REGENERATIVE ENERGY

Compilation of My Posts in Renewable Energy Experts

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ADVANCED RENEWABLE

Foreword

Praise be to Allah SWT who has given me sustenance in the form of free time, knowledge, health and various other blessings so that I have the opportunity to be able to write these articles almost every day. This book is a collection of my articles on the Renewable Energy Experts Group on the professional networking media Linkedin.Com.

Through this media, tens of thousands of people have read these articles every day, so it is hoped that this compilation will make it easier for those who want to seriously explore the idea that we are promoting which is the title of this book, namely Regenerative Energy. As with compilation books, the order of writing is left as is, according to the order of writing and not according to the theme of discussion.

In this way, readers of this book are expected to be able to follow the progress of our thinking about Regenerative Energy, since it was initiated until its latest position when this book was published. As an article on social media, this book is certainly not intended to be a scientific work because it is hoped that it can be read by anyone who is interested in this new field. However, I can confirm that the science and technology contained in it is not science fiction.

Of the technologies I reveal in these articles, about half of them we tested and developed in our our lab. The rest is the result of experiments by other researchers from various parts of the world. In fact, some of the technological machines that I reveal in this book can also be ordered in commercial versions already.

As with the R&D process, of course all the science and technology revealed in this book is not final, everything may be refined, either by ourselves or by the readers. Therefore, if there are readers who want to coordinate with us in the further development of these technologies, we would really appreciate it.

Hopefully this book will be useful for the writer and those who read it, in this world and in the afterlife. Hopefully many people can have their burden due to difficulties in dealing with their energy needs in particular are relieved, as clean and affordable energy should be for everybody in this planet, among others in the form of this Regenerative Energy.

In simple words, Regenerative energy is energy that you can produce out of waste and emissions, as long as you have any of these two, you are having your own sources of energy. The rest, you will need technology and best practice on how to make this Regenerative Energy available for you – this is what this book all about.

Writer

Muhaimin Iqbal

Jakarta, March 2024

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1. Carbon Cycles for Cold, Heat, Power and Fuels (CHPF)

The new commodity in the energy transition era that will be very dominant in the next 7 to 27 years is carbon, namely when world countries pursue their respective NDC (Nationally Determined Contribution) targets by 2030, and pursue the 2050 Net Zero Emission target. People will be willing to pay a high price to be able to 'remove' their CO2 emissions. On the other hand, the Onboard Carbon Cycles (OCCY) technology that we introduced, does not just 'remove' carbon by moving it to another place, but converts CO2 into the energy we need.

Different from other Carbon Capture and Utilization (CCU) concepts, which usually involve an expensive process of capturing CO2, then transportation is also expensive because it has to use very low temperatures or high pressure, the subsequent process is also expensive before it is finally reused, at OCCY all those expensive processes are eliminated.

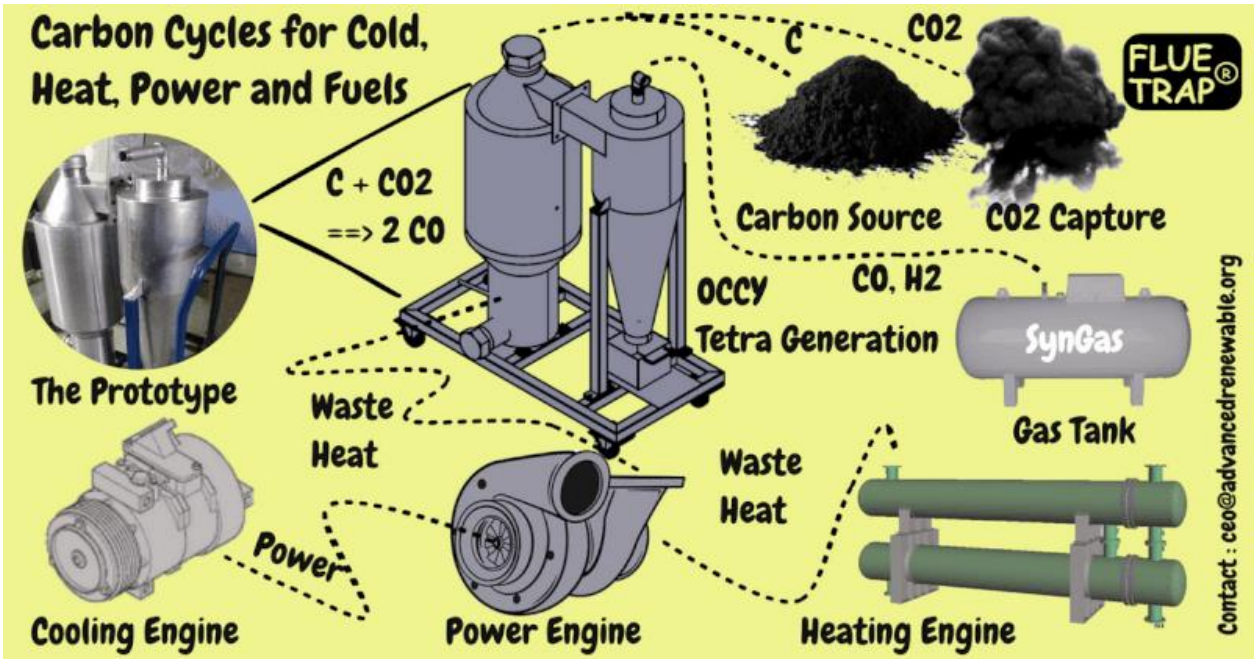
CO2 does not need to be transported because it will be immediately converted into energy and reused at the place where the CO2 came from - this is what we call 'Onboard' because there is no need to go off board or leave/move to another place. Then there is no need for cooling or pressurization because it will be used immediately. So what is the recovered CO2 used for?

What is definitely needed on a large scale and continuously is for energy recovery, so apart from the FlueTrap technology which I have previously introduced in this media, the heart of Onboard Carbon Cycles (OCCY) is a gasification reactor which we call OCCY Tetra Generation. Tetra in Latin means 4, because the CO2 that we process will become four types of energy.

The first is waste heat from the OCCY reactor, which has a high temperature of between 800-1000 degrees Celsius, which can be directly converted into power or electricity using what we call a Waste Heat Gas Turbine (WHGT). For cooling, even the rotation of the turbine and compressor axes can directly drive the air conditioning compressor without needing electricity first - so this is a very efficient cooling system.

Second, the exhaust gas that comes out of the turbine is still at a high temperature and can be directly used as heat energy by using an appropriate heat exchanger. Third, the turbine/compressor axis which is connected to an electric generator will produce cheap electric power because it comes from waste heat. Electricity is not the main product but a product of waste.

Fourth are products that can be produced from the syngas itself, this can be whatever fuel we need at the moment. It can be hydrocarbons such as petrol, diesel, jet-fuel and LPG, it can be oxygenates such as methanol, ethanol and DME, and it can even be a carbon-free fuel, that is, when carbon is only used as a hydrogen carrier.



2. Green Electricity With Micro Gas Turbine

As long as the majority of our electricity still uses fossil energy, especially coal, the electric vehicles that are currently starting to become popular will not be truly emission-free. But there is a shortcut to make these electric vehicles emission free more quickly, namely if they are charged using green electricity. Where does this green electricity come from?

Green and carbon-neutral fuel is actually abundant in around us, both in cities, in villages and even in the middle of forests and on remote islands. In cities this material is urban organic waste, in villages it is agricultural or plantation waste and in forests and remote islands it is forest waste.

There are many ways to do this, which is common with waste or biomass power plants. But this usually has to be done on a large scale to be efficient, it still has other problems, namely mobilizing bulky biomass with low energy content - also the electricity it produces is not cheap.

However, now there are other ways to produce green electricity on a small scale, in units of tens to hundreds of kilowatts, so that it is simply supplied with local biomass - which does not need to be transported to distant places. I have previously introduced the enabler for this, namely the OCCY Tetragen gasification reactor: https://lnkd.in/gm8C6sxs

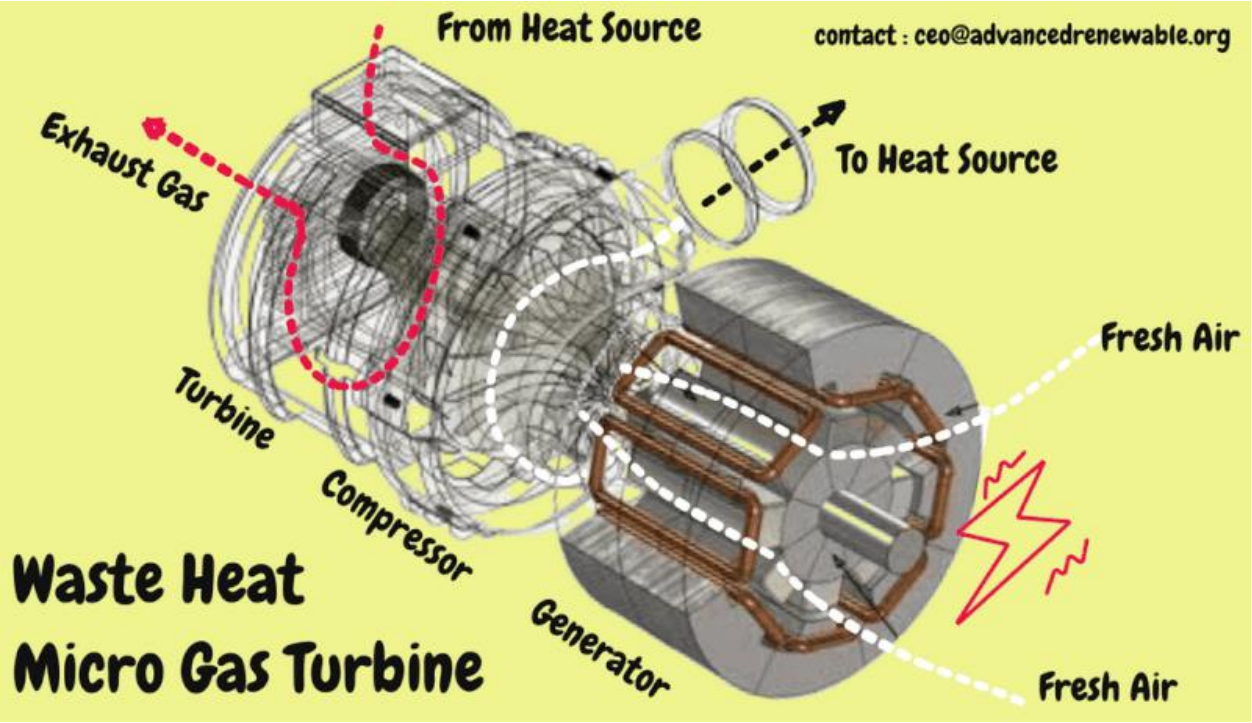
OCCY Tetragen's main product is syngas which can be processed into various fuels whatever we need, what we will use to produce electricity is only waste heat from the reactor. Because this reactor has a high temperature in the range of 800-1000 degrees Celsius, the waste heat can be very large and of high quality - so it has the potential to be converted into reliable electrical power.

For the current state of the art technology, the most efficient machine for converting this waste heat into electricity that we chose is the Micro Gas Turbine (MGT). Apart from being efficient, this MGT is

very reliable, simple and easy to make and maintain. In essence, only one component moves, namely the shaft and the components attached to it.

From the left end in the sketch below, the shaft is rotated by a blast of high pressure hot air originating from the waste heat of the OCCY reactor. This high pressure hot air originally comes from the component in the middle, namely the compressor which sucks in outside air and compresses it. Once this compressed air is exposed to the OCCY waste heat it will expand very strongly and come out to spin the first component or turbine.

Because the turbine and compressor shaft are the same, when the turbine rotates so does the compressor, meaning that it sucks outside air into the OCCY hot zone and then moves the turbine to continue operating without stopping - as long as the OCCy continues to produce heat. Likewise, the rotor on the generator is connected directly to the same shaft, and will continue to rotate and produce sustainable green electricity.



3. Introducing the New Oil: CO2 Oil

If petroleum reserves are only controlled by a handful of rich countries in the world, this is not the case with this oil - all countries have it, so there will no longer be one country that depends on another country for its oil needs. The new oil mines are found in factory and power plant chimneys, ship smokestacks, aircraft and vehicle exhaust gases, and anything that has been emitting CO2 emissions.

So we call this new oil as CO2 Oil, it can be produced by anyone who has the resources, it doesn't have to be the world's energy giants who do it, even medium-level businesses in the regions can do

it. The majority of the technology are mature, there is only one technology that we have to develop ourselves because it is not yet widely available on the market.

The technology that we developed ourselves is in the upper left corner of the sketch below. We call this technology the Onboard Carbon Cycles (OCCY) Reactor, its function is to capture CO2 and convert it into CO following the Boudouard reaction. After becoming CO, part of it is used to produce hydrogen through the Water Gas Shift (WGS) Reactor, the other part goes directly to Fischer-Tropsch Synthesis reactor (FTS).

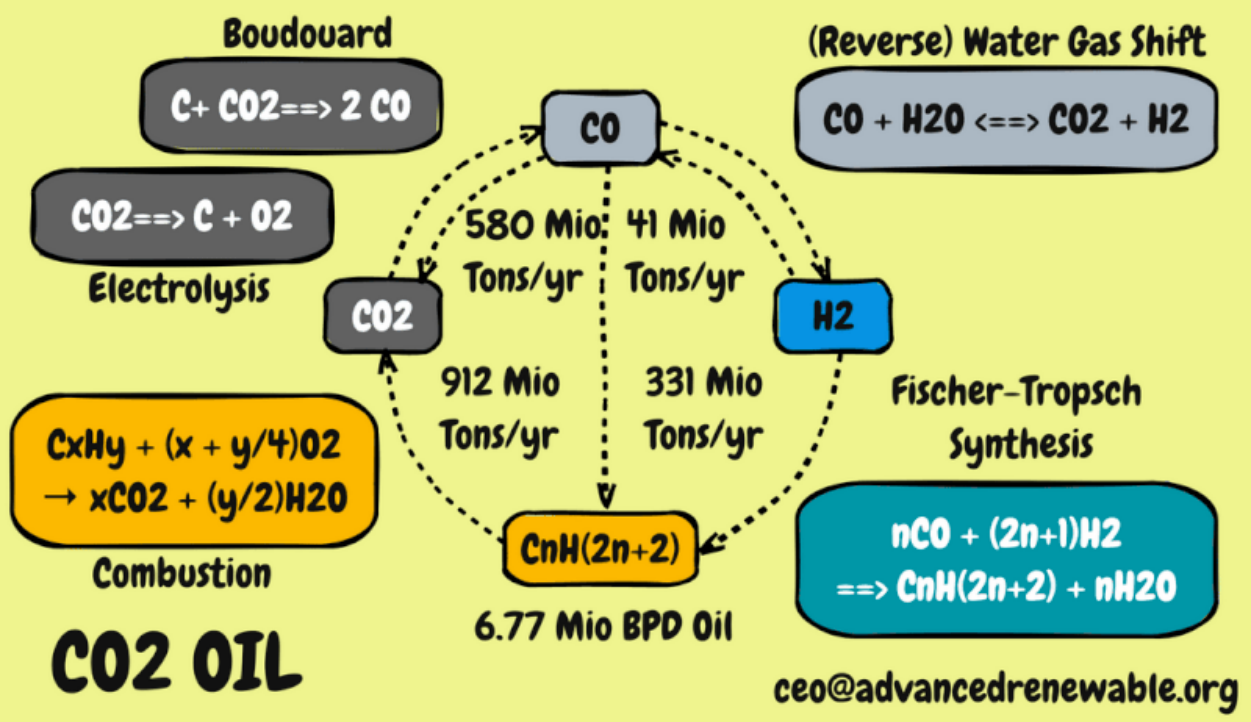
FTS is a mature technology that has been used on a large industrial scale since World War II, its function is to process CO and H2 to become Synthetic Crude Oil (Syncrude), more or less like petroleum but this one is renewable. It is from this syncrude that all the hydrocarbon fuels that we use today can be produced, in the form of diesel, jet-fuel, petrol or LPG.

When the fuel is used, it will be burned and will produce CO2 again, this CO2 is what we can recapture with various FlueTrap technologies that we have developed. From here CO2 will start the next cycle again with the OCCY process mentioned above.

You can imagine now that if countries use this technology, all of them will have the same opportunities and access to oil, we will no longer need to import oil or LPG raw materials. But how big is the potential?

Take the case of Indonesia, for example, in the NDC (Nationally Determined Contribution) scheme, we have committed to reducing 32% of our CO2 emissions from Business As Usual 2030, or the equivalent of 912 million tons of CO2e per year. Imagine if we only processed what we have committed to reducing CO2 emmission, into renewable crude oil (syncrude), this would be equivalent to 6.77 million barrels oil per day (BPD). This is approximately equivalent to 10 times our current daily crude oil production capacity!

We will return to being an oil exporting country again if we do it first, or at least become self-sufficient in oil - if other countries do the same.



4. Technology Integration for Waste and Emission Valorization

Due to the complexity of waste and emissions, there is no single technology that can be fit for all. What is needed is then to integrate all existing technologies, so that all these problems are resolved optimally. Moreover, this integration will also create a flexible process of increasing value or valorization according to our needs.

There are at least 3 groups of technologies that we study, namely thermochemical, biochemical and electrochemical. The first one is the one we have tried the most and we are sharing the results here, because the first one (thermochemical) is relatively easy, and there are many types of waste that can be processed. All urban solid waste, agricultural, plantation and forestry waste - all can be processed using this thermochemical technology.

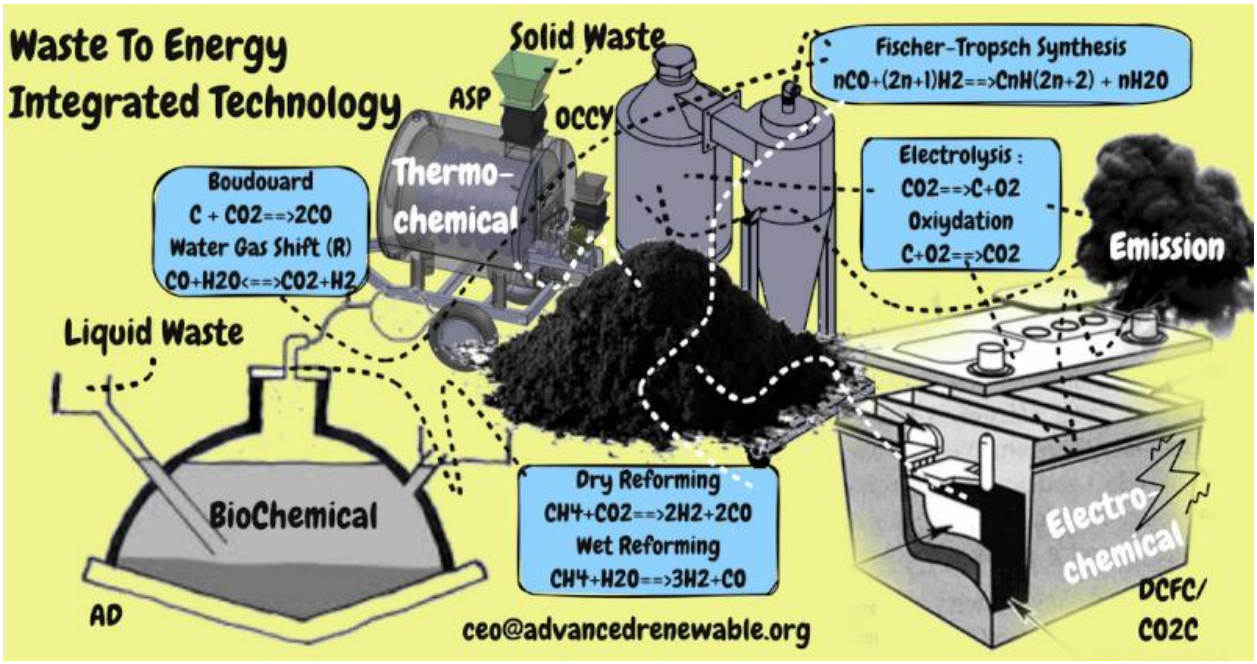
Among those included in this thermochemical group are gasification reactions, Boudouard reaction, Water Gas Shift Reaction, Reforming and Fischer-Tropsch Synthesis (FTS) to process rubbish or solid waste into liquid fuel final products such as gasoline, diesel, bio-jet and LPG.

The second is biochemical, for example if we want to handle industrial liquid waste, then one of the option is an anaerobic digester (AD), the result will be a gas called biogas. The largest content is methane gas (CH4) and CO2. Because the use of biogas is limited, whereas if it is to be stored or transported it is expensive, especially if it is to be purified and compressed, what we recommend is reforming it into CO and H2 or syngas. Biogas which has been reformed into syngas can be

processed using the first technology, especially FTS to become liquid fuel, as in the example above.

The third technology is electrochemical, we can use it to capture CO2 emissions, then convert them into carbon and oxygen through electrolysis, the carbon can be converted again into liquid fuel through the first technology, while the oxygen is released to increase the concentration of O2 in the earth's atmosphere. Or vice versa, using charcoal from the first technology to convert it into electricity directly through Direct Carbon Fuel Cells (DCFC).

By combining these three technologies, any waste, solid or liquid and even CO2 gas, can always be converted into liquid fuel, electricity or carbon materials. We will always be able to choose the most effective way to turn this waste and emissions into products with the maximum value that we need.



5. Clean Energy Between Waste and Emission

Direct lessons from Him, the Creator and All-Knowing, are sometimes so clear and real, but we failed to understand them even though we read them hundreds of times. One of them is this verse: "It is truly for you that from livestock it is truly a lesson. We give you drink from what is in their stomachs, from between their dung and blood, pure milk that is easy to digest for those who drink it" (QS 16:66)

What lesson is meant? one of them is that something that is very pure and clean, could come from something that in our eyes is dirty and disgusting. The milk He gave as an example can be drunk directly and is healthy, even though it comes from the animal's stomach, it is not mixed with the animal's feces or blood.

So now we just have to apply it to our other needs, we cannot make milk like what Allah created, but

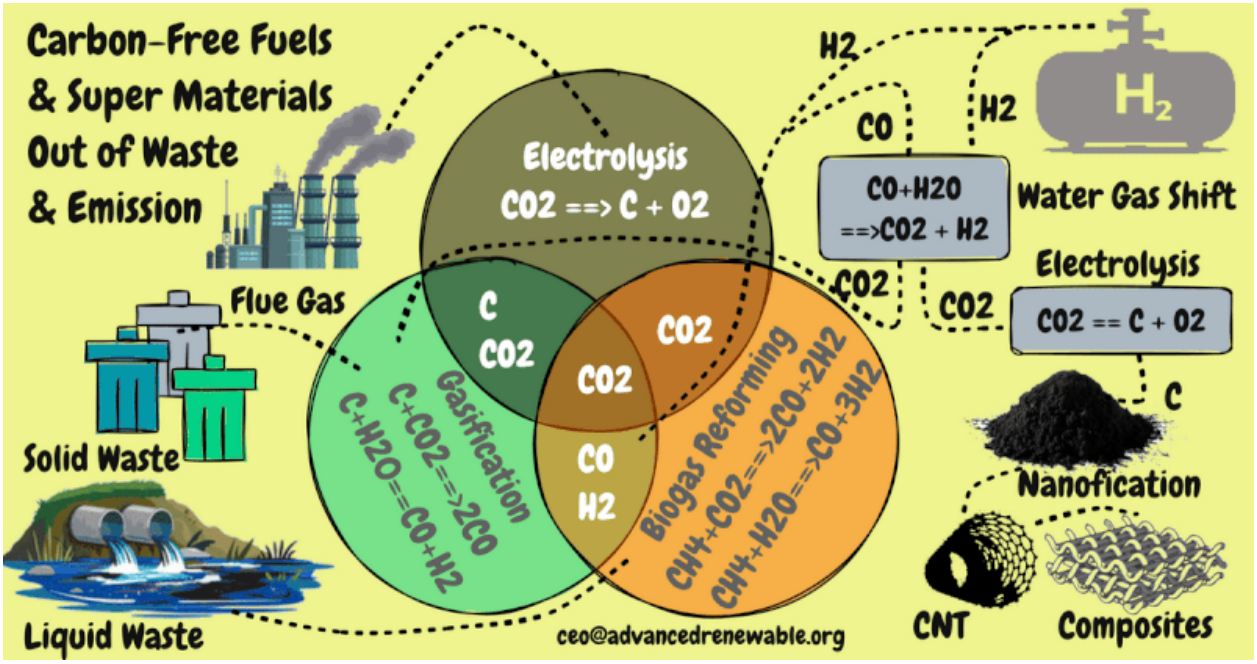
we are told to take lessons from the process of producing clean milk. We need clean energy now, energy that does not pollute the environment, does not add CO2 to the earth's atmosphere, and this energy can come from dirt, garbage, waste, even from air pollution or emissions.

So the sketch below is how we can extract clean energy that is even carbon-free, from solid waste, liquid waste and from air emissions. If it is from solid waste the process is gasification to produce syngas (CO and H2), if it is from liquid waste the result is biogas (CH4 and CO2) which when it is reformed will also become CO and H2. If it comes from air pollution, it can be electrolyzed first into C and O2, or directly gasified with carbon to produce CO and H2.

CO and H2 are very clean fuel sources, the H2 can be directly separated into H2 stock, while the CO can be used to produce further H2 using the Water Gas Shift (WGS} reaction. From this reaction the H2 combines with H2 which is separated from the previous syngas, while CO2 has three further options.

The first option is electrolyzed again to return to C and O2, the C is new fuel and the O2 is a source of clean air. The second option, CO2 is directly gasified with carbon or charcoal to directly produce CO and H2 again, and in the third option carbon is used as raw material for future materials such as Carbon Nanotubes, then becomes Carbon Nano Composites and so on.

So after we succeed in producing the carbon-free fuel in the form of hydrogen mentioned above, the waste in the form of CO2 will still be able to be used repeatedly for the next hydrogen production process, or when it is removed from the carbon-hydrogen-carbon cycle, it will become a new material that very light but very strong, a future material that can replace almost all existing materials. If there is something clean and abundant, why keep hunting for what is dirty?



6. Biggest New Energy Potential: Energy Regeneration

So much resources have been devoted to the hunt for new energy, so far there is no global consensus on what the ideal new energy is for the future. This could be because we are looking for it in the wrong place, we are looking for 'what', whilst the answer is not in 'what', but in 'how'.

If we think that new energy is renewable, such as biomass for example, in the 16th century England experienced a firewood crisis already. Even for renewable energy, if it is only used once, it will never meet human needs which continue to grow. So what's the answer?

Our Creator tells us to read His verses on the earth and on our own bodies (QS 51:20-21), how life on earth can exist for millions of years, how our fragile bodies - not as strong as iron or steel - but can last up to 60 more years without rust. How our skin cells die every 2-3 weeks, but the artists' faces remain shiny for more than 60 years and so on. What do they all have in common?

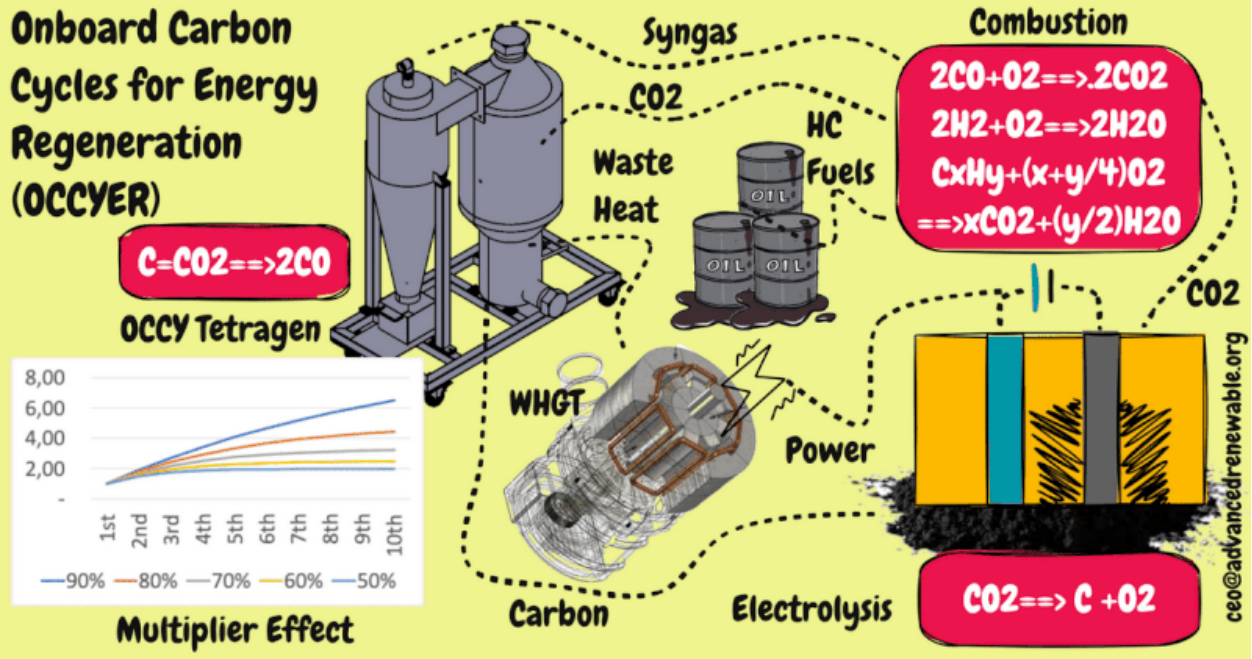
It is a regeneration system that Allah created, it exists in nature, in plants, livestock, even the smallest single-celled creatures, in humankind in its complete form and in the form of body parts such as skin and bones, all have their own regeneration system.

And Allah also revealed this to us in His verses "Isn't He the One who created the beginning and then repeated it? (QS 27:64), even repeating or regenerating His creation is easier, "And He is the One who started the creation, then repeated it again, and that is more easy for Him" (QS 30:27).

So the key to energy sufficiency for the world is not a matter of what energy we use, but how we use it. If we can use this energy continuously over and over again, by creating a regeneration system, then even limited energy such as oil and gas will be able to be used continuously without running out. Because it is only used initially, the rest that applies is energy regeneration, which is the process of producing new energy from the use of previous energy.

The sketch below is an example of an energy regeneration system that we call Onboard Carbon Cycles for Energy Regeneration (OCCYER). This system only requires three technologies, the first is the OCCY reactor that we made, the second is the Electrolyzer which is already on the market, and the same goes for the third machine which we call Waste Heat Gas Turbine (WHGT).

Every time energy is used, it generally produces waste heat and CO2 emission, we recover the waste heat into new energy via WHGT, while CO2 can be recovered in two ways, namely directly with the OCCY Reactor to become new syngas, or via an electrolyzer to become new carbon. Both are building blocks for all forms of energy, any energy and fuel can be produced from syngas (CO, H2) and carbon (C).



7. Carbonization For Decarbonization

It seems paradoxical, but these are the decarbonization machines that we have developed at WastoE (Waste To Energy) studio, these machines are ready to be demonstrated for institutions or corporations that need these technologies for their decarbonization programs.

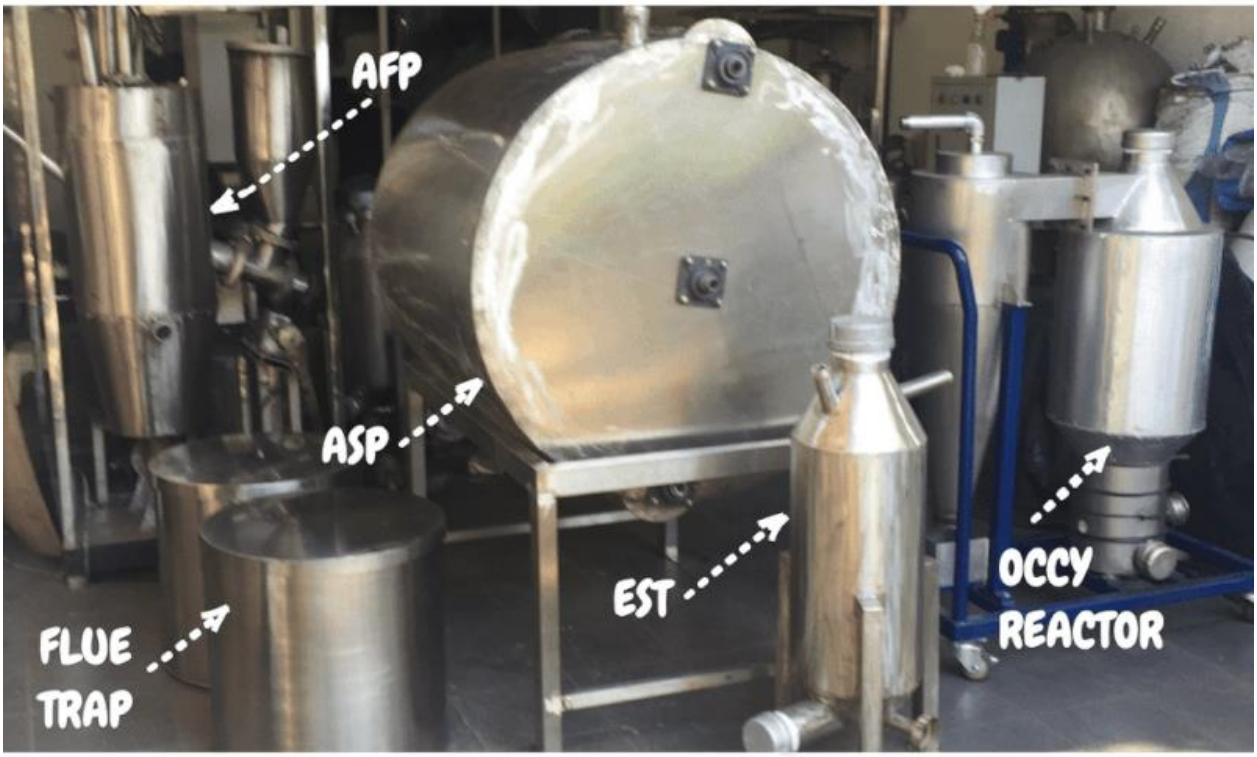
First in the photo there is a machine that we call Autothermal Slow Pyrolysis (ASP), which is used to carbonize rubbish or any waste. After being processed into carbon or charcoal, the volume of trash or waste will decrease to around 1/3 of its original volume. This charcoal is odorless, cannot emit leachate and methane - the two main contaminants of rubbish and waste, and its energy content has jumped twice to above 7,000 kcal/kg. Charcoal is a form of solid fuel that can be converted into any fuel.

Second is the FlueTrap machine, apart from its function of eliminating smoke in the charcoal making process in the first machine, FlueTrap also has its own side products, the type of product of which can be regulated by adjusting the solution we use to capture exhaust gas from the ASP machine. If the by-product we want is fertilizer, then the solution is a reactant. If we want fuel again, then the solution is an adsorbent. If what we need is pesticide, then the solution is a solvent. And if what we need is materials such as Carbon Nanotubes (CNTs), then the solution is an electrolyte.

Third is what we call Ecogas SmartTube (EST), which is used to convert charcoal into synthetic gas or syngas. This syngas can be used directly as energy, replacing diesel, gasoline or LPG. Fourth is what we call the OCCY Reactor which is a refinement of EST, apart from being able to perform functions like EST - OCCY can directly process CO2 into syngas, OCCY is also equipped with waste heat capture instruments to be converted directly into electricity via a Waste Heat Gas Turbine (WHGT).

And the fifth is the Autothermal Fast Pyrolysis (AFP) machine, which is similar to ASP only the reaction speed is very high. This machine is used to convert biomass from rubbish or waste directly into Bio-Oil according to ASTM D 7544 standards.

These machines are part of 100+ Technological Sketches for Civilization, the book of which can be downloaded at www.advancedrenewable.org. So apart from these 5 machines that I am showing here, Insha Allah, there will be 95+ more machines that we can build to improve this civilization, from a civilization that damaging the earth - to a civilization that prospers it.



8. Bringing Springs to the Desert

Since creating His representatives on earth, namely humans, Allah has wanted His creation to be intelligent and able to overcome all the challenges of its time. Since 1,400 years ago we have been challenged to go beyond the the sky and earth (55:33), we are also told to read His verses (His instructions) to bring springs of water on earth that is as dead as in the desert (36:33-34).

It may be that we don't need to travel to the corners of the sky and the depths of the earth, nor do we need to live in a desert where there is almost no life, but when we continue to think about extremes like this, various solutions to the problems of normal life on earth will be more easily resolved.

His instructions on how to bring springs in the desert, for example, are now very possible with science and technology. In a number of other verses, when Allah wants to revive the earth with plants, it is usually preceded by a verse about the fall of rain. But not in Surah Yaasin 33 mentioned above, the grain just growing on dead earth. How can it be without water? That's where we are told to think!

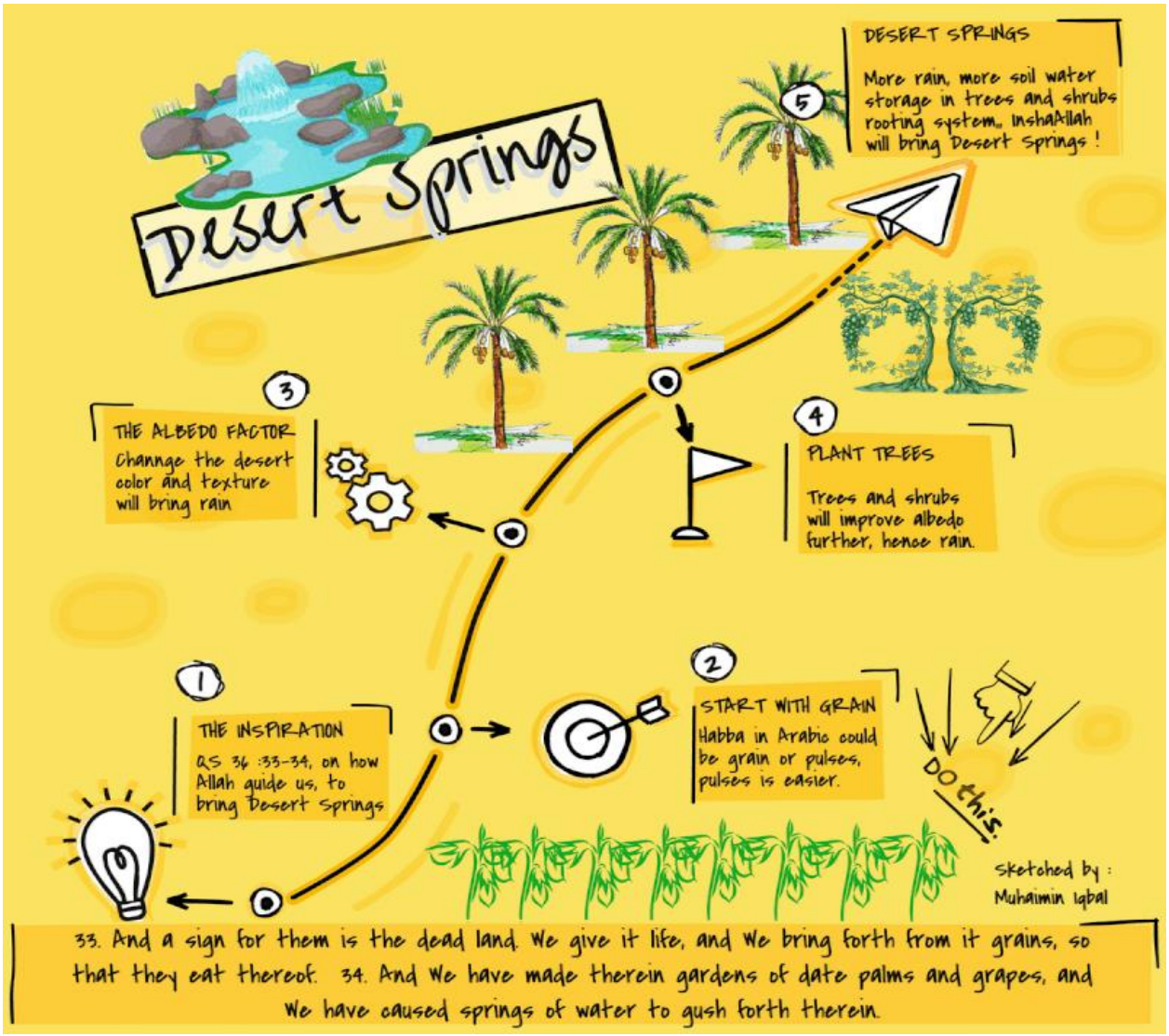
We must be able to solve this water problem before we can plant crops in the desert. With Capacitive De-Ionization (CDI) technology, for example, it is now possible to desalinate seawater en masse and cheaply. Whilst with a combination of drip irrigation and terra-preta (farming on black soil or charcoal), farming can be done with very little water because the charcoal will be able to store this water, so it is not easily lost by run-off or evaporation.

With charcoal that is activated and then nanofinished, we will be able to produce very effective nano-sized leaf fertilizer, which is sprayed into the stomata of the leaves and is immediately absorbed - without having time to evaporate in the hot desert.

The combination of desert soil that has been cultivated using terra-preta techniques and grain crops that grow quickly will immediately change the color and texture of the desert. This change will reduce albedo - namely the reflection of sunlight hitting the earth's surface. When the albedo decreases, the clouds that form in the desert atmosphere will have time to clump together and eventually become rain.

That's when we will be able to start planting larger plants, shrubs and even trees such as date palms. The root system of these plants will help store rainwater that falls so that it will gradually create water reserves in the soil, and in time it will come out as springs.

So based on His instructions above, which we then using contemporary technology for implementation, Insha Allah, we can bring springs to the desert. Well, if we can do it in the desert even, in a tropical country with lots of rain, we must be able to at least maintain the existing springs, and then in the long term we must be able to bring new springs!



9. Waste Heat Gas Turbine in The Making

The machine we are making is based on the previous sketch here (https://lnkd.in/gH46Ekv9), it will be the first of its kind in the world.

In terms of type, it is a Gas Turbine, but does not require special fuel, because waste heat from any heat source can be converted into electricity. In terms of combustion, it is external combustion - a source of heat elsewhere, but does not require a special heat exchanger, nor does it require a heat-carrier fluid.

And more important than that, this will be a new way to generate green electricity anywhere, anytime cheaply. Electric car owners in urban areas can make their cars completely emission-free, and no longer depend on utility's grid. Meanwhile, people on remote islands also have the same access to electricity. Welcome to the new Gas Turbine family member, the Waste Heat Gas Turbine (WHGT)!

10. Low Cost Sustainable Aviation Fuel (SAF)

The souvenir from my meeting with the core and largest players in the world aviation industry is the potential that exists in this country. The aviation world will only be able to achieve Net-Zero Emissions in 2050 (world) or 2060 (Indonesia), if they replace their fuel with what is called Sustainable Aviation Fuel (SAF). With SAF, the aviation world will be able to reduce 80% of its emissions compared to fossil fuels, the remaining 20% will then can be sought from other sources of emission reduction.

SAF is essentially a biofuel but one that doesn't compete with food like our palm cooking oil. What is permitted are agricultural, forestry waste, urban organic solid waste, energy crops and plants that

grow very quickly such as microalgae. So the solution to green aviation is clear, but what is the problem?

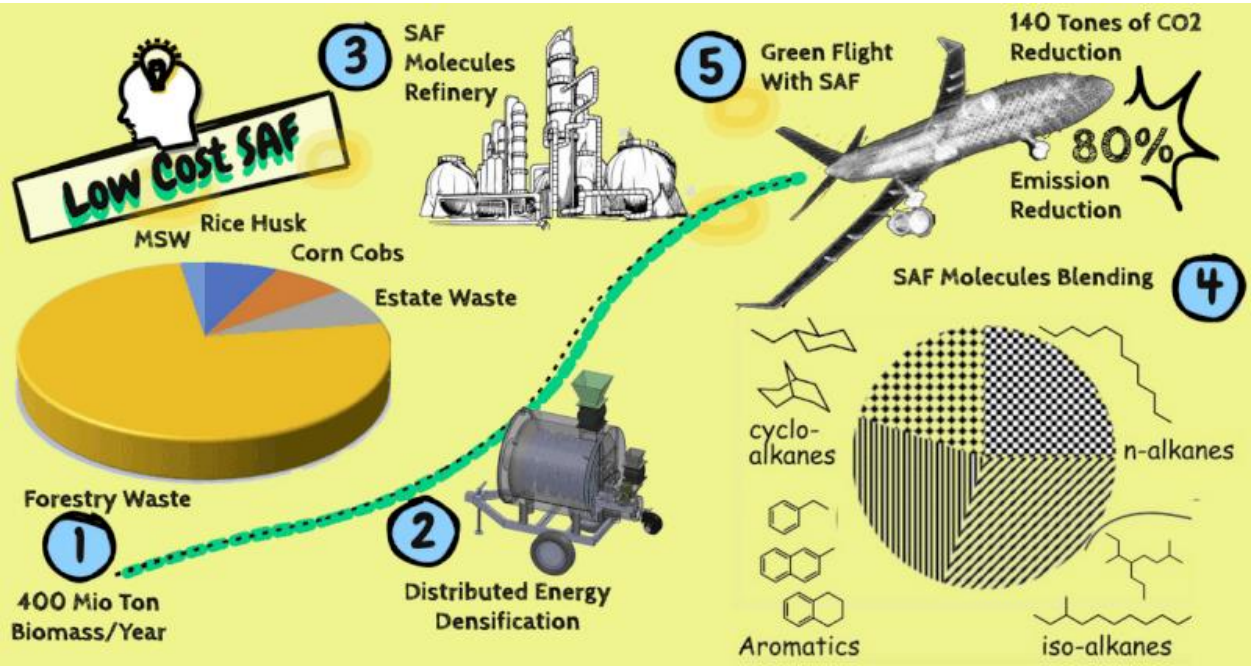
Currently there are at least two main problems, namely supply and price. From the supply side, currently in the world only around 1% of the market needs are available to replace aircraft fuel with SAF. Meanwhile, in terms of price, currently the price of SAF is still around 2.5 times more expensive than regular aircraft fuel.

So this is the potential for us that I mentioned above, without even having to plant energy crops or microalgae - we have around 400 million tons of biomass every year that we have barely processed. The biggest is from forest waste in the form of fallen twigs and leaves, which if not taken also has the potential for fire, if taken and processed into SAF it could become the potential for new economic growth in this country. The remainder in smaller amounts is plantation, agricultural waste and urban solid waste.

The challenge is how to collect this large, bulky and low calorie biomass? This is where our technology comes in! Like the complete series of machines that I presented in the previous upload here (https://lnkd.in/guhEfprm), the function of this series of machines is to densify biomass energy. From bulky and low calorie biomass, to dense and high calorie charcoal pellets.

These charcoal pellets are very competitive to be sent to processing industries anywhere in the world and are ready to be used as the feedstocks for SAF molecules. From charcoal through gasification and Fischer-Tropsch Synthesis it will become n-alkanes and iso-alkanes, namely half of the SAF blend, the other half is in the form of aromatics and cyclo-alkanes which can be processed through pyrolysis and upgraded with Fluidized Catalytic Cracking (FCC). Brand owners and market holders can then blend these molecules into standard SAFs that they sell.

Because the material is cheap from waste and garbage, the process is simple, SAF from this country which is processed using this route should be able to compete in the global market. If you are the investor we are looking for, this is a great opportunity that we can explore together.



11. Charcoal Industrialization

While other people are on holiday, our team at the Waste To Energy (WastoE) studio is targeting the completion of a very important machine in the biomass industry. This machine, which we call Autothermal Slow Pyrolysis (ASP), will be an enabling factor for utilizing biomass from waste and trash into raw materials for various industries with high to very high value.

The value proposition of this ASP is processing biomass from waste into charcoal, without causing new problems such as smoke. After becoming charcoal, waste which is generally bulky, low in calories and sometimes also disgusting, has an unpleasant aroma, etc., it becomes compact with a volume of only 1/3 of the original biomass, has no aroma, is clean, easy to handle, and has high calories, above 7,000 kcal/kg.

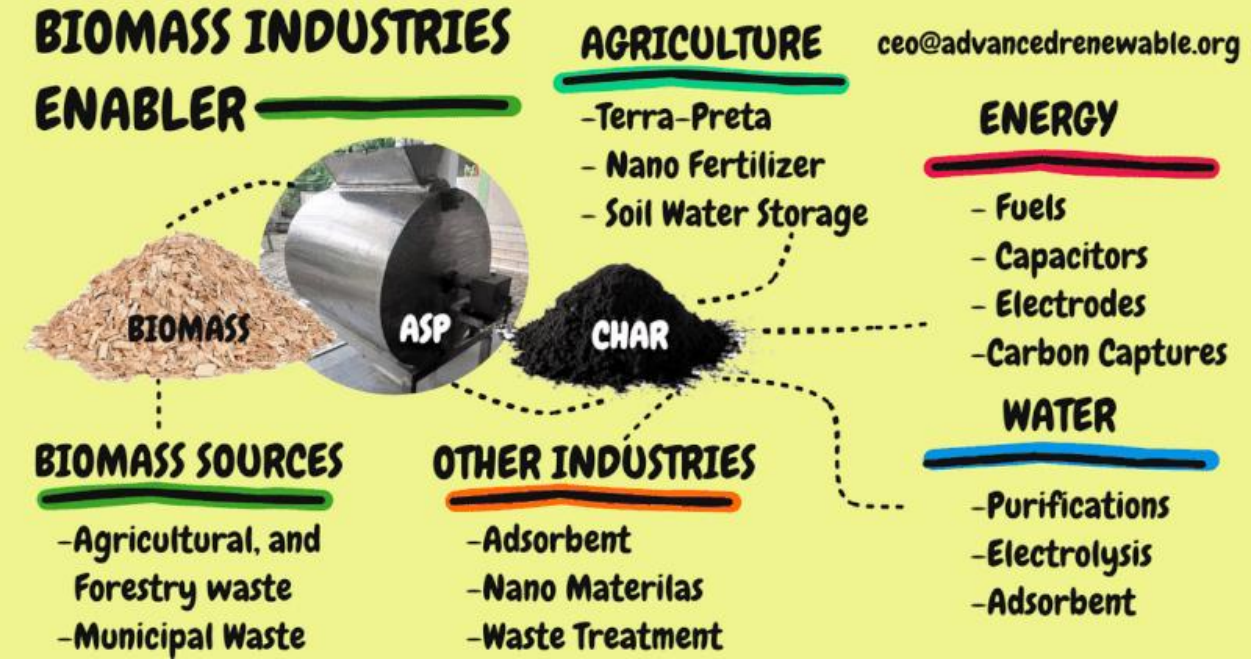
After becoming charcoal, especially if it is pelleted to become a standard industrial raw material - the charcoal pellets can be sent anywhere in the world for further processing according to the industry that uses them. In the energy industry, apart from being able to be processed into any fuel, such as diesel, bio-jet, gasoline, LPG, methanol, ethanol, DME and hydrogen carrier, charcoal is also an effective material for becoming super capacitors for energy storage.

In the agricultural industry, charcoal has been proven to fertilize the land for thousands of years in the Amacon people - Brazil with what they call terra preta, black soil. Charcoal can be a carrier for very effective nano fertilizer. Charcoal can also be a soil water storage instrument for agriculture in arid lands and even deserts. The project for desert countries which we call Desert Springs Projects (DSPs) also uses this charcoal for initial land recovery.

In the drinking water industry, charcoal, apart from being effective as a raw material for water purification after being made into activated carbon, is also the most likely candidate in terms of availability and cost - to provide the cheapest and lowest energy seawater desalination process. Through Capacitive De-Ionization (CDI) technology, with the help of charcoal, communities that currently have water shortages will be able to obtain cheap fresh water. Even agriculture in deserts, as in the DSPs mentioned above, is also possible after fresh water can be obtained from seawater desalination through CDI technology.

Apart from the energy, agriculture and clean water industries, charcoal in various forms is also needed for other industries such as food, pharmaceuticals, chemicals, etc. Even in the materials industry, charcoal after nanofication will become a raw material for the materials industry which is light, very strong and does not depend on mining products.

All of the industries mentioned above will soon be able to access cheap raw materials in the form of charcoal and its various derivative products, with the presence of ASP machines which, Insha Allah, will become enablers of charcoal-based industrialization.



12. Ultimate Energy Efficiency and Decarbonization With OCCYER

The new year is here, the world is one year closer to the SDGs 2030 and Net Zero Emissions 2050. The world will be increasingly panicked about the decarbonization target, while also being haunted by the uncertainty of fuel prices and availability. But the good news at the end of this year is that the machines we prepared to tackle both are now ready to be tested at an industrial level.

We named the machine OCCYER, from old English which when means guard, and in Arabic means (Abdul) Muhaimin which is the same name of the person who designed this machine! However, OCCYER actually stands for Onboard Carbon Cycles for Energy Regeneration. This machine will be a tool for energy efficiency as well as full carbon capture and utilization. How it works is as in the sketch below.

I use the application model as a diesel generator with a capacity of 1MW, which in full load operation - normally this generator will require 310 kg of diesel per hour. Apart from producing 1 MW of power, this generator will also produce CO2 emissions of 837 kg CO2 per hour.

This CO2 is what we capture with OCCYER, which operates based on the Boudouard Reaction, in this reaction CO2 will be reacted with element C at a high temperature (range 800-1000 degrees Celsius). For this reaction you need a heat source and C as a reactant, we can get both from the same source, namely charcoal. So for these two needs the OCCYER used to process CO2 from the diesel generator mentioned above will need around 228 kg/hour of charcoal.

