Preliminary Energy Analysis conducted at PEEKAY STEEL

In Foundry Section

As part of the course EE6401 Energy Audit and Management,

Instructed by Dr.Ashok. S, NIT Calicut during monsoon semester 2015

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ABSTRACT

- Company Profile
- Plant details
- Manufacturing Process
- Specific Energy Consumption
- Observations
- Techno Economic Analysis
- Conclusion and Suggestions

COMPANY PROFILE

Peekay Steel Castings Pvt Ltd, which is the flag-ship company of the reputed Peekay Group, commenced manufacture of Steel Castings in 1997. It has an annual turnover of US $ 50 million with a growth rate of 50%. Peekay Steel Castings are exported to USA, Europe, Far East, the Middle East and ASEAN Countries. Over the years the company has gained international reputation as leading manufacturers and suppliers of quality steel castings.

Peekay makes steel castings with piece weights ranging between half a kilo and 15 tons. Its Calicut and Coimbatore foundries produce 13200MT of Steel Castings annually using latest advanced technology processes.

PLANT DETAILS

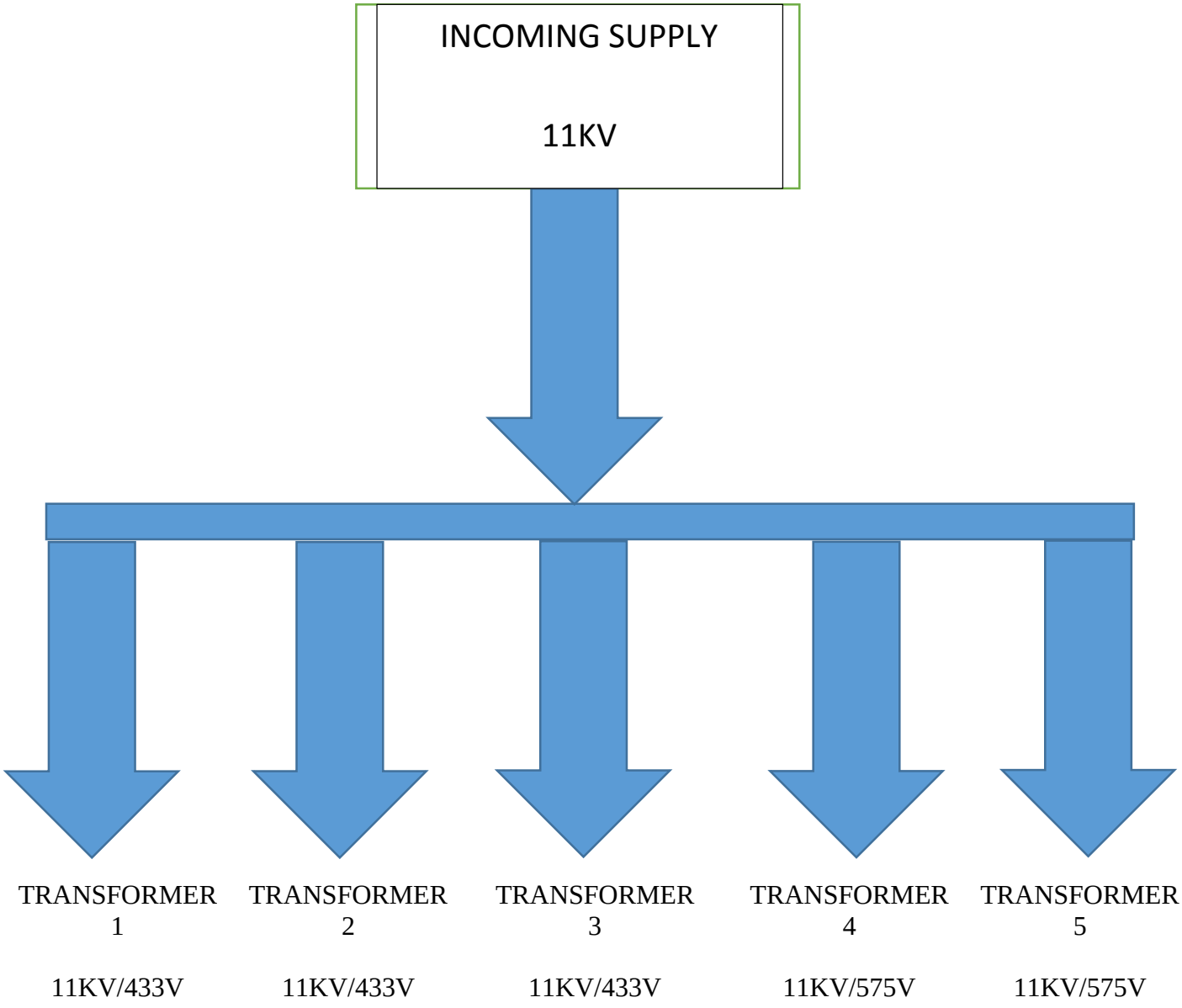
- SUPPLY VOLTAGE - HT 11 (KV)
- Contract Demand - 4000 kVA
- Connected Load - 3249.506 kW
- Maximum Demand - 4313 kVA (September 2015)
- Average PF - 0.97 (September 2015)

