

Proposals of the „Kolontár Team” to the 150 years BASF on „Efficient Chemical Storage of Energy for Stationary Applications”

H-8468 KOLONTÁR, HUNGARY, 2015.

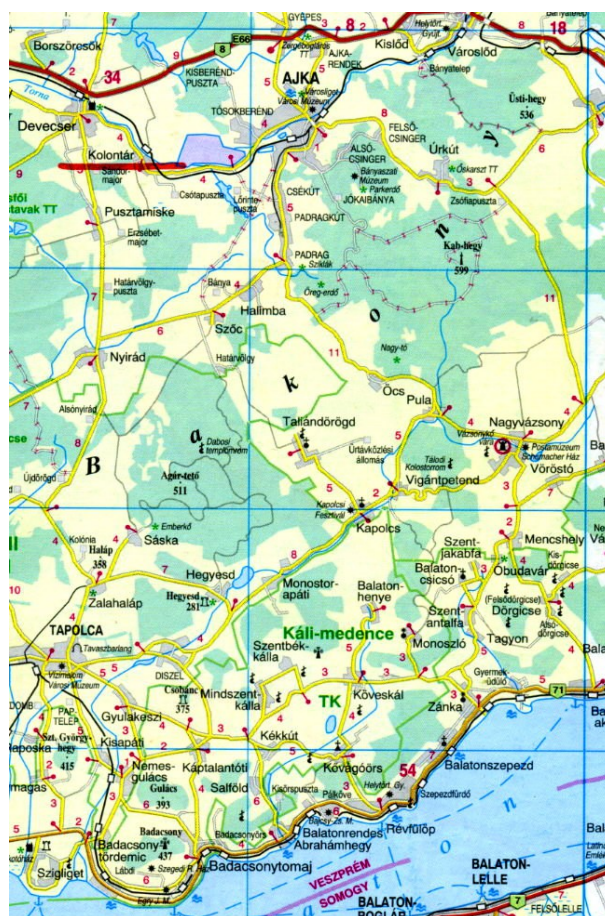


Proposals of the „Kolontár Team”to the Chemistry Creator BASF on „Efficient Chemical Storage of Energy for Stationary Applications”

Introduction

Our Kolontár Team congratulate BASF Company on the present occasion of 150th anniversary!

Kolontár is an ancient Hungarian village, it was reenlivened by the German settlers after the Turkish occupation.



<http://hu.wikipedia.org/wiki/Kolont%C3%A1r>

The industrial workforce was employed at the Ajka Aluminium Factory, but there was an environmental catastrophe - one of the biggest in Europe – the red mud deluged the surrounding after the crash in the dam.

http://en.wikipedia.org/wiki/Ajka_alumina_plant_accident

The enormous damage and the elimination of workplaces the village and inhabitants live under very hard circumstances. It is to a greater extent detrimental area in the European Union. Taking into consideration the advantageous side – **that is why the area and any investment with new to-be-**

investors can require support from the EU.

This area after century old industrial heritage are equipped with infrastructural opportunities. In the next city Ajka a biomass power station is connected to the European Network of Transmission System Operators for Electricity (ENTSOE). by the help of this connection this area can receive renewable electricity from Europe. In Kolontár a new solar park is being built and nearby windturbines are working. The alumina-production built up a complete specialized railway station for chemical materials. The road network remained untouched, too. The workforce are well-trained in the chemical industry. The Veszprém Chemical University is nearby, it means not only specialists for the next generations but gives research opportunities as well.

We formed a Team, a so called task force to create new possibilities to raise the number of workplaces in the Kolontár area. We took into consideration the strengths and the given biomass and the inferior quality coal and the abundant water supply just in the neighbourhood. Our aim is to establish a green chemical industry and do hope our imaginations meet the programmes of the jubilant and creative BASF.

In our views the planned production of methanol on the one hand is a profitable endeavour of an inevitable chemical item, on the other hand is a good method to reserve renewable electricity by the help of chemical knowledge and experience.

The production line can receive renewable electricity at any time and the methanol can be used later even for gas-turbines in case of necessity again in the form of current.

Our applicant Kolontár Team developed our technologies by the support and everyday co-operation with different Hungarian Universities.

Members of our Kolontár Team:

Primus Patent Development/Exploiting Company, the Team leading force

Self-government of Kolontár

Civil Organisation for the Health of the Kolontár Area

Barrister of our Team Dr. Bándi's Law Office as our Contact Person

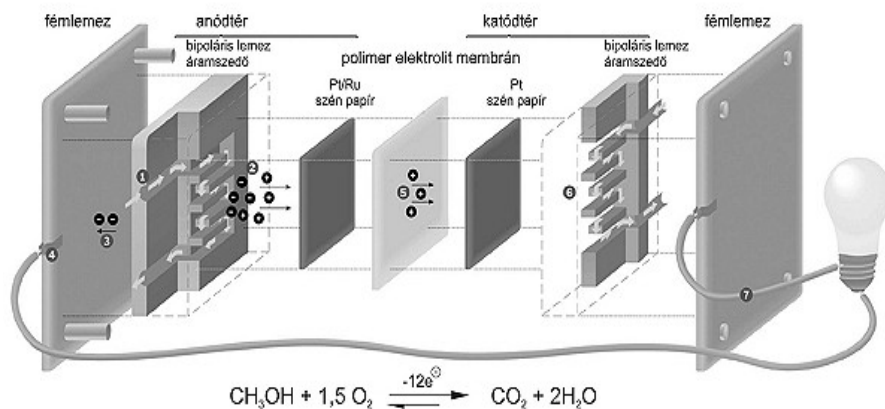
Technical resume

In our proposal we produce ultragreen methanol of high clearness out of cellulose. The cellulose recreates in a drum-furnace heated by the renewed electricity and we get synthesis gas CO+H₂. Adding H₂ to it from hydrolysis — again from renewed electricity --- and using BASF synthesis at a high effectiveness methanol is the end-product CO+ 2 H₂ →CH₃OH.

