

BIM - industria 4.0 no contexto da sustentabilidade

Metodologias e desafios

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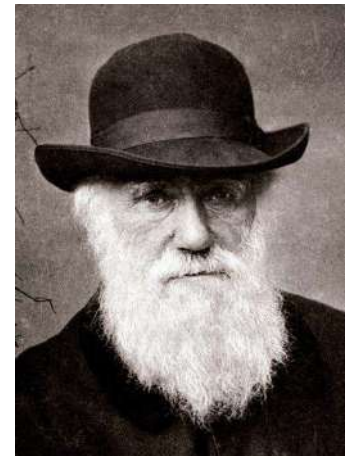
Porque construimos?

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Por uma questão de sobrevivência

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A sobrevivência do mais apto



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A sobrevivência do mais engenhoso



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Temos a capacidade de criar o nosso próprio habitat e ecossistema

Não importa o local na terra!... nós adaptamo-nos!

Ou será que?!?



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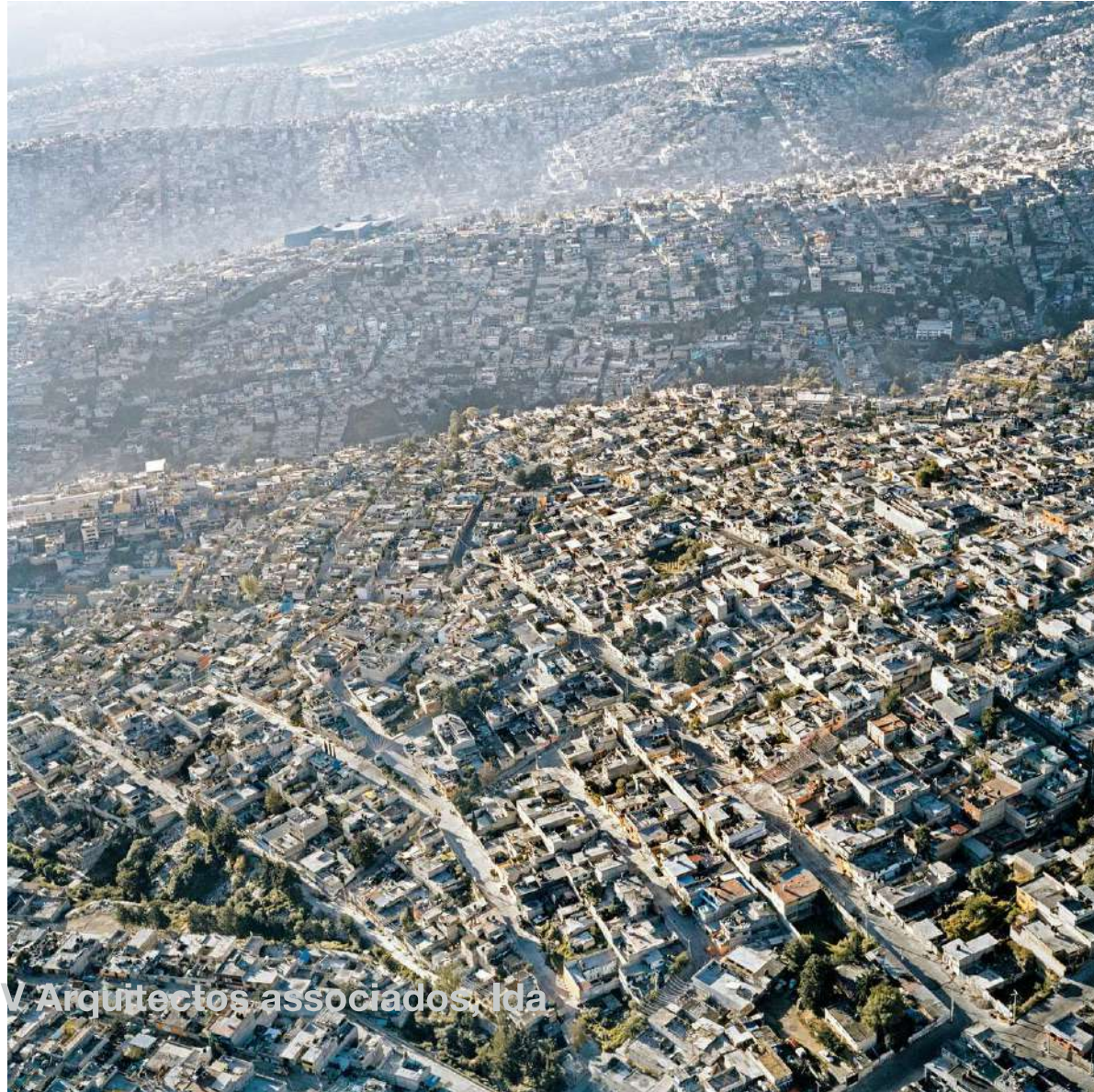
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NATIONAL
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Photograph by Yann Arthus-Bertrand, Altitude

SEVEN BILLION, JANUARY 2011

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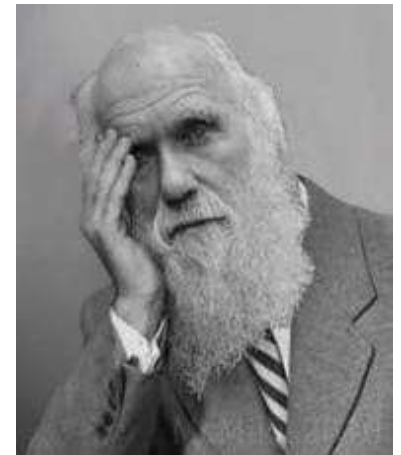


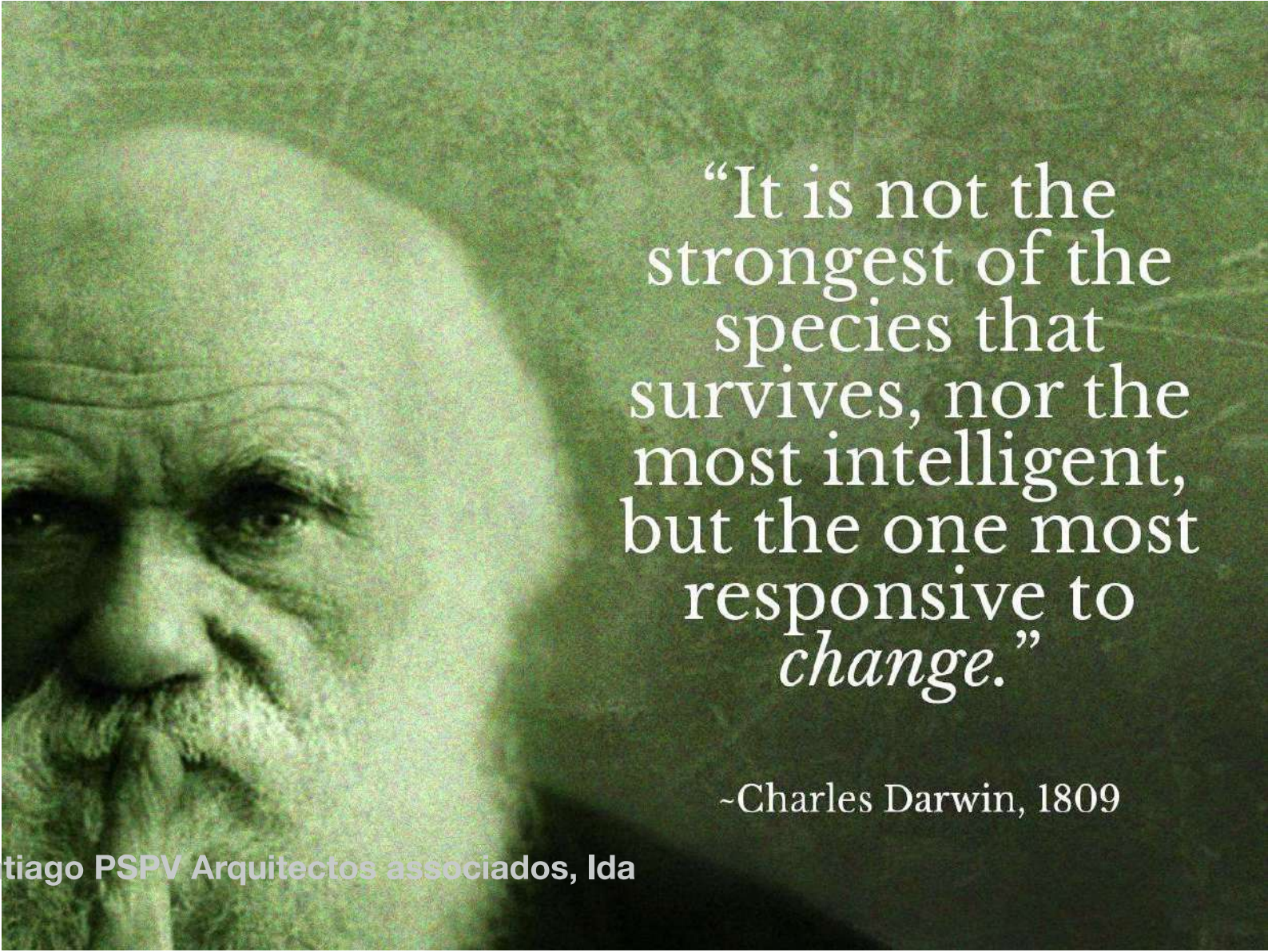
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A sobrevivência do mais inapto?!?

Esperemos que não!

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“It is not the
strongest of the
species that
survives, nor the
most intelligent,
but the one most
responsive to
change.”

~Charles Darwin, 1809

**Precisamos de adaptar-nos... a
um planeta em mutação!**

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**Não podemos dar-nos ao luxo de
perder... isto!**

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Somos felizes aqui!...

Será possível fazê-lo?



