BIOGASDONERIGHT
AND SOIL CARBON SEQUESTRATION

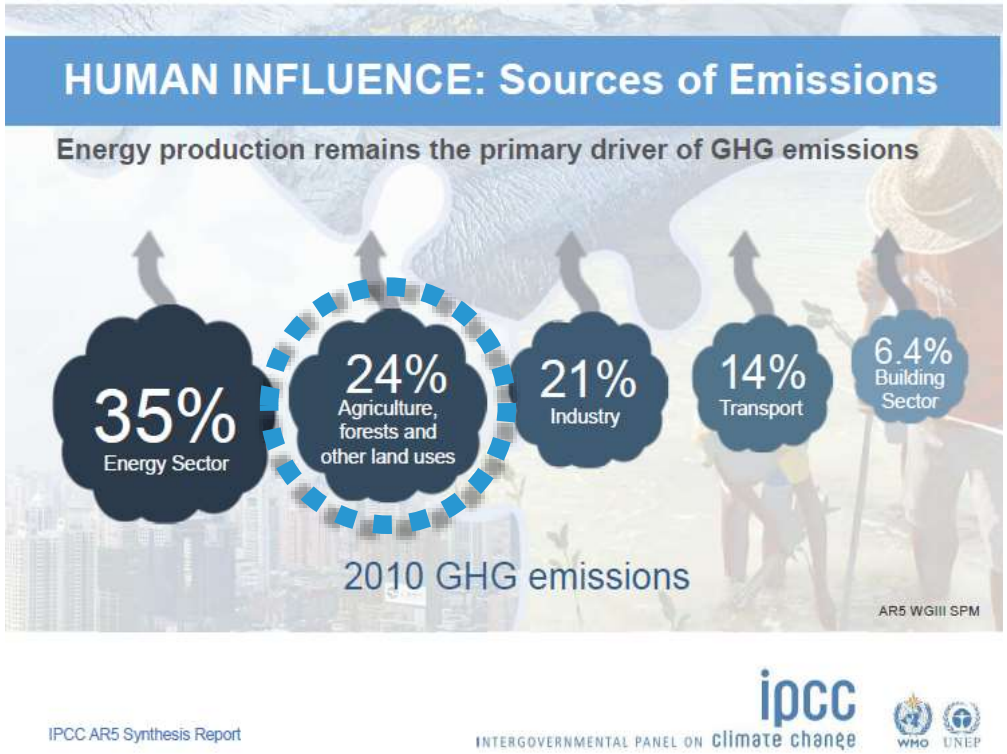
THE ITALIAN AGRICULTURAL REVOLUTION

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?

