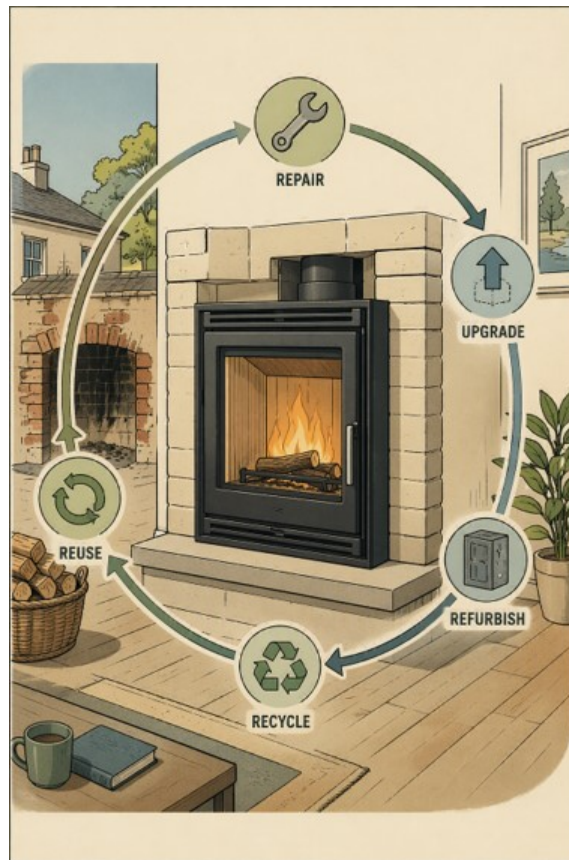


Modular fireplace

Proposal Sheet

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Content

1	General Information	2
2	Abstract	3
3	Pedagogic goals & prerequisites.....	3
4	Sustainability Goals	4
5	Case Description.....	4
6	Case Pack Components	5
6.1	General Documentation	5
6.2	Student's Documentation.....	5
6.3	Teacher's documentations.....	5

Abbreviations

TCS	Teaching Case Study
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1 General Information

Activity Sector	Product development, logistics, service development		
Keywords	Modularity; Retrofit for minimizing new resource consumption; Resiliency		
Author(s) / Institution / Country	 Christina Koch Pedersen, UCN, Aalborg (Denmark)  Lasse Christiansen, UCN, Aalborg (Denmark)  Bent Rosenkilde, UCN, Aalborg (Denmark)		
Public	Initial and alternative education ☒ Beginners ☐ Intermediaries ☐ Experts	Continuing education ☒ Beginners ☐ Intermediaries ☐ Experts	
Domain(s)	☐ CSR ☐ Economics ☒ Entrepreneurship ☐ Finance ☐ HRM ☐ Information Systems ☐ Law ☐ Marketing ☐ Political Sciences ☐ Strategy ☐ Supply chain & logistics	☒ Arts, Architecture, Design, Ergonomics ☐ Education Sciences ☐ Geography & Urban Planning ☒ Information & Communication Sciences ☐ Literature & Language Sciences ☐ Medical Sciences ☐ Physical Activities & Sport Sciences ☐ Psychology, Sociology, Philosophy, Demography	☐ Biology & Neurosciences ☐ Chemistry, Biochemistry ☐ Earth & Universe Sciences ☐ Electrical, Electronics ☒ Energetics ☐ Mathematics & Computer Science ☐ Mechanical Engineering ☐ Physics ☒ Processes
UN SDG	☒ 9 Industry, Innovation, and Infrastructure ☒ 12 Responsible consumption and production ☒ 13 Climate Action		
Place in the Circular Economy Model	☒ Raw materials ☐ Distribution ☐ Collection	☒ Sustainable design ☒ Consumption Reuse Repair ☒ Waste management	☒ Production ☐ Residual waste 

2 Abstract

Nordic Heat Solutions, a Scandinavian company specialising in high-efficiency wood-burning fireplaces, is exploring how modular product design can support sustainable building renovation and circular economy principles. In response to increasing EU requirements for energy efficiency, emissions, and product sustainability, the company is investigating a modular fireplace concept designed for retrofitting existing open fireplaces and outdated built-in solutions.

During an internal innovation initiative, management has identified modularisation and R-strategies as key levers to reduce lifecycle CO₂ emissions, extend product life, and increase customer value. A cross-disciplinary project team has been formed to explore how a modular fireplace design can balance environmental performance, technical feasibility, safety regulations, and economic viability.

