# THERMODINAMIC LIMITS OF SUSTAINABLE DEVELOPMENT
## „The Reign of Quantity and the Signs of Times" (R. Guénon)



FRAGILE!

**WESSLING Hungary Ltd. 1047 Budapest, Fóti út 56.**

Tamás János **Szigeti**

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Jeremiah  Guénon  Hamvas  Spengler

Crisis in the world (ethical, later physical)

**Is there relation between the crises and the sustainable development?**

**Susan George: Lugano report → YES!**

In the Middle Ages the principles of „**resource management**" was at least well known as it is today amongst villages. Their lands was used with restraint. However, this is rarely achieved in the public domain, in the case of common using of the fields of the villages.

If a family from a village from own livestock had grazed one more animal on the common pasture, the advantage of this illegitimate act remained at the family. While the **disadvantage of over grazing** was shared with the entire village…
To avoid the disadvantages, the neighbours had to send more and more animals into the common fields…So the pasture destroyed as soon as it possible. Recently the common pasture are disappeared. But the tragedy remained with us. → **Remember Guénon and the ecological footstep!**

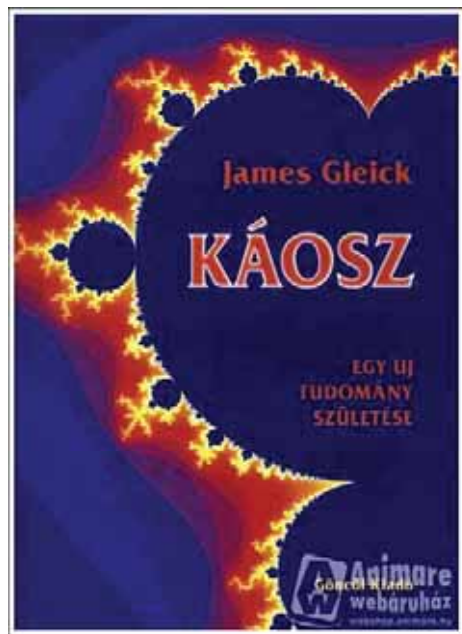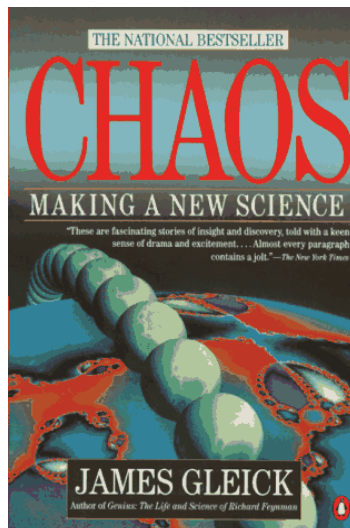*Alvin* **Toffler:** *The Third Wave (1980) Bantam Books
(The industrial Age = Second Wave Society, the Information Age = Third Wave Society)*

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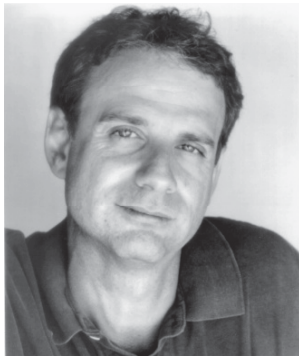
„… nowadays no one doubts the possibility a general recession of the world…Perhaps we have week hope to correct the contemporary… mental health under **current chaos**…"

(René **Guénon**, The Crisis of Modern World, 1927)

Hungarian edition: James **Gleick**: Káosz, Göncöl kiadó Bp. 1999. p.13.

