GREEN CHEMISTRY: Cornerstone to a Sustainable California

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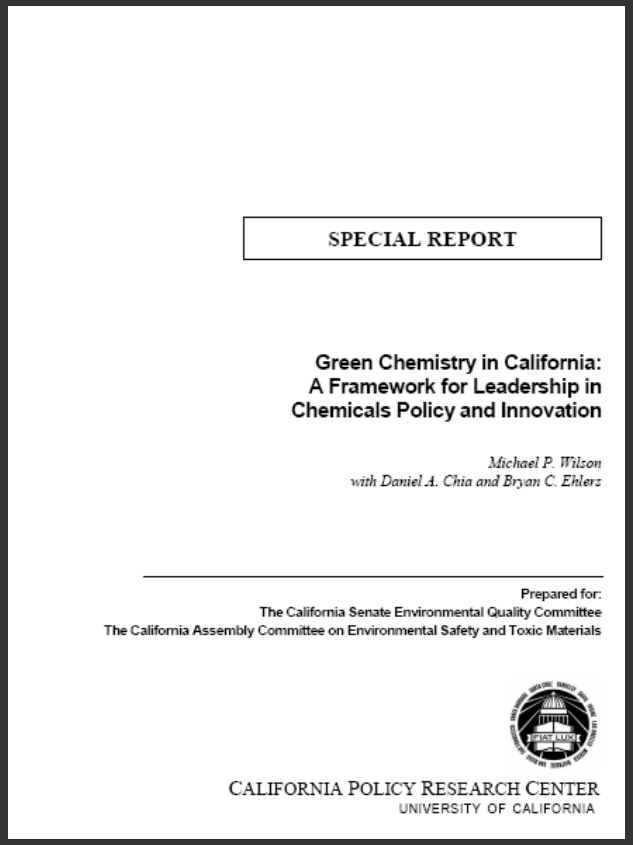


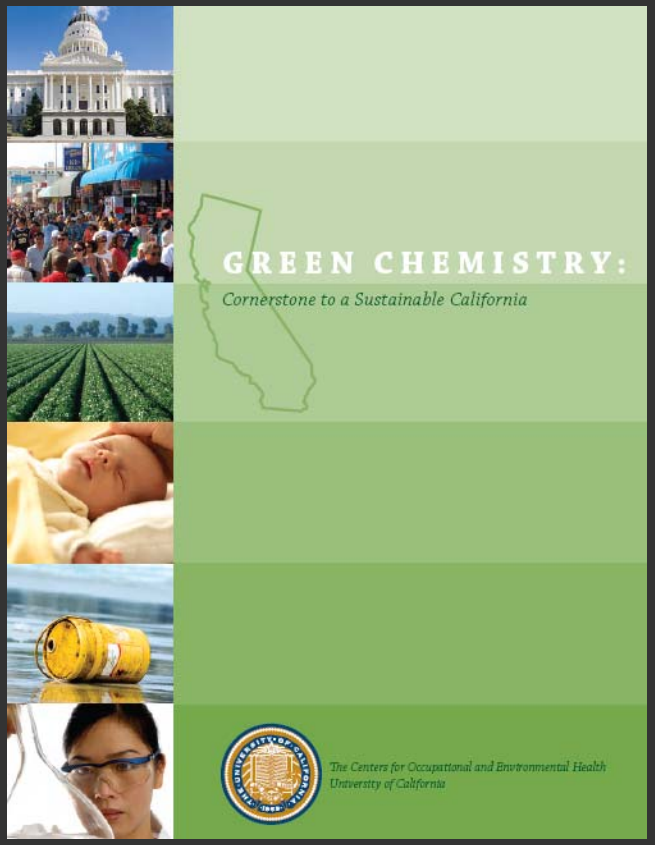
SPECIAL REPORT

Green Chemistry in California:
A Framework for Leadership in
Chemicals Policy and Innovation

Michael P. Wilson
with Daniel A. Chia and Bryan C. Ehlers

Prepared for:
The California Senate Environmental Quality Committee
The California Assembly Committee on Environmental Safety and Toxic Materials

CALIFORNIA POLICY RESEARCH CENTER
UNIVERSITY OF CALIFORNIA



GREEN CHEMISTRY:
Cornerstone to a Sustainable California

The Centers for Occupational and Environmental Health
University of California

2006: UC report to the Legislature

Green Chemistry in California:
A Framework for Leadership in
Chemicals Policy and Innovation

