MOLECULAR
CRACKING
TECHNOLOGY

MCT

Pyro-Kat

Technically and economically most effective EU solutions in the treatment and disposal of hazardous waste

In the treatment and disposal of various waste there are no wrong or correct strategies. There are only successful or unsuccessful technologies.

PYRO-KAT?! MCT?! GET?!

- **PYRO-KAT** is the brand under which MCT technology-based plants are produced.
- **MCT** - **M**olecular **C**racking **T**echnology is a flexible, reliable and clean technology that cracks different waste on high-value products.
- **GET** delivers, supplies and provides the Pyro-Kat systems based on the Pyro-Kat patents and technology, and represent them worldwide and exclusively.

COMPARISON OF MCT TECHNOLOGY AND OTHER TECHNOLOGIES OF WASTE PROCESSING

- **Burning**
  - Oxygen + fire
    - Simple and very dirty
- **Various processes based on oxygen conversion**
  - Pyrolysis, plasma, etc.
    - Complicated and very dirty
- **MCT - Molecular Cracking Technology**
  - Low temperature circular gasification with very little oxygen presence
    - Simple, clean and smart

WASTE THAT CAN BE PROCESSED WITH MCT TECHNOLOGY – 1/3

HOSPITAL WASTE

INDUSTRIAL WASTE

SLUDGE FROM PURIFIER

SLAUGHTER-HOUSE WASTE

MUNICIPAL WASTE

CONSTRUCTION WASTE

OUTDATED FOOD

OILY SAND & HEAVY OILS

WASTE THAT CAN BE PROCESSED WITH MCT TECHNOLOGY – 2/3

LANDFILL WASTE

CAR TIRES

AGRICULTURAL WASTE

ELECTRONIC WASTE

MARPOL

OUTDATED MEDICATIONS

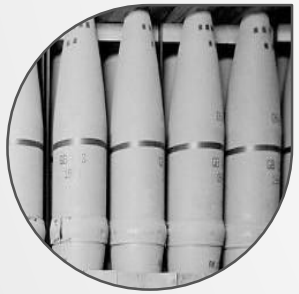
PLANT PROCE-SSING WASTE

TANIN FROM LEATHER PROCESSING

WASTE THAT CAN BE PROCESSED WITH MCT TECHNOLOGY – 3/3

FRUITS AND VEGETABLES REMAINS

POISONS



ASBESTOS

OLIVE GROUT WASTE

WASTE FROM OIL PLANTS

OUTDATE CHEMICALS

FOSFATS

INDUSTRIAL SLUDGE

PREPARATION OF WASTE FOR PROCESSING WITH MCT TECHNOLOGY

- Waste that is processed by MCT technology may or may not have to be sorted before processing
- Waste can be up to 80% moisture (optimally 40%)
- The waste must be cut to pieces of diameter up to 50 mm and length up to 100 mm
- Waste grinder equipment is not an integral part of MCT technology but can be delivered together with MCT technology
- When communal waste is processed, 50% of landfill waste and 50% of new waste can be combined
- Different types of waste can be combined into a mix and thus increase the energy value of waste

SMOKE POLLUTION FROM FACTORIES & MCT TECHNOLOGY

- Various industries across the world use different materials and chemicals to produce their products. The energy sector, still mostly, uses coal, for generating electricity that is particularly damaging human health and the environment.

