OPTIMUS: Optimising the energy use in cities with smart decision support system

The goal of OPTIMUS is to provide a series of tools that enable local administrations:

- to assess the level of compliance of the city with regard to the energy performance targets at the city level
- to set up specific targets to achieve by improving the performance of buildings
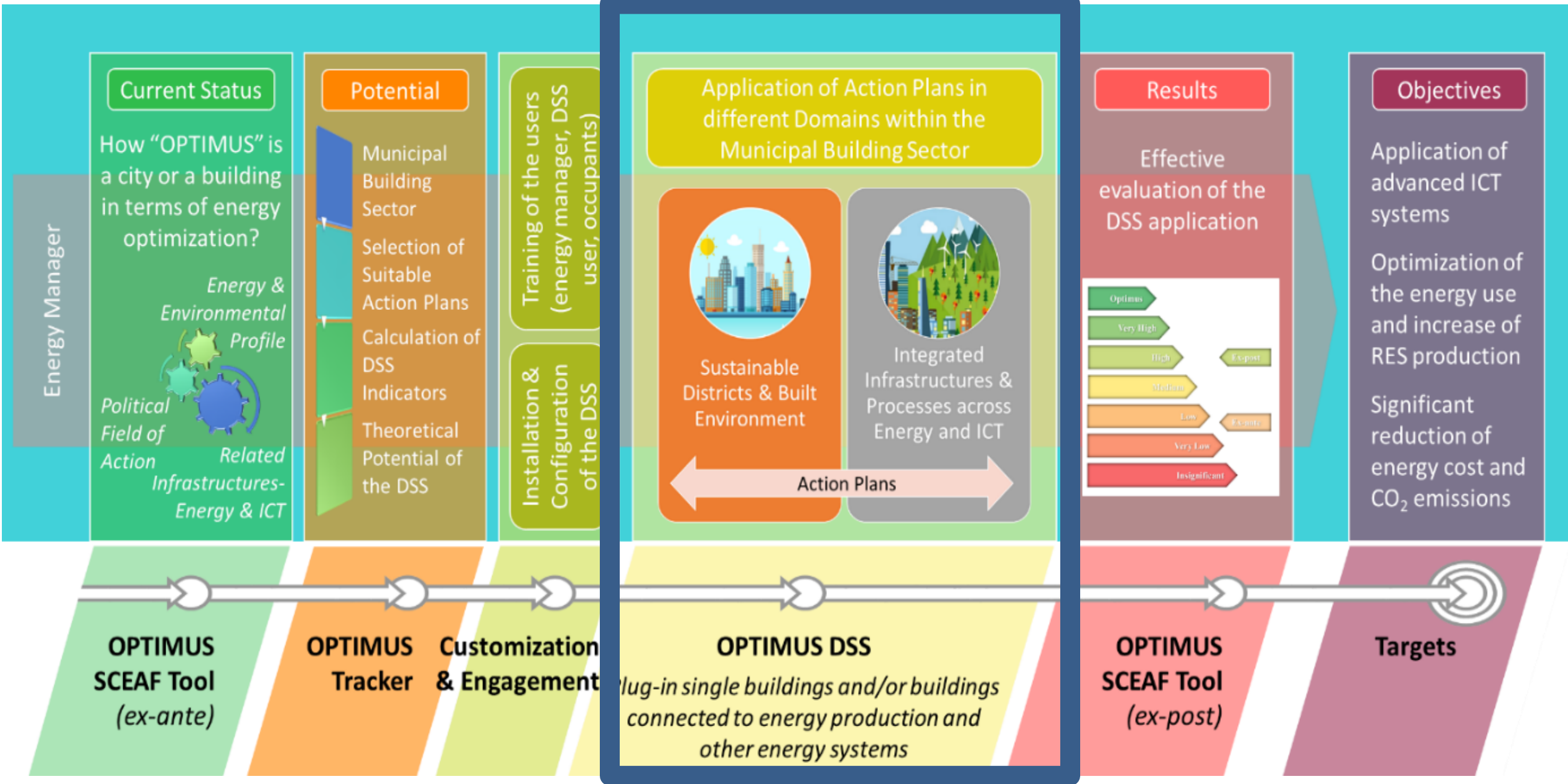- to adopt measures to improve the building performance over time

OPTIMUS

OPTIMISING ENERGY USE IN CITIES THROUGH
SMART DECISION SUPPORT SYSTEMS

Local Renewables Conference Freiburg, September 27, 2016

WWW.OPTIMUS-SMARTCITY.EU

Multiscale evaluation

Current Status

How "OPTIMUS" is a city or a building in terms of energy optimization?

