TWR

THE WORLD RESOURCE FOUNDATION

FINANCIAL RESOURCES TRUST AND SERVICES

PEOPLE HELPING PEOPLE

DIESEL FUEL VIA THE CATALYTIC DEPOLYMERIZATION

Transformation of wastes material in Diesel, water and fertilizer

Agenda

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   1.2 Solution
2. **Main Characteristics**
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   4.2 Example installation biomass waste
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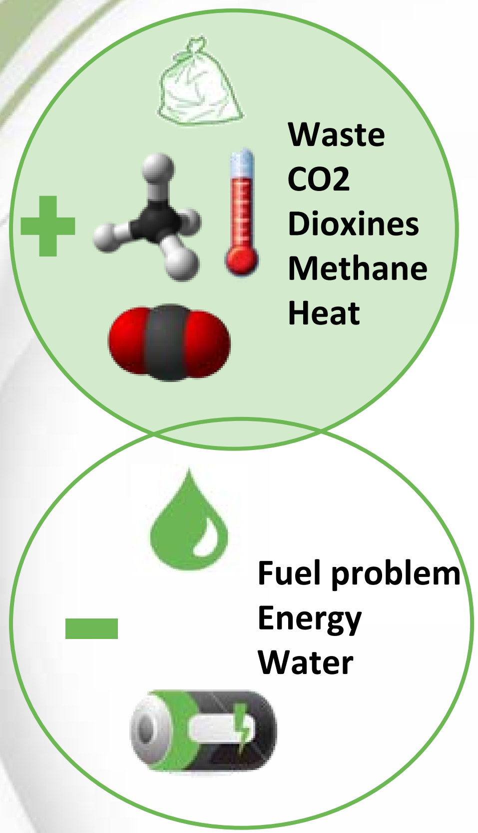
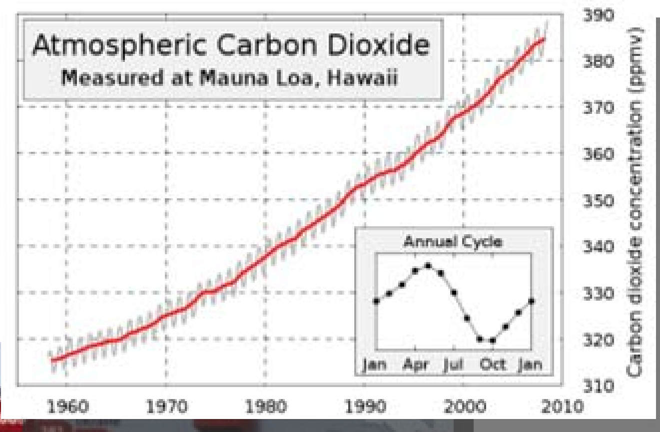
Appendix A: CO_2 Calculation

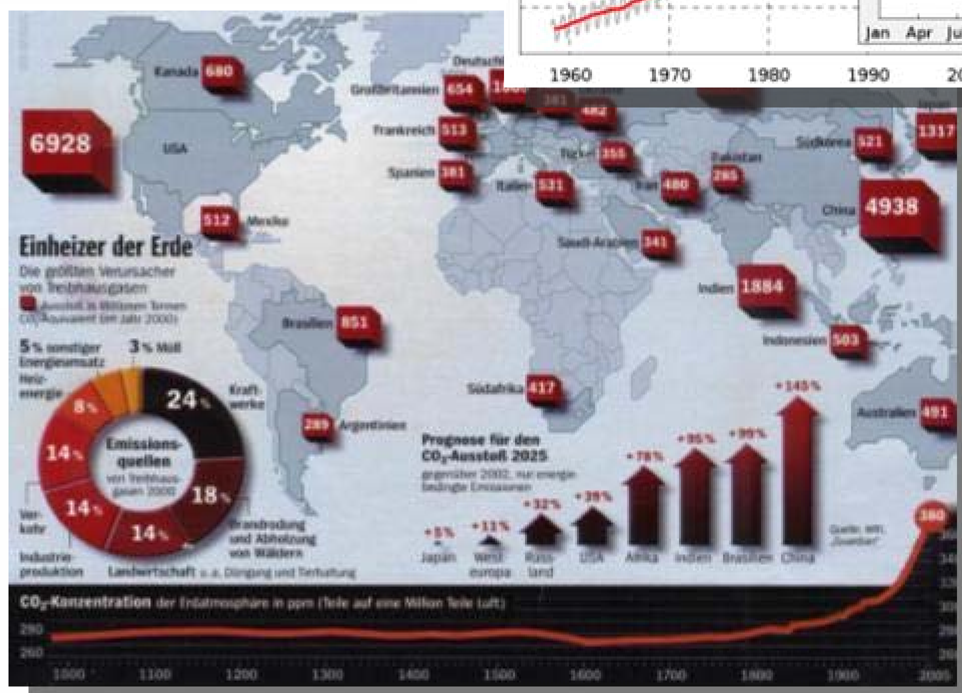
1. Introduction

1.1 Problems



- More and more waste
- CO2 rise (burning)
- Methane rise (combustio
- Heat pollution rise





