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Sibiu Innovation Days
06-07 November, Sibiu - RO
EMERGING DISRUPTIVE TECHNOLOGIES:
Balancing Innovation, Risks, and Societal Impact

Renewable Energy Sources and Circular Economy Applied in an Academic Community as an Example for Smart Sustainable Development

PROF. DR. TEODOR VINTILĂ

University of Life Science, Timisoara
Department of Biotechnology

The European Commission has set a target of producing **35 billion cubic metres of biomethane in the EU** by 2030 as part of its **REPowerEU plan**.

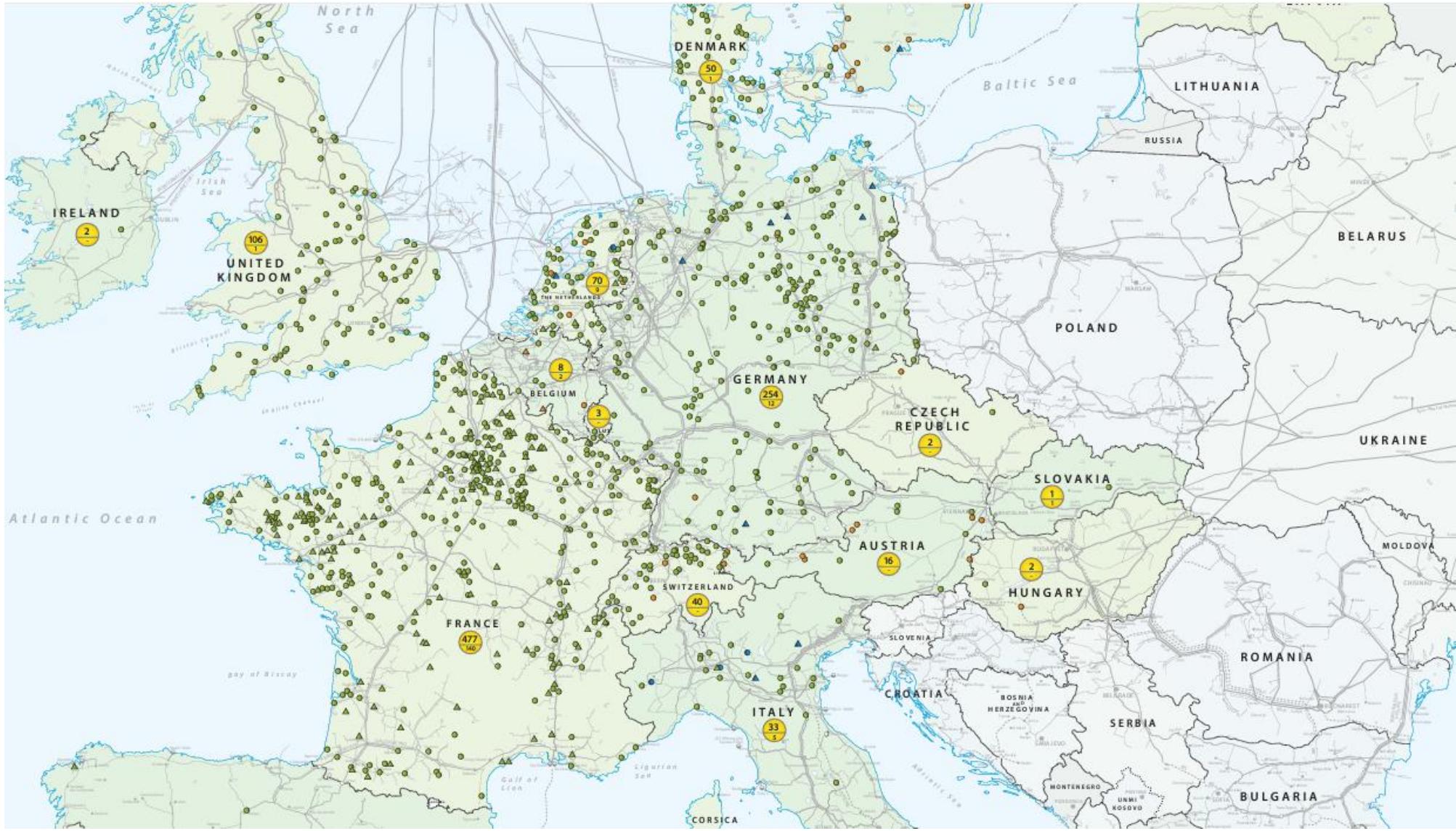
The target will replace 20% of natural gas imports with a sustainable, cheaper and locally produced alternative, such as biogas and its purified variant: **biomethane**.

This new field will not only produce biomethane, but will also help reduce exposure to food price volatility, as the digestate replaces increasingly expensive and carbon-intensive synthetic fertilisers.

- Building around **5,000 new biomethane plants** over the next eight years and with around **€80 billion in capital investment**, European money spent in the European internal economy.

Good practice examples

According to the trade association Biogas Danmark, Danish biogas has displaced Russian gas of DKK 3.7 billion in the first eight months of the year. This means that biogas currently takes **up 40% of the methane in the natural gas grid** supplied to companies and private customers. According to the Danish Energy Agency's forecast, biogas will account for **72% of the gas flowing in the natural gas grid by 2030**. (https://www.bioenergy-news.com/news/biogas-takes-up-40-of-methane-in-denmarks-natural-gas-grid/)



Romania - TARGET COUNTRY

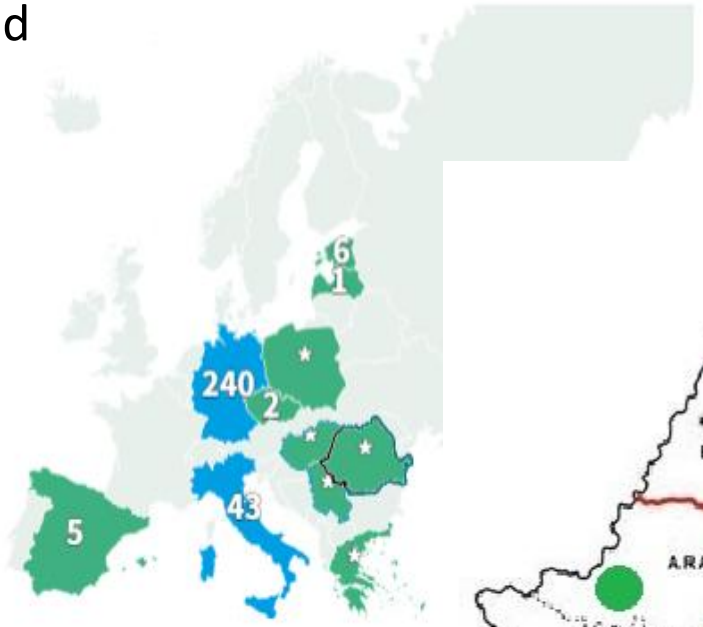
* No biomethane production.

GREENMEUP

0 biomethane plants, 19 biogas plants in operation in Romania

Romania and Danube Region need to be there….

*Building around **5,000 new biomethane plants** over the next eight years and with around **€80 billion in capital investment**, European money spent in the European internal economy.*