We propose other procedure of greater volume as another green plan. Here in Hungary great quantity of inferior quality coal (lignite) can be easily obtained. With plasma-energy the lignite and sewage water at a phase become synthesis gas C+H₂ and adding to it hydrogen from hydrolysis by the BASF methanol synthesis we get the result.

Both procedures are extraordinarily profitable, the proportion of new material and the production

rate is high. The gained methanol is easily sold chemical agent or in the gas-turbine produces electricity or heat. The hectic electricity production can be easily stored that is why our methods are direct hit. The suggestion of the USA/Hungarian Nobel Prize winner György Oláh offers new opportunity in the field of fuel cells. The mass production of these fuel cells is the nearest future.



We emphasize: beside our method green fuels can be produced by Fischer-Tropsch synthesis or nowadays by Audi/Sunfire technology as well. Our suggestion of energy storage is suitable for producing Diesel and kerosin fuel or metan (CNG), too.

Description of our Proposal

There are a lot of solutions for energy storage with other chemical procedure. We adjust our plans to the given Hungarian realities. Our country has mild climate, extraordinarily good agricultural soil, fruitful agriculture with abundant „cellulose” – so wheat hay, residue of corn, lake cane, sedge but on territories without other use energy-cane gives a good harvest. Many lignite mines are nearby with extended mine-industry. Number of sunshine hours is very high, there are large renewed energy-producing plants, any kind of electricity are available even from the European International Network at any time and price.

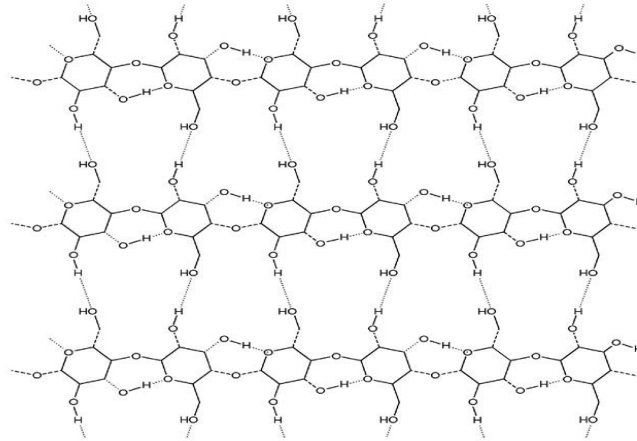
Our team decided the use of cellulose and lignite for producing methanol and preserved energy. We took into consideration the other production method for fuel, using FT synthesis, too.

Our technological suggestion shows the material and structural background of the cellulose-based ultra-green solution to the highly esteemed BASF.

Pyrolysis of Cellulose

Cellulose is a complicated carbohydrate, ***the most frequent organic material on Earth, because great part of the structure of plants is cellulose.***

Texture of Cellulose:



Its formula $(C_6H_{10}O_5)_n$ Easy to realize this is exactly the same total formula, as the grape sugar molecule (after the photosynthesis) lost one molecule water. If the grape sugar molecule $(C_6H_{12}O_6)$ is written in another way gives 6 pieces of $(CO + H_2)$. That is why the cornleaf – one of the dryest cellulose contains of some water, too. From the mixture of hydrogen and carbonmonoxide gas a lot of organic material can be created, this mixture is called synthesis gas. Out of the cellulose we can produce $(CO + H_2)$ synthesis gas by pyrolysis. In this context pyrolysis means heating organic materials in closed place without air and other chemically disadvantageous materials.

One of the Hungarian Agricultural Institutes during their research stated that cellulose-pyrolysis gives synthesis gas at different temperatures.

Production of Gas by Pyrolysis of Cellulose

| Temperature (°C) | Production of Gas by 50°C (lit/kg) | Produced Gas (lit/kg) | H2 | CH4 | C2 | C2= | C3 | C3= | C4 | CO | CO2 | Heat - value | |
|------------------|------------------------------------|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|-------------|
| | | | | | | | | | | | | Max MJ/m³ | Min MJ/m³ |
| 200 | 0,0 | 0,0 | 100,0 | 0,0 | | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 12,8 | 10,8 |
| 250 | 0,1 | 0,1 | 6,0 | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 8,80 | 85,20 | 1,9 | 1,8 |
| 300 | 5,7 | 4,7 | 0,1 | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 10,50 | 89,40 | 1,4 | 1,4 |
| 325 | 11,4 | 16,3 | 0,0 | 0,1 | 0,02 | 0,03 | 0,00 | 0,01 | 0,00 | 27,90 | 71,90 | 3,6 | 3,6 |
| 350 | 7,6 | 50,3 | 0,1 | 0,4 | 0,08 | 0,10 | 0,03 | 0,05 | 0,01 | 38,90 | 60,40 | 5,3 | 5,2 |
| 350 | 12,9 | 85,0 | 0,3 | 6,5 | 1,49 | 0,80 | 0,50 | 0,62 | 0,16 | 27,70 | 62,00 | 9,0 | 8,5 |
| 350 | 218,3 | 87,9 | 0,3 | 8,8 | 2,41 | 1,16 | 0,79 | 0,93 | 0,27 | 23,70 | 61,60 | 11,0 | 10,3 |
| 400 | 4,5 | 90,4 | 0,3 | 8,9 | 2,00 | 0,95 | 0,63 | 0,84 | 0,06 | 18,40 | 67,90 | 9,4 | 8,8 |
| 450 | 8,0 | 100,2 | 1,3 | 24,2 | 7,35 | 2,04 | 2,14 | 2,25 | 0,14 | 21,00 | 39,60 | 23,4 | 21,6 |
| 500 | 9,9 | 109,9 | 5,8 | 45,1 | 9,45 | 1,49 | 2,09 | 1,39 | 0,71 | 16,00 | 17,80 | 32,8 | 29,9 |
| 550 | 13,9 | 125,7 | 24,8 | 53,3 | 1,99 | 0,08 | 0,18 | 0,46 | 0,05 | 8,70 | 10,50 | 27,6 | 24,9 |
| 600 | 11,1 | 137,9 | 32,6 | 46,6 | 0,36 | 0,02 | 0,01 | 0,00 | 0,00 | 8,10 | 12,30 | 24,1 | 21,5 |
| 650 | 10,4 | 148,4 | 48,8 | 39,1 | 0,11 | 0,01 | 0,00 | 0,00 | 0,00 | 9,70 | 2,30 | 23,1 | 20,6 |
| 700 | 13,3 | 162,8 | 57,4 | 33,2 | 0,03 | 0,01 | 0,00 | 0,00 | 0,00 | 8,20 | 1,20 | 21,6 | 19,2 |
| 800 | 9,1 | 179,6 | 76,8 | 18,7 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 3,70 | 0,80 | 17,8 | 15,5 |
| 900 | 4,9 | 189,3 | 88,0 | 6,9 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 4,60 | 0,50 | 14,6 | 12,5 |
| 1000 | 4,2 | 197,5 | 88,4 | 2,2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 8,90 | 0,50 | 13,3 | 11,5 |
| Total | | 197,5 | 25,7 | 18,5 | 1,36 | 0,37 | 0,33 | 0,36 | 0,08 | 19,10 | 34,20 | 15,1 | 13,7 |

