Compressed Air Solutions (CAS) Welcome

"Energy Saving Opportunities in Compressed Air System"

"We Do Not Inherit The Earth From Our Ancestors, We Borrow It From Our Children."







Godrej & Boyce

- Aerospace
- Appliances
- A V Solutions
- Construction
- Electricals & Electronics
- Interio (Furniture)
- Locks
- Lawkim Motors
- Material Handling
- Precision Engineering
- Process Equipment
- Security Solutions
- Storage Solutions
- Tooling
- Vending
- Godrej Infotech







Godrej Infotech



Godrej Agrovet



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Godrej & Boyce is a **125-year-old** flagship company of the Godrej Group with a turnover of over **10 billion USD** and spread over **3200 acres** in Mumbai. Our family of almost **28,000 Employees** works together to realise a brighter and more sustainable future for our country and communities.

As one of 14 businesses of Godrej & Boyce company, **Godrej Electricals & Electronics** is as old as the company.

Our businesses strives to contribute to the vision of the group by delivering **Sustainable Technology Solutions**.

Compressed Air Solutions is one of the important business vertical of **Godrej Electricals & Electronics**







We have always actively championed *social responsibility*....

Environmental sustainability and *innovation* are the key part of our processes and value chain across the business

Our Legacy...



Our story began as part of India's Swadeshi movement - the original "Make in India" movement.

Sustainability...

Lungs of Mumbai

Godrej Mangroves spread in hundreds of Acres stores and protects City from around 50k Tonnes of CO2 releases

Capability...

Godrej Aerospace associated with Indian Space Research Organisation in mission of launching Mars Orbiter spacecraft





As a part of the global EP100 initiative, we are proud to announce that we aim to double our energy productivity and reduce carbon intensity by 60% by 2030. Doing more with less energy is a commitment that we are extremely proud of and we will champion to the best of our abilities.

Only 7 Indian companies have committed to this initiative. Godrej & Boyce is one of them.

EP100 (Energy Productivity 100) is a campaign that brings together a growing group of energy-smart companies committed to doubling their energy productivity by 2030. EP100 is led by

The Climate Group in partnership with the Alliance to Save Energy.

(EP)² by 2

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COMPRESSED AIR SOLUTIONS

Energy Efficiency in Compressed Air Systems



- Inlet Cooling (1-2%)
- Efficient Compression: Technology, Sizing (5-7%)
- Heat Recovery (10%)
- Multiple Comp Group Control) (2-3%)

Energy Saving Opportunity:





• Efficient Design: (2-3%)

dewpoint

• Filter Service / Replace

(Min Pr Drop) (3-4%)

• Storage capacity

• Technology as per

Distribution

- Design & sizing : (2-3%)
 - Segregation as per Pressure & Flow.
 - Line Sizing & Storage

~ 10 % 🗸

Leak-Tight Design (7-8%)





- Optimization of artificial demand and energy saving (12-13%)
- Efficient Blow-off and Boosters (2-3%)
 ~ 15 % ↓

Generation to End Use Approach: 50% Saving Potential

~ 5 % 🗸

Source: Bureau of Energy Efficiency, India; Godrej CAS Analysis



Total Approach to *Energy Efficiency* in Compressed Air Systems





CAS - Sustainable Energy Saving Solutions







+1000 Air Audits

Team of Experienced Auditors

Experience in All Manufacturing Sectors

Total Solution Provider with Guaranteed Energy Savings

ControlAiR™ IFC & ICC

Supply & Demand Side Management Solution

4 to 25 % Energy Saving in Air Compressors with supply & demand side optimization
Constant Plant Pressure within +/- 1 psig

+4500 Systems Installed in India, South East Asia & Netherlands

ES Solutions

Design, Installation of zero leak, energy saving Al Piping

Heat Recovery systems in compressors

Centralized Monitoring of complete compressed air system for continuous improvements



WHY PENUMATIC ENERGY IS THE MOST INEFFICIENT SOURCE OF ENERGY?



Compressed Air Energy

• Compressed Air: Fourth Utility, after Electricity, Natural Gas & Water



10% of industrial electricity used to power air compressors

400 TWh electricity consumption in compressed air systems worldwide equals the electricity production of 110 coal fired power stations of 600 MW each & producing CO_2 emissions of 400 Million Tonnes per year

400 TWh = 400,000,000,000 kWh

Source: Energy Audit 2006 seminar Finland



Basic Compressed Air System

Supply Side: Air Compressor Room

- Air Compressors
- Heat Exchanger
- Wet Air Receivers Tanks & Condensate Drains
- Air Treatment Equipment: Air Dryers & Filters with Condensate Drains
- Dry Air Receiver Tanks & Condensate Drains

Demand Side: Air Consumption in Factory

- Piping Distribution
- Pneumatic equipment: Machines & Tools
- Cleaning
- Drying
- Conveying







Fig : Sankey Diagram For Compressed Air System

Out of 100 % Electricity Input,

- 5 % are mechanical losses
- 80 % are heat losses
- Finally, only 15 % is Actually Used

Compressed Air: Most Expensive Form of Energy!



Energy Cost Energy Cost of Running Air Compressor - Example: 500 cfm, 100 psi(g) Air Compressor i.e. 120HP / 90kW Motor running 24 hrs X 365 days with 70% Load Factor consumes \simeq 600,000 kWh annually Water at rate of Rs. 7/kWh, Costs Rs. 42 Lacs/year Electricity 1000

Which is 3 to 4 times the cost of Compressor itself !!

Compressed Air: Most Expensive Form of Energy!



Compressed Air Utilisation In Conventional System





Energy Losses – Artificial Demand Waste 20%

Every industry has problem of fluctuating Air Pressure at End Use (Demand Side)



When an air application is supplied higher pressure than it needs, it will consume more air than it should. The additional air consumption is **Artificial Demand**.



Variations in Compressed Air Pressure Real Time Data



Even with VSD Compressor/Centrifugal Compressor, Pressure May Be Stable At Compressor, But Not At The End Use (Demand Side)





End Use Requirement Real Pressure



Just because of the plant 4 required the pressure of 7 bar, all other plants receive air at 7 bar pressure.

This is artificial demand.



Problems With Fluctuating Air Pressure:

- Higher Energy Consumption.
- Inconsistent equipment performance.
- Variable product quality.
- Increased maintenance costs.
- Premature equipment failure.
- Higher operating costs.
- Interruptions in production schedules.







Artificial Demand

An air cylinder that is specified to use 30 psig, uses

70% more air at 60 psig,

230% more air at 90 psig,

300% more air at 120 psig.

Virtually all air-powered equipment work this way – the more pressure delivered, the greater the air used. Auditors call this phenomenon as

Artificial Demand.



Conventional Compressed Air System





Godrej ControlAiR Intelligent Flow Control (IFC) System

Demand Side Management System





Godrej ControlAiR™ Intelligent Flow Control (IFC) System



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"Energy Conservation Is The Foundation Of Energy Independence"

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Our Solutions Are Helping The Industry To Save Energy Everyday



ControlAiR IFC's Achievements & Credentials

Confederation of Indian Industry (CII): Green Product Certification



MyHIJAU: Green Label by Government of Malaysia (Ministry of Energy, Green Technology & Water)









Compressed Air System – With IFC and Useful Storage Concept



The IFC creates useful storage – it helps to run the system more efficiently by providing a normal pr. Band at the comps and primary receivers, and by maintaining a stable reduced system pressure





Compressed Air System with IFC





IFC Reduces Load Time



IFC Reduces loading time of the CompressorGives Energy Savings





IFC Reducing Loading time & Increasing Unloading time of the CompressorGives Energy Savings



Energy Savings with Fixed Speed Compressor





Energy Savings with Variable Speed Compressor





- Works with All Brands & Types of Air Compressors
- \bullet Reduces Artificial Demand & Save Energy, 4 \sim 25 %
- Provides Constant Pressure at the End Use, within +/- 1 psig
- Fail To Open System with Autobypass facility
- Improves control performance of VSD Compressors
- 99 Pressure scheduling & remote PC Visualization software can be done
- ROI < 1.5 years





COMPRESSED AIR SOLUTIONS

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HMI Touch Screen









Pressure Graphs: With IFC System MCONTROLAIR









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Food & Beverage



ControlAiR[™] IFC Case Studies



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ControlAiR[™] IFC Case Study in 7 barg Network @ Textile Industry



- Reduction in Artificial demand leading to energy saving in air compressors
- Constant plant pressure within +/- 0.5 psig
- Recued Yarn breakages by 17% leading to higher production due to less downtime

Simple Payback Period with Energy Saving @ 8%: 09 months



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ControlAiR™ IFC Case Study in 40 bar PET Application @ Beverage Industry



Benefits: Quality Improvement and Energy Saving

- Very Stable air pressure : 5 barg fluctuations reduced to just within 0.2 barg
- Reduction in Artificial Demand → Energy saving ~15% in Compressed Air!
- Simple Payback Period with Energy Saving @ 15%: <6 months

Simple Payback Period with Energy Saving @ 16%: 2 months



ControlAiR™ IFC Case Study in Nitrogen Application @ Auto Ancillary Company



- Very Stable N2 Pressure Production interruptions completely eliminated
- Equivalent reduction in Artificial Demand → 2X Saving in Nitrogen than in Compressed Air!
- N2 Generator Capacity Reduction by 27%

Simple Payback Period with Energy Saving @ 16%: 2 months



Installation in Textile Plant



Installation Glimpses

Installation in Electronics Plant, Thailand



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Godrej ControlAiR ICC (Intelligent Compressor Control) Supply Side Management System





Automation, Intelligent Operation & Energy Saving Air Compressors





Traditional Air Compressors Control

Fixed Cascade: a series of individual pressure switches set at different levels.

- Selection Cascade: a series of individual pressure switches + selector switches to base or trim l oad compressors.
- Pressure Switches: Repeatability not precise

H Variation in Δ P band.





Inherent Drawbacks – Air Compressor Pressure





Inherent Drawbacks – Air Compressor Control

- Pressure `fine tuning' of Individual compressor on day to day basis Not Practical
- 2) Picking up the best suited/ Capacity compressors to meet the instantaneous demand --- Not Possible.
- 3) Pre schedule the compressor utilisation without manual intervention -- Not Possible

Inherent Drawbacks – Air Compressor Monitoring

- 1) No provision to monitor the compressed air system
- 2) No provision to collectively provide compressor utilisation diagnostic data to the user.
- 3) Thus, any system efficiency deterioration can go undetected and result in increased operating costs.



Intelligent Compressor Control: Supply Side Management Solution

Intelligent Control, Automation, Monitoring, Visualisation & Energy Savings in Air Compressors





Intelligent Compressor Control: Supply Side Management Solution





Single Pressure Band Technology



- Time Rotation Mode
- Equal Running Hours Mode
- Energy Saving Mode









Waste Heat Recovery in Compressed Air System

Compressed Air Generation Inefficiency



>80% of compressor power is rejected as heat





Heat recovered Water Temp. Rise Use Hot Water in Process Applications



~65-75% heat is rejected in Oil



from Oil to Water

(a)

65% Heat can be recovered

Heat Available in Oil at 80-100 °C



Engineering + Chemical (Boiler Feed Water)



FMCG (Washing Process)



Automobile (Washing Surface Treatment)

Waste Heat Recovery can deliver additional 10 - 12% saving copyright - all rights reserved

COMPRESSED AIR SOLUTIONS

Efficiency Improvement with Aluminum piping

Benefits over Conventional MS Piping

- 50% Quicker Installation
- Highly Safe. No Welding at site



Rust Free



Minimal Pressure Drop



- Minimal Air Leakages
- Easy rectification at site



Light Weight. 1/4th of MS Pipe







Life of Installation >10 years

Efficiently Designed AI Piping Project to deliver ~10% saving





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COMPRESSED AIR SOLUTIONS



New Energy Efficiency opportunities through Online Data Monitoring



Increased Efficiency Using Godrej Control Systems



COMPRESSED AIR SOLUTIONS



➢ INDIA — HEAD OFFICE

CHINA

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- INDONESIA
- > ITALY
- S. KOREA
- > MALAYSIA
- > NETHERLANDS
- > PHILIPPINES
- > TAIWAN
- > THAILAND







"Create Wealth from Thin Air!"

Contact Us

Prasad R. Shrirame – 9833033648 – shrirame@godrej.com

Godrej & Boyce Mfg Co Ltd

Compressed Air Solutions Godrej | Electrical & Electronics Pirojshanagar, Vikhroli, Mumbai – 400079. India Tel.: +91-22-67962251 to 2255

E-mail: casene@godrej.com;

Web : www.godrejcas.com ; www.godrej-airsolutions.com