R2CITIES
Residential district renovation Avoiding methodology flaws and reducing risk
- Webinar at EUSEW 2017 -

EUSEW – 19 June 2017 – 11 am

EeB.ENERGY.2012.8.8.3,
grant agreement No.314473

Residential district renovation – How to avoid methodology flaws and reduce risk

SPEAKERS

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Objective

- Discuss how to design and align a retrofitting strategy drawing on the practical experience of the R2CITIES project:

  ✓ Integrated design methodology
  ✓ Making it happen – the Valladolid case study
  ✓ Benefits for stakeholders

SPEAKER

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Brief project presentation

Start date: July 2013

Duration: 60 months

Total budget: 14.8 million EUR

EU funding: 9.1 million EUR

17 partners from 5 different EU countries

31% of project partners are SMEs

R2CITIES will develop and demonstrate replicable strategies for designing, constructing and managing large scale district renovation projects for achieving nearly zero energy cities.

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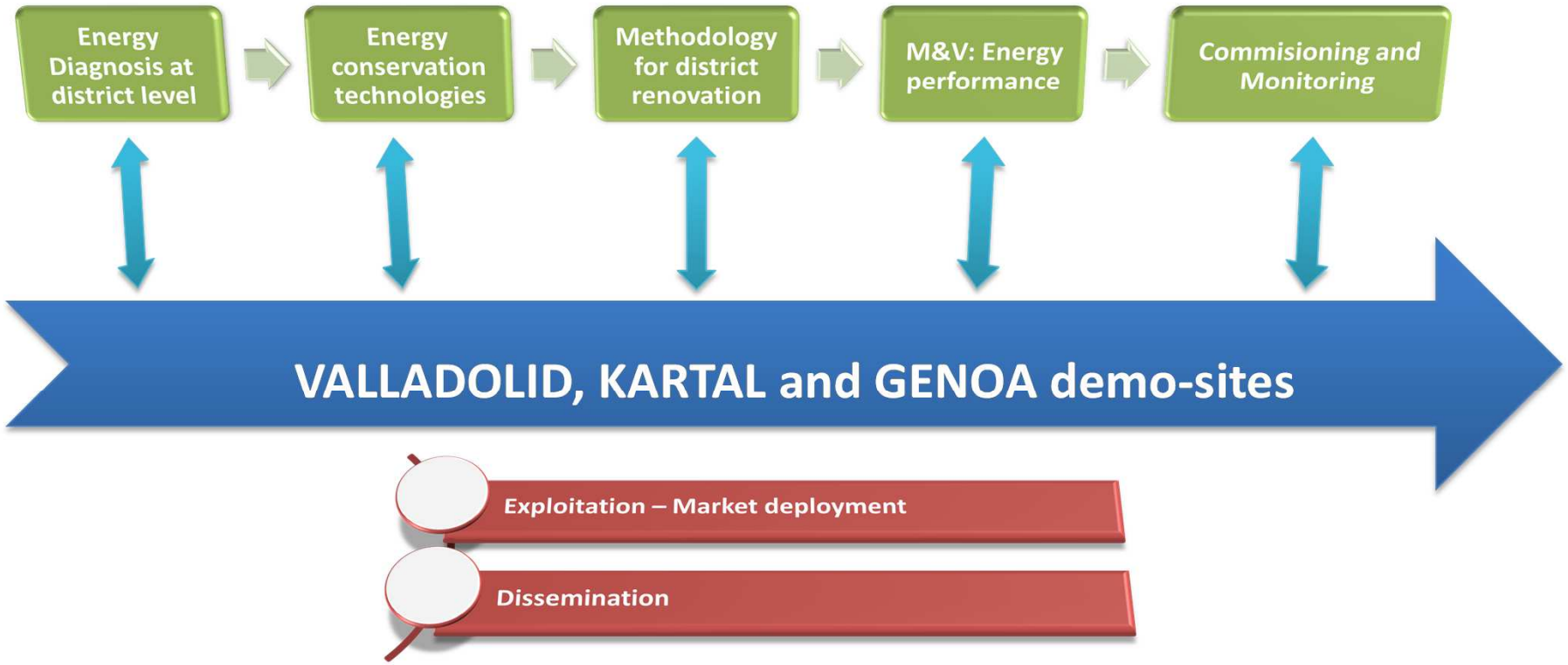
R2CITIES Project Overview



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The Project

Develop and demonstrate replicable strategies for designing, constructing and managing large scale district renovation projects for achieving nearly zero energy cities

GENOA

The social housing district of Lavatrici was developed during 1980-1990. The pilot is located on the west part of the city in the so called Pegli 3 District on a natural hill.

KARTAL

The use of low efficiency lighting systems and appliances and a slim insulation means very high energy consumption for Yakacik district of Kartal, Istanbul and therefore a high potential for improving.

VALLADOLID

A complete retrofitting based on façade improvements, ICTs and renewable energy systems will be implemented in the Cuatro de Marzo district, the demo site chosen for the R2CITIES project.

Expected Impacts

57.000 m2 renovated surface area

60% reduction energy use

860 dwelling involved

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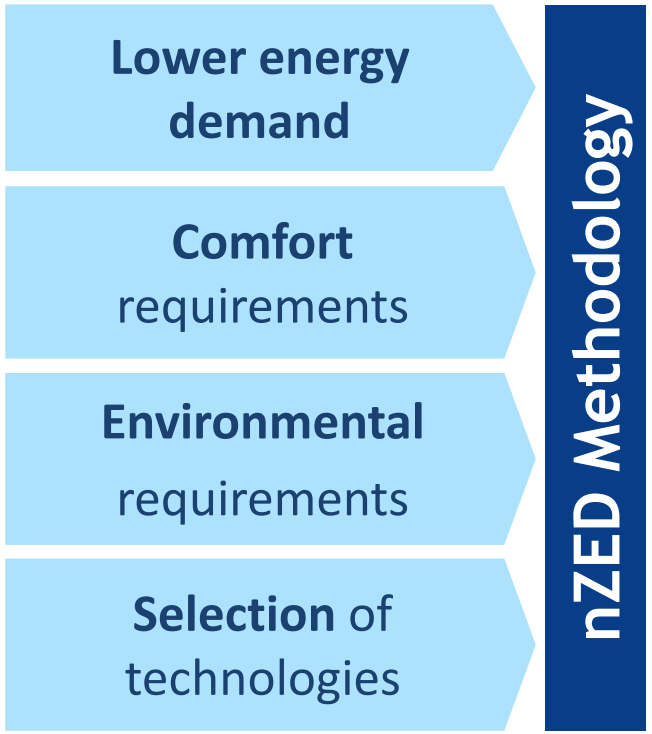
District energy retrofitting design methodology - Objectives

- District renovations are **complex** and require **different stakeholders** to cooperate
- Projects have to focus on **cost-effective energy management** and **environmental sustainability** but also on **social and urban aspects**
- Guidelines are necessary **throughout** the project - diagnosis, design, execution, commissioning, evaluation



District energy retrofitting design methodology

Approach overview

R2CITIES Methodology

√ **Phasing: objectives and expected results**

Specific recommendation for district , considering the building types and the climatic conditions.

√ **Integrated Project Delivery (IPD) +BIM**

Use of IPD principles. Consider the whole value network in the construction process. Recommendations for the use of BIM and energy performance simulation.

