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Of culture, consumption and cost: A comparative analysis of household energy consumption in Kenya, Germany and Spain

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ABSTRACT

Energy consumption statistics for countries of the Global North and South support the idea that an increasing standard of living and level of technology is coupled with a rise in per capita energy consumption. What might be true on a national level looks different at the household level. In a first step, we compared the household energy consumption of Kenya, Germany and Spain with the result that the energy used per capita in households in Kenya (0.31 toe pc) is estimated to be even higher than in Spain (0.16 toe pc) or Germany (0.23 toe pc), if energy for heating is disregarded. The same is true for the household CO_2 emissions in the three countries. The use of firewood or charcoal as main cooking fuel is the main driver for the overall household consumption in Kenya; our result is therefore transferable to a number of countries where firewood and charcoal consumption is at a comparably high level. In a second step, results from a case study on different and diversified households in the small town Mumias in Western Kenya are presented. They confirm what has been found at the macro level and offer additional insights into daily life practices.

1. Introduction

Per capita energy consumption is a main criterion when comparing energy consumption levels in the Global North and South. Such a comparison reveals that industrialized countries use on average six times more energy per capita than an average Asian or African country (Fig. 1).

Various indicators such as the share of undernourished population, Human Development Index, and Subjective Well Being Index show that roughly 2 toe per capita (pc) per year (toe: tonnes of oil equivalent; 1 toe = 42 GJ) are necessary to satisfy people's basic needs on a global average basis [1]. Hence, most industrialized countries have in principle the chance to reduce their energy consumption to 2 toe pc without loss of welfare, whereas underdeveloped and developing countries inevitably need to increase energy consumption to improve living conditions.

However, the per capita energy consumption does not necessarily correlate with that of the individual households, which are on the other hand the key units for an individual's welfare. The few existing comparative studies about the energy consumption at the household level between countries of the Global South and North don't account for different climate conditions [2], rather display different fuel usage in different countries or do not contribute to the question of how much energy is required to satisfy basic energy needs [3,4]. Moreover, since fundamental differences in energy sources, needs, and availabilities are to be expected, the question of how to compare such data is presently unresolved.

A closer look at International Energy Agency (IEA) data shows that household energy consumption is extremely diverse and to some extent independent of climate conditions (Fig. 1). The values of the annual per capita total primary energy consumption (TPES), total final energy consumption (TFC), and of the total final energy consumption in the residential sector only (TFC, residential) clearly show that household energy consumption in industrialized countries is not the key factor for overall energy consumption; the average share of total final consumption is only 20% compared to Africa and Asia with 56% and 32% respectively. This aspect is often overlooked in discussions about individual energy consumption in the Global North and South.

Per capita household energy consumption differs significantly among countries with a similar economic standard (GDP pc) and level of human development (HDI) or is even lower in higher developed countries than lower developed countries. An example for the latter

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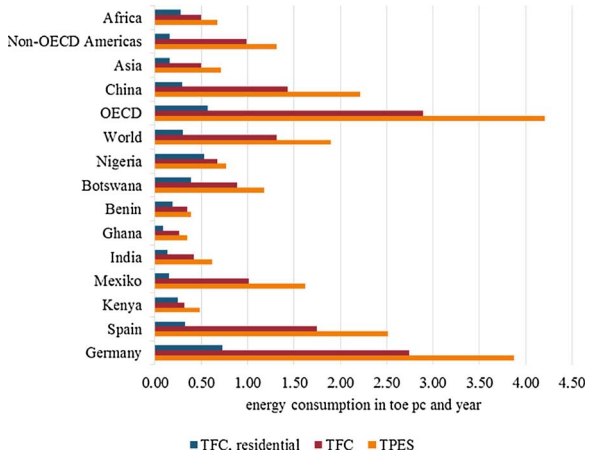

Fig. 1. Per capita primary and final energy consumption in selected countries and regions of the world 2013 [ab].

[a]Data: International Energy Agency [5] and calculated on basis of country statistics available at iea.org for 2013.

[b]TFC, residential: total final consumption in the residential sector; TFC: total final consumption at the national level; TPES: total primary energy supply at the national level.

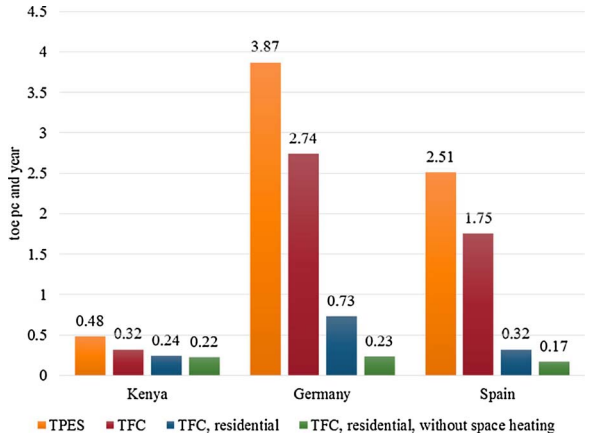

Fig. 2. Primary and final energy consumption (toe per capita and year) in Kenya, Germany and Spain according to data of IEA [abc].

