SUMMARIES

Hendel J., Śliwa T., Gonet A., Łuczak R., Gałuszka Ł., Kowalczyk J.: **Demand for heat from rock mass and borehole heat exchangers for a ventilation system in case of the auditorium at the Faculty of Drilling, Oil and Gas at AGH UST in Krakow** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

While calculating the heat demand for a ventilation system, the average monthly dry-bulb temperature is taken as the external temperature. While analysing a facility for public use, dedicated for 150 people and possessing a large share of transparent external walls it was shown, that using an hourly temperature in calculations, the obtained total energy demand (i.e. for heating and air conditioning) is 22% higher than the result obtained while taking into account an average monthly temperature. The obtained result points out the necessity of an individual approach to any large room, taking into consideration a temperature in a period of time significantly shorter than one month.

Keywords: *geothermics, heat demand, ventilation, calculation of thermal balance, heat pumps*

Rychlicki S., Stopa J.: **Directions of development of Polish gas and oil** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Period of 2000–2015 in exploration and production of hydrocarbons was not the most successful. The last major discovery of new reservoirs took place in the second half of 20^{th} century and first half of 21^{st} century, when the reservoirs of Kościan, Brońsko, BMB and LMG were discovered. Unfortunatelly, following years did not develop these significant discoveries. We can wonder if it was connected with the lack of exploration strategy, problems with financing or less availibility of discovering new reservoirs.
The article presents the state of research both conventional unconventional hydrocarbon deposits and their directions of future research in Poland.

Keywords: *oil, gas, prospection in Poland*

Yen Adams Sokama-Neuyam, Jann Rune Ursin: **Experimental and theoretical investigations of CO_2 injectivity** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Laboratory sandstone core flooding experiments were conducted to investigate the impact of brine desaturation and salt precipitation on CO_2 injectivity. An attempt was then made to reduce the impact of salt precipitation on CO_2 injectivity by injecting a slug of diluent prior to CO_2 injection. The effect of brine salinity, CO_2 injection rate and initial core permeability on the efficacy of this mitigation technique was investigated. Decrease in diluent brine salinity improved injectivity but there exist a critical brine salinity below which CO_2 injectivity was further impaired. It was also observed that, above a certain CO_2 injection rate, alternating CO_2 injection with the diluent brine could not enhance CO_2 injectivity. Injectivity improvement also depends on initial permeability of the porous medium. Up to about 30% injectivity improvement was observed in the experiments.

Keywords: *CO_2 iniection, brines*

Jann Rune Ursin: **Gas-condensate banking and well deliverability. A comparative study using analytical- and numerical models** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Reservoir condensate blockage in the reservoir and in particular in the close vicinity of the wellbore may result in significant loss of well deliverability for medium to tight gas reservoirs. The dynamics of fluid flow in these types of reservoirs are investigated by way of analytical description and by numerical simulation of radial two phase flow behavior.
The analytical model is based on a single phase semi steady-state solution, being revised for two phase flow of gas and condensate oil. As the liquid is dropping out of the gas, a saturation distribution of immovable oil is seen to develop radially in the reservoir with time. Condensed oil not being part of this saturation distribution is produced to the surface. The numerical model is a cylindrical, single well, fine gridded, simulation model run on the Eclipse E300 compositional simulator. The base case study comprises a rich gas condensate fluid (GOR ~ 1000 Sm^3/Sm^3), an initial gas-in-place volume of 750 MSm^3, and reservoir permeability of 10 mD. A gas flow rate of 0.5 MSm^3/day is leading to a production period of about 4 years. A comparative study is performed by varying parameters such as pressure development, development of bank of immovable oil both radially and as function of time, condensate blockage effects, and gas and condensate oil production and onset of reduced well deliverability. Sensitivity analysis are performed by studying variation in the productivity index, non-Darcy and mechanical skin, and sensitivities related to permeability.
It has been confirmed in this study that condensate blockage has a direct and negative impact on well deliverability, where both the plateau period and the bottom hole pressure are reduced. We also show that the analytical model compares well with the numerical models and that many features describing gas-condensate banking and well deliverability are adequately described in the model. The analytical model also offers insight into the process of reservoir liquid storage in gas condensate reservoirs.

