TMMOB MAKİNA MÜHENDİSLERİ ODASI

MAKİNA ÖĞRENME MERKEZİ

MAKİNA HANGAR

YAKLAŞIK SIFIR ENERJİLİ BİNALAR

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REMM Institute

EĞİTİM İÇERİĞİ

TMMOB MAKİNA MÜHENDİSLERİ ODASI

MAKİNA ÖĞRENME MERKEZİ

MAKİNA HANGAR

1 Küresel ısınmanın termodinamik boyutu

2 Termodinamiğin ikinci yasasının anlattıkları

3 Binalarda enerji tasarrufu ile sürdürülebilirlik yeterli mi?

4 Yaklaşık sıfır enerjili bina mı yaklaşık sıfır ekserjili bina mı ?

5 Güneş Enerjisi

6 Isı pompaları

7 İki yeşil bina örneği

8 Exergy star yeşil bina sertifikasyon sistemi

9 Sonuç ve öneriler

10 Soru ve cevaplar

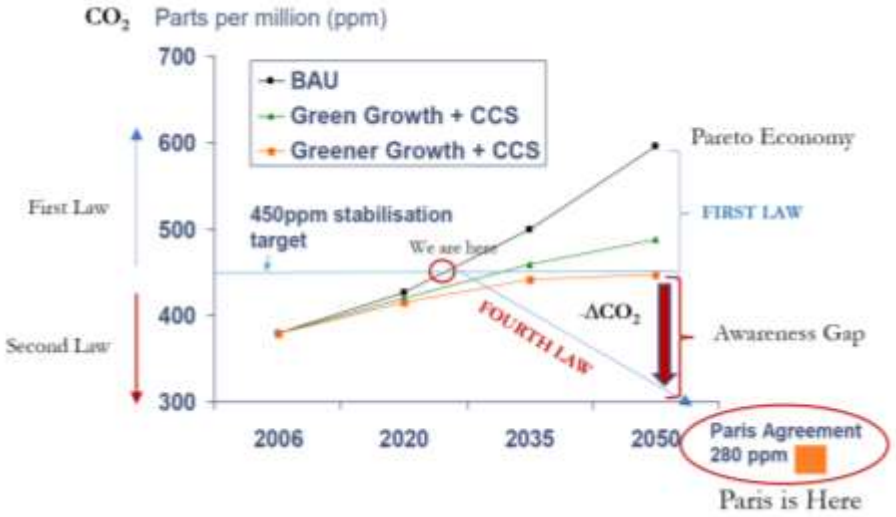
KÜRESEL ISINMANIN TERMODİNAMİK BOYUTU

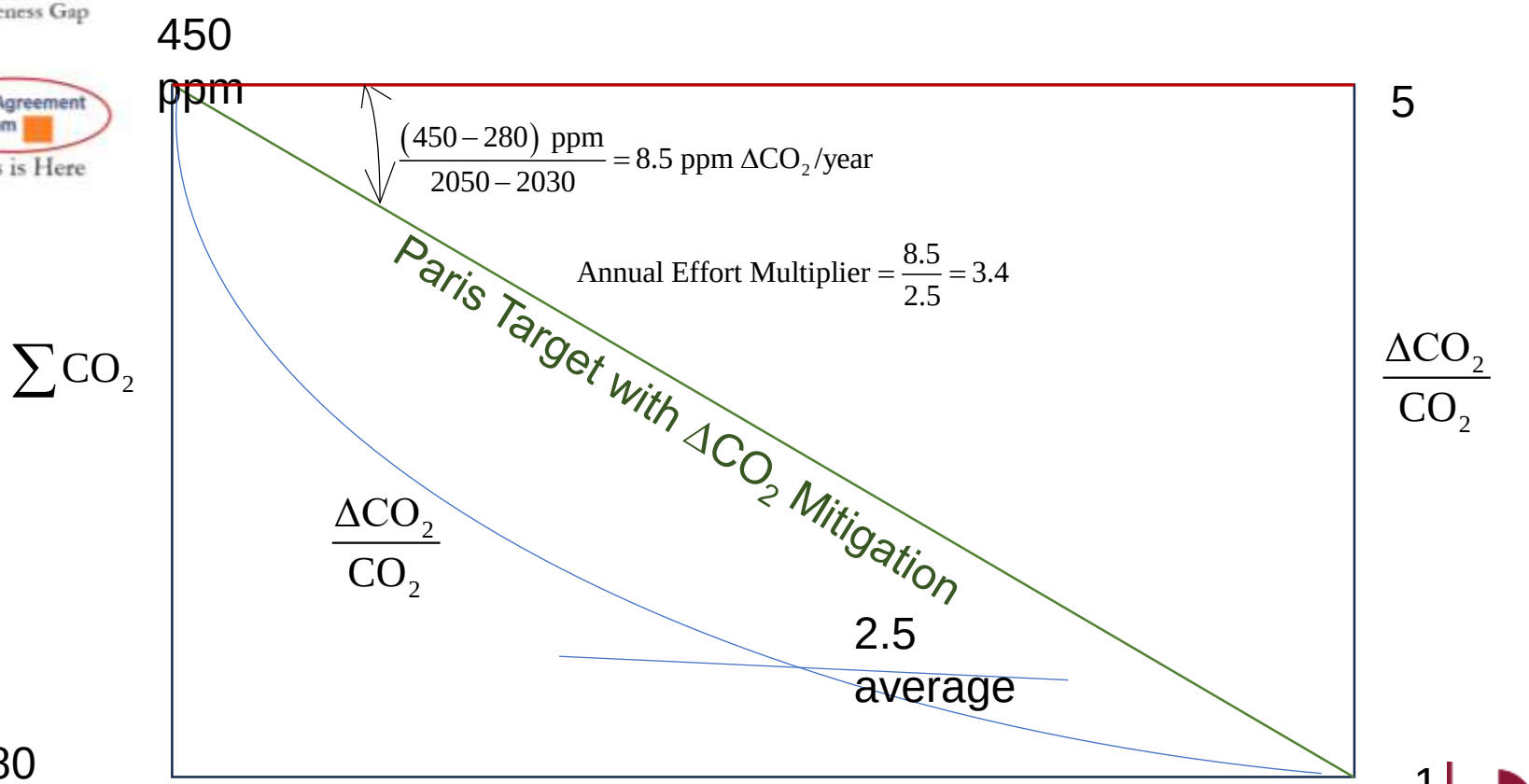
Niçin görmüyoruz?

$$\Delta CO_2 = k\varepsilon_{des}$$

BAU: Her zamanki senaryo
CCS: Karbon tutumu ve depolama
Green(er) Growth: Yeşil (daha yeşil) büyüme (Doğrusal Ekonomi ile)

NE YAPMALI?


CO2 Parts per million (ppm)
700
600
500
400
300
BAU
Green Growth + CCS
Greener Growth + CCS
Pareto Economy
First Law
FIRST LAW
450ppm stabilisation target
We are here
FOURTH LAW
ΔCO2
Awareness Gap
Second Law
2006
2020
2035
2050
Paris Agreement 280 ppm
Paris is Here


450 ppm
5
$\frac{(450-280)\ ppm}{2050-2030} = 8.5\ ppm\ \Delta CO_2/year$
Annual Effort Multiplier $= \frac{8.5}{2.5} = 3.4$
Paris Target with ΔCO_2 Mitigation
$\sum CO_2$
$\frac{\Delta CO_2}{CO_2}$
$\frac{\Delta CO_2}{CO_2}$
2.5
average
280 ppm
2030 Tipping Year
2050
1
Paris Agreement

YAKLAŞIK NET SIFIR ENERJİ BİNASI MI YOKSA YAKLAŞIK NET-SIFIR EKSERJİ BİNASI MI?

EKSERJİ NEDİR?

$$E_X < \left(1 - \frac{T_1}{T_2}\right) \times Q$$

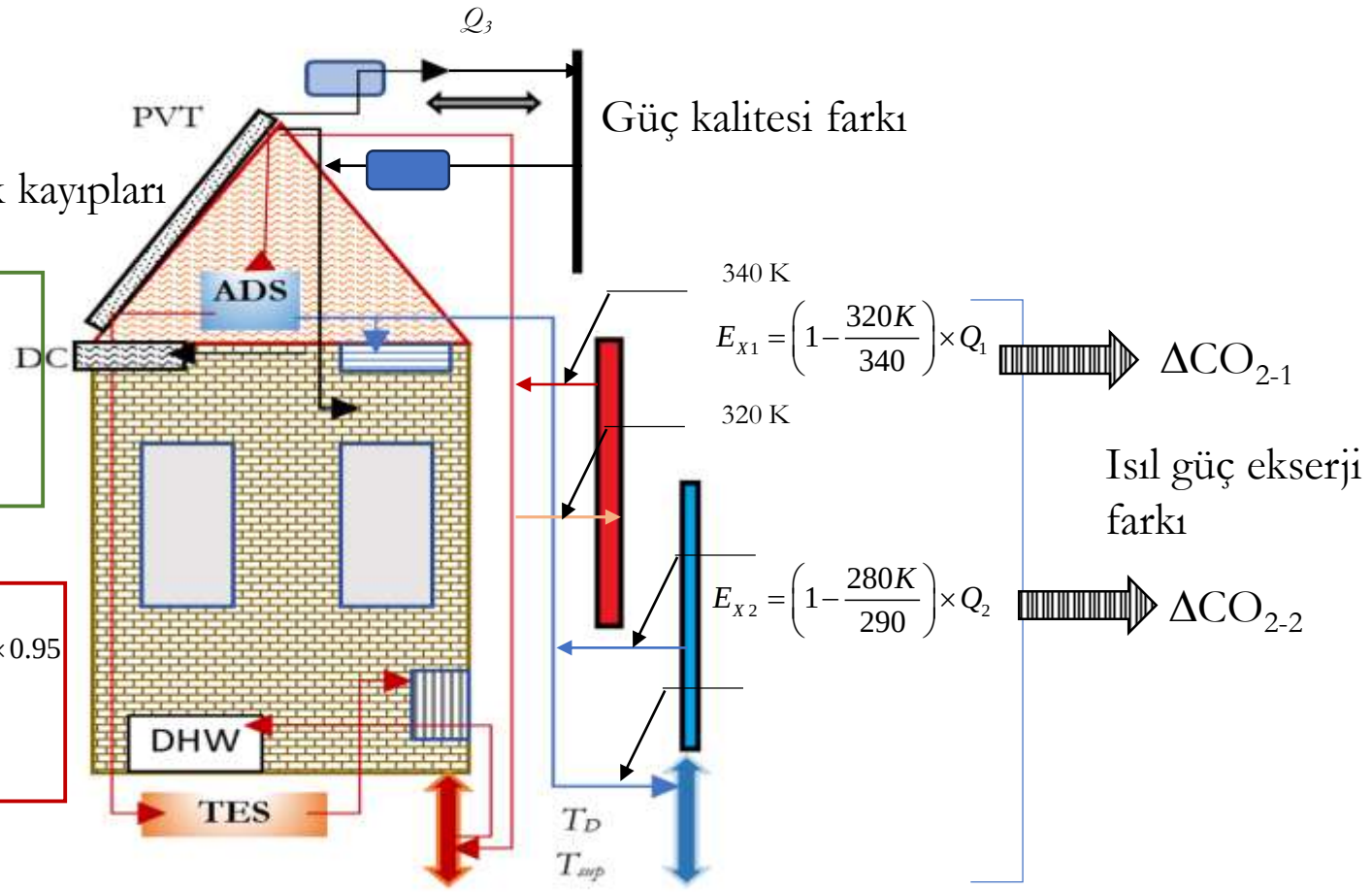
Yeşil Bina Bölge

$$Q_1 + Q_2 + Q_3 = Q_1 + Q_2 + Q_3$$

net Sıfır Enerji Binası

$$Q_1 \times \left(1 - \frac{T_{ref}}{320K}\right) + Q_2 \left(1 - \frac{T_{ref}}{290K}\right) + Q_3 \times 0.95 \neq Q_1 \times \left(1 - \frac{T_{ref}}{280K}\right) + Q_2 \times \left(1 - \frac{T_{ref}}{290K}\right) + Q_3 \times 0.95$$

net Sıfır Exerji Binası



Bölge Enerji Sistemi

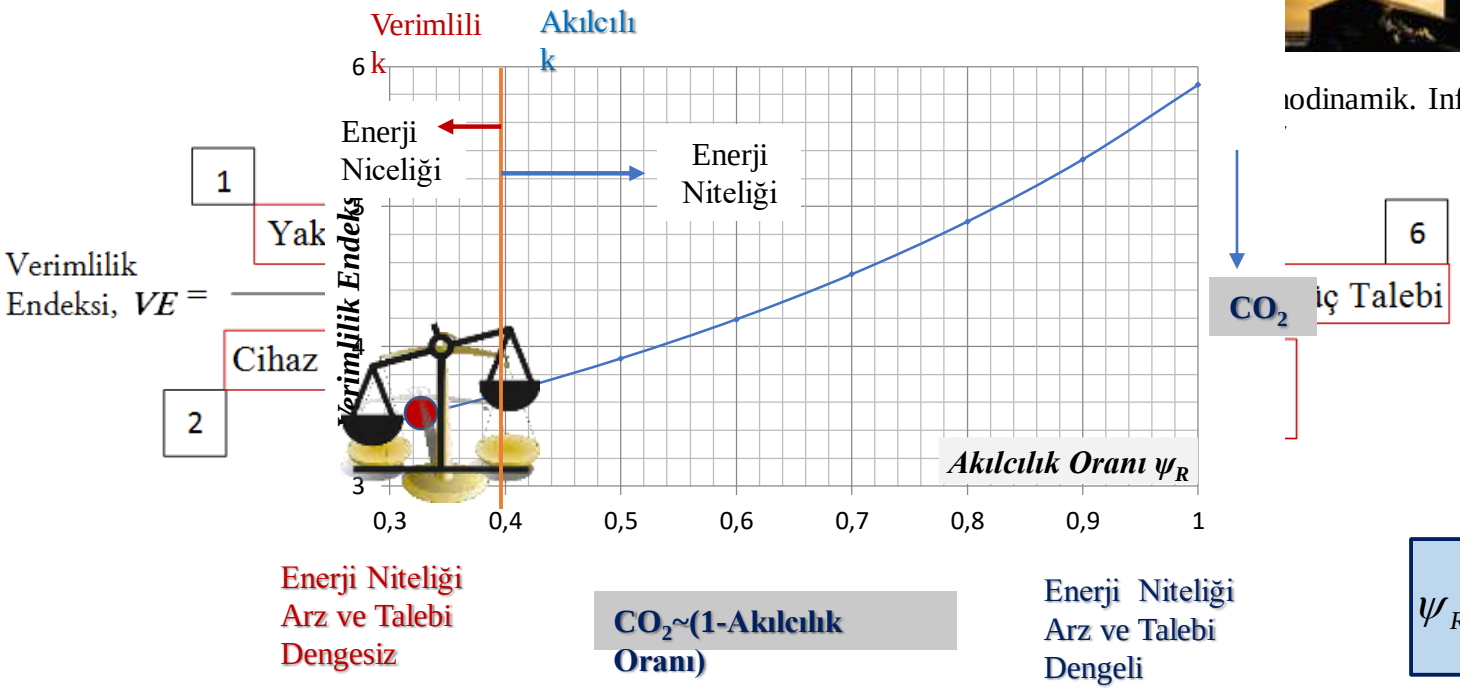
KÜRESEL ISINMADA NEREDEYİZ

Yapılar Toplam Yıllık Enerji Tüketiminin %40 kadarından sorumlu

- **Dünya Sağlık Örgütünün Verilerine Göre:**
  Avrupa'nın Havası En Kirli 10 Şehrin 8'i Türkiye'de.

- **İstanbul havası en kötü metropol konumunda yer alıyor.**

...odinamik. Info, 17, 03,



Enerji Niteliği Arz ve Talebi Dengesiz

CO_2~(1-Akılcılık Oranı)

Enerji Niteliği Arz ve Talebi Dengeli

$$\psi_R = \frac{\varepsilon_{talep}}{\varepsilon_{arz}}$$

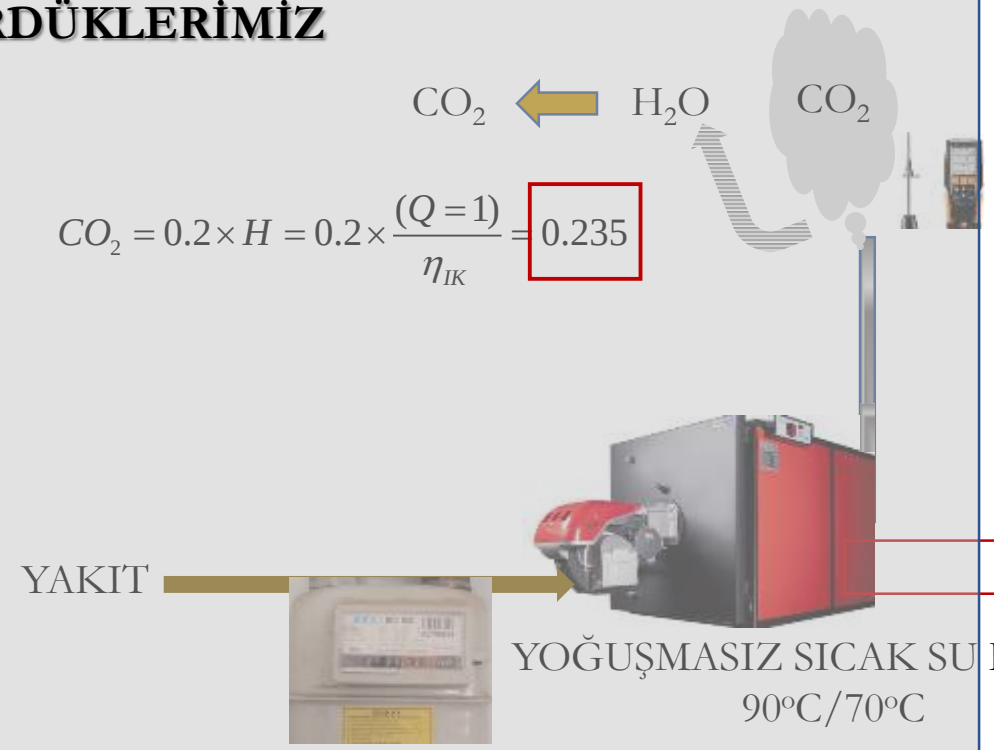
Termodinamiğin 1. Yasası Misyonunu Bitirmek Üzere

MAHALLİNDE GÖRÜLEMEYENLER *Ancak Termodinamiğin İkinci Yasası ile* HESAPLANIR. GÖRÜLEMEYENLER İSE *Ancak Atmosferde Görülür*

ΔCO_2

$$\Delta CO_2 = 2.1 \times \text{Katma Değer Kaybı}(\varepsilon)$$

GÖRDÜKLERİMİZ



$$CO_2 = 0.2 \times H = 0.2 \times \frac{(Q=1)}{\eta_{IK}} = 0.235$$

$$H = m^3 \times \text{üst ısıl değer}$$

$$\text{Maliyet} = m^3 \times \text{Birim Fiyat}$$

$$\frac{\Delta CO_2}{CO_2} = \frac{1.71}{0.235} = 7.3$$

EKSERJİMETRE

$$Q_{EX} = Q \times \left(1 - \frac{T_2}{T_1}\right)$$

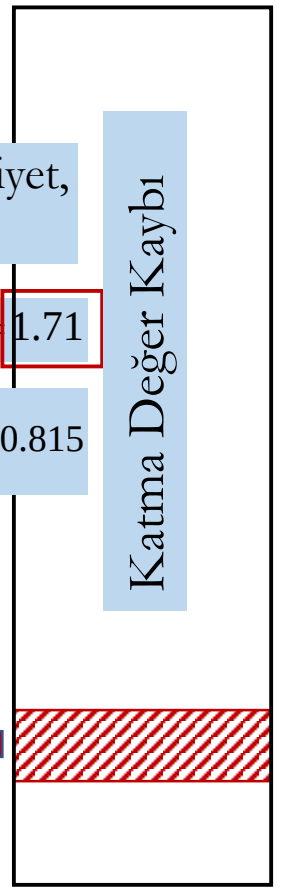
GÖRMEDİKLERİMİZ

$$\varepsilon_{yakıt} = \left(1 - \frac{283\ \text{K}}{2235\ \text{K}}\right) = 0.87$$

Ek salımlar, maliyet, malzeme, enerji

$$\Delta CO_2 = 2.1 \times 0.815 = 1.71$$

$$0.87 - (Q=1) \times \left(1 - \frac{343\ \text{K}}{363\ \text{K}}\right) = 0.815$$

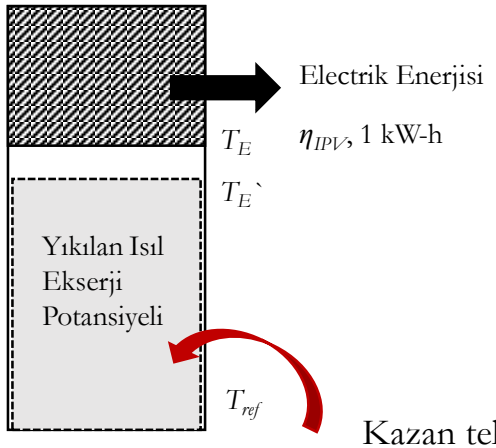


GÖRMEDİKLERİMİZ GÖRDÜKLERİMİZİN YEDİ KATI

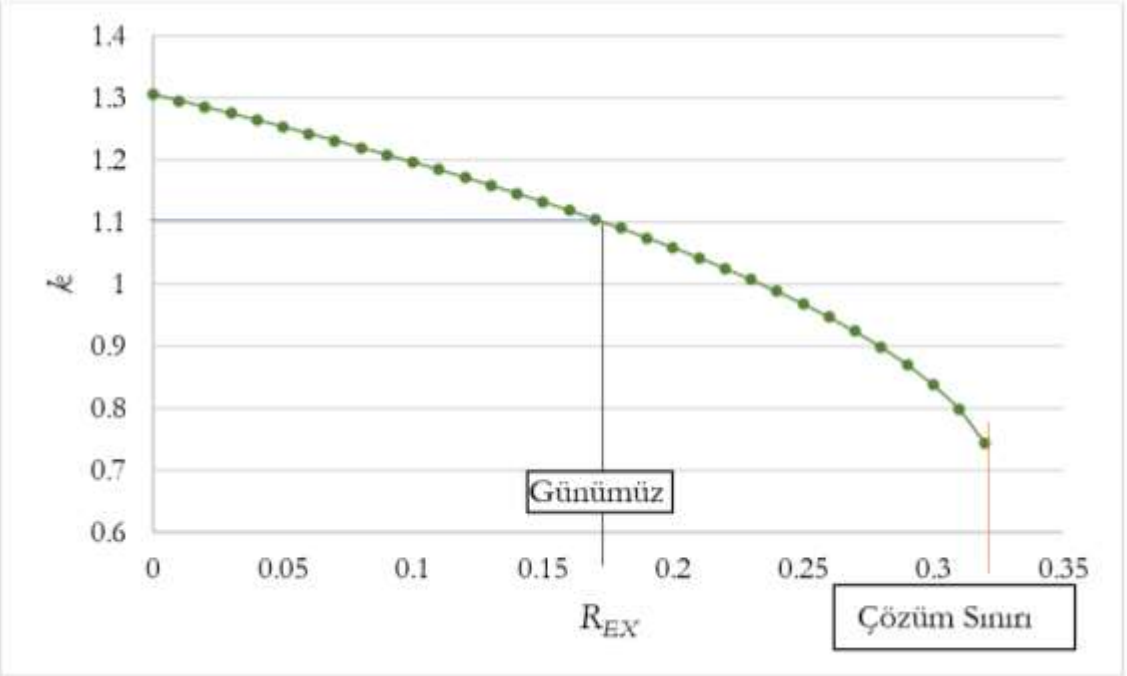
k= 1.1. Güneş Gözesi

$$k = \frac{\Delta CO_2}{E_{Xdes}} = \frac{\left(\frac{0.2}{\eta_{IB}}\right) \times E_{des}}{E_{des} \times \left(1 - \frac{T_{ref}}{T_E`}\right)} = \frac{\left(\frac{0.2}{\eta_{IB}}\right)}{\left(1 - \frac{T_{ref}}{T_E`}\right)}$$

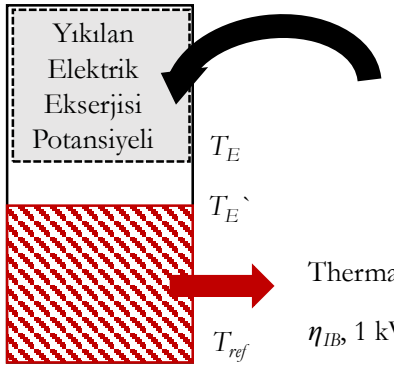
$$k = \frac{\left(\frac{0.2}{0.8}\right)}{\left(1 - \frac{283K}{350K}\right)} \times (1 - 0.15) = 1.11$$



Kazan telafi ediyor



k= 2.1. Düzlemsel Güneş Toplacı



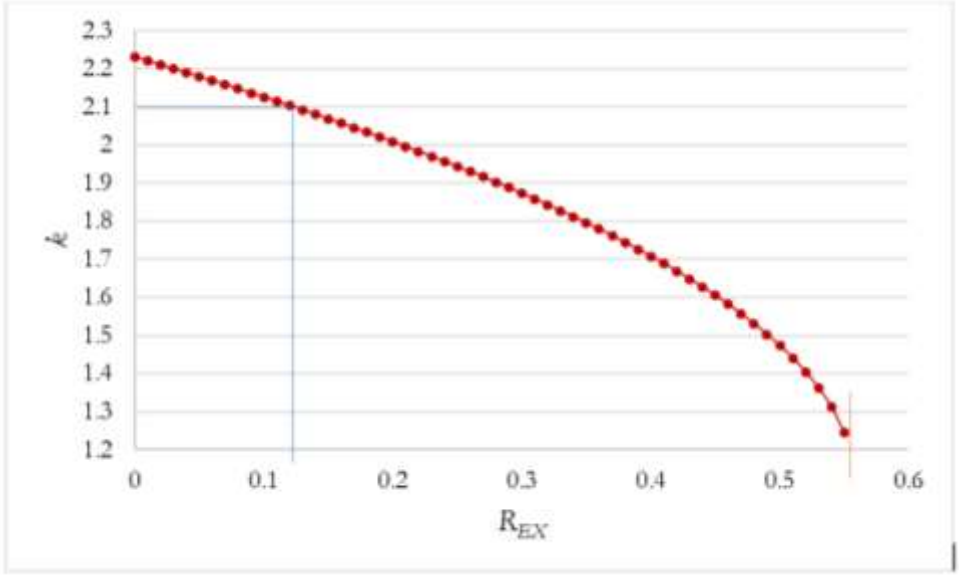
Şebeke telafi ediyor

Thermal energy

η_{IB}, 1 kW-h output

$$k = \frac{\left(\frac{0.35}{\eta_{PP}\times\eta_T}\right)}{\left(1-\frac{T_{ref}}{T_E`}\right)} + \sqrt{\left\{\frac{\left(\frac{0.35}{\eta_{PP}\times\eta_T}\right)}{\left(1-\frac{T_{ref}}{T_E`}\right)}\right\}^2 - 4\times1\times\frac{\left(\frac{0.35}{\eta_{PP}\times\eta_T}\right)}{\left(1-\frac{T_{ref}}{T_E`}\right)}\times R_{EX}}}{2\times1}$$

R_{EX}: Ekserji-tabanlı yıllık yenilenebilir enerji katkısı



BİNALARDA ENERJİ TASARRUFU SÜRDÜRÜLEBİLİRLİK İÇİN YETERLİ Mİ?

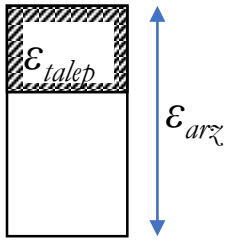
$$CO_2 = \frac{c_k}{\eta_I} \times Q$$ Birinci Yasa

$$\Delta CO_2 = k \times \varepsilon_{des} \times Q = k \times \varepsilon_{\sup} \times (1-\psi_R) \times Q$$ İkinci Yasa

$$\frac{\Delta CO_2}{CO_2} = \frac{k \times \varepsilon_{\sup} \times (1-\psi_R) \times Q}{\left(\frac{c_k}{\eta_I}\right) \times Q} = \frac{k \times \varepsilon_{\sup} \times (1-\psi_R)}{\left(\frac{c_k}{\eta_I}\right)}$$

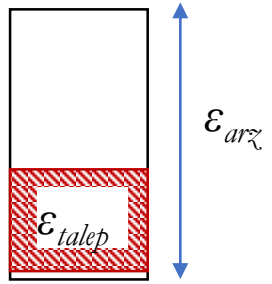
1.1

2.1



ÖRNEK

$$\frac{\Delta CO_2}{CO_2} = \frac{2.1 \times 0.87 \times (1-0.3)}{\left(\frac{0.2}{0.85}\right)} = 5.43$$



$$\psi_R = \frac{\varepsilon_{talep}}{\varepsilon_{arz}}$$

Enerji Tasarrufu ile Q, dolayısı ile salımlar azalır ama salım oranları değişmez. ΔCO_2 yi azaltmak gerekir.
Bu ise ψ_R değerini arttırmak azaltmak yani enerjinin kalitesini akılcı kullanmanın yükseltilmesi ile mümkündür.

$$\frac{\Delta CO_2}{CO_2} = (2-\psi_R) + PEF \times (1-\psi_R) = (2-0.3) + 2.5 \times (1-0.3) = 5.55$$

PROJEKSYONLAR NE DENLİ TUTARLI?

https://www.ren21.net/gsr-2023/modules/energy_supply/01_energy_supply/

REN21
RENEWABLES NOW

Select Language

Module Content

RENEWABLES IN ENERGY SUPPLY

Module Overview

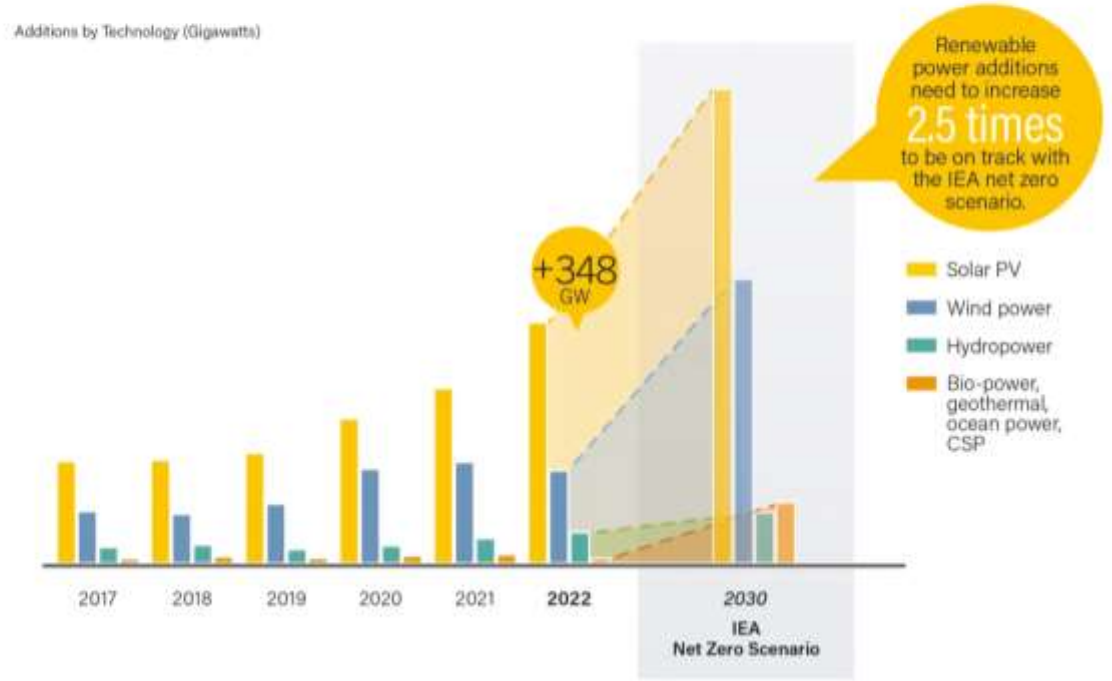
Policy

Investment

MARKET DEVELOPMENTS

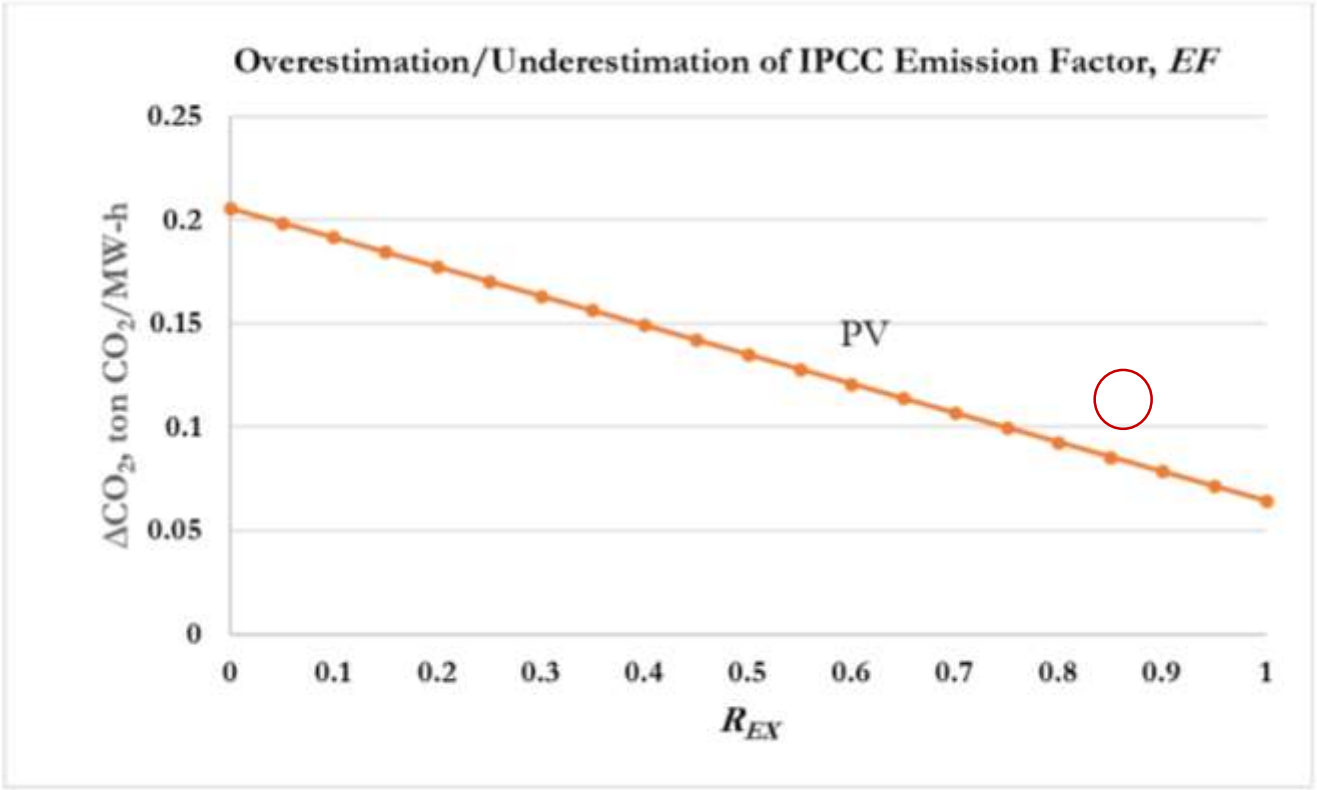
FIGURE 6.

