

Bharat Electronics Ltd, Bangalore

UNIT PROFILE:

Bharat Electronics Ltd. (BEL), the public sector giant and the pioneer in professional electronics in India, has always been a frontrunner in forwarding the cause of Energy Conservation. Founded in 1954 to meet the Defence needs of the Government of India, BEL today, is India's premier Electronics Organization, churning out amazing systems keeping pace with progressive technologies, the world over.

Today the company stands tall with over 52 glorious years of service to the nation. A commemoration in the making of over 350 different products, comprising communications equipment, solar – powered traffic signals, solar energy, radars for military and civil use, optical and opto–electronic equipment, sound and vision broadcasting equipment, electronic components and electronic voting machines etc., etc.,.

Even after 52 years of rigorous innovation and creation, BEL has never let its Energy Conservation philosophy get behind the scene. The approach has always been simple, focussed and result oriented.

APPROACH TO ENERGY CONSERVATION:

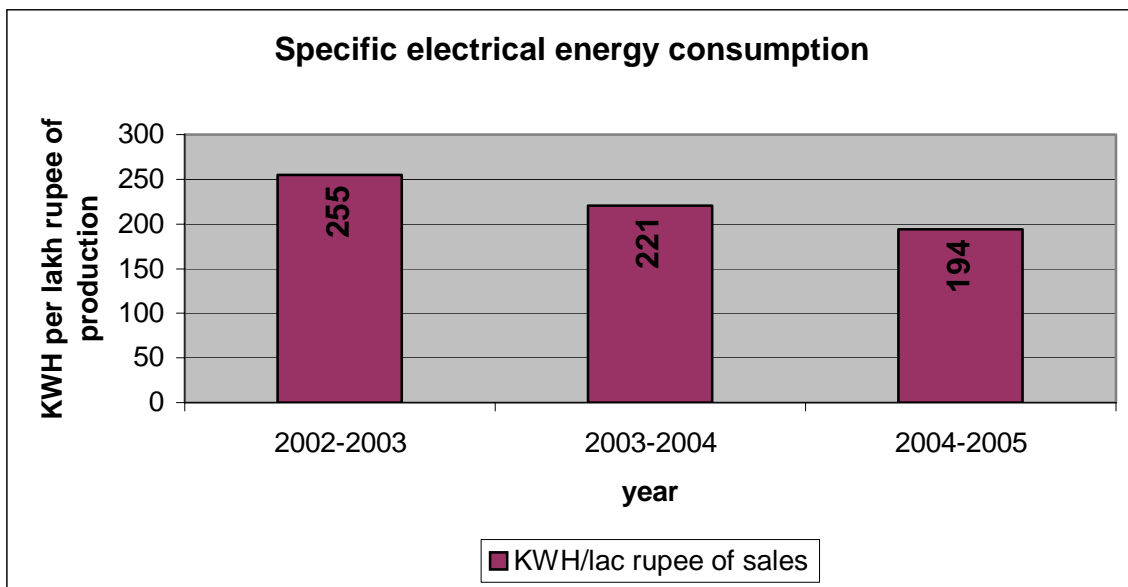
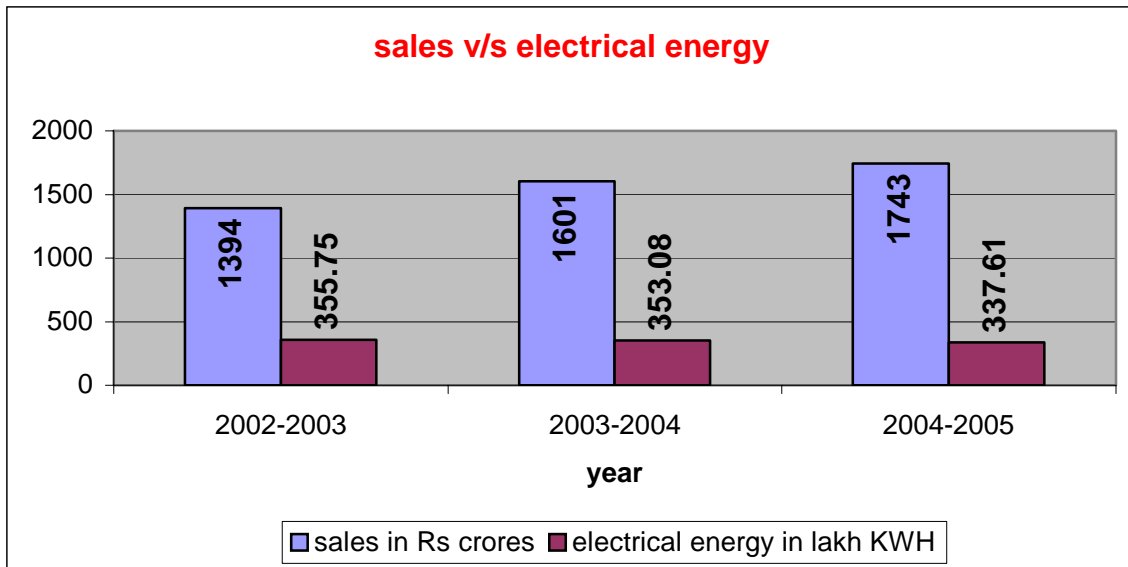
The various forms of energy in-put in Bhart Electronics are :

