Resource Recovery and Circular Economy	
Unit Code	**J4S2 35**
Date of Validation:	**2020**
SCQF Level:	**10**
SCQF Credits:	**15**

1. Rationale

This module integrates solid waste management principles for resource recovery, together with the policy, concepts, and technologies facilitating this. It demonstrates how these can be implemented in practice to recover the value from waste, enabling students to evaluate the economics of the resources hierarchy in relation to a circular economy. Students are introduced to a variety of treatment methodologies including eco-industrial developments in keeping with current policy, and have the opportunity to analyse each methodology in terms of the three pillars of sustainability.

2. Learning Outcomes

At the conclusion of this module the student should be able to:

LO1:	Evaluate current waste strategy proposals and review EU / UK and policy framework for resource efficiency and waste minimisation, re-use, recycling and recovery.
LO2:	Review and evaluate the political, economic, technological and engineering means to recover resources and value from waste, including materials, energy and nutrients.
LO3:	Assess waste recovery technologies including energy from waste as an alternative to landfill ('Cradle to Cradle' versus 'Cradle to Grave')
LO4:	Review and communicate the concept of circular economy and resource (value) recovery from waste, the wider challenges related to these, and evaluate these as real-life applications in a widespread range of situations (companies, cities, highly developed and developing countries, global supply chains).

3. Content

3.1	**Waste Policy and Guidance** Historical and current legal requirements for waste management outlining the role of the waste and resource hierarchy's and drive towards resource efficiency and a zero waste policy.
3.2	**Waste reduction** The reduction of waste is considered the most resource efficient and sustainable method for dealing with waste. Legislative and socio-economic drivers of this waste management strategy will be highlighted together with discussion i.e. Love Food Hate Waste, Packaging Directive and Producer Responsibilities.
3.3	**Waste re-use and recycling** Collection and reuse of reclaimable wastes (e.g. tyres, asphalt, wood) and the role of third sector organisations. Collection of recyclable materials. Separation of recyclable materials. Comparison of different approaches to material recycling, including economics, environmental effects and market size. Comparison of economics of recycling and disposal. Recycling and reduction technologies for a range of materials, e.g. organic materials; metal, glass, plastic; hazardous chemicals.
3.4	**Energy Recovery** Comparison of a range of energy recovery technologies, e.g. incineration, pyrolysis, gasification and landfill gas burning.
3.5	**Socio-economic drivers**

	Links between Gross Domestic Product (GDP) and waste generation will be analysed, together with a discussion of waste generation in developed versus developing countries. Evaluation of whether or not situational variables (such as socio-demographics, access and provision) will be undertaken with regards influence on recycling behaviour.
3.6	**Circular Economy and Resource Recovery from Waste** Review what the concept of circular economy means in theory and how it can be translated into practice within a Global North and Global South socioeconomic, governance, and innovation environments.

4. Approaches to Learning and Teaching

Notional Study Hours:

Typically, students will have to undertake about **150 hrs** of study to successfully achieve the learning outcomes for this module; this will be made up of a combination of both scheduled and independent study as indicated below.

Scheduled Study: Typically consisting of:	**30 hrs**
Lectures	12 hrs
Seminars	3 hrs
Tutorials	8 hrs
Practical classes or workshops	3 hrs
External visits	4 hrs
Independent Study:	**120 hrs**

5. Graduate Attributes

Opportunity to develop the following aspects of graduate attributes will be included within this module:

Graduate Attribute	**Learning Activity and Aspect Developed**
1. Academically competent	Gain knowledge of a range of waste management issues, waste policy and waste treatment options; Communicate ideas effectively via presentation to a group of peers; an ability to contextualise knowledge and ideas in relation to current understanding within the scientific literature.
2. Critical thinker	Synthesis and analysis of data from the current scientific literature, and subject specific literature in more novel areas, to support argument; Informed reasoning and problem solving in relation to a specific current environmental pollution issue
3. Desire for learning and personal development	Gain a fuller appreciation of their field of study, and how our knowledge and understanding progresses through the design, data collection and statistical interpretation of investigative projects..
4. Responsible member of society	Recognition of the value of cultural diversity and the importance of ethical and environmental issues with regards to waste management options and suitability; an understanding of the global responsibilities and issues within waste management. Understand the most sustainable option for waste management in relation to resource efficiency and circular economy.
5. Employability	Students will gain professional/academic knowledge, and will gain skills (e.g. using literature, scientific writing, delivering presentations) that will be valuable in the workplace

6. Assessment

This module will be assessed using the following methods:

Assessment Method	Contribution to Grade (%)	Nature of Assessment
Research Briefing	40%	A 2 page (250 words) research briefing (vocational skill) of a recent waste related report / research paper. (LO1 and 3)
Report / Essay	60%	A 2750 word report on a topical area of interest within the area of waste / resource recovery technologies, innovation, policy and drivers of change (social, economic, environmental). (LO 2 and 4)

7. Reading

Required:

Making Things Last
https://www.gov.scot/publications/making-things-last-circular-economy-strategy-scotland/

Circular economy bill
https://www.gov.scot/news/circular-economy-bill/

UK Statistics on Waste
https://www.gov.uk/government/statistics/uk-waste-data

Waste Data for Scotland
https://www.sepa.org.uk/environment/waste/waste-data/waste-data-reporting/waste-data-for-scotland/

Scotland and the Circular Economy Report, Zero Waste Scotland
https://www.zerowastescotland.org.uk/content/scotland-and-circular-economy-report

Valuing our Clothes Report, WRAP
https://www.zerowastescotland.org.uk/content/valuing-our-clothes-report-0

Scotland's Zero Waste Plan, June 2010
http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Waste-1/wastestrategy

Waste (Scotland) Regulations 2012
http://www.legislation.gov.uk/sdsi/2012/9780111016657

Waste Framework Directive
http://ec.europa.eu/environment/waste/framework/index.htm

Cradle to Cradle – Remaking the way we make things, William McDonough, Michael Braungart - Random House (2008) ISBN 0099535475

Towards the Circular Economy – Economic and business rationale for an accelerated transition by the Ellen MacArthur Foundation.
https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf

Franco-Garcia et al. (2018). Towards Zero Waste: Circular Economy Boost, Waste to Resources

Additional:

Lomberg, B (2003) The Skeptical Environmentalist-Measuring the real state of the world. Cambridge University Press. ISBN 0 521 01068 3

Leonard, A (2010) The Story of Stuff. Simon & Schuster. ISBN 978 184901 038 2

EU Waste Policy – The Story Behind the Strategy, December 2005
*ec.europa.eu/environment/**waste**/pdf/**story**_book.pdf*

8. Staff

Module Leader:	Jennifer Carfrae (Edinburgh Campus) Amy Gray (Aberdeen Campus)