Section of Environment, Energy, and Resources
AMERICAN BAR ASSOCIATION

Air Quality Committee Newsletter

Vol. 20, No. 4 August 2017

A joint newsletter of the the Air Quality Committee, the International Environmental and Resources Law Committee, and the Section of International Law's International Environmental Law Committee

URBAN AIR POLLUTION

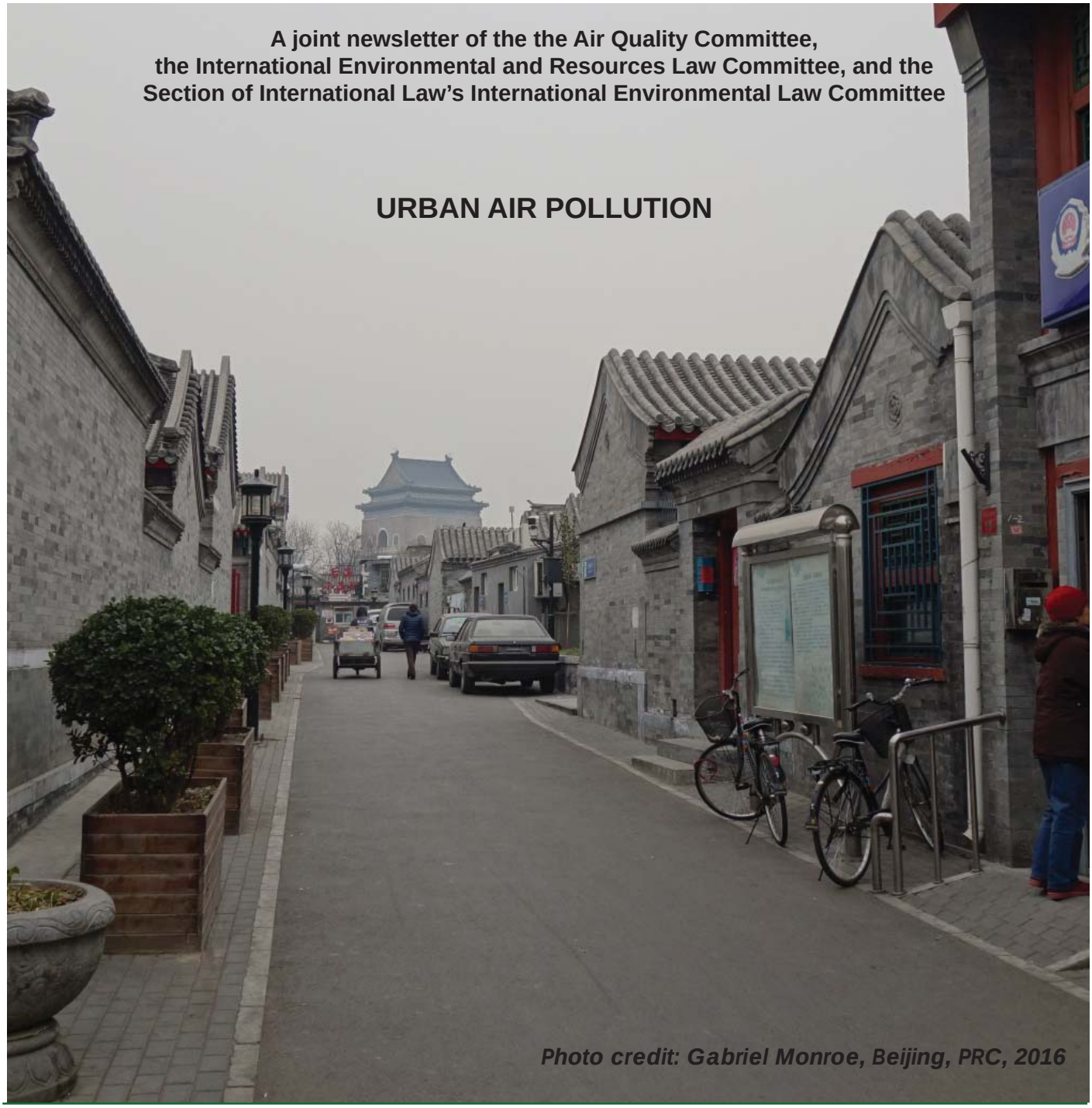

Photo credit: Gabriel Monroe, Beijing, PRC, 2016

Air Quality
Committee Newsletter
Vol. 20, No. 4, August 2017
Irene A. Hantman, Rod Johnson, and David Loring, Editors

Issue Theme: URBAN AIR POLLUTION

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AMERICAN BAR ASSOCIATION
SECTION OF ENVIRONMENT, ENERGY, AND RESOURCES

CALENDAR OF SECTION EVENTS

August 30, 2017
Supreme Court Year in Review: The Environmental Cases and A Review of Justice Gorsuch's Environmental Jurisprudence
Non-CLE Webinar

September 22-24, 2017
The Lincoln Charter of the Forest Conference
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Primary Sponsor: Lincoln Record Society

October 18-21, 2017
25th Fall Conference
Baltimore Marriott Waterfront
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March 8, 2018
Environmental Policy Symposium
The University of Mississippi School of Law
Oxford, MS

April 16-18, 2018
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CHAIR MESSAGE

Stephanie Altman, Shannon Martin Dilley, Elizabeth Hurst, Lauran Sturm, Alicia Cate, and Anastasia Telesetsky

As the chairs of the International Environmental and Resources Law Committee (IERLC), Air Quality Committee, and the Section of International Law International Environmental Law Committee (IELC), we are pleased to offer a joint special edition newsletter: Urban Air Pollution.

This newsletter focuses on issues surrounding urban air pollution. The convergence of transportation, industry, and development pressures in urban areas around the world cause air pollution-related health crises that afflict more than half the total current global human population. Although the challenges of dealing with urban air pollution are widely shared, comprehensive and successful approaches to addressing such pollution remain relatively rare. This newsletter touches on legal and technological developments for addressing the air pollution epidemic choking cities around the world.

