

# Green Chemistry

*Environmentally Friendly and Economically Viable*



Green Chemistry Symposium III: The Synthesis of Success  
October 30, 2007 -- Sacramento, California

Dr. Catherine T. "Katie" Hunt  
2007 President,  
American Chemical Society



# Outline

- ✓ *Thank You*
- ✓ *The Sustainability Challenge*
- ✓ *Defining Green Chemistry and Engineering*
- ✓ *ACS Commitment to Green Chemistry*
- ✓ *The Government Role in Green Chemistry?*



*Thank you... to the Home Team!*



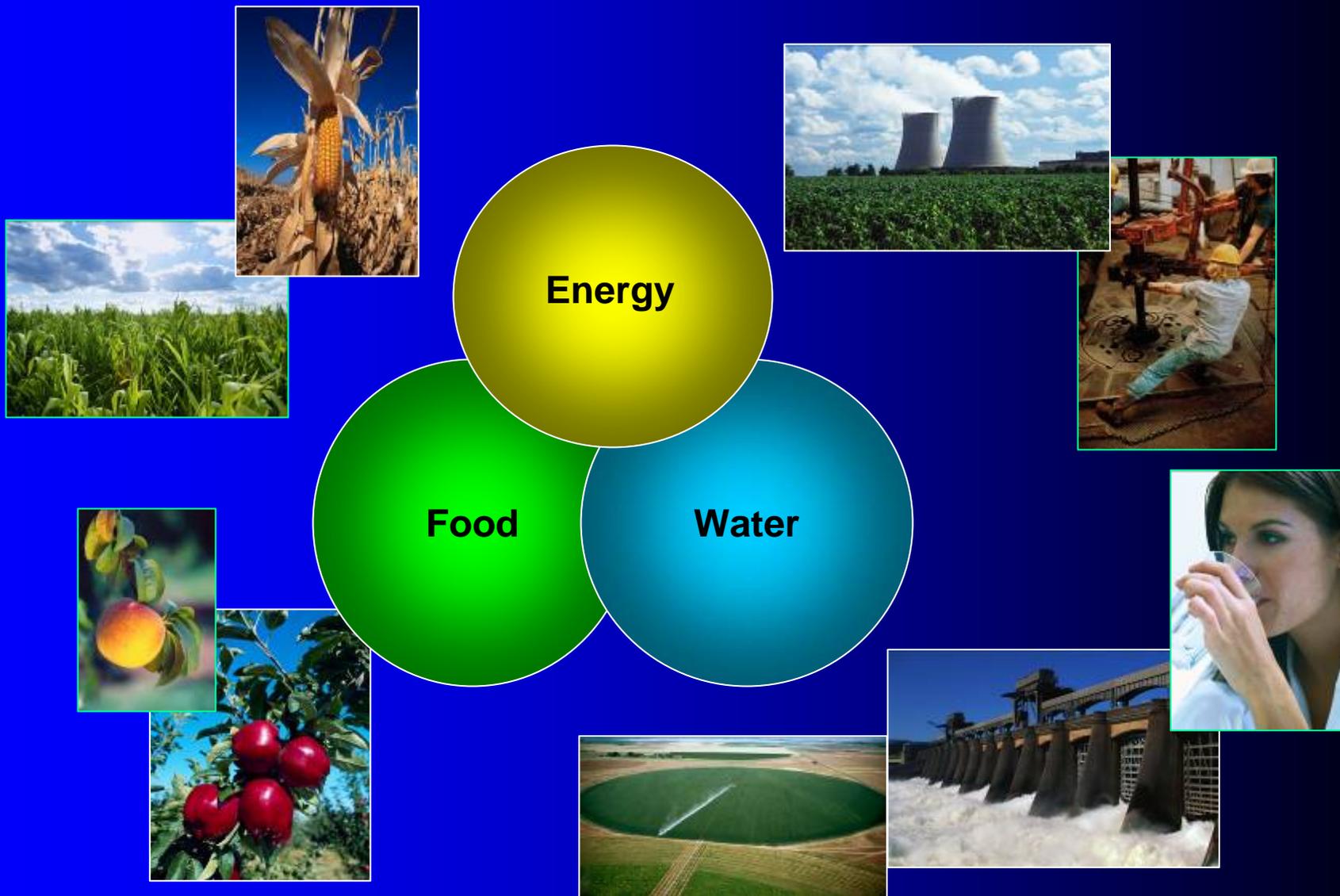
*Husband, Wes,  
and son, James,  
Mt. Rainier,  
August 2005*

