

Course Syllabus
VERSION 1.8

ISEN 463 *Circular Economy*

Northwestern University

Instructors: [Jenny Carney](#), Vice President, WSP

Possible Guest Lecturers:

[Garry Cooper, Rheaply](#)

[Danielle Decatur, Microsoft](#)

[Anita Kedia Schwartz, WSP](#)

TBD, [AMP Robotics](#)

TBD, [Break Free from Plastic](#)

TBD, City of Chicago Sustainability / Waste Management Planning Team

Office Hours: By appointment

Class Room: Tech L361

Class Timing: Spring 2021 (March 29, 2021 – June 4, 2021 Tu, Th 6:30-7:50pm); Finals June 7-11, 2021

Course Synopsis: This class will cover the core principles of a circular economy. It will use systems thinking to understand the technological, economic and policy implications of circular economy transitions. It will focus on real-world applications, evaluating the feasibility of achieving zero waste and circular outcomes within industries or geographies.

Course Goals: Students will develop a solid foundation in:

- **Systems Thinking and Circular Design:** This paradigm underlies much of the development of CEs and is an effective professional tool. Through this course, students will develop the necessary skills to be able to integrate a systems-based perspective in their analyses of situations. Systems Thinking will be cultivated through case studies and analysis projects.
- **Material Flows:** A basic understanding of the current state of waste and materials management systems, and the technological and other constraints that must be transcended to deliver circular outcomes. This course will impart an understanding of topics such as the biological cycle, energy flows and industrial ecology. Through the medium of case studies, it will also explore properties of common materials such as metals, rubber and plastic—focusing on the manner in which these properties can aid the integration into a circular system.
- **Business Models:** A circular economy requires new and changed business models to function. We will analyze models of financing and running a circular system. We will also look at the bigger picture, exploring how global supply chains can scale up to faster implement and accommodate circular economies.

- **Incentivizing and Measuring the Circular Economy:** Policy considerations are important to the success of a circular economy. This course will consider the practicalities of delivering a circular economy, addressing the key incentives of all stakeholders involved. It will also consider the available tools to measure the impact and circularity of such systems.

Grading/Assessment:

Grading will be based on the following rubric:

Component	Weight	Details	Due
Participation	10%	Based on attendance and instructor assessment of preparation and participation in class on a weekly basis	Ongoing
Quizzes	20%	Conventional in-class quizzes based on the content. These will be declared beforehand and will focus on the details of current practices and outcomes of the linear economy, emergent standards and measurement methodologies to drive circular outcomes, and theoretical frameworks explored in class. Questions may include definitions, analyses, etc	Week #3 Week #5
Case Study Assignments	30%	There will be two case studies assigned. Students will research circularity approaches and use case study examples and datasets to evaluate against assigned case questions and develop positions (usually 2-3 questions). Topics will vary but may include quantifying environmental and business implications, or assessing how the case reallocates benefit and burden, meets financial viability criteria, or addresses consumer behavior and social values considerations.	Week #4 Week #6
Final Presentation & Paper	40%	<p>Groups of 3-4 students will identify a waste-generating practice with potential for circular disruption, design a circular solution concept and consider the aspects of its implementation.</p> <p>Students will be expected to deliver:</p> <ol style="list-style-type: none"> 1. 10-minute Elevator Pitch of Solution (Powerpoint Presentation in Class) 2. A written, 5-page paper submitted at 8am on the morning of the last class. <p>Students will be assessed in the following ways:</p> <ol style="list-style-type: none"> 1. <u>Peer Ratings:</u> Group members will rate each other's contributions. (5%) 2. <u>In-Class Presentation:</u> The group will receive a team grade base on the clarity of the message and the quality of presentation (10%) 	Week #10



		<p>3. Written Project: The instructor will provide a grade to the group based on the assessment of the issue/opportunity for a circular solution, the quality of the recommendation/solution and the depth of implementation planning and risk assessment. Further details on expectations for the project will be shared when teams are formed (25%)</p> <p>All students will be expected to be involved and engaged in presentations of others. Failure attend or show respect during the presentation of the others could result in a reduction in the team grade on the final project.</p>	
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Grading Policy:

Grades will be assigned based on all the work you have completed during the semester following the traditional practice of A=90-100, B=80-89, C=70-79, D=60-69, F<60.

Course Readings:

The following texts are required for the class.

1. Webster, K. *Circular Economy: A Wealth of Flows*. Ellen MacArthur Foundation, 2nd Edition, 2016.
2. Raworth, K. *Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist*. Random House, 2017. Print.

