



Reducing band changing time of dust collection unit for 4th battery

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Recently, iron and steel production has been increasing rapidly around the world. The need for steel in our country and around the world leads to the opening of many iron and steel factories and the existence of multiple production processes. Among these factories, one of the companies whose establishment dates back to the past is İsdemir. Since 1970, the production capacity of flat and long products has been increasing day by day and serves in many sectors. There are many reasons for the high liquid iron capacity in İsdemir. The most important of these are related to energy efficiency and energy saving. Using the latest technology in our company's production processes, not compromising on quality, uninterrupted and safe production, as well as important issues in the production process is high energy efficiency and savings. In this study, energy saving was achieved by making improvements for the change time of the band in dust collecting system for the 4th battery of coke factory. A 5-hour stop is experienced when changing the band in the battery and during this stopping time the furnace thrust and coke transferring to blast furnaces cannot be made. With these improvement efforts, the 5-hour stopping time in the band change was reduced to 2 hours. Coke production losses are reduced via decreasing of the stopping time in 4th Battery dust collection unit. With the shortening of the stopping time by 3 hours, approximately 14 more furnaces were pushed further, resulting in approximately 156 tons of coke production. In addition, the net income obtained as a result of the improvement is 4.211,39 TL.

Keywords: Dust Collection, Band Change, Stopping Time, Battery, Steel Production, Coke Production.

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1. Introduction

The iron and steel industry (ISI) has an important place in the world economy but is also the world's largest energy-consuming sector. China and the USA are the leading countries in iron and steel production in the world. Iron and steel production process are closely associated with energy and energy related terms such as conservation of energy resources, energy efficiency, saving of energy and reduction of emission. The Turkish iron and steel industry has an energy consumption rate as about 25% of overall energy [1]. New technologies and proposed improvements have novel property that is named as being energy efficient. Because in addition

to their energy decreasing property, they provide increasing productivity rate. In the literature, there are many studies that are related with energy and relevant terms with energy like energy consumption, energy requirements, exergy and energy efficiency etc [2]. Energy management and standardization, which is also an important issue, is an important way to increase energy efficiency, reduce emissions and reduce energy costs. Higher energy efficiency is achieved with techniques and processes that use energy management, while less energy is consumed in a controlled manner. Although too much energy consumption in the iron and steel industry that has a great importance in the world, their resulting earnings and net return is too much. There are 3

integrated iron and steel plant in Turkey, which Ereğli Iron and Steel Plant Co. (Erdemir), Iskenderun Iron and Steel Works Co. (Isdemir) and Karabük Iron and Steel Works Co. (Kardemir). In 1939, the first integrated iron and steel factory was established in Karabük and production is still ongoing. Erdemir, which started production in 1965, is the second integrated iron and steel plant. The third and largest integrated iron and steel factory is Isdemir, established in 1977. With the liberalization of economic activities, these facilities, which were primarily state-owned, were privatized [3]. Energy management and standardization are very important and useful parameters for these three big iron and steel companies. In order to use these parameters, the processes in the plant must be understood very well. Steel production in integrated iron and steel plants consists of many processes. The steel production process starts with the preparation of coal as a result of crushing, sieving and sintering processes. The coal is then converted into coke by the coal preparation unit at a certain temperature and pressure in the coke unit. Coke and, in some cases, coal directly charged by coal preparation is charged to blast furnaces. In blast furnaces, with the help of coke coal, the iron oxide is reduced by taking the oxygen of the ore and liquid crude iron is obtained. The liquid raw iron coming to the meltshop is converted to liquid steel by making the necessary impurities and adding the necessary alloys. Examples of these impurities are elements such as carbon, silicon, phosphorus and sulfur. The liquid steel is then turned into semi-finished products (billet and slab) in Continuous Casting Plants [4, 5]. One of the most important of these processes is the coke production process. Coke factories constitute the first ring of the process in steel production. During production, many processes complement each other and produce the desired coke. A good manufacturing process should be environmentally responsible. Developments in the iron and steel sector should directly support nature and the environment. The quality standards of the produced products develop only in a good environment and are passed on to the next generations. In summary, coke production is as follows. The imported coals are kept in the furnaces for a certain time period at a certain pressure and temperature. The coking time varies according to the process and the capacity of the furnaces and average coking time is 19-20 hours. The coke formed after 19 hours is taken from the ovens and extinguished by using an aqueous or dry extinguishing system and sent to the coke crushing and screening unit to be sent to blast furnaces. The removal of coke from the furnaces takes place using pushing machine. Gas and dust clouds released during coke repulsion should not be discharged into the environment. Dust collection system should be used for this. Dust collection system is a system that is sensitive to the environment and collects dust from

