POTENTIALS OF RENEWABLE ENERGY IN TURKİYE AND ARCHITECTURAL PRACTICES

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demeteryildiz@gmail.com

ISTANBUL OKAN UNIVERSITY

TEMİZ ENERJİ VAKFI
1994

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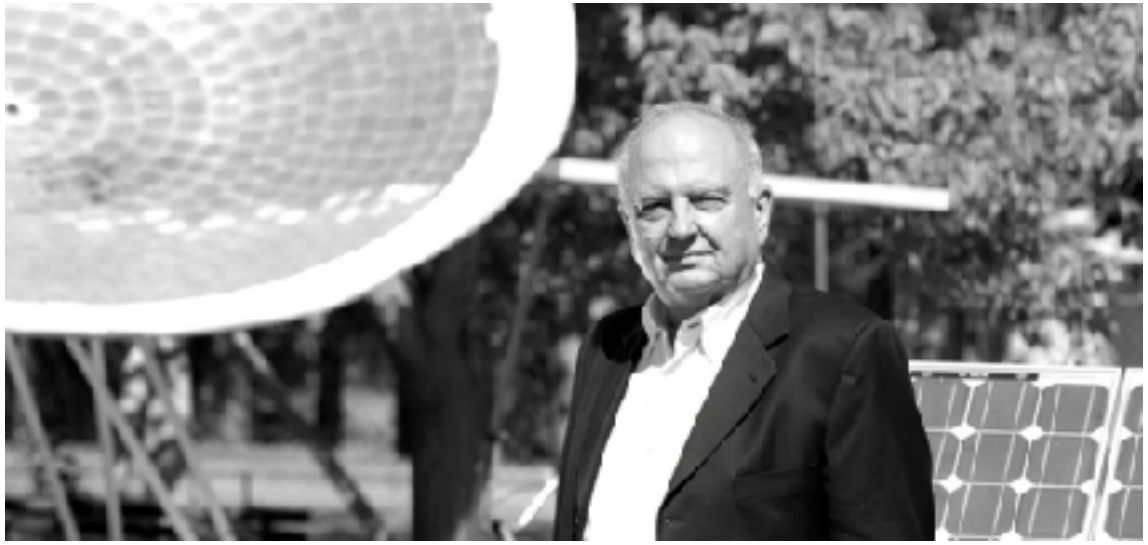
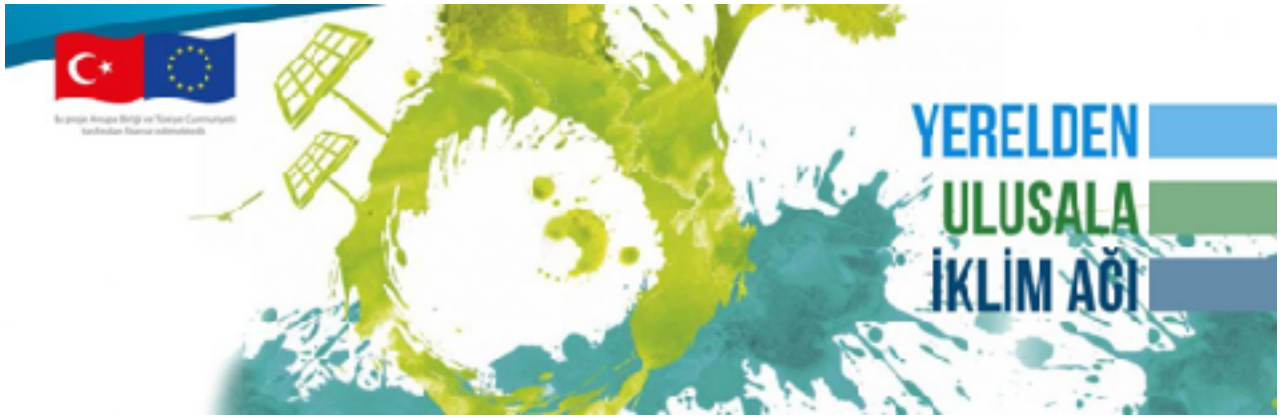
1994

CLEAN ENERGY FOUNDATION 1994



It was founded in 1994 by Dr. Demir Inan with the support of TUBITAK. 14 personal and 4 corporate members took part in the foundation. I was the president of the foundation between 2017-2020.



National and International funded projects

PROJECTS & APPLICATIONS

MUGLA UNIVERSITY STREET LIGHT-PV PANELS

One ton of chicken manure/per day biogas system in Çorum

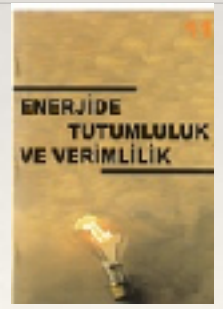
Illumination of the Van Cat statue with solar panels

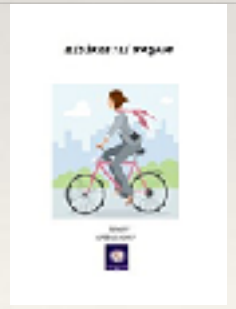
Solar powered interior lighting of Harran Culture House

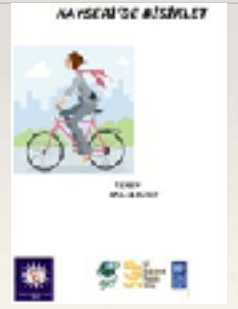
Illumination of a bus stop in Çorum with solar energy

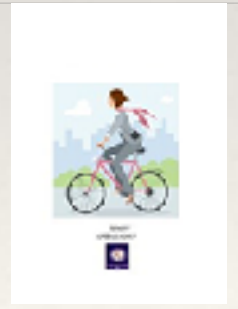
IZOCAM A.S. in educational buildings solar powered street light

PUBLICATIONS OF TEMEV









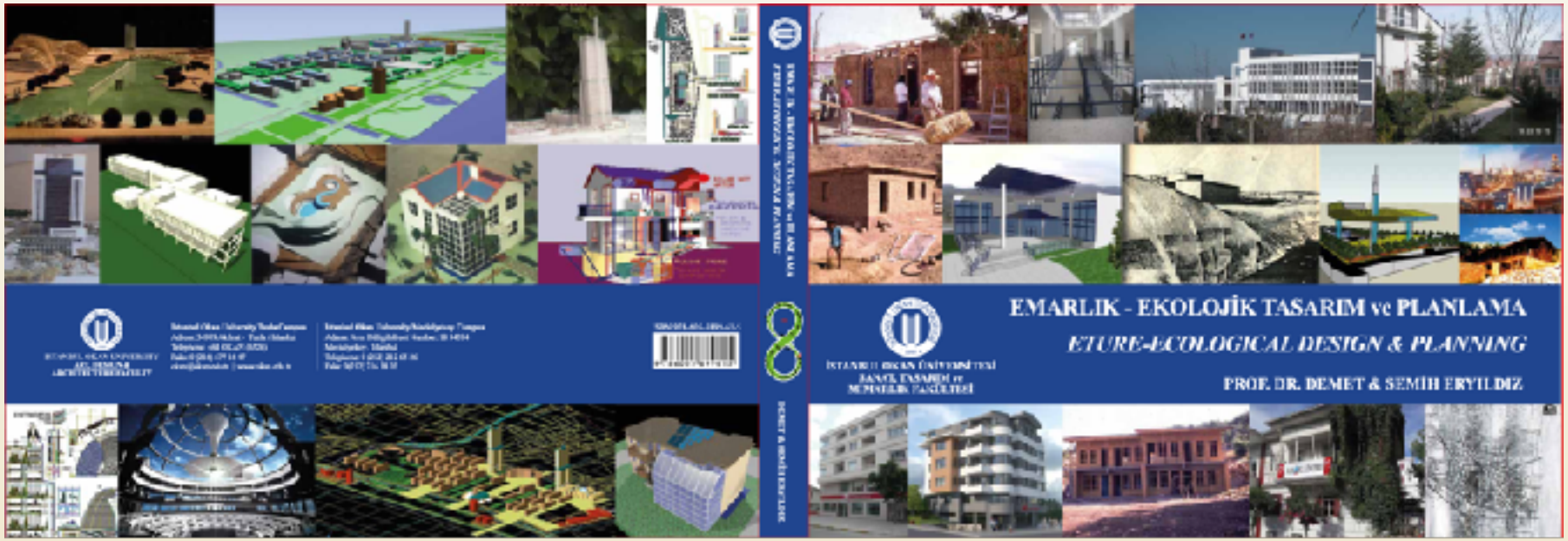
Prof. Dr. DEMET IRKLI ERYILDIZ

Prof. Eryıldız, was born in Çorum/Turkey on September 19, 1956. She has undergraduate degree from A.D.M.M.A (State Academy of Engineering and Architecture – Ankara) in Architecture (1979); Master of Science degree, from METU (Middle East Technical Uni. Faculty of Architecture) (1984); Ph.D, from METU (Middle East Technical Uni. Faculty of Architecture) (1995). Her M.Sc. thesis is on Passive Solar Heating and Ph. D. thesis is about Acoustics of Ancient Theatres. Prof. Irkli Eryildiz is also a post-doc graduate of *Institute for Housing Studies – Rotterdam, 1986.*

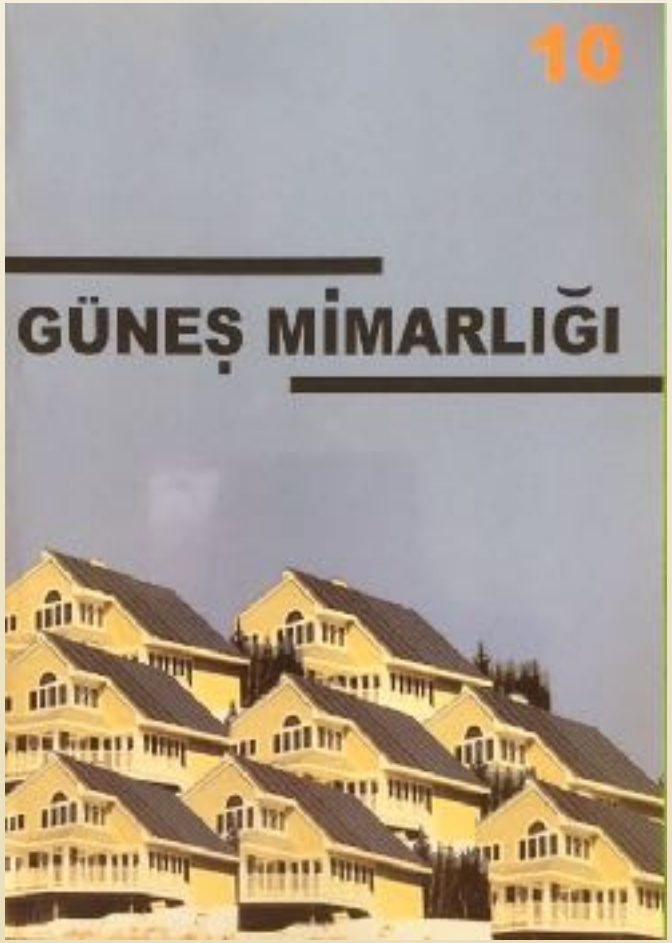
She is currently working at **Istanbul Okan University** at the Faculty of Art, Design and Architecture and teaching research methods, environmental control systems, sustainable architecture, acoustics, active and passive systems in design, and architectural design. She was dean of the Faculty of Art, design and Architecture between 2016-2019.. She is the founding member of the Energy Efficient Building Design Post Graduate Programme of Maltepe University. She's got several senatorships for university senates. She held many academic and administrative positions at Gazi University, Girne American University, European University of Lefke and Maltepe University. Besides these Universities she had also taught at Middle East Technical University, Osman Gazi University and Bahçeşehir University.

Prof. Eryıldız was executive member of many NGOs like as, Global Eco-Village Network, TÜBİTAK, Clean Energy Foundation, and Chamber of Architects – Ankara Branch etc. She was The president of Clean Energy Foundation between 2017-2020.

Except from many papers and articles published nationally and internationally, she is editor of many books on architecture and has supervised many masters and Ph.D. thesis. She has translated famous book of Ken Yeang`s *Eco Design to* Turkish with H. S. Eryıldız. She is co-author of the bilingual (English-Turkish) almanac E-Techture. She has many awards in architectural competitions. She has also jury responsibilities such as the 1st International Clean Energy Congress UTEK 2008 which was a joint event of Clean Energy Foundation and the University of Hacettepe's Research Center of New and Clean Energy (YETAM), 1st Clean Energy Congress of the Youth, jury president of the international competition at the ''Climate Responsive and Clean Energy Houses'' of 2008. Prof. Irkli Eryildiz is also a jury member for the national ''Urban Transformation and The Use of Clean and Renewabe Energy'' Competition, a joint project of TEMEV and Maltepe University for the year 2012.



H. SEMİH ERYILDIZ - DEMET IRKLI ERYILDIZ



NUR DEMİRBİLEK - DEMET IRKLI ERYILDIZ

OUR PUBLICATIONS

THE PLACE OF ARCHITECTURE IN THE CLIMATE CRISIS THAT IS BOTH GLOBAL AND LOCAL

- THERE ARE INTERNATIONAL NEGOTIATIONS ON CLIMATE CHANGE
- THESE DECISIONS CAN BE IMPLEMENTED WITH POLICY AND ACTIONS AT THE LOCAL LEVEL:
- LOCAL CLIMATE CHANGE ACTION PLANS ARE DONE BY YIDEP IN TÜRKİYE
- LOCAL GOVERNMENTS ARE AUTHORIZED AND RESPONSIBLE FOR THE MAKE AND IMPLEMENTATION OF LOCAL PLANS ACCORDING TO CLIMATE POLICIES
- SPATIAL PLANNING IS COMING UP AS LOCAL LEVEL MASTER PLANS.
- RENEWABLE ENERGY IS AN IMPORTANT COMPONENT OF THIS PLAN.

CLIMATE CHANGE & ARCHITECTURE

- According to the United Nations Intergovernmental Panel on Climate Change, the deadline to reduce carbon dioxide emissions by 50% is; 2030.

- The American Institute of Architects (AIA) asked members to make all new buildings and major renovations 100% carbon neutral by 2030.

