

ENERGY CONSIDERATIONS
IN
ENGINEERING DESIGN

THE ETHIC AND THE REALITY

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Engineering Professionalism:

Engineering professionalism is characterized by conformance to the technical and ethical standards related to practice of engineering.

Ethics:

"...A set of moral principles or values..."

Moral principles are those guiding principles that are necessary for mankind to exist in a harmonious society.

“A critical fact in the world of 1801 was that nothing moved faster than the speed of a horse. No human being, no manufactured item, no bushel of wheat, no side of beef, no letter, no information, no idea, order or instruction of any kind moved faster. Nothing ever had moved any faster, and, as far as Jefferson’s contemporaries were able to tell nothing ever would.”

“The fact is that Civilization requires slaves. The Greeks were quite right there. Unless there are slaves to do the ugly, horrible, uninteresting work, culture and contemplation become almost impossible. Human slavery is wrong, insecure and demoralizing. On mechanical slavery, on the slavery of the machine, the future of the world depends.”

- **The energy reserves of the earth are being depleted at an exponentially increasing rate**
- **There will be a serious shortage of readily available reserves in the not too distant future**
- **Many of these reserves are well beyond the control of the countries that represent the largest consumers**
- **Loss of the energy needed to power the economy and lifestyles of mankind would be a disaster of unmeasurable proportions**

- **The engineering community has the ability to design machinery to utilize differing amounts of energy to accomplish the same purpose**
- **Properly applied design philosophy will result in lower investment cost for systems which use less energy**
- **The only long term or permanent solution is to achieve a world society based upon sustainable technology.**

- **Storage systems for domestic hot water**
- **Minor changes in tolerable temperature and humidity**
- **Lowered room ceiling heights**
- **Refine accuracy of calculations and remove excessive safety factors**
- **Add return air systems where permissible**
- **Utilize air-to-air heat recovery system**
- **Matching air handling systems to spaces of similar usage**

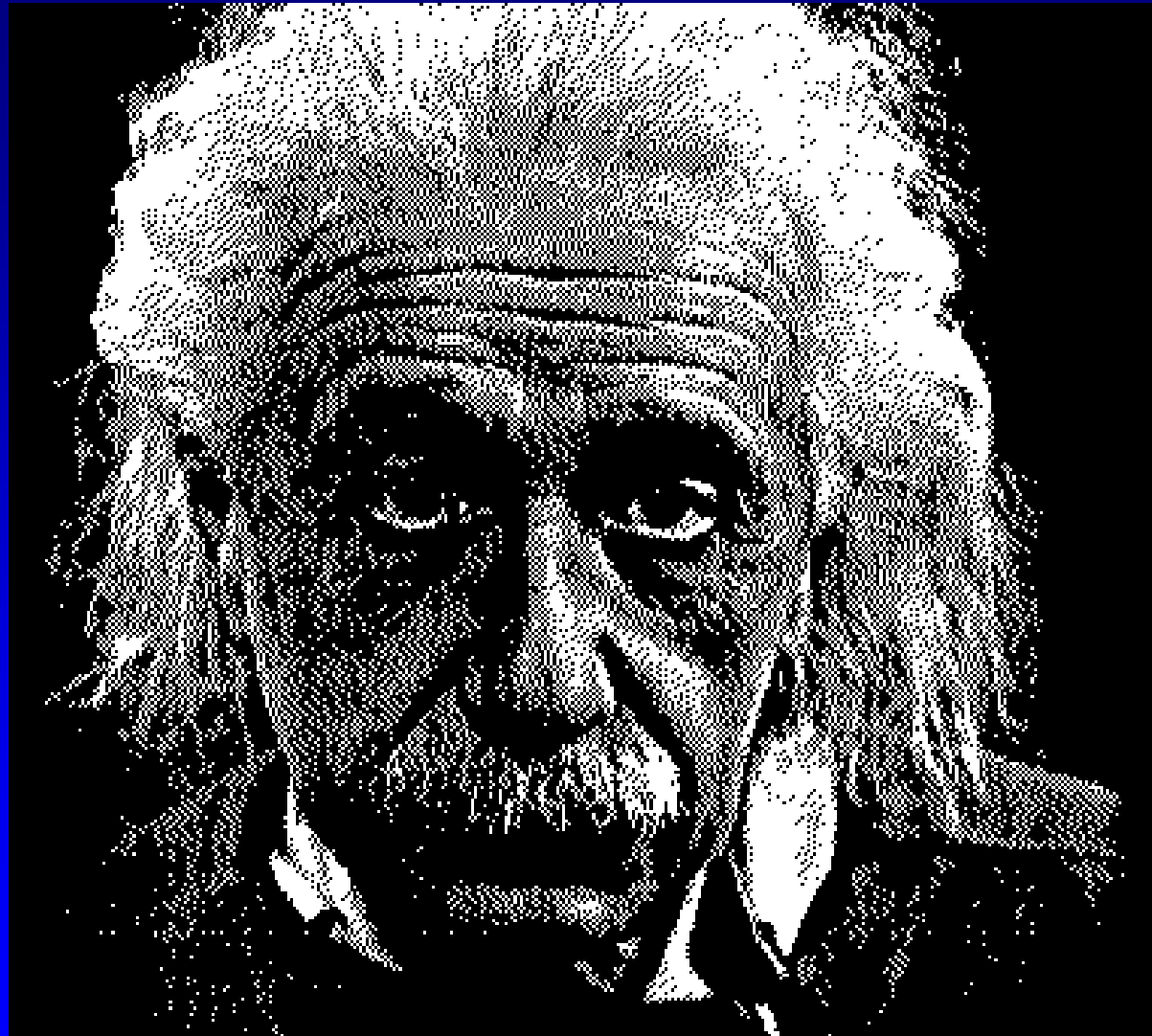
What is good for a business is not necessarily good for the economy

but

what is good for the economy is *always* good for business

...to practice our profession with an emphasis upon our responsibility to protect the long-range interests of the society we serve and, specifically, to incorporate the ethics of energy conservation and environmental preservation in everything we do.

