SMART, SUSTAINABLE CITIES FOR CLIMATE CHANGE MITIGATION

The Bioclimatic design and Low-Carbon Urban Isle Approach

Smart Isle Urban

IENE

Επενδύοντας στην Ενεργειακή Αποδοτικότητα

24.05.2018

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Thanks to the EU and the Research Promotion Foundation for funding, in the frame of the collaborative international Consortium (SUI) financed under the ERA-NET Cofund Smart Cities and Communities Cofunded Call. This ERA-NET is an integral part of the 2014 Joint Activities developed by the Joint Programme Initiative Urban Europe (JPI Urban Europe).

SUSTAINABLE CITIES: OXYMOROUS OR REALISTIC?

- ***Cities have significant advantages*** *and should not be considered as areas that simply burden the environment.*
- *They can ensure a high quality of life with low energy consumption, waste, pollution and generally less damage to the environment from healthy suburban or rural areas.*
- *Services and especially health services in cities are much better organized than in rural areas and this is evidenced by recent epidemiological and demographic studies showing that urban survival rates are higher*

Challenges

- ***At their worst, cities can be a major drain of resources and source of pollution***

URBANISATION

- *3.5 bn / 50% of the Worlds Population Live in Cities Today*
- *By mid 21st century the majority of population will be living in cities- 6.3 billion / 70% of world population*

Impacts of fast urban growth

URBAN PROBLEMS

With rapid urbanisation, sustainability in Cities nowadays is more crucial than ever

- ***Urban areas with large populations and voracious consumption patterns consume energy and water and create waste***
- ***Cities produce nearly 70 percent of global greenhouse gas emissions.***
- ***In developing countries, cities bear up to 80 percent of the costs associated with climate change.***
- ***The city's electricity consumption is increased to compensate for the Heat island phenomenon.***

COMBATING THE URBAN PROBLEMS

- ***Tackling problems*** *such as congestion, bad air quality, and waste management can help reduce health costs, lower carbon emissions, and capture methane.*
- *These, in turn, offer a critical co-benefit – climate change mitigation.*

URBANISATION and ENERGY

Energy Consumption

- ***Energy is the main parameter that determines the quality of life in cities as well as their environmental quality.***
- ***Urbanization dramatically affects energy consumption.***
- ***A recent study has shown that while 1% increase in GNP (***Gross **National** Product) ***increases energy consumption equally, urban population increase by 1% increases energy consumption by 2.2%, i.e. more than doubled.***

