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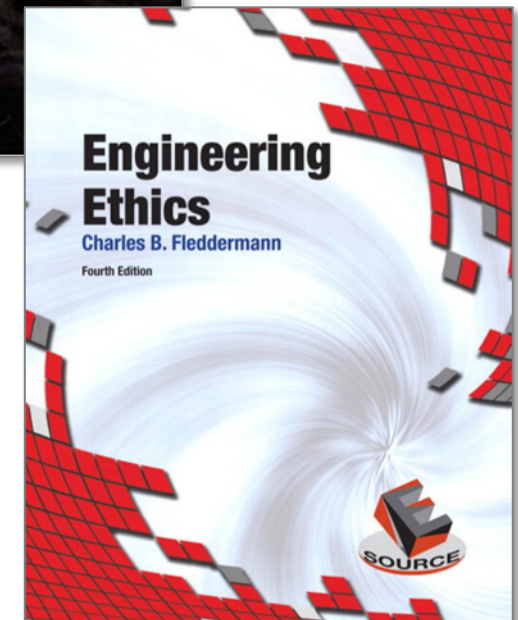
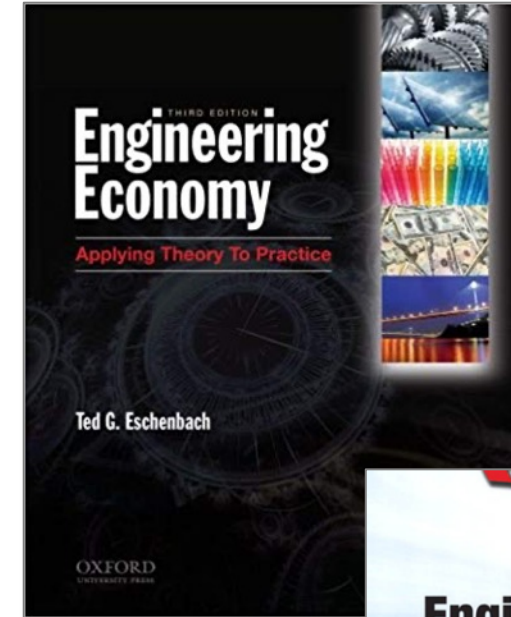
David Kaplan, Ph.D.  
UF Environmental Engineering Sciences

David Kaplan, Ph.D.

# UF Environmental Engineering Sciences

# Coming Up

- **Today:** Engineering vs. environmental vs. ecological economics; HW 1 released (due 1/27)
- \*\*\* **QUIZ 1** \*\*\* (due Sunday, 23:59)
- **Next Week:** MLK Day (no class Monday); Read Eschenbach Ch. 1 and Fleddermann (before class on Wednesday)





## ENGINEERING SCHOOL OF SUSTAINABLE INFRASTRUCTURE & ENVIRONMENT

### 2<sup>nd</sup> ESSIE Conversations and Engagement Event

Dear Students, Faculty and Staff,

Welcome to the Spring 2021 Semester! ESSIE invites you to take part in an exciting welcome event that we have scheduled. We look forward to a great semester.



Kirk Hatfield, Ph.D.,  
ESSIE Director and Professor

**Theme: Daring to Design an Enduring Society**  
<https://www.essie.ufl.edu/about/>

**Date:** Friday January 15, 2021  
**Time:** 12:40 pm – 1:40 pm (Period 6); *login at 12:30 to say hi!*  
**Zoom Link:** <https://tinyurl.com/yxer4rm6>  
**Meeting ID:** 984 8881 4813 **Password:** Vision

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CHANG-YU WU



KURTIS GURLEY



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QUÍÑONES



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ALBERTO  
CANESTRELLI

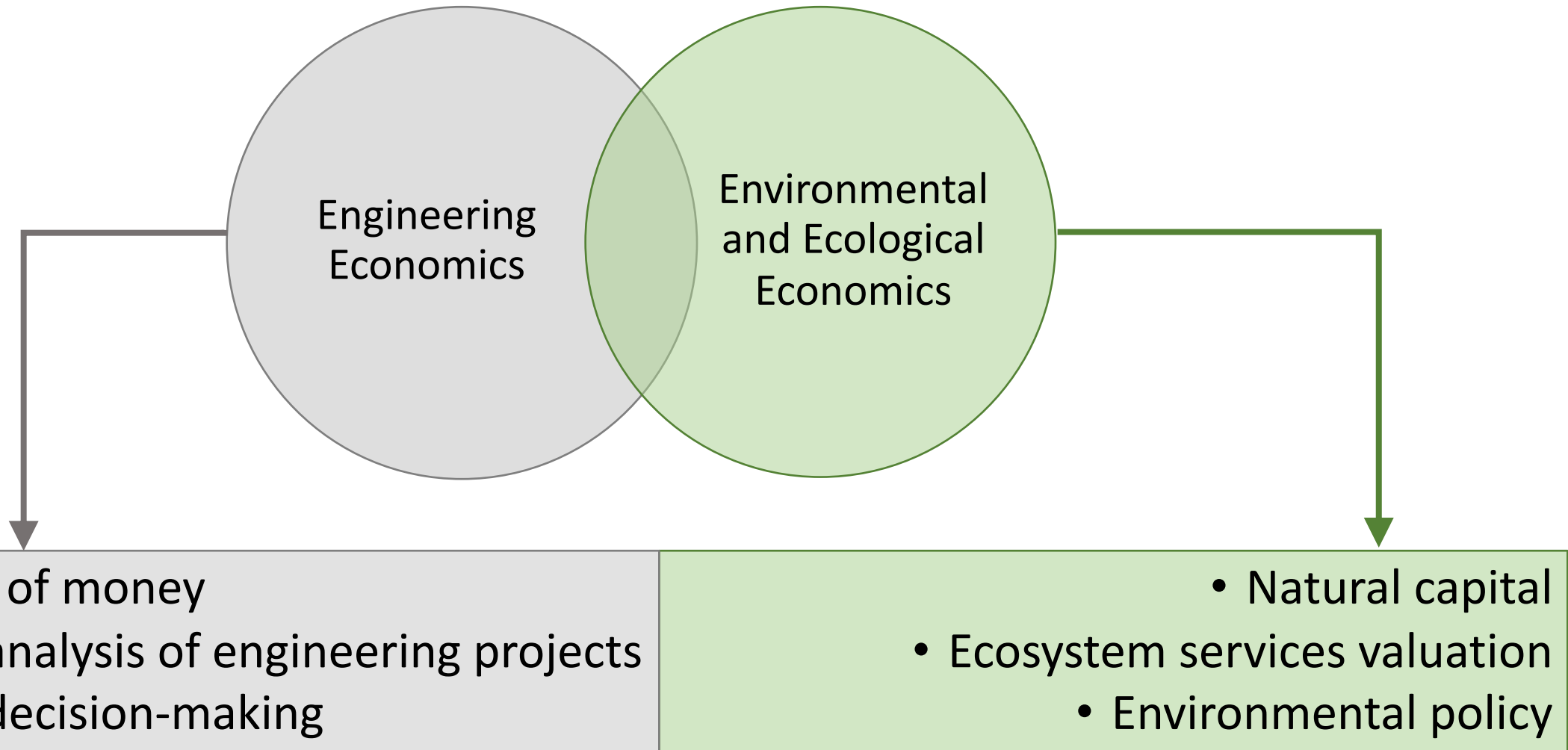


ANDREW ALTIERI



# Last Time

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# Some definitions, but first...