Pyrolysis of Cellulose

Measures show the production of gas gradually by 50°C. At a temperature of 1000 C° 97,3% of cellulose gives CO + H2 synthesis gas. beside 2,2% methan and 1,5% carbondioxide do not disturb our methanol production. During this procedure 2-3% pyrolysis ash remains back, as residue of the trace elements. This ash contains of high quantity SiO2 and sodium, potassium, magnesium with Cl and S. We can easily separate this ash and it is good for crop cultivation because of its trace elements. **So cellulose gives us chemically very clean CO + H2 synthesis gas.**

Our team point out the cellulose pyrolysis at a temperature about 500 C° gives a gas of high heat-value int he system. This gas can apply for heating or gas for cars with 31 MJ/m3 vs. natural gas (CNG) with 34 MJ/m3 We can continue the pyrolysis above this temperature and the proportion of carbonmonoxede/hydrogen can be modified. See later int he „analisator” block.

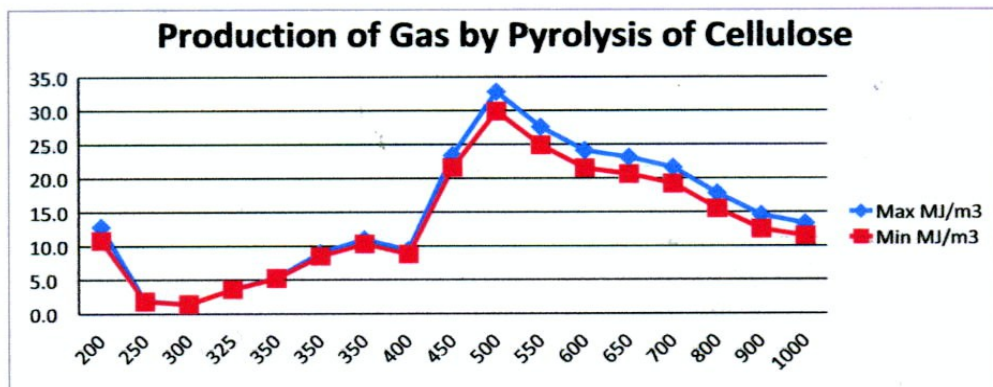
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|------------------|------------------------------------|-----------------------|-------|------|------|------|------|------|------|-------|-------|-----------------------|-----------------------|
| | | | | | | | | | | | | Max MJ/m ³ | Min MJ/m ³ |
| 200 | 0,0 | 0,0 | 100,0 | 0,0 | | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 12,8 | 10,8 |
| 250 | 0,1 | 0,1 | 6,0 | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 8,80 | 85,20 | 1,9 | 1,8 |
| 300 | 5,7 | 4,7 | 0,1 | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 10,50 | 89,40 | 1,4 | 1,4 |
| 325 | 11,4 | 16,3 | 0,0 | 0,1 | 0,02 | 0,03 | 0,00 | 0,01 | 0,00 | 27,90 | 71,90 | 3,6 | 3,6 |
| 350 | 7,6 | 50,3 | 0,1 | 0,4 | 0,08 | 0,10 | 0,03 | 0,05 | 0,01 | 38,90 | 60,40 | 5,3 | 5,2 |
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| 700 | 13,3 | 162,8 | 57,4 | 33,2 | 0,03 | 0,01 | 0,00 | 0,00 | 0,00 | 8,20 | 1,20 | 21,6 | 19,2 |
| 800 | 9,1 | 179,6 | 76,8 | 18,7 | 0,01 | 0,01 | 0,00 | 0,00 | 0,00 | 3,70 | 0,80 | 17,8 | 15,5 |
| 900 | 4,9 | 189,3 | 88,0 | 6,9 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 4,60 | 0,50 | 14,6 | 12,5 |
| 1000 | 4,2 | 197,5 | 88,4 | 2,2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 8,90 | 0,50 | 13,3 | 11,5 |
| Total | | 197,5 | 25,7 | 18,5 | 1,36 | 0,37 | 0,33 | 0,36 | 0,08 | 19,10 | 34,20 | 15,1 | 13,7 |

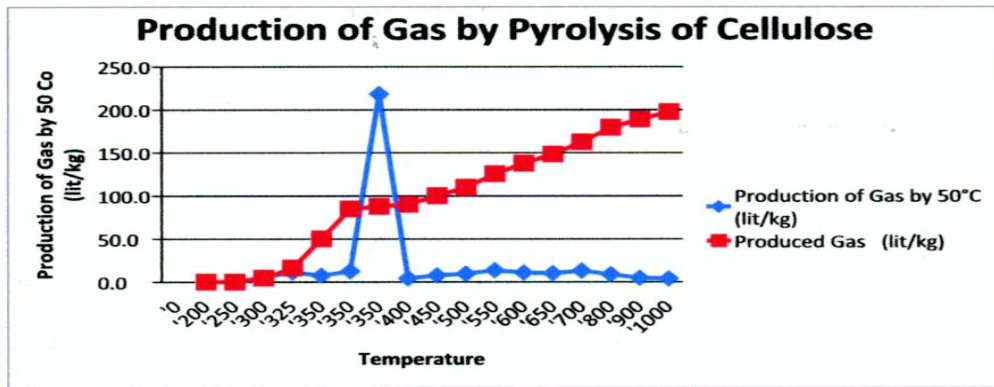
Pyrolysis of Cellulose on 500 C°

This new result is seen int he next document

The



dynamism is important int he gas production (apart from a measuring mistake)



Pyrolysis Gas Production from Cellulose

During the pyrolysis up to the temperature 1000°C the total weight of cellulose transforms into very clean CO + H₂ synthesis gas.