Energy & Environmental Profile

Political Field of Action

Related Infrastructures-Energy & ICT

Energy Manager

Potential

Municipal Building Sector

Selection of Suitable Action Plans

Calculation of DSS Indicators

Theoretical Potential of the DSS

Training of the users (energy manager, DSS user, occupants)

Installation & Configuration of the DSS

Application of Action Plans in different Domains within the Municipal Building Sector

Sustainable Districts & Built Environment

Integrated Infrastructures & Processes across Energy and ICT

Action Plans

Results

Effective evaluation of the DSS application

Optimus
Very High
High
Medium
Low
Very Low
Insignificant

Expert

F-Expert

Objectives

Application of advanced ICT systems

Optimization of the energy use and increase of RES production

Significant reduction of energy cost and CO_2 emissions

OPTIMUS SCEAF Tool *(ex-ante)*

OPTIMUS Tracker

Customization & Engagement

OPTIMUS DSS *Plug-in single buildings and/or buildings connected to energy production and other energy systems*

OPTIMUS SCEAF Tool *(ex-post)*

Targets

OPTIMUS DSS

OPTIMUS
OPTIMISING ENERGY USE IN CITIES THROUGH
SMART DECISION SUPPORT SYSTEMS

CITY level

BUILDING level

DSS

Climate

environment

Renewable energy
production

energy
production

Monitoring

building

Occupancy
Social feedback

people

energy costs

Energy market

PREDICTIVE
MODELS

*To calculate
predicted
data*

RECOMMENDED
ACTIONS

*Derived from
inference
rules*

A systemic approach to energy efficiency

OPTIMUS DSS

CITY level

Target indicators (SCEAF+Tracker)
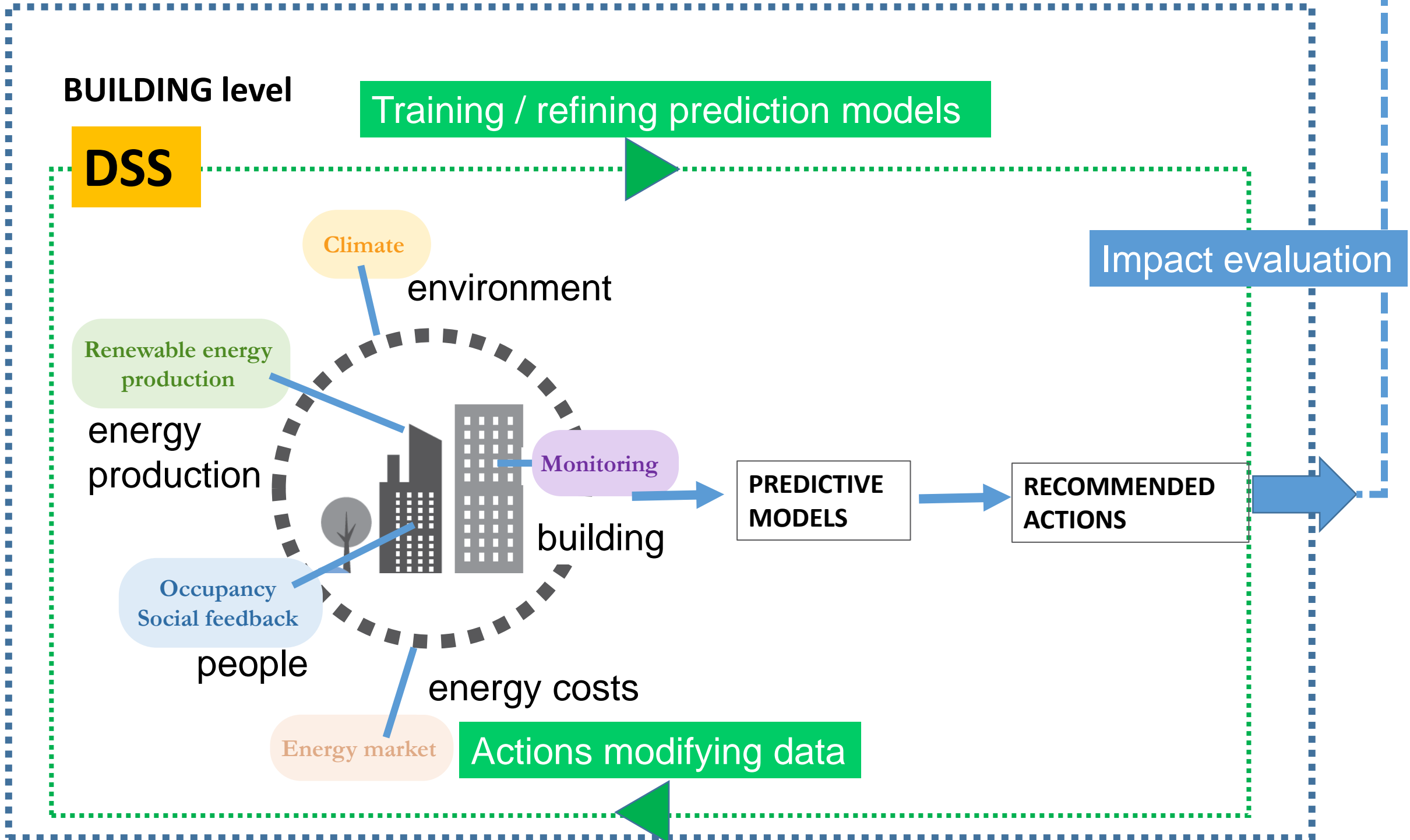
BUILDING level

