

**PUNJAB STATE ELECTRICITY REGULATORY COMMISSION
SCO NO. 220-221, SECTOR 34-A, CHANDIGARH**

**Petition No. 3 of 2012
Date of Order: 28-10-2013**

In the matter of : Petition U/S 86/94 of Electricity Act 2003 regarding treatment to be meted to Billet / Induction heating load by PSPCL and quashing of CC 38/2009 dated 29.10.2009.

AND

In the matter of: M/s Ludhiana Hand Tools Association, D-90, Phase-5, Focal Point, Ludhiana

Versus

Punjab State Power Corporation Limited, The Mall, Patiala
(through its Chairman cum Managing Director)

Present: Smt.Romila Dubey, Chairperson
Shri Virinder Singh, Member
Shri Gurinder Jit Singh, Member

ORDER

Ludhiana Hand Tools Association (Association) has filed this petition praying for quashing the Commercial Circular (CC) No. 38/2009 dated 29.10.2009 issued by erstwhile Punjab State Electricity Board (PSEB) without Commission's prior approval. The Association has also prayed for defining the term power intensive which should be made applicable to those industries which have a demand factor above 90% and load factor above 80%.

2. The Association has submitted that it has more than 200 members and is a registered body. The members of this Association are involved basically in the forging process for manufacture of Hand Tools. The load of such units is predominantly of general nature but there is billet heater load also which ranges from as low as 3% to about 50% (in a few cases). On an average, such load is of the order of 25-30%. Most of these units are quite old and all of them have always been treated as general category loads and were also billed under this category tariff, whether it is basic tariff or MMC or grant of power factor incentive etc. The Association has further submitted that the term 'Power Intensive' has not been defined till date anywhere, even though power intensive units have been identified in the form of arc/induction furnaces along with their auxiliary loads and gas plants etc, as per clause 7.7 of General Conditions and Schedules of Tariff

approved by the Commission in April, 2006, and adopted/circulated by erstwhile PSEB vide CC No. 36/2006 dated 14.07.2006. Subsequent to this, the field staff of erstwhile PSEB started treating forging units as power intensive category, simply because some of them have started adopting latest technology of induction heating for heating billets because of various advantages, and started harassing and penalizing them who had no option but to approach the dispute settlement committees, which unfortunately had been handing out decisions mostly in favour of PSPCL relying upon its CC No. 38/2009 dated 29.10.2009, which was even otherwise not valid/legal, having been issued without prior approval of the Commission.

It has been submitted by the petitioner that CC No. 38/2009 dated 29.10.2009 was issued on the basis of a report of a committee headed by CE/Operation (Border), constituted by CE/Commercial vide office order dated 17.10.2007. This committee recommended that billet heating is at an unstandard voltage and high frequency. The petitioner has alleged that these recommendations are mostly irrational and irrelevant. Power intensive equipment loads, as the name implies, should be those whose demand/load factor is high, like normal induction furnaces which have demand factor as high as 90-95% and load factor above 80%. The load factor of most of the forging units varies from 12% to 45%, and on an average, it is of the order of about 30%, and its demand factor is hardly 50%. It has been submitted that as per ESR, the demand factor of forging units is 50% and load factor is 35%.

The members of the Association approached various functionaries of PSPCL to get justice, and as a result another sub-committee was constituted by CE/Commercial vide letter dated 28.04.2010 under the chairmanship of CE/DS (Central). This committee observed that the billet heaters should not be considered as power intensive irrespective of whatever frequency or voltage these operate.

It has further been submitted that notwithstanding the fact that the harmonics generation in these units is hardly 3-4% against the limit of 8% prescribed by IEEE-519-1992, it is to be kept in view that these billet heaters are used after supply from PSPCL is converted into DC and then inverted into AC. These harmonics, if any, are not adversely affecting PSPCL system because of the buffer provided by DC system between PSPCL system and the billet heaters.

3. The petition was admitted vide Order dated 31.01.2012. PSPCL was directed to file reply by 21.02.2012.

4. PSPCL in its reply to the petition filed vide letter dated 23.02.2012 has submitted that a committee to sort out the issue whether billet heater load is to be considered as power intensive or general load was constituted. The committee recommended as under:

The principle of heating in case of billet heaters is heating through induction at unstandard voltage and high frequency. The temperature achieved is about 1100 Degree Celsius. The process is similar to that of heating in case of induction furnaces where unstandard voltage and high frequency supply is used for the process of melting the metal. The temperature achieved is again about 1500-1600 Degree C.

On the basis of the above recommendations of the committee, PSPCL decided to treat the billet heater load as power intensive load and CC No.38/2009 dated 29.10.2009 was accordingly issued. Various representations were received from Ludhiana Hand Tools Association, Apex Chamber of Commerce and Industry and other Associations for considering billet heater load as general category load, instead of power intensive unit (PIU), on the plea that billet heater load is being used for pre-heating in forging industry and it is environmental friendly technique. The Board of Directors of PSPCL, in order to redress the grievance of the billet heater load industry, decided that all the Large Supply consumers having billet heater load upto 25% of sanctioned load or 500 kW, whichever is higher, may be considered as General Industry consumers. This decision of Board of Directors was sent to the Commission vide memo no.19854 dated 26.07.2011 for concurrence. The Commission vide its letter no.5908-09 dated 30.09.2011 intimated as under:

It has been desired by the Commission that criteria for including/declaring an industrial unit as power intensive needs to be specified by the licensee after approval of the Commission. The criteria to be specified may be in the form of energy consumption in kWh per tonne of the finished product of the unit and the unit having the energy consumption in excess of the specified limit would be declared power intensive unit. In the meantime,

the prevailing practice for treating the Billet Heater Load as power intensive load may continue.

In view of the above direction of the Commission, a committee was constituted by PSPCL (vide O/O No.150/DSS-1/Billet Heater dated 05.04.2013, comprising of Dy. CE/Sales-1, Addl.SE/Sales-5 and Addl.SE/CBC).

Regarding the claim of the petitioner that the harmonic generation in these units is hardly 3-4% against the limit of 8% prescribed by IEEE-519-1992, PSPCL submitted that recently, in compliance to the orders of the Commission issued in Petition No. 1 of 2009 filed by Northern Railways, the study of the traction substations and 13 nos. large scale industries covering different manufacturing processes was got conducted from CPRI, Bangalore. One of the firms, Happy Forging Limited, which is also one of the members of the petitioner Association, was also included. The harmonic distortion (voltage) levels were measured as 3.2% and total harmonic distortion level was measured as 12.4%. The CPRI report has followed IEEE-519 standards. However, Indian Standards issued by Central Electricity Authority (Technical Standards for connectivity to the grid) Regulations, 2007 vide notification dated 21.02.2007 states as under:

- (i) Total Harmonics Distortion (THD) for voltage at connection point shall not exceed 5% with no individual Harmonic higher than 3%.
- (ii) The Total Harmonics Distortion for current drawn from the transmission system at the connection point shall not exceed 8%.

It has further been submitted by PSPCL that in the case of Happy Forgings Limited, the total current harmonic distortion level was measured by CPRI as 12.4% which is more than the limit of 8% as prescribed by Central Electricity Authority. It has been submitted that it is clear from the petition that for billet heating purpose, industry is employing the process of power rectification and inversion to get the required voltage level and frequency and it has now been completely established that uninterrupted power supply (UPS) give rise to very high level of harmonics and the same principle of rectification and inversion is employed in billet heating as well as in UPS. It has been prayed by PSPCL in its reply that as conveyed by the Commission in its letter no. 5908-09 dated 30.09.2011, the prevailing practice for treating the billet heater load as power intensive load may be continued and the present petition may thus be dismissed.

5. The Commission in its order dated 05.03.2012, after hearing the arguments advanced on behalf of the petitioner and PSPCL, observed that the criteria for declaring an industrial unit as power intensive needs to be specified by the licensee after approval of the Commission. The Commission directed PSPCL to submit a concrete proposal specifying the criteria (based on detailed calculations) for treating an industrial unit having billet heater load as general industry or power intensive, as already directed in Commission's letter no. 5908-09 dated 30.09.2011. PSPCL was also directed to involve leading Metallurgical and Chemical Engineering Experts from Punjab Engineering College and Punjab University to expedite its recommendations.

6. PSPCL took the matter with Director, Punjab Engineering College and University of Technology, Chandigarh vide its letter dated 13.03.2012, in compliance to Commission's order dated 05.03.2012.

