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4th International Conference on Sustainable Solid Waste Management

Biogas from residual grass: a territorial approach for sustainable bioenergy production

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[3]Bioenergy and Climate Change Section, Veneto Agricoltura

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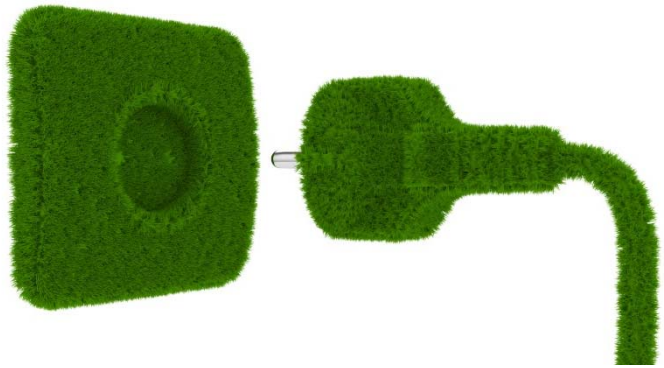

From **Grass** to **Energy**

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Flanders (Belgium)

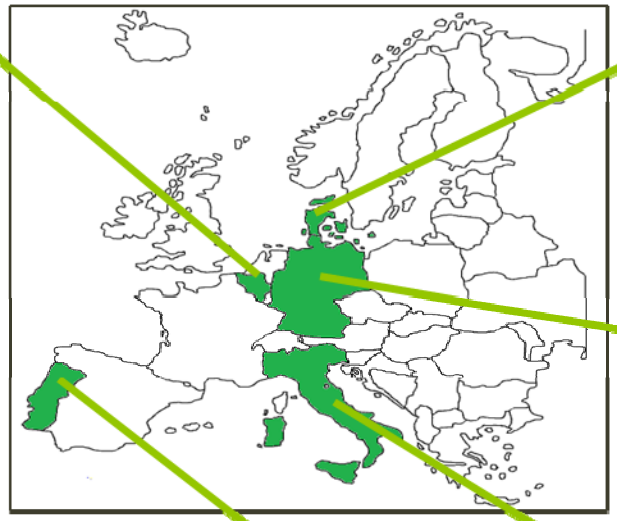
dlv The force behind your company

UNIVERSITEIT GENT

inagro ONDERZOEK & ADVIES IN LAND- & TUINBOUW

PXL

pro|natura Werk maken van Natuur !



Denmark

UNIVERSITY OF SOUTHERN DENMARK

Germany

IBBK

izes gGmbH Institut für ZukunftsEnergieSysteme

Portugal

LNEG Laboratório Nacional de Energia e Geologia, I. P.

Italy

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VENETO AGRICOLTURA Azienda Regionale per i settori Agricolo, Forestale e Agro-Alimentare

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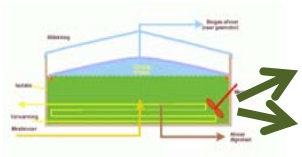
Ecologic mowing

Purification

Ensilaging

Digestion



CHP

Biomethane fuel

Composting

SUPPLY

± 800 000 tons of grass (waste) generated

Actually 70% disposed, 30% composted

MISSING VALORISATION CHAIN

Due to :

- Missing logistics
  Investments required on both sides
- Legislative framework
- No contact between stakeholders

Possibilities

- Increased renewable energy production
  1 ton grass ~ 340 kWel and 400 kWth
- Primary energy savings (in composting)
- Less uncontrolled grass disposal
- Jobcreation (social economy)

VALORISATION

Biogas plants looking for more sustainable feedstock

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Italy, Veneto Region

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Italy, Veneto Region

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Grass «origin» in the Veneto Region

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Grass «origin» in the Veneto Region