DSS

Training / refining prediction models

Impact evaluation

Climate

environment

Renewable energy production

energy production

Monitoring

building

PREDICTIVE MODELS → RECOMMENDED ACTIONS

Occupancy Social feedback

people

energy costs

Energy market

Actions modifying data

OPTIMUS DSS

OPTIMUS
OPTIMISING ENERGY USE IN CITIES THROUGH
SMART DECISION SUPPORT SYSTEMS
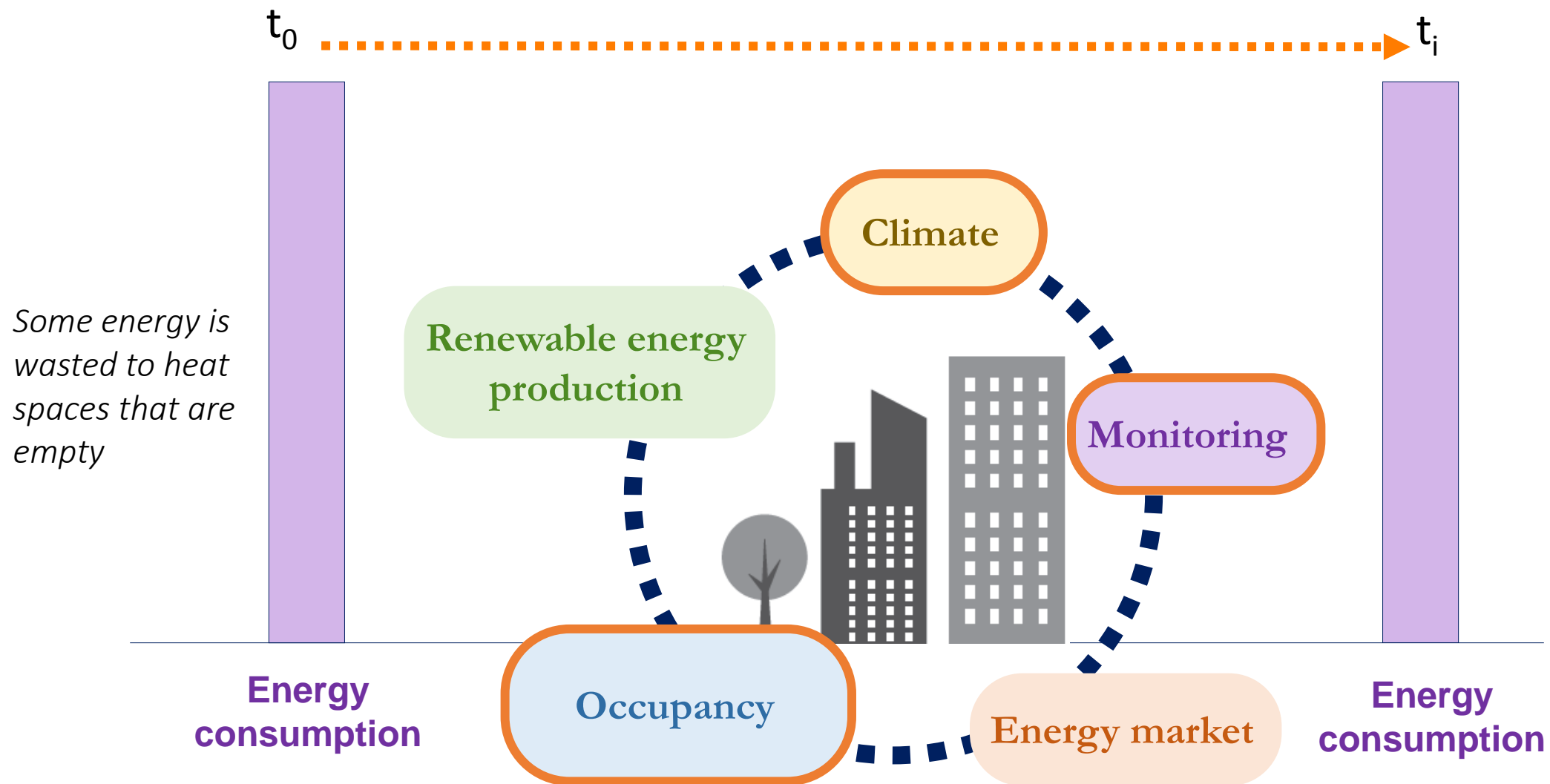
CURRENT SCENARIO