# *The Challenge...*

*Creating a Sustainable  
Chemical Enterprise –  
Environmentally Friendly  
and Economically Viable.*



# *Sustainability... Chemistry is Key!*



# The Scientific Community Responds



**Cape Town Declaration**

Recognizing that Green Chemistry in the design of chemical products and processes that reduce and/or eliminate the use and/or generation of hazardous substances; we, the individuals who have convened in Cape Town, South Africa for the first Pan-African Green Chemistry Conference on January 24 – 26, 2007, have deliberated and have found that:

- Green Chemistry is imperative in meeting the challenges of sustainability, providing for the needs of the current generation while preserving the ability of future generations to meet their needs.
- Green Chemistry is essential in ensuring that the products and processes of our society are mutually beneficial to our environment and our economy.

It is the tremendous future potential for African leadership in the implementation of Green Chemistry that we, the individuals who have convened in Cape Town, South Africa, for the first Pan-African Green Chemistry Conference on January 24 – 26, 2007, hold ourselves personally responsible for...advancing Green Chemistry...

*“We... hold ourselves personally responsible for...advancing Green Chemistry...”*

Stellenbosch, So. Africa, 2007  
Cape Town Declaration

## Scientific Societies Respond

Paris, July 15<sup>th</sup> 2007

We, leading national chemical societies, representing nearly 300,000 members and some of the best scientific minds on the planet, pledge to work together to promote global sustainable development, demand responsible use of resources, and ensure that the next generation of scientists protects and maintains the well-being of the Earth and its inhabitants. The need to address these intertwined issues is urgent, and chemistry is absolutely essential to the development of solutions.

The Earth's threats. Ch collaborate

- Edu
- sust
- Inn
- to a
- tech
- Con

Paris, July 15<sup>th</sup> 2007

We, leading national chemical societies, representing nearly 300,000 members and some of the best scientific minds on the planet, pledge to work together to promote global sustainable development, demand responsible use of resources, and ensure that the next generation of scientists protects and maintains the well-being of the Earth and its inhabitants. The need to address these intertwined issues is urgent, and chemistry is absolutely essential to the development of solutions.

The Earth's systems, upon which we all depend, are facing complex and imminent threats. Chemistry must contribute towards a sustainable future. To this end, we will absolutely essential to the development of solutions.

The Earth's systems, upon which we all depend, are facing complex and imminent threats. Chemistry must contribute towards a sustainable future. To this end, we will absolutely essential to the development of solutions.



**“We...pledge to work together to promote global sustainable development...”**

Gesellschaft  
President, Dr.  
Pr. Dr. Dieter

Dieter

American Ch  
President  
Dr. Catherine

Catherine

Gesellschaft Deutscher Chemiker  
President, Pr. Dr. Dieter JAHN

Dieter Jahn

American Chemical Society  
President  
Dr. Catherine T. HUNT

Catherine T. Hunt

Canadian Society for Chemistry  
President  
Dr. Russell J. Boyd

Russell J. Boyd

Chemical Society of Japan  
President  
Pr. Dr. Akira FUJISHIMA

Akira Fujishima

Société Chimique de France  
President  
Pr. Dr. Armand LATTES

Armand Lattes

Boston, August 19, 2007

Sociedad Química de México  
President-Elect  
Dr. Ensebio Juarrán Cosío

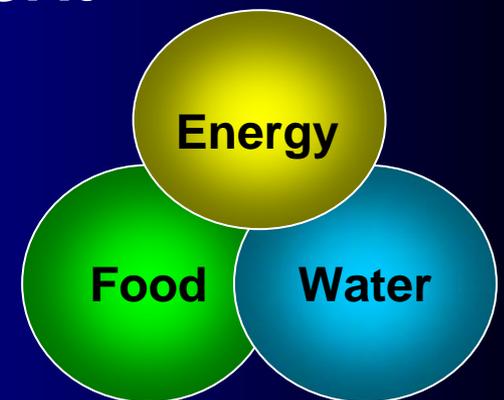
Ensebio Juarrán Cosío



# What's Needed...?



- ***Innovation*** – recreating our companies, our universities and ourselves
- ***Collaboration*** – building a vibrant and vocal technical community
- ***Education*** – engaging legislators, the public, the media and the next generation.



