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Off grid systems case study - charging plaza for e-bikes

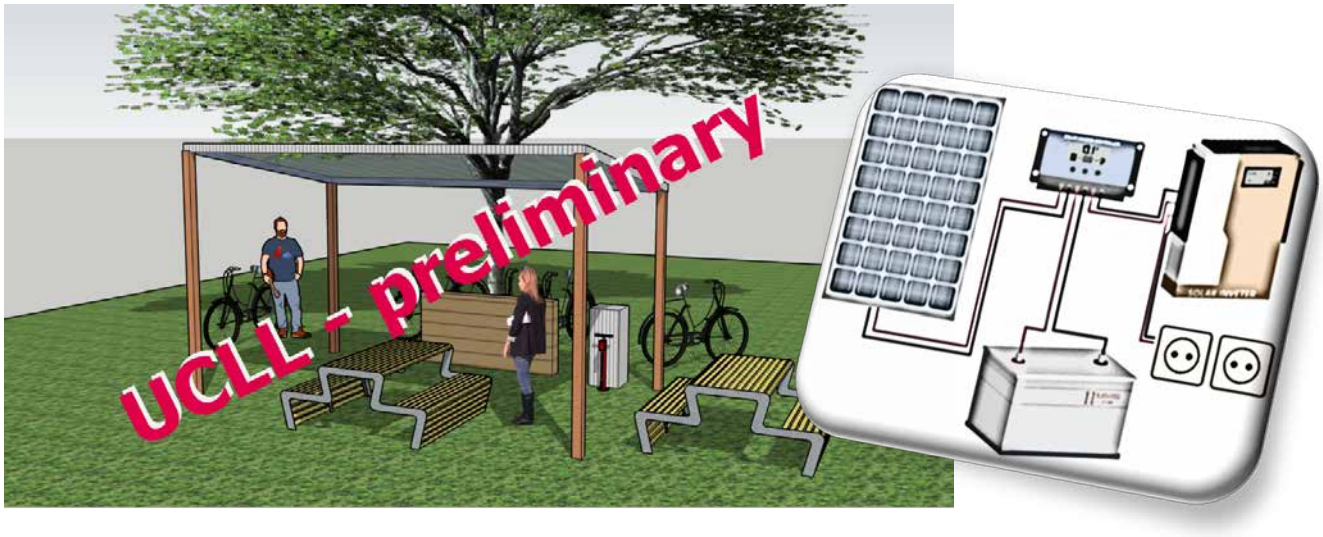
Peter Van Hout
7/09/2026

UCLL
UNIVERSITY OF APPLIED SCIENCES

COURSE DESCRIPTION

OFF Grid Systems

Case Study - Charging Plaza for E-bikes



BACKGROUND – RELEVANCE

A case study is used to gain knowledge and insights about OFF Grid Systems. A Charging plaza for e-bikes will be the case study. The electrification in mobility is not limited to only electrical cars and busses. Small mobility of persons happens a lot with bikes and steps. The breakthrough of the e-bikes (electrical bicycles) has happened earlier then the breakthrough of electric vehicle (EV) and has known a steeper rise according to sales figures. About 1/3 of the Belgian families owns an e-bike which is a big contrast com-paring the share of EVs : almost 5% of the Belgian car fleets is electric.

E-bikes are used for leisure and professional purposes. Although that the range of e-bikes is quiet fair, sometimes it is good to know where people can charge their e-bikes while on route, especially in far remote places where no electrical grid is provided. In public places where the electrical grid is sufficient present, it is not hard to find a connection for charging the e-bikes. But for leisure and tourism purposes, it would be nice to have a charging plaza for e-bikes in the middle of nowhere.

ABSTRACT

This course will set the scene for an OFF grid system by a case study : Charging Plaza for e-bikes. All the needed electrical components and devices like PV panels, MPPT, inverters etc. will be explained separately. It gives the student thorough knowledge about the working and their characteristics. Li-ion batteries are getting more attention and explanation concerning their physics, construction, characteristics and operation with a BMS. After this first part, designing and dimensioning of a complete OFF grid system will be discussed based upon the user needs and regarding regulations and safety requirements. This theoretical approach also comes with exercises.

