

70th Annual Convention of The Sugar Technologists' Association of India Equipment Design And Maintenance (Engineering) Section

1

High Pressure Boiler Water Treatment- by C.G. Pimpalkar and D.M. Ghalsasi

C.G. Pimpalkar

Good morning everybody, respected chairman of this session, co-chairman and fellow delegates, Ugar sugar works Ltd. Has started co-generation in 1994, at present 4 boilers having capacity 75 ton/hr 2 no, 17 ton and 18 ton 1 no having 62kg/sq cm pressure. The present co-gen capacity of the plant is 44 MW generation, and 28 to 13 MW export to the grid, boiler water management depends on its pressure, the boiler water treatment requires specially to avoid 3 major problems, deposit, corrosion and carry over because of the above problem areas where the impact observed are reduction in heat transfer, failure of boiler tube water losses heat losses, increased maintenance cost, increased operational cost and losses of productivity and unplanned shut down. These are the impurities which are present in the boiler water, boiler water treatment is classified in 3 parts i.e. 1st is pre treatment, deaeration and internal treatment. Pre treatment consists of clarification, filtration, softening; de-alkalization, de-mineralization and membrane technology are the typical pre treatment schemes. The DM water outlet parameters are maintained as shown in the slide, a typical configuration of DM plant which is used is shown, we have 3 DM plants, 72 ton/hr, 60 ton/hr and 30 ton/hr.

Deaeration, this mechanical deaeration usually has higher capital cost, but operating cost is low therefore practically physical deaeration is followed prior to chemical deaeration, the necessity of removing these gases from feed water is to prevent corrosion, dissolved oxygen will cause spitting and corrosion to the boiler feed lines and return condensate lines. Carbon-di-oxide is also present and the 2 gases acting simultaneously the rate of corrosion will be increased by 10 to 40%.

Internal treatment, even with sophisticated internal treatment external treatment plants some impurities always enter the boiler through feed water therefore there is a need for internal treatment. The amount and the type of chemicals used depend on the plant operations and feed water quality. Internal treatment consists of following types

1. Phosphate treatment
2. Deoxygenation
3. All volatile treatments

1. Phosphate treatment

This is the most common method of the treatment of boiler waters operating 1000 psig pressures, in this method addition of tri sodium phosphate and caustic sod is used to maintain the ph of 10 to 11.

Coordinated phosphate control

Caustic attack to the boiler metal increases with increasing pressures so free caustic alkalinity must be minimized. The alkalinity is maintained in the boiler by using coordinated combination of Tri sodium phosphate, di sodium phosphate and mono sodium phosphate.

Poly phosphates

These are long chain phosphates which form fairly soluble phosphates with the skin firming salts.

2. Deoxygenation

Corrosion and pitting of boiler metals obviously can be of serious consequence. It is important that boiler water should not contain dissolved oxygen. For this a mechanical deaeration followed by a chemical deaeration is used. Oxygen scavengers include both volatile products and non volatile salts are used.

Amine technology

The main cause of corrosion in the boilers system is due to the presence of dissolved oxygen and carbon-dioxide. The treatment therefore involves the use of oxygen scavenger and amines,

Neutralizing amines

Single neutralizing amine can be used but more often a blend of amines with different ratios are used, volatile amines are used to neutralize the carbonic acid, amines react with carbonic acid to form amine carbonates or bi carbonates to fix CO_2 more often a blend of amines are used.

Filming amines

There function is different from the neutralizing amines; it protects metal from both oxygen and carbon-dioxide by forming a film on metal surface.

These are the parameters fixed by ASME for the boilers at different pressures, this is the feed water parameters and these are the boiler water parameters.

To run high pressure boilers smoothly its important to maintain the feed water and water quality as per the design specification, to maintain these parameters, water treatment was done by using basic chemicals like hydrazine hydrate, T.S.P, morpholine and caustic soda, we were facing carry over problems frequently, turbines were forced to stop for washing purpose 2 to 3 days every month, because of that we were unable to export power as per schedule and crushing cane with the desired capacity. These are the turbine blends which you can see the scale deposition on the turbine blends, when we were using basic chemicals we were facing a lot of problems and carry over of the calcium and phosphate content and we were forced to stop the turbine. After changing water treatment from basic to branded chemicals and changing doses we maintained boiler water parameters as below, and this is the photograph after opening the turbine, no deposition was observed and no stoppage of the crushing or the exportable power during the season.

The causes of carry over

Carry over happens mainly due to the mechanical and chemical causes.

Mechanical causes

Boiler design

In adequate or leaking separating equipment(drum internals)

High water levels

Method of firing

Load characteristics

Chemical causes

High total dissolved solids
High alkalinities
Presence of oily and organic materials
Method of external and internal treatments

To overcome these problems following steps had been taken in Ugar sugars

Remedies to mechanical causes

Sudden load change due to treating of grid reduced with consultation of grid personnel's
Power export and in-house load taken on dedicated turbines
Boilers are being provided with automation system
Drum internals were modified to improve the steam quantity
L.P. and H.P. dosing points were modified

Remedies to chemical causes

Phosphate- hydroxide method by adding TSP has been replaced by coordinated phosphate method to avoid high pH and high alkalinity
Use of basic chemicals for boiler water treatment were replaced by branded chemicals
Additions of volatile chemicals like amines and oxygen scavengers were added at LP dosing only and phosphate at HP dosing only
D.M. water pretreatment improved to avoid carry over of colloidal scavengers were added at LP dosing only and phosphate at HP dosing only

Impact of boiler water treatment

Boiler stoppages during operation will result in loss of heavy power generation and production losses, proper boiler treatment has reduced production losses and increased exportable power, instead of using basic chemicals if one can use the branded chemicals boiler and turbines will remain healthy, less stoppages and more profits thank you.

Chairman- the author has presented many papers on this subject, this time he has come out with some details about the internal and external treatment required for the high pressure boilers and I think the paper is self explanatory because the paper is very detailed and if you have any queries I request all the delegates to ask the author, if no question we can move to another paper. Please give a big hand to Mr. Pimpalkar

Installation of Rubberized Roller on Top Roller to Prevent Juice Flooding- by Anil Singh and Deepak Sharma

Deepak Sharma

Respected chairman, co-chairman senior technocrats and distinguished delegates, we were facing this problem for the last 4 to 5 years and I have made so many alterations but the problem could not be solved completely, by installation of rubberized roller the problem has almost reduced and rest of the system will be discussed in my slides.

We had the following problems at our plant, whenever imbibition is required to increase about 230% on fiber juice flooding was observed over top roller of the last mill, and then we have to divert some quantity of the imbibition at 3rd mill also. This problem is very common for the conventional mill specially last mill where lotus roller is not being used due to flooding of juice bagasse pol and moisture increase, we have developed a system to avoid flooding over top roller. A rubberized roller was made with B type circumferential grooving according to the top roller grooving, the size of the roller is 290 mm dia and 2.14 mt length, it is fitted over the top roller with the help of brackets on pressure plates to lift according to the top roller, the idea behind this arrangement is that the teeth of the rubberized roller will match with top roller grooves and rubberized roller will rotate in the opposite direction of the top roller. This is the rubberized roller arrangement drying, the brackets were made on the arms of the pressure plates, these are the brackets and this is the arms of the pressure plates and this is the rubberized roller. The arms of the pressure plate and roller fitted on the top roller, the center of the rubberized roller has kept about 4° incline towards feet side, from the central line of the top roller. This is the detailed drawing of the rubberized roller, a 60 mm thickness rubber lining was made over MS pipe of 168 OD and B type circumferential groove made according to the top rollers grooving. This is the arrangement photograph of the rubberized roller, these are some photographs of the rubberized roller after working of 2 months and we can see that there are no significant war and tear marks on the rollers.

Conclusion

After fitting the rubberized roller the flooding of juice stopped and we were able to increase the imbibition quantity. Resulted in increase in milling extraction and reduction in bagasse pol and moisture, As the system is installed in last mill but if there is flooding in intermediate mills the system maybe installed there also, it will also help reduce the power consumption, these are some data, we have taken before fitting the rubberized roller and after the fitting and I have taken 18 days data. Before fitting, the average bagasse pol was 1.4 and moisture was 15.81, after fitting of rubberized roller the average pol reduce up to 1.69 and moisture reduced up to 49.66. this is the calculation of bagasse saving due to the reduction of moisture in bagasse and we have saved about 46.5 ton bagasse in 1 day and saving due to reduction in bagasse pol has not been considered, and approximate cost Rs. 50,000 involved to develop the system and will return in 1 day. This is the actual working of rubberized roller, the roller is rotating in the opposite direction of the top roller, this is the quantity of juice before the rubberized roller and juice is trying to flood over the top roller but the rubberized roller is resisting the juice quantity. This is the juice quantity before the rubberized roller and after the rubberized roller the juice is not flooding. I am thankful to STAI for publishing this paper and I am also thankful to my management for giving me this opportunity and for encouraging me from time to time thank you.

The paper is open for discussion

Question- BH Shrikant- this is not a question. I would like to extend some help to the author to make his experiment and presentation technically better. You have mentioned only rubber, rubber is a general term, when you are going for a specialized experiment you must be more specific, see rubber means natural polymer of aspirin, which is the softest of this kind, synthetic rubber again there are various synthetic elastomers which have been developed all over the world for specific purposes, so to increase the wear and tear resistance for the rubber mill you, can go to the rubber manufacturing association which is situated in Bombay and can go for more specific synthetic elastomers there are about 22 different synthetic elastomers from which you can choose which is more appropriate for your rubber mill to increase the wear and tear resistance for that mill.

Question- Jasbir Singh- sir, this is a attempt to reduce the overflow from the top roller, what I could get from the presentation but the actual flooding is going on means the juice is overflowing up to the top roller till brim but he has put a rubberized roller so that the overflow is avoided so I will request the author that we should have some more better technical parameters to improve the drainage of the fixed side, by improving the mechanism on the feed side or drainage system. The drainage of the juice is more important that just preventing the overflow.

You are very right sir, this is a purely temporary solution this cannot be a permanent solution for the technocrats, it is the geometry of the milling which plays a major role, it is the drainage by heel clearance, lotus roller the juice should be drained otherwise the re-absorption will be there.

Question- Jasbir Singh ji has rightly said that it's a good effort, to control the menace of the over flooding from the last mill. But I suggest to the authors that they should consider the effect of roller arching on the rubber which they have put on the rubberized roller, what is the good effect and what is the bad effect, what is the provision to have the roller safe from the arching which we do during the season thank you.

Question- I think the best solution for avoiding this flooding is installation of pressure so that it will increase the capacity also and you will avoid this flooding also, juice will be drained from the sides of the mill and capacity of the grooves will be reduced.

Answer- author- this is the calculation of 4th mill juice drainage area and we have taken the maximum capacity of 300 ton TCH and the maximum quantity has taken 275 on fiber and the feed extraction has taken 65% and the available area is 22600 sq mm and the available area is 22800 sq mm that also maybe some reason for flooding, the height of the roller, before installation of the rubberized roller we have done also some modification, the height of our roller is above the top roller but we have decreased the height of the and increased the dia of the top roller by 40 mm and decreased the dia of the by 100 mm so juice drainage area available is sufficient to meet the maximum capacity. 2nd question was GRP installation, although it is the permanent solution of juice flooding but it involves so much money. And the last question was arching of the roller; I want to show the slides although there is sufficient space available for the roller arching. Thank you.

3

Boiler Raising Calculation: new trend - by Amod Sharma and O.P. Mishra

Good afternoon everybody, honorable chairman, deputy chairman, technocrats and delegates, before I start the basic topic I would like to tell you the reason behind it, normally the boiler reading when the people are trying to work it out is on a mass basis, what is the balance of bagasse in the factory, because steam is measured everywhere so based on that 1 permutation combination is done to work out what is the approx bagasse raising and normally particularly at my previous organization at mawana, we had been facing a lot of problems particularly with the accounting people, that whenever you declare at the end of the month that what is the bagasse quantity you have consumed so always 1 question mark is generated, so keeping that thing in mind I have tried at Triveni Chandanpur I have tried to work out the methodology as to how technically we can work out the quantity of bagasse consumed in a boiler so its based on that.

Everybody knows that bagasse right now is a prime product n term of co-generation and sale price in the market so we gone to the optimizing the quantity of bagasse consumed in a way when the data you have is available with you, you can definitely try to optimize the quantity of bagasse because I am not going to read the total content because all the details are with you, so at Triveni we have 1 90 ton boiler where we have 6 feeders so we tried to calculate the raising through bagasse feeder VFDs which is hooked to the DCS because everybody knows there is 1 way to calculate the raisings through thermal basis but I have tried to work it out on basis of the set volume that every feeder has a set volume and if you know the average RPM of the feeder you can at least 95 to 98 you can work it out what is the quantity of the bagasse you have taken to the boiler. So based on this concept I have tried to work out the quantity of bagasse by individual feeder given to the boiler and that was done based on what is the drum dia , casing dia i.e. what is inside the casing that volume is there and RPM we have taken from the because all the feeders are hooked to the VFD and that is ultimately controlled by the DCS so we have taken the average RPM, when we have the RPM we have the area of the bagasse casing so based on that we have worked out the volume of the bagasse at per minute or per hour, then next point is what is the density we have to take, normally at our unit IJT has recommended as taken in the design i.e. 130-135 kg/metric³ as a density so we have started trying what is the real density in movement because everybody knows that when the bagasse is coming to the feeder is the movement of density its not exactly what is in the chute definitely its varying. So we tried to work it out that what could be the density of the bagasse so we have tried to take out the data for the month as to what is the quantity, what is the steam and with different density value starting from 140 to 100 and we tried equate with the quantity of bagasse what is exactly saved, all permutation observation data particularly based on the density we have focused on the density value and basically before coming to this, all calculation on the raising part we have tried to take out these data's on the basis of exact individual feeders bagasse quantities consumed and we tried to validate to what is raising because every boiler is designed for certain raising value so keeping that thing in mind that what density it is coming to the optimum at different, say our boiler is 90 ton so 90 ton to say 50 ton what are the variations is known so we have tried to take out the figures from the dishes and what figure is coming is tabulated here and sometimes whenever we have some abnormal operation of the boiler because of some choking we have some abnormal values also and where it is highlighted you can see that on that day

particularly there has been some problem with the feeder so that was cross validation of the readings. These are some pictorial views, what we have taken on the dishes these are the individual feeders bagasse quantity is coming based on the area what area and RPM and we have a density value indicated here just for the sake of permutation, that where at least the figure is coming to the optimum level so for that purpose density factor we have indicated here, and it was taken for the normal boiler operation when we have under load operation yes it is raising 1.99 and with 105 as density factor.