OVERVIEW OF POTENTIALS, PRODUCTION ROUTES AND EXISTING POLICY FRAMEWORKS IN ROMANIA, WITH FOCUS ON WEST REGION

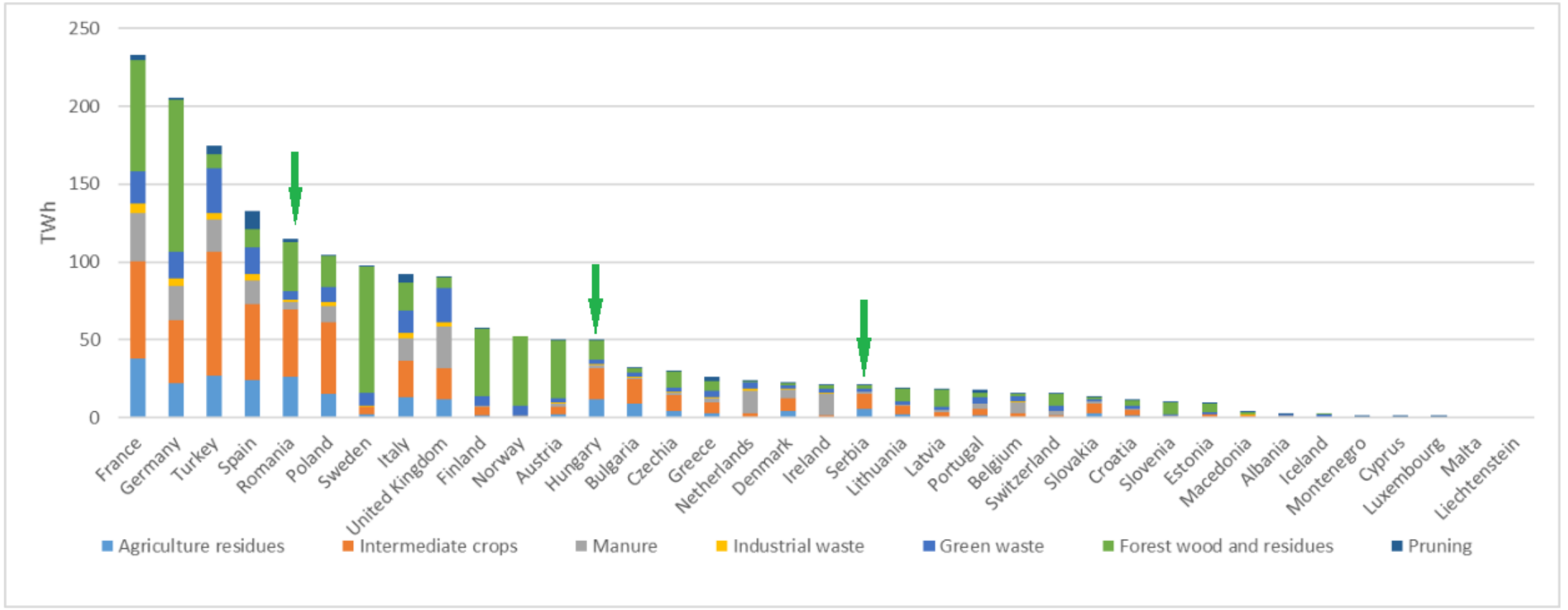
Study made by
Dr. habil. Teodor Vintilă, Associate Professor at:
University of Life Science "Regele Mihai I" from Timișoara

Comparing the technical potential for biomethane production in Romania of 3.39 billion m^3 / year with the natural gas consumption of 11 billion m^3 / year, it can be estimated that by using technically available organic wastes from Romanian bioeconomy,

1/3 from natural gas consumption of the country can be covered by a biomethane production system based exclusively on organic wastes!

Europe and neighbouring countries have a large potential of biomass available for producing biomethane

The study shows that biomass is largely available in some countries such as France, Germany or Spain. Outside the EU, Turkey has a large potential as well. Although there are uncertainties, the potential of biomass available in 2050 in EU27+10 could allow to produce over 1700 TWh_{HHV} of biomethane. The study shows that the among all the biomass available, intermediate energy crops, if developed, could provide a large share, around 26% of the total. The study also shows that the use of wood from forest growth could boost the potential in 2050.



Source: Geographical analysis of biomethane potential and costs in Europe in 2050 - Engie

Potential: 114 TWh

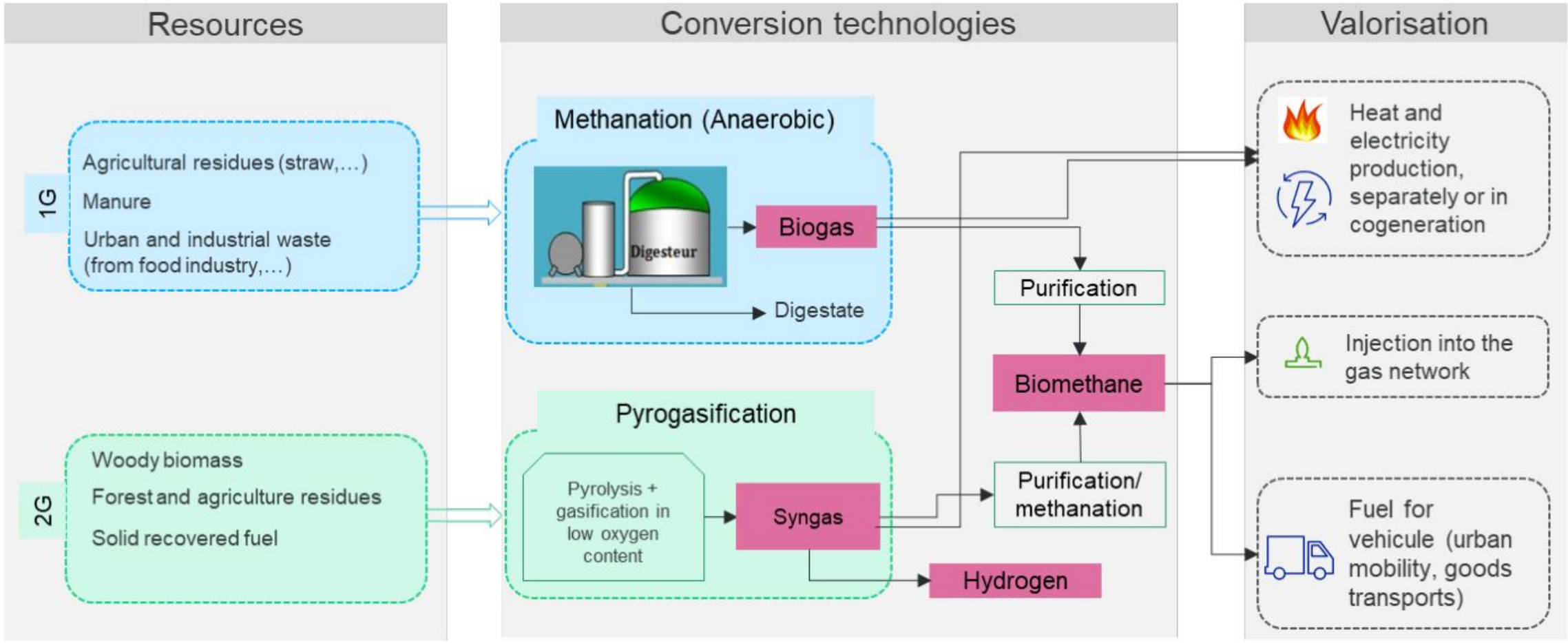
Potential meet the needs?

TWh	Agriculture residues	Intermediate crops	Manure	Industrial waste	Green waste	Forest wood and residues	Pruning
France	38,00	62,60	30,40	6,58	20,61	71,12	3,95
Germany	21,83	41,04	21,72	4,47	17,64	97,67	0,89
Turkey	26,83	80,03	20,17	4,49	28,74	8,76	5,67
Spain	24,22	48,37	15,42	4,20	17,35	11,68	11,48
Romania	26,06	43,30	5,03	1,11	6,00	31,52	1,52
Poland	15,43	45,77	10,33	2,91	9,69	19,57	0,52
Sweden	1,78	5,04	0,37	0,20	8,78	80,52	0,01
Italy	12,96	23,31	14,42	3,87	14,11	18,04	5,39
United Kingdom	12,07	19,56	27,15	2,30	21,83	7,38	0,04
Finland	1,61	5,08	0,72	0,24	5,97	43,45	0,00
Norway	0,19	0,74	0,26	0,14	6,20	44,86	0,00
Austria	1,84	5,00	2,07	0,66	3,04	37,22	0,20
Hungary	11,57	19,91	2,17	0,57	2,84	12,40	0,53
Bulgaria	8,97	15,90	0,87	0,25	2,91	2,84	0,49
Czechia	4,39	9,83	1,55	0,54	2,72	10,42	0,13
Greece	2,92	6,87	2,31	0,71	4,47	6,30	2,34
Netherlands	1,00	2,04	14,12	1,29	4,12	0,89	0,02
Denmark	4,17	8,27	5,33	0,67	2,02	1,59	0,01
Ireland	0,67	1,06	13,27	0,97	2,55	2,35	0,00
Serbia	5,42	9,62	1,33	0,38	2,00	1,77	0,12
Lithuania	1,83	5,81	0,59	0,28	1,53	8,32	0,03
Latvia	0,80	2,38	1,66	0,17	1,59	11,57	0,01
Portugal	1,56	3,94	3,29	0,49	3,71	3,09	1,62
Belgium	1,00	1,54	7,25	0,74	3,47	1,08	0,03
Switzerland	0,58	0,99	2,47	0,39	3,09	7,52	0,06
Slovakia	3,13	6,14	0,75	0,27	1,38	1,67	0,10
Croatia	1,72	3,06	0,74	0,21	1,83	3,29	0,17
Slovenia	0,24	0,45	0,44	0,08	0,61	7,89	0,10
Estonia	0,44	1,57	0,10	0,04	1,11	5,88	0,00
Macedonia	0,37	1,04	0,35	0,15	0,52	1,30	0,11
Albania	0,15	0,33	0,88	0,24	0,46	0,21	0,15
Iceland	0,00	0,00	0,08	0,01	2,06	0,00	0,00
Montenegro	0,01	0,02	0,03	0,03	0,35	0,57	0,01
Cyprus	0,00	0,00	0,23	0,02	0,44	0,02	0,11
Luxembourg	0,05	0,09	0,31	0,03	0,16	0,17	0,01
Malta	0,00	0,00	0,10	0,00	0,09	0,00	0,00
Liechtenstein	0,00	0,00	0,01	0,00	0,01	0,00	0,00

