PHYSICAL POWER ENGINEERING AT THE CULS PRAGUE

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Abstract
We teach the new subject "Physical Power Engineering" at the Czech University of Life Sciences Prague for few years. This subject has certification for doctoral study programme. The students take knowledge about all energy sources, about energy production and about general situation in the world power engineering. This year the new book was written. The book is a fundamental scientific monograph about power engineering and it can be used as the textbook for this subject. It summarise experience of the authors for many years.

Key words: Physical power engineering, energy sources, doctoral study programme

Introduction

The new subject "Physical Power Engineering" is taught for doctoral study programme at the Czech University of Life Sciences, Faculty of Engineering. The main aim of the subject is significantly improve the knowledge of students in the field of energy production and energy usage. The students will obtain good knowledge about processes running during conversion of the primary and secondary energy sources into energy and about influence of the processes on the environment. This processes have physical base, that is the reason that some part of the subject speaks about physical fundament. But we suppose, that the students studied fundamental physics in the past. The lectures summarise details about usage and conversion of the all energy sources and the ecology aspects. We plan excursion as well. The number of hours per week is 2/0.

The subject

The subject is composed for one semester and it is finished with an oral/written exam. It is accredited in Czech language and in English language as well. This subject is new, nevertheless one foreign student graduated last year in English language.

The student obtain fundamental knowledge in the field of the power engineering. The graduate has information about the situation in the energy sources and energy usage in the world and in the Czech Republic as well. Besides he has knowledge about the consequence of the higher and higher energy production. Each energy source is described and discussed during the semester, the accent is given on the renewable energy sources and on the consequence of the fossil fuels usage.

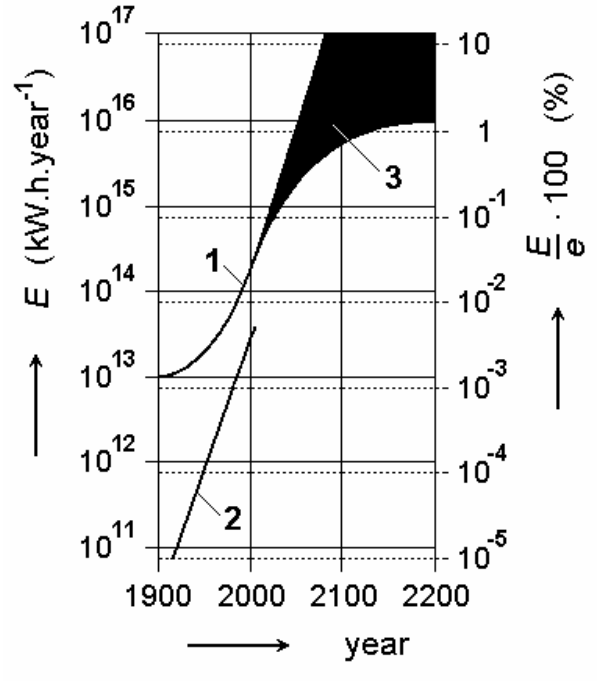

Fig. 1 *Global production of energy,* 1 - *total production of energy,* 2 - *electric energy production,* 3 - *prognosis (e - energy coming from the Sun)*

Sustainable development is a frequently discussed topic nowadays. Future technological development cannot continue to be based on growth of production and consumption of fossil fuel based sources (oil, coal, natural gas) because deposits are gradually being exhausted. They also represent a considerable burden for the environment. At present the consumption of energy from fossil fuels is much faster than its accumulation. Hopefully, there is general recognition that adoption of renewable energy sources is the only viable alternative for growth of our civilisation. International political and scientific conferences have been organised to deal with this problem, including the key Kyoto conference in 1997. Total energy production on Earth is growing exponentially; in the year 2000 it already exceeded $E = 10^{14}$ kWh/year. If this trend continues it would reach $E = 10^{17}$ kWh/year within less than a century [1,2]. This would be a catastrophic scenario which global ecosystems would probably not survive. Alongside power production itself many well-known and much discussed side effects need to be taken into consideration, such as emissions of dangerous or even poisonous gases, production of fly-ash, radioactive waste, emissions of greenhouse gases, acid rain, global warming, and melting of glaciers. It should be stressed that during the last Ice Age the average temperature was only 4°C lower than today and that, based on recent estimates, average temperature could grow by 4°C within next 50 years. This increase would have a catastrophic impact on global ecosystems. The most pessimistic scenarios estimate average temperature growth of as much as 9°C within next century. The concentration of atmospheric CO_2 grows by 0.4% annually and the concentration of methane grows even faster. The greenhouse effect is probably the cause of current high-risk climate change. Greenhouse gases absorb infrared radiation from the Earth's surface, partly reflecting it. This effect disturbs the balance between energy absorbed and radiated by the Earth. So far it has not been proved beyond doubt that these climate changes are caused by human activity. Rapid climate change and fluctuation of sea level by as much as 100 m in periods of the order of a thousand years have occurred historically.