Other standards, reports, articles and essays will be assigned and distributed in class. Recommended or required additional reading will include but is not limited to:

- UL 2799 Environmental Claim Validation Procedure for Zero Waste to Landfill
- UL 3600 Outline of Investigation for Measuring and Reporting Circular Economy Aspects of Products, Sites and Organizations
- *Circularity Gap Report 2020*. Circle Economy. 2020.
- [Achieving Operational Zero Waste: An inside look into Microsoft's operational zero waste journey](#). Microsoft, in partnership with WSP. 2020.
- Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. *What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050*. Urban Development;. Washington, DC: World Bank. 2018 © World Bank. <https://openknowledge.worldbank.org/handle/10986/30317> License: CC BY 3.0 IGO.
- Ellen MacArthur Foundation, "The New Plastics Economy: Rethinking the Future of Plastics"
- 2020 Chicago Waste Characterization Study

Websites:

At points you may be required to watch videos, read blogs, or explore websites outside of class.

CLASS OUTLINE

Weekly Topic	Description
<p>1: Intro to Circular Economy, Systems Thinking, and Course Logistics</p>	<ul style="list-style-type: none"> ● Introduction to course, its objectives and expectations of students ● When and why did the economy become linear? ● Orientation to circular economy and systems thinking principles <p>Required Readings <i>Circular Economy: A Wealth of Flows</i>. Introduction and Chapter 3 <i>Doughnut Economics</i>. Chapters 2 and 6 Robin Wall Kimmerer, Serviceberry essay</p> <p>Tuesday, 3.30 NA</p> <p>Thursday, 4.1 - Virtual only</p>
<p>2: The State of Waste in the Linear Economy</p>	<ul style="list-style-type: none"> ● Waste generation and management flows and characterization ● The environmental and social impacts of linear and extractive practices ● Economic drivers of current state approaches ● Overview of constraints to adopting circular practices <p>Required Readings <i>What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050</i> <i>Circularity Gap Report 2020</i></p> <p>Tuesday, 4.6</p> <p>Thursday, 4.8</p>
<p>3: Human Behavior and Circularity</p>	<ul style="list-style-type: none"> ● Fundamentals of human behavior as consumers, producers, and materials managers ● Values and norms in the US & beyond ● Nudging behavior change for circular outcomes <p>Required Readings <i>Circular Economy: A Wealth of Flows</i>. Chapters 5 and 7 <i>Doughnut Economics</i>. Chapter 3</p> <p>QUIZ #1 COVERING WEEKS 1-2</p> <p>Tuesday, 4.13</p> <p>Thursday, 4.15 - Lecture, breakout,</p>



<p>4: Infrastructure & Technology Transformation for Material Flows in Circular Systems</p>	<ul style="list-style-type: none"> ● Material flows in circular systems ● Processing realities of common materials such as cardboard, plastics, cloth, rubber and metals ● Reverse logistics infrastructure needs and opportunities ● Impacts of flows beyond raw materials such as transportation, energy <p>Required Readings <i>Circular Economy: A Wealth of Flows</i>. Chapters 6 and 8</p> <p>CASE STUDY #1 DUE</p> <p>Tuesday, 4.20</p> <p>Thursday, 4.22</p>
<p>5: Material palettes and product design</p>	<ul style="list-style-type: none"> ● Product life cycles ● Materials conducive to circularity based on physical properties ● Proprietary versus open-source circular systems and the implications for product design and branding ● Examples of circular and non-circular designs in food, packaging, electronics, and clothing <p>Required Readings Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of Plastics”</p> <p>QUIZ #2 COVERING WEEKS 4-5</p> <p>Establishment of groups for final project, review of final project objectives and output, discussion of potential topics.</p> <p>Tuesday, 4.27 Guest lecture: Garry Cooper, Rheaply (confirmed)</p> <p>Thursday, 4.29</p>
<p>6: Business-scale circularity & measurement</p>	<ul style="list-style-type: none"> ● GHG accounting, waste-related emissions and voluntary actions by companies ● Corporate sustainability, zero waste, co-opetition and global supply chain influence ● Measuring zero waste and circular progress in business operations ● Leading practices from Fortune 500 companies ● New business models and innovative small-scale players <p>Required Readings UL 2799 Environmental Claim Validation Procedure for Zero Waste to Landfill UL 3600 Outline of Investigation <i>Achieving Operational Zero Waste</i></p> <p>CASE STUDY #2 DUE</p>