Grass from the Veneto Region

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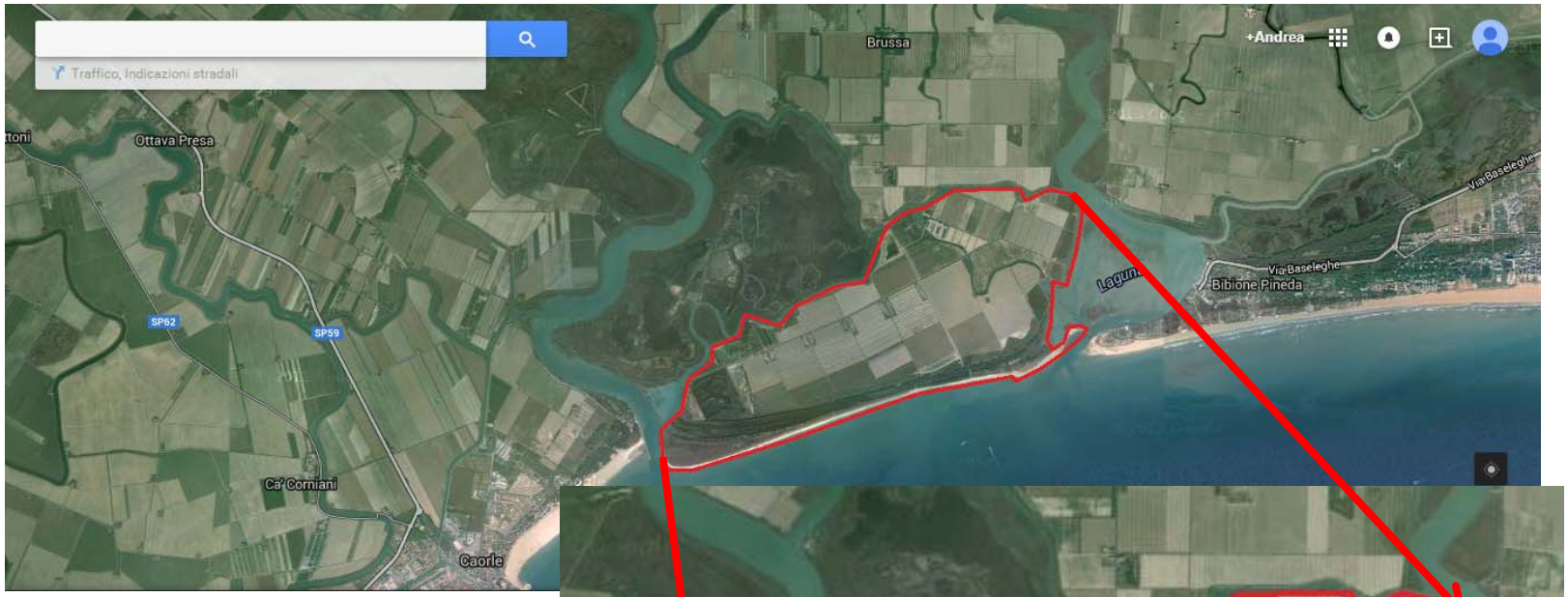

Landscape management

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Inventory of grass availability for the Veneto Region

We considered the streams:

- **Wasted grass (code 20.02.01) from public parks, private gardens, parking areas and schools, roads ….**
- **«Landscape management» grass coming from river banks, recreational areas, hills ….. (not for feed use) equivalent to 6 ton DM/ha/year (hectares defined on a GIS base)**

Total of 200,000 tonDM/yr
Considering a 25% capture capability !

