

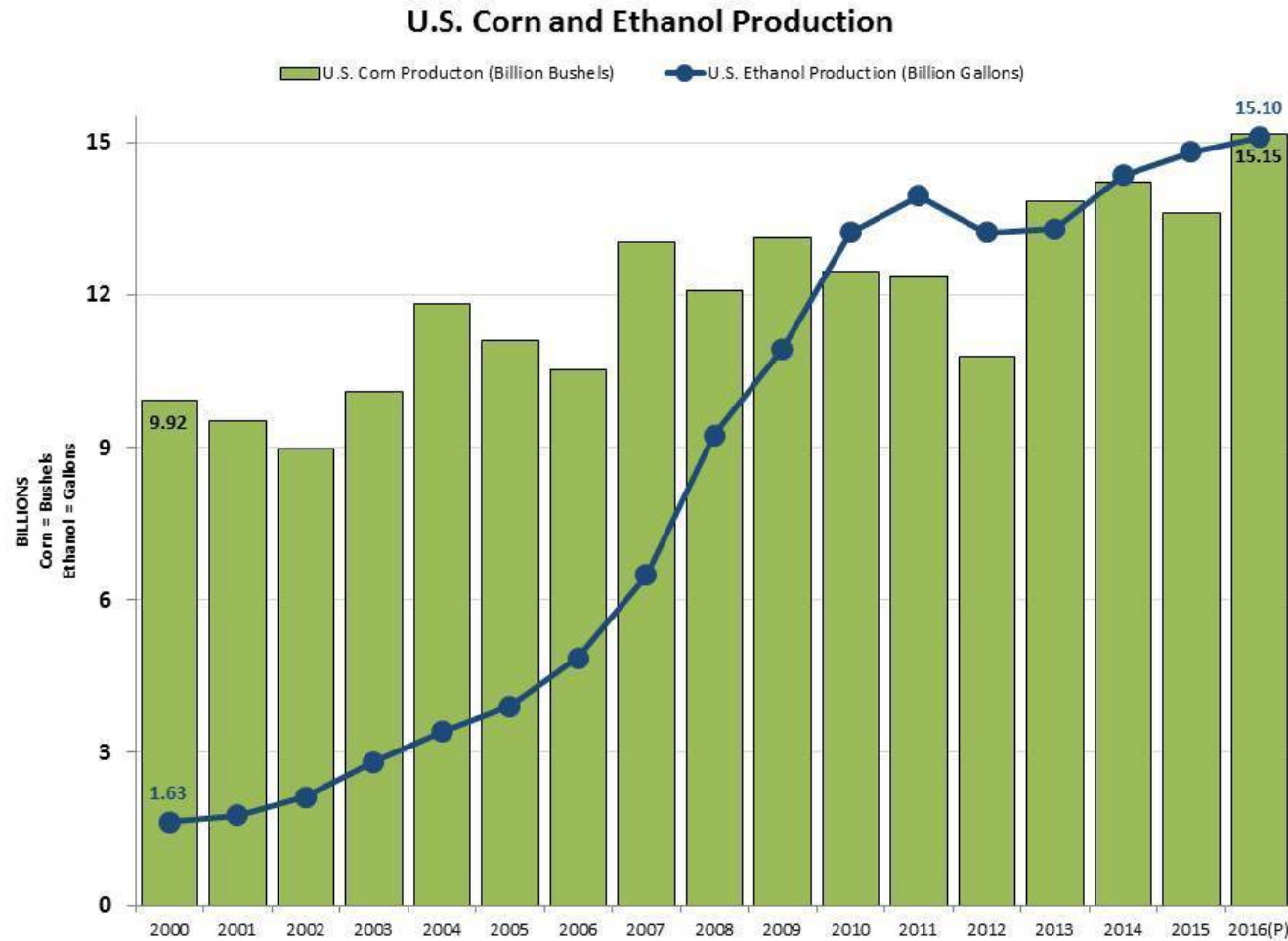
# Roundtable: Is Your Fuel Killing You?