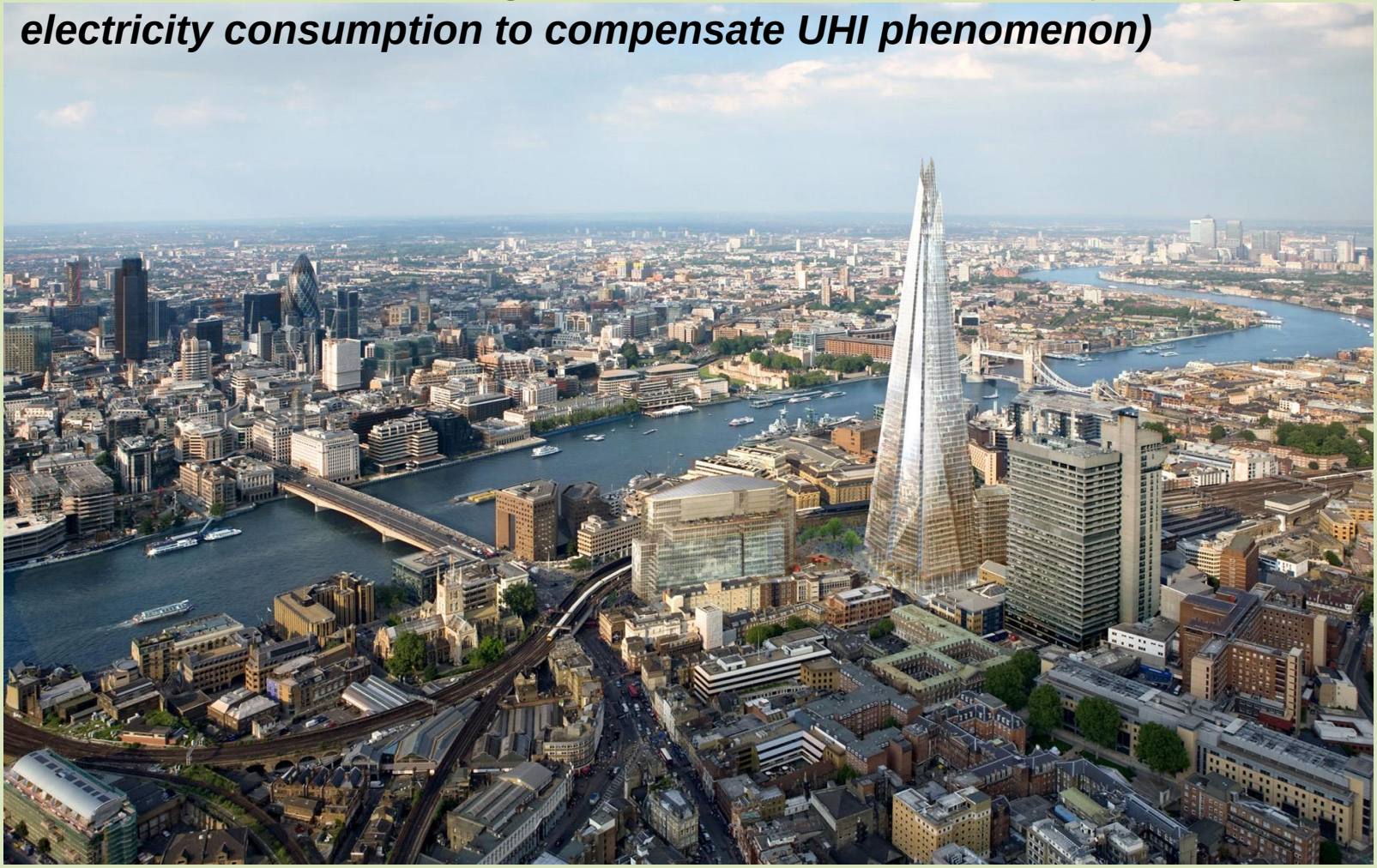
URBAN ENVIRONMENTAL PROBLEMS

Urban Heat Island and Energy Consumption

- ***Comparisons of energy consumption in the central and peripheral parts of cities indicate that because of the increased temperatures (Urban Heat Island effect) the city center consumes more energy.***
- ***It is estimated that about 3-15% of the city's electricity consumption is spent to compensate for the Heat island phenomenon.***
- ***The required peak load for air conditioning of a typical building in the center of Athens is almost double that in the southern and northeastern areas of the city.***
- ***This creates significant environmental problems***

URBAN ENVIRONMENTAL PROBLEMS

London- ***intense urban growth and Urban Heat Island (30% city's electricity consumption to compensate UHI phenomenon)***



SUSTAINABILITY IN CITIES

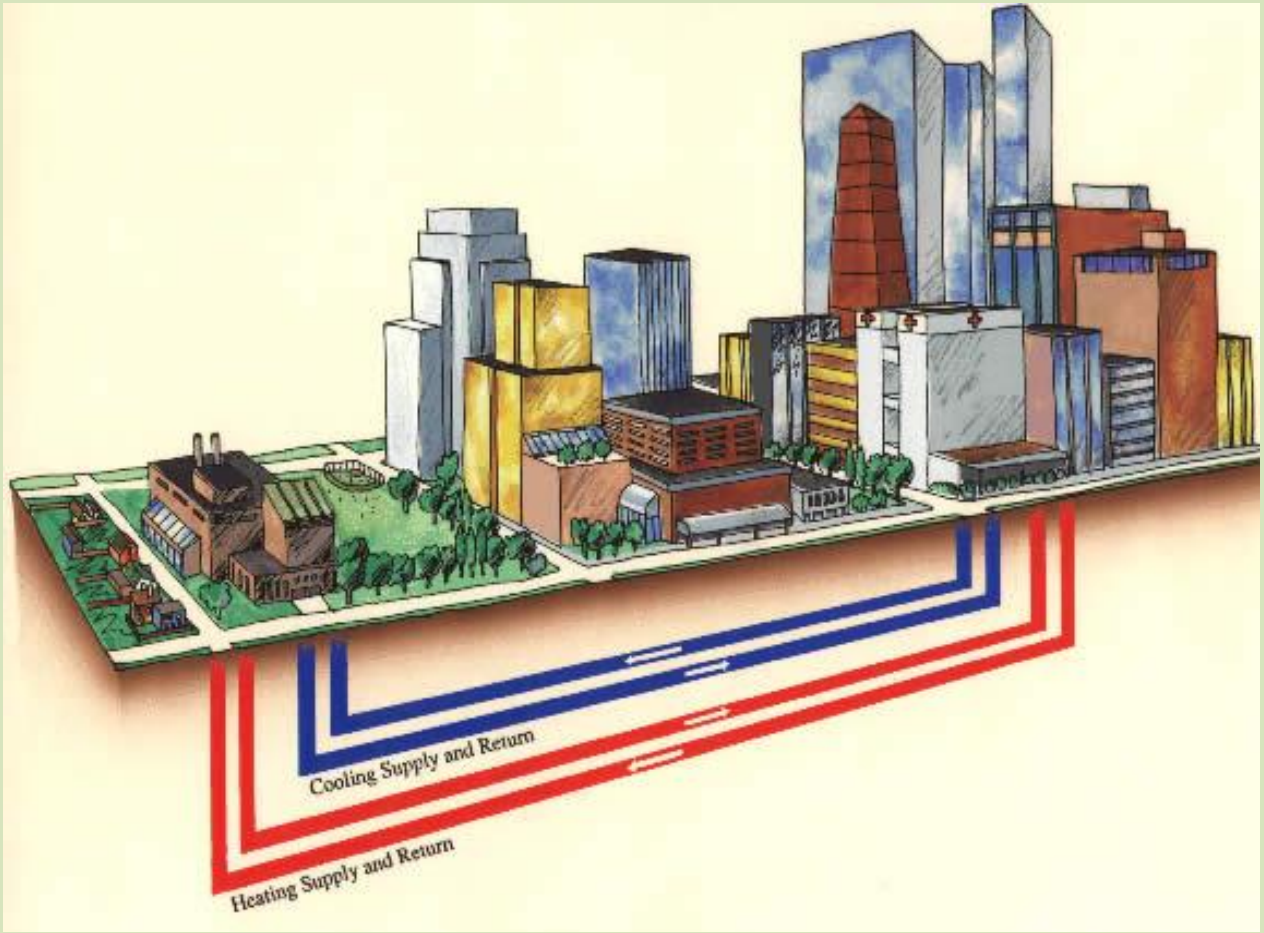
A common and progressive problem-solving approach is needed with adapted strategies and tools aimed at reducing energy consumption and improving the environment in cities, such as:

SUSTAINABILITY IN CITIES

VIABLE URBAN ENERGY SYSTEMS

Adoption of sustainable centralised (district) or decentralized energy supply systems for buildings, using renewable sources such as solar energy and biomass, (heating and cooling).

It is perhaps the most advanced and efficient strategy for penetrating viable energy options at the level of cities which have constant and high energy needs.