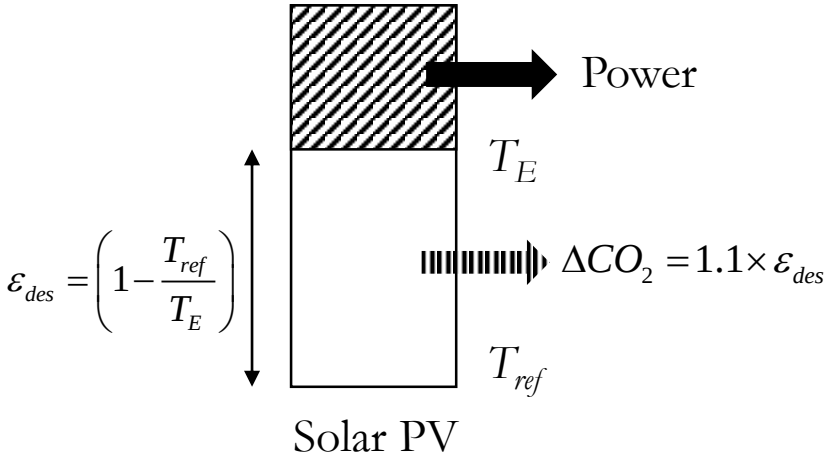
Renewable Power Capacity Annual Additions by Technology, 2017-2022, and Increases Required by 2030 to Achieve the IEA's Net Zero Scenario



YENİLENEBİLİR ENERJİ KAYNAKLARININ KARBONSUZLAŞMADAKİ ROLÜNÜN ABARTISI

UN Tool 07





$$\varepsilon_{des} = \left(1 - \frac{T_{ref}}{T_E}\right)$$

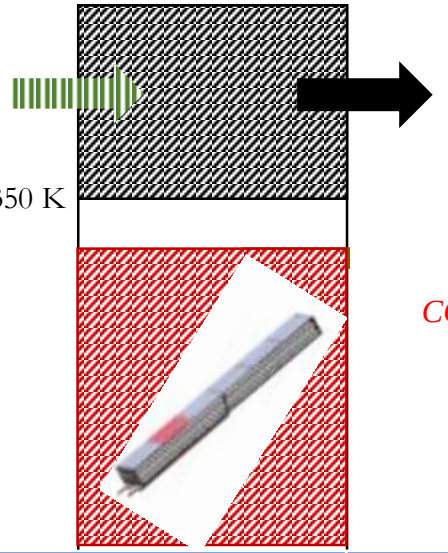
$$\Delta CO_2 = 1.1 \times \varepsilon_{des}$$

ENERJİ Mİ EKSERJİ Mİ DAHA ÖNEMLİ?

Karar Verme Mekanizmasında Her İkisi de..

Çevresel Kazanç

$$CO_2 = -\frac{0.2\times 1}{0.52} = 0.31 \text{ kg/kW-h}$$



$$\| CO \qquad \frac{1.1}{.31} = 3.5$$

1 kW-h Elektrik, verim 0.18

Parasal Kazanç = 1.2 TL/kW

Çevresel Zarar

$$\Delta CO_2 = +2.1\times 0.53 = +1.1 \text{ kg/kW-h}$$

Çevresel Zarar

$$CO_2 + \Delta CO_2 = +\frac{0.2\times(1-0.18)}{0.85} + 2.1\times 0.82 = +1.9 \text{ kg/kW-h}$$

Parasal Kayıp = 1.2 TL

Parasal Kazanç = 1.2 TL, Toplam Kazanç=2.4 TL/m^2

$$\psi_{R_{PV}} = 1 - \frac{\text{Ekserji Yıkımı}}{\text{Ekserji Girdisi}} = 1 - \frac{\left(1-\frac{283K}{350K}\right)}{(I_n\times 0.95/1.367)} = 0.65$$

0.55= Birim ekserji

0.80

$$\psi_{R_{KAZAN}} = \frac{\text{Ekserji Talebi}}{\text{Ekserji Girdisi}} = \frac{\left(1-\frac{330\text{ K}}{350\text{ K}}\right)}{0.87} = 0.07$$

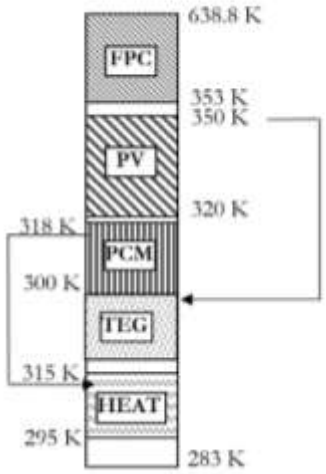
$$\psi_{R_{FPC}} = \frac{\left(1-\frac{310\text{ K}}{330\text{ K}}\right)}{0.55} = 0.11$$

$$\psi_{R_{PVT}} = 1 - \frac{0.1}{(I_n\times 0.95/1.367)} = 0.82$$

Sistem	Birinci Yasa Verimi	İkinci Yasa Verimi	Ekserji Akılcılığı, ψ_R	ΣCO_2	Güneş Enerjisinden Kazanç TL/m^2
PV	0.18	0.17	0.65	0.59	~0
Kazan	0.85	0.05	0.07	1.9	-
Düzlemsel Toplaç	0.75	0.08	0.11	1.1	1.2
PVT3	(0.85)	0.21	0.82	0.21	2.4
Kombine Çevrim Santrali	0.52	0.57	0.40	0.76	-

GERÇEK PROJEKSİYON: BİTMEYEN ΔCO_2

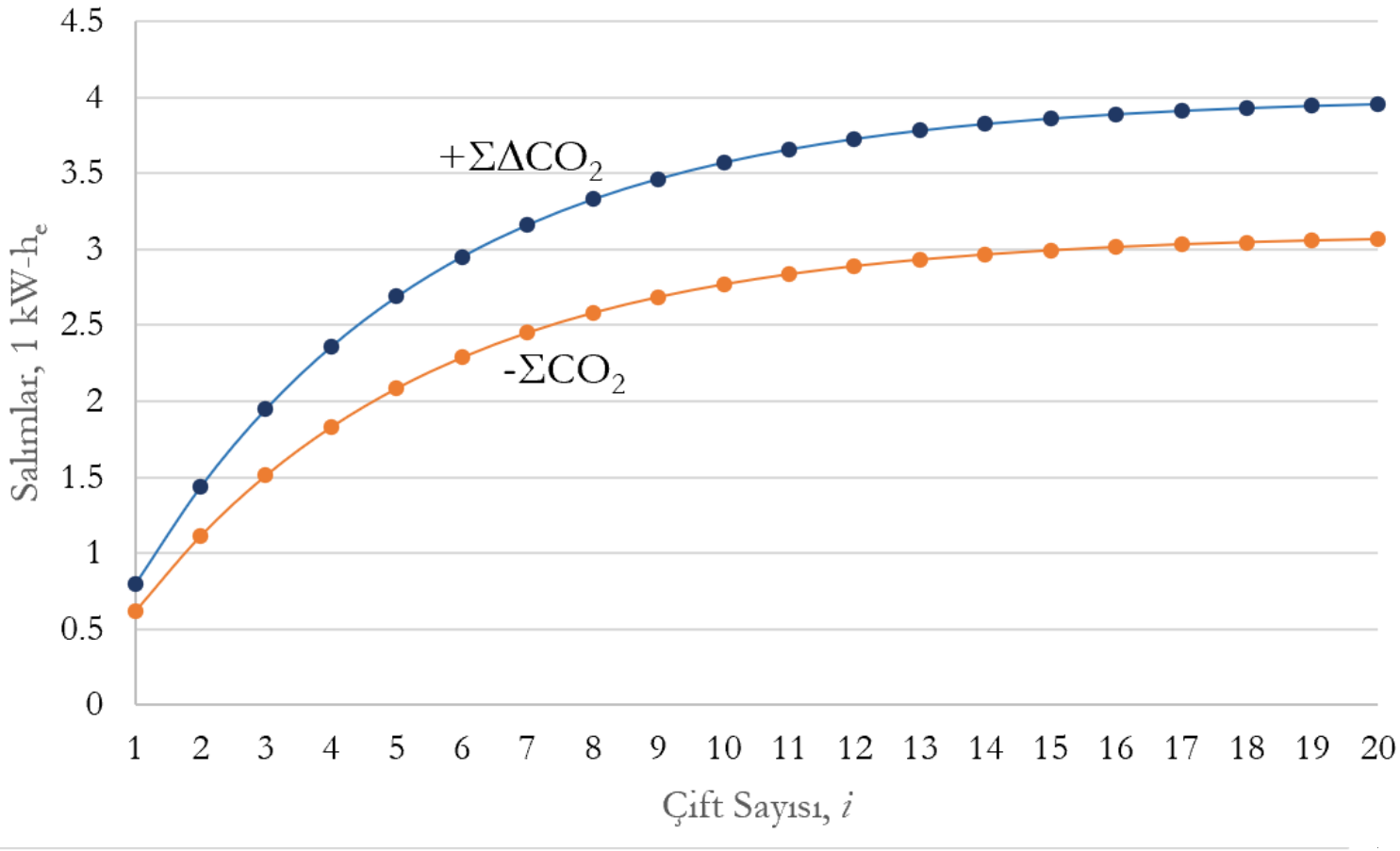
Diminishing Returns

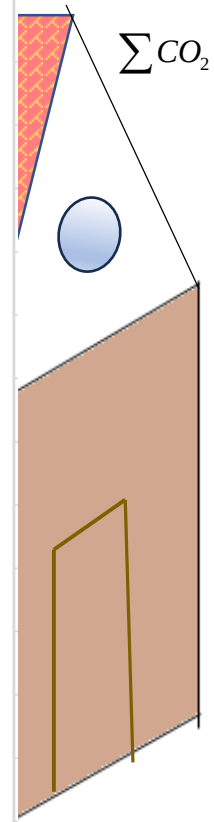


$$\sum \Delta CO_2 = \left(\frac{1}{\eta_{IPVi}} - 1\right)\{(1-\eta_{IFPC}) \times PEF \times 0.2\} \times (1-\eta_{PVi})^{i-1}$$

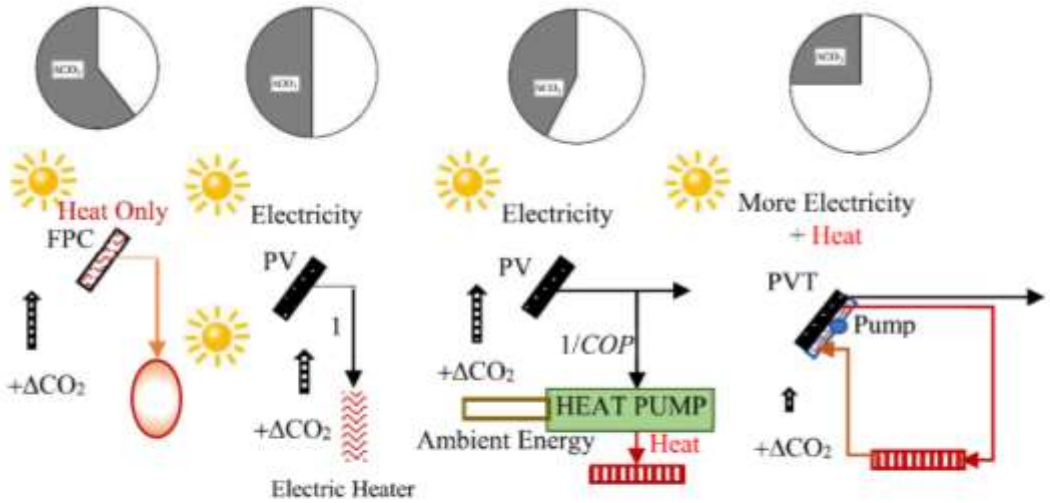
$$\sum CO_{2replaced} = \sum_{i=1}^{n} 0.2 \times \left[PEF + \frac{(1-\eta_{IPP})}{\eta_{IB}}\right] \times (1-\eta_{PVi})^{i-1}$$

$$\sum CO_2 = \sum \Delta CO_2 - \sum CO_{2replaced}$$





GÜNEŞ ENERJİSİNDEN EN AKILCI YARARLANMA YÖNTEMLERİ



Solar Hot-Water Collector (FPC) ΔCO_2~0.65

Pumpless Direct PV Heating ΔCO_2~0.50

PV Heating With Heat Pump ΔCO_2~0.35

Simple PVT With Pump ΔCO_2~0.25

En Ucuz

En yüksek verim
En Düşük Akılcılık

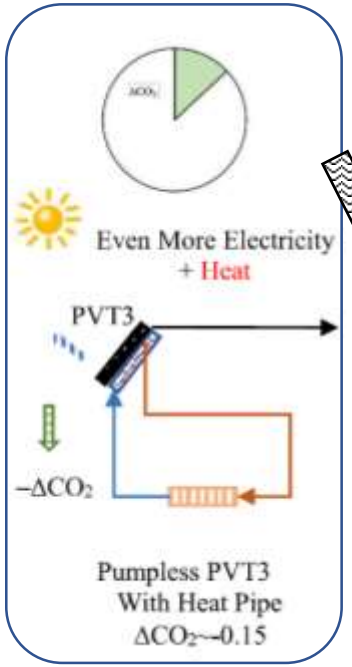
Ekonomik

En düşük verim!
Çok az akılcı

Ekonomik Değil

Yüksek *COP*
Marjinal akılcılık

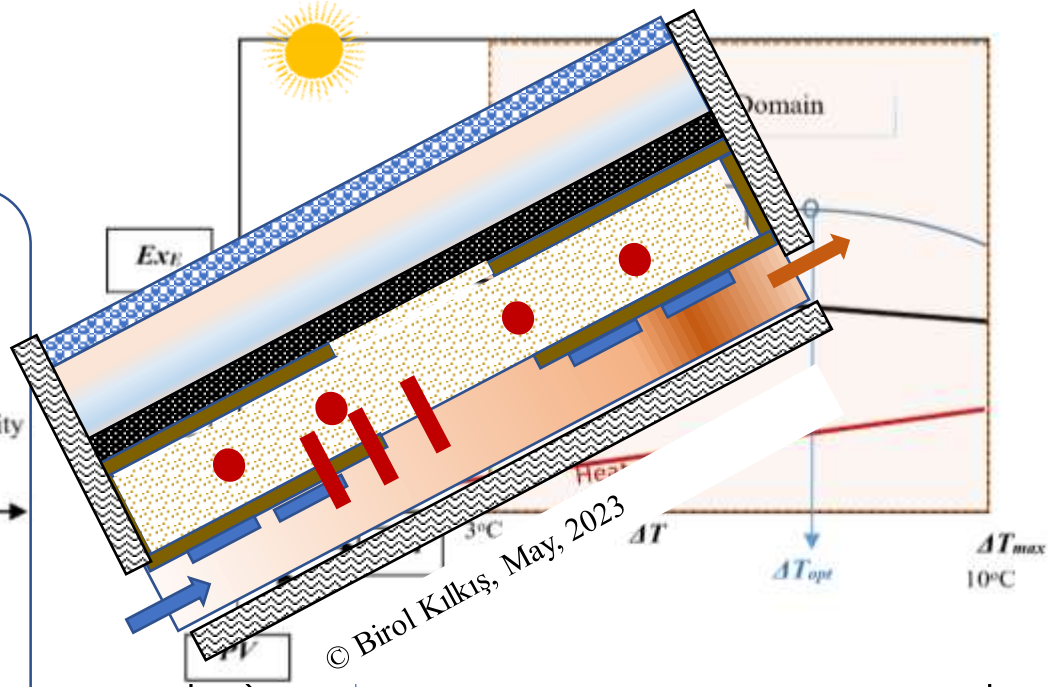
Çok az Ekonomik
Daha Yüksek verim
Marjinal akılcılık

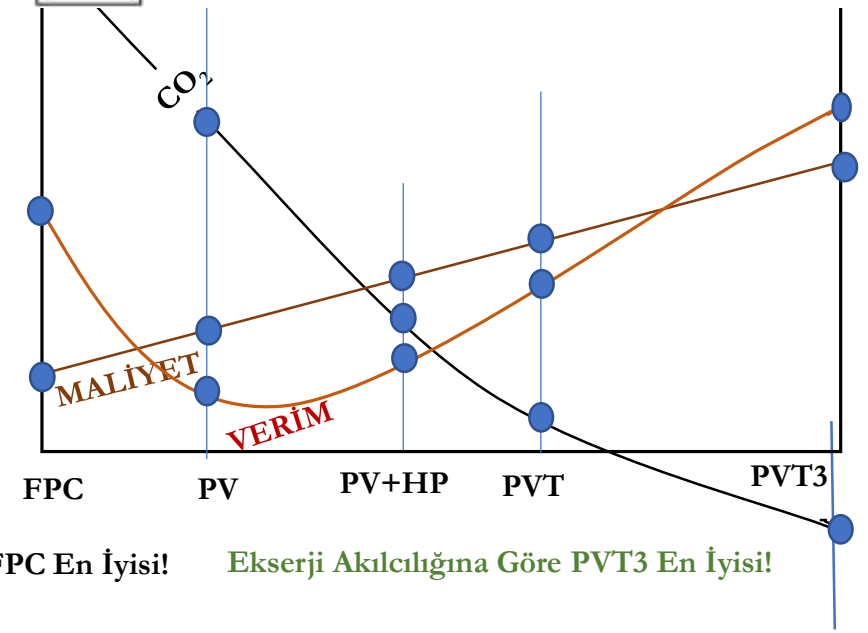


Pumpless PVT3 With Heat Pipe ΔCO_2~-0.15

Ekonomik

Daha Yüksek verim
Yüksek Maliyet
En yüksek akılcılıkHigh Rationality

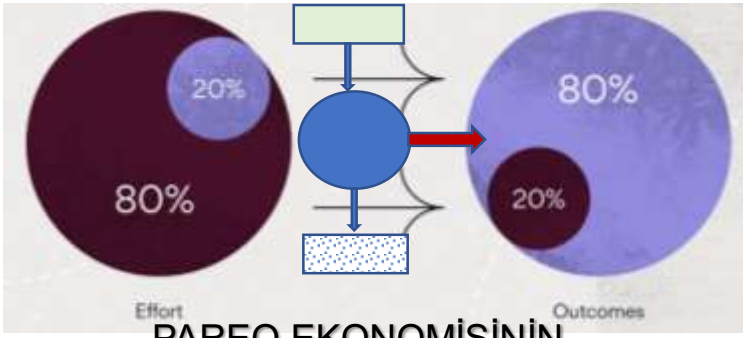




Doğrusal (Pareto) Ekonomiye Göre FPC En İyisi!

Ekserji Akılcılığına Göre PVT3 En İyisi!

KLASİK EKONOMİNİN DEĞERİ –*Doğa Pareto Prensibini Kullanmaz*



Pareto prensibi ve Carnot Çevrimi

PAREO EKONOMİSİNİN DEĞERİ

$$\varepsilon_{pareto} = \frac{0.2}{0.8} = 0.25 = \left(1 - \frac{287.5K}{T_{f_{pareto}}}\right)$$

$$T_{f_{pareto}} = 383.3\ \text{K}\ (110.33^{o}\text{C})$$

Pareto prensibi sadece 360 W/m^2 güneş enerjisi akısına karşılık gelir!
Bunun üzerindeki enerjiler Pareto prensibince tariflenemez ve değerlendirilemez.

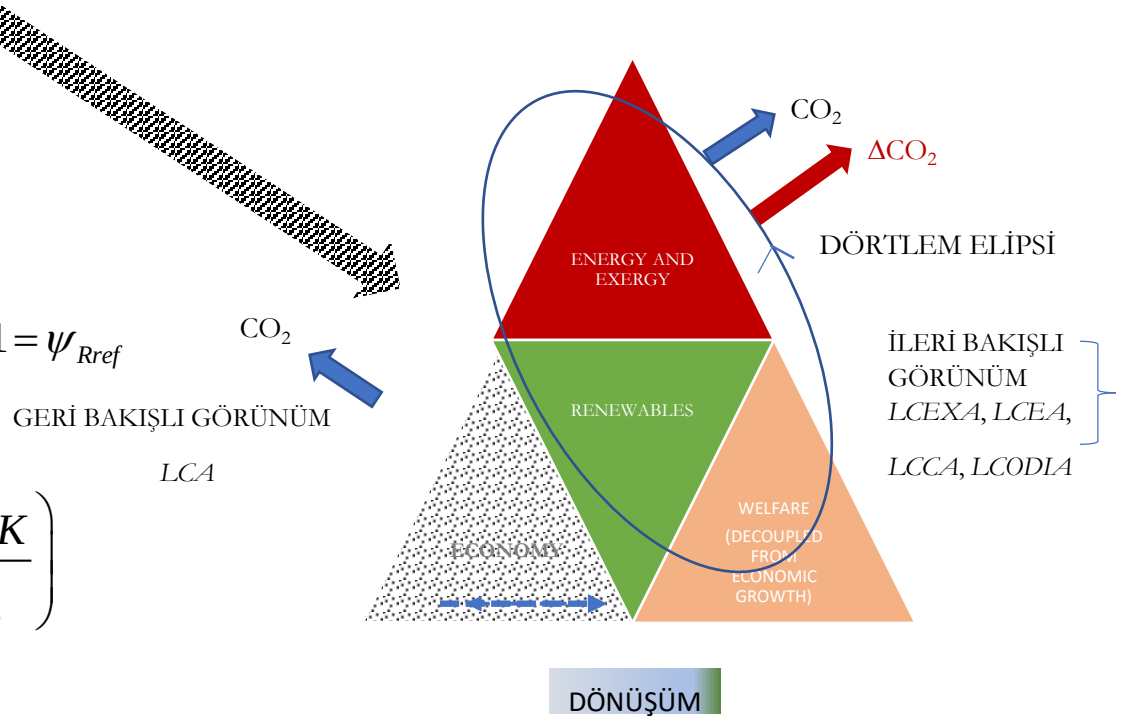
EKSERJİ TABANLI KARBONSUZLAŞMANIN YÖNTEMİ

Pazar Eknomisini Dönüştürerek

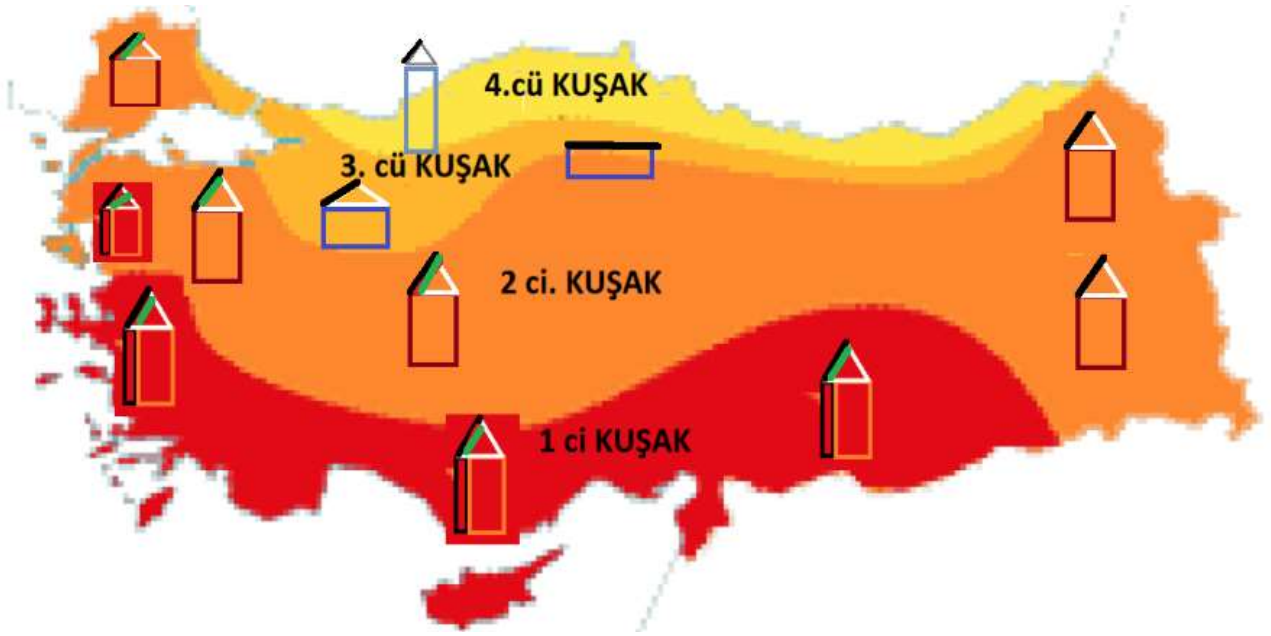
$$\varepsilon_{pareto} = 0.8 \times \varepsilon_1 + 0.2 \times \varepsilon_2 = 0.21 = \psi_{Rref}$$

$$\varepsilon_{pareto} = 0.21 = \left(1 - \frac{287.5K}{T_{f_{pareto}}}\right)$$

$$T_{f_{pareto}} = \frac{287.5K}{(1-0.21)} = 363.92\ \text{K}$$

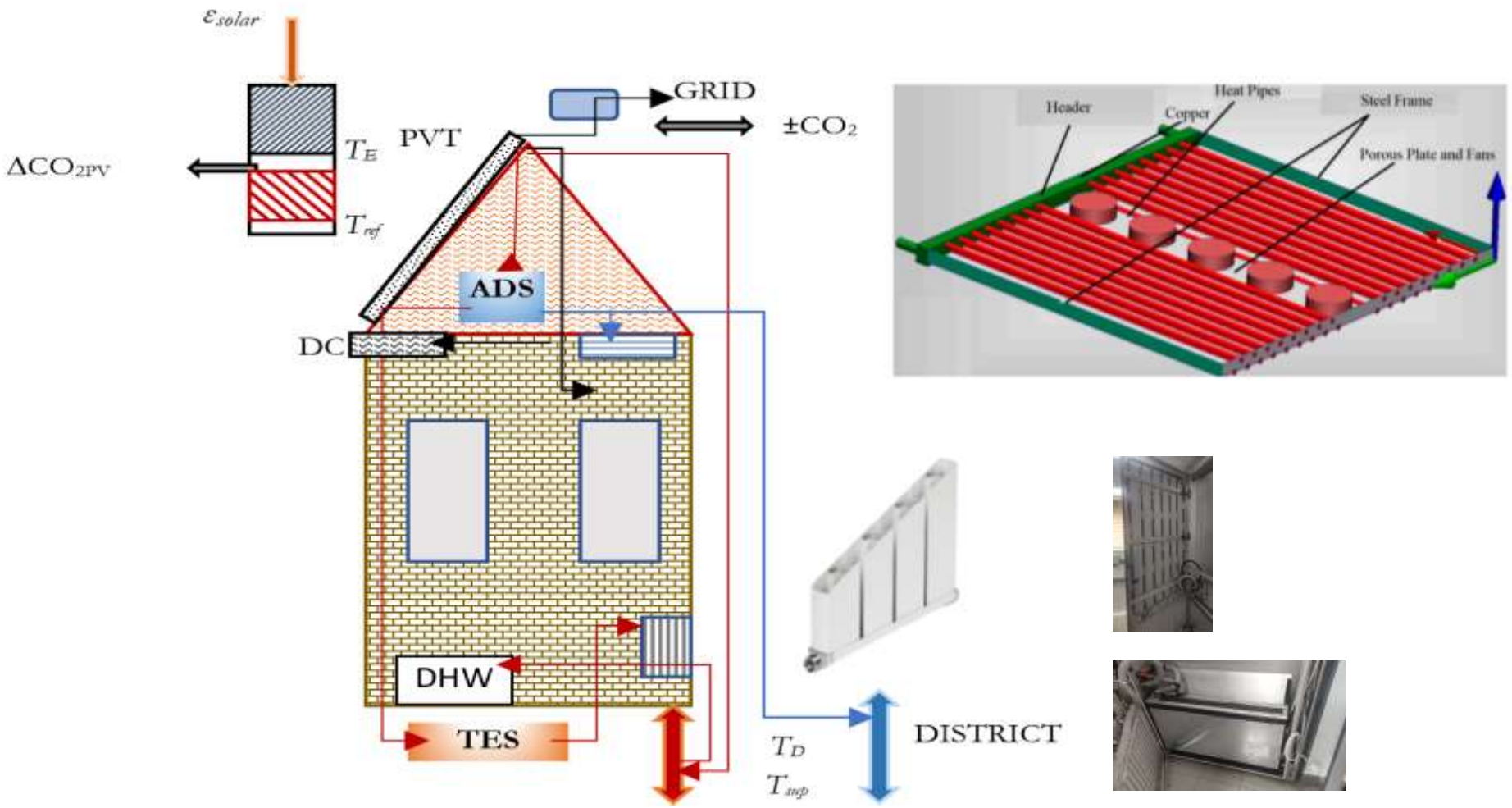


AKILCI GÜNEŞ ENERJİSİ DEĞERLENDİRME HARİTASI

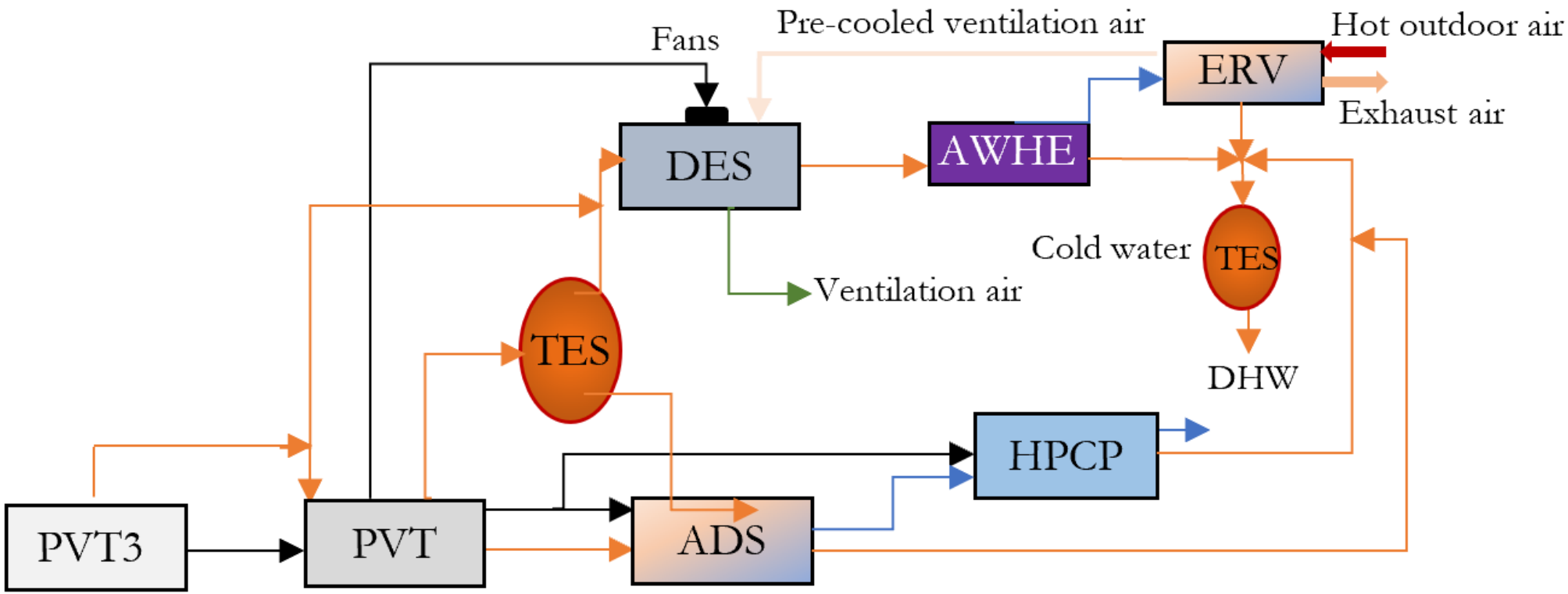


Güneş Kuşağı Bölgesi	Önerilen PV ve PVT sistemleri ve konumları
1	Çatıda PVT, Cephelerde PVT
2	Çatıda PVT veya yerel iklime göre sadece PV
3	Çatıda veya düz çatıda PV
4	Çatıda PV

