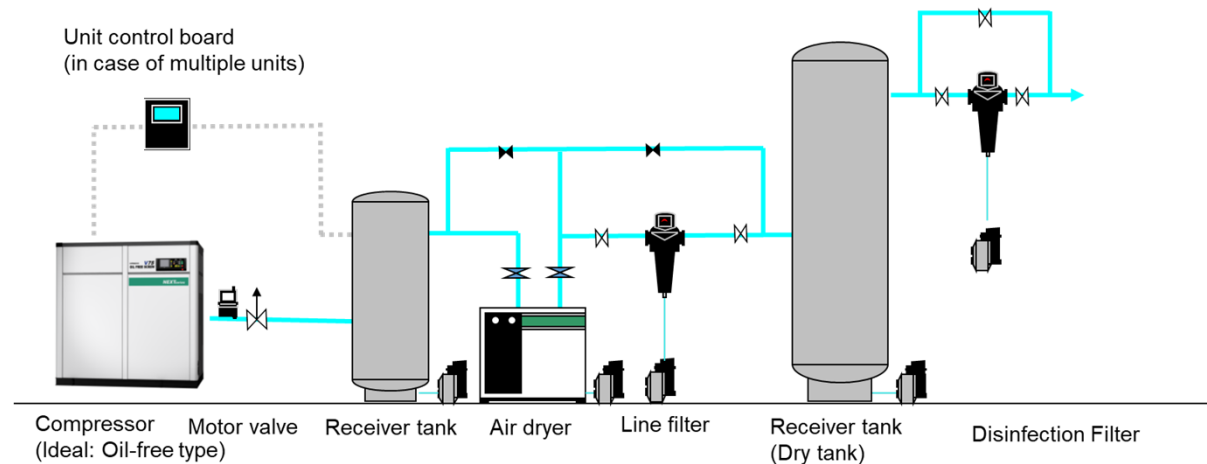


JITMAP Activities and Results

- Compressed Air System -

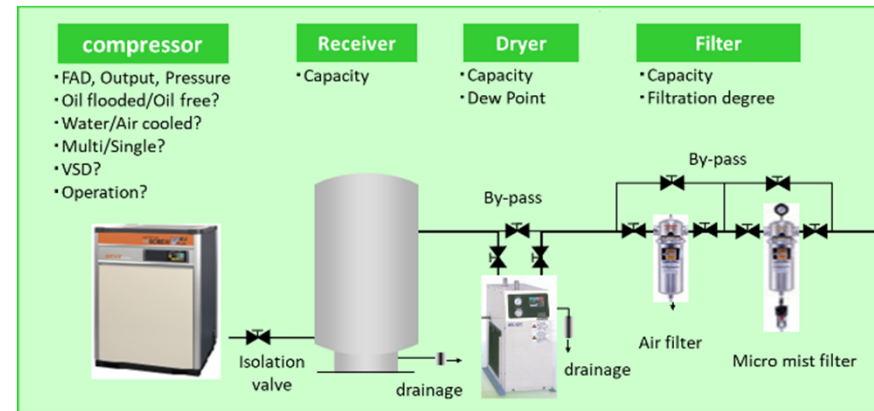
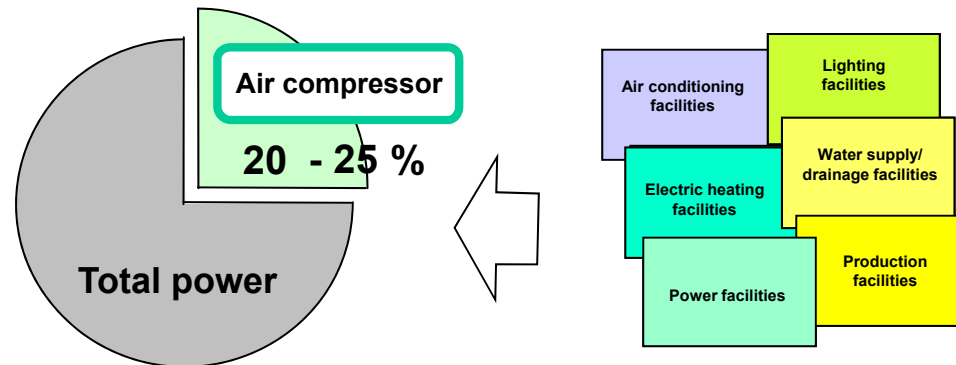
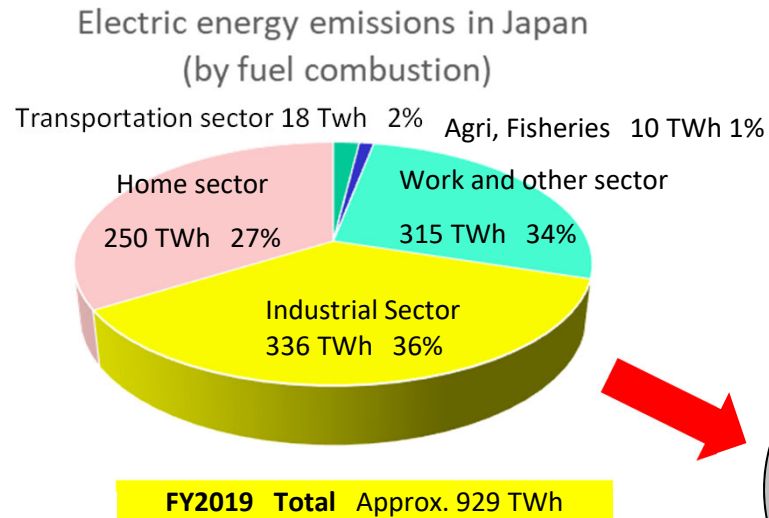


