

Innovative Approach to save Energy Cost in Chlor-Alkali ,Chemical & Agro-chemical Industries

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Concept of Innovative Approach

(Energy cost saving)

- Approach: Methods (for energy cost saving)
- Innovative Approach: Making meaningful changes in methods of measurement, monitoring and control systems for cost saving.
- Innovation Vs Invention
- Invention: Never done before (Faraday)
- Innovation : Ever doing meaningful changes (here, it is in order to save energy cost)

Doing things *differently*-is
an *Innovative Approach*. (Not doing different things)

Innovation involves...

(Energy Cost saving)

- Adoption of new Idea / thinking (**Implementation**)
 - new technology
 - new process
 - new application

to save energy cost on long term basis even at 15~30 % higher initial investment cost.

New... costs more in smart business environment !!

- Investing for **renewable resource** of energy
Solar-thermal, Solar-Electrical, Wind, Biomass, etc.
- Committed support of top management and dedicated efforts of shop-floor associates.

Energy Culture of Agro-chemical Industry

Electrical : 50 ~ 55 %

Thermal : 45 ~ 55 %

Resources:

- Furnace Oil: Producing less Carbon Dioxide than Coal, but costlier.
- Gas: Cleaner and Greener fuel, (CDM-fuel)
- Electricity:
- State Electricity Board
- Captive Power Plant

Energy Culture of Chlor-Alkali Industry

Electrical : 75-80%

Thermal : 20-25 %

Resources:

- Furnace Oil: Producing less Carbon Dioxide than Coal, but costlier.
- Gas: Cleaner and Greener fuel, (CDM-fuel)
- Electricity:
- State Electricity Board
- Captive Power Plant-Coal /Naphtha/Gas based

Innovative Improvements in Chlor-Alkali Plants

- Use VFD for pumps/blowers
- Use of VFD for chlorine compressors is a proven initiative, working at GACL,UPL.
- Sulfur Removal System (SRS) is also well established system to have clean brine without barium carbonate dosing eliminating the layer of barium on membranes causing higher voltage drop across elements and higher SEC.
- Use grade-1 salt with low calcium & magnesium impurities as compared to 0.2 & 0.1 % for grade -3 salt. This will surely save the SEC.

Areas / Major Equipments consuming Energy

Thermal:

- Boilers
- Steam Ejectors
- Dryers :RVD,SPD,FBD
- Reactors: Agitators
- Filters:ANF
- Centrifuges
- Heat Exchangers

Electrically driven Equipments:

- Pumps- Process & Utility
- Refrigeration Compressors (Utility)
- Cooling Towers
- Air Compressors /Blowers (Utility)

Innovation in Measurements & Beyond

(Measure what you want to manage)

Key Success Factors: Energy Conserv.Cell (Full time)

Off /on line Measurement, Analysis, Action Plan,
RESULTS

Electricity:

- Use portable energy analyzer for power, powerfactor rather than simple clamp-on meter and current measurement. (kW, p.f give better data about loading of motors than amperage). DCS/PLC deployment for large loads.

Temperature: Portable temp. Gun, Thermography

Pressure: Portable Digital Electronic Pressure Gauge

Flow: Portable Ultrasonic Flow meter (upgraded tech.)

Mass flow: Coriolis principle based, mag.flowmeters

Innovative Approach during Project stage

- P & IDs to indicate tapping points for **portable** pressure, temperature, flow instruments to measure equipment performance at least once / twice a year to assess /calculate operating **efficiency**.
- **Ensure** only energy efficient EFF1 or better class of electrical motors.
- **Ensure** that the **motor loading** immediately after commissioning of new plant is not less than 70 % in any stage. Calculation of motor sizing / load needs to be doubly made sure as life cycle operating cost of motor is about 85~90 % than the initial procurement cost.
- Invest for energy efficient and eco-friendly technology for all new projects / package units and **make provision** to measure the energy flow-electrical or thermal.