A coal power plant with output P = 1000 MW pollutes the atmosphere with about 10^{10} kg of CO_2 annually, to say nothing of other gases such as SO_2 and fly-ash (often slightly radioactive). These emissions occur even from plants with high-quality desulphurization units and fly-ash separators, causing acid rain and reduction of soil and water pH.

Some hope comes from prognoses that we cannot extrapolate recent trends, and that energy production will saturate, e.g., by implementation of power saving technologies, and that the curve of energy production in time will approach the asymptotic level of $E = 10^{16}$ kWh/year, which will never be exceeded. Such a trend might perhaps be acceptable from the point of view of sustainable development. But prognoses vary to a great degree, as shown on Fig. 1, and only time will tell which is the correct one.

Fig. 2 shows increasing of the population, world energy consumption and CO_2 concentration in the atmosphere, Fig. 3 shows changes of the average temperature.

The new book

We wrote some books about energy sources in the past. The last book was a monograph about solar energy [3], it was written in English language and it was launched in May 2006. The new book was written this year [4] (in Czech language), it deals with all energy sources and with consequence of the fossil fuels usage and energy consumption increasing. Figs. 1-3 are used in the introduction of the book. The accent is given on the renewable energy sources and nuclear energy sources. We believe, that these sources are most important for the future. The book is divided in 14 chapters, the supplement and colour inset is in the 15th chapter. References are in the end of the book. Each chapter is a theme for one week of the semester. The content is following:

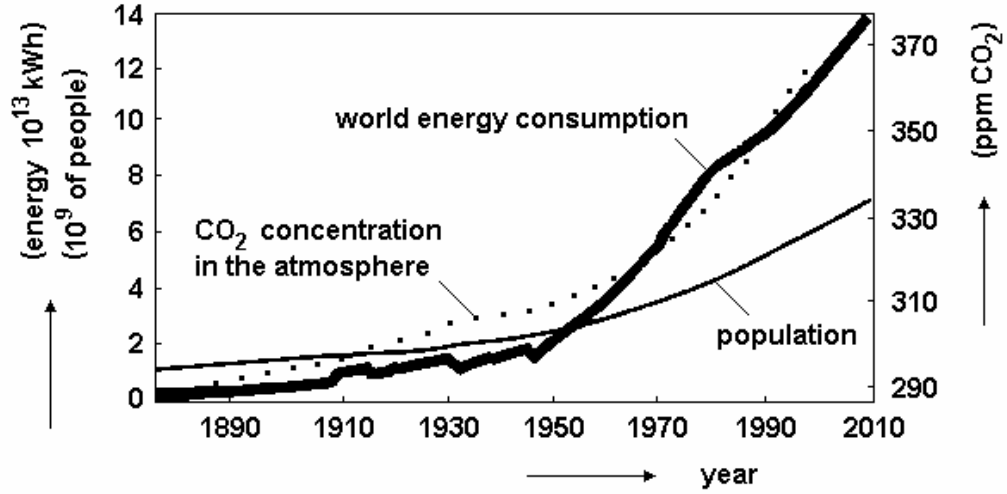

Fig. 2 *Increasing of the population, world energy consumption and CO_2 concentration in the atmosphere*

