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Gas Transportation System of Transition to "Green Technology"

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Abstract: *The gas transmission system consists of a complex structure. In the Republic, the gas transportation system consists of a three-stage system, since already in the world almost many states have switched to a two- or one-stage system.*

The article presents data on the gas transmission system, their impact on the environment. And also the feasibility study and the transition to green technology are given.

Keywords: *Gas, Green technology, system.*

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Introduction

Industrial pipelines are divided into two groups: metallic and non-metallic. The main features of metal pipes are strength, non–metallic pipes are corrosion resistance and, as a result, their durability [1-6].

Using pipes, a person managed to ensure the supply of water, oil, gas and other substances in the direction he needed. Pipes were made of almost all kinds of materials that humanity had discovered. At the beginning of the application, the pipes were wooden, then clay, copper, bronze, glass, cast iron, concrete, steel (since 1852), asbestos cement, reinforced concrete, polyvinyl chloride, since 1952, high-pressure polyethylene pipes have been used in Germany and America, since 1955 from low-pressure polyethylene, since 1958 from propylene, since 1972 from polybutene. Metal-polymer multilayer pipes have been used in England since 1979. In Russia, metal-plastic pipes have been manufactured since 1981, and biplastic pipes since 1991.

The requirements for the convenience of transportation, storage, installation and operation of pipes are constantly increasing, as well as reducing the costs of construction and operation of pipelines.

In the second half of the XX century, with the growth of the possibilities of organic chemistry, pipes made of polymer materials began to be used in the construction of technological pipelines.

Polyethylene is a thermoplastic polymer material that is obtained by polymerization of ethylene. During the technological process, ethylene molecules polymerize into a high-molecular compound and form polyethylene.

Such a polymer is considered linear, PE63 polyethylene is produced on the basis of a linear structure. By changing the parameters of the polymerization technology - pressure and temperature - they get:

- high-pressure polyethylene (HDPE);
- medium-pressure polyethylene (LDPE);
- low-pressure polyethylene (HDPE).

The gas supply system must ensure uninterrupted gas supply to consumers, be safe in operation, simple and convenient in maintenance, must provide for the possibility of disconnecting individual elements or sections of gas pipelines for repair and emergency work:

Now, the gas supply of the city in the Republic consists of a three-stage system. This consists of the following steps below: the gas of the main gas pipeline with high pressure through the gas distribution point with a pressure of 3-12 kcm / cm2 is supplied to the gas pipeline with medium pressure. With an average pressure, the gas pipeline through the hydraulic fracturing with a pressure of 0.05-3 kcm /cm2 is supplied to the gas pipeline with low pressure, through the hydraulic fracturing with low-pressure gas (up to 0.05 kcm /cm2) gas is supplied to consumers.

Low-pressure gas pipelines transport and distribute gas to residential, public buildings and consumer service enterprises. In the gas pipelines of residential buildings, a pressure of up to 3 kPa is allowed, and in consumer service enterprises and societies, buildings - up to 5 kPa. Usually, the networks maintain a low pressure of up to 3 kPa and all these buildings and enterprises are connected to the gas network directly without pressure regulators.

In accordance with the Decree of the President of the Republic of Uzbekistan dated October 4, 2019 PP-4477 b "On approval of the strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030", the task was set to modernize the infrastructure of industrial enterprises, ensure their sustainability by increasing energy efficiency by at least 20% and wider use of clean and environmentally friendly technologies and industrial processes, as well as the introduction of green technology, that is, reducing atmospheric emissions, discharges into water and waste.

Materials and methods

Ensuring reliable and safe operation of pipelines transporting valuable hydrocarbon raw materials to the consumer is the most important strategic direction for the stable development of the regions of the Republic of Uzbekistan. And only an integrated approach to this issue, taking into account the specifics of the region where the pipeline route passes, will be able to give a real picture of the reasons leading to the disruption of stable operation [7, 8].

The length of the gas pipeline in the Fergana Valley is 7,213 km. The capacity of the gas pipeline is 7,213 km. The peculiarity of this gas transmission system is the extreme operating conditions. The sharply continental climate is characterized by long summers. The average temperature ranges from 20 to 32 °C, while the average temperatures in the cold period are in the range from 0 to -10 °C [9].

All these conditions undoubtedly impose their own specifics during the construction of the pipeline system and determine a rather rigid approach when choosing the technological modes of operation of the gas pipeline, main and auxiliary equipment [10].

Ensuring the safety of this gas pipeline system is of great importance for the energy security of the Republic of Uzbekistan. Analysis of data for the last years of operation of the gas pipeline indicates the occurrence of various emergencies. Therefore, the task of this study is to classify the factors of

accidents and damage to gas pipelines with the determination of the main share of the most significant. To achieve this goal, it is necessary to conduct:

- classification of the causes of emergencies;
- analysis of the causes;
- determination of the main share of the most significant factors for each individual year of operation
- comparison of the results obtained in order to determine the factor with the maximum share of causes leading to emergencies.

A review of the literature on the analysis of cause-and-effect relationships of accidents in the main pipeline system revealed 5 main groups of factors, according to which researchers classified the causes of accidents and incidents [11].

The first group of the main causes leading to accidents and incidents is related to the violation of technological regulations during the construction and repair of gas pipeline facilities. The second group of causes of accidents that violate the safety conditions of transport and hydrocarbons includes corrosion and stress corrosion defects. Moreover, the authors separately, as a percentage, consider corrosion damage as a result of internal and external corrosion. The third group of factors includes defects in equipment and materials related to factory defects and violation of operating conditions. The fourth group is associated with violation of operating requirements and erroneous actions of maintenance personnel due to insufficient training or unfair attitude to a number of work performed. The fifth group of emergencies includes accidents and incidents resulting from natural disasters.