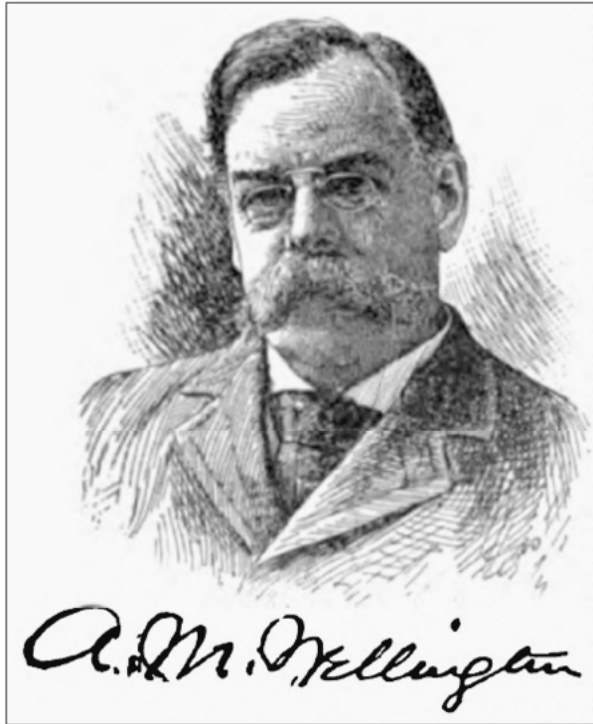
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## Micro- vs. Macroeconomics



# Engineering Economy/Economics

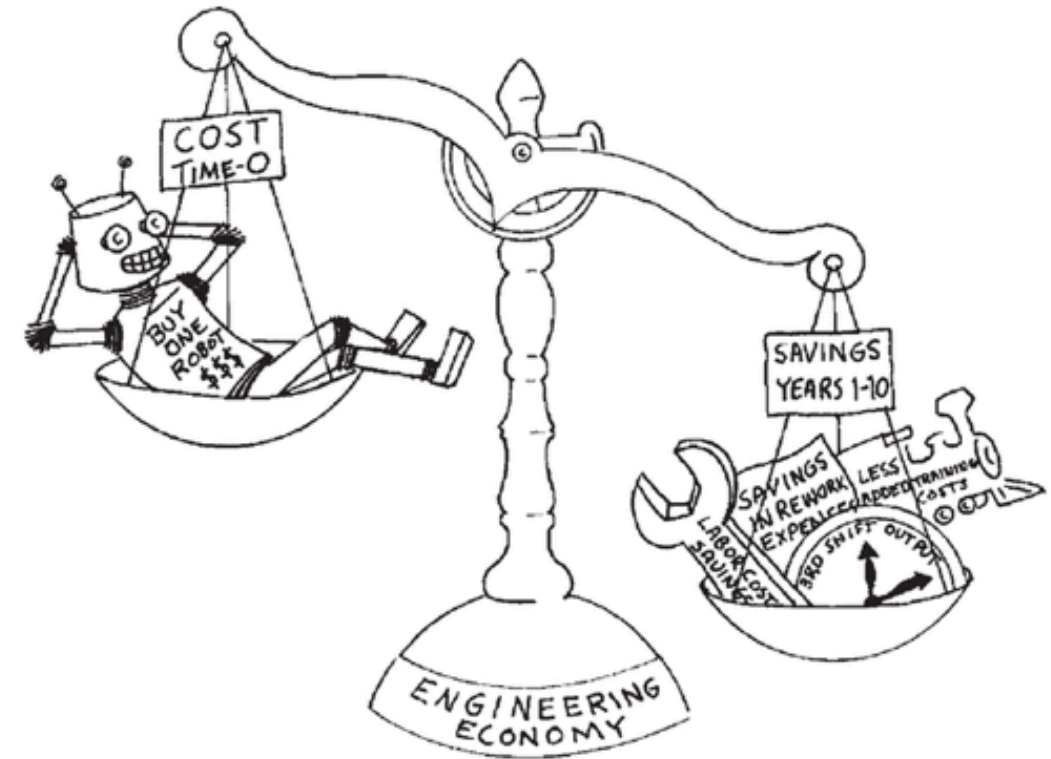
**Engineering economy:** Making engineering decisions by balancing expenses and revenues that occur now and in the future.



An engineer  
can do for a  
dollar what  
any fool can  
do for two.

Arthur Mellen Wellington

**EXHIBIT 1.1** Engineering economy balances current and future revenues and costs



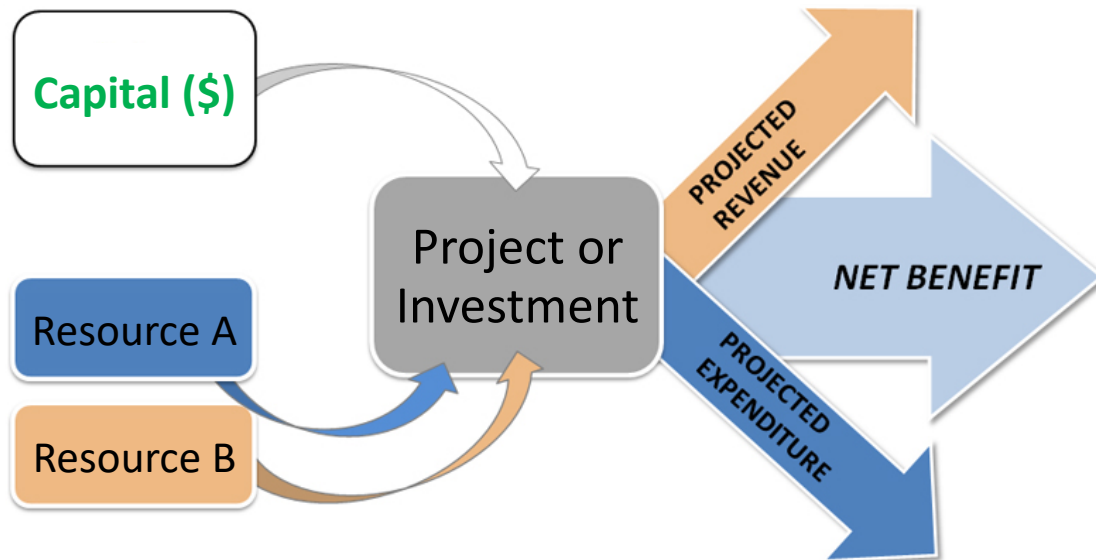
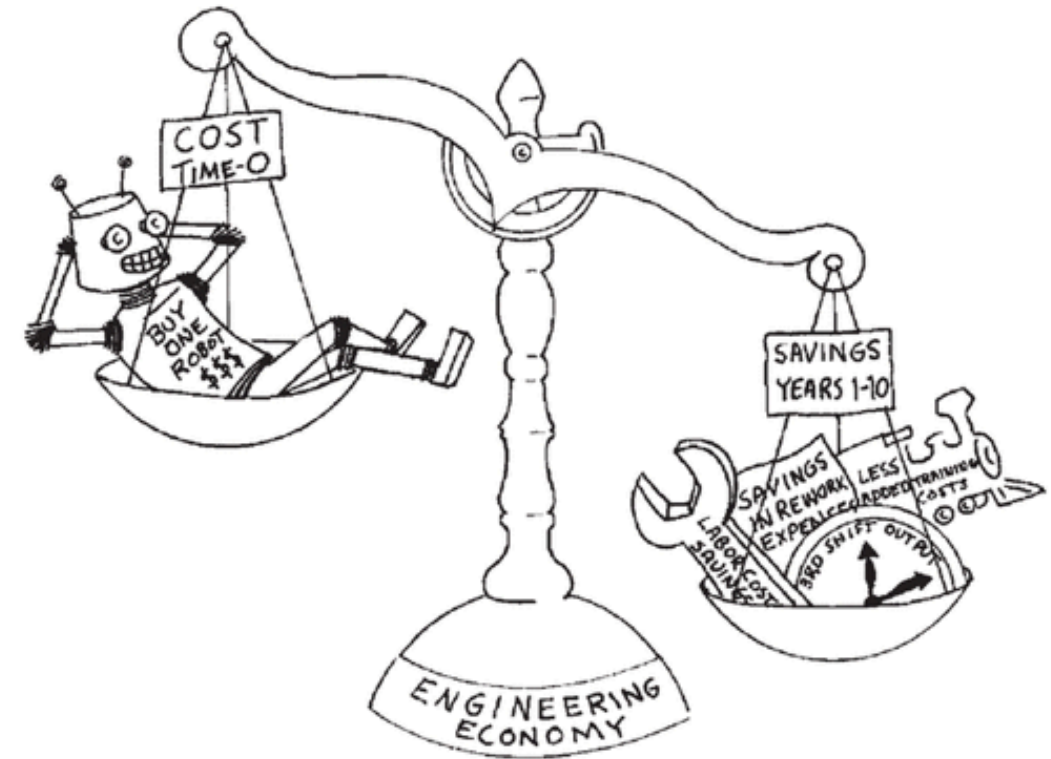
*(micro- or macroeconomics?)*

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**EXHIBIT 1.1** Engineering economy balances current and future revenues and costs