- Steffen Mueller, PhD, University of Illinois at Chicago  
Energy Resources Center

**THE  
UNIVERSITY OF  
ILLINOIS  
AT  
CHICAGO**

**Iowa RFA Meeting  
2018**

# Increase in Corn Ethanol Use



# Decrease in Air Toxins

## Ambient and Emission Trends of Toxic Air Contaminants in California

Environmental Science & Technology

Article

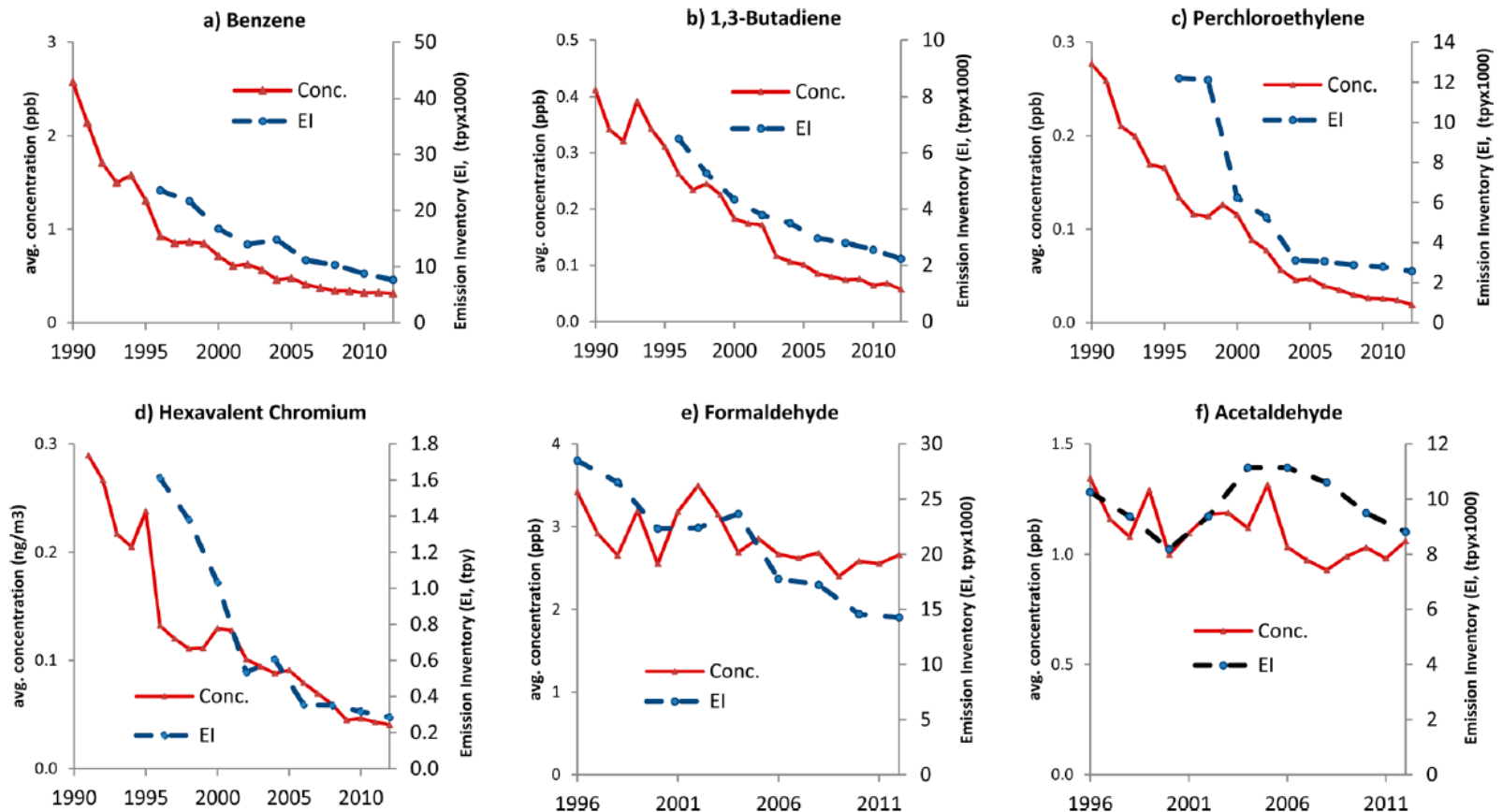


Figure 3. Statewide annual average concentrations and emissions inventory (EI) trends for six toxic air contaminants. EI data were available starting in 1996. (a) Benzene (1990–2012), (b) 1,3-Butadiene (1990–2012), (c) Perchloroethylene (1990–2012), (d) Hexavalent Chromium (1991–2012), (e) Formaldehyde (1996–2012), (f) Acetaldehyde (1996–2012).

## It's the Relative Toxicity that Counts

- "Toxic air contaminant" means benzene, 1,3-butadiene, formaldehyde, or acetaldehyde.
- "In each test, the emission rate of each toxic pollutant shall be multiplied by its relative potency, as shown in the following table, and the four products shall be summed."

