

Energy and Civilisation

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ABSTRACT: Animals of all species except one derive their energy mainly from one single source - food. Humans are the exception: they derive most of their energy from food and fuel. Their dependence on fuel reflects the peculiar human bond with fire. The paper presents a brief overview of how the human fire regime was formed, and then transformed by agrarianization (the rise of agriculture, which was primarily focused on the production of food) and industrialization (which until now has been highly fuel-intensive). The entire process can be seen as a continuous process of collective learning or civilization, marked in its current phase by increasing differentiation between specialists with great expertise in dealing with fire and fuel, and the majority of laypeople who are lacking in experience and competence.

KEYWORDS: Energy, Fire, Fuel, Civilization

Prologue: A layman's reflections on energy

Energy is an important subject to examine from a sociological perspective. I am honoured to have been invited to deliver the keynote speech for this conference. [\[1\]](#)^[#N1]

Honoured and embarrassed. While preparing this lecture I found myself confronted with the question, what do I know about 'energy'?

I am familiar with the word in a psychological sense. I sometimes say, for example, that I admire a person for his energy, his ability to perform an impressively great array of tasks. I also find the sociologist Randall Collins enlightening when he writes about the emotional energy that can be generated by specific social events.

But then there is the meaning of the word energy as it is used in the natural sciences. And that meaning is to me a mystery. I am given to understand that the rays of the sun that reach the earth contain energy, and that a tiny portion of that energy is transformed by plants into vegetation, in a process called photosynthesis. Animals that feed themselves on plants, or on herbivorous animals, are the secondary (or tertiary) consumers of this solar energy.

How am I to comprehend all this?

Just to diminish my own confusion I decided a few days ago to reflect on a simple action I perform about once a week when I wind up my grandfather's clock, which has a fixed place on one of the walls in my house. That clock is a piece of matter, hanging motionless on a hook. It ceases being motionless the moment I start winding it. Then, the spring is given a tension; and the clock has been ingeniously designed in such a way that the tension is very slowly released at a highly regular pace, so regular that it can drive the mechanism of the hands that show from moment to moment what time it is and thus provide me with a vital piece of information.

This thinking about my clock is an amateurish way of gaining some understanding about how the concept of energy can be related to the two equally general concepts of matter and information to form a comprehensible triad. I, as a living human being, have somatic 'energy'. When winding the clock I transfer a tiny bit of my energy into the clock. The clock starts moving, thus releasing the energy I have put into it. Slowly but inevitably, that energy is being used. Where does it go? In the terminology of thermodynamics, it is 'dissipated': it can no longer be found at any specific location and it can therefore no longer be used for any specific purpose. If I wish to keep the clock going, I shall have to inject another small dose of my own somatic energy into it.

How, from where, do I get my own somatic energy?

Energy

I shall not fill the rest of my talk with reflections about my grandfather's clock, a piece of dead matter, driven by energy, and supplying information. I shall now proceed to sketch, very briefly, the theme of 'Energy and civilisation' on a far larger canvass. I shall reconsider the well-known fact that, in the course of time, humans have learned to exploit more and more sources of energy. This has required new technologies, new forms of social organisation, and new individual skills. In the latter sense, learning to exploit new sources of energy always was also a process of civilisation, involving new forms of personal discipline.

The concept of energy continues to puzzle me. It is defined differently in different natural sciences, and even the measurements vary, from calories to kilowatts to joules.

In this lecture I shall follow the Dutch physicist Frank Niele, who uses the concept of energy as developed in thermodynamics; in simple words, it refers to 'the capacity to do work', 'the capacity to cause change' (Niele 2005:149). According to this definition, energy is not a concrete entity, it is a capacity, a potential. It is intangible, like information. All that is tangible can be regarded as matter.

We humans, like all other animals, are specific combinations of matter, energy, and information. More precisely, we are specific combinations of matter and energy, steered and structured by information. Not just that: we are *made up of* matter, energy and information, we *are* matter, energy and information – M.E.I.

This statement leads us to the question of how, and from which source, we get our energy. The answer is, as is generally known today, that the primary source of energy for humans, as for all animals, is food – food that is found either in plants and seeds, or in other animals, as meat. From food we derive our energy, our strength to live and act and get things done.