IPCC MITIGATION REPORT 2014

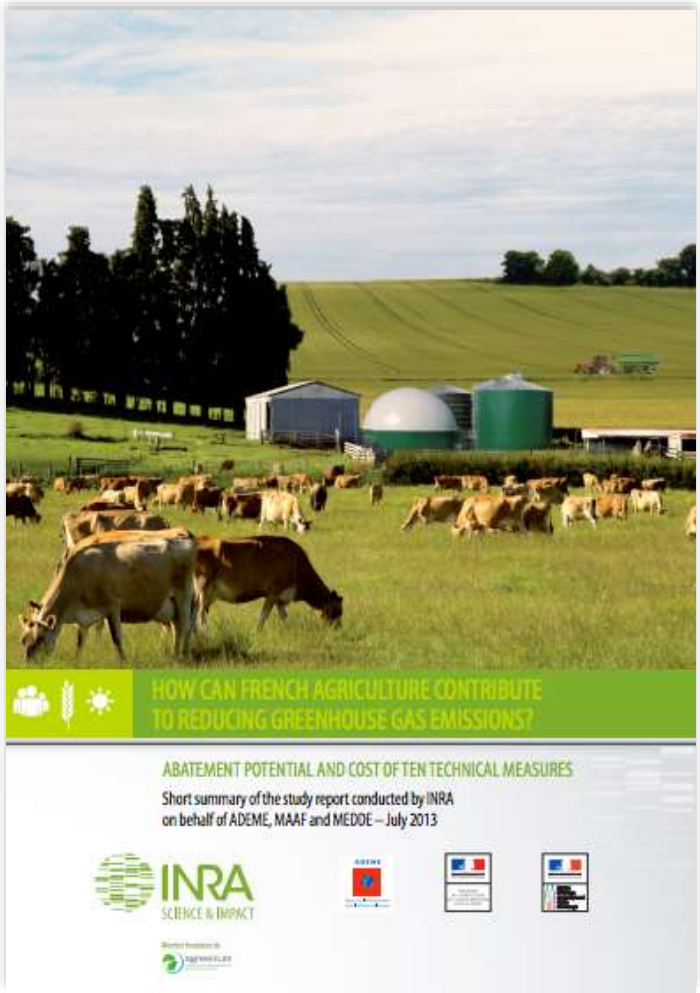


Agriculture alone is responsible for 12% of the GHGs emission globally

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



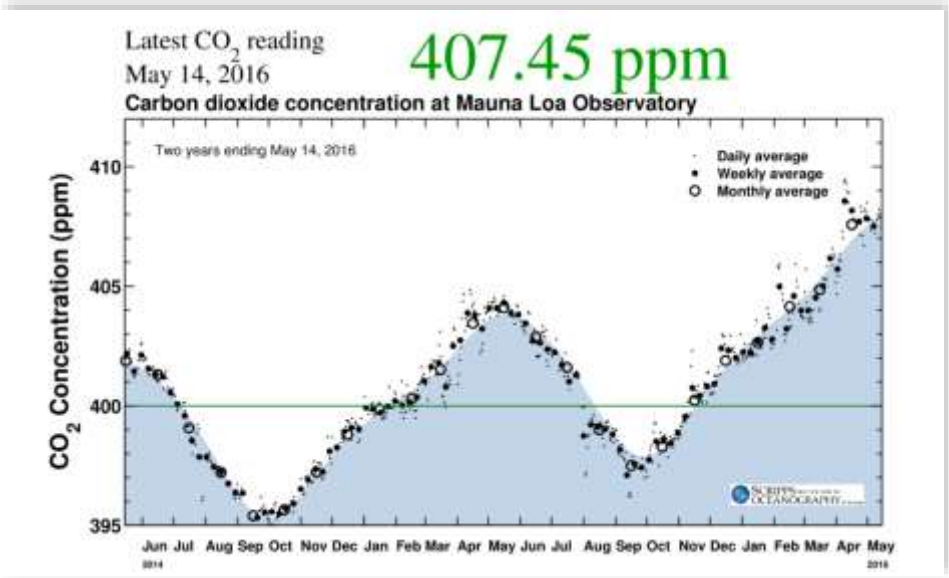
LET DECARBONIZE CURRENT AGRICULTURAL PRACTICES (2)

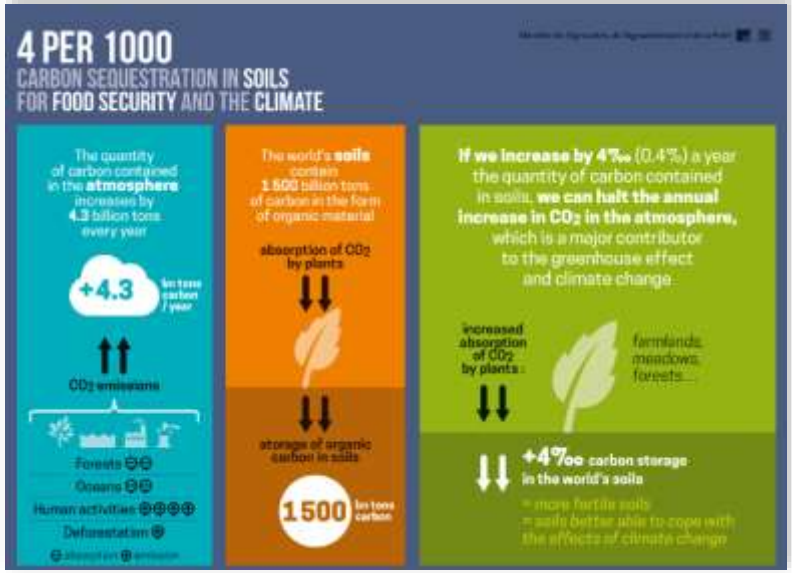
6. Improve Nitrogen Usage Efficiency (NUE) via increased organic fertilization, drip irrigation with digestate liquid fraction , cover crops, etc.
7. Increased Net Primary Production (NPP) via increased Water Usage Efficiency (WUE) applying drip irrigation, CAM plants where C3 & C4 crops give marginal 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 BIOGASDONERIGHT

- 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

BIOGASDONERIGHT 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
- **<u>Target for2030: 8 billions Nm3 BioCH4/year with an ecological agricultural intensification</u>**

Biomethane development

and the decarbonisation strategy in Italy

Position Paper of Consorzio Italiano Biogas - Snam - Confagricoltura for COP 21 - Paris

The fundamental role of biomethane in the Italian energy transition

The Consorzio Italiano Biogas, Snam S.p.A. and Confagricoltura share the vision of a fundamental role for biomethane in the Italian strategy for fighting climate change and for an energy transition towards a low-carbon economy based on sustainability and circularity in the use of scarce resources.
This vision is based on specific elements that characterize the biomethane production and utilization value chain.

Biomethane is an energy source that is:

- ***renewable***, because it is produced from biomass of agricultural origin that are renewed over time and can be virtually inexhaustible;

- ***sustainable***, because biomasses in their lifetime have incorporated carbon that is contained in the atmosphere: its consumption does not release the carbon sequestered in fossil sources fields, with almost no additional greenhouse gas emissions; and, if produced according to the principles of "biogas done right"[1], it helps to significantly reduce emissions in the agricultural sector, where they account for over 14% of total emissions[2] (in Italy 7%); because its production can take place while preserving biodiversity and the carbon storage function performed by forests and farmlands.