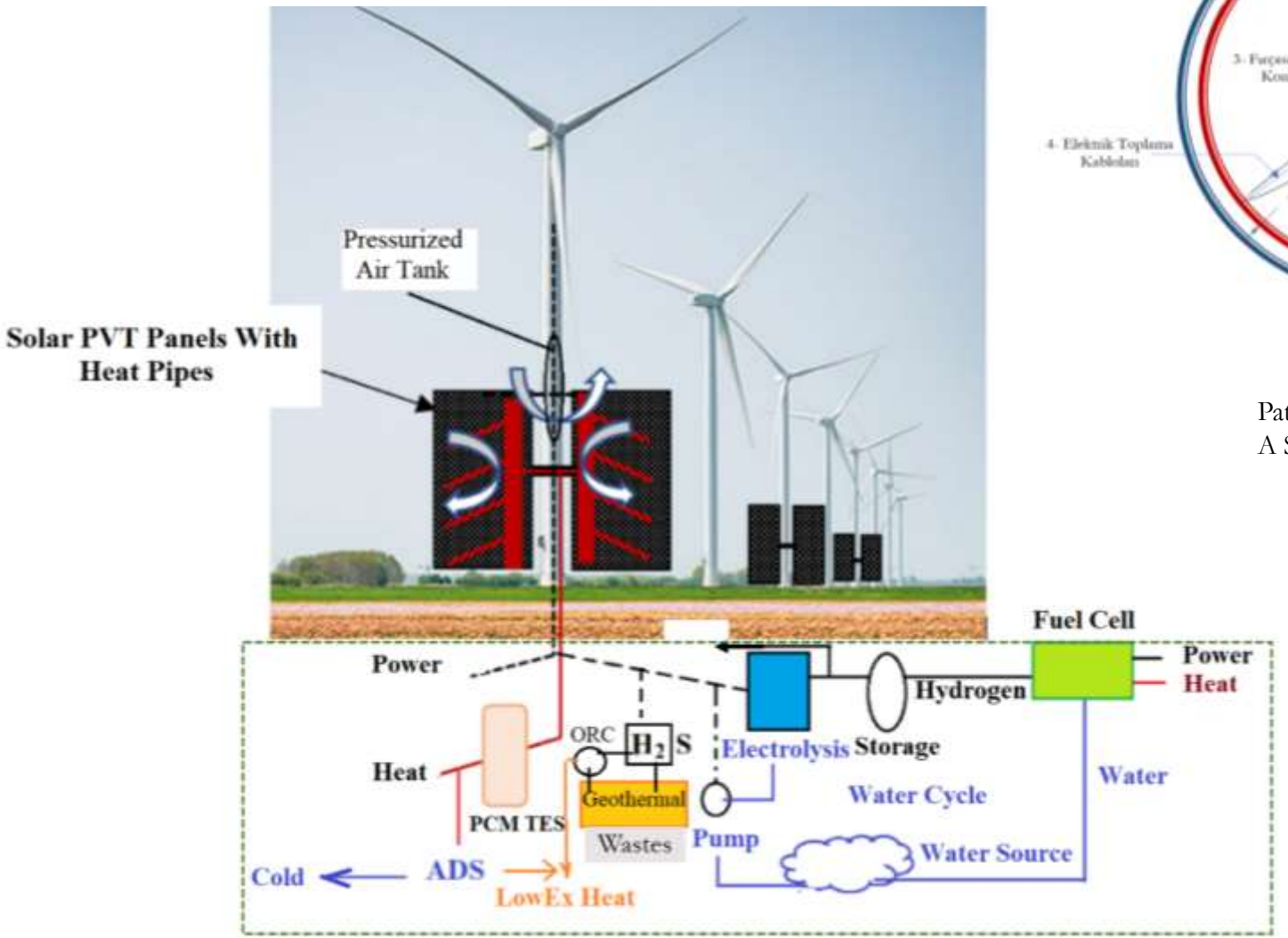
NEREDEYSE-SIFIR CO_2 KENDİ ÜRETİR/TÜKETİR GÜNEŞ EVİ

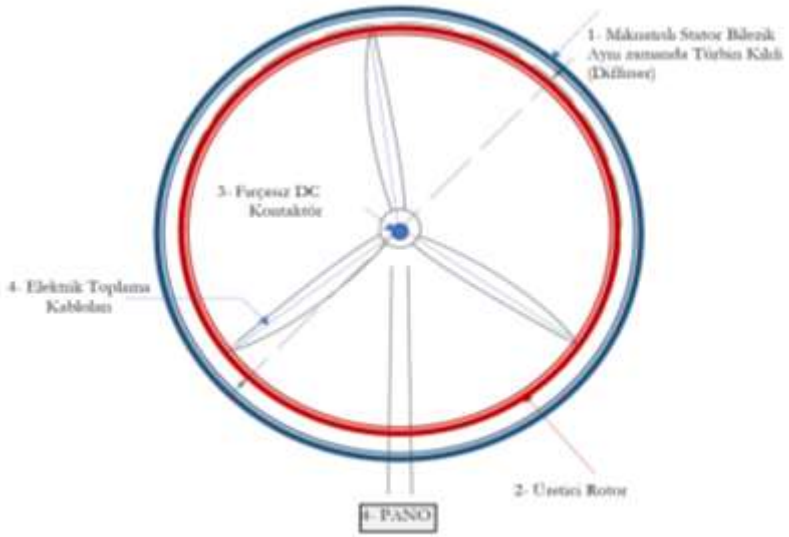


GÜNEŞ ENERJİSİ İLE SOĞUTMA



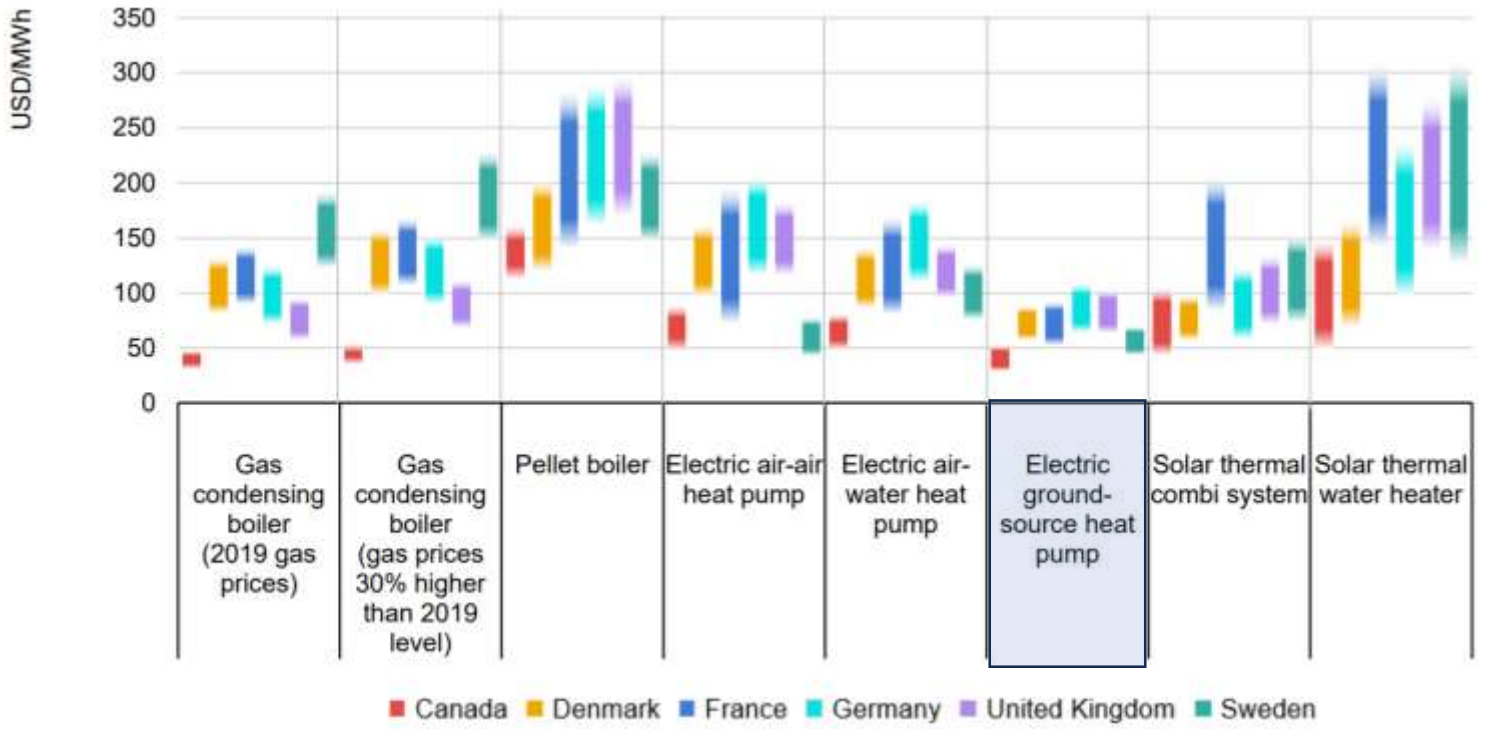
VERİMLİ ARAZİ KULLANIMI VE MELEZ YENİLENEBİLİR ENERJİ KÜMELENMESİ



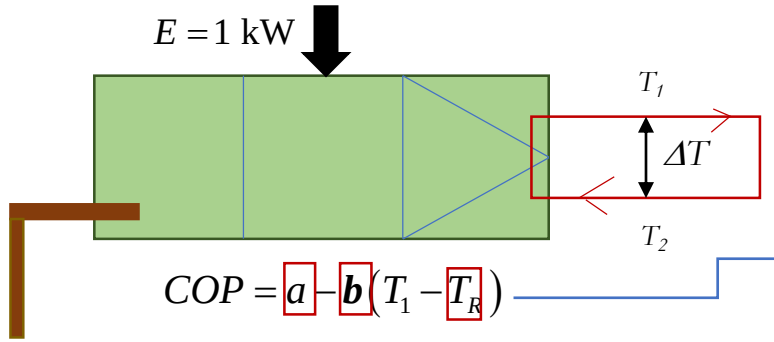


Patent Pending 2004, Kilkis
A Synectic Approach

ISI POMPALARI



ISI POMPASININ PERFORMANSI



$$COP = a - b(T_1 - T_R)$$

T_R=308 K

$$Q_{EX} = COP \times \left(1 - \frac{T_2}{T_1}\right)$$

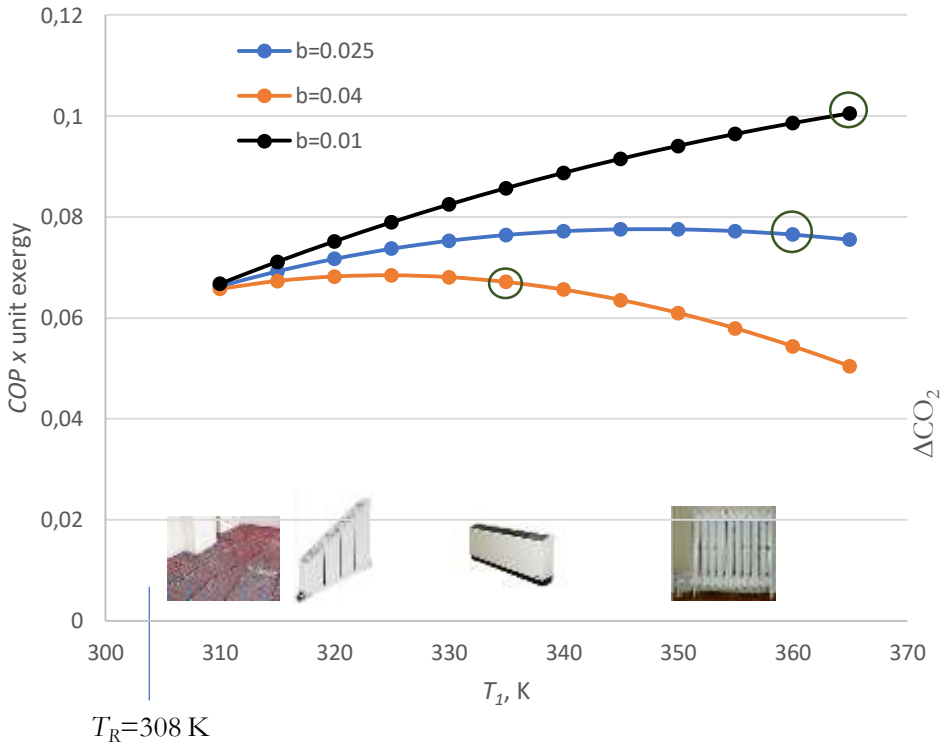
$$Q = COP \times 1 = c \times \left(\left[\frac{T_1 + T_2}{2}\right] - T_a\right)^n$$

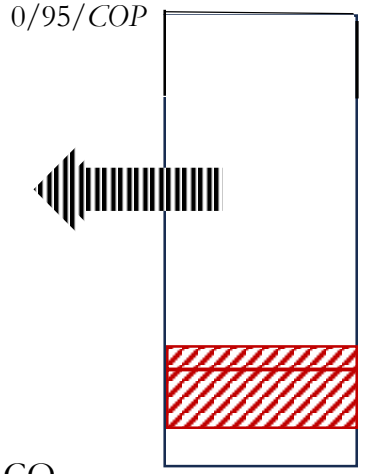
$$\Delta T = T_1 - T_2 = 5 + d \times (T_1 - 308\ \mathrm{K})$$

0.1

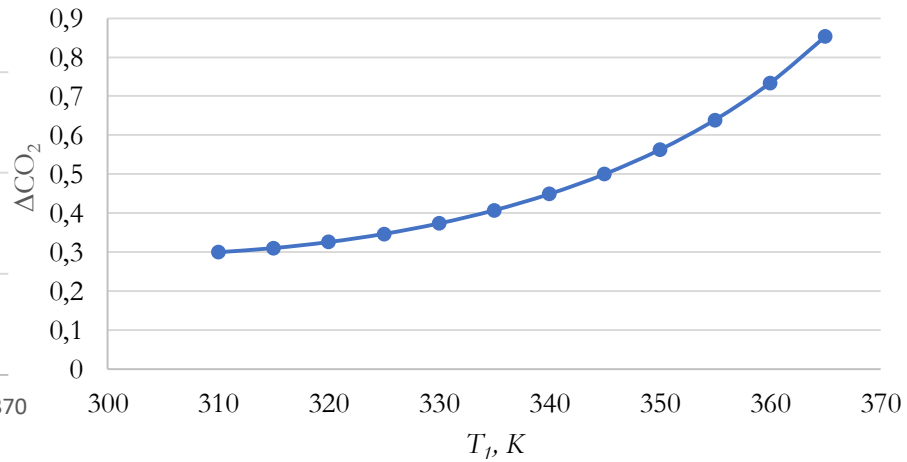
Dört eşitlik ve sekiz değişken

KAYNAK ⟸ ISI POMPASI ⟹ UYGULAMA



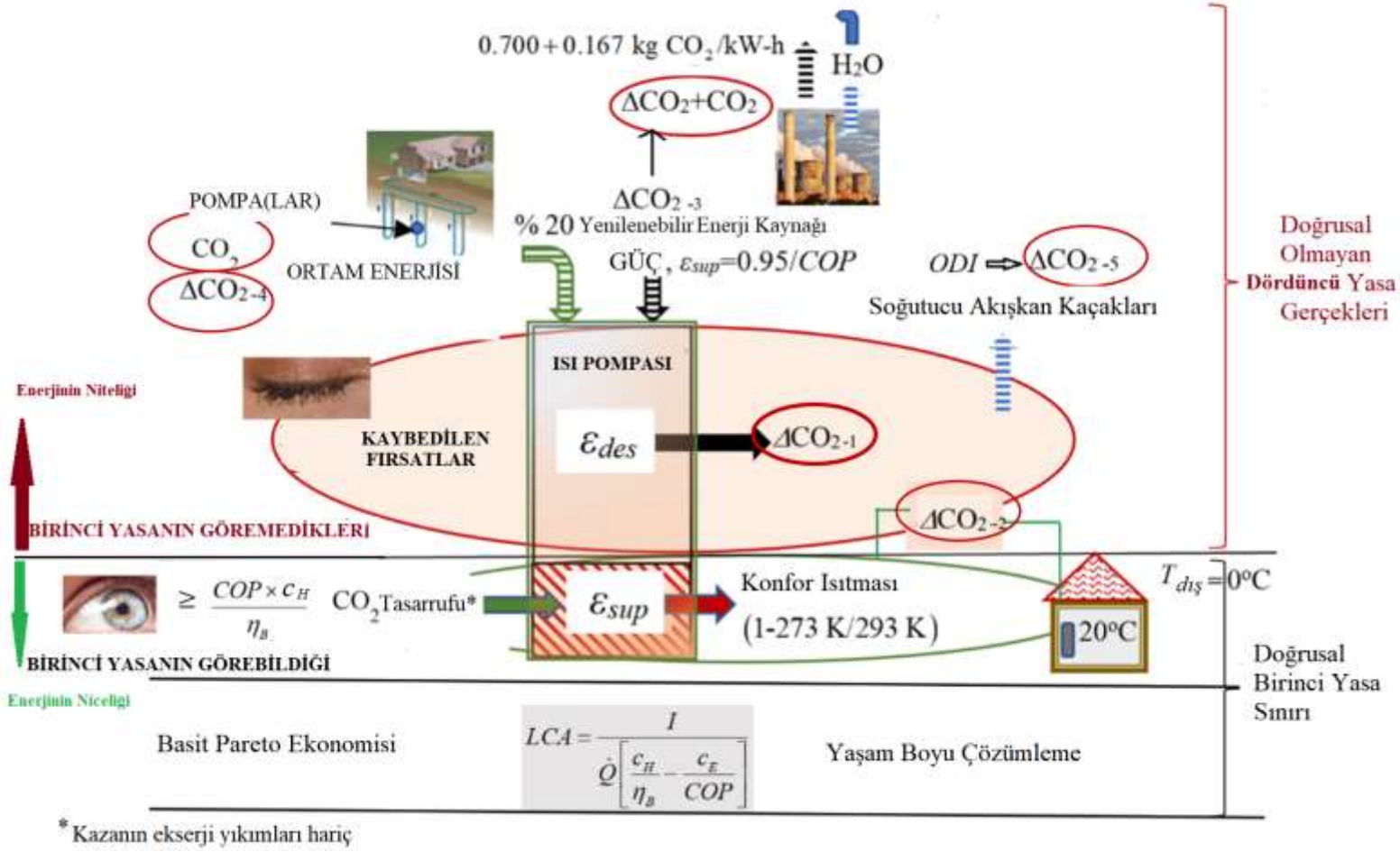


ΔCO_2



ISI POMPALARINDA GÖRDÜKLERİMİZ ve GÖREMEDİKLERİMİZ:

Toprak Kaynaklı Bir Isı Pompasının Gerçek Hikayesi

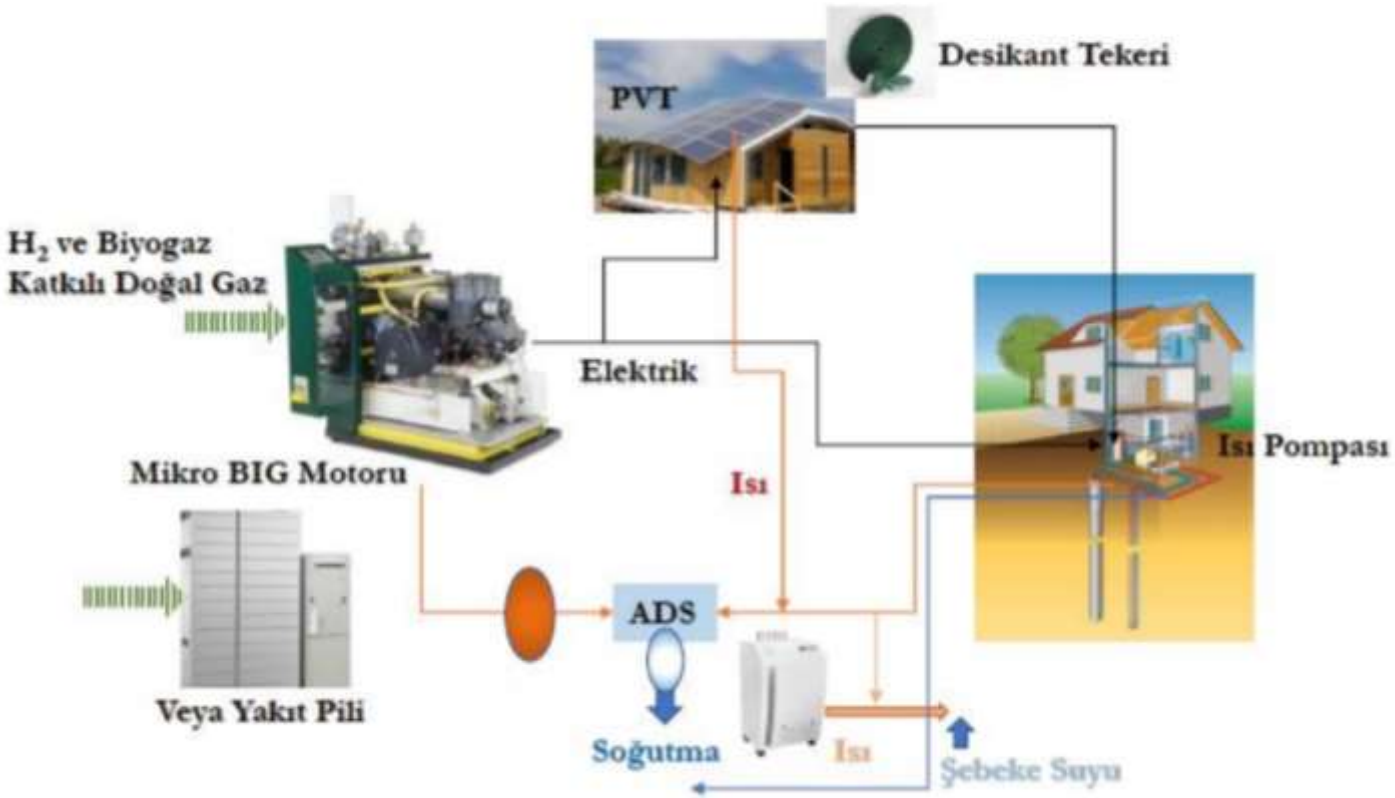


2. Yasaya göre altı farklı asal salım kaynağı bulunmaktadır. Ayrıca değerlendirilemeyen enerji, malzeme ve maliyet unsurlarına işaret eder..

Birinci yasanın görebildiği sadece mahallinde ikame ettiği bir kazanın gerçek salımlarıdır..

KONUTLARDA ÜÇLÜ ÜRETİM

Mutlaka Doğal Gaz Kullanacağız Diyorsak.. Bari Hidrojen ve Biyogaz Katalım



Şekiller:

Integration of Microgeneration and Related Technologies in Building

Energy in Buildings and Communities Programme

October 2014

Final Report of Annex 54

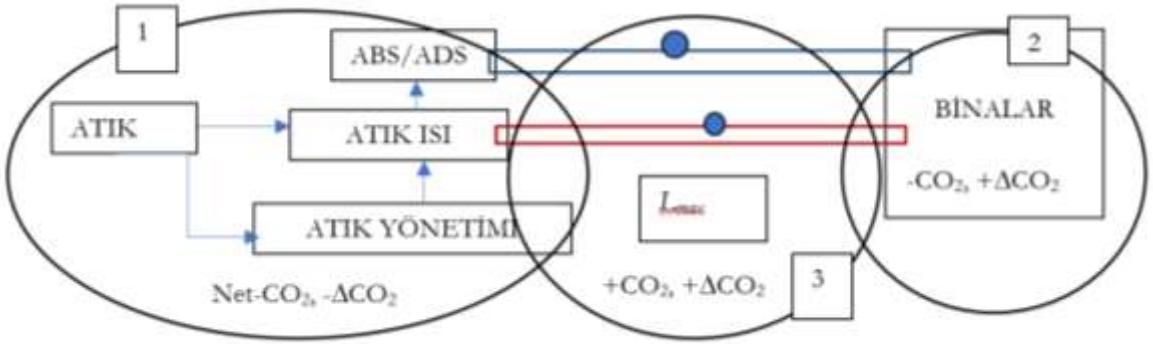
Edited by

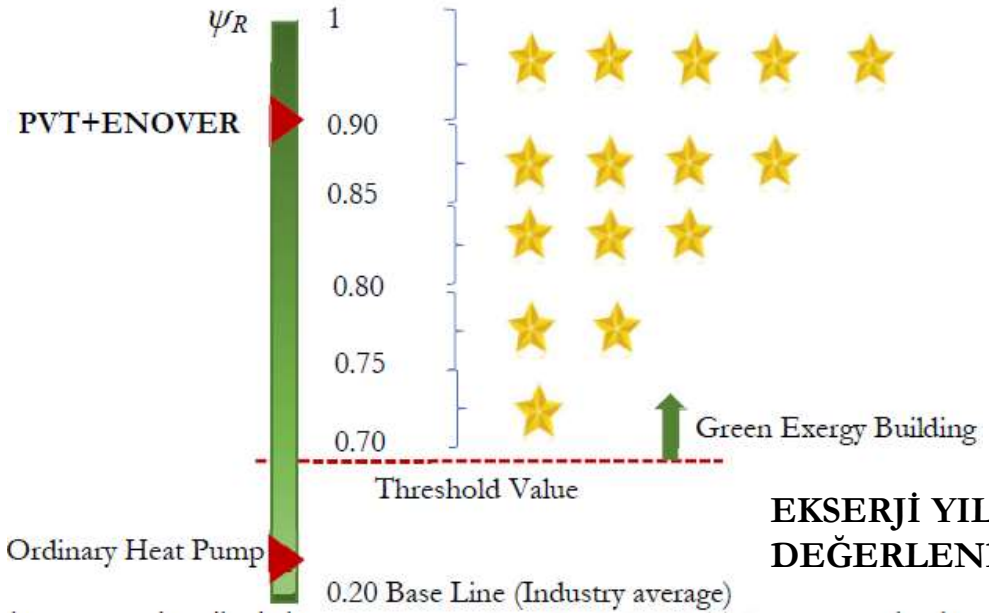
Evgueniy Entchev (National Resources Canada, Canada)

Peter Tzscheutschler (Technische Universität München, Germany)

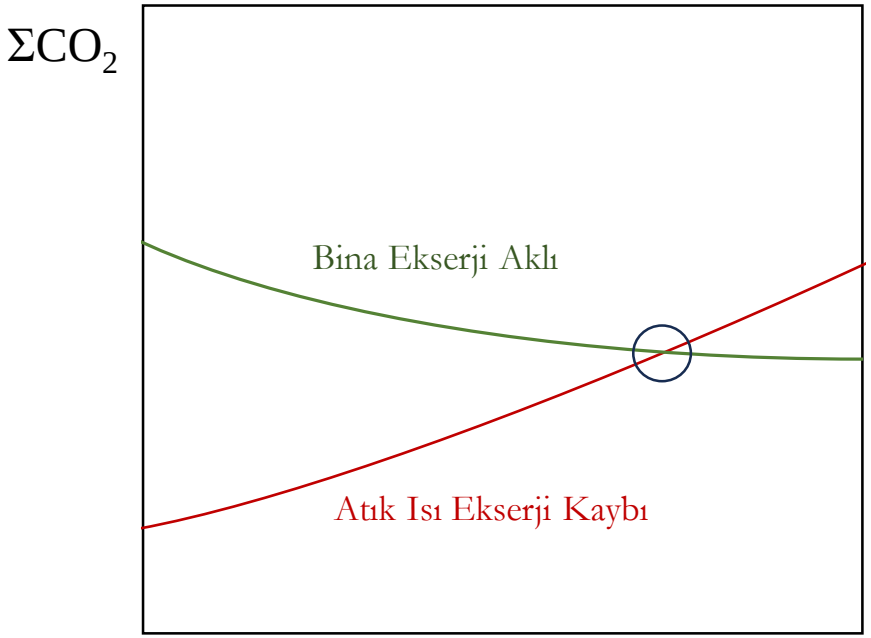
On behalf of IEA EBC Annex 54

BİNALAR NE KADAR NET-SIFIR OLMALI?





EKSERJİ YILDIZI DEĞERLENDİRME SİSTEMİ



Ekserji Yıldızı

ENERJİ AKILCI TARIMDAN EKSERJİ AKILCI TARIMA

Güç üretimi uğruna ağaç kesemya gerek yok!

Cumhuriyet.com.tr 28.07.2023

Water Reservoir and
Sink for Floods
Aquaculture

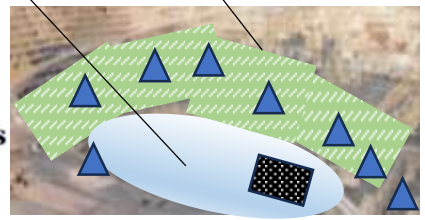
Terrace Greenhouses

$$\Delta CO_2 \square 0.8\times(1-\psi_R)$$

$\psi_R = 0.65$

Electricity

Missed Opportunities



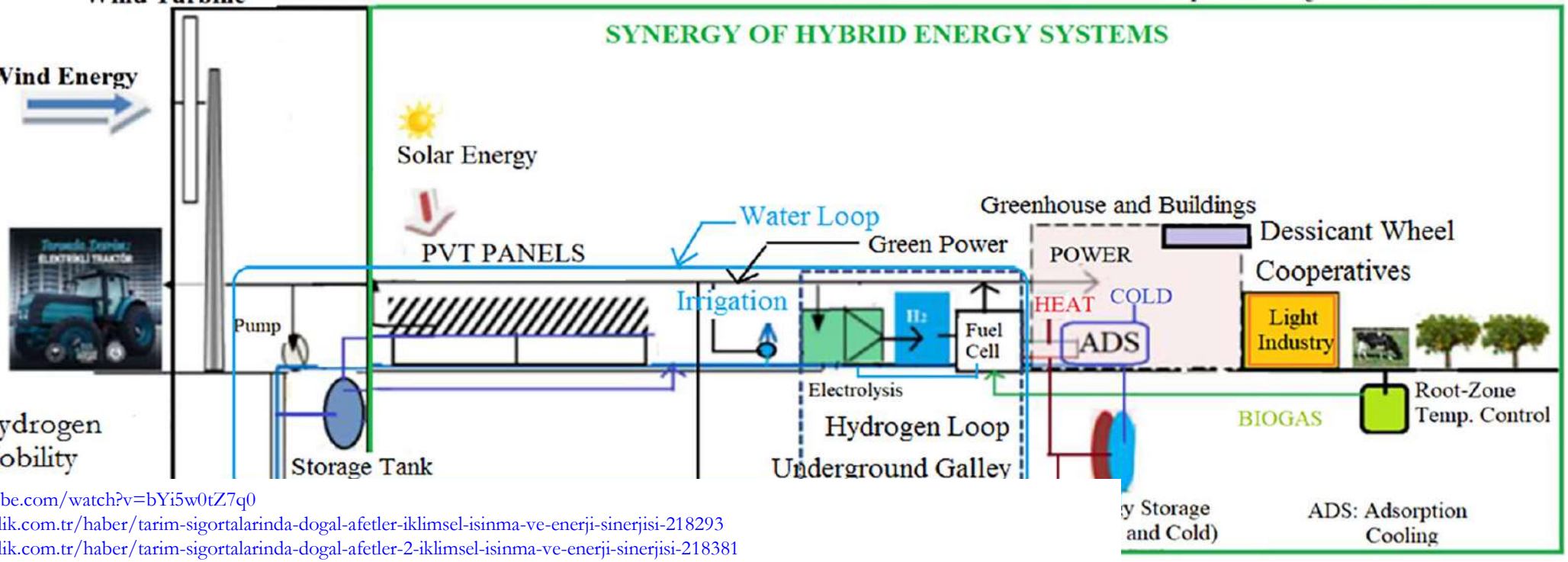
$\psi_R = 0.90$

Electricity

Gained Opportunities

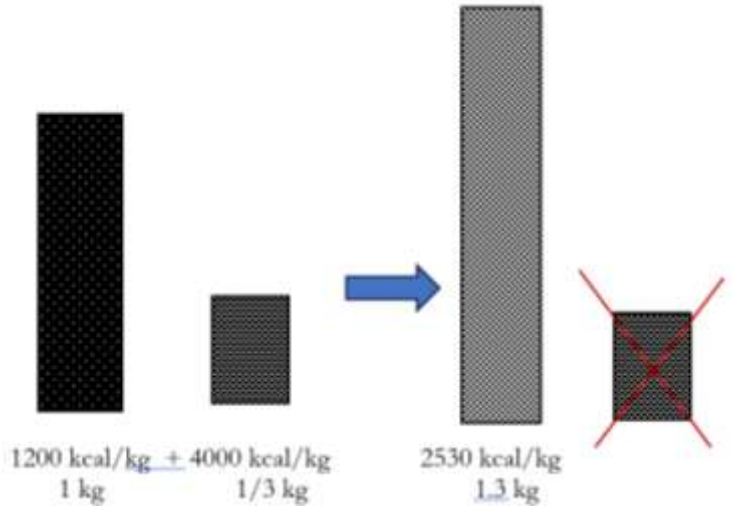
Steam
Hot Water
Heating
Cooling
Organic Fertilizer
Mobility
Energy Storage
Optimized Irrigation

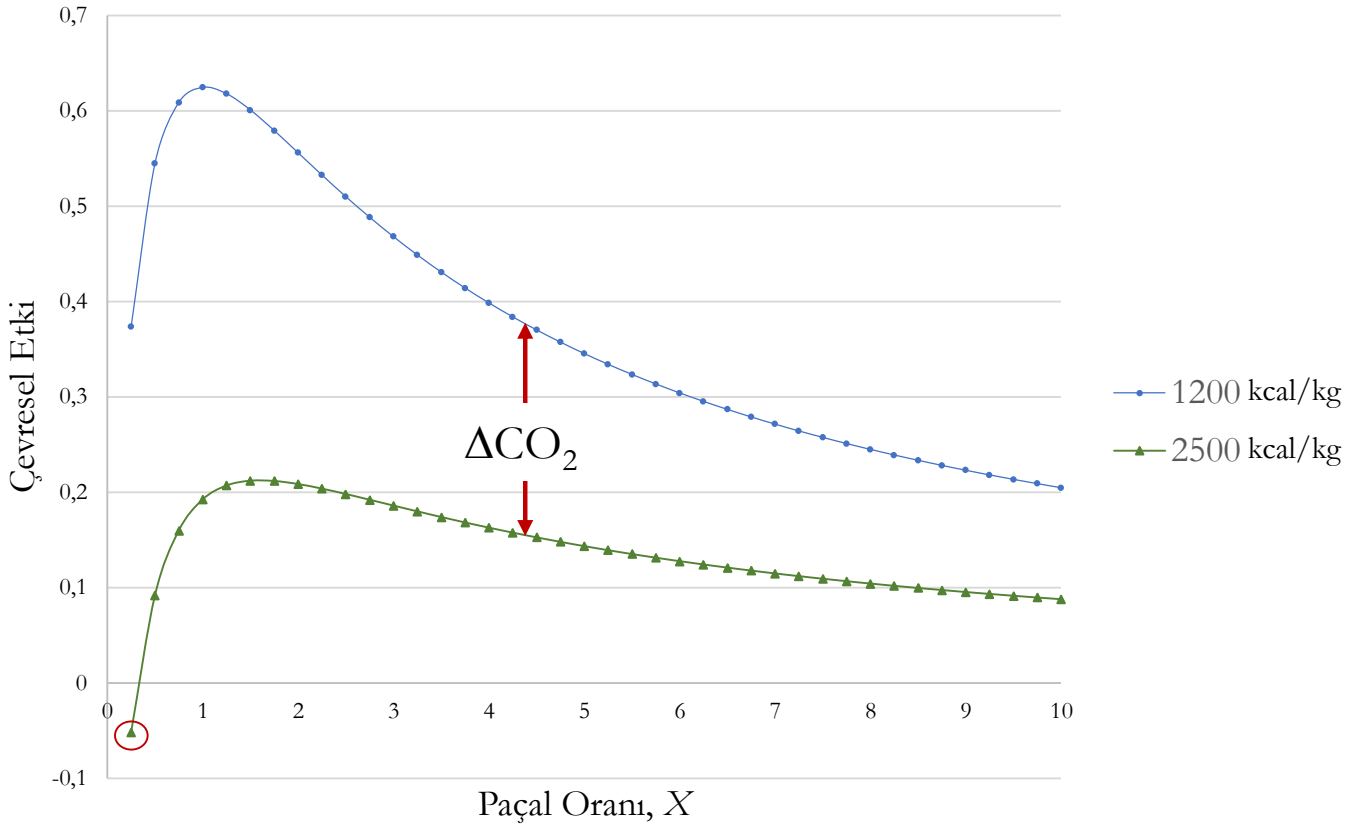
Wind Turbine



https://www.youtube.com/watch?v=bYi5w0tZ7q0
https://www.aydinlik.com.tr/haber/tarim-sigortalarinda-dogal-afetler-iklimsel-isinma-ve-enerji-sinerjisi-218293
https://www.aydinlik.com.tr/haber/tarim-sigortalarinda-dogal-afetler-2-iklimsel-isinma-ve-enerji-sinerjisi-218381
https://www.aydinlik.com.tr/haber/tarim-sigortalarinda-dogal-afetler-3-iklimsel-isinma-ve-enerji-sinerjisigunes-enerjisinde-sinerji-21846

TARIM YERİNE EKMEK İÇİN KÖMÜR?





