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ENERGY CONSUMPTION AND ITS DETERMINANTS FROM 1900 TO 2100 IN THE DEVELOPED AND DEVELOPING COUNTRIES

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1. Overview

We carry out an analysis of the energy consumption from 1900 to 2100. We take into consideration the World as a whole, as well as the developed and developing countries. On one hand, we perform a retrospective analysis in order to highlight the historical trends; on the other hand, we consider some hypotheses in order to show future trends. The relationships between energy consumption and its main determinants – notably population, revenue and energy intensity – represent an important part of our analysis. In fact, the key questions are economic growth per capita and energy intensity's evolution in the long-term. Our goal is to show the energy challenge and its relationships to the socio-economic development and environmental changes.

2. Method

We highlight the long-term trends through the application of different types of functions. In particular, we test linear, exponential and logistic functions. The difficulty is that they should fit the available historical data and also correspond to the accepted hypotheses for future evolutions.

The data are provided by different historical sources. The sometimes quite controversial hypotheses concerning the long-term future trends are discussed in the light of economic theory, notably the theory of economic growth. The International Energy Agency and other international organizations' hypotheses are integrated in our analysis.

Another difficulty lies in the determination of the dynamic nexus between energy consumption, revenue per capita and energy intensity. In order to conclude on socio-economic development, one should also consider the relationship between energy consumption, revenue per capita and the human development index (published by the United Nations Development Program). We provide some statistical relationships taking into consideration the recent literature on this issue.

3. Results

The most interesting result is represented by the application of a logistic function over the period taken into consideration. Although historical trends are in general better represented by exponential functions, the "S-curve" allows discussing the main questions related to "sustainability". In particular, we point out the hypotheses that one should accept to assume the stabilization of the energy consumption. They concern population, revenue, energy intensity (which in turn depends on technological progress and economic structures' changes), as well as the so-called "life-styles". The results are noteworthy when the analysis of the developed and developing countries' trends are carried out separately and then combine together. Not surprisingly, the most complex problems arise during the "transition period".

4. Conclusion

Our article combines an historical and a prospective analysis that takes into consideration a period of 200 years. It highlights the socio-economic and environmental challenges related to the energy consumption growth in the developed and developing countries. Furthermore, it provides benchmarks to a discussion over the long-term trends, which remains quite controversial and conjectural.