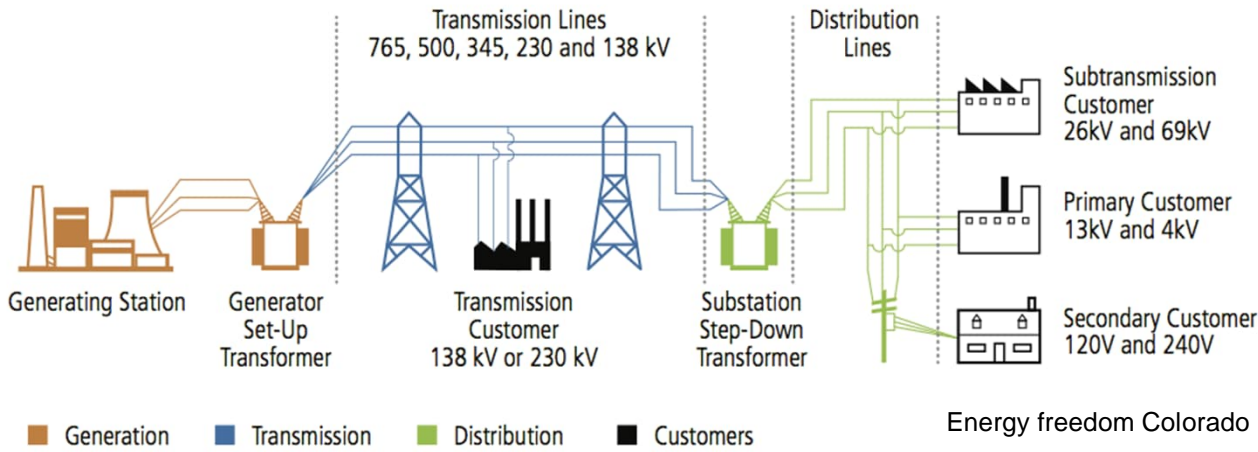


AAE-E3070 / MTEK0014

Electrical Energy Storage Systems

Course Intro
2024

Electrical Energy Storage Systems



**Electricity grid
ELEC**

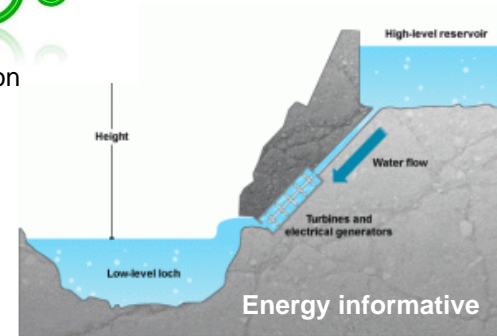


New energy updates



European commission

**Storages
ENG/UTU**



Energy informative

Indentent learning outcomes (ILO)

1. Describe operating principles of key energy storage technologies, including their benefits and fundamental limitations.

2. Select relevant technologies for energy storage, including storage and conversion components.

3. Design an energy storage interface for a power system or a power train, as a member working cooperatively in a small multidisciplinary team.

4. Share the expertise of ones field in a heterogeneous team

Teaching Staff



Annukka Santasalo-Aarnio
Aalto - ENG



Pekka Peljo
UTU



Floran Martin
Aalto - ELEC



Rayane Mourouvin
Aalto - ELEC



Gabriel Gonzalez
UTU



Mousumi Dey
UTU



Hassan Rouhi
Aalto - ENG



Arjun Muralidharan
Aalto - ENG

Teaching methods

Active self-study
(Read / Reflect / Report)

Flash talks/Industrial talks/Video lectures

Team work to apply concepts to your own case study
(formulated as a poster)

Poster workshop
Discussion + Reflection

Timetable at the first week

- **Tuesday**

8.30 – 9.00 Introduction to the course

Initial Team building for the in person/online teams

Break 10 min.

9.10 - 10.00 Introductory sessions

- Introduction to Electrical Engineering (Aalto U5 + UTU)

- Introduction to Storages, for ELEC students (Aalto, room U262)

- **Thursday** 14.00-16.00 Team meet and selection of the topics (in person in Aalto, Online for online teams)

Course timetable (example)

Seminar part

(Tuesdays/Thursday)

8.30 Feedback of assignments

8.40 – 9.10 *Flash talk/Industrial talk*

Break 5 min.

