Textile process and electrical equipment used in the development and production of the textile industry in Uzbekistan

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Abstract. The article identifies ways to increase energy efficiency in textile industry. The power consumption modes of the electrical process devices involved in the technological processes were analyzed and the most efficient operating modes were identified. In addition, the technological process in the textile industrial enterprise was analyzed, adapted to the consumption of the most electricity, and the sequence of energy consumption was compiled and analyzed.

1 Introduction

We know that textiles are one of the biggest drivers of our economy and development. Previously, Uzbekistan ranked 6th and 3rd in terms of cotton exports, respectively. However, over the last 10 years, exports of raw materials have been declining, with an emphasis on exports of processed products. This is because the price of 1 kg of fiber in the world market is around $ 1.5, while the price of the finished product is around $ 25. In other words, we can see that the existence of a large economic force in the textile sector is reflected in prices.

2 Experimental research

There is a lot of legal support in our country, which is reflected in the following. In other words, in accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 211 of July 25, 2011, the Ministry of Economy of the Republic of Uzbekistan together with the World Bank launched the project "Improving energy efficiency in industrial enterprises." Another example is the Decree of the President of the Republic of Uzbekistan No. PF-5282 dated 14.12.2017 on the completion of JSC "Uzbekyengilsanoat" and the establishment of the Association "Uztextile Industry". Also, on 22.08.2019, the President of the Republic of Uzbekistan signed a resolution "On urgent measures to increase energy efficiency in the economy and social spheres, the introduction of energy-saving technologies and the development of renewable energy sources." The above reforms, well-chosen strategies and clear management have shown a positive growth trend for the country's textile companies. An example of this is the results of January-October 2019 and 2020 in the textile industry in our country. In January-October 2020, a total of 4,886 textile enterprises in the Republic of Uzbekistan produced goods worth 26.9 trillion sums. Compared to January-October 2019, the physical volume index was 112.3%. In January-October 2020, exports of textile products amounted to $ 1524.7 million, accounting for 11.4% of total exports of the Republic, an increase of 15.9% over the same period last year. Also, at the beginning of the year, 522 different types of textiles were exported to 65 countries [1-7].

Fig.1 shows the share of spun yarn, semi-finished products and finished textile products in Uzbekistan in 2020.

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Fig. 2. Textile products produced in Uzbekistan in 2021

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The role of ready-made products in the field of Textiles is growing, as far as we are concerned. From the above data, it can be seen that the importance of the technological process of textiles is reflected in the figures. This technological process consists of the following: The process of production in textiles is divided into 5 main sequences. These include: cleaning, spinning, weaving, wetting, and garment manufacturing [8-16].

Fig. 3. The process of converting cotton into a finished raw material in general

Number 1 and 2 show primary and secondary energy consumption. That is, A, B, and C are the main consumers in the spinning, measuring, weaving, wetting, and garment manufacturing processes. Heating and cooling, sanitation, transportation, outdoor work, etc. are secondary energy consumers. Each stage has its own individual energy consumption, for some need a lot of electricity, others need heat. The spinning process consumes more electricity with different steps. The amount of electricity consumed in this process varies depending on the type of spinning system, the different and two-part operation of the machine, the preparation of the yarn and the characteristics of the raw material. On average, in the production of 1 kg of individual yarn, the spinning process and the various processes of the machine account for 80% of energy consumption. Dimensioning is the main process between spinning and weaving. The measurement process often requires steam generated by gas, oil, or electricity before bending. The weaving process requires only electricity. The room temperature is controlled at 25°C and humidity 65% [17-25, 45].

The humidification process requires the consumption of hot water, steam, and hot air. The mechanical part of the humidification process consumes electricity. This process consumes less electricity than other processes.

The garment manufacturing process includes stocking, cutting, sewing, vacuuming, ironing and transportation. Only heating and ironing may require steam and hot air.

Textiles are fabrics made of woven yarn. Fabric production is not an easy process, so scientists and devices are being developed by scientists around the world to facilitate this process. The following is information on equipment used in the textile industry [26-35, 44].

The spinning process is the basis of fabric production, because it consumes the most electricity. This is the process by which a long yarn is formed - a yarn woven from short fibers. This production process is done on a spinning machine. This modern machine has a capacity of 18 kW, weighs 12 tons and has 240 rotating shafts and up to 1,800 revolutions per minute, and costs $ 60,000.