7. The petitioner filed its rejoinder on 14.03.2012 to the reply submitted by PSPCL. The petitioner in its rejoinder submitted that the respondent has not only avoided giving response to the important issues raised by them in their petition but has even tried to mislead the Commission. PSPCL has referred to the report of the earlier committee, but has not mentioned about the later committee which had strongly recommended that the billet heater load be not treated as power intensive, whereas the earlier committee had recommended treatment of billet heater as power intensive on the basis of so called high level of harmonics generated. The later committee had clearly brought out that the harmonics level was much below the specified limits. The Commission in its letter no. 5908-09 dated 30.09.2011 had rightly observed that the criteria for including an industrial unit as power intensive needed to be specified by the licensee after the approval of the Commission. Thus, the instructions issued by CE/Commercial vide CC No.38/2009 dated 19.10.2009 were not in order, being without authority. It has further been submitted that the observation of the Commission that the criteria to be specified be in the form of energy consumption in kWh per tonne of finished product and that unit having energy consumption in excess of the specified limits be declared as power intensive unit, is not only logical in principle but also close to the concept followed by PSPCL for a long time. It is because of this factor that even units other than induction furnaces, like Chloro Alkali Plants have been

treated as power intensive as the same have utilization factor above 80%. On the other hand, loads of certain welding sets and even microwave gadgets which have induction heating are not covered in the category of power intensive because their utilization factors are quite low. The petitioner has further submitted that instead of linking energy consumption/kWh with production, it should be linked with utilization factor of a unit as has been done all along by the respondent corporation. It has again been stressed in the rejoinder that any unit whatsoever type of load, having utilization factor above 80% should be declared power intensive, to be governed by the rules and regulations relating to power intensive category. The petitioner has prayed to accept its prayer as per petition with retrospective effect from the date of issue of CC No. 38/2009 dated 29.10.2009 in which it was decided to consider billet heater load as power intensive and was issued without the approval of the Commission.

8. The Commission in its order dated 21.03.2012 directed PSPCL to refer the matter to CPRI, Bangalore, with a view to expedite the report on the criteria for declaring/treating industrial units as general industry or power intensive industry. In order to avoid harassment to the industrial consumers using billet heater in their industry, the Commission also ordered that all such industrial units should be considered at par with general industry for the purpose of enforcing power regulatory measures till the disposal of this petition. The Commission further ordered that such consumers shall continue to be covered by the existing instructions of PSPCL for the purpose of levy of power factor incentive and MMC charges etc. during this period.

9. The Commission in its order dated 04.04.2012 directed PSPCL to entrust the consultancy to CPRI regarding specifying criteria for considering an industrial unit as power intensive industry or general industry. During hearing on 08.05.2012, the petitioner and the respondent brought to the notice of the Commission some recent judgements of the Punjab and Haryana High Court having bearing on the subject matter of this petition. After hearing the petitioner and the respondent, the Commission directed that a copy of the relevant judgements shall be filed with comments by the petitioner and the respondent. The Commission further directed PSPCL to associate the petitioner Association with the studies to be undertaken by CPRI.

10. The petitioner Association submitted the copy of the judgement dated 21.12.2011 in CWP No. 5222 of 2010 along with comments, on 31.05.2012. However, PSPCL did not file any document in this regard. The Commission in its order dated 04.07.2012 directed PSPCL to implement the judgement dated 21.12.2011 of Hon'ble Punjab and Haryana High Court immediately. The Commission further directed PSPCL to associate the petitioner Association and get the report of CPRI study expedited.

11. The Commission in its order dated 13.09.2012 observed that PSPCL has submitted the copy of the study report of CPRI in compliance with the Commission's orders dated 09.05.2012 and 04.07.2012, and PSPCL has issued CC Nos. 28/2012 dated 06.09.2012 for implementation of Punjab & Haryana High Court judgement dated 21.12.2011. PSPCL prayed for time of two weeks to study the report of CPRI for making submissions on the same. The Commission in its order directed PSPCL to file submissions on the following:

- (i) *Explain the inordinate time of two months taken for implementation of Punjab and Haryana High Court Judgement dated 21.12.2011 as per Order dated 04.07.2012 of the Commission.*
- (ii) *Intimate the number of industrial consumers having Billet heater load, whose loads were checked alongwith detail of penalties imposed during period from 04.07.2012 to 06.09.2012.*
- (iii) *Steps taken to redress the grievance of industry and refund of penalty in view of High Court Order.*

PSPCL was also directed to hold a joint meeting with CPRI and the petitioner Association to consider the report and offer comments on the report submitted by CPRI.

12. The Commission in its order dated 08.10.2012 observed that the respondent PSPCL has filed the comments on the points raised in the Commission's order dated 13.09.2012, vide CE/Commercial letter no. 1137 dated 01.10.2012, as under:

- (i) *As per directions of the Commission dated 4.7.2012 to implement the Pb. & Haryana High Court Judgement dated 21.12.2011 it was apprehended that this judgement was applicable in case of single consumer i.e. petitioner (Samrat Forging). Accordingly clarification/Legal Advice was sought from Legal Section regarding*

whether to implement the judgement on single consumer or in general to all industry of that category. The time taken by Legal Section to give advice and subsequent approvals from competent authority resulted in time period of two months in issuing instructions.

- (ii) As per directions of the Commission dated 4.7.2012 to implement the Pb. & Haryana High Court judgement, the instructions were issued vide CC 28/2012 dated 6.9.2012 and the instructions have been made applicable w.e.f. 24.12.2011. Hence there is no point in levy of any penalty on the industrial consumers checked during period from 4.7.2012 to 6.9.2012. If any penalty has been imposed during this period that shall be refunded/nullified.*
- (iii) Instructions have been passed on to the field offices vide CC 28/2012 dated 6.9.2012 and action is being taken accordingly.*

PSPCL further submitted that a meeting with CPRI officers and the petitioner was held on 25.09.2012 and also submitted the minutes of the meeting signed by PSPCL and CPRI, whereas the petitioner had refused to sign the same.

The CPRI also made detailed presentation to the Commission on 25.09.2012 and it was asked by the Commission to incorporate the observations made during the presentation in the final report which the CPRI agreed to supply by 15.10.2012. The Commission further decided that further course of action in the case shall be decided after considering the final report of CPRI.

13. The petitioner Association vide letter dated 05.10.2012 submitted its objections/observations on the draft report submitted by CPRI, which were forwarded to CPRI for considering while finalizing the report in the matter.

14. The study report (ERED/EA/128/2012-2013 of August 2012) of CPRI covered 11 No. industries for study. The Commission conveyed its observations on the study report carried out by CPRI to the respondent PSPCL vide letter no.9303/04 dated 31.12.2012, which are reproduced below:

It has been observed that Technical Study carried out as per present report of CPRI, pertains to some cases of billet heater consumers having loads in the range of 100 kVA to 11000 kVA rating. The study has been

conducted for a short period and as such is required to be organized for the timings during which around 10 billets of particular size are heated upto 1200⁰C considering 6 to 8 cases in each category of 100 to 500 kVA and 500 kVA onwards. The Electrical Qualitative study/parameters such as Harmonics/Transients, p.f., Grid/Feeder sizes, variable frequency should principally be made basis for further study; in addition to energy consumption in kcal/kg of Billet Material. Accordingly, you are advised to recall CPRI team to Punjab for about a week to conduct detailed study and cover broader spectrum of consumers to complete the report in discussions with PSPCL/P SERC.

15. PSPCL placed a Work Order dated 29.04.2013 on CPRI for getting a broad based study conducted to cover a larger number/spectrum of consumers, as per Commission's letter dated 31.12.2012. The description of the scope of work as given in the Work Order placed on CPRI is reproduced below:

To find out criteria for declaring the industry as Power Intensive Unit on the basis of following parameters:

The study is required to be organized for the timings during which around 10 billets of particular size are heated up to 1200⁰C considering 6 to 8 cases in each category of 100 to 500 KVA and 500 KVA onwards. The Electrical Qualitative study/parameters such as Harmonics/Transients, p.f., Grid/Feeder sizes, variable frequency should principally be made basis for further study; in addition to energy consumption in kcal/kg of Billet Material.

16. PSPCL submitted the broad based final report of CPRI (No.ERED/EA/128/2012-13 dated 26.07.2013) on billet heaters vide its letter no. 6172 dated 26.08.2012. The extracts from executive summary as contained in the final report are reproduced below:

PSPCL declared induction furnaces, induction billet heaters, induction surface hardening machines and arc furnaces as power intensive industries.

In order to define the criteria for declaring induction billet heaters as Power intensive industries, 28 numbers of Billet heating induction furnaces of 10 kW to 4000 kW and 10 numbers of induction surface hardening machines are studied in the vicinity of Ludhiana, Jalandhar, Mohali & Khanna Circles.

At the same time, to study and compare the behavior and nature of Billet heating induction furnace with induction melting furnaces and arc furnaces, five numbers of induction melting furnaces of different capacities from 300 kg output to 6000 kg output are also studied. One arc furnace was also studied to know the behavior of arc furnace.