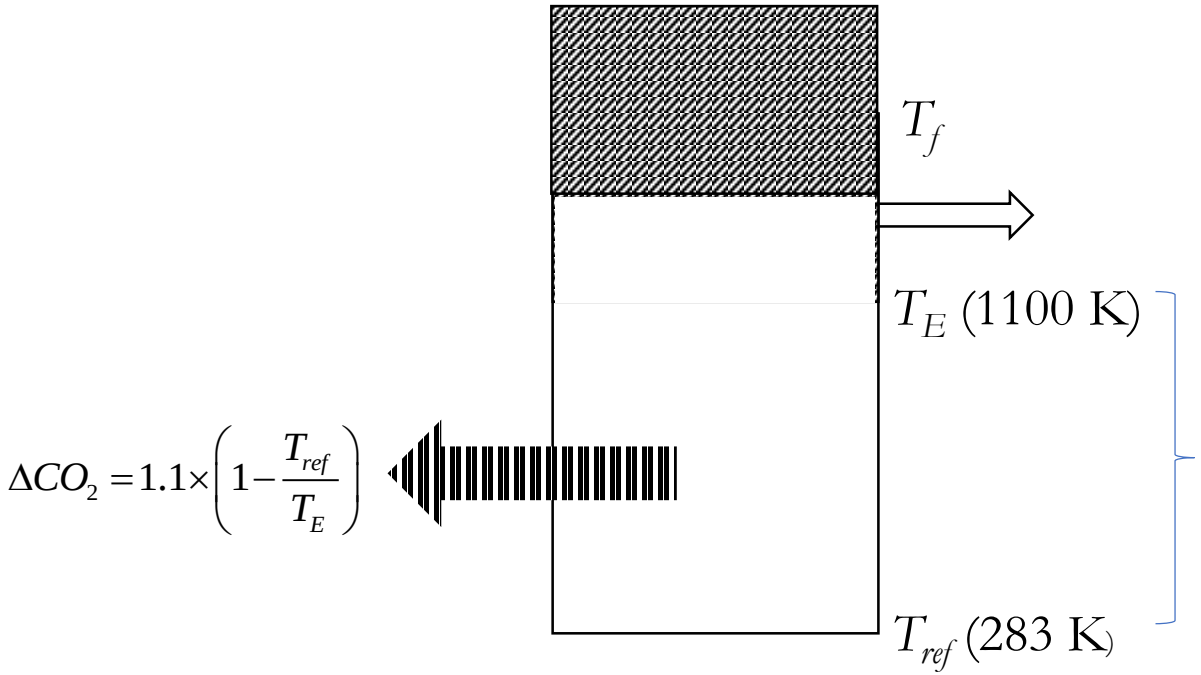
$$\text{Alt Isıl Ekserji Değeri } (AIEXD) = (AID) \times \left(1 - \frac{283\ \text{K}}{T_f}\right) \quad [\text{kcal}_{ex}/\text{kg}]$$

$$AIEXD_{güneş} = \frac{I_n^2}{TSI} = \frac{I_n^2}{1.367} \quad [\text{kW}_{ex}/\text{m}^2]$$

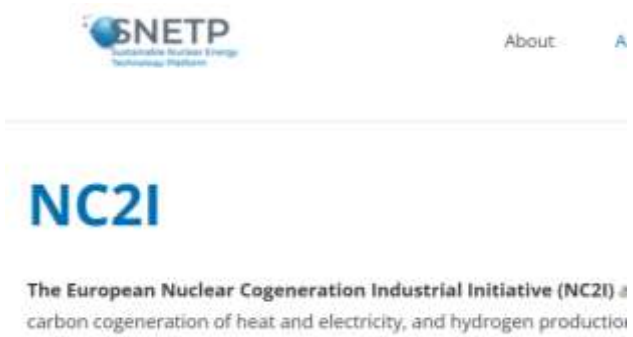
Tek pozitif nokta paçal oranı 0.4 ve Alt Isıl Değer>2500 kcal/kg

SANTRALLERDE ATIK ISININ DEĞERLENDİRİLMESİ

$$CO_2 = \frac{0.23}{\eta_{PP} \times \eta_T} = 0.23 \times PEF$$ {Prizde birim elektrik ekserjisi için}



Nükleer Santral

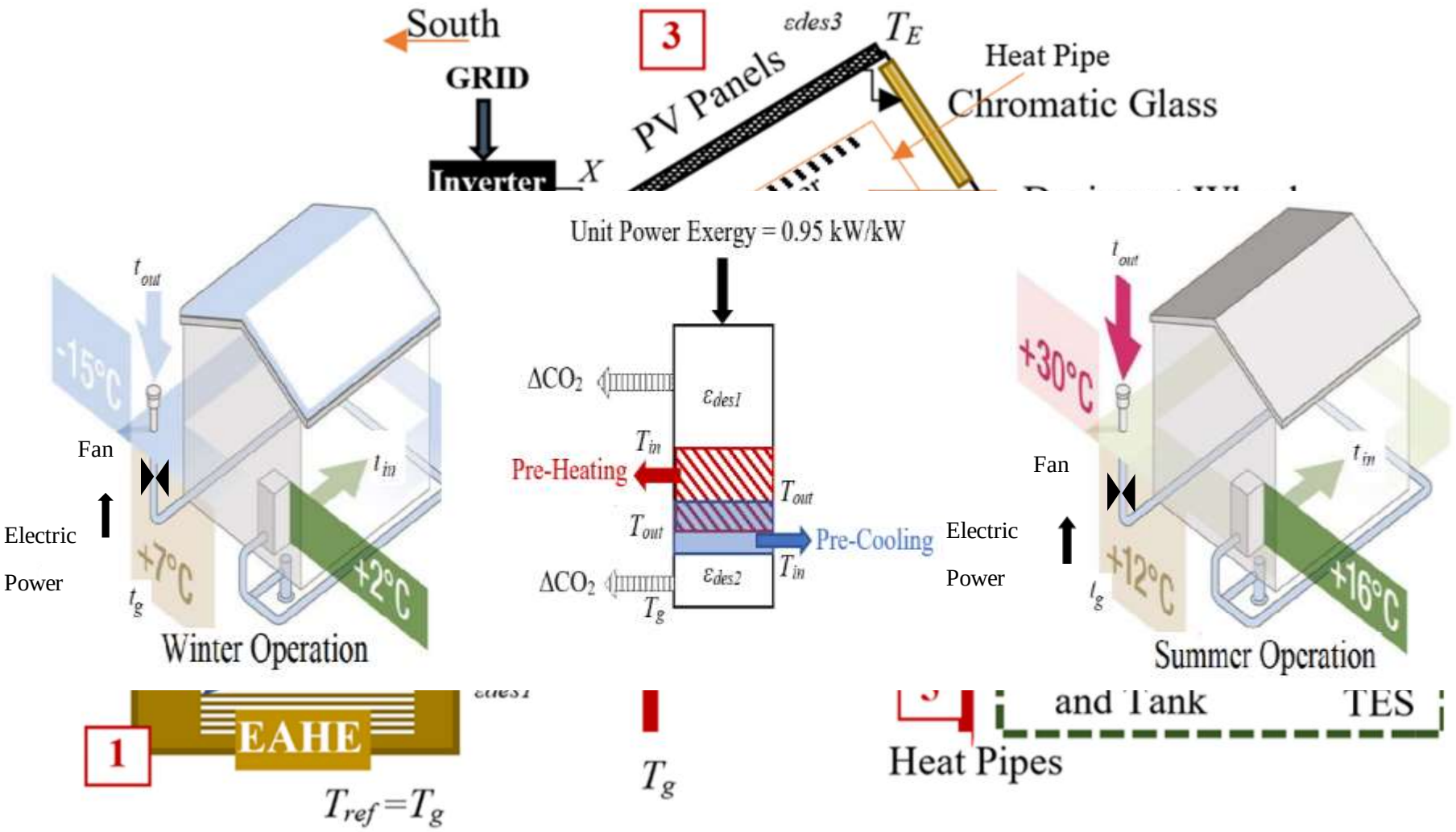


http://snetp.eu/nc2i/

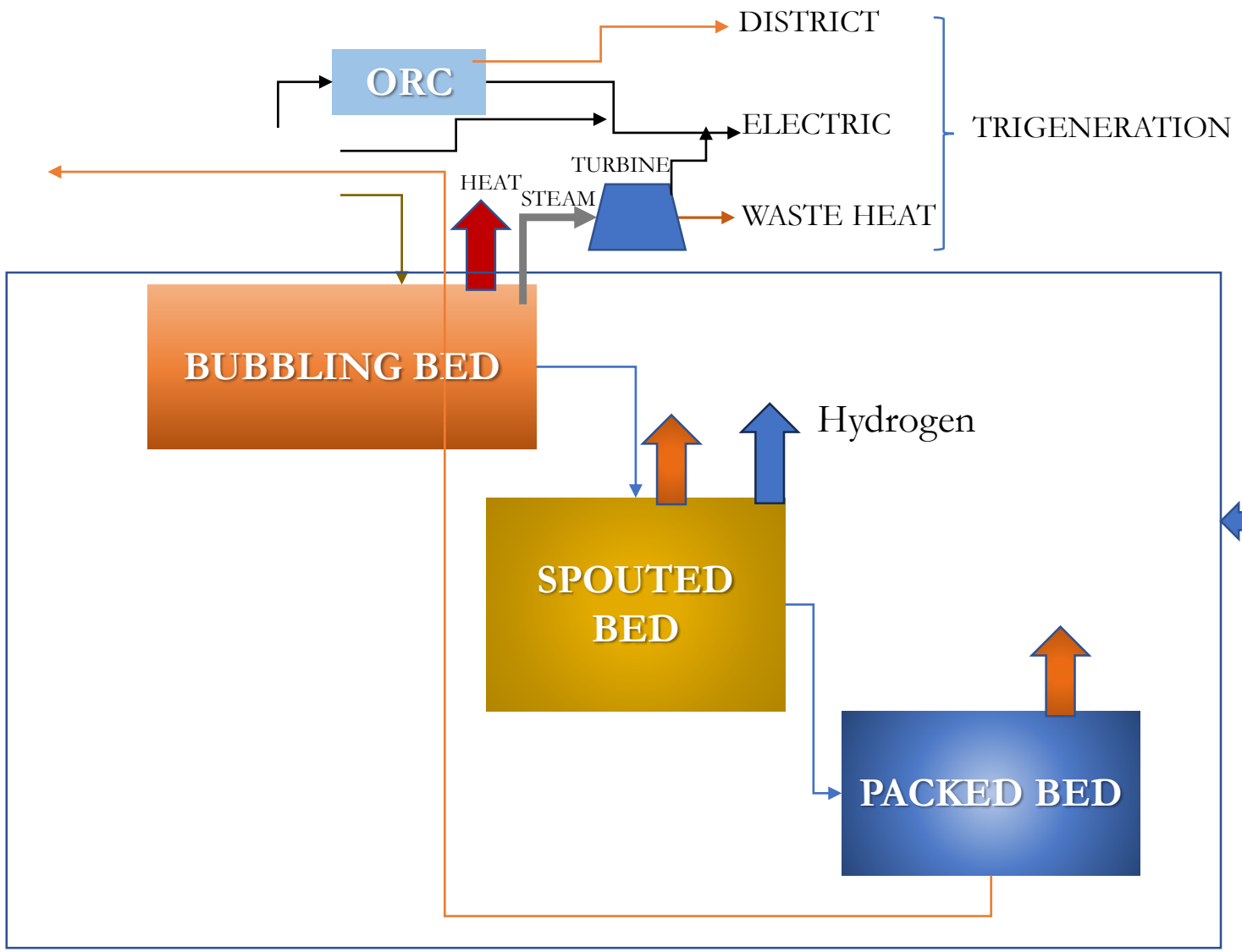
https://www.sciencedirect.com/science/article/abs/pii/S0306261921001975
https://world-nuclear.org/information-library/non-power-nuclear-applications/industry/nuclear-process-heat-for-industry.aspx

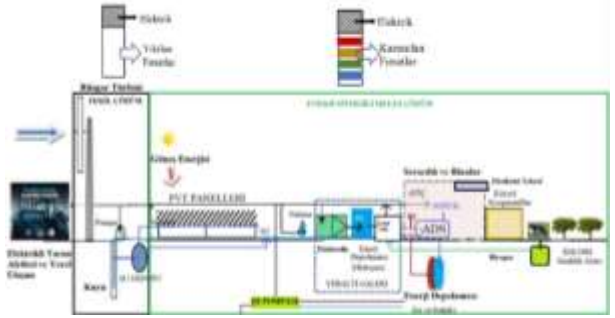
https://dergipark.org.tr/tr/download/article-file/385626

ENERJİ VE ÇEVRE DUYARLI SERACILIK

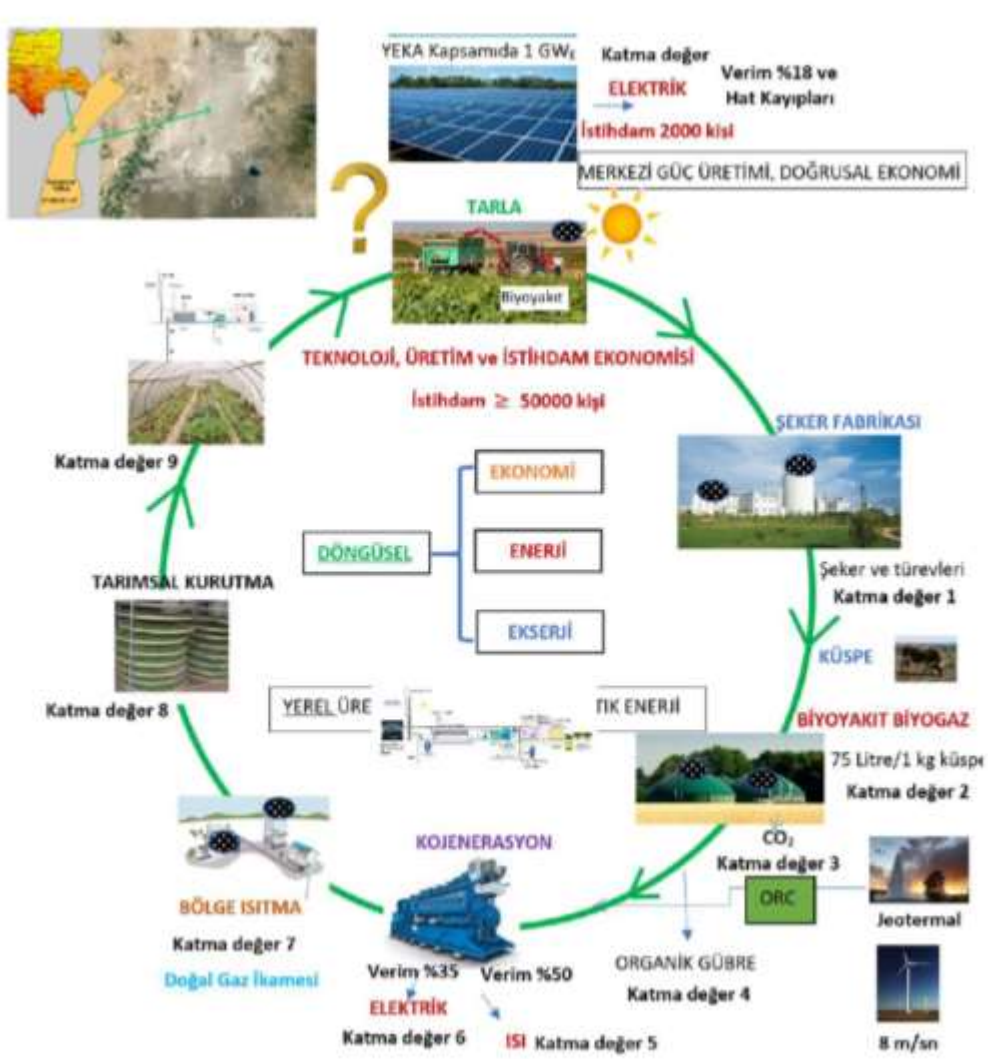


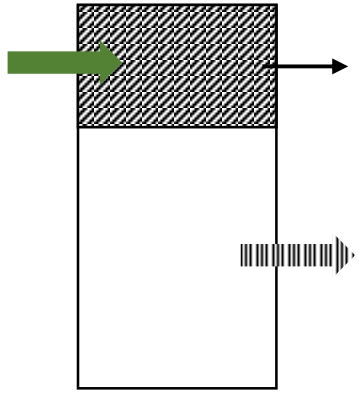
LİNYİT SANTRALİ, YEŞİL TARIM VE SANAYİ ÜÇLÜSÜ *Nearly-zero Emission*



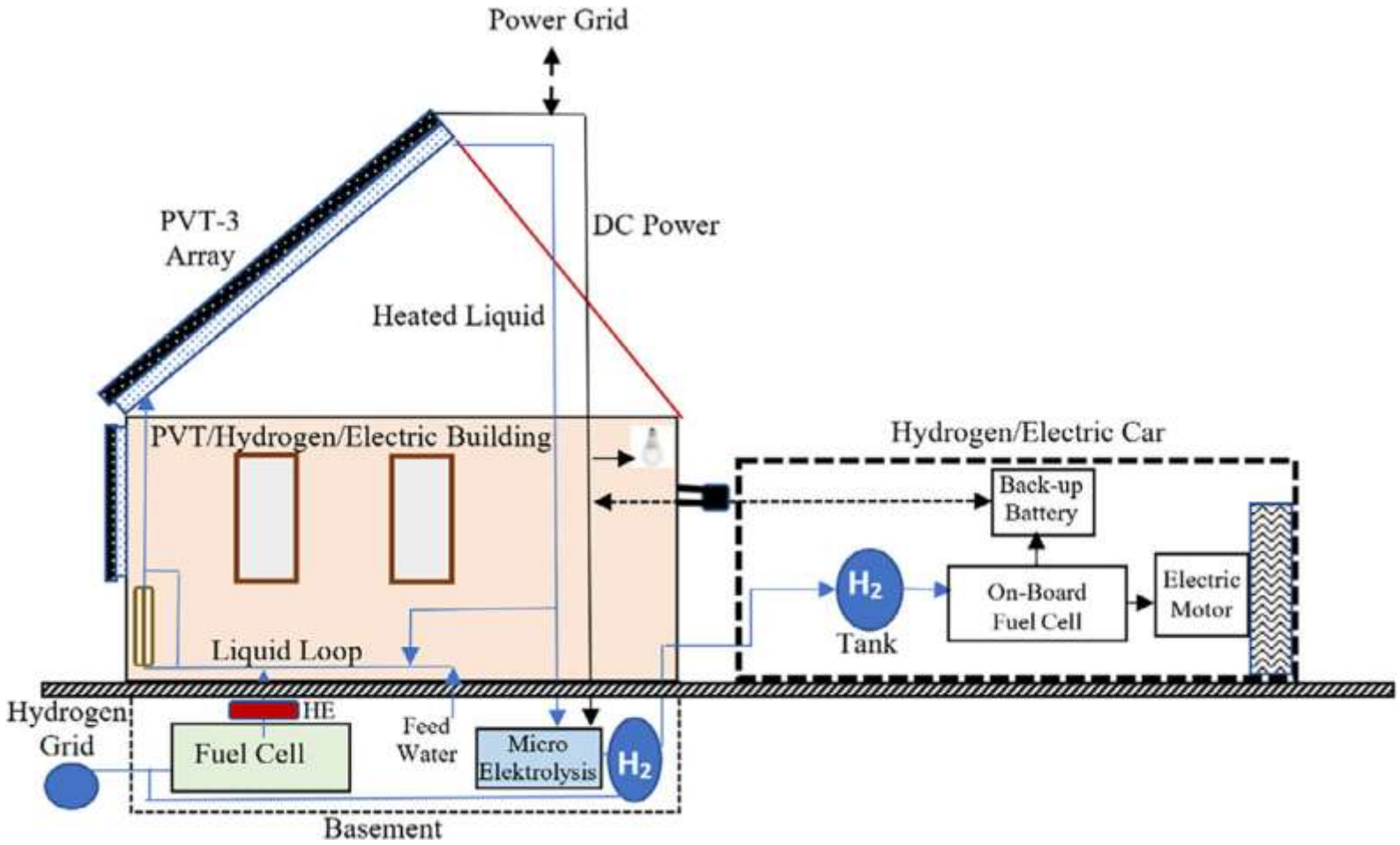


EKSERJİ-ÇEMBERİNDE TARIM VE GÜNEŞ ENERJİSİ





HİDROJEN EVİ



ESER YEŞİL BİNA ÖRNEĞİ

ESER LEED YEŞİL PLATİN BİNASI

Birlikte Isı ve Güç (Kojen)

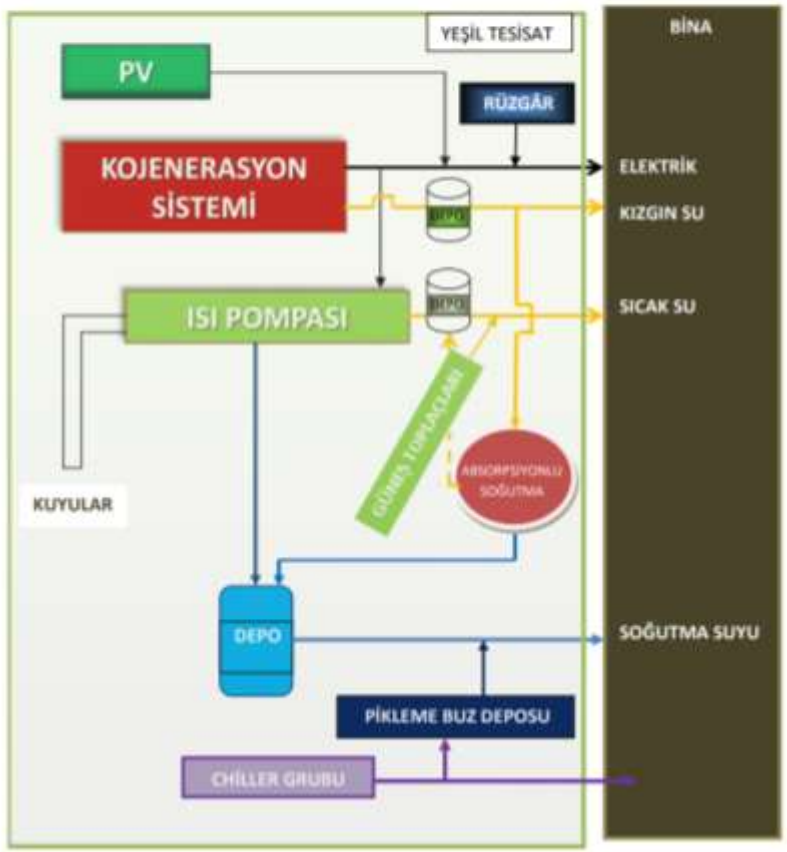
Depolama Örneği: Buz Tankı

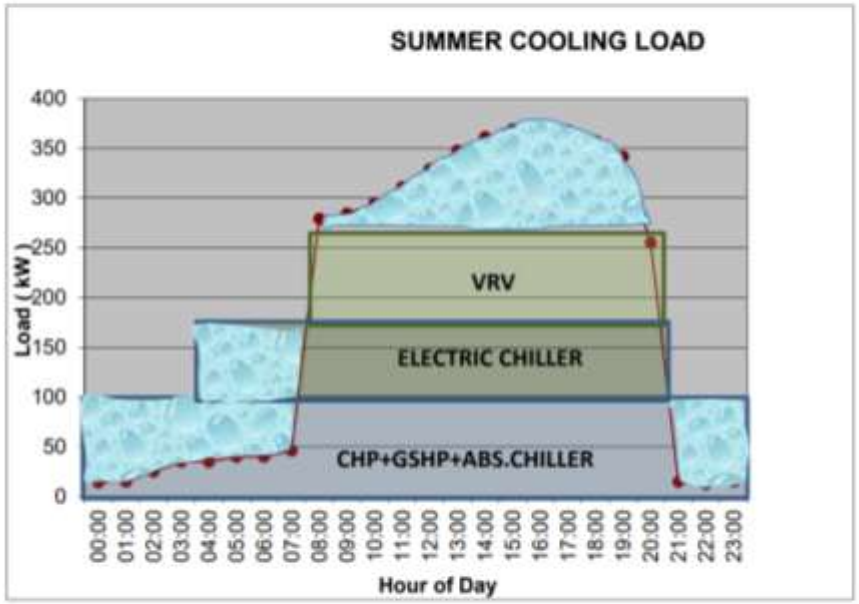
Isı Tahrikli
Soğutma (ABS)

Güneş Pilleri

Rüzgar
Türbini

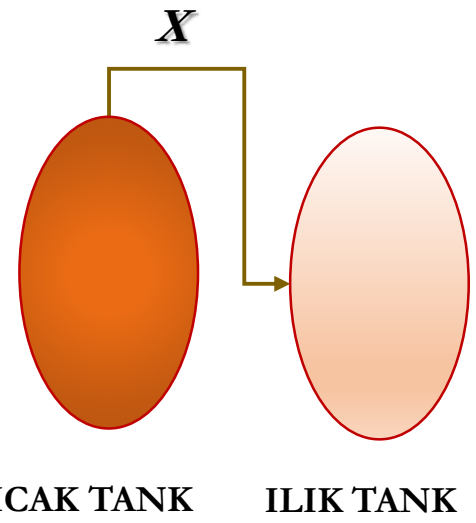
ESER LEED YEŞİL PLATİN BİNASI
Yakıt ve Yenilenebilir Harmanlı Üçlü Üretim



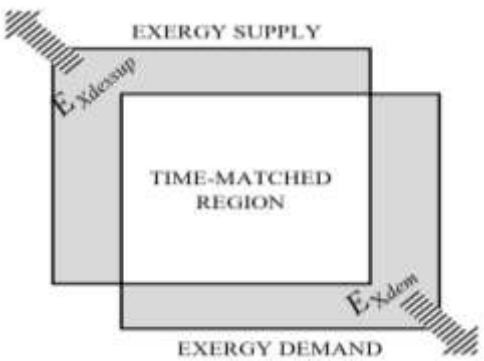


ISIL DEPOLAMADA KARIŞIM

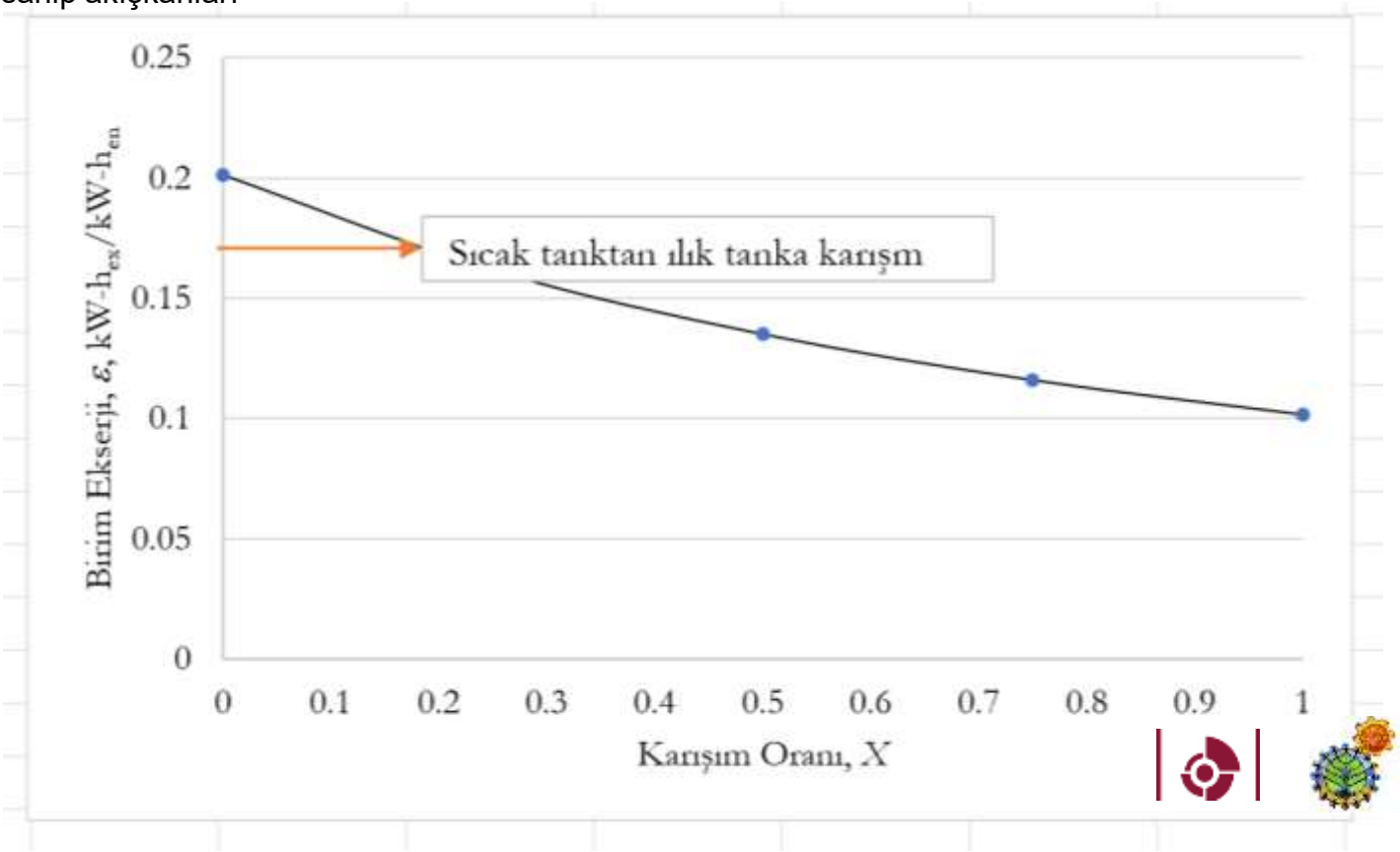
Farklı ekserjiye sahip akışkanları karıştırmayın



ΔCO_2

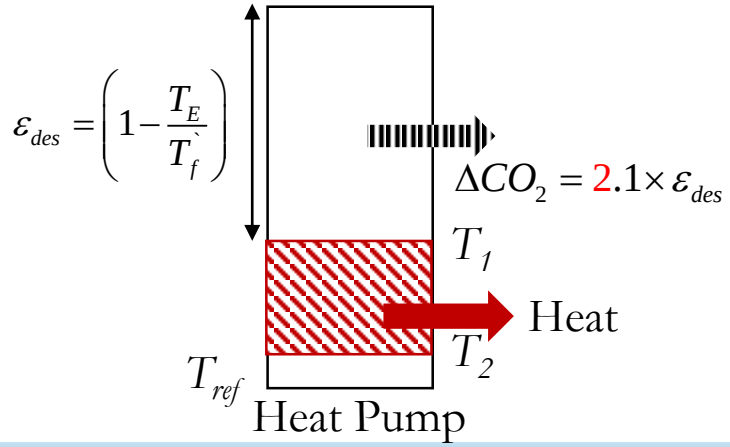


ΔCO_2



NE DENLİ EKSERJİ AKILCI?

Odense Veri Merkezi

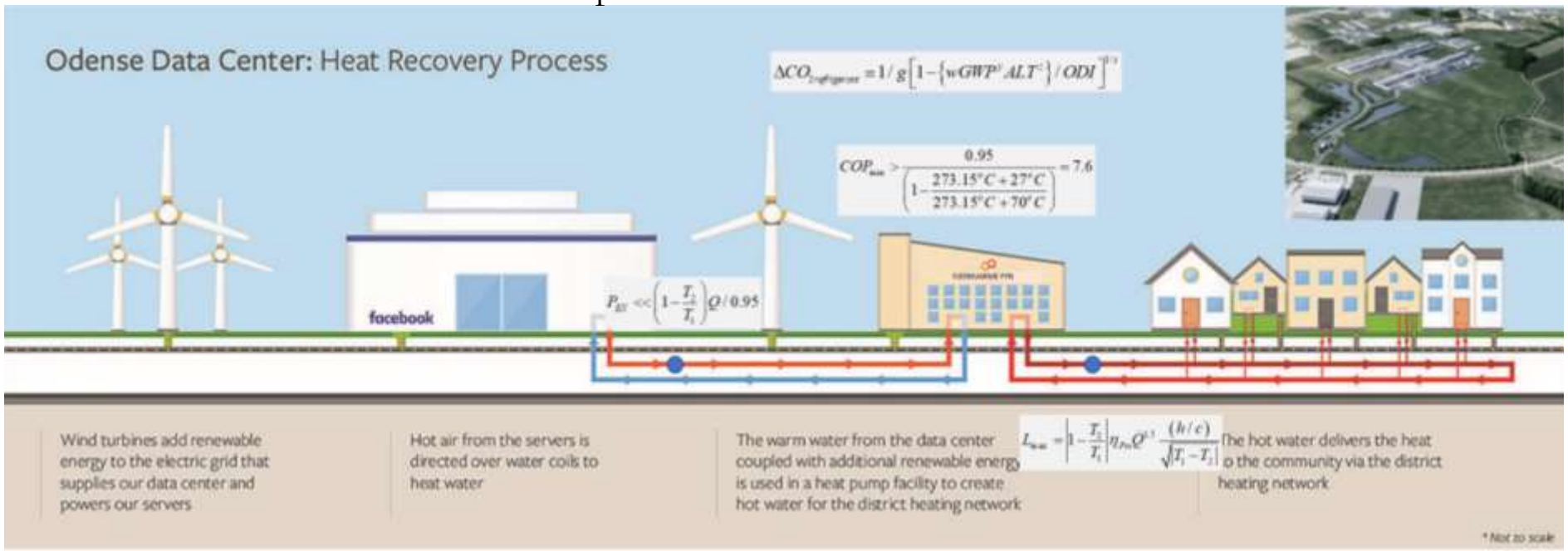


1- Maximum district size, L_{max}

$$L_{\max} \le \left|1 - \frac{T_2}{T_1}\right| \eta_P \dot{Q}^{1.5} \frac{(h/c)}{\sqrt{|T_1 - T_2|}}$$

2- Pumping exergy

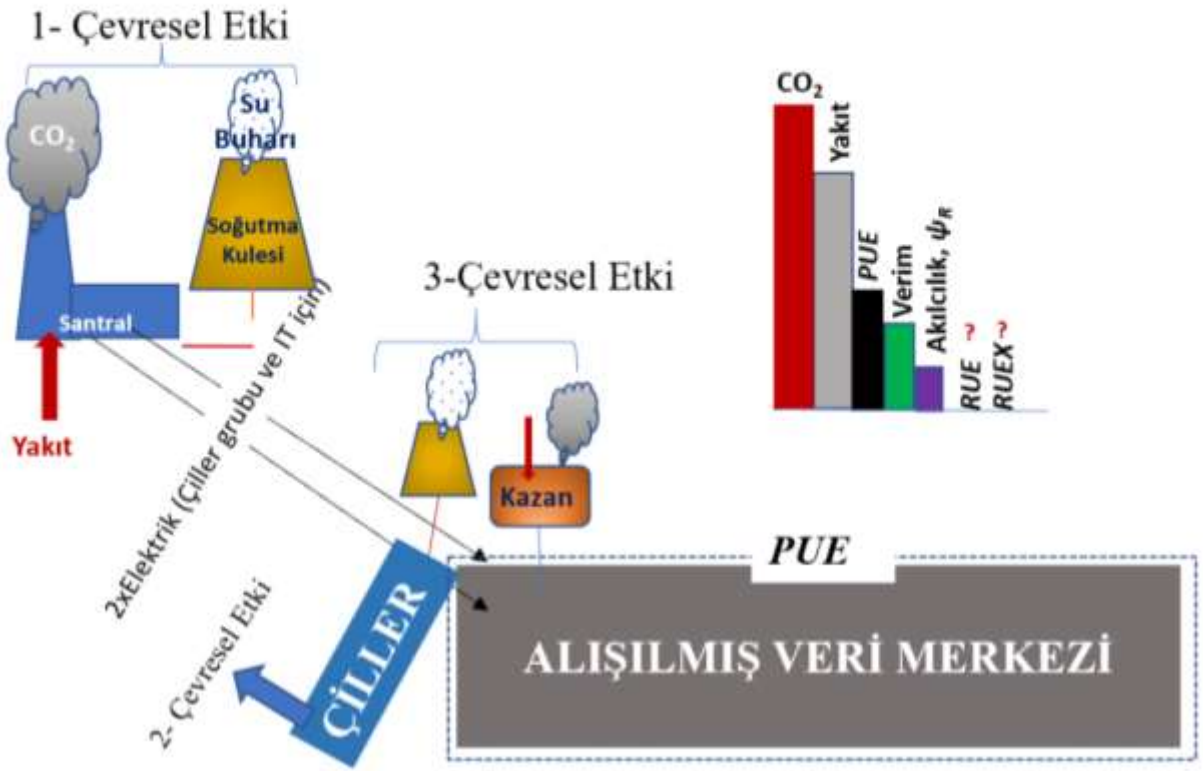
$$P << \left(1 - \frac{T_2}{T_1}\right) Q / 0.95$$



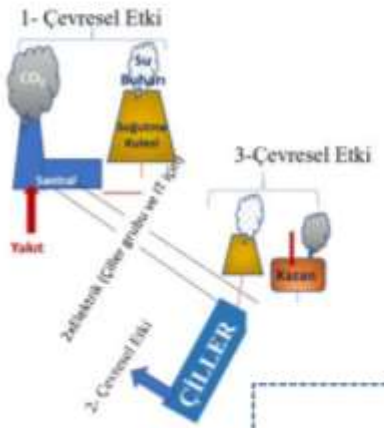
'The project was integrated into the strategy to decarbonize the district heating system and relies on the waste heat from a data center operated by Meta. The excess heat from the data center is upgraded via the means of a large heat pump from 27°C to 70°C, enabling the delivery of hot water and space heating to nearby homes at a suitable temperature.'