*Improving people's lives through  
the transforming power  
of chemistry!*



# ACS Environmental History



- 1912 First environmentally related technical section
- 1952 First Committee on Air Pollution
- 1967 Started publishing *Environmental Science & Technology*
- 1968 First Committee on Environmental Improvement
- 1969 Published *Cleaning Our Environment: The Chemical Basis for Action*
- 1995 Convened Stakeholders to Establish U.S. Presidential Green Chemistry Challenge Award and Green Chemistry and Engineering Conference (annual)
- 2001 Established ACS Green Chemistry Institute

# 12 Principles of Green Chemistry

*Paul T. Anastas and John C. Warner,  
Green Chemistry: Theory and Practice (2000)*

1. Prevent waste
2. Achieve atom economy: maximize incorporation
3. Use less hazardous synthesis steps
4. Design safer chemicals
5. Use safer solvents and auxiliaries
6. Design for energy efficiency
7. Use renewable feedstocks
8. Reduce derivatives (make what you want!)
9. Catalytic reagents are superior to stoichiometric
10. Design for degradation
11. Real-time analysis for pollution prevention
12. Inherently safer chemistry prevents accidents

# 12 Principles of Green Engineering

*Paul T. Anastas and Julie B. Zimmerman,*

*Design through the 12 Principles of Green Engineering (2003)*

1. Consider non-hazardous inputs/outputs
2. Prevent waste, rather than treat or clean up
3. Design operations to minimize consumption
4. Design to maximize efficiency
5. Design for "output pulled" rather than "input pushed"
6. Promote recycle, reuse, or beneficial disposition
7. Design for targeted durability, not immortality
8. Size for need, not "One Size Fits All"
9. Promote material reuse
10. Design with available energy and material flows
11. Enable reuse of component parts
12. Renewable materials and energy inputs

# *Educating the Next Generation*

- *Hancock Student Awards*
- *Breen Memorial Student Fellowships*
- *Annual Summer School Program*
  - 2 weeks, National Science Foundation (NSF) Funding
  - 50-60 students/postdocs
  - 10-12 instructors across industry and academia



# *Educating International Audiences*

via Video

- Green Chemistry workshop for high school teachers (Hong Kong)



- African Chemical Congress (Ethiopia - 2006)

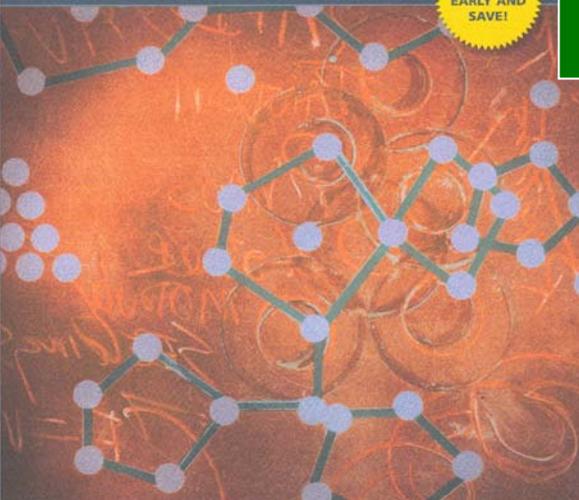
# Convening Scientists



ONLINE REGISTRATION NOW OPEN

11th Annual Green Chemistry & Engineering Conference

REGISTER EARLY AND SAVE!



> *From Small Steps to Giant Leaps — Breakthrough Innovations for Sustainability*