# Engineering Economy/Economics

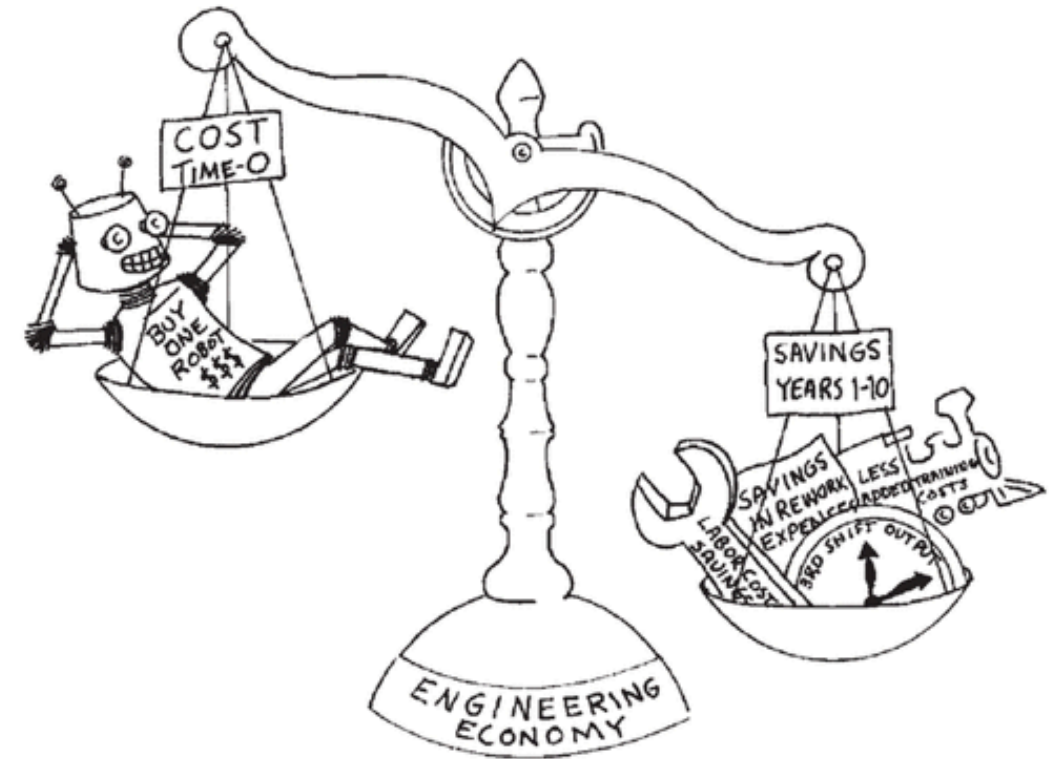
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Uses mathematical formulas to account for the time value of money and to balance current and future revenues and costs.

Quantifies benefits and costs of engineering projects to determine if they save/make enough \$\$\$ to justify investment.

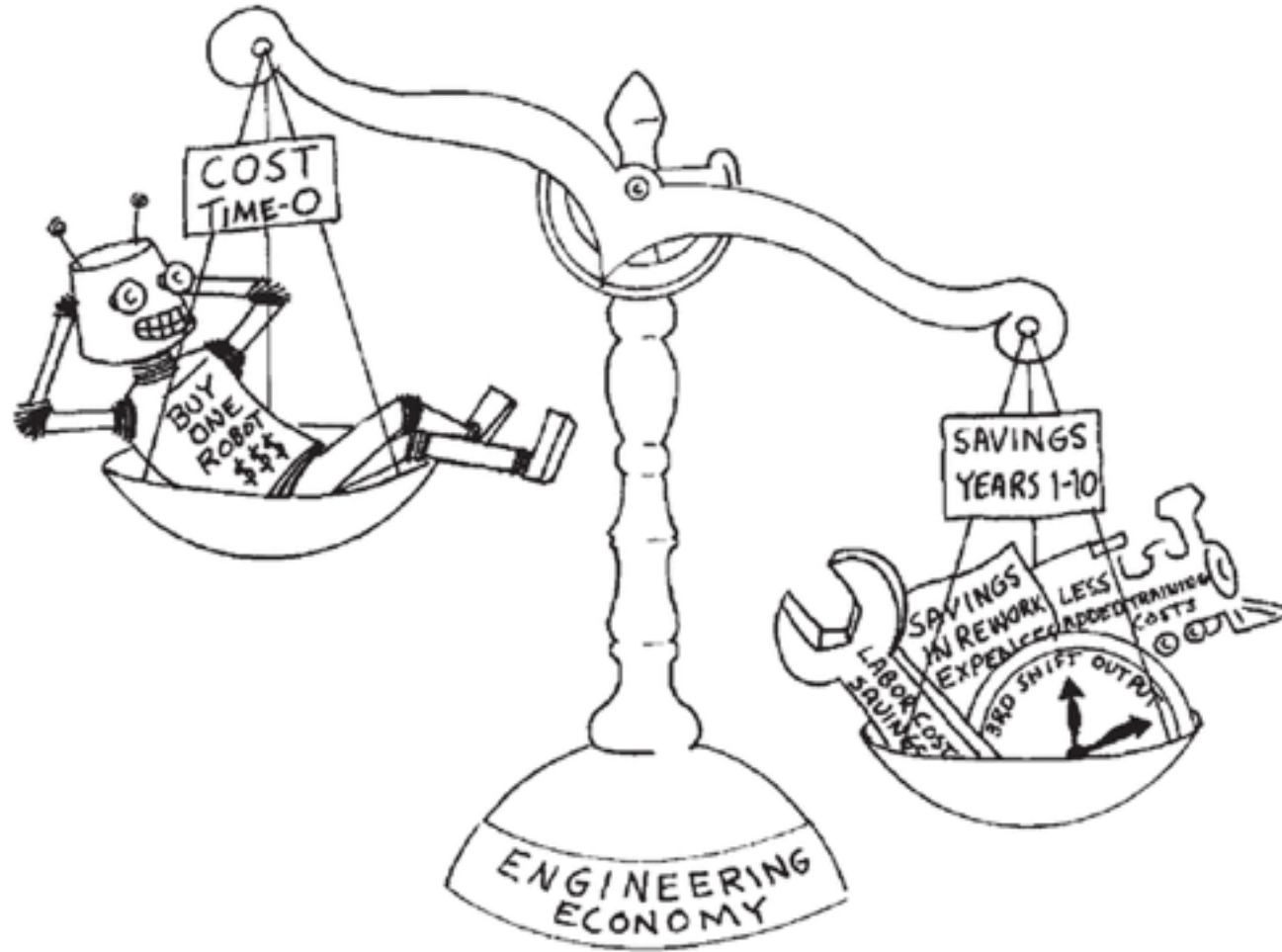


**EXHIBIT 1.1** Engineering economy balances current and future revenues and costs



# Engineering Economy/Economics

**EXHIBIT 1.1** Engineering economy balances current and future revenues and costs



# Engineering Economics in ENV 4601

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1/24	Economics of environmental quality – who pays for a clean environment? <i>How</i> clean? <i>Who</i> pays?		Harris 1996, <a href="#">Video 1</a>	<b>HW 1 Due (1/27)</b> HW 2 Assigned
1/31	Time value of money: understanding interest	Cash flow diagrams and equivalence	Eschenbach Ch. 2	---
2/7	Valuation of “natural capital” and ecosystem services (ES) – what is the environment worth? How can it be measured?		<a href="#">Guerry et al. 2015</a> , <a href="#">Video 2</a>	<b>HW 2 Due (2/10)</b> HW 3 Assigned
2/14	Engineering economy factors I	Engineering economy factors II	Esche	3/7
2/21	Engineering economy factors III	Catch-up and exam review	---	3/14
2/28	<b>Exam 1</b>	Digging deeper: can markets protect the environment?	<a href="#">Stavi Grist</a>	3/21
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				4/4
				4/11
				4/18

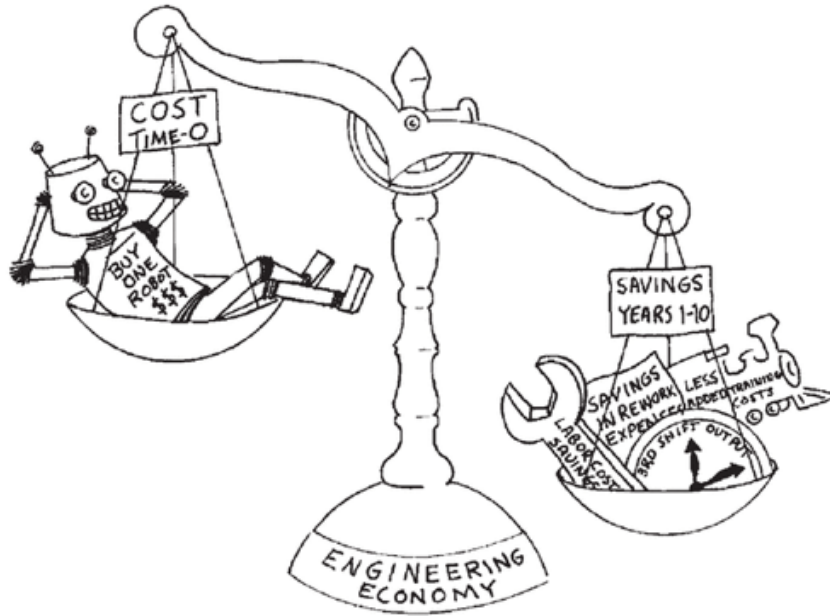
Present worth I	Present worth II	Eschenbach Ch. 5.1-5.6	---
Equivalent Annual Cost I	Equivalent Annual Cost II	Eschenbach Ch. 6.1-6.7	<b>HW 4 Due (3/17)</b> HW 5 Assigned
Internal rate of return I	Internal rate of return II	Eschenbach Ch. 7.1-7.6	---
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<b>Exam 2</b>	<b>Reading Days - No Class</b>	<b>*** THERE IS NO “FINAL” ***</b>	



# Environmental Economics

**Environmental Economics**: Application of “mainstream” economic principles to environmental and natural resource issues

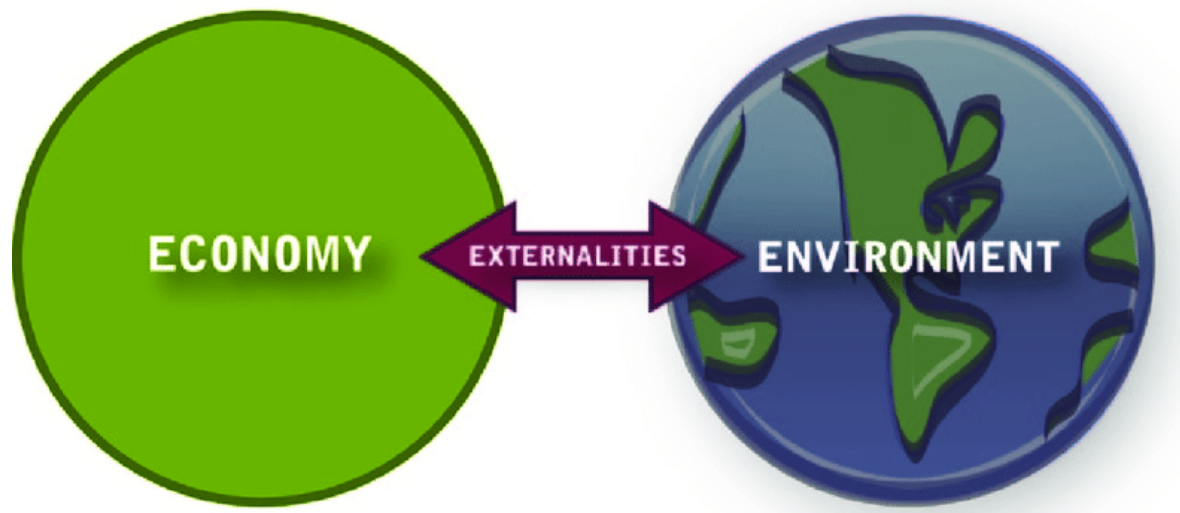
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# Environmental Economics

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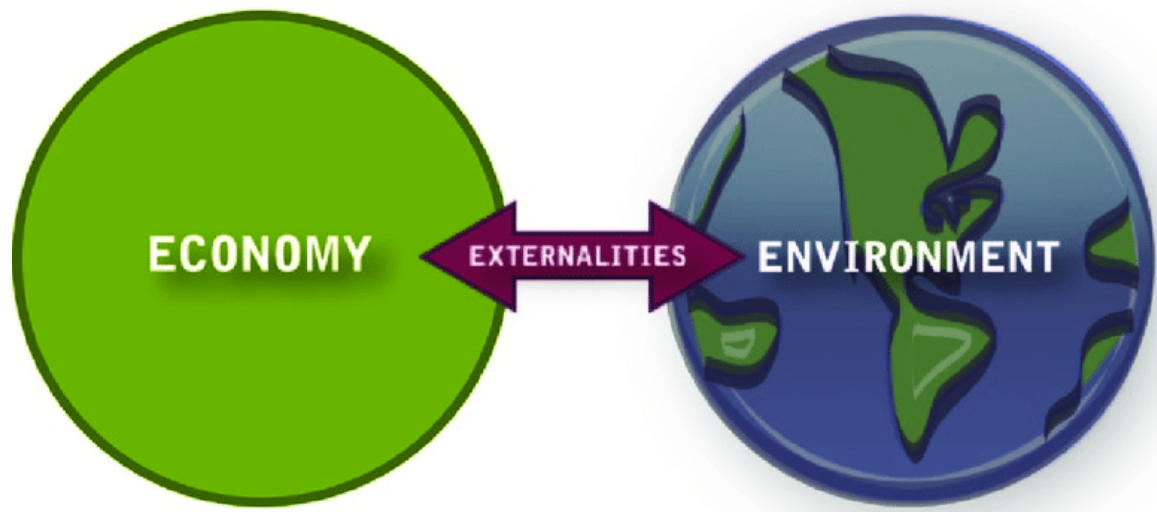
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**Externality**: a cost or benefit of economic activity that affects a party who did not choose to incur it.

# Environmental Economics

**Environmental Economics**: Application of “mainstream” economic principles to environmental and natural resource issues



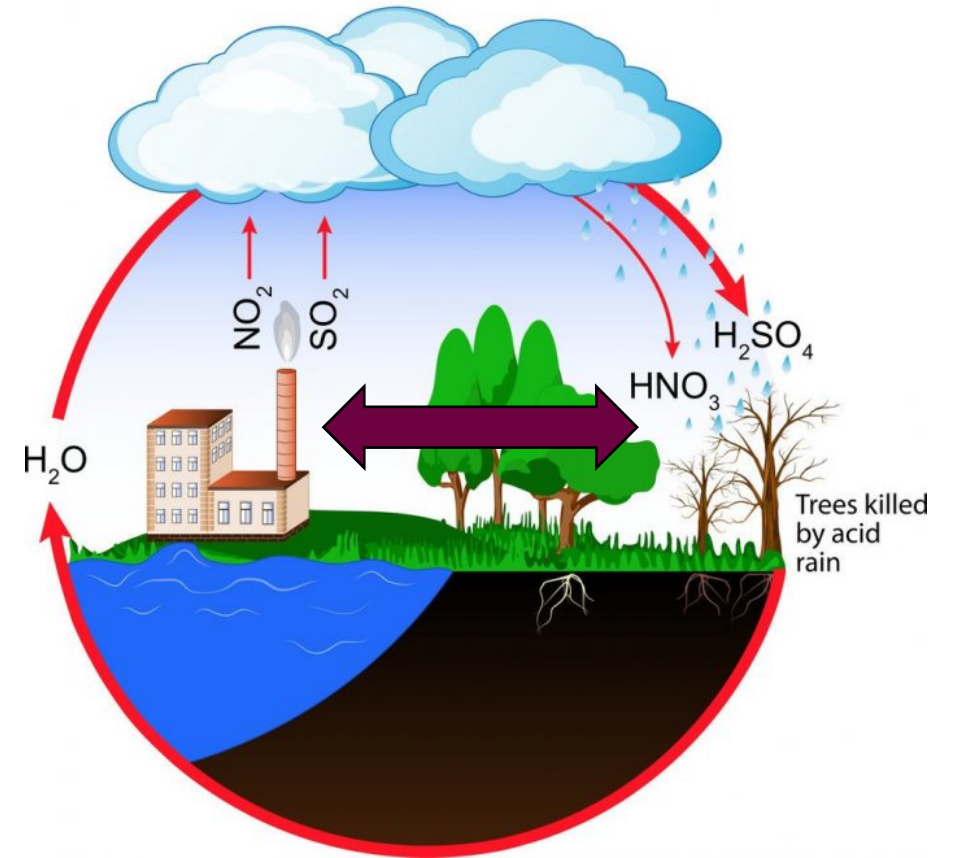
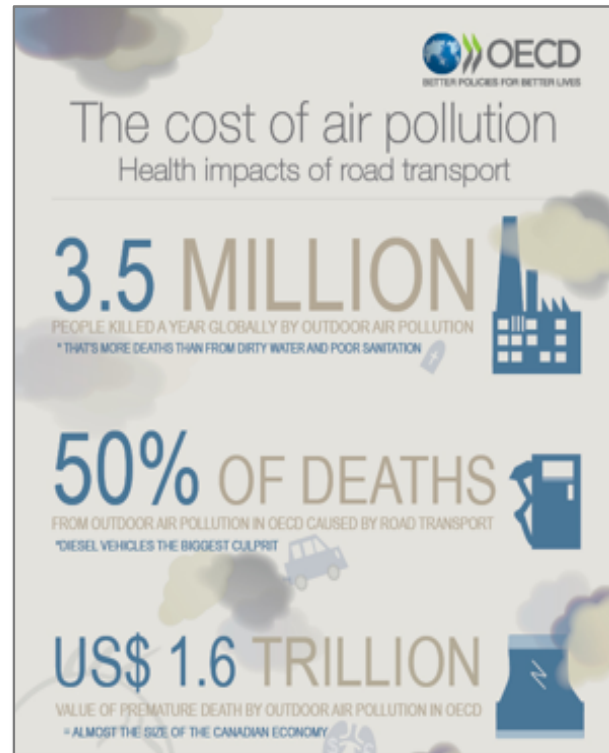
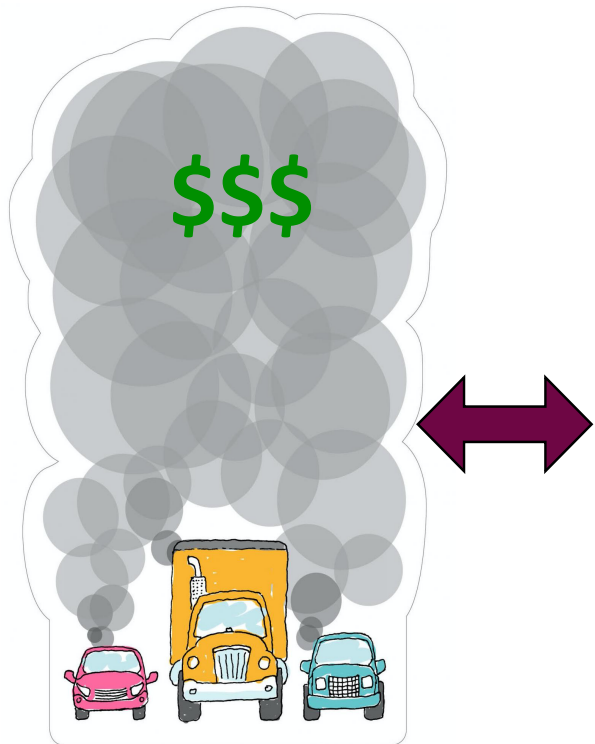
## **A few questions:**

1. Example of environmental externality?
2. (How) are externalities related to costs?
3. How can/should society deal with the issue of environmental externalities?

**Externality**: a cost or benefit of economic activity that affects a party who did not choose to incur it.



# Environmental Externalities



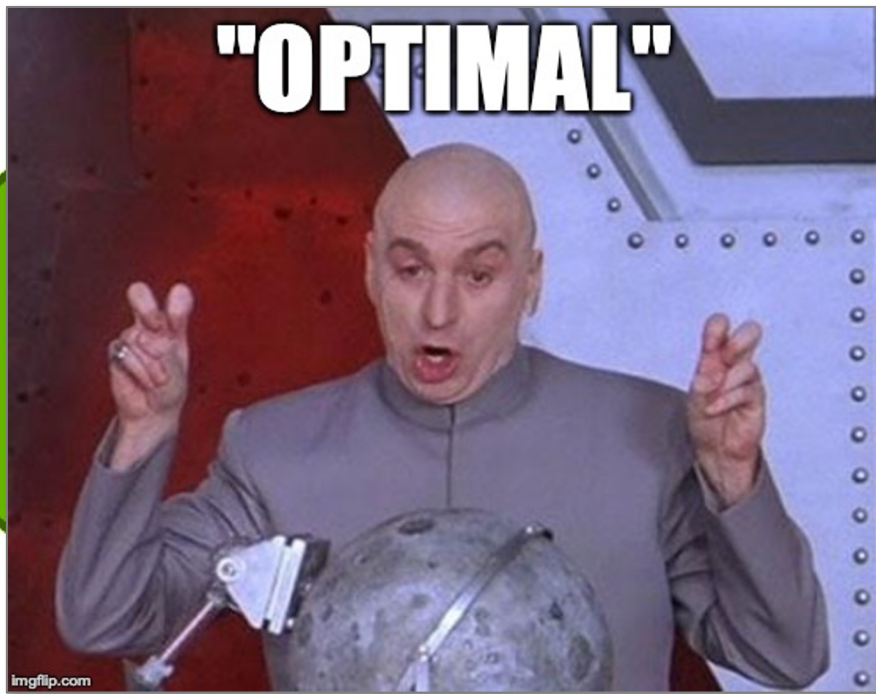
# Environmental Externalities





# Environmental Economics

Environmental Economics: Application of “mainstream” economic principles to environmental and natural resource issues



## Four Core Concepts

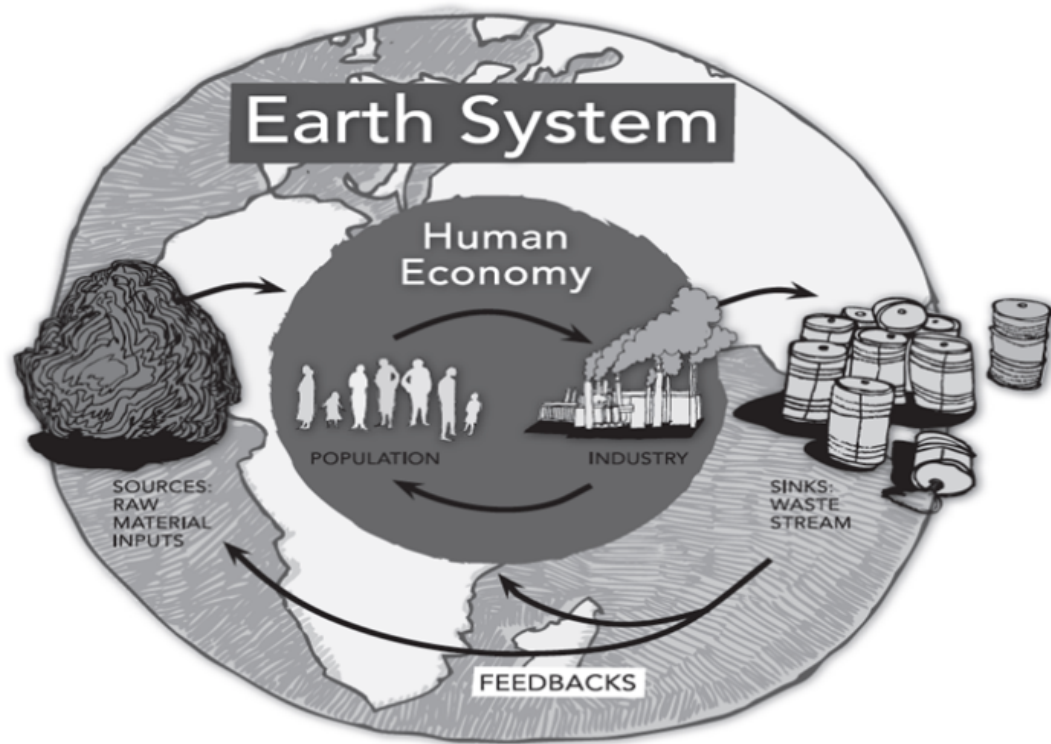
1. Theory of **environmental externalities**
2. Optimal management of of **common property and goods**
3. Optimal management of **natural resources** over time
4. Economic valuation of **environmental goods and services**