√ **District Sustainability Indicators (DSI) matrix**

Establishing scientific criteria for the retrofitting of European districts and cities.

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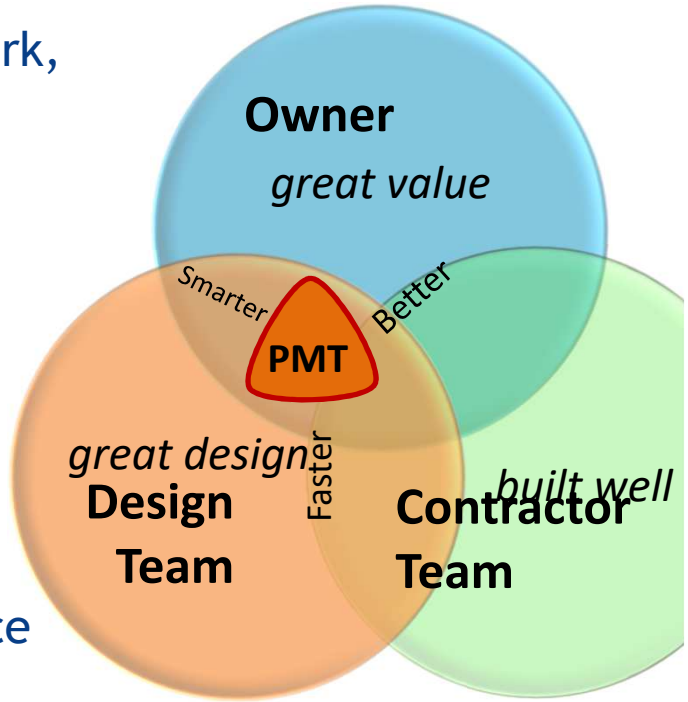
District energy retrofitting design methodology
IPD and BIM

Integrated Project Delivery (IPD)®

- Contractual implications **enhance collaborative** work, stakeholders are engaged early on
- Representatives share **responsabilities, risk and rewards.**
- **Project Management Team (PMT)** ensures project goals are achieved

BIM

- **Maximum** collaborative work.
- Compatibility with LCC, LCA and Energy Performance tools.



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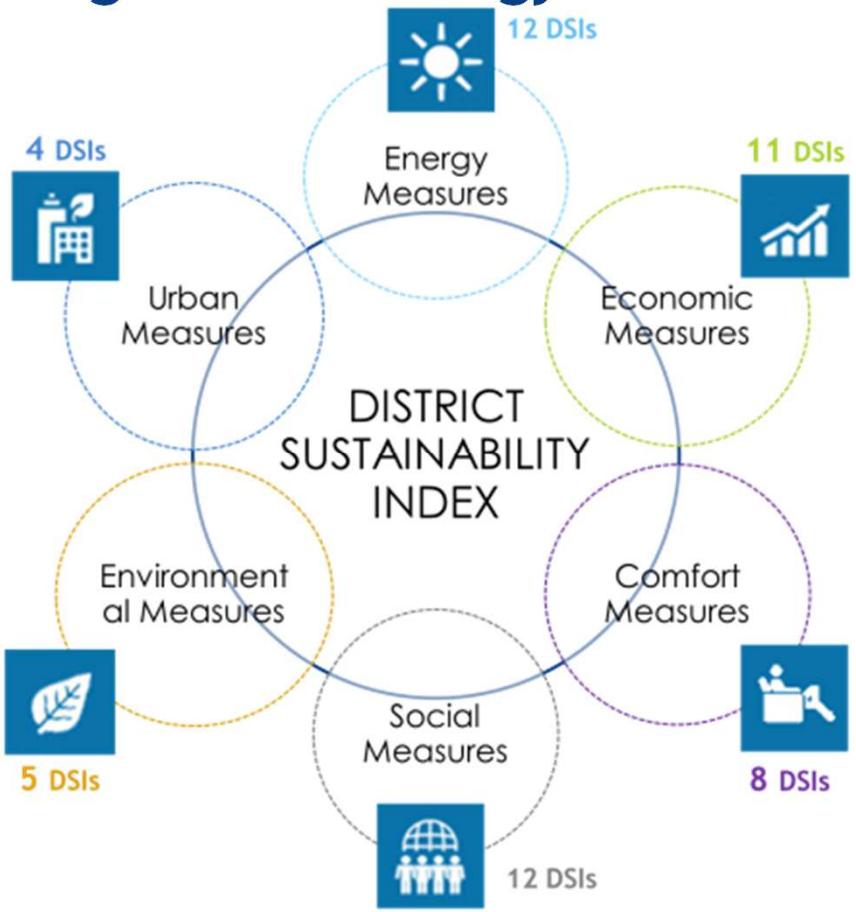
District energy retrofitting design methodology

DSI matrix

- Evaluation **criteria.**
- **CONCERTO** Premium guidelines + extra indicators
- **Normalization, scaling and weighting** criteria.
- **Energy (EN)** category is an input for the other categories.
- Designed for **diagnosis** (baseline), **selection** of alternatives and final **assessment.**



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District energy retrofitting design methodology

DSI matrix

Energy index (12)			Units	Application Phase		
				Diagn.	Eval.	Assess.
EN1	DEN	Density of final energy demand or consumption	kWh/m^{2}a	x	x	x
EN2	Efesu	Maximum and annual/monthly efficiency of energy supply units	kWh/kWh	x	x	x
EN8	ESS	Degree of energetic self-supply	%	x	x	x

Environmental index (5)			Units	Application Phase		
				Diagn.	Eval.	Assess.
ENV1	FEN	Final energy demand and consumption	kWh/m^{2}a	x	x	x
ENV2	PEN	Primary energy demand and consumption	kWh/m^{2}a	x	x	x
ENV3	GHG	Greenhouse gas emissions	t/m^{2}a	x	x	x

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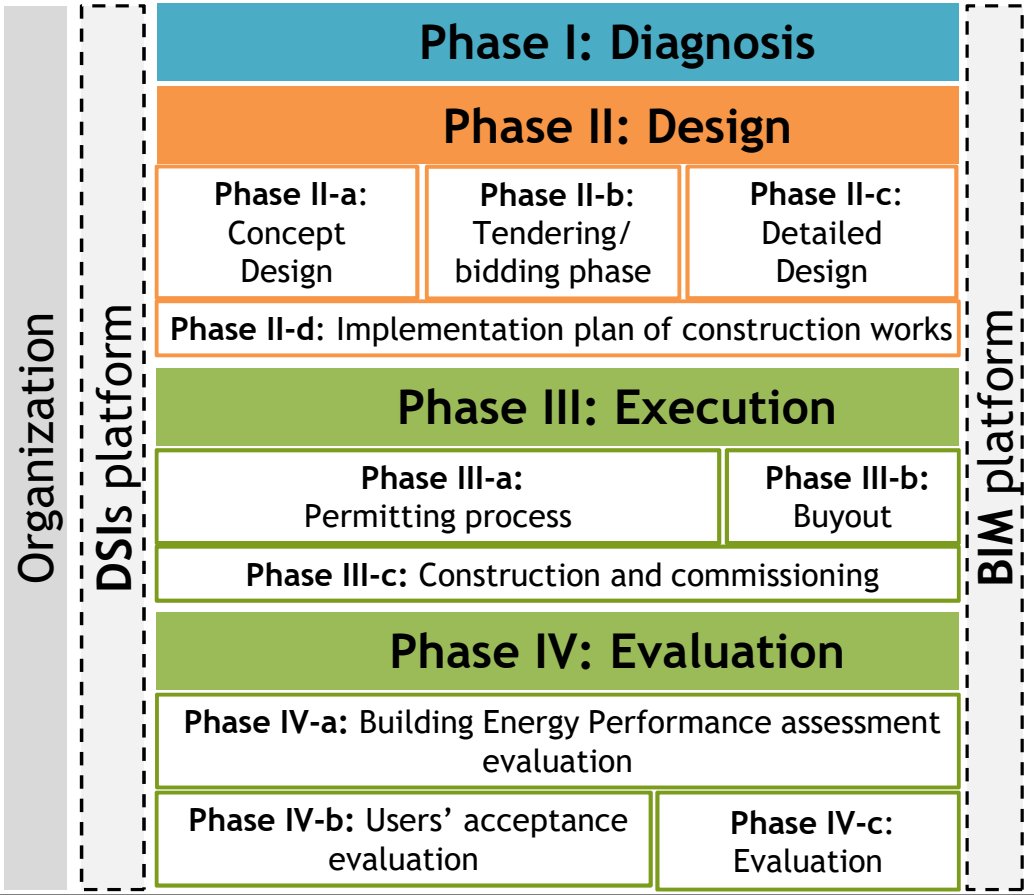
District energy retrofitting design methodology

