# HYBRID BIOGAS - EB SYSTEM FOR ELECTRICITY AND BIOFERTILISER PRODUCTION

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Low energy electron beams for industrial and environmental applications

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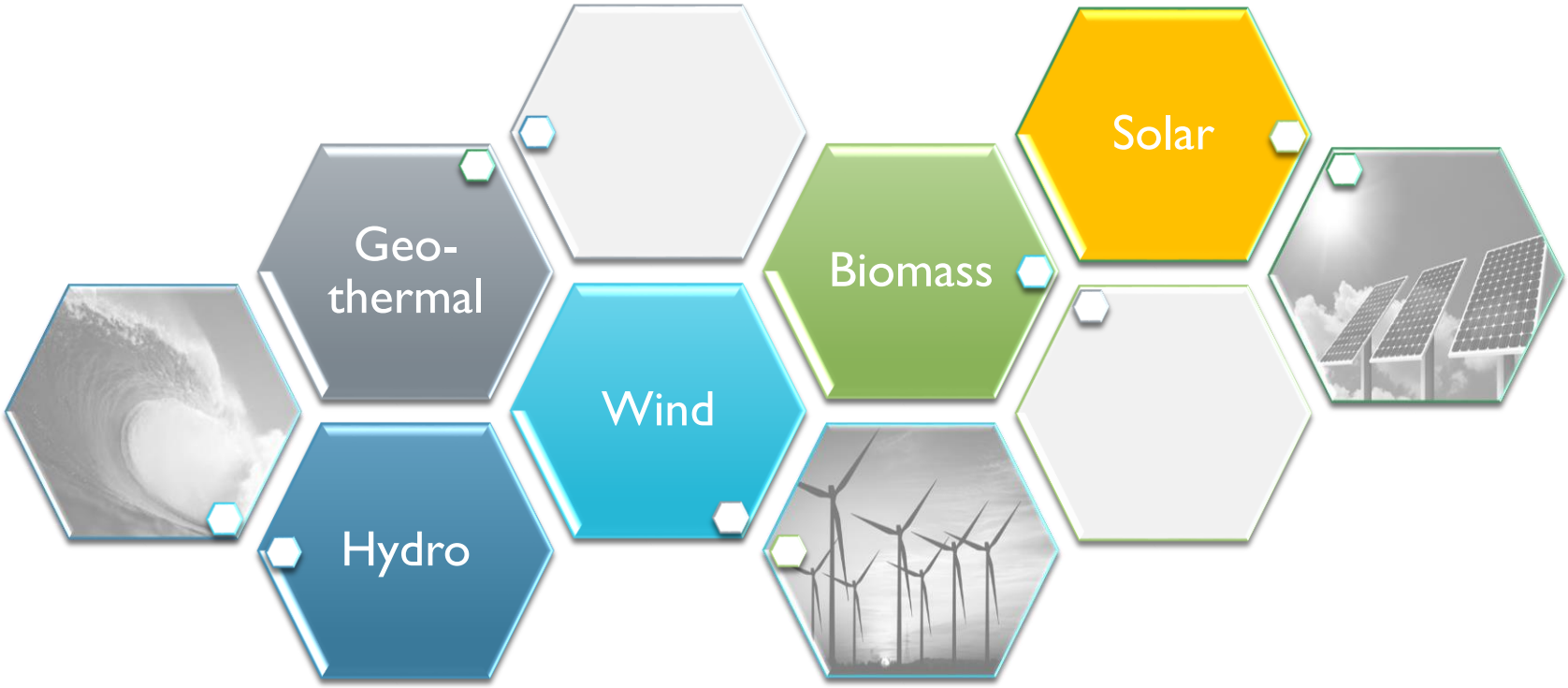
# RENEWABLE ENERGY SOURCES



# BIOGAS

- Biogas is produced by the biological breakdown of organic matter in the absence of oxygen.
- Biogas consist mainly of methane and carbon dioxide and a very small amounts of other substances, but its composition varies depending upon the origin of used feedstock.
- It can be used as a low - cost fuel for heating purpose also in modern waste management facilities where it can be used to generate and electrical power.
- The combustion of biogas reduces the emission of sulfur dioxide and nitrogen oxides in comparison to the combustion of fossil fuels.
- Biogas production is a versatile biotechnology capable of converting almost all types of biomass to methane and carbon dioxide under anaerobic (absence of oxygen) conditions.