SUSTAINABILITY IN CITIES

IMPROOVING THE MICROCLIMATE

Real Goods Building- California

A hypothetical 'green' city that combines

- *Appropriate Materials (Light colour Roads, White Roofs)*
- *Dense urban vegetation,*
- *Appropriate planning of urban elements,*

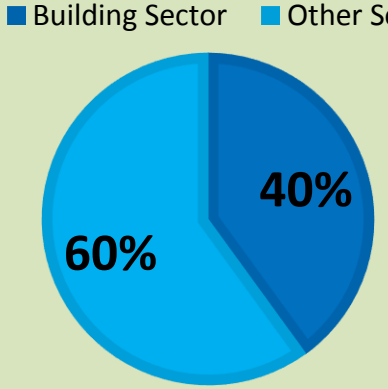
It is by 17degrees C lower than a conventional city.

Temperature in urban parks can be up to 8 degrees C lower than adjacent urban areas.

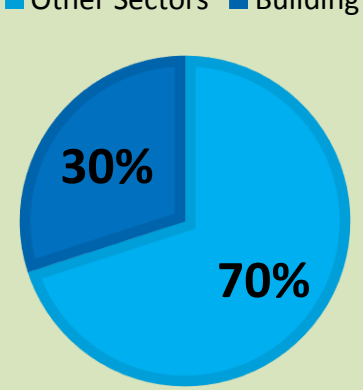
SMART SUSTAINABLE CITIES
ENERGY AND BUILDINGS

The rational planning of cities must take into consideration the building scale. The Design and the refurbishment of the building:

TOTAL ENERGY CONSUMPTION



TOTAL CO2 EMISSIONS

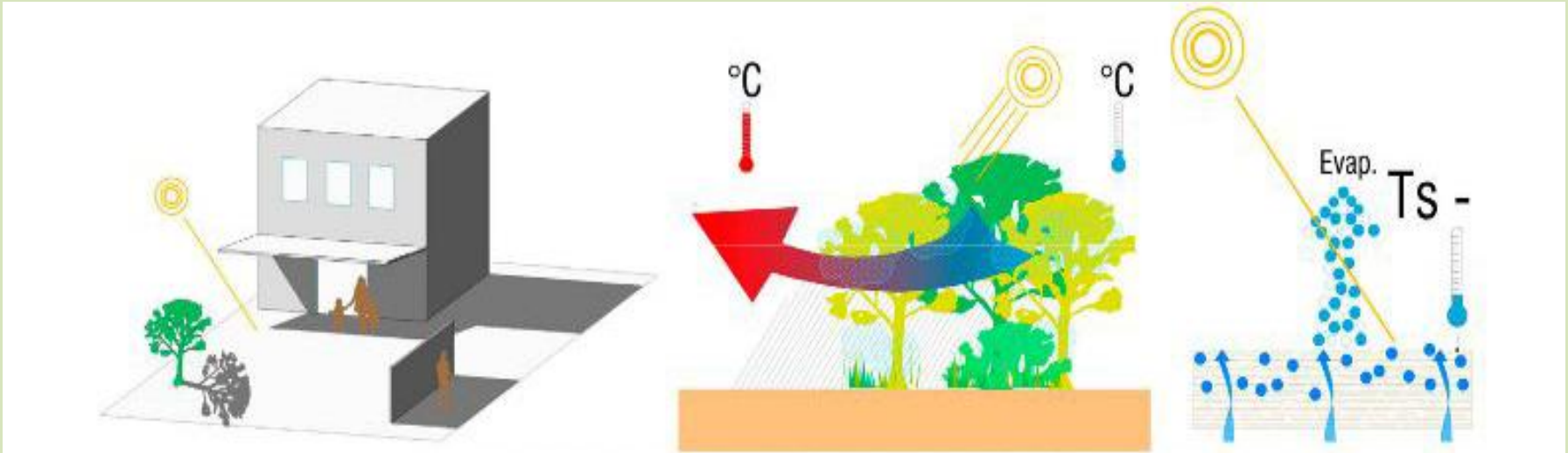


Worldwide buildings are responsible for more than 40 percent of global energy use and one third of global greenhouse gas emissions, both in developed and developing countries.

These figures demand urgently the reduction of energy consumption in Buildings

SMART SUSTAINABLE CITIES
BUILDING REFURBISHMENT & BIOCLIMATIC DESIGN

- ***With energy-saving improvements to existing buildings***
  - ***The average annual rate of new construction in Europe amounts to 1%.***
  - ***The radical upgrading of existing buildings in Europe, anticipating nearly zero-energy buildings, would save yearly, 32% of total primary energy use***
- ***Using bioclimatic design for new buildings***
  - ***For Indoor Comfort and Conventional Energy Reduction***



1.1. Solar protection, 1.2. Micro-breeze creation, 1.3. Permeability of materials.

SMART TECHNOLOGY

- *Techniques of this form have reached a very high level of maturity and already contribute to improving the energy balance of buildings.*

Μελλοντική Αστική ανάπτυξη, Albert Speer & Partner (AS&P) Artist Impression

SMART SUSTAINABLE CITIES
FUTURE PROSPECTS

- *None of the above priorities should be addressed individually.*
- *The nature of the problems requires integrated, comprehensive theoretical and practical solutions. In other words,*

NEW APPROACH FOR THE DESIGN AND CONCEPT OF CITIES

Μελλοντική Αστική ανάπτυξη, Albert Speer & Partner (AS&P) Artist Impression

THE SUI PROJECT

SUI - Smart bioclimatic low-carbon urban areas as innovative energy isles in the sustainable city

The Smart Urban Isle aspires to **move forward with the urban energy savings** and **CO2 reduction**

The SUI project aims at **a new urban planning** that allows cities to grow in a **sustainable** way

The project will probe Smart Urban Isle as innovative basic energy unit in the Smart City

