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Sustainable (Chemical) Solutions

Alvise Perosa



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Sustainable





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...to avoid this:



Rethinking Nature in Contemporary Japan: Science, Economics, Politics



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Rethinking Nature equals Rethinking Science...

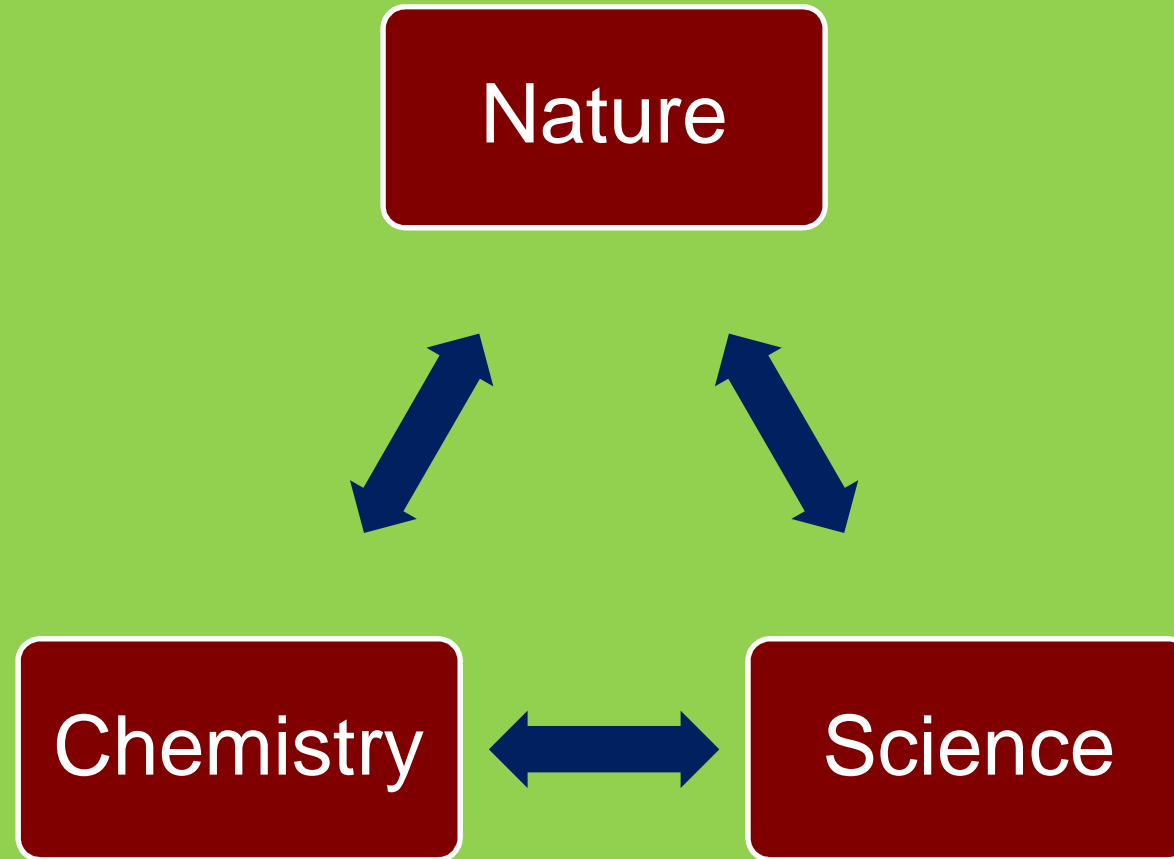


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...from a chemist's perspective.



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Role of chemistry?





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Impact on:



ENERGY



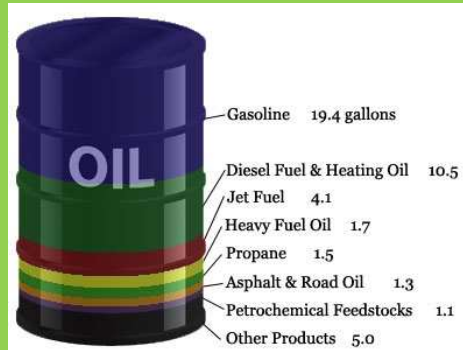
PRODUCTS



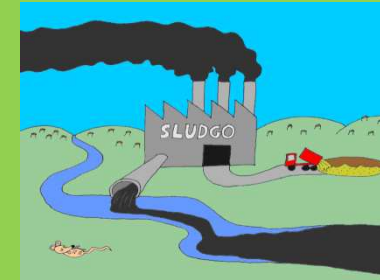


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Where are we now?