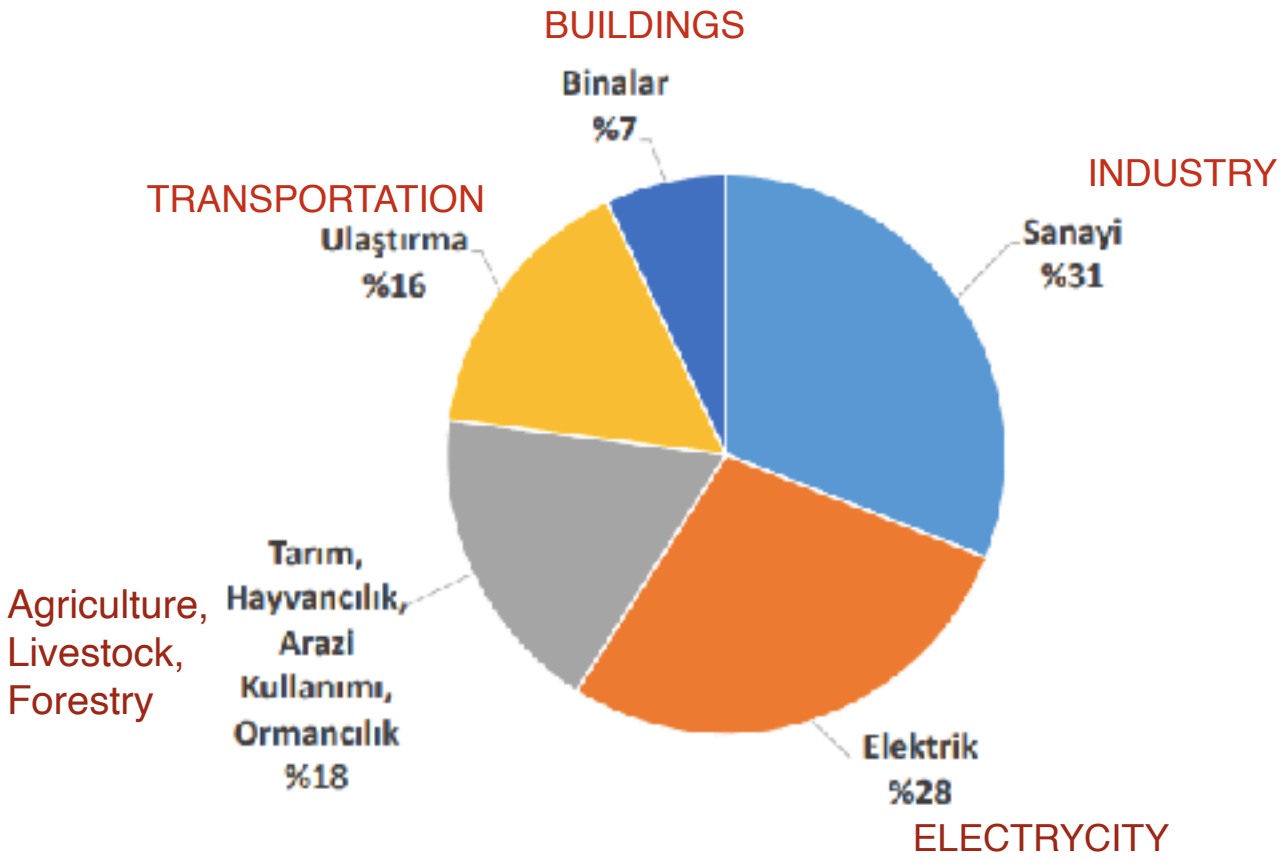
Paris Agreement

The long-term goal of the agreement is to continue global efforts to keep the global average temperature rise below 1.5°C. (http://iklim.csb.gov.tr/paris-anlasmasi-i-98587)

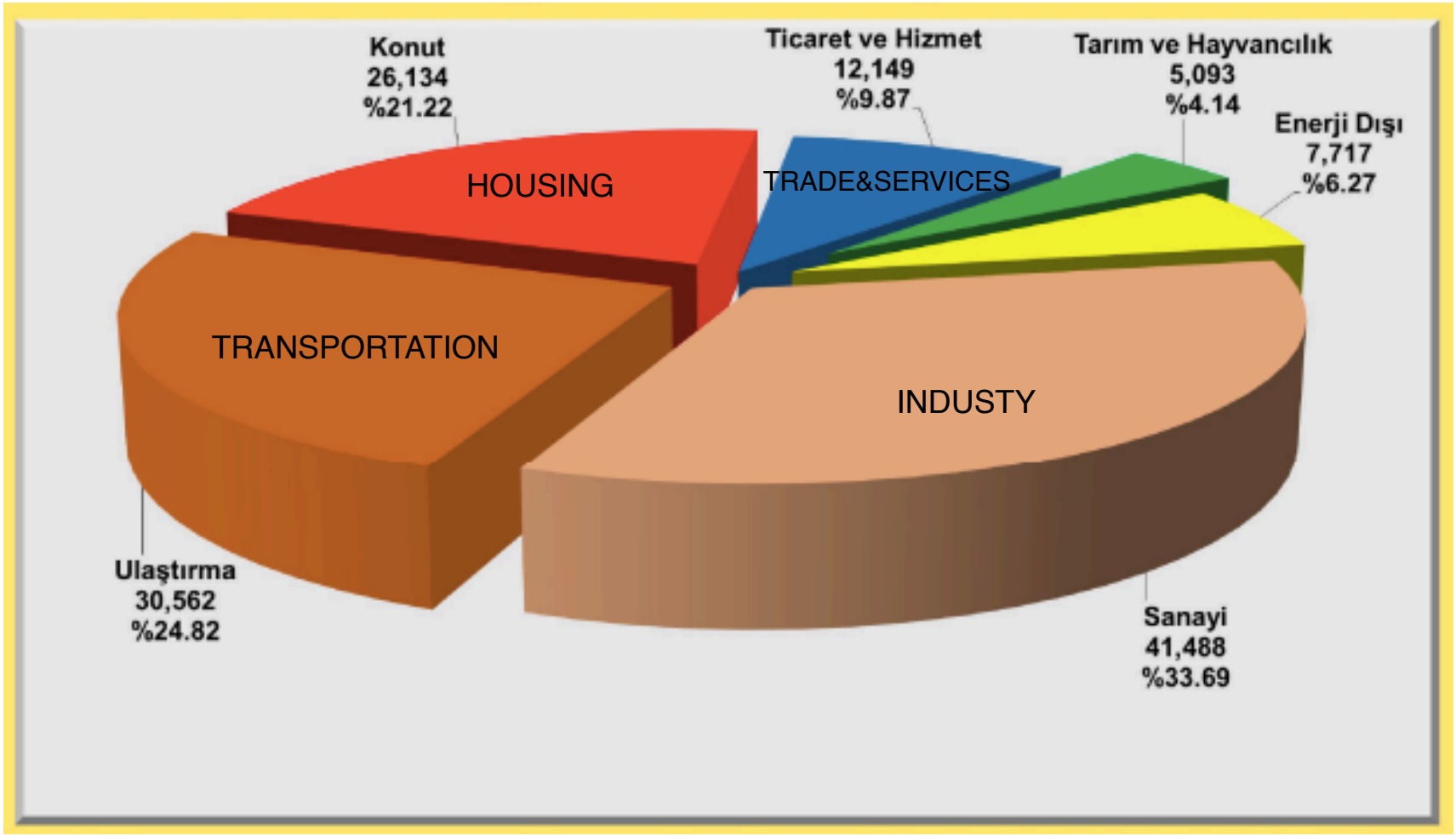
What do architects and planners think in this situation? Are our cities ready for this?
Our cities are not ready for climate change

The problems facing our planet once again reveal the importance of urbanization and architecture. At this point, we need to understand the need not only for reproduction but also for designing by saving resources. In this point, Urban Transformation can be an opportunity for Türkiye.

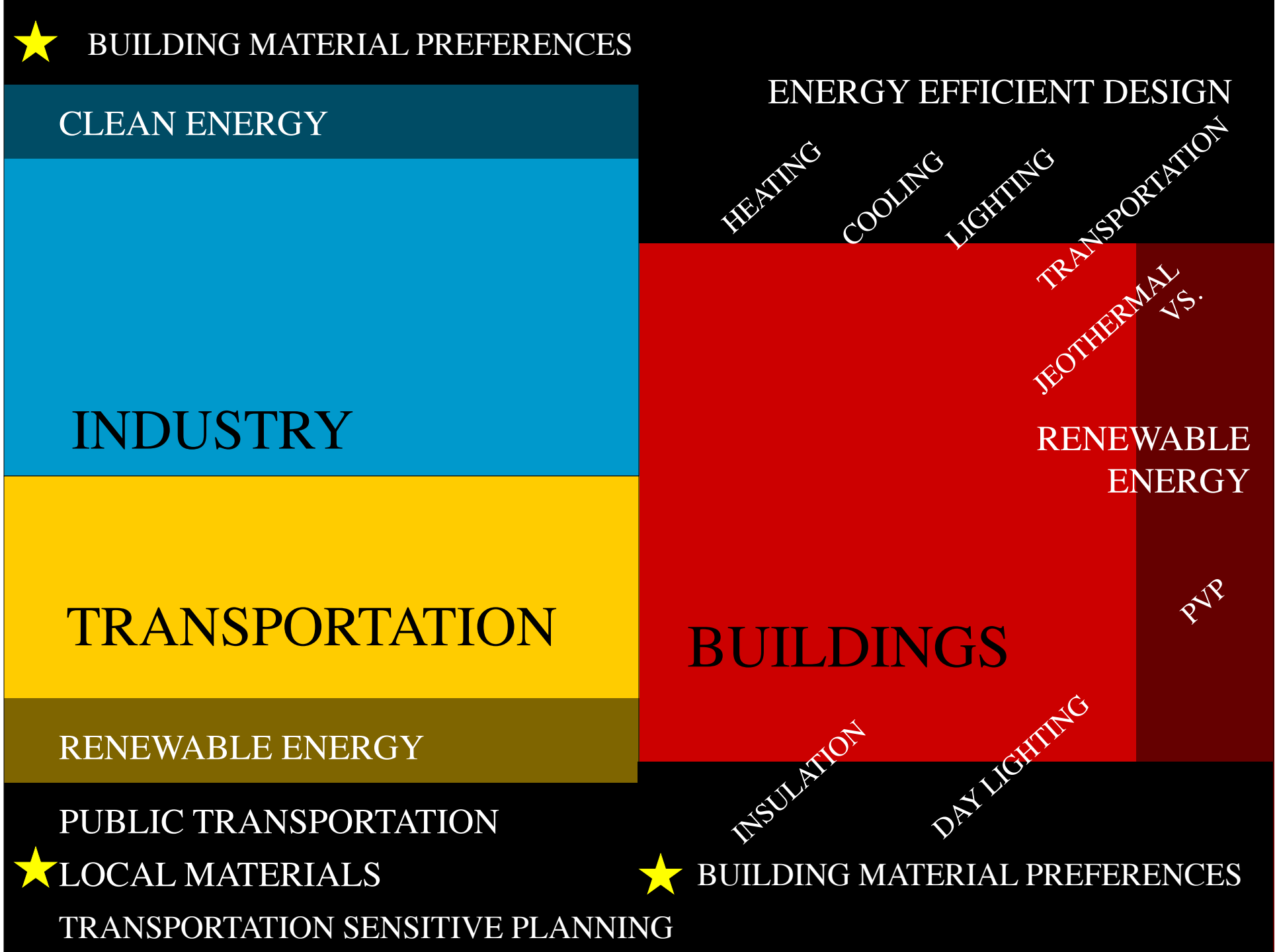
Global Emissions by Sector



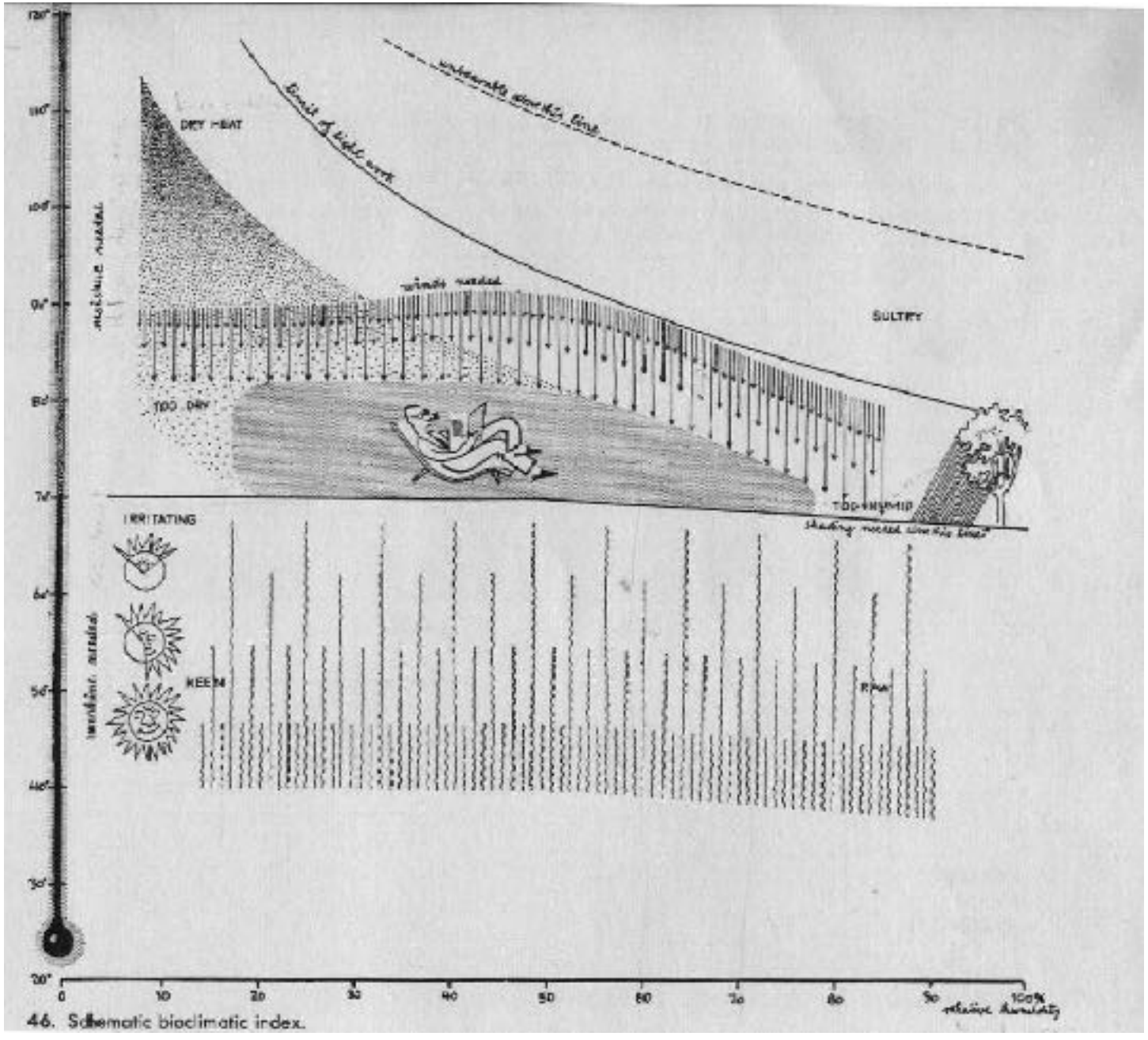
Sectoral Analysis of Türkiye's Primary Energy Consumption Distribution 2021
Total 123.1 Million TOE



Source: ETKB-EİGM


BUILDING MATERIAL PREFERENCES
CLEAN ENERGY
ENERGY EFFICIENT DESIGN
HEATING
COOLING
LIGHTING
TRANSPORTATION
INDUSTRY
JEOTHERMAL
VS.
RENEWABLE
ENERGY
TRANSPORTATION
BUILDINGS
PVP
RENEWABLE ENERGY
INSULATION
DAY LIGHTING
PUBLIC TRANSPORTATION
LOCAL MATERIALS
BUILDING MATERIAL PREFERENCES
TRANSPORTATION SENSITIVE PLANNING

BIO-CLIMATIC NEEDS



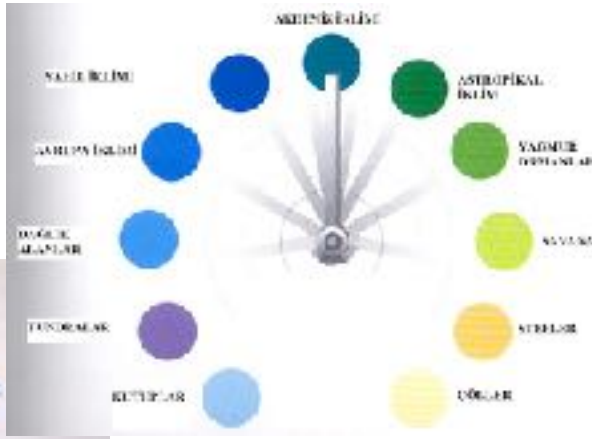
46. Schematic bioclimatic index.