The induction billet heater works on the principle of transformer. Due to mutual inductance, the magnetic field produced surrounding the coil induces an equal and opposing electric current in the billet and billet will heated up due to the resistance to the flow of the induced current i.e., eddy current. The rate of heating of the billet is dependent on the frequency of the induced current, the intensity of the current density, the specific heat of the material, the magnetic permeability of the material, and the resistance of the material to the flow of current. Induction heat treating involves heating a billet from room temperature to a higher temperature, as is required for different applications like induction tempering or induction austenitizing. The heating rates and efficiencies depend upon the physical properties of the billets (chemical composition of metal). These properties are temperature dependent, and the specific heat, magnetic permeability, and resistivity of metals change with temperature. The resistivity of steel at room temperature is about 18.8 micro ohm-cm which about nearly 11 times that of copper (1.7 micro ohm-cm). As the temperature increases the resistivity of steel increases drastically compared to copper. The steel exhibit a resistivity of about 121.9 micro ohm-cm at a temperature of 980°C and that of copper resistivity is 9.4 micro ohm-cm.

The magnetic permeability of steel is high at room temperature, but when the steel temperature crosses the Curie temperature (just above 780 °C), steels become nonmagnetic with the effect that the permeability becomes the same as air. As the steel is heated by induction heating from room temperature to higher temperature, the alternating magnetic flux field causes the magnetic dipoles of the material to oscillate as the magnetic poles change their polar orientation every cycle. This oscillation is called hysteresis, and a minor amount of heat is produced due to the friction produced when the dipoles oscillate. When steels are heated above Curie temperature they become nonmagnetic, and hysteresis ceases. Because the steel is nonmagnetic, no reversal of dipoles can occur. Therefore only eddy current will help in heating.

The billet heaters, surface hardening machines and induction melting furnaces work on the same principle of AC variable high frequency power supply. In both cases, the grid power frequency supply (50 Hz) is converted to DC by rectifiers and inverted back to varying frequency AC source. The heating effect depends on the frequency i.e., at high frequency the heating or melting is fast.

The power quality parameters are almost similar in both induction billet heaters / surface hardening machines as well as induction furnaces and

there is no difference in power quality parameters like current & voltage harmonics, voltage flicker and voltage dip.

The sudden change in non-linear load due to billet heating and melting of metals cause dip in voltage which again depends on network short circuit capacity. During measurement the non-linear load of 600 kVA was in service. At Kay Jay Forging, during measurement at 11 kV incomer side, the current is increased by 12.21 % which had reduced the voltage by about 1.265 % which is very high. The average voltage change during the entire measurement is 0.65 %.

At Nidhi Furnace, during the measurement at main incomer on 11 kV side, the current is increased by about 603.5 %, the voltage drop is 2.91 % which is on higher side. This higher voltage may be due to the short circuit MVA is less (11 kV incomer for the contract demand of 2500 kVA).

During measurement the non-linear load of 40 kVA was in service at Presto Forging, the current at main incomer on 11 kV side is increased by 69.23 %, the voltage dip is 0.026 % which is on lower side compared to Kay Jay Forging.

The average voltage dip is measured in the range of

- *Billet heaters: 0.03 to 0.65 %*
- *Hardening machines: 0.09 to 0.47 %*
- *Induction furnaces: 0.09 to 2.05 % and*
- *Arc Furnace : 0.70 %*

The average voltage drop (curve fit value from graph) at 400 kVA non-linear load (billet heater load) is about 0.30 %.

The total voltage drop due to six industries in one 11 kV feeder is 6×0.40 % (average value from curve fit) = 2.4 %. The estimated voltage drop for 11 kV feeder for average distance of 6 km based on KVA-KM basis is 4.68 % (data provided by PSPCL)

The total voltage drop due to non-linear load of average six industries (having a nonlinear load of 500 kVA each) and the voltage drop due to resistance of conductor is $(2.4 + 4.68) = 7.08$ %. Considering the diversity factor of 70 % for industrial load, the voltage drop will be 4.96 %. This voltage drop is not in the control of utility and is due to industrial power pollution and load. As per IE rules 1956 rule number 54, the voltage dip must be maintained at -9.0 %. Therefore the utility will have a margin of only about 4.04 % on negative side for maintaining the voltage within permissible limit of IE rule 54 which is very less & critical.

At Varun steel industries, during the measurement at 66 kV incomer side, the current is increased by 176.5 %, the voltage drop is 0.27 %.

At Happy Forging (billet heaters), during the measurement at 66 kV incomer side, the current is increased by 1.13 %, the voltage drop is 0.53 %.

At Happy Forging (induction hardening machines), during the measurement at 66 kV incomer side, the current is increased by 9.17 %, the voltage drop is 0.09 % which is on lower side compared to Kay Jay Forging.

The non-linear loads like induction billet heaters, surface hardening machines and induction furnaces, generate inter harmonics in the system. The inter harmonics are not the integer value of the harmonics. These inter harmonics create the voltage flicker in the system. The integer harmonics can be suppressed by installing the harmonic filters but it is very difficult to suppress the inter harmonics which cause voltage flicker in the system. These voltage flickers cause inconvenience to the human eyes. The flicker limits as per IEEE Standard 1453 – 2004 (refer Figure 7), “Measurement and limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems”.

IEC flicker meter’s output is simple: if the output is greater than 1.0, the flicker is generally irritable to humans (as per IEC 61000-3-7); if less than 1.0, it is not. These results have been successfully validated with many years of real world testing in several countries. The flicker meter’s main output is in a unit called P_{st} , meaning, “Perception of light flicker in the short term.”

The average harmonic current is measured in the range of

- *Billet heaters: 1.0 to 10.67 A*
- *Hardening machines: 0.80 to 13.74 A*
- *Induction furnaces: 2.37 to 18.86 A and*
- *Arc Furnace : 6.36 A*

The harmonic current increases with the increase in non-linear load i.e., capacity of induction billet heater / hardening machines. For all induction billet heaters, hardening machines and induction furnaces, the harmonic current is almost same but in case of Nidhi Furnace the harmonic current is high because the contract demand is 2500 (during study only one furnace of 4.0 t capacity furnace was in service) & is connected with 11 kV system. Therefore, to compensate the harmonic current at PCC, higher short circuit level (i.e., higher impedance level of utility grid) is required to suppress the harmonic currents.

Due to non-linear loading, the current waveform is distorted. This non-linear loading distorts the voltage waveform at billet heater. The non-linear loading of billet heaters distorts the voltage waveform and pollute power quality of the utility grid.

The presence of harmonics in the system reduces the capacity of distribution capacity of utilities i.e., transformers, overhead lines, cables, circuit breakers, etc.

The approximate capacity loss due to harmonics present in industries at PCC are computed. The average distribution capacity reduction is computed as:

- *Billet heaters: 0.12 to 0.84 %*
- *Hardening machines: 0.03 to 0.66 %*
- *Induction furnaces: 0.10 to 2.27 %*
- *Arc Furnace : 0.6 %*

The capacity loss increases with the increase in non-linear load i.e., capacity of induction billet heater / hardening machines. For all induction billet heaters, hardening machines and induction furnaces, the capacity loss is almost same but in case of Nidhi Furnace the capacity loss is high because the contract demand is 2500 (during study only one furnace of 4.0 t capacity furnace was in service) & is connected with 11 kV system. But on the other hand at Varun Furnace the capacity loss is 0.1 % & is less because the incoming power supply voltage is 66 kV. During the measurements, at both these industries, only one induction furnace of 4.0 t capacity was in service. Similarly at Happy forging where surface hardening machines are installed and incoming voltage is 66 kV, the distribution capacity loss is very less of about 0.03 %.

As the harmonic current increases the true maximum demand will increase but the static energy meters will record only RMS value of maximum demand. The average excess demand is computed as:

- *Billet heaters: 19.7 to 597.8 kVA (4.10 – 24.84 %)*
- *Hardening machines: 40.0 to 185.0 kVA (7.41 – 30.0 %)*
- *Induction furnaces: 59.2 to 275.6 kVA (6.59 – 20.5 %)*
- *Arc Furnace: 654.9 kVA (4.68 %)*

It can be seen from the Figures that the excess demand increases with the increase in non-linear load i.e., capacity of induction billet heater / hardening machines. For all induction billet heaters, hardening machines and induction furnaces, the capacity loss is almost same.

Since the concern is with respect to power or demand not with energy parameters, therefore, the demand factor is essential.

The demand factor is varying in the range of:

- *Billet heaters: 8.34 to 100.57 %; At few industries like Nicks India, Turbo tools, Sunitha Bicycle & Presto Forging demand factor is less may be due to lower rating of billet heaters are used.*

- *Hardening machines: 21.09 to 91.59 %; At Happy forging the demand factor is less may be due to high contract demand.*
- *Induction furnaces: 35.96 to 103.63 %*
- *Arc Furnace: 70.05 to 79.84 %*

The demand factor for all billet heaters, induction hardening machines, induction furnace and arc furnaces is almost same. And there is no significant difference in demand factor for all these machines.

The non linear load will not exhibit true power factor. The true power factor of non linear load (where harmonic currents are present) consists of two parameters i.e., displacement factor and distortion factor.