At this time, accidents mainly occur due to corrosion and stress corrosion defects as well as old equipment.

Research results

The proposed system of gas pipelines, that is, the use of polyethylene pipes for gas distribution networks will solve the problems of protecting them from corrosion, significantly increase durability, and minimize operating costs. As well as the transition of the gas distribution system to a two-stage one. A two-stage gas pipeline system is a high-pressure gas pipeline that transmits gas to a medium-pressure gas pipeline from here through a gas regulator; gas is supplied to the population.

In this case, if you take the gas supply system to the Republic of Uzbekistan, low-pressure gas distribution points (hydraulic fracturing) are dismantled and gas regulators are placed in front of gas meters. Gas regulators, as well as hydraulic fracturing, perform the function of pressure rationing.

The proposed gas pipeline system and two-stage system are much more efficient from an economic point of view.

Consider their maintenance and repair, as well as construction and installation work (1 km of gas pipeline; one worker).

Table 1. The cost of construction and installation works of steel and polyethylene pipes with a length of 1 km

№	Indicators	Steel	Polyethylene
		Ø 159	Ø 159
		Wide trench	Wide trench
1	Earthworks, sum*	3 411 965	3 411 965
2	Backfilling of trenches and ditches with the movement of soil up to 5 m by bulldozers with a capacity of 79 (108) kW (hp), 2 group of soils*	343 229	286 024
3	The device of the sand cushion under the pipe *	8 148 711	8 148 711
4	Installation of an underground gas pipeline *	39 094 699	1 101 418
5	Laying of gas pipelines from single polyethylene pipes into a trench, the diameter of the gas pipeline is up to 160 mm **	-	156 263 797
6	Laying of insulated steel gas pipelines with a nominal diameter of 150 mm in the trench **	220 115 238	-
7	Laying the signal tape	-	1 067 568
8	Laying of PV wire 2,5мм^2	-	13 004 367
9	Cleaning of the pipeline cavity by air purging	353 920	353 920
10	Installation of an inventory unit for cleaning and testing the gas pipeline	327 359	327 359
11	Pressure rise during air testing of low and medium pressure gas pipelines [up to 0.3 mpa] with a nominal diameter of up to 200 mm	104 769	104 769
12	Exposure under pressure up to 0.6 mpa when testing the strength and tightness of gas pipelines with a nominal diameter of 50-300 mm **	923 414	923 414
13	Incut	200 000	184 053
14	Other costs	49 412 447	38 291 894
15	Total	385 859 136	227 735 439
16	Electrochemical protection	80 000 000	-
17	Total with VAT	465 859 136	261 895 755

1. SHNK 4.02.01-04 "Earthworks";
2. SHNK 4.02.34-04 «Communication, radio and television facilities. Wired communication facilities»

3. SHNK 4.02.22-05 «Water supply - outdoor networks»

The tables show the costs of construction and installation work in addition, there are costs for their maintenance. As we know, steel pipes are subject to corrosion for their long-term maintenance, it is necessary to constantly make it more accurate to carry out electrochemical protection (EHS) every year. For carrying out EHS, there is equipment SKZ-5 or SKZ - 3, which consists at market prices of 80,000,000 sums per 1 km. And for polyethylene pipes, this installation will not be necessary, only you will need an iron for soldering plastic pipes, which costs 1,101,418 sums. Accordingly, if we use steel pipes, the cost of everything is for one km of the gas pipeline with its construction, as well as its maintenance, 465,859,136 soums, for polyethylene pipes it will be 261,895,755 sums.

Using polyethylene pipes with construction, as well as their operation of 1 km, it will be possible to save twice.

If you look at it from the point of view of ecology, then land resources are protected from corrosion, as well as emissions when switching to a two-stage system. On average, according to methodology No. 3018, 3600 m3/year (2.4048 tons/year) is emitted from hydraulic fracturing According to the resolution of the Cabinet of the Minister "On further improvement of economic mechanisms of environmental protection in the territory of the Republic of Uzbekistan" No. 202 dated April 12, 2021, the coefficient for each ton of methane is 0.0692. It looks like this:

Table 2. Emissions from hydraulic fracturing are compared to the transition of a two-stage system

Names	Methane emissions	Amount of compensation payments
Emissions before the use of a two-stage system	2,4048	47 094, 64
Emissions after the application of a two-stage system	-	-

The table shows the calculation for one hydraulic fracturing; an average of 3,500 low-pressure hydraulic fracturing in the regions, respectively, this amounts to 164,831,240 sums per year.

Conclusions:

Based on the above data, the following conclusions:

- using polyethylene pipes is much cheaper;
- their operation is much easier than steel pipes;
- the transition to a two-stage gas transportation system will significantly reduce greenhouse gas emissions, since we know that methane is considered the main greenhouse gas. Uzbekistan signed the agreements of the Paris Convention in April 2018, and there is such a paragraph: ... by 2030, greenhouse gas reduction by 10%. With this, we can reduce greenhouse gas emissions.

In accordance with the Decree of the President of the Republic of Uzbekistan dated October 4, 2019 No. PP-4477 B "On approval of the Strategy for the transition of the Republic of Uzbekistan to a "green" economy for the period 2019 - 2030", the task was set to increase the energy efficiency of the economy and rational consumption of natural resources through technological modernization and development of financial mechanisms." Based on this, the gas transportation system will also switch to a green economy by switching to a two-stage system and updating the gas transportation system.

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