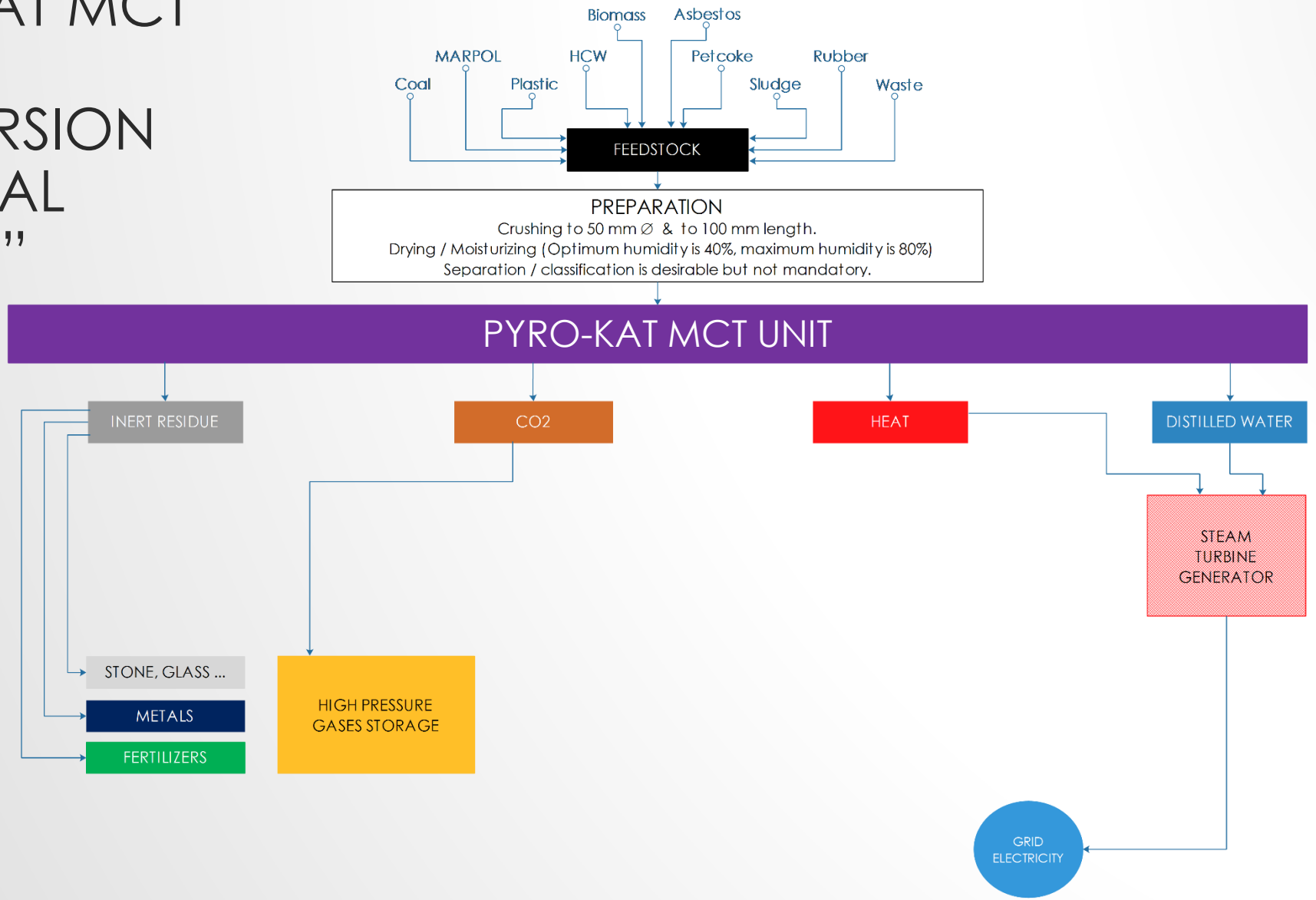
- **The installation of standard pollution control equipment is expensive.** A study by MIT found that it may cost coal power plants € 215,000 to € 330,000 per megawatt to install control systems for particulate matter, SO_2 and NO_x. For a typical coal power plant producing 500 megawatts, it could cost more than € 100 million to install controls at a newly built plant and € 150 million to retrofit an existing facility.

- **MCT technology solves this problem in a completely different way.** On one hand, smoke pollution is raw material for MCT technology, and on the other hand, fuel utilization, passing through MCT technology, is significantly increasing.

