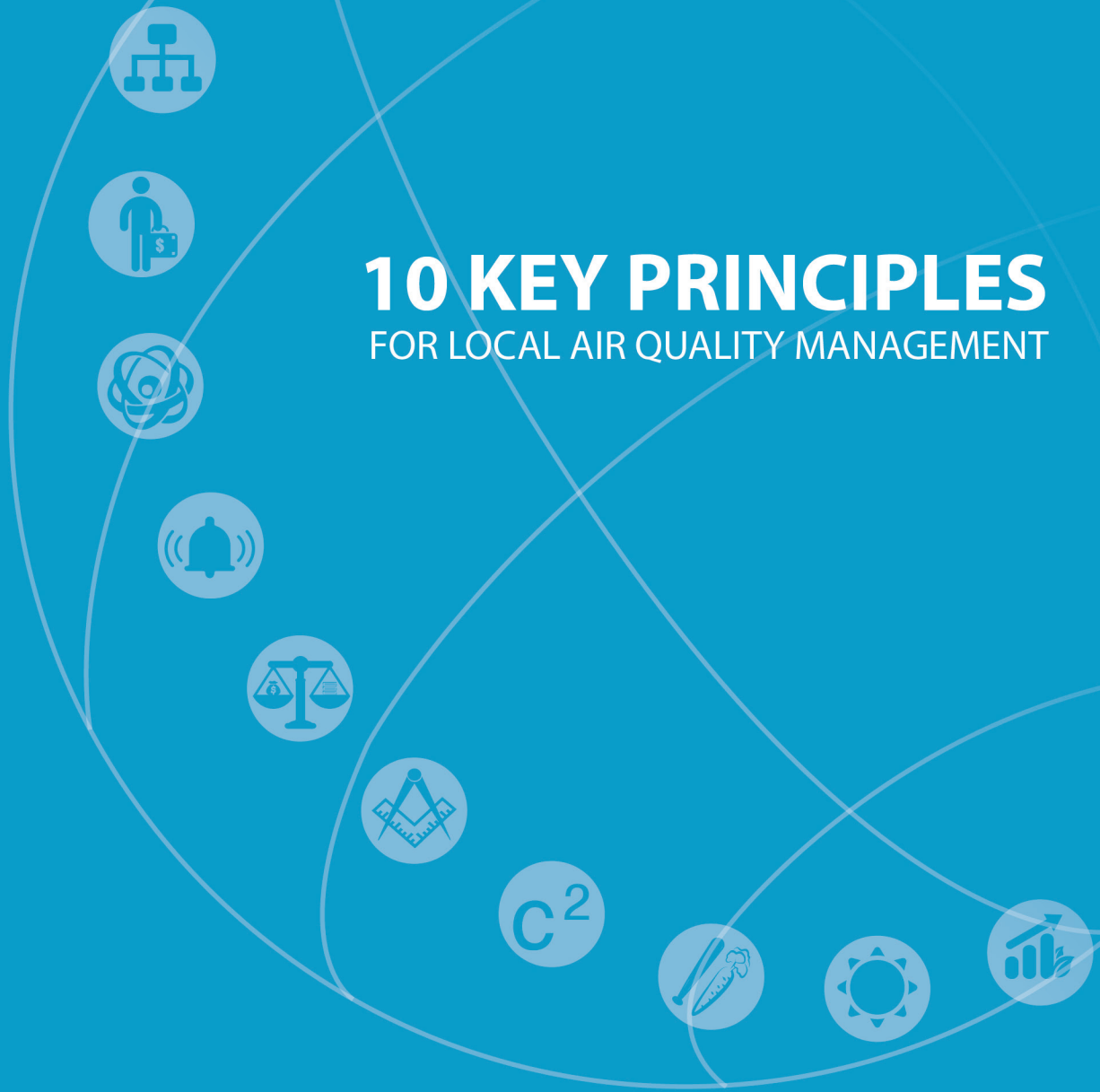

10 KEY PRINCIPLES

FOR LOCAL AIR QUALITY MANAGEMENT

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Acknowledgement:

Paulson Institute
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China Center for International Economic Exchanges
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BACKGROUND

China is facing severe air pollution challenges. The Chinese government is taking serious efforts to improve air quality and its impacts on public health. The State Council has issued the "*Air Pollution Prevention and Control Action Plan (2013-2017)*" and required local governments to meet a number of air quality improvement targets. The local governments have also developed their own action plans on air pollution control. However, due to their lack of management experience, many of them have insufficient capacity to properly manage the air quality program and meet the State Council's targets. Without effective changes, meeting the Chinese national air quality standards and the WHO air quality guidelines will be even more challenging in the long-term for the local governments.

China also needs to simultaneously address severe air pollution and climate change. China has already set reduction targets for air pollutants and GHGs emission intensity. Local provincial governors and city mayors are also faced with challenges to meet targets for both air quality and climate change mitigation. An optimized approach could help the local government achieve multiple targets with lower costs. Hence, the integration of policies that combine air pollutant and greenhouse gas emission reductions will result in cheaper and more effective solutions for both air pollution and climate change.

International experience suggests that improving air quality is no easy task; it will demand serious efforts and a comprehensive approach. Short-term actions are not enough, good policy frameworks and detailed management systems have to be built.

This document offers 10 key principles for developing a good air quality management system based on international experiences and connecting them with China's circumstances. We hope that governments at different levels in China can use these principles in developing their air quality management systems.

This document will first outline the 10 key principles and then provide in-depth analysis and policy recommendations for each of them.