example: CO2 rise diagram

1. Introduction
1.1 Problems

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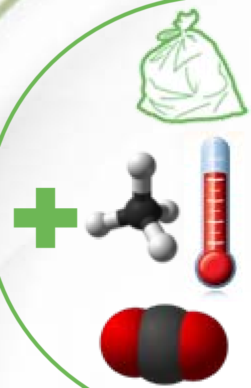
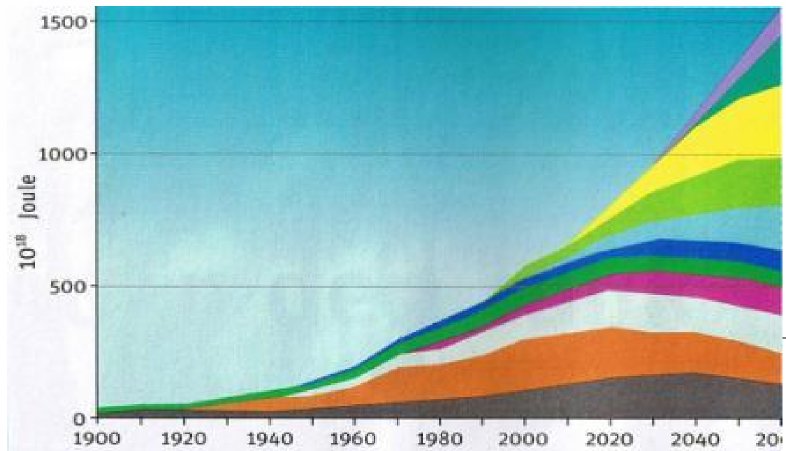
Limited fossil fuel resources
Rising energy consumption
Rising relevance of alternative energy sources

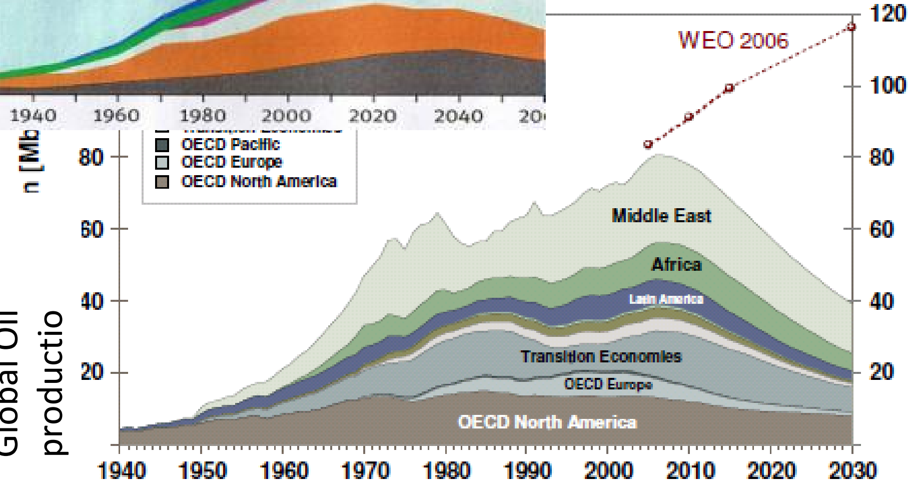


Waste
CO2
Dioxines
Methane
Heat

Fuel problem
Energy
Consumption



Energy by source



Global Oil productio
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1. Introduction
1.2 Solutions

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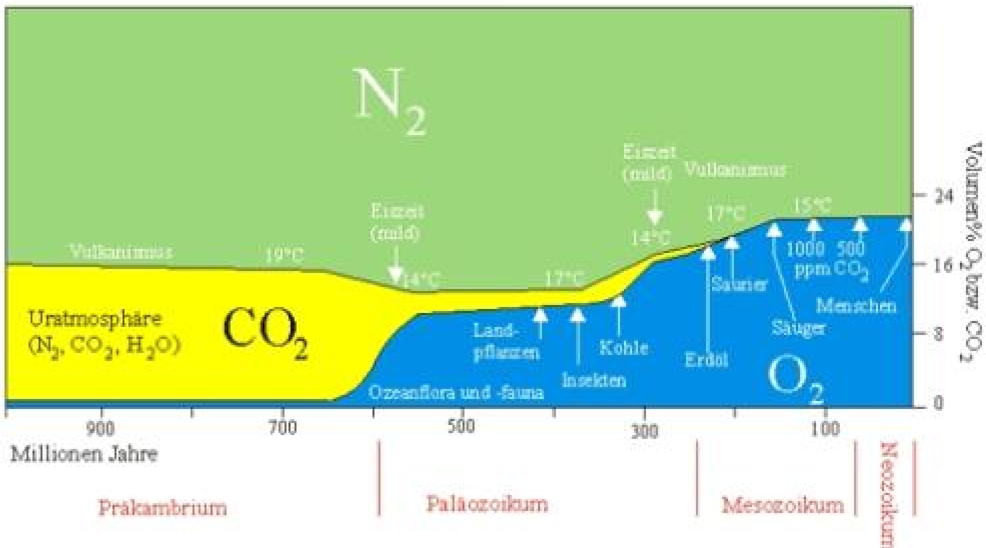


