



*Greening Energy
Market and Finance*

Construction of an Microgrid Cooperating with a Residential Estate and Installation for Refuelling Buses with Hydrogen

Track 3 - Climate & Business



Introduction

What is the objective of the case study?

This case study is an example of the development and implementation of a green energy project, with emphasis on the business side

What is the case study about?

A microgrid installation cooperating with a housing estate is to be implemented. Due to the close vicinity of the bus depot, an installation for refuelling buses with hydrogen are to be built at the same time. The hydrogen installation will be powered from renewable energy sources coming from the microgrid.

What does the case study include?

- ✓ Task 1: Risks identification and mitigation
- ✓ Task 2: Performing PEEST Analysis
- ✓ Task 3: Proposals of sources of financing
- ✓ Task 4: Develop a schedule for the project



Task 1: Risks

CLIMATE RISKS

Factor	Risk materialization effect	Forms of mitigation
Strong winds and storms	severance of power lines and destruction of devices	laying cables underground and providing for insurance of devices
Heat waves	workers with heart and blood pressure problems will go on sick leave	<ul style="list-style-type: none">- creating a microclimate around the microgrid (planting trees, installing shades, etc)- green crops around and green walls of buildings and installations
Low windiness / low sunlight	insufficient generation from a renewable energy source	simultaneous introduction of renewable energy technologies with different generation profiles (PV and wind together), as well as taking into account a reserve source - a gas or biogas turbine and an energy storage allowing the use of surplus energy during a shortage



Task 1: Risks

CLIMATE RISKS

Factor	Risk materialization effect	Forms of mitigation
Floods	delays in the delivery of components as a result of flooding the access road to the microgrid and the refuelling station	anti-flooding infrastructure (eg. preparation of a paved road, choosing specific materials)
Frosts	danger of road accidents, safety of workers, delays of works, destruction of devices	company procedures for working conditions and safety of workers, training of personnel and providing for insurance of devices



Task 1: Risks

FINANCIAL RISKS

Factor	Risk materialization effect	Forms of mitigation
Funding risk	No funding received	proving that the project is credible and compliant with the climate policy
Credit risk	The bank will not grant a loan	proving that the project is profitable, caring for public profile of company and information activities
Interest rate risk	The interest installment of the loan will increase	fixed interest rate
Increase in prices of materials and components	Higher project implementation cost	securing prices in the agreement with the contractor
Changes of costs of energy	Project becomes more expensive and public is less invested in innovative solutions	Provision of subsidies from government for the project development and customers Preparation of scenarios and economic forecasts in advance to include in the initial budget



Task 1: Risks

FINANCIAL RISKS

Factor	Risk materialization effect	Forms of mitigation
Customer base loss	Project becomes less profitable due to customers changing energy provider	Marketing campaign, providing for long term contracts and retention policies with benefits and services for customers





Task 1: Risks

OTHER RISKS

Factor	Risk materialization effect	Forms of mitigation
Technical Risk	Failure of the software (e.g. internal management system)/hardware systems(wirings and circuitry malfunctions)	Hiring experts in the area in order to identify and solve potential issues. Purchase of spare parts for quick intervention (use the proceeds of the funding)
Management Risk	Human error leading to potential outages, underperforming managers, ethical issues (fraudulent activities) etc.	HR (a system for the evaluation of manager performance, conflict mitigation etc.), having a system of checks and balances
Legal and Company Risk	Participants of the project not complying with the rules and regulations which could lead to financial and reputational damages (due to lack of knowledge)	Hiring of legal experts and organizing training programs for staff/managers to learn about their responsibilities and duties from the legal perspective.



Task 1: Risks

OTHER RISKS

Factor	Risk materialization effect	Forms of mitigation
Earthquake Risk	Strong earthquakes damaging key structures leading to prolonged periods of unreliability of electricity generation etc.	Purchasing earthquake insurance as well as regular structural integrity checks and repairs.
Political Risk	Unexpected change in policies, laws and consensus that the project is relying on, affecting the functioning and profitability of it, leading to an unpredictable future of the microgrid.	Creating relationships with local authorities, regular political risk analysis in order to anticipate future changes in policy as well as ensuring support of the local communities to keep the operation going.
Cyber Risk	Offensive maneuvers sabotaging the software/hardware of the microgrid in order to cause outages and financial losses.	Creating a robust software system that is monitored by seasoned professionals around the clock and keeping the personnel informed about good practices to minimize the risk of error