Author Shannon Martin Dilley first offers an orienting survey of the existing international legal framework for control of particulate matter (PM), one of the categories of urban air pollution most detrimental to human health, including case study snapshots of jurisdictions that have successfully implemented integrated strategies to address PM. N. Lindsay Simmons focuses on the evolving approach of the People's Republic of China to address the serious air pollution plaguing Chinese cities. The newsletter concludes with Lillian Rafii's exploration of the confluence of legal, policy, technological, and market drivers for the U.S. state of California's leading role in the adoption of renewable energy storage infrastructure—a shift with exciting potential to improve urban air quality.

We encourage members to attend and enjoy interesting CLE content and networking with colleagues. SEER continues to provide timely information and assistance to our members to aid them in becoming better lawyers. Please take note that the next Annual (25th) Fall Conference will be held in Baltimore, Maryland, from October 18 to 21, 2017. Additionally, the ABA Section of International Law Fall 2017 Conference will take place in Miami, Florida, from October 24 to 27, 2017.

Our committees enjoy active participation by members, with quality programs arising from member involvement. If you want to get more involved in any of our committees' activities, please let our committee chairs know (IERLC—Stephanie Altman at stephanie.l.altman@gmail.com or Shannon Martin Dilley at dilleyshannon@gmail.com; AQC—Elizabeth Hurst at elizahurst@aol.com or Lauran Sturm at Lauran.Sturm@tn.gov; or SIL IELC—Alicia Cate at alicat.intlenvlawcomm@gmail.com or Anastasia Telesetsky at atelesetsky@uidaho.edu). Additional information is available on the committee websites.

Our newsletter editors are always ready to entertain article ideas, and we also welcome periodic guest editors to help put together these newsletters. If you wish to propose an article, please contact our committee newsletter vice chairs (IERLC: Gabriel Monroe at gm62@cornell.edu; AQC: Irene A. Hantman at ihantman@verdantlaw.com, David Loring at dloring@schiffhardin.com, or Rod Johnson at rjohnson@enochkever.com; or SIL IELC: Anna Mance at annamance@gmail.com and Linda Lowson at lmlowson@gmail.com).

Stephanie Altman *and* **Shannon Martin Dilley** *are co-chairs of the International Environmental and Resources Law Committee.* **Elizabeth Hurst** *and* **Lauran Sturm** *are co-chairs of the Air Quality Committee.* **Alicia Cate** *and* **Anastasia Telesetsky** *are co-chairs of the International Environmental Law Committee in the Section of International Law.*

OVERVIEW OF THE INTERNATIONAL FRAMEWORK FOR CONTROL OF PARTICULATE MATTER

Shannon Martin Dilley

International responses to air pollution problems have advanced through treaties, resolutions, and multilateral agreements. Global progress, first through the Montreal and Kyoto Protocols, and more recently, the Paris and Kigali Agreements, highlights what countries can achieve when working together. Each such protocol or agreement shows an evolution based on science and mutual understanding that there is a problem affecting all countries.

Particulate matter (PM) has received less attention than stratospheric ozone or climate change but is nonetheless a significant human health problem in many areas around the world, especially in large urban centers. Control of PM has achieved mixed progress worldwide. Even in countries that have adopted ambient air pollution standards, urban areas often continue to be afflicted with high PM levels.

At least three-and-one-half billion people worldwide live in urban areas. Eighty percent of people living in urban areas are exposed to air pollution at levels above what the World Health Organization (WHO) considers healthy. WHO, A Global Assessment of Exposure and Burden of Disease 11 (2016), *available at* http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1. In a recent study, WHO identified air pollution as the "biggest environmental risk to health." *Id.* Air pollution also impedes national sustainable development. It affects a wide variety of sectors—the economy, worker productivity, health-care costs, and tourism. UNEP, *Strengthening the Role of the United Nations Environment Programme in Promoting Air Quality, Resolution 1/7* (2014), *available at* http://www.cepal.org/sites/default/files/pages/files/k1402364.pdf. Air pollution is most severe in low- to middle-income cities and impacts the most vulnerable populations—children, elderly, and the poor. WHO, Air Pollution Levels in Many of the World's Poorest Cities (May 12, 2016), http://www.who.int/mediacentre/news/releases/2016/air-pollution-rising/en/.

This article outlines the current international framework for control of PM and highlights the need for action at the international, national, and state level to control PM in urban areas. Local governments can reap air pollution control benefits, among others, by implementing sustainable development goals. Such benefits have been demonstrated by the planning experiences of two specific urban areas surveyed briefly below—Curitiba, Brazil and Freiburg, Germany.

Particulate Matter

PM is a complex mixture of solid and liquid particles suspended in the air. The particles can include dust, dirt, or soot containing sulfates, nitrates, ammonia, sodium chloride, and black carbon. PM_{10} consists of particles with diameters less than 10 micrometers and $PM_{2.5}$, or fine PM, which has a diameter smaller than 2.5 micrometers. WHO, A Global Assessment of Exposure and Burden of Disease 19 (2016), *available at* http://apps.who.int/iris/bitstream/10665/250141/1/9789241511353-eng.pdf?ua=1 (hereafter, WHO, Global Assessment). Sources of PM include combustion of gas and diesel engines from vehicles and stationary sources such as manufacturing, power generation, residential, and industrial activities. WHO, *Health Effects of Particulate Matter: Policy Implications for Countries in Eastern Europe, Caucasus and Central Asia* (2013), *available at* http://www.euro.who.int/__data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-final-Eng.pdf.

Air pollution accounts for more than three million premature deaths annually. WHO, Global Assessment, *supra*, at 11. This includes deaths related to lung cancer, stroke, chronic obstructive pulmonary disease, acute lower respiratory disease, and cardiovascular disease. *Id.* at 44.