The OCCYER output will be CO with an energy content of around 10.5 MJ/kg. With an output of

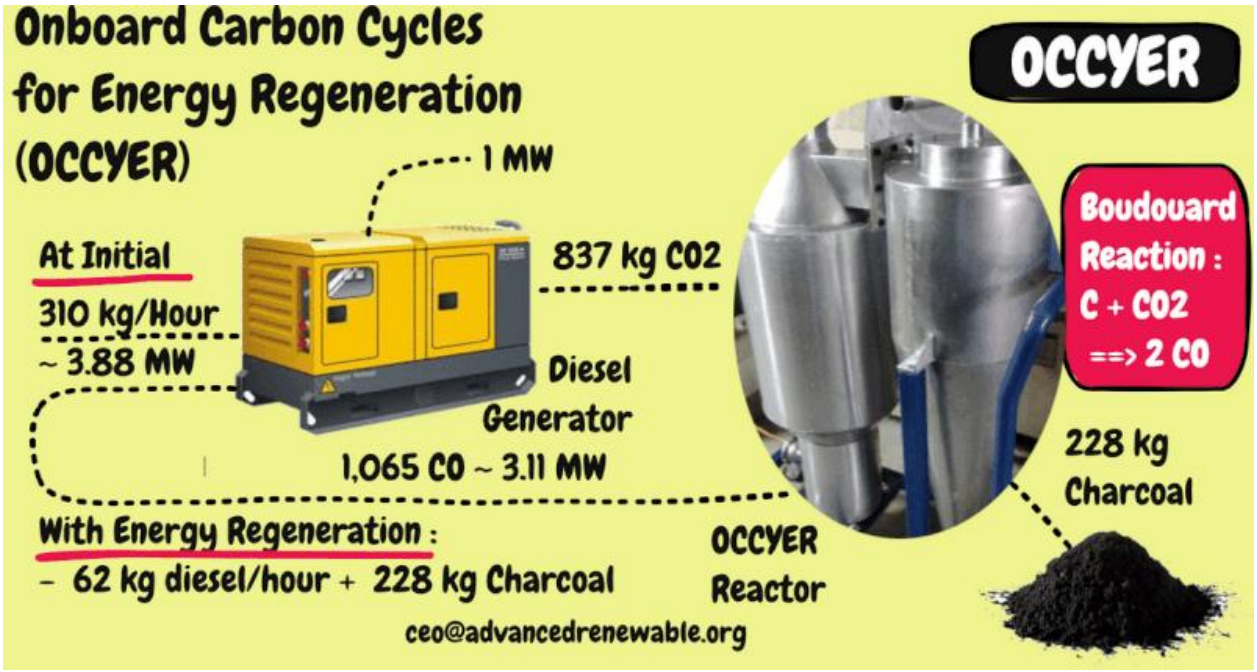
1,065 kg CO, this means the equivalent of 3.11 MW of energy or approximately the equivalent of 80% of the energy content of diesel fuel required by the generator if it runs normally without energy regeneration with OCCYER.

In other words, through the use of OCCYER, the diesel fuel needed by the 1 MW generator will decrease to just 20%, and the rest will be met from CO from CO2 capture and circulation. For this, charcoal is needed as a reactant, but the price of charcoal is much lower than diesel, only around 20% of diesel price as well.

Apart from this very significant fuel savings, emissions of 837 kg of CO2 become zero because it is completely absorbed by the OCCYER reactor, and converted into the new and renewable energy mentioned above.

OCCYER has two target markets, namely industrial markets that need energy efficiency and industries that need decarbonization, or both. Apart from being able to be installed on diesel generator engines, OCCYER can also be installed on any combustion engine that emits exhaust gas containing CO2.

We are looking for partners for production, marketing and investment for OCCYER throughout the world, those who are interested can contact us on this media or via the email mentioned in the sketch below.



13. OCCYER for Extreme Weather Acceleration Prevention

While those of us in the southern hemisphere are sweltering, residents of the northern hemisphere are shivering from record-breaking cold temperatures. The scapegoat is the same, namely climate change, but we are accelerating climate change along with what is called the tragedy of the common.

When we are hot, we increase the intensity of our AC to stay cool. Likewise, those who are cold in the land of the 4 seasons, the cold weather makes them burn a lot of fossil fuels to heat their rooms. The impact is that the more fuel is burned the faster climate change accelerates, the more fuel is burned again- the faster climate change. Like a snowball that rolls bigger and bigger and faster.

The good news is that just as we accelerate climate change together, we can also stop it together. The way to do this is not through regulations or laws, but through incentives. People will voluntarily do it if there is a direct incentive that they can enjoy. But what are those incentives?

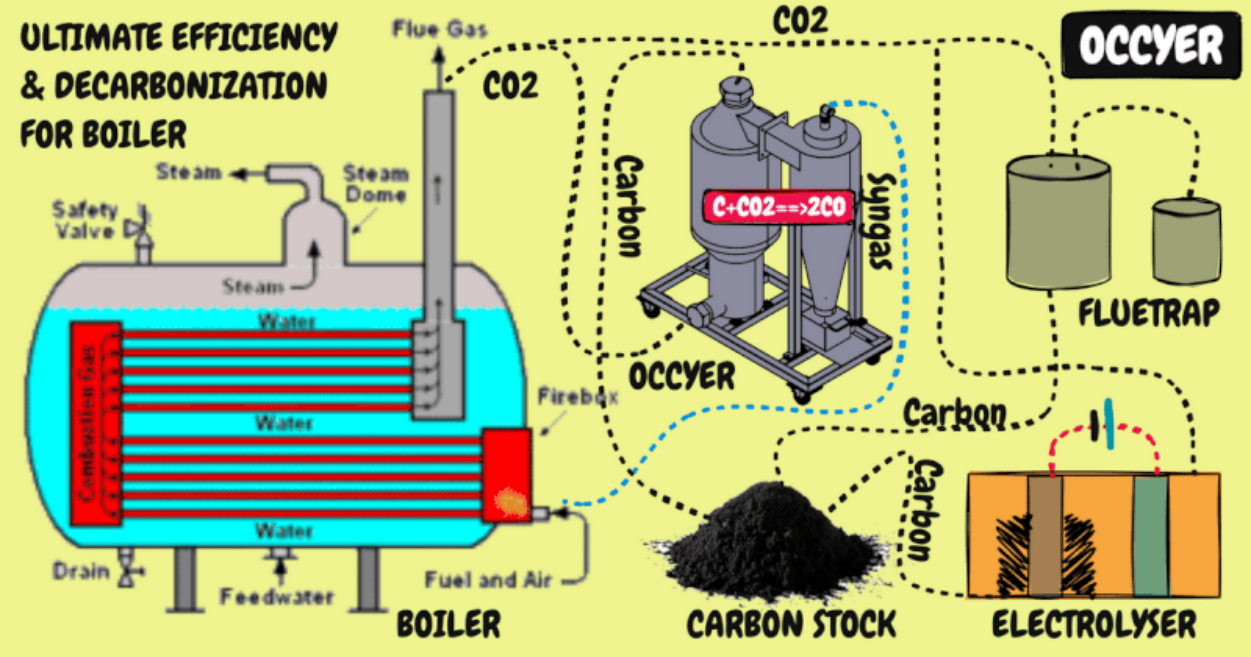
The incentive is in the form of extreme energy savings as well. With this technology which we call OCCYER (guardian), we will together be able to protect the earth because we have a direct interest in saving cost, and indirectly also in keeping the earth comfortable to live in. OCCYER, which also stands for Onboard Carbon Cycles for Energy Regeneration, works like the sketch below.

The world's 4 season cities will never be able to achieve Net Zero Emissions if they cannot handle the fuel to heat their tall buildings, only with the OCCYER concept can they still use fossil fuels - but in much smaller quantities, the majority of energy is supplied by CO2 which is regenerated to become energy again.

There are three ways that we use in OCCYER technology to convert CO2 into new energy. The first way is to react directly with Carbon in the OCCYER reactor, in this reactor CO2 is reacted with carbon to become CO - which is the main element of syngas. This CO contains 10.5 MJ/kg of energy and can be directly fed back to the standard boiler.

The second and third methods are options that can be taken, namely to handle excess CO2 so that it can be stored cheaply for future energy reserves. This can be done with an adsorbent using a technology we call FlueTrap, or using an electrolyte in electrolysis technology. Both will store carbon reserves in solid form, which can be reused as a source of element C in the OCCYER reactor.

With this, the world community will voluntarily save its energy to the maximum, and at the same time emissions from all boilers in the world will automatically be absorbed into zeo emissions. For those who are interested, the machine prototype can be tried in our workshop.



14. The Year of ClimTech

If in previous years we were very familiar with FinTech, AgriTech, DeepTech etc., the coming years will be the years for ClimTech or Climate Technology - namely all forms of technology that will be needed for climate action, for efforts to improve the direction of global climate change.

It is in the field of ClimTech that our workshop at the WastoE (Waste To Energy) studio focuses. Throughout 2023, there were at least 9 tools or machines in the ClimTech category that we have developed in this workshop, 8 of which are in the photo below. Only 1 was not caught on camera because it is small, namely what we call the Ecogas SmartStove.

From the top clockwise, the Autothermal Fast Pyrolyser (AFP) is used to process biomass into Bio-Oil according to ASTM D7544 standard. Then the FuzzyLogic Catalytic Cracking (FCC) reactor is used to upgrade the Bio-Oil produced by AFP into a fuel similar to gasoline or diesel which we call BioLite.

Then there is a multifunctional reactor, for esterification, transesterification etc., essentially for processing low quality vegetable oil into biodiesel fuel. Then there is also the Biodiesel Reactor, to process standard vegetable oil into biodiesel. The largest is a newly finished reactor funded by the Tagar#Temasek Foundation, as a winner in the Climate Impact Innovation Challenge (CIIC). We call this Reactor an Autothermal Slow Pyrolyser (ASP), its function is to convert any biomass including rubbish and waste into charcoal.

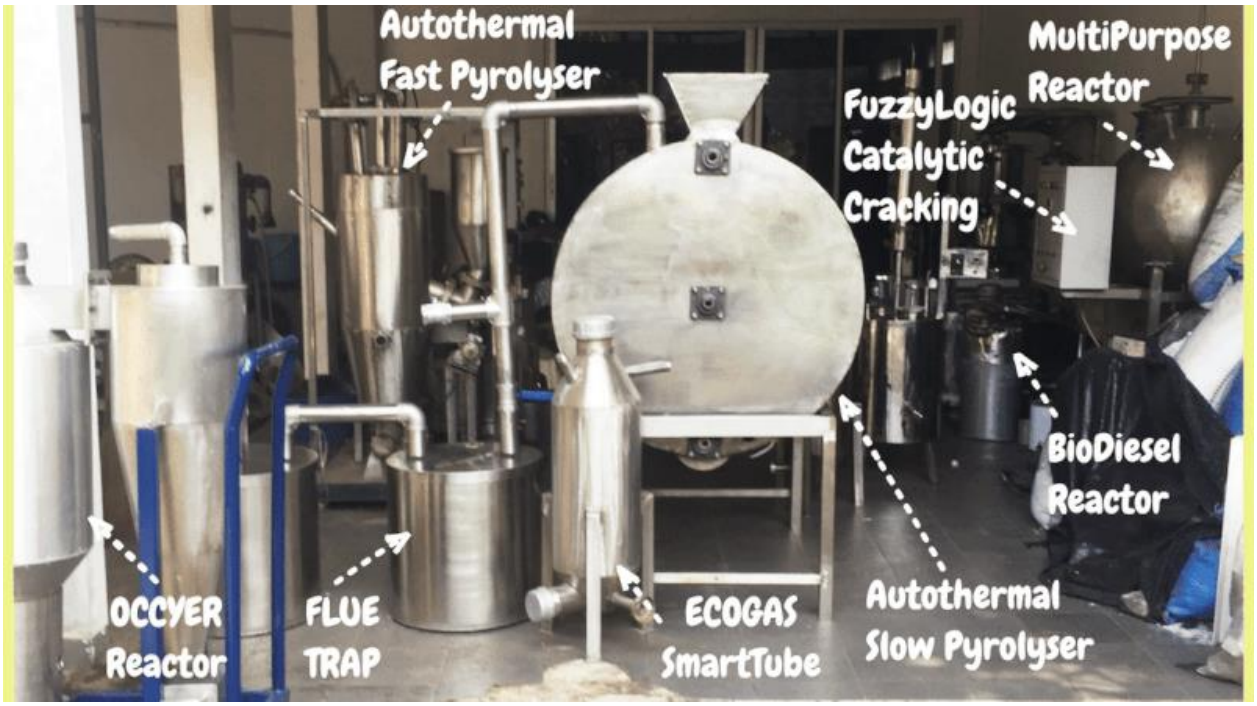
Next to it is the Ecogas SmartTube (EST), which is funded by the Tagar#Temasek Foundation as well, its function is to process charcoal from ASP into synthetic gas (syngas), which is fuel that is ready to use and can be processed into whatever fuel we need, such as diesel, gasoline, LPG,

methanol, ethanol, DME and even hydrogen.

Next is the FlueTrap, its function is to catch any exhaust gas that comes out of the chimney or exhaust. Because more than 95% of the flue gas content is generally CO2, after being captured by the FlueTrap, this CO2 can be converted into fertilizer, new fuels, or materials such as Carbon Nanotubes (CNTs) etc.

The last one is our masterpiece for 2023, namely what we call the OCCYER (Onboard Carbon Cycles for Energy Regeneration) Reactor. The purpose is to capture CO2 in-situ and in-time, in place and when it appears, to be converted directly into energy (CO), either for in-situ use or processing into advanced fuels.

As an overall, we have prepared quite a complete set of 'weapons' to fight the acceleration of climate change. Those of you who need these machines can order them from us, or even if the ClimTech machine you need is not yet here - we are willing to design it and build it specially for you. Welcome to ClimTech Year 2024!



15. FEW for All

In less than 48 hours from the time this article was uploaded, the world will enter the new year 2024 when the world is not going well. Wars in a number of regions of the world have caused extraordinary humanitarian crises. The three basic needs of Food, Energy and Water (FEW) which should be accessible to all mankind - are becoming increasingly scarce for millions of people in the world.

So technological development must lead to the availability and affordability of these three basic needs or FEW, in any situation, even in a war situation, it must not sacrifice the weak by not having access to these FEW.

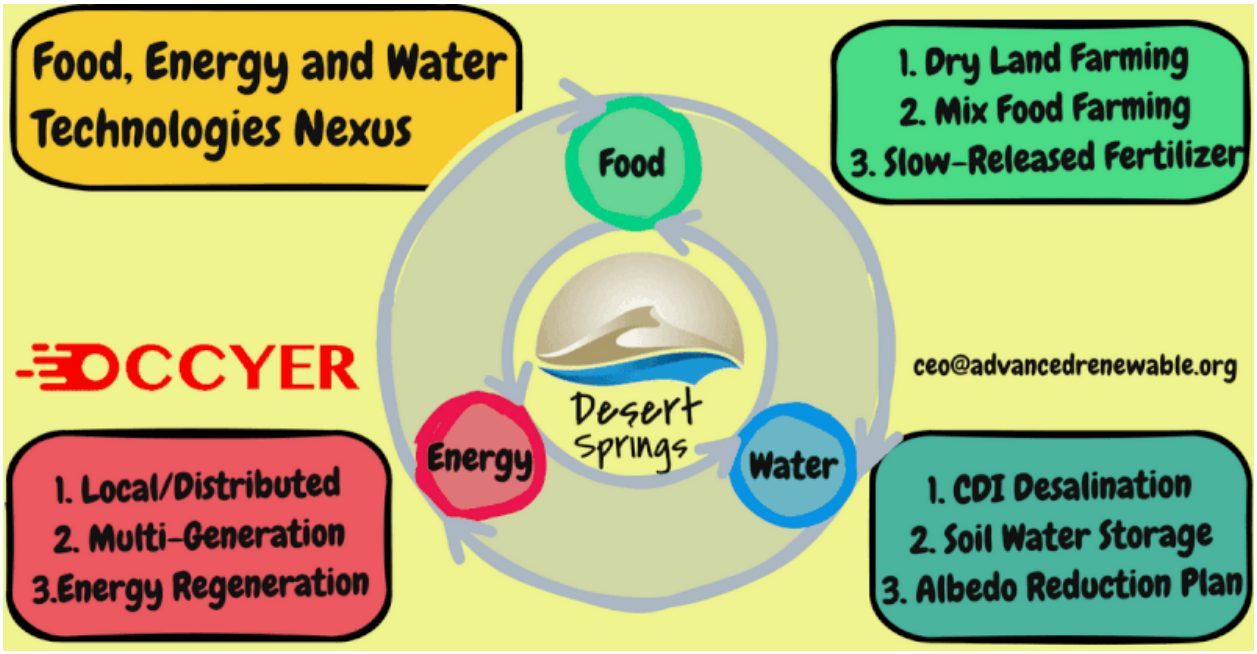
We at the Advanced Renewable Organization (ARO), which has just entered its second year, are focused on developing technologies that are really needed by all of humanity to fulfill the three basic needs mentioned above. ARO's vision is FEW for All, and it is for this vision that we have developed 9 technology groups, 3 each for Food, Energy and Water.

Firstly, to ensure the availability and affordability of food, what we are developing is farming on barren land or dead earth, mix food farming - reducing dependence on rice and wheat, and switching to nuts (pulses), fruit, vegetables, spices and a few cattle products. Then, so that barren/dead land that has been successfully fertilized cannot be damaged again by chemical fertilizers, we have also developed slow-release fertilizer technology instead.

Second, for energy, everything must be based on local resources - so that no region/country is dependent on other regions/countries in terms of energy. Each resource is also used for multi-generation, various forms of energy such as cooling, heating, power and various fuels can be produced from the same source. Next, each type of basic energy source must also be able to be used repeatedly with the concept of energy regeneration.

Third, for water, to meet short-term needs, what we have chosen is desalination using Capacitive De-Ionization (CDI) technology because it is cheap and energy efficient. For the medium term, we are developing Soil Water Storage, which increases the water storage capacity in the soil. Meanwhile, for the long term, we are introducing the Albedo Reduction Plan, namely by reducing the albedo or reflection of sunlight after it hits the earth's surface, rain - inshaAllah - will fall even in areas that are currently desert.

To facilitate the dissemination of these technologies to all regions in the world that need it, We have initiated two model projects, that are already include the 9 technologies mentioned above. These two projects are Desert Springs to solve food and water on arid or even dead land, and OCCYRE (Onboard Carbon Cycles for Energy Regeneration) for a comprehensive energy solutions - for anyone and anywhere. InshaAllah, the details will be discussed in Mabid Peradaban 2.0, bit.ly/MABID20



16. Sketches That Become Solutions

The big and serious problems around us, the key to solving them lies in a group of thinking people called Ulil Al-Albab. Who is Ulil Albab? Allah attributes it to those who continue to remember Him and continuously think about His creation, until he/she finds the essence of the problem - that nothing is wasted in His creation (QS 3:190-191).

So now how do we not quickly get tired of constantly thinking about His creation? One way is to make it fun - make it fun to think, it can be entertainment. Designing a machine, for example, will be very tiring when we are busy looking for references and cheat sheets from other people's work. But it becomes fun when we think like artisans - imagine and create doodles or sketches that are easy to enjoy.

By making these sketches we are also implementing the guidance of the Prophet SAW, that knowledge is like a hunted animal, it is very difficult to catch and even if it is caught it will easily escape again. It's like a game animal, so that it doesn't get loose again, it has to be tied up, similarly, so that knowledge doesn't get loose easily, it has to be tied up, and the tie of knowledge is writing.

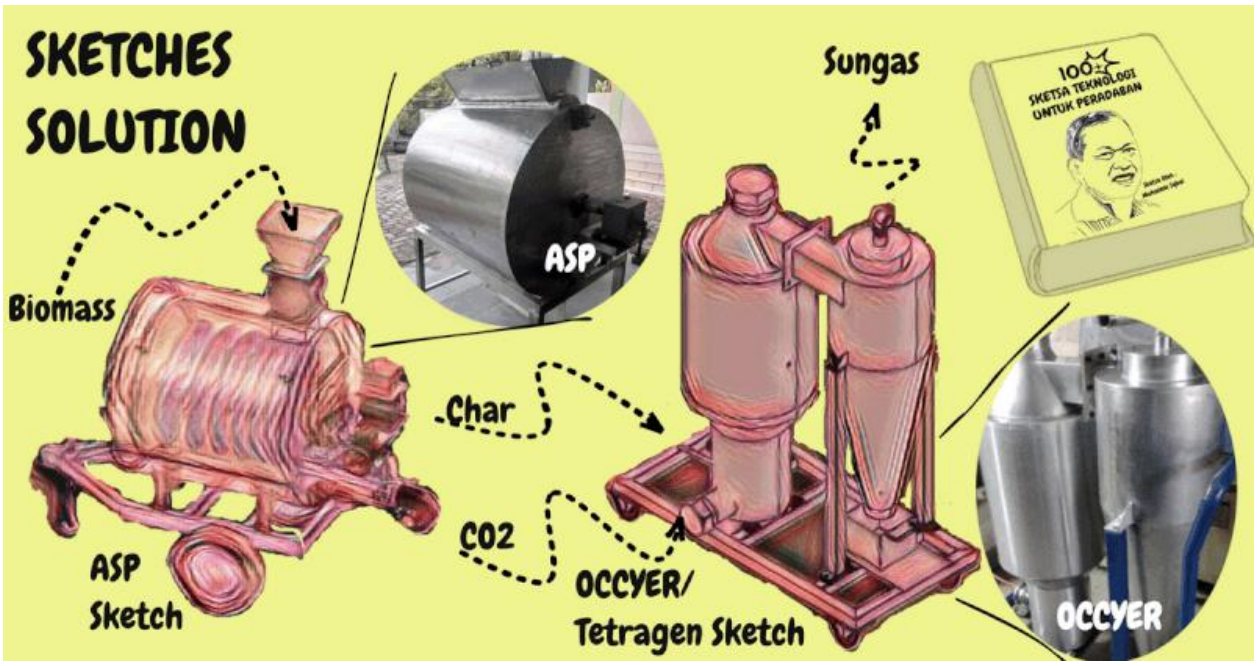
So the book "100+ Sketches of Science for Civilization" which can be downloaded for free at www.advancedrenewable.org is the fruit of hunting for 'game animals' called science, which we then tie together with sketches and writings that explain it.

Of the more than 100+ sketches I made above, we have actually made only about 10% of the items (the machines). Of the 10% that we have made, the following two are my favorites, namely the Autothermal Slow Pyrolyser (ASP) machine, and the OCCYER/Tetragen machine - the second one has the same external appearance, only the internals are different.

Even though it is done in a fun way, these machines are serious machines. The ASP machine, for example, is one of the machines we designed that won the ASEAN Climate Impact Innovation Challenge (CIIC). The machine that can carbonize all of rubbish and waste, can turn a big problem (waste) into a big opportunity - namely charcoal which is the basic material for all forms of new renewable energy.

The second engine is even more powerful, if we direct the configuration to Tetragen - it can produce four types of energy at once, namely Cold, Heat, Power and Fuels (CHPF). If we change its internal configuration for carbon capture and utilization (CCU), then it becomes a machine for ultimate energy efficiency and decarbonization which we call OCCYER (Onboard Carbon Cycles for Energy Regeneration).

Insha Allah, we will discuss these machines along with more than 98 other machines in a fun way, as productive year-end entertainment at the Mabid Peradaban 2.0 event, the details of which are here: https://lnkd.in/gp3-gsWP



17. Super Cleaner for Pollution in the Sea, Land and Air

Among the technology sketches that I often share in this media is what we call an Autothermal Slow Pyrolyzer (ASP), the main function of which is to process all types of rubbish and waste except for metal, glass and soil (cement, stone, soil, etc.) . The product is multi-purpose charcoal, which is can be used for energy, agricultural, or cleaning water and air.

As a water and air cleaner, the potential of charcoal is no less interesting than the potential in energy

and agriculture. All pollution in the sea, land and air can be cleaned using this cheap method of charcoal. The sketch below is more or less how it works.

After biomass from rubbish or waste has been carbonized, it is activated into activated carbon (AC) to increase its reactivity by expanding its surface. After this activation, 1 gram of charcoal can have a surface area of more than 4,000 m2 so it becomes very effective as an adsorbent - which will bind contaminants in sea water, liquid waste and even CO2 emissions in the air.

More than that, the character of this AC can be adjusted to suit the target of the contamination it will catch. This character setting process, or what is called functionalization, will be able to create a specific AC for dealing with oil spills at sea, for example, which of course requires different adsorbent characteristics from handling industrial waste in general.

Likewise, if the AC is to be used to capture CO2, apart from setting the functionalization so that the AC can absorb CO2 effectively - we can also control how much CO2 will be captured by each gram of this AC. Even though with special settings 1 gram of AC can capture up to 25 g of CO2, for example, this may not be what is desired if the captured CO2 is immediately used as fuel again.

When CO2 and its adsorbent (AC) are to be used directly for syngas production, for example, what is needed is only an AC that can capture CO2 at maximum of 4 times of the weight of the AC used. This means that even simple activated charcoal is quite effective in capturing CO2 emissions.

So to clean our earth from piles of rubbish, waste, water pollution, oil spills in the sea and even CO2 emissions which are the scourge of global warming and climate change, what is initially needed is only one simple machine - a carbonization machine which we call the ASP carbonizer. All of us can be involved in cleaning this earth, if we want!

18. Fuel Efficiency and Zero Emission

As long as reducing emissions is still seen as a heavy burden that must be borne by all institutions, corporations and industry, the emissions reduction target will be slow - especially in countries where law enforcement is weak. So what we are proposing is to make reducing emissions no longer a target, but as an impact of very significant fuel savings.

Without being forced by law, business and industrial actors will rush to do this voluntarily if they can save fuel significantly. So this is the essence of the Onboard Carbon Cycles for Energy Regeneration (OCCYER) concept.

To make it easier to understand this concept, I have used the sketch below as a model to explain how OCCYER works and the results. I took a boiler as a use case, because on average this boiler consumes a lot of fuel and is used in almost all industries, high-rise buildings for heating, commercial buildings, etc.

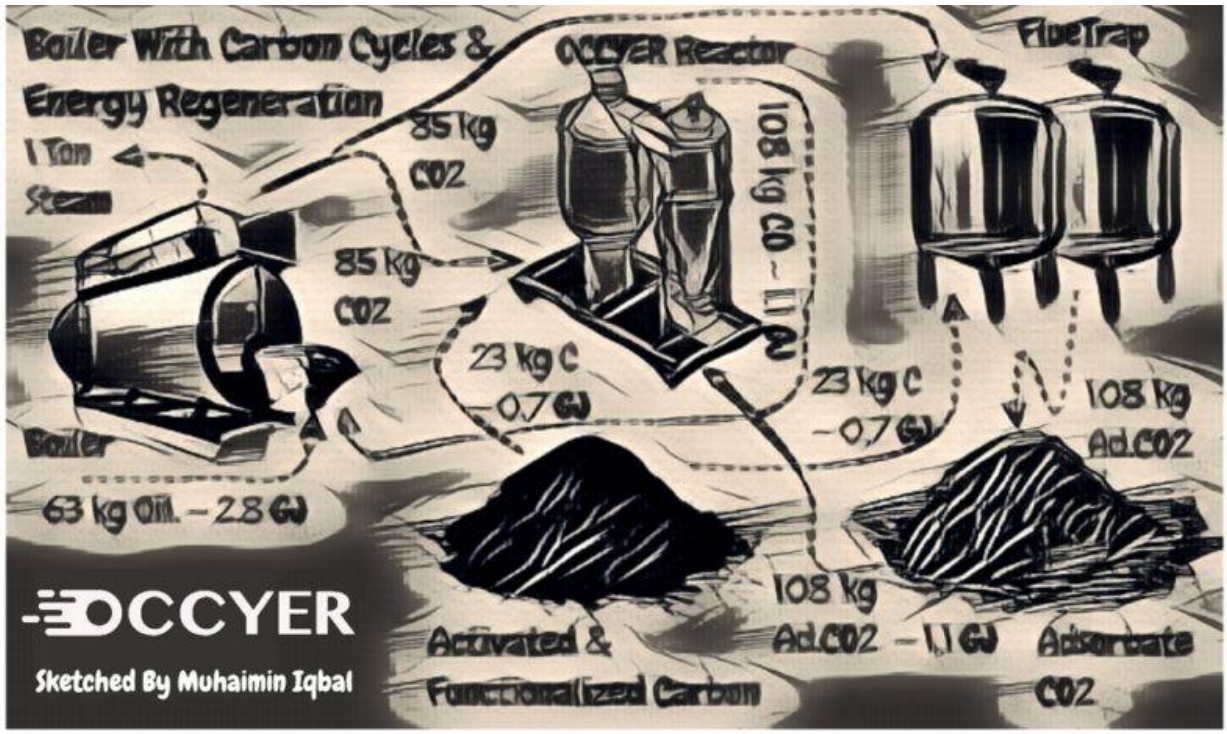
For every 1 ton of steam produced by a boiler, on average it takes 63 kg of oil and will emit around 170 kg of CO2. These CO2 emissions could be captured by the OCCYER system in two ways, the first way is captured using an OCCYER reactor and the CO2 is reacted with activated and functionalized carbon to become CO - which is the main component of a new fuel called synthetic gas or syngas.

The second way, CO2 is captured using another technology that we call FlueTrap. This FlueTrap is a form of passive CO2 capture and operates at STP (Standard Temperature and Pressure), so it is cheap. For this, what is needed is a suitable adsorbent so that carbon capture can be effective and measurable. The result is CO2 adsorbate, namely CO2 that is attached to the adsorbent - and can be reused as fuel in the OCCYER Reactor.

Apart from the OCCYER reactor and FlueTrap, the third component needed in this system is charcoal or carbon which is activated and functionalized in such a way, so that it remains cheap but has multiple uses. It can act as a reactant to convert CO2 into CO in the OCCYER reactor, but it can also act as an adsorbent in the FlueTrap System to bind CO2 into energy reserves that can be stored cheaply to be reused whenever needed.

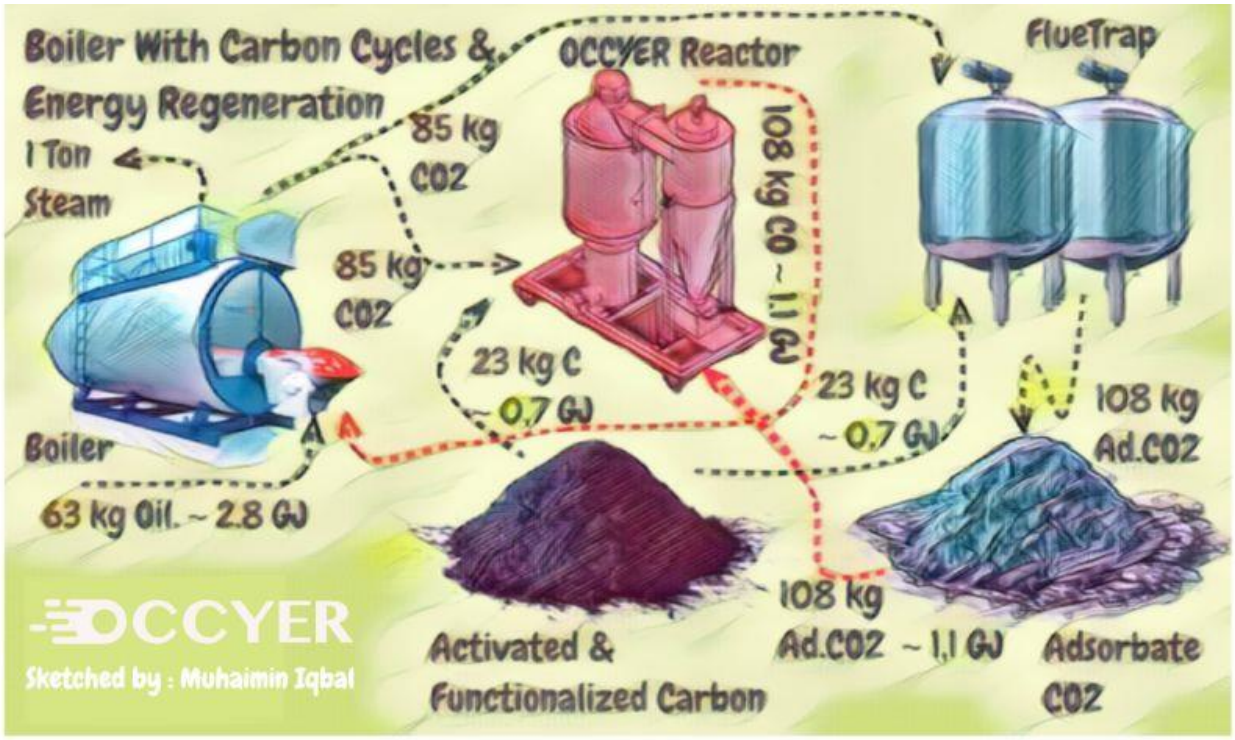
If the two CO2 captures mentioned above are used together to save boiler fuel, around 78% of fuel can be saved. Meanwhile, the impact of implementing OCCYER in the boiler will create a zero emission boiler, because all CO2 emissions are captured and reused as fuel.

We are looking for partners all over the world to produce, market, finance and disseminate this system, so that the world can immediately save energy, and as the impact, the world will also soon be free from increasingly overwhelmed by CO2 emissions. Interested?



19. Fuel Efficiency and Zero Emission - In Color

This is exactly the same as my upload earlier today here: https://lnkd.in/gfzAFxHG , only the sketch was made using a brighter crayon technique, because the one this morning used charcoal painting technique or conte, it wasn't clear enough for technical reference - the numbers.



20. Dedieselization And Decarbonization At Once

Providing energy for this maritime country with more than 17,500 islands is certainly not easy. There are so many islands and remote areas whose electricity needs so far can only be served by Diesel Power Plants (DPP). The problem is that diesel is not cheap, electricity from DPP is the most expensive electricity in terms of fuel.

Diesel replacement with renewable energy sources such as biodiesel from vegetable oil - are not cheaper than diesel from petroleum. Green Diesel or Fischer-Tropsch Diesel can actually be produced from biomass which is always available in this tropical country. However, this requires a fairly long series of processes, so the economics still need to be studied. Likewise, various other energy alternatives such as solar, wind, etc.

Of all the problems mentioned above, the solution I offer could be the most feasible alternative for this program called dedieselization. This solution uses Onboard Carbon Cycles for Energy Regeneration (OCCYER) which I have shared in several previous posts.

The essence of OCCYER is to capture CO2 emissions from it source, then convert some of it directly into new energy in the form of CO (10.5MJ/kg) and the other part as energy reserves in the form of adsorbate - CO2 attached to the carbon adsorbent. The adsorbent and adsorbate in solid form can be a 'storage' for CO2, as well as an energy stock that can be used as fuel in the OCCYER reactor at any time.

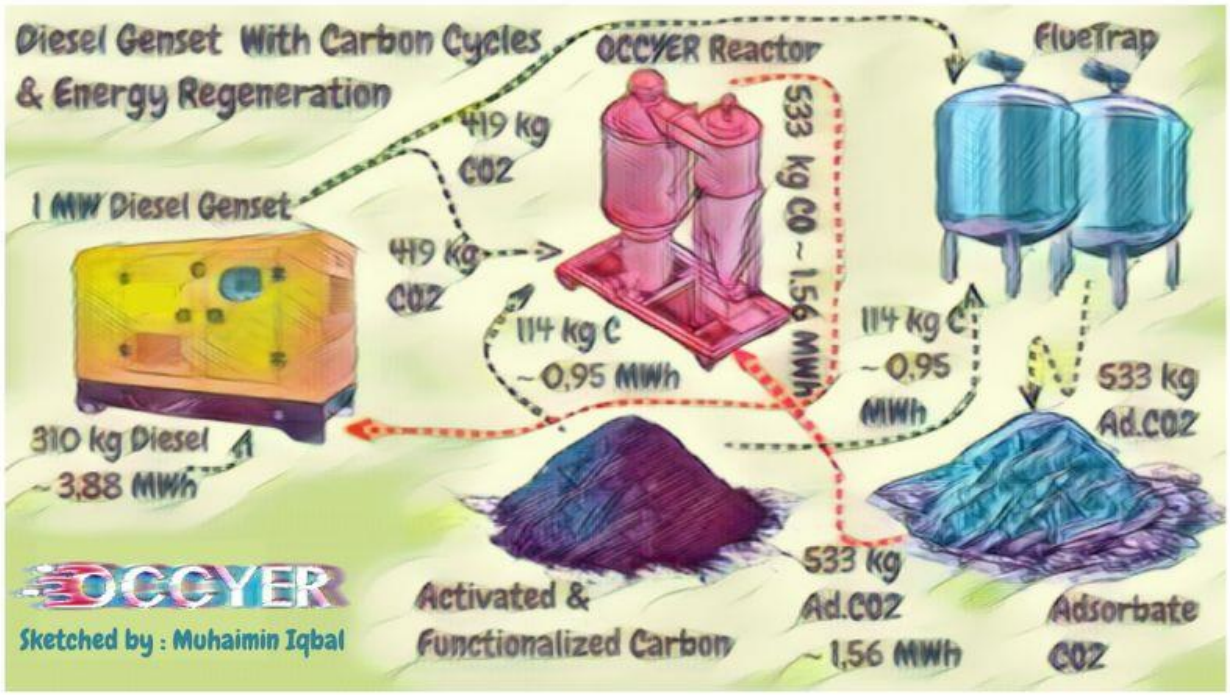
The OCCYER solution consists of 3 components, the OCCYER reactor which functions to capture some of the CO2 as well as being a new energy production machine in the form of CO and H2 or

what is called syngas. The CO comes from the reaction of CO2 with carbon in a reaction called the Boudouart reaction, while the H2 comes from the charcoal used as the CO2 reactant. Standard charcoal has an H2 content of around 5% of the weight of the charcoal.

Second is the FlueTrap to capture CO2 which is not used directly, for this we need an adsorbent which is also made from charcoal. The third is the consumables, namely charcoal which is specially activated and functionalized, so that it can become an effective reactant at high temperatures (in the OCCYRE reactor) and become an adsorbent at normal temperature and pressure in the FlueTrap.

The advantage of the OCCYRE solution is that the raw material is charcoal which can always be produced wherever the DPP is located. Up to 97% of diesel fuel in PDP can be replaced with syngas from OCCYRE, but in the scenario in the sketch below we only replace 80%. This will already be a very cheap and reliable electricity solution for all corners of the country.

More than that, the impact of this enormous diesel savings is that CO2 emissions will become zero, because all CO2 emissions are captured and reused as energy or energy reserves.



21. So That Our Cities Don't Get Hotter and Hotter

Half a century ago we still had cool cities, but now there are almost no cool cities in this country anymore except those that are really on the top of mountains. Cities are becoming hotter and increasingly hot, in part due to the Urban Heat Island (UHI) phenomenon, namely cities that are getting hotter surrounded by suburbs that are still relatively cool.

However, when cities get bigger, the island of Java for example - will soon become one very big city,

then there will no longer be any cool surrounding areas, everything will become UHI. What causes UHI and how to prevent it?

There are two main causes, the first is the density of urban buildings which makes the green belt very, very inadequate - this is because it has become derelict, it is no longer possible to dismantle the city. The second is due to the increasing use of energy, especially air conditioning - because more than 55% of our urban energy is for air conditioning.

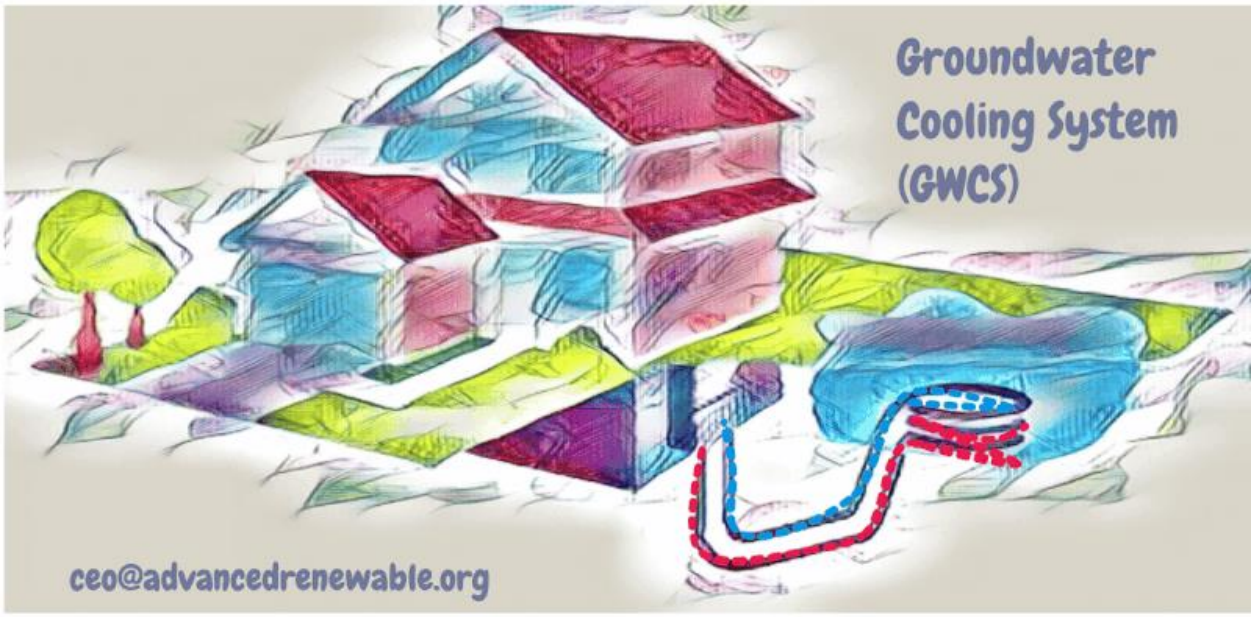
The increase in energy use for conventional air conditioning that we still use in our cities has two impacts on the earth's surface temperature, the first is a global impact - namely through CO2 emissions which increase global warming, and the second is a local one - namely the accumulation of waste heat from all the air conditioners installed in all buildings in the city - this is what together causes the UHI phenomenon.

Cities in developed countries, especially in 4 season countries, have realized this and are starting to shift the use of their cooling and heating systems. They campaign for the use of heat pumps for heating and air conditioning.

The temperature at a depth of about 3 meters from the ground surface is relatively stable throughout the year, this is called shallow geothermal (SG). In winter when the surface temperature is lower than the SG, the room is heated with a heat source from this SG. On the other hand, when the summer surface temperature is higher than the SG, the heat is dissipated into the SG so that the room cools. This is where a heat pump is needed to move heat from or into the room.

When heat is removed from our spaces it means cooling occurs, and in our tropical cities, we don't need heating - what we always need is cooling. Because of this, we cannot use SG - especially in October to April - when the temperature is higher than our average ground surface temperature.

So what's in return for us? It is our groundwater that always has a lower temperature than the ground surface, so in our cities we can also switch to air conditioning using a heat pump which is much more energy efficient and does not cause the UHI effect, by using groundwater as a source of cooling our rooms, so that our cities remain comfortable to live in - and stop heating the earth's surface. The following sketch is a brief overview of how a heat pump works for a Groundwater Cooling System (GWCS).



22. Truly Green EV

If we follow the scenario that the world will reach Net Zero Emissions by 2050 (Indonesia 2060), then the electric car we have bought now will not be truly emission-free until the end of its life. However, if the desire to introduce an electric car is truly strong enough to reduce emissions - not just a marketing gimmick, then our electric car can be truly green right now. For this, what is needed is Green Charging system - Public Electric Vehicle Charging Stations (PEVCS) whose electricity is 100% emission free.

How is this completely green PEVCS built? The following sketch explains it. The first thing we need is an ordinary diesel generator, but the diesel fuel is filled with green diesel (Fischer Tropsch Diesel). If we stop here however, electricity from diesel fuel is generally expensive, definitely less attractive than coal electricity.

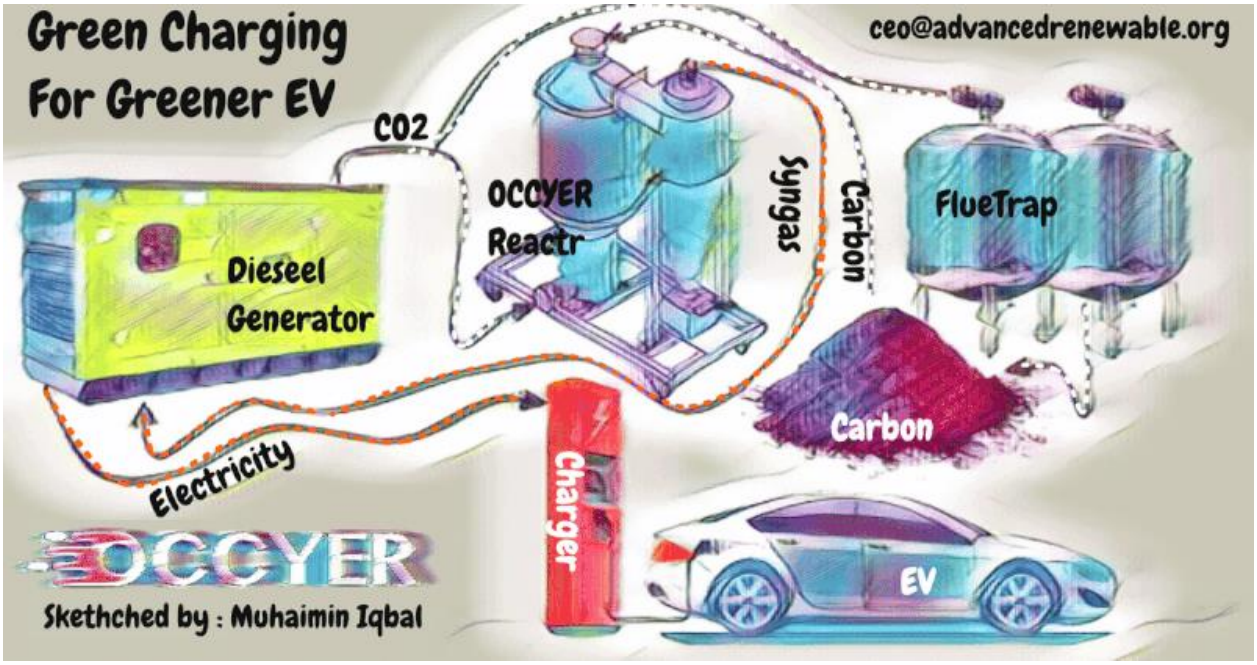
So the next step, CO2 emissions from diesel are captured in two ways, first directly using an OCCYER reactor to be converted into syngas - and the syngas is fed back to the diesel generator to reduce the need for diesel fuel. Second, CO2 are captured using a FlueTrap and the yield is CO2 which is bound to the carbon adsorbent, could be used to produce more syngas whenever needed.

This system is what we call Onboard Carbon Cycles for Energy Regeneration (OCCYER), which can be used to replace the need for diesel fuel with syngas up to 97%. And there is no need to maximize it to 97%, because only 80% of diesel is replaced by syngas product from these carbon cycles - the cost of producing this green electricity will already be cheaper than coal electricity.

With one paddle, two or three islands were passed. CO2 emissions in the transportation sector will soon be reduced, along with extraordinary energy savings. Apart from that, Green Charging is off-grid, does not depend on electricity from the utility company, so it can be provided by the community

wherever it is needed.

Opportunities for startups in the EV ecosystem, renewable energy, carbon capture and utilization, energy efficiency, etc. Your startup can focus on the business model, we provide the technology!



23. Introducing New Commodity : CO2Crude

For countries that do not have their own oil resources and depend on oil imports from other countries, this is good news. Your country will soon be able to have your own oil resources, even better, while mining this new oil - your country will also automatically clean the atmosphere of CO2 pollution.

This new oil mine actually comes from carbon capture, namely all sources of emissions from smokestacks in factories, power plants, and also from ships. In the future, it can even be developed for motorized vehicles that still use Internal Combustion Engines - both petrol and diesel.

The process is not something new, it just needs to be integrated. Initially it was CO2 capture from the chimneys mentioned above, we call the technology FlueTrap - essentially it binds CO2 with a suitable and cheap adsorbent. This captured CO2 is then reacted with carbon (C) in a reactor that we call Onboard Carbon Cycles for Energy Regeneration (OCCYER) to become syngas (CO and H2). FlueTrap and OCCYER are the core technologies we are developing.

Then, after it becomes syngas, it goes to the next process, namely Fischer-Tropsch Synthesis (FTS) to make it into an alkane, namely CnH(2n+2) or alkene CnH2n, both of which are called synthetic crude (syncrude), but because the origin of the C is also from CO2, so we call it CO2Crude - this is the new commodity.

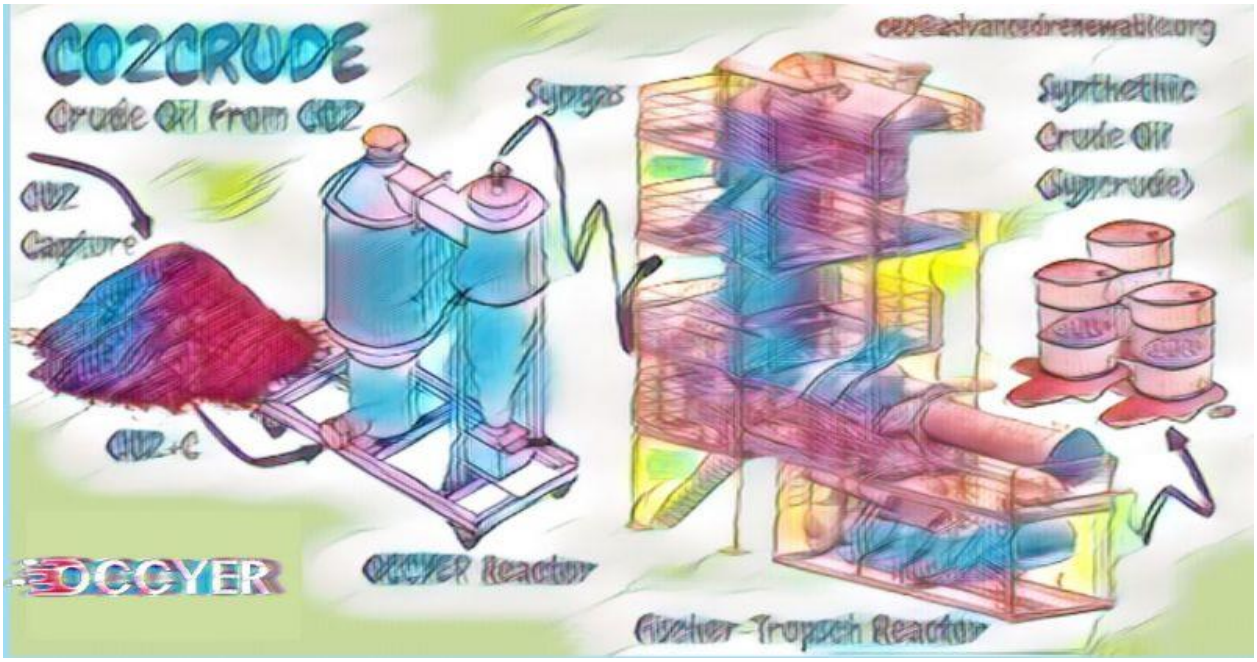
Syncrude or CO2Crude can enter the standard refinery process - which already exists in oil refineries in general, to be converted into diesel, jet-fuel, gasoline, LPG or other chemical products replacing all forms of petrochemical derivative products.

So how big is the potential of this CO2Crude? Very, very big! Each MW of diesel power plant has the potential to produce CO2Crude of around 86 Barrels Per Day (BPD). Those that use coal fuel have even greater potential, around 103 BPD CO2Crude.

CO2 emissions, which have been haunting world economic growth and all kinds of disasters they cause, could actually be the biggest new energy source that is right before our eyes. The technology is also mature technology from the last century.

The carbon capture that we use is an adsorption technique that has been widely used in other industries, the OCCYER reactor operates based on the Boudouard reaction discovered by France scientist - Octave Leopold Boudouard at the end of the 19th century. Meanwhile, the Fischer-Tropsch Synthesis reactor has been used in Germany since World War II.

This potential of CO2Crude can be exploited by anyone who needs new energy or needs to reduce CO2 emissions. Our team is ready to accompany institutions or corporations who want to explore this opportunity.



24. The Broken Cage

Efforts to reduce CO2 emissions in the earth's atmosphere are progressing very slowly, so what is racing fast is global warming and global climate change. This is related to what we call a broken cage. The bird cage should have strong and complete bars, because if even one is broken, the bird will be able to fly through the broken bars.

Likewise, the world's efforts to reduce CO2 emissions, if most countries have done it, but there are one or two large countries that have not done it in a disciplined manner - then the efforts of most of these countries are almost in vain. The CO2 released from one or two large undisciplined countries is enough to pollute the earth's atmosphere again with CO2 released into the air, due to ignorance or weak law enforcement in one or two of these countries. In fact, of the 200 or so countries in the world, it is very likely that there will always be 1% who ignore this.