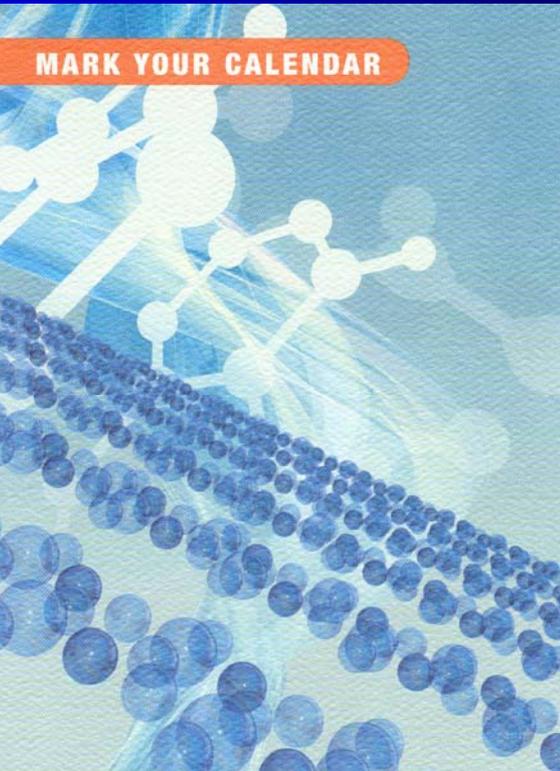
June 26–29, 2007  
CAPITAL HILTON ■ WASHINGTON, DC



[www.GCandE.org](http://www.GCandE.org)

## Green Chemistry Conference

MARK YOUR CALENDAR



12th Annual Green Chemistry & Engineering Conference

FOR MORE INFORMATION, PLEASE VISIT:  
[www.GCandE.org](http://www.GCandE.org)

JUNE 23–27, 2008  
WASHINGTON, DC



[www.GCandE.org](http://www.GCandE.org)

Innovation Collaboration Education

# Publishing Green Chemistry



ACS Journal and Magazine Coverage of Green and Sustainable Chemistry and Engineering

# Communicating Green Chemistry

- ACS Green Chemistry Institute had more media coverage in 2006 than ever in its history.

- Over 40 million pairs of “eyes” for print stories
- Over 20 million pairs of “eyes” for web stories



- ACS GCI launched a radio series with NPR-Marketplace that featured several Green Chemistry topics on the morning and evening drives.

# Connecting Scientists and the Public

## Green Chemistry Resource Exchange

[About](#) | [Glossary](#) | [Help](#) | [Contact Us](#)

SEARCH

CONTRIBUTE

JOIN

LOGIN

 PRINT THIS PAGE

### Welcome to the Green Chemistry Resource Exchange

- **Our mission** is to provide the public with a straightforward collection of media dealing with green chemistry and innovative technology as well as the means to share new ideas and research.
- **Search and Browse** the resource exchange with a keyword or select from our list of over 60 search categories.
- **Contribute** news articles, scientific journal articles, multimedia presentations, publications, and other media sources with the green chemistry community.
- **Join** and become a member of the exchange to contribute and receive green chemistry e-mail updates.

[Browse and Search](#)

Sponsored by The ACS Green Chemistry Institute

[www.GreenChemEx.org](http://www.GreenChemEx.org)

# Building Focused Collaborations



## Pharma Roundtable Mission

To catalyze the implementation of GC and GE in the pharmaceutical industry globally.

## Corporations and ACS

- ✓ Sharing a commitment to integrate GC and GE from drug discovery through to final production
- ✓ Informing and influencing the research agenda

# Enabling Industrial Change



## National Environmental Methods Index

<< Back Analyte (main) Search Regulatory Search General Search NEMI Home

*For this search, you must select an analyte, either by name or by code.*

Type the exact analyte name or code into the appropriate field to the right. You may enter a name or code, but not both.

—OR—

If you are unsure of the spelling of an analyte name, press 'Find an Analyte by name or code'

### Select Search Criteria

*Analyte Name or Code (required)*

Analyte Name:  Find an Analyte by Name or Code...

- OR -

Analyte Code:

---

Media Name\*:

Source\*:

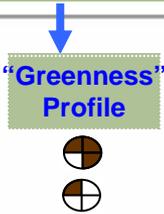
Instrumentation\*:

Method Subcategory\*:

\* optional Search NEMI

[View Results in a New Window \(Printable Format\)](#)  
[Export results for Microsoft Excel](#)  
[Export results as a tab separated text file \(can be opened in any text editor or spreadsheet\)](#)

New column in the search results



www.nemi.gov

# *Recognizing Innovation: Green Chemistry Awards*



## US Presidential Green Chemistry Challenge Award

- Collaboration of ACS and US EPA
- Awarded each June at the National Academy of Sciences
- Recognizing improvements from industry, small business and science.

