

AI e Ingegneria

sfide e opportunità per la
progettazione rigenerativa

Giambattista Brizzi | Progettare il Progettista XII | 06 giugno 2024



Where we work

Here's where we know local markets well

Our global presence is centred in Europe (EMEA). We have a strong team in Brazil and various partnerships in Americas (AMER/LATAM), as well as partnerships in Asia Pacific (APAC). We support many of our clients globally.

The Netherlands
(Headquarters)

Brazil

Colombia

France

Germany

Italy

Kuwait

Spain

United Kingdom



What we do

Innovative design for building installations and industrial processes requiring high performance



Airports



Real Estate



Health Care

people centric
public/private clients
usually locally embedded



Life Sciences



Electronics



Data Centres

process/technology centric (industrial)
private clients
mostly international networks

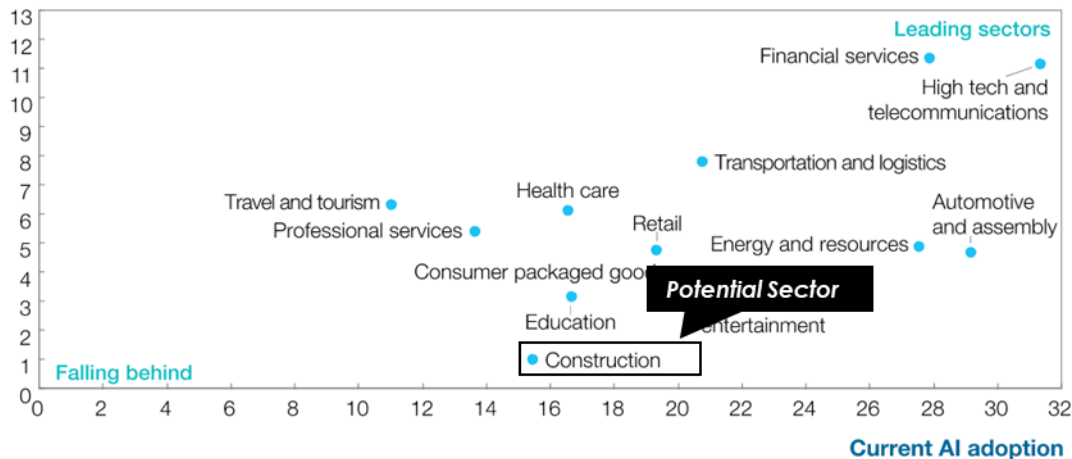
Intelligenza Artificiale per la Progettazione della Luce | APIL 6 giugno 2024

AI Impact Yesterday

Nel 2020 nasce la consapevolezza dell'hype, ma il settore delle costruzioni era rimasto piuttosto indietro tra i settori che guidavano l'adozione dell'IA e che puntavano a far crescere maggiormente i loro investimenti.

Future AI demand trajectory¹

Average estimated % change in AI spending, next 3 years, weighted by firm size²



Source: McKinsey 2020

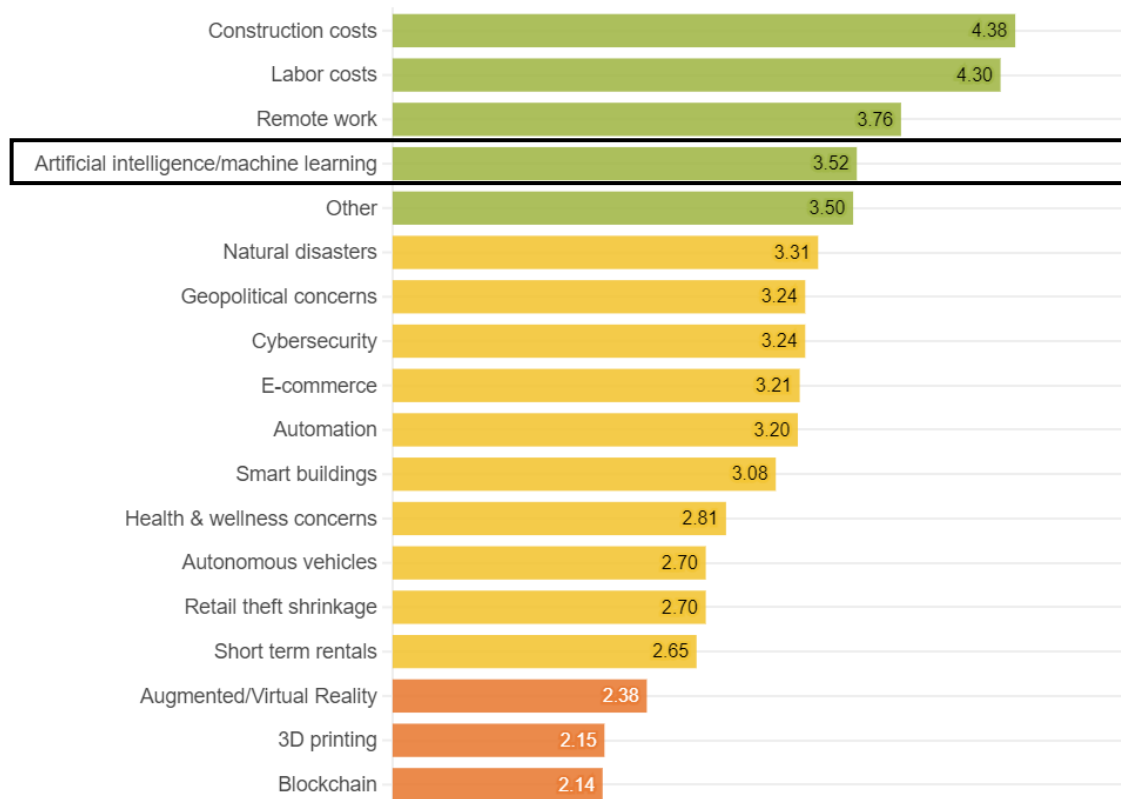
Current AI adoption
% of firms adopting one or more AI technology at scale or in a core part of their business, weighted by firm size²

