Climate is sensitive to energy consumption
Consumption is due to demand
Demand is driven by architectural design
So climate is sensitive to design
So what design is sensitive to climate?

Austrian Embassy Jakarta

Fritz OETTL

ECREEE, ECOWAS, Praia Cpo Verde june 2014

Austrian Embassy Jakarta first „green“ embassy building worldwide

Client: Austrian Foreign Ministry
Lead Architect and Engineering: pos architekten
Local partner: Tim 7, Yogjakarta
Contractor: PT.PP, Indonesia

Competition: Nov 2008
In Operation: June 2011

1.000 m² usable area,
20 workplaces, visa office,
convention hall for conferences,
concerts and events

Sustainable design-

What for?

Building stock

- contributes 49% to energy consumption
- emits 47% of CO2
- uses 45% of ressources for structure and equipment

60% increase of building stock in Asia until 2020
(basis 2011)

Jakarta Daily
Sabtu, 30 April 2011
“Pollution in Jakarta is becoming a bigger issue every single day , and we all have our ways in contributing….

Downtown Jakarta
Menteng district
Austrian Embassy

What is…

Jakarta, current state of design vision and building standards, e.g. Mandala Multifinance – Modern Office Building in Jakarta

"…To reduce the greenhouse effect, use the glass facade Super Silver Clear Stopsol type of PT Asahimas Flat Glass Tbk. This type of glass makes the heat absorption effect is not so big, so it has no effect on the consumption of electrical energy to cool office spaces…"
http://www.house-arch.com/mandala-multifinance-modern-office-building-in-jakarta.html

Supersilver Clear

Structure	Light properties (EN 410)		Energy Properties			Ug-Value
	LT%	LR%	EA%	SF%	SC%	W/(m².K)
10|	62	33	19	64	0.74	5.6
4|	64	35	9	69	0.79	5.8
6|	63	34	12	67	0.77	5.7

What could be…

Some technical features of Austrian Embassy

96 m2 photovoltaic generator

sun protection by external screen of local timber

air tight and thermally insulated building shell

interior good natural daylight conditions

green spaces with water sepage & rain water cistern

Bamboo stands → CO_2 sequester

cooling by concrete core temperature control

slow speed air ventilation with energy recovery

Possible?

CO_2 Emission (equivalent)

in tons per year for estimate 1000m2 rough floor area

Reduction of CO2 emissions by 84,8% or 72,9 tons.- or

72,9 kg / m2 r.f.a.

e.g. Zentral-Jakarta

„Jakarta Pusat“ 48,17 km2

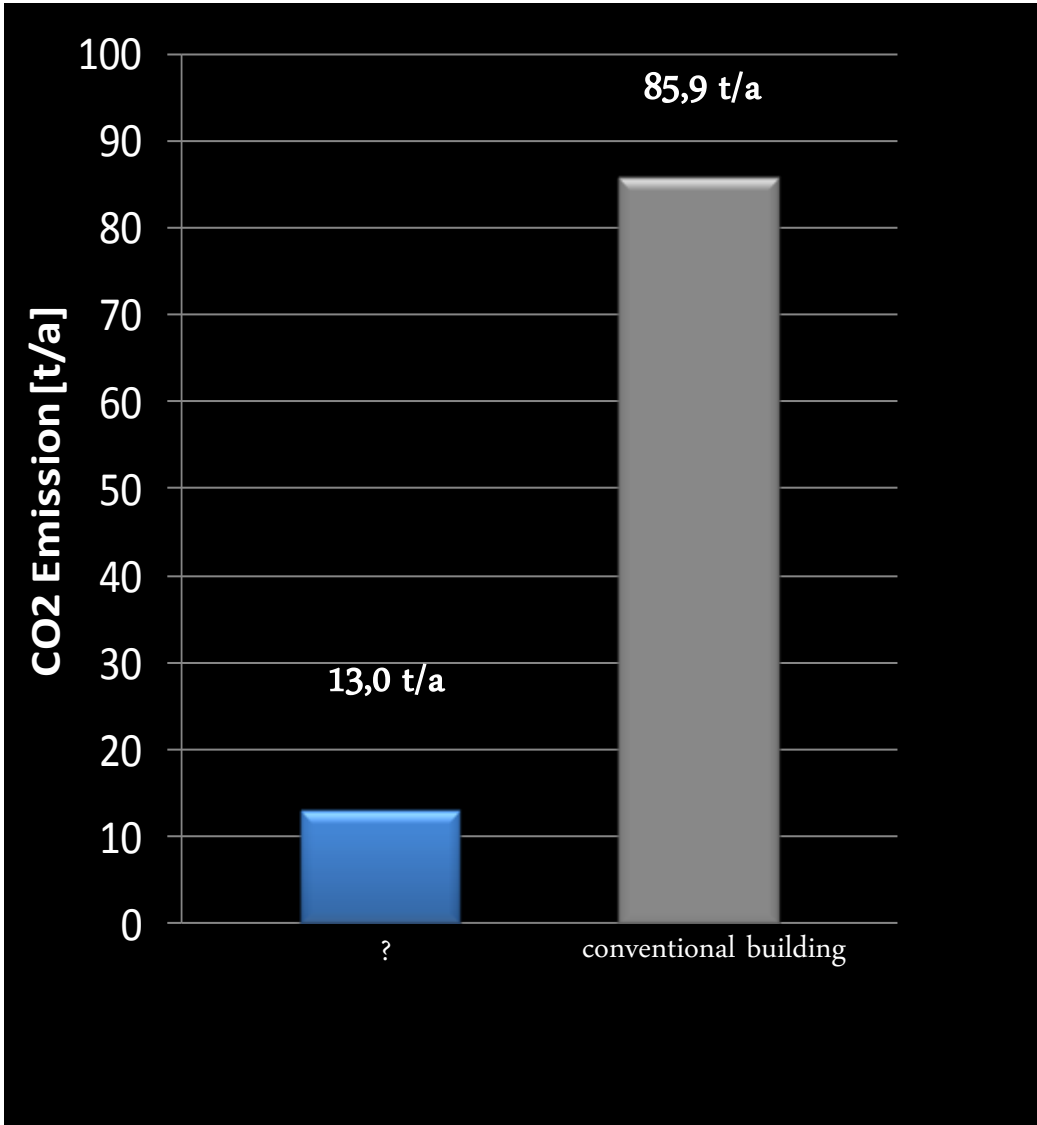
Estimate 2 m2 rough floor area per 1 m2 district area.

Means approximately

96 mio m2 r.f.a.

Potential of reduction

7 mio tons CO2 p.a.



Sustainable design ?

a multiple strategy- some simple guidelines

1. keep in mind aesthetics and the user

keep in mind aesthetics

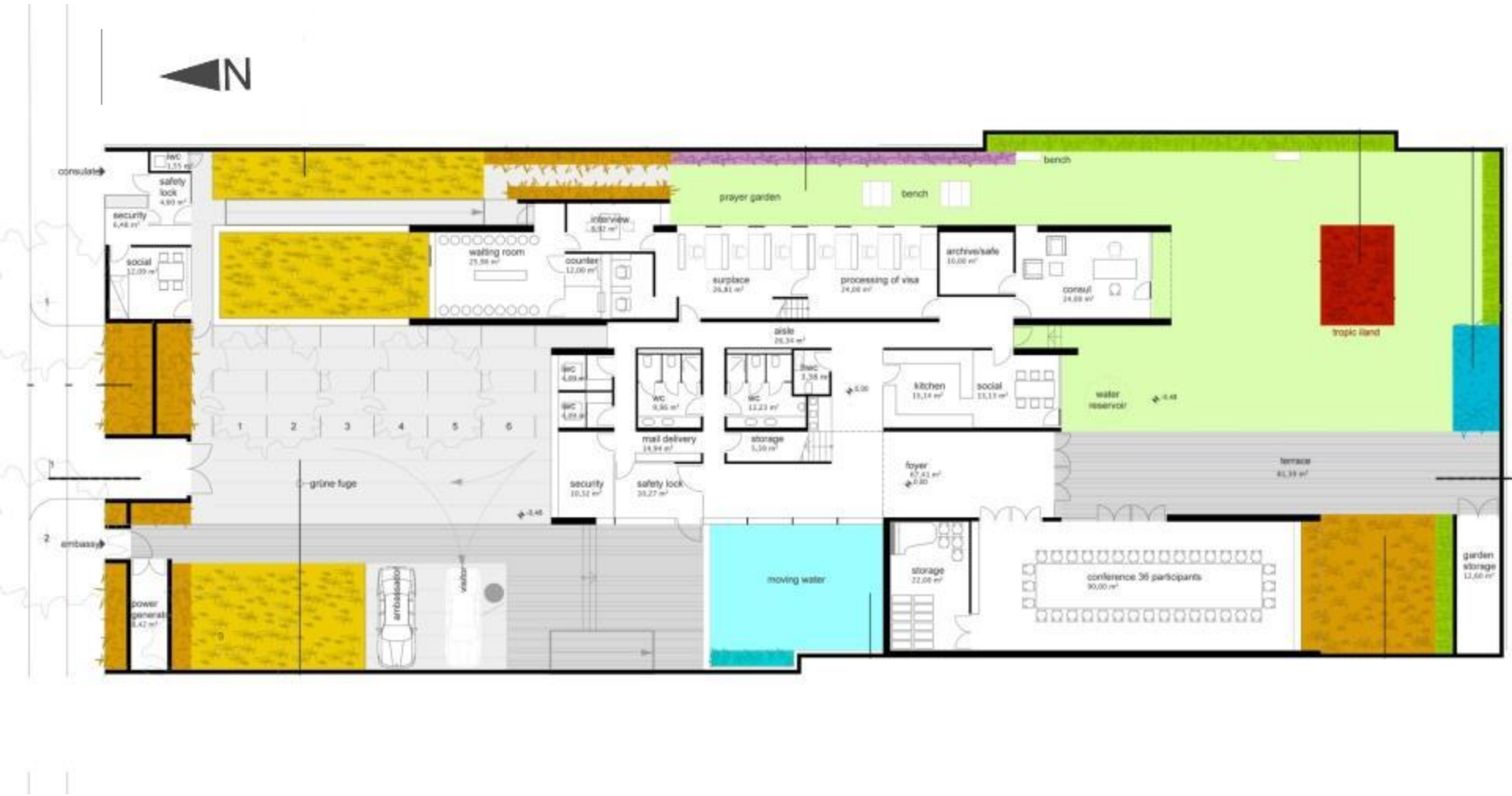
a beautiful building will persist by the appreciation of the users and owners

