Industries and companies can voluntarily create plans to take measures that suit their own circumstances. Industry groups set their target for emissions reductions in their VOCs Voluntary Emissions-Reduction Programs. Members of the industry group implemented actions that suited them and worked together with others by sharing effective methods for reducing VOCs emissions.

What are VOCs?

VOCs stands for “Volatile Organic Compounds”. Examples are toluene, xylene and ethyl acetate which are found in paint, printing ink, glue, detergent, gasoline or paint thinner, which are commonly known substances. Photochemical reactions involving these substances is considered to be one of the causes of photochemical smog.

Why do we have to reduce VOCs emissions?

When VOCs are emitted into the atmosphere, photochemical oxidants are formed in the lower atmosphere through photochemical reactions which cause photochemical smog. Smog is harmful to people’s health. Besides VOCs, substances like NOx, SO2 or NH3 are also known as components of photochemical smog.

Besides smog, VOCs also cause health hazards including sick building syndrome (SBS) and multiple chemical sensitivity (MCS) in working environments and housing spaces.

To reduce emissions of VOCs...

In FY 2010, emissions were reduced by more than 40% compared to FY 2000! *(the target was 30%)*

Legal regulations

For the following six facility types, a minimum threshold for ventilation capacity was introduced. Reference values for VOCs concentration levels were established for facilities in which these thresholds are exceeded.

- Manufacturing facilities for chemical goods
- Painting and coating facilities
- Glue-related facilities
- Printing facilities
- Facilities using industrial detergents
- VOCs storage

VOCs Voluntary Emissions-Reduction Programs

Industries and companies can voluntarily create plans to take measures that suit their own circumstances. Industry groups set their target for emissions reductions in their VOCs Voluntary Emissions-Reduction Programs. Members of the industry group implemented actions that suited them and worked together with others by sharing effective methods for reducing VOCs emissions.

Let us show you some examples of the voluntary efforts

In the revised Air Pollution Control Act (implemented from April 2006), the reduction of VOCs emissions is promoted through the combination of legal regulations and the VOCs Voluntary Emissions-Reduction Programs.
Effect of the Voluntary Emissions-Reduction Programs?

About 0.182 million tons of VOCs emissions were covered by the voluntary emissions-reduction programs in 2014, which was 66% less than the figure in 2000. The total amount of VOCs emissions in Japan for 2014 was 0.692 million tons. The reduction rate for the same period was 50%, demonstrating that the programs had an outstanding effect.

By reducing VOCs emissions, the program not only contributes to air pollution control, but has also positive impacts on the points listed on the right.

Here are some voluntary efforts by companies

Case 1: Change to VOCs-free Material

Company : A Ltd.
Industry : Chemistry

VOCs reduction target processes

- Metal and rubber adhesives
- Cleaning process for urethane foam products
- Coating process

Key efforts

- **Change to water-based adhesives**
  Developed an emulsion adhesive in cooperation with an adhesive manufacturer and changed from organic solvents to water-based adhesives. This required new drying equipment, but in some cases it can be achieved without the equipment, if the process is reviewed appropriately.

- **Change to VOCs-free detergent**
  The reduced cleaning power of the VOCs-free detergent is compensated by buying stock parts and bathing the parts in warm cleaning water for several hours.

- **Change to original water-based paint**

**Effects**

- **Usage of chlorine-based VOCs:** Reduced by 74% from 2010-2015!
- **Reduced risk!**
- **Improve working environment!**

(Source) Company A

Costs

- Saving raw material expenses by avoiding evaporation of products containing VOCs

Work environment

- Reducing odor and hazardous gases
- Less risk of fire and other hazards

Neighborhood

- Less trouble with local residents due to odor

Public evaluation

- Efforts count towards corporate social responsibility

Figure: VOCs emissions in units of 10,000 tons VOCs
(Source) Voluntary Emissions-Reduction Programs
**Case 2: Development of portable VOCs-decomposition equipment**

**Company: B Ltd.**  
**Industry: Coating line of automobiles and other products**

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**VOCs reduction target processes**
- Open-air paint and body work

**VOCs decomposition Scrubber (purchase available)**
- Emission volume: 95m³/minute (1.5kW)
- Price: Below 3 million yen
- Maintenance: no absorbent, no chemical agent, (water, electricity, waste treatment are necessary)
- Compared to ordinary scrubber, water and energy cost is about one third, and total cost including maintenance and installation is about one third.

