

Are Green H2 + Whitegold Lithium really good for Brazilians?

In recent months, we have been bombarded daily by various articles and, so-called, supposedly serious studies/diagnoses (most of them, clearly, from business and/or government and/or consultancy lobbies, perhaps much more in search of investors/financing banks/funds/consultants/unwary voters etc.), but everyone is looking for fantastic, if possible sustainable and at least renewable/so-called clean ways to produce – without risks and with low costs and high efficiency – the famous truly green/sustainable vehicular hydrogen (Green H2), in other words , to continuously produce electricity in the internal vehicle hydrogen cell (without the need for giant batteries or repeated recharging at sockets).

Obviously, I'm not here analyzing plug-in rechargeable electric vehicles – current and future –, the so-called “Hardwired EV”. Also, I will not analyze the “PHEV” or “plug in” hybrid vehicles, both types of which are already well known and debated. Idem, I will not comment here about vehicles powered by petroleum derivatives or other fuels, described as dirty and unsustainable, because they have already been proven to be the main cause - not the total solutions - for the very high current levels of atmospheric pollution (not so much degradation).

We are already at a true crossroads of future successes or risks in the manufacture, conversion, use and sales of electric vehicles powered by H2 and between:

1) High dangers of having or causing – some in conscious ways – MUCH GREATER “SOCIO-ENVIRONMENTAL DEGRADATIONS OF SOILS, SUBSOILS, WATER AND BIOMES ETC., THESE EVEN WORSE THAN WHAT WE ALREADY HAVE WITH PETROLEUM DERIVATIVES “versus” HASTED ADOPTIONS AND EVEN JAMBLINGS OF TECHNOLOGIES STILL LITTLE KNOWN OR REALLY PROVEN SOCIO-ENVIRONMENTALLY AND ENERGICALLY, ALL IN A TRUE DESPERATION TO - ONLY NOW - TRY TO QUICKLY REDUCE THE GLOBAL WARMING BEYOND THE RUPTURE OF THE OZONE LAYER. Shouldn't we first diagnose H2 much better and only then start by reconverting only large and/or public vehicles such as trucks, trains, buses, boats, ships, etc.?.;

2) Threats and Risks (or joys) of having “GIANT FUTURE BUSINESS PROFITS FOR SOME, BUT DEATHS OF MANY OTHER COMPANIES AND THEIR CURRENT JOBS” versus the consequent RISES IN PERSONAL COSTS/REDUCTIONS IN POOR FAMILY INCOME PLUS SIGNIFICANT RISES IN PRICES ELECTRIC VEHICLES – even if only for up to 20 initial years of reconversions - MORE THAN THE current RESIDENTIAL AND EVEN THE INDUSTRIAL ENERGY COSTS (much greater ELECTRICAL demands added in very rapid reconversions - even via dangerous kits etc., as when in the beginning of the NG Natural Gas vehicles - of millions of traditional petrol vehicles for electric vehicles “versus” reductions and non-expansions – little encouraged – of our necessary/fundamental electrical offerings in the next 50 years). Same regarding the USES OF OUR SUSTAINABLE SOURCES FOR PRODUCTIONS AND EXPORTS OF THE VEHICULAR GREEN H2 SUCH TO EUROPEAN COUNTRIES (see much current press about the repeated denials of their local manufacturing in Germany and the Netherlands, etc.) WHO DON'T WANT TO PRODUCE THEM THERE OR IN NEIGHBOR AFRICA - there also with much more sun and winds -, PREFERRING TO DEGRADE HERE AND ALSO who knows, possibly even, TRY TO STEAL OUR WATERS MORE WINDS, SUN ETC.” and even kill our workers and people only here. In short: the risks of producing, storing, transporting and using H2 are still extremely high, so much so that it is part of the atomic bombs with the greatest known destructive powers. I also think that consumers and European deputies/senators/leaders are well aware of all these risks, including political ones, and, therefore, put a lot of pressure on their leaders and companies so that such H2 - of any type or color - is not manufactured there;

3) Very high risks - only aware of by some peoples - of ENCOURAGING PURE OR HYBRID ELECTRIC VEHICLES, RECHARGEABLE FROM OUTLETS, EVEN THOUGH THE PRODUCTION OF THEIR HEAVY BATTERIES AND/OR MUCH H2 TO BE THEIR SOURCE CAN TO POLLUTE AND TO DEVASTATE MUCH MORE THAN THE CURRENT VEHICLES ALREADY DO, EVEN

RECHARGEABLE WITH PETROLEUM DERIVATIVES, NATURAL GAS AND EVEN WITH CANE ETHANOL OR BIODIESEL, THAT IS, WITH KNOWN AND EVEN CONTROLLABLE RISKS.

About the types, colors, costs, prices, technologies and risks of using H2 vehicular, industrial or residential – and their risks and ways of obtaining (only about 20% of these technologies already available, said to be clean or even sustainable, are those used to produce the H2 Green vehicle in Brazil), it's a good idea to read my previous articles here on this same website, some of which are already out of date, which is normal in the face of new information and research.

