PORTFOLIO

By Mahdi Zangeneh

CONTEXT

INFORMATION DOCUMENT

Name: Mahdi Zangeneh

Date of birth: 12/28/1993

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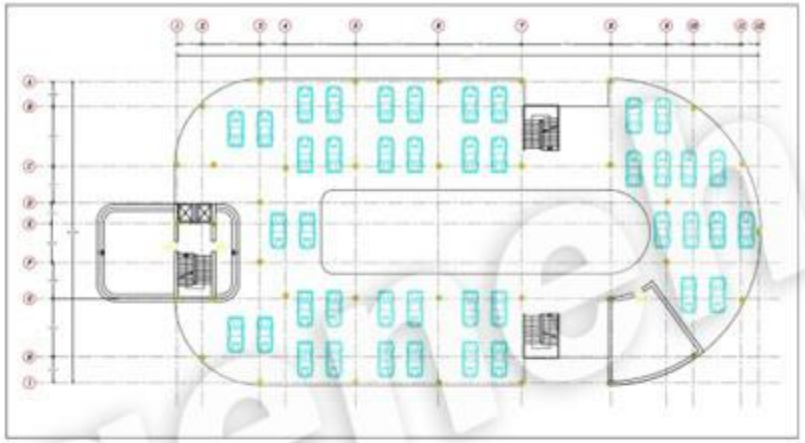
Field of Study: Current Student of Politecnico di Milano, Sustainable Landscape and Architecture

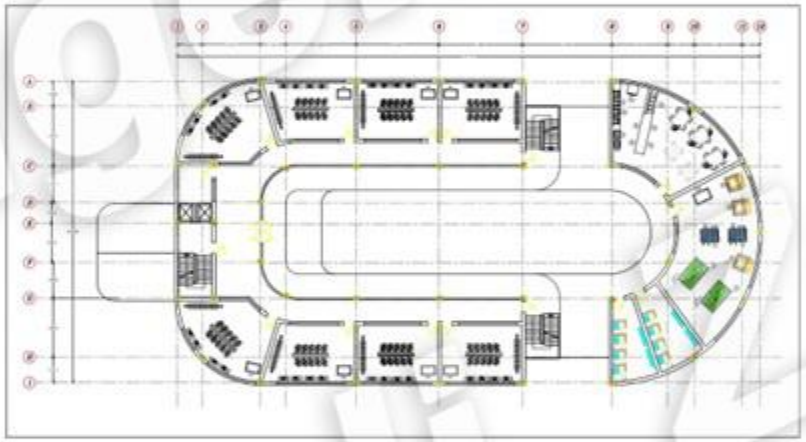
Practiced apps: Rhino, Design Builder, Ladybug, Photoshop, Premiere, QGIS, AutoCAD, Fooocus AI

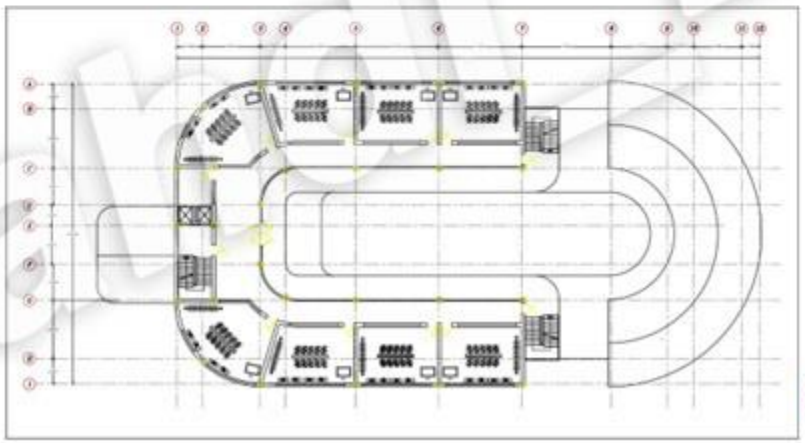
Language: Persian (birth language), English (IELTS 7)

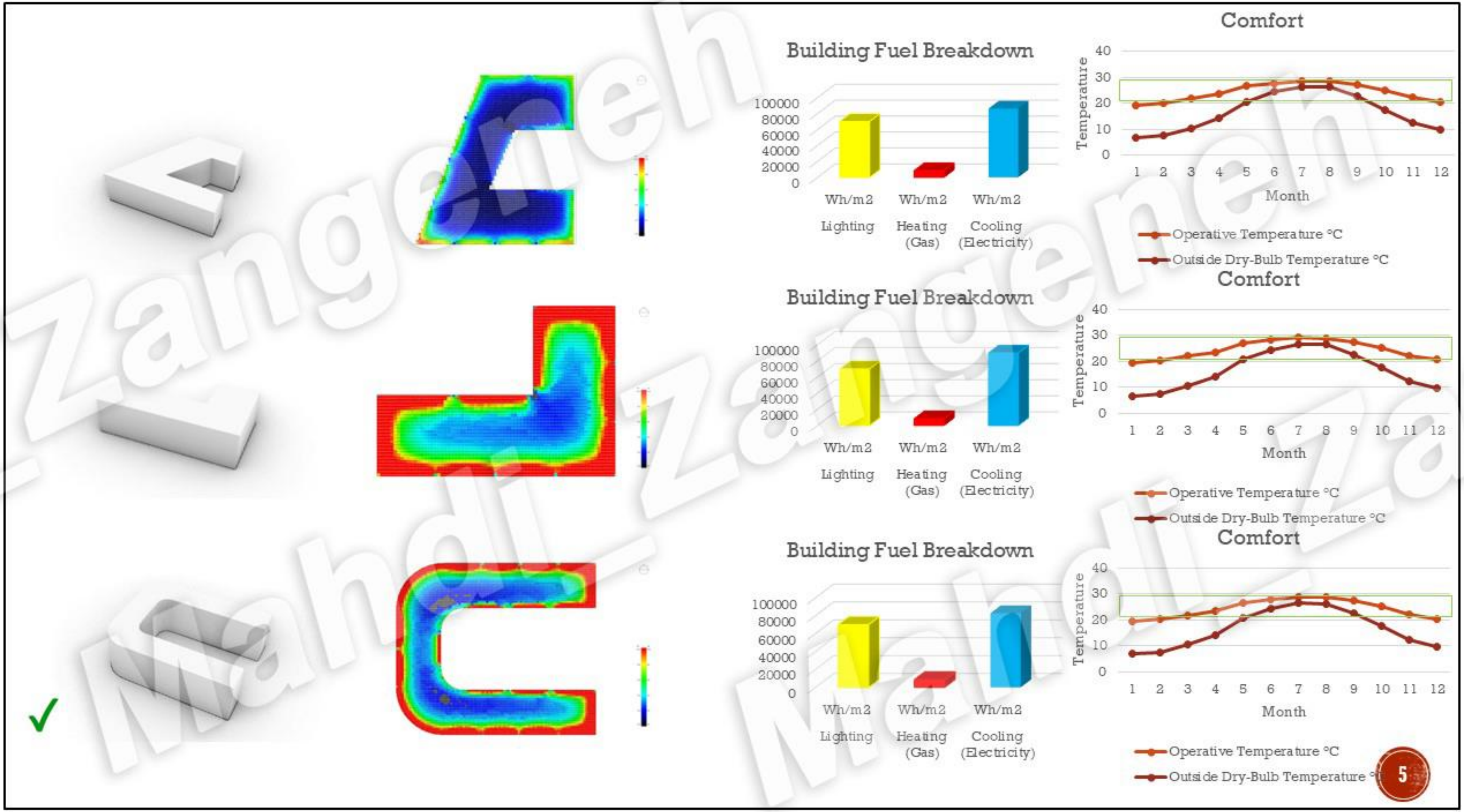
SHOPPING MALL

Our aim in this project was to design a shopping mall in the city of Rasht, Evaluate different forms, orientations, compare suitable energy generation solutions, analysis building fuel breakdown, roof slope, WWR, window shaders, illuminance, different materials and HVAC system through simulation using Design Builder v6.1.0.006