Biomass potential in EU-27 + 10

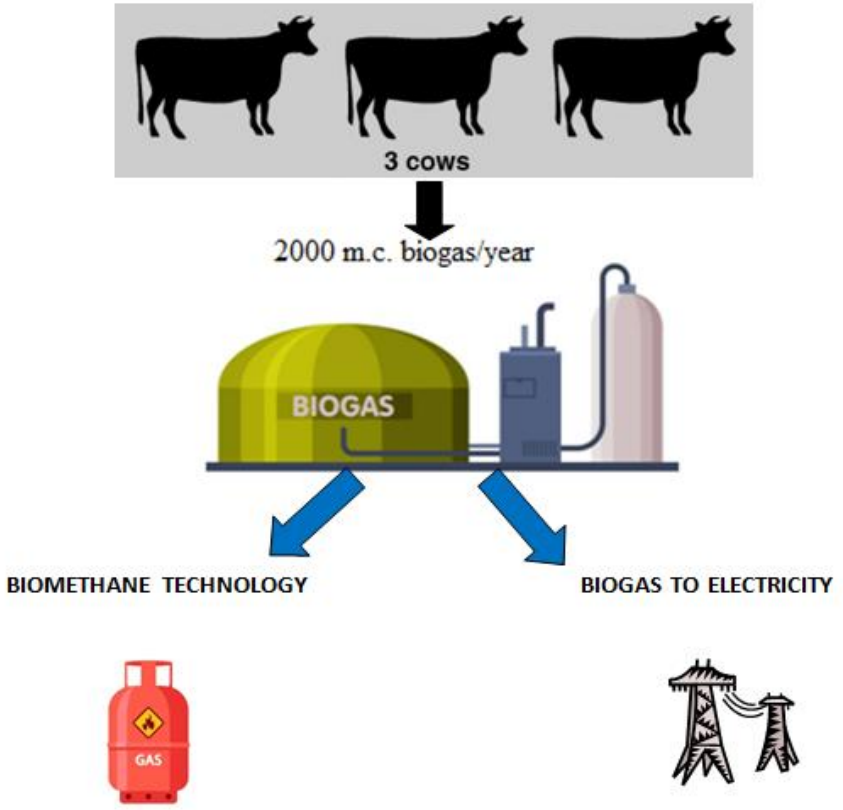
Natural gas consumption in Romania is 11-12 billions c.m./year, equivalent of **110-120 TWh /year**

- Biomethane and Biohydrogen technologies from agricultural and woody biomass



• IS IT ANY MORE ATTRACTIVE THAN OTHER?
• BIOGAS TO BIOMETHANE, OR TO ELECTRICITY?
ACTUAL ROMANIAN MARKET LEVELS THE PRICES

Natural gas price likely to increase from geo-political reasons. Market needs more gas in the future.



Electricity price likely to decrease due to development of other renewable sources.

BIOMETHANE technology delivers more energy to E system than biogas-to-electricity technology !

•Competitive use and availability of feedstock for biomethane production in România

Business case study: Consider recuperation of lignocellulosic agricultural by-products and their conversion to second generation biofuels (biomethane, ethanol)

Biorafinery in Podari, Dolj – construction finalized in October 2021

(Sursa: Clariant Specialty Chemicals/Clariant News)

Corden BioChem, a German company operating in the field of industrial biotechnology, announces a strategic investment in Romania, by acquiring the decommissioned bioethanol factory in Podari, Dolj

"The Podari factory represents an example of replicable industrial reconversion in Romania, where agricultural tradition is intertwined with cutting-edge technology to support national competitiveness in a modern economy"

Dr. Klaus Pellengahr, Managing Director of Corden BioChem

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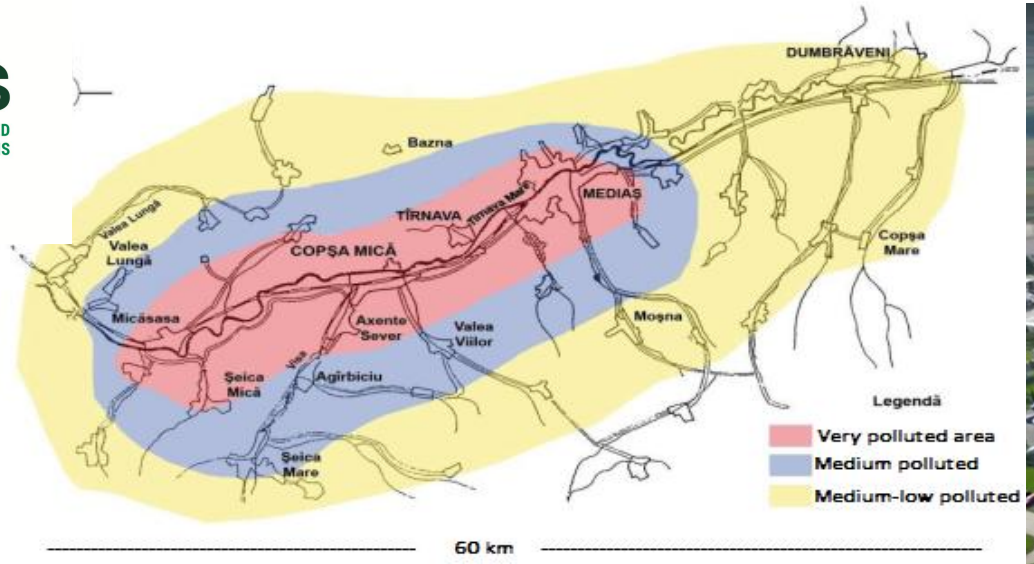
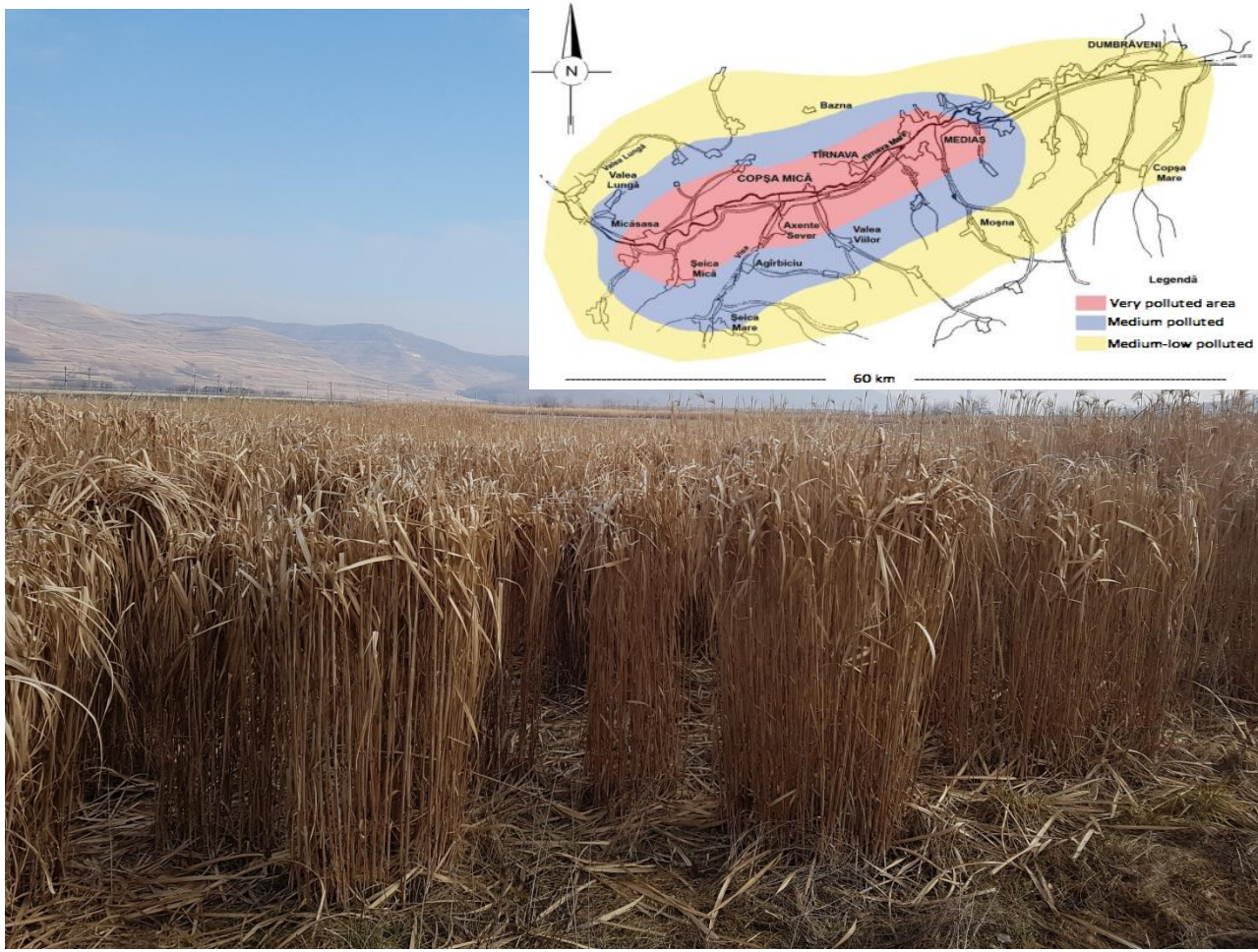
REGIONAL INCLUSIVE BIOBASED ENTREPRENEURSHIP SOLUTIONS