Its use can take place in a way that is:

- ***flexible***, because it can be used in every energy uses, from the production of heat and cold to the generation of electricity, and as a fuel in the transport sector; it can even become a raw material for the production of biomaterials and biochemicals ;

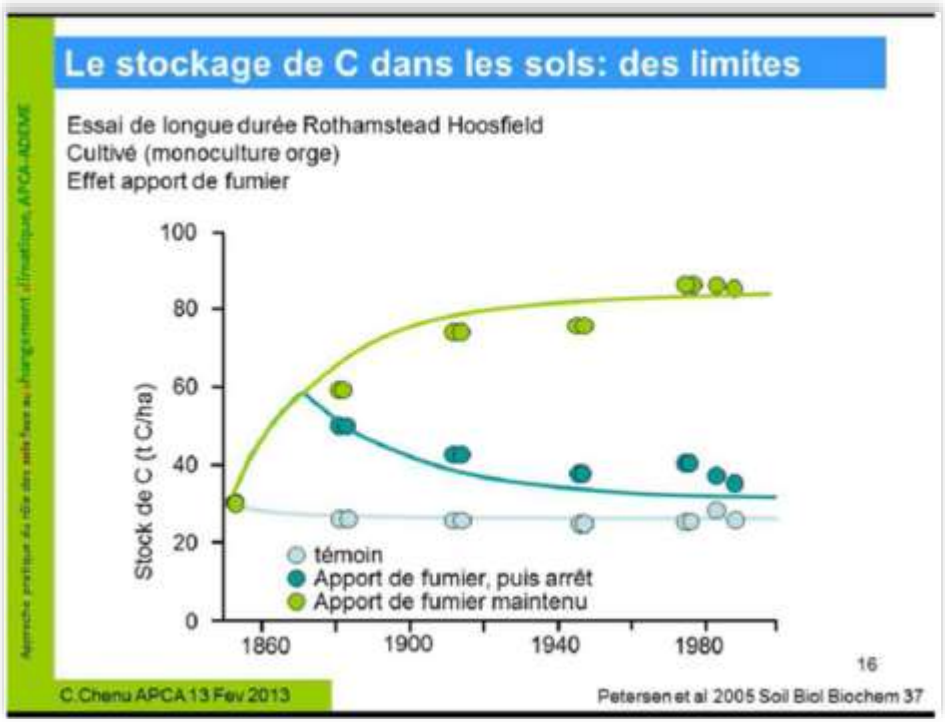
[1] See for instance "Biogasdoneright and soil carbon sequestration" www.consorziobiogas.it
[2] IPCC Mitigation Report, April 2014

1

Link

SOIL CARBON SEQUESTRATION: IT WORKS, IT IS EASY AND CHEAP

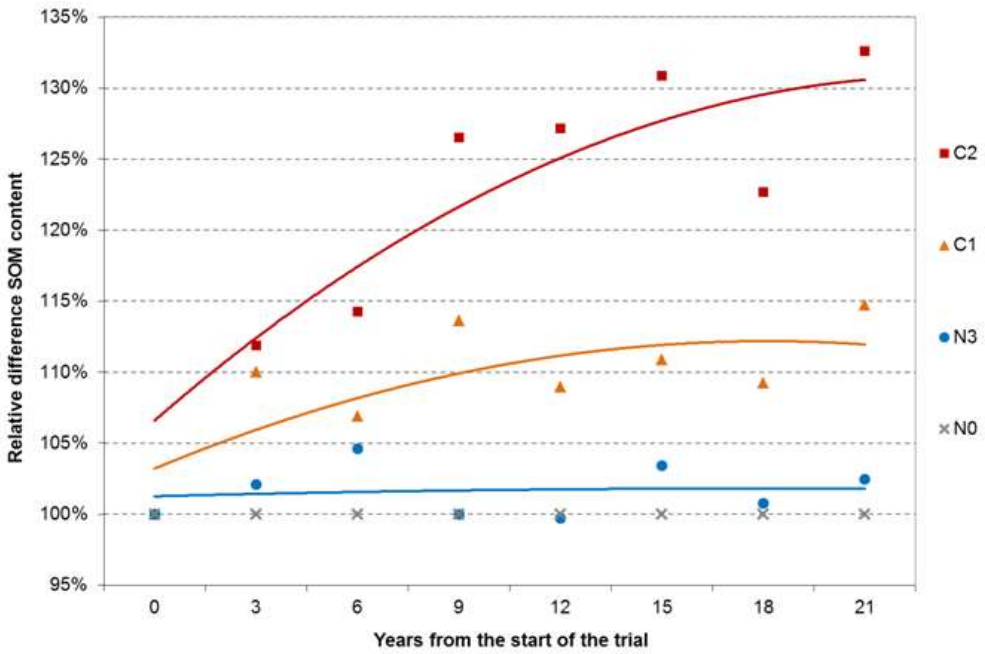
- Soil can sequester Carbon at the Gton scale needed
- Continous fertilization via manure increase soil Carbon content
- Can we sequestrate Carbon in soil via digestate? Yes!



