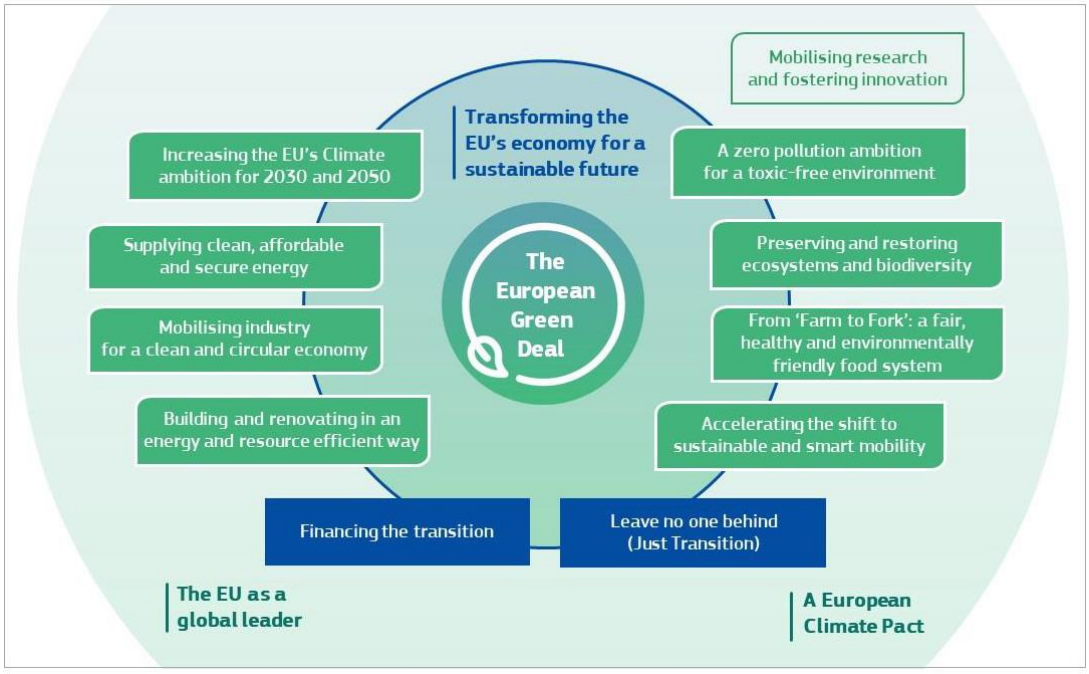
4TU.Responsible Sustainability Challenge

a 15 ECTS project for Master Honours students,
designed by the 4TU.Research Centres Ethics & Technology, Energy and High-Tech Materials

Summary
Maximising sustainability in technological developments is an overwhelmingly important challenge for present and future engineers. Whereas we can be "behind schedule" now, in 2050, when the present students are in leading positions, solutions *must* be found and implemented. But technological solutions also have societal, ethical and environmental aspects when implemented in society. This project aims to approach the development and implementation of sustainable technology in a multidisciplinary manner, with an emphasis on energy, materials and ethics.

Course contents
Multidisciplinary groups of 5 to 8 students, preferably from at least two of the four TU's, will be formed. Each group chooses a topic that is related to developments in technology aiming at increasing sustainability in society. The members of each group are Master students from different disciplines, in order to approach the chosen topic in a multidisciplinary manner. In the project, the students should consider ethics, energy and materials in an integrated manner. The group is free to choose its topic, with the following boundary conditions:

- the topic has substantial technological aspects;
- the topic has substantial societal and ethical aspects;
- the topic addresses a distinct sustainability problem and envisions concrete improvement after further technological development and societal implementation;
- the topic relates to the Green Deal of the European Union (see https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en).



Sustainable technology is to be developed for the application of energy and resources and for the protection of climate and environment, while maintaining economic activity and human welfare.

Examples of project topics are offshore wind energy, zero-carbon steelmaking, batteries in a circular economy, sustainable and smart mobility, green budgeting practices.

The study that the group performs summarises and critically analyses the state of the art and the future developments and effects of implementation on the basis of scientific and political literature and discussions with relevant experts. It is of paramount importance that the group formulates a critical and creative holistic view on the technological, ethical and societal aspects of the chosen topic at an academic level.

Study goals

The challenge has the following characteristics:

- it addresses real-world problems, with stakeholders involved;
- it is inherently interdisciplinary and involves complex project-based work;
- it requires thinking on different levels of abstraction, including system level;
- it inherently addresses the societal and ethical aspects of the chosen problem.

Hence, the emphasis will be on developing the following competences[1]:

- the student is able to reformulate ill-structured research/design problems, takes account of the system boundaries in this and is able to defend the new interpretation against involved parties;
- the student chooses the appropriate level of abstraction, given the process stage of the research/design;
- the student is able and has the attitude to, where necessary, draw upon other disciplines in his or her own research/design;
- the student has a systematic approach, characterised by the development and use of theories, models and interpretations from different disciplines;
- the student is able to communicate verbally and in writing about research and solutions to problems with colleagues, non-colleagues and other involved parties;
- the student is able to perform project-based work, is pragmatic and has a sense of responsibility, is able to deal with limited sources, is able to deal with risks, is able to compromise;
- the student is able to work within an interdisciplinary team;
- the student is able to analyse and to discuss the societal consequences (economic, social, cultural) of new developments in relevant fields with colleagues and non-colleagues and integrates these consequences in scientific work;
- the student is able to analyse and discuss the ethical and the normative aspects of the consequences and assumptions of scientific thinking and acting with colleagues and non-colleagues (both in research and in design) and integrates these ethical and normative aspects in scientific work.

Each of these competences involves aspects of knowledge, skills and attitude.

Education method

The project starts with a match-making event for enrolled students to define topics, to meet fellow students and form groups. On the basis of the chosen topic and the universities involved, each group forms a supervisory team. The group independently studies the chosen topic and formulates their analysis and conclusions, in regular contact with supervisors and academic and external advisors. At the plenary sessions that will be organised four times per year each group presents the recent progress

[1]Taken from the Academic Criteria and Quality Assurance framework, developed in Eindhoven, but more widely applied, https://pure.tue.nl/ws/portalfiles/portal/2008910/591930E.pdf

and future planning. In June of the graduation year of the Honours students a symposium is organised at which each group presents and discusses its study. The study is summarised in a scientific report.

Literature

A European Green Deal; Striving to be the first climate-neutral continent:
https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en
Green Deal document: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF
Annex to Green Deal document: https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_2&format=PDF

Assessment

The group writes a report on the study that they performed. The report has the structure of a scientific document: context & background, challenges, approach, results & discussion, conclusions & recommendations. The study is comprehensive in covering aspects of technological, ethical and societal nature. The group gives a presentation on their study in the symposium that will conclude the project. The final presentations and reports will be combined into an accessible video and white paper with a clear message and appeal for society and governments.
The final mark is based on both the report (75%) and the presentation (25%).