustion, methanisation
- Energy sale (electricity, gaz): photovoltaic power, methanisation
- Direct consumption: combustion, solar thermal energy, geothermy
- Rental of surfaces (roof, grassland): onshore wind, photovoltaic power

50 business models / 11 analyzed
Renewable Energy mix in 2030 and 2050 for the agriculture

Number of farms involved in renewable energy production

- Biocarburant
- Biogaz élec
- Biogaz injec
- Eolien
- Solaire photovoltaïque
- Pompe à chaleur
- Solaire thermique
- Production de biomasse chaleur

Target 2050
## Compatibility & Business model studied

<table>
<thead>
<tr>
<th>Type of unit</th>
<th>Investment</th>
<th>Exploitation</th>
<th>Business</th>
<th>Name of the Business model</th>
<th>Model development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methanisation (on-farm)</td>
<td>Individual unit</td>
<td>Only one farmer</td>
<td>Farmer</td>
<td>Electricity sale and heat consumption</td>
<td>3-Vente d'électricité, unité individuelle</td>
</tr>
<tr>
<td></td>
<td>Little collective</td>
<td>Farmers</td>
<td>Farmers</td>
<td>Electricity sale, heat consumption and sale</td>
<td>8-Vente d'électricité, collectif d'agriculteur, unité sur exploitation</td>
</tr>
<tr>
<td>Methanisation (centralized)</td>
<td>Collective</td>
<td>Farmers’ company shareholders of a project company</td>
<td>Farmers’ company shareholders of a project company</td>
<td>Gas sale</td>
<td>14-Vente de gaz, collectif d'agriculteur, unité chez acteur tiers</td>
</tr>
<tr>
<td>Wind</td>
<td>....</td>
<td>....</td>
<td>....</td>
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</tbody>
</table>
On-farm methanisation: only 25 installations in France...but, mais number is likely to increase in the next few years; high variability of the systems in this model (cattle / pig, dry / wet, installed power...)

This model has not yet found its technical and economic stability; need a well-designed model that is simple to build and mass-produced to lower the cost of investment (hardware standardization)
Anaerobic digestion can raise fears, for example about future economic difficulties due to the fragility of some external supply resources, or about the complexity of farm management.

- Significant impact (on the revaluation of a job as a farmer sometimes difficult and on its involvement) :
  - Provides confidence and generates motivation for agricultural activity.
  - Investment in new skills.
  - Brings the pride of having conducted this type of project and of having gone through a long and difficult procedure.
  - Opening to the outside (not only the agricultural activity).
  - Multifunctionality generated by anaerobic digestion into the farms.
  - Generates links between actors of the same territory.

- The socio-economic impact is highly variable / Depending on the goals sought by the project leaders, they will have to move towards different methanization models:
  - For a strong impact on the income : individual anaerobic digestion unit,
  - For a strong impact on the logistics of materials and the release of working time : unit of collective anaerobic digestion
A recent prospective study in France
Gas demand from 276 to 361 TWh in 2050 could be met by renewable gas in the scenarios studied.
The forecast study shows 4 markets:

- **Biowaste**: 9% of the total, including waste and CIVE at 12%.
- **Agricultural residues**: 41%.
- **Manure**: 39% (with biogas collection).

**Market Analysis**:

1. **Small scale** (target 70,000 installations): 70,000 – 10,000.
2. **“Big individual”** (target 2,500 installations): 2,000 – 5,000.
3. **Small agricultural unit** (target 170,000 installations): 170 à 760.

**Industrial** (with agrofood waste and CIVE)

- **< 75 kW**: 5000 à 12,000 t.
- **100 à 350 kW**: 18 à 22,000 tonnes.
- **400 à 550 kW**: + de 30,000 tonnes.
- **+ de 600 kW**: + de 600 kW.

**Target 2030 (ADEME)** = 6,000 installations éq.
• 44 upgrading plants for biomethane (+18 in 2017)
  – 2 landfills
  – 4 MSW (biowaste or separated waste)
  – 7 WWT sludge
  – 31 agricultural and/or agro food waste

• The main part in the North East of the country
10 years of ADEME investment grants

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<tbody>
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<td>Grants (MEUR)</td>
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<td>2</td>
<td>6</td>
<td>7</td>
<td>26</td>
<td>37</td>
<td>33</td>
<td>39</td>
<td>39</td>
<td>37</td>
<td>41</td>
<td>269</td>
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<tr>
<td>Projects (nb)</td>
<td>10</td>
<td>16</td>
<td>26</td>
<td>24</td>
<td>66</td>
<td>96</td>
<td>99</td>
<td>122</td>
<td>88</td>
<td>87</td>
<td>110</td>
<td>744</td>
</tr>
<tr>
<td>Energy (GWh)</td>
<td>44</td>
<td>50</td>
<td>132</td>
<td>143</td>
<td>463</td>
<td>430</td>
<td>561</td>
<td>690</td>
<td>528</td>
<td>449</td>
<td>533</td>
<td>4023</td>
</tr>
</tbody>
</table>

**Evolution of AD projects by type of energy recovery**

*Cogeneration projects at first and injection now*

*An industry increasing and profitable → Have a stronger diffusion with private and participative funds*