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

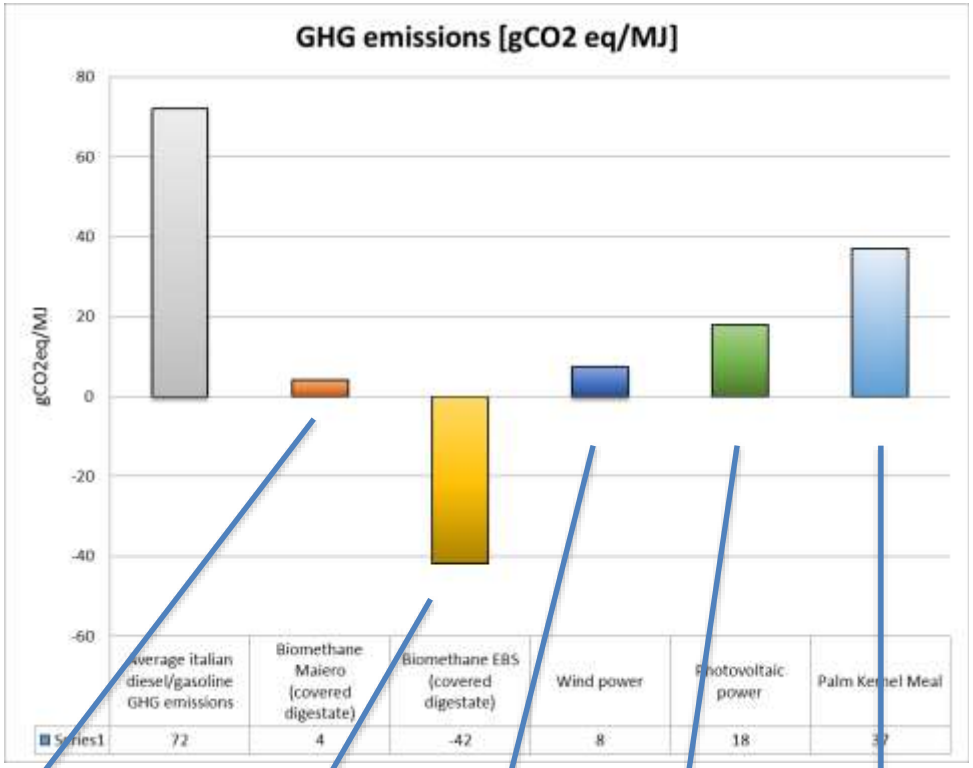
#14pour1000 !!



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
- **<u>Toward Carbon negative agriculture!</u>**