The **sustainable development** is a certain kind of increasing economical and technical line, which satisfies in the best way the current demands, without to harm the chances of the next generations**. Is it reliable? Entropy?**

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In the **Carnot-cycle** assuming reversible processes, the quotient of infinitesimal heat exchange and the absolute temperature of the process, is zero:
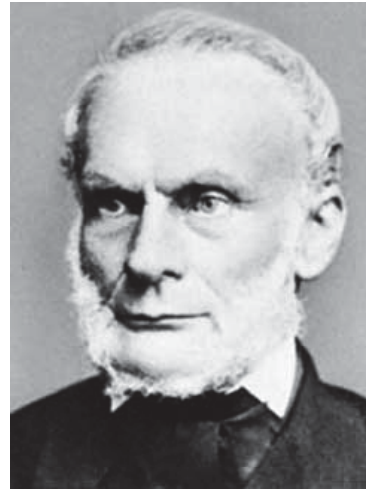
$$\oint \frac{dQ}{T} = 0$$

The name of circle integral function mentioned above – based on advice of Claude **Claussius** – is the **ENTROPY**, and to be indicated with block letter „**S**". Without more deduction, the entropy alteration of the isotherm reversible processes the next:

$$\Delta S = \frac{\Delta Q}{T} \geq 0$$

Nicolas Léonard Sadi **Carnot**
(1753-1823)

Rudolf Julius Emanuel **Clausius**
(1822 – 1888)

Alteration of entropy: ΔS > O
The spontaneous processes lead to an increase in entropy.
The spontaneous processes involve an increase in disorder.

# The two main law of thermodynamics

**1st: The law of energy conservation**
**2nd: The law of entropy increase**

**The laws apply to isolated systems**

**The question:**

**How the earth opened, or what extent a closed system?**

## The 1st law (energy conservation law):

Any production-increase has two effects:
- It demands energy and raw material from the environment
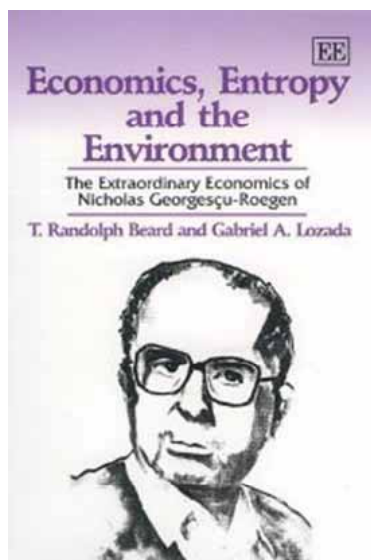- Increases the loading of the waste-assimilating capability of environment

**Therefore the first law means a quantitative limit of the development**

## The 2nd law (entropy increasing law):

The second law defines the flow direction of the energy. Measures the usefulness of the energy, it's the negative value of the usefulness. The degradation of environment can be characterized with the entropy.

**Therefore the second law means a qualitative limit of the development**

after Katalin Martinás

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Economics, Entropy and the Environment
The Extraordinary Economics of Nicholas Georgescu-Roegen
T. Randolph Beard and Gabriel A. Lozada



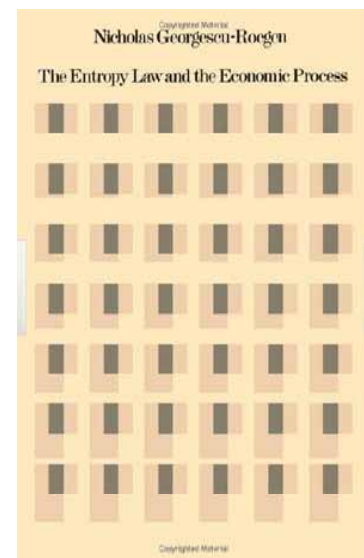Nicholas Georgescu-Roegen
The Entropy Law and the Economic Process

**The Second Law of thermodynamics** is valid amongst the economical and environmental phenomena too!

It means:

The economical processes also can increase of the disorder of a system, using other word:
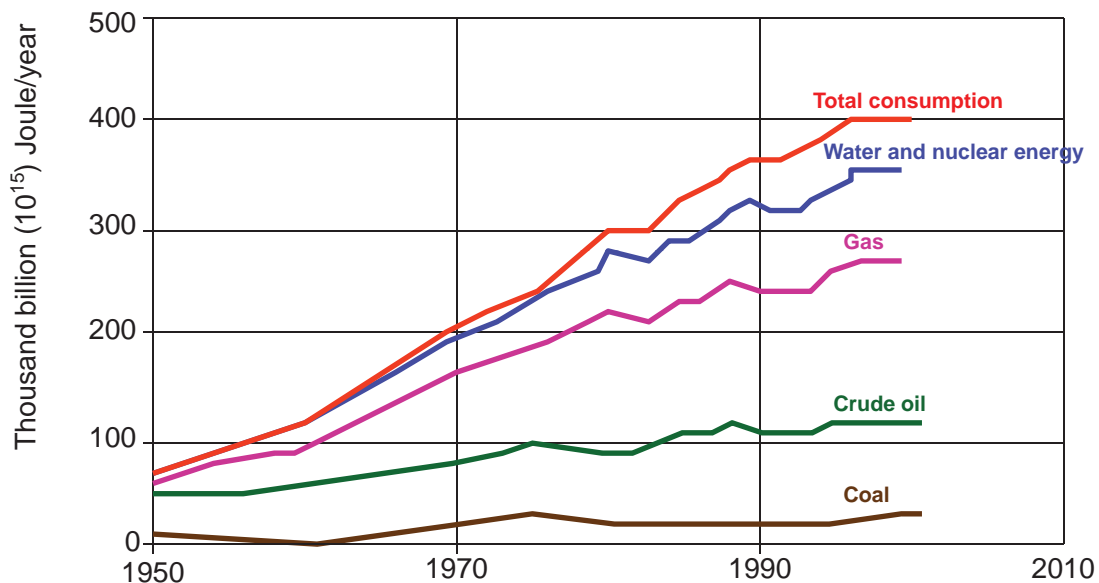
**INCREASE THE ENTROPY**

**Dennis L. Meadows** (born June 7, 1942) is an American scientist and Emeritus Professor of Systems Management, and former director of the Institute for Policy and Social Science Research at the University of New Hampshire. He is President of the Laboratory for Interactive Learning and widely known as the co-author of Limits to Growth.
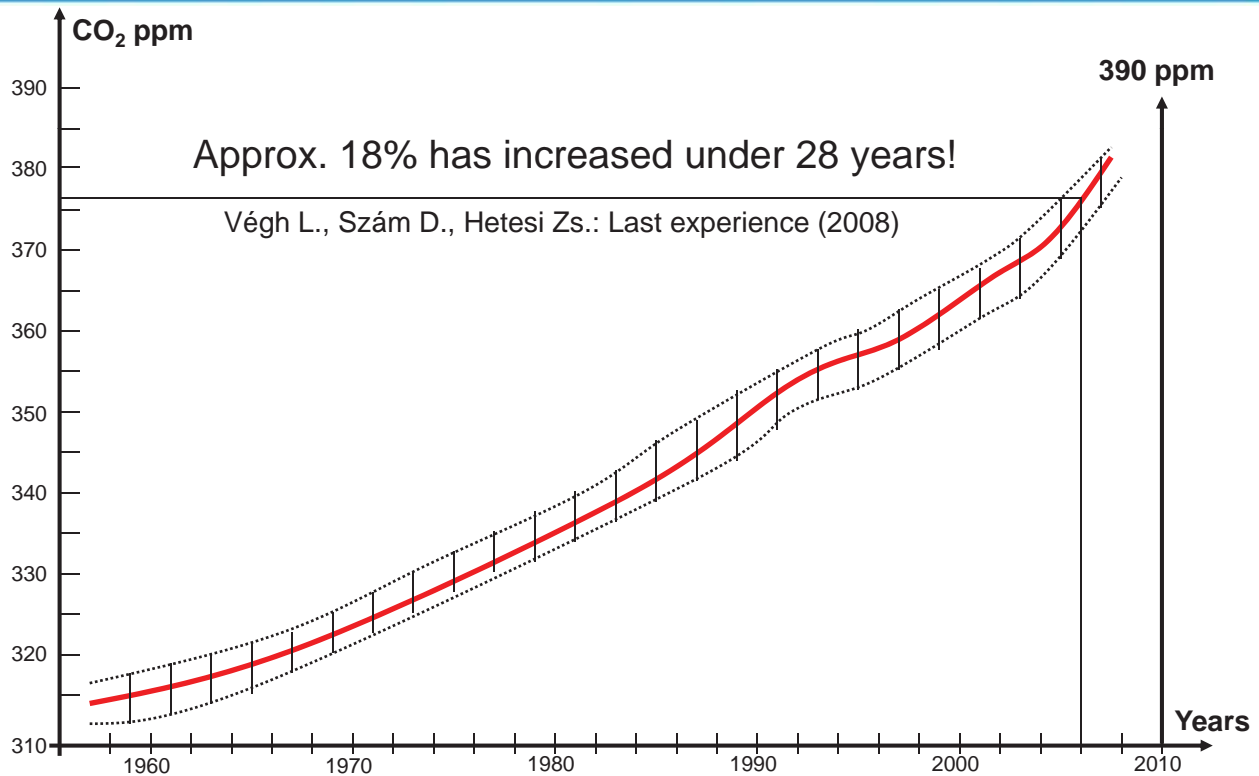
The Limits to Growth is a 1972 book modeling the consequences of a rapidly growing world population and finite resource supplies, commissioned by the **Club of Rome**. Meadows coauthored the book with Donella H. Meadows, Jørgen Randers, and William W. Behrens III.

