Presentation on
Energy Efficiency Opportunities in
Indian Dairy Industry

Presenter : Sandeep Bhalla
Date : 09-03-2018
Umang Dairies Ltd. - One of the Leading Companies of JK Organisation

- Cement
- Tyre
- Paper
- V-Belts, Oil Seals & Power Transmission Systems
- Agri Genetics
- Clinical Research
- Dairy Products
- Hospital & Health services
- Education
- Defence Electronics

USD 4 Billion
23 manufacturing plants
Present in 100 countries
More than 30,000 employees
Plant with State of the Art Technology & Minimal Environmental impact

Drying Plant
Capacity: 4.5 Lakh Liter / Day

Liquid Milk Plant / Culture Products Plant
Capacity: 7 Lakh Liter / Day
Umang Dairies Ltd. - Certifications

- HACCP
- FSSC 22000:2011
- ISO 14001:2004
- ISO 9001:2008
- OHSAS 18001:2007
UMANG DAIRIES LIMITED

Own Brands

Pvt Labels

Job Work – Mother Dairy
Umang Dairies Ltd. – Proud to be Associated with...
Milk Production in India

Projected Production in 2020 = 190 Million tons @ CAGR = 4.5%

Source: USDA Economic Research Service using USDA, Foreign Agriculture Service PSDonline Dataset & FAO Food Outlook Nov, 17
Milk Availability in India – Per Capita

Year 2016 (grams/day)

Avg. per Capita (US, Europe, Australia, Argentina) > 410

India Avg. per Capita = 344

Source: Dairy India (Seventh Edition)
Milk Processing in India

Milk Production (146.3 million tons) - 2015

- Retention (Producer): 54.6
- Retention (Consumer): 15.6
- Organised Processing (Coop/Govt): 15.6
- Organised Processing (Pvt): 16.4
- Traditional Processing / Sale: 44.2

Milk Production (190 million tons) - 2020

- Retention (Producer): 58
- Retention (Consumer): 28.9
- Organised Processing (Coop/Govt): 23
- Organised Processing (Pvt): 23.7
- Traditional Processing / Sale: 56.4

21.2% increase in Retention (Producer)
27.6% increase in Retention (Consumer)
68% increase in Volumes

Source: Dairy India (Seventh Edition)
Indian Dairy Consumption – by Product Type

- Fluid Milk: 46%
- Ghee (clarified butter): 27.50%
- Butter: 6.50%
- Yoghurt: 6.50%
- Dehydrated condensed milk: 3.50%
- Non-fat dry milk powder: 7%
- Paneer (cottage cheese): 2%
- Other value added products including ice cream: 1%

Source: Report by CII & Shakti Sustainable Energy Foundation on Indian Dairy Industry, Dec-2013
Typical Energy Consumption in Milk Processing Plants

Major Energy Consuming Equipments:
1. Refrigeration System
2. Evaporators & Spray Dryers
3. Homogenizers
4. Separators & Clarifiers
5. Pasteurizers
6. Air Compressors
7. ETP
8. CIP Boilers

Source: Report by CII & Shakti Sustainable Energy Foundation on Indian Dairy Industry, Dec-2013
### Energy Consumption & Savings Potential in Indian Dairy Industry

<table>
<thead>
<tr>
<th>Specific Energy Consumption</th>
<th>Range</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical (kWh/MT)</td>
<td>25-60</td>
<td>40</td>
</tr>
<tr>
<td>Thermal (kCal/MT)</td>
<td>20,000-90,000</td>
<td>60,000</td>
</tr>
</tbody>
</table>

- **Dairy Companies in India (2015)** = Around 925
- **Dairy Plants in India (2015)** = >1150
- **Installed Processing Capacity - Dairy Industry (2015)** = 130,000 Tons/Day (TPD)
- **Actual Processing of Dairy Industry (2015)** = 85,479 TPD (66% Cap Utilization)
- **MTOE in 2015** = 0.30 Million MTOE