At a very early stage, our ancestors (*Homo erectus*) managed to supplement their own muscle power (somatic strength) with extra-somatic objects such as sticks and stones that were used as tools and weapons. I say it in one casual sentence; it is of course a fact of momentous importance.

In the same artless way I can say that in addition to tools, language has been crucially important, first for the survival of humans and then for their increasing dominance over other species. Language enabled humans to communicate and to share information more efficiently.

Tools and weapons provided humans with means for using their own physical strength more effectively. But neither language nor tools and weapons were 'sources of energy', although tools in particular greatly enlarged the impact of human actions. Tools and weapons helped humans to collect more food and to make their lives more secure. By the way, the distinction between 'tools' and 'weapons' is not as clear as the words suggest.

The same objects can serve both purposes; we usually speak of tools when the functions are primarily 'productive', of weapons when the functions were primarily 'destructive'.

For us, the first phase in the development of human society is marked not only by the presence of language and tools and weapons but even more clearly by the *absence* of all later innovations: there were no industrial plants or factories, no cultivated fields, nor even regular control over fire. If we wish to give a name to this early phase, we may call it the phase of 'foraging', a term that brings out the prominent place of food as almost the only source of energy.

Fire

The first major change which our early ancestors brought about in the ecological conditions in which they were living was the domestication of fire. This change marked the transition from a foraging regime to a fire regime.

I shall not speak at length about the original domestication of fire. I have discussed it in my book *Fire and Civilization* (Goudsblom 1992).

By learning to control fire humans gained access to a source of energy that was not used on a regular basis by any other animal. The domestication of fire brought a second source of energy, next to food, within human reach, fuel. This has been one of the crucial events in human history: the discovery that certain things could be identified and used as 'fuel'. I did not mention it in so many words in my book because it seemed so self-evident. I now realise that it was far from self-evident.

Fuel, for our early ancestors, consisted of dead wood, freely available, lying around in every forest. As we now know, it contained a store of solar energy that could be released by exposing it to heat and letting it burn, a way of 'dissipating energy'.

Of course, our early ancestors did not think of fuel in these modern terms; but they did learn to use it for various practical purposes. They incorporated fuel as a source of energy in their societies, they made it part of the anthroposphere. [\[2\] \[#N2\]](#)

From the very beginning, the control over fire served several functions. It provided light, heat (for comfort and cooking), and protection from predators. Cooking in particular served as a 'productive' function, although of course cooking is based on the 'destructive' effects of fire: destroying tough fibres and poisonous substances.

We can now clearly distinguish three phases in the formation of the fire regime as a socio-ecological regime. In phase 1, no human group had fire; in phase 2, some groups did; and in phase 3, all groups did. In addition to being a unique feature of human groups, it eventually became a universal human feature.

Survival units with fire turned out to be more productive and more formidable; but also more destructive and more vulnerable. These statements have fascinating implications. I mention just one: the same series of stages or phases was repeated in the successive formation of the next two major socio-ecological regimes: agrarian and industrial. At first none, then some, and eventually all human groups used the products of agrarian, and subsequently, industrial work.

Agrarianisation

You may think that I have spent a disproportionately long time on the origins of the fire regime. But you have to bear in mind that the fire regime has continued to be the dominant socio-ecological regime for at least 250,000 years, and maybe even far longer, as has been argued recently by Richard Wrangham (2009) and Frances Burton (2009). The next socio-ecological regime, the agrarian regime, has originated and spread all over the globe only during the last 10,000 to 15,000 years; and the industrial regime has risen to dominance during no more than the last 250 years.

For the rise and spread of agrarian regimes I propose to choose the name 'agrarianisation', coined after 'industrialisation'. Human history in the past 10,000 years was the history of agrarianisation. During this phase, new sources of energy were incorporated in human groups. These sources were not dead, like fuel, but alive: they consisted of living material – plants and animals.

Those plants and animals were used mainly for food, and a few other purposes, such as clothing or traction. But by far the greatest yields of agriculture and livestock rearing were the increasing amounts of food thus made available for human consumption. Through their domesticated plants and animals, human communities were empowered with extra sources of energy derived from solar energy.

