

# PROJECT OVERVIEW

R2CITIES provides an easy-to-use framework for designing and managing large-scale residential district renovation strategies for achieving nearly zero energy cities.

The results of this European demonstration project are now being made available to empower towns and cities to reduce their energy consumption, become more eco-friendly and meet the demands of citizens.

At three real district demonstration sites in different countries, R2CITIES has applied a set of techniques and technologies, which include energy performance and savings plans, district sustainability indexing, rigorous measurement and verification, and guidelines on making a business case for renovation. Energy consumption at the demo districts has been brought down by as much as 50%.

Insights and resources	
Energy conservation technologies	Optimised use of modern building and insulation materials, renewable energy sources, ICT applications, measuring equipment, heat recovery and cooling systems
Holistic methodology for district renovation projects	A definition of district sustainability indicators (DSIs) for a replicable framework to support decision-making Specific building and district solutions and guidelines based on integrated project delivery applied to real districts Integration of building information modelling and life cycle analysis to ensure sustainable renovation
District monitoring	Rigorous verification of energy savings using international protocols such as IPMVP User comfort impacts and sustainability ratings included in the DSIs for broad monitoring scope Real-time performance tracking for immediate feedback Cost-effective technology use and control strategies
Energy data management	Web-based energy data manager for buildings and districts Energy management platforms (EMPs) for data collection, sharing and storage Predictive energy-efficient control scenarios District monitoring platform (DMP) to retrieve and aggregate data from different sites for DSI visualisation, strategy definition and benchmarking
Standards and regulations	References obtained from demonstration districts will be fed into the Smart Cities Information System to provide guidance on best practice and policy-making
Business planning (exploitation)	Support for long term replication and deployment strategies that reduce costs and risks, based on tested real-world scenarios Sustainability metrics offer interesting insights on making a serious business case for district renovation in other places

# RESOURCES AVAILABLE

- Discover the R2CITIES reports on integrated design methodology applied to district renovation, energy performance analysis and social acceptance
- Learn more through articles, interviews and videos on the R2CITIES website: [r2cities.eu](http://r2cities.eu)
- Consult our experts on how to deploy the framework in your districts
- Get a free copy of our best practices book

## THE CONSORTIUM



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R2CITIES is a member of the My Smart City District cluster and community



Residential Renovation towards nearly zero energy CITIES



Designing and delivering strategies for energy retrofitting of urban districts  
The smart way to renovate residential districts



[www.r2cities.eu](http://www.r2cities.eu)



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# Who can benefit from R2CITIES?

## MUNICIPALITIES AND CITY PLANNERS:

The tested framework enables a viable scenario to be built for renovating a district according to a sustainability index. In this way, one reduces risk and pre-empts difficulties before they occur. Furthermore planning policy can be better refined to fit real conditions.

“The R2CITIES framework enabled us to establish a successful analysis on a city district for energy efficiency based renovation projects. The project, which is important for livable spaces and a sustainable environment, has created awareness and a role model in the field of energy efficiency. In that sense it is a powerful tool for decision makers at every level.”

Burak Korkmaz – Kartal Municipality

## TENANTS AND RESIDENTS ASSOCIATIONS:

In addition to energy-saving measures, the project closely examines how residents adopt the new technologies and assesses their perceived comfort levels. Rigorous monitoring of energy parameters ensures transparent data about energy savings and cost reduction for residents.

“It was really interesting to be part of a European project in which real interventions was done and put in place in the district. I'm a tenant and I'm used to spending time in my house, it was nice for me to cooperate with the project team giving my feedback.”

Sergio Pandolfini – Comitato Quartiere San Pietro residents' association, Genoa

## CONSTRUCTION COMPANIES AND ARCHITECTS:

Workflows with multiple stakeholders across the value chain are greatly enhanced, thus saving time and money. The key performance indicators and energy performance monitoring facilitate decision making and economic analysis. Risks and personnel costs are reduced through better design and decision making.