Technology proposal

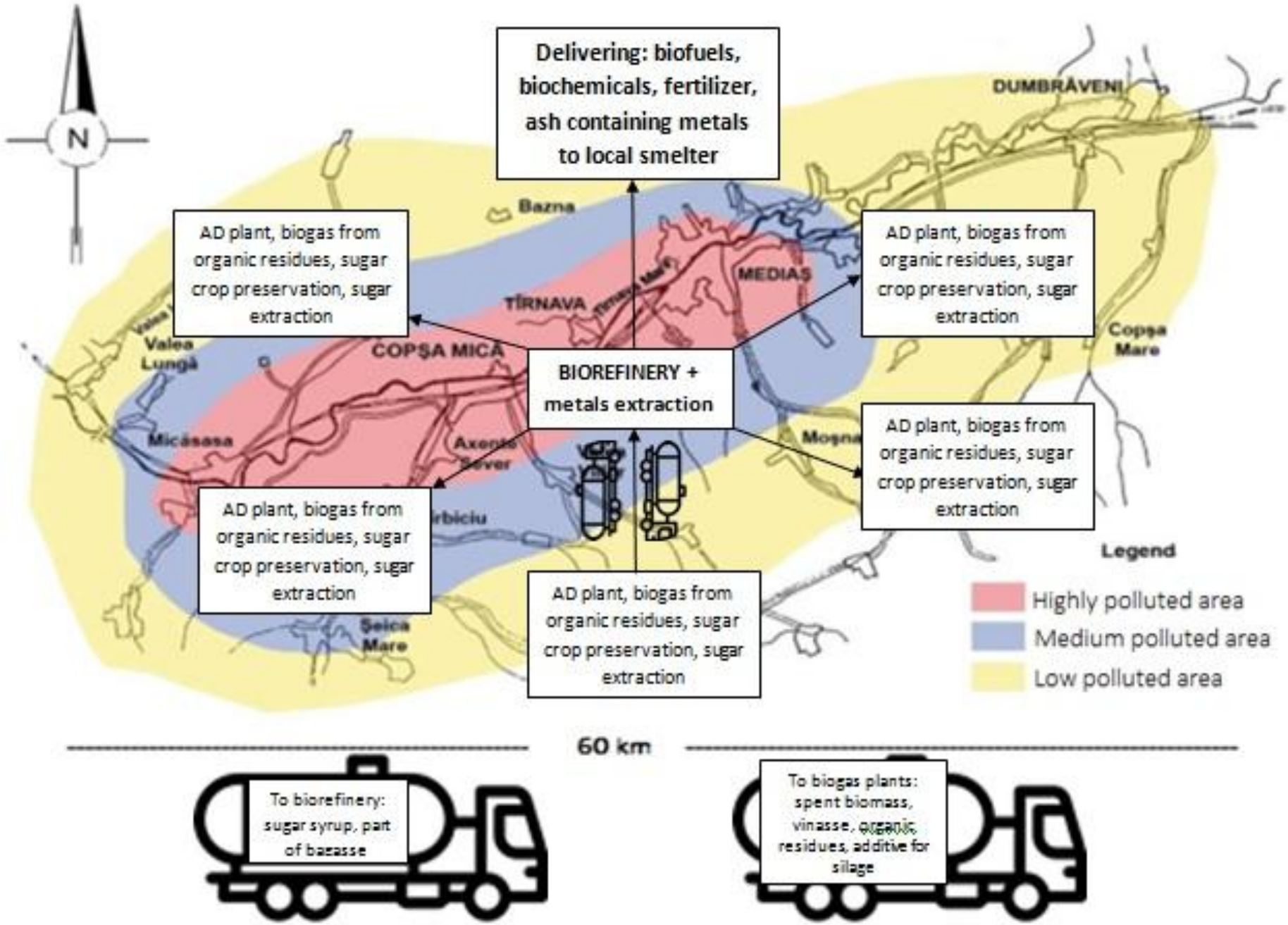


20000 ha arable land in polluted area

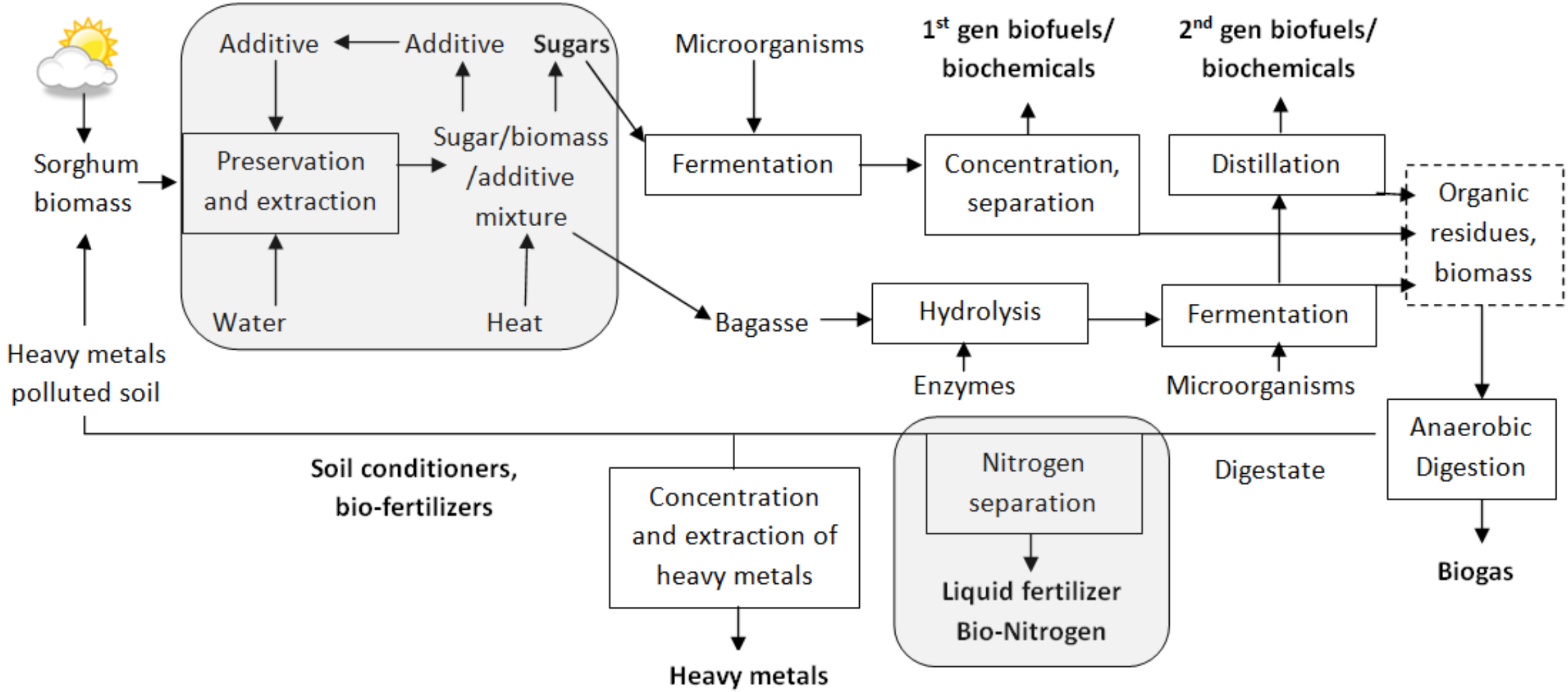
Technical/theoretical potential, source of feedstock	Biomass, tons	Biomethane potential, mill. m^3CH_4/year	Percentage of AZOMUREȘ nat. gas consumption %	Percentage of Romania nat. gas consumption %
Tech. potential = 50% of Copsa Mica polluted area + actual contracted capacity of Ludus sugar factory	600000 silage + 31500 beet pulp	54+2 =56	5.6	0.51
Teoretical potential = 100% of Copsa Mica polluted area + maximum capacity of Ludus sugar factory	1200000 silage + 75600 beet pulp	108+4.9 =112.9	11.29	1.02