AI Impact Today

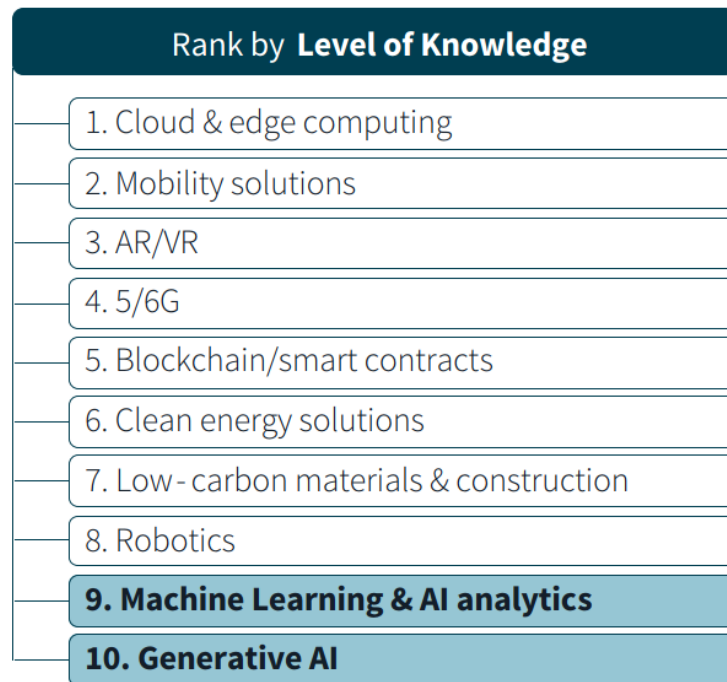
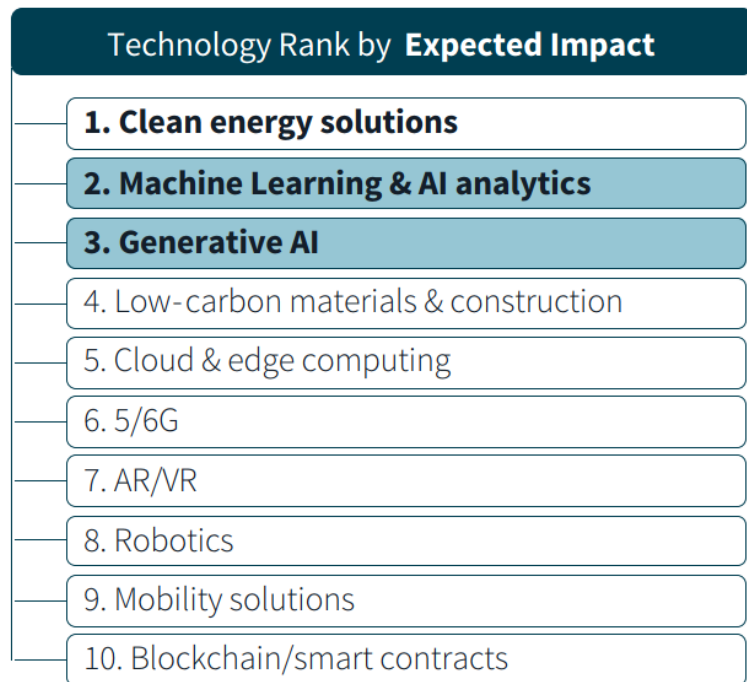
Emerging Trends in Real Estate 2024 surveys, ULI and PwC

Importance of Real Estate Industry Disrupters in 2024

1-No importance  5-Great importance



AI and GenAI are expected to have a significant impact, but understanding remains low



Source: JLL / Global Real Estate Technology Survey 2023

**COSA
PENSERESTI DI
UN'AGENZIA CHE
OGGI NON USA I
COMPUTER?**

ANNI 80

COMPUTER

**COSA
PENSERESTI DI
UN'AGENZIA CHE
OGGI NON USA
INTERNET?**

ANNI 90

INTERNET

**COSA
PENSERESTI DI
UN'AGENZIA CHE
OGGI NON USA I
SOCIAL?**

ANNI 00

SOCIAL

**COSA PENSERAI
DELLA TUA
AGENZIA SE UN
DOMANI NON
USERÀ L'IA?**

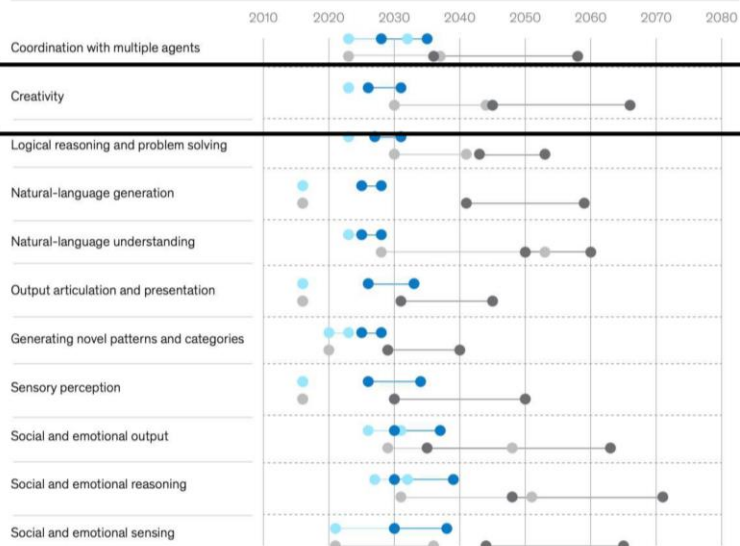
ANNI 20

IA

As a result of generative AI, experts assess that technology could achieve human-level performance in some technical capabilities sooner than previously thought.

Technical capabilities, level of human performance achievable by technology

Estimates post-recent generative AI developments (2023)¹ ● Median ● Top quartile
Estimates pre-generative AI (2017)¹ ● Median ● Top quartile
○ Line represents range of expert estimates



¹Comparison made on the business-related tasks required from human workers. Please refer to technical appendix for detailed view of performance rating methodology.
Source: McKinsey Global Institute occupation database; McKinsey analysis

Prima dell'avvento dell'Intelligenza Artificiale Generativa si prevedeva che l'AI avrebbe raggiunto un livello di creatività pari a quello dell'uomo attorno al 2065. Oggi siamo scesi al 2031.

Source: McKinsey 2023

AI Impact Today



V1 Febbraio 2022



V2



V3



V4



V5



V5.1



V5.2



V6 Dicembre 2023

**Images generated on MidJourney by Henrique Centieiro and Bee Lee*

Will robots take my job?



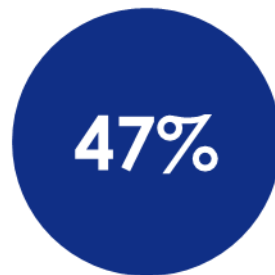
Fotografi



Avvocati

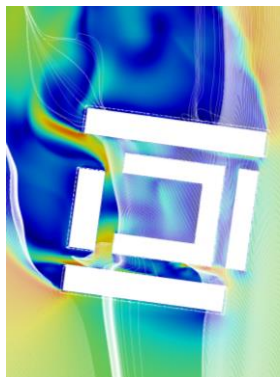


Ingegneri Meccanici

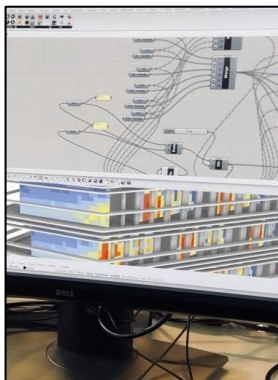


Giornalisti

Source: <https://willrobotstakemyjob.com/>



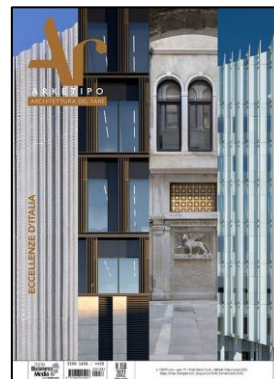
Analysis



Computing



Education

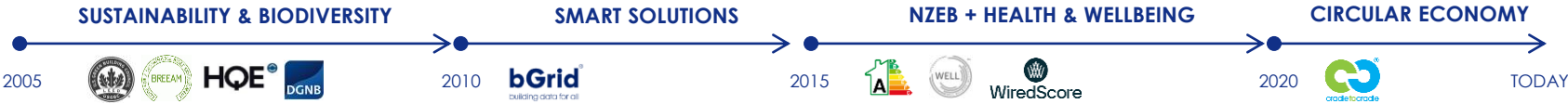
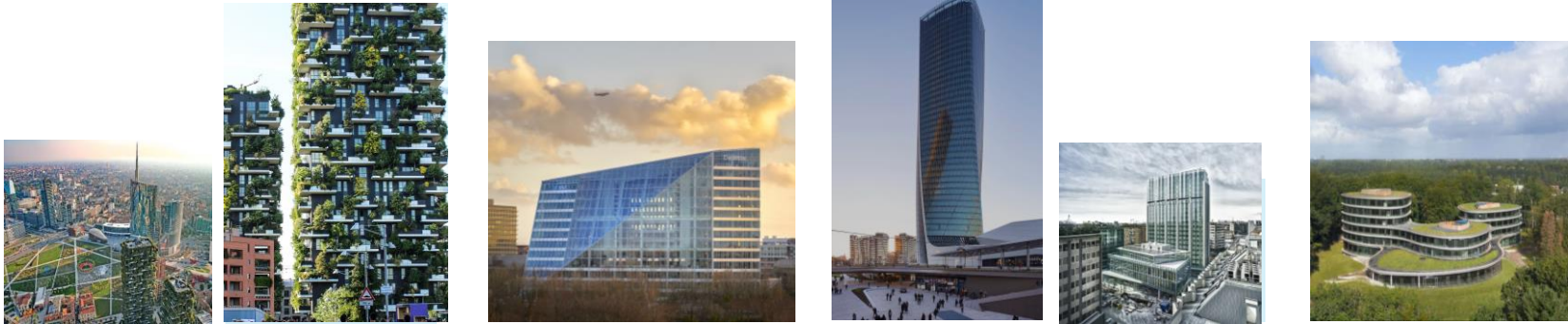


