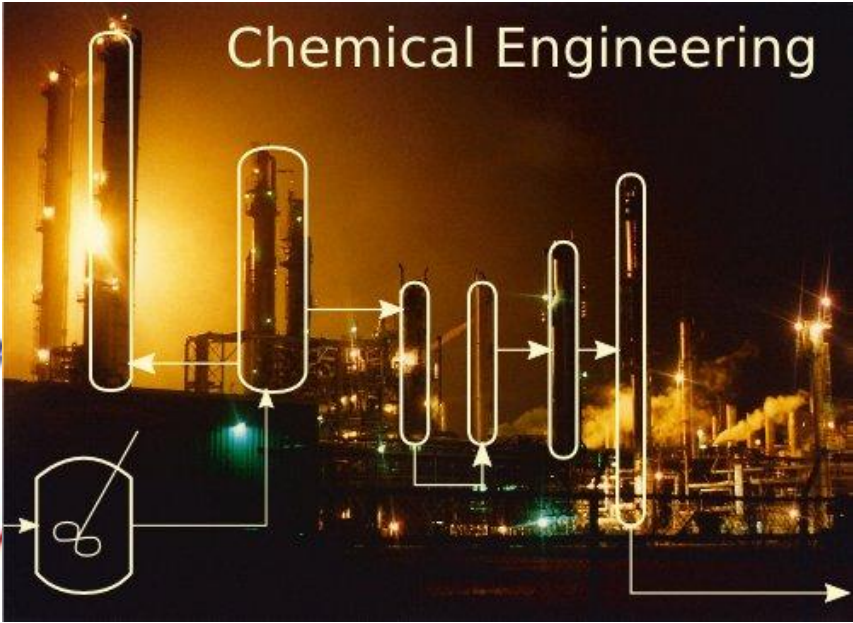




Chemical Engineer



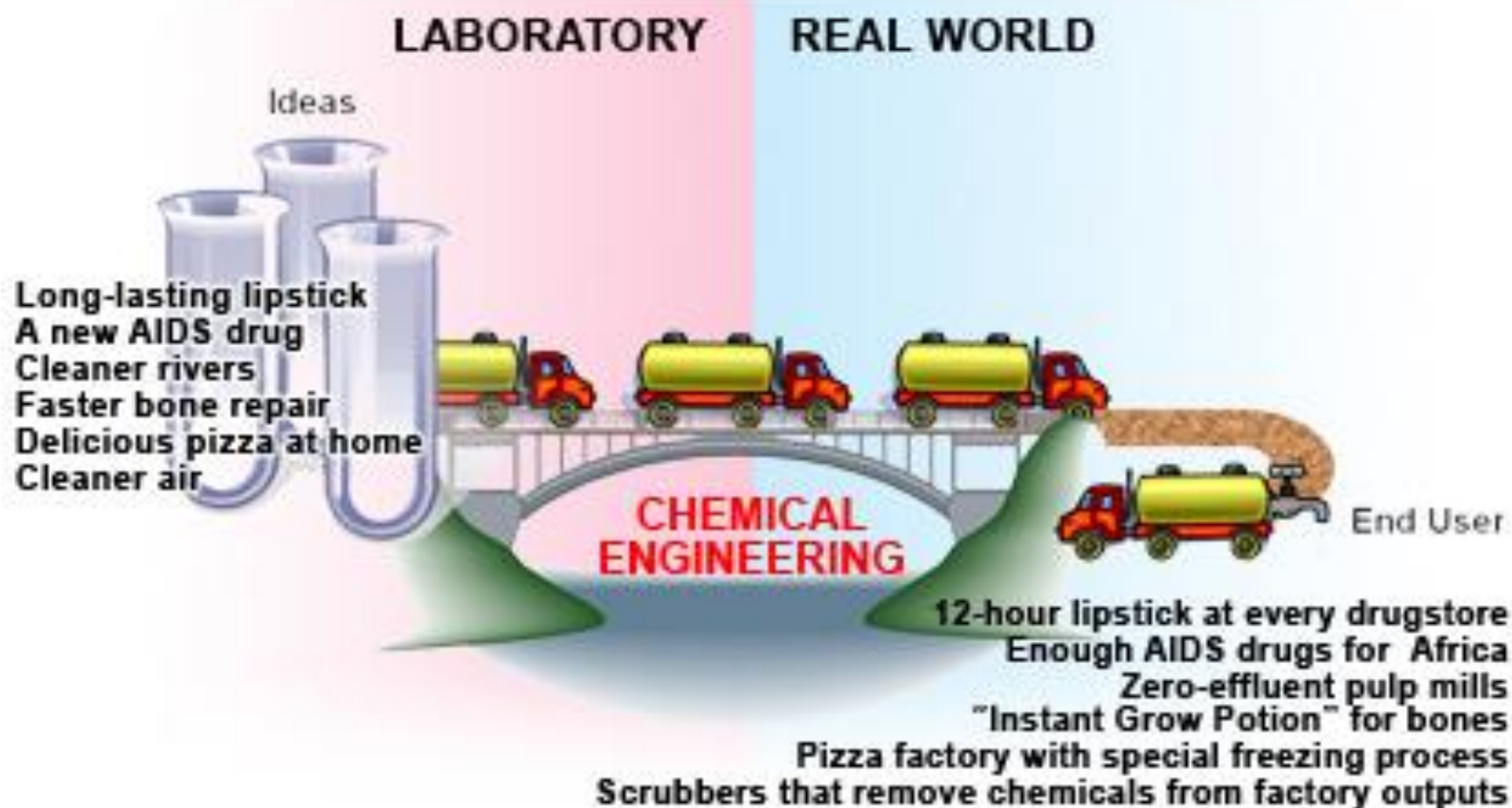
Chemical Engineering



# What are Chemical Engineers?

“Chemical engineers” use math, physical sciences (physics, chemistry), life sciences (biology, microbiology and biochemistry), and economics to solve practical problems. The difference between chemical engineers and other types of engineers is that they apply a knowledge of chemistry in addition to other engineering disciplines. Chemical engineers may be called “universal engineers” because their scientific and technical mastery is so extensive.

# From Test Tube to Truckload



# History of Chemical Engineering

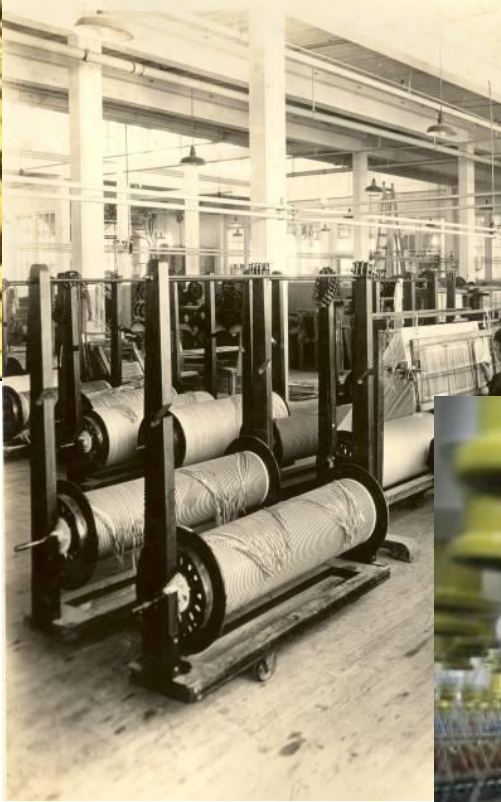
## ***Before 18<sup>th</sup> Century:***

Industrial chemicals were mainly produced through *batch processing*.

## ***Industrial Revolution (1700-1800):***

Industrial production shifted from batch to *continuous processing*.





# History of Chemical Engineering

## ChE Principles:

**1805** - John Dalton published Atomic Weights, allowing chemical equations to be balanced and the basis for chemical engineering *mass balances*.

**1824** - Sadi Carnot was the first to study the *thermodynamics* of combustion reactions.

**1850** - Rudolf Clausius applied the principles developed by Carnot to *chemical systems* at the atomic to molecular scale.

# History of Chemical Engineering

## ChE Principles:

**1873 to 1876** - Josiah Willard Gibbs developed a *mathematical-based*, graphical methodology, for the study of chemical systems using the thermodynamics of Clausius.

**1882** - Hermann von Helmholtz showed that measure of chemical affinity is determined by the measure of the free energy of the *reaction process*.

**1883** - Osborne Reynolds defines the dimensionless group for *fluid flow*, leading to practical scale-up and understanding of flow, *heat and mass transfer*

# History of Chemical Engineering

## ChE Education:

**1882** – a course in "Chemical Technology" is offered at University College London.

**1885** –a course in "chemical engineering" is offered at Central College (later Imperial College), London.

**1888** –a new curriculum at Massachusetts Institute of Technology (MIT) started: Course X, Chemical Engineering.





Course X at MIT: "to meet the needs of students who desire a general training in mechanical engineering, and at the same time to devote a portion of their time to the study of the applications of chemistry to the arts, especially to those engineering problems which relate to the use and manufacture of chemical products."

