EMS and in integrating the EMS into overall management practices. It is not intended for use by certification/registration bodies. ISO/DIS 14001 defines an overall environmental management system, closely modeled on the ISO 9000 quality systems standard, and covers the following key elements:

- Establishment of an appropriate environmental policy
- A planning phase
- Implementation and operation of the EMS
- Checking and corrective action procedures,
- Periodic management reviews of the overall EMS [3].

4. Harvesting Rain Water

A simple solution to meet the water shortage and improve the quality of ground water lies in rain water harvesting. It is not only easy to install & cost effective, but also undoubtedly the best way to meet the current water crisis. We take a look at 4 easy methods to harvest rainwater.

4.1 Recharge Pit

Dig a deep pit. After excavation fill the pit with pebbles and boulders. Direst the rain water collected at roof and other sources to this recharge pit. Make sure that water is silt free and clean the pit regularly. (Cost: Rs. 2500-5000)

4.2 Gravity Head Recharge well

The roof top rainwater is channelized to a well and it recharges due to gravity. It is suitable where land availability is limited and land pit is overlaid by impermeable soil. Though a bit expensive, this method recharges ground water quickly and effectively. (Cost: Rs. 60000-90000)

4.3 Abandoned Well

This is by far the most popular method and yields good results. A dry or unused well is used as recharge structure. The recharge water is guided through a pipe to the bottom of well to avoid scouring of bottom. Take care to clean the well before making it a recharge structure. Add chlorine to well water periodically to avoid contamination. It is suitable for buildings with a roof area of 1000+ sq m. (Cost: Rs. 8000-12000)

4.4 Abandoned / Running Hand pump

Same as abandoned well method (3), here a running or abandoned hand pump is used instead of well. It is suitable for smaller buildings of roof area up to 150 sq. M. This is very cost effective method and water can be used for household purposes after adding chlorine. (Cost: Rs. 1500-2500)

Benefits of rain water Harvesting:

- Quality of ground water improves.
- Raises the level of ground water.
- An ideal and the most cost-effective solution to meet the water crises. Decreases water logging in low lying areas [3].

5. Distribution of Water on Earth

Of the total water on earth, only 3 % constitutes fresh water, which is of usable quality. Rest is saline water lying in oceans. 97% (1230 mil. Cu. Kms.) in oceans. 3 % (37.5 mil . cu. Kms.) fresh water. Of this 3% of fresh water only 23 % is available to us as 77 % is locked in glaciers and ice caps. 1 % Lakes, rivers. 11% ground water <800 m. 11% ground water >800m. 77% glaciers, ice caps.

6. The law is in place, but who will act on it?

Did you know that it is mandatory for every house hold to have a rooftop rainwater harvesting system wherever the ground water level is below 8 meters? The Central Ground water authority had issued a notification to this effect a way back in 2001, with even a deadline of March-2002.

Awarded by the Delhi CM for his effort, Kharbanda has been collecting rainwater from his rooftop for household use in a storage tank. He also diverts and overflows into an old dried up tubewell to recharge the water level. The entire exercise cost him just Rs. 20,000/-

Delhi's geology makes conditions favourable for artificial recharge. An estimate shows that a roof area of only 50 square meters receives annual rainfall of 30550 litres, of which 18330 litres can be harvested. The quantum rises exponentially for larger roof areas, which are abound in cities.

"Very little has been done in water reuse and recycling within the buildings as a strategy to reduce the water demand." Concedes Delhi Master Plan 2021. The new bylaws have made water harvesting compulsory in all new buildings built on plot of 100 square meters and above.

Buildings with a daily discharge of 10,00 litres or more also have to incorporate waste water recycling systems and the recycled water must be used for horticulture. Urbanization, which uses concrete in major way, has drastically cut down the earlier easy entry of rainwater underground for natural recharge. But Chennai, with an annual average rainfall of 1290 mm, has posted quite a few success stories in rain-water harvesting. IIT- Madras, for instance, now has rain-water harvesting systems in all its hostels. The water is piped into four large wells, which double up as storage tanks as well as help recharge ground water. Rashtrapati Bhavan, too has been harvesting rainwater since 2000 and a spokesman described the system as "very efficient catering to a lot of needs" of the sprawling establishment [4].