Vide: https://www.agrolink.com.br/colunistas/coluna/importar-h2-d-brasil-e-nos-roubar-energia-sustentavel--agua-_477411.html

Please see at Portuguese: https://www.agrolink.com.br/colunistas/coluna/importar-h2-d-brasil-e-nos-roubar-energia-sustentavel--agua-_477411.html

AS RECENT DIAGNOSES AND EXTERNAL OPINIONS – ALL GREAT PROOFS OF MY THESES AND ANALYSIS TO BE FOLLOWING –, LET'S SEE, in summary, THAT according to recent diagnoses and guidelines (October 2023) from the important energy consultant Mrs. Raphaela Ribas (see full link below and now published on the internet) **“Dancing to other people’s music” in the energy transition could cost Brazil dearly**, with **“One of the main risks being subjection to rigid rules created by third parties, which can be used by competitors as an instrument of market control.”**

Still, in summary, the main conclusions of her diagnoses and her conclusions are:

- 1) “The Brazilian energy transition is complex in itself, as there are several sources and sectors involved. The Transition needs to consider cost to the consumer and security of supply”;
- 2) “Replacing Brazilian fossil fuels (oil, gas, coal) with renewable fuels is a process that needs to take into account the cost to the consumer and security of supply”;
- 3) “A "run over" replacement could harm Brazilian economy, in addition to running the risk of sanctions if it does not meet decarbonization targets, for example, the Brazilian economy could be harmed if the energy transition leads to a "run over" replacement of products and technologies”;
- 4) **“Another consequence of leaving loose ends in the energy transition is that, without well-defined guidelines, Brazil may be subject to environmental standards dictated by other countries, which are potentially unfair and incompatible with our reality. "This will be an instrument of market control"”;**
- 5) “The question is how to stimulate the lithium more the EV national productions without repeating the history of inefficiency that is usually linked to the granting of subsidies. The cases of the Brazilian and it vehicle industries are classic, which for many years were accommodated under overprotection against imports. The consumer was the one who lost, paying dearly for inferior quality products”;
- 6) “The Challenge is how to balance Brazil’s interest with the need for partnerships”. Thus, the idea is not simply to sell Brazilian energy, but to form contracts in which national companies can also acquire techniques and knowledge to develop over time”;
- 7) “Foreign investments are welcome and relevant for Brazil partnerships development in the general assessment of the market. The injection of capital helps to leverage projects more quickly, taking advantage of windows of opportunity, since the country does not have the funds to finance this alone”;
- 8) “Developing national industry current is the government's motto and understandable, but it doesn't happen overnight, because the Chinese industry is very strong”;

9) “Another advantage of international partnerships is the import of knowledge by Brazil. China, for example, is far ahead of Brazil in solar energy generation and car electrification technology. Furthermore, Brazil depends on foreign inputs and components for the energy transition, such as solar modules”;

10) “OUR GOVERNMENTS need to get everyone on the same page, and LOCAL COMPANIES also need to do their part”;

11) “Brazilian Clear rules regarding State interference, deadlines, targets and other aspects would bring more security to both foreign investors and Brazilian businesspeople”.

12) “One of the main risks is the subjection of “the Country” to rigid rules created by third parties, which can be used by competitors as an instrument of market control;”

13) “A point subject to discussion is about incentives to leverage Brazilian projects, helping them to gain scale and competitive prices. Other countries are already opening their coffers to subsidize their industries – which, with this anabolic steroid, can suffocate outside competitors. In Brazil, lobbies are already moving in Congress and the Executive to guarantee their fair share of tax incentives”;

14) “The State’s ability to give up revenue also appears limited. Only in the federal government, tax waivers for the benefit of restricted groups of taxpayers amount to more than 4% of the Gross Domestic Product (GDP) and are successively extended even without proof of return, which keeps taxes high for people and companies not granted the benefits”;

For more details, please read in Portuguese: <https://www.gazetadopovo.com.br/economia/dancar-a-musica-dos-outros-na-transicao-energetica-pode-custar-carro-ao-brasil/>

In addition to the brilliant diagnosis above (which very much to confirm and to complement everything that I insistently write and warn about here for more than 5 years), let's look at other recent technical-marketing and socio-environmentalist positions:

1) According to the Brazilian Photovoltaic Solar Energy Association (ABSOLAR): “Developing the national industry is the government's motto and something understandable, but it doesn't happen overnight. If the Chinese industry is very strong, we cannot stop counting on imports of photovoltaic panels from China”;

2) As for the serious FGV Energy Consulting: “We need to fight so that these international ties do not become us (obstacles) against Brazil. So, we need to have a defined and comprehensive strategic plan on what the energy transition will be like here. A well-designed policy is the path to balance between Brazilian interests more the need for partnerships with abroad”;

3) Still for the FGV too: “It is difficult to think about expanding Brazil Sustainable Energies without commercial partners. Having natural resources does not allow us to do without international resources”;

4) Also, according to the specialist in environmental Brazil law, Adv. Antônio Fernando Pinheiro Pedro - responsible for a World Bank study on the carbon market in Brazil: “We need to work more on the national product. If not, you end up creating a demand [for imported goods] that is not necessarily due to a lack of adequate planning. Today there are many initiatives for the energy transition, but we are not seeing national coordination”;

5) Still for him too: “the generation of renewable energy in the country is progressing at a rapid pace, especially with wind plus solar farms. But there are doubts about the transmission capacity and reliability of these sources for the stability of the system.” The lawyer recalls that “the Brazil 90% blackout on August 15, which affected almost all states in the country, was related to performance transmissions problems in wind and solar plants in the Northeast”;

6) Also, for him (as I always write here): “the trend towards electrification of the vehicle fleet is expected to be rapid and high”. “This means that there will be overload to charge the vehicles. What do we intend to do to meet this demand? he asks”;

7) To another energy Brazilian expert who has been following the sector for decades (unidentifiable): “The energy transition has ended up becoming a means of making foreign policy. If there is no strategic plan saying what will be done, from which sources, what will be State interference, in short, something that gives certainty about the direction for companies and investors, can become 'greenwashing'”.