BDR DOUBLE CROPPING

BDR AGROWASTES

WIND

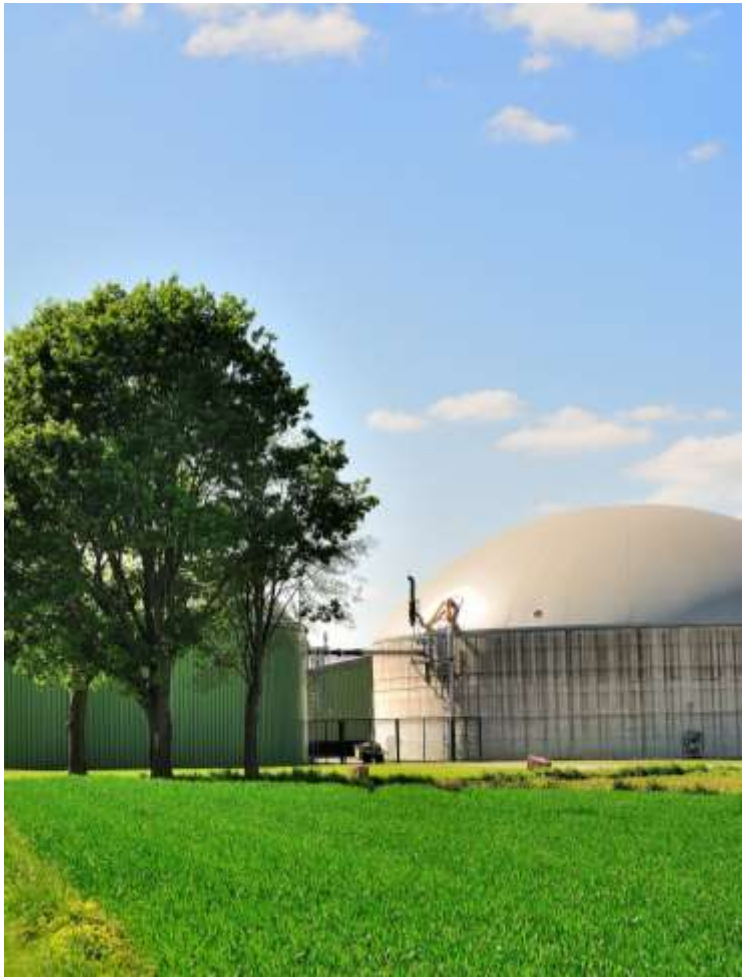
PV

PALM OIL DIESEL

BIOGASDONERIGHT: SOMETHING MORE THAN A BIOENERGY

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

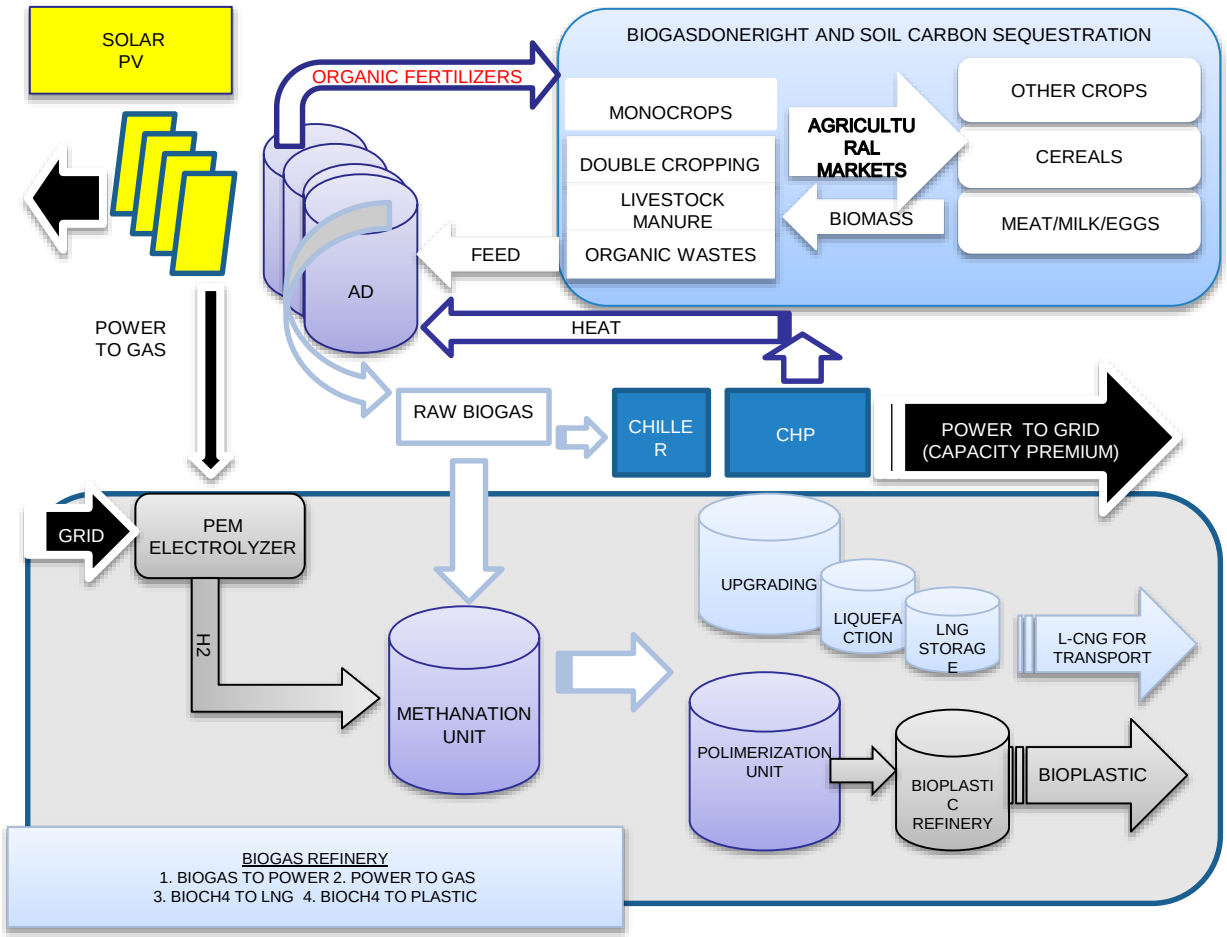
- It allows the soil to be covered the whole year
- It increases the rotations
- It turns agrowastes into a precious resource
- It improves the WUE and NUE at the farm
- **It turns the farms from carbon emitter to a carbon sink**