7. Energy Saving Potential

Table 1: Sectorwise Potential

Sector	*Potential (%)*
Economy as a whole	Up to 33
Agriculture	Up to 30
Industrial	Upto 25
Transport	Upto 20
Domestic & Commercial	Upto 20

7.1 Scope of Energy Conservation in Power Generating Sectors (in general)

a) Steam System

- Fix steam leaks and condensate leaks (A 3 mm diameter hole on a pipe line carrying 7 kg/cm2 steam would waste 33 kilo liters of fuel oil per year).
- Ensure process temperatures are correctly controlled.
- Maintain lowest acceptable process steam pressures.
- Recover boiler blow down
- Ensure condensate is returned or re-used in the process (6^0C raise in feed water temperature by economizer/ condensate recovery corresponds to a 1% saving in fuel consumption, in boiler).
- Check operation of steam traps.
- Remove air from indirect steam using equipment
- (0.25 mm thick air film offers the same resistance to heat transfer as a 330 mm thick copper wall.)

b) Insulation

- Repair damaged insulation (A bare steam pipe of 150 mm diameter and 100 m length, carrying saturated steam at 8 kg/cm2 would waste 25,000 litres furnace oil in a year.)
- Replace wet insulation.
- Ensure that all insulated surfaces are cladded with aluminum
- Insulate all flanges, valves and couplings

c) Electricity Distribution System

- Correct power factor to at least 0.90 under rated load conditions.
- Relocate transformers close to main loads.
- Set transformer taps to optimum settings.
- Disconnect primary power to transformers that do not serve any active loads
- Shut off unnecessary computers, printers, and copiers at night.

d) Motors

- Properly size to the load for optimum efficiency.
- (High efficiency motors offer of 4 - 5% higher efficiency than standard motors)
- Use energy-efficient motors where economical.
- Use synchronous motors to improve power factor.
- Provide proper ventilation
- (For every 10 oC increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
- Balance the three-phase power supply. (An imbalanced voltage can reduce 3 - 5% in motor input power)
- Demand efficiency restoration after motor rewinding.(If rewinding is not done properly, the efficiency can be reduced by 5 - 8%).

e) Drives

- Use variable-speed drives for large variable loads.
- Use high-efficiency gear sets.
- Use precision alignment.
- Check belt tension regularly.
- Eliminate variable-pitch pulleys.
- Use flat belts as alternatives to v-belts.
- Use synthetic lubricants for large gearboxes.
- Eliminate eddy current couplings.
- Shut them off when not needed.

f) Fans & Blowers

- Use smooth, well-rounded air inlet cones for fan air intakes.
- Avoid poor flow distribution at the fan inlet.
- Minimize fan inlet and outlet obstructions.
- Clean screens, filters, and fan blades regularly.
- Minimize fan speed.
- Use low-slip or flat belts.
- Check belt tension regularly.
- Use variable speed drives for large variable fan loads.
- Use energy-efficient motors for continuous or near-continuous operation

g) Pumps

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Increase fluid temperature differentials to reduce pumping rates.
- Repair seals and packing to minimize water waste.
- Balance the system to minimize flows and reduce pump power requirements. Use siphon effect to advantage: don't waste pumping head with a free-fall (gravity) return.

h) Compressors

- Consider variable speed drive for variable load on positive displacement compressors.
- Be sure lubricating oil temperature is not too high (oil degradation and lowered viscosity) and not too low (condensation contamination).
- Change the oil filter regularly.
- Periodically inspect compressor intercoolers for proper functioning.
- Establish a compressor efficiency-maintenance program. Start with an energy audit and follow-up, then make a compressor efficiency-maintenance program a part of your continuous energy management program.

i) Chillers

- Increase the chilled water temperature set point if possible.
- Use the lowest temperature condenser water available that the chiller can handle. (Reducing condensing temperature by 5.5 0C, results in a 20 - 25% decrease in compressor power consumption)

- Increase the evaporator temperature (5.50C increase in evaporator temperature reduces compressor power consumption by 20 - 25%)
- Clean heat exchangers when fouled. (1 mm scale build-up on condenser tubes can increase energy consumption by 40%)
- Optimize condenser water flow rate and refrigerated water flow rate.
- Replace old chillers or compressors with new higher-efficiency models.
- Use energy-efficient motors for continuous or near-continuous operation.
- Do not overcharge oil.
- Avoid over sizing match the connected load.
- Isolate off-line chillers and cooling towers.
- Establish a chiller efficiency-maintenance program. Start with an energy audit and follow-up, then make a chiller efficiency-maintenance program a part of your continuous energy management program [5].

j) Cooling towers

- Use two-speed or variable-speed drives for cooling tower fan control if the fans are few.
- Turn off unnecessary cooling tower fans when loads are reduced.
- Cover hot water basins (to minimize algae growth that contributes to fouling).
- Periodically clean plugged cooling tower water distribution nozzles.
- Replace splash bars with self-extinguishing PVC cellular-film fill.
- Replace slat-type drift eliminators with high-efficiency, low-pressure-drop, self-extinguishing, PVC cellular units.
- Optimize cooling tower fan blade angle on a seasonal and/or load basis.
- Correct excessive and/or uneven fan blade tip clearance and poor fan balance.
- Use a velocity pressure recovery fan ring.

k) Lighting

- Reduce excessive illumination levels to standard levels using switching, delamping, etc.
- Aggressively control lighting with clock timers, delay timers, photocells, and/or occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapor lighting, etc. Efficacy (lumens/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high pressure sodium, metal halide, fluorescent, mercury vapor, incandescent.
- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider daylighting, skylights, etc.
- Use task lighting and reduce background illumination.
- Change exit signs from incandescent to LED [6].

l) DG sets

- Optimize loading
- Use waste heat to generate steam/hot water /power an absorption chiller or preheat process or utility feeds.
- Use jacket and head cooling water for process needs
- Clean air filters regularly
- Insulate exhaust pipes to reduce DG set room temperatures [5].

m) Water & Wastewater

- Recycle water, particularly for uses with less-critical quality requirements.
- Use the least expensive type of water that will satisfy the requirement.
- Fix water leaks.
- Test for underground water leaks. (It's easy to do over a holiday shutdown.)
- Check water overflow pipes for proper operating level.
- Automate blow down to minimize it.
- Reduce flows at water sampling stations.
- Eliminate continuous overflow at water tanks.
- Promptly repair leaking toilets and faucets.
- Use water restrictors on faucets, showers, etc.
- Use self-closing type faucets in restrooms.
- Use the lowest possible hot water temperature.

8. Focus Areas

Focused efforts on conservation of energy “Energy saved is energy Generated” to remain as the main theme Adopt new technology for energy conservation of the consumable resources.

8.1 Economical gain in saving PW consumption

PW was passing from Unit-1 to Unit-2 through UGP supply & return tie MV’s of (Unit-2 side) at the rate of 24 m3/day (as measured by measuring jar in the over flow line and extrapolated) which was overflowing through the Unit-2 PW surge tank over flow line to CB basement Earlier Unit-1 PW surge tank level COIS low & high set points were at 2200 & 3100mmWC respectively, and Experiment was conducted to reduce the passing rate by maintaining lower level in Unit-1 PW SURGE TANK, based on that PW surge tank low /high level set point of Unit-1 reduced to 2000, & 2300mmWC and it is observed that over flow of Unit-2 PW surge tank stopped. However, PW surge tank very low level set point was not changed.

Economical gain for 1 day in saving PW loss =24m^3/day*COST OF DM WATER/M^3=24*1.46*1000*30 = ` 10,51,200 per month [6].

8.2 Economical gain in saving the power consumption by changing the cycle timing of Unit-2 VRD 1&2.

Earlier cycle time of DR-1 &2 was 4 hrs heating +2 hrs cooling in which heater operating time was 16 hrs in 24 hrs.More over regeneration fan will be continuously operating. Present cycle time of DR-1 &2 is 5hrs heating+3 hrs forced cooling+4 hrs natural cooling with that heater operation time is 10 hrs in 24 hrs. So, there is net saving of 6 hrs heater operation and saving of 8 hrs in regeneration fan operation in 24 hrs. *(Assuming cost of electricity is ₹ 3.04/unit)*

7.1 Power consumed by BASE HEATER (current 146amps, and power factor is 1 for heater) =√3*VOLTAGE*CURRENT*PF*=√3*415*146*1= 104.82kw.
Power consumed by base heater in 6 hrs =104.82*6= 628.92 KWhr
Economical gain by base heater per month=628.92*3.04*30 = ` 57357/month/unit

7.2 Power consumed by TRIM HEATER is 33% of the total heating capacity, ie measuring = 628.92*0.33 = 207.54 KWhr.
Economical gain by trim heater per month = 207.54*3.04*30 = `18928/month/unit.
So total saving in electricity cost through power saving of base heater trim heater =57357+18928 = ` 76285/month/unit

7.3 Similarly saving of 8 hrs in regeneration fan operation in 24 hrs. Power consumed by regeneration

FAN=√3*VOLTAGE*CURRENT*PF*=√3*415*11*0.85= 6.71KW
Power consumed in 8 hrs=6.71*8=53KWhr Saving in Cost of electricity consumed by regeneration fan in 24 hrs =53KWhr*3.04*30 = ` 4834/month/unit.
Total monetary gain through changing the VRD CYCLE TIMING for the Station is = (76285+4834)*2 = ` 162238 per month [6].

9. Steps taken for effective implementation of EMS

1) Energy conservation lecture on energy saving, energy conservation tips were given.
2) Energy Conservation Committee Meetings will be conducted and recommendations by the ECC implemented.
3) Energy Audit carried out in-house/outside team and recommendations of audit team is implemented.
4) Energy conservation targets identified for every year and Energy conservation targets achieved for the year are reported.
5) Good practices and procedure adherence and implementation of STAR techniques [5].

10. Conclusion

An EMS shifts the focus of environmental issues from a defensive, reactive posture to one that is proactive and based on sound planning and informed decision making. EMS implementation is designed to support the mission of the organization or facility and facilitate mission activities.

Regulatory and other requirements are considered in setting EMS priorities, but are no longer regarded as the only acceptable basis for establishing environmental goals. Perhaps most important, an EMS represents a major culture change from the old paradigm where environmental issues were seen as an impediment to mission success. As EMS implementation takes hold, environmental awareness increases along with recognition of the impact environmental issues have on the mission and goals of the organization. Moreover, as the EMS process matures within your organization or facility, not only will the environment benefit, but so will the pursuit of the mission and goals or your organization. [5]

Any type of development activity has both beneficial and adverse impacts on the environment in which it operates. The impacts are identified and evaluated by the project proponents to reduce their negative impacts and maximize the positive effects on the surrounding environment. The proposed project will generate an optimum employment generation for the local population.

Full pledged Environmental Management Cell exclusively for the proposed project shall be constituted with qualified Engineers. Overall, the proposed project will have positive impact on the Environment if, the recommended Environmental Monitoring, Health, Safety & Environmental Management aspects are fully implemented in high spirit by the project proponents.

11. Future Scope

The efforts towards identifying the potential areas and taking appropriate steps as effective tool towards Environmental Management Module. Our future target is making chlorination and pretreatment plant and DM water plants as the Environmental friendly and utilizing the optimum output with eco friendly measures.

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