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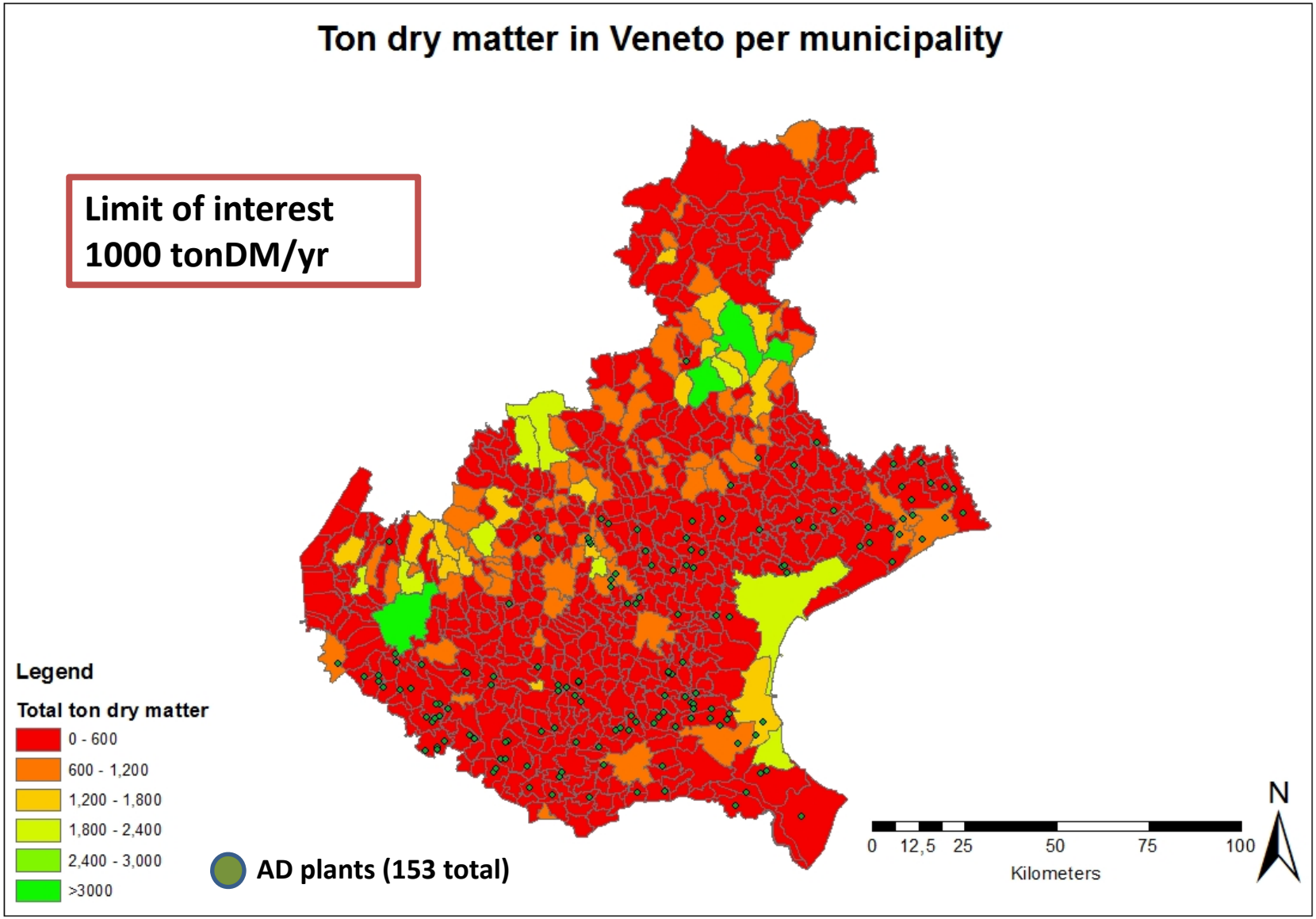

