BIOGAS DONERIGHT
AND SOIL CARBON SEQUESTRATION
THE ITALIAN AGRICULTURAL REVOLUTION

Piero Gattoni - President CIB
SOME BASICS QUESTIONS

• Why producing Bioenergy with the current conventional farming, that emits as much and the transport sector?
• Why producing energy crops, even if „no food“, occupying land whereas need for Food & Feed?
• Can the production of Bioenergy reduce emissions of conventional farming, turning farming and agroforestry from a problem to part of the solution?
• How can the Biogas refinery speed up a cost-effective penetration of intermittent renewables in the energy market and produce biomaterials and biochemicals?
Agriculture alone is responsible for 12% of the GHGs emission globally.
WHEN WE PRODUCE RAPESEED BIODIESEL, NOTHING CHANGES AT THE FARM LEVEL

To lower emissions from agriculture we need:

1. Mitigate emission from agroresidues and wastes
2. Keep the soil covered all year round, thus increasing photosynthesis and rotations
3. Increasing soil fertility via greater crop residues, manuring and digestate applications
4. Disturb the soil as low as possible, via minimum tillage, strip tillage, sod seeding, precision farming and increased rotations techniques
5. Lower fossil inputs in fertilization and energy use, via organic fertilization, nitrogen fixing crops, biogas and biomethane in agriculture mechanization
6. Improve Nitrogen Usage Efficiency (NUE) via increased organic fertilization, drip irrigation with digestate liquid fraction, cover crops, etc.

7. Increased Net Primary Production (NPP) via increased Water Usage Efficiency (WUE) applying drip irrigation, CAM plants where C3 & C4 crops give marginal yields, increased field capacity thanks to soil greater organic carbon content ad its water buffering capacity

8. Lower pesticides and Plant Protection Products inputs, direct seeding on cover crops, increased organic fertilization, increased pollinator insects and increased biodiversity
BUT FROM WHERE BIOMASS SHOULD COME FROM?

- Using perennial, maybe no food plants thus turning farms into woodland where to work few days per year just for harvesting?
- Biomass means Algae?
- Or only waste to energy?
- Can we produce food AND fuel with the same land at the scale required?
- Or better “must” we produce food AND fuel?
WE MUST PRODUCE MORE IN AGRICULTURE, WITHOUT INCREASING GHG EMISSIONS, INCREASING PHOTOSYNTHESIS AND STORING CARBON IN SOIL

We need carbon negative systems and soil is the most abundant, cheap sink for carbon. Moreover, more carbon in soil fights climate change at local level and increased food security.
BIOMASSES OF THE BIOGAS DONERIGHT

- Livestock effluents
- Agroresidues and agrowastes
- Cover crops before or after cash crops
- Food or perennial crops to revegetate abandoned lands, where C3 and C4 are not farmed anymore, among these Cactaceae, alfalfa, perpetual meadows
BIOGAS DONERIGHT IS HIGHLY EFFICIENT AND EASILY SCALABLE

- Biomethane is the key for the future energy mix
- Renewable and sustainable
- Flexible, programmable
- Allows integration Gas and electricity grid
- With Power to Gas stabilizes the electricity grid
- **Target for 2030:** 8 billions Nm3 BioCH4/year with an ecological agricultural intensification
SOIL CARBON SEQUESTRATION: IT WORKS, IT IS EASY AND CHEAP

- Soil can sequester Carbon at the Gton scale needed
- Continuous fertilization via manure increase soil Carbon content
- Can we sequestrate Carbon in soil via digestate? Yes!
LONG TERM EXPERIMENTS (> 20 YEARS) TELL US IS HAPPENING