- Electricity - For Production and services
- HSD - For Transport
- Petrol - ForTransport
- LPG - For Production & Canteens

However, the major form of energy input is Electricity.

ENERGY CONSUMPTION DATA OF BANGALORE COMPLEX:

SPECIFIC POWER CONSUMPTION DETAILS	UNIT	2002-2003	2003-2004	2004-2005
Annual sales turnover	Rs lakhs	139400	160100	174300
Electrical power purchased	KWH (lakhs)	343.90	342.69	334.51
In-house generation	KWH (lakhs)	11.85	10.39	3.10
Total electrical Energy consumption	KWH (lakhs)	355.75	353.08	337.61
Total electrical Energy cost	Rs. (Lakhs)	1636	1788	1716
Total Thermal Energy consumption for process	Million Kcal	1005	916	888
Total thermal energy cost for process	Rs. (Lakhs)	20.94	21.39	25.07
Total energy cost (Electrical +Thermal)	Rs. (Lakhs)	1657	1809	1741
Total Manufacturing Cost in Rs. (lakhs)	Rs. (Lakhs)	119209	128525	126541
Energy Cost as % of manufacturing cost	%	1.39 %	1.41 %	1.38 %
Specific Electrical Power Consumption	KWH/lac rupee of sales	255	221	194
Specific Thermal energy Consumption	Mkcal/lac rupee of sales	0.0072	0.0057	0.0051
Specific energy cost in % over sales	%	0.66%	0.65%	0.54%

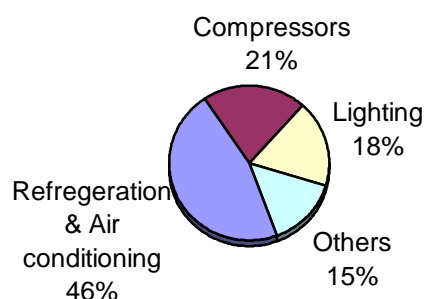


ELECTRICAL ENERGY CONSERVATION

The entire plant load is categorized as follows

- Air conditioning
- Compressed air
- Lighting
- Others (includes equipments, motors, drives, pumps etc.,)

CONTRIBUTION FOR ENERGY CONSERVATION



The air conditioning in the production facility is provided with the help of centrally air conditioning plants and direct expansion (DX) plants. The installed refrigeration (generation) system consists of 14 chillers of 100 TR capacity each, 4 chillers of 280 TR capacity each and DX plants of total installed capacity 3500 TR in the plant. The operating load estimated is 1.5 MW for compressor plant and gas plant. As BEL being the electronic industry with high AC&R requirement for clean room atmosphere, special effort was made to reduce the energy consumption by rescheduling the operation in air conditioning plants, compressed air plants with the provision of split A/Cs & portable compressors to keep the operation at actual required time and shifts for optimum utilization. The connected lighting load was estimated at 1.5 MW with around 22000 light fittings and operating load is estimated to be around 900 KW. The lighting load in the factory is made more energy efficient by replacing with energy efficient light fixtures and CFL lamps. Replacement with energy efficient motors, pumps, cooling towers incorporated with advanced variable frequency drives with microprocessor based monitoring system is in place to augment the energy conservation activities.