Keywords: *gas condensate, two phase fluid flow, condensation, reservoir condensate saturation, effective permeability, gas and condensate production, linear dynamics, numerical simulation*

Jann Rune Ursin: **Recognizing and describing processes in producing and abandoned oil- and gas reservoirs that may cause environment footprints and identifying technologies to impair these** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The content in this report was presented at the 3rd MUSE steering committee meeting at UoS, in Stavanger, December 10th, 2015. The project report consists of five individual reports, each focusing on various themes:

1. **Hydrocarbon Reservoir Behaviour during the Process of Abandonment and Thereafter**
   by Victor Chukwudi Anokwuru, IPT/TN/UoS
2. **Monitoring Techniques Applied to CCS-EOR**
   by Intergrity Obara, IPT/TN/UoS
3. **Risk Assessment**
   by Emil Gazizullin, IPT/TN/UoS
4. **Environmental Considerations of CO_2 Projects**
   by Oduro Takyiwa Susanna, IKM/TN UoS and Yen Adams Sokama-Neuyam, IPT/TN/UoS
5. **How to Reduce the Likelihood of Environmental Impacts During Plug and Abandonment**
   by Alexander Steine Johnsen, Preben Emil Haugen and Jann Rune Ursin, IPT/TN/UoS

The reports are all written under supervision of the WP2 project leader. All reports are based on open sources; local (UoS) reports, publications available on the internet, official publications and journal papers, and communications with a great number of individual resource persons in the Norwegian oil and gas industry.

The relevance of the work presented in the above mentioned reports, in relation to the MUSE project objectives is, as far possible, promoted through carefully following the project description (part of the AGH–UoS partnership agreement) and with reference to a preliminary WP1 progress report from mid February 2015; WP1-Selecting reservoirs for application of CO_2 storage with IOR technology and feasibility studies.
The work in the MUSE project is accomplished through the willingness and skills of UoS department master students, hired as project assistants. Fortunately for the project there are quite a few high class student, capable of writing high quality technical reports at UoS.
The five reports are presented sequentially and all reports are the responsibility of the author and all reports are approved by the WP2 project leader.

Keywords: *MUSE Projects, oil and gas reservoies*

Niezgoda T., Miedzińska D., Stanisławek S., Kwietniewski M.: **Overview of issues related to mixing CO_2 and proppant in the method of gas extraction from shale rocks** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

To increase the efficiency of fracturing process, proppant materials are added to fracking fluid. This admixture allows to keep developed fracks, that tend to lock, opened. The aim of this overview is to present methods of carbon dioxide and proppant mixing. The most often applied methods are as follows: special medium admixing, direct proppant with CO_2 mixing. Liquid CO_2 and proppant blenders are currently commercially used, but are not very popular.

Keywords: *carbon dioxide, proppant, gas, shale*

Kulynych V., Maruta M.: **ALOHA – modern tool for modeling the risks associated with the spread of volatile pollutants in extraction of hydrocarbons** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

During the drilling works or exploitation of hydrocarbons working devices such as high-performance engines of drilling equipment and machines are often the main sources of gaseous and particulate pollutants emitted into the atmosphere. At the time of an emergency, eg. gas leakage or eruption in a short time in the atmosphere can get high concentrations of gases such as methane and hydrogen sulphide.
The Ordinance of the Minister of the environment dated 29 January 2013 determines the basic criterion for risk of H_2S assessment in mining companies extracting oil or natural gas, where is possibility – during the eruption of open holes or wells-flow on the surface of the liquid containing hydrogen sulphide, posing a hazard to workers, the mining plant traffic and people staying close to driving traffic mining plant.
The paper presents the modelling of the spread gases in the atmosphere during the "normal" operation on drilling rigs and the gas leakage from the damaged pipeline. Was also made an attempt to mark safe points of the evacuation out in the moment of the emergency incident.