The first hands on part is done in a laboratory environment where students are getting familiar with the components, devices and technology. Different lab setups will be executed.

The second hands on part is building a complete and real life OFF grid system, together with commissioning and monitoring with an EMS.

KEYWORDS - HASTAGS

OFF grid systems, Charging, battery storage, Li-ion Batteries, BESS battery energy storage system, renewable energy, EMS energy management system, electrical bike, solar energy, PV panels

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FOCUS ON …	Knowledge	Application		Implementation	
CDIO		Conceive	Design	Implement	Operate
DIFFICULTY LEVEL	Basic	Intermediate		Advanced	
EQF LEVEL	5-6	CREDITS	3	LANGUAGE	English

LEARNING OUTCOMES

1. General overview of an OFF grid system
2. Electrical insight and working of electric components and devices in an OFF grid system
3. Knowledge of energy storage concepts
4. Physics and working of Li-ion batteries and battery systems
5. Getting familiar of electrical components and devices in a laboratory environment
6. Dimensioning and design of an OFF grid system
7. Selecting components and devices based upon a blueprint
8. Hands on, building and commissioning of an OFF grid system

PRIOR KNOWLEDGE REQUIRED

1. Basic physics and electricity
2. Basic mathematics and algebra

PRACTICAL ORGANISATION - follow up on line for eventual changes		
	Theoretical part/simulations/exercises	Hands on part
ORGANISER/ISSUER	UCLL - UC Limburg vzw / Peter Van Hout	UCLL - UC Limburg vzw / Peter Van Hout
ERASMUS CODE	2025-1-BE02-KA131-HED-000318833-5	
WHEN	September 2026 8 x 2 hours, mon.-thu., 18h00 – 20h00 Sept. 7th – Sept. 10th Sept. 14th – Sept. 17th	October 2026 2 + 3 days Oct. 5th – Oct. 6th , lab sessions Oct. 7th – Oct. 9th , skills competition
WHERE	Online	UCLL Laboratories Agoralaan, 2590 Diepenbeek, Belgium
TEACHER(s) INSTRUCTOR(s)	Peter Van Hout (UCLL)	Peter Van Hout
COURSE MATERIAL	available in www.Xdemia.com	available in www.Xdemia.com
SOFTWARE USED	Freeware online tools	Freeware online tools
OTHER MATERIAL	-	Equipment & installation tools will be provided
MAX ATTENDEES	18	6 x 3
REGISTRATION	TBD Contact : peter.vanhout@ucll.be	TBD Contact : peter.vanhout@ucll.be
CONTACT PERSON	peter.vanhout@ucll.be	peter.vanhout@ucll.be
EXAM	E-assessment	Short report

COURSE PROGRAM			
	DATE	LOCATION	TOPIC
	18h – 20h		
1	Mon. 7/9/2026	Online	General overview with case study : Charging Plaza for e-bikes
2	Tue. 8/9/2026	Online	Electrical components and devices
g	Wed. 9/9/2026	Online	Storage concepts and energy conversion
4	Thu. 10/9/2026	Online	Li-ion batteries : cel working and characteristics
5	Mon. 14/9/2026	Online	Li-ion batteries : BMS and charging
6	Tue. 15/9/2026	Online	OFF (and ON) grid systems regulations and protection
7	Wed. 16/9/2026	Online	Design and Sizing of the system
8	Thu. 17/9/2026	Online	Monitoring and EMS
9	To be scheduled	Online	E-assessment
	Whole day		
1	Mon. 5/10/2026	UCLL Diepenbeek	Hands on part – Labs
2	Tue. 6/10/2026	UCLL Diepenbeek	Hands on part – Labs
3	Wed. 7/10/2026	UCLL Diepenbeek	Hands on part – Skills Competition, building the OFF grid system
4	Thu. 8/10/2026	UCLL Diepenbeek	Hands on part – Skills Competition, building the OFF grid system
5	Fri. 9/10/2026	UCLL Diepenbeek	Hands on part – Skills Competition, building the OFF grid system
6	To be scheduled	Online	Short Report