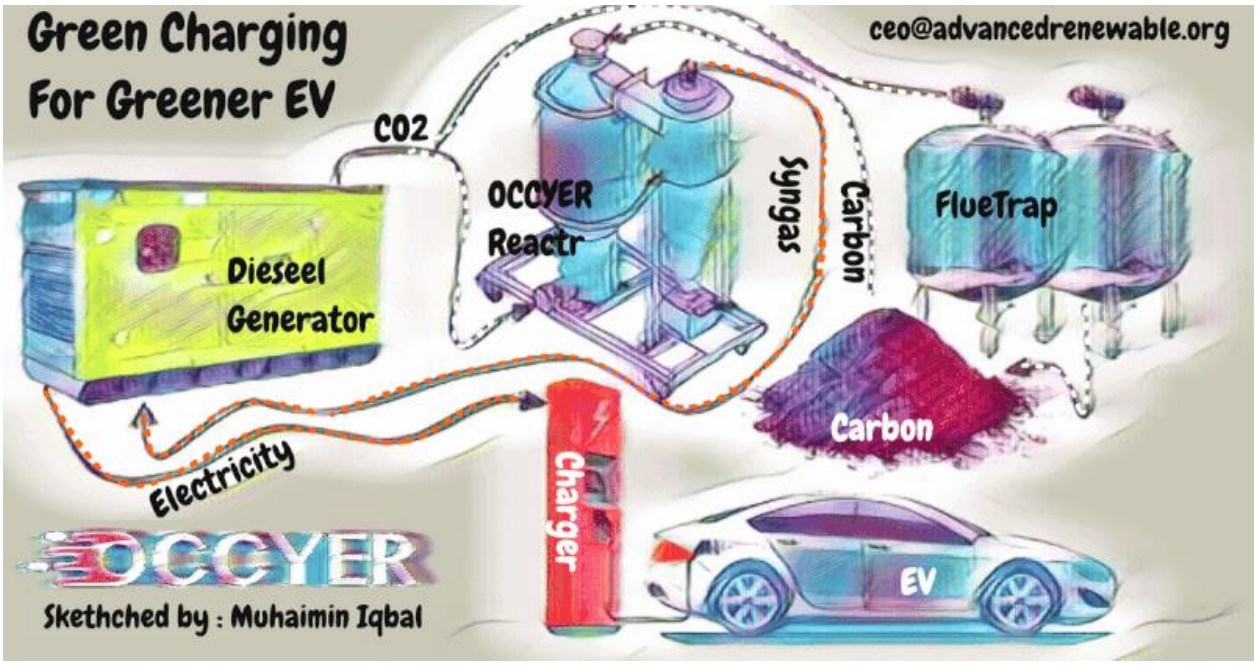
So how can we ensure that the war against CO2 emissions is not like the broken cage? The 'birds' are baited in their cages. With the cage door open even, the 'birds' will come to the cage voluntarily because they are attracted to the food inside.

Thus, we can reduce CO2 emissions by 'feeding' in the cage. If we can capture CO2 emissions, then we can easily circulate them into new fuel that can be continuously used over and over again, then users will immediately get two benefits at once, namely extraordinary fuel savings, as well as the automatic impact of reducing emissions to a lower level, approaching zero emissions - because the CO2 is always captured and reused.

A set of technologies we call Onboard Carbon Cycles for Energy Regeneration (OCCYER) are the 'bait' in the cage mentioned above. If with this OCCYER the industrial players who use it can be very competitive with its cost leadership, the fuel is so cheap, so that the products can compete in the global market, then without a perfect 'cage' law enforcement even, industrial players will compete the race itself to pursue this cost leadership - the impact of which is a reduction in CO2 emissions.

What about industries that don't want to use it? they will lose themselves. When competitors can reduce their production costs with extraordinary fuel savings, so that their products become cheap, people will automatically abandon the same products that are still expensive. Industries that cannot compete will die by themselves.

I have explained the technical workings of OCCYER in a number of previous uploads, while this upload is a philosophical explanation - which I hope can be used to explain easily to stakeholders, potential users of this technology.

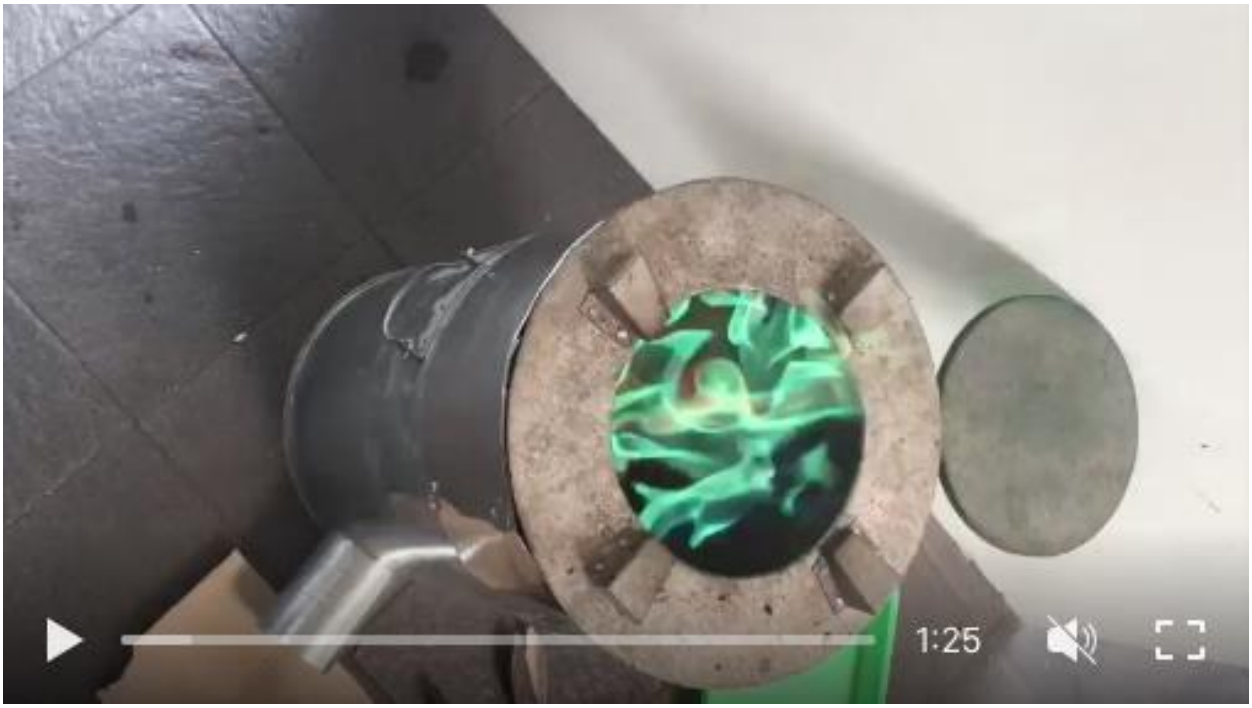


25. The Super Fire Burner

Among the various types of stoves and burners that we make, this one is the most powerful in producing very high heat energy in a very short time. So we call this burner the Super Fire Burner.

The technique we use is a combination of gasification and direct combustion. The fuel used is biomass charcoal - from any biomass, the one in the tube of the burner is gasified while the one in the bin is for direct combustion.

With this technique, the high temperature we need for the carbonization machine - which requires a temperature of 500 degrees Celsius, can be achieved in less than 2 minutes from the time the burner is on. Temperatures much higher than this are possible, so for those of you who need high heat energy with cheap materials - namely charcoal/biomass, you can order this Super Fire Burner already.



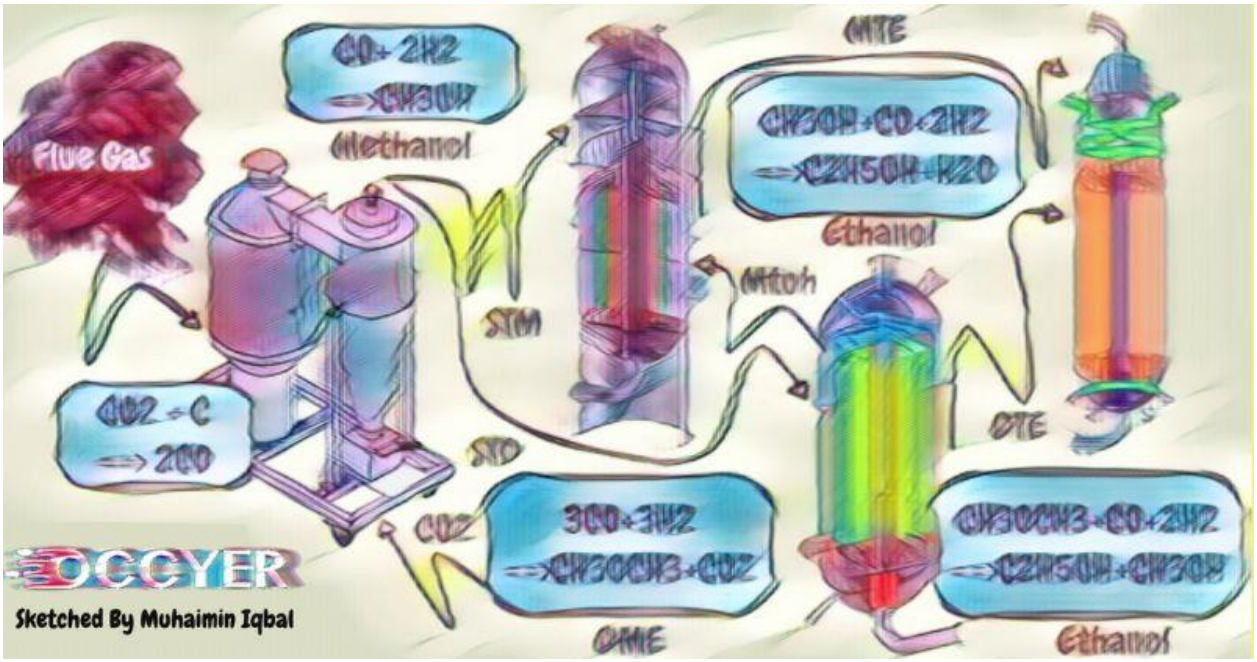
26. Oxygenates Trilogy for Carbon-Free Fuel

There are three types of oxygenated fuels or what are called oxygenates, which are similar to each other, namely methanol, DME and ethanol. All three can be born by the same mother, namely CO2 captured by our FlueTrap technology. All three can fill each other's need for substitute fuel for petrol and diesel.

Methanol and DME are even like twins, DME can be obtained from drying methanol, or conversely, methanol can be obtained from hydration of DME, while ethanol can be produced from both. All three can even be used as effective hydrogen carriers, to provide carbon-free fuel more cheaply.

When all three are used as hydrogen carriers, the reforming process will release CO2, and this CO2 is also captured and reprocessed to become new oxygenates, and so on so that carbon can be circulated continuously without having to emit emissions into the earth's atmosphere.

The process of capturing CO2 (with FlueTrap), gasifying it into syngas (CO and H2), then into methanol, DME and Ethanol is what we use as the starting point for the birth of carbon-free fuel, namely hydrogen which is cheaper in terms of production and distribution. The reforming process of the three into hydrogen, inshaAllah, will be uploaded separately.



27. Technology Inspiration For Prophet Sulaiman's Vehicle

When Allah ended the most beautiful story in the Qur'an, namely the Story of Prophet Yusuf Alaihi Salam, All called it is not a made-up story, but a guide for believers: "Indeed, in their stories there is a lesson for people who have reason. It (the Qur'an) is not a fabricated story, but justifies the previous (books), explains everything, and (as) guidance and mercy for the believers." (QS 12:111)

And so are the other stories that are in the same book, all of them are a guide for those who have reason (Ulil Albab) and those who believe in His books, not only in the Qur'an, but also in the books revealed to previous Prophets.

Based on this principle, the stories can be a source of information and inspiration for everything, including to answer the challenges of current problems. I take the problem of congestion-free and emission-free transportation for example, we can take inspiration from the story of the Prophet Sulaiman Alaihi Salam (QS 34:12).

Sulaiman was given a very fast vehicle, half a day's journey was equal to a month's journey for other vehicles in his time. This vehicle is in the form of wind! Well, if we use the vehicle of Prophet Sulaiman as an inspiration for the birth of the current mode of transportation, with the most cutting-edge technology at the moment, what does this vehicle of Prophet Suaiman look like? Here is a sketch of the technology as a result of my scribbles.

I will combine the 'wind' technology that is commonly used in Wing In Ground Effect (WIGE) and Venturi Effect (VE) vehicles - this VE is already used for the AEROMINE wind generator turbine without a windmill. The result is what I call the Wing In Ground and Venturi Effect (WIGVE).

The WIGE works so that the vehicle can run very fastly by flying low - about half of its wingspan, while the VE is to generate electricity while it's on the run. While the main engine uses electricity from Direct Carbon Fuel Cells (DCFCs) Inspiration QS 36:80, whose carbon emissions are captured and electrolysed to become new fuel (Carbon). For this, electricity is needed, so electricity from the VE is used.

In this way, the vehicle will be able to run very fast and almost without the need for fuel anymore, because the carbon used in DCFCs-even the emissions are recovered into new energy with the system that I have introduced before, which is what I call Onboard Carbon Cycles for Energy Regeneration (OCCYER) - Inspiration from QS 30:27.

I know some people in other parts of the world who can make it happen technology like this, but if you are also interested in joining and making it happen, please join!

28. Wind Powered Vehicles and Beyond

Inspired by the vehicle of Prophet Sulaiman AS which used wind, yesterday I have shared here a Wing In Ground Effect (WIGE) type vehicle which can be designed to use wind power and Direct Carbon Fuel Cells (DCFCs) hybrid (https://lnkd.in/gyNa -Kqd).

The same thing can also be done for land vehicles, still hybrid to compensate for the weaknesses of each energy source. If it is made new, the concept is more or less like in the sketch below. DCFCs to power the vehicle when it is static or moving slowly in traffic jams.

When the vehicle is moving fast, its tail which is designed in such a way will cause a low pressure

effect according to Bernoulli's law. This low pressure will suck in air from another source, pass through the turbine and produce electricity. Electricity can be stored or used directly to power vehicles. In this second mode, carbon for DCFCs is easier to store and cheaper than storing electricity.

Because the position of the turbine does not directly block the air flow from the front of the vehicle along the way to its tail, the presence of this turbine does not interfere with the vehicle's aerodynamics. The vehicle can still go as fast as it can and at the same time electricity is produced by manipulating air flow with a combination of Bernoulli's law and the Venturi effect.

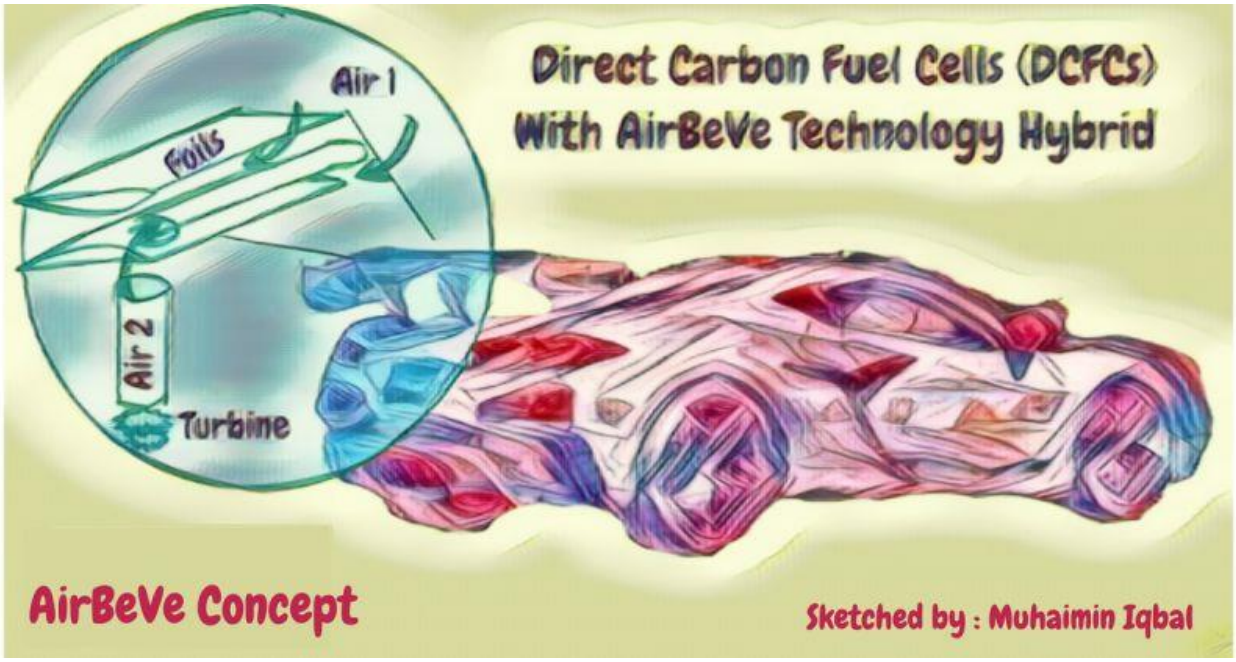
The system that we introduced as AirBeVe (Beyond Vehicle) essentially utilizes the wind that arises around the vehicle when the vehicle is moving quite fast. Not only can it be used for electric and hybrid vehicles, it can even be used for internal combustion engine (ICE) vehicles, both petrol and diesel.

It's just that for ICE vehicles, AirBeVe does not function to provide power, but rather to clean CO2 emissions. The electricity produced by AirBeVe is used to electrolyze CO2 into O2 (clean air) and pure Carbon - which is a multi-purpose fuel that can be used outside of vehicles, this is where we introduced the term BeVe or Beyond Vehicle.

So for those who still use ICE cars like me, the opportunity to help clean the earth's atmosphere from CO2 pollution is no less than for those who already use electric cars. Even our ICE cars will continue to produce energy in the form of pure carbon every time we use them - if the car has AirBeVe installed in it. InshaAllah.

29. AirBeVe - Beyond Vehicle

Just clearer sketch from previous sharing here : https://lnkd.in/gjWR-dtE



30. A New Perspective on Wind Power

One renewable energy that will always exist on earth is wind. Unfortunately, with the current technology - the wind on our land has an average speed of 3 m/s or 10.8 km/hour, it is not yet economical to mine as a renewable energy source.

So wind power generation with current technology is only feasible for coastal areas or other areas that have wind speeds around twice that on our land. Or if done on land, you need a high place such as the roof of a high-rise building to get sufficient wind speed.

This is the current technology as is today, namely a wind power plant that stays in one place, it is passive and just depend on whatever the speed of the wind that comes to it. What if we make the wind power plant mobile?

This is what I call a new perspective, when we place a power generator on our car, for example, the speed will be the sum of our car speed plus the wind speed - if the car is in the opposite direction to the wind. Or equal to the speed of the car minus the wind speed - if the direction of the car is in the same direction as the wind.

Because the power produced by a wind power plant is a function of the cube of the wind speed, then when the wind speed becomes ten times, the power produced is 1,000 times. If the wind speed is

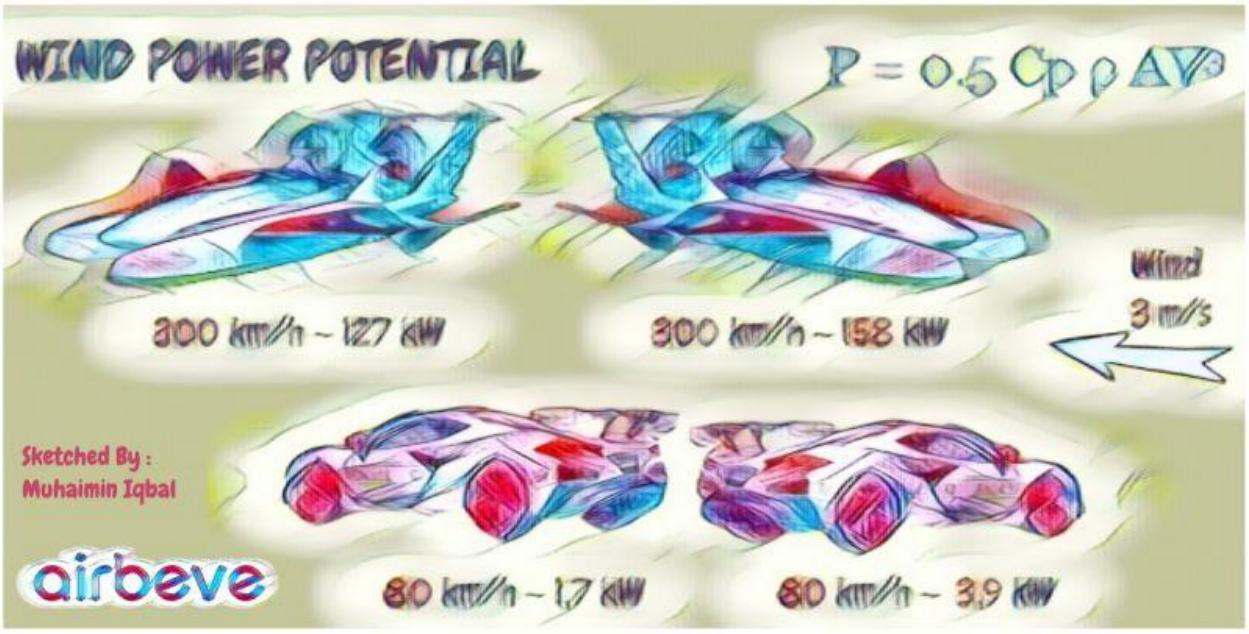
100 times greater, the power produced will be 1,000,000 times greater!

The illustration in the sketch below shows an example of the calculation for each m2 of vehicle cross-section (A) used. If our car is traveling at an average of 80 km/hour and in the direction of the wind, the potential electrical energy is only around 1.7 kW, if it goes against the wind it will increase to 3.9 kW.

But if we put the same generator in 'Prophet Sulaiman's vehicle' which is reconstructed with current technology to become the Wing In Ground and Venturi Effect (WIGVE), when it flies 300 km/hour in the direction of the wind, the potential electricity produced is 127 kW per m2 cross section which is used to catch the wind. Even further when it flies against the wind, the potential will be even greater, namely 158 kW per m2 cross section.

The challenge is just to arrange so that the cross-section used to catch the wind does not affect the aerodynamics of the vehicle. And this can be overcome with the Bernoulli Equation (BE) and Venturi Effect (VE), that's why we introduced this system under the name AirBeVe - air flow managed with BE and VE.

Also means Beyond Vehicle (BeVe), because with the excess electricity produced by 'Prophet Sulaiman's vehicle' it could not only provide enough energy for itself, but it also became a flying power generator - the excess electricity could be downloaded for other purposes when it land!



31. Future Hybrid Vehicles : REEHA

Future hybrid vehicles could need almost no fuel - because it will be so economical. Inspired by the vehicle of Prophet Sulaiman Alaihi Salam, we call the vehicle REEHA which in Arabic means wind,

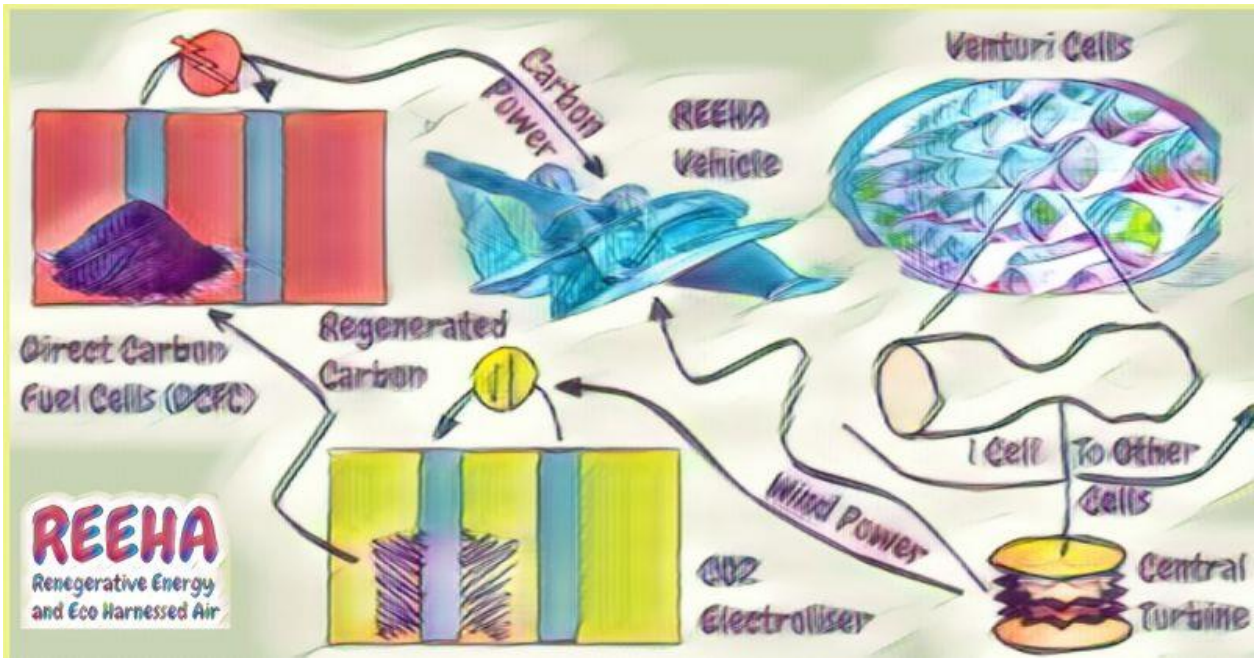
but it is also an abbreviation for the two energies it uses, namely Regenerative Energy (RE) and Eco Harnessed Air (EHA) - wind captured using environmentally friendly methods, and Oxygen released by the RE.

At the start of the engine and in the idle position, REEHA uses electrical energy produced from Direct Carbon Fuel Cells (DCFC). Once the vehicle flies fast, the wind passing through its fins is converted into electricity using a wind turbine. This turbine is under the vehicle and does not face the direction of the wind, so it does not interfere with the vehicle's aerodynamics.

The wind from the front of the vehicle is passed through a group of cells, each of which is in the form of a Venturi tube, so that the wind coming from the front is passed through the Venturi tube without any obstacles to reach the rear of the vehicle. The low pressure that arises in the middle of the Venturi tube - which is the constrained part - of each cell together will suck air from the turbine below very strongly, from here the turbine rotates and produces electricity.

The electricity produced from the turbine is used for two things, namely to power the vehicle directly while it is flying, and secondly for the electrolysis of CO2 produced by the DCFC. The results of this electrolysis are oxygen which is released into the air, and the accumulation of solid carbon - which is stored as fuel reserves for the DCFC.

So electrical energy only needs to be stored just enough to start the vehicle, the rest of the energy is stored in the form of carbon. The majority of the vehicle's energy when it is flying is from an electric turbine driven by air that is suck in by Venturi cells - which are a collection of Venturi tubes spread throughout a number of parts of the vehicle's body.



32. The Wind That Brings Good News

In the midst of the world energy crisis - energy prices are not getting cheaper, and it is not getting cleaner as suggested in SDG target number 7 - Affordable Clean Energy, there is actually good news. The news say: "And among His verses is that He sends the wind as a bearer of good news and so that you may experience some of His blessing and so that ships can sail by His command and so that you can seek some of His bounty , and that you may be grateful." (QS 30:46)

The wind that Allah revealed in Quran 14 centuries ago still exists today and will continue to exist as long as the earth rotates, so the characteristics of the wind mentioned above are the same. That it is the bearer of good news, it is His blessing, It is the source of energy for transportation, it is the means to seek sustenance and for that we must continue to be grateful.

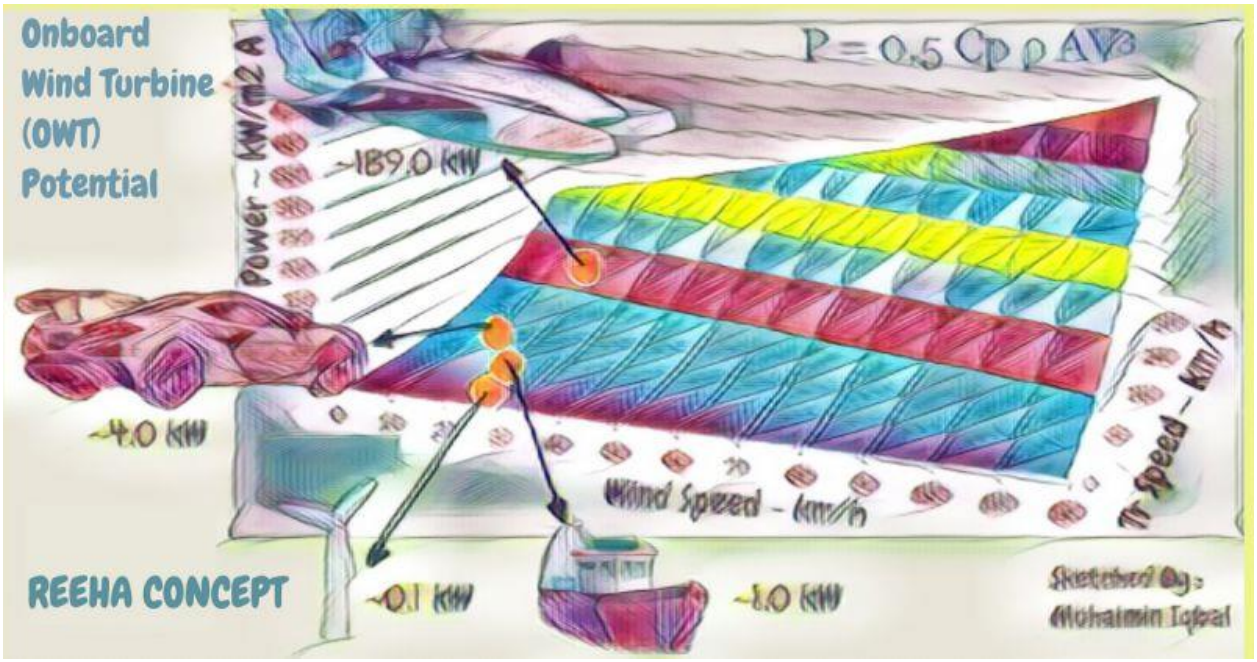
So why is it that we are not utilizing this clear, sustainable and clean energy source at this time? Even our ancestors from this maritime country were smarter in using it for sailing. The key here is also mentioned in the verse above - that wind energy is for sailing!

Of course the 'sailing' can be actualized differently according to each era. In the days of our ancestors, sailors could sail anywhere with their cleverness in controlling sailing ships. In this age of super-sophisticated technology, 'ship sails' which can be different, can be much more effective, and even though our 'ship' uses wind energy - our sailing does not have to follow the direction of the wind, going against the wind should be no problem either.

This is where technological solutions are needed that are appropriate to this era, the sails must be sophisticated - able to capture the wind optimally from any direction, and at the same time be able to decouple the direction of the ship from the direction of the wind. So the 'sails' that we are currently developing is a collection of very many small venturi tubes which we call Venturi Cells (VC).

VC which resembles fish scales can be placed on any part of our 'ship' which can also be any vehicle, whether on land, sea or air. Fish scales are never an obstacle to fish travel in the water - they actually make it easier, this is also the function of this VC - it can capture wind optimally but does not affect the aerodynamics of our vehicle - instead it improves it.

Based on the sketch below, we can estimate the energy that we can mine with this VC, with two variables, namely wind speed and the speed at which our 'ship' sails. Because the energy produced is a cubed function of the combination of these two speeds, that is where the importance of utilizing this wind for 'sailing ships' lies. You can see the respective energy produced by the 4 examples of VC applications in the sketch below, the faster the 'ship sails', the higher the energy that can be mined.



33. Introducing Regenerative Fuels

In the world of energy, the term Regenerative Energy (RE) is known, especially for electrical energy. Like in electric cars or electric trains, when the car or train is in the process of braking - the rotation of the wheels is used to re-generate electricity - which is then stored in the battery for the car or returned to the electrical network via pantographs for the train.

What about internal combustion engine cars, ships, industrial/commercial boilers, diesel power plants etc., is it possible to present the same concept, so that the use of fuels such as petrol, diesel, heating oil, industrial fuels, marine fuels etc. can be very economical? InshaAllah, we can.

Different with electricity, where the regeneration process is easier because the motor and generator can be the same machine whose function reversed, the process of producing Regenerative Fuels (RF) is more complicated. When petrol or diesel is burned, the results are heat, power and CO2 - which is most likely to be turned back into petrol or diesel? Our choice is in the CO2.

We can capture CO2 and process it directly into new fuel, namely syngas (CO and H2). This requires a special reactor to react CO2+C into 2CO - which is the main element of syngas. For the reactant we need C which can be taken from any biomass/charcoal.

Syngas can be used directly to replace petrol, diesel, marine fuel, industrial fuels, etc. However, when we manage to capture all the CO2 emissions again, there will be an accumulation of carbon in this system, a nice problem to have though - we just need to solve what the CO2 accumulation is for?

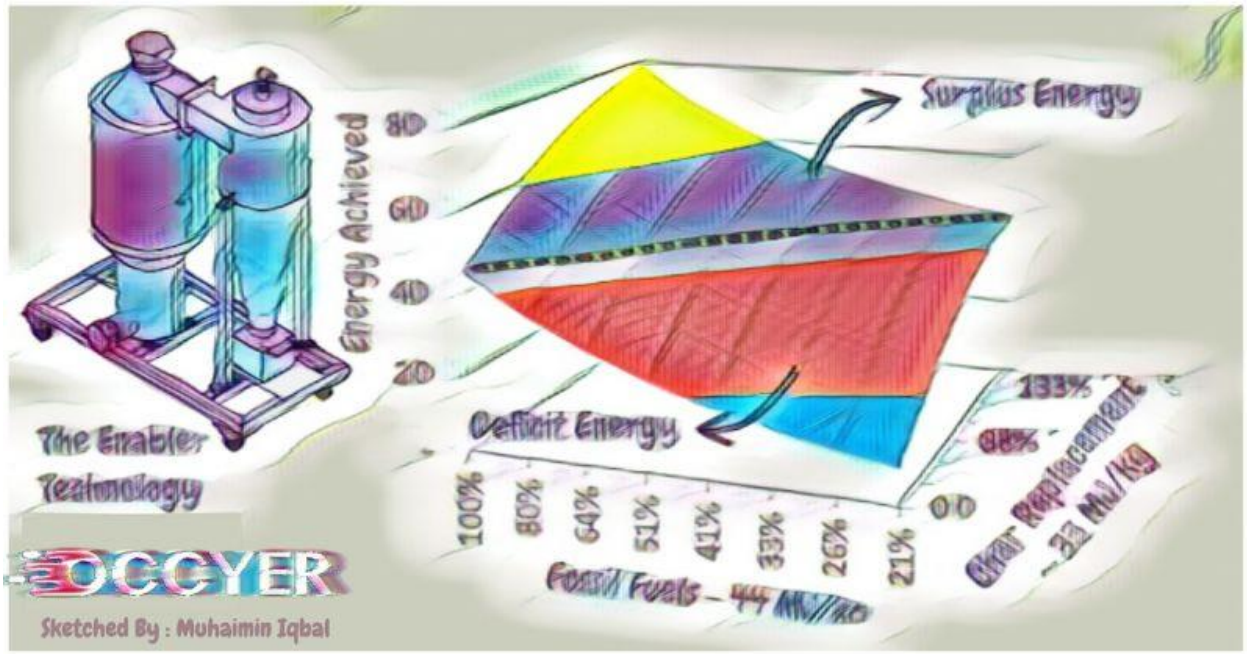
CO2 can be 'bound' with adsorbents that are cheap and easy to logistics, such as activated charcoal

with special functionalization. The combination of adsorbent and adsorbate (CO2) can be used as the next syngas producer.

Or if desired, the RF really returns to the original fuel, the one from petrol goes back to petrol, the one from diesel goes back to diesel, etc. This can also be done, namely after the CO2 is processed into syngas with the OCCYER reactor, the H2 content is increased through the Water Gas Shift (WGS) Reactor, then entered the Fischer-Tropsch Synthesis (FTS) Reactor, then cracking and distillation to become fuel exactly as before.

Due to the length of this last process, we prefer to use a combination of the first and second processes, namely the OCCYER reactor to make syngas directly, and the CO2 that needs to be stored for the next syngas raw material can simply be captured with the appropriate reactant using FlueTrap technology, which we have builded the prototype also.

As a result, with this RF we will not only save energy very significantly, but will also automatically reduce CO2 emissions to close to zero emissions!



34. Regenerative Fuels for New Energy Security

Even without a war crisis, energy would not be more available and affordable, especially now that war hot spots are popping up everywhere. Before Ukraine was finished, Gaza appeared and then the Red Sea. So now every country, region, institution and corporation absolutely needs to immediately review its energy security strategy, not only to ensure its availability and affordability - but as far as possible also to remain in line with its net-zero emission target.

The good news is that the potential source of the greatest energy security is very likely already

within our eyes, so all we need to do is open our eyes and just think - then we will be able to see it very clearly. We call this enormous new potential as Regenerative Fuels - as I introduced yesterday here, https://lnkd.in/gBFJ9ucm

This post serves to clarify how your institution or corporation can build your own energy security - you don't have to wait for local government policy, because generally government policy is not as responsive to problems that can suddenly arise at any time.

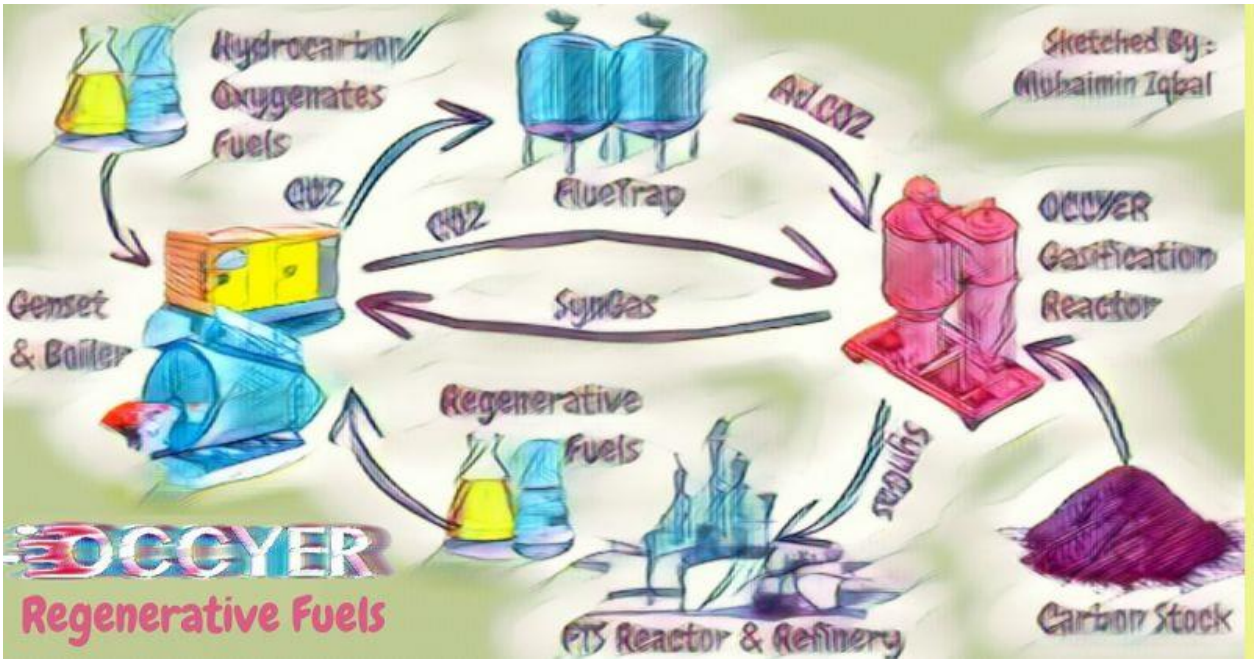
Our technology that is most ready at the moment is for static energy machines such as generators and boilers. The emissions from these two types of machines can be directly captured with the two machines we made, namely the FlueTrap and the OCCYER reactor. FlueTrap functions to 'capture and bind' CO2 emissions with adsorbent, so that it can be used as new fuel at any time.

Meanwhile, the OCCYER reactor can directly process CO2 emissions from generators or boilers to become syngas. Likewise, the CO2 bound to the adsorbent output from the FlueTrap also requires this OCCYER reactor to convert it into syngas. Syngas is an example of a Regenerative Fuels that is the simplest and easiest to produce, but can be a substitute for all types of fuel already.

Whether the fuel is in the form of hydrocarbons such as diesel, gasoline and LPG, or in the form of oxygenates such as ethanol, methanol and DME, all combustion waste in the form of CO2 can be captured and reused for the production of syngas as Regenerative Fuels, and the same syngas can be used directly to replace the original fuels.

The carbon reserves collected in this system which we call OCCYER (Onboard Carbon Cycles for Energy Regeneration) can always be easily processed using the OCCYER reactor to become syngas again. In fact, if desired, this syngas can also be processed into fuel that is exactly the same as the original one through a series of Fisher-Tropsch Synthesis (FTS) reactors and refineries.

The time is now to build energy security for your own institution or corporation, as a form of anticipation of increasingly uncertain global geopolitics. While saving energy, it also reduces emissions. CO2, which was previously considered as source of problems, has now become a source of solutions!



35. Future Wind Power

A few days ago I uploaded the potential of wind power, if the wind power plant moves, (https://lnkd.in/gCExwvGJ), it can be installed on vehicles, ships and even planes. However, for this you cannot use the concept of a wind turbine that blocks the wind like the current wind turbines, because it will affect the aerodynamics of the vehicle.

Instead, wind speed is captured with what we call Venturi Cells - a large number of venturi tubes that can be mounted towards the front of the vehicle - but without inhibiting the speed of the oncoming wind. The low pressure in the constrained section of the venturi tube will suck in air and produce power from a turbine that can be placed in any part of the vehicle - which does not interfere with the vehicle's aerodynamics.

This is the first test of how Venturi Cells work as a basis for further development.

36. Regenerative Energy Philosophy

After The Creator created this earth in two days, He then created its contents in four days (QS 41:9-10). So with this, He has provided all the needs of the people of the earth very adequately, if only we use them with His guidance.

This guidance is spread in His words in the Qur'an and also in previous books, but also in His verses which are attached to every object and event (QS 3:190), or it can also be in both - namely written in His book and attached to the object or event.

Examples of both of these like in trees, He mentions trees a lot in His book. A good tree, for example, is said to have strong roots, its branches reach to the sky and bear fruit all the time with His permission (QS 14: 24-25).

It is with the fruit of these trees and plants that humans throughout the earth, from the time Adam and Eve were the only two on this earth to the 8 billion inhabitants of the earth today - all of them can still eat. Even the fruit we eat contains seeds that can grow into new trees, as well as from other seeds - some of which we eat and some to grow new plants or crops.

The process of growing new trees and plants is called the regeneration process, the adjective attached to objects that can grow is called regenerative. So when we use it as an energy concept, it becomes regenerative energy, meaning energy that is able to grow to always be able to meet the needs of humans who need it.

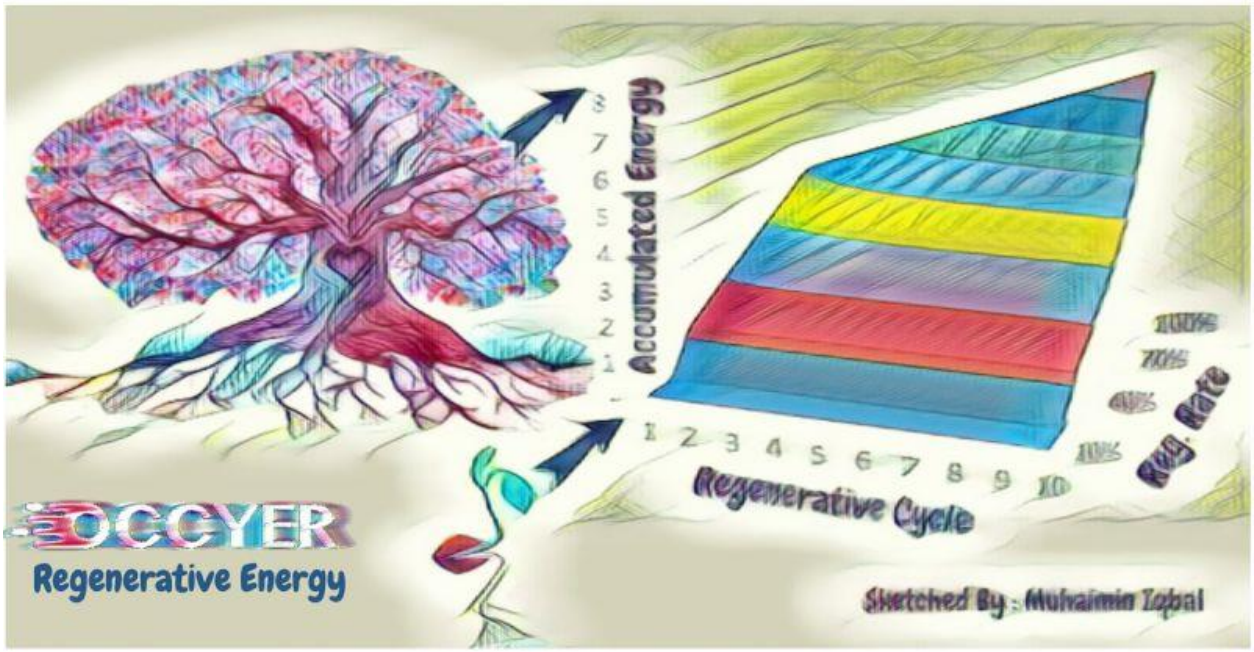
Current energy supplies and usages are disposable, no matter how much energy sources there are,

it will definitely run out due to rapidly accelerating human needs, both per capita needs and accumulative needs due to the continued increase in the number of inhabitants on this earth.

If trees and plants undergo a regeneration process with their seeds, with what energy can they always be regenerated? With their elements, which only changing form when the energy is used, the law of conservation of energy states that energy cannot be created nor destroyed, it only changes form.

So if we can master this change in energy form, we will always be able to 'grow' new energy. What we have developed is that when fuel is burned, the waste that haunts the world is CO2. However, it is precisely from this CO2 that we can 'grow' new energy. When CO2 is reacted with C, it will become 2CO, this CO is the main component of syngas - and it is the new 'seed' of new energy - which can grow into whatever energy or fuel we need.

With this regenerative energy concept, even countries or communities with limited energy sources will always be able to meet their energy needs, all that is needed is to 'replant' their CO2 waste. For this, a number of technologies are needed, and we already have this ready with the OCCYER reactor, FlueTrap etc. all of which I have shared in a number of previous uploads in this media.



37. CO2 Regenerative Energy (CO2RE)

This civilization's biggest problem could very well be the source of its own solution. This problem is CO2 emissions which are the cause of global warming, climate change and disaster after disaster. Meanwhile, the solution which also comes from CO2 itself is Regenerative Energy, so we call this solution CO2RE, Regenerative Energy which comes from CO2.

Any type of fuel can be produced from CO2, but there is an initial process which is the key - namely converting CO2 into CO first, this CO together with H2 are the main components that form synthetic gas or syngas. The process is called gasification, and can be carried out directly at the emission source with a reactor that we call Onboard Carbon Cycles for Energy Regeneration (OCCYER). If done at a different place/time than the emissions, the CO2 emissions must be captured first using another technology which we call FlueTrap.

After becoming syngas, it is a building block for all types of fuel, besides that, syngas is also a fuel that can be directly used as a substitute for diesel, petrol or LPG. However, syngas can also be reconstituted into more complex fuels, either from oxygenates, namely fuels containing oxygen such as methanol, ethanol and DME, it can also become hydrocarbons such as diesel, jet-fuel, gasoline and LPG, and it can even become The carbon-free fuel, which is hydrogen.

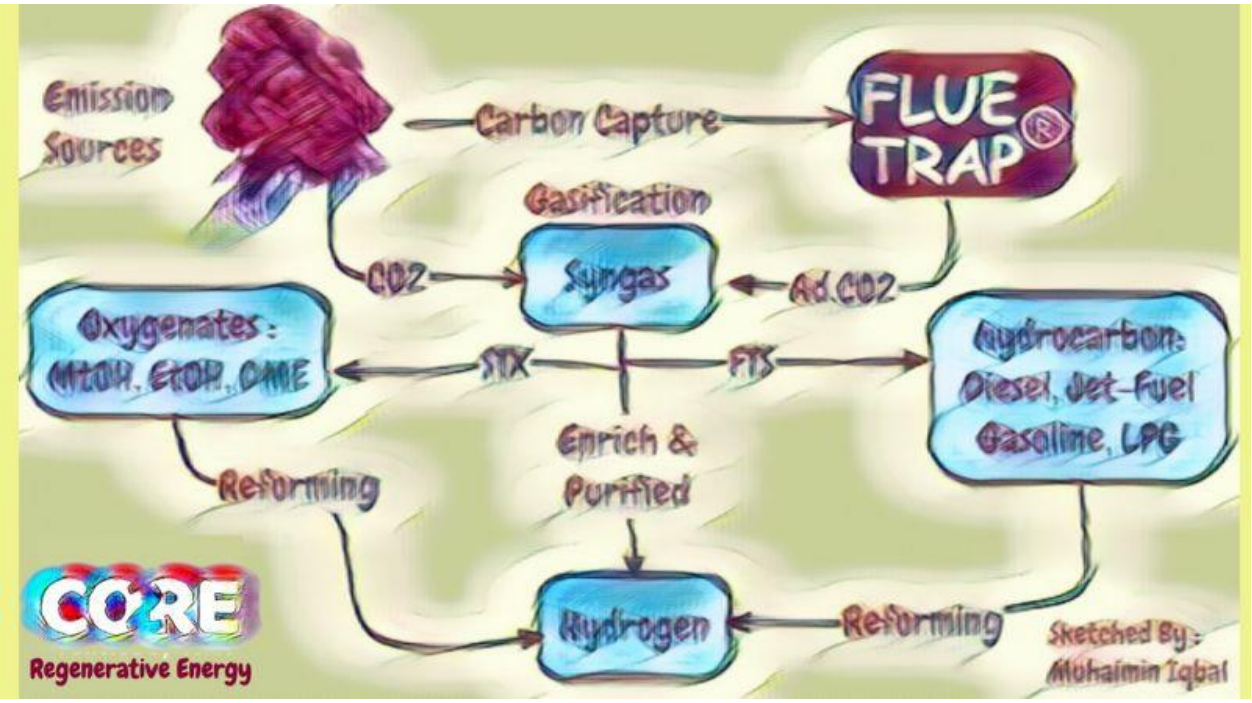
The process from syngas to oxygenates we call STX - Syngas to X, X becomes M when the desired product is methanol, E when the desired product is Ethanol and D when the desired product is DME.

Meanwhile, the most likely route from syngas to hydrocarbons is via the Fischer-Tropsch Synthesis (FTS) route. By setting the appropriate catalyst, temperature and residence time, the FTS reactor can be directed to produce diesel, jet-fuel, gasoline and LPG.

Furthermore, syngas can also be processed into the cleanest fuel which is the world's idol, namely hydrogen. Hydrogen can be obtained in at least three ways from syngas. The first way is that syngas which is rich in CO and poor in H2, is first enriched in hydrogen at the expense of CO through a process called Water Gas Shift (WGS), after it becomes syngas which is rich in H2 it is then purified from other elements.

Hydrogen can also be obtained through reforming both from oxygenates and hydrocarbon fuels. Even though this road is a long winding road, it can be more profitable because the logistics of oxygenates and hydrocarbons is much cheaper than direct hydrogen which requires very high pressure or very low temperatures for logistics - either way it is very expensive logistic.

CO2RE's technology is relatively mature, the only new ones are the key technologies that I called OCCYER and FlueTrap above, the rest are many other people that have made them ready on the market. Indeed, with difficulty there is ease!



38. Night in the Remote

Until now, diesel is still the mainstay for various energy needs on islands and remote areas. The problem is that diesel is the most expensive fuel for producing electricity, my calculation is that the cost of producing electricity from diesel can be 5-7 times the selling price of electricity - depending on how far away and how difficult the area that needs this diesel.

Other energy sources such as solar are difficult to rely on in areas where there are lots of clouds, while wind and geothermal are not always available in areas that need them. Likewise, tidal energy from sea tides should be abundant in this archipelagic country, which covers almost 3/4 of its territory by sea, but it is not yet ready to be utilized. So what's the solution?

The most likely thing is to use regenerative energy, namely energy that is 'regrown' from any fuel that has been used in the area or island. If the existing power generating engine is a diesel generator, for example, then the most sensible thing is to utilize the existing infrastructure, only the emissions from burning the diesel are fully captured and gasified.

After becoming syngas, the new fuel in the form of syngas is then re-used by the existing diesel generator. If all CO2 emissions can be recovered and converted into syngas again, the need for external fuel in the form of diesel will drop drastically, the accumulation of carbon ready to be used as fuel will continue to increase over time as diesel and carbon from local biomass charcoal are added, meaning over time this area will have an energy surplus - it can add new generators if needed.

This is the concept of regenerative energy, fuel is not used up once but can be 'planted' again to

become fuel for the next energy need. CO2 does not fly into space to pollute the earth's atmosphere, but it is converted into syngas - which is cheap, ready-to-use energy, because the raw material is from our own emissions.

Regenerative energy in the form of syngas is not only used for diesel generators, it can also be used for diesel used for fishing boats and transportation vessels, so that even the most remote islands will always be able to grow their own economy.

Thousands of islands are still dark at night or still have 'on-off' electricity because the diesel supply to the islands is easily disrupted due to natural factors like the wave season, or economic factors because it is very expensive to bring diesel fuel to these islands, inshaAllah, it will be soon become the new beauty of nature in the night - when clean energy is available cheaply and abundantly.

The sketch I made below I named 'Night in the Remote', it is one of the islands that currently still looks dark at night, but it will soon become a new beauty at night, when we can provide enough energy to this island, and this means regenerative energy.

39. Regenerative Hydrocarbons

In the next few decades, internal combustion engine (ICE) vehicles, both diesel and petrol, will still dominate the world's highways. Unless the fuel for ICE is completely replaced with a carbon-neutral one such as advanced biofuels, the world's cities will still be filled with carbon emissions from this transportation.

The problem is that advanced biofuels, such as those launched by the European Union in the Renewable Energy Directive II (RED II), are progressing slowly even in Europe, they are also barely

known in other parts of the world. So what can be done to accelerate the reduction of emissions from the transportation sector?

The concept we are proposing is to replace the fuel for ICE engines with exactly the same fuel used now, petrol engines still use petrol, diesel engines still use diesel fuel. It's just that the petrol and diesel, or what we generally call hydrocarbon fuel, are the product of a regeneration process from CO2 emissions - from any emission source.

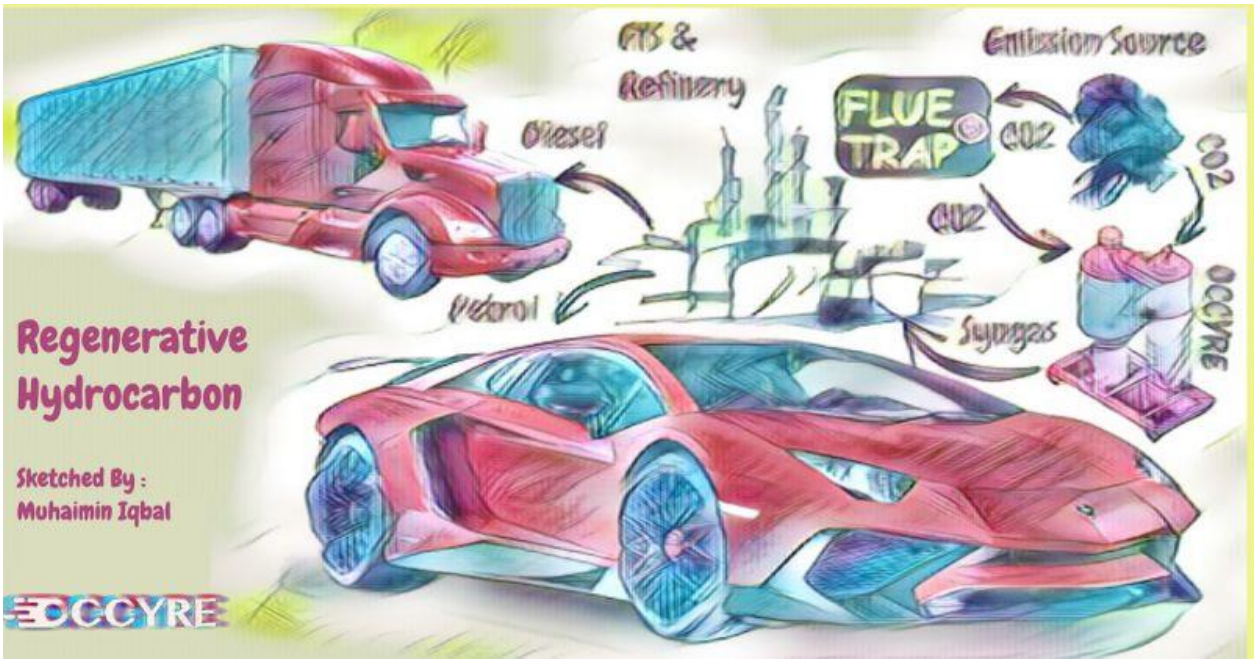
Thus, every time an ICE vehicle emits CO2 emissions, the same amount of CO2 - even though it is in another place and from another source of CO2 emissions, is processed back into this regenerative hydrocarbon fuel. What are the benefits of doing this?

All ICE vehicles that use regenerative hydrocarbon from CO2 will automatically become carbon-neutral, because they don't emit new CO2, they only recycles the already existing CO2. The world doesn't need to bother looking for new fuels, because there are so many sources of CO2 emissions, found in factory chimneys, power plants, buildings and commercial areas, even from ships and airplanes.

Factory infrastructure, spare parts and ICE vehicles themselves, which have existed for more than a century, can still be used and there is no need to worry about ICE vehicle emissions anymore - as long as they use regenerative hydrocarbons. you can imagine, how much the world - especially the automotive industry can save with this.

As for the regenerative hydrocarbon production process itself, the technology is also relatively mature. With the combination of FlueTrap technology and the Onboard Carbon Cycles Regenerative Energy (OCCYRE) reactor that we developed, all CO2 emissions can be converted into syngas (CO and H2). This syngas can be directly processed in the Fischer-Tropsch Syntheheis (FTS) reactor along with its cracking and refinery to become diesel, gasoline, jet-fuel, LPG and all forms of hydrocarbon derivative products.

This regenerative hydrocarbon can even be produced on a small scale, so that access to this carbon-neutral fuel can be immediately available in any part of the world that needs it.



40. Start Where People Stop

Colossal phenomena in the form of global warming, climate change and disaster after disaster caused by the continuing increase in CO2 concentrations in the earth's atmosphere, cannot be separated from the habits of the earth's inhabitants as a whole. We continue to burn fuel and stop there, do not care with what happen after fuel burned.

What happens when fuel is burned? at least it changes into three forms, the first is power or electricity, the second is waste heat and the third is emissions. The one becomes power or electricity, is what we use to run our vehicles, light our homes, etc. However, the portion of energy that we use is only in the range of 25% for Internal Combustion Engines, up to 40% for turbine generators.

The second is waste heat, not much has been utilized - but there is number of technology available to utilize this waste heat. If this waste heat is not utilized, the impact will only be local - namely heating at the location of the burning, or the city where the burning is located, such as the Urban Heat Island (UHI) effect which I have uploaded before.

The third is the current global problem, namely exhaust gas emissions, the majority of which contain CO2. Because this CO2 is invisible, factories and power plants, as well as our own vehicles, fills the earth's atmosphere every day with this exhaust gas - without making us feel guilty.

Regulations can be enforced in one country to reduce exhaust gas emissions, but if there are only a small number of countries in the world that don't care - then the concentration of CO2 in the earth's atmosphere will still continue to increase. The problem is that CO2 doesn't need citizenship, it doesn't need a passport to cross from one country to another until it fills the entire earth's

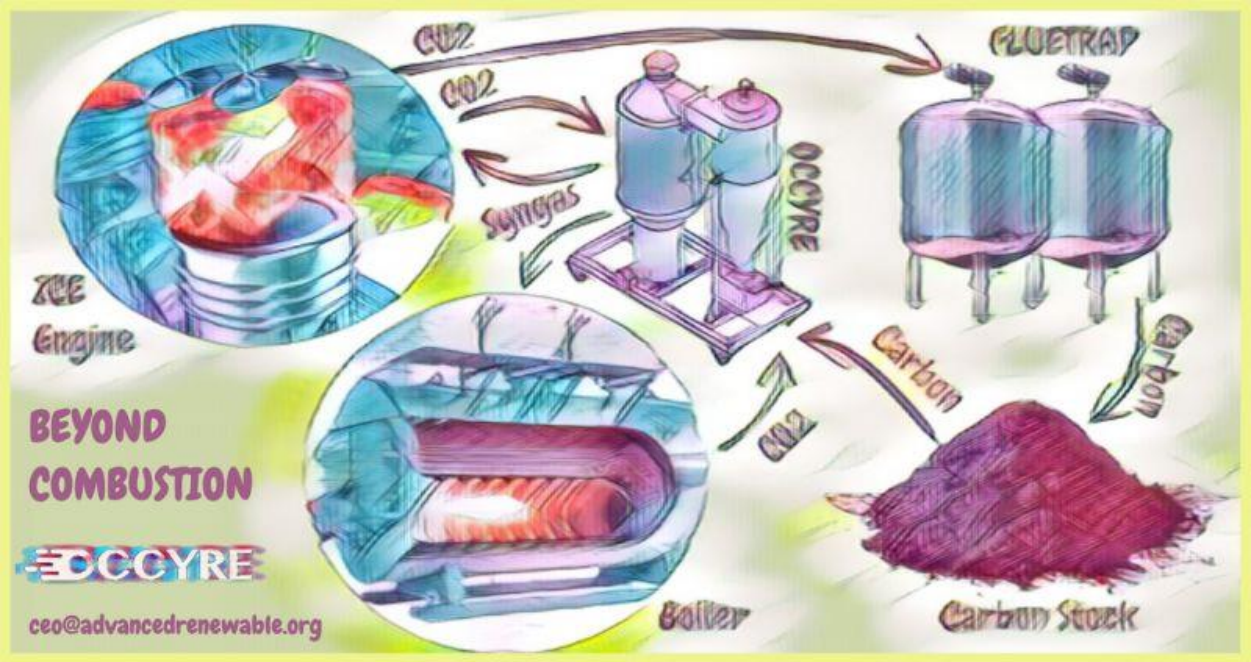
atmosphere. It is enough that one or two countries are not disciplined in reducing their emissions, it will damage the efforts of all countries that are disciplined in reducing their CO2 emissions.

So here is the concept of regenerative energy that we are promoting, we can start from where people stop. That is, when people just stop at burning, the majority of the burning waste is in the form of CO2 which we collect to be processed into energy again.

There are two benefits at once from this regenerative energy concept, firstly, world CO2 emissions will drop automatically because we will capture as much CO2 as possible, secondly there will be sustainable new energy sources that can be 'grown' from 'seeds' in the form of CO2.

What if there are countries or parties who don't want to do it? they will lose themselves, one or two countries or parties implement it first - they will become very competitive because their energy costs will become very cheap, other countries or parties that do not follow the same efforts will lose their competitiveness.

For this, only one step is needed, a step that starts from where people stop. Pick the CO2 and use it to regenerate new energy!



41. Self-Sufficiency With Regenerative Energy

If we only have one fruit tree in front of our house, that fruit can give us more produce than our own need. Fruit trees can do this because they have regenerative abilities, namely the ability to grow or grow again.

If our main need, namely food, is maintained in sufficient supply in the world until the end of time through its regenerative abilities, why not another need, namely energy? So, if we attach this regenerative property to energy, then it becomes regenerative energy, the sufficiency of this energy

will be maintained until the end of time as well.

To be able to plant trees, we buy tree seeds first. Likewise with energy, initially people still needed to buy energy seeds - namely conventional fuels like the ones we use today. It can be gasoline, diesel, LPG, even coal.

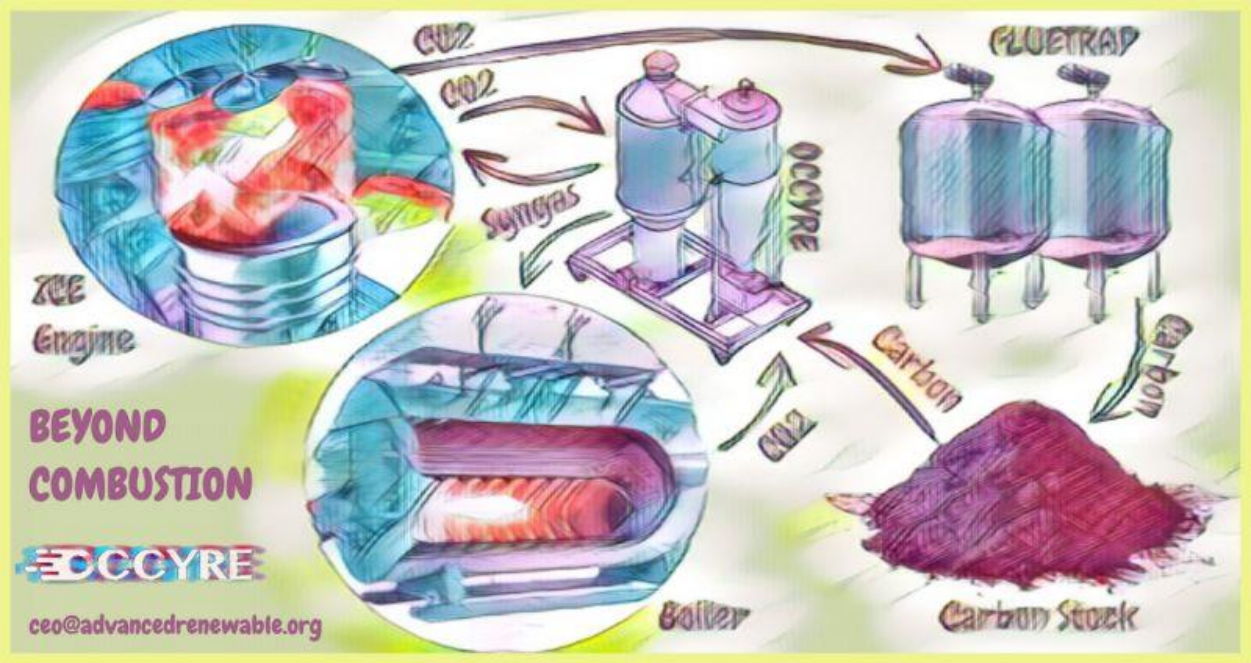
After the fuel is burned by an existing engine, it could be an Internal Combustion Engine (ICE) such as a petrol and diesel engine, it could also be a boiler, etc., the exhaust gas emissions will contain a lot of CO2. This CO2 is what we capture with other C elements, to undergo the 'energy seeding' process through the Boudouard reaction, namely C + CO2 ==> 2 CO. The latter (CO) is the energy seed we need.

CO, which is the main element of syngas, can be directly used as a replacement fuel for ICE engines, boilers and any furnace, but can also be further processed to produce various kinds of modern fuels. Can produce oxygenates such as methanol, ethanol and DME, can produce hydrocarbons such as gasoline, diesel, jet fuel and LPG, and even produce carbon-free energy such as hydrogen.

From the sketch below, note the comparison that energy can grow like a tree. How big a tree can grow is based on the availability of nutrients the soil has and its access to sunlight. How much regenerative energy can we produce? It depends on our mining success rate (Regenerative Rate), and how fast the rotation or mining cycle is.

If we have a 'seed' in the form of 1 liter of diesel which contains around 38 MJ of energy or around 10kWh, with an electricity conversion efficiency of 30% it will only produce 3 kWh of electricity, because it is only used once to produce electricity.

However, if we capture CO2 emissions and 'plant' them back into regenerative energy, assuming 80% success rate and repeating this for just 7 cycles, then the cumulative result will be equivalent to 4 liters of diesel or 40 kWh, assuming the electricity conversion is the same 30%, then with just 7 catches from 1 liter of the same 'seed' we can produce 12 kWh of electricity. Even without subsidies, electricity will be cheap, and that's where our energy self-sufficiency will be founded!



42. Renewable and Regenerative Energy, What's the Difference?

In a number of previous posts, I shared about the concept of Regenerative Energy - the technology of which is now relatively ready to be implemented. Meanwhile, what the world is currently discussing is still limited to Renewable Energy. What's the difference between the two? I will take the example of Renewable Fuels and Regenerative Fuels (RF) to explain it.

Renewable fuels or more specifically, the newest in the European Union's RED II is called Advanced Biofuels (AB), involving long-term absorption of CO2, for the plant growth process, and from biomass - plant waste, AB is produced.

Because the process takes a long time, which can take years (point 3 in the sketch), AB production is far less than what the world currently needs. Even when the world population was still small, and the fuel used was biofuels already (firewood), England experienced an energy crisis in the 16th century. At that time their forests were almost completely cleared for firewood. As a result, the presence of renewable energy like AB is necessary, but will not be able to meet the growing world energy needs.

That is why we are promoting the concept of Regenerative Energy, namely new energy produced from the use of previous energy. When fuel is burned, on average only 25% to 40% is used as power or electricity, the rest becomes waste heat and CO2 emissions. I have shared energy production from waste heat previously.

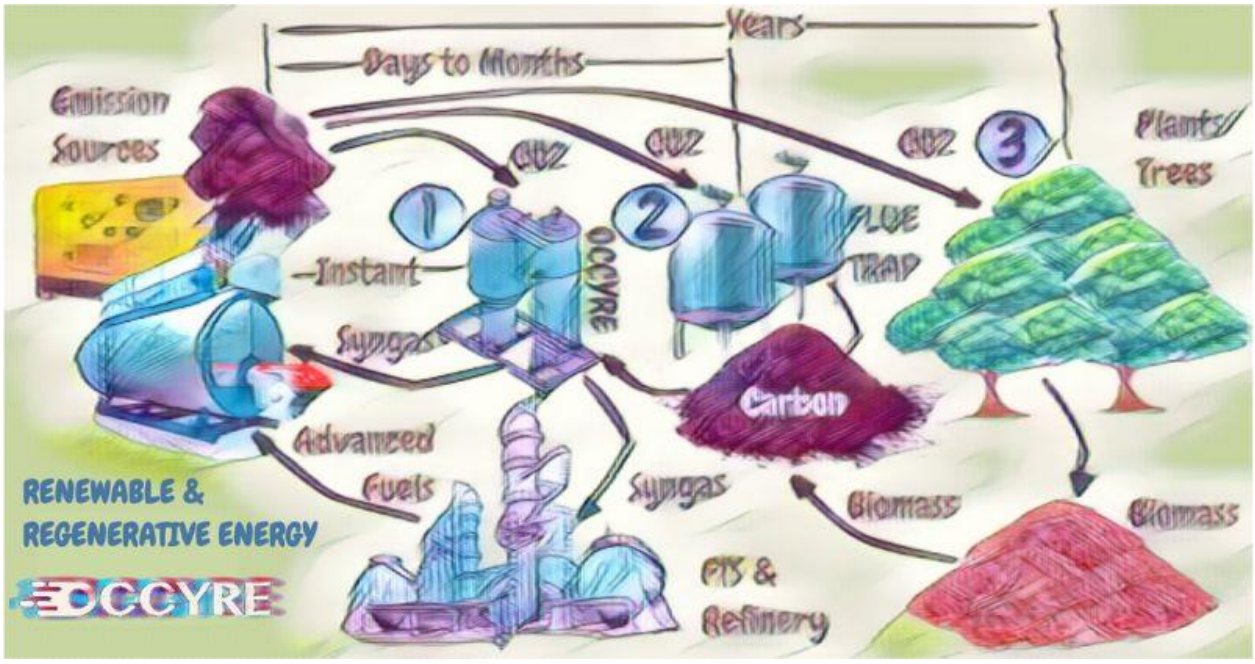
So for Regenerative Energy, especially RF, we focus on processing CO2 emissions into new fuel.

The process can be very fast or instant, namely when we capture CO2 and immediately convert it into new energy again via the Boudouard reaction, becoming CO (C + CO2==>2CO). This CO is the main element of syngas which can be directly used to substitute all types of fuel that were originally used (point 1).

However, this instant cycle also has its limitations, namely that there will be an accumulation of carbon - both from the small amount of fuel that is still being used, as well as from the carbon used as a reactant in the Boudoard reaction mentioned above. So we also accompany this process by capturing CO2 with an adsorbent, so that the captured CO2 can also be stored for fuel needs at another time/place (point 2).

The CO2 cycle at point 2 also runs quickly - in a matter of days or months from the time the CO2 is captured until it becomes new fuel. Points 1 and 2 in the sketch are RF, while point 3 is for AB. RF is not limited to CO, but can be used for all types of fuel that we need today through the Fischer-Tropsch Synthesis (FTS) process.

If AB relies on the photosynthesis process of plants for its CO2 cycle, in RF we speed up this cycle with two main technologies, namely the Onboard Carbon Cycles for Regenerative Energy (OCCYRE) reactor and the FlueTrap reactor. OCCYRE and FlueTrap are two enablers for the presence of Regenerative Energy.



43. In Search of the Rare

As the hunt for new energy, its production and storage becomes increasingly demanding, Rare Earth Elements (REE) are also increasingly needed. REE are chemical elements that are generally found in the second row from the bottom of the periodic table, from Lanthanum (La) to Lutetium (Lu). So

what is REE for?

Almost all new energy production and storage requires it. For example, for production using catalysts, among the best catalysts are La and Ce (Cerium). For energy storage with batteries, one of the best is also La. Then, if we need a very strong magnet for a very effective motor or electric generator, for example, we need Dysprosium (Dy) or Holmium (Ho).

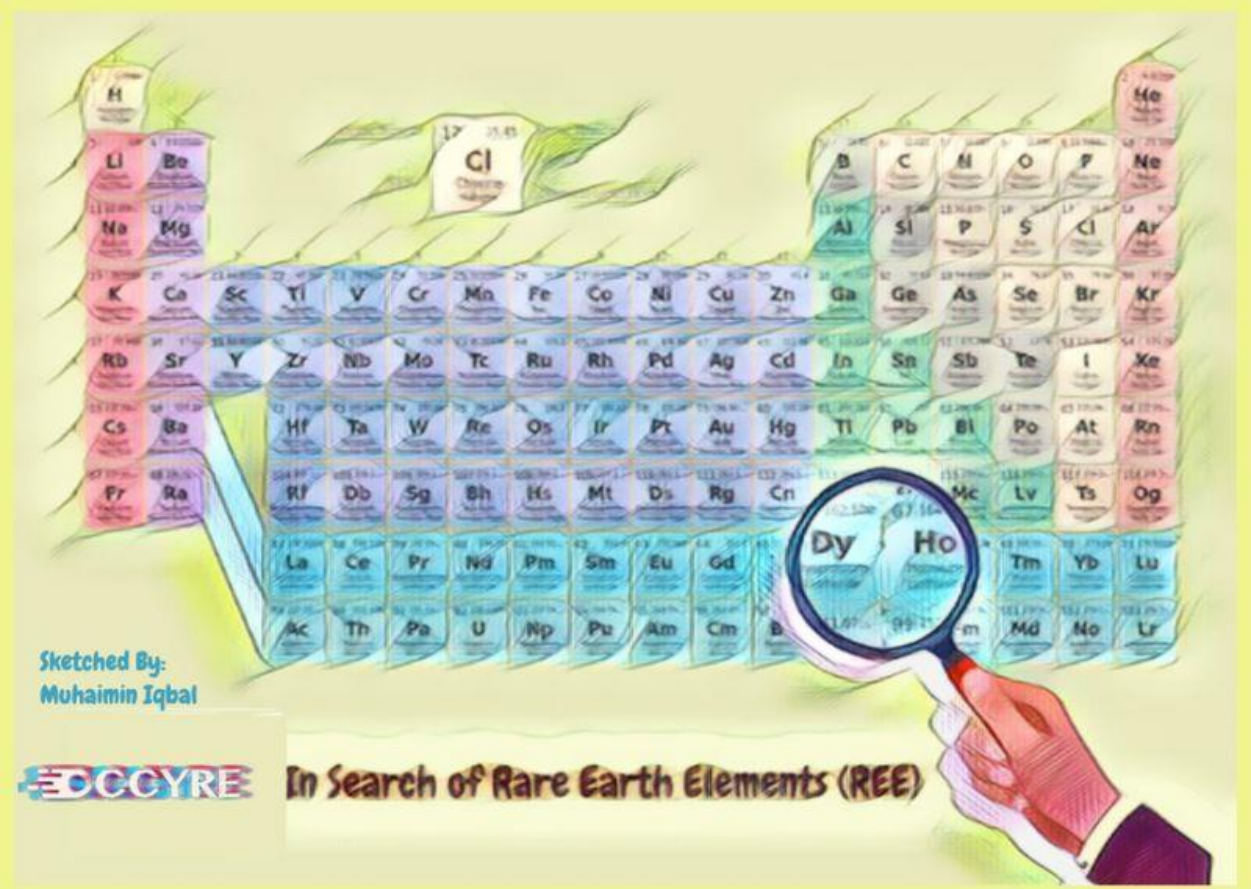
The problem is that as the name suggests Rare Earth Elements, these elements are distributed on the earth's surface in very low concentrations. The extraction technology that is most widely used today involves high energy and chemical solvents that are not environmentally friendly. Because of this, some developed countries are reluctant to produce it and throw it into countries that want to produce it - complete with the resulting environmental impact.

The good news is, now scientists - including those in the Advanced Renewable Organization (ARO) ecosystem - are exploring new ways to hunt for REEs, which are more energy efficient, cost effective and also environmentally friendly. The technique we are studying is biosorption which involves microorganisms either from certain groups of bacteria or certain species of microalgae.

In the country of the ring of fire - a country surrounded by volcanoes, our REE sources are actually very abundant, even though the concentration remains very low, but if we succeed in mining them in an effective, low cost and environmentally friendly way, it is very possible that this country will become a very large REE producer in the future, as this country is already known as a major producer of gold, copper, tin and nickel.

Even though the operation will be cheap, biosorption which will involve an army of microorganisms requires expensive research in sophisticated laboratories. Because even after we obtain the most suitable species of bacteria or microalgae, the same as humans - they will not immediately be able to carry out their duties as we wish.

It takes a lot of treatment and breeding until the army of microorganisms is ready to become productive 'miners' to mine REEs which are rare and expensive - but much needed in this era of energy transition. So researchers, doctoral candidates who are working in this field at home and abroad - especially those who have access to the sophisticated laboratories needed, can join the Advanced Renewable Organization (ARO) ecosystem on preparing the mining industry of the future, the REE mining!



44. Waste of Waste Regenerative Electricity – WoWRE

Energy in the future should not become more expensive and dirtier, but on the contrary it could become cheaper and cleaner. The key is in the regenerative concept, energy that can grow and reproduce. This is also in line with the law of conservation of energy which we have known since we were in high school.

That in an isolated system, energy cannot be created nor destroyed, it only changes from one form of energy into another. So if we master the changes - we will be able to regenerate this energy. When we burn fuel, apart from becoming power or electricity, it also becomes heat, and leaving behind it CO_2.

This CO_2 is fully oxidized carbon so it cannot be burned again, but if we can decompose CO_2 into C and O_2 (via electrolysis), or into 2 CO after adding the element C (via Boudouard reaction), then the original CO_2 which no longer has energy, will become C which contains energy of around 30 MJ/kg, or become CO which contains energy of around 10.5 MJ/ kg.

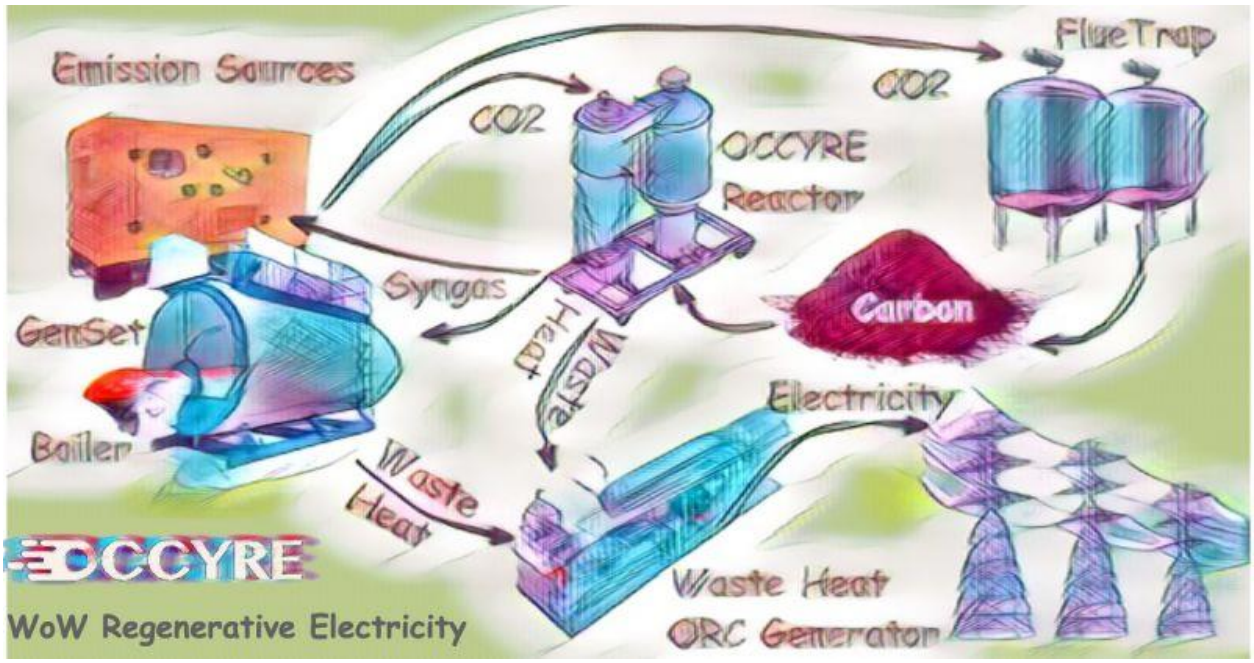
After becoming C or CO, various new forms of fuel can be produced, and I have shared them previously, including through this upload: https://lnkd.in/g2JH-QEh.

What if what we need is not fuel but electricity? No problem either, electricity should even be cheaper, because it is produced from Waste of Waste (WoW). When we react CO2 and C to become CO for example, this reaction requires a high temperature of at least 800 degrees Celsius, where does the energy come from? it can be from C which we mine from CO2 through the electrolysis process mentioned above, or C from biomass waste - wherever it comes from, the C is essentially waste.

When we burn C waste to produce these high temperatures, it also produces new waste - namely waste heat, this is what we call WoW. There are many technologies on the market already to convert this waste heat into electricity, you can use a Thermo Electric Generator (TEG), Stirling Engine, Micro Gas Turbine or Organic Rankine Cycle (ORC) Turbine.

The next question is, where does C, which we used as the basis for the Regenerative Energy concept, come from and reproduce more and more? There are three sources of C, first is C from regenerative CO2 which is captured and electrolyzed or converted into CO in the Boudouard reaction, second is C from hydrocarbons fuel which, although very small, is still used as a companion fuel in the energy machines we use, and third is C from Charcoal which is used as a reactant in the Boudorad reaction in the OCCYRE reactor.

From the second and third C sources, from time to time this Regenerative Energy system will increase energy stocks in the form of C or CO. And this is where energy will be cleaner - because no CO2 is released into the earth's atmosphere, and cheaper because less new fuel is needed.



45. Regenerative Gas Turbine (RGT) for Distributed Power

The need for electrical energy is growing massively along with technological developments, and will require different solutions from those that currently exist. Communities in remote areas or islands really need an electricity supply that is available at all times, as well as urban communities who are starting to use electric vehicles more and more - need public electric vehicle charging stations (PEVCS) that can spread more quickly.

Apart from that, modern society is also very eager to be able to immediately use clean energy, while the average electricity provider in the world will only achieve Net Zero Emissions between 2050 and 2070.

So what is needed are small power generating units that are easy to provide anywhere at any time, or what is known as distributed power generation. However, the small-scale power generation units that are generally used today require fossil fuels, especially diesel, so apart from the expensive electricity production costs, they also have high CO2 emissions.

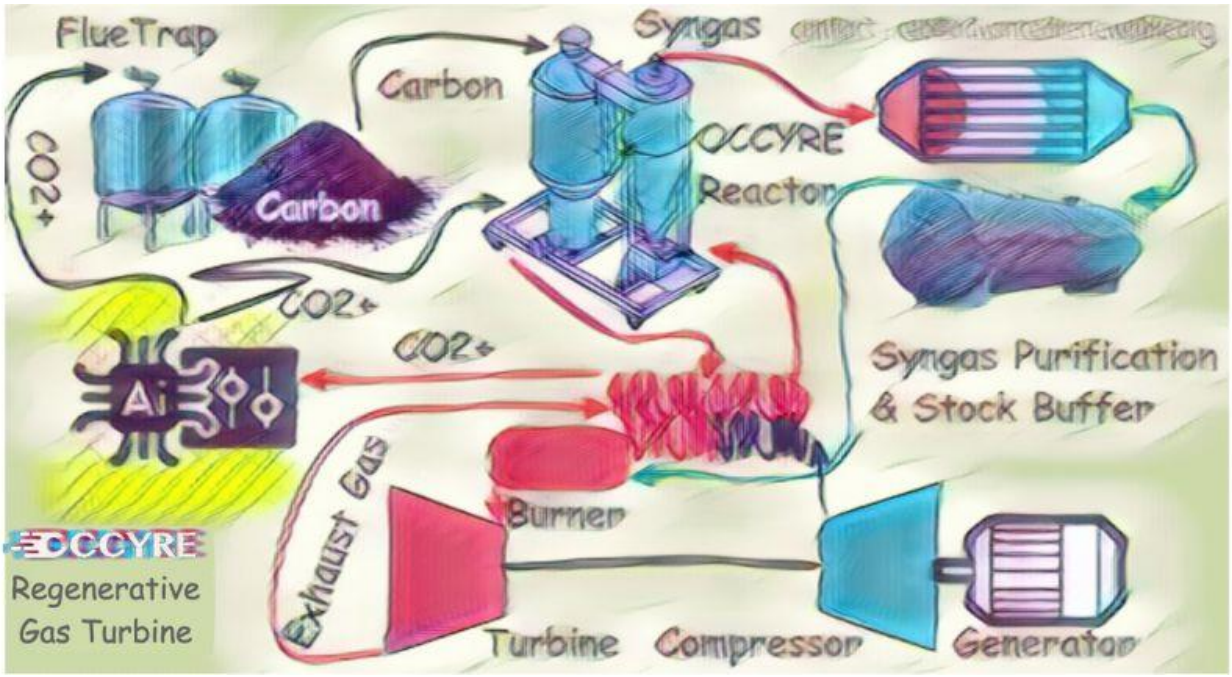
The existence of thousands of Diesel Power Plants (DPP) in this country of 17,500 islands is a necessity, due to emergency conditions when there are no other options. So my sketch below could be an option, to provide electricity anywhere and anytime, and more than that the electricity produced is also close to zero emission.

We call this new power plant as Regenerative Gas Turbine (RGT). The electricity generation is produced from a gas turbine, while the gas fuel uses syngas produced by the OCCYRE (Onboard Carbon Cycle Regenerative Energy) reactor. OCCYRE uses two carbon fuels from local biomass or carbon from captured CO2 emissions using FlueTrap technology, and CO2 which is directly reacted into CO in the reactor (Boudouard reaction: CO2+C==> 2CO).

There are two benefits at once from using RGT, firstly the cost of fuels will be very cheap - because it is from local biomass which does not require expensive transportation costs, second fuel is even free because it is from CO2 which is captured in-situ and instantly converted into energy again (CO).

The second benefit is that RGT has almost zero emissions, because all the CO2 is captured and used to produce energy again. If there are still very few emissions, it is due to unavoidable factors - for example when local biomass is still transported by means of transport using internal combustion engines (ICE) etc.

We can make the two technologies that are enablers of RGT, namely the OCCYRE reactor and FlueTrap, while many gas turbines have been developed on the market, including micro-sized ones. So if you are interested in becoming our partner in providing gas turbines, preferably using an External Combustion Gas Turbine (ECGT), then you can become our partner in this new energy industry.



46. Go Beyond Sustainability with Regenerative Energy

Currently we are still in the most destructive civilization, emissions are still increasing along with the soaring consumption of fossil energy. The impact is that the earth's temperature continues to warm, climate change continues to reach new extremes, and disaster after disaster continues to occur.

Therefore, various parties, sectors and countries are taking their own steps to make efficient use of fossil energy. It is hoped that with this, emissions will begin to fall along with the increase in the use of carbon neutral energy.

If all countries and all parties are serious, it is still possible that we can achieve the 2030 Sustainable Development Goals (SDGs) target. But is it possible that we can achieve more than that? more than just sustainable? Not only does it stop damage to the earth but also repair it? The answer is very possible!

The culprit behind global warming and climate change, which is attributed to emissions represented by CO2, could actually be the starting point, from where improvements can be made. With the principle that nothing is wasted from His creation (QS 3:191), everything must have benefits, if we can continue to remember Him, and think about His creation - including CO2.

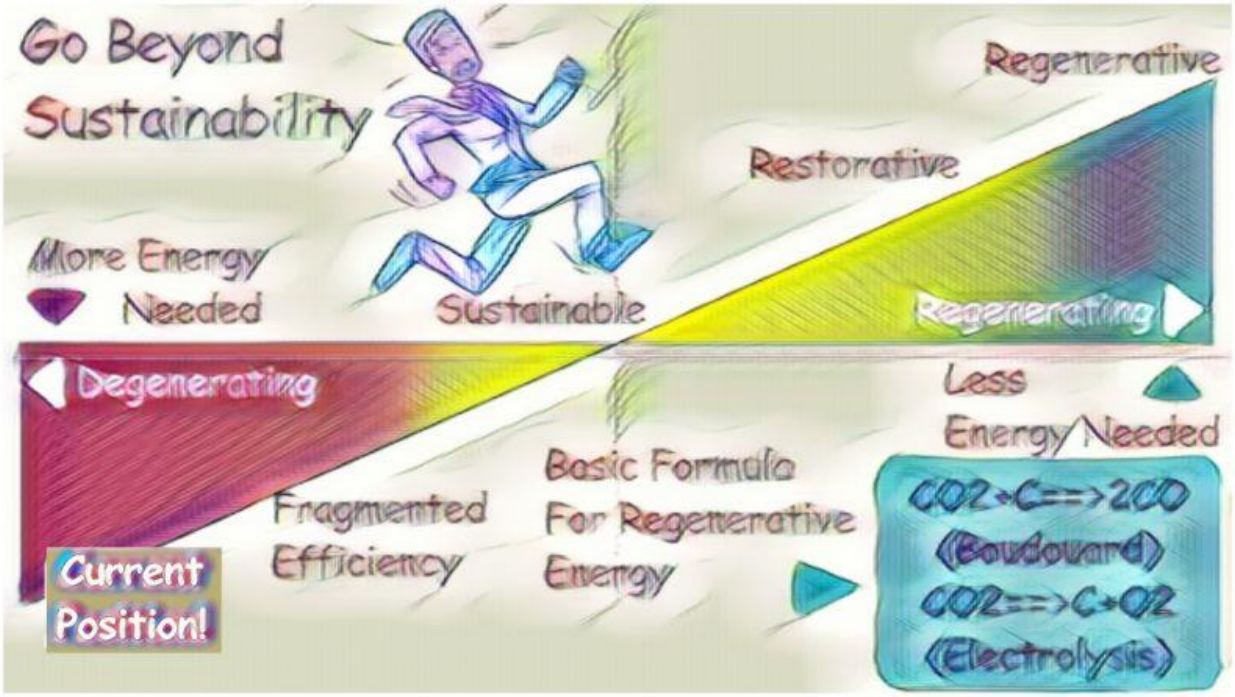
CO2, which is a form of carbon that has been fully oxidized so that it no longer has any calorific value, can be returned to become a new energy source. With the Boudouard reaction CO2+C==>2CO, it has changed into CO which contains the energy of 10.5 MJ/kg CO. If it is electrolyzed , CO2==>C+O2, it becomes pure carbon which contains 30 MJ/kg of energy or about

2/3 of the energy in the gasoline or diesel we use today.

So, if we can capture as much CO2 emissions as possible, then not only will our earth's atmosphere be cleaner, but we will also accumulate new energy stocks in the form of CO or C, meaning our need for conventional energy will continue to fall.

The illustration in the sketch below depicts the path we need to take. Currently we are at the lowest point with fossil energy consumption still increasing, there must be an efficiency movement as soon as possible and balance it with carbon-neutral energy, so that the 2030 SDGs target can be achieved.

However, we can actually leapfrog, which is more than just targeting sustainability, but also launching a movement that is to improve this earth (restorative), and ultimately regenerate all the blessings and prosperity that are born from this earth (regenerative). He who made us from dirt (earth), He also made us capable of bringing its prosperity (QS 11:61). InshaAllah.



47. Simple Regenerative Power Generation

There are many situations that make people need their own power plant. Projects or communities in remote areas and islands, emergency situations due to natural disasters, war, recharging electric vehicles, the need for green electricity, reducing emissions and also efficiency.

All these reasons can now be answered with one solution which we call regenerative energy. I uploaded the difference with current fuel use and even the difference with sustainable energy yesterday here: https://lnkd.in/gKPbeaQj

In short, if energy use is now done by simply 'consuming' fuel, no matter how much fuel it burns, with the regenerative concept - fuel is also burned, but the results of the combustion are 'grown' again into new fuel. So the regenerative character is growing, because it grows - it will not run out, look at the graph I presented in the post above.

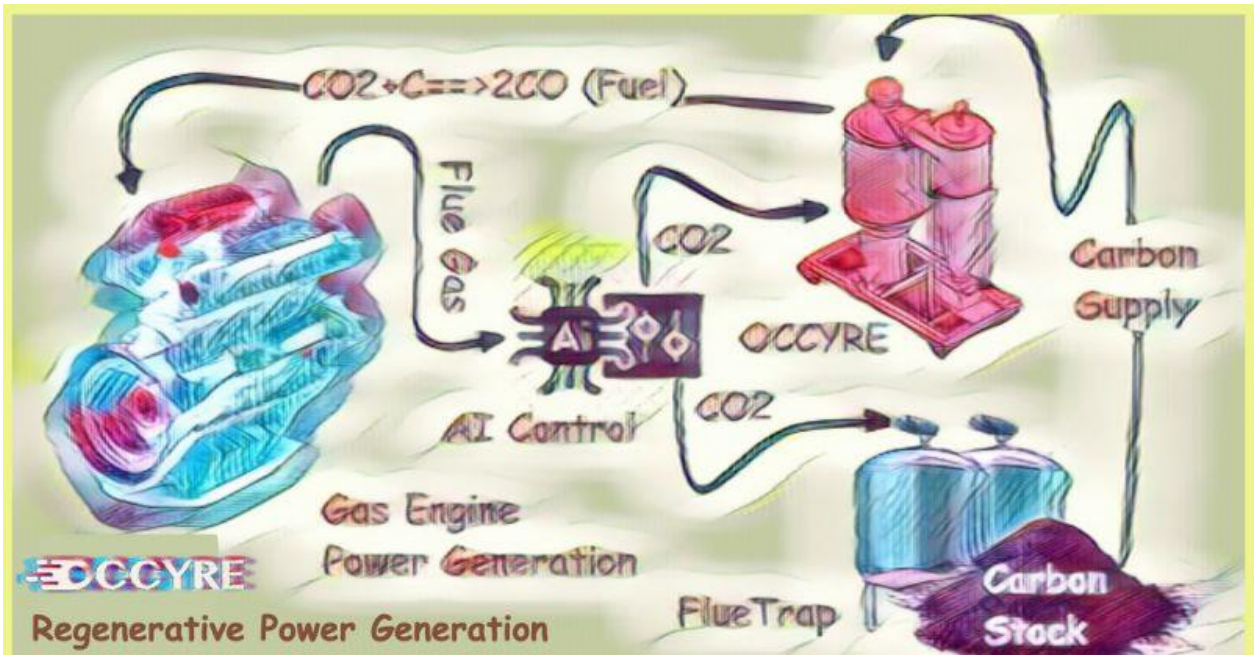
So with this regenerative concept the need for fuel is very little and emissions automatically approach zero - all CO2 emissions are captured and turned into energy again. This seems like a crazy idea, but it's real. Now it can even be realized with machine configurations that are already available on the market. The sketch below is a simple configuration, but it is very reliable for providing this regenerative power generation.

The main engine can be purchased from a number of well-known brands that produce gas engines for power generation. This is a type of internal combustion engine but has been specifically designed for gas fuel. Almost all world-famous generator brands release gas versions. Because it has been designed for gas fuel, of course it can also be fueled with syngas.

This syngas fuel is what we regenerate or grow back from exhaust emissions from the gas engine itself. With today's increasingly sophisticated control systems, using AI Control for example, in real time you can control how much flue gas is instantly processed back into syngas via the OCCYRE reactor, and how much is stored in the form of adsorbate after being captured with the FlueTrap, to become a reserved carbon/energy.

OCCYRE reactor and FlueTrap are two enabler technologies for regenerative energy developed by Advanced Renewable Organization (ARO) R&D which are now ready for production, while the gas engine itself just needs to be chosen from well-known brands on the market, or those that are not well-known but cheap .

InshaAllah, this regenerative energy will be a game-changer in the world of the energy and fuel industry, those who adopt it early will certainly get many benefits of the first movers. The energy industry will not be free from the competition law, disrupt or be disrupted!



48. World of Regeneratives

Since the beginning of creation until the end of time, Allah has been maintaining the whole contents of the earth with a system of regeneration. He created the beginning, then repeated it, and that is easier for Him (QS 30:27). This is what applies to humans, namely first Adam and then Eve, then what goes on is the regeneration system. This also applies throughout the animal kingdom and plant kingdom.

So modern humans learn from what is on this earth and create similar systems to provide various solutions to their life problems. In the medical world, what is called regenerative medicine has emerged, which is a type of medical treatment that does not just cure disease, but regrows tissues and organs that have begun to be damaged so they can grow and function as before.

The same thing happens in the world of agriculture, known as regenerative agriculture. If currently existing large-scale agricultural projects tend to destroy forests, destroy land and flood agricultural lands with chemicals, regenerative agriculture is different, the target is to return land fertility and productivity to its original position - without chemical treatment. Even with this regenerative agriculture concept, the earth that was previously barren can become fertile again.

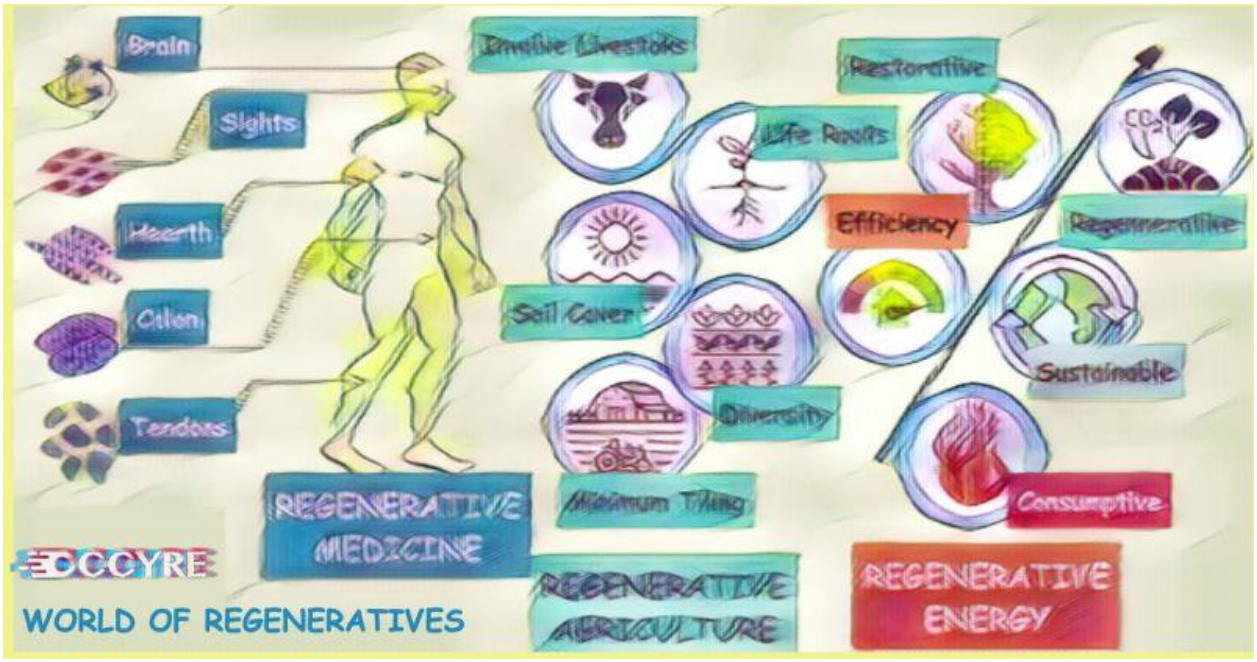
So now we are introducing the same thing, namely regenerative energy. The similarity with the previous examples is in the concept of grow or re-grow. Because energy can be grown, countries that are rich in energy sources such as oil and coal do not need to worry that their energy sources will run out.

Likewise, countries that do not have a lot of energy resources do not need to continue to depend on other countries, initially they buy a little - then use it continuously - until they also have a large energy stock. I have often shared how to grow this energy in various previous posts.

Essentially is that the byproduct of energy use, which has been considered waste or burden, is converted into new energy resources. Waste heat can be converted directly into electricity with various technologies such as Thermo Electric Generator, Waste Heat Gas Turbine, ORC Turbine, etc.

And what is very interesting because of its flexibility to become various new forms of energy is CO2 emissions. If all this time CO2 emissions have become the scourge of global warming, climate change and disaster after disaster, with the concept of regenerative energy, CO2 becomes the 'superior seed' for various types of fuel that we need today, and still has the opportunity to produce waste from its waste - in the form of regenerative electricity.

Huge amount of energy sources will be exhausted if it is only burned, on the other hand, even a small amount of energy sources will always be enough to meet all needs, if it is always regrown, this is the core message of the regenerative energy concept.



49. Mastering Carbon Cycles for Regenerative Energy

Carbon is becoming a problem of global warming, climate change, extreme weather, and disaster after disaster, because in the current era of super-sophisticated technology, carbon - in the form of CO2 - is released into the atmosphere. In fact, when we maintain this CO2 on land, it actually becomes a resource that we really need, including becoming new energy which we call regenerative energy.

The basis of science and technology was even developed more than a century ago, including what was done by Leopold Boudouard - who at the end of the 19th century discovered what we later knew as the Boudouard reaction. With this reaction, CO2 emissions can be converted back into fuel in the form of CO gas when it is reacted with carbon.

The reactor that we call OCCYRE (Onboard Carbon Cycles for Regenerative Energy) is a form of technology that we developed based on the Boudouard reaction mentioned above. So by combining this OCCYRE reactor with the FlueTrap technology that we have also developed, both using adsorbent or using electrolyte, we will always be able to capture CO2 emissions and convert them into new fuels.

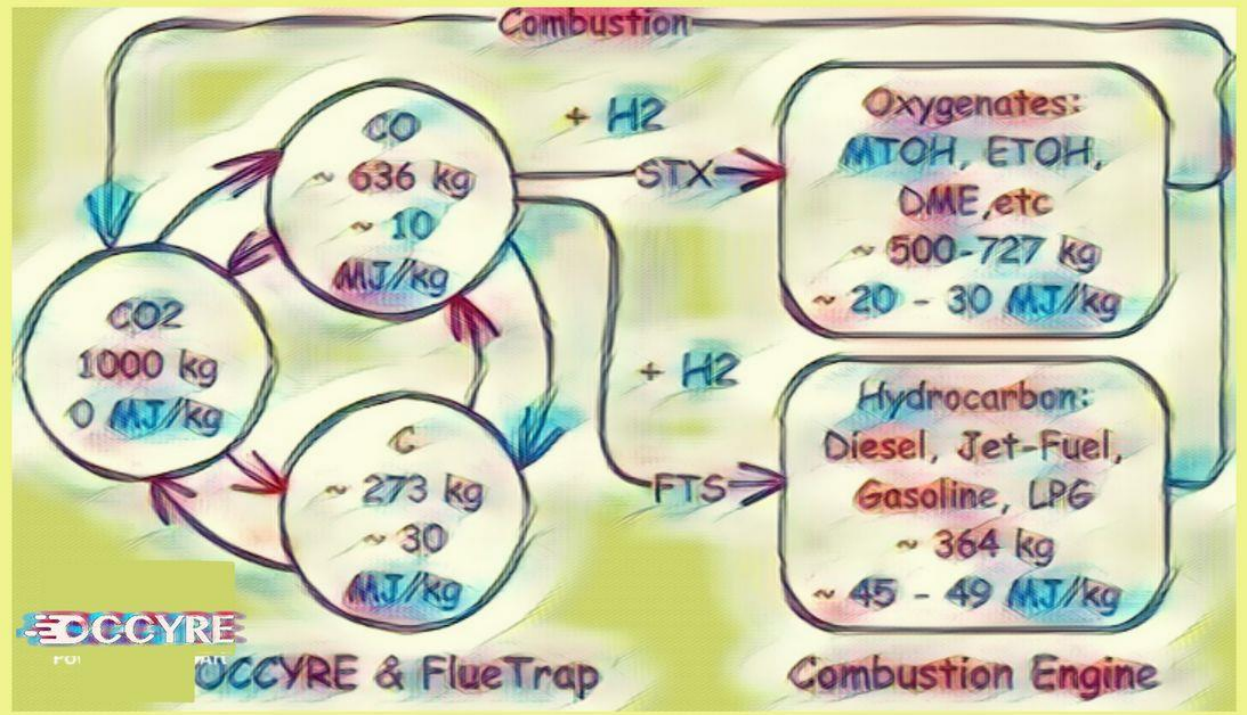
The simplest one is if we convert it into CO via the Boudouard reaction, then the CO is directly used as a substitute fuel for diesel, gasoline, LPG, etc. However, apart from being able to be used as direct fuel, CO is also a building block for all types of fuel that we know and use today.

CO can be processed into oxygenates, namely fuels that contain oxygen such as methanol, ethanol and DME. We call the process STX, where X=M for methanol, X=E for ethanol and X=D for DME or Dimethyl Ether.

CO can also be used to produce hydrocarbon fuels which are currently most widely used, such as diesel, jet-fuel, petrol and LPG. The process has also been used since the last century in Germany, South Africa, Qatar, Malaysia etc. namely what is called Fischer-Tropsch Synthesis or FTS.

For both the process of becoming oxygenates or hydrocarbons, CO requires additional substance in the form of hydrogen. But even this hydrogen can also be produced from CO itself, which is when CO is reacted with steam, the reaction is called Water Gas Shift (WGS).

As a result, by mastering the CO2 - CO or C - Oxygenates or Hydrocarbon cycle, we will get two benefits at once, firstly, our earth's atmosphere will be free from industrial era CO2 emissions, and what left will only be pre-industrial CO2 - such as from human, animal and plant respiration etc. Secondly, fuel will always be available affordably for anyone who needs it - because it is just waste from combustion itself, which is captured and reprocessed back into the original fuel - whatever the original fuel was.



50. Visualization of Vision: Springs in the Desert

There is one quite long surah in the Koran, which the average student from childhood to grandparents memorizes, namely the surah Yaasiin (Surah No. 36). There are those who memorize it every Friday evening and few even memorize it every evening until the end of their lives. Why is this surah so important?

Many scholars discuss the virtues of this surah based on the hadiths of the Prophet Sallallaahu

'Alaihi Wasallam. Among them is reading it to completion, equivalent to reading the Koran 10 times because it is the heart of the Koran. Sins are forgiven, the torment of the grave is lightened, and those who make a habit of reading it every evening will die like the death of the shuhada.

However, surah Yaasiin is actually not only for matters after we die, surah Yaasiin also provides solutions to the complex problems of life in modern civilization with its various problems. For energy matters, for example, surah Yaasiin's provides inspiration that the source is from green trees or plants (Verse 80). So you don't have to wait for plants to become black fossils in millions of years to become energy, from plants that are still fresh or green, fire or energy can be directly produced.

Surah Yaasiin's also challenges us to think as hard as we can to achieve sufficient food and water for all mankind. The inspiration is in the dead earth which He revives with the grains we eat, then date palm trees and grapes grow until they emit springs of water (Verses 33-34).

So based on these inspirations we then envision far into the future, that inshaAllah, there will always be enough food, energy and water (FEW - Foon, Energy and Water) for all of humanity, because even from dead land in the desert where there is no water today -In the future we will be able to plant food plants until they emit their own springs.

Technologically, it is now possible for us to build a project which we call this as Desert Springs Project, and I have shared the technical summary here: https://lnkd.in/geN6nvn6 , Interested to make it happen?

51. Regenerative Carbon for Carbon-Free Energy

Ideally, the energy we use should be free from CO2 emissions, and the most possible one at the moment is hydrogen. Only hydrogen production and distribution is currently still experiencing major obstacles. On the production side, the majority still depends on fossils (methane) which emit CO2

emissions in the reforming process, or if it is done through water electrolysis, it requires electrical energy that is greater than the energy carried by hydrogen itself. On the distribution side, the problem is density, it takes a pressure of 700 bar to be able to carry around 40 kg of hydrogen in 1 m3 of tank.

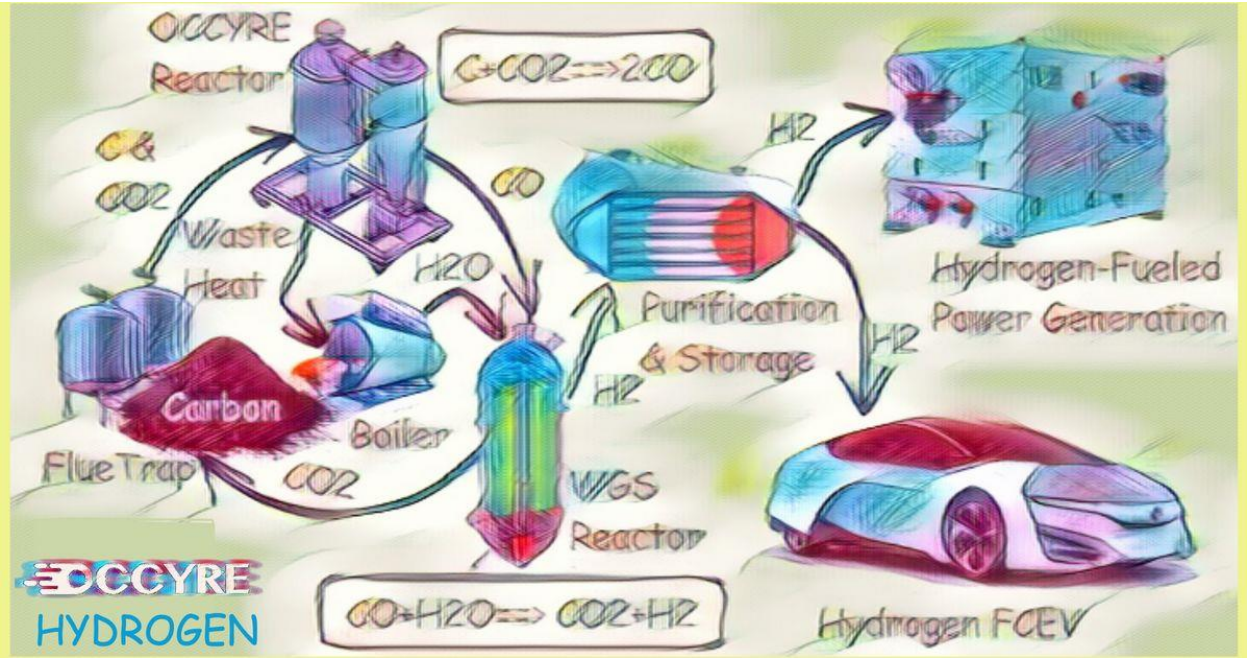
So the production and distribution of hydrogen using regenerative carbon could be a solution, while also addressing CO2 emissions released by other energy uses. There are two sources of carbon that we can use, the first is from CO2 emissions which we capture using FlueTrap technology, and the second is carbon from biomass charcoal.

By using an OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor which operates primarily based on the Boudouard reaction, C and CO2 are converted into CO. Next, using a WGS (Water Gas Shift) reactor, the CO is reacted with hot steam to produce hydrogen. The steam is produced by utilizing waste heat from OCCYRE which operates at temperatures above 800 degrees Celsius. OCCYRE itself is designed to be autothermal, meaning it produces its own heat by sacrificing a small portion of carbon.

In the reaction within WGS reactor, apart from producing H2, also produces CO2, and this CO2 is re-captured with a FlueTrap to undergo the next process cycle. Because overall no CO2 is released into the atmosphere, while it is possible to add new CO2 from outside the system which is captured by the FlueTrap, and also additional carbon from charcoal - then this system will accumulate carbon as stock - that is what we call regenerative carbon, carbon that continues to grow in the system, which can be used also for other purposes outside the system itself.

As the main source of heat energy needed in this system is a small portion of carbon that continues to grow, the energy costs for hydrogen production will be very low. Furthermore overall CO2 emissions in this process will be close to zero because all CO2 is reused to produce CO and then H2.

Because the process is relatively simple, this entire system can be installed directly in-situ, at the user's location so that it does not require expensive hydrogen distribution costs - hydrogen is produced directly on site as and when when it is about to be needed.



52. Carbon-Neutral Regenerative Hydrocarbon

Until the year of Net-Zero Emission which is targeted by the world in 2050, Internal Combustion Engine (ICE) cars may still dominate the world's roads. The petrol or diesel engine car that you just buy now will almost certainly still be around for the next 26 years - because these cars, especially those from well-known brands is built-to-last, are built to last for many-many decades. Sales of new ICE cars will also continue for at least the next decade.

So how can the world achieve its Net-Zero Emission target if its roads are still filled with ICE cars? The petrol or diesel fuel is replaced. In the European Union's Renewable Energy Directive 2 (RED 2) scheme, what is planned is Advanced Biofuels, including Fischer-Tropsch Gasoline and Diesel which are produced from agricultural waste and urban organic waste.

The same fuel, Fischer-Tropsch Gasoline and Diesel that we propose will be even better than the European Union's Advance Biofuels. Why is that? Apart from using agricultural waste and urban organic waste to extract the carbon element, this fuel, which we call Regenerative Hydrocarbon (RHC), also uses CO2 emissions from industrial exhaust gases and power plants as a carbon source.

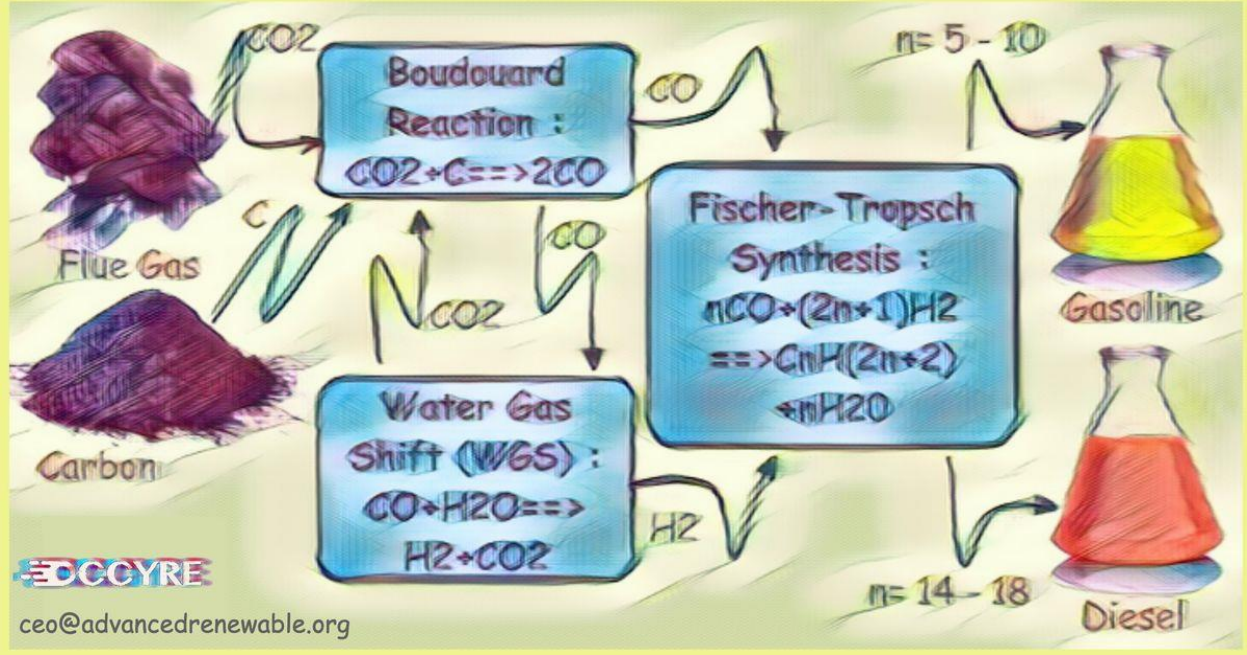
Both sources of C from biomass and emissions - will make RHC completely carbon-neutral. Even though your old petrol or diesel vehicle will still emit emissions when used by your children and grandchildren, the emissions are compensated for by the CO2 absorbed from the flue gas and absorbed by the plants used to produce this RHC.

The technology to produce RHC is even now ready and has been used piece by piece in industry since the last century. For the Fischer-Tropsch Synthesis (FTS) process, CO and H2 are needed.

The CO is obtained from the Boudouard Reaction with input of CO2 and C, while the H2 is obtained from Water Gas Shift (WGS) with input of CO and H2O steam. The CO is from the first reaction, and the heat to produce H2O steam is also hot from the waste heat of the first reaction.

The WGS reaction apart from producing H2 also emits CO2 - which is recaptured and fed back to the first reaction. Through the FTS reactor, the resulting products can be directed to become gasoline, diesel, jet-fuel, LPG, etc. namely by adjusting the process parameters, especially the catalyst used, its temperature and residence time.

So with this way we can produce very affordable clean fuel - because there is no need to buy crude oil to be able to produce gasoline, diesel and other fuels. Moreover, your ICE cars will automatically meet Net Zero Emission standards if they use this Regenerative Hydrocarbon fuel. Even countries that do not have oil reserves will be able to produce it without the need for imported raw materials.



53. CO2 Emissions, How Low Can You Go?

The magnitude of the CO2 that we release into the Earth's atmosphere every day is truly enormous, and this is still happening massively to this day throughout the world. As an illustration, in this country alone we have around 51 Giga Watt diesel and coal power plants, this alone produces around 1,224,000 tonnes of CO2 emissions per day.

When the world targets Net Zero Emissions 2050, or 2060 for us, it is this amount of 1,224,000 tonnes of CO2 per day that must be sought for absorption or off-set. So massive efforts will be needed to capture CO2 at this mammoth scale. If not, we have to look for an offset from the carbon credit market - the assumption is that in 2050 the market will cost US$ 50/ton, it will take US$ 61.2 million per day for our electricity to become Net Zero Emission in those years.

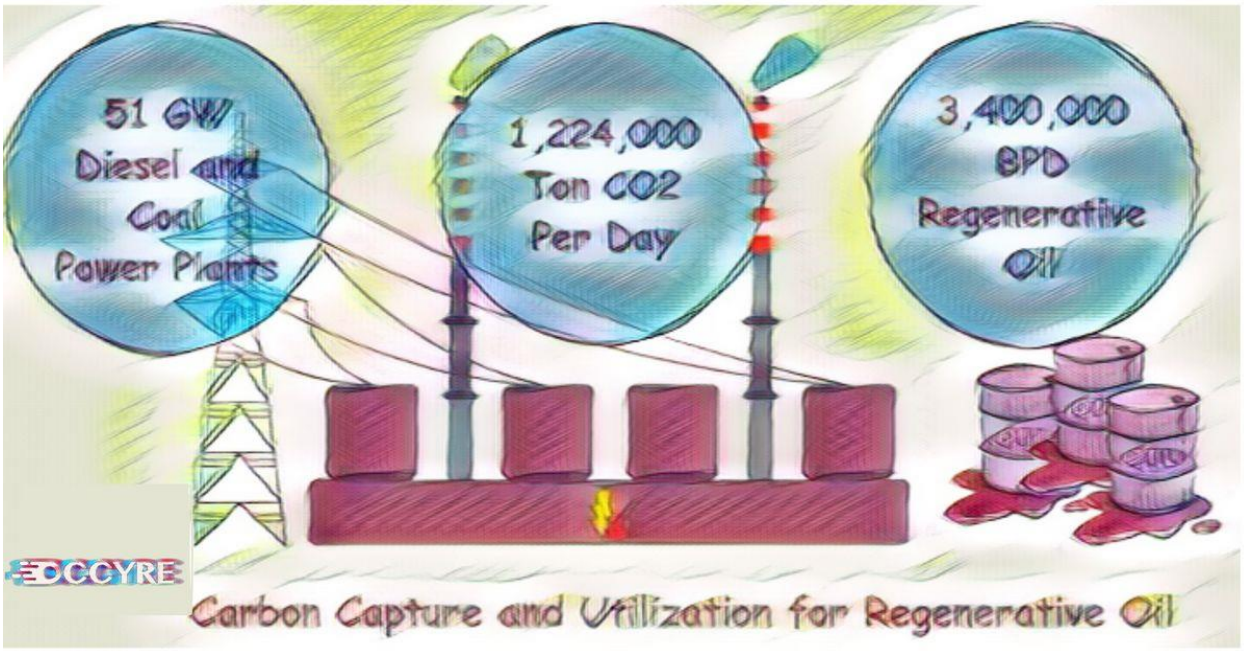
Of course, this will be an unreasonable thing to do at that time, while other absorption options that could offset the massive emissions would also not be cheap to start doing at any time - because of the massive emissions that have been a part of our life since the last century.

But there is another more interesting solution that we propose, namely not seeing CO2 as an emission that must be eliminated or must be offset with something else, we can see it from the perspective of CO2 as a new oil mine that we can use to replace all our energy needs.

If we do this, we will not only make our electricity automatically Net Zero Emission, but our electricity company will suddenly become a giant oil company as well. CO2 emissions of 1,224,000 tons per day if we capture all of it and use it to produce oil which we call Regenerative Oil, this will be equivalent to oil production of 3,400,000 Barrels Per Day (BPD) or more than 3x our oil production target in 2030.

What we call Regenerative Oil is generally called synthetic crude or syncrude, its character is very similar to crude oil - only it is produced through Fischer-Tropsch Synthesis (FTS) and the main raw material is CO2 absorption - so it bears this Regenerative Oil name, I have highlighted the technology in previous upload here :https://lnkd.in/eTWdUq4V

Mining oil from smokestacks is certainly easier than searching for oil from the depths of the earth and the depths of the ocean, it is also more certain because flue gas as a source of CO2 clearly exists. And more than that, two targets achieved at once, while mining new energy, we also automatically reduce emissions to their lowest point.

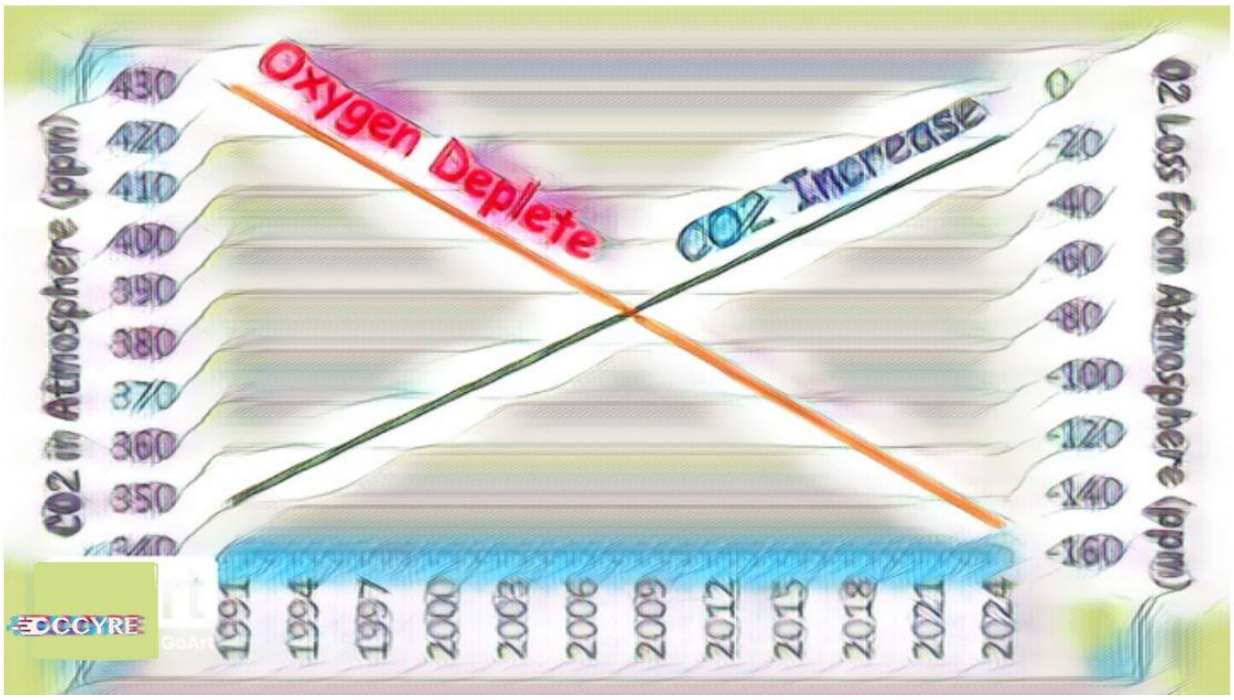


54. Beware of Oxygen Depletion

Actually, it's not just the increase in CO2 that we have to be wary of because of its impact on global warming, climate change, etc. What the world must also be aware of is oxygen depletion, for every kilogram of CO2 we release into the air, around 0.73 kg of oxygen is lost from the earth's atmosphere.

In the pre-industrial era, oxygen production from plant photosynthesis was sufficient to compensate for the oxygen lost from the combustion process. But when more and more people burn fuel while oxygen producers do not increase - instead they tend to decrease, namely decreasing forests and green lands throughout the world, then what happens is the depletion of oxygen in the earth's atmosphere, although slowly but surely - as long as CO2 emissions will continue to increase, oxygen will continue to deplete.

The rough indication is more or less like in the graph below, as CO2 concentrations increase in the last three decades alone, around 160 ppm of oxygen in the Earth's atmosphere has disappeared. So we must immediately reduce these emissions, plant as many trees as possible, so that there is still enough oxygen available for all the inhabitants of this planet.



55. Decoupling Economic Growth and Carbon Emissions

The economic growth pursued by countries in the world is still identical with the growth of energy needs. Unfortunately, until now, the growth in energy demand is also identical with increasing CO2 concentrations in the earth's atmosphere.

All efficiency efforts have been carried out, replacing with new energy, some even replacing with nuclear power - all good efforts to reduce emissions, but not enough and still taking too long. The earliest it will be 2050 is that a number of countries in the world will achieve their Net Zero Emissions, some are pushing it to 2060 and some even 2070.

Economic growth which also requires additional energy can actually be decoupled - or separated from emissions growth, that is, if all emissions released from burning fuel - can be captured and converted into energy again. This is what we call Regenerative Energy (RegE), it is not actually new because in electric vehicles and electric trains - this has also been used in the form of regenerative electricity.

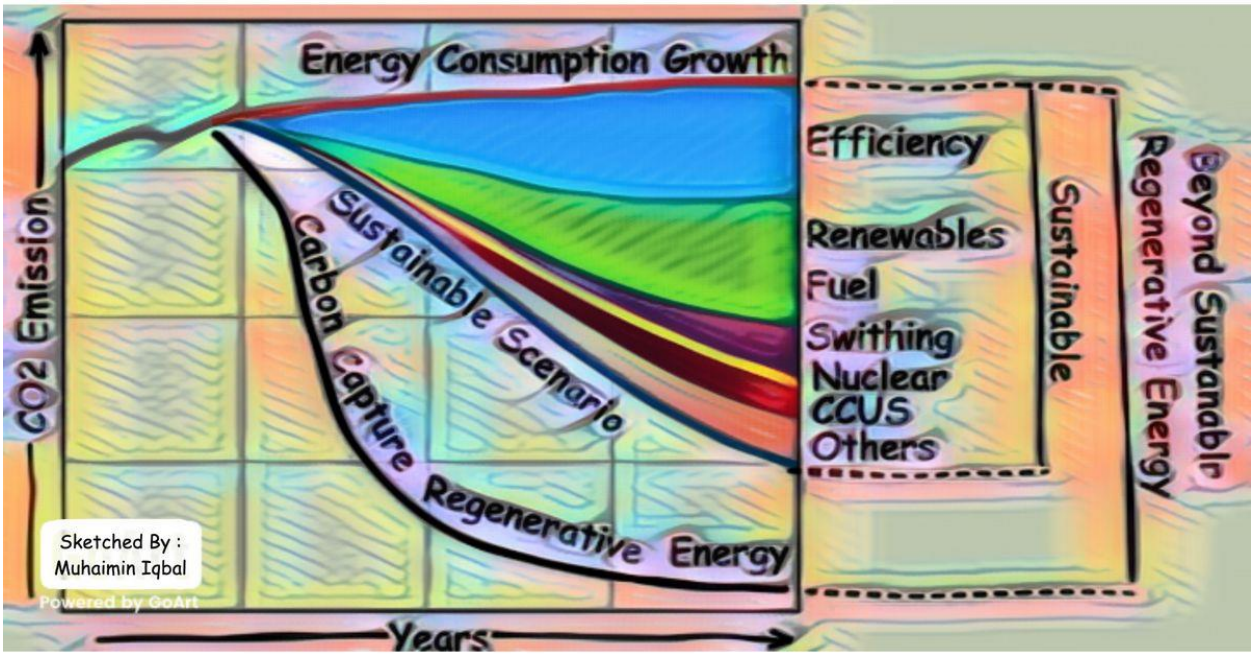
What is new in this concept is that only objects which is regenerated, namely CO2 which is used as fuel again, whatever fuel is needed by the emitter itself. With this concept, it is in the best interest of anyone who emits emissions to capture their emissions as much as possible - because this is needed to reduce fuel consumption, while reducing CO2 emissions is only a positive impact from the use of CO2 by those emitting the emissions themselves.

Because of the benefits are for those emitters themselves, even without laws, industry will voluntarily do so. CO2 which is no longer a burden but becomes a resource for new energy will accelerate emissions reductions, and economic growth does not have to be accompanied by increasing emissions.

The technology we have prepared is in the form of an OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor and various supporting technologies. Currently, it is only suitable for static emission sources such as power plants, boilers, diesel generators, etc. Meanwhile, the mobile ones can only be used on ships that need decarbonization as well as desulfurization.

For airplanes and cars in particular, we are currently still preparing the technology. The inspiration came from horse-drawn carriages (andong) in Jogjakarta. The horses carry bags behind them, so that their manure doesn't splatter along the path they pass. Why does modern motor vehicle technology - not 'carry bag' like this so that CO2 emissions are not spread throughout the journey as well? CO2 is invisible, but if it is allowed to spread in the air, it is no better than horse manure!

I have previously uploaded a summary of the technology, like the one here: https://lnkd.in/eTWdUq4V, those interested in implementing it can discuss it with us.



56. AI That Isn't Always Smart

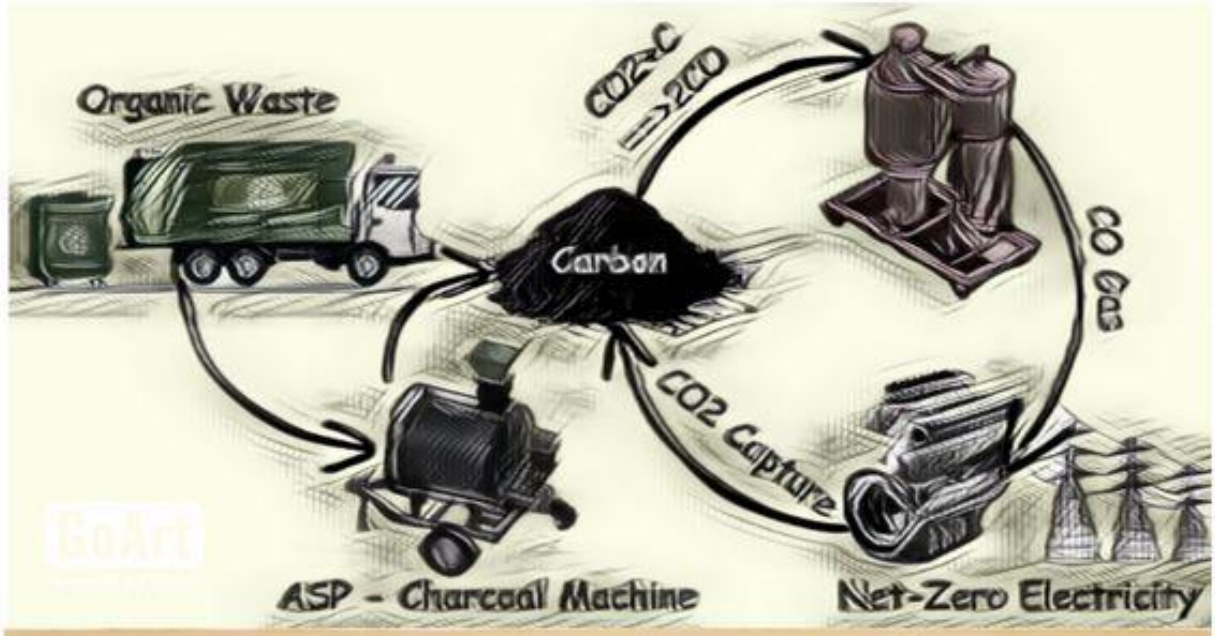
Many people use AI (Artificial Intelligence) applications, for fun I also try to use them for graphic illustrations in some of our engineering processes to make them easier, faster, better, etc.

But it turns out the results are not always as expected, the two images below are from the exact same source of my doodles. The one above is correct, it is as I expected, but from the same materials and data - the one below turns out to be very unexpected.

Notice how inconsequential the AI is this time, the picture in the top right corner is meant to be a sketch for the OCCYRE (Onboard Carbon Cycles Regenerative Energy) reactor, what did the AI capture and draw? A couple of kings and queens from a fairy tale!

The AI didn't stop here, she was inconsequential, she described my gas engine as a chariot for the king and queen. Then she made electricity poles into their castiles. Perhaps this particular AI is designed to think like a little girl who can imagine wildly, about the fairyland she imagines - beyond the intelligence of adults.

So be careful when using AI!



57. Carbon Talks

I am often asked whether the Regenerative Energy concept that I often share in the media does not conflict with the law of conservation of energy? My answer is quite the opposite, that the concept of Regenerative Energy was born directly from the law of conservation of energy.

The law of conservation of energy more or less states that in an isolated system, energy cannot be created and cannot be destroyed, it only changes form from one form of energy to another. So from

this law a derivative was born - I call it the Law of Regenerative Energy, it states that if we can master the change in forms of energy from one to another and vice versa, then we will always be able to regenerate (regenerate) new energy!

Because what we are discussing is about energy from carbon - which is an abundant raw material, to explain the Law of Regenerative Energy we use an illustration of a dialogue between three carbons as in the sketch below. The three forms of carbon are CO2, CO and C.

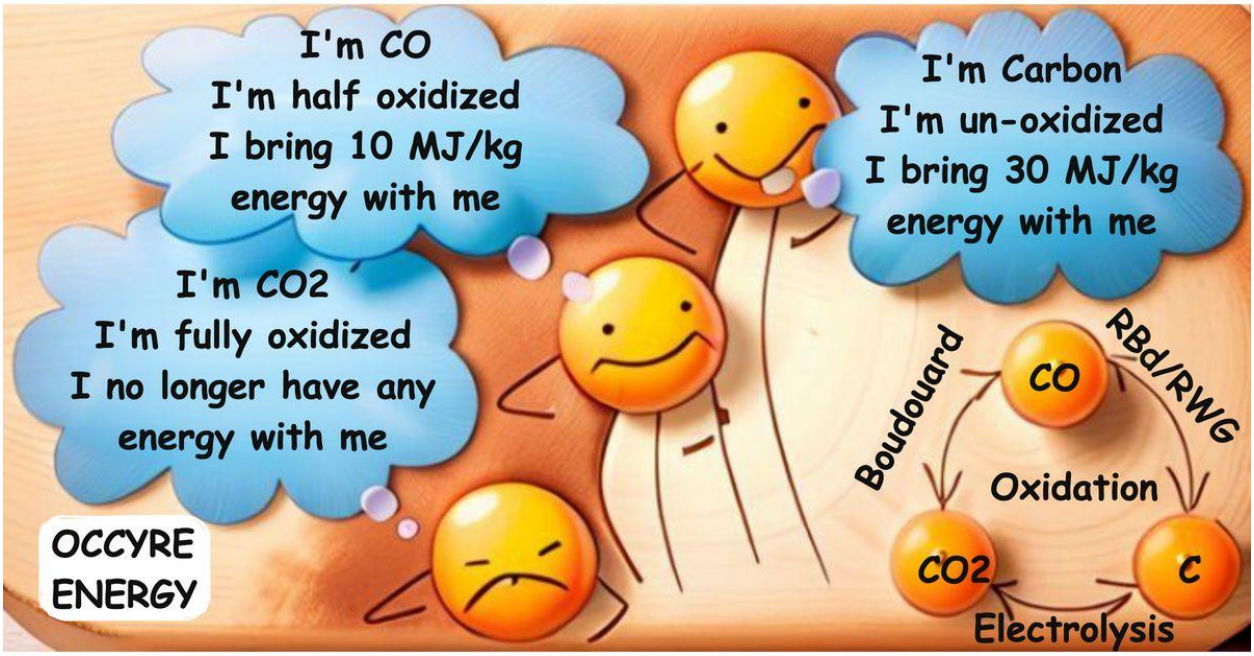
CO2 is a form of carbon that is fully oxidized, therefore it no longer contains energy or 0 MJ/kg. Because it no longer contains this energy, the whole world tries to throw it away, considering it an object that is no longer useful. Even though none of His creations is in vain, it is certainly also useful for those who want to think about it.

So from this thought the concept of Regenerative Energy was born, if only we could take one O from CO2, into CO, then it would contain energy again, the amount in the range of 10 MJ/kg. The French scientist at the end of the 19th century, namely Octave Leopold Boudouard, formulated the reaction, namely CO2 + C==>2CO. This reaction occurs at temperatures in the range of 800 degrees Celsius.

Even further if we could remove two Os from CO2, it would become pure C containing about 30 MJ/kg of energy. The reaction is CO2 electrolysis, namely CO2==>C+O2, this reaction requires electrical power, appropriate cathode, anode and electrolyte.

So to give birth to new energy - Regenerative Energy from CO2, it does require energy in the form of heat or electricity, but heat can be easily obtained from cheap materials such as from rubbish and waste, and from the waste heat from this waste (waste of waste) can also be used to produce more cheap electricity. So the process of producing new energy, which we call Regenerative Energy, can be very competitive compared with any energy that is only used once and then the CO2 is wasted, polluting the entire earth's atmosphere.

The technology for the entire Regenerative Energy process is what we call OCCYRE (Onboard Carbon Cycles Regenerative Energy), that is, apart from producing new, low cost energy from carbon (CO2) - we also automatically clean the earth's atmosphere, because truly nothing is in vain from His creation.



58. Roadmaps To Regenerative Fuels

When CO2 is allowed to accumulate in the air, it cause various problems such as global warming, climate change, extreme weather, etc. If it is successfully captured and retained on earth, it becomes useful and full of blessings, able to maintain the fertility of the soil, as well as being a basic ingredient for the production of all types of fuel.

CO2 capture can be done with adsorbents, reactants, solvents or electrolytes depending on the target product to be produced. In this sketch I used the 2 cheapest and easiest methods. First it is captured with an adsorbent using FlueTrap technology, then the CO2 is stored in the form of adsorbate - so that it can be used at any time.

The second way is that CO2 is captured and reacted directly with carbon to become CO gas. This process requires reactant carbon which can be taken from biomass charcoal or carbon from CO2 which has been electrolyzed to become pure carbon. The production of CO gas from CO2 requires a reactor which we call OCCYRE (Onboard Carbon Cycles Regenerative Energy). This reactor is the heart of the entire subsequent Regenerative Fuels process.

From CO gas, plus H2 carried from biomass charcoal, multipurpose syngas will be produced. Syngas itself is a simple fuel, but it can be used as a substitute for petrol, diesel, LPG, etc., the only problem is that its calories are still low in the range of 10-15 MJ/kg. Syngas can also be further upgraded into complex fuels in the form of oxygenates - fuels containing oxygen such as ethanol, methanol and DME, or into hydrocarbons such as gasoline and diesel, or into carbon-free fuels such as hydrogen and ammonia.

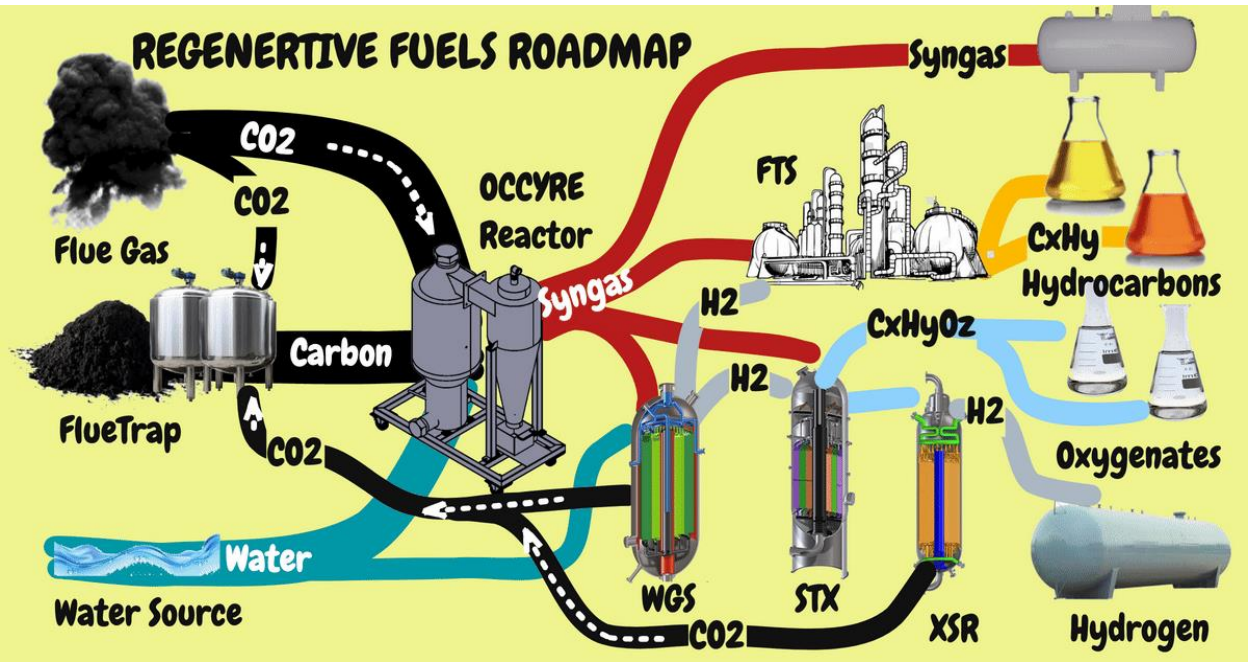
For the oxygenate fuels, we call the route STX where the ST is 'Syngas To' while X=E for ethanol,

X=M for methanol and X=D for DME or DimethylEther. Oxygenates fuels are cleaner fuels that can also replace hydrocarbon fuels.

If you want hydrocarbon fuel as is generally used today, then the route is from syngas through a process called Fischer-Tropsch Synthesis (FTS). By adjusting the catalyst, temperature and residence time, the FTS results can be directed to become diesel, jet fuel, gasoline, etc.

If what is desired is carbon-free fuels such as hydrogen, the route can be via Water Gas Shift (WGS) directly from syngas, or it can also be via Oxygenates Steam Reforming (XSR) - where the X is from E, M and D mentioned above.

From the process of CO2 journey to become various regenerative fuels, there is also CO2 emission that comes out, namely from the WGS process - when syngas is upgraded to produce hydrogen, and from the XSR process - when oxygenates are reformed into hydrogen. All CO2 emission from this process is also captured and processed into syngas again, to start the new regenerative fuels journey.



59. Carbon-Free Power

In the midst of the continued increase in global carbon emissions as a result of the increasing use of fossil fuels, with mature technology now we can start to provide carbon-free power. The following sketch is a carbon-free distributed micro power generation configuration that can be economically available today.

The energy source is still carbon which can be obtained from flue gas or any biomass charcoal, it's just that the carbon here is not burned, it is only used as a hydrogen carrier, what is burned itself or

more precisely what is oxidized is only hydrogen. When hydrogen is oxidized, apart from producing energy for electricity generation in this case, it also produces waste, but the waste is only water.

So all carbon, whether from pure carbon (charcoal) or from CO2, is only used to produce CO via the Boudouard reaction, C+CO2==>2CO. And this is the essence of the Onboard Carbon Cycles Regenerative Energy (OCCYRE) reactor, namely the technology that we use to give birth to Regenerative Energy, its starts from this Boudouard reaction.

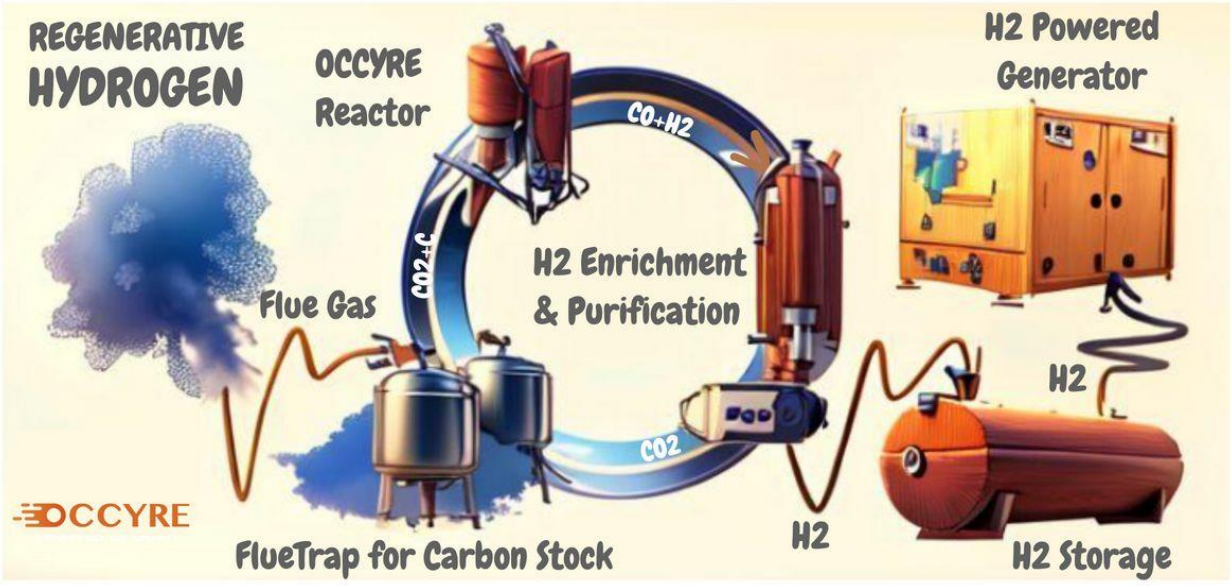
Along with the presence of CO produced by the OCCYRE reactor, H2 is also present, only the concentration is still low. This H2 comes from two sources, first from H2 carried by charcoal - because standard charcoal contains around 5% of this H2. More H2 is also present from water if the OCCYRE reactor is run using steam as the gasification agent.

Because what we need for carbon-free power generation is only H2, while the composition of syngas contains more CO than H2, this is where CO is used as a hydrogen carrier - only delivering hydrogen. The reaction uses Water Gas Shift (WGS), CO+H2O==>H2+CO2. Through this reaction we use up CO to produce H2, but this reaction also releases waste in the form of CO2 emissions.

What is needed then is the purification/separation of CO2 and H2, pure H2 is the product we aim to produce carbon-free power generation. Several well-known brands have prepared generator sets that run on hydrogen fuel - no need to reinvent the wheel - just use what is already available on the market.

The CO2 waste from WGS is recovered with a FlueTrap and stored in the form of adsorbate - namely CO2 bound to C which we use as an adsorbent. This combination of CO2 and C with a ratio of around 3.7:1 (w/w) is the input for the OCCYRE reactor to start a new cycle of production of CO, H2 and so on.

From this we can see that carbon-free power can be produced sustainably at low cost, because there is no expensive fuel in the whole process.



60. Regenerative Hydrogen From Estuaries

One of the greatest energy potentials in this country that has not been exploited at all is energy from river estuaries. This country of 17,500 islands has around 70,000 rivers, which means we also have around 70,000 estuaries. What's so special about this estuaries?

At estuaries, fresh water is discharged into sea water. While there is only around 2.5% fresh water on earth, once it has been mixed with sea water which is 97.5%, it takes a lot of cost and energy to turn it back into fresh water. However, our Creator makes things easy for us, namely through the mechanism of rain - salty sea water becomes fresh again through the rain.

It's just that we waste most of the blessings of this rain, in Jakarta which has 13 rivers, for example, we want this rainwater to be thrown into the sea as soon as possible, even though when we throw this blessed rainwater into the sea - it becomes useless for us.

With a simple reaction called Water Gas Shift (WGS), CO+H20==>CO2+H2, we can separate hydrogen from water at low cost. The CO2 waste through the Boudouard reaction, CO2+C==>2CO, is used to produce CO which we then reuse over and over.

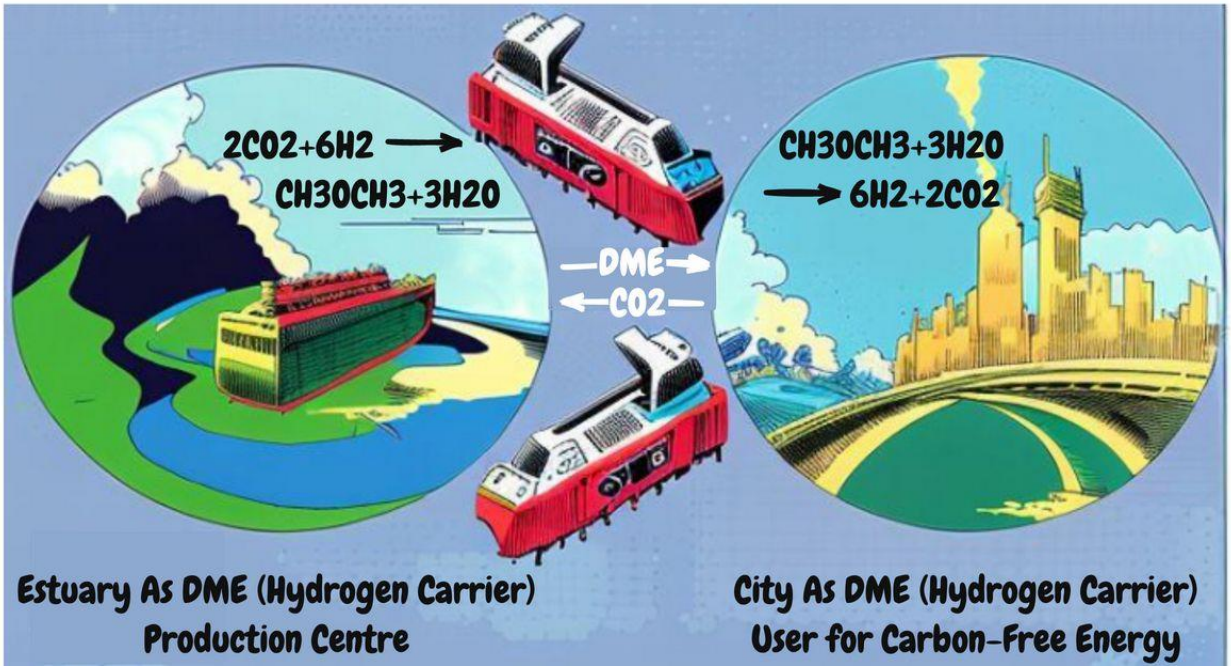
At this point there are still two problems that need to be solved, firstly, H2 produced at estuaries is generally far from the clean energy needed in city centers. Meanwhile, logistics for H2 in its original condition is very expensive, because it requires a pressure of 700 Bar or a temperature of minus 253 degrees Celsius. The solution is, before being sent, the H2 is 'stored' first as DME (Dimethyl Ether) which only requires 5 Bar pressure for logistics.

In city centers, DME is reformed into H2 again and used as clean, carbon-free energy. Can be used for very clean power plants, fuel cell vehicles, etc. This reforming process will produce CO2 again, but the CO2 produced is only in the centers where reforming is carried out.

This concentrated CO2 becomes easier to capture and reuse to produce hydrogen in estuaries. Why does it have to be at the estuaries? Because the production of 1 kg of H2 requires around 9 kg of fresh water. So that the water we use does not compete with drinking water and water for agriculture, we can use fresh water that we want to throw into the sea.

The second problem is that we need carbon for the Boudoard reaction and for process heat, where does this carbon come from? Apart of carbon from CO2, there is also biomass which generally accumulates at estuaries, biomass accumulates from upstream to downstream of the river.

So we call this hydrogen as Regenerative Hydrogen, because overall the sources used are all from waste. Carbon is from CO2 emissions and organic waste, then the water source is the water that we want to throw into the sea at the estuaries. Moreover these resources also being reused it again and again, endlessly.



61. Offboard and Onboard Carbon Cycles

Until this super modern era, all the activities of the inhabitants of this planet Earth that emit CO2, still release it into the Earth's atmosphere. As a result, there is an accumulation of CO2 which is increasing in concentration day by day, causing global warming, climate change, extreme weather and disaster after disaster.

Actually, there is a natural mechanism that absorbs this CO2, namely plants. The only problem is that when the plants on the earth's surface do not increase or even tend to decrease, while the growth of CO2 emissions is accelerating, then relying on plant uptake is certainly not adequate for efforts to reduce these emissions.

Apart from inadequate absorption of CO2 by plants, it also takes a long time, while waiting for it to be absorbed by these plants, CO2 in large concentrations remains in the earth's atmosphere - and causes all the problems mentioned above. The natural absorption of CO2 by plants is what we call Offboard Carbon Cycles, it is necessary and important to exist - just not enough to absorb the rate of CO2 emissions of the industrial era.

So what we need is the acceleration of direct carbon absorption from emission sources, CO2 absorption directly where it appears and when it appears, in-situ and in-time, this is what we call Onboard Carbon Cycles. Carbon in the form of CO2 is never released into the earth's atmosphere, but is immediately captured and reused.

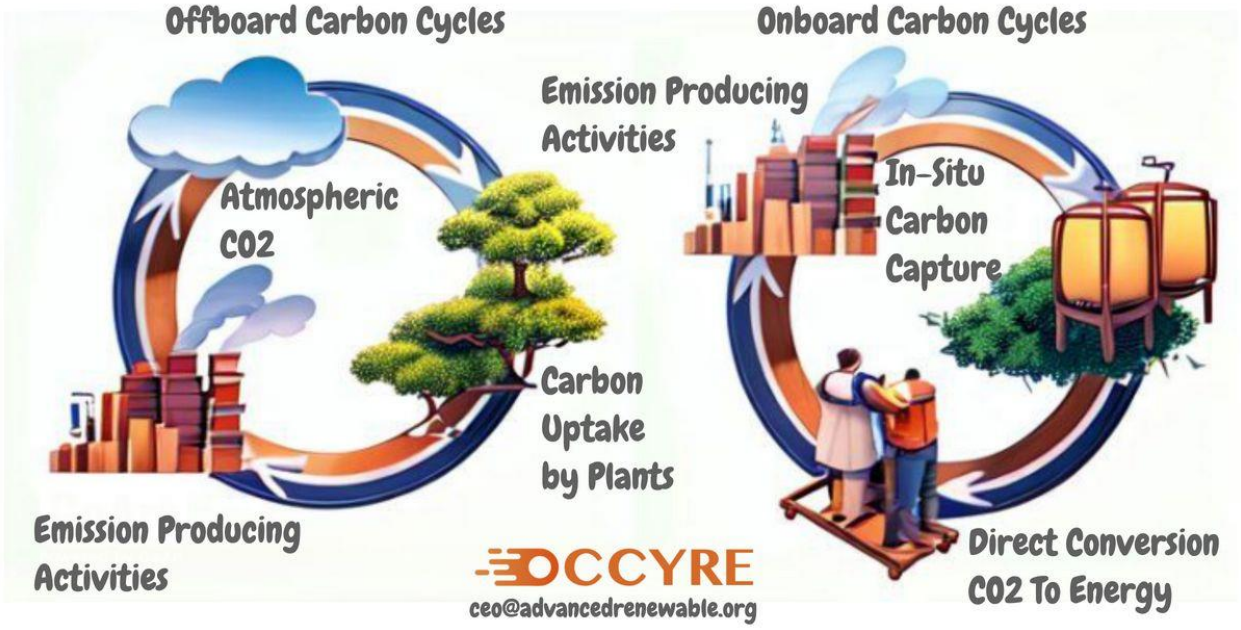
So what is the use of the CO2 that has been captured? The easiest thing and the need for it is really great is to use it as energy, so the new energy that is born from capturing CO2 is what we call Regenerative Energy. Meanwhile, we call the reactor that allows the conversion of CO2 into

Regenerative Energy as the OCCYRE (Onboard Carbon Cycle Regenerative Energy) reactor.

With the presence of Offboard and Onboard Carbon Cycles, Insha Allah, there will be an accelerated reduction in emissions into the earth's atmosphere, the driver is no longer a commitment to agreements between countries in the world such as NDC (Nationally Determined Contribution) etc., but the driver is the needs of each individual, each corporation, industry and institution - that by implementing Onboard Carbon Cycles they will gain two benefits at once.

Firstly, the energy savings will be very significant - a small amount of fuel will be enough because it is used and re-used it over and over again, and secondly the reduction in emissions will also be very drastic - because all CO2 will be captured to become a new fuel source.

What about those who are reluctant to do it for various reasons? They will lose themselves, because while other industries or corporations can reduce costs very significantly from energy savings, those that don't will definitely lose their own competitiveness.



62. Regenerative Energy Infinity Model

That all the inhabitants of the earth will continue to receive their sustenance until the end of time is certain, that is His decree "And not a single creature moves on the earth but Allah guarantees its sustenance for everything..." (QS 11:6). But this doesn't mean that good fortune will come by itself, someone has to work for it.

Like our food, there must always be farmers on this earth who grow food, so that even if we don't grow it ourselves - we can always buy the food we need. The same is true with energy.

If energy is something that will run out, then what energy will be left for the 10 billion people on earth

who will live in this century? So, just like our food, which must continue to be grown and even increase its productivity, energy must also be 'grown'.

There are two ways of 'grow' this energy, the first literally - that is growing anything for our food, the waste can then be used for energy - this is what we call biomass energy. This one will play an increasingly important role in this century and its contribution will continue to increase, but it will not be enough to meet energy needs which continue to soar along with the growth of the world's economy and population.

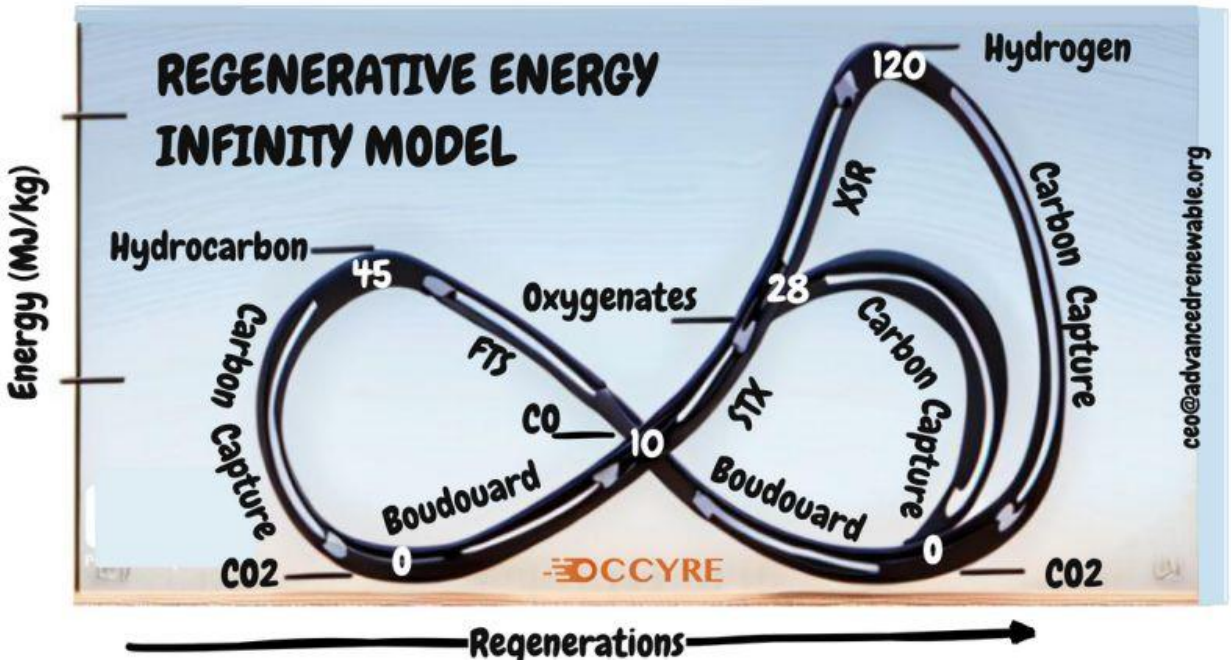
So we also need a second method of 'growing' energy, which grows and bears fruit instantly. This follows the law of conservation of energy which states: "In an isolated system, energy cannot be created and cannot be destroyed, it only changes form from one form of energy to another".

So this change in the form of energy is the basis for the birth of the Regenerative Energy concept that we are promoting. The point is that if we can master the change in energy forms from one form to another, then we will always be able to 'grow' new energy. The infinity model sketch below illustrates this in simple way.

When the hydrocarbon fuels we use today are burned, for example, apart from producing power and waste heat, they emit CO2 emissions. This CO2 is what we capture and 'grow' into new energy in the most basic form, namely CO, the reaction uses the Boudouard reaction in a reactor which we call OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor.

This CO can be used directly as energy (10 MJ/kg), or used to produce oxygenates - fuels containing oxygen. These oxygenates can also be used directly as fuel (20-28 MJ/kg), or to deliver hydrogen through reforming. The result is hydrogen which contains high energy (120 Mj/kg) and is also very clean.

However, the reforming process to produce hydrogen from oxygenates also produces waste CO2 emissions, and this can also be captured and re'grown' to become CO. From this CO, hydrocarbon fuels such as gasoline, diesel, etc. can be re-produced again via Fischer-Tropsch Synthesis (FTS). And so this process repeats itself, on and on immortally until the end of time!



63. Perpetual Carbon Cycles, Learning From the Nature

Since the first two humans were sent down to earth, Adam and Eve, this earth has been inhabited with an ever-increasing population. The growth of the world's population is due to a regenerative process, a couple of humans - giving birth to the next new humans.

Because humans continue to increase in numbers, the means to support life are also created by the same principle, namely regenerative growth. Farmers grow grain, some of which we eat - some of which is replanted. Likewise with livestock, they grow and reproduce - regeneratively, so that we can continue to enjoy meat, milk, cheese, etc.

As with the regenerative system for ourselves and our food, energy must also be able to grow like that. This energy growth also occurs in nature, which we know as biomass energy. It's just that biomass energy doesn't cycles quickly enough to keep up with the growth of world population and the growth of technology adoption - because the higher the adoption of technology, the more energy people need, we need to find new way in energy regeneration.

We must be able to accelerate this regenerative energy growth by cycling the energy element that is easiest to cycle, namely carbon. If in nature the carbon cycle is from CO2 with water and sunlight to CxHyOz (Biomass), then when it is burned it will produce CO2 again, which we speed up is also similar, namely CO2 - CO -Oxygenates (CmHnOy) or Hydrocarbons (CxHy), when these regenerative fuels are burned, CO2 will also be produced.

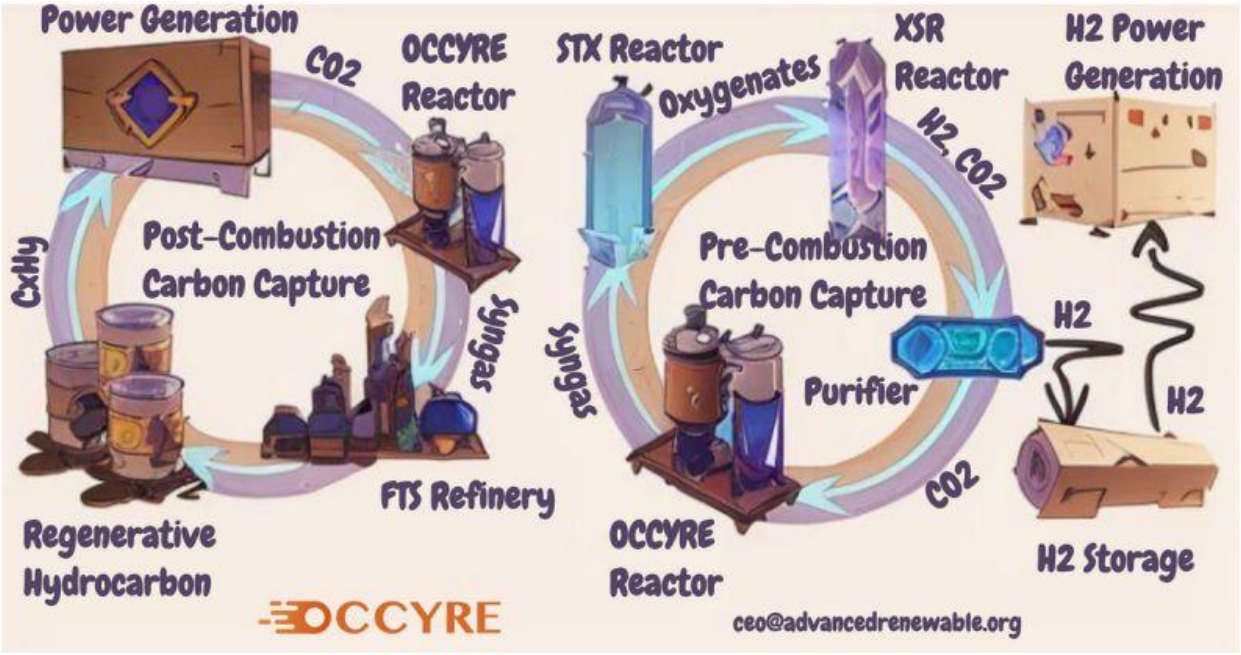
The prerequisite to produce regenerative fuels is our ability to capture CO2, which until now has

always been released into the earth's atmosphere. There are two CO2 capture systems that we introduce, namely what we call post combustion and pre-combustion like in the graphic below.

Post-combustion is when hydrocarbon fuel is used in conventional engines such as generator sets, boilers, etc. We capture CO2 emissions from combustion in these machines and convert them into CO through the OCCYRE Reactor. CO and H2 - which can also be produced from CO via Water Gas Shift, are then converted into hydrocarbons again via Fischer-Tropsch Synthesis, so that they can be used in the same engines again.

Meanwhile in pre-combustion, we capture CO2 and convert it into CO with OCCYRE as well, but the CO produced is used to synthesize oxygenates which are not burned directly. Oxygenates such as methanol, ethanol and DME - Dimethyl Ether, can be used as hydrogen carriers. Oxygenates are reformed in-situ to produce the required hydrogen, while the waste in the form of CO2 is recycled again using the OCCYRE reactor. When H2 is burned or oxidized, it no longer produces CO2 emissions.

Just as humans will continue to exist regeneratively on this earth until the end of time, so will their sources of sustenance, including energy which is also produced in this regenerative way.



64. Carbon Capture and Utilization To the Max

Decades since it was agreed by world leaders that carbon emissions into the earth's atmosphere must be reduced, the reality is that up to now emissions are still increasing, the earth's surface temperature is still warming, climate change is still worsening, and extreme weather is still breaking record after new record.

There must be a new driving factor, so that emission reduction can proceed quickly, and this new driving force can no longer be pressure from outside through laws and commitments between

countries, the new driving force must come from within the emissions stakeholders themselves. And that very effective internal driver is cost savings.

If people are asked to reduce emissions and at the same time it will cost a lot of money, there will be a tendency not to do it. On the other hand, if there is an incentive to reduce costs significantly, people will do it voluntarily.

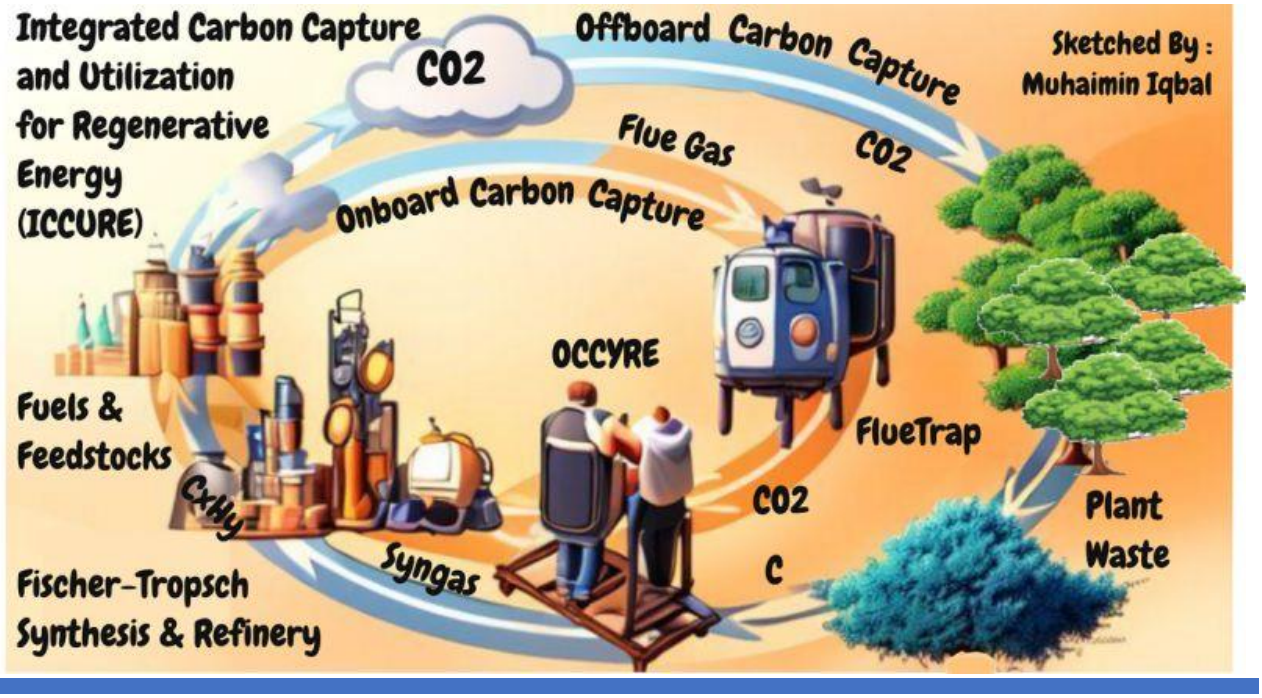
So the solution we are proposing is to change the focus from reducing emissions to saving energy. If our energy costs can become very cheap because of this, then people will flock to do it, and those who don't do it will lose themselves because they will be unable to compete.

We formulate this solution in the scheme below which we call Integrated Carbon Capture and Utilization for Regenerative Energy (ICCURE). Through this scheme, CO2 emissions are captured in two ways at once, namely offboard - capturing CO2 through plants, and onboard using FlueTrap and OCCYRE technology.

The plant we chose is Tamanu (Calophyllum inophyllum), because it is a halophyte type of plant - that is, it grows well in saline water. So it can be planted in arid lands including deserts - because it can be irrigated with sea water, there is no need to fight with fresh water for our drinking water and food crops.

The results of offboard and onboard carbon capture will be the right combination when both are used for feedstocks for the OCCYRE reactor, which operates based on the Boudouard reaction. From offboard it becomes a source of C, while from onboard it becomes a source of CO2, both of which will produce CO gas which is the main component of syngas. From this CO, all types of fuel that we need can be produced, whether in the form of oxygenates, hydrocarbons or carbon-free fuels.

Because this fuel is obtained from all waste sources, namely CO2 emissions and plant waste, the fuel will be cheap, people will voluntarily use it. And the impact is that all emissions will be absorbed by themselves, both offboard and onboard. Detailed proposals are available for institutions or corporations that need it.



65. Carbon Sequestration and Regenerative Energy from Tamanu Trees

This tree was previously chosen by the Wali Songo to fortify a group of small islands in the north of Java - later known as Karimunjawa - so that they would not be drowned by sea water abrasion. It was planted right up to the edge of the sea, so that the fruit 'nyemplung' into the sea - so in Javanese it is called nyamplung. The cleric who preached this environment was later called Sunan Nyamplungan - his real name was Syeh Amir Hasan, son of Sunan Gunung Muria.

Now six centuries later, our search for the ideal tree for offboard carbon sequestration, to be coupled with our onboard technology, come up with the same results - the plant whose international name is tamanu and scientific name Calophyllum inophylum - is the best for massive global carbon sequestration. Why is that?

Firstly, for carbon absorption we cannot use land that is already fertile, it must be land that is barren or even dead which can be revived with these plants. Second, it must not depend on fresh water because critical lands in the world are critical precisely because there is no fresh water. Third, it must be productive from the tree itself, so that people do not need to cut it down to take the wood.

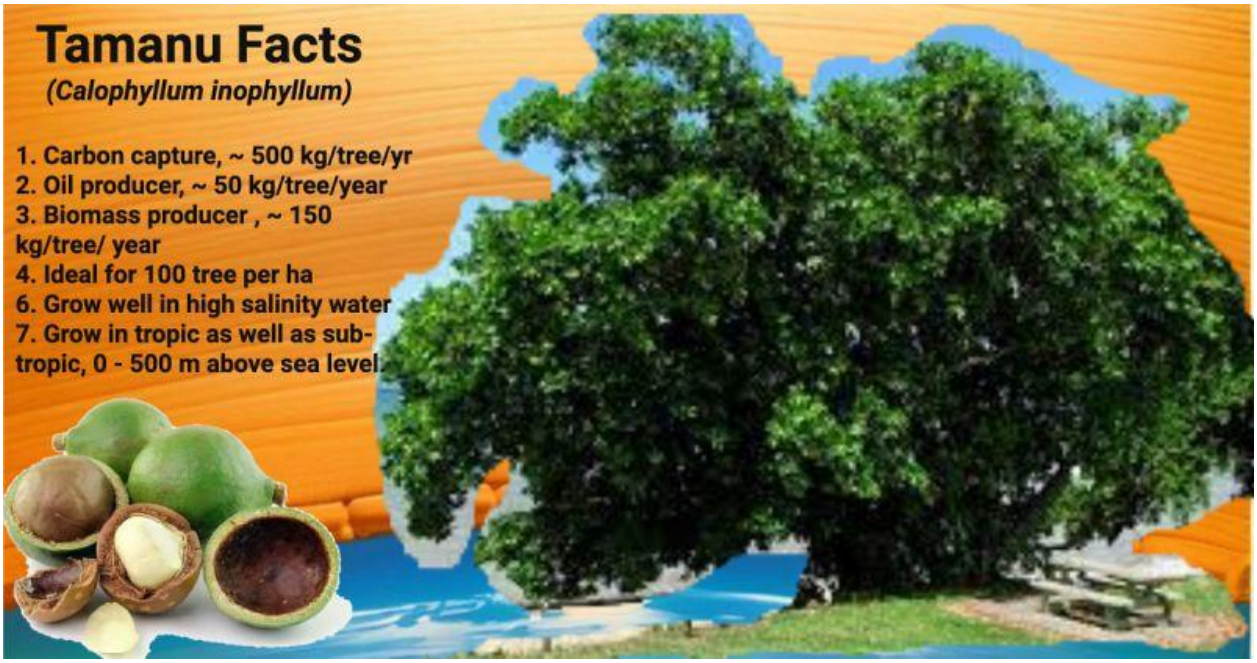
These three criteria are all present in this tamanu or nyamplung tree. That it can live in arid land can be seen in the habitat of this plant which has spread throughout the archipelago, generally on arid coastlines. That it can live in saline water has been proven more than six centuries since Sunan Nyamplungan planted it on the edge of the Karimunjawa islands mentioned above.

Apart from carbon capture, the yield of this tree itself is mainly taken from the fruit, the fruit has a very high oil content - it can reach 50 kg of oil per tree per year after the tree is four years old or more. This tree also remains productive until more than 50 years old.

Tamanu oil is not edible, but its price on the international market is more expensive than even expensive edible oils. Generally used in the wellness industry, for antiaging in particular because of the active compound in it called Calophyllolide. Meanwhile, tamanu fruit shells are similar to candlenut shells, containing high energy - so we can take the carbon.

The latter is what we use as sources of C in the Boudouard reaction, which will react the C with CO2 to become CO gas, It is the main component of syngas which can be used as a sustainable feedstocks for all types of fuel that we use today.

Because it can live on saline water even on dead land, you can imagine the vast area that can be planted with this tamanu, in the MENA (Middle East and North Africa) region alone, where for thousands of years the majority of land has been barren, now it can become a reforestation target as well as a CO2 absorption area for the whole world, among other things, can be done with this tamanu tree.



66. Carbon as an Asset, Not a Burden

Like a wild animal, carbon is only dangerous if it roams in the wild - the earth's atmosphere uncontrolled. It becomes a multi-purpose resource when we can 'tame' it and manage it optimally, including as energy. All forms of energy that we use now and in the future can all be produced from carbon, the graph below explains this.

The right graph is carbon accumulation as a result of energy use. This carbon accumulation - the majority of which is in the form of CO2, occurs naturally in the earth's atmosphere until now - because we have not managed it yet! Once we successfully capture and manage it, it becomes an asset that we can convert into any kind of fuel, which I summarize in the left graph.

CO2 is fully oxidized carbon, does not contain energy (0 MJ/kg), but if we could take out just one O, with the OCCYRE reactor operating based on the Boudouard reaction, it would become CO which already contains energy (~10 MJ /kg). If both O are taken by electrolysis, it becomes a pure solid carbon whose energy content is equivalent to 2/3 of the energy of petroleum (~30 MJ/kg).

It would be even more interesting if the CO is used to produce a higher fuel, the most ideal would be if the CO is used to produce hydrogen with the Water Gas Shift (WGS) reaction, the result would be pure hydrogen with a very high energy content (~120 MJ/kg).

If hydrogen is not used directly in-situ and in-time, it may needs to be stored and transported, then hydrogen can be 'stored' in the form of oxygenates, because storing and transporting pure hydrogen is very expensive - it requires a pressure of 700 Bar or a temperature of minus 253 degrees Celsius.

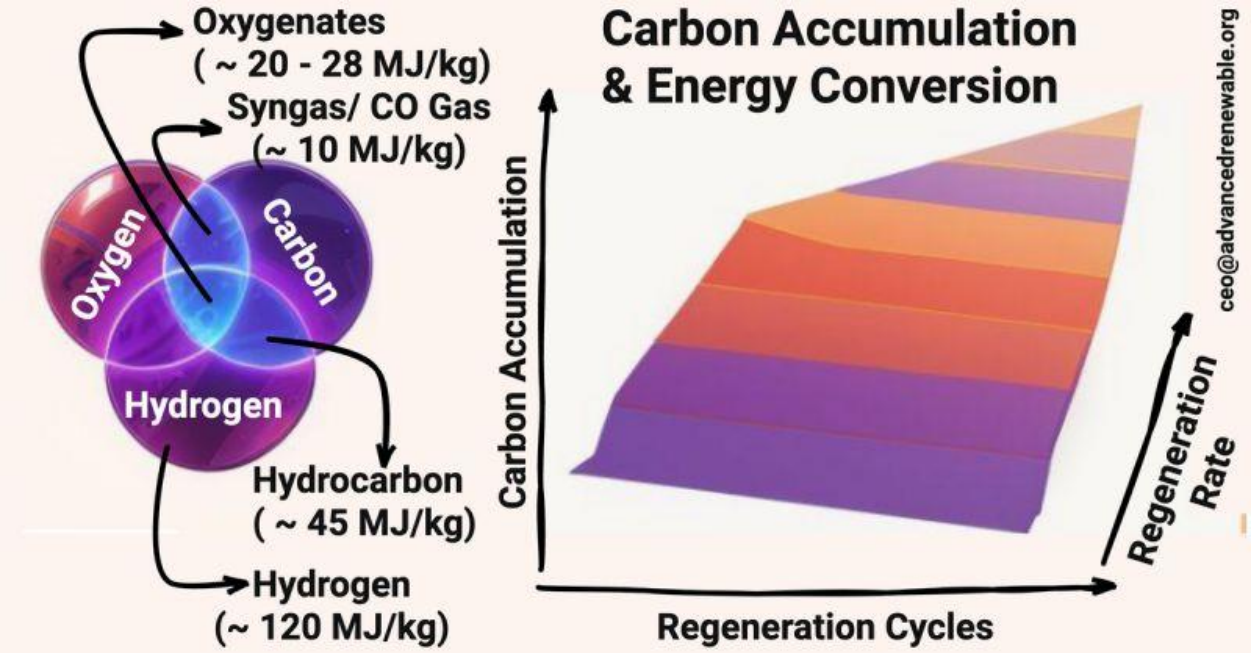
Oxygenates such as methanol, ethanol and DME (Dimethyl Ether) apart from being able to function

as a hydrogen carrier, can also be used directly as fuel with medium calories (~ 20 - 28 MJ/kg).

Because what is currently most needed is still hydrocarbon fuel such as diesel, jet-fuel, gasoline and LPG, CO can also be used as feedstocks for this hydrocarbon fuels production. For this CO needs a companion H2 - which can also be produced from CO via the WGS reaction mentioned above.

With a series of various fuel products that can be derived from CO2 to CO and so on, it is ironic that the world perceives CO2 as something that still has to be thrown into the air with all its consequences, giving rise to problems of global warming, climate change, extreme weather, etc., then the world must spend colossal funds to try to remove it again from the earth's atmosphere by what is called decarbonization.

Why not capture it directly at the source of emission and re-use it as energy? This is where a change in perception is needed, from seeing CO2 as a burden to CO2 as an asset, after that we can solve the technological needs.



67. Dedieselization Without Killing the Diesel Engine

Among the most populous power generating machines in the world are diesel engines. Because of their mass production since the last century, these diesel engines are also relatively cheap compared to other power plants. Therefore, it is a solution for providing electricity in areas that are not yet reached by the electricity network.

Even though the engine is cheap and easy to get, the fuel is not the same. Power plants using diesel fuel are among those with the most expensive electricity production costs per unit kilowatt. The range is 5-7 times more expensive than the average cost of producing electricity with other energy

sources.

Besides that, diesel fuel is also a significant contributor to CO2 emissions in the earth's atmosphere. For every liter of diesel fuel burned, 2.64 kg of CO2 is released into the earth's atmosphere. So because of the high price of fuel and the high level of emissions, number of countries are determined to reduce the use of diesel engines for electricity generation - with a program called dedieselization.

However, this program is also not a cheap program because it requires replacing the massive infrastructure of diesel engines that have been installed throughout the world since the last century.

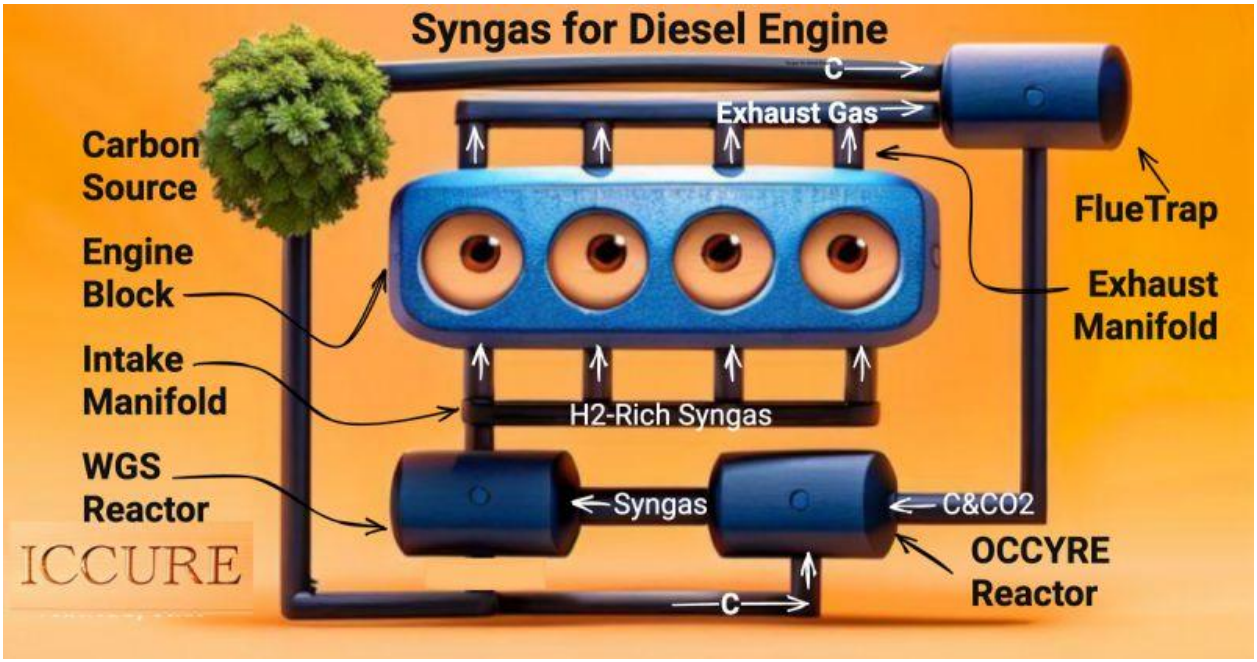
This dilemma between the high cost of electricity using diesel fuel and the high investment in replacing it is what we have solved, among other things, with what we call regenerative syngas. Diesel-powered power generating machines can still be used in their entirety, only the fuel is replaced, namely with syngas produced from the diesel engine's own exhaust gas.

For this we modified the diesel engine configuration as in the illustration below. There are three components that we added, namely FlueTrap to capture CO2 with an adsorbent, with this all CO2 emissions are captured and reused as fuel.

The second is the OCCYRE reactor, which is a CO2 gasification machine with carbon to produce syngas. However, standard syngas has low calories, only in the range of 5-7 MJ/kg, so its performance is not good when used directly as a substitute for diesel.

So we added one more component, namely the Water Gas Shift (WGS) reactor. With this WGS, the H2:CO ratio of the syngas components can be increased from the standard below 0.5 to much higher ratio in the range of 3 and even 4. With this, the energy content of syngas will increase to 29 - 42 MJ/kg, or can approach diesel which is 45 MJ/kg .

With this regenerative syngas, not only does fuel become very cheap because of it came from waste CO2 emissions itself, while emissions into the earth's atmosphere also become close to zero because all emissions are captured and used as fuel again. This is the cheapest and most feasible dedieselization solution!



68. Low Cost Clean Energy With Regenerative Syngas

The world has agreed that by 2030, all inhabitants of the planet earth must be able to access clean, modern energy (SDGs no. 7). However, until now, the world has not moved closer to energy that is more affordable, let alone clean. Fossil energy continues to dominate the world and is clearly not becoming more affordable. So our think tank, Advanced Renewable Organization (ARO) offers this solution.

We call this very clean fuel with close to zero carbon emissions as Regenerative Syngas (RS). It can be produced anywhere from raw materials consisting of three low cost components, namely CO2 emissions, carbon (charcoal) and water.

The illustration below is the reaction formulation and machine configuration. There are essentially two chemical reactions that we use for the RS production process. The first is the Boudouard reaction, which was discovered by the French scientist Octave Leopold Boudouard at the end of the 19th century, namely when CO2 is reacted with carbon C, it will produce 2 molecules of CO gas.

The second reaction is a discovery by the 18th century Italian scientist, Felice Fontana, namely when we react 1 of the 2 CO molecules from the first reaction with water, the result is 1 molecule of CO2 and H2. All reactions when added together will become the 3rd reaction, namely C + H2O==> CO + H2 or what is called syngas. What is the meaning of these reactions?

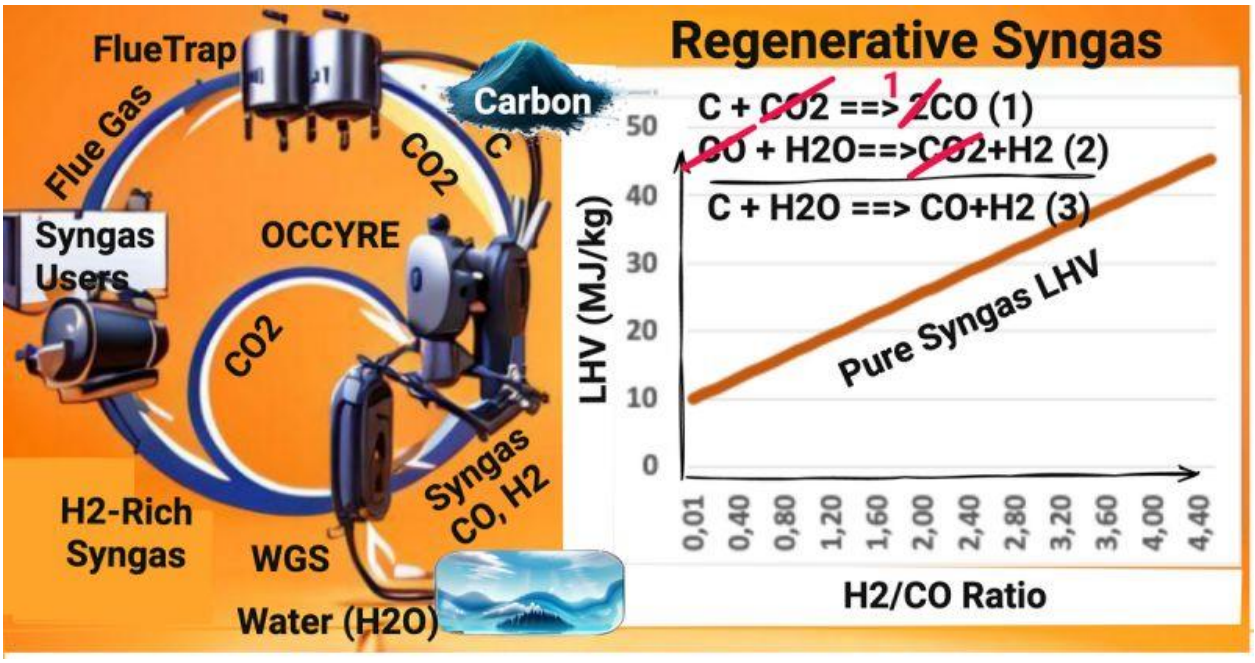
This where the key to decarbonization is, we can see that CO2 is 'lost' in this series of reactions and turns into syngas. The illustration on the left is a series of machines and processes to execute the two reactions mentioned above. First, CO2 from the emission source is captured using FlueTrap

technology, after which it is reacted in the OCCYRE reactor to become syngas.

OCCYRE's output is still standard syngas, rich in CO but still poor in H2 - because it only relies on H2 carried by charcoal. So through the second reaction, this syngas is enriched with more H2 which comes from steam. This steam heat source uses waste heat originating from the OCCYRE reactor which operates at temperatures above 800 degrees Celsius. Meanwhile, the source of energy for OCCYRE itself comes from burning some part of the carbon.

The second reaction also functions as a control, how much energy density we want our syngas has, the higher the composition of H2 - which is taken from the steam, the higher the LHV (Lower Heating Value) of this syngas. Syngas with a high LHV close to the LHV of petroleum is very versatile fuels and feedstocks, can be used as any fuel, for power generation, to produce heat/steam, and even to produce hydrocarbons and oxygenates fuels.

Because there are two sources of carbon used in this system, namely from charcoal and from CO2 emissions, apart from producing reliable, low cost and clean energy, we also clean the earth's atmosphere from CO2 emissions - wherever the source of the emissions comes from!



69. Regenerative Ecosystem for Food, Energy and Water (REFEW)

Currently the population of this earth has reached 8.1 billion people, and will reach 10 billion in less than the next three decades. Life's sustenance will be sufficient for every body though, because it has been guaranteed by our Creator.

The three basic needs, namely Food, Energy and Water (FEW), can definitely be provided for all the

inhabitants of this earth. For this purpose, we are developing a project called Regenerative Ecosystem for Food, Energy and Water (REFEW), we make it a as means for our Environmental and Social Activities (ESA).

If so far the fulfillment of these three basic needs has been a struggle competing each other for resources, in this REFEW project - all three are designed to grow each other, and this mutual growth is also the keyword that differentiates it from similar projects designed by other activists.

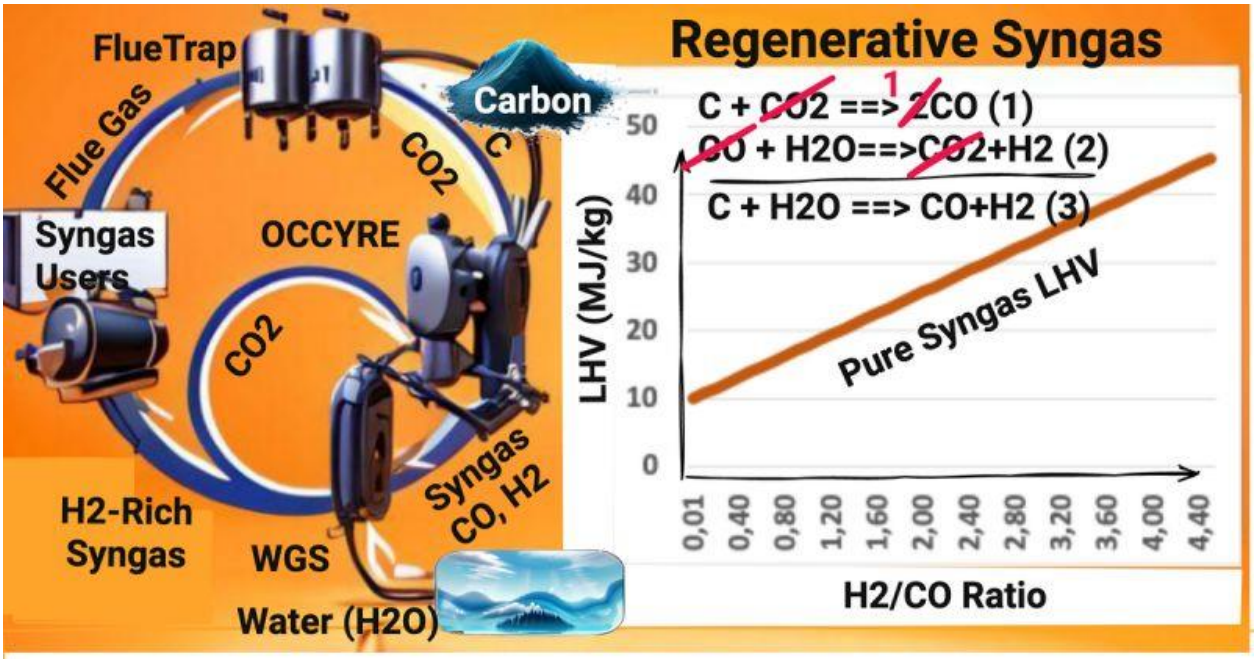
Starting from Food, His guidance is that we must be able to grow food plants even on dead earth, with what? starting with the grains or pulses we eat. But how can we plant if there is no water? Initially, a little water can be brought from other places, or distilled from sea water with environmentally friendly and energy efficient technology, with CDI (Capacitive De-Ionization), for an example.

This small amount of water then must also be stored properly in the soil, for this purpose biochar is needed so that ground water is stored effectively. With black soil or what is called Terra Preta, we will be able to start planting on initially dead soil with a little water. Starting from the grains or pulses we eat, from types of legumes will be better, as beside high in protein, they can also directly fix nitrogen from the air - this is important when our soil is still nutrient poor.

After plants grow, the surface of the earth will change - from barren or dead earth that reflects sunlight strongly - called high albedo, to green earth with low albedo. High albedo means that clouds don't have time to clump large enough, because they are always 'shot' by this strong albedo. When the albedo decreases, the clouds can clump together into large ones, and rain can fall in areas that were previously barren.

In land that is green, the earth is alive and strengthened by the ability to store ground water, when it rains - water will accumulate in the soil and in the long run will emit springs. In areas where rain falls and even springs come out on previously barren earth, any plant can grow - biomass will be abundant.

Land that was previously barren will be able to meet all the needs of its inhabitants, including energy - because to produce clean energy, for an example with the one we call regenerative syngas (https://lnkd.in/gQcndYt2), the only input needed are CO2 emissions, biomass/carbon, and water - which at the time everything will be abundantly available.



70. Environmental and Social Actions – ESA

For several years up to now, the world's commitment to sustainable growth has also been followed up at the corporate level. World financial authorities have long required the implementation of sustainable finance for banks, the non-bank financial industry, bond issuers and public companies.

At its peak, this year the European Union came into force with new financial reporting standards that very strictly regulate what is often called Environmental, Social and Governance (ESG). The new financial reporting standards are called European Sustainability Reporting Standards (ESRS). Like other EU standards, this ESRS will soon have an impact on other parts of the world.

Of the three ESG elements, the G element (Governance) is not a problem for big companies that are already subject to this kind of regulation, but the other two elements, namely E (Environmental) and S (Social), not all of them have sufficient resources to be able to implement them thoroughly. So this becomes an extraordinarily large market for consultants, audit services, etc., who assist these corporations in fulfilling the obligation.

Even this will not be enough because the E&S ultimately has to be truly implemented in the real world, there must be parties who work physically in the field to improve the environment and social conditions with all their parameters, including but not limited to reducing CO2 emissions, availability of clean water, adequate food supply, sustainable growth, GDP (Gross Domestic Product), HDI (Human Development Index) and so on.

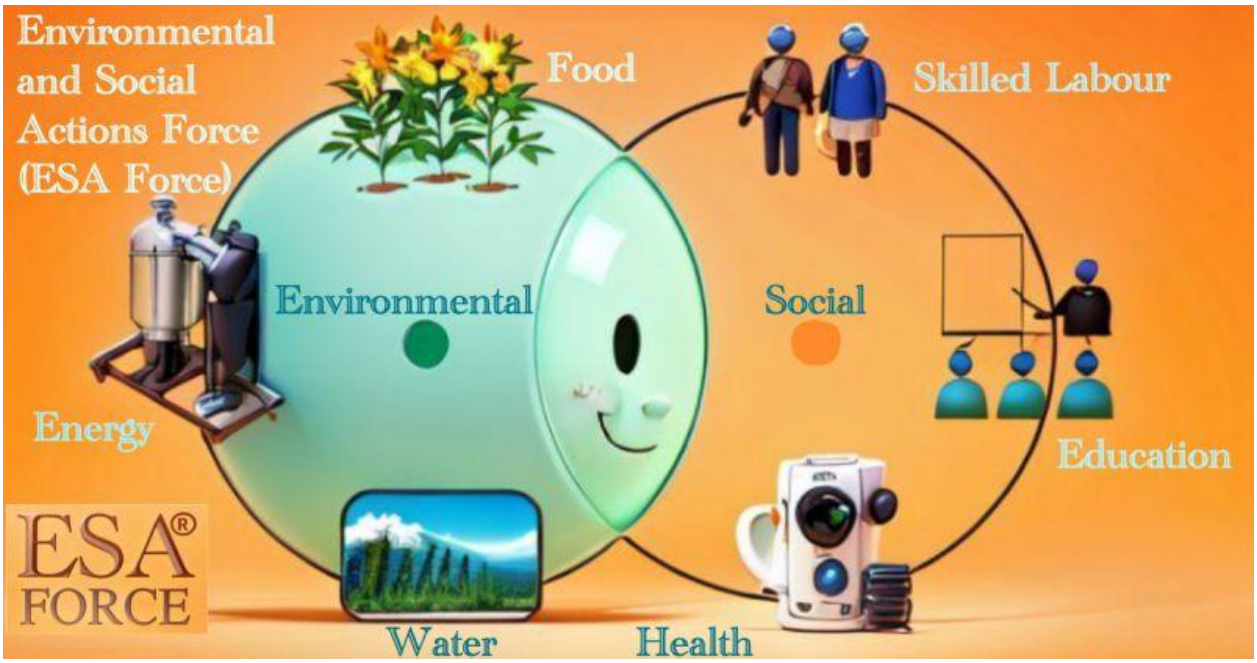
Because this requires very large resources, and can actually distract the corporations from their core businesses if they go too deep into the E&S area themselves, our very productive think tank - Advanced Renewable Organization, has again launched a new service which we call Environmental

and Social Actions Force (ESA Force).

The purpose of the ESA Force is to help corporations, institutions and also governments to implement ESG - especially the E&S elements. The real program in the field is more or less like in the diagram below. For environmental - we focus on three areas that have the biggest impact, namely Food, Energy and Water. We call this program as REFEW (Regenerative Ecosystem for Food, Energy and Water), the detail is in the previous upload: https://lnkd.in/gFWsyUvy

For social programs, we focus on 3 areas as well, that have a direct impact on improving HDI, namely health, education and quality employment opportunities. We will share details of this social program in a separate upload.

Because of the massive potential opportunities with this ESA Force, we invite all parties who can see the same opportunities and are interested in joining this ESA Force, as co-founders, c-level executives, country directors, investors, field implementers and various other positions that will open all over the world. Please contact us via private message of this media.



71. Two Sides of the Same Coin of CO2

Like two sides of the same coin, so far we tend to see carbon in the form of CO2 from only one side - namely as a form of emissions that pollute the earth's atmosphere, causing global warming, climate change, extreme weather and all the consequences it causes.

We have not yet seen the other side which is full of potential, including being the biggest new energy source that is before our eyes. This new energy, which we call Regenerative Energy (RE), can come in various forms, in the form of power/electricity or liquid and gas fuels, from oxygenates,

hydrocarbons or carbon-free energy such as hydrogen.

By looking at these two sides as a whole, we will also be able to justify a more appropriate CO2 handling pattern. Because when CO2 is only seen as a source of emissions, the handling pattern will tend to become a cost center only. Likewise, when we only look at CO2 as a new energy source, we tend to compare it with other energy sources that could be cheaper, such as hydropower, wind and solar.

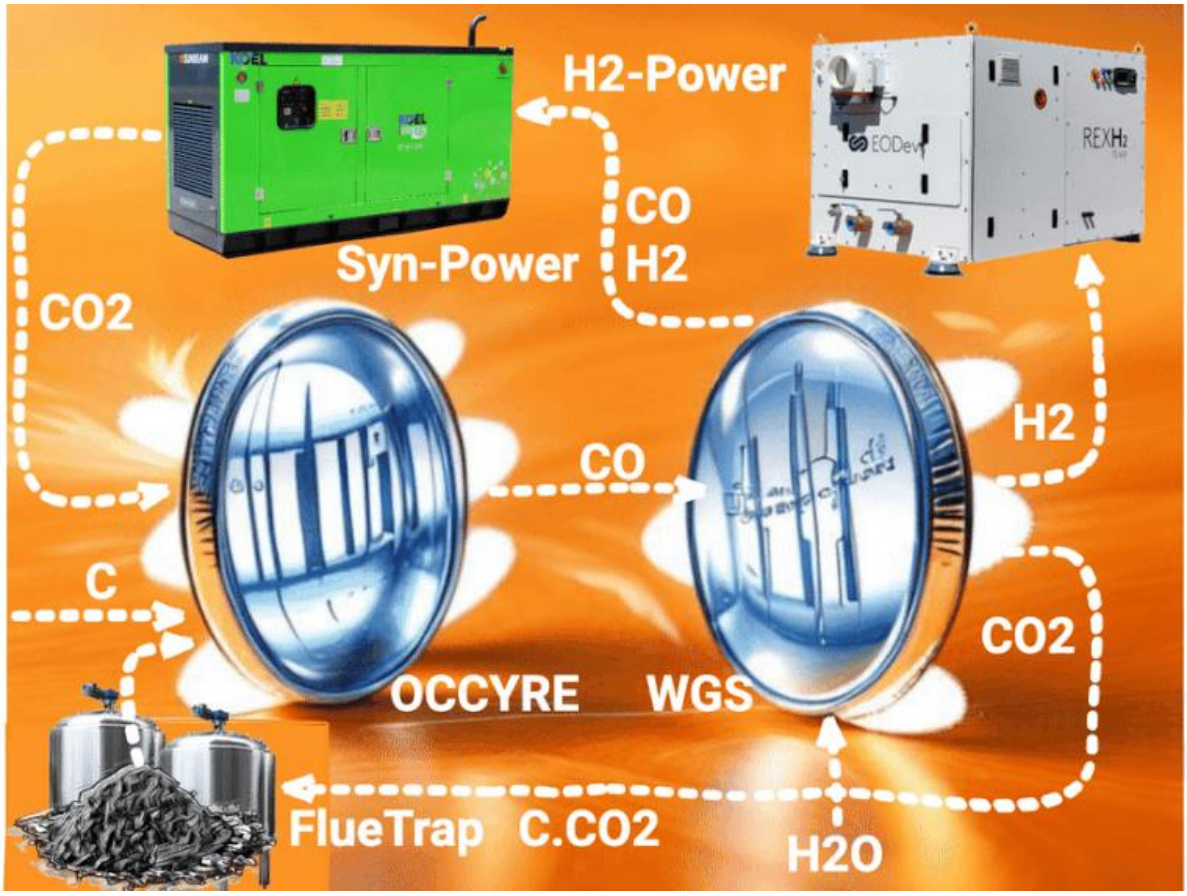
If hydroelectric, wind and solar electricity existed together with electricity from coal and diesel, for example, then it is true that the first three do not add CO2 to the air, but the last two will require large costs to reduce CO2. Imagine if RE is present along with diesel and coal-powered electricity, the presence of RE not only adds a new source of energy that is emission-free, but also absorbs CO2 from power plants that use diesel and coal that exist with it.

The illustration below is that if we put side by side diesel power as an example with RE, all the CO2 will be absorbed through two reactions, Boudouard (CO2+C==>2CO) which is the left side of the coin, and Water Gas Shift or WGS (CO+ H2O==>H2+CO2) is the right side of the coin. The CO2 that emerges from the WGS is then re-captured again to enter the next cycle.

The increase in energy efficiency will be very significant, because the energy that was originally only produced by burning diesel (45 MJ/kg), through the thermomechanics process - namely the heat that drives the diesel engine - generally only has an efficiency of under 30%, with RE the energy will be added by thermochemicals energy - namely when CO2 changes to CO in the OCCYRE reactor, then CO changes to H2 in WGS, and finally when H2 reacts with O2 to form water by releasing 120 MJ/kg of heat.

Of course, to be able to process CO2 into CO and then also H2, you need energy, namely heat. But this heat energy can be obtained cheaply from burning carbon or biomass - which is not as expensive and scarce as diesel. Then from CO2 to H2 with an energy content of 120 MJ/kg, only around 22.5 MJ of heat energy is needed, or only around 18.75% of energy is used for process.

With a configuration like this, energy efficiency which was originally below 30% jumps to around 57% and is now emission free!



72. Regenerative Syngas for Multipurpose Fuels and Feedstocks

Regenerative Syngas (RS) is syngas (CO and H2), which is produced from onboard carbon capture, such as using the FlueTrap and OCCYRE reactor, and offboard carbon capture through the photosynthesis process of plants into biomass. This is to differentiate syngas produced from fossils such as coal and natural gas, and renewable syngas from biomass. I have previously uploaded detailed production here: https://lnkd.in/gQcndYt2

Two goals can be achieved at once by using this RS, firstly, industrial emissions, power plants and other emission sources can be captured and do not pollute the earth's atmosphere, secondly we can obtain raw materials for low cost fuel whose sources are abundant. So what lind of use can this RS in current technology?

The diagram below is a usage that we have reviewed and tested some of them, starting from the bottom right corner. Internal Combustion Engine (ICE), both petrol and diesel, can have their fuel substituted with RE. RE can also be a feedstock for various chemical industries which currently depend on fossil raw materials.

RS can produce direct electricity very effectively using Fuel Cells technology, especially Solid Oxide Fuel Cells (SOFC). The most widely used is when RS is used to produce Advanced Fuels. It can be in the form of oxygenates such as methanol, ethanol, Dimethyl Ether (DME), hydrocarbons such as gasoline, diesel, jet-fuel, LPG, or to produce carbon-free fuels such as hydrogen and ammonia.

Because this RE is produced using a special gasification reactor, the OCCYRE reactor - namely a reactor that can facilitate the Boudouard reaction (C+CO2==>2CO) effectively, at temperatures above 800 degrees Celsius, there is potential for other energy that can also be processed, namely energy from waste heat.

The simplest thing is to use this waste heat for heating or air conditioning, and for water heating. What's even more sophisticated is that the waste heat can still be used to produce more electrical energy. Mature technologies can use an Organic Rankine Cycle (ORC) microturbine, or it can also use a Thermo Electric Generator (TEG).

From the examples of RE utilization below, we can see that whatever form our energy needs - they can actually be met from RE which is produced, among other things, from raw materials in the form of CO2 emissions. What does this mean? two big problems in the world today - the solutions are before our eyes, namely the problem of CO2 emissions which is very worrying because of its impact on global warming, climate change, extreme weather, etc. and energy security problems which have reached a critical point in a number of countries.

The solution to these two big problems is the same, we capture the CO2 emissions and process them into basic energy. The simplest thing for this is to start processing them into Regenerative Syngas.

73. Regenerative Energy, How It Grows

Regenerative is the characteristic of being able to grow or grow again, when we attach this word to something - then that something will have the characteristic of growing. It is easy for us to understand how humans, animals and plants all grow and reproduce, filling this earth with these regenerative properties. So how does Regenerative Energy (RE) grow? Where does the extra energy come from?

The same as humans, we grow because the cells in our bodies duplicate, when we give birth to offspring - this repeats itself very quickly, from one cell growing into children whose bodies are even bigger than us. How can we grow? because there is food and drink intake into our bodies.

So it is the same with RE, to be able to grow continuously to meet human needs which are also growing, energy to grow needs to be supplied. What is the intake? the cheapest and easiest is the intake that we have been disposing of - both what we have thrown into the earth's atmosphere in the form of CO2 emissions, and what we have thrown away in the form of rubbish and waste - the majority of which is also carbon.

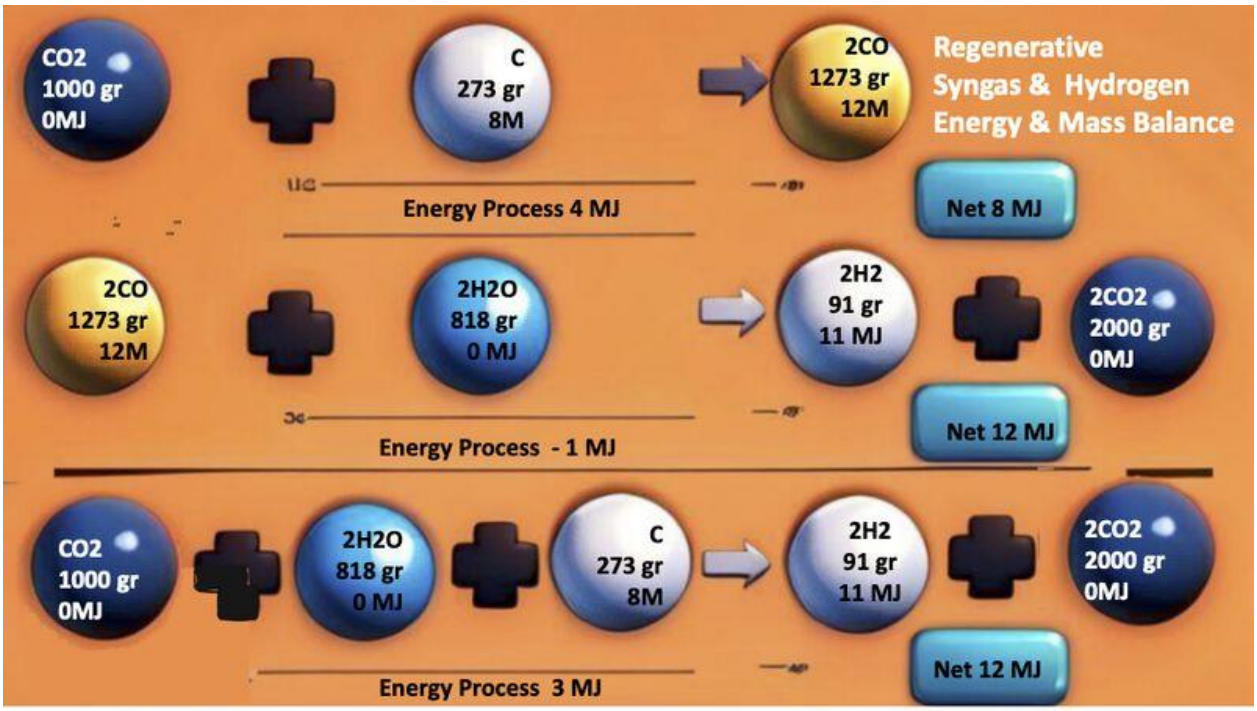
In the graph below, we can see how the CO2 that we react with Carbon (C) immediately becomes new energy. Initially it becomes CO gas which can be directly used as fuel, or processed further. What we can show in the graph is if we use CO to produce hydrogen.

With whatever route the 'initial intake' is in the form of CO2 and C, when it is used for energy it will result in CO2 being released again. It can be done through post-combustion, for example we burn CO - the result is heat and CO2. It can also be done without combustion or pre-combustion, for example when we react CO with water, the result is hydrogen and CO2.

Because there are 2 C, namely from CO2 and from Carbon C, no matter how it is processed, there will be 2 CO2 waste, and this is what has been accumulating in the earth's atmosphere and causing global warming, climate change, extreme weather, etc. However, when we capture the 2 CO2, it can become new energy again, where originally we had 1 CO2 and 1 C, when we have used the energy either as syngas or H2, the waste consists of 2 CO2, this is what becomes the raw material for the next new energy next.

How to utilize this new 2 CO2? We can repeat the same process by adding 2 C and so on. Or we can do it another way, we add not 2 C but 6 H2 for example, What will happen? It will become liquid fuel from the oxygenates group - containing oxygen, or hydrocarbon fuel - when the O is separated.

The reaction of CO2 with H2 to become hydrocarbon fuels such as gasoline, diesel, LPG etc., can now be done economically because the H2 can be produced cheaply using the electrolysis of water with electricity, which again electricity is produced regeneratively from CO2 and C as mentioned above. .



74. Introducing Regenerative Hydrocarbon Equation (RHCE)

This is good news for people around the world. In the midst of an increasingly uncertain geopolitical crisis, energy security is also starting to be disrupted in a number of countries. Now any country in the world can produce its own petroleum or hydrocarbons economically, by utilizing three things that are certain to exist in every country - or any part of the world. These three things are carbon emissions (CO2), biomass (carbon or C producer) and water.

How to produce regenerative hydrocarbons as an economical substitute for petroleum? The following are the most feasible three processes - at least base on our experiments. These three processes are not our inventions, but rather the inventions of scientists from three centuries ago, what we have done is simply simplify them so that hydrocarbons are easy to produce and affordable - anywhere.

The first process was discovered by Oliver Leopold Boudouard from the 19th century, essentially he changed CO2 and C into CO gas. For the application, we created a reactor which we call OCCYRE (Onboard Carbon Capture for Regenerative Energy) - equation 1.

The second process is a discovery by Felice Fontana from the 18th century, essentially changing CO gas and water into H2 and CO2. For the application we created a reactor called Water Gas Shift (WGS) - equation 2.

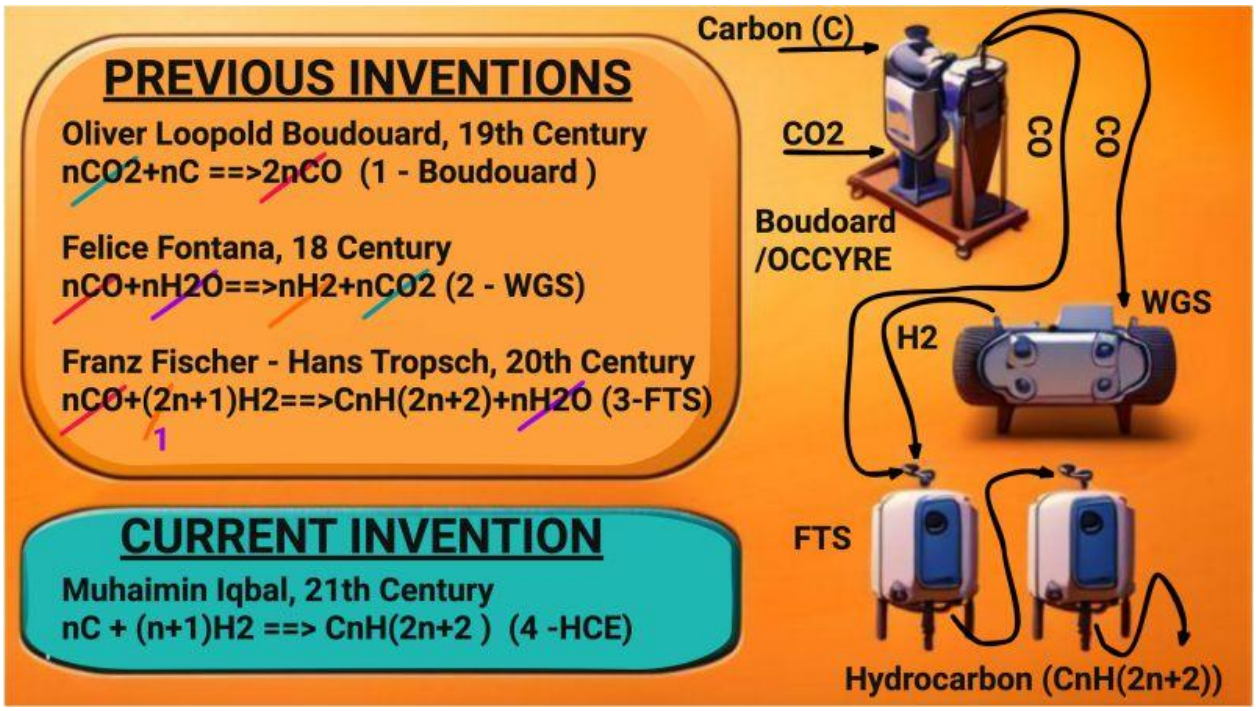
The third process was the discovery of Franz Fischer and Hans Tropsch a century ago, the 20th

century. Essentially it is to change CO and Hydrogen gas into the Hydrocarbons that we know today, which can be used for petrol, diesel, jet-fuel, LPG and so on.

We then simplify these three processes discovered by their respective inventors in different centuries - as in the left part of the illustration below, the same molecules but on different sides will cancel each other out, so the result is the very simple 4th equation.

Because we haven't found anyone who has named this 4th equation, we temporarily name it the Regenerative Hydrocarbon Equation (RHCE). The most economical process uses the 3 steps mentioned above, but to easily understand it in terms of business model planning etc., the 4th equation that we found can be a great help.

In essence, if we can make C reactive to produce CO - one of it with OCCYRE, and the next also to produce low cost hydrogen - with WGS, then we will be able to produce low cost Hydrocarbons with the FTS reactor. This is the answer to the world's goals in SDGs number 7, clean and affordable energy, which must be achieved before 2030!



75. Regenerative Health In 3 Steps

There is a common thread between environmental programs and social programs that we initiated at Environmental and Social Actions (ESA) (https://lnkd.in/gpuX73Jz), that common thread is one word, namely 'Regenerative'. If in the energy sector we introduce the concept of Regenerative Energy (RE), then in the health sector there is Regenerative Health (RH).

Just as RE is used to solve the problem of energy needs in a fundamental way, similarly in the

health sector with RH, it is to overcome all health problems in a very basic way. If in RE what we use to 'give birth' to new energies is carbon, in RH the source of health is what is called Stem Cells. What exactly are these Stem Cells?

Stem Cells are stem cells from which new cells are born with various functions. If the quantity and quality of these Stem Cells is maintained, new cells will always be born that our body needs to replace cells damaged due to age, disease or injury/accident, etc.

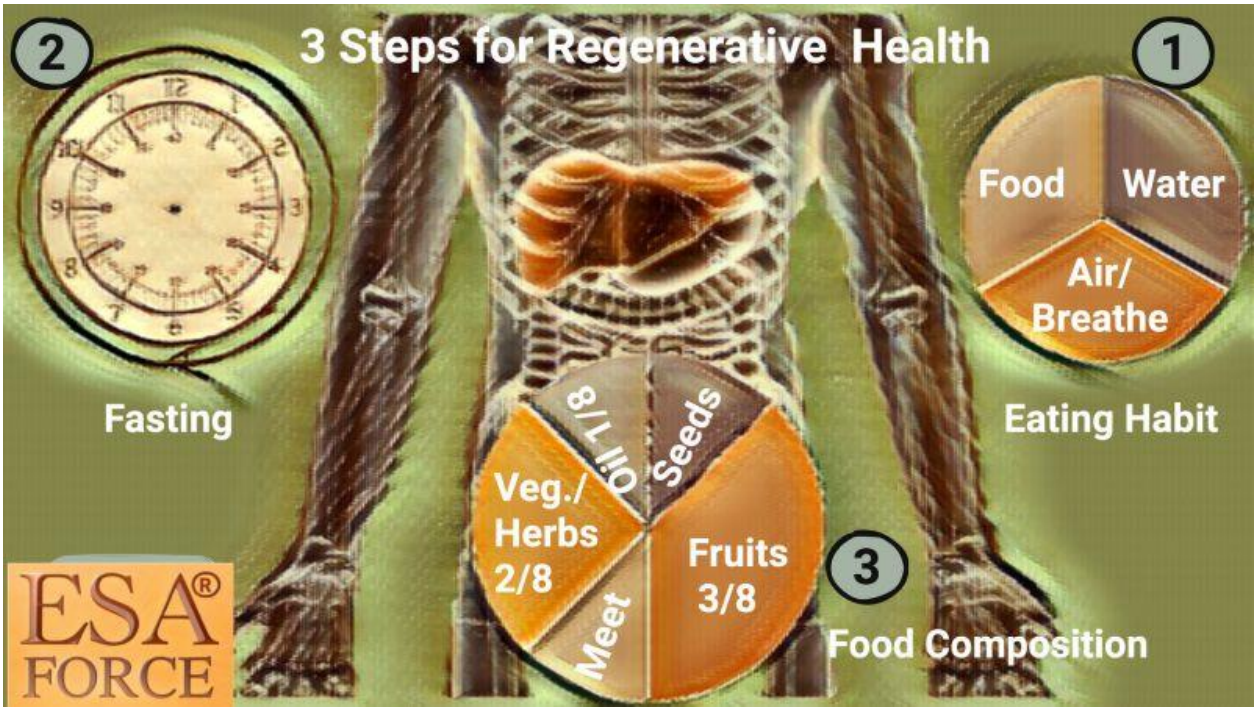
Because of the extraordinary nature of Stem Cells, there is an expensive treatment using Stem Cell injections - to multiply Stem Cells in the patient's body. However, this is not the case with the RH concept, the quantity and quality of Stem Cells are not produced by injection from outside the body - but are grown internally by our own body.

RH essentially maintains our body's health by maintaining the quantity and quality of Stem Cells in the body. So what can we do for this? These three steps will be able to maintain and improve the quantity and quality of Stem Cells in our body.

First, by ensuring that our stomach is always not in a full position, there must always be empty space in it. In the hadith it is stated that 1/3 of our stomach is for air or breathing. The scientific language is Caloric Restriction (CR), experiments carried out by scientists with mice showed that emptying their stomachs between 10%-40% over a long period increased the production of Stem Cells in the stomachs of these experimental mice.

Second, by fasting frequently, or also called Dietary Restriction (DR). The difference with CR is that if CR gets used to having a stomach that is 1/3 empty continuously, DR allows the stomach to not get any food/drink at all but for short periods - around 12 hours at a time. The impact on the quality of Stem Cells is by improving the quality of their functions. The combination of CR and DR will increase the quantity and quality of Stem Cells in our body.

How do we maintain our body's energy and nutritional needs so that they are always adequately maintained even though our stomachs are always not full and we often fast - don't eat/drink at all for about 12 hours at a time? Our food combinations need to be kept rich in nutrients, not rich in energy, so the third step of RH is High Nutrition (HN) food, not High Energy!



76. Color of Regenerative Syngas Flames, Color of Our Future!

Carbon is physically black, when it is released into the earth's atmosphere in the form of CO2 it also gives the impression of black. However, when we react the carbon or charcoal with its own CO2 emissions, the flames that emerges from both can be colorful as in the photo below. That's what we call Regenerative Syngas, low cost energy because the ingredients are all from waste - namely biomass waste or charcoal and CO2 emissions.

The machine to produce Regenerative Syngas is what we call the OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor, which is the first of three machines that I introduced in the Hydrocarbon Equation, in the previous upload: https://lnkd.in/g2SDKvCG

The colors of the syngas flames depend on the level of purity of the syngas and the hydrogen content in it. The hydrogen in this syngas comes from hydrogen in the charcoal that we use, because on average charcoal contains around 5% hydrogen.

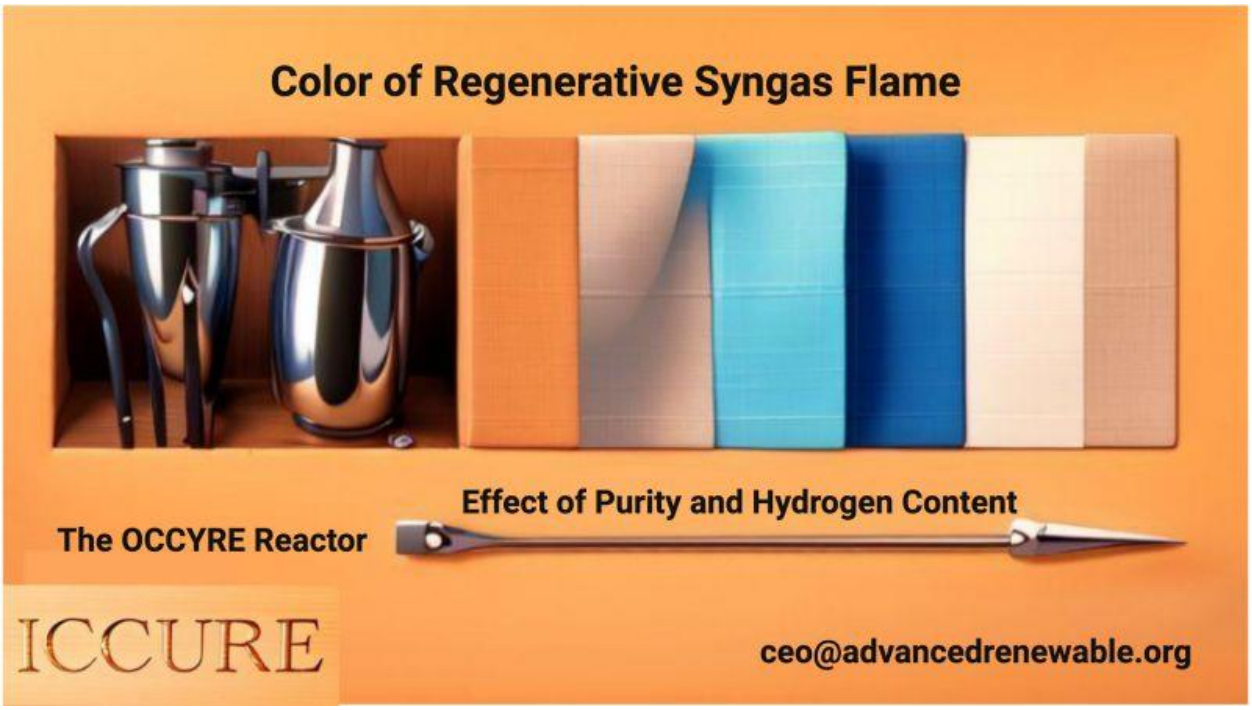
We can control the level of syngas purity and hydrogen content which influence the color of the syngas flames using two parameters, namely the purification parameters and the catalyst we use. In this OCCYRE reactor, we only use plant-based catalyst, so apart from being environmentally friendly - the aim of producing affordable fuels must still be maintained.

With the qualities of Regenerative Syngas like this, it can be used for anything. Can be used as direct fuel, for this case does not require purification and increasing the hydrogen content, or if we

want to process it into Regenerative Hydrocarbons such as gasoline, diesel, jet-fuel, LPG etc., then it needs a higher hydrogen content, at least an H2/CO ratio of above 2.

To become liquid fuels of the Regenerative Hydrocarbon type, the syngas output from the OCCYRE reactor will then become feedstock in the second machine, the Water Gas Shift (WGS) reactor and the Fischer-Tropsch Synthesis (FTS) reactor mentioned in the above upload.

The beauty of the colorful flames from these Regenerative Syngas seems to have inspired the Advance Renewable Organization (ARO) team, how beautiful the world will be in the future, when we can convert waste and CO2 emissions into Clean and Affordable Energy, SDGs no7 - which is the world's goal that must be achieved no later than 2030. InshaAllah, we can achieve it before that!



77. Introducing Biofuels 5.0: Regenerative Oxygenates (REOX)

In the development of biofuels, the world knows Biofuels 1.0, namely those whose raw materials still compete with food, 2.0 which use waste such as lignocellulose, 3.0 which use non-food plants that grow very fast such as microalgae, 4.0 which use biomass from genetically modified plants specifically for biofuels feedstock. So what is Biofuels 5.0?

The Biofuels 5.0 that we are introducing here uses raw materials from a combination of biomass waste and CO2 emissions. The advantages compared to the previous four generations of biofuels are in the CO2 cycle. CO2 emissions from biomass even if it is released into atmosphere is still carbon-neutral, but if we don't release this carbon-neutral substance into the earth's atmosphere,

instead capture it and reuse it for fuel production, we will get three benefits at once.

First, we will have an endless source of carbon, because every time it is used as an energy producer, the CO2 emissions are captured and reused. Second, economic growth and world energy needs do not necessarily have to be followed by growth in emissions. And third, all countries, all regions and even communities in remote areas should be able to produce their own energy from local raw materials. This is the democratization of energy - where all parties should have equal access to energy.

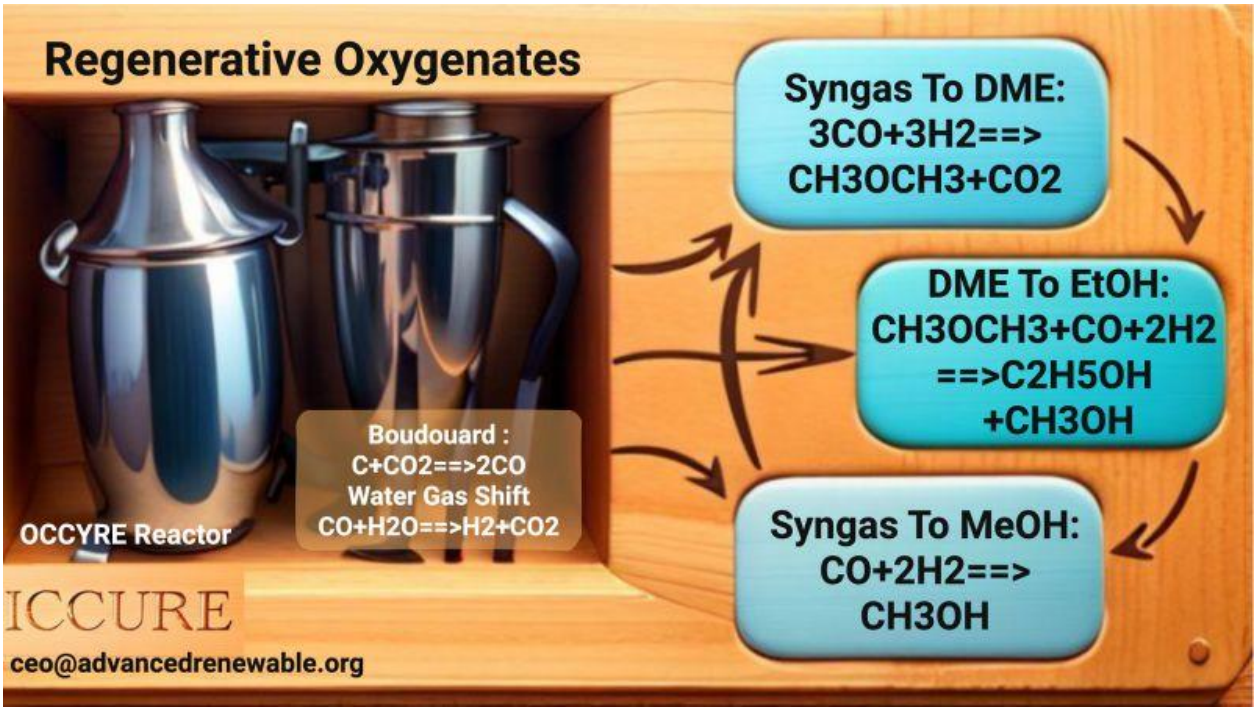
So how can we produce this Biofuels 5.0? The one from the Regenerative Hydrocarbon type, I have previously uploaded the formulation here: https://lnkd.in/gXYMQWqE , while the one in the illustration below is from the Regenerative Oxygenates (REOX) type, what exactly is this REOX?

It is a fuel containing oxygen, whose production involves the utilization of recirculated CO2. I take the three most common examples, namely Ethanol, Methanol and DME - all three of which can be produced from combining biomass waste and CO2.

The different from the previous 4 generations occurs at the beginning of the production process. In REOX, CO2 and carbon from biomass are reacted to become the main component of syngas, CO gas. The reactor we made for this uses the Boudouard Reaction formulation, while to produce H2 from CO we use Water Gas Shift (WGS). We call the reactor itself OCCYRE (Onboard Carbon Cycles for Regenerative Energy).

The OCCYRE output in the form of CO and H2 gas can be used to produce all kinds of oxygenates. The simplest is Methanol, it can be directly produced from 1 CO molecule and 2 H2 molecules, drying 2 Methanol molecules will become DME, DME can also be produced directly from 3 molecules of CO and H2 each.

Ethanol and Methanol can be produced simultaneously from 1 DME molecule, 1 CO molecule and 2 H2 molecules, and so on. The point is that Affordable Clean Energy for people allover the world, which is the world want to achieve it before 2030 (SDGs 7), should be achieved sooner rather than later!



78. Regenerative Generator First Appearance

If you are looking for a machine like the one in this photo, it is guaranteed that it is not yet on the market, in fact this picture is the first and there are no other ones like it yet. Those who designed this machine were not all humans, but human assisted with Artificial Intelligence or AI. No matter how smart AI is, it still needs humans to give it the input parameters it needs.

So when we want a future power generating machine that is super efficient in fuel, and uses fuel that must be available in all parts of the world - wherever humans live - there must be fuel for this. This is the engineering works by our engineers at the Advanced Renewable Organization (ARO) assisted by AI.

This machine is mainly fueled by carbon or charcoal, because charcoal can always be made from leftovers from food and our other activities. Charcoal also contains high energy, around 30 MJ/kg or 2/3 of diesel fuel. Charcoal is easy to store and is very stable even over thousands of years.

From this charcoal, when it react with oxygen, it can become gas fuel in the form of CO gas. If we react further the CO gas with steam, it will produce hydrogen, and the by-product output is CO2 (Water Gas Shift Reaction). So that CO2 does not pollute the earth's atmosphere, CO2 is recaptured again and reacted with charcoal, resulting in more CO (Boudouard reaction). More CO which react with steam produces more hydrogen again, and so on.

So the main fuel that must be present is charcoal and water, while CO2 can come from outside the engine or from within the engine itself. This is what according to AI, the most efficient and clean power generating machine, that is the cheapest in terms of electricity production costs, and can be

provided on the entire surface of the earth, wherever humans live. If you are engineer or investor who are interested to make it really happen, you can be part of us who want deliver Affordable Clean Energy (SDGs no 7) long before 2030, part of it with this kind of machine!

79. Regenerative Hydrocarbon Micro Refinery

In contrast to the fossil era where energy sources came on a large scale and were supplied continuously for decades, energy sources made from biomass are relatively small and spread out, there are production centers that only harvest in certain seasons. Apart from that, biomass energy is also bulky, large in volume with a low average energy content.

So when we want to process biomass into regenerative fuels, which I have often uploaded before, a different industrial approach is needed. It would be more economical if the refineries are made mobile on a micro scale, so that they could be present at biomass production centers in the appropriate season.

Below is a micro refinery that we call Regenerative Hydrocarbon Micro Refinery (RHMR), which we designed - with the help of AI, based on the Hydrocarbon Equation formulation that I introduced previously here: https://lnkd.in/gXYMQWqE

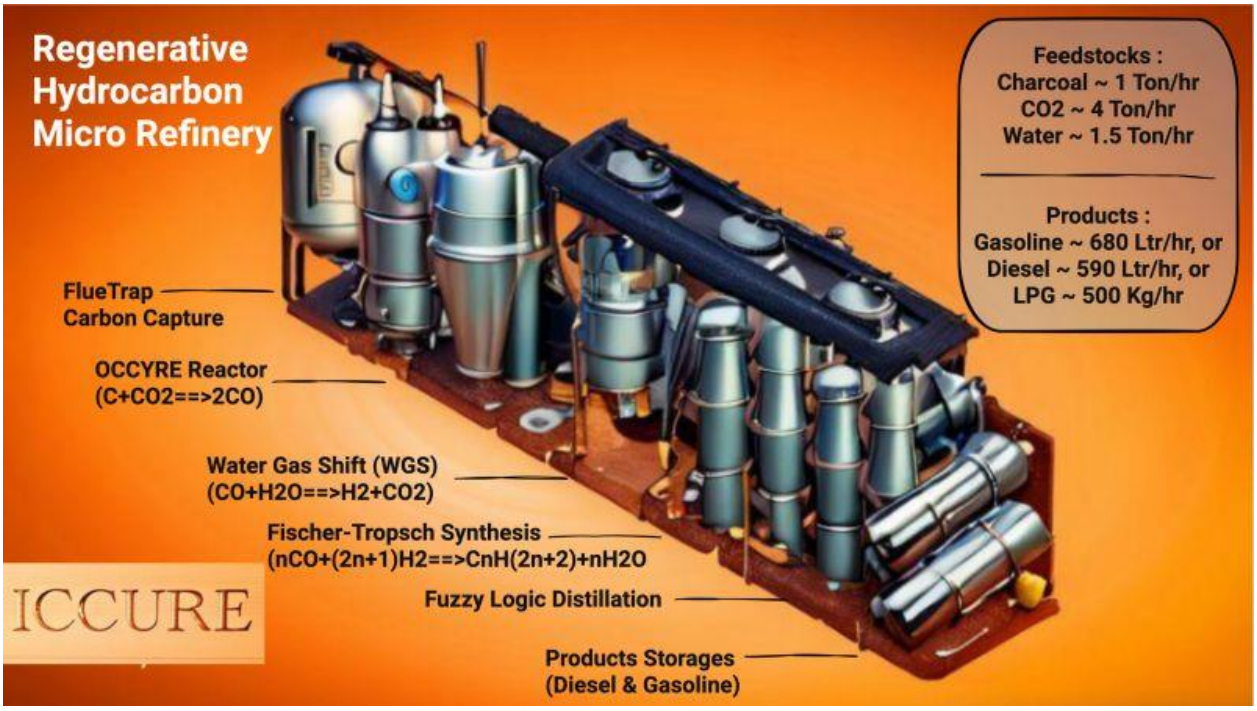
Apart from using biomass charcoal and water which are the main feedstocks for RHMR, it can also be provided with feedstock from CO2 emissions, both from the RHMR system itself and from other sources of CO2 emissions. So the RHMR unit could be brought to close to biomass center - which we compact in one 40 ft container, can also be installed in industrial environments that emit CO2 emissions.

Because the reactors for the entire process have to be able to fit in one container, we have to adjust the design of each reactor, as do the supporting facilities - there are a lot of things we have to re-design, or even need different technology. For distillation of the final products, for example, we cannot use a distillation tower because it will not fit in the container, instead we use Fuzzy Logic Distillation technology - for which we registered the patent.

RHMR is an autonomous plant that doesn't even need an external energy source, electricity for the process is generated from the waste heat of the OCCYRE reactor which operates at temperatures above 800 degrees Celsius. The OCCYRE reactor itself only needs a blower to start, which can be run from the truck's electrical system which draw RHMR, then the OCCYRE waste heat is converted into electricity via the Organic Rankine Cycle (ORC) reactor. The heat source for OCCYRE itself is obtained by sacrificing a small portion of charcoal for process heat, the rest is processed into products.

The feedstocks for RHMR are charcoal and water, and as an option we can also add CO2. Apart from CO2 being an additional source of C, it is also to ensure that this system does not emit emissions - it can even absorb emissions from other emission sources. Detailed specifications are in the image below.

How much does this RHMR unit cost? Well, for those who are serious about applying it, we can make a detailed proposal not only of price but also the overall financial performance projection.



80. Machines of Civilization

Since the industrial revolution of the 18th century, technological civilization has developed very rapidly covering all aspects of life. Of course, there are a lot of good things that come with these technologies, just improvements here and there that are not good, such as the impact on the environment.

This has been realized by world leaders at least 32 years ago, when more than 100 world leaders gathered in Rio de Janeiro at the 1992 Earth Summit. However, even now, after 32 years have passed, the world has not improved, the earth's temperature is still increasing, climate change is still getting worse, extreme weather is still breaking new records, etc.

So we need a tipping point that can change drastically from deterioration to improvement, but what can be this tipping point? Let's go back to the root of the problem, namely what the world has missed since the industrial era. One thing that we missed and have not yet corrected is the concept of burning fuels and let the CO2 to accumulate in earth's atmosphere.

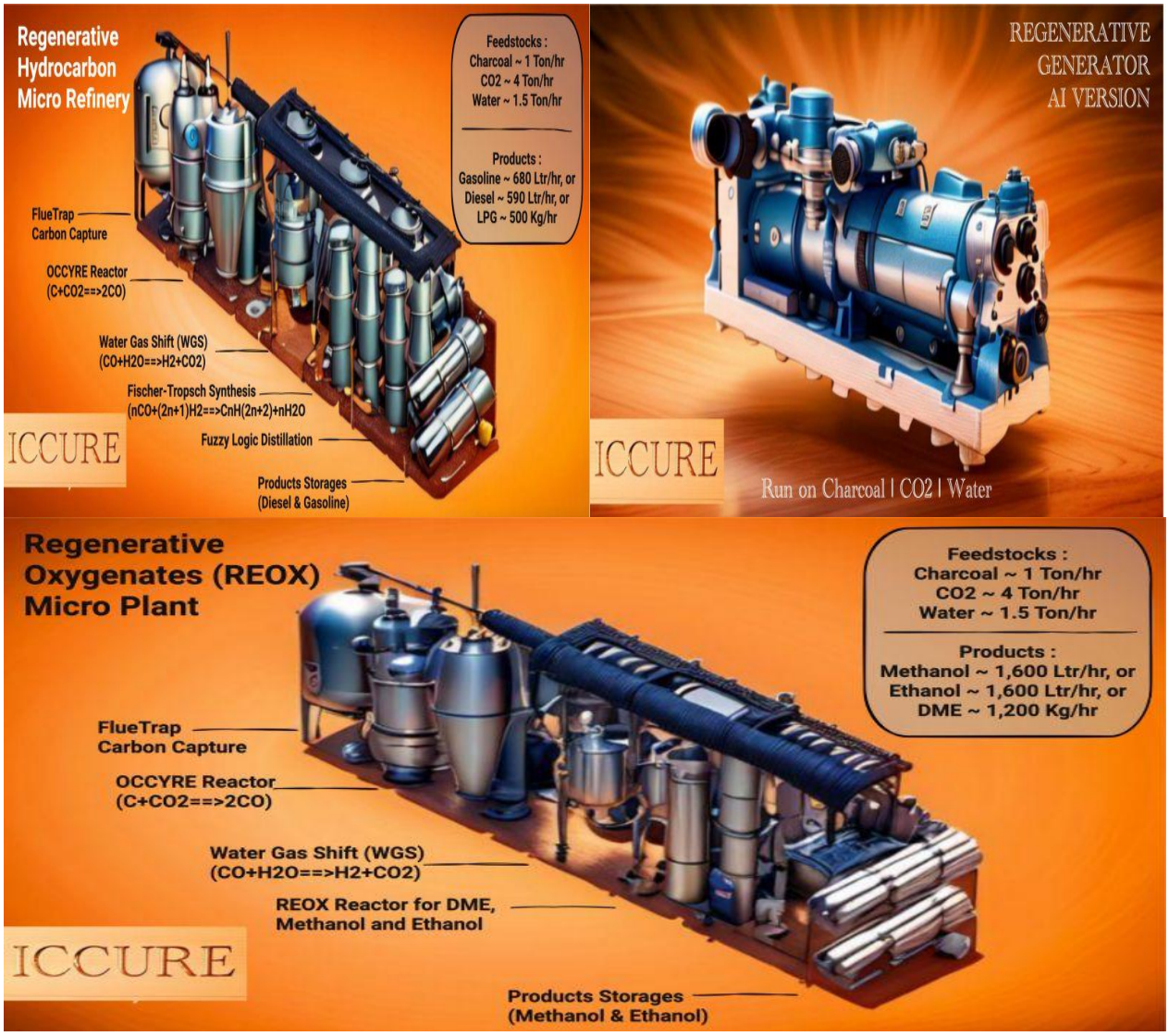
All machines that have been built since the industrial revolution era until now consume a lot of fuel and are all burned down - leaving an accumulation of CO2 in the earth's atmosphere. Of course, modern machines that are being built now are becoming more efficient, but they still use the concept of burning disposable energy and still increase the accumulation of CO2 in the earth's atmosphere.

So this is where we from the Advanced Renewable Organization (ARO) see the tipping point that we can actually do, a point where drastic, fundamental and far-reaching changes can be made quickly. That is, when we don't stop at the point where fuels are just burned, but also captured back the combustion waste, the majority of which is CO2.

The French scientist at the end of the 19th century, Octave Leopold Boudouard, had actually discovered something very basic, which could be used to process CO2 into energy. That is, when CO2 is reacted with carbon, it will become CO gas - which is the main component of syngas. From this syngas all modern fuels can be produced, including to produce electricity.

The photos below are energy machines that we designed with the help of AI, based on the above Boudourad reaction. Starting from power plants, refineries to produce hydrocarbon fuels - both of which I have uploaded their details in two previous posts. The newest one here is a micro plant to produce new fuels which we call Regenerative Oxygenates, especially methanol, ethanol and DME.

The common thread is that all of these energy machines can process CO2 emissions back into energy again through the Boudouard reaction mentioned above, which we make it in the form of a reactor we call OCCYRE (Onboard Carbon Cycles for Regenerative Energy). With OCCYRE, we will be able to stop throwing CO2 into the earth's atmosphere, and at the same time we can use it as a new energy source that already exists in abundance before our eyes.



81. The Heart of Regenerative Energy

In a series of previous posts, I have shared various energy machines to produce Regenerative Electricity, Regenerative Hydrocarbons and Regenerative Oxygenates. The common thread of all these complex machines is in the 'heart', namely the reactor which converts CO2 and Carbon into CO gas - the main component of synthetic gas or syngas.

Because one of the feedstocks is CO2, the electricity or fuel produced has the name Regenerative - which means it is able to grow or regrow again from what was originally thrown away. The 'heart' of the Regenerative Energy machines is what we named according to its function - namely the OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor.

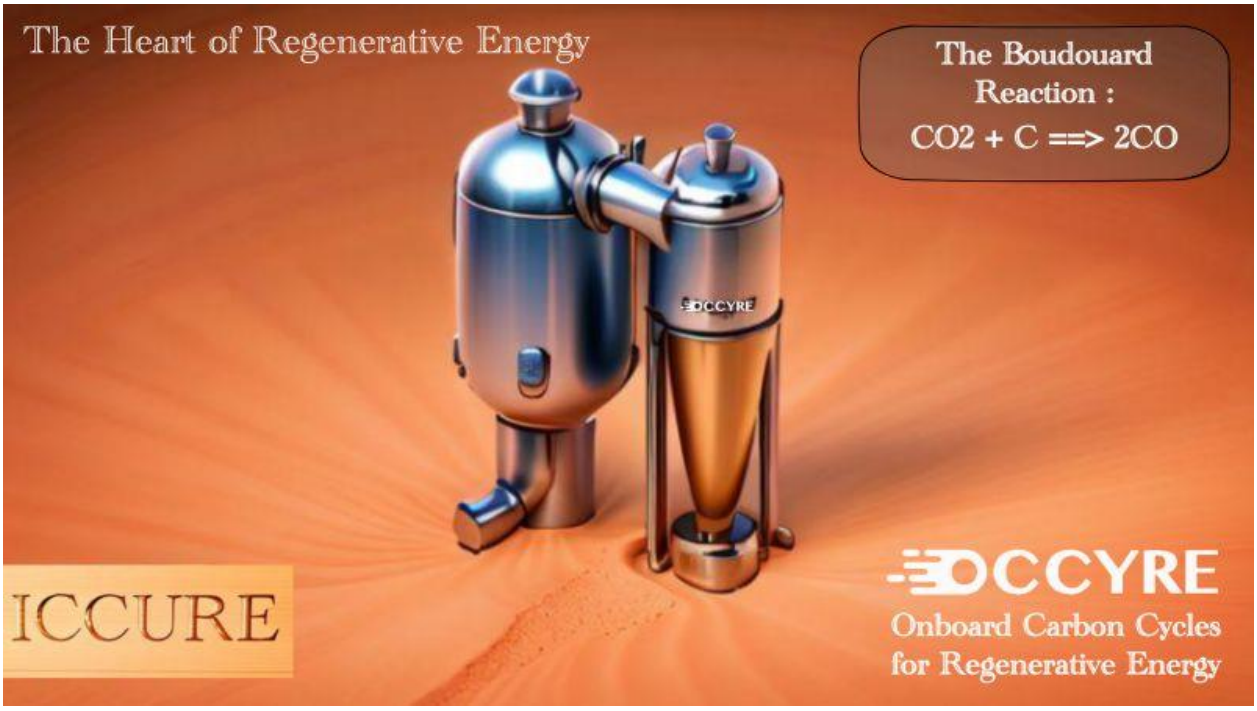
The new appearance of the OCCYRE reactor drawn by my new assistant called AI (Artificial Intelligence) is as in the photo below, but the physical shape that we have produced in the field is a little rougher than this AI work, which is in a number of my previous uploads.

Like the heart of our body, the OCCYRE reactor is what provides clean energy input in the form of CO gas for the various machines that I have introduced above. This CO gas can be used as direct fuel for gas engines, diesel engines and gasoline engines. It's just that the calories are still low, in the range of 10 MJ/kg or less than 1/4 of the calories of oil in general.

So ideally, if it is used directly to generate electricity using a special generator, or used to produce higher calorie fuel in the form of hydrocarbons or oxygenates - for which I have previously uploaded all the machine designs as mentioned above.

The output from the OCCYRE reactor, the main element of which is CO gas, is also ideal for producing low cost hydrogen gas, because it can be produced where it is used and when it will be used - in-situ and in-time. This will eliminate the very expensive logistics problem of hydrogen, because if hydrogen is to be transported or stored it requires a pressure of 700 Bar or a temperature of minus 253 degrees Celsius.

To make CO gas a base for low-cost hydrogen production, apart from the OCCYRE reactor, another reactor is needed, which we call the Extra High Hydrogen (XH2) reactor. What does this XH2 look like ? Insha Allah, I will share it in the next upload.



82. Enabler for Green Hydrogen Economy

Hydrogen is the cleanest fuel that is idolized by the world today, dozens of world biggest companies guarantee it with so-called Green Hydrogen Pledges. It's just that until now hydrogen still experiences two main obstacles, namely production and logistics.

For hydrogen production, there are currently at least 4 technologies, the first uses water electrolysis - this is not yet energy efficient, it is only feasible if the electricity is clean and very cheap. Second, with steam reforming from fossils, apart from depending on fossils, the process also produces very large CO2 emissions. Another way is to use nuclear energy and solar energy to separate H2 from water, the technology is not yet mass-produced.

The second problem is logistics, it requires very high pressure of up to 700 Bar or a very low temperature of minus 253 degrees Celsius to store and transport hydrogen. So for these two big problems, the reactor we designed below can overcome both at once.

This reactor, which we call Extra High Hydrogen (XH2), can be an enabler for mass green hydrogen production. The raw material itself is syngas - specifically CO which was produced by the previous reactor, namely OCCYRE (https://lnkd.in/gDU3R9fR). Because the raw materials are carbon from biomass and CO2, the hydrogen produced by this technology, apart from being green, is also regenerative - it can be grown and re-grown again from the byproducts of previous combustion.

The core of the XH2 are two reactor tubes that complement each other. The right tube receives CO input from OCCYRE and steam from waste heat utilization, both of which are reacted to produce H2 and produce CO2 waste. Because CO2 must be separated from H2, this CO2 is absorbed by an oxide (XO) which we use as an adsorbent. After binding CO2, XO will turn into carbonate (XCO3) and be sent to the left reactor tube.

In the left reactor, XCO3 will be cleaned to become XO again by releasing CO2 out of XH2 - which is than re-captured again with FlueTrap technology and processed into CO through the OCCYRE reactor mentioned above. So both products from this reactor are beneficial, the H2 is the long-awaited clean energy, while the CO2 is the raw material for regenerative energy - for any fuel, including turning it back into H2.

Because XH2 and its OCCYRE can be placed directly in any part of the world, there is no need to store or transport expensive hydrogen, it can be produced in-situ and in-time, only where and when it is needed, while what is stored and transported is charcoal only - easy and low cost logistics.

With XH2 and the previous reactor OCCYRE, green hydrogen could be produced cheaply and massively to respond the world's clean energy needs - anywhere in the world, as what its need only charcoal, CO2 and water. We are looking for partners, manufacturers and investors allover the world to disseminate this technology, so we can accelerate our planet's atmosphere cleaning process.

83. Introducing Regenerative Hydrogen Equation

In the previous post, I shared the equation for producing hydrocarbon fuels with what I call the Regenerative Hydrocarbon Equation (RHCE), this equation was derived from three scientists from three centuries earlier, the details of which can be seen here: https://lnkd.in/gXYMQWqE

The equation itself is nC+(n+1)H2==>CnH(2n+2), and this is where all the types of fuel we use today such as diesel, petrol, jet-fuel, LPG etc. can be produced. The C element can come from any garbage or biomass waste, but where does the H2 molecule come from? What differentiates it from renewable fuels or advanced biofuels?

So this is where Regenerative Hydrocarbon is different, the hydrogen is produced from the CO2 regeneration process, together with C it becomes CO gas, and part of the CO is used to produce hydrogen. In the process of producing hydrogen, CO2 will also be produced, but this CO2 is re-captured back for the next hydrogen production cycle.

From here the regenerative properties are embedded in the hydrogen that we produce in this way, every single CO2 molecule is used repeatedly to produce a number of hydrogen molecules. So the derivative products also have regenerative properties, such as the example of Regenerative Hydrocarbon mentioned above.

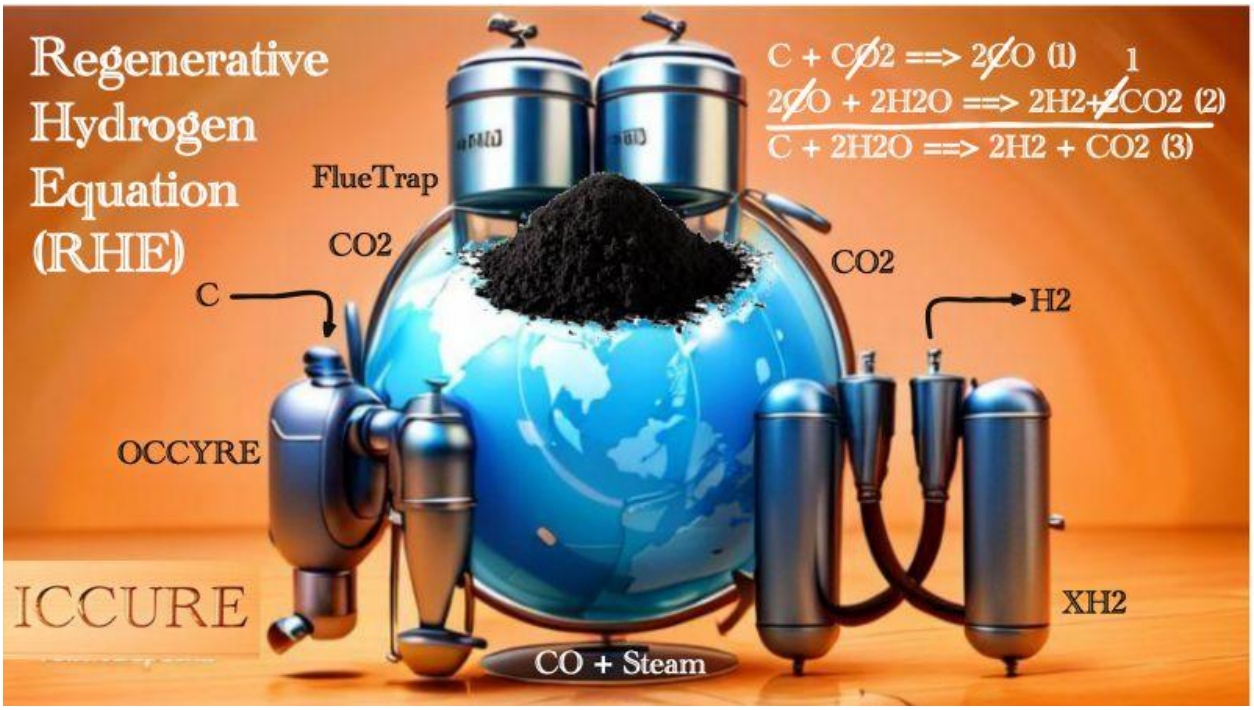
The process of producing Regenerative Hydrogen itself can be seen in the illustration below. We use three interrelated technologies to produce this Regenerative Hydrogen. The first is the FlueTrap, which is to capture CO2 with an adsorbent, then store the captured CO2 in the form of adsorbate - namely CO2 that is tied to the adsorbent.

The second technology is OCCYRE (Onboard Carbon Cycle for Regenrative Energy), whose function is to react the CO2 captured by the FlueTrap with element C and the result is CO gas - equation 1, or Boudouard Reaction. These CO gas molecules are then reacted with H2O in the form of steam, to produce H2 and CO2 - equation 2 or Water Gas Shift (WGS).

If we combine equations 1 and 2, the result is the 3rd equation, namely C+2H2O==>2H2+CO2, which I named it as the Regenerative Hydrogen Equation (RHE). From this RHE, we can easily see that Regenerative Hydrogen is produced from element C and water, and the waste CO2 is re-captured and reused to produce further hydrogen.

For RHE execution, the FlueTrap, OCCYRE and XH2 technologies which their details had been uploaded previously are needed. With CO gas produced by OCCYRE and H2 from XH2, any fuel, whether oxygenates, hydrocarbon or carbon-free fuels - all can be produced from those two molecules.

This is good news for the world community, because wherever you are you can produce the fuel you need - even if there is no oil, gas or coal where you are, because all you need are carbon from waste/biomass and water!



84. GTX Reactor, Fuels to Prosper The Rest of Us

The reality is that for the next few decades our energy needs will still come from hydrocarbons. The roads will still be filled with Internal Combustion Engines (ICE) vehicles, both petrol and diesel, the need for cooking and other heating will still depend on LPG and natural gas etc.

The use of hydrocarbons in the form of liquid or gas fuels that we know so far, apart from having a bad impact on the environment with very high emissions, is also bad for the economy of countries that do not have their own sources. Energy imports are generally one of the largest imports for non-oil and gas producing countries. Meanwhile, these imports are reducing factors in a country's GDP, so energy imports become an impoverishing factors for countries that do not have sufficient sources of their own.

Replacing heating machines, vehicles or transportation, power plants etc. from oil or gas fuel to new fuel is also not easy, because it will require a very large investment. So the solution we offer is to continue using all existing machines, both with gas and liquid fuel - only the hydrocarbon fuels need to be replaced, no longer using petroleum and natural gas, but everything can be synthesized from charcoal and water.

We have completed designing all the reactors needed for this, and we have even made prototypes of some of them. Our latest design is the one in the image below, which we call GTX Reactor. Its function is to convert CO gas from the OCCYRE reactor (https://lnkd.in/gDU3R9fR) and H2 gas from the XH2 reactor (https://lnkd.in/ga8DJsWE), both of which we have uploaded previously, into hydrocarbon fuels that we need.

The feedstocks for this reactor are gases (CO and H2) and the product is whatever hydrocarbon fuel we need, the name GTX is taken from Gas To X, where X is M for methane, D for diesel, G for gasoline, J for Jet-Fuel, L for LPG etc. With the same feedstocks and reactors, the differences in the final products are controlled by 4 parameters, namely pressure, temperature, catalyst and residence time.

Because the raw materials in OCCYRE and XH2, the precursors for GTX, are only carbon from charcoal and H2 from water, with the option of CO2 captured - either from the system process itself or CO2 from outside the system, then all the fuels produced by GTX are also regenerative, can be regrown again wherever there are C, CO2 and H2O.

With fuels that can be fully produced domestically, we don't need to lose a lot of foreign exchange to import the oil and gas we need. Energy independence is the way to our prosperity. If Arab countries can be rich because they have oil and gas, we should also be able to prosper because we have charcoal, CO2 and water!

85. CO2? Just Can It!

Inspiration for an innovation can come from anything and whenever it appears, this innovation is an example. What happens when we open a can of fizzy drink? There is a sensation of sound and feels that I had not yet found the right words to describe in English except fizzy. In Javanese the sound that we hear from inside the fizzy drink is called 'krinyis-krinyis', and when we drink the sensation in the mouth it feels 'sengkring-sengkring'.

The sound and taste sensation of this canned drink is our source of the inspiration, it comes from the same CO2 as the CO2 that is horrendous in the world with global warming, climate change, extreme weather, etc. In fact, the source of CO2 in these canned drinks is also from industrial smokestacks or power plants, which is purified in such a way that it becomes food grade and sold to the beverage canning industry, etc.

If this source of emissions can be feedstocks for the soft drink industry, why not for various other industries? All we need is to can all the exhaust gas from industry, power plants and later also motor vehicles. So we designed a can for the CO2 capture as in the picture below.

This is even better than the CO2 in our drink cans. When a drink can is opened, the sound and taste sensation mentioned above is from CO2 which will escape into the earth's atmosphere - meaning in the beverage industry, the CO2 ends up being released back into the air.

In this CO2 can, which I will henceforth call CO2Can, the CO2 that is captured is not released back into the atmosphere, it remains on earth even if the lid of the can is opened. How could that be? Inside this CO2Can we fill it with media to bind the CO2 so it doesn't fly anymore.

The type of media depends on the intended use of the captured CO2. Using adsorbent if CO2 will be used as Regenerative Energy, use reactant if CO2 will be used as slow release fertilizer, use solvent if it is for beverage industry mentioned above, and use an electrolyte if the CO2 will be used for the advanced materials industry such as Carbon Nanotubes (CNTs), etc.

So that this innovation is truly effective in reducing CO2 emissions, CO2Can is present in a complete ecosystem starting from the supply of carbon capture media, to the utilization of captured CO2. For the Regenerative Energy industry, for example, CO2 from CO2Can can directly become feedstock for the OCCYRE reactor (https://lnkd.in/ga6KcnzT) to produce CO gas, which is the building block for all subsequent forms of Regenerative Energy.

After becoming CO gas, it can be fed to the XH2 reactor for hydrogen production (https://lnkd.in/gnwS-Nrt), or fed to the GTX reactor to become various hydrocarbon fuels that we use today (https://lnkd .in/gXhsCdVq). So wherever you find CO2, just can it!

86. Regenerative Energy Ecosystem

This is a complete ecosystem of reactors which I previously uploaded in detail one by one, what is uploaded here is the integration to become a solution that we call Integrated Carbon Capture and Utilization for Regenerative Energy (ICCURE).

The first is in the top left corner, Autothermal Slow Pyrolysis (ASP) - which is the process of carbonizing biomass into charcoal. After undergoing the activation and functionalization process in the same reactor, this charcoal will be ready to become an adsorbent in the CO2CAN reactor, and a

reactant in the OCCYRE reactor.

The second is the CO2CAN reactor, whose function is to capture and bind CO2, both from within the ICCURE ecosystem itself and CO2 from other emission sources. CO2 will be stored by CO2CAN in the form of adsorbate - CO2 which is bound to the adsorbent. This bond is only released when CO2 is about to be used for further processing.

The third is the OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor, which is a reactor where CO2 in the form of adsorbate is debonded by heat and reacted with charcoal produced by the ASP reactor. Through the Boudouard reaction, C + CO2==>2CO, the result is CO gas which is the main component of syngas and building blocks for all subsequent forms of regenerative energy.

Fourth is the XH2 (Extra High Hydrogen) reactor, which processes CO gas from OCCYRE through the Water Gas Shift (WGS) reaction, CO+H2O==>H2+CO2, the main result is hydrogen (H2), with byproduct in the form of CO2. This CO2 is then withdrawn back into CO2CAN to be stored in the form of adsorbate again, to become raw material for the next CO gas production process.

Fifth is the GTX (Gas To X) reactor, which processes some of the syngas and H2 with a minimum ratio of H2/CO>2, to become hydrocarbon fuels such as gasoline (GTG), diesel (GTD), jet-fuel (GTJ) and LPG (GTL).

Even though this hydrocarbon fuel is exactly the same as fossil hydrocarbon, this one is regenerative - it can be regrown again, namely use CO2 to regenerate CO gas through the OCCYRE reactor mentioned above.

As the ultimate feedstocks for this regenerative energy are only biomass, CO2 and water, clean and affordable energy as per SDGs no 7 - should be achievable long before its due in 2030!

87. Environmental and Social Actions

This year is a critical year for a number of cities in developing countries, the waste management crisis has reached its peak. A number of final waste disposal sites (FWD) have had to be closed due to over capacity, while the waste produced by city residents certainly cannot stop. What is the solution?

Large corporations, public companies, issuers and other financial institutions should be able to do something. Most of The Financial Services Authority in the world has required them to produce a Sustainability Report or what is widely known as ESG. Apart from corporations affected by this regulation having to report their activities related to ESG, they also have to reserve appropriate funds for these activities.

Fund allocation reports can be made easily, but what are the real actions that really have an environmental and social impact? This is where we offer to utilize ESG funds, especially ES, to deal with the above unstoppable waste in our cities.

In principle, waste should not be left as waste and then simply moved to another place and remains waste. But the waste which is a burden or liability is quickly converted into assets, the simplest of which is charcoal.

When biomass waste turns into charcoal, there are two benefits for the environment at once. Firstly, the waste volume has automatically decreased to only 1/3 of the original waste volume. Second, waste which was originally a liability has now become an asset, namely becoming carbon-neutral energy when used as fuel, and even becoming a carbon sink when used to treat agricultural land and used as material.

The social impact will be tremendous, society will value waste - because it is a potential asset. Society will no longer need a landfill because this prospective asset will definitely be maintained by its owner. So what kind of assets can be produced from this waste? it could be regenerative energy which I often upload on this media, it could be a land fertilizer, it could be a future advanced material such as Carbon Nanotubes etc.

But this all needs to start with an example and be campaigned in a structured, systematic and sustainable manner (TSM), one of which is through the use of cool waste collection and processing fleets like in this photo. Waste is collected from where it appears and immediately after its appearance, it is then processed into charcoal while traveling to the carbon pool - for the next process.

Is your corporation wants to start first as part of your ESG activities? Our team from ESA Force is ready to execute it in the field.

88. Green Hydrogen Carrier, Deliver More Than It Can Carry

The reactor designed by the Advanced Renewable Organization (ARO) team, which we call XH2 (Extra High Hydrogen), turns out to have another function that is no less interesting. If the first function is to produce hydrogen and at the same time separate the waste in the form of CO2 (https://lnkd.in/ga8DJsWE), we can also use this XH2 as a very effective hydrogen delivery system.

We know that conventional hydrogen logistics are very expensive because to store or transport it requires a pressure of 700 Bar or a temperature of minus 253 degrees Celsius, and even then it can only store around 42 kg of hydrogen for each m3 container.

By utilizing XH2, hydrogen can be stored in the form of methanol or ethanol, which at standard atmospheric temperature and pressure is already a liquid. Or if you want it in gas form, you can use DME (Dimethyl Ether) which for logistical needs only requires a pressure of around 5 Bar.

Not only is liquid handling cheap and easy, or low pressure is definitely cheaper and easier than very high pressure, hydrogen delivery using ethanol or DME has other advantages. That is, the hydrogen delivered will double when ethanol or DME is reformed! Where does this 100% additional hydrogen come from? hydrogen from water which is used to reform ethanol or DME.

If the carrier used is methanol, only 1.5 times the hydrogen carried by the methanol itself is delivered, or a 50% more hydrogen. See the reforming reactions for each of these carriers in the image below.

So this XH2 reactor will truly be an enabler of the hydrogen economy, because both production and delivery of green hydrogen can be much lower cost than it is now. The era of carbon-free energy could also be before our eyes, because from the reaction below we can see that CO2 production from XH2 will be concentrated in this machine - so it is easy to capture and reuse to generate further hydrogen. There is no more excessive CO2 in our air!

89. Oily Waste Solution

Many people process oil waste, as well as biomass waste. The problem is that in industry, commercial complexes and also in land fils these two are oftenly mixed. Even though the two can be separated with great difficulty, the effort and costs for this are not feasible in waste processing. So what's the solution?

So that both can be processed simultaneously in the same process without the need for separation, elements of product similarities must be sought that can be obtained from both. Biomass when reformed with steam will become CO and H2, the same goes for oil - it also becomes CO and H2 when reformed with steam.

If we put both into the reactor that I introduced earlier, Extra High Hydrogen or XH2, then they both produce CO and H2, this is what we call syngas. Syngas from oily waste tends to have high calories, so it can be used as energy to replace petrol, diesel or LPG, especially for static engines.

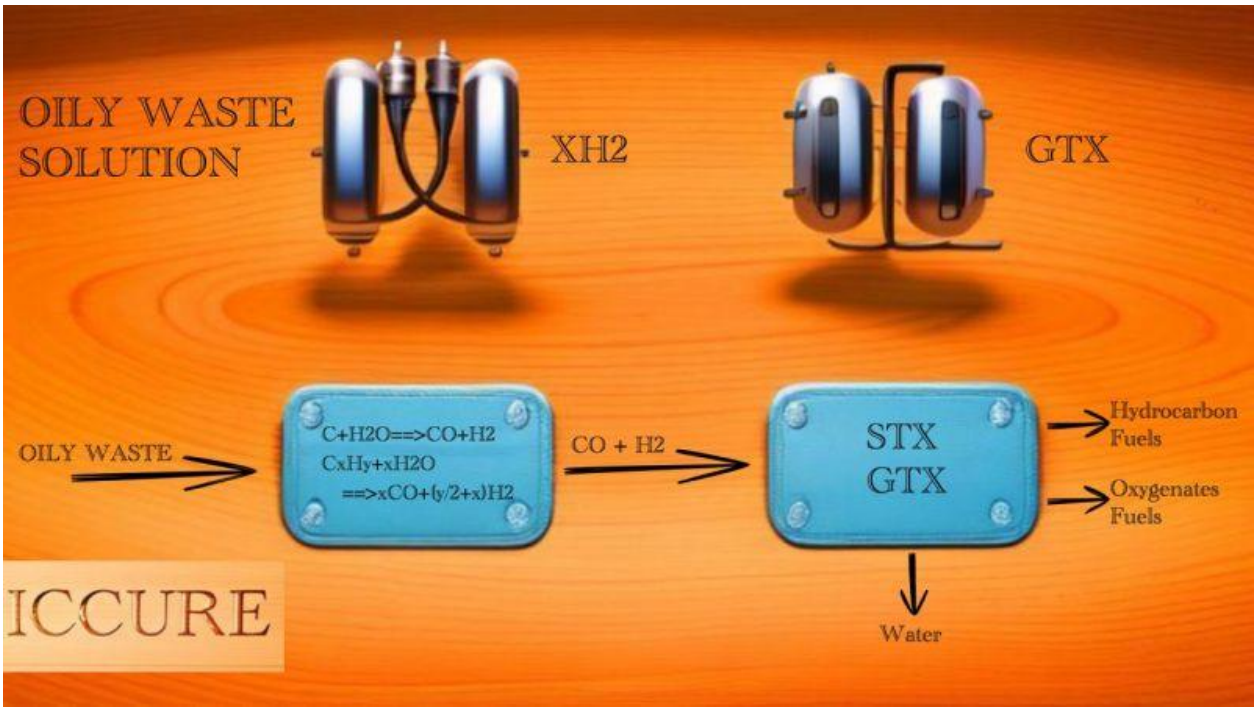
It would be even more valuable if this syngas was used as fuel for transportation, for this it can be used as fuel for oxygenates such as ethanol, methanol and DME, we call the reactor STX, from

Syngas to X, where X = M for methanol, X=E for ethanol and X=D for DME.

The calories and value are higher if we process this syngas into hydrocarbon fuels such as diesel, gasoline, jet-fuel and LPG. The reactor that we introduced previously was named GTX, from Gas To X, where X=D for diesel, X=G for gasoline, X = J for Jet-fuel, and

Even more than that, we can process this generally annoying oily waste into carbon-free fuels, namely hydrogen. Only one reactor is needed, the XH2 mentioned above, only the result in the form of CO is looped to produce H2 again via the Water Gas Shift (WGS) reaction.

As a result, whatever your industry, whatever the form of waste, it is very likely that it can still be used as raw material for the next industry, especially the energy industry which we call Regenerative Energy, namely energy that is regenerated from rubbish, waste and emissions. Truly nothing is wasted in His creation!



90. Distributed Energy Resources, Regenerative DME Micro Plant

In the energy transition era, especially in empowering biomass, the industrial approach must be different from the fossil era. Its dispersed character, with low energy density and specific gravity - makes transportation of raw materials uneconomical if the process is centralized.

By making the process from raw materials to the final product spread, there will be many benefits. These include reducing the carbon footprint in terms of transportation, in addition to the basic

biomass energy which is already carbon-neutral, growing the local economy, and also being effective in addressing local energy needs.

In an island country like ours, fuels such as diesel, which is needed for power generation and ship transportation, and LPG, which our society has become dependent on in the last two decades, depend heavily on huge subsidies. Apart from transportation costs, the irony is that this subsidy is for something that we mostly import - namely oil and gas - diesel and LPG raw materials.

The good news is that both diesel and LPG can actually be completely replaced by local fuel which can be produced anywhere in the country, even the most remote islands and areas can produce this multi-purpose fuel. The raw material is biomass which is always available, even better if it is used in urban or industrial areas - because it can use CO2 emission raw materials of up to around 80%, the 20% remain biomass carbon or charcoal.

The product is a fuel called Dimethyl Ether (DME), which can directly replace LPG without any changes - including the cylinders and distribution or refilling system, and can also replace diesel up to 97% - the remaining 3% is for the lubrication material.

The DME production process is also relatively simple, the picture below is a compact design that fits in a 20 ft container, so that it can be sent anywhere easily, it can be used to address energy needs anywhere, including projects in remote areas.

Because the raw materials are biomass and CO2 - which is in excess everywhere, anything we burn will definitely produce CO2, this unit which we call the Regenerative DME Micro Plant (RDMP) can also be used to overcome energy needs in disaster areas, both natural disasters and man-made disaster like war etc.

RDMP in this container has a production capacity of around 1.5 tons DME per hour, if it uses biomass fuel completely - it needs 3 tons of biomass per hour, or if it is in charcoal form it needs around 1 ton of charcoal per hour. Or it can be replaced with 0.6 tons of charcoal plus 2.4 tons of CO2 per hour.

If you use a combination of charcoal and CO2 as raw materials, DME will become Regenerative DME, namely DME that is grown again from waste and emissions. While solving energy problems, we also clean CO2 emissions from the earth's atmosphere. This unit can be produced in any part of the world that needs it now, we are therefor looking for our global parter now.

91. Compact Enabler for Carbon Capture and Utilization

Even though the world's enthusiasm for reducing carbon emissions is very strong,
The planet is still warming, climate change is still getting worse, extreme weather is still breaking records. Why is it that after 32 years of efforts to improve - since the Earth Summit in Rio de Janeiro 1992 - world sustainability is still deteriorating?

The results of our research show that the majority of sustainability matters are still viewed from one side only by the industry - namely burden, not yet seen as a potential for improving the bottom-line. Carbon capture is still just a concept that must be budgeted for, while its utilization is still up in the air.

So this is the solution that we offer to industry, reducing emissions which has the opportunity to become a profit center and no longer just as a cost center. Carbon emissions are captured and converted into energy in one compact system which we call Compact Carbon Capture and Utilization (C3U). With C3U, it is very easy for industries that emit emissions to capture and utilize their emissions as a new energy source which we call Regenerative Energy.

There are four technologies that we integrated compactly in a space the size of a 20 ft container - so that it is easy to transport and install in any location. The first is FlueTrap technology, to capture CO2 directly from the source, in any industry and even on ships.

After CO2 is captured with an adsorbent, part of it is stored in the form of adsorbate to become

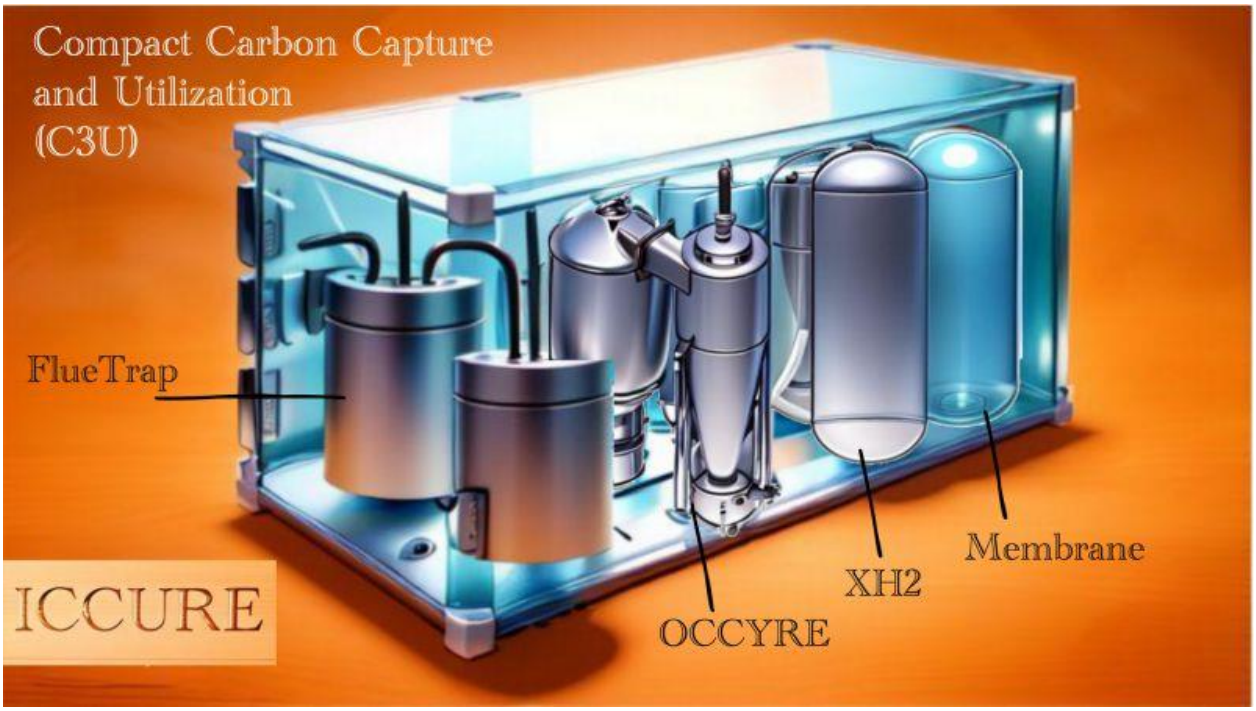
carbon stock, part of it is reacted with carbon in the OCCYRE (Onboard Carbon Cycles for Regenerative Energy) reactor to become CO gas. CO gas can be used as fuel, or processed further using an XH2 (Extra High Hydrogen) reactor.

It is through XH2 that the quality of syngas which was originally rich in CO is improved to become rich in H2, even though it is still syngas - if the H2/CO ratio is increased to the range of 4-6, the calories per unit weight are already in the range of oil and natural gas calories, it can be very effective in replacing diesel , LPG etc. In fact, if desired, this H2-Rich Syngas (HRS) can be further purified through a fourth reactor, namely a membrane reactor - for the production of pure hydrogen.

With this, C3U has a dual function, capturing CO2 emissions while also becoming a source of new and clean energy for industry. One C3U unit is capable of capturing around 2 tons of CO2 per hour or the equivalent of the emissions released by a diesel generator with a capacity of 2 MW.

Once converted to HRS and reused as fuel for the same machine, the energy savings will range between 50 - 77%. This is where the CCU program using C3U is no longer a cost center, but has a direct impact on improving the company's bottom-line.

This C3U unit can already be ordered throughout the world, even early users of this system in each country can become our business partners in the country concerned.



92. Race Towards Green Hydrogen Delivery

One of the clean energies that the world has been waiting for is green hydrogen. Many technologies for truly green hydrogen production have been proven, such as the use of renewable energy from

hydropower, wind, etc. for water electrolysis.

The problem is that even if hydrogen is produced greenly, delivering it to end users is neither easy nor cheap. Hydrogen transported in tanks with a pressure of 700 bar, can only transport around 40 kg of pure hydrogen per m3. Even at an extra low temperature of minus 253 degrees Celsius, liquid hydrogen can only be transported around 70 kg/m3.

So various cheaper hydrogen carrier technologies emerged, the graph below is the technology options currently available. Some use ammonia, with a capacity of 107 kg/m3. Using solid magnesium in the form of MgH2, with a capacity of 134 kg/m3.

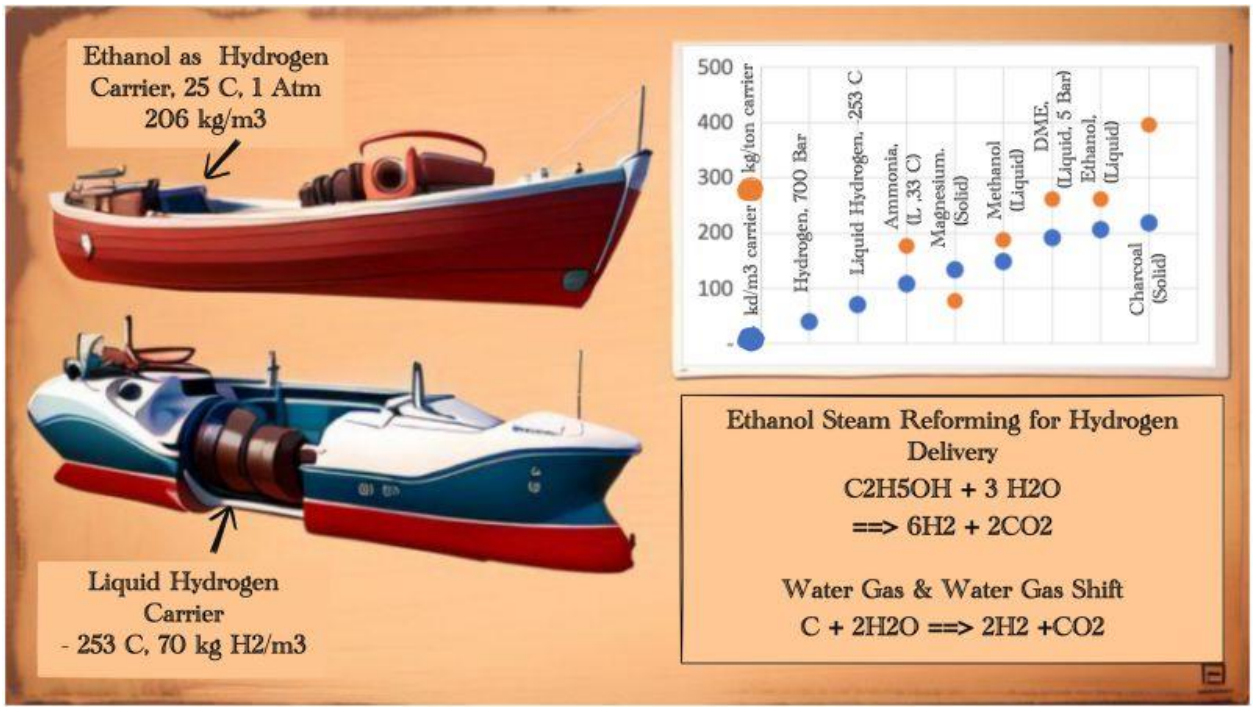
The next technology is to use oxygenates as carriers that can deliver more hydrogen than it carries itself. The choices are methanol, ethanol and DME. All three will get additional hydrogen from the steam used for reforming the oxygenates. Like the example of ethanol reforming formula below. Methanol, ethanol and DME are capable of delivering H2 up to 149 kg/m3, 206 kg/m3 and 192 kg/m3 respectively.

From here we can see that oxygenates such as methanol, ethanol and DME have the potential to become H2 carriers which are much more effective than other carriers such as ammonia and magnesium, especially superior as compared with pure hydrogen at a pressure of 700 Bar or a temperature of minus 253 degrees Celsius.

On top of that, our research show that there is other carrier that is much more effective and much cheaper, even compared to carriers of the oxygenates. We use charcoal for this new carrier with special treatment. Charcoal, which generally already carries hydrogen in the range of 3 - 8%, can be increased to deliver H2 up to 40% of the weight of the charcoal through two processes, namely Water Gas (WG) and Water Gas Shift (WGS) reaction.

The chemical reaction equation that we derived from WG and WGS becomes what we call the Carbon To Gas (CTG) reaction, with the formula C+2H2O==>2H2+CO2. We can see here that carbon can directly deliver hydrogen with the help of steam, from this reaction we can also see how charcoal is able to deliver much more hydrogen than other hydrogen carriers.

With this charcoal as H2 carrier, actually H2 is produced in-time and in-situ, when and where it is needed. Apart from hydrogen will have a very low cost in production and delivery, the carbon footprint can be reduced to its lowest point. What is needed for this CTG system is a special reactor for the WG and WGS processes mentioned above, plus a FlueTrap to capture CO2 emissions from the processes. I will share the reactor design in the next upload.



93. Carbon for Hydrogen Production and Delivery

In a previous upload (https://lnkd.in/g6PJJWkF) I shared data showing that charcoal can be a hydrogen carrier with the highest delivery potential compared to other carriers, especially compared to pure hydrogen.

Compared to other existing solid carriers, namely magnesium, charcoal has a 5x higher delivery capacity. Compared to ammonia and methanol, it is 2x higher, and compared to ethanol and DME, charcoal has a delivery capacity 1.5 times higher. Charcoal logistics costs are also definitely much cheaper than all of other types of hydrogen carriers mentioned above.

By using charcoal as a hydrogen carrier, the hydrogen production pattern is also changed. From being produced centrally and then shipped very expensively to the user's location, to being produced in-situ and in-time, on the spot and when the user wants to use it.

Because there will be a need for small hydrogen production units, but as many as users, this hydrogen production unit must be made in a compact and scalable form according to user needs. Our AI-based design is in the picture below.

Similar to the previous reactor which we call XH2, the difference is - this reactor for hydrogen production is equipped with a membrane reactor. The essence of the process is a combination of Water Gas (WG) and Water Gas Shift (WGS) reactions, plus purification.

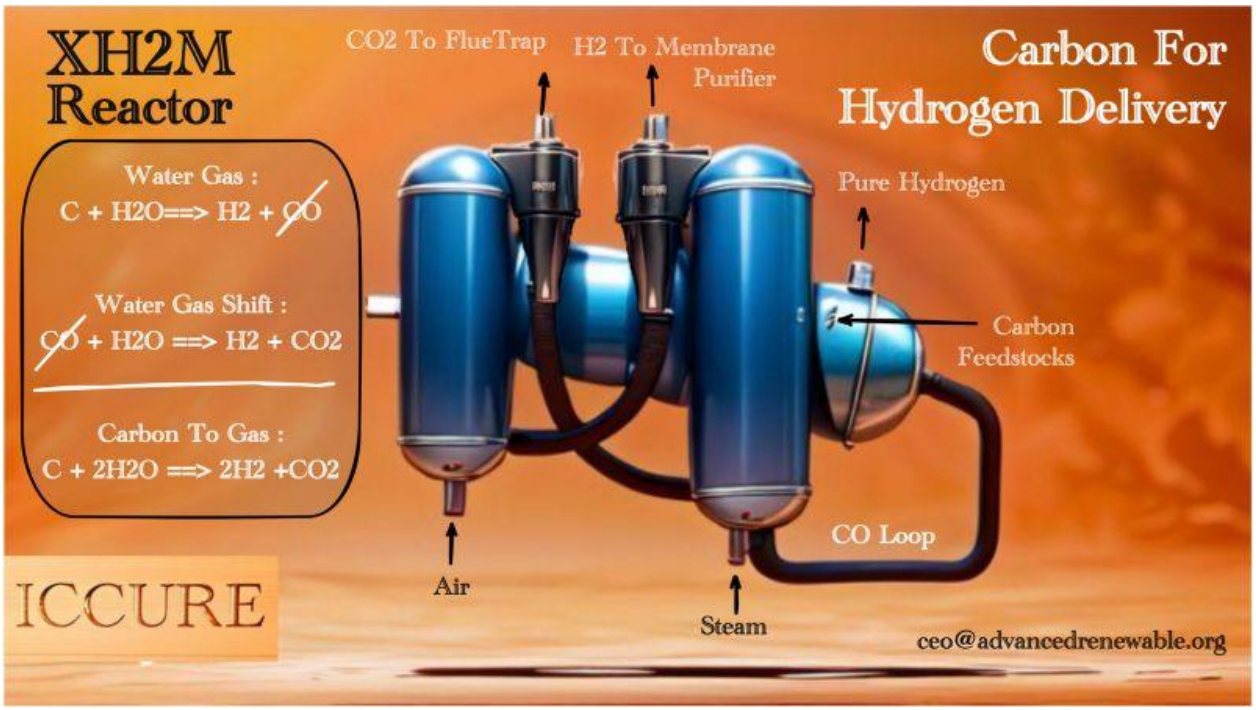
We derive from these two chemical reactions into a simpler formula which we call Carbon To Gas (CTG) reaction, because after these reactions the two products are all gas, C + 2H2O==> 2H2 +

CO2. Hydrogen (H2) is the product we want, while CO2 is the emissions we capture back using FlueTrap and OCCYRE technology to become CO gas. The CO gas can be used to increase Hydrogen production again using the same reactor under the WGS reaction.

Overall, the CTG reaction mentioned above is very energy efficient because the reaction is only slightly endothermic, 90 kJ/mol C. To produce 1 kg of H2, for example, only requires around 6 kWh of energy with the resulting H2 energy content being 34 kWh/kg. Compare this with H2 via the electrolysis process, which requires 53 kWh of electrical energy to produce the same energy of 34 kWh/kg.

So not only will the costs of storing and shipping H2 be greatly reduced by using H2 on demand which is produced in-situ and in-time with charcoal feedstocks, but also in terms of energy requirements for the process which is very low compared to other hydrogen production processes.

These reactors can be produced on an order basis, but we are looking for global partners for mass production, so that it will be much cheaper per unit. If these reactors can be produced cheaply, then Clean and Affordable Energy (SDGs no. 7), will really be achieved long before the SDGs year 2030!



94. Regenerative Energy Building Blocks

Like a building, if we can produce good bricks - then we will be able to build any building we want. Likewise with the Regenerative Energy concept that we are promoting, if we can produce good energy building blocks - then we can produce Regenerative Energy in any form.

The building blocks of Regenerative Energy are essentially three elements, namely C, H and O.

However, for ease of production and handling, they are made in the form of two molecules, namely CO and H2, a combination of the two which is called synthetic gas or syngas. How to produce both?

Both can be produced from fossils in the form of petroleum, coal and most commonly from natural gas, but because these fossils are not sustainable - we can produce them sustainably from any flue gas. Generally, this exhaust gas contains around 95% CO2, so this CO2 is what we can use to produce these Regenerative Energy building blocks.

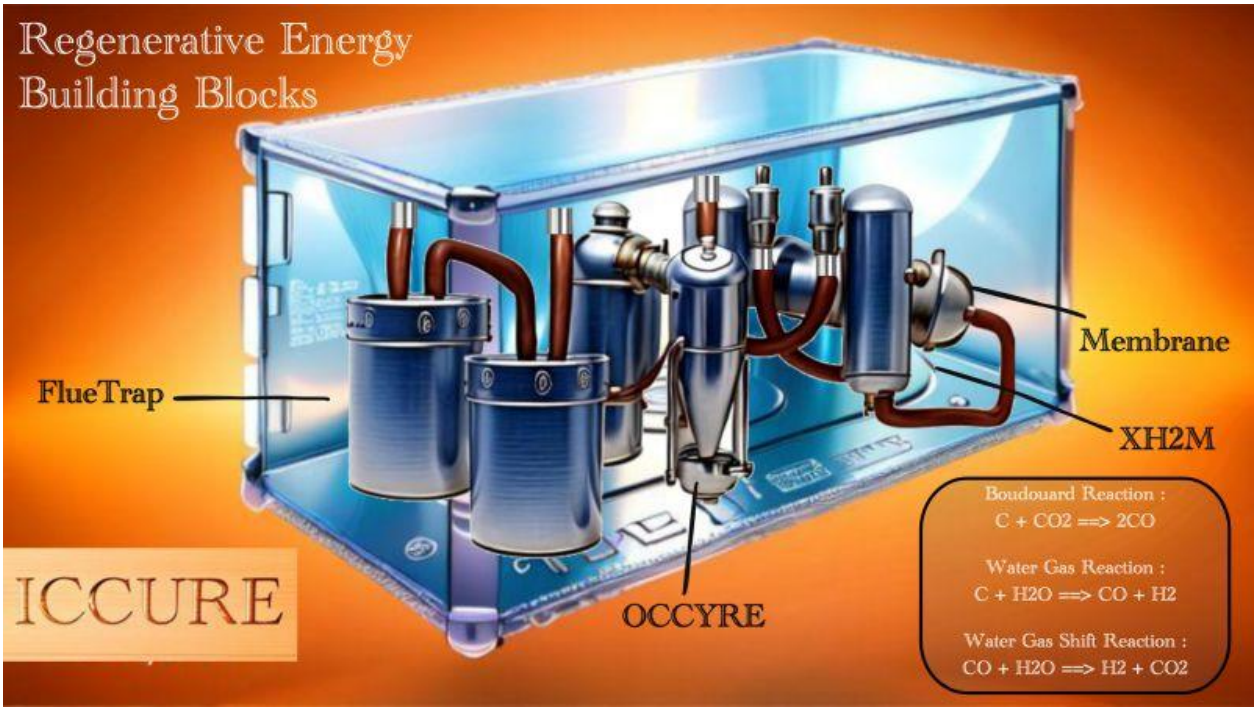
By doing this, we can get two benefits at once - firstly, CO2 emissions problems will be resolved, and secondly we will get endless energy raw materials. CO2 itself can be electrolyzed into C and O2, but this requires expensive energy so we chose another route.

The pathway we chose is to react CO2 with C through a reaction called the Bourdouard reaction, CO2+C==>2CO. We can see from just this one reaction that CO2, which was originally a burden to be disposed of, turns into an asset in the form of one of the two Regenerative Energy building blocks molecules mentioned above. How to obtain another molecule, namely H2?

The H2 molecule can be obtained through a reaction called the Water Gas reaction, C + H2O ==> CO + H2. If pure H2 is desired, the CO can also be converted into more H2 using the Water Gas Shift reaction, CO + H2O ==> H2 + CO2. The latter (CO2) is then recaptured, back into raw material for subsequent CO and H2 production. And so on, the production process of Regenerative Energy building blocks will take place in a sustainable manner, continuously.

Of course, this requires input for the energy needed in the process and as a reactant in the three reactions, this input is C and H2O. The C can be obtained from local biomass, requiring C around 27% of the weight of the CO2 processed. Meanwhile, H2O is always present in any part of the world, so this Regenerative Energy can be produced in any part of the world as long as there are three resources needed, namely CO2, C from biomass and water!

We have simplified the process itself in a compact reactor arrangement, the size of a 20 ft container, which can process up to 2 tonnes of CO2 per hour. It can now be ordered and we are looking for partners for mass production throughout the world, so that Clean and Affordable Energy - SDGs number 7 can be achieved before SDGs year of 2030.



95. Advanced Waste Valorization

The waste crises continues to haunt our cities, at the same time the heavy burden of procuring energy, some of which still has to be massively imported - continues to be a significant factor in reducing our GDP, meaning it is still an impoverishing factor for those of us who continue to import this energy.

The solution to the first problem to overcome the second problem, waste into energy, has also been implemented, but it is still too small compared to the existing pile of waste, and has not had an impact on reducing fuel imports in the form of oil or gas. What caused it?

Garbage and biomass waste are actually very cheap sources of carbon, the carbon or C content in biomass ranges from 50% (original biomass) to 85% (biomass processed into charcoal). Meanwhile, it is from this C that all kinds of fuel and energy that we need can be produced.

However, when waste is only burned to become electricity, for example, the selling price of electricity which is only around US$ 0.1/kWh becomes a barrier. With the selling price of this final product, even 1 kg of waste that has become RDF (Refused-Derived Fuel) will at best only priced around 40% of the final product, or US$ 0.04/kg. At this level of selling price for RDF, processing waste into RDF is not yet a sustainable solution - because it definitely still has to be subsidized from other funding sources.

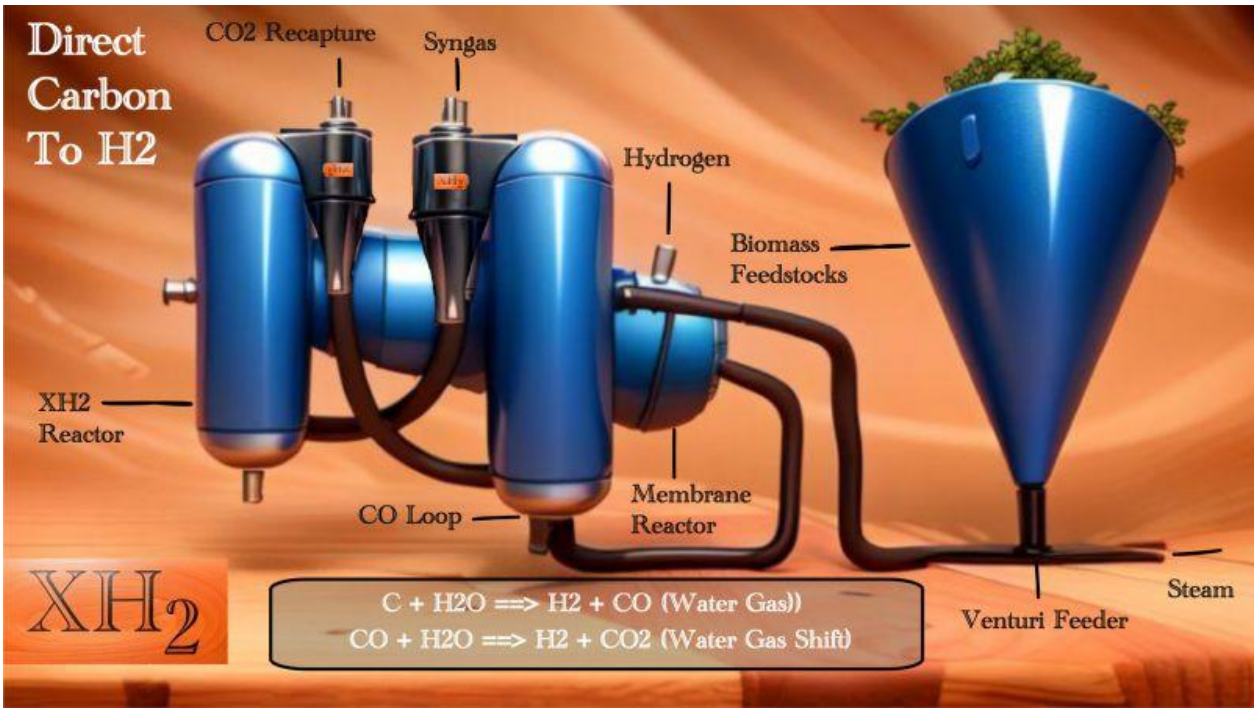
There is still a need for other solutions so that people are interested in processing their waste completely, and this can only be done if the business model is sustainable. For this, trash and waste must be directed as far as possible into products with the highest selling value. And in the energy

sector, the highest selling price currently is hydrogen - above US$ 6/kg, next are hydrocarbon fuels such as gasoline and diesel - in the range of US$ 1.1/kg, and oxygenates fuels such as ethanol and methanol in the range of about US $0.5/kg.

From these comparative figures, if we can process our trash and waste into one of the fuels mentioned above, the waste processing business will be very promising. If it is economically attractive, piles of waste will automatically disappear from our cities.

The machine below is one of our engineering works for processing any waste into hydrogen and syngas. Can be given feedstocks in the form of charcoal or native biomass. It takes 2.5 kg of charcoal to produce 1 kg of hydrogen, it takes 7.5 kg of dry biomass waste for the same 1 kg of hydrogen, whereas if it comes from wet waste, depending on the water content - it can be in the range of 15 - 25 kg of wet waste.

Whichever route is chosen, it is still very attractive because the current selling price for 1 kg of hydrogen is in the range of US$ 6 mentioned above. There is still enough room to make sophisticated machines, recruit the best talents and provide attractive returns for investors who want to invest in processing waste into hydrogen, hydrocarbon fuels and oxygenates.



96. Introducing Regenerative Energy Equation

Because humans grow regeneratively, from 2 humans in the world to more than 8 billion today and still growing, all the needs for life are also grown in the same way by the Almighty Creator. Our food, from plants and livestock, grows in the same way as ours, namely regenerative.

So our energy needs should also be met, not from something that runs out but from something that grows. Biomass energy is an example, only because our energy needs are much faster than biomass growth, for every biomass we use as energy - we must also be able to regenerate new energy from it waste or emissions.

This is where we bring our concept of Regenerative Energy (RE). Just as humans, plants and livestock will not run out until the end of time, so will the supply of our other needs, namely energy. With this RE concept, all humans living on this planet should be able to continue to meet their energy needs, without depending on those who have sources of oil, coal and natural gas.

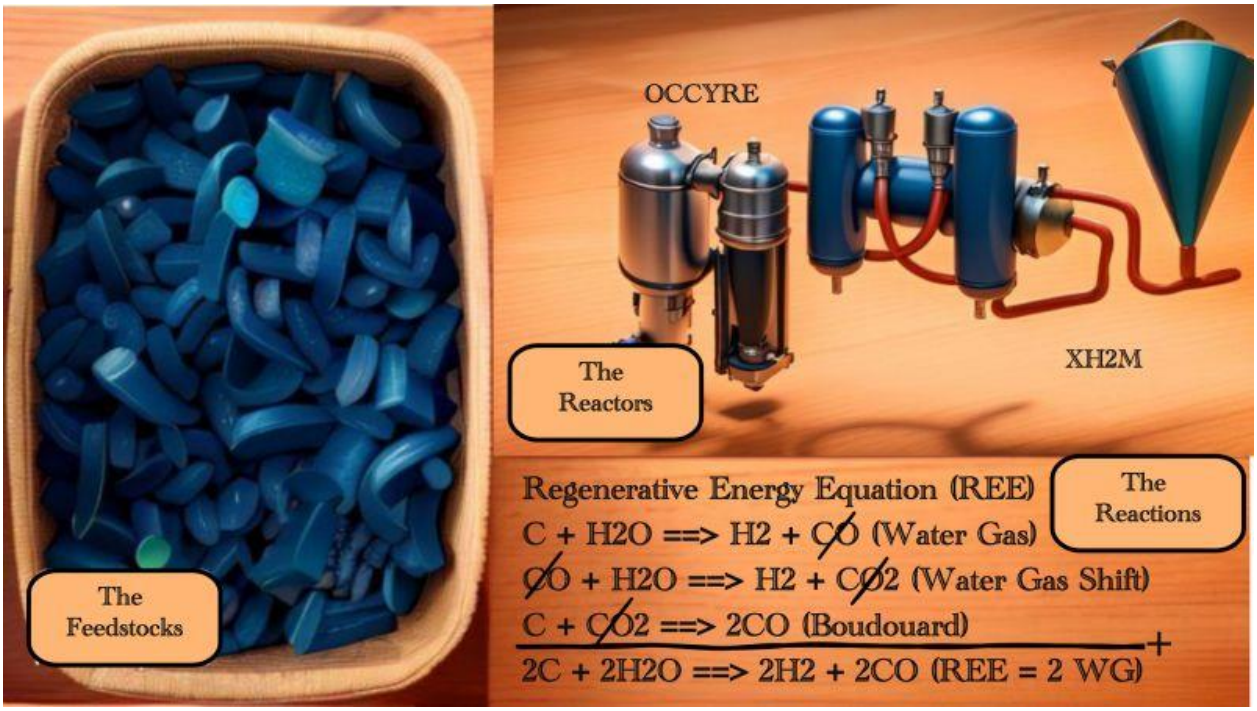
The RE concept is actually simple, this concept can be explained in detail and even scientifically with just one slide as below. The assumption is that we start from the beginning, since thousands of years ago humans have been able to use charcoal as fuel. Only modern humans want to use charcoal for sophisticated machines, so we react charcoal with water to produce H2 and CO gas, the reaction is called Water Gas (WG).

H2 is the clean energy that we want, while we react the CO gas again with water, the result is H2 again and CO2, in a reaction called Water Gas Shift (WGS). This second H2 adds to the H2 from the first reaction, but this time there is waste CO2 emissions, how can it not pollute the earth's atmosphere?

We react CO2 with carbon/charcoal to produce two molecules of CO gas, the reaction is called the Boudouard reaction. If this CO gas is returned to reaction 2, it will produce more H2, more CO2, etc. CO2 will always be used up in this RE system when it is reacted with carbon - reaction 3. And so on, as long as there is carbon or charcoal and water, clean H2 energy can always be produced and the CO2 emissions can always be reprocessed.

So when I add up the three reactions, the result is the 4th reaction which I call the Regenerative Energy Equation (REE). REE is equal to 2 times the WG or the first reaction. This is where the concept of growing energy or Regenerative Energy can be easily understood.

Like the division of cells in our bodies, plants and livestock, 1 cell divides into 2, 2 into 4 and so on. Likewise, Regenerative Energy, as long as there is charcoal and water - it will be able to continue to divide and grow. Clean energy will be affordable for all humanity across the planet earth - isn't it SDGs No. 7?



97. Introducing Low Cost Green Hydrogen

It could be that carbon-free energy is in sight, namely green hydrogen. The two main obstacles that have haunted hydrogen economy - can now be overcome. Green hydrogen production can be truly green and low cost - both in terms of production and logistics.

If so far the majority of hydrogen is still produced through expensive steam methane reforming (SMR), or water electrolysis, now it can be produced directly from charcoal. Through two reaction steps in the reactor which we call XH2 - Extra High Hydrogen, the charcoal pellets in the photo turn into hydrogen with a delivery rate that is much higher than other hydrogen carriers - see the comparison in the graph.

Hydrogen production in this way is also very energy efficient, apart from the heat energy that can be produced from sacrificing part of the carrier or charcoal itself, the energy requirements are also very low compared to, for example, the energy requirements for electrolyzing water into hydrogen and oxygen.

Of the two Water Gas and Water Gas Shift reactions that we use to produce hydrogen from charcoal, the total delta enthalpy for both is only +90 kJ/mol. If we just burn charcoal, this delta enthalpy reaches - 394 kJ/mol. This means that to produce the heat energy needed for this hydrogen production reaction to occur, we only need to sacrifice 90/394 parts of the charcoal, or 23% of the charcoal.

With the concept of autothermal, we can produce hydrogen from charcoal by sacrificing 23% of the

charcoal as a heat energy source, while 77% of the charcoal will be processed into hydrogen. Apart from only needing 6 kWh to produce 1 kg of hydrogen, this 6 kWh is in the form of heat that can be produced by cheap heat sources.

With this process, hydrogen logistics, which is very expensive because it requires a pressure of 700 Bar or minus 253 degrees Celsius, can be avoided. The method is to only produce hydrogen in-situ and in-time, only where and when it is needed. It is where hydrogen is needed that we install the XH2 reactor mentioned above.

Those who need green hydrogen can already order this XH2 reactor and its charcoal feedstock supply as in the photo below. The XH2 reactor can be seen here : https://lnkd.in/g_SbVEvE

98. Regenerative Fuels Family

SDG number 7, Affordable Clean Energy, which the world agreed to achieve by SDGs year 2030, should be very likely to be achieved, if all possible pathways for this are actually implemented. Among these pathways, we from the Advanced Renewable Organization (ARO) are promoting Regenerative Energy (RE) pathways.

Regenerative Fuels (RFs) particularly, which are part of RE, all types of fuel that we need today can be produced through this RE route. The three main raw materials for this which are definitely available throughout the world - so that SDGs number 7 is also evenly distributed throughout the world, are CO2 emissions, carbon from biomass and water. The diagram below is the path for each of the fuels we need, if produced from these three raw materials.

CO2 emissions can be reacted directly with charcoal in the OCCYRE reactor, the result is syngas

which is rich in CO, if there is a little H2 in this first syngas content - this comes from the H2 contained in the charcoal - which on average charcoal still contains H2. Syngas which is rich in CO can be upgraded to be rich in H2 using the XH2 reactor.

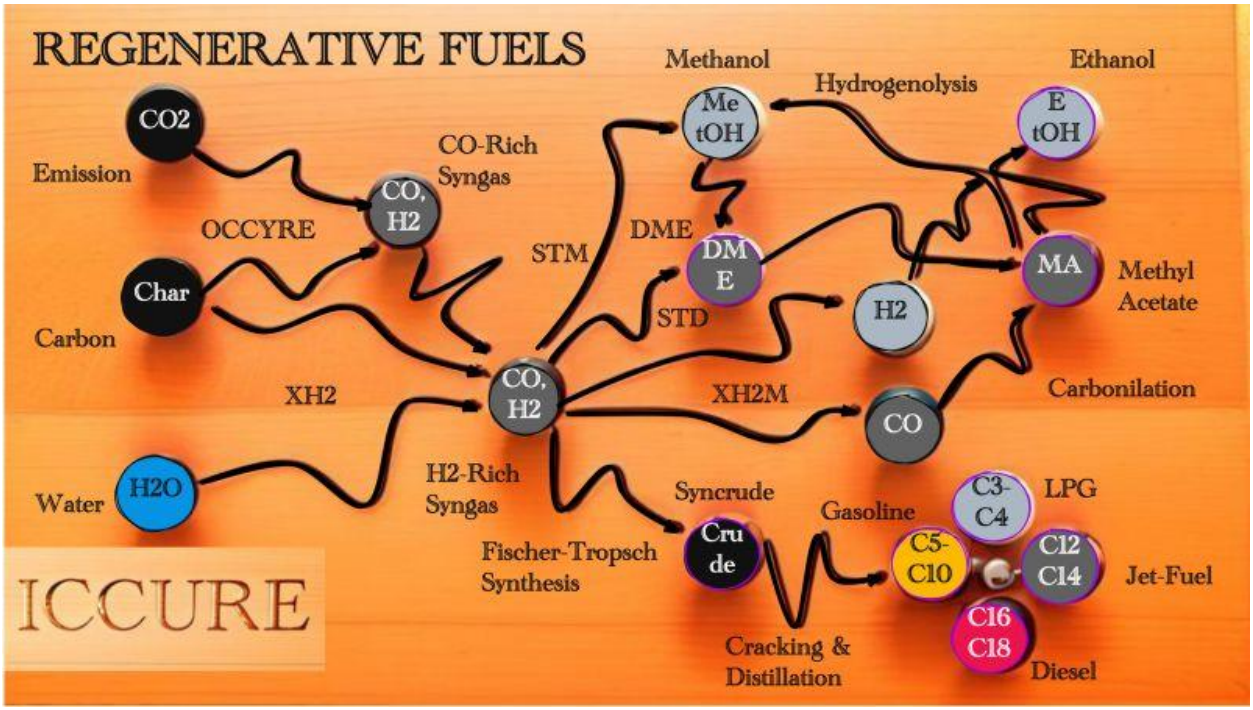
The XH2 reactor can also be given input in the form of charcoal or biomass with water, the result is straight H2-Rich Syngas. This H2-Rich syngas can be adjusted to the H2/CO ratio and can even be separated between H2 and CO with a Membrane or XH2M reactor. On average, an H2/CO ratio of >2 in molecule units is needed to be processed into the next fuel effectively.

In the oxygenates fuel group, DME (Dimethyl Ether) and methanol can be produced directly from syngas whose H2 content has been upgraded. DME can also be produced from dehydrated methanol. Meanwhile, ethanol can be produced through two DME processes, namely through carbonylation to convert DME into Methyl Acetate (MA), and then hydrogenolysis to convert MA into ethanol with the by-product methanol.

Other fuels from the hydrocarbon group, such as gasoline, diesel, jet-fuel and LPG, can also be produced from H2-Rich syngas. The main process is Fischer-Tropsch Synthesis, and the result is synthetic crude or syncrude. Syncrude is very similar to crude oil from petroleum - only the origin is different.

Syncrude, through the cracking and distillation process, will be able to produce all types of hydrocarbon fuel that we need as mentioned above. All the processes in the diagram below, separately, part by part - have been proven because they have been carried out in industry for the last three centuries.

What we need now is to use all these mature technologies to solve current problems, namely carbon emissions in particular and the affordability of clean energy for the entire population of this planet earth, or SDGs number 7 which I mentioned at the beginning of this article above.



99. The Oxygenates

Ideally our fuel is hydrogen because the oxydation waste is only water. However, because the logistics of hydrogen are very expensive, requiring a pressure of 700 Bar or a temperature of minus 253 degrees Celsius, then if it has to be stored or shipped, hydrogen can be 'stored' naturally with charcoal - because it is cheaper in terms of logistics and hydrogen production.

However, if for one reason or another people are reluctant to use charcoal for various reasons, the next hydrogen carrier that is very effective is oxygenates, namely fuels that contain oxygen. Apart from being a hydrogen carrier, these oxygenates have very wide uses.

Among the most popular oxygenates are ethanol, methanol and DME. All three can be used as direct fuel or further processed or become feedstocks for various types of industry. As a fuel, DME for example can replace both LPG and diesel, ethanol can be a mixture of up to 85% with gasoline (E85), while methanol can be up to 15% mixture in gasoline (M15).

Because of their flexible use, these oxygenates can become a reliable energy stock for areas that have been dependent on energy supplies from other regions or countries. Oxygenates can be a very reliable energy security supply.

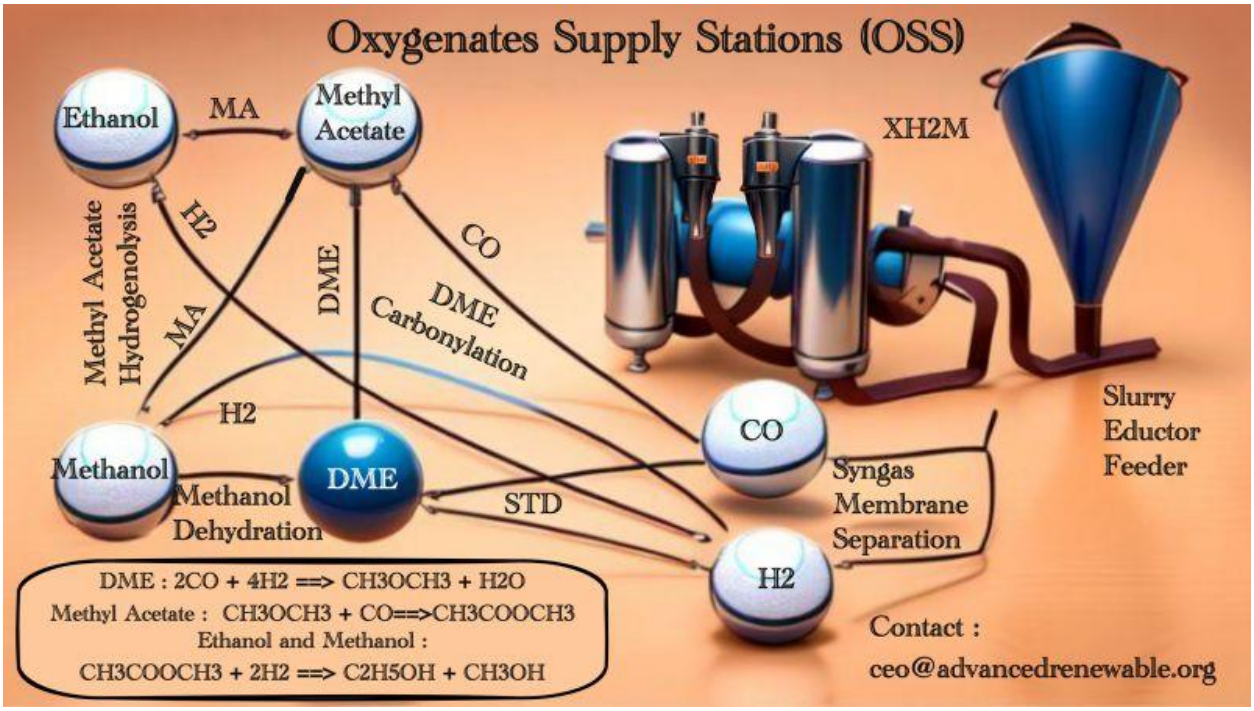
One of the R&D works of the Advanced Renewable Organization (ARO) is a microplant for the production of the 3 types of oxygenates mentioned above, namely DME, ethanol and methanol. The three are interrelated and can be made into one compact microplant package.

The raw material we choose is mixed-waste, namely waste that does not have to be sorted - between organic and non-organic, only materials that need to be taken out are those do not decompose at a temperature of 1000 degrees Celsius such as metal, glass and stone. The waste also doesn't have to be dried - because this system can process both wet and dry waste.

The principle of the process is that the waste is crushed until it becomes flour or slurry if it is wet waste, then using a special feeder called the Slurry Eductor Feeder, the flour or waste slurry is made into a steamed-slurry which is sent into the XH2 (Extra High Hydrogen) reactor. In XH2, waste is converted into H2-Rich Syngas which is ready to be used as a production base for oxygenates.

The easiest route is DME (Dimethyl Ether) first. From this DME, ethanol and methanol can be produced simultaneously through two stages, namely carbonylation of DME to become Methyl Acetate, then hydrogenolysis of Methyl Acetate to become ethnanol and methanol simultaneously. With this microplant which we call Oxygenates Supply Systems (OSS), city governments, industries, commercial and residential complexes - no longer need to throw away waste, let alone landfill it!

The image in the photo only shows the XH2 unit along with the feeder system and product separation, while the units for the DME, methanol and ethanol reactors are in the previous uploads.



100. Fuels From Our Yesterday's Trash!

Like it or not, the fact is that the most widely used fuels in the world today are still fossil fuels, especially oil and gas. Unfortunately, oil and gas are not distributed evenly and supplies are limited. As a result, some countries become very rich because they have more than they need, while others are very dependent on supplies from these rich countries.

But this oil and gas was once - millions of years ago - also originally biomass, from plants, animals and microorganisms. Can we produce oil and gas like petroleum and natural gas, but from fresh biomass? biomass from our trash that we threw away yesterday?

The answer is yes, we can! And in our laboratory, at the Advanced Renewable Organization (ARO), the entire process chain has been designed, the majority of parts have been tested. The appearance of the microplant is as in the picture below, this is for a capacity of around 750 liters of fuel per hour.

In essence, there are 4 stages of the process from wet or dry, organic or non-organic waste to become hydrocarbon fuel like the ones we use today, diesel, gasoline, jet-fuel or kerosene and LPG. The first stage is that the waste is milled into flour if it is dry or slurry if it is wet. These are the feedstocks that we put in the reservoir at the far right.

With a special technique called a slurry eductor, the flour or slurry is pressed by steam to enter the XH2M reactor chamber to be gasified, the output will be H2-Rich Syngas, namely syngas with an H2/CO ratio >2.

From here the syngas will be pressed again into the next reactor which we call GTX, Gas To X, X=D

for diesel, X=G for gasoline, X=J for Jet-fuel, and X=L for LPG. These letters are not just the name for the desired product, but also relate to the required process parameters. Each letter represents at least 4 different parameters, namely operating temperature, residence time, pressure and the corresponding catalyst.

Even after controlling it with appropriate parameters, there is no guarantee that the output from XH2M is the fuel we want. It could be that the C chain is yoo long, or too short, etc. So we send the output from XH2M into another reactor which we call the Fuzzy Logic Reactor - apart from cracking, this reactor also sorts the final product so that it suits what we need.

With this Hydrocarbon Micro Refinery series, affordable and clean energy as mandated under SDGs target number 7 should be achieved throughout the world long before SDGs year 2030. Because the raw material is from rubbish and waste that we threw away yesterday, and now these will become our fuels!