Welcome to The Metalithic Age
- a radical pathway from energy crisis to energy culture

The [Power] Book
by Ludger Hovestadt & Vera Bühlmann, with Sebastian Michael

The [Power] Book speaks to a wide audience and is written in an accessible and engaging tone, without, however, trivialising what is after all a serious and contentious issue. By contrast, this synopsis is kept in a more succinct and direct style that summarises the book’s basic lines of argumentation.

The [Power] Book shares the wide-spread concern about our planet: there is a genuine energy and CO$_2$ problem, and The [Power] Book acknowledges this. At the same time, however, the book takes issue with the way in which our attention is being forced on the limitations that fossil fuels as well as renewable sources of energy impose on us. It therefore asks for a change of perspective.

Today’s technology opens up access to the limitless solar energy stream. This puts the perceived boundaries to growth in a new light: the solar energy stream is capable of delivering an abundance of potentially available energy. The [Power] Book postulates that we are not as yet fully aware of this enormous potential and shows how we can solve, with photovoltaic solar technology that is available right now, not just our energy problem but also our CO$_2$ problem, because this technology has no adverse effect on the planet’s climate.

There is a technological path to a world where CO$_2$ neutral energy is available in abundant quantities, and at the core of it lies the convergence – already underway – of energy and information technology. For a variety of reasons, which The [Power] Book explores, we can expect developments in this direction to accelerate at a breathtaking pace, exceeding by far most predictions to date. This new way of looking at things does however entail a radical change in our understanding of the socio-political aspects of energy provision. Which is why this book puts it into a cultural-historical context. The [Power] Book propagates, for our 21st Century way of life, an end to meaning for some of the most essential achievements of the Neolithic Age, most notably our command of fire and our ability to control mechanical technologies in a linear way. This far-reaching break with our traditional relationship with nature may in fact even mark the beginning of a new age, which we propose to call the Metalithic Age.

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A New Perspective on The Energy Problem

The [Power] Book stems from a deep concern for the predicament of our planet and for the cultural space humankind inhabits on it: yes, there is an energy problem. And yes, there is a CO₂ problem.

But unlike other prominent contributions to the energy debate (such as The Limits to Growth or An Inconvenient Truth) we see these problems as rooted in, a) the particular constellation of their causes, b) the technical solutions currently employed to address them, c) the pervading tone of discussion of these problems in the media, and d) the political strategies that are, as of today, on the table to deal with them. The mutual interplay between these elements and the resulting ‘awareness feedback’ results in a pessimistic perspective becoming the dominant one. So new problems are being approached with exactly the same old mindsets that have led to them in the first place: we are running in circles.

The [Power] Book shifts our focus away from scarce resources and the logistical structures that exist to manage them, and instead directs our attention to the sun: an embodiment of abundance. Taking this as our starting point, we pose afresh questions about what we, as a society, mean by ‘nature’ and ‘culture’. In doing so, we open up a new frame of reference for how we elect to deal with the problems of our day, and it is for this reason precisely that we are able to offer a concrete and technically viable pathway towards a solution.

This pathway proposed by The [Power] Book invites a robust cultural-historical integration of new energy garnering and distribution technologies and therefore explicitly goes beyond a purely technical understanding of the relationship between nature and culture. Nevertheless, new technologies do play a central part of our argumentation, as does the proliferation for the first time of some existing technologies.

Science and The Longing for Order in Nature

Science has always been concerned with establishing reference points within an overriding attempt to systemise the behaviour of nature. Which is why science necessarily presupposes a concept of nature, whichever way this happens to be defined, within which such reference points can exist. This means science sets out a level of ever more densely integrated functionality which we conceive today as a quasi-materialist order of our world. Examples in physics would be absolute zero in temperature, the speed of light or the gravitational boundary; examples in biology might include the concept of a gene as purely a case of arranging matter. This order and its functionality obtains its consistency from the concepts that we have put at its foundation.
Science and the multitude of apparatus and systems made possible by it thus afford us a layer of order, which we have become very successful at employing to the end of utilising nature’s fossil energy stores for our existential requirements. Through them, we position ourselves opposite nature, within a geometrical and algorithmic framework that is comparatively stable and allows us to make nature tangible for ourselves.

But there are now increasingly compelling signs that we have reached the boundaries of how far we can go with this type of deducible order: not just the CO₂ and energy problems, but other issues of global significance, such as water supply crises and famine, point towards this. We are beginning to realise that these very dense and differentiated structures that have established themselves over time are in fact beginning to be in conflict with each other: the world has become too narrow for them!

A New Relationship Between Science and Rationality

The [Power] Book postulates that these boundaries are not primarily of a material kind, even if we feel the consequences of reaching them on a material-existential level, as indeed we do, and in a very real way. But the book seeks to demonstrate that we are indeed capable of overcoming the boundaries themselves, and with them also the consequences of having reached them.

