The Global Grid for Empowering Renewable Energy

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Energy is the lifeblood of our societies. From the beginning of mankind, every time societies could master a form of energy and turn it into something useful, they have managed to make significant progress. For example, four hundred thousand years ago, humans managed to benefit from the controlled use of fire. It was a turning point in human evolution. It allowed humans to cook, to obtain warmth and provided greater protection against animals. Another example, some twelve thousand years ago, agriculture was discovered. It was the key element in the rise of sedentary civilization. But what exactly is agriculture? It is only an organized way for capturing energy from the sun by using photosynthesis. And still another example, the Dutch golden age, have you heard about the Dutch golden age? It is a period of time covering most of the 17th century when Dutch trade, science, military and art became some of the most acclaimed in the world. This stage in Dutch history is recognized as having been made possible thanks to windmill technology that the Dutch had developed. It allowed them to harvest the energy from wind to perform a multitude of functions: to drain land, to saw wood, to grind grain. And the cars, the trucks, the ships, the airplanes, all these things that define so much the way we live, why are they there? Because we have mastered the way to use oil to move people and freight.

Our societies are built on energy, they depend on energy and they are thirsty for affordable energy. So what happens when this energy is no longer affordable? Basically, we go into a recession. Let us take the example of oil. A third of our energy used today comes from oil. At the end of the nineteen seventies, the Iranian revolution sent oil prices skyrocketing. It triggered a recession in the US, which then spread to Europe. And we have a problem. We rely for more than eighty percent of our energy on fossil fuels, and the days of cheap fossil fuels, at least cheap gas and oil, are over. Why? It is not because we are running out of gas or oil. We are not running out of them. However, accessing oil and gas has become more and more expensive. One indicator, called the energy return on investment, can be used to demonstrate this. It is the ratio of the amount of energy acquired from a particular energy resource compared to the amount of energy expended in obtaining that energy. A century ago it took, on average, one barrel of oil to obtain 100 barrels of oil, or an energy return on investment of 100. In the nineteen seventies, American oil and gas production had an energy return on investment that had dropped to 30. Now it is less than 15. So what about shale oil and shale gas, the so called US ñenergy miracleò? They only have an energy return on investment equal to 6. And what happens to a society when sourced energy has a too low energy return on investment? Well, imagine that your body is that society. Imagine also that the oxygen you breathe is energy. When the energy return on investment decreases, it is as if the level of oxygen in the air decreases. So with less oxygen in the air, you would have to breathe harder and harder. Once below a certain threshold, most of the energy you expend is on breathing, and you are subsequently unable to do anything other than breathe. When society invests too much energy into producing energy, the energy sector starts cannibalizing other human activities.

And here comes perhaps a solution: renewable energy. Technology for harvesting renewable energy, and especially wind energy and solar energy, has improved beyond belief over the last twenty years. Today most of the people are convinced that renewable energy is a credible alternative to fossil fuels. But is it really credible? Yes. But only if the energy return on that amount of energy invested in creating the ability to generate renewable energy is high enough.

And we have a problem. The energy return on investment is currently not that high for solar power and wind power. For solar panels placed in suitable locations, it is around ten. For a windmill, in a good location, the energy return on investment is between twenty and thirty. This is not exceptionally high. And even if we can rightly expect these numbers to increase due to technological improvements, there are still other factors that will have a negative effect on the energy return on investment. The first problem encountered is that in many countries you have only a limited numbers of prime locations suitable for harvesting renewable energy, and especially wind energy. For example, in Spain it was already established several years ago that technological improvements cannot compensate anymore for the decrease in wind quality at the locations where on shore wind farms can still be built. Second, there is also a problem of intermittency regarding solar and wind energy. Solving this problem of intermittency will require building energy storage devices. But this requires é energy, and there are also inevitable energy losses too when storing electricity. All this may significantly decrease the energy return on investment of an energy system based on wind or solar energy. So what is my solution to address this problem? Build a global grid, an electrical grid spanning the whole planet and connecting together the majority of the power plants across the world. The key infrastructure element of this global grid would be very long high-voltage transmission lines which would be capable of carrying electricity with little loss.

Why would a global grid empower renewable energy? First, let us tackle this problem of fluctuation of renewable energy sources. This problem would virtually disappear in a global grid environment. Why? Because the larger the area on which you collect solar and wind energy, the less the total amount of energy collected will vary over time. For example, with a global grid, you can easily imagine that at around midday in North America, when the sun is shining, rather than storing its excess of solar energy, the US could start sending it to Europe, where the evening had begun. Similarly, Europe would send its excess of solar energy to the United States to cover their morning surge in demand, or to another part of the planet where it would be night. This global grid would not only provide a natural solution to the problems of fluctuating energy levels, but it would also boost the energy return on investment of solar panels and windmills. How is this so? Because the global grid would also connect places located far from major existing electrical networks where there is ample sun or a lot of wind. This would allow for the harvesting of renewable energy with a fantastic energy return on investment. A solar panel in the Sahara desert produces more than two times more energy than the same panel installed in Brussels or New York. And you have also places like, for example, the Kerguelen Islands. These are a group of islands in the south Indian Ocean, which are roughly the same size as Puerto Rico. There you probably have among the best onshore wind resources on the planet. A windmill built on these islands could have an energy return on investment of perhaps 100, which is the same as you had for oil a century ago! A global grid could connect such places to the rest of the planet.

Of course I know what you are going to tell me. Building such a global grid is technologically unfeasible. It is science fiction. Well, no, the electrical industry has already managed to develop very long overhead lines and undersea cables, and there are now no major technological hurdles in the way. And do not forget that a global grid is just a global network of cables, and we have already managed to build a global network of cables more than one

century ago. It was the telegraph network. You could also tell me that building such a global grid would be too costly and that the gains that it would bring in terms of reduction of storage needs and access to prime locations for harvesting renewable energy would be offset by the cost of building this global grid. No. I estimate that the cost of building this global grid would be less than ten percent of the benefits it would bring.

Europe has pioneered renewable energy, so it could also pioneer the adoption of a global electrical grid. And here is what I want to suggest to the EU government. Develop electrical connections between Europe and Greenland. With these connections you will be able to tap into the immense wind resources that Greenland has. Afterwards, work with Canada and the USA for developing connections between Greenland and North America. These connections would be extremely valuable since they would allow for electricity exchanges between Europe and North America. These exchanges could be used to mitigate problems related to the fluctuations of electricity production and consumption.

In a few centuries, historians will perhaps write about the 6Earth's Big Energy Problemô at the beginning of the 21st century. I am not sure whether they will write that it led to a decline of our societies or whether we managed to overcome the problem. But I am pretty sure about one thing: if our societies decide to build a global electrical grid, historians will write: ñThe building of a global grid at the beginning of the 21st century was one of the key elements in the rise of the prosperous civilization that we know today.