The distortion factor is inversely proportional to current THD. Therefore, as the current THD increases, the true power factor will become less. For a non linear load even if their displacement factor is good but the true power factor will be low. Therefore, all these induction billet heaters, surface hardening machines and induction furnaces exhibit higher current THD which cause lower true power factor.

The presence of harmonics in the system i.e., current harmonics from the industry leads to voltage harmonics and voltage harmonics increases the iron losses (hysteresis loss _frequency & eddy current losses _ square of frequency) of utility power transformers.

The average energy loss is computed as:

- *Billet heaters: 0.30 to 58.09 kWh/month*
- *Hardening machines: 0.73 to 48.43 kWh/month*
- *Induction furnaces: 5.4 to 221.7 kWh/month*
- *Arc Furnace: 72.5 kWh/month*

The energy loss in utility power transformer increases with the increase in non-linear load i.e., capacity of induction billet heater / hardening machines. But the energy loss due to Nidhi furnace is very high because the harmonic current is high and the main incoming voltage is 11 kV.

In most of the induction billet heaters, hardening machines, induction furnaces and arc furnaces, the impact of energy loss in utility power transformer is almost same but depends on the utility voltage level of power supply at PCC.

In the billet heaters the energy is used to only heat the billets of smaller size and there is no change in state of material. But in case of induction melting furnaces, while heating the iron is converted from solid to liquid i.e., state change. In induction furnace, the melting temperature is higher in the range of 1500 – 1600 °C compared to billet heaters in the range of 1200–1250 °C & surface hardening machines in the range of 950–1150 °C. At higher temperature, the steel resistivity will be very high which

draws higher current and hence the SEC will be high. Thus the energy used at induction furnace is higher compared to billet heaters and surface hardening machines.

The average Specific Energy Consumption (SEC) for different machines is:

- *Billet heaters: 0.24 to 0.83 kWh/kg of steel; but at presto forging the SEC is in the range of 0.013 to 0.026 kWh/piece of tools and is very less because the heating will take place at hardly 25 to 35 mm at front portion of tools which is forged only front portion.*
- *Hardening machines: 0.126 to 18.86 kWh/piece of surface hardening and is varying widely may be due to varying in temperature and different surface area.*
- *Induction furnaces: 0.74 to 0.902 kWh/kg of steel and is slightly high compared to billet heater may be because of higher temperature requirement & change of state of material from solid to liquid.*
- *Arc Furnaces: 0.455 to 0.669 kWh/kg of steel and is comparable with both billet heaters and induction furnaces.*

*The SEC **increases with the increase in non-linear load** i.e., capacity of induction billet heater / hardening machines whereas in case of induction furnaces as the capacity of induction furnace increases the SEC decreases.*

Therefore, it is very difficult to differentiate billet heater and induction melting furnace as far as power quality and power supply parameters are concerned but SEC will be less for billet heaters compared to induction melting furnace. But the concern is with power or demand and not with energy consumption.

Therefore, the utility must provide higher level of short circuit MVA to absorb the power quality pollutants created by the industry which is having a larger capacity of non-linear loads. The utilities to overcome these issues of power quality and voltage fluctuations in the grid, they are declaring industries whose loading pattern is non-linear as power intensive industries.

The Billet heaters and surface hardening machines can be considered as power intensive industry because already induction furnaces are considered as power intensive industries by PSPCL. The working principle and operational behaviour with respect to power supply and power quality parameters for billet heaters, surface hardening machines & induction furnaces are same. The impact of power quality parameters like voltage dip, voltage flickers, voltage & current waveform distortions, harmonics, capacity loss of utility distribution system, demand factor, energy loss in distribution system, etc; have same effect. Only the specific energy consumption for induction furnaces is slightly higher compared to billet heaters

due to the change of state of material from solid to liquid & higher degree of melting temperature.

The non-linear load is the load where the current is not proportional to voltage and current waveform is distorted which distorts the voltage waveform. The induction billet heaters, induction surface hardening machines, induction furnaces can be considered as non-linear load because these equipments produce heavily distorted current waveforms that cause the distortion of voltage waveform which will also create voltage dips & voltage flicker in the system.

17. The report was discussed in the meeting of the Commission on 29.08.2013 and it was decided to upload the CPRI report on the website of the Commission and issue a public notice in the leading newspapers inviting comments from stakeholders/general public. Accordingly, a public notice and a corrigendum were issued inviting comments from the general public/stakeholders on the CPRI report and the comments of PSPCL on the CPRI report. Copy of the public notice along with a copy of Final Report dated 26.07.2013 submitted by CPRI and a copy of the corrigendum along with copy of the comments of PSPCL on the Final Report submitted by CPRI were also sent to the petitioner Association vide letter no.4971 dated 02.09.2013 and letter no.5397 dated 10.09.2013 respectively .

18. PSPCL vide its letter no. 6225 dated 05.09.2013 submitted comments of the committee constituted by PSPCL on the final report of CPRI on Billet Heaters and also submitted that the comments of the Committee may be read as comments of PSPCL on the CPRI report. This Committee concluded that **LS consumers where the Billet Heater/Induction Surface hardening machines are installed should be treated under PIU category to protect the techno financial aspects of PSPCL.** The comments of the committee/PSPCL are reproduced below:

Then PSEB issued CC No.38/2009 in the year 2009 treating Billet Heater loads as a power intensive unit (PIU) consumers and accordingly the Billet Heater loads were checked by Enforcement Agency of PSEB in March, 2010. As a result of Enforcement checkings, the consumers tariff was changed from General to PIU as per CC No.38/2009 and consumers approached to the Hon'ble High Court. Hon'ble High Court decided on 21.12.2011 as under:

1. *The criteria adopted for treating an industry that has Billet Heaters as Power Intensive Units (PIU) is to have been examined by PSEB and after various representations have been received from the Ludhiana Hand Tools Association and the Apex Chamber of Commerce and Industry, the CE/Commercial has informed the Secretary/PSERC in a bid to redress the grievances of petitioners, it has been decided that the LS consumers having Billet Heater loads upto 25% of sanctioned load or 500KW whichever is higher could be considered as General category consumers.*
2. *The decision will only conclude the issue on the existing state of affairs with the decision taken by the Electricity Board in the manner of redressal of grievances of the effected industries. If, there is any change in the policy or any other legally enforced directive, the exercise of such a power shall not be fettered this order. The parties will have independent cause of action a fresh change of categorization is done.*

In this context, Hand Tools Association and the Apex Chamber of Commerce and Industry approached the Hon'ble PSERC vide petition No.03/2012 for deciding the policy regarding Billet Heater loads. Hon'ble PSERC in its petition No.3/2012 issued interim order dated 4.7.2012 which was circulated vide CC No.28/2012 till the final disposal of petition No.3/2012 regarding policy of Billet Heater loads. According to CC No.28/2012 regarding interim relief to the Billet Heater consumers under petition No.3/2012 that all the large supply consumers having billet heater load upto 25% of connected load or 500KW, whichever is higher may be considered as general category consumers and this interim order was enforced w.e.f. 24.12.2011 and will remain applicable till the disposal of Petition No.3/2012 of Hon'ble PSERC.

For the final disposal of Petition No.3/2012, Hon'ble PSERC has directed PSPCL to form a committee for the study of more Billet Heater consumers located at Mohali, Mandi Gobidgarh, Ludhiana & Jalandhar be got carried out from CPRI, Bangalore. Accordingly, PSPCL vide its O/O No.150/DSS-1/Billet Heater dated 5.4.2013 constituted the committee of the following members to co-ordinate with CPRI, Bangalore:

- | | | |
|----|--|---------------|
| 1. | <i>Dy.CE/Sales-1, PSPCL, Patiala</i> | <i>Member</i> |
| 2. | <i>Addl.SE/Sales-5, PSPCL, Patiala</i> | <i>Member</i> |
| 3. | <i>Addl.SE/CBC, PSPCL, Ludhiana</i> | <i>Member</i> |

The committee has checked about 18 No. Billet Heaters, 4 No. Induction Surface Hardening Machines, 5 No. Induction Furnaces, 1 No. Arc Furnace and minutes jointly signed during measurement at consumer premises

placed at Annexure-III of the report (Page 471 to 499). The committee also referred recent IEEE transactions on the subject of Billet Heaters & "The Electricity Council, UK" papers on the subject of Induction Furnaces (for heating with or without melting). CPRI (Govt. of India) issued the final report after checking all the electrical parameters tabulated in the report (Page 1 to 499) and finalised the report on 26.7.2013 regarding study of Billet Heater loads & Induction Surface hardening machines. Also, the executive summary of the report is placed at page (i) to (ix). The committee of PSPCL officers and CPRI (Govt. of India) officers jointly signed the minutes of meeting on 26.7.2013 vide No. CPRI/ERED/PSPCL/83/2013-14 wherein the qualitative criteria for identifying the power intensive industry for Billet Heater & Surface hardening machines with connected load above 100KW LS consumers of PSPCL. CPRI reported that the Billet Heaters and Induction Surface hardening machines have the impact of power quality parameters like voltage dip, voltage flickers, voltage & current wave forms distortions, harmonics, capacity loss of utility distribution system, demand factor, power factor, energy losses in distribution system, energy intensive factors etc. are all same as that of Induction Furnaces. Thus Billet Heater & Induction hardening machines having same effect on PSPCL power system that of induction furnaces.