WHO sets Air Quality Guideline values based on target micrograms per cubic meter ($\mu g/m^3$). For PM_{10}, target values are set at a 20 $\mu g/m^3$ annual mean and 50 $\mu g/m^3$ for a 24-hour mean; $PM_{2.5}$ target values are set at 10 $\mu g/m^3$ annual mean and a 25 µg/m3 24-hour mean. WHO, *WHO Air Quality Guidelines for Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide* (2005), *available at* http://apps.who.int/iris/bitstream/10665/69477/1/WHO_SDE_PHE_OEH_06.02_eng.pdf. Some countries have adopted ambient air quality standards that meet these guidelines; still, there are many that have not. Relatively few urban areas with ambient air quality standards meet those standards. The areas with the highest exposure are the Eastern Mediterranean, South-East Asia, and the Western Pacific Regions. WHO, Global Assessment, *supra*, at 33. The WHO Urban Ambient Air Pollution database shows that the top megacities that exceed the guidelines are Delhi, Shanghai, Sao Paulo, Mumbai, Mexico City, Beijing, Cairo, Dhaka, Buenos Aires, Kolkata, and Istanbul. WHO, *WHO Urban Ambient Air Pollution Database—Update 2016*, *available at* http://www.who.int/phe/health_topics/outdoorair/databases/AAP_database_summary_results_2016_v02.pdf?ua=1.

The United Nations Environmental Programme (UNEP) has identified overlapping causes for increased PM levels, such as lack of monitoring, standards, implementation, enforcement, political will and awareness of the issues, poverty, and lack of transition to modern fuels or cooking facilities. UNEP, Global Environmental Outlook, 47, 61 (2012), *available at* http://www.unep.org/geo/sites/unep.org.geo/files/documents/geo5_report_full_en_0.pdf. Fortunately, according to WHO, key sources of urban air pollution can be reduced by "policies and investments supporting cleaner transport and industry, energy-efficient housing, electrification of homes, renewable power generation, and proper waste management." WHO, *Air Pollution*, http://www.wpro.who.int/topics/air_pollution/en/ (last visited May 13, 2017). Such reductions require "action by public authorities, industry, and individuals at national, regional and even international levels." WHO, Health Effects of Particulate Matter: Policy Implications for Countries in Eastern Europe, Caucasus and Central Asia 11 (2013), *available at* http://www.euro.who.int/__data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-final-Eng.pdf.

International Framework

Convention on Long-Range Transboundary Air Pollution

On November 13, 1979, 32 countries in the pan-European region adopted the United Nations Economic Convention for Europe, Convention on Long-Range Transboundary Air Pollution (CLRTAP). CLRTAP entered into force in 1983, being the first convention to deal with transboundary air pollutants. UNECE, *The Convention and Its Achievements*, http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/the-air-convention-and-its-protocols/the-convention-and-its-achievements.html (last visited May 13, 2017). To date, there are 51 parties and 32 signatories, including Canada, the European Union, and the United States. United Nations, *Convention on Long-Range Transboundary Air Pollution Status*, https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-1&chapter=27&clang=_en (last visited May 13, 2017).

The convention defines "air pollutant" to mean:

> the introduction by man, directly or indirectly, of substances or energy into the air resulting in deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property and impair or interfere with amenities and other legitimate uses of the environment . . .

1979 Convention on Long-Range Transboundary Air Pollution, *available at* http://www.unece.org/fileadmin/DAM/env/lrtap/full%20text/1979.CLRTAP.e.pdf.

Parties to this convention have committed to developing policies and strategies to combat the discharge of air pollutants, including the exchange of information, consultation, research and monitoring, and taking into account efforts already made at national and international levels. *Id.*

The convention originally did not contain targets. Over time, parties have adopted protocols that have established legally binding targets for emission reductions for specific air pollutants. The parties have adopted the following such protocols:

- 1985: Helsinki Protocol (sulfur dioxide)
- 1991: Geneva Protocol (volatile organic compounds or "VOCs")
- 1994: Oslo Protocol (polluter pays principle)
- 1998: Aarhus Protocol (persistent organic pollutants and heavy metals)
- 1999, Gothenburg Protocol (sulfur dioxide, nitrogen oxides, ammonia, and non-methane VOCs).

UNECE, *Development of the Convention*, http://www.unece.org/index.php?id=43545 (last visited May 13, 2017).

In 2012, parties amended the Gothenburg Protocol to include emission reduction commitments for fine PM and black carbon, a short-lived climate pollutant. *Id.* The proposed 2012 amendments also include national emission reduction commitments for the main air pollutants by 2020. However, these provisions remain unratified. The executive body will be meeting in December 2017 in Geneva, Switzerland. UNECE, *Meetings & Events*, http://www.unece.org/environmental-policy/conventions/envlrtapwelcome/meetings-and-events.html#/ (last visited May 13, 2017). If the parties ratify the amendments, PM will become a covered air pollutant. As of right now, there are no legally binding PM targets under this framework.

United Nations Environment Assembly

In June 2014, the United Nations Environment Assembly (UNEA) held a high-level platform for decision making on the environment. UNEA adopted "Resolution 1/7: Strengthening the Role of the United Nations Environment Programme in Promoting Air Quality." Resolution 1/7 encourages governments to formulate action plans, establish and implement nationally determined ambient air quality standards, promote sustainable development and a multisector approach to improve air quality and human health, and make air pollution data more accessible to the public. UNEP, *Strengthening the Role of the United Nations Environment Programme in Promoting Air Quality, Resolution 1/7* (2014), *available at* http://www.cepal.org/sites/default/files/pages/files/k1402364.pdf. Governments were encouraged to share examples of such efforts with UNEP before the UNEA in 2016. UNEA reaffirmed some of these principles in the May 2016 meeting, *see Delivering on the 2030 Agenda for Sustainable Development*, UNEA, UNEP/EA.2/Res.5 (Aug. 3, 2016), *available at* http://wedocs.unep.org/bitstream/handle/20.500.11822/11180/K1607143_UNEPEA2_RES5E.pdf?sequence=1&isAllowed=y.

WHO Resolution WHA68.8

In May 2015, the Sixty-eighth World Health Assembly adopted WHO Resolution WHA68.8 to address the health effects caused by air pollution. Resolution WHA68.8 reaffirmed the commitment to promote sustainable development policies that support healthy air quality in the context of sustainable cities. WHO, *Sixty-eighth World Health Assembly, WHA68/2015/REC/1, Health and the Environment: Addressing the Health Impact of Air Pollution, WHA68.8* (May 26, 2015), *available at* http://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_R8-en.pdf.