coke production at a certain capacity without leaving it to nature.

In recent years, more attention has been paid to the use of energy more efficiently by the steel industry, and there are many improvements in this area. These improvements in energy consumption are aimed at reducing energy consumption, reducing environmental damage and economic profitability. Any changes made to one of the processes in an integrated plant affect the entire plant. It is therefore an important parameter to optimize the use of energy and raw materials for the entire plant [6, 7]. In this study, in order to increase energy efficiency and saving, the improvement of the stopping time during the band change was made in the dust collecting unit of the 4th battery of the Isdemir coke factory.

With the proposed improvement works, the 5 hour stopping time was reduced to 2 hours. Therefore, energy saving and efficiency improvements have been achieved by shortening this downtime. During this 3 hour profit period, the amount of coke produced was increased by pushing 14 more furnaces. This increased the amount of energy obtained. Pre-stop preparation activities, team collaboration, equipment procurement, location analysis are the most important parameters that ensure effective use of stopping time. All these parameters lead to an increase in energy efficiency and savings. Efficiency and savings ensure efficiency in production and continuity of uninterrupted production. With this improvement, about 156 tons more coke was obtained. Considering the labor and coke production costs at the standstill, this improvement has resulted in a profit of 4.211,39 TL. Since this improvement will be used for each band change for the battery and is applicable to other batteries, the total gain amount will increase further. There are many suggestions such as improvement in Isdemir, all of which have the common point of reducing energy consumption and minimizing the harm to the environment.

2. Result and Discussion

As shown in Figure 1, dust collection band is made of hard, thick, rubber materials. It covers the dust collection system along the battery and prevents the accumulated dust from coming out. The dust collecting band is fixed on both sides using the stretching method and the band is made ready after the necessary adjustments are made.



Figure 1: Dust collection tape disassembly work

As in Figure 2, multiple teams work in dust collecting band change. These teams can be listed as: mechanical maintenance, electrical maintenance, band workshop team and battery operation team. 3 mechanical maintenance personnel, 1 electrical maintenance personnel, 2 operational personnel and 6 band team personnel worked during the stop. The whole team has worked as a team following all rules regarding occupational health and safety.



Figure 2: Team work in band disassembly

As in Figure 3, Teams in the band workplace aim to complete the work during the stop time by making all equipment ready the day before the stop. Necessary controls are made, risks are evaluated, precautions are taken and the system is analyzed.

The dust collecting band is moved by means of machines installed on both sides of the system and placed on the dust collecting channel. This process is almost impossible to do with manpower. For this reason, the machines used are extremely important. However, these machines must be fixed to the ground well before use because if it is not fixed to the ground, it may move, the band may slide and even a work accident may occur.