On the final submission of report to PSPCL and Hon'ble PSERC by CPRI on 26.7.2013, Hon'ble CMD/PSPCL has constituted the following committee vide O/O No.365/DDS-1/Billet Heater dated 23.8.2013 to comment upon the study report of CPRI:

- | | | |
|----|-----------------------------------|---------|
| 1. | CE/Commercial, PSPCL, Patiala | Member |
| 2. | CE/ARR&TR, PSPCL, Patiala | Member |
| 3. | SE/DS, City West Circle, Ludhiana | Member |
| 4. | Addl.SE/CBC, PSPCL, Ludhiana | Member. |

The committee members concluded as under:

1. CE/Commercial

CE/Commercial was of the view to consider all the Billet Heater consumers with connected load above 100KW under LS category should be treated as per power intensive unit category (PIU) under LS category.

2. CE/ARR&TR

CE/ARR&TR is agreed with the comments given by CE/Commercial as above.

3. SE/DS West Circle, Ludhiana

From the report of CPRI, it is very difficult to differentiate between Billet Heaters, Induction Furnaces or Hardening Furnaces as far as the measured technical parameters are concerned. But merely declaring an industry as PIU/Non-PIU based upon these measured parameters alone without taking into account the load of Billet Heater, Hardening Furnace etc. with respect to the total sanctioned load of the industry is not justified. For example, the whole industrial process of industries like Nicks India Tools having one 175 KVA Billet Heater with sanctioned load of 1633.284KW or Eastman Industry having 3x200KVA Billet Heaters with total sanctioned load of 3044.783KW should not suffer for installation of small non linear loads as compared to other linear loads installed. Rather, the industry need be encouraged to use these recent & advanced technical appliances. OR, the declaration of PIU should only be based on single non-linear load or summation of non-linear loads used beyond certain limits. The other power injected Polluents due to production of harmonics leading to capacity loss, excess demand or voltage flickers etc. can be addressed separately by imposing harmonic injection penalty.

4. Addl.SE/CBC, Ludhiana

Addl.SE/CBC, Ludhiana is agreed with the report of CPRI because the billet heater and the induction surface hardening machines has the same impact of electrical technical parameters like voltage dip, voltage flickers, voltage & current wave form distortions, harmonics, capacity loss of utility distribution system, demand factor, power factor, energy losses in distribution system, energy intensive factors etc. as that of Induction Furnaces on PSPCL (Utility) power system.

Therefore, the committee members in majority concluded that LS consumers where the Billet Heater/Induction Surface hardening machines are installed should be treated under PIU category to protect the techno-financial aspects of PSPCL.

These comments were also uploaded on the website of the Commission on 10.09.2013 for inviting comments from the general public/stakeholders.

19. The objections from 9 number stakeholders were received. The Commission forwarded these 9 number objections to PSPCL for its comments. PSPCL submitted its point-wise comments, as below:

Comments of Objectors	Comments by PSPCL
<p>1. Venus Industrial Corporation</p> <p>(i) A study of Billet Heater was conducted by the office of Chief Engineer/Commercial, PSPCL, Patiala vide its office order no. 15 dated 28.04.2010. The report concluded that the billet heater should not be considered as power intensive irrespective of on whatever frequency or voltage these operate. Moreover, the industry needs to be encouraged to utilize the billet heater in contrast to oil fired furnaces, so as to clean the environment by reducing the carbon emissions and it will make the industries compete with the industries in the developed parts of the world.</p>	<p>Venus Industrial corporation has referred to the report of the committee constituted by CE/Commercial vide office order no.15 dated 28.04.2010. Prior to this committee, the then PSEB CE/Commercial had constituted a committee vide office order no.321 dated 17.10.2007, which had declared Billet Heaters as Power Intensive Load, because these are operating at un-standard voltage and un-standard frequency. Both the committees constituted by CE/Commercial vide office orders dated 28-04-2010 and dated 17-10-2007 in their reports found that the billet heaters are working on the principle of induction heating and the final temperature of the Billets found to be above 1100°C for these forging units. The power factor of these industries was also observed to be 0.95 to 0.98. The committee constituted vide order dated 17-10-2007 recommended to the then PSEB that the billet heater load is to be considered as power intensive load. However, committee constituted vide order dated 28-04-2010 recommended that the Billet heater load should not be considered as power intensive. Since both committees have taken only few parameters mentioned above while making recommendation on the issue of billet heaters and also Hon'ble Punjab and Haryana High Court in its judgment dated 21-12-2011 was of the view regarding the</p>

	<p>policy for deciding the billet heater load, in this regard, Hon'ble PSERC directed PSPCL to get study conducted from CPRI, Bangalore (Govt. of India Undertaking) and various results were taken by CPRI for the billet heater load.</p> <p>In the CPRI report (page 4), it has been stated that while converting power supply from power frequency to high frequency AC supply, harmonics are generated, which pollute the power supply of grid. Thus, Billet Heaters distort the current wave form and that distorts the voltage wave form of incoming power supply. These distorted wave forms and harmonics cause voltage flicker and sudden voltage dips in the grid supply. Therefore, billet heater load affects the PSPCL utility power system</p>
<p>2) The Hon'ble PSERC vide its order dated 21.03.2012 directed PSPCL to conduct study from CPRI. The PSPCL approved CPRI (A Govt. of India undertaking) to do the needful. Based on the findings of the CPRI report, Dy CE/Sales-1 vide its memo no. 976/80/DDS-1/Billet Heater dated 06.09.2012 stated " All the large supply consumers having Billet Heater Load up to 25% of connected load or 500 KW, whichever is higher, may be considered as General Category Consumers."</p> <p>HENCE REPORT: FAVOURABLE FOR INDUSTRY.</p> <p>RESULT: REJECTED BY PSPCL.</p>	<p>It is agreed that Hon'ble PSERC vide its order dated 21.03.2012 directed PSPCL to conduct study from CPRI, which was done, but the instructions issued by Dy CE/Sales 1 vide its memo no.976/80/DDS-1/Billet Heater dated 06.09.2012 were not based on the findings of the CPRI report, but on the instructions of Hon'ble PSERC order dated 04.07.2012 to implement the judgement of Hon'ble Punjab and Haryana High Court dated 21.12.2011. In the above said judgement in case of CWP no. 5222 of 2010, the Hon'ble Punjab and Haryana High Court had also ordered in Para 2 of the judgement that " If there is any change in policy or any other legally enforceable directive, the exercise of such a power shall not be fettered by this order. The parties will have independent cause of action if a fresh change of categorization is done in future".</p>
<p>3) The Hon'ble PSERC again directed the PSPCL to re-conduct the study and to associate the petitioner Association</p>	<p>CPRI was again approached to conduct further study as per Hon'ble PSERC letter no.9303/4 dated</p>

<p>with the studies to be undertaken. PSPCL strangely enough again approached CPRI to conduct another study.</p> <p>PSPCL DOES NOT ASSOCIATE OR INVITE THE PETITIONERS IN THE CPRI STUDY.</p> <p>HENCE REPORT: UNDER CONSIDERTION.</p> <p>RESULT: PSPCL INTERPRETS THE SECOND REPORT AS DEFINING BILLET HEATERS AS PIU AND HENCE ACCEPTABLE.</p>	<p>31.12.2012, wherein it was directed that electrical qualitative study/parameters such as Harmonics /Transients , power factor , grid/feeder sizes, variable frequency should principally be made basis for further study; in addition to energy consumption in kCal/kg of Billet Material. Accordingly, PSPCL was advised by Hon'ble PSERC to recall CPRI team to conduct detailed study and cover broader spectrum of consumers 100 to 500KVA and 500KVA onwards. The study is not a separate work, but is continuation of the earlier study. Further, the Hon'ble PSERC directed PSPCL to associate the petitioner Association with the studies to be undertaken which was duly complied with as apparent from Annexure-III of the CPRI report (Minute signed during the measurements, page no.472 to 499 of CPRI report).</p>
<p>4) In the second report submitted by CPRI, the scope of the work includes demand factor and while in its executive summary at page no. (vi) the report categorically says "Since the concern is with respect to power or demand not with energy parameters, therefore the demand factor is essential." But at the end of report later in the conclusions drawn by CPRI at point no. (vii) it says "Since the concern is with respect to power or demand not with energy parameters, therefore the demand factor will NOT play a major role." How the study report can differ on the same issue in itself. It seems that the CPRI is totally influenced and pressurized by PSPCL and the findings are on the expected lines as PSPCL wanted.</p>	<p>Demand factor is calculated based on the actual peak maximum demand divided by the contract demand. The demand factor will represent how much peak power is utilized during a particular month. This will not give actual representation of the peak power used by the industry. For example, the industry may have touched the maximum recorded demand ten to twelve times in a month and other industry may have touched the maximum recorded demand only once in a month. Therefore, the impact of peak demand of non-linear load on the power system will vary for the above two different scenarios. Therefore, the power intensity cannot be directly linked to only demand factor.</p>
<p>The following law points need to be addressed.</p> <p>1. Why the PSPCL rejected earlier two reports found favorable with industry?</p>	<p><u>Law Points:</u></p> <p>1. As explained above in point no.1.</p>