## ACS Affordable Green Chemistry Award

- Endowed by Rohm and Haas Company
- Recognizing scientific discoveries that deliver cost-effective and environmentally friendly products and/or processes

# *Educating Business about Green Chemistry*

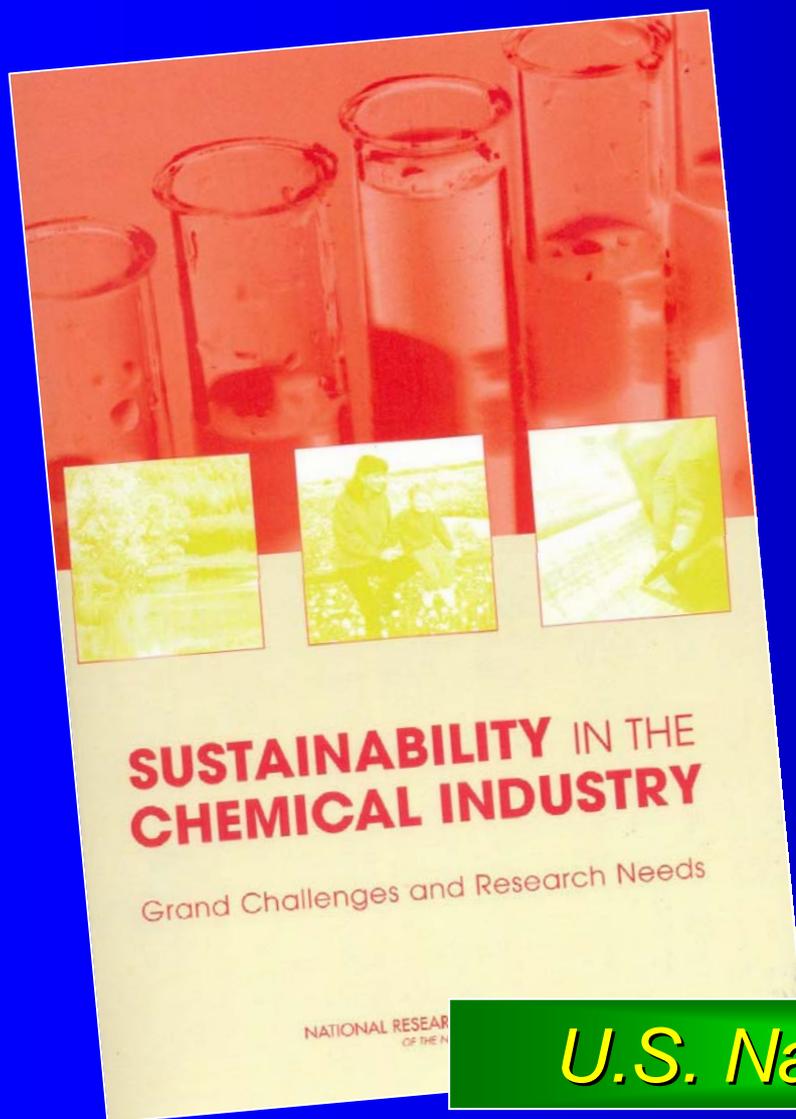


*Case studies being used in MBA programs  
from Oregon to New York.*

- **Environmentally friendly cleaning products (DuPont)**
- Green List™ Nontoxic ingredients (SC Johnson)
- **Eco-friendly Plastic Resins (NatureWorks)**
- Green Manufacturing of Zoloft® (Pfizer)
- **Environmentally friendly and recyclable carpeting (Shaw)**
- Biobased paint coatings (ADM)



# *Establishing a National Agenda*



- Collaborating across industry, academia, government and scientific societies
- Bringing together sustainable chemistry and engineering
- Looking at the long term, i.e., *20-years and a 100-years...*

*U.S. National Academies Report*

# *Research and Education Challenges*



- Green and Sustainable Chemistry and Engineering
- Life Cycle Analysis
- Toxicology
- Renewable Feedstocks
- Renewable Fuels
- Energy Intensity of Chemical Processing
- Separation, Sequestration and Utilization of Carbon Dioxide
- Education

# *Identifying Incentives and Barriers to the Adoption of Sustainable Chemistry*

## Harvard/Yale/ACS Workshop - February 2007

- Collaborating across academia, industry, government and NGO's
- Documenting current barriers to green chemistry
- Creating an information exchange mechanism