Innovative Approach during Operation of plant

- If DCS /PLC based operation is deployed, then have **alarms annunciation** when **SEC** exceeds norms by 5 % or 10 % for a product or utility equipment.

e.g.

If **Effectiveness of Cooling tower** deteriorates by 20 % it must sound and record an alarm.

If **SEC** of Chillers or Air Compressors **exceeds norms** by 15 %, **auto alarm message** should be generated to get transmitted by “system” to top leadership team by e-mail.

- **Operator guide message** may be generated for identifying the efficient pump / compressor/blower/ fan on the basis of weekly running hours of the group of equipments.
- e.g. Which pump is most **energy efficient** and **most inefficient among** the multiple pumps.

Innovative Approach in “pumping system”

- Have pressure profile across the network of pressurized pipes to identify the avoidable loss of ENERGY in elements of pumping system: Pump, Piping, Manual / Control valves, and End- Equipment (e.g. HE of condenser, After cooler etc.)
- When **loading profile** of pumping requirement varies with the change of product, sequence of batch, **VFD is ideal**.

Way back technology supplier of France, (Niro-Kestner had come to GACL in 1994 with PFDs **having no control valve** in response to Director (T)'s suggestion to have latest automated plant of Phosphoric Acid with @ 50 close loops)

- Today's scenario is best suited for plants having **no or minimum control valves** deploying **VFDs all over**. This suits now due to improved **reliability of VFDs at low price** for **R & D based “concept to commissioning”** agro-chem. plants

Electrical Motors

Opera.& Maintenance in “Agro Chem.”

Target for “Zero Re-Winding ”to avoid in-efficiency

How ? (Micro mpds instead of “thermal overloads”)

- Plan for 20 ~30 % replacement of motors every year by **energy efficient motors** deployed on 20~24 X 7 service and replace burnt /old motor from such stock.
- 100 % motor loading survey is **must** which is normally not done even in statutory energy audits (**smaller than 15 HP/10 HP are excluded**)
- Smaller the motor large is the benefit in terms of replacement by EFF 1 motors.
- Size reduction, VFD, Del-Star load-sensible change over for **reactor-agitators is recommended.**

Innovative Improvements in Boilers / Thermal energy resources

- **Online** measurement of boiler **SEC** per ton of steam and **boiler efficiency** with **mass flow** meter on gas & **vortex type** steam flow meters.
- Heat recovery from flue gases for less than 120 Degree Centigrade by **Evaporative Economizer** or patented technology.
- Use of biomass briquettes as fuel for boilers up to 3 tons capacity. **DM water** in place of soft water
- Solar thermal feed water heaters to improve SEC per ton of steam
- Solar Concentrators to produce low pressure steam for canteen cooking

Innovative Improvements in R E A C T O R S

Electrical:

- **EE Planetary Gear Box** instead of belt driven conventional horizontal Gear Box.
- **Del-Star change** over operation by load sensitive sensors for EE operation with same ease
- **VFD is costlier but cost effective on long term**
- **Online monitoring of current/ power by digital signal** to sound alarm when it exceeds norms

Thermal:

- **Temperature sensitive auto steam trap module**
- **Innovative thermal insulation**
- **Optimizing the SEC and the batch cycle time for techno-economical operation of reactor by**

Innovative Improvements in Evaporation Process

- **Heat Recovery by technologically upgraded flooded Plate Heat Exchangers**
- **Multi Effect Evaporators for better heat transfer/recovery.**
- **On line Steam Flow measurements and logging to monitor SEC per ton of product.**
- **Online temperature and pressure profile of the evaporator on DCS / PC based monitoring system with digital HART signals.**
- **Deployment of wireless technology for temperature / pressure measurement of locations at height in MEEs.**

Innovative Improvements Vacuum Generators

- **OTL technology is maintenance prone and energy inefficient system compared to energy efficient Dry Vacuum pump system.**
- **Steam Ejectors deployed for creating vacuum as required for the reactor is highly energy intensive process.**
- **The on line monitoring of pressure and temperature will enable operator to run the plant efficiently with ease of operation.**
- **Water flow meters on condenser cooling water is also a medium cost measure for monitoring the performance of the steam ejector.**