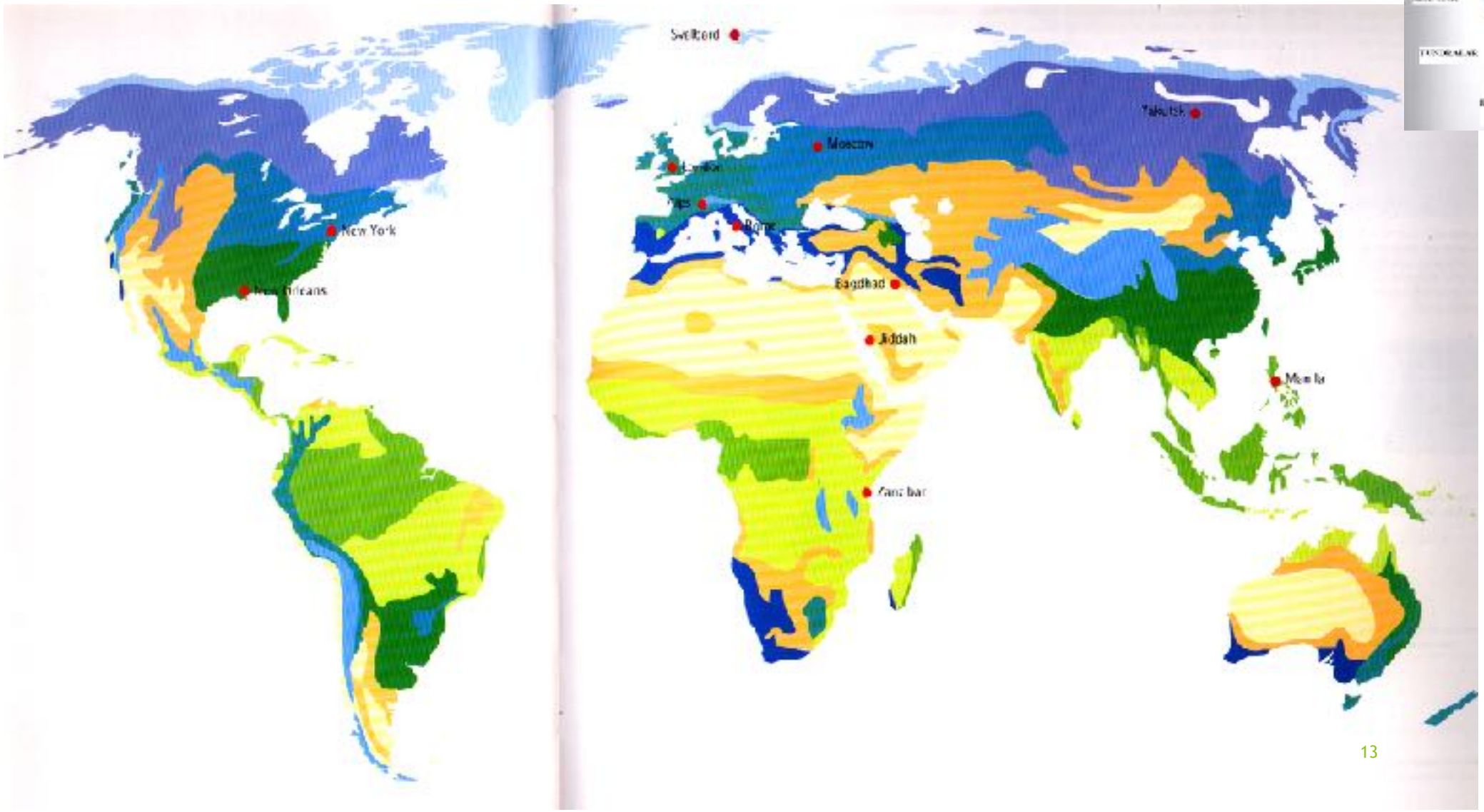
We need energy in buildings for

- Heating
- Cooling
- Moisture Balance

Renewable Energy is the most important resource to provide this needs

CLIMATE ZONES

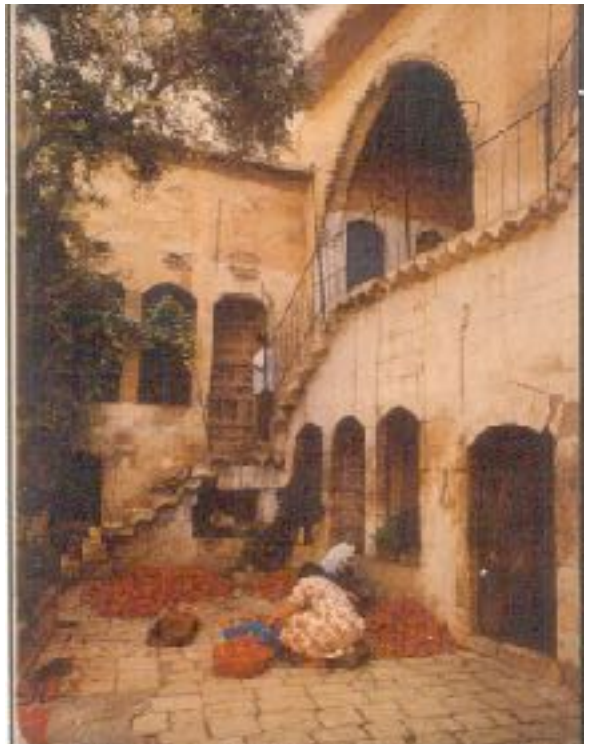




Türkiye Climate Map

TÜRKİYE İKLİM HARİTASI

CLIMATE FRIENDLY & ENERGY EFFICIENT EXAMPLES OF LOCAL ARCHITECTURE



DİYARBAKIR

HARRAN

MUĞLA

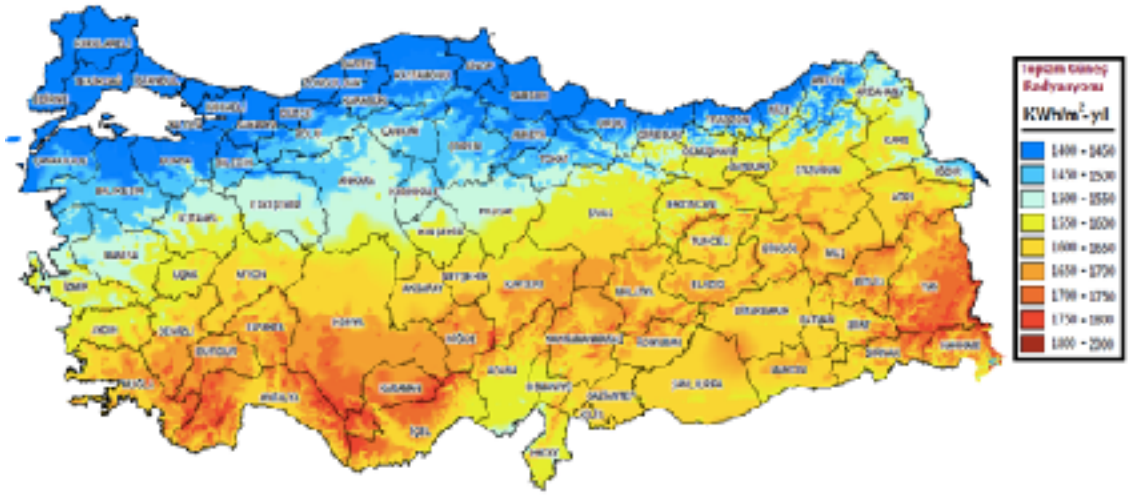
BLACKSEA REGION

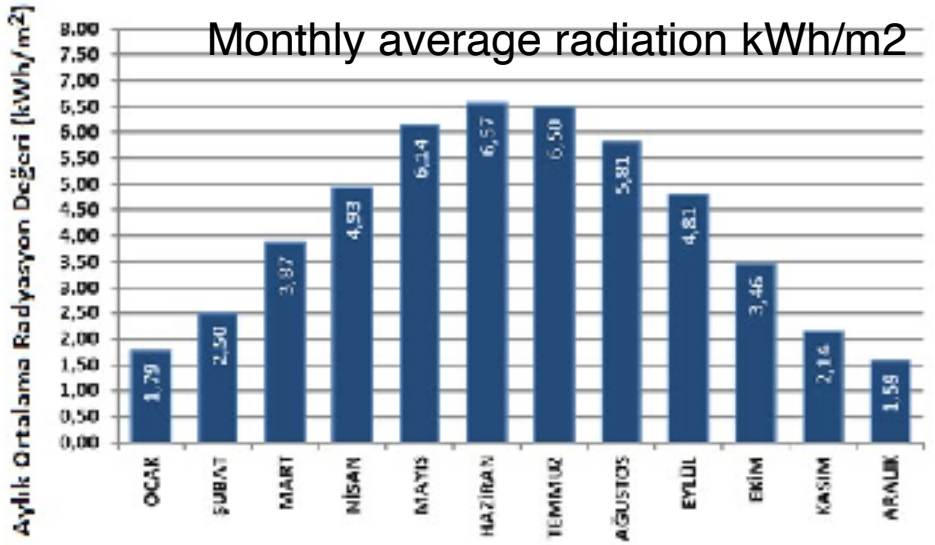
- Design for energy efficiency
- Material preferences

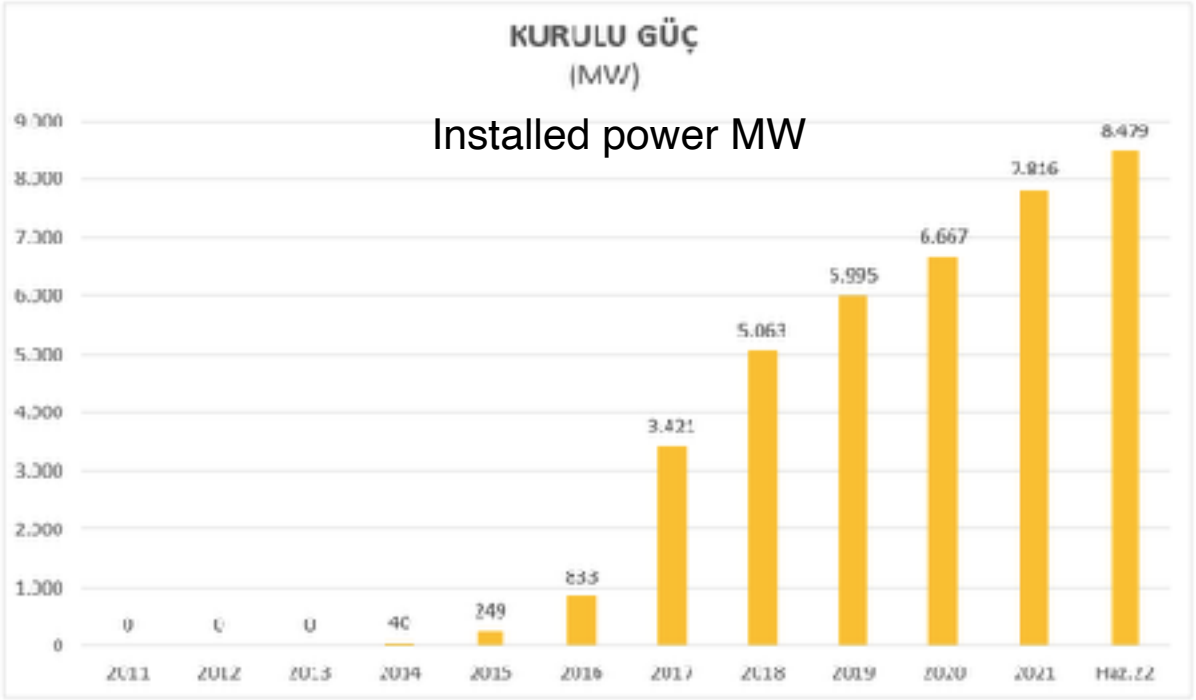
ANATOLIA & SUN

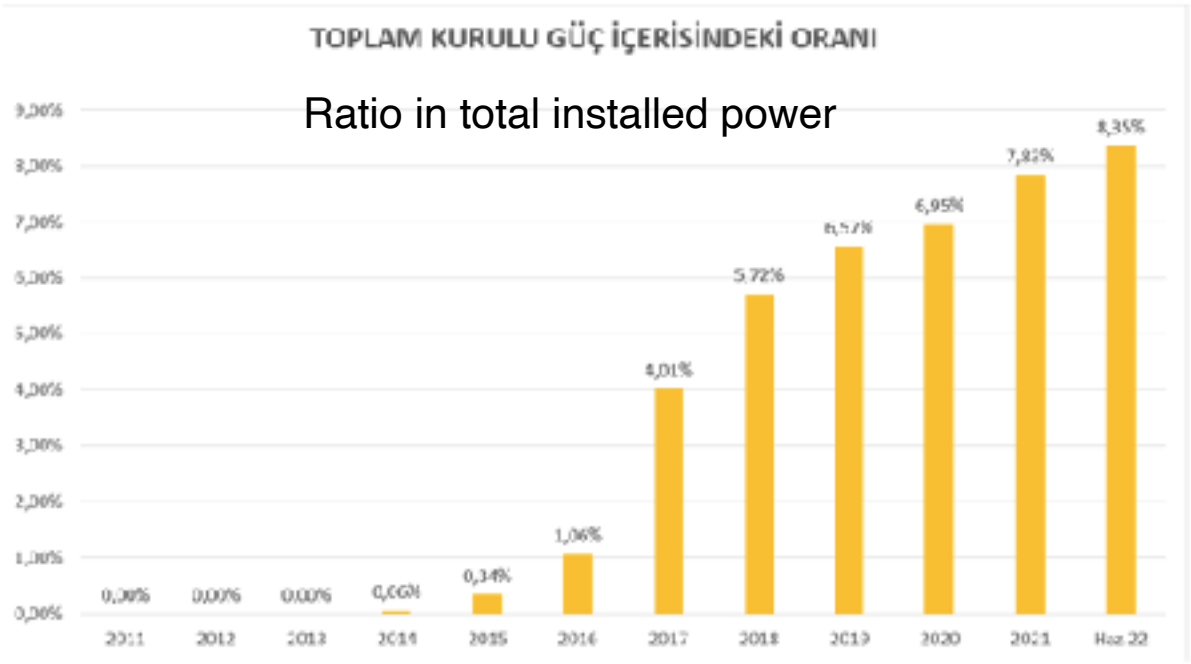
- Sun; Beginning with the Hittites, it has been important in all aspects of life, agriculture and architecture in all Anatolian culture.
- Turkey's location between 36-42 degree North latitudes is also an advantage in terms of solar energy use.
- Türkiye is located in a very suitable region for passive solar energy use.
- Obtaining hot water from collectors is very common, especially in the Aegean and Mediterranean regions.
- Energy production from PVs has come to the fore in recent years.