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BIM

é um processo para a

Sustentabilidade

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Redução das Emissões de CO2

**Eficiência energética + Energias renováveis
+ Materiais**

Directiva EU EPB 2010

Manter o aumento da temperatura global abaixo dos 2°C

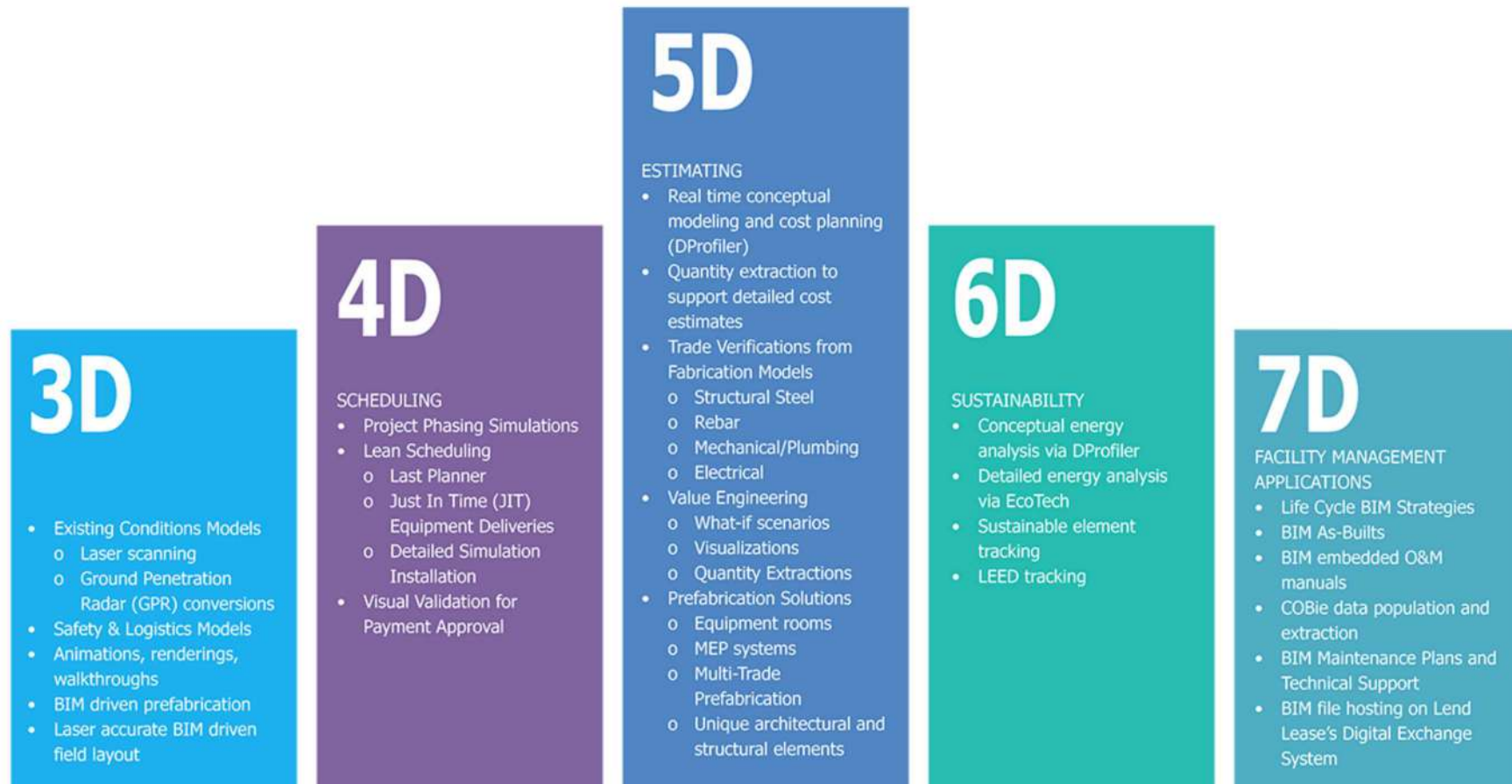
**Os edifícios são responsáveis por 40% do consumo de energia
edifícios "nzeb" são necessários - todos os edifícios públicos até
2018 - todos os edifícios até 2020**

BIM para quê?

**Tomada de decisões
Desenho orientado por dados
Desempenho do edifício**

BIM para **Adaptação!**

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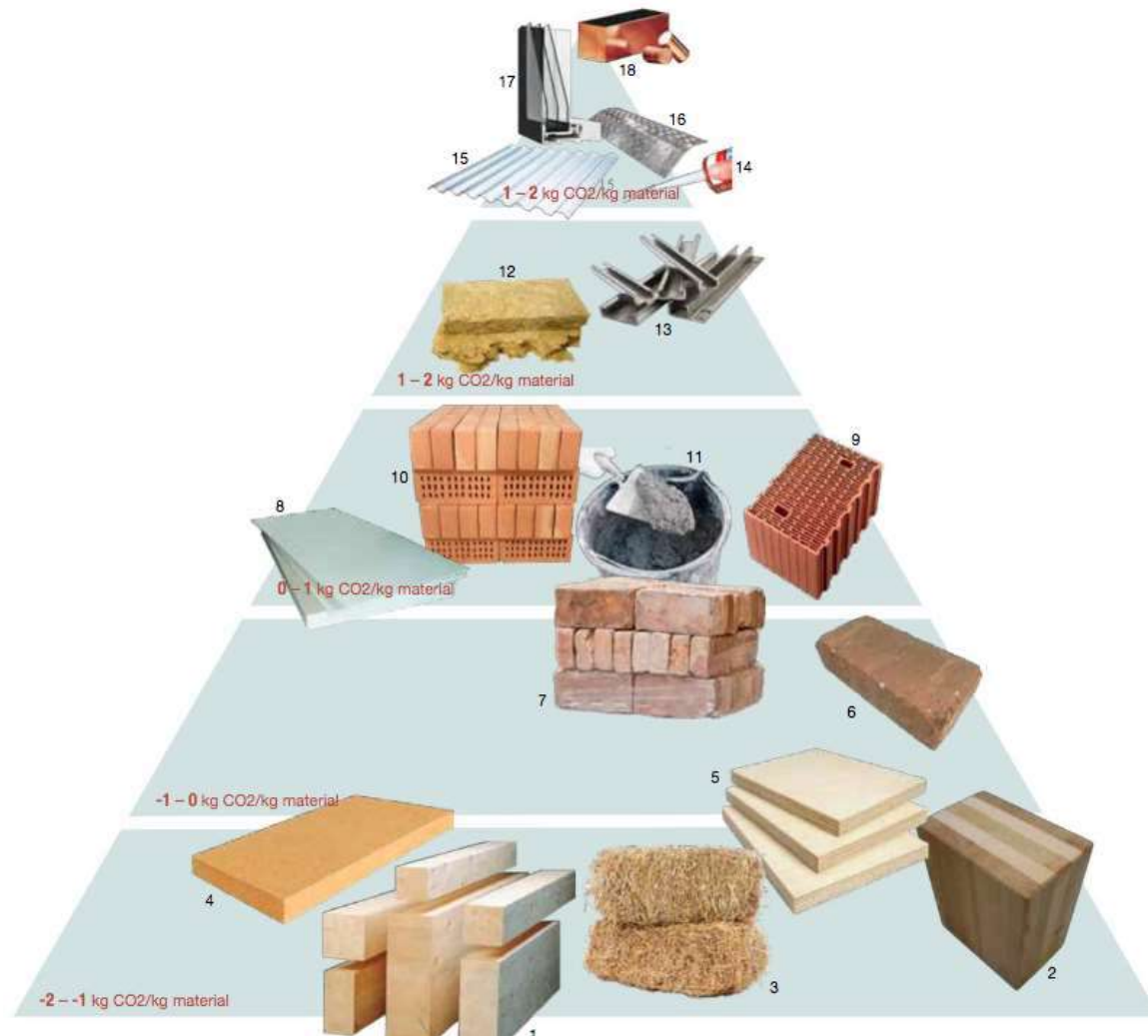


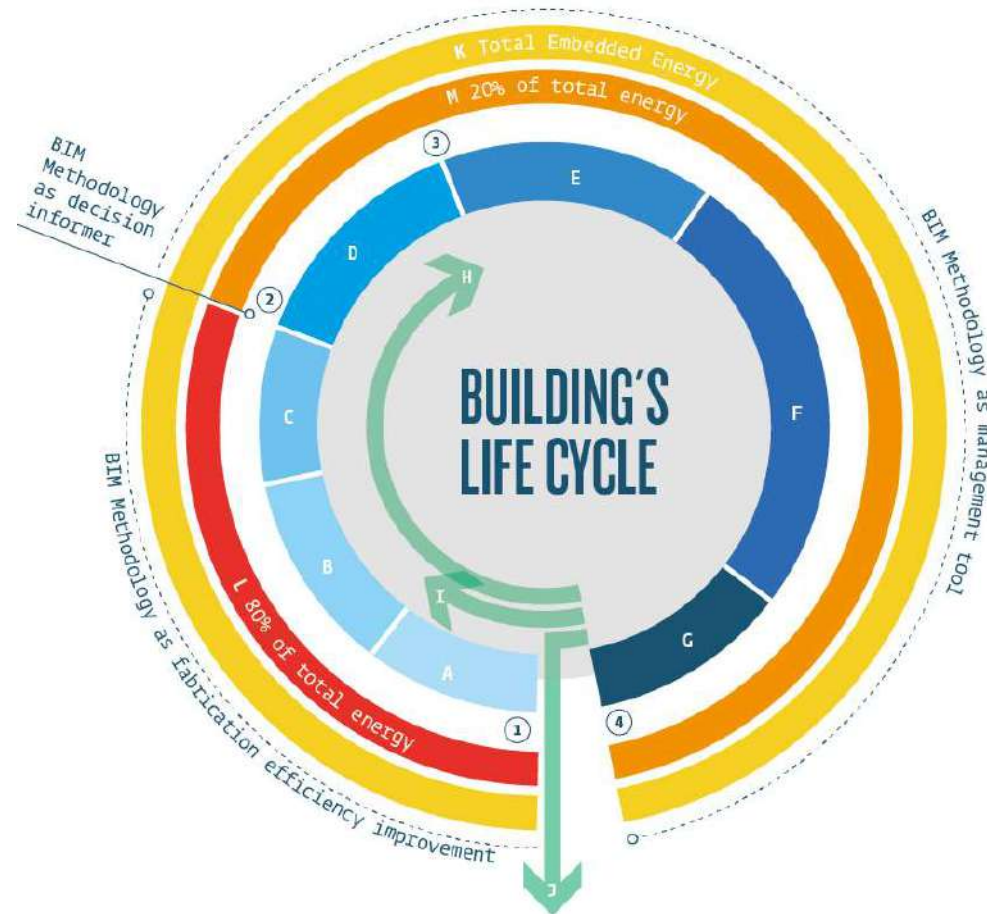
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The building material pyramid Byggemateriale pyramide

Kg CO2/m2 material Kg CO2/m2 materiale

GWP analysis based on EPD's (ISO 15804) Phase A1-A3 production.
GWP-analyser udarbejdet på baggrund af EPD's (ISO 15804) Phase A1-A3 production.





