Eco Industrial Parks – A RECP Opportunity

A Case Study Of Transforming Existing Estate To Eco Industrial Park

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- Opportunity for RECP Centre to work on RE & CP at MICRO and MACRO level.
- Can use the synergy at other parks for replication
- Challenges – to delivery the solutions at Micro and Macro level.
- Existing tools are available of application of RE and CP at unit level, further can be taken up at park level
- Additional tool required
  - Clean Technologies
  - Development of Industrial Symbiosis
- GCPC – a RECP Centre is established by the Industries Department of the State Govt. and closely working with the Industrial Development authority, therefore assisting Govt. to promote concepts of Eco – Industrial Development.
- Financial assistance schemes are included in Industrial Policy 2009.
GUJARAT - INDUSTRIAL SCENARIO

GUJARAT CLEANER PRODUCTION CENTRE
Located on the western coast of India, Gujarat is a leading industrial state with a unique combination of strategic geographic location, state-of-the-art infrastructure, multilingual workforce, and concentration of corporate and financial resources.

- **Strong Economy**
- **Pragmatic Governance**
- **Strategic geographic location**
- **Conducive Business Environment**
- **Strong Industrial Base**
- **Preferred investment destination in India**
- **Base to world's leading brands**
- **Pioneer in PPP**
- **Facilitating Industrial Infrastructure**
- **Driven by Initiatives (Industrial Policy 2009, etc.)**
**STRONG INDUSTRIAL BASE**

**Contribution of Gujarat to India - Sectors**

- Salt processing: 85%
- Diamond processing: 80%
- Petrochemicals: 62%
- Chemicals: 51%
- Pharmaceuticals: 45%
- Engineering: 9%

**Contribution of Gujarat to India - Products**

- Soda Ash: 100%
- Groundnut: 42%
- Cotton: 35%
- Fabrics: 30%

**Gujarat’s share in the world**

- World’s largest grass root petroleum refinery at Jamnagar
- India’s first LNG chemical port terminal at Hazira
- World’s largest producer of processed diamonds
- Amul ranked world’s top 21 largest dairy business by International Farm Comparison Network (IFCN)
- World’s largest producer of castor and cumin
- World’s largest gas based single location sponge iron plant
- World’s 3rd largest producer of denim
- World’s largest single location copper smelter at Dahej
DMIC: PROPOSED MODULES IN GUJARAT

- Palanpur Mehsana Industrial Area
- Ahmedabad Dholera Investment Region
- Vadodara-Ankleshwar Industrial Area
- Bharuch-Dahej Investment Region
- Surat Navsari Industrial Area
- Valsad Umbergaon Industrial Area
- Surat Navsari Industrial Area
- Valsad Umbergaon Industrial Area
- Mundra
- Kandla
- Dholera
- Ahmedabad Dholera Investment Region
- Palanpur Mehsana Industrial Area
- Vadodara-Ankleshwar Industrial Area
- Bharuch-Dahej Investment Region
- Surat Navsari Industrial Area
- Valsad Umbergaon Industrial Area
- Proposed Logistic Park

Gujarat Cleaner Production Centre

DMIC Alignment
DMIC Influence Area
- Cities
- Investment Region
- Investment Area
- Industrial Area
- Proposed Logistic Park
1. **Reactive Steps**: Underground Effluent collection pipeline, 28 CETPs, 8 TSDFs and effluent disposal pipelines have been provided by GoG.

2. **Proactive Steps**: Gujarat Cleaner Production Centre was established in August 1998 with the technical support of NCPC and UNIDO and with the financial support of GIDC. GCPC is one of the 4 regional Cleaner Production Centres of India.
Transformation Process of Existing Industrial Parks into eco industrial parks integrating environment, energy and climate issues

- Macro Level
- Micro Level
- Industrial Symbiosis
Eco-Industrial Development Seeks To Achieve

- Resource efficiency in energy, materials, water, and transportation, with the cost savings gained through higher efficiency;

- Cleaner production through good housekeeping, reduction and substitution of toxic materials, strict control of emissions, separation of by-product or residual materials, etc.;

- Use of renewable energy and materials to replace fossil fuel sources and finite material supplies;
Rehabilitation of existing buildings to higher energy and environmental standards and use of green architecture and engineering in new facility and infrastructure design;

Enhancement of quality of life and economic development in neighboring communities through projects between industry and community government and community-based organizations.