Keywords: *ALOHA, environmental monitoring, the threat of hydrogen sulphide, methane*

Kondrat O.R., Hedzyk N.M.: **Enhanced natural gas recovery from low-permeable reservoirs** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

This paper presents the analysis of challenges concerning development of natural gas fields with low--permeable reservoirs and experimental results of conducted laboratory researches, which provide the opportunity to establish regularities of adsorption-desorption processes in tight sands and develop technologies that enable increasing gas recovery factor from low-permeable reservoirs.

For this purpose, a series of laboratory experiments were carried out on the sand packed models of layers with different permeability (from 9.7 to 93 mD) using methane, nitrogen and carbon dioxide. The pressure in the experiments varied from 1 to 10 MPa, temperature – 22–60°C. These studies revealed the influence of pressure, temperature, reservoir permeability and non-hydrocarbon gases injection rate on the course of adsorption-desorption processes and their impact on the gas recovery factor.
The obtained results of conducted experiments show high efficiency of non-hydrocarbon gases injection to enhance gas recovery and feasibility of their application in the natural gas field with low-permeable reservoirs.

Keywords: *low-permeable reservoirs, desorption, gas recovery factor*

Buitrago Gomez L.A., Miska S.Z., Ziaja M.B.: **Experimental study of layouts of PDC cutters in core bit drilling** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Over the past two decades, various single cutter force models have been developed that consider formation properties and bit characteristics. These models have been extensively used to describe the interaction of a Polycrystalline Diamond Compact (PDC) bit with formation rocks; however, their use to predict bit drilling efficiency is usually inadequate.
There is an ample of field evidence that the density and layouts of PDC cutters affect drilling efficiency. Still, however, there is no reliable model of the PDC bit performance allowing determination of these bit design features for a specific bit's applications. In order to better understand the relationship between rock properties and PDC cutter layouts for different bit applications, laboratory drilling tests were performed with PDC core bits. The concept of an eight-blade PDC core bit was used to build a bit with a common body and replaceable heads. Core-bit design features such as: bit, cutter size, and cutter geometry were constant. In this study, the full-scale test rig facility at the University of Tulsa was used to obtain consistent data for six different layouts of PDC cutters.
Operating parameters, such as the rate per minute (RPM) and weight on bit (WOB), were varied and performance parameters (rate of penetration (ROP) and bit torque (TQB)), were measured at each time step with the frequency of 10 Hz. The ROP were calculated as a function of bit displacement over time. All operating parameters were recorded as part of the data acquisition platform. Depth of Cut (DOC) was calculated from ROP, and the average WOB and TQB were estimated at each depth of cut. Tests were performed on two different rocks: Bedford and Carthage Limestones.
For the purpose of comparing performance among different cutter layouts, we experiment with a maximum of four different depths of cut, which corresponded to four different weights on bit. The tested layouts allowed a constant maximum DOC per cutter of 0.25 in. Water was the drilling fluid for the entire experimental phase.
The results showed that under the same drilling parameters, the cutter layout plays a key role in drilling efficiency. Strong linear relationships were found between DOC, WOB and TQB at different conditions that were characteristic of the specific bit design. Also, the PDC cutter layouts affected the relative drilling performance differently for different rock properties.

Keywords: *PDC cutter, cutters layout, PDC bit, coring, drilling efficiency*

Kopey B.V., Kryvonozhko T.A., Liakh M.M., Yuriev E.V.: **Mathematical model of gas--liquid-sand mixture separation in the four-phase separator of inertial type for subsea application** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

In this article the construction and mathematical model of four-phase separator is realized, which is based on inertial separation mechanism of gas-liquid-sand mixture. Also we have put the problem on the basis of this model to obtain the dependence of separator efficiency on the parameters which play a crucial role in the technological process of separating gas-oil-water-sand mixture into a solid, liquid and a gas phase.