<p>2. Why the CPRI again approached to conduct the study where as its earlier report on the same subject rejected by the PSPCL?</p> <p>3. Why PSPCL not hired/approached another agency apart from CPRI to conduct the study?</p> <p>4. Why the PSPCL did not comply with the directions of Hon'ble PSERC to associate or invite the petitioner associations with the studies to be undertaken by CPRI?</p> <p>5. Whereas in its previous report CPRI had kept billet load up to 500KW outside its purview of polluting loads, but now it has brought down to 100KW without giving any logic for deviating from its earlier recommendations. Why did the agency deviate from its earlier scope of study?</p> <p>6. Is PSPCL interested only to fill its empty coffers by categorizing the billet heaters under PIU?</p>	<p>2. As per PSERC directive, explained in point no.3 above.</p> <p>3. As per PSERC directive, explained in point no.3 above.</p> <p>4. It is wrong to say that PSPCL did not associate or invite the petitioner Association during CPRI study at consumer's premises. Annexure-III of the CPRI report "Minutes signed during the measurements" page no.472 to 499 clearly shows the participation of petitioner Associations in the study.</p> <p>5. As explained above in Para 3, the scope of the study was widened to include loads above 100KW on the directions of Hon'ble PSERC.</p> <p>6. Charge is denied. PSPCL is only following the report submitted by CPRI, Bangalore which is an independent agency run under Government of India.</p>
<p>PYE HAND TOOLS</p>	<p>PYE HAND TOOLS</p>
<p>1. The report now submitted by CPRI nearly one year after submission of earlier report is not much different. It has again dwelt upon the issues like generation of harmonics, voltage dip etc. Therefore why a second study was got conducted about the same issues is not understandable.</p>	<p>As per comments already given in Point 3 of M/s Venus Industrial Corporation, first report was for loads above 500KW only. In the second report loads 100KW to 500KW (LS consumers) having Induction Billet Heater/Hardening Machines have been covered. This report has wider scope and is conclusive. In the second report, concept of curie temperature relating to SMS/composite steel plants, Transients/Harmonics/Voltage dip/P.F. due to electrical acceleration of such non linear LCR cases with variable</p>

	<p>frequency Invertors/convertors, which affects the performance of electrical distribution system has been discussed. Further, heavy immunity has to be provided to the system as also discussed in the report.</p>
<p>2. a. The comments submitted by PSPCL are in the form of minutes decision of a subcommittee headed by Chief Engineer (Commercial) and does not seem to have the approval of Board of Directors of PSPCL and thus should not be taken cognizance of.</p> <p>b. The whole report seems to have been 'doctored' by PSPCL functionaries who were actively involved throughout the period whether for field analysis or while drafting the report. This Association which had approached the Commission on the subject through a petition was never associated with, even though specifically directed by the commission. Not only that, when a presentation was made by CPRI before the commission on 25.09.2012, members of this Association were not allowed to participate, whereas PSPCL's officers took active part. They were associated subsequently also, till the preparation of final report.</p>	<p>3. a. Not agreed. The comments submitted by PSPCL and now put on Hon'ble PSERC website is the report of CPRI, Bangalore.</p> <p>b. Report is not doctored. The report is based on technical principles involved with steel plants; curie temperature, P.F. (displaced), electrical acceleration adequate fault levels required are the main feature of report. Design of 11KV distribution feeders with respect to billet heater/surface hardening machines has also been discussed. Extra/enhanced conductor size, grid sizes, fault levels are required. It is wrong to say that PSPCL did not associate or invite petitioner Association during CPRI study at consumer's premises. Annexure-III of the CPRI report "Minutes signed during the measurements", page no.472 to 499 clearly show the participation of petitioner Association in the study. Regarding appearing on 25.09.2012 at Hon'ble Commission's office, where members of the Association were not allowed to participate in the presentation made by CPRI, matter may be taken up with Hon'ble PSERC.</p>
<p>3. Whereas in its previous report, CPRI had kept billet load up to 500 KW outside its purview of polluting loads, its has now brought it down to 100 KW without giving any justification for deviating from its earlier recommendations. It only reflected the arbitrariness of approach while dealing with a subject having serious</p>	<p>Same as comments to point no.3 of M/s Venus Industrial Corporation.</p>

<p>and far reaching implications.</p>	
<p>4. Both reports are against the points of references made by this Association through the petition (still pending before PSERC) as well as directions given by PSERC which vide its order dated 21.03.2012 directed "to refer the matter to CPRI Bangalore with a view to expedite the report on the criteria for declaring/ treating industrial units as general or power intensive." It nowhere asked for restricting the study to billet heaters. Our prayer in the petition was that "the term power intensive be defined so as to be made applicable to those industries which have demand factor of above 90% and load factor above 80%. CPRI was thus required to study the consumption pattern of different types of industries to indentify their demand/load factors, more so when PSPCL's own existing instructions are based upon the above concept of the term "Power Intensive" as listed below:</p> <p>i. Advance consumption deposit i.e. security and MMC, where power intensive units are required to pay more per KW/KVA amount as compared to others simply because they have more per KW/KVA consumption of power.</p> <p>ii. As a power regulatory measure during the period of shortage, power intensive units are subjected to more power cuts, simply because they would provide much greater relief to the system being guzzlers of energy.</p> <p>iii. Power Factor incentive: PI units are given incentive when their PF is more than 0.95 as compared to 0.9 of others. Again it is based upon premise that their consumption levels being high, much more amount of incentive would have to be paid if threshold level is kept at 0.9 in their case.</p> <p>Instead of confining its study to carry</p>	<p>Hon'ble Commission vide its order dated 05.03.2012 had directed PSPCL to submit a concrete proposal specifying the criteria (based on detailed calculations) for treating an industrial unit having Billet Heater Load as general industry or power intensive. Further, the analysis with regard to Harmonics, Variable Frequency, p.f., Grid/Feeder sizes in addition to energy consumption in kcal/kg of Billet Material was included in the Electrical Qualitative Study to be undertaken by CPRI as per PSERC memo dated 31.12.2012 .</p> <p>As per PSPCL record.</p> <p>Adequate as per study, but also true in case system immunity is also not so good.</p> <p>True PF varies with higher current THD in case of Billet Heater/Surface Hardening Machines and Induction Furnaces causing lower true power factor as per CPRI report (para 3.8 page 40).</p> <p>CPRI was again approached to</p>

<p>out field analysis in above context, CPRI has gone beyond the points of references. Even the directive of PSERC dated 30.09.2011 is very clear wherein it had stated that the criteria to be specified may be in the form of energy consumption in KWH per ton of the finished product and that the units having energy consumption in excess of the specified limit be declared as power intensive. It had no where asked for analysis with regard to harmonics or voltage dip etc. which are indicators of power pollution and not intensity of power consumption. The remedy to take care of power polluting elements of an industry is already enshrined in PSPCL's existing instructions, where by various surcharges like rolling mill surcharge (5%), arc furnace surcharge (7.5%) and surcharge of 5% on induction furnaces running at 11KV and with contract demand above 2500KVA, are levied but no surcharge is levied on induction furnaces if they run at a voltage of 66KV and above because pollution effect is substantially reduced at that level.</p>	<p>conduct further study as per Hon'ble PSERC letter no.9303/4 dated 31.12.2012 wherein it was directed that electrical qualitative study/parameters such as Harmonics /Transients, p.f., grid/feeder sizes, variable frequency should principally be made basis for further study; in addition to energy consumption in kcal/kg of Billet Material. Accordingly, PSPCL was advised by Hon'ble PSERC to recall CPRI team to conduct detailed study and cover broader spectrum of consumers 100 to 500KVA and 500KVA onwards. The study is not a separate work but is continuation of the earlier study.</p>
<p>5. This type of study was carried out by CPRI earlier against petition no. 1/2009 filed by Northern Railways. Measurements of harmonics was done at about 11 no. industries which included forging units like Punjab State Forging and Agro and Happy Forging Limited etc. As per that study also THD (Voltage) individual was found to be less than 2% against IEEE-519 standard of 3%. Similarly total THD was about 1.5% against a standard of 5%. In the earlier CPRI report pertaining to billet heater and covering harmonics and voltage dip part, it is clearly brought out that in case of none of billet heater industries, THD (Voltage) and total demand distortion (TDD) were beyond specified limit. As</p>	<p>In the objective note it was mentioned that power intensity has to be defined based on the Specific energy consumption (SEC) (kWh/Tonne) and Energy intensity factor (EIF) (kWh/kVA). The energy is the time integral of power which depends on two parameter i.e., power and time. The main intention in this study is to define the power intensive industry, not the energy intensive industry. Therefore, in order to define the power intensive industry, the following power quality parameters are studied in detail apart from SEC and EIF:</p> <ul style="list-style-type: none"> • voltage dip