November, 2014

Principle 1

Establish and implement a sound local air quality management structure

Principle 2

Ensure sufficient human and financial resources

Principle 3

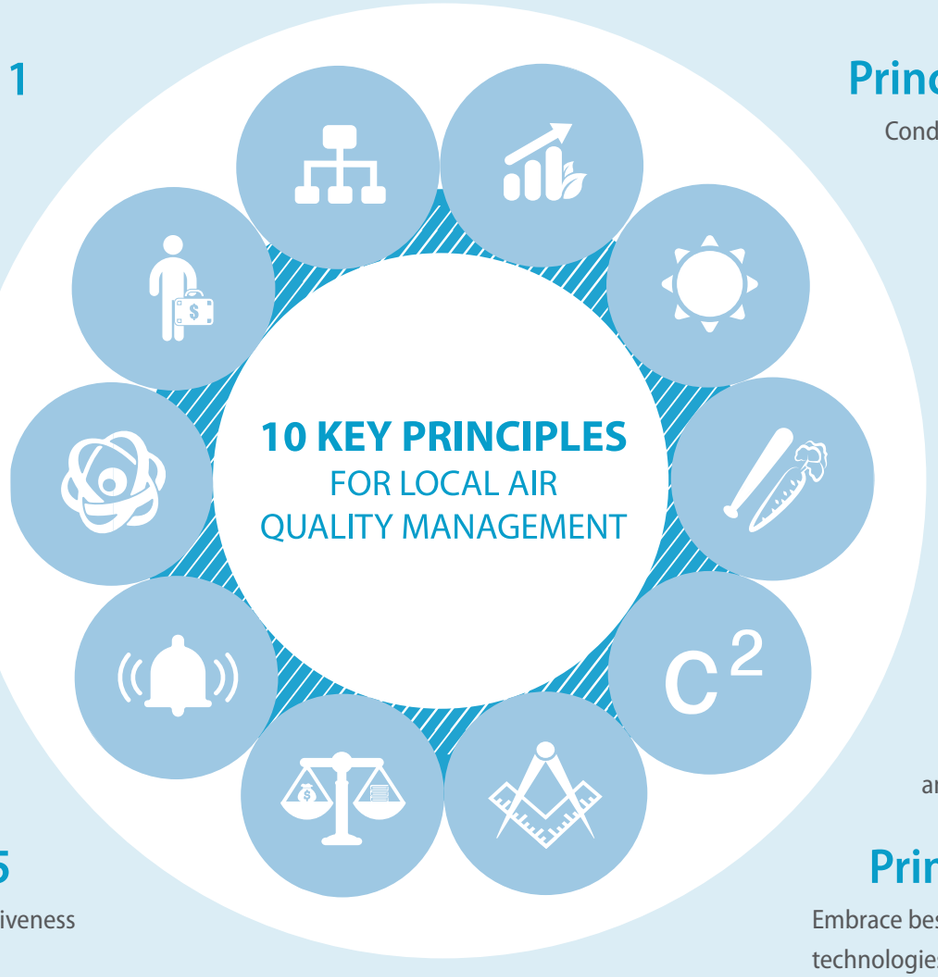
Apply state-of-the-art scientific analysis

Principle 4

Establish emergency episode forecasting and response system

Principle 5

Develop control measures and prioritize based on cost-effectiveness



Principle 10

Conduct regular monitoring and evaluation for continuous improvement

Principle 9

Enhance transparency and encourage public participation

Principle 8

Ensure adequate implementation and enforcement with incentives and penalties

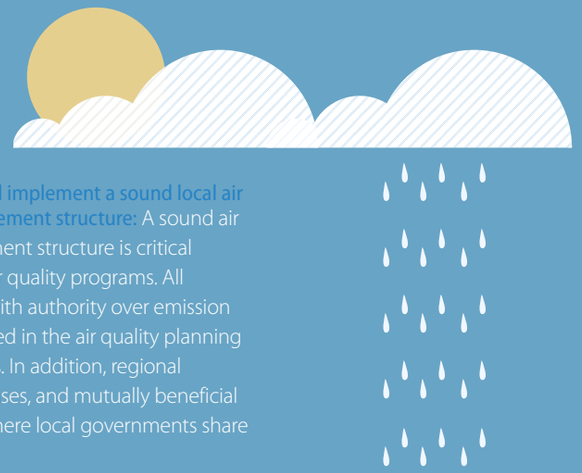
Principle 7

Optimize co-benefits for air pollutants and GHGs (greenhouse gases) when identifying and selecting control policies, measures and technologies

Principle 6

Embrace best available control technologies (BACTs) and best available technologies (BATs)

10 KEY PRINCIPLES
FOR LOCAL AIR QUALITY MANAGEMENT



Principle 1

Establish and implement a sound local air quality management structure: A sound air quality management structure is critical for the success of air quality programs. All government entities with authority over emission sources should be included in the air quality planning and implementation process. In addition, regional collaboration, consistent databases, and mutually beneficial strategies should be established where local governments share a common air mass.

Principle 2

Ensure sufficient human and financial resources: An air quality program will fail if there is insufficient human resources to manage and implement the program. Public and private expenditures on air pollution control should also be made sufficient to achieve the ultimate objective of clean and healthy air.

Principle 3

Apply state-of-the-art scientific analysis: Air quality management decisions should be based on the most current science. Where data gaps exist, local governments should still weigh existing evidence to guide their decisions.

Principle 4

Establish emergency episode forecasting and response system: The government should respond promptly and effectively to major air quality episodes to minimize serious public health impacts.