# History of Chemical Engineering

## ChE Institutes:

**1908** – the American Institute of Chemical Engineers (AIChE) is founded.

**1922** – the UK Institution of Chemical Engineers (IChemE) is founded.

**1996** – the Thailand Institute of Chemical Engineering and Applied Chemistry (TiChE) is founded.

# A Century of ChE Profession in 2008



**What have been the  
accomplishments we came up with?**



# TOP 10 Chemical Engineering Contribution to Society



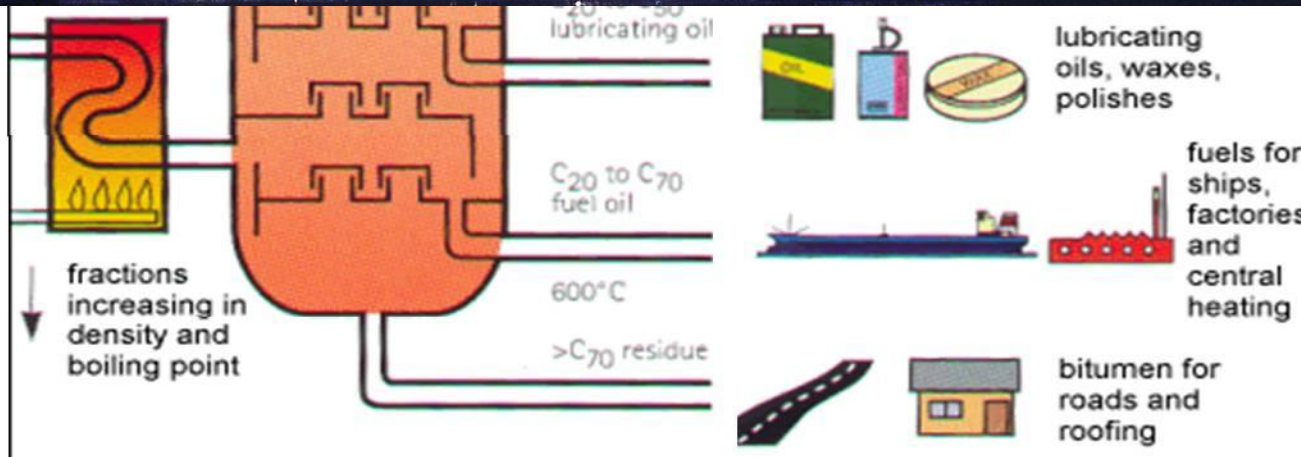
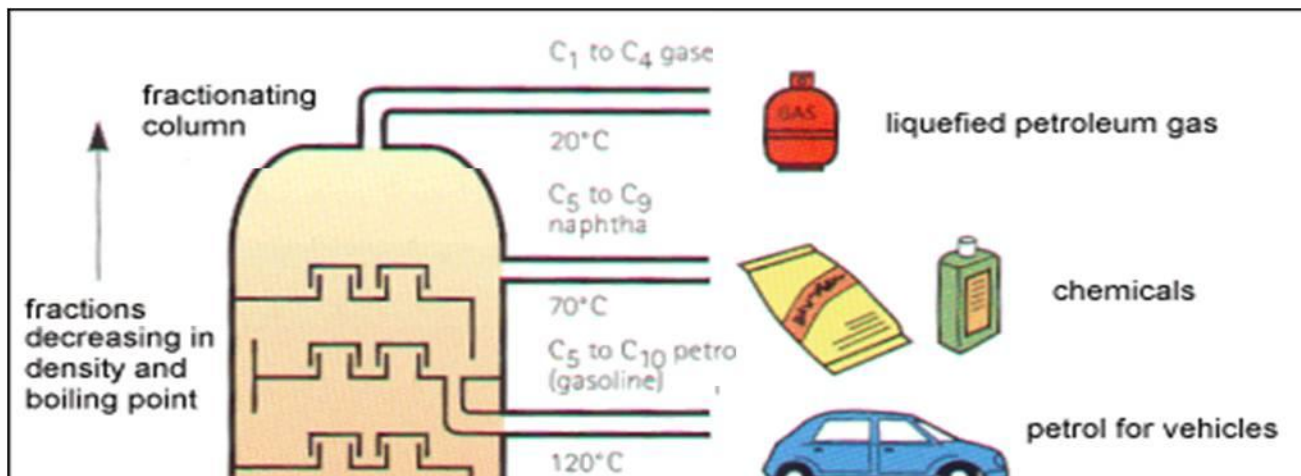
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, 2010

# **TOP 10 Chemical Engineering Contribution to Society**

## **1. FUELING THE WORLD'S ECONOMIES**

- The world's economy needs energy to keep it moving.
- Chemical engineers stretch fossil fuels into various energy supplies, e.g. gasoline, diesel, jet oil, etc.





