



Building a Sustainability Model through the Biodiesel Project

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Where do we come from?

Chemical Engineering

Sustainability & Technology

Paradigm Shift

Biodiesel Project

Education

Financial

Showcase

SEEDS

Model

Conclusions





Chemical Engineering

Chemical Engineering

Sustainability & Technology

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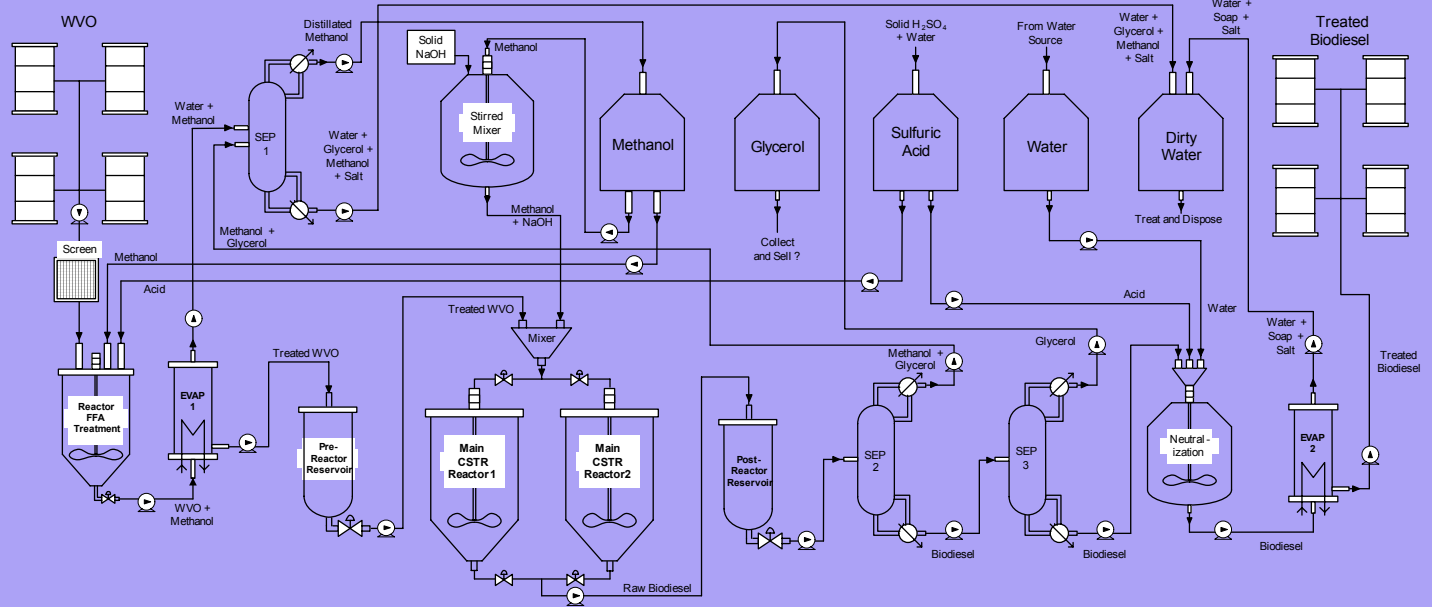
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feed



Chemical Process



product
byproduct



Sustainability and Technology

- Innovation towards clean energy
- Utilization of renewable resources

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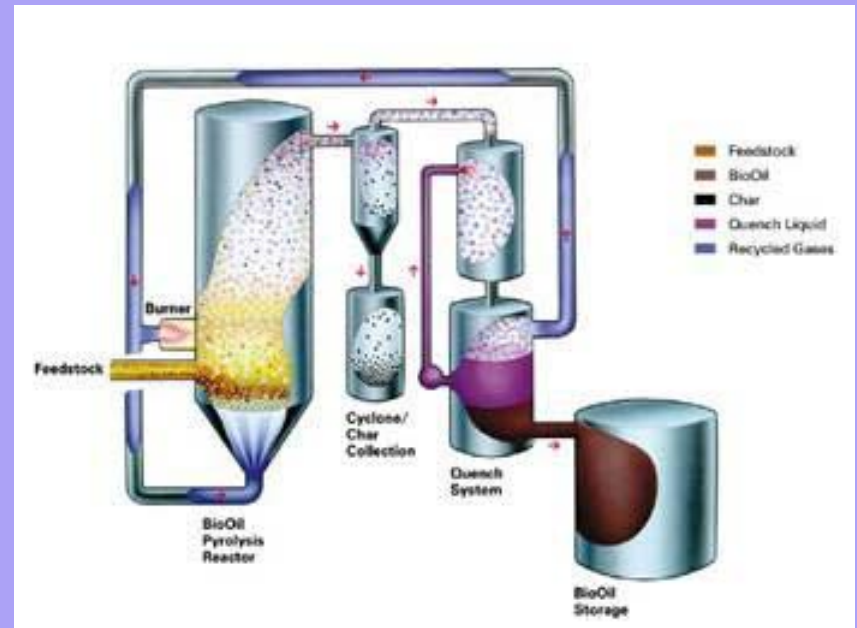
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Sustainability and Technology