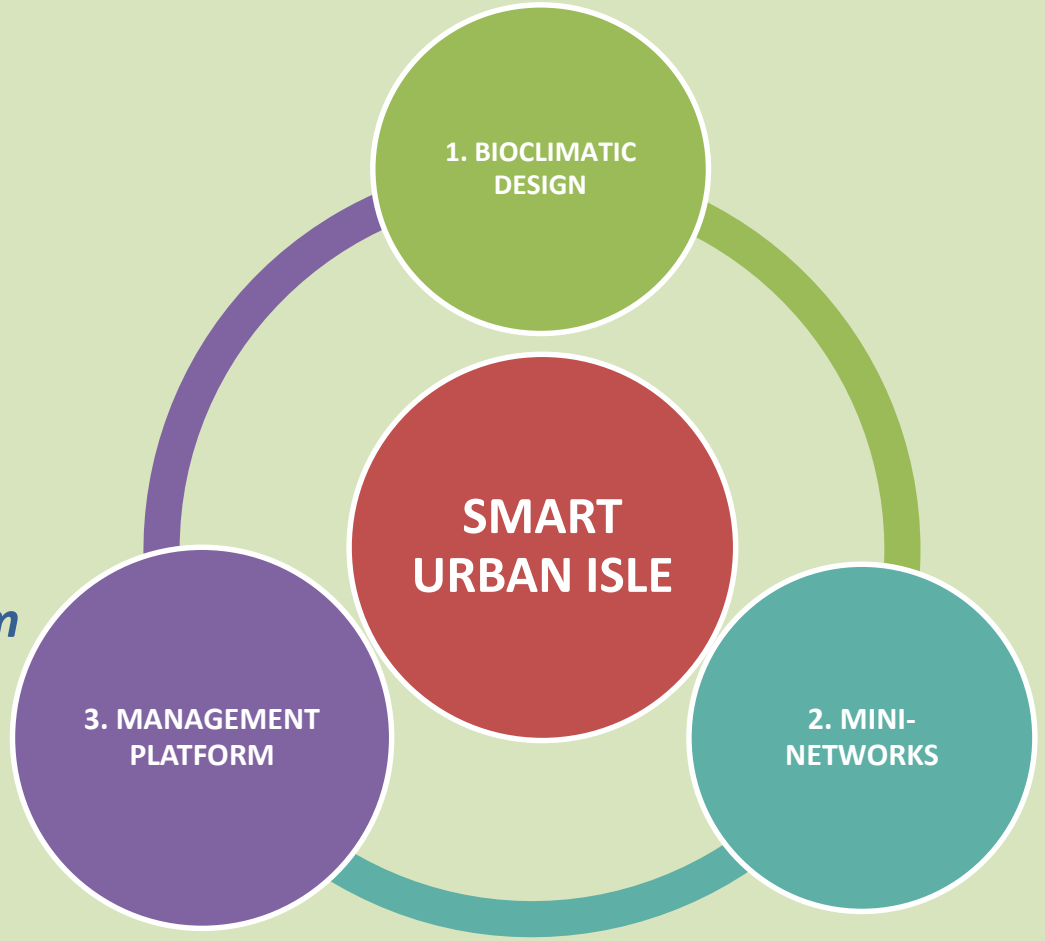
Objectives

- *Investigate, implement and validate energy neutral 'Smart Urban Isle' (SUI)*
- *Locally balance the energy system*
- *SUI project aims at a whole new urban planning that allows cities to grow in a sustainable way*

THE APPROACH

Threefold Approach

1. *Bioclimatic design of buildings and urban planning*
2. *Mini networks, which include decentralised renewable energy generation, energy storage and distribution*
3. *An Energy Management System to control, manage, monitor the SUI and optimize energy flows*



THE BIOCLIMATIC DESIGN

Objectives

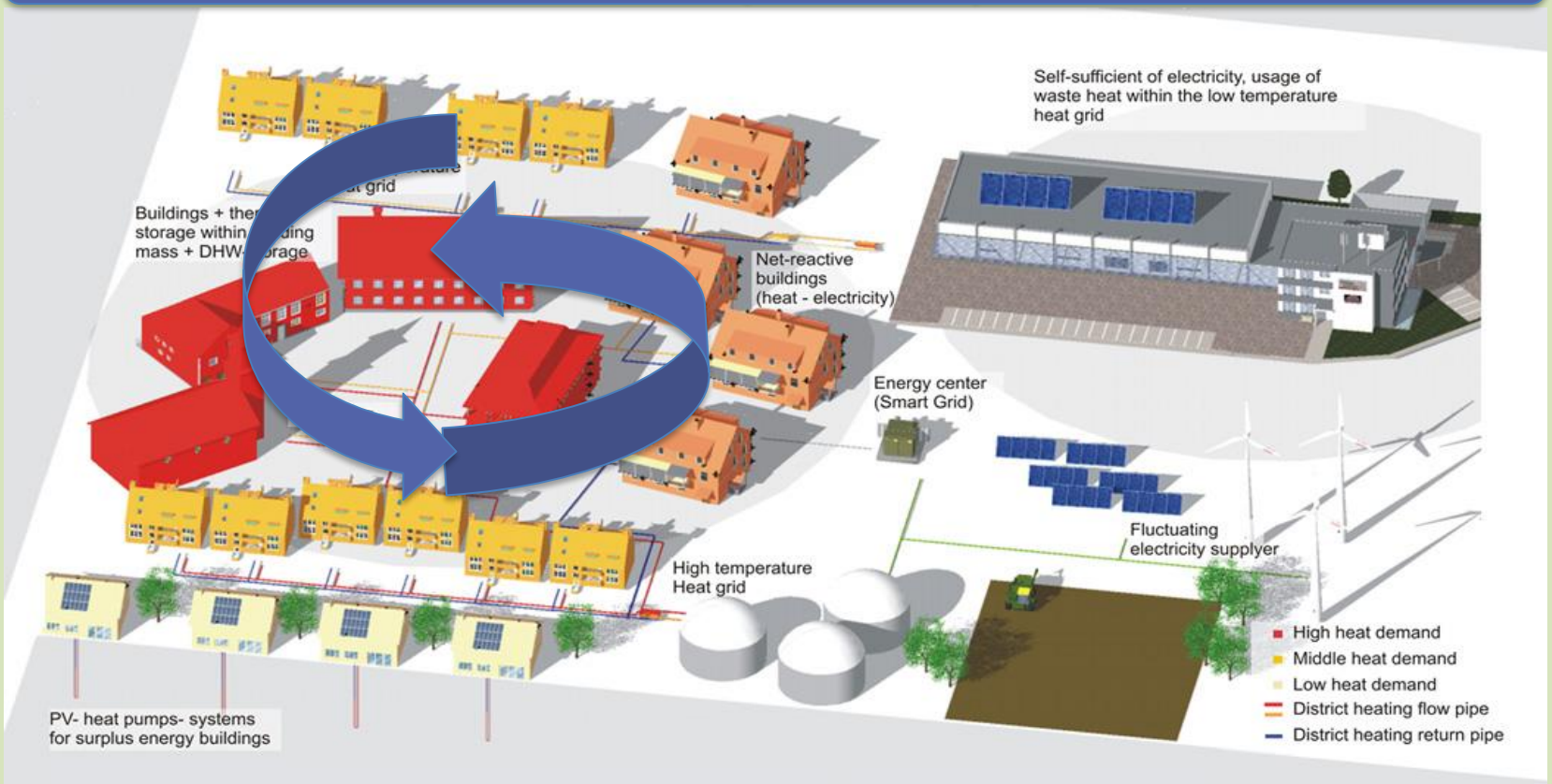
- ***To determine the energy consumption and human comfort conditions within the existing buildings as well as the surrounding area.***
- ***Enhance the energy performance and improve comfort conditions both indoors and outdoors .***
- ***Reduce the conventional energy use with energy efficient design.***