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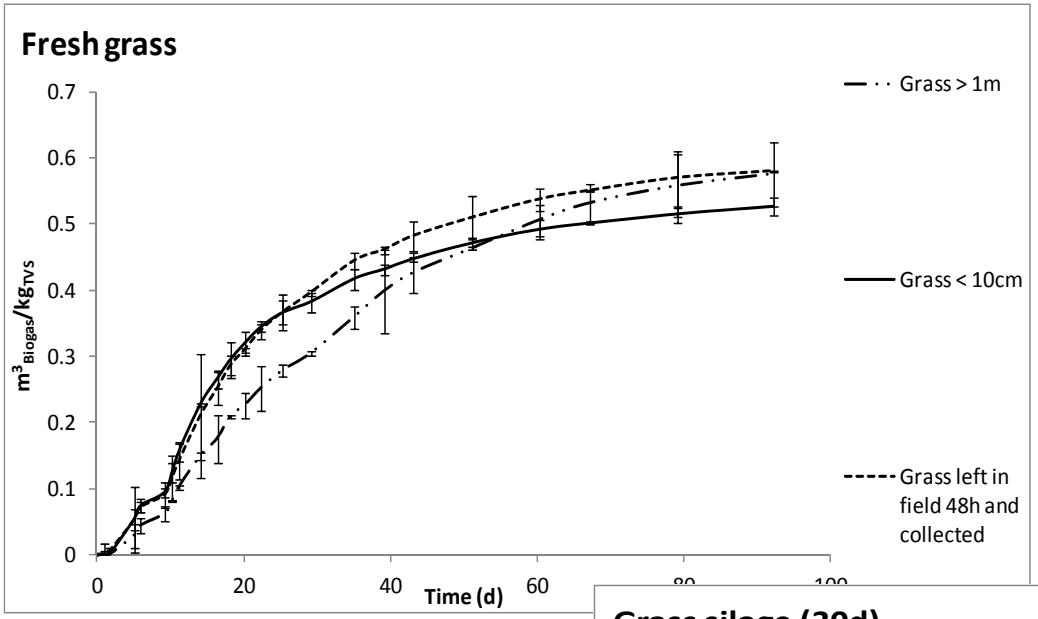
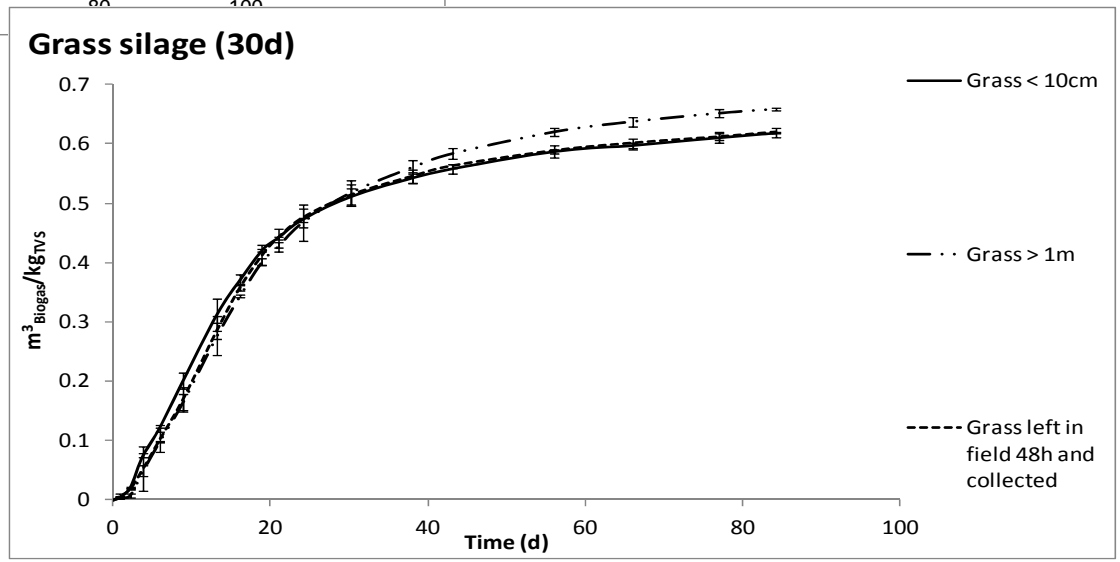
Energy recovery (BMP trials)





So, we have the feedstock and there is an interesting energy potential, but what about logistic chain ??

- **It is already there in the case of waste**
- **It should be build up for other streams ….**

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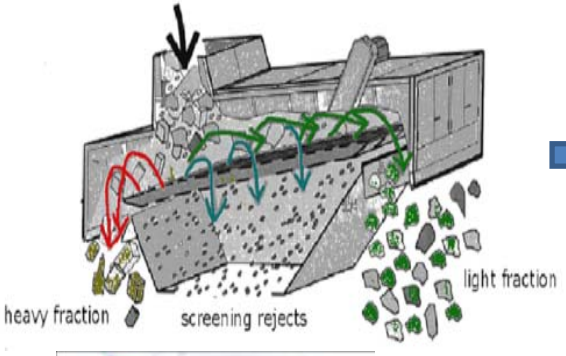
Mowing