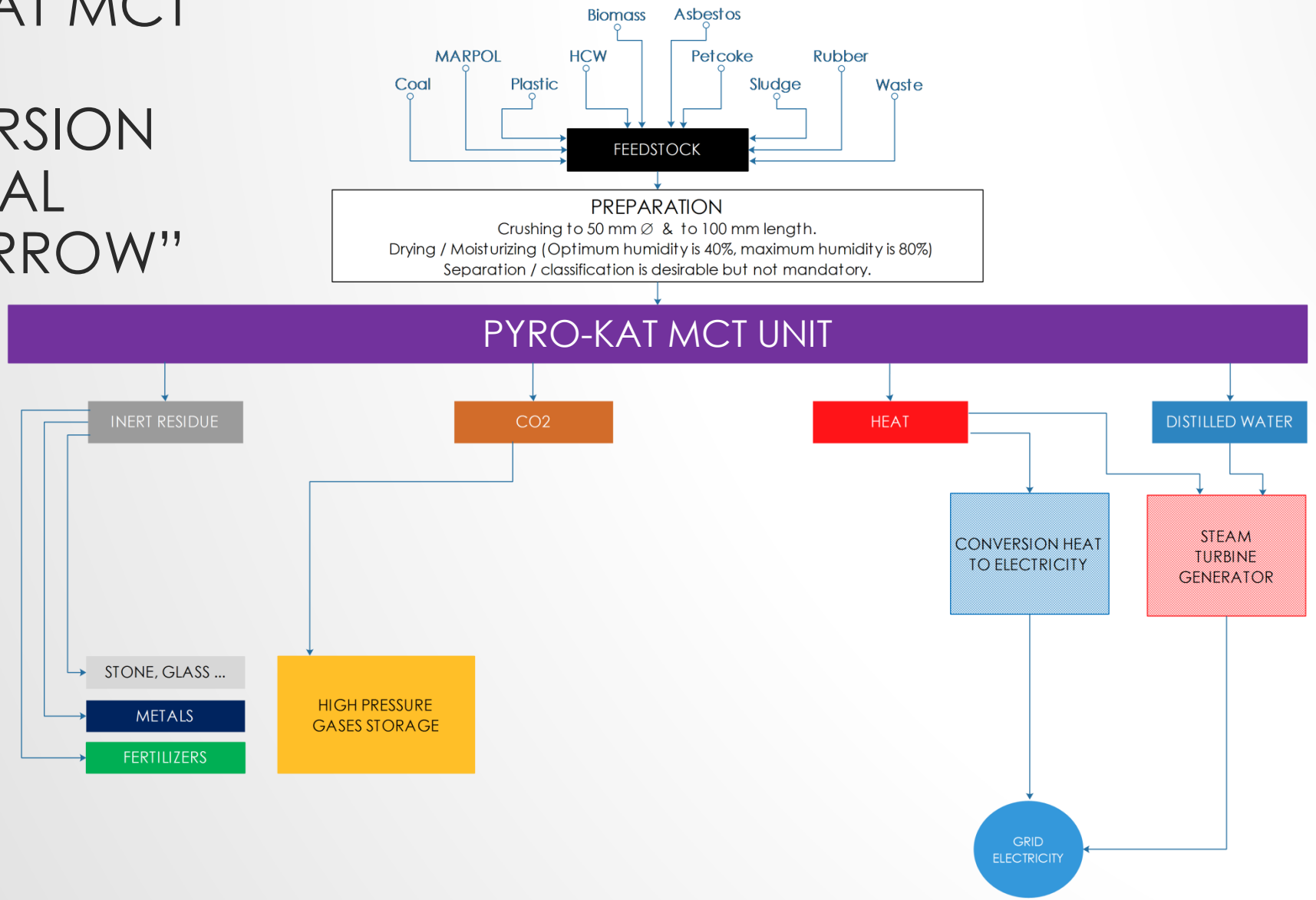
MCT TECHNOLOGY HAVE BEEN APPLIED IN THE FOLLOWING AREAS

- **Hospitals**
- **Pharmaceutical industry**
- Automotive industry
- **Chemical industry**
- Power industry
- Thermal-electric power station
- **Tobacco industry**
- **Wastewater treatment**
- Paints, varnishes and adhesives industry
- Shipbuilding industry
- Construction industry
- Typography industry
- **Food industry**
- Furniture and woodworking industry
- Footwear industry
- Refining industry
- Distillers industry

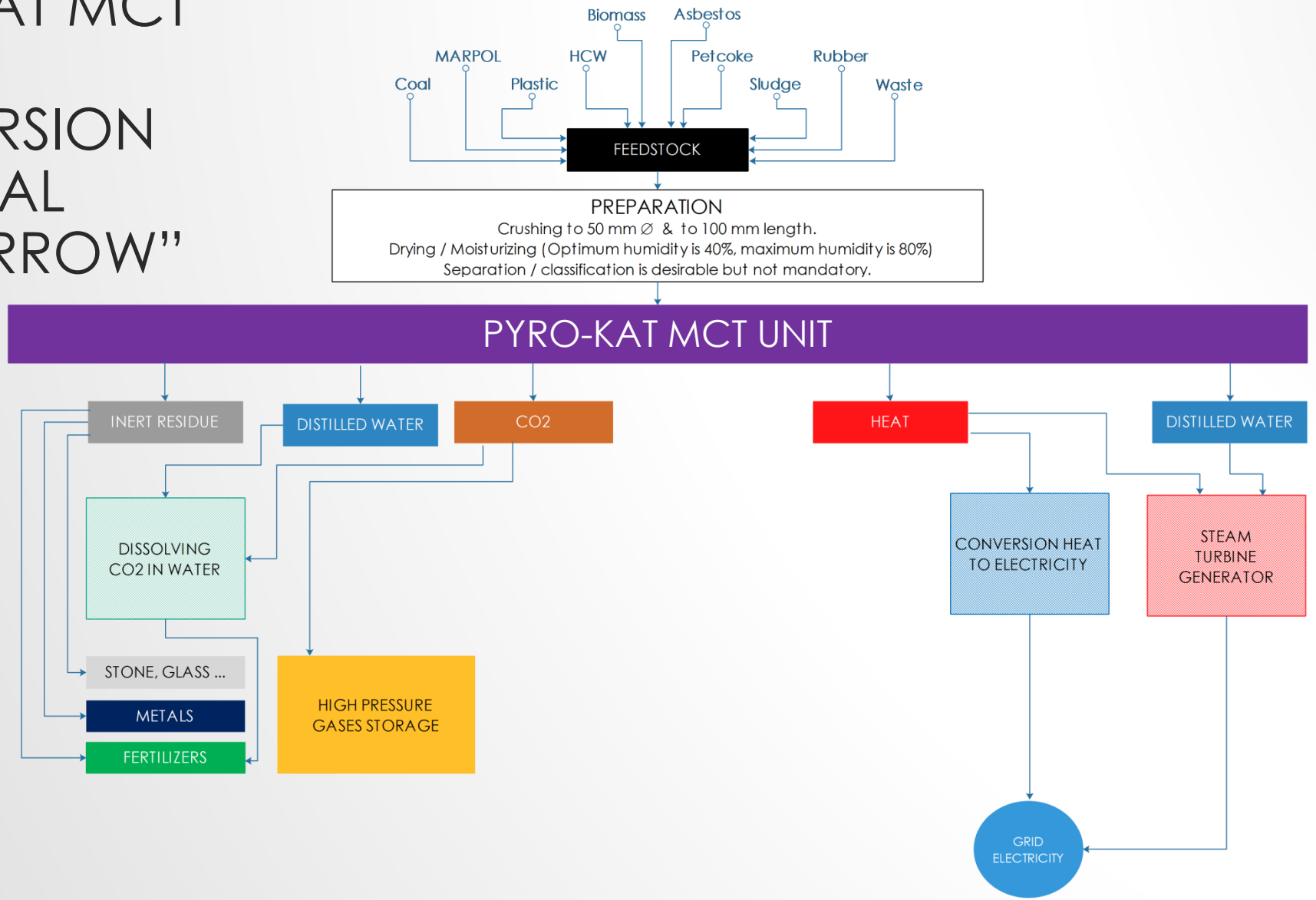
PYRO-KAT MCT WASTE CONVERSION POTENTIAL „TODAY"