Principle 5

Develop control measures and prioritize based on cost-effectiveness: The government should conduct analysis on and disclose the cost-effectiveness of air quality measures. First, the government should select the most cost-effective measures to sustain government, public and private support for air quality regulations and standards. Selecting the most cost-effective measures will also guarantee the most emission reductions and air quality benefits within a given funding level.

Principle 6

Embrace best available control technologies (BACTs) and best available technologies (BATs): The best available control technology should be applied to every emissions source to maximize emission reductions and to achieve the greatest economic and regulatory efficiency.

Principle 7

Optimize co-benefits for air pollutants and GHGs (greenhouse gases) when identifying and selecting control policies, measures and technologies: An optimized approach can help the local governments achieve multiple targets with lower costs. Hence, the integration of policies that combine air pollutant and GHGs reductions will bring cheaper and more effective solutions for both air pollution and climate change.

Principle 8

Ensure adequate implementation and enforcement with incentives and penalties: Penalties for non-compliance should be substantial enough to discourage bad behavior and prevent non-compliant actors from gaining a competitive advantage.

Principle 9

Enhance transparency and encourage public participation: The public should be informed to generate trust in the government's air quality decisions.

Principle 10

Conduct regular monitoring and evaluation for continuous improvement: Progress should be regularly monitored using quantifiable metrics that are confirmed by air quality measurements. Plans should be updated every three to five years to reflect new information.

Principle 1

Establish and implement a sound local air quality management structure

A sound air quality management structure is critical for the success of air quality programs. All government entities with authority over emission sources should be included in the air quality planning and implementation process. In addition, regional collaboration, consistent databases and mutually beneficial strategies should be established where local governments share a common air mass. The key elements of this principle include:

1. Secure buy-in and commitment from the mayor and/or governor.

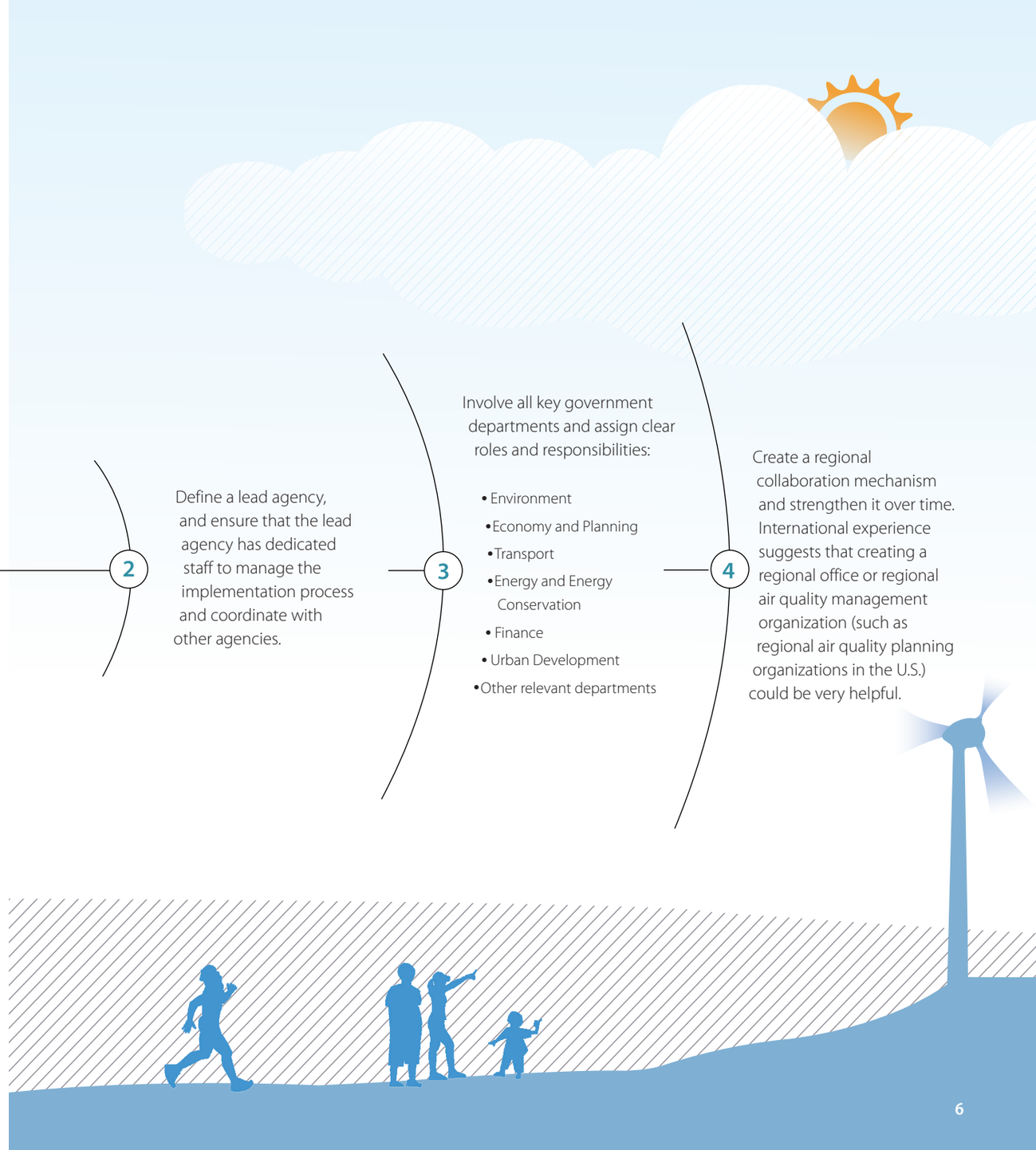
Obtaining commitments early in the process ensures collective understanding, provides opportunities for input, reveals the best opportunities for success, and identifies constraints. Cooperation among agencies and regions is also critical to passing new regulations and for successful implementation.

