CHAPTER VI

RESULTS

6.1 Results

6.1.1 The result of mixing the scrap and chemical composition received

According to implementation the plan in Chapter 4 during 2 January 2002 to 15 February 2003, the result of collecting the data from the record report can be sorted out into the heat day and month report. For the heat report, the example of mixing scrap result following 2-basket pattern can be shown in Table 6.1

Table 6.1 The example of mixing the scrap following 2-basket pattern in each heat to producing the molten steel MScode00001

Scrap type	*Basket 1*		*Basket 2*		*Total*	
	(tons)	*m3*	*(tons)*	*m3*	*(tons)*	*m3*
S183	17.00	39.38	17.00	39.38	34.00	78.75
S187	7.00	16.25	0.00	0.00	7.00	16.25
S400	5.00	8.13	3.00	4.88	8.00	13.00
S406	1.00	0.75	0.00	0.00	1.00	0.75
S517	35.00	31.50	30.00	27.00	65.00	58.50
S900	0.00	0.00	3.00	2.88	3.00	2.88
S922	1.00	0.63	0.00	0.00	1.00	0.63
S923	2.00	1.25	0.00	0.00	2.00	1.25
F111	0.500	0.50	0.000	0.00	0.50	0.50
I116	20	6.06	10	3.03	30.00	9.09
Total	88.50	104.44	63.00	77.16	151.50	181.59
Density	0.847412136		0.816526815		0.834289343	

As can be seen in Table 6.1, there are mixing the scrap into 2 basket and there 9 types of scrap that are re-arranged from the original type to convenient for mixing the scrap and receiving the chemical composition precision. According to mixing the scrap from this pattern in each heat, the density result of each heat is approximately 0.83 ton/m^3. At this density, melting the scraps is saved the energy as shown in Chapter 4. And then mixing the scrap from this patter can receive the chemical composition in Table 6.2

Table 6.2 The example chemical composition received from melting scrap 2-basket pattern in each heat

Metallic Input		*Input Ratio*	*C*	*P*	*S*	*Mn*	*Si*	*Weight*
type		%	%	%	%	%	%	(tons)
S183		22.52	0.15	0.01	0.02	0.3	0.1	34.00
S187		4.64	0.25	0.03	0.07	0.3	0.2	7.00
S400		5.30	0.25	0.03	0.09	0.3	0.15	8.00
S406		0.66	0.05	0.01	0.02	0.3	0.2	1.00
S517		43.05	0.15	0.025	0.04	0.4	0.1	65.00
S900		1.99	0.04	0.02	0.02	0.3	0.15	3.00
S922		0.66	0.04	0.02	0.02	0.4	0.1	1.00
S923		1.32	0.04	0.02	0.02	0.3	0.1	2.00
I116		19.87	3.300	0.150	0.050	1.000	1.250	30.00
Scrap Mix	***ratio***	100.00	0.78	0.05	0.041	0.48	0.337	151.00
	(tons)	151.00	1.18	0.07	0.06	0.73	0.51	

According to Table 6.2, the chemical composition received from melting the scrap mix following the 2-basket pattern are percent of carbon approximately 0.78 percent , percent of Phosphorous approximately 0.05 percent, percent of Sulpher about 0.04 percent, percent of Manganese around 0.48 percent, and percent of Silicon roughly 0.34 percent.

After mixing the scrap following this pattern, we can shown the example quantity of utilizing of the scraps each day in Table 6.3

Table 6.3 the example quantity of scrap mixing each day.

Scrap type	*Bulk density (tons/m^3)*	*Scrap Mix*								*Total*
		1st heat	*2nd heat*	*3rd heat*	*4th heat*	*5th heat*	*6th heat*	*7th heat*	*8th heat*	
S183	0.432	34.00	34.05	34.02	34.01	34.00	34.02	33.98	34.02	272.10
S187	0.431	7.00	7.02	7.03	7.00	6.98	7.00	7.03	6.95	56.01
S400	0.615	8.00	8.03	8.05	7.95	7.98	7.98	8.02	8.01	64.02
S406	1.333	1.00	1.02	1.03	1.02	1.00	0.98	0.95	1.02	8.02
S517	1.111	65.00	64.80	64.90	65.10	65.20	64.80	65.10	65.10	520.00
S900	1.043	3.00	2.95	3.02	3.02	2.98	3.02	3.02	3.00	24.01
S922	1.600	1.00	0.95	0.95	1.00	1.03	1.02	1.02	1.04	8.01
S923	1.600	2.00	2.02	2.02	1.98	2.03	1.95	2.05	1.98	16.03
F111	1.000	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	4.00
I116	3.300	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	240.00
Total(tons)		151.50	151.34	151.52	151.58	151.70	151.27	151.67	151.62	1212.20
Volume (m3)		181.59	181.57	181.72	181.65	181.71	181.41	181.76	181.66	1453.07
Avg. Density		0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

According to Table 6.3, this table is the example of mixing the scrap in each day by separating into 8 heats for each furnace in the work-day and the company has 2 Electric arc furnaces so the company can run 16 heats per day in the work-day. If it is the holiday (Saturday, Sunday, and so on), the company works 24 hour per day. For these days, the company can run melting the scrap about 19 heats per EAF furnace. So the total heat that the company can run in the holiday is about 38 heats per day.

The example chemical receiving melting the scrap in that day, can be shown in Table 6.4

Table 6.4 The example chemical composition received from melting scrap 2-basket pattern in each day

Heat No	***c***		***p***		***S***		***Mn***		***Si***	
	(tons)	*%*	***(tons)***	*%*	***(tons)***	*%*	***(tons)***	*%*	***(tons)***	*%*
1st heat	1.179	0.778	0.070	0.046	0.061	0.040	0.729	0.481	0.510	0.336
2nd heat	1.179	0.777	0.070	0.046	0.061	0.040	0.728	0.480	0.509	0.336
3rd heat	1.179	0.777	0.070	0.046	0.061	0.040	0.729	0.480	0.510	0.336
4th heat	1.179	0.778	0.070	0.046	0.061	0.040	0.729	0.481	0.510	0.336
5th heat	1.179	0.778	0.070	0.047	0.061	0.040	0.730	0.481	0.510	0.336
6th heat	1.179	0.777	0.070	0.046	0.061	0.040	0.728	0.480	0.509	0.336
7th heat	1.179	0.778	0.071	0.046	0.061	0.040	0.730	0.481	0.510	0.336
8th heat	1.179	0.778	0.070	0.046	0.061	0.040	0.730	0.481	0.510	0.336
total	9.431	0.778	0.564	0.046	0.490	0.040	5.833	0.481	4.076	0.336

According to Table 6.4, in this example day, the chemical composition that the company receives are carbon 9.42 tons (~ 0.777-0.778 percent), phosphorous 0.564 tons (~0.46 percent), Sulfur 0.49 tons (~ 0.04 percent), Manganese 5.8 tons (~0.48 percent) and Silicon 4.076 tons (~0.336 tons). It shown the chemical compositions received from mixing this scrap are rather constant so it is easy to adjust the chemical composition to be the specification required.

After seeing the example of mixing the scrap and the example result of chemical composition received, the next data demonstrated is the quantity of utilizing the scrap and the result of chemical composition following this pattern in January and February in the electric arc furnace 1 (EAF 1). It is shown in as shown in Table 6.5-6.8

Table 6.5 The production report of EAF1 in (2-31 January, 2003)

Raw Material Report Production Date 1-31 January 2002 EAF 1

Date	S183	S187	S400	S406	S517	S900	S922	S923	F111	I116	Total	Volume	Density	Production	Yield	Pro.Time	T-T-T
	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	m3	ton/m3	(tons)	%	(mins/day))	(mins)
2/1/02	272.10	56.01	64.02	8.02	520.00	24.01	8.01	16.03	4.00	240.00	1212.20	1453.07	0.83	1012.19	83.50	594.8	74.35
3/1/02	272.10	56.01	64.02	8.02	520.02	24.01	8.01	16.02	4.00	240.03	1212.24	1453.09	0.83	1012.46	83.52	594.64	74.33
4/1/02	646.24	133.02	152.05	19.05	1235.00	57.02	19.02	38.07	9.50	570.00	2878.98	3451.04	0.83	2425.54	84.25	1412.27	74.33
5/1/02	646.24	133.02	152.05	19.05	1235.05	57.02	19.02	38.05	9.50	570.07	2879.07	3451.09	0.83	2424.18	84.20	1412.08	74.32
6/1/02	272.12	56.02	64.03	8.02	520.03	24.02	8.02	16.02	4.00	240.02	1212.30	1453.20	0.83	1021.37	84.25	594.8	74.35
7/1/02	272.15	56.02	64.02	8.01	520.01	24.01	8.01	16.03	4.00	240.03	1212.29	1453.22	0.83	1020.75	84.20	594.8	74.35
8/1/02	272.10	56.01	64.03	8.00	520.00	24.02	8.02	16.03	4.00	240.02	1212.23	1453.09	0.83	1029.06	84.89	594.72	74.34
9/1/02	272.10	56.03	64.02	8.02	520.02	24.01	8.01	16.02	4.00	239.95	1212.18	1453.11	0.83	1029.14	84.90	594.8	74.35
10/1/02	272.12	56.03	64.02	8.03	520.03	24.02	8.02	16.00	4.00	240.02	1212.29	1453.20	0.83	1030.69	85.02	594.56	74.32
11/1/02	646.24	133.07	152.05	19.05	1235.05	57.02	19.02	38.05	9.50	569.88	2878.93	3451.14	0.83	2447.38	85.01	1412.27	74.33
12/1/02	646.29	133.07	152.05	19.07	1235.07	57.05	19.05	38.00	9.50	570.05	2879.19	3451.35	0.83	2447.31	85.00	1412.27	74.33
13/1/02	272.10	56.01	64.02	8.01	520.03	24.02	8.01	16.01	4.00	240.03	1212.24	1453.10	0.83	1030.65	85.02	594.56	74.32

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Table 6.5 The production report of EAF1 in (2-31 January, 2003) (Cont.)

