

**young cities**

Developing Urban Energy Efficiency  
Tehrān-Karaj

**Young Cities Research Briefs | 15**

# Eva.S: Evaluation Strategies and Data Processing of Indicator Values

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# 1 Executive Summary

Process orientated indicator values are helpful tools for net working, visualization and for the understanding of complex systems. A evaluation and monitoring system is internationally needed and accepted according to the International Standards and indicators used by the BNB/DGNB, BREEAM, LEED, African Green City Index (GCI), Asian GCI, European GCI, ESTIDIMA (Pearls), GREEN Pyramids. The newly established *Eva.S* evaluation tool represents a challenge as much as a competent opportunity and toolbox for project development, assessment and management of the project progresses.

A comprehensive strategy is necessary to enable a relevant, scientific monitoring to capture and assess qualitative and quantitative effects related indicators of the measures planned and/or realized the first time by *Eva.S* and the YC-Project. The YC-Project working phases were attended during data mining by evaluation matrices and visualization of results by so-called radar diagrams from the beginning on.

The development and realization of a project is a process in several distinct project-phases and this will certainly not end with its implementation. Sectorial considerations and therefore possibly inefficient measures in case of changes in the project can be prevented because the presented interaction and feed back effects in a within the evaluation and monitoring strategy is integrated from the beginning on of the project with the focus on the analysis of work flow and rating checks.

The now available evaluation tool *Eva.S* serves as an instrument for the project participants to handle and present their dimensions (fields of action), categories i.e. CO<sub>2</sub>, energy efficiency, sustainability, work packages and finally to present the overall results in a clear and manageable way. Because of the numerous projects and possibilities of *Eva.S* and its multiple applications and visualization of the processes for interpretation and competent communication to public the indicators values and the investigated evaluation strategy are of significant relevance and acceptance for planning, construction and process orientated monitoring as well as “grade of achievements” for Megacities, New Towns and New Urban Settlements.

## 2 Methods of Data Evaluation and Rating

### 2.1 Data sets, handling of data and the data bank

The project relevant data are processed in a format of quantitative and qualitative indicators selected in categories like CO<sub>2</sub>, Energy, Water, Air Quality, Water and Land Use, Social-cultural quality, Economy, Environmental Management. The sustainability has to be proved by social-cultural quality, ecological quality and economic quality after the classical technical qualities of sustainability. This operation is resulting in a set of project specific indicators. The effect related indicators and measures selected are finally proved and visualized as results and rated in a radar diagram. The indicator concept includes a rating system 1–10 (Table 1).

Rating Level	
Definition 1–2	best practice
Definition 5	accepted average value
Definition 8–9	most worse rating
Definition 10	failure/criteria to prove a failure
The rating 3, 4, 6, 7 reflects to project specific indicators	

Tab. 1: Rating Level 1–10

The rating system is similar to the common rating tables of the International Standards (ISO, CEN) to demonstrate in particular the “grade of achievement” of the measures.

Original data sets were mined and organized in a matrix by the topics: strategic dimensions, work packages (WP), objectives, measures, impact, input indicators (data of initial situation), objective indicators, target values (qualitative and quantitative) and measuring methods. At this time the data bank contains 135 original data sets. In the individual data sets the project rating is always implemented.

The 135 data sets are allocated in 26 dimensions:

- Awareness Raising
- Environmental Assessment
- Capacity Building

- Life Centre/Structural Design
- Life Centre/Energy
- Life Centre/Architecture and Engineering
- Transport and Mobility
- Urban planning and design
- Climatology
- Water and Waste Water Management
- Energy Management
- Energy-efficient Homes – Urban Design and Architecture
- Integrated Urban Infrastructure Technologies
- Office Building/Energy
- Office Building/Architecture
- Office Building/Structural Design
- Modern Iranian Housing/Energy
- Modern Iranian Housing/Architecture
- Modern Iranian Housing/Structural Design
- New Quality Building/Energy
- New Quality Building/Architecture
- New Quality Building/Structural Design
- New Technology/Energy
- New Technology/Architecture
- Technology/Structural Design

The 26 Dimensions were condensed and evaluated according to three fields of action (FoA): Reduction of Resources—Consumption, Energy and Climate and Sustainability. For feeding and editing *Eva.S* a solid data base of the dimensions and a set of relevant and productive evaluation criteria for the field of actions is of fundamental importance. The mining of the data was in close connection to the given objectives as well as to the work packages of the YC project and feed back by the project teams.

