Danfoss Solutions to Achieve Scale in Energy Efficiency

International Energy Services Conclave 2019

8th March 2019
Danfoss Group Global

CLIMATE
While meeting the global climate challenge, our products also contribute to human productivity and well-being indoors by optimizing heating, ventilation and air conditioning systems.

ENERGY
No matter what we do, the goal is to optimize performance, increase efficiency and minimize waste. This means that our technologies enable our customers and society as a whole to get more from less.

FOOD
Our solutions meet the constant need for more and better food by improving agricultural productivity and keeping food fresh all the way to consumers with minimum waste.

INFRASTRUCTURE
We help build the roads, buildings and energy systems for the world’s growing cities and support progress for people, communities and businesses across the world.
Key facts

5.8 Bn €
Global Sales

WORLDWIDE SALES
in more than 100 countries

72 FACTORIES
in more than 20 countries

USA, CHINA AND GERMANY
Top three markets

26,645
Employees

NORDBORG, DENMARK
Headquarters
20% of the world’s energy consumption is electrical energy

Source: IEA World Energy Outlook 2016
50% of electrical energy is used by electrical motors

Source: IEA World Energy Outlook 2016
AC drives have potential to save 8% of global electricity consumption by 2040.

Source: IEA World Energy Outlook 2016
75% of AC drives are used on pumps, fans and compressors.

Source: IEA World Energy Outlook 2016
The Food Supply Chain

- Animal and Crop Farms and Fisheries
- Handling and processing center
- Storage, warehouse cold houses
- Food Supply Chain
- Consumers and food services
- Market centers and retail center
- Transport and Distribution
Wastage of Food In India

6700000 Tonnes of Food Produce is wasted worth Rs. 100000 Crore
Cold Chain is required for

- Fruits.
- Vegetables.
- Meat / Poultry products
- Milk & Other Perishable Products
The Fruit & Vegetable Processing
Important Factors to consider for Cold Chain Infrastructure

1. **Energy Efficiency**
2. **Safety**
3. **Process Control & Automation**
4. **Reliable Operation**
5. **Low Wastage**
6. **Low Cost of Ownership**
Process Requirements in Food Processing

- Heating / De-hydration
- Cooling / Refrigeration & Temp Control
- Cleaning / Sorting / Grading Processing
Ref Systems in Cold Chain & Food Processing Industry

- **Food, Drinks & Snacks**: Precooling chambers, Packing & Cold Storages
- **Meat, Fish & Alternatives**: IQF, Blast freezer, Plate freezer & Freezer stores
- **Milk & Milk by products**: BMC, Chilling centers, Dairy plant & Cold store
- **Fruits & Vegetables**: CA / Cold rooms Ripening, Precoolers & Freezer rooms
- **Bread, Cereals & Spices**: Variable humidity stores & Cold stores
Refrigeration Systems

High Performance Refrigeration System has

• Energy Efficiency
• System Automation
• System Safety
Why Energy Efficiency is Important

01 1 Energy Unit Saved is 2 Units Produced

02 Lower Cost of Operation

03 Environmental Protection

04 Sustainability of Operations
Energy Efficiency in Refrigeration Systems

Where to look for Energy Leakage ???

Diagram showing the components of a refrigeration system, including a condenser, compressor, expansion device, and evaporator, with arrows indicating energy flow and leakage points.
Drive Technology Application in Ref. Systems

VLT® Drive Control on Compressor / Condenser Fans / Evaporator Fans improves COP of the system
Fluctuations in Load and Fixed Capacity

The Solution is Variable Frequency Drive

- **Compressors**
- **Fans**
- **Pumps**
Fluctuations in Load and Fixed Capacity

What VLT® Brings to the Refrigeration System

- Save Energy by System Capacity Modulation
  (Reducing System Speed at Part Loads)

- Save Overall System Cost (DG Size/ Compressor Size/ Cables etc.)

