Teaching Case Study

Sunshine for production!

Analysing the implementation of photovoltaic panels, energy storage and optimizing production schedules in a manufacturing company

Proposal Sheet

By

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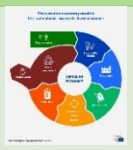
CONTENT

1 GENERAL INFORMATION

Activity Sector	Photovoltaic energy production and storage		
Key words	?		
Author(s) / Institution / Country	Krzysztof Kalinowski, Silesian University of Technology (Poland) Damian Krenczyk, Silesian University of Technology (Poland) Agnieszka Sękala, Silesian University of Technology (Poland) Sebastian Temich, 2APA Sp. z o.o. (Poland)		
Public	Initial and alternative education ☒ Beginners ☒ Intermediaries ☐ Experts	Continuing education ☒ Beginners ☒ Intermediaries ☐ Experts	
Domain(s)	☐ CSR ☒ Economics ☐ Entrepreneurship ☐ Finance ☐ HRM ☐ Information Systems ☐ Law ☐ Marketing & Sales ☐ 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		
Place in the Circular Economy Model	☐ Raw materials ☐ Sustainable design ☒ Production ☐ Distribution ☐ Consumption Reuse Repair ☐ Collection ☐ Waste management ☒ Residual waste		

2 ABSTRACT

The students are working in a company at APA Group as Junior Engineers. They have been assigned the task of designing a PV installation for a manufacturing company XY whose main activity is industrial processing. The company XY uses considerable amounts of electricity every day. Currently, all of its energy comes from the power grid, which means that the company uses traditional energy sources, such as burning fossil fuels, which negatively impact the environment and are burdened by rising operating costs. Rising energy prices, changing environmental regulations and pressure to meet ESG (Environment, Social, Governance) standards are forcing the company to look for innovative solutions to reduce its negative impact on the environment while reducing operating costs.

The company XY is considering investing in the installation of photovoltaic (PV) panels on the roof of the production hall, which would allow it to generate renewable energy that it could use in its manufacturing processes. However, the company faces a challenge as energy production from PV is unstable and dependent on changing weather conditions. Therefore, the installation of PV panels alone may not be sufficient to meet the company's energy needs.

In addition, the company XY is considering investing in energy storage facilities that could store surplus energy produced during peak sunshine periods and then use it during peak production hours or at night when the PV panels are not active. The company also wants to optimise its production schedule to match its production processes with the availability of renewable energy, which would maximise the use of PV energy and minimise energy consumption from the grid.

APA is a market leader in intelligent industrial automation and building management systems. APA has more than 20 years of experience and dozens of successful implementations for institutions, individuals, municipalities and industrial plants worldwide.

3 PEDAGOGIC GOALS & PREREQUISITES

This Teaching Case Study aims at the following **pedagogic goals**:

- Enable students to discover and identify relevant environmental and economic indicators to compare different industrial solutions and find arguments for discussion.
- To understand that solar energy is a valuable and economically viable way to reduce the consumption of energy and, therefore, to reduce the carbon footprint of production processes.
- Present and defend a solution to the supervisor, client and project manager.

The following **prerequisites** are recommended:

- Basic knowledge of how energy is obtained and stored from the sun and possible solutions in this area to better understand the case.
- Basic knowledge of the organisation of production processes (engineering studies).

4 SUSTAINABILITY GOALS

This TCS allows students to understand how photovoltaic panel deployments in manufacturing companies contribute to sustainability goals, offering numerous environmental, economic and social benefits.

TCS shows students different perspectives in environmental areas and how photovoltaic systems provide clean, renewable energy that helps reduce greenhouse gas emissions and combat climate change.

In addition, the TCS makes students aware that by switching to solar energy, manufacturing companies can reduce their dependence on fossil fuels and contribute to SDGs, which calls for clean and affordable energy. In addition, photovoltaic panels have a relatively long lifespan of 20-25 years, providing a lasting positive impact on the environment.

5 CASE DESCRIPTION

Year of the problematic	2024	
Duration for students	Preparation:	45 (90) min 45 min: reading of all related information + potentially 45 min: working through the self-learning material
	Implementation:	4,5 h 3,0 h: Analysis phase and result elaboration by students 1,5 h: Result presentations + debriefing
Languages	☒English	☒ Other: Polish (Documents addressing students only)
Use case	☒ In class	☐ Examination TCS
Category	☐ C1: Case written in collaboration with a company which has given its consent for using of 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		10 / 18
Number of pages: Teachers' note:		5
Diffusion licence		See cover page

6 CASE PACK COMPONENTS

Document name	Description	File name	# pages
Proposal Sheet	Teaching Case Study description. This file can be published to inform interested persons about the Teaching Case Study This document	SCABEE TCS Sun4Prod (2024) – Proposal Sheet.pdf	8
Company agreement	Agreement of the company to use their internal information and data	SCABEE TCS Sun4Prod (2024) – Company agreement APA.pdf	3
Base scenario	The document for students including the mission and all necessary information.	SCABEE TCS Sun4Prod (2024) - Base Scenario.pdf	18
Analysis form (student, beginner)	A spreadsheet containing forms to analyze various possible options with the given information. Forms containing formulas for use without advanced technical skills in calculating energy demand. The document structure and sheets are protected against unintentional deletion or modification. The unlock password is “SUT”.	SCABEE TCS Sun4Prod (2024) - Analysis form (student, beginners).xlsx	8
Teacher’s note	Document for teachers to guide them through the Teaching Case Study.	SCABEE TCS Sun4Prod (2024) - Teacher's note.pdf	14
Analysis forms (teachers)	Excel file with completed analysis forms to help teachers in the evaluation phase. This document can also be helpful when teachers want to update data or enter parameters for their region. The document structure and sheets are protected to avoid unintentional deletion or modification. The password to unlock is “SUT”.	SCABEE TCS Sun4Prod (2024) - Analysis form (teachers).xlsx	8
Evaluation (report)	Suggestion for the evaluation of the submitted presentation document/report	SCABEE TCS Sun4Prod (2024) - Evaluation report.docx	1