Phasing

- **Step by step** to ensure that the **design solutions deliver on** with energy efficiency, comfort, cost-effectiveness and sustainability
- **Objectives and responsibilities** are set for each project phase. Common risks and barriers are highlighted, while recommendations cover decision making and project documents contents.



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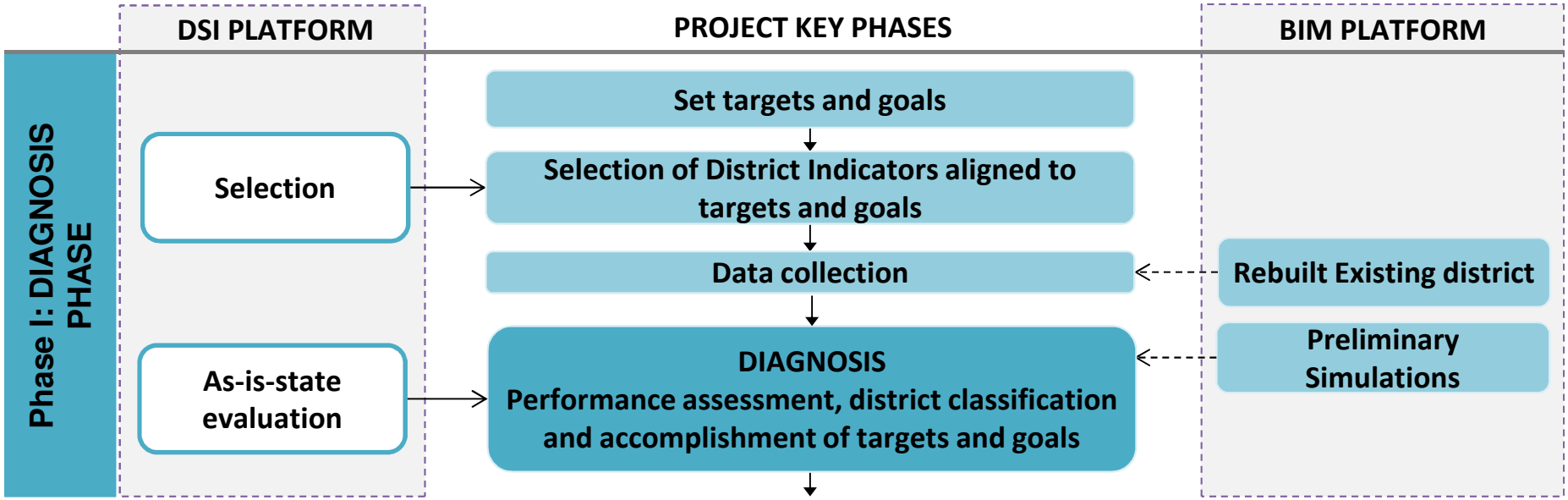
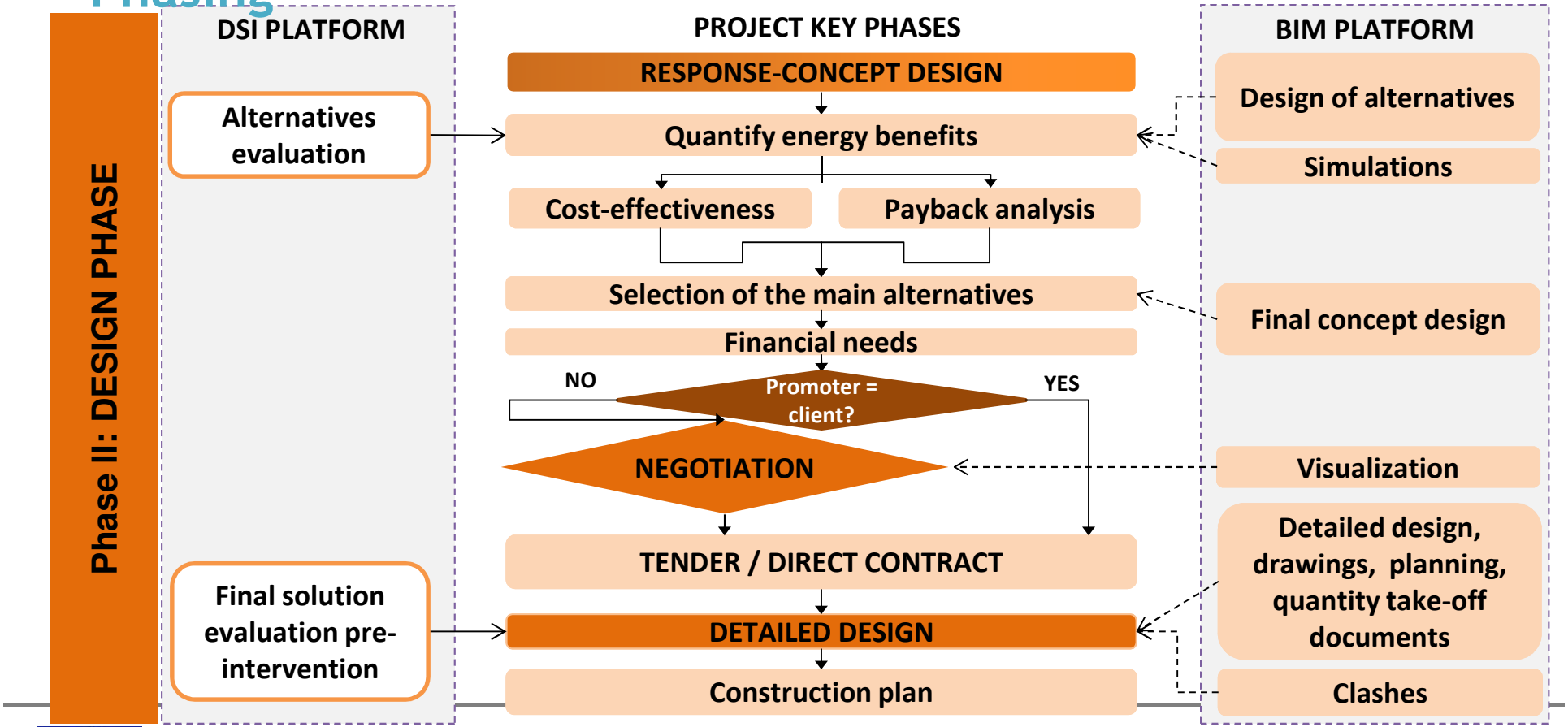
District energy retrofitting design methodology