Keywords: *separator, four-phase, efficiency, subsea, oil, gas, water, sand*

Włodek T., Łaciak M., Kurowska K., Węgrzyn Ł.: **Thermodynamic analysis of hydrogen pipeline transportation – selected aspects** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Nowadays we can observe an increasing seek for a new alternatives for the sources and devices of energy storage. One of those sources is hydrogen which can be used in process of energy storage (analogous for compressed air). Hydrogen energy storage facility (in most cases – salt caverns) is often located at long distance from hydrogen source. Due to high amount of hydrogen to be transported transport by tank trucks must be rejected because of its low efficiency. The optimal way of hydrogen transport is pipeline transportation. Hydrogen can be transported by pipeline as a pure fluid or as a component in natural gas mixture. The main target of this paper is the thermodynamic analysis of hydrogen pipeline transportation as a pure fluid or as component of natural gas. Provided analysis includes pressure drop and temperature changes for different assumed cases of hydrogen pipeline transport.

Keywords: *hydrogen, hydrogen transportation, hydrogen pipeline transport, pipeline*

Duse D.M., Duse C.S.: **Open Educational Resources (OER) in gas and petroleum engineering education** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The education and the training of the new generations is already visible to be challenging, due to the changes in the psychological profile of students and to the needs that they have regarding education. The computer is present in the lifes of the young people from a very early age, leading to the meaning it gets form the current and prospective students, the "Z" Generation. Therefore talking about Open Educational Resources is not just an idea, as it increases into a constant in education in general, but particularly in engineering educatio. This paper aims to present the actual directions of open education in Oil and Gas Engineering, and to focus the attention on the future needs.

Keywords: *Open Educational Resources, engineering education*

Lankof L., Polański K., Ślizowski J., Tomaszewska B.: **Possibility of energy storage in salt caverns** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

In this article the methods of energy storage in salt caverns in the form of hydrogen, compressed air and natural gas were compared. Also the general issues concerning the geological, ecological and legal requirements for the storage of substances in rock salt deposits as well as the possibility of analyzed substances storage in the Zatoka Gdańska region and in the Goleniów salt dome were discussed. Moreover the suggestions concerning management of the brine coming from caverns leaching were also presented in this article.

Keywords: *energy storage, salt caverns, natural gas, compressed air, hydrogen*

Ziaja J., Movchan V.: **Pulling force simulation of jet bits in radial drilling technology** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Radial drilling technology, of which the jet bit is the key device, is a research focus in the field of oil drilling and production. This paper shows mechanical equations for jet bits and analyzes the behavior of water while passing the jet bit. Were set up few important conclusions. The generation of the pulling force

is mainly due to the inlet pressure of the jet bit; the backward jets can significantly increase not only the pulling force but also the stability of jet bits. The pulling force would reach 311 N while sumilation, which can steadily pull the high-pressure hose forward.

Keywords: *nozzle head, flexible hose, słmulation*

Kuczyński S., Liszka K., Łaciak M., Oliinyk A., Strods R., Szurlej A.: **Technological and safety aspects of CNG home fast refueling units** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Despite all global economic shifts and the fact that natural gas is recognized worldwide as the main and the leading alternative to oil products in transportation sector, there is a huge barrier to switch passenger vehicle segment to natural gas – the lack of refueling infrastructure for natural gas vehicles. The key to solving that problem and providing barrier breaking refueling infrastructure solution for natural gas vehicles (NGV) is home fast refueling units. It operates using natural gas (methane), which is being provided through gas pipelines at client's home, and electricity connection point. It enables an environmentally friendly NGV's home refueling just in minutes. The underlying technology is one stage hydraulic compressor (instead of multistage mechanical compressor technology) which provides the possibility to compress low pressure gas from residential gas grid to 200 bar for its further usage as a fuel for NGVs. More than efficiency and convenience, the direct hydraulic compressor technology provides compelling cost and lifetime advantages as well as superior convenience over other solutions.
Aims of this article is to compare technical, technological and safety aspects of home refueling units and estimate a perspectives of natural gas vehicles as an alternative for regular vehicles.