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Solution A

Concrete and Brick

MATERIALS		
Name	Embodied Carbon	Embodied Energy
Brick		
	121 663,06 kgCO ₂	1 520 788,29 MJ
Concrete		
	14 307,48 kgCO ₂	98 948,91 MJ
Concrete - Structural		
	250 326,32 kgCO ₂	2 427 406,78 MJ
Gravel		
	145,12 kgCO ₂	2 408,94 MJ
Insulation - Plastic Hard		
	18 550,24 kgCO ₂	474 061,80 MJ
Membrane - Rainproof		
	9 474,36 kgCO ₂	235 942,18 MJ
Membrane - Vapor Barrier		
	4 158,69 kgCO ₂	165 270,34 MJ
Plaster - Gypsum		
	5 085,80 kgCO ₂	70 418,83 MJ
Plaster - Lime Sand		
	5 708,56 kgCO ₂	37 624,60 MJ
Reinforced Concrete - Structural		
	102 162,16 kgCO ₂	983 627,44 MJ
Timber - Floor		
	8 389,94 kgCO ₂	186 414,08 MJ
TOTAL	539 971,75 kgCO₂	6 202 912,18 MJ

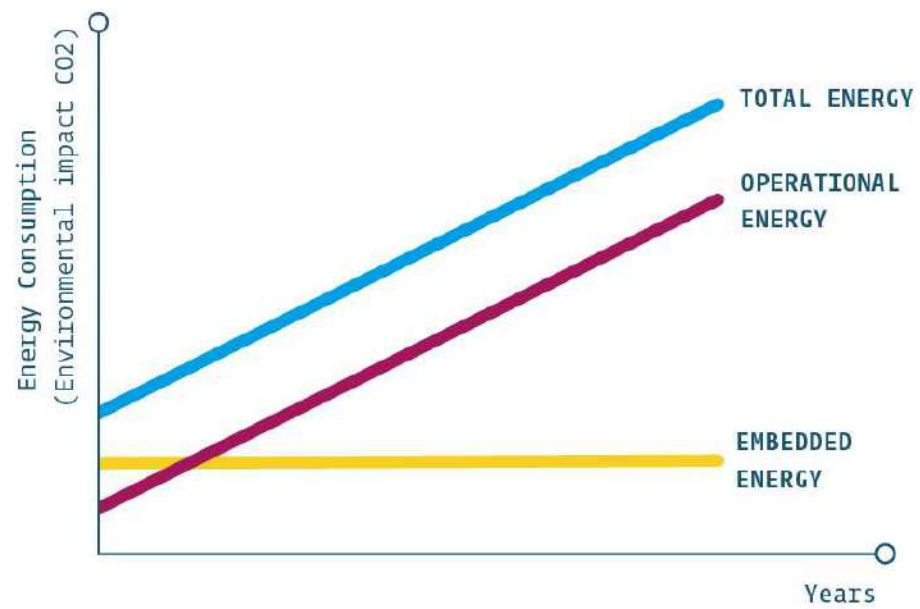
Solution B

Wood

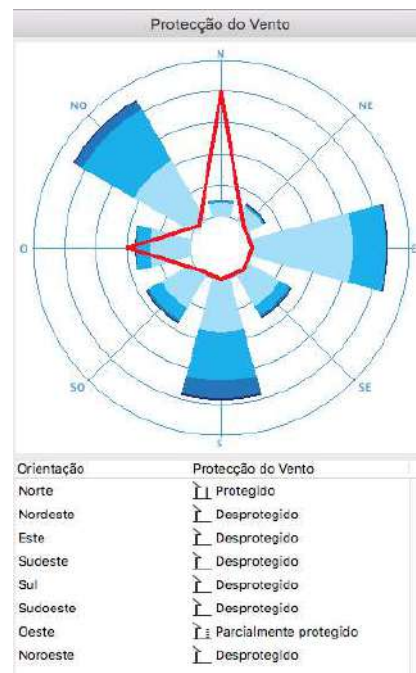
MATERIALS		
Name	Embodied Carbon	Embodied Energy
Concrete		
	14 307,48 kgCO ₂	98 948,91 MJ
Gravel		
	145,12 kgCO ₂	2 408,94 MJ
Insulation - Mineral Hard		
	36 757,61 kgCO ₂	472 279,61 MJ
Membrane - Rainproof		
	9 474,36 kgCO ₂	235 942,18 MJ
Membrane - Vapor Barrier		
	4 158,69 kgCO ₂	165 270,34 MJ
Plaster - Gypsum		
	5 085,80 kgCO ₂	70 418,83 MJ
Plaster - Lime Sand		
	5 708,56 kgCO ₂	37 624,60 MJ
Reinforced Concrete - Structural		
	51 081,08 kgCO ₂	491 813,72 MJ
Timber - CLT		
	0,00 kgCO ₂	409 746,53 MJ
Timber - Floor		
	8 389,94 kgCO ₂	186 414,08 MJ
TOTAL	135 108,65 kgCO₂	2 170 867,74 MJ



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Definições Ambientais

Localização e Clima:

36° 46' 9" N, 9° 15' 21" O Localização do Projecto...

☒ Fonte climática: PRT_Lisboa.085360_JW Dados Climáticos...

Nível do Terreno:

☐ Distância de afastamento 0,000

☒ Modelado por elementos de Malha

Transferência de Calor de Superfície...

Tipo de Solo: Cascalho

Condutividade Térmica	1,400	W/mK
Densidade	2200,00	kg/m³
Capacidade de Calor	1900,00	J/kgK

Envolvente: Jardim

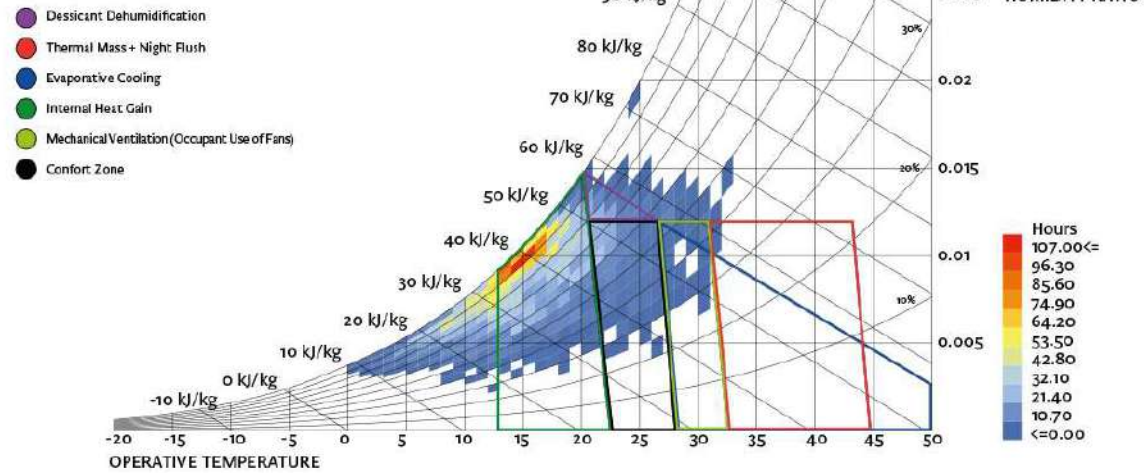
Reflectância do Chão 20 %

Protecção do Vento...

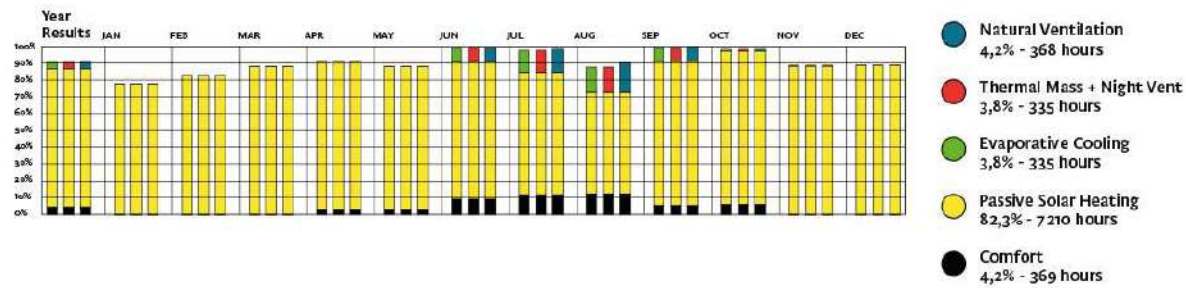
Sombreamento Horizontal...

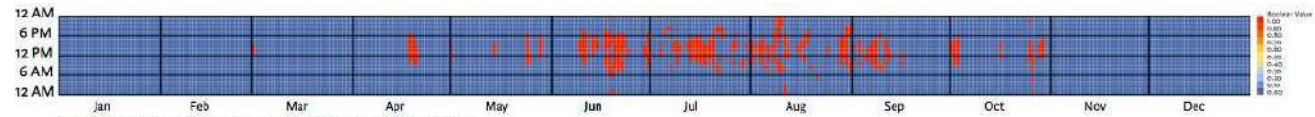
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Psychrometric Chart
PORTO_PRT
1 JAN 1:00 - 31 DEC 24:00



