Urban metabolism: resource and energy recovery systems (2 units)

Integration module (Stream no.3: Urban water)

Course description

As more than half of the global population now call the urban environment home, ensuring the sustainability of urban production and consumption is crucial. There is a need to reduce the linear flow of water, material resources and energy, through promoting technologies and practices which achieve recovery, re-use and demand reduction.

Viewing urban areas as systems that 'metabolise' inputs, ultimately releasing them back to the environment as wastes, this module will use the notion of urban metabolism to frame and present an approach, set of tools and technologies for tracking and managing urban resource flows. Emphasis is placed on water, with coverage of technologies to manipulate water flow in urban systems to optimise its 'metabolism' by reducing intake and recovering resources that it carries.

The aim of this course is to equip students to systematically quantify physical flows in complex systems leading to an ability to construct urban metabolism models and use the models to critically characterise, evaluate and identify how to improve urban sustainability.

Key topics include: defining systems and subsystems; process and systems modelling; urban sustainability and relationships between urban metabolism and sustainability; infrastructure for manipulating water flow in urban systems; technology for recovering resources from water streams.

Course introduction

This course equips students with the skills, tools and technologies for studying urban areas as systems with inputs and outputs (wastes); to critically assess the relationships between metabolic information and urban sustainability, and; to understand the strengths,

weaknesses and opportunities of urban metabolism as a framework for informing policy and management.

The course is developed in three sections, covering topics as follows:

• Principles of a 'systems approach':
  - scale
  - boundaries
  - units and relationships
  - data requirements and sources

• Urban areas as systems that metabolise input:
  - principles of and approaches to understanding urban metabolism
  - urban sustainability, policy and management
  - relationships between urban metabolism and sustainability

• Infrastructure for flow management and resource recovery:
  - types of intervention for resource flow management
  - infrastructure options for managing resource flows in water and associated systems

Course delivery

- **Full-time** (on-campus) students, including international students, are required to enrol in the internal offering in Semester 2.
- **Part-time** (external) students are required to enrol in this module in Semester 4. The Semester 4 intensive six-day workshop is held at the beginning of the semester (new location, to be advised early 2012). The remainder of the course will be taught externally on-line.

Assumed background

The following modules are pre-requisites for this course: WATR7000, WATR7001, WATR7002 and WATR7003.

Learning objectives

After successfully completing this course students should be able to:

- define systems by identifying appropriate system boundaries;
- donduct material and energy balances to quantify material flows and energy inputs and losses;
- understand accumulation and the difference between steady-state and dynamic models;
- understand the history and theory of 'urban metabolism';
- understand relationships between urban metabolism and sustainability;
- construct and use urban metabolism models to characterise and evaluate urban sustainability;
- describe key water management technologies for intervening in urban metabolisms; behavioural change through to technologies for manipulating water supply and wastewater treatment;
- describe resources carried with water flow, and describe technologies for utilising and / or recovering those resources;
- critically assess how to make use of recycling as strategy to optimise resource use;
- critique the limitations of urban metabolism models for managing urban sustainability.

Teaching staff

Course Coordinator: Dr Steven Pratt (The University of Queensland)

Lead Lecturer: Dr Brian McIntosh (International WaterCentre)

Lecturer: Dr Steven Kenway (The University of Queensland)

Brisbane river (photo: Brisbane Marketing)