Nowadays, all rooms in a building are heated without taking into consideration climatic conditions of each room and their occupancy

OPTIMIZED SCENARIO

Knowing the occupancy of the rooms and the climate it would be possible to adapt the consumption level to the forecasted conditions
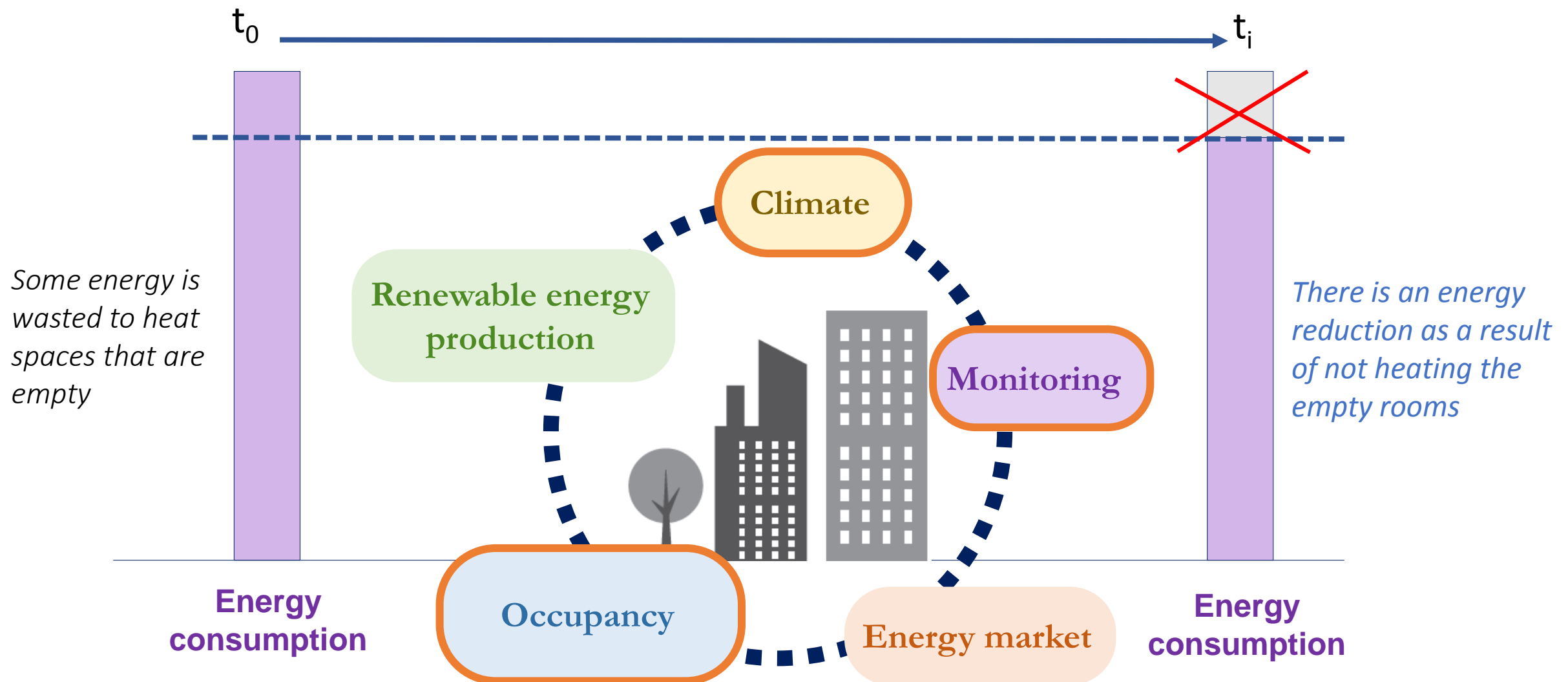
t_0 .... t_i