COMFORT STRATEGIES

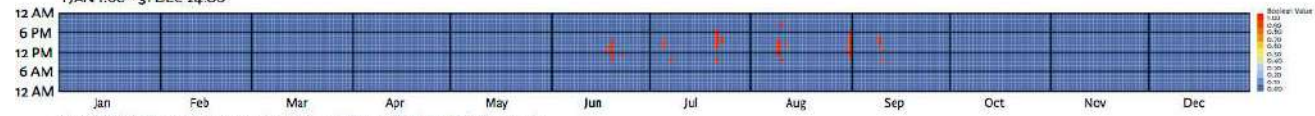




Comfortable Hours in Comfort Polygon (Boolean Value) - Hourly

PORTO_PRT

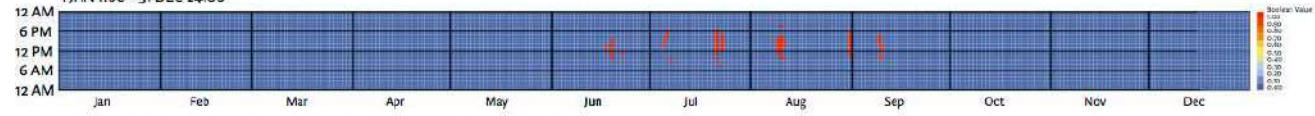
1 JAN 1:00 - 31 DEC 24:00



Comfortable Hours in Evaporative Cooling Polygon (Boolean Value) - Hourly

PORTO_PRT

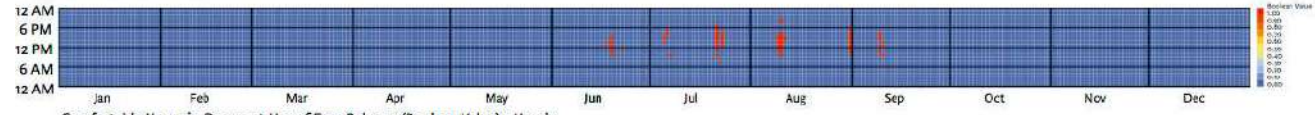
1 JAN 1:00 - 31 DEC 24:00



Comfortable Hours in Thermal Mass + Night Vent Polygon (Boolean Value) - Hourly

PORTO_PRT

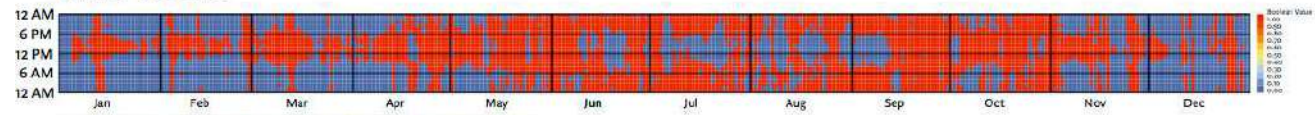
1 JAN 1:00 - 31 DEC 24:00



Comfortable Hours in Occupant Use of Fans Polygon (Boolean Value) - Hourly

PORTO_PRT

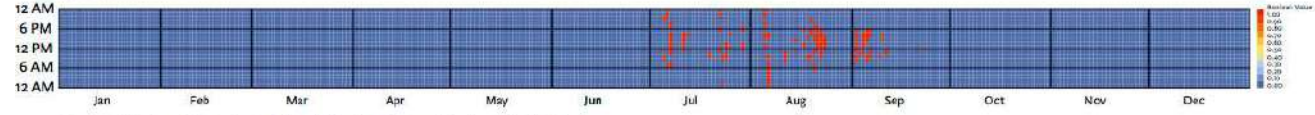
1 JAN 1:00 - 31 DEC 24:00



Comfortable Hours in Internal Heat Gain Polygon (Boolean Value) - Hourly

PORTO_PRT

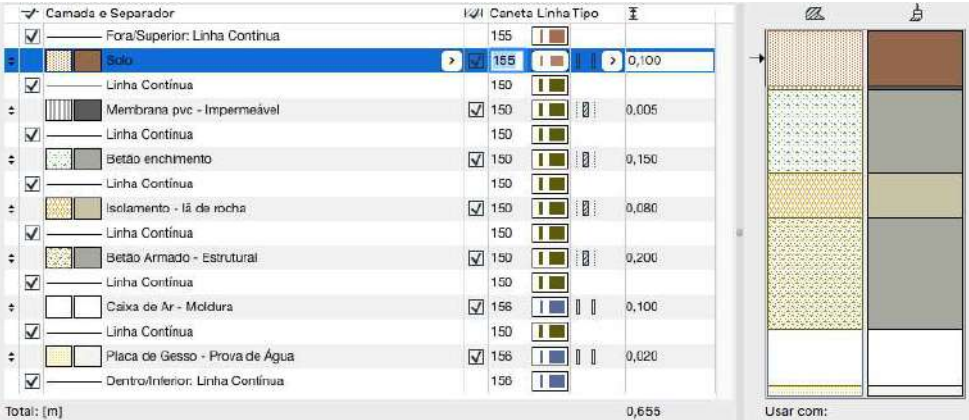
1 JAN 1:00 - 31 DEC 24:00



Comfortable Hours in Dessicant Dehumidification Polygon (Boolean Value) - Hourly

PORTO_PRT

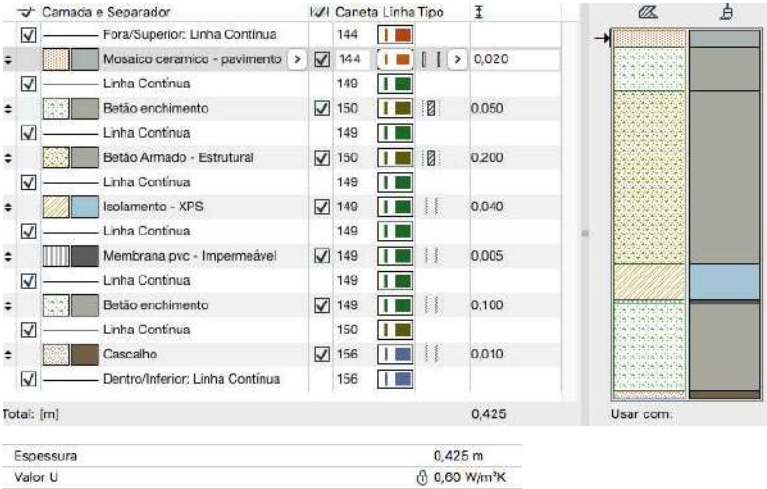
1 JAN 1:00 - 31 DEC 24:00



Espessura	0,655 m
Valor U	0,29 W/m²K
Infiltração	1,10 l/sm²

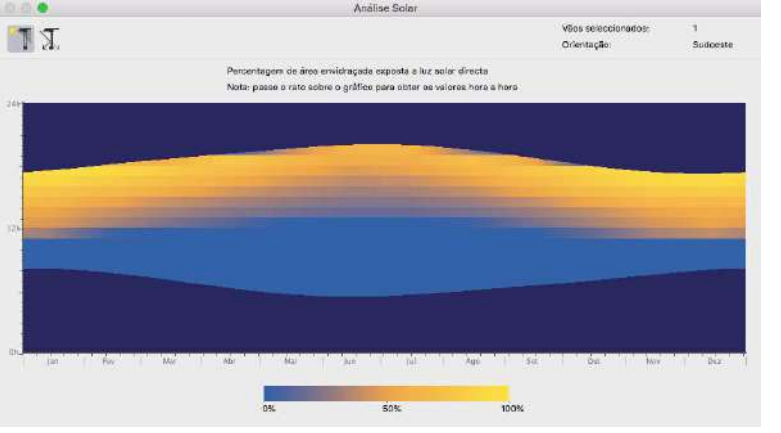
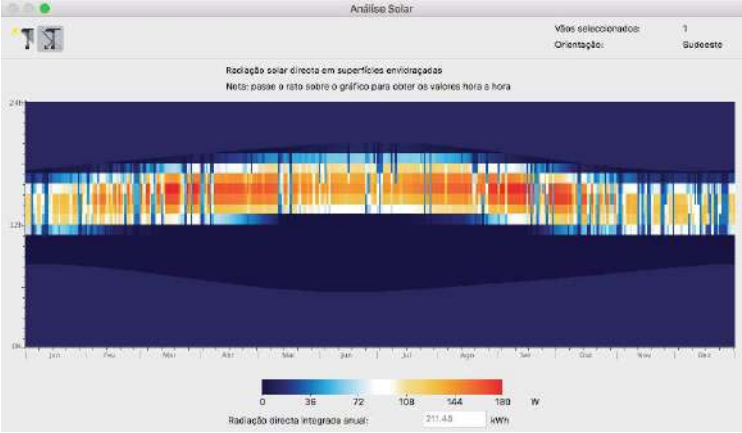
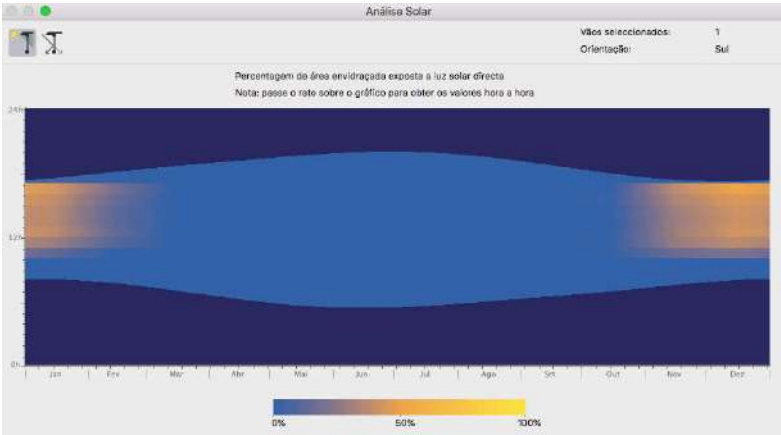
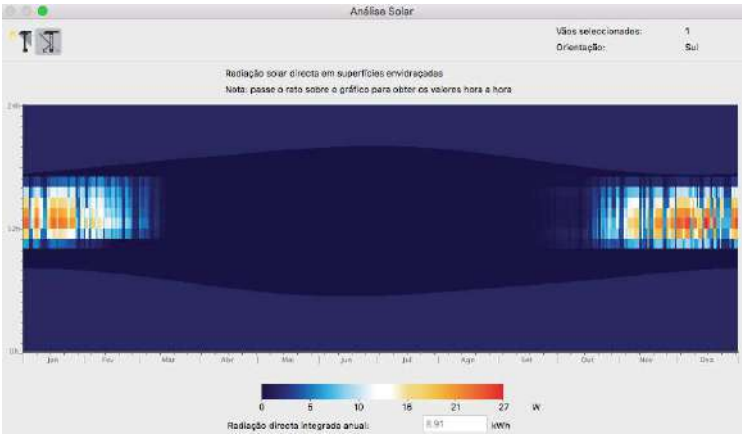


Espessura	0,450 m
Valor U	0,29 W/m²K
Infiltração	1,10 l/sm²



Espessura	0,425 m
Valor U	0,60 W/m²K

Tipo	Janela
Orientação	Vários
Bloco Térmico	Vários
Total Área opaca	10,89 m²
Total Área envidraçada	60,66 m²
Área total	61,45 m²
A abrir Catálogo...	
Transmitância Solar Total	49,00 %
Transmitância Solar Directa	39,00 %
Análise Solar	Abrir Análise...
Total Perímetro	145,196 m
Opaco Valor U	1,86 W/m²K
Envidraçado Valor U	1,28 W/m²K
Global Valor U	Vários
Valor-Psi de Perímetro	0,13 W/mK
Infiltração	0,23 l/sm
Sombreamento	Persiana Exterior



Avaliação de Desempenho Energético

[Project Number] Habitação

Key Values

General Project Data

Project Name:
City Location:
Latitude:
Longitude:
Altitude:
Climate Data Source:
Evaluation Date:

Habitação
Belas - Sintra
38° 48' 9" N
9° 15' 21" W
264,00 m
PRT_Lisboa...0_IWEC.epw
23/05/2019 15:43:07

Building Geometry Data

Gross Floor Area:
Treated Floor Area:
External Envelope Area:
Ventilated Volume:
Glazing Ratio:

400,27 m²
358,26 m²
505,74 m²
881,87 m³
11 %

Building Shell Performance Data

Infiltration at 50Pa:

2,01 ACH

Heat Transfer Coefficients

Building Shell Average:
Floors:
External:
Underground:
Openings:

U value
0,63
0,60 - 0,60
0,20 - 0,92
0,61 - 0,95
1,61 - 2,42

[W/m²K]

Specific Annual Values

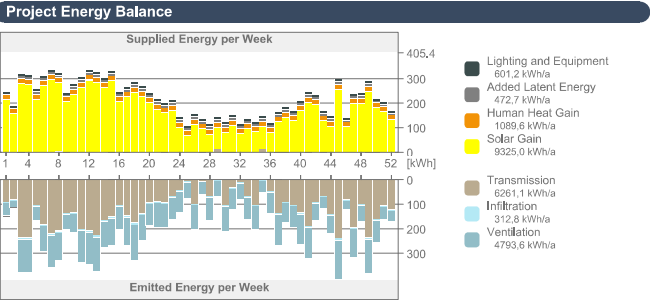
Net Heating Energy:
Net Cooling Energy:
Total Net Energy:
Energy Consumption:
Fuel Consumption:
Primary Energy:
Fuel Cost:
CO₂ Emission:

0,00 kWh/m²a
0,00 kWh/m²a
0,00 kWh/m²a
1,68 kWh/m²a
1,68 kWh/m²a
5,03 kWh/m²a
-- EUR/m²a
0,36 kg/m²a

Degree Days

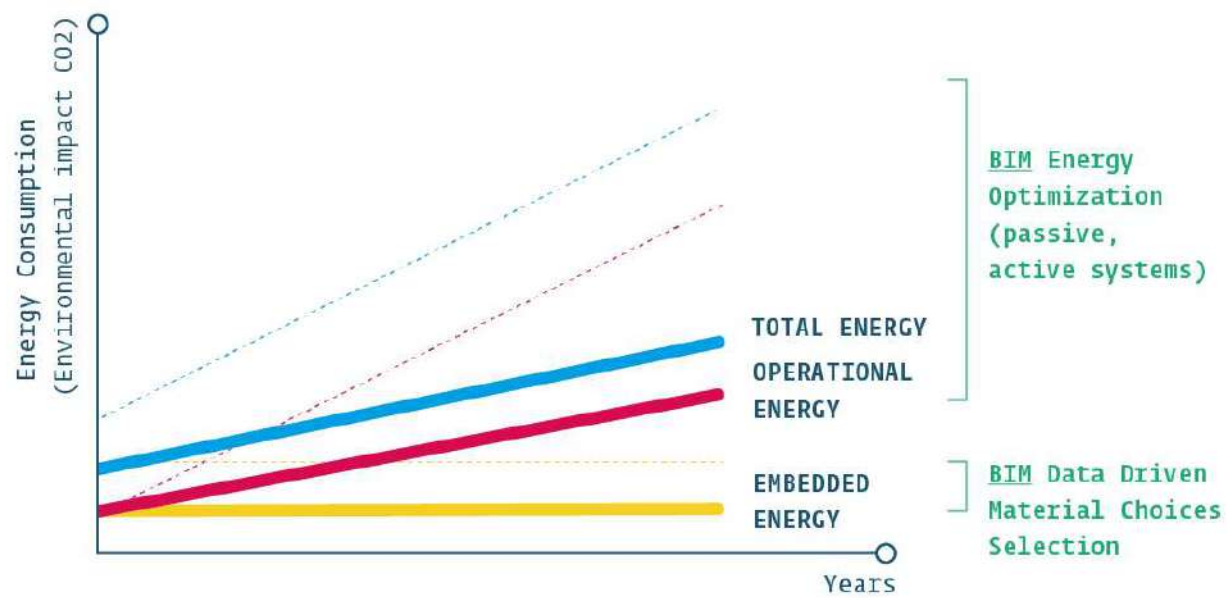
Heating (HDD):
Cooling (CDD):

2231,77
1592,25



Thermal Blocks

Thermal Block	Zones Assigned	Operation Profile	Gross Floor Area m²	Volume m³
001 Sala	1	Residencial	56,48	129,79
002 Cozinha	1	Residencial	19,75	46,12
003 Quarto suite	1	Residencial	25,52	54,97
004 Quarto sul	1	Residencial	17,85	38,88
005 Quarto 1 poente	1	Residencial	17,09	38,69
006 Quarto 2 poente	1	Residencial	19,53	42,41
007 Quarto sul ro	1	Residencial	15,59	33,26
008 Distribuição	3	Residencial	42,21	94,74
009 Instalações sanitárias	4	Residencial	26,77	55,97
010 Cave	5	Não condicionado	159,47	347,05
Total	19		400,27	881,87



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“Buildings use about 40% of global energy, 25% of global water, 40% of global resources, and they emit approximately 1/3 of GHG emissions.(...)”

<http://www.unep.org/sbci/AboutSBCI/Background.asp>
consultado em abril de 2018

“Cities are major contributors to climate change: although they cover less than 2 per cent of the earth’s surface, cities consume 78 per cent of the world’s energy and produce more than 60% of all carbon dioxide and significant amounts of other greenhouse gas emissions.(...)”

<http://unhabitat.org/urban-themes/climate-change/>
consultado em abril de 2018

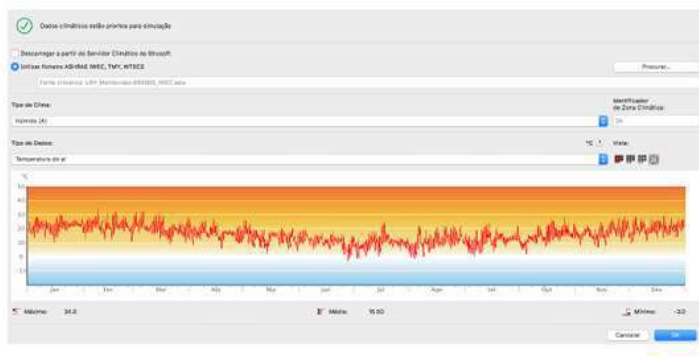
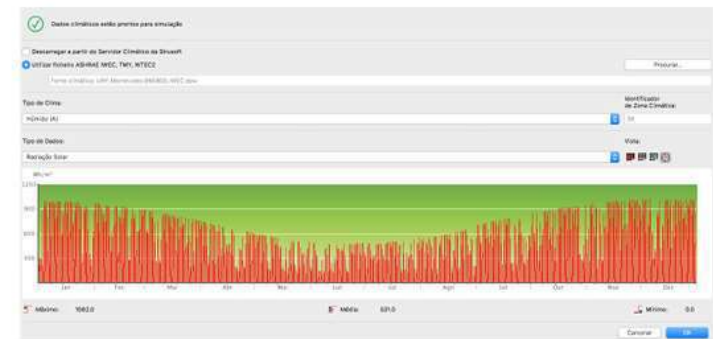
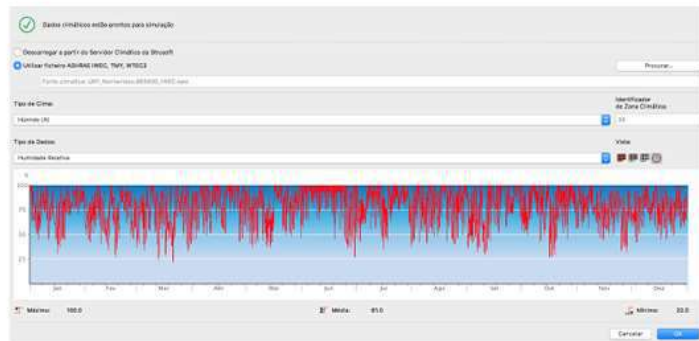
“Yet, buildings also offer the greatest potential for achieving significant GHG emission reductions, at least cost, in developed and developing countries. Furthermore, energy consumption in buildings can be reduced by 30 to 80% using proven and commercially available technologies.(...)”

<http://www.unep.org/sbci/AboutSBCI/Background.asp>
consultado em abril de 2018

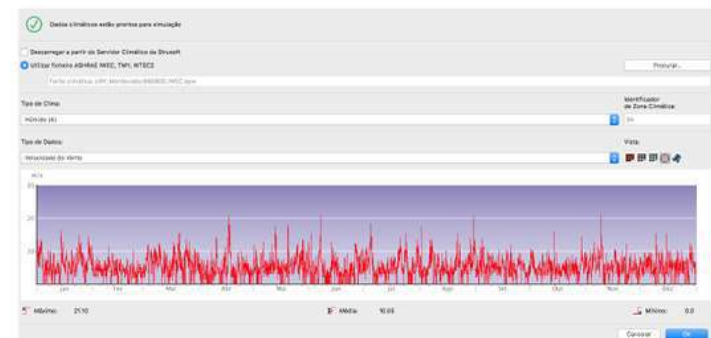
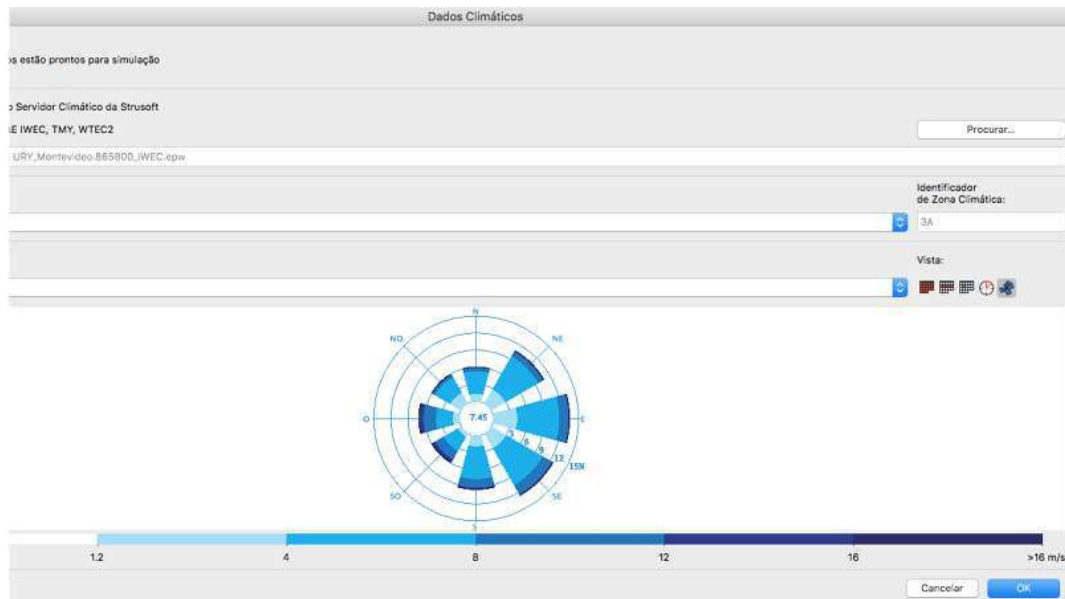
EM - PDL
GUARDA-SOL URBANO
AMÉRICA DO SUL