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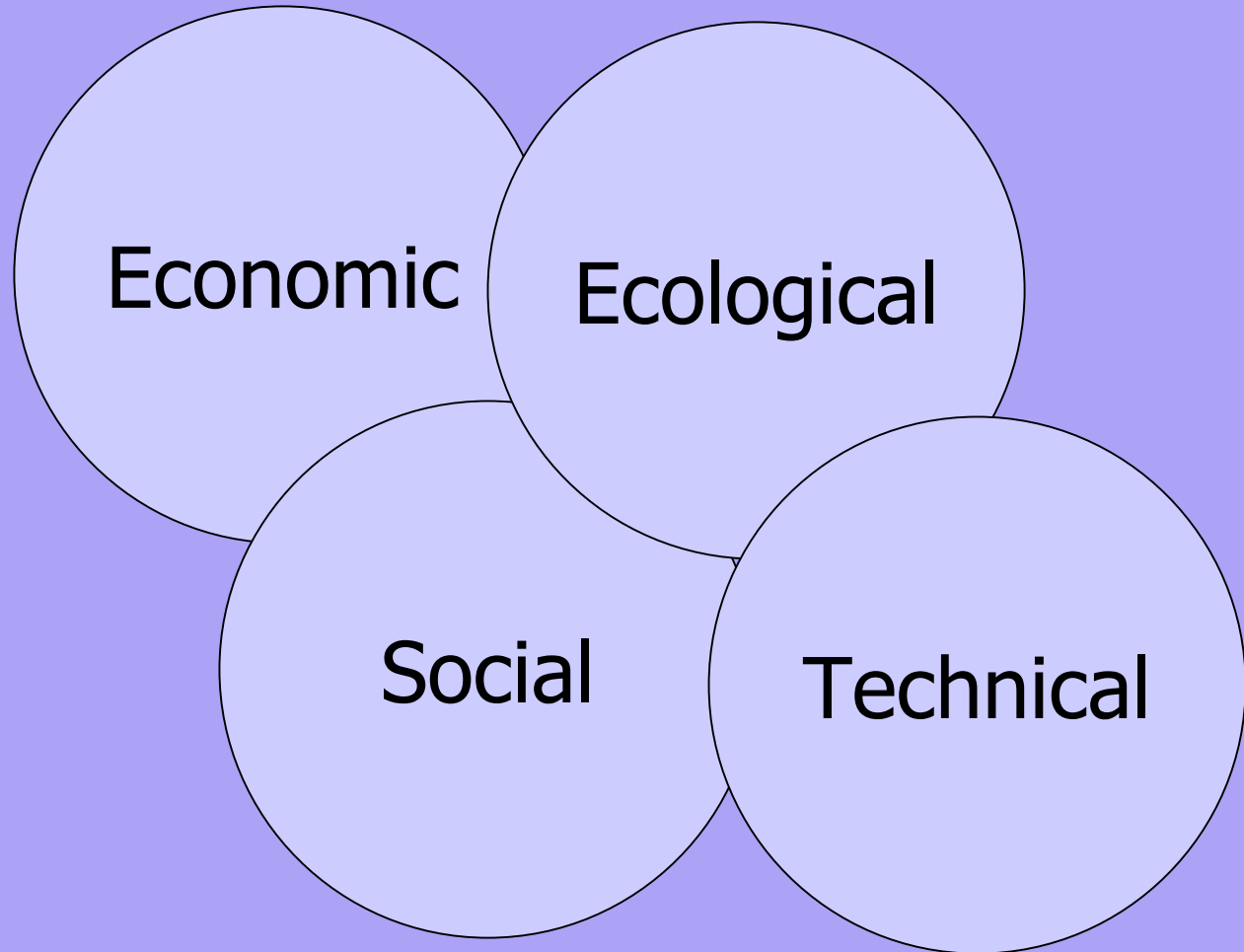
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Green Chemistry and Engineering

