SÜRDÜRÜLEBİLİRLİLİK
SÜRDÜRÜLEBİLİR ENERJİ

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Center for Energy, Environment and Economy
Head, Mechanical Engineering Department
Ozyegin University
Istanbul, Turkey

Dokuz Eylül Üniversitesi, İzmir
Kasım 29, 2017

ÖZYEĞİN UNIVERSITY

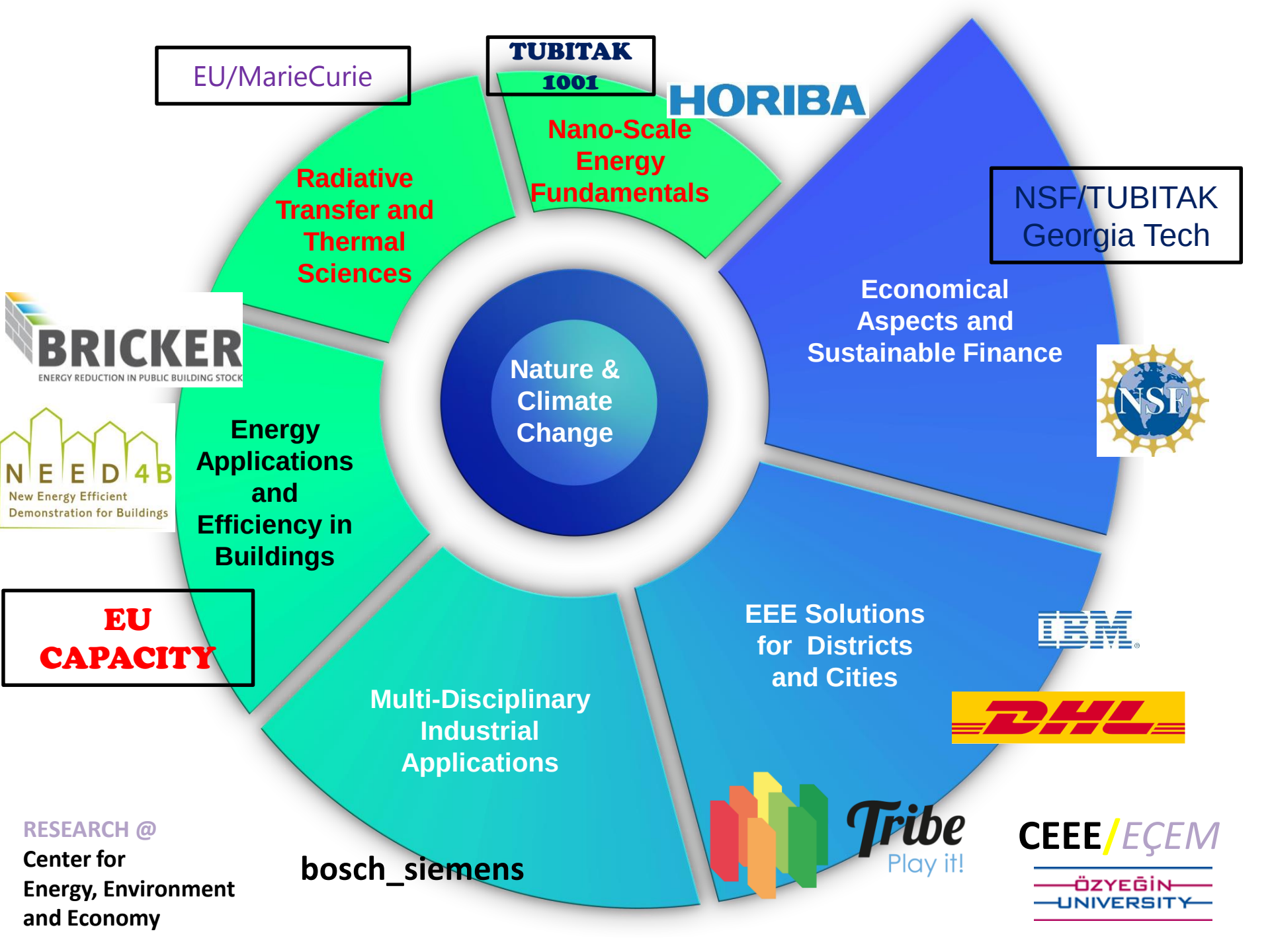
CEEE/EÇEM

Sustainable Energy &

3 LEED GOLD BUILDINGS

4 ONGOING EU PROJECTS (3 million USD)

CEEE/EÇEM


EU/MarieCurie
TUBITAK 1001
HORIBA
Nano-Scale Energy Fundamentals
Radiative Transfer and Thermal Sciences
NSF/TUBITAK Georgia Tech
Economical Aspects and Sustainable Finance
BRICKER
ENERGY REDUCTION IN PUBLIC BUILDING STOCK
NSF
Nature & Climate Change
NEED4B
New Energy Efficient Demonstration for Buildings
Energy Applications and Efficiency in Buildings
EU CAPACITY
EEE Solutions for Districts and Cities
IBM
DHL
Multi-Disciplinary Industrial Applications
Tribe
Play it!
bosch_siemens
RESEARCH @
Center for Energy, Environment and Economy
CEEE/EÇEM
ÖZYEĞİN UNIVERSITY

NEED4B
New Energy Efficient Demonstration for Buildings

CAMPUS GENERAL VIEW

CONCEPT DESIGN: RMJM
DESIGN DEVELOPMENT: B-DESIGN
LEED CONSULTANT: ALTENSIS
EPC CONSULTANT: ONUR ENT

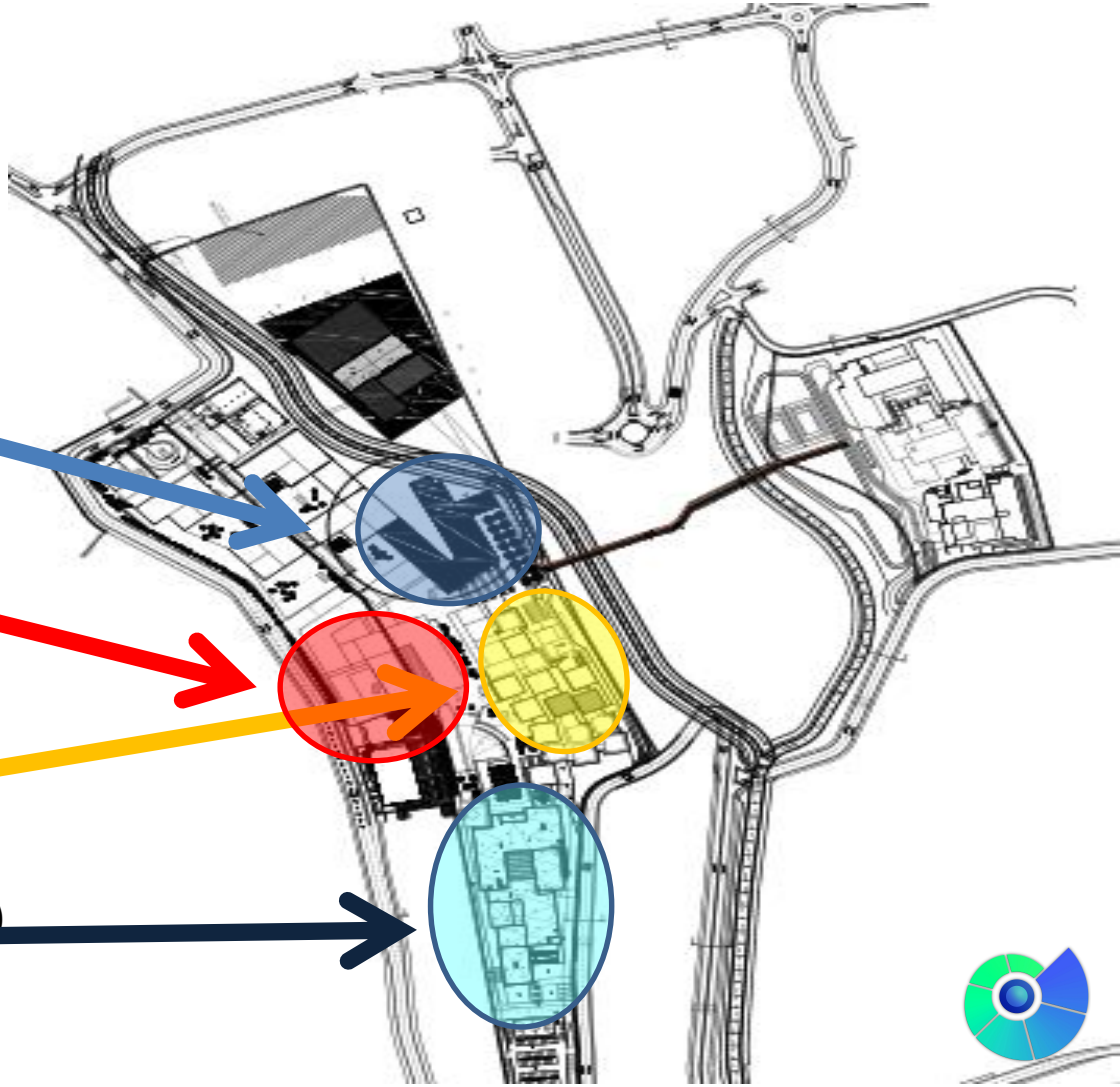
Özyeğin University

ScOLa Bldg (NEED4B)

Business Bldg (LEED GOLD)
72 points

Student Center (LEED GOLD)
70 points

Engineering Bldg (LEED GOLD)
72 points



OzU and CEEE

A new type of campus, following the sustainability principles.

OzU's students, faculty and staff are all part of the eco-system.

All buildings and external spaces follow the concepts based on sustainability.

Innovative teaching paradigms.

Center for Energy, Environment and Economy
@ Ozyegin University

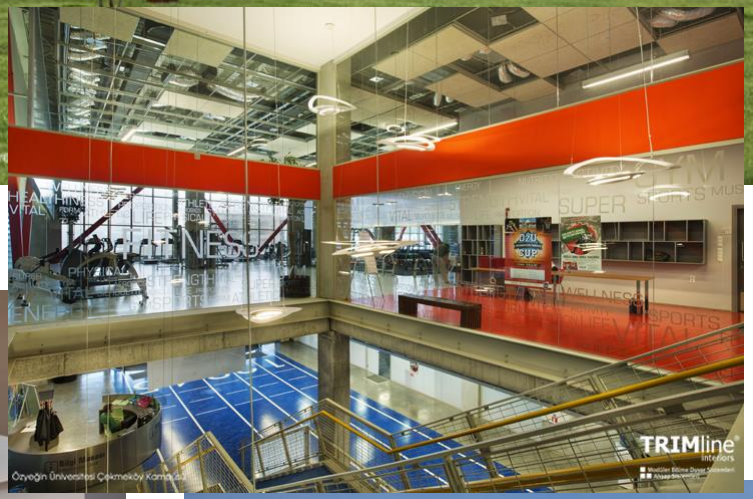
A Sustainable Energy Center!

Ozyegin University Campus View (in 2011, there was nothing in this view!)

Solar PV, Green Roofs, Solar Shades, Facades, Smart Automation…


TRIMline
interiors


ÖZU


TRIMline
interiors


TRIMline

Education at CEEE

CEEE 211: Coherent Teachings for Istanbul 2050.
This course has received the IBM Global Academic Initiative in 2011.

ME 373: Technology and Society
Required Course for Mechanical Engineering Students.

ME 563: Sustaibale Energy, Materials and System
This course was co-rganized with IMSAD.

ENGLISH PREPARATORY SCHOOL READING ASSIGNMENTS

YAPI Writings: BİLİMLE BİRLİKTE (M. Pinar Mengüç)

RTL

UK

Optics & Thermodynamics

Sustainable Energy & Buildings

CEEE/EÇEM

ÖZYEĞİN UNIVERSITY

CEEE/EÇEM

PAST STUDIES AT RTL

#OPTICS
#RADIATIVE TRANSFER
#THERMAL SCIENCES
#EM-WAVE SCATTERING
#NANO-SCALE TRANSPORT PHENOMENA

Flames and Combustion Systems

Particle Characterization Systems

Nano-Scale Manufacturing with Electron-Beam

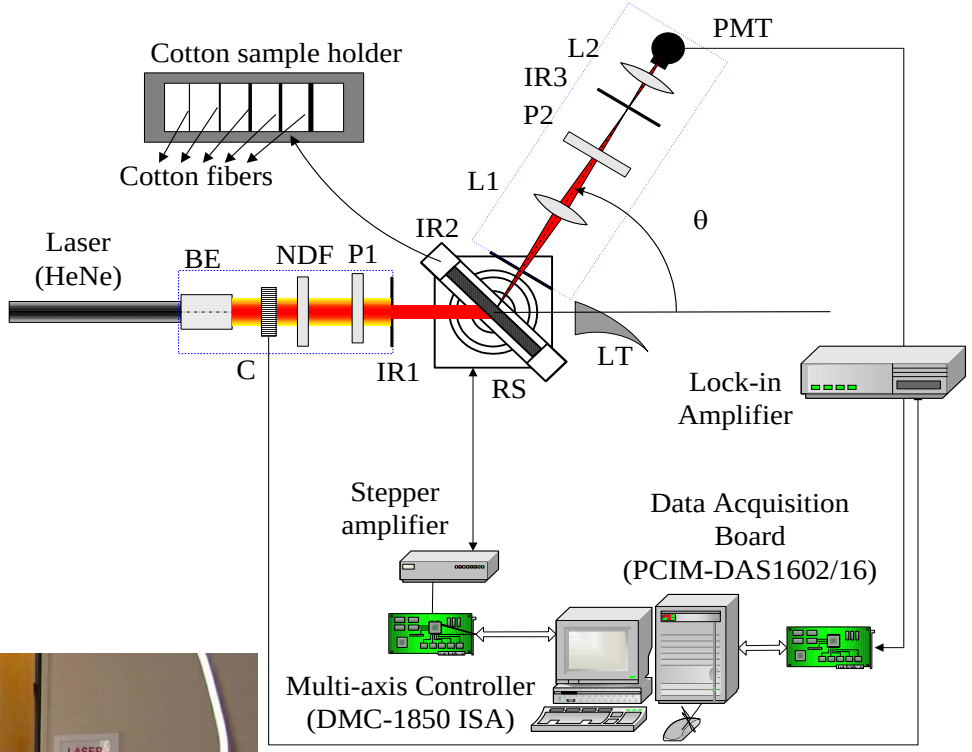
Nano-Scale Radiative Transfer for Energy Harvesting

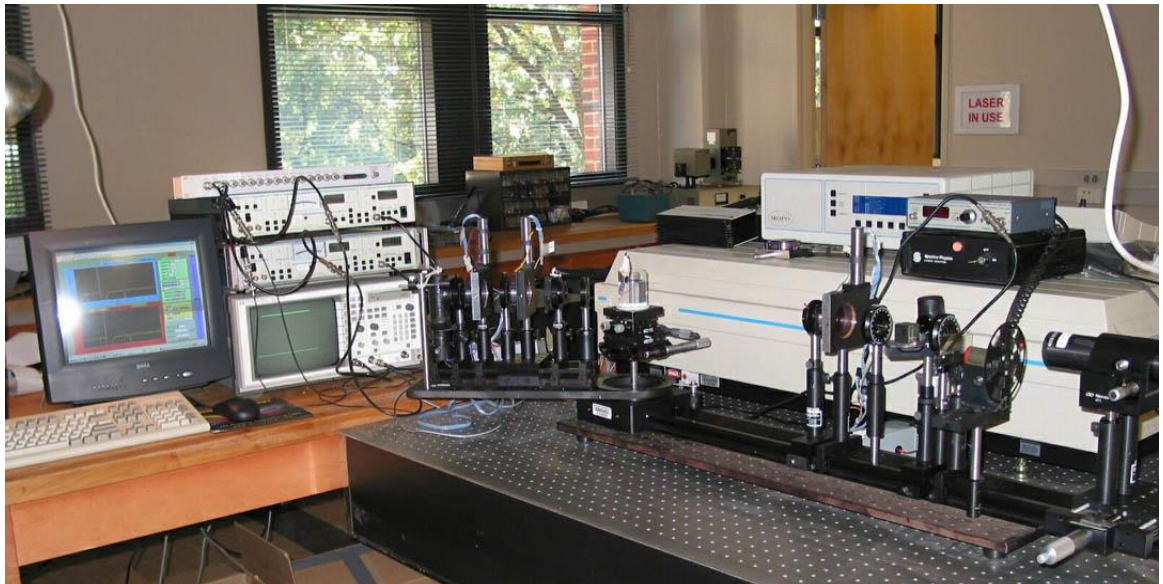
CEEE/EÇEM

ELLIPTICALLY-POLARIZED LS SYSTEM FOR NPs

Experimental System:

Precision Nephelometer.
To measure different particle shapes and sizes down to 50-70 nm





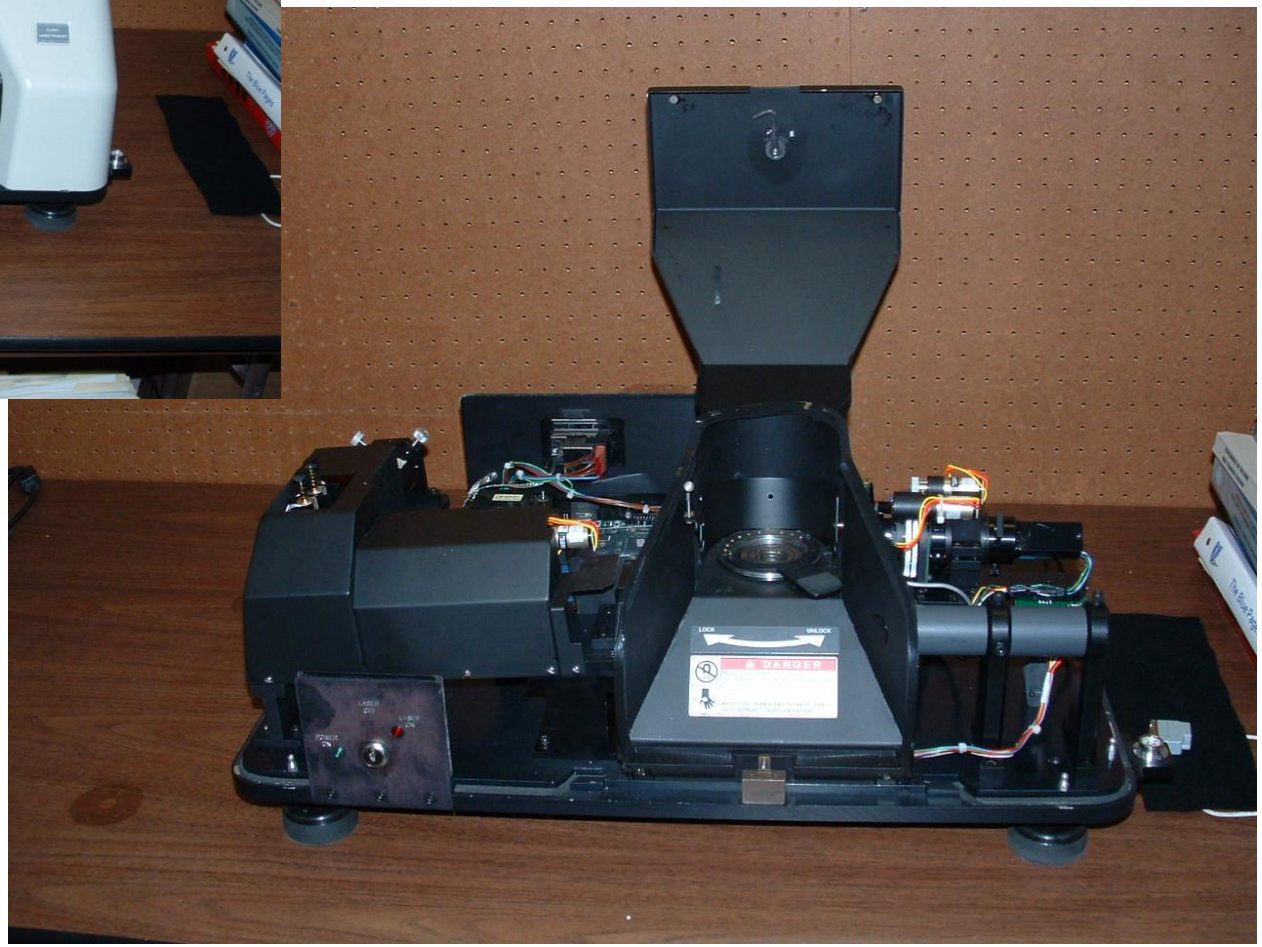
With …
S. Manickavasagam, M. Aslan
JQSRT 2006; JNR 2006

CEEE/EÇEM

ELLIPTICALLY-POLARIZED LS SYSTEM FOR NPs

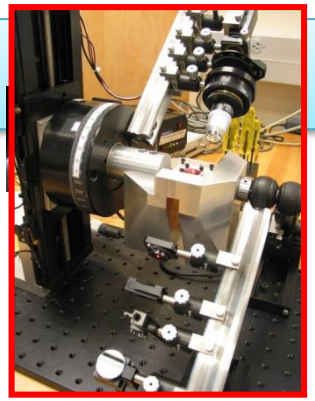
RTL → HORIBA

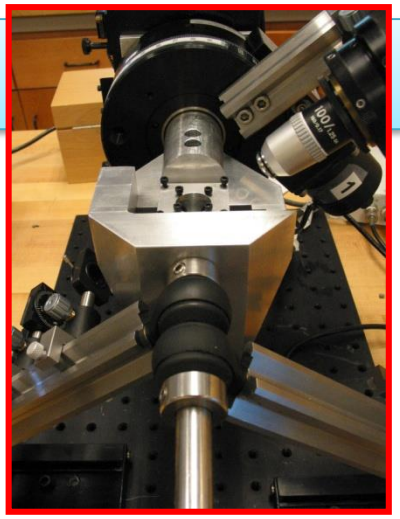
R&D 100 Award, 2003



Patent by Mengüç and Manickavasagam, April 13, 2004; #6,721,051

NANO-MEASUREMENTS





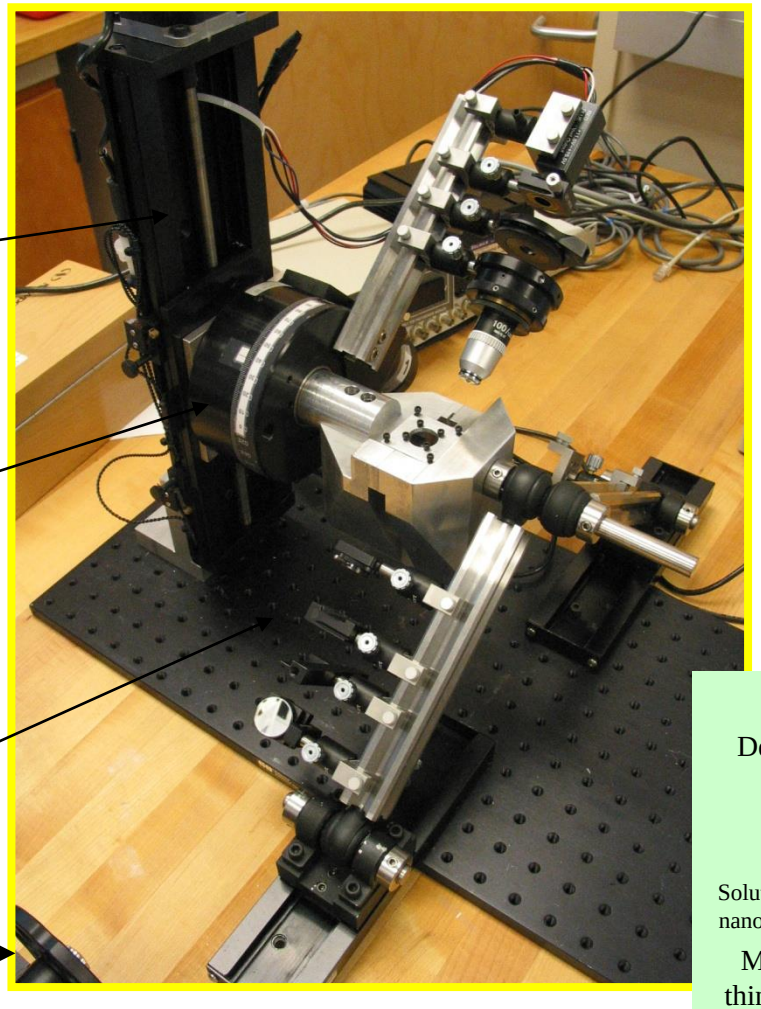
PMT

Translation stage to control incident angle

Rotational stage

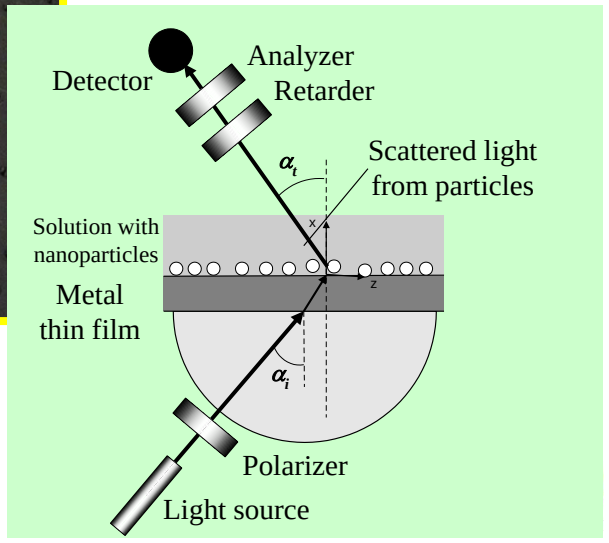
Incident light optics

Light source



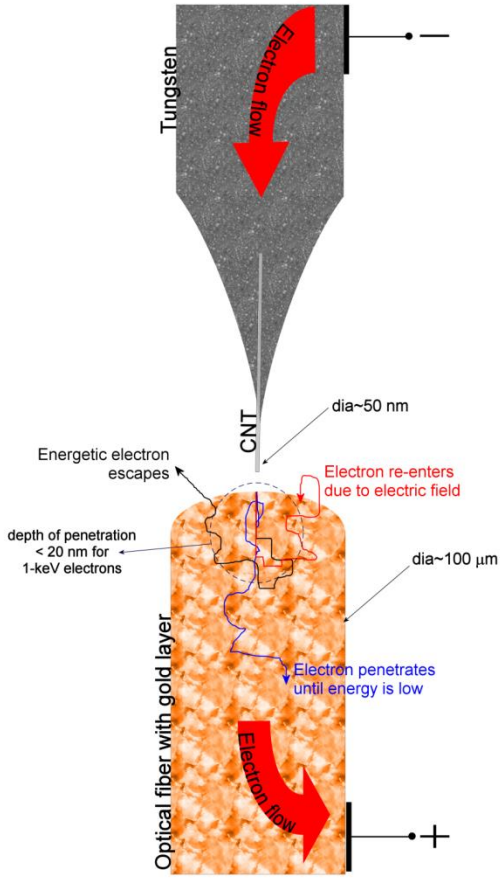
Motor Control Unit

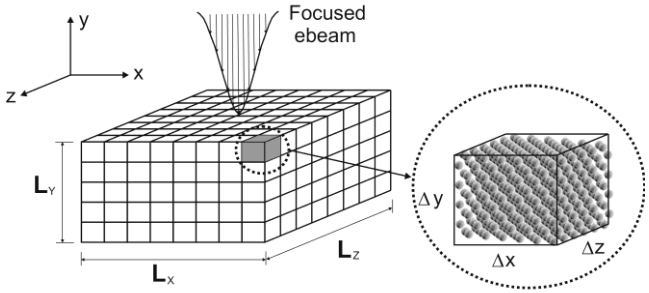
Scattered light optics

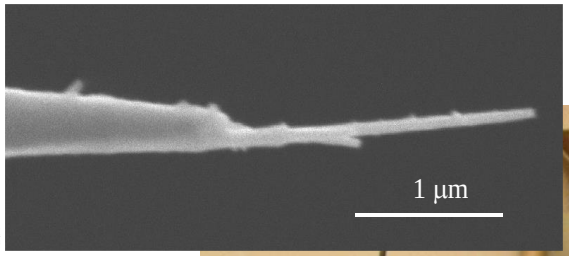


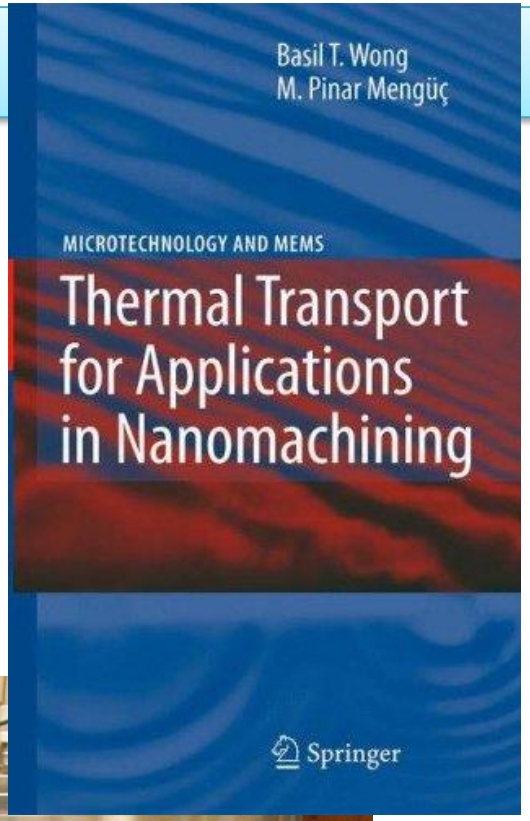
With M. Francoeur, R. Vaillon, M. Aslan
Nano-Scale Diagnostics and Harvesting