Articles

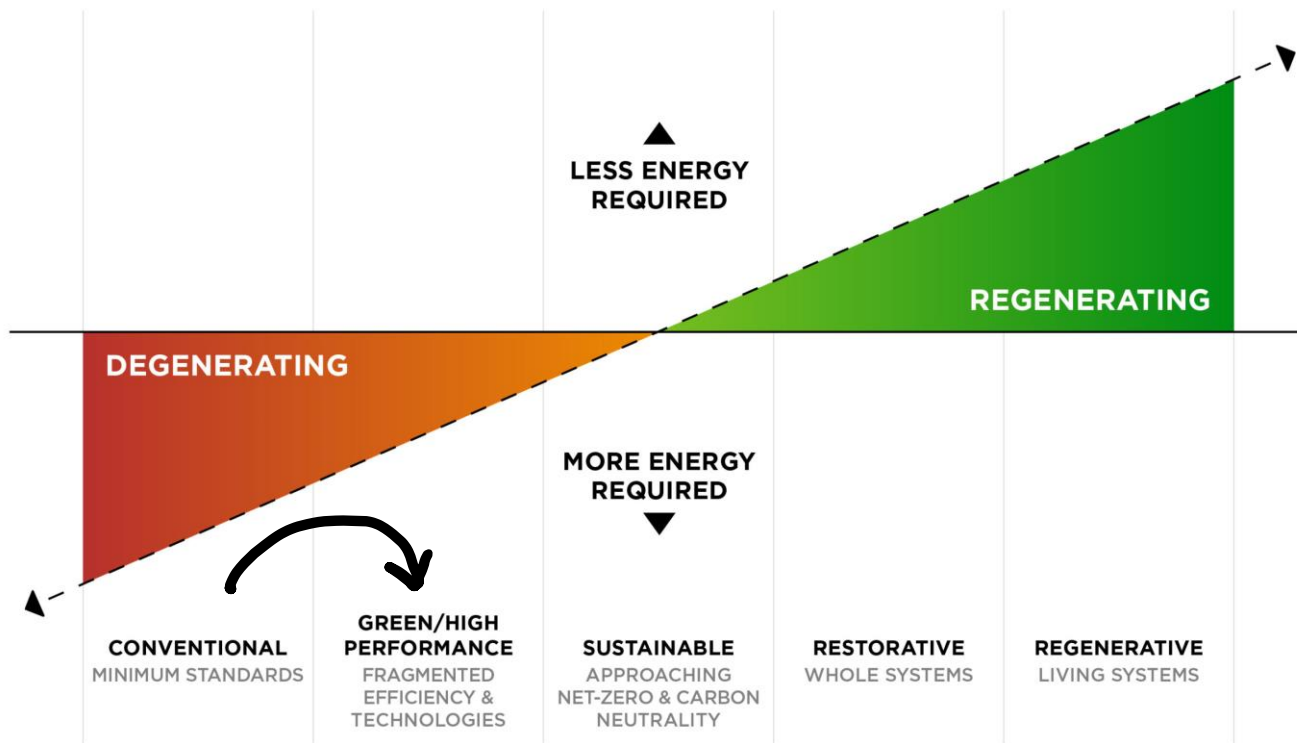


Design
Collaboration

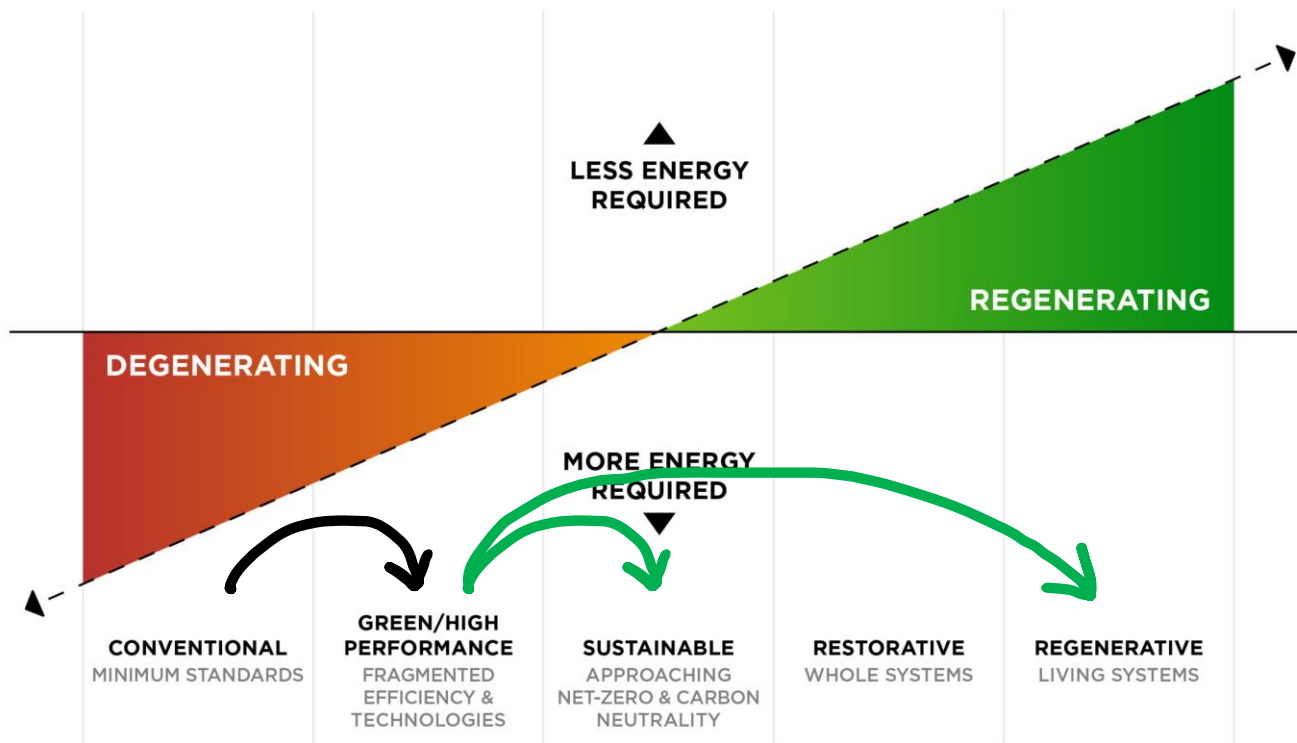
Evolution of our challenges



Where are we now?



What's next?