## 2.2 The work flow for managing the data

- Step 1: data mining, organization project data in matrices and indicator templates (Figure 2)
- Step 2: data feeding the *Eva.S* evaluation tool by project data sets
- Step 3: data check by a multi array grid (processor) for sustainability criteria
- Step 4: monitoring and decision loop, resulting products and alternative strategies
- Step 5: dissemination of results, rating of results and visualization

### Step 1:

Data mining, organization in matrices (Figure 1a and b): dimensions, condensed field of action and selection of a set of project related specific indicators (Figure 2).

SD Dimension	WP	Objective	Strategies	Measures	Impact	Impact Indicators	Objective Indicators	Target Values	Measuring Methods
Urban Planning and Urban Design	1. Mixed used Schemes	Reduction of fossil energy use and carbone emissions	Reduction of distance travelled	Horizontal and vertical mix of uses combined with compact urban form	Short way structure decreases-ing motorized traffic	Inhabitants per ha	CO <sub>2</sub> in g/capita (compared to other quarters of HNT)	Reduction of CO <sub>2</sub> emissions by 4-7% per capita (BBR, Germany)	Simulation and comparing results with realized projects

Fig.1a: Urban Planning and Urban Design, Mixed-Use Schemes: Field of Action Energy and Climate, Team 1 Strategic Dimension.

FOA Strategic Dimension/Team	WP	Objective	Target Values qualitative/ quantitative*	Contribution Sustainability
1	Urban Planning and Urban Design	1. Mixed used Schemes (Soil)	Reduction of fossil energy use and carbone emissions	Reduction of CO <sub>2</sub> emissions by 4-7% per capita (BBR, Germany)
			Reduction of emissions (Air) and reductions of sealed soil (Soil)	Optimized surface/volume ratio e.g. GFZ (Geschossflächenzahl – floor space index) fraction of sealed soil on total land
2	Urban Planning and Urban Design	1. Mixed used Schemes (Soil)	Reduction of CO <sub>2</sub> emissions	Saving fossil energy and reducing CO <sub>2</sub> emissions
			Reduction of emissions (Air) and reductions of sealed soil (Soil)	Reduction of the world-wide CO <sub>2</sub> emissions and the greenhouse effect. Responsible land use
3	Urban Planning and Urban Design	1. Mixed used Schemes (Soil)	Enhanced economic value	Energy saving housing as future trend
			Social variety	Higher security (qualitative) plans

Fig. 1b: Urban Planning and Urban Design, Mixed-Use Schemes: Field of Action (FOA) 1 Climate and Energy, Field of Action (FOA) 2 Resources, Field of Action (FOA) 3 Social-cultural quality.

<b>Indicator</b>	
<b>Objective</b>	Objective indicator
	Indicator—Definition
<b>Methods</b>	Explanation
	Process of interaction with other indicators
	References
	Notes
	Standards of measurements/units of measurements, endpoints/target values and units (if available)
	Definition Average—Rating 5
<b>Evaluation</b>	Definition Rating 1-2
	Definition Rating 8-9
	Results
<b>Project</b>	Rating
	Comments

**Fig. 2: Indicator Template for organizing the project results in a manageable way. The definitions for the rating 1-9 and rating 10 are given in Tab. 1.**

The information given in the matrices is very complex and has to be condensed for dissemination and better handling and understanding. For feeding the data via the matrices into a data bank there has to be a step between concerning a systematic and comparable way in organizing the data in an indicator template (Figure 2) including a rating (Table 1) by the project teams and experts. In the YC-Project there are finally 135 sets of data implemented in the format of the so-called indicator sheets (Figure 2) which were continuously up dated and reflected in close collaboration by the teams of the project. These 135 data sets are finally needed to convert the data in a readable format for machines.

## Step 2:

Feeding the *Eva.S* evaluation tool via a main mask and drop down menu (Figure 3) followed up by a flow through and feed back due to the selected field of actions and the selected specific indicators by a processor like multi array grid after checked by the i.e. classical sustainability criteria: social-cultural quality, ecological quality and economic quality (Figure 4).