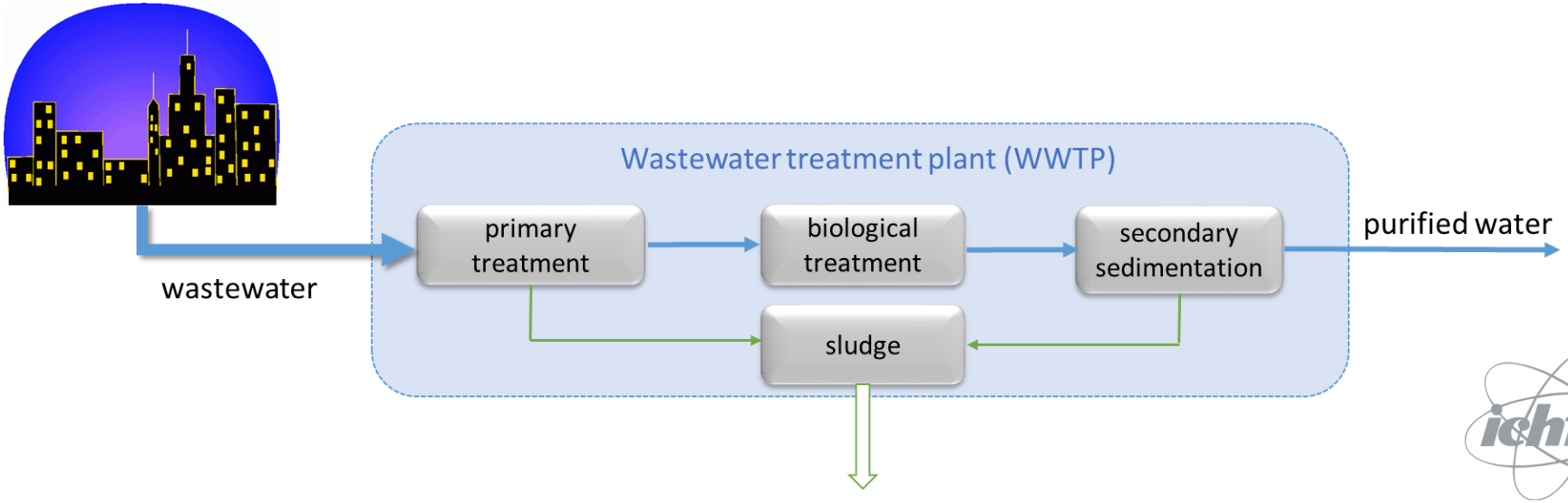
| Country | Reference | Total biogas production<br>From agricultural residues, industrial wastewater, biowaste, landfills and sewage sludge | Biogas production in WWTPs<br>only from sewage sludge | |
|---|---|---|---|---|
| | Year | GWh/y | GWh/y | % of total production |
| Australia | | n.a. | n.a. | n.a. |
| Austria | 2013 | 570 [3] | n.a. | n.a. |
| Brazil | 2014 | 613 [3] | 42 [3] | 7 % |
| Denmark | 2012 | 1.218 [1] | 250 [1] | 21 % |
| Finland | 2013 | 567 [2] | 126 [2] | 22 % |
| France | 2012 | 1273 [3] | 97 [3] | 8 % |
| Germany | 2014 | 41.550 [2] | 3.050 [2] | 7 % |
| Ireland | | n.a. | n.a. | |
| Norway | 2010 | 500 [1] | 164 [1] | 33 % |
| South Korea | 2013 | 2.578 [1] | 969 [1] | 38 % |
| Sweden | 2013 | 1.686 [1] | 672 [1] | 40 % |
| Switzerland | 2012 | 1.129 [1] | 550 [1] | 49 % |
| The Netherlands | 2013 | 3.631 [1] | 711 [1] | 20 % |
| United Kingdom | 2013 | 6.637 [3] | 761 [3] | 11 % |

[1] Energy generated as gross gas production
[2] Energy generated as electricity, heat, vehicle fuel or flared (excluding efficiency losses)
[3] Electricity generation only (excluding efficiency losses)
n.a: data not available

http://www.iea-biogas.net/files/daten-redaktion/download/Technical%20Brochures/Wastewater_biogas_grey_web-1.pdf