ENERGY CONSERVATION COMMITMENT, POLICY AND SET UP

COMMITMENT:

Realizing the importance of energy conservation and effective implementation of energy conservation measures, BEL management has set up a Standing Committee on Energy Conservation and Energy Audit (EC&EA) at Corporate level in 1988 with the following terms of reference.

- Identify and quantify various forms of energy inputs and peak demand in all Units.
- Prepare specific proposal on implementation of energy conservation measures and reduction of peak demand, along with investment needed.
- Study the scope of energy conservation and usage of non-conventional energy sources,.
- Audit the usage of energy and suggest conservation measures.
- Maximizing the Capacity Utilization.
- Technology Up-gradation with energy efficient processes and equipments.
- Motivating, training and encouraging our employees for continual improvement in processes resulting in energy conservation.
- Promoting the use of renewable natural resources.
- Recommending Best performing unit in energy conservation for annual award.

The committee has been continuously monitoring the energy consumption and several steps have been initiated towards energy conservation in the company. It has also conducted several energy audits and

formulated guidelines for implementation of energy conservation measures and distribution of Energy Conservation awards for best performing Units in the area of Energy Conservation.

Committee is also responsible for arranging energy audits through The Energy and Resources Institute (TERI) at regular intervals and follow up for implementation of audit recommendations.

ENERGY CONSERVATION POLICY:

Energy conservation policy is embedded in to the environmental policy. Policy emphasizes on conservation of natural resources like Water, Fuel & Energy with continual improvement in all our operations and processes.

ENERGY CONSERVATION CELL STRUCTURE:

Corporate level standing committee headed by the additional General Manager with members from each unit is formed. Energy conservation committee at each unit is also functioning to monitor and review regularly on energy conservation activities for continual improvement.

Award for best performance of the unit in energy conservation is also being given annually. Award will be distributed by one of our directors after study and approval of the proposal.

To give more impetus on energy conservation , energy conservation day is celebrated through out the company during energy conservation month(December) of every year.

The corporate standing committee for energy conservation and energy audit is also responsible for fixing the energy conservation target, monitor, audit, review and assists for implementation of energy conservation measures.

Corporate standing committee for energy audit and conservation is in active role from 1988-89.

ENERGY CONSERVATION ACHIEVEMENTS:

Major energy conservation achievements in the unit during FY:2004-05 are as follows:

1.Conversion of AC plant to chilled water system from direct expansion system

Background:

The reciprocating chillers were 30 years old, operating at higher specific power consumption of 1.27-1.38 KW/TR.

Action taken:

Screw chillers of energy efficient (0.75 KW/TR) is installed and networked. Other plants will also be included in the network to achieve more energy conservation in future.

Annual Energy saving : 1.48 lakh KWh
Annual Cost saving : Rs 7.41 lakh
Cost of implementation : Rs 54 lakh



2.Installation of Variable speed drives (VSD) – for AHU9/10

Background:

Normally blowers are operated as per the requirement. The measured airflow from these blowers is around 70% of the rated capacity also the requirement of airflow varies as per ambient conditions. The best method to control the airflow rate is by optimizing the speed of the blower. The airflow requirement will go down as low as 50% some times. For reduction in flow variable speed drivers can be installed to these blowers.

Action taken:

VSD's incorporated in AHUs. After the installation blowers were operated at lower speed (20 - 30% less speed than rated),this has resulted in reduction in power consumption.

Annual reduction in power consumption	: 0.12 lakh kWh
Annual cost savings	: Rs. 0.6 lakh
Cost of implementation (2 VSD's)	: Rs. 2 lakh

3. Switching - off one total fresh air fan

Observation:

The flow control dampers are damaged for these fans. These fans supply fresh air to main AHU continuously.

Actiontaken:

Dampers have been provided for airflow control to these fans and it is proposed to stop one total fresh air fan, by this reduction in power consumption can be achievable.

Annual reduction in power consumption	: 0.36 lakh kwh
Annual cost savings	: Rs.1.8 lakh
Investment made (Dampers)	: Rs. 2.0 lakh

4. Minimising the leakages by periodic monitoring and deploying efficient air guns and clamps and valves

Background:

To identify the leakages and to quantify the compressed air leakage, no load test was conducted when the entire plant was not in operation. Detailed leakage survey was conducted, to find out the leakage points. Majority of leaks are from hose pipe connections near clamps from old air guns and old valves.