MINI NETWORKS

A SUI mini network concept in

Combination of energy generation, with RES - storage and distribution to supply the energy demand,

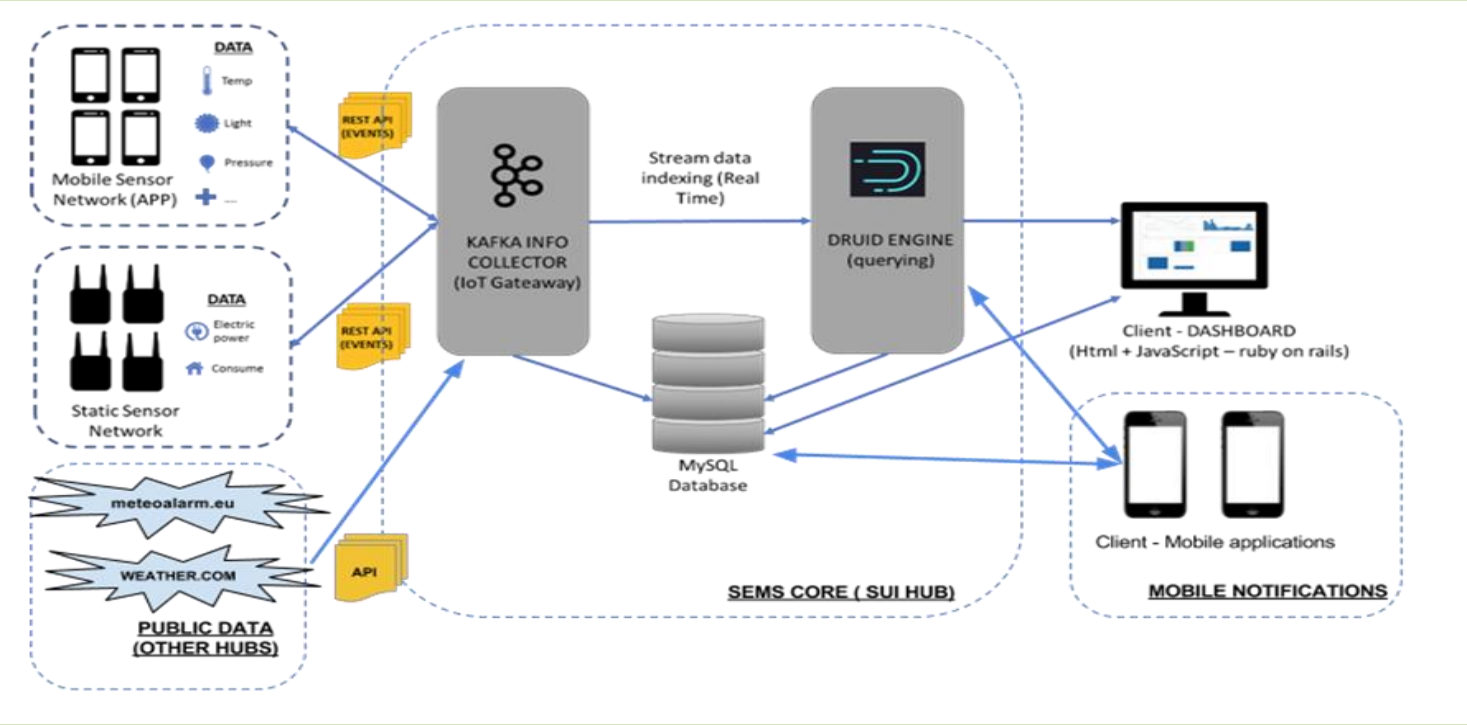
Generate, distribute, exchange and store
as much as possible locally.



MANAGEMENT PLATFORM

*The **main objective of the SUI Energy Management System** (SEMS) **is the development of a Software to provide a bidirectional energy management interface that implements the gateway between the electrical utility and the customer, and their electricity consuming/generating devices**.*

+ The possibility of scheduling local electricity generation together with local electricity consumption to increase the capacity offered to the utility.