These are some detail of the previous season 2007-08 Vs 2008-08, we have substantial increase in the raising, this raising improvement is not because in the last season we have a average of 2.19 and then in the next season we have 2.25 so raising calculation, in term of working out the raising we have done many other things, like we have kept our feeder on auto, which was not running on auto, we have operated the boiler on full 60% 70% soot level. In term of working out the raising we have done many things in the boiler we have tried to optimize the ID FD we have tried to optimize the feeder on different pressures because we have 6 feeders so 3 feeders have been operating at a different pressure and other 3 at different set value for on and off or earthing control purpose so that way we have got improvement in raising. For the working of the raising we have tried to work out with the atomization of the feeder and boiler control and on that way we have tried to work out the boiler raising on day to day basis because it looks more justified if you have real time data calculation and it is more presentable data as compared to taking out that what is the balance quantity of the plant. This is all about the methodology I have worked on in the last season and still definitely in the coming season it will further improve in the system to make it more realistic thank you.

chairman- in your paper you have said that raising of the boilers can be calculated on day to day basis by using RPM of feeder burnt density and movement in $105\text{kg}/\text{m}^3$ sweat volume so in this case these variables which are very sensitive to particular condition now you can say the bulk density of the bagasse you have considered 10 to $105\text{kg}/\text{m}^3$ but it cannot be said that it will be in this range all the time, because the moisture and RPM the compactness between the feeder will not remain same so slight variation in the observation would lead to very big error. That means the accuracy of measurement will be very difficult in this case and that is the base your of measurement so I don't know how you can conclude the total operation of the boiler in that case.

PNR. Rao- authors have done a commendable job in trying to find out the evaporation/kg of bagasse but I would like to as our chairman rightly pointed out the method adopted is subject to so many errors so for this purpose ASME as well BSI have formulated a different method for calculating the efficiency or raising of the boiler, I hope you know that? No, well let me explains now again as I said earlier in some other context basically efficiency is 100-losses so this exercise is confined only to measuring the losses and which are very easy to determine i.e. sensible heat and condensation loss+ unburnt losses which you can measure from your electro static or whatever catch all you have plus you have radiation loss for radiation loss you have a table provided by ASME which perhaps is similar with BSI so that radiation loss also is accounted so it will be 1- all these losses which can be measured fairly accurately. This is one way there is another way we used to do at NSI, in these old boilers where we had no instruments or any such things, what we used to was and there was a doubt about what was the actual steam production also, so we used to have water meter which was well calibrated and we used to

measure the level of water in the drum, before the start of the experiment we used to carry it out for about 8 to 12 hrs and we have control right from cane discharge to the carrier, we used to have control over the imbibition water we used to measure it accurately as well as the mixed juice so we had a good ideas of what was the bagasse being produced, now the only unfortunate part is that all that bagasse is not consumed some of it was saved so we measure the amount of bagasse saved by bailing and weighing the bagasse so we had a good idea of what is the exact amount of bagasse being utilized as well as the amount of water which was being supplied and levels in the initial and final stages being the same and we used to request them not to blow down for the period of the experiment. This is the old method but the new one is recommended by ASME and BIS and I would suggest you adopt this method thank you.

Voice becomes feeble

Answer- author- 1st question regarding density, I have already told that definitely we have taken as a controlling factor and we have still because in the last 3 month of the season we have arrived at this raising what we have tried to work it out because there is density in a moment because bulk density will be very less, so it will be around 100-105 but in the coming season we will be doing for normal plant operation probably we will be able to know the better narrow range of the density that we should take for the bagasse. As reference to Agarwal sahibs question regarding because here we are trying to work out the quantity, mass of the bagasse which is going to the boiler efficiency definitely is a separate part when you are going to work out the efficiency definitely you are going with the heat method its purely quantity of the bagasse what is going to the boiler that we are trying to work out so that's why we have not considered much on the part of what efficiency what is the losses radiation and other things so its purely concentration was on quantity of bagasse going to the f\individual feeder going to the boiler for that particular steam generation. Dr. Singh's question regarding average RPM, basically we have a VFD on all the feeders and they are all hooked to the DCS and we have a real time data recording of the RPM and we have customized the report what I have shown in the pictorial view that the report is customized in a way that average RPM on hourly and day basis is taken from the system and that Is taken as reference of calculations of the average RPM for a day or hour whatever you want to you do, and regarding Jasbir Singh's question regarding plant stoppages in fact you know that last season for the whole industry it has been a very short and we had to stop the plant regularly at 7 -8 hrs, one thing what I want to indicate is that the way we have worked out on the normal operation when the plant was running on 90-95 of the rated capacity and when it was running at low capacity definitely when milling plant was stopped 90 ton boiler is operating at 18-20 ton steam generation capacity definitely this thing was not coming because say in 24 hrs 5 hr-8 hr plant is stopped on that day raising was coming abnormally low 1.99 ,1.9,1.8 like that so that stoppages under load operation if the boiler definitely the type of control you cannot have at so low operation so its indicated in lower raising value thank you.

K.R. Patil

Friends, I will be presenting this paper, the abstract of the paper is, bagasse drying is a potent way to achieve the energy efficiency, now everywhere since many years we have been thinking about the energy maybe in terms of steam or electricity but bagasse drying is helping in both ways, electricity generation as well as steam generation. It results in reduction of weight of bagasse but improves 1st calorific value 2nd furnace combustion temperature and 3rd is overall performance of the steam generation. **Calorific** value is increased it is a known fact that if the moisture content in bagasse increases the calorific value also increases but when it is at the cost of the reduction of the weight of the bagasse, because when bagasse is dried the moisture in bagasse is getting evaporated and the same quantity of bagasse is used as a fuel that means the energy of the bagasse which is considered for the bagasse drying remains same. now 2nd is furnace combustion temperature, this increases when dried bagasse is used as fuel in boilers, the main reason that the combustion occurs due to low condensation loss and also low **sensible** heat loss and that is why the combustion temperature in the furnace increases, but friends you should keep in mind that the high temperature in the furnace is also very dangerous, because many times the slagging effect of the walls in the furnace grids is dangerous for the performance of the boiler **and** that is why the design temperature of the boiler should be maintained, so 2 parameters i.e. calorific value and furnace combustion temperature are the very important parameter to decide the steam generation,. The paper also deals with the effect of the variation of the flue gas temperatures on bagasse drying. Now these are the 2 equations, almost everybody here knows these equations of GCV and NCV both these equations you can see that there are 2 variables 1 is W i.e. moisture% bagasse, and S means pol% bagasse, now if you see the bigger figure to which W is attached, the biggest figures is with W that means moisture content in the bagasse plays a very important role to decide the heat content in the bagasse and that is **why we have to concentrate** to remove this moisture from the bagasse so that the dried bagasse can be burned into the boiler. **Now** what are the ways and means to dry the bagasse. There are basically 3 ways 1 is by using solar energy 2nd steam as energy and 3rd hot flue gases from the boiler at 150° to 220° C. now use of solar energy for drying is **a** ancient approach because since many years we are using solar energy for drying **purpose**, as everybody knows that it is a laborious work which is attached with the **windage** also, so solar energy in case of bagasse drying is not at all advisable. 2nd is steam, now we are fighting for steam availability in the factory all the time, and if we use this thing just for bagasse drying it is a criminal activity which will be carried out by the engineers. **So** steam is a precious commodity for the engineers and the chemists, so steam cannot be used as a heating media for drying the bagasse. 3rd is hot flue gases from boiler, this is the area where we can recover the energy or heat energy for drying the bagasse and this paper deals with the bagasse drying on this issue. Now many times it is asked that what is the temperature of flue gas which is coming out from the bagasse drier, friends if you will read the literature where Hugot also has mentioned, that the condensation i.e. dew point for the flue gases is in between 60° to 70° C so safely we can have a flue gas temperature after the bagasse drier maybe 80° so that the maximum heat can be utilized for bagasse drying. Now slightly I am diverting from the subject, mechanical de-watering of bagasse, why it is necessary, before thermal drying of bagasse the maximum potential to reduce

the moisture must be exhausted because if you see details of the slide, moisture% bagasse and water/ 100 dried solids of the bagasse at 50% of moisture there are 10 units/100 drying units of the bagasse, but if the moisture is reduced from 47 it is 89 45 it is 82 40 it is 67 35 it is 54 if we compare this from 50% to 35% then thermal bagasse drying from 50% to 35% moisture it needs to remove 100-65 i.e. 46 units of bagasse/ 100 units of bagasse has to be only removed, when thermal bagasse drying is carried out from 47 instead of 5% to 35% it will need to remove only 89-54 earlier chart if you see it is 35 units of water, that means removal of 3% of moisture from 50 to 47% reduces the moisture % in the bagasse drier from 46 to 35% i.e. 11 units are reduced that means it is very essential to remove as much as possible moisture from the bagasse at the milling section itself then it shall be fed to the bagasse dryer. Now the bagasse coming from the mill is about 50% some bagasse which is saved for off season but the rest of the bagasse which is required for the boiler is taken at a moisture of W1% i.e. 50% it is spread to the boiler and after boiler it is dried and it comes at a moisture content of W2%. These bagasse when it is burnt in the boiler the flue gases thus generated represented by temperature T1 is given to the drier and after the drier the heat content of the gases is absorbed by the bagasse and the temperature reduces and goes to T2. now the condensation i.e. dew point loss the T2 has relevance with that temperature because T2 the temperature of this gas coming out of the drier should not touch the condensation point, otherwise the moisture will be condensed into the system itself which is highly acidic which will damage the material of construction if all the heat recovery resistance. Now let us consider a sugar plant of 100 TCH having a boiler of 50 TPS capacity working at 87 pressure and fine drying 515° C temperature and matching TG set is of course 10 mw, the bagasse is available as a mill weight bagasse moisture rate i.e. omega 50% and pol % bagasse is 1.5%, flue gas temperature which is available old boilers it is about 170° but today's boilers that is used for cogeneration high pressure boilers is 150°C, the HP heater outlet temperature heater for the water which was feed to the boiler is about 165°C.

Now friends, this is the area where we have to concentrate when you are installing the bagasse drier, because unless and until you optimize the steam consumption for the sugar manufacturing you will not be able to spare the steam for the power generation which is the main aim today so as to export surplus power to the national grid. Now here I have considered evaporators operating as a quadruple, here you can see A, B and C all are continuous pan which I have taken from the 3rd body A pan 2nd body B pan 1st body C pan, similarly RJ J1 and J 2 on the respective readings are taken from those bodies, clear juice heating 1st reading is also taken from the 1st body because you can heat up to 103° C by using the vapors from the 1st body. Now considering all this heat and mass balance the condenser load remains less than 1% and hence in all totality the steam consumption for all continuous pans evaporator and miscellaneous leakages comes to about 39%, which is most practical and I think that to bring this figure it will require much efforts. Now this is a combined heat power cycles, this has been designed based on 39% steam consumption for the sugar factory, now here you can see the boiler is having 50 tons/ hour capacity and operational parameters are 87 eta G and 515° temperature this steam is then sent to the double extraction cum condensing turbine where the power is generated and the bleeds are available at 8 ata 2.5 ata condensing route. 8 eta steam is of course used for the HP heater, in the HP heater the water is heated from 90° to 150° to 165° C and 2.5 eta steam is going to deareator and remaining steam goes to the sugar factory and the rest of the steam goes to the condensing route, now why this type of configuration has been selected because this cycle compares with the topping cycle because many times the state electricity boards compel to use the topping cycle method for exporting the electrical power top their grids and if it is not