Acceleration of the natural time intensive transformation process from 300 million years to 3 minutes using Alkat technology.
100% 100% crystalline catalyst instead of minerals (clay soil).
280 – 330 Cº max temperature instead of natures 4Cº.

NATURE: **300 Mio. years**

Step 1

Transformation of organic material via minerals to bitumen **and extraction of oxygen in form of CO2**

Step 2

Depolymerization of bitumen **to oil and gas.**

ALKAT: Minutes

Step 1

Preparation process **with catalytic CO2 – extraction at 200º Celsius, Mixing of catalyst with Biomass of any kind to** bitumen**, and distillation of water.**

Step 2

TWRKDV Installation - Depolymerization at 280º Celsius (Molecular shortening**) to Diesel.**

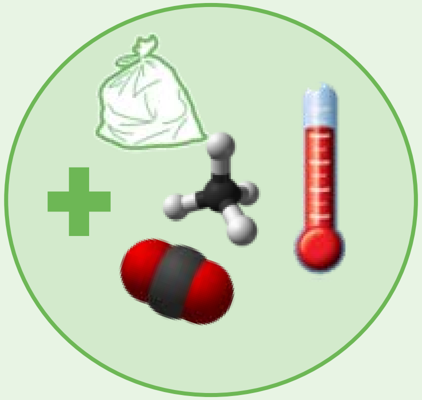
Step 3

Continued cleaning of the TWRKDV through ash separation into the ash containment (catalytic evaporation)

1. Introduction
1.2 Solutions

- Primary production of diesel for engines, jet fuel for turbines.
- Secondary production of electricity (Peak Load) and purposes of biochemistry.
- Production of distilled water.

Autonomic production process: No additional Energy, water or light needed.
The installation consumes aprox. 5-15% of its own Diesel production.



- No Dioxins
- No CO2 (CO2 is recycled except for the exhaust of the generator)
- Any kind of biological material, or waste, can be processed (except for glass, stones, ceramics or metal)
- Heat of 300º Celsius is re-entered in the dehydration process. (lower heat pollution)
- -0,1 bar low pressure (No risk of explosion).
- PH – 9 (no corrosion of the components of the installation)
- Emissions: The installation is a closed system (no chimney).

2. Main characteristics

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Input

MSW (municipal solid waste)
Domestic / community waste
All Plastics
Animal residues
Crude oils residues
Waste oils
Fats
Sludge waste
Agricultural waste
Bio mass
Cut materials

Output

Diesel fuel
Distillied water
Ash = Fertilizer (1-3%)
CO_2 (Re-entered in the process)

Appliance

- **Fuel** (Diesel, Jet Fuel)
- Generator: fuel for electricity (Peak Load)
- **Industrial chemistry**

Conclusion

Transformation into a energy storage medium for any adequate fields of aplieance.

Advantages:

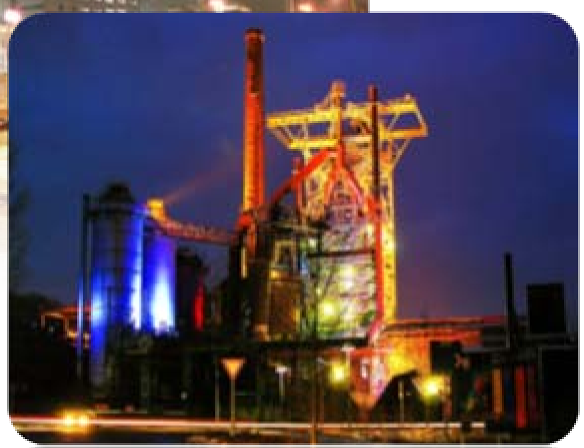
- **No emissions**
- **Without impact on the food chain**
- **Efficiency** (concerning the hydro carbon value) considerably higher in comparison to other technologies.
- Notably lower heat pollution with a temperature of max 300º Celsius isolated in the production process.