Keywords: *CNG, natural gas, safety, natural gas vehicles*

Kowalski R., Liszka K., Łaciak M., Oliinyk A.: **Pressure regulating station at actual conditions** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

In order to avoid improper work of some appliances in pressure regulating stations, it is needed to heat up the gas stream before its pressure decrease. This is done by heating system, which consist of natural gas boiler, heat exchanger, pipes and the working medium that circulate in the system (describing in simple terms). Surfaces of thermally uninsulated heating system have temperature above ambient temperature, what could be the cause of heat loss. This paper presents the results of performed calculations, based on data obtained from the test rig, which has been mounted in the working pressure regulating station. Test rig has been designed in such a way, that it is possible to calculate total heat loss of the heating installation and thus determine the energy efficiency of natural gas heating process.

Keywords: *heating system, pressure regulating station, gas pressure station, heat loss, energy efficiency*

Gonet A., Fijał J., Jamrozik A., Stryczek S., Bilstad T.: **Categorization of the drilling waste as a criterion of selecting the methods of their detoxication, recovery and management** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Being aware of the problems affecting our environment, novel technological solutions have been dealt with to improve its quality. Mining is a sector generating substantial volume of waste and it also refers to drilling operations. On the basis of laboratory investigations and the analyses of legal regulations, three categories of drilling waste have been distinguished depending on the environmental impact of the waste and on the potential technologies of their treating and successful utilizing. The essentials of the solutions proposed

have been presented and for each of the categories a processing flow chart has been prepared. At the ends of the processing lines, the flow charts specify the possibilities of utilization of the final products.

Keywords: *categorization waste, drilling waste, management drilling waste*

Rzepka M., Stryczek S., Kremieniewski M., Wiśniowski R., Dębińska E.: **Recipes of cement slurries for sealing casing in deep wellbores** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The authors of this paper discuss issues connected with the sealing of deep casing columns. The results of analyses of cement slurry recipes recently used for sealing wellbores in Poland have been presented. Laboratory experiments were performed on samples at temperature 90–120°C and pressure 60–70 MPa. Recipes of slurries were worked out at the Oil and Gas Institute Section in Krosno and Cement Services (EXALO group). Slurries were based on 10% NaCl brine with such additives as:

- 20–25% of latex (prevents gas migration and lowers filtration);
- silica powder (increases thermal resistance of hardened cement slurry at high temperature);
- hematite (weighing material: 30–110% of cement mass);
- microcement (sealing up the cement matrix).

The G type HRS drilling cement, meeting standard 'PN-EN ISO 10426-1 "Oil and gas industry" – Cements and materials for cementing wellbores', was used as a binder. The density of the presented slurries ranged between 2050 and 2350 kg/m^3, plastic viscosity a hundred or so mPa·s and thickening time from 3.5–6 hrs. The filtration of slurry oscillated between 30 and 40 cm^3/30 min, with zero water settlement. The compressive strength of hardened sealing slurries was high (frequently over 30 MPa).
The detailed analyses of slurries and hardened cement slurries as well as works on the improvement of recipes, resulted in the systematic improvement of the quality of cementing jobs on production casing in deep wellbores on hydrocarbon deposits.

Keywords: *cement slurries, deep wellbores*

Wysocki S., Wójtowicz A., Gaczoł M.: **Influence of ionic hydration's inhibitors on swelling of clays and shales** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Mud designed for drilling in clay rock and weakly compacted rock are developed based on inorganic or organic additions in order to improve inhibition of clay hydration. The paper presents the research results of influence of ionic hydration's inhibitors on swelling of clays and shales.