Ecological site planning and utilization based upon clear understanding of the carrying capacity of air, water, and ground systems and the nature of remaining native ecological systems.

Establishing environmental management systems such as ISO 14000 with objectives and indicators informed by eco-industrial development, not only compliance with regulations.
<table>
<thead>
<tr>
<th>Macro Level</th>
<th>Micro Level</th>
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<tbody>
<tr>
<td>▪ Support in improving environmental infrastructure in the existing industrial parks including waste water treatment and safe disposal, drainage system, waste management etc.</td>
<td>▪ Support in promotion of State-of-the-art Cleaner Production, clean technologies, waste minimization and process improvements among the existing industries so as to reduce the generation of pollutants and to improve the needed infrastructure...</td>
</tr>
<tr>
<td>▪ Support in developing and implementing viable models of public-private partnerships for tackling water pollution and waste management</td>
<td>e.g. Cleaner Production, Environmental Management , Specific Operation like blending &amp; grinding</td>
</tr>
<tr>
<td>e.g. CETP, TSDF, NOVEL(Spent Acid Recovery)</td>
<td>e.g. Cleaner Production Centre</td>
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Naroda Industrial Estate is located in Ahmedabad in the north-west of India. Naroda is approximately three miles from Ahmedabad town (8 km), near the intersection of National Highway No. 8 and National Highway 59. Naroda Industrial Estate was Established in 1964.

There are around Thirty-One types of Classified Industries, i.e. Dyes, Dye Intermediates, Chemicals, Pharmaceuticals, Engineering, Foundry, Agrochemicals, Textiles, Electronics etc.

The Estate measures to 337 Hectares and houses 689 plots and 426 sheds. There are housing colonies also, to benefits the workers and owners. The Estate is self sufficient with all the infrastructural facilities i.e. Water Supply, Roads, Street Lights, Post Office, Hospitals, Banks, Canteens and a Police station.
Google View: Naroda Industrial Estate
LAYOUT OF NARODA INDUSTRIAL ESTATE

(Layout prepared by GIS software)
EXISTING ROAD
PROPOSED VIEW OF ROAD

GUJARAT CLEANER PRODUCTION CENTRE
PROPOSAL PLAN - INFRASTRUCTURE AND UTILITIES

GATEWAY - PLAN

GUJARAT CLEANER PRODUCTION CENTRE
GREEN BELT
NEPL, a company incorporated under the companies Act, 1956 was promoted by NIA to set up Common Effluent Treatment Plant of 3 million liters per day capacity at a cost of Rs. 150 million (USD 3000000).

The CETP has capabilities of effluents received from

Existing CETP to upgrade by segregate and then sent to Multi Effect Evaporator
SCREEN CHAMBER

GUJARAT CLEANER PRODUCTION CENTRE
NEPL has developed a TSDF site. The details of the site are as follows:

**Area of site:** 205 m * 205 m  
**Depth:** 20 m  
**Capacity:** 8.50 MT  
**Waste:** 100 to 125 tonne/month

**Various Type of Solid Waste:**
- Iron Sludge
- ETP Sludge
- Brine
- Gypsum Waste
- Waste carbon from the ETP
- Incineration Ash
LAYOUT OF FOCAL POINT
(Layout prepared by GIS software)

Legend:
- BURROW_PT
- COMMERCIAL
- C_TYPE_RESI
- E_TYPE_RESI
- LGU_RESI
- LGU_2 RESI
- common facilities
- open_green
- NGCP
- NARODA
- railway_line
- New_ROAD
- NARODA_ROAD
- UC_001
- UC_014
- UC_016
- UC_06
- UC_07
- utility_service
- UC_019
- UC_020