## ACS Workshop - April 2008

- Focusing on incentives and impediments
- Emphasizing industry involvement
- Establishing an ACS public policy agenda

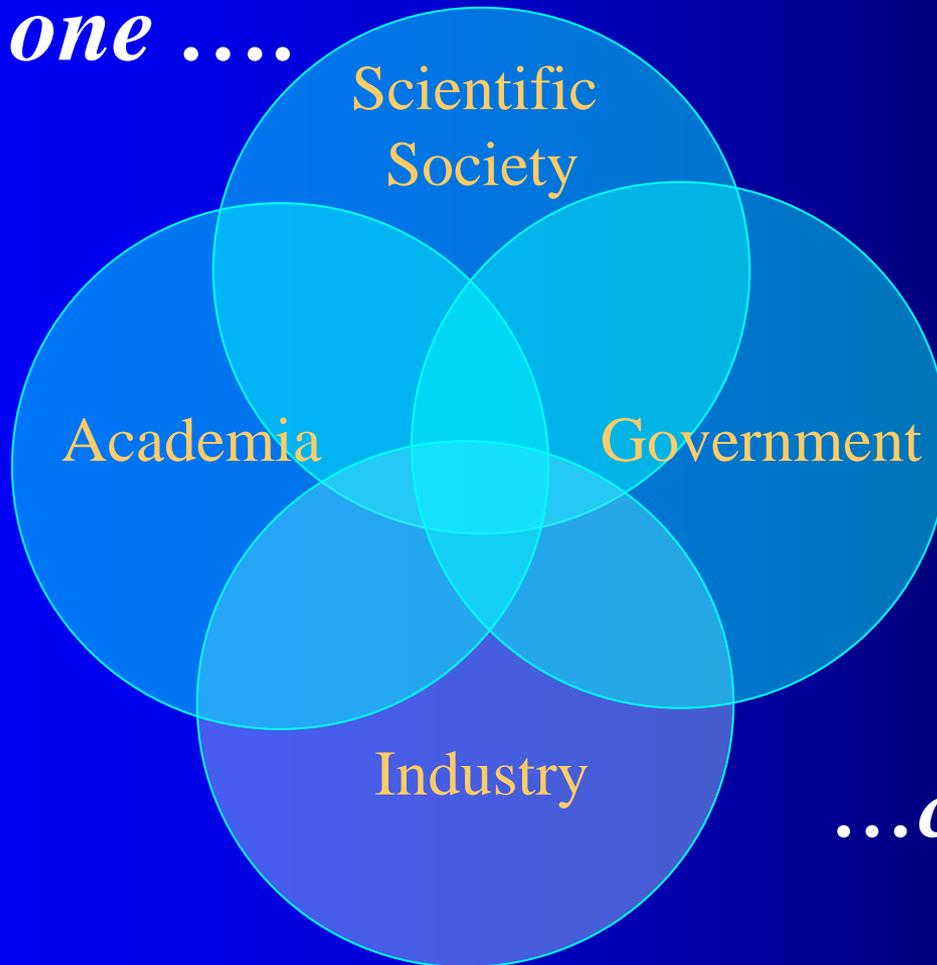
# *The Government Role in Green Chemistry*

- Providing regulatory flexibility for superior environmental performance through clean technologies
- Enhancing tax incentives for research, development, and adoption of cleaner technologies and processes
- Funding research and development of new environmentally benign processes and technologies
- Facilitating sharing of information and ideas about preventing pollution and applications of new technologies
- Guaranteeing preferential government purchasing of safer technologies
- Organizing award programs to recognize businesses that incorporate pollution prevention



# *Changing the Way We Innovate!*

*No one ....*



*...can go it alone!*

# Thank You!

## Organizers

*California Department of Toxic Substances Control*



## Major ACS Partners for Green and Sustainable Chemistry and Engineering

*ACS Green Chemistry Institute*

*U.S. Environmental Protection Agency*

*National Academies*

*American Chemistry Council*

*American Institute of Chemical Engineers*

*Harvard and Yale Universities*

# Contact Information

*Dr. Catherine T. “Katie” Hunt*

President, American Chemical Society

president@acs.org

www.acs.org