YC EVALUATION STRATEGY, Mainform

Dataset-ID:

Project-Name:

Location:

Field of Action:

Dimension:

Workpage:

Objective:

Strategy:

Measures:

Output:

Impact Indicators:

Objective Indicator:

Initial Situation:

Target Value:

Measuring Method:

Result:

Result Formula:

Explanation:

Indikator-Sheet:

Median:

Rating:  quantitative  qualitative  select

Projectrating:

Int. Rating:

Rate-Explanation:

Interactions:

References:

Notes:

Measurement:

Definition 1-2:

Definition 8-9:

Fig. 3: Main input mask of the *Eva.S* evaluation tool for feeding the project data bank by project results via a so-called drop-down menu.

The data bank and the *Eva.S* evaluation tool are operating in Open-Office. The access to the data bank and *Eva.S* in general is without a barrier for the user feeding of data into the main input mask and finally the reading out and the display of the results. The input mask is equipped with drop-down menu (Fig. 3).



**Step 3:**

Data check by a multi array grid (processor) for sustainability criteria social cultural, economy and ecology. Flow through and feed back due to the selected field of actions (FoA) and the selected project specific indicators (Figure 4).

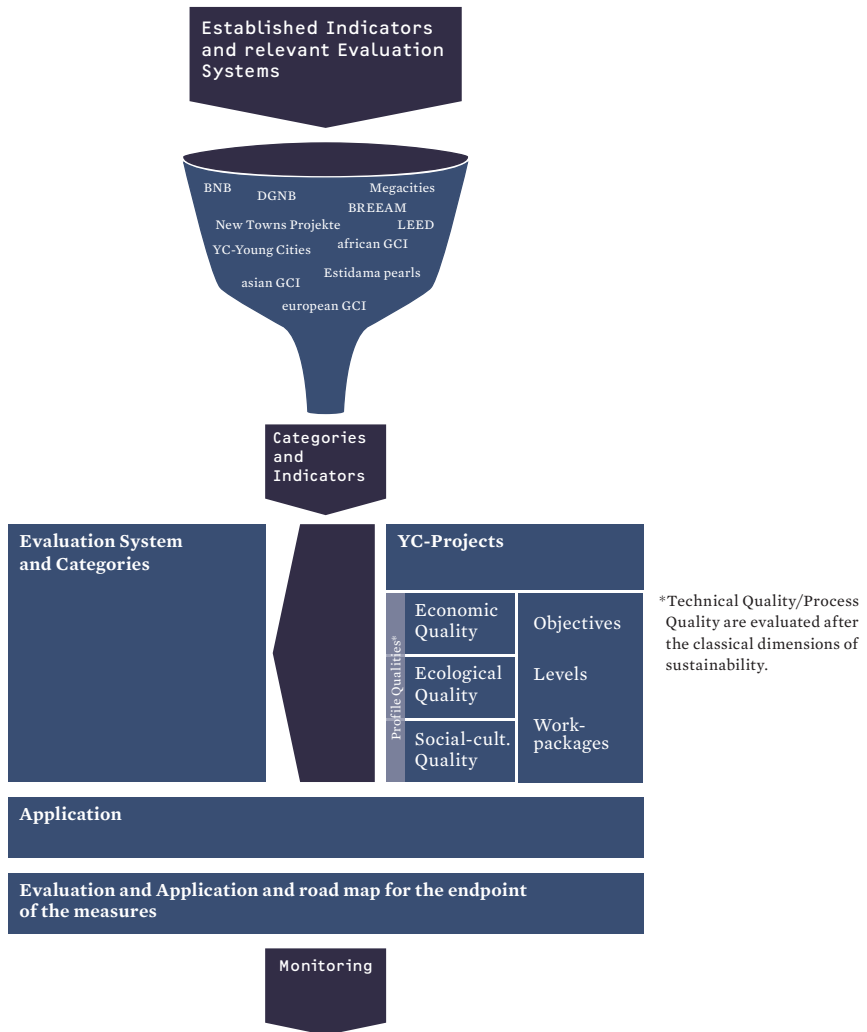


Fig. 4: Flow through and selection by a processor-grid to select specific indicators after check by classical sustainability quality criteria: social cultural,economy and ecology. The original funnel is filled with available and established International Standards and Indicators used by the BNB/DGNB, BREEAM, LEED, African Green City Index (GCI), Asian GCI, European GCI, ESTIDIMA (Pearls), GREEN Pyramids etc.. The outputs are sets of general indicators following special categories

**Step 4:**

Monitoring and decision loop of the project (effect related support chain and feed back), resulting products and alternative strategies.

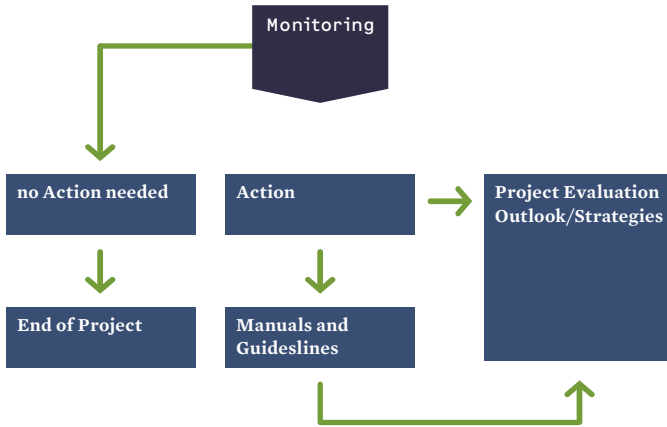


Fig. 5: Monitoring of the project—effect related decision support and outlook

The *Eva.S* evaluation tool is working in the background linked to the data bank and the given objectives and achievements of the project progress. This can be monitored and demonstrated at any time and at any place/location in the web: <http://yc.liebreznz.info/refina/index.php>. The displays of the project results are shown in Figures 6 and 7.

**EVALUATION STRATEGY AND DATA PROCESSING OF INDICATOR VALUES**

**Project:** Young cities - developing urban energy efficiency  
**Field of Action:** Energy/Climate - Reduction of CO<sub>2</sub>-emission  
**Dimension:** Landscape Planning

**Working-Package:** 08. Mitigation / Adaptation

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	A correct classification is currently not possible because no exact / empirical values are available. Therefore only a rough estimate is possible. A positive assessment of the amount of food carbon is justified, since the targeted planting of adapted vegetation achieves a significantly higher proportion of carbon sequestration than it was the case before or without the project.	3	Quality

**Dimension:** Capacity Building  
**Working-Package:** 28. Case Studies on Energy-Efficiency and Building Quality

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**EVALUATION STRATEGY AND DATA PROCESSING OF INDICATOR VALUES**

**Location:** Tehran - regional

Definition of Median Rating (5):	Rating:	Ratingtyp:
collected, described and categorized cases including professional details and suggestions for renovating and reconstruction around 30 described evidenced cases of improper workmanship in at least 5 categories	1	Quality

**Working-Package:** 29. Pilot Workshops

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Tehran - regional	at least two training workshops with at least 30 participants	2	Quantity

**Working-Package:** 30. Construction Training Center in Haehtgerd New Town

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	Room plan, design and operation model are available and generally agreed by Iranian and German partners	3	Quality

**Dimension:** Environmental Assessment  
**Working-Package:** 27. Environmental Assessment

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**EVALUATION STRATEGY AND DATA PROCESSING OF INDICATOR VALUES**

**Location:** Tehran - regional

Definition of Median Rating (5):	Rating:	Ratingtyp:
The method has been successfully developed and applied in the research project's case study	7	Quality

**Dimension:** Awareness Raising  
**Working-Package:** 31. Lifestyles and Energy Consumption Patterns

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Tehran - regional	Survey results are analyzed, described and documented in a report. Survey results are disseminated among a broader public. Survey results are documented in a report.	2	Quality

**Working-Package:** 33. Communication and Education

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	Concept is developed and printed on posters. Citizens' Exhibition is shown to the public.	2	Quality

**Dimension:** Energy Management  
**Working-Package:** 14. Energy-Management

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**EVALUATION STRATEGY AND DATA PROCESSING OF INDICATOR VALUES**

**Location:** Tehran - regional

Definition of Median Rating (5):	Rating:	Ratingtyp:
10% primary energy demand reduction and 25% solar fraction for heating and cooling	5	Quantity

**Dimension:** Urban planning and design  
**Working-Package:** 01. Mixed use schemes

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	A Connected Node Ratio of 0.4 to 0.7	10	Quality

**Working-Package:** 02. Energy efficient compact urban form

Location:	Definition of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	Medium FAR 0.6 (according to Haehtgerd NT regulations)	3	Quantity

