Strategies for a Green Industrialisation

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It always seems impossible, until it is done.
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On the island of El Hierro, part of the Canary Islands region of Spain, a local economy was designed that one day will be independent in water and fuel and will stimulate small-scale local industries. Moreover, it did not take long to propose a strategy based on wind energy, hydro-power and flywheels. The goal was to provide renewable energy and abundant water to stimulate agriculture and local food processing industries. It has proved to be a successful project and today the island has high employment rates and, for the first time in decades, children and grandchildren imagine a future and a profession on the island. All too often we forget that energy is a medium, not a purpose. Our lives depend on water, food, housing, health and mobility and each one of these core activities of life requires energy. It is therefore important to shift from a debate on "renewables or not", or worse "for or against fossil fuels", to a debate about our capacity to respond to the basic needs of everyone in our society. If we are prepared to transform our intentions to a focus on meeting needs, then the fossil fuel debate will quickly shift to a new content.

Funding for Green Industrialisation

When Javier Morales, then the deputy mayor of the island El Hierro, part of the Canary Islands region of Spain, asked me to assist in the design of a local economy that one day will be independent in water and fuel and will stimulate small-scale local industries, it did not take long to propose a strategy based on wind energy, hydro-power and flywheels. The goal was to provide renewable energy and abundant water to stimulate agriculture and local food processing industries, especially meat, cheese and yogurt. The total investment for this project at the start of 1997 was estimated at €67 million. The response from the political and financial world was that if this little island of no more than 10,000 inhabitants required an investment of so much money, then we were out to build a "white elephant".

Is this true? Let us look at it from another angle.

At the time the island was spending €8 million a year on importing diesel fuel to generate electric power. It is interesting that this economic and energy model was considered

normal: water and power was expensive, rendering industrialisation impossible. However, it does not take an economist to realise that the total cost for the local population of importing the fuel – while assuming major risks – over a decade is €80 million, and that money goes straight to the oil producers, none of which are based in Spain. So we raised the question: "How can the import of polluting fossil fuels be considered normal while redirecting a guaranteed expense for everyone on the island into local renewable sources of energy that plough money back into the economy is considered a white elephant?"

The idea to convert El Hierro into the first island self-sufficient in water and fuel became reality for a total cost of €86 million. The additional €21 million was imposed after a volcanic eruption forced additional infrastructure. The facility was inaugurated in 2013! Now the islanders are very determined to embark on the next step: all 6,000 vehicles must be electric within a decade. It is surprising that, even after the successful implementation of the renewable grid, opponents formulate the same "white elephant" comments. How can an island afford to spend €150 million on the conversion of a car fleet from fossil fuel to electric? And again we asked the same question in response: "How can an island permit the annual expense of €12 million for the purchase of fuel and diesel to power vehicles on the island?" All this money is channelled outside the economy. What would it mean if the €8 million for power and the €12 million for fuel remained in the territory?

The island of El Hierro has decided to create its own electric car leasing company. All taxis and rental cars will be electric with immediate effect, and as soon as there are 500 electric vehicles on the island the car leasing company will install a smart grid, which stabilises the network delivering micro-currents when needed, and stores excess energy in car batteries. As soon as there are 2,500 vehicles, the combination of wind, hydro, flywheels and batteries will offer a level of efficiency that further drives down the cost of water. Indeed, water is life and for centuries this island has suffered from a dramatic shortage of this most precious substance. Just imagine the turnaround thanks to renewables and a smart grid complemented by zero emission mobility: double the amount of water on the island at half the cost.

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The time has come to go beyond the "for or against". This divisive approach to life, where we pitch the good against the bad, forces people in society to take positions. We cannot neglect the fact that the convenience of fossil fuels and their abundance for decades has permitted too many to live in air conditioned atmospheres, unaware of the unintended consequences caused by the excessive incineration of coal, petroleum and natural gas. We need to lift the debate towards one that discovers the tremendous opportunities to create a thriving local economy using what is locally available. It is a shift from cheap and easy fuel, which permits us to cut costs with an inconvenient truth, towards local energy sources that per-

Bascos viewpoint, El Hierro (Archive of La Frontera City Council).

mit us to expand the economy of the territory with readily available resources, sustainably of course.

Water and power is life and for centuries this island has suffered from dramatic shortages of both, rendering industrialisation impossible. Just imagine the turnaround thanks to renewables: double the amount of water on the island at half the cost. Today, industrial production includes a meat packing enterprise processing goats and sheep; a cheese and yogurt factory, combined with the processing of fresh fruits; and a winery converting locally grown grapes into wines. The island has high employment rates and, for the first time in decades, children and grandchildren imagine a future and a profession on the island.