Some energy is wasted to heat spaces that are empty

Climate

Renewable energy production

Monitoring

Occupancy

Energy market

Energy consumption

Energy consumption

1. ADAPTING OCCUPANCY OF ROOMS TO CONSUMPTION

OPTIMUS DSS

CURRENT SCENARIO

Nowadays, all rooms in a building are heated without taking into consideration climatic conditions of each room and their occupancy

Knowing the occupancy of the rooms and the climate it would be possible to adapt the consumption level to the forecasted conditions

t_0 ⟶ t_i

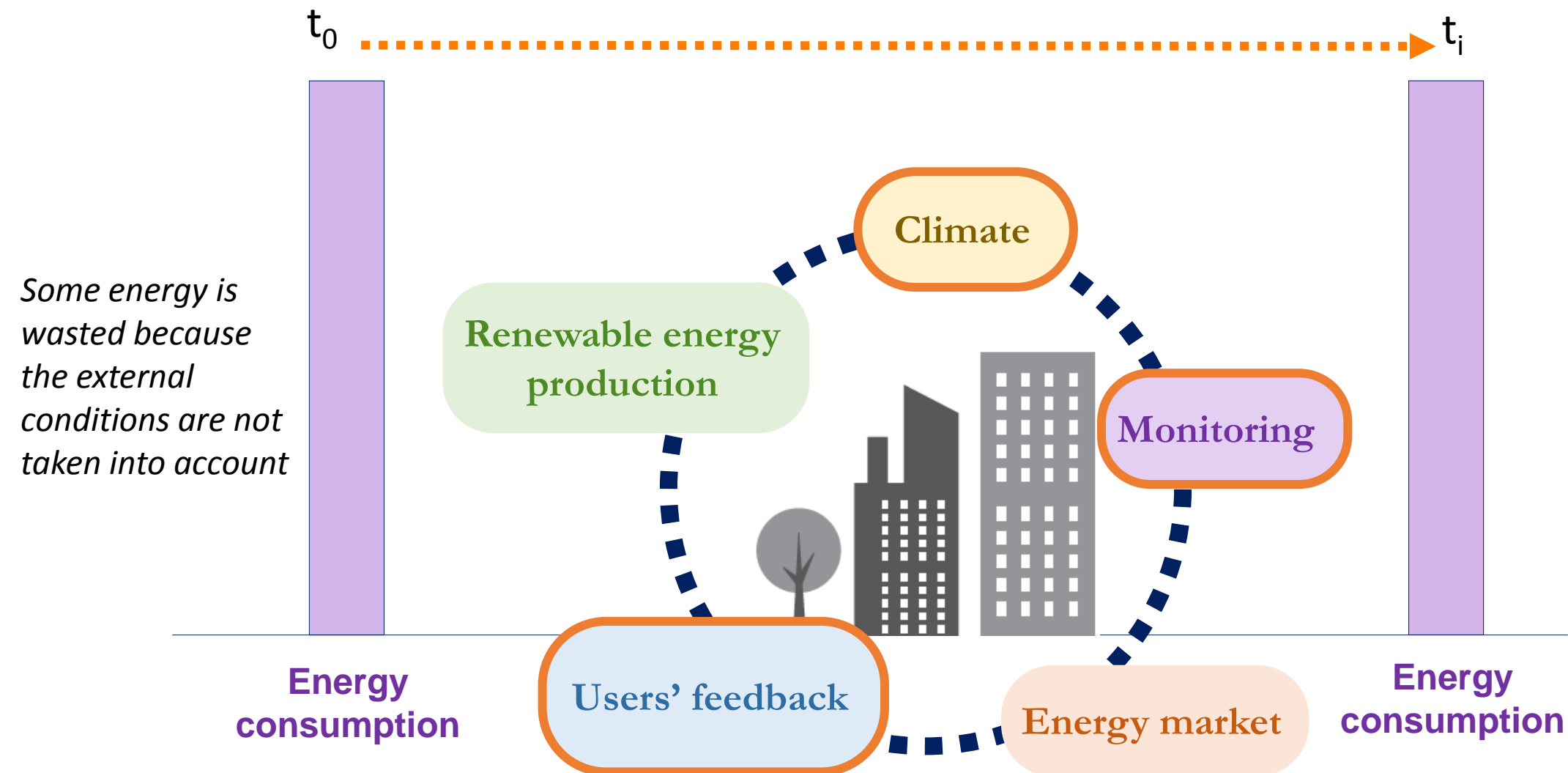*Some energy is wasted to heat spaces that are empty*