	<i>Relative Potency</i>
1,3-butadiene	1.0
benzene	0.17
formaldehyde	0.035
acetaldehyde	0.016



ATTACHMENT A-13; State of California;  
California Environmental Protection  
Agency; AIR RESOURCES BOARD;  
Stationary Source Division CALIFORNIA  
TEST PROCEDURES FOR EVALUATING  
SUBSTITUTE FUELS AND NEW CLEAN FUELS  
IN 2015 AND SUBSEQUENT YEARS;  
Adopted: March 22, 2012

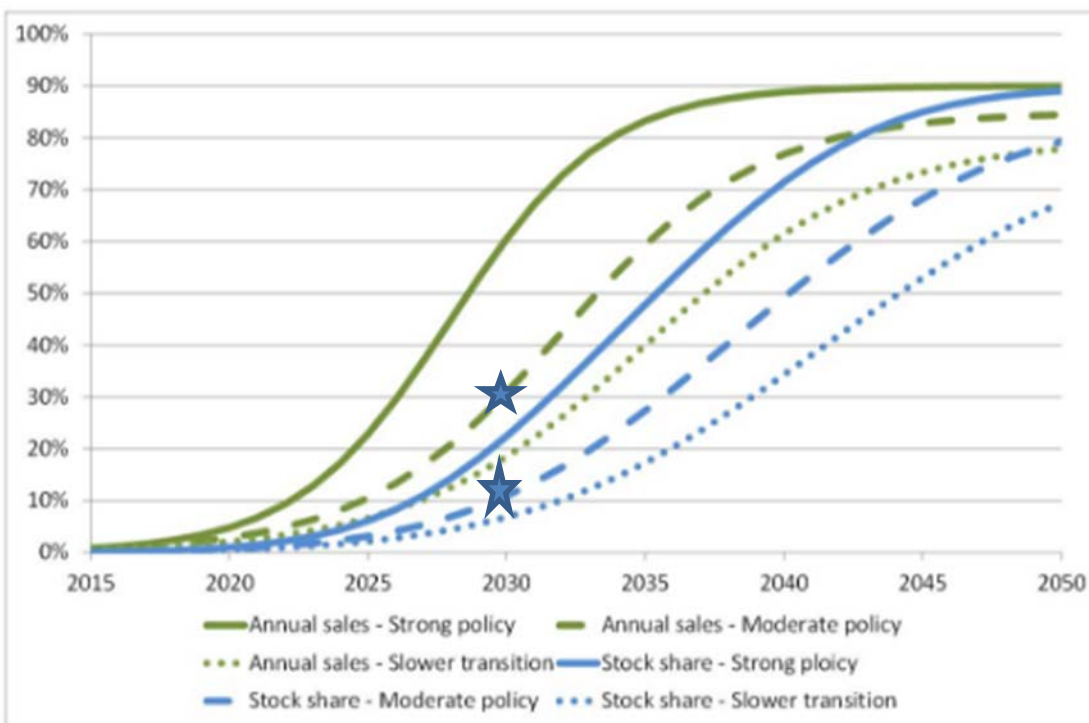
# **New Emissions Study for 5 Major Global Cities including Beijing/Tianjin**

**The University of Illinois at Chicago  
International Biofuels and Emissions  
Analysis Model (iBEAM)**



# Electric Vehicles are not the Silver Bullet to Clean Air: We will need very high annual Electric Vehicle Sales to Turn over Existing Vehicle Stock

- Whitmore global EV adoption model: Annual EV vehicle sales will account for between 20% to 60% by the year 2030 converting to 7% and 22% of total vehicle stock depending on the policy scenario.
- Roland Berger report cites annual new vehicle sales of EVs by 2030 of 19% (3% Battery Hybrid plus 3% Plug-in Electric Vehicle plus 1% Full Hybrid and 11% Mild Hybrid) which would correspond more closely with the slower adoption scenario by Whitmore



Green Line: Annual Sales  
Blue Line: Vehicle Stock Change

Source: Whitmore, Adam: How fast could the market for electric vehicles grow?

# Summary

- E10/E15 emissions reductions for pollutants/toxins under the Clean Air Act
  - For example ethanol reduces toxicity and cancer risk by diluting **and substituting** for 1,3 Butadiene and Benzene.
- In our **Global Ethanol Study** we showed that adding ethanol to the Fuel Supply results in significant immediate emissions reductions
  - Total Hydrocarbon Reductions (THC, VOC) resulting in Significant Risk Reductions of Ozone for the Area
  - Significant Polycyclics and Weighted Toxins Reductions Reducing Cancer Risk for the Area
  - No effect on NOx
  - Reduced CO Emissions reduces heart disease and other health effects
- **Even high annual sales will only slowly change electric vehicle stock:** Ethanol for the current vehicle stock and electrification of future vehicle sales provide a combined solution to the pollution problem
- Linear Refinery Programming Showed that these Ethanol Blends Given Each country's Refinery Structure can be Produced with **Additional Profits to the Refining Sector.**