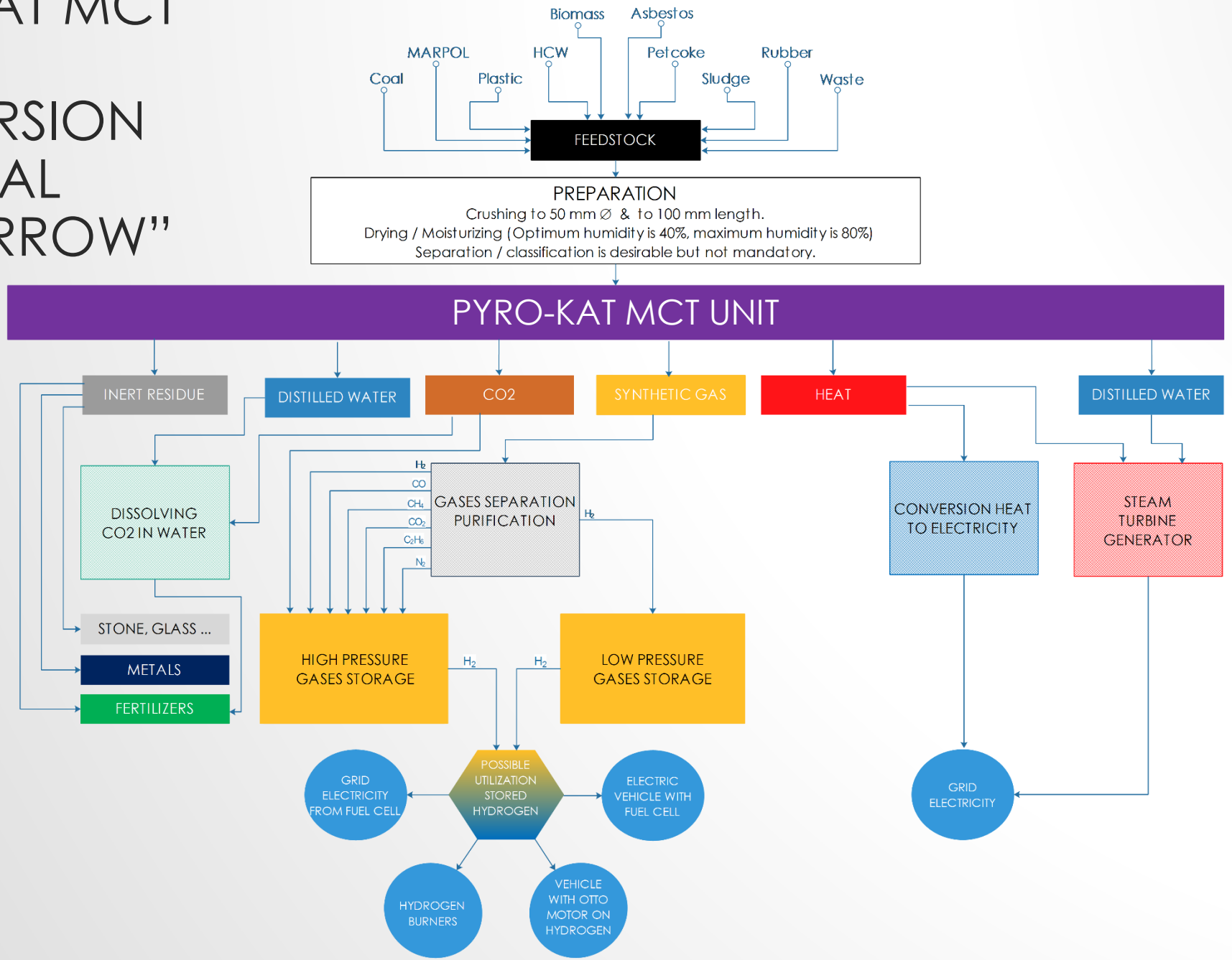
PYRO-KAT MCT WASTE CONVERSION POTENTIAL „TOMORROW"