satisfactory then your project becomes invalid to export even though you generate the power you are not able to export the power to the electricity board grid so this is the most efficient cycle based on these parameters for power generation and the total power generation is 9330 KW with 49.88 tons of steam, now I have done the comparison for the case 1 and case 2 case 1 is with 50% moisture and case 2 is with 43% moisture, friends you will say that from where you have got this 43% moisture, there are calculations made for this how to come to this 43% because unless and until you know the heat and mass balance of the complete system you will not be able to find out what moisture % will be available after the bagasse drier. Many papers I have seen people are just randomly saying that our moisture % has come to 28% 32% it is just like steam consumption for sugar manufacturing, no it is not like that you have to see that what is the quantity of flue gases available with you the net heat available for bagasse drying is fixed, because the temperature remains of the bagasse drier T1 and T2, only moisture ultimately that will be available after the bagasse dryer. Now the boiler efficiency in case of 50% is 71%, for 43% it is 74.50%, GCV in case of 50% is 2270, in case of 25% it is 78% of course you must understand these kilo calorie/kg if it is more in case of 43% we should understand it is /kg it is coming for the dry weight of bagasse, and that is why if you convert it to 50% it will be again 2270. NCV is also the same, then condensed heat lost this is a very important term, here we are getting the gain because in 50% condensed heat loss in the boiler is 475 and in case of 43% that is reduced i.e. 457.5 this is the real gain and that is why the efficiency of the boiler is increased. Then sensitive heat loss, it is 158.7 and 172.87 but actually speaking in the actual practice because this 172.87 is calculated on the basis of 30% excess air but if you dry bagasse at the rate of 43% into the furnace the excess air quantity will be reduced, and it will be about 22 to 23% and at that time the sensitive heat loss will remain again same i.e. 158.7. here the flue gas volume is 4.8 in case 1 and here it is 5.1 it is increased this is the real rise in volume and steam to bagasse ratio here again this is the figure that is controlling everything, i.e. in case 1 it is 2.46 and case 2 it is 2.85, so this is the real figure where we are getting the benefit of the bagasse drying, the steam generation in both the cases I have kept same 49.88 and bagasse required to generate the same quantity of steam in case 1 it is 20.23 tons whereas to generate the same steam but at 43% moisture the bagasse quantity is 16.92 tons, then the combustion temperature in case 1 is 1126 and 1205°C in the 2nd, this is a very relevant parameter that we are achieving and all these calculations are given in my paper I am not going to show the calculation in the presentation. Now, additional bagasse saving, because we have seen for 49.88 tons we are requiring 20.23 and 16.91 and that means there is a bagasse saving but with respect to 43% drying in bagasse but I have converted to 50% and it comes to 1.4%. if we use this additional bagasse available for generation of the power it comes to about 700 KW and if consider the 125 KW captive power consumption for bagasse drying the net surplus power will be 575 KW which can be exported to the national grid from the sugar factory and at the rate of rs.3.05 per unit for 160 days you can get rs 68 lakh in one season. Friends everything technical is okay but whenever it comes it is economics which plays an important role, while adopting the technology so I have considered some economics of this, bagasse drying system entails substantial capital cost of corrosion resistance equipment, because even we are saying that the dew point temperature is not allowed to happen into the system many times there are the pocket condensation where this condensation occurs and that time the corrosion should not occur to damage the equipment and the system and that is why you have to use corrosion resistance steel i.e. M 409, secondly recovery of sensible heat takes place in air heater and economizer which are inherent system components of the boiler, this is very important, in the original days when the

boiler flue gas temperature was 220° that time most of the boilers had no economizers and even if air heater was installed it was very small but today our boilers are very high pressure boilers and most of the boilers are fitted with very good quality and very good sizing economizer and air heater where the economizer can deliver the temperature of the feed water more than 220° and air temperature more than 180° C that means we have to see that a economizer and air heater design for the boiler must be economically designed depending on the parameters which are required for the particular application i.e. bagasse drying, it is advisable to remove water moisture at maximum possible from the bagasse by mechanical means, that we have seen 11 units of per 100 units of the dry bagasse they are eliminated with the moisture reduced from 50 to 47%. Most of the boiling switch for co-generation has flue gas temperature of the order of 150°C and this is very true if you see today most of the boilers which are installed in the sugar factory has a boiler flue gas temperature of 150 so naturally assumption for the bagasse drying should be on the optimistic basis, you should not consider 170, 180,200 like that otherwise the equipment sizing will be difficult for the design. If the flue gas temperature available is lower then the bagasse saving obtained due to the bagasse drying is also low, hence it is not economical considering the capital and operating cost of the bagasse dryer.

Conclusion

Burning of bagasse with low moisture increases boiler efficiency that we have seen and you can refer to my paper, all the detailed calculations are given, with reduction in bagasse moisture condensation also reduces, this is the reality for the bagasse dryer and while sensible heat loss increases but I have told in this case because it seems to be increased but if we reduce the excess air it will come to the original level, then reduction in bagasse moisture improves the ratio of steam to bagasse , then reduction in moisture of bagasse improves the furnace temperature and improves the combustion efficiency, then additional bagasse saving due to the drying process can generate extra electrical power, that can be exported to the electrical grid and surplus power which is available, after exporting it you can get the additional income to the sugar factory to the tune of 68 lakhs/ annum, thank you.

Paper is open for discussion

Question- A. Krishna- I see that the author is sufficiently confused, between bagasse drying and boiler efficiency, what you have presented in the table 3 is, if bagasse drying separate you are burning dried bagasse separately and that bagasse separately then that is true but if you see your fig.1 it's a close circuit bagasse drying with the flue gases as a result the boiler efficiency is if you see the overall temperature difference what is boiler efficiency? The flue inlet and the flue gas outlet energy loss in the flue gas, now the energy lost in the flue gas is low if it is 80°C which is what you want to bring it down to for bagasse drying therefore fig.1 and table 3 are totally different concepts, for your information exactly the same scheme of bagasse drying is working in Ugar sugar mills and I have proved practically and theoretically that 80 ton/ hr boiler can at the most dry 20 tons/hr of wet bagasse from 50% to 40% in a continuous rate while bringing the boiler flue gas temperature to about 100°C so coming to the material of construction again, you are totally wrong is saying that the air heater is no way affected because for during the bagasse in fact you have to draw the flue gases out tat much more than 180°C so the question of taking care of any condensation in air heater or elsewhere is non existent so please do not consider this to be in any way related to a presentation of bagasse drying with flue

gas in boiler is all together a different concept from the presentation that you have given in the table3.

Question- I will ask the author to just to go to that comparison table and I agree with Mr. Krishna, what he told, you have shown in the comparison table that condensation loss increases by 18 units whereas the sensible heat loss there is a drop in condensation loss and increase in sensible heat drop and that is also of 14 units, so only 4 units difference is there whereas in the denominator the GCV increases much more so there will not be any increase in efficiency what he told, it is the saving in bagasse not the increase in efficiency and that 74% on GCV I think it is a theoretical figure it is difficult to get that figure.

Question- BH Shrikant- bagasse drying there are certainly various advantages that are there, but one disadvantage that you have mentioned that sensible heat loss will be more, it is true okay again to reduce that more sensible heat loss air is to be reduced from what you mentioned, there is typical irrelevancy that I do observe here, because 150% of the air over the theoretical requirement of the air to ensure complete combustion that is fit, if you reduce that air to the boiler will it not hamper the very purpose in ensuring the complete combustion, a typical irrelevance that I do observe here.

Question- dr. Paul- I wish that JP Mukherjee was alive to listen to you, in 66-67 when I presented that pre drying of bagasse is going to save bagasse he was vehemently opposing me by saying that instead of drying bagasse you put hot air in the boiler, I told him look Mr. Mukherjee boiler doesn't have a mechanism to eat that moisture, it has to go out of the chimney so when it goes out it will take the calorific value of your burning bagasse to go out of this chimney that's why I want to reduce the moisture before its fired, he did not agree but I wanted to mention over here you see, the direct contact heat transfer from flue gas to the wet bagasse is a difficult proposition in the sense that the moisture content of the flue gas that means its limited to the dew point of the flue gas, the moment the moisture content comes to the dew point temperature it will dump the moisture in the bagasse instead of picking up the moisture so what you are trying to do that how long or how far flue gas can pick up the moisture, it is depending on the temperature of the flue gas and the moisture content of the flue gas, unless we pre dry the bagasse and reduce the moisture content the flue gas will have the same 50% moisture in the exit flue gas and it will dump moisture, this what has happened in Jamuna nagar we tried this in a direct contact heat transfer and the bagasse elevator and instead of drying bagasse here moisture increased from 50% to 55%, so they had to redundant the system, but off late I had in Berlin Pakistan has done bagasse pre drying system, they have copied some south Indian factories bagasse pre drying system, which is used by the flue gas but I was not being able to reconcile that unless you pre dry the bagasse first just like egg first or the hatched chicken first, so unless you pre dry the bagasse first the moisture content of flue gas will not be reduced and if the moisture content of flue gas is reduced then it can pick up the moisture so the cycle is such that you have to first reduce the moisture content in the flue gas and then that flue gas will be able to pick up moisture from the incoming 50% moisture, my aim was to reduce the moisture content up to 35% , I proved theoretically that by the increase of calorific value $1/3^{\text{rd}}$ of the bagasse can be save which can be sufficient for sustaining a paper mill of 120 ton/day, but my predecessors did not agree with me and I had to reason with them, anyway my fear is that every factory cannot follow the same system because the moisture content of the

incoming bagasse and the flue gas moisture content unless its high pressure boiler and low moisture comes in the flue it will not be possible for picking up moisture from the incoming wet bagasse, this is my observation.

Question- PN Rao- a very interesting paper and I am glad lots of discussions are taking place, I would like to put it in a proper perspective, let us take that the bagasse entering the boiler house is at 50% moisture, now you have also a bagasse dryer which dries the bagasse to 43% moisture, and it goes to the boiler, now consider the efficiency of the boiler, it is input- losses will be the efficiency, now what are the losses, 1st is you are getting in 50% moisture bagasse, and inside you are drying it all right but from the drier, moisture is going out to the atmosphere so it carries away all the latent heat so latent heat is not saved and also you have sensible heat in the dry flue gases so you have a situation in which you do not save the heat required for evaporating the water that is wasted and that is the biggest chunk, I will put it in another way, instead of having a bagasse drier I have a similar situation 50% moisture bagasse entering the boiler station and then I have exit flue gas at 80°C so now the sensible heat loss at 80° is the same in both the cases, now the latent heat of moisture is taken away in that 80° C so as far as efficiency is concerned input- losses is same provided the exit temperatures are same now this is not my theory it has been discussed in plane, also says that it doesn't make any difference as long as the exit flue gas temperatures are same, similar papers have come in recent in ISSCT and all that and there is 1 paper presented by my worthy colleague dr. Ghosh in ISSCT he also has proved that as long as the exit flue gas temperatures are same whether you have a drier or any other heat recovery unit the efficiency will be substantially same, there maybe some slight difference, maybe you might have a higher temperature in the furnace but by and large efficiency does not change much, also further point to note is that you require as you rightly said 125 KW I do not know how you got that figure but it is there, power required for conveying the bagasse operating the drier and one more thing once you pass it through the bagasse drier along with the flue gas, the bagasse has to be separated from the flue gas then again, you have to have a high efficiency cyclone or something which again may not have 100% efficiency, maybe 95-96 so you are getting into a cycle of high energy consumption and very little or negligible benefit by way of efficiency. So that's why this business of bagasse drier using flue gas has not caught on in a big way in the world, except perhaps in cases of factories who have perpetual problem of high moisture like, those who have diffuser who have 52-54-55% moisture and they are unable to burn bagasse then they are forced to go for this bagasse drier thank you.

Speaker unknown- we are confusing between boiler efficiency and steam to fuel ratio but I will support here honorable author, he is stressing on steam fluel ratio, this will certainly improve by reducing the moisture in the bagasse, our calorific value have gone high in the bagasse, less bagasse will be consumed and at the same stem consumption less bagasse will be, no we are not talking of efficiency now he is stressing on steam to fluel ratio and he has saved 1.4% bagasse, my observation is as above I totally agree with the author and the boiler efficiency is a totally separate subject which is not a point of discussion.

There is discussion taking place and voice fades

Answer- author- friends, I fully agree with Bhagat sahib that the work done on bagasse drying till today maybe about 30-35 years have passed many technologists have come and settled in the industry but bagasse drying could not settle, every time we are finding some new problems, and just now Mr. Krishna was saying that he doesn't agree to this material of construction should be

stainless steel MO he say it should be MS, these disputes are because nowhere it has been installed and observations have been made, now Ugar I think for the last 2-3 years it is working but actually the results are not published because last year STAI had a technical write up on bagasse drier in Ugar, then only that much technical part was available otherwise we have no available data as such so unless and until we start somewhere to think over the bagasse driers it will nit come into the picture and it will not be proven in the sugar factory.

Voice becomes feeble as someone else is speaking

Author- Mr. Krishna said that he is not agreed to the this material of construction but Mr. Krishna also have no idea. I have read some paper from international journals, they have recommended to use M 409 it maybe due to this fact of condensation, or this gases in the ducting, secondly doctor from NSI, he says why that difference is (end of cassette)

That points have to be considered I have not considered purposely because many tomes what will happen the ID fan and FD fan which are installed just before they remain as it is and that's why I have considered the existing fan capacity, Shrikant his question I am not able to answer because it is not related to my engineering side, Dr. Paul has said that in 66-67 he had a difference of opinion with Mr. JP Mukherjee on this issue but today this is a need of technology implementation on every front, whatever energy is there and whatever energy is going in waste we have to tap it and we have to use it for the energy conservation so this bagasse driers for 30-35 years they were not in the market but I am sure that within 5-10 years it will be commercialized mostly almost all sugar factories will have to use it as they have to save the bagasse for maybe co-generation or other applications, now Mr. rao has said that the latent heat is going in vain because it is vented from the bagasse drier but we have no excuse for that because whatever heat is released it is in the form of vapors which have moisture present in the bagasse, and that is why we have to with latent heat loss which is taking out from the bagasse drier, Mr. Jasbir Singh has given me support on this that the bagasse consumption and efficiency by the steam to bagasse ratio this is very relevant that has been said in our sugar factory for about 5-6 years, we have high pressure boilers where this observation has been done and its true, of course Bhagat sahib is our mentor and he has always given support to the new technologies so I welcome his comments on this. Thank you very much.