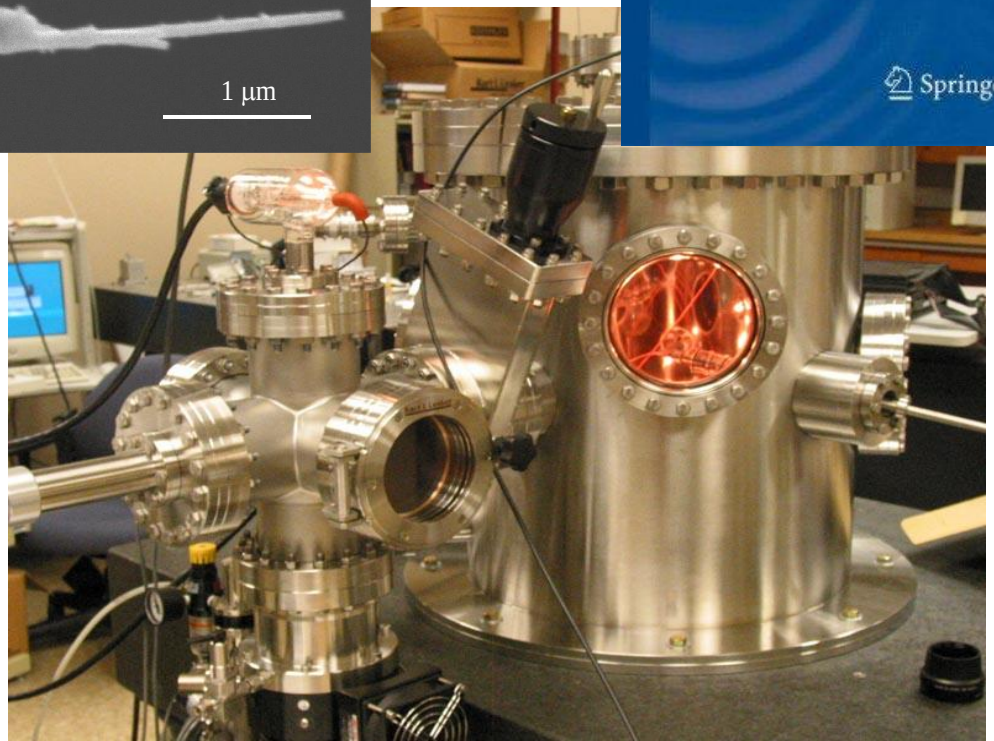
PAST STUDIES AT RTL











Patent by
Vallance, Rao, Mengüç
December 9, 2003; #6,660,959

CEEE/EÇEM

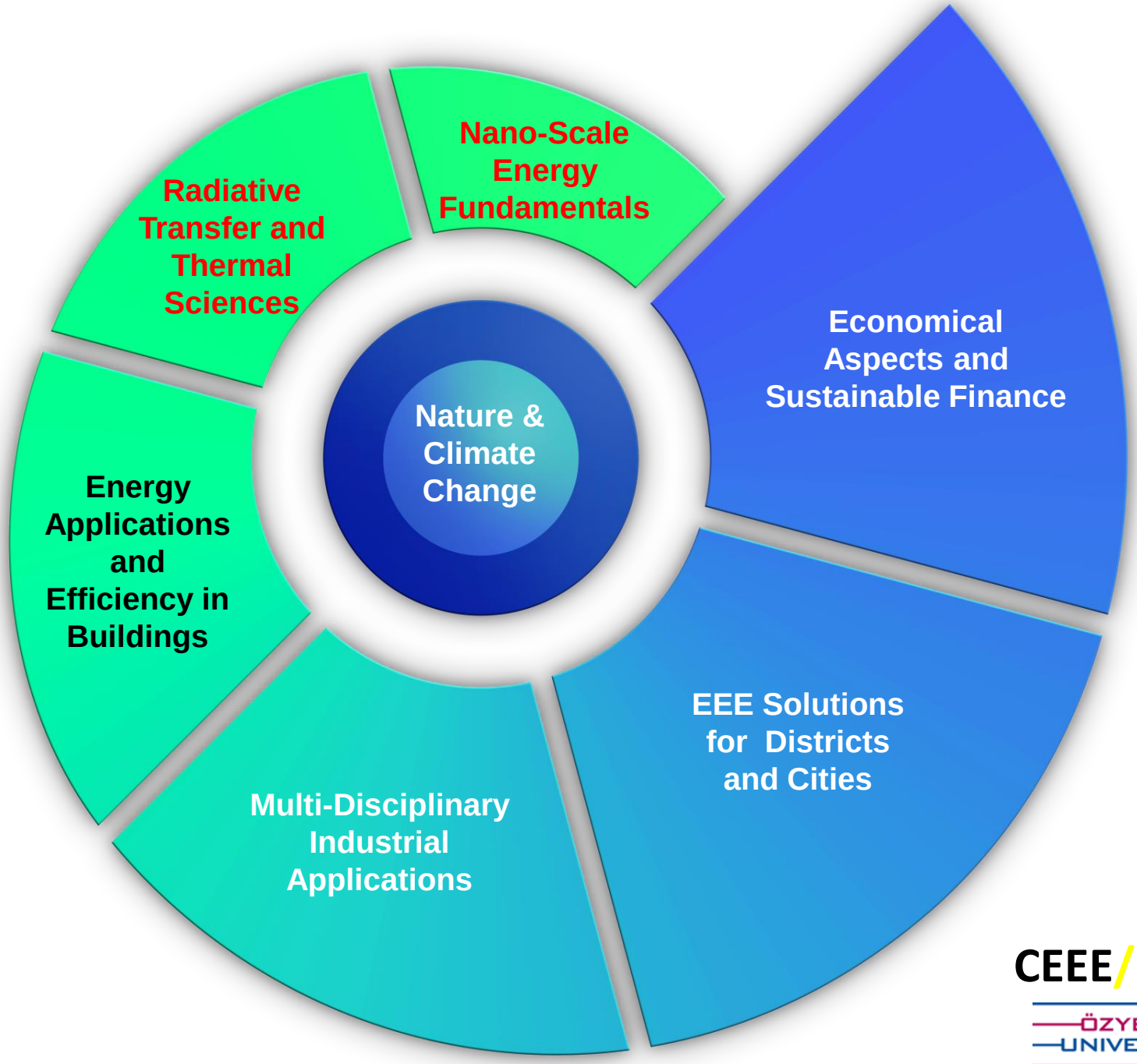
CURRENT STUDIES AT CEEE

#RADIATIVE TRANSFER
#EM-WAVE SCATTERING
#NANO-SCALE ENERGY HARVESTING

#SUSTAINABLE BUILDINGS
#ENERGY EFFICIENCY
#HUMAN-BUILDING INTERACTIONS
#OPTICS IN BUILDINGS
#COMFORT
#SERIOUS GAME

Energy Efficiency in New and Renovated Buildings
Thermal and Visual Comfort
Integrated Engineering and Architecture
Sustainable Materials

CEEE/EÇEM



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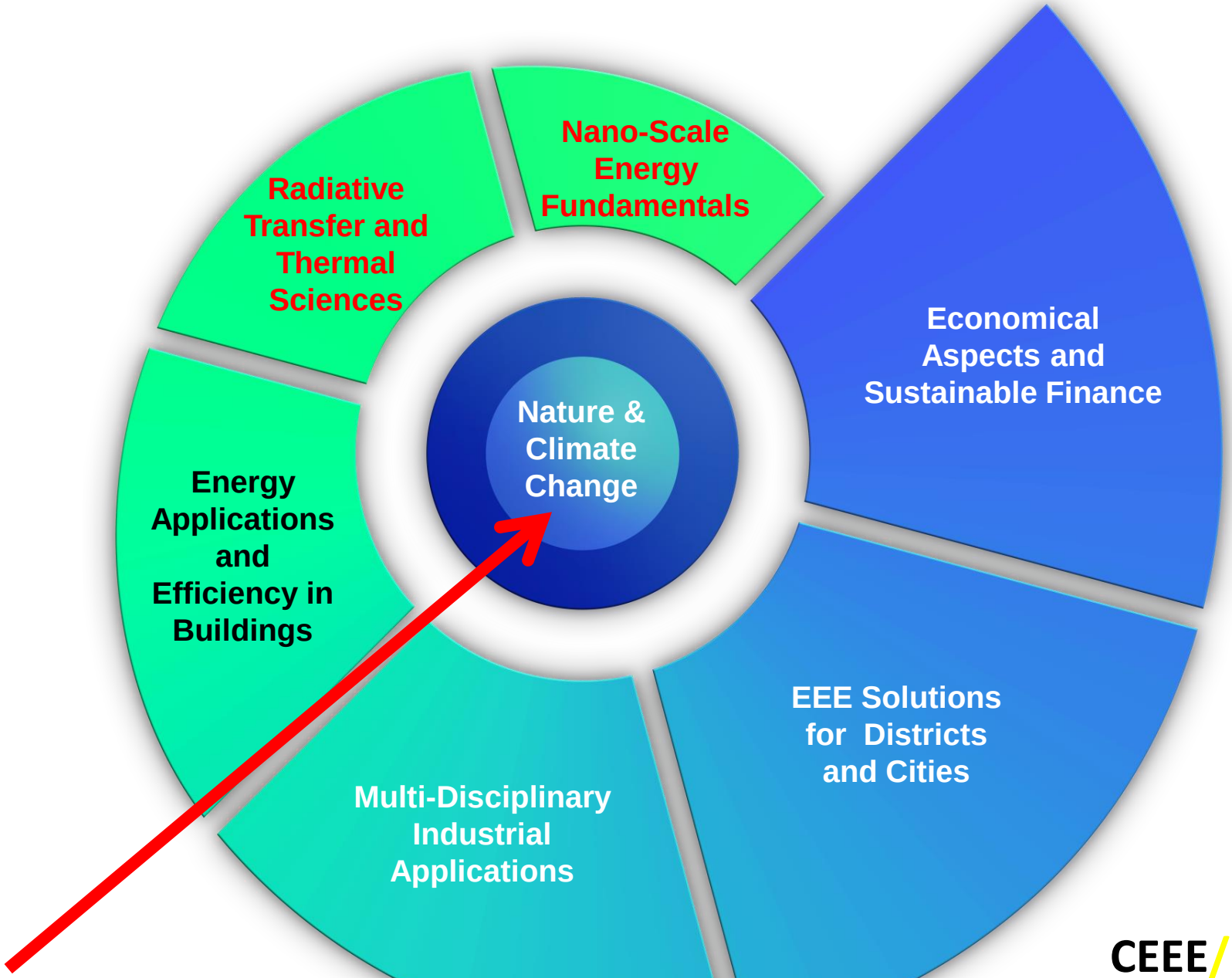
Center for Energy, Environment and Economy: CEEE/ECEM

…. We consider living in harmony with the nature and the development of the strategies to overcome the negative impact of the climate change on our surroundings as the meaningful objectives for all of our activities…

CEEE at OzU was established in 2009 at OzU to focus on Energy, Environment and Economy and to be a depository of engineering and business knowledge in Turkey for both fundamentals and real-world applications.

Along this line, CEEE aspires to develop solutions and strategies to avoid the negative impacts of climate change to our surroundings. This is only possible with a participative approach by all interested parties, not necessarily only from Turkey, or from the rest of the World.

http://www.ozyegin.edu.tr/energy



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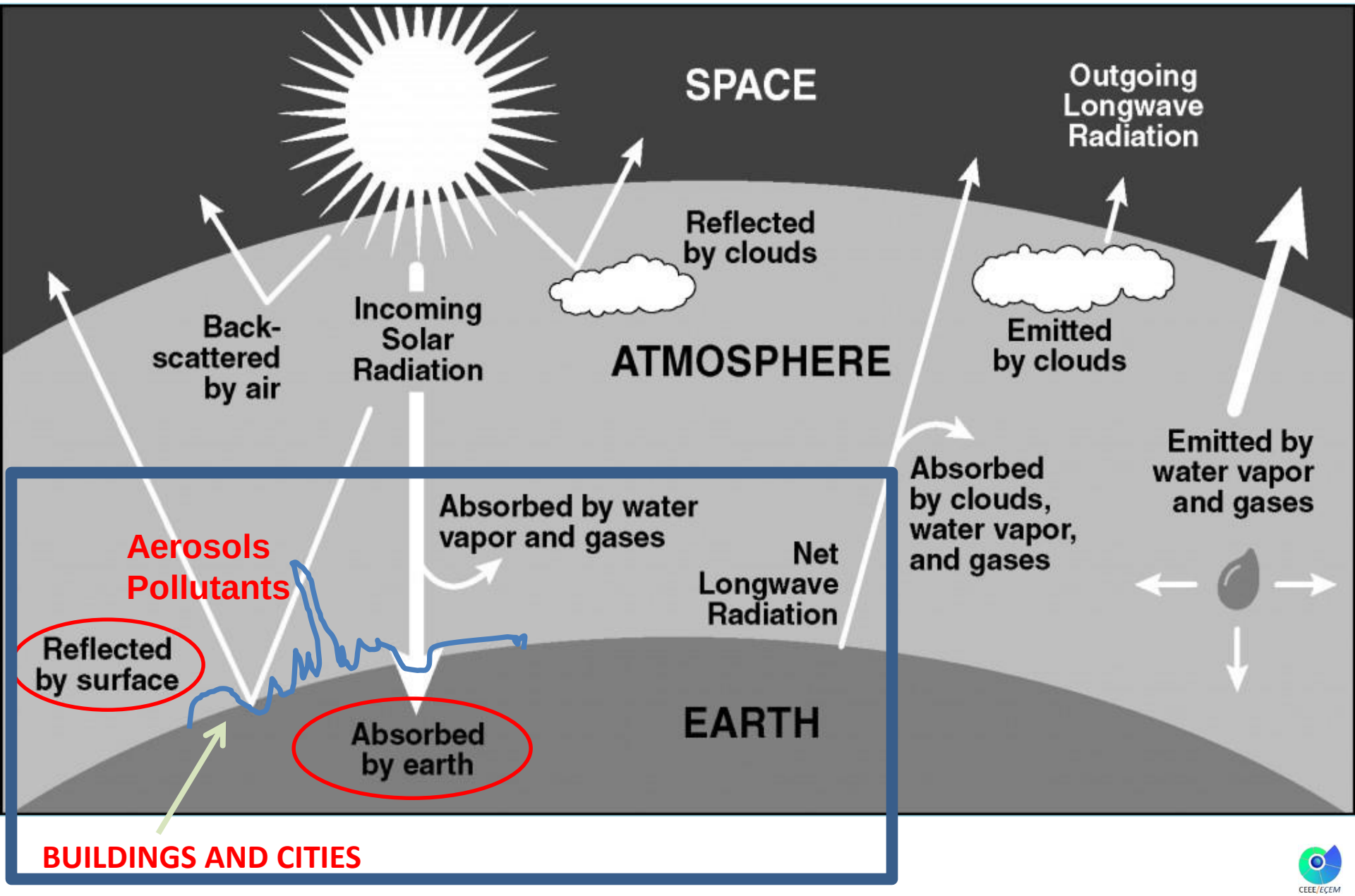
Q_solar

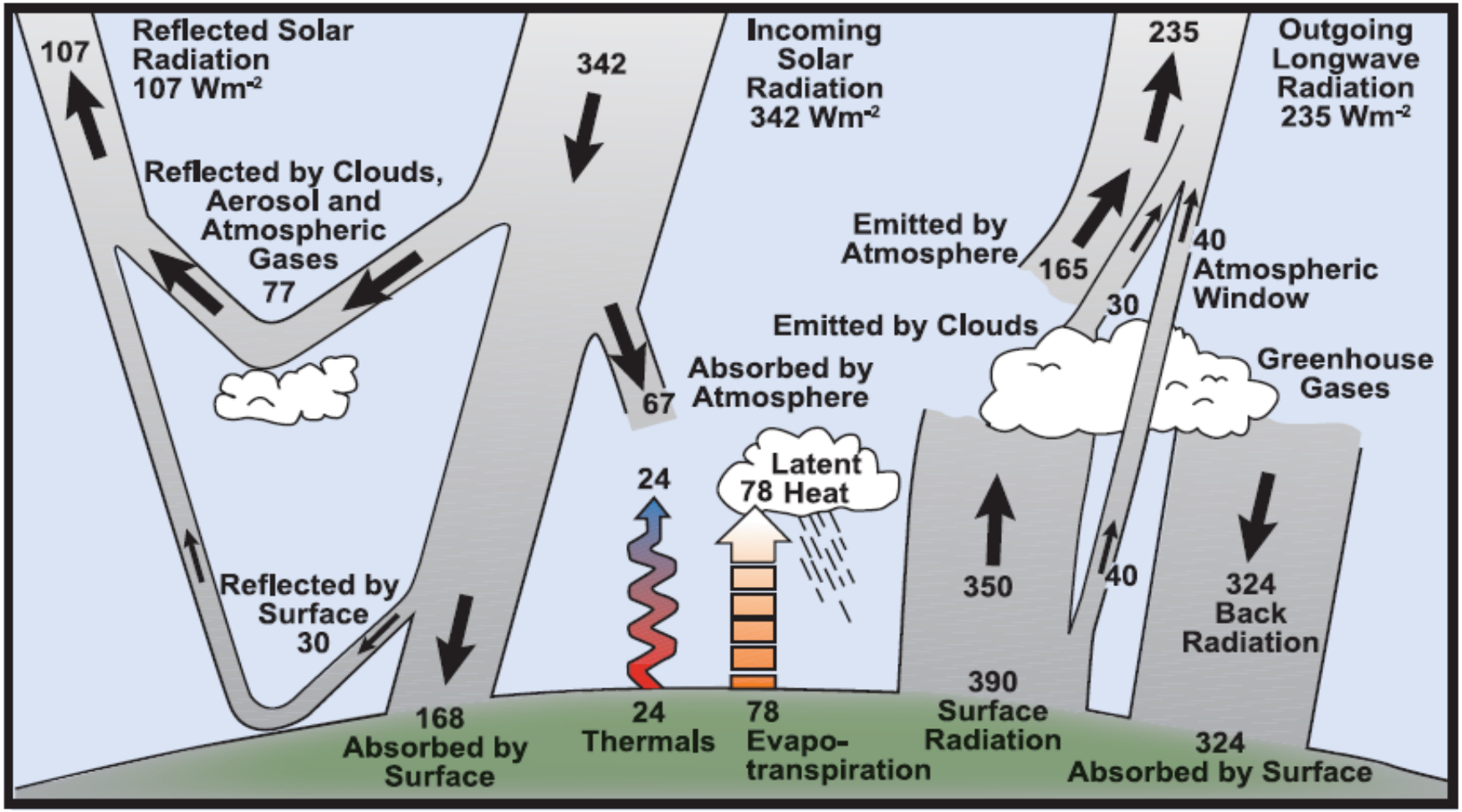
Reflected Q_solar
+
Emitted Q_terrestrial

Trapping by
GHGs
(CO_2+H_2O)

RADIATION TRANSFER & LIGHT SCATTERING



THERMAL SCIENCES FOR UNDERSTANDING CC

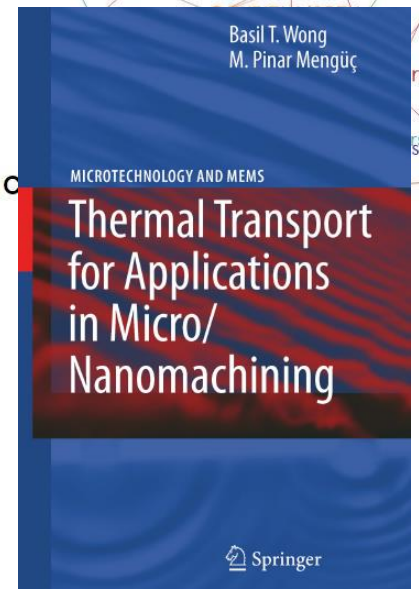


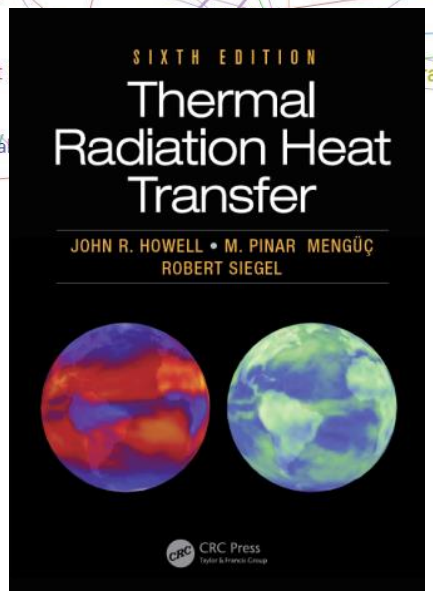
FAQ 1.1, Figure 1. *Estimate of the Earth's annual and global mean energy balance. Over the long term, the amount of incoming solar radiation absorbed by the Earth and atmosphere is balanced by the Earth and atmosphere releasing the same amount of outgoing longwave radiation. About half of the incoming solar radiation is absorbed by the Earth's surface. This energy is transferred to the atmosphere by warming the air in contact with the surface (thermals), by evapotranspiration and by longwave radiation that is absorbed by clouds and greenhouse gases. The atmosphere in turn radiates longwave energy back to Earth as well as out to space. Source: Kiehl and Trenberth (1997).*

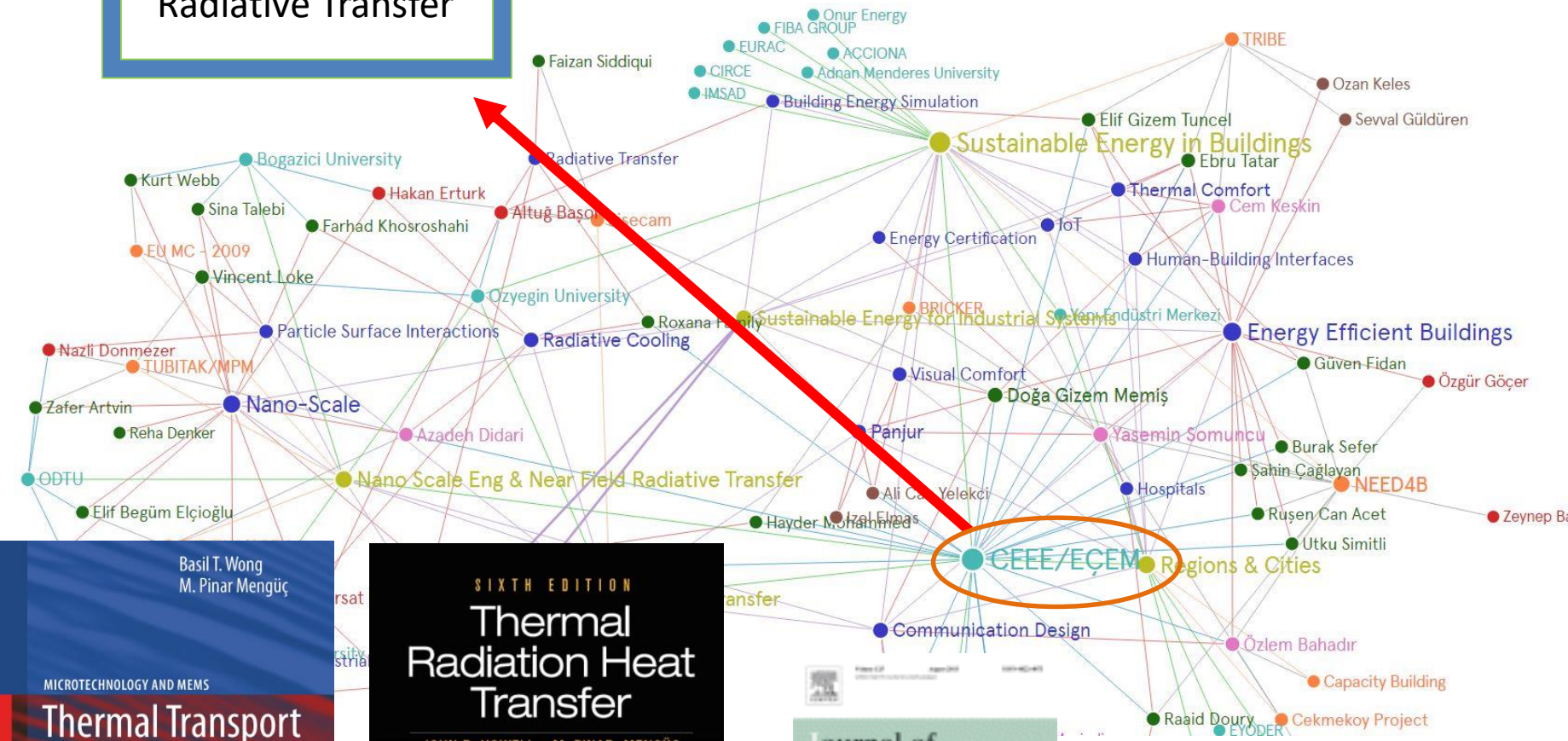
Global cooling: increasing world-wide urban albedos to offset CO2, Hashem Akbari et. al, Climate change, June 2009.