SOLAR ENERGY POTENTIAL OF TÜRKİYE



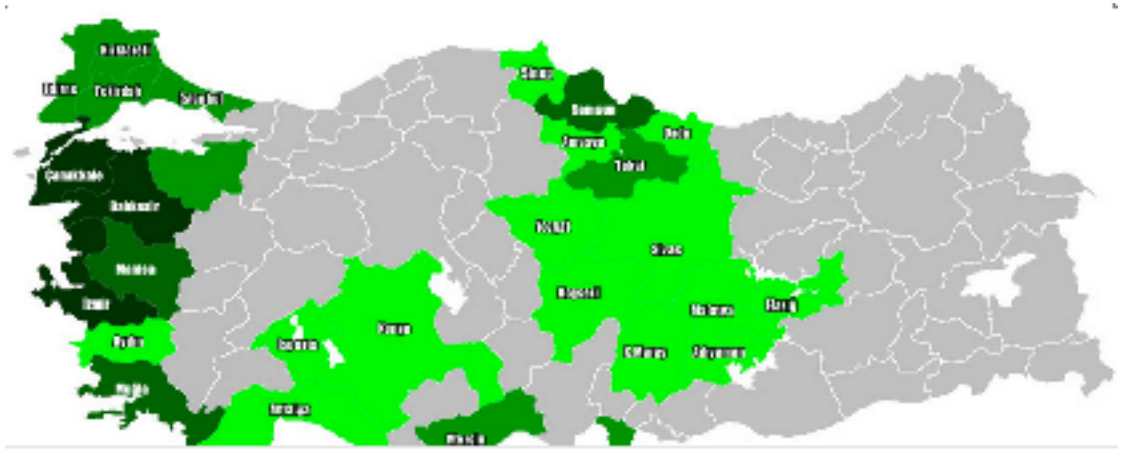


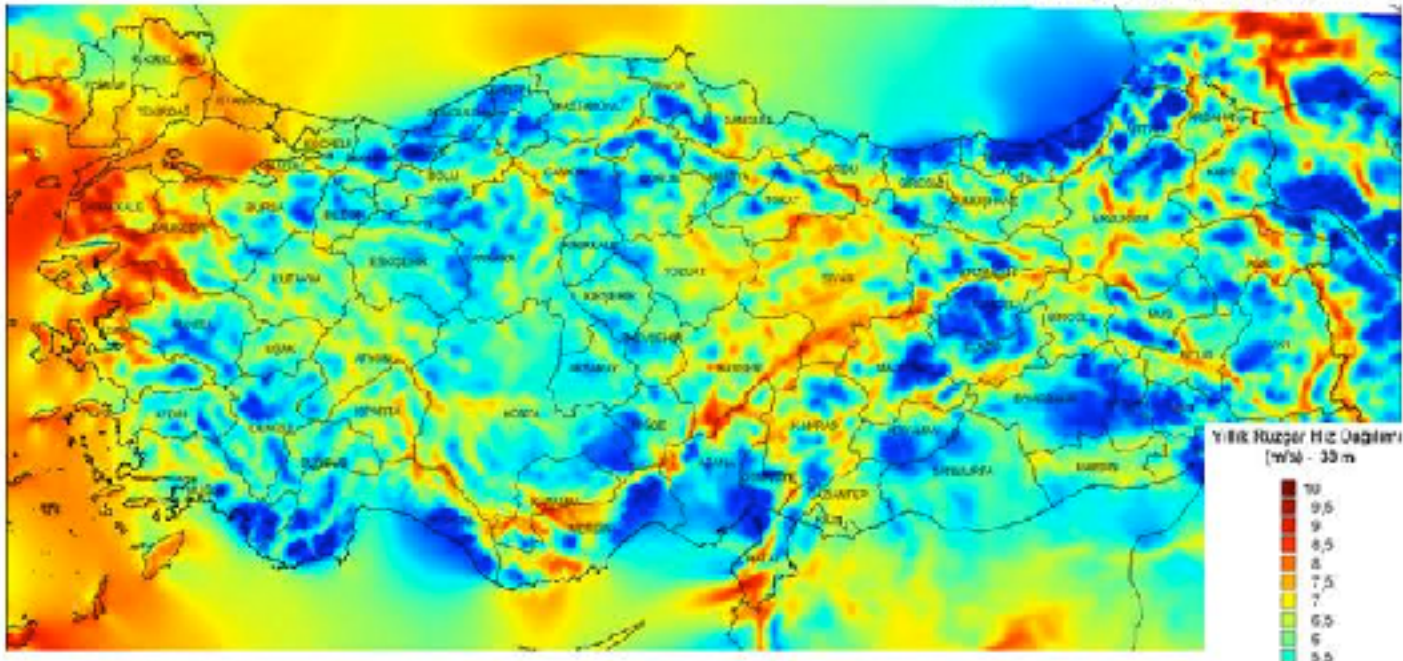




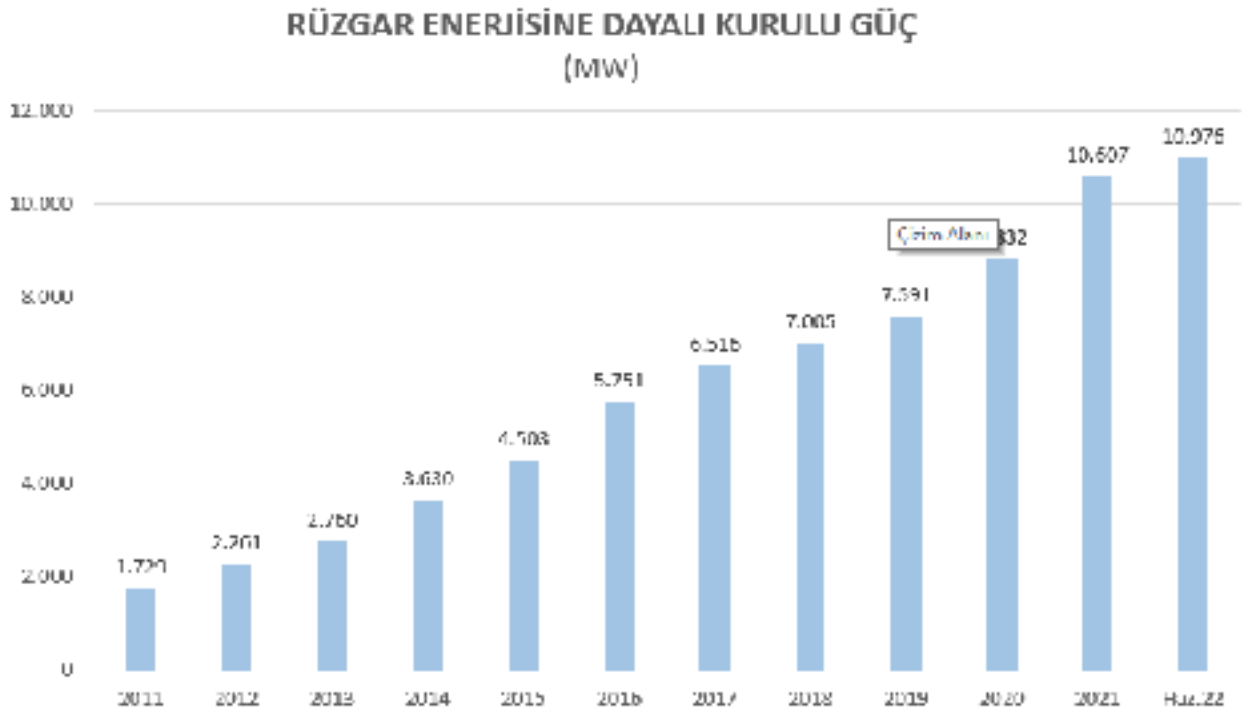
https://enerji.gov.tr/eigm-yenilenebilir-enerji-kaynaklar-gunes

WIND ENERGY POTENTIAL OF TÜRKİYE

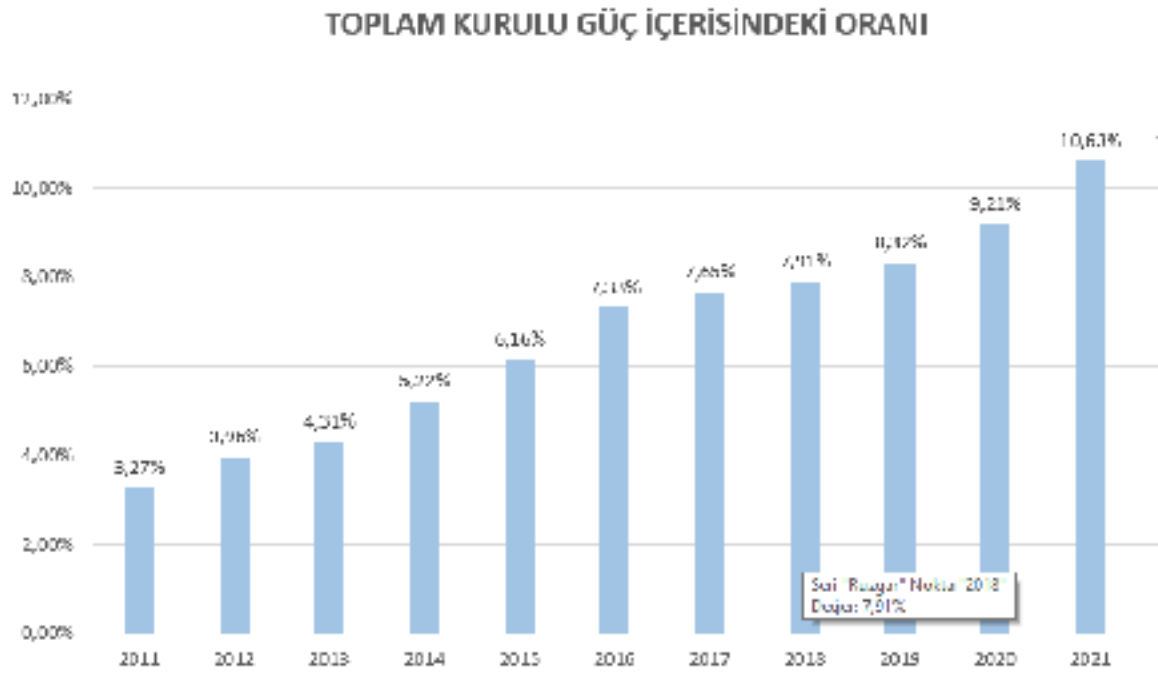




WIND ENERGY POTENTIAL OF TÜRKİYE



Installed power



Ratio in total installed power

https://enerji.gov.tr/eigm-yenilenebilir-enerji-kaynaklar-ruzgar

PEARL RIVER TOWER

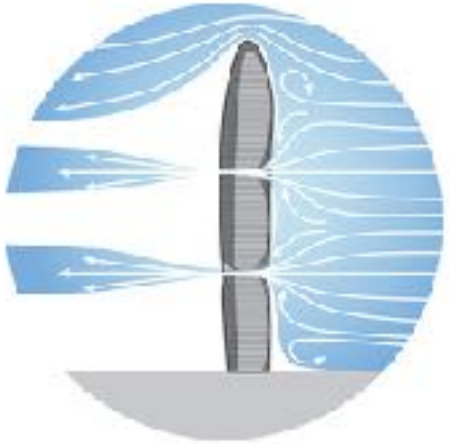
GUANGZHOU, CHINE

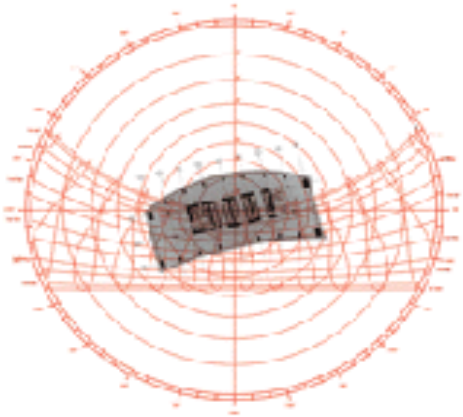
It has been designed with passive heating, cooling and ventilation systems, keeping energy conservation in the foreground.

It produces its own energy, by wind turbines, solar cells integrated into the façade, and electric energy is obtained with fuel cells.

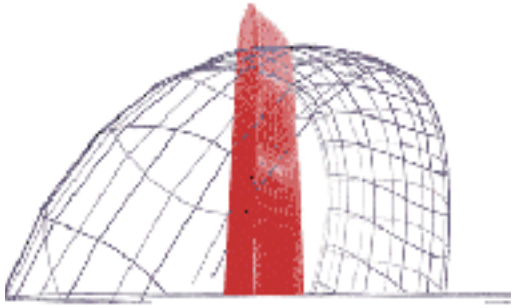
Hot water production is done with solar collectors.

ZEB





Sun Path Diagram Plan

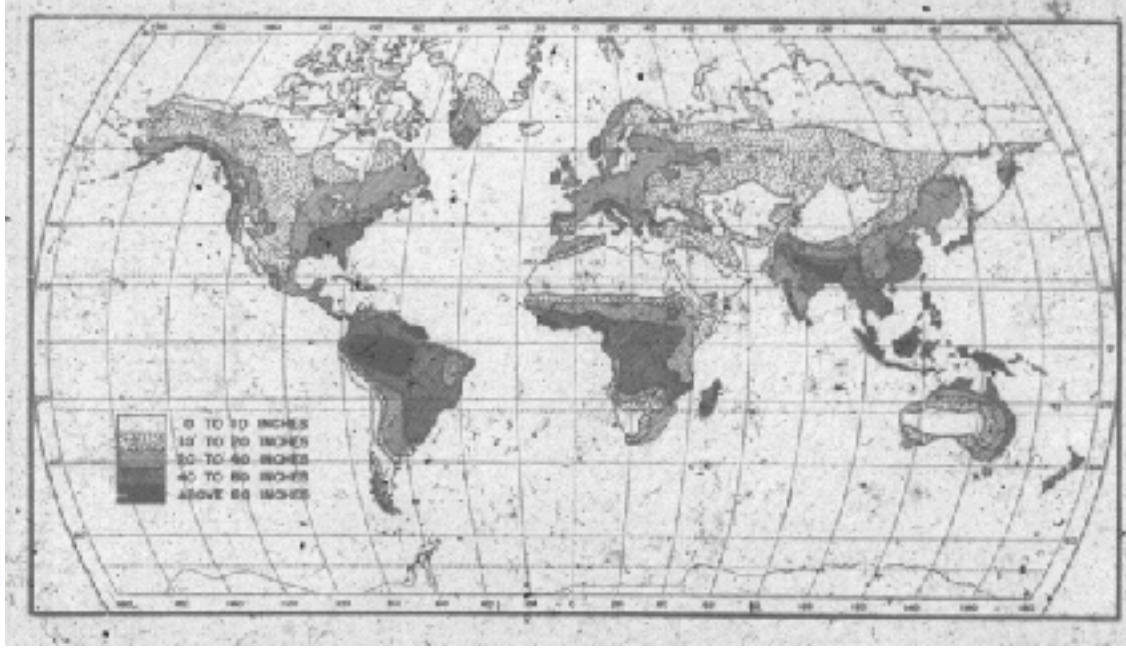


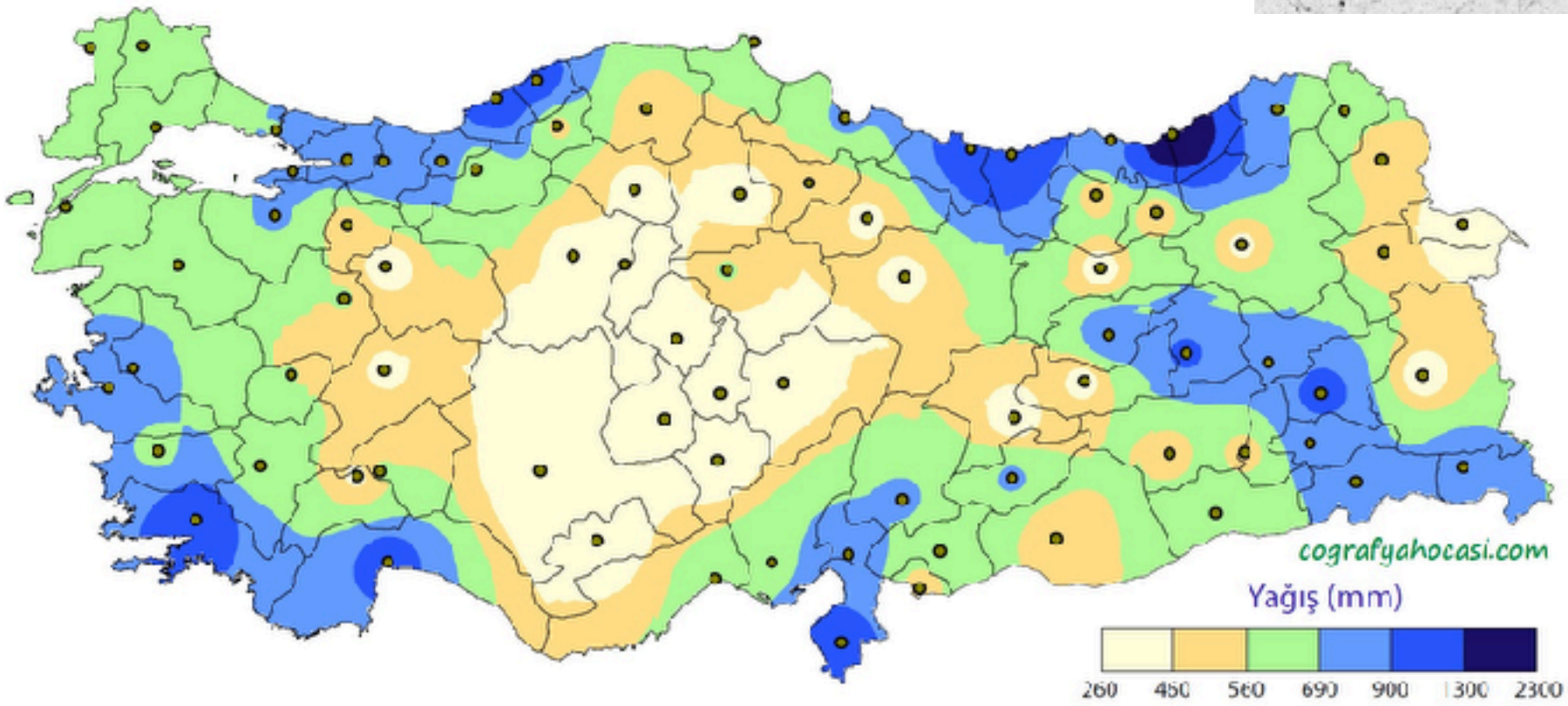
Sun Path Diagram

https://windside.com/pearl-river-tower/578-prt_wind_flow_through_side/

https://global.ctbuh.org/resources/papers/download/453-case-study-pearl-river-tower-guangzhou-china.pdf