**Dimension:** Energy-efficient Homes – Urban Design and Architecture  
**Working-Package:** 04. Energy-Efficient Building Typologies for Mass Housing

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Fig. 6: Eva.S-examples of the main form for the display of project results

**EVALUATION STRATEGY AND DATA PROCESSING OF INDICATOR VALUES**

**Working-Package:** 24. Energy-Efficiency

Location:	Definitaion of Median Rating (5):	Rating:	Ratingtyp:
Shahre Javan Community - local	Slightly improvement in energy consumption patterns	2	Quality
Shahre Javan Community - local	Slightly improvement in energy consumption patterns. According to energy simulation of New qQuality, heating and cooling demand of building is reduced about 40% cooling and 60% heating	2	Quantity
Shahre Javan Community - local	Slightly reduction in heating demands of building in compare with building implemented by qualified office in Tehran region	4	unknown

**Dimension:** New quality / Structural Design

**Working-Package:** 22. Structure & Materials

Location:	Definitaion of Median Rating (5):	Rating:	Ratingtyp:
Tehran - regional	Usage of materials the same as building constructed by high construction offices in Tehran region	4	Quality

**Dimension:** New technology / Architecture

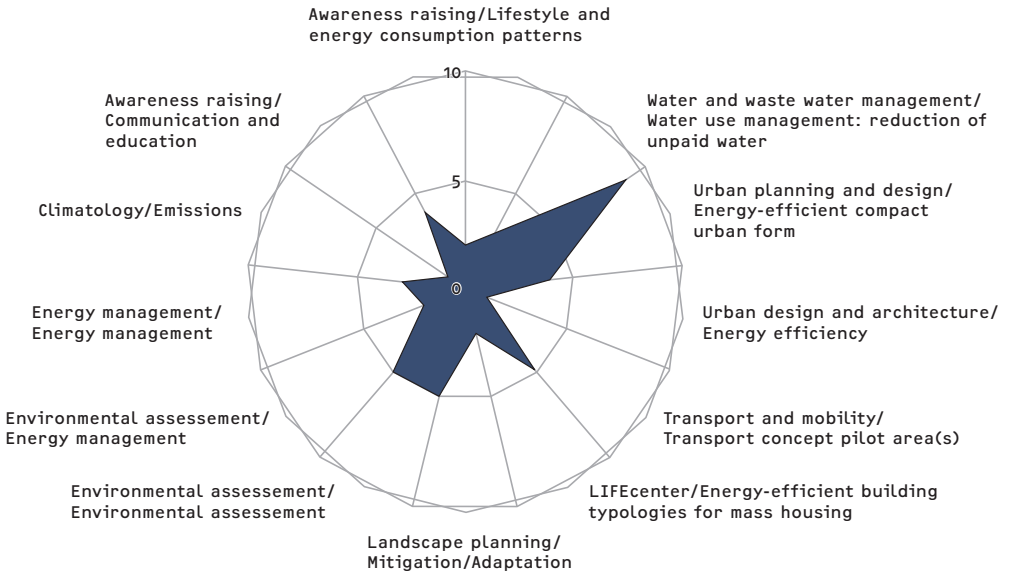
Seite 16/46 Datum: 2013-06-18

Fig.7: Main Form of the Eva.S evaluation tool for the display of project results concerning Energy-Efficiency and Structure & Materials including rating and location.

**Step 5:**

Dissemination of results, rating of results (Figures 6, 7) and visualization by i.e. radar diagrams (Figures 8–11).

In this example the results in the three fields of actions “Reduction of Resources Consumption”, “Energy and Climate” and “Sustainability” are visualized by radar diagrams (Figures 8–10).