Phasing



District energy retrofitting design methodology

Phasing



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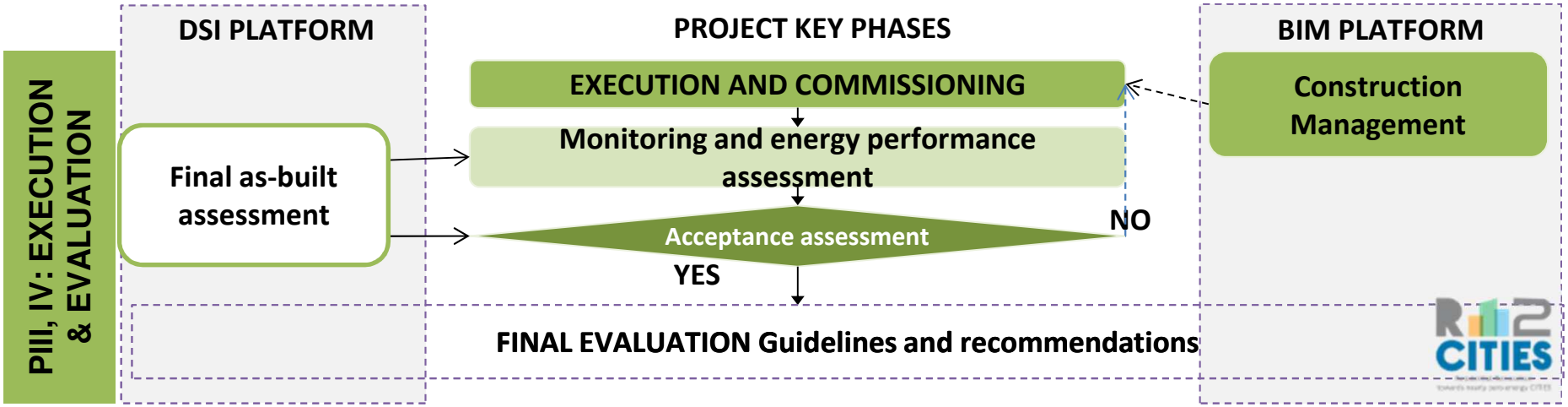
District energy retrofitting design methodology
Phasing



SPEAKER

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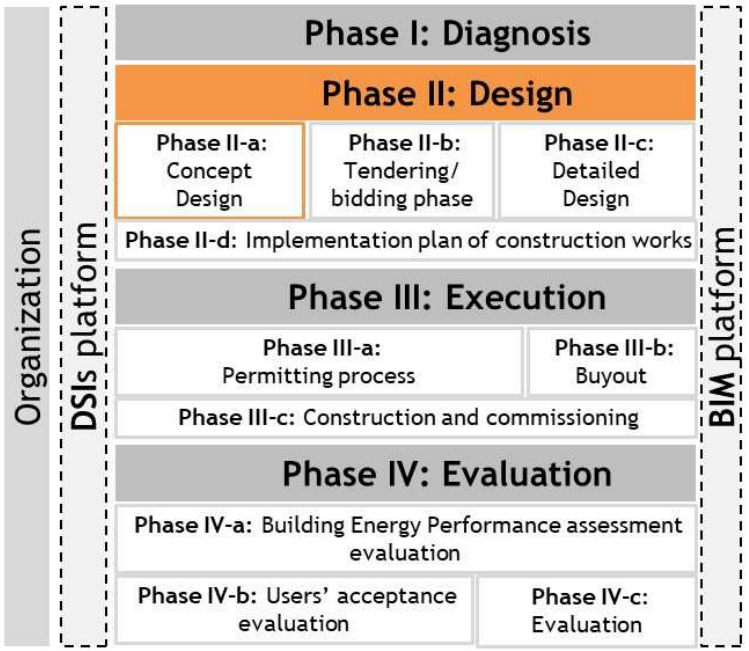
VALLADOLID case study

- Implementation of the Methodology in the R2CITIES demosites
- During Phase II of the Methodology (Design phase)
- For supporting the Decision Maker in the selection of retrofitting scenario



Steps

ECM analysis	Scenario definition	DSI calculation for each scenario
Normalization & weighting	Ranking of Scenarios	Scenario selection

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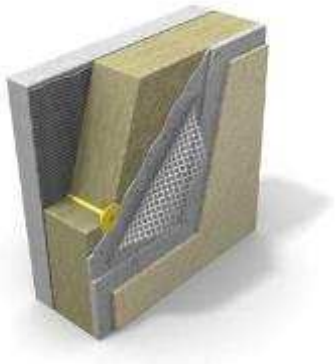
VALLADOLID: ECMs considered

	SOLUTION	code
STAGE 1	Façade solution 1 ETICs solution 60mm ($U \leq 0.38$ W/m²K)	ECM1
	Façade solution 2- Ventilated façade system ($U \leq 0.40$ W/m²K)	ECM2
	New windows or additional external windows (North: $U \leq 2.60$ W/m²K; East, West and South: $U \leq 2.70$ W/m²K) and Glazed enclosure of the balconies ($U \leq 2.80$ W/m²K and SHGC ≤ 0.73)	ECM3
	Insulation below top slab ($U \leq 0.38$ W/m²K)	ECM4
	Insulation above ground slab ($U \leq 0.49$ W/m²K)	ECM5
	Interior partitions between conditioned and no conditioned areas ($U \leq 1.00$ W/m²K)	ECM6
	Adequate ventilation	ECM7
	Biomass boiler District Heating	ECM8
	Programmable thermostatic radiator valves	ECM9
	Efficient lighting systems	ECM10
	Building applied Photovoltaics (BAPV)	ECM11
	Solar thermal collectors	ECM12
	Façade solution 3 ETICs solution 100mm ($U \leq 0.27$ W/m²K)	ECM13
STAGE 2	Solar thermosiphon collectors	ECM14
	Efficient condensation low-temperature boilers	ECM15
	PV parking lot for electric cars charging	ECM16



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VALLADOLID: ECMs considered

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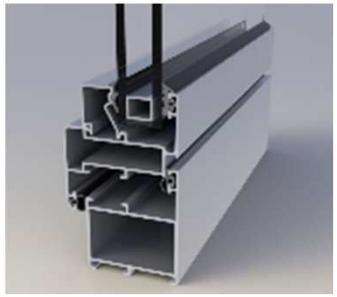

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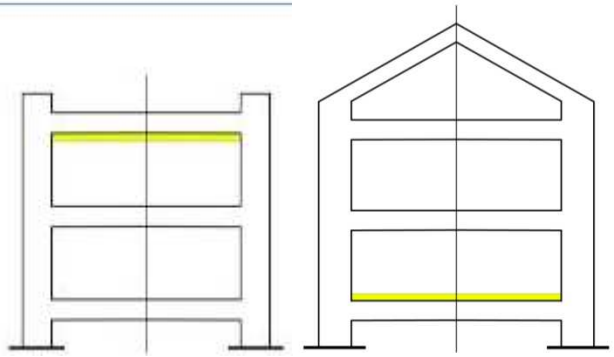