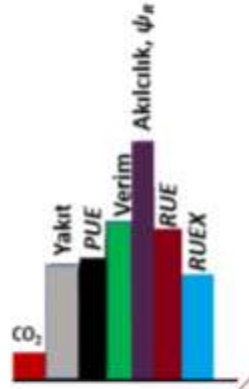
https://sustainability.fb.com/wp-content/uploads/2020/12/FB_Denmark-Data-Center-to-Warm-Local-Community.pdf

VERİ MERKEZLERİ



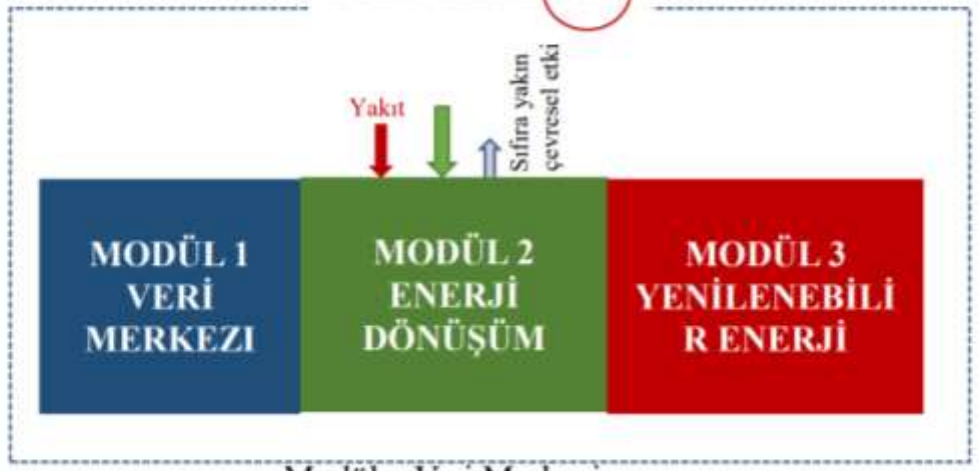
VERİ MERKEZLERİ





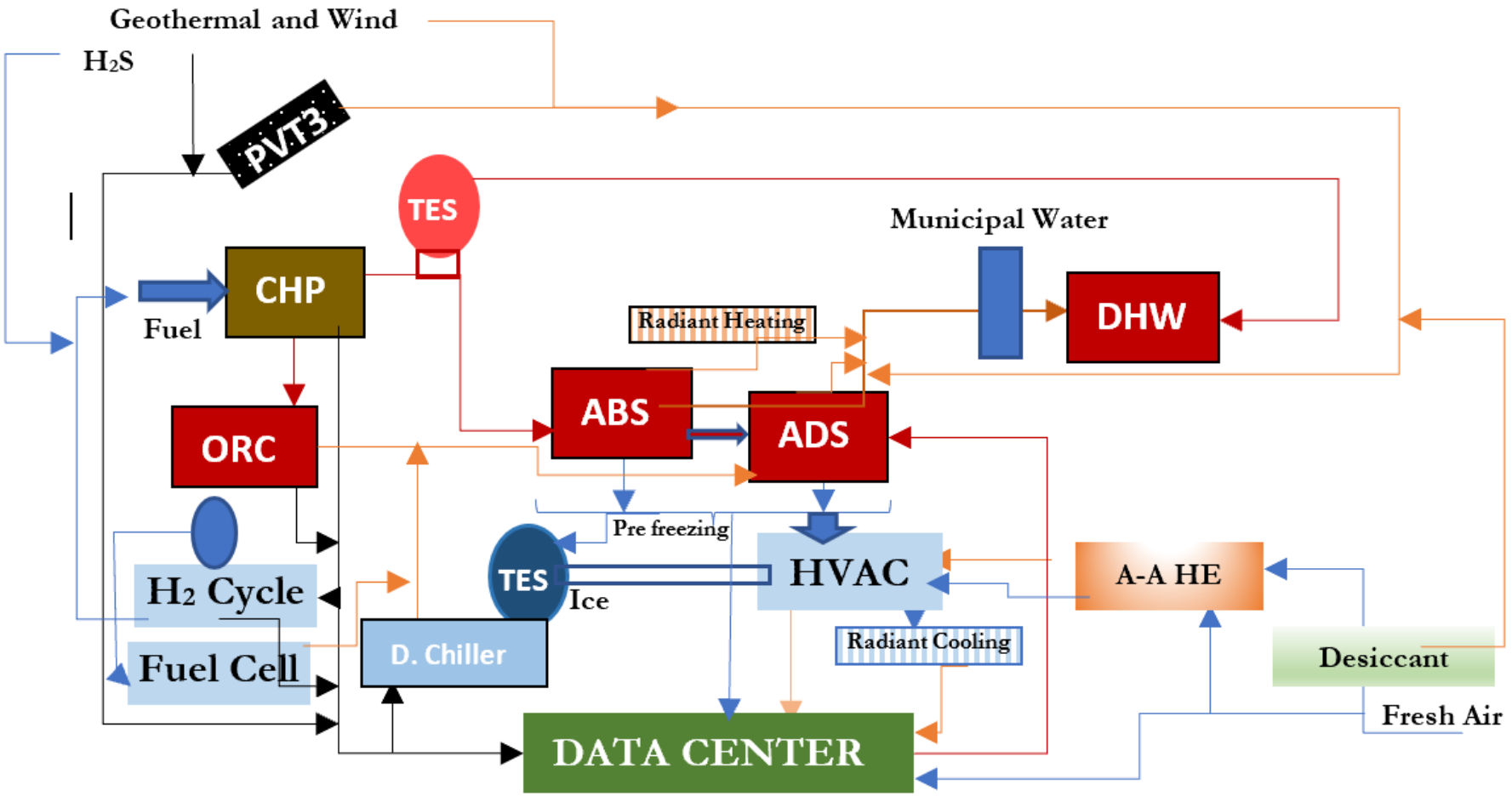
Tüketilen enerjinin kaynağını, nasıl dönüştürülüp veri merkezinde nerelerde kullanıldığını sorgular. *RUEX RUE* nin ekserji tabanlısıdır.

PUE YERİNE ***RUE***

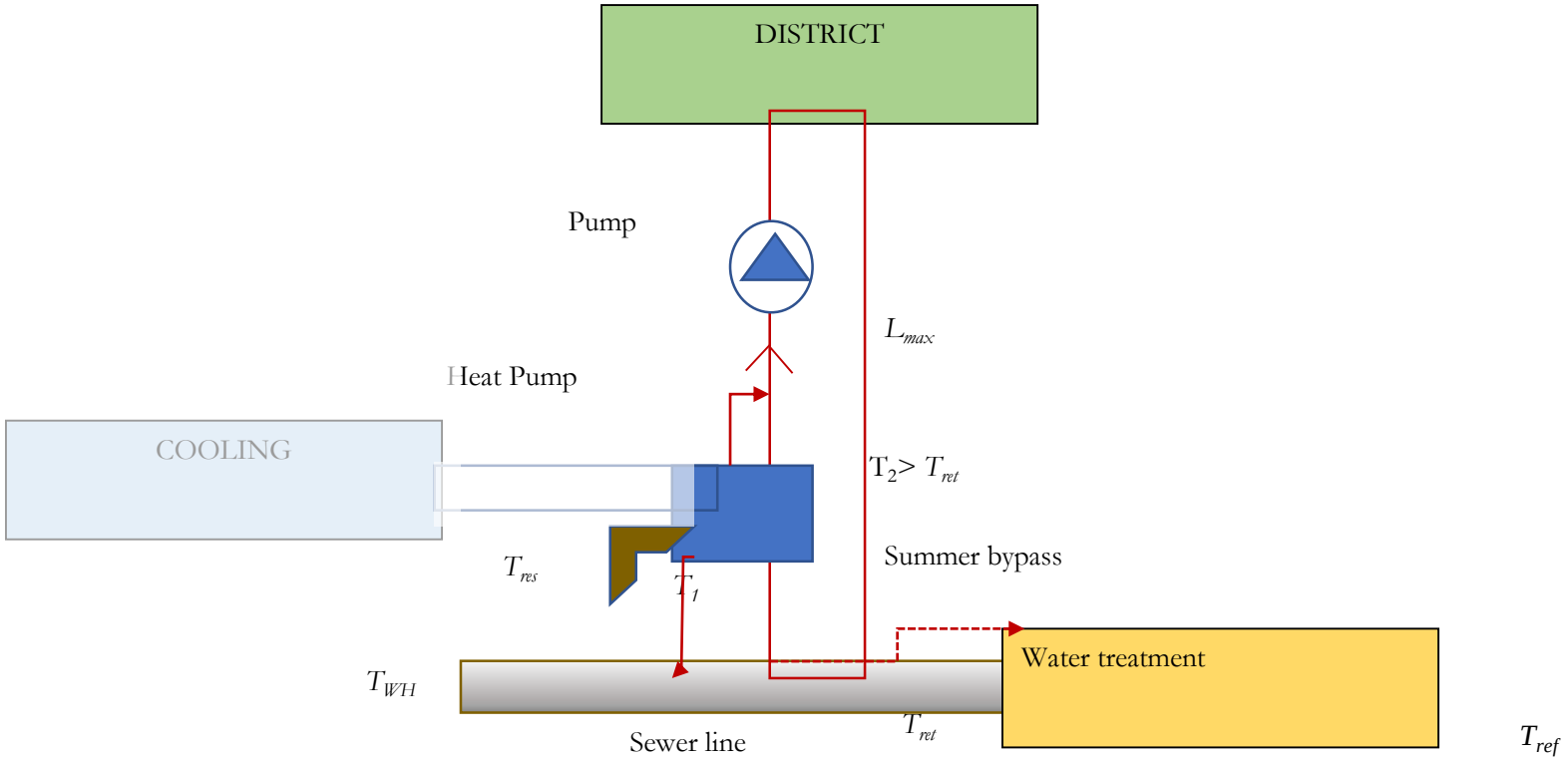


Modüler Veri Merkezi

YAKLAŞIK SIFIR CO_2 SALIMLI VERİ MERKEZİ



KANALİZASYON ISISI

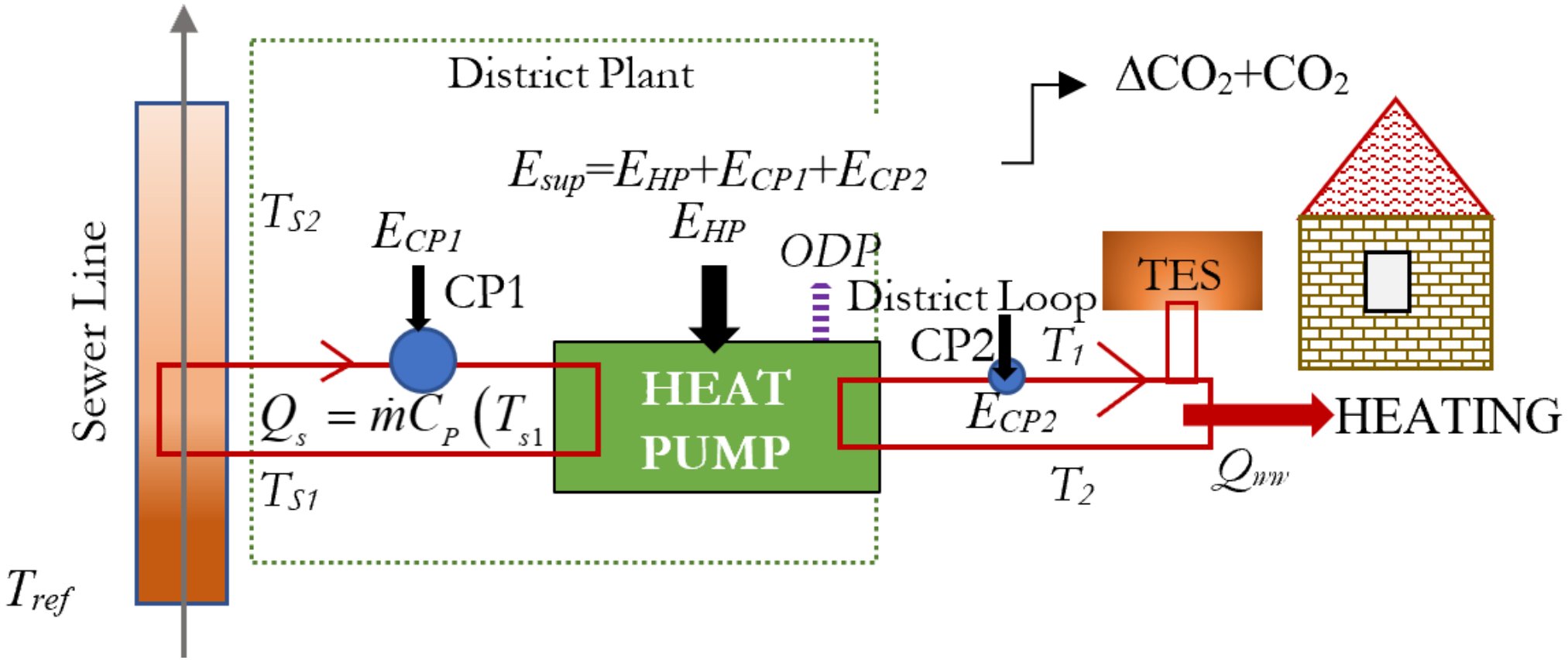


$$\text{Available unit exergy of sewer water} \le \left(1 - \frac{286\ \text{K}}{298\ \text{K}}\right) = 0.04\ \text{kW-h}_{ex}/\text{kW-h}_{en}$$

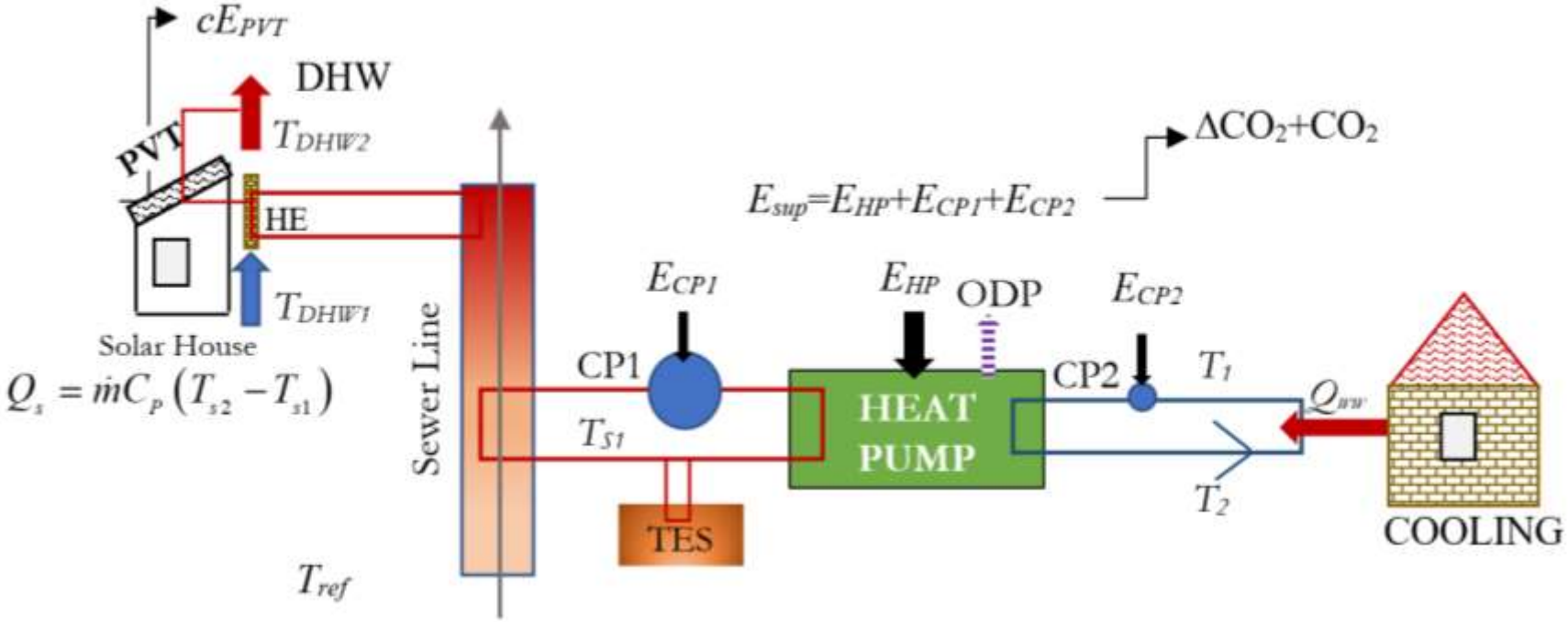
$$P_{EL} << \frac{0.04}{0.95}\ \text{kW-h of electric demand/kW-h of heat delivered}$$

$$\Delta CO_2 = 0.63 \times \left(P_{EL} \times 0.95 - 0.04\right)\ \text{kg CO}_2/\text{kW-h}_{\text{exergy gained}}$$

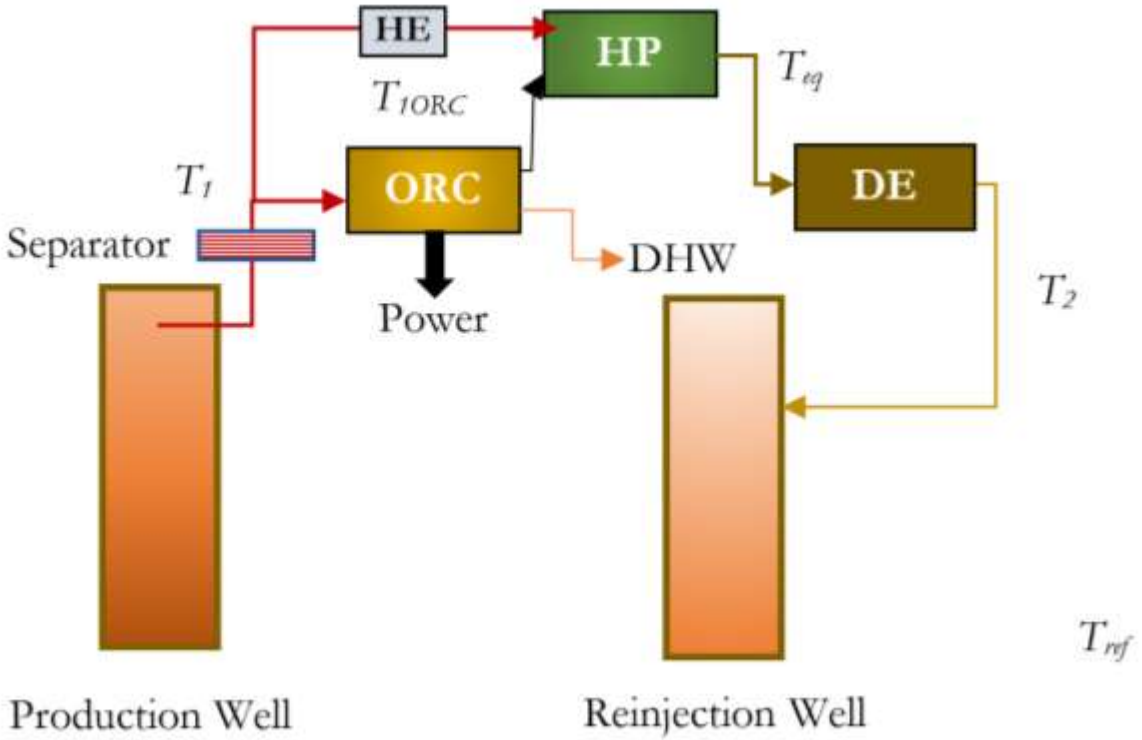
ISITMA



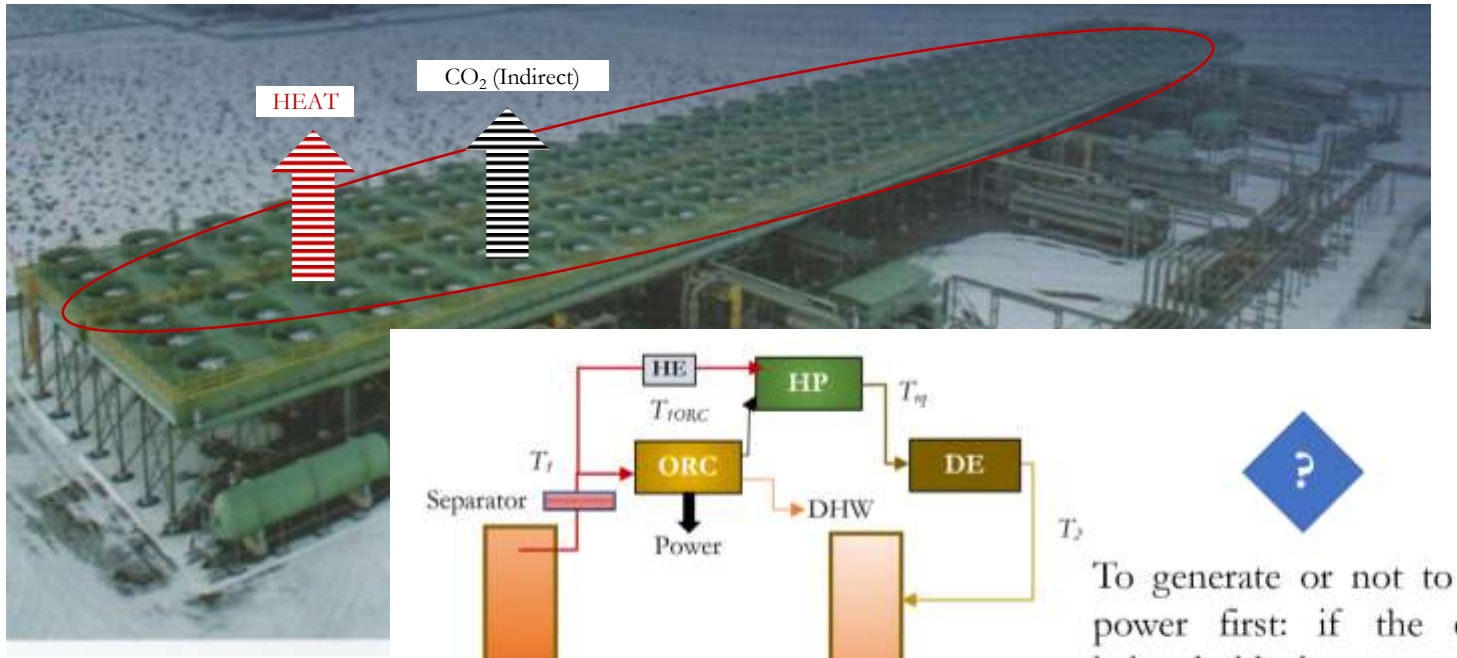
SOĞUTMA



JEOTERMAL ENERJİDE KARAR VERME YÖNTEMİ



$$\eta_{I_{ORC}} \times 0.95 + (1-\eta_{I_{ORC}}) \times \left[\left(1-\frac{T_{ref}}{T_{1_{ORC}}}\right)-\left(\frac{0.95}{COP_{HP_{ORC}}}\right)\right] > \eta_{IHE}\left[\left(1-\frac{T_{ref}}{T_1}\right)-\left(\frac{0.95}{COP_{HP_{DE}}}\right)\right]$$



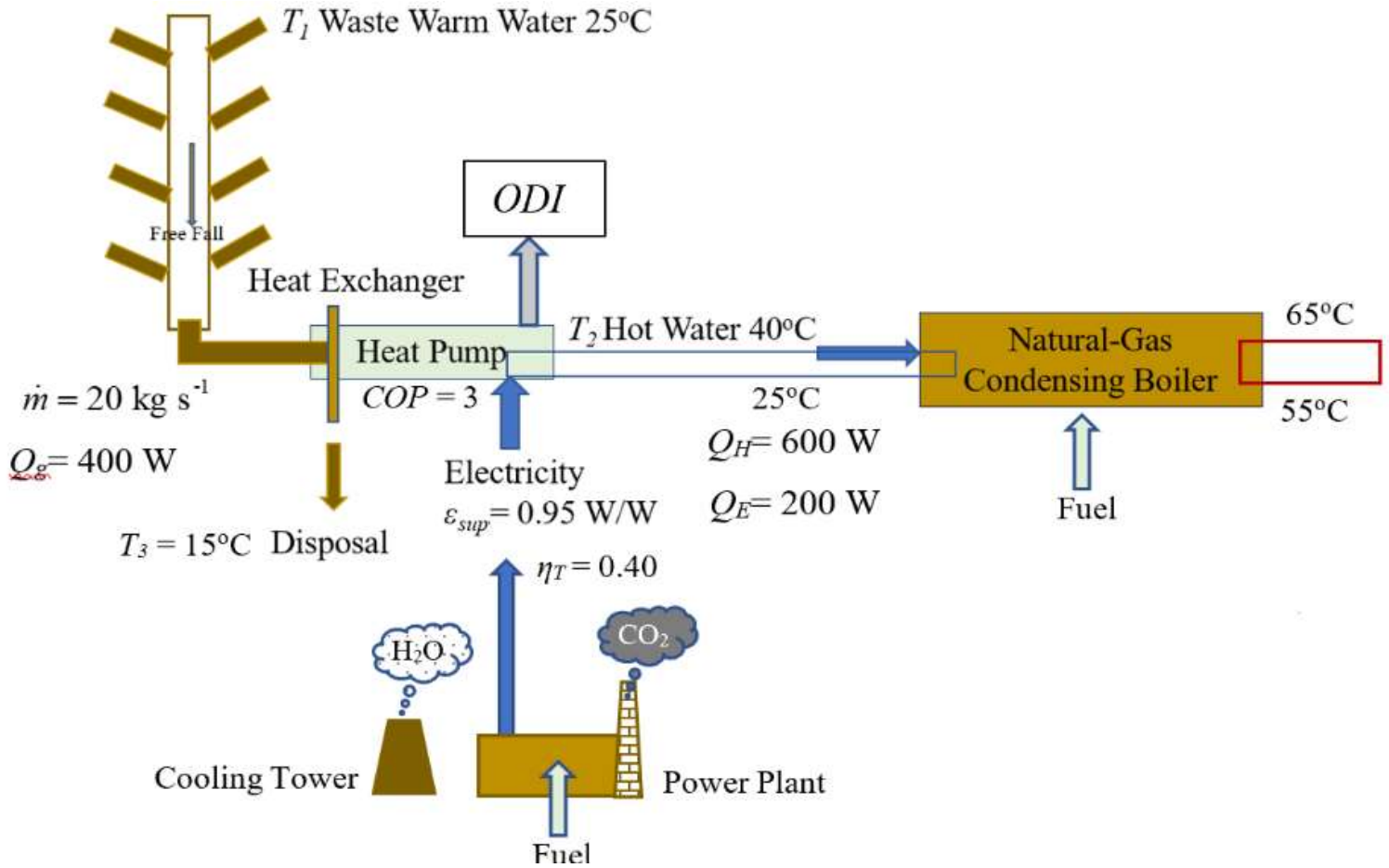
?

To generate or not to generate power first: if the condition below holds the answer is **YES**.

T_{ref}

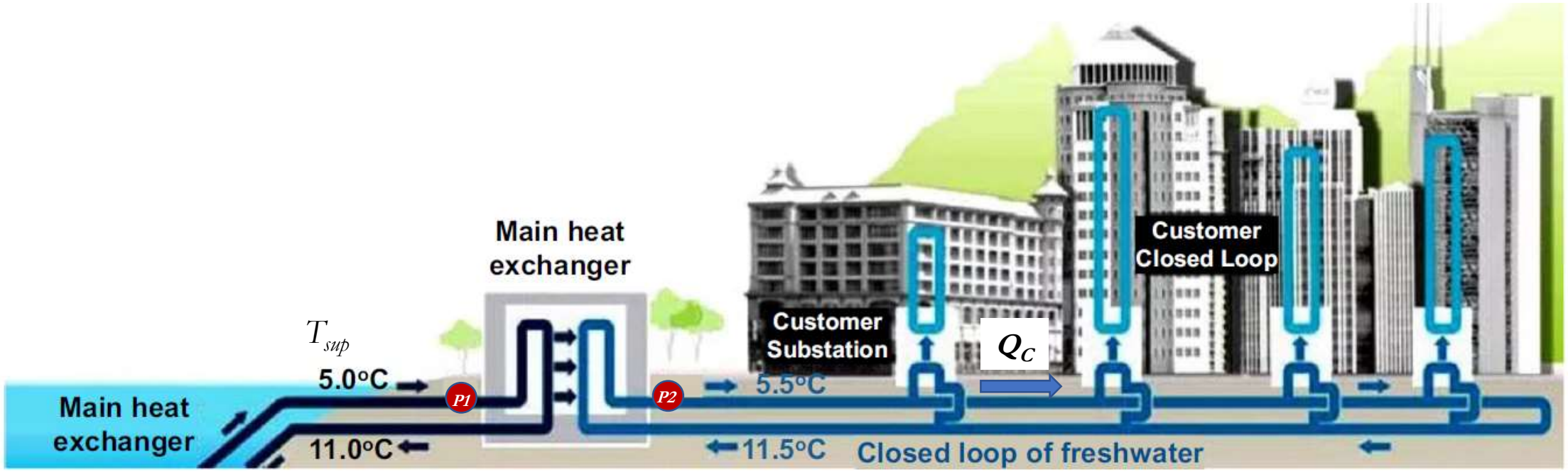
$$\eta_{I_{ORC}} \times 0.95 + (1 - \eta_{I_{ORC}}) \times \left[\left(1 - \frac{T_{ref}}{T_{I_{ORC}}} \right) - \left(\frac{0.95}{COP_{HP_{ORC}}} \right) \right] > \eta_{IHE} \left[\left(1 - \frac{T_{ref}}{T_1} \right) - \left(\frac{0.95}{COP_{HP_{DE}}} \right) \right]$$

BİNALARDA ATIK SUDAN YARALANABİLİRMİYİZ?



NE DENLİ EKSERJİ-AKILCI?

Derin Deniz Bölge Klima Sistemi

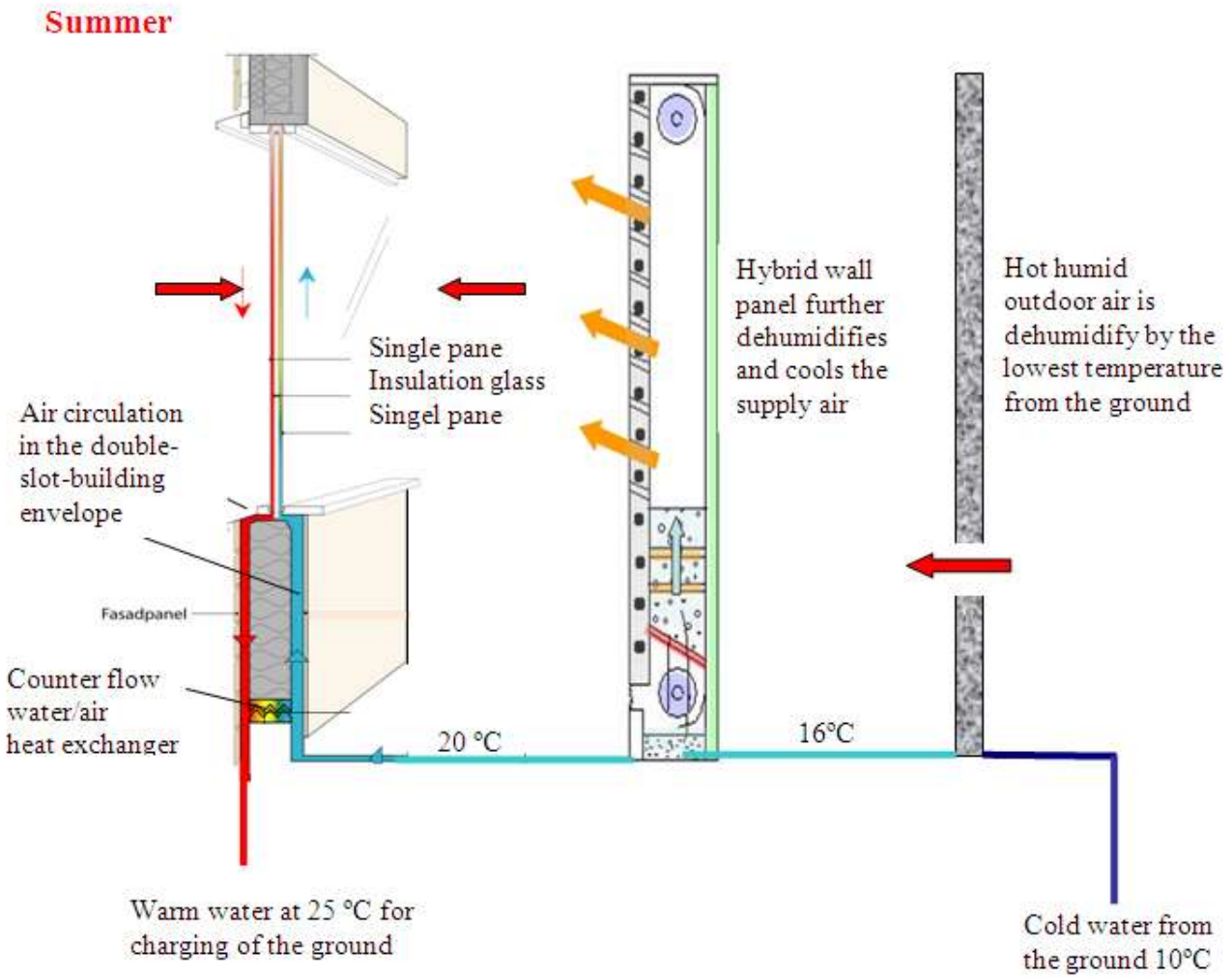


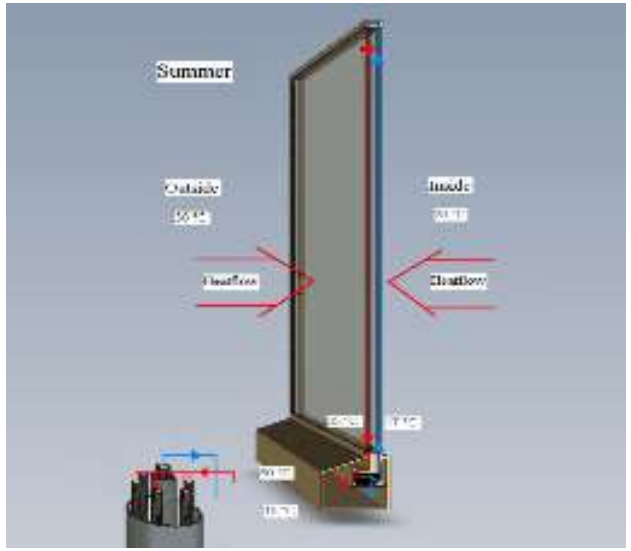
https://www.ecosisltd.com/sea-water-air-conditioning

$$(P_1 + P_2) << \frac{Q_C}{0.95} \times \left(1 - \frac{T_{\text{sup}}}{T_{ret}}\right)$$