- N0: unfertilised test
- N3: mineral fertilisers (urea and superphosphate, recommended N and P input)
- C1: composted biosolids at rate 1
  - 7.5 Mg DM ha⁻¹ yr⁻¹ until 1994, 5 Mg DM ha⁻¹ yr⁻¹ onward, except the last three years (from 18 to 21) when the application rate was based on nitrogen (170 kg N ha⁻¹ yr⁻¹)
- C2: composted biosolids at rate 2
  - 15 Mg DM ha⁻¹ yr⁻¹ until 1994, 10 Mg DM ha⁻¹ yr⁻¹ onward, except the last three years (from 18 to 21) when the application rate was based on nitrogen (340 kg N ha⁻¹ yr⁻¹)
  - composted biosolids are a mixture of dewatered sludge and wheat straw, 9:1 w/w respectively, turned for 2 months in an open platform and left for a further 1-1.5 months

Paolo Mantovi – CRPA 2016 unpublished personal communication
WHAT ABOUT BIOGASDONERIGHT LCA?

- Better LCA among renewables
- Better LCA among biofuels
- Best option to lower Carbon footprint transport sector
- **Toward Carbon negative agriculture!**

![Graph showing GHG emissions comparison between different energy sources](chart.png)
BIOGAS DONERIGHT: SOMETHING MORE THAN A BIOENERGY

The Anaerobic Digestor infrastructure is able to revolutionize the farming practice:

- It allows the soil to be covered the whole year
- It increases the rotations
- It turns agrowastes into a precious resource
- It improves the WUE and NUE at the farm
- **It turns the farms from carbon emitter to a carbon sink**
BIOGAS DONERIGHT CAN BE DEPLOYED AT ANY LATITUDE AND ANY AGRICULTURAL CONDITIONS
VISION FOR THE FUTURE: BIOGAS REFINERY

- Integration of natural gas and electricity grid
- Production of renewable & organic fertilizers
- Production of biochemicals and biomaterials
- Mitigation of emissions

Our aim: an integrated biorefinery distributed on the territory that brings circular economy at the farm level
BIOGAS REFINERY: A FLEXIBLE, DISTRIBUTED MULTIPURPOSE PLANT

BIOMASS A

BIOMASS B

BIOMASS C

BIOMASS PLANT

CO2

OTHERS

ALGAE

EMISSION FREE CAR

POWER TO GAS

BIO CH4

ELECTRICITY

HEAT

LIQUID

SOLID

BIOCHAR

FERTILIZERS

BIOPLASTICS
• Wind and PV are becoming always cheaper
• Their share on the energy mix is increasing
• **How to have a spare capacity, interconnect gas and electricity grid and stabilize intermittent energy sources? With distributed biogas refineries**

Source: Bloomberg
NEXT CHALLENGE: STORAGE OF RENEWABLE

- Can a biogas refinery:
- Take the excess of R.E. from the grid and transfer it where is needed for a cost < 50€/MWh?
- Produce biofuel for a cost < than 50€/MWh and transport it in the gas grid?
- Is the gas grid the cheapest option (< 10€/MWh) for energy transport and storage?
CONCLUSIONS

- If we decarbonize overnight our energy system, would we be able to avoid the risk of abrupt climate change and stay < 1.5°C temperature increase? No…
- We need BECCS system, that are easy, scalable and cheap
- Biogasdoneright is a BECCS easy, scalable (>4 Gton C/year)
- Biogasdoneright contribute to increased photosynthesis, more food production, more renewable carbon production for energy and chemistry and storage of Carbon in the soil
- The biogas refinery is an effective tool to link the power with the gas grid, where the gas grid is the cheapest and effective way to store and deplace in the timespan and in the space large amount of energy

Example of Biogasdoneright in action: Cooperativa La Torre: 2 biogas plants of 1 MW each.
Daily input: 90 tons cow manure, 90 tons cow slurries, 38 tons eggs laying chicken manure, 10 tons rabbit manure, 5 tons spent mushrooms litter, 10 tons sugar beets, 30 tons corn silage, 5 tons rye grass (all wet weights)
Daily output (energy): 48MWh
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WHY DO WE NEED NEGATIVE EMISSIONS

Carbon Removal Vital in Case of Emissions Budget Overshoot

Mitigation phasing out fossil fuel and decreasing the unitary carbon content for products and services

Carbon negative emissions: enhancing natural (or artificial) carbon sink