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Can We Learn from History?

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The development of energy use in Northern Europe is investigated, with an emphasis on the region that some 13–1400 years ago became Denmark, and by using evidence from archaeological finds, climate science and written documents from more recent periods. The role of energy technology in permitting changes in society and – together with changes in food provision technologies – in allowing sustainable living for an increasing population, is demonstrated, with possible lessons relevant for the present debate on handling the required energy, economy and environmental management transitions. The author's recent book *A History of Energy* (Routledge, Cambridge 2011) is used as a reference.

The popular saying 'history does not repeat itself' does not mean that nothing may be learned from history. As a matter of fact, quite a lot can be learned from history, such as not repeating the mistakes of the past. The Romans said 2000 years ago that it was human to make mistakes once in a while, but that repeating the same mistake was unforgivable.

The newly founded research field of energy history[1] provides several examples of past experiences from which we might learn today. Before discussing a few such case stories, a brief overview of energy history will be given, using the North European country that is presently named Denmark as a proxy. Figures 1 and 2 give the per capita energy use (rate of energy converted) and population size as they have unfolded over the past 125,000 years. It is seen that energy use over long periods of time has been stable or modestly increasing (e.g. during the early period of introducing agriculture and its draft animals), but that the last 100 years have been very unusual, with exponential growth during the period 1950–1970 and again from 2000–2010, plus growth during the first half of the twentieth century that was higher than in the preceding centuries (except for the interruption of the Second World War). Generally speaking, one would expect historical stable energy use to be replaced by growth only as a consequence of some breakthrough in technology or in social organisation. Such a breakthrough happened during the early twentieth century in Denmark, due to industrialisation, and again during the mid-century decades, due to the development of the Scandinavian welfare economy. It is clear from Figure 1, that compensation for the wartime unavailability of imported fuels cannot explain the unprecedented growth. Later, the oil supply crises of 1973/74 and 1979/80

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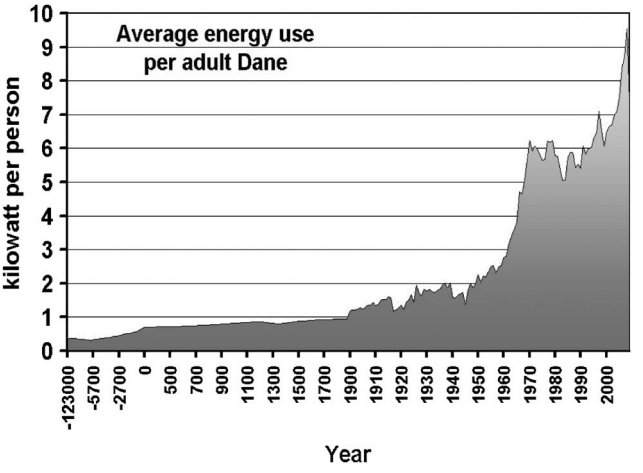


Figure 1. Average per capita Danish primary energy use (conversion per unit of time) over time.[1]

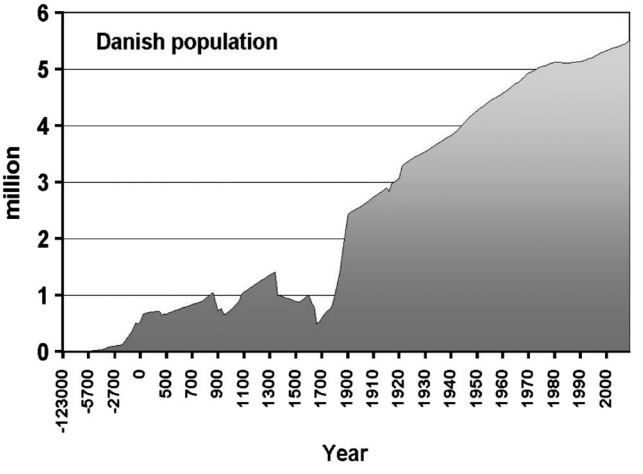


Figure 2. Danish population over time, adjusted to current size of territory.[1]

abruptly stopped the growth in energy use, due to the introduction of, at the time, already known energy efficiency measures neglected during the exceptional growth period. The energy growth after 2000 is entirely due to an increase of a single activity: worldwide international shipping by the company Maersk (which is even more impressive when considering that ships are the most energy-efficient form of transport).

The development in Danish population size, shown in Figure 2, helps understand the development of energy usage. The growth of a population results from birth rates exceeding death rates. Birth rates were high all the time until 1970, but often so were death rates: Figure 2 shows the effect of introducing agriculture some 7000 years ago (allowing a higher population growth), it shows the effect of the emigration of farmers about

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1000 years ago, notably to England and France, in the wake of the Viking raids to these places, and of the bubonic plague 650 years ago, followed by the negative effects of lost wars and social decay under incompetent kings, and finally it shows the positive effects of increased medical insights and the associated decline in death rates over the last 200 years.

A recent example of consumer behaviour after the 1973/74 oil supply crisis illustrates the type of lesson that history may teach us. The price of oil had not changed over the preceding 96 years (when corrected for general inflation),[2] but the cost of energy had become a smaller fraction of the cost of products and services such as space heating or transportation, due to the higher salaries earned during the period of exceptional economic growth. Therefore, energy efficiency measures that were economically viable had not been carried out, as they were considered to save too little to warrant the effort. For this reason, several measures could be implemented during the years following first the doubling and then quadrupling of the oil price, without a noticeable reduction in economic revenue. The cooperative sentiment of individual citizens even caused a number of measures to be implemented, e.g. adding insulation to detached dwellings, that were only marginally economic, with payback times of over twenty years.[3] However, such efforts were not extended to apartment houses, because the tenants did not own their apartments and the owners did not see the payback time as attractive. In addition, in industry, only efficiency measures with a payback time of under 1–2 years were carried out.