2. Main characteristics

2.1 Technology comparison

Conventional processes

- Waste combustion
- Waste gasification
- Pyrolysis
- Refinery



OUR TECHNOLOGY

Chemical process:
Catalytic depolymerisation via alkaline silicates

2. Main characteristics

2.1 Technologies by emissions 1<2

Oil- and plastic residues

Emissions	Waste combustion	Waste gasification	Pyrolysis	ALKAT
CO2	100% - no additional firing	80% - no additional firing	50%	20% by own energy consumption
Dioxin	allowable limit	allowable limit	Exceeds allowable limit	no Dioxins
Resins	None	**very problematic**	**very problematic**	None

Auto recycling material

Emissions	Waste combustion	Waste gasification	Pyrolysis	ALKAT
CO2	100% - no additional firing	80% - no additional firing	50%	20% by own energy consumption
Dioxin	allowable limit	allowable limit	Exceeds allowable limit	no Dioxins
Resins	None	**very problematic**	**very problematic**	None

2. Main characteristics

2.1 Technology by emissions 2<2

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Domestic waste (pre dried – no metal, glass or ceramics)

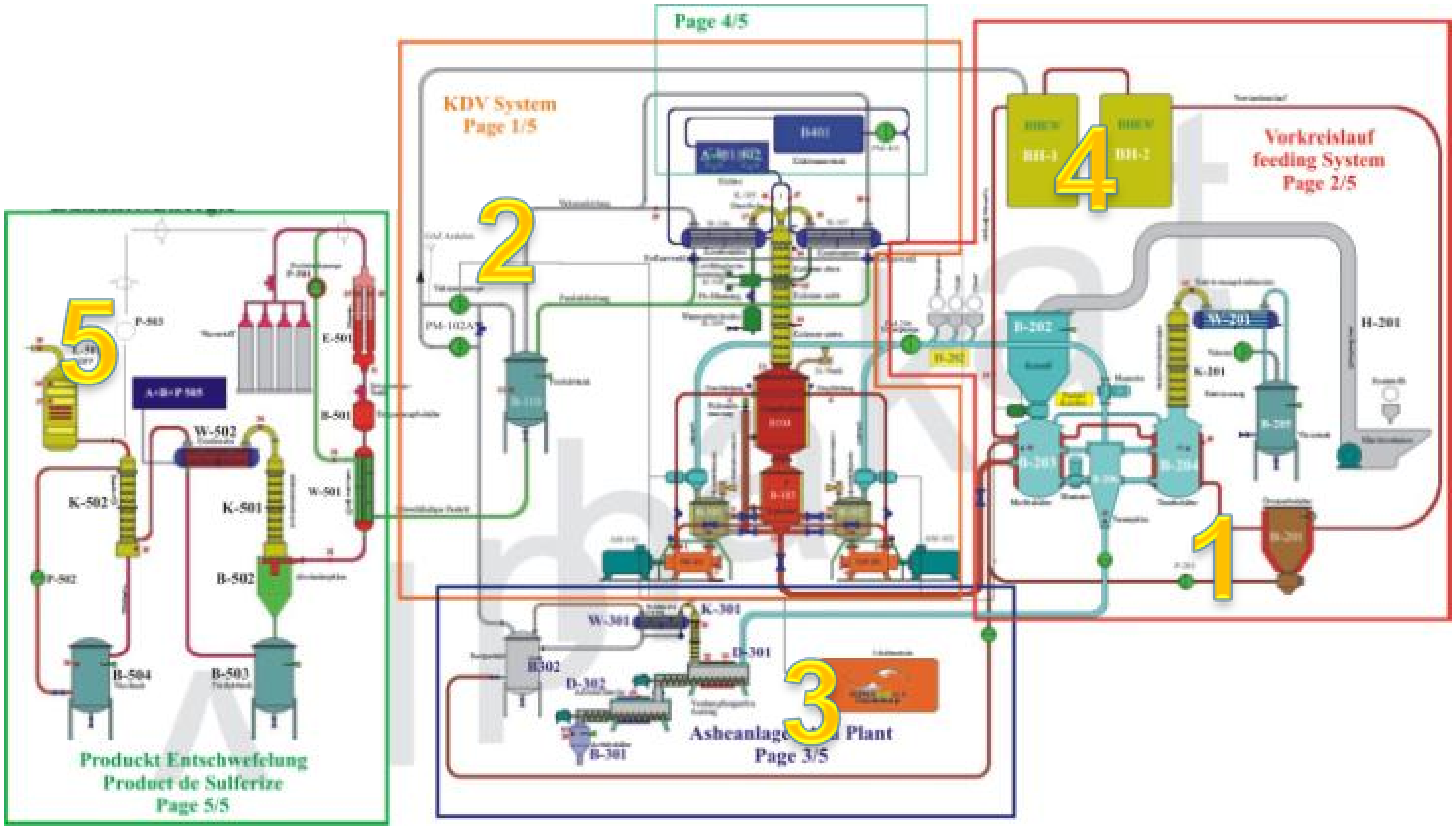
Emissions	Waste combustion	Waste gasification	Pyrolysis	ALKAT
CO_2	100% - no additional firing	80% - no additional firing	50%	20% by own energy consumption
Dioxins	allowable limit	allowable limit	Exceeds allowable limit	no Dioxins
Resins	None	**very problematic**	**very problematic**	None