Task 1: Risks

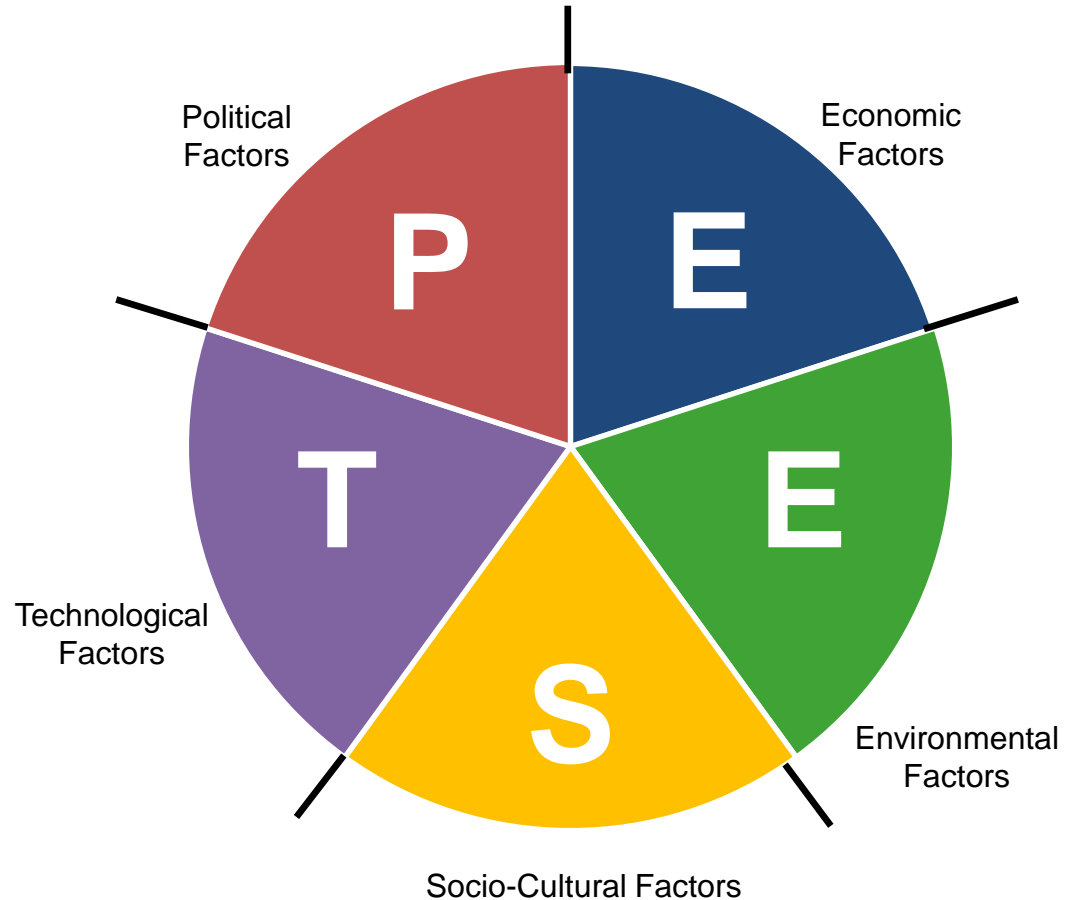
OTHER RISKS

Factor	Risk materialization effect	Forms of mitigation
Timetable Risk	Some operations not happening according to plan, leading to delays.	Regular monitoring of the time table, identifying potential sources of delay, course corrections and suggesting preventive measures.
Procurement Risk in the preliminary phase	Suppliers backing out due to financial reasons, legislation changes etc.	Having a list of potential back-up suppliers and contractors to ensure smooth execution of the timetable



Task 2: PEEEST analysis

Due to the fact that the project is part of the climate policy, an additional factor - the environmental factor was included in the PEST analysis