CHEMICAL DYES AND PHARMACEUTICAL INDUSTRIES
GUJARAT CLEANER PRODUCTION CENTRE

NARODA INDUSTRIAL ESTATE

CERAMIC MINERAL AND GLASS INDUSTRIES
NARODA INDUSTRIAL ESTATE
Innovative Ceramic Thermal Insulation – it could save up to 33% of kiln car energy costs

**Ultralite**: A unique lightweight refractory material that has excellent thermal insulation properties.

- Proven energy saving insulation for kiln cars
- Reduce carbon footprint
- Possibility of Heat Recovery
- Easy to install - lightweight and free flowing
- 100% safe to use, handle and store
- Can be used as raw material for refractory castables and monolithic components
They have installed **Ultralite** in Kiln trolley which gives **33% of energy saving** to the industry.

<table>
<thead>
<tr>
<th>SHF report</th>
<th>Calculations</th>
<th>Original Construction</th>
<th>Ultralite Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cool Face Temperature</td>
<td>127°C</td>
<td>100.7°C</td>
<td></td>
</tr>
<tr>
<td>Total Heat Flow Per Car Per Firing Cycle</td>
<td>131.226 M Joules</td>
<td>88.106 M Joules</td>
<td></td>
</tr>
<tr>
<td>Total heat Stored Per Car</td>
<td>219.609 M Joules</td>
<td>148.604 M Joules</td>
<td></td>
</tr>
<tr>
<td>Total Combined heat</td>
<td>350.835 M Joules</td>
<td>236.620 M Joules</td>
<td></td>
</tr>
<tr>
<td>Percentage Energy Saving</td>
<td></td>
<td>33%</td>
<td></td>
</tr>
</tbody>
</table>
Manglam dryer is installed recently which saves 40% time for drying and also reduce manpower

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<table>
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<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Manually Drying takes</strong></td>
<td>36hrs</td>
</tr>
<tr>
<td><strong>Manglam Dryer takes</strong></td>
<td>14-15hrs</td>
</tr>
<tr>
<td><strong>Time saved</strong></td>
<td>40%</td>
</tr>
<tr>
<td><strong>Cost of installment of Manglam Dryer</strong></td>
<td>Rs. 1,000,000 (USD 20000)</td>
</tr>
</tbody>
</table>
## Fuel - Switchover from LDO to PNG

### Present Average daily PNG consumption

<table>
<thead>
<tr>
<th>Present Average daily PNG (900.00 Cubic Meter)</th>
</tr>
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<tbody>
<tr>
<td>Cost of PNG per m³ inclusive of taxes</td>
</tr>
<tr>
<td>Proposed saving on PNG</td>
</tr>
<tr>
<td>Cost of saving per day (900*12%*21.30)</td>
</tr>
<tr>
<td>No. of workings days in year</td>
</tr>
<tr>
<td>Proposed annual saving in Rs.</td>
</tr>
<tr>
<td>(USD 13802.4)</td>
</tr>
<tr>
<td>Rate of return on Investment</td>
</tr>
</tbody>
</table>

\[
\text{Rate of return on Investment} = \left( \frac{7,30,382.08}{6,90,120.00} \right) \times 12% 
\]
Timer Installation

- Centrifuge is an operation in dyes and dye intermediates sector which requires running around 12 hrs a day for separation purpose, and is highly energy intensive operation. Optimum time require for removal of moisture is around 30-35 minute. But because of the negligence of the worker, almost it runs for around 40-45 minute or may be for 1 hr. consuming more energy. To overcome this, a simple timer can be installed on centrifuge.

- As soon as the time will be over, the motor will automatically stop running and thus saving the electrical energy.
COST BENEFIT ANALYSIS

In general, dyes and dye intermediates industry requires centrifuge around 12 hrs to run per day. Based on that, following calculation has been done.

- No. of centrifuge: 3 (minimum)
- Working hours per day: 12 hours
- Hp of centrifuge motor: 7.5

**Economic Benefits:**

- Investment for Timer Installation (One Time): Rs. 1500/- (USD 30)
- Total installation cost: Rs. 4500/-

  Present energy cost considering each centrifuge is running 4 hrs a day against requirement of 3.5 hours.