5

Electrostatic Precipitator for Bagasse Fired Steam Generators (Boilers)) - by K. Suresh Kumar (author not present)

6

Flash Condensate at Safe Height for Smooth, Effective Withdrawal and for Steam Economy- by P. Shekhariah and M. Venkata Ramana

P. Shekhariah

Respected chairman and co-chairman and distinguished delegates, the steam economy is now playing a major role in our sugar industry to reduce the cost of production as well as quality sugar production, in this context in our unit also we have planned to reduce the steam consumption and improve the working conditions, as you all know the race is on in every sugar

factory to reduce the steam consumption, in this aspect flash of the condensate also is playing a roll in reducing the steam consumption, in our factory we have called for experts to advice for steam economy but unfortunately due to the layout of the factory erected in 1950s, our evaporator platform height is just 4.5 mt only so in that context we were unable to have the in the normal practices as being advised or practiced in various other sugar factories. The experts also did not come forward so we ourselves planned our friend Mr. Venkata Ramanna had the novel idea of keeping the flash tank above the platform of evaporator, normally the sugar factories are installing the common flash tank just below the evaporator platform and digging the pits for providing the sufficient ceiling leg about 2 mt below the ground whereas on our factory it has become a very-very serious problem so Mr. Ramanna has come with the idea to provide this flash tank above the evaporator platform accordingly we have arranged this flash tank above the platform and we could successfully run the system very efficiently and effectively. The detailed calculations are given in eth paper as to how we have arrived at the flash tank level height above the calendria about 2.5 mt is provided and friction loss is also a detailed calculations are given now how to start the flash tank, normally we have to keep the ceiling filled we have to open the cold water in the calendria in such a way that all the ceiling legs are filed up with the water its chilled water but in due course it will fill up with condensate and comes out of the total flash bottle and fills the final mound then stop the cold water filing and drain out all the calendria cold water and open the flash walls of the ceiling . this is the arrangement what we have provided, height of the flash bottle above the calendria normally it will be apprehended by many of our colleagues but its theoretically proved and practically proved to be very effective and easy to operate. These are the 2 conditions, 1 is for exhaust condensate another is for vapor condensate. A clear indication is given what would be the condensate levels in the 1st and 2nd leg and flash, normal pressure difference body to body would be .35 kg and if we consider friction losses and free flow of the condensate from leg to the bottle to will arrive minimum 300 mt. so accordingly in this case we have shown 4 mt for this exhaust condensate and 2 mt for the vapor condensate, it can be even more. Why we have arrived at the system is, this condensate bottle the flash bottle above the platform which will avoid abnormal working conditions of the factory, normally we try to keep system very steady i.e. crushing steam flow, juice flow to all our equipment i.e. juice heaters, clarifier or evaporator even. With all our pre planned conditions there will always be fluctuations due to various reasons because operation conditions are varying from person to person or company to company, or equipment to equipment or even condition of the particular shifts even, this will lead to the abnormal fluctuation in the evaporator working, this will result even in the normal working i.e. ceiling provided to the flash so in our new system we have provided 250 to 300% excess height compare to the 50 to 70% excess than the theoretical approach. this is the figure practical equipment where we have arranged this flash bottle, this is the side glass where you can observe freely from the evaporator platform itself, in correlation with the evaporator juice levels along with that what would be the height of that bottle, the advantage of this new bottle over the conventional flash bottle is that you need not dig the pit for providing the ceiling legs and secondly we can observe the working condition of the flash bottle whether its really working or failing that we can ensure 100% successful operation. The maintenance also is very easy because we need not get into the pits and keep the life of the ceiling leg long. my thanks are to the management shri Goka Gang Raju for giving me this opportunity for submitting this paper, my thanks are also due to our CEO and also all my engineer and chemists and also STAI.

The paper is open for discussion

There are no questions from the audience

7

Energy Generation - Operation and Performance Study -by S.N. Patil he has 2 papers 1 is this and the 2nd is **Energy Generation- Care of Boilers**

S.N. Patil

Respected chairman, vice chairman, delegates so I am presenting my papers on energy generation. The study was carried out at our factory specifically considering multi fuel boilers, we are having multi fuel boiler, cogeneration plant we have carried out the trials for the factory and because of shortage of cane or something like fuel today we are starting and keeping the machinery of huge crores idle so in off season we have to run the unit anyhow by any means using other fuels also. So we tried the boiler for coal so the manufacturer supplied the boiler to us with coal as well as bagasse. With only single coal it was not possible to run the boiler with full capacity so we have carried out a simple modification in our coal feeders, in spreaders get changed and we tried to operate the boiler at full capacity so that we can get the 13MW power to run the boilers in off season as well. So in abstract I will give introduction. Our plant with all cogeneration machinery all modern equipments, we have DCS controlled plant and are operating the plant in our boiling house with only 20 man power and all VFDs and DC drives all measuring equipments are there.

Coming to the operation performance and study, making power export or to generate the power, it is of prime importance to control the losses, generation is very important but after generation to control the losses is of prime importance, because we are generating with lots of efforts and lots of resources we are using for generation so after generating we should take every care to save whatever we have generated, just we can take a round around the factory we see that lot of drains, vents and all electricity wastages, lot of steam is going out from pipes and traps, insulations are not proper somewhere so we should 1st clarify all our equipments and installation would be far from losses as maximum as possible. For this presentation, I have carried out both the studies for coal as well as bagasse; here specifically I am mentioning the coal. For running the boiler on coal that boiler manufacturer we have discussed how to run the boiler with coal, we have found that coal quality is very important for the design of the boiler which he has supplied to us, because the boiler which he has supplied is used for coal and bagasse he has mentioned but it was only for bagasse what I think it was in suspension because bagasse burns in suspension so the height and flame of the bagasse is different form the coal and the length from the, coal is having higher density than bagasse because bagasse is very low density ad particulate matter, moisture is there but for coal it is more dense so coal is burning so we have taken 2nd study to modify the system of giving the air to the grate, in the grate they have provided the dampers to control the air for combustion so before that combustion takes place, one should take care that air quantity what we are seeing 30% 40% excess we are giving but I think we are having all monitoring measurement it maybe 32% or 35% so that we can get exact picture at 32% also, this coal when it burns it liberates carbon monoxide also, carbon dioxide also it is 100% combustion CO_2 we are checking at 100% combustion we are getting CO_2 % at 18 to 19%, because we are using it theoretically here, if we are using the air at 30-40 or 50% we are getting different CO_2 content because of the dilutions. The CO_2 content is same as our coal content is same for carbon

content so CO_2 does not vary with the fuel. It only varies with the addition of the air, so how we can judge that we can give the air and we can measure the oxygen content of the flue gases, I have put my ultimate analysis on software and I have found out the exhaust gases analysis for Co content CO_2 content SO_2 content and GCV I have found on software.

What I think, I just want to tell here, in burning efficiency how we can improve it to control the losses, by controlling the losses by giving the proper air and that we are giving 35% or 32%, at 32% we have taken the software and measured the oxygen content at 35% we have taken the oxygen content and what we have found out what is the solution for finding the correct combustion, that we have taken the ashes from the bottom of the furnace, we have done ID corrections whatever supplier has provided we have kept as it is then we have modified the dampers, drafts by taking 20-30-40% ratios, at that time we have collected the air, we found that tremendous unburnt carbon was going out because of that, 2nd thing we have collected, the coal quality is very important with respect to size. If there is a size of 1/4th inch i.e. if above 80% of fuel is of 1/4th inch then the fuel will burn efficiently, if its below 1/4th the % is more the carryOver is more unburnt % is going to the ESP and all that, we have measured this at 4 places, from that we have found as to how to get the complete combustion as per stoichiometry using the excess air that we have calculated sir, 2nd if we have used here is only 10 to 15% to create turbulence and all these things I cannot explain the basic all engineering of the turbulence and combustion for getting the flame and complete combustion, it helps complete combustions of the coal also, some suspension particles are there burning in the flame, so it gets there so drafts are controlled also moisture in fuel is very important, very 1st moisture as well as air we are giving combustion, air is useful for any combustion, air inlet and outlet exhaust is very important, if we are giving the air at people temperature and pressure and if we are removing the air at proper temperature and pressure what we have measured by taking trial and measures we have found to our surprise that our flue gas temperature was 150 or something. Sideways we have taken the study for economizer and evaporator to verify their heat transmission and flue gas draft as well as heat transfer efficiency because heat transfer efficiency is related with the flue gas temperature, if heat transfer efficiency is not proper at boiler heat transmission surfaces then flue gas temperature will increase, it will indicate that whether your heating surfaces are proper or not that also we have studies, we got the ratio for absurd and abnormal conditions also i.e. turn down of the boiler design so at under load or over load of the boiler at 100% or 60% loading of the boiler turn down ratio we got .78 and .71 that ratio was recommended by Hugot. In case of air heater also we have done, here I can tell 2 points in economizer and air heater regarding the dew point corrosion of the gases so we have to take care the dew point corrosion of the gases for bagasse its 90-95 its all right but coal which is having maximum sulphur content about 1.5 or something like that because we got the coal of different specification and different type I have cited the literature 140 or 150 we have to maintain otherwise at 120° C dew point corrosion will start so we have to maintain that temperature so what we are thinking that whatever fuel available we are putting and are getting the output as steam and power but what I thought, why should we not analyze for theoretical quantity available in fuel itself so that how much we are getting practically, so that we should reach to the point as maximum as possible by ultimate analysis I found that at 30% moisture of the coal I got about 7.4 kg but why we are not getting 7.4kg steam /kg fuel because practically we are getting 6 so I have found out the reason of the moistures, drafts as well as combustion temperatures and super heaters we are maintaining limitations through the super heaters so that all effects the fuel so we got the efficiency of 82% what I inspired from the

article in sugar scene that CTB Mauritius study I think, the author has taken the efficiency of same type of boiler he has taken, the efficiency of 92% on GCV basis, but his coal was having 60 to 100 GCV and same he was having the coal feeder at 1 mt height, he was adding the bagasse at 3 mt height, everything we have cross checked and modified in our system so that we are getting 92% efficiency with 6200 GCV so why cant we get it, so I tried to get it at 5800 GCV I tried to get 82 to 84 efficiency, previously we were getting 75% efficiency. We found that grid type because of chemistry of the fuel, fusion ash pint and chemistry of the fuel this leads to the grid clinker and ash clinkers because our sugarcane bagasse contains different chemicals so fusion as chemistry at 800 to 900 temperature when we burn the grate temperature if we not maintain bed level of fuel and ash the continuous ash discharge is very important. If we are not removing the ash continuously then there is a grid type formation is observed. Unburnt carbon because of the high air secondary emission therefore we are getting the unburnt in ESP or something that we have rectified, emission norms that I have already sent the samples to the Karnataka pollution board and they have sent their report, they said it is ok. For smooth functioning of the system, adequate spares to be maintained, DG set of sufficient capacity because we faced lot of problems when no power, turbo feed pump also provided with the boiler but sometimes we are not taking care, sufficient capacity of water reservoir because once we started the power generation and all we have to really stick to our commitment to the end users of the power whether inside or outside the factory because power is used for production as well as export, if production hampers then ultimately it leads to losses and if export hampers then penalties are there, proper coordination is required. Training facilities to the staff i.e. we have to train the staff so that they should report the correct figures and write the correct figures in the log books, no doubt automation instruments are their but instrumentations we should verify daily, otherwise I had the experience that one day the temperature was 113 for flue gas 2nd day it was 150, I asked my instrument engineer he said that instrument is all right then I have suggested him 2-3 points to cross check then he has corrected them and we got the same 150 temperature. Optimum skilled man power instead of crowd, this is the need of the sugar factory, and in Mauritius studies he was having only 4 man power at boiler station for cogeneration. All analytical data sample calculations are tabulated and are there in the proceeding I have not taken here thank you.

8

Energy Generation- Care of Boiler - by S. N. Patil

Our main objective is the smooth functioning of man and machinery to get optimum efficiency and life and cost benefits to industry thereof society and nation.

In the past 25 years our industry reached from rural to the global level by application of modern concepts and thoughts. In present energy situation one cannot neglect operation and efficiency to achieve a goal.

What we conserved in our practical day to day observation and performance we are neglecting somewhere the things by just keeping records and reports from our subordinates. In my previous paper is told that our subordinates or our team should be trained to report correct information.