Keywords: *drilling mud, hydration inhibitors, shales*

Śliwa T., Decan G., Sapińska-Śliwa A., Bieda A., Kowalski T.: **Comparative analysis of borehole heat exchanger use in different climatic conditions** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The climatic conditions and the heating and cooling load between Ghent, Belgium, and Krakow, Poland, are compared. The cost of heating and cooling is calculated and compared. Heating in Belgium is done by using natural gas, just like in Poland, but due to higher gas prices, cost of heating is higher in Belgium than in Poland. That is why an interesting alternative for heating and cooling, namely borehole heat exchanger coupled with a heat pump, is calculated. This seems to be an economic and environmentally friendly alternative for heating and cooling.

Keywords: *borehole heat exchanger*

Ştefănescu D.P., Maulidani O.A., Audrey B.: **Compressor application for extending production life cycle in mature fields** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

Mature gas fields are subject to network backpressure fluctuation causing liquid loading condition. The liquid loading, theoretically, occurs when the gas velocity is below its critical velocity which commonly happens in mature fields when rates become "low". Based on Turner or Coleman's equations, the critical velocity is proportional to the wellhead flowing pressure. This means, when the wellhead pressure increases as the result of higher external (sales) pressure, then the critical velocity will be higher. This condition will give a "pseudo" production decline of the wells.
Gas compression is among the best fit-for-purpose solution to overcome the above challenges. Gas compression will help to reduce the wellhead flowing pressure which increases the gas velocity above the critical velocity as well as the well gas rate by lowering the bottomhole flowing pressure. The wells will be capable of unloading the liquid inside the wellbore and the reservoir will suffer a higher pressure drawdown. Moreover, the wells will not be impacted by the external pressure fluctuation as long as this latter is below the compressor discharge pressure.
Gas compression has been implemented in Laslau Mare mature gas field to extend the production life cycle. 5 wellhead compressors have been installed since 2010 and 1 group compressor since 2014. Both types of compressor show positive results. This paper explains the application of compressor in Laslau Mare field starting with candidate selection up to cash flow analysis. A big emphasis will be given to the compressor/well performance.

Keywords: *mature fields, gas compression, production life cycle*

Ştefănescu D.P., Nitulete A.: **Noninvasive stimulation opportunities in a marginal gas field** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The Laslau Mare field is a brown gas field in the Transylvanian Basin. The field was developed in the 1970s and the production consists of more than 99% methane gas and low WGR (average of 0.03 m^3/kscm). Current reservoir pressures are at a less than a third of initial values.
As in any mature field with increasing water production and reservoir pressure depletion, several degrees of formation damage and tubular obstructions have been observed. Mud invasion, plugged perforation, water blockage and scale precipitation at the near wellbore region are factors impairing wells to produce at potential.
Adding to the above the fact, the reservoir is water sensitive (low reservoir pressures and water wet reservoir). Severe constraints on production were seen when performing any sort of operation requiring the use of water based fluids, as severe losses occur. These procedures have always given post-job challenges to production engineers. Skin induced by mud or liquid losses is highly affecting wells post job performance. Long recovery times have been observed following workovers' operations in Laslau Mare (0.5 to 2.5 years recovery for workovers and one to three months for wash treatments).
Perforation and re-perforation operations are one of the best way to overcome the formation damage, bypass the invaded zones and open new production zones. Historically, perforation was done with casing guns in overbalanced condition. This practice induces immediately a skin created by fluids losses and prolong the flow back periods making the stimulation much less effective. Another methodology is to run through tubing guns and perforate in underbalanced conditions with smaller guns being limited by the completion size. In the latter case, the perforation performance are much less than the casing gun ones. In both cases, the full potential of the well is not achieved.
A newer methodology is introducing re-perforation/perforation with casing guns in underbalanced, dry conditions, within snubbing operations. The methodology allows instantaneous gain of production and maximizes well recovery factor in the long term. Two pilot operations were executed with very good results and promising opportunities arise for candidate wells in the field.