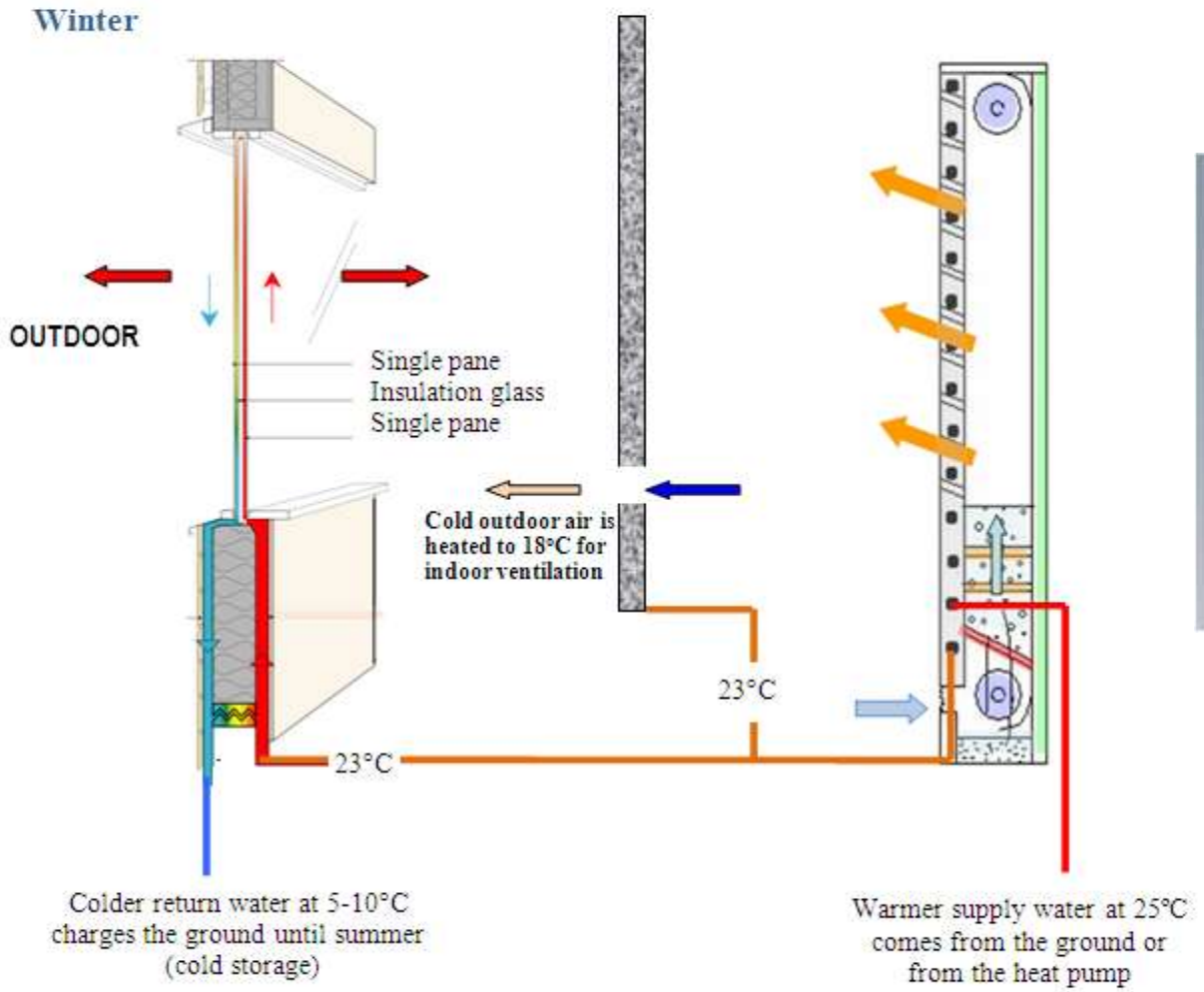
$$(P_1 + P_2) << \frac{1\ \text{kW}}{0.95} \times \left(1 - \frac{278\ \text{K}}{284\ \text{K}}\right) = 0.0022\ \text{kW}$$

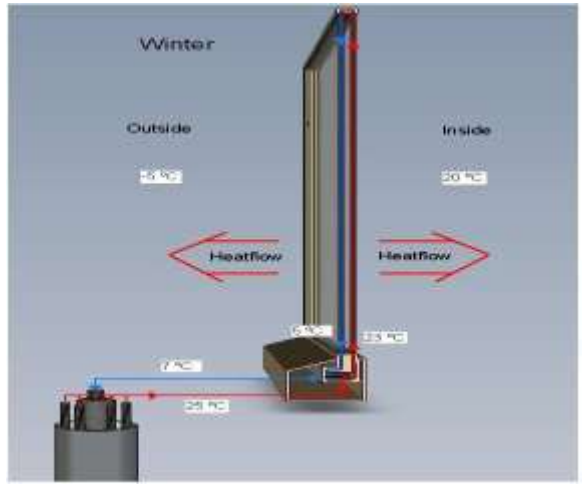
YENİLİKÇİ ÇÖZÜMLER-Etkin Pencere. Yaz İşletmesi





YENİLİKÇİ ÇÖZÜMLER-Etkin Pencere. Kış İşletmesi

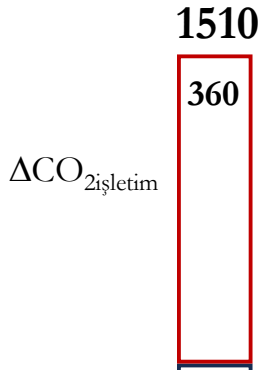




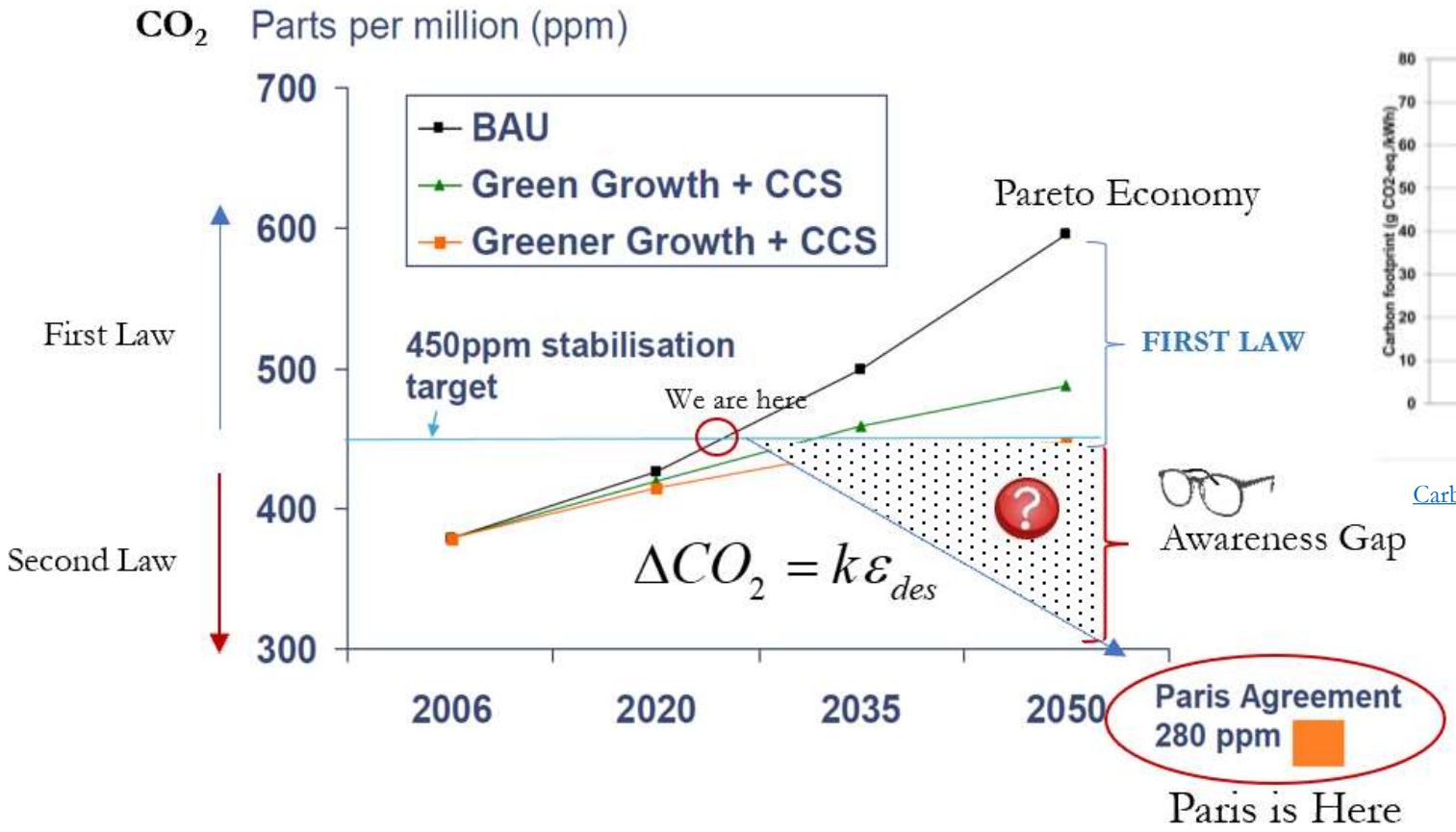
Platell, P, Kılkış,B.

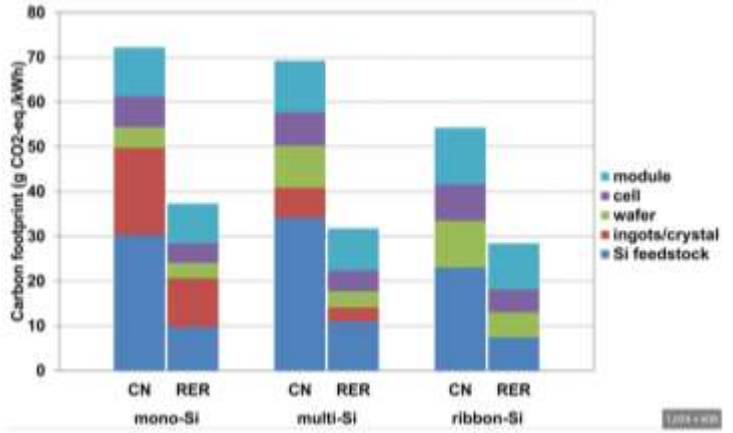
MELEZ DUVAR PANELİ

SONUÇ VE DEĞERLENDİRME



2.ci yasa uygulandığında gömülü CO_2 kaynaklarının da ek ΔCO_2 boyutu olduğu ve bu günkü koşullarda işletim sırasında da önemli bir ΔCO_2 boyutunun olduğu öne çıkmaktadır. Bu nedenlerle, günümüz projeksiyonları küresel ısınmaya karşı oldukça yetersiz kalmaktadır. Küresel ısınmaya karşı daha etkin ve sürdürülebilir bir yol haritasının çizilmesinde mutlaka ΔCO_2 salımlarının-kısacası- ekserji yıkımlarının çok aza indirilmesi gelecek için bir ön koşuldur.
Paris anlaşmasına ancak bu şekilde ulaşılabilinir.





Carbon footprint of solar panels in Europe vs. China | Flickr

HİDROJEN EVİ-2

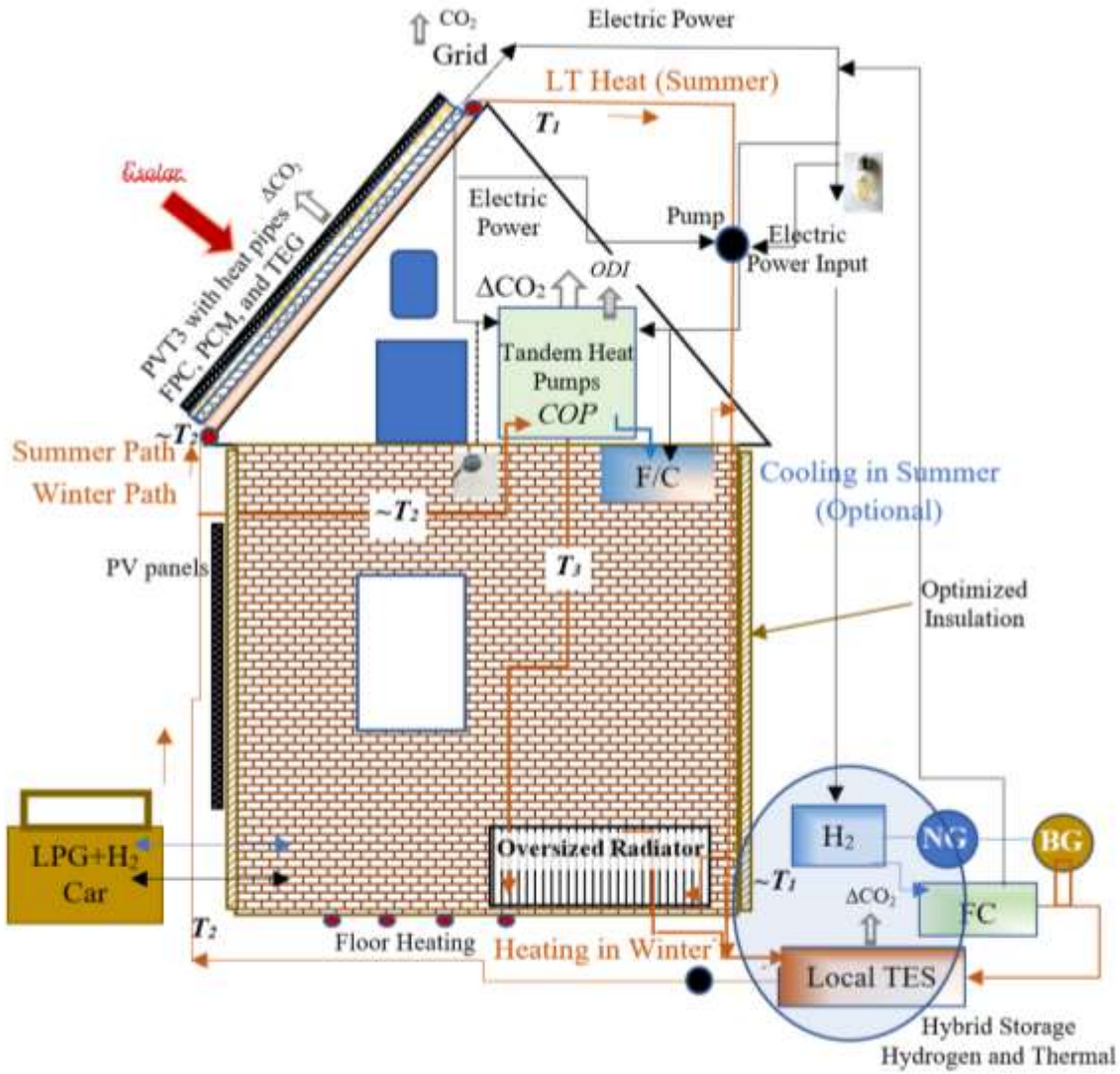
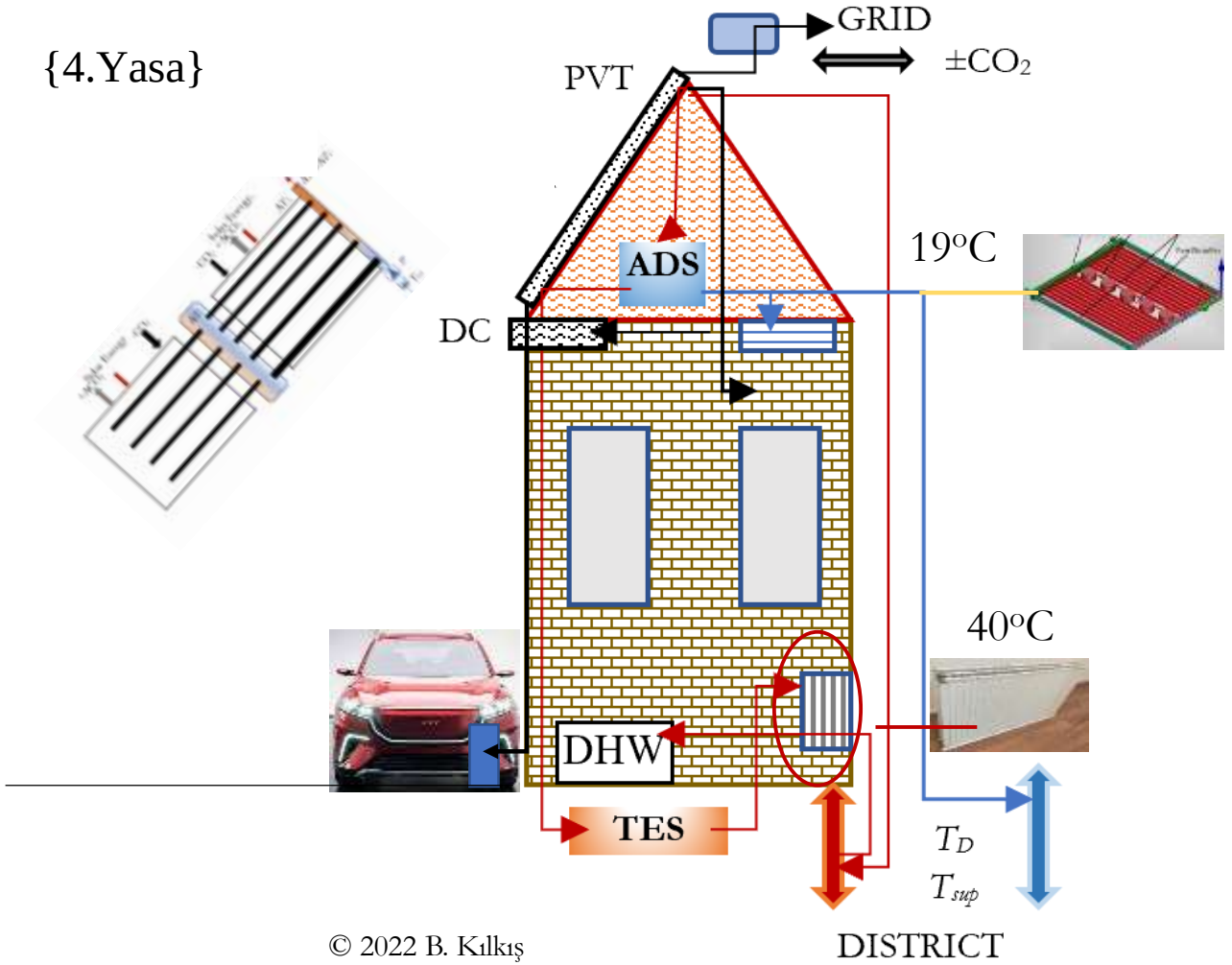


Figure 47. LowEx Hydrogen House with Existing NG Pipelines and Local H_2 Production and Biogas

ISI POMPASI ve KAZAN OLMADAN NE YAPARIZ?

Çok Şey..

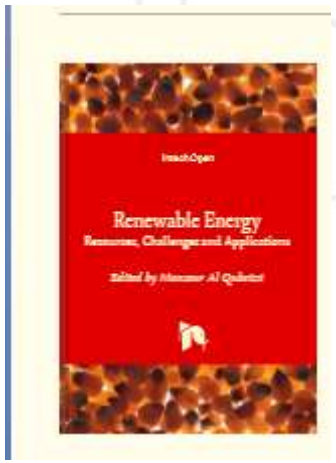
{4.Yasa}

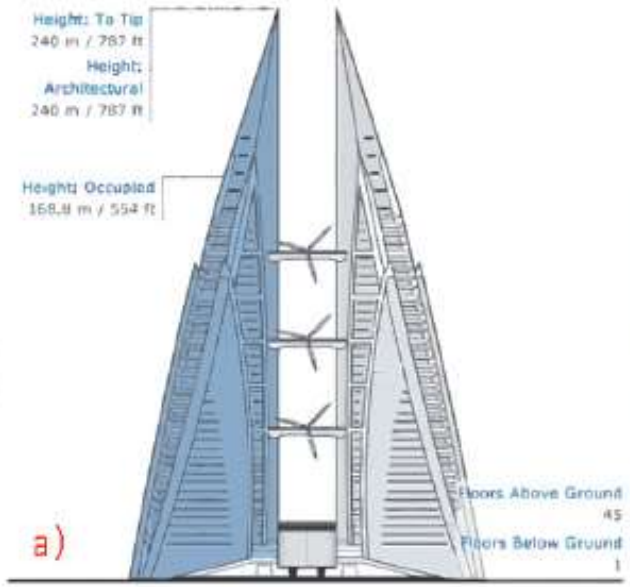


ODAKLI GRUP

AKILLI MI?

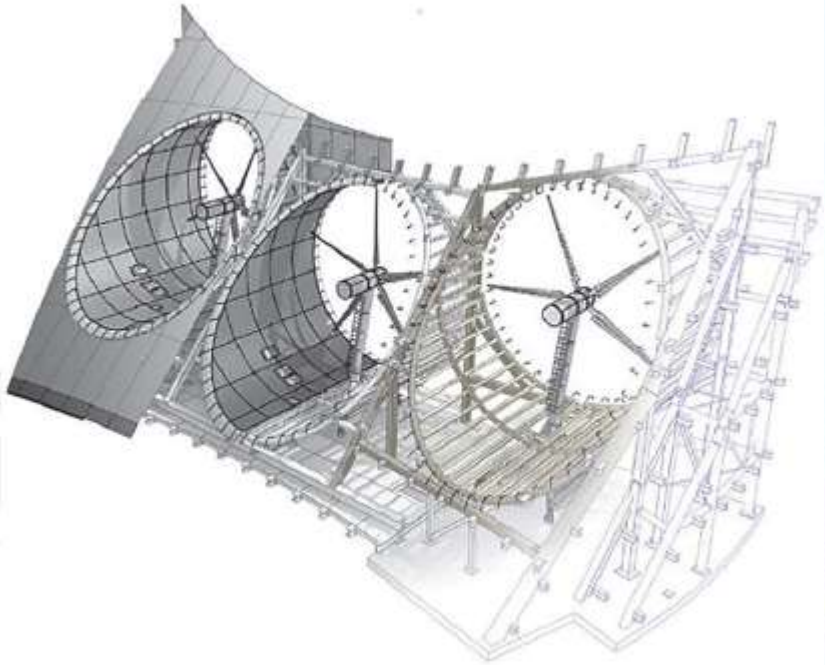
Renewable Energy - Resources, Challenges and Applications

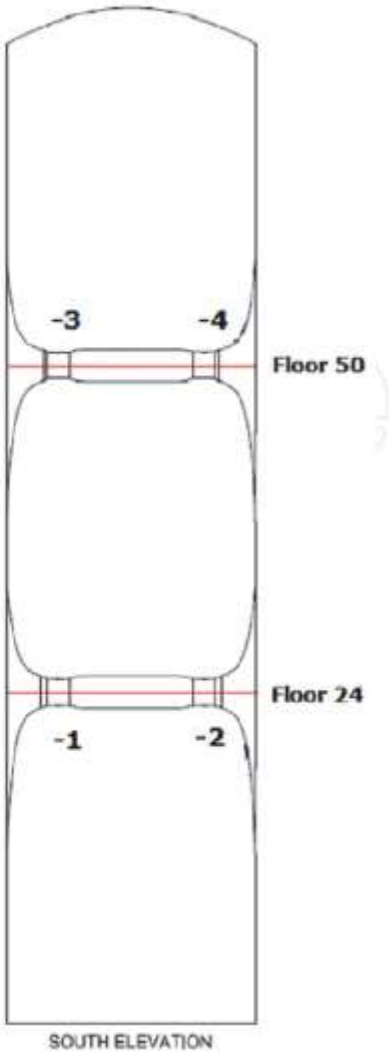




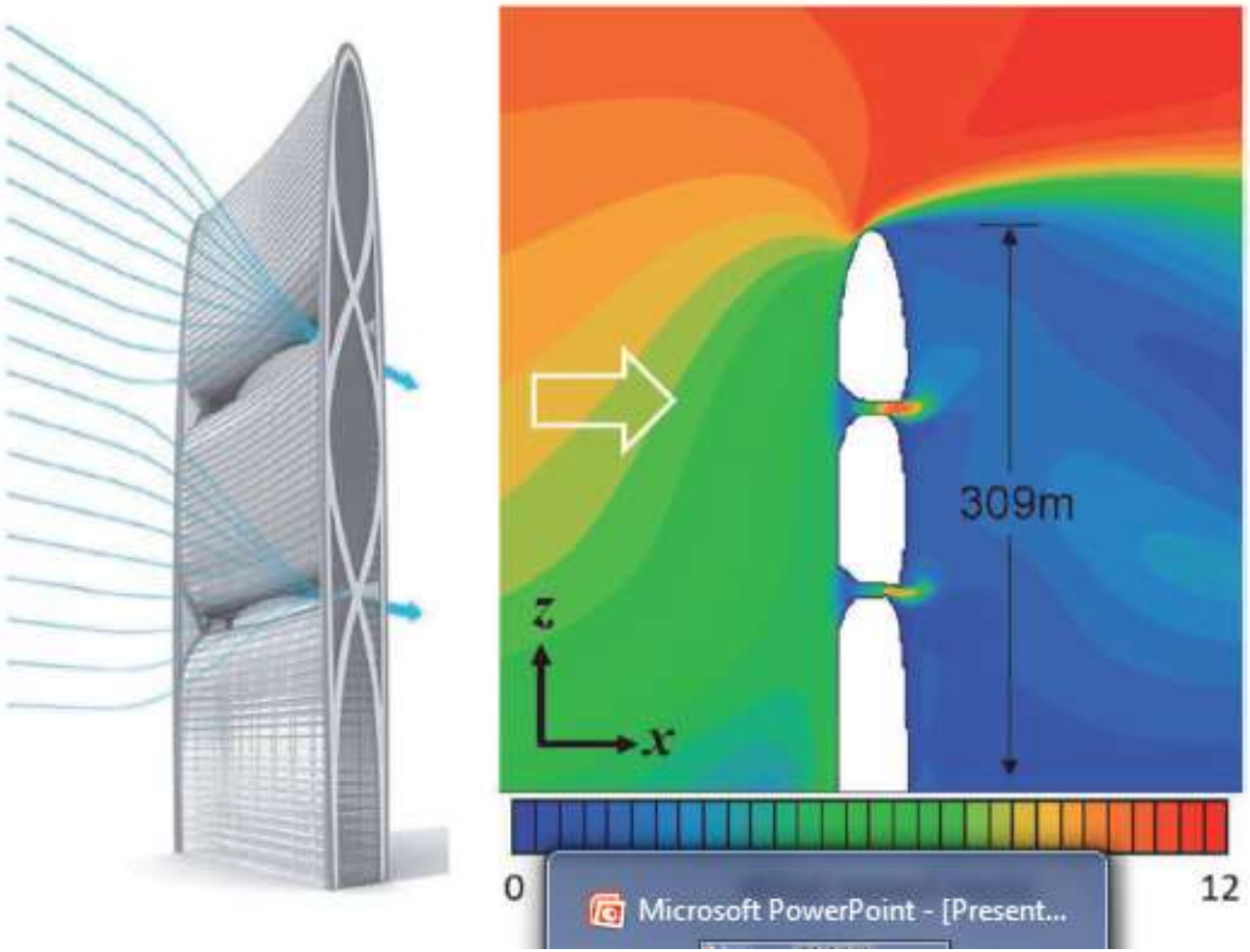
Wind Turbine Integration to Tall Buildings

Ilker Karadag and Izzet Yuksek





SOUTH ELEVATION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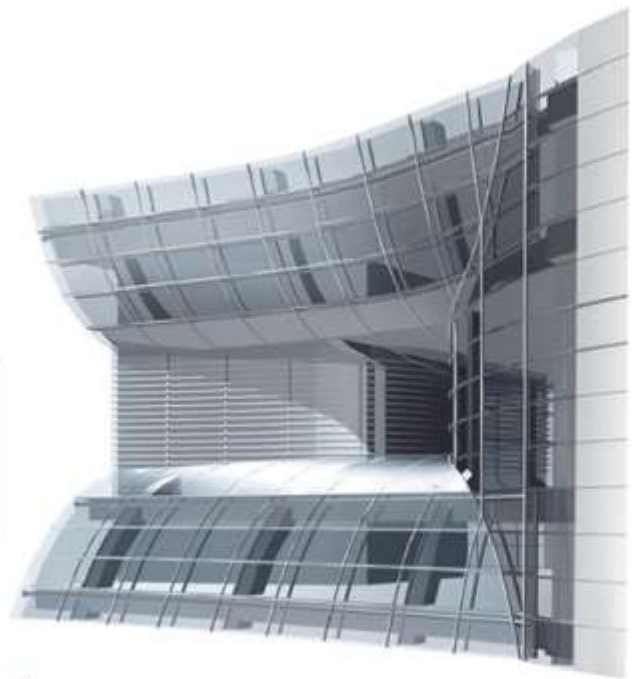
Microsoft PowerPoint - [Present...



a)

b)

GÜNÜMÜZDE KONFOR

Işınım/taşınım oranını % 60-65 dolayında tutan,

operatif sıcaklığı ön plana çıkaran panel ısıtma ve soğutma sistemleri günümüzde gelişerek termo-elektrik sistemlere ve güneş enerjisine yönelmiştir.

BİNA PERFORMANSINDA ANCAK GÖRÜLENLER ÖLÇÜLÜP BİLİNİR

ECBCS Annex 49

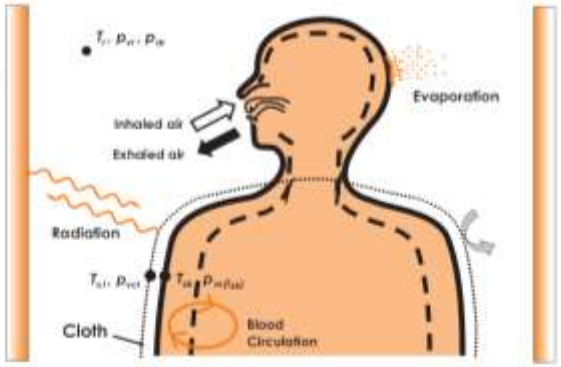
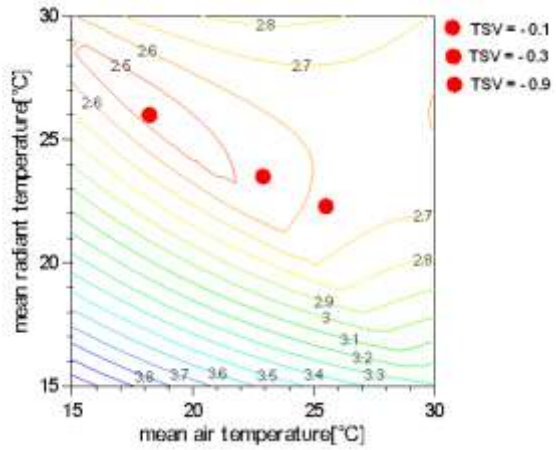
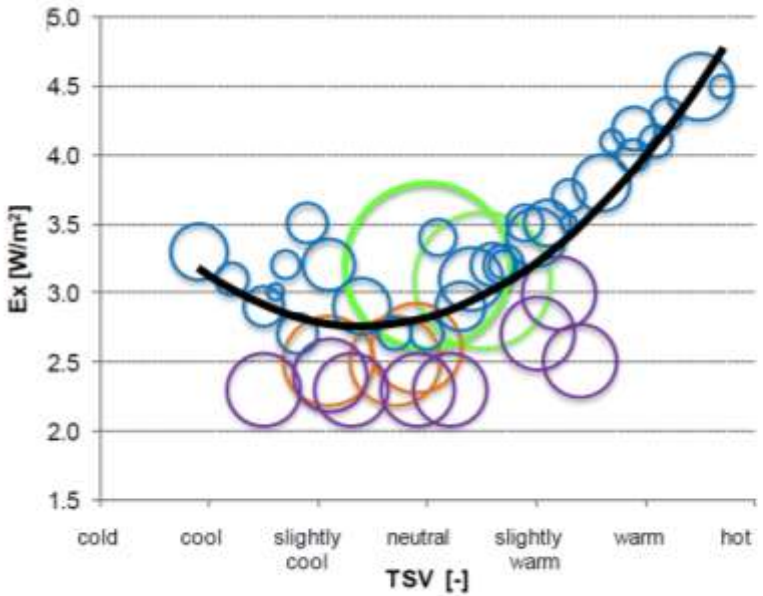


Figure 3.2: Modeling of a human body consisting of two subsystems: the core and the shell. The core is the central portion of the body whose temperature constant at 37°C in from the variations temperature and hu shell is the periphe whose temperature much on the variati ing temperature an on the level of meta





$$CO_2 = 0.2 \times H = 0.2 \times \frac{Q}{\eta_{IK}}$$

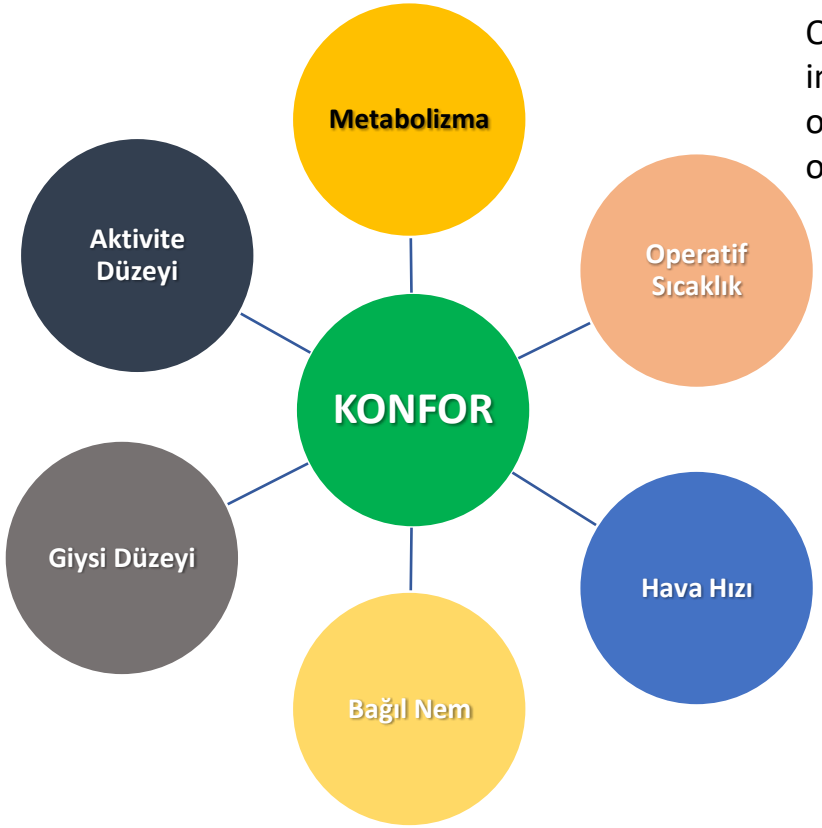
YA

Q

$$H = m^3 \times alt \text{ ısıl değer}$$

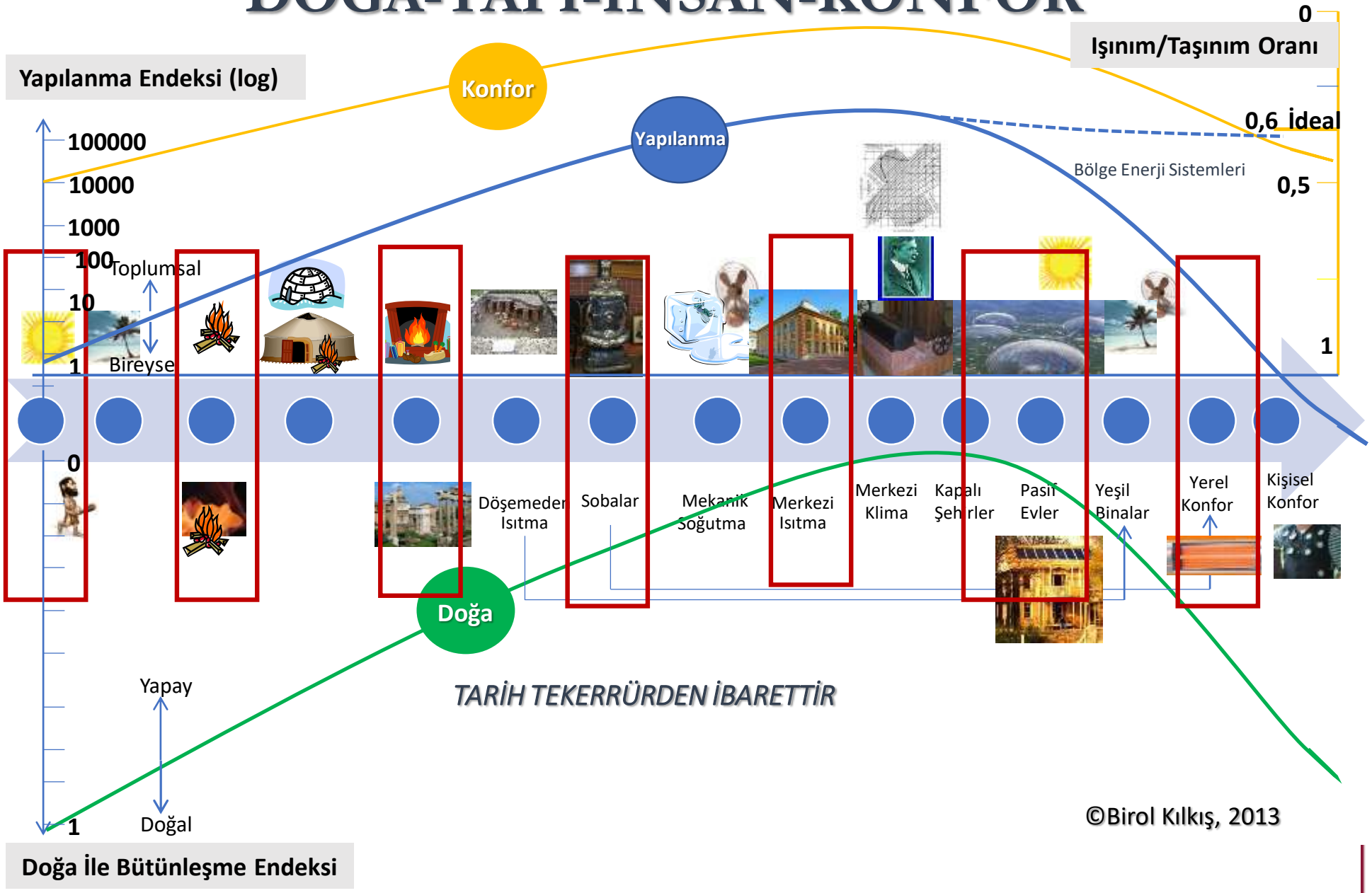
$$\text{Maliyet} = m^3 \times \text{Birim Fiyat } (\textit{üst} \text{ ısıl değere göre})$$

KONFORUN ANA BİLEŞENLERİ



Operatif sıcaklık, hava sıcaklığı ile insanı çevreleyen tüm yüzeylerin ortalama ışınım sıcaklığının bir ortalamasıdır.

