Key Experience in Air Pollution Prevention and Control in the U.S.– A Case of California

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Outline

- Air Quality in California
 - Today
 - 40's–70's, Similar to China Today
- Keys to California Success
- Enforcement Tools
- Applicability to China
- Air Quality Trends
- Economic Growth & Environmental Protection
- Benefits Much Greater Than Costs
- Summary



Air Quality After World War II

- Unhealthy levels of lead, NO₂, SO₂, CO, ozone, particulate matter & air toxics
- Poor visibility
- Difficulty breathing
- Extreme eye irritation
- In Los Angeles:
 - Over 100 smog alerts annually
 - Over 300 days with unhealthy air annually
- Vegetation & material damage





Traffic on World's First Freeway (1950s)





Los Angeles: October 1968





Examiner Collection photo courtesy of The Los Angeles Public Library

Reminds Me of California in the 60's





11/4/14 - http://www.china.org.cn/environment/2013-11/04/content_30497246.htm

Key Principles of California Programs

- Protect public health top priority
- Apply sound science and engineering
- Push technology forward ability to move ahead of EPA
- Maintain level playing field
- Provide open public process
- Consider whole picture system management approach
 - Lifecycle emissions, carbon footprint, multimedia effects, social-economic impacts
- Keep up with changing data health, models, technology, etc.



Significant Guidance for Effective Air Quality Management

- Health based air quality standards, regularly updated to reflect new scientific data, form the basis for effective AQM
- Atmospheric research programs can enhance the effectiveness of pollutant reductions
- Multi-pollutant control has been shown to be most effective in terms of protecting public health and reducing long term costs
- Ambient measurement should include pollutants leading to ozone and fine particulates, sulfur pollution and toxic compounds
 - NO, NO₂, SO₂, CO, O₃, VOC, PM₁₀, PM_{2.5}
 - Toxic compounds: mercury, lead & benzene



Local Air Pollution Agencies– Necessary for Regional Approach

- California has several more environmental agencies at the regional and county level
- Local labor force is essential to success
- Local agencies are best at enforcement, community outreach, daily monitoring and emergency response
- The downside: inconsistency in application and enforcement of regulations



Performance-based Regulations

- Mobile Sources (>99% gasoline, 98% diesel reduction)
 - Cleaner engines
 - After treatment
 - Cleaner gasoline & diesel fuel
 - Alternative fuels
- Stationary Sources (80-90% reduction)
 - Low-NO_x burners
 - Selective catalytic reduction
 - Cleaner fuels
- Area Sources (>75% reduction)
 - Vapor recovery
 - Low-volatility solvents, paints, consumer products



Enforcement of Regulations in California

- California benefits from multiple enforcement pathways
- Federal government, state government, regional environmental agencies, local prosecutors and private citizens can all bring legal action
- Statutory fines have increased over time
- Penalties cover each day of violation and increase with severity of noncompliance



Key Enforcement Tools

- Clear regulatory language
- Detailed permits specifying requirements
- Continuous emission monitors and emissions testing
 - Self-reporting of results
- Periodic, unannounced inspections
- Regular audits of local programs
- Rule-by-rule evaluations
- Strategic "strike forces"
- State-sponsored training



Other Lessons that May Apply in China

- Reach for best available control technology (including those capable of zero emissions) at every opportunity
- Science changes constantly
 – Stay abreast of important findings and regularly update health protective air quality standards
- Provide financial support to key research institutions to acquire scientific data and train scientists and technicians
- Clean energy efficiency is a win/win strategy for the environment
- Remove old vehicles— either through incentive programs or regulations



California's Emission Trends









THE INTERNATIONAL COUNCIL ON CLEAN CARBIO 2013

Maximum 8-hr Ozone Concentrations, 1975-2012



CARB, 2013

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Annual Mean PM_{2.5} Concentrations, 1999-2012





40 Years of Progress on Diesel Soot



THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

Air Pollution Reduced 75-90% Despite Growth



- Ozone Los Angeles peak cut over 70%, hours of exposure reduced 90%
- PM₁₀ annual-average levels cut 75%
- **Air toxics** Over 80% cancer risk reduction (since 1989)



Controlled Costs Much Less Than Benefits

- Costs of Control
 - ~10 billion per year (in 2001)
- Benefits of Control
 - \$40 in health benefits for each \$1 of control (1970-1990)
 - \$4 in health benefits for each \$1 of control (1990-2010)
 - Air pollution control industry 32,000 jobs & \$6.2B (2001)
 - Clean energy industry 123,000 jobs & \$27B (2009)







Concluding Comments

- California experience has significant relevance to China
- Despite substantial progress, California continues to have strict regulatory & incentive programs to meet new air quality standards
- California has moved to include GHG & SLCPs
- China can & has taken advantage of lessons learned elsewhere
- China has moved rapidly in several areas—e.g. NO_x control (see next slide), control of vehicle population, removal of old vehicles, building scientific & technical resources (e.g. CAAC)



Improvements in Nitrogen Oxides

Trends in Passenger Car Exhaust Emissions Standards

NOx Emissions Standards

Grams/Kilometer

ON CLEAN TRANSPORTATION



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Thank You!