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- 12 principles of green chemistry (1998)
- 12 principles of green engineering (2003)
- Benign and sustainable chemical technology (2003)
- Advances in green chemistry and engineering (2004)



Sustainable Process

End of the pipe treatment/Pollution prevention

Potential incidental releases and leakage from waste disposal

Source reduction and in-process recycling

Cradle to cradle model



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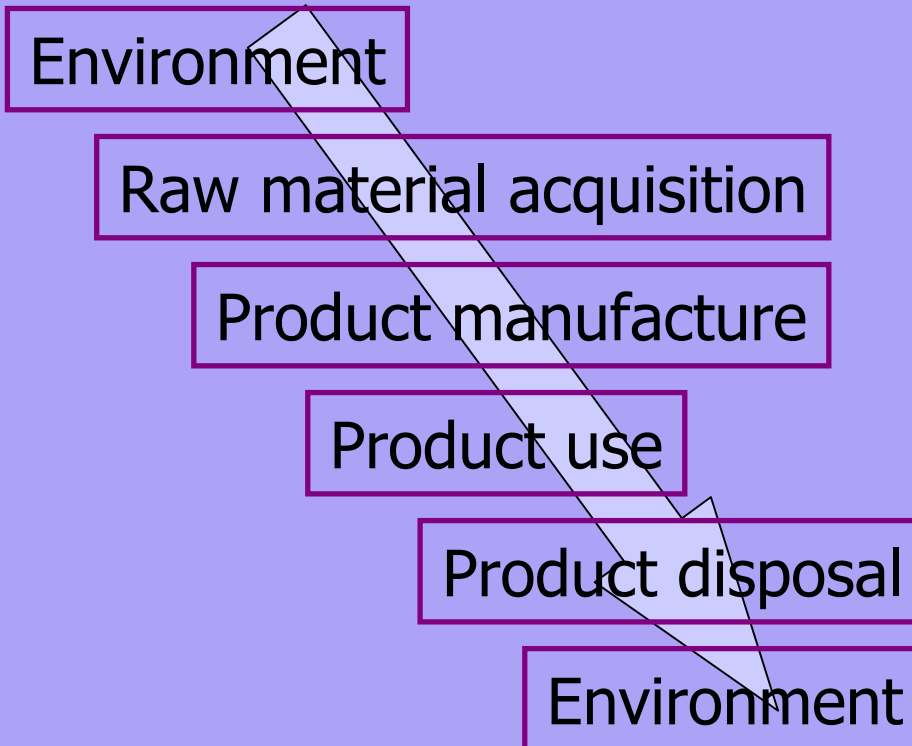
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Example: Hydrogen Economy

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Steam reforming of hydrocarbons

Partial oxidation of hydrocarbons

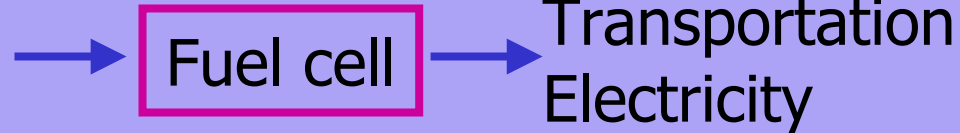
Coal gasification

Hydrogen

Electrolysis of water

Biomass gasification

Biomass Bio-processing





Interdisciplinary Education

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linking scholars, managers, and decision makers **to promote the sharing** of knowledge, ideas, and goals **among a community** working on science and technology for sustainability



Biodiesel

- An alternative diesel fuel made from renewable biological sources such as vegetable oils and animal fats

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History of Biodiesel Project at UBC

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- Biodiesel production at UBC started by two students, Geoff and Peter
- SFU lent the 60L batch Biodiesel reactor
- Naoko Ellis started academic research
- Environmental Youth Alliance initiated community linkages
- Campus Sustainability Office