**Fig. 8: Dissemination of YC-Project Results.**  
**Field of Action: Reduction of Resources–Consumption**

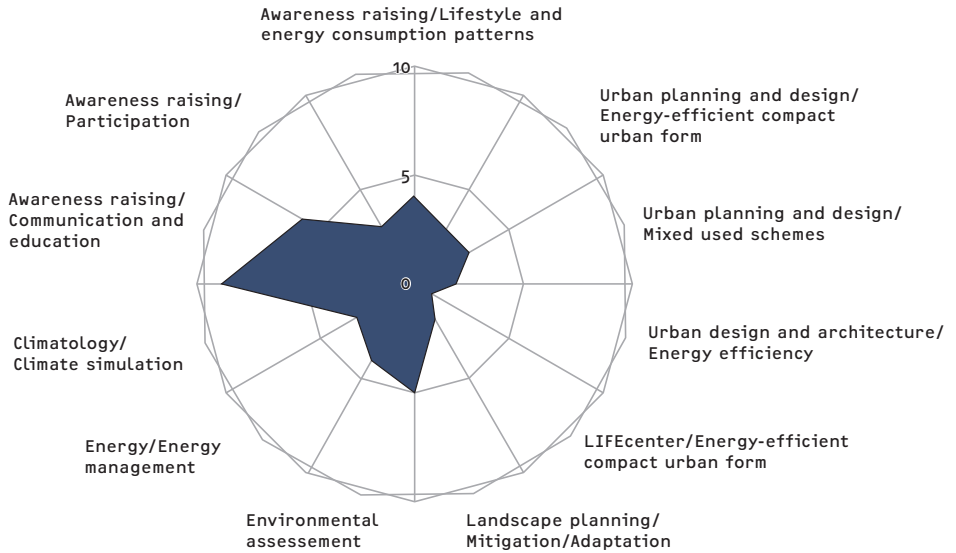


Fig.9: Dissemination of YC-Project Results.  
Field of Action: Energy and Climate