CEEE / ECEM

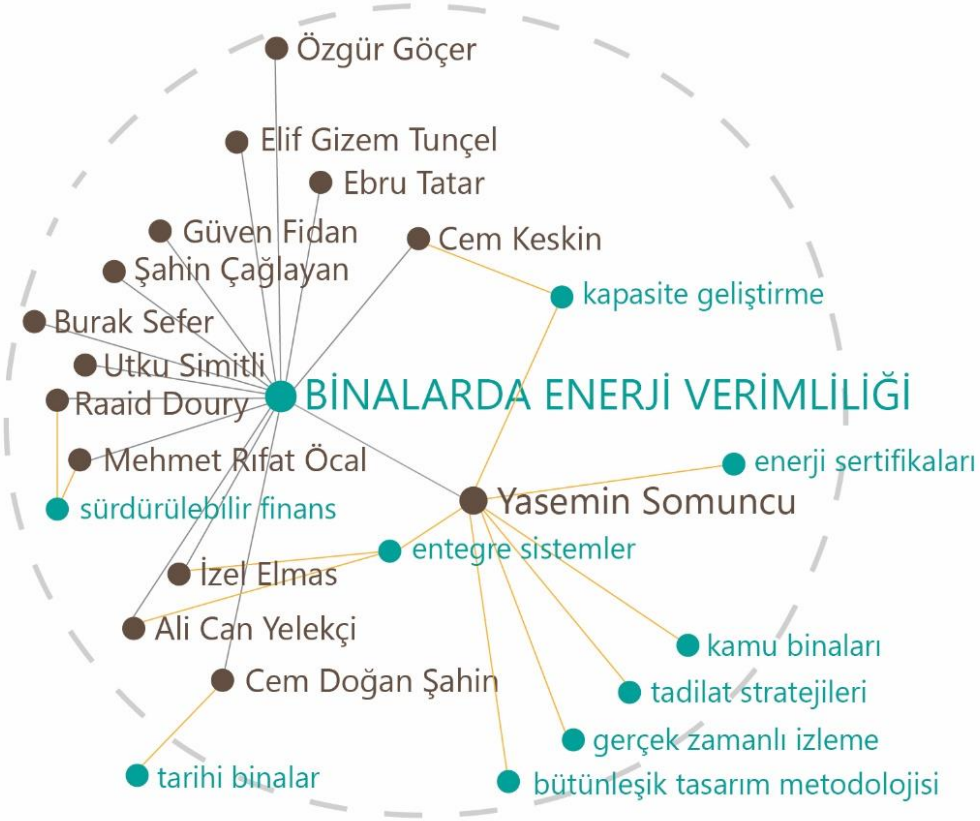
Radiative Transfer





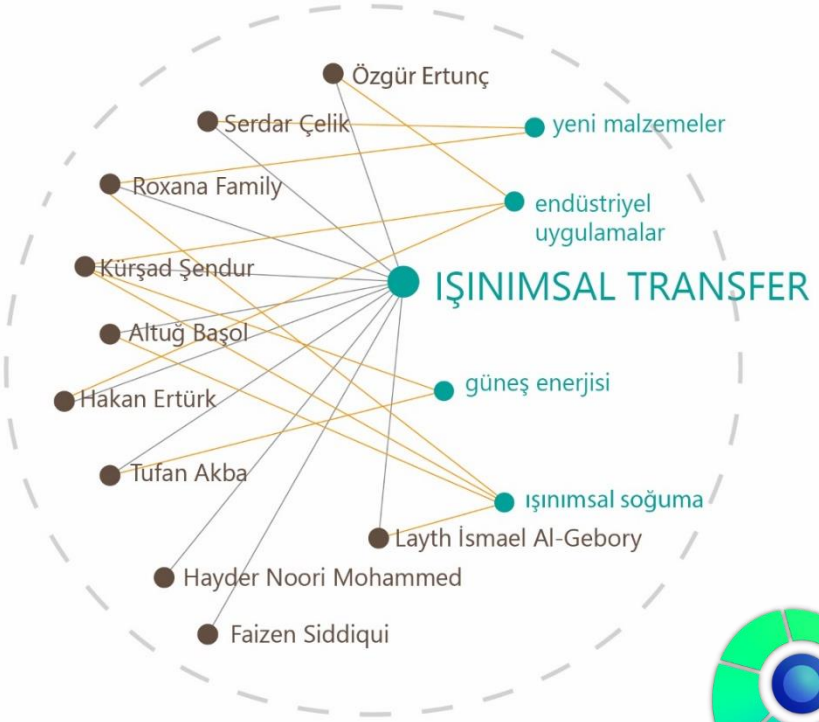


BİNALARDA ENERJİ VERİMLİLİĞİ

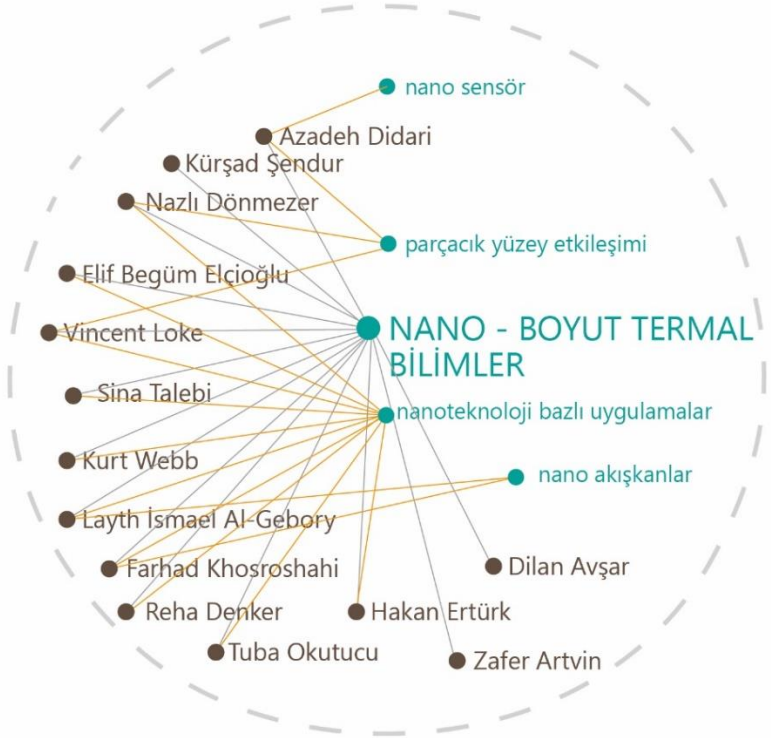


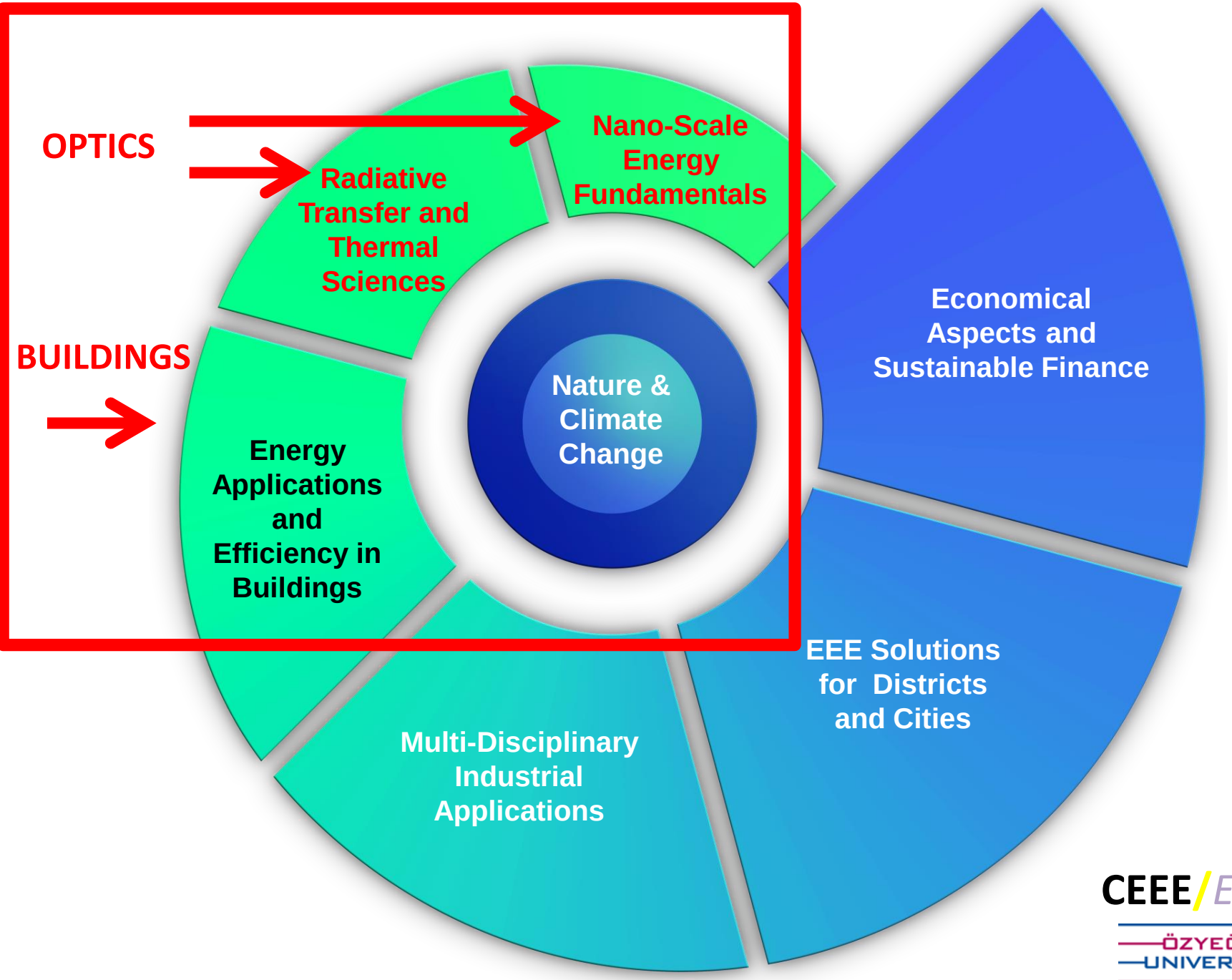
İNSAN - BİNA ETKİLEŞİMİ

IŞINIMSAL / ISI TRANSFERİ



NANO - BOYUT TERMAL BİLİMLER





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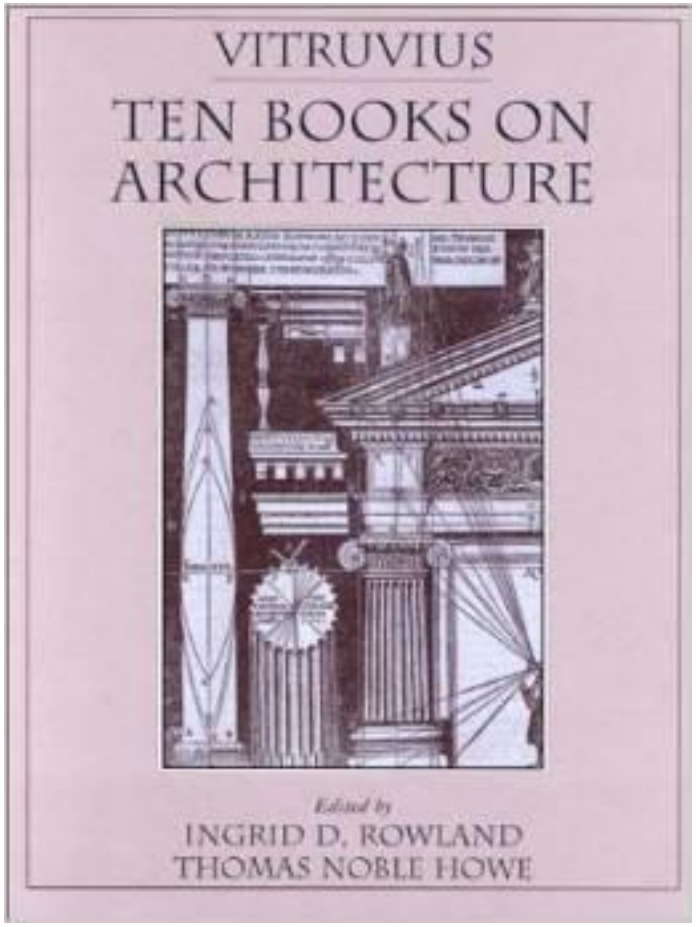
ÖZYEĞİN UNIVERSITY

PERSONAL INSPIRATION

VITRIVIUS: ARCHITECT OF ROME

UNDER THE PROTECTION OF CESAR AUGUSTUS
1st Century BC to 1st Century AD

An **architect** should be…



The science of **optics** enables him to introduce with judgment the requisite quantity of light, according to the aspect.

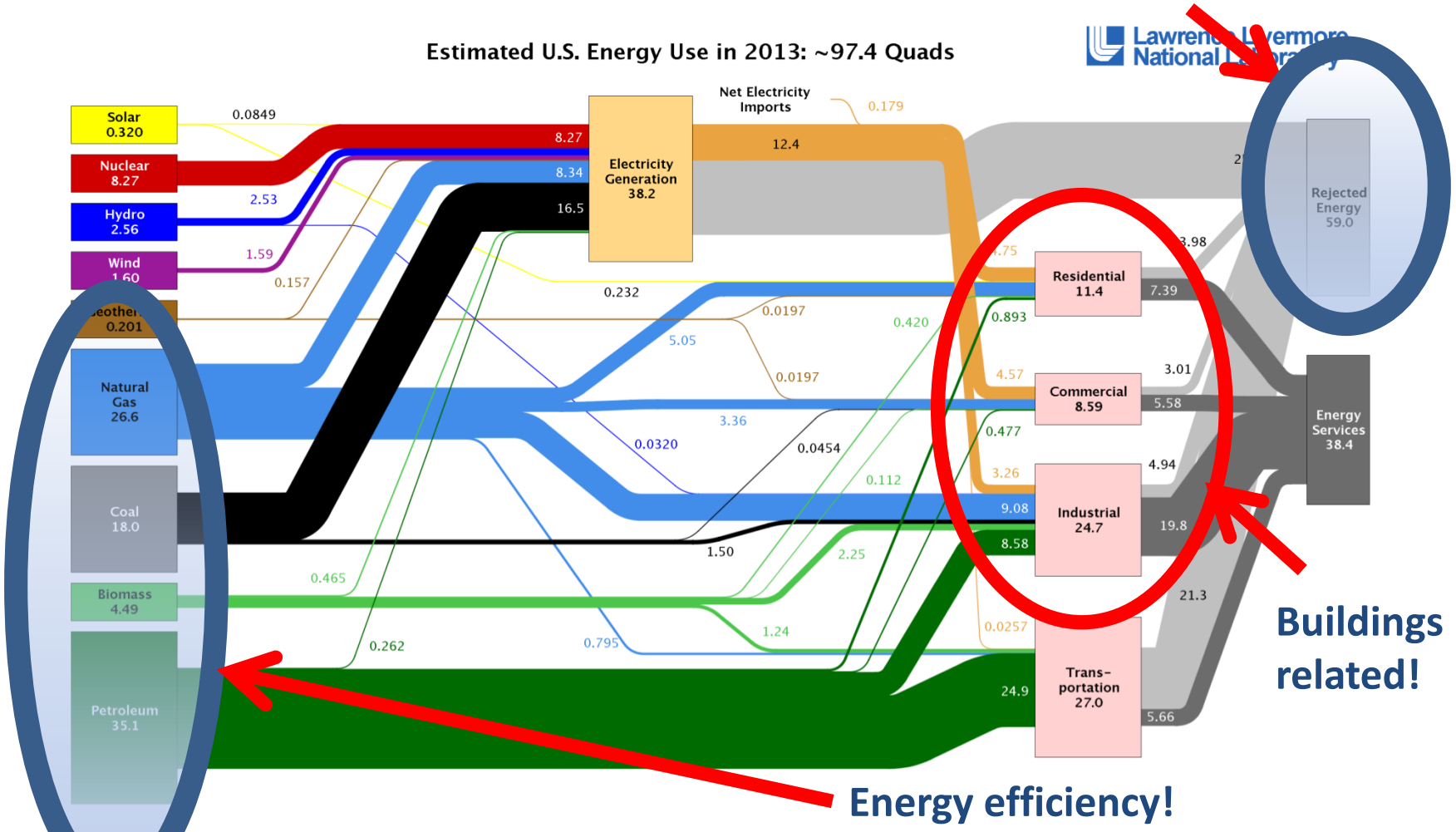
WHY SUSTAINABLE BUILDINGS?

Energy efficiency!

Low Hanging Fruit… Steven Chu

ENERGY MODALITIES

Harvesting Rejected Energy



Flows of energy through the U.S. economy. The light gray bands on the right indicate energy that performs no useful service (i.e., was…). The dark gray bands on the right indicate energy that is used in the residential, commercial, industrial, and transportation sectors. Note that roughly 88 percent of the energy that presently enters the U.S. economy involves combustion of a fuel, which releases carbon dioxide to the atmosphere (1 quad is 10^{12} BTUs or 293 TWh). SOURCE: Lawrence Livermore National Laboratory, https://flowcharts.llnl.gov/.

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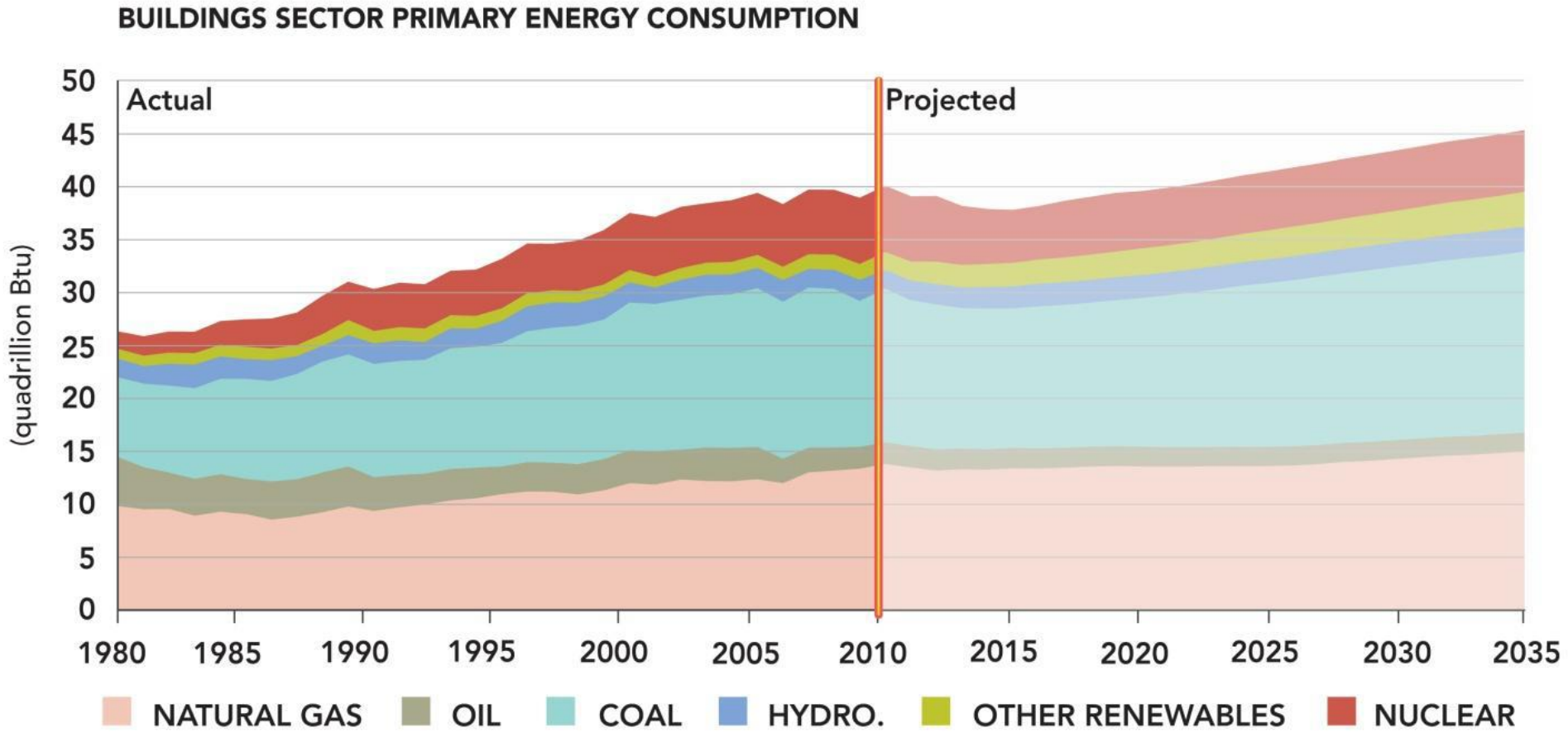
ENERGY USE IN BUILDINGS IN THE USA



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COST OF ENERGY

Bloomberg New Energy Finance. *Levelised Cost of Energy Update, Q3 2012* http://www.bnef.com/WhitePapers/download/114 (Bloomberg New Energy Finance, 2012).

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MODALITIES FOR ENERGY RESEARCH

(1) Energy Generation

(2) Energy Conservation

(3) Energy Harvesting

(4) Energy Efficiency

MODALITIES FOR ENERGY RESEARCH

(1) Energy Generation

(3) Energy Harvesting

Depends on effective transfer of energy

Radiation Transfer: Far-field and Near-field

OPTICS

(2) Energy Conservation

(4) Energy Efficiency

Sustainable Buildings

Integrated Architecture and Engineering

Comfort, Innovative financing, Risk analyisis, Radiating Cities

BUILDINGS

CEEE/EÇEM

ORIGINAL CEEE FOCI

Energy Harvesting:
Solar PV/TPV
Solar Concentrating Systems

Radiative Cooling for Buildings

Advanced Materials
System Integration

Nanotechnology
Financial Systems

→ **BUILDING INTEGRATED SYSTEMS**

CEEE/EÇEM

THE FOCUS

LIGHT

HEAT

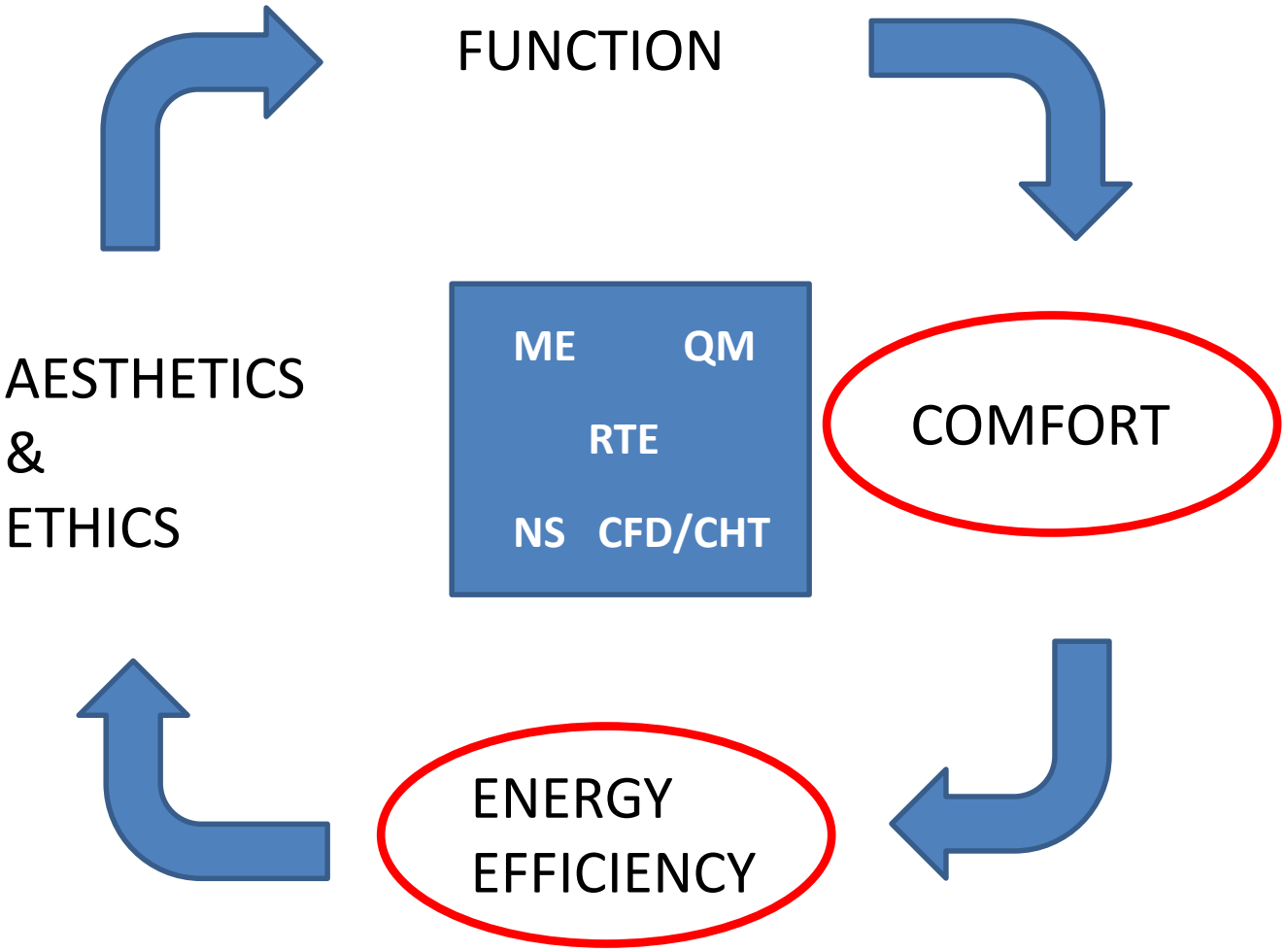
OPTICS AND BUILDINGS

ME QM

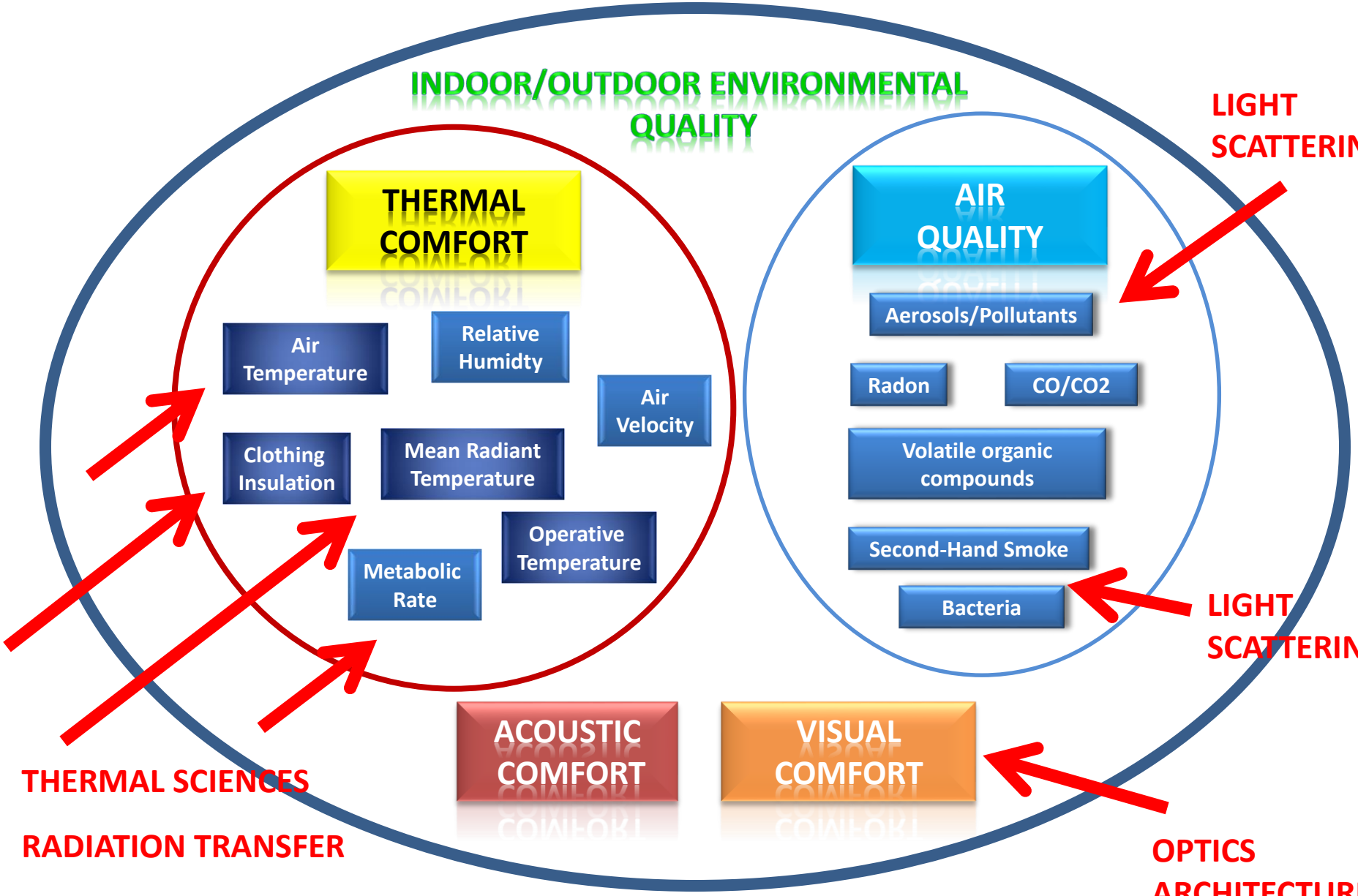
RTE

NS CFD/CHT

OPTICS AND BUILDINGS



FUNDAMENTAL STUDIES NEEDED FOR C O M F O R T



Center for Energy, Environment and Economy
@ Ozyegin University

A Sustainable Energy Center!

Ozyegin University Campus View (in 2011, there was nothing in this view!)

Solar PV, Green Roofs, Solar Shades, Facades, Smart Automation…

FROM SCIENCE TO SOCIETY

DEVICES, MATERIALS & METHODOLOGIES

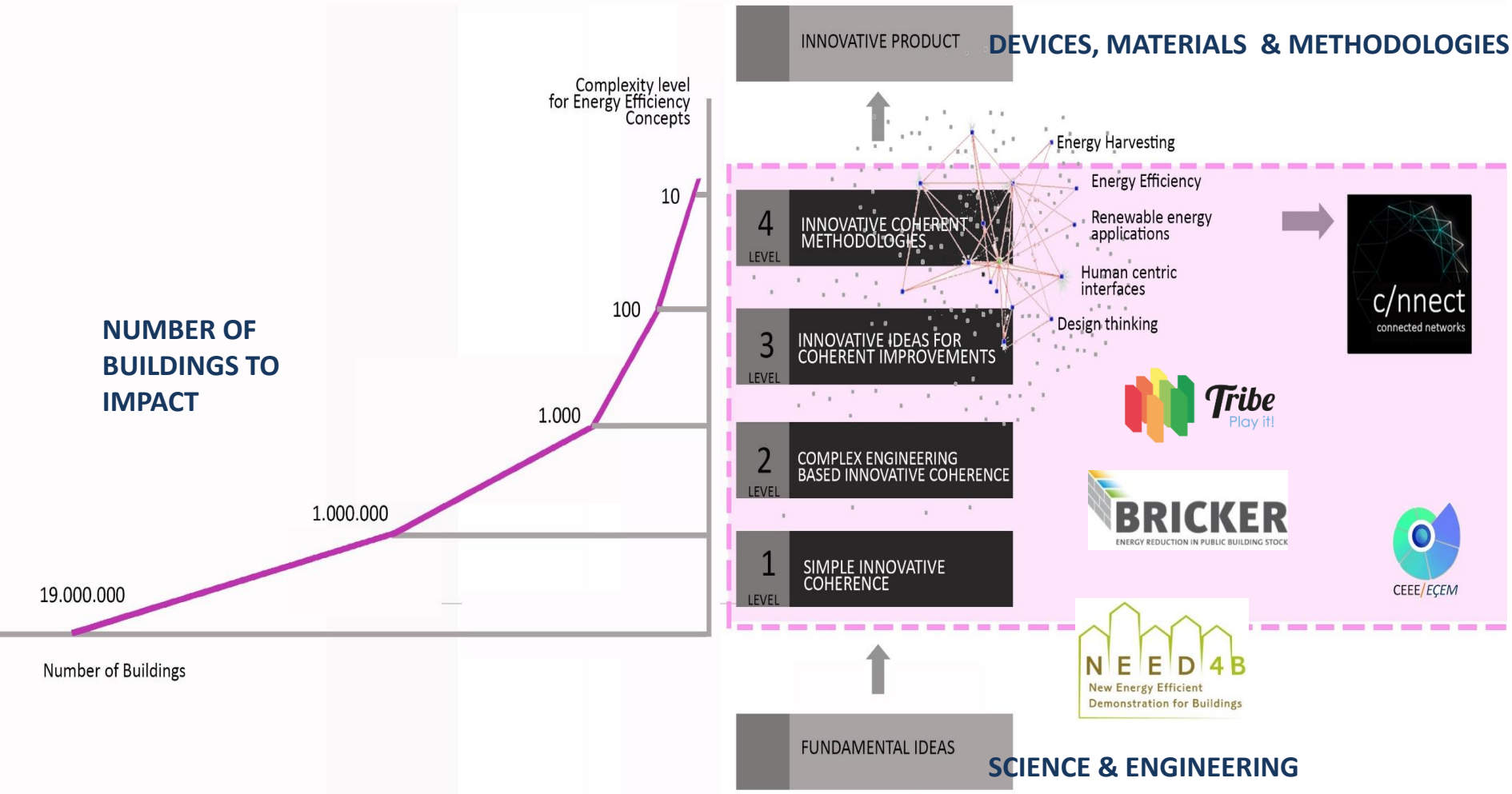
SCIENCE & ENGINEERING

CEEE PROJECTS ON
ENERGY EFFICIENCY FOR BUILDINGS

EU CAPACITY

CEEE/ECEM

FROM SCIENCE TO SOCIETY



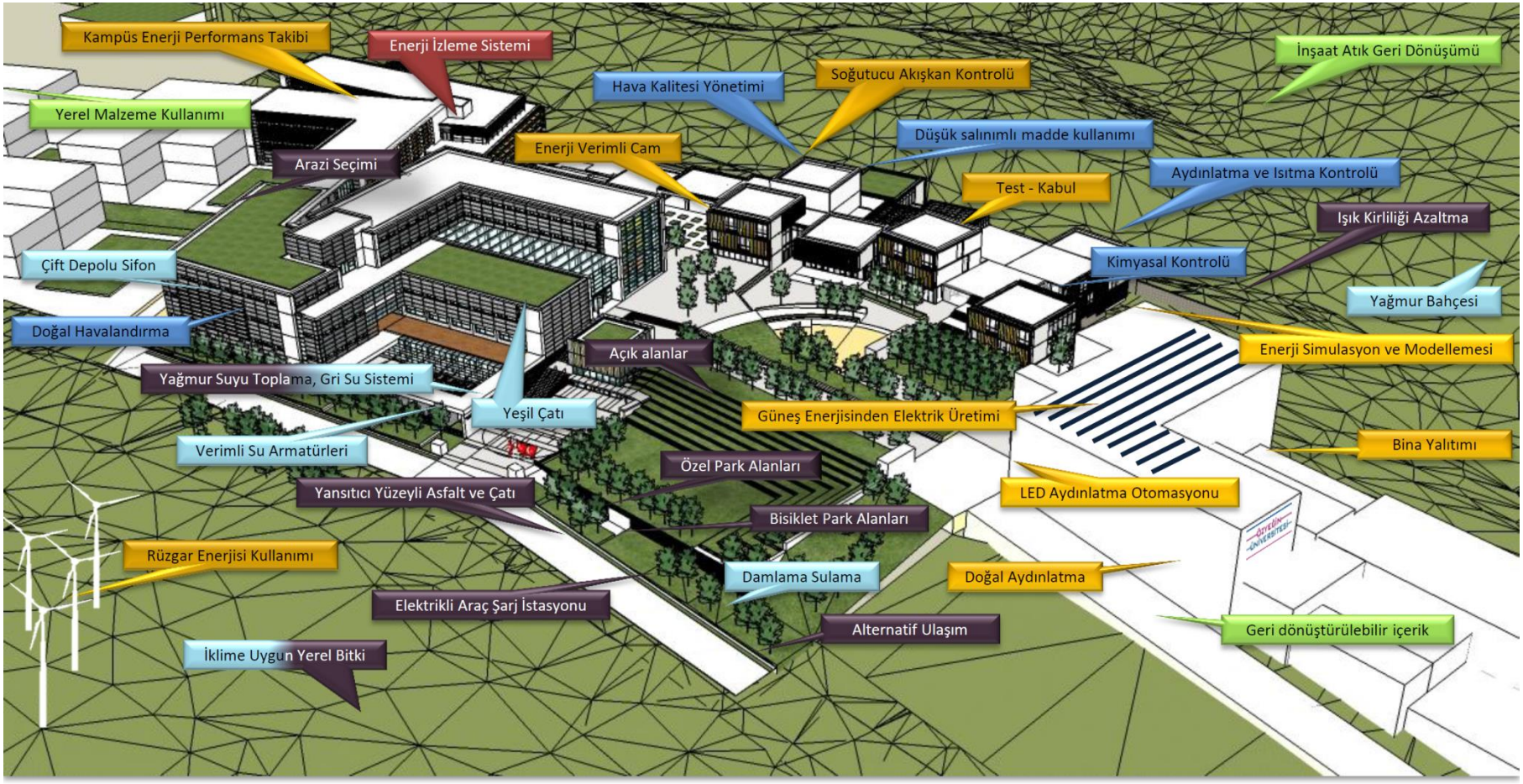
ENERGY EFFICIENCY FOR NEW BUILDINGS

OZYEGIN UNIVERSITY: SCOLA BUILDING

NEED4B
FP7-PROJECT
TURKISH PARTNERS: OZU-FIBA-B.DESIGN

CEEE/EÇEM

Ozyegin Univ Campus

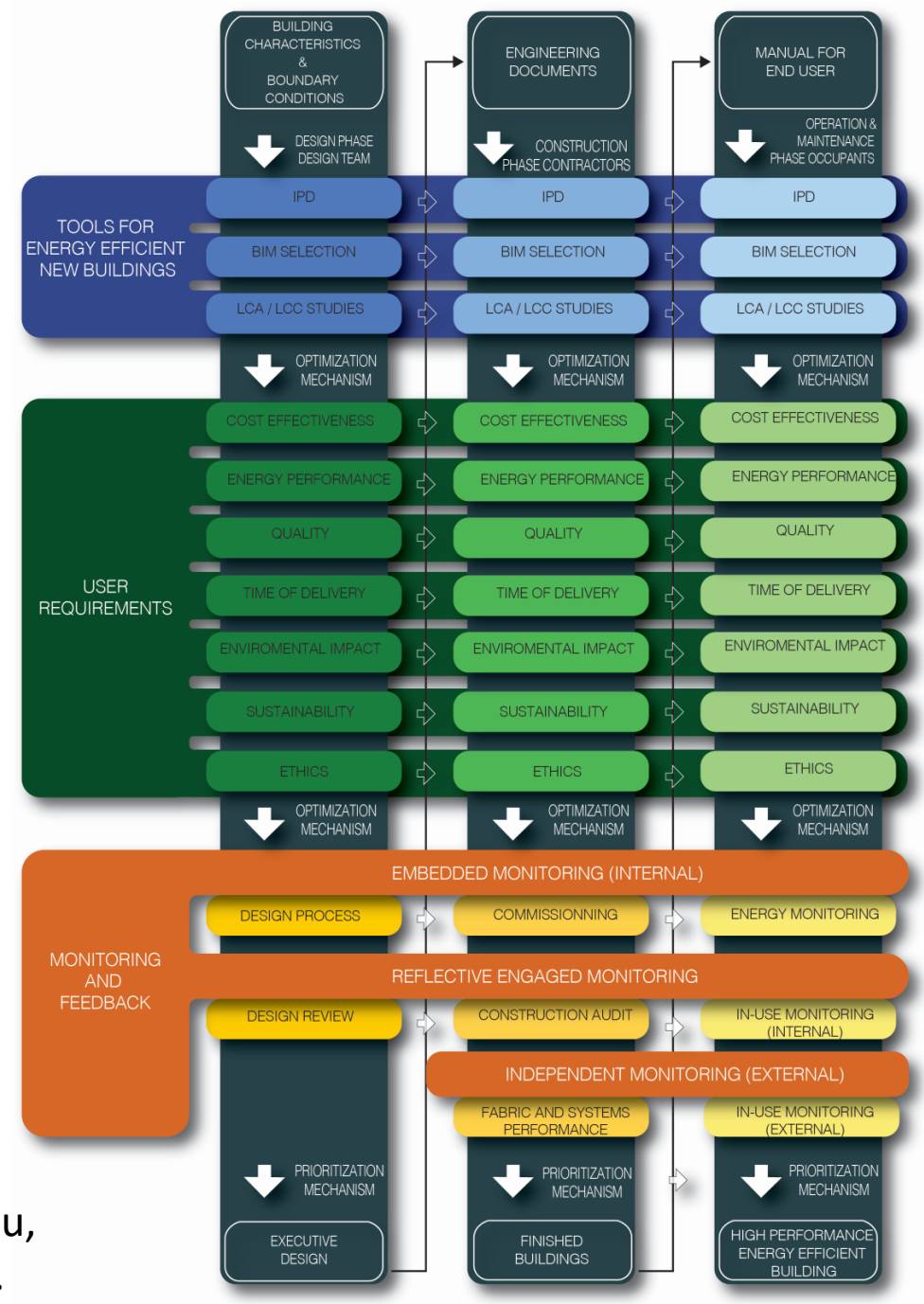


NEED4B is a an EU-FP7 Project, and applied to one of the campus buildings, SCOLA, at Özyeğin University in Istanbul.

The measurements over the last two years reveal that SCOLA has very low energy density, only **57** kWh/m²/year.
A typical academic building in Turkey uses **255** kWh/m²/year in the 2. heating zone.

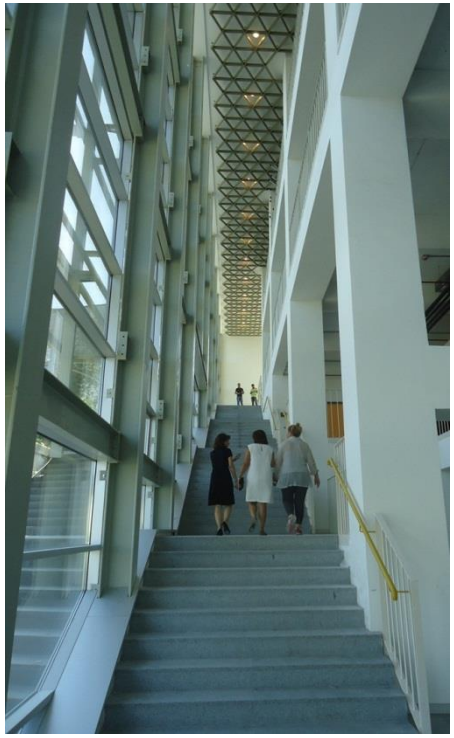
The real-time measurements of the SCOLA building indicate far better results compared to the different buildings in the university campus, which have been rewarded with LEED Gold or Silver.

NEED4B
New Energy Efficient
Demonstration for Buildings

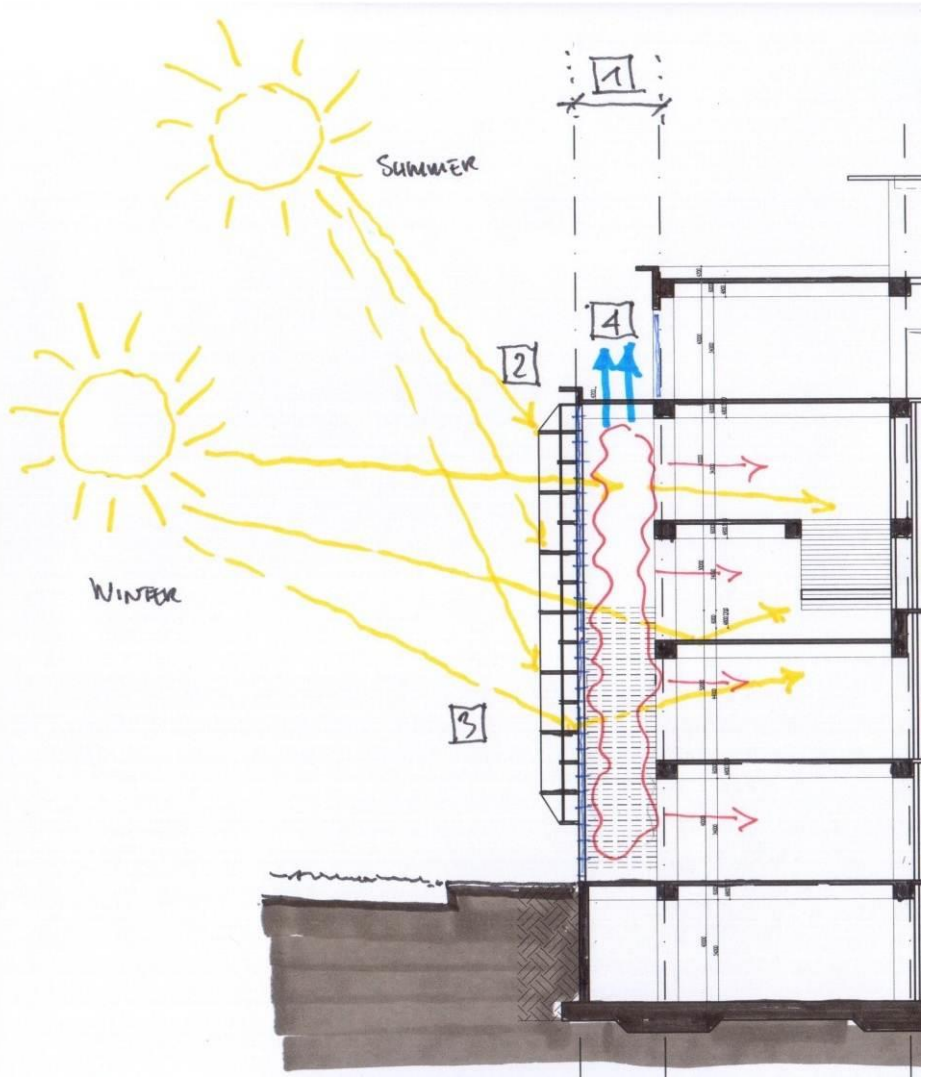


With Yasemin Somuncu, Architect, CEEE/EÇEM.

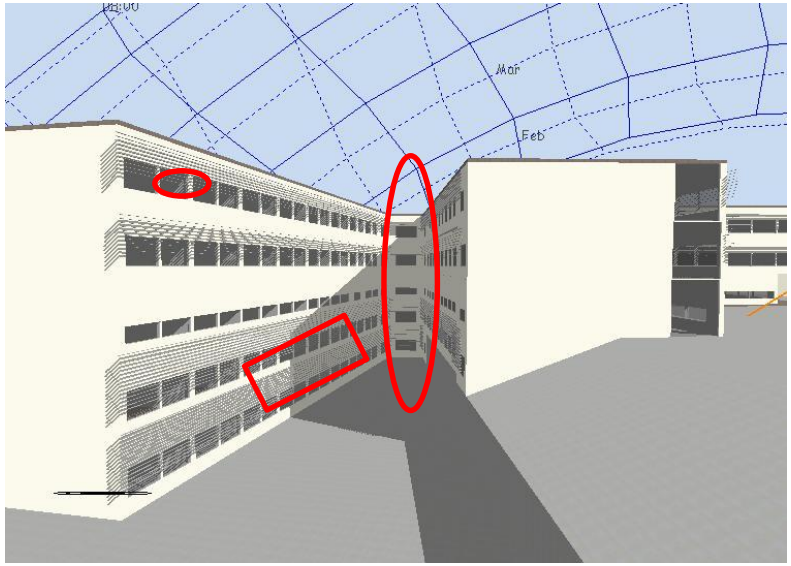
Design Statement

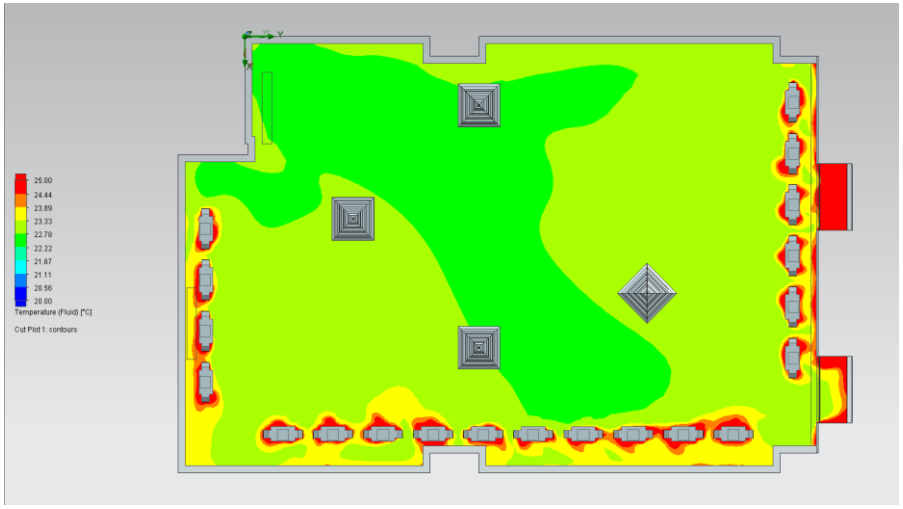


1. South facade buffer zone
2. Solar Gain Control / Summer horizontal shading elements
3. Solar Gain / Winter horizontal shading elements
4. Exhaust during summer



Full Building Energy Simulation





EQUEST

CFD

EnergyPlus

DesignBuilder Software

Revit

CEEE/EÇEM

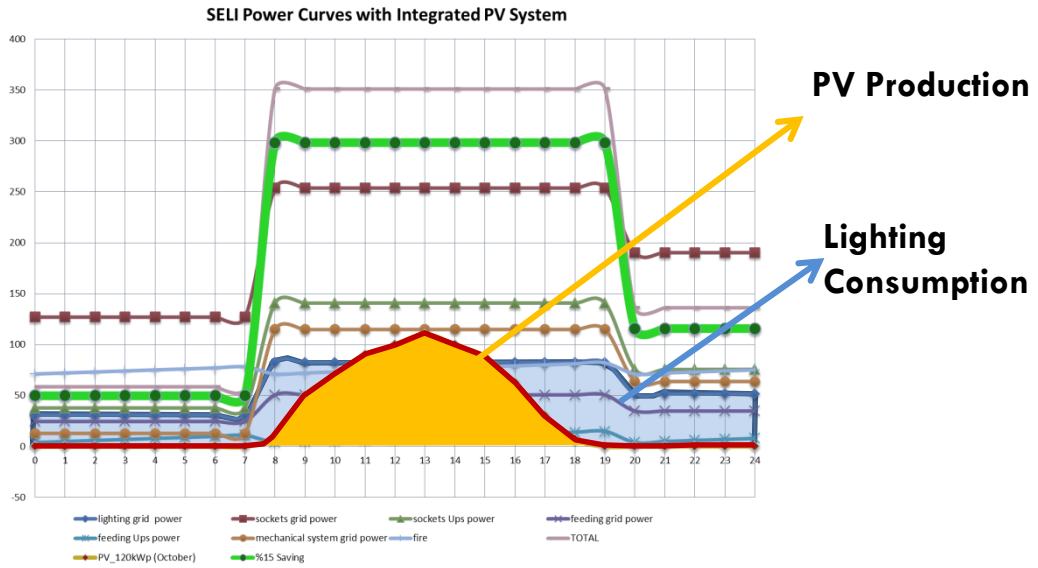
Innovations & Progressive Technologies

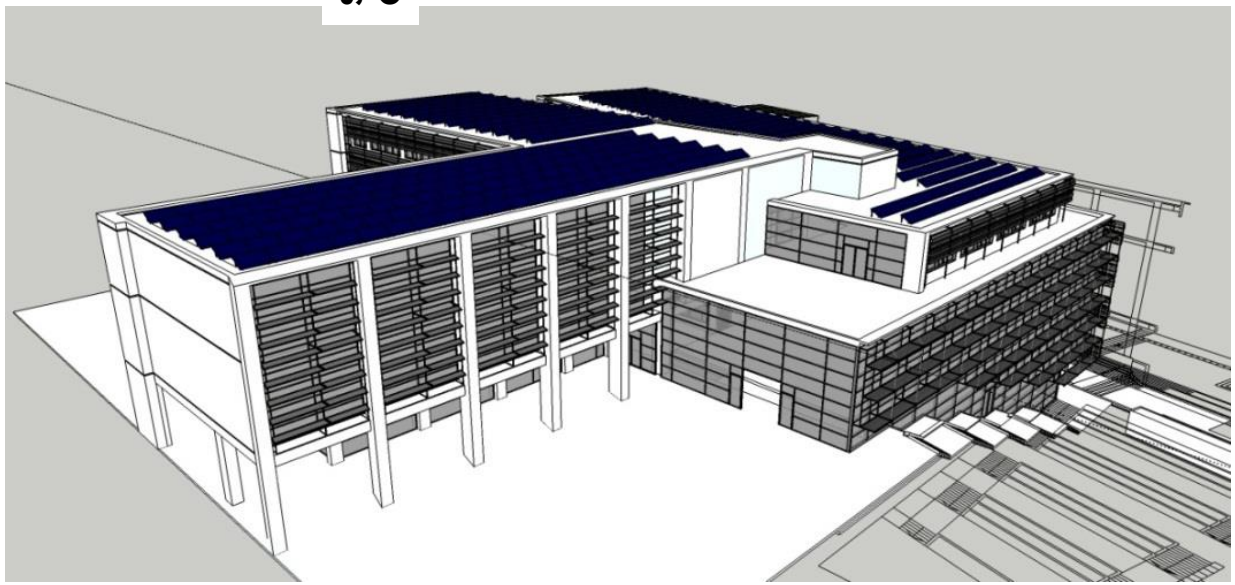
PV PANELS

120 kWp
CAPACITY

Performance Values

SCOLA Load Curves with PV production in October

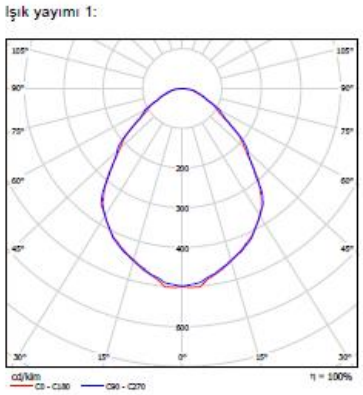


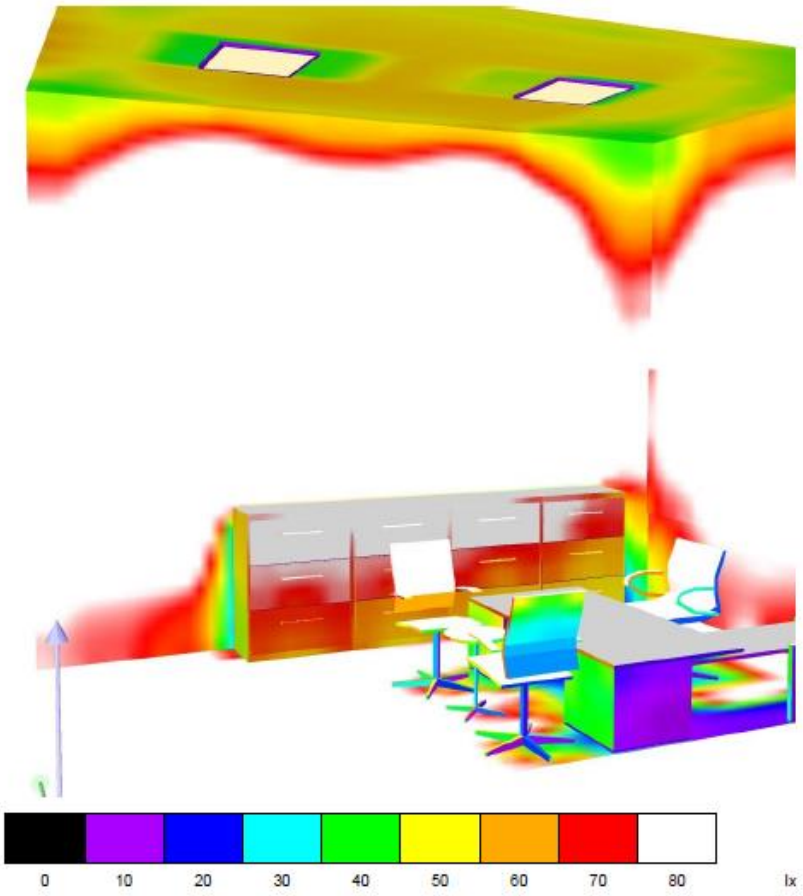


Innovations & Progressive Technologies

LED USAGE

3,3 – 5,8 W/m^2 ENERGY DENSITY



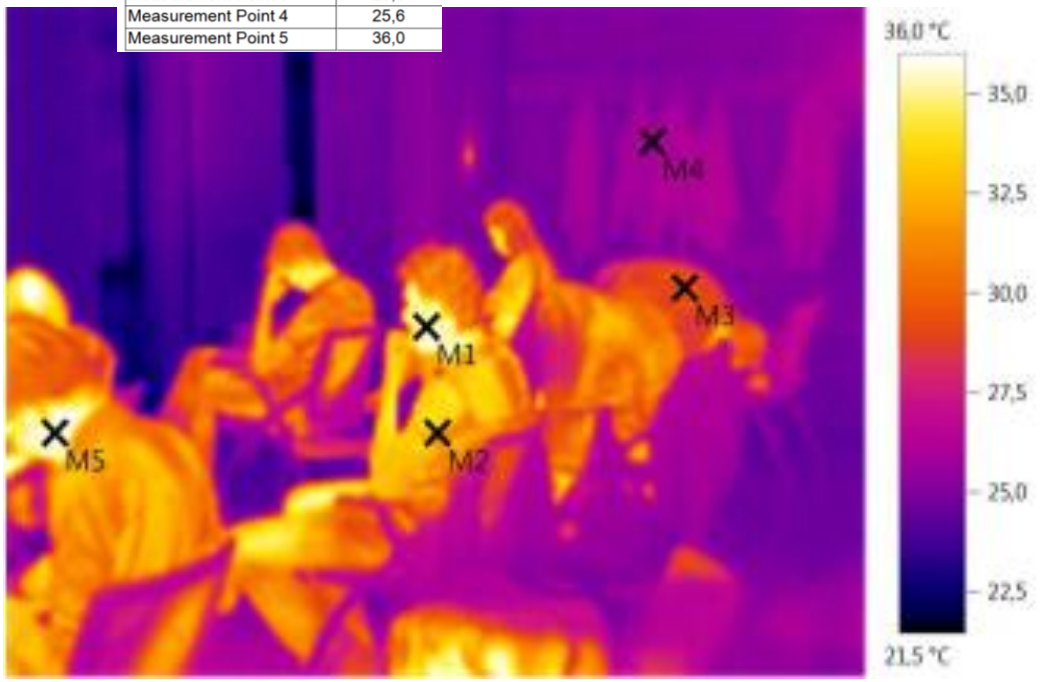


LIGHTING SIMULATIONS FOR OFFICES

CEEE/EÇEM

DESIGN AND COMPARISONS

Measurement Subjects	Temp. [°C]
Measurement Point 1	36,2
Measurement Point 2	33,8
Measurement Point 3	29,6
Measurement Point 4	25,6
Measurement Point 5	36,0

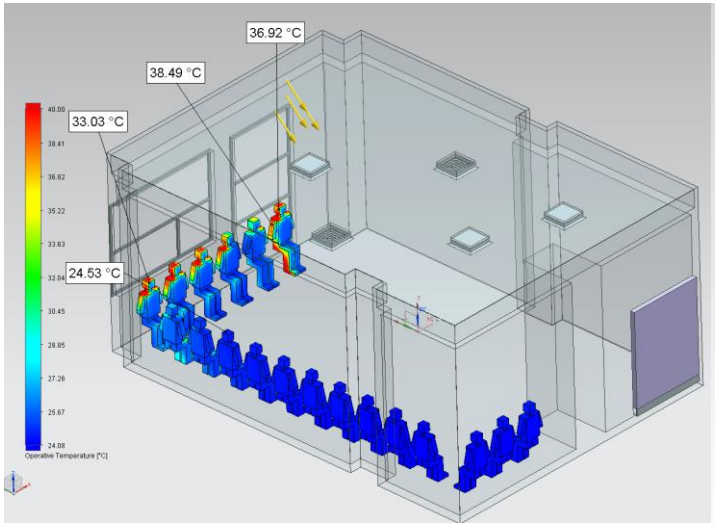


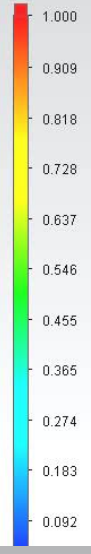
TEMPERATURE AND IR-CAMERA MEASUREMENTS

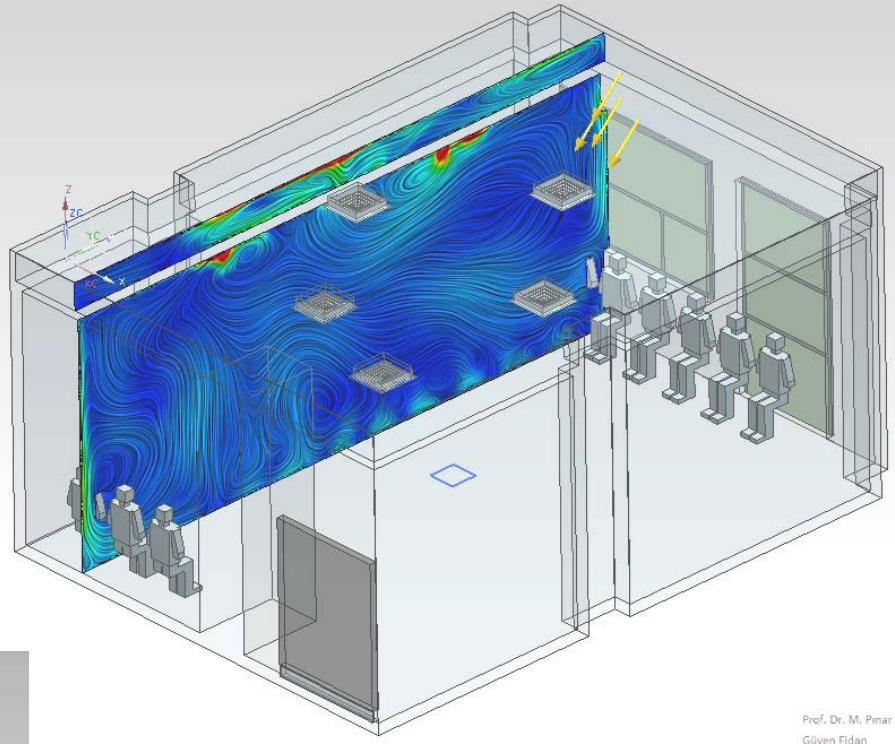
With Güven Fidan, OzU, CEEE, MSME 2016.