Biodiesel Emission

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Emission	B100	B20
CO	-43.2%	-12.6%
HCs	-56.3%	-11.0%
NO _x	+5.8%	+1.2%
CO ₂	-78.3%	-15.7%
Particulates	-55.4%	-18.0%
Air Toxics	-60 to -90%	-12 to -20%
Mutagenicity	-80 to -90%	-20%

Source: http://www.eere.energy.gov/biomass/pdfs/biodiesel_handling.pdf

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UBC Biodiesel Pathway

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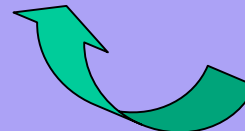
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Batch Operation

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- 120 L/wk batch process
- labour intensive operation
- produced by trained students





Pilot Plant Design and Construction

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- 1000 L/day semi-continuous process
- Automatic control system



- Proof of concept on community scale model
- Feasibility study for small communities





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- Department of Commerce
 - 4th year project
- Department of Chemical and Biological Engineering
 - 4th year thesis
 - 4th year design project
 - Master's thesis projects
- Department of Mechanical Engineering
 - 4th year design project
 - Master's thesis project



Department of Commerce

UBC Biodiesel Initiative: Helping Communities To Help Their Future

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- Developed a business plan based on:
 - Non-profit organization
 - Production of Biodiesel at UBC
 - Recycle waste vegetable oil
 - Design a transferable model
 - Educate other universities and small communities



Chemical Engineering 4th Year Design Project

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Conclusions

- Analysis and presentation of process options
- Process conception and evaluation of process options
- Complete stream tables and Process Flow Diagram
- Energy balances
- Piping and Instrumentation Diagram, including all control schemes
- Equipment design and sizing
- HAZOPS analysis
- Plant layout, piping and labor requirements
- Environmental impact analysis and permitting requirements
- Operating strategy – including start-up and shut-down procedures
- Process economics and viability



Mobile Biodiesel Production Plant





Mechanical Engineering 4th Year Project

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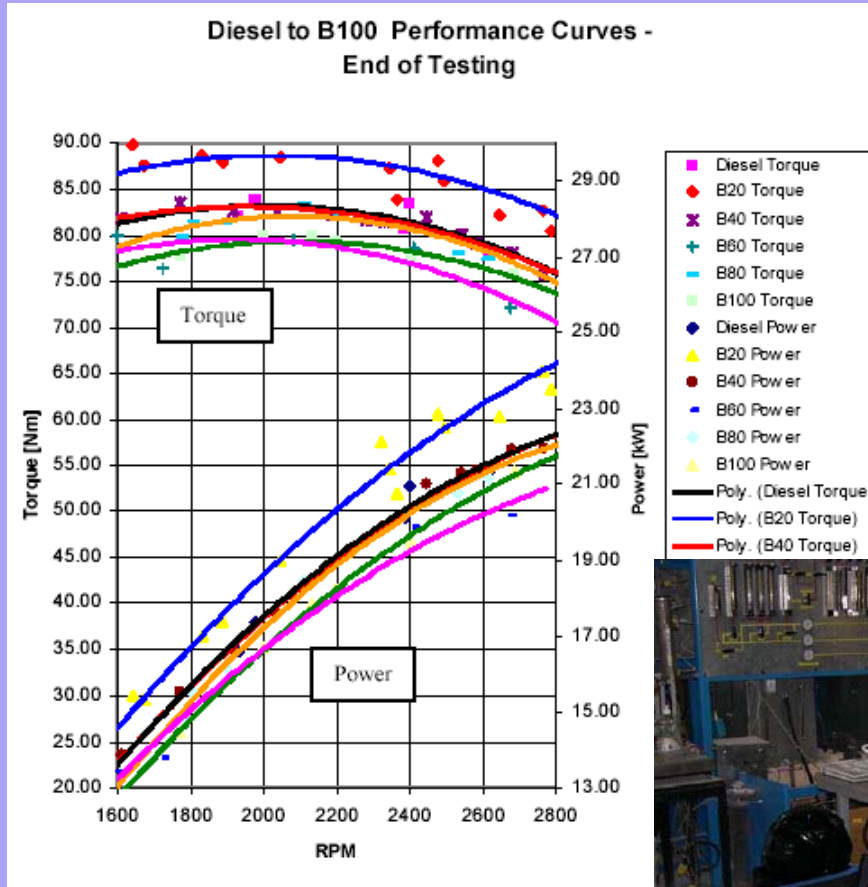
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Partnership and Funding



Both partners, EYA and UB, have mutual goals of concrete environmental solutions, research and innovation, youth skill and career development, and demonstrating sustainability.