“By using the R2CITIES methodological approach, the various stakeholders identify and work towards shared goals from an early stage. The key advantage is optimised design and efficient execution of the renovation works.”

Javier Bonilla Diaz – Acciona Construcción

## POLICY MAKERS AT ALL LEVELS:

R2CITIES has produced a set of best practices, and captured energy performance data on which policy decisions and future regulations can be built. Results contribute to the Smart Cities Information System to inform a wide group of policy makers on a European level.

“The district energy performance observed after the retrofitting is the best example of the project's success. Sharing the acquired experience and data will strengthen European transformation at all echelons of policy making. It contributes to an evidence-base to enable sounder policy making that takes into account both the technical and non-technical aspects of district renovation.”

Cecilia Sanz Montalvillo – Fundación Cartif

## THE RESEARCH COMMUNITY:

R2CITIES methodological approach combined with various energy saving measures offers a benchmark for analysing energy efficient systems and comparing scenarios.

“As a research institute, we established linkages with industry and public that gave us fresh vision for solving problems in practice. We have developed more disciplined and commercial approaches whilst improving effectiveness of management across the whole project processes to overcome some critical challenges.”

Hatice Sozer – Istanbul Technical University

## FOR DEVELOPERS AND INVESTORS:

R2CITIES offers a viable methodology that embraces more than specific energy efficiency renovation. It combines state-of-the-art data management payback analysis and business planning to ensure renovation is commercially and sustainably viable.

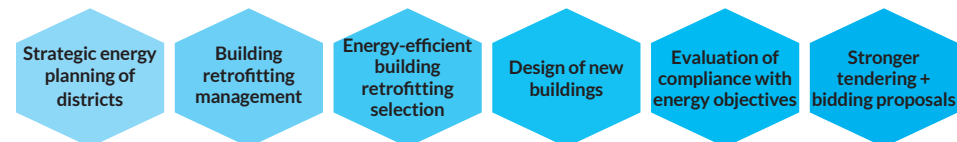
“R2CITIES is a Smart City project that confirms to the market that a systematic approach is needed: adequate business models and high quality technical interventions, which guarantee energy performance and savings, allow the replicability of future Smart City projects as well as the creation of a trustable energy efficiency market.”

Giovanni Tordi – Officinae Verdi SpA

# How it works

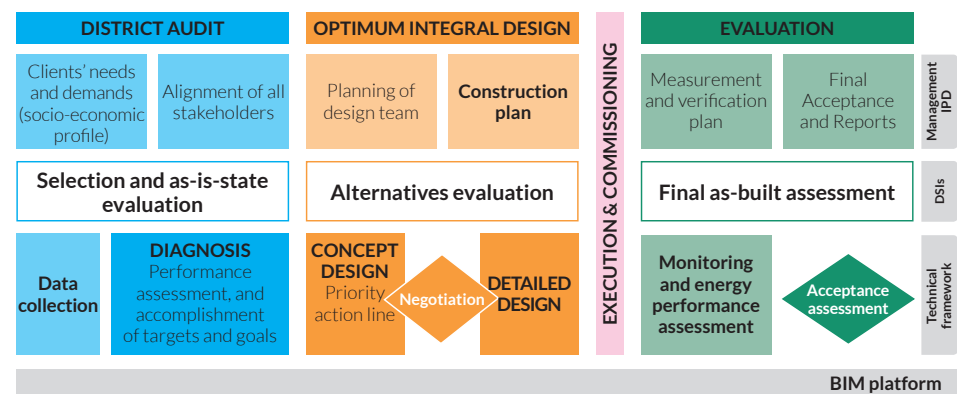
A design methodology has been developed to enhance planning and implementation of an integrated energy retrofitting process at district level. It enables optimal solutions to be set out by evaluating a set of District Sustainability Indicators while drawing on Integrated Project Delivery and Multi-Criteria Decision Making.

