



UNIVERSITATEA PETROL-GAZE DIN PLOIESTI
ȘCOALA DOCTORALĂ

HABILITATION THESIS

”CONTRIBUTIONS ON EXTENDING THE LIFE CYCLE OF MATURE GAS FIELDS THROUGH REHABILITATION CONCEPT”

-SUMMARY-

Candidate:

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The subject of this habilitation thesis is circumscribed to the important technical and scientific concerns of the specialists from the hydrocarbon companies, both gas and liquid.

The motivation of these approaches in relation to the economic profitability elements aims to monitor and regulate three fundamental indicators of the hydrocarbon companies: the hydrocarbon recovery factor, the replacement ratio of reserves and the production decline of the reservoirs. If for the first two indicators is seeking to obtain the maximum values, for the last indicator, a series of techniques and technologies are applied to minimize it.

I felt it is necessary to make this statement because over 35 years of activity in the natural gas domain, both in production and in secondary education and, especially, in higher education, I have accumulated sufficient theoretical and practical knowledge, therefore I can develop and coordinate works or projects from gas natural engineering area. It's worth to mention that such complex activities are achievable in the context in which multidisciplinary teams established in this respect are motivated and, in addition, have the necessary expertise.

I have to remember that my beginning on the real understanding of what it means "Practice of Natural Gas Extraction" (D-P Ștefănescu, volume 1 and 2) started to be outlined after many years of activity, coordinating the entire activity of an important natural gas production section from Transylvanian Basin. Combining these experiences with a doctoral program focused on research, rigorously drawn up by late prof. dr. eng Ion Crețu, the doctoral thesis entitled "*Contributions to the study of the exploitation of depleted natural gas reservoirs*" was finalized and presented in the summer of 1994.

The approach, in the above-mentioned thesis, of concrete subjects related to the improvement of the performances of natural gas reservoirs in order to maximize the recovery factors materialized in the years that followed, through a series of studies, researches, projects and publications with the following main topics until 2000:

- Equivalence of microscopic equations for the gas flow in the reservoir, associated with the initial and the limit conditions, with the system of algebraic equations based on the use of the approximation method of derivatives by finite differences of the appropriate type, led to the realization of numerical methods that allowed the study of the recovery gas from predetermined geometry reservoir;



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- Interpretation of the detailed research on the phenomenon of mass phase transfer for the water phase with direct implications, both, on the improvement of the quality of the physical flow model of hydrocarbons and on the nature and quantity of the water produced by the wells, made it possible to establish the necessary corrections for the material balance equation, as well as the differentiation of water produced relative to sources;
- Foreseeing pressure measurement campaign in order to stimulate the gas wells by applying different chemical treatments and hydraulic fracturing, has been a special concern for the increase of gas production versus the consumption needs of the Romanian society;
- Ecological aspects associated with natural gas production have contributed to solving the problem of the injection of considerable volumes of produced water into depleted formations, based on appropriate calculation methods which had as input data the hydrodynamic parameters.

Solving these complex problems adjacent to natural gas engineering without claiming their exhaustive settlement has paved the way for experimenting, as a first step, a new concept, namely the *rehabilitation* of mature gas fields, implemented after 2000.

Personally, I have been involved, from the beginning, to implement such rehabilitation project of a mature gas reservoir located in the central area of the Transylvanian Basin, for the first time in Romania within the company where I'm working.

The rehabilitation project, a successful one, started in 2003 and is still ongoing, and during the 15 years of the project I had the quality of project team member and, especially, as the director of the management steering committee.

The state mentioned above corroborated with my position as being the author of university courses entitled "*Rehabilitation of natural gas mature fields*" and "*Maximization of gas recovery factor through geological re-configuration and numerical simulation*" constituted for me the defining arguments for the elaboration the habilitation thesis entitled "*Contributions on extending the life cycle of mature gas fields through rehabilitation concept*".

The habilitation thesis is structured on three sections, where the first section, the most developed one, presents the researches, the postdoctoral achievements, many of them being the subject of articles published, both in the country and abroad, and previously, presented at different scientific conferences and events.



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In one of the chapters of this section are analyzed the rehabilitation steps based on the real cases and the production history, and later, the benefits related to the rehabilitation process, which is individualized for each rehabilitating field.

Another chapter of this part is dedicated to the way how I managed to transfer my theoretical and practical knowledge to the bachelor students, master students and doctoral students, knowledge accumulated over many years of activity. I have done this and will continue to do it through my specialized writings to which I will refer in this thesis, as well as the personal contributions to this concept called the *rehabilitation in integrum* of mature gas reservoirs.

This first section it ends with a set of conclusions regarding the impact that this complex process can have on extending the life cycle of mature gas fields, conclusions generated from the continuous monitoring activity of petroleum operations included in the rehabilitation projects.

The second section was conceived as a passage in time, seldom shaded by facts, sometimes by inappropriate attitudes, of how I tried to improve myself both as a specialist and as a university professor. This double quality that I have currently determined me to approach the achievements of my professional career in two chapters. In the first chapter, I present my accomplishments and my contributions in my field of competence, and in the second chapter the evolution at the university level, considering me lucky because I succeed to combine the productive activity and the didactic activity. I will also present in this chapter the ways of transmitting to the students, both the theoretical and practical knowledge in the field of natural gas production and engineering, as well as facilitating the access to the production platforms.

The habilitation thesis ends with a bibliographic selection where the specialized papers are listed, both in Romanian and in English, papers that I have consulted over time and which are related to the subject of this paper.

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