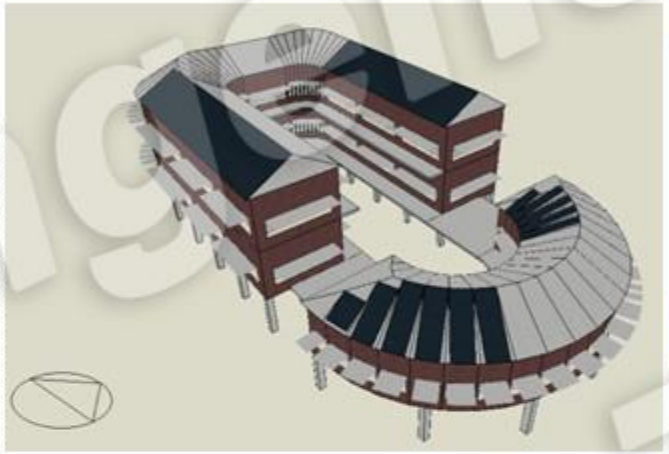


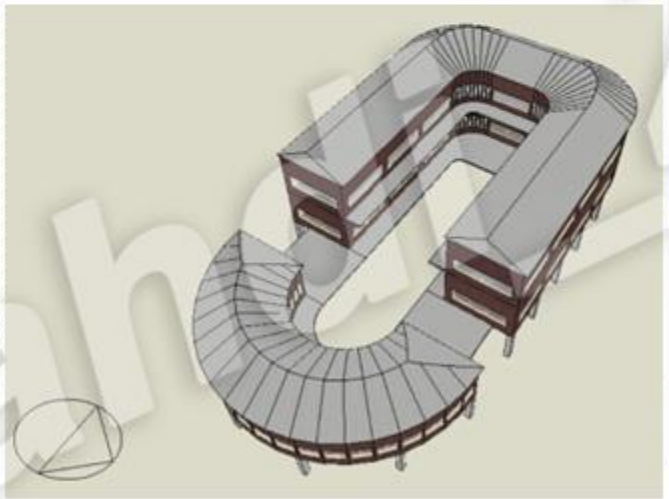




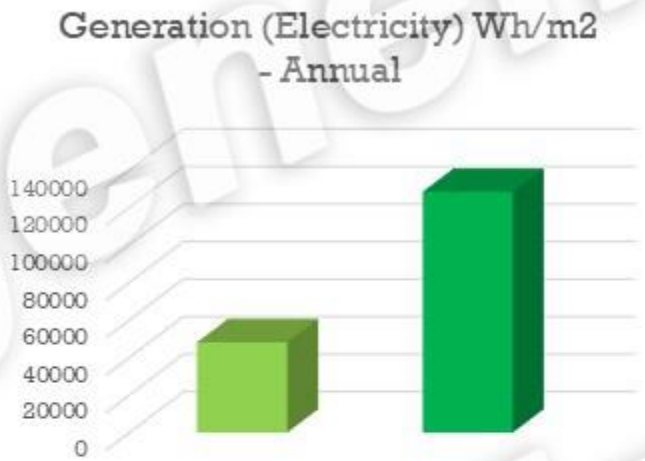
Orientation, PV panels & Wind turbine

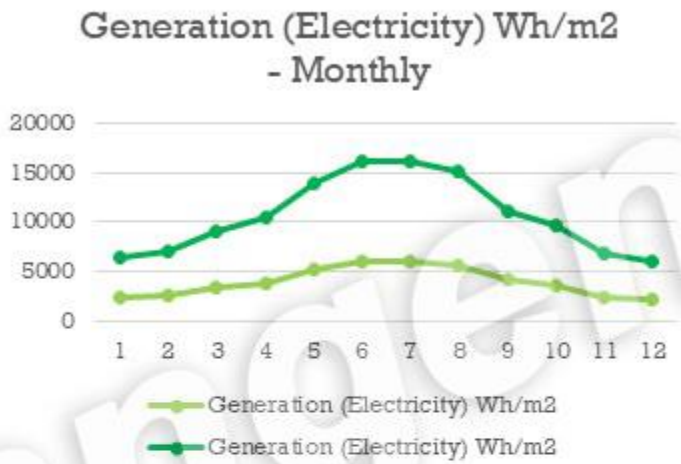
The next step was further studies to find the best orientation possible by rotating the building 45 degree at a time, and also find the effect of adding pilots, pitched roof, PV panels and wind turbines base on previous analysis of the climate and site.





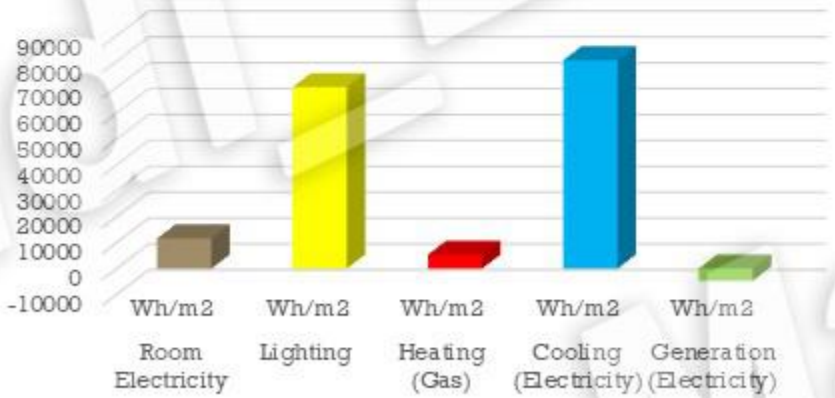
Rotation Degree	Room Electricity Wh/m2	Lighting Wh/m2	Heating (Gas) Wh/m2	Cooling (Electricity) Wh/m2
0	11680	70080	5353.183	80488.21
45	11680	70080	5777.989	83480.52
90	11680	70080	5837.825	83964.01
135	11680	70080	5865.366	83088.34
180	11680	70080	5556.414	79796.59
225	11680	70080	5814.312	86027.86
270	11680	70080	5826.984	86689.55
315	11680	70080	5791.503	83416.77





Total Area = 230.02 m2

	Generation (Electricity) Wh/m2
COP 0.15	48092.16
COP 0.40	128245.8

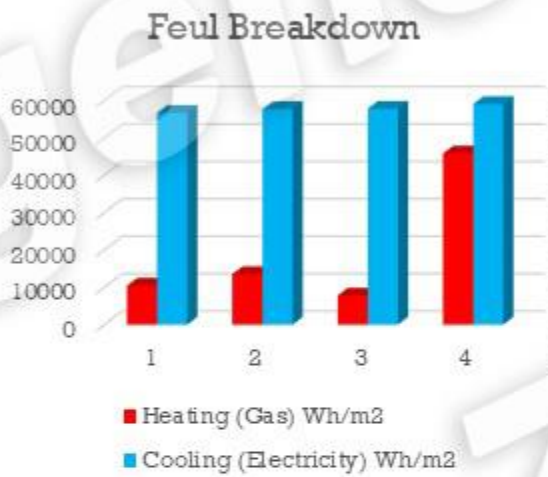


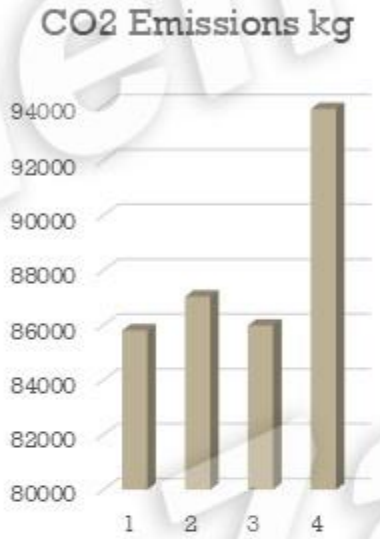
External Walls

Our aim here was to find out the best materials for external walls, internal walls, roof, external floor, internal floor and window through replacing different materials and combination and getting comfort, fuel and Co2 analysis via Design builder so we can choose the best option by comparing the results.