Zone wise Energy cost

Zone 1 (6AM to 6PM) - 5.2/Unit

Zone 2(6PM to 10PM) - 7.8/Unit

Zone 3(10PM to 6AM) - 3.9/Unit


INCOMING SUPPLY
11KV
TRANSFORMER 1
11KV/433V
TRANSFORMER 2
11KV/433V
TRANSFORMER 3
11KV/433V
TRANSFORMER 4
11KV/575V
TRANSFORMER 5
11KV/575V

Foundry

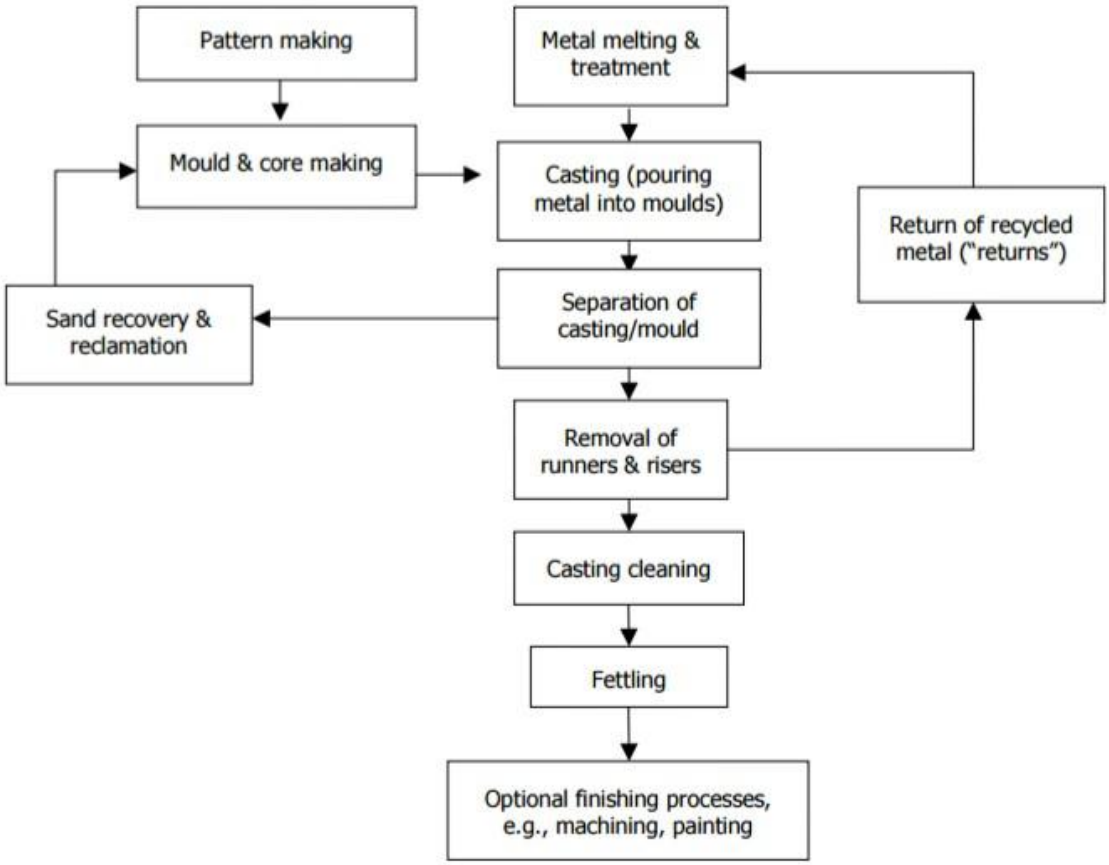
Foundry process involve four parts

1. Melting

2. Molding

3. Pattern making

4. Fettling



Description of the foundry process Foundries produce castings that are close to the final product shape, i.e., “near-net shape” components. Castings are produced by pouring molten metal into moulds, with cores used to create hollow internal sections. After the metal has cooled sufficiently, the casting is separated from the mould and undergoes cleaning and finishing techniques as appropriate.

1. Melting : Molten metal is prepared in a variety of furnaces, the choice of which is determined by the quality, quantity and throughput required.

2. Molding : Molding is the process of manufacturing by shaping liquid or pliable raw material using a rigid frame called a mold or matrix. This itself may have been made using a pattern or model of the final object.

3. Pattern making : Patterns are used to create the shape in the sand, into which molten metal will be poured to become the casting. Patterns can be made from metal, wood or plastic. Most patterns are made from aluminum , called matchplates and have a long life before wearing out.

4. Fettling : the removal of feeders and excess material from a casting is the first stage of finishing a casting. The metal removal is often achieved using manual cutting or grinding. However, more emphasis is being placed on automatic fettling, whereby the casting is placed in a machine programmed to remove materials from specific areas. The method of fettling must be taken into account at the initial casting design stage, so that the process is fast and efficient.

OBSERVATIONS

- The average power factor of the company is found to be 0.97 and they are getting a reward of around 80000 Rs per month

- Since the Maximum Demand (Average 5200kVA) is almost closer to 130% to the Contract Demand (4000kVA) there is no scope for a reduction in the Contract Demand.