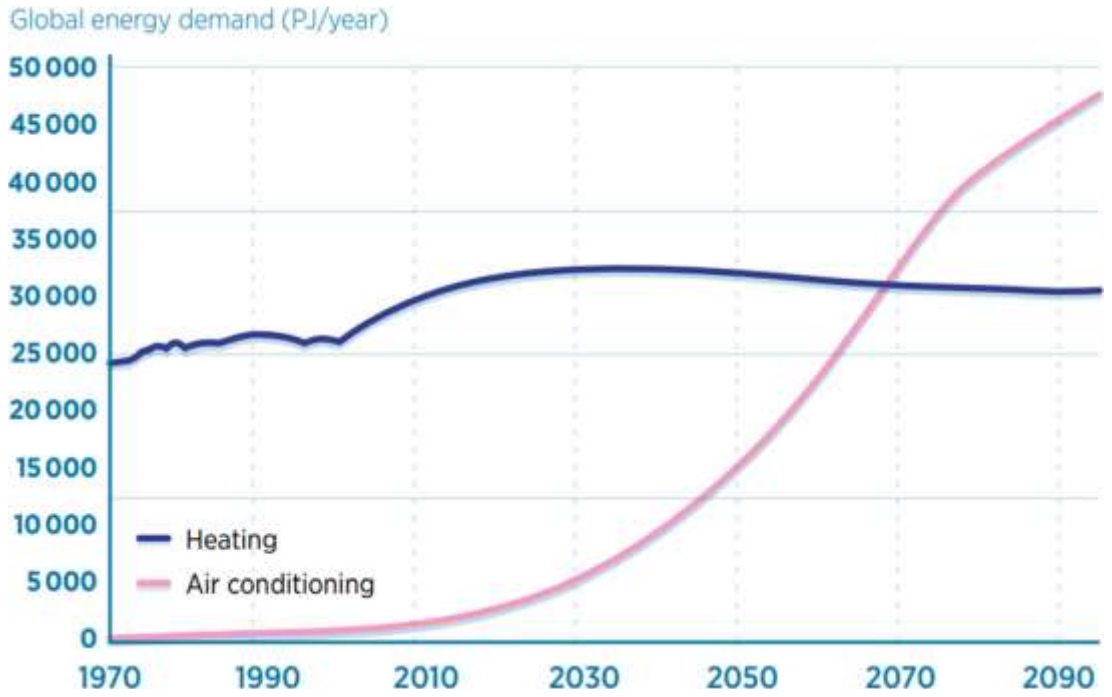
DOĞA-YAPI-İNSAN-KONFOR



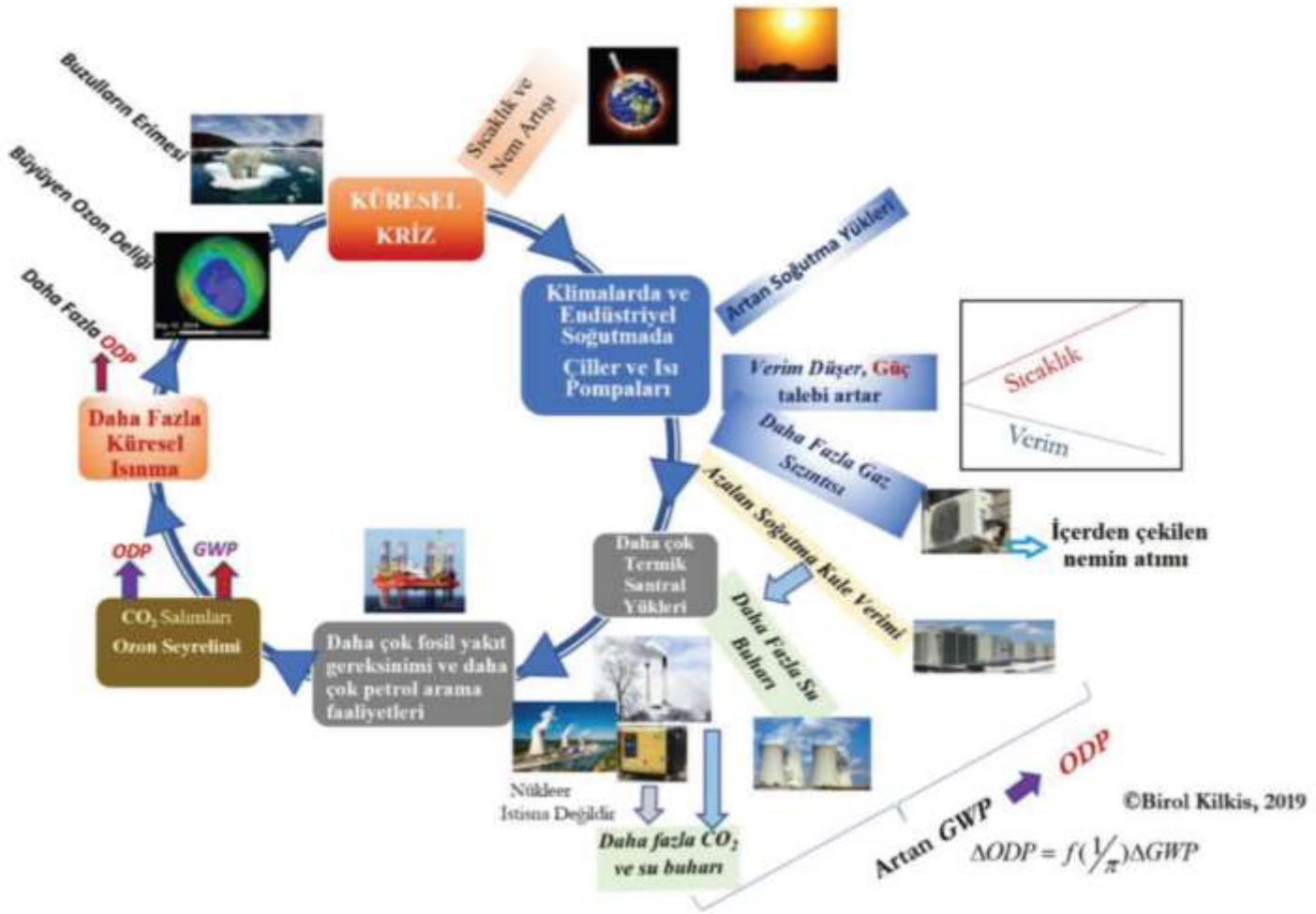
GÜNEŞ BACASI

OSTİM BİNASINDA UYGULAMA

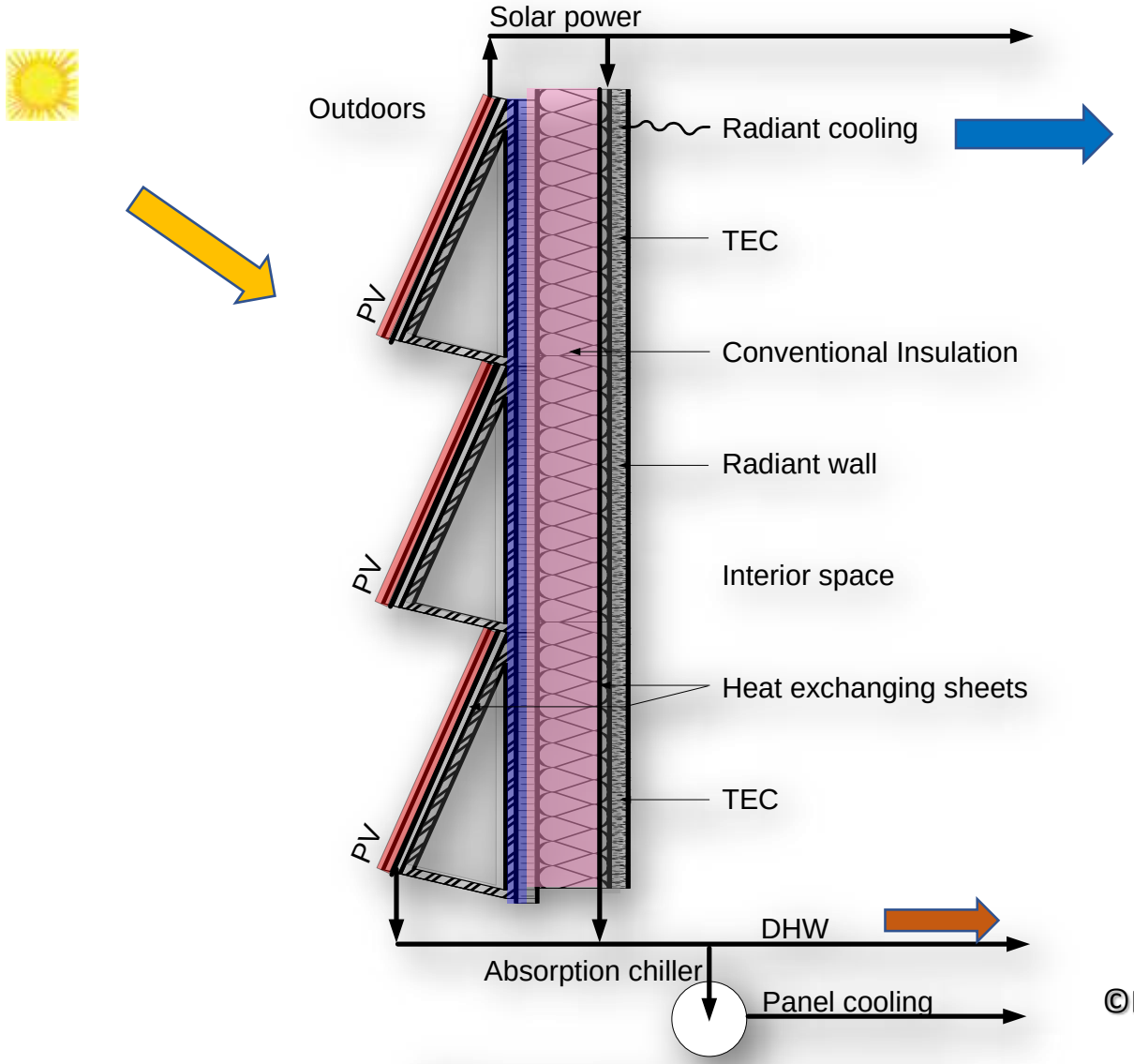
SOĞUTMA YÜKLERİ



SOĞUTMADA KISIR DÖNGÜ

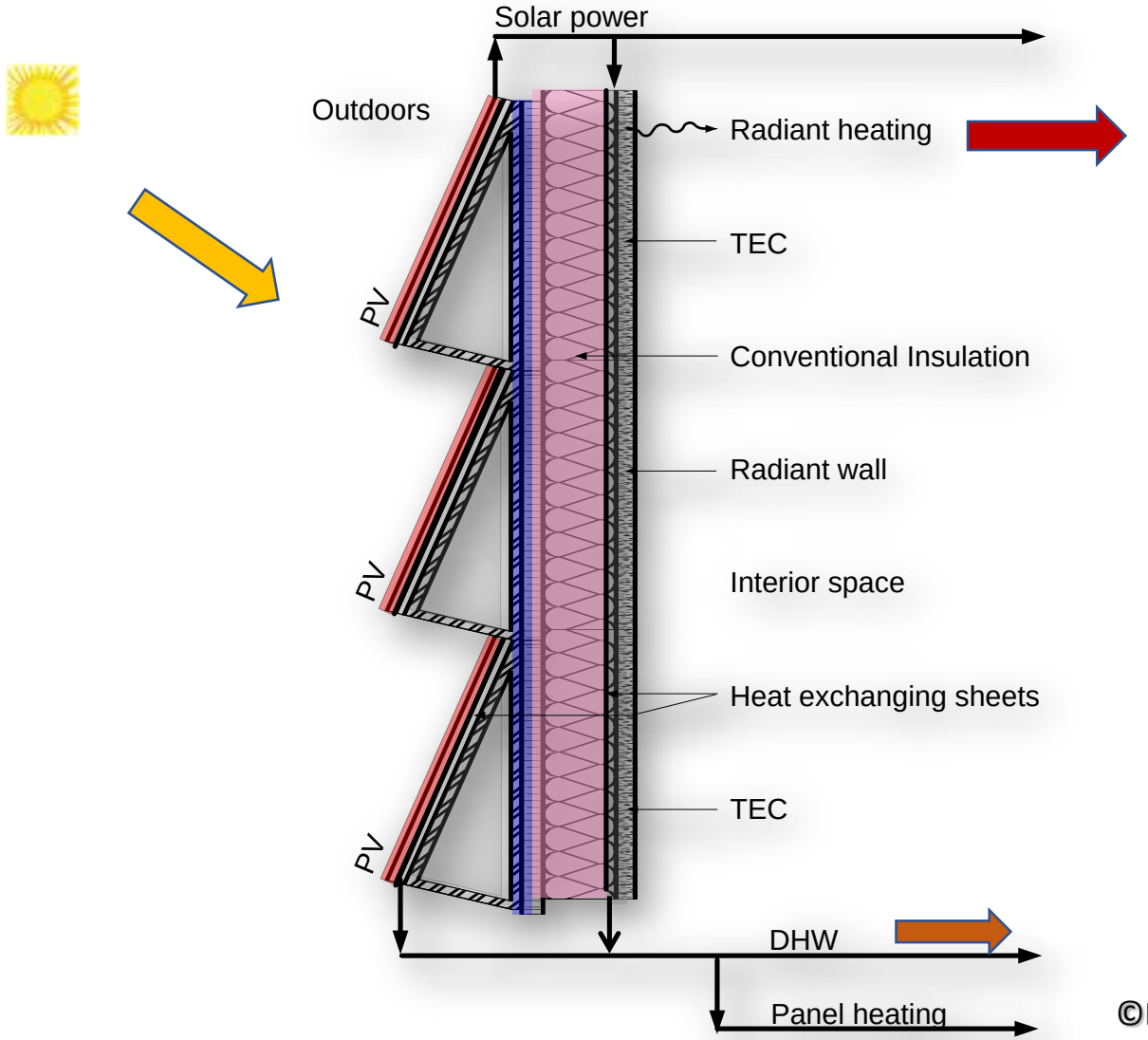


GÜNEŞ ENERJİLİ ÜÇLÜ ÜRETİM SİSTEMİ: ELEKTRİK, SOĞUTMA, SICAK SU (YAZIN)



Solar tri-generation (summer)

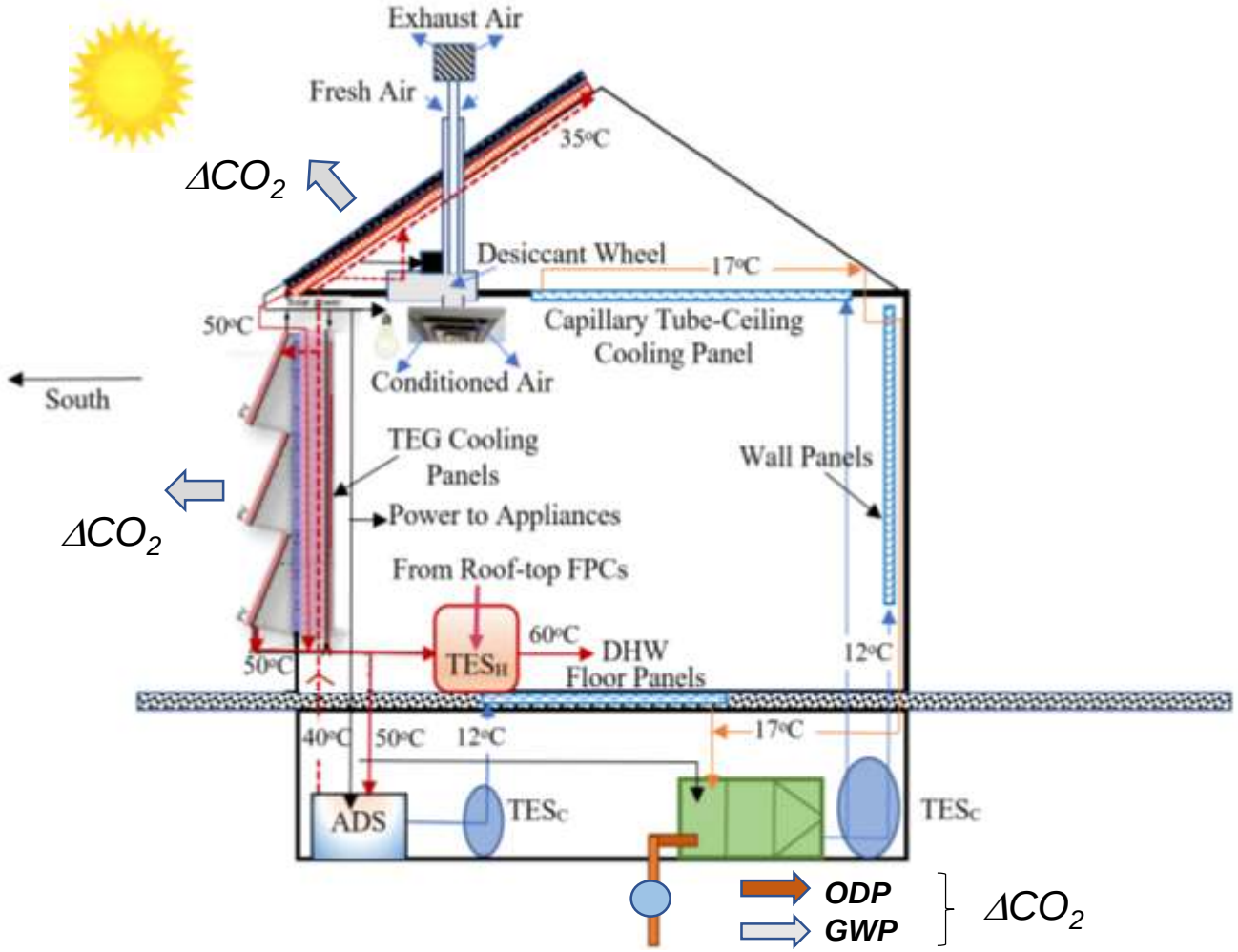
GÜNEŞ ENERJİLİ ÜÇLÜ ÜRETİM SİSTEMİ: ISITMA, SICAK SU, ELEKTRİK (KIŞIN)



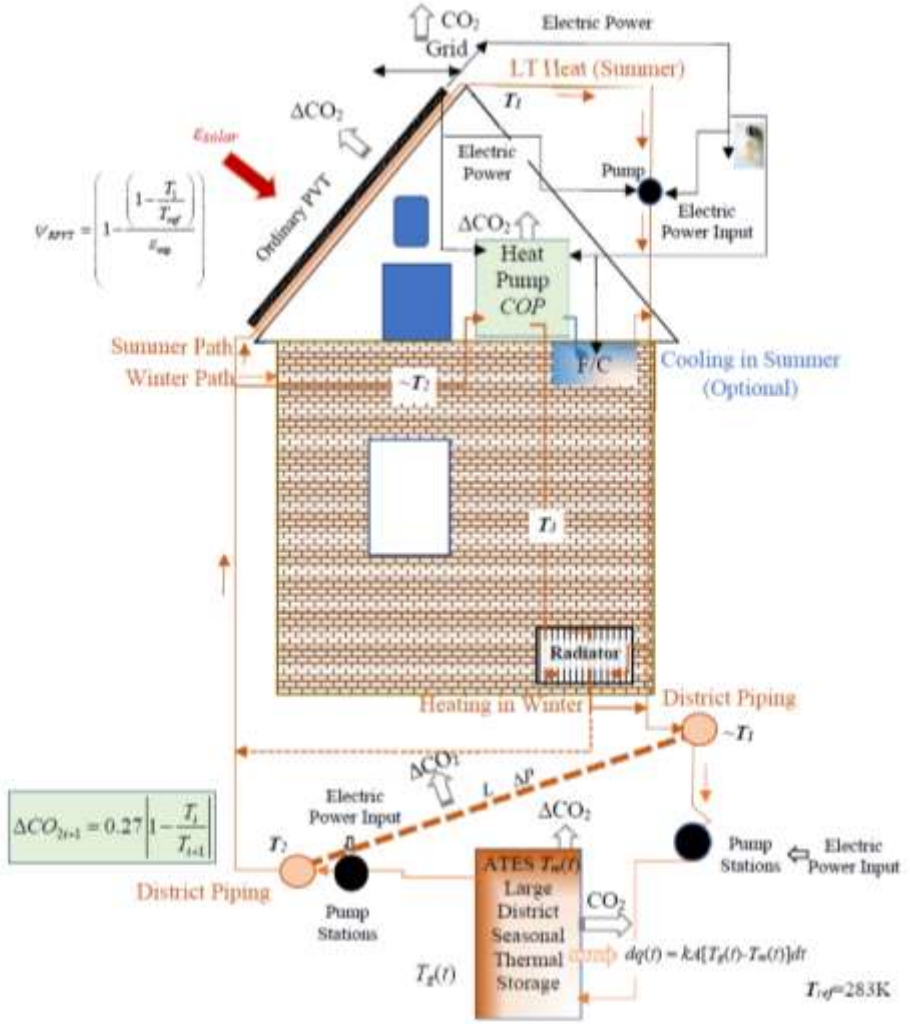
Solar co-generation (winter)

KENDİ ÜRETİR GÜNEŞ EVİ

ZEB ama ZC Değil



DEZONNET MAHALLE ISITMA SİSTEMİ-Haarlem Hollanda

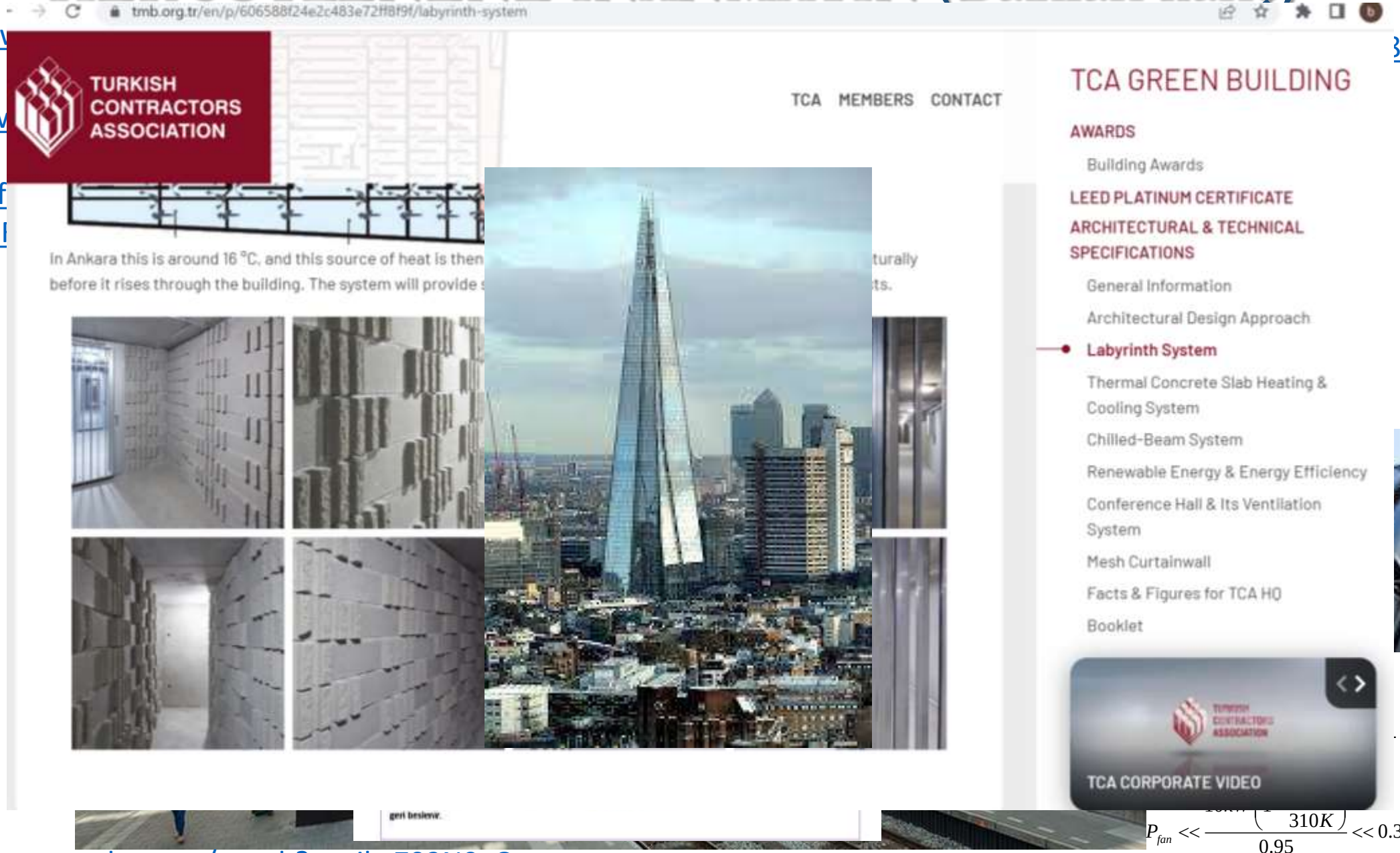


HER SÖYLENENE İNANMAYIN (Bazıları hariç)

https://w

https://ww

https://m.f
7mZgkir01



344.pdf

https://www.youtube.com/watch?v=ejkoZ03N0gQ

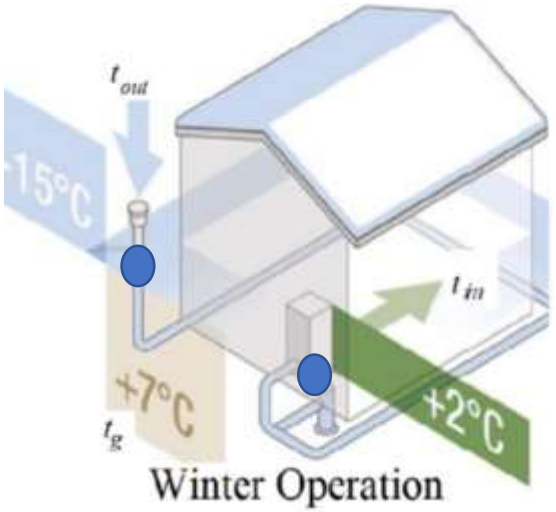
$$P_{fan} << \frac{\left(\frac{310K}{}\right)}{0.95} << 0.34\ \text{kW}(340\ \text{W})$$

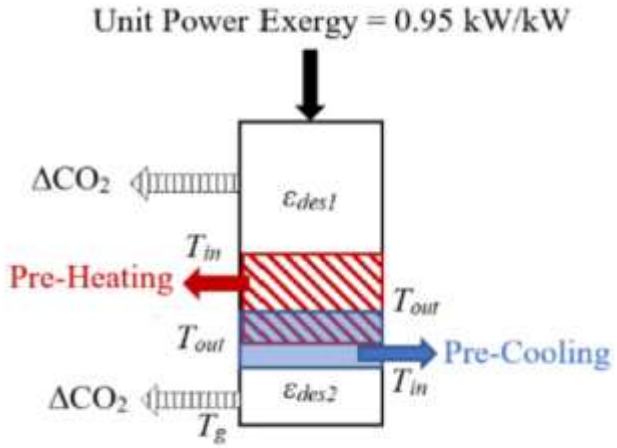
Yeşil binalar ne kadar yeşil? Çözümleme sınırımız nedir?

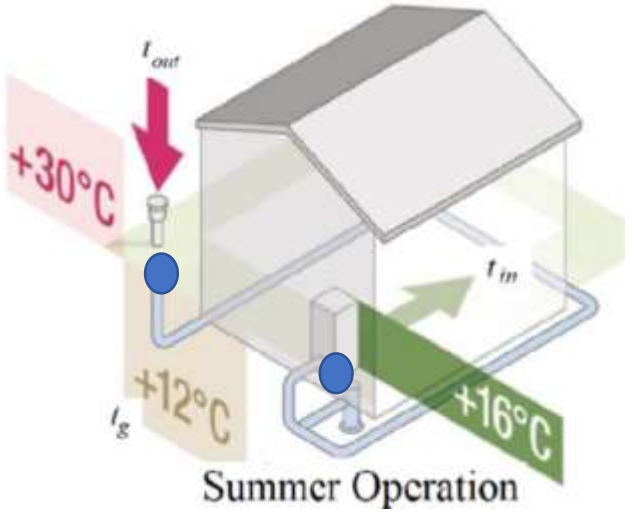
Bir sürdürülebilir binanın çevre etkisi de hesaba sayısal olarak katılmalı ve yeni ölçütlerle bina kabuğunun dışına çıkarak çevre de göz önünde bulundurulmalıdır. Kanun ve yönetmeliklerde, kılavuzlarda bu ölçüt mutlaka yer almalıdır. Bir örnek aşağıda verilmiştir.

$$\sum CO_{2i}\left(\frac{c_i}{\eta_i}\right)+\left(\frac{c_j}{\eta_i\eta_T}\right)(1-\psi_{Ri})+\left(\frac{c_j}{\eta_i\eta_T}\right)+\frac{a}{b}\left(\frac{\text{Kesilen ağac}}{\text{dikilen ağaç}}\right)$$

DOĞRU BİLİNEN BİR YANLIŞ







Ön ısıtma veya soğutmada kullanılan fan elektrik toplam gücü dikkate alınmalıdır.