- **Projected Processing of Dairy Industry (2020)** = 52.6 Million tons
- **MTOE in 2020** = 0.50 Million MTOE

### Estimated Savings Potential in Indian Dairy Industry

1. Energy Efficiency = 15-20% (0.075 – 0.1 Million MTOE)
2. Reduction in Cost of Energy = 15-20%

*Source: Report by CII & Shakti Sustainable Energy Foundation on Indian Dairy Industry, Dec-2013 & Dairy India (Seventh Edition)*
Ways to Reduce Energy Bill in Indian Dairy Industry

- 50%: Higher Investments with Longer Payback
- 30%: Low Investment & Faster Payback
- 20%: Process Control & Monitoring

Source: Experience of Umang Dairies Ltd & Dairy India Yearbook 2007
Indian Dairy Industry – Less Focus on Energy

1. Lack of awareness on the Energy efficiency
2. Lack of organizational commitment
3. Narrow focus on Energy
4. Not clear about existing level of operations and efficiency, due to lack of instrumentation & non availability of Energy consumption data
5. Limited manpower
6. Lack of trained manpower
7. Limited information on new technologies
8. Cost of Energy conservation options
## Indian Dairy Industry – Less Focus on Energy

### Typical Cost Sheet of Various Dairy Products

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Particulars</th>
<th>Milk Powder</th>
<th>Fluid Milk (PPM)</th>
<th>Curd / Chhachh</th>
<th>Butter / Ghee</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Variable Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Material</td>
<td>88.55</td>
<td>97.38</td>
<td>84.62</td>
<td>96.21</td>
</tr>
<tr>
<td>1.2</td>
<td>Energy</td>
<td>7.00</td>
<td>0.96</td>
<td>7.58</td>
<td>1.09</td>
</tr>
<tr>
<td>1.3</td>
<td>Casual Labour</td>
<td>0.60</td>
<td>0.55</td>
<td>2.47</td>
<td>0.55</td>
</tr>
<tr>
<td>1.4</td>
<td>Stores</td>
<td>1.09</td>
<td>0.28</td>
<td>1.23</td>
<td>0.32</td>
</tr>
<tr>
<td>1.5</td>
<td>Repairs</td>
<td>0.50</td>
<td>0.09</td>
<td>0.12</td>
<td>0.18</td>
</tr>
<tr>
<td>1.6</td>
<td>Sub Total</td>
<td>97.74</td>
<td>99.25</td>
<td>96.02</td>
<td>98.35</td>
</tr>
<tr>
<td>2</td>
<td>Fixed Cost</td>
<td>2.26</td>
<td>0.75</td>
<td>3.98</td>
<td>1.65</td>
</tr>
<tr>
<td>3</td>
<td>TOTAL COST</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

All Values in %
# Approaches Towards Energy Efficiency for Indian Dairy Industry

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Approach</th>
<th>Adoption by Umang Dairies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Cogeneration / CHP</strong>  – reduces cost of energy by 15-30%. Useful for Dairy plants with electric load&gt;1MW and high demand for steam. Cheaper fuels further add to reduce cost.</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td><strong>Trigeneration</strong>  – Energy system efficiency can further increase by 5%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><strong>Desuperheater</strong>  – Waste heat recovery</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td><strong>Vapour Absorption Refrigeration</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td><strong>Variable Frequency Drives</strong>  – Huge scope in Refrigeration / Air compressors, boiler fans, homogenizers, various pumps</td>
<td>Yes</td>
</tr>
<tr>
<td>6</td>
<td><strong>Lighting</strong>  – LEDs can reduce Dairy plant electric load by 1-2%</td>
<td>Yes</td>
</tr>
<tr>
<td>7</td>
<td><strong>Flash Steam Recovery</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td><strong>Evaporative Condensers in place of Air/Water Condensors</strong>  – Potential to save 10-20% of energy of refrigeration compressor</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td><strong>O₂ Analyzer / Automatic O₂ Sensor for Boiler / HAG</strong></td>
<td>Yes</td>
</tr>
</tbody>
</table>