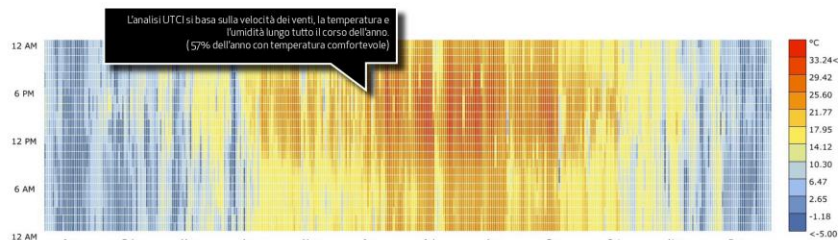
THE COMPUTATIONAL PROCESS

1. COLLEZIONARE I DATI E VISUALIZZARE LA PARTE IMPORTANTE

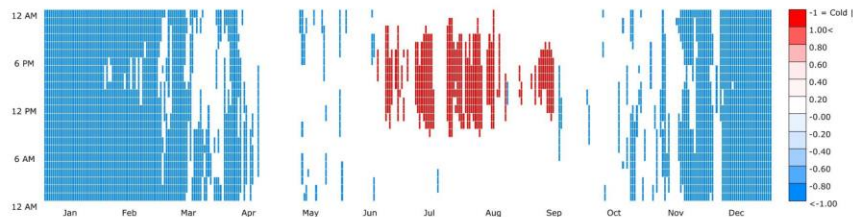
Initial Analysis

UTCI (Universal Thermal Climate Index) - Hour of Heatstress / comfortable / Coldstress

Media oraria dei valori di UTCI

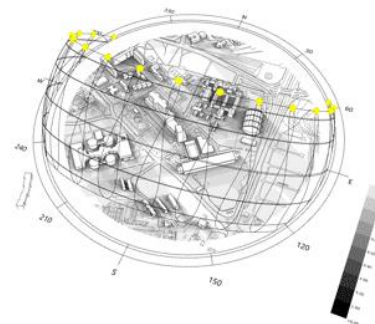
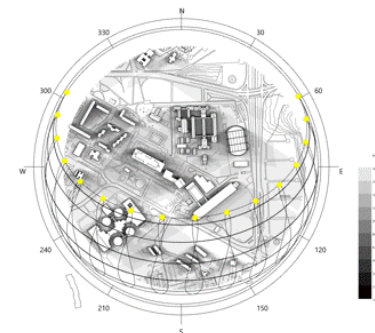


Universal Thermal Climate Index (°C) - Hourly
Milano-Linate_ITA
1 JAN 1:00 - 31 DEC 24:00

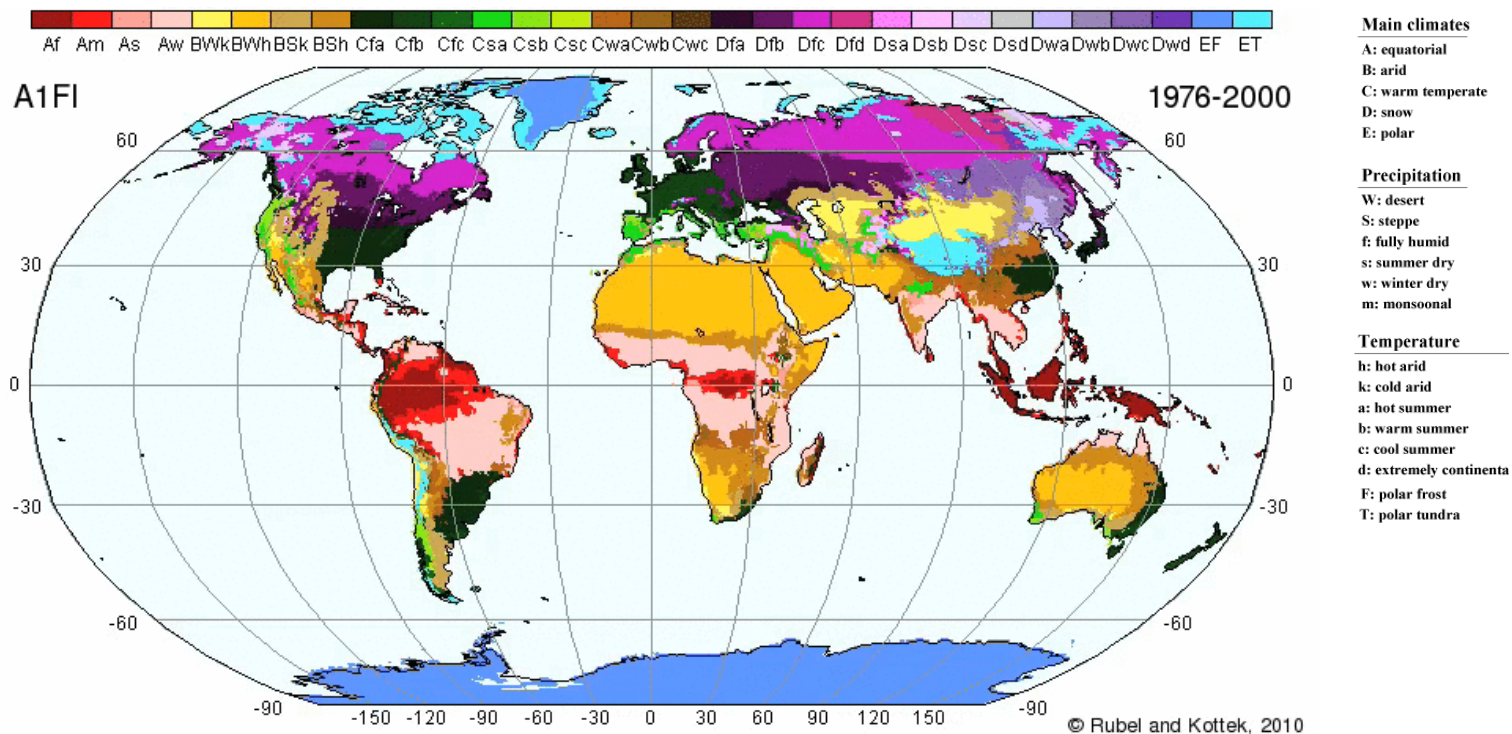


Thermal Stress (-1 = Cold | 0 = Comfort | 1 = Hot) - Hourly
Milano-Linate_ITA
1 JAN 1:00 - 31 DEC 24:00

- Heatstress (temperatures above 26 degree celcius / 78.8 Fahrenheit)
- No Thermal Stress (temperatures between 9 and 26 degree Celcius / 48.2 and 78.8 Fahrenheit)
- Coldstress (temperatures below 9 degree celcius / 48.2 Fahrenheit)