Climate

Renewable energy production

Monitoring

There is an energy reduction as a result of not heating the empty rooms

Occupancy

Energy market

Energy consumption

Energy consumption

1. ADAPTING OCCUPANCY OF ROOMS TO CONSUMPTION

OPTIMUS DSS

CURRENT SCENARIO

Nowadays, the set-point is established for a fix time every day independently from the temperature and the thermal sensation of occupants

t_0 .... t_i

OPTIMIZED SCENARIO

Knowing the thermal sensation of occupants and the climate conditions we could change the set point temperature

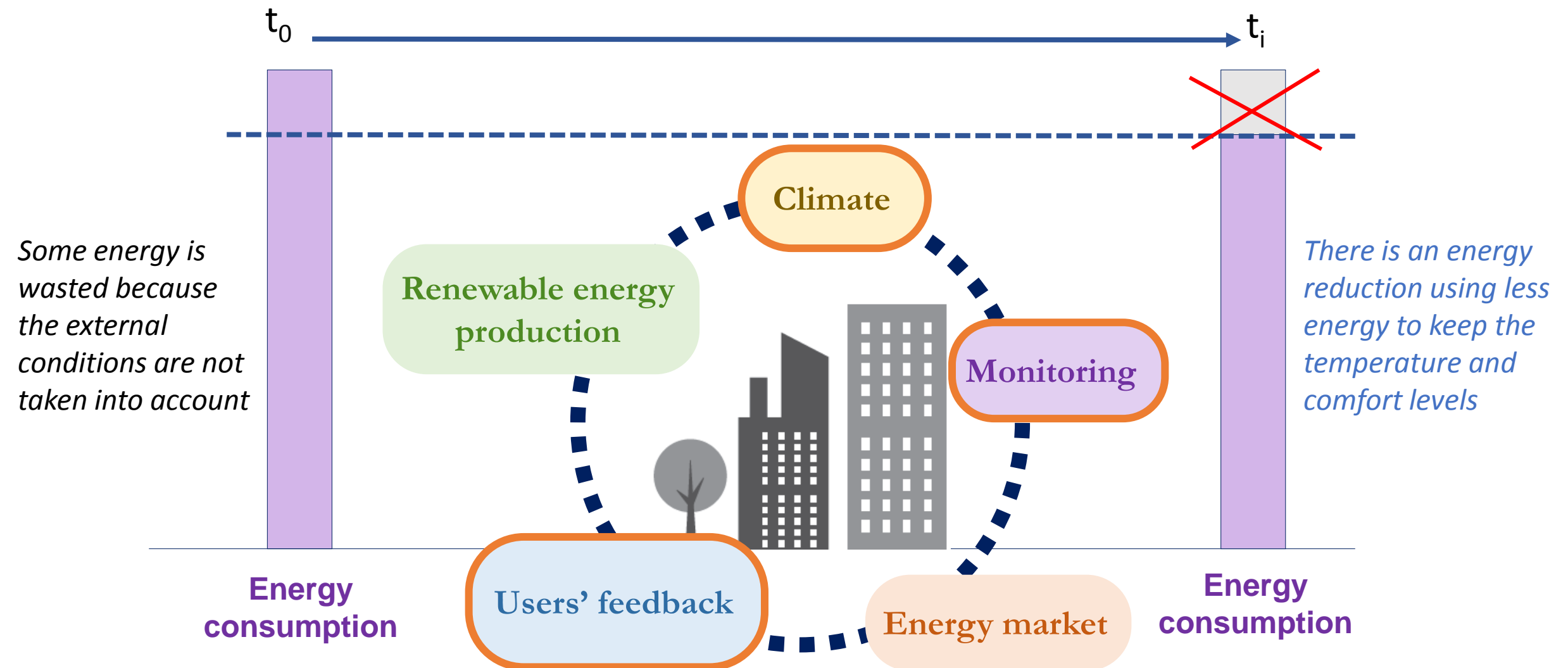*Some energy is wasted because the external conditions are not taken into account*

Climate

Renewable energy production

Monitoring

Users' feedback

Energy market

Energy consumption

Energy consumption

2. ADAPTING SET-POINT TEMPERATURE TO THERMAL COMFORT

OPTIMUS DSS

CURRENT SCENARIO

Nowadays, the set-point is established for a fix time every day independently from the temperature and the thermal sensation of occupants

OPTIMIZED SCENARIO

Knowing the thermal sensation of occupants and the climate conditions we could change the set point temperature

t_0 ———————————→ t_i

Some energy is wasted because the external conditions are not taken into account

There is an energy reduction using less energy to keep the temperature and comfort levels