Raw Material Report Production Date 1-31 January 2002 EAF 1

Date	S183	S187	S400	S406	S517	S900	S922	S923	F111	I116	Total	Volume	Density	Production	Yield	Pro.Time	T-T-T
	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	m3	ton/m3	(tons)	%	(mins/day))	(mins)
14/1/02	272.12	56.02	64.03	8.02	520.01	24.00	8.02	16.00	4.00	240.03	1212.25	1453.15	0.83	1030.53	85.01	594.4	74.3
15/1/02	272.13	56.02	64.01	8.02	520.00	24.01	8.00	16.02	4.00	240.00	1212.21	1453.13	0.83	1030.74	85.03	594.4	74.3
16/1/02	272.13	56.02	64.02	8.01	520.00	24.02	8.01	16.01	4.00	240.00	1212.22	1453.15	0.83	1030.63	85.02	594.48	74.31
17/1/02	272.12	56.01	64.03	8.01	520.05	24.03	8.02	16.01	4.00	240.05	1212.33	1453.20	0.83	1029.87	84.95	594.56	74.32
18/1/02	646.31	133.05	152.05	19.02	1235.00	57.05	19.02	38.02	9.50	570.00	2879.02	3451.24	0.83	2447.74	85.02	1411.89	74.31
19/1/02	646.29	133.05	152.04	19.05	1235.02	57.05	19.00	38.05	9.45	570.02	2879.02	3451.17	0.83	2447.45	85.01	1411.7	74.3
20/1/02	272.12	56.01	64.01	8.01	520.02	24.02	8.02	16.02	4.00	240.03	1212.26	1453.13	0.83	1030.78	85.03	594.4	74.3
21/1/02	272.12	56.01	64.01	8.02	520.02	24.01	8.01	16.00	4.00	240.00	1212.20	1453.10	0.83	1030.85	85.04	594.32	74.29
22/1/02	272.10	56.02	64.00	8.01	520.03	24.03	8.00	16.02	4.00	240.00	1212.21	1453.09	0.83	1030.62	85.02	594.32	74.29
23/1/02	272.09	56.01	64.02	8.00	520.04	24.02	8.00	16.03	4.00	240.02	1212.23	1453.08	0.83	1030.76	85.03	594.32	74.29
24/1/02	272.08	56.01	64.01	8.01	520.00	24.02	8.02	16.02	4.00	240.03	1212.20	1453.02	0.83	1030.85	85.04	594.24	74.28
25/1/02	646.21	133.02	152.05	19.00	1235.10	57.05	19.00	38.07	9.50	570.05	2879.05	3451.06	0.83	2447.77	85.02	1411.51	74.29

Table 6.5 The production report of EAF1 in (2-31 January, 2003) (Cont.)

Raw Material Report Production Date 1-31 January 2002 EAF 1

Date	S183	S187	S400	S406	S517	S900	S922	S923	F111	I116	Total	Volume	Density	Production	Yield	Pro.Time	T-T-T
	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	m3	ton/m3	(tons)	%	(mins/day))	(mins)
26/1/02	646.19	133.02	152.02	19.02	1235.00	57.05	19.05	38.05	9.50	570.07	2878.98	3450.92	0.83	2448.28	85.04	1411.32	74.28
27/1/02	272.10	56.02	64.02	8.02	520.01	24.02	8.01	16.03	4.00	240.03	1212.26	1453.12	0.83	1030.78	85.03	594.32	74.29
28/1/02	272.10	56.01	64.01	8.00	520.00	24.03	8.01	16.03	4.00	240.00	1212.19	1453.06	0.83	1030.85	85.04	594.32	74.29
29/1/02	272.12	56.01	64.00	8.01	520.00	24.01	8.00	16.03	4.00	240.03	1212.21	1453.08	0.83	1030.62	85.02	594.24	74.28
30/1/02	272.12	56.02	64.02	8.02	520.05	24.01	8.02	16.02	4.00	240.00	1212.28	1453.18	0.83	1030.44	85.00	594.4	74.3
31/1/02	272.10	56.01	64.03	8.01	520.03	24.02	8.03	16.00	4.00	239.95	1212.18	1453.09	0.83	1030.72	85.03	594.32	74.29
total	11156.44	2296.68	2624.75	328.61	21320.68	984.68	328.47	656.76	163.95	9840.41	49701.42	59577.69	0.83	42151.00	0.85	24374	74.311

Table 6.6 The production report of EAF1 in (1-15 February,2003)

Raw Material Report Production Date 1-15 Febuary 2002 EAF 1

Date	S183	S187	S400	S406	S517	S900	S922	S923	F111	I116	Total	Volume	Density	Production	Yield	Pro.Time	T-T-T
	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	m3	ton/m3			(mins/day))	(mins)
1/2/02	574.43	118.25	135.15	16.93	1097.78	50.69	16.91	33.84	8.43	506.67	2559.08	3067.59	0.83	2175.47	85.01	1411.7	74.3
2/2/02	574.43	118.24	135.15	16.93	1097.82	50.69	16.91	33.82	8.44	506.73	2559.17	3067.64	0.83	2176.07	85.03	1411.51	74.29
3/2/02	272.12	56.01	64.02	8.02	520.00	24.01	8.03	16.02	4.83	240.00	1213.06	1453.95	0.83	1031.34	85.02	594.4	74.3
4/2/02	272.10	56.02	64.03	8.01	520.03	24.02	8.02	16.03	4.83	240.02	1213.11	1453.98	0.83	1031.26	85.01	594.48	74.31
5/2/02	272.10	56.02	64.02	8.02	520.01	24.02	8.03	16.02	4.82	240.03	1213.09	1453.95	0.83	1031.49	85.03	594.32	74.29
6/2/02	272.10	56.02	64.02	8.01	520.03	24.03	8.02	16.01	4.82	240.01	1213.07	1453.95	0.83	1031.23	85.01	594.48	74.31
7/2/02	272.10	56.01	64.00	8.01	520.05	24.01	8.03	16.02	4.82	240.00	1213.05	1453.90	0.83	1031.34	85.02	594.4	74.3
8/2/02	646.24	133.05	152.05	19.02	1235.07	57.07	19.05	38.02	11.45	570.02	2881.04	3453.13	0.83	2450.04	85.04	1411.32	74.28
9/2/02	646.24	133.02	152.00	19.02	1235.12	57.02	19.07	38.05	11.45	570.00	2880.99	3453.02	0.83	2449.71	85.03	1411.51	74.29
10/2/02	272.12	56.00	64.02	8.01	520.03	24.03	8.02	16.02	4.81	240.01	1213.07	1453.95	0.83	1031.23	85.01	594.48	74.31
11/2/02	272.12	56.02	64.02	8.02	520.00	24.01	8.01	16.02	4.81	240.01	1213.04	1453.95	0.83	1031.33	85.02	594.4	74.3
12/2/02	272.12	56.00	64.03	8.02	520.00	24.02	8.03	16.03	4.82	240.02	1213.09	1453.96	0.83	1031.25	85.01	594.4	74.3

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Table 6.6 The production report of EAF1 in (1-15 February,2003) Cont.

Raw Material Report Production Date 1-15 Febuary 2002 EAF 1

Date	S183	S187	S400	S406	S517	S900	S922	S923	F111	I116	Total	Volume	Density	Production	Yield	Pro.Time	T-T-T
	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	(tons)	m3	ton/m3			(mins/day))	(mins)
13/2/02	272.12	56.01	64.01	8.02	520.03	24.02	8.00	16.02	4.82	240.00	1213.05	1453.94	0.83	1031.34	85.02	594.32	74.29
14/2/02	272.10	56.01	64.01	8.02	520.03	24.01	8.02	16.02	4.82	240.00	1213.04	1453.90	0.83	1031.33	85.02	594.4	74.3
15/2/02	646.29	133.02	152.02	19.05	1235.07	57.05	19.00	38.05	11.45	570.00	2880.99	3453.12	0.83	2449.13	85.01	1411.51	74.29
Total	5808.73	1195.71	1366.56	171.12	11101.07	512.70	171.15	341.99	99.42	5123.52	25891.95	31033.92	0.83	22013.5509	0.85	13001.6	74.2973

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In compliance with Tables 6.5 and 6.6, we know the quantity of utilizing the scrap for each day in EAF 1, for example, there are utilizing the scrap about 1,212 tons on the working day and 3,450 tons on the holiday or festival day. It indicated that the utilizing the scrap for producing the product about 2424 tons per day and 6900 tons per day on working day and holiday respectively because the company has the 2 EAF (EAF1, EAF2) to run continuous process in each day. And then the densities of mixing the scrap into the buckets are approximately 0.83 tons /m^3 that it is in the range of saving energy (between 0.8-0.9 tons/m^3).

According to data from the table 6.5 and 6.6, we can shown in the graph of density, scrap utilization, production result, and yield in Figures 6.1 -6.4

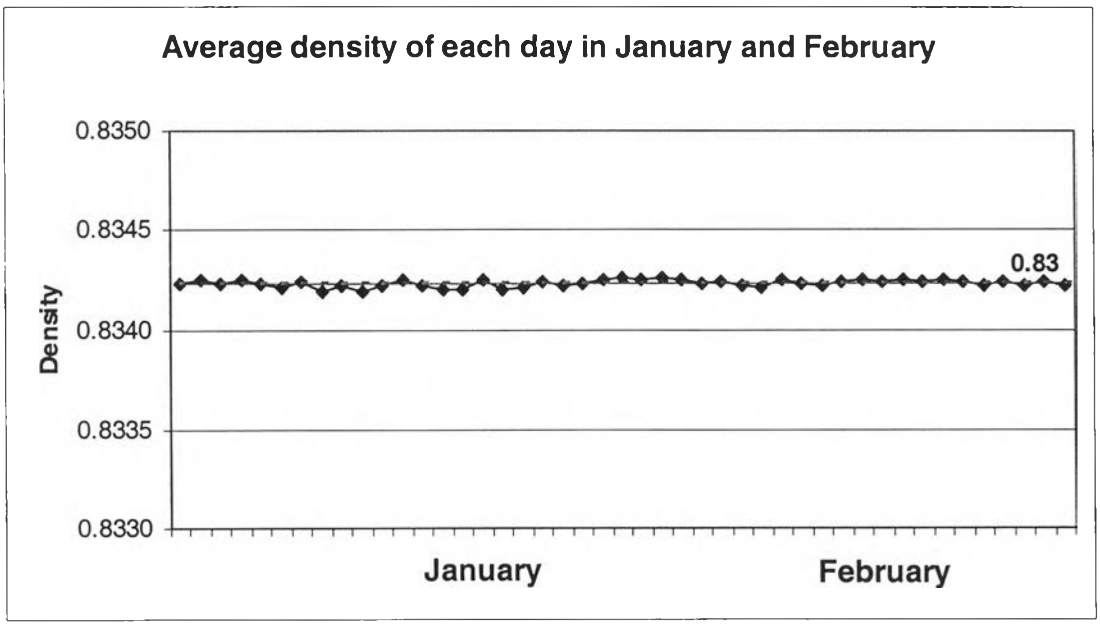

Figure 6.1 The density of mixing the scrap 4 baskets

In January and February, the scrap preparing worker provides the scrap to the basket at the 0.83 ton/m^3 as shown in Figure 4.6. According to Figure 6.4, the density that saving energy for melting scrap are about 0.8-0.9 ton/m^3 and the worker can provide the scrap density in the rage of saving energy range. So the company receiving the benefit from saving energy for melting scrap and can reducing the time for melting due to saving energy too.