“GREENWASHING” IS A TERM USED TO DESCRIBE DECEPTIVE MARKETING STRATEGIES IN WHICH COMPANIES PROMOTE A FALSE OR EXAGGERATED ECOLOGICAL IMAGE IN ORDER TO ATTRACT CONSUMERS CONCERNED ABOUT THE ENVIRONMENT”;

8) “A good more fundamental URGENT Plan (Governmental) will be a reference to guide economic agents, banks, investors. Then it would be necessary to know what Brazil's industrial policy is, to know what the energy of the future will be, where these sources will be, what their role is, if there will be incentives, if the market will play a role", adds the expert, who asked not to be identified.

Returning to my own main diagnosis, I inform too.

What is currently unanimous is that the production of vehicular Green H2 occurs mostly from capturing high volumes of electricity from wind, solar, biomass, etc. to be able to electrify/electrolyze water (before it was the main, and almost the only technology available to manufacture that H2, but now it is also possible via ethanol + water reform to obtain the so-called the Green H2 – all in a new machine worldwide, a reformer, invented by Universities in the USA and France since 2001) - but now in much faster and expert development at the USP Brazil SP State University, the Unicamp Brazil University and others universities in Brazil, all with the support of some foreign manufacturer of traditional vehicles).

ABOUT THE, STILL FEW, CURRENT FORMS OF PRODUCTION AND/OR USES OF VEHICULAR “H2 GREEN”, really, (THEREFORE, COMING ONLY FROM REALLY SUSTAINABLE ENERGY SOURCES), I note that the Brazilian press more even renowned business consultants are quite lost and with each group kicking and very disturbing their readers or customers, WITHOUT UNDERSTANDING AND WITHOUT EXPLAINING IT VERY DIFFERENT SOURCES AND FORMS.

Therefore, I will try to briefly clarify here the 4 main current ways still in research/development to offer the possible ELECTRIC GREEN H2 vehicle, **only 01 of which is direct and internal:**

1) H2 GREEN by the ELECTROLYSIS OF VERY PURE WATER and with a large consumption of electricity and pure or clean water and whose storage and transport are extremely expensive and dangerous; all with green H2 for EXTERNAL EV VEHICLE INJECTION;

2) Rapid syngasifications of urban waste more from biomasses, debris, food leftovers, wood scraps, cultivated tree, plastics, old tires/clothes/leather etc. (all for the production of synthesis gas, more commonly called “syngas”). For safe production of H2, initially contained in up to 43% of the syngas, but concentrable, but such green H2 also for EXTERNAL EV VEHICLE INJECTION;

3) Production of green H2 using pure ethanol to be processed in medium-sized reformers, installed at gas stations. This is a Brazilian USP + Toyota Mirai EV Project, but with such a green H2 also for EXTERNAL VEHICLE INJECTION too;

4) Production and direct use of green H2 (see technical sketch above) obtained with the reforming of a mixture of ethanol + water to be processed and after to be injected as a sustainable final fuel by the internal SOFC fuel cell - well described and analyzed above - to produce such internal green H2 and to be injected immediately. So, this is for INTERNAL VEHICLE INJECTION. Therefore, for Brazilians, this is the our

MOST MODERN, MOST EFFICIENT CURRENT PROJECT, WITH LOWER RISK AND WITHOUT STORAGE OR TRANSPORTATION.

On the other hand,, what accelerated more than changed global/business/governmental interests were the combinations of increasing global warming (many deaths and disasters and environmental damage as early as 2023) plus the fast World electric vehicle dream and already with a lot of money flowing.

Please, also see the following links in English:

https://www.researchgate.net/profile/Vanessa-Fierro-2/publication/223040725_Ethanol_Reforming_for_Hydrogen_Production_in_a_Hybrid_Electric_Vehicle_Process_Optimization/links/5a2bf6e9a6fdccfbf8713d9/Ethanol-Reforming-for-Hydro-gen-Production-in-a-Hybrid-Electric-Vehicle-Process-Optimization.pdf ;

More in English too at: <https://www.sciencedirect.com/science/article/abs/pii/S0378775303004373> ;

Another to see our RECENT one in English from August/2023 and by the FAPESP-SP and with plenty of data and results about recent developments at our USP-SP:

<https://agencia.fapesp.br/worlds-first-hydrogen-from-ethanol-plant-will-be-built-at-university-of-sao-paulo/42182>

However, cannot be denied, because it is well known that that hydrogen has the lowest density in the gaseous state and the second boiling point of all known substances, making it difficult to store it in the gaseous or liquid state. When in gas form, a large volume and high-pressure storage system is required (from 250 bar to 1,200 bar) and, when in liquid state, its storage must use cryogenic systems, that is, in very low temperature (from -34°C to -253°C).

Furthermore, the energy consumption for compressing hydrogen is high, as around 2.21 kWh/kg is consumed to raise the pressure from 0.1 to 80 MP (800 atm or bars). Also, its liquefaction consumes more up to 15.2 kWh/kg.

Also, for the our UDOP (NATIONAL BIOENERGY UNION) – see link below – hydrogen is a substance that is difficult to handle, due to its low density and because it is highly flammable. Its liquefaction requires energy consumption equivalent to 40% of the energy content of the liquefied mass and even its storage in cylinders, at 750 bar pressure, consumes the equivalent of 15% of its energy content of the compressed mass. Transported through pipelines, now at lower pressures, it can also present leakage losses, in addition to the energy consumed in its compression and, if the transported gas is used to generate electrical energy in fuel cells, this energy will only be about 1/ 4 of that consumed to obtain hydrogen (IN other words, WITH A VERY LOW FINAL ENERGY YIELD OF ONLY 25%).

Also, when liquefied, its transportation over long distances is still burdened by evaporation losses, at a rate of 1% per day.