2. Define a lead agency, and ensure that the lead agency has dedicated staff to manage the implementation process and coordinate with other agencies.

3. Involve all key government departments and assign clear roles and responsibilities:

- Environment
- Economy and Planning
- Transport
- Energy and Energy Conservation
- Finance
- Urban Development
- Other relevant departments

4. Create a regional collaboration mechanism and strengthen it over time. International experience suggests that creating a regional office or regional air quality management organization (such as regional air quality planning organizations in the U.S.) could be very helpful.



Principle 2

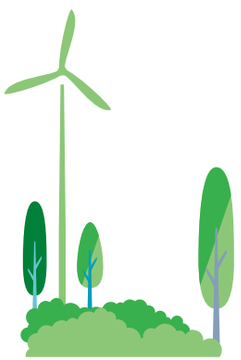
Ensure sufficient human and financial resources

An air quality program will fail if there is not enough human resources to manage and implement the program. Public and private expenditures on air pollution control should also be made sufficient to achieve the ultimate objective of clean and healthy air. The key policy elements to implement this principle are:

Funding criteria should include but are not limited to:
(1) Total quantity of government expenditures as a percent of GDP;
(2) Funding stability - diversity of funding sources, including those from the central government, local government, and future uses of emissions fees and penalties collected;
(3) How the government spends money and its effectiveness.

The local government should assume that whatever funding structure exists today will change in the future. The central government is investing substantial financial resources today to improve air quality. Over time, national funding is likely to change and decrease as a percentage of total funds provided to a city or province. Local governments should evaluate what sources can be developed to diversify funding and sustain long-term improvements to air quality.

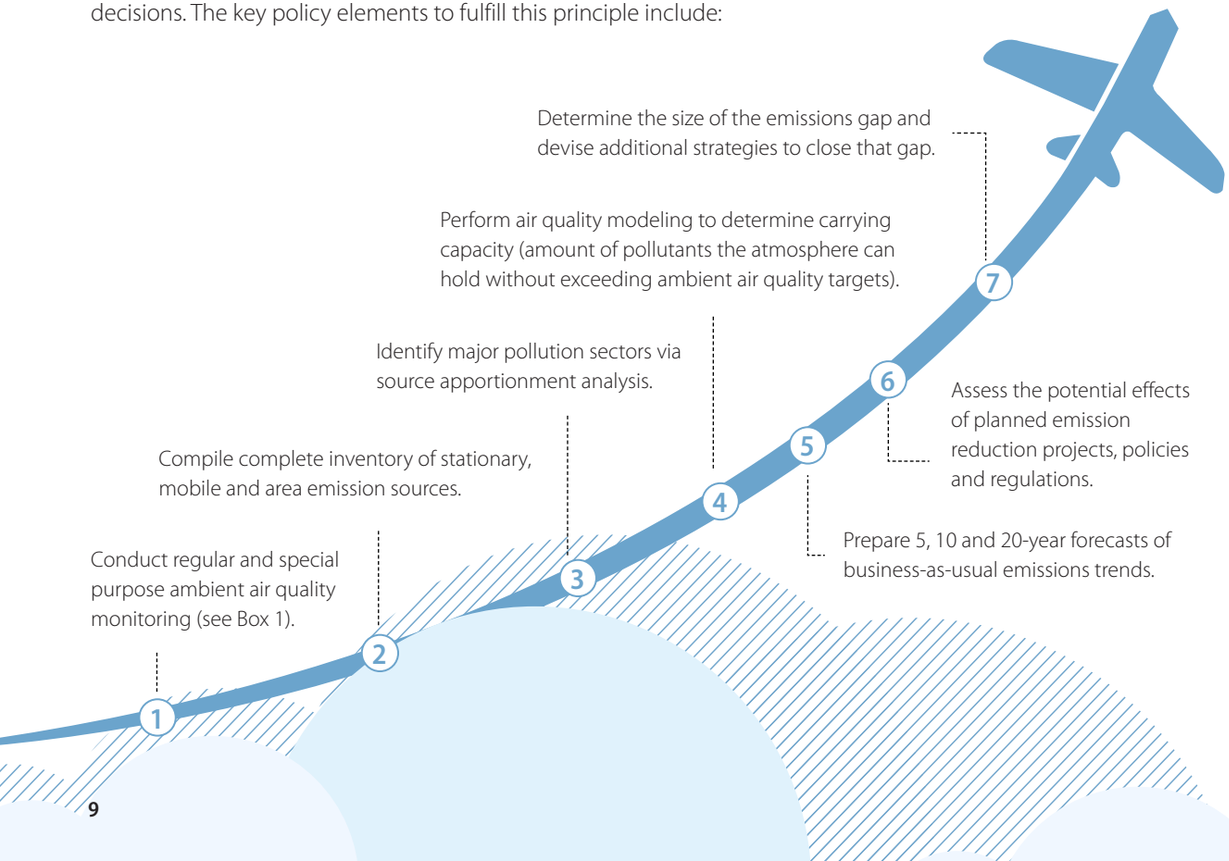
- Identify minimum necessary staff and relevant skills and conducting regular needs assessments. Develop quantitative metrics to help fulfill the various responsibilities of the air quality program. For example, the local government should set a metric for how many times on-site checks need to be conducted by government enforcement staff for every major source.
- Hire new personnel, re-assign existing staff, and/or contract for new services to meet the necessary needs.
- Provide training and professional development, including upward mobility for the staff. Provide a solid career path with opportunities for staff to advance. This will build institutional knowledge and memory, use human and financial resources efficiently, and enable opportunities for new staff to learn from more experienced colleagues.
- A relatively stable and focused technical staff base is also important. This includes having staff rotations relatively infrequently, especially between different environmental media (e.g., from air to water or waste). Some international experiences show that having a dedicated air department in national environmental department and also the local environmental department is effective.
- Develop diverse funding sources:
  (1) Seek national funding and look for incentives for exemplary performance;
  (2) Get local government funding;
  (3) Develop programs such as permit fees or emission fees to generate funding from polluting industries.
- Leverage private sector investments and form public-private partnerships (PPP).
- Increase government spending efficiency and effectiveness. This could be done through regular public spending performance evaluations. Local governments should also consider pooling resources with other governments in the region to avoid duplication and achieve higher efficiency.