The book used the World3 model to simulate the consequence of interactions between the Earth's and human systems.
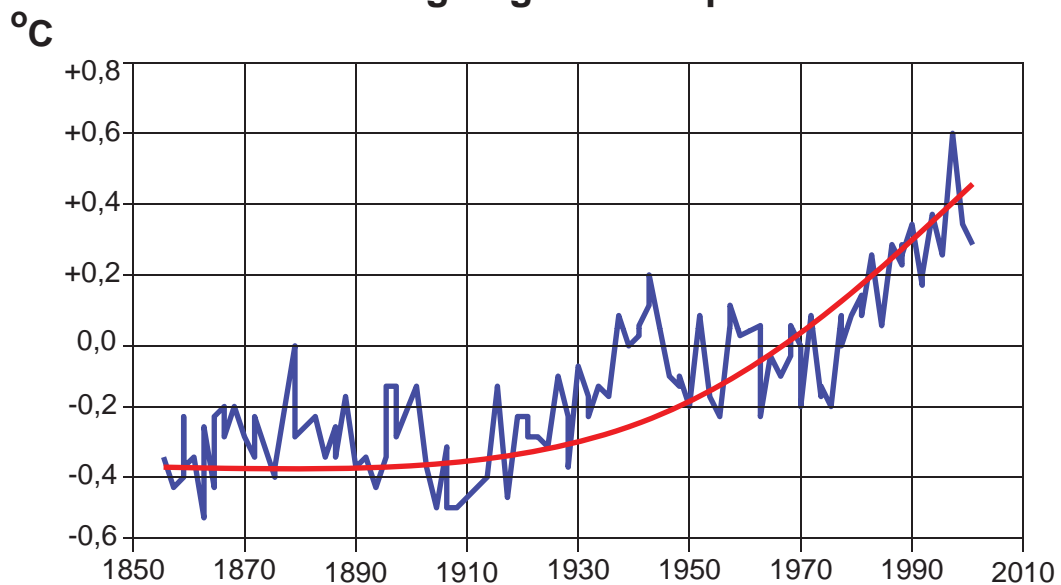
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## The energy consumption of the world



(Meadows et al.: Limits to growth

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Quality of life

**Increase the CO$_2$ level in the atmosphere 1958-2006**

CO$_2$ ppm

**390 ppm**

Approx. 18% has increased under 28 years!

Végh L., Szám D., Hetesi Zs.: Last experience (2008)

**Years**

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WESSLING
Quality of life

**Temperature**

**Increasing of global temperature**

$^o$C

The global average temperature is increased approx. 0,6 % during the last century (Meadows et al.: Limits of growth)