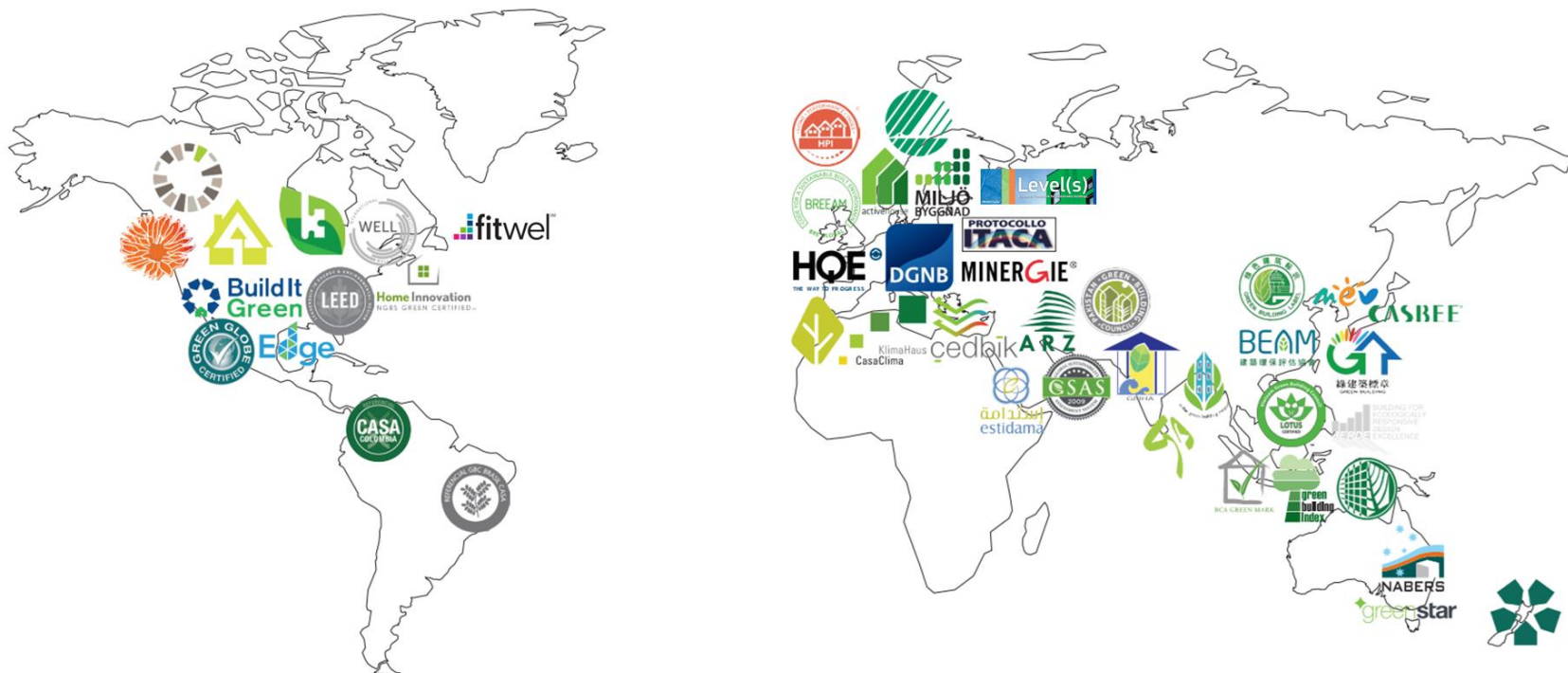
The Impact of Climate Change



THE COMPUTATIONAL PROCESS

2. DEFINIRE I TARGET

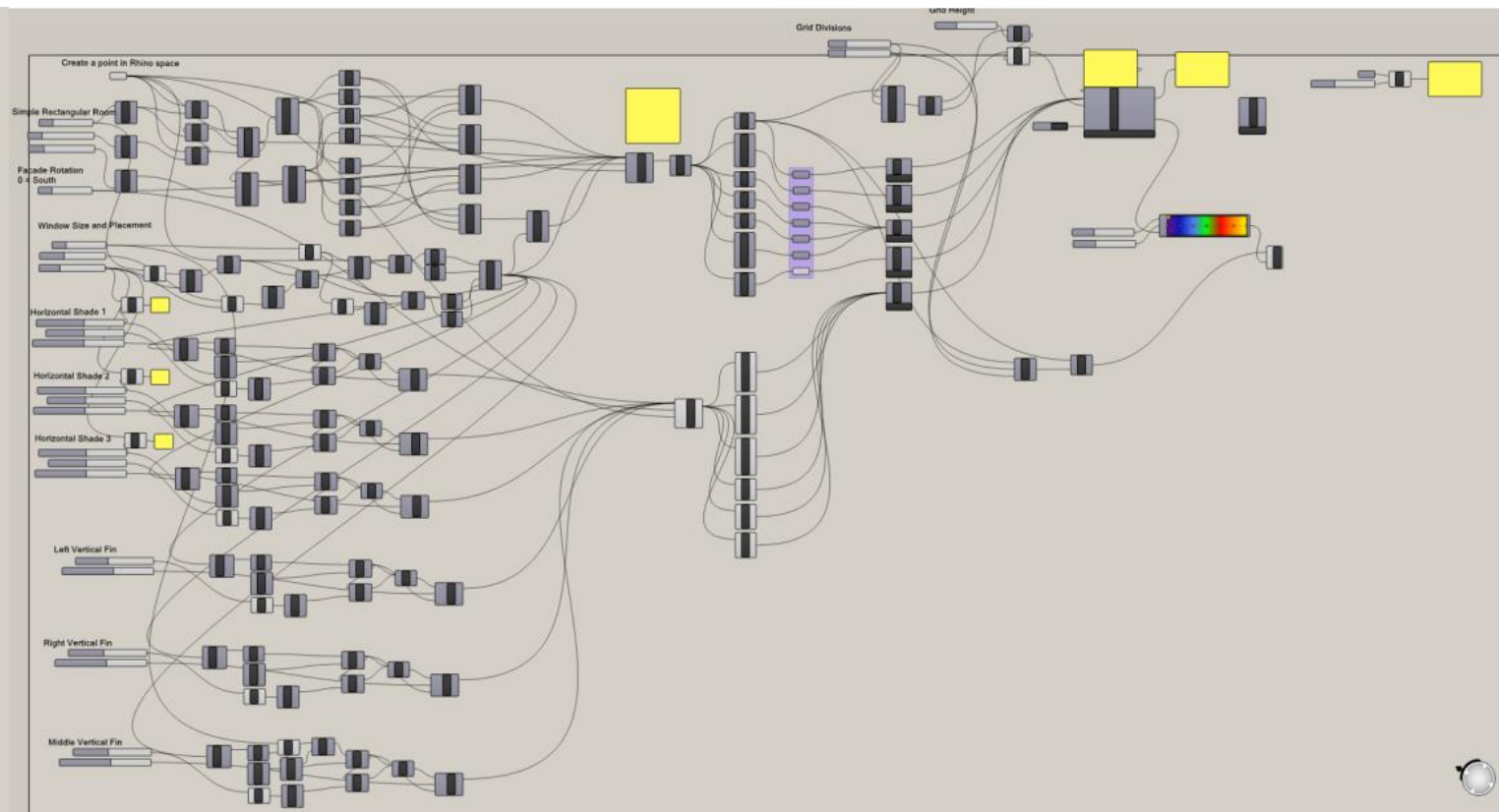
International Rating Systems



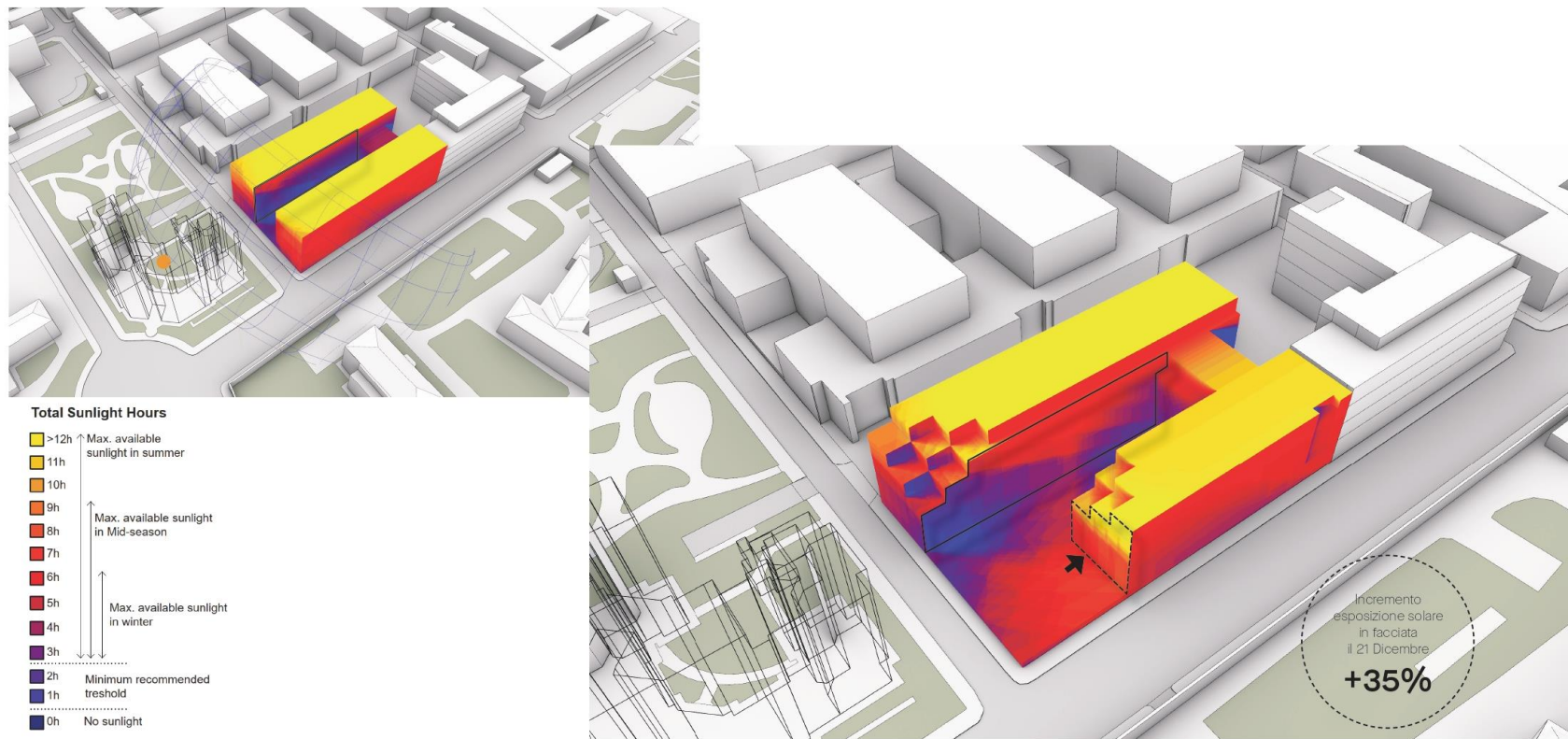
THE COMPUTATIONAL PROCESS

3. ANALISI DEGLI SCENARI E VISUALIZZAZIONE DEI RISULTATI