Steps from investigation to implementation

The 3 Steps towards Implementation

Step 1

- Analyze the existing situation
  - Building/Area/Mobility
  - Renewable energy potential

Step 2

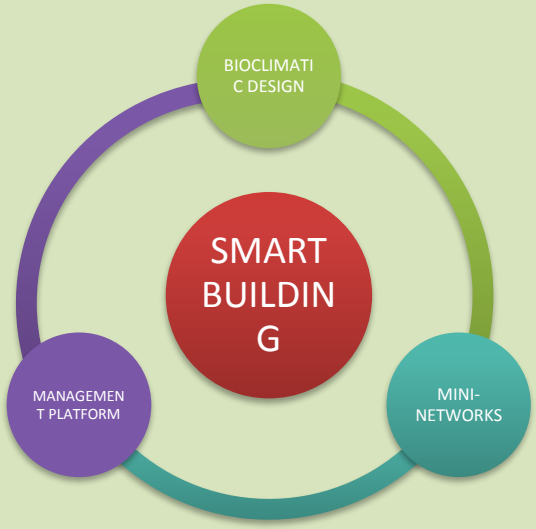
- Propose and evaluate a set of scenarios
  - Bioclimatic measures
  - RES systems
  - Management platform

Step 3

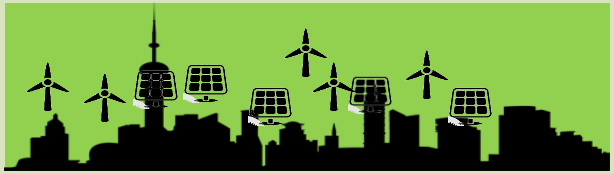
- Make an in-depth feasibility analysis of the chosen scenario/measure
- Implement and validate the concept

IMPLEMENTATION

Smart Urban Isle as innovative basic energy unit in the Smart City



Implementation in 7 Municipalities



- Santa Cruz Tenerife (ES)
- Amsterdam (NL)
- Iasi (RO)
- Winterthur (CH)
- Zurich (CH)
- Limassol (CY)
- ecoEnergyLand (AT)

SUI Case study - Santa Cruz de Tenerife (Spain)