Action taken:

The air leakages were brought down by new ball valves, improved hose clamps, and air guns. Weekly survey on holiday have been done to arrest the leakages in the network to avoid wastages and improve energy conservation.

Annual energy savings (Taking no load power into consideration)	: 2.24 Lakh kWh
Annual cost savings	: Rs.11 lakh
Cost of implementation	: Rs.1.0 lakh

5. Temperature controllers for cooling tower

Background:

The load on the cooling towers is observed (connected to diffusion / yellow room / mask /silicon furnace) very less during off peak hours but the cooling fan used to run continuously irrespective of temperature control. For precise control of outlet water temperature plant is installed with thermostatic controllers. With this, fan power consumption is reduced.

Action taken:

Temperature controllers for cooling towers were installed in the plant and existing 15 HP single motor was replaced with two nos of 7.5HP and operation of motor is restricted as per the requirement for optimum utilization.

Annual Energy saving	: 0.30lakh kwh
Annual Cost saving	: Rs 1.52 lakh
Cost of implementation	: Rs 0.40 lakh



6. Installation of Electronic Chokes in place of Conventional Copper Chokes for tube lights

Background:

The plant had about 2300 no. of Fluorescent tubes of 36W with conventional chokes in the plant. The power factor with conventional copper chokes is very poor and is below 0.7 in some areas. The power consumption of the tube light fittings with conventional copper choke is measured as about 53 W. they are replaced with electronic choke, which consumes about 25 watts.

Action taken:

Retrofitting electronic chokes for these lamps has yielded energy savings of 25 W per fitting. The retrofitting is done by T5, 4ft, 28W tubes supplied by M/s OSRAM INDIA Pvt Ltd for 1000 chokes.

Power saving with e-choke	: 25 W
Annual Energy savings	: 0.67 lakh kWh
Value of annual savings	: Rs. 3.26 lakh
Cost of implementation	: Rs 4.5 lakh

7. Installation lighting Voltage Controller to reduce the voltage to the lighting

Background:

Single-phase voltages for lighting circuit were found to be between 230-340V, which can be classified as higher from energy conservation point of view. By use of reduced voltage controller, set at 205 V exclusively in the lighting circuits, a saving of about 20 % in the lighting energy consumption is achieved.

Action taken:

Total 13 lighting voltage controllers for boundary lighting, street lighting, Assembly hangers and administrative block lighting have been installed.

Annual energy savings	: 1.213 lakh kWh
Value of annual savings	: Rs 5.95 lakh
Cost of implementation	: Rs 9.5 lakh



8.Replacement of Fluorescent tube lights with CFL in selected areas

Observation:

The plant makes use of Fluorescent tube lights in almost all areas inside the plant. It was also observed that the lamps in the corridor passages and in toilets are in operation for 10 hours a day.

Action taken:

Replaced the 36 W tube lights in passages, corridors and toilets with 18 W CFL. This has given a saving of 18 W per lamp. Around 750 tubes mainly at all the corridors and toilets are replaced.

Annual energy savings	: 0.36 lakh kWh
Value of annual savings	: Rs1.70 lakh
Cost of implementation	: Rs1.95 lakh.

9.Energy Efficient motors

Background:

Optimum sizing of motors as per the actual process requirements will improve the motor efficiency by means of improved percentage loading, improved power factor and reduced heat losses. Replaced old existing standard motors at Compressor plant with energy efficient motors

Action taken:

1.At compressor plant old 2 no's of 90 KW standard motors replaced with energy efficient motors.

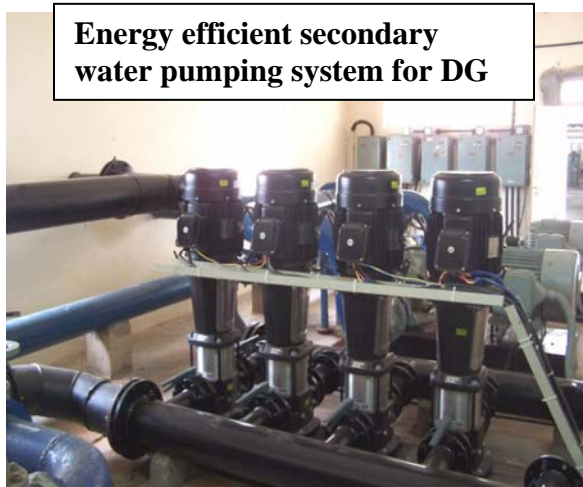
Annual Energy saving	: 0.80 lakh kwhr
Annual Cost saving	: Rs 3.92 lakh
Cost of implementation	: Rs 4.6 lakh