*(micro- or macroeconomics?)*



# Ecological Economics

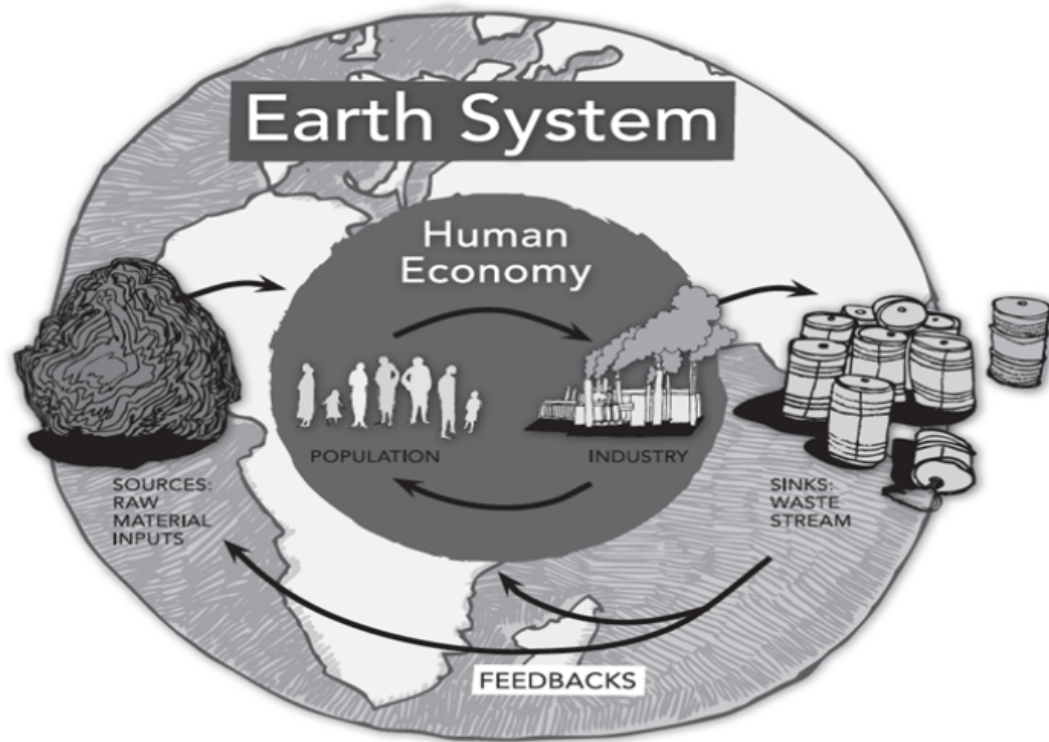
**Ecological Economics**: Interdisciplinary field that views the economic system as part of the broader ecosystem, subject to biophysical laws



*(micro- or macroeconomics?)*

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*“The economy is a wholly owned subsidiary of the environment, not the reverse.”*

- Herman E. Daly

Reproduction is more pleasurable  
than death.

— Herman E. Daly —



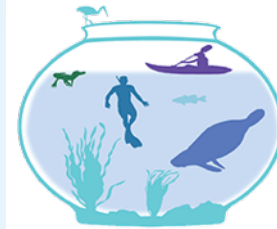
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Howard T. Odum  
Center for Wetlands



Howard T. Odum  
**FLORIDA  
SPRINGS  
INSTITUTE**



## Energy, Ecology, and Economics

BY HOWARD T ODUM



Money and market values cannot be used to evaluate real wealth from the environment.

– Howard T. Odum

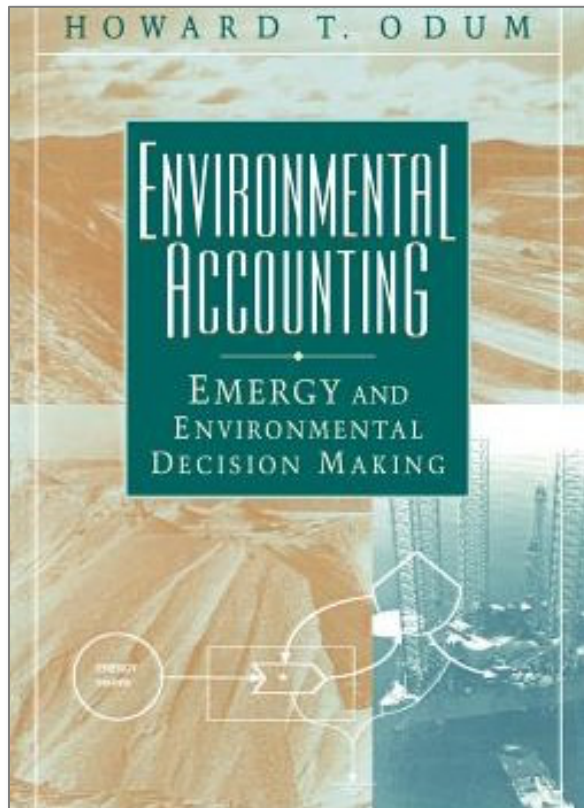


*(micro- or macroeconomics?)*



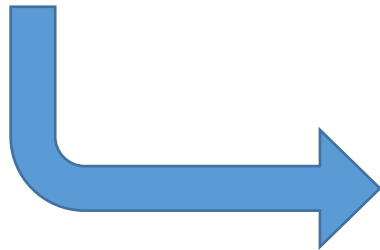
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Understanding the economy requires that both money circulation and the pathways of real wealth be represented together but separately.

Money is only paid to people and never to the environment for its work...  
Therefore, money and market values cannot be used to evaluate the real wealth from the environment. When the resources from the environment are abundant, little work is required from the economy.



Ecosystems (2000) 3: 21–23  
DOI: 10.1007/s100210000005

**ECOSYSTEMS**  
© 2000 Springer-Verlag

## The Energetic Basis for Valuation of Ecosystem Services

Howard T. Odum<sup>1</sup> and Eugene P. Odum<sup>\*2</sup>

<sup>1</sup>Environmental Engineering Sciences, University of Florida, Gainesville, Florida 32611; <sup>\*2</sup>Institute of Ecology, University of Georgia, Athens, Georgia 30602, USA