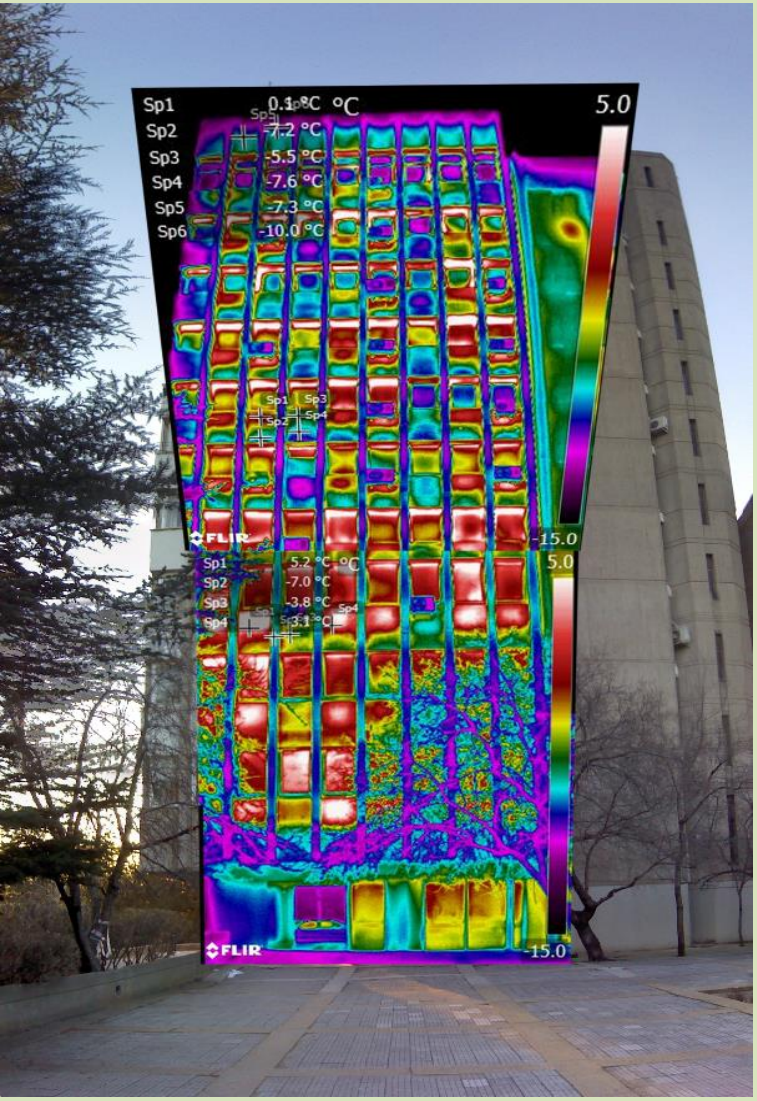
The Building

Santa Cruz building

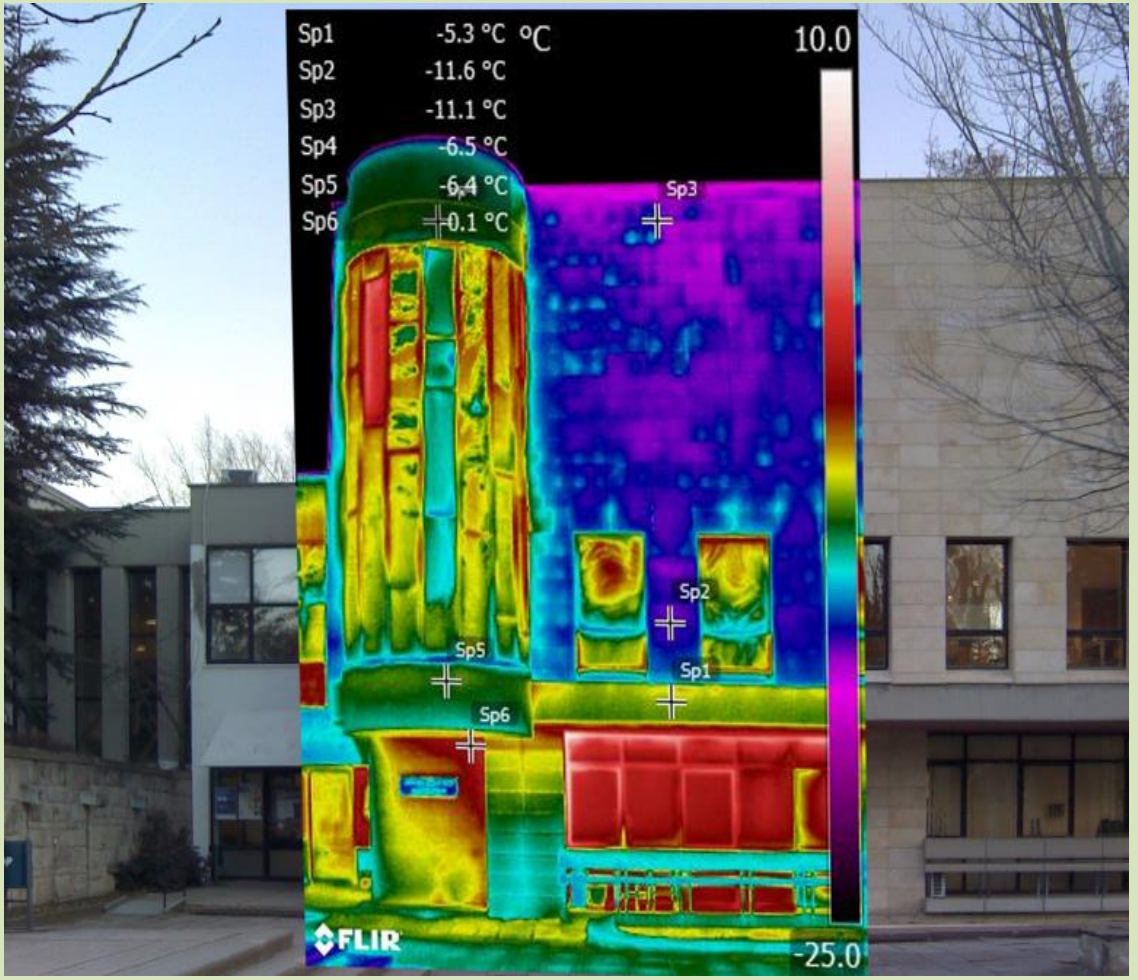
The Area

Santa Cruz Isle Area (inside red circle)

SUI Case study – METU Ankara (Turkey)



IR Thermography (METU)



SUI Case study – Winterthur (Switzerland)

https://maps.google.ch

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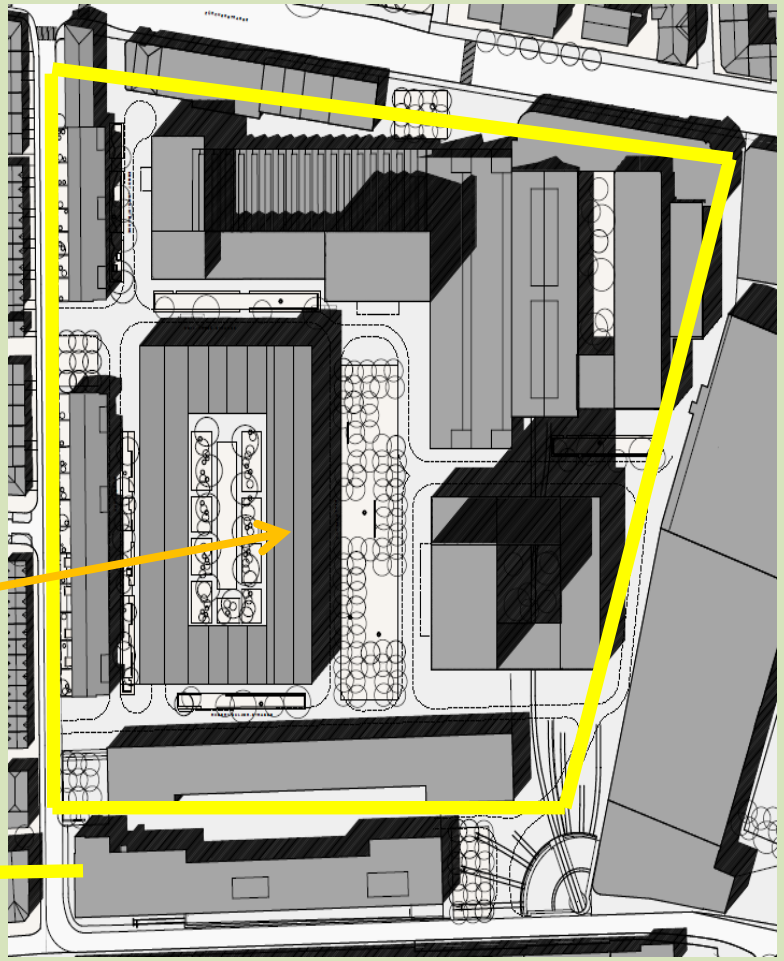
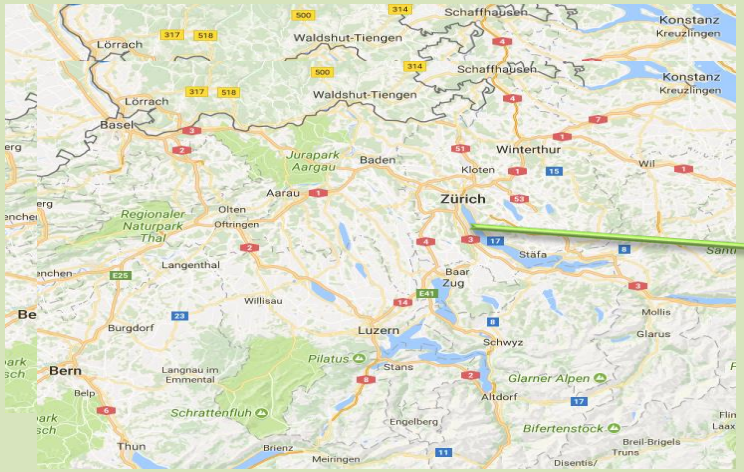