Major Electrical Loads

UNIT	Operating Power (kw)	Rated Power (kw)	% loading
INDUCTION FURNACE - 1 **(575 VOLT)**	2200	2500	88%
INDUCTION FURNACE - 2 **(575 VOLT)**	1500	1800	83.33%
TOTAL CRANES =19 **(433 VOLT)**			Differ with respect to lifting requirment
15 TON (6)	20 kw each	120	
1O TON (5)	15 kw each	75	
5 TON (8)	7.5 kw each	60	

➢ COMPRESSOR LOADING

COMPRESSOR RATING	NO OF COMPRESSOR USED
100 HP	2
60 HP	2
75 HP	1
70 HP	1

- The average power factor is only 0.97 which is on the lower side with fixed capacitor bank so an Automatic steeped Power factor Correction unit capacitor banks has been suggested to correct the PF to 0.99.

- Since all the induction furnace is installed with inbuilt capacitor bank so there is no need to supply reactive power.

- Option1: Operating induction furnace nearer to its rating during off load period will increase efficiency as well as costing of energy will also be less. As now these furnaces are operating at 88% and 83.3% the loading can further be increased up to 98%.

- Option 2: Replacement of the switched capacitor bank with 12 step APFC near transformer supplying load to cranes will increase the power factor.

TECHNO-ECONOMIC ANALYSIS

Calculation for power factor correction of compressor and cranes

Average Power factor : 0.97

Corrected power factor : 0.99

Average kW load : 346 kW + 265 kW = 611 kW

Reactive power supplied without APFC and capacitor banks =148.53kVAR

Reactive power supplied with APFC and capacitor banks =66.068kVAR

Reduction in kVAR= kVAR supplied by capacitor banks =82.462 kVAR

A 12 step APFC can be provide with a 100 kVAR capacitor banks

Total savings due to power factor correction = 17kW, average operating hours 14hr = 238 kWH/day

Daily savings =Rs 1237.6

Monthly saving = Rs 14851.2

Cost of 12 step APFC= Rs 220000 (Havells make)

Cost of 100 kVAR capacitor banks =Rs 220000

Simple payback period =initial cost /Annual savings= 1 year 3 months

CONCLUSION AND SUGGESTIONS

- An 12 step APFC with capacitor banks shall be provided to improve the power factor

- Operating induction furnace nearer to its rating during off peak hours (zone 3- 10 PM to 6 AM) will increase efficiency as well as costing of energy will also be less.