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1

Energy consumption by sectors...Examples in Japan



- ✓ Energy consumed for the industrial sector (factories): **About 36%** of the total energy consumption and **about a quarter of that amount** by air compressors in Japan.
- ✓ Since energy consumption by air compressors can be relatively reduced easily, there is a **strong need for energy conservation through inverter control and multiple unit control (volume control)**.
- ✓ The effects of these activities can **reduce CO2 emissions and help protect the environment in India**, where the industrial structure is relatively similar.

BEE's Energy Conservation Guidelines for MSME & FS (Walk through)

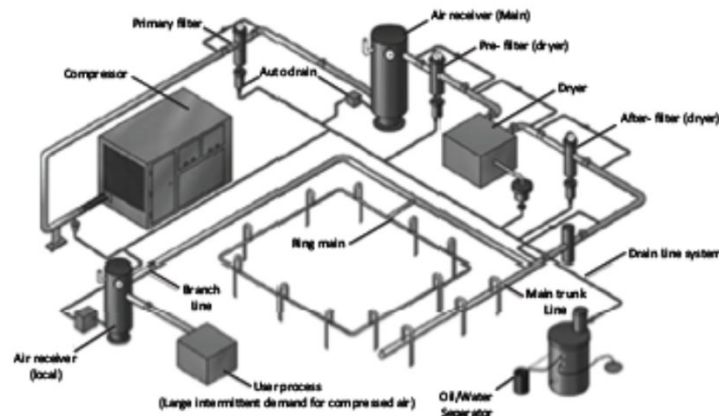
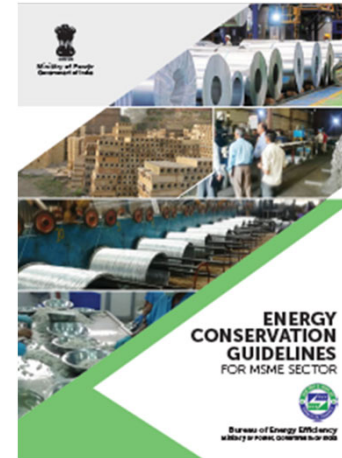
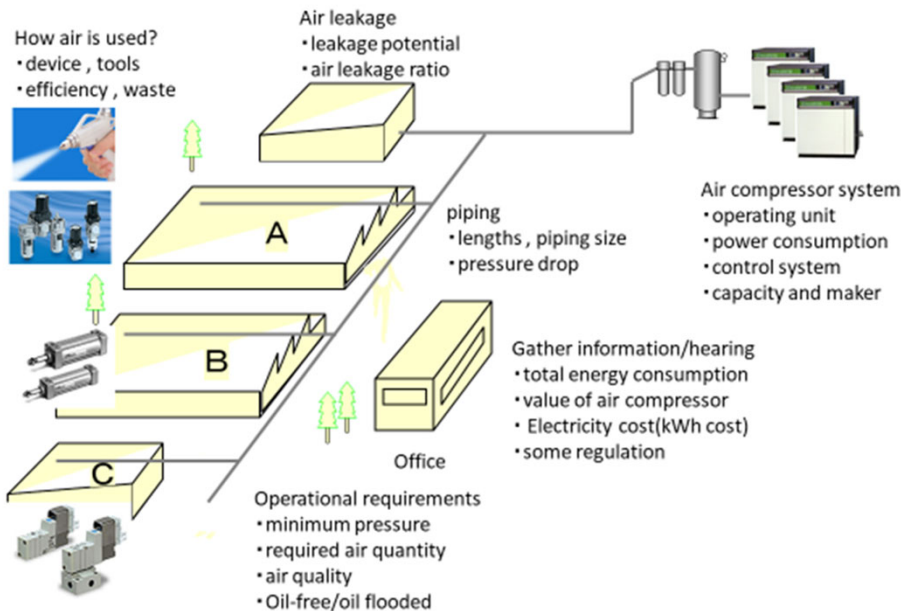