In addition between the HVAC systems available for this region we chose which one has the best performance overall.

(we only represent the results for the external walls and HVAC system in this presentation)





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3 ✓

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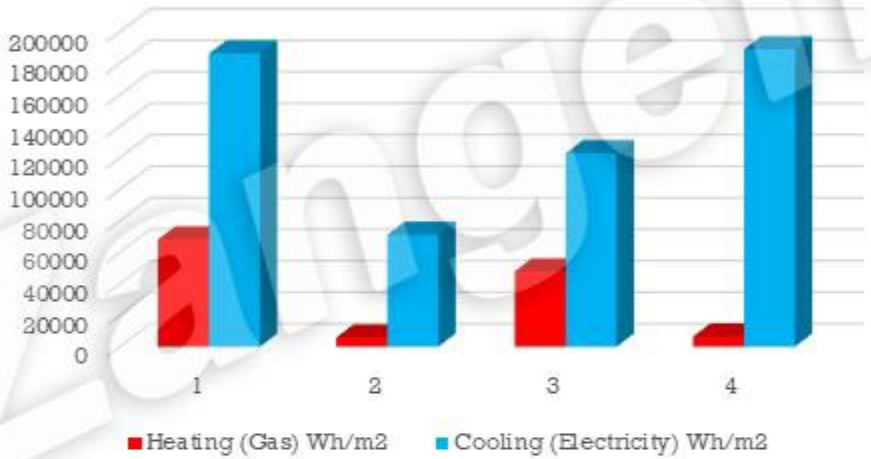
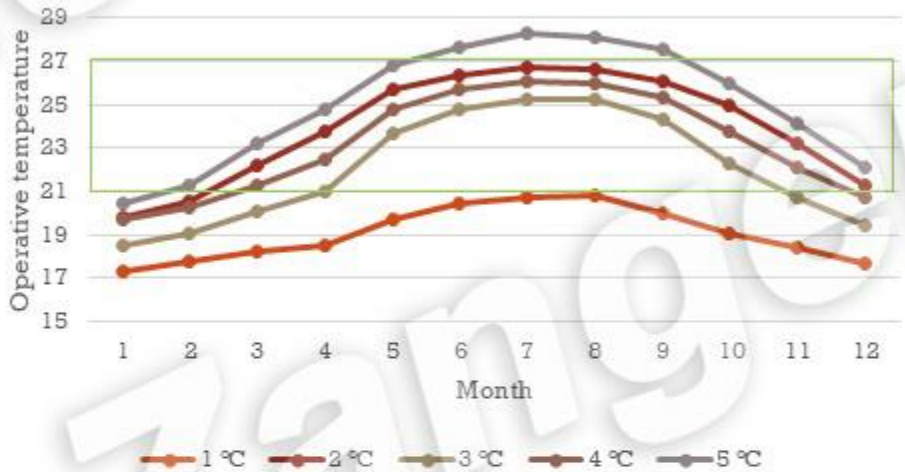
HVAC System

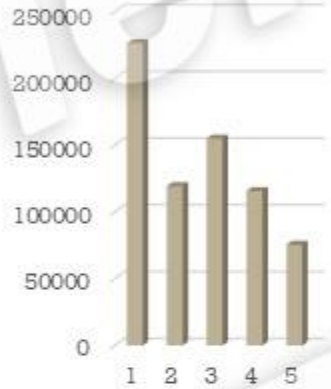
Fuel Breakdown

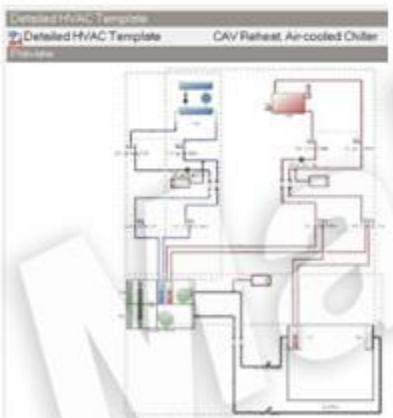


Comfort



CO2 Emissions kg





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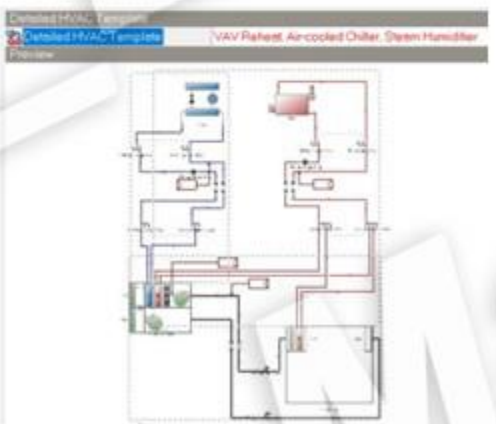

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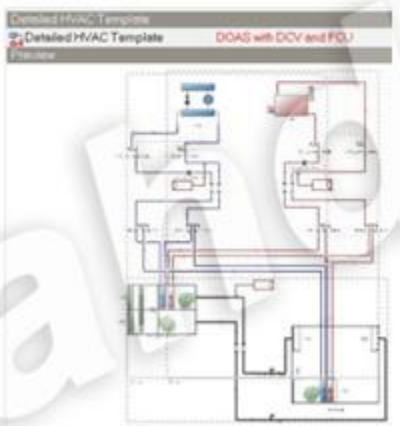

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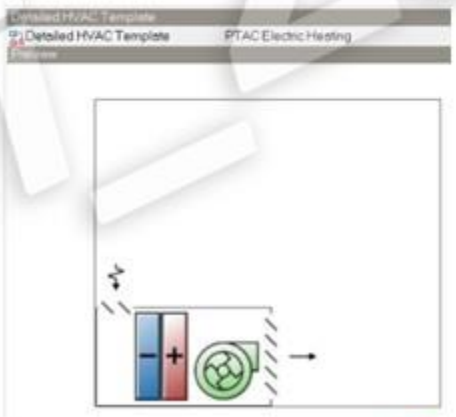

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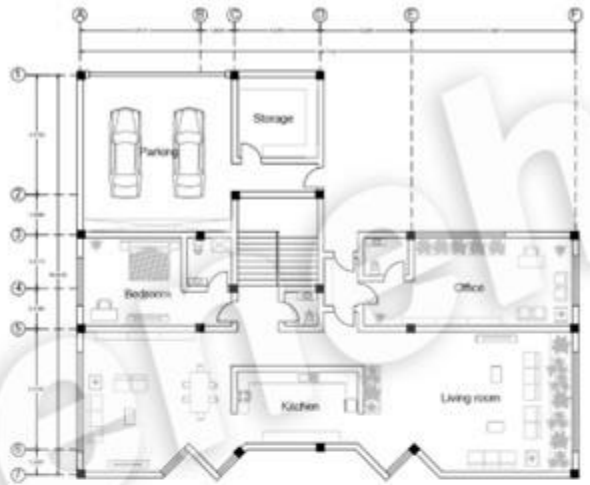
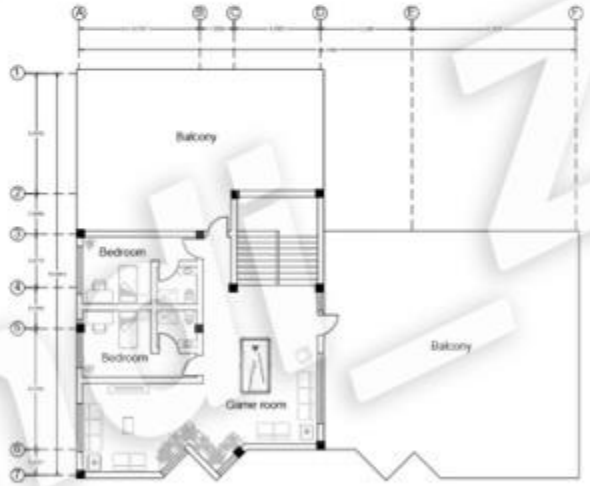
RESIDENTIAL VILLA

Our aim in this project was to design a house in the climate of Hamedan and use CFD simulation to evaluate the wind velocity, impact of it and obtain the comfort level inside the building while HVAC system is off.

