HOW TO DEVELOP A BIOGAS SYSTEM: REQUIREMENTS, LOGISTICS, REGULATIONS AND ECONOMICS OF BIOGAS PLANTS IN EUROPE

Dr. Agr. Guido Bezzi
Resp. Agronomy Area
CIB – Consorzio Italiano Biogas e Gassificazione - Italy

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Biogas is a growing energy sector in Europe.

More than 17,000 plants and 8339MWe installed at the end of 2014.
BIOGAS SECTOR IN EUROPE

- Variability in increasing rate demonstrate the effect and the adaptability of biogas system at national policy changes.
- Agriculture is the first sector for biogas developing (Germany and Italy have a lot of installations in farm).
- Landfill and Sewage are other important sectors for biogas.
- Average size of new installation: Agriculture: 480kWe; Landfill 670kW; Sewage Sludge 230kW.
The growth of biogas in Europe is different between countries
Germany and Italy play a principal role in biogas sector
Biogas have good developing potential already unexpressed relating to 2020 NREAP
2020 National Renewable Energy Action Plan (NREAP) biogas targets are related to energy, heat and biofuel production.

Some countries have to develop a large part of biogas and biomethane system.
BIOGAS AND FEEDSTOCK

- Biomasses from agriculture are the most important feedstock for biogas
- In Germany principally derived feedstock from energy crops, Italy from manure and by-products
- Some countries have developed first waste valorization in Landifill and Sewage plant
Biomethane have good potential but his growing is limited by absence of legislation in some countries.

1,8 billion m$^3$ of biomethane produced mainly in north Europe.

Biomethane is a sustainable biofuel that helps to reduce significantly transport emissions.
Biogas jobs are 5% on average of total renewable jobs and they are increasing instead the decrease of job in renewables.

In Italy biogas exceed other renewable for permanent jobs related to productivity.

In Germany are estimated more than 49,000 jobs created, in Italy more than 12,000.
BIOGAS SUPPORT SCHEME
# BIOGAS AND BIOMETHANE

<table>
<thead>
<tr>
<th>Resource</th>
<th>Potential [1×10⁹ m³]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody Biomass</td>
<td>66</td>
</tr>
<tr>
<td>Herbaceous Biomass</td>
<td>11</td>
</tr>
<tr>
<td>Wet biomass residues</td>
<td>26</td>
</tr>
<tr>
<td>Energy crops</td>
<td>48-143</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>151-246</strong></td>
</tr>
</tbody>
</table>

*Green Gas Grid Project, 2013
European Biomethane Roadmap
Maximal technical potential*

**EU 28 NG consumption 2013**
462×10⁹ m³ (2% down from 2012)
BIOGAS AND BIOMETHANE POTENTIAL

- European Biogas system have huge potential beyond renewable electricity
- It is a decentralized and domestic source of methane
- When applied in agriculture contribute to local and rural development
- Biogas system can promote high GHG savings and enabling gas greening
- Biogas system is a key factor to respect EU 2020 and 2030 objectives

WHAT ARE FACTORS THAT INFLUENCING BIOGAS SYSTEM DEVELOPMENT?
DEVELOPMENT OF BIOGAS SYSTEM

Key factors

• Country strategies and policies
• Type of biomass and biomass availability assessment
• Economics and subsidies
• Regulations
COUNTRY STRATEGIES AND POLICIES: ITALY

- Decreasing Feed-in-Tariff that promote biogas in agriculture (small plant)
- Increasing use of by-products instead dedicated crops and soil use efficiency

BIOGAS IN ITALY

- 3° biogas in the world, behind China and Germany
- 2 Mrd Nmc of methane produced per year
- 4,5 Mrd € of realized investments
- More than 1,300 plants on farms today
- About 1,000 MWe installed power and 8 GWhe/year produced
- 12,000 stable jobs from the sector
BIOMASS ASSESSMENT

• A lot of animal manure
• High production area
• Advanced agriculture

• A lot by-products from agriculture
  Unexplored biogas potential
• Need to restore agriculture

Farm manure distribution
Livestock Information: type, number, confinement period, spatial livestock distribution
Feedstock data: feedstock composition (DM, OM), biogas yields
### ITALIAN BIOGAS AND BIOMETHANE ROADMAP

- High land use efficiency
- Double crop system
- Restore Fertility
- Recover soil with new crops
- By-products and manure valorization
- Waste and landfill valorization
- 8 billion m$^3$ biomethane is the potential to 2030

#### Potential of “Biogasdoneright” (biogas fatto bene)

<table>
<thead>
<tr>
<th>Potential of “Biogasdoneright” (biogas fatto bene)</th>
<th>2010</th>
<th>2013</th>
<th>2015</th>
<th>2020</th>
<th>2030</th>
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</thead>
<tbody>
<tr>
<td>Biogas From Agricultural Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First harvest Used Agricultural Land (ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land efficiency ha/mln Nm$^3$ Bio-CH$_4$ eq</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ha/Mwel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biogas from Agricultural Resources</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Billion Nm$^3$ Bio-CH$_4$ equivalent</td>
<td>0.6</td>
<td>1.7</td>
<td>3.5</td>
<td>5.8</td>
<td>8.0</td>
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<tr>
<td>equivalent Mwel</td>
<td>276</td>
<td>791</td>
<td>1591</td>
<td>2652</td>
<td>4000</td>
</tr>
<tr>
<td>Biogas from urban wet waste, landfill and waste</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Billion Nm$^3$ Bio-CH$_4$ equivalent</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
<td>0.7</td>
<td>1.0</td>
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<tr>
<td>equivalent Mwel</td>
<td>100</td>
<td>125</td>
<td>200</td>
<td>300</td>
<td>450</td>
</tr>
<tr>
<td>Total “Biogasdoneright” (biogas fatto bene) potential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Billion Nm$^3$ Bio-CH$_4$ equivalent</td>
<td>0.8</td>
<td>2.0</td>
<td>3.9</td>
<td>6.5</td>
<td>9.0</td>
</tr>
<tr>
<td>equivalent MWel</td>
<td>376</td>
<td>916</td>
<td>1.791</td>
<td>2.952</td>
<td>4450</td>
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ECONOMICS AND SUBSIDIES
### Rural Development

- Reduced emission in manure and by-products management
- Soil covered and reducing leaching risk
- Crop rotation and soil use efficiency
- Double crop, minimum tillage and precision farming
- Improve of soil matter in soil

### Market Development

- Technological innovation in agriculture
- Digestate as a fertilizer
- High efficiency in crop and digestate management
- Breeding, new crops etc...
- Biomethane, new mechanization etc...

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**BIOGAS DRIVE RURAL AND MARKET DEVELOPMENT**
BIOGAS AND BIOMETHANE REGULATIONS AND POLICIES

Biogas Related Policies on the EU Level

- Transport and Gas
  - ILUC
  - Future Transport Fuels
  - Bio-methane Standards (CEN)

- Power and heating
  - Sustainability recommendations

- Digestate
  - End-of-Waste Criteria for digestate
  - Revised Fertiliser Regulation
  - REACH

- Waste policies
  - Revision of Waste Framework and Landfill Directives

- Support schemes
  - State Aid Guidelines on Energy and Environment

- Targets
  - National Renewable Energy Action Plans
  - 2030 Target for RES

- Energy Union
- ETS
- Emissions in medium combustion plants
- Renewable heating & cooling strategy
- European Energy Security Strategy
- CEN/TC groups on biogas definition

+ many more to come...
Thanks for your attention