BIOGASDONERIGHT CAN BE DEPLOYED AT ANY LATITUDE AND ANY AGRICULTURAL CONDITIONS

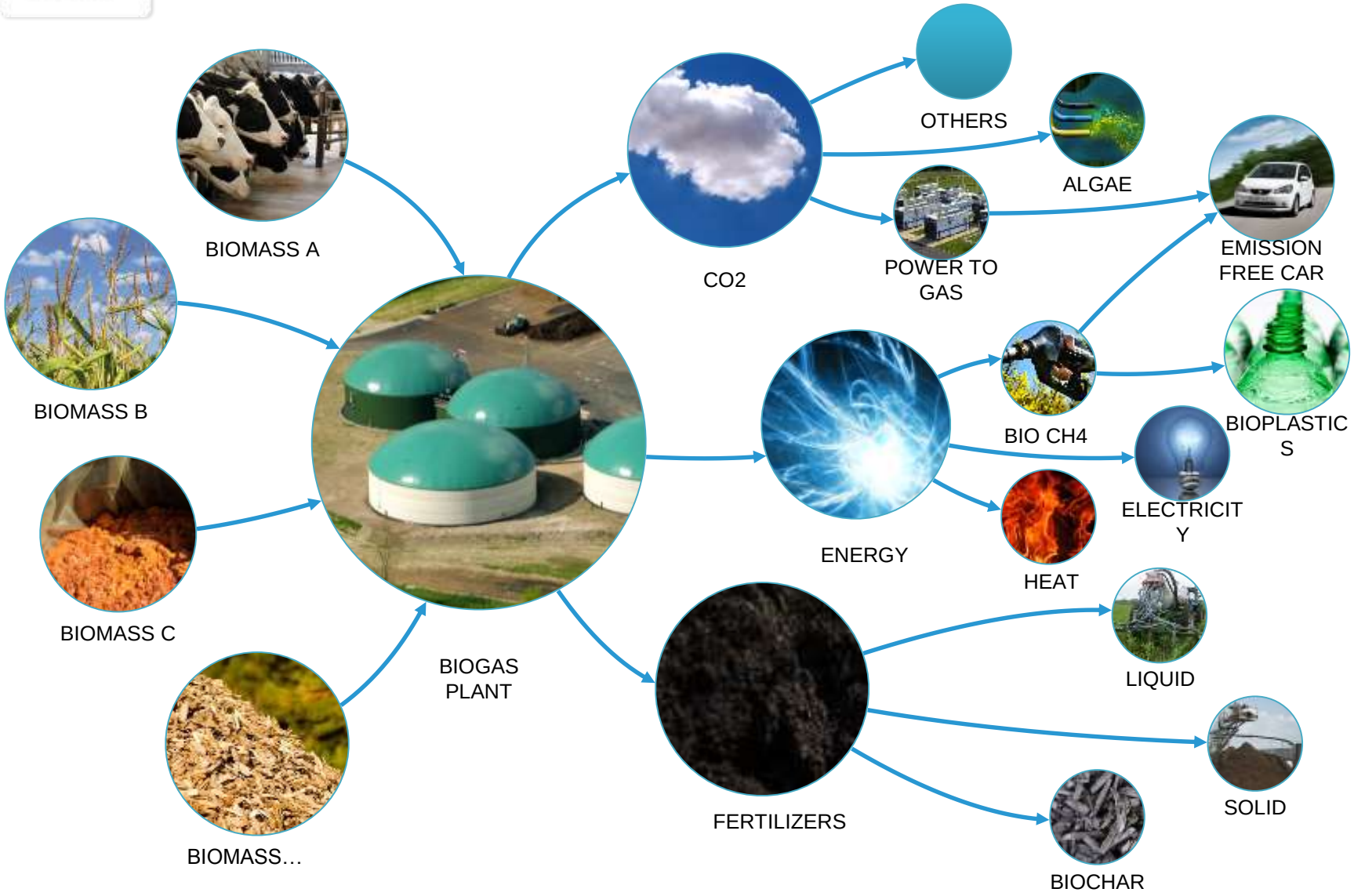
VISION FOR THE FUTURE: BIOGAS REFINERY

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



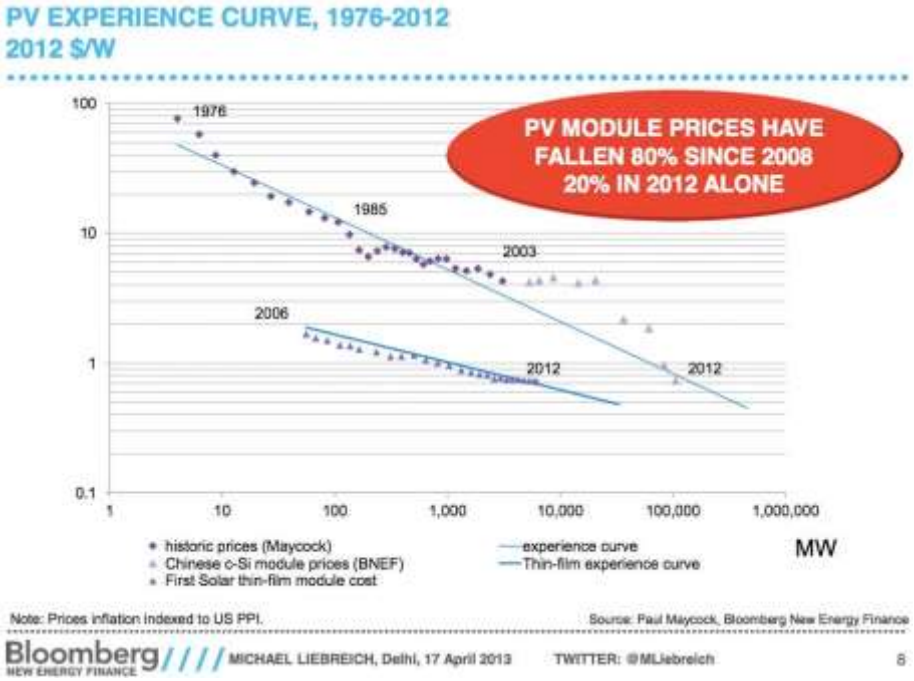
Our aim: an integrated biorefinery distributed on the territory that brings circular economy at the farm level

