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# METHODS FOR TRANSPORTING OIL AND GAS

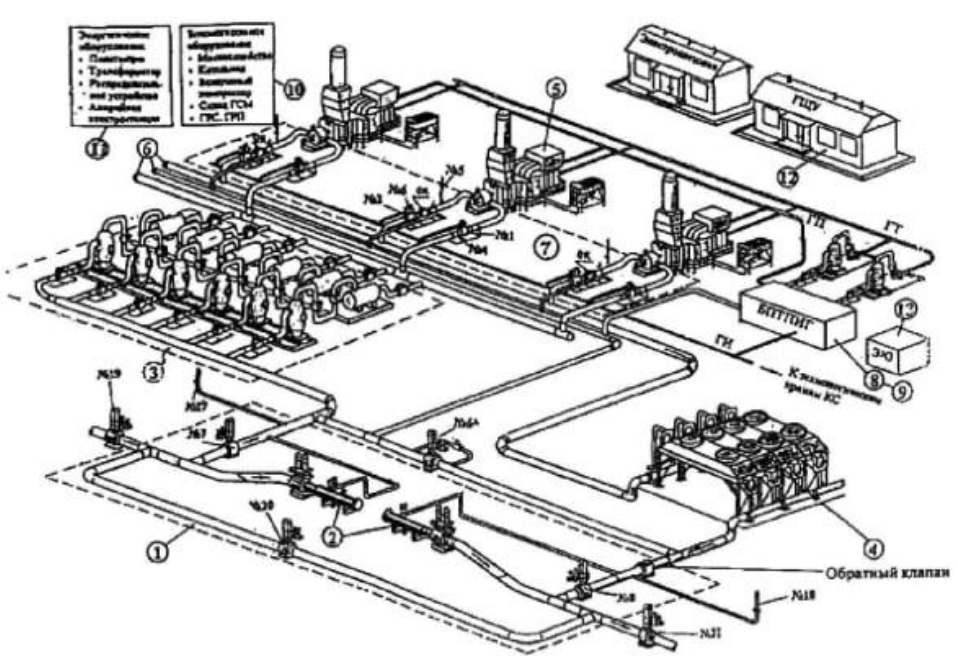
**Gulmira Kulbayeva Tarakhtiyeva**
Associate professor of Tashkent Technical University named after Islam Karimov

## ABSTRACT

An attempt has been made to explain to the scientific and technical establishment the fact that the fuzzy controllers with input/output parameters represented by the set of precise terms of automate control objects, which operative algorithm is verbally presented as a unique experience of experts in the domain, in simpler way, with higher speed, slighter error and less costs as compared with the standard fuzzy controllers.

**Keywords:** axial pumps, pumping, oil.

Currently, one of the main types of oil and gas transportation is pipeline. As the gas moves through the pipeline, it loses energy, overcoming frictional forces both between the gas and the pipe wall and between the layers of gas. Therefore, after a certain distance, it is necessary to build compressor stations (CS), where the gas is compressed.




**Picture 1**

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1 - Schematic diagram of the layout of the main equipment of the compressor station: 1 - node for connecting the compressor station to the main gas pipeline; 2 - chambers for launching and receiving the cleaning device of the main gas pipeline; 3 - process gas purification plant, consisting of dust collectors and filter separators; 4 – process gas cooling unit; 5 - gas pumping units;
6 - technological pipelines of the compressor station piping; 7 - shut-off valves for technological pipelines for piping units; 8 - installation for the preparation of starting and fuel gas; 9 - installation for the preparation of pulsed gas; 10 - various auxiliary equipment; 11 - power equipment; 12 - main control panel and telemechanics system; 13 - equipment for electrochemical protection of pipelines tying CS.

Calculations show that for pumping = 90 million nm/day, on a pipeline section of 1400 mm, = 100 km, it is necessary to spend power = 50 MW. With an increase in productivity by 30% of the design one, the power must be more than doubled while maintaining the final pressure, which leads to significant electricity consumption and an increase in the cost of one cubic meter of gas. But at the moment it is the cheapest way to transport gas and oil.