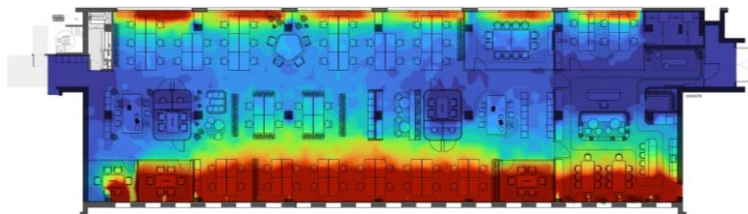
Parametric analysis: Rhino + Gh scripts



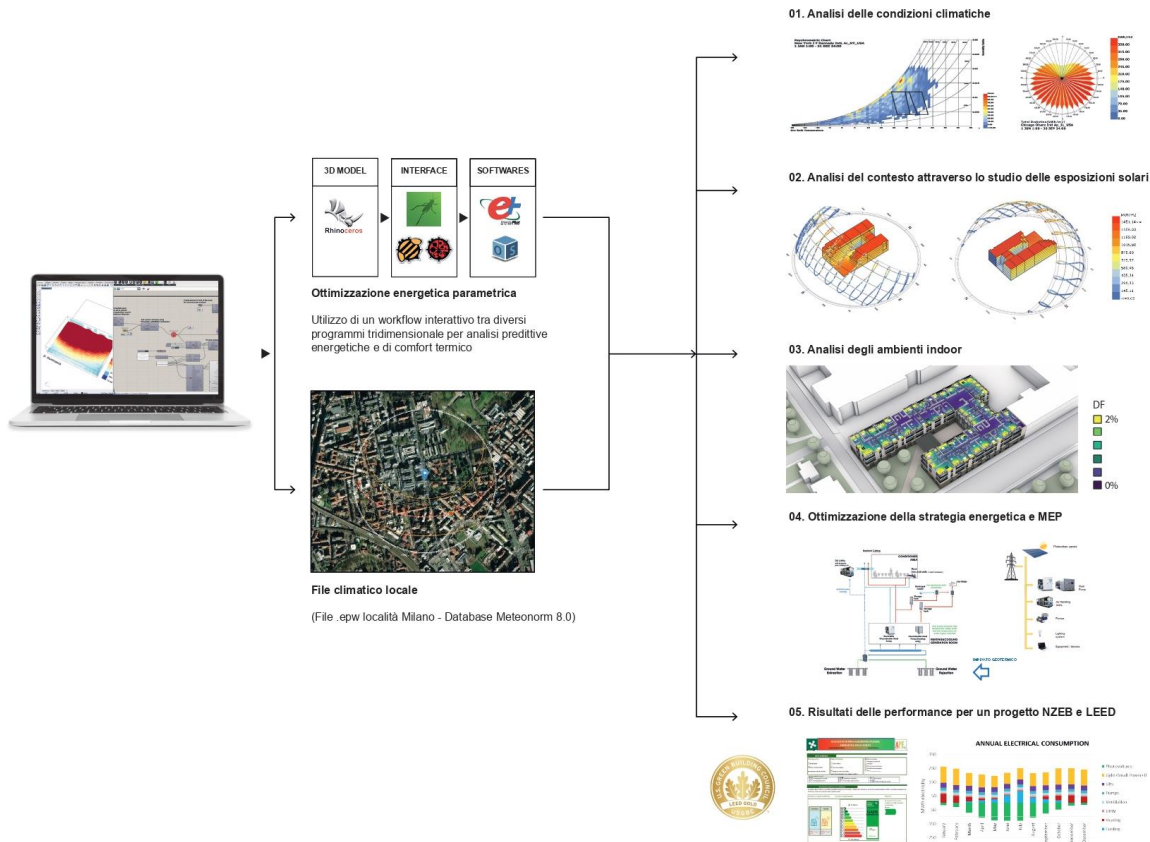
Sunlight Potential



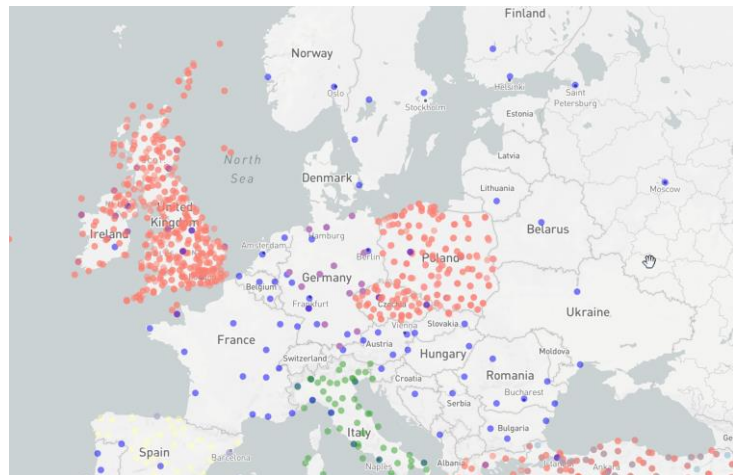
Daylight Potential



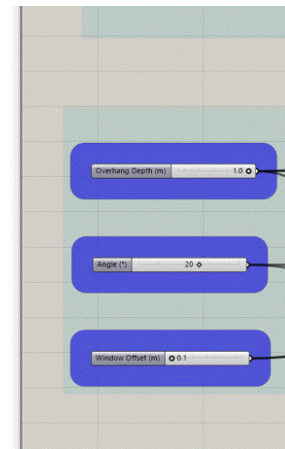
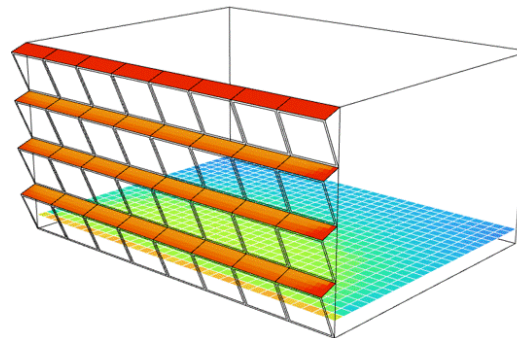
Our Computational Process