Principle 3

Apply state-of-the-art scientific analysis

Understanding the science is the foundation of solving air pollution. Air quality management decisions should be based on the most current science. Where data gaps exist, local governments should still weigh available evidence to guide their decisions. The key policy elements to fulfill this principle include:



Box1. Specific purposes of ambient air quality

Fence line:
Used to assess enterprise emissions and to act as an early warning system in case there is a plant emergency.

Neighborhood:
Used to assess contributions from a particular industrial facility or facilities.

Urban:
To provide assessment of general pollution levels in a city.

Regional:
To assess fluxes of air entering and leaving an urban area (helpful for determining regional air pollution transport).

Roadside:
To assess pollution from vehicles and effects on adjacent residents (generally within 50 meters of road).

Special purpose:
Includes temporary monitors to assess pollution in a particular neighborhood, and portable/hand held monitors used to pinpoint pollution sources.

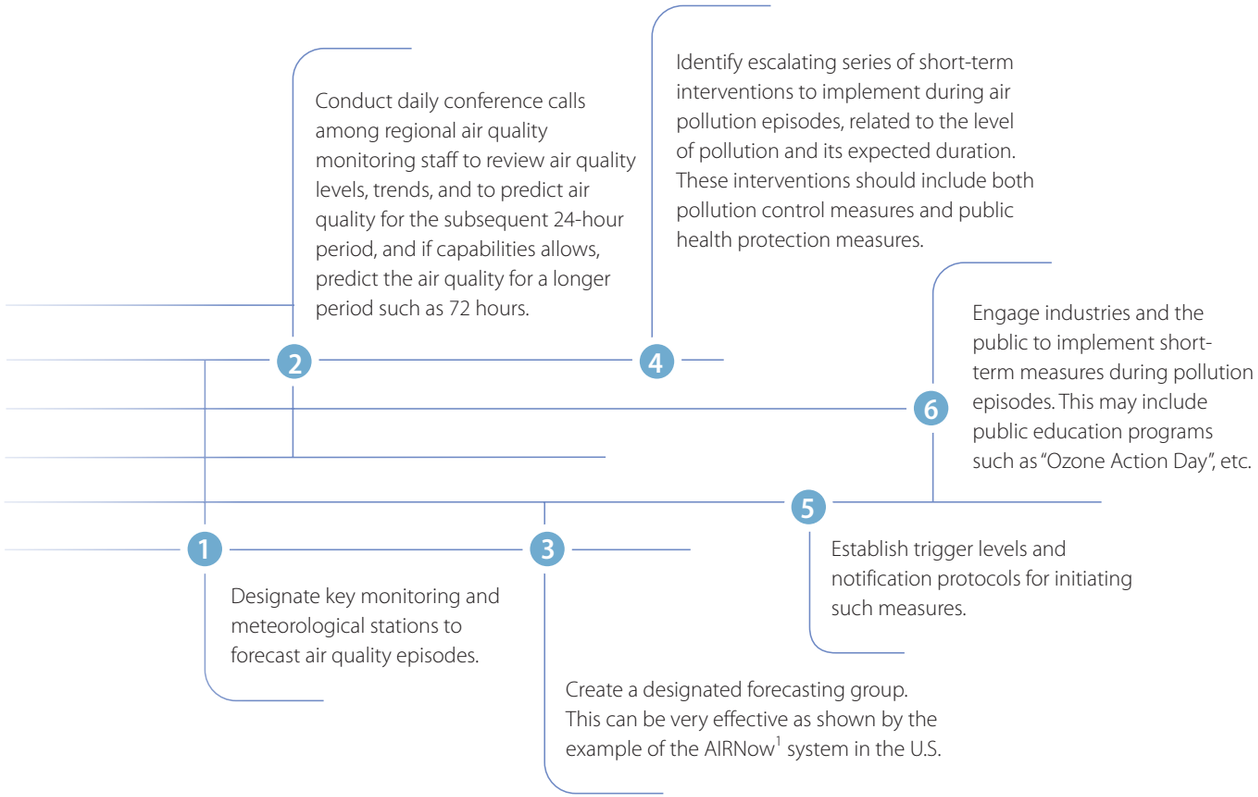
The air quality planning process is iterative. Precision in each of the above topics is not a necessity to adopt and implement emissions control measures. Similarly, actions to improve air quality do not require perfect inventory creation or source identification. Local governments should start with actions that address the largest contributors to local air pollution. Then, they should learn from and extract lessons and best practices from their colleagues to improve the assessment of air quality data, the scope and precision of the emissions inventory, and inputs to air quality models.

Meeting the air quality standards will require short, medium and long-term measures to improve air quality. Creating medium and long-term measures will sustain air quality improvement over time, and will help to inform development of national level actions to be addressed through national policies and plans.