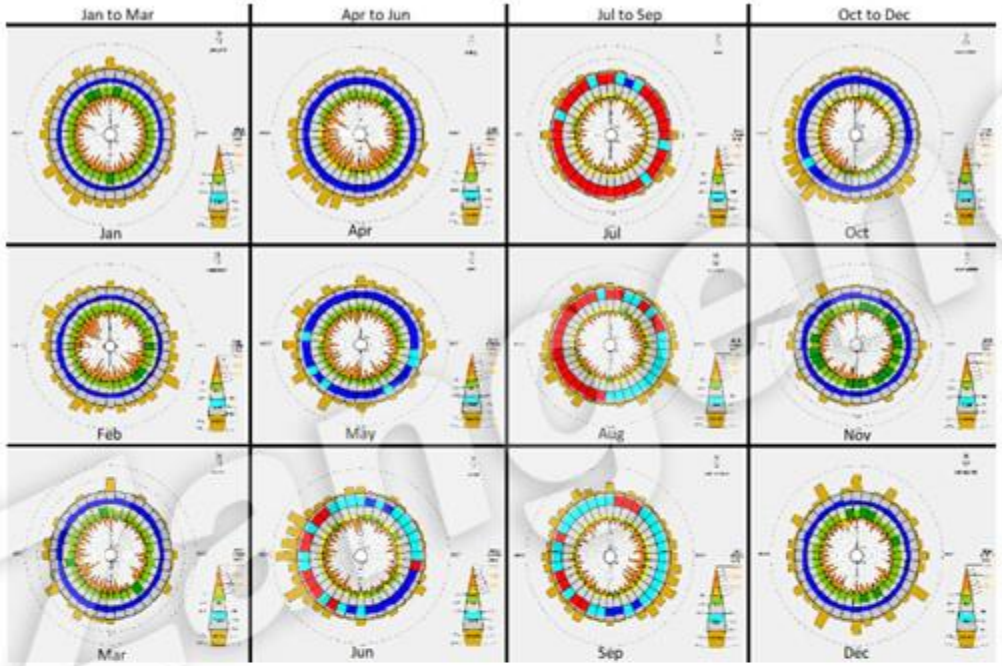
In this simulation Western wind (28th Dec, 14:00) with average velocity of 4 m/s was considered.