BIOGAS REFINERY: A FLEXIBLE, DISTRIBUTED MULTIPURPOSE PLANT



BIOGAS REFINERY

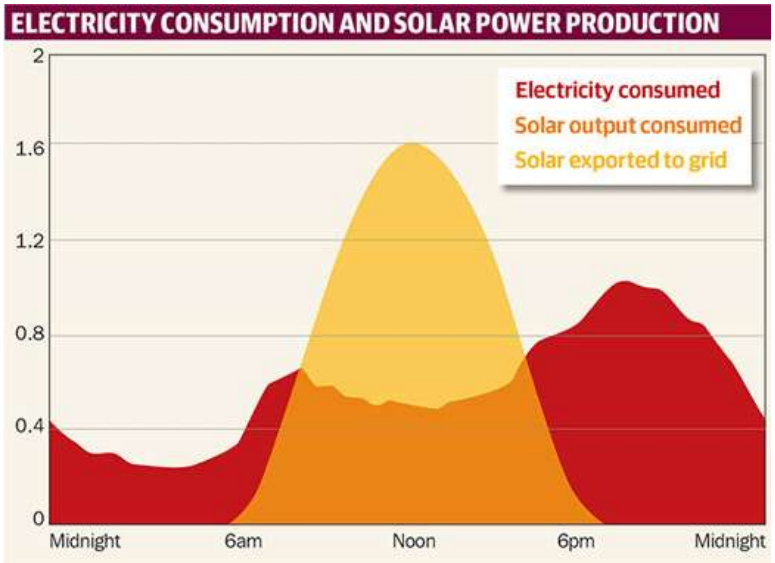
- Wind and PV are becoming always cheaper
- Their share on the energy mix is increasing
- **<u>How to have a spare capacity, interconnect gas and electricity grid and stabilize intermittent energy sources? With distributed biogas refineries</u>**



Source: Bloomberg

NEXT CHALLENGE: STORAGE OF RENEWABLE

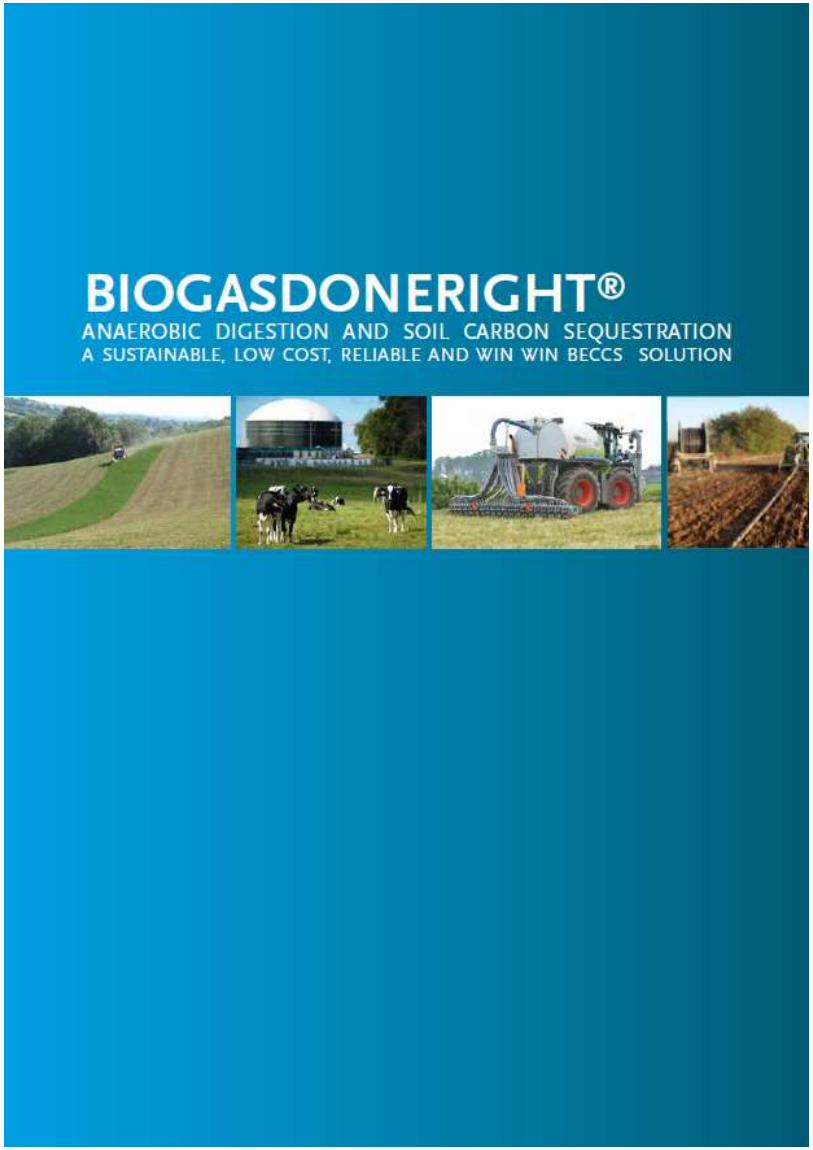
- Can a biogas refinery:
- Take the excess of R.E. from the grid and transfer it where is needed for a cost < 50€/MWh?
- Produce biofuel for a cost < than 50€/MWh and transport it in the gas grid?
- Is the gas grid the cheapest option (< 10€/MWh) for energy transport and storage?