Figure 5.1 Air compressor network



Energy Conservation Guidelines for MSME Sector

Checking with FS (Feasibility study ~ Walk through)



Recommendations for reducing the industrial facility's environmental impact

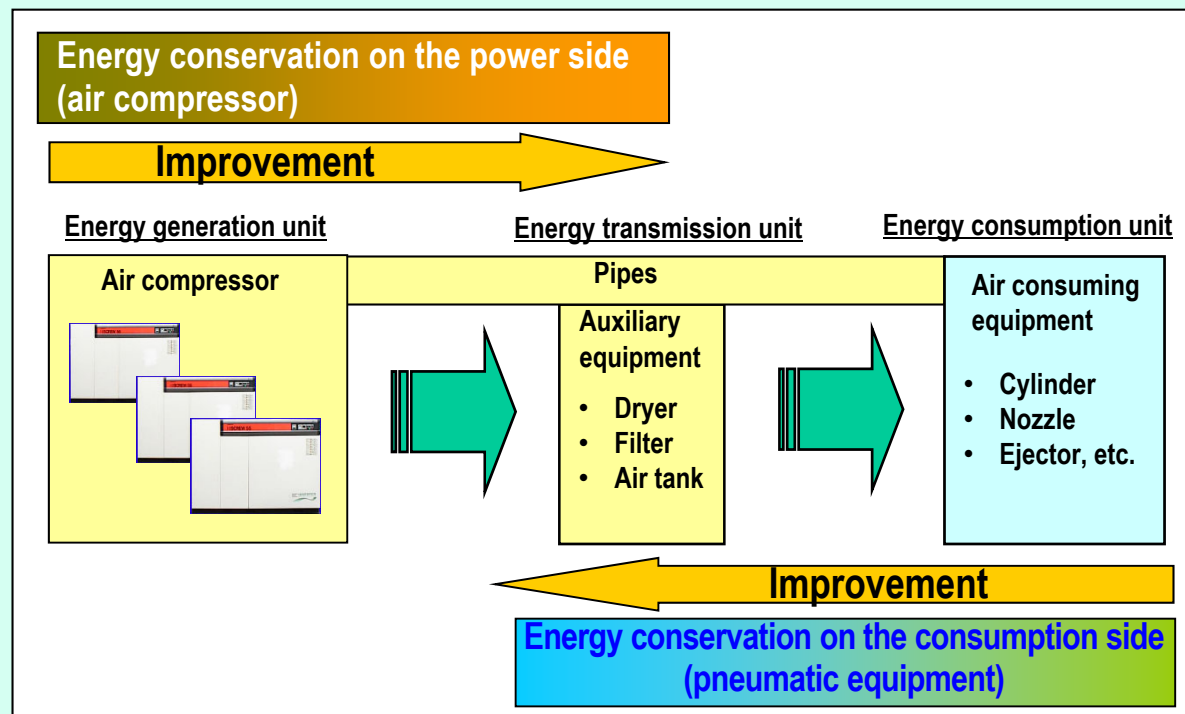
- **Reduction of industrial wastes**
 - ... Maintenance cycle, amount of lubricating oil, maintenance parts
- **Drain treatment ... Detoxifying**
- **Vibration and noise reduction**
 - ... Considerations to ecosystem and environment
- **5R activities (realizing the recycling-base society)**
 - ... Recycle, Reuse, Reduce, Refine, and Reconvert to Energy

3

Which units of the air system have the potential to save energy?

Visualizing the energy distribution of an air compressor.

- ① **Energy generation unit (air compressor):** Installing an inverter compressor and unit control are highly effective. If pressure fluctuation is controlled by the size of the air tank, the energy-saving effect is big.
- ② **Energy transmission unit (piping system):** Piping size is directly related to pressure loss. A well-balanced air system minimizes pressure loss.
- ③ **Energy consumption unit:** Air volume, supply pressure and efficiency of consuming equipment need to be considered.