Principle 4

Establish emergency episode forecasting and response systems

The government should respond promptly and effectively to major air quality episodes to keep serious public health impacts to a minimum. Many places in China are now facing frequent air quality episodes, and citizens expect the government to respond immediately when air pollution reaches crisis levels and to prevent those episodes from happening. Therefore, it is important to a robust episodes response system. The key elements of this principle include:



An air quality episode response system needs to be developed with an effective emissions inventory, accurate air quality modeling, comprehensive control measures design and well-functioning implementation, monitoring and evaluation systems. Experiences accumulated during each pollution episode should inform and help refine the overall air quality program to achieve long-term air quality improvements.

[1] *http://www.airnow.gov/*

Principle 5

Develop control measures and prioritize based on cost-effectiveness

Air quality regulations require both the private and public sector to change behavior or use financial resources on technologies that reduce pollution. Conducting and disclosing the cost-effectiveness of air quality measures, prioritizing the most cost-effective measures to implement can ensure sustained political, public, and private support for air quality regulations and standards. Selecting the most cost-effective measures will also guarantee the most emission reductions and air quality benefits with a given funding level. The key elements of this principle include:

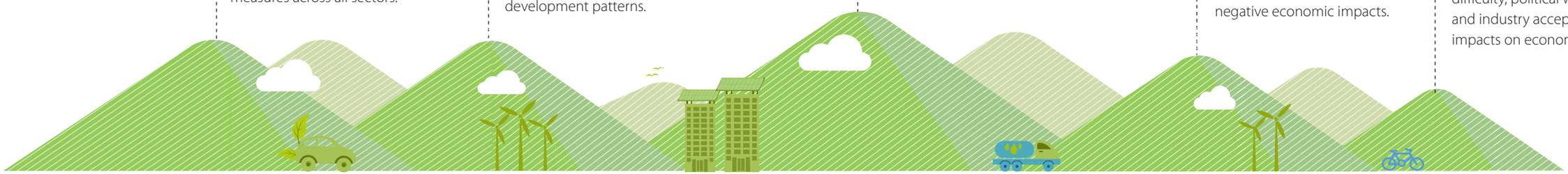
Evaluate all scopes of control measures across all sectors.

Include control measures such as energy efficiency, energy structure, transportation demand and fuels, and land use and development patterns.

Conduct cost-benefit analysis using a consistent methodology. Cost-benefit analyses should compare the cost of pollution control against the cost of doing nothing (public health costs and other negative externalities). There are cost-benefit analysis tools that can be used such as COST (estimating control technology costs) and BenMap (evaluating the health benefits of air quality improvements)[2].

Evaluate impacts on the economy (GDP) to give decision makers opportunities to understand implications and select the optimized approach that could reduce pollution with limited negative economic impacts.

Prioritize measures with criteria such as: emission reductions and air quality benefits, cost, time of implementation, technical difficulty, political will, public and industry acceptance, impacts on economy, etc.



When developing control measures for local air quality plans, it is also important to develop contingency control measures. As part of the scientific analysis, the local government will have determined how many tons must be removed from its airshed, at a minimum, to reach air quality standards. The local government should also have a contingency plan to remove of extra tons if necessary, implementation and enforcement may not achieve 100% of the expected reductions due to atmospheric chemistry changes and the fact that actual economic growth for the region can vary from the initial assumptions made when the air quality plan was developed. These contingency control measures are normally measures that are lowly ranked on cost-benefit analysis, but should be adopted if there is risk of not meeting air quality targets.

[2] *COST and BenMap tools can be found at http://www.abacas-dss.com/*

Principle 6

Embrace best available control technologies (BACTs) and best available technologies (BATs)

BACTs should be applied to every emissions source to maximize emission reductions and to achieve the greatest economic and regulatory efficiency. The key elements of this principle include:

Require BACTs/BATs for new source.

Promote BACTs/BATs for existing sources, particularly at times of modernization.

BACTs/BATs should include end-of-pipe, root-of-pipe and whole process controls.