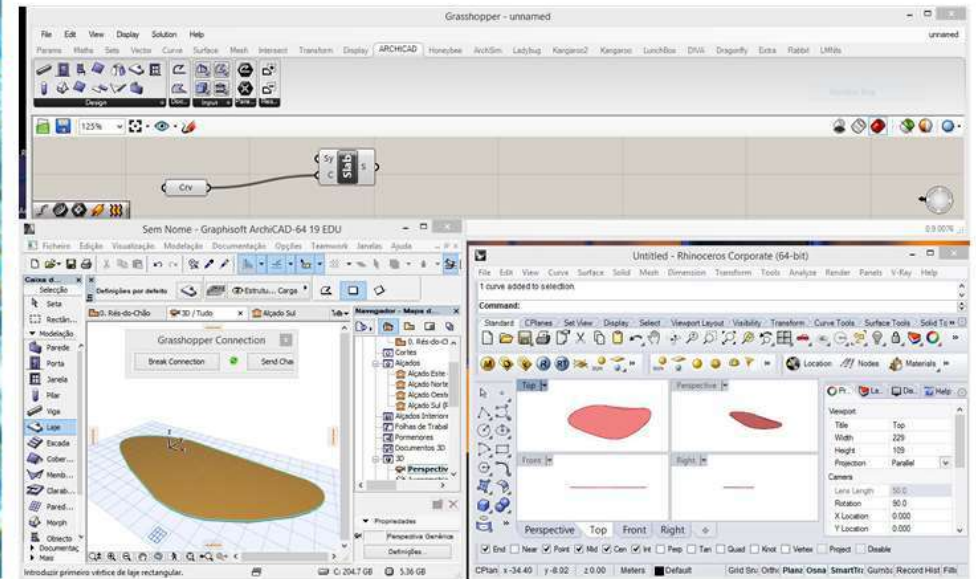
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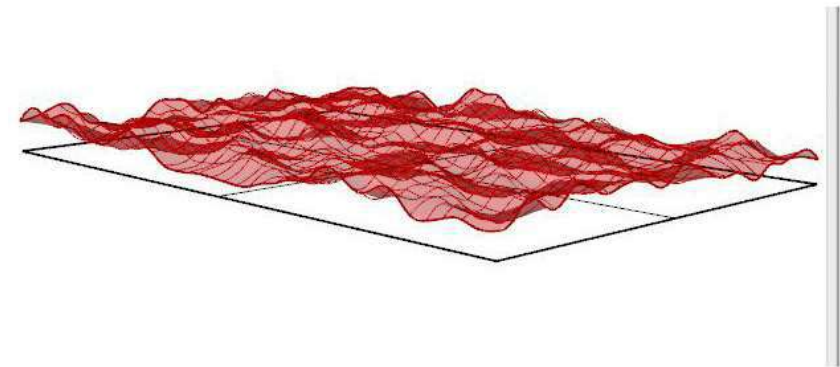
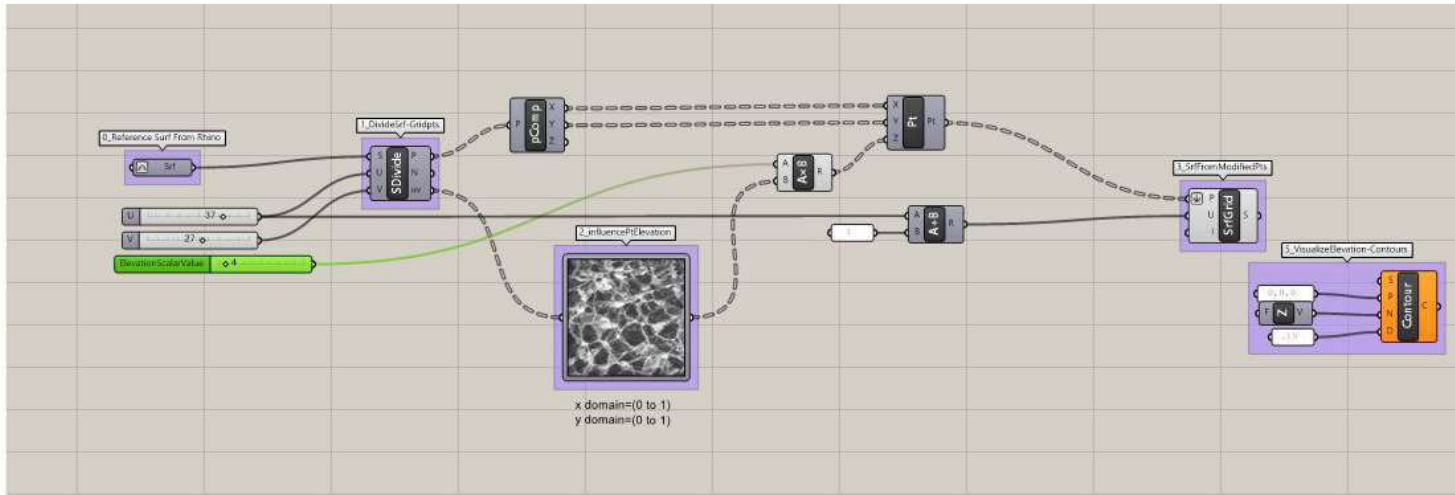
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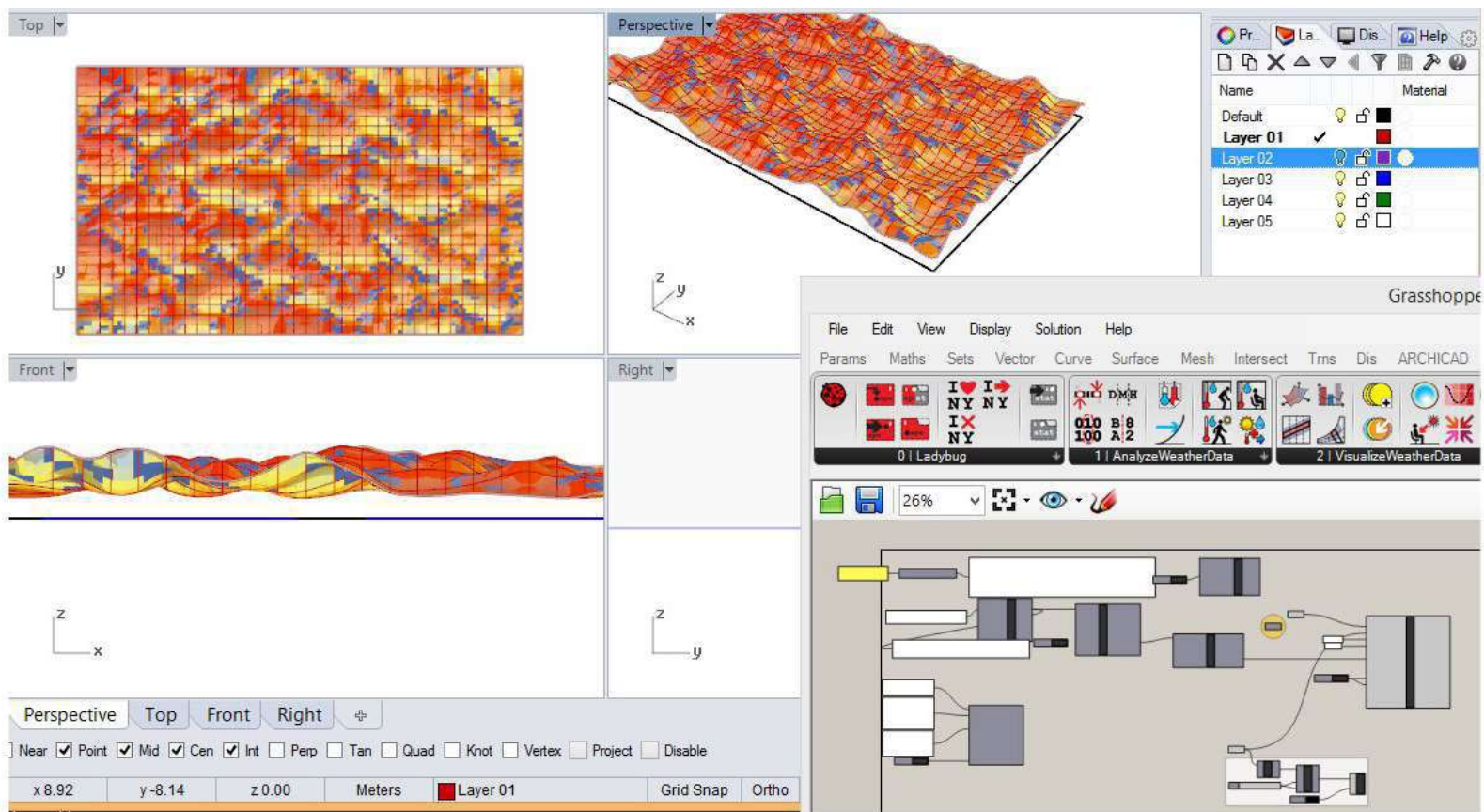
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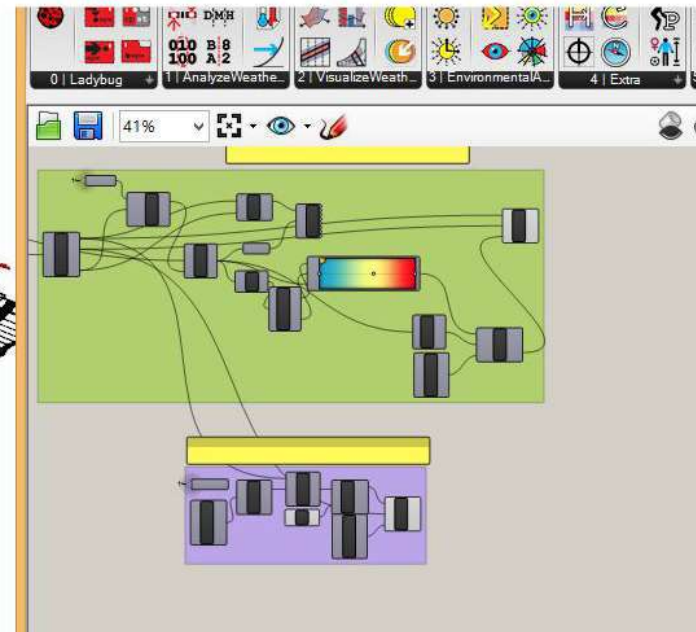
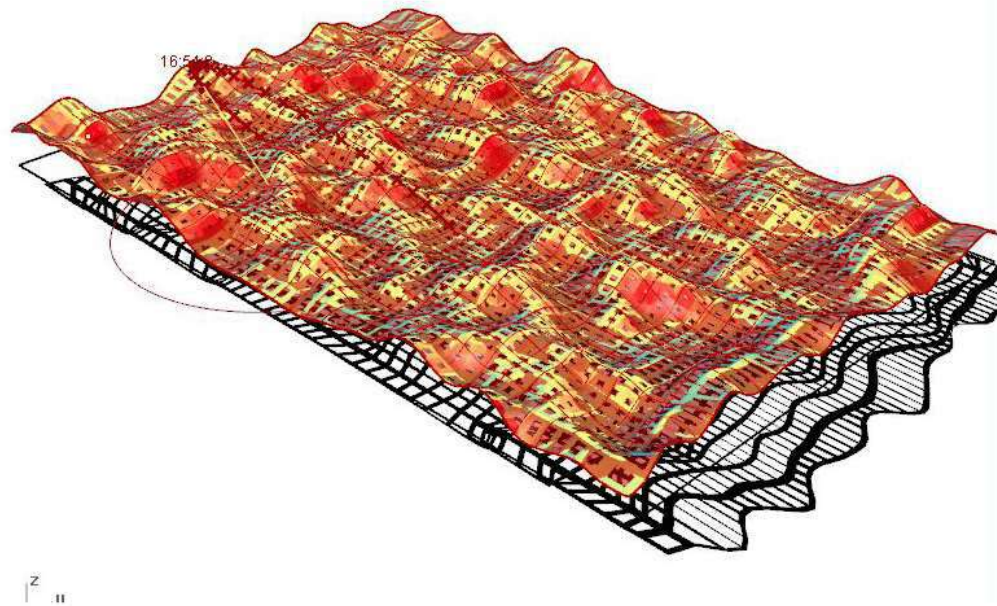