Pneumatic equipment



Air control valve



Air cylinder



Vacuum equipment

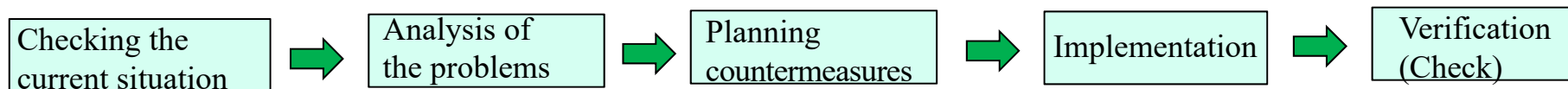
4

Examples of improvement measures in air systems

Cost (All costs are relative to compressed air system improvement)	Low investment cost	Relatively reasonable investment cost	Large investment cost
Payback period	Short (less than half year)	Case by case	Max. 4 years
Ease of implementation	Easy (Soft technology)	Slightly difficult (Hard + Soft technology)	Difficult (Hard + Soft technology)
Effect	Small ~ medium	Medium	Large
Measures for improving energy efficiency	1. Reduce air pressure 2. Stop supply for not-in-use area 3. Repair leakage 4. Ventilate compressor room to cool down 5. Efficient air equipment blow gun, air cylinder, nozzle, joint, valves	1. Restructure piping system 2. Size up air-dryer and filter 3. Size up receiver tank 4. Adopt booster compressor 5. Divide line pressure	1. Make clean air system, oil-free system 2. Introduce multi-controller system 3. Use inverter VFD(VSD) compressor 4. Restructure compressor system choose large size or divide 5. Recover waste heat and energy

In implementing any of the above measures, the first step is to consider the following issues in advance.

- Survey to understand the current situation and continuous monitoring
- Basic unit management: Proper management of specific consumption by installing an air flow meter.
- Service life and cost recovery period: Is it effective to replace the equipment or to continue using it?



5

JITMAP activities on Compressed Air

- **8 on-site missions from FY 2016 to 2019** and a Follow-up survey for previous activities by TERI in FY 2020.
- **FS** was conducted **mainly for MSME** as well as for several large companies upon their requests.



Feasibility Studies (FS): a total of 25 companies
Trainings for energy auditors & managers: 5 times
(220 participants)
Awareness Workshops: 5 times (360 participants)
Multi-Stakeholder Meetings: 2 times

- Lessons learned through these on-the ground activities: **Japanese technological products are still not well known and trusted in the industrial sector.**
- **Our ultimate goal: To match machine and equipment (hard-technology) with the appropriate operational practices (soft-technology)**
Our challenge: To make it a reality.
- In order to achieve this, we **need to continue our activities and act in a way that will benefit both India and Japan.**

1. Realization of CO2 emission reduction in Indian companies:

- 1-1. Contributed to raising their awareness that the efficient use of compressed air saves energy.
→ **Appropriate measures were taken by understanding about where there is waste and what kind of effects can be obtained.**
- 1-2. Establishment of various appropriate operational practices of technology (**soft-technology**) :
→ **CO2 emissions and energy consumption were significantly reduced.**
- 1-3. Increased recognition of effectiveness of technologies such as inverters (**hard-technologies**)
→ **Many cases have been reported in which air compressors have actually been introduced and effective.**

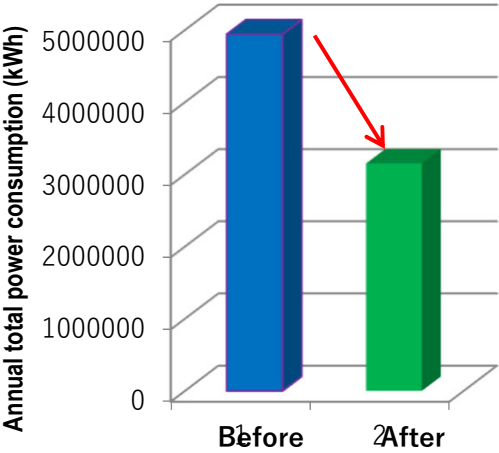
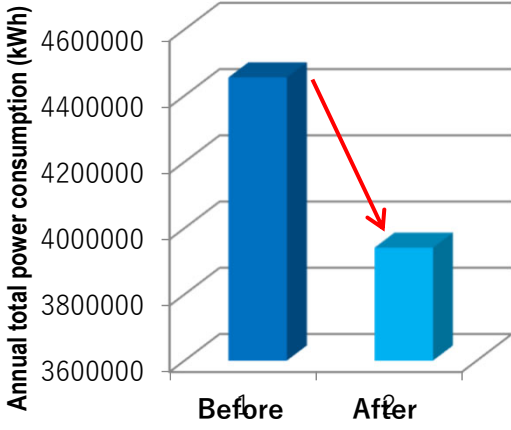
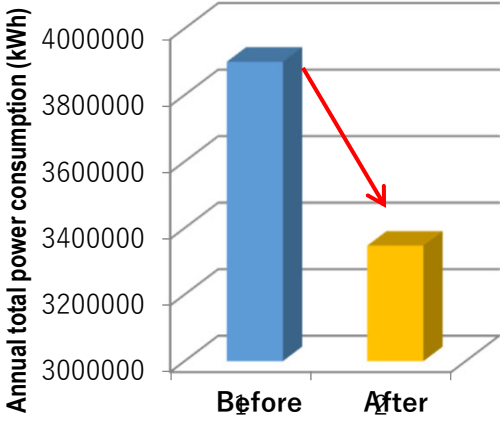
2. Results of the activities:

- 2-1. **Certain evaluation of activities** such as FS, workshops, trainings, etc. **by Indian government and companies.**
- 2-2. **Raising environmental consideration and awareness (co-benefits).**
 - Reduction of NOx and Sox in proportion to reduction of electricity consumption.
 - Reduction of air and soil pollution and pollutants in wastewater.
 - Reduction of waste: extended maintenance intervals, reduction of maintenance parts, regular maintenance.

3. Building reliability:

- **Many cases where Indian companies have understood our improvement proposals and implemented them, resulting in reducing CO2 emissions and energy consumption.**
- Several companies presented these success stories elsewhere or came to us to report on them, which can be examples of recognition and trust in our activities.

Examples of follow-up results in energy conservation (FY2019)

A: Forging Factory (MSME) Compressor ratio; 35%	B: Textile Company (PAD DC) Compressor ratio ; 15%	C: Textile Company (MSME) Compressor ratio ; 25%
<ul style="list-style-type: none"> Stopping unnecessary units --- review OF operational control. Stopping buried pipes. Measures against air leakage. Maintenance of air equipment. 	<ul style="list-style-type: none"> Optimization of operation . . . Centrifugal as base + Variable Screw Indoor ventilation measures. Measures against air leakage. From Grove Valve to Needle Valve. 	<ul style="list-style-type: none"> Pressure optimization . . . Reducing fluctuations. Introduction of receiver tank at the end Introduction of high performance drain traps Measures against air leakage.
<p>Energy reduction effects 1,790,245kWh/y 36.2% CO2 reduction effects 1,665t/y</p>  <p>Annual total power consumption (kWh)</p> <p>Before After</p>	<p>Energy reduction effects 514,107kWh/y 11.5% CO2 reduction effects 478t/y</p>  <p>Annual total power consumption (kWh)</p> <p>Before After</p>	<p>Energy reduction effects 552,750kWh/y 14.2% CO2 reduction effects 514t/y</p>  <p>Annual total power consumption (kWh)</p> <p>Before After</p>

8

Transitioning to Business to Business (B to B) from the research stage

The following issues are suggested to be continuously discussed and implemented between the governments of India and Japan for further facilitate the transition to business-to-business.

	Issues	Contents
1	Gradual reduction of import tariffs	Act on Special Measures Concerning Imports of High Efficiency Products, etc.
2	Introduction of the Energy Conservation Law	evaluation system on business classification, establishment of annual energy reduction.
3	Top-runner system	Dissemination of high-efficiency products, IE3
4	Environmental Protection Law	Water pollution prevention, air quality laws (clean air), waste reduction
5	Indian version of subsidy system	Diagnosis and proposal forms, incentives
6	International exhibitions	Improvement of technology and exchange
7	Strengthening interactions	Ministries, local governments, and organizations (forging industry, textile industry, etc.)

9

Specific activities that should actually be conducted in B to B

- What Japanese companies should do when doing business with Indian companies -

	Activities	Contents
1	Recognition of Japanese products	First, it is important to let people know about them.
2	Communication and mutual understanding	Building a sense of trust with the people of India.
3	Introduction of high-efficiency methods and systems	Soft technology; energy efficiency diagnostic methods, optimized control.
4	Promotion of high-efficiency products	Inverters (VSD, VFD), etc.
5	Introduction of concept of LCC (Life Cycle Costing)	Concept of cost merit
6	Long life product development	Proper maintenance and parts supply, Re-Use, etc.
7	Short-term or long-term monitoring	Status Monitoring
8	Monitoring through the application of IoT technology	Energy conservation and preventive diagnosis through mutual communication
9	Continuous education	Strengthening workshops and trainings.
10	Meetings to exchange opinions	Energy auditors, customers, etc.

Continuous activities · · · Improvement of diagnostic techniques in India through OJT and dissemination activities