Figure 3 (a): Mechanism for dust collecting band system



Figure 3 (b): Stretching apparatus for dust collecting band system

3. Calculation

In this section, labor costs and production amount are calculated for pre-improvement and post-improvement. The stopping time before recovery is 5 hours. Firstly, labor cost calculated during this period is 2.131.8 TL and production loss cost is 3.160.31 TL. After improvement, this stopping time was reduced to 2 hours. Calculated labor cost is

852.72 TL and production loss cost is 228 TL within this period. For the net cost gain, the difference between the pre- improvement and post-improvement calculations is taken. The net cost gain is calculated as TL 4,211,39 and the gain proves the accuracy of the calculations. The amount of profit obtained as a result of the calculation is not limited to the labor cost and production loss in 3 hours. All teams working in another unit or in another process within 3 hours can make profit in many different areas and gain profit to the unit. These tasks include improvement process, production, maintenance and repair. As with this improvement, when the cost-cutting activities are implemented in many units of the factory, the net amount of revenue that can be obtained will be much higher. This ensures production continuity and increases productivity in production.

Table 1: Previous status report

KOK FABRİKASI ÜRETİM ve TÜKETİM RAPORU													
4. Batarya						TOPLAM / ORTALAMA							
İtme Sayısı	Ceviz Kok Üretim	Met. Kok Üretim	Toz Kok Üretim	Top. Kok Üretim	Kok Nem	Topl. Düz. Kömür Tüketim	Ort. Kömür Nem	Topl. İtme Sayısı	Topl. Ceviz Kok Üretim	Topl. Met. Kok Üretim	Topl. Toz Kok Üretim	Topl. Kok Üretim	Ort. Kok Nem
74	79,06	1076,99	107,46	1263,5	0	7804	8,28	300	395,75	5391,3	537,95	6325	6,18
88	41,88	1218,97	171,21	1432,05	0	8104	8,48	314	182,35	5308,1	745,55	6236	6,14
ÜRETİM FARKI					168,55								

As shown in Table 1, the difference between normal coke production before improving and the amount of coke produced during stopping time is 168.55 tons.

Table 2: Next status report

KOK FABRİKASI ÜRETİM ve TÜKETİM RAPORU																			
4. Batarya						5. Batarya						TOPLAM							
Gün	Ceviz Kok Üretim	Met. Kok Üretim	Toz Kok Üretim	Top. Kok Üretim	Kok Nem	Düzeltilmiş Kömür Tüketim	Kömür Nem	İtme Sayısı	Ceviz Kok Üretim	Met. Kok Üretim	Toz Kok Üretim	Top. Kok Üretim	Kok Nem	Topl. Kömür Tüketim	Topl. Düz. Kömür Tüketim	Ort. Kömür Nem	Topl. İtme Sayısı	Topl. Üretim	
25.04.2019	97,59	1174,51	147,01	1469,11	0	2591	2576	10,22	80	131,23	1576,5	1917	1990,44	4,59	8694	8552	10,22	326	4
26.04.2019	118,28	1150,75	137,92	1406,95	0	2291	2374	9,96	80	139,17	1548,5	1895,35	1893,25	4,7	8672	8550	9,96	326	4
ÜRETİM FARKI					12,16														

As shown in Table 2, after the improvement the difference between the normal coke production amount and the coke amount produced during the downtime is 12.16 tons.

The improvement was standardized. Therefore, the existing instruction on dust collection band replacement was rewritten. Some changes were made to the instruction and saved in the system. The

most important item in the instruction relates to the preparatory work before the stop. Before the stop, the whole team comes together and make a plan to complete the work within the specified time interval. All staff on the day of the work knows what to do and thus no time loss. Therefore, there is no postponement at the scheduled start time and production starts just in time.

4. Conclusion

With the improvement in dust collecting band change, improvements in both energy saving and energy efficiency have occurred. Production was started early by shortening downtime and more production was made. With this improvement, there were 3 hours of time savings and a profit of TL 4,211. Coke production started 3 hours early and a total of 156 tons more coke was produced. After the improvement was made, the dust collection band change instruction in the system was updated and reloaded to the system. Subsequent work was carried out according to these instructions, and the improvement thus became standard. While updating the instruction, improvements were made on issues such as organizing before work, procurement of equipment, creating a business plan and starting work on time.

5. Reference

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