9.15 - 10.00 *Flash talk/Industrial talk*

Poster sessions weeks (2, 4, 6)

Contact (Aalto U5), Tuesday

10.00 – 11.00 Poster preparation

11.05-11.30 Gallery walk

Best poster vote + joint discussion

ZOOM (Aalto + UTU), Thursday

1 h Poster preparation (Online)

30 min poster gallery walk

Best poster vote + joint discussion

Teaching Schedule (Preliminary)

Week	Theme	Personal task	Team Project Flow
1 (9.1)	Background (ELEC/Storage)	Assignment 1 Energy arbitrage	Team building + topic selection
2	Energy storage interfaces	Quizz I	<i>Poster presentation 1:</i> Introduce the project with interfaces and storage technology
3	Overview of storage system	Assignment 2 Storage comparison	Evaluate the power and energy rating of the components
4	Storage selection strategy Industrial speakers	Quizz II	<i>Poster presentation 2:</i> Introduce a combination of 2 storage system in the project
5	Sustainability of storage systems Industrial speakers	Quizz III	Evaluate the power and energy rating for different strategy
6	Economic analysis Industrial speakers	Assignment 3 Industrial reflections	<i>Poster presentation 3:</i> Implement a sustainable and an economical perspective
8 (26.2)	Presenting the Final work	-	Report the complete solution

Assessment

1. Personal tasks

Quizz (3 x 4 p.)	12
Assignment 1	10
Assignment 2	10
Assignment 3 + Inter-Peer evaluation	10
<u>Course Official Feedback</u>	<u>3</u>
	45 p.

2. Group tasks

Final report	34
<u>Posters (3 x 7 p.)</u>	<u>21</u>
	55 p.

Group tasks (55 % of grade)

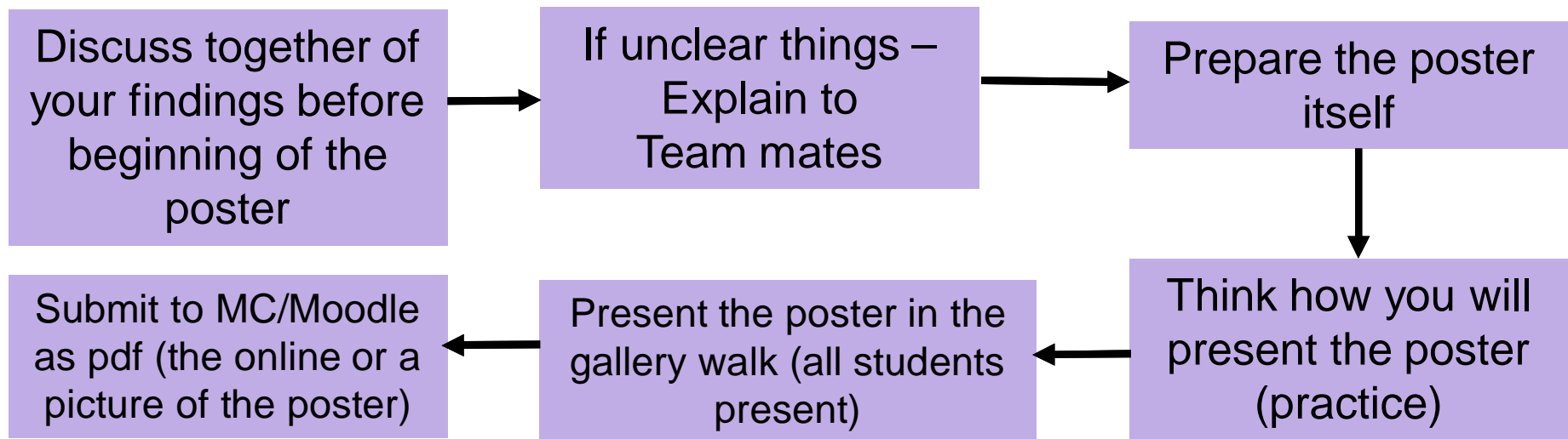


<https://joshsherin.wordpress.com/tag/group-work/>

- There are **no Exam** on the course
- Teams to do peer teach (different backgrounds)
 - **Poster preparation**, where you apply the theory that you had study/learn for your case project
 - **Oral presentation** You will reflect weekly your case to your peers and teachers with your poster. Final presentation of the group work you will present this to whole class
 - **Written report**: The team will prepare a written report on the case
- You will also prepare **individual tasks** as assignments (45 % of grade)