Oil-based industry



Burn 90%



Products 10%

Green

Chemistry

**Green: possibly
Sustainable: no!**

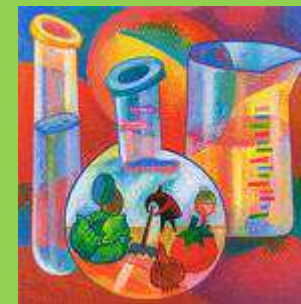




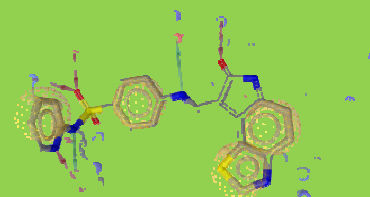
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Green Chemistry

Alternative chemical processes



Greener solvents

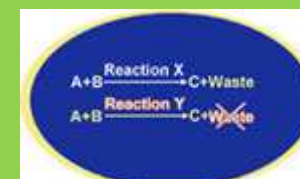


Molecular design



Safer chemicals

Higher efficiency





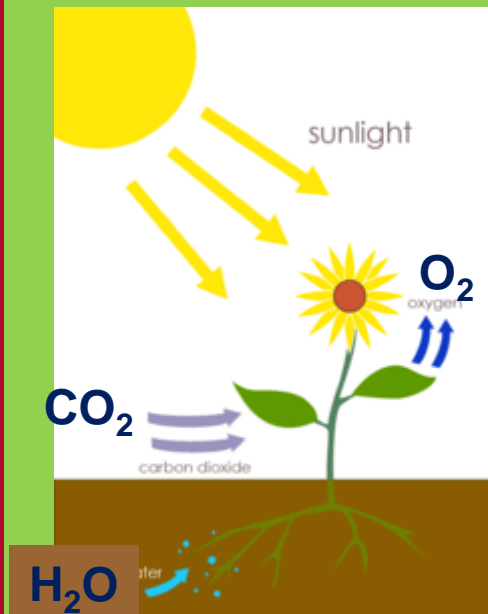
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The way forward:

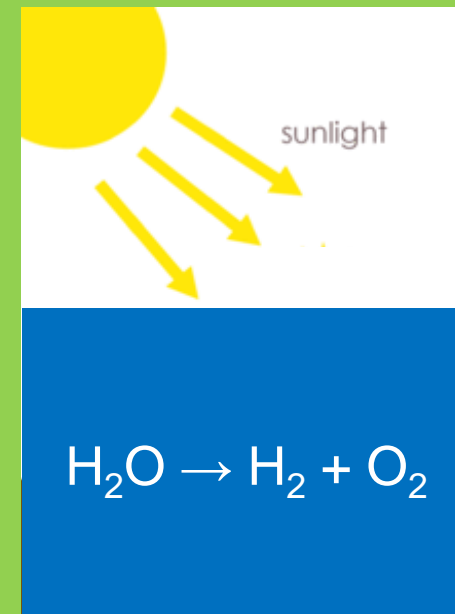
Learn from Nature

Move away from fossil resources

What Nature does



Grand challenge





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One step a a time

Alternative energy sources

Wind



Energy

Solar



Energy

Nuclear



Energy

Renewable resources



Energy + Products

Green: yes
Sustainable: yes



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Renewable biomass

Chemical
technologies



Fuels

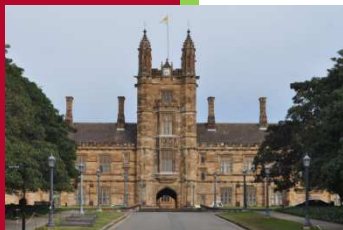
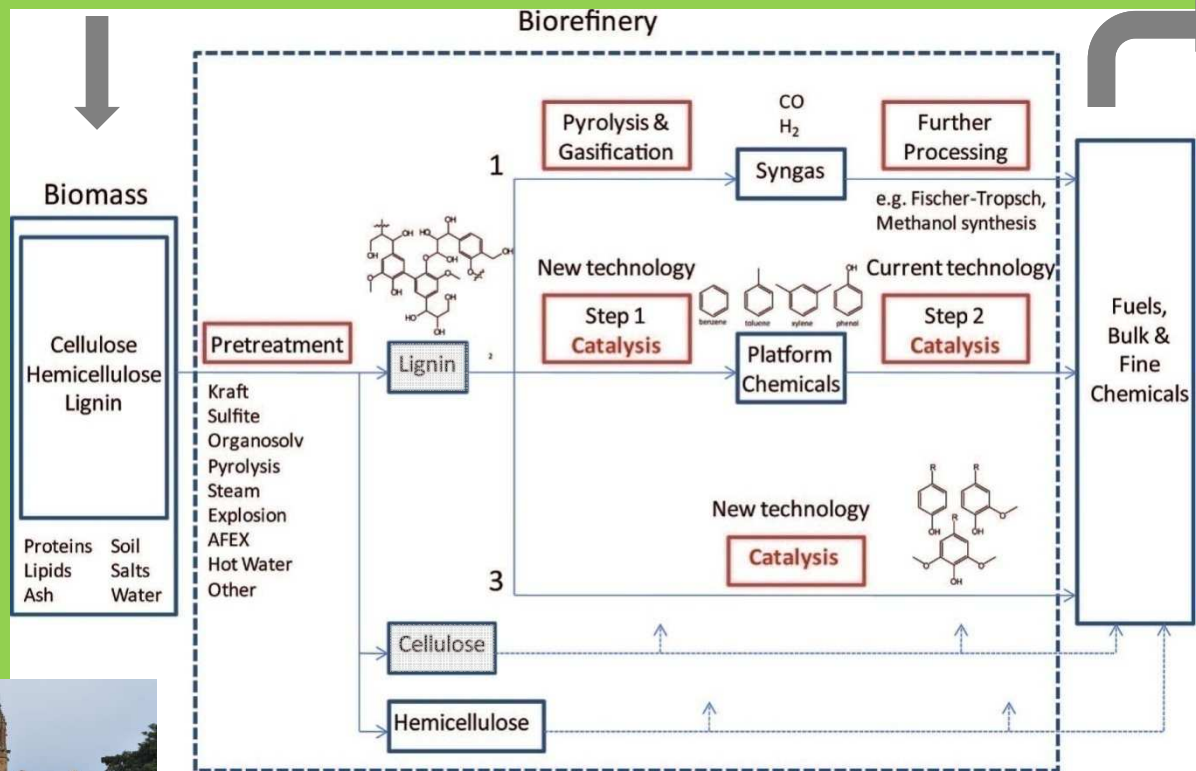
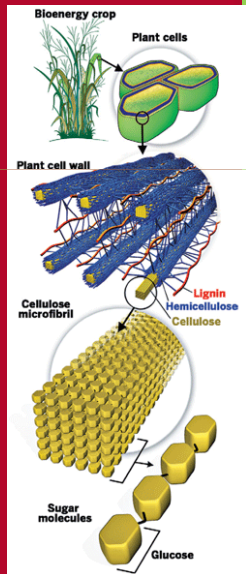
Bio-based
chemical products

CO₂



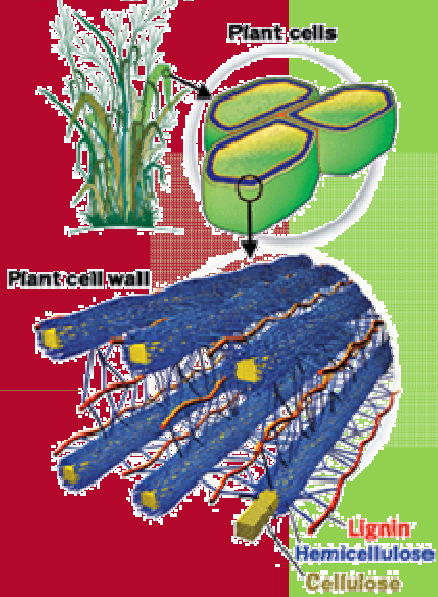
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Aim: the biorefinery