Climate

Renewable energy production

Monitoring

Users' feedback

Energy market

Energy consumption

Energy consumption

2. ADAPTING SET-POINT TEMPERATURE TO THERMAL COMFORT

OPTIMUS DSS

OPTIMUS
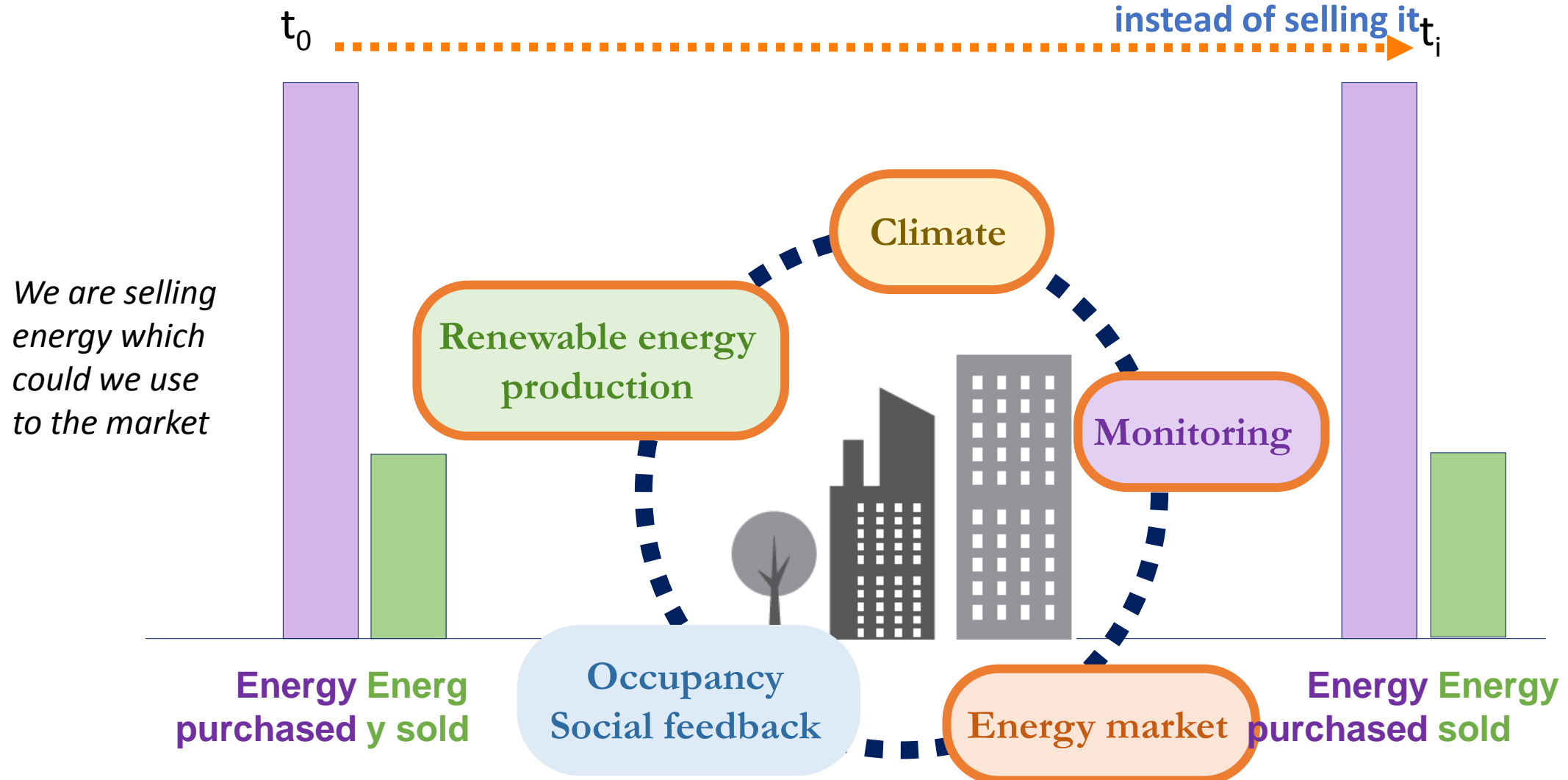OPTIMISING ENERGY USE IN CITIES THROUGH
SMART DECISION SUPPORT SYSTEMS

CURRENT SCENARIO

Nowadays, we might be selling all the produced renewable energy to the grid whereas it could be used by the system