How to prepare the poster

- Before poster preparation – remember to do your **own personal study** before starting the poster
- If you need to find papers for your team coordinate the search to have different papers
- When you **meet** for poster preparation

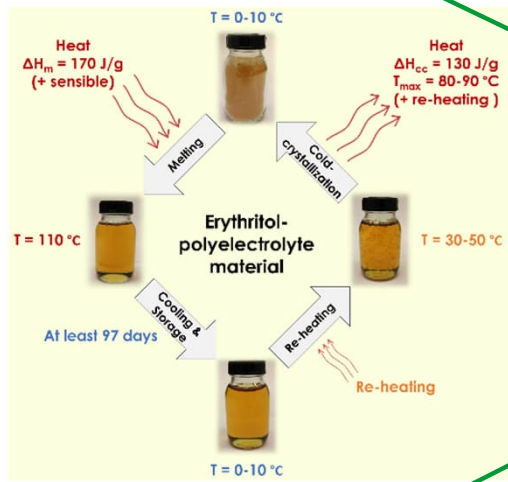
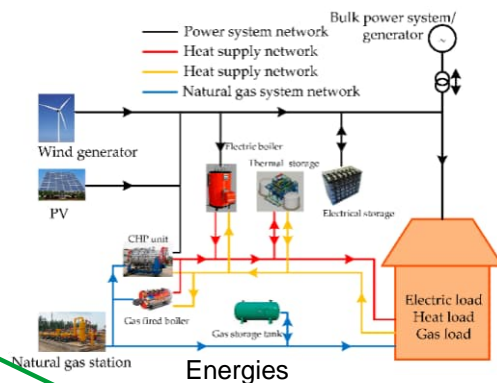


Courses of Energy Conversion or Storage (Aalto)

- **CHEM-E4255 Electrochemical Energy Conversion**
Introduces in more detail of electrochemical energy storage systems
- **ELEC-E8412 Power Electronics**
Introduces electric power conversion devices that are commonly needed in energy storage systems.
- **ELEC-E8405 - Electric Drives**
Covers fundamentals of the electric-to-electric and electric-to-mechanical power conversions
- **AAE-E3100 Energy Carriers**
How energy carriers are used in traffic (power to fuels/hydrogen) and EVs

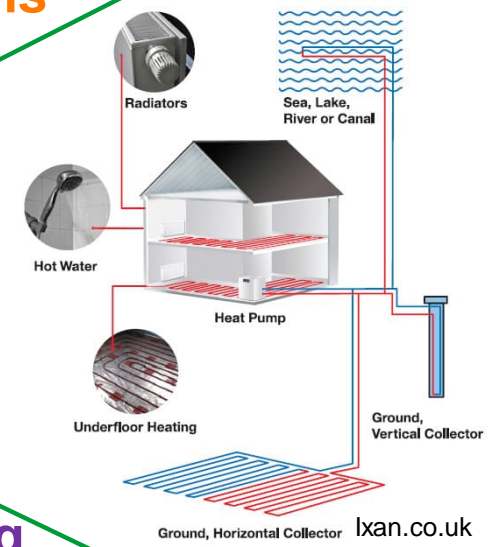
AAE-E3080 Thermal Energy Storage Systems (period IV-V)

Thermal Energy Storage Systems

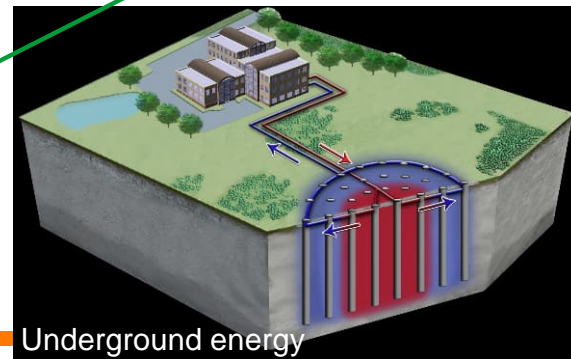


New Heat Storage materials

Heat pumps



Using soil/buildings as Energy Storage



Underground energy

Questions?