# ENERGY CONSUMPTION AND EDUCATION OF PERSONAL NEEDS

## POTROŠNJA ENERGIJE I POTREBA ZA OBRAZOVANJEM KADROVA

**Zoran KARASTOJKOVIĆ[*1], Milesa SREĆKOVIĆ[2], Nikola BAJIĆ[1], Zoran JANJUŠEVIĆ[3]**
[1] IHIS IRC Technoexperts, Zemun, Serbia
[2] Belgrade University, Faculty of electrical Enineering, Belgrade, Serbia
[3] Institute for nuclear and other mineral raw materials, Belgrade, Serbia

*Potrošnja energije se često posmatra kao statistički podatak, kako u građanstvu tako i u industrijskom obimu. Često, svako smanjenje potrošnje energije se predstavla kao veliki uspeh ekonomije. Energija se ne troši unutar ekonomije već najvećim delom u tehničkim ili biološkim procesima Jedan od najvećih potrošaća energije, ne samo danas već oduvek, je metalurgija. Milioni i milioni tona različitih metalnih materijala se proizvede širom sveta svake godine, za pravljenje širokog asortimana mašina, automobile, aviona i td.*

*Proizvodni ciklus svakog metalnog proizvoda počinje sa topljenjem, livenjem ili sinterovanjem. Dalje, ovi proizvodi se podvrgavaju kovanju, valjanju. Mašinskoj obradi (struganju. Glodanju, i td.), termičkoj obradi i često se štite od korozije. U celom proizvodnom ciklusu, od topljenja rude ili legiranja sa nrugim (ne)metalima, uglavnom se troši toplotna energija. Tako se u navedenim ciklusima mora utrošiti ogromna energija. Jasno je da se svaka greška u proizvodnom ciklusu odražava na povećanje potrošnje energije, u ovom slučaju za pretapanje loše napravljenih proizvoda. Ko je više sposoban da smanji troškove: ekonomisti ili inženjeri?*

*Svedoci smo da u mnogim zemljama postoji enormno veliki broj (ništa drugo do prava hiperprodukcija) neteh-ničkih zanimanja, kao što su ekonomisti, menadžeri, pravnici i sl, koji mogu samo da govore nešto o potrošnji energije ali, realno, oni ne mogu da reše nijedan od ovih ozbiljnih problema, niti da smanje troškove. Obrazovanje stručnjaka za rešavanje spomenutih problema, je od ekstremne važnosti za opstanak bilo kog društva/države.*

***Ključne reči:*** *potrošnja energije, metalurgija, potrebe za obrazovanjem*

*Energy consumption rather is considered as a statistical date, both in civil or industrial scale. Frequently, every decreasing of energy consumption is represented as a great success of economy. The energy has not spent inside the economy but almost at technical or biological processes. One of the greatest consumer of energy, today but always, is metallurgy. Millions and millions tons of various metallic materials are produced all over the world every year, for accomplishing a wide assortiment of machines, cars, planes, etc.*

*Production cycle of every metallic product begins by melting, casting or sintering. Further, those products undergo to forging, rolling, machining (turning, milling, etc.), heat treating and commonly are protected against corrosion. In the entire production cycle, from melting the ore or alloying with other (non)metals, mainly is used the heat energy. So, in those cycles a huge amount of energy must be spent. It is clear that every mistake in named production cycles is resulted on increasing of the energy consumption, here for remelting of scrap metallic products. Who is more able to cut expencies, the economists or engineers?*

*We are wittnesses that in many countries today exists an enormous number (nothing else than pure hyperproduction) of non-technician professions, as like economists, managers, lawyers, etc, who can only talk something about energy consumption, but really they could not to solve any of these serious kinds of problems, neither to decrease expenses. The education of proffesionals, for solving of mentioned problems, is of extremly importance for survival of any society/state.*

***Key words:*** *energy consumption, metallurgy, education needs*

[*] Corresponding author: zoran.karastojkovic@gmail.com

## 1. INTRODUCTION

There is no need for further explaining that there is no any field of human activity without energy consumption. So, the energy consumption is of extremly importance for a common life. In nowdays, the energy consumption is on pretty high level, and used practically everewhere (in technologcical processes, telecominations, music, etc).

Only technical branches, including research fellows, scientists or professors at various laboratories at universities or companies all over the world, are envolved in production of energy and/or creating the new equipment(s) or material(s). Others (non-technicians), are only consumers and often fanatic rooters, with one clear demand: there is a need for more energy. From them (non-technicians) comes just one reasonable task - the energy must be cheep, and nothing more.

