Energy Intensity under a new perspective: The (de)coupling of economic welfare from energy resources

Dr. Panos KALIMERIS [1]

School of Economics, Business Administration & Legal studies, International Hellenic University, Thessaloniki

Prof. Dr. Kostas BITHAS

Department of Economic and Regional Development, Panteion University of Athens

[1] *Contact details of corresponding author*

Tel: +30 231 837565
Fax: + 2310 474590
e-mail: p.kalimeris@ihu.edu.gr

Address: University Campus, 14 km Thessaloniki-N.Moudania, 57001 Thermi, Thessaloniki, Greece

Abstract

It is broadly accepted that, after the WWII, global GDP has been produced with substantially decreasing energy inputs (Krausmann *et al.*, 2009). This is the so-called decoupling of economic growth from energy resources. Decoupling is empirically estimated through the Energy Intensity (EI), defined as the ratio of energy use to economic growth, namely the amount of energy that is required to produce one unit of GDP. There exist various alternative applications of the E_t/GDP_t prototype that could be briefly summarized in four categories: Total Energy Consumption $(TEC)_t/GDP_t$ (Kauffman, 1992); Total Primary Energy Supply $(TPES)_t/GDP_t$ (Krausmann *et al.*, 2009); Domestic Energy Consumption $(DEC)_t/GDP_t$ (ibid); and Useful Work $_t/GDP_t$ (Ayres and Warr, 2010). Contemporary research is mainly directed towards criticizing the energy measurement techniques, the proper energy aggregation, and the substitution between qualitative different energy resources. Eventually, all these studies are mainly dealing with the appropriateness (or not) of the nominator of the E_t/GDP_t prototype, which represents the *Natural System*, while the relevant literature completely ignores the important implications and constraints raised by the use of GDP, as the predominant denominator, which represents the *Human System*. Our analysis (Bithas and Kalimeris, 2013, 2016) attempts to re-evaluate the energy-economy link in the context of Coupled Human and Natural Systems (CHANS) (Liu et al., 2007), by proposing an alternative framework which estimates the (de)coupling of economic welfare (the output of *Human System*) from energy resources (the input from *Natural System*). An empirical evaluation is performed for various national economies.

References

Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K. H., Haberl, H., & Fischer-Kowalski, M. 2009. "Growth in global materials use, GDP and population during the 20th century". Ecological Economics, 68(10), 2696-2705.

Kaufmann, R. K., 1992. "A biophysical analysis of the energy/real GDP ratio: implications for substitution and technical change". Ecological Economics, 6(1), 35-56.

Bithas, K., Kalimeris, P., 2016, "Revisiting the Energy-Development Link: Evidence from the 20th Century for Knowledge-based and Developing Economies", Number of edition. SpringerBriefInEconomics, Springer UK. DOI: 10.1007/978-3-319-20732-2.

Bithas, K., Kalimeris, P., 2013. "Re-estimating the decoupling effect: Is there an actual transition towards a less energy-intensive economy?" Energy 51, 78-84, *http://dx.doi.org/10.1016/j.energy.2012.11.033*

Ayres, R. U., and Warr, B., 2010. The economic growth engine: how energy and work drive material prosperity. Edward Elgar Publishing.

Session : A2