Why I have covered this paper, if we are taking the work from anything we have to take care of its health, so if are taking work form the boiler we have to take care of the health of the boiler and that depends mostly upon the water chemistry because water we are giving as input as fuel to the boiler. Fuel quality we have to take care water quality we have to take care so if we take

care of the health of the boiler we will get good results so we have taken care of the water treatment section, the clarifier there was sweeping silica's were there in the clarifier we have rectified it by doing the proper flow rate to the clarifier because flow rate was 175 cubic meter and the pump installed was 150 cubic meter so the silica was sweeping to the DM plant. For the new project proper flushing, chemical boil out so here I can mention in chemical boil out whatever chemical boil out we are performing we have to analyze the concentration of the chemicals in boil out material. Unless and until we give the proper concentration we cannot say that chemical boil out is completed with proper temperature so we maintain feed water and make up water parameters and check the following. Deaeration, or removal of traces of oxygen mechanically and with amines, Deaeration is the preventive tools for corrosion and protection of the metal so we take care of the oxygen and analyze the oxygen as mentioned in data, when our oxygen level was more we observed the findings that reddish surface was there in the drums so alkalinity to prevent the corrosion. Here I can say that alkalinity is related to the adherent and non adherent phosphate role, if we are dosing the phosphate optimization of alkalinity is very important, alkalinity increases the non adherent sludge will increase because that non adherent sludge creates a intermittent blow down and adherent sludge creates CBD so maximum possible alkalinity is to be maintained to create the adherent sludge. phosphate and sludge conditioning, it is a role of chemicals to create but phosphate also is having interesting characteristics at high pressure and high temperature, we have to give the proper dose of phosphate because after that it will not work.

Control on concentration of solids in boiled water, this is important in the sense of priming and carry over and foaming of the water so that steam purity and steam quality will deteriorate so water quality in all the sense is very important from all the angles of Deaeration alkalinity phosphate and sludge conditioning, control on concentration and solids in boiler. We are giving surface blow down and continuous blow down for the adherent sludge and non adherent sludge we are giving bottom blow down.

Care while working situation, why I mentioned this is because we are frequently stooping the boilers for the cost issues and fuel issues so our huge crores worth of machinery we are keeping idle, so idle machinery will get rusted so we have to take care of the rusted machinery by taking care according to the situation, if situation is longer or shorter or for a few months this points are there, method for smaller shut down, recommended water parameters maintained in filling the water, this I have already mentioned in the tabulation, these are standard norms. Feed water adequately deaerated, this is very important, deaerations by both mills off season we cannot get steam so we have to give a dose of oxygen scavenger chemicals, so we can use the oxygen scavenger base up to 2000 to 3000 ppm maybe more by studying hourly analysis of the oxygen content of the water. Ingress of oxygen or other gases avoided to accumulate by maintain steam filing or pressure greater than atmosphere. These are the steps to be taken, because our boilers are open to the air so lot of wind is coming so we make the boilers compact sop that no air should go inside the boiler. System should be completely filled with conditioned DM water, sufficient chemicals to be added to get the residual norms, this is important, we are analyzing the blow down water the residual norms are very important unless and until we maintain the residual norms the chemical treatment is not important, regular check on Ph on dissolved oxygen value followed, When boiler required for service water, water to be drained to normal working level before start.

For a longer period of more than a month, the wet method does not hold well because of condensation of atmospheric moisture hence corrosion in system empty the boiler and dry it

blowing warm and dry air. Care for non self draining part to be taken, all parts should be blown with warm dry air because normally people neglect this, put blinds at open connections, use of dessicants chain type or simple line we can put but take care we have to remove the tray before operation.

Modern system provided with online testing facilities and alarming signals, this is a topic related with entrainment, condenser leakage or juice side tube leakage so modern system provided with online testing facilities and alarming signals because once the system is not working we cannot get the signal the feed water directly from the semi kestner or anything goes to the boiler and high pressure boiler is a very serious matter, any abnormal change recommended in water parameters observed then possible check, this recommended water parameters observed abnormal change, how we will come to know the abnormal change expert instrumentation always in working online system is there it should work. Lab can help but it requires a frequent checking either hourly or half hourly. Ph of boiler drops rapidly, on the ph observation we can say that if the ph drops we can say there is a leakage in the system either in condenser or juice. Phosphate level of boiler water drops down very low due to reaction of residual phosphate, whatever we are maintaining drops down very rapidly because the salts present in the water contaminates the condensate so it reacts with the phosphate and reduces the phosphate level forms the acid it is very dangerous, conductivity rises due to slat ingress. In such a situation immediate action is required immediately start chemical dosing pump to maintain excess phosphate 5 to 20 ppm and ph 9 to 10 making solution somewhat concentrated not more concentrated than normal frequent check on ph and phosphate, do not operate the boiler if ph and electrical conductivity not maintained as $ph > 8.0$ and condensate < 300 .

Take recommended pressure hydraulic test of leaky equipment, recommended water quality parameters and results achieved are tabulated for reference. If everything goes smoothly no one worries but we must be alert to safety by training our staff and making them system aware, reporting abnormalities immediately thank you.

Question-chairman- I myself have 1 question for you and its related to the performance study of the boiler, on pg. 65 you have said that economizer feed water inlet temperature is 61°C and outlet temperature 181°C , how come you have considered to this inlet of the economizer temperature because the economizer is always fed with water after deareator as this is high pressure boiler.

Question- jasvinder Singh- I would like to know that when running the boiler on 100% coal did you face any problem in ash handling system of the boiler or if the existing system is sufficient secondly I would like to know the cost in both the cases i.e. in / unit of power generation in case of coal and bagasse.

Answer- author- sir regarding the 61° because it was actually 61° , deareator was not working, feed water coming from this co-gen condenser was 50° we raised to 60° , in such a awkward situation I have measured what is the effect on the economizer, that I know should heat the water and not evaporate it, super heater should give the duty of the economizer is to heat the water but why I have written 61° is to study the effect as up to what temperature we can go. Secondly coal cost wise I am saying we are investing crores of rupees on equipment and not getting the bagasse, I have experienced that my teams in south India are cutting the trees near the factory and collecting the wood chops and burning in the boiler, they are not taking care of

the boiler so we have to run the boiler with any fuel to generate and earn something because to keep idle crores of machinery is a time built factor, cost wise we can say coal 100% power projects are running, here for sugar factory coal is additional facility bagasse is our main fuel. I have carried out the study with bagasse also and that we have modified I have not covered that topic whole because we have modified the coal feeders because what the manufacturer had given the distance between coal feeder was very narrow we have expanded the difference and reduced the unburnt losses because 6 bagasse feeder were there 4 coal feeder were there.

9

The 5th paper is also on the same topic **Sugarcane Bagasse Drying using Hot Air- A case study of Lab Model- Dinesh B. Uphade, Prof. S.R. Patil**

The authors are not present

10

The 7th paper is **Bagasse Gasifier- by Kolli Satyanarayana**

Author not present

11

Bagasse Drying by faster rate of evaporation- a very simple designed device for energy conservation- by Dr. Rajeev Kumar Sharma, Mahesh Kumar Kaushik and Naresh Pal

Dr Rajeev Sharma

Respected chairman and co-chairman of the session, all senior delegates here and my colleagues, I think shri JJ Bhagat has created a good atmosphere for me by saying that the last paper everybody is confused, one should reach on some conclusion. Actually this simple paper is in support of bagasse drying by spending a very little amount and by execution of this at factory level it self, I think need not to introduce that how much % of bagasse saves how much% of steam that is all I think unnecessary and wastage of time, I will come to how this idea came into my mind, several times I was looking but at this juncture I deeply observed when I was standing on mill station during my consultancy services in Haryana, emerging out vapors from bagasse these are going out again condensing on bagasse when I took the sample of bagasse just after emerging out of the discharge roller and analyzed it and compared it with bagasse after some distance in the carrier there was a difference but wonderfully this difference was on negative side, it was about .25 to .30% reduced moisture at that time, I thought when this moisture is emerging out from the hot bagasse how it is again being condensed in the form of droplets how its again reduced but at the same time I thought that this physico chemical reaction locate when he bones between the liquid molecules are broken and it takes the form of vapors, if anyhow this reaction can be enhanced then maybe possible that the maximum evaporation from this bagasse at this stage only may take place so it is supporting for bagasse drier even if you are putting 50% moisture there it may put 49% moisture it may reduce the load on bagasse drier even. Developed a hood type design, put it on last mil after the discharge roller and macerator almost

just to give the passage to bagasse, to go on the carrier and the design is like that so that it creates a almost closed atmosphere and the natural passage to that chimney from which the vapors are emerging out, the suitable exhaust fan like is given and this created a artificial pressure difference as compared to the evaporation under atmospheric pressure, so it enhanced the rate of evaporation and when the moisture content in bagasse is observed it was of the tune of .775 to 1% or .95 as compared to 2.5 in natural gas, so again it reduces that bagasse moisture as compared up to the tune of .5 to .75 this is actually the brief description of theory and brief description of the device, nothing else you can also do it at factory level just create a hood on that give a exhaust there a problem is created definitely and you have to sort out, in that factory it was near by to bagasse so this pipe was thrown there otherwise there will be bagacillo in the moisture, this has to be kept in mind, this is the paper and a table is given there, this reference is when the bagasse moisture % in the mill, average it was 49.8, it was reduced to 48.94 difference is of the tune of .86, in other mill when the bagasse moisture was 49 it was in the range of 48.4c and in last mill when they were achieving about 49.8% it was reduced to 48.9 definitely the bagasse % moisture was higher in the mill, this reduction was slightly higher, this is the paper, thank you.

Paper is open for discussion

There are no questions

12

The 14th paper is **The Impact of Steam parameters on Co-Generation Efficiency and Cost-An Experience of Simbhaoli Sugars Ltd. - By A.P. Singh**

A.P. Singh

Good afternoon everybody, my paper on this topic deals with the brief description of co-generation fundamentals and how the industry has done the continual improvement in adoption of new technology and adopted co-generation in making industries more viable with growth of technologies and its acceptability with the experience of others. Impact of steam parameters in sugar industry and its effect of per unit generation cost in different modes of operation, impact of steam parameter on co-generation plant equipment installations its efficiency its cost realization analysis and experience of Simbhaoli sugar and then my recommendation and conclusion.

As all of you know how sugar industry has improved continuously, specially in the field of steam and energy, sugar industry since starting is in co-generation when it started generation of power and steam both for the plant and over the years of growth and improvement sugar industry adopted improved technology for steam and power gradually and started thinking for reduction of steam consumption of the plant and saving of the plant and saving of bagasse also, during modernization has stabilized its extreme generation in the range of 32 to 42 kg for some time, we can say till the mid 90s and with further improvement of the technologies of steam and power industry started thinking of making surplus power by utilizing waste heat and during mid 90s some sugar industries started thinking for utilization of waste heat by avoiding the PRDS steam through turbine, of course after the announcement of the policy of the MNES govt. of India sugar plants were encouraged to do this and they are installing additional turbo alternator set

for generating power instead of passing steam through the PRDS, when they have started utilizing waste heat that is actually the incidental co-generation has been started in India during the mid 90s, just I have given 1 example of 3500 tcd plant during mid 90s how they have adopted the co-generation, this is the start of the co-generation fundamentals, I have considered 3500 TCD plant which requires steam of approx. 75 TPH steam and power of approx. 5 MW, and utility installation what they were doing is this installation of 2x3 MW, DG set and 80 TPH 42 kg 420° boiler. Generally exhaust available from DG set is around 41TPH at 1.5 kg and 34 TPH steam is bleed through the PRDS to the process, now after considering this 34 TPH power when we convert it in the power its equivalent to 4.4 MW of generation of power on this steam parameter, then some plant has adopted by installing additional 5MW of DG set and started generating surplus power and started export of power to the national grid and also started earning money by exporting around 1 lakh unit daily and earning in today's time its 3.25 in those days it was actually 2.25 lakh daily, this type of co-generation is called incidental co-generation and has only installation investment only and this is actually the start of the co-generation fundamentals in the sugar industry during mid 90s.

The technological improvement- how the sugar industries have done the continuous improvement in technology, after mid 90s improvement and adoption of the co-generation in the sugar plant the technological up gradation has been started and some people after getting convinced from others some management has started thinking for upgrading their technology and adopting this co-generation fundamental with the improved technology what is available in India with the consultation of they manufacturers and consultants and then they have gone to the pressure of 65 kg 480° C and further improved to 87 kg and 510 to 515° C boiler parameter and adopted this extraction condensing turbine for co-generation of the plant. Adoption of grid cum extraction condensing turbine, actually this has given the benefit to the plant in reducing the steam consumption of the plant actually what was happening initially in sugar industry, whenever there is a fluctuation of steam pressure sometimes if there is less consumption in the process then either from the turbine side or form the process side steam was vented out but actually steam generated at the boiler was counted and every steam consumption of the plant was more but by adopting extraction condensing DG set this is maintaining the exact pressure, for e.g. If we are maintaining 1.5 kg it will maintain 1,5 kg whenever there is less requirement power generation will remain constant the surplus steam will go in the condenser and that will be stopped by the governor also, so average steam consumption of the plant is reduced by adoption of this DG set and after that the thermo dynamic efficiency improvement has taken place with the consultation of the consultants and manufacturers and after observing the benefit of the thermo dynamic efficiency with the installation of HP and LP heaters. Further improvement plant has done in the pressure and temperature and also in thermo dynamic improvement is by adopting 105 or 110 kg cm or 35 or 45°C boiler with the double stage HP heater LP heater in the turbine side and adoption of this high steam parameter with thermo dynamic improvement increases the steam to bagasse ratio and it resulted in enhancement of capacity of the co-generation plant of a sugar plant and finally plant is able to install more capacity of power plant in their campus and with improved thermo dynamic cycle efficiency and high steam parameters industry can generate around 135 KWH/ ton of crushed cane and if we consider 35 KWH as the consumption of the plant including the co-generation if the plant a 100 KWH of power will be available for the export to the grid. Whereas in incidental we were able to generate around 65KWH and only 35 KWH we were exporting to the grid, to install and operate this type of high equipment water management and complete automation of the plant is required along with the high skilled level of

the operating persons, and online monitoring specially for steam and water is essential to monitor the condition of the water and steam. Just I have given 1 table, impact of steam parameters on power generation and its per unit cost, I have considered 2 modes of operation 1 is back mode and 2nd is the condensing mode of operation. In back pressure mode of operation we have considered for 45 kg 420° and 65 kg 480°, 87 kg 510° and 1.5 kh 535° with available feed water, feed water for 45 kg we are using 105° 65 kg I have considered 115° only for 87 I have considered 170° of the feed water through Hp heater and 105 its round 225°. this is the back pressure mode of operation and we have considered only per unit cost after considering only 16 to 20% of the energy utilized by the Dg set.

