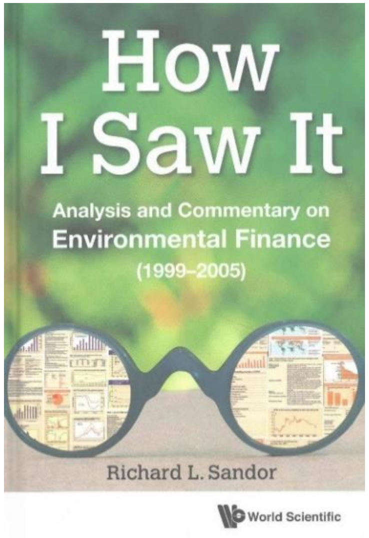
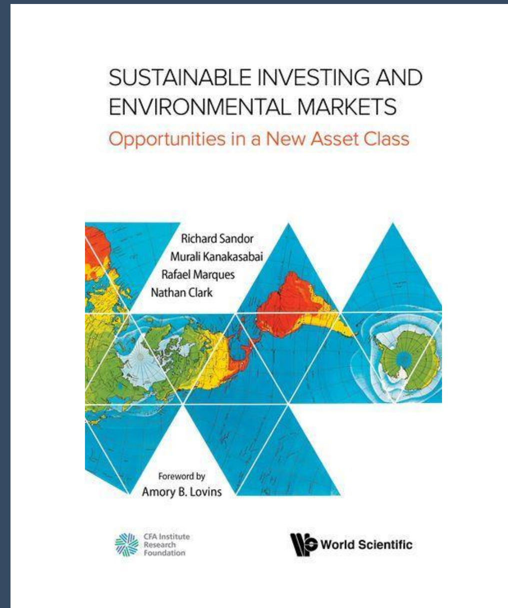
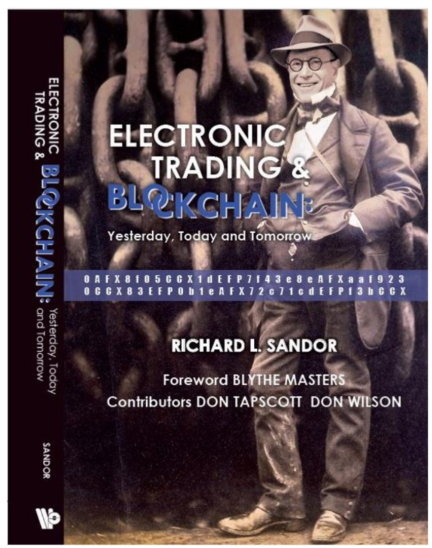






Carbon Markets and Pricing

GUIRR Presentation
July 14, 2021

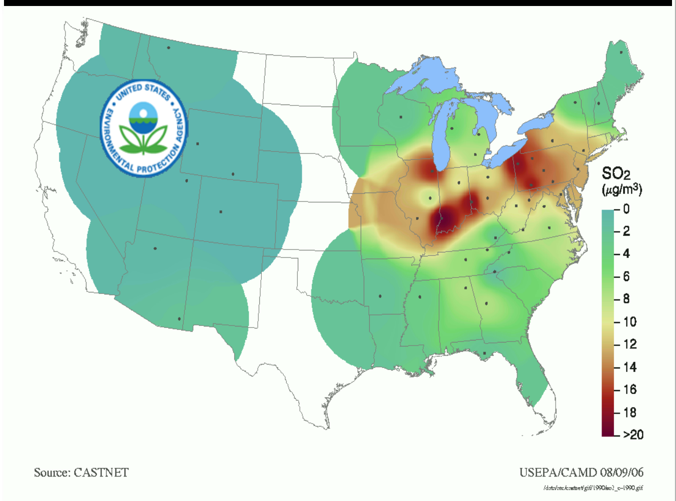
By
Dr. Richard L. Sandor

Perception:
Acid Rain Program under 1990 Act will fail

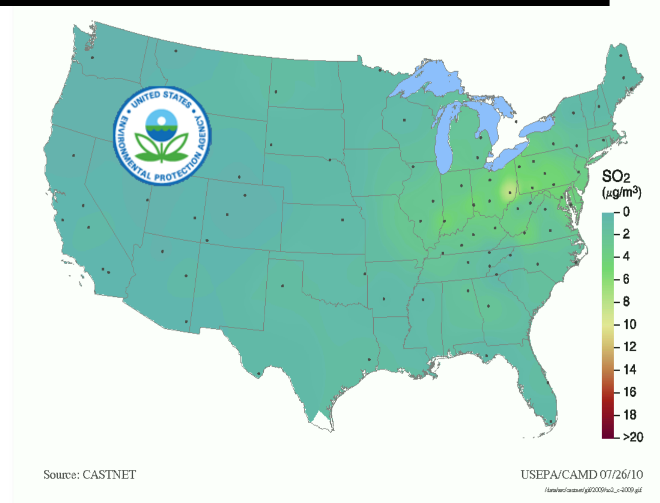
Progress in air quality management is dramatic