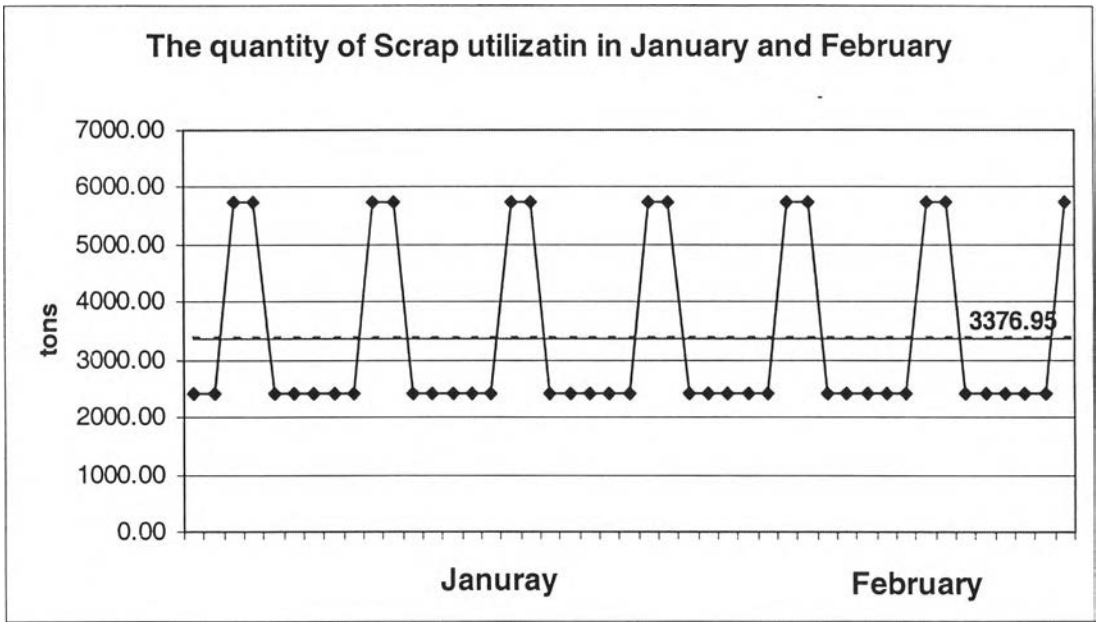

Figure 6.2 The quantity of the used scrap in November, and December

In the Figure 6.2, it shows the utilization of the scrap each day in January and February by collecting the data from Tables 6.5 and 6.6. As you can see in the graph, the average quantity of scrap utilization is about 2,424 tons per day on the working day and 5,758 tons per day on the holiday and festival day. If we average these data, the average of utilization of scrap is equal to 3376.95 tons per day.

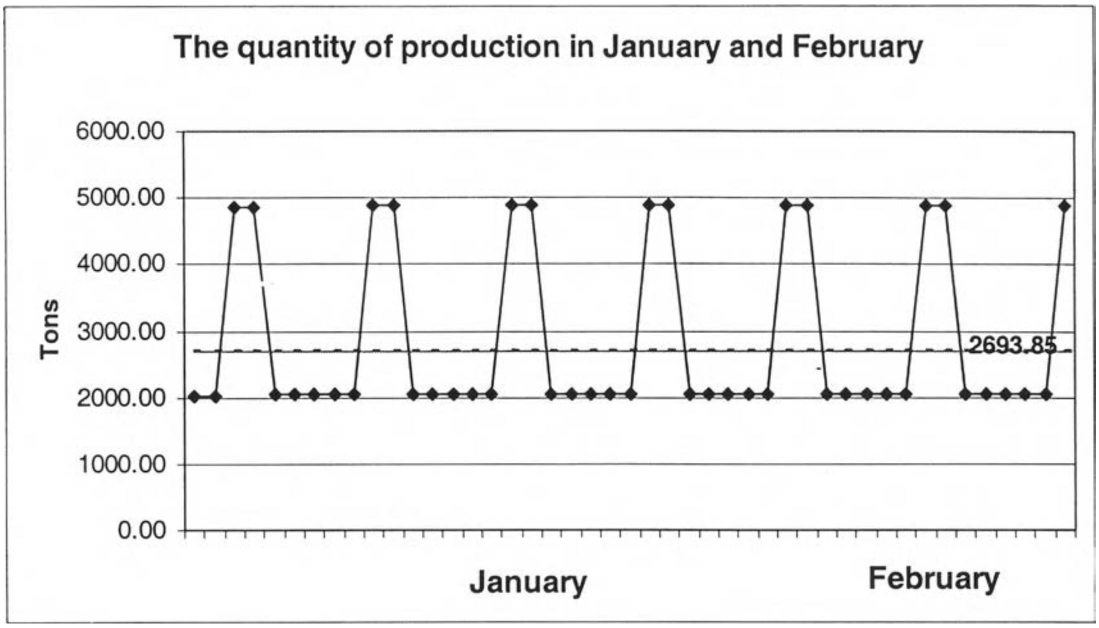

Figure 6.3 The result of production in December and November

According to Figure 6.3, the company uses the scrap about 2,424 tons per day on the working day and 5,758 tons per day on the holiday and festival day. After passing the production process, it can produce the product about tons per day on the working day and 3,800 tons per day on the holiday and festival day. According to these data, they can be taken to calculate the yield received from this formula.

$$Yield = \frac{Output(production)}{Input(Scrap\ used)} x\, 100$$

Following this formula, the yield of the company in November and December can be plotted into Figure 6.4

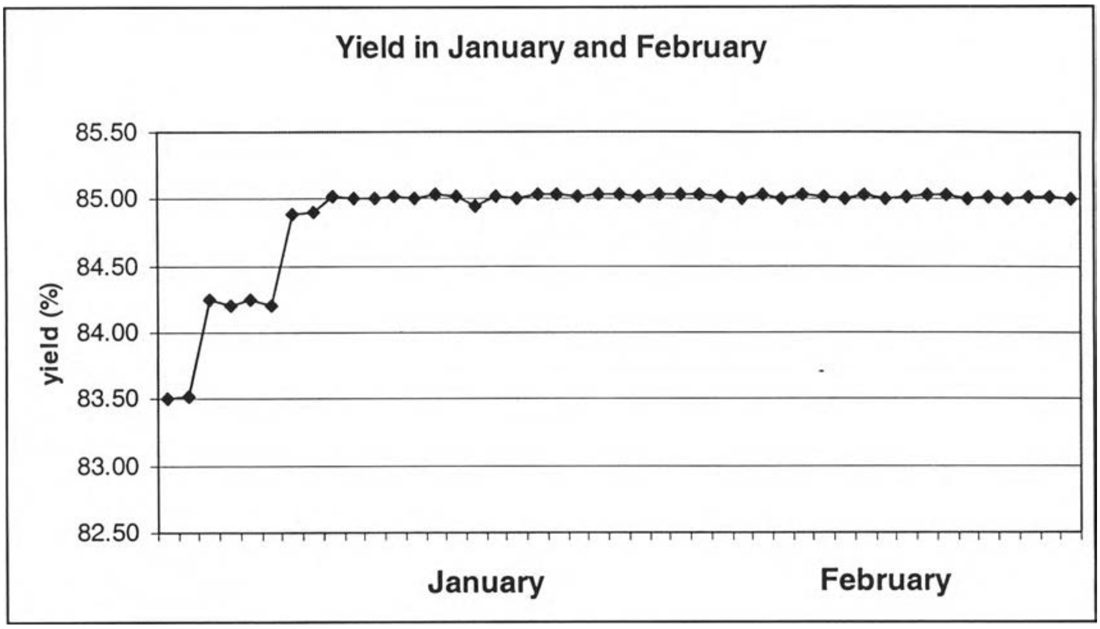

Figure 6.4 The result of Production yield in December and November

As you can see in Figure 6.4, Yield is quite low in the first period of implementing the new pattern of basket if comparing with in the next period. The cause of this are that the worker that preparing the pattern of the basket are not familiar with the new quantity of the each scrap type because the equipment of taking the scrap can not take the certain quantity of scrap and the type of scrap are different from the original. So the quantity of the scrap mixing in the basket pattern is not constant. However, when the worker know the how much weigh can be received from picking the each scrap to the basket one time, the element of the scrap in the basket are constant and then it makes yield can improve from about 83.5% to 85 %.

By the way, from using the scrap in table 6.5,and 6.6. the chemical compositions are received from melting process can be shown in Tables 6.7 and 6.8

Table 6.7 The chemical compositions received after passing the melting process in January

Date	C		P		S		Mn		Si	
	tons	%	tons	%	tons	%	tons	%	tons	%
2/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
3/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
4/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
5/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
6/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
7/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
8/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
9/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
10/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
11/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
12/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
13/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
14/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
15/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
16/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
17/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
18/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
19/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
20/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
21/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
22/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
23/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
24/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
25/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17

Date	*C*		*P*		*S*		*Mn*		*Si*	
	tons	*%*	*tons*	*%*	*tons*	*%*	*tons*	*%*	*tons*	*%*
26/1/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
27/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
28/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
29/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
30/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
31/1/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
Total	386.70	0.39	23.11	0.02	20.11	0.02	239.14	0.24	167.13	0.17

Table 6.8 The chemical compositions received after passing the melting process in February (1-15)

Date	C		P		S		Mn		Si	
	tons	%	tons	%	tons	%	tons	%	tons	%
1/2/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
2/2/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
3/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
4/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
5/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
6/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
7/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
8/2/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
9/2/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
10/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
11/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
12/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
13/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
14/2/2002	9.43	0.39	0.56	0.02	0.49	0.02	5.83	0.24	4.08	0.17
15/2/2002	22.40	0.39	1.34	0.02	1.16	0.02	13.85	0.24	9.68	0.17
Total	206.32	0.39	12.33	0.02	10.73	0.02	127.59	0.24	89.17	0.17

After the scraps in Tables 6.5 and 6.6 are melted in the EAF1, the chemical composition received in January and February can be shown in Tables 6.7 and 6.8. The percent of carbon, sulfur, phosphorous, manganese and silicon are still about 0.39, 0.02, 0.02, ,0.24 and 0.17 respectively.