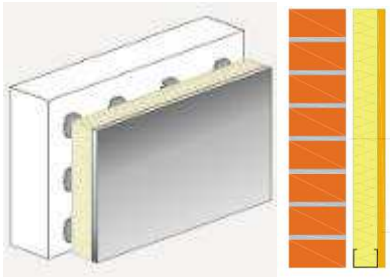

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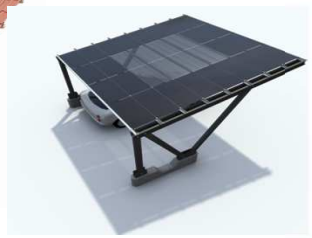
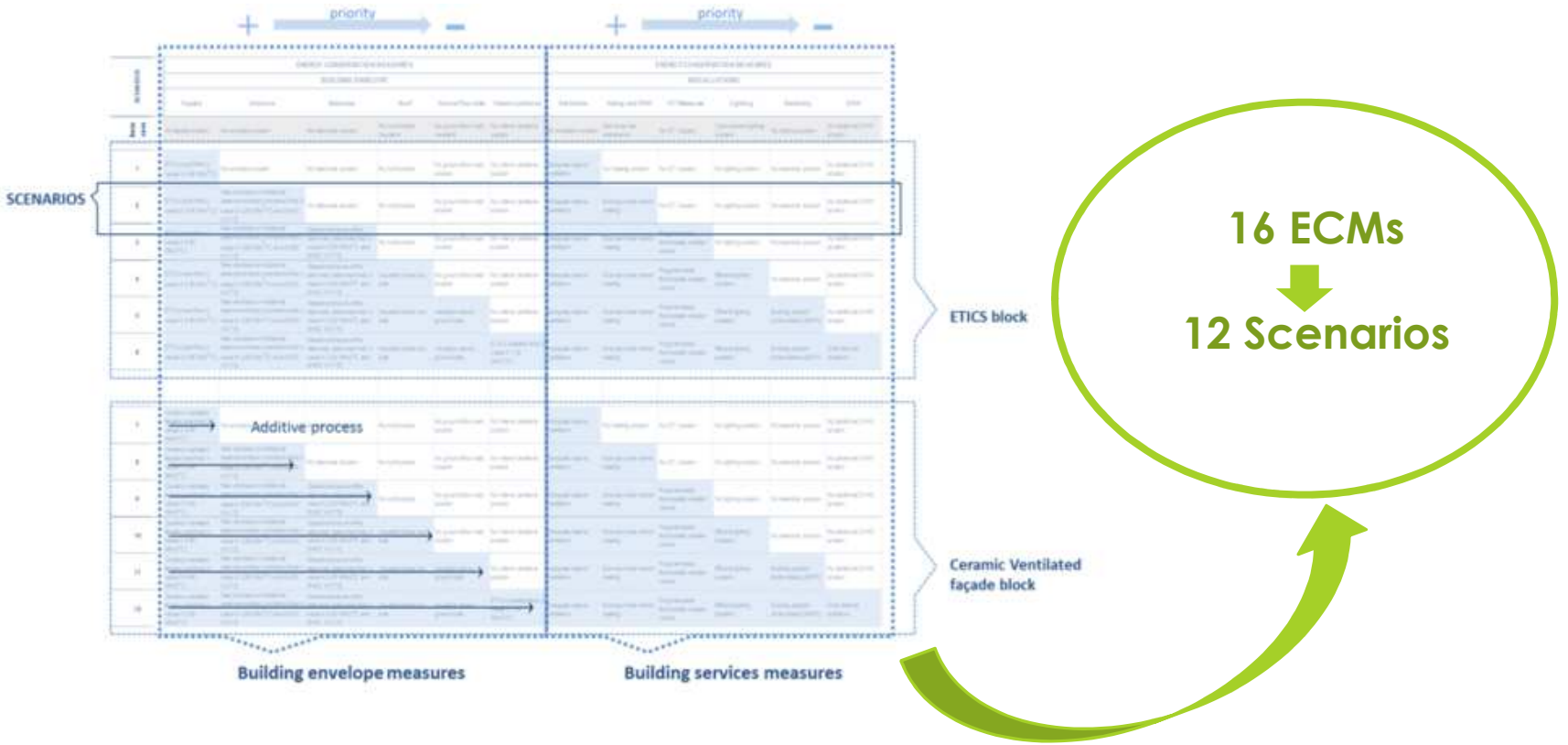
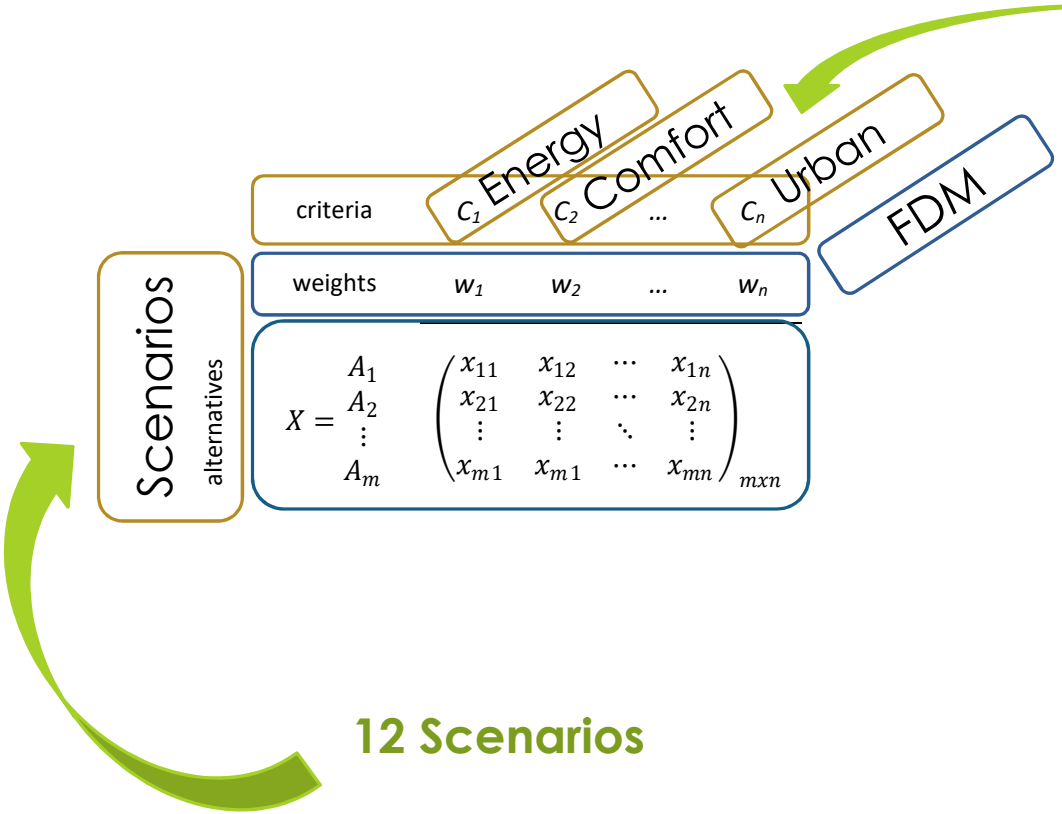
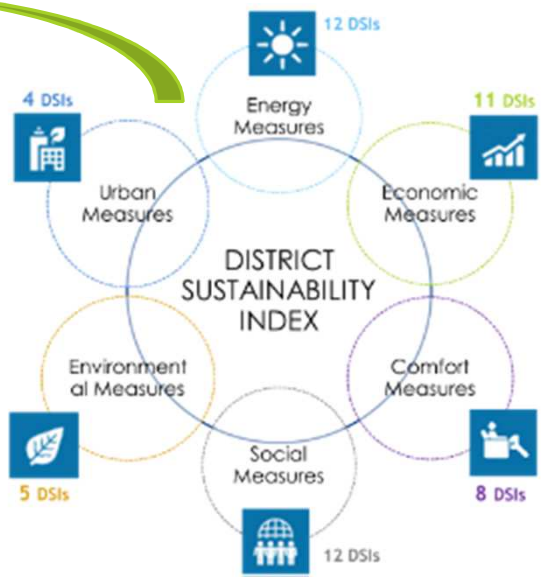