In some areas where the process of agrarianisation had advanced relatively far, attempts were also made to exploit other, non-living sources of energy such as water (mills, for many purposes) and wind (mills and ships).

The art of sailing the oceans was a very important vector in the changes occurring in what we now regard as the pre-modern era, the transition from the Middle Ages to modern times, or, more accurately, from a predominantly agrarian to a predominantly industrial socio-ecological regime.

Industrialisation

Sailing ships made European expansion possible, through colonisation overseas. But, in shaping the modern world, at least as important as sailing ships were fossil fuels.

As Kenneth Pomeranz (2000) has argued, these two vectors, 'coal and colonies' have been the decisive driving forces in 'the rise of the West' during the last three or four centuries. The importance of coal in particular has been stressed by Rolf Peter Sieferle (2001) in his book on the 'subterranean forest', a magnificent image, not a metaphor, for it evokes something very real: the enormous residue of solar energy from a remote past, contained in a concentrated form in geological formations.

Once people started mining the underground treasures of coal, and later oil and gas, they were no longer dependent only on solar energy stored recently in living plants and animals (as in the foraging regime), nor on energy stored over a slightly longer period in dead wood (as in the original fire regime). By exploiting fossil fuels, humans made use of materials that had no attraction whatsoever to any other animal but which in our times became a most precious (if not *the* most precious) commodity on earth.

The industrial regime is now spread all over the world. Just as for hundreds of thousands of years there have been no human groups living without fire, today there are none living without the products of agriculture and large-scale industry. Even though there is sometimes talk of post-industrial society, the industrial regime is still the dominant regime. It has absorbed both the fire and the agrarian regime.

The economic, financial, political, diplomatic regimes of our times are all enveloped in, and dependent upon, the industrial regime. The history of the past 250 years has been the history of industrialisation, just as the

history of the past 10,000 years has been the history of agrarianisation.

Civilisation

What I have been describing above as briefly as possible may be regarded as a process of civilisation.

I shall not try to define that term. I only wish to stress that I intend not to use it as an evaluative concept. The way I look at it, civilisation is a phenomenon that is neither inherently good nor bad. But, just like energy, it is there, it is real, the process of civilisation is a process that can be observed and studied as a process of collective learning (see Christian 2004). As individuals we all take part in this process, we keep it going, but it is basically a social, a collective process that envelops many generations. It usually proceeds in one direction: from the older generation to the younger; but not exclusively so. Fortunately, sometimes older people are sometimes still able to pick up ideas and skills from younger ones.

In my approach to the process of civilisation I myself follow a scholar from an older generation, Norbert Elias. But I do so with a different emphasis. In his pioneering study of the process of civilisation, Elias (2000 [1939]) focused his attention on changes, innovations: the emergence of new standards of conduct among the secular upper strata in Western Europe over six centuries. He chose this focus for good reasons, since every convention that we pick up from others has once been an innovation. However, especially when we extend the scope of our inquiries over even larger eras and areas, we encounter streams of continuity underlying the changes that Elias recorded in *The Civilizing Process*.

Partly following in Elias's own footsteps, I have extended the scope of my inquiries: to humankind at large, from its earliest beginnings, and including the relationships between humans and other animals. In this way I have returned to the original sociological programme as formulated by Auguste Comte and Herbert Spencer, but also drawing upon new insights from biology, anthropology, archaeology, ecology, and even geology (see Westbrook 1991).

And within this very long-term perspective, while recognising the enormous importance of change and innovations, I am struck by the underlying continuity. The process of civilisation, just like biological evolution, is a process of continuity and change, primarily continuity: to a large extent, it consists of reproduction, repetition, recurrence. All innovations, no matter how radical, have originated from earlier innovations, in a 'great chain of becoming' (there is not just a 'great chain of being'). [3][#N3]

In the course of human history, collective learning has become increasingly more specialised. While billions of people nowadays profit from the industrial regime, only a small minority are actively engaged in sustaining and controlling it and possess the relevant knowledge and skills.