“Thus, the use of hydrogen has generally been carried out close to the place where it is obtained.”

The our UDOP diagnosis in Dec/2022 pointed out too that to produce just 01 kg of electrolytic hydrogen, around 50 kWh is needed, that is, with an energy efficiency of around 67%, LOW (dependent on the efficiency of the electrolyser) and its cost has been close to Us\$ 5/kg. Electricity represents 80% of this cost and the rest comes from water treatment, catalysts and equipment. On the other hand, comparatively, hydrogen obtained from fossil fuels STILL ONLY COSTS about Us\$ 2/kg.

Therefore, currently - in TRUTH - obtaining Green Hydrogen is still more expensive than the traditional one FORMS, BUT which involves carbon dioxide emissions.

See more data in the link at Portuguese with public information at :

<https://www.udop.com.br/noticia/2022/12/16/potenciais-e-desafios-do-hidrogenio-verde.html#:~:text=Um%20kg%20de%20hidrog%C3%AAnio%20eletrol%C3%ADtico,da%20%C3%A1gua%2C%20catalizadores%20e%20equipamentos> .

Also, the SERIOUS production of Green H2 requires high volumes of 03 types of water, WHICH ADD TO 09 LITERS FOR 01 LITER OF H2, as shown below. Such captures/filtering/purifications and supplies of water also lead to large local electrical consumption, which cannot be transferred by the uses of so-called Green H2 (more exportable).

Recently, according to technicians from the serious Brazil consulting in Portuguese the Linsul (www.linsul.com.br) - in the link with public information - in the production of Green Hydrogen it is necessary to distinguish 03 types of water: 1) Ultrapure water (used as raw material for the electrolyze); 2) Cooling water; 3) Common raw water.

“The amount of Ultrapure water used for electrolysis is quite different from the raw water extracted from the environment, and the quality of ultrapure water and cooling water is also different.

Therefore, we need to deal with each one separately.

Let’s look at Ultrapure water first.”

“Ultrapure water consumption: We can accurately calculate the amount of ultrapure water needed to produce green hydrogen, using the atomic composition of water, H₂O. As oxygen is 16 times heavier than hydrogen, it is responsible for 89% of the mass of water, which means that 9 liters of water are needed to produce 1 kg of hydrogen. This relationship can be very useful in determining the water requirements for a specific hydrogen production capacity.” “Most electrolyzers consume 45–55 kWh per 01 kg of hydrogen, which means that 0.16–0.2 liters of ultrapure water are needed for each kWh or 163–200 liters/hour of ultrapure water per 01 MWh of capacity of the electrolyzer”.

“So, roughly speaking, the production of 100,000 tons of Green Hydrogen per year will consume 900,000 m³ (= 900 tons) of ultrapure water.”

See more recent data about at Portuguese: it - link with public information - at:

<https://tratamentodeagua.com.br/artigo/tratamento-agua-geracao-hidrogenio-verde/>

As can be seen, it is not easy (except in irresponsible speeches and intensive lobbies) – much less socio-environmentally and economically sustainable – to produce H₂ vehicle via new real sustainable energy sources for the intensive vehicular, industrial and residential electrifications, planned for the next 30 to 40 years.

Recently, we are also being invaded with much daily news (obviously, they only publish the good news that interests them, including those supported by the Green Press, Consultants, Researchers and even hundreds of fancy environmentalist NGOs) about giant lithium mines and their explorations and others strategic vehicle electrical minerals in Brazil more about their current and miraculous uses in electric batteries vehicles (these, in general, weighing 200 kg to 550 kg and with a useful life of up to 15 years - the majority weighing 300,0 kg/ud., compared to just 14,4 kg/ud. of the current traditional petrol vehicle battery). Such electric batteries are most often installed, in groups, in vehicle subfloors, like a gaseous or chemical or even explosive “bomb”.

Also, what's worse is that almost no one in the world seriously knows what to do with such batteries after their full use plus their essential disposal. According to our the EBC Brazilian consulting - link below with

public information - currently, Brazil registers more than 100 thousand hybrid and electric vehicles sold. **The total weight of the electric batteries that power these cars is around 34 thousand tons, of which at least around 30 thousand tons are components at the end of their useful life,**

Please see at Portuguese: <https://agenciabrasil.ebc.com.br/geral/noticia/2023-05/destino-errado-de-bateria-de-carro-eletrico-poe-em-risco-meio-ambiente#:~:text=An%C3%A1lises%20indicam%20que%2C%20enquanto%20uma,entre%20dez%20e%2015%20anos> .

Still in the case of the current extraction of the miraculous lithium, the predicted joint devastations both increase and greatly worsen future socio-environmental risks against soils, subsoils, micro-regional biomes and, mainly, both in many km²/m³ of our surface waters (streams, rivers, lakes, giant dams, sea etc.) and in our deep aquifers. Brazil has about 10 giant ones and with a lot of deep and very good/clean/sustainable water in different locations. Obviously, all very well denied, almost immediately, both by companies, such as by Consultants, Governments, NGOs, the Press, etc. Everything happens today, in fact, as has already happened in the current devastations and in recent disasters – with many deaths and severe environmental degradation with the ruptures - of cheaters, ineffective and not useful - mineral waste and water containment dams as recently occurred in the our Brumadinho iron mineral City – MG more in the Mariana iron mineral City - MG and other smaller ones, even pre-announced.

IT HAPPENS THAT ONLY TO MANUFACTURE 01 VEHICLE BATTERY, A LARGE TRACTOR NEEDS TO BURN 1,000 LITERS OF DIESEL IN 12 HOURS, to move 250 tons. of land, of which 42 t. will be extracted (mostly underground and up to 300 m deep) to produce essential minerals (12 kg of lithium + 30 kg of nickel + 22 kg of manganese + 15 kg of cobalt + 100 kg of copper + 200 kg of aluminum, steel and plastics).

OBVIOUSLY, THESE ARE STILL A "SCORED EARTH" POLICY AND EXPLORATIONS, BUT ALSO SOLAR BATTERIES AND COMPONENTS OF SOLAR PLATES AND EVEN WIND GENERATOR BLADES ALSO HAVE THESE HIGH MINERAL CONSUMPTIONS MORE THAN COMPOSITES AND OF GRAPHENE.

OBVIOUSLY, THEY COULD EVEN BE A POLICY OF EXPLORATIONS, possibly almost of the TYPE of a lot of "SCORED EARTH" - even common in Brazil - but perhaps even uncontrollable and without returns.

Obviously, LITHIUM mining still destroys much less land and water (from the ground, subsoils and neighboring streams/rivers) than the giant and continuous devastations - and for more than 110 years, since the first world war - caused by dozens of mines of iron, copper, bauxite/aluminum, manganese (in order, the most mined and consequently most demanded minerals, in volumetric terms, in the World), but which also generate many jobs, income, taxes and developments and in many countries in the World .

Also, it would even be utopian to condemn them - only them - for the environmental damage caused and not even give them the chance to, at least, explore in a more dignified and even somewhat clean or sustainable way.

After all, its minerals prove that, in some ways, they also help a lot in controlling/reducing the biggest global problem - quite uncontrolled at the moment - which are the gigantic carbon emissions from vehicles, industries, fires, devastation forestry, etc., and the same applies to other much worse gases, such as methane (from landfills, landfills, biodigesters, swamps, cattle, sheep/goats, etc.) and sulfuric and nitric gases (industrial gases).

Also, the World and its people still need a lot of housing, schools, hospitals, leisure, vehicles, furniture, asphalt, industries, food, etc., all dependent on good mineral exploration, including much of the jobs generated. Human beings still cannot live in the open air or alone with just water and some vegetables, etc.

HOWEVER, WHAT IS VERY SCARING ABOUT LITHIUM MINING ARE THE LOW FINAL VOLUMES OBTAINED FOR EACH 01 TON OF SPODUMENE WELL PROCESSED, AND THIS CONSIDERING THE CURRENT BEST TECHNOLOGIES AVAILABLE IN THE WORLD.

Comparatively, while a traditional car for 04 people weighs between 1,300 and 1,800 kg (80% of which comes from well-processed mineral derivatives, such as iron/steel, copper, carbon, graphene/graphite, composites, etc.), its conventional battery only weighs 14.5 kg (about just 1% -2% of its total weight), in a similar electric vehicle its weight increases to between 1,600 and 2,000 kg, much more thanks to the weight of its giant battery and with 350 to 550 kg/ vehicle (around 25% of its final weight). Also, while 01 ton of pure earth (hematite) extracted and revolved provides up to 700 kg of good quality iron (average yield of 70%, reaching 85% in some mines), 01 ton of well-processed earth, already in the form of well-concentrated spodumene, only provides 12 kg of Lithium (yield of 1.2%). According to Harben (2002), among the main mineral sources of Lithium (Li₂O), those with the highest concentrations are exactly the spodumene deposits with a content of up to 7% Lithium, followed by the Ambligonite ore with 5% plus Petalite ore and Lepidolite ore with 4% each, respectively.

Fight for water IN THE EXTRACTION MORE IN THE PROCESSING OF LITHIUM:

“According to a consultant from the Motor1 website (<https://motor1.uol.com.br/> - with public information), the high consumption of water, an increasingly scarce resource in the world, is the most critical point of concern. It takes 2.1 million liters of water to refine every 1 ton of lithium (also recently called “white gold”), an amount sufficient to produce batteries for ONLY 80 electric cars like the Tesla Model S with its battery module that has 12 kg of lithium.

“This characteristic of lithium mining becomes even more worrying because most of the known reserves of the metal are located in desert areas, where mining contaminates and diverts water from where it is already rare and essential for the survival of fauna, flora and local communities.”

SOME RECENT SOCIO-ENVIRONMENTAL TRUTHS AND TO BE DEBATED MUCH BETTER:

- 1) “While it takes 2 to 3 grams of lithium to produce an iPhone 11 battery, the energy module of a Tesla Model S needs 12 kg of the metal, but depending on the vehicle, this amount can reach 30 kg”;
- 2) **“WORSE IS THAT Some projections indicate that more than 60% of vehicles sold in the world from 2030 onwards will be electrified and will consume 90% of the lithium produced in the world”;**
- 3) **“By the end of this decade, global lithium consumption for electrified car batteries is expected to grow from the current 350,000 tonnes/year to 3.0 million tonnes per year, according to calculations by Rio Tinto, the second largest mining company in the world”;**
- 4) **“The International Energy Agency, linked to the Organization for Economic Cooperation and Development - OECD, estimates that global demand for lithium is expected to grow 40 times over the next 20 years, placing the ore's classification in the same category as oil as an element of energy security worldwide”.**

See more details in the Portuguese link below with public information:

<https://motor1.uol.com.br/features/605782/lado-sujo-carro-eletrico-litio/>

Honestly, personally, I believe that also the explorations, uses in global plug-in electric vehicles and even our lithium exports will not take off for a long time, although they are the current fashion.

On the other hand, sincerely and personally, I already believe that explorations, uses in plug-in global electric vehicles and even our exports of LITHIUM will not take off for a long time, although they are the current fashion and hope of many, especially in poor municipalities in the their deposits and which go through so many social difficulties (a lot of hunger) and lack of government support that they cannot have long-term visions of the effects of possible intensive exploratory devastation against their people, biomes, biotas, places and water bodies.

PLEASE, ALSO, TAKES NOTE THAT EVERY DAY THE DISCOVERY OF ANOTHER GIANT LITHIUM (spodumene) MINE IS ANNOUNCED.

So, I think that in just another 3 years, lithium will already be on the market and with much more VOLUMES production, cheaper, purer and closer to the ports of other countries.

Furthermore, no one yet knows, or can project/measure/outline, I think, whether this drop I predict in LITHIUM prices - due to excess supply, even if controlled and temporary - will reduce the final prices of electric vehicles plugged into a socket and, thus, somewhat hold back global demand for lithium and its final prices.

Lithium prices will almost certainly fall subsequently, as its supply will expand much more than demand at the beginning and new, cheaper competitors - especially EVs (electric vehicles) running on H2 ethanol and EVs with sodium batteries (much more abundant and cheaper, although still less effective)

For the most part, as happened in the conventional automobile industries "versus" the oil industries, I think that **NEVER WILL THE PLUG OR HYBRID ELECTRIC INDUSTRY GROW FASTER THAN THE INDUSTRY OF THEIR NEW SOURCES, WHATEVER THEY MAY BE.** Today it is already clear that the annual increase in global sales of traditional vehicles is already much lower than the annual increases in the supply of fuels, biofuels and NG. If there were previous fuel supply crises, they were false, cartelized and just to raise prices.

EVEN IF THE EV TRIUMPH - which is fundamental for cleanups plus urgent socio-environmental solutions - the oil industry and the above auxiliaries will still survive for around 200 years in the world, I **THINK** - whether we like it **OR NOT** - ditto the Asians and the other bettors and supporters of the EV, H2 only from ethanol, singás, biogas, etc.

On the other hand, no one yet knows, or can project/measure/outline, I think, whether this drop I predict in lithium prices - due to excess supply, even if controlled and temporary - will reduce the final prices of its connected electric vehicles. in socket and, thus, somewhat hold back the global demand for lithium and its final prices.

MY MAIN CONCLUSIONS about the new sources and technologies to move clean or sustainable electric vehicles against to the detriment of the old and very polluting vehicles moved by OIL derivatives:

1) I think that simply changing current energy sources to try to quickly reduce high carbon emissions - historic and never taken seriously - are being done in haphazard ways and at the whim of only the clear interests of some Companies, Governments, Lobbyists, Researchers and NGOs; always to the detriment of other old companies and with possible large losses of other energy, water, soil, subsoil, biomes, jobs, income, taxes, etc.;

2) Also, I think that the accelerated/little studied and minimalist reconversions, which are proposed and which are already being implemented, from the millions of traditional vehicles – highly polluting with carbon – for electric and/or for hybrid and/or for hydrogen vehicles, which carry high movements and possible degradation of existing electricity, water and soil, etc. **THEY COULD BE A BIG SOCIO-ENVIRONMENTAL, ENERGY AND STRATEGIC MISTAKE/POSSIBLE ERROR OF THE NEXT DECADES;**

3) Probably, Brazil will be embarking again and clearly - due to intense lobbies, but perhaps because we still have Ministers, Governments and Secretaries who are not very knowledgeable - in the so-called Dutch Disease, in which many natural resources are destroyed without social or socio-environmental gains and for profits only by some from other countries;

4) I think that Brazil should explore - as quickly as possible and until it runs out - its old oil plus the pre-salt oil plus the new oil from our "Equatorial Margin" (very far from the coasts of the our Amapá State and some states in the northeast), even with world demand and prices reducing progressively and little by little with the planned major vehicle and even industrial conversions planned for the next 30 to 50 years;

5) In addition, answer me urgently: How will we evolve socio-environmentally and energetically IF BRAZIL ELECTRIC GENERATION - vehicular, industrial or residential - WITH SUSTAINABLE ENERGY DEMANDS VERY HIGH VOLUMES OF RARE ORE, turning over millions of tons. of soils and subsoils up to 300 m deep (such as in spodumene mines for lithium) MORE THAN A LOT OF WATER?? THUS, WITH POSSIBLE SOCIO-ENVIRONMENTAL DAMAGE - DIFFICULT TO PREVENT/REDUCE AND/OR MITIGATE - AND MUCH GREATER THAN IT WOULD BE IF IT WAS BETTER THAN BY OIL DERIVATIVES??;

6) So, personally, technically and socio-environmentally, I hope THAT THE WORLD SUSTAINABLE FUTURE ENERGIES NEED, FIRSTLY, for faster and VERY MUCH better more INTENSIVE researches to implement the following projects, which are much less degrading, and are also proven to be very depolluting, cleaning and large producers of electricity for various uses, including the real Green H2 vehicle.