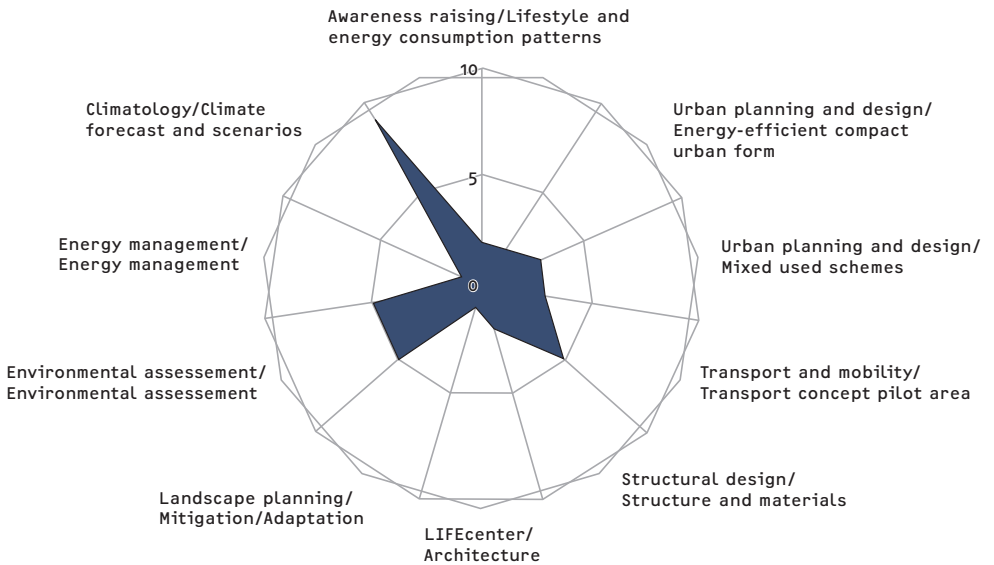


Fig. 10: Dissemination of YC-Project Results.  
Field of Action: Sustainability

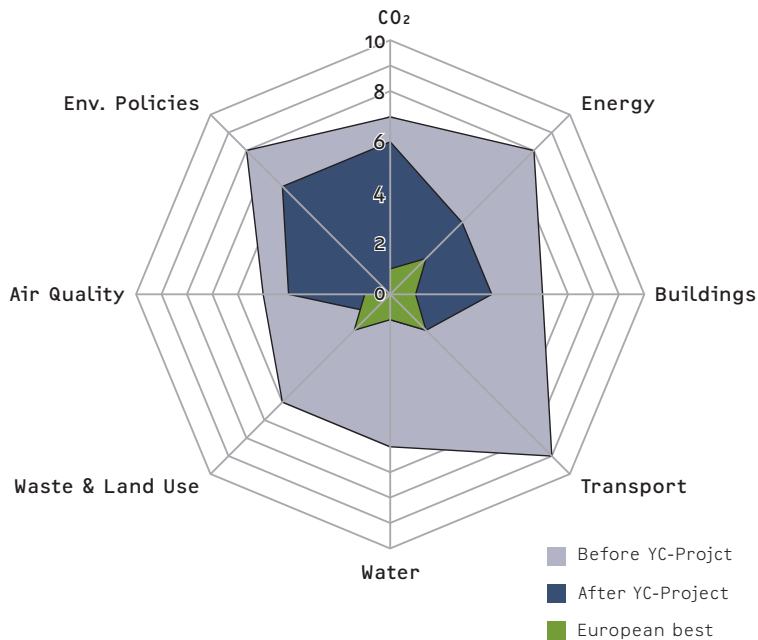


Fig. 11: Dissemination of YC-Project: overall results

In Figure 11 it is clearly demonstrated that there is a substantial input concerning improvements by the YC-Project in all disciplines like CO<sub>2</sub>, Energy, Water, Climate etc. comparing the situation before the YC-Project was in place and than the reductions and improvements after the YC-Project measures became real beside other YC-inputs.

## 3 Conclusion

The *Eva.S* evaluation tool was developed in the Young Cities Project by the Evaluation and Monitoring group. But from the first beginning on it was designed also for other applications and potential projects and test runs were consequently performed. Because the YC-Project data bank was build up slowly but constantly and the number of data sets were not as robust as the REFINA data sets so the first runs were done successfully with the data sets of the REFINA project (Bock et al 2009, Preuß et al 2010). Finally we discussed proved applications of *Eva.S* at the communal authorities level. There will be a training and application of *Eva.S* for legal frame work.

The risk analysis and monitoring studies (Hansen 1993, 1997, 2007) were added values for the project development, evaluation and monitoring according to the well accepted International Standards. The risk analysis part of *Eva.S* was tested and optimized by the “MORIX feasibility studies” in the REM (Real Estate Management) Master Courses of the Technische Universität Berlin (BIT—Berlin Institute of Technology). Many new aspects and directions for future applications and new perspectives of *Eva.S* are discussed in ZIA (2013) and will be certainly applied in the near future. The YC-databank and *Eva.S* are present in the web by the following address:  
*<http://yc.liebrenz.info/refina/index.php>*.

## 4 Summary

1. *Eva.S* data bank is serving (administrate) the YC-Project by 135 data sets, 3 Fields of Action (FoA) and 25 Work Packages.
2. *Eva.S* is easy to feed by a Drop-Down menu.
3. *Eva.S* is Open Source/Microsoft Office
4. *Eva.S* is not an E-book—it is a evaluation tool
5. *Eva.S* is from now on a web based application and has access world wide:  
<http://yc.liebreznz.info/refina/index.php>
6. The *Eva.S* project data are evaluated by qualitative and quantitative project specific indicators proved by the classical dimensions of sustainability: social-cultural quality, economic and ecological quality.
7. The dynamic and constantly up-dated *Eva.S* evaluation tool has many potential applications in the field of evaluation and monitoring. Stakeholders are project developer, political decision maker of municipal authorities.

### Acknowledgments

The authors thanks the Young Cities Project Center for data handling and project logistics to supply the Evaluation-Monitoring Group with on-going data sets.

The authors gratefully acknowledge the BMFT for funding the Young Cities Project.



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# Imprint

**Design/Typesetting** büro-d | Communication Design Berlin

**Publisher**

Universitätsverlag der TU Berlin

ISSN 2196-517X (Print)

Universitätsbibliothek

ISSN 2196-6583 (Online)

Fasanenstr. 88

ISBN 978-3-7983-2587-6 (Print)

10623 Berlin | Germany

ISBN 978-3-7983-2588-3 (Online)

[www.univerlag.tu-berlin.de](http://www.univerlag.tu-berlin.de)

*Simultaneously published online on the Digital Repository  
of the Technische Universität Berlin*

URL <http://opus.kobv.de/tuberlin/volltexte/2013/4066/>

URN <urn:nbn:de:kobv:83-opus-40667>

[<http://nbn-resolving.de/urn:nbn:de:kobv:83-opus-40667>]

All texts are based on scientific research performed within the Young Cities Project. All pictures, tables and graphics are courtesy of the respective article's authors, unless otherwise mentioned.

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The volume before you results from the federal funded research project “Young Cities–Developing Urban Energy Efficiency”. It has been written by

**Technische Universität Berlin**  
***Department of Ecological Impact Research***  
***and Ecotoxicology***

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