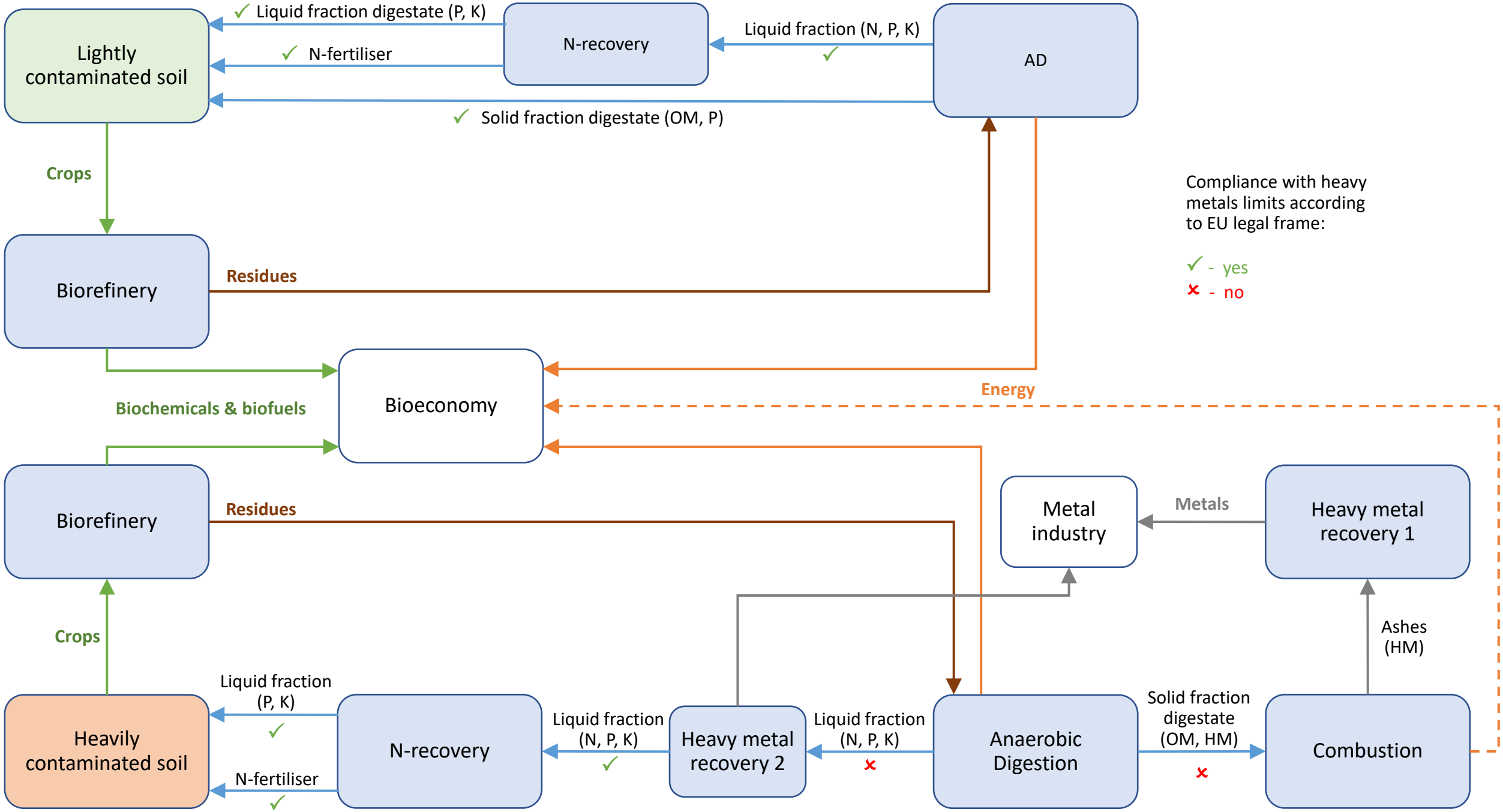
Sweet sorghum
and
Miscanthus giganteus
cultures adopted by local land owners to use the polluted soil for forages and energy purpose.

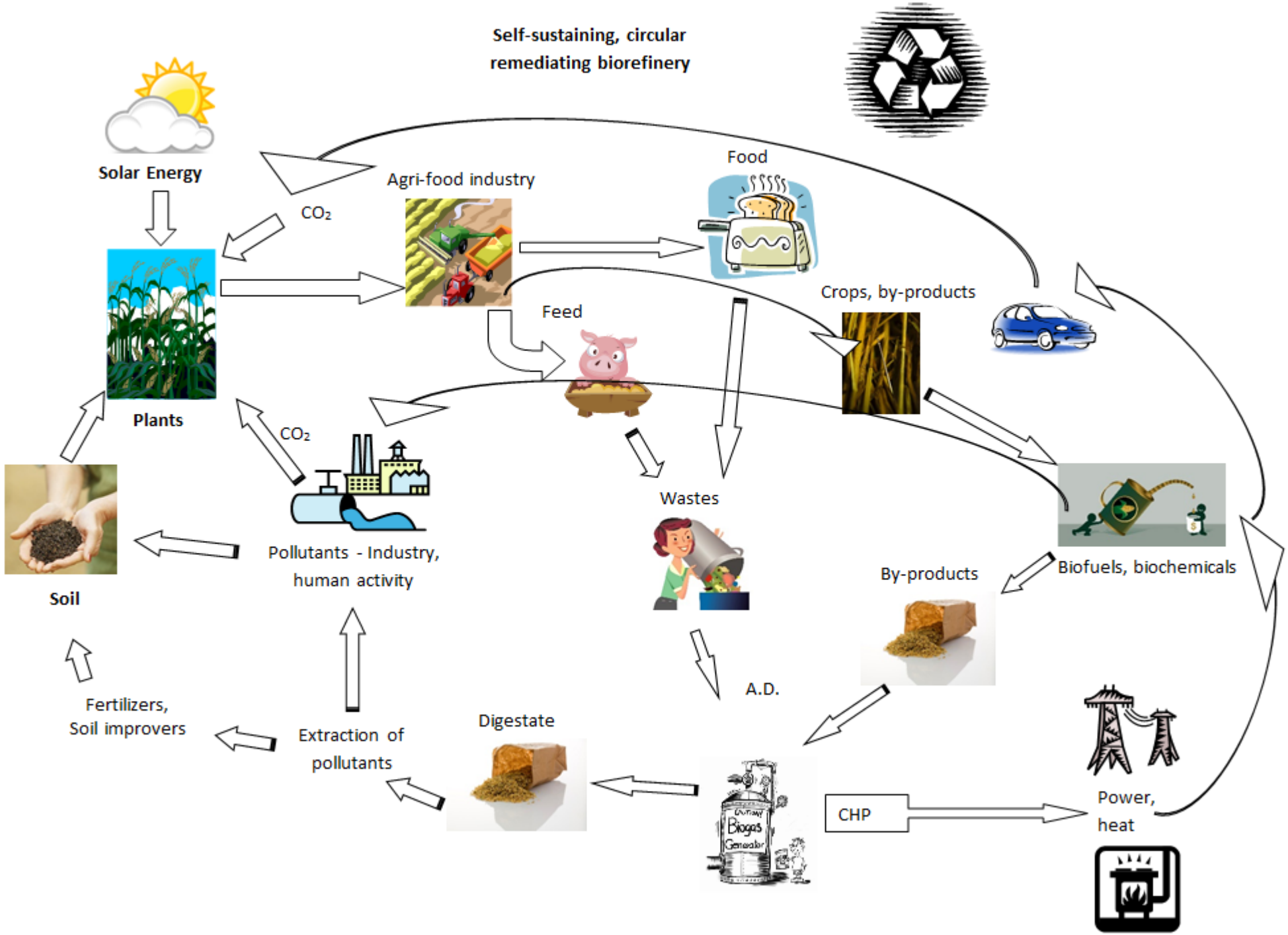


Proposed value chain and biosystem to be developed



Biorefinery of sugar crops cultivated in marginal lands to obtain biofuels and biochemicals in a circular economy. In grey boxes innovative processes developed by project team.