Multicriteria parametric analysis



Overhang Depth = 1 m
Angle = 20°
PV Module Area = 2.5 m²
Glazing Module Area = 5 m²
PV Solar Rad = 878 kWh/m²
Window Wall Ratio = 85 %
Average lux = 704 lux
Heating Load = kWh/m²
Cooling Load = kWh/m²



Epw **weather data** della Città scelta

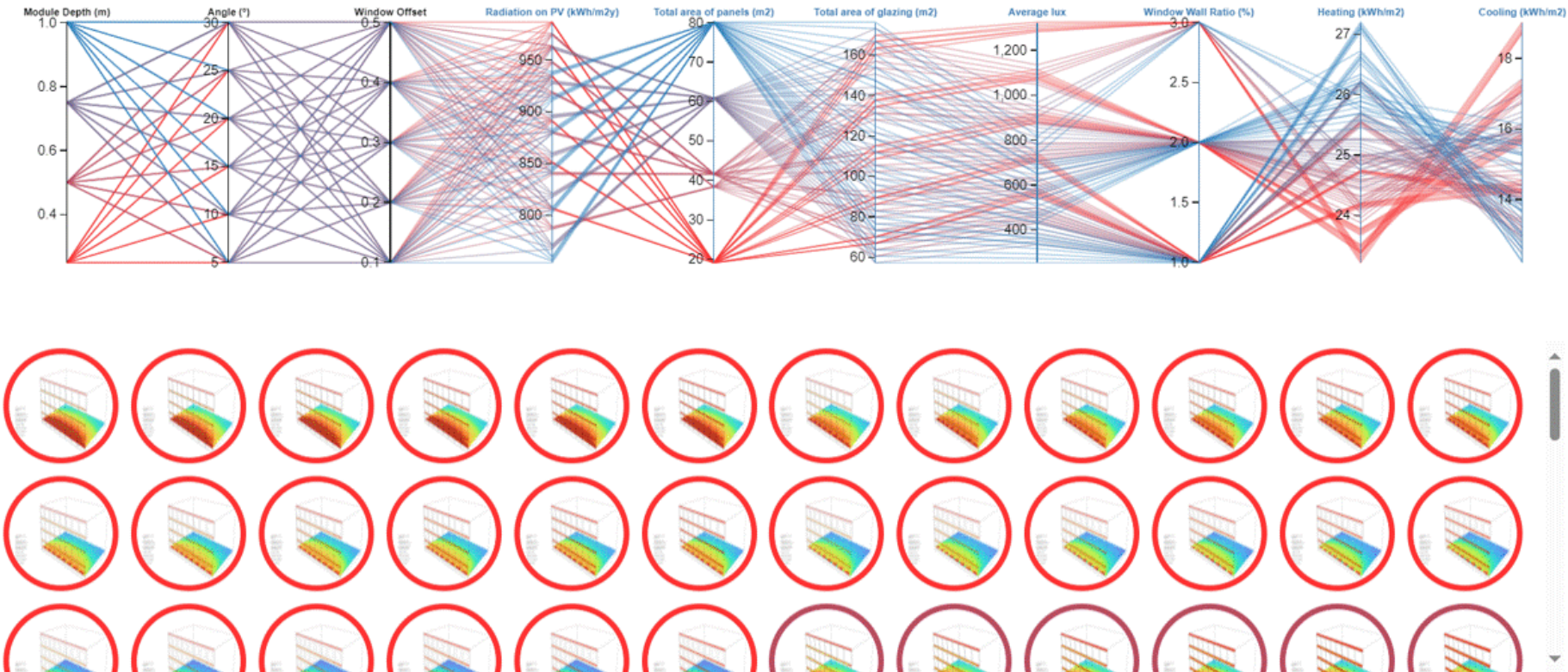
Bilanciare daylight e consumi è importante

Simulazioni annuali di luce naturale **climate-based** sono notoriamente molto lunghe da calcolare.

Colibri è in grado di combinare **centinaia di iterazioni**

Variabili: Overhang depth, Window to wall ratio, PV Module area, Glazing Tilt, Glazing properties, etc...

Multicriteria parametric analysis



What is Generative Artificial Intelligence (AI)?



Generative AI is a type of artificial intelligence (AI) that uses machine learning algorithms to create new and original content like images, videos, text, and audio.

1 Forming a Database

A neural network, consisting of various information or media files like images, text, data, sounds, etc., forms the basis of artificial intelligence.



2 Inputting a Prompt

The user provides the AI with a description or sample of the desired content...



Prompts can be any user-submitted material, like words, numbers, or photos.



3 Generating Content

...and the AI uses its neural network to generate new examples that are similar to the ones it has trained from.



<https://www.weforum.org/agenda/2023/02/generative-ai-explain-algorithms-work/>

This image was created on MidJourney using the following text prompt:
a technical illustration of a woman sitting behind a desktop computer on a long table, isometric view, 3D rendering, realistic, 4k

```
# Import required libraries :
import numpy as np
import matplotlib.pyplot as plt

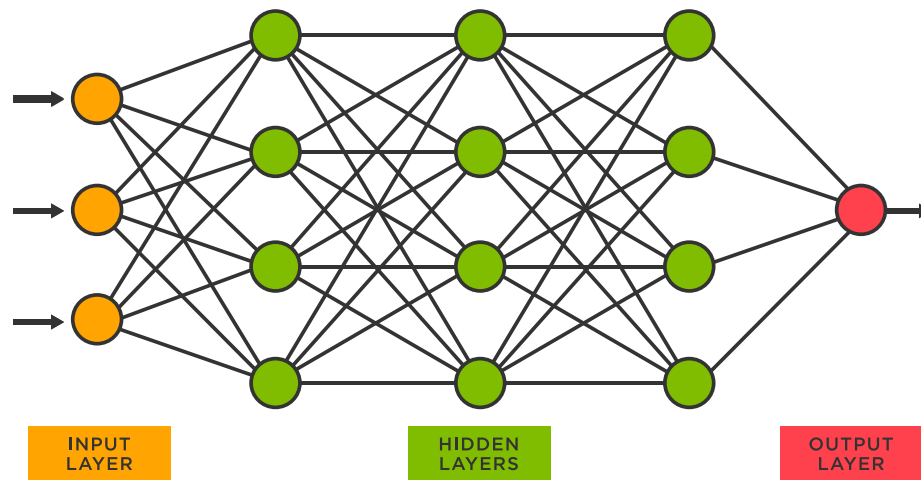
# Generating input dataset :
# It will generate 100 points between -10 and 10.
input = np.linspace(-10,10,100)

# Define sigmoid function :
def sigmoid(X):
    val = 1/(1+np.exp(-X))
    return val

# Output values :
output = sigmoid(input)
plt.plot(input,output,c="b")

#This will decrease the steepness :
output = sigmoid(0.5*input)
plt.plot(input,output,c="r")

#This will increase the steepness :
output = sigmoid(2.5*input)
plt.plot(input,output,c="g")
```