General impact: Energy consumption

Own consumption	Waste combustion	Waste gasification	Pyrolysis	ALKAT
Heat pollution	800-1500ºC Depending on input material	750-950ºC Depending on input material	450-950ºC Depending on input material	280-300ºC Maximum Temperature

3. System functionality

3.1 Plant summary



1 Pre-Process
Liquification of solid materials in oil and evaporation of water

2 TWRKDV
Transformation in middle distillate (Diesel) and transport to storage tanks

3 ASH
Residues: catalyst, fertilizer, precious metals, heavy metals

4 CURRENT-GENERATORS
Diesel generator to induce electricity into network and own consumption

5 DE – SULPHUIZATION
OPTIONAL

3. System functionality
3.2 Input and "Feedstock"

INPUT

MSW (municipal solid waste)
Domestic / community waste
All Plastics
Animal residues
Crude oils residues
Waste oils
Fats
Sludge waste
Agricultural waste
Bio mass
Cut materials

Vorbehandlung der Abfälle

"FEEDSTOCK"

- **Particel Size:** Max. 40mm, optimal 25mm or smaller
- **Humidity:** Max. 20% of weight
- **inorganics:** % weight pending on composition

PRODUKTION:

1,2 t biological mass = aprox 500L diesel depending on the water saturation.

- NO chimney (closed system)
- NO heat pollution
- NO Methane / Dioxins

OUTPUT

- **Diesel quality** 65 "Cetan" , freezing point ca. -60 Cº
  20% more efficient than regular gas station diesel
- Lower freezing point aprox. -60 Cº
- **Distilled Water**
- **1-3% ash (fertilizer)** binds hazardous materials (e.g. heavy metals) in crystalline form.

3. System functionality
3.3 Production

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PROCESS (Post-Feedstock input)

Process 1 mixture, adsorption, reaction:

Mixing of the catalyst with input material through:

Propulsion (consumes 3-10% of the diesel production) diesel motor, electro motor, gas turbine.

The mixing turbine (high revolutions), mixes the entry material with the catalyst. A temperature of 300ºC is reached through friction.

Adsorption: Docking of the crystalline ionized catalyst on the molecular ties of the material.

Reaction: Molecular ties are shortened to the desired molecule chain length. Through this chemical process.

Process 2 adsorption / reaction / desorption:

Separation of the catalyst, diesel, water and ash

Process 3 evaporations:

Distillation of diesel

The Diesel is pumped to the storage in tanks.

Catalyst and noble metals can be recovered out of ash.

Process 4 (optional) : Desulfurization plant (Hydrofiner) removes sulfur from the diesel if necessary.

PARAMETER	SIZES	DIMENSIONS
PH9 **Low pressure 0.1 bar** **Temp. max 300 Cº** **Closed circuit system ,** **Redundant system design** **All components exist twice**	**150 l/h** **500 l/h** **1000 l/h** **2000 l/h** **5000 l/h** **modular**	**500 l/h = 25 x 25 x 10 m** **2000 l/h = 50 x 50 x 12 m** **5000 l/h = 100 x 100 x 20 m** (*) pending on transport and storage logistics