Claening



Used fresh

Transport

Ensilage

Extrusion

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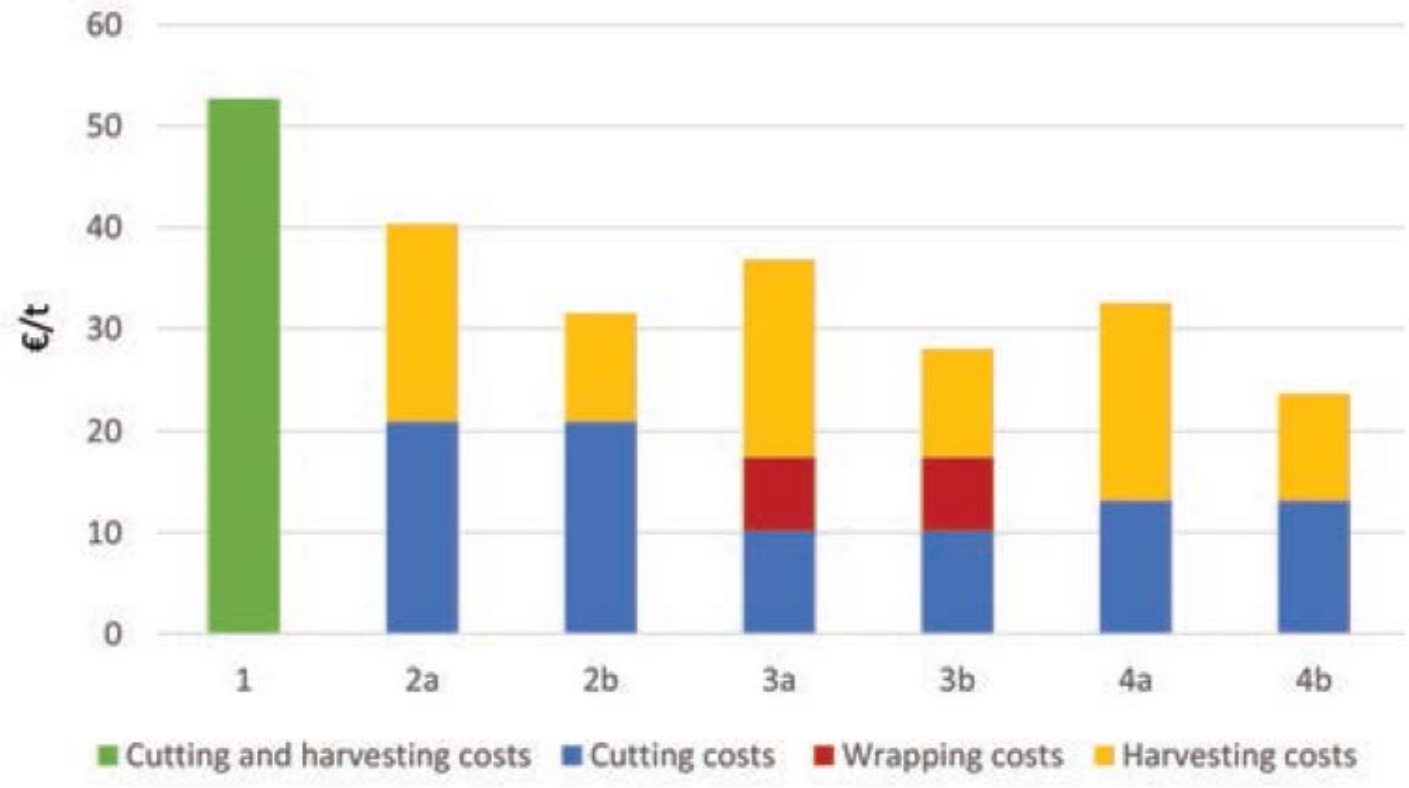

Figure 1. Economic comparison between mowing and harvesting systems.

(Boscaro et al, 2015)

Avg cost of 30 Euros per ton (similar to energy crops)