# **TOP 10 Chemical Engineering Contribution to Society**

## **2. CREATING CLEANER ENERGY**

Chemical engineers are creating a new generation of clean energy technologies.

- Nuclear power plant
- NiMH battery
- Alternative energies such as Air , Wind, Water, Solar, etc.

# NiMH battery for vehicles

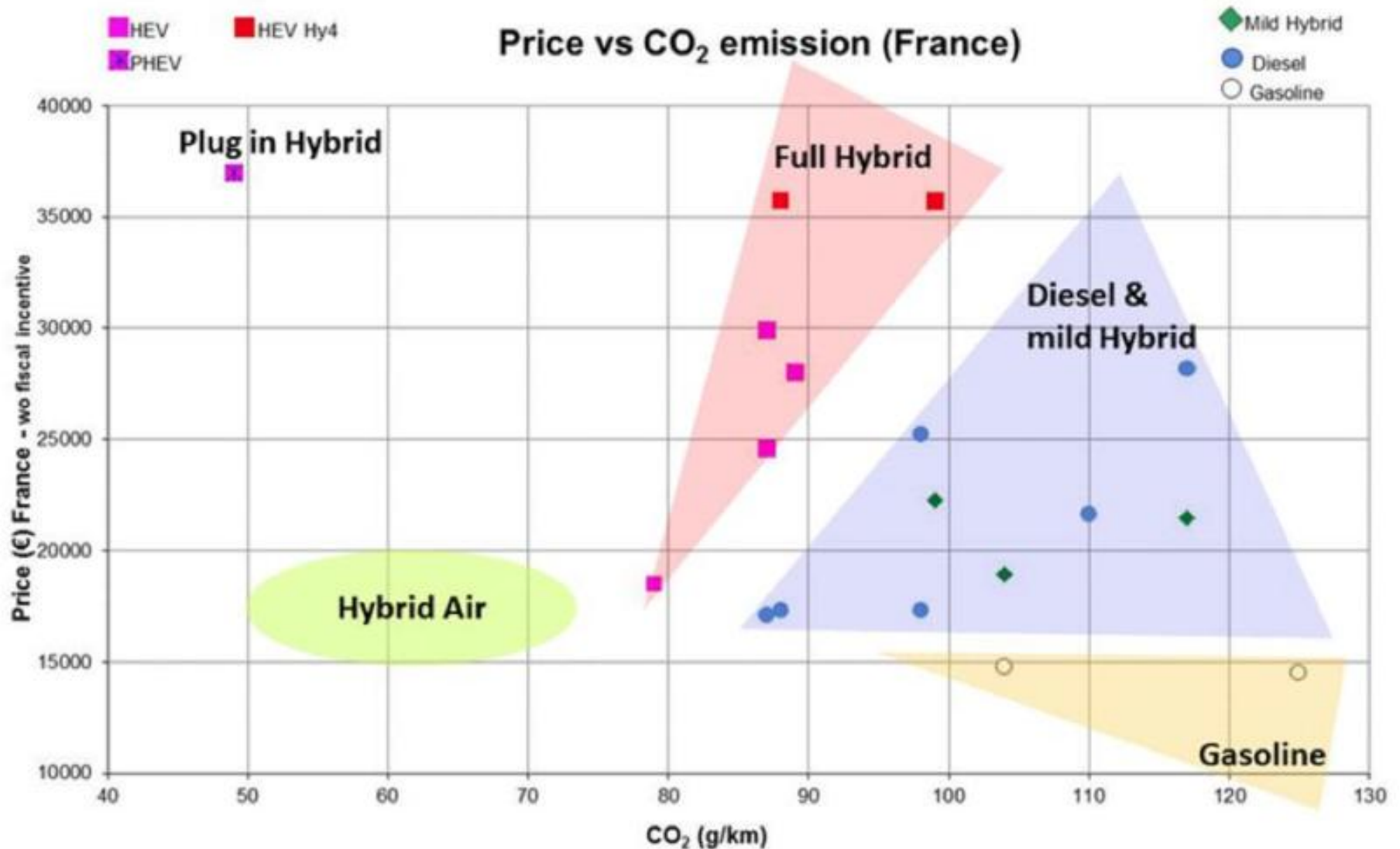




# Air for vehicles



## Price vs CO<sub>2</sub> emission (France)





# **TOP 10 Chemical Engineering Contribution to Society**

## **3. PRODUCTS FOR GROWING POPULATIONS**

- Water purification
- Water desalination
- GMO foods
- Green productions

Ultrafiltration hollow fiber membrane  
model 4040B/S  
PAN, double-skin hydrophillic,  
0.01 micron, 2200 liters/hour