Condensing mode of operation where steam is utilized only for condensing mode and the per unit cost of generation is given in condensing mode. The impact of steam parameters also we are telling however its investment is more but realization in long term is beneficial and a detailed comparative I have given for a 5000 tcd sugar plant 210 tch and 29% of the average bagasse production 15 days of continuous operation and 45% of steam consumption, (end of cassette)

The surplus exportable to the grid for 45 is 11.5 Mw and for 105 its 20 MW and realization for this I 13 crores and for 105 its 24 crores, and this figure is for the d\saved bagasse and of season generation and realization during the off season and total realization after considering the season and off season realization of 5000 tcd plant with 45% steam consumption and other things.

The Simbhaoli sugars co-generation, actually with the announcement of the policy and with the initiative of sugar industry Simbhaoli sugar has initiated to set up a co-generation plant in 1995, that was the 1st cogen plant in UP with synchronization with the grid and after getting the advantage of this co-generation realization of the money it has added the value of Simbhaoli sugars growth and finally Simbhaoli sugars has expanded its capacity from 7500 to 10000 and added 1 more 87 kg high pressure boiler and DG set of 22 MW and we replaced the old grid system of 33KV to 132 KV and after that we were able to generate to export around 19MW in place of 5MW to the national grid and we are also saving bagasse for off season operation and we are also supporting our distillery with the saved bagasse and by adoption of this parameter we have got registration in the UNFCC presidium and now we are generating CER and getting its benefits also.

In other units we have installed cogen plants and there also we are exporting in the tune of 19 MW to the national grid and in Brijnathpur unit we are in the final stages of 22MW cogen plant.

Conclusion, after considering the table and being convinced it's advisable to adopt technology of high enthalpy steam parameters along with the improved thermo dynamic efficiencies for new cogen plant. Its more realization by exporting more power and actually its also showing the technical and financial addiotinality which is the requirement of the CDM project if its technically and financially additional then they will consider it for its registration in CDM, by adopting this high enthalpy parameter of course this will get the addiotinality and will be eligible for registration and this will also enhance the overall availability of renewable and environment friendly energy to the national grid for sustainable development of the national energy program thank you.

Chairman- friends its really a good paper the author has tried to compare the surplus power generation on the various pressure so this paper really gives the good guidelines for selection of the boiler pressure particularly for power generation, now whenever a sugar factory is in the stage of implementation of the power project there is always confusion as to what pressure they

should adopt but looking at his paper and that he has given it seems that 87 kg/cm² pressure seems to be most optimistic considering all the factors like operating condition then water treatment and the instrumentation required and of course lastly but not the least the economics i.e. cost/MW at 87 I think that gives nearly good cost economics i.e. return on investment so I think 87 at 515° steam parameters as he has mentioned seems to be adequately good for the sugar industry conditions thank you. Now please ask your questions.

Question- dr. Paul- the author has I think has taken a lot of theoretical exercise for the thermo dynamics for this high pressure technology, if you remember the non conventional energy dept. has started giving incentive at 45 bar to start with, I wrote them and established that if you switch over to 65 you can produce more power than 45, they changed the incentive from 45 and most of the sugar factory who had 45 lost a lot of incentive, now I think what you should do the cost benefit this is the 65 v\bar to 87 bar in boiler composition material construction is entirely different and cost structure is very high, if I remember ten in today's context its 115, 110 is available at 515° temperature now the cost structure of that boiler and the ancillary not only boiler the steam line all has to be different material construction, mild steel cannot do, a very low carbon and molybdenum alloy is required for the high pressure for 115 bar steam to be passed through so this cost benefit is theoretically all right, you can generate more power there is no doubt because thermo dynamic says diagram you go by 115, 87 you can see the additional energy available but what is the cost difference, can I switch on from 87 to 115 anyway you have to give a comparative cost structure to the sugar industry that if you do this ,this the cost and this is the benefit and whether your 132 KVA line you have to generate 132 KVA you cannot generate it for 40. so its the frequency which allows the grid, if the frequency is less it will not accept, so these are the caution place where you have to maintain this ritually there is no exception thank you very much.

Discussions taking place

The author's voice is very feeble

13

Planetary Speed Reducer for Mills- by T.S. Ingle

and

14

Productivity Improvement through Energy Efficient Equipments -by R. Chandrashekharan

Chairman- so we will be ending at this moment as most of the paper have been presented, I am sorry that I could not give chance to present 7 to 8 papers because the authors were not present in the hall but rest of the papers were read and it was a good interaction between the audience and the authors, I am sure that you will be getting god ideas from these papers and you will be implementing them in your sugar factories so I am very much thankful to you as well as I am thankful to the management of STAI for giving me and my co-chairman for heading this seminar in the engineering section, thank you very much

U.S. Mishra

Respected chairman, co-chairman senior technocrats and dear delegates, this paper is totally based on my own experiences. In Indian sugar mills traditionally, there were 3 roller mills with or without head on crushers to 1st mills. No. of mills and roller sizes was kept as per capacity requirement. System of positive on individual mills along with the light duty under feed rollers for increasing capacity was introduced, the sum commonly used pressure feeder where TRP or GRP of different duties and shapes, the concept of new millings, namely pinion based mills, mills without trash plate and 2 roller mills etc came into picture. The 6 roller mills comprising of 3 roller mills 2 GRPF and 1 full fledged feed roller are most popular nowadays, many concepts with respect to the driving and designing also have been brought into picture to reduce power consumption. In sugar factory mill was considered to be huge power consuming center. To reduce milling power consumptions there was improvement made in cane preparation, for improving cane preparations; old type 1st and 2nd cutters etc were slowly replaced with heavy duty choppers, cane cutters with reversal rods, heavy duty fibrizer or shredders. With the improvements in preparation feeding problems arise at the conventional 3 roller mills, to solve the feeding problems the device is slightly, (end of cassette)

To combat, the ill effect of TRPF system, GRPF with full size under feed roller were introduced, the GRPF has its own slippage characteristics show in case of excessive pressure during mill diffusers the chances of break downs reduced considerably, the GRPF has its reception property to the extent of 20 to 30%, thus juice load on succeeding mills is reduced, due to reduced juice load on the mill drainage problem is also reduced, re-absorption is reduced and ultimately the milling efficiency is also improved. It renders comparatively dry feed to mills, so chance of mill slippage is also reduced. The setting of GRPF and under feed roller and more critically the pressure feed routes of GRPF with respect to the conventional 3 roller mills is a very tedious job, looking to the repeated problem in setting of the pressure chute ultimately concept of the integral 6 roller mills was developed. In integral 6 roller mills head stalk was so designed that its geometry allowed the proper sitting of all the 6 rollers for suitable setting of the pressure chute which is critical part of the configurations, in the setting of pressure feeder the way in which the compressed bagasse is allowed to expand at the exit of the pressure feeder of the roller is very important as had decided the operating stability of the system while designing the pressure chute and final tuning of the setting, operating data in the corrections to the imperial method should also be utilized for maintaining suitable pressure in the feeders. To my experience, the following points are worth consideration while designing the pressure feeder chutes, no separating distance of the scraper should be 50 mm + to the distance between the bottom of the grooving of the pressure feeder rollers. The chute diversions should be maintained $3 \times 4''$ / foot, the chute exit should ensure a contact angle of bagasse blanket to the top and feed roller of the mill not more than 50°. The pressure should be so positioned that its longitudinal center line should be symmetrical to each roller pair and due allowances should be given for any change in mill geometry due to wear of the rollers. A typical diagram to work out the contact angle of the scraper is given below, the contact angle thus varies from 18° to 22° as per size of the rollers, for above diagram the nominal scraper contact angle maybe calculated with the relations given below, where D is the root dia in the millimeters asymmetric pressure

chute setting diagram annex.1, the light pressure chute the trash plate setting is also an important task, mostly people follow a top method for the mill setting which is described in his book, it has been observed that the top method of the trash plate setting has the following difficulties, there is a wide variation in the trash plate setting from engineer to engineer for same operating feed opening, the 2 end point arbitrarily selected the use for the drying profile may not be accurate, its also differ from mill to mill depending on the apex angle of the mills, method is very tedious and time consuming. To neutralize the negative effect of the top method a quick and simple for the test drive profile has been used. The salient feature of this method are as under, in this method it is not essential to maintain toe angle, to prevent excessive top roller flooding and wear of the trash plate top the feed acceptance angle should be 15° to 16°. The acceptance angle of the roller with respect to the trash plates back side profile is maintained in the range of 24° to 30°. To maintain proper transition from feed to trash plates tip joining is done through compass and to avoid the re-absorption stop profile of trash plate the arch should match with the root of the feed roller roof. The ratio of operating feed opening are kept in the range of 140 -150-185 instead of 15-75 and 215 looking to maintain the top roller acceptance angle not more than 30°, the procedural details are shown in next slide thank you very much.

Voice is feeble

////////////////////

See Next page.

70th Annual Convention of The Sugar Technologists' Association of India

Utilities Of Energy Efficiency & Conservation in Sugar Industry (Energy Conservation) Section

1

Sugarcane Bagasse Gasification- by Dinesh B. Uphade and S.R. Patil
Author not present

2

Energy Conservation Measures for A Model Plant- by K.P. Singh

K.P. Singh

Good afternoon chairman and delegates, I am from Balrampur Chini Mill, I have been in the industry for the last 15 years, prior to that I was working with the suppliers, when I joined the sugar industry, I found that the method of measurement was not at all there in the industry, the measurement of steam at boiler was there and the juice and water was being measured by the old weighing system, and there were no electrical measurements only generation was being measured but when we introduced co-generation there was a need for energy saving and then we started the plant measurement at each and every station, the Haidargarh Chini Mill was installed 7 years back.

The sugar industry is passing through the unprecedented crisis due to mismatch of sugar price and sugarcane price, because of the government policies, farmers have diverted to other crops in absence of long term policies for sugarcane pricing, the cane cultivation has reduced to 60% specifically in UP. Due to acute shortage of sugarcane bagasse has become a very precious item nowadays and needs to be saved by reducing consumption of electrical energy and steam energy. This can be done by introducing systematic and scientific approach to control and recover the wastages and leakages of steam, hot water and electricity, metering, measuring counting of wastage and leakage is the eye opener and this can be practiced in the industry. The technologies adopted at the time of installation of the Haidargarh plant for energy conservation are listed below.

1. we have used 690V DC drive for mill prime movers
2. regeneration type DC motors at batch centrifugal machine
3. H.T. motors (11 KV) for shredder- 750 kW x 2 Nos.
4. variable frequency drives - 90 No of VFDs are installed in the plant on various fans pumps and carriers
 - a. approximately 40% power is saved by use of VFDs against dynamo drives in all carriers
 - b. almost 30%-40% power is saved in all the pumps and fans by use of VFDs
 - c. the cost of VFD payback is 3 seasons maximum
 - d. saving/ annum in a 5000 TCD plant is more than Rs. 70 lakhs

We have used planetary drives in all the crystallizers magma mixers, pug mills, about 20 planetary gears are used, the overall transmission efficiency of this planetary gear drive is approx. 90% as substantial power saving is obtained in comparison of worm gear which are used in the industry, massecuite crystallizer of 90 ton capacity is being run now with 3.7 KW planetary gear drive whereas in the conventional factory the minimum KW is 11.5 with the open worm gearing. A total of 71 KW planetary gear drives are installed in the factory against the conventional requirement of 194 KW for the same duty. The cost benefit ratio of these drives, is power requirement for conventional drives is 194.5 KW, power requirement for planetary drives is 71.3 KW, reduction in power is 123.2 KW, net saving / day is 2956.8 KW, our saving / season of 150 days is 443520 KW power and the net amount saved the rate given here is the rate of the time pf the PPA now, it is much more than that so the total amount saved in a year is 13.3 lakhs @ of rs. 3 and the installation cost of these 2 drives were 40 lakhs. We have used helical gear boxes, these are for all kind of carrier's magma, massecuite and molasses pump, sugar melt, milk of lime handling equipment, molasses conditioners and other material handling equipments in place of worm gear, there is not a single worm used in the factory. Efficiency of the helical gear drive approximately 96% whereas the worm type gear boxes it is hardly 70%, the total KW of helical gears at haidargarh is 963.9 KW, which is equivalent to the worm gears of 1320 KW, the saving is calculated here @ of 3 with 38.44 lakhs/season and if we see the differential cost only of the worm gears and helical gears the payback is hardly 1 season.

Use of anti friction bearings, we have used anti friction bearings for all, mill gearings, carriers, crystallizers, pug mills, magma mixers and pumps for massecuite, magma and molasses. Conventional GM liners are used in all above machines but at haidargarh we have used only antifriction bearings. Use of antifriction bearings helps in lesser power consumption, approx. 5% and reduces the maintenance cost.

