

## **Energy transitions and revolutions**

*to be presented by Marina Fischer-Kowalski, Institute of Social Ecology, Vienna*

The primary focus of this presentation is analytical and historical: What is the temporal relation between the process of energy transition and the occurrence of social revolutions, irrespective of the historical period in which they happen? Do revolutions matter for the speed of the transition, and do they also matter in terms of demographic change and rising incomes? Our presentation builds upon previous research that pursued these questions by comparing the course of the transition from an agrarian biomass-based energy regime to a fossil fuel based energy regime at various times across a number of countries. Some of these countries staged a revolution in the course of this process (such as UK, France, Germany, Austria, Russia, China and others), other countries made a more continuous transition (such as the Netherlands, Australia, Sweden and others). Obviously, the transition to a fossil fuel regime may take place with or without a social revolution.

That there should be some relation is to be expected considering the social and distributional aspect of the rise of fossil fuels. The declining branch, energy from biomass, is connected to the structural position of two collective actors or classes: landed aristocracy and peasants (Goldstone 1980). This holds for all agrarian societies, while the degree of autonomy of the peasants, property relations and the interrelatedness of the landowners with the state powers may vary. If the share of land based energy declines, so does the structural position of both aristocrats and peasants in society. Inversely: The use of fossil fuels benefits two relatively new collective actors: urban capitalists (that may be former landed gentry, or originate from lower strata), and wage labourers. The more use of fossil fuels, the more resources to those new classes (even if very unequally so). This creates structural conditions for a redistribution of power. For a revolution to actually occur, it apparently takes an additional trigger (such as a war, a famine, a particularly unwanted ruler...). However, every social revolution we could identify and embed into a sufficiently long time series of energy use, happens exactly in the early phase of the energy transition, when fossil fuels have no more than a 1-digit share in the country's total primary energy consumption. This observation holds for historical events as different and distant from one another as the UK revolution in 1642 and the Chinese revolution in 1949. We will be able to present a more sophisticated statistical analysis of a further extended set of countries to delineate the critical phase.

We think our analysis and findings have more than historical relevance. On the one hand, there are still countries on our globe that are approaching this critical phase of transition to fossil fuels. On the other hand, we are just facing a next energy transition. The situation the world confronts now, namely another energy transition away from fossil fuels, and possibly a transition into a lower level of societal energy use, is likely to create about as much social turmoil as we have seen during the last energy regime transition. We will make an effort at better understanding the similarities and dissimilarities between these transitions. What we can see so far is that in the highly industrialized countries, the rapid incline of the energy system towards ever more fossil energy has more or less come to a halt in the early 1970s. In view of the heterogeneity of transition processes in the earlier time periods we have documented, such synchronization is a new phenomenon that requires particular methodological attention and maybe a new global rather than country wise approach.

Another benefit of this long term perspective are new insights on the question of how to operationalize, and specify quantitatively, a country's transition to „modernity“. In contrast to the dominant emphasis on technological development (which is chronically difficult to quantify) we quantitatively document the energy transition. This guides an alternative interpretation for the transition to “modernity”, not focussing on technological change, but on the transition from a biomass-based to a fossil-fuels based energy regime instead. For this, we present two specific indicators: the share of fossil fuels among societies' primary energy use, and primary energy use per capita. The parameter “primary energy use”, to make sense for periods before the industrial transformation, needs to be adjusted by including food for humans and feed for animal livestock to

so-called Domestic Energy Consumption (DEC; Haberl 2001). If we use this information, we obtain reliable quantitative indicators on an annual basis informing about each country's stage of transition to "modernity", also well applicable to current development processes, and easy to relate to other processes such as urbanization, demographic change and growth in income. Our findings suggest that globally the first "take off" into the fossil fuel regime happened in the Netherlands and the United Kingdom, and much earlier than usually dated as industrial transformation. The take-off starts in the early 16<sup>th</sup> century, quite at the same time when the humanities locate the start of the modern age, and well over 100 years before Newcomen invents the steam engine.

### **Selected References**

- Cleveland, C.J. Podobnik energy datasets. Retrieved from <http://digitaluniverse.net/energytransitions/view/exercise/51cbf0fa7896bb431f6a3cc8>. Internet . 2011. 16-4-2012.
- Gales, B., Kander, A., Malanima, P., Rubio, M.d.M., 2007. North versus South: Energy transition and energy intensity in Europe over 200 years. *European Review of Economic History*, 11 (02), 219-253.
- Gerding, M.A.W., 2010. Canals and Energy. The relationship between canals and the extraction of peat in the Netherlands 1500-1950. *Peatlands International*, 2/2010, 32-37.
- Goldstone, J.A., 1980. Theories of Revolution: The Third Generation. *World Politics*, 32 (3), 425-453.
- Gruebler, A., 1998. *Technology and Global Change*. Cambridge University Press, Cambridge.
- Haberl, H., 2001. The Energetic Metabolism of Societies, Part I: Accounting Concepts. *Journal of Industrial Ecology*, 5 (1), 11-33.
- Maddison, A., 2008. *Historical Statistics for the World Economy: 1-2006 AD*. <http://www.ggdc.net/maddison/>,
- Mitchell, B.R., 2003. *International Historical Statistics Europe 1750-2000*. Palgrave Mcmillan, New York.
- Podobnik, B. Podobnik energy datasets. Retrieved from Knowledge Network for Energy Transitions. [<http://www.netransitions.net/resources/view/165158/>], edited by Culer Cleveland 2011]. Internet . 2006b. 16-4-2012b.
- Unger, R., 1984. Energy Sources for the Dutch Golden Age: Peat, Wind and Coal. *Research in Economic History*, 9, 221-253.
- Warde, P. 2007. *Energy Consumption in England and Wales, 1560 -2000*. Naples: Consiglio Nazionale delle Ricerche. Istituto di Studi sulle Società del Mediterraneo.

### **Short abstract**

What was the relation between the transition to fossil fuel use and the occurrence of social revolutions? We use long term time series data for the transition from an agrarian biomass-based energy regime to a fossil fuel based „industrial“ energy regime for a number of countries. Some of

these countries staged a revolution, other countries made a more continuous transition. However, we find every social revolution we could identify happened exactly in the very early phase of the energy transition. This observation holds for historical events as different and distant from one another as the UK revolution in 1642 and the Chinese revolution in 1949. We will be able to present a more sophisticated statistical analysis of the critical phase and discuss how far our findings have something to say about the next transition away from fossil fuels.