The resolution specifically highlighted the concern over fine PM being classified "as a cause of lung cancer by WHO's International Agency on Research for Cancer." *Id.* at 2. Member States were urged to develop and strengthen multisector cooperation on the international, regional, and national levels as well as raise awareness; facilitate research; monitor illness caused by air pollution; develop a coordinated policy dialogue to address

the impact of air pollution; and facilitate transfer of expertise, technologies, scientific data, and good practices. *Id.*

Sustainable Development Goals

In September 2015, the United Nations General Assembly adopted Transforming Our World; The 2030 Agenda for Sustainable Development. United Nations, *Sustainable Development Goals*, http://www.un.org/sustainabledevelopment/sustainable-development-goals/ (last visited May 14, 2017). This agenda set out 17 sustainable development goals (SDG), three of which were related to air pollution: SDG 3 (ensure healthy lives and promote well-being for all at all ages) calls for a substantial reduction in mortality rates attributed to air pollution by 2030; SDG 11 (make cities inclusive, safe, resilient, and sustainable) calls for special attention to air quality; and SDG 7 (ensure access to affordable, reliable, sustainable, and modern energy for all) calls for clean fuels and renewable energy. *Id.*

A69/18 Road Map

On May 6, 2016, at the Sixty-ninth World Health Assembly, parties adopted a draft road map for an enhanced global response to the adverse health effects of air pollution. Parties identified four important pillars to achieve this purpose: (1) expanding the knowledge base; (2) monitoring and reporting; (3) global leadership and coordination; and (4) institutional capacity strengthening. WHO, *Draft Roadmap for an Enhanced Global Response to the Adverse Effects of Air Pollution, A69/18* (May 6, 2016), *available at* http://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_18-en.pdf.

Specifically, the proposed road map focuses on building and disseminating global evidence and knowledge of the health impacts of air pollution as well as effective policies for intervention. It identifies a knowledge gap and the need for monitoring and reporting so the health sector can leverage leadership at a global, national, subnational, and local level. *Id.*

Most important, it identifies the importance of synergies with other global processes, such as the implementation of the SDG and follow-up to the Paris Agreement. For example, implementation of the SDG can prevent air pollution but also climate change mitigation has a potential co-benefit of addressing other kinds of air pollution.

Local Government Initiatives

Because the international framework contains no legally binding requirements for control of dangerous urban air pollutants such as PM, and in some cases national action may not be possible due to lack of political will, local governments have a particularly important role in planning to improve air pollution levels. Two local initiatives show how good urban planning can reduce PM and other air pollutants, leading to health and economic benefits.

Curitiba, Brazil, is one successful example of such sustainable urban planning. Curitiba integrated urban planning, green spaces, transportation, and waste management strategies to design low-emission communities. The government and city planners used "radial linear-branching patterns" that divert traffic from the city center and encouraged industrial development only in certain areas. These efforts resulted in reduced transportation time, job creation, lowered fuel use, heightened property values, and improved air quality. United Nations, *Sustainable Urban Planning, Curitiba*, https://sustainabledevelopment.un.org/index.php?page=view&type=99&nr=57&menu=1449 (last visited May 14, 2017).

A second example is the city of Freiburg in southwest Germany. This city incorporated sustainable transport and land use in urban planning by prioritizing public transport infrastructure development ahead of residential expansion, improving public transportation, promoting bicycling and walking, and placing restrictions on car use. As a result, Freiburg's air pollution levels meet WHO guidelines for fine PM concentrations. WHO, *Case Studies of Healthy,*

Sustainable Cities, http://www.who.int/sustainable-development/cities/case-studies/en/ (last visited May 14, 2017).

These two case studies show how integrated planning can lead to better air quality and health. With local government action, these urban areas have cleaner air and reduced health risk.

Conclusion

A large number of people live in urban environments and breathe polluted air that contributes to health risks. These risks are preventable with proper planning and strategy. The international framework does not contain any legally binding mandates regarding dangerous air pollutants such as PM. Although some countries have adopted ambient air quality standards, successful implementation of such standards to alleviate urban air pollution is difficult.

Policy makers at global, regional, national, and local levels should appropriately categorize air pollution for what it is, a public health risk, and integrate air pollution mitigation strategies into health prevention and health care delivery strategies. There is ample incentive to adopt policies that address air pollution not only because of the health benefits but also because of the cost savings. In adopting these policies, decision makers should use the SDG in planning and explore leveraging the goals of other instruments, such as the Paris Agreement, to achieve air pollution reduction co-benefits.

Shannon Martin Dilley *is an attorney at the California Air Resources Board. She is co-chair for the International Environmental and Resources Law Committee. The views represented in this article are those of the author and do not represent the views of her employer.*

THE FUTURE OF CHINA'S URBAN AIR POLLUTION UNDER THE 13TH FIVE-YEAR PLAN

N. Lindsay Simmons

China's cities experience some of the worst air pollution in the world. In 2014, Beijing experienced more than 200 days of air pollution categorized as "unhealthy" or worse, based on the 2012 Environmental Protection Agency's (EPA) standards. George Gao, *As Smog Hangs over Beijing, Chinese Cite Air Pollution as Major Concern*, Pew Research Center (Dec. 10, 2015), *available at* http://www.pewresearch.org/fact-tank/2015/12/10/as-smog-hangs-over-beijing-chinese-cite-air-pollution-as-major-concern. Twenty-one of these days were categorized as "hazardous," whereas only ten days that year were categorized as "good." *Id.* Beijing is not alone; in 2013, 33 of 74 reporting Chinese cities reported that, at some point in the previous year, $PM_{2.5}$ levels reached over 300 $\mu g/m^3$—levels that are hazardous to human health. Xu Nan & Zhang Chun, *How Did China's Air Pollution Get This Bad?*, China Dialogue (Jan. 14, 2013), *available at* https://www.chinadialogue.net/article/show/single/en/5604-How-did-China-s-air-pollution-get-this-bad-. Due to increasing concerns over public welfare and the environment in China, the Chinese government has begun to address urban air pollution in its two most recent five-year plans.

China's five-year plans are guiding documents that communicate the government's vision for future reforms to the various branches of the bureaucracy, industry, and citizens. Michael Meiden, China's 13th Five-Year Plan: Implications for Oil Markets 3, Oxford Energy Comment (2016). For the majority of its decades of history since being founded in 1949, the People's Republic of China's five-year plans have exclusively focused on economic growth and development, with the underlying goal of developing China "faster and better." *Id.*; Lu Feng & Wenjie Liao, *Legislation, Plans, and Policies for Prevention and Control of*

Air Pollution in China: Achievements, Challenges, and Improvements, 112 J. Cleaner Production 1549, 1554 (2016). However, beginning with the 11th five-year plan (2006–2010), this underlying goal changed from "faster and better" to "better and faster," focusing less exclusively on economic development. Lu Feng & Wenjie Liao, *supra*, at 1554. In 2011, the Chinese government introduced the 12th five-year plan (2011–2015), which was the first to specifically incorporate goals related to environmental concerns, including urban air pollution. *Id.* Such goals in the 12th five-year plan were further developed last year, when, in March 2016, China released its 13th five-year plan (2016–2020).

This article examines the ways in which the 13th five-year plan builds off and exceeds the 12th five-year plan's goals to reduce air pollution in the country, especially targeting highly polluted cities and regions such as Beijing. First, the article will discuss China's history of urban air pollution and its primary contributors. Second, it will examine the goals enumerated in the 13th five-year plan that directly address urban air pollution. Lastly, the article will examine the 13th five-year plan's new goals for the energy sector aimed at reducing the nation's reliance on fossil fuels that emit harmful air pollutants.

Urban Air Pollution in China

The combustion of coal is the primary contributor to urban air pollution in China. *See* Edward Wong, *Coal Burning Causes the Most Air Pollution Deaths in China, Study Finds*, N.Y. Times, Aug. 17, 2016, *available at* https://www.nytimes.com/2016/08/18/world/asia/china-coal-health-smog-pollution.html.

The national consumption of energy has drastically increased in the past few decades; in 2015, newly disclosed data revealed that China had been consuming up to 17 percent more coal than was previously believed. Chris Buckley, China Burns Much More Coal than Reported, Complicating Climate Talks, N.Y. Times, Nov. 3, 2015, available at https://www.nytimes.com/2015/11/04/world/asia/china-burns-much-more-coal-than-reported-complicating-climate-talks.html. According to these data, China consumed approximately 4.2 billion metric tons of coal in 2013—half of the global coal consumption. Id.; BP, BP Statistical Review of World Energy June 2016, at 33 (65th ed. 2016), available at https://www.bp.com/content/dam/bp/pdf/energy-economics/statistical-review-2016/bp-statistical-review-of-world-energy-2016-full-report.pdf.

This massive consumption of coal has caused severe air pollution in China's cities in recent years. In January 2013, Beijing experienced concentrations of $PM_{2.5}$ levels 30 times higher than the levels deemed safe by the World Health Organization (WHO). Jonathan Kaiman, *Chinese Struggle Through "Airpocalypse" Smog*, The Guardian, Feb. 16, 2013, *available at* https://www.theguardian.com/world/2013/feb/16/chinese-struggle-through-airpocalypse-smog. Harbin experienced a similar event in October 2013, when $PM_{2.5}$ reached levels of 1000 μg/m^3, 40 times higher than the levels deemed safe by WHO. Simon Denyer, *Smog Emergency in Harbin Highlights Growing Pollution Problem in China*, Wash. Post, Oct. 22, 2013, *available at* https://www.washingtonpost.com/world/choking-smog-paralyzes-cities-in-northeast-china-closing-schools-airports/2013/10/22/ba2c46d6-3b04-11e3-b0e7-716179a2c2c7_story.html?utm_term=.b651cee32208. High levels of pollution in cities have led citizens to grow increasingly concerned over the quality of their air; a 2015 Pew Research survey showed that 75 percent of Chinese citizens said that air quality is at least a "moderately big" issue, and 35 percent[1] of the population said it is a "very big" issue. George Gao, *As Smog Hangs over Beijing*, *supra*.

The sharp increase in pollution and related public concern in recent years has moved the Chinese government to directly address urban air pollution in its two most recent five-year plans.

Directly Targeting Urban Air Pollution

The 12th five-year plan first attempted to tackle the growing problem of urban air pollution by requiring that the most densely populated regions of China reduce annual concentrations of PM_{10} by 10 percent, SO_2 by 10 percent, NOx by 7 percent, and $PM_{2.5}$ by 5 percent below 2010 levels by 2015. Xiaopu Sun et al., *China's Air Pollution Rules: Compliance and Enforcement Lessons from Global Good Practices*, 46 Envtl. L. Rep. News & Analysis 10,958, 10,963 (2016). Specific regions, including Beijing, Tianjin, Hebei, Yangzi River Delta, and Pearl River Delta, were required to reduce annual concentrations of $PM_{2.5}$ to a greater degree—by 6 percent below 2010 levels by 2015, rather than by 5 percent. *Id.* As a result, many of these regions began passing local legislation to address air quality. By early 2016, many of these regions had made progress in meeting their targets, with $PM_{2.5}$ levels down by 14.1 percent in 74 reporting Chinese cities. Barbara Finamore, *Tackling Pollution in China's 13th Five Year Plan: Emphasis on Enforcement*, NRDC (Mar. 11, 2016), *available at* https://www.nrdc.org/experts/barbara-finamore/tackling-pollution-chinas-13th-five-year-plan-emphasis-enforcement.