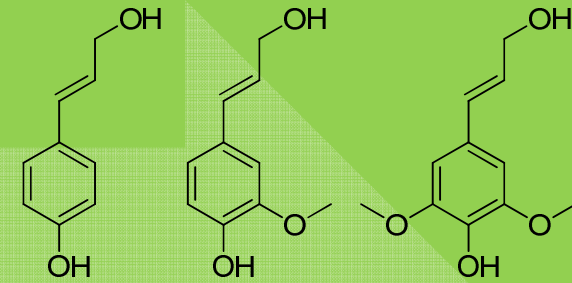
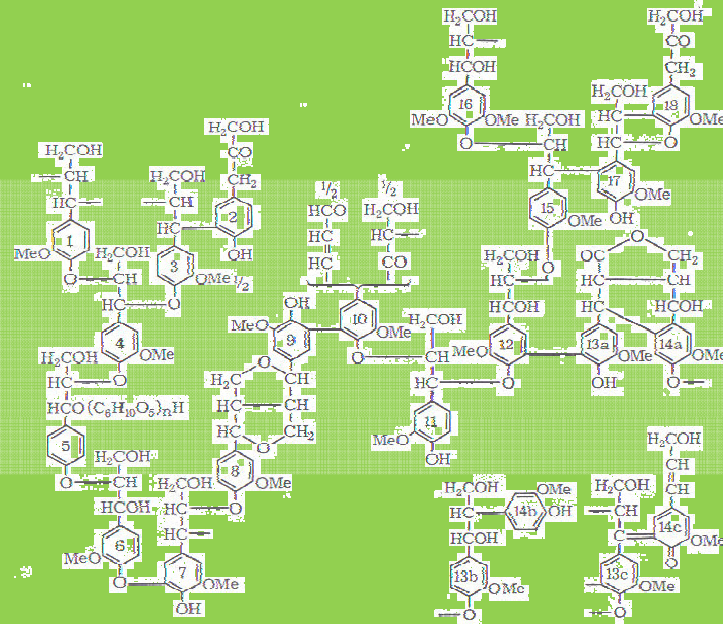




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Bioenergy crop



Lignin: renewable chemical feedstock



- Useful as a source for a variety of chemicals
- Only source of renewable aromatics.





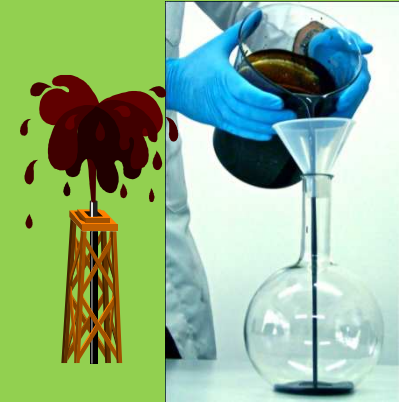
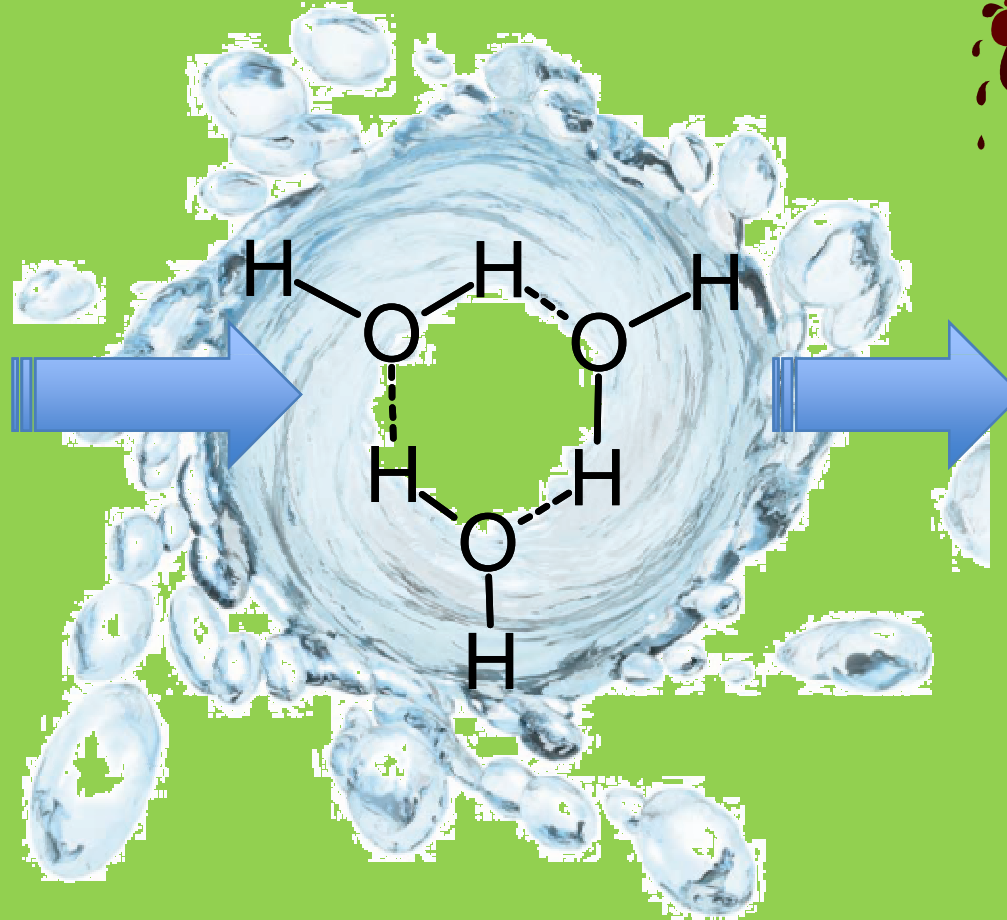
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Low Value \$
High Oxygen



