

Eco-Efficiency Conference , Egmond aan Zee

The laws of energy efficiency

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INTRODUCTION

- The demand for energy is an issue that has not been well studied. Either people will get the hang of it through awareness or through their pockets...or through the law.

Where is Science and scientists researching in energy efficiency?

- Suppose that every human being had a limit of the amount of air he or she can consume in a lifetime. What wouldn't we do to learn to breathe well? Surely, on doing so, we would all live longer and eat less and we would all follow a philosophy of life based on frugality. And we would plant more trees to give us a longer life!

ABOUT PHYSICAL AND HUMAN LAWS

- **There are two types of law: physical and human.**

The physical ones are unalterable.

**No majority in a democratic vote at world level could change the law of gravity.
Only our comprehension of them changes, but they do not.**

However, the human ones are more flexible.

They can change and usually do so following events. Customs adapt and respond to the system of values of the society that creates them.

ABOUT PHYSICAL AND HUMAN LAWS

1 MOTTO AND 12 LAWS

MOTTO

Energy efficiency is an inexhaustible source of energy and imagination. Once discovered, it is forever

1ST. LAW (The law of ENTROPY)

Energy is not lost, but degraded

All natural processes are spontaneous and their energy quality is lost without producing useful effects.

Corollary 1: Losses of quality must be monitored, maintaining the necessary specifications for the product.

The additional excess is more and more costly.

Corollary 2: Maintaining quality is synonymous with efficiency.

Corollary 3: Segregate the polluting flows; do not mix them.

Mixing is the most inefficient operation

2ND. LAW (The law of INTELLIGENT CONTROL)

Intelligent control means maintaining the quality required with the total irreversibility as low as possible

Corollary 1: Control systems should not just be reactive (feedback) but also proactive (feedforward, anticipation and prediction).

Predict the accident, before braking.

Corollary 2: The control systems cannot be isolated and disconnected, competing against each other to achieve their partial objectives, but need to be integrated in a co-coordinated and hierarchical way to meet the global objectives.

Two drivers cannot drive one car at the same time.

3rd. LAW (The law of Zidane)

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4th. LAW (The R Law)

The more advanced a product is in its productive process, the higher its cost and the more energy is unused with its loss

Corollary 1: Never let a product degrade.

Recover, reuse, recycle, recognize.

Corollary 2: Design first for reuse; then recycle.

Ecodesign

5th. LAW (The Law of supply and demand)

Couple through time the supply and demand for energy

Storing energy is inefficient, expensive, slow and technologically complex.

Corollary 1: The Armstrong corollary . Make intensive research in energy storage.

Any small step in energy storage will be a giant leap for mankind

Corollary 2: The Pinch corollary. A plant may have cold flows to be heated up, and heated flows to be cooled down. Couple them according to its temperature and amount of energy to interchange.

Amplify your vision. Design with Pinch analysis and system s integration.

6th. LAW (The Aristotle's law)

Any system is part a greater one

Corollary 1: The industry and urban system must be a part of the natural system.

The connections must be multiple and ongoing, not discrete and aggressive.

Corollary 2: If a system is not integrated, integrate it and make it multifunctional; there will be great opportunities for energy savings. Practice Industrial Ecology.

7th. LAW (Nature does not produce waste)

All waste is a defeat in the connection and design of the system. Resources are converted into products and waste, which in turn must be a resource for new products and waste until the cycle is completed.

Corollary 1: Design products considering their life cycle.

Corollary 2: Embrace biomimesis in product design:

Zero waste and renewable energy.

8th. LAW (The Notary's Law)

In the construction of a house, the biggest consumption of energy takes place in the building materials which costs the least per unit of energy consumed. At the end of the process , signing the deeds is what costs the most money per unit of energy effort

Corollary 1: Energy is cheap because we value products of ingenuity more than what nature gives us, and does not demand payment.

Corollary 2: To save resources, the Notary curve must be flattened.

We must pay more for what naturally costs more.

9th LAW (The law of the Eleph-ant)

• Efficiency or Robustness? Both



10th. LAW (Efficacy vs Efficiency)

Efficiency is hard to match with the efficacy. Efficacy is achieving something regardless of cost; efficiency is doing so with as few resources as possible

Corollary 1: Doing things well takes time. Nature has its pace, changing it is difficult.

The size of a heat exchanger is given by the speed with which heat is transferred

A forest grows at its natural pace

**Nine women do not make
a child in one month!**

11th. LAW (The law of dematerialisation)

Less material, less water, less energy and a longer lifetime make a better product

Corollary 1: Services' economy.

In the majority of material products, only the service provided is of interest. So services need to be dematerialized. The objective is to make the manufacturers responsible for them until the end. They shall be responsible for recycling and keeping them in good condition.

Corollary 2: Minimise. reduce space and look up scales. A smaller volume means less packaging, less transport costs, less storage and less waste. Small is beautiful.

Corollary 3: Simplify.

12th. LAW (The law of replacement)

Nature is the most precious thing we have. It belongs to all of us that are living and that will live. Nothing should be taken from it without being replaced.

Corollary 1: The greater the cost of replacement, the more that a resource should be preserved.

Corollary 2: Biological products are replaced by the sun, geological ones by the internal heat of the Earth. Take even better care of the latter. **The shortage of minerals will be definitive.** In addition they need a lot of water, energy, other materials, environmental damage and in many cases corruption to extract them. Their real cost is immensely greater than their price.

Corollary 3: If you respect nature, it will work for you.

REFLECTIONS

And these laws are based on Thermodynamics, Economics and the logic for Sustainability of resources, which constitutes Thermoeconomics. The human laws will always be subsidiary to these.

ABOUT ECOEFFICIENCY GOVERNMENT

- Regulation and governing is as necessary as legislation

you must not only think about the general, technological and ethical criteria, but also about
Action Plans.

CONCEPTUALISING

That is, it is important to know how to direct action in an orderly manner to turn ideas into demonstrable facts. In this case it would be those of less energy consumption encouraging, at the same time, technological development with more respect towards the natural environment.

ABOUT ECOEFFICIENCY GOVERNMENT

- Therefore, the four categories for good governance in energy efficiency - the four Pros- are:

- 1) PROCESSES**
- 2) PRODUCTS**
- 3) PROCEDURES**
- 4) PROMOTION AND DISSEMINATION**

REFLECTIONS

**People count. And do counting.
We are part of nature.**

**And none of the ten thousand million people that
there will be within several generations will be
us.**

**They will also have the right to use the energy
that we have not wasted.**

REFLECTIONS

Therefore, through CIRCE we are promoting a global initiative on energy efficiency called:

The Krakow Declaration for an EU Initiative for Energy Efficiency in the Process Industries.

<http://www.uii-co2.es/krakow/>.



Let it be done!

Thank you for your attention!

Antonio Valero