Aesthetics refer to a bouquet of topics

Set of space, volume, light, void- appropriate selection of materials-..

keep in mind the user

The floorplan is a diagram of function and the basis of space



Ground floor

a functional design will gain the respect of the user
And offers multitude opprortunities for future activities
Conference-music-lecture-meeting-reception-exhibition…

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a functional design will gain the respect of the user
And offers multitude opprortunities for future activities
Conference-music-lecture-meeting-reception-exhibition…

a functional design will gain the respect of the user
Offers „Chill out“- and smokers places

keep in mind the user

a floorplan meeting the requirements precisely will gain the respect of the user

First floor

Always keep in mind the user

Waiting lounge

Always keep in mind the user

Working place

Sustainable design ?

a multiple strategy- some simple guidelines

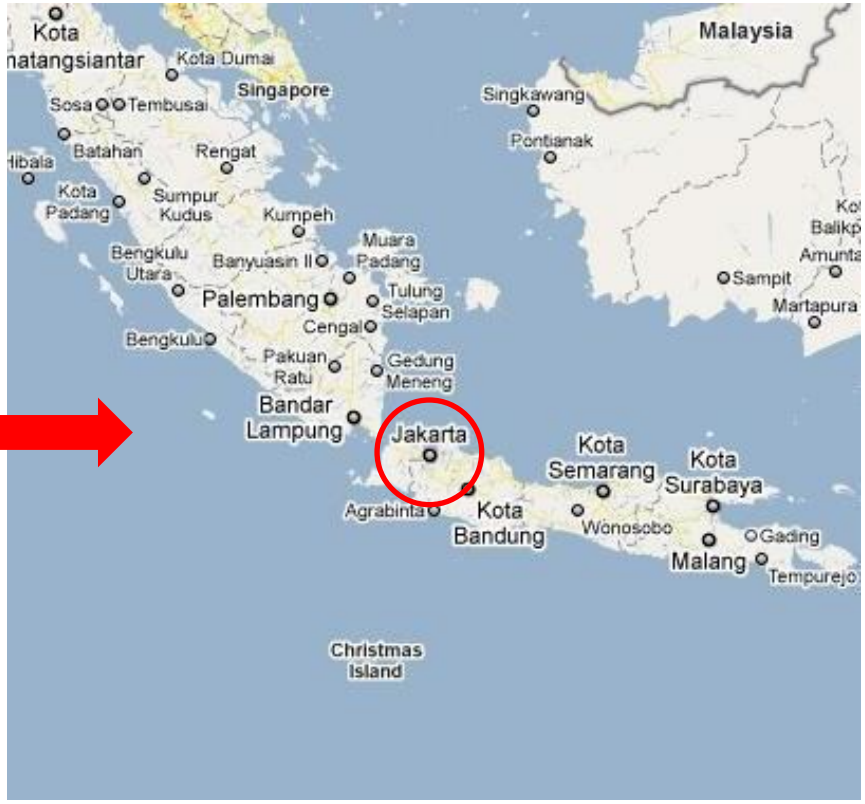
1. Always keep in mind aesthetics and the user
2. **Try to understand local conditions**

Try to understand local conditions

Equatorial location, latitude -6,13°: the design has to meet the conditions of hot and humid climate

Temperature: min max range from **21,4° to 35,2° C° _ Annual average: 27,5°**

Humidity relative: min max range from **43,0 to 100% _ annual average 79,7%**



Try to understand local conditions

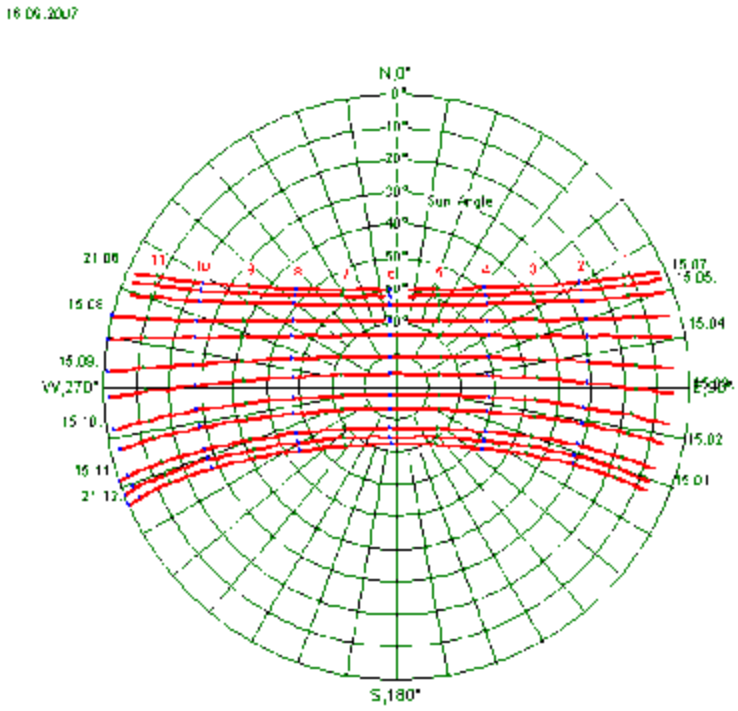
Solar Incidence, Jakarta

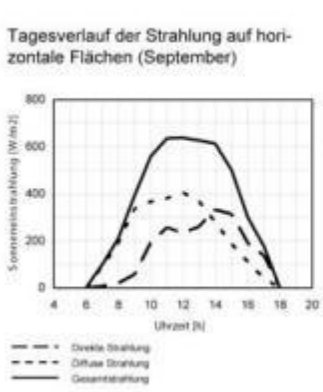
650 Watt on horizontal areas

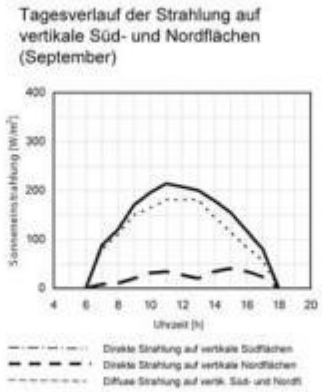
200 W on vertical areas facing north and south

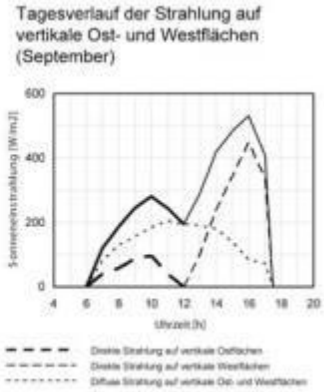
300 W on verticals facing east

550 W on verticals facing west









Solar incident in Watt /local time 6 am-pm
fltr: horizontal, NS, EW areas
__ total; _ _ direct; -- diffuse radiation