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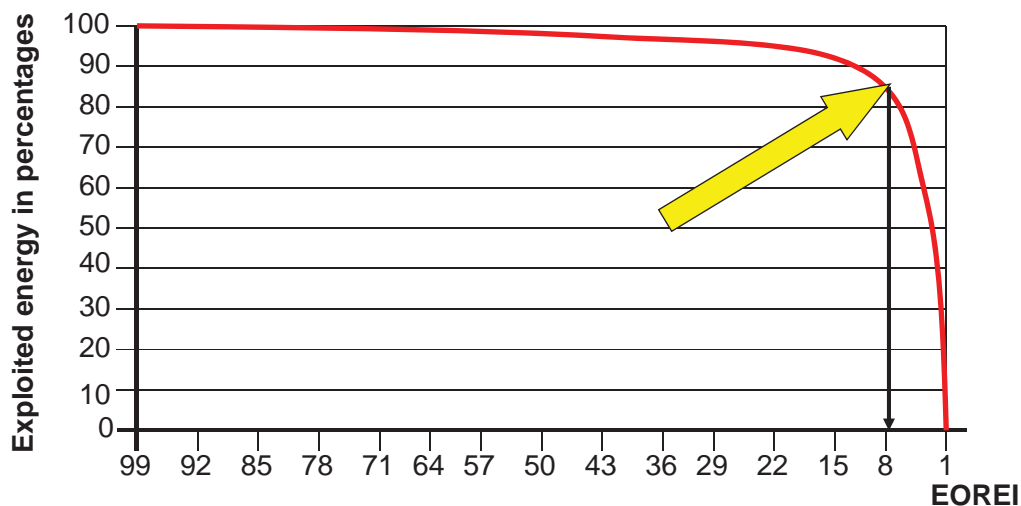
At the 1:8 EROEI (**E**nergy **R**etrieved **O**f **E**nergy **I**nvested) ratio there is a harm, while the exploitation of the crude oil my be lost its profitable. This situation is expectable within a few years, when may arise a significant crude oil deficit.

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## Entropy decreasing and increasing courses in the soil-plant system



### Decreases the entropy: photosynthesis
- Biological base process
- So kind of „collecting" phenomena forming a more organised molecule i.e. carbon hydrates from carbon dioxide and water
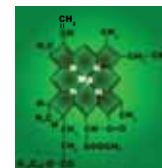
### Increases the entropy: respiration
- Contrary to the photosynthesis
- Scattering phenomena
- Forming again carbon dioxide and water from carbon hydrates
- It is fed by heat energy

An American political scientist. His main work the **„Clash of Civilizations"** (1993, 1996) thesis of a post-Cold War new world order.

**His main theses:**
- Civilisations are mortal
- Global civilisation non expectable
- The modernisation don't release western like life forms

**The conditions for the survival of West:**
- To be removed the old official systems
- To be stopped to consider the West to universal
- Should place emphasis on preserving the uniqueness of the West
- West should exercise restraint
- Conflict resolution through mediation, common (in other civilizations)

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**Impact of Population Growth**
Paul R. Ehrlich; John P. Holdren
*Science*, New Series, Vol. 171, No. 3977. (Mar. 26, 1971), pp. 1212-1217.
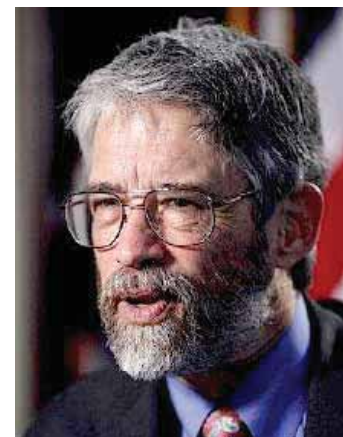


