

# VOC emission reduction policy in Japan through the “best mix” of policies

## Factors for success and failure

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# 1. INTRODUCTION

# 1. Introduction

- Early 2000s - Still low achievement of ambient standards for SPM and photochemical oxidants
- Opinion report by the Central Environment Council in 2004
- ⇒ Revision of the Air Pollution Control Law
  - ◆ concept of “best policy mix” (legal control and voluntary approach)
  - ◆ target: 30% reduction of VOC by 2010 compared with the 2000 level
- Results
  - ◆ Successful reduction of VOCs: reduction by 44.1 % (2000→2010)
  - ◆ Steady decrease in ambient SPM concentration
  - ◆ Ox warning numbers not reduced as expected

**Question 1** “What were the factors which facilitated the success in the VOC reduction?”

**Question 2** “What were the factors which hindered the improvement in the ambient level of photochemical oxidants despite the reduction in the precursor?”

## 2. JAPAN'S VOC REDUCTION POLICY

## 2-1. Historical background (1)

Japan successfully decreased air pollutant emissions in the 1970s and 1980s, and has managed to keep the ambient air concentrations leveling off since then.

### ■ measures to reduce emissions

- ◆ statutory ambient air environmental quality standards (EQS)  
5 pollutants (*SO<sub>2</sub>*, *CO*, *SPM*, *NO<sub>2</sub>*, and photochemical oxidants)
- ◆ regulatory measures addressing stationary sources  
strict emission standards, total emission control programmes for specific areas
- ◆ measures to address mobile sources  
Automobile NO<sub>x</sub> Law → Automobile PM/NO<sub>x</sub> Law
- ◆ Efforts by local governments in collaboration with private sectors  
Pollution Control Agreements (*kogai boshi kyotei*)

→ Compliance rates of the ambient air EQS have improved considerably for *SO<sub>2</sub>*, *NO<sub>2</sub>* and *CO*.

However, those for *SPM* and *photochemical oxidants* remained low even early 2000s(OECD 2010) .

## 2-1. Historical background (2)

### ■ *SPM and photochemical oxidants in FY 2002:*

- ◆ *SPM*: EQS attainment rates were 52.6% at ambient monitoring stations and 34.3% at roadside stations
  - ◆ *Photochemical oxidants*: frequency of *photochemical oxidant warnings* increased over years and the total number of warnings during FY 2002 was 184 days in 23 different prefectures, which was still equivalent to the level of mid-1970s.
- *VOC* emission reduction increasingly drew attention as a **common precursor of *SPM* and *photochemical oxidants*.**

### ■ **Deliberation on the issue**

- ◆ September 2003: MOEJ was requested to examine the potential reduction measures of *VOC* emissions from stationary sources through getting advice from experts .  
→ The Review Committee on *VOC* Emission Reduction established.
- ◆ February 2004: the Central Environment Council submitted to the MOEJ an opinion report on the emission control of *VOCs*.
  - warned of urgent need to address *SPM* and *photochemical oxidants*
  - emphasized the need to reduce the emissions of *VOCs* from the stationary sources in a comprehensive manner

→ **the Air Pollution Control Law revised** (promulgated on 26 May 2004)

## 2-2. Outline of the scheme (1)

### ■ *Definition of VOCs (Article 2-4)*

- ◆ *Organic compounds which are emitted into the air or in gaseous form when dispersed*
- ◆ *The revised law focuses on **precursors of SPM or photochemical oxidants** – eight substances were excluded from the targeted VOCs (e.g. methane, Chlorodifluoromethane)*

### ■ *Introduction of “**best mix**” of the policy measures*

- ◆ *mentioned in the Basic Environmental Plan*
- ◆ *among the recommendations by the Central Environment Council’s opinion in February 2004*
- ◆ *in this context, “**combination of legal emission control and voluntary actions by business entities to reduce emissions and spread of VOC**” (Article 17-2)*

### ■ *VOC emission reduction target*

- ◆ *30% by 2010 compared to 2000*  
*10% by legal control and 20% by voluntary actions*