<p>regards voltage, except at Happy Forging, in all other cases, it was below 0.216% which CPRI mentions as uncomfortable and that in the range of 0.11% as normal. You would kindly appreciate that such a conclusion is only a personal perception of CPRI and it is not backed by any standards or technical basis. The same is therefore required to be rejected.</p> <p>As regards energy consumption levels, the CPRI report has clearly brought out that specific energy consumption of billet heaters is much less (of order of .013 to .54 kWh per kg (average about 0.4) as compared to induction furnaces which have a figure of 0.74 to 0.902 kWh per kg. Even the utilization factors of billet heater industries are much lower as compared to induction furnaces. Infact, we had been submitting this fact right from the beginning. Even the commission's directions were to define power intensive or otherwise based upon whether energy consumption levels were high or low.</p> <p>Lastly, we would like to sound a word of caution that recommendation of CPRI regarding term "power intensive", if accepted would not only be irrational but would also lead to total chaos as the term non linear load used in this all-inclusive and would bring in its domain all industries having load above 100 kW as a very significant observation has been made by CPRI that "The declaring of the power intensive industry need not be on the type of production like billet heater". PSPCL had also taken a decision in its WTD's meeting held on 13.10.2010 and conveyed to PSPCL on 26.07.2011 that all large supply consumes having billet heater loads up to 25% of sanctioned load or 500 KW whichever is higher be considered general category consumers.</p>	<ul style="list-style-type: none"> • voltage flickers, • voltage and current waveform distortions, • harmonics, • capacity loss of utility distribution system, • demand factor, • power factor • energy loss in distribution system, <p>Considering all the above parameters, it was decided that the induction billet heaters, induction surface hardening machines and induction furnaces lead to the power quality issues.</p>
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<p>From the forgoing, it is clear that the report is not only irrational and beyond the points of reference but has been prepared with a bias and preconceived ideas. The members of the Association therefore feel that it will be of no use participating in the meeting scheduled for October 7, 2013 or take part in any further meeting/deliberations on the subject.</p>	<p>Concluding Para of Pye Tools Pvt. Limited:- It is submitted that CPRI report is not irrational but has been prepared on the basis of field measurements, observations, study results and discussions held with petitioner Associations at the time of conducting of measurement at the consumer's premises.</p>
<p>S.S. Products of india.</p>	<p>Same as Pye Tools.</p>
<p>Hand Tools Manufactures Association</p> <p>That the report now submitted by CPRI seems to have been prepared under the influence and directions of PSPCL, because in the report earlier submitted in August, 2012, it was declared by CPRI that "The Power Intensive Industry can be defined as the Industry which is having a bulk non-linear load (i.e. Single non-linear equipment or the summation of small non-linear loads of Billet Heaters & Induction Furnaces etc.) of 500 kVA or more.</p>	<p>Same as point no.3 of Venus Industrial Corporation.</p>
<p>But now in the subsequent report submitted in July 2013, it has been concluded that "Billet Heaters & Surface hardening Machines irrespective of their capacity can be considered as Power Intensive Industry". From the above, it is evident that this report is contrary to the earlier report submitted in August 2012 and seems to have been prepared and submitted to the suitability of PSPCL, because the Engineers of PSPCL. associated the CPRI people right from start to the end and their views have been considered and incorporated. None of the consumers was allowed to associate with the CPRI Team.</p>	<p>Same as point no.3 of Venus Industrial Corporation.</p>
<p>Basically the term Power Intensive load is not an Engineering term based on linear or non-linear load, it is an English word which means any single bulk load, may be linear or non-linear load. A tubewell motor of 1000 H.P. (Linear Load) can be termed as Power Intensive Load as compared to 100 KW Billet</p>	<p>Section 3.0 Power Intensive Industry Page 9 and 10 of CPRI report may be referred to. Regarding a tubewell motor of 1000 HP (linear load), in- rush current of motor starting will drop the voltage momentary, depending on the network short circuit level, and the</p>

Heaters Load (non-linear) provided both are provided with adequate capacity of capacitors to maintain power factor near unity.

A billet heater cannot be equated with Induction Furnace because the load factor & demand factor of Induction Furnace are 0.80 and 0.90 respectively, whereas the average load factor of Billet Heater varies between 0.5 to 0.6 and the demand factor is 0.80. No doubt both the Billet and Induction Melting Furnace are based on the principle of Induction of Electricity, but in case of Induction Melting Furnace, full power is drawn right from beginning to the end of the cycle, even when the charge gets melted, full current has to be maintained. Moreover, the load drawn by Induction Furnace is a jerk load. Whereas in case of Billet Heater furnace, the load drawn by the furnace depends upon the size of load/charge. If M.S. Round of size 12mm is heated, it draws less current and when 22mm size MS Round is heated, it draws almost double current and when coil is empty it will draw negligible power. Whereas in case of Induction Melting Furnace, irrespective of quantum or size of charge/material to be melted, it draws full power right from beginning to the end of the cycle.

So, for the same capacity say 100 kW each, the billet heater will draw almost 50 to 60 % of the power drawn by Induction Melting Furnace. Moreover, the CPRI team in its report has mentioned the Demand Factors/Utilization Factors of various Billet Heating Industries & Induction Melting Furnaces industries which are as under:

Name of Industry	Kind of Inds	Demand factor/UF
Happy Forging	Billet Forging	UF
Ismeet Forging	ditto	65%
Nicks India	ditto	52%
Eastman Casting	Billet Heater	39.45%

voltage will come back to normal. But in case of induction billet heaters, the voltage at incoming will be chattering (continuously varying) which will create voltage flickers which are harmful to human eyes. The intensity of voltage flickers will depend on the capacity of billet heater (non-linear load).

Not agreed. Refer 3.9 "Demand Factor" of CPRI Report, page 41, wherein it is stated that the demand factor for all billet heaters, induction hardening machines, induction furnace and arc furnaces is almost same, and there is no significant difference in demand factor for all these machines.

JVR Forging	ditto	54.85%	
Presto Forging	ditto	UF 20.6%	
Happy Forging (Hardening)	ditto	UF 28.31%	
INDUCTION FURNACES			
Garg Furnace	Melting	85.52%	
Nidhi Steel	ditto	104.66%	
Varun Steel	ditto	104.66%	
<p>From this report, the CPRI team itself has substantiated on record that Demand Factor of Induction Melting Furnace is almost double than that of Billet Heaters and hence the Billet Heaters cannot be equated with Induction Melting Furnace and as such cannot be declared as Power Intensive Loads.</p> <p>So far as considering the non-linear Loads as Power Intensive on the grounds of harmonic current is concerned, it is brought to the notice of Hon'ble Commission that the sources of Non-linear loads are Rectifiers, Welding Transformers, computer equipments with switched mode power supply, variable speed motors and drives, photo copiers, laser printers, Fax Machines, battery chargers, UPSs, Florescent lights, medical diagnostic equipments and microwaves.</p> <p>These equipments & gadgets cover 90% of the domestic & NRS loads and most of these gadgets/equipment do not install capacitors for the improvement of power factors. Will the authorities declare all these as power intensive load because all these generate Harmonic currents?</p>			<ul style="list-style-type: none"> • Regarding rectifiers & VFD, again the capacity matters, if the capacity is higher, the same power quality issues can be observed. • Regarding welding transformers, the load will not be constant & will be varying which may not lead to serious power quality issues. • Regarding computers, photo copiers, laser printer, fax machine, battery chargers, UPSs, Florescent lights, medical diagnostic equipments, microwave ovens, other domestic equipments etc., their capacity is very less compared to the network short circuit level in the 11kV system.
<p>In case of Billet Heaters, the consumers are maintaining power factors between 0.90 to unity, otherwise they are compensating PSPCL by way of paying heavy power factor surcharge.</p>			<p>Incase Billet Heater consumers do not maintain power factors between 0.90 to unity, then they have to pay power factor surcharge, but power factor surcharge does not compensate PSPCL for the reduction in the capacity of distribution capacity of PSCP i.e.</p>

	transformers, overhead lines, cables, circuit breakers etc, on account of the pollutants injected in the grid on account of Billet Heaters.
The Regulatory Commission has itself recommended in November 2011 that the power intensive load should be defined based on energy consumption.	Regulatory Commission vide its letter no.9303/4 dated 31.12.2012 widened the scope of the study to include electrical qualitative parameters such as Harmonics/Transients, Power Factor, Grid/Feeder Sizes, Variable Frequency in addition to energy consumption.
So keeping in view the above explained facts, it is established that the billet heaters cannot be equated with Induction Melting Furnaces and declared power intensive load, because their demand factor and load factor being much lesser (almost 50%) than that of the induction furnaces and the report of the CPRI team being biased and prepared to the suitability of PSPCL needs to be rejected.	Billet Heaters and Induction Hardening Machines have been equated with Induction Furnaces and Arc furnaces by CPRI report.
Dalpat Forge (India)	Same as Pye Tools.
H.R.ImpexPvt. Limited	Same as Pye Tools.
Rama Steel Forge	Same as Pye Tools.
Ludhiana Hand Tools Association	Same as Pye Tools.
R.N. Gupta and Co. Ltd.	Same as Pye Tools.