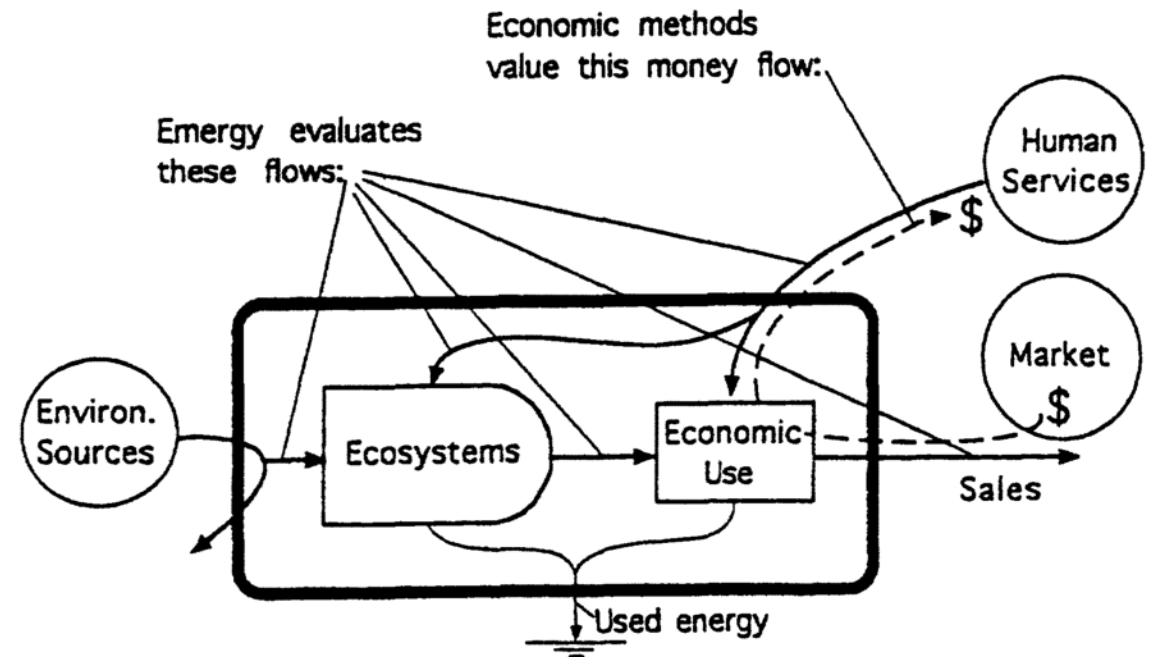
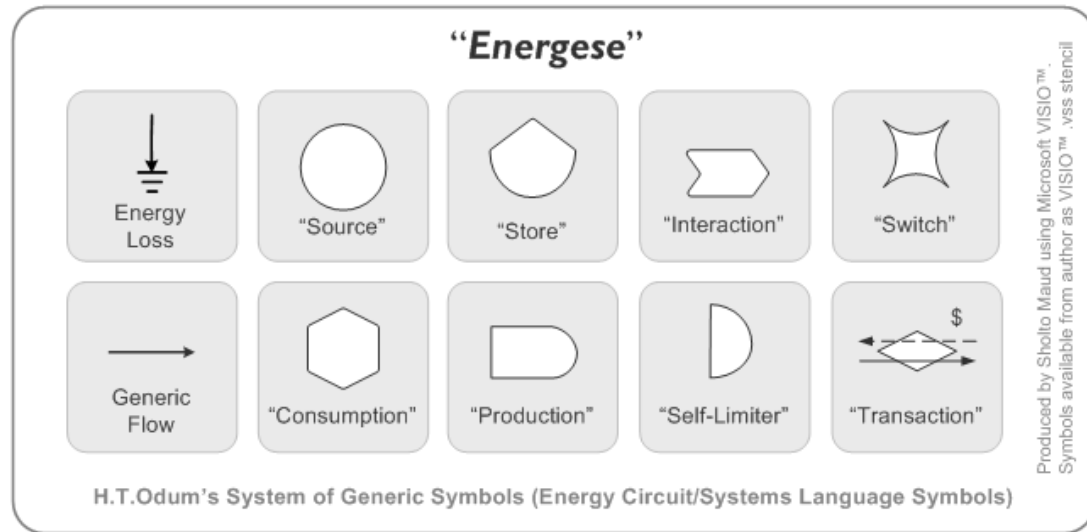
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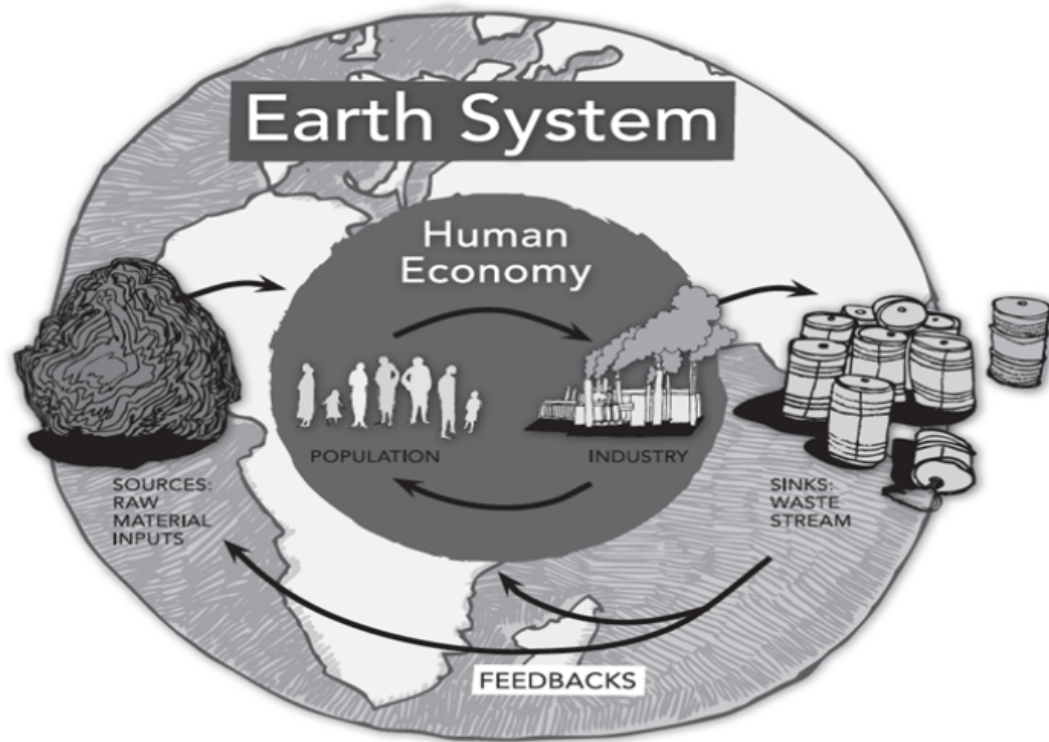
**Energy or “Energy Memory”**: the amount of energy consumed in direct and indirect transformations to make a product or service.



*(micro- or macroeconomics?)*

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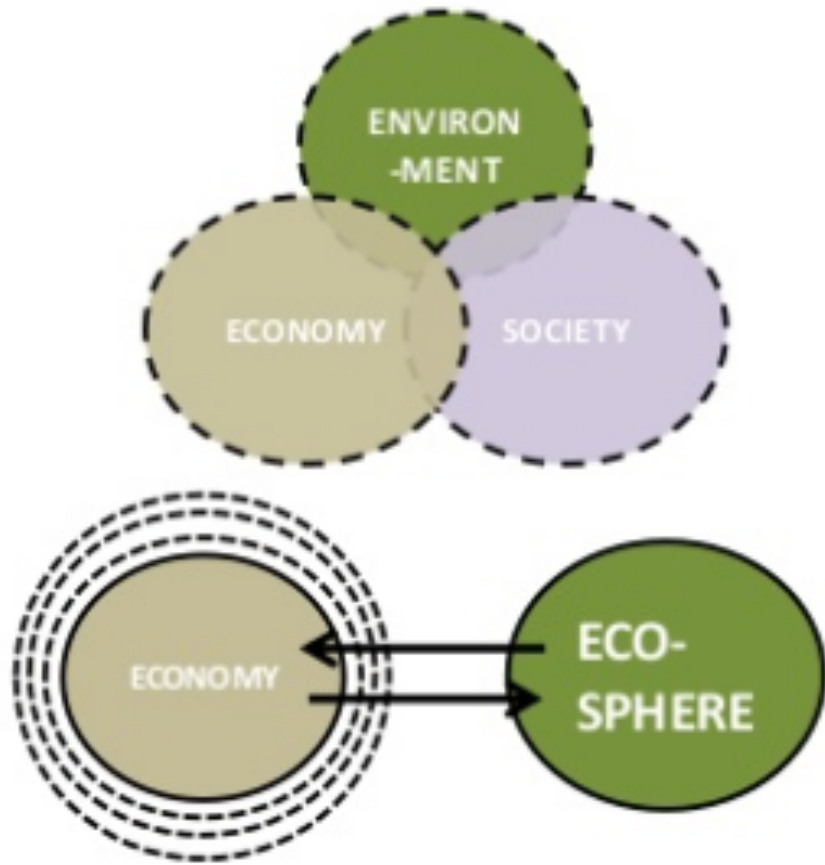
## **Three Core Concepts**

1. The economic system is a **subset of the broader ecological system**
2. Sustainability should be defined by **ecological not economic criteria**
3. **A range of academic disciplines** and perspectives, in addition to economics, is required to balance social, environmental, and economic needs

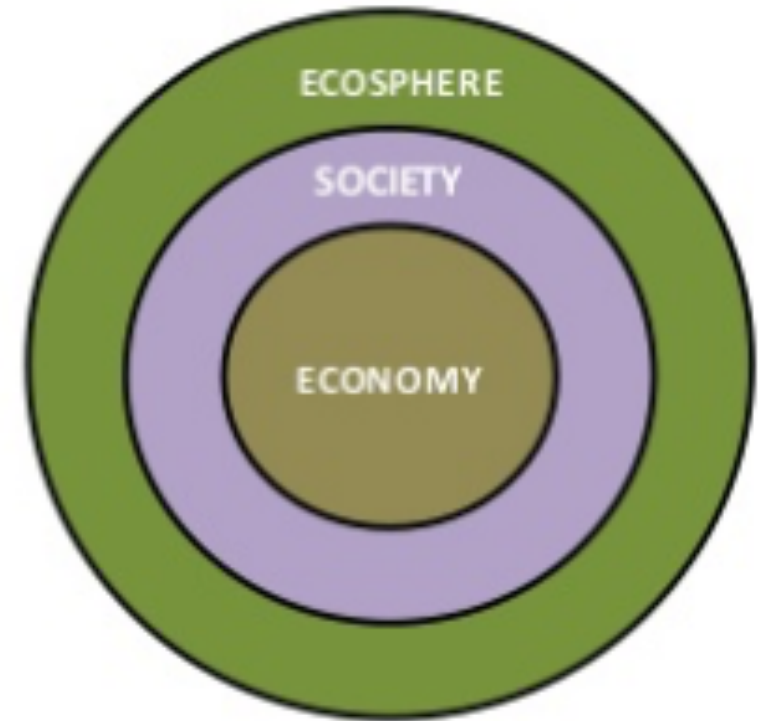
*(micro- or macroeconomics?)*

# Environmental vs. Ecological Economics

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VS.