Additionally, answer-me too:

1. Why there is little research, development or even talk about sustainable energies that are also very environmentally clean, almost free, and arising from the possible rapid syngasifications OF BILLIONS OF CONTINUED daily tons of URBAN and RURAL MSW more comes from ANIMAL or HUMAN FECES, old tires, plastics, leftover leather and fabrics, etc., ALL ALREADY MAJOR SOCIO-ENVIRONMENTAL PROBLEMS, EVEN MORE IN THE SUM??;

2. Why in Brazil still are very few of the very modern MINI PCH (MHP = Mini Hydroelectric Power Plants) and/or of good and cheap VORTEX MHP electrical generators, implemented in Brazil? (to be implanted in millions of artificial short falls, up to 4 m high from a minimum of 200 mm of constant running water);

3. Also, why don't we generate electricity in Brazil with the MINI PCH (MHP = Mini Hydroelectric Power Plants), to be installed in SMALL and SHALLOW CURRENTS (minimum of 1 meter in depth) and NEIGHBORS thus, with few losses in generation and electrical transport? Note: as the Brazilian relief is well suited, it is rare that there is not a small stream or even a medium to large river that is located more than 40 km from the center of small/medium power demand areas and/or in places with greater isolated or collective demands for small/medium electrification;

4. Why in Brazil aren't to build very much medium to large electrical generating plants along almost 9,200 km of our total oceanic coast, all for large ELECTRIC captures from offshore waves more tides? Note: According to old diagnoses from our the BNDES Development Bank, around 75% of the current total Brazilian population – 214.3 million inhabitants – resides and consumes within only 300 km of ocean beaches;

5. Finally, why in Brazil we still produce little ETHANOL fuel from SPIRILED CORN crops such as with the "Azospirillum brasiliense" a good bacterium – see below in Portuguese (main topic of this article), all FOR the manufacture of electric EV HYDROGEN (mainly in internal hydrogen cell) to be obtained in recent and very modern internal ethanol reforming machines for such H2 for immediate use and without storage, in addition to being much cheaper to produce and with much lower risks? Please also

see article: “Bacteria increase corn productivity and reduce chemical fertilizers” in Portuguese at <https://www.embrapa.br/busca-de-noticias/-/noticia/2467608/bacterias-aumentam-produtividade-do-milho-e-reduzem-adubos-quimicos> .

So, these last revolutionary and strategic socio-environmental and energy projects THAT I RECENT PROPOSE only here with spiralized corn for bioethanol-DDG-H2 only direct injections EV (no fuel/h2 tank) with biological inoculations (and, therefore, with low use of petroleum-derived fertilizers) would be the best environmental projects in the world, as in one go, they would be able to solve 04 socio-environmental and economic problems and even electrical:

1) Strong increase in carbon capture levels in many subsequent crops, as corn is one of the fastest and most intensive plants in photosynthesis, and therefore, the one that captures the most real CO2. See my recent article: “CO2 Sequestrations Compared - Before Native Trees Amazon/World, our Corn for Ethanol/DDG sequesters 14 times more and new fast trees, 11 times more” - see in Portuguese at <https://www.linkedin.com/pulse/sequestro-intensivo-de-co2-como-novas-arvores-com-apanas-cezar/?originalSubdomain=pt> ;

MORE in Portuguese too: “Intensive CO2 sequestration: How new trees just 2 to 5 years old capture up to 11.0 times more carbon than what native trees with an average of 186 years“ at: <https://www.linkedin.com/pulse/sequestro-intensivo-de-co2-como-novas-arvores-com-sobre-cezar/?originalSubdomain=pt>

PLUS – now in English - still about CO2 of Our Corn for Ethanol/DDG (a sustainable plus high-protein process residue for animal feed, only slightly less rich than hi-pro soybean meal) + Fast Tree will Clean the World IN ENGLISH at: https://www.agrolink.com.br/especies/equinos/coluna/co2-our-corn-for-ethanol-ddg--fast-tree-will-clean-the-world_479538.html .

Take Note, too:

1) While in the Brazil Amazonia forest, the most beautiful and very old giant trees - with an average age of 182 years and 50 meters high (up to 90 meters and they have a crown diameter between 3.0 m to 30.0 m, that is, allowing populations between 20 to 900 trees per hectare/year) – that only grow between 22 cm to 40 cm/year at average of 31 cm/year (because they have a minimum and real annual growth, precisely due to the very low level of photosynthesis) much less (-85%) when to be well compared (scientifically, by measurements in field towers) to grow up to 200 cm/year in new fast and modern researched/developed forest trees such as the “white angico tree”, this up to 4 meters high and only 2 years old;

However, still far superior and better than such new modern trees above, our modern corn culture for Ethanol/DDG (“Distilled Dry Grain”, an very high-protein industrial derivate as feed for fast fattening of animals) allows up to 90,000 plants per hectare and up to 2.20 m high – including lateral growths of up to 1.5 m in diameter of its tops and with thousands of leaves plus dozens of “meritalos” and ears - and with up to 2.5 harvests/year. As leaves and stems grow by continuous photosynthesis-chlorophyllization, from the supply of carbon in the air plus water and with good soils, there is nothing to discuss about the levels of their real sequestration, measured by kg/hectare above, even so well compared in my articles above. Note: Our agro forestry research already has around 15 types of trees, shrubs and even fruit trees with much faster growth, almost without knots and also with good socio-economic benefits (processing with low losses and/or good volumetric storage and for many years of a lot of CO2s in furniture/civil construction works and/or complementary feeding of small local animals), some of which are also good collectors/extractors of water from groundwater or deep aquifers to local surfaces);

2) Possible good reduction in methane emissions from cattle and other ungulate animals, which would be fed by the DDG (sustainable, as a very high-protein process residue for animal feed, only slightly less rich than hi-pro soybean meal) arising from the intensive production of such corn, as above;

3) Already high and recognized reductions in CO2 emissions due to the vehicular uses of corn ethanol;

4) Possible future intensive uses of corn ethanol by reformers mixing it with water for the production of real sustainable vehicular H₂. Obviously, also in these cases, the uses of spirilla corn ethanol will be much more sustainable than those of sugarcane for ethanol too, because, those, in addition to coming from lands with high uses of petroleum-derived fertilizers (also with spirilla), they produce a lot of Co₂ due to the intensive burning of its bagasse for energy purposes in the plants.