Lightly contaminated soil
✓ Liquid fraction digestate (P, K)
✓ N-fertiliser
N-recovery
Liquid fraction (N, P, K)
✓
AD
✓ Solid fraction digestate (OM, P)
Crops
Biorefinery
Residues
Compliance with heavy metals limits according to EU legal frame:
✓ - yes
✗ - no
Biochemicals & biofuels
Bioeconomy
Energy
Biorefinery
Residues
Metal industry
Metals
Heavy metal recovery 1
Crops
Ashes (HM)
Liquid fraction (P, K)
✓
N-fertiliser
✓
Heavily contaminated soil
N-recovery
Liquid fraction (N, P, K)
✓
Heavy metal recovery 2
Liquid fraction (N, P, K)
✗
Anaerobic Digestion
Solid fraction digestate (OM, HM)
✗
Combustion

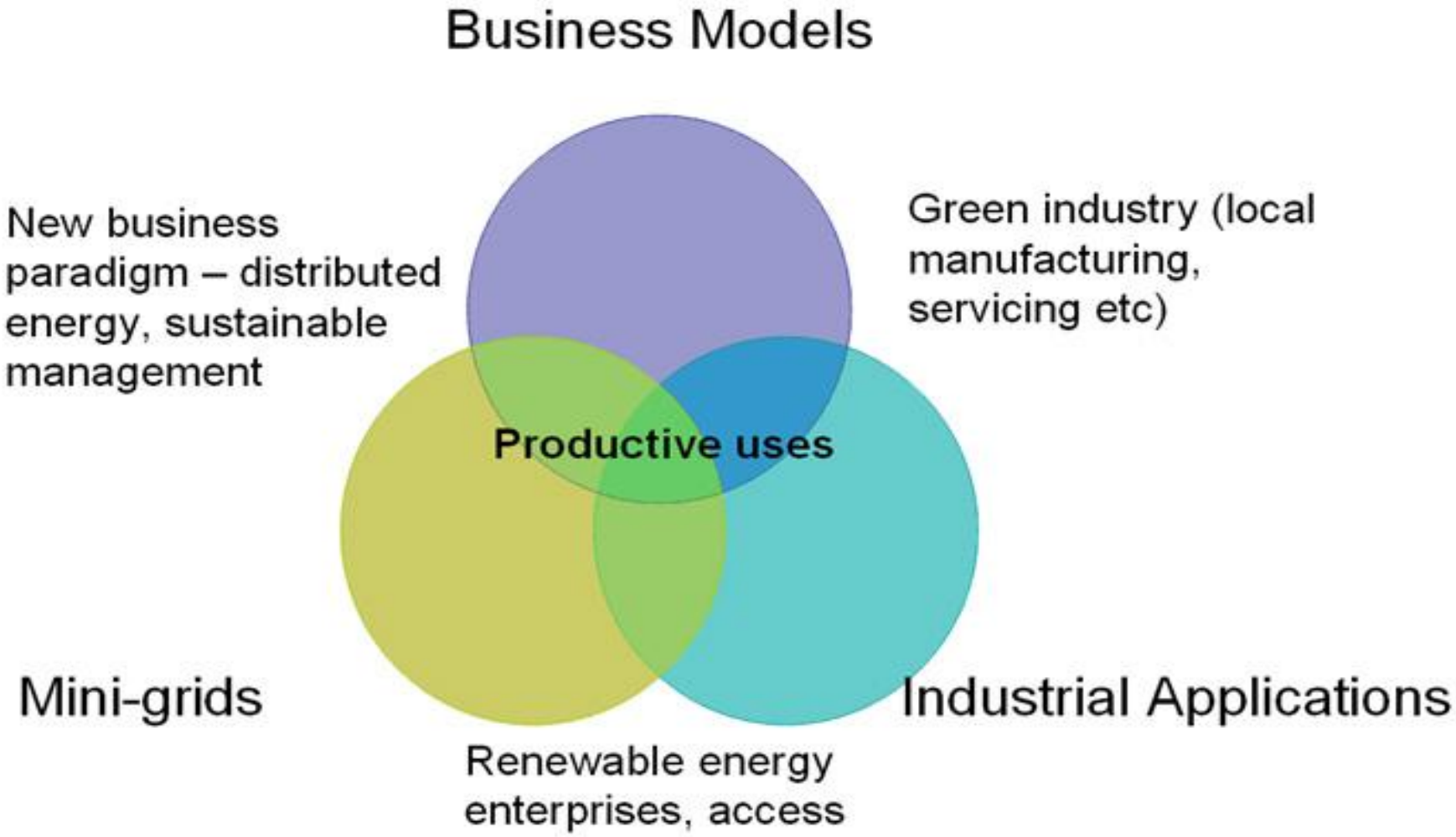

Self-sustaining, circular
remediating biorefinery
Solar Energy
CO_2
Agri-food industry
Food
Crops, by-products
Feed
Plants
CO_2
Soil
Pollutants - Industry,
human activity
Wastes
Biofuels, biochemicals
By-products
A.D.
Fertilizers,
Soil improvers
Extraction of
pollutants
Digestate
CHP
Power,
heat

Experience in the field

RES and Circular Economy Applied in an Academic Community as an Example for Smart Sustainable Development, project 2020/55421

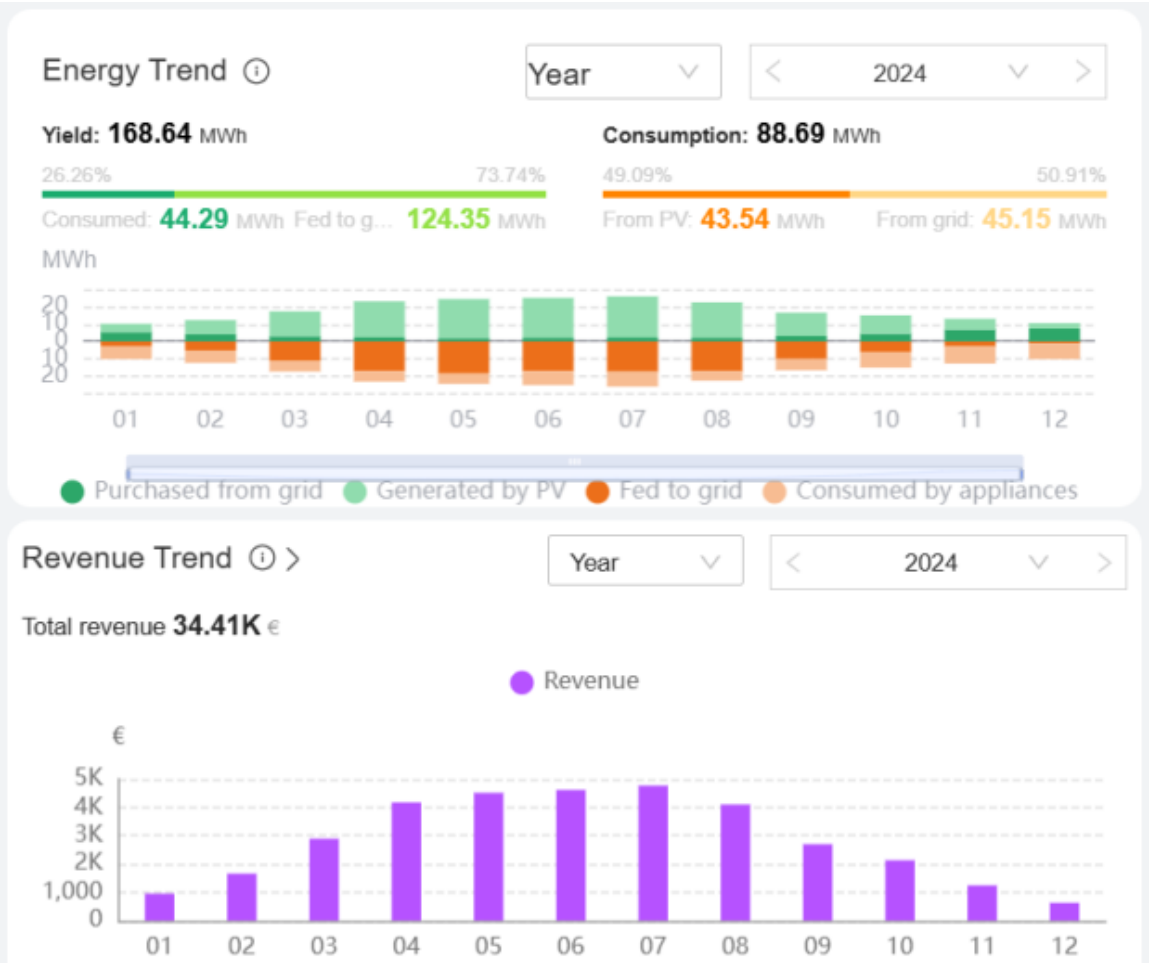
Project delivered an integrated development in the field of renewable energy (both electric and thermal), consisting in a dispatchable energy and circular economy system composed of biogas and photovoltaic technology

Smart management of resources & Self-sufficient energy production with a circular economy approach in ULST King Mihai I in Timisoara



PV component of the dispatchable energy system

The target: *flat roof buildings*. Production of energy from **PV: 170 MWh / year.**