2. Energy Efficient secondary water pumping system for DG sets with advanced demand based control systems

Annual Energy saving	: 0.11 lakh kwhr
Annual Cost saving	: Rs 0.56 lakh

3. Down sizing of motors at Mask A/C plant-Existing 20 HP motors have replaced with the 10 HP motors.

Annual Energy saving	: 0.54 lakh kwh
Annual Cost saving	: Rs 2.75 lakh



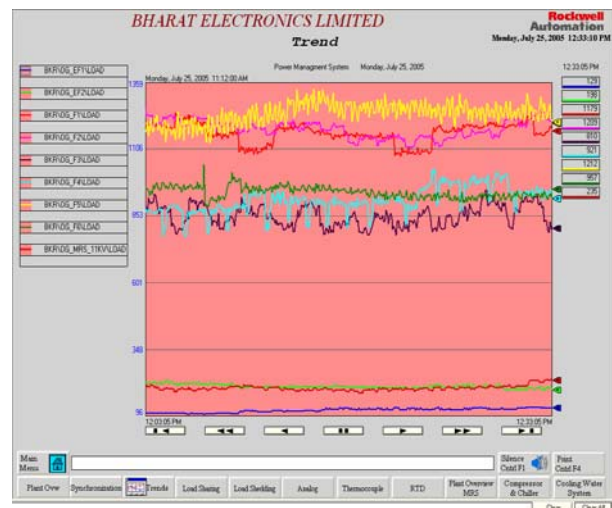
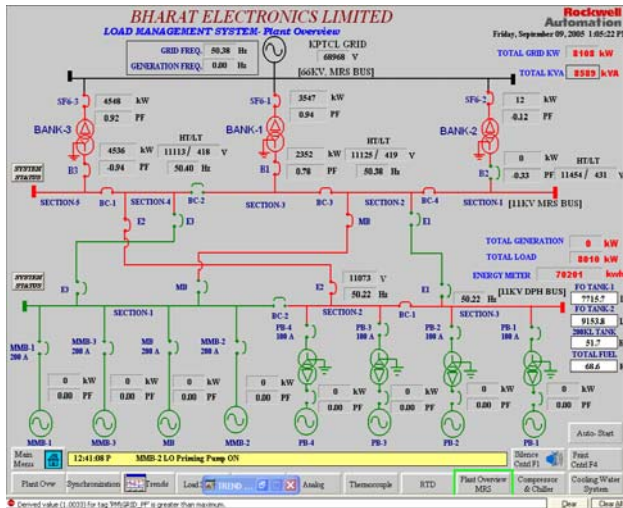
Energy efficient secondary water pumping system for DG



Energy efficient motor for air compressor

10. PLC based automation of power supply distribution system

For on line monitoring of load pattern , energy monitoring, controlling of equipments and optimum utilization of system capacity, PLC based SCADA system has been introduced. The system enables us for energy management - monitor energy consumption of various load centers with online energy data logging, which assists for energy consumption analysis and for identifying potential areas available for energy saving.



Real time load and energy monitoring system

11. Measures implemented for conservation of water:

- Replacement of natural draft cooling towers by induced draft cooling towers (no splashing, spillage etc.).

Replacement of cooling towers - Rs. 2.40 lacs.
Water conservation is 5KL per day.

- Replacement of conventional air cooling system (water spray) by CELDEK cooling pads.

Replacement of systems - Rs. 10 lacs.
Water conservation is 8KL per day.
Electrical energy conservation.

- Using industrial / domestic recycled water to cooling towers, horticulture and toilets flushing.

Replacement of piping works is Rs. 4 lacs.
Water conservation is 30KL per day.

- Installation of Hydro-Pneumatics system(Demand based water management).

Installation of systems is Rs. 6 lacs.
Water conservation is 5KL per day.
Electrical energy conservation.

- Rain water Harvesting pond of 170 million ltrs capacity established.

Recharges ground water.
Project Cost -Rs.57 lakhs.
A social & environmental cause as well.