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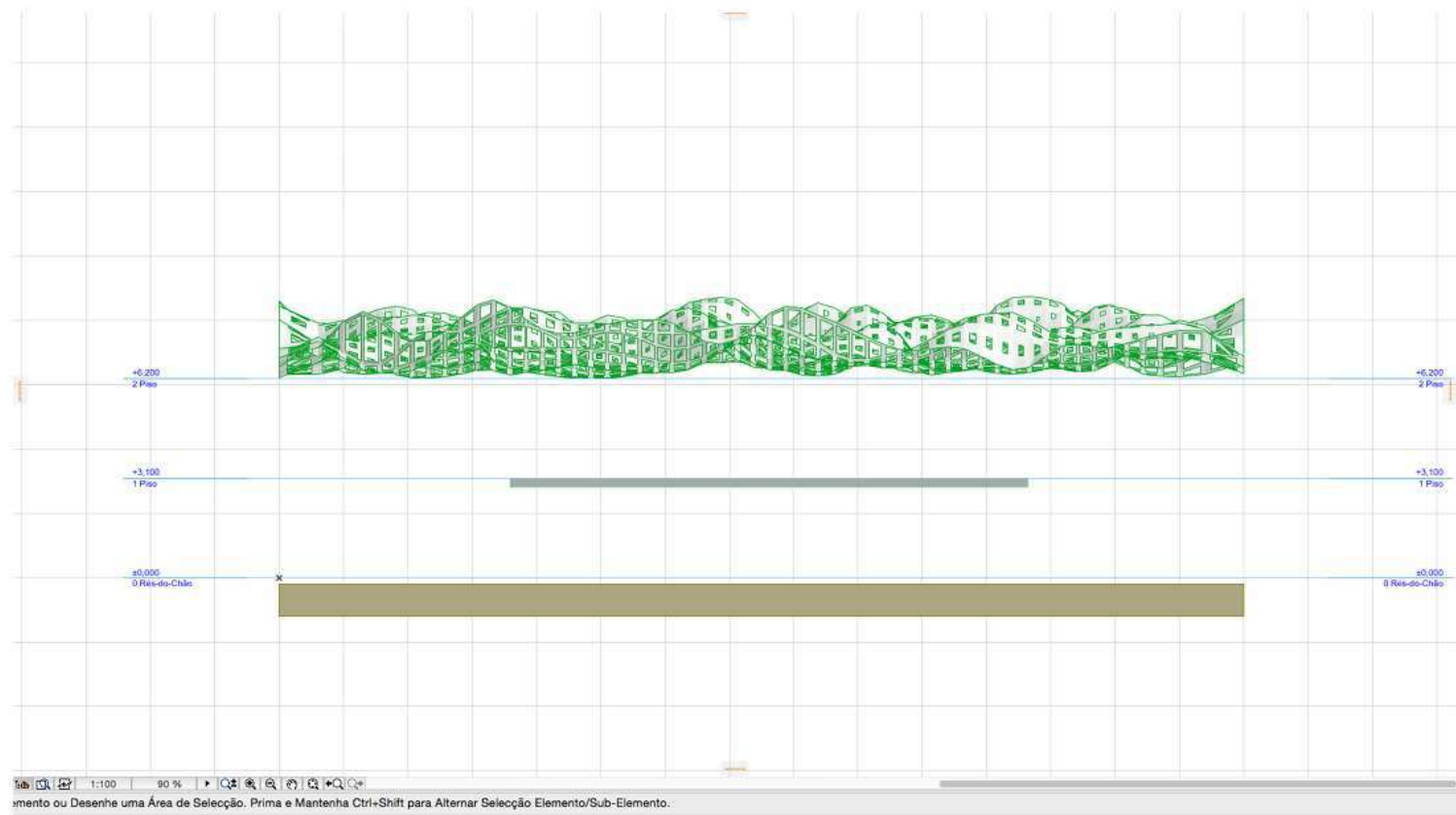


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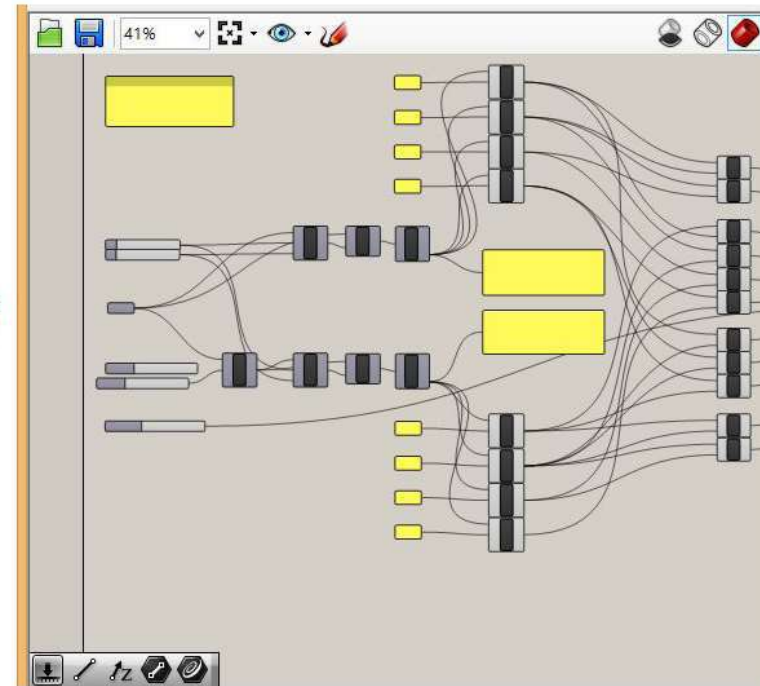
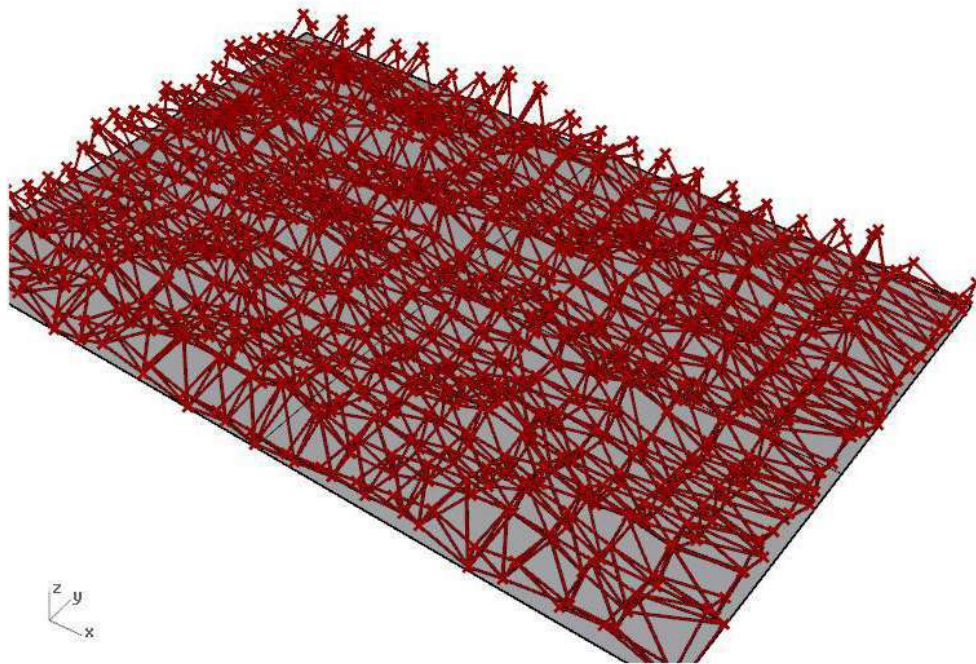
TEMPERATURA DIURNA ANUAL MÉDIA 20°C