We are selling energy which could we use to the market

OPTIMIZED SCENARIO

Knowing the prices of the energy in the market (selling and buying) and the consumption load it can make sense to shift some loads to use renewable energy instead of selling it
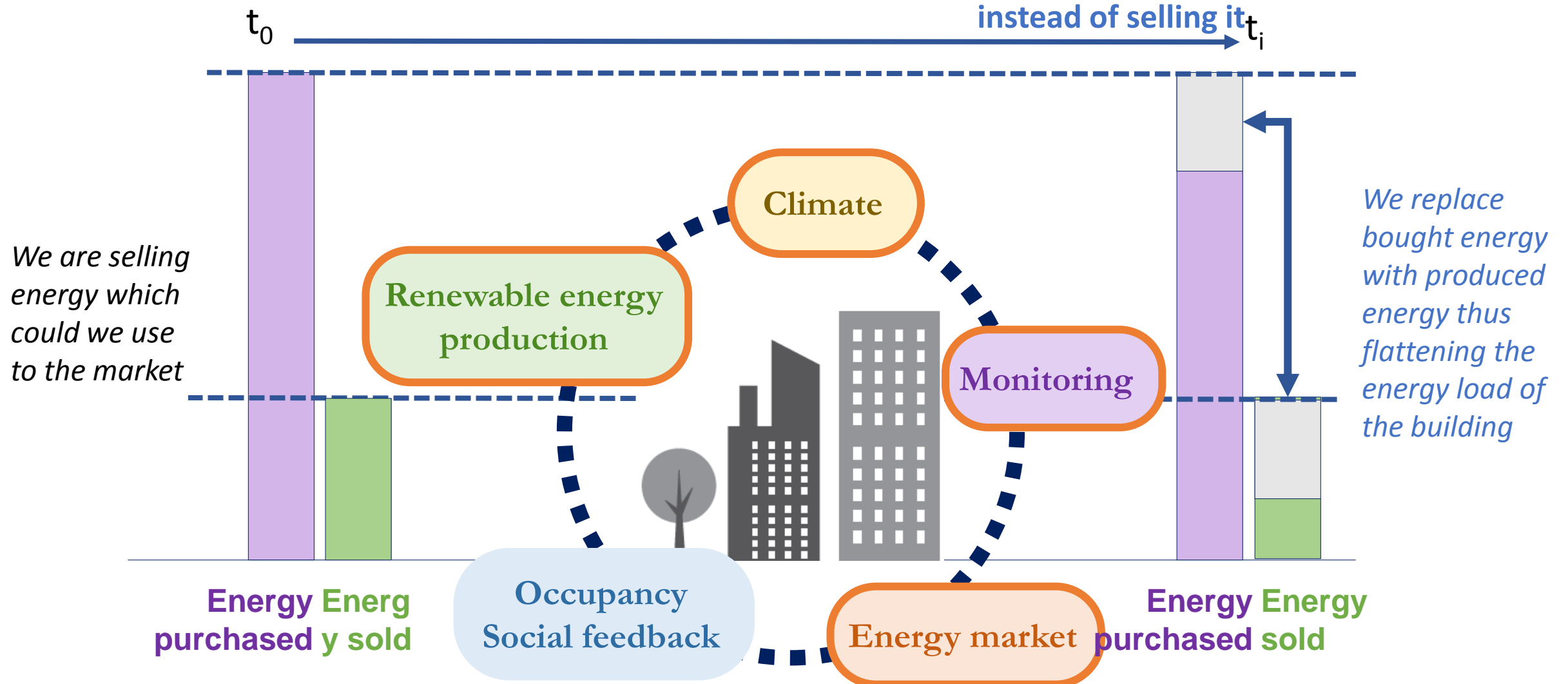
t_0 .... t_i

Climate

Renewable energy production

Monitoring

Occupancy Social feedback

Energy market

Energy purchased **Energy sold**

Energy purchased **Energy sold**

3. LOAD SHIFTING BASED ON RENEWABLE ENERGY PRODUCTION

OPTIMUS DSS

OPTIMUS
OPTIMISING ENERGY USE IN CITIES THROUGH
SMART DECISION SUPPORT SYSTEMS

CURRENT SCENARIO

Nowadays, we might be selling all the produced renewable energy to the grid whereas it could be used by the system

OPTIMIZED SCENARIO

Knowing the prices of the energy in the market (selling and buying) and the consumption it might make sense to shift some loads to use renewable energy instead of selling it

t_0 ⟶ t_i

We are selling energy which could we use to the market

We replace bought energy with produced energy thus flattening the energy load of the building

Climate

Renewable energy production

Monitoring

Energy purchased **Energy sold**

Occupancy Social feedback

Energy market

Energy purchased **Energy sold**

3. LOAD SHIFTING BASED ON RENEWABLE ENERGY PRODUCTION