Monitoring of Selected Action Fields of the European Green Capital Essen 2017

Short Version

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1 Introduction

The European Green Capital Award was founded 2008 to award cities that make continuous efforts for high environmental standards and sustainable development. With awarding Essen in the year 2017, already existing commitments in topics like climate change, mobility, environmental and resource protection, were honoured as well as the commitment to sustainably manage its ongoing economic structural change.

It is therefore very important to identify and assess the ways in which activities of the European Green Capital had a measurable impact within the city. Is the impact of the Green Capital year only limited to a wide range of events and marketing activities or can a mid- to long-term impact be recognised? What level of popularity and social acceptance did the Green Capital have among citizens and how did it contribute to achieve environmental targets of the city?

These and other questions were the starting point for the research accompanying the Green Capital, which was carried out by a team of the Wuppertal Institute, the University of Duisburg-Essen, the Ruhr-University Bochum and the Technical University Dortmund.

The research team conducted interviews with participants of selected events of the Green Capital, evaluated a broad web-based survey from autumn 2017 and undertook an impact analysis in four selected fields of action: green areas and climate change, local transport and mobility, air quality and CO₂-emissions and finally eco-innovation and employment.

This report lays a foundation for the document that the city presents to the European Commission as final Green Capital report. It is a translated short version of a more detailed report that was given in German language to the City of Essen in September 2018.
2 Targets and activities of Essen as European Green Capital of 2017

2.1 Targets of the City of Essen

The application of the City of Essen for the title European Green Capital was associated with the overall objective to further develop the quality of life perspective in Essen. In this context the existing structural economic change shall actively be managed towards economic, social and ecological sustainability.

Within the scope of the twelve given action fields, the targets of the City of Essen have explicitly been documented in its application defined as follows:

<table>
<thead>
<tr>
<th>Action fields</th>
<th>Sub-targets</th>
</tr>
</thead>
</table>
| **1. Climate change – damage reduction and adaptation** | • Reduction of CO₂-emissions by 40 percent until 2020 (base year: 1990)  
• Reduction of CO₂-emissions by 95 percent until 2050 (base year: 1990)  
• Implementation of strategies for climate adaptation (“Resilient City”) |
| **2. Public transport** | • Change in modal split for public transport / private transport / bicycle / pedestrians up to 25 percent each until 2035 |
| **3. Public green areas that encompass sustainable land use** | • All inhabitants of Essen have access to the “Grüne Wegenetz” (green walkways) in less than 500 m distance until 2020 (today: approx. 75 percent)  
• Active development of Essen to a green city with high quality of life and leisure time |
| **4. Nature and biodiversity** | • High quality of life through balancing urban and unspoiled natural areas (based on the EU Biodiversity strategy)  
• Stabilising of the conservation of species  
• Integration of natural protection in agriculture and forestry and in the development of settlements |
| **5. Air quality** | **Target 2020:**  
• Reduction of the PM₁₀-yearly average value to <29 µg/m³.  
Guarantee of the annual maximum of 35 exceedances of the daily average value of 50 µg/m³, also in years with frequent low exchange weather conditions.  
• Area-wide compliance with NO₂-thresholds  
**Target 2035:**  
• Area-wide compliance with WHO-guideline value for PM₁₀ (20 µg/m) and reduction of PM₁₀-exceedances of the EU-daily threshold (50 µg/m) to zero  
• Compliance with the EU-threshold and WHO-guideline value for NO₂:  
  o Annual average: 40 µg/m³,  
  o Hourly average: 200 µg/m³ with max. 18 exceedances p.a. |