[a]Residential sector is not including private/public transport. Including transport would lead to a significant increase of figures for Germany and Spain!

[b]TPES: total primary energy supply at national level; TFC: total final consumption at national level; TCF, residential: total final consumption in the residential sector only.

[c]Data: TPES: Key World Energy Statistics 2015 [5]; TFC and TFC residential data from country profiles at iea.org; TFC residential without space heating was calculated by the share of domestic energy spent for heating: 47% for Spain in 2010, [8]; 68% for Germany in 2012, [7]; for Kenya the energy spent for heating had to be estimated, as no figures are available. In general space heating is only common in zones of higher altitude (70–90% of households), whereas in zones of lower altitude no space heating is reported [9]. With the exception of Nairobi, no specific heating devices are available in the market. Firewood and charcoal are used for space heating with their respective cooking stoves. Available studies do not differentiate between the use of firewood and charcoal for cooking and heating. A study on Nairobi [10] indicates a 13% higher electricity consumption in the coolest month of the year. Based on these studies and in comparison to the domestic heating shares of Germany and Spain, we assumed a share of 10% for domestic heating in Kenya.

case would be Spain (0.32 toe) and Nigeria (0.53 toe), while Ghana (0.09 toe), Benin (0.19 toe) and Kenya (0.24 toe) would be examples for the first case. The emerging markets Mexico (0.15 toe) and India (0.14 toe) have a significantly lower per capita household energy consumption than the developing African countries (0.28 toe) (see Fig. 1). The figures indicate, that household energy consumption is either decoupled from the economic standard and level of human development − as countries even within a region like Ghana (0.09) and Nigeria (0.53) differ by the factor five − or that data concerning household energy consumption is unreliable in some countries or regions of the wold. The latter explanation is supported by statements of the IEA: data on biomass consumption for a large number of countries are inconsistent and often do not include all categories. Therefore, the numbers only give a broad impression and are not strictly comparable between countries.[1]

In the first part of this paper (Section 2), the energy consumption statistics at the household level in Kenya, Spain and Germany are analysed. Kenya has been chosen, because it is the economic leader of the East African Community and has the highest developed energy market in the region. Germany and Spain were chosen as representatives for industrialized countries with different climate conditions. The background of this direct comparison is the question whether improvements in the standards of living at the household level are necessarily coupled with an increase in per capita energy consumption at the household level. Has the acquisition of a number of electrical appliances an influence on the overall household energy consumption? Hence, does getting out of poverty (achieve sustainable development goals, sustainable energy for all) always mean to consume more energy?

In a second part (Section 3) we will take a closer and ethnographically orientated look at the small town of Mumias in Western Kenya in order to give answers to the following questions: How do values of energy consumption translate into real life situations? Do current statistics provide useful data to estimate people's energy consumption and needs?

2. Data on energy consumption in Kenya, Spain and Germany

Fig. 2 displays key data of individual consumption of primary and final energy (total, only residential, and residential without space heating) for Kenya, Germany and Spain.

Germany has the highest annual primary energy need with about 3.9 toe pc followed by Spain with 2.5 toe pc and Kenya with only 0.5 toe pc. Unsurprisingly the same is true when looking at the TFC in the three countries.

The comparison of residential energy consumption gives a different picture: Germany still shows a three times higher per capita consumption than Kenya, but the consumption of Spain is only 30% higher. Climate conditions in the three countries are different. The colder climate in Germany forces households to spend 68% of their energy on space heating [7] Spanish households still use 47% for space heating [8]. The share of household energy used for space heating in Kenya is difficult to estimate. In most regions of the country it will be close to zero, but not in the zones of higher altitude [9]. Thus we regard space heating not so much as a factor in the standard of living, but as something directly linked to climate conditions.[2] In consequence we disregarded the fraction of energy used for space heating in our study, because we wanted to know if a higher standard of living at the household level,[3] expressed by the ownership of a large number of electrical appliances in Spain and Germany, necessarily translates into a higher per capita household energy consumption. Discounting space

[1] IEA states: "Biofuels & waste is comprised of solid biofuels, liquid biofuels, biogases, industrial waste and municipal waste. […]. Data under this heading are often based on small sample surveys or other incomplete information. Thus the data give only a broad impression of developments, and are not strictly comparable between countries. In some cases complete categories of vegetal fuel are omitted through lack of information. […]."[6]

[2] We are aware that this cannot be assumed for a comparison between any countries. Space heating is part of the standard of living in other countries, where people are not able to heat their houses sufficiently and therefore suffer from health issues. This is described in the discourse about fuel poverty, which we do not want to get engaged here.

[3] Standard of living comprises factors within the household (e.g. type of building) and beyond the household level (e.g. employment, equality, healthcare, education). We only deal with standard of living at the household level in terms of energy consumption, which we reduce to the availability of household technology (e.g. for cooking, hot water preparation, entertainment) and the number and type of energy consuming devices in a household.