- Brings System Automation

- Safety and Protection
Capacity Modulation – Standard Recip Compressors

Reciprocating Compressor
- Solenoid Valve Capacity Control

- Traditional Compressor Capacity Control
  - Reciprocating.
  - Pistons determine Compressor Capacity
  - Pistons position are determined by suction pressure PID control
  - Slow system control due to 150s dead band
- System delays cause energy losses
  - lower temperature operation
- No linear capacity control possible (discrete control system)

A capacity of 100% is necessary for a 76% of demand, 24% of Energy Losses
Capacity Modulation - VLT Drive on Recip Compressors

Reciprocating Compressor
- VFD Capacity Control

- VFD Compressor Capacity Control
  - Reciprocating
- Pistons and VFD actuate together for Compressor Capacity
- VFD speed is determined by suction pressure PID control
- There is no dead band (Ramp up/down time is max 30s)
- More linear control possible (unite steps + linear control)
- Minimum speed must be maintained (Motor refrigeration, Oil pressure)

For a demand of 76% a capacity of 76% is required.
No Energy Losses
Efficient Defrosting – Hot Gas Defrosting with Automation

- Faster Defrosting Process
- Less Water Wastage
Danfoss Automation Solutions for Cold Chain Infrastructure

Freon Automatic Controls  Industrial Automation  Electronic Controllers

Variable Frequency Drives  Industrial Refrigeration
How Danfoss India supports Cold Chain Industry

- Optimized Cold Chain Solutions
- Consultancy on Energy Management System Safety and Process improvements
- Danfoss Learning Portal
- Seminars on available Technologies for Cold Chain
- Learning Centre at Chennai Campus for Entrepreneurs / Industry stakeholders
- Centre of Excellence – like NIFTEM / VIT to train the people on Technological solutions and new advancements
- Engagement programme with Students and Industry
Danfoss Centre of Excellence in Cold Chain Technology Management – NIFTEM Sonepat

Danfoss & NIFTEM join hands to support Cold Chain Industry on Technology implementation and Skills Development for Entrepreneurs / Industry stakeholders / Operators / Students
Danfoss Centre of Excellence in Cold Chain Technology Management – NIFTEM Sonepat

Knowledge Sharing

Interface With Industry

Technology Management & Consultancy

Best Practices Sharing

Skill Development

Make India Food Factory of the World
Case Story

HINDUSTAN UNILEVER LTD.

NALAGARH (H.P.)
HINDUSTAN UNILEVER LTD. NALAGARH

- Manufacturer of Kwality Walls Ice Creams
- Part of Unilever Group
- Unilever is the world’s biggest ice cream manufacturer, operating under the Heartbrand And Kwality Wall’s is present in India since 1993.
- Ice Cream Manufacturing Plant at Nalagarh Distt. Solan (Himachal Pradesh)
HINDUSTAN UNILEVER LTD. NALAGARH

- Recip Compressor - Kirloskar KC-51 Compressor
- Motor Size - 55 KW
- Drive – Danfoss VLT FC 103 Refrigeration Drive
- Drive Size – 55 KW
- Max Motor Amp - 96 A
- Loading – 24 Hrs a day
- Max Load Amp – 76 A
Energy Savings Calculations & ROI

Average Max KWh @ 50 Hz Operation 47.8 KWh
Running Hrs 1955 Hrs
Cumulative KWh 80291 KWh
Average KWh Consumption per Hr. 41.07 KWh
Energy Savings with Drive per Hr. 6.73 KWh
Electricity Cost (Rs. Per Unit) Rs. 6.25 per KWh
Energy Saved per Hr. Rs. 42.07
Operation Time Hrs per Day 24 Hrs / Day
Operation Time per Year 340 Days
Total Time of Operation per Year 8160 Hrs / Year
Energy Savings Achieved per Year Rs. 343252 Per Year
Total Cost of Investment of Drive integration Rs. 250000
Simple ROI on Investment 0.73 Years
Cold Store in Midnapore West Bengal

VLT FC 103 Drive installed on KC 4 Compressor
Cold Store in Usha Foods & Cold Store Singur  West Bengal

VLT FC 103 Drive installed on KC Compressor
Godwin Cold Store Kanpur UP

VLT FC 103 Drive installed on Metlex 3 Cylinder Compressor
Katihar Cold Store Kanpur UP

VLT FC 103 Drive installed on Metlex Cylinder Compressor with Slip Ring Motor
Mana Cold Store Singur West Bengal

VLT FC 103 Drive installed on Metlex Compressor with Slip Ring Motor
Danfoss Cold Chain Videos

Danfoss Cold Chain (via torchbrowser.com).mp4

Pageo Foods Ltd Case Study: Danfoss India (via torchbrowser.com).mp4