Respect sunpower

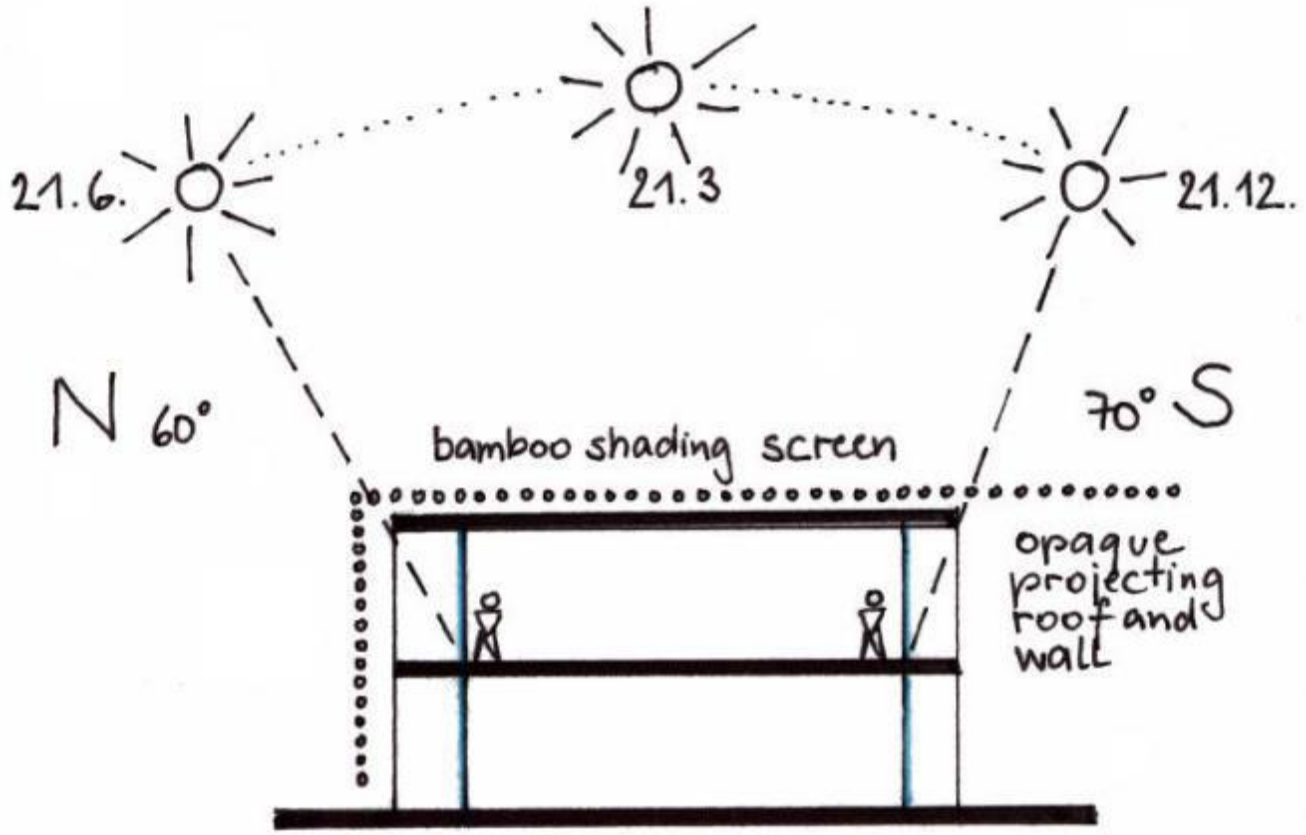
and soothe it

By orientation of building

By shading

By blocking

By insulating



Sustainable design ?

a multiple strategy- some simple guidelines

1. Always keep in mind aesthetics and the user
2. Try to understand local conditions
3. **Adopt comfort- terms of references**

Adopt comfort terms of references

Proposed design and key **decision of client**:

Target temp. 18° C ☹ or 25° C ☺

Target humid. 40% ☹ or 60% ☺

Result?

1. Significant reduction of cooling and dehumidification loads
2. Change to radiant cooling and downsizing of HVAC System

Monitoring data 15.9.2011, 8 a.m.

room	temp °C	Humid. %
Entrance locker	23,7	60,1
Lobby	23,5	61,2
Confer. R.	23,7	60,1
Kitchen	23,8	58,2
Consul	23,8	59,2
Visa office	23,8	58,7

Sustainable design ?

a multiple strategy- some simple guidelines

1. Always keep in mind aesthetics and the user
2. Try to understand local conditions
3. Adopt comfort- terms of references
4. **Reduce external loads**

Design Basics

(includes simulation!)

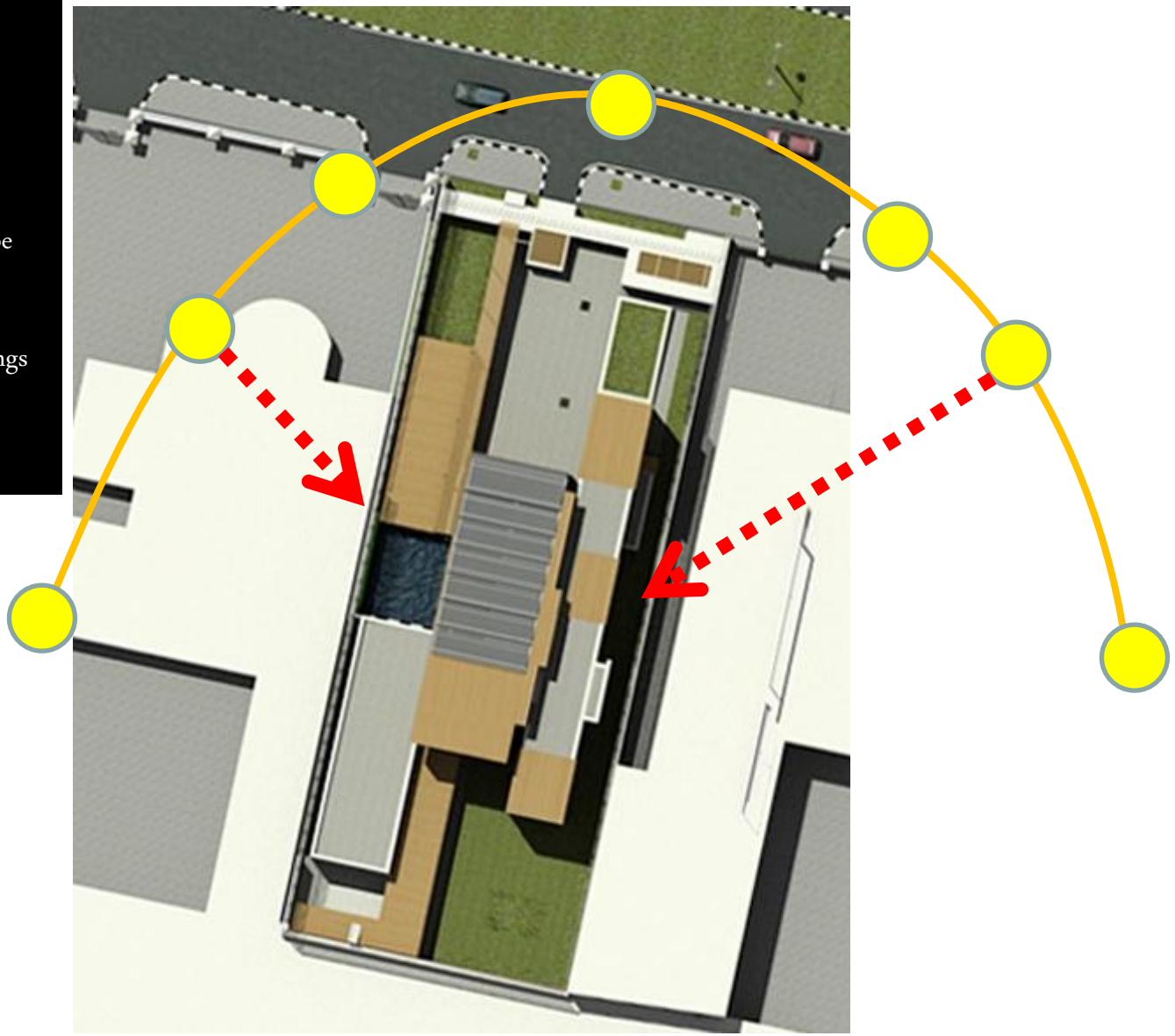
Orientation: windows preferably oriented north and south