Our desire for a robust order in our material settings requires that we establish a new kind of relationship between science and rationality, a specific order within the system that has as its components technology, concepts and potentials. When looked at from this perspective, the realisation that our world has become too narrow and reached its boundaries only really means that for the time-being our conception of nature is no longer capable of lending our behaviour any dependable kind of consistency.

The Solar Energy Stream and Energy Storage in the Ground

Within the framework of science, nature can be regarded as a system of multi-layered conversion and storage processes for the sun’s energy stream. The order which has until now supported our material relationships naturally stems from the type of relationship we have with the ground – ‘naturally’ because for thousands of years we have learnt to find our resources in the ground or close to the earth’s surface and to technically cultivate them there. This order has been systemised, over a very long time, within our knowledge of geometry and mechanics as well as territorially organised social structures.
But now, since relatively recently, we have the means to tap directly into the solar energy stream. We are now able to emancipate ourselves from material, earth-bound resources, thanks to conversion, storage and distribution technologies geared towards energy that’s garnered directly from the sun. In energy terms, therefore, the part that biological, physical nature plays in our culture is beginning to be taken over by a culturally synthesised energy ‘nature’.

**Nature Loses its Geometrical Consistency**

In science, and in our Western culture generally, geometry, in its Euclidean formulation as an axiomatic method, is considered the guiding principle for connecting intuition and strict formality to the end of creating a pervading and controlling relationship with what we have come to call ‘nature’.

Yet, during the 19th Century, developments in mathematics itself caused a crisis in this foundation of the natural sciences. In its wake, our ‘tried and tested’ concept of nature became problematic. A new branch of mathematics emerged, which threw overboard our long-held views of the relationship between intuition and nature, while at the same time making possible the development of technologies that were of an entirely different kind to the mechanical ones that had hitherto been known: technologies based on electricity.

In the operational sphere of complex numbers, the stabilising reference points provided by a scientific-functional structural layer occur as just one specific actualisation of an enormous potentiality which is embodied in the new symbolic systems of what has now become a so-called ‘deterritorialised analysis’. On a practical level we have long since got used to this potentiality. It supplies our buildings with the epitome of accessible energy: electricity. When looked at this way, our ability now to connect directly to the solar energy stream marks the conclusion, for the time-being, of a development which only towards the end of the 19th Century began to split from the geometrical basis of a technical culture, a culture which at just that point started to produce a structure which is turning into our energy nature, in more than one sense.

**Electricity and a Partnership With Nature**

Electricity, later in combination with information technology, has allowed us to create technical infrastructures of previously unimaginable effectiveness. The electricity grid itself could be regarded as a symbol for the near-ubiquitous availability of energy we have become so used to. Certainly on the level of energy consumption we now accept
this as an everyday fact of life. The [Power] Book argues that in the foreseeable future this same kind of all-pervasive access will also become a reality at the level of energy production. We are on a course of development that leads us directly to a repositioning of culture in relation to nature and to the solar energy stream: human culture will find itself no longer within, as part of (or subordinate to) what we have so far conceived as ‘nature’, accessing the energy stream only indirectly through its ‘natural’ stores, but next to nature, on a par with it. An equal to nature, so to speak, drawing, like nature, directly from the solar energy stream. It is up to us now to invent a genuinely cultural cascade of storage and conversion processes. And they will no longer have to be wrestled from nature. We will no longer unbalance the global equilibrium between natural flows of energy and resources, because energy will ‘flow’ directly through our culture. As Michel Serres puts it: we will learn to negotiate an equilibrium with nature in terms of a partnership. Humankind is entering its ‘adolescent stage’.

With this idea already turning into fact, the positioning and character of the technical systems that we can think of for solving the problems discussed in The [Power] Book naturally also change.

The Potentiality of Electricity

The new characteristic of these systems expresses itself technically in electricity and in technologies that operate with electricity as a ‘substrata’ – namely information technology. With electricity we have in our living rooms, for the first time, energy in the form of pure potentiality. Gone are the candles for lighting and the wood for heating. A symbolic system, dreamt up by ourselves, distributes, through thin cables, electricity, and in doing so it liberates us from the principle of immediate causality in the use of energy.

This symbolic availability of energy, which has been at our disposal for no more than a hundred years, has unleashed a tidal wave of inventions of electrical devices. They translate the symbolic phenomena of electricity into tangible, physical ones: they turn our night into day, they allow us to look inside our bodies, they supply us with meteorological charts and through them in turn lend us an awareness – a ‘proprioception’ – of our planet. Last but most certainly not least, electricity powers the internet, an infrastructure for information sharing and social networking on an unprecedented and never before even imagined scale.