## R2CITIES methodology scope



### The 4 stages of the R2CITIES methodology

- District audit
- Evaluation of energy conservation measures and optimum integral design
- Retrofitting works, operation and maintenance
- Measurement and verification of energy savings and acceptance plan



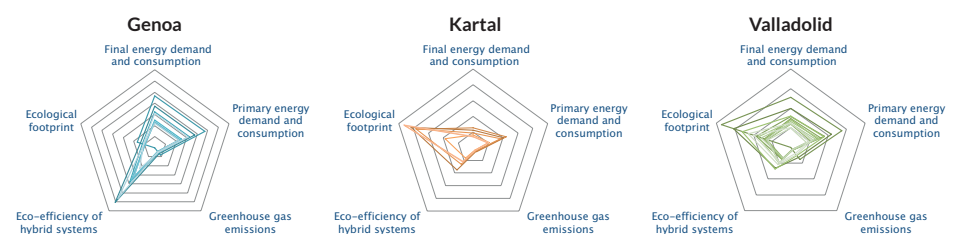
## Methodology deployment at the 3 R2CITIES demo districts

Concept design ensures a sound scenario-building process allowing the holistic renovation framework to adapt to the specificities of each district.

District sustainability indices (DSI) are calculated for each aspect to allow the right energy conservation measures to be selected.



### 3 very different interventions – one holistic framework



# Real-world results

Real districts have been used to demonstrate how renovation can be planned, delivered and monitored. Three sites were selected for renovation as a way to challenge and prove the effectiveness of the R2CITIES approach in different scenarios: climates, countries, building types and user habits.

## Kartal - Turkey

In the Yakacik district of Kartal, lighting systems, appliances and insulation were inefficient. R2CITIES solutions cover passive design, heating and cooling sources, and integration of renewables.



- Heat insulation on exterior walls, energy-efficient façade (double glazed and Argon-supported windows)
- Water and air sourced heat pumps and 150 solar collectors installed over an area of 2,121m<sup>2</sup>
- Eco-friendly lighting solutions with KNX-standard control (LED lighting with motion sensors, presence detectors and daylight sensors)
- Building Information Modelling to manage complicated infrastructure
- Water management system (Greywater)
- Energy monitoring and management software

## Valladolid - Spain

The Cuatro de Marzo district is a highly populated housing estate with medium to poor construction quality. R2CITIES has provided a combination of insulation technology, shading, renewables and ICT applications.



- 11,790m<sup>2</sup> of private dwellings retrofitted across 13 different buildings
- Involvement of 390 inhabitants in the funding scheme of the energy retrofitting intervention
- 60% domestic hot water covered by solar energy
- 2,300 kW worth of high-efficiency boilers installed in individual dwellings
- Advanced window, façade and roof insulation fitted over some 10,900m<sup>2</sup>

- Smart lighting in common areas within the buildings for electricity savings of 40%
- 6 buildings selected by data mining techniques in order to monitor and then extend results
- Technology transfer among local SMEs through this intervention (local builders selected by each building community)
- 3.7 kWp Photovoltaic plant in a 37.5 m<sup>2</sup> Parking-Lot that will be used for feeding an e-vehicle charging point

## Genoa - Italy

Genoa's Lavatrici council estate has benefitted from passive and low-cost solutions drawing on natural resources. Overall energy savings stand at 53%.



- Retrofitting of 162 dwellings covering a net area of 12,123m<sup>2</sup>
- Replacement of metallic windows with new PVC windows with a U-value of 1.18 W/m<sup>2</sup>K
- Installation of domotic units for use by residents
- 13 kWp rooftop photovoltaic plant covering the heating system's electricity consumption
- Close collaboration with residents' association for social acceptance of interventions

- 4 in-situ laboratory flats for monitoring energy performance and indoor comfort
- Renovated heating system with new boilers and enhanced building envelope
- 89% of tenants are satisfied: more comfortable temperatures, improved sound insulation and better air quality