In addition to pipeline transport, special tankers are used - gas carriers. This is a ship on which gas is transported in a liquefied state under certain thermobaric conditions. But for this gas transportation, it is necessary to stretch a gas pipeline to the seashore, build a gas liquefaction plant on the shore, a port for tankers - gas carriers, and the tankers themselves. This type of transportation is considered economically feasible when the distance of the consumer of liquefied gas is more than 3000 km.

In 2017, Russian gas exports amounted to 208.6 billion cubic meters.m.

There are also other projects for gas transportation, for example, using airships, or in a gas hydrate state, but these projects have not been widely used for various reasons.

Oil transportation is also developing. With the growth of production, the volumes of transportation of petroleum products also increased, delivery methods improved. For a long time this was done in a very primitive, caravan way. Wooden barrels and waterskins were filled with oil or kerosene, loaded onto wagons and thus delivered to the place. Or on the water - in oak, and later steel barrels. This method of transportation was very expensive, the cost of petroleum products was too high. As a result, having started the production of kerosene first, Russia was not able to supply it at reasonable prices even to the domestic market: kerosene was purchased in

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America. In 1863 D.I. became interested in this problem. Mendeleev. As a way out, he suggested transporting oil products not in barrels, but in specially equipped holds of ships using the bulk method. This method of transportation was called the "Russian way". Ten years later, when the idea was implemented by the Artemiev brothers and fully justified itself, the method proposed by the great Russian scientist began to be used everywhere.

Another convenient way to transport oil products is rail transport. The geography of railway oil transportation from production sites to refineries, storage facilities or consumers is tied to the so-called oil and gas basins. The global volume of oil transportation by rail increases every year by 3-4%, and in Russia this figure reaches 6%. As a result, electricity consumption also increases.

Despite the convenience of the railway method of transporting oil products over long distances, oil products - such as gasoline, diesel fuel, or liquefied gas - are optimally delivered by tank trucks over short distances to the point of sale. Transportation of fuel in this way significantly increases its consumer value. The profitability of trucking is limited to a distance of 300-400 km, which determines their local nature - from the oil depot to the gas station and back. Each type of transportation has its pros and cons. The fastest air method is very expensive, requires special security measures, therefore this delivery method is rarely used - in cases of emergency or inability to deliver fuel and lubricants in another way. For example, for military purposes or in cases of actual inaccessibility of the area for modes of transport other than air.

Most oilfields are located far from oil refining or marketing sites, so fast and cost-effective delivery of "black gold" is vital to the prosperity of the industry.

Oil pipelines are the most cost-effective and environmentally safe way to transport oil. Oil pipelines are equipped with equipment for dehydration and degassing of oil, equipment for heating viscous grades of oil.

For pumping oil, taking into account heat recovery with simultaneous heating of oil to reduce its viscosity and increase the pumping speed due to this, it is advisable to use axial centrifugal pumps [1–7]. To maintain the required pressure, special pumping stations (NPS) are installed. Oil in them moves at a speed of up to 3 m/sec. under the influence of the difference in pressure created by pumping stations. At the beginning of the highway - the main ones, then every 100-150 km - intermediate ones. The length of the main pipelines in Russia is 217 thousand km, incl. 151 thousand km of gas pipelines, 46.7 thousand km of oil pipelines, 19.3

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thousand km of oil product pipelines. The structure of pipeline transport facilities includes 487 pumping stations on oil and oil product pipelines, tank farms with a capacity of 17.4 million m 3, as well as 247 compressor stations, 4053 gas pumping units and 3300 gas distribution stations. They are installed at intervals of 70–150 kilometers, depending on the topography of the route. At a distance of 10–30 kilometers, valves are placed in the pipelines, which allow shutting off individual sections in the event of an accident.

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