This drum-furnace with a capacity to 1000 - 1100°C is a mass/serie product available in the USA, Germany, Switzerland, China. usw.

The production time according to other sources is advantageous and the procedure relatively speedy. After those results the cellulose transfers in a simple drum-furnace at a temperature of 1000 - 1100°C without disturbing residue into high clean CO + H₂ synthesis gas.

"Biomassza anyagok jellemzése termikus analízis és analitikai pirólízis alkalmazásával" (MTA TTK 2014. Bp.)

Production of Hydrogene

Main task in the production of synthetic methanol is the hydrolysis.. In reference libraries the chemical reaction is taught:



The energy demand of hydrogene production: 33,583 kWh/kg hydrogene

A lot of industrial equipments are available with different outputs.

The hydrolysis takes place with direct current, just what the photovoltaic PV solar panels serve. The loss of conversion is spared if the solar plant is near the hydrogene tank.

Production of Methanol

As described above, out of our synthesis gas and hydrogene we would like to produce a very important chemical basic material, the methanol.

Earlier the industry produced methanol by pyrolysing the timberwood with catalysis. Nowady CO and H₂ are the sources. Since 1923 BASF have applied the synthetic methanol production:



The material gain, the result of conversion of the synthetic methanol based on synthesis gas depend on the catalysator, temperature and pressure but mainly on the quality of the synthesis gas. BASF proved we can achieve very good results in the methanol synthesis if we use CO + 2H₂ synthesis

gas. As we describe at the cellulose pyrolysis, our synthesis gas from cellulose is poor in hydrogen concerning the BASF requirements toward the optimum $\text{CO} + 2\text{H}_2$ synthesis gas. That is why we are to add hydrogen to our synthesis gas.

There are many other chemical technologies having hydrogen as side-effect, so the methane oxidation by water-steam $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$

But the most profitable way producing clean hydrogen is the hydrolysis using DC.

$2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ Some get hydrogen and separately oxygen.

There are commercialized, relatively cheap, reliable hydrolysis equipments, in our procedure we use these units. We need a reliable analyser and portioner for preparing the intended gas mixture and in the optimal proportion add the synthesis gas from the drum-furnace and hydrogen from hydrolysis – now we are ready to the reaction : $\text{CO} + 2\text{H}_2 \rightarrow \text{CH}_3\text{OH}$

The basic task of the BASF contest: how to reserve chemically renewable electrical energy from solar cells and wind turbines and/or hydropower stations.

Our Team proved with the representation of our solution: it is now totally simple.

A)

Do produce and use plants made of cellulose because totally green and renewable eg. energy cane, energy grass or wheat hay, corn residue, linen, usw. Those materials in vacuum or in inert atmosphere in drum-furnace by pyrolysis give us the starting mixture $\text{CO} + \text{H}_2$ synthesis gas. We gain electrical energy for heating the drum-furnace from renewable energy e.g. characteristically from wind turbines.

B)

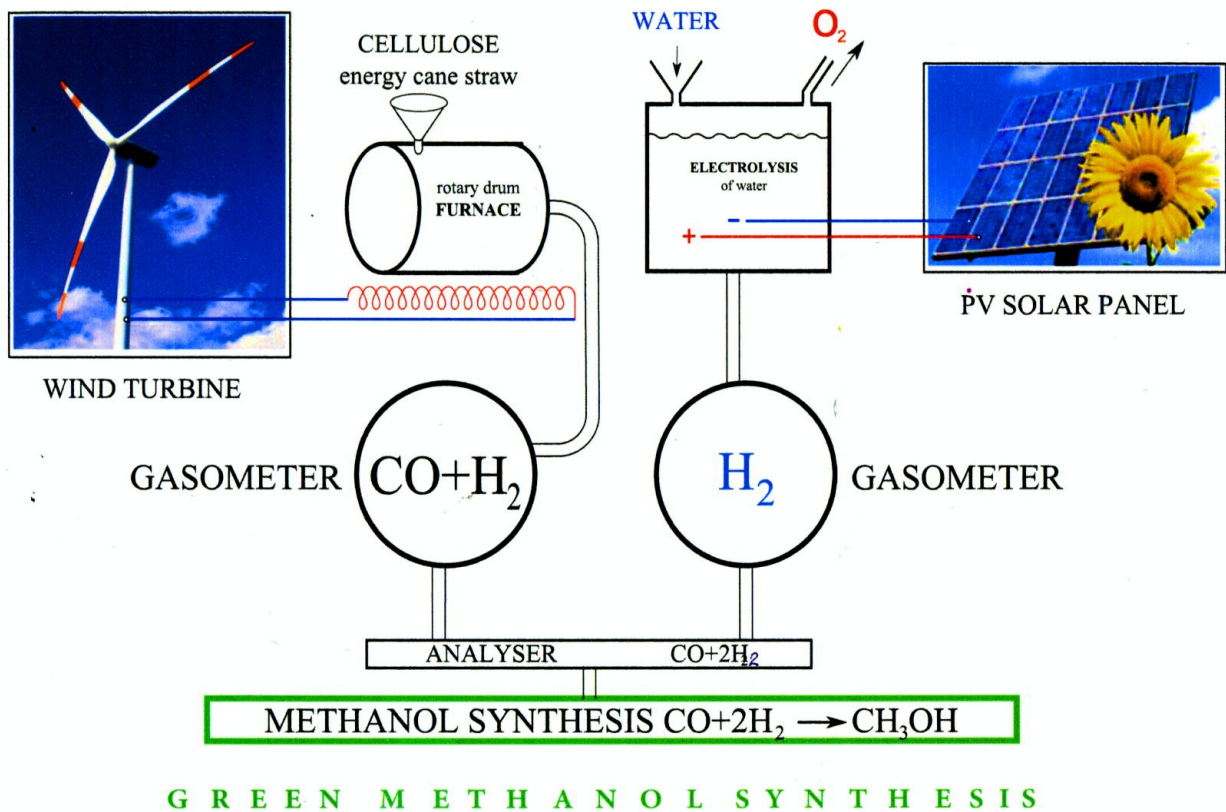
Do produce hydrogen by hydrolysis out of water and the need of energy stemmed from renewable electricity, characteristically from photovoltaic sources. Our proposal solves the former converter problem: no need to convert DC to 230 Volt standard AC and later to convert back to DC for hydrolysis. Our procedure has plus effectivity.