The United States has made huge strides forward in significantly reducing criteria emissions – particulate matter, sulfur dioxide, carbon monoxide, lead, ozone, and nitrogen oxides – while substantially increasing coal-based generation and meeting the electricity needs of an expanding population in the context of a growing economy.

1990 SO_2 Concentrations



2009 SO_2 Concentrations



MANDATORY SO2 Program: Environmental Benefits

US Clean Air Act 1990

Acid Rain Program annual benefits (2010):	**$122B**
Costs (2010):	**$3B**

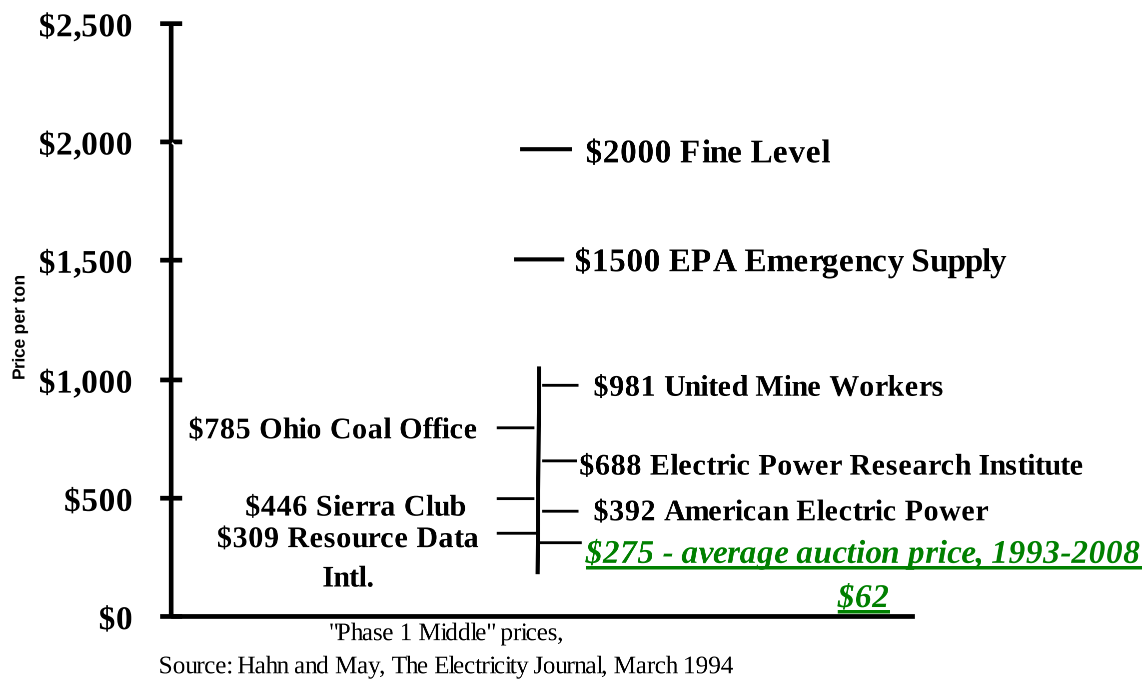
→This is a 40-to-1 benefit/cost ratio

SO2 Program: Health Benefits

US Clean Air Act 1990

- EPA estimated the annual avoidance of about **32,000 and 42,000 premature deaths** in **2010** and **2020**, respectively
- **Other benefits:** reduced aggravation and incidence of heart and lung ailments, increased productivity, reduced absences from school/work, and visibility improvement in some parks

Reality:
Pre-1992 SO2 Allowance Price Forecasted vs. Actual



Perception:
EU ETS Is A Failure

The Economist

Carbon trading

ETS, RIP?