Last generation biofuels



High Value \$
Low Oxygen





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Chemistry: Green AND Beautiful

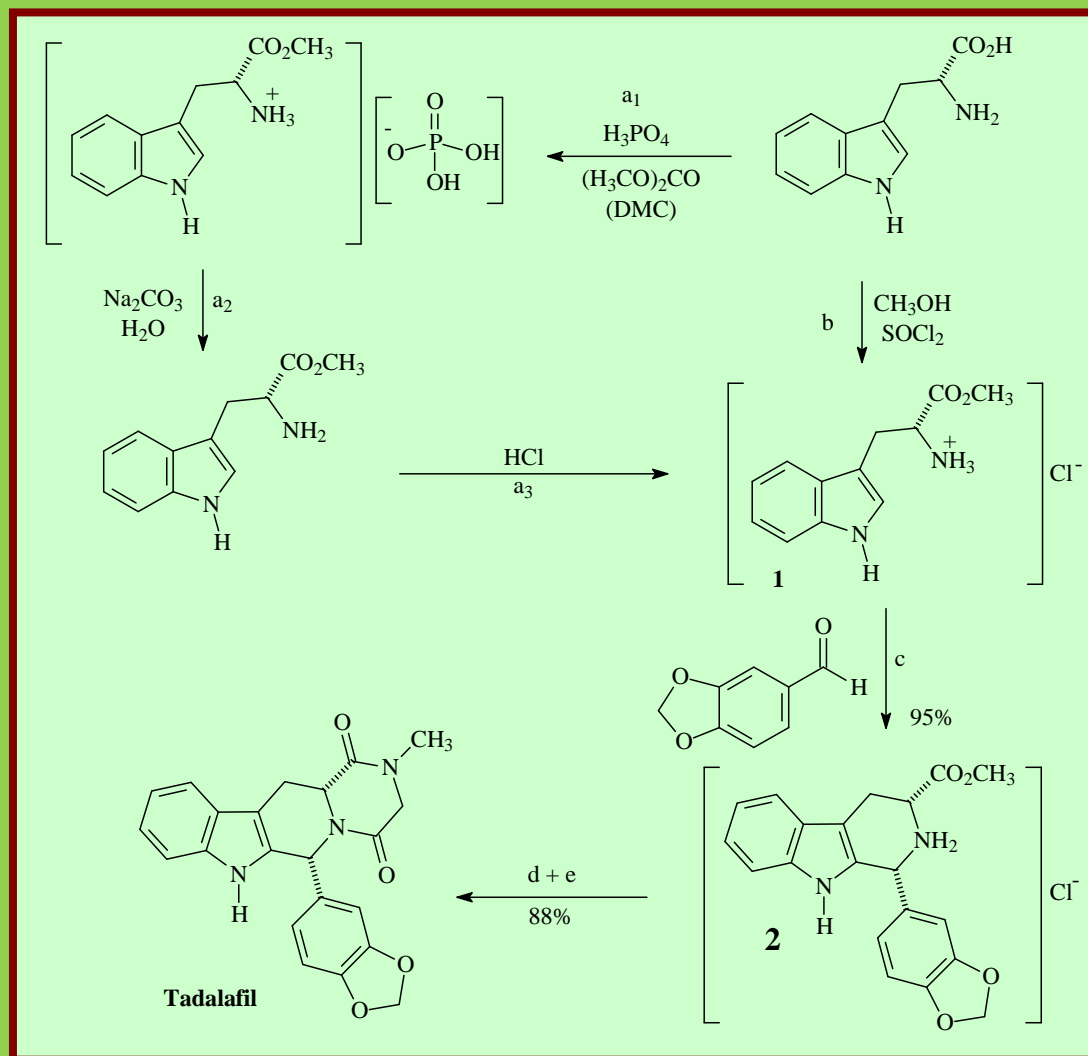
- It improves knowledge of the laws of Nature
- It teaches to apply the laws of Nature
- ... and it's creative