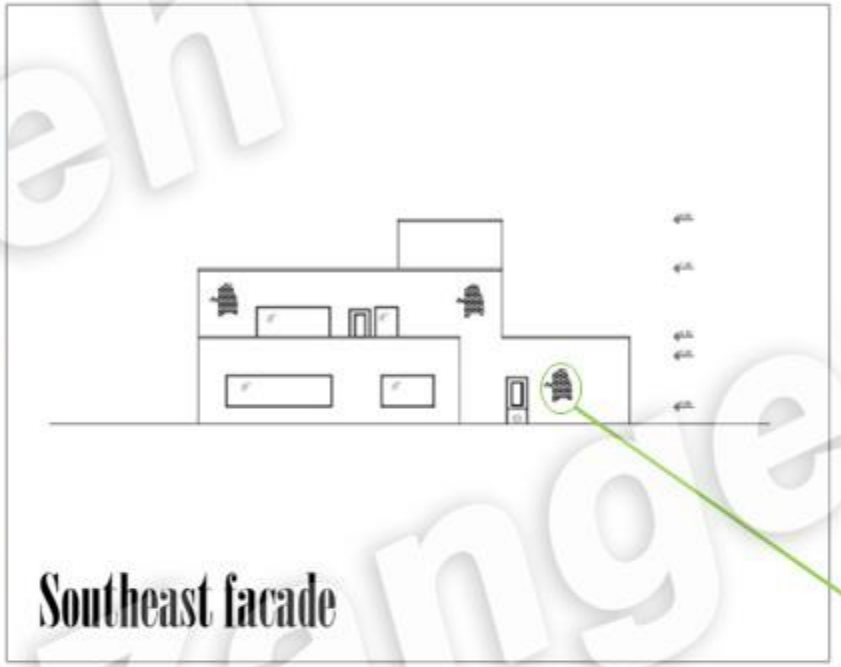


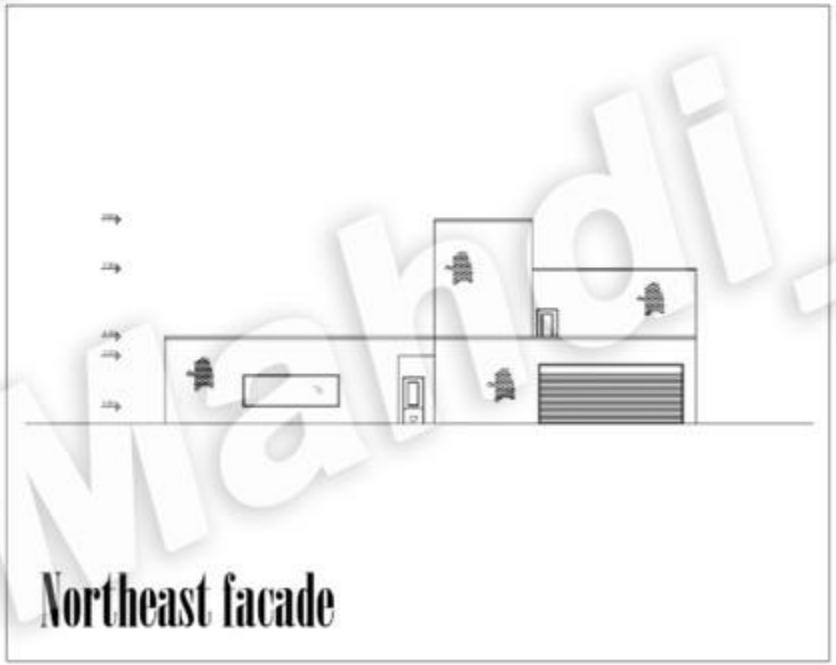
Ground floor plan

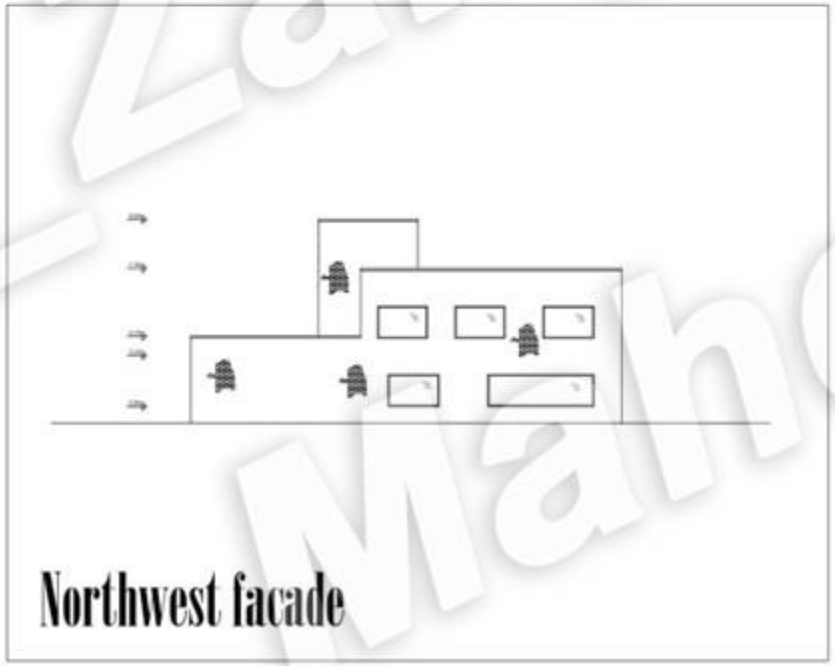


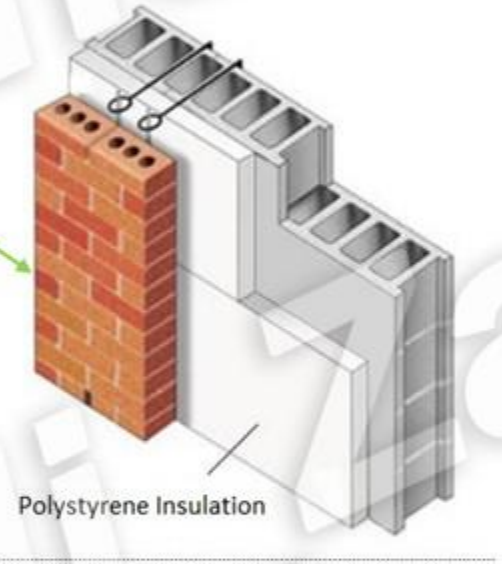
First floor plan

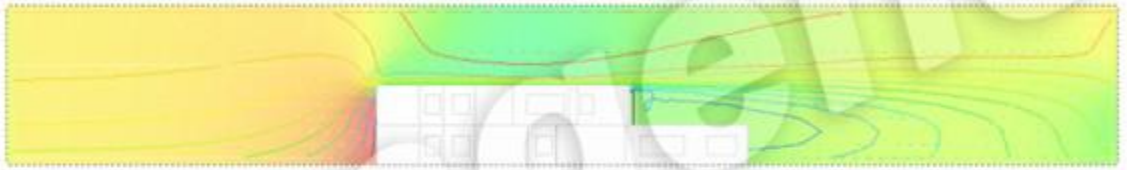


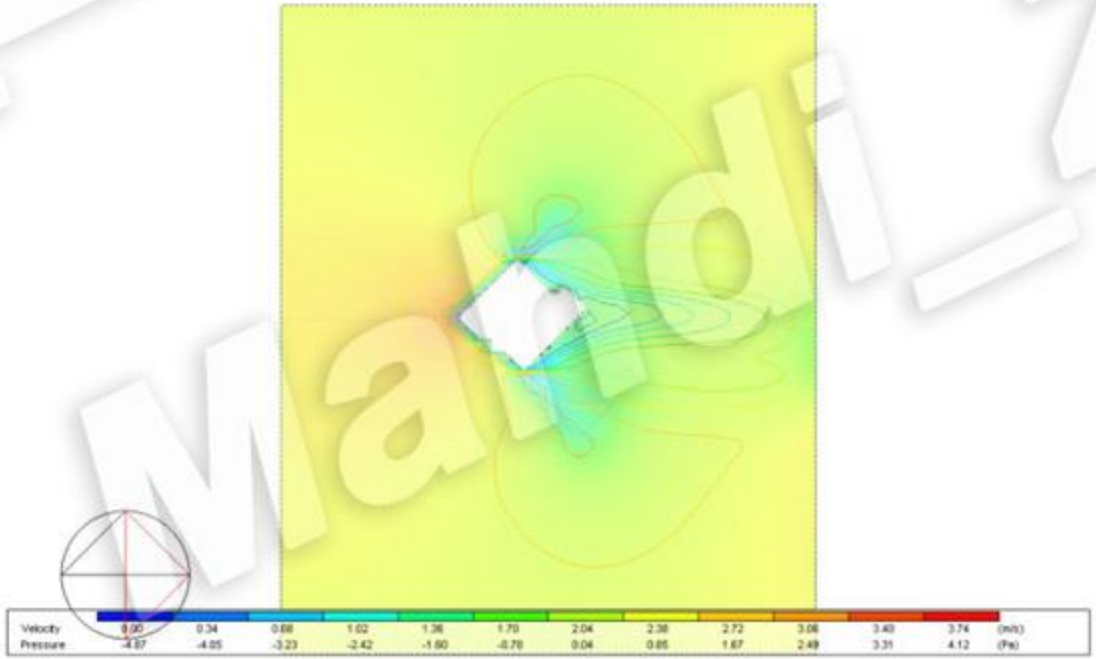






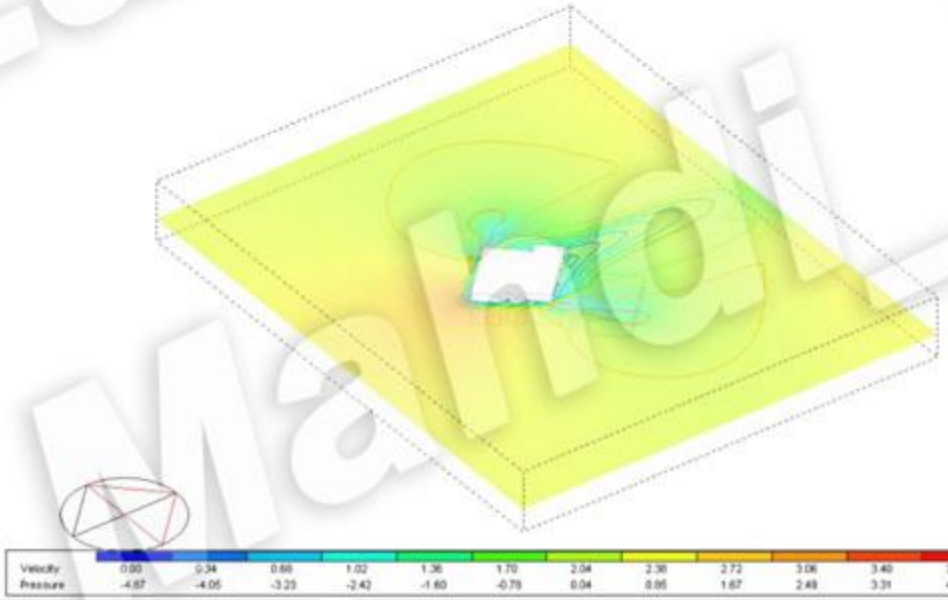


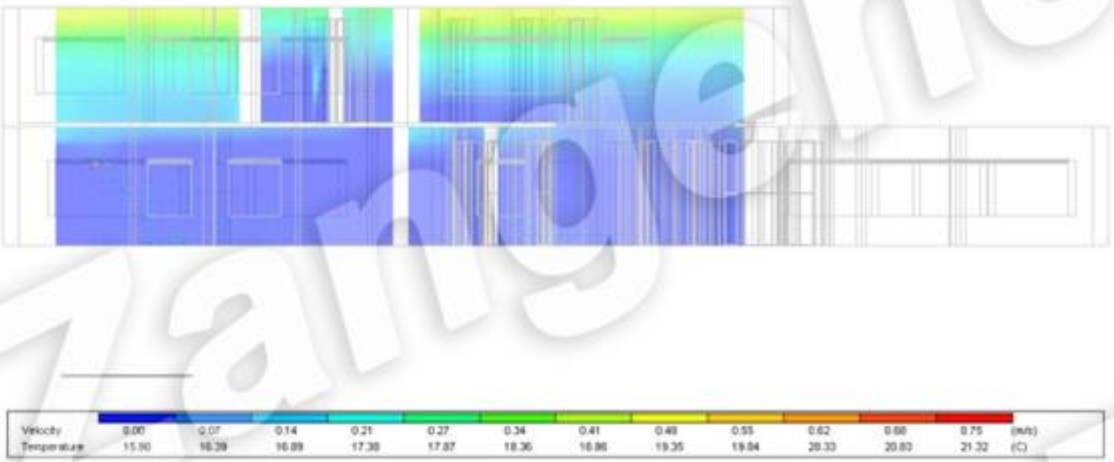


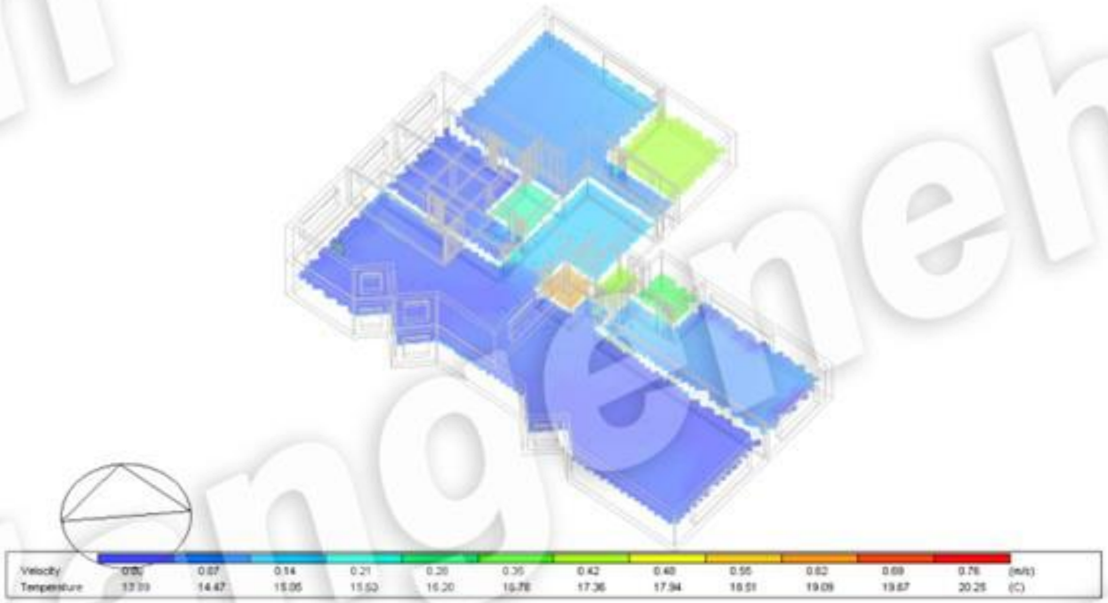


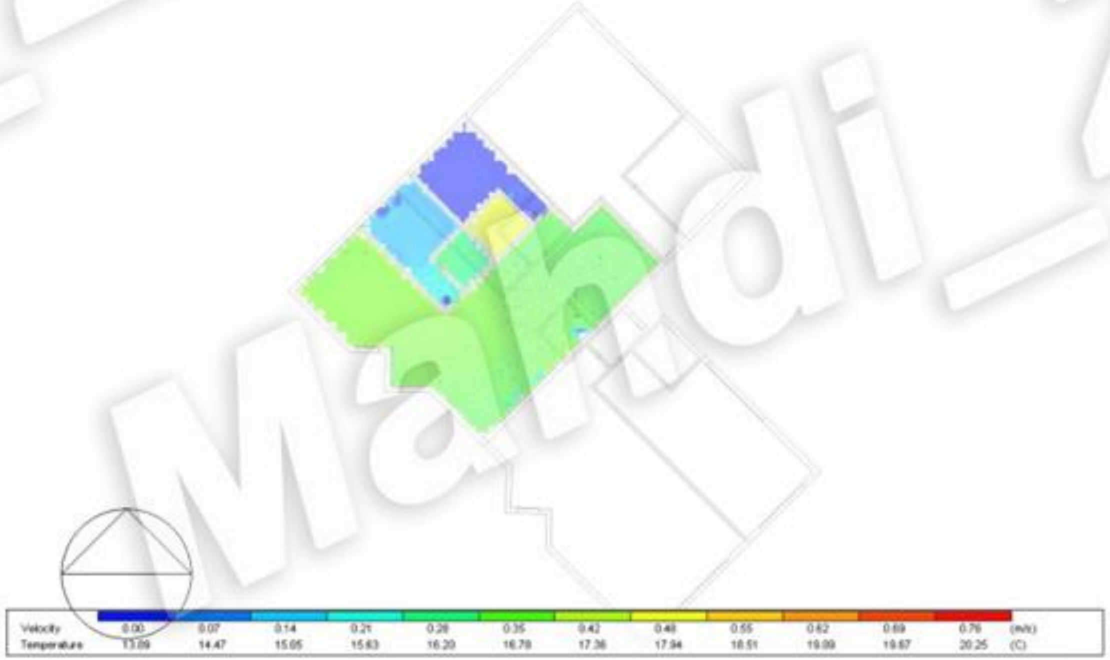