Access to the enormous energy sources available today is limited to social networks with enormous power differentials. This was already so in the era of agrarianisation. Within the western world today, access to energy-driven privileges has become even more unequal. Just think of the differences between an average person in Mozambique and the USA, or between rich and poor within the US.

Those differences are far greater with regard to fuel than to food, and particularly to the products manufactured by using fuel. They lead to such problems as how we can foster a more equal distribution of energy and – no less important – whether it is possible to attain moderation in the demand for energy. The same three aspects of technology, social organisation, and individual discipline come together here, as three 'fronts' that require simultaneous attention. It may be a sociologist's bias, but I am inclined to put social organisation at the centre.

We wish to live lives with optimal emotional energy, pleasurable and meaningful. We have reached a stage where as humans we do not have to fear any large animals any more. We rely on our collective tools and weapons. The bars in our zoos are real and reliable ‘social constructions’.

The fire regime absorbed the foraging regime, and strengthened the position of human groups in the animal world. The agrarian regime, absorbing the fire regime, added enormous supplies of food. The industrial regime, absorbing the agrarian regime, opened the riches of the subterranean forests.

These socio-ecological regimes are collective and anonymous. If you don’t smoke (as I hope you don’t), it may well be that you have not lit a fire for months. In all highly industrialised societies the fire regime has become almost completely incorporated in the world of industrial production. As long as industrial production can proceed properly and peacefully, the many uses of fire take place unobtrusively, causing minimal direct inconvenience to those of us who profit from it while driving our cars or enjoying a comfortable temperature in our homes and offices.

And yet, if you regularly watch the news on television, you will no doubt have seen pictures of fire, almost daily. Fire is still with us, even if in ordinary life it is no longer as visible as it is in situations that capture our attention as ‘news’. The presence of fire is one of the fundamental continuities in the process of human civilisation. Whether we like it or not, humankind has become a species of ‘pyrophites’.

With these brief impressions I have tried to give you an overview of how we have reached the present situation. I have dealt mainly with the past, but with a past that is still extant today. I hope my contribution may serve as a point of reference for your further discussions about the present and the future.

Epilogue: ‘short-term perspectives are necessarily misleading’

I conclude with a quotation from *The Symbol Theory*, the last book written by Norbert Elias before he died at the age of 93. In the final section he wrote, a little tongue in cheek:

‘Life on earth and so the existence of humankind depends on the sun. Cosmologists inform us that the sun is at present at the middle of its foreseeable lifespan, as one might call it metaphorically, and that they expect the sun to continue its role as a life-supporting star for several thousand million years. If humankind does not destroy itself, if it is not destroyed by a meteor or another cosmic collision – which are certainly very real possibilities – the natural conditions of its existence will give humans the opportunity to tackle the problems of their life together on earth, or wherever, for a very long time to come. A future of 4,000 million years should give humans the opportunity to muddle their way out of several blind alleys and to learn how to make their life together more pleasant, more meaningful and worthwhile. In the context of humanity’s future, short-term perspectives are necessarily misleading’ (Elias 2011: 173).

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Biography

Joop Goudsblom, a Dutch sociologist, first read Norbert Elias's book on the process of civilization in German in 1952. He met Elias in person at a conference in 1956. Over the years, he has been actively propagating Elias's work. Most of his own work is in Dutch. His publications in English include *Dutch Society* (1967), *Sociology in the Balance* (1977), *Nihilism and Culture* (1980), *Fire and Civilization* (1992) and (with Bert de Vries) *Mappae Mund: Humans and their Habitats in a Long-term Socio-ecological Perspective* (2002). While in his earliest work the biological theory of evolution is rarely mentioned, over the years it has come increasingly more to the foreground as an integral part of his sociological perspective on human history and human ecology.

Notes

1. Paper read at the international conference 'Social Aspects of the Energetic Issues'. Chieti, Italy, 26-27 May 2011. [\[#N1-ptr1\]](#)
2. On the concept of anthroposphere, see De Vries and Goudsblom 2002. [\[#N2-ptr1\]](#)
3. The historian of ideas Arthur O. Lovejoy traced the origins of the notion of the 'great chain of being' in a famous book (1936). [\[#N3-ptr1\]](#)