PYRO-KAT MCT WASTE CONVERSION POTENTIAL „TOMORROW"

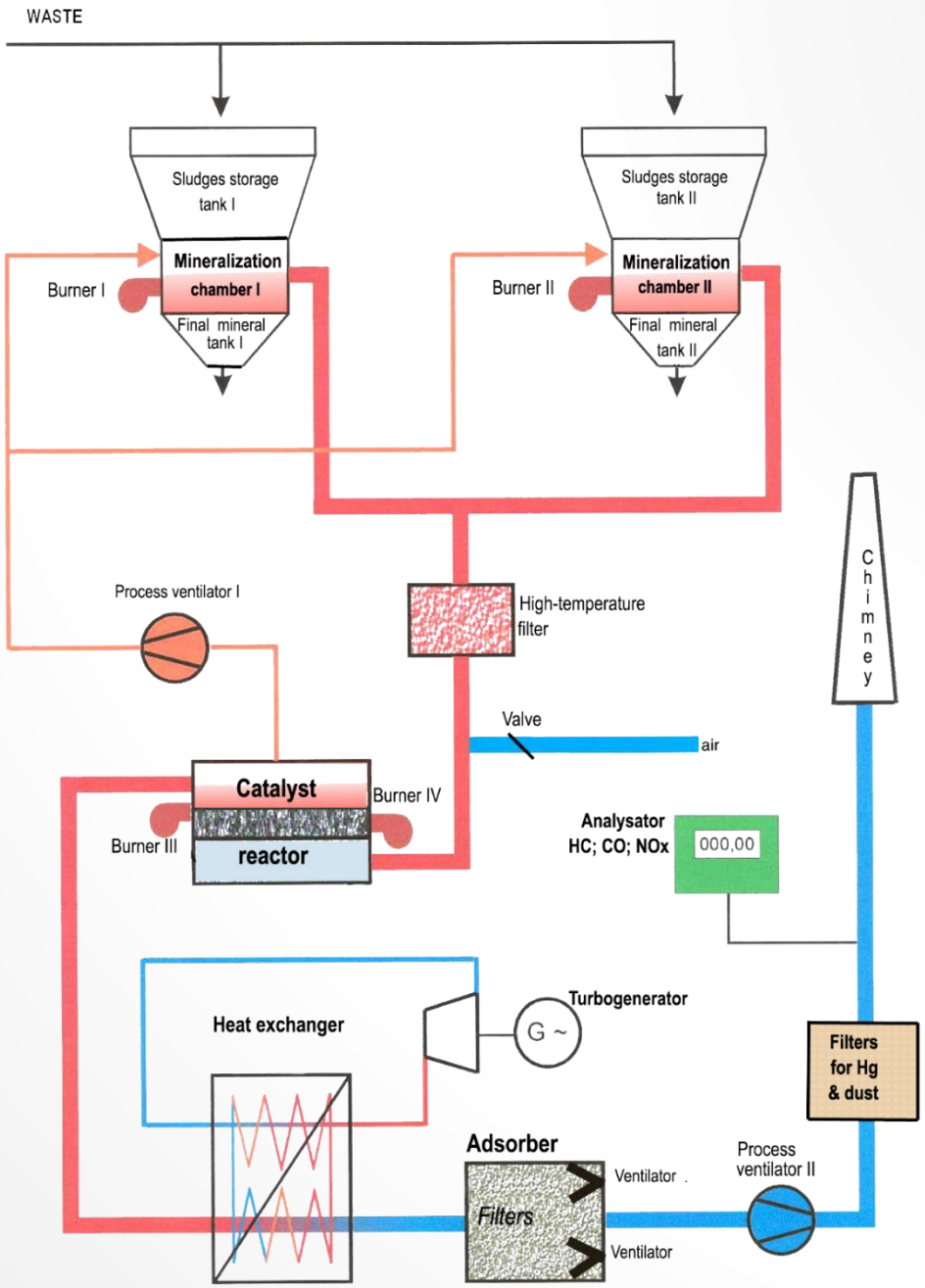


PYRO-KAT MCT WASTE CONVERSION POTENTIAL „TOMORROW"