Today, fossil fuels are seen as unacceptable for several reasons, including emission of greenhouse gases and other pollutants, as well as the increasing environmental cost of extraction, now that the easily accessible reserves have been used and only some shale-oil, tar sands and deep, mostly off-shore, resources are left. The energy-efficiency investments that appeared marginal 30 years ago have proven highly profitable at current oil prices, and the Danish government presumably regrets that it only prescribed better energy standards for new buildings, because the motivation for people to invest in efficiency beyond what was imposed by law faded after 1990. The average lifetime of buildings in Denmark is over 100 years, so this means that the majority of buildings standing today are gravely substandard in terms of energy needed for space heating. The lesson is thus to make use of occasional scary setbacks to implement long-lasting solutions, because waiting makes the consumer willingness and political support evaporate. The same can be said of the current financial crisis that should have led to a total reorganisation of the banking and financing business, but so far has just caused governments to throw taxpayer's money at that sector of the economy that caused the problem in the first place.

The energy efficiency case from the 1970s is an example of decoupling between energy use and economic activity, where the latter continued to grow and energy use did not. Economic literature and advice from economic think tanks to governments had up to this time announced the coupling between economy and energy use as rigid and indisputable.[4] The energy crisis spurred the creation of a new paradigm and decoupling is currently seen globally and in nearly all energy-using sectors. Passenger cars have on average become 2.5 times more energy efficient between 1973 and 2012, while car prices have declined in real (inflation-corrected) terms. Similar efficiency improvements have been achieved for electricity-consuming appliances, including household as well as

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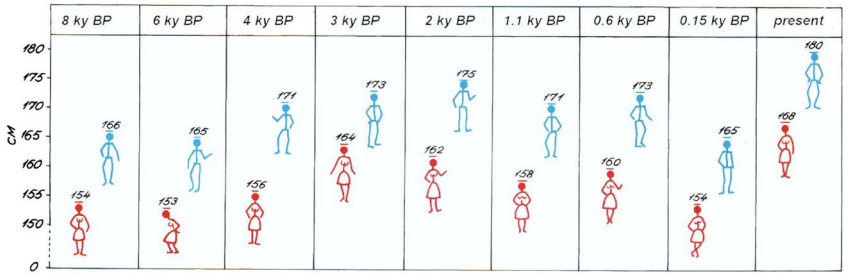


Figure 3. Body height of Danish males and females, from middle Stone Age to the present.[5] The unit ky BP is 1000 years before present.

computer-related equipment. In the latter case, miniaturisation has required a very high energy efficiency because of the heat damage that would otherwise occur in the components. This means that in some sectors, energy efficiency needed only a small push to materialise, but in other sectors, such as the building sector, this is evidently not the case and concerted political action is required.

A second example that reaches much further back in history is the development of well-being or welfare. A proxy for measuring the status of health and fulfilment of genetic disposition is body height. Low height may on average signal insufficient nutrition or lacking food components, related to poor social conditions or to inappropriate lifestyles caused by bad habits or by insufficient knowledge of the underlying mechanisms. Figure 3 shows changes in body height over time, as derived from uncovered Danish skeletons[5].

The decrease in variability of food intake at the time of introducing agriculture is seen to imply a small decrease in body height, but was soon more than compensated for by the addition of milk to the diet, from livestock. After the relative maximum in height, about 2000 years ago, body height again decreases. A possible cause is the stratification of social structure, with the introduction of slavery (presumably the idea came from trade contact with Mediterranean countries). The decrease is halted at the start of the Renaissance, where Danish society opened up to new ideas of social organisation and put an emphasis on science and public debate. Later, the introduction of industrial production methods created a working class with limited means to acquire healthy nutrition, as demonstrated by body height reaching its lowest level in 6000 years. However, the twentieth-century welfare concept and new medical insights on nutrition and lifestyle changed this, now showing average body heights larger than ever before.

Here is a new opportunity to learn from history. The return to eighteenth-century liberal economic ideas that has characterised the yuppie ('young urban professional') generation from the 1990s has led to new increases in social stratification. Solidarity is decreased and the emphasis on the success of each individual increased, which will eventually lead to more social tension and less social stability, a situation known from history that it is not in our interest to resurrect.

A final example is furnished by the many examples of war activities characterising Danish history (as well as that of most other European countries). From Medieval times, Danish kings repeatedly, without being provoked, joined most wars breaking out on the

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European continent and nearly always lost, leading to a progressive shrinking of the Danish territory and, more importantly, to periods of intense suffering by the Danish people –most pronouncedly in those wars where foreign troops entered Denmark and where fighting and occupation hit the entire civil population, such as during the Swedish wars in the seventeenth century and the wars with England and Germany in the nineteenth century. The latter was initiated, not by a king but by the new, democratically elected government. Presently, after a century of keeping out of wars, the Danish government again joins one war after the other (Afghanistan, Iraq, Libya, Mali), without any threats to Denmark proper being involved. Certainly opposing fundamentalist terror is necessary, but military intervention may not be the best way. One problem with the fight against Islamic fundamentalism (and, not long ago, against centralised communism) is that Europe over its history has committed many similar acts of terrorism (crusades, inquisition, colonising), and that religious fundamentalism is not very foreign to, for example, our present North American ally. History should have taught us not to respond militarily unless our country itself is being attacked, and at least not to participate in foreign wars unless a clear United Nations mandate solicits assistance. All warfare marks all those involved, and many soldiers returning from distant wars have shown substantial difficulties to reintegrate into a civil society. History tells us that what has worked in the past is solidarity and respect for basic human rights. No arguments suggest that we throw this evidence away.

Acknowledgement

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