The students act as members of this project team. A wood-burning fireplace with a glass door has been selected as a pilot product for the team's work. The task is structured into two main steps:

1. **Analysis of sustainability and circularity potential:**

Analyse the fireplace's lifecycle at both the building and product levels. Identify applicable R-strategies (e.g. Refurbish, Repair, Reuse, Recycle) and map the current product journey, highlighting environmental impact hotspots and opportunities for improvement through modularity. Consider when a fireplace like this is better than an open one.

2. **Modular concept development:**

Develop a modularisation concept for the fireplace by defining functional modules, standardised interfaces, and design solutions that enable maintenance, upgrades, repair, and end-of-life recovery. Evaluate trade-offs between sustainability benefits, cost, performance, aesthetics, and regulatory compliance.

This teaching case aims to strengthen students' ability to integrate Circular Economy thinking into product design within the context of building renovation. By working with realistic constraints and strategic objectives, students learn to develop modular, sustainable design concepts that align environmental ambitions with business and user requirements.

3 Pedagogic goals & prerequisites

Considering the product design and building renovation perspective, the overall pedagogical goals within environmental sustainability for this teaching case are as follows.

The students will be able to:

- 🔗 Understand how modular product design and retrofitting can extend product and building lifespans, and how this influences environmental impact and circularity.
- 🔗 Analyse a product's lifecycle at both building and product levels, including material flows, use-phase performance, maintenance, and end-of-life scenarios.
- 🔗 Identify and apply relevant R-strategies (e.g. Refuse, Reduce, Repair, Refurbish, Reuse, Recycle) in the context of sustainable renovation and product design.
- 🔗 Develop and evaluate modularisation concepts that balance environmental benefits with technical feasibility, safety requirements, aesthetics, and economic viability.
- 🔗 Communicate sustainability-oriented design concepts clearly and convincingly to multiple stakeholders.

Moreover, the case supports a broader range of learning opportunities across fields such as engineering design, circular economy, modularity theory, building regulations, customer value creation, and strategic decision-making. These additional learning potentials are embedded in the case but are not explicitly formalised here, leaving it to educators to adapt and emphasise them according to the intended learning outcomes of their course.

4 Sustainability Goals

This TCS focuses on two key aspects of environmental sustainability: *replacing unsustainable energy consumption and R-strategies*, emphasising how these factors can be influenced by developing a product that can be fitted into existing renovations of the building mass.

For environmental impact, the focus is on conducting a (simplified) design phase for a product platform for fitting more energy-efficient fireplaces in existing buildings.

For R-strategies, the emphasis is on implementing principles for modularity for both service life, retrofit and production.

5 Case Description

Year of the problematic	2026
Duration for students	Preparation: 2 hours Implementation: 2 days
Languages	☒ English ☐ Other:
Use case	☒ In class ☐ Examination TCS
Category	☐ C1: Case written in collaboration with a company which has given its consent for using its internal sources such as the company name, figures, photos, videos, and so on. Join the agreement sheet. ☐ C2: Case based on real company information and with the acceptance of the company to use its data, but names or figures (of company and persons) are modified to keep them confidential. Join the agreement sheet. ☐ C3: Case written using external public sources (annual report, websites, brochures, newspapers, ...) where names or verbatims of the protagonists are used. Join the agreement sheet. ☐ C4: Case based on real company using public information without the agreement of the company (generally, the names (company and persons) are changed to anonymous ones. Impossibility to make the link between the TCS and the company. ☒ C5: Imaginary case based on teacher's experience who collected information from several companies in order to write a case study with a fictive integrative company. It can also be a compilation of different situations of several periods put together at the same time to form a pedagogic tool.
Number of pages: Statement / Annex	4 / 5
Number of pages: Teachers' notes:	12
Diffusion licence	See cover page

6 Case Pack Components

6.1 General Documentation

Table 6.1: General TCS documents

Document name	Description	File name	# pages
Proposal Sheet	Teaching Case Study Description. This file can be published to inform potentially interested persons about the Teaching Case Study (this file).	SCABEE TCS Modular Fireplace (2026) - Proposal Sheet.pdf	7

6.2 Student's Documentation

Table 6.2: Documents for students (to be shared when TCS is applied)

Document name	Description	File name	# pages
Case scenario	The document for students includes the mission and all necessary information.	Modular Fireplace (2026) - Base Scenario.pdf	13

6.3 Teacher's documentations

Table 6.3: Documents for teachers (not to be shared with students)

Document name	Description	File name	# pages
Teacher's note	The document is for teachers to guide the students through the Teaching Case Study.	SCABEE TCS Modular Fireplace (2026) - Teacher's Note.pdf	12