  - = 7.5 Hp
  - = 7.5 * 0.746 KW
  - = 5.58 KW * 12 hrs (3 nos * 4 hrs)
  - = 66.96 KWhr / Day
  - = Rs. 334.8/day
= Rs. 100440/annum

Energy cost after installation of timer,
Now it will run for the setting time of 3.5 hrs:
= 7.5 Hp
= 7.5 * 0.746 kW
= 5.58 kW*10.5 hrs (3 * 3.5 hrs)
= 58.59 Kwh/Day
= Rs. 292.95/day (considering the unit cost of Rs. 5.0/unit)
= Rs. 87885/annum (considering the working days 330)

Saving in term of energy cost:
= Rs. 100440 – Rs. 87885
= Rs. 12555/annum (USD 251.1)

Calculated savings are based on the minimum numbers of centrifuge. If they use more centrifuge and install timer the payback period will be less.

**Payback period = (4500/12555)*12 = 4.3 months**
Use of Agitated Nutsche filter

- In dyes and dye intermediates all products are highly water soluble, so there is high filtration loss in nutch filter.

- **Agitated Nutsche Filter – New Technology for Filtration**

- Agitated Nutsche filter is a closed vessel designed to separate solid & liquid by filtration under pressure & vacuum, it offers an economical operation where maximum percentage of liquid in slurry is separated through mechanical means.
ECONOMICAL BENEFITS

- **Investment:** Rs. 7,25,000/- (5000 liter Capacity)

- **Energy Cost in Centrifuge considering existing operation in member units:**
  - Sulfonation Section: 7.5Hp motor (4 hrs operating time)
  - Reduction Section: 7.5 Hp motor (6 hrs operating time)
  - For 60 batches/month, 330 days per annum and at the rate of Rs.5/unit the total energy cost of existing system is Rs. 1,84,140 / year (USD 3682.8)

- **Energy Cost in Agitated Nutsche Filter (ANF):**
  - 5000 lit, motor of 12 Hp, operation time is reduced to 2 hrs
  - Sulfonation Section: 7.5Hp motor (2 hrs operating time)
  - Reduction Section: 7.5 Hp motor (2 hrs operating time)
  - For 60 batches/month, 330 days per annum and at the rate of Rs.5/unit the total energy cost with suggested ANF is Rs. 1,18,800 per year

- **Saving in Energy Cost:** Rs. 65,340 /year (USD 1306.8)
In this traditional way of drying, the product is spread in the open Sun light on ground or on a hard surface to achieve desired level of drying. The product is often turned practically to obtain uniform dying. The important factor affecting the drying process are relative humidity and temperature of air, air flow rate, initial and final moisture content of the product and type of dryer. During rain & storm, it has to be shifted or covered by impervious material. The main attraction of this method is simplicity and low cost.
SOLAR DRYER PILOT PLANT DEVELOPED IN NARODA INDUSTRIES
## Cost Comparison of Sulphonation Process:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Sulphonation with</th>
<th>Cost/kg SO₃ reacted (Rs.)</th>
<th>Waste Streams</th>
<th>Initial Cost</th>
<th>Hazards</th>
<th>Mode of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sulphamic Acid</td>
<td>48.73</td>
<td>-</td>
<td>Low</td>
<td>Not found</td>
<td>Batch/Continuous</td>
</tr>
<tr>
<td>2.</td>
<td>Chloro Sulphonic Acid</td>
<td>24.36</td>
<td>HCl</td>
<td>Corrosive</td>
<td>Batch/Continuous</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Oleum</td>
<td>14.62</td>
<td>H₂SO₄</td>
<td>Low</td>
<td>Highly Hazardous</td>
<td>Batch/Continuous</td>
</tr>
<tr>
<td>4.</td>
<td>Dry Air + SO₃</td>
<td>8.6</td>
<td>-</td>
<td>Very High</td>
<td>Not much</td>
<td>Continuous only</td>
</tr>
</tbody>
</table>
Most of the industries of cluster use iron powder as reducing agent. This technology is employed on a large scale because of its simplicity. Using iron powder as reducing agent generates large amount of iron oxide sludge, which is hazardous and required to send to the landfill sites.