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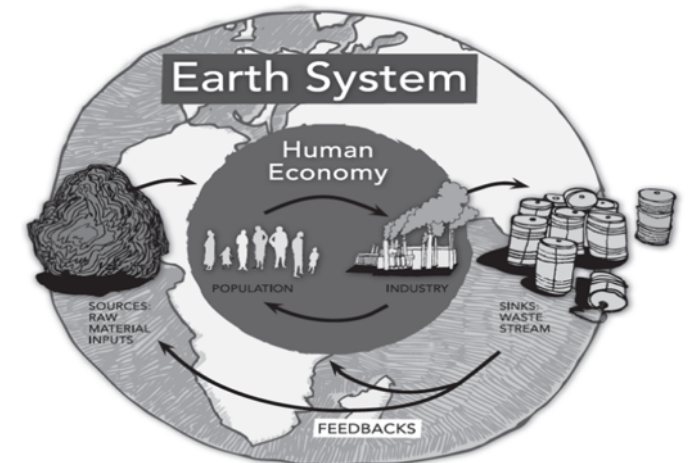
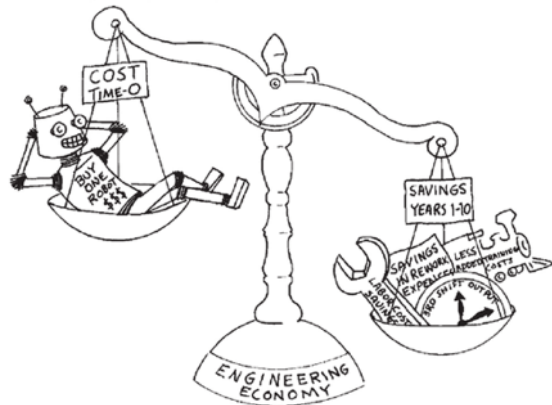
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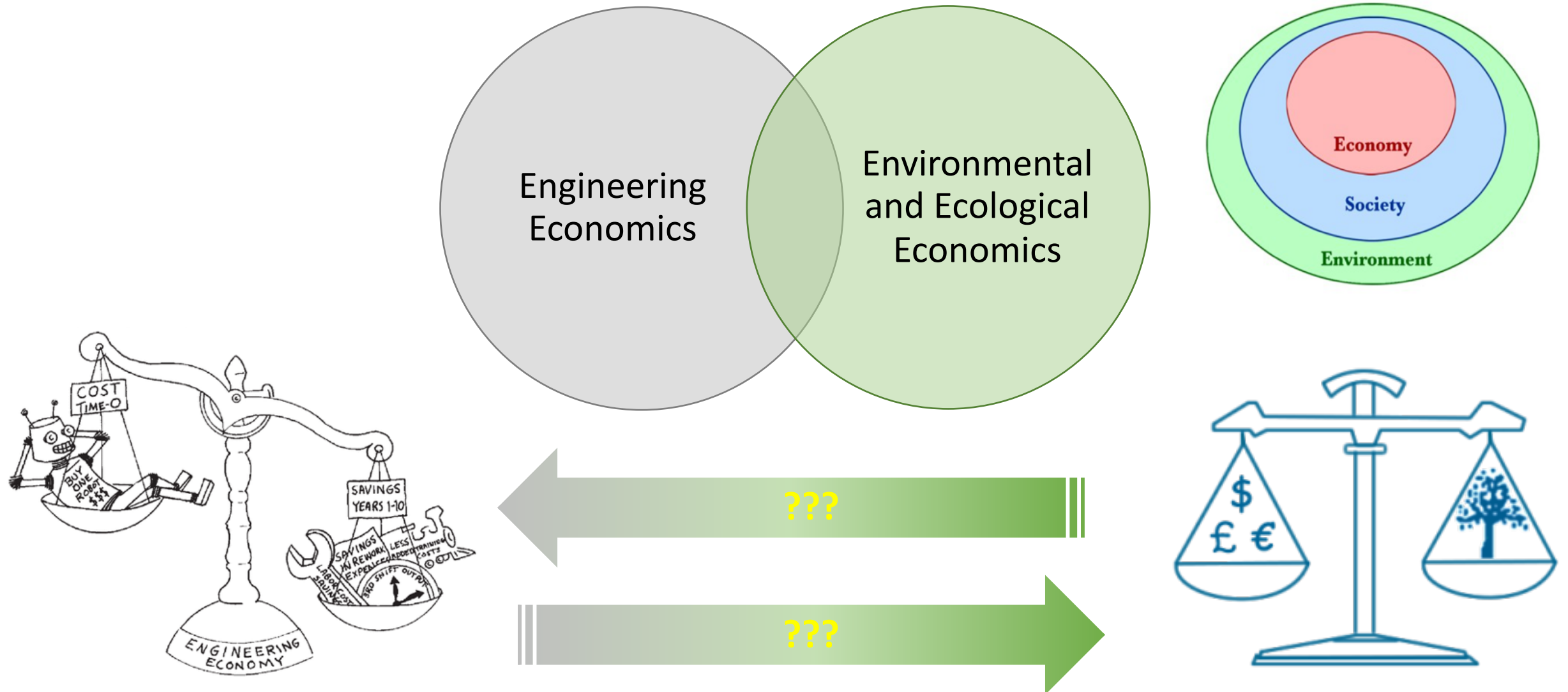
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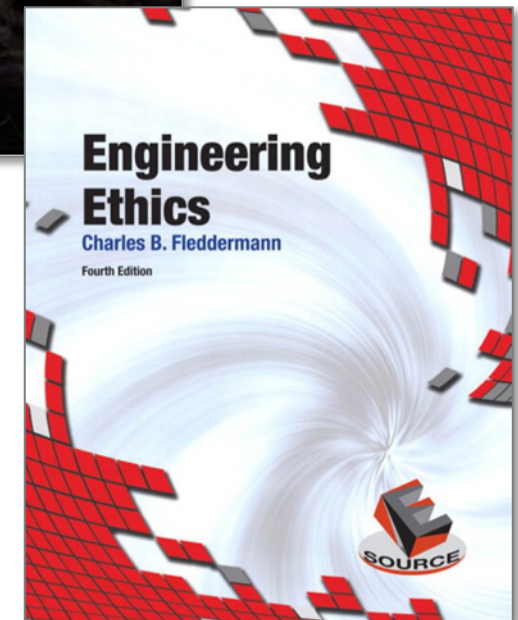
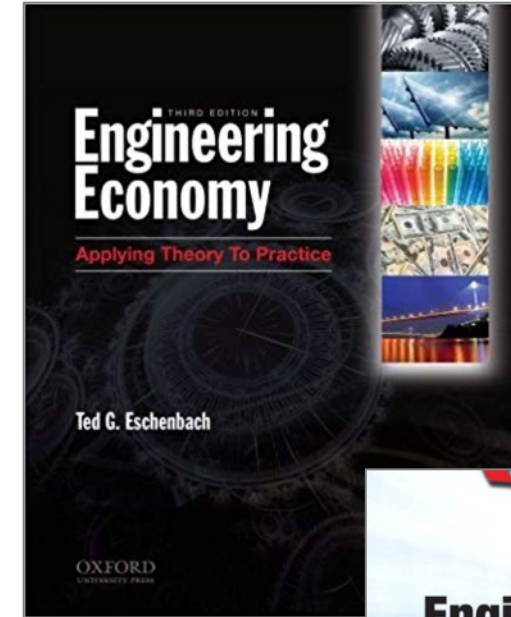


# So...what's the relationship?



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