## 2-2. Outline of the scheme (2)

### Legal control

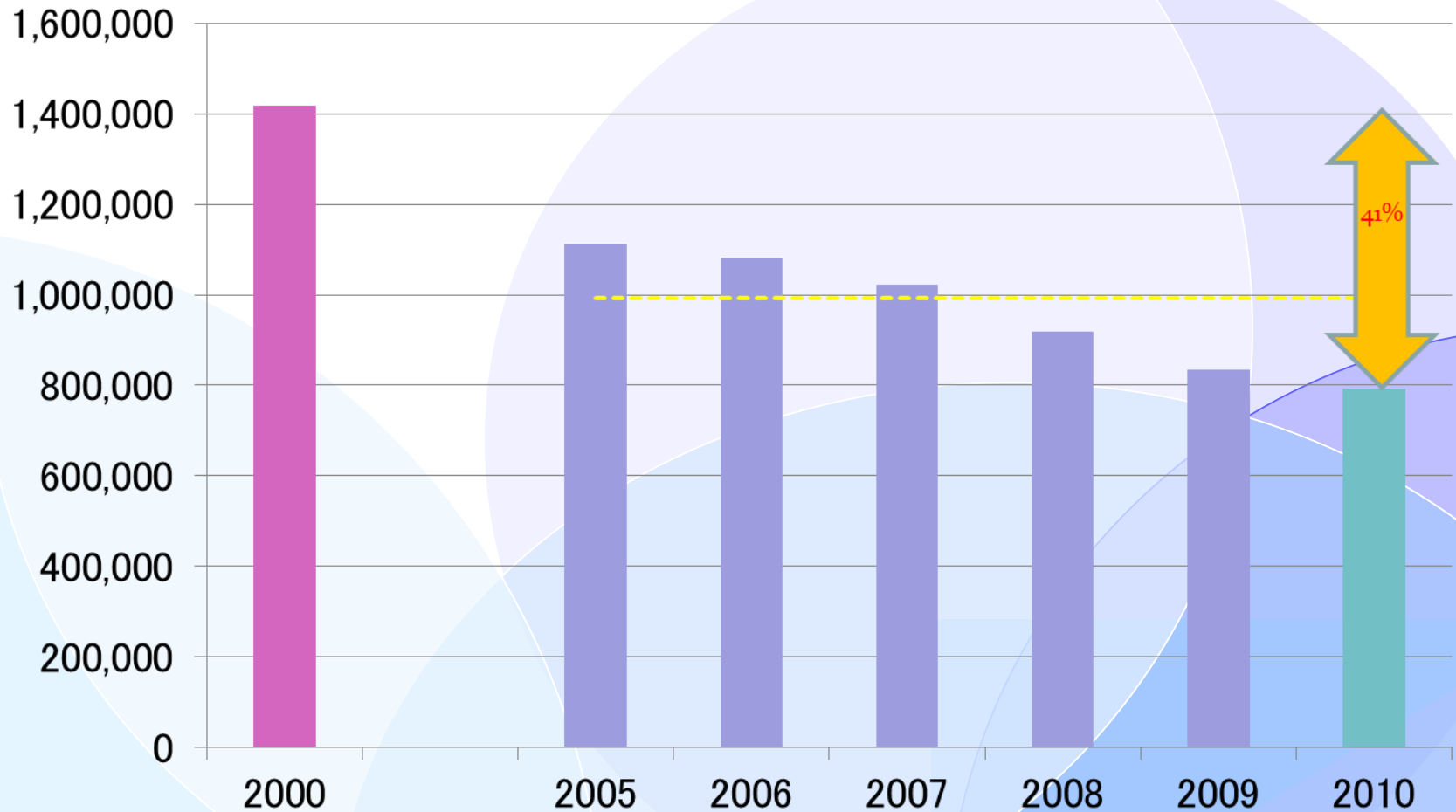
- Only large scale emitters ( $> 50$  t/year)
  - ◆ notify installation/change of facilities
  - ◆ comply with emission standards
  - ◆ monitor VOC concentrations
- Regulated facilities
  - ◆ painting facilities
  - ◆ drying facilities (for painting, adhesives, photogravure or offset printing, chemical production)
  - ◆ cleaning facilities for industrial production
  - ◆ VOC storage tanks
- Tax benefit to purchases of emission reduction equipment

### Voluntary actions

- Small and medium sized facilities / unregulated facilities
- Reduction measures and information disclosure/verification systems left to business entities' discretion
- Government expected to facilitate voluntary action
  - Joint Working Group of the Industrial Structure Council under METI
- No financial incentives provided

## 2-3. Policy outcome (1)

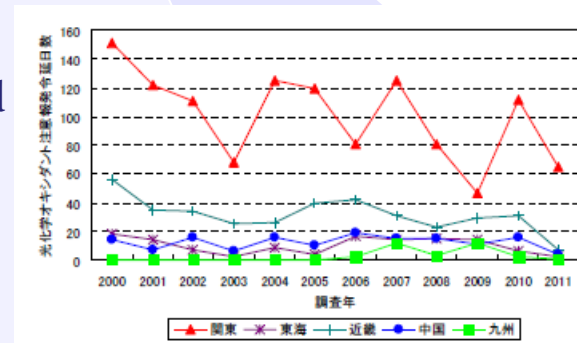
VOC emission (2000-2010) (tonnes)