VALLADOLID: Scenario definition

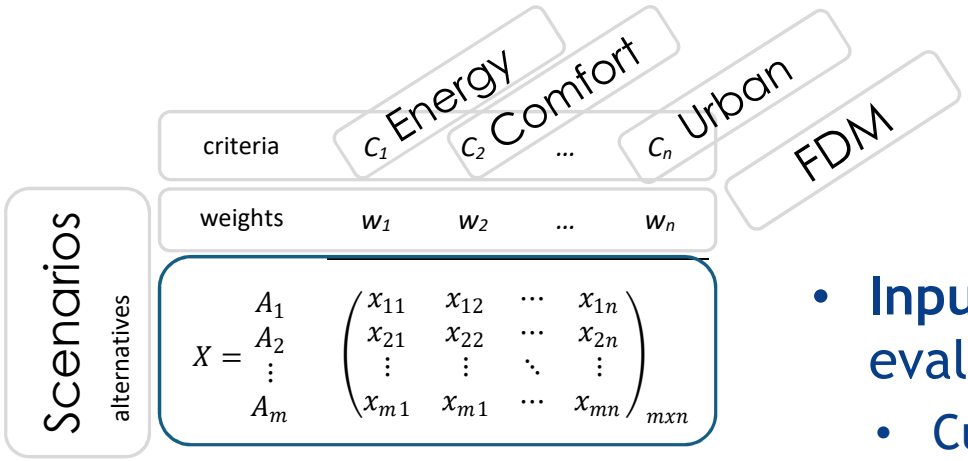


DSIs calculation for each scenario





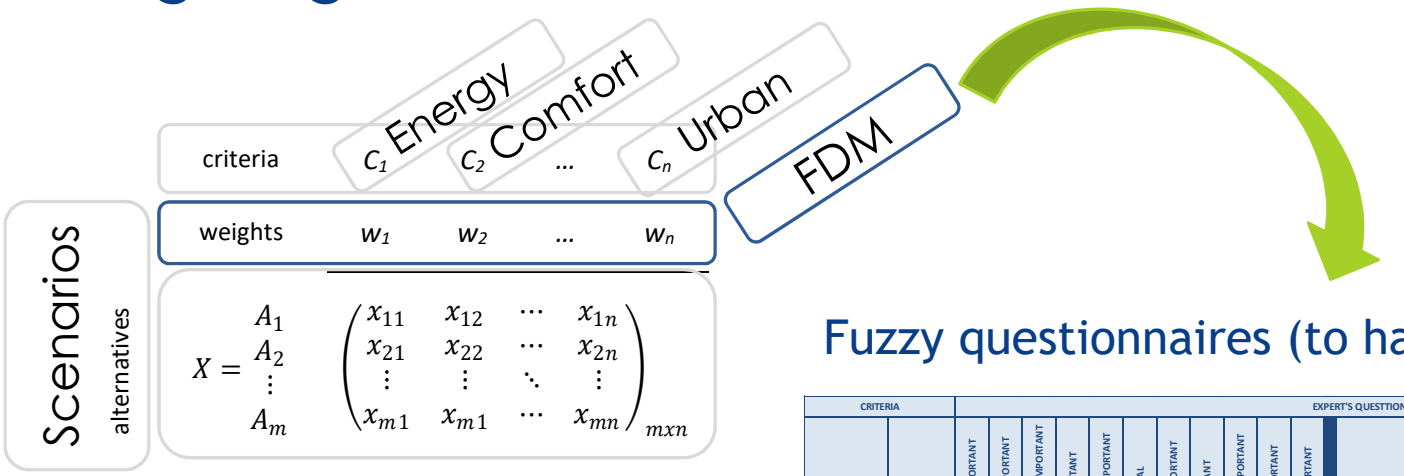
DSIs normalization



- **Inputs** to the evaluation tool:
  - Current status DSI (diagnosis outcomes)
  - Boundaries per DSI
  - Target per DSI
  - Status of each DSI for each candidate scenario

Matrix normalization

Weighting of DSIs



Fuzzy questionnaires (to handle uncertainty)?

CRITERIA			EXPERT'S QUESTTIONAIRE												
DSI		UNITS	VERY UNIMPORTANT	QUITE UNIMPORTANT	SOMEHOW UNIMPORTANT	UNIMPORTANT	NEARLY UNIMPORTANT	NEUTRAL	NEARLY IMPORTANT	IMPORTANT	SOMEHOW IMPORTANT	QUITE IMPORTANT	VERY IMPORTANT	GRAPHICAL REPRESENTATION	EXPLANATION OF DSI MEANING
			0	1	2	3	4	5	6	7	8	9	10	REPRESENTATION	
EN1	DEN	kWh/m²a	0	0		a		c		e		0	0		Density of final energy demand or consumption
EN3	Pesu	kW	c	d	0	e	0	0	0	0	0	0	0		Maximum and annual/monthly power of energy supply units

Fuzzy Delphi Method → from opinions with uncertainty to weights

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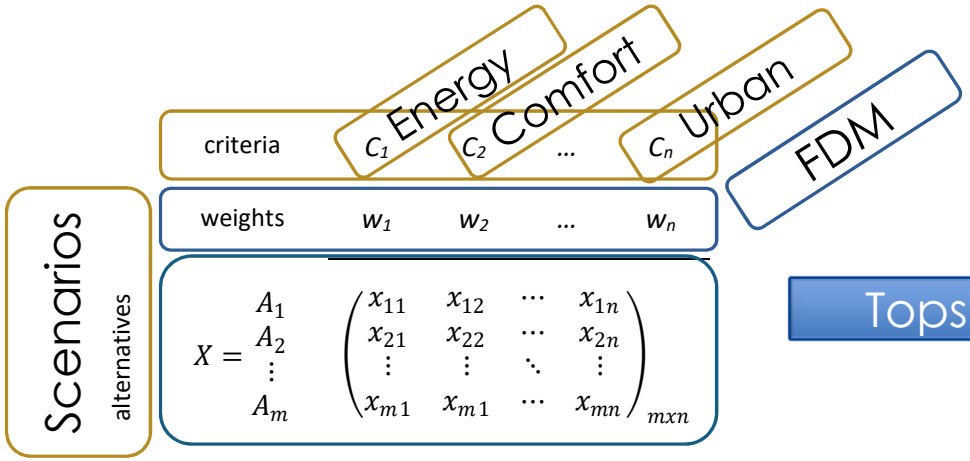
Basis of Decision Support for District Retrofitting: how does it work?

