ESM 273: Life Cycle Assessment (LCA)

Syllabus, Winter 2016

Time & Room:	Mondays, 1:00-2:15pm, BH1424 Wednesdays, 1:00-2:15pm, BH3035 (GIS Lab) No class on 1/18, and 2/15.
Final report:	Is due on Friday, March 4, 5pm
Final exam:	Date TBD
Instructor:	Roland Geyer, BH3426, extension 7234, geyer@bren.ucsb.edu
Office hours:	By appointment
TA:	Joe Palazzo, BH3031, jpalazzo@bren.ucsb.edu
Office hours:	By appointment

Books on Life Cycle Assessment (LCA):

- Highly recommended:
  Environmental Life Cycle Assessment (Schenck & White, Eds.)
  http://aclca-shop.lcacenter.org/ ($45 student price)
- Life Cycle Assessment (Matthews, Hendrickson & Matthews)
  http://www.lcatextbook.com/ (free)
- Environmental Life Cycle Assessment (Jolliet et al.)
  https://www.crcpress.com/engineering-environmental/life-cycle-analysis

Date	Topics & Readings
Theory Session 1:	
Mon, 1/4	Topics: • Introduction • History of LCA • LCA terminology • Goal & scope definition
Lab Session 1:	
Wed, 1/6	Topics: • Steel paper clip example • Plans, processes, flows • Scaling unit processes
Theory Session 2:	
Mon, 1/11	Topics: • Inventory analysis • Aluminum bike frame example • Computational structure of process-based inventory analysis Reading: • Koffler, Geyer, Volz (2014) Life Cycle Inventory, Chapter 5 in Environmental Life Cycle Assessment, Schenck & White (Eds.), ACLCA, Vashon Island, WA.

Lab Session 2:	
Wed, 1/13	Topics: • Balancing the steel paper clip plan (impact assessment sneak preview) • Parameterized processes • Free and fixed parameters • Modeling a PET blow molding process
Lab Session 3:	
Wed, 1/20	Topics: • Lab project kick-off: Functional unit (FU) and reference flows (RF) • Inventory modeling: Cradle-to-gate beverage container production • Global parameters • Model material production and forming of your beverage container
Theory Session 3:	
Mon, 1/25	Topics: • Computational structure of process-based LCA • Allocation • Dealing with co-production in attributional LCA Reading: • Ekvall & Finnveden (2001) Allocation in ISO 14041 – a critical review, Journal of Cleaner Production, 9(2001) 197-208.
Lab Session 4:	
Wed, 1/27	Topics: • Using transportation processes • Building and using dummy processes • Advanced use of parameters • Model transportation of your beverage containers
Theory Session 4:	
Mon, 2/1	Topics: • Recycling in LCA • Recycled content, avoided burden, and other methods Reading: • Atherton (2007) Declaration by the Metals Industry on Recycling Principles, Int. Journal of LCA 12(1) 59-60.
Lab Session 5:	
Wed, 2/3	Topics: • Build PET recycling processes • Use of avoided burned method • Model beverage container end-of-life management
Theory Session 5:	
Mon, 2/8	Topics: • Life cycle impact assessment (LCIA) • Characterization factors • Computational structure of LCIA Reading: • Jolliet et al. (2016) Pages 105-121 of Life Cycle Impact Assessment, Chapter 5 in Environmental LCA, CRC Press, Boca Raton, FL.

Lab Session 6:	
Wed, 2/10	Topics: • Review production and forming, transportation, end-of-life modeling • Finish beverage container plans
Lab Session 7:	
Wed, 2/17	Topics: • GaBi inventory modeling Q & A • Review beverage container plans
Theory Session 6:	
Mon, 2/22	Topics: • Advanced topics in impact assessment Reading: • Jolliet et al. (2016) Pages 121-144 of Life Cycle Impact Assessment, Chapter 5 in Environmental LCA, CRC Press, Boca Raton, FL.
Lab Session 8:	
Wed, 2/24	Topics: • Quantities in GaBi • Balancing GaBi plans • Selecting impact categories • Perform impact assessment
Lab Session 9:	
Mon, 2/29	Topics: • How to use the parameter explorer in GaBi • Perform scenario analysis
Lab Session 10:	
Wed, 3/2	Topics: • LCA project wrap-up • Project Q & A
Theory Session 7:	
Mon, 3/7	Topics: • Economic input-output (EIO) LCA Reading: • Hawkins & Weber (2014) Input-Output Models for Life Cycle Assessment, Chapter 7 in Environmental Life Cycle Assessment, Schenck & White (Eds.), ACLCA, Vashon Island, WA.
Theory Session 8:	
Wed, 3/9	Topics: • Attributional versus consequential LCA • Future developments in LCA Reading: • Ekvall & Weidema (2004) System boundaries and input data in consequential life cycle inventory analysis, Int. Journal of LCA 9(3) 161-171.