In every society or country are present branches for energy production or energy consuming. The problem arises always when the consumption of energy is overcomming its production rate inside at any country. Such disbalance in reality represents the big problem when society is going to be a stable nation. The best solution for every society/country is to paid an attention not only for consumption but rather on production of energy. It is evident that there are versatility of methods used for production of energy, particularly for electricity. For electrical or other types of energy production (as from biomaterials, solar, etc.) must exist a remarkable number of technicians, and after that follows the jobs for economist, lawyers, managers, etc. It is well known that from the entire mankind history versatile improvements were made only by technical skilled fellows, not others. Or, may be telecomunications were made by economists, lawer, managers?

Special problems arise when is intending to improve, ordinary complex, technological shedules in industry during production of any component, neither the component is used in a common life or not. These solutions need very well knowledge in production methods and advanced technologies for every component. Such technical skills could be learned out only at technical colleges or universities, it is clear not at any kind of humanistic branches. The great number of human profiles could not insure the new production methods or technologies. So, what is the aim of constantly growing the number of human branches in a society, up to the hyper-production level? Is it the right way for better production or quality of products? Not at all.

Fellows or scientists from human branches may talk (or make a noise) for example about $CO_2$ emission level, or to discuss about particular statistical data, but nothing more. They could not ensure any technical measure for decreasing of the mentioned level of emission, or to improve the shedule of production solution/regime. The every component from car/vehicle/plane or any other machine element or component is produced by using one or more tools (either in production and control cycle) during: casting, forging, machining, heat treating, etc, and all of those technological operations could not be provided without engineers.

## 1 ENERGY PRODUCTION METHODS

Main methods for energy production are:

- From coal (thermo-energetic power plants),
- Biological processes (for example producing alcohol from lotus leaf),
- Electrochemical processes (electrolysis of water and than combustion of hydrogen and oxygen),
- Wind,
- Solar and
- Nuclear processes.

All of those processes, including biological, are technical in their nature and need very complex equipment. It means that one who is dealing with them must to know a lot of physics, chemistry, electrochemistry, thermodynamics, mechanical engineering, design, etc. It is clear that for producing of any mentioned kind of energy, many skills are needed, of course the technical skills. If is needed to consider all expensives in production cycle – what is a problem in applying of addition for basic and the simpliest mathematical operation by engineers? Why we spent both an

enormous energy and money for education in great number (read: hyperproduction) of economists, managers, etc.? However, those professions may have exist in great number, but only in countries with high production level, it means no everywhere.

One example known to everybody is a motor on fossil fuel, which is used for consuming fossil energy, and rarely for production of electricity in so called motor-generator. Look at one fossil fuel motor, Fig. 1.

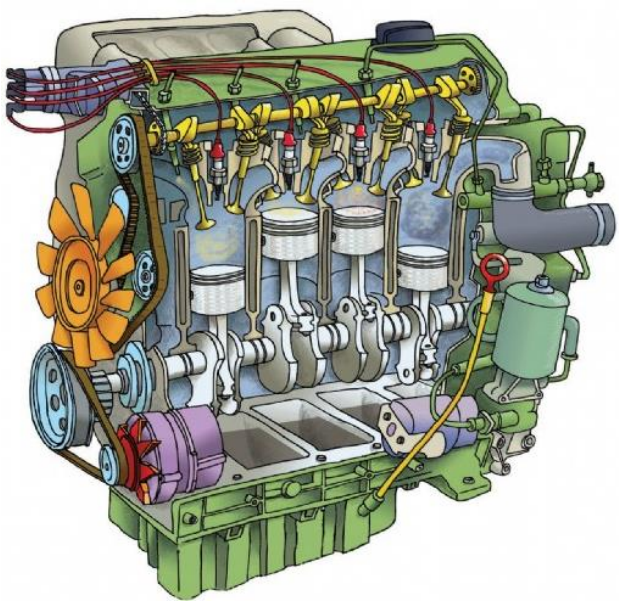


*Fig. 1. Stereoscopic view of fossil fuel motor*

Such motor, generaly, contains thousands of machine elements/components. For producing of every element/component (either made from metal or plastics) is needed at least one tool, with many examples that for a particulary job must be used even 10 or more tools. The production of such tools must start with their construction and further by applying the versatility of technological operations. It is clear that all of those jobs must be done very precisely and provided only by engineers. The addition of production expences is, however, less demanding job in comparison to construction and making of a tool. This is just one example, but obviously there are many others. So, why the job of engineers are neglected when the state is planning the amount of profiles for proffesional education? It is easier to import any kind of product/goods, and for such jobs the economists or merchants are needed. But, is the such import of finished products, it means without a really production and developing factor for the state?

One question more: who invented a solution of renewable nonpolluting energy source, as could be seen from Fig. 2, engineers or...?