- CONCERTO PREMIUM – SCIS indicators used not only in monitoring
- Part of R2CITIES METHODOLOGY [design support tool – Fuzzy Delphi Method & TOPSIS approach]



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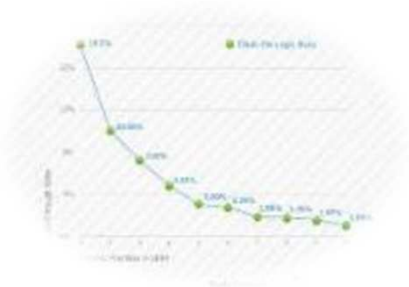
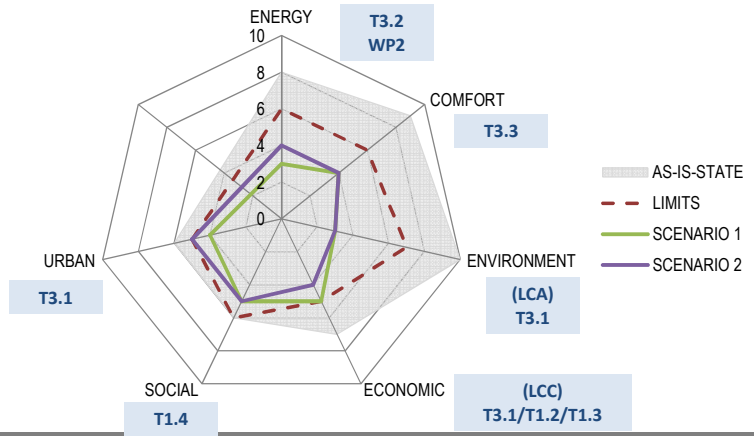


RANKING



SUSTAINABILITY INDEX: DSI

VALLADOLID: Ranking of Scenarios

SCENARIO	INDEX VALUE							
	ENERGY	ECONOMIC	COMFORT	SOCIAL	ENVIRONMENT	URBAN	SCORE	RANKING
1	0.409	0.620	0.342	0.540	0.010	0.321	0.256	12th
2	0.455	0.563	0.323	0.541	0.619	0.396	0.573	10th
3	0.493	0.491	0.454	0.541	0.735	0.435	0.700	5th
4	0.554	0.453	0.380	0.541	0.780	0.471	0.692	6th
5	0.522	0.456	0.390	0.541	0.913	0.536	0.753	2nd
6	0.437	0.577	0.425	0.540	0.240	0.402	0.358	11th
7	0.472	0.508	0.399	0.541	0.671	0.453	0.647	8th
8	0.502	0.481	0.407	0.541	0.835	0.488	0.775	1st
9	0.553	0.411	0.427	0.541	0.809	0.517	0.707	4th
10	0.521	0.394	0.432	0.542	0.907	0.582	0.728	3rd
11	0.508	0.572	0.345	0.541	0.543	0.533	0.592	9th
12	0.463	0.511	0.347	0.541	0.714	0.566	0.671	7th

SCENARIO	INDEX VALUE							
	ENERGY	ECONOMIC	COMFORT	SOCIAL	ENVIRON.	URBAN	SCORE	RANKING
1	0.409	0.62	0.342	0.54	0.01	0.409	0.321	4th
6	0.437	0.577	0.425	0.54	0.24	0.437	0.402	3rd
11	0.508	0.572	0.345	0.541	0.543	0.508	0.533	2nd
12	0.463	0.511	0.347	0.541	0.714	0.463	0.566	1st

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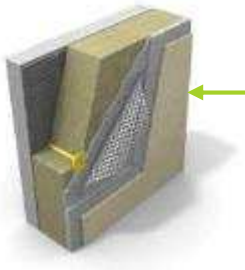
VALLADOLID: Description of Selected Scenario



SOLUTION	code
Façade solution 3 ETICs solution 100mm ($U \leq 0.27$ W/m²K)	ECM13
New windows or additional external windows (North: $U \leq 2.60$ W/m²K; East, West and South: $U \leq 2.70$ W/m²K) and Glazed enclosure of the balconies ($U \leq 2.80$ W/m²K and SHGC ≤ 0.73)	ECM3
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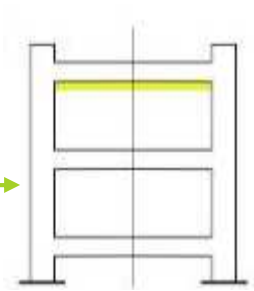

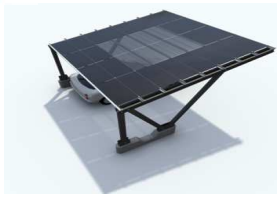

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DEMOSITES general information

GENOA

Energy efficient measures:

- Windows replacement
- Replacement of gas boilers by new condensation boilers. Variable flow pumps
- Individualization of dwellings (electrovalves)
- Advanced control and monitoring
- PV plant in roof (13kWp for thermal plant supply)
- In-situ laboratories (full monitoring)

KARTAL

Energy efficient measures:

- Envelope insulation improvement (thermal bridges elimination)
- Glazing replacement of all windows
- Radiant heating and cooling (low temperature)
- Renewable energies (Energy mix)
  - Solar thermal on roof
  - Heat pumps with geothermal and heat recovery
- Efficient lighting (LED)

VALLADOLID

Energy efficient measures:

- Façade retrofitting (ETICs insulation)
- Roof insulation
- Windows Replacement (doubling existing)
- Solar thermal (60% DHW)
- New Boilers (min COP: 1.0)
- PV parking lot (4.2 kWp)
- ICT (thermostats, improved control)

SPEAKER

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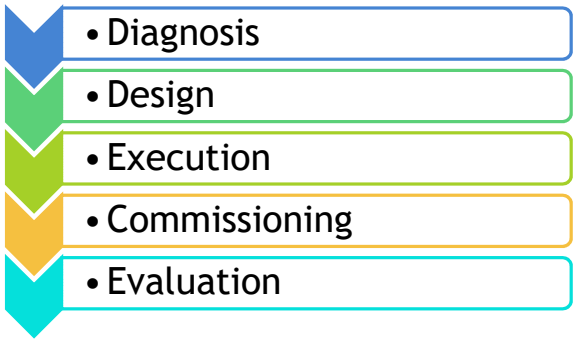
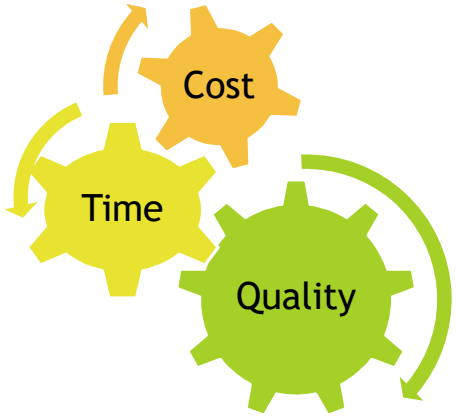
Methodology

- systematically design complex renovation projects in **all phases**
- improve **decision-making** and management of large-scale retrofitting projects
- overcome **technical barriers** of large scale retrofitting activities
- assuring **targets are reached** within specified time and cost frames and desired quality





Unique Selling Point

Improving your decision-making and management

keeping your retrofitting project in the right path!