Innovative Improvements in Cooling Towers

- Monitoring and recording the % effectiveness on PC based system by online /off line sensing of C.T input, output and WBT (range, approach)
 - Monitoring the quality of water w.r.t. TDS, Ph, etc.
 - Eliminate algae formation by covering the open deck on the top of wooden cooling tower against the sun light.
 - P.M.schedule to be planned in every winter with complete overhauling and cleaning of C.T. basins, fills, nozzles, fans, motors & pumps.
- 1 degree decrease in temperature of C.T. can bring about 2.7 % saving in refrigeration power.

Innovative Improvements in VAM / Gas turbines, Boilers

- Switch over of fuel

Use more eco-friendly and energy efficient fuel. i.e. use natural gas fired VAM instead of using steam fired

- Such change over in VAM & Turbines can be considered for **CDM and Carbon Credit** benefits

- Use DM water in Boilers

- Evaporative Economizer is well established technology to extract heat from flue gases up to 60 degree centigrade.

Innovative Improvements in RVDs / SPDs

- Variable Speed Drive for optimizing the batch cycle time and quality of drying.
- Steam trap online monitoring
- Temperature measurement of rotating part by **wireless temperature sensors**
- **Online monitoring of the energy** data and comparing the same with peer group industry on **dash board of DCS.**
- **Star-Delta-Star** change over by **load sensitive transducer through DCS.**

Innovative Improvements in Heat Exchangers

- Online pressure and Temperature monitoring for both media on DCS / PLC. Or use Temperature Gun
- This may help in predictive maintenance**
- Calculated Efficiency of HE can be displayed on DCS as per formulae.
 - The data can be trended for historical records to keep track of the performance of Heat Exchangers.
 - Condensers of Chillers (HE) have impact on Energy Consumption of refrigeration compressors
 - **Evaporative Condensers** is a proven solution for Refrigeration compressors.

Innovative Improvements in Centrifuges

- **Online monitoring of Current /Power to suggest the imbalance in the basket leading to higher consumption due to damaged bearings.**
- **Non-contact monitoring of temperature by Temperature Gun**
- **VFD to vary the speed of centrifuge as per process needs.**

Innovative Improvements in Water Conservation

- **Meters for each plant:**
Maintenance free magnetic flow meters
- **Rain water HARVESTING** in ponds
- **Auto faucets** in wash basins, rest rooms
- **Turbine type meters** with transparent cover and switch option is cost effective solution.

Innovative Improvements by use of RENEWABLE ENERGY

Solar Thermal

Canteen for 500- cost effective

Solar photovoltaic

- Remote wireless transmitters**
- DCS/PLC Operating Voltage is DC**
- Payback period 3 yrs if considered at project stage as compared to UPS with redundancy.**

Wind Power

- Cost-effective on Life cycle cost basis and improved designs considering the depreciation benefits of 80 % to save the tax.**

Innovative Improvements by use of Wireless Technology

- **Difficult to reach location**
- **No fire hazards**
- **No cable losses since no cable**
- **Low installation and commissioning time.**
- **Possible to detect surface temperature of rotating equipment**

Plants using this technology in this Gujarat:

Meghmani Fine Chemicals Limited, Dahej

Reported no trouble since about a year.

Innovative Improvements in EC by New principles of science & technology.

- **Thermography** for in situ analysis of status
- **Ultrasonics** for portable flow metering and leak detection of compressed air/ nitrogen /vacuum.
- **Flow metering by magnetic, vortex, coriolis, target, principles.**
- Magnetic savers on water lines to prevent scaling
- Online monitoring of **energy data** by digital communication- **RS 485 or HART** protocol.
- Temperature Guns using laser technology.
- Using hybrid system for DC load using solar power.
- Using renewable fuels like biomass briquettes, solar thermal energy, wind with tax benefits.

Question- Answer Session

Thanks