The 13th five-year plan continues to build and expand upon the 12th five-year plan's urban air pollution reduction goals. The 13th five-year plan has called for greater reductions of air pollutants, now requiring that SO_2 and NOx be reduced an additional 15 percent by 2020. *Id.* The 13th five-year plan also seeks to address urban air pollution in new ways. First, the plan includes two new binding targets for air pollutants; requiring that factories reduce $PM_{2.5}$ emissions by 25 percent, and that overall volatile organic compounds (VOCs) emissions be reduced by 10 percent. Liu Qin, *China's Five Year Plan to Radically Tighten Air Pollution Targets*, Climate Change News, Nov. 3, 2016, *available at* http://www.climatechangenews.com/2016/03/11/chinas-five-year-plan-to-radically-tighten-air-pollution-targets; Deborah Seligsohn & Angel Hsu, *How China's 13th Five-Year Plan Addresses Energy and the Environment*, Mar. 10, 2016, *available at* https://www.chinafile.com/reporting-opinion/environment/how-chinas-13th-five-year-plan-addresses-energy-and-environment. Second, the plan requires that cities achieve air quality that meets the measurement standards for "good" or "excellent" air quality days[2] 80 percent of the year. *Id.*

Development of Energy Goals

Achieving the 13th five-year plan's targets for energy development would also result in a reduction of air pollutants. As noted, *supra*, China currently consumes 50 percent of the world's coal: more than twice the combined amount consumed by the next two largest consumers, India and the United States, which account for approximately 10.6 percent and 10.3 percent of the world's consumption, respectively. BP, *supra*, at 33. Aware of the close causal connection between coal power and pollution, the Chinese government has made a concerted effort in recent years to (1) reduce its overall consumption of energy; and (2) diversify its energy sources to include more non-fossil fuels. The 12th five-year plan aimed to reduce overall energy consumption by 16 percent of 2010 levels by 2015, and to source at least 11.4 percent of China's energy from non-fossil fuels, compared to the 8.3 percent in 2010. *China Announces 16 Pct Cut in Energy Consumption per Unit of GDP by 2015*, The Cent. People's Gov't of China, Mar. 5, 2011, *available at* http://www.gov.cn/english/2011-03/05/content_1816947.htm.

China met and exceeded these goals. In 2015, the national energy consumption rate was 18.2 percent below 2010 levels and renewable energy resources accounted for 12 percent of its energy portfolio. Ma Tianjie, *China's 5 Year Plan for Energy*, The Diplomat, Aug. 6, 2016, *available at* http://thediplomat.com/2016/08/chinas-5-year-plan-for-energy. Furthermore, coal consumption rates finally peaked in 2013, and have since fallen by 2.9 percent in 2014 and 3.7 percent in 2015. Edward Wong, *Statistics from China Say Coal Consumption Continues to Drop*, N.Y. Times, Mar. 2, 2016, *available at* https://www.

nytimes.com/2016/03/03/world/asia/china-coal-consumption-down.html?_r=0.

The 13th five-year plan continues to build off the 12th five-year plan's goals. It aims to (1) reduce its energy consumption by another 15 percent below the 2015 level; (2) reduce coal consumption to no more than 58 percent of its total energy; and (3) source more than 15 percent of its total energy from non-fossil fuels. Ma Tianjie, *supra*. Furthermore, the 13th five-year plan sets a cap on the nation's total energy consumption at five billion metric tons of standard coal equivalent by 2020, i.e., 16.3 percent more energy than the nation consumed in 2015. *Id.* If China attains these goals, especially those connected to reducing its reliance on coal and increasing its reliance on non-fossil fuel energy sources, the country will be well on its way to alleviating its serious urban air pollution.

Conclusion

If China meets the goals of the 13th five-year plan, as it met those of the 12th five-year plan, it is likely that China's urban air pollution will be much closer to acceptable levels by 2020. WHO recommends that cities achieve an annual $PM_{2.5}$ average of less than 10 $\mu g/m^3$. Many of China's cities are far from reaching an annual average of 10 $\mu g/m^3$. Nonetheless, annual concentrations of $PM_{2.5}$ have decreased significantly in several cities since 2013. A 2016 study examining air pollution in five of China's major cities, Beijing, Chengdu, Shenyang, Shanghai, and Guangzhou, found that over the past three years $PM_{2.5}$ averages have declined by at least 9 $\mu g/m^3$ in all five cities and as much as 34 $\mu g/m^3$ in Chengdu. Xuan Liang et al., $PM_{2.5}$ Data Reliability, Consistency and Air Quality Assessment in Five Chinese Cities 25 (2016). Furthermore, the sharpest decline in $PM_{2.5}$ levels occurred in the two most polluted cities: Beijing's $PM_{2.5}$ levels declined from an average of 99 to 81 $\mu g/m^3$ and Chengdu from 97 to 63 $\mu g/m^3$. *Id.* Although these averages are far from the WHO's guideline of 10 $\mu g/m^3$, the progress is significant. Likewise, the country is pushing hard to decrease its reliance on coal and other pollutant-emitting fossil fuels in pursuit of cleaner energy options. In January 2017, the Chinese government announced its intention to spend $360 billion through 2020 on renewable energy sources such as solar and wind. Michael Forsythe, *China Aims to Spend at Least $360 Billion on Renewable Energy by 2020*, N.Y. Times, Jan. 5, 2017, *available at* https://www.nytimes.com/2017/01/05/world/asia/china-renewable-energy-investment.html. If China continues on this path, it is likely it can return many of its cities' air to healthy levels over the course of the next decade or two.

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Endnotes

1 Notably, the number of citizens that believe air pollution to be a "very big" issue is down from 47 percent in 2013, the year that many Chinese cities experienced their worst air pollution. Compare George Gao, supra, with Environmental Concerns on the Rise in China, Pew Research Center (Sept. 19, 2013), http://www.pewglobal.org/2013/09/19/environmental-concerns-on-the-rise-in-china.

2 In order to qualify as a "good" or "excellent" air quality day, the air quality must score below 100 on China's 0 to 500 Air Quality Index. Deborah Seligsohn, *How China's 13th Five-Year Plan Addresses Energy and the Environment* (Apr. 27, 2016), *available at* http://www.uscc.gov/sites/default/files/Deborah%20Seligsohn_Written%20Testimony%20042716.pdf.