There are, on our planet today, an estimated 500,000,000,000 electrical devices: an incredible, even fantastical development, considering that just over a century ago people had to light actual flames in order to cook and to heat and light, at best passably well, their indoor spaces.
Big Holes

While at the user/consumer end we have got extremely used to the potentiality of electricity, at the producer end it is a different story altogether. Here, we have delegated the responsibility for generating our energy to ‘energy providers’. And they, to this day, use long-established, traditional ways of ‘producing’ energy, along mechanical-geometrical ideas. So, ever more capable systems are being used to deplete nature’s energy stores. Power plants that convert fossil or mineral fuels into energy grow to gigantic proportions. The ‘big holes’ that are being dug into the earth for the purpose of mining resources get their counterparts in enormous big fires, and each are the cause of ever more acutely felt worry. It is dynamos, powered by fires, that generate the electricity which alone makes possible the global availability of energy at consumer level.

The Convergence of Energy and Information Technology

Today, a multitude of technical alternatives to ‘big holes’, ‘big fires’ and dynamos for generating electricity present themselves. The [Power] Book does not position itself favourably or unfavourably in relation to any particular method of energy generation, but instead expects an open market to come into play, in which different systems will compete with each other.

The framework, however, for such a technological and economic competition will shift markedly from the current situation. And using photovoltaics as an example, we are today able to illustrate very clearly a new framework for energy generation. In it, we have a radical new technological system, which is capable of producing energy in the form of electricity and making this electricity available (as an energy potential) to the roughly 500 billion devices globally. Uniquely, it can do so directly from the solar energy stream, bypassing classical nature, and without impacting on the earth’s energy and resources balance, which in turn means without having to detour via the traditional reference systems (geometry, mechanics, territories).

Kilowatts as Kilobytes

Photovoltaics do away with mechanical parts. Therefore, photovoltaic foils can be printed. This makes photovoltaics a system which for the first time takes energy generation onto the same economic path that information technologies have been on for fifty years. Therefore, they follow Moore’s Law in principle, and we can
expect a price reduction per unit capacity of 30% per year, every year, for the foreseeable future. So the energy generators of the future will be printed matter, of infinite flexibility in terms of size and shape, they will be cheaper to produce than any mechanical system, and they will be available in abundance.

**Factor 10,000**

Quite apart from being subject to a dramatic cost erosion, this technological path utilises an inexhaustible source of energy which offers dimensions that could not even be conceived of in the context of traditional perspectives: the solar energy stream expends more than 10,000 times the amount of energy on planet earth than all of us are currently using. Today’s photovoltaics panels and foils, although they are still in their infancy, achieve an efficiency of 10%-20%. A simple calculation shows that even at this level, no more than the equivalent approximately of half the land surface of Spain would suffice to meet our entire global energy requirement.

This technological path converts the energy of relativistic rays into electricity, and can be expressed only in the world of complex numbers and their mathematics. The source of these rays is not location specific, it’s immaterial and inexhaustible: this is not simply another ‘alternative’ source of energy, it categorically eclipses ‘renewable’ energy sources, in qualitative terms.

**Energy Generation as a Consumer Product**

Through the convergence of energy and information technologies by way of photovoltaics, and resulting from its almost limitless scalability, energy generation itself enters an entirely new sphere of potentiality and availability. We will leave behind the obsolete, hierarchical energy generation and distribution systems. In the process, energy generation will become, in the most radical way imaginable, a ‘consumer product’.

We can expect that this will unleash a level of competition for better solutions previously unimaginable in the energy industry. This will elicit fast and dynamic investment which it will no longer be possible to control centrally. We anticipate a development which is comparable to that witnessed in information technology. There, we have already experienced what it means when consumers – in this case of data – also become producers. Encyclopaedias and TV stations become the competitors of Wikipedia and YouTube. Decentralised energy technology will be structured digitally: energy and information technology will converge. With this kind of energy technology, energy consumers can also become energy producers and
traders. The affairs relating to energy generation will no longer be delegated, energy will no longer be ‘received’, it becomes something that can be freely symbolised, traded, negotiated and talked about.

Digitalising the Electricity Grids

In the new system, energy consumption and energy generation will be equally volatile. Our existing, static and hierarchically organised infrastructures will fail because they are incapable of mapping the processes which they are meant to handle in an orderly fashion.

We will therefore obtain an infrastructure such as we are used to from information and communication technology. Here, before you send any data, you test, both in terms of situation and projection, whether sender and receiver of the data are accessible, whether a line for data transmission is available and whether the contractual framework for the transaction is in place. Only once this has been established on a symbolic level does actual data get transmitted, that is executed in actual physics.