12.cost reduction through Renewable energy sources

- **Solar water heating system installed capacity of 59,750 liters per day at various units for Hot water requirement resulting in saving of 72 KL diesel per annum.**

Investment incurred is Rs 47 Lakhs.

Return on investment is Rs 15.85L

Tapping of SUN energy

- **Two numbers of 60cu.mtr Bio Gas plants converting canteen waste in to cooking gas resulting in saving by 15.5 MT of LPG per annum.**

Project Cost is Rs. 4 L.

Return on investment is Rs. 4 L/annum

Conservation of Natural resources.



- **2.4 MW wind power mill (Proposed to complete by April 06)**

Proposed capacity : 2.4 MW
 Expected Generation : 48 lakh Kwhrs (Gross) / 42.24 lakh Kwhrs (Net)
 Cost of the project : Rs.12.5 Crores.
 Cost of generation per kwh : Rs.2.01 (avg. for 15 years)
 Pay back period : 5 years

UTILISATION - Energy generated is for utilization in Bangalore complex.

BENEFITS:

No recurring input expenditure
 Power generation from first day of installation and commissioning.
 Negligible operation cost.
 Environmental friendly.
 Economically viable.

OTHER MEASURES IMPLEMENTED DURING 2004-05:

- *De-lamping of lamps wherever natural light is available*
- Installation of timer controllers for switching ON & OFF lighting circuits including those for streetlight, at predetermined time to avoid unnecessary burning of lamps.
- Providing anodized aluminum sheets for metallic reflectors to improve the illumination level without increase in wattage.
- Isolating heat generating Equipments from AC area at wave soldering at assembly sections
- The compressed air network is decentralised for both high pressure and low pressure air requirements. However, at receiver end at the outside of compressor room itself, provisions have been made to interconnect either line in case of emergency.
- Energy efficient cooling tower have been installed in place old cooling towers,resulting in annual saving of 17000kwh.
- Double skinned AHU's – Improved insulation (double skin) and avoided heat loss and assisted in energy saving.
- The delivery pipe sizes of most of the compressors are adequately sized, which has resulted in less pressure drop across the distribution lines.
- A few compressors are also installed at individual sections, which run only during night shift operation to meet their intermittent requirements.
- Replacement of existing open type water pumps with submersible pumps
- Installation of split air package conditioners instead of central air conditioning system
- Reducing the radiation and convection losses by suitably modifying the furnace door opening

ENERGY CONSERVATION PLANS AND TARGETS:

Energy conservation is on going process at Bharat Electronics Limited, Bangalore and plant is committed for its continual improvement and always looking for new avenues on continuous basis. Following major proposals are in hand as part of the future plans for energy conservation.

Sl. No.	Proposal	Annual Savings Potential		Cost of implementation, Rs.lakh	Project commencement and completion year
		Energy L.kWh	Value, Rs. Lakh		
REFRIGERATION AND AIR-CONDITIONING SYSTEM					
1	Installing lower head condenser water pumps	0.34	1.51	1.60	2005-06
2	Interconnecting and switching "off" of auxiliary equipment – DX plant	0.67	2.97	0.75	2005-06
3	Installing variable speed drives – Air washer blower	1.05	4.67	8.00	2005-06
4	Replacing reciprocating chillers with screw/centrifugal chillers of 2 x 350 TR	18.4	81.88	110.0	2006-07

Sl. No.	Proposal	Annual Savings Potential		Cost of implementation, Rs.lakh	Project commencement and completion year
		Energy L.kWh	Value, Rs. Lakh		
	capacity				
5	Installation of variable speed drives for solar cell AHU	0.24	1.07	2.00	2005-06
6	Optimising condenser water flow rate and enhancing cooling tower capacity	1.03	4.58	3.0	2005-06
7	Overhauling of DX plant compressor	0.61	2.73	1.00	2005-06
COMPRESSOR SYSTEM (GAS/AIR)					
8	Replacing the existing high pressure reciprocating compressors with single centrifugal compressor of 2500 cfm	13.21	58.80	90.00	2007-08
OTHERS					
10	Installation of electronic chokes in place of conventional chokes	3.11	13.83	20.50	2005-06 2006-07 2007-08
11	Conversion of delta connection into star connection	0.18	0.80	Marginal	2005-06
Grand Total		38.8	172.6	237.8	