Shade

Thermal Insulation of Building envelope

Airtight building envelope

Balance of transparent and opac openings

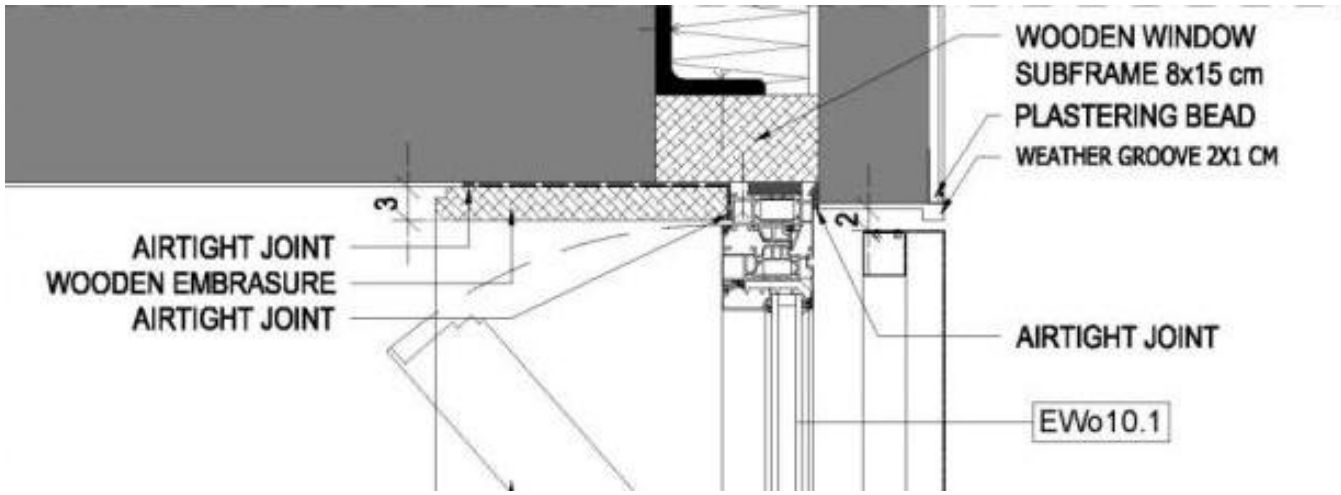


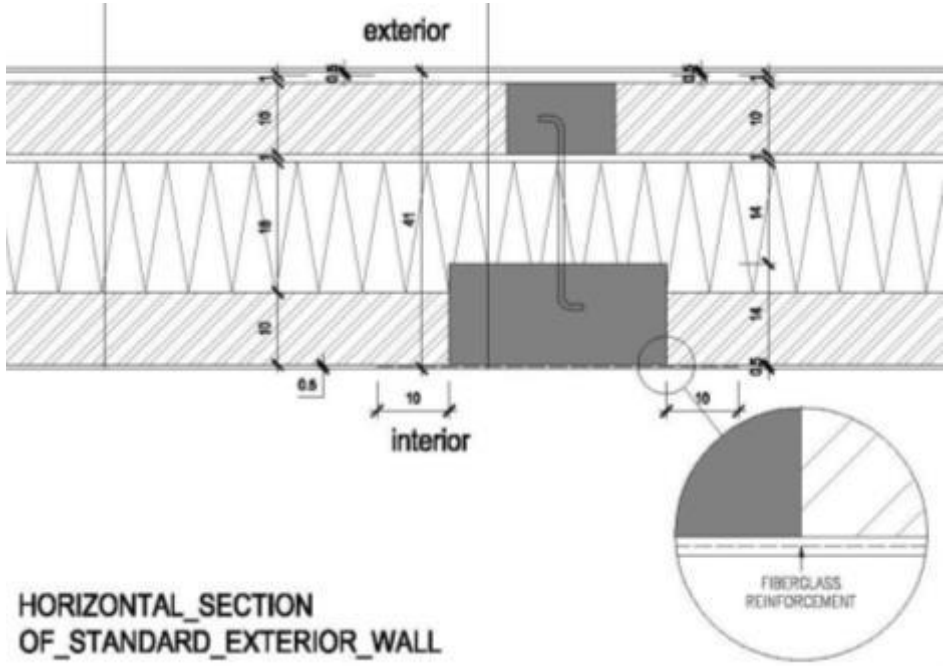
Shade
By exterior timber screen
By recessing openings

Detail work
Building envelope

Adopting passive house knowledge

Insulation airtightness





HORIZONTAL_SECTION
OF_STANDARD_EXTERIOR_WALL

Exterior wall detail
thermal simulation

Load reducing sequence:

1. Opaque opening ratio
2. Insulated glazing
3. Recessed openings
4. Exterior shading

Austrian Embassy Jakarta: two-pane thermal glazing

U-Value: <1,1W/m2K, g-Value 0,3

Sustainable design ?

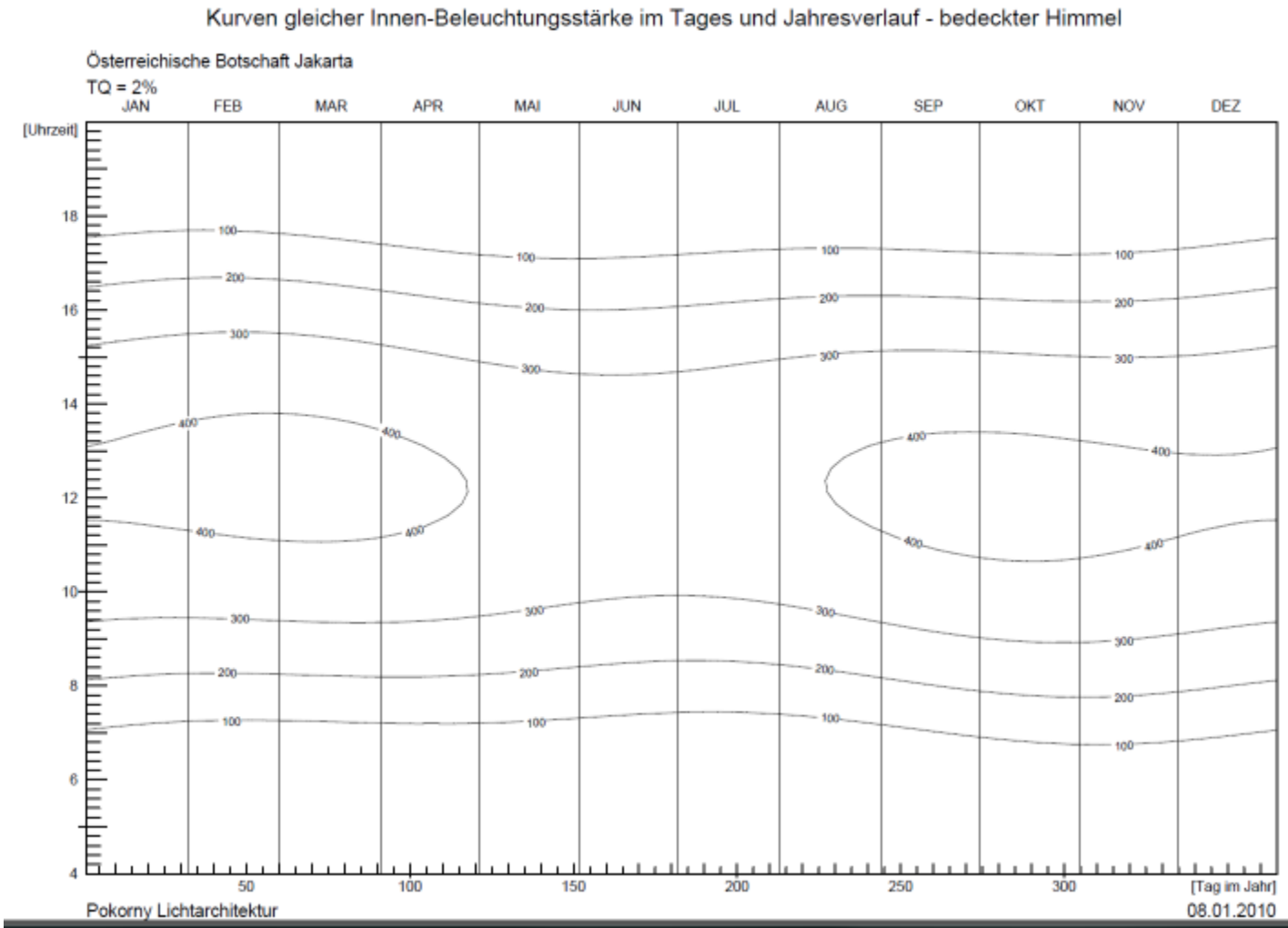
a multiple strategy- some simple guidelines

1. Always keep in mind aesthetics and the user
2. Try to understand local conditions
3. Adopt comfort- terms of references
4. Reduce external loads
5. **Balance Light and loads**

