Multi-zone simulation results of Europoint complex for self-sufficiency in energy consumption and food production in Rotterdam

The research focuses on optimising different zones of the Europoint complex in Rotterdam to achieve self-sufficiency in energy consumption and food production. For this reason, three buildings of the complex are parametrised in Grasshopper 3d Algorithmic Modelling Environment. The parametric models include various design variables related to the number of farming floors, shape, and the properties of the façade design with shading devices. Residential parts of the towers are divided into 3 subdivisions (building zones) to identify the best parameter sets for various floor levels considering the density of the surrounding. In each building zone, 1 floor level is considered to conduct the simulation results that corresponds to data collection from 9 different floor levels of the Europoint complex. Latin Hypercube Sampling method is used with Honeybee and Ladybug plug-ins developed for environmental analysis in Grasshopper during the sampling process. The collected data presents the results for residential energy consumption including heating, lighting, and equipment loads, energy generation of the towers, and daylight factor for each orientation in each zone. Detailed explanations of the design parameters, performance aspects, and glazing types are given in below. The published data can be used for sensitivity analysis, surrogate modelling, and statistical analysis for energy and daylight related works on Europoint complex in Rotterdam.

Creator:

Berk Ekici, Chair of Design Informatics, TU Delft, the Netherlands

Contributors:

Okan F.S.F. Turkcan, Department of Architecture, TU Delft, the Netherlands

Michela Turrin, Chair of Design Informatics, TU Delft, the Netherlands

I. Sevil Sariyildiz, Chair of Design Informatics, TU Delft, the Netherlands

M. Fatih Tasgetiren, Department of Industrial and Systems Engineering, Auburn University, USA

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	Notation	Explanation	Boundary	Unit
Performance aspects	z1	Building zone 1		
	z2	Building zone 2		
	z3	Building zone 3		
	N	North		
	S	South		
	E	East		
	W	West		
	DF	Daylight factor		%
	Etot	Total energy of the building zone		MWh
	Eg	Total energy generation through PV panels		MWh
	Tvis	Visible transmittance of the material		
	U-val.	U value of the material		[W/m2 K]
	g-val.	G value of the material		
	cop1	Coefficient of performance = 1		
	cop5	Coefficient of performance = 5		
Design parameters	x1	Number of farming floors	[0, 10]	
	x2_t1, x3_t1	Extrusion of farming BIPV in tower1	[0, 25]	meter
	x2_t2, x3_t2	Extrusion of farming BIPV in tower2	[0, 10]	meter
	x2_t3, x3_t3	Extrusion of farming BIPV in tower3	[0, 20]	meter
	x4, x5	Extrusion of roof BIPV	[0, 5]	meter
	x6,…,x9	Glazing type	[1, 13]	
	x10,…,x12	Shading reflectance of zone 1	[0.3, 0.6, 0.9]	
	x20,…,x22	Shading reflectance of zone 2	[0.3, 0.6, 0.9]	
	x30,…,x32	Shading reflectance of zone 3	[0.3, 0.6, 0.9]	
	x13,…,x15	Shading distance of zone 1	[0.25, 1.50]	meter
	x23,…,x25	Shading distance of zone 2	[0.25, 1.50]	meter
	x33,…,x35	Shading distance of zone 3	[0.25, 1.50]	meter
	x16,…,x19	Window reduction size of zone 1	[0.0, 0.1]	meter
	x26,…,x29	Window reduction size of zone 2	[0.0, 0.1]	meter
	x36,…,x39	Window reduction size of zone 3	[0.0, 0.1]	meter

Glazing types	Configuration	Argon	Air	Krypton	Type	Tvis	U-val.	g-val.
1	4 – 16 – 4	✓			Double	0.8	0.75	2.6
2	4 – 12 – 4		✓		Double	0.79	0.55	1.6
3	4 – 16 – 4		✓		Double	0.79	0.55	1.3
4	4 – 16 – 4	✓			Double	0.71	0.44	1.1
5	5 – 15 – 12	✓			Double	0.78	0.63	1.1
6	5 – 10 – 4		✓		Double	0.7	0.49	0.8
7	4 – 12 – 4 – 12 – 4			✓	Triple	0.7	0.6	0.7
8	9 – 10 – 4 – 10 – 13			✓	Triple	0.64	0.35	0.5
9	4 – 16 – 4 – 16 – 4	✓			Triple	0.69	0.48	0.6
10	4 – 12 – 4 – 12 – 4		✓		Triple	0.63	0.39	0.9
11	6 – 12 – 5 – 12 – 12			✓	Triple	0.62	0.42	0.4
12	6 – 12 – 4 – 12 – 8			✓	Triple	0.72	0.51	0.7
13	4 – 15 – 4 – 15 – 4	✓			Triple	0.7	0.74	0.6