The efficient technology is catalytic hydrogenation which can eliminate the use of iron powder and thus the problem of sludge.
INDUSTRIAL SYMBIOSIS

- Renewable Energy
- Waste Museum
- NOVEL Infrastructure Ltd. (Spent Acid Recovery)
- Fly Ash
- Iron Sludge Project
- Energy Van
Industrial Symbiosis

- Spent Acid Recovery
- Energy Van

Iron Sludge

Renewable Energy

Fly Ash

Waste Museum
Naroda Enviro Project Ltd. have with support of GEDA (Gujarat Energy Development Agency) developed a renewable energy biogas plant and generated electricity. The waste like banana skin, potato skin, sesame husk, bread etc. generated by member units of GIDC Naroda Estate is collected and through a digester, generating methane and with 80% methane and 20% diesel NEPL are generating power which illuminates night time Naroda CETP lighting.

<table>
<thead>
<tr>
<th>Biodegradable Waste</th>
<th>Qty. (Kgs/Day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sesame Husk Seeds</td>
<td>1000</td>
</tr>
<tr>
<td>Sugar syrup</td>
<td>2000 lits.</td>
</tr>
<tr>
<td>Decomposed Vegetables / Fruits</td>
<td>4500</td>
</tr>
<tr>
<td>Herbal waste</td>
<td>1000</td>
</tr>
<tr>
<td>Banana skin</td>
<td>2200</td>
</tr>
<tr>
<td>Potato skin</td>
<td>300</td>
</tr>
<tr>
<td>Oil sludge</td>
<td>100</td>
</tr>
<tr>
<td>Mixture waste</td>
<td>125</td>
</tr>
<tr>
<td>Rejected bread</td>
<td>500</td>
</tr>
<tr>
<td>Rejected bread waste – side cuttings</td>
<td>500</td>
</tr>
</tbody>
</table>
Plant Capacity: 85 m³/day  
Total Cost: Rs. 10 Lacs (USD 20000)  
Daily requirement of waste:  
Approx. 2 Tons  
Daily Units generated:  
Avg. 120-130 units  
Daily bio-fertilizer (manure) generation: Approx 700 Kgs.  
(30-35 % on dry weight basis)
Further, NEPL have developed “Waste Museum” first of its kind in the world where nearly 1500 industrial units hazardous waste will display showing characteristics, quantity and name of the generator to encourage industrial symbiosis to reduce the dumping of waste on land and creating products.
Spent acid ($\text{H}_2\text{SO}_4$) collected from 3 industrial estate (Naroda, Vatva, Odhav) to produce Ferrous Sulphate ($\text{FeSO}_4$), which is sold to cement industry. This includes Comprehensive Treatment Plant Of 1000 m$^3$/Day Capacity, Including Biological Treatment. About 100-150 user industries will benefit from this waste exchange.
The diagram illustrates a process involving firms A and B, and the flow of chemical substances and waste.

Firm A uses dyes/pigments and spends H₂SO₄. The spent H₂SO₄ is turned into solid waste with hydrated lime/limestone, which is then neutralized with COD removal. The treated water is discharged.

Firm B also uses dyes/pigments and spends H₂SO₄, which is neutralized with hydrated lime/limestone, resulting in solid waste. The neutralized waste water goes through COD removal, treated water, and discharge.

Carbon dioxide (CO₂) is produced in the process, as indicated in the diagram.
Iron Sludge Project

Dye Intermediate industries are producing large quantity of Iron Sludge, which involving large quantity of Iron powder. As an Iron Sludge use in a road making material and also being sent to brick manufacturing.

Fly Ash

Fly Ash is also being sent to manufacturing of brick industry

Recycling Drums

Used Chemical Drums / Containers are sent to Authorized Detoxification common facility. And then the Drums are reused by industry.

DPMC

The Estate planning to set up Disaster Preventive Management Centre under Gujarat State Disaster Management Policy.
Thank You!