Indoor light conditions

Balance energy block and light transmission

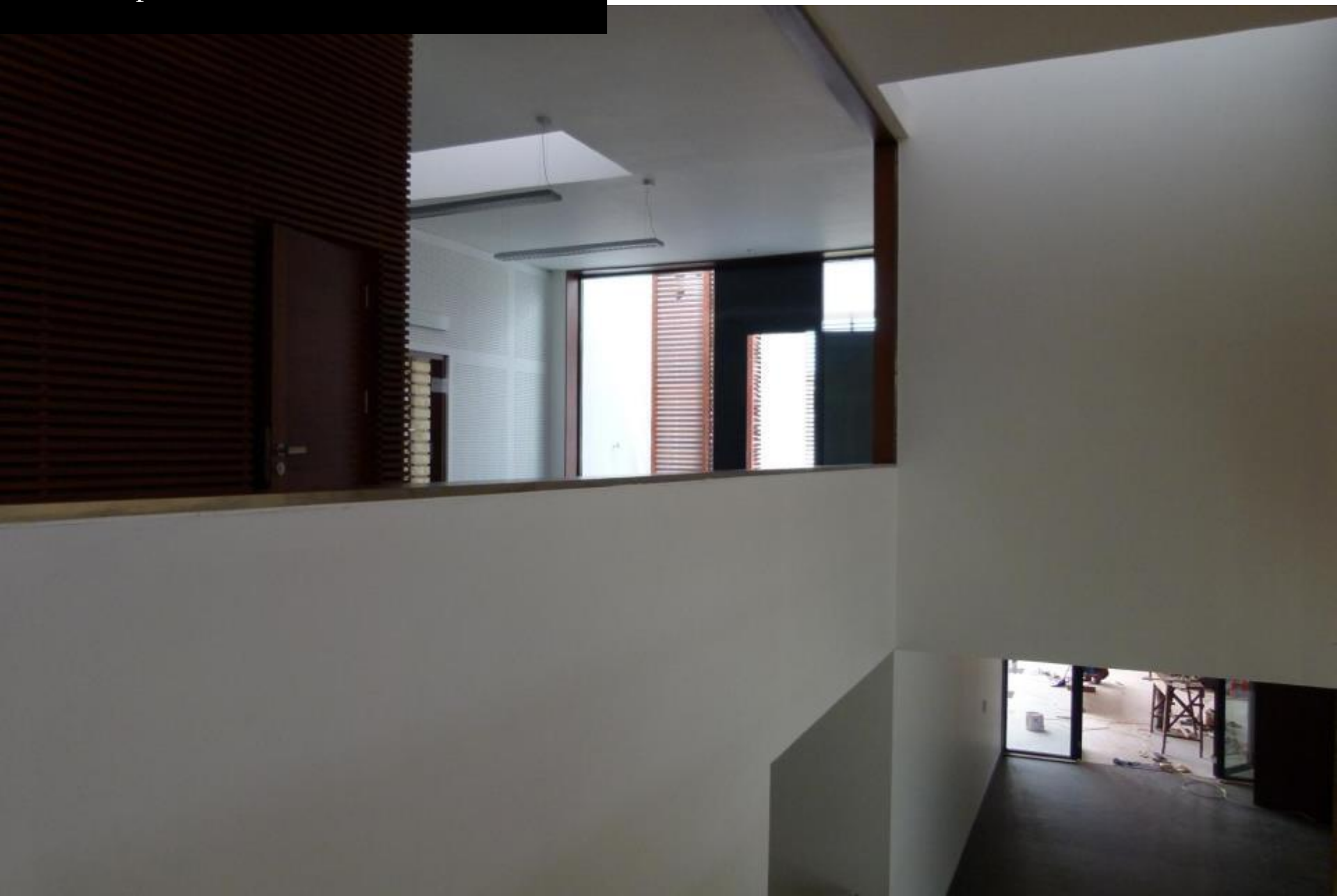
Calculation of daylight ratio



Natural daylight comfort

Natural daylight

...from top



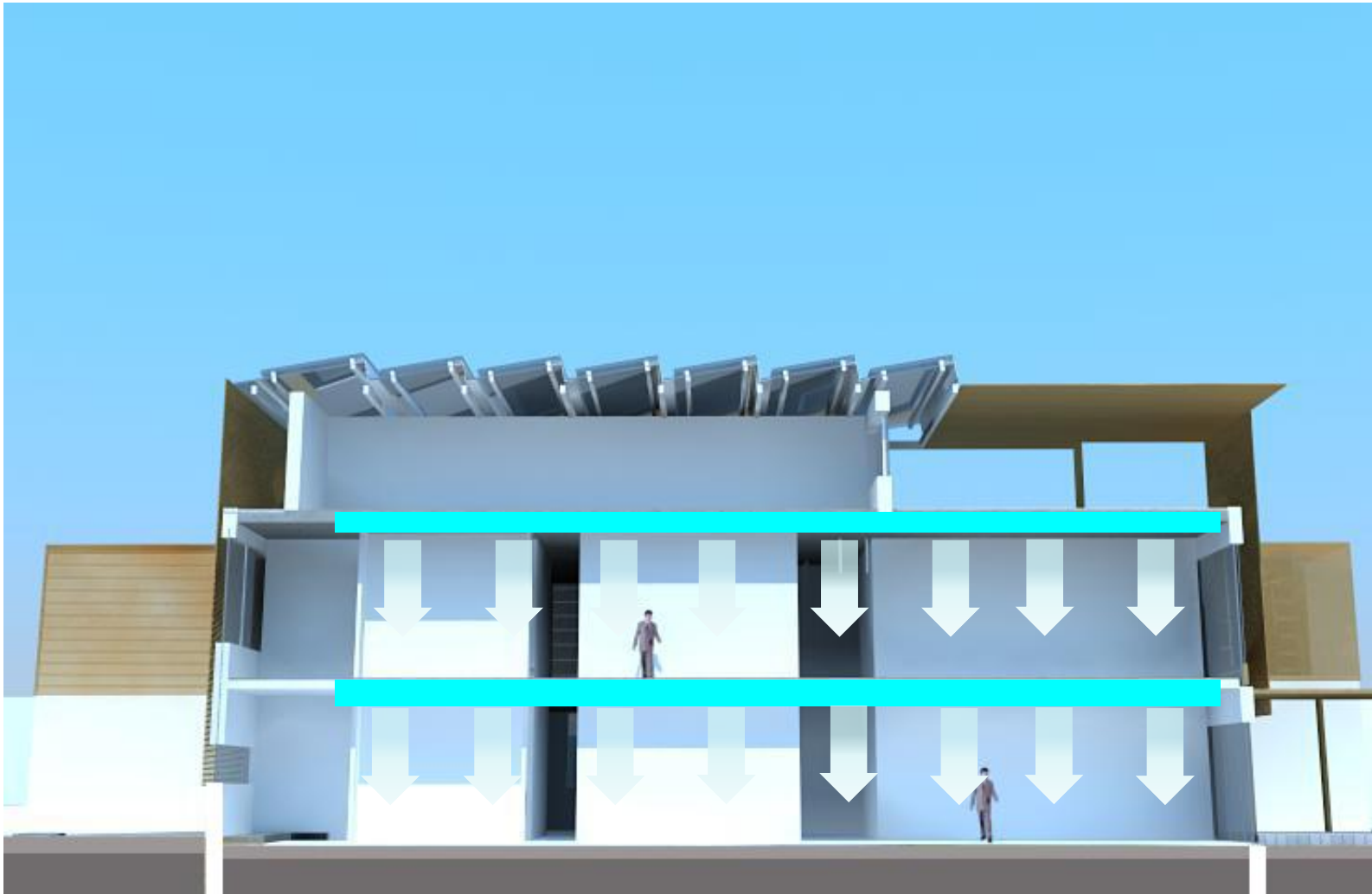
Sustainable design ?

a multiple strategy- some simple guidelines

1. Always keep in mind aesthetics and the user
2. Try to understand local conditions
3. Adopt comfort- terms of references
4. Reduce external loads
5. Balance Light and loads
6. **Make technical services efficient**

Technical services serve the user comfort

gentle radiant cooling instead of cold breeze of split units

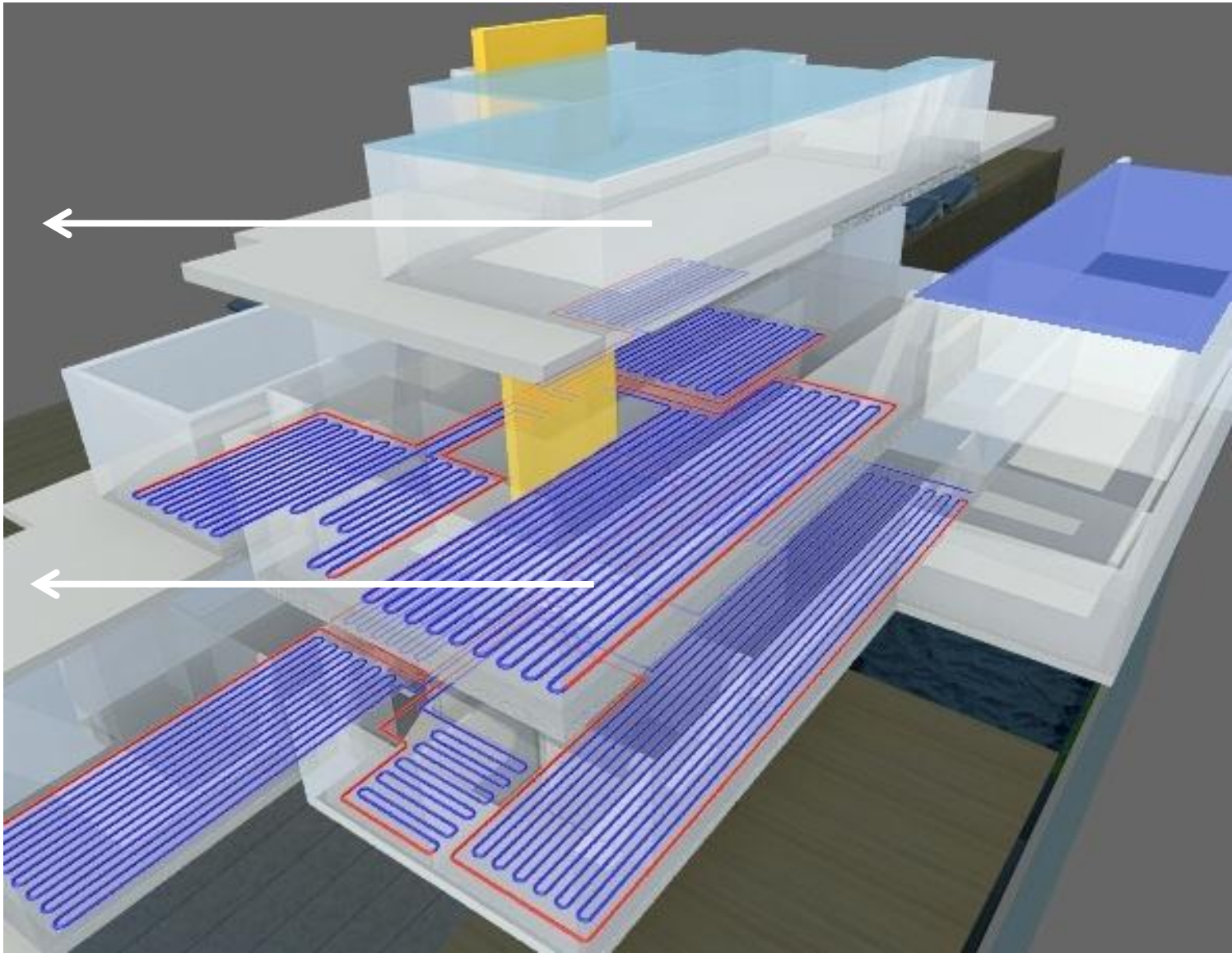


CCTC- Concrete Core Temperature Control
Covers the cooling load

chiller and HVAC equipments

Concrete Core Temperature Control (CCTC)

More comfort, less energy consumption



Ventilation (with coolness recovery)

Provides dehumidified air with gentle air flow

Adopting passive house knowledge

Sustainable design ?

a multiple strategy- some simple guidelines

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2. Try to understand local conditions
3. Adopt comfort- terms of references
4. Reduce external loads
5. Balance Light and loads
6. Make technical services efficient
7. **Increase renewables**