The results shows that the 45 degree rotation of the building helps a lot to reduce the Wake region and its impact on the east side and minimize the boundry layer, also from West (high pressure) to East (low pressure) both pressure and velocity of wind will be reduced.

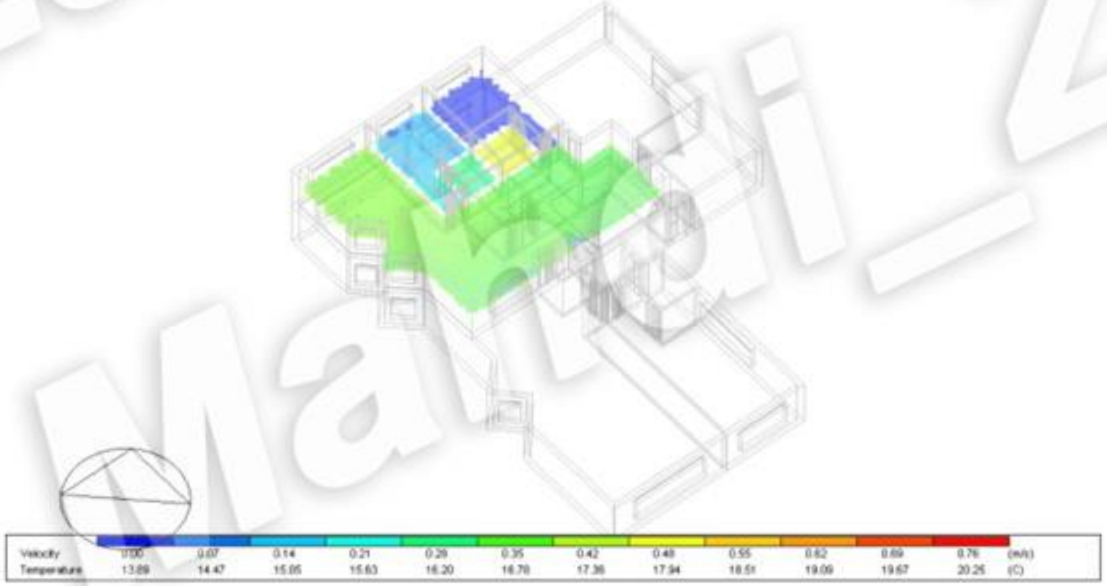
For the interior part of the building as it was expected the eastern sides due to the impact and direction of the wind are colder, however in the coldest parts, the inside temperature is almost twice the outside (wind temperature 7.4 Celsius) while the HVAC system is off.