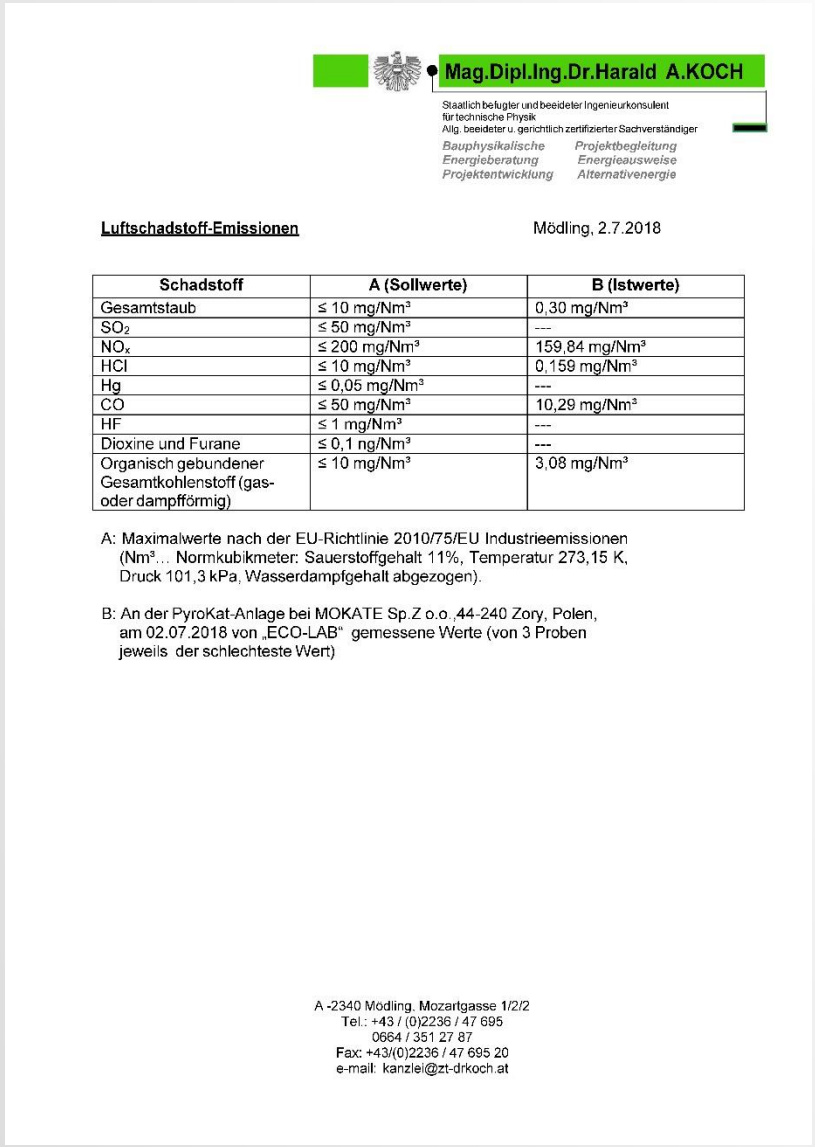


PROCESS FLOW DIAGRAMM

- The main advantage / innovation of MCT solutions is circular gasification.
- **Classic gasification**, a process that is being used by competitive technologies, is aiming to generate synthetic gas from input raw materials (waste). Generated synthetic gas is used in gas turbines and / or gas engines to initiate the electric power generator. This is useful, but in this process, however, they produce harmful exhaust gases.
- The MCT, in a **closed circular system**, maximizes the overall thermal potential of the gases produced in the process to provide pure heat, distilled water, clean CO2 and an inert residue.
- The created heat is used to provide steam and feed steam turbines for the production of electricity, heating and cooling.
- **The goals of MCT solutions are to enable:**
  - **economically viable solutions,**
  - **harmonization with EU standards,**
  - **permanent and final disposal of waste at places where waste is generated and / or where waste must be disposed of.**



AIR POLLUTANT EMISSIONS?