The failure to reform Europe's carbon market will reverberate round the world

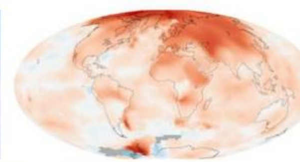
The Telegraph

EU has 'failed' to save carbon market from long-term gloom, say analysts

CORPORATE EUROPE OBSERVATORY

EU emissions trading: 5 reasons to scrap the ETS

OCTOBER 26TH 2015 | ENVIRONMENT



try again,
fail again,
fail better.

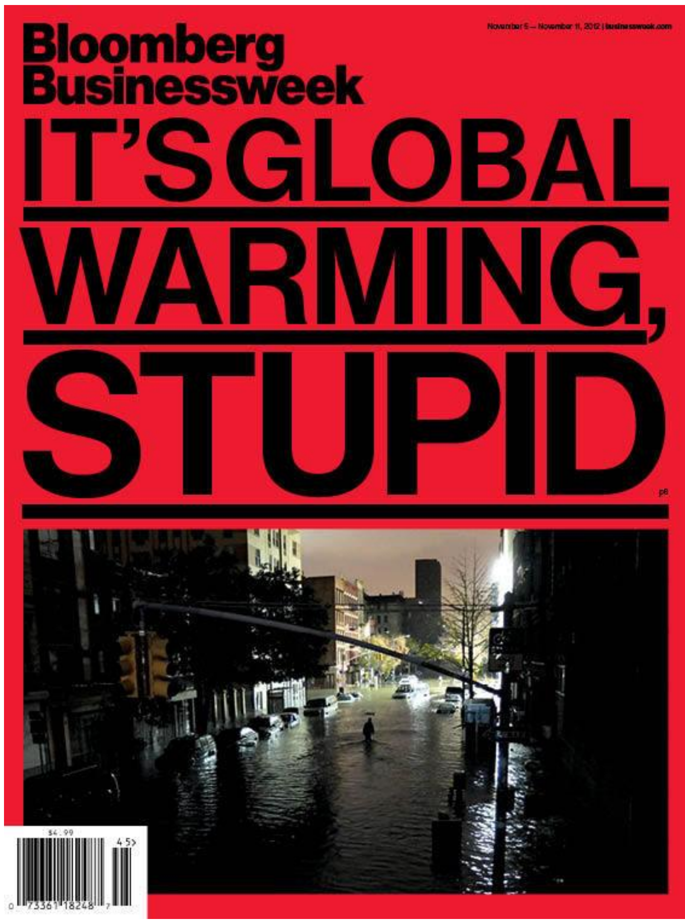
climate policy

Why the EU ETS needs reforming: an empirical analysis of the impact on company investments

Reality:
EU ETS Is A Success

	Tons of Emissions (Millions)	% Below Baseline
1990 Emissions	5,735	
Phase II 2008-2012 Target	5,276	8
Phase III 2013-2020 Target	4,588	20
Latest EU Emissions Data (2019)	4,358	24%

Perception:
Environmental Markets Are Dead in the US



Reality:
There are 16 Carbon Markets and Renewable Energy Markets in the United States

1	CCA
2	NJ Solar RECs
3	PJM RECs
4	RGGI
5	MA Solar II RECs
6	MD Solar RECs
7	MA RECs
8	MD RECs
9	MA Solar I RECs
10	CT RECs
11	PA RECs
12	PA Solar RECs
13	NEPOOL RECs
14	LCFS
15	NJ RECs
16	TX RECs

Resource: INCUBEX Building tomorrow's markets

Reality:
Carbon Open Interest vs Gold

North American Markets	ICE	Nodal	Total
RECs, Carbon & Renewable Fuels	1,105,726	135,412	1,241,138

EU Markets	ICE	EEX	Total
EU ETS & UK ETS	1,656,869	265,792	1,922,661

Total Gold Futures and Options	1,349,963

Resource:

INCUBEX
Building tomorrow's markets

Reality:
U.S. Carbon Markets are Achieving their Goals

- RGGI emissions have dropped 40% since 2005
- 2019: RGGI cap is 80,179,708, RGGI adjusted cap is 58,288,301
- 2020: RGGI cap is 78,175,215, RGGI adjusted cap is 56,283,807
- NJ will rejoin in 2020 and VA is probable to join as well.