CEEE/EÇEM

THERMAL COMFORT VIA CFD w/RADIATION







Prof. Dr. M. Pınar Mengüç
Güven Fidan
CEEE/EÇEM

GÜVEN FİDAN

THERMAL COMFORT VIA CFD w/RADIATION

Pre-Processing

- Enviromental Pressure
- Inlet Flow Rate
- Outer Wall Condition
- Solar Radiation
- Radiative Surfaces

→ Architectural Details → 1:1 Scale – 3D Model → Material Properties → Boundary Conditions → Mesh Discretization

Solving

Governing Equations of Momentum, Mass and Energy+
Discrete Ordinates Radiation Model +
K-Epsilon Turbulence Model

Post-Processing

Simulation Results

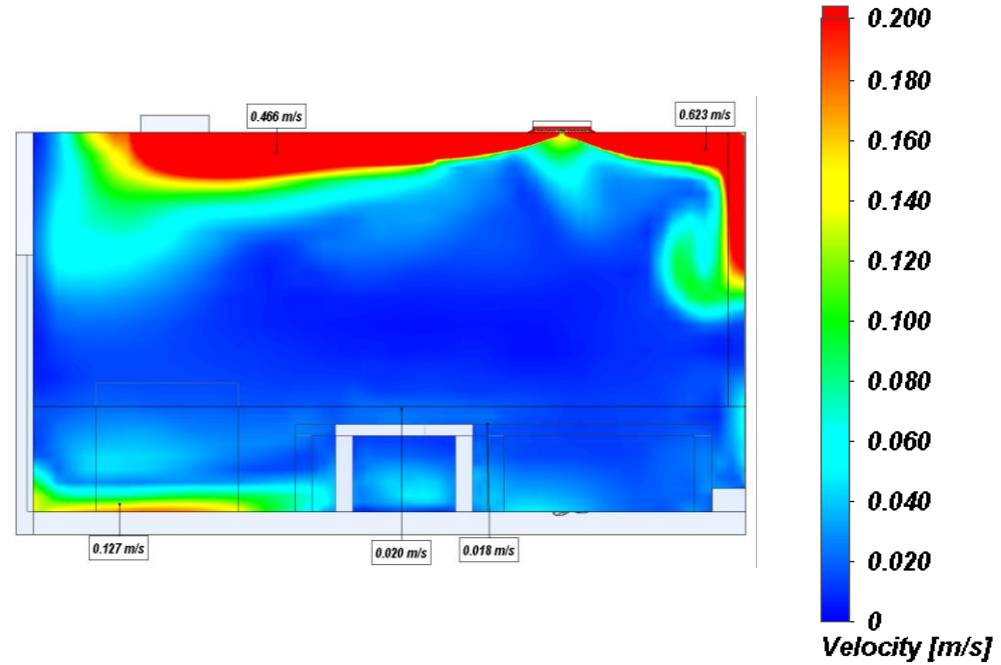
- Velocity
- Temperature
- Relative Humidity
- Mean Radiant Temperature

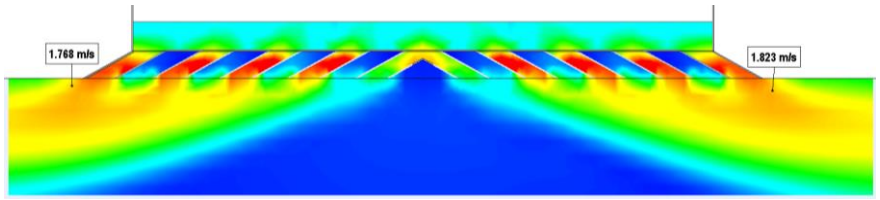
\+

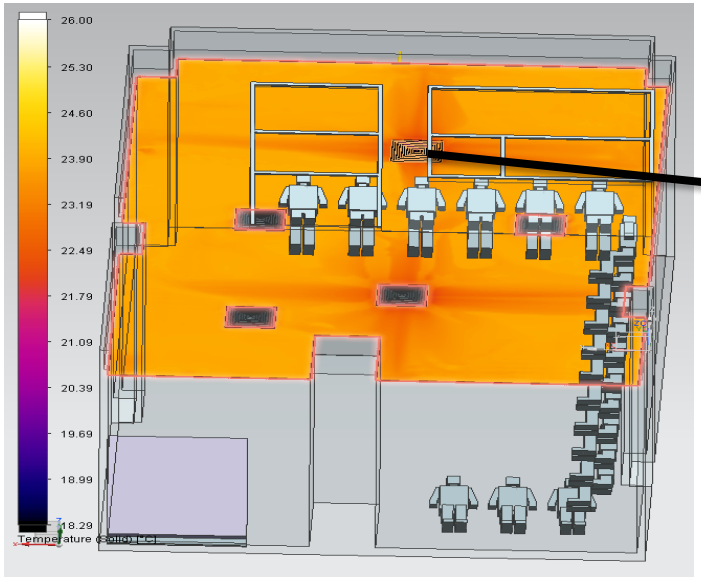
- Thermal Resistance of Clothing
- Metabolic Rate

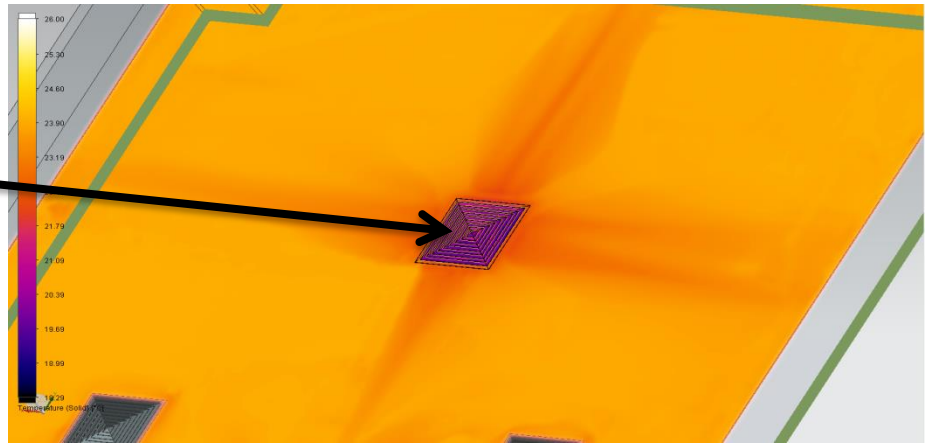
Thermal Comfort Results

- Predicted Mean Vote
- Predicted Percentage of Dissatified

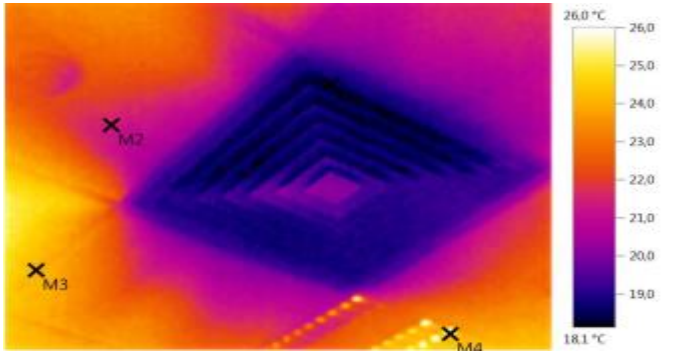








Computational Fluid Dynamics

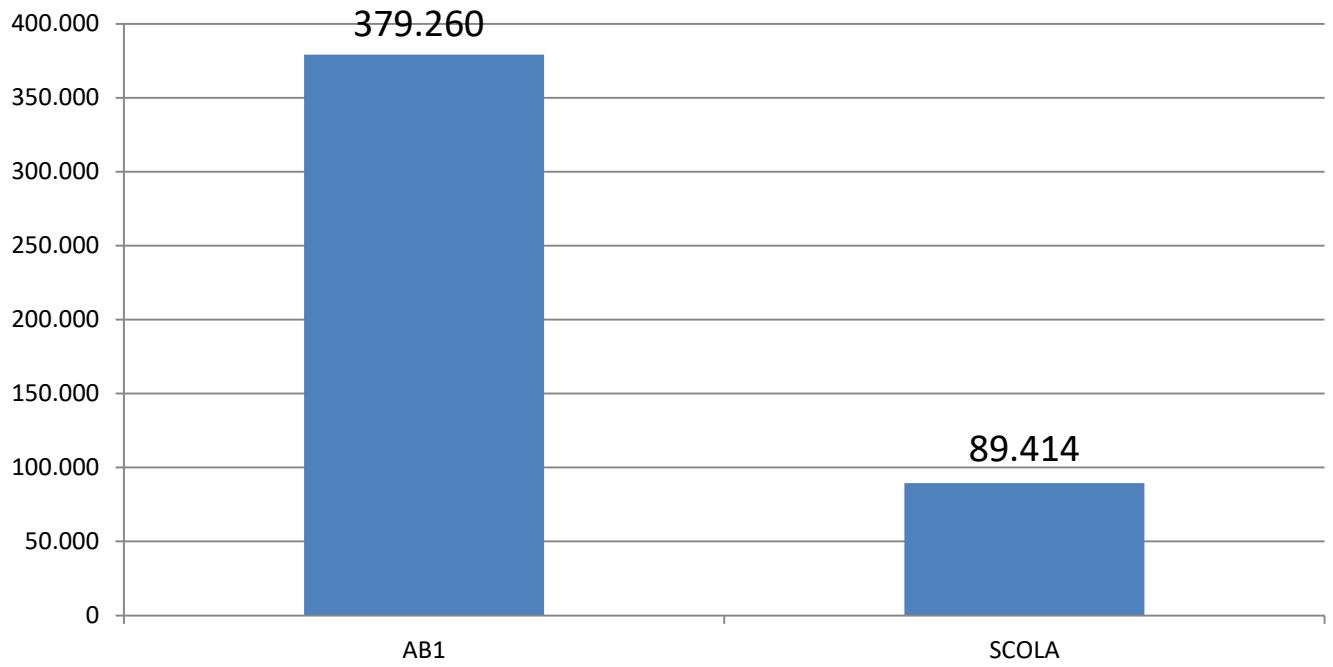


Measurement Subjects	Temp. [°C]
Measurement Point 1	18,4
Measurement Point 2	21,3
Measurement Point 3	24,1
Measurement Point 4	26,7

Measurements

With Güven Fidan, OzU, CEEE, MSME 2016.

TOTAL SAVINGS AT SCOLA: 200,000 USD/year



AB1: 134 kWh/m2/year **SCOLA: 57 kWh/m2/year**

Typical Academic Building in Turkey (TAB): 220 kWh/m2/year

SAVINGS: %60 vs the best %75 vs the avg

CEEE/EÇEM

ENERGY APPLICATIONS AND RADIATIVE TRANSFER

ADNAN MENDERES UNIVERSITY

MEDICAL SCHOOL BUILDING

BRICKER
FP7-PROJECT
TURKISH PARTNERS: OZU-ADU-ONUR ENERGY

CEEE/EÇEM

BRICKER

ENERGY REDUCTION IN PUBLIC BUILDING STOCK

BRICKER aims to develop a scalable, replicable, high energy efficient, zero emissions and cost effective system to refurbish existing public-owned non-residential buildings to achieve at least 50% energy consumption reduction.

- DURATION: 4 YEARS (2013-2017)
  EU CONTRIBUTION: 8,6 million €
  TOTAL BUDGET: 12,9 million €
- ADU BUILDING BUDGET: 2,2 million €
  - EU CONTRIBUTION: 1,4 million €

BRICKER aims to develop a scalable, replicable, high energy efficient, zero emissions and cost effective system to refurbish existing public-owned non-residential buildings to achieve at least 50% energy consumption reduction.

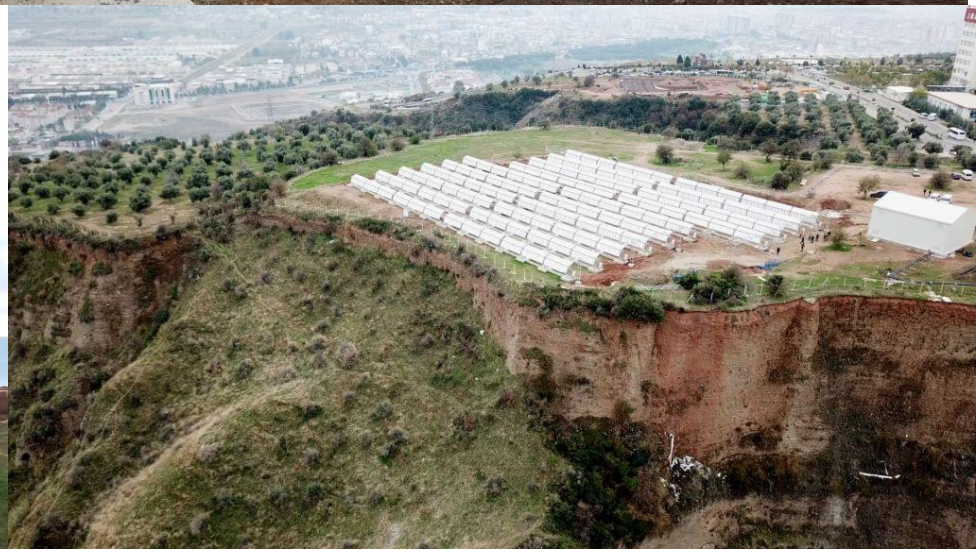
BRICKER

ENERGY REDUCTION IN PUBLIC BUILDING STOCK

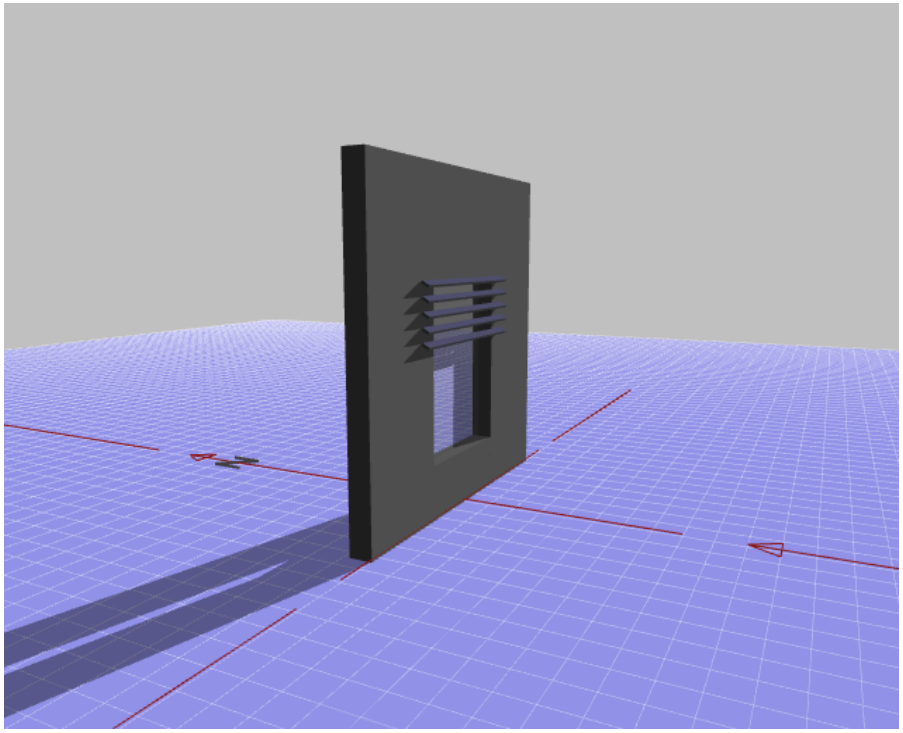
BRICKER
ENERGY REDUCTION IN PUBLIC BUILDINGS STOCK

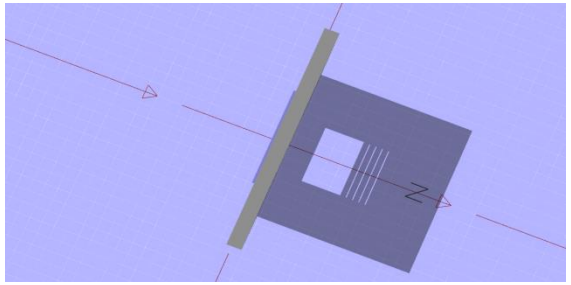
Monitoring and Performance Evaluation of Adnan Menderes U Demo Building before Renovation

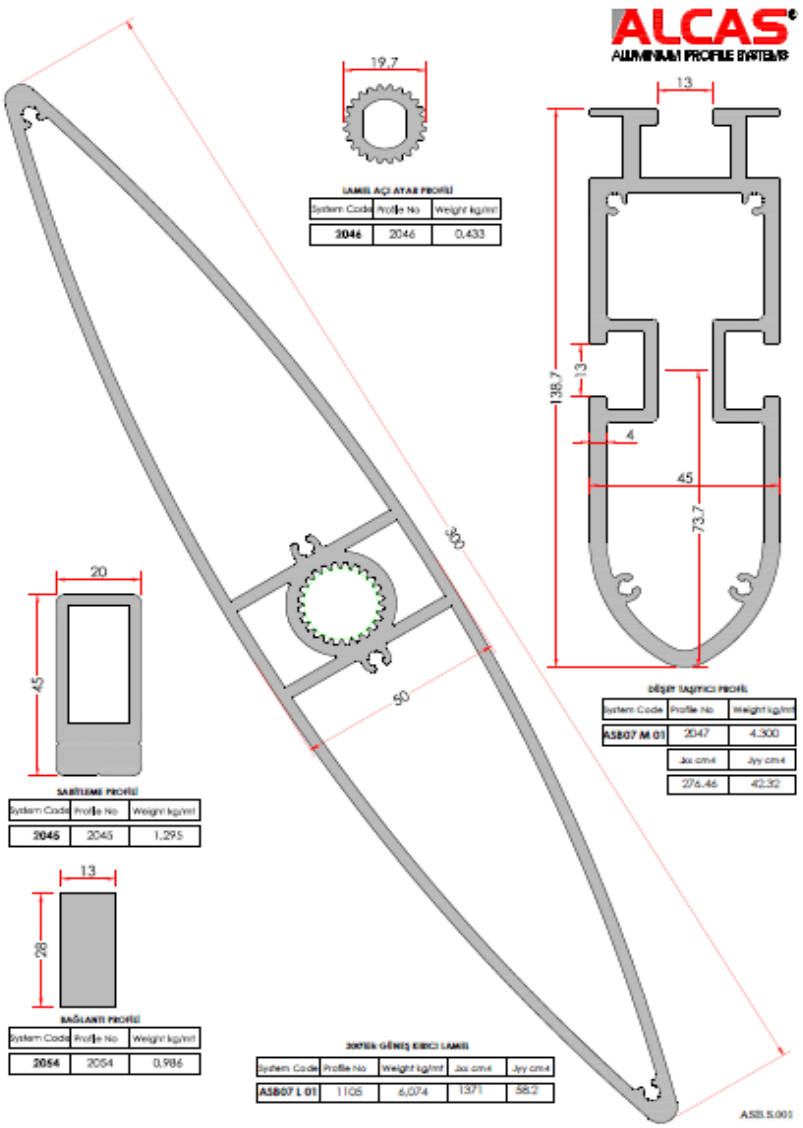
20 modules of the solar collector system PTMx-36 (SOL): Phase 1
Ground installation over seperate foundations for each plate



HORIZONTAL SUN SCREEN
Aluminium sun breaker simulation via ShadowFX V3

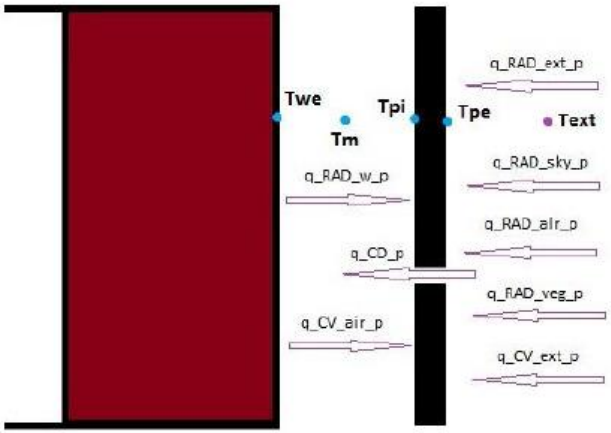


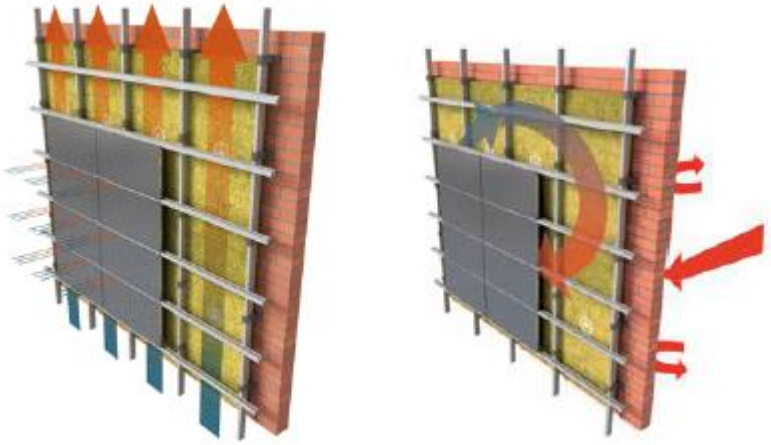


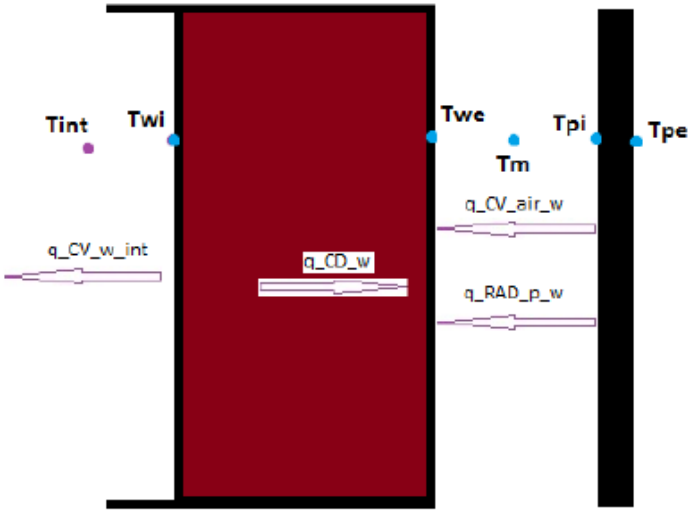


INNOVATIVE, SUSTAINABLE AND LIGHT WEIGHT VENTILATED FAÇADE

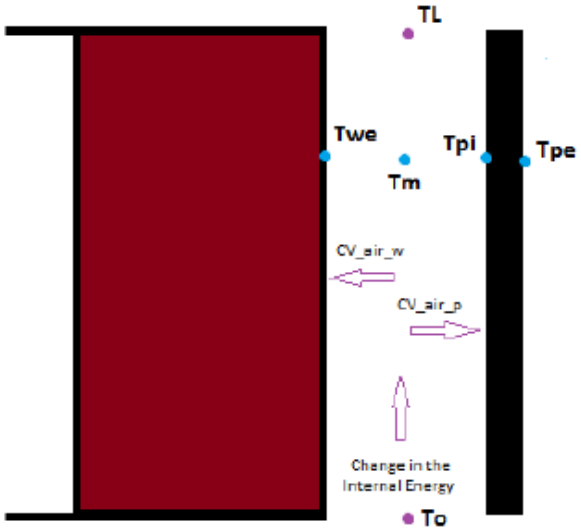
Energy Balances





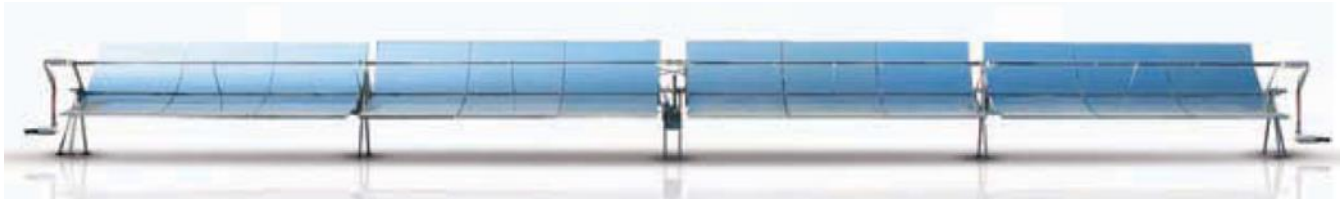


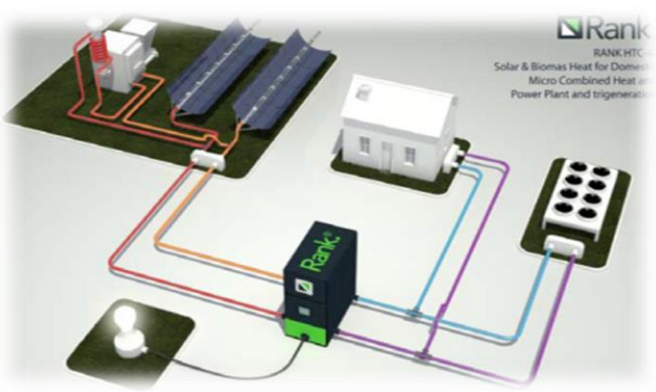
Wall Inputs

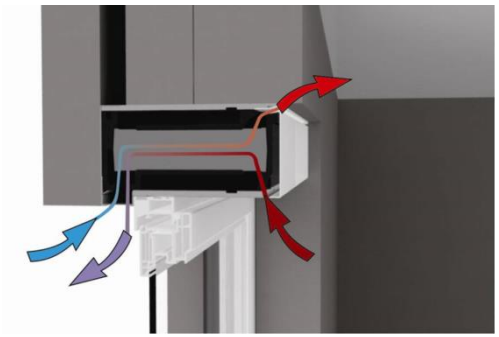


Cavity Inputs

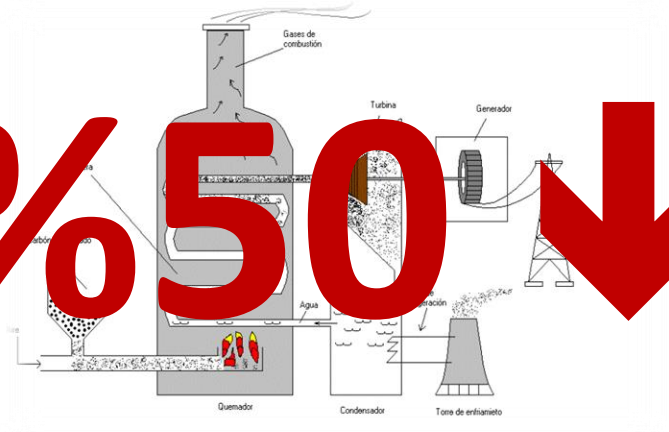
CEEE/ECEM

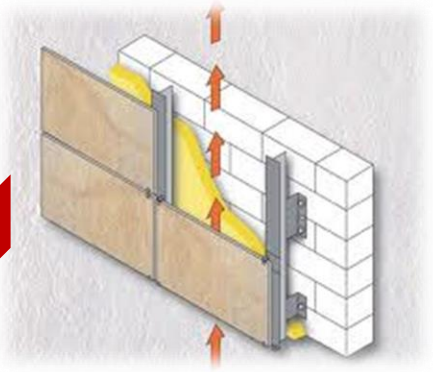



Rank
Rank



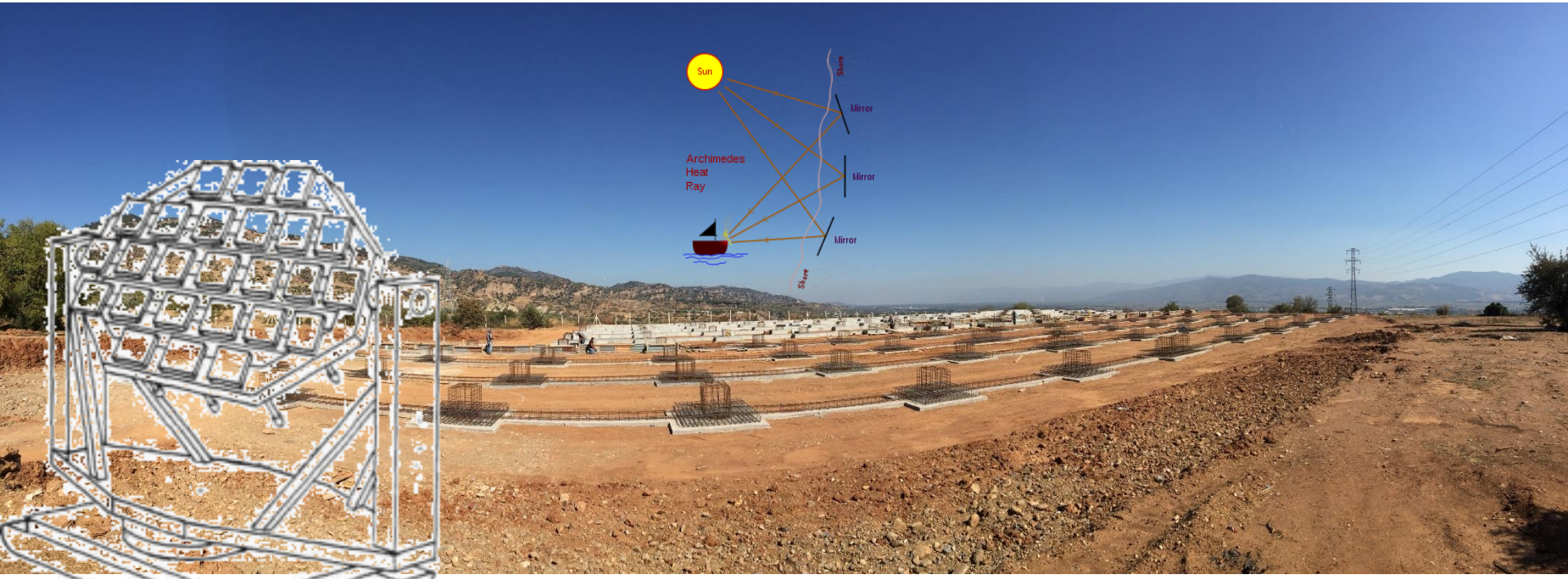
%50↓


Gases de combustión
Turbina
Generador
Agua
Quemador
Condensador
Torre de enfriamiento



BRICKER
ENERGY REDUCTION IN PUBLIC BUILDING STOCK

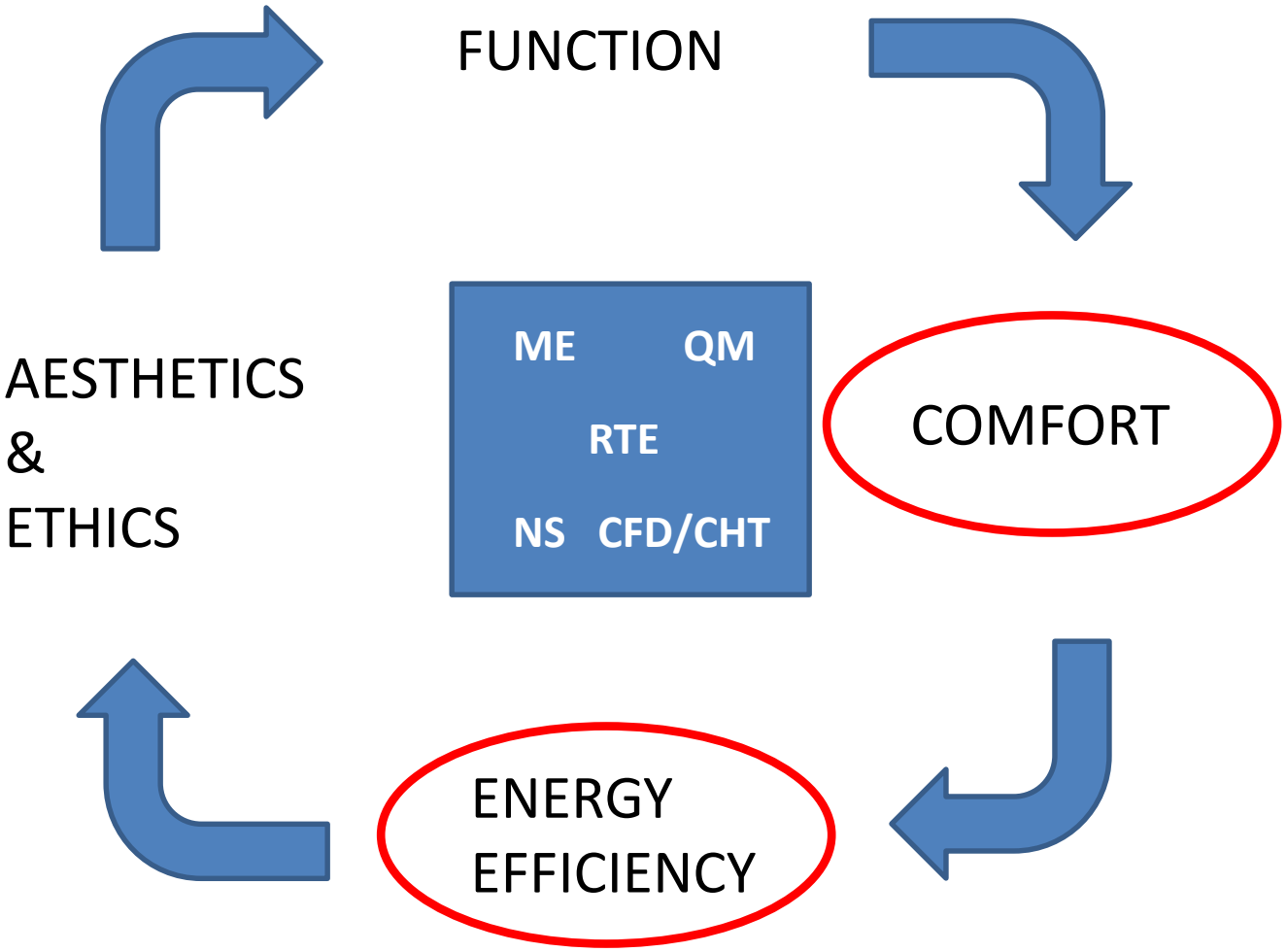
OPTICS & BUILDINGS
TOTAL SAVINGS (ESTIMATED): 500,000 USD/year



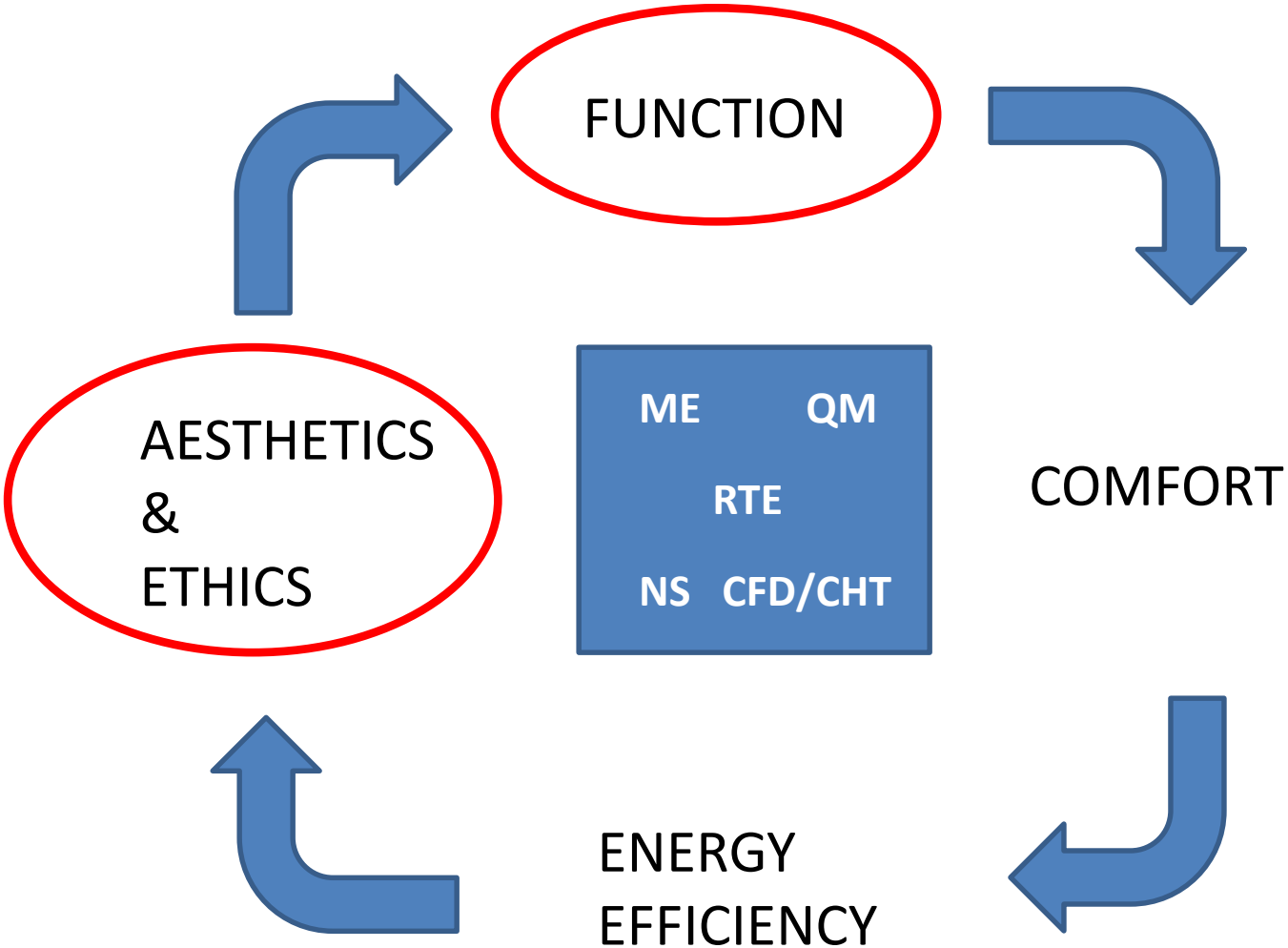
CEEE/EÇEM

BEHAVIOR BASED MEASUREMENTS AND IMPLEMENTATIONS

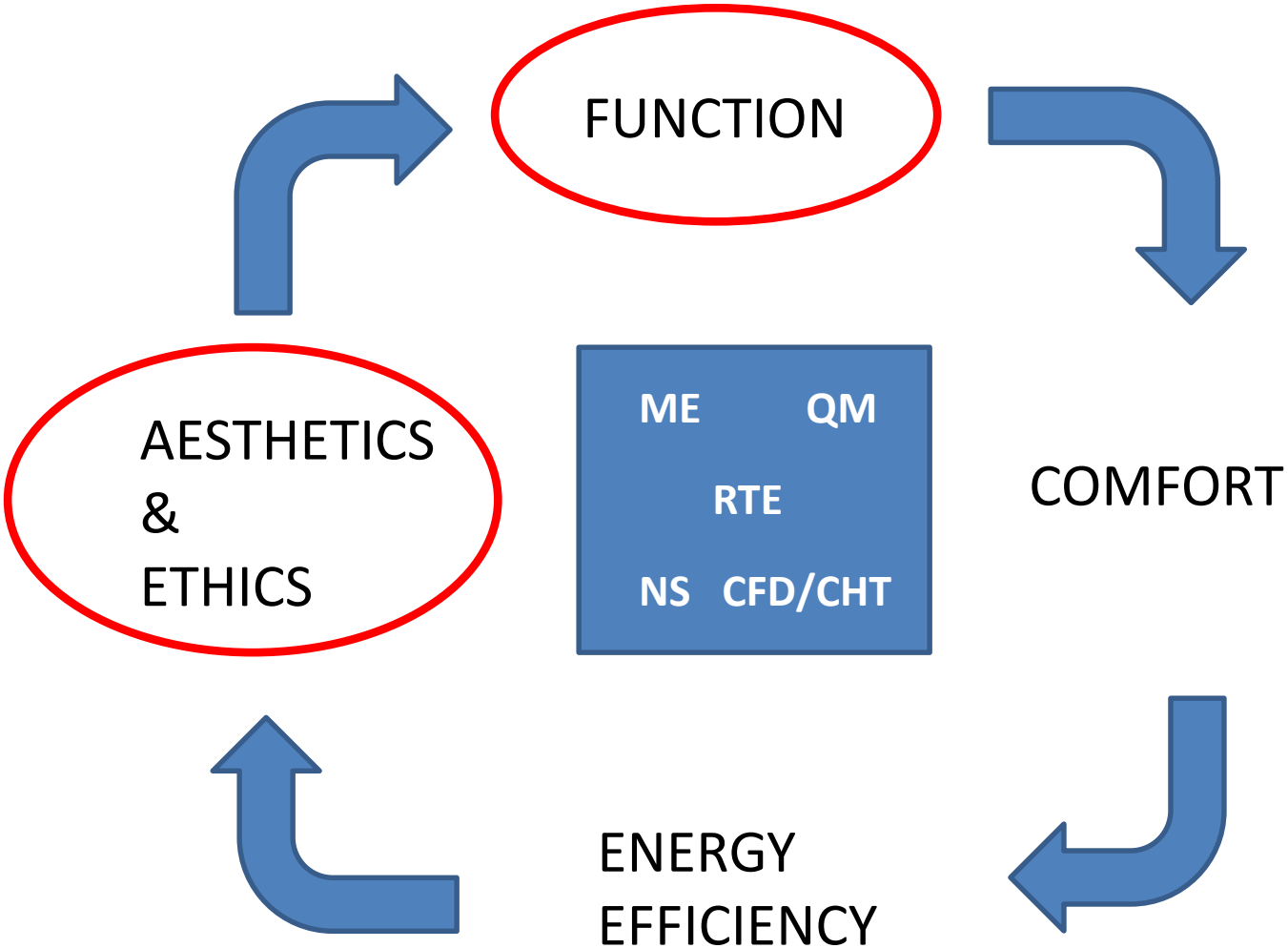
OPTICS AND BUILDINGS



OPTICS AND BUILDINGS

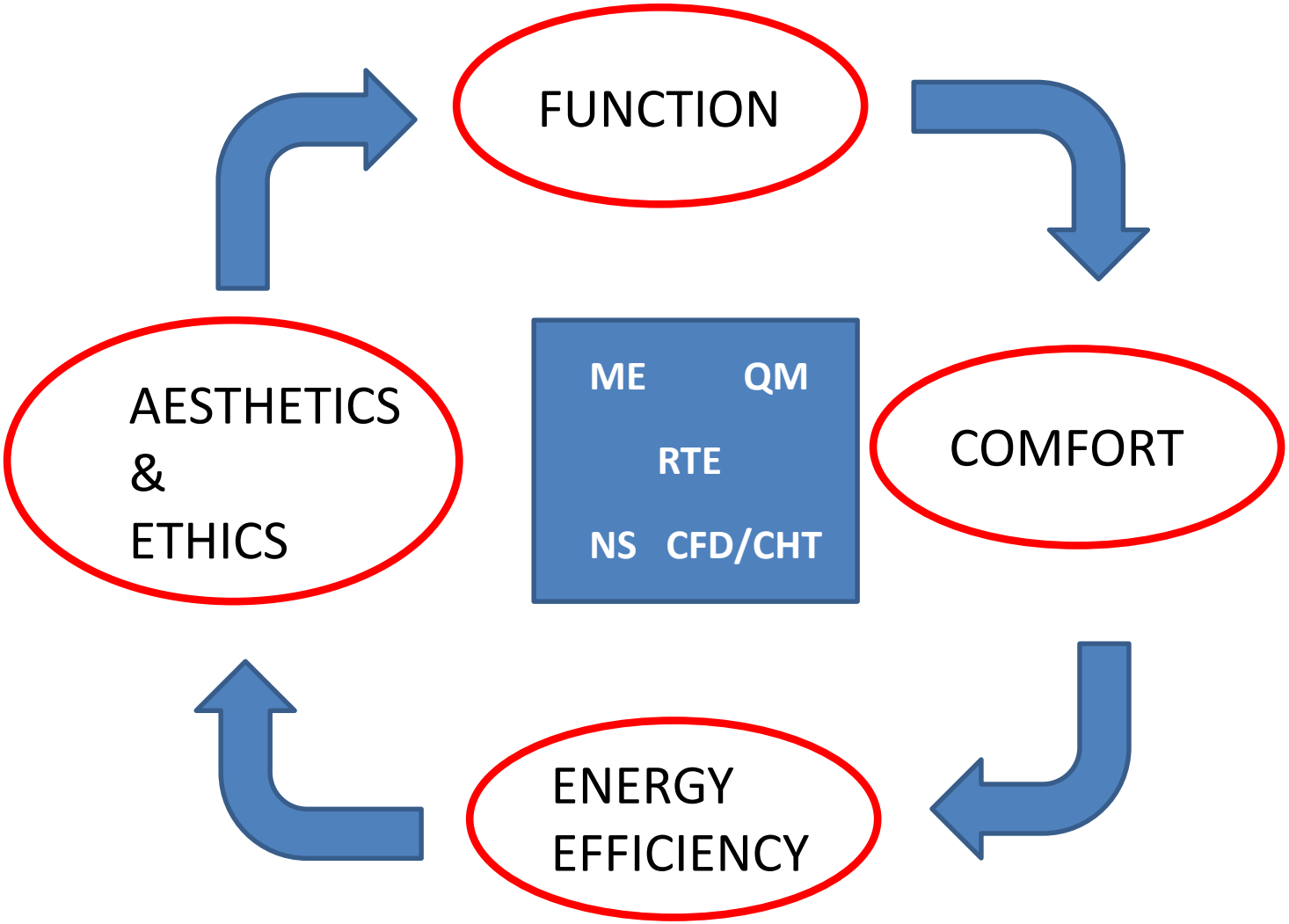


BEHAVIOR AND BUILDINGS



BEHAVIOR

AND BUILDINGS



ENERGY AND BEHAVIOR

OZYEGIN UNIVERSITY ENGINEERING BUILDING

TRIBE
HORIZON 2020 PROJECT
TURKISH PARTNER: OZU

BIG PICTURE: SMART INTEGRATION of TECHNOLOGIES

Drawing by: Ebru Tatar, MSME 2018. Elif Tunçel, MSME 2018

Wearable Tech.

- Heart-rate metrics
- Tracking motions
- Muscle effort

- Skin conductance
- Breathing patterns
- Facial recognition

«Change is detected!»

Mood Sensing Tech.

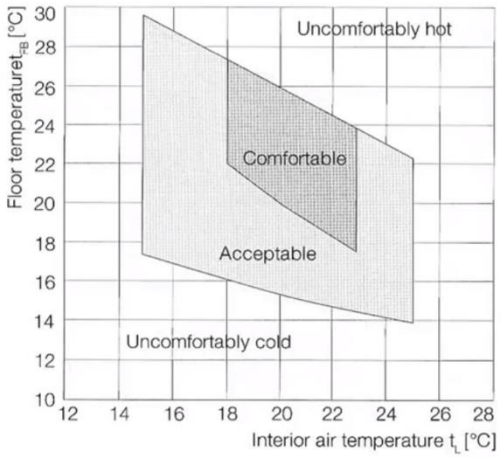
IoT

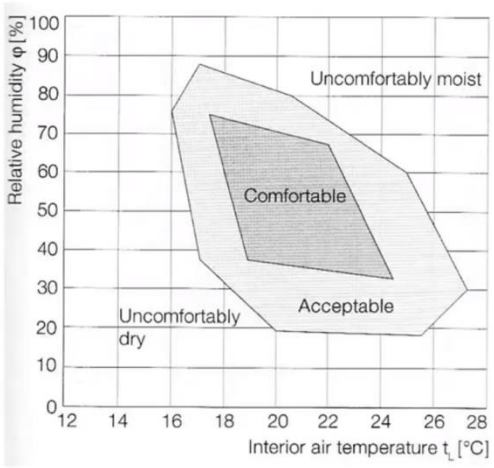
- WiFi
- Bluetooth
- Local networks

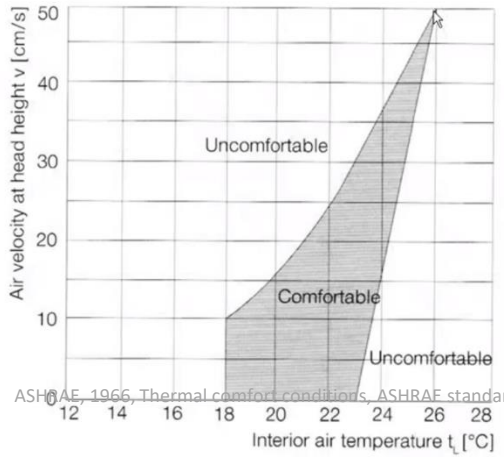
- HVAC
- Lighting
- Acoustics

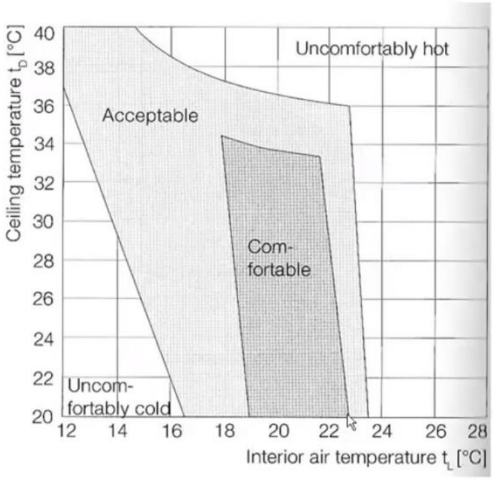
Building Systems

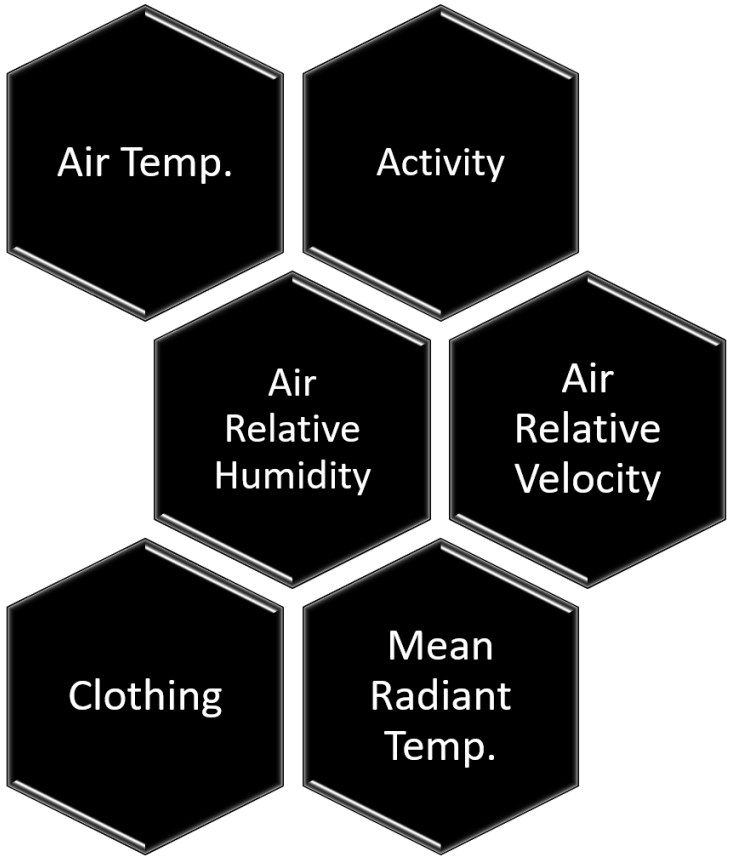
Complex Thermal Comfort?





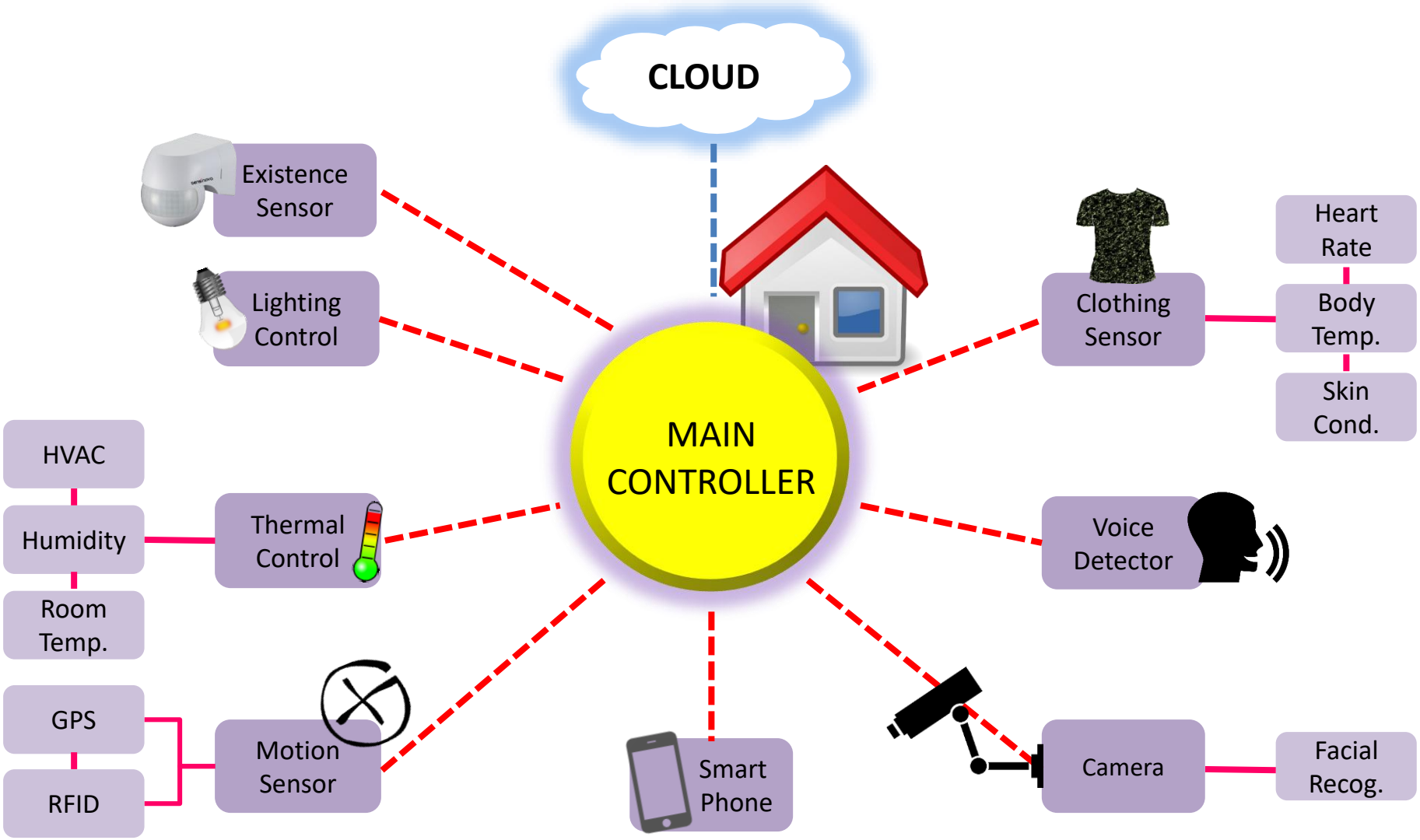






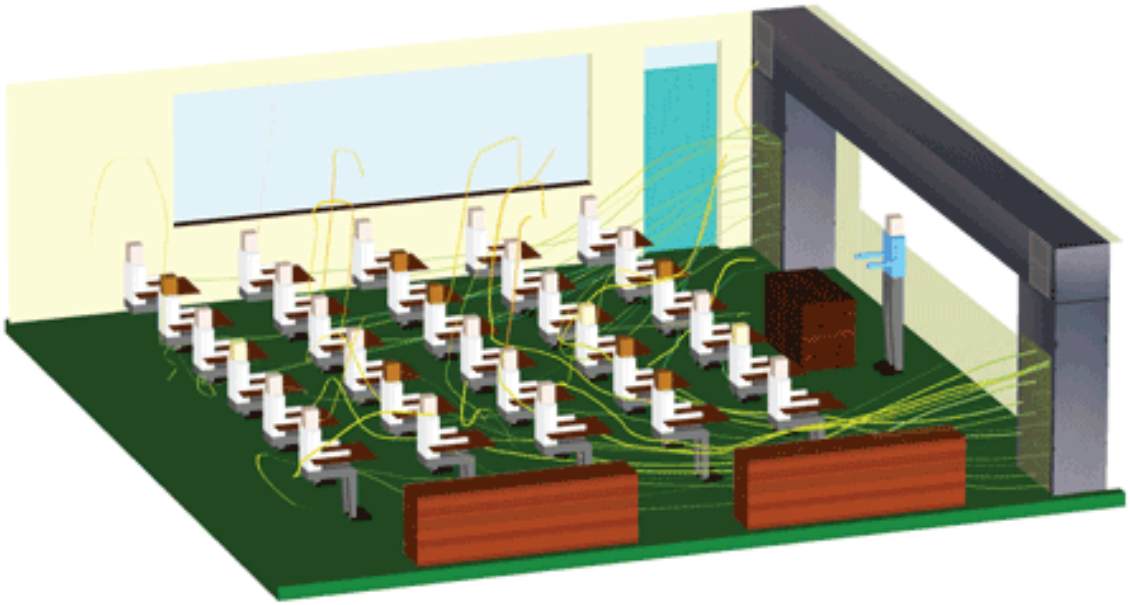
ASHRAE, 1966, Thermal comfort conditions, ASHRAE standard 55.