SUI area / System border

SUI Case study – Zürich (Switzerland)



LOSINGER MARAZZI

This part of the buildings by now is constructed and in operation

SUI Case Study – Limassol (Cyprus)

THE NEIGHBOURHOOD

Location: **Limassol,** Old town centre

Uses: retail stores and education, cafeterias and wine and cocktail bars.

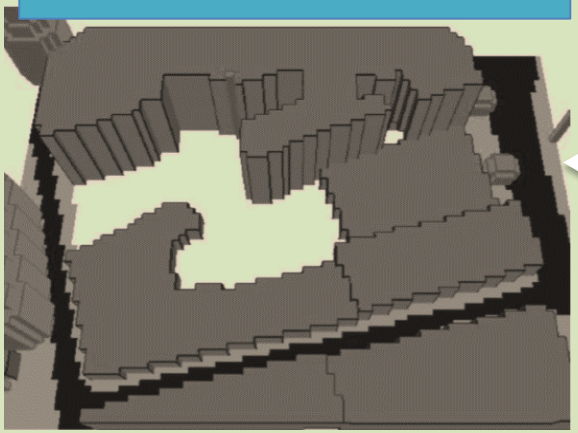
Building: University Administration building

Construction: 1979

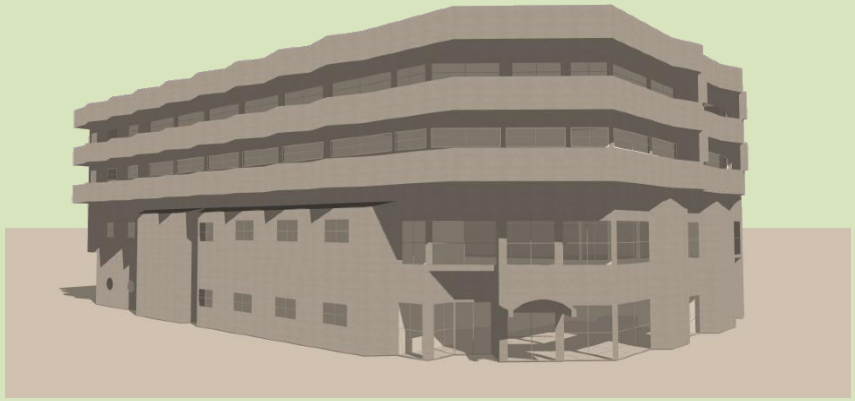
Renovations: 2011 & 2015

Description: 3-storey building. It is equipped with all kind of services. It includes approximately 60 workplaces, a lecture room for 30 people and 2 meeting rooms.

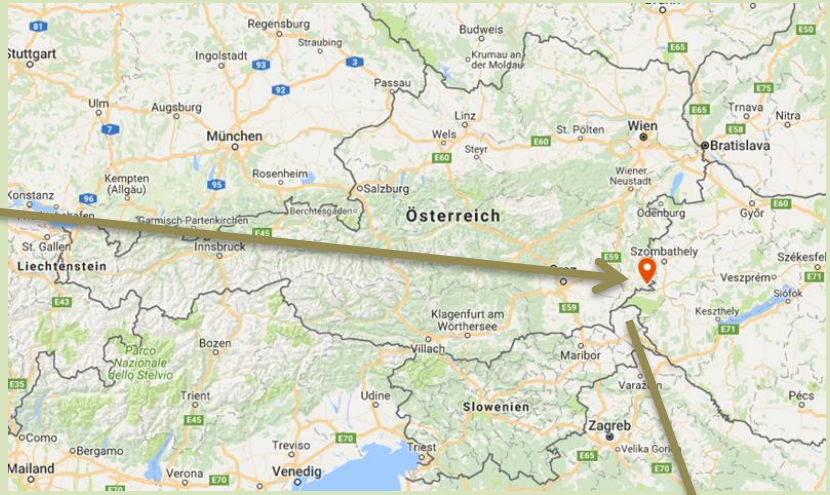
THE ISLE



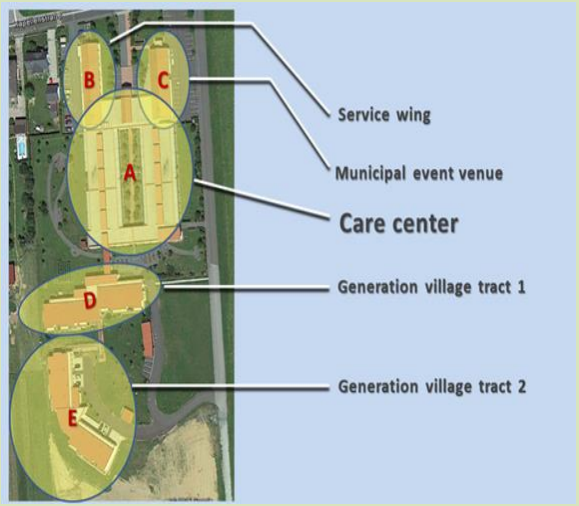
THE BUILDING



SUI Case Study - EcoEnergyLand (Austria)



Location



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http://smarturbanisle.eu/

http://www.cyi.ac.cy/index.php/sui-overview.html

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