C)

Analysed and quantitative measured and optimally portioned we formed the produced gas into the best material for the methanol synthesis and lead in the BASF methanol synthesis equipment.

D)

The hard core of the procedure is the gained methanol as energy source and important chemical material. It bears and stores the energy from the solar cells and wind turbines – for a long time without any restriction.



Green Methanol Production from Cellulose

Different sorts of renewable energy – needed for the drum-furnace and hydrolysis – can compatibility vary and convert with each other – even in need the national network, too, using the night current. Such night current is available from nuclear power stations and coal-based power plants – both opportunities are at hand in many countries.

Apart from the ultragreen methanol production the wind and sunshine are not constant sources to windturbines and solar cells. But using our proposal those currents are suitable for producing synthesis gas and hydrogen at any time. The production can be directed constantly and periodically together or separate one or the other gas.

The produced gases go to technological tanks at any time they are at our disposal – when drumfurnace and hydrolysis are on using cheap and green current. The synthesis gas goes from the analyser unit into the methanol synthesis unit using the reserve tanks according to the demands and plans. Well designed gas tanks eliminate all the meteorological uncertainty, so the methanol production follows the foreseen plans.

The electrical need of our technological proposal and efficiency of energy storage

Our proposal in the given form is not yet a description of a working and real factory, that is why we show you now how 1 metric ton (1000 kg) cellulose transform into methanol using our procedure. The technological loss depends on the construction but does not exceed some percents.

The gas quantity from cellulose is decisive already above 350°C but with strong estimate for the sake of simplifying we give the transform of cellulose into $\text{CO}+\text{H}_2$ synthesis gas directly on 1000°C temperature.

As the specific heat of cellulose $c = 1,55 \text{ kJ/kg}^\circ\text{C}$, <http://mek.oszk.hu/00000/00056/html/068.htm>

for warming up cellulose to 1000C° the energy demand is

$$Q = c \times m \times T \text{ in our proposal } Q = 1,55 \text{ kJ/kgC}^\circ \times 1000\text{kg} \times 1000\text{C}^\circ = 1,55 \times 10^6 \text{ kJ}$$

In the market a lot of rotating, closed drum-furnace of good performance with ohmic heating are available. We can choose the proper unit (volume, max. temperature, termogravimetric controll, usw.)

We are counting with a standard, simple Chinese, ohmic heating, closed, vacuum rotating drum-furnace with a capacity of max 1 metric ton, max. temp. 1400C°, ohmic heating 300kW, price approx. USD 13 000.-

Provided that the procedure is in stages, input 1000 kg cellulose (eg. energy cane) and after the whole period the CO + H₂ synthesis gas gets into the gas tank. The time demand at 300 kW is

$$Q = c \times m \times T = P \times t = W \quad (P = \text{el. performance, } t = \text{time, } W = \text{el. work})$$

The result: 1,435 hours

Thus our drum-furnace of 300 kW gives us within 1,435 hours --> **CO + H₂ synthesis gas from 1000 kg cellulose with the energy demand of 430,5 kWh.**

The next formula shows CH₃OH --> (CO + H₂) + H₂ (CO + H₂) / H₂ = 15/1 we should add to our synthesis gas from 1000 kg cellulose 150 kg hydrogen to have the CO + 2H₂ synthesis gas to the BASF methanol synthesis.

As mentioned above, the need of hydrogen is from hydrolysis using renewed sources of current. The formula:



Energy demand of hydrogen from hydrolysis 33,583 kWh/kg (H₂)

To 1 ton synthesis gas made of cellulose **we add 150 kg hydrogen – its energy demand is 5037,5 kWh/150kg H₂**

Energy demand to the production of 1 metric ton methanol 4755 kWh.

The burning heat of methanol 22,46 MJ/kg, heat-value 19,49 MJ/kg,
<http://fizika.qwqw.hu/?modul=oldal&tartalom=1113126>

1 metric ton of methanol is equivalent to 22460 MJ burning heat, its heat-value 19490 MJ = 5414 kWh !

At first sight it is 114% energy gain. But our team do not dream about perpetuum mobile, because we added to 1 ton methanol 0,9 metric ton of cellulose, and this 0,9 metric ton of cellulose burning value: 4320kWh ... Easy to understand the performance gives us quite a good result. On the other hand hydrogen mixed with raw hay is not a good storage method at all...

The result – how much electricity gives this methanol depends on the turbines and the power stations. Taking a modern power station with gas turbines of combined cycle with 75% performance, we regain the invested energy at any time in 100% --- with our technology, made methanol from cellulose and water, and working with green electricity.

We emphasize the renewed energies can reserve and store easily with production of methanol by BASF synthesis.

Besides the performance the logistical advantages are high above the other methods, so water storage, hydrogen gas, compressed air, accumulator because suitable methanol store can be installed everywhere and transferred by railways or trucks to the consumption place/end use.

Profitability and volume of production

We can regain the electric energy used for reservation apart from location and time in a suitable power station because the newly produced energy approximately the same as the invested one.

Literally it seems the invested and the regained energy are the same, the material costs (cellulose + water) and other side-costs (wage + amortisation + other material costs) appears as a loss.

Our American (USA) colleagues estimate these costs between 2-12 US cents/kg concerning local wages, material costs and the volume of production including average price of electricity.

