Our air is cleaner, but challenges remain

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Narrative: The US continues to make progress on improving air quality since the Clean Air Act’s enactment in 1970. This graph from US EPAs Air Trends website displays how regulations and advancements in technology have led to efficiency improvements, lower emissions, and cleaner air. While the economy (GDP) has continued to grow, the aggregate emissions from the major criteria pollutants EPA regulates have shrunk by 60% since 1990.

Source: U.S. Environmental Protection Agency

URL: http://www.epa.gov/air/airtrends/index.html

Notes: 2
Here is a closer look at national trends by each pollutant since 1990. The greatest progress is seen in Sulfur Dioxide (SO\textsubscript{2}) – a major precursor to acid rain. SO\textsubscript{2} has diminished largely due to emission scrubbers on power plants, and advancements in manufacturing lower sulfur fuels. Progress is less substantial on ozone (O\textsubscript{3}) and fine particulate matter (PM\textsubscript{2.5}). A significant challenge with ozone and PM\textsubscript{2.5} are their precursors. Put simply, pollutants are created either directly by emissions sources like power plants or indirectly when “precursor” pollutants mix together in the atmosphere, and chemically react to form a new pollutant. PM\textsubscript{2.5} is emitted during combustion (vehicles, fires), but also forms in the atmosphere when volatile organic compounds (VOCs), nitrogen dioxide, and sulfur dioxide chemically react. Here we focus only on direct emissions, and therefore do not cover ozone, however ozone’s precursor pollutants (NO\textsubscript{x}, SO\textsubscript{x}) are discussed.

Source: U.S. Environmental Protection Agency
Notes: Figure 4b Comparison of national levels of the six common pollutants to the most recent national ambient air quality standards, 1990-2010. National levels are averages across all monitors with complete data for the time period.
Narrative: This graphic shows how air quality changed between 1980 and 2010, and between 2000 and 2010. There is no data for particulates in 1980. You can see that all of the major air pollutants have declined in recent decades.

Source: Environmental Protection Agency

URL: http://www.epa.gov/airtrends/aqtrends.html

Notes: EPA creates air quality trends using measurements from monitors located across the country. The table below shows that air quality based on concentrations of the common pollutants has improved nationally since 1980.
Here’s a slightly different way of looking at the issue: the emissions sources responsible for each of the pollutants. Once again, there have been dramatic improvements in recent decades.

Source: Environmental Protection Agency
URL: http://www.epa.gov/airtrends/aqtrends.html
Notes: EPA estimates nationwide emissions of ambient air pollutants and the pollutants they are formed from (their precursors). These estimates are based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources. Emission estimates are based on many factors, including levels of industrial activity, technological developments, fuel consumption, vehicle miles traveled, and other activities that cause air pollution.
Narrative: Although the nation’s air quality is clearly improving, tens of millions of Americans are still exposed to unhealthy air. In total, about 124 million people lived in counties that exceeded one or more federal health standards.

Source: Environmental Protection Agency
URL: http://www.epa.gov/airtrends/aqtrends.html#comparison
http://www.epa.gov/airtrends/2011/dl_graph.html

Notes: Number of people (in millions) living in counties with air quality concentrations above the level of the primary (health-based) National Ambient Air Quality Standards (NAAQS) in 2010.
“Despite great progress in air quality improvement, approximately 124 million people nationwide lived in counties with pollution levels above the primary NAAQS in 2010. Note: In 2008, EPA strengthened the national standards for 8-hour ozone to 0.075 ppm and the national standards for lead to 0.15 µg/m³. This figure includes people living in counties that monitored ozone and lead concentrations above the new levels.
In addition, from 1990 to 2005, emissions of air toxics declined by approximately 42 percent. These reductions are the result of implementing stationary and mobile source regulations. The majority of the air toxics emitted in 2005 are also precursors of ozone and/or particle pollution.”
Narrative: This map shows the estimated cancer risk by census tract. In the West, areas around big cities, such as Los Angeles, Phoenix, Denver, and Portland, have higher rates of cancer associated with toxic air pollutants.

Source: Environmental Protection Agency
URL: http://www.epa.gov/airtrends/2011/dl_graph.html
Notes: Estimated census-tract cancer risk from the 2005 National-Scale Air Toxics Assessment (NATA2005). Darker colors show greater cancer risk associated with toxic air pollutants.
Narrative: This map shows how many days on which a city’s air quality index exceeded 100, a level at which pollution can be unhealthy for sensitive groups. Los Angeles stands out as the Western city with the worst air pollution, while Seattle and Portland in the Pacific Northwest have relatively few bad air days. In general, the number of bad days has been decreasing over the past decade.

Source: Environmental Protection Agency

URL: Number of days on which AQI values were greater than 100 during 2002-2010 in selected cities.
Narrative: Let’s take a look at the sources of air pollution, beginning with those that directly emit particulate matter, PM2.5. As you can see, not all states are equal contributors, and the source profiles by state also vary. California, the 8th largest economy in the world and most populous state, is not surprisingly the largest polluter. Within California, the sources are relatively evenly distributed. Note that fire and dust were significant in 2008. From 2007-2009, California was in a drought. Overall PM2.5 levels were higher in 2008 than in 2006 (as seen in our earlier slides) and the drought could have been a major reason why. Dust also is a major polluter in arid states like New Mexico. “All other sources” is made up of agriculture, industrial processes, solvents, and miscellaneous.

Source: U.S. Environmental Protection Agency
URL: http://www.epa.gov/air/emissions/multi.htm
Notes: Multi-Pollutant Comparison by Source Sector and by State, Short Tons. Relative sizes of the pies by state are calculated by ratio to the largest emitting state. In this case California.
Next let’s look at NOx (oxides of nitrogen). NOx is important because along with VOCs and carbon monoxide, it is a major precursor to ozone. Ozone, while a critical element in the upper atmosphere is a pollutant at ground level – we usually observe it as smog. As you can see, California once again dwarfs the other states, and the primary culprit is mobile sources. This is the result of a large population doing a lot of driving in a sprawling state. There is also a lot of industry serving those people, and California houses the largest ports in the United States. Ships, trucks, trains, and supporting equipment, along with the vast number of passenger cars, are the reason California’s NOx levels loom large over other Western states.

Source: U.S. Environmental Protection Agency
URL: http://www.epa.gov/air/emissions/multi.htm
Notes: Multi-Pollutant Comparison by Source Sector and by State, Short Tons. Relative sizes of the pies by state are calculated by ratio to the largest emitting state, in this case California.
Narrative: California has done better with sulfur dioxide. As you can see here, the largest states for sulfur dioxide emissions are Arizona, Colorado, and Wyoming. What these states have in common is coal. Coal power plants are the single largest source of anthropogenic sulfur dioxide. Wyoming not only gets 95% of its power from coal plants, but it’s also a major supplier of coal and is home of the Powder River Basin. If you look at Washington and California, mobile sources are one-third or more of sulfur dioxide emissions. Washington and California are not major coal burning states, but they are significant marine ports. The large freight ships that carry containers of goods between the U.S. and Asia burn bunker fuel, which is inexpensive but very dirty, and has high sulfur content.

Source: U.S. Environmental Protection Agency
URL: http://www.epa.gov/air/emissions/multi.htm
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Relative sizes of the pies by state are calculated by ratio to the largest emitting state, in this case California.
Volatile organic compounds (VOCs) are important because they're a precursor to ozone and PM2.5. They are emitted in many consumer goods (cleaning fluids, paints, printing inks), as well as industrial sources and fuels. Because they are in pesticides, agriculture can also be a significant source in some states, like Idaho. Overall, VOCs are more of a concern for indoor than outdoor air quality: EPA has found that VOCs can be 2-5 times higher inside households than outside.

Source: U.S. Environmental Protection Agency
URL: http://www.epa.gov/air/emissions/multi.htm
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Carbon monoxide emissions have declined steeply, falling on average 80% below the national standard for CO over the last 20 years, due to advancements in vehicle technology and fuels. Though California remains the largest source for CO in the West due to the large number cars and trucks, it remains in compliance with EPA standards.

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