Clean energy supply as a prerequisite for a sustainable, equitable and globally connected world

How we got here

Throughout the history of the earth, nature has constantly been evolving to maintain a natural balance within its biosphere as more interlocked ecosystem developed, resulting in a well functioning long-term energy supply system.

However, with the start of man-made techno-diversity over two centuries ago, this balance has been broken, and what is now known as a ‘technosphere’ took over. This has been defined as "all human complex social structures with associated infrastructure and technological artefacts that allow the flow of energy, information and materials within the system" by Jan Zalasiewicz and Mark Williams of the University of Leicester.

Over the hundreds of thousands of years of its existence, and in hindsight also used to create this technosphere, mankind has been feeding off the active food cycles of the biosphere. But industrialisation demanded more energy than could easily be gained from the short cycles of the biosphere, and, as a result, we began to use fossil reserves that accumulated geologically over millions of years.
Now, one could also argue that it was the other way around and that it was our ability to access fossil resources that sparked industrialisation, but while this might be true for Europe, coal was in widespread use in China for centuries without setting off any industrial revolution.
Nonetheless, by burning these fossil treasures we have increasingly been destroying the original balance of our planet.

Transformation

Until not long ago too little thought about the impact this may have was given, but, finally, the time has come for us to assume responsibility and to reshape our biased socio-technological system, so that it again balances with the natural biosphere we once inherited and simultaneously works as a new building ground for what is yet to come.
The solution is simpler than it may appear at first: The universe provides us with a gigantic flow of energy. If we can use this energy in an entirely sustainable way, we will be able to power the technosphere without further damaging our ecosystem.

Thereafter, the use of renewable energy requires innovative technologies. When we founded Solon, the world’s first listed solar panel maker, in 1997 in Berlin-Kreuzberg, we consciously added “for solar technology” to the company’s name to underline that - in contrast to the existing fossil-nuclear energy industry - renewable energies require no additional fossil resources to be purchased or consumed. A one-off investment in (solar) technology suffices - and then, thanks to the sun, one has constant and permanent access to renewable energy.

At the time, we used to compare the self-making of good to the purchase of commodities: recurring consumption costs are replaced by a one-time investment and its management, thus securing its – and one’s own - future.

Myths & Obstacles

The topic of energy creation and consumption is so complex that it is unsurprising that discussions about energy are often irrational and heavily loaded with myths, beliefs, emotions - and conducted with great commitment. Unlike most goods, energy is complex, a basic human need and dangerous. But energy also means power. It is inextricably linked to money, authority and influence – as well as the potential loss thereof.
The hidden extend of its power becomes clear when realising that energy markets are by far the largest markets in the world. In 2012, US oil companies alone recorded a profit of over 80 billion dollars. A simple price difference of one dollar per barrel of oil costs Germany about 40 billion dollars a year. Currently, this money is not sensibly invested in our future thereafter, but simply gone. Would you want this to continue in the future?

The complexity of the issue makes it difficult for most to understand the rational and responsible consequences of our currently prevailing use of energy. Few people know the difference between energy and power, or can explain the elementary law of conservation of energy. Similarly, most people find it hard to differentiate between weather and climate. And indeed, it's hard to fathom the importance of the 2-degree climate target if the temperature difference between morning and noon can already be more than 12 degrees.

Access to energy has a long and distinguished history of enticing people to unethical and irresponsible behaviour towards their peers, the nature and the environment. But hope remains: societal change and the technical progress hold the potential to fundamentally alter our approach to that most wondrous drug.

Energy sources over history

To understand how, let us go back to the 16th century, when Europe's incessant warring turned to a new source of energy: The emerging water mills, which produced 10-25 kilowatts and afforded millers, who had acquired the know-how on the use of hydropower, a prominent position in society complete with influence and prosperity. Of course, the energy was linked to a specific geographic location: to use it, you had to go to the mill. Because the energy was not transportable, the conflicts were always carried out locally around the mills themselves. Thousands of people were killed in the fights for these first power plants.

Soon after, intercontinental slave trade became the first globalised forceful exploitation of energy. Slave labour had long been the backbone on which civilisations had flourished, yet ocean-crossing vessels took industrial slavery to a new level. Hundreds of thousands of people were carried to where their labour force was most needed. To justify this inhumane exploitation, the slavers simply denied their slaves were human beings, inventing racial constructs that poison human interaction to this day.

The development of the steam engine, which shifted power from those controlling land and people to those controlling more fleeting capital, enabled superiority for

those using this newly found energy source. It eliminated the need to extract energy from humans held in bondage, even if the plight of those operating the steam power machines was little better. At the same time, the rapidly increasing energy demand for mobile and decentralised applications, for example agricultural machines, created a demand for transportable, liquid fuels.

It was bad luck for whales that their oil made for such a good fuel, putting these great beasts into the focus of the energy industry. Having abolished slavery, whalers based on the eastern seaboard of the United States declared the whale a great dangerous monster to be hunted across the seven seas. Now, is was the whales' time to be denied the right to exist, further leading to the near extinction of these natural wonders, and their tormentors be declared heroes of their time.

Again, it wasn't a sudden affliction with kindness or decency that turned the attention of the energy industry elsewhere, but the colonisation of the western U.S. and the discovery of the first oilfields. These easily accessible, abundant energy sources drove to unknown heights and provided the fundament of America's global power.

With the introduction of the fossil fuels, coal and oil, living creatures no longer needed to fear for survival to feed the human's ever-increasing energy hunger - except, of course, the mine workers who were victims of "misfortunes". From there on, the biochemistry of subterranean sources of energy defined the material state of its countries and the whole world became hostage to its own addiction to energy and its dealer, the global fossil energy industry.
The need for ever more oil, coal, and with it, unprecedented amounts of steel became the defining forces of the 20th century, its history and wars.