Automation through DCS and VFD, the industry has been using automation for the past 20 years but not whole heartedly whereas we introduced the system is having the VFDs on 90 no. units and the DCS having a single water start factory. The VFD and DCS combination shares approximately 15% steam and 30% electrical power by avoiding the fluctuations in cane feeding specifically and the juice flow liquid flow becomes consistent by the use of VFD and the DCS system, the raw juice level control, controls the speed of the feeding cane carrier, we have the control system of the juice whatever tonnage 150-200 whatever is fixed the pump will give the discharge to the control point only and the tank level will be either plus side or minus side and due to this difference of level the carrier speed is being varied so that there is no time, the pump runs dry or the tank is not overflowing. The variation of juice flow is hardly .5 ton we have never seen a fluctuation of 1 ton it is always in points only, and we have used energy efficient lighting and highly efficient motors in our plant, we have 10% standby set of evaporator because we don't stop the plant for the cleaning purpose, we have a set of quintuple with double evaporator. We have continuous pan on B massecuite siphon discharge of condensate now power for the condensate discharge except the last body condensate. We have fully automated efficient water injection system, the water consumption is 3000 m³/ hr @ 216 TCH, this has happened because of the VFD and DCS.

We have done the following modifications/ correction in the past 5-6 years n our factory to conserve the steam and power.

1. Use of 1st vapor instead of exhaust formula for molasses conditioning and pan washing. Prior to

this we were using exhaust for pan washing and molasses conditioning.

2. Exhaust applied is only at 1 place i.e. S.K. and 1st body of the quintuple and nowhere else and the exhaust is being measured before entry into the semi kestner, it is not that we measure the steam at the boiler, and again the condensate is also measured before traveling to the boiler
3. The exhaust condensate recovery increased to 96-98% from 85% and most of the factories have 80-85% recovery only, as far as the exhaust condensate is concerned but in last 5 years we have put steam trap in all the drains and the outlet of the drains is also connected to the exhaust condensate bottle or some tank wherever required because we have observed many times if the control is not proper or the insulation is not proper lot of water comes out of the traps also, so we tried to maintain the insulation etc but still whatever droplets or water comes out it is taken to the exhaust condensate bottle.
4. We are very particular for throttling of the noxious/vent connections which help in reducing steam and helps in recovery of hot water, otherwise in most of the factories the vents are kept open by the operator and they resist for throttling the same.
5. Stopped flash vapors of exhaust condensate from feed water tank venting as a lot of heat was going waste through this route, and to stop this we have taken the following measure, we have started super heated wash water through a plate type heat exchanger by exhaust condensate which was earlier being done by 7 kg medium pressure steam, we have started heating of secondary condensate through plate heat exchanger by exhaust condensate we have reduced temperature of this to 100- 102° from 120° which was earlier going to the boiler at 120° and the flash vapor were going out of the feed water tank.
6. Utilization of CBD flashes for deareator.
7. Introduction of effective flash vapor recovery system.
8. Pan washing by 1st vapor.
9. We have avoided 7 kg steam anywhere in the plant except sulphur furnace.
10. Mill washing which was earlier being done by 7 kg steam is now being done by hot water of 80-85° C.
11. The cane carrier slats which were being cleaned by the steam now are cleaned by the compressed air.
12. very precise control of noxious venting also
13. Using of steam traps of adequate size and design, this is very important. People are using traps but they are not adequately designed at the time of purchase. The water coming out of the traps is collected and sent to the feed water tank.
14. We are heating the DM water whatever we are using through PME by mill maceration water the maceration water we were using at about 80° earlier, and now that comes down to 75° after heating the DM water.
15. We have replaced the gear pumps by screw pumps/ high flow pumps for molasses and melt flow etc.
16. We are using surplus hot condensate of 80-85° C temp for hot water maceration to increase the temperature of mixed juice as well as the temperature of bagasse also
17. We have tried to arrest all kinds of leakages of steam, hot water and vapors.
18. Bagasse handling conveyors are covered fully and made leak proof to save bagasse as because of the wind lot of bagasse flies in the factory though it is not measured or accounted but it is to the tune of 1 to 2% in later part of march and April

All above has helped us to reduce our steam consumption 4 to 5% which was earlier 45% is now 40%.

Our steam consumption is reduced from 45 to 40% that is almost 30% of maceration on fiber and we are getting almost 120% of mixed juice of 12 to 12.5 brix.

Power consumption is reduced from 36 KW to 30KW/ ton of cane during the last season, section wise consumption is given below, right now the can handling and milling is consuming 14.5 KW/hr/ ton of cane it means it is not a feeling, every thing is being measured by meter and every device has got a meter. The process action is consuming approx. 7 KW/hr; thru power plant including ESP is always on we never bypass it. So the power consumption in the power plant is 7.5KW/hr/ton of cane. Of course our power plant is bit bigger than the sugar plant capacity. Factory lighting, street lighting, offices and colony lighting and other utilities are 1 KW/hr/ton of cane and totaling 30 KW/hr/ ton of cane.

This could be achieved by fine tuning of the automation causing consistency in cane feeding, a well maintained conventional sugar mill consumes more than 4 to 45 KW/hr/ton of cane crushed.

I am presenting here some interesting case studies of the conservation of steam and power.

Case study no1 milk of lime tank - we have used only 1.1 KW gear motor for the preparation of milk of lime tank against the conventional drive of minimizing 7.5KW installed anywhere in the factory, it is valued @ rs 3, 1.38 lakhs in a season of 150 days.

Case study no.2, VFD Vs control valve- a 55 KW VFD at the boiler feed transfer pump was installed later, earlier the deareator water level was being maintained through level control valve, and the pump was running at full speed, later a suitable VFD was installed to save the power consumption on the figures are given here, there is a saving of 7 KW which amounts to 1.83 lakhs/ annum, the measurement is a eye opener for us and we are installing meters everywhere, wherever we want to see or save the power. The investment was hardly 3 lakhs and the payback was 1.5 season only.

Case study 3, boiler feed water pump- in the 1st season, though we installed the VFD but because of the fear our engineers and operators were not using the VFD and the pump was running at its full speed. The pump capacity is 65m³/ hr, motor installed is 500 KW, load at full RPM when the VFD was not being used was 400 to 425 KW/hr, after installation of VFD the pump is running at almost 90% of its RPM and the power consumed now is 325 to 350/hr, the power saved is almost 75 KW/hr, revenues earned is 32.4 lakhs, the cost of installation of 2 VFDs was 20 lakh only and the pay back was 185 days only.

Case study no.4, installation of energy meters at residence of officers & staff colony- for effective monitoring, we have installed energy meters at all consumption points to measure and monitor the energy consumption. Awareness regarding energy conservation amongst staff is created in plant training and seminars. Power consumption of colony before installation of meter in 1st year was 3200KWH/day for the utilities and after installation of the meter we had fixed the units for the officers and staff depending upon their level, 300-400 units etc and now the consumption is reduced to 1200 KWH/day, everybody is happy because they are getting power free of cost and the company saved 2000KWH/day which is costing about 21.9 lakhs @ rs.3 and the cost of energy meters installed was hardly 3.5 lakhs, switches have been provided even for lights and slight glasses of pans and supply tanks etc. the operators switch on the bulb only when it is required otherwise in a conventional sugar factory there is no switch the bulb is installed on the 1st day, and removed only last day. The power consumption of the entire plant in off season is limited to max. 1500KWH for maintenance, all officers switch off their AC, fans, lights before

leaking they are not dependent on peons and other staff, on/off timers is provided for street lighting, CFL lights used for replacement of conventional bulbs and tube lights, there is no bulb now being used in the factory.

Case study no. 5, injection pump drive- the VFD was installed in 2nd year of operation, the installed power is 187KW, consumption with DOL starter prior to putting the VFD was 3600KWH/day, after putting the VFD it reduced to 3050 KWH/day, net saving of 550KW and the revenue earned is 2.48 lakhs in a season of 150 days, the cost of installation of VFD was 7.5 lakhs, the return is 3 seasons. Case study no. 6, earlier we installed the gear pump for molasses handling and they were replaced later by the screw pumps after studying the power consumption and maintenance of the screw pump, the power consumption of a geared pump was 8 KW when it was running on DOL and in the screw pump the power consumption reduced to 5KW, of course its without VFD with DOL only but because of the losses in the gear pump the power consumption was high, the power saved in a season is 10800 KWH, earning rs. 32,400 and we have replaced more than 10 pumps based on the study.

Case study no.7, we have installed a plate type heat exchanger to heat boiler DM water with imbibition water, plate heat exchanger raises the temperature of DM water from 27°C to 72°C, the source of heat is taken from the imbibition water prior to going to the mills, and the water temperature is 80 to 85° C. the DM water used in a season of 150 days is 14000m³ DM water temperature 27° DM water after ph is 72° , bagasse saved calculations are 387 metric ton, and the total saving after installation of the spray type heat exchanger is 5.03 lakhs, investment made was 5 lakhs, payback was 1 season of 15 days.

Likewise we have studied 100s of places after putting the VFD but I have presented here only few cases and the conclusion is, the energy conservation by adoption of systematic and scientific approach to measure and control leakages, wastages and adoption of proper technology are the key to success and enhance productivity and efficiency of the plant. Thank you.

Chairman' -This is really a very good paper which discusses about the case studies on various issues like DC motors, now we are always in confused state whether the DC motor should operate on 690V or 450V, now here in this paper he has selected 690V which is really a very good voltage because the DC motor operation is getting stabilized which is free of the harmonics which is very important and that is why 690 V particularly for the mills which are driven by the high HP motor i.e. 750 HP then we should go for 690V otherwise for motors below 750 or even 500 they will be run on the voltage of 460, now secondly there is choice between VFD and dyno drives , now in earlier plants we are using for the variation in the speed dyno drives but dyno drive has a limitation as dyno drive has best efficiency when it operates between 900 to 1200 rpm but in case of VFD even if it starts at 0 rpm the torque is constant and that is why dyno drives are not preferred over VFDs and of course when VFD is giving power at constant torque which is required by the application there is a power saving, then planetary gear box has created a very good room for saving of the power and most of the applications are in boiling house maybe for crystallizers pumps where motors of 15-20-25hp motor are replaced by planetary gear box. Then helical gears these are also very important because the application where there is a jerk and a torque requirement there is very heavy damage of the gear top portion where there is a torque action on to the surface of the gear, but in case of helical gears it is multi faceted gear where this is double helical gears and where most of the load is transferred to the complete surface area of the gear and that is why gear is and the life of the total unit is very good. Then I remember Singh sahib presented a paper 3-4 years back, that time the power consumption of his

plant was about 36KW/ton and now it has come to 30KW/ton that means it is a conscious effort that he has put in as the power consumption of the same plant has come to 30KW/ton that means a saving of 6KW/ton. These very small issues making a very big dent to the total application has shown us the ways and means to save power and conserve energy so friends I urge you to ask question.

The voice becomes very feeble of the author as well as the person asking question.

Question- a very good effort and I appreciate that in particular the equipments also you measured and generally it is not done in the industry.

Answer- author- yes, people are not measuring that is our whole problem we are going by thumb rule or by feeling, we have to measure it and then replace and then measure it.

Question- yes, but still I think the figures you got is 30KW/ton I think it can be still reduced.

Answer- author- it can be reduced, our plant is not working at full capacity, its working at hardly 50-70% capacity and otherwise it can come down to 27-28.

Question- it's a commendable job no doubt but I think the return you have calculated on the basis of purchase power, the Rs.3/KW.

Answer- author- Rs.3 export power i.e. exporting rate at the time of the installation of the plant now its Rs.4.

Question- no but you have got the by-product power now, your generating cost of the power at the sugar factory is much less than purchase power from the grid.

Author- yes but they are purchasing at 12.5% price that's all.

Question- no but what is your generating cost of power.

Author- it is 0 as you said, if we take the bagasse 0 its 0 if we take the cost of bagasse it will vary

Question- you are saying that if I had the power to export I would have got the money.

Author- I have got the money I am a power exporting plant.

Question- S.K. Pandey- Haidargarh I have also visited many times. Its really having a power consumption of 30KW/ton I had the opportunity of working at mankapur which is comparatively a new unit, there too we could not go less than 35KW/ton of cane, it is really a single man show chasing and training the people as well as looking after the equipment by shri K.P. Singh ji and I request you all to give him a big hand for his achievement.

Author- the factory is pit less there is no pit in the factory there is no smell in the factory during off season or in the season, you cannot make out whether the plant is working or not.

Question- Mr. Shankar- I just want to know, you have added VFDs to the existing motors straight away, generally motors you have to select which suitable for VFD because there is clash of insulation which takes place in the motor, I mean we have to go for resin coated coils and all, did you take care of these things.

Answer- author- you are very right, we are purchasing motors only suitable for VFDs, class A4 something, I am not a electrical engineer but we have taken all care, even if 1 KW is suitable for VFD, whether VFD is there or not the motors purchased are suitable for VFD duty and there is no cost difference if you buy in bulk but if you buy 1 there is some difference.

Question- my query is to the chairman, 30KW/ton is a very big achievement but I have been informed that in electrical driven plant the power consumption has been reported as low as 22-25KW/tch, I want to know whether this is a practical approach we can get it or somewhere we are getting this type of consumption.

