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Faculty of Applied Sciences
Sustainable Building Design (SBD) Lab



The integration of photovoltaic panels system in net-zero energy buildings under Mediterranean climate

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The River Gallery

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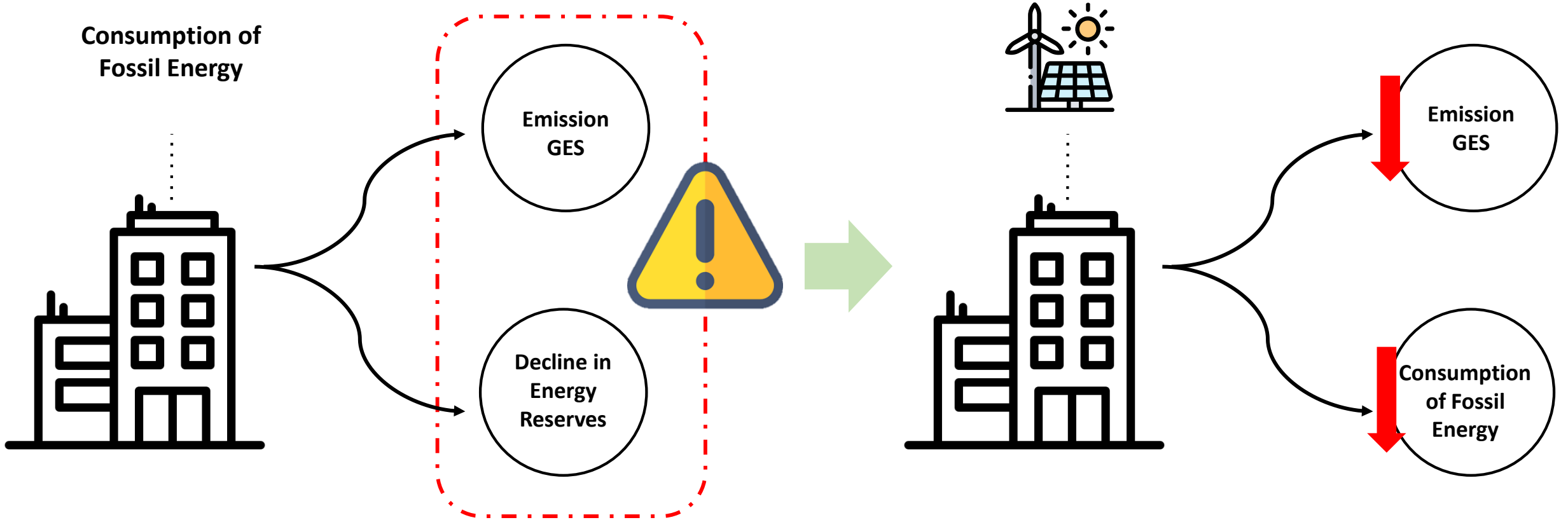
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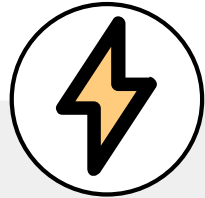
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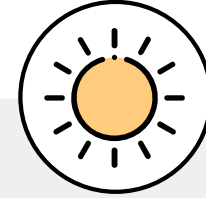
Introduction



Introduction



The building sector in Algeria represents the largest energy consumer, accounting for 46% of the total

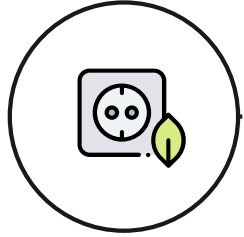


The Mediterranean basin has a significant solar energy resource with 2500 hours of sunlight per year



How can we contribute to improving the energy efficiency of a recreational building located in a Mediterranean climate to make it energy self-sufficient using solar energy, and what are the techniques and technologies that should be employed?

Hypothèses



1 The use of photovoltaic panels allows for the generation of renewable solar energy to cover the total energy needs of the building, contributing to transforming it into a net-zero energy building



2 The use of renewable solar energy will minimize energy costs



3 The use of renewable solar energy will reduce greenhouse gas emissions.

Aim and Objectifs

Reduce buildings' dependence on fossil fuels with solar panels.

1

Evaluate the feasibility and effectiveness of integrating these systems

2

Assess the economic and environmental benefits of using these systems.

Presentation of case study



Located on Algiers in the municipality of El Harrach, precisely on the left bank of the El Harrach river.

With a latitude of $36^{\circ}43'43''\text{N}$ and a longitude of $3^{\circ}07'50''\text{E}$, at an altitude of 3 meters above sea level

Presentation of case study



The 'The River Gallery Cultural and Art Center' project is a complex designed to host a wide range of cultural, artistic, and recreational activities. Its aim is to promote art and culture while providing opportunities for artistic training.