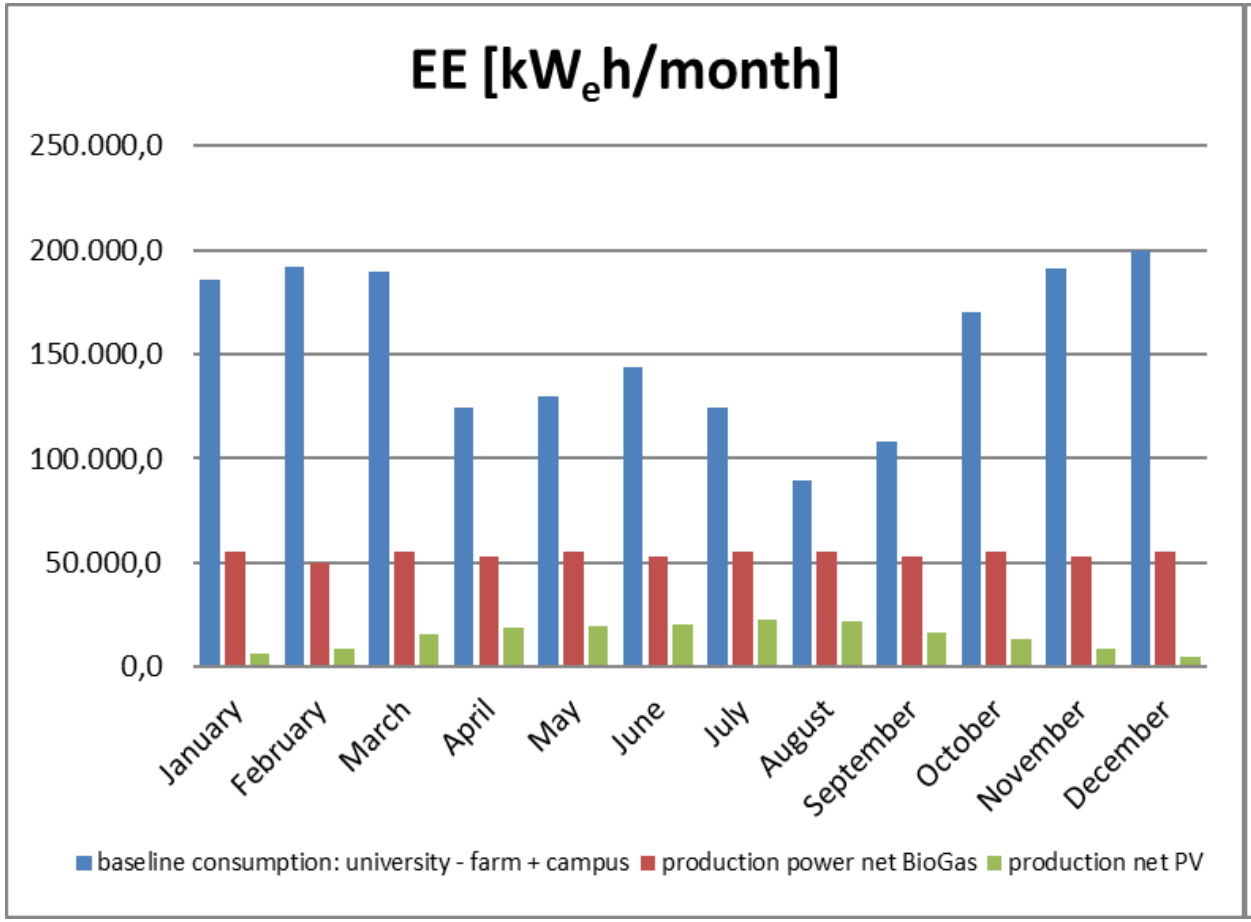
Biogas Plant

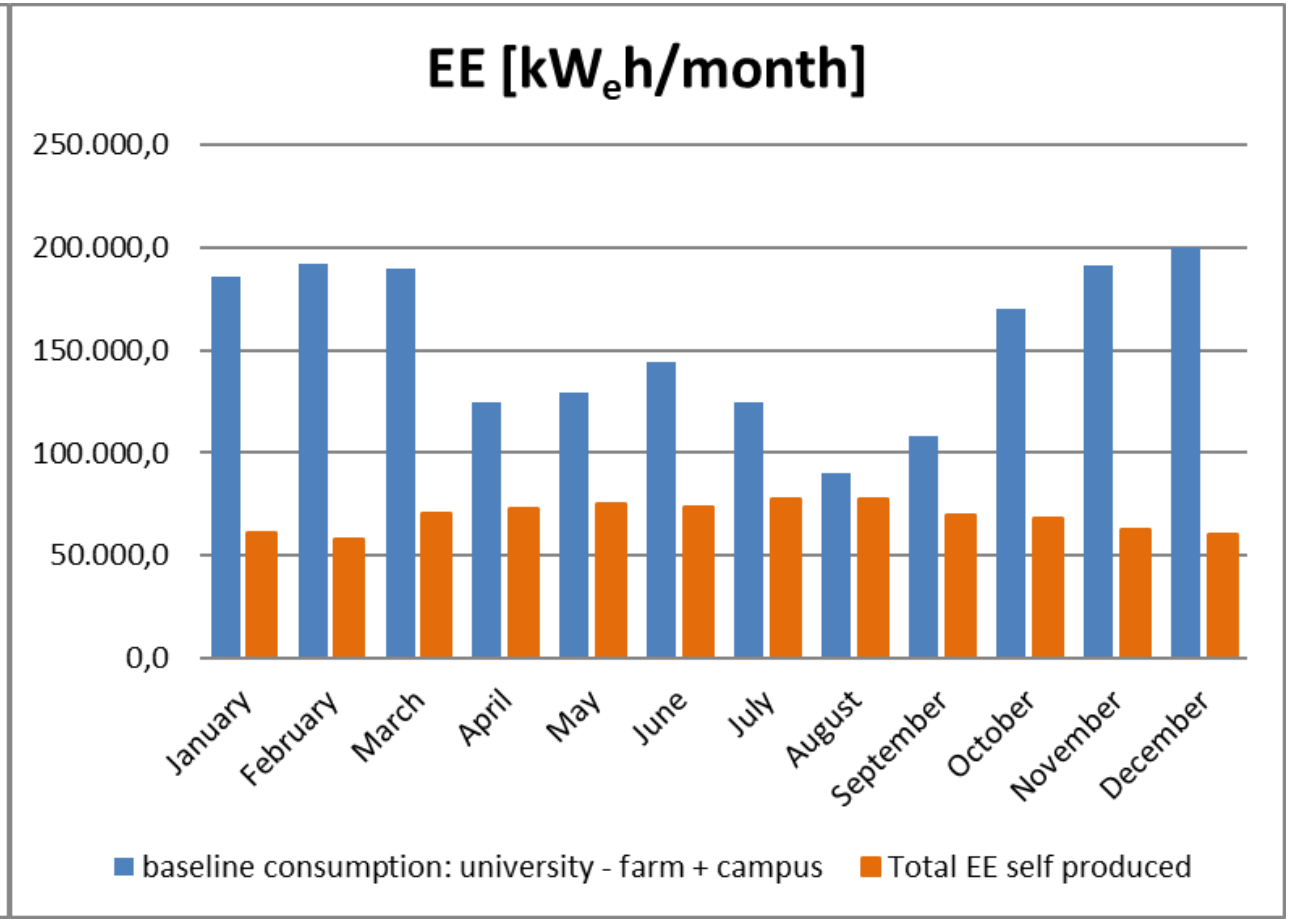
Approximately 3000 tons per year available feedstock for bioenergy production through AD-CHP.
Average methane yields to be obtained by AD of the available substrates up to **2 million Nm^3/a.**
Gross energy delivery of approximately **2000 MWh/a.**
Biogas converted in the CHP to
650 MWh electricity + 800 MWh thermal energy per year.

Feedstock available in campus or in the farms in the near proximity of the campus:

- **animal wastes**: manure, bedding, feed residues etc (4-5 tons per day available);
- **plant biomass,** such as plants and crops residues from the experimental lots, green cuts;
- **food residues** from campus canteen;
- **organic residues** from food industry, trade and municipalities in the area of Timisoara.

Local potential for renewable energy:
- space
- bioresources





BIOGAS PLANT AT ULST DIDACTIC FARM

RENEWABLE GASES, PRELIMINARY PROJECTS

Delgaz Grid successfully tested the operation of the grid with a mixture of hydrogen and natural gas

6 November 2023 OIL&GAS

Delgaz Grid has undertaken, for the first time in Romania, the implementation of the first project that aims to test sustainable home heating based on a mixture of natural gas (80%) and hydrogen (20%). The project, called 20HyGrid, runs from November 2022 to October 2024 and aims to demonstrate that, from a technical point of view, it is possible and safe to add hydrogen, in a proportion of 20% by volume, to the existing natural gas distribution networks and facilities in Romania.

BIOMETHANE, PRELIMINARY PROJECTS

Cooperation agreement for the largest biomethane production project in Romania, with a total capacity of up to 15 MW. DN AGRAR will provide the raw material for biomethane production through a long-term contract to ensure the sustainability of the project, and BSOG Energy will develop the necessary infrastructure.

BIOMETHANE, PRELIMINARY PROJECTS

Engie Romania has received a license to carry out the activity of supplying biogas/biomethane from the National Energy Regulatory Authority (ANRE).

It is the first license of this type granted in Romania, stated the president of ANRE, George Niculescu.

HEINEKEN România încheie un parteneriat cu ENGIE pentru a accelera eforturile de decarbonare

NON TECHNICAL CHALENGES!!!