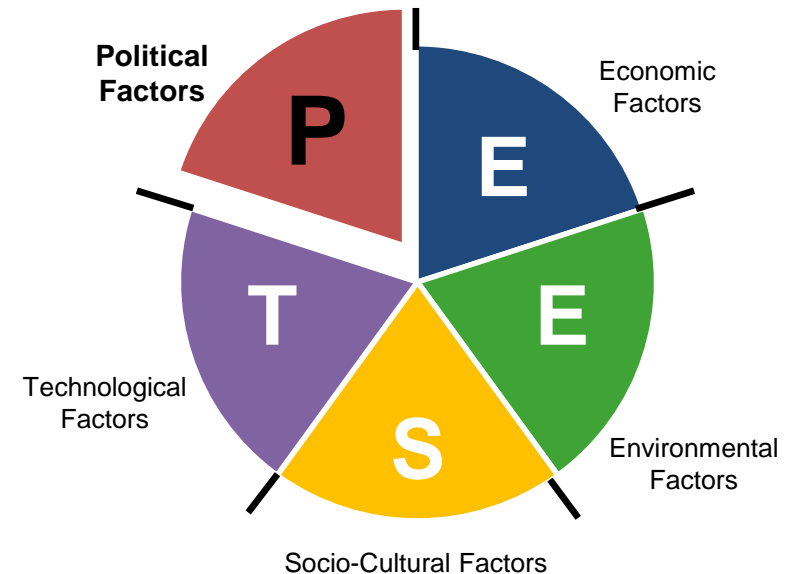


Task 2: PEEEST analysis

POLITICAL FACTORS

Considerations:

- Political stability
- Energy policy
- Trade restrictions
- Changes in the law
- Company policy and customers' expectations
- Tax Policy
- Employment laws
- Potential conflicts of RES with local legislation
- Global political environment (eg. war, pandemic)
- Company viability (eg. liquidity of funds, number of projects)
- Difficulty in securing permissions
- Archaeology, forestry and other restrictions
- Ownership status of land / ground



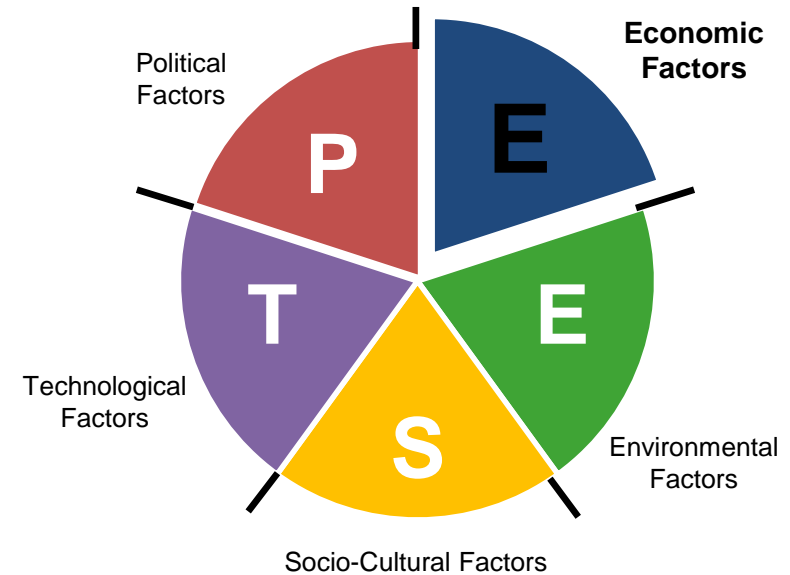


Task 2: PEEEST analysis

ECONOMIC FACTORS

Considerations:

- Economic trends and forecasts
- Interest rates & inflation
- Input cost factors (ef. materials, services, labour)
- Trade policy
- Changes in cost of energy
- Money supply (eg. liquidity, own capital)
- Customer base loss
- Securing funding and availability of funds
- Changing of profitability of the project



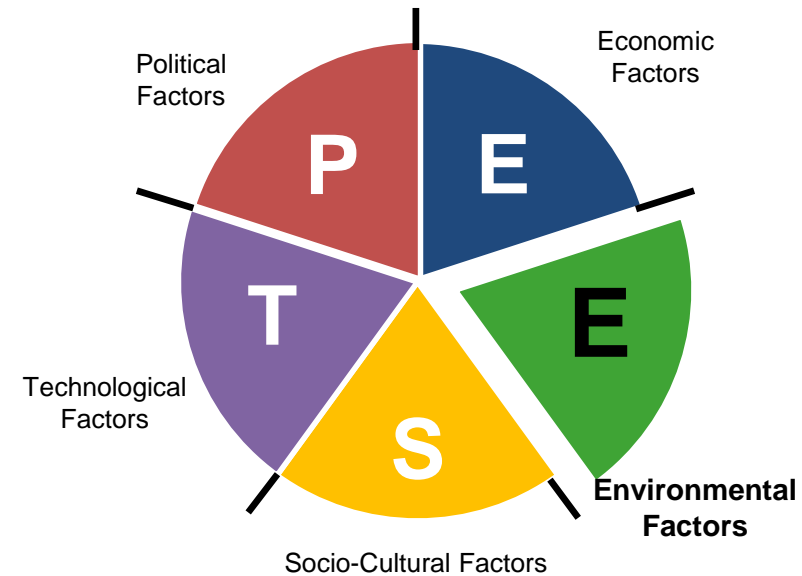


Task 2: PEEEST analysis

ENVIRONMENTAL FACTORS

Considerations:

- Extreme weather events (e.g., floods, frosts, heat waves)
- Natural disasters (e.g., earthquake)
- Poor weather conditions (e.g., low sunlight)
- Geographical location
- Availability of non-renewable goods (e.g., access to natural resources)
- Environmental policies (e.g., obligations for increasing share of RES, CO₂ allowances)



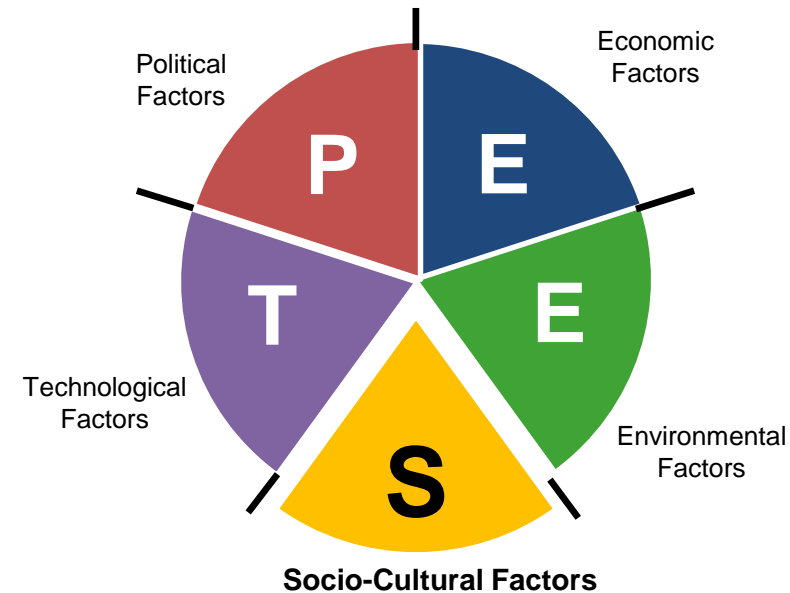


Task 2: PEEEST analysis

SOCIO-CULTURAL FACTORS

Considerations:

- Demographics, age distribution, income, education and level of life quality
- Social awareness (eg. health/safety consciousness, environmental protection)
- Cultural attitudes
- Consumer lifestyles and expectations
- Neighbourhood relations project area
- Reputation and image of energy company
- Changes in personnel of project development & management
- Links of the population to local authorities



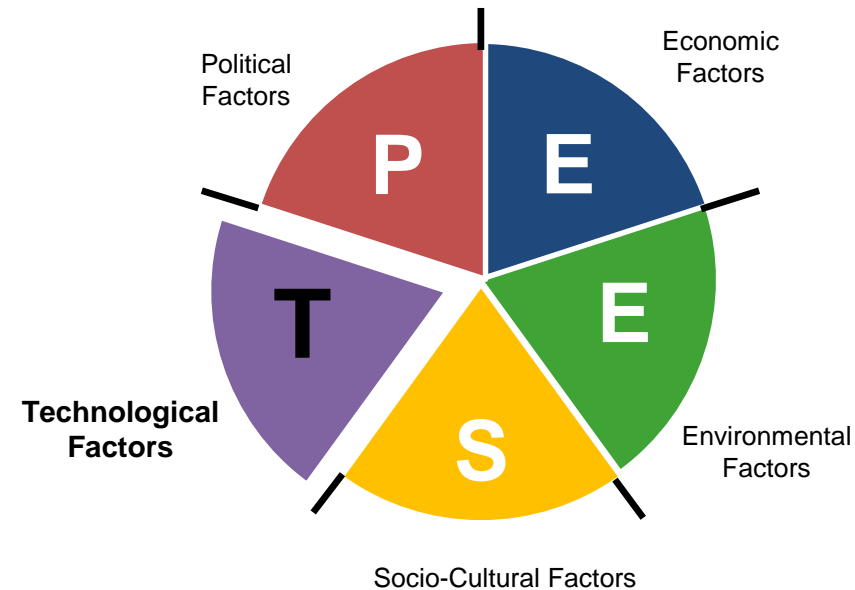


Task 2: PEEEST analysis

TECHNOLOGICAL FACTORS

Considerations:

- R&D developments
- Rate of technological change related to legislation adjustment
- Technology incentives (i.e. gov't subsidies)
- Technology used and the rate of success in implementation
- Degree of innovation of technology and automation used (especially for hydrogen installation)
- Expected impact of project on ground, air, water, etc.
- Experience of company involved in development in similar projects
- Availability of professional experts to develop the project
- Availability of materials and supply chain





Task 3: Sources of Funding

- **Innovation fund (2021-2030) (Article 10a(8)):**

https://ec.europa.eu/clima/eu-action/funding-climate-action/innovation-fund_en

- **Modernisation Fund (2021-2030) (Article 10d)**

https://ec.europa.eu/clima/eu-action/funding-climate-action/modernisation-fund_en

- **Horizon Europe**

https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en

- **Green Bonds**



Task 3: Sources of Funding

Final choices of funding:

Innovative fund: small- scale projects

- **Successful projects funded:** GreenHyseO, Location: Italy, Project: decarbonize rail and bus transport in Valcamonica by creating a hydrogen powered fleet of trains through 3 green hydrogen production plants.
- **Criteria for eligibility:** Demonstrate highly innovative technologies using renewable energy/ reduce greenhouse gas emissions/ potential for scalability/ present cost, risk efficiency reports.
- **Features of the fund:** Capital expenditure between 2.5 and 7.5million euros. Covers any country in the European Union/ Maximum coverage: 60% of capital expenditure.



Task 3: Sources of Funding

About the Green bonds:

- **Problem:** How to cover the 40% requirement of Capital Expenditure?
- Potential Solution: **Green Bonds**
 - Physical Asset (Solar Panels/ Hydrogen Plants): Used as collateral for Govs or companies to diversify its finance sources through green bonds
 - Mortgage Bonds Green Assets (Buildings): Use our real estate to obtain green mortgages

Another Benefit (Hedging and Risk Mitigation):

- Objective: Protection against disaster/ Antifragility
- Tool: Long Strangle



Task 4: Schedule

Assumptions:

- After risk & PEEST Analysis it is decided that only photovoltaics are chosen as RES
- The project is split into two sections: microgrid and hydrogen components. Each section will undergo a separate tender and construction phase
- In the schedule tasks are grouped in bigger categories of tasks
- The schedule is presented in months, not weeks for convenience and simplicity
- The last task on schedule is the integration of the two sections (the microgrid and the hydrogen components)