The price of a suitable quality methanol is about USD 1/kg, our suggested procedure is profitable at all. From our profit we buy higher quantity of electricity than the input side's one if the methanol is sold as basic material for the chemical industry, fuel for special engines, or using the fuel cell invention of the Nobel Prize winner – Professor Gyögy Oláh of Hungarian origin.

The next question: is the use of methanol profitable using directly in electrical power stations?

The formula sounds very simple. If the electricity input is lower than the energy price (electricity and heat) produced by the power station, the answer is simple again: YES.

Our former developments were motivated by using the so called „deep valley electricity” from the Hungarian nuclear plant or coal-based power stations.

„Deep valley electricity” means the smallest demand on behalf of consumers. Their demand depends on the part of the day and seasons of the year. In Hungary this cheap current is measured separately and legally regulated. Sommertime on workdays between 3,00-06,30 hours, wintertime 02,00-5,30 hours. day off time it ends by one hour later.

About the power stations we emphasize: every effect leads to a constant discharge is technically advantageous for them to exploit the „deep valley current.”

The hard core of our suggestion, that production of synthesis gas and hydrogen is on during the „deep valley period” and in the mean time filling up the gas tanks, too. With suitable big tanks the regulated production goes round the clock. The gas production in division depends on the temporary cheap current.

The methanol as heating material can be used at any time - mainly to the peak demand, adjusting to the peak hours of consumption or in shortage in the system within a short period. This time the gas-based power stations can help because the methanol is an exceptionally good fuel.

The difference between the „deep valley” and peak hours current covers abundantly the costs of methanol production, even brings extraprofit. Regarding the power stations, the price of „deep valley” current less than a half taking into consideration the price of the peak hours.

Another root of the economic problem: heating value of methane 50MJ/kg but the methanol 19,9 MJ/kg. Producing the same heat-energy, we need 2,52 times more methanol than methane. Our calculations show if the power station using „deep valley current” for its own methanol production and actuates its turbines with this methanol, the cost of the combustible is less than a half – comparing with the Russian natural gas here in Hungary. Hungary imports her necessities, that is why our suggestion takes a ***great step towards the independency of power economy.***

The pyrolysis of cellulose produced seriati/periodic gives at a temperature on 500C° synthesis gas of high heat-value. After compression we abstract it gaining *green fuel „autogas” (CNG)* which raises the profitability.

With the reservation of green current we substitute the „deep valley electricity” by the current produced on the „bad place and bed time”.

The place of the methanol production is indifferent, because the superfluous current can easily send via International Electricity Network directly to the factory.

The time of current utilisation is indiffereent, too, thinking of the capacity of gas production/storage for the product goes to the storage tank, apart from the secpion of the day and the wheather.

Hydroelectric plant by high water and windturbines enjoying advantageous wind do not stop in „deep valley” periods, so the sunshine does not match ti the current production int he International Electricity Network and/or the demands of the customers.

The methanol accomplishes such a difficult task. Every problem can be solved int he field of energy storage by the help of our solution.

Reservation of Green Currents into Methanol is Profitable, Independent from Place, Time, Wheather and Saves us from Energy Crises

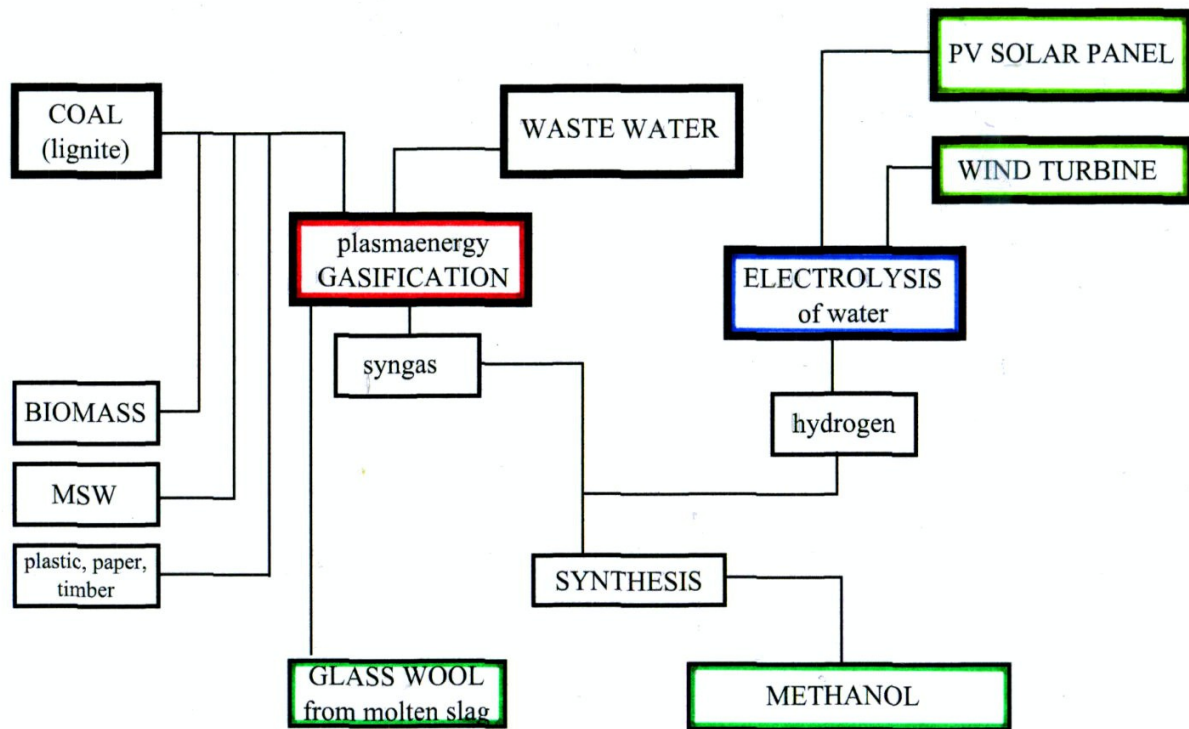
In our days the growing pace of „green currents” wins over nuclear plants’ capacity and the volume of green current – waiting for reservation will cause new problems. Hungary – with good agricultural possibilities – produces some hundred thousand tons of cellulose, but power plants burning biomass and the agriculture itself demand a certain part of it – the production seems to be too little for future demands. *The Hungarian possibilities make it easy to produce in great volumes, what mor, with huge profits.*

In Hungary there is enormous lignite (soft burnish coal) treasure. The lignite is very suitable for chemical industry.

Our proposal: instead of chemical treatment of sewage pyrolysis of lignit by sewage water into CO + H₂ synthesis gas, adding hydrogene from hydrolysis to the BASF methanol synthesis or the Fischer-Tropsch synthesis are the proper solutions.

The production of synthesis gas is made from broken lignite mixed with municipal solid waste (MWS), waste plastic, oil mud, wasteoil, etc. We can use sewage from slaughter-house, canning factory, packing house, car-wash, restaurant – these liquid wastes are treated now at a high cost.

METHANOL FROM COAL



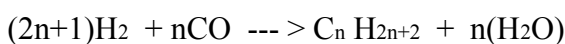
Methanol from Lignite

The applied plasmatorchs here in the plasmaenergy driven pyrolysis blocks are of 500kW – 2MW and are suitable to produce 200000 metric tons/year synthesis gas, and the electricity demand of the hydrogen from hydrolysis. By the help of some methanol producing blocs all the quantity of green current surplus can be converted into methanol and later reserved.

As above proved the profitability of mixing lignite with sewage and other wastes, which become here productive material – vs. the costs of household rubbish, sewage, sewage plants, usw. This facts make the synthesis gas production extraordinarily profitable.

We raise the question: does the need exist to produce so much methanol?

There are other useful fuels, like diesel, kerosene and methane – the BASF Fischer-Tropsch (FT) synthesis gives solution for our researcher. The production is based on the FT formula:



To simplify $C_n H_{2n+2}$ as hydrocarbon $n=1$ carbon atom $\rightarrow CH_4$ methane is chosen, $CO+3H_2$ so $CO/ H_2 = 1/3$ proportion is needed for producing synthesis gas to the FT synthesis.

To enlighten the above mentioned extraordinarily profitable production apart from the USA CTL (carbon to liquid) and BTL (biomass to liquid) technologies, but do study the advertised Audi/Sunfire „supergreen” technology, created for carbon dioxide-elimination and gaining green current.

The Audi-idea is based on the carbon dioxide extracted from air mixed with hydrogen
 $\text{CO}_2 + 4\text{H}_2 \rightarrow (\text{CO} + \text{H}_2) + 2\text{H}_2 + \text{H}_2\text{O}$ and they get $\text{CO} + 3\text{H}_2$ synthesis gas to the FT synthesis.

Our Team knew this solution, applied by the US Navy at their aircraft carriers category „Nimitz”, where the produced CO_2 (unpleasant infrared reflector...) mixed with hydrogen made by her nuclear power the new fuel is ready.

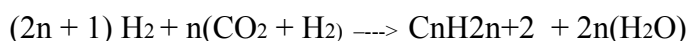
John Morgan, Jan 2013.: Cost Model for US Navy Zero Carbon Nuclear Synfuel Process
[http://webcache.googleusercontent.com/search?](http://webcache.googleusercontent.com/search?q=cache:4gLxLpDwnAkJ:https://bravenewclimate.files.wordpress.com/2013/01/synfuel-cost-model.xlsx+&cd=1&hl=hu&ct=clnk&gl=hu)

[q=cache:4gLxLpDwnAkJ:https://bravenewclimate.files.wordpress.com/2013/01/synfuel-cost-model.xlsx+&cd=1&hl=hu&ct=clnk&gl=hu](http://webcache.googleusercontent.com/search?q=cache:4gLxLpDwnAkJ:https://bravenewclimate.files.wordpress.com/2013/01/synfuel-cost-model.xlsx+&cd=1&hl=hu&ct=clnk&gl=hu)
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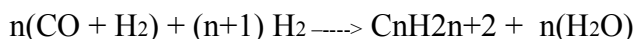
After an economical survey the author stated the price of synthetic fuels is 17 US cent/Liter.

Audi/Sunfire process is nearly the same with a slight difference, because the carbon dioxide quote and the green „deep valley” current make the procedure cheaper.

Our Kolontár Team’s suggestion to the BASF competition and by using the BASF synthesis – far more profitable than the Audi-idea. The Audi/Sunfire formula:



vs. our Kolontár Team:



Our advantages: by the end of the process half of the water than at Audi/Sunfire system and the water can be recirculated into the lignite pyrolysis. And the biggest clue: $n(\text{CO} + \text{H}_2)$ component brings big profit!

Another proof: Audi/Sunfire input is $\text{CO}_2 + 4\text{H}_2$ synthesis gas vs. our successful solution $1/2(\text{CO} + \text{H}_2) + 2 \text{H}_2$ synthesis gas. It means our Kolontár Team require only half of the hydrogen! It is vital important, because the highest cost in the procedure is the hydrogen itself, seeing the 33,583 kWh/kg cost even beside cheap current.

In the Audi/Sunfire technology 1 metric ton of fuel requires 3,12 metric tons of CO_2 plus 0,4 metric tons of hydrogen from other sources.

We emphasize again, our technology produces $\text{CO} + \text{H}_2$ synthesis gas from waste materials from the beginning is profitable, the Audi/Sunfire method is expensive with the carbon dioxide extract from the air.

The Kolontár Team/BASF-FT technology requires half of the hydrogen than the Audi/Sunfire and the US navy synfuel solution, what more: The Kolontár Team/BASF methanol technology demands one quarter of expensive hydrogen than the others and the bringing out of material is far more advantageous.

If we choose convenient input, the Kolontár-BASF $\text{CO} + \text{H}_2$ technology as a matter of course is paying proposition/lucrative. The US Navy produce 1 liter fuel for 17 US Cents, our methanol production amounts up to 8-10 US Cents/kg.

Deducing the extragainful result our energy reservation programme can translate from blueprint into fact switching in „deep valley” current from power station and/or renewable sources.

Environment Protection

The Audi/Sunfire fuel has an enormous wide publicity campaign because their extra green fuel is made from air – it is the carbon dioxide – and water by the help of renewable green current. We are really happy because of high degree of efficiency, bio-decomposition of ultra clean fuel and the working system. But the US Air Force applied it already in 2006 at the B-52 fleet and continued it later more and more.

We point out, our methanol solution and/or synthetic fuel production at least as green as theirs. In our days hydrocarbon energy sources, alcohols, biomass produce useful energy to the mankind by burning and gaining heat for further ims. Carbon dioxide and water are the final „product”. This process can be reversed by producing out of combustion products – with charging energy – again fuel.

Clear-gearded method of working if the product of new types of fuels does not base on burning fossil fuel eg. coal or oil but we lead new energy sources into the production, excluding carbon dioxide emission.

Nowadays these electric energies int he form of renewable currents come from nuclear/hydroelectric plants, solar panels, windturbines. In the flora of the Earth the carbon dioxide is circulating – photosynthesis is energy production, dry-rot-slow burning is the consumption.

Photosynthesis : $\text{CO}_2 + \text{H}_2\text{O} + \text{sun energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{oxygene}$

Dry-rot /burning: $\text{C}_6\text{H}_{12}\text{O}_6 + \text{oxygene} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$

In the engine hydrocarbon-based fuel burns into carbon dioxide giving energy - like fossil fuel in power stations.

We prepare a human driven circulation in the production of synthetic fuel or other energy-giving goods.

The Audi case: fuel production $\text{CO}_2 + \text{H}_2\text{O} + \text{energy} \rightarrow$ or $\text{CO}_2 + 4\text{H}_2 \rightarrow \text{C}_n\text{H}_{2n+2} (+ \text{O}_2 + \text{H}_2\text{O})$
but

the Kolontár/BASF: fuel production $(\text{CO} + \text{H}_2) + 2 \text{H}_2 \rightarrow \text{C}_n\text{H}_{2n+2} (+ \text{O}_2 + \text{H}_2\text{O})$

Either fuels burns in the engine $\text{C}_n\text{H}_{2n+2} + \text{oxygene} \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{energy}$

The germ of our induced circulation: before burning the fuel has chemical potential energy and bigger part of it evolves with the effect of oxygene. To restore the original position we should invest energy.

In the Audi/Sunfire system: to achieve 1 metric ton of Diesel fuel they use 3,12 metric tons of CO_2 carbon dioxide plus 0,4 metric tons of hydrogene with an energy consumption of 13,433,2 kWh – here the hydrogene brings back into the syístem the former burnt energy.

In our Kolontár/BaSF technology we need 2,1 metric tons of $\text{CO} + \text{H}_2$ synthesis gas with 0,2 metric tons of hydrogene getting from other renewed sources, with 6717 kWh energy.

The two sorts of philosophy are different. The Audi/Sunfire starts from the end of the burnt/ dry-rotten CO₂ „end-product” but our Kolontár/Basf technology steps into the decomposing process and by a pyrolysis move CO + H₂ synthesis gas before the ending stage. It does not extract carbon dioxide from the atmosphere but prevents it from spreading into the air together with methane and other dangerous gases.

Both process are ultragreen, but our Kolontár/BASF procedure is more economical, offers less energy consumption and more efficient and productive.

Summary

We presented in our Proposal the renewed green electrical energies (water, wind, photovoltaic current production) can be preserved and stored well and in an environmental form in methanol by the help of the BASF methanol synthesis. This type of reservation is simple, efficient and profitable – gives brilliant logical opportunities leading the green current to the place of production and the produced methanol to the consumers.

We presented two procedures.

If we use cellulose biomass (or for practical purposes produce cellulose of great cleanness e.g. energy cane) we can produce ultraclean green-methanol, using only green materials and currents.

We can produce methanol of high cleanness by green currents in huge industrial volumes if we use Hungarian lignite with recycled waste (sewage water and add hydrogen originated from hydrolysis after the lignite-watergas reaction. With sophisticated input this procedure is not only extraprofitable but green as well. If the abundant production of green current makes it necessary or there is an overproduction of methanol, we should produce synthesis gas by these green currents and out of this gas, applying the BASF Fischer-Tropsch synthesis, we would produce very efficient, ultraclean and biodegradable fuels, the market demand grows day by day bigger and bigger.

Our solution is extraprofitable, not only green but helps nations toward their independency in energy and fuel.

We presented the Kolontár Team and the Ajka-Kolontár area have good infrastructural and workforce possibilities. Re-establishing chemical industry of this type is economical and desirable to this Hungarian-German ancient village after so much sufferings. Such a newly re-established industry can be multilaterally supported by the European Union.

Allow us to congratulate on the 150th anniversary of the Chemistry Creator BASF and we hope our proposals will be judged favourably. If it is possible to establish an ultraclean green methanol producing pilot plant in the frame of a joint venture and help this Hungarian-German population in the Kolontár area after their so very hard life-history.

Kolontár, 29th May 2015

Sincerely yours,

The KOLONTÁR TEAM



***SYNPETROL
HUNGARY
INC.***



Primus Patent Development/Exploiting Company

PRIMUS Találmányhasznosító Kft.

Pres/CEO Dr. Zacsek Gyola

H-1201 Budapest, Hatvani u. 25.

Cégjegyzékszám: 01-09-063736

Adószám: 10814361-243

Bank: KH BANK Zrt.

IBAN: HU60104012824952485250571009

SWIFT CODE: OKHBHUHB

Kolontár Self-Government

Kolontár Község Önkormányzat

Provost: Tili Károly

H- 8468 Kolontár, Kossuth utca 24.

www.kolontar.hu

Kolontár and Surrounding Civil Organisation

Kolontár és Környéke Egészségéért Egyesület

Pres.: Varga József

H-8486 Kolontár, Arany János utca 33.

www.pozttrauma.atw.hu

Dr. Bándi's Law Office

Representantative and contact person of Kolontár Team

Pres.: Dr. Bándi Kund CLJ

H-1028 Budapest, Vadalma utca 12/B

Phone/Fax: +36 1 3768025

Mobile: +36 30 2440452

mail: attorney80@t-online.hu