Fig. 4. Spinning machine

The weaving machine is designed for the production of textile fabrics, it can be loosing and without loosing, round and flat, wide and narrow. Knitting machines are selected depending on what fabric should be produced: linen, silk, cotton or wool. The following is a modern weaving machine called ST-ERL-808 with a maximum speed of 800 RPM. The width of the fabric is from 600 mm to 1200 mm. Moreover, there are several fabrics getting produced in textile manufacturing industries including woven fabrics, non-woven fabrics, and knitted fabrics. To produce all those fabrics, heavy machinery is used by the textile manufacturing industries in many countries. Presently, there are several weaving machines...
that are dominating the textile market. However, majorly they are divided into three basic types- Circular, Shuttle, and Narrow Fabric. a) Circular loom: This machine contains several circulating shuttles that move around the periphery disseminating the weft. The major concern of this machine is producing tubular fabric and thereby getting used to produce seamless fabric products such as clothing, fire hose, hosiery, sacks, etc. The modern circular machine uses electromagnets for high-speed fabric production. The speed of this loom is manageable and hence preferred by many of the textile manufacturing industries in many countries. a) Shuttle loom: This machine is mainly controlled via electronic and used to weave warp and weft patterns. This loom is a kind of micro wood or plastic that contains bobbins that are filled with yarn. It is fluttered across the loom back and forth to form interlacement that helps in producing fabric easily and more efficiently. This is also easy to operate and worker-friendly. c) Ribbon loom: A ribbon loom is a kind of narrow fabric loom that is highly efficient to weave more than forty pieces together. This loom has a jacquard fitted at the top of them, which is controlled by a stack of perforated cards. The weaving machine & jacquard machine are perfectly integrated into a seamless single control panel to provide ease of operation while ensuring error-free weaving. This fabric loom also helps in the effective processing of complex patterns like brocade and matelassé, etc. [36-43].

The dye line and printing machine allow fabrics to be dyed with natural or synthetic dyes. The printer applies color prints with ink or melts the screen pattern onto a ready-dyed fabric. The following modern machine is a high-speed 6-color combination and the rollers work synchronously with low noise. The rollers rotate at 120 meters per minute, while also printing shapes on material up to 8-100 meters per minute. In the industrial set up of the economy, the printing machines are growing in large numbers. Different printing techniques and processes are used by every industry for effective communication. Any machine used in printing ink on the substrate (printing medium) which can be cloth, paper or plastic, is referred to as the printing machinery. By applying pressure to the substrate, the printing machinery transfers the ink on the printing medium resting on an inked platform composed of movable type. The development of industrial printing machines changed a lot of things in the world. It would make transfer and preservation of historical records, scientific findings, and knowledge easy and possible. There's a great advancement in the printing machinery introduced in the market today given the improvement in science and technology.

Washing and measuring machines are identified. The washing machine washes and dries woven fabrics after printing or dyeing, and inspection equipment is used to check the quality of the finished woven product, its length, width and density. Moreover, Washing in the general sense means washing something. In the case of textiles, washing is the process of removing excess chemicals from fabric or products after a wet processing process. There are different chemicals for different wet processing. So the chemicals used in a process can cause serious damage to the next process. So after the completion of any wet process, the product must be washed. [24-29].
They also can cut prepared materials which are needed in textile industry. This machine can work faster and more efficient than previous one. An important field of application is the calibrated length measurement in textile fabric inspection, when the finished product is sold by length or by square meter. Other applications include length measurement for incoming and outgoing goods, as well as in production machines and slitter rewinders, where it is necessary to obtain precise information about material lengths. In these cases more efficient machines should be used in the process [10-12, 45].

3 Research results

Taking into account the fact that the textile industry has its place almost all over the world, it was considered how important it is in Uzbekistan. In this process, the sequence of actions for the development of the textile industry in Uzbekistan was presented. In this case, it was determined that if the textile process consists of cleaning, spinning, wetting, dyeing, and printing, the process of spinning the product is considered to be the process that requires more electricity consumption. If almost any scientific work is done to increase the efficiency of electricity consumption in a textile industrial enterprise, this process should be directed to the spinning part. In our article, the spinning machine was replaced with a more efficient one, and the results were compared and acknowledged.

<table>
<thead>
<tr>
<th>Spinning machine</th>
<th>Power</th>
<th>Weight</th>
<th>Number of rotating shafts</th>
<th>Number of revolutions 1 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>18kVt</td>
<td>12 tons</td>
<td>240</td>
<td>1800</td>
</tr>
<tr>
<td>Previous</td>
<td>20kVt</td>
<td>15 tons</td>
<td>260</td>
<td>1600</td>
</tr>
</tbody>
</table>

This table 1 shows the former product spinning machine in a textile industry and the current more efficient modern spinning machine. In this case, a spinning machine with a power of 2 kw, a weight of 3 tons less and 20 more rotating parts was selected.

4 Conclusion

1. Based on the above, it can be concluded that the following processes are considered as the points of the textile industry with high energy consumption: spinning, wetting, garment production.
2. The operating conditions of electrical equipment that cause these cases have been studied, and on the basis of these studies, ways to achieve their energy efficiency through the optimization of power consumption regimes, the use of energy-saving devices in the technological process have been identified.
3. It was found that the most electricity consumption is required in the process of spinning the product, among the processes that have a significant role in the consumption of electricity in the textile industrial enterprise.
4. Secondary electricity consumers can also take small measures to improve energy efficiency. These actions can be applied to product heating, cooling, transportation and other activities.

References