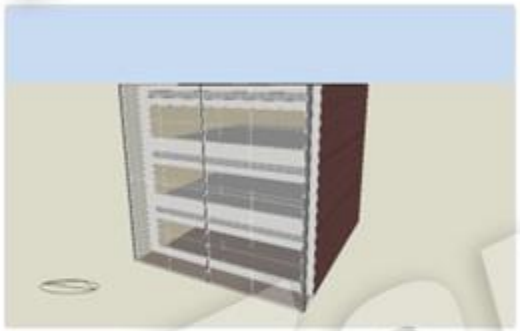


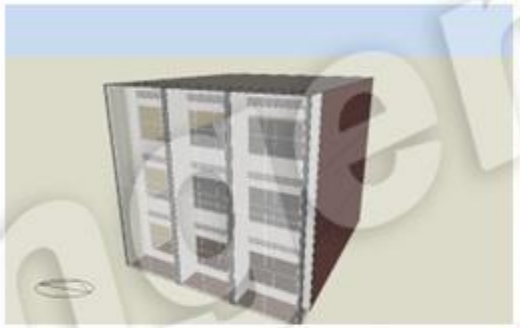


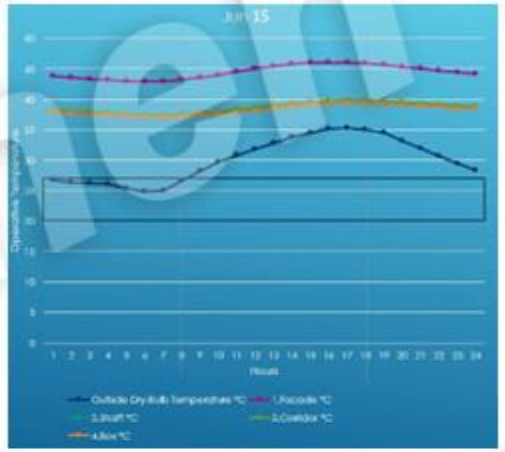
DOUBLE FAÇADE OFFICE

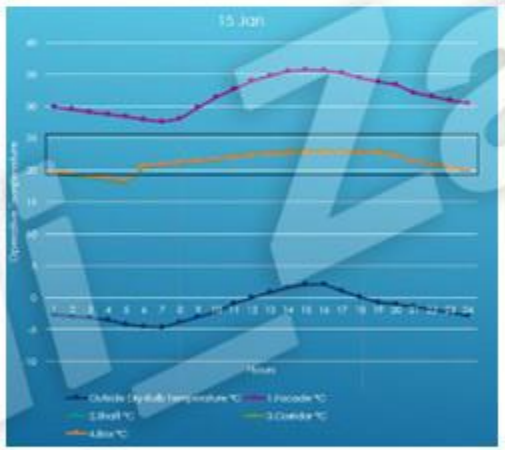
Our aim here was to simulate four types of façade for a three floor office (Façade, Shaft, Corridor and Box) and compare them based on the operative temperature generated for a summer typical day and a winter typical day.

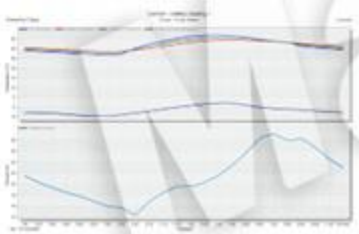
The results from Design Builder v6.1.0.006 showed that the Box façade has the best performance and can result in more comfort hours when users are in the office.

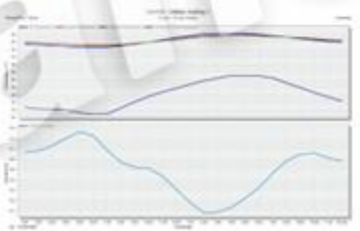








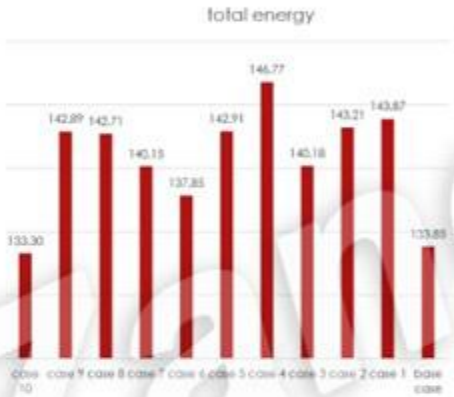


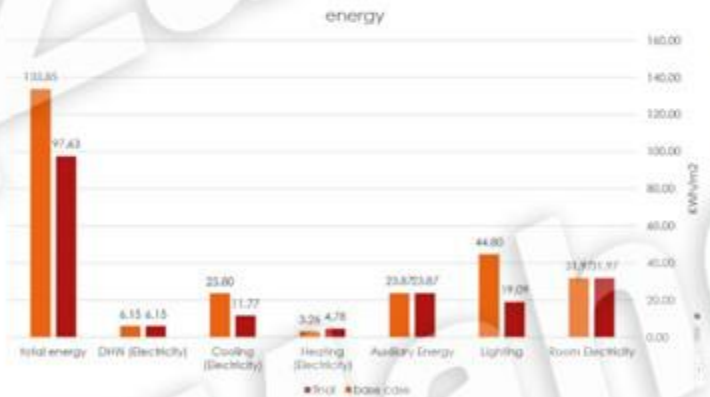


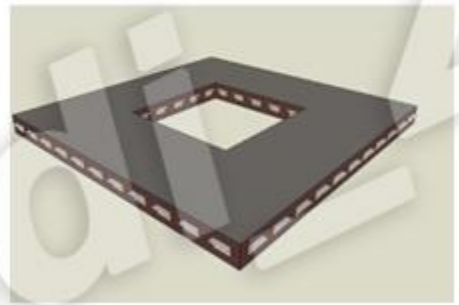
BUILDING OPTIMIZATION GAME

Our aim here was to simulate 11 forms in Tehran climate, find the best form and optimize it's orientation and annual energy consumption with a limited budget.

The results from Design Builder v6.1.0.006 showed that form 10 with no change on orientation, roof and wall combine with WWR 20%, Glass type 3, shading type 2, LPD 9.3, daylight sensor and occupancy sensor has the best performance overall.







KWh/m2	Room Electricity	Lighting	Auxiliary Energy	Heating (Electricity)	Cooling (Electricity)	DHW (Electricity)	total energy
glass base	31.97	44.80	23.87	3.32	23.19	6.15	133.30
glass opt1	31.9728	44.80121	23.87441	3.009819	22.2382	6.147033	132.04
glass opt3	31.97	44.80	23.87	2.95	18.48	6.15	128.22

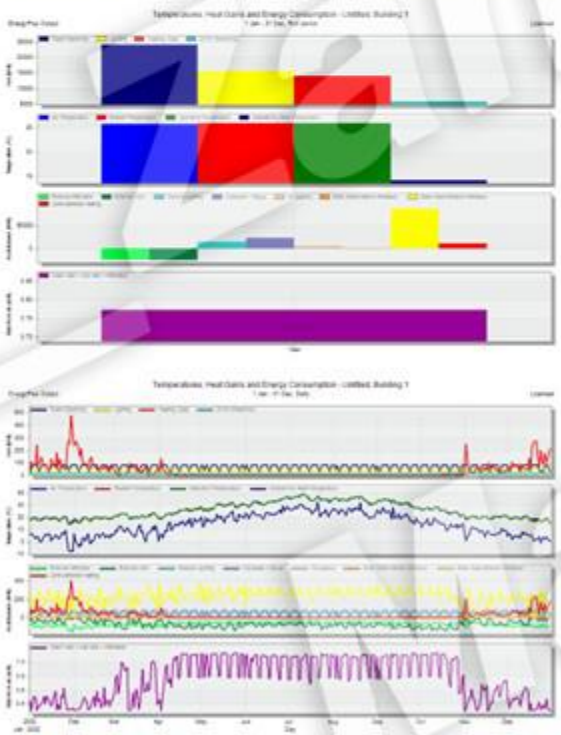
KWh/m2	Room Electricity	Lighting	Auxiliary Energy	Heating (Electricity)	Cooling (Electricity)	DHW (Electricity)	total energy
roof base	31.97	44.80	23.87	3.32	23.19	6.15	133.30
roof R60	31.97	44.80	23.87	2.67	23.59	6.15	133.05