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MINISTERUL ENERGIEI

STRATEGIA ENERGETICĂ A ROMÂNIEI 2025-2035, CU PERSPECTIVA ANULUI 2050

Extract:

Despite the significant potential for biomethane production in Romania, 2 billion m3 per year at the horizon of 2030 (having the capacity to replace approximately 80% of current natural gas imports with biomethane), Romania represents one of the least developed biogas markets of the EU, and the current number of CNG filling stations, i.e. 3, is not enough to have a higher uptake of biomethane in transport.

*…The development of the biomethane sector could provide the equivalent of **2 billion m3 per year** at the horizon of 2030, in the medium term, at the horizon of 2040, the potential rising to approximately **5.5 billion m3 per year**. In the long term, to reach the "net zero" scenario, biomethane is an important pillar in the heating sector, with a production potential of 65 TWh / **8 billion m3 per year** in the horizon 2050….*

…In 2023, only 0.69% of the electricity produced in the country came from biomass, bioliquids, biogas, waste and waste and sludge fermentation gases, in capacities totaling 118 MW of installed power.

MINISTERUL ENERGIEI

NON TECHNICAL CHALENGES!!!

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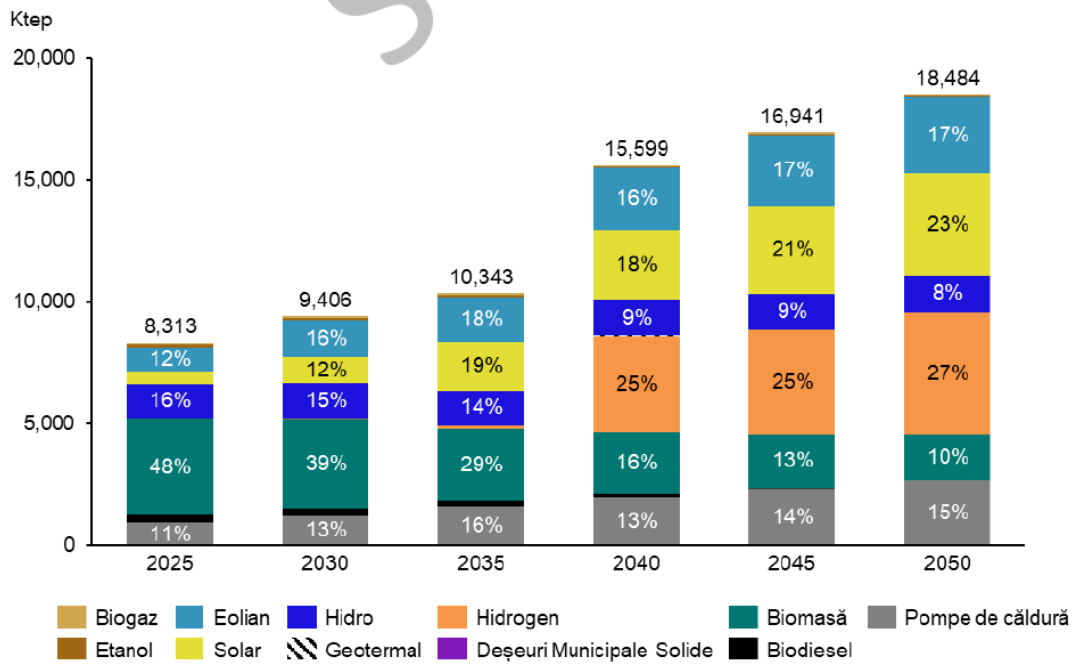
STRATEGIA ENERGETICĂ A ROMÂNIEI 2025-2035, CU PERSPECTIVA ANULUI 2050

Traiectoria ponderii SRE, per tip de combustibil, în consumul final brut



…Certification of biomethane in the network is needed, through a register of guarantees of origin similar to that in the electricity market, to monitor the quantities of biomethane produced and traded, with a view to excluding double selling and double accounting. Also, given the still high production cost of biomethane compared to natural gas, an initial financial support mechanism will be needed to encourage this sector…

!!! However…

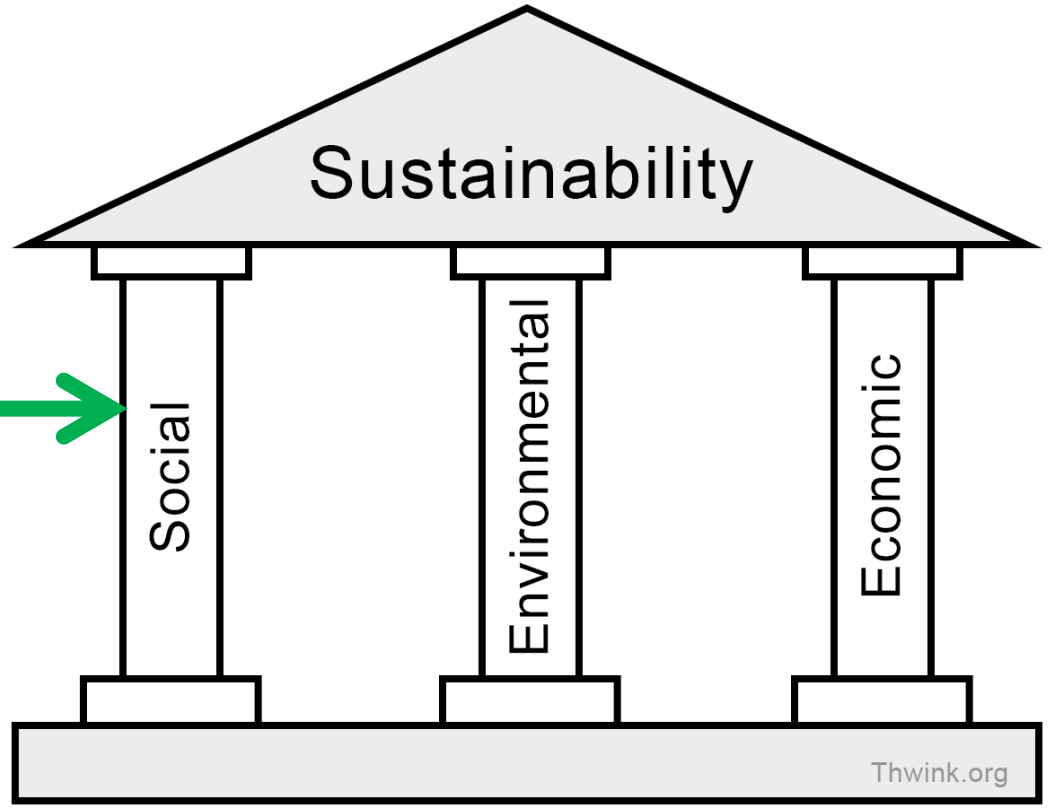
Romania's objective regarding the share of RES energy in gross final energy consumption for the year 2035 is 41.1% in 2035 and 86.1% in 2050. The targets will be met, mainly, by increasing the installed capacity to produce energy from ***hydropower, wind, solar and geothermal***, as well as through the partial ***electrification of heating and cooling systems***. Biomass will continue to play an important role, but its share in total RES will ***decrease*** from 52% in 2023 to 29% in 2035.

RIBES will create a significant impact by delivering innovative and tailored governance solutions and business models capable of fostering grass-rooted circular bioeconomy value chains, with particular attention devoted to the advanced sustainability of regional inclusive biobased entrepreneurship solutions, thus contributing to strengthening rural development and innovation in participating regions.

Biomass from various types, especially by-products and organic wastes resulted from agro-food supply chains are considered feedstock for production of compost, vermicompost, biogas to electricity. Bio-based products such as digestate, compost, bio-humus from vermicomposting are considered in RIBES project as the main tools to be used for remediation of areas contaminated by chemical and fossil energy industry.

RIBES

REGIONAL INCLUSIVE BIOBASED ENTREPRENEURSHIP SOLUTIONS



RESILIENCE AND ENERGY SECURITY

two concepts learned after the last two major crises (the Pandemic and the Conflict in Ukraine) are the elements that should define how we will design our future strategies, strategies that must not replace energy independence, even from Russia, with another **dependence on the energy provided by any other country**.

ROMANIA Potential: **114 TWh** **Natural gas consumption** 11-12 billions c.m./year, = **110-120 TWh /year**

TWh	Agriculture residues	Intermediate crops	Manure	Industrial waste	Green waste	Forest wood and residues	Pruning
France	38,00	62,60	30,40	6,58	20,61	71,12	3,95
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United Kingdom	12,07	19,56	27,15	2,30	21,83	7,38	0,04

CIRCULAR BIOECONOMY IS PART OF ROMANIAN TRADITION

Funded by the European Union

Mulțumesc pentru atenție!

GREENMEUP

BIOLOC
Biobased and social innovation to revitalise European local communities

Visit and find out about our projects in CIRCULAR BIOECONOMY

RES-CIRCULAR

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