3. System functionality
3.4 Advantages and highlights

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Advantages

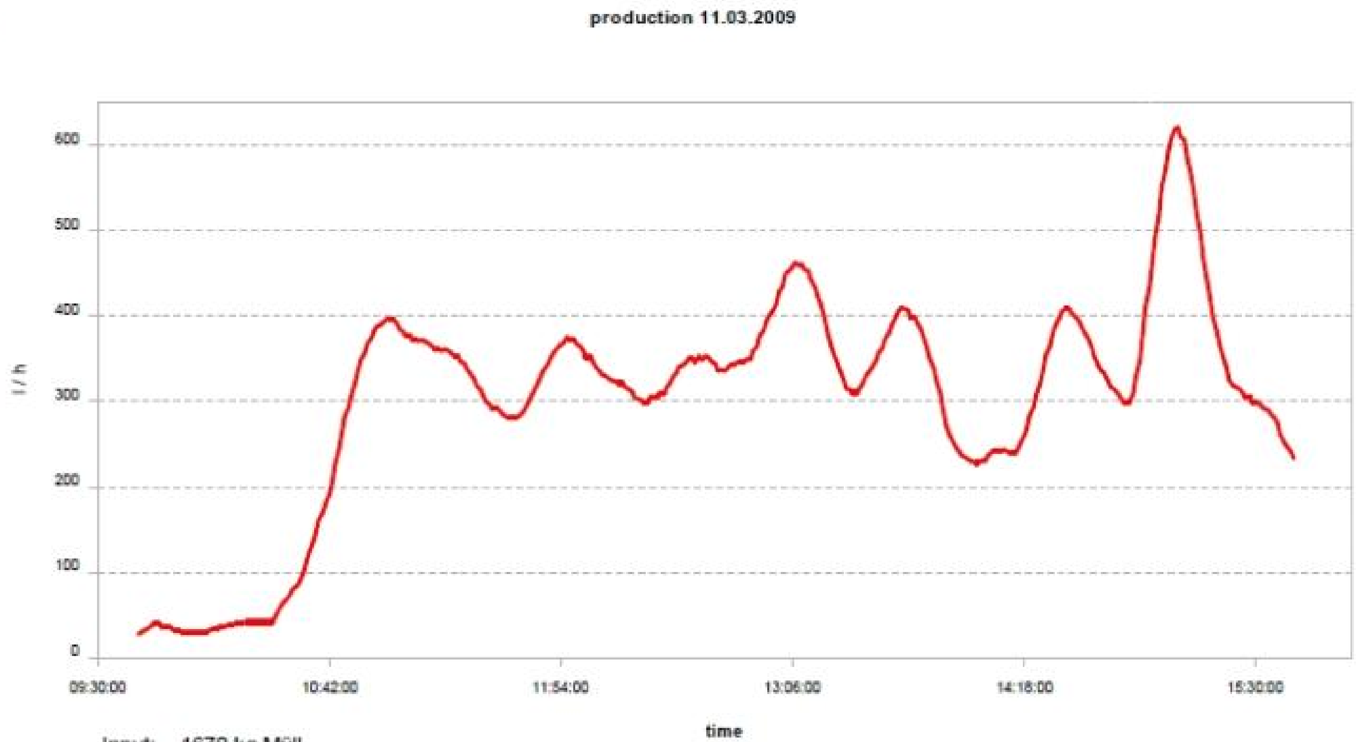
- Technological imitation of the natural oil synthesis **realized in minutes**
- Synthetic fuel can be produced at **competitive costs**
- The **quality of diesel is higher** than the EU standard for diesel fuel .
- **No polluting residues**. The technology integrates inorganic harmful substances in salt
- **Environmental protection, energy production and creation of jobs** are combined by the use of our technology.

Highlights

- Through **this process**, it is possible to use **all hydrocarbon containing materials** – with reduced concentration of water and inorganic materials.
- The efficiency of the process is very high with an **effect degree of 65-85%** at a low reaction temperature (280ºC). The plant produces no coke, coal, resins, furans, olefins, etc., as well as injurious gases. The plant requires **no cleaning system** even running under full load.
- The plant works **without additional firing**. The reaction heat is caused by friction in the turbine under avoidance of superheated surfaces. **Material inflammation** is therefore **excluded**.
- **Security** of the plant and the feeding system is guaranteed through the low pressure in the system.
- Remainder materials occur in solid form and offer the possibility to recycle the catalyst as or to extract noble metals (platinum, gold, silver, copper).
- The catalyst consumption depends on the composition of the entry material and later recovery out of the ash plant - i.e. Is mostly added in the starting phase of the plant, prolongued adding of the catalyst is usually low.

3. System functionality

3.5 Production Hoyersweda



Input: 1670 kg Müll
35 kg Kathalysator
150 kg Kalk

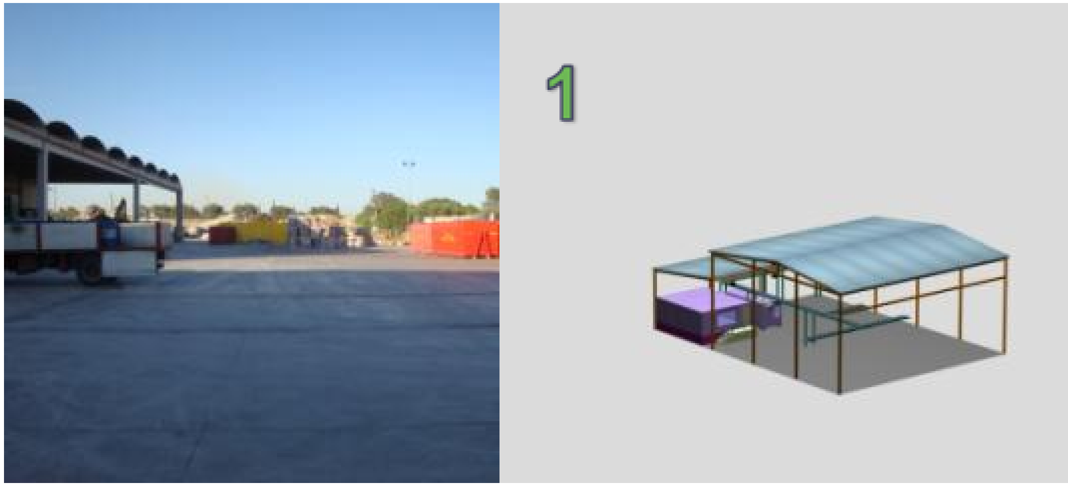
Output: 100 kg für Ascheanlage
600 l Wasser
1200 l Diesel