6.1.2 Time utilization of melting the scrap

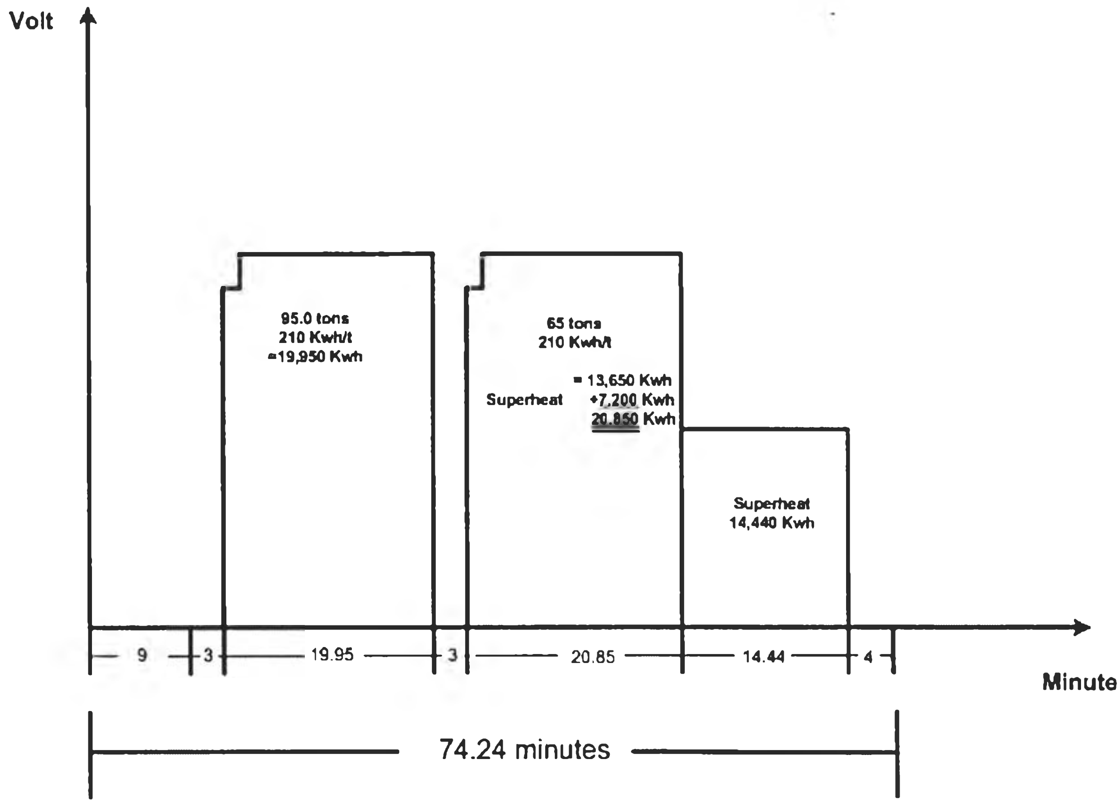

Figure 6.5 Procedure of used energy for melting process

According to the procedure above, we found that

On time	=	55.24 mins/heat
Off time	=	19 mins/heat
Total	=	74.24 mins/heat

On time 55.24 minutes can be separate into:

On Ttime

From Scrap: $$\frac{151t\ x\ 331.4\ Kwh/t}{1000\ Kwh/\min} = 50.04 \text{ minute}$$

From Addition Lime: $$\frac{5.2t\ x\ 1000Kwh/t}{1000Kwh/\min} = 5.2 \text{ minutes}$$

Off time 25 minutes can be separate into:

OFF Time

Charging bucket 4 times	=	6	minutes
Tapping time	=	4	minutes
Other	=	9	minutes

However, from the table 6.5 and 6.5, we will see that T-T-T time is about 74.3 minutes in practical. It is slightly different from the calculation. So the result of melting time is the level acceptance.

6.1.3 Yield result

Scrap using = 151 tons

Production receiving = 128.35 tons

Yield = $\frac{128.35}{151} x100$ percent

= 85 percent

According to this result, if we take this result to compare with the calculation result at the same quantity of scrap(151 tons), the comparison of both can be shown in the table below:

Table 6.9 The comparison result between the current managing scrap and the calculating the result of managing the scrap to improvement at density 0.6 ton/m^3 and 0.85 ton/m^3 respectively

Item	***Current managing scrap***	***Calculating to Improving***	***Difference***
Scrap	151 tons/heat	151 tons/heat	0
Production	128.35 tons/heat	132 tons/heat	3.65
Yield	85%	87.42%	2.42%
On-Time			
-Scrap	55.24 minutes	55.24 minutes	0 minutes
-Addition Flux	5.2 minutes	5.2 minutes	0 minutes
Off-Time			
-Charging	6minutes	6 minutes	0 minutes
-Tapping	4 minutes	4 minutes	0 minutes
-Other	9 minutes	9 minutes	0 minutes
T-T-T	72.24 minutes	72.2 minutes	(-.04) minutes

6.1.4 Disadvantage managing the 4-basket pattern

Disadvantages of managing the raw materials (scrap, pig iron, flux and so on) 2 baskets at density 0.83 tons/m^3 can be shown Table 6.10:

Table 6.10 Disadvantages of managing the raw materials 2 baskets comparing with standard at density 0.83 tons/m^3

Disadvantage	***Lose time/heat (minutes)***	***Loss time/2months (minutes)***	***%***
Long time for Melting scrap time	0	0	0
Long time for Melting Addition time	0	0	0
Long time for Charging the baskets to EAF	0	0	0
Total	**10.8**	**36325.8**	**100**

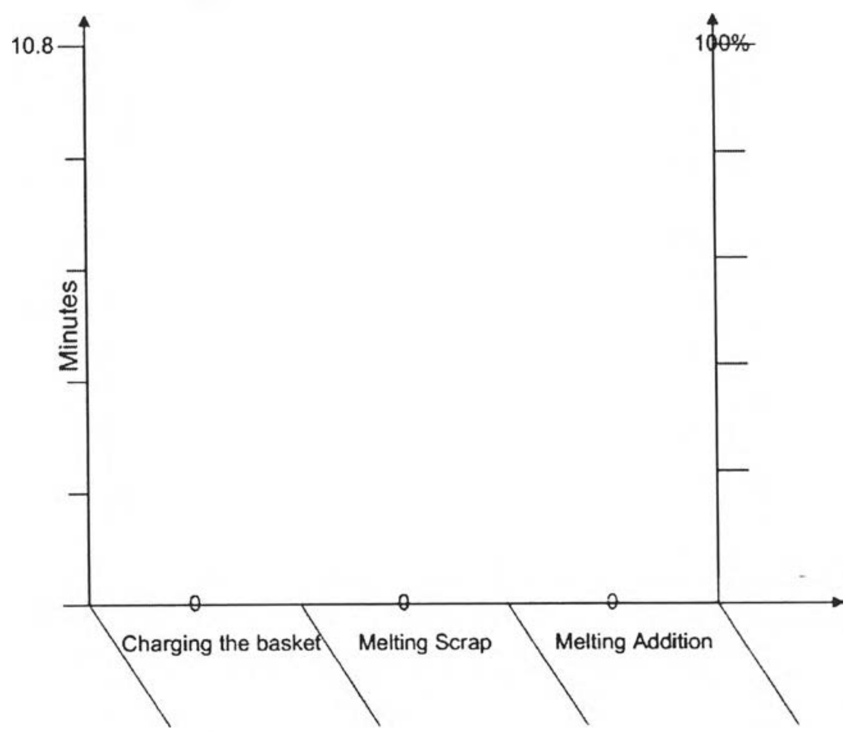

Figure 6.6 The Pareto chart of lose time due to managing 2 baskets

According to the table 6.9 and 6.10, these data can be shown in the pareto chart demonstrate the lost time due to managing scrap 2 baskets in figure 6.6, scrap using, production quantity, and yield in January and February in figure 6.7 and total scrap using, production quantity, and yield in 1.5 months in figure 6.8.

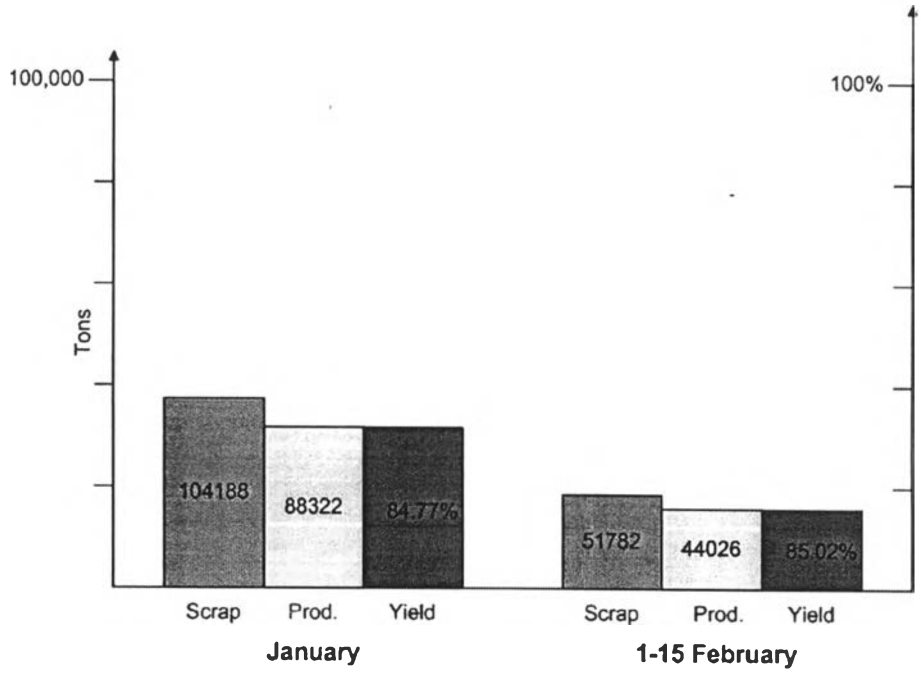

Figure 6.7 Scrap using, production quantity, and yield in January and February(1-15)