2008: UC report to California EPA

Green Chemistry: Cornerstone to a
Sustainable California

127 UC faculty signatories from seven campuses

- Total daily California sales of chemical products alone: 644 million pounds (2,700 tankers)
- Total daily U.S. chemical production and importation: 42 billion pounds (623,000 tankers)

Source: TSCA IUR (2006) and CA Air Resources Board (1997)

Industry, consumer, business choice

- Necessary information

Function	Price
Performance	Hazards

Industry, consumer, business choice

- Available information

Function	Price
Performance	Hazards

Government's ability to prioritize risks

- Necessary Information:

Identity	Sales volume
Uses	Hazards

Government's ability to prioritize risks

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Toxic Substances Control Act (TSCA) of 1976: Consequences

Data Gap (*transparency*):

- Producers not required to generate health & environmental data
- Businesses, consumers and workers lack hazard information

Safety Gap (*accountability*):

- EPA lacks authority to act on imminent hazards
- Producers not required to take responsibility for product lifecycle

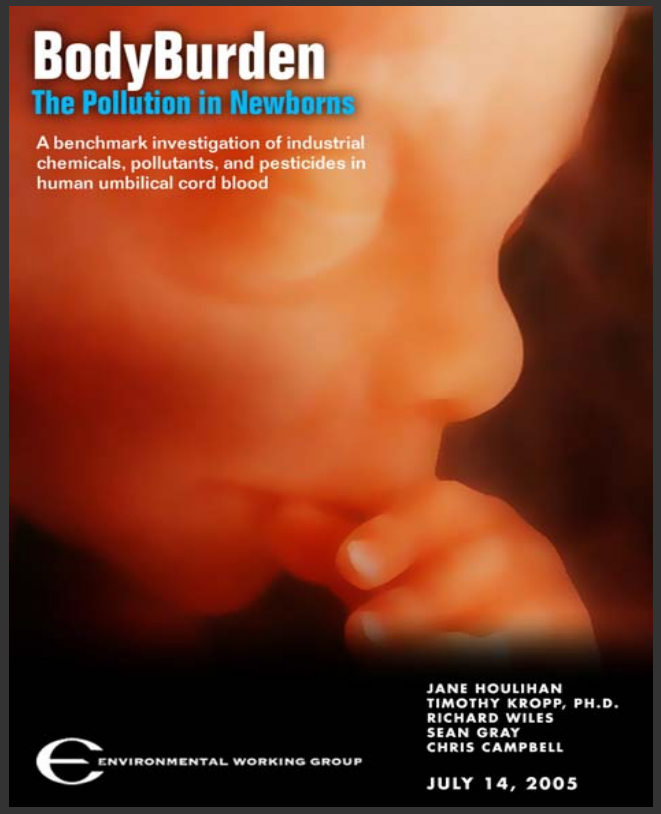
Technology Gap (*innovation*):

- Market weaknesses; lack of education, research and technical assistance discourage innovation

Externalized cost: Hazardous waste

- 61 of 85 of CA largest hazardous waste sites leaking into groundwater
- 94% pose “a major threat to human health or the environment.”
- US EPA estimates 600 new sites needed each month until 2033

Externalized cost: 287 Synthetic chemicals pollutants detected in umbilical cord blood



Mercury

Polyaromatic hydrocarbons (9)

Polybrominated dibenzodioxins & furans (7)

Perfluorinated chemicals (9)

Polychlorinated dibenzodioxins & furans (11)

Organochlorine pesticides (21)

Polybrominated diphenyl ethers (32)

Polychlorinated naphthalenes (50)

Polychlorinated biphenyls (147)