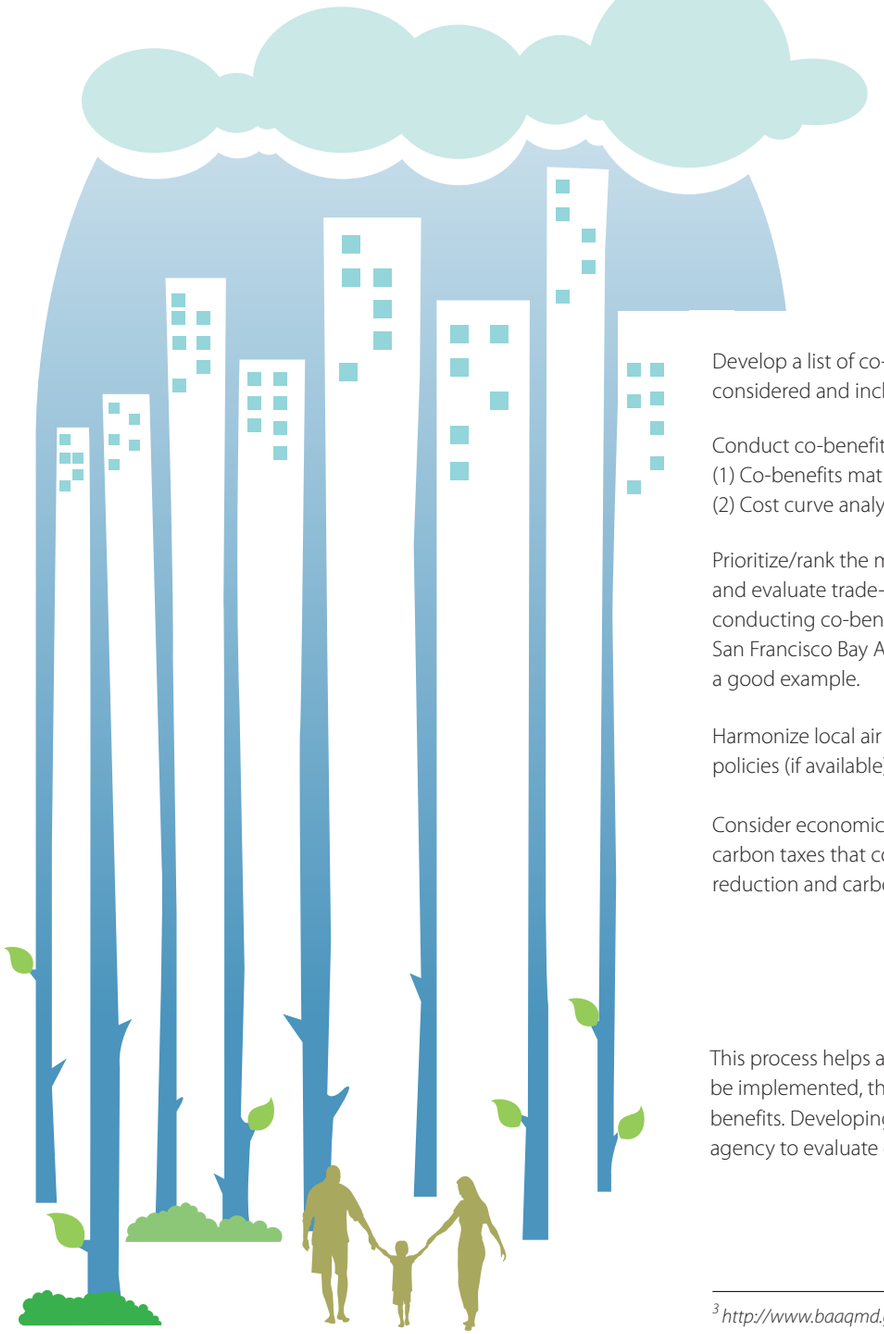
International experience reveals that a mix of end-of-pipe, root-of-pipe and whole process controls achieves the same environmental goals more cost-effectively and in the same timeframe or even sooner. Enterprise level evaluations, like those conducted for BATs, are consistent with how large industries operate their facilities. Such evaluations also allow the enterprise to optimize emissions controls across pollutants, and provide for more flexibility operationally while meeting overall air quality objectives.

BACTs and BATs evolve over time. The process should accommodate these changes and be flexible to adopt and require improved technologies as they become technically and economically viable.

Principle 7

Optimize co-benefits for air pollutants and GHGs when identifying and selecting control policies, measures and technologies

China needs to simultaneously address severe air pollution and climate change. China has already set reduction targets for air pollutants and GHGs emission intensity. Local provincial governors and city mayors are also faced with challenges to meet targets for both air quality and climate change mitigation. For air quality, there are 12th FYP emission reduction targets for SO_2 (8%) and NO_x (10%), as well as the State Council AQ Action Plan ambient $PM_{2.5}$ and PM_{10} reduction targets. For climate change, there is the national 12th FYP carbon intensity reduction target (17% reduction). An optimized approach could make the local government achieve multiple targets with lower costs. Hence, the integration of policies that combine air pollutant and greenhouse gas emission reductions will bring cheaper and more effective solutions for both air pollution and climate change. The key elements of this principle include:



Develop a list of co-control measures/policies that need to be considered and included in the air quality plans.

Conduct co-benefits analysis for control measures, including:
(1) Co-benefits matrix;
(2) Cost curve analysis.

Prioritize/rank the measures considering GHGsB benefits, and evaluate trade-offs. There are few examples in China of conducting co-benefits analysis of local air quality plans. The San Francisco Bay Area's "2010 Clean Air Plan"[3] could serve as a good example.

Harmonize local air quality and low carbon development policies (if available).

Consider economic policies such as resource taxes and carbon taxes that could achieve both benefits of air pollution reduction and carbon emissions reductions.

This process helps an agency to fully understand the scope of measures that can be implemented, their direct pollutant reduction benefits, and the ancillary co-benefits. Developing the full scope of control measures allows the air quality agency to evaluate effects, possible trade-offs, and barriers to implementation.

[3] *http://www.baaqmd.gov/Divisions/Planning-and-Research/Plans/Clean-Air-Plans.aspx*

Principle 8

Ensure adequate implementation and enforcement with incentives and penalties

Emission reductions and air quality improvement can only be achieved if a good air quality program is well implemented and enforced. Penalties for noncompliance should be substantial enough to discourage misbehavior and to prevent bad actors from gaining a competitive advantage. The key elements of this principle include:

At the government level:

The government evaluation system should include air quality management indicators so that more attention is given to air quality issues. Underperforming local government officials and departments should be dealt punitive measures, including halting the permitting of the new sources for the jurisdiction and job assessment for the responsible officials.

At the enterprise level:

- (1) Penalties should be consistently given for violations and be high enough to guarantee compliance and deter violations;
- (2) The government should conduct routine enforcement activities, including unannounced inspections;
- (3) Enterprises should have a robust reporting and recordkeeping system, including disclosure of emissions data;
- (4) Enterprises should have a routine and consistent licensing and compliance structure. This structure can provide certainty and accountability. Setting clear standards encourages enterprises to identify key personnel and their responsibilities;
- (5) Enterprises should also be required to obtain operating licenses. These licenses should outline key parameters and operating conditions. The licenses should also require that records are kept and submitted to the government. These records should document emissions and ensure continuous compliance with air quality standards and requirements.