production 11.3.2009 1/1

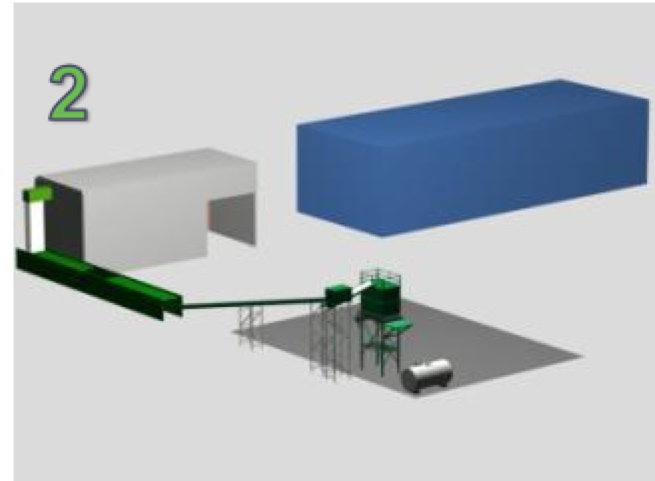
Waste2Oil Itaska

4. Scenarios

4.1 Industrial Plant MSW Tarragona



Plant building with control center and electricity generators



Waste preparation plant: Clean, shredder, store and transport

Alkat plant with link to diesel tanks

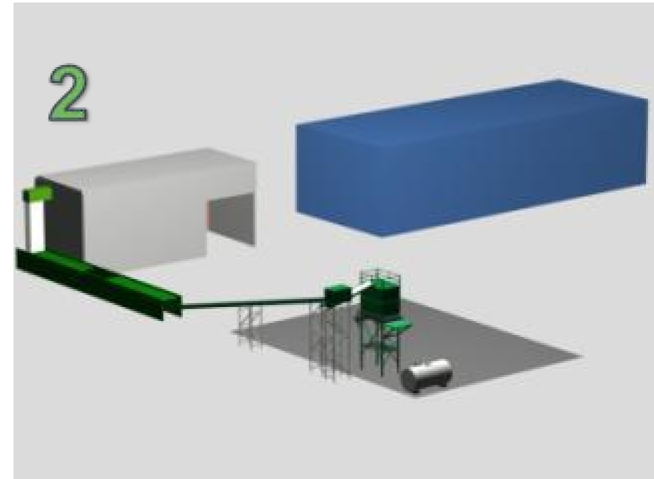
Characteristics:

- Recyclable plastic is separated and sold
- Organic waste is dehydrated
- Entry of the prepared material into the TWRKDV plant
- Diesel production and storage in tanks
- Diesel current generator to provide the necessary electricity to operate the whole plant with its installations or to induce the electricity in the network and provide it to all consumers
- The produced diesel is used to operate all consumers on the installation

4. Scenarios

4.2 Example plant Biomass waste

Plant building with control center and electricity generators



Waste preparation plant: Clean, shredder, store and transport

Alkat plant with link to diesel tanks

Characteristics:

- Modified “Feedstock”preparation process.
- lower costs of feedstock treatment / preparation

Examples:
Cut material of the sugarcane harvest, sludge, contaminated / oily sand/earth, "biofuel" plants forestry residues, mineral oil - residues, color residues, etc.

4. Scenarios
4.3. Example residues Biomass

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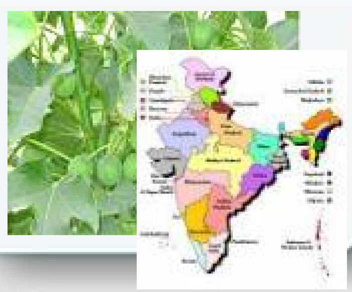
Examples biomass:

- **Sludge**
- **forestry waste**
- **agricultural waste**
- **energy through photosynthesis**

  synthetic diesel made from plants of all types and its residues, **without intervening in the food chain**

  - planting in deserts with new plant types such as "Jatropha" or "Sandpeaches" having roots up to 20 m
  - Harvest without destruction or intervention on the food chain
  - Creation of new jobs through planting, harvest and transformation in diesel
  - Creation of social structures

Jatropha



-1000 ha.
-8,000 t Diesel per year

Zuckerrohrernte

-1000 ha.
-9,000 t Diesel per year

Palmenernte

-1000 ha.
-7,000 t Diesel per year

Appendix: CO2 CALCULATION

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Every ton of TWRKDV Diesel prevents 3.1428 tons of CO2 emissions. Therefore, the TWRKDV technology has significantly lower CO2 emissions than burning technologies. The CO2 from the TWRKDV technology stems exclusively from the oxygen content of the biomass and the 10% consumption of the process used by motor.