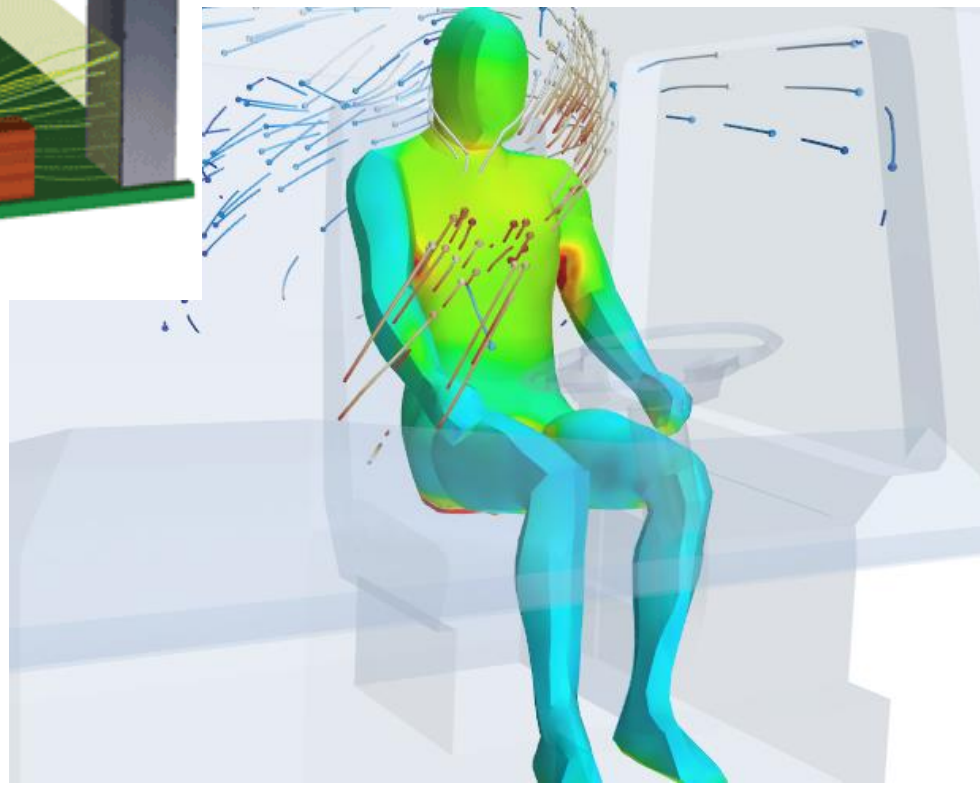
SYSTEM ARCHITECTURE



Drawing by Ebru Tatar, MSME 2018. Elif Tunçel, MSME 2018; for Schneider Final

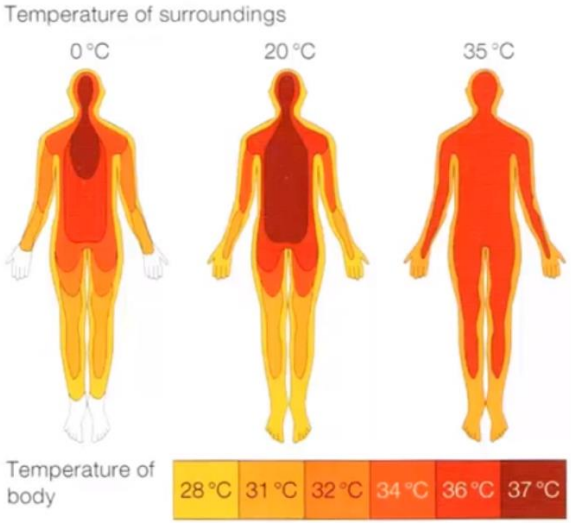
CFD and Star-CCM Thermal Comfort Wizard

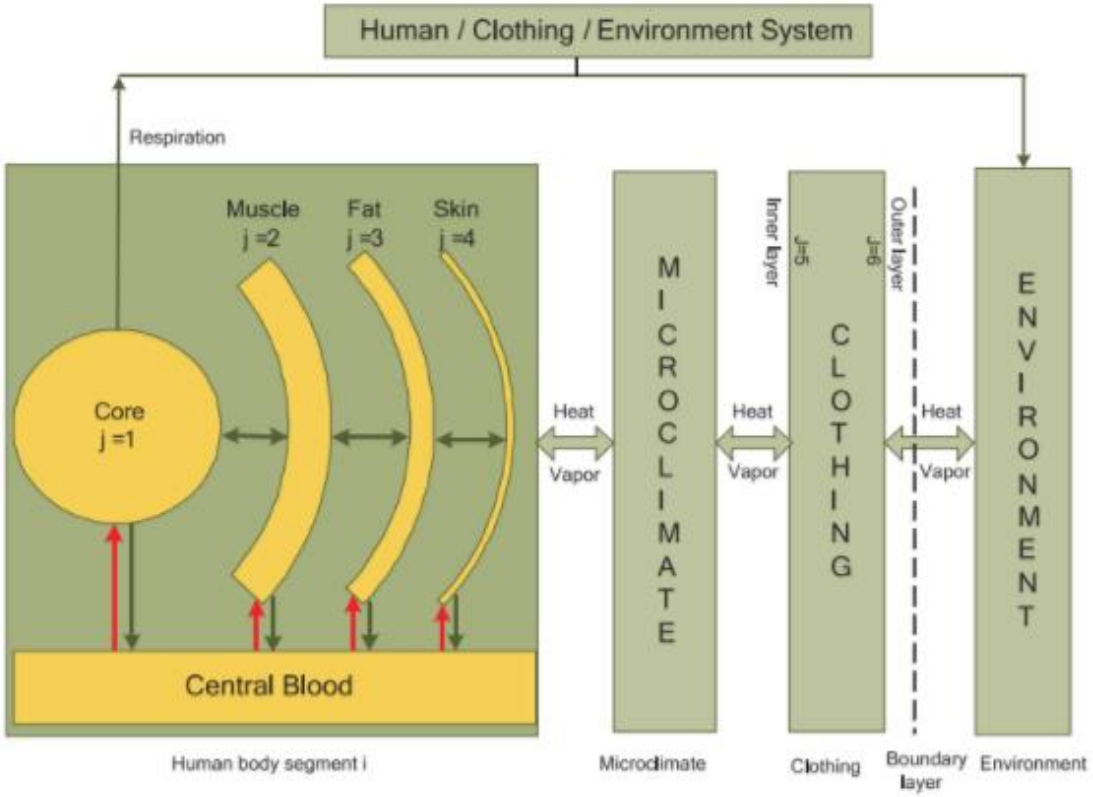


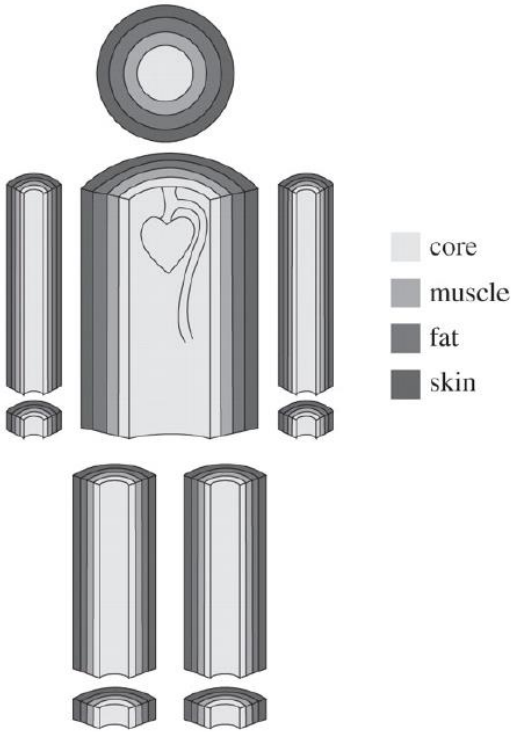


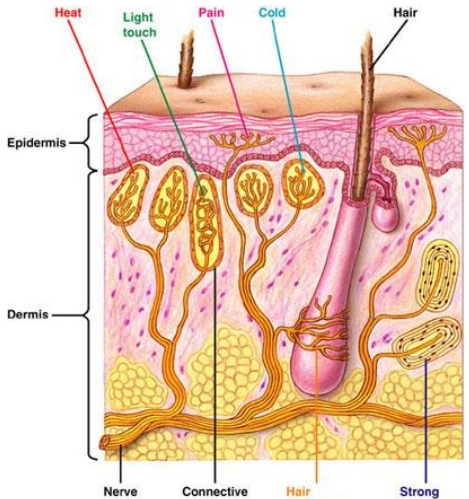
Ozyeğin University students:

Cem Keskin, PhD, 2018.
Güven Fidan, MSME 2017.
Ruşen Acet, MSME 2018.
Ebru Tatar, MSME 2018.
Elif Tunçel, MSME 2018









Ozyeğin University students:

Ebru Tatar, MSME 2018.
Elif Tunçel, MSME 2018


507
1000
7313 W
0
10:52 Fri 11 Jan 2002
Bob Alison
Prefered Temp
21°
Energy efficiency
B
Satisfaction
25
Knowledge
44
Climate attitude
52
Norm sensitivity
Help Desks
F. Shaman: Now, where is there a power switch for a lam


310
425
Open Offices
2016-01-13 08:48:0
15°
1120 W
323 kWh
CO2
0


310
425
Open Offices
2016-01-
15°
Office Workstation
X
The modern version of a carpenter's workshop.
Except less is crafted and more is modern.
Upgrade to LCD
200
2
-20%
+2%
0


500
500
107843
0
14:29 4 Jan 2002

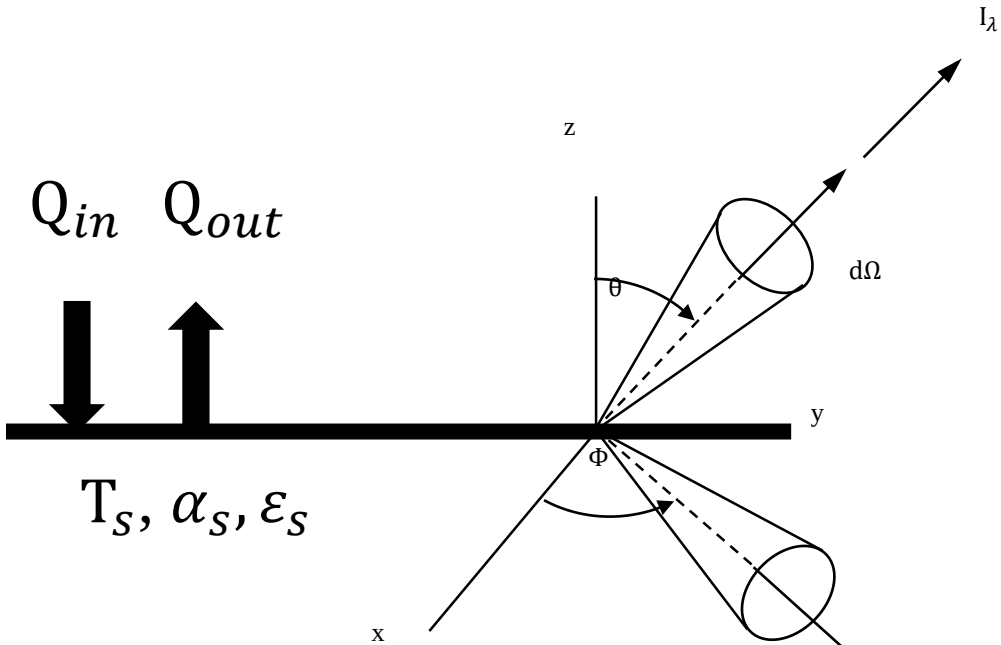
8.

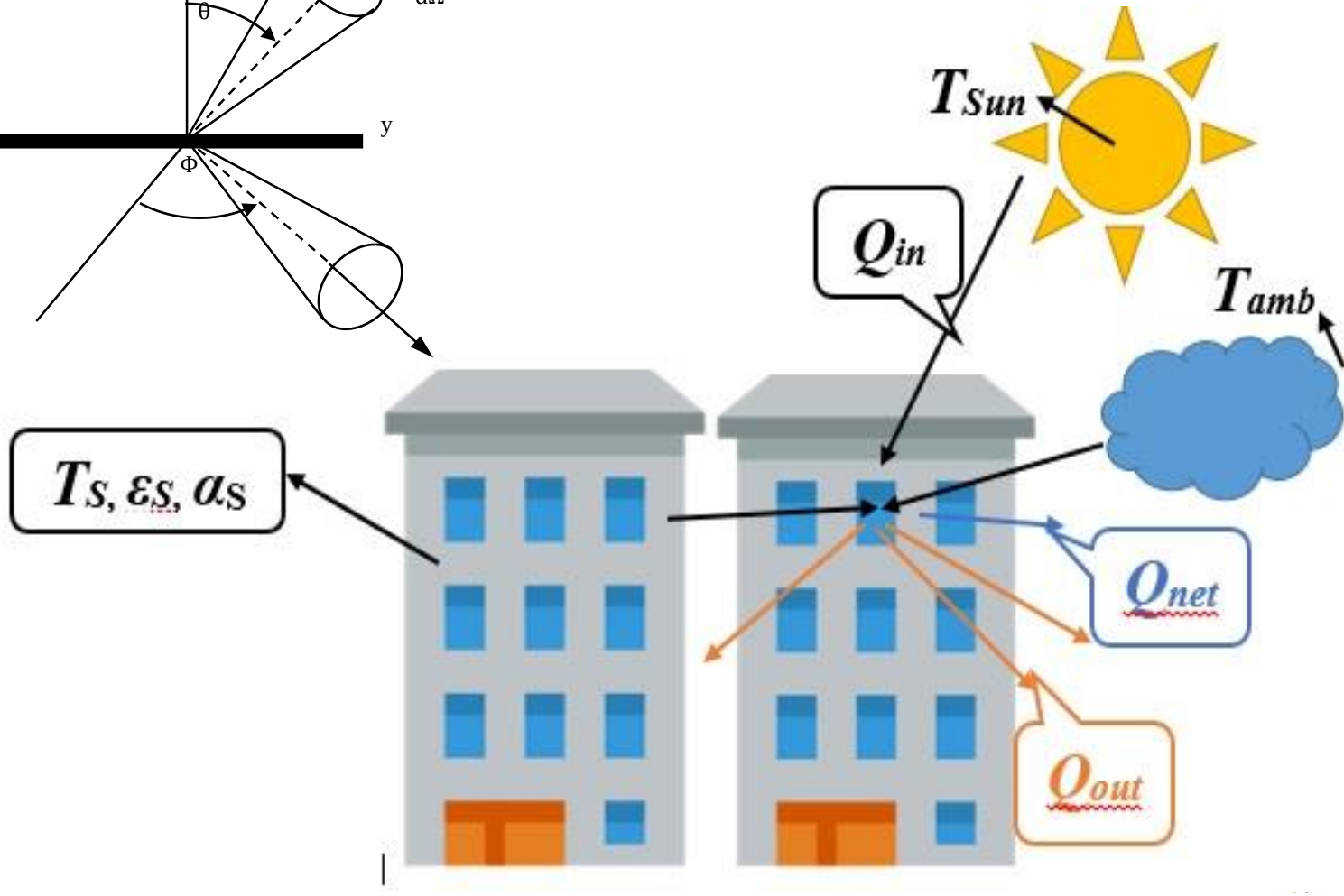
OTHER
CEEE BUILDING RELATED
FUNDAMENTAL RESEARCH

Sustainable Building Materials
Radiative Behaviour of Compact Systems
Biologicaly Inspired Near-Field Radiative Transfer

Radiative Cooling (OzU, SU, BU)

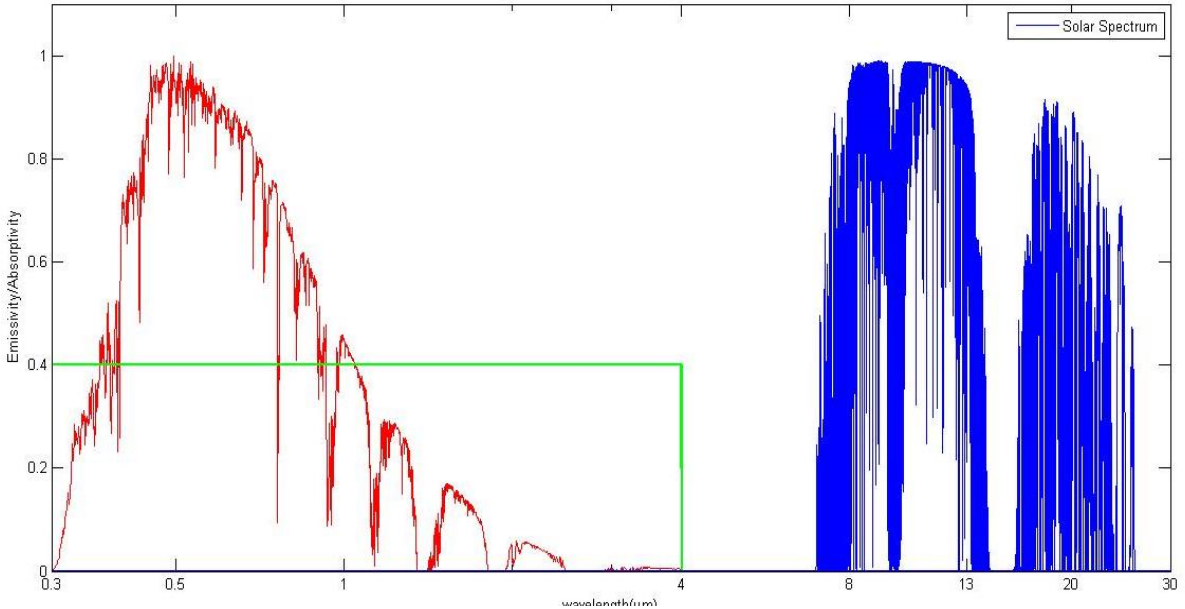
RADIATIVE COOLING



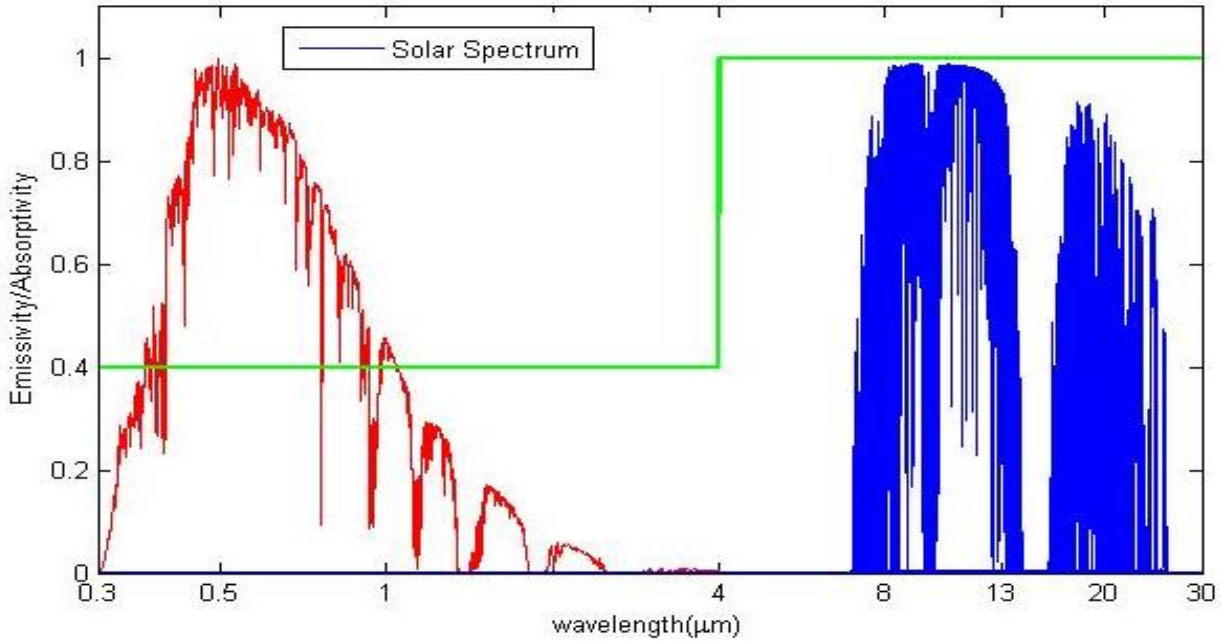


RADIATIVE COOLING: SPECTRAL WINDOWSC

Original

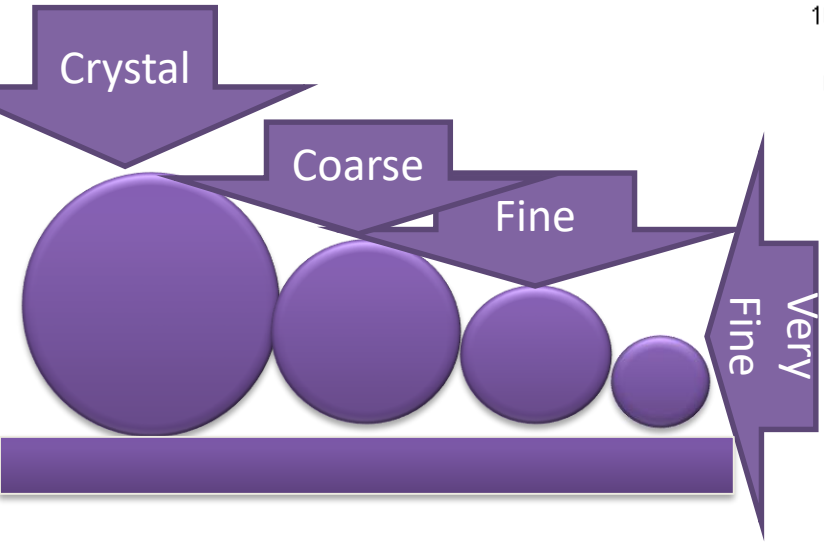


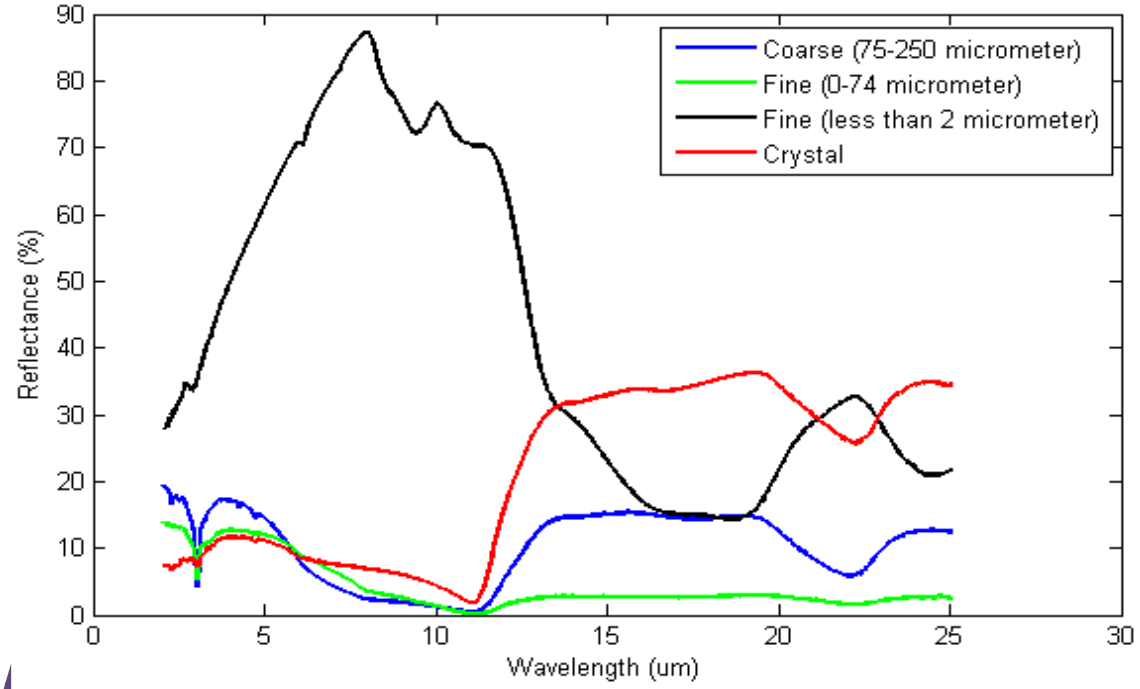
Modified



EFFECT OF PARTICLES ON SPECTRA

Comparisons as a function of particle size





Effect of Particle Size on Radiative Cooling (TiO2 as a pigment),
plotted by Matlab, Data has taken from
http://speclib.jpl.nasa.gov/search-1

MATERIALS USED FOR BUILDINGS (OzU) 2016, 2017

XPS= Extruded Polystyrene Foam<<	
Coated XPS	
EPDM= Black Membrane	
Red Membrane	

Porous Silisium Powder	
Perlite Pumice Cement Composite Materials	Bioinsulation
Painted and Coated bioinsulation panel	

Family and Menguc; 2016

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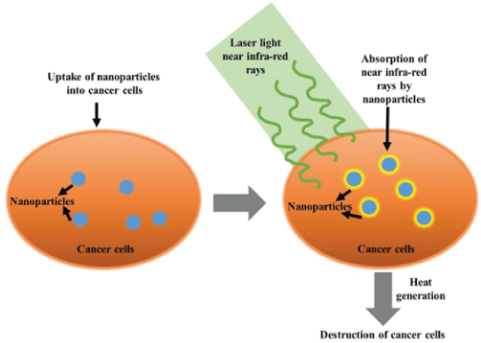
MODELING NEAR-FIELD RADIATION TRANSFER

Energy Harvesting

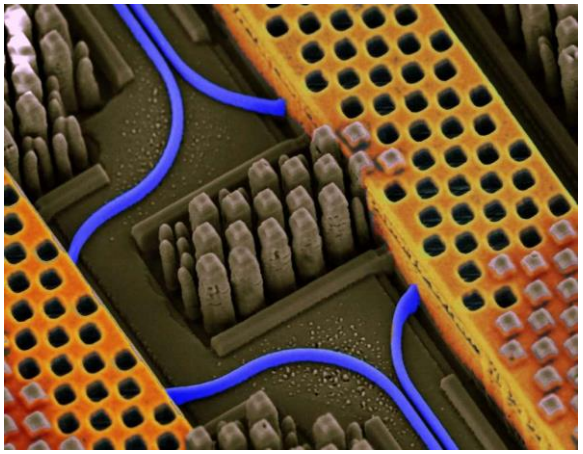
Source: Google image

Applications of Near-field radiative transfer…



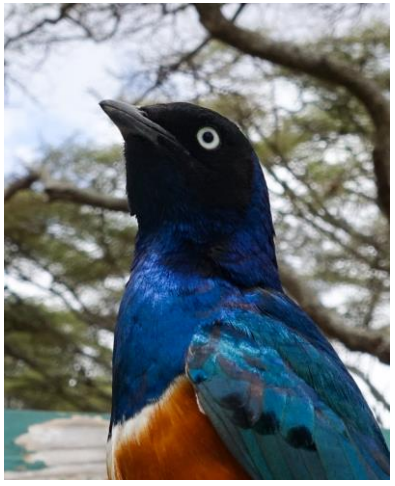
Thermal Therapy

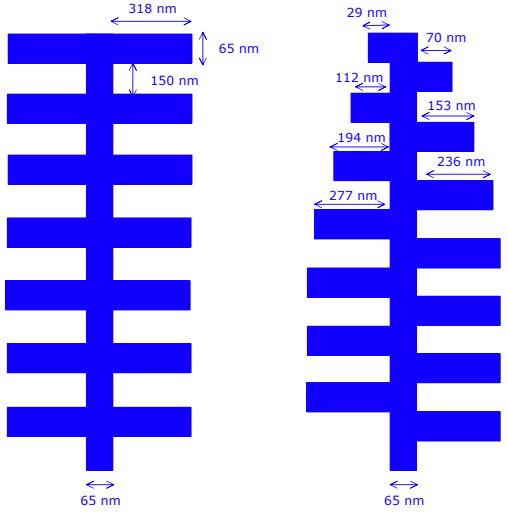
Source: Google image



Integrated Nanophotonics

Source: Google image





Biologically inspired radiative cooling

Left: Photo of *Superb Starling of Tanzania* bird, middle: *Morpho* butterfly, Photographed by M. Pinar Mengüç, right: schematics of *Morpho* butterfly structure.