Chairman- your observation of power consumption for the sugar factory only manufacturing sugar is up to 24 to 25KW/ton that we have also observed in Maharashtra but 30 with cogeneration i.e. with high HP boiler is really a tremendous achievement because I have seen the plants with cogen and HP boilers, is maybe more than 32-33 KW/ton but in this case if he has achieved 30kw/t its miraculous and we must congratulate him, we once again give him a big clap and close the discussion thank you.

Author- I will try to answer this question, many people talk to me and I talk to many people, what is your power consumption? Many people say 22 to 24 then I ask what is the unit installed at the shredder fibrizer sir, this is a fibrizer that is not measured, my factory there is 1 turbine i.e. power turbine that's all there is no other kind of turbine or drive. So 22 they are correct, the power measured by them, but the power of the shredder is not measured by them.

Voice again becomes feeble

3

Targeting Energy Efficient Parameters for co-gen Scheme in Sugar plant- by K.C. Dalela

K.C. Dalela

Good Morning everyone my name is KC Dalela and I have worked in Triveni and ABB Baroda. The title is slightly long but this topic is very popular i.e. co-gen with reference to sugar plant only, and I have taken this considering a capacity of sugar plant as 3000 tcd or 125 tph. If we refer co-gen, I think we have been discussing for the last 15 years or more because I still remember when I was working with ABB Baroda I presented a co-gen paper somewhere in Hyderabad or Bangalore in 1994 and this is 2009 so 13-14 years have gone but still we are there only debating what should be the parameters for maximum generation of power which may be fed to grid. I will divide this topic in 2 parts, no.1 is that maximum generation of steam, how to generate maximum steam this is 1 part, the another part would be if we have generated maximum steam within the available fuel then what should be the steam parameters most suitable to generate maximum surplus power to be fed to the grid. Now as far as generating more steam is concerned, I think Mr. Patil has yesterday presented a paper on bagasse drying and he has given so many methods of bagasse drying but I would like to add one device also i.e. electrical heating of bagasse and if I remember correctly he has shown in his slide that at 50% moisture steam to fuel ratio as 2.4 and at 43% its of the order of 2.8, in my presentation I have taken 2 factors 1 is the thermal economy as far as the boiler is concerned, thermal economy means raising the temperature of

feed water to a certain level so that the load on the boiler reduces and if you look here all the condensate from the process or make up water etc going into the feed water goes to deareator to remove oxygen which may cause corrosion, and then there is a slight improvement in the temperature in deareator and then going to hp heater and from their to boiler so I have considered from hp heater to boiler, the water temperature as 150°C these figures are just indicative, I am not going into debate of it cannot be 150 or 130 or it can go to 170, what is have considered is 150°C hp heater and this is fed to the boiler which reduces the load of they boiler so we are gaining in terms of heat, another factor which is also important to generate maximum steam is moisture content in the boiler and I think yesterday a lot has been talked about, in my presentation I have taken moisture % at 45%, I am slightly conservative I have taken steam to fuel ratio as 2.4:1 so to my mind these are the 2 factors 1 is the thermal economy as far as the boiler is concerned, so that the load reduces and the 2nd important factor is moisture content so we are reducing the moisture content and increasing the heat, and heat means steam generation so if you go further again I have taken bagasse % as 27.5% on cane, now the process steam at 2.5 bar going to the process which I have taken as 42% and if you consider sulphur heating through 8 bar steam i.e. 4% so 42+ 4= 46% is going to process. This is what I have considered, for HP heater and ejector system I have taken 5.5 tons at 8 bar so what I am saying is a TG set which is double extraction cum condensing, double extraction is at 2.5 bar absolute which is 1.5 kg going in the process for heating of juice and at 8 bar its going to sulphur burners and ejectors an HP heater and things like that. Now coming to these figures which I have chosen, the steam generation comes out to be 80 tph, with the bagasse as 27.5% and also 3% as bagasse wind age loss, I have taken maximum with these 2 factors with the HP heater which gives a temperature of 150°C to the boiler in order to reduce the load in the boiler 2nd Is the bagasse drying which is 45%. This is 1 part with this we can generate for 3000 tcd which is 125 tph on **(the voice of the speaker has become feeble also end of cassette)**

Commonly known as steam generation, how much steam can generate 1KW power, so it can be calculated also for taking various steam parameters, various temperature combination like 45 bar and 420°C and then 67 or 65 bar to 510 or 515°C, so if you take all these combination and work out the steam consumption you will find that the steam consumption reduces as we go higher on temperature, and pressure. So 2 things are very clear, no.1 efficiency cycle can be increased by raising steam temperature and pressure secondly steam consumption can also go down or reduce if we increase temperature and pressure. Now what we are debating, which would be the most suitable combination of pressure and temperature in terms of maximum surplus power generation, this is the effect of steam parameter of steam consumption in turbine, increase in the stem inlet pressure by 1 bar reduces steam consumption by .3%, in condensing and .7% in evaporation and increase in inlet temperature by 10° reduces the steam consumption by 1% in condensing and 1.5% in back pressure so if you compare this figure you will find that the temperature plays a important role compared to steam pressure. Now then we come to steam temperature, its very critical because the pressure and temperature are opposite to each other, if you increase the temperature the allowable stresses will drastically fall down, so the most important part as I said highest permissible temperature now the permissible will limit the temperature and also the material construction and the temperature plays a very important part as far as mechanical properties of material is concerned and in any temperature application equipment related to high pressure like boiler or turbine another very important property is creep which is nothing but change in dimension, material will expand if you increase the

temperature so there is allowable creep stresses you cannot go beyond that and if you cross those limits the material gets ruptured, there are 3 types of creep but the secondary creep is very important, no.2 the important part is the life of equipment, in case of turbine I know the life has been taken as 100,000 hrs which is about 11.5 years or something like that, if it works continuously and in that t period the creep should not increase by .1%. this is a factor which will limit the temperature, now turbine consists of 3 important parts, 1 is casing, rotor and flange and pipe fittings, these are the 3 important parts which I will very briefly say that in terms of turbine cylinder these are the allowable temperatures for different material. If a plain carbon steel it can go up to 226°C or 800°F if its half moly steel it can go up to 45°C and if its chrome half moly it can go to 538°C or 1000°F now if we go for 538°C that's the limit however in this case where the temperature goes to 538 like that the other material are also added to increase the creep. Looking at this similarly if you go to flange and pipes ASME so 42 bar 430° 67 bar 510° and 85 and 385° and so on this is regarding flange and if you go to rotor turbine again similar combination are their and keeping in mind the life cycle.

So in nutshell I have taken these 3 parameters 42 bar and 430°C 67 bar and 510°C and 85 and 385°C, now this is a table where I have done the comparison between the bars and temperature and if you look at it you can see the increase in the net power from 42 bar 430°C or 67 bar 510°C is the increase in the net power and if you go to 85 and 538°C its additional 12% so the maximum gain we are getting is shifting from 42 bar to 67 bar. In simple terms 430°C gives you 97KWhr/ton of cane, 67 will give 119KWhr/ton of cane and 85 bars will give 128KWhr/ton of cane. In this temperature I would say 510°C metallurgy becomes stringent and expensive in initial project cost and maintenance increase in the pressure rating have little advantage in improving the power generation, secondly its also important to keep in mind that the super heater steam temperature response is a little erratic even with a good steam temperature control system, historically sugar industry has been slow in adopting and developing new technologies due to considerations of cost, maintenance etc so in the end I would suggest that 67 bar and 510°C would be a better combination of pressure and temperature in terms of surplus power generation because temperature is a limiting factor you cannot go beyond 538 otherwise the cost will be high I am talking in terms of sugar plant and not power generation units thank you.

Chairman- I must congratulate the author for a very nice presentation and a very educative paper on parameters of cogen. My comments on the paper are, the temperature of the deareator water you have said 115°C but if you study the water treatment there are many books and one of the books on water treatment says that the deareator temperature water should not be more than 105° because he says that the oxygen content in the water evaporates immediately when it starts boiling and up to 105 the maximum oxygen is getting out from the water and that should be the optimum temperature for the deareator and after 105 if you start heating again it starts absorbing the oxygen from the air, 2nd you have taken HP heater of water outlet to the deareator, so I want to highlight how and why you have taken this temperature. In furnace there is a variation if the bagasse is dry from the level of 50% to 30%. In that case the furnace temperature goes on increasing as the condensation loss on reducing but of course we have limitation of keeping the furnace temperature to more than 1150 or 1200. Because this limitation has been created because of the slagging effect of the walls and the grates of the boiler and that is why we have to modify the boiler in terms of the shape and the dimension of the furnace

particularly when we will be adopting for the bagasse drying for the cogen plant that time we have to think that the boilers of present design which we are using today will not be suitable for the burning of the bagasse which will be burning at about 40 to 35% of the moisture. Then steam consumption you have said 42%, this is of course today's figure it may come down to 30/32% but of course for getting that figure of 30 to 32% we will need to scrap today's boiling house layout totally, because to get the steam consumption of 30% you must have continuous pan for A B and C pan boiling which will boil down to the 3rd vapor just like KCP and in that case today's evaporator body, if you study the overall installation of the sugar factories of evaporator the 3rd body which generates design for only dealing to the raw juice heating but if you go for boiling of the A B and C massecuite on continuous pan definitely the 3rd body evaporator set will have more heating surface area that will completely change the picture of the evaporator set. I am not saying that steam consumption of 30 or 35% cannot be brought down but you will require major changes not only in evaporator set but also in pan. Now you have considered sulphur burner of 5 tph but today if you see the sulphur heating I generally done by electrical heating so that you can reduce the 8 ata reading from the steam turbine and that can utilize for power generation. On pg. no. 20, you have said that there is a rise of power generation in case of 67 pressure (the speaker is speaking too fast) according to me if you followed the topping cycle for cogen that is the most efficient cycle because of you compare the power generation with the same quantity of steam and if you change the bleed in the condensing route or even to the 2.5 eta bleed the power generation is different but you have to see that the total efficiency should be maximum in that case the power generation even though its less the quantity of fuel required for generation of the same quantity of steam will be reduced and in that case you will find that there will be fuel economy rather than having more fuel or power generation, because many times these topping cycles are not designed as per as the requirement of the cycle and in case of high pressure boilers particularly as you go on increasing the pressure and temperature both in that case the cycle efficiency goes on increasing, because the main subject of the distribution of the steam to the particular route for a particular application maybe heater or deareator or condensing route it should be designed in the topping cycle mode and in that case the cycle efficiency goes on increasing from 67 to 87 to 105 to 140 like that. Of course the temperature has the limitation of 540 i.e. the critical temp of the steam you cannot increase the temperature beyond this because the material even today can be standard temperature of 540°C because the materials i.e. alloy steel available today has the creep strength which will be suitable only for 540°C and if you see the temp which is followed in the power generation of big size 250 or 500 MW thermal power station there also the temp of 54 is not crossed till today and maybe in the coming time if the metallurgy for the temperature is designed then in that case the alloys available for withstanding more creep for withstanding the temperature then it can be possible to go for 600° C of course research is going on, I have seen the literature which they are claim that within 2-3 years they will be coming with 600° C temperature that alloy has been developed but they are testing it because the testing time requirement is you have said is 1 lakh hours that means it's a time consuming job and that is why they are testing the material and if its suitable then definitely this will completely change the scenario of the power sector. Then regarding the pressure at the condensing route, now the turbines which are available not only in India even if its imported its about .1 eta i.e. about 27 inches of vacuum but if you study it properly every reduction of 1 inch of the vacuum there is 5% reduction of the power.. if your turbine is running at 27 and whatever the power is generating if you reduce it to 26 it is not in your hand but the system if reduces to 26 maybe because of the leakages, water or condensing circulation water

then in that case if the vacuum falls down by 1 inch there will be a reduction of 5% of the power generation within the same quantity of the steam. This is a very important factor and with these comments I will ask the delegates to ask questions if any.

Dr.Paul- I have made some reservations, as per the author he has concluded that 67 bar is ideal for sugar industry, but Europe has gone beyond that, last time we went to Germany and visited some complex there 87 and 110 bar are operating, another thing which I would like to point out here the creep stress is irreversible process because it goes to the tactic composition and its irreversible, its permanent damage and another observations that turbine doesn't have any stomach to eat or drink steam, it only degenerates the steam input with respect to entropy, enthalpy and super heat but that is no material transformations from this pound to that pound so some of they misnomers which are being carried out in our engineering dept should be carried out in the sense that this is not going to stand in any international forum, because we cannot deliberate anything with misnomers name or anything.

4

The 10th paper is **Prospects for Tremendous Energy Conservation -by B.L. Mittal**
Author not present

REF.No: VSI/SE-STAI/

/2009-2010

Date: 20.02.2010

To,
Secretary,
The Sugar Technologists Association of India,
C-Block, 2nd Floor ,Ansal Plaza, August Kranti Marg,
New Delhi-110049.

Subject: The concise Report on the Transcription of the papers presented during the Engineering and Energy Conservation Section of 70th Annual Convention of STAI at Udaipur from 26-29 August 2009.

Reference: Your letter No. /email STAI/AC/7/2010/4196 dated 29.01.2010.

Dear Sir,

This has reference to your letter for checking the transcription of the papers presented during the Engineering and Energy Conservation Section of 70th Annual Convention of STAI at Udaipur from 26-29 August 2009.

I have gone through all the papers transcription and checked it thoroughly. Necessary rectifications are carried out.

I am sending herewith the concise report of transcription papers for your reference and further needful action please.

Thanking you,

Yours faithfully,

K.R. Patil
Technical Advisor(SE)
VSI, Pune.

Encl.: As Above,