That makes us “molecular designers”



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Creative



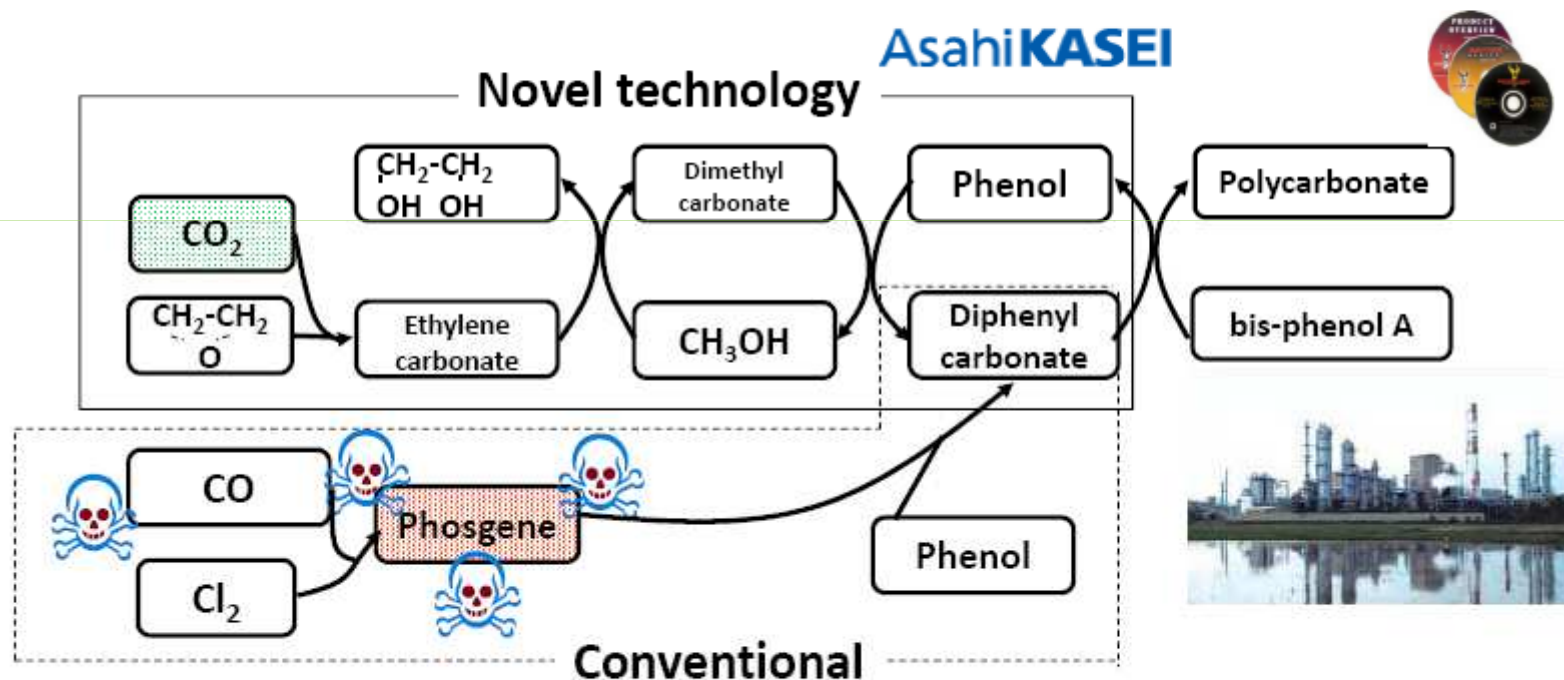


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Examples in Japan

Novel **Non-phosgene** Polycarbonate Production Process Using By-product CO_2 as Starting Material

Awarded by Minister of Economy, Trade and Industry: **Asahi Kasei Corporation** ('02)



- 3. **Less Hazardous Chemical Syntheses**
- 5. **Safer Solvents** and Auxiliaries
- 12. **Inherently Safer Chemistry** for Accident Prevention