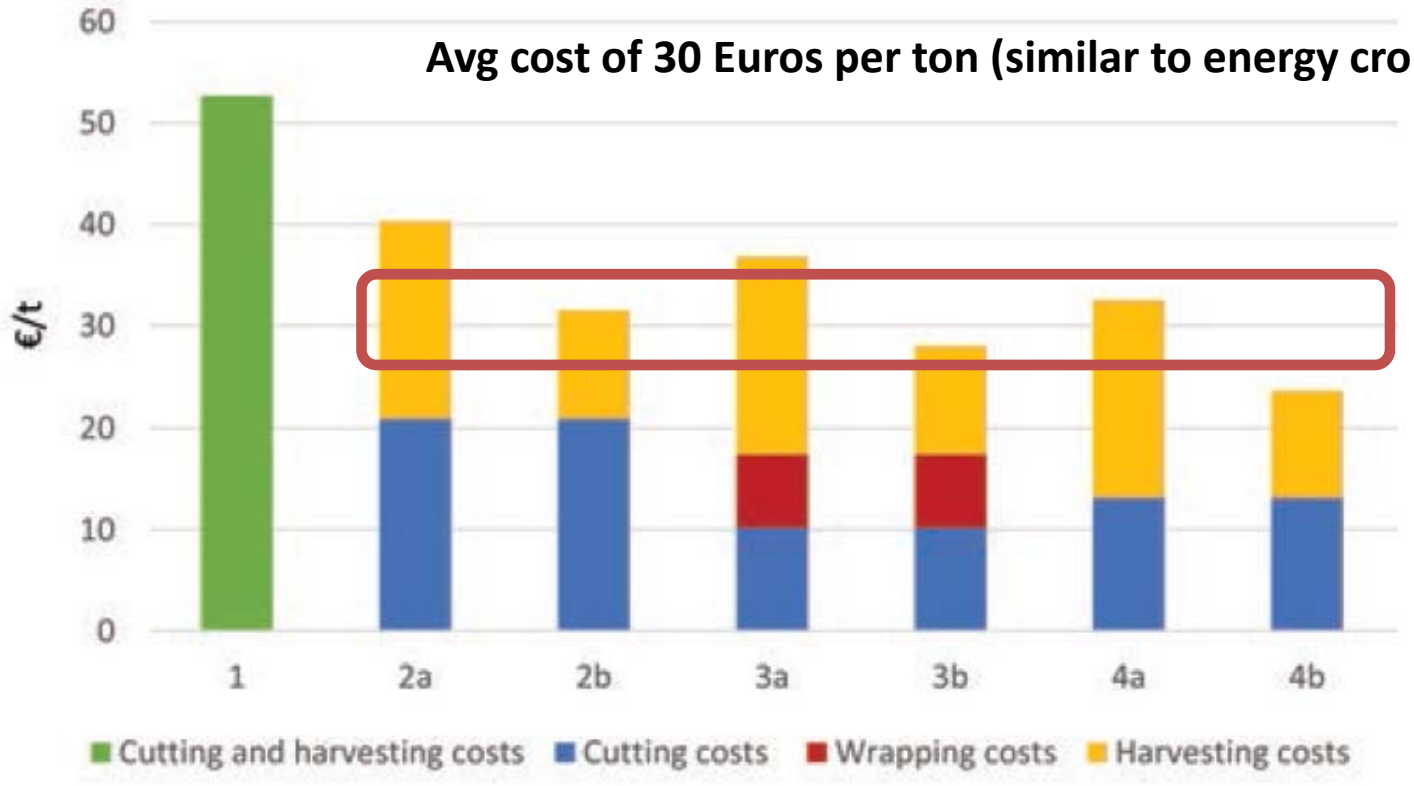

Figure 1. Economic comparison between mowing and harvesting systems.

(Boscaro et al, 2015)

Table 7. Energetic analysis of the systems and CO_2 emissions.

Mowing and harvesting systems	Energy input (MJ/ha)	Energy input (MJ/t)	CO_2 emissions (kg CO_2/ha)	CO_2 emissions (kg CO_2/t)
1	4796	799	229	38
2a	3028	505	157	26
2b	2894	482	147	24
3a	2682	447	144	24
3b	2547	424	134	22
4a	2405	401	128	21
4b	2271	378	118	19

(Boscaro et al, 2015)