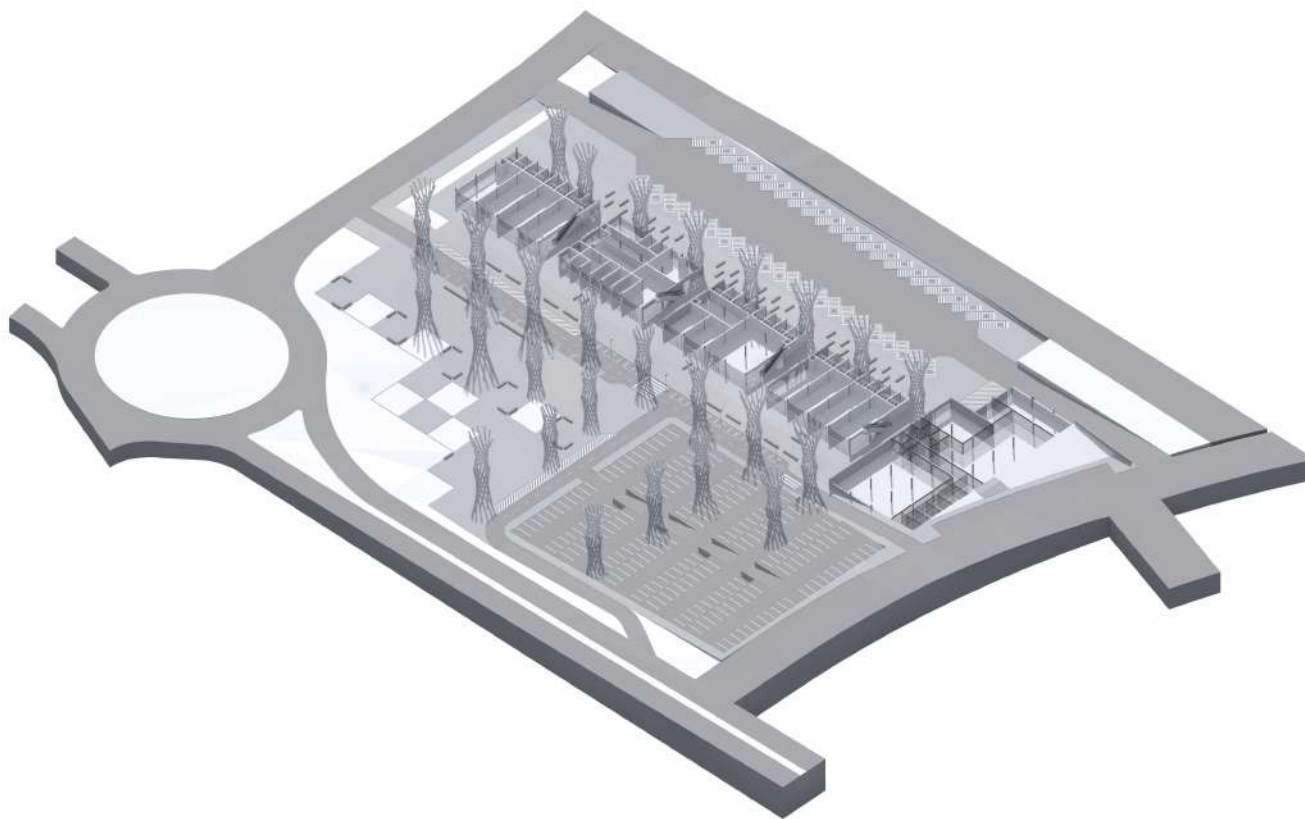
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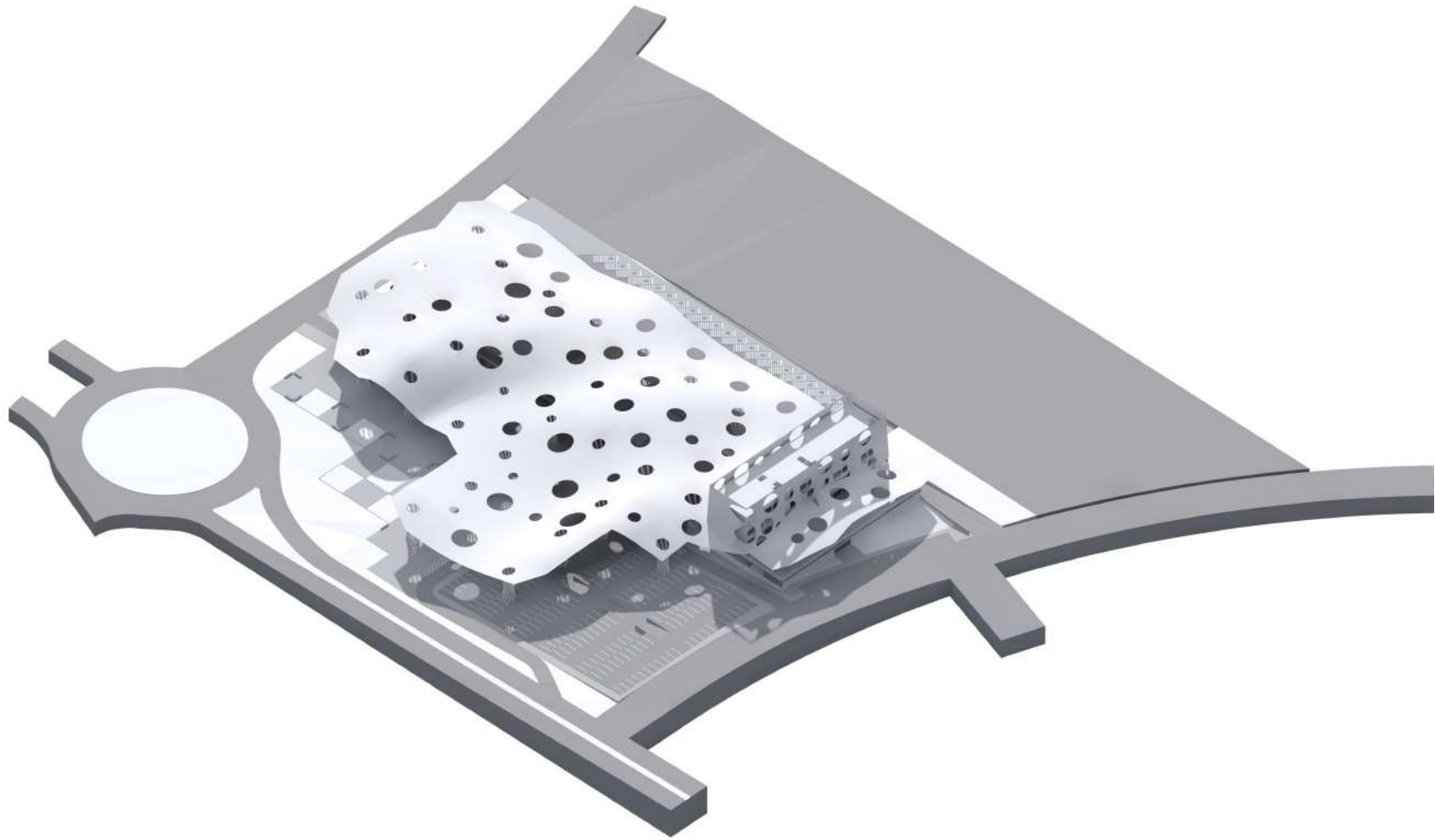
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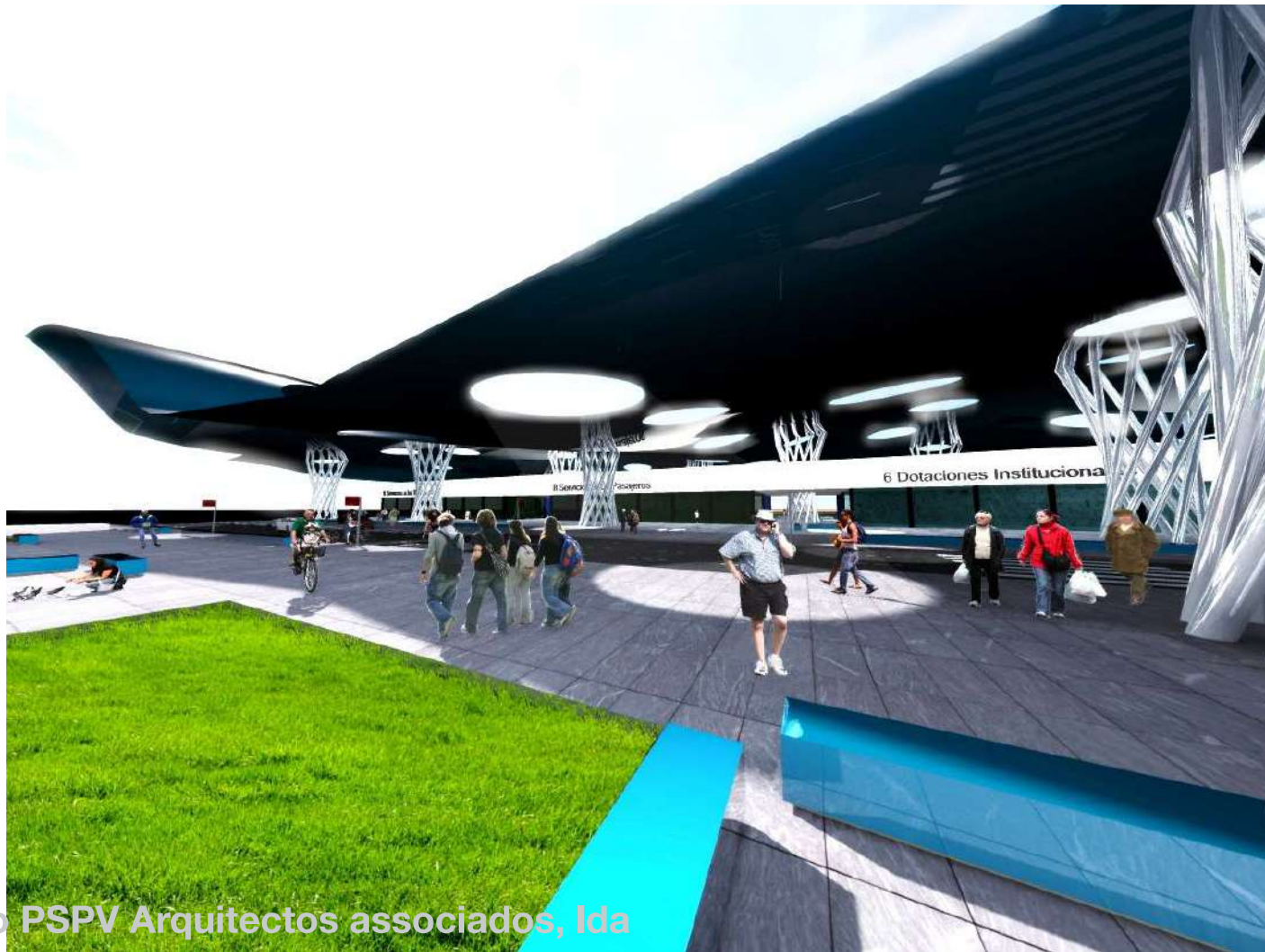
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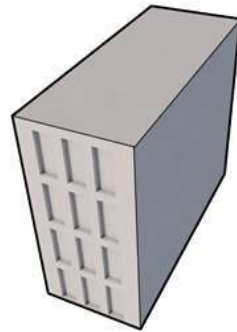


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Ser humano+Tecnologia + Natureza = Sustentabilidade



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Obrigado!

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