20. A public hearing in the matter was held on 07.10.2013. In this hearing, nobody from the petitioner Association and general public attended the public hearing. PSPCL officers including some of the members of the committee constituted by PSPCL and the representative of CPRI attended the public hearing. A presentation on the final report dated 26.07.2013 was made by the representative of CPRI. The officers of PSPCL put up their views on the report and stressed that the report of CPRI and the comments of PSPCL on the report sent vide letter no. 6225 dated 05.09.2013 should be accepted.

21. In view of the submissions made by the petitioner Association, findings of CPRI, the objections received from the various stakeholders and the submissions made by the respondent PSPCL, as brought out above, the Commission observes and decides as under:

- i) CPRI in its final report No. ERED/EA/128/2012-13 dated 26.07.2013 on study of Induction Billet Heaters/Surface Hardening Machines and Induction & Arc Furnaces has concluded that the working principle and operational behavior with respect to power supply and power quality parameters for Induction Billet Heaters/Surface Hardening Machines and Induction & Arc Furnaces are the same. The impact of power quality parameters like voltage dip, voltage flickers and voltage & current waveform distortion, harmonics, capacity loss of the utility distribution system, demand factor, energy loss in distribution system etc. have the same effect. Only the specific energy consumption for Induction Furnaces is higher as compared to Induction Billet Heaters/Surface Hardening Machines due to change of state of material from solid to liquid. The Induction Billet Heaters/Surface Hardening Machines and Induction Furnaces are non-linear loads because these equipments produce heavily distorted current waveform that causes distortion of voltage waveform, which also creates voltage dip and voltage flickers in the system. These conclusions of CPRI are based upon the behavior of Induction Billet Heaters/Surface Hardening Machines/Induction Melting Furnaces/Arc Furnaces, as observed by CPRI during study, as brought out below:
- (a) The Induction Billet Heaters/Surface Hardening Machines and Induction Melting Furnaces work on the same principle of AC variable high frequency power supply. In this case, the grid power frequency supply (50 Hz) is converted to DC by rectification and then inverted back to varying frequency AC source. The heating factor depends on the frequency i.e. at high frequency, the heating and melting is fast.
- b) The power quality parameters are almost similar in case of Induction Billet Heaters/Surface Hardening Machines as well as Induction Furnaces, and there is no difference in power quality parameters like current and voltage harmonics, voltage flickers and voltage dip. The sudden change in non-linear load due to billet

heating and melting of metals causes dip in voltage which again depends on network short circuit capacity.

- c) The non-linear loads like Induction Billet Heaters/Surface Hardening Machines and Induction Melting Furnaces generate inter-harmonics in the system. The inter-harmonics are not the integer values of the harmonics and these create the voltage flicker in the system. The integer harmonics can be suppressed by installing the harmonic filters, but it is very difficult to suppress the inter-harmonic which cause voltage flickers in the system. These voltage flickers cause inconvenience to the human eyes.
- d) The harmonic current increases with the increase in non-linear load i.e. capacity of Induction Billet Heaters/Surface Hardening Machines/ Induction Melting Furnaces. Due to non-linear loading, the current waveform is distorted. This non-linear loading distorts the voltage waveform of billet heaters. The non-linear loading of billet heaters distorts the voltage waveform and pollutes the power quality.
- e) The presence of harmonics in the system reduces the distribution capacity of the utilities. The capacity loss increases with the increase in non-linear load i.e. capacity of Induction Billet Heaters/Surface Hardening Machines /Induction Melting Furnaces.
- f) As the harmonic current increases, the true maximum demand will increase. But the static energy meters will record only RMS value of maximum demand. The excess demand increases with the increase in non-linear load i.e. the capacity of Induction Billet Heaters/Surface Hardening Machine /Induction Melting Furnaces.
- g) The demand factor for all the Induction Billet Heaters/Surface Hardening Machines, Induction Furnaces and Arc Furnaces is almost same and there is no significant difference in demand factor for all these machines.
- h) The non-linear load will not exhibit true power factor. The true power factor of non-linear load (where harmonic currents are present) consists of two parameters i.e. displacement factor and distortion factor. The distortion factor is inversely proportional to current THD.

Therefore, as the current THD increases, the true power factor will become less. For a non-linear load, even if its displacement factor is good, but the true power factor will be low. Therefore, all Induction Billet Heaters/Surface Hardening Machines and Induction Furnaces which exhibit higher current THD shall cause lower true power factor.

- i) The presence of harmonics in the system increases the iron/energy losses of utility power transformers. The energy loss in utility power transformer increases with the increase in non-linear load i.e. capacity of Induction Billet Heaters/Surface Hardening Machines and Induction Melting Furnaces.
- j) The specific energy consumption (SEC) increases with the increase in non-linear load i.e. capacity of Induction Billet Heaters/Surface Hardening Machines, whereas in the case of Induction Furnaces as the capacity increases, the SEC decreases.
- k) The utility has to invest more to provide higher level of short circuit MVA to absorb the power quality pollutants created by the industry having a large capacity of non-linear loads of Induction Billet Heaters/Surface Hardening Machines/Induction Melting Furnaces.
- ii) The power quality parameters are almost same whether the induction load in respect of Induction Billet Heaters/Surface Hardening Machines is as low as 20 kVA or is as high as 4000 kVA.
- iii) PSPCL in its comments on the Final Report of CPRI has submitted that all the Large Supply industrial consumers where Induction Billet Heaters/Surface Hardening Machines are installed should be treated under Power Intensive Unit (PIU) category to protect the techno-financial aspects of PSPCL.
- iv) The comments/objections received from various objectors including the petitioner Association have been adequately commented upon by the respondent PSPCL as brought out above in para 19 above. No body from the petitioner Association and general public attended the public hearing on 07.10.2013, although the Commission gave it a wide publicity and invited the petitioner Association through letters dated 02.09.2013 and 10.09.2013 to attend the public hearing.

During public hearing on 07.10.2013, the respondent PSPCL stressed for acceptance of Final Report of CPRI dated 26.07.2013 and the comments of PSPCL on the Final Report sent vide letter no.6225 dated 05.09.2013.

- v) The Commission accepts the comments of PSPCL given vide letter no. 6225 dated 05.09.2013 and decides that **all LS consumers where the Induction Billet Heaters/Surface Hardening Machines are installed shall be treated under PIU category.** This Order of the Commission will be applicable with effect from 01.01.2014. The respondent PSPCL shall issue a public notice in the leading newspapers having wide circulation in the State for wide publicity to the Order of the Commission and its impact. The requisite formalities, if any, required for implementing this decision by PSPCL be completed before 01.01.2014.

22. The Commercial Circular No. 38/2009 dated 29.10.2009 was allowed to be in operation by the Commission vide letter No.5908-09 dated 30.09.2011. This circular was amended vide Commercial Circular No.28/2012 dated 06.09.2012 issued by PSPCL in compliance with Order dated 04.07.2012 of the Commission directing PSPCL to implement the Order dated 21.12.2011 of the Hon'ble Punjab and Haryana High Court in CWP No.5222 of 2010, as under:

“All the large supply consumers having Billet Heater Load upto 25% of connected load or 500 kW whichever is higher may be considered as General Category Consumers”.

This amendment of CC No. 38/2009 dated 29.10.2009 through CC No. 28/2012 dated 06.09.2012 renders the prayer to quash CC No. 38/2009 infructuous.

The Order dated 21.12.2011 of the Hon'ble Punjab and Haryana High Court further states as under:-

“If there is any change in policy or any other legally enforceable directive, the exercise of such a power shall not be fettered by this Order”.

Accordingly, the Order of the Commission as per para 21 (v) above, shall supercede Commercial Circular No.28/2012 with effect from 01.01.2014.

The petition is disposed of accordingly.

Sd/-
(Gurinder Jit Singh)
Member

Sd/-
(Virinder Singh)
Member

Sd/-
(Romila Dubey)
Chairperson

Chandigarh
Dated: 28-10-2013