WHAT IS CALIFORNIA'S ROLE IN LOCAL GOVERNMENT ENERGY STORAGE POLICY?

Lillian Rafii

As the renewable energy generation market matures, energy storage presents the next frontier in distributed energy implementation. Many renewable energy sources, such as solar and wind, produce discontinuous energy that is primarily used by the consumer or fed into the grid for a net metering discount. Renewable energy storage has long captured the attention of scientists, policy makers, and energy professionals who envisioned it as a solution to California's "duck curve" problem of a high mid-day net load from an abundance of renewable power production from solar compared to the low-energy availability but high usage in the evening hours.

Analogous to a dam regulating a steady stream of water, renewable energy storage acts as a reservoir for when electricity is needed. Such regulation has the potential to drive significant reductions in air pollution from the energy sector by improving efficiency in energy delivery and facilitating optimization and utilization of intermittent renewable energy sources such as solar and wind. But until now, barriers of cost, grid integration, and technological advancement have slowed energy storage adoption. Although the technology for batteries and other storage technology have existed for hundreds of years, they have not been integrated into a grid system until recently. For example, the most common battery applications are still powering smaller electronics and appliances. Former attempts at larger scale applications, such as Ford's 1966 attempt at a battery-run vehicle, were famously unsuccessful. The concept of pairing generation with storage has existed for years and now finally the more reasonable costs and ability of storage options to hold enough of a charge can make that concept a reality. Recently rapid technological advance from both the storage hardware to the software application of managing how and when the energy is stored and released has created numerous storage options. Storage solutions are now expected to play a pivotal role in combating climate change, decarbonizing the grid, and achieving renewable energy goals.

California cities and urban centers are in a unique position to promote and experiment with storage solutions. Much of this is due to the state's aggressive renewable energy mandates and incentive programs. Sustainably integrating renewable energy into daily use will be increasingly critical as forces such as changing temperature patterns, climate change policy goals, and market-based regulatory emissions reductions structures influence the operation of the grid system. This article explores the background California policy, programs California cities have embarked on or can learn from, and challenges that cities still face in promoting energy storage.

California's Storage Policy Landscape

Due to a confluence of several pivotal factors, including dropping costs, legislative mandates, and a statewide incentive program, California currently leads the United States of America in renewable energy storage deployment. Certainly, hardware and software costs for batteries and renewable energy storage have dropped significantly over the past ten years. Electric vehicles powered by lithium ion batteries have become increasingly popular purchases for many California residents. California itself has hastened the exploration of energy storage through its sweeping greenhouse gas reduction legislation and its Self-Generation Incentive Program, which provides incentive funding to new and existing distributed energy resources.

Overlying targeted energy storage legislation is California's goal, codified in 2015 by Senate Bill 350, to source 50 percent of its electricity from renewable energy sources by 2030. On the energy storage front, California enacted AB 2514 in 2010, which directed the California Public Utilities Commission (CPUC) to explore and set targets for viable and cost-effective storage systems by 2020. Assem. Bill 2514, 2009–2010 Reg. Sess. (Cal.

2010). AB 2868, enacted in 2016, directed up to an additional 500 MW of storage to be developed by the three investor-owned utilities: Pacific Gas and Electric Company, Southern California Edison, and San Diego Gas and Electric. Assem. Bill 2868, 2015–2016 Reg. Sess. (Cal. 2016). AB 33 instructed the CPUC to study the potential of large-scale bulk energy storage, specifically pumped hydroelectric storage, for rapid ramping of energy needed for the grid. Assem. Bill 33, 2005–2016 Reg. Sess. (Cal. 2016).

Building on California's legislative direction, the CPUC has approved the Self-Generation Incentive Program (SGIP), which is administered by a group of utilities. Its goal is to provide "incentives to support exciting, new, and emerging distributed energy resources." The SGIP is designed to provide rebates for distributed energy systems on the customer side of the utility meter and has an authorized budget of $566.69 M through 2019. Seventy-nine percent of these funds are reserved for energy storage projects. Finally, Senate Bill 700, proposed in 2017, would expand current California funding for energy storage installations from primarily commercial and industrial customers to residential customers, targeting solar plus storage systems. Sen. Bill 700, 2017–2018 Reg. Sess. (Cal. 2017). If adopted, Senate Bill 700 would direct a certain percentage of SGIP funding toward promoting energy storage systems in low-income neighborhoods.

How Can Local Governments Promote the Development of Renewable Energy Storage Adoption?

Cities are uniquely positioned to promote the adoption of workable renewable storage options and can start by streamlining the permitting process, engaging in pilots, and planning ahead for energy needs.

Soft Costs and Permitting

Critical to wide-ranging renewable storage deployment are the local permitting processes of each city. The building permitting process for installing a battery, the most common form of residential energy storage, can range thousands of dollars for the same permit, even between neighboring cities. For example, requirements and costs of fire department-issued safety permits vary from region to region. Cities do not exactly operate blind in this regard, as many cities addressed similar challenges when creating more efficient solar permitting processes. Inconsistent and unpredictable soft costs of implementation create friction that delays battery implementation and have nothing to do with the capability of the technology itself. In the solar realm, Governor Brown released the California Solar Permitting Guidebook to assist municipalities and project managers to maintain uniformity in solar installations. Office of Governor Edmund G. Brown Jr., California Solar Permitting Guidebook (2012, updated in 2017).

To address this issue relating to the installation of energy storage infrastructure, Assembly member David Chiu introduced AB 546 during California's 2017–2018 legislative session, which would encourage the Governor's Office of Planning and Research to provide guidance on energy storage permitting and potential factors in assessing fees. Assem. Bill 546, 2017–2018 Reg. Sess. (Cal. 2017). AB 546 would also require permitting forms to be publicly available online. *Id.* At this point, no official guide exists for California battery deployment, but that does not need to stop cities from working to create one.

Pilots

Cities and urban areas can also smartly explore energy storage in a way that will benefit them and their residents through testing pilot programs. As energy demands for urban areas increase and infrastructure ages or is not updated as quickly, electric transmission line failures are a looming concern in many parts of the USA, including California. Trying pilot projects now that are catered to an individual community's need may be able to alleviate future problems with administration of the grid.