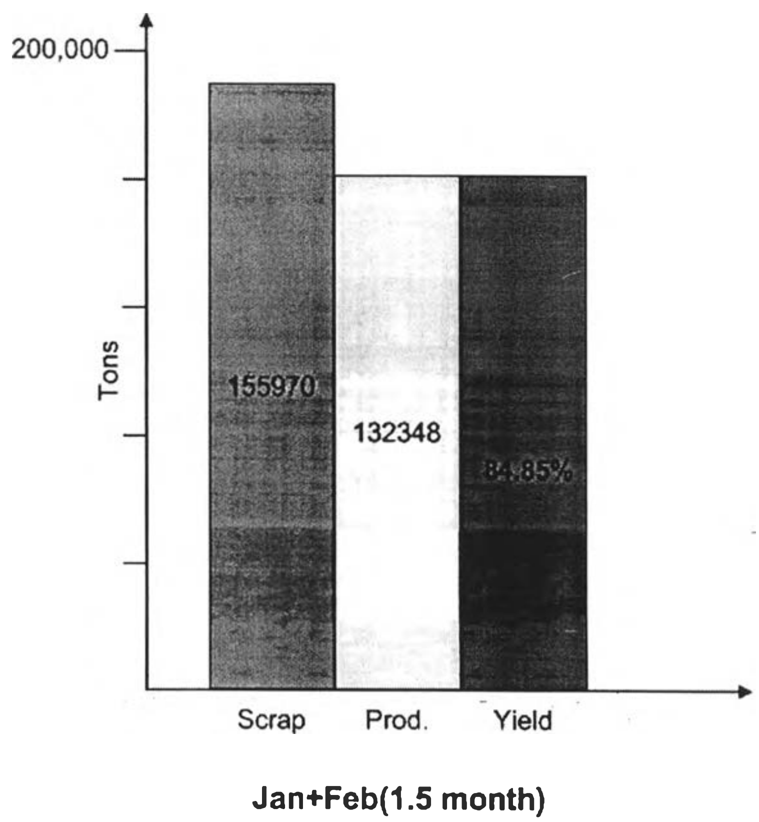

Figure 6.8 Total Scrap using, production quantity, and yield in 1.5 months

6.1.5 The utilizing of flux for 2 baskets

According to utilizing of flux for 2 baskets from calculation in Chapter 5, the company fixes the quantity of flux using following calculation. And the result of chemical is nearly the specification that require from this pattern. So the quantity of flux using can be shown in the process below:

- Add material additive charging to the baskets

Table 6.11 Charging Flux in Scrap basket

CaO (Kg)	*Dolomite (Kg)*
500	-

- Add between melting by EAF Material Weighting/Charging

Table 6.12 EAF material Weighting/Charging

Charge No.	*Bin No.2 CaO*	*Bin No.3 B-Dolomite*
1st	1600	700
2nd	700	440

- Add before refining by Tapping Material Weighting/Charging

Table 6.13 Tapping Material weighting/Charging

Charge No.	*Bin No.2 CaO*	*Bin No.5 B-Dolomite*
1st	1200	60

According to utilizing the flux above, the total flux utilizes are equal to 5,200 kg/heat. The detail of utilizing can be show below:

Flux Utilization of 2 basket pattern

CaO	=	500+7,600+700+1,200	Kgs
	=	4,000	Kgs
B-Dolomite	=	700+440+60	Kgs
	=	7,200	Kgs
Grand Total Flux	=	4,000+1,200	Kgs
	=	5,200	Kgs
Melting flux time	=	$\frac{5.2 \text{ tons} \times 1000 \text{ Kwh/tons}}{1000\text{Kwh/min}}$	
	=	5.2	Minutes

6.1.6 Comparing the result before and after improvement

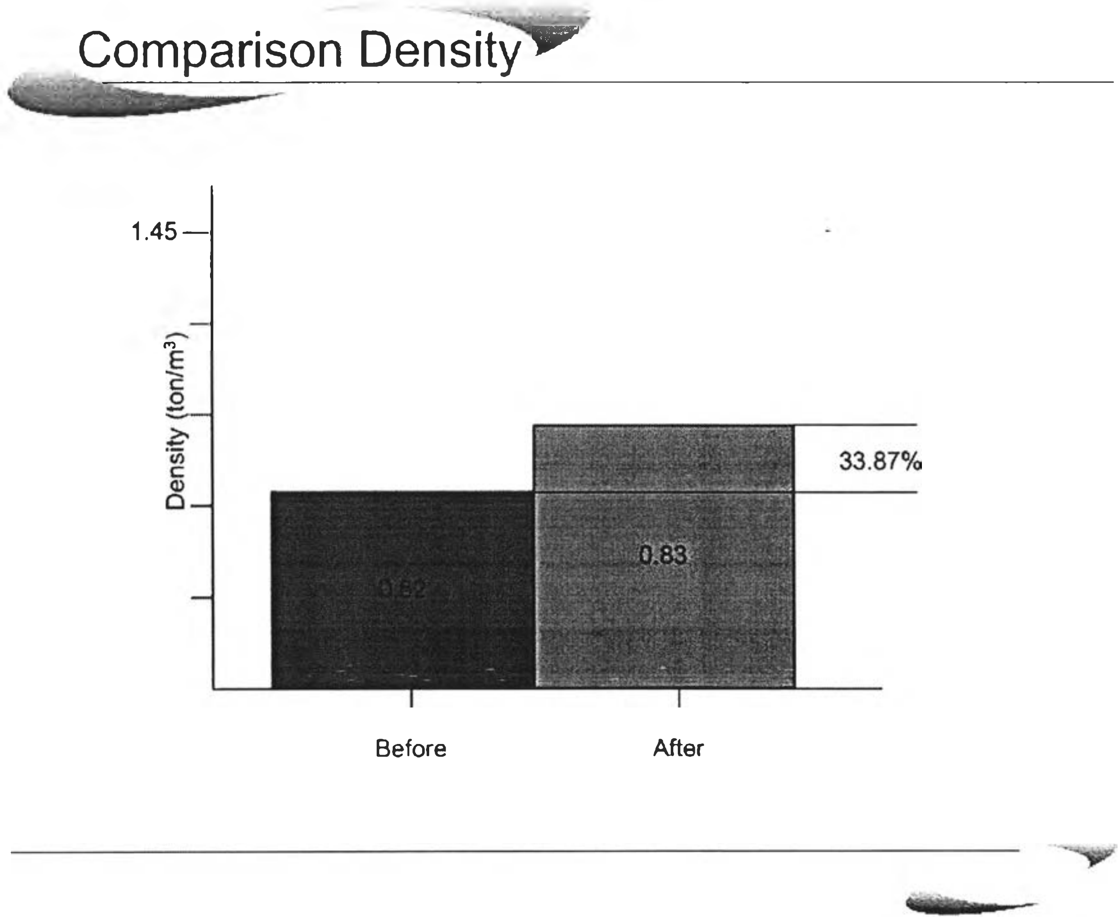

Figure 6.9 Comparison density of before and after improvement

As you can see Figure 6.9, the density before improvement is 0.62 ton/m3 and the density after improvement is 0.83 ton/m3. It shows that the new pattern of the mixing makes the density increasing from the past. Increasing the density from 0.62 to 0.83 makes EAF saved the energy to melting the scraps. In addition, the quantity of basket reducing due to improve the density leads to the charging time reducing too. So the company should fix at this density that has more benefit from the past.

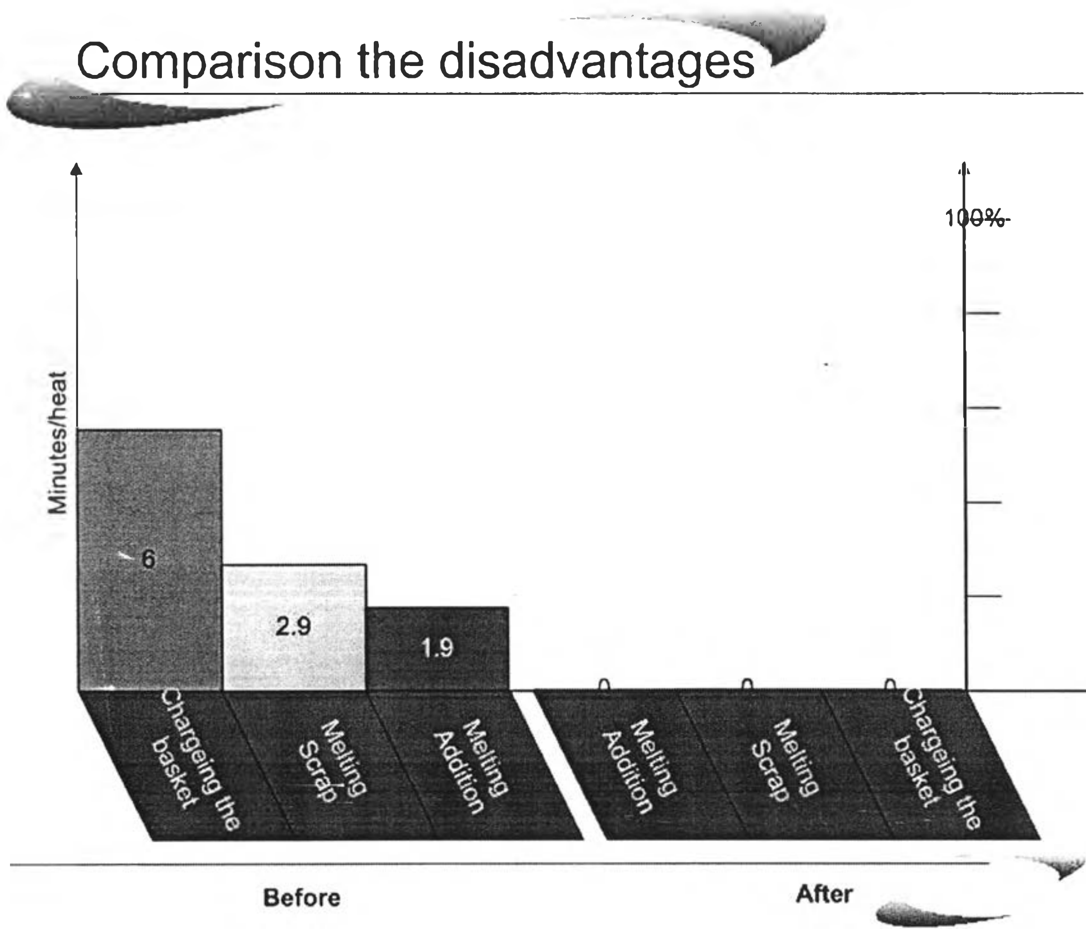

Figure 6.10 Comparison the disadvantage of before improvement and after improvement with the standard company.

As shown in Figure 6.10, it shows that the company before improvement the company has to loss time due comparison with the standard Japanese company to charging the basket 6 minute per heat, melting scrap 2.9 minutes per heat, and melting time 1.9 minutes. However, after improvement, the company can melt both scrap and addition following the standard pattern. It makes the company don't have the difference time between the standard company. In addition, the company can reduce the charging scrap time from 4 times for 4-basket pattern to 2 times for 2-basket pattern like the standard company so there is no loss time happened due to charging the scrap.