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Allg. beeideter u. gerichtlich zertifizierter Sachverständiger

Bauphysikalische Energieberatung Projektentwicklung
Projektbegleitung Energieausweise Alternativenergie

Luftschadstoff-Emissionen Mödling, 2.7.2018

Schadstoff	A (Sollwerte)	B (Istwerte)
Gesamtstaub	≤ 10 mg/Nm³	0,30 mg/Nm³
SO_2	≤ 50 mg/Nm³	---
NO_x	≤ 200 mg/Nm³	159,84 mg/Nm³
HCl	≤ 10 mg/Nm³	0,159 mg/Nm³
Hg	≤ 0,05 mg/Nm³	---
CO	≤ 50 mg/Nm³	10,29 mg/Nm³
HF	≤ 1 mg/Nm³	---
Dioxine und Furane	≤ 0,1 ng/Nm³	---
Organisch gebundener Gesamtkohlenstoff (gas- oder dampfförmig)	≤ 10 mg/Nm³	3,08 mg/Nm³

A: Maximalwerte nach der EU-Richtlinie 2010/75/EU Industrieemissionen (Nm³... Normkubikmeter: Sauerstoffgehalt 11%, Temperatur 273,15 K, Druck 101,3 kPa, Wasserdampfgehalt abgezogen).

B: An der PyroKat-Anlage bei MOKATE Sp.Z o.o.,44-240 Zory, Polen, am 02.07.2018 von „ECO-LAB" gemessene Werte (von 3 Proben jeweils der schlechteste Wert)

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POLLUTANT	SETPOINTS	MEASURED VALUES
TOTAL DUST	≤ 10 mg/Nm³	0,30 mg/Nm³
SO_2	≤ 50 mg/Nm³	---
NO_x	≤ 200 mg/Nm³	159,84 mg/Nm³
HCl	≤ 10 mg/Nm³	0,159 mg/Nm³
Hg	≤ 0,05 mg/Nm³	---
CO	≤ 50 mg/Nm³	10,29 mg/Nm³
HF	≤ 1 mg/Nm³	---
Dioxins and furans	≤ 0,1 ng/Nm³	---
Organically bound total carbon (gaseous or vaporous)	≤ 10 mg/Nm³	3,08 mg/Nm³

SETPOINTS
Maximum values according to EU Directive 2010/75 / EU Industrial emissions (Nm³ ... standard cubic meter: oxygen content 11%, temperature 273.15 K, pressure 101.3 kPa, water vapor content deducted)

MEASURED VALUES
At the Pyro-Kat MCT plant at MOKATE Sp.Z o.o., 44-240 Zory, Poland,
Values measured by "ECO-LAB" on July 02, 2018 (out of 3 samples the worst value)

INERT RESIDUE?

- The rest of the waste, which can not be converted into gases and water vapor in the MCT process, will be transformed into harmless carbonized granules that are used as a filler for asphalt and / or as sand for making concrete and / or as fertilizer.
- From inorganic substances in the raw material (such as metal, glass, sand, etc.), after passing through the MCT unit, a solid residue is classified by categories.
- MCT technology guarantees less than 5% of inflamable matter in a solid residue and thus complies with the latest and most stringent environmental regulations that limit waste that is taken to less than 5% inflamable matter of organic content.
- Considering average municipal waste - the inert residue is up to 10% of the input volume of waste.

ESTIMATED ENERGY CONTENTS OF DIFFERENT KINDS OF WASTE

Kind of waste	Energy content of input waste MJ/kg
Mixed household waste	9 – 15
Paper	16 – 19
Biomass	16 – 18
Hemp	16 – 17
Car tires	34 – 35
Oil sludge	36 - 38
Tar and refinery residues	38 - 39
Neoprene	29 - 30
Nylon	31 - 32
Mixed plastics (polymeric)	40 - 46

PRODUCTION OF ELECTRICITY?

- Considering the production of electricity - today the steam produced in the MCT process is primarily used.
- The steam drive steam turbines, and they drive generators for producing electric energy.
- Steam turbines and generators may or may not be an integral part of the MCT plant.
- MCT technology is constantly evolving and improvements are underway, such as hydrogen purification and hydrogen fuel combustion/cell, as well as thermolytic converters that directly convert heat into electricity. This is a guarantee that the plant will certainly not be outdated.