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**Key efforts**
- Installation of the in-house-developed VOCs-decomposition scrubber  
  Installed a suction hood adjacent to car parts and body coating workspace. Placed an in-house-developed microbubble generator into the hood (cost about 4 mil. yen). This device decomposes the VOCs in exhaust gas.

**Effects**
- Cut VOCs emissions by 92% with the installation of the scrubber and other efforts. (2008)
- Better working environment due to less odor.
- Patent for the scrubber (sold over 30 devices)
- Demand in overseas and other industries (e.g. steel industry) and need in other process are also prospected.

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**Making a new painting area**
- New painting area can generate air flow in the direction from ceiling to floor and absorb air including VOCs in the floor. This absorbed air is appropriately treated by water scattering and microbubble. In addition to cleaning air in a new painting area, this new area also contributes to the improvement of working environment in adjacent workspace because this room also absorbs air in that workspace.
Case 3: Gasoline Vapor

Company: C Ltd.
Industry: gas station

First step
Company C explored if installation of VOCs recovery facility could gain return through receiving subsidies from the government and business circle.

VOCs reduction target process
- Vapor during fueling at gas station
- Vapor in unloading from tank truck into underground gas tank.

Key efforts
- **Installed new fueling facilities with vapor recovery for fueling**
  - Installed 7 new facilities for fueling vapor reduction. Each unit costing 2.7 million yen.

- **Installed vapor recovery system for unloading.**
  - Installed 10 new facilities for unloading vapor reduction. Each costing 7 million yen.

Effects
- **Economic benefit from recovery at gas station**
  - 100 - 300 thousand yen / year by fueling recovery
  - Average recovery rate in unloading is 0.1%. Initial investment cost is expected to be recovered in 7-8 years.

【Attention!】
- Investment recovery may be difficult at low sales gas station and in cold regions.

(Source) Company C

Gas station
Case 4: Improvement of the process with alarm and awareness

Company: D Ltd.
Industry: Offset printing

**Background**

Company D tried to get “green printing certification to differentiate his products. It raised green awareness, initiating various VOCs reduction efforts.

**VOCs reduction target process**

- Offset printing
- Volatilizing from solvent and waste

**Key efforts**

- **Introduction of alarm**
  Installed nine VOCs detection alarms (ringing over 200ppm). Each costing 40,000 yen.
  “This enabled workers to understand which action leads to an increase in VOC density, which could reduce emissions.”

- **Capacity Building for workers**
  Workers received technical training on how to deal with organic solvents, enhancing understanding of VOCs.

- **Review on solvent distribution and delivery cycle**
  Easy management of solvents led to reduction of VOCs. Installed storage tank with cover for waste.

- **Change of solvent**
  Changed solvent to an environmentally better one.

- **Advise from experts**
  Above action was advanced with free advice from experts dispatched by Tokyo local government.

**Effects**

- Half solvent use!
- Got certification of green printing
- Enhancement of workers’ safety-consciousness (all workers wearing masks)

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Company: D Ltd.
Industry: Offset printing

GP mark is for eco-friendly printing

(Source) MRI
Case 5: Change paint and painting process

Company: E Ltd.
Industry: Automobile parts

**VOCs reduction target processes**
- Painting process
- Coating process

**Key efforts**
- **Change constituent of paint**
  Developed 100% silicon coating material (no solvent)

- **Change painting process**
  Installed plasma treatment facility.

**Effects**
- VOCs emission was reduced by 68% in 2015 FY compared to 2003 FY.

![Graph showing VOCs emission reduction](source)

Case 6: Installation of eco-friendly devices

Company: F Ltd.
Industry: Offset printing

**VOCs reduction target processes**
- Offset printing (especially printer cleaning)
- Volatilization from stock solutions and waste cloth

**Key efforts**
- **Employee education on risks and the need to control VOCs**, i.e. sealed containers.
- **Installation of a new detergent dispenser** which sprays the proper quantity.
- **Measure the VOCs concentration** every two weeks with a new device and keep the concentration below 200ppm.
- **Installation of UV printers**. Mainly for improving production efficiency but with a positive effect on VOCs emissions reduction.

**Effects**
- **ISO14001 certification**
- **VOCs emissions reduced by about 2/3 in 3 years from 30ppm to 10ppm**
- **Improvement of employee awareness**

![Making employees awarded](source)
Case 7: Installation of VOCs disposal facility

Company: G Ltd.
Industry: Soft packaging gravure printing

VOCs reduction target process
- gravure printing
- dry laminate printing

【Challenge】
- High initial investment cost for VOCs disposal facility (270 million yen)
- Increase in maintenance cost

Effects
- Reduction of VOCs emission rate (emission/use)
- Save energy cost
- Improvement of workers’ environmental consciousness

Key efforts
- Installed micro gas turbine VOCs disposal facility
  Burning VOCs in exhaust gases at high temperatures. Can conserve electricity and steam.
- Installed catalyst device
  This could dispose residual VOCs after burning.
- Developed gravure proof printing
  This conserved film, ink, energy and time.
- added covers to a printing facility
- Storage of waste with cover

Case 8: Adoption of no solvent powder paint

Company: H Ltd.
Industry: Construction

VOCs reduction target process
- Finishing process of aluminum curtain wall

Effects
- Reduction of VOCs by using no solvent powder paint
- Adoption of low temperature painting can reduce CO2 emissions during painting.

Key efforts
- Adoption of powder paint
  Baking paint is generally used as a finishing process of aluminum curtain walls, but a no solvent powder paint was adopted on a large scale.

Inspection of aluminum curtain wall
(Source) Company H
Characteristics of the Japanese VOCs Voluntary Emissions-Reduction Programs

Legal regulations (direct or as frameworks), economic instruments and voluntary efforts are representative instruments for environmental policies. There are justifiable concerns that voluntary efforts don’t have similar binding power to legal regulations for companies, but there are advantages related to costs and applicability to individual circumstances.

<table>
<thead>
<tr>
<th>Overview</th>
<th>Legal regulations</th>
<th>Economic instruments</th>
<th>Voluntary efforts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Restrictions and regulations</td>
<td>Taxes, Surcharges, Subsidies, Emissions trading</td>
<td>Voluntary approach, Negotiated agreements etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pros</th>
<th>Penalties for not following restrictions</th>
<th>Economic efficiency and ecological effectiveness</th>
<th>Lower operation and monitoring costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less margin for injustice</td>
<td>Decision making limited only by budgetary constrains</td>
<td>Better fit to individual circumstances</td>
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<td></td>
<td>Predictable effects</td>
<td>Motivation for continuous efforts</td>
<td>Increased awareness of employees</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Cons</th>
<th>High costs of legal action</th>
<th>Decrease in economic competitiveness with increased production costs</th>
<th>Companies independently set their goals, which results in different goals for companies with different levels of commitment.</th>
</tr>
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<td></td>
<td>inflexibility</td>
<td>Taxes can be a heavy burden for low-income households</td>
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<td></td>
<td>Possible economic damage</td>
<td>Less public acceptance and understanding</td>
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Efforts to reduce VOCs emissions have had a great impact in Japan!!

In Japan’s approach to decreasing VOCs emissions, the VOCs Voluntary Emissions-Reduction Programs plays a significant role. It started in 2005 with 22 organizations participating. In 2014 the program included 40 organizations with 7,300 participating companies.