Unaware of the Consequences

The shift to fossil fuel has hooked us on the habit of free spending on energy without any consideration for the amount of money drained from the local economy. Economists merely notice the impact on the balance of payments of a nation but seldom realise the profound leakage this causes and the need to start generating export revenues in order to pay the bill. A country like Argentina produces enough food for 400 million people in the world, or ten times more than its own population needs. However, the country has 750,000 malnourished children under 18. How do you explain this blind focus on growth, increased output and the neglect of food and nutrition? Argentina's drive towards

food exports exacerbated energy consumption and at a rate of 100,000 barrels per day (4 million per day, or 1.5 billion per year); it is responsible for the trade deficit even when petroleum prices are at an all time low.

Fossil fuel is like a drug, it blinds us to its impact and consequences. Even if we know, we do not want to know. One of the well-documented unintended side effects of burning fuel are emissions, not just carbon but also nitrogen and sulphur oxides, popularly known as SOx and NOx, which not only contribute to climate change but also affect the health of every breathing species on earth. We needed a scandal of the magnitude of Volkswagen to realise that the maximum pollution levels set by European and Californian authorities to safeguard the respiratory health of children is openly defied by the industry, to the point that car executives of the leading German maker installed deceptive software cheating the general public, and until recently with impunity. While we are slowly waking up to the collateral damage created by these emissions we have no idea how we have unravelled the web of life on Earth from a permanent and diligent cycle of carbon sequestration and storage, to one that permanently emits all carbon. Let us take the example of silk.

A century ago, the world production of silk hovered around one million tons per year. Today output hardly reaches the 100,000 tons level. The arrival of Nylon, this synthetic polymer developed by scientists at Dupont de Nemours, introduced the knock-out phase for this natural polymer produced by the mulberry caterpillar (which the English mistakenly call a worm). The traditional ecological economist would enter the debate and calculate the amount of carbon emitted by one million tons of petroleum used to produce Nylon, and compare this with the carbon sequestered in the process of silk. While this is a correct approach it is incomplete.

When China embraced the farming of silk 5,000 years ago, their first interest was not the silk but rather the conversion of savannas into fertile areas. Indeed, it was quickly noted that the symbiosis of a caterpillar that would devour about 50% of the canopy of the mulberry tree left on the ground a rich mix of excrements so nutritious to micro-organisms that it triggered the creation of top soil. An area considered infertile planted with mulberry trees would be ready for planting water melons within a decade. What few people realised is that the caterpillars triggered a soft and unnoticed chemistry that fixes carbon massively into the soil, creating a black earth that would continue to serve humanity for centuries. This ecosystem service was the real success of the mulberry/caterpillar symbiosis. Silk was a by-product.

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Now, with the arrival of Nylon, we not only substitute natural silk with petroleum derivatives at high energy expense but, worse, we stop creating top soil, the sequestration of organically-bound carbon and nitrogen. The lack of continuous cycles of top soil generation with a blend of minerals and nutrients through the creation of additional "ecosystem services" leads to the mining of carbon and nitrogen up to a point that there is none left. As soon as carbon is less than 5% or 6%, then the farmer is obliged to maintain production by irrigation since poor carbon soil cannot retain water, and by adding synthetic fertilisers and nitrogen since the core feedstock (carbon) is too depleted. Of course, this is only viable with the infusion of a massive input of fossil fuels. Silk is natural

and resistant, and has a useful life of at least three generations or one hundred years. Nylon is a typical throw away product symbolised by ladies' stockings that are discarded in the bin the day any minor damage is visible. Nylon is never recycled.

Once we realise that petroleum-chemistry is not only about substituting a natural fibre (silk) with a synthetic one (Nylon) but about substituting a system that cycles carbon with long retention and storage systems into one that leads to the permanent spewing of carbon into the atmosphere due to this throw-away culture, our addiction to petroleum becomes even more debilitating. It is like a drug addict who is not only endangering his or her own life but destroying the whole social tissue by promoting illegal production and trade that enriches a few and leaves society with all the costs of rehabilitation, violence and penitentiary services.

Reverse the System towards Green Industries

The key question is how to reverse this trend. We cannot go back in time and suggest that silk has to pick up its past glory as a fashion. It is difficult to imagine the substitution of Nylon and all of its synthetic varieties by silk. However, once we take the time to study the real chemistry of silk, then we realise that there is an exceptional product portfolio at our feet that could not only serve humanity but also revive silk farming, even beyond the levels of production practised a century ago. The new fields include medical and cosmetic applications.