THERE IS NO INFINITE SOURCE
OR INFINITE SINK



“Concern for man himself and his fate must always form the chief interest of all technical endeavors...-- in order that the creations of our mind shall be a blessing and not a curse to mankind. Never forget this in the midst of your diagrams and equations.”

***“Blessed are those who have no
talent.”***

Mechanical Engineering
is the Applied Science
of Energy Conversion

- **Self-educate**
- **Educate others**
 - **Engineering students**
 - **Practicing engineers**
 - **Others**
 - **Clients**
 - **Employees**
 - **Legislators**
 - **Public-at-large**
- **Assume the leadership role in business and interprofessional relations**
- **Become involved in government activities**
- **Engineering societies must become activists**
- **Commercial interests must be restrained**
- **Economists must be educated in the unique value of energy**
- **The engineering community must stand vigilant to assure that they are not misled, duped or misused**

Suggested Reading

Title	Author	Publisher
• The Prize	Daniel Yergin	Simon & Schuster
• The Commanding Heights	Daniel Yergin & Joseph Stanislaw	Simon & Schuster
• Hubbert's Peak	Kenneth S. Deffeyes	Princeton University Press
• Crude Awakenings	Stephen A Yetiv	Cornell University Press
• Maestro	Bob Woodward	Simon & Schuster

There's No Turning Back

Game Plan

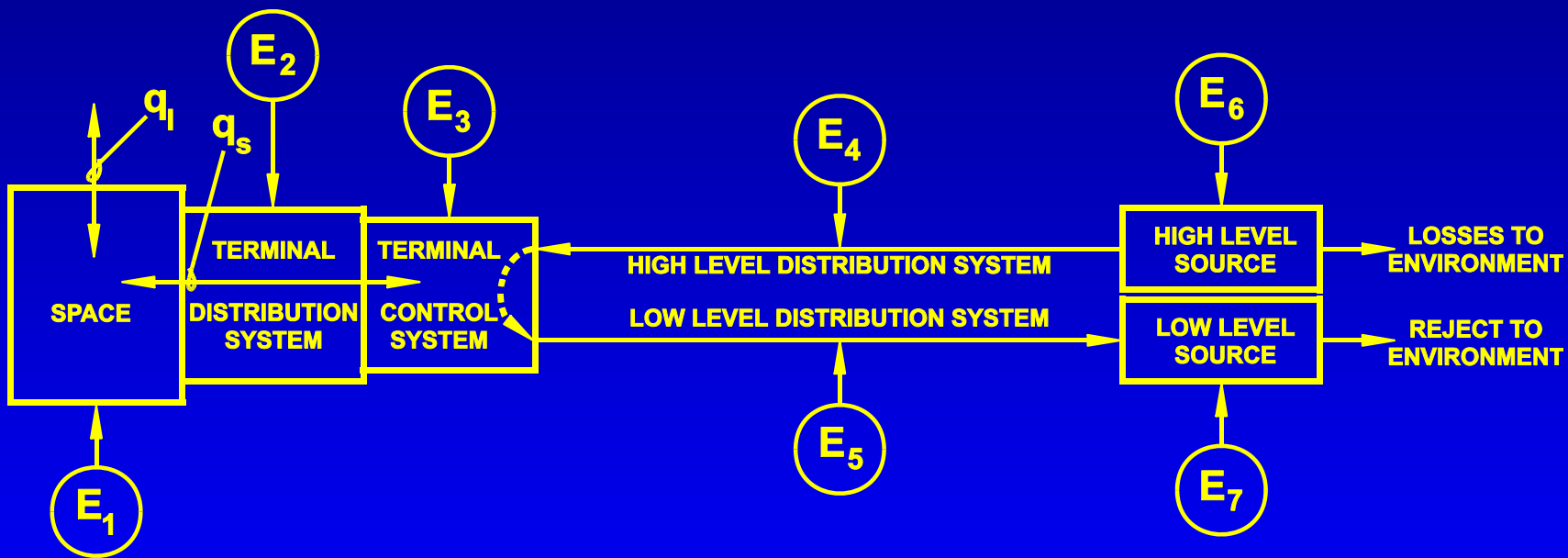
- 1. Design machinery and systems to provide the same performance while consuming less energy**
- 2. Convert from non-renewable to renewable energy sources**
- 3. Minimize or eliminate waste of all kinds**

ENERGY (POWER X TIME)

POWER (ENERGY / TIME)

FOOT POUNDS
HORSEPOWER HOURS
BRITISH THERMAL UNITS
KILOWATT HOURS
TON HOURS
THERMS
GALLONS

FOOT POUNDS / MINUTE
HORSEPOWER
BTU / HOUR
KILOWATT
TONS
THERMS / DAY
GALLONS / HOUR



$$q_s = \text{CFM} (1.08) (t_r - t_s)$$

$$\text{HP} = \frac{(\text{CFM})(\Delta P_T)}{6350 \eta_F}$$

$$\text{kWh} = \frac{(\text{CFM}) (\Delta P_T) (\text{HOURS})}{8512 \eta_M \eta_F}$$

$$\text{kWh} = \frac{(\text{CFM})^3 (\text{HOURS})}{8512 \eta_M \eta_F}$$

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