**Flush Out Water  
Impurities**



# **TOP 10 Chemical Engineering Contribution to Society**

## **4. REMOVING HARMFUL SULFUR FROM FUELS**

- Catalytic converter for car's exhausted gas
- Unleaded gasoline → gasohol
- Air pollution control

# TOP 10 Chemical Engineering Contribution to Society

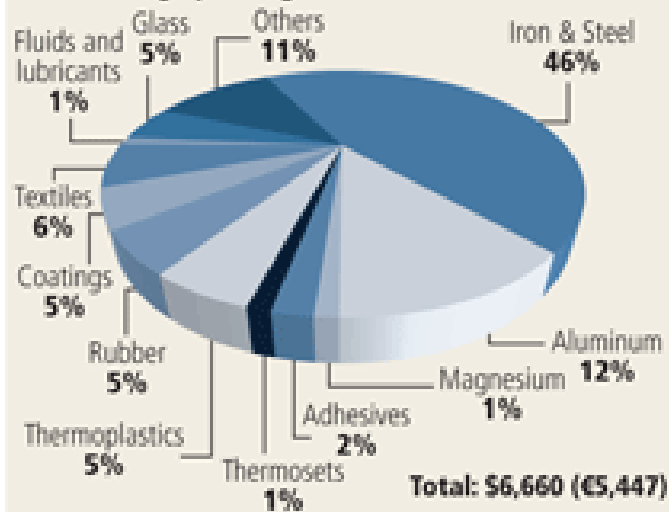
## 5. BETTER LIVING THROUGH CHEMISTRY

Chemical engineers have made plastics possible.



## TYPICAL AUTO MATERIALS BREAKDOWN

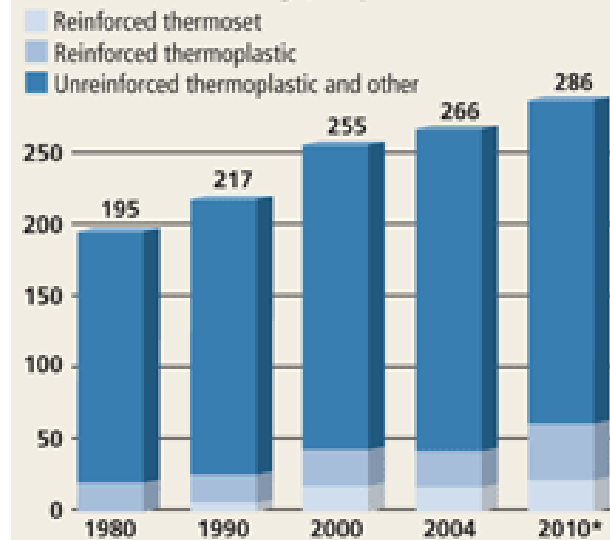
2005 average passenger car materials value