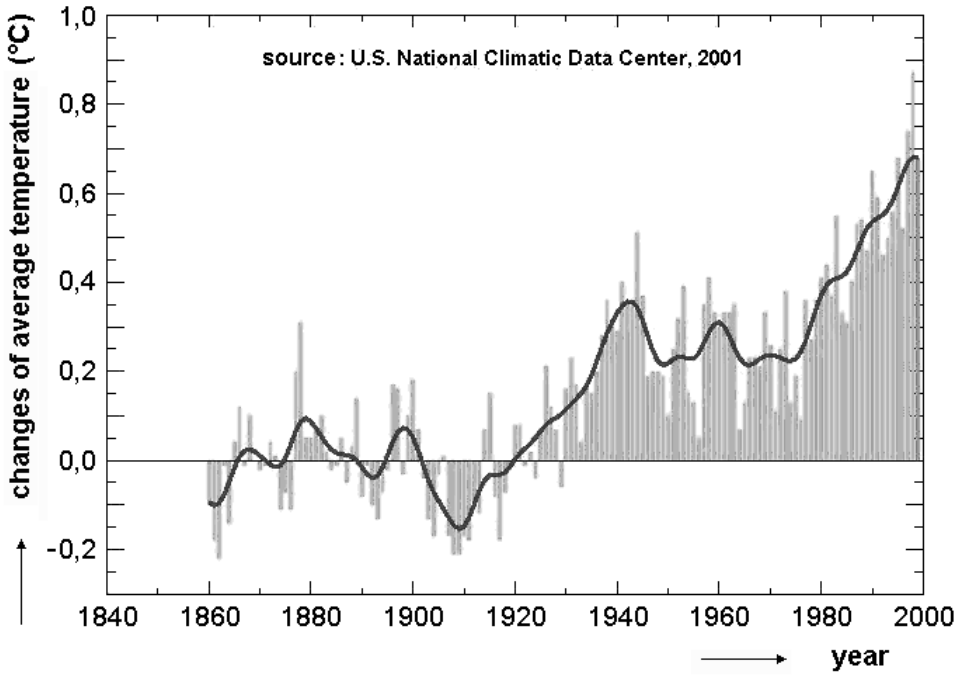

Fig. 3 *Changes of the average temperature*

1. Introduction
2. Energy conversion, quantities, units
3. Fossil fuels
4. Basis of thermodynamics
5. Power stations for fossil fuels
6. Water power stations and wind power stations
7. Solar energy
8. Solar power stations and photovoltaic systems
9. Basis of nuclear physics
10. Nuclear power stations
11. Hydrogen - fuel for the future
12. Biomass - renewable energy source
13. Husbandry with the energy
14. Energy balance of the universe, global problems, climate changes
15. Supplements

We hope, the book will be launched in 2007 and the editor is Czech University of Life Sciences Prague.

Conclusion

We hope, the new subject covers this very topical theme and it increase the quality of the study at the Czech University of Life Sciences. The new book supports the subject and it yields fundamental information for the students in the doctoral study programme. The book yields orientation in this actual problem for the public as well.

References

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[3] POULEK V. - LIBRA M. 2006. Solar energy, photovoltaics - promissing trend for today and close future. Book, Czech University of Agriculture Prague, 153 pages, ISBN 80-213-1489-3
[4] LIBRA M. - POULEK V. 2007. Energy sources and energy usage. Book, Czech University of Life Sciences Prague, 140 pages, (the book is prepared in the press)

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(CULS), Prague, Czech Republic, cedikj@tf.czu.cz. Abstract - The utilization of dynamic methods for the measurement of operating parameters of road vehicles is beginning to grow due to small time-consuming and low initial investment funds. Dynamic measurement of power parameters of the engine or brake are generally based on the knowledge of the moment of inertia of the rotating masses both of engine and transmission system including driving wheels.Â At the same time the suggested method allow the analysis of major power parts individually and their consistency with the overall physical load. There is often required to synchronize the work of the lower limbs, trunk and upper extremities. Czech University of Life Sciences Prague (CULS; (Czech: ÄŒeskÃ¡ zemÄ›dÄ›lskÃ¡ univerzita v Praze), ÄŒZU; also Czech University of Agriculture in Prague) is a university of agricultural education and research in Prague, the Czech Republic, established in 1906. Studies of agriculture were established at the Czech Technical University (ÄŒVUT) in 1906, and the first agricultural engineers graduated in 1911. In 1920 the Faculty of Agriculture and Forestry was established, and in 1952 the faculty became an