## 2-3. Policy outcome (2)

### ■ SPM and ozone concentration – indication of reduction

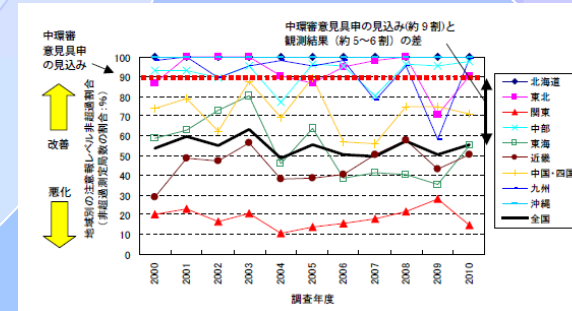
- ◆ Possibility of reduction in photochemical oxidants in highly concentrated areas
- ◆ Photochemical oxidant warning frequencies – declining trend in Tokai and Kinki areas
- ◆ Attainment rate of SPM exceeds the expected achievement (around 93%) (note: also need to consider effects of vehicle regulations)



(Ox Committee 2012)

### ■ Photochemical oxidant warning frequencies – reduction far from the expected level

- ◆ Significant gap from the ex-ante estimate: “the number of the monitors that do not exceed the warning level would increase up to approximately 90%”



(Ox Committee 2012)

# 3. DISCUSSION

# 3-1. Factors that facilitated the over-achievement of the VOC emission reduction target (1)

## ■ Efforts by stakeholders

<p>Industry</p>	<p>Compliance with the legal regulation Development and implementation of voluntary actions - 40 plans by 43 business associations (9,365 companies) in FY 2010</p>
<p>Local governments</p>	<p>Awareness raising on the VOC reduction in emitting facilities Promotion of the low-VOC products</p>
<p>National government</p>	<p>[Ministry of the Environment]</p> <ul style="list-style-type: none"> <li>• Development of emission inventory</li> <li>• Awareness raising through seminars, pamphlets, awards, etc.</li> </ul> <p>[Ministry of Economy, Trade and Industry]</p> <ul style="list-style-type: none"> <li>• Development of a countermeasure manual</li> <li>• Awareness raising through a compilation of good practices, seminars etc.</li> <li>• The Environmental Risk Countermeasures Joint Working Group of the Industrial Structure Council</li> </ul>

# 3-1. Factors that facilitated the over-achievement of the VOC emission reduction target (2)

## ■ Factors that facilitated industry's participation

### [Motivation]

- ◆ In order to avoid legal regulation
- ◆ Participation by the industry representatives in the policy-making process
- ◆ Environmental awareness or strategy

### [Benefits]

- ◆ Cost savings (painting, printing, industrial cleaning, etc)

### [Design of the scheme]

- ◆ Designed to utilise business associations
- ◆ Follow-up scheme of the outsiders (small companies without affiliations with associations)

### [Existing schemes]

- ◆ Voluntary management programme of hazardous air pollutants
- ◆ Pollutant Release and Transfer Register (PRTR) system
- ◆ Green Procurement Law

## 3-2. Barriers that hindered the reduction in photochemical oxidants

*“The causes of the gap between the current status of photochemical oxidant warnings and the ex-ante estimate have not been fully sorted out”*

(The Working Group on the VOC Countermeasures for the Next Period)

- Lack of scientific knowledge regarding Ox formation and limitation of computer simulation
- Naturally formulated VOCs (from vegetation)
- Potential for ozone formation (MIR:Maximum Incremental Reactivity) differs among VOCs.
- Area-specific conditions
- Transboundary factors

### Special committee on VOC of the Air Environment Committee of the Central Environment Council (December 2012)

- Concluded that it is appropriate to continue the current emission reduction scheme based on a mix of legal regulation and voluntary actions.
  - ◆ Importance of information disclosure and assessment
  - ◆ Considerations to alleviate burdens on the business (e.g. frequency of mandatory monitoring, etc.)
  - ◆ Continuation of emission inventory development and monitoring on air pollutants
- Proposed the dissolution of VOC committee into a new committee to address not only VOC, but also photochemical oxidants and PM<sub>2.5</sub>.



# 4. CONCLUSION

- The VOC control policy can be considered as an initial step towards the multi-pollutant and multi-effect approach as it aims to reduce PM and Ox.
- While there was neither punishment nor economic incentives related to the voluntary participation, the voluntary approach led to significant reduction in emissions due to the factors identified above. This indicates potential for a multi-pollutant and multi-effect approach (i.e. VOC, an important precursor can be reduced through not only regulatory measures but also through a policy mix with voluntary approach).

- On the other hand, the original aim, that is, reducing Ox concentration fell short of expectation. The identified factors that hindered the expected improvement indicate that further scientific research is a prerequisite for a success of a multi-pollutant and multi-effect approach. They also suggest a need to further investigation in the decision making rules under scientific uncertainties.