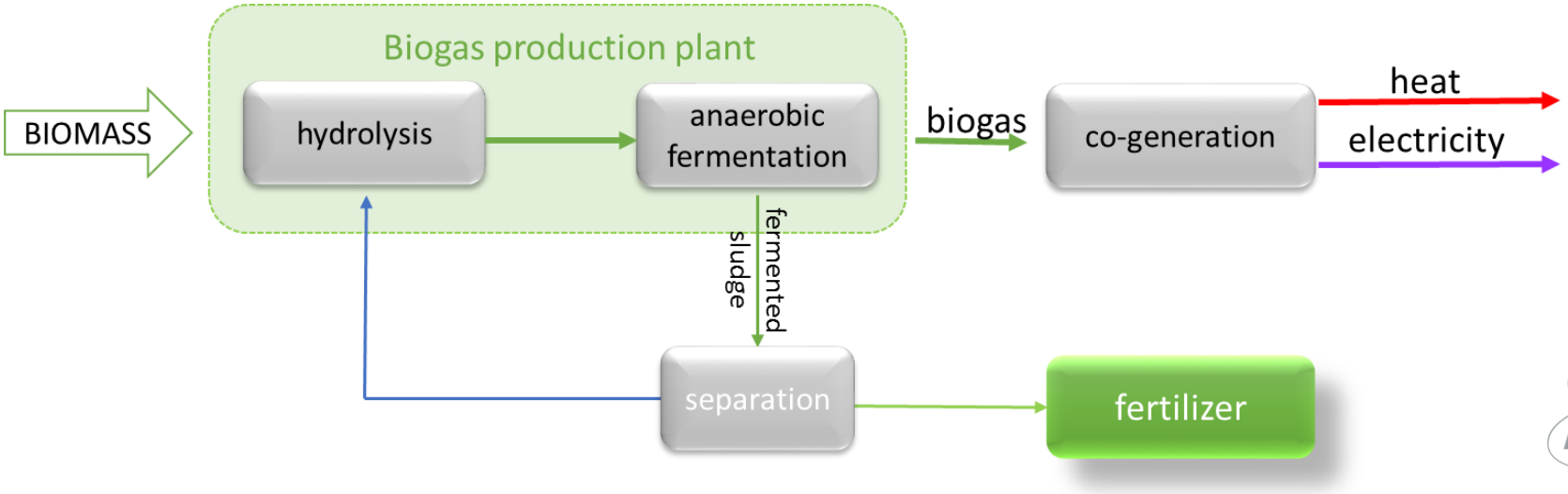
# WASTEWATER TREATMENT PLANTS

- In wastewater treatment plants (WWTPs) sewage sludge is produced as part of the water cleaning process.
- The sludge contains the particles removed from the wastewater, which are rich in nutrients and organic matter, leaving the water clean for its release into nature. Growing population centers and expanding industry, which are increasingly well served by wastewater treatment facilities, result in rapid growth of sewage sludge production.



# BIOGAS PRODUCTION USING SEWAGE SLUDGE

- The sludge is pumped into the anaerobic reactors where digestion takes place, usually at mesophilic temperature (35 – 39 °C). During a retention time of around 20 days, microorganisms break down part of the organic matter that is contained in the sludge and they produce biogas, which is composed of methane, carbon dioxide and trace gases. Biogas is used to feed cogeneration systems in order to simultaneously produce heat and electricity.