Externalized cost: Workplace exposures

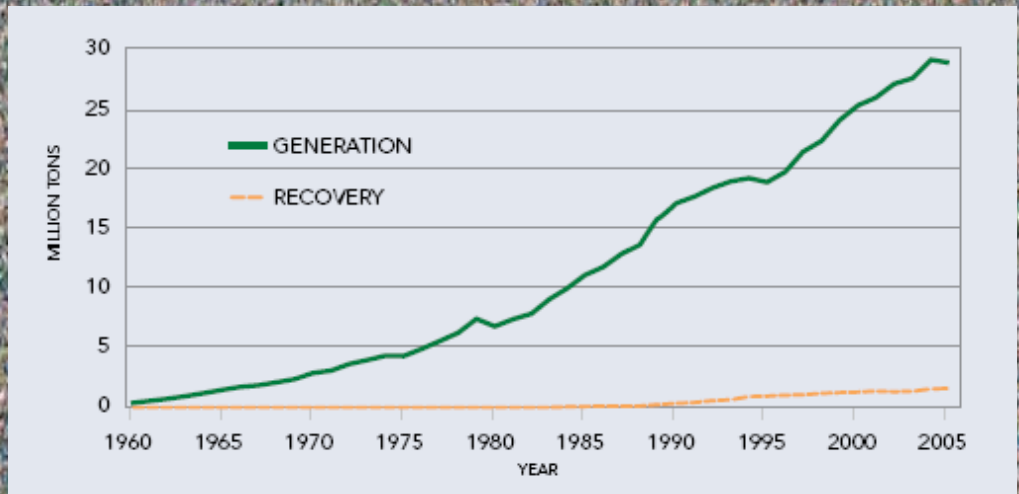
- 200,000 cases of chronic disease in 2004 in CA
- 4,400 deaths
- Of 2,800 HPV chemicals, PELs set for 193 (~7%)
- Of suspected workplace carcinogens & reproductive toxicants, 60% are HPVs

Externalized cost: Product waste

Graphic arts courtesy of Chris Jordan ~~ chrisjordan.com

Coke
PEPSI
Coca-Cola
vitamin water

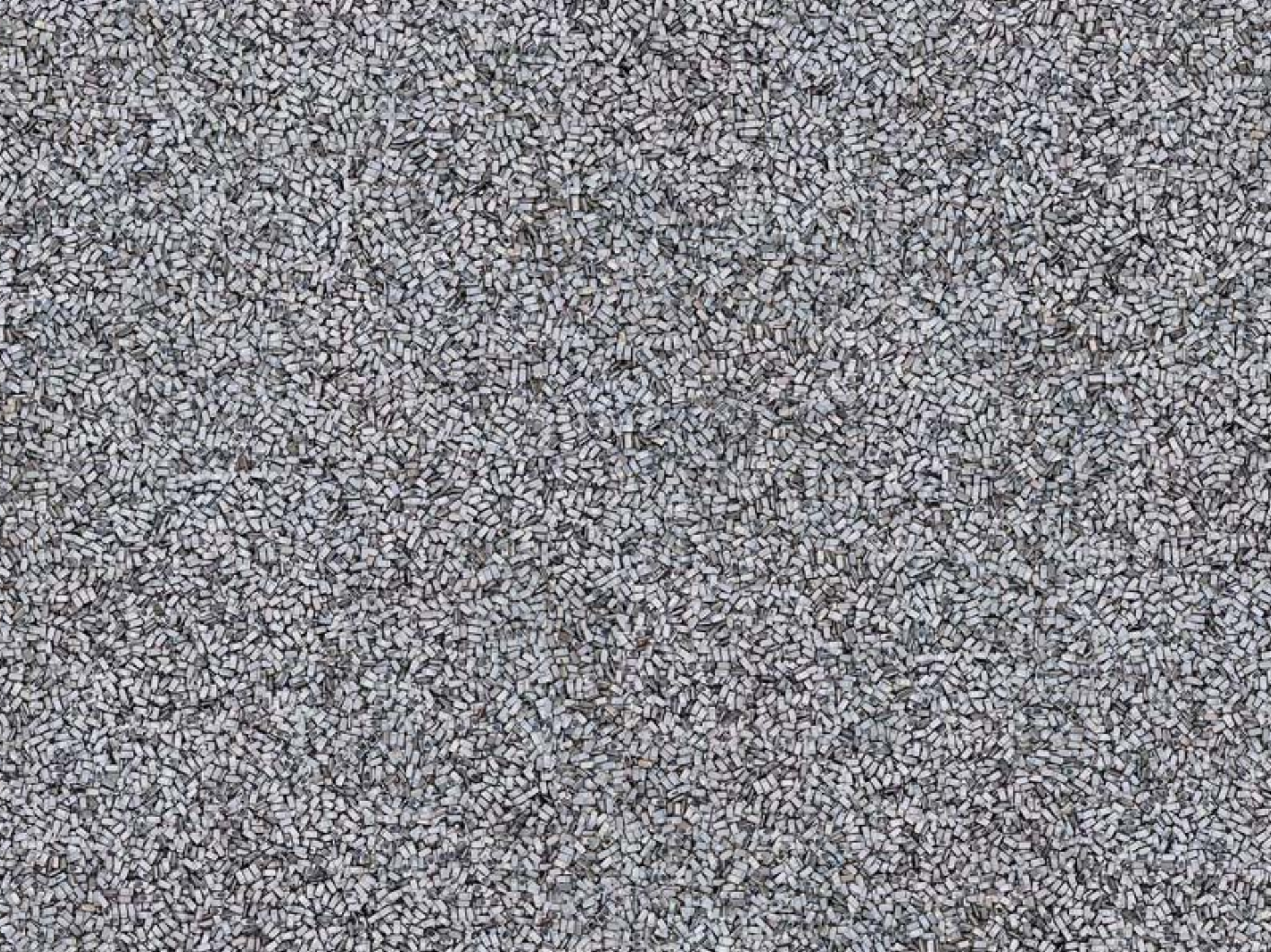
Two million plastic bottles discarded every 5 seconds in the U.S.



