

Summary

Habilitation Thesis

RESEARCHES AND RESULTS REGARDING THE VALORIZATION OF COAL THROUGH THE PRISM OF ENVIRONMENTAL PROTECTION

The professional evolution and the exercise of the university teaching profession implies the approach of the binomial didactic activity - scientific research activity in a flexible and dynamic way, proving both receptivity to the new and capacity for critical reflection. Going through the hierarchical stages of this profession implies the need for lifelong learning and training, one of the steps being to obtain the certificate of qualification.

The didactic activity supposes a development of the didactic capacity and performances both direct by carrying out all types of teaching activities - coordination (course, seminar, laboratory, project, guidance and coordination of bachelor's and dissertation works), and indirect by designing and elaborating teaching materials, textbooks and course materials, traditional, printed or interactive work and project guides based on multimedia technologies. In this context, the didactic activity focused on supporting the disciplines Environmental protection in Mining Engineering, Use of underground spaces in Mining Constructions, respectively Engineering and Environmental Protection in Industry, Ecology and Environmental Protection in Industrial Engineering, Investigation of Environmental Factors, Technologies and equipment for air pollution in the specialization Engineering and environmental protection in industry, Modern methods of industrial pollution prevention in the master's degree Control and monitoring of environmental quality, respectively Accident risk assessment - SEVESO directives in the master's degree Environmental management and protection.

The didactic activity has been extended to the bachelor and master commissions as a member of the Environmental Engineering commission since 2008 until now, respectively since 2016 member in doctoral guidance commissions in the field of Mines, Oil and Gas.

*The scientific research activity is validated through books, studies, research and published works as well as by recognizing their impact. The results of the research activity were presented in national and international academic and scientific events, through articles published in journals or in the volumes of conference papers. The habilitation thesis entitled "[Research and results on coal recovery through the prism of environmental protection](#)" presents the synthesis of scientific activities carried out after obtaining in 2008 the scientific title of doctor, following the public support on 30.11.2007 of the doctoral thesis entitled "*Study of reduction atmospheric pollutants released by burning solid fuels in power plants, with application to C.E.T. Paroşeni* ", elaborated under the coordination of prof.univ.dr.ing. Mircea Georgescu, University of Petroşani.*

After obtaining the doctorate in 12.03.2008, I continued my research, I studied and learned continuously. We considered that any stage is like a lesson, and the lessons are like the nectar of flowers, and our duty is to collect it like bees. We must not take refuge in the past or in the future, but the present must be assumed and lived intensely and to the end without apologies and lamentations. Thus, the research results were materialized through 3 dissertation papers (2009 - Evolution of air quality in the area of Paroşeni Thermal Power Plant; 2012 - Assessment of ecological status in the area of CET Paroşeni based on

bioindication; 2013 - Assessment of risks for safety and health at work at the University of Petroșani), 1 bachelor thesis (2010 - Research on SO₂ reduction solutions at Paroșeni Thermal Power Plant) and 1 doctoral thesis, Environmental Engineering (2016 - Studies and research on the life cycle of sludge resulting from urban wastewater treatment), under the coordination of prof.univ.dr.ing. Tiberiu Rusu, Technical University of Cluj Napoca.

The habilitation thesis highlights those achievements that attest to the author's ability to coordinate and lead scientific research activities related to the field of engineering sciences, especially the field of Mines, Oil and Gas.

On a global scale, coal has been and will remain one of the main primary energy resources, being the cheapest option for generating it. Coal deposits are available in large quantities, being spread unevenly across different geographical areas of the globe.

Compared to oil and natural gas, coal has the advantage of a more stable and less sensitive price at a number of international events, on the other hand, it has the disadvantage of significant additional costs, due to the necessary technologies to reduce emissions in the environment.

The latest data shows that coal is currently used to produce 40% of the total amount of electricity worldwide, and its utilization rate has increased by over 50% over the last 10 years.

Even though countries in Europe and North America are trying to move to alternative energy sources, the reductions are being canceled out by large economies, most of them from Asia, which mainly use coal, also holding significant reserves of this fuel.

Romania has a diversified, but quantitatively reduced, range of primary energy, fossil and mineral resources: crude oil, natural gas, coal, uranium ore, as well as significant potential for renewable resources.

The importance of the energy sector (resources - energy industry - consumption), a strategic sector for any state, is best emphasized by the fact that, in the case of Romania, energy represents a product of great economic, social, strategic and political value.

Romania, with a long tradition in the mining industry, has sufficient reserves of coal (oil and lignite) that can ensure the continuity of production for more than 150 years, being one of the most important coal producing countries in Europe, the seventh place among the producers of coal from the member countries of the European Union, and one of the major lignite producers, and in the world it ranks seventeenth in coal production. In recent years, in Romania, coal represented approx. 30 ÷ 40% of the energy mix (1/5 of the oil burning and the rest of the lignite burning), followed by hydro with 28%, nuclear 20%, 7% wind power and so on.

In the context in which the Romanian hydrocarbons (oil and natural gas) are depleted in the medium term, and the import increases at prices difficult to sustain, coal remains the main available fuel for the production of electricity in power plants.

The more intensive use of coal (domestic and imported) will involve improved technologies, including in terms of reducing pollutant emissions.

The use of coal as a raw material for the production of electricity and heat over the next decades could make it possible to plan long-term use of it in the future, to make long-term profits, to recover the capital invested by entrepreneurs and to carry out research on the use and economics of coal resources, not only in the area of interest of the applied sciences, but also in that of the fundamental sciences.

For existing coal-fired power plants (oil and lignite), a number of techniques of rehabilitation and modernization can be applied to improve thermal efficiency.

*The habilitation thesis entitled "**Researches and results regarding the valorization of coal through the prism of environmental protection**" reflects the inter, intra and cross-disciplinary concerns acquired in over 15 years of professional activity, in engineering sciences, in the fields of Mine, Oil and Gas, but also Environmental engineering, as a member of the academic community, following the principle of complementarity.*

The qualification thesis elaborated represents a logical synthesis of the results of the main research works in the field of engineering sciences, and is structured in three parts, which include the description of the didactic and research activity, as well as the future career development plan, plus the related bibliography.

The results presented in the paper are based on a series of researches, materialized in works published in specialized magazines or at international conferences, as author or co-author.

The first part of the thesis presents the synthesis of the didactic and scientific results obtained throughout the entire academic career, as well as elements related to national and international visibility. Also in this part are presented the permanent concerns for documentation and improvement in the fields of teaching and research. Through the scientific contribution resulting from the research activities are presented briefly the theoretical bases and developed the elements of analysis, research and interpretation specific to the topic addressed.

Through the synthesis of the scientific and professional results, the most important achievements obtained by the authors in the didactic and scientific research activity were presented. During the teaching activity held as a holder within the University of Petroșani, as an associate in other universities in the country (Constantin Brâncuși University of Tg. Jiu) I have taught disciplines both in the field and in the specialty for students, masters.

The future career development plan sets out the main research directions that can be addressed within the doctoral theses. In Part II, the objectives regarding the didactic activities, mentoring and dissemination of the results of future research are also outlined.

The Part III - the bibliography includes the list of bibliographic landmarks, grouped into their own and general, used during the researches carried out and the elaboration of the habilitation thesis.