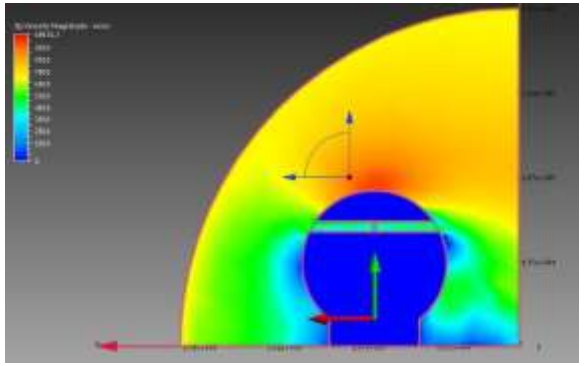
$$\text{Toplam fan gücü} << \dot{Q} \times \left| 1 - \frac{T_{giriş}}{T_{çıkış}} \right|$$

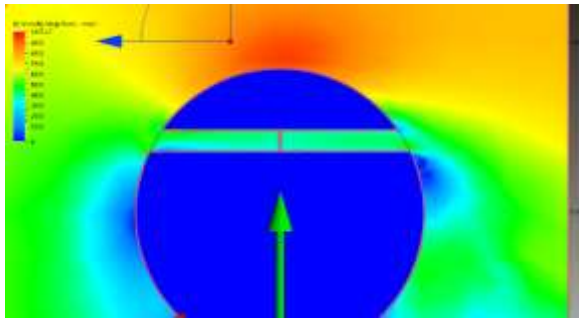
YEŞİL BİNA DERKEN KOMİK OLMAYALIM

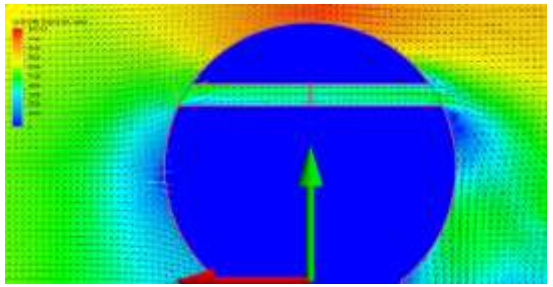
GÖLGEME SORUNU

BİR BAŞKA SORUN

ASTANA EXPO CITY 2017

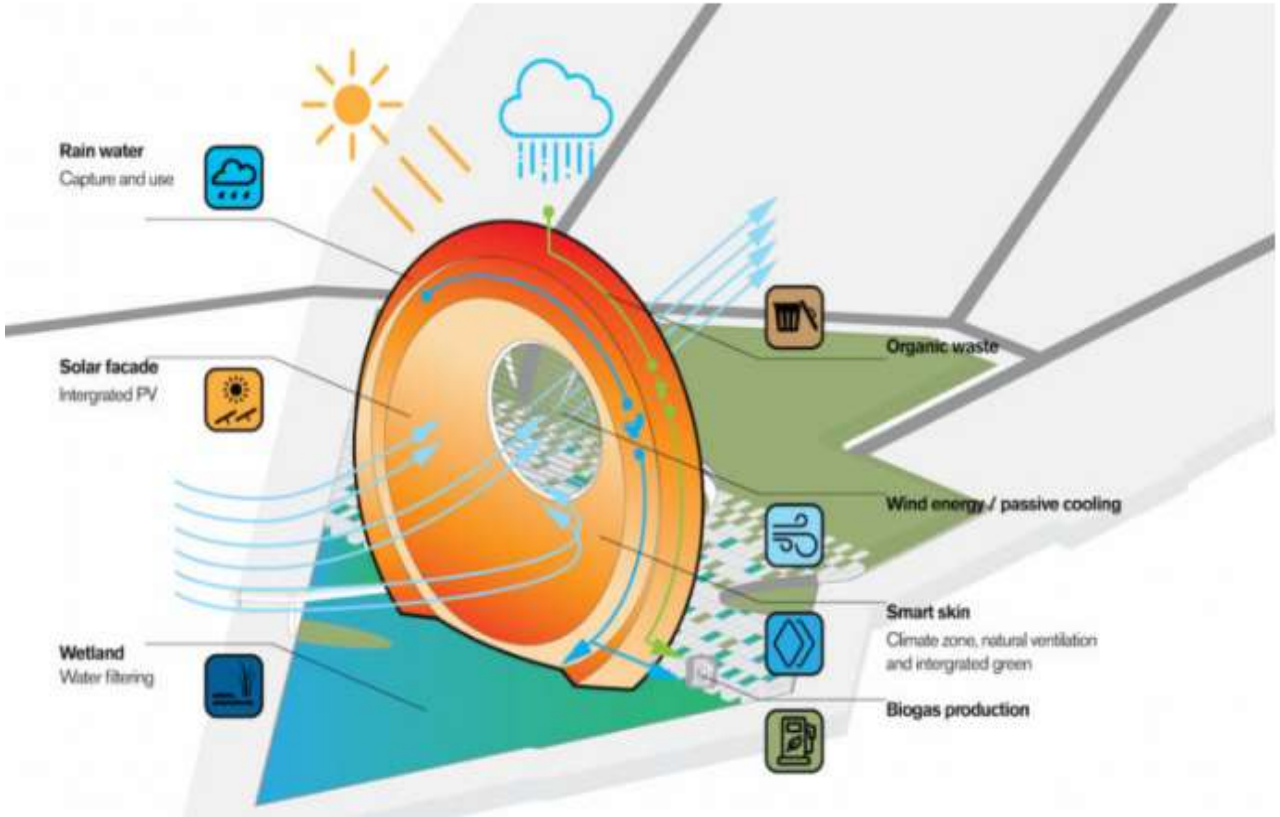




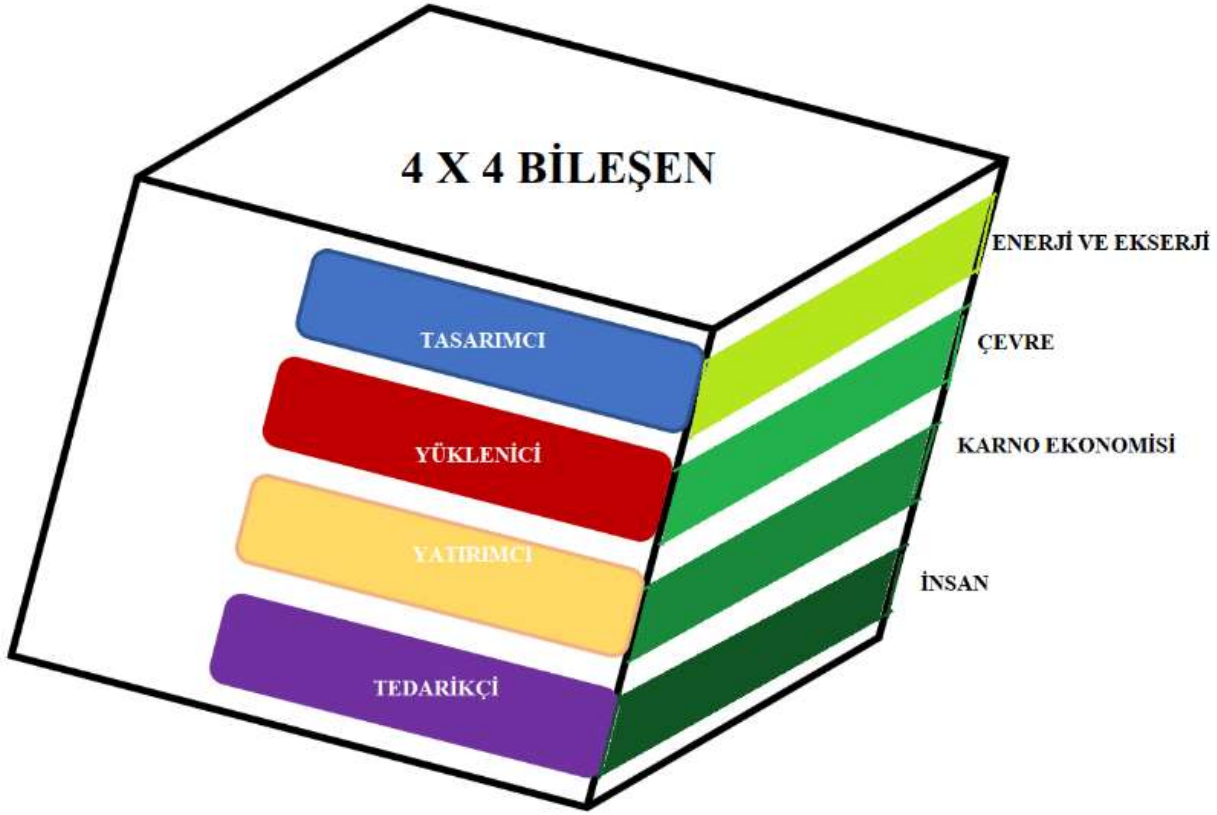


CFD Analizlerini Yapan Y. Doç. Dr. Özgüre Erol a Teşekkür ederim

ROTTERDAM


Rain water
Capture and use
Solar facade
Intergrated PV
Wetland
Water filtering
Organic waste
Wind energy / passive cooling
Smart skin
Climate zone, natural ventilation
and intergrated green
Biogas production

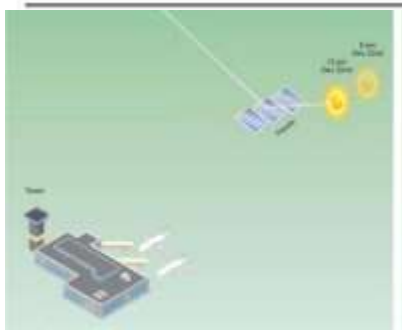
KÜRESEL KRİZİN 4 x 4 BOYUTU

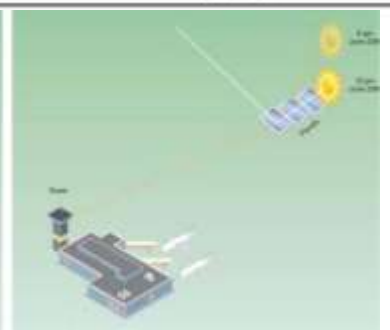


YENİ YEŞİL BİNA ÖLÇÜTLERİ

Next-level Green Establishment Metrics.

Metric		Explanation	Requirement	Existing Certificates
ψ_R		Rational Exergy Management Efficiency	> 0.70	x
η		1st Law Efficiency	> 0.75	Partly satisfies
η_{II}		2nd Law Efficiency	> 0.50	x
PES_R		Exergy-Based Fossil Fuel Savings Ratio	>50%	x
PER		Primary Energy Ratio, $COP \times \eta$	>2	Partly satisfies
SF	Heating	Peak Load Shaving Factor	>0,3	x
	Cooling		>0,4	
DF		Diversity Factor	<0,2	x
EDR		CO_2 Sequestration Ratio	>0,70	Indirectly satisfies
SEO		Renewable Energy Ratio	>0,50	Partly satisfies
$MREX$		Exergy-Levelized Humidity Control	$MREX$ > 3,5	x
OR		Deforestation Factor	<0,05	Partly satisfies
HO		Hygiene Ratio	<1	x
PMV_{EX}		Exergy-Levelized Thermal Sensation	≤0,6	x
IAQ/IAQ_{ref}		Indoor Air Quality Index	≥0,9	x
S		Number of visitors per exergy spending	>0,15 [kW-h/visitor]	x
ε_H		Exergy-Comfort Index	≤2,5 W/m^2	x
$\Delta CO_2/\Sigma\ CO_2$		Ratio of CO_2 emission components	<0,40	x
ODI		Compound Ozone-Depletion Index	<0,05	x
CWI		Global Warming Index $CWI = ODI/\psi_R$	<0,07	x
GAR		Exergy ratio spent in transit and residence	0,01	x
SA		Smallest Social Area Permitted	SA > 20 m^2/person]	Part
SAD		Real-time Control of SA	YES/NO	x
PR		Decoupling ratio of sensible to latent Loads	>0,3	x

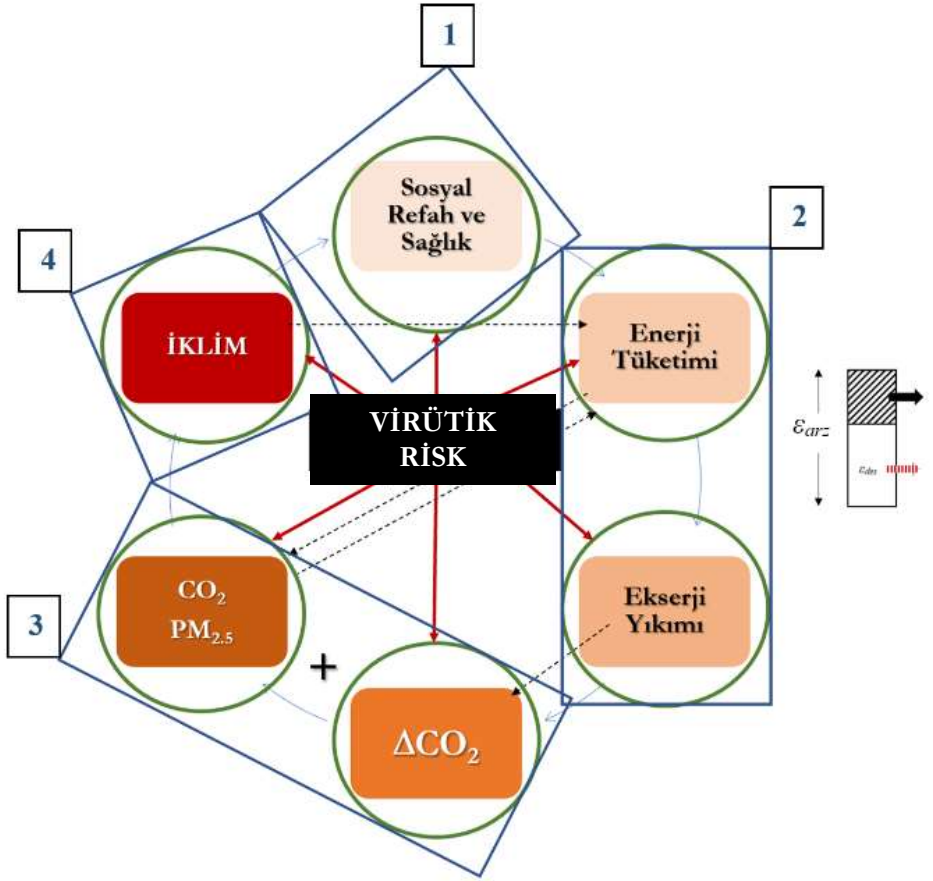




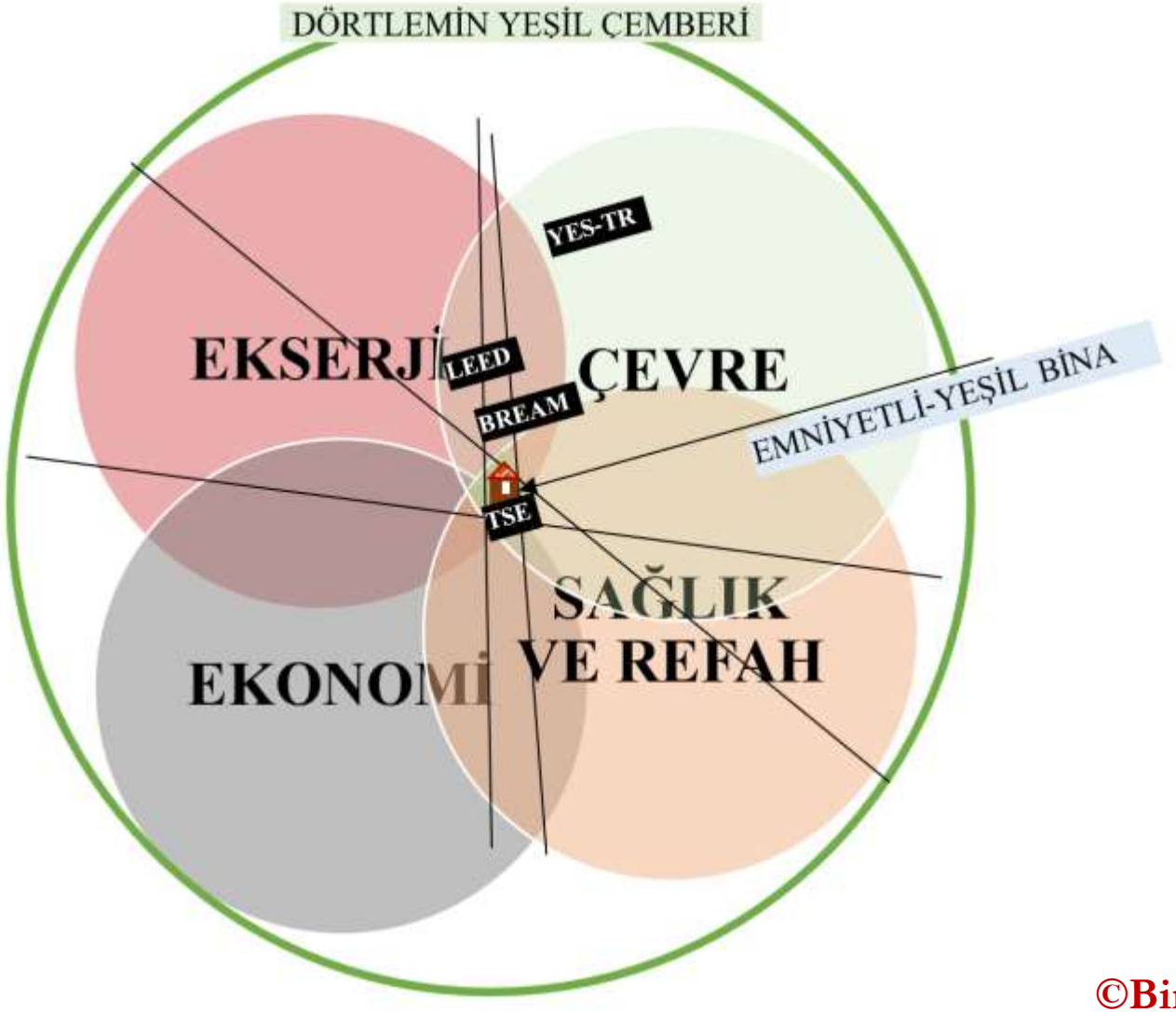
New IAQ Limits for Large Green Establishments.

Particle	New Upper Limits
CO	<310 μg/m^3
$P_{2,5}$	<8 μg/m^3
P_{10}	<20 μg/m^3
$(NO + NO_2)$	<75 μg/m^3
CO_2	<120 ppm
HO	<1 (Eq. (60))

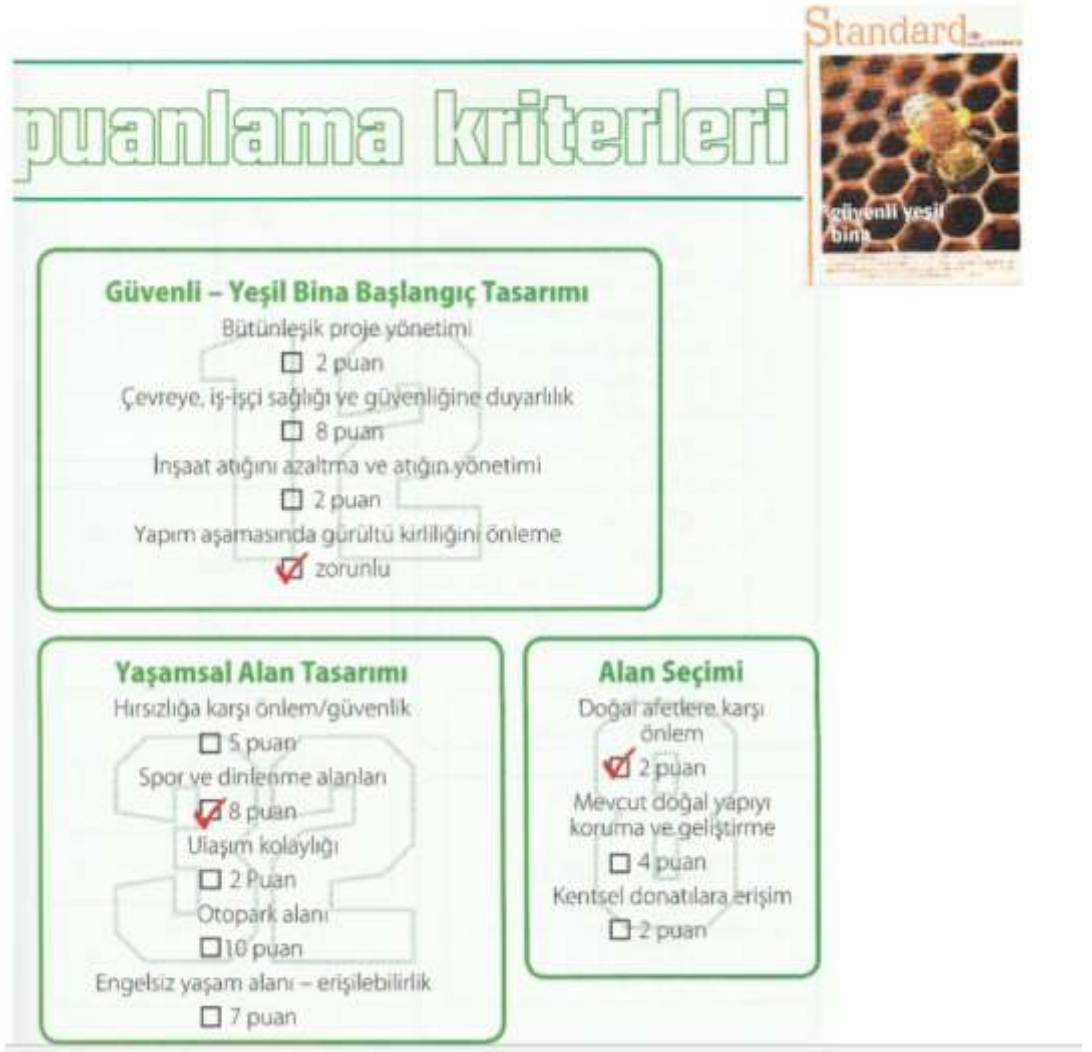
TSE GÜVENLİ VE YEŞİL BİNA BELGESİ



BÜTÜNSELLİKTE EMNİYETLİ VE YEŞİL BİNA



TSE BELGELENDİRME SİSTEMİ ANA HATLARI



DEPREM GÜVENLİĞİ

Şekil 3. Deprem Güvenliği Ön Koşuldur.

IGA HAVAALANI

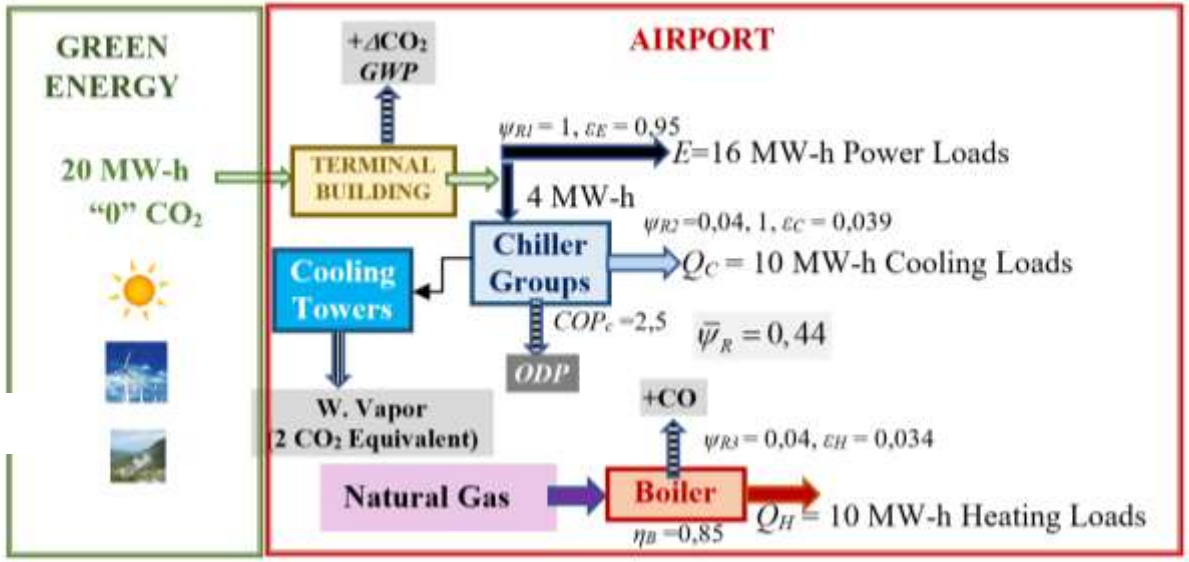
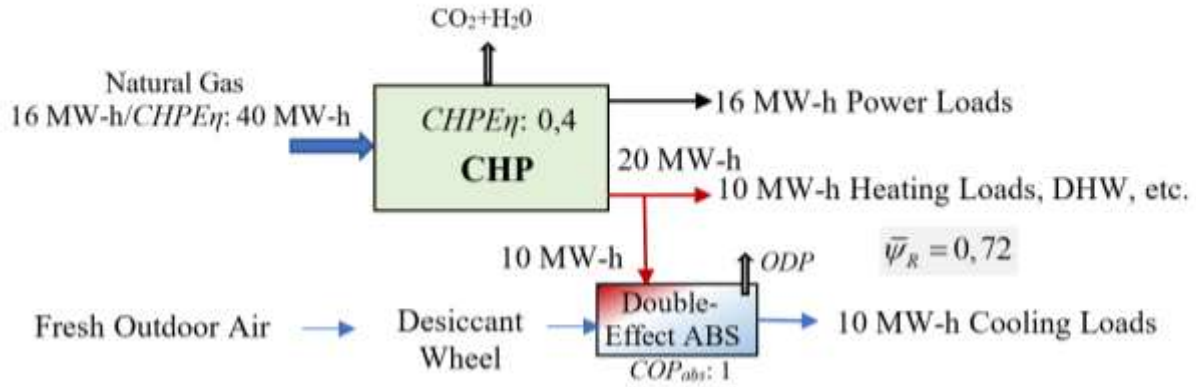
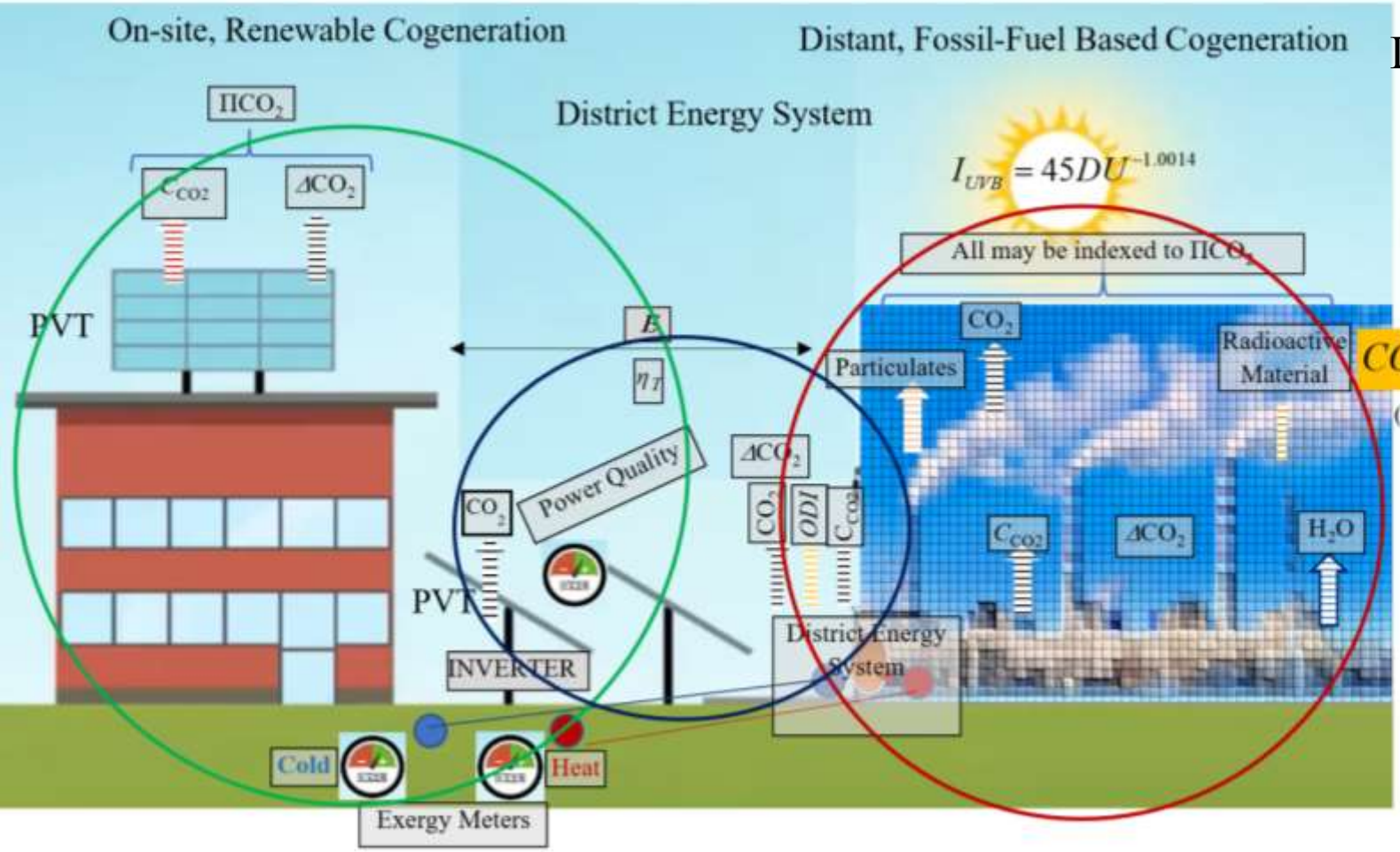


Figure 14: Partial Misuse of Green Energy at the IGA Airport Terminal Complex



NET SIFIR BİNA?



$$\Pi CO_2 = CO_2 + \Delta CO_2 + aC_i^b + cI_{UVB}^d$$

TOTAL **DIRECT** **AVOIDABLE** **RADIATION** **OZONE**

DEPLETION

$CO_2 \simeq aC_i^b$

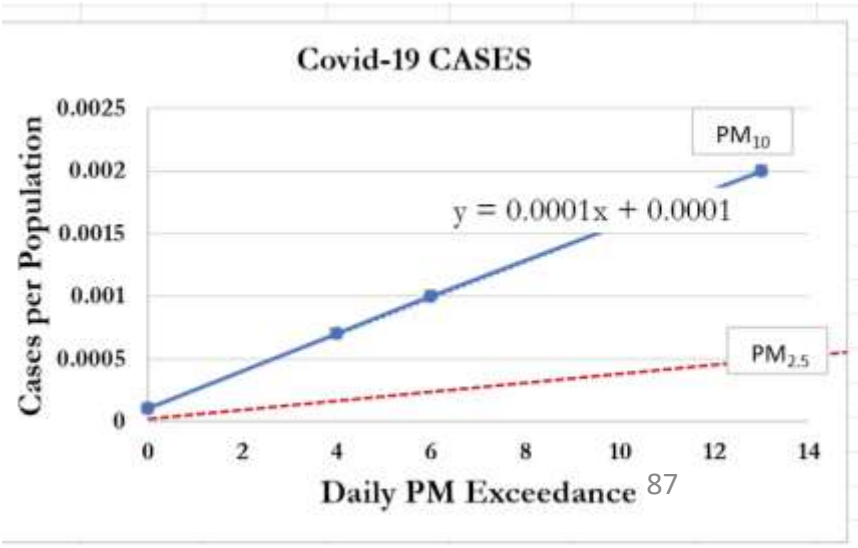
(Coal and Lignite)

$$PM_{2.5} = f\,\Pi CO_2$$

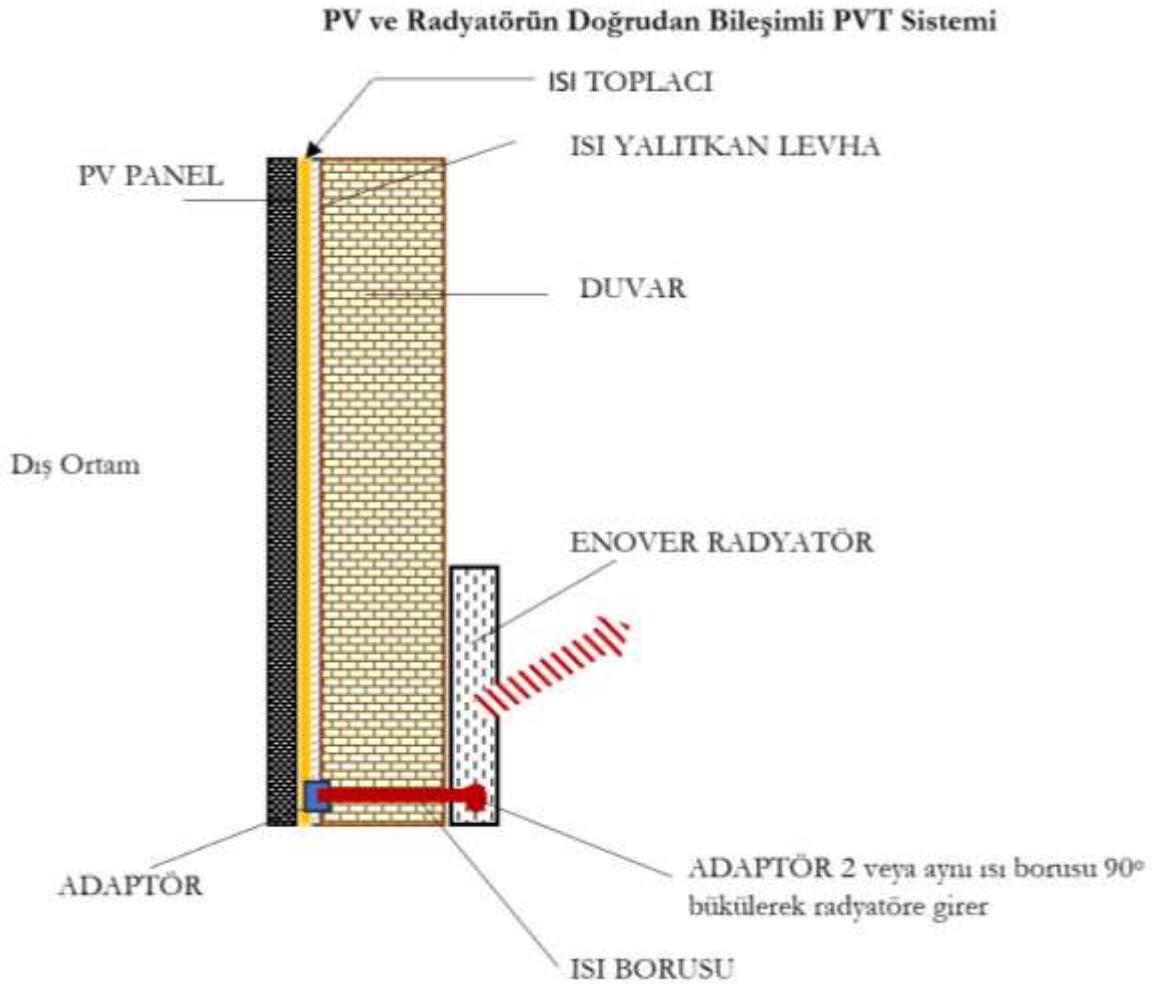
Marine Diesel *f* = 0.002

Coal *f* = 0.09

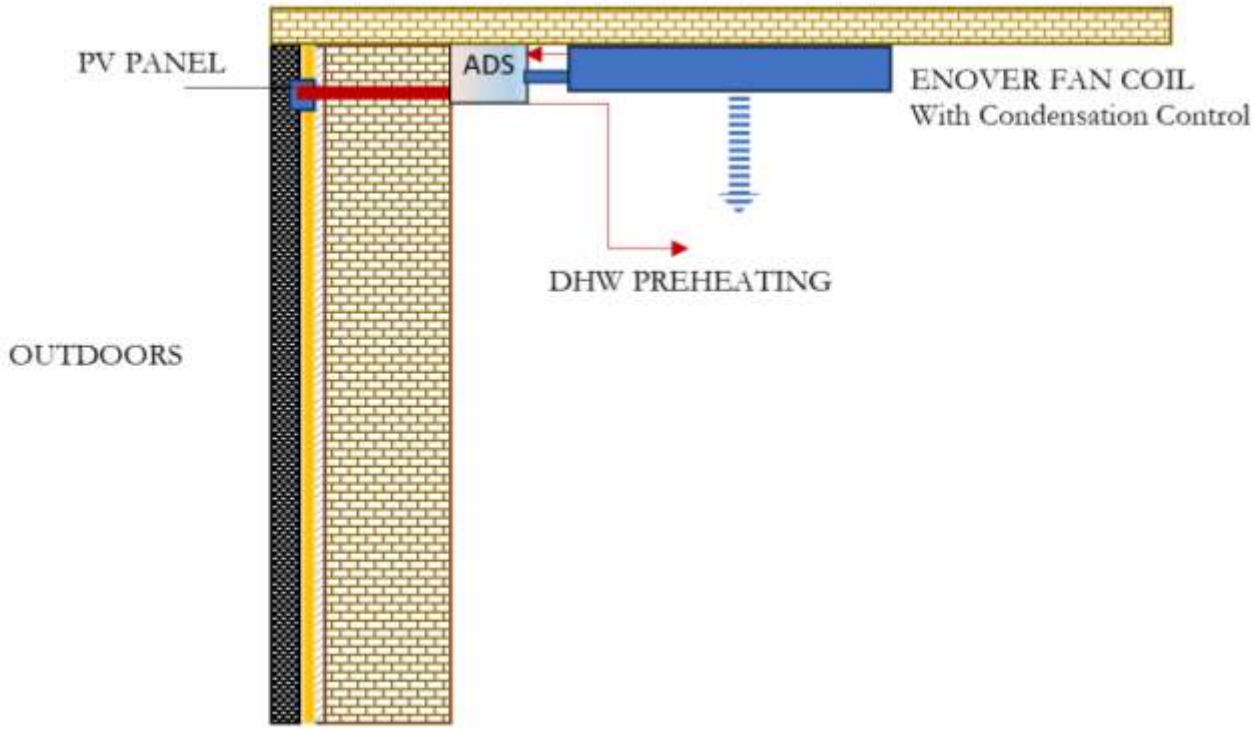
From IEA statistics find the average from a sectors



ISI BORULARININ ÖNEMİ



TAVANDAN SOĞUTMA



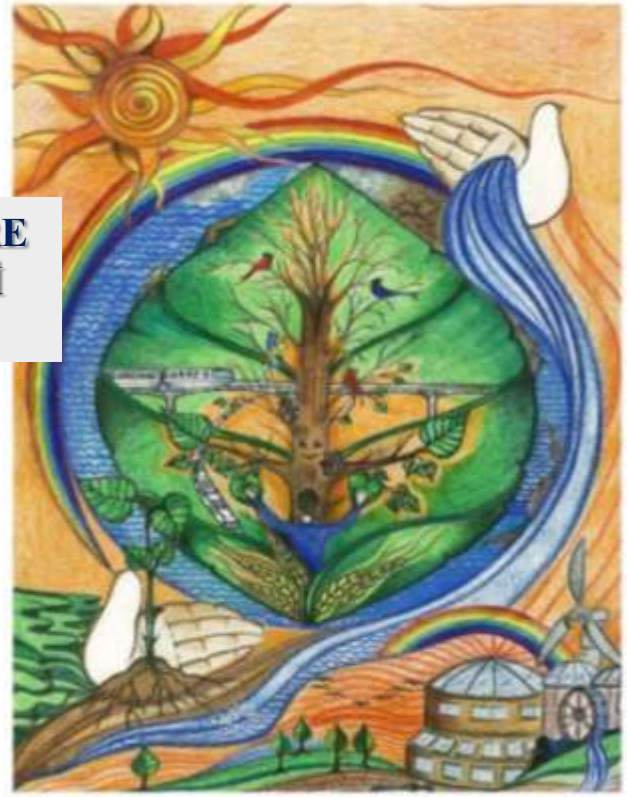
İkinci Yasayı Rehber Edinerek

DOĞRUSAL PİYASA EKONOMİSİNİ BIRAKIP ÇEVREYİ YETERİNCE TANIYIP DOST OLMALIYIZ

Çevre piyasa ekonomisi KULLANMIYOR!

O ZAMAN ZATEN ÇEVRE BİZLERE ÇÖZÜMLERİ GÖSTERECEKTİR.

Akıl ve buluşlar neredeyse sonsuzdur



Şan Kilkis, UNESCO Prize 2002