Disaster preparedness or bolstering critical infrastructure is well suited for energy storage pilots, because the more options for reliable energy in a disaster, the better. If large storage facilities are available, they may be used instead of, e.g., a diesel backup generator. San Francisco is currently in the midst of implementing the Solar and Storage for Resiliency Project, sponsored by the U.S. Department of Energy, which intends to deploy a plan for stored solar energy to be able to provide for critical loads after an emergency. City and County of San Francisco Department of Environment, *Solar and Energy Storage for Resiliency*, *available at* https://sfenvironment.org/solar-energy-storage-for-resiliency. A recent report from San Francisco showed that gas and electric lines can take days or weeks to recover from a disaster and so preparing additional options will likely hasten recovery. City and County of San Francisco Office of Resilience & Recovery, Lifelines Interdependency Study (2014). Using storage as even a short-term backup would help fill the gap until permanent fixes are in place and the electrical system powers back up.

In 2015, unexpected events led to an encouraging demonstration of renewable storage applications. That year the Aliso Canyon Storage Facility, a gas storage facility used by Southern California Edison (SCE), suffered a gas blowout, leaving SCE below its load capacity requirement. This came at a difficult time for SCE, because it had a few years previously decided to close the San Onofre Nuclear Generating Station, which had already reduced its load capacity. When the CPUC demanded that SCE improve their load capacity, SCE turned to an energy storage solution they could deploy both quickly and cost-effectively to ratepayers. SCE selected multiple suppliers for an astounding 261 MW of energy storage resources to cover their load capacity. The speed at which SCE was able to deploy batteries—in under a year—paled in comparison to the multiyear process of building another gas plant. Although unexpected, SCE's load capacity scenario offered a successful demonstration of how energy storage systems can be deployed in both an affordable and time-sensitive manner.

Finally, opportunities exist for California cities to partner with private companies and learn from their programs. For example, companies such as ChargePoint, which manufactures electric vehicle charging stations, provide the smart meter software that attaches to the charging station. The accompanying software allows a city to manage its electricity load by adjusting the charge based on timing, although the practice varies by city.

Currently, the economics of energy pricing lends itself to commercial customers benefiting from storage compared to noncommercial customers. At this time, the ideal use for a battery is peak shaving, that is, gathering energy to store during periods of light usage on the grid and delivering energy to the user during times of high demand. This technique reduces electrical consumption during periods of maximum demand on the grid, often when energy prices are at their highest. Time-of-use pricing, currently in place for commercial and municipal customers, but not widespread for residential customers until it will become the default in 2019, allows batteries help to manage peak load. This means that time-of-use utility customers can avoid hefty demand charges by effectively managing their grid through the installation of a battery pack and the accompanying software that many companies include to time when to store and when to buy energy from the grid. The software generally includes the ability to time energy purchase when prices are low and switch power usage to the battery at peak demand when prices are the highest. Utilities have engaged in partnerships with companies such as Stem, which provides demand response services that are instantaneous, that automatically meet demand response commitments without having to notify and wait for a response from customers. Although a partnership or engagement may look different with a city or municipal electrical company, lessons can be learned from applications that have succeeded. Such lessons could be especially useful for exploring the best demand management practices before time-of-use rates reach all residents.

Planning Ahead

The CPUC estimates that by the mid-2020s, up to 85 percent of California energy customers will be using community choice aggregators (CCAs) or direct access providers. Today, the majority of ratepayers use long-standing investor-owned utilities for their energy needs. This shift is expected to create many changes to the energy rate structure and to how the grid will function. Given this impending systemic upheaval, cities can and should begin thinking about how they will adjust to the changes in the next few years.

Although batteries remain highly popular for smaller-scale storage applications, numerous other energy storage solutions abound. Along with batteries, current large storage options include chemical storage, compressed air, pumped hydroelectric storage, and other technologies able to integrate into the grid system. One such creative and simple option, the Ice Bear, is a distributed ice battery being deployed by SCE to commercial and industrial buildings in Orange County in SCE's efforts to reach its storage goals.

The Electric Power Research Institute, a nonprofit research institute that studies the electric power industry, released a guide that presents a cost benefit model for planning integrated and distributed energy resources into an electric system. Factors to consider include costs of the storage system, installation, and operations for both utilities and customers. Electric Power Research Institute, The Integrated Grid (2015). Such resources can help cities evaluate storage systems in planning ahead for future adoption.

Current Issues Facing Local Cities in Battery Deployment

Certainly, many barriers remain for cities and urban areas before they will achieve widespread energy storage adoption. At this point, energy storage solutions are not usually a city's first step in reaching renewable energy goals. For example, despite consistent and dramatic lowering of battery costs, the costs of batteries are still high compared to other energy optimization measures. Yet, given the significant technological advancements in hardware and software and the increasing popularity of electric vehicles, prices will likely lower even further. Costs have dropped enough for businesses to justify deploying them for demand charge management, and residents may follow when time–of-use rate structures commence in the coming years.

On a larger scale, utility companies and municipalities are already building storage facilities to regulate peak demand. Here, a mix of battery and non-battery options are used given a battery's short-term storage abilities.

The new wave of utility management and grid usage, discussed briefly above, will ultimately be an enormous factor in energy management. Both the energy market and flow of electricity, now primarily flowing in one direction toward the consumer, may be modified in the future to accommodate a need for a two-way flow. In addition, the expansion of smart meters, now used by many homes and electric vehicle charging stations, can be creatively managed to regulate the flow of energy with the help of storage reservoirs. While the potential redesign of the utility structure is a complex topic on its own, the deployment of smart meters by cities could lead to battery adoption in front of and behind the meter.

Conclusion

Renewable energy storage technology provides an optimal low-carbon solution for storing renewable energy power, contributing to overall improved air quality and cleaner energy on the grid. Increasing energy storage deployment will likely be a key aspect of rapid changes currently under way in the California electric market. Many different applications exist for storage use, and California cities are uniquely situated to creatively lead the way for broader adoption.

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