In an agricultural and technological society, each human individual has a negative impact on his environment. The total negative impact of society on the environment, can be expressed with a single terms by relation:
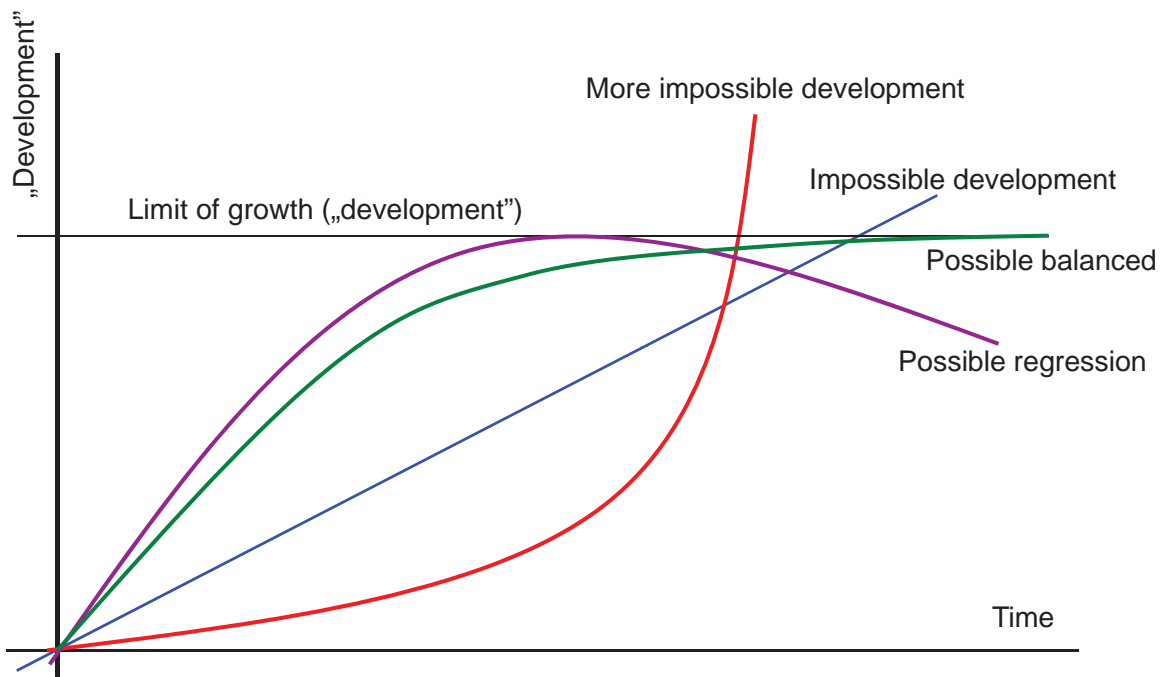
$$I = F * P$$

Where **P** is a population, **F** is a function which measures per capita impact.

## A contemporary Arab proverb: Contemporary "Carnot cycle"?

„My grandfather has been driven **a camel**, my father had a **motorcycle**,  I've got a **land cruiser engine**, my son's **helicopter** flies around here and there, but for my grandchildren is waiting a **camel again** "
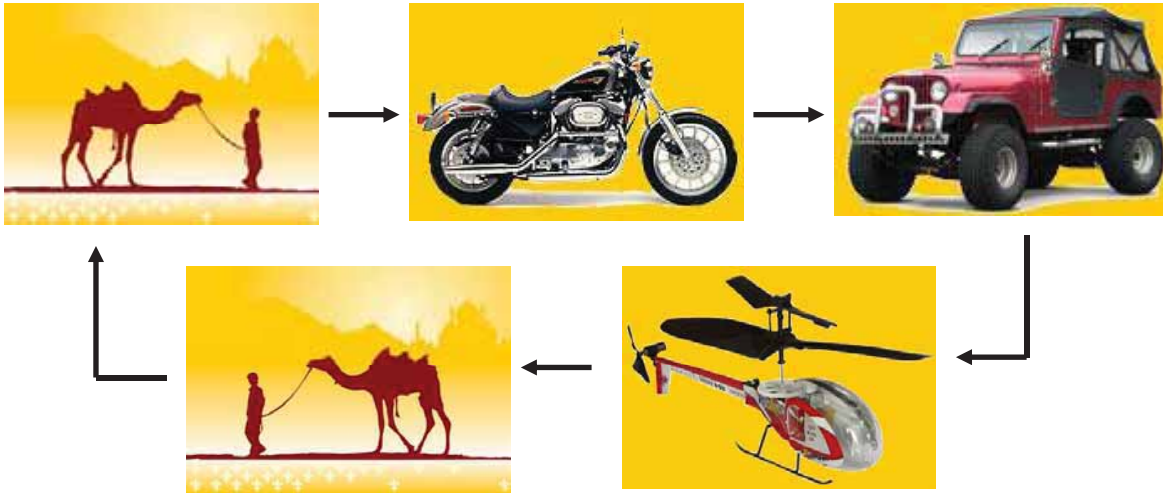
The „sustainable" development in physical system is impossible!

Αντηροποσζ = forward looking (Greek)