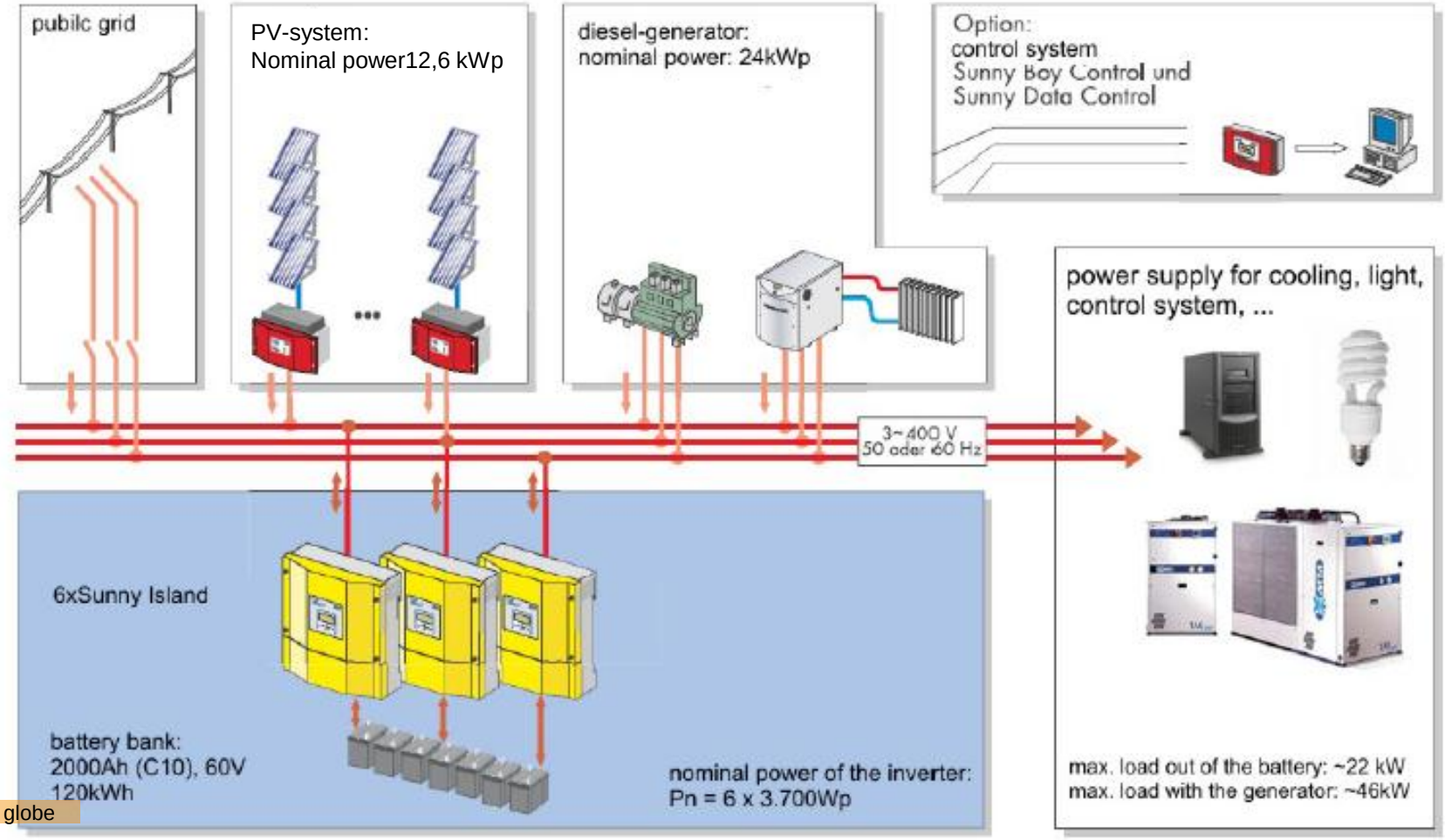
Use Solar electric power

reduce fossile energy demand

22% coverage of total annual electric energy demand

Increases safety by double back-up

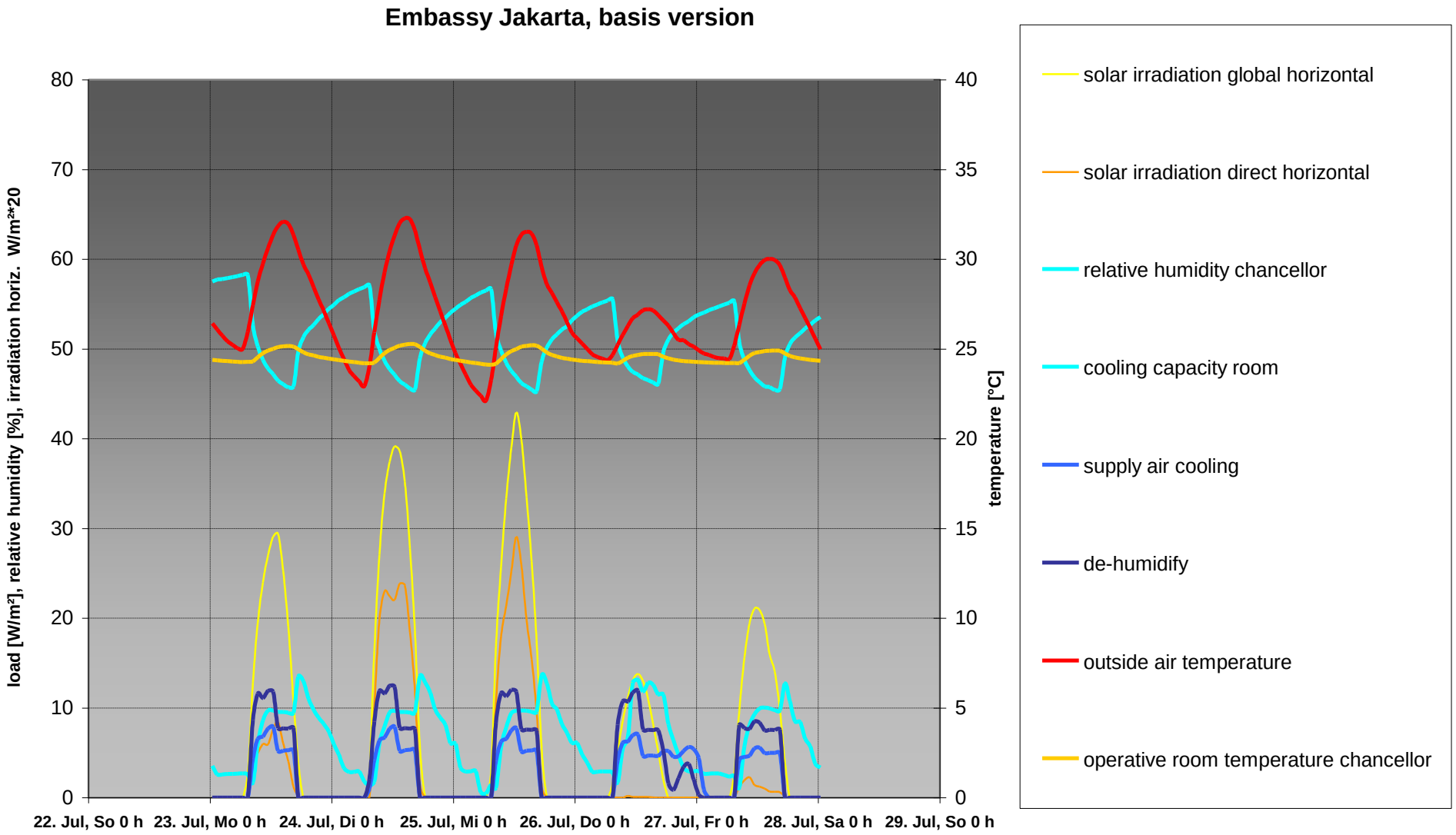
Stand alone 24h emergency operation mode



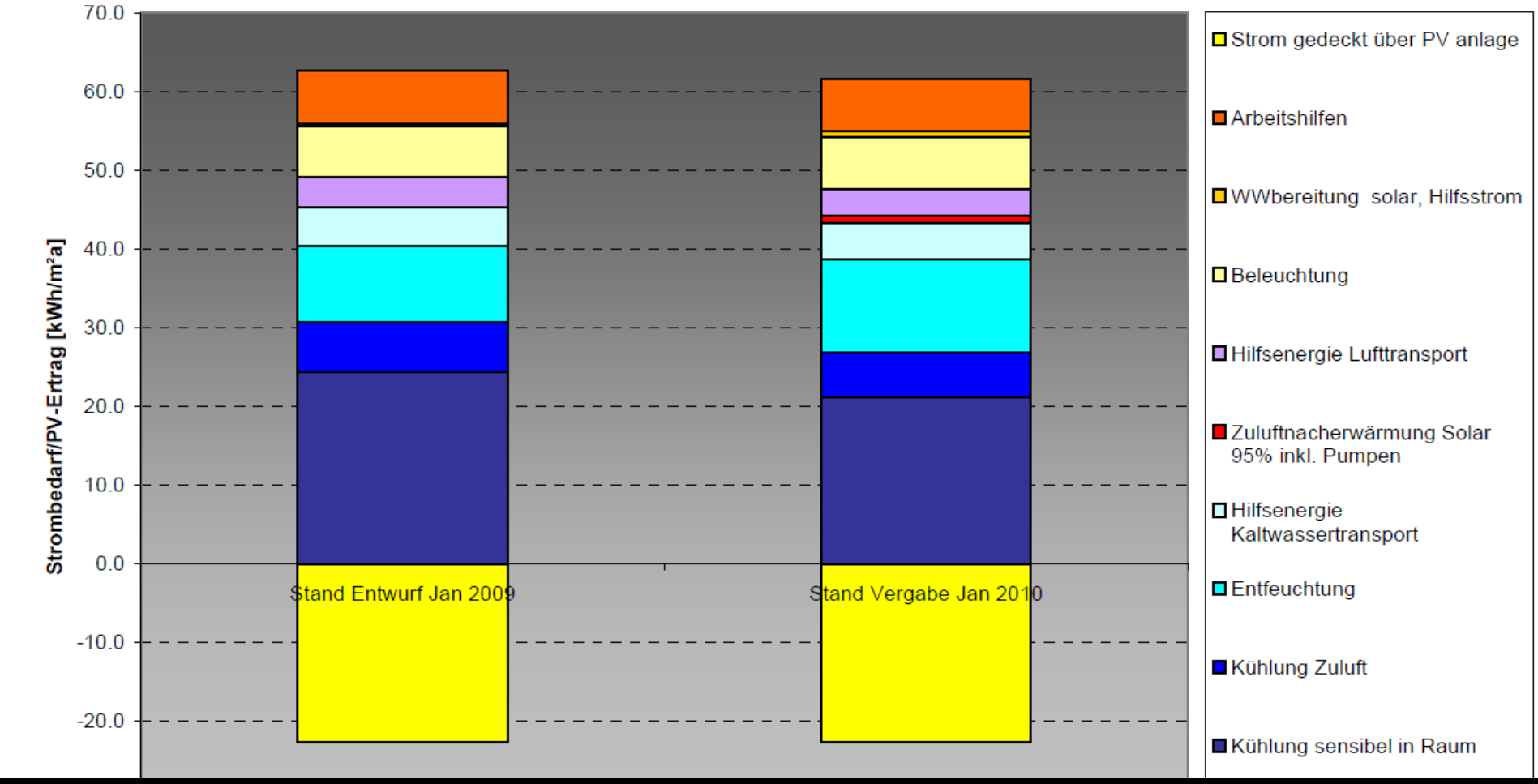
Increase use of renewables energy production “on-house”