Türkiye Annual Average Precipitation Map



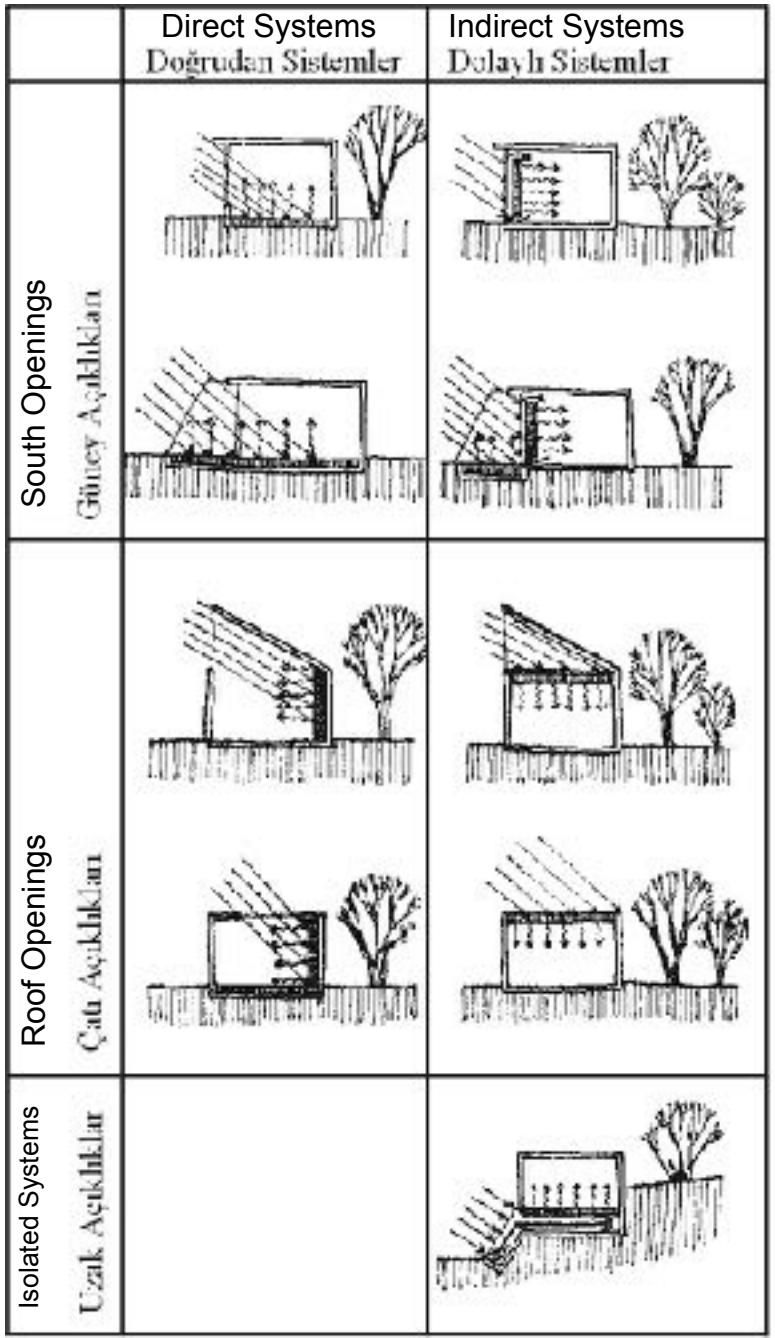


Renewable Energy Installed Power (MW) in TÜRKİYE

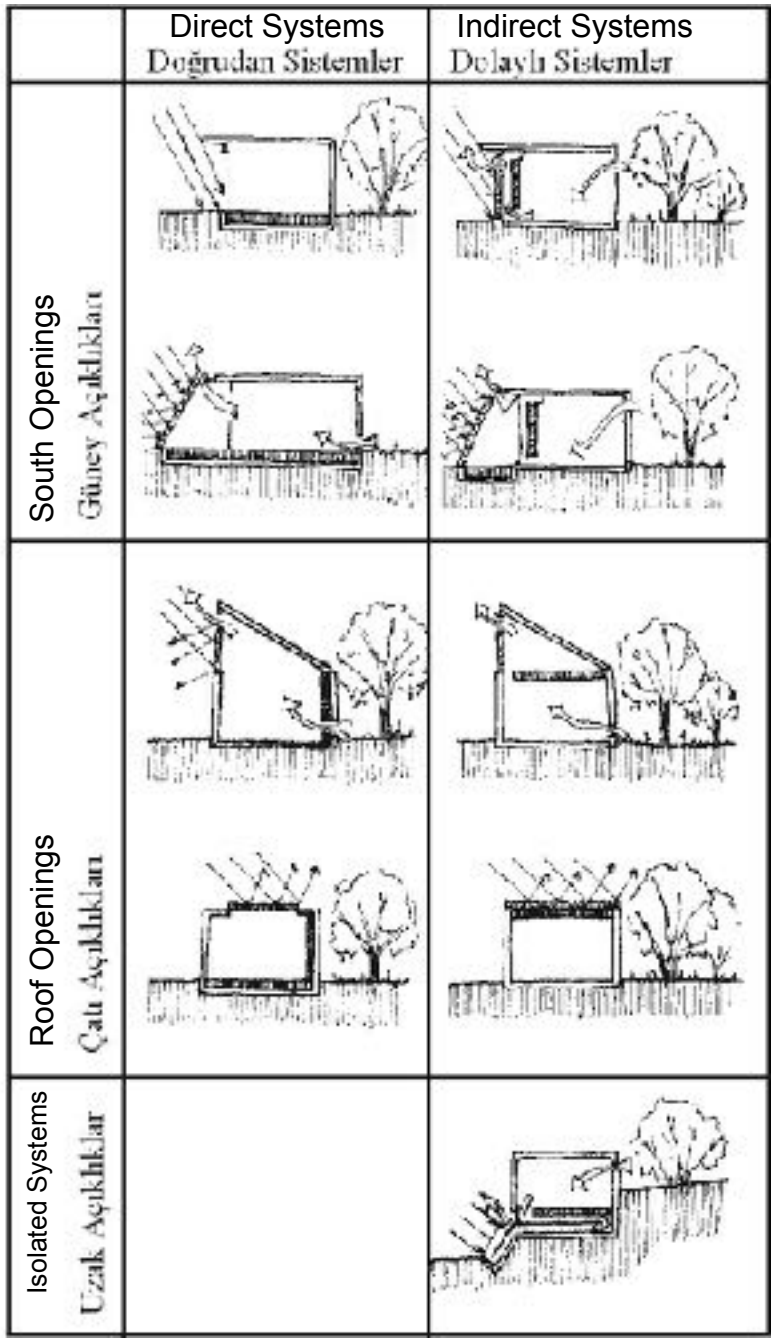
Kurulu Güç (MW)													
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Hidroelektrik	**21,0**	**929,7**	**246,2**	**598,2**	**2.116,3**	**9.960,0**	**11.096,3**	**11.706,4**	**12.588,5**	**12.446,3**	**13.095,0**	**11.793,0**	**7.648,8**
Akarsu	8,0	916,6	246,2	569,9	2.092,1	5.557,9	6.012,9	6.210,7	6.269,1	6.246,4	5.488,4	4.882,3	3.537,9
Rezervuar	13,0	13,0	0,0	28,2	24,3	4.402,1	5.083,4	5.495,7	6.319,4	6.199,9	7.606,6	6.910,7	4.110,8
Jeotermal	**72,4**	**72,4**	**140,4**	**227,8**	**389,9**	**599,2**	**752,1**	**996,8**	**1.252,7**	**1.503,0**	**1.578,6**	**1.709,8**	**1.641,8**
Rüzgar	**563,1**	**685,0**	**106,5**	**824,8**	**2.732,1**	**4.319,8**	**5.238,7**	**6.200,0**	**6.495,6**	**6.974,3**	**8.275,1**	**9.286,3**	**8.042,8**
Güneş	**0,0**	**0,0**	**51,8**	**0,0**	**0,0**	**0,0**	**12,9**	**13,9**	**81,7**	**174,9**	**396,4**	**468,8**	**468,8**
Fotovoltaik	0,0	0,0	51,8	0,0	0,0	0,0	12,9	13,9	81,7	174,9	396,4	468,8	468,8
Biyokütle	**56,6**	**73,4**	**101,6**	**139,7**	**185,2**	**203,7**	**300,0**	**349,2**	**503,1**	**778,7**	**1.223,2**	**2.266,1**	**2.220,3**
Atık	0,0	0,0	1,7	5,4	17,7	23,6	90,0	127,3	216,2	403,6	765,4	1.805,0	1.875,5
Biyogaz	22,6	0,0	0,5	43,8	59,2	60,0	22,9	24,1	30,8				341,6
Çöp	34,0	73,4	99,4	90,5	108,3	120,0	187,1	197,8	256,0	375,1	457,8	418,2	3,1
Enerji Bitkisi	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0			42,9	0,0
Genel Toplam	**713,1**	**1.760,4**	**646,6**	**1.790,4**	**5.423,6**	**15.082,7**	**17.399,9**	**19.266,3**	**20.921,5**	**21.877,2**	**24.568,4**	**25.524,0**	**20.022,5**

https://www.mmo.org.tr/sites/default/files/gonderi_dosya_ekleri/T%C3%BCrkiye%20Enerji%20G%C3%B6r%C3%BCn%C3%BCm%C3%BC%202023_Sunum_May%C4%B1s%202023.pdf

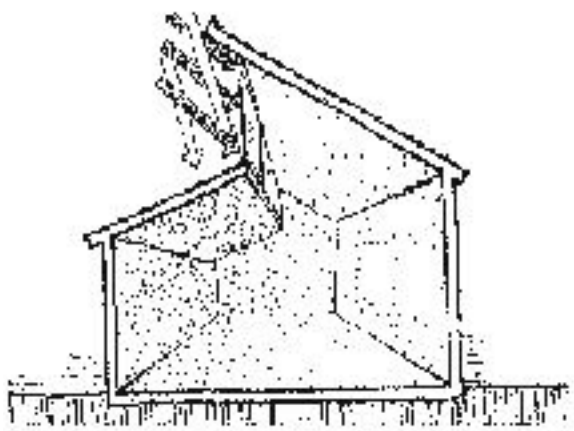
Passive Solar Heating

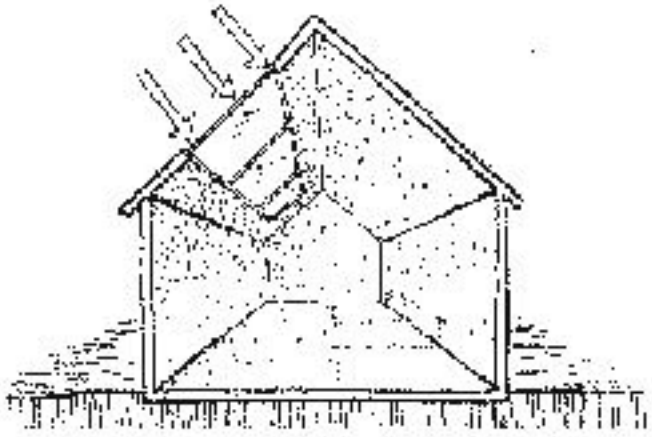


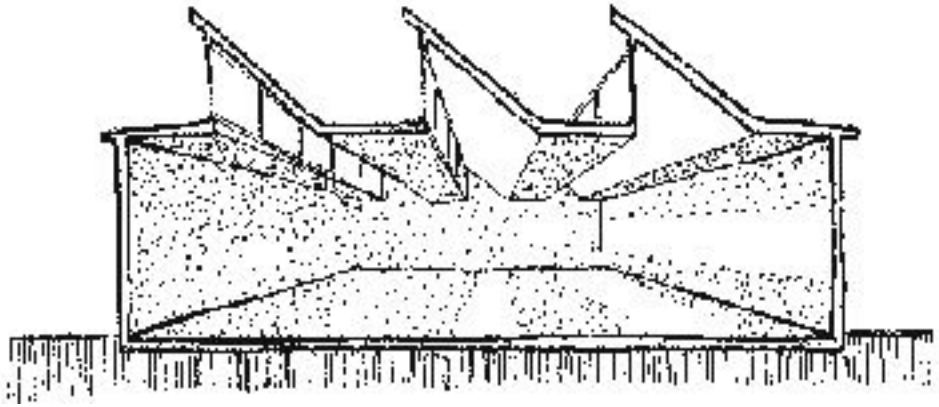
Passive Solar Cooling



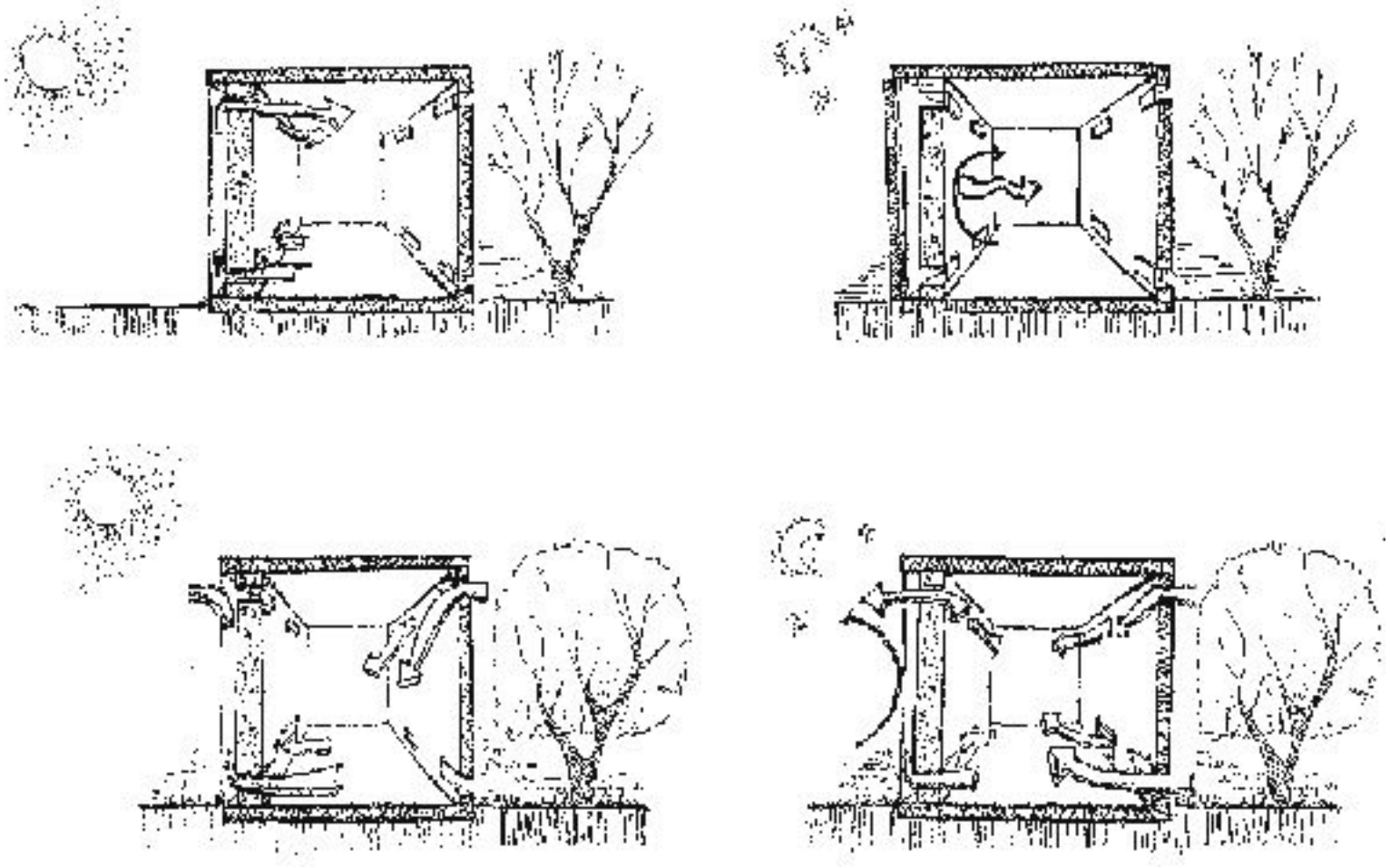
SOLAR ROOF





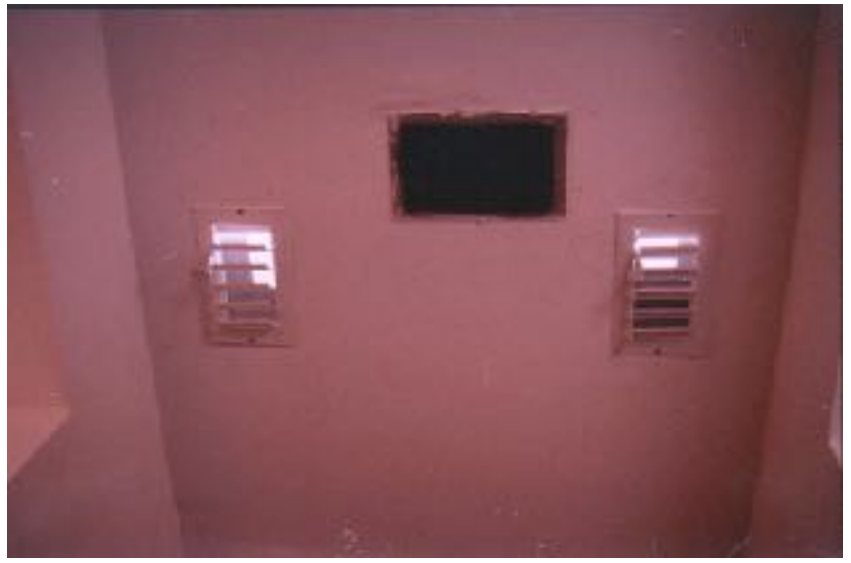


TROMBE WALL



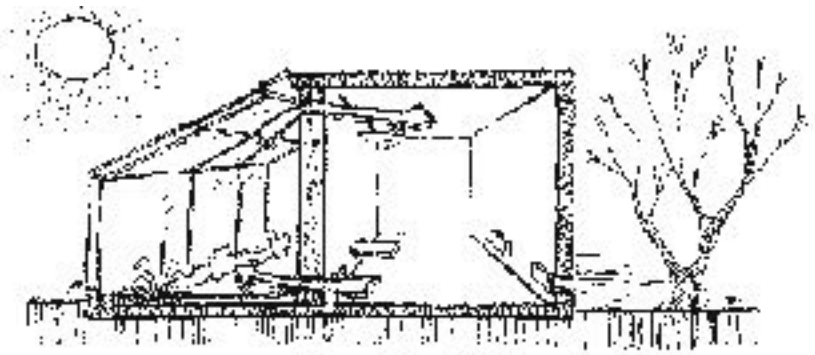
Trombe duvarı kış ve yaz - gündüz ve gece çalışma ilkesi
(sol üst kış gündüz, sağ üst kış gece - sol alt yaz gündüz ve sağ alt yaz gece)