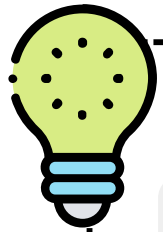
- Area : 5889,75 m²
- Gabarit : R+2

Description of photovoltaic system

System PV	Type of system PV	A grid- connected energy storage system
	Capacity of the system	480 000 W
Photovo ltaic panels	Number of panels	1200
	Cell type	Monocrystallin
	Unit Dimensions	1 x 1.7 m
	Unit power	400 W
	Solar Positioning System	Bi axial
The inverter	Inverter power	480

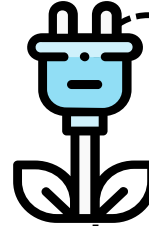
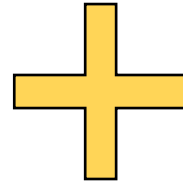


Estimation of the average annual consumption of the project



Illumination

470836,4 WH



Equipment

3074140 WH

The average annual consumption of the project



1 293 914,05 KW

The investigation method

Retscreen is a software for analyzing renewable energy and energy efficiency projects developed by the Government of Canada. It is a highly useful tool that assists energy and environmental professionals in evaluating the feasibility of renewable energy and energy efficiency projects

Application
international
e



RETScreen
Expert

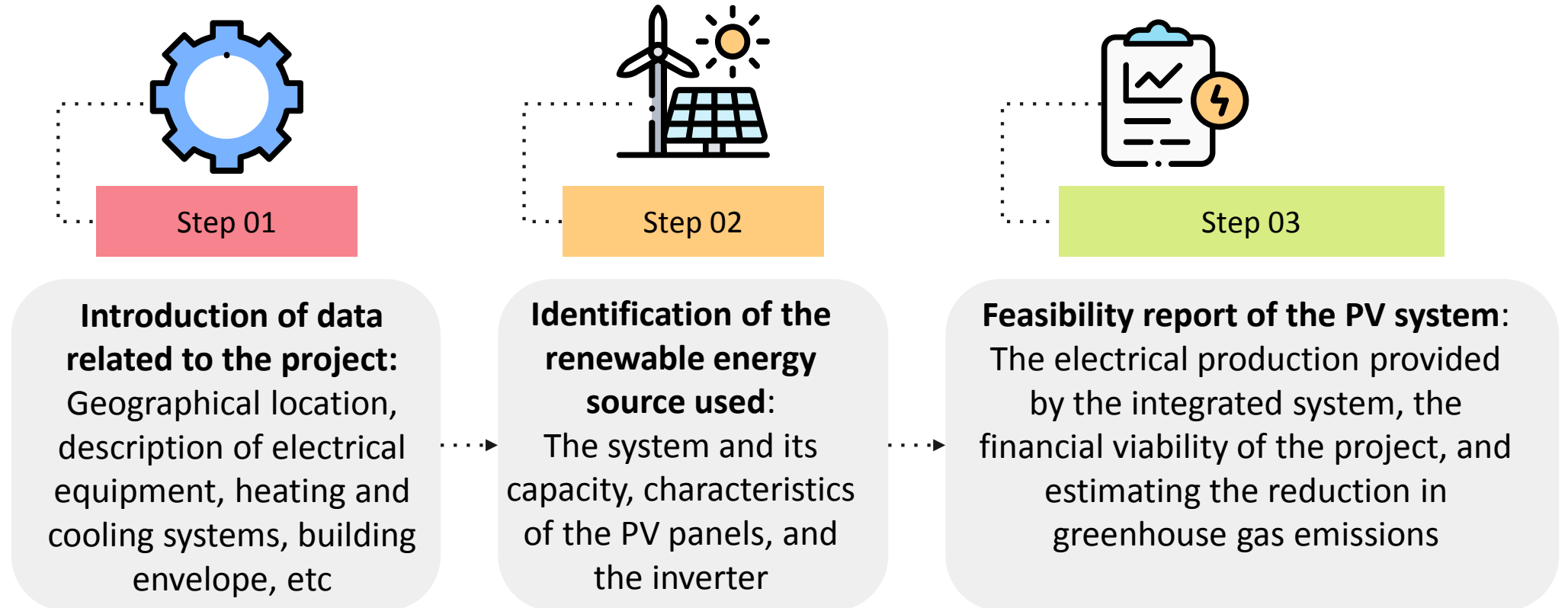
"Evaluation
of project
viability

Free to use

Ease of use

Simulation of a photovoltaic system using Retscreen

The simulation involves three steps:



Interpretation of the results

Photovoltaïque - Niveau 2

Évaluation des ressources

Système de positionnement solaire

Biaxial

⬆️ Afficher information

Mois	Rayonnement solaire quotidien - horizontal kWh/m ² /j	Rayonnement solaire quotidien - incliné kWh/m ² /j	Prix de l'électricité - annuel DZD/kWh	Production d'électricité kWh
Janvier	2,20	4,09	4,68	54 643,861
Février	3,00	4,77	4,68	57 454,714
Mars	4,10	5,87	4,68	77 615,626
Avril	4,90	6,19	4,68	78 529,592
Mai	6,00	7,70	4,68	99 487,816
Juin	6,20	7,76	4,68	95 522,631
Juillet	7,00	9,24	4,68	115 320,681
Août	6,40	8,94	4,68	111 193,750
Septembre	5,10	7,30	4,68	88 992,339
Octobre	3,30	5,13	4,68	66 262,041
Novembre	2,70	5,13	4,68	64 670,475
Décembre	2,00	3,92	4,68	52 153,681
Annuel	4,42	6,35	4,68	961 847,207