## Approaches Towards Energy Efficiency for Indian Dairy Industry

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<tbody>
<tr>
<td>10</td>
<td><strong>Use of Methane out of Anaerobic Digester</strong> – 0.34 m³ can be generated out of 1MT effluent treatment. Around 2645 kCal/MT of milk can be produced. Potential to save 1-3% of overall energy.</td>
<td>Under Progress</td>
</tr>
<tr>
<td>11</td>
<td><strong>Replacement of old Motors by Energy Efficient Motors</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>12</td>
<td><strong>Use of Screw Compressors (Air/Refrigeration) in place of Reciprocating</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>13</td>
<td><strong>Increase Condensate Recovery to 80%</strong></td>
<td>Under Progress</td>
</tr>
<tr>
<td>14</td>
<td><strong>Optimize Transformer loading (70-80%)</strong></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td><strong>Maintain Power Factor of (0.98-1.00)</strong></td>
<td>Yes</td>
</tr>
<tr>
<td>16</td>
<td><strong>Auto blow down in Boilers</strong></td>
<td></td>
</tr>
</tbody>
</table>

# Approaches Towards Energy Efficiency for Indian Dairy Industry

## Use of Renewable Energy

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Approach</th>
<th>Adoption by Umang Dairies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use of Biomass / Agro based Fuels</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Use of Solar Energy – Power/ Heating</td>
<td></td>
</tr>
</tbody>
</table>

Process Related Energy Efficiency Measures for Indian Dairy Industry

1. Automation
2. Insulation
3. Pasteurization
   i. Use Pasteurizers with higher regeneration efficiency (>92%)
   ii. Reduce Pasteurization temperature by controlling microbial count in raw milk
   iii. Explore new technologies like photo purification using lamp emitting UVC band light (a micro biocidal wavelength)
4. Homogenization
   i. While addition of fat, only high fat phase should be homogenized
   ii. Achieve same creaming index with less pressure using technologies like NanoVALVE
   iii. Optimize CIP fluid volumes
5. Cleaning in Place (CIP) Optimization
   i. Increase process cycle time
   ii. Explore alternate chemicals
   iii. Optimize volume & temperature
6. Optimize Equipment Sizing
7. Reduce Reprocessing
8. Cold Sanitation

At Umang, most of above points are either implemented or under implementation.
## Results of Energy Efficiency Initiatives at Umang Dairies Ltd

**Reduction in Energy Cost by 15.6% in last 3 years**  
*(Year 2014-15 to 2017-18)*

### Comparison of Specific Energy Consumption – European Dairy Plants & Umang Dairies

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Product</th>
<th>Energy Consumption (Million kCal/ton of Product) *</th>
<th>Energy Consumption (Million kCal/ton of Product) at Umang Dairies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk Powder</td>
<td>2.41</td>
<td>2.58</td>
</tr>
<tr>
<td>2</td>
<td>Fluid Milk</td>
<td>0.24</td>
<td>0.14</td>
</tr>
<tr>
<td>3</td>
<td>Butter</td>
<td>0.47</td>
<td>0.50</td>
</tr>
</tbody>
</table>

* Typical Energy Consumption Correspond to European Dairy Plants

*Source: Report by CII & Shakti Sustainable Energy Foundation on Indian Dairy Industry, Dec-2013*
Suggestions to Improve Energy Efficiency in Indian Dairy Industry

1. Creation of Awareness
2. Formulation of favourable policies by Govt. of India to encourage energy efficiency in Dairy Industry
3. Benchmarking – Indian / International
4. Creation of Technology Upgradation Fund – low cost funding for new energy efficient technologies and automation
5. Subsidies for Cogeneration
6. Inclusion of Dairy Industry in Schemes like - REC / PAT
Thank You.....