Comparison Scrap utilization/heat

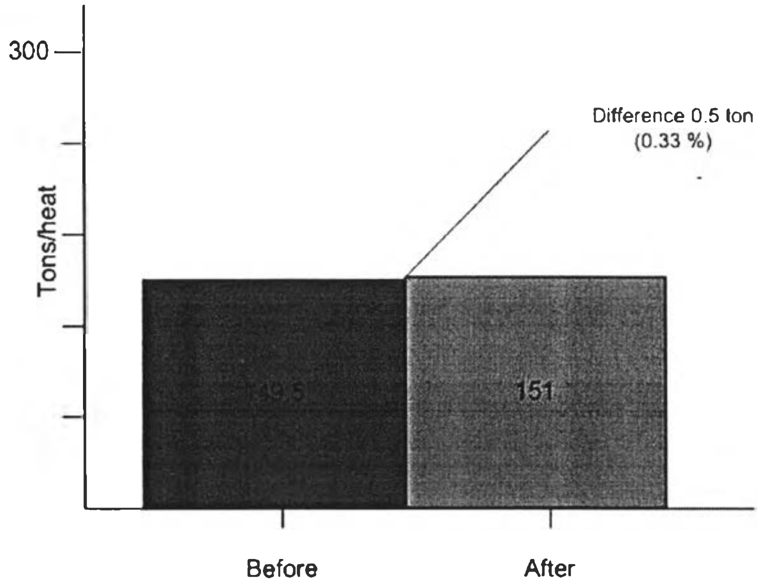

Figure 6.11 Comparison scraps utilization of before and after improvement

Before improvement, the company used the scraps 149.5 tons per heat in 4 baskets for being the raw material to produce the steel. In the planning of improvement, the company tries to set the weight of the scrap (new categorizing the scrap) equal before improvement by calculation from the program mixing the scrap. However, in practical, the quantity of scrap taken from the crane is about 151 tons. So the company using this to consider the quantity of using the other raw material and the melting process. However, the quantity of before and after improvement are slightly different about 0.5 tons or 0.33 percent. So the company used this quantity of the scrap to be the standard of this product (MS code00001).

Comparison Production received/heat

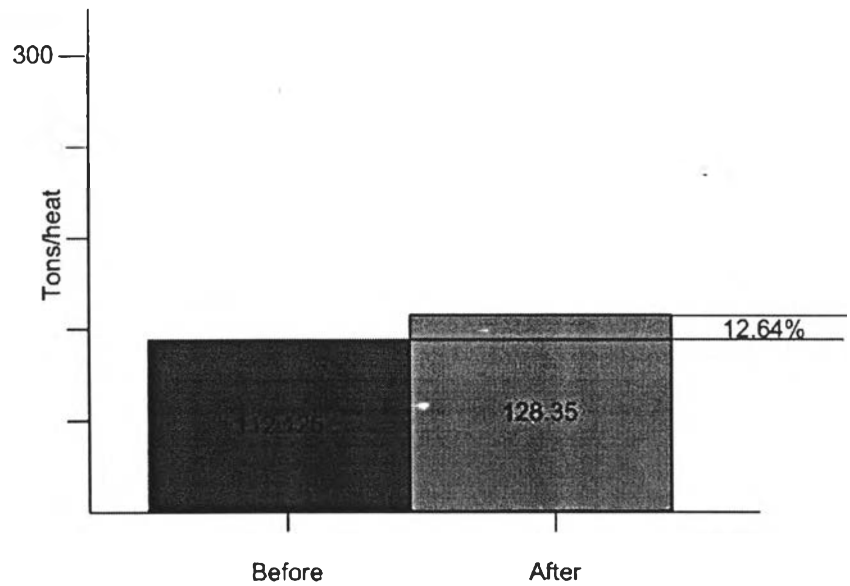

Figure 6.12 Comparison Production received of before and after improvement

According to Figure 6.12, the production per heat before improvement is 112.125 tons and after improvement is 128.35 tons. The difference production between before and after improvement is about 16 tons per heat or 12.64 percent. As you can see in Figures 6.10 and 6.12, the quantities of scrap used are slightly different (0.33%) but the output of the melting these scraps are quite different (12.64%). It shows that after improvement the company receiving the increasing output rate more than increasing the input rate. It means the yield after improvement is more than the yield before improvement. The comparisons between yield before improvement and after improvement can be shown in Figure 6.13. So if we consider at 1 month (28 days) that separate into 20 working days and 8 holidays, the quantity of heat before improvement is equal to 296 heats per month per furnace and the quantity of heat after improvement is equal to 312 heats per month per furnace. So the quantity of output per months that receives increasing from improvement is equal to:

$$Increa\sin g\ output \quad = 296x16 + (312 - 296)x128.35$$
$$= 6792\ tons\ /\ furnace$$

As you can see, after improvement, the company can increase the production abut 6792 tons per furnace. Due to having 2 furnaces, the production increasing is equal to 13584 tons. This is the high benefit receiving from improvement. If comparison this into sale price, the company can sale increasing about 203,760,000 baht per month

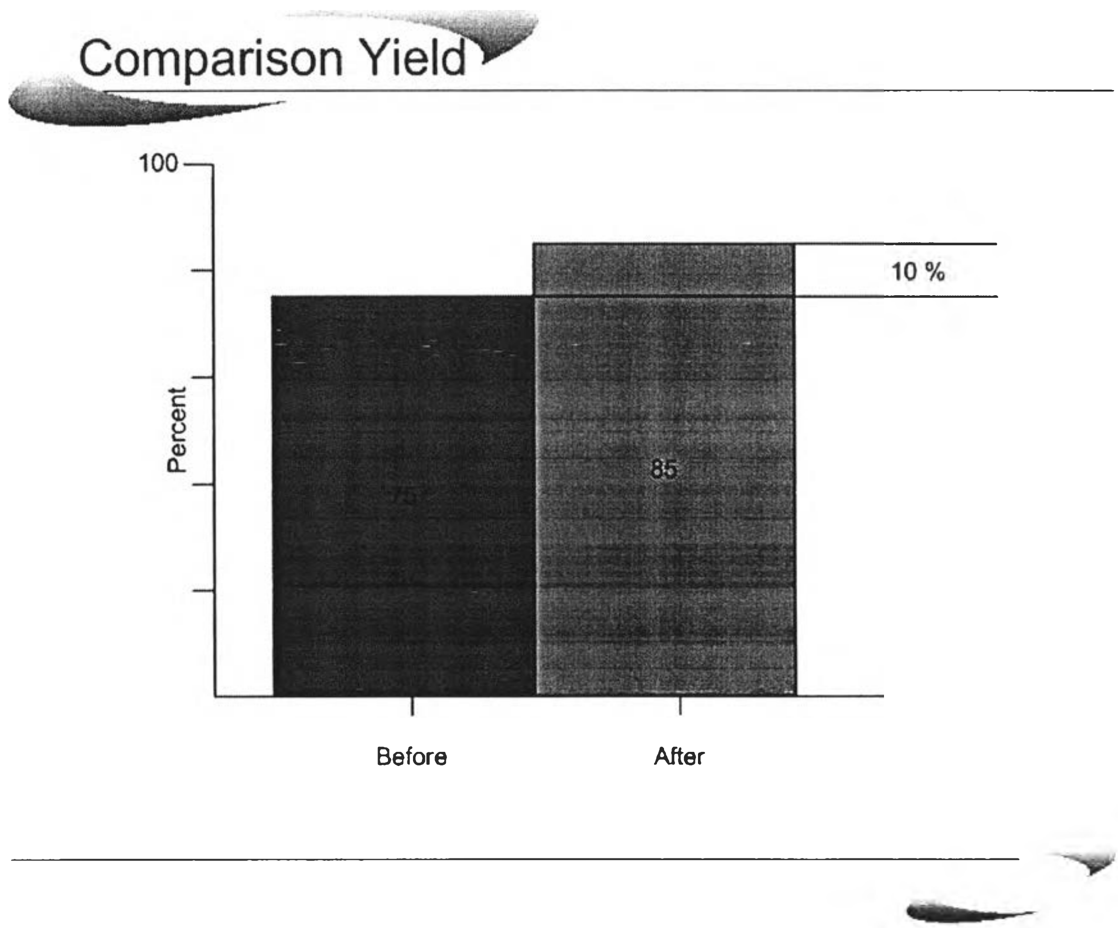

Figure 6.13 Comparison Yield of before and after improvement

Yield is the rate of output and input. As you can see from Figures 6.11 and 6.13., before improvement, the company uses the scraps 149.5 tons and received the output is 112.125 tons so yield before improvement are equal to :

$$Yield_{before\ imrovement} = \frac{149.5 - 112.125}{149.5} x100 = 75\%$$

After improvement, the company uses the scrap 151 tons and receiving the output is 128.35 tons so yield after improvement are equal to:

$$Yield_{afteri\ improvement} = \frac{151 - 128.35}{151} x100 \quad = 85\%$$

So yield after improvement are increased by 10% from before improvement. It leads to the company can receiving the product.