Rayonnement solaire annuel - horizontal

MWh/m²

1,61

Rayonnement solaire annuel - incliné

MWh/m²

2,32

The annual electricity consumption:

1293914,05 KWh

The annual electricity generated by the PV system :

961847,2065 KWh

This allows covering **74.33%** of the building's annual electricity consumption

Annual electricity bill before system integration

605 5517,7 DZD

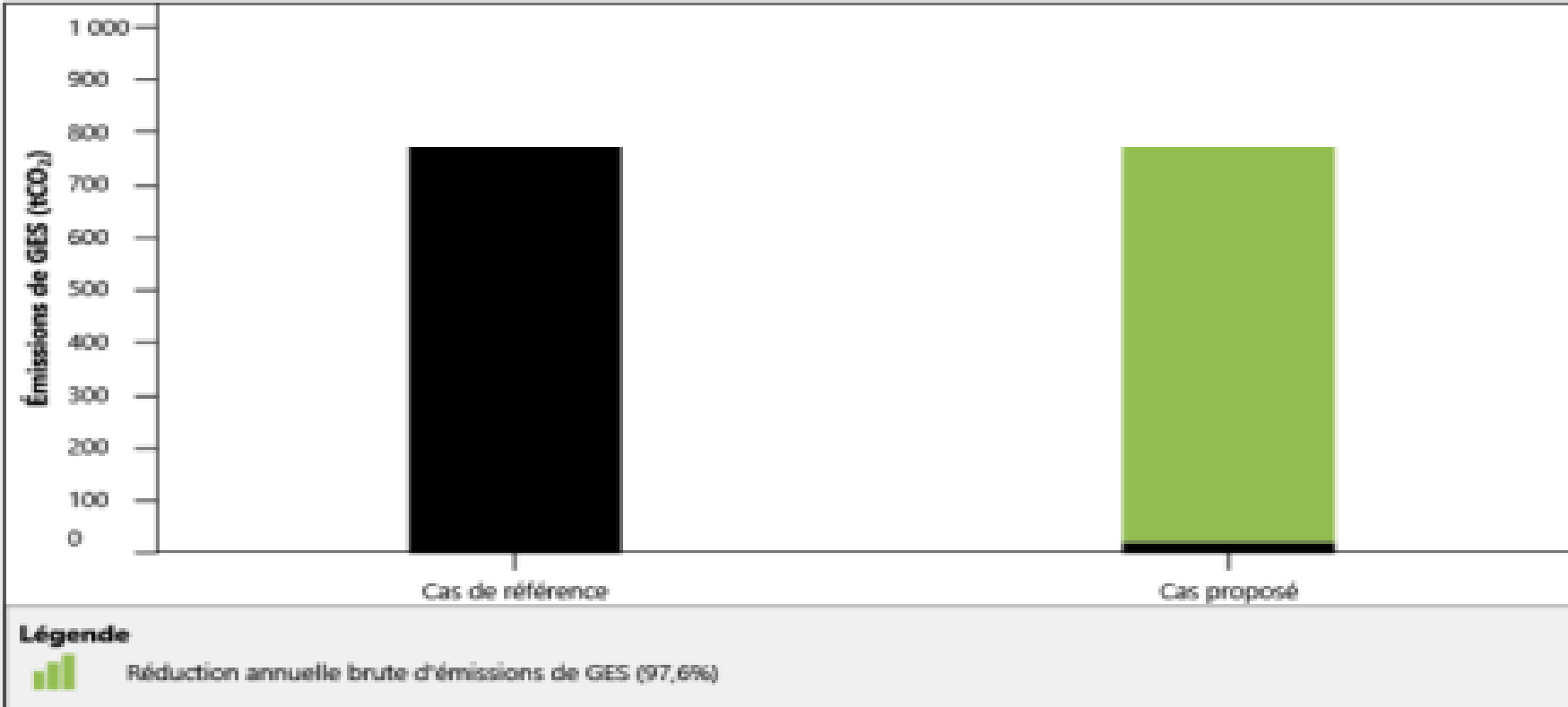
-25 %

Annual electricity bill after system integration

155 4072,8DZD

Interpretation of the results

Émissions de GES



And this enables a reduction

790,5 t

De GGE



Equivalent of 140 cars and

trucks



Conclusion

- The obtained results confirm the second and third hypotheses, which are: the installation of a photovoltaic system will be advantageous from both an economic and environmental perspective. The first hypothesis, which states that the use of a photovoltaic system can generate solar energy to cover the total energy needs of the building, making it net-zero, is not confirmed in our case study. The system only covers 74.33%."
- In conclusion, photovoltaic production contributes to improving the energy performance of a recreational building in a Mediterranean climate. It also helps limit fossil energy consumption and reduces greenhouse gas emissions.

**Thank you for
your attention !**