60,000 plastic bags used every 5 seconds in the U.S.

Plastic Contamination: the Pacific Gyre

- 90% floating debris in oceans is plastic
- Plastic outweighs phytoplankton 6:1
- Projected to grow 10-fold in 10 years
- Plastic found in 48-86% seabirds & marine mammals



426,000 cell phones retired each day in the U.S.

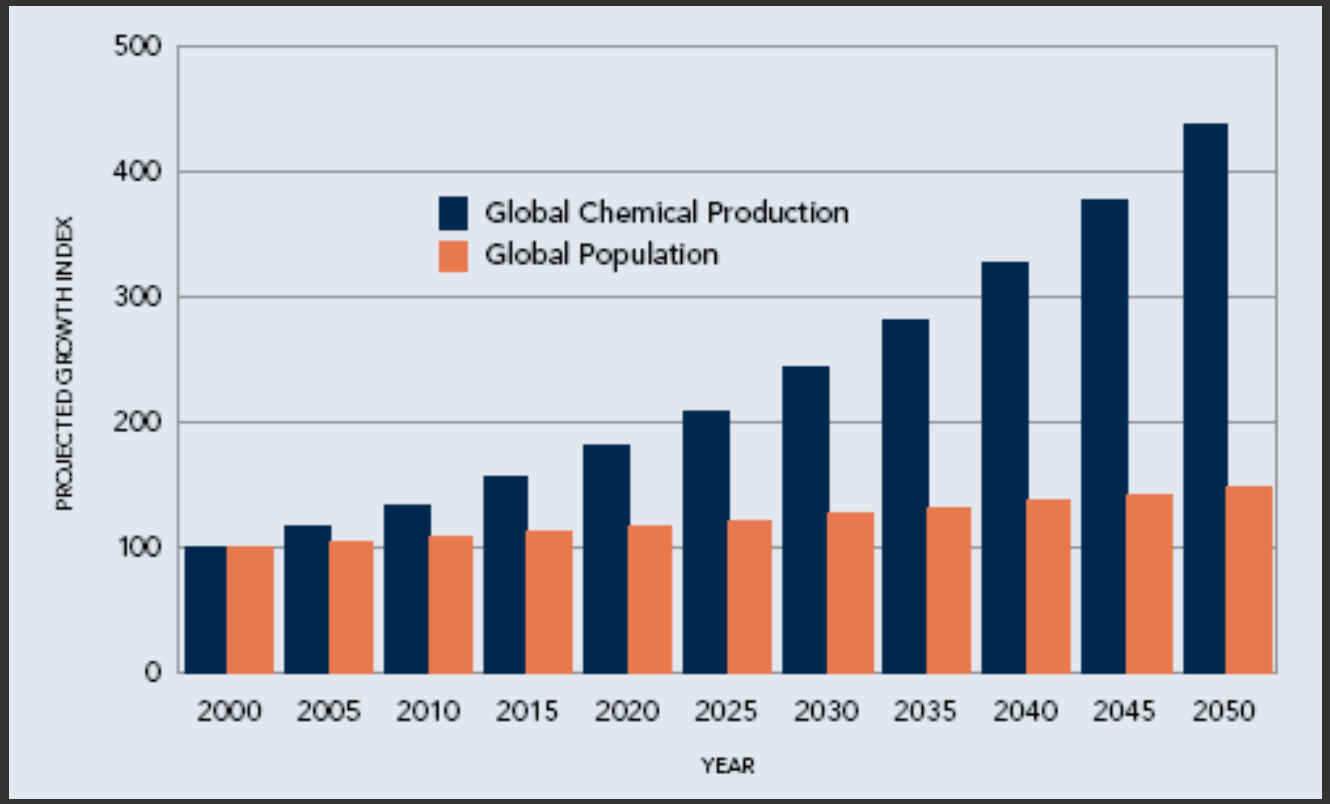
Externalized cost: Global Transport of Hazards

80% of U.S. electronic waste transported to Asian countries.
Lianjiang River, Guiyu Province, China *Photos: Basel Action Network*

Global Chemical Production

Growing 3% per year

Doubling every 25 years



European Union: The New Global Leader

- **Cosmetics Directive** (2004)
- **WEEE:** Waste in Electrical and Electronic Equipment (2005)
- **RoHS:** Restriction on Hazardous Substances (2006)
- **REACH:** Registration, Evaluation, Authorization, and Restriction of Chemicals (2007)

- California is the top U.S. exporting state to the E.U.

GREEN CHEMISTRY

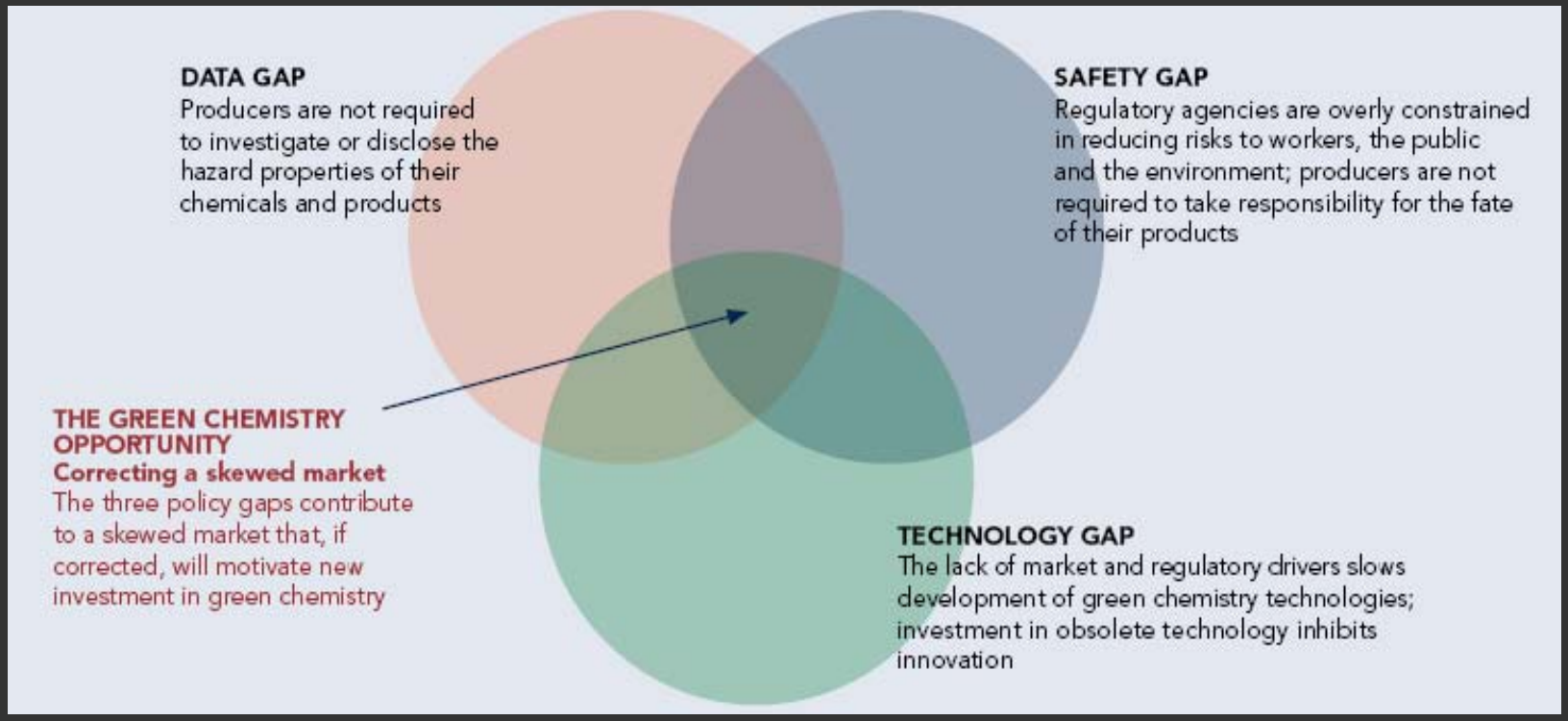
The design of chemical products and processes to reduce or eliminate substances hazardous to human health and the environment.

1. Make safer products
2. Use less-toxic feedstocks and processes
3. Design for cradle-to-cradle use
4. Account for energy efficiency

Anastas, P.T. and J. Warner. 1999. Green Chemistry Theory and Practice

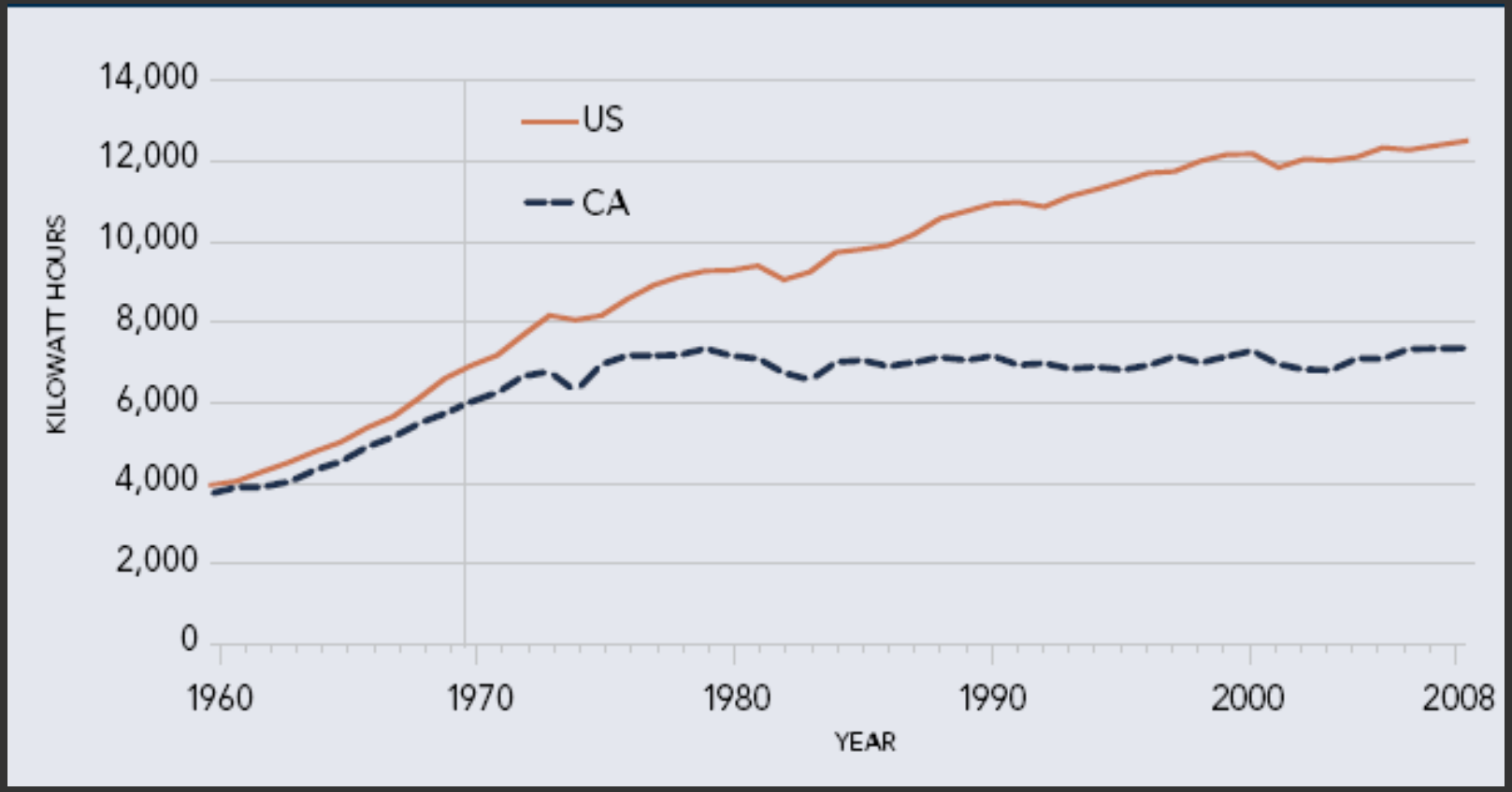
Chemicals and materials policy:

Closing the gaps & producer responsibility



California leadership

Per Capita Electricity Consumption, 1960-2007



Source: California Energy Commission, 2007

Thank you!

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