So the system for energy provision of the future is on a primary level symbolically projective and not physically reactive. Providers and consumers, storers and conducters will negotiate all activities at a symbolic level. All these dimensions are embedded in political and judicial systems, whereby they will be operated within a competition of technical systems, and also economically evaluated as such.

The arguments put forward by The [Power] Book are not pure theory. With digitalSTROM®, Ludger Hovestadt has developed a concrete, working technology which proves that the idea of a worldwide digital energy infrastructure is technically viable and makes economic sense. digitalSTROM® equips every electrical producer, storer or user with a single-chip computer which connects the device across the existing cables and connects it to a potentially global network, while giving it symbolic representation on the network. The functionality of such a system of devices with regard to energy, comfort, security and data protection are being negotiated in the internet, differentiated on a regional, territorial, political and legal basis, and economically evaluated. So each electrical device no longer simply uses or provides energy, but instead it plays, just by being connected to electricity, a multitude of negotiated roles, simultaneously and in different symbolic systems. The concepts as well as the prerequisite hardware and software components are already known to us from the internet and mobile phone technology.
Free Competition Among Systems

As mentioned before, The [Power] Book does not advocate a particular system or a simple technological solution. Rather, it welcomes an open competition on a new plateau. From this vantage point, we believe there will be two development strands that in all likelihood will be able to establish themselves prominently: on the one hand low temperature thermal solar power for the simple form of energy that is required to meet local thermal requirements, namely the heating and cooling of air and water. (The stores for these local heat exchange systems will most probably come to act as a buffer for the new energy infrastructure which features a high proportion of volatile regenerative energy sources.) On the other hand, there will be a wide spread of photovoltaic installations which will deliver the high-end, networked electricity required for a multitude of uses in our future industries and information societies. This kind of plateau will be able to solve our resources, energy and CO₂ problems almost in passing while at the same time providing an abundance of energy.

When Will it be Ready?

It is not for The [Power] Book to make quantitative forecasts as to acceptance thresholds or market developments. The book focuses on the qualitative characteristics of a possibly near energy future, for which almost all the components, building blocks and modules are at the ready, today. Whether, how, when and to what extent this new energy culture will establish itself may well be more dependent on personal and social engagement than on technical or economic conditions.

If we draw a comparison between the proposed energy model and developments in internet and mobile phone technology, we realise that a change in perspective on how we organise vital aspects of our world can happen very quickly. Therefore, the evolution of a decentralised energy provision is entirely possible. Much will depend on us recognising clearly the nature of our current energy problem, and, most particularly, on us realising that this problem isn’t a technological one. Of equal importance will be a fully understood and properly set legal framework for the technical and economical differentiation.

An Optimistic Energy Future

The [Power] Book has come about as a reaction to the in parts apocalyptic environmental scenarios which have, interestingly enough, failed to make calls for frugality any more attractive to the majority of people, nor have they made them any
more likely to be heeded on a broad scale. And how should they? All of culture, most especially urban culture, has been following a principle of densification, in energy terms as much as any other. If we get fixated on appeals for saving energy, which are based on a concept of energy as exhaustible resources, we are doing nothing more and nothing less than demand that we surrender any notion of urban culture.

Much of our situation today is reminiscent of the problem Londoners faced at the end of the 19th Century, when it was feared that by 1950 at the latest London’s streets would be knee-deep in horse manure. The prognosis was bad. And it stemmed from a structurally conservative extrapolation of retro-applied statistical observations. In other words: it assumed that the future would take shape in line with the technology and mind-set of the past. But it’s impossible to predict the future. It is only possible to create it. Fear is bad for the creative transformation of a perspective, and it’s bad for conducting a search for new perspectives in an open-minded future.

In that sense, our CO₂ problem looks at least somewhat similar to that of the horse manure prophets. There is indeed a problem, but the more time passes, the less this seems due to any genuine factual reasons, rather than a causal loop. Showing timidity within an old reference system and saving resources which are going to run out one way or another is obviously not a sensible strategy for solving problems. What we need is imagination, a change of perspectives and mindsets and resymbolisation.

In the case of London manure, the internal combustion engine came along to solve the problem, at the same time providing people with a hitherto unheard-of level of mobility, while of course bringing about problems of a new kind at the same time, and on a grand new scale. Nevertheless, our chances are good that we will be able to solve the energy and the CO₂ problem by way of a symbolist energy technology, in the process opening up unimagined potentialities on a whole new plane. The sooner we do so, the better, if the climatologists with their pressing and compelling warnings are anything to go by. And we can all do something towards a rapid implementation of a new energy model. All of us, at all levels.

The [Power] Book propagates, for our 21st Century way of living, the end of the fundamental role played by the kind of technology which originated in the Neolithic Revolution. At long last we can leave the Stone Age behind. Welcome to the Metalithic Age!