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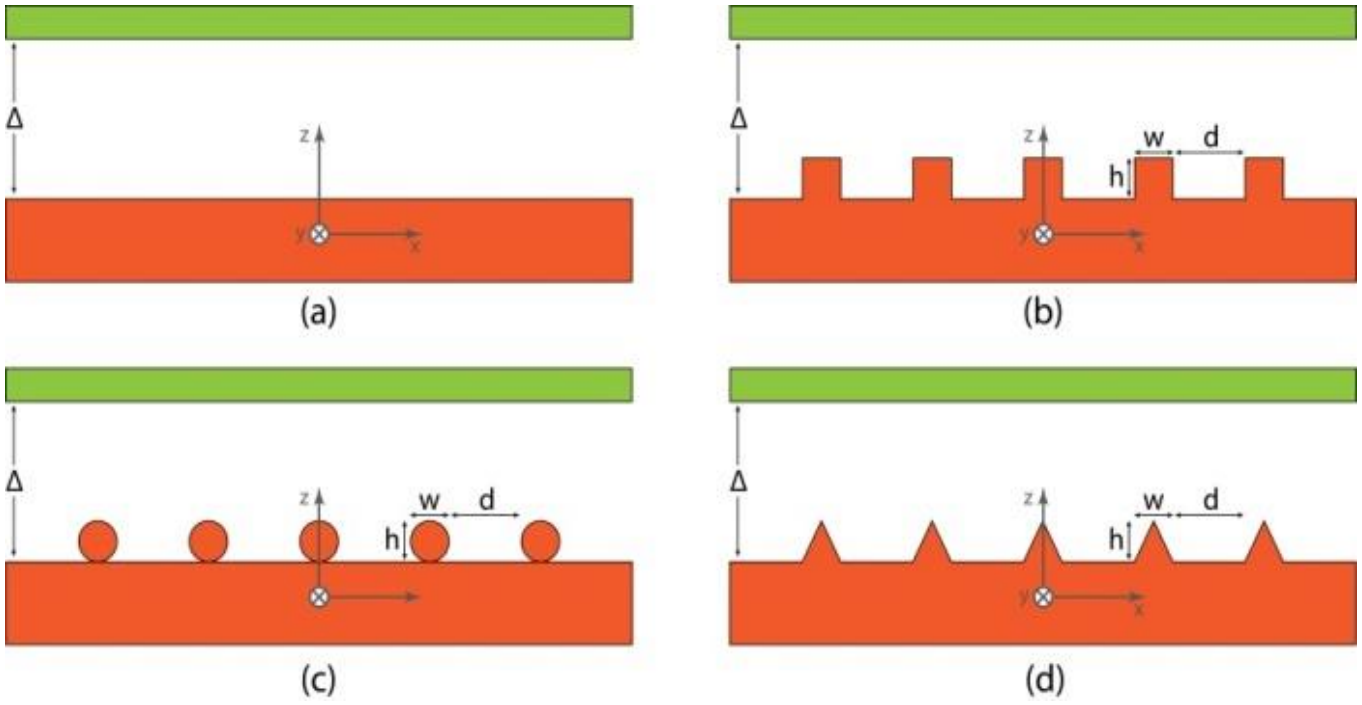
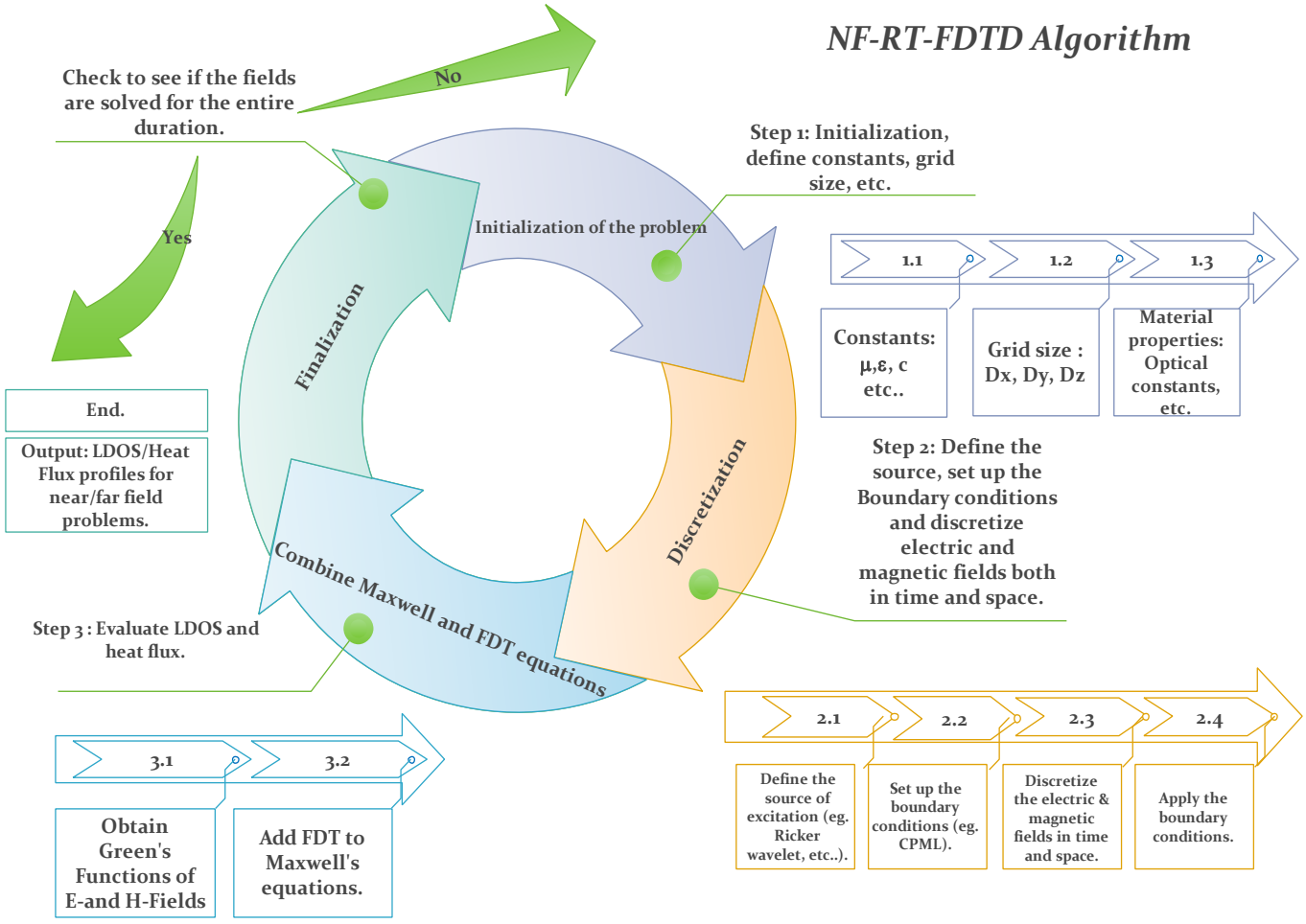
RADIATIVE COOLING: VIA NEAR-FIELD EFFECTS

HOW TO USE NEARFIELD RADIATIVE TRANSFER FOR COOLING?



Azadeh Didari, PhD 2016, Ozyeğin University; Senior Researcher, 2016-2018.

NF-RT-FDTD Code



NF-RT-FDTD is a code which solves near-field thermal emission and radiation problems of linear and non-linear nature in complex geometries.

Azadeh Didari, PhD 2016, Ozyeğin University; Senior Researcher, 2016-2018.

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ÖZYEGİN ÜNİVERSİTESİ

Azadeh Didari, PhD 2016, Ozyeğin University; Senior Researcher, 2016-2018.

İlk kez 2010 yılında Endonezya Üniversitesi tarafından oluşturulmuş

‘GreenMetric Dünya Üniversiteler Sürdürülebilirlik Sıralaması’

çevre, **ekonomi** ve **eşitlik** kavramlarına odaklanarak dünyanın en çevreci yükseköğretim kurumlarını

Yapı ve Altyapı, **Enerji ve İklim Değişikliği**, **Atık**, **Su**, **Ulaşım** ve **Eğitim**

başlıklarında değerlendiriyor.

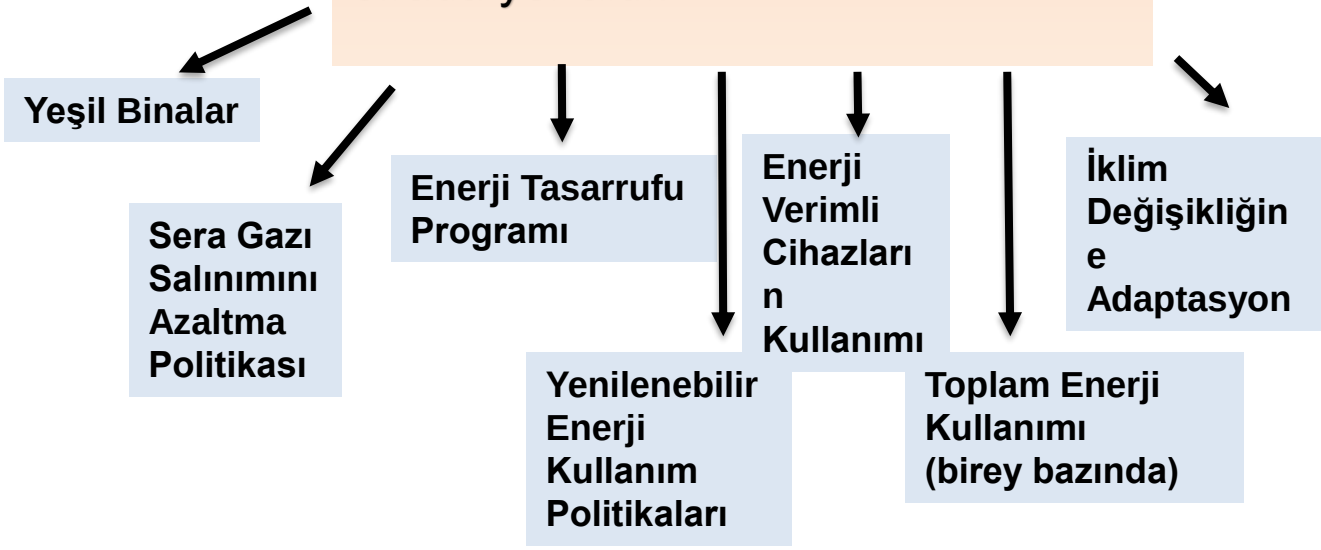
Greenmetric 2015

Dünya Sıralaması ilk 10:

1. Uni. of Nottingham (İngiltere)
2. Uni. of Connecticut (ABD)
3. Uni. of California Davis (ABD)
4. Uni. College Cork (İrlanda)
5. Uni. of Oxford (İngiltere)
6. Uni. of California Berkeley (ABD)
7. Uni. of North Carolina Chapel Hill (ABD)
8. Uni. of Bradford (İngiltere)
9. Uni. de Sherbrooke (Kanada)
10. Northeastern Uni. (USA)

Türkiye Sıralaması:

Özyeğin Üniversitesi genel sıralamada **İkinci** olurken **Enerji ve İklim Değişikliği** kategorisinde; dünyada 170. **Türkiye'de Birinci** sırada yer aldı.



http://greenmetric.ui.ac.id/overall-ranking-2016/

Neden Özyeğin Üniversitesi?

UI GreenMetric
World University Ranking

Ranking	University	Country	Total Score	Setting and Infrastructure	Energy and Climate Change	Waste	Water	Transportation	Education
258	Webster University		3797	556	795	1275	355	452	364
259	Universitat Rovira i Virgili		3771	545	900	1350	275	152	549
260	Ozyegin University		3764	378	950	975	566	453	442
261	University of Illinois Springfield		3743	710	703	1275	325	376	354
262	Illinois State University		3732	435	522	1500	325	561	389

Greenmetric 2016

Dünya Sıralaması ilk 10:

1. Uni. of California Davis (ABD)
2. Uni. of Nottingham
3. Wageningen Uni. & Research (Hollanda)
4. Uni. of Connecticut (ABD)
5. Uni. of Oxford (İngiltere)
6. Uni. fur Bodenkultur Wien (Avusturya)
7. Keele Uni. (İngiltere)
8. Uni. of California Berkeley (ABD)
9. Nottingham Trent Uni. (İngiltere)
10. Newcastle Uni. (İngiltere)

Türkiye Sıralaması:

Özyeğin Üniversitesi Türkiye'den başvuran vakıf üniversiteleri arasında **Üçüncü** oldu.

İndikatörlere göre;

- **Su**: tüm üniversiteler arasında **Birinci;**
- **Eğitim**: özel/vakıf üniversiteleri arasında **Birinci;**
- **Ulaşım**: özel/vakıf üniversiteleri arasında **İkinci;**
- **Yapı ve Altyapı**: özel/vakıf üniversiteleri arasında **Üçüncü;**
- **Enerji ve İklim Değişikliği**: özel/vakıf üniversiteleri arasında **Üçüncü;**
- **Atık**: özel/vakıf üniversiteleri arasında **Dördüncü.**

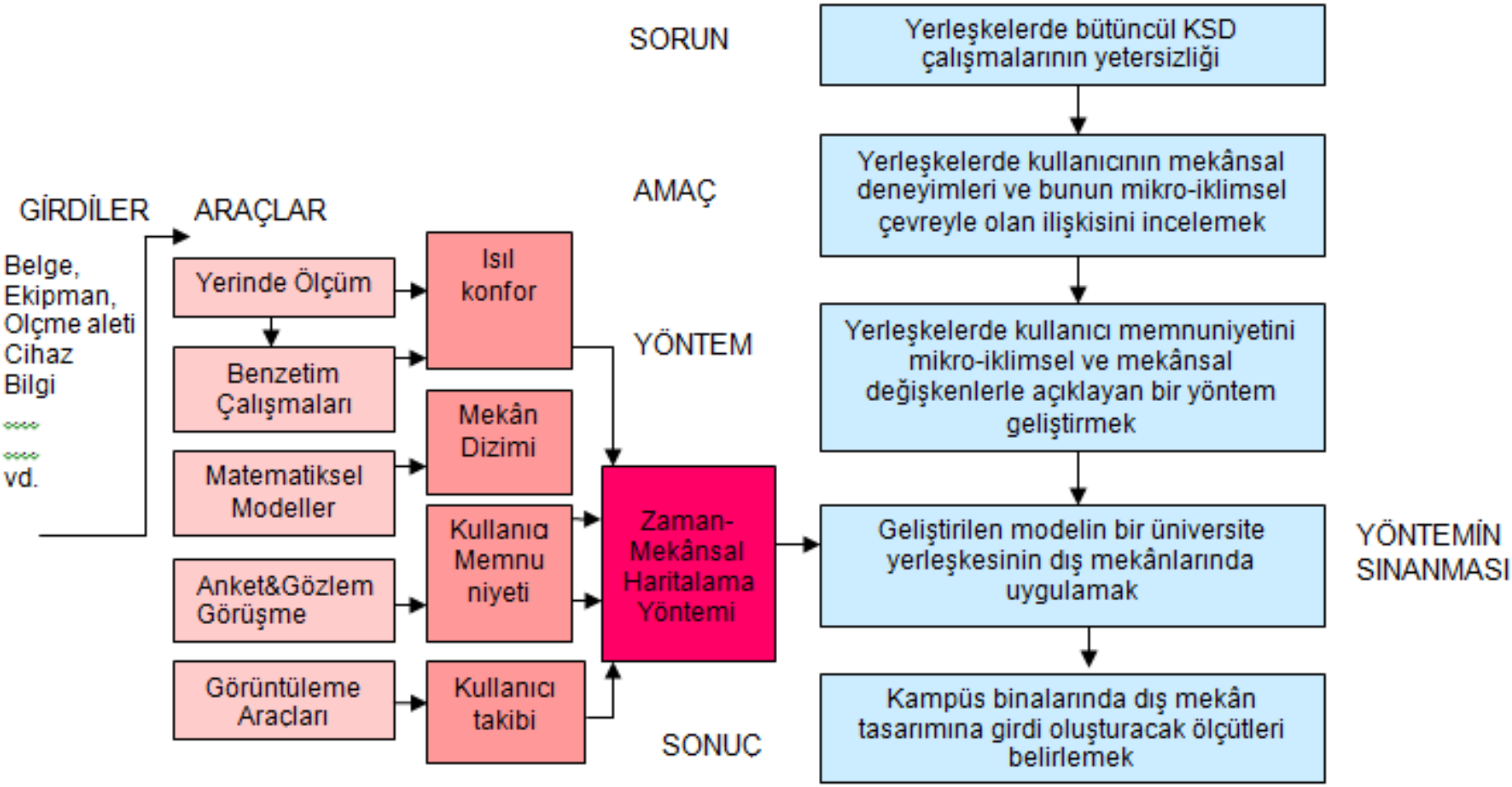
http://greenmetric.ui.ac.id/overall-ranking-2015/

Çalışmanın amacı ve ulaşılmak istenen hedefler nelerdir?

Son yıllarda önemi daha da vurgulanan çevre ve sürdürülebilirlik yaklaşımları, bu konularla yakın ilişkisi bulunan çevre kalitesi ve kullanıcı memnuniyeti alanlarında da araştırma ve uygulamaların artmasına neden olmuştur.

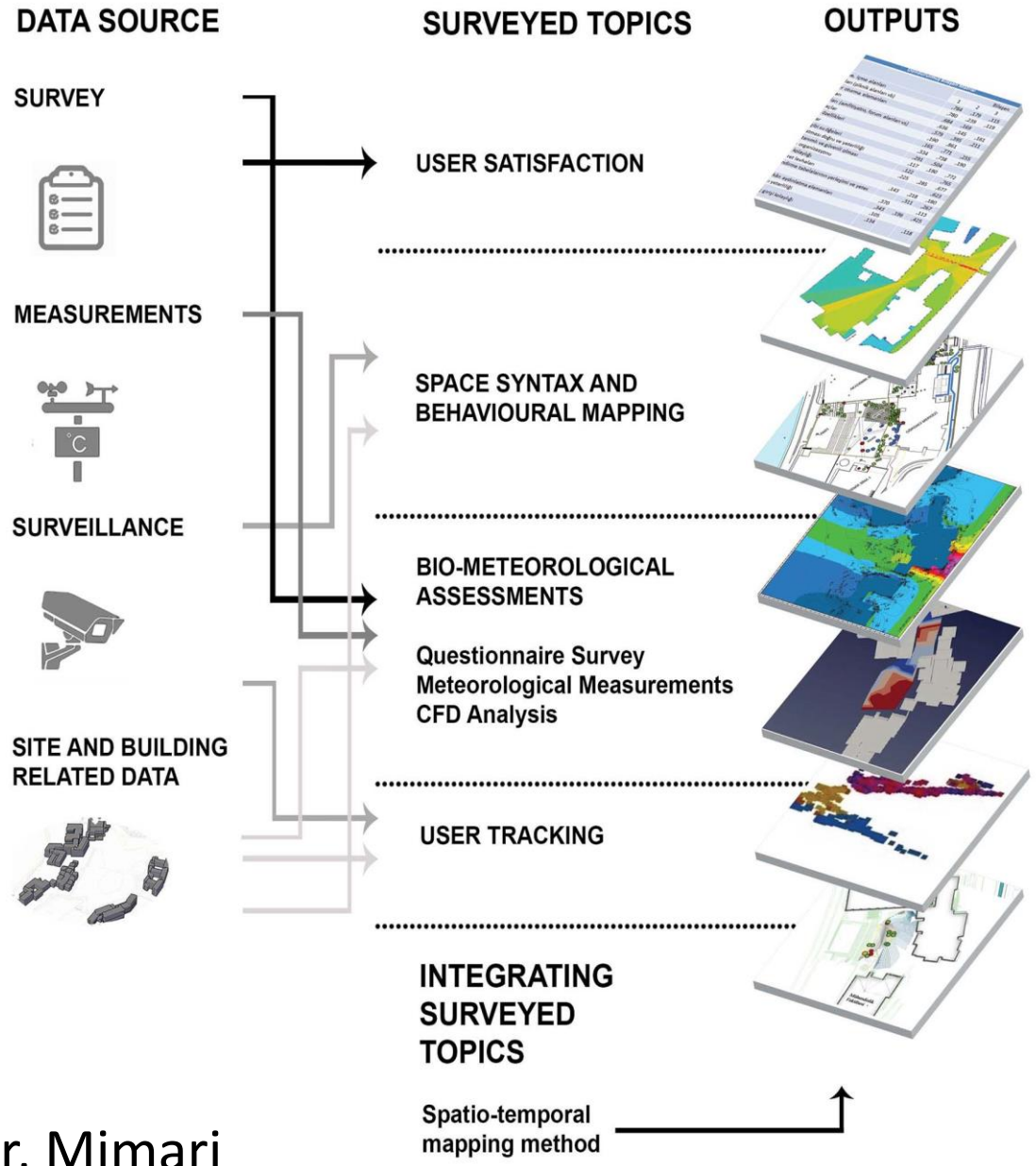
Bu bağlamda, araştırmanın temel amacı

kullanıcı-çevre-mekân arasındaki karşılıklı etkileşimin arakesitinde bulunan dış mekânlarda kullanıcının mekânsal deneyimleri ve bunun mikro iklimsel çevreyle olan ilişkisini KSD çerçevesinde dikkate alan bir çalışma yürütmektir.



Doç. Özgür Göçer, Mimari

Çalışmanın modeli ve önerilen yöntem



Doç. Özgür Göçer, Mimari

NEAR-FIELD RADIATIVE TRANSFER RESEARCH AT CEEE/OzU AND IN TURKEY

NEAR-FIELD RADIATIVE TRANSFER DEVICES and APPLICATIONS

M. Pınar MENGÜÇ /OzU

Nano-Scale RADIATIVE TRANSFER MEASUREMENTS

M.Pınar Mengüç/OzU
Hakan Ertürk/BU
Tuba Okutucu/METU

David Kurt Webb/OZU

Nano-Scale DEVICE FABRICATION

M.Pınar Mengüç/OzU
Tuba Okutucu/METU

Zafer Artvin /METU
Reha Denker/METU
Begum Elcioglu/METU

FLUCTUATIONAL ELECTRODYNAMICS

Mathieu Francoeur/UTAH
M.Pınar Mengüç/OzU

Azedeh Didari/OzU

NEAR FIELD RADIATON TRANSFER CALCULATIONS

M.Pınar Mengüç/OzU

Azadeh Didari/OzU
Vincent LOKE
Sina Moghaddam/BU

PLASMONIC EFFECTS FOR NANO-SCALE COOLING

Kürşat Şendur/SU
Ali Koşar/SU
M.Pınar Mengüç/OzU

Roxana Family/OzU
Eren Yalcın/OzU-SU
Erdem Ogut/SU

COMSOL Multiphysics

Tuba Okutucu/METU

Hakan Ertürk/BU

Todd Hastings/UK

Gazi Huda/UK
F. Khosroshahi/BU

CEEE/EÇEM

SUSTAINABLE ENERGY IN BUILDINGS RESEARCH AT CEEE/OzU AND IN TURKEY

SUSTAINABLE ENERGY FOR BUILDINGS AND CITIES

M. Pınar MENGÜÇ /OzU

HIGH PERFORMANNCE NEW BUILDINGS
'FP-7 NEED4B'
"SCOLA OzU"

M.Pınar Mengüç/OzU
Yasenin Somuncu
Saadet Ozkan

Sahin Cağlayan
Utku Simitli
Burak Sefer
Güven Fidan
Doğa Gizem Memiş

SUSTAINABLE FINANCE
NSF/TUBITAK

M.Pınar Mengüç/OzU

Godfried Augenbroe/ GT
Rifat Ocal/OzU

ZERO ISTANBUL 2050

IBM 2010-2013

M.Pınar Mengüç/OzU

Ozlem Bahadır/OzU

RENOVATION OF A MEDICAL SCHOOL BUILDING
"FP7-BRICKER"

M.Pınar Mengüç / OzU
Yunus Çengel/ ADU
Onur Günder

Layth Ismael
Hayder Mohammad

GAME AND APPS FOR ENERGY EFFICIENCY
'Horizon 2020' TRIBE

M.Pınar Mengüç/OzU

Cem Keskim
Cem Doğan Şahin
Ebru Tatar
Elif Gizem Tuncel

LOGISTICS/ISTANBUL

DHL 2011-2012

M.Pınar Mengüç/OzU

Okan Orsan Özener
Burcu Balcık

CEEE/EÇEM

Disiplinlerarası Araştırmalar Haritası

>> binalarda enerji verimliliği

#enerji_verimliliği
#bütünleşik_tasarım
#gerçek_zamanlı_takip
#düşük_enerji_tüketimi
#çevresel_konfor
#bütüncül_işbirliği, #hastane

>> insan - mekan etkileşimi

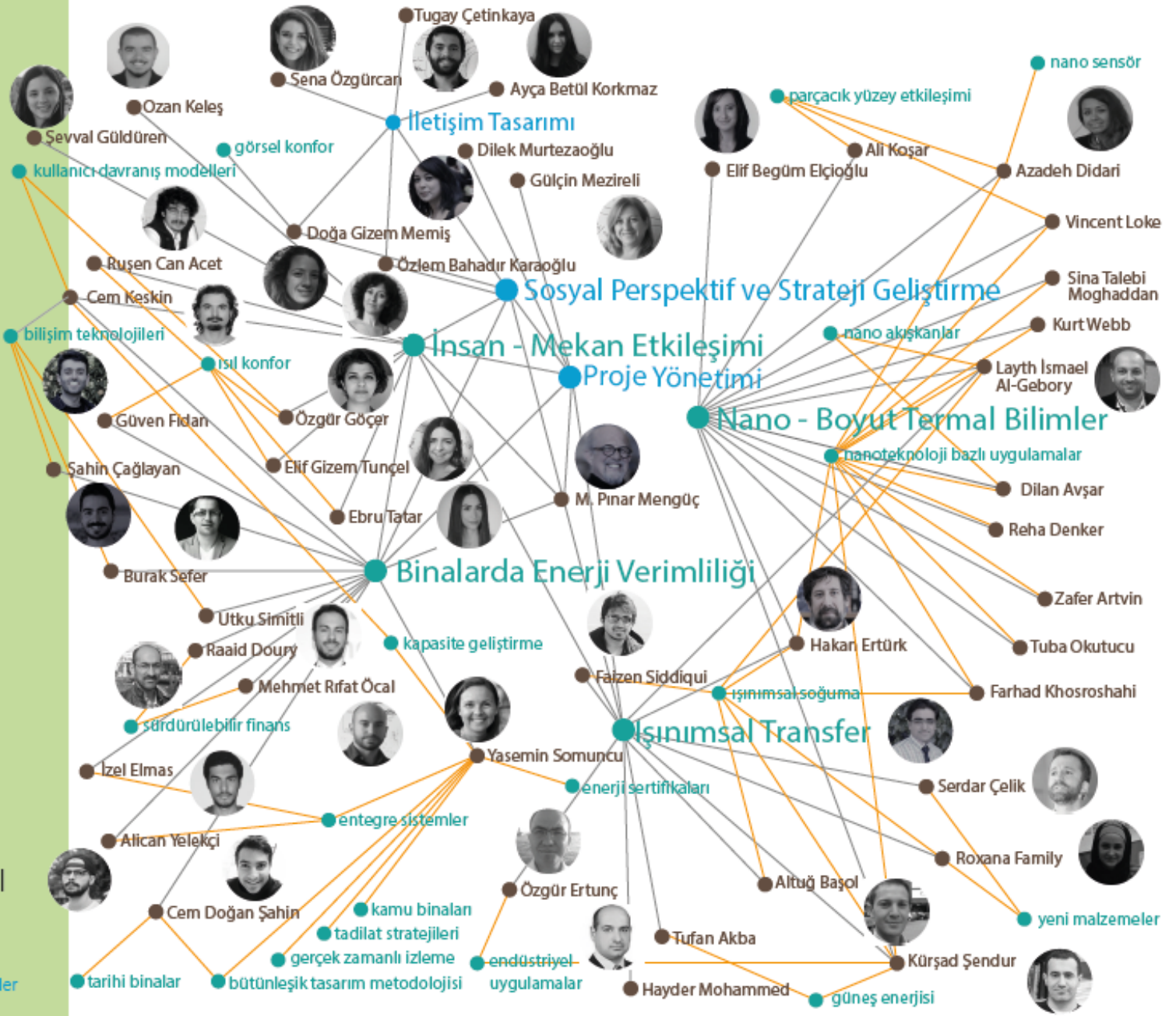
#bina_enerji_simülasyonu
#davranış_değişimi
#görsel_konfor, #termal_konfor
#VR #complexity
#sistem_tasarım_düşüncesi
#ciddioyun #data_science
#düşük_bina_işletme_maliyeti

>> ışınımsal transfer

#fırınlar, #alev, #güneş_enerjisi
#spektrum, #enerji _verimliliği
#malzemeler, #cam

>> nano - boyut termal bilimler

#nanosüspansiyonlar, #sensörler,
#enerji_harmanlama, #nano-boyut
#yeni_malzemeler, #fonksiyonel_yüzeyler

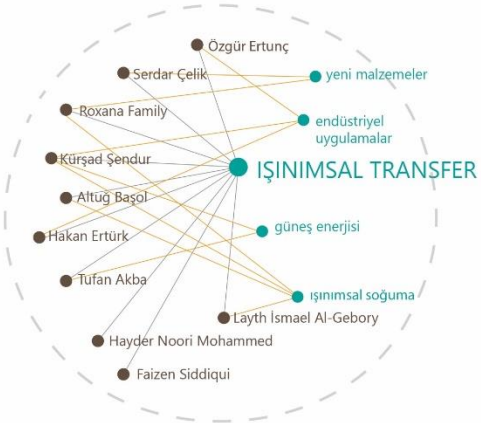


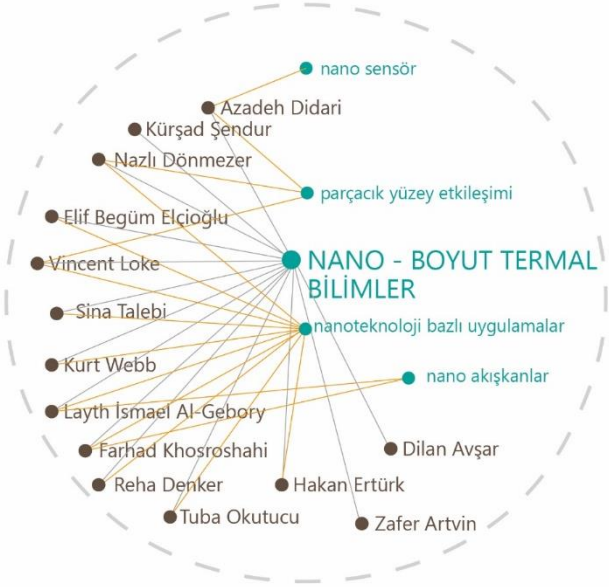
İNSAN - BİNA ETKİLEŞİMİ

BİNALARDA ENERJİ VERİMLİLİĞİ

NANO - BOYUT TERMAL BİLİMLER

IŞINIMSAL / ISI TRANSFERİ





FUTURE OF CEEE

#RADIATIVE TRANSFER
#EM-WAVE SCATTERING
#NANO-SCALE ENERGY HARVESTING

#SUSTAINABLE BUILDINGS
#ENERGY EFFICIENCY
#HUMAN-BUILDING INTERACTIONS
#OPTICS IN BUILDINGS
#COMFORT
#SERIOUS GAME

#DIGITIZED BEHAVIOR
#COLLABORATIVE MULTIDISCIPLINARY STUDIES
#COMPLEX SYSTEMS AND CONNECTIVITY

CEEE/EÇEM

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mpmenguc.com