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<http://www.eya.ca/>



Funding Opportunities

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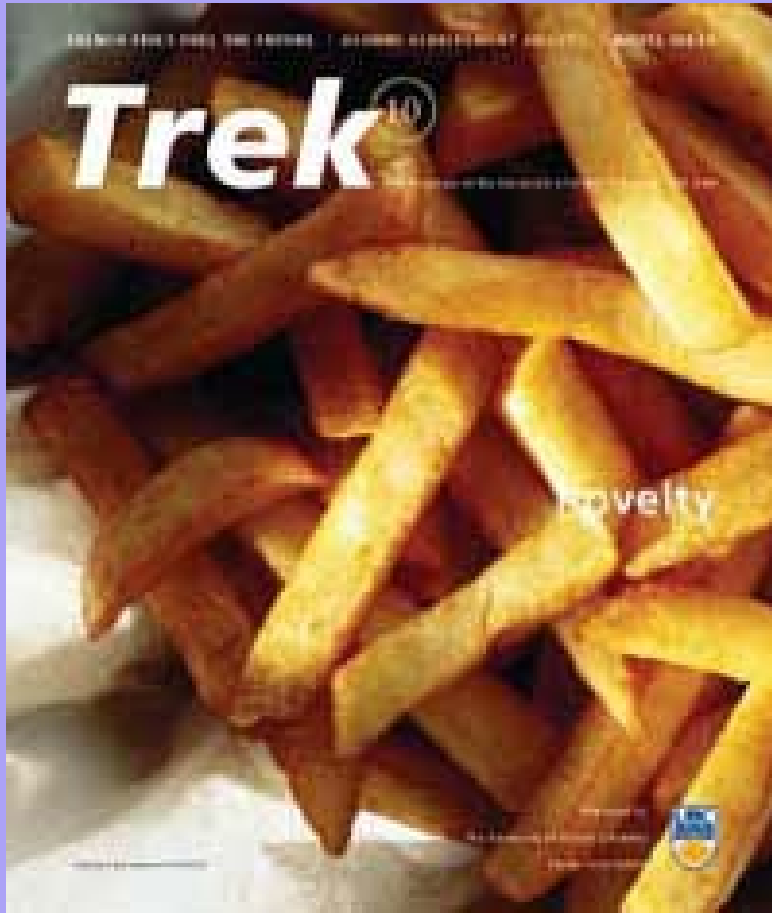
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- EYA
- UBC
 - Campus Sustainability Office
 - Campus Land and Building Services
 - Chemical and Biological Engineering
- VanCity Environmental Fund
- Fisher Scientific Environmental Fund
- MOST (Moving on Sustainable Transportation)



Showcase



A new project by environmentally aware students may change the way we fuel our cars, save us from the collapse of the oil industry, and clean up the air. All the while, ensuring good quality french fries.

http://www.alumni.ubc.ca/files/pdf/trek/issues/04fall/10_French_Fries_Future.pdf

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Finally, grease that's good for you!

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Address <http://www.peak.sfu.ca/the-peak/2002-3/issue3/fe-biodiesel.html> Go Links Norton F

e.Peak Features

Simon Fraser University's Independent Student Newspaper Since 1965 - Online Since 1994

[Home](#) 3, vol 112 -- September 16, 2002

[About](#) Finally, grease that's good for you!
Kathleen Deering, The Ubyyssey

[Masthead](#)

[Et Cetera](#) VANCOUVER (CUP)-Geoff Hill stands proudly by his "Biodiesel Van," a hulking orange VW Westfalia beauty, which doubles as both his home and the only existing vehicle at the University of British Columbia running solely on 100 per cent biodiesel, a fuel made from recycled vegetable oil.

[Archives](#)

[Contact](#)

[Links](#) I admire the new decal pressed to the back window of the van -"We combust your fat."