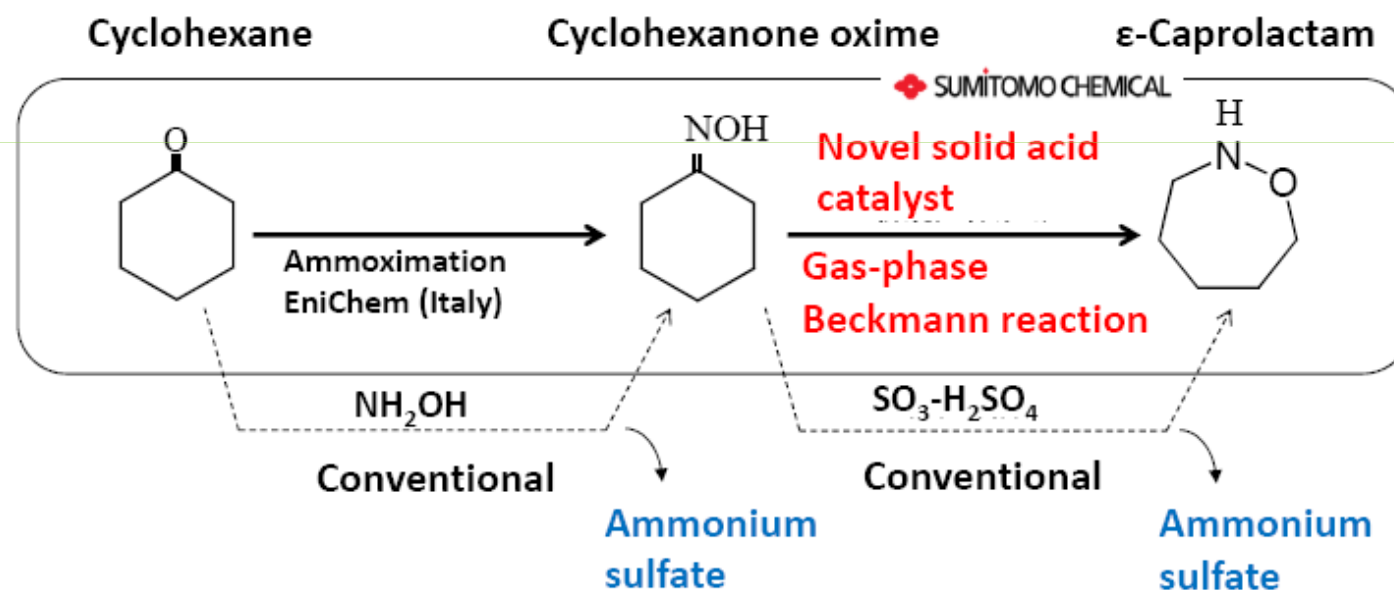


Examples in Japan

Novel ϵ -Caprolactam Production without ammonium sulfate formation



Awarded by Minister of Economy, Trade and Industry: **Sumitomo Chemical Co.** ('03)



1. Prevent waste
9. Catalysis



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Examples in Japan

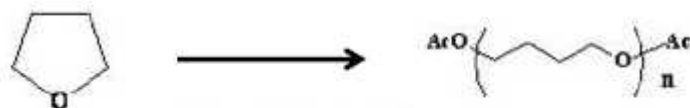
The Development of an Environmentally Benign THF Polymerization Process



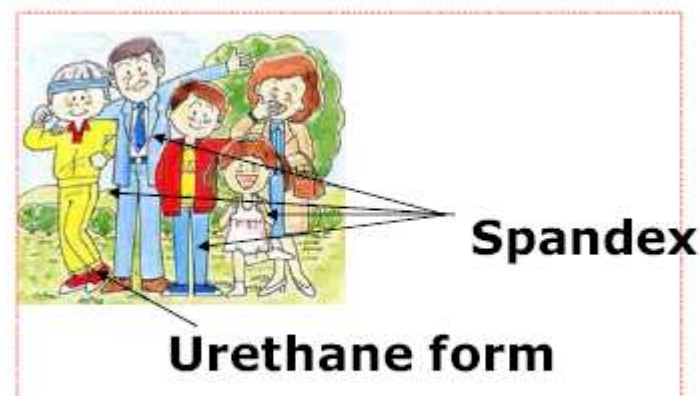
Utilizing Solid Acid Catalysis

Awarded by Minister of Economy, Trade and Industry: **Mitsubishi Chemical Corporation** ('07)