	<p>Tuesday, 5.4</p> <p>Thursday, 5.6 Guest lecture: Danielle Decatur, Microsoft (need to confirm)</p>
<p>7: Local/regional-scale circularity & measurement</p>	<ul style="list-style-type: none"> ● Regulatory approaches and incentives for circularity ● Policy success and failure examples ● Adapting local infrastructure to meet global supply chains ● Measuring circularity within geographic boundaries ● Leading practices in the US and internationally <p>Required Readings <i>Circular Economy: A Wealth of Flows</i>. Chapter 9 2020 Chicago Waste Characterization Study</p> <p>FINAL PROJECT OUTLINE DUE</p> <p>Tuesday, 5.11</p> <p>Thursday, 5.13</p>
<p>8: Equity in the Circular Economy</p>	<ul style="list-style-type: none"> ● Upfront premiums for participating in circular systems ● The moral economy, economic inclusion and the circular economy workforce ● Is the circular economy for economic growth or social and environmental well-being? <p>Tuesday, 5.18</p> <p>Thursday, 5.20</p>
<p>9: Implementation minutia and scaling approaches</p>	<ul style="list-style-type: none"> ● Detailed review of implementation examples, including the array of changes necessary, quantitative analysis for planning and reporting, stakeholder mapping, and troubleshooting implementation obstacles ● Examples covered might include: <ul style="list-style-type: none"> - Eliminating single-use cups - Composting food waste - Eliminating packaging waste <p>Tuesday, 5.25</p> <p>Thursday, 5.27</p>
<p>10: Final Presentations</p>	<ul style="list-style-type: none"> ● Groups will present the 10-minute elevator pitches of their final presentations and field questions about their proposals. <p>FINAL PROJECT DUE</p> <p>Tuesday, 6.1</p> <p>Thursday, 6.3</p>



OUTLINE OF A CIRCULAR ECONOMY

PRINCIPLE

1

Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows
 ReSOLVE levers: regenerate, virtualise, exchange



Regenerate Substitute materials Virtualise Restore

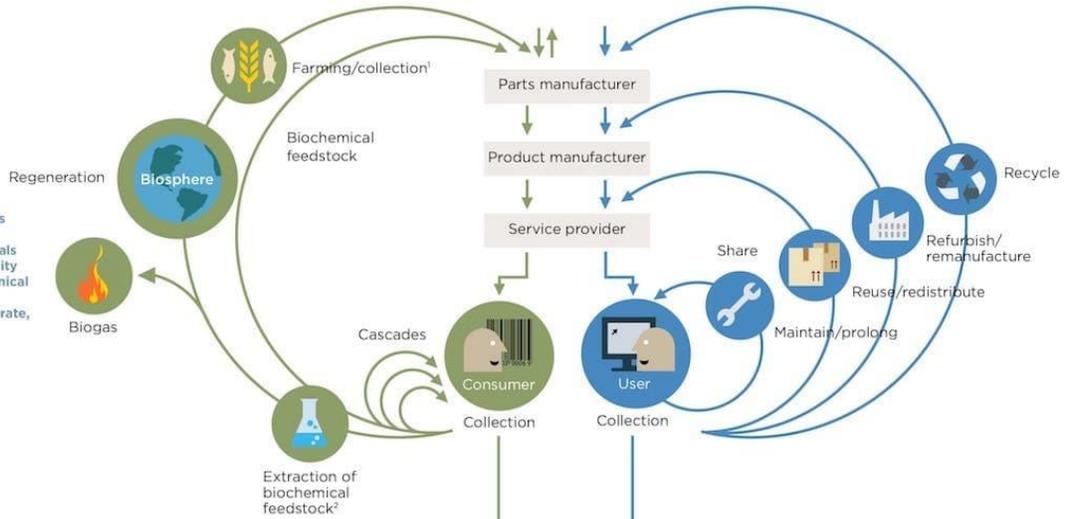
Renewables flow management

Stock management

PRINCIPLE

2

Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles
 ReSOLVE levers: regenerate, share, optimise, loop



PRINCIPLE

3

Foster system effectiveness by revealing and designing out negative externalities
 All ReSOLVE levers

Minimise systematic leakage and negative externalities

1. Hunting and fishing
 2. Can take both post-harvest and post-consumer waste as an input
 Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Source: Ellen MacArthur Foundation, 2019¹

¹ <https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic>