SOUTH EAST CENTRAL RAILWAY

CENTRALISED COOLING vs WINDOW MOUNTED DESERT COOLERS

Increased Comfort & Economy

Traditionally for cooling of office areas in summer window mounted desert coolers (DC) using 18- inch fans have been in use.

On SECR we have done away with this method of cooling and it has now been replaced with Centralized cooling (CC) where-in, like Air Conditioning, cool air distribution is thro' ducts.

In place of Desert coolers in every window, one or more big-sized (36", 3-phase) cooling fan with suitable water arrangement is installed at a convenient place, out of sight.

Principle of operation remains same.

And here the similarity ends.

DESIGN: The design of CC is worked backwards i.e. from requirement of degree of comfort. Degree of comfort is related to the number of cool air changes per hour. All air is fresh as there is no re-circulation. Cooling effect is on account of motion of air, equitable distribution, and maintaining a positive pressure inside. Typically for big offices at least 30 air changes per hour is necessary.

Some of the disadvantages of DC are:

Sr	WINDOW MOUNTED COOLERS	CENTRALISED COOLING
1	Number of coolers can at best be equal to number of windows. This is not enough for the cfm required for comfort	
2	Windows get blocked	
3	Daily water filling	
4	Air throw is limited and directional	
5	Unclean environment – water everywhere.	No such disadvantage
6	New power connections	
7	Fan Noise- for higher speed fans	
8	More maintenance	
9	Installation and removal every season- manpower	
10	Transportation damages	
11	Storage space requirement	
12	Painting and repairs every year before installation	
13	Low efficiency of smaller fans	
14	Poor aesthetics, etc	

COST BENEFIT ANALYSIS:

In last two years, following areas have been provided with centralized cooling systems on SECR:

OFFICE	VOLUME CFT	COST Rs.
CE+CEE	45,720	1,99,752
CE/C + CEE/C	1,05,840	4,15,870

FACON + CSTE	1,05,840	4,15,840
CMM	40,163	1,03,968
GM Bldg Second floor	58,968	3,85,915
GM Bldg first Floor	49,183	1,03,968
GM Bldg Grd floor	90,170	2,07,935

We take one case of the above viz Office of CE and CEE (45,720 cfm) for the purpose of comparison.

To get same degree of comfort we'd need to install 24 window- mounted DCs. Firstly there are not so many windows available in any office of this volume. Therefore, same degree of comfort is simply not achievable.

Comparison as per CFM requirement – energy units saved:

Item	**Desert cooler**			**Centralised air cooling**		
	Nos.	**per unit**	**Total**	**Nos.**	**per unit**	**Total**
CFM	24	1400	33600	2	16770	33540
Size and speed of fan	24	18", 900 RPM	-	2	36", 700 RPM	-
Fan capacity in watts	24	200	4800	2	1200	2400
Pump capacity in watts	24	45	1080	2	375	750
Power requirement in watts	-	245	5880	-	1575	3150
Utilization per day	-	-	10 Hrs	-	-	10 Hrs
Utilization per year in days	-	-	150 days	-	-	150 days
Unit consumption per year	-	-	**8,820**	-	-	**4,725**

Cost Comparison

Item	**Desert cooler**			**Centralised air cooling**		
	Nos.	**Per unit**	**Total**	**Nos.**	**Per unit**	**Total**
Cost of equipment	24	5000	120000	2	24500	49000
Cost for ducting and labour charge	-	-	-	2	75000	150000
Total cost	-	-	120000	-	-	199000
Depreciation of equipment (codal life 05 years for desert cooler and 20 years for Centralized air cooling)	-	@20%	24000	-	@5%	9950
Cost of energy	-	-	37838	-	-	20270
AMC charge for coolers	24	1000	24000	2	0	0
Total cost per annum in Rs.	-	-	85838	-	-	30220

Total saving per annum by Centralised air cooling system	-	-	-	-	-	**55,618**

Add to these cost of the factors listed as disadvantages. Savings are big, and benefits bigger. Proportionately, for volumes cooled using Centralised cooling in the offices already provided with this a total saving of 36,500 units is direct saving alone.

Centralised Air-Cooling System at GM Building, Bilaspur

Saving of Electrical Energy thro' effective use of bifurcation of lighting circuit (70% and 30%) at Bilaspur Station.

The lighting circuit of Bilaspur station has been bifurcated into 70% and 30% on all the platforms.

100% lights are switched on 15" before the arrival of the train and are switched off after 10 minutes of departure of train.

Cost of Circuit modification on all the platforms was about Rs. 50,000/-

The Total lighting load at Bilaspur Station is 110 Amps.

Detail is as under:

S.No.	Platform No.	Total lighting load	Corresponding 30% lighting load	Corresponding 70% lighting load
1	1	55 Amp	15 Amp	40 Amp; (*Applicable only 20 amps as all offices are on this PF)*
2	2 & 3	35 Amp	10 Amp	25 Amp
3	4	10 Amp	2 Amp	8 Amp
4	5 & 6	10 Amp	3 Amp	7 Amp
5	Total	110 Amp	30 Amp	80 Amp

To understand the total savings accruable from operation of this provision as planned we have assumed:

i. Equitable occupation of platforms by trains arriving between 1900 hrs to 0600 hrs.
ii. One train at a time on any PF.
iii. Only half load on PF-1
iv. Effective number of PFs is 4.

This implies that at any time with a train at one PF there will be 100% light on that PF, and 30% on all others.

With the above the extent of savings comes to around 40,000 Units per year that can be saved using this feature alone for lighting.