Antalya – Saklıkent National Observatory Guesthouse - Trombe Wall

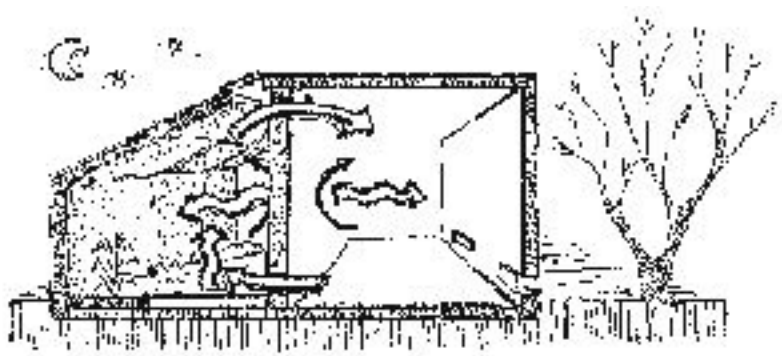


Inside view of the air valve of the trombe wall

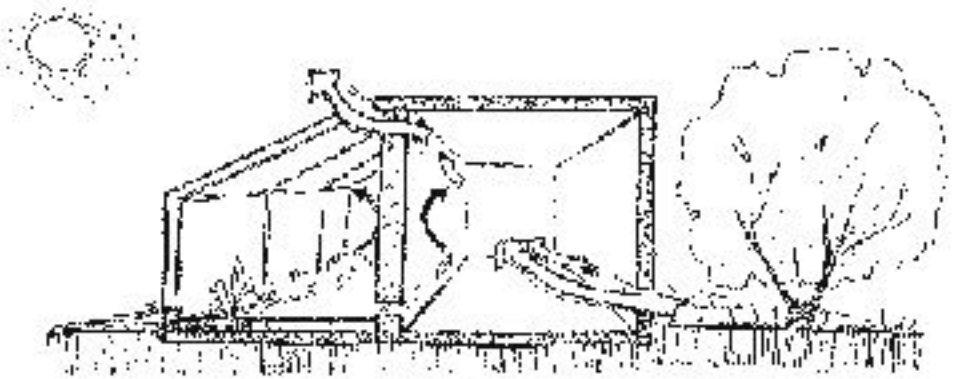
Trombe Wall with Greenhouse



Kış gündüzü



Kış gecesi



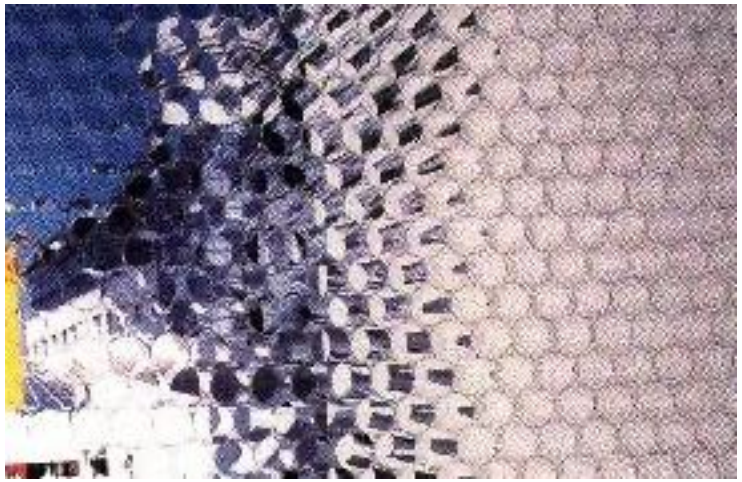
Yaz gündüzü ve gecesi

Antalya – Saklıkent National Observatory Guesthouse - Trombe Wall with Greenhouse

SOLAR WALLS

- This technique uses building surfaces that receive intense sunlight as solar walls.
- In this technique, the wall works like a collector and the heated air between the two walls is taken into the building.
- It is mostly applied in industrial buildings.
- Metal materials are used in the construction of these walls.

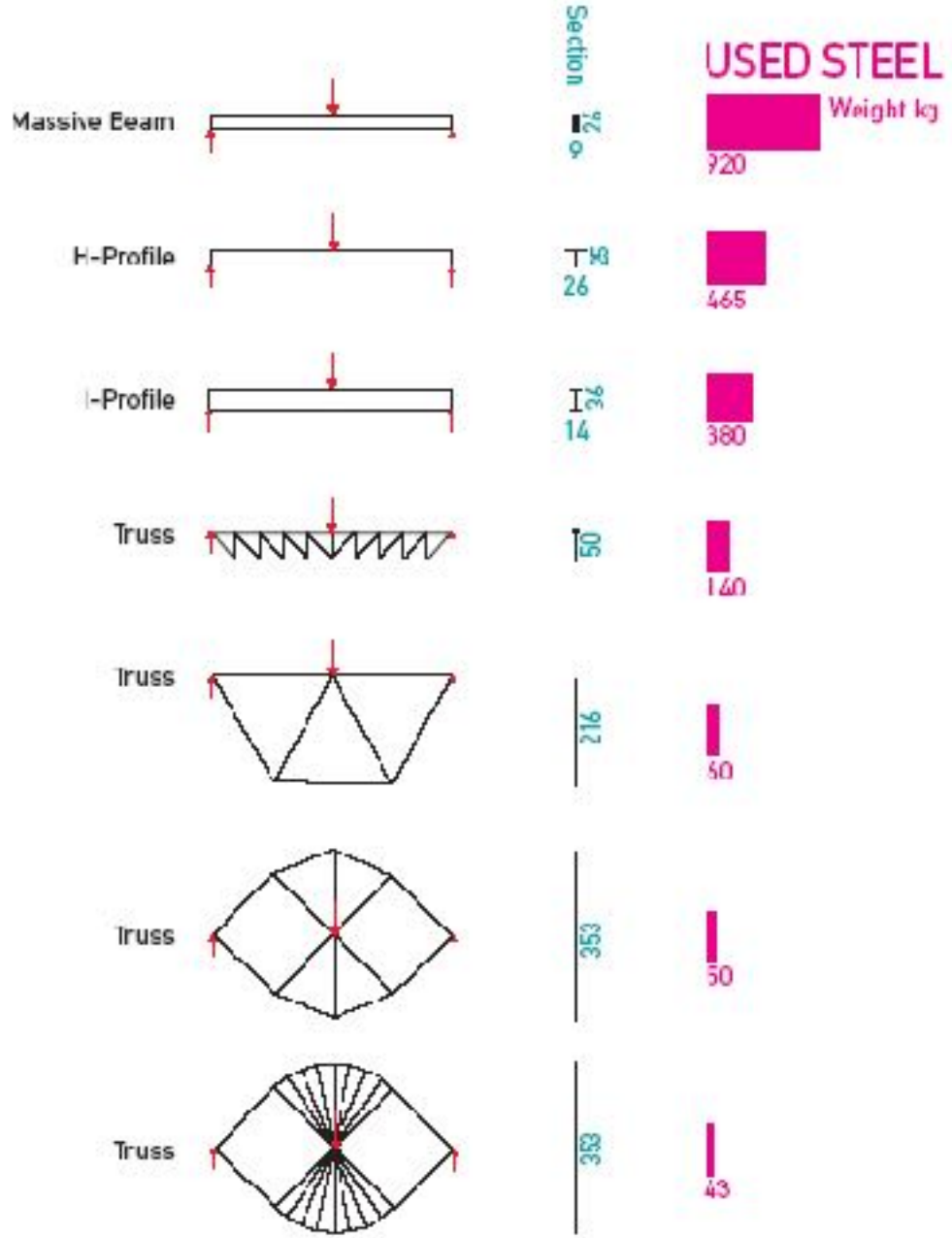
TRANSPARENT INSULATION



- With the developments in insulation material, it has been possible to use transparent insulation in buildings constructed in recent years.
- These materials, which allow light to be taken into the buildings, have an advantage as they do not let the incoming light out and transfer it to the other ends.

INSULATION

SAVING MATERIAL BY USING KNOWLEDGE



Amendment to the Regulation on Energy Performance in Buildings

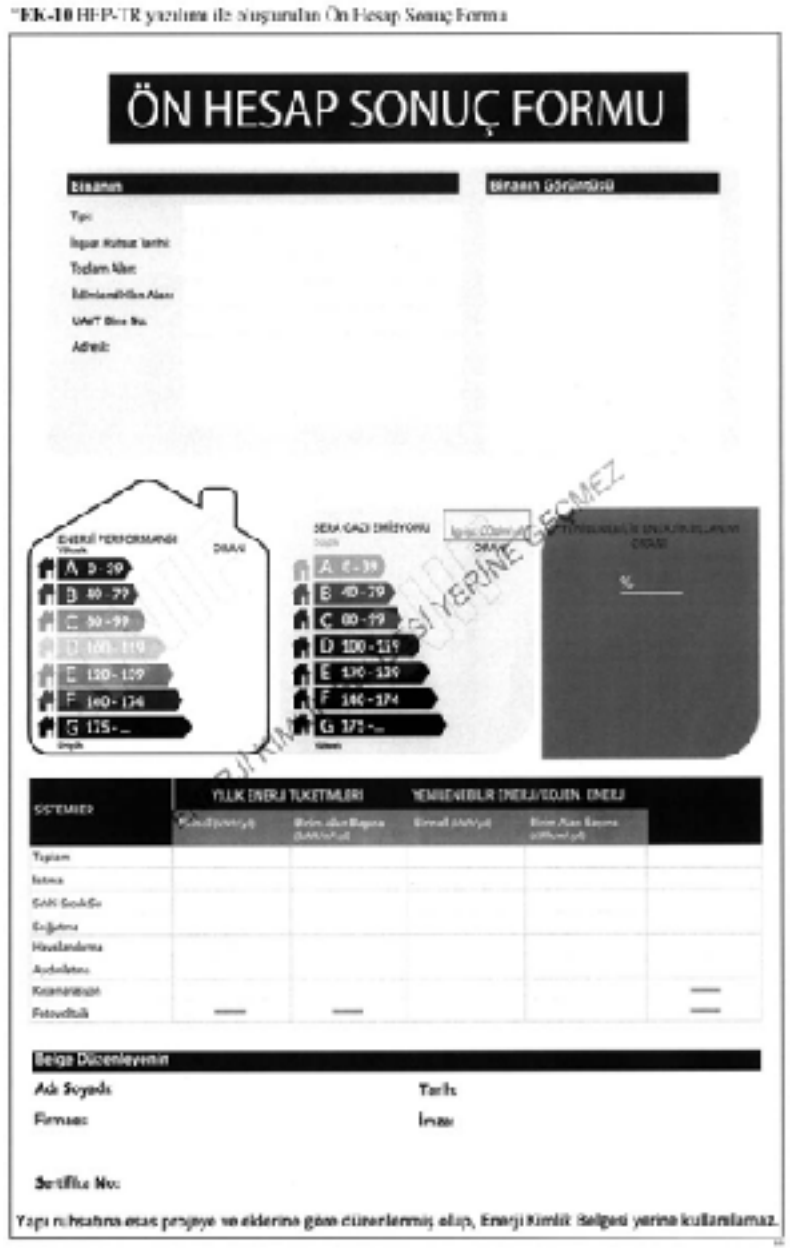
According to the regulation, 5% of the building's energy consumption between 2023 and 2025

From 2025, 10% will be met from renewable energy.

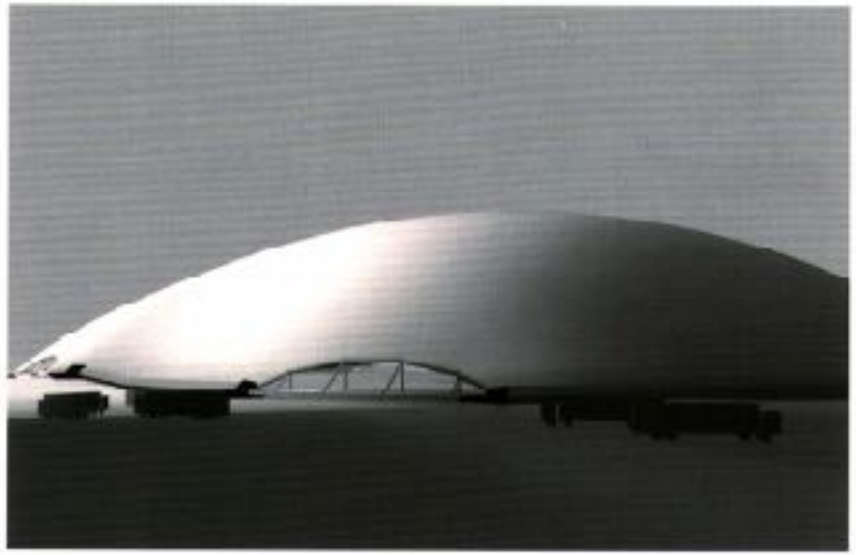
Again as of the same dates, it has become a necessity in constructions over 2000 m2 and 5000 m2.

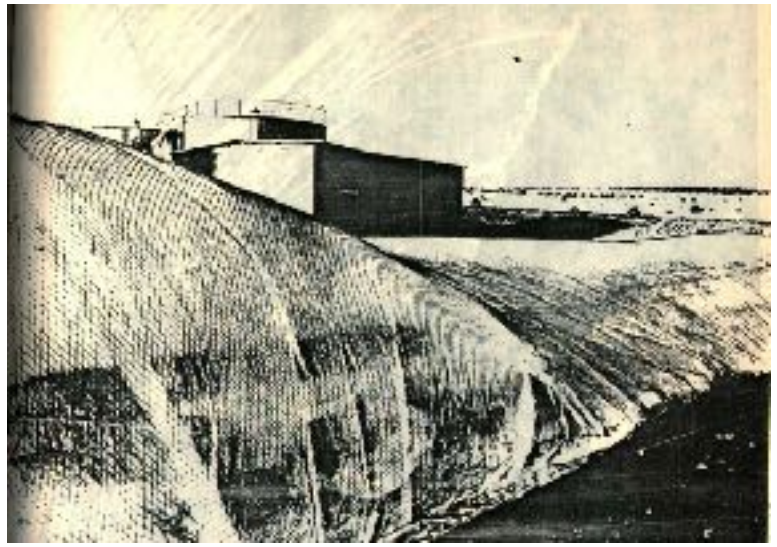
In addition, thermal insulation has been greatly increased. Buildings over 2000 m2 will be constructed as NSEB.