California Cap and Trade:

- THIRD COMPLIANCE PERIOD (2018-2020): 2018: 358.3M; 2019: 346.3M; 2020: 334.2M

- Emissions have dropped 13% since peak levels in 2004 by 2016 and are back below 1990 levels, the program goal of AB32 by 2020. Program now calls for a further 40% reduction by 2030. Under a business as usual scenario, emissions where projected to exceed 500M in 2020

Resource:
INCUBEX
Building tomorrow's markets

Cost of Carbon

RGGI	$7.97
CALIFORNIA	$18.80
EUROPEAN UNION	€52.92

Perception: China and India’s Environmental Crisis

Reality: China’s Emissions Trading Pilots

- Tianjin (started by the Chicago Climate Exchange)
- Guangdong
- Beijing
- Shanghai
- Shenzhen
- Chongqing
- Hubei
- *Qingdao*

- **HEADLINE: CHINA TO BEGIN NATIONAL CAP-AND-TRADE IN SUMMER OF 2021**

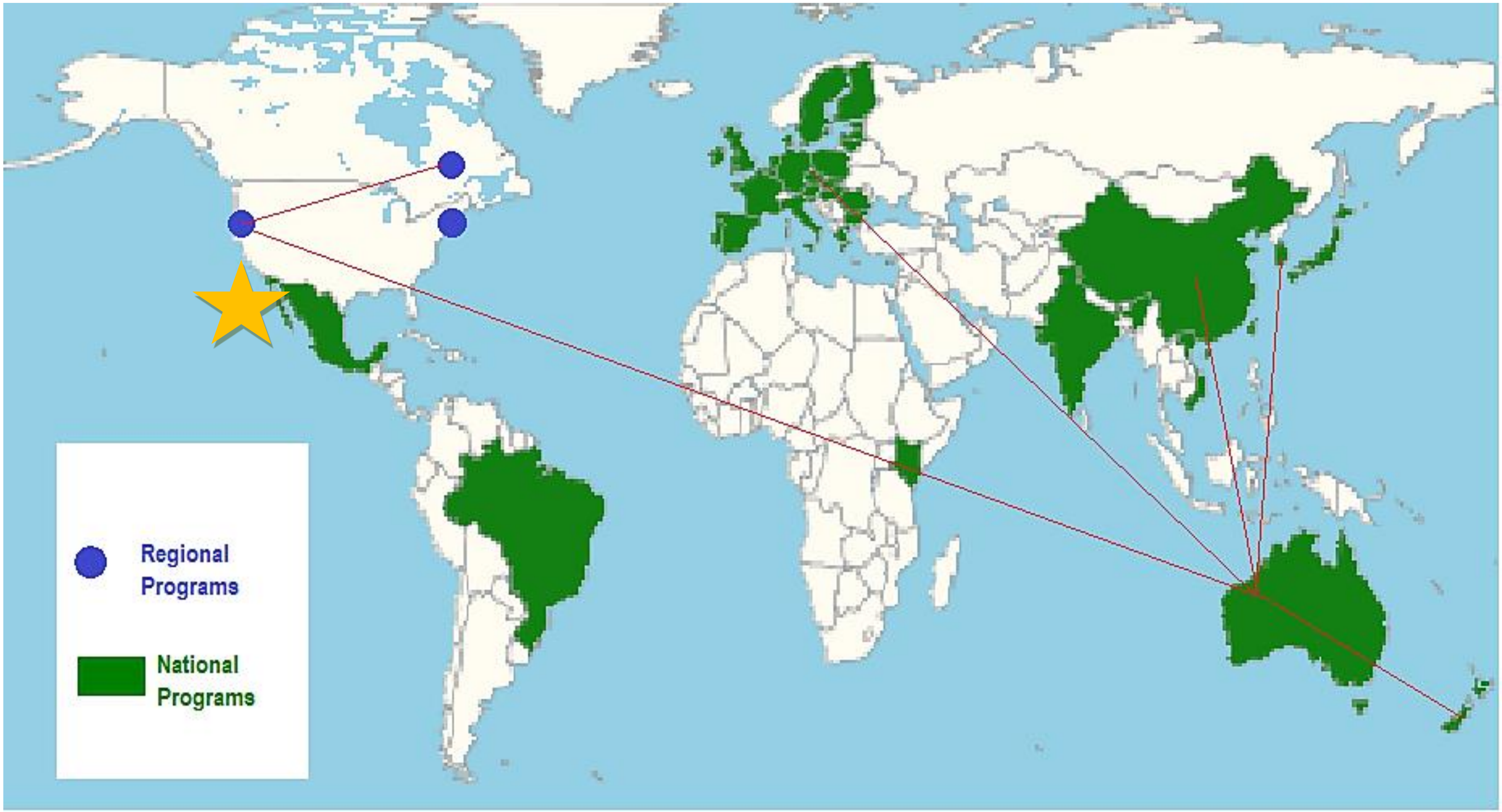
TODAY
Bastille Day July 14, 2021

THE WALL STREET JOURNAL.