A new hope?

Towards the middle of that century coal and oil were joined by a new, superior form of energy generation: Nuclear energy. It first determined World War II and then dominated the discussion about the future of energy supply for the next fifty years.

The promise of almost infinite, cheap energy using nuclear fission fascinated so many intelligent people because it promised a way out of the recurring theme of exploitation of creatures and nature. And it was attractive for the energy industry too: infinite and cheap energy for everyone to use meant incredible profits and protected knowledge for selected few. These factors should still the energy hunger while guaranteeing the energy industry's perpetual dominance.

However, progress allowed new players to join the field. With insights into the limitations of further growth of fossil fuels, and driven by the oil crisis of the early 1970s, renewable energies entered the main stage, previously disregarded as natural antagonists compared to energy generation from nuclear fission, coal, oil and gas. Yet, renewable energies are by their nature decentralised and their development and use does not required large corporations, and hence overcome all weaknesses of fossil fuels.

Chernobyl and Fukushima have, at least in Germany, ended the discussion about the use of nuclear power. And thanks to Germany's famous renewable energy law (EEG), renewable energy has propelled from the antagonist's to the protagonist's role

in most medium-term political objectives.

Our energy debates now revolve around how to best implement the full transition to renewable energies and how fast this can be done, but not about whether it can, or indeed should, be done. The individual positions in this debate are determined by whether the speakers think they are on the winning or losing side of this development and, considering how strongly the transition will impact current power structures and wealth, this is hardly surprising.

To manage the transition without too much collateral damage, it is imperative to appreciate the epochal and survival-critical scale of this transformation. Policy makers need to be careful in planning and implementing the required measures which ought to be based on our value system, the best knowledge of our planet and its systemic feed-back loops.
To secure prosperity for future generations we need to achieve a decarbonised, sustainable economy by 2050. Still, our children will have to deal with the immense legacy costs we are leaving them with, such as the final disposal of nuclear waste to name one.

The supply of energy in this economy must be achieved through a renewable energy economy that, unlike today's energy industry, is geared towards harnessing renewable energy sources to the greatest possible benefit for society, rather than individuals. Such a renewable energy economy requires an efficient, reliable market design that should be politically discussed and adopted as a ‘pact of the generations’.

More than windmills and solar modules

So far, discussion of renewable energies are mostly limited to windmills and solar modules as the visible signs of the new energy future. However, these two groups of generators only form a small part of what a renewable energy economy will include. Clean generation has to be integrated into a nervy network supported by a storage infrastructure, and to be managed by energy trading companies. These companies need to understand flexibility and be forecasting specialists, as to be successful on the market they also must anticipate the needs of their customer groups.

A renewable energy economy is about more than just electricity. The Paris Climate Change Agreement stipulates that net greenhouse gas emissions must be reduced to zero in the second half of the century. To achieve this, we must supply almost everything that is fossil-powered today with renewable energy instead. This applies to cars, trucks, heaters and air conditioning systems. Electric mobility solves one piece of the puzzle, but we will also need synthetic hydrocarbons that power CO2-neutral combustion engines. All this must be implemented and distributed as products and services to become widely available.

All this will become economically viable because we will no longer have to import oil or gas, at least not at nearly the current volume. We must stop enriching others, and by building an on renewable-based energy system, we can pass our wealth to our children and grandchildren instead. Which is why, beyond reducing carbon emissions, a clean future holds much promise for Europe, which remains the world’s largest energy importer today.

Getting there

The basic technology to turn all this into reality does exist, but there is still much to do. Sun and solar have only run through their first industrialisation cycle and cannot - yet - provide all the energy we need. There is a lack of critical integration technologies, storage and intelligent control systems that make power available at whatever time it is needed.

Measured by their potential, both technologies are at an industrial development level comparable to Ford's T model in the car industry. At the time, it would have been unthinkable to travel with a T model from Munich to Hamburg without breaks at 130 km/h average and six litres consumption.

Yet today, some people are ‘judging’ the performance of solar modules and windmills, the generators of the future, in a system that is badly suited for them, yet alone built towards their requirements.
The debate around the “base-load” capability of renewables is one example. Base-load is a misleading term, a spin for the fact that we cannot simply turn off fossil or nuclear power plants - the reason some countries illuminated their highways at night and introduced night storage heaters. In fact, “base-load" is defined as the minimum level of power that “must-run" thermal plants produce that must - somehow - be consumed. In other words: a flexible demand profile has been adapted to the inflexible technical system of large centralised power plants. Currently, any kind of flexibility results in very high inefficiencies; one of the reasons that volatile generators have a high cost. The future renewable energy industry, however, will be characterised by the fact that it is able to deal efficiently with flexibility, both technically and economically.

There is a fundamental difference between the construction of a renewable energy economy and the “business as usual”-scenario. By constructing a new, modern and sustainable infrastructure we are investing into long-term assets. Users will be confronted with an initial costs, which, due to reasonable financing, can be recovered soon. What’s more: they are investment-related costs, whereas the consumptive cost of fossil fuels is simply lost.

Towards a European dimension

To build the infrastructure for a coordinated Europe-wide trade and transport of renewable energies, we should rethink much of what is currently being planned. Done right, this is a unique opportunity not only to use energy efficiently, but to also spread prosperity and security fairly throughout Europe by building a modern renewable energy economy that everyone can be part of.

For the sake of European peace and coexistence, a CO2-free, European and liberalised energy economy is the most desirable and, at this time, the most sensible set of measures we can devise for coming generations. Just as the start of the European idea was linked to sharing coal, steel and nuclear technology, a European energy policy of renewables could lead the EU out of the current deadlock and open a new chapter of European integration.