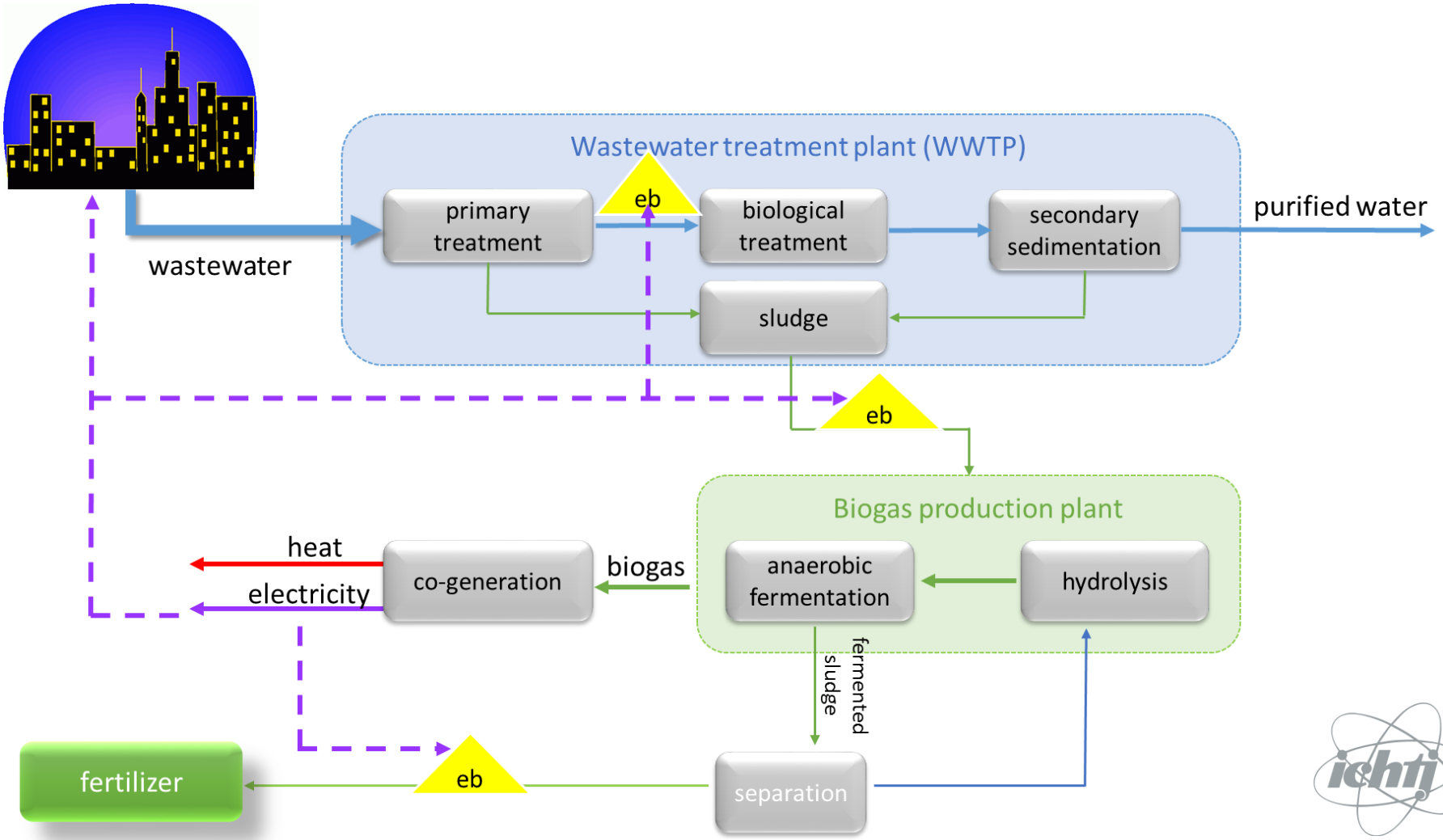
# ADVENATGES OF ANEAROBIC SLUDGE FERMENTATION PROCESS

- Post-fermentation slurry contains 3 – 5% of dry matter,
- Dry matter content can be increased up to about 35% applying dewatering process,
- The volume of organic matter is reduced by about 50% in comperison to unfermented substrate,
- Improvement of fertiliser value eg. a part of the organic nitrogen is converted to ammonium, which is more easily accessible for plants,
- Reduction of methane emission to the atmosphere in comparison to untreated sludge,
- Odour reduction.

# SLUDGE DISINFECTION

- The sludge of municipal wastewater origin is biologically contaminated by viruses, bacteria and eggs of parasites.
- Anaerobic fermentation can reduce number of pathogenic microorganisms but can't eliminate them completely.
- Dissinfection process must be applied.
- Under irradiation the decomposition of pollutants and elimination of microorganisms in water undergo due to reaction of water radiolysis products.

# HYBRID BIOGAS - EB SYSTEM



# BIOGAS PLANTS – INCT EXPERIENCE

Participation in the design and start-up of biogas plants with capacity of 1.2 MW in Koczergi and Międzyrzec etc.

# ADVANTAGES

**Advantages of proposed solution:**

- Environmental friendly technology
- Biogas production is disposal of problematic wastes
- Production of renewable power through combined heat and power cogeneration
- Production of microbiologically safe organic fertiliser
- Technology can be applied in any place with sufficient biomass resources while there is no need to ensure external electric energy supply

# THANK YOU FOR ATTENTION