Neural Network

Generative AI add to the learning process

YouTube Summary with ChatGPT

Get summary of the YouTube videos.
Learn better with ChatGPT 

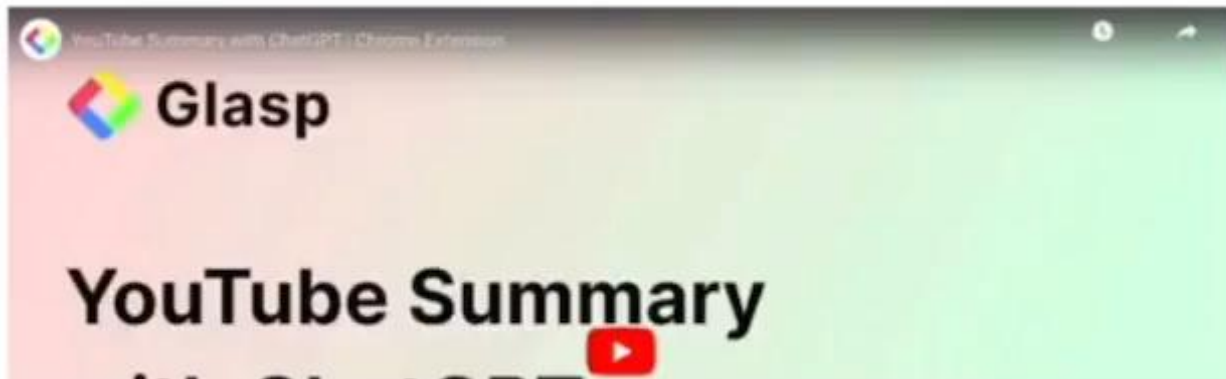


Install on Chrome



Install on Safari

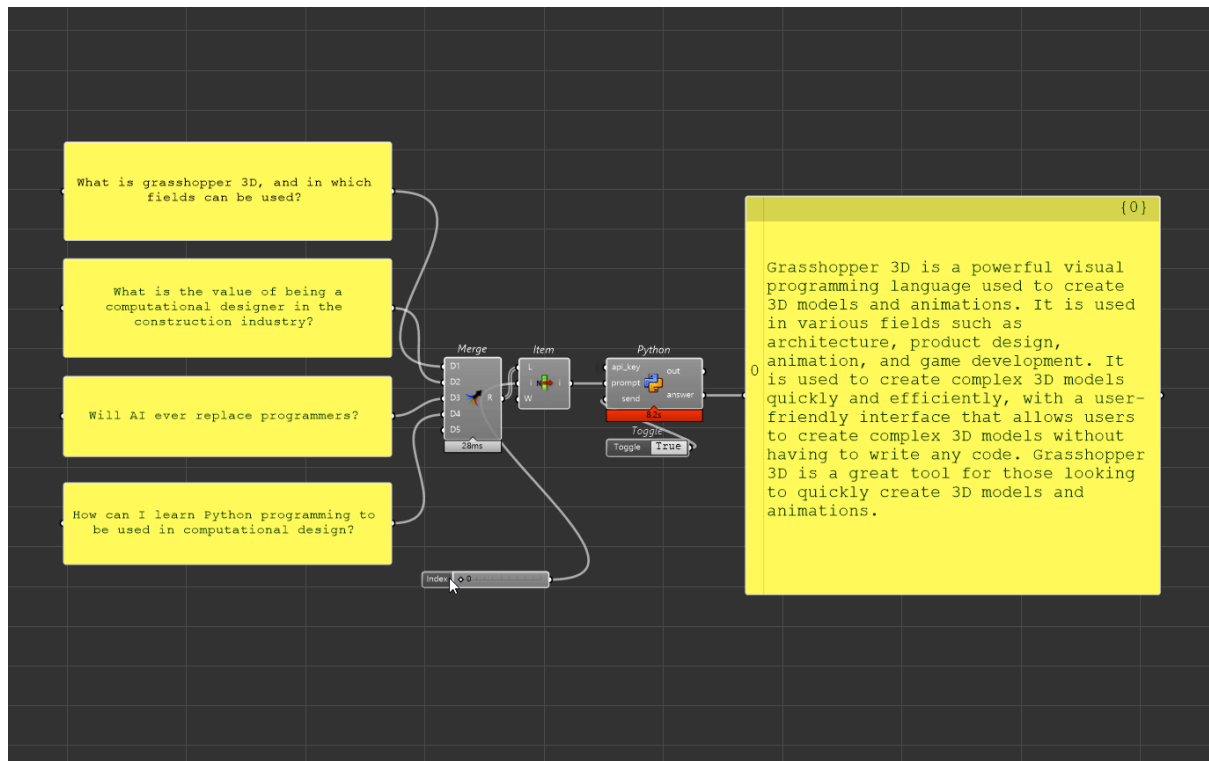
No sign up required



Generative AI add to the computational process

```
openAI_ChatGPT3.py
1 import urllib2
2 import json
3
4 # Set the endpoint URL and the prompt text
5 url = "https://api.openai.com/v1/completions"
6
7 # Set the API key and other parameters
8 data = json.dumps({ "model": "text-davinci-003", "prompt": prompt, "temperature": 0.5, "max_tokens": 1024})
9 headers = { "Content-Type": "application/json", "Authorization": "Bearer (0)".format(api_key) }
10
11 answer = "Send to prompt to Open AI"
12
13 if send:
14     # Make the request
15     req = urllib2.Request(url, data, headers)
16     response = urllib2.urlopen(req)
17
18     # Parse the response
19     response_text = response.read()
20     response_json = json.loads(response_text)
21
22     # Read the answer
23     answer = response_json["choices"][0]["text"]
24
25 print(answer)
```

API tokens are available upon payment to use ChatGPT on Python



Giambattista asking Prompt 1:

*Can you generate a portrait picture of an
highly successful person in a company*



Giambattista asking Prompt 2:
*Thank you, but why did you choose to
represent a male, white and young guy?*

AI Tool answer: *The data used to train the model comes from a wide range of publicly available sources across the internet, reflecting diverse content from around the world. However, it may have biases influenced by the prevalence and representation of certain demographics in the training data.*

This can sometimes lead to overrepresentation of certain groups, such as white males, in generated images. If you have specific preferences for the image, I can create a new one based on your detailed description.

- **Le AI sono meri strumenti che usiamo nel nostro business, è nostra la responsabilità dell'output finale**
- **È molto difficile che esista una normativa <aggiornata> alla velocità di sviluppo dell'AI**
- **Se utilizzi un tool che si basa sull'intelligenza artificiale presta attenzione a:**
 - *I diritti che ti vengono concessi sui contenuti che crei*
 - *Responsabilità legali di quanto creato*
 - *Privacy dei dati che si danno in pasto all'AI (dati personali e dati sensibili di progetto)*
- **Validazione personale:**
 - *Conoscere i propri AI prompt*
 - *Essere consapevoli dei bias*
 - *Verificare sempre il risultato attraverso fact-checking*
 - *Chiedere ai colleghi per migliorare i propri AI prompt e i risultati.*
- **Creare delle policy aziendali o almeno delle linee guida tra i collaboratori di uso dell'AI**

Will robots take my job?

L'intelligenza artificiale generativa non ha l'obiettivo di sostituire i professionisti.

È uno strumento software che aiuta e facilita il vostro lavoro: automatizza le cose noiose e progetta quelle fantastiche. Ma l'IA generativa ha bisogno di domande appropriate per dare risposte corrette.

Thank you