Keywords: *noninvasive simulation, Laslau Mare field, Transylvanian Basin*

Blacharski T., Janusz P., Kaliski M., Zabrzeski Ł.: **The effect of hydrogen transported through gas pipelines on the performance of natural gas grid** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The increasing production of electricity from renewable energy sources has been accompanied by growing interest in technologies allowing the storage of energy. One of the means allowing its storage is the Power-to-Gas technology thanks to which the excess power may be converted into another energy carrier such as hydrogen. One possibility is to blend the resulting hydrogen with natural gas and inject it into the natural gas grid. The paper discusses both the effect that hydrogen blend has on the performance of gas pipelines, and the main thermodynamic events occurring while the mixture of hydrogen and natural gas is transported.

Keywords: *natural gas, transmission system, gas transport*

Şuţoiu F., Foidaş I., Avramescu M.: **Operations for improving the gas flow in the wellbore adjacent zone** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

During the whole period of a natural gas reservoir exploitation, from the start of production until the total reservoir energy depletion, may apear some phenomena which by their nature can affect the natural gas flow from the layer into the well.
The flow resistance greeted by gas in the adjacent borehole may have multiple causes.
In the majority of cases, geological elements are those which definitive influence the behaviour in exploitation of those reservoirs, so the existence of some traps due to the continuity and discontinuity character of the porous-permeable medium or to some reservoir parameters with low values, drasticaly reduces the posibility of extraction of a bigger volume of geological gas resource.
Also the exploitation performances of gas reservoirs, through different wells, are major affected because of the skin factor. This produces an increased flow resistance in the adjacent zone of the borehole which is a plus to the resistance caused by the hydrodynamic imperfection to the mode and open degree of the productive layer.
During the maturity stage of natural gas reservoirs, a special attention is granted to prevention and control of this unwanted effects which may affect natural gas flow from the reservoir into the well, through different operations.
The stimulation of these productive layers through different operations aiming the reduction of geological nature constraints, thereby become a complex approach having the finality the increasing of exploitation performances itself.
In Romgaz were tested and are used a series of stimulation technologies of the productive layers. From there historic we conclude that perforations or re-perforations using deep penetration tools, acidizing and nitrogen injection are applied with success to the productive wells.
Regarding the increasing of the recovery factor for wells with high water income or for wells with mixed flow regime or with water drive regime, were successfully tested the polymer injection technology that helps to maintaining or optimising the productive wells.

Keywords: *natural gas resource, well operations, stimulation technologies, perforations, re-perforations, acidizing, nitrogen injection, polymer injection, skin factor, recovery factor*

Cepil M., Rybicki C.: **Application of compact separators in development of nonconventional gas reservoirs** • AGH Drilling, Oil, Gas 2016 • Vol. 33 • No. 2

The installation to the collection and transport of gas in case of the evil conventional occupies a great many places. When we are meeting variable factors in time e.g. with the efficiency this we are in a position

to propose installations smaller and divided into modules which in case of the reduction of the quantity of extracted gas would be able to to be deducted in the easy way or augmented of the existing installation. Economic aspects engaged searches of more effective installations to the cleaning and the drainage of gas. Already from the early 90s of the 20^{th} century, the oil industry sacrificed many attention to methods of the separation. This permitted the discovery of such separators as Gas/Liquid Cylindrical-Cyclone (GLCC). In comparison with conventional, compact separators are easy in the installation and the service, require the small maintenance. The simplicity of the construction, smaller measurements and the balance GLCC provides savings of costs.
In the paper authors will review solutions of compact separators and also the preliminary adaptation and the definition of measurements for given parameters of technological exploited of natural gas reservoirs.

Keywords: *compact separators, nonconventional gas reservoirs*