*Fig. 2. Wind generators of electricity and charging of an electric vehicle*

The lithium-ion batteries now are known to mass media. For their inventions are spent huge attempts, materials, knowledge, etc, to the today appearance, Fig. 3

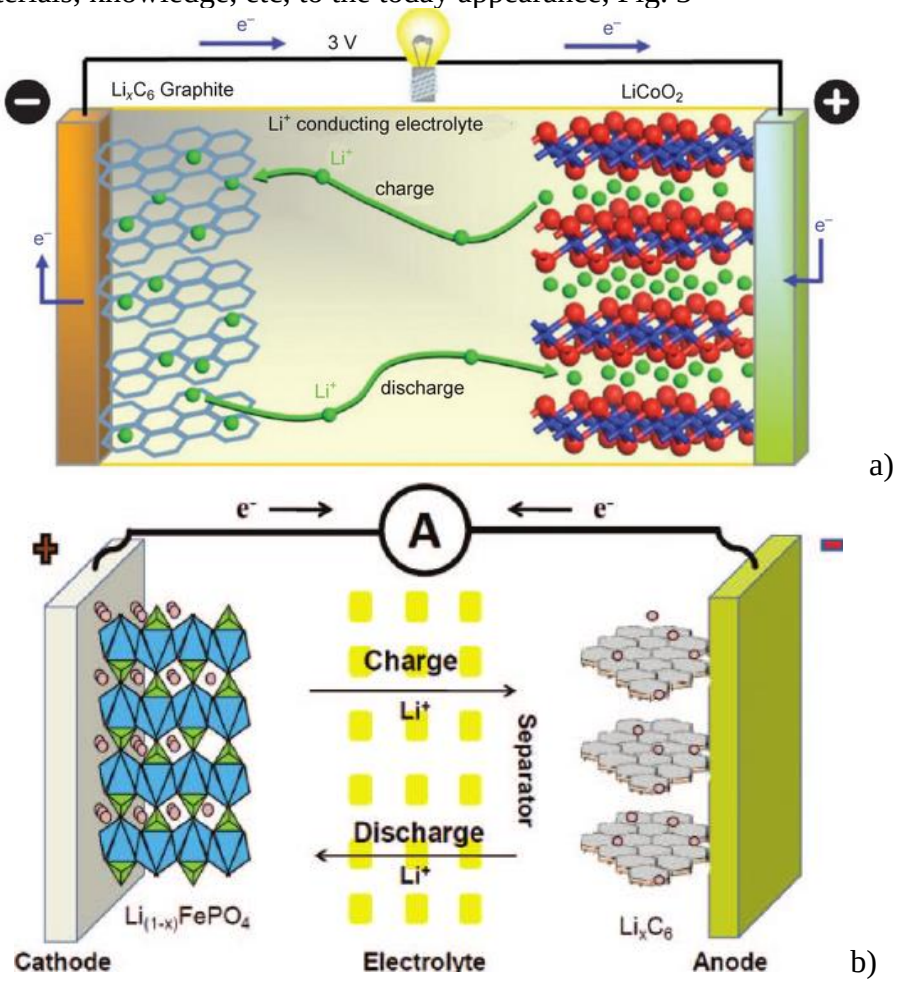



*Fig. 3. Scetches of two examples of an automotive lithium-ion battery*

The ecological impacts are not included in this brief review. Find out of real solutions for decreasing the ecological problems are not a scope of economists, managers, etc, but only by technicians, however, in cooperation with biologists and medicine personals. Once again, we must more precisely planned the education profiles which are missing, but not to make hyperproduction professions which in future will be without any serious job?

## 2 ENERGY USAGE

List of energy usage will be extremly long, in one sentence - in all kinds of life. From that point of view, just one question arises: who is able to decrease the energy consumption in industry? Almost the engineers. The serios question might be: why we in Serbia are obsessed for hyperproduction of non-profitable educated profiles?

From all industrial branches the highest energy consumers are mining and metallurgy. For such illustration pretty well example in Serbia is the copper ore: supose that in ore is present copper in amount ≈0.3%, it means that 99.7% is waste material. But, all of those materials have to be excavated, and transported on the Earth's surface, for further processing (flotation, melting, refining, casting, deforming), machining (by turning, milling, grinding, polishing) and sometimes for surface coating. All of those operations are no doubt technical in their nature. Every mistake in production shedule and rejected component means that both material and energy used in production cycle are irevirsibile lost.

From mentioned industrial processes the metallurgy is the greater consumer of energy: at the down of mankind it was a heat (from wood and/or coal) but today it is almost electrical energy. O-

ne's has to imagine how many energy must be used for production a tone of copper metal when 99.7% of escavated material is waste! Other metals, used for production elements/components, Fig. 1, must be first melted, casted and shaped into plate, bar or wire, than machined to the final product.

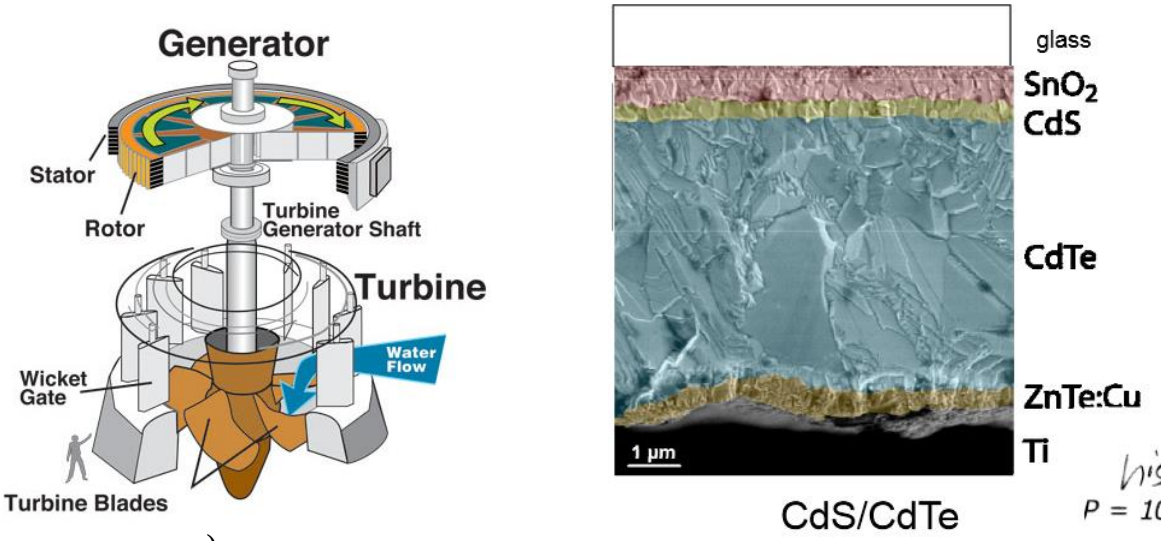
Metallurgical engineering is engaged in vehicle industry, military, aviation... and nano science. The statistical monitoring of energy consumption could be a job for economists and or managers, but this job could be easily conducted by engineers. From statistical data, in Serbia is spending more energy for production of goods, about 4:1 in comparison to industrial countries in Europe.

## 3 NUMBER OF PROFILES FOR EDUCATION

The energy production methods and also the usage in industrial processes require very skilled technicians, engineers and stuffs, while generally the energy consumption ordinary does not. So, if the number of students at humanistic branches overcomes the number of students from technics, than such society becomes nonsustainable. The ratio between students of technics and students of humanistic sciences in some periodes was in ratio about 1:2, even less. From that point of view arises a question: what is our target?

### *3.1 Discussion*

In energy production methods only technicians may have give the real improvements or innovations. Most of industrial processes, no matter from the kind of production, are great consumers of energy. Two very different examples of complex technological processes in generating the electricity are shown in Fig. 4a) and b).




a) b)

*Fig. 4. Scetch of one hydroelectric power plant a) and cross section through cadmium telluride used in solar cell b)*

From the economical reasons the producing of multilayer coating is an expensive step, so it is cheaper to deposit just one layer. That is a thrue only from the economical reasons but no way from technical function(s) of layer like this.

Analysis about load/stress or strain distribution in machine components/aggregates, for example, represents very specific job and needs significant technical knowledge and skills.

Another of key questions is: what about technical or medical diagnostics? Who has necessary skills for providing them?

Farther, laser techniques today are widely applied in many procedures either, in producing or controling of various machine elements/components. These jobs dont belong to lawyers, economists or managers. Here is mentioned just a small number about technical problems in generating the electricity, of course that problems are really serious and need many knowledge and various skills.

## 4 CONCLUSION

It is not enough to know someting about who is the greatest consumer of energy but the next step should be to educate people who will be able to decrease the energy consumption. For achieving that goal, the constant task all over the world is improving a particular industrial process, whatever is the kind of process. These jobs could not be done without engineers. This is why the education of personal needs must be addapted to the real state.

New technologies followed or applied with hyperproduction of lawyers, economist or managers have no sustainability. For growing the import – than economist and managers could help. But, is this a really goal of a state? The ratio about 1:1 between students of technics to students of humanistic sciences will be better than 1:2 as earlier, for approaching to a kind of sustainable society.

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