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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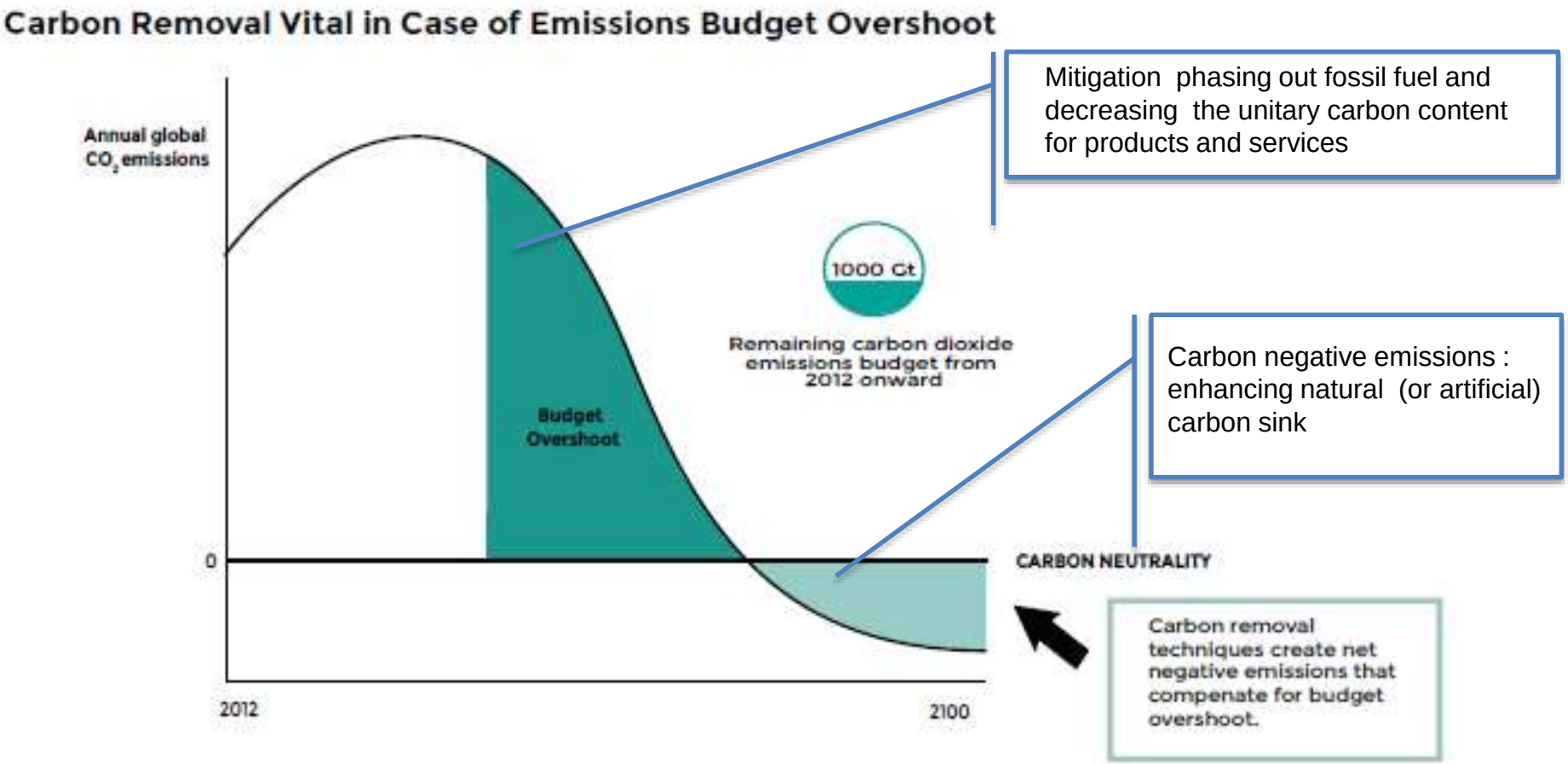
CIB
Consorzio Italiano Biogas e Gassificazione
segreteria@consorziobiogas.it
P.IVA: 09248721004

c/o Parco Tecnologico Padano
Via Einstein,
Loc. Cascina Codazza
Lodi (LO)

Segreteria
Telefono +39(0)3714662633
Fax +39(0)3714662401

WHY DO WE NEED NEGATIVE EMISSIONS



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