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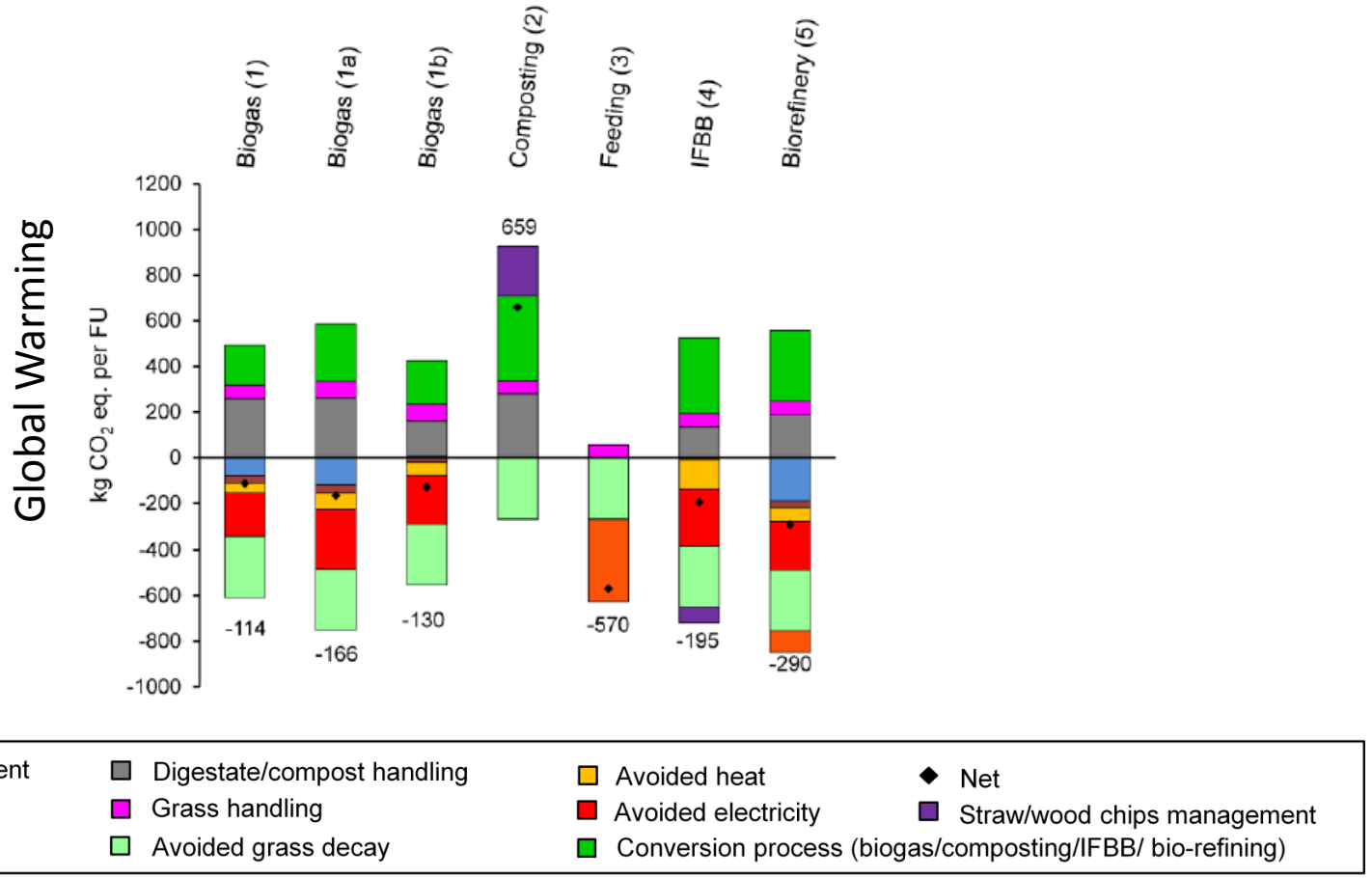
Life Cycle Analysis