- Conventional process : FSO_3H catalyst (corrosive), neutralized by $\text{Ca}(\text{OH})_2$. A significant amount of waste material (0.12kg/kg-PTMG).
- **Novel process : Solid-acid catalyst (not corrosive; without waste)**



Mitsubishi Chemical
30 kT/Y



1. Prevent waste
9. Catalysis



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Some of the key issues involved:

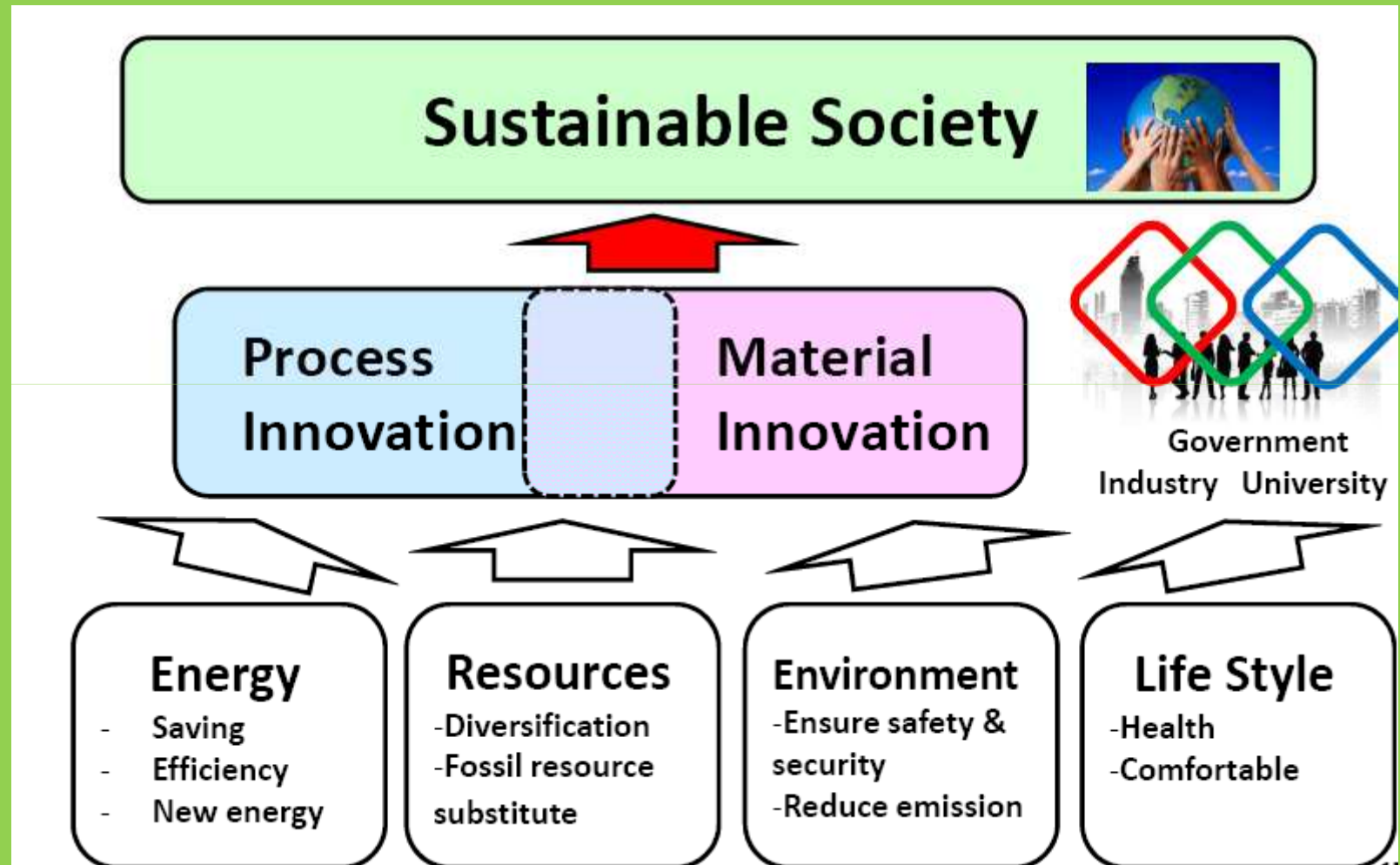
- Knowledge
- Development
- Environment
- Health
- Security
- Economy
- Products
- Processes
- Materials
- Fuels
- Energy

In a SUSTAINABLE way!



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In summary:





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Thank you!