Silk has unique tensile strength, permits cells to grow on and in it, and is a natural inhibitor against the growth of fungus and specific bacteria. This natural design at the molecular level has been studied in great detail by scientists. It is an amazing reality that unfolds before our eyes: silk can regenerate cartilage and thus avoids knee replacement based on titanium; silk provides the scaffolding for the regeneration of nerves after trauma, including the potential to make quadriplegics walk again.

While these are only small volumes that we can foresee for medical applications, the big market will be in cosmetics where synthetic emulsifiers have become the standard, causing massive marine pollution with micro-beats that end up in our food chain. Everything from shaving creams for men to emulsifiers in night creams to reduce wrinkles can now substitute the non-degradable plastic beads with silk, and that would – conservatively – require 2 million tons of silk.

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We have to realise that while our addiction to petroleum is causing havoc to the atmosphere and debilitates our ecosystems in its capacity to perform ecosystem services, the reverse is also true. Wherever there is bad news, we can find very good news. In other words, if the medical and cosmetics industry, understanding the documented challenges it is facing today, were to revert to silk as an option, then we will have to embark on the same massive scale of tree planting that the Chinese, Turkish and Italian societies had embarked on throughout history. In those days it was to please the rich and wealthy with the finest clothing. Now it is to design better products with better quality at competitive costs while offering a chance to increase soil fertility and offer a response to the urgent need to have sustainable agriculture with a wealth of nutrition in the soil

Once we understand that renewables are not white elephants and that natural systems are capable of strengthening "the commons" that provide ecosystem services, then we still have a challenging task before us to expand these interconnected insights to the hard realities of this continuous search for more of the same that will never lead anywhere. As Lester Brown, founder of the Worldwatch Institute stated: "the end of the Stone Age was not a lack of stones; the end of the petroleum age may well not be a shortage of petroleum." However, we are stuck with a tremendous institutional-technological lock-in. While silk may create some inroads in niche markets that are quickly making a pervasive impact, the tenacity of the petroleum and gas industry to do more of the same is not only a proof of insensitivity to the reality of climate change, and its damaging effects on life on earth, it is ignoring the hard facts that are known but deliberately covered up and then fiercely contested. Worse, it is forgetting that every coin has two sides, and we have yet to discover both with our heart and soul.

Change the System

We will only succeed in creating a fossil free world if we change our production and consumption system. The case of coffee is one of these obvious examples that surprises many and demonstrates once more how ignorant we are about the opportunities before us or the magnitude of the damage we cause.

Coffee is a globally traded commodity. An estimated 10 million tons of green coffee travels the world. Who is aware that only 10,000 tons are actually ingested, and a staggering 9,990,000 tons is discarded as waste. At best, this left-over from the brewing process is composted, even though we know that between the moment of brewing and the moment of disposal there is a vast generation (once more) of methane gas. We all know that agriculture causes major methane emissions. But what we do not know is that many of these emissions could easily be avoided. The coffee processing industry, from the makers of instant coffee to the chains of coffee shops, have all found their ecological solutions that unfortunately belong to the same category of "substituting high fat with regular fat, while we know we cannot have fat."

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While the incineration of coffee waste, like so many other forms of agricultural residues, is often presented as a fine substitute for fossil fuels, we forget that the generation of methane gas and carbon emissions cannot be overlooked. It is not the mere burning instead of rotting; it is the whole supply chain that requires a fresh approach. So the substitution of fossil fuel with coffee left-overs is doing "less bad". We need to "do more good". And here goes our logic: coffee is treated either by heat or by inert gases to extract the soluble part that offers us either a powder to produce an instant drink or a hot coffee to enjoy. Since the biomass has been pre-treated it is ideal for farming mushrooms. Do we realise that 60% of the cost of mushroom farming is the sterilisation of the substrate and this energy is no longer required if we use processed coffee and use the grounds on site?

The case of coffee is just one of the many examples that demonstrate that with a minor shift in handling and processing we are able to create energy efficiencies that have not been

considered viable. We can farm mushrooms with 60% less energy and no need to transport raw materials. The advantage is that most of these solutions do not require new technologies or complex engineering, or heavy capital investments. These solutions are pragmatic and can be implemented by "you and me". The only way that we will succeed in steering business towards sustainability is by understanding that it is not difficult, it is different.