China Set to Launch the World's Largest Emissions-Trading Program

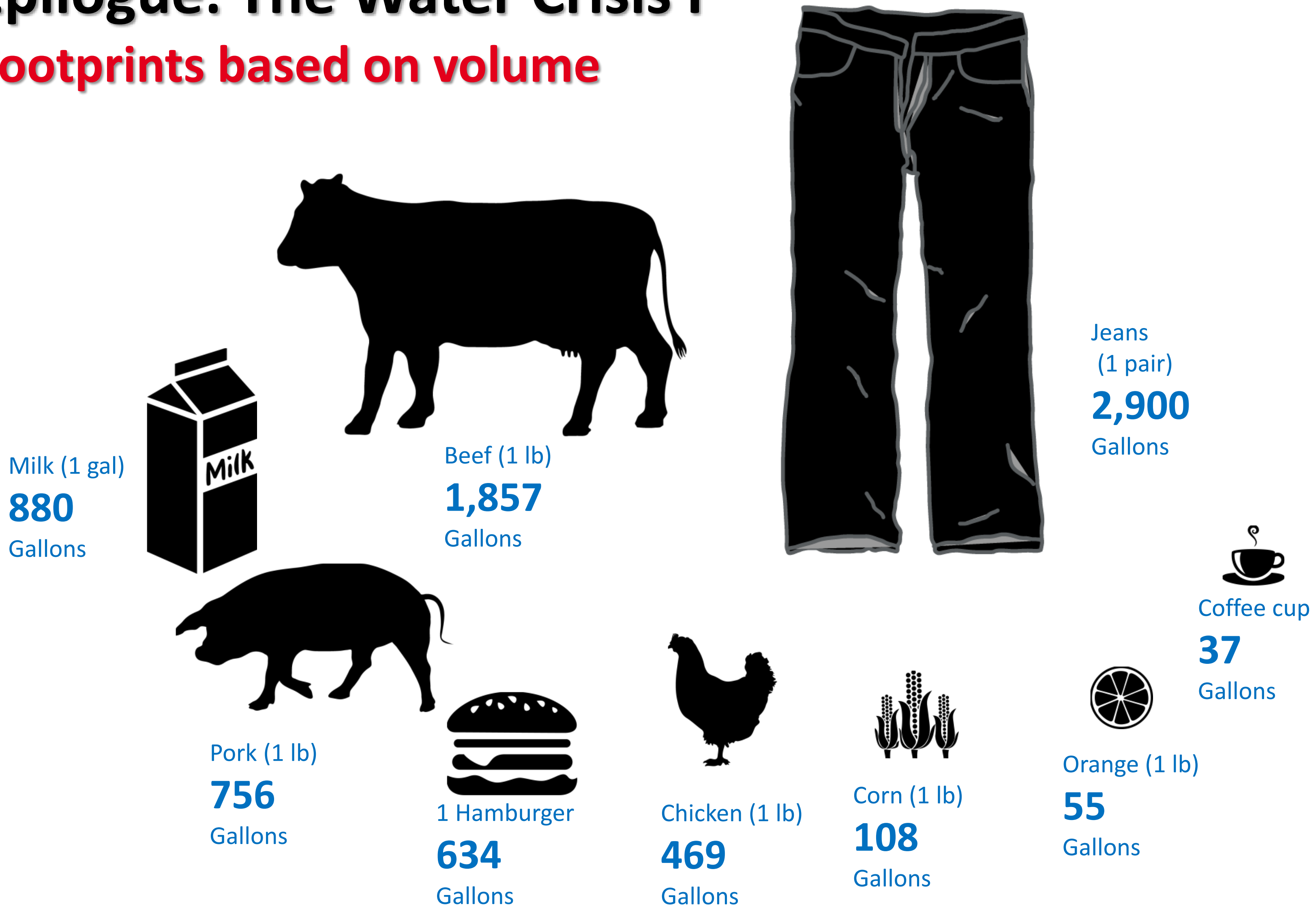
Carbon market will double the share of global emissions covered under such systems

Reality: Cap-and-Trade Worldwide



Epilogue: The Water Crisis I

Footprints based on volume



Epilogue: The Water Crisis II