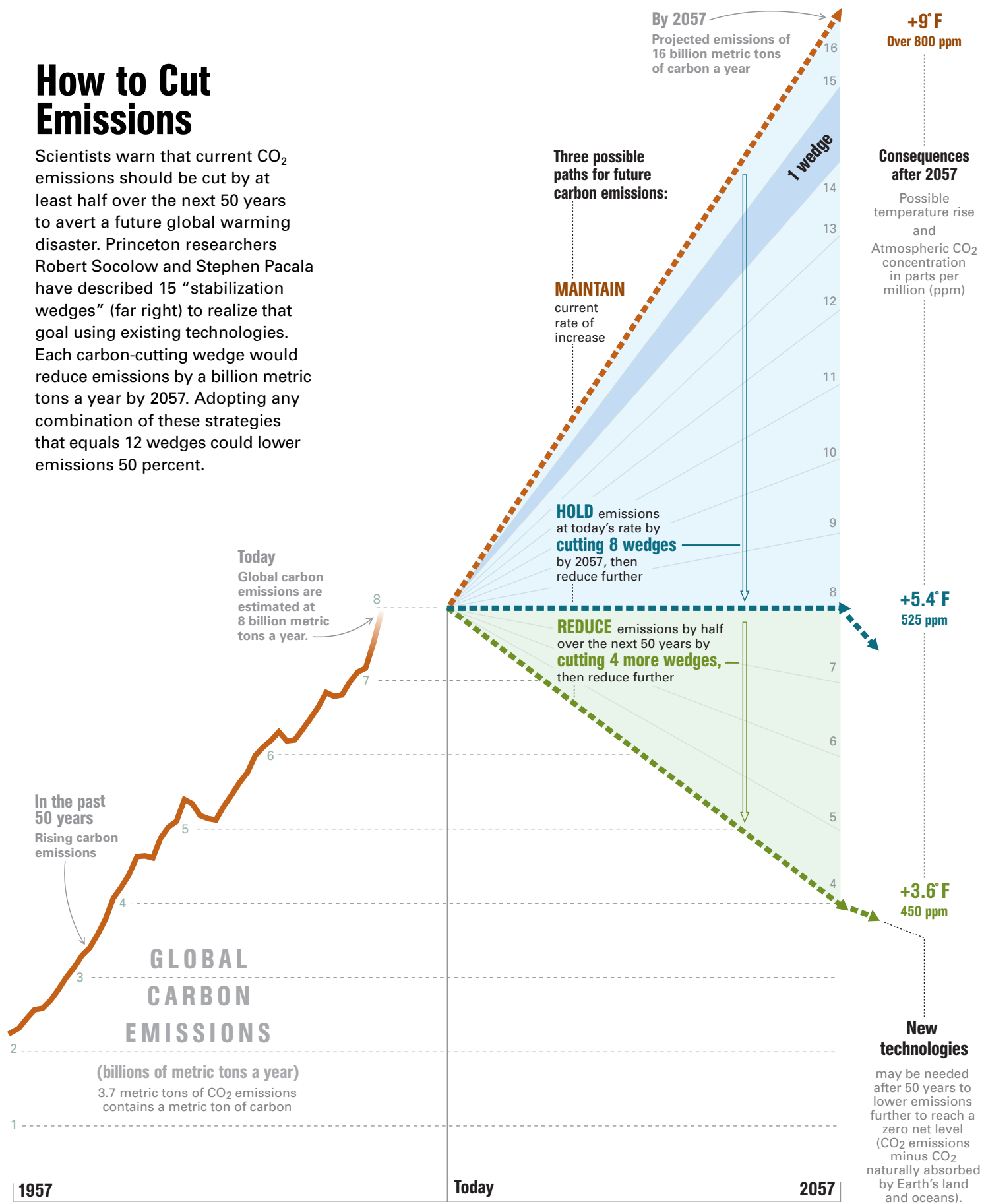


How to Cut Emissions

Scientists warn that current CO₂ emissions should be cut by at least half over the next 50 years to avert a future global warming disaster. Princeton researchers Robert Socolow and Stephen Pacala have described 15 “stabilization wedges” (far right) to realize that goal using existing technologies. Each carbon-cutting wedge would reduce emissions by a billion metric tons a year by 2057. Adopting any combination of these strategies that equals 12 wedges could lower emissions 50 percent.



ONE WEDGE AT A TIME

Each strategy listed below would, by 2057, reduce annual carbon emissions by a billion metric tons.

- Consequences after 2057**
Possible temperature rise and Atmospheric CO₂ concentration in parts per million (ppm)
- EFFICIENCY AND CONSERVATION**
 - Improve fuel economy of the two billion cars expected on the road by 2057 to 60 mpg from 30 mpg.
 - Reduce miles traveled annually per car from 10,000 to 5,000.
 - Increase efficiency in heating, cooling, lighting, and appliances by 25 percent.
 - Improve coal-fired power plant efficiency to 60 percent from 40 percent.
 - CARBON CAPTURE AND STORAGE**
 - Introduce systems to capture CO₂ and store it underground at 800 large coal-fired plants or 1,600 natural-gas-fired plants.
 - Use capture systems at coal-derived hydrogen plants producing fuel for a billion cars.
 - Use capture systems in coal-derived synthetic fuel plants producing 30 million barrels a day.
 - LOW-CARBON FUELS**
 - Replace 1,400 large coal-fired power plants with natural-gas-fired plants.
 - Displace coal by increasing production of nuclear power to three times today's capacity.
 - RENEWABLES AND BIOSTORAGE**
 - Increase wind-generated power to 25 times current capacity.
 - Increase solar power to 700 times current capacity.
 - Increase wind power to 50 times current capacity to make hydrogen for fuel-cell cars.
 - Increase ethanol biofuel production to 50 times current capacity. About one-sixth of the world's cropland would be needed.
 - Stop all deforestation.
 - Expand conservation tillage to all cropland (normal plowing releases carbon by speeding decomposition of organic matter).

SOURCES: ROBERT H. SOCOLOW AND STEPHEN W. PACALA, PRINCETON UNIVERSITY (UPDATED REPORT); OAK RIDGE NATIONAL LABORATORY (GLOBAL CARBON EMISSIONS DATA); ICONS BY JONATHAN AVERY; GRAPHIC BY JUAN VELASCO, NGM ART