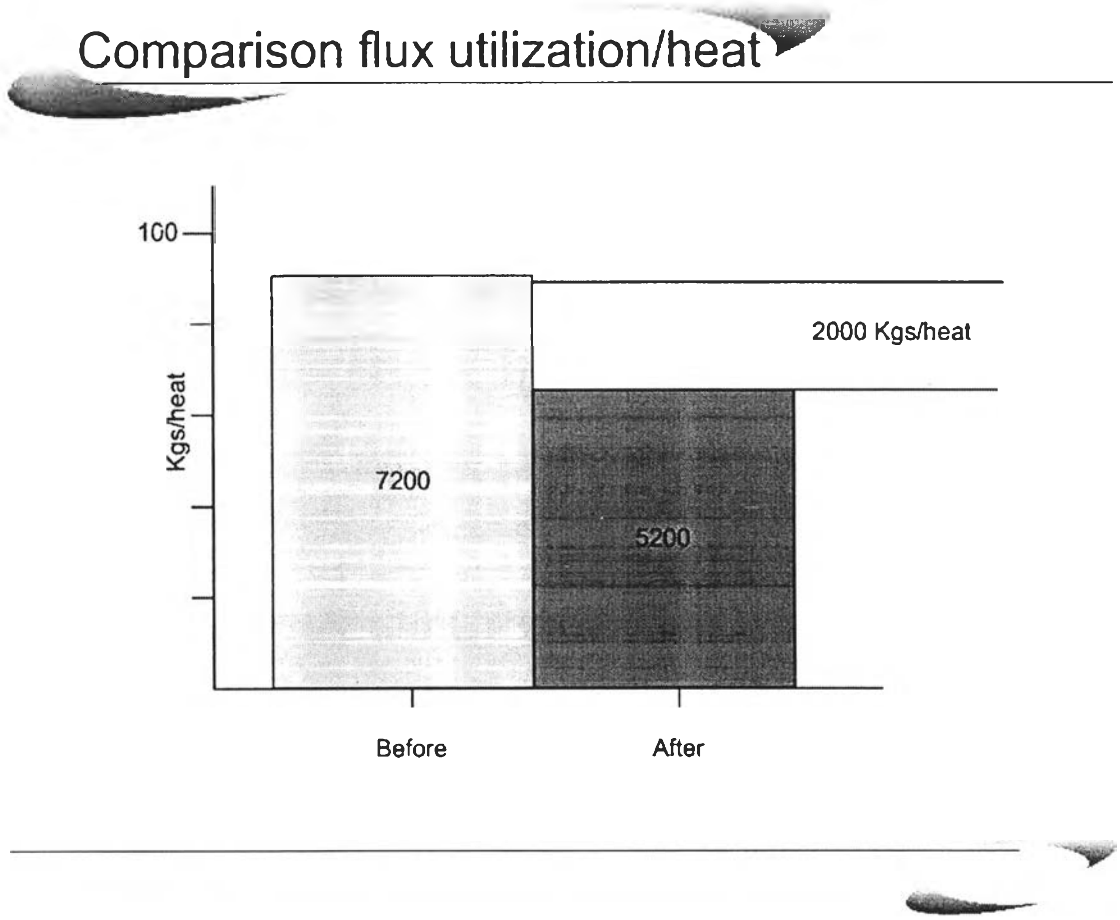

Figure 6.14 Comparison flux used of before and after improvement

The total flux used before improvement is equal to 7200 kilograms and the flux used after improvement is equal to 5200 kilograms. The difference of flux used before and after improvement is equal to 2000 kilogram. So if we consider at 1 month (28 days) that separate into 20 working days and 8 holidays, the quantity of heat before improvement is equal to 296 heats per month and the quantity of heat after improvement is equal to 312 heats per month. However, if we consider at the same quantity of heat at 312 heats, the quantity of flux reduce by:

$$
\begin{aligned}
\text{Flux Reducing} &= 312x2 \\
&= 624 \text{ tons/furnace}
\end{aligned}
$$

However, the company has two furnaces so the reducing of flux used are equal to 624x2 = 1248 kilograms. Flux reduces 1248 tons per month consider at the same quantity of heat at 312 heats per furnace. It makes the company can reducing the cost of flux (about 5 bath/kg).. In addition, the company saves the time from reducing melting the flux about 1248 minutes.

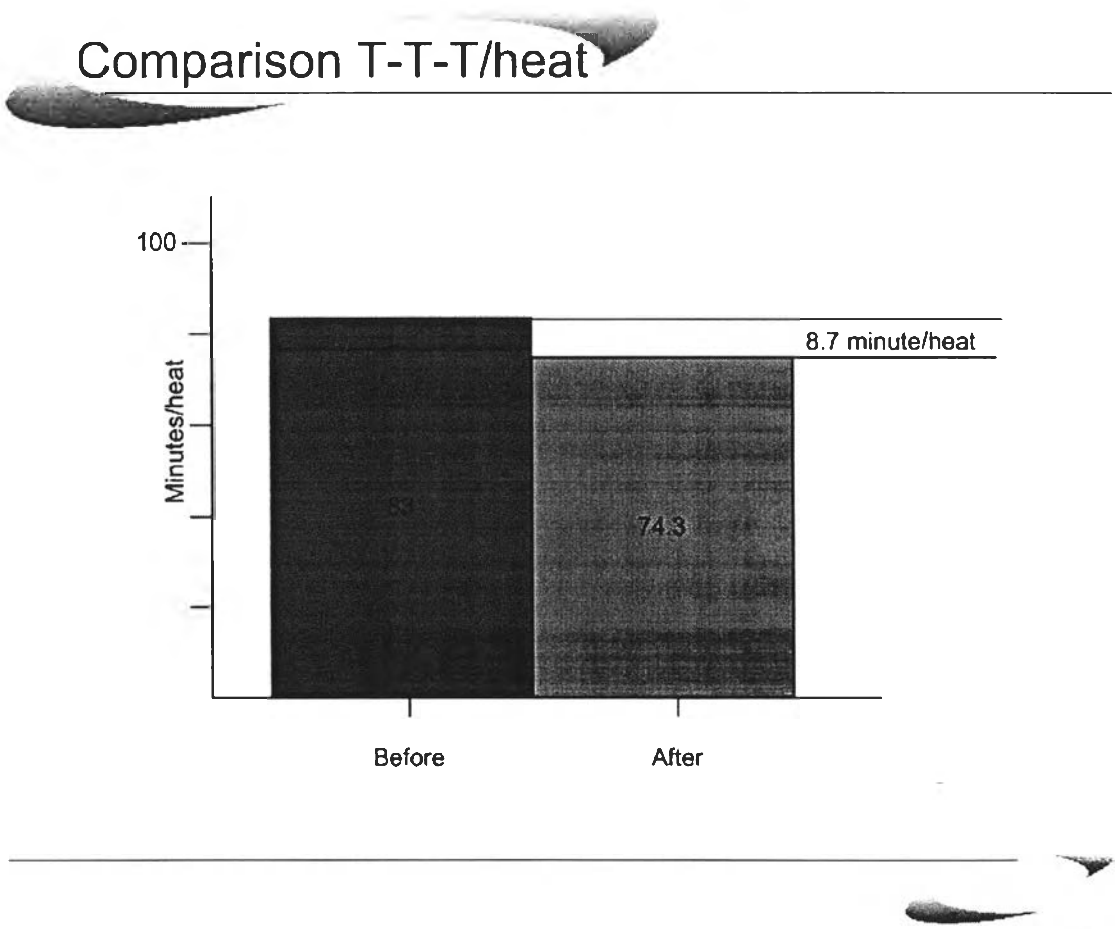

Figure 6.15 Comparison Tap-To-Tap between before and after improvement

As you can see in Figure 6.15, the company reduces the T-T-T time about 8.76 minutes per heat. As we consider the time used in 1 month (28 day). The company can reduce the time equal to :

$$T-T-T\ reducing \quad = 8.7 \min x312\ heat$$
$$= 2714 \min ute$$

However, if we consider at time used in the 1 month (28 days) by separating into working day (11 hours, 20days) and holiday (24 hours,8 days), the company can run the production 8 heat/day on the working day and 17 heat/day on the holiday. So , in 1 month (28days), the company can run the quantity of heat equal to:

$$Quantity\ of\ heat_{before\ improvement} \quad = \frac{11x60}{83}x20 + \frac{(24x60)}{83}x8$$
$$= 8x20 + 17x8$$
$$= 160 + 136 \quad = 296\ heats$$

And the quantity of heat after improvement can be show below:

$$Quantity\ of\ heat_{afterimprovement} \quad = \frac{11x60}{74.3}x20 + \frac{(24x60)}{74.3}x8$$
$$= 8x20 + 19x8$$
$$= 160 + 152 \quad = 312\ heats$$

As comparing the two quantity, the company receive the quantity of heat increasing =312-296 =16 heat per month for 1 furnace. However the company has two furnaces. So the company can increase the quantity of heat by 32 heats per month

6.2 Analyzing Operating cost, Sale price and Profit per Month before and after Improvement

For this improvement, the company has changed the new scrap types, change the addition flux, and so on but no increasing investment and labor cost. Therefore, the detail of the cost per $ton_{product}$ before and after improvement can be shown in Table 6.15 and Table 6.17 respectively.

Before improvement

Table 6.14 The scrap price in November and December

Type	Unit Cost Baht/t_s	Quantity t_s	Cost Baht
Po(ex)	6,300.0	9.0	56,700.0
Po	6,000.0	17.0	102,000.0
A	5,400.0	33.0	178,200.0
B	5,000.0	65.5	327,500.0
I	7,000.0	25.0	175,000.0
Total		149.5	839,400.0
	Average (Baht/t_s)		5,614.7

Table 6.14 showed the price of each scrap that the company can find in November and December and the quantity of each scrap used in each heat. From this price and quantity, it can be calculated the average cost per ton_{scrap} equal to 5614.7 baht at density 0.62 ton/m^3. After calculating the cost per ton of the scrap, it can be calculating the production cost per $ton_{Product}$ as shown in Table 6.15

In Table 6.15, It shows the production cost per $ton_{product}$ by calculating cost from the scrap used to produce the product 1 tons, Energy used, Addition used, Ferro-alloys used, Maintenance cost, Refractory cost, Labor cost, Rolling mill cost, and the other cost.

Table 6.15 Production Cost per $ton_{product}$ of the product before improvement

Description	Unit Cost (Baht/Unit)	Quantity ($Unit/t_{Product}$)	Cost ($Baht/t_{Product}$)
Scrap	5,614.72	1.33	7,486.27
Energy			
-Electrical	1.75	517.30	905.28
-Oxygen	4.00	35.00	140.00
-Natural gas	5.50	3.00	16.50
-Electrode	150.00	2.00	300.00
Addition			
-Flux	4.00	64.00	256.00
-Coke	6.00	46.00	276.00
-CaF_2	6.00	3.74	22.44
Ferro-Alloys			
-Fe-Si	40.00	4.00	160.00
-Fe-Mn	25.00	10.00	250.00
-Al ash	10.00	1.60	16.00
-SiC	30.00	2.00	60.00
Maintenance Cost	180.00	1.00	180.00
Refractory Cost	320.00	1.00	320.00
Labour Cost	30.00	1.00	30.00
Other	120.00	1.00	120.00
Roll Mill Cost	895.00	1.00	895.00
		Total Cost	11,433.48

So for the product 1 tons, the cost of production is equal to 11433.48 baht per $ton_{product}$