[Search](#) When the Ubyyssey wrote a story about Geoff Hill's unique project in Februarv. Hill had made only one litre of biodiesel. It was made in a

www.peak.sfu.ca/the-peak/2002-3/issue3/fe-biodiesel.html

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Sustainability Day

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In communities such as
Quesnel, Whistler,
Bowen Island,
City of Richmond



... and on campus



Campus Sustainability Office

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SEEDS Project
**Social, Ecological, Economic
Development Studies**
*Student, staff and faculty
working towards sustainability in
tandem*



Provided support in
closing the loop on
campus



<http://www.sustain.ubc.ca/seeds.html>



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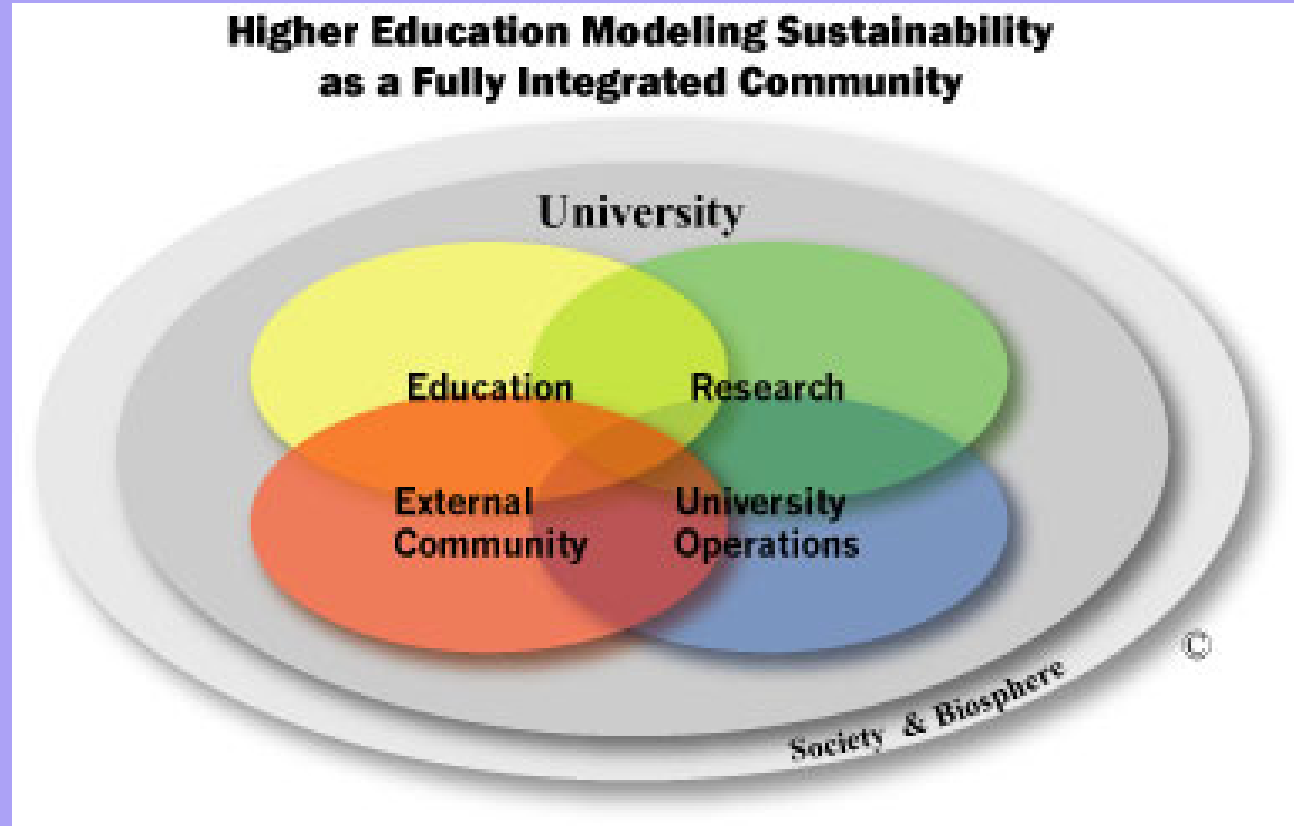
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<http://www.scup.org/gfx/sustainability.jpg>

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We have not inherited this world from our
parents, but we have it on loan from our
children