

# Session 7: Linking sustainable chemistry to the 2020 goal? Education

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**“Sustainable Chemistry** is a continuous process of change, which measures its success on the basis of criteria and indicators. If the current process is to be successful, **Education for Sustainable Development** **needs to start with schools and must be continued in vocational training”**

**Agree or Disagree?**



## ***12 principles for green chemistry***

## ***12 principles for green engineering***

## ***General criteria for Sustainable Chemistry***

## ***How widely are these taught? Extensively, mediocre, not all***

Anastas, P. T.; Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press: New York, 1998, p.30. By permission of Oxford University Press.; <http://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles/12-principles-of-green-chemistry.html>  
Anastas, P.T., and Zimmerman, J.B., "Design through the Twelve Principles of Green Engineering", Env. Sci. and Tech., 37, 5, 94A-101A, 2003.; <http://www.acs.org/content/acs/en/greenchemistry/what-is-green-chemistry/principles/12-principles-of-green-engineering.html>  
Nachhaltige Chemie: Positionen und Kriterien des Umweltbundesamtes, page 6; 2009  
<http://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/3734.pdf>

WHAT?



HOW?

**“State-of-the-art knowledge on Sustainable Chemistry should be more closely integrated into education, university training of chemists, engineers, process engineers, product designers, management experts and economists, as well as into the related vocations.”**



## Green refill

“Manufacturers are snapping up chemists who can make their products more environmentally friendly.”

“No longer is the most valuable chemist the one who sits in the lab. It’s the one who knows about application and how to think about safety in the design phase,”



**19 MARCH 2015 | VOL 519 | NATURE | 379**



**Curricula specifically for green chemistry are rare, in part because the subfield is multidisciplinary **BUT they do exist****

Yale University in New Haven,  
University of Toledo in Ohio;  
University of Massachusetts, Lowell;  
University of California, Berkeley  
University of York, UK  
University of Copenhagen

Method Products of San Francisco,  
California - Berkeley Center for Green  
Chemistry in California  
GlaxoSmithKline Carbon Neutral Laboratory  
for Sustainable Chemistry, University of  
Nottingham, UK, GlaxoSmithKline - São  
Paulo Research Foundation to build a green-  
chemistry research centre in Brazil.

## Session 7: Linking sustainable chemistry to the 2020 goal? Break-out group: Education

1. WHAT IS THE CURRENT LANDSCAPE: NATIONAL, EU, GLOBAL?
1. WHAT ARE THE NEEDS AND WHERE: PRIMARY, SECONDARY, TERTIARY, INDUSTRY, CONTINUAL PROFESSIONAL DEVELOPMENT?
2. WHAT ARE THE BARRIERS AND CHALLENGES?
3. HOW DO WE GET THERE AND BY WHEN: 5, 10, 15 AND 20 YEAR VISION
4. IF TIME PERMITS THEN – CAN WE QUANTIFY TARGETS: NUMBER OF NEW GRADUATES? NUMBER OF NEW JOBS? NUMBER OF NEW INDUSTRIES?

# Linking sustainable chemistry to the 2020 goal? group: Education Main findings.....in a nutshell:

## Break-out



**NEEDS TO PROMOTE SUSTAINABLE CHEMISTRY IN EDUCATION:**

.....

**WHERE TO PROMOTE IT? PRIMARY, SECONDARY, TERTIARY, INDUSTRY, CONTINUAL PROFESSIONAL DEVELOPMENT?**

.....

**MAIN BARRIERS AND CHALLENGES:**

.....

**5, 10, 15 AND 20 YEAR VISION: HOW DO WE GET THERE?**

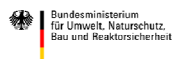
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**QUANTIFYING TARGETS? IS IT POSSIBLE? NUMBER OF NEW GRADUATES? NUMBER OF NEW JOBS? NUMBER OF NEW INDUSTRIES?**

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**FURTHER ASPECTS: .....**

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# Linking sustainable chemistry to the 2020 goal? group: Education Main findings.....in a nutshell:

Break-out

**CURRENT LANDSCAPE:** FRAGMENTED; **EMERGING GLOBAL LANDSCAPE...GO ON.....AT PRESENT:** MINORITY...



**NEEDS TO PROMOTE SUSTAINABLE CHEMISTRY IN EDUCATION:** WHOM TO EDUCATE? THE CHEMISTS / THE CONSUMERS / THE CUSTOMERS / THE SUPPLY CHAIN.../INDUSTRY: WE CAN NOT WAIT FOR YEARS / WHAT S ALREADY AVAILABLE (EXAMPLE FROM INDIA) / SURVEY ON TOOLS / HOW TO GET ACCESS (UPDATES...QUALITY QUALITY ) / MEDICAL INDUSTRY: ANNUAL UPDATES....SIMILIAR FOR CHEMISTS INCENTIVISATION GET A GREEN CUP.....OVERVIEW ON LABELS MANY INFORMATION INCLUDED TEACHING MATERIAL ON ECODSIGN, LESS ON CHEMICALS BASICS ON SUSTAINABLE CHEMISTRY FOR THE VALUE CHAIN....NO SYMBOL FOR SUS CHEMISTRY.....GO TO KHAN ACADEMY WITH SUSTAIN CHEM...

**KEY MESSAGE:** NOT EACH CHEMICAL IS BAD.....FROM KINDERGARDEN TO CAPACITY BUILDING CONTINIUOS PROFESSIONAL TRAINING NOT A BURDEN CAPACITY BUILDING

**WHERE AND HOW TO PROMOTE IT?** PRIMARY, SECONDARY, TERTIARY, INDUSTRY, CONTINUAL PROFESSIONAL DEVELOPMENT? INCLUDE IT IN THE GENERAL TEXTBOOKS ? REQUIRE CREDIT POINTS FOR BASICS OF SUS CHEM? OWN CURRICULUM: EACH STUDENT HAS TO GET IT / INVO;VEMENT OF STAKEHOLDERS: THEY GIVE INPUT TO UNIVERSITY

**MAIN BARRIERS AND CHALLENGES:** LACK OF KNOWLEDGE / TRADITIONAL CHEMICAL STUDY: OFTEN SUSTAINABILITY IS NO TOPIC / **LIMITED CAPACITY (OF CONSUMERS) TO BE EDUCATED / TEACH SUSTAINABLE SCIENCE ...SUSTAINABLE LIFE....SAY GOODBYE TO THE CLASSICAL STUDY OF CHEMISTRY IN THE LAB....TEACH TOXICOLOGY....TEACH MODELLING....**

**5, 10, 15 AND 20 YEAR VISION:** HOW DO WE GET THERE? KEEP PUSHING CONTINOUSLY

**QUANTIFYING TARGETS? IS IT POSSIBLE? NUMBER OF NEW GRADUATES? NUMBER OF NEW JOBS? NUMBER OF NEW INDUSTRIES? .....**

**FURTHER ASPECTS:** (ECO-) TOXIKOLOGY / MODELLING / ENVIRONMENTAL CHEMISTRY...