In 1 month: Average production/month = 73,271.5 $ton_{product}$

Average Cost/month = 88,232x11433.48

= 837,748,516.29 Baht/month

Sale price = 15,000 baht/ $ton_{product}$

Average Total Sale = 15000x73271.5

= 1,099,072,500 Baht/month

therefore: Average Profit = 1,099,072,500-83,774,8516.29

= 261,323,983.71 Baht/month

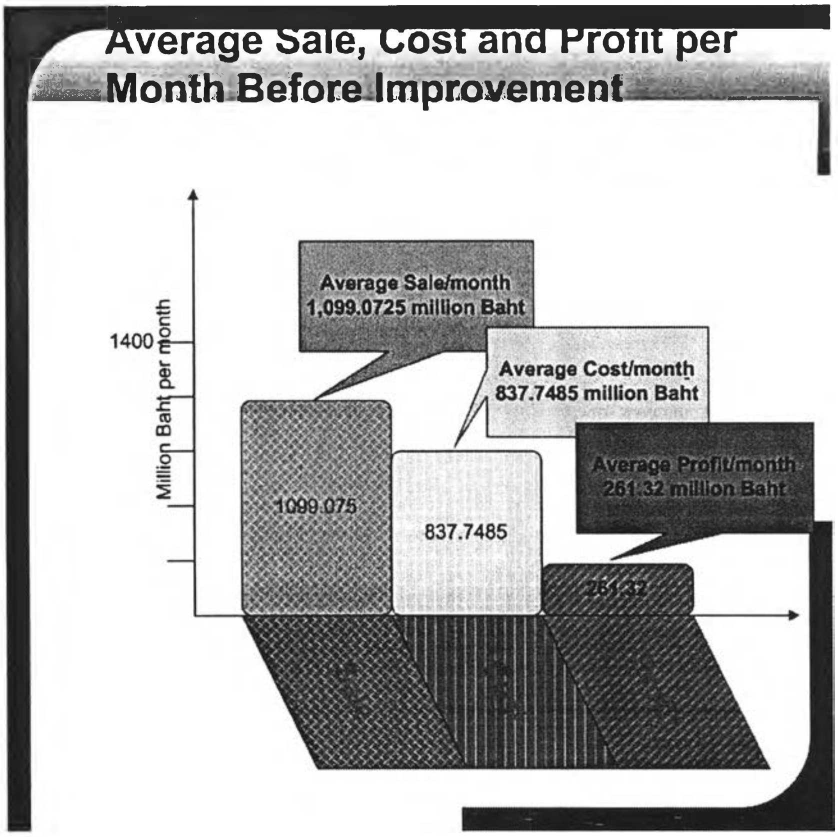

Figure 6.16 Average Sale, Cost and Profit per Month before Improvement

After Improvement

Table 6.16 The scrap price in January and February

Type	Unit Cost	Quantity	Cost
	Baht/t_s	t_s	Baht
S183	6,090.0	34.0	207,060.0
S187	6,525.0	7.0	45,675.0
S517	6,960.0	65.0	452,400.0
S400	7,100.0	8.0	56,800.0
S406	7,400.0	1.0	7,400.0
S922	6000	3.0	18,000.0
S923	6,000.0	2	12,000.0
S900	6,000.0	1.0	6,000.0
I116	7,000.0	30.0	210,000.0
Total		151.0	1,015,335.0
	Average (Baht/t_s)		6,724.1

Table 6.16 showed the unit cost per ton_{scrap} of each scrap type, quantity of scrap used in 1 heat, and the cost from each scrap type per heat. All of these can be

calculated the average cost per ton $_{scrap}$ equal 6724.1 baht per ton$_{scrap}$. However, 1 ton product has to used 1.18 ton scrap. So the production cost of producing the product 1 ton can be shown in the figure 6.17

Table 6.17 Production Cost per ton$_{product}$ of the product after improvement

Description	Unit Cost (Baht/Unit)	Quantity (Unit/$t_{Product}$)	Cost (Baht/$t_{Product}$)
Scrap	6,724.07	1.18	7,910.87
Energy			-
-Electrical	1.75	430.39	753.18
-Oxygen	4.00	35.00	140.00
-Natural gas	5.50	3.00	16.50
-Electrode	150.00	2.00	300.00
Addition			
-Flux	4.00	40.50	162.00
-Coke	6.00	30.00	180.00
-CaF_2	6.00	3.74	22.44
Ferro-Alloys			
-Fe-Si	40.00	4.00	160.00
-Fe-Mn	25.00	10.00	250.00
-Al ash	10.00	1.60	16.00
-SiC	30.00	2.00	60.00
Maintenance Cost	160.00	1.00	160.00
Refractory Cost	280.00	1.00	280.00
Labour Cost	23.00	1.00	23.00
Other	100.00	1.00	100.00
Roll Mill Cost	890.00	1.00	890.00
		Total Cost	11,423.99

So for the product 1 tons, the cost of production is equal to 11423.99 baht per ton$_{product}$

In 1 month: Average production/month = 88,232 ton$_{product}$

Average Cost/month = 88,232x11433.48

= 1007961561.11 Baht/month

Sale price = 15,000 baht/ ton$_{product}$

Average Total Sale = 15000x88,232

= 132,480,000 Baht/month

therefore: Average Profit = 1,323,480,000-1,007,961,561.11

= 315,518,438.88 Baht/month

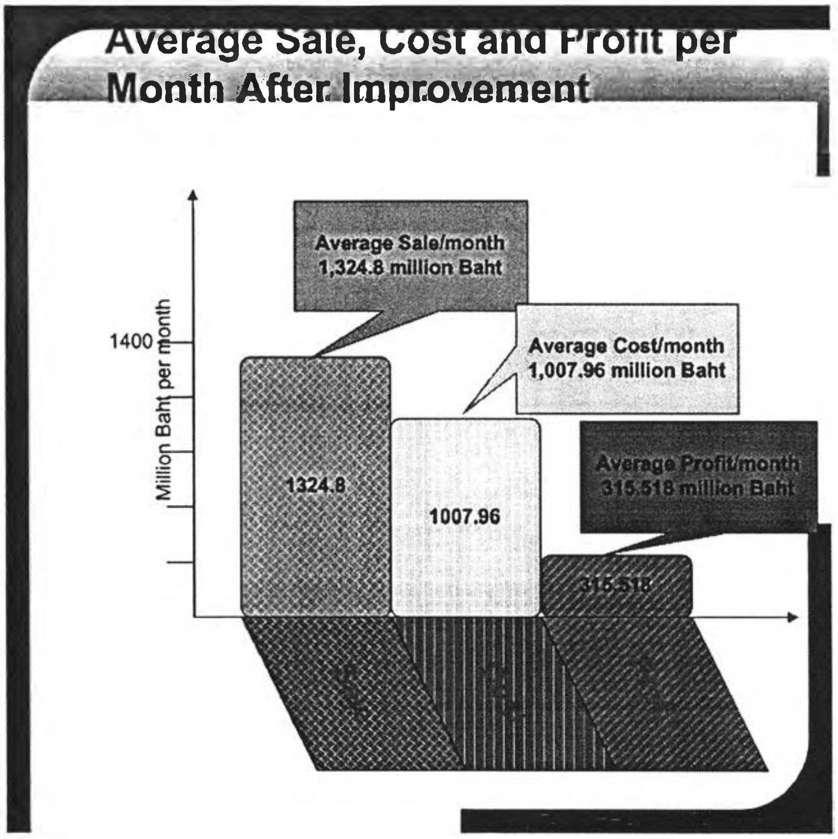

Figure 6.17 Average Sale, Cost and Profit per Month after Improvement

Comparison Profit before and after improvement

From Figure 6.16 and Figure 6.18, the sale after improvement increase from 1,099.079 million Baht to 1,324.8 million Baht so the sale increases by 20.53 percent. The cost after improvement increases from 837.748 million Baht to 1,007.96 million baht. The difference is about 20.31percent. From the sale and cost, the profit after improvement increase from 261.32 million baht to 315.518 million baht. The increasing profit is equal to 54.198 million baht (about 20.%) as shown in figure 6.18

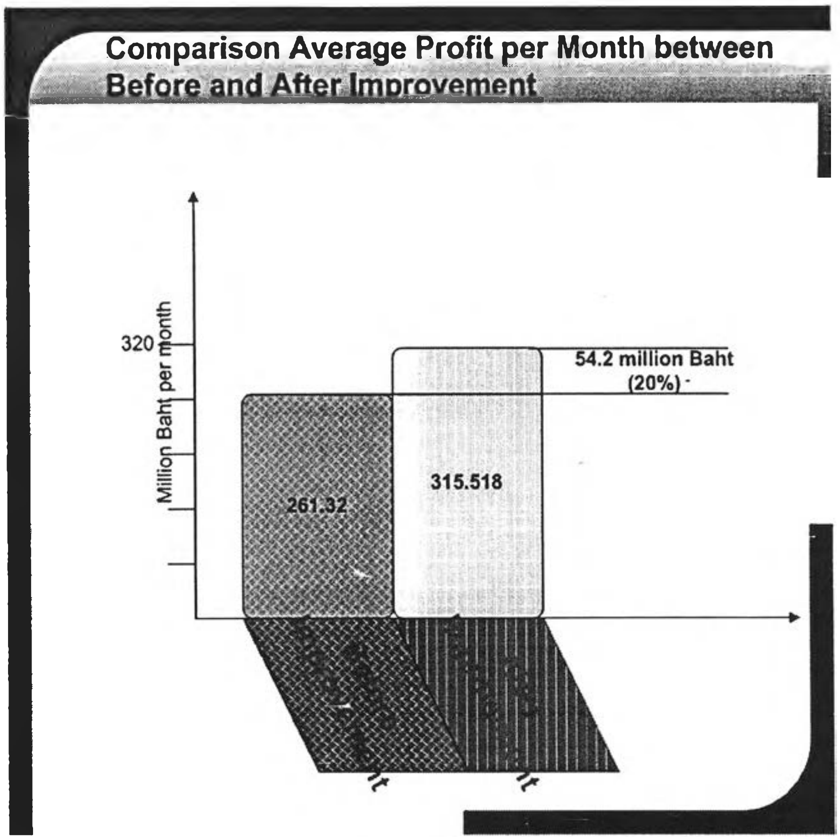

Figure 6.18 Comparison average profit per month between before and after improvement

6.3 Conclusion Result

- Managing of the suitable plan and method for improvement about the scrap and chemical composition received lead to improve yield in the melting process.

- New Pattern of melting the scrap in the EAF makes reducing the cost due to using the electrical energy reducing and using indirect raw material reducing as shown in the table 6.18

Table 6.18 Comparing using energy, lime, production, and yield before and after improvement.

Items	Before Improvement	After improvement
Energy	387.96 KwH/ T_{scrap}	365.82KwH/ T_{scrap}
Lime	7200 kgs/T_{scrap}	5200 kgs/T_{scrap}
Production	750 kgs/ T_{scrap}	870 kgs/ T_{scrap}
Yield	75%	85%

- Time using for melting the scrap reduce from the past. It lead to the more time for producing from T-T-T =83 minutes/heat to 74.24 minutes /heat

- According to efficiency increasing from the improvement, it makes all functions, departments, top management and so on are awareness and unique to improvement in the next project improvement.

- It makes the company can sent more products to support market requirement by profit after improvement increasing by 54.2 million baht per month from before improvement.