If we add fan load for summer season alone estimated on similar lines this saving of energy units alone becomes 45,000 per year.

Considering extent of savings possible we have assigned one TA&AC staff solely for operation of this facility now starting with BSP.

SEGREGATION OF DOMESTIC LOADS FROM COMMERCIAL LOADS

For AGN station in NGP:

Before bifurcation

Total units Consumption on Commercial tariff: 9175
Cost Rs 37,352

After bifurcation:

Domestic Units: 7,000
Cost: Rs 27,486

Commercial Units: 2175
Cost: Rs 8,652

Savings per month: Rs 1,214

COST OF BIFURCATION:

i. OH conductor, cabling, switches and labor" Rs 49,585
ii. Payment to SEB for metering Rs 7,540

Total Rs 57,125

Pay back period 47 months

After bifurcation two separate bills get generated for payment.

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Annexure-4

Power Factor of Traction Sub-station of SEC Railway during 2006-07

S. No.	Name of TSS	Avg PF
1	RAIGARH	0.92
2	KHARSIA	0.92
3	CHAMPA	0.94
4	KORBA	0.95
5	AKALTARA	0.94
6	BILASPUR	0.94
7	BELGAHANA	0.91
8	PENDRA ROAD	0.91
9	UDALKACHHAR	0.91
10	BISHRAMPUR	0.70
11	ANUPPUR	0.90
12	NOWROZABAD	0.91
13	BHATAPARA	0.92
14	URKURA	0.93
15	BHILAI	0.93
16	RAJNANDGAON	0.89
17	PANIAJOB	0.90
18	AMGAON	0.84
19	BHANDARA	0.82
20	KACHEWANI	0.80
21	KANHAN	0.83
1	**Total Average Power Factor**	**0.89**
2	**Average Power factor of traction load**	**0.80**
3	Total unit consumption o SECR in KWh	813823453
4	KVAh on 0.80 PF [3/2]	1017279316
5	KVAh on 0.89 PF [3/1]	913430920
6	Saving in KVAh [4-5]	103848396
7	Saving in KWH assuming avg PF 0.9 [6x0.90]	93463557
8	Saving in Lakh KWh [7/100000]	935
9	CSEB Energy charge per KVAh @ Rs.	2.75
10	Saving in Rs [6x2.75]	285583090
11	Saving in Lakh Rs [10/100000]	2856

Out of 21 there are 15 TSS of CSEB where energy billing system is on KVAh basis

SAVINGS ACHIEVED DUE TO SWITCHING OFF STANDBY TRACTION TRANSFORMER

S. No.	TSS	Standby transformer capacity in MVA			
		2003-04	2004-05	2005-06	2006-07
1	RIG	12.5	12.5	20	20
2	KHS	20	20	20	20
3	CPH	12.5	12.5	20	20
4	KRBA	12.5	12.5	12.5	12.5
5	AKT	20	20	20	20
6	BSP	20	20	20	20
7	BIG	30.24	30.24	30.24	30.24
8	PND	20	20	20	20
9	APR	54	54	54	54
10	UKR	-	-	-	-
11	NRZB	54	54	54	54
12	BYT	20	20	20	20
13	URK	20	20	20	20
14	BIA	12.5	12.5	12.5	12.5
15	RJN	20	20	20	20
16	PJB	20	20	20	20
17	AGN	20	20	20	20
18	KWN	20	20	20	20
19	BRD	20	20	20	20
20	KNHN	20	20	20	20
TOTAL MVA		**428.24**	**428.24**	**443.24**	**443.24**

No load loss is taken 1% of full load capacity
ref- Electrical Technology by Sri . B. L. Theraja

Hence approx. energy saving during 8 months, since 4 month of rainy season both transformers are energised condition

Year	MVA	No load loss	No. of months	No. of days in month	Hrs in day	1000	Total KWh	Lakh KWh
2003-04	428.24	0.01	8	30	24	1000	22199961.6	222
2004-05	428.24	0.01	8	30	24	1000	22199961.6	222
2005-06	443.24	0.01	8	30	24	1000	22977561.6	230
2006-07	443.24	0.01	8	30	24	1000	22977561.6	230

Total saving in Rs **22977561 x Rs 4.32 =99263066.1**

Saving in Lakh Rs. **= 993**

Power Factor and Maximum Demand Controller provided at Traction Sub-stations

over South East Central Railway

MD Controller (SATEC make) **Cost – Rs.58,000/-**

Solar based lighting system for Electrification of Manned Level crossing gates over South East Central Railway

Action Plan for Energy Conservation

1. **Do's and Don't Action plan has been drawn for loco pilots for conservation of energy.**

2. Provision of Retro-reflective Notching up boards at appropriate locations before UP gradient to avoid stalling.

3. Provision of retro-reflective coasting boards.

4. Condition of dropping on the tracks in the sidings, have been improved by continuous monitoring.

5. Trials with multi G-9 power in loaded trains have resulted in re-generation of about 30% of input energy.

6. Provision of Maximum Demand Controllers, in balance 8 TSS to avoid penalty of contract demand bursting.

7. These MD controllers can be used for switched capacitor banks also.

8. Provision of Static Capacitor type arrangement in TSS has been proposed in Pink Book 08-09.

9. Switching off Standby Transformers at TSS to avoid Iron Losses.

10. Usage of State of the Art Infra Red Thermal Image recorder for Checking Hot Spots due to loose connections in PSI and OHE in live condition.

11. Timely revision of contract demands.