In cellulose the emission of CO2 is 60% lower than at the incineration.
In case of mixtures of cellulose and the mineral proportions of plastic, rubber and oil, the percentage corresponding to the required mix ratio is 80.6% lower.
Oils and plastics lower by 91%.
This is calculated as follows:

Material	CO2 Combustion	CO2 TWRKDV	Co2 reduction in%
1. Cellulose	100%	40%	**60%**
2. Cellulose + rubber or bitumen	100%	19,4%	**80,6%**
3. Oils and Plastics	100%	9%	**91%**

Example Calculations:

<u>1. Cellulose</u>

Materials:	Cellulose = CO2 + water + saturated hydrocarbons
Result (chemical):	$C_6H_{11}O_5 = 2\ CO_2 + 1\ H_2O + C_4H_9$
Result TWRKdV (quantity)	1000kg cellulose = **744 kg CO_2** + 152 kg of water + 296 kg Diesel
Result combustion	1000kg cellulose= **1860 kg CO_2** + 610.5 kg of vapor

= -71% CO2 + 10% CO2 consumption

= -60% CO2 emission reduction

Appendix: CO2 CALCULATION

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2. 2. Cellulose (1 ton) + rubber or refinery residues, or unsaturated oils (1.06 tons)

Materials:	Cellulose + Rubber = CO2 + diesel + water
Result (chemical):	4 C6H1O5 + C50H92 = 4 C16H34 + 10 CO2
Result TWRKDV (quantity)	1t cellulose + 1.06 tons of rubber = **675 kg CO_2** + 1385 kg Diesel
Result Combustion	1t cellulose + 1.06 tons of rubber= **5028 kg CO_2** + 1781 kg of vapor

= 90.6% CO_2 + 10% CO2 consumption

= 80.6% CO_2 emission reduction

3. Oils and Plastic

Materials:	Oils and plastic s= CO2 + diesel + water
Result (chemical):	5C6oH120 = 2 CO2 + 18 C15H30
Result TWRKdV (Quantity)	1 ton of oils and plastics = **282 kg CO_2** + 910 kg Diesel + 116 kg of vapor (Gen.)
Result combustion	1 ton of oils and plastics = **3143 kg CO_2** + 1286 kg of vapor

282 kg of CO_2 + 116 kg of vapor consumption

= 91% CO_2 emission reduction

Appendix: CO2 CALCULATION

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Chemistry of the processes:

Nature designed the oil formation in 2 steps:

1. CO_2 extraction of dead animals and plants for the withdrawal of all oxygen from the biomass and thus release of decaying matter in oils and incorruptible materials.
2. Depolymerizaton of long molecules to shorter molecules, ie. oils from bitumen, diesel, and finally lighter hydrocarbons such as gasoline and natural gas.

The TWRKDV process is also designed in 2 steps.

1. The removal of the oxygen content in the form of CO_2, and not H_2O, as opposed to thermally, - technical processes, such as in the carbonization, where H_2O and coke are produced. CO_2 extraction is given by the low reaction temperature of the natural process in the preparation process technique at 200 ° C.
2. The second step of the depolymerization reaction takes place in the reaction turbine at 280 ° C. By this process not only is complex organic matter, such as cellulose structure , converted to alkaline structure, but it also creates even a surplus hydrogen, which is technically used in the TWRKDV to hydrogenate plastics and oils.

The task for the **technical input materials**, is therefore to add **hydrolyzing biomass** to the input of technical waste as plastics,
rubber. This leads us towards nature, as all the biomass in the TWRKDV reaction can release more or less hydrogen.

Entering **pure biomass** always results in a high quality product of saturated hydrocarbons in the middle distillate range (diesel). The resulting hydrogen reacts with oxygen to a part of the reaction water and the CO_2 production
is reduced by that amount.

Appendix: CO2 CALCULATION

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The TWRKDV reaction:

1.Diffusion catalytic re-formation of the molecular structure
2.Extraction of oxygen-CO2
3.Deposition of molecular thin catalyst by bringing up with catalyst oil supplied to the hydrocarbon mass without the coke deposits
without dehydration
without resin material formation
4. in a continuous process
Formation of saturated hydrocarbons
Prevention of olefins
Prevention of Aromatics, thus avoiding the possibility of dioxin or furans
5. Ion exchange detach (the halogen acids and sulfur and regeneration of the catalyst with lime)

The reaction steps of TWRKDV:

1.Entry System
2.Pre process technique with conversion of solids into a paste with total drainage (200 ° C)
3.TWRKDV process with “friction turbine" with the release of hydrocarbons as middle distillate (diesel) and the remaining amount of CO2 (280 ° C)
4.Ash plant for limitation of salinity and inorganic substances is not feasible (metal, glass, ceramic, stone), and toxic substances (heavy metals, etc.) and possible recovery of precious metals (e.g., electronic waste)
5.Post desulfurization by “hydrofiner” (optional)

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THANKS

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