96 m2 solar photovoltaic generator on top

Evaluate the design
Dynamic building simulation -
Reliable basis for sustainable design desicisions



Evaluate the design
Dynamic building simulation -
Reliable basis for sustainable forecasts



Final take over at march 2012, detail balancing of HVAC until sep 2012, monitoring ongoing set up

Sustainable design ?

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1. Always keep in mind aesthetics and the user
2. Try to understand local conditions
3. Adopt comfort- terms of references
4. Reduce external loads
5. Balance Light and loads
6. Make technical services efficient
7. Increase renewables
8. **Consider local culture and expertise**

On site, concrete casting works, CCTC laying

AEJ, layout of pipes for CCTCl, jun 2010

Know how transfer
Blower door test

What do we gain by sustainable design? Besides user friendly architecture- some energy savings for the owner

results of design simulation

annual total energy demand in kWh per m2 usable area:

AEJ building 39,9

compared to

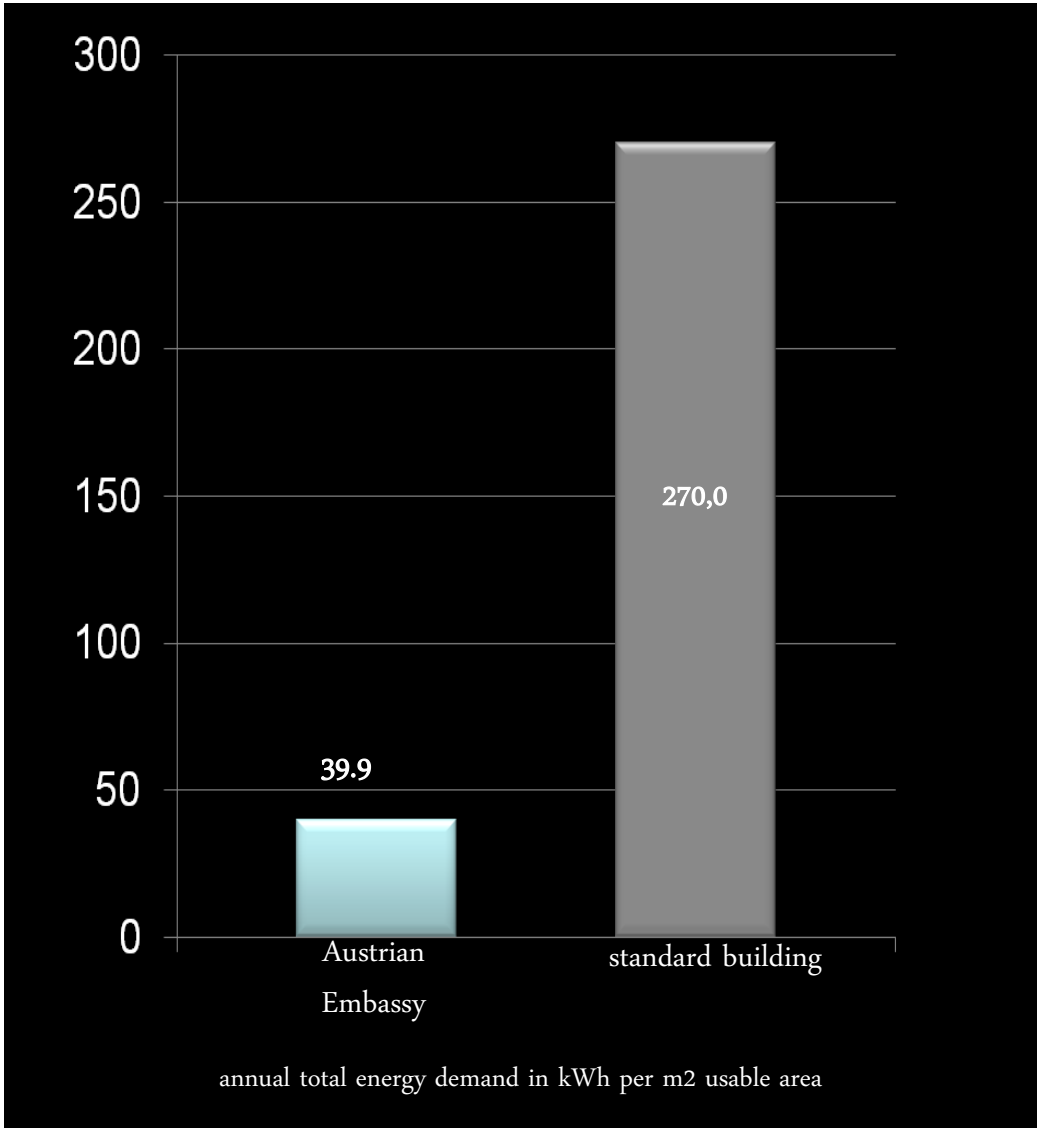
“standard building” 270,0

energy saving is 85,2%

Photovoltaic generator covers 22% of annual total electric energy demand by solar power

Fully air conditioned office in Jakarta consumes 5 times more energy than that of non air conditioned building

AEJ building has same energy demand as a non-air-conditioned office building in Jakarta



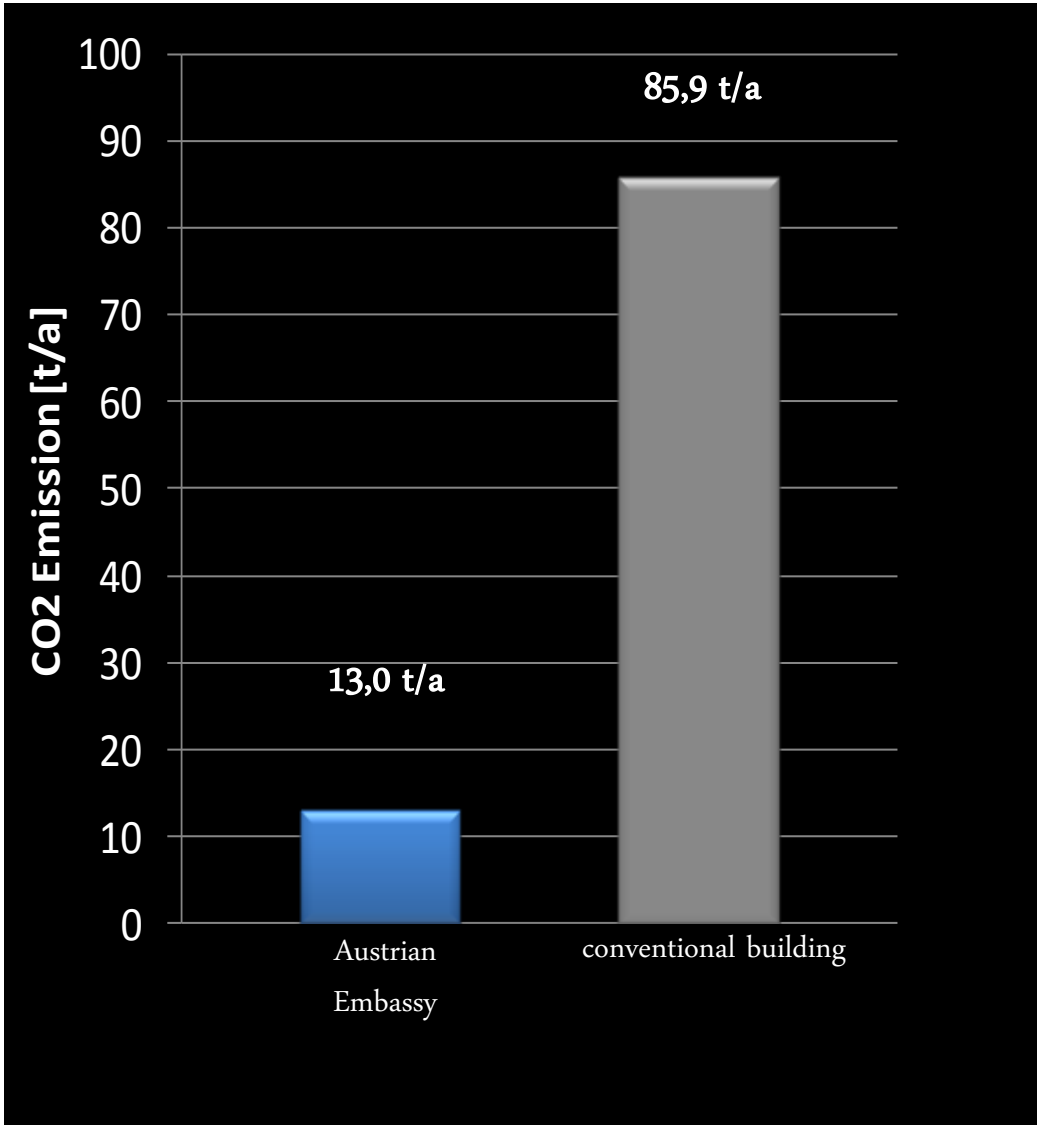
What does the environment gain?