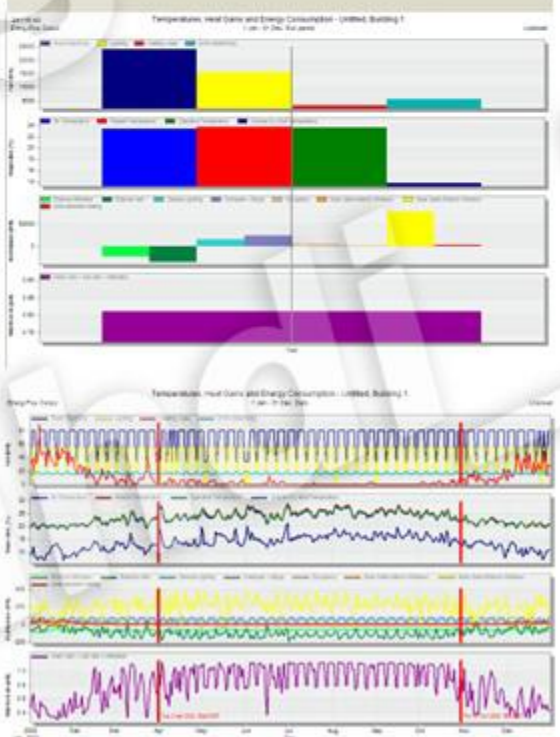
KWh.m2	Room Electricity	Lighting	Auxiliary Energy	Heating (Electricity)	Cooling (Electricity)	DHW (Electricity)	total energy
wall base	31.97	44.80	23.87	3.32	23.19	6.15	133.30
wall R19.5	31.97	44.80	23.87	3.19	24.63	6.15	134.61
wall R28.5	31.97	44.80	23.87	3.07	24.56	6.15	134.43

VILLA ENERGY SIMULATION

Our aim here was to simulate a villa and analysis the annual total energy consumption of the building for heating and cooling, and compare the comfort hours generated for two different locations (Hamedan & Karaj).

The results from Design Builder v6.1.0.006 showed a close conditions but our villa has a lower annual energy usage in Hamedan climate.

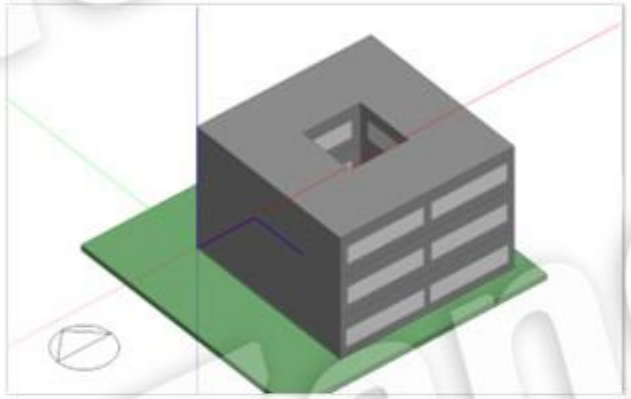


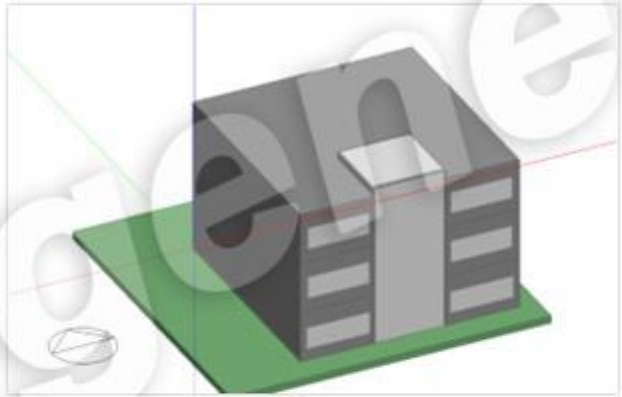


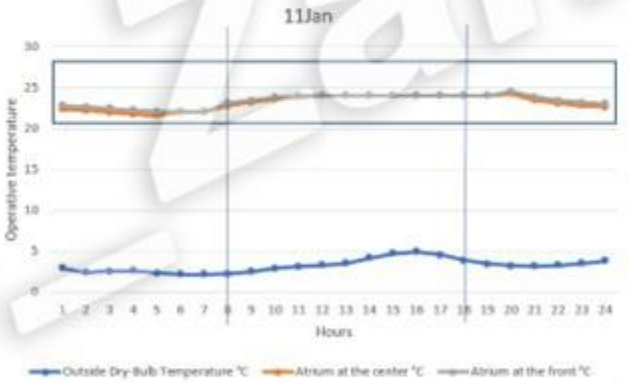
ATRIUM NATURAL VENTILATION

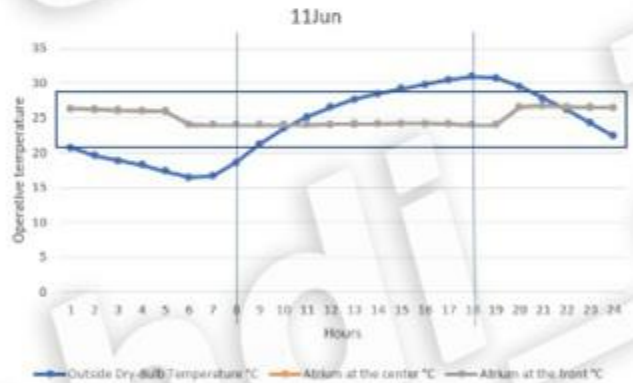
Our aim here was to simulate an office when an atrium was at the center of the building and when it was in between of the façade, and compare the natural ventilation effect on comfort based on generated operative temperatures for a typical summer day and a typical winter day.

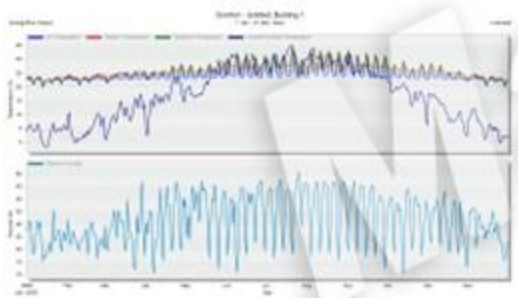
The results from Design Builder v6.1.0.006 showed that both models are very similar but when atrium was located at the center it shows slightly better performance during active hours.

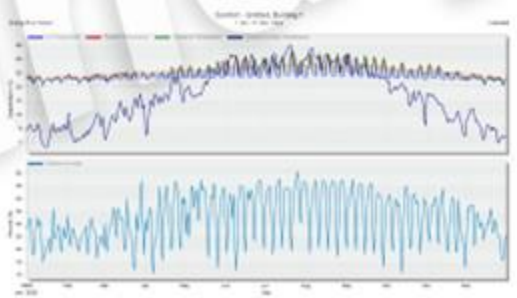












THANKS FOR YOUR TIME