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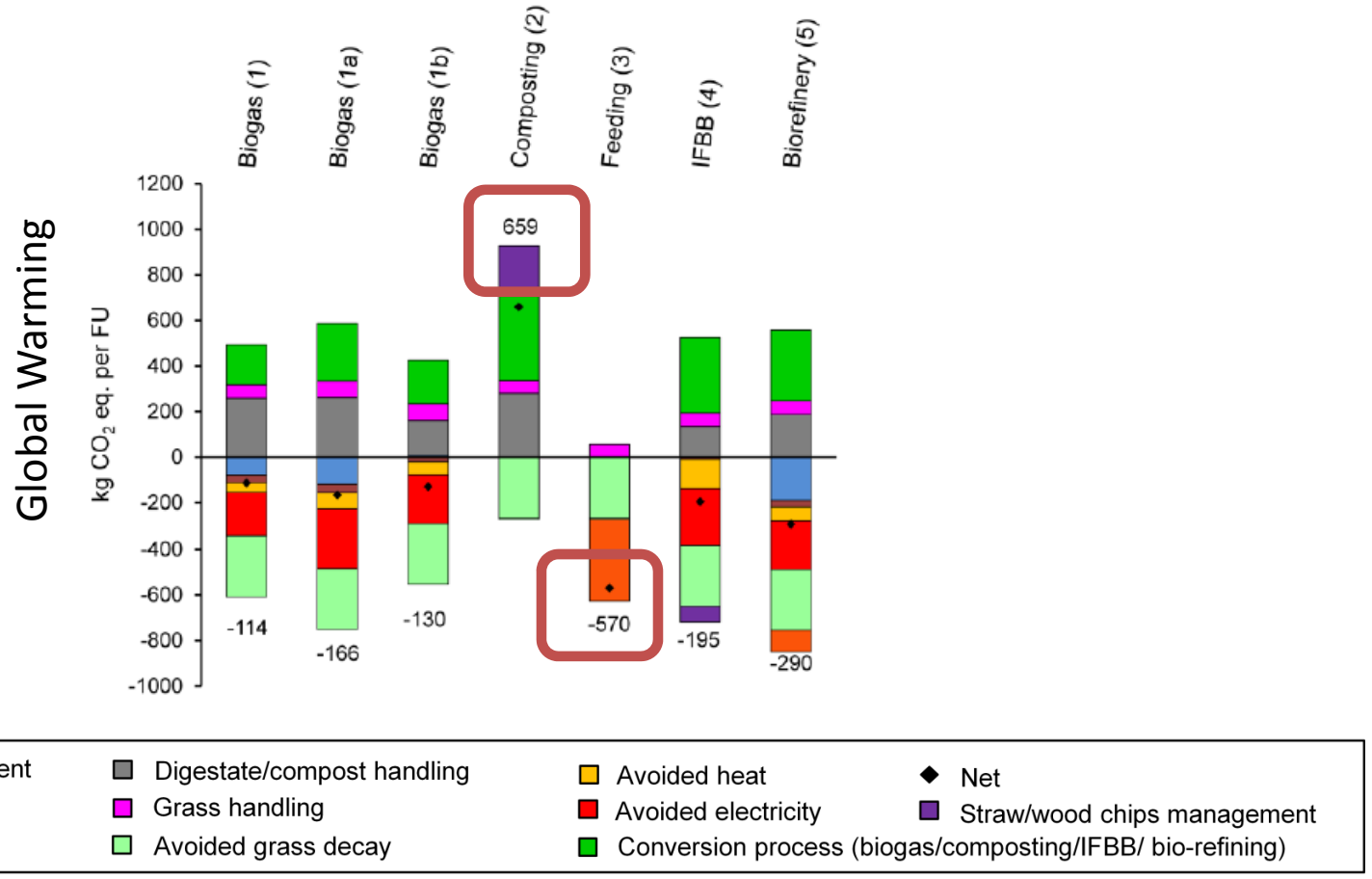

Table 3 - Energy balance of grass energy valorization

	Urban Waste management		Riverbanks and Roadsides		Natural and Rural Areas	
	5km	30km	5km	30km	5km	30km
Energy output (MJ/t)	4680	4680	4680	4680	4680	4680
Energy input (MJ/t)	1258	2133	2057	2932	1155	2030
NEG (MJ/t)	3422	2547	2623	1748	3525	2650
EROEI	3,7	2,2	2,3	1,6	4,1	2,3

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Energy balance positive also for distance of 30 km or more

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Take home messages / 1

- Large availability of residual grass, both as waste and landscape management residue not intended for feeding
- Interesting energy potential (600 m^3/tonDM or 300 kWh_{ee} per ton raw material
- EU projection: > 30 000 000 (based on surface) tonDM/yr and > 7 billion Nm^3 biogas / year

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Take home messages / 2

- ❑ **Sustainable economic/energetic/environmental chain**
- ❑ **A considerable number of jobs is created (avg 1,5 persons per AD plant)**
- ❑ **Some «grey» areas in legislation (waste or not waste ?)**

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Acknowledgments

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Project “GRass as a GReen Gas Resource: Energy from landscapes by promoting the use of grass residues as a renewable energy resource (GR3)”, IEE/12/046/SI2.645700

Website : **www.grassgreenresource.eu**

GIS focus

The Veneto Region has one of the most detailed map regarding the use of land:
starting from the database **G.S.E. Land - Urban Atlas**
then **improved by using**
satellite imagines SPOT 5
(multispectral band 10 m, panchromatic band 2.5 m) and
integrating the data with several different **databases**:
TeleAtlas, Roads Map, Numerical Regional Chart, DEM, and forestry maps,
a detailed map for the "Land Use" for the Veneto Region was defined.

This is a **1:10.000 map** with a thematic area with **detail of 0.25 ha** and **5 levels of "land use"** based on the **Corine Land Cover nomenclature**.

The map can be find at
http://idt.regione.veneto.it/app/metacatalog/getMetadata/?id=551&isIe=false.