ECONOMICAL BENEFITS

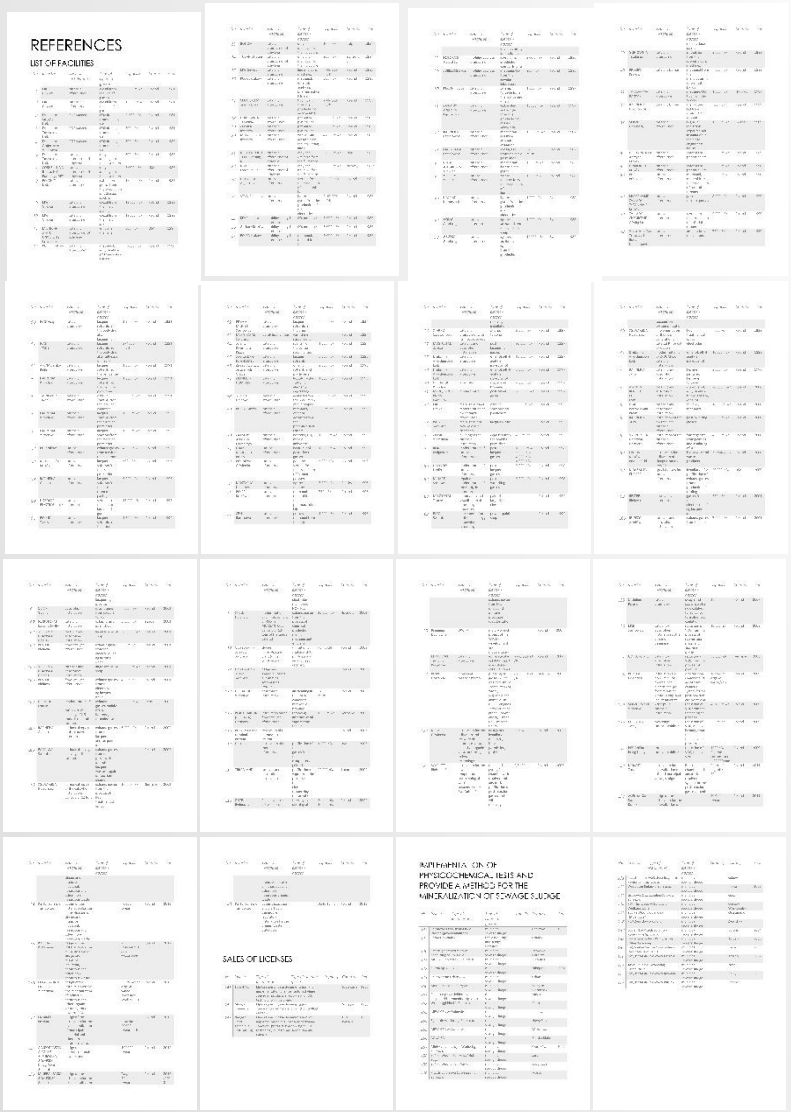
- Operational **running time of the system units is in average 25 years** (some of them are more than 30 years in continuous operation).
- Very **low operational, maintenance, and repair costs** are guaranteed by extremely strong reliability (high product quality with decades of industry experience).
- **Return on Investment** in most cases is calculated **between 3 to 5 years**.
- **Replacement of catalysts** is in most cases (normal unit size) only necessary **between 10 to 15 years** with a guarantee of 5 years.
- **Total operating costs are significantly lower** compared to other methods, technologies, systems and applications, **due to the innovative technology and flexible infrastructure** with decentralized installations, mobile units on trucks, reduced logistic costs, etc.

EXAMPLE OF MCT-80 AND MCT-300 FACILITIES

- **PYRO-KAT MCT 300**
  - Maximum processing capacity — 300 tons **municipal waste** daily
  - Available Electrical Energy per Year — 122.400.000 kWh (elektr.) yearly
  - Available Residual Heat Energy per Year — 61.200.000 kWh (therm.) yearly
  - Expected volume of production of distilled water — 150 m^3 daily
  - Annual minimum working hours — 340 days x 24 h = 8160 h/year

- **PYRO-KAT MCT 80**
  - Maximum processing capacity — 80 tons **municipal waste** daily
  - Available Electrical Energy per Year — 32.640.000 kWh (elektr.) yearly
  - Available Residual Heat Energy per Year — 16.320.000 kWh (therm.) yearly
  - Expected volume of production of distilled water — 40 m^3 daily
  - Annual minimum working hours — 340 days x 24 h = 8160 h/year

GENERAL TECHNOLOGY REFERENCES



- production of more than 140 complete factories for processing waste and toxic gases
- 3 licenses for the production of specific gas purification plants
- production of more than 30 processing plants for municipal sewage sludge
- the first plant was set up in 1981
- 19 registered patents and invention projects concerning environmental protection
- …

MCT REFERENCES FOR HOSPITALS

- NATO in Poland has completed a profound check and analysis of the MCT technology for hospital use
- Tests brought optimal results, and the MCT technology is certified for use in military hospital environments
- NATO has purchased the first system, which is a mobile one for 5 – 10 tons per day of hospital and hazardous waste in field operations
- NATO has ordered 5 additional systems and gave an option of 40 systems more

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GLOBE
ENVIRONMENT
TECHNOLOGIES

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