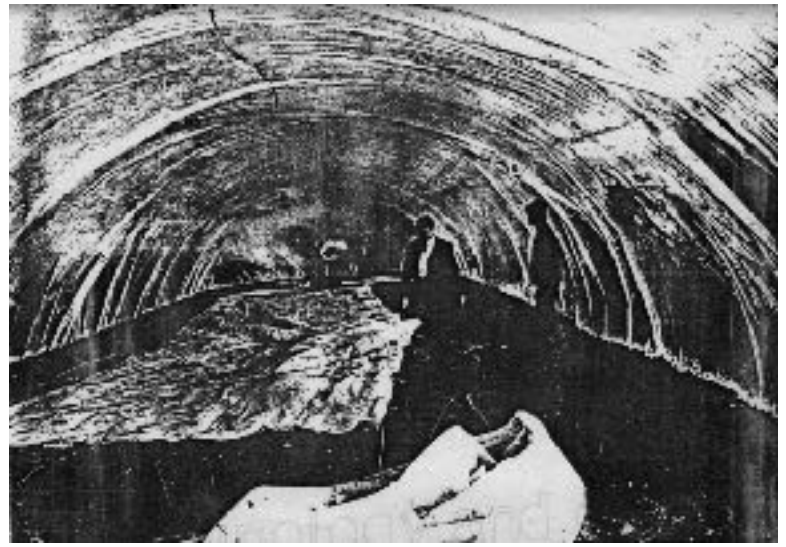
NSEB: Nearly Zero Energy (consuming) Building

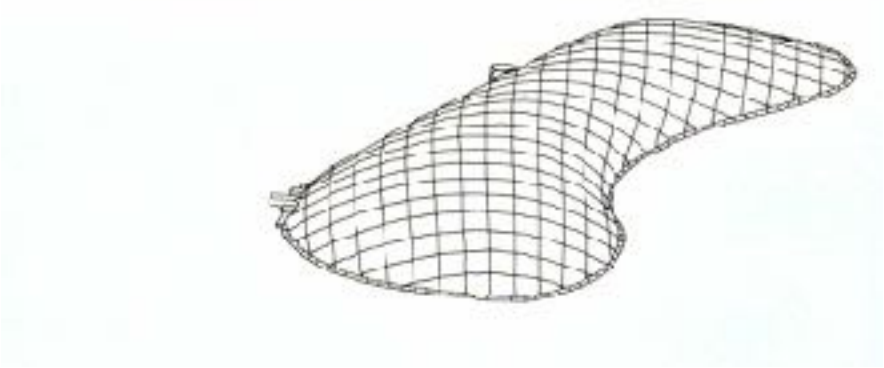


Minimum Footprint



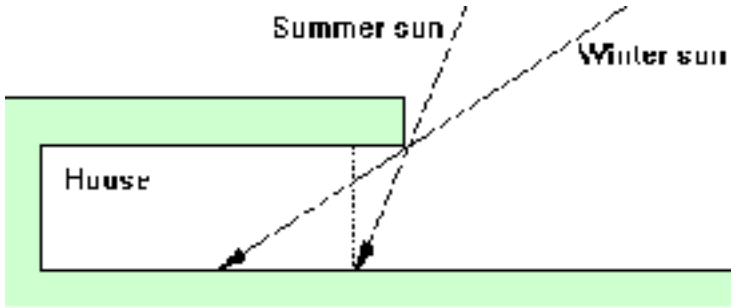






1972 - METU

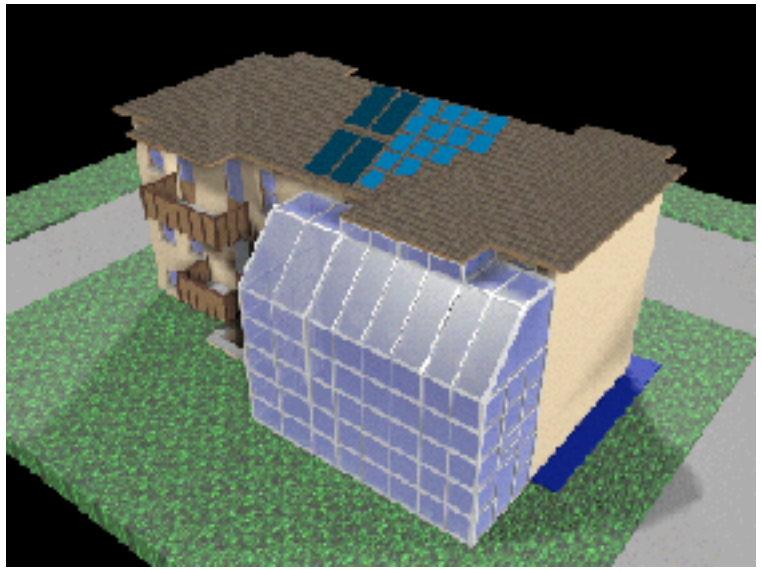
Durudeniz - Muğla

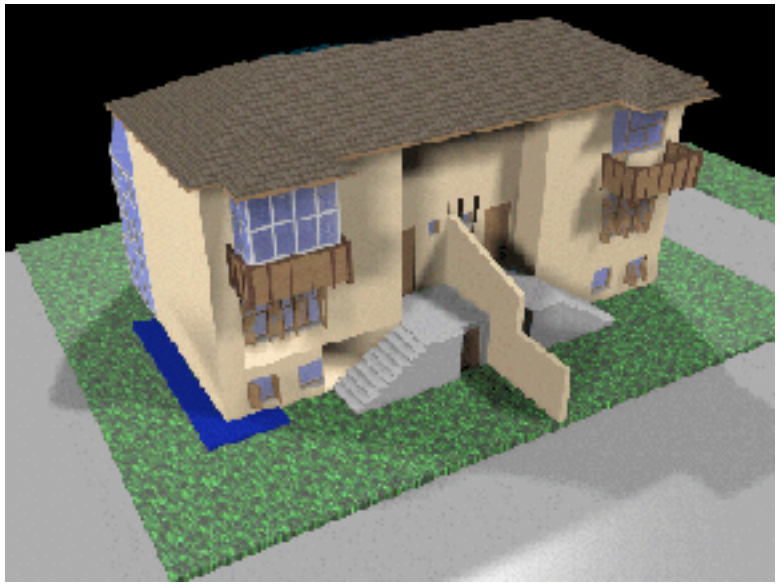


Bodrum İkizada Base Station

Wind&Solar Energy

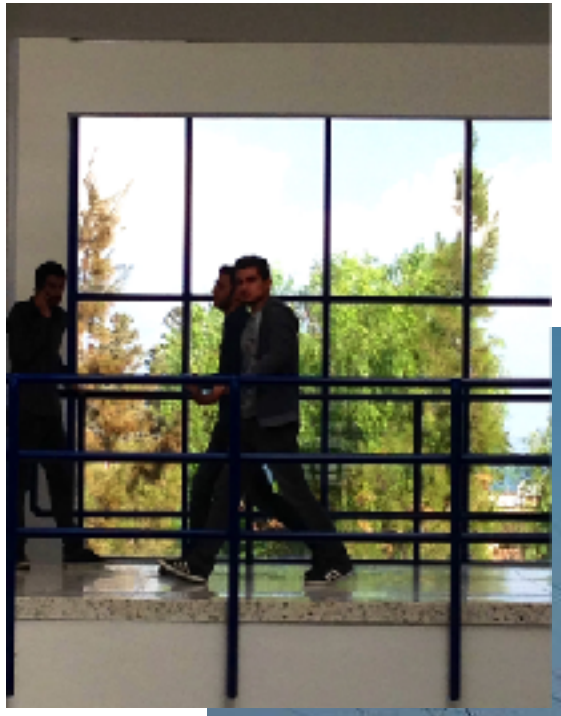
ECOLOGICAL RENEVATION
PASSIVE ENERGY USE





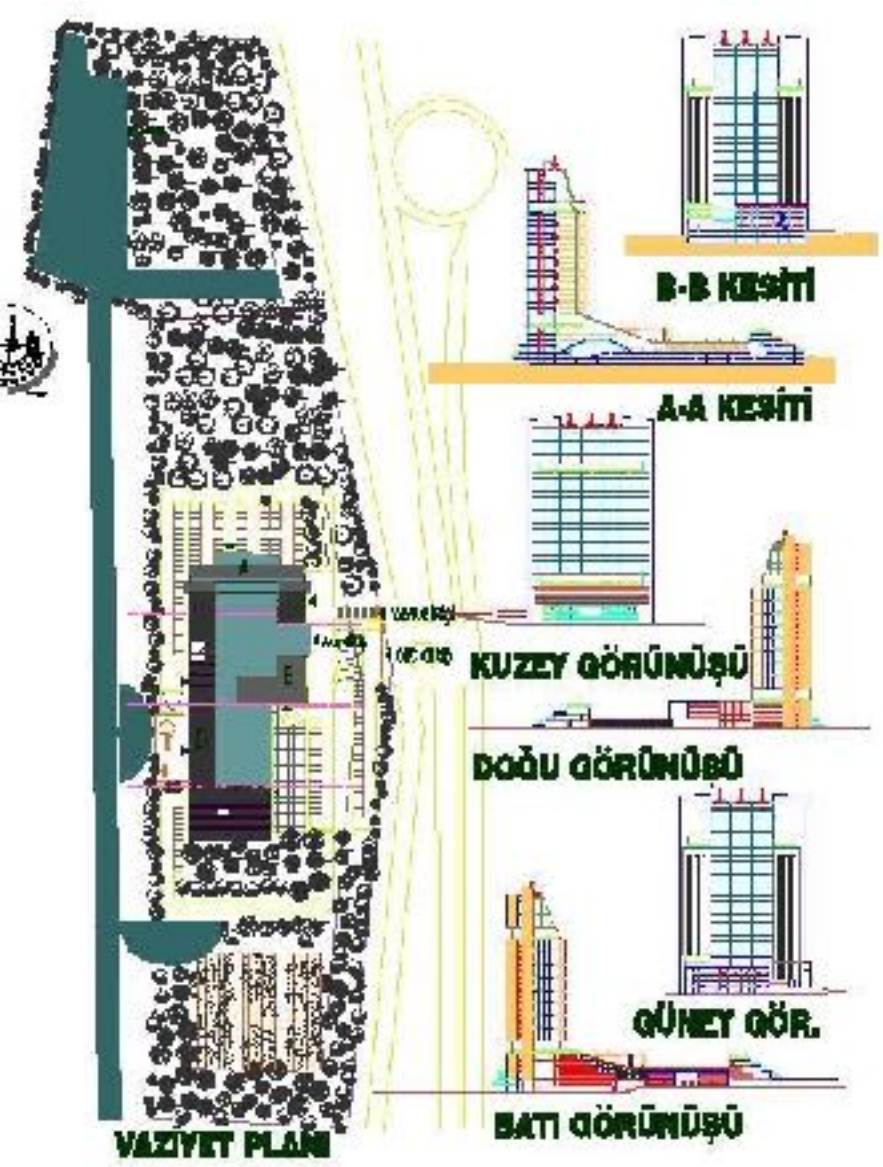
Özgür- Batıkent -1986

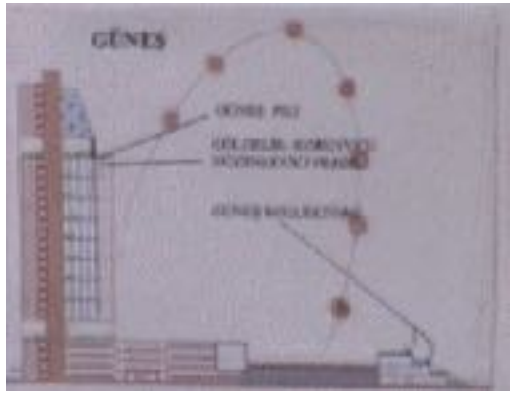
European University of Lefke
Prep. School - Energy Efficient Smart Building

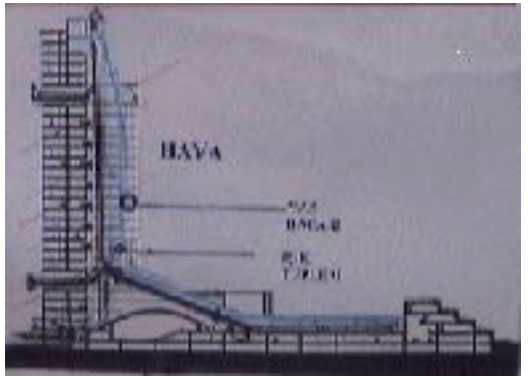


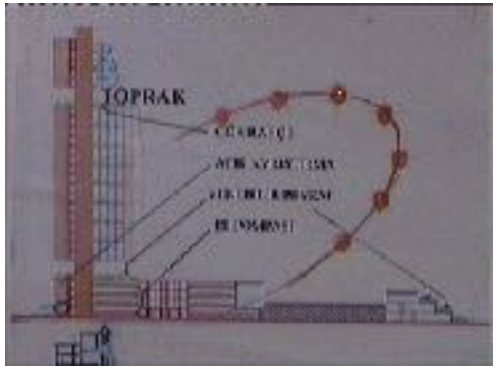
- right orientation
- shading devices

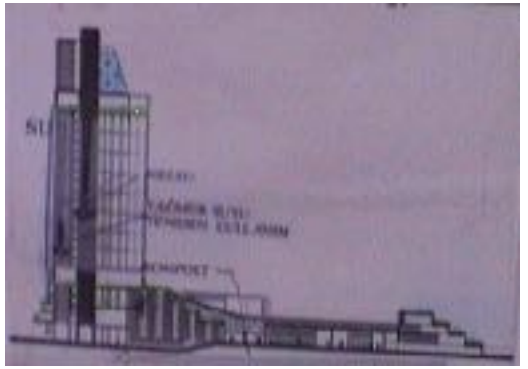
Ministry of Environment - Design Competition