Enforcement evaluation:

Appropriate metrics and indicators should be developed for the enforcement process. For example, the number of inspections should be conducted for a certain type of enterprise, the methods to determine the level of fines, etc.

Principle 9

Enhance transparency and encourage public participation

The government should inform the public to generate trust in the government's air quality decisions. Involving the public and getting public support is critical to the success of an air quality program. It is also important to manage public expectations. It will still take fifteen to twenty years for China's air quality to significantly improve. Sustaining political, public, and private support over that period requires transparent information disclosure. The key elements of this principle include:

The government should also encourage voluntary actions by the private sector, including corporate social responsibility programs conducted by industry and investors, etc.

CSR

Invite public input and comments during the key stages of air quality regulatory development, planning and implementation. This could be conducted in various formats including public hearings, community roundtables and workshops, etc. The government should respond in a timely manner to meaningful and substantive comments for air quality policies and plans.

Respond quickly to public inquiries regarding air quality management, through various communications tools such as: hotlines, interactive micro-blogs, WeChat, etc.

Disclose information for the entire process of air quality planning, implementation, and monitoring and evaluation.

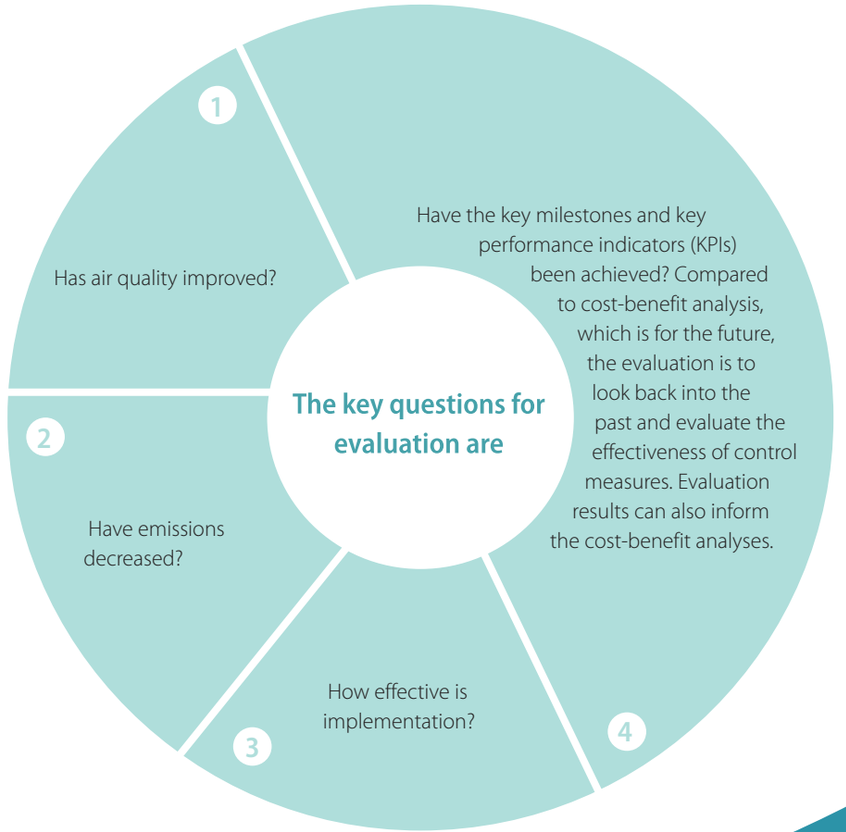
- The air quality data is increasingly more transparent. This improvement represents a good example of giving the public and businesses information that is consistent with what they are seeing and breathing.
- Local air quality plans and their implementation progress must also be disclosed to further improve transparency. For example, the government should disclose an air quality management report each year that includes information regarding progress in improving air quality and details on the areas that were not as successful as planned. These reports should also include future commitments to correct inadequate performance.

Developing and reporting on key indicators is crucial to enable public understanding of progress being made to improve air quality, barriers that have to be overcome, and additional control measures that must be adopted to further reduce pollution. The following are examples of indicators that should be reported: air pollution concentrations and their trends over time (at least five years), intensity based metrics (pollution per GDP, grams of coal per kWh electricity generation), quantity of pollution (tons emitted), number of violations of China's air quality standards per year and their trends over time.

Principle 10

Conduct regular monitoring and evaluation for continuous improvement

Progress should be regularly monitored using quantifiable metrics and confirmed by independent air quality measurements. Plans should be updated every three to five years to reflect new information. Periodic reviews build agency confidence on the efficiency of emissions control measures, detect the gaps and deficiencies that need to be filled and corrected, and help identify the additional resources that are needed to succeed. The key elements of this principle include:



Conduct annual implementation evaluations and assessments. This includes evaluating the ambient air quality monitoring network, and the metrics and indicators developed during the planning process to show progress in meeting air quality requirements.

Compare emissions inventory trends with those from ambient air pollution monitors. If inventory reflects emissions decrease, but no change is observed at monitors, conduct detailed inspections/audits of the facilities nearby and analyze ambient data to determine what has changed from when the air quality plan was developed.

Encourage third-party evaluations of government progress on air quality management.

Use both government and third-party assessment results to develop next year's annual work plan.

Conduct formal three-year reviews, mid-term reviews, and final reviews. Use the results to revise the current air quality plans and inform future air quality plans.

Air quality plans and regulations should be adjusted to reflect improvements in science and knowledge of the public health and environmental effects of pollution. Air quality plans should also be updated frequently and revised in response to new standards or requirements.

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