CO_2 Emission (equivalent)
in tons per year

AEJ building 13,0
standard building 85,9

73 tons less CO_2 Emission

Minus 85%



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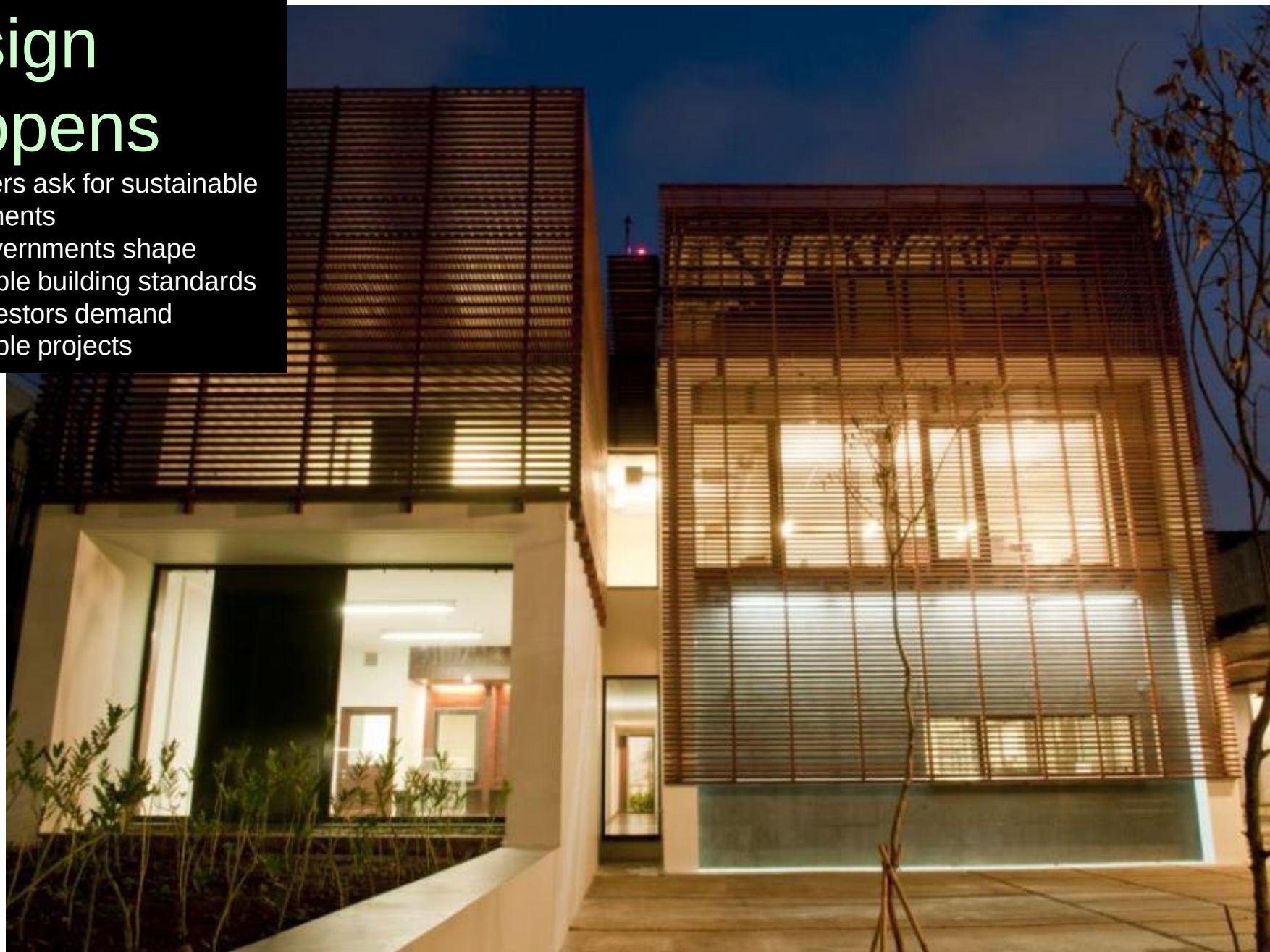
5. Balance Light and loads
6. Make technical services efficient
7. Increase renewables
8. Consider local culture and expertise
9. **talk about and learn**

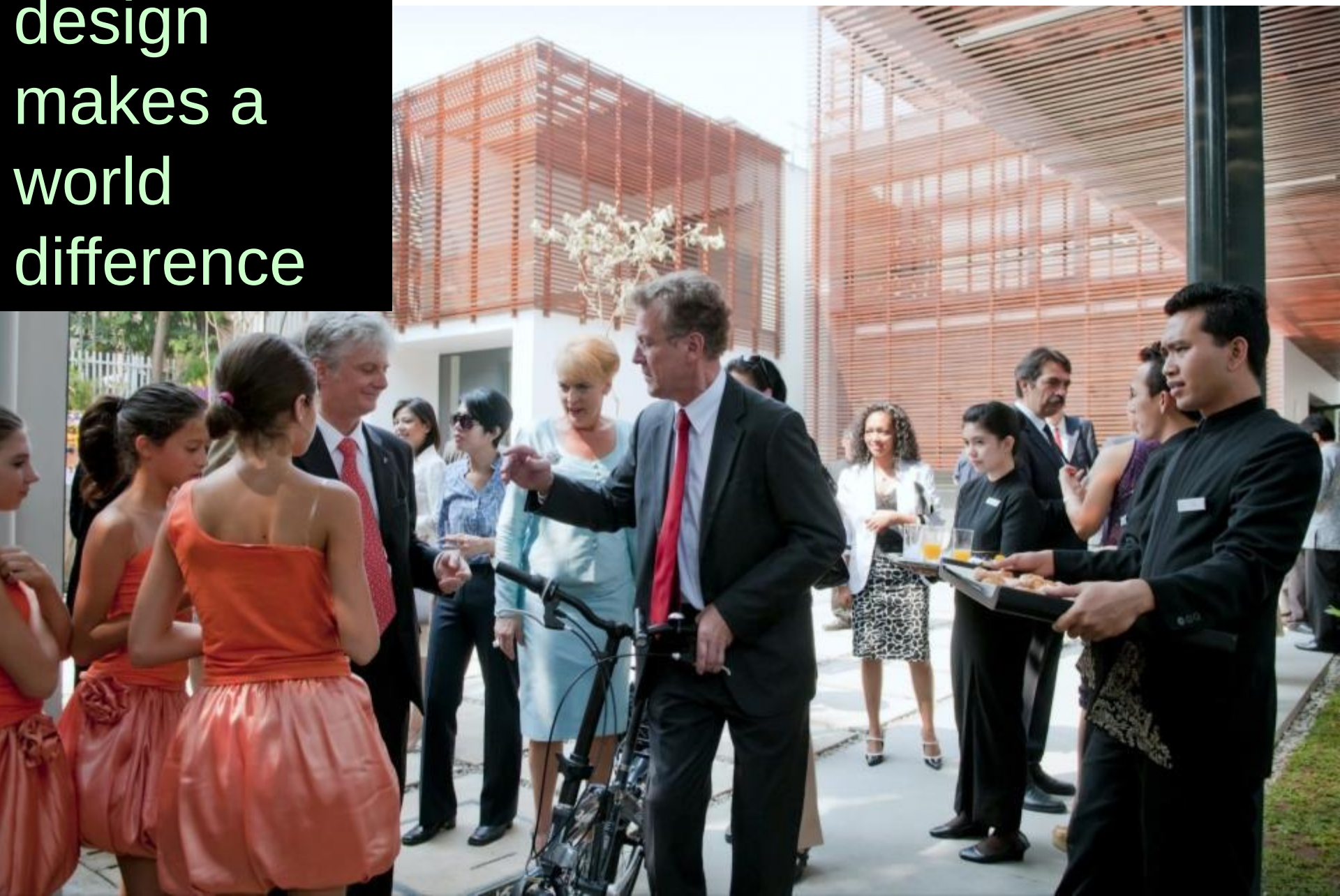
Sustainable design matters

For user
For owner
For society
For environment

Sustainable design happens

once users ask for sustainable environments
once governments shape sustainable building standards
once investors demand sustainable projects



Sustainable design shows the true colors
What we build today shows how we care about tomorrow

Sustainable design makes a world difference