WAYS OF SAVING ON THE CONSTRUCTION OF PETROCHEMICAL PLANTS

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Bashkirian Oil Refineries

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The experience gained in the construction of oil plants in Bashkiria convinces us that several superfluous items which prolong the building time are tolerated in the design of both the separate plants and the technological units.

Some of these have the following causes.

The existing standard construction specifications in the Soviet Union, in particular the so-called fire protection specifications, are clearly obsolete. These standard specifications are not based on statistical data of economic studies and production experience, but are of historic origin and often have no foundation at all.

The obsolescence of these standard specifications becomes particularly evident when they are compared with analogous foreign specifications.

As a rule, a foreign plant of the same capacity and built according to the same technological plan occupies a 2-3 times smaller area and costs 20-30% less than a similar plant in the Soviet Union. Our construction standards specify much more space between the technological installations, production units, and tank parks; the waste gases to be flared must be carried away over larger distances, and the space between the separate components of the technological units must be larger, which makes these units less compact.

In most organizations designing chemical plants it has become a tradition to place most of the equipment inside buildings. As a result, the industrial experience accumulated in several plants, where a considerable part of the equipment was removed from buildings and placed in uncovered areas, is completely ignored.

Constructing a plant for the production of synthetic fatty acids from solid paraffins, the Giprozhir institute installed all technological units, inclusive of a multicolumn unit for the preliminary rectification of the paraffin to be converted, in a building with a volume of 80,000 m³. This was done recently, in spite of the circumstance that it is already an established practice in oil refining plants to place analogous units in the open.

To improve the sanitary conditions and the technological process, it was found necessary during construction and operation of this plant to remove part of the apparatus from the building and to place it in the open. In Bashkiria we also moved many parts of various plants from buildings to open areas.

The existing experience on the construction and operation of equipment in open areas must be utilized more generally. In petrochemical plants and oil refineries the pumps, manifolds, power substations, a considerable part of the cooling and heat exchange equipment, the rectification columns, etc., should be located in open areas, while light buildings of plastic glasses and other light synthetic materials should be constructed for part of the equipment.

We calculated that the building cost of the plant can be reduced by 15-20% and the operation costs be markedly lowered by removing the equipment to the open.

The utilization of air-cooled condensers in our industry is of special importance.

It is known that oil refineries and chemical plants require a large amount of water. It suffices to mention that up to 60,000 m³ of water/h are circulated in a modern plant. The pumps circulating this water consume a large amount of electric energy, the cost of which amounts to about 6-8% of the total cost of refining 1 ton of crude oil.

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Owing to the large consumption of cooling water, the amount of waste water in the water containers increases, which makes it necessary to construct very expensive purifying installations. In addition, cooling towers, circulation stations, oil separators, and receivers of large diameter and capacity are necessary for the circulation of water.

The cost of these installations in the “Twelfth Meeting of the Communist Party of the Soviet Union” Oil Refinery in Ufa, for example, constituted 12.7% of the total plant investment.

These costs can be noticeably curtailed by the extensive use of air-cooled condensers instead of water coolers; the Institute of Engines for the Oil Hydrogenation Industry has collected the technical documentation and worked out the specifications for the construction of air-cooled condensers.

It is known that in foreign countries these condensers have found extensive application and that modern plants are constructed where preferably only these condensers are used. However, our machine industry manufactures only a small number of these installations so that it is not to be wondered at that the engineering organizations do not include these condensers in the technological units and equipment designed by them.

It is necessary as soon as possible to organize the production of air-cooled condensers and to utilize them extensively in plants.

The cost of petrochemical plants may be further considerably reduced by installing waste heat boilers and utilizing the waste heat in the production of steam.

Petrochemical plants consume large amounts of heat. Thermal power stations of high capacity are usually built in the neighborhood to provide the steam needed by the plants. At the same time the petrochemical plant wastes a vast amount of heat which might be used for the production of steam, together with the waste gases and the cooling water.

In our visits to several foreign oil refineries and petrochemical plants we found that these plants extensively use waste heat boilers for the production of steam, so that the resources are utilized very efficiently.

In our oil refineries and petrochemical plants, waste heat boilers are installed solely in separate technological units and they normally operate inefficiently owing to constructional shortcomings and poor exploitation.

In foreign countries, waste heat boilers are installed in almost all combustion units, including aviation fuel, thermal and catalytic cracking, platforming, gas turbine units, etc.

The profit attainable by installing waste heat boilers can be estimated from the following data.

People engaged in rationalizing the Novoufa oil refinery designed a waste heat boiler of relatively simple construction and proposed to install this boiler in order to utilize the heat of the stack gases exhausted from the tubular furnaces of the thermal cracking unit.

According to their calculations, this boiler can produce 18 tons of steam per hour at 12 atm., i.e., precisely the amount of steam provided by the power station to the cracking unit. Realization of this suggestion would save 182,700 rubles per year, and 13,680 tons of fuel/year. The waste heat boiler unit recompenses its cost with approximately 7 months operation.

It should be noted that foreign catalogs are hardly consulted in designing novel technological units in our country and that utilization of highly efficient apparatus and engines used in world-wide practice is not considered in the plans.

The circumstance that the designs are oriented solely on equipment produced in series in our country and not on the development of the most ideal apparatus constructions or on the purchase of the most suitable equipment from foreign countries in many cases adds enormously to the construction cost and prolongs the times of constructing and starting up new production plants.

This may be illustrated by the following example.

The Leningrad Gas Hydrogenation Plant designed a typical catalytic cracking unit with a consumption of 300,000 tons of starting material per year. All the basic parts of this unit meet the modern requirements; exceptions are the compressors for the circulation of the hydrogen-containing gas. In foreign countries, a single compressor of the rotation type, placed in the open or in a light building with plastic glass walls, is used for this purpose.