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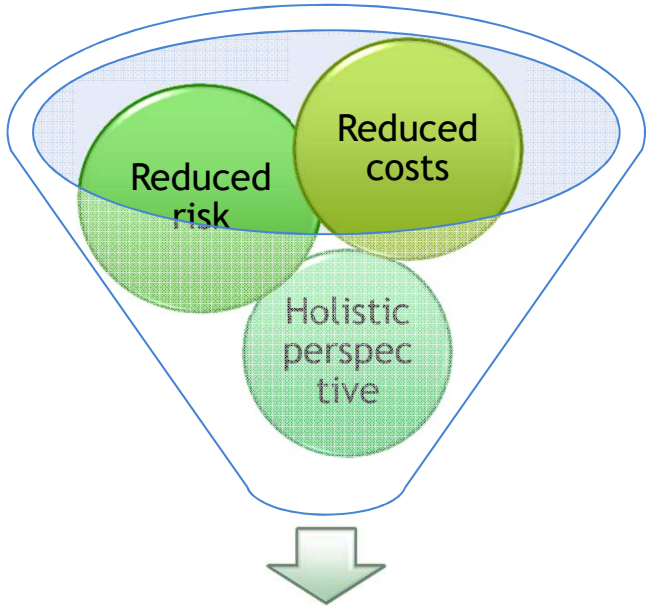
Values

- ✓ **Reduces costs and risks**
  - ▶ avoiding mistakes that occur in construction phase due to a misconceived design
  - ▶ detecting system failures by constantly gathering information
- ✓ **Gets the job done**
  - ▶ improving project management and collaboration among stakeholders
  - ▶ validated on 3 different districts
- ✓ **It is holistic**
  - ▶ ensures covering many aspects: energy, economic, sustainability, comfort, social, urban

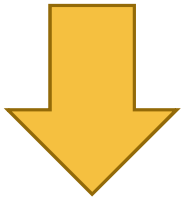


Product Benefits

Integrated methodology serving as a **decision-support tool**

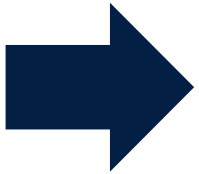
to select the optimum district energy retrofitting intervention

enabling



energy consumption
material usage
CO2 emission

energy **efficiency**
renewable energies use
economic feasibility



Zero-Energy Districts & Cities

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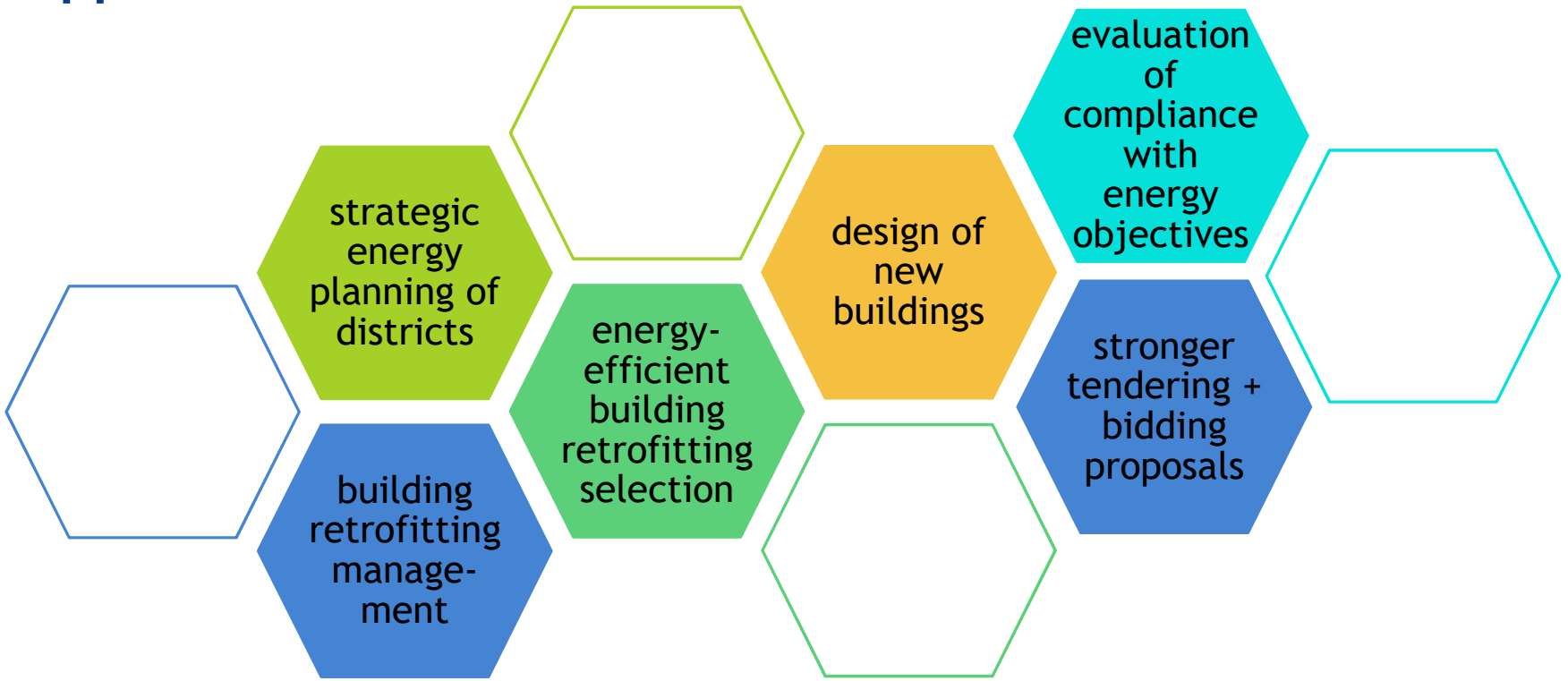
Application Fields



How Municipalities Benefit

- ✓ obtain **tools to plan and implement** large scale urban retrofitting projects
- ✓ perform **district analysis** prior to the interventions
- ✓ **improve decision-making** in building energy retrofitting considering various factors (costs, consumption, emissions, RES, comfort)
- ✓ **assure energy performance** after retrofitting interventions in order to fulfil energy efficiency obligations
- ✓ organize workflow in a multi-stakeholder project team
- ✓ **enhance involvement** of various stakeholders

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How Building Construction Companies Benefit

- ✓ **reduce risks** in conducting large-scale renovation projects
- ✓ **assure energy performance** after retrofitting interventions
- ✓ **reduce personal costs** due to time savings
  particularly in the design and decision-making process
- ✓ **improve organizational tasks** and communication workflows
  before/during/after an intervention
- ✓ **attract further customers**

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Product Offers

Consulting Service

- identify optimum energy efficiency retrofitting interventions
- review procurement methods
- set goals and KPIs

Software Tool

- evaluate results of different interventions under a common method
- assign project responsibilities and track results
- assure quality for in-house projects
- include the methodology as part of other training program

If you are interested please contact:

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