Task 4: Schedule

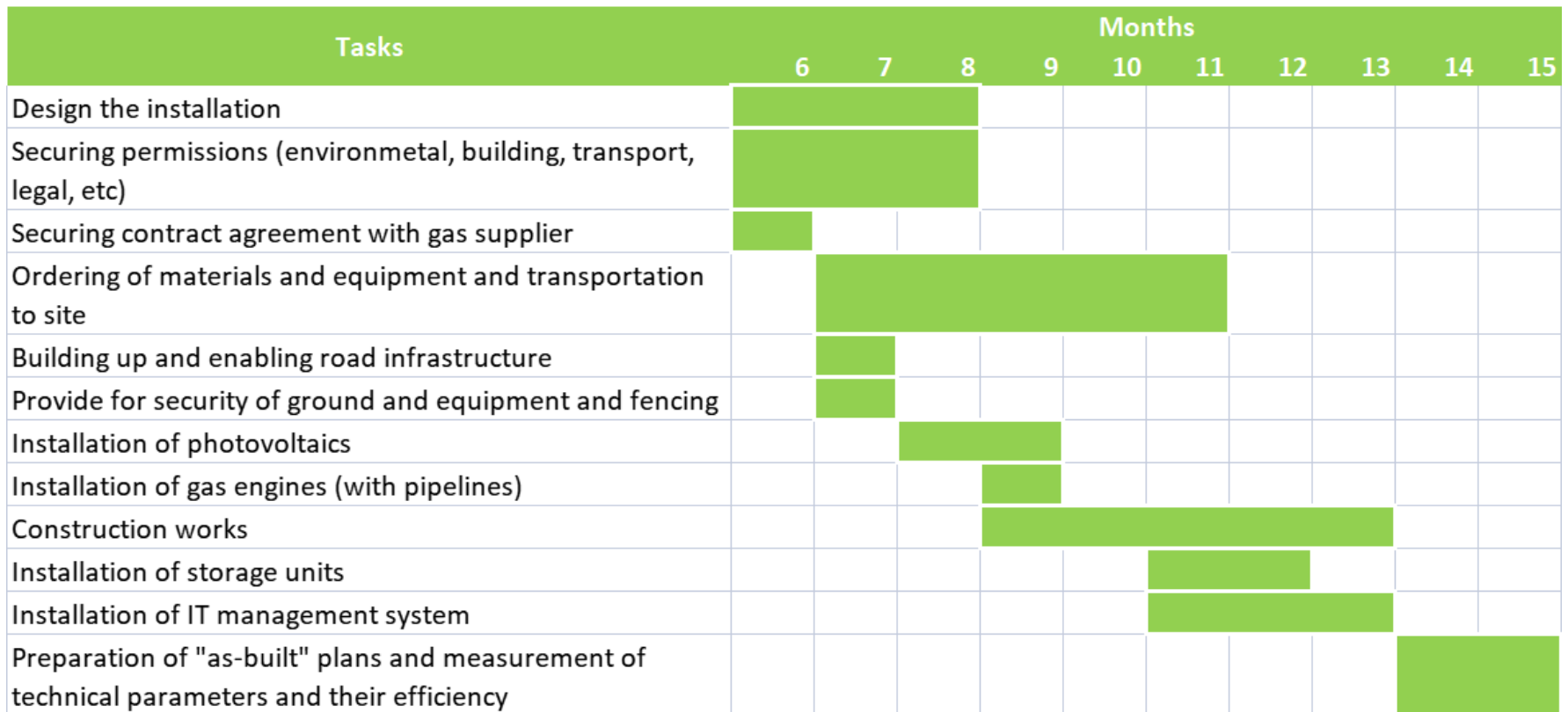
Phase 1: Preliminary works for microgrid

Tasks	Months				
	1	2	3	4	5
Determine technical assumptions	■				
Preparation of tender documents	■				
Submission of proposals from possible contractors		■			
Reviewing the proposals and negotiations with applicants			■		
Handling objections and signing contract with selected Contractor					■



Task 4: Schedule

Phase 2: Construction of microgrid





Task 4: Schedule

Phase 3: Testing of microgrid

Tasks	Months			
	14	15	16	17
Testing of all components of microgrid installation separately	■			
Testing of integrated microgrid installation		■		
Testing of IT monitoring system			■	
Integration of microgrid to hydrogen installation				■



Task 4: Schedule

Phase 1: Preliminary works for hydrogen installation

Tasks	Months							
	1	2	3	4	5	6	7	8
Determine technical assumptions	█							
Geographical assessment	█							
Preparation of tender documents	█							
Submission of proposals from possible contractors		█						
Reviewing the proposals and negotiations with applicants			█	█				
Special security design (because hydrogen is really dangerous)				█	█			
Handling objections and signing contract with selected Contractor					█			
Preliminary legal analysis						█	█	█



Task 4: Schedule

Phase 2: Construction of hydrogen installation

Tasks	Months										
	6	7	8	9	10	11	12	13	14	15	
Design the installation	█										
Securing permissions (environmetal, building, transport, legal, etc)		█									
Agreement with energy supplier to connect to the grid in the event of no solar energy production/no storage		█									
Ordering of materials and equipment (including the electrolyser) and transportation to site		█									
Building up and enabling road infrastructure		█									
Provide for security of ground and equipment and fencing		█									
Construction works: Parking lots for buses			█								
Construction works: Installation of the water demineralisation station			█								
Construction works: Installation of electrolyser (in accordance with the timeline of microgrid project)					█						
Construction works: Installation of storage units						█					
Construction works: hydrogen refueling station								█			
Construction works: Infrastructure connecting the hydrogen production to the microgrid									█		
Preparation of "as-built" plans and measurement of technical parameters and their efficiency									█		





Task 4: Schedule

Phase 3: Testing of hydrogen installation

Tasks	Months				
	13	14	15	16	17
Testing of all components of the hydrogen station	■	■			
Testing of IT and monitoring system			■	■	
Testing of integration of hydrogen installation into microgrid					■



Final thoughts

Questions?

Remarks?

... Thoughts for the future?





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