MY COMPLEMENTARY PROPOSALS:

For me, the Brazilian people needs and very much to debate before and/or for posterior careful implementation (very well analyzed and even corrected in time and form) of the following suggested measures (to be implemented over the next 5 years):

1) It would be necessary to intensely research and date (as freely and publicly as possible) carbon footprints plus methane footprints and, above all, we install thousands of towers for daily measurements of real, local emissions and recaptures of these gases (especially Co₂), mostly in fields for crops and in forests for trees, as long as they have high levels of photosynthesis. We don't even know yet if the best socio-environmental path is, really, not emitting carbon (only electric vehicle proposal), but, yes - or who knows - it would be much better to sequester much more carbon - with a view to much more corn and of spiralized sugarcane plus implementation of new forests with new trees that sequester very quickly (not least because the following and continued environmental projects and vehicle systems – much more for non-emissions – of Co₂ in the last 40 years have achieved little or have been working); ditto methane footprints; ditto for other gases; ditto the renewal and recovery of watersheds in agroforestry desertification's/abandonment of biomes and their effects on biomes and biotas; ditto new reforestation except with eucalyptus or pine; ditto mapping and ways to boost CO₂ sequestration by sea and lake algae, etc.;

2) Establish the following suggested measures (also to be implemented in the next 5 years): We need much more immediate and compared responses regarding the effective results from sequestrations “versus” non-emissions by APPLIED SCIENCE – NOT BY COMPANIES AND GOVERNMENTS – BECAUSE THESE ENTITIES ALREADY OWE US MANY TRUTHS;

3) I think that our Petrobrás - and/or other companies authorized by the Federal Government, including winners of exploratory auctions -, in addition to obtaining and allocating the majority of their high total NET exploratory profits, and/or located, to their shareholders and Governments would also be able to allocate a small part of the subsequent net profits (10%) to the challenge of buying, restoring, assembling and reassembling centers for minimal processing and then selling cheaply or exchanging for final products (never giving up) at least 30.0 million of hectares of land, proven to be degraded, at auctions offered by banks and other creditors or purchased directly, etc. for “Cooperative Family Farm” and/or for Family Farm Integrators/Fosters, all well trained and motivated, in fact, as was negotiated, only later, with the Vale do Rio Doce Company and other mining companies in the cases of the socio-environmental disasters in Brumadinho -MG and Mariana-MG. If Petrobras or other companies wanted, they could even set up and/or sponsor/encourage models of vertical integration of agricultural and animal production plus agroforestry promotions (except for eucalyptus and pine) to be the priority recipients of such “in natura” productions” or processed, including to receive carbon credits, external contributions in partnerships and, better yet, export and also to use the images in their corporate socio-environmental reports in Brazil and abroad.

4) Obviously, in the next 20 years - also with a small part (5%) of the net resources compensating for so much oil - we would build a sustainable and proven scientific and socioeconomic model to reforest as much as possible by providing billions of seedlings and/or seeds from fast trees/ good wood MORE resources for research by EMBRAPA into better varieties of “spirillated” corn for ethanol/DDG production. All this would occur - progressively and planned only by the EMBRAPA SOILS AND/OR the EMBRAPA FORESTS - in a large part of already degraded Brazil (total area estimated by Embrapa soils of 140 million hectares, 25% larger than our entire cultivated area of close to 110 million HECTARES) .IN THE AMAZON ONLY AGRICULTURAL EXPLORATIONS WOULD BE ALLOWED THROUGH

MEDIUM TO GIANT MFS PROJECTS, OR SEMI-PRIVATE ILPFE OR RPPN, but all only with forest replanting's with fast trees and large real capturers of carbon and water... All foreign resources captured or donated WOULD BE CONTRIBUTED TO NATIONAL FUNDS TO BE MANAGED ONLY BY BNDES plus a NEW PETROBRAS plus a NEW EMBRAPA.

5) Captures of truly sustainable solar, wind, biomass and waste energy, etc., would be directed at 40% to the expansion of industrial or residential electricity. Thus, 60% could go to ELETRIFY vehicles in sockets, but our energy priority would be much more corn for ethanol and vehicular H2 + thousands of small family PCHs or Coop aggregators BY 01-deep currents in streams and rivers + thousands of families PCHs by VORTICES (small artificial drop of just 4 m and in creeks and streams with a minimum and constant flow of 200 mm.

MY STRATEGIC OBSERVATION: “THESE REVOLUTIONARY AND STRATEGIC SOCIO-ENVIRONMENTAL, VEHICLE AND ENERGY PROJECTS, WHICH I PROPOSE ABOVE, WITH MUCH GREATER FUTURE CROPS OF SPIRILATED CORN (WITH BIOLOGICAL INOCULATIONS AND, THUS, WITH LOW USES OF FERTILIZERS DERIVED FROM PETRO LEO), OF CERTAINTY, THEY WOULD QUICKLY FIGURE AMONG THE BEST SOCIO-ENVIRONMENTAL PROJECTS IN THE WORLD, AS IN ONE TIME THEY COULD QUICKLY RESOLVE 04 ENVIRONMENTAL, ECONOMIC AND EVEN VEHICLE ELECTRIC PROBLEMS (NON-CARBON EMISSIONS), WELL ANALYZED ABOVE”.

I FINISH WITH THE FOLLOWING QUESTIONS AND DOUBTS: Why do governments, scientists, universities, large companies, consultants, GREEN PRESS, NGOs, etc. DO YOU ONLY WANT TO SUPPORT WHAT IS VERY VISIBLE?? OR MORE FASHIONABLE?? OR THAT GIVES MUCH MORE views and audiences on newspapers and TV reports?? OR WHAT MUCH MORE RESOURCES ARE SPENT ON?

End

Brazil – 10/20/2023

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