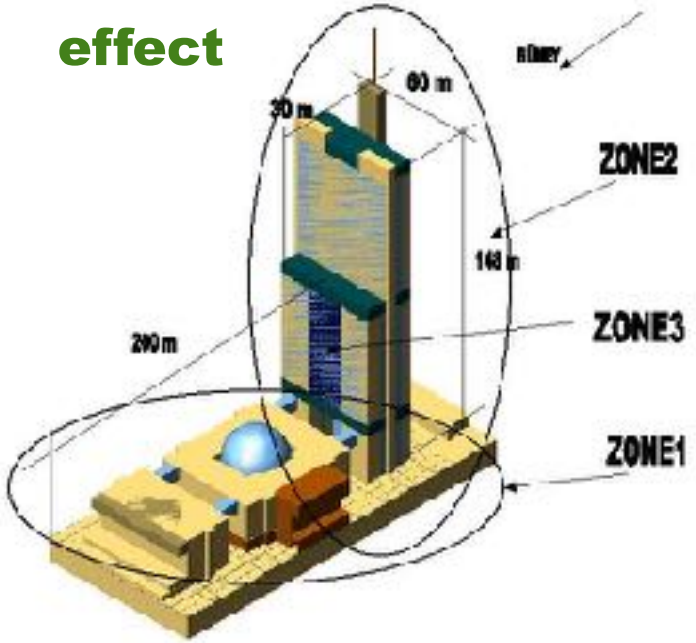




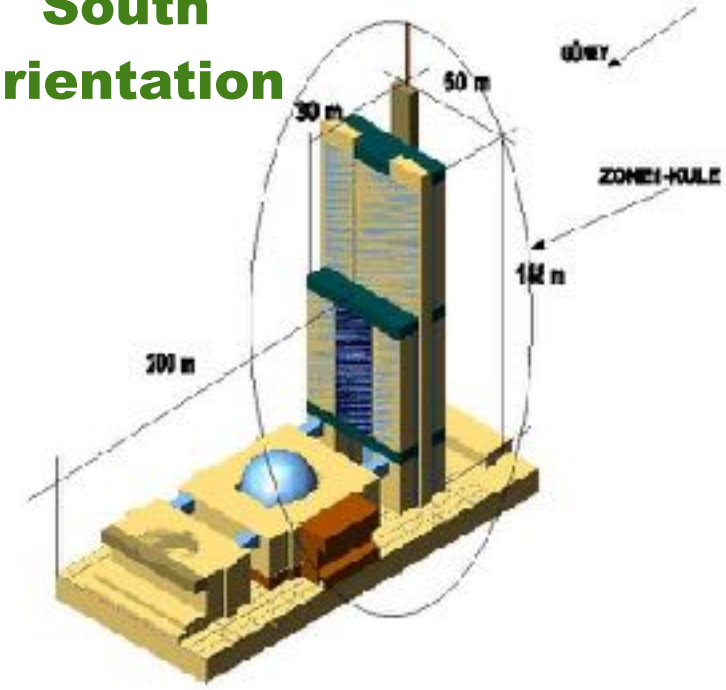


İstanbul Metropolitan Municipality - Design Competition

Greenhouse effect

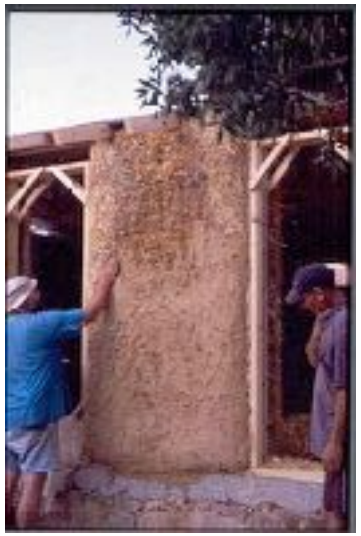


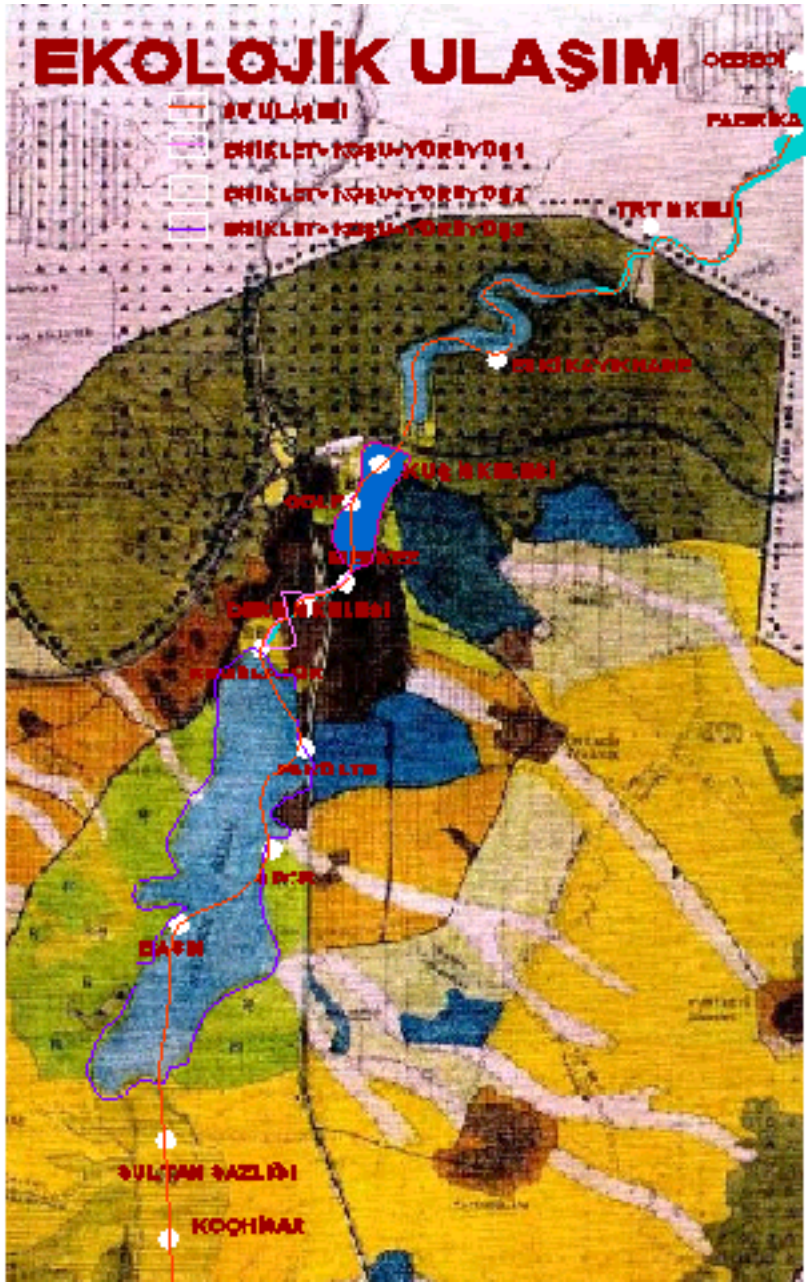
South orientation



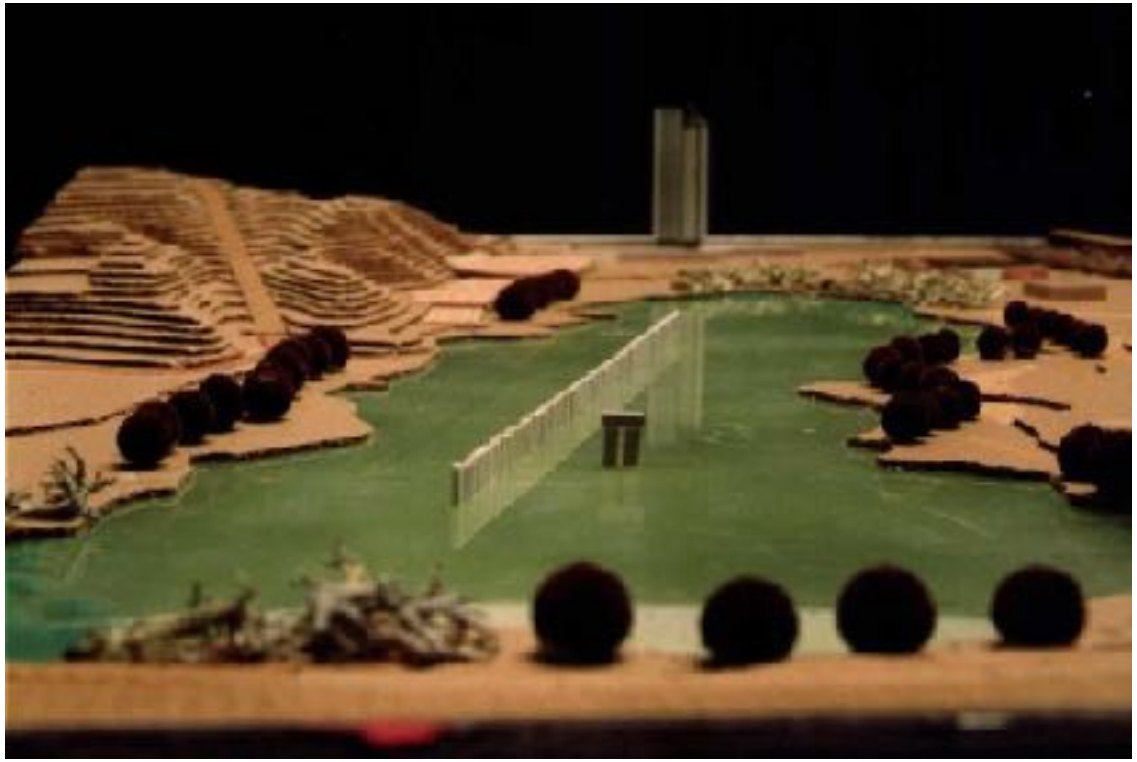
13% gain from passive design

SUPER INSULATION STRAWBALE 2000 - HASANDEDE

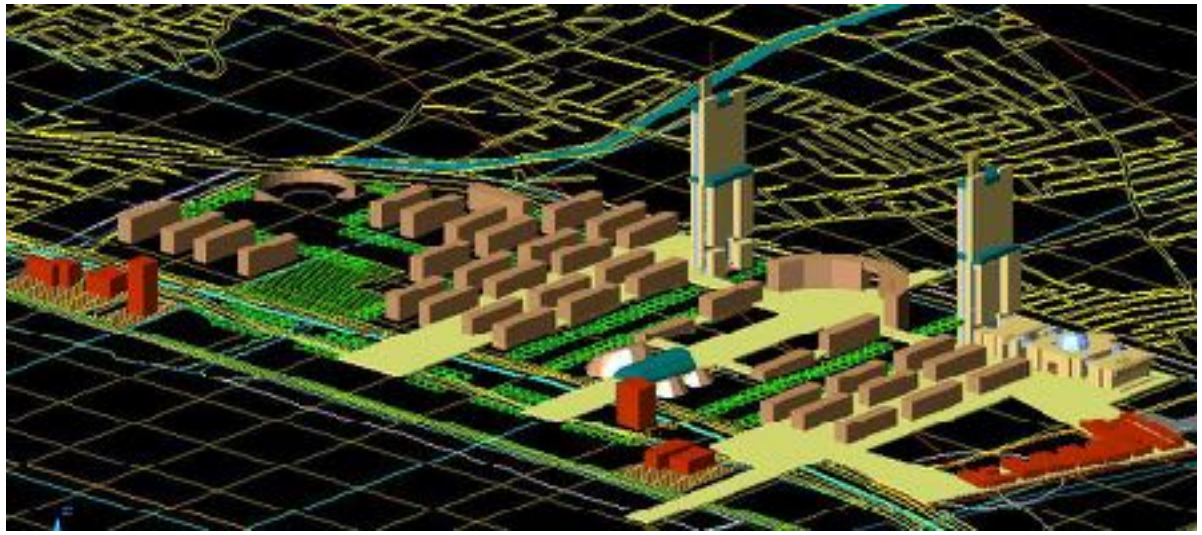


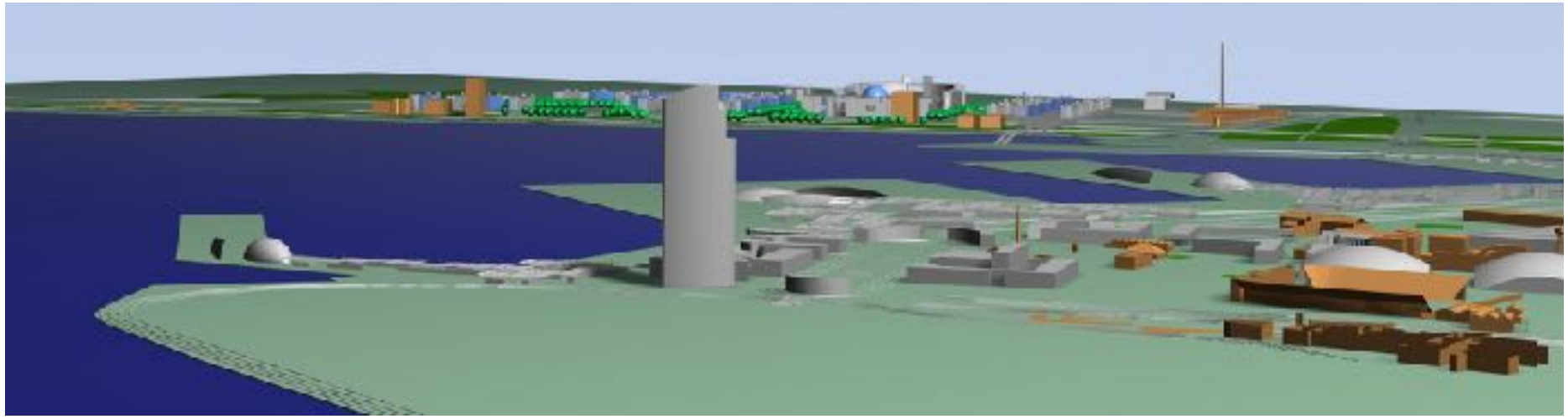


GÖLBAŞI - COMPETITION

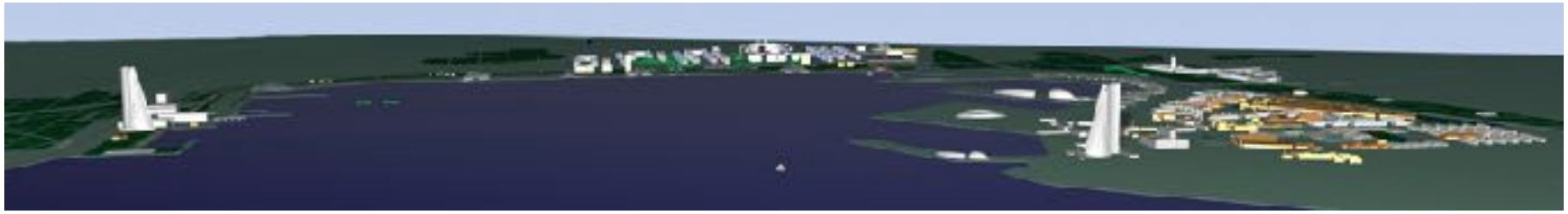


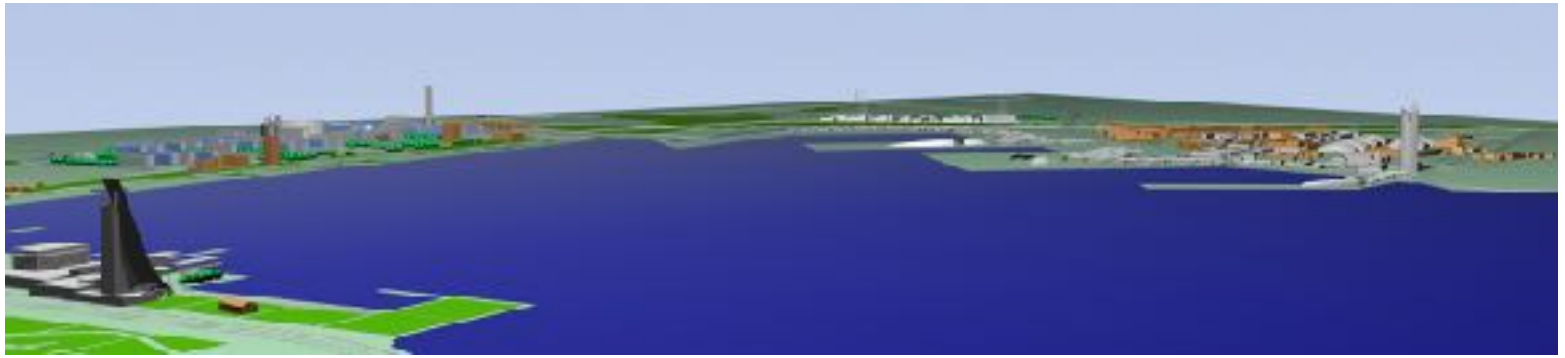
İzmir - Urban Design Competition
Passive design for solar and wind planning





İzmir - Urban Design Competition





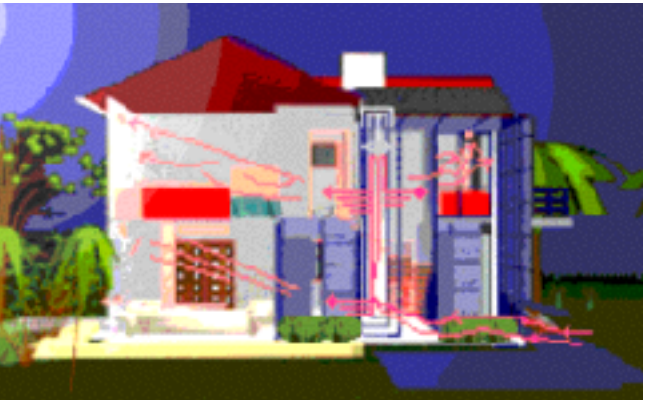
- ALTERNATIVE TRANSPORTATION ON THE LAND & SEA

Renewable Energy, Carbon Emissions & Buildings

- Buildings use two-fifths of our planet's resources, and the UN's Global ABC report states that CO2 emissions produced by the buildings and construction industry are responsible for 38% of energy-related CO2 emissions. To stop the increase in CO2, we need to reduce emissions from buildings by 60% by 2050 compared to today.
- Zero-energy buildings, or more accurately, zero-carbon buildings, are the extreme point of this approach.

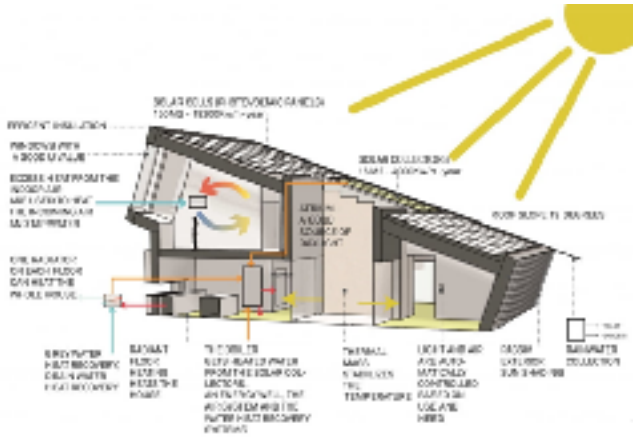
ZERO ENERGY BUILDINGS “ZEB”

https://yapidergisi.com/zeb-pilot-evi-norvec/



- passive design that evaluates climate inputs and natural data available in the environment,
- starting with super-insulated low-energy buildings that aim to maximize energy efficiency.
- It is known that it has developed in an evolutionary line based on ecological criteria and extending to high-performance buildings.

SEB strategies, which were first applied within the framework of residences, then started to give examples of successful applications in mass housing, even in skyscrapers and office towers.



ZEB (The Research Center on Zero Emission Buildings), Norway Plus House Larvik; Snøhetta,

What should be done?

- An effective environmental and building inspection system should be established.
- It should be ensured that future generations are brought up with good environmental education.
- Non-governmental organizations and public institutions should carry out joint studies.
- Planned city areas should be created instead of unplanned urbanizations.
- The use of Clean Energy should be ensured.
- Effective laws should be established by the state to prevent environmental problems.
- The main task of local and central governments should be the resolution of environmental problems.

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THANK YOU...