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1 Source: https://media.essen.de/media/egc2017media/egc2017_bilder/grafiken_2/12_ziele_poster.de.pdf (last access: 31.07.2018)
### Action fields (continuing) | Sub-targets (continuing)
---|---
**6. Quality of acoustic environment**
- Until 2018 avoiding target values of $L_{DEN}$ 65 dB(A) and $L_{Night}$ 55 dB(A)
- From 2035 on no noise disturbance excelling $L_{DEN}$ 55 dB(A) and $L_{Night}$ 45 dB(A)
**7. Waste production and management**
- Updating of the waste management concept of the City of Essen
- Increasing of the recycling quota from 40 percent (2012) to 65 percent (2020)
- Reduction of waste production per capita
- Urban Mining – Increase of collected scrap electronics
**8. Water management**
- Assurance and increase of the quality of drinking water
- Near-nature bathing in the Ruhr river
- Climate change adaptation of water management
**9. Wastewater treatment**
- Improvement of wastewater collection: implementation of the reconstruction of the Emscher river until 2020
- Improvement of rainwater treatment: near-nature rainwater management (decoupling of 15 percent rainwater until 2020)
- Improvement of the hygienic situation of the Ruhr river through increased wastewater treatment
**10. Eco-innovation and sustainable usage**
- Development of the “Green Economy” in Essen (currently 12,755 insurable employments in the “Green Economy”)
- Promotion of research and innovation
- Participation in “KlimaExpo.NRW”
- Strengthening of ecological education and related cooperation
- Continuation of the project ÖKOPROFIT
**11. Energy efficiency**
- Increase of the retrofitting rate following low-energy house standards up to 3 percent annually
- New municipal buildings up to zero-energy house standard
- Use of potentials of renewable energies (a third of energy supply through solar power until 2050)
- Development of an energy consumption plan
- Continued decrease of overall energy consumption of Essen (by 19.6 percent from 1990 until 2011)
**12. Integrated environmental management system**
- Sustainable (future-proof) city using the local strategy “Essen.2030”
- Development of an integrated environmental management system for the communal administration
- Keeping budgets for environmental and climate protection on a high level
- Creation of a new climate culture under the trademark klima|werk|stadt|essen
2.2 Realisation by means of different programmes

In order to achieve the planned targets, in 2017 five superior project clusters were established and classified to different subprojects, events or other activities. In contrast to the twelve action fields defined by the EU as relevant for the application, these five topics were in an adequate way able to thematically focus the activities of the city and to tailor the format of events and projects with regard to the specific target groups.

The following topics have been addressed to:

- The programme “My Paths” described all sustainable topics regarding mobility, e.g. car-sharing, bicycle traffic and public transport.

- The programme “My Rivers” concentrated on the rivers Emscher and Ruhr including their tributaries as well as the green and blue infrastructures of the city associated therewith.

- “My Green” referred to a range of topics from public parks and green areas to the common and private use of areas.

- “My Shopping” describes the sustainable consumer behaviour in daily life. This includes a range of topics from food production and fair trading to building material as well as waste and recycling.

- Finally, the last programme “My Future” refers to all jobs and training possibilities associated with environmental issues as well as the education for environmental topics and sustainability.

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3 The structure of accompanying research

3.1 Project design

The design of the accompanying research taken as a basis for the present short version of the report is formally composed of three components (respectively work packages):

1 | Monitoring of the principal impact of activities on the Green Capital (WP 1)
2 | Monitoring with regard to four central environmental indicators (WP 2)
3 | Concept development to monitor eight additional fields of action by the year 2022 (WP 3)

The present report documents the results especially with regard to WP 1 and WP 2. While the first describes the results of a city-wide survey and of interviews made during events of the European Green Capital – Essen 2017 (EGC), the latter concentrates – at least rudimentarily – on the long-term impact of the activities of the Green Capital on four selected action fields.

The following action fields were chosen in agreement with the City of Essen:
- Urban green areas and climate change
- Local traffic and climate change
- Air quality (incl. CO₂-emissions)
- Eco-innovation and sustainable employment

3.2 Data sources and surveys

The project and its results relate both to available data as well as to statistical surveys and primary data sources and surveys as follows:

Table 2: Data sources and surveys

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Data sources and surveys</th>
<th>Level of impact</th>
<th>Survey made by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Direct Monitoring of activities and events (AP 1)</td>
<td>Output and outcomes</td>
<td>Project consortium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project office EGC</td>
</tr>
<tr>
<td>2</td>
<td>City-wide survey (AP 1)</td>
<td>Output und outcomes</td>
<td>Project consortium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project office EGC</td>
</tr>
<tr>
<td>3</td>
<td>Expert interviews (AP 3)</td>
<td>Impact</td>
<td>Project consortium</td>
</tr>
<tr>
<td>4</td>
<td>Impact analysis (AP 3)</td>
<td>Impact</td>
<td>Project consortium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supported by the project office EGC</td>
</tr>
<tr>
<td>5</td>
<td>Other activities</td>
<td>Output und outcomes</td>
<td>Other actors, coordinated by the project team</td>
</tr>
</tbody>
</table>

In the following the results of the interviews (chapter 4) and the analyses of the four mentioned action fields (chapter 5) are documented briefly.
4 Output analysis: The online survey

Within the scope of the accompanying research regarding the European Green Capital – Essen 2017 the project consortium prepared online interviews with the citizens of Essen. The objective of the survey was to explore the degree of popularity of the project in the city, to investigate the quality of events, projects and products and to estimate the impact of the Green Capital on the participants.

The survey’s design should meet the following topics:

- Questions on the general quality and satisfaction of life in the city
- Questions on the level of information and the participation in activities regarding the Green Capital 2017
- Personal details of the participants

The survey took place in the period from 25 September to 20 October 2017. Since the questionnaire should only be answered by citizens of Essen, at the beginning of the survey it was explored whether Essen was the place of residence of the interviewees. In total, 1,885 persons participated in the survey, 1,586 of which lived in Essen. Finally, 945 inhabitants of Essen answered the questionnaire completely.

Table 3: Participants of online survey

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Method of survey</th>
<th>Duration of survey</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Survey via online-questionnaire (LimeSurvey)</td>
<td>25 Sep. – 20 Oct. 2017</td>
<td>1,885</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>1,586</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>1,068</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>945</td>
</tr>
</tbody>
</table>
4.1 Evaluation of the quality of life in Essen and the challenges for urban development

The interviews clearly reveal that the citizens of Essen are satisfied to a high extent with the quality of life in their city: Approx. 80 percent of the interviewed persons like to live in Essen and approx. 75 percent are satisfied with the shopping facilities in their city. More than 80 percent see Essen as a city with many parks, forests and gardens.

However, with regard to the development in the field of eco-friendliness the evaluation is more reserved. Merely 50 percent of the interviewees agree with the statement that Essen has become more eco-friendly in the last ten years. The share of responses that entirely agree with this statement is – with a value of a little more than 10 percent – significantly lower.

Within the scope of the assessment it has been examined as well whether the quality of life is judged differently by the citizens in the north and the south of the city. The hypothesis taken as a basis here was that the citizens of Essen in the northern and southern zip code areas give a different judgement of their quality of life. In particular with regard to the southern districts a better judgement of the quality of life has been expected.

The result is that there were no significant differences with regard to the judgement of their quality of life depending on the place of residence of the interviewed persons. The following figure 1 therefore indicates the results of the participants from all zip code areas.

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**Figure 1: Evaluation of quality of life in Essen**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Natural</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I like living in Essen</td>
<td>539</td>
<td>542</td>
<td>243</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Essen offers majority and completely a high living quality</td>
<td>274</td>
<td>68</td>
<td>401</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Good shopping possibilities are available in Essen</td>
<td>437</td>
<td>652</td>
<td>283</td>
<td>69</td>
<td></td>
</tr>
<tr>
<td>Essen is a city with many parks, forests and gardens</td>
<td>575</td>
<td>631</td>
<td>209</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Numerous good leisure activities are available in Essen</td>
<td>254</td>
<td>636</td>
<td>417</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td>Essen becomes more environmentally friendly in the last ten years</td>
<td>192</td>
<td>548</td>
<td>474</td>
<td>174</td>
<td></td>
</tr>
</tbody>
</table>

Source: Wuppertal Institut and UA Ruhr
The analysis of the open question “Which are the biggest environmental challenges for you in Essen?” reveals that for