SOURCES: AMERICAN COMPOSITES MANUFACTURERS ASSOCIATION, AUTOMOTIVE COMPOSITES ALLIANCE

## AUTO PLASTICS & COMPOSITES USE

North American average, lbs per vehicle



SOURCES: AMERICAN COMPOSITES MANUFACTURERS ASSOCIATION, AUTOMOTIVE COMPOSITES ALLIANCE NOTE: \* Estimate



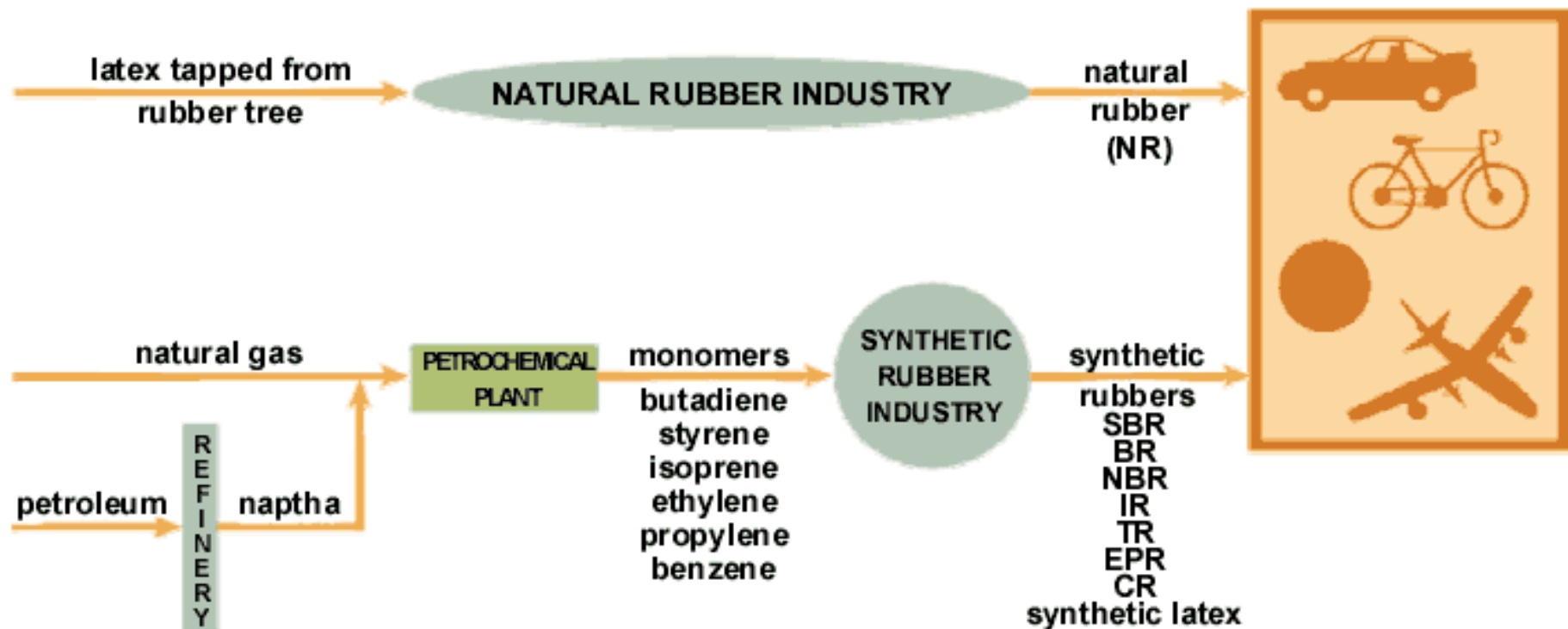


# **TOP 10 Chemical Engineering Contribution to Society**

## **6. STRETCHING NATURAL RESOURCES**

Chemical engineers make innovative materials.

- Synthetic rubbers
- Bio-plastics
- Kevlar
- etc.



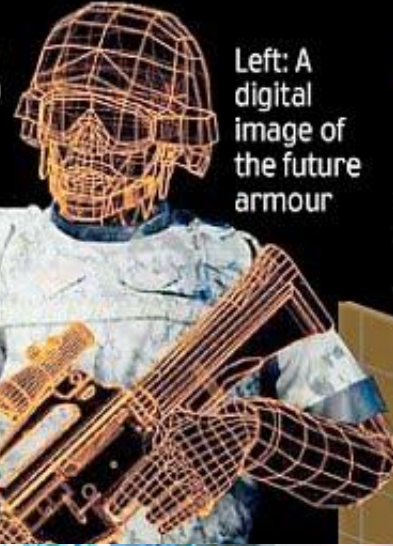
# Kevlar Vests



## HOW IT WORKS

### TRADITIONAL VEST:

Contains 31 layers of Kevlar. When bullet hits, the impact is concentrated on a small area and causes a deep indentation



Left: A digital image of the future armour

**LIQUID ARMOUR:** Contains ten layers of Kevlar with thick fluid between each layer. When bullet hits, the fluid solidifies and absorbs the impact over a wider area

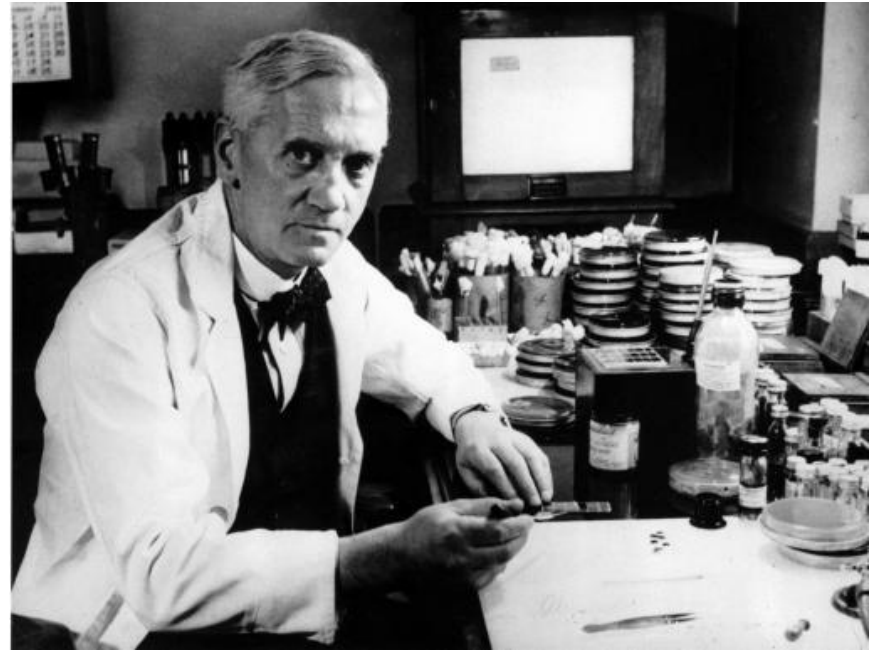


# **TOP 10 Chemical Engineering Contribution to Society**

## **7. LARGE SCALE PRODUCTION ENGINEERING**

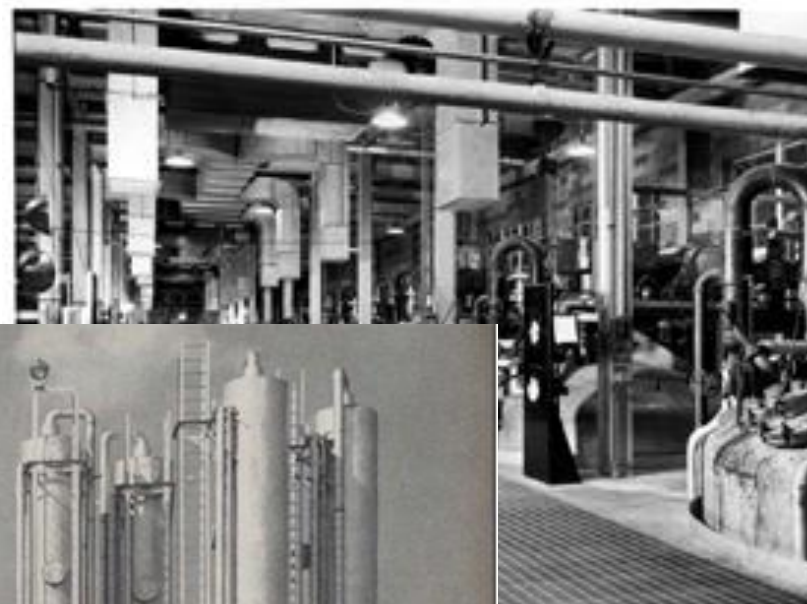
Even if a product was created by a scientist, there is a good chance it was perfected and made practical by chemical engineers.

# Penicillin Discovery



In 1929, Sir Alexander Fleming discovered a strain of mould that inhibit bacteria *Straphylococcus* growth, called penicillin.





MEDICINE

HUGE TANKS AND STILL ARE PART OF THE COMMERCIAL SOLVENTED' PENICILLIN PLANT IN TERRE HAUTE, IND. THIS IS ONE OF 13 U. S. PLANTS MASS-PRODUCING THE DRUG

**PENICILLIN**

MASS PRODUCTION OF DRUG REPLACES SLOW LABORATORY METHODS  
TO MEET MILITARY NEEDS AND PROVIDE A LIMITED CIVILIAN SUPPLY

# **TOP 10 Chemical Engineering Contribution to Society**

## **8. CONVENIENT & ABUNDANT FOOD**

When popping your favorite ready-to-eat meal in the microwave, thank chemical engineers!

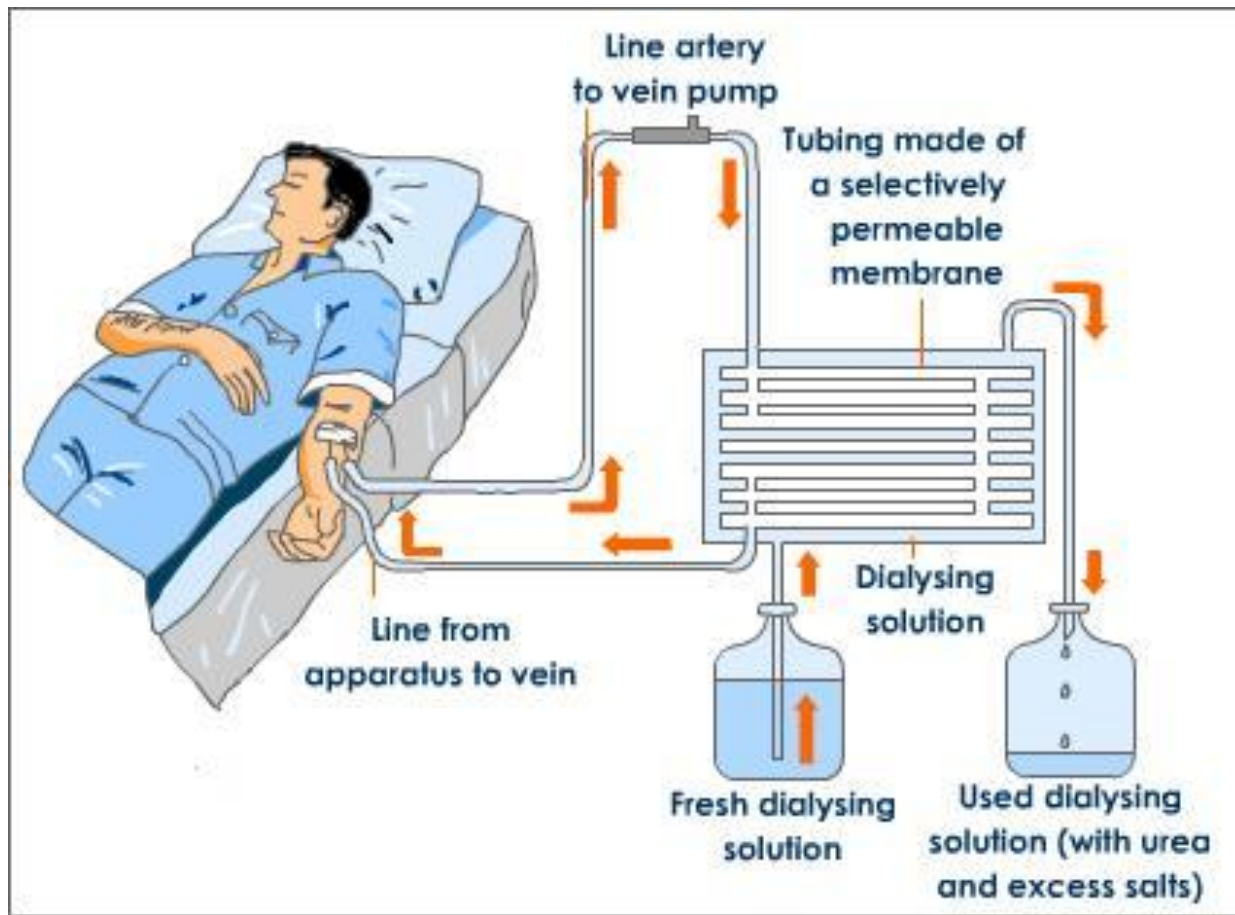
- Processed food, canned food
- Powder coffee, Powder milk
- Sterilized food

# **TOP 10 Chemical Engineering Contribution to Society**

## **9. HEALING DISEASES & EXTENDING LIFE**

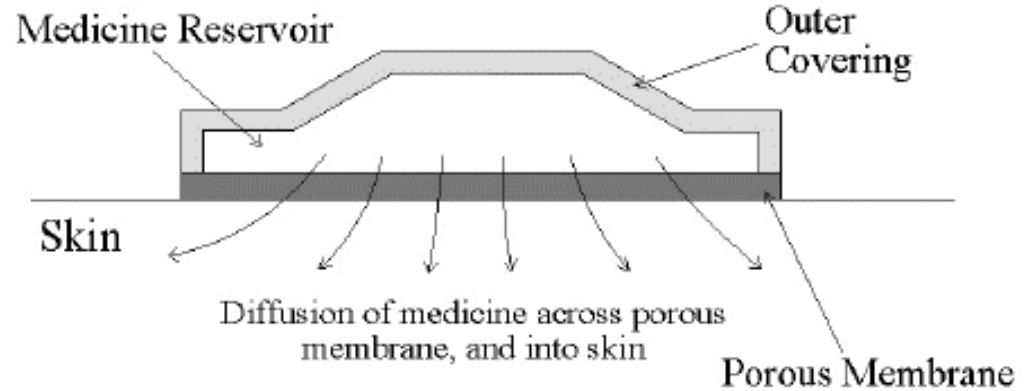
Chemical engineering has advanced medical science, improving the quality of life and saving millions of lives.

# Dialysis (Artificial Kidneys)





# Transdermal Patch





# **TOP 10 Chemical Engineering Contribution to Society**

## **10. POWERING THE PERSONAL COMPUTER**

The tools chemical engineers use to improve computers may have long-winded names, but their advances make our gadgets all the more powerful.

- Germanium-based silicon chips that help your laptop perform faster.
- From thin-film liquid crystal displays to software that simulates complex industrial processes.

# Chemical Engineers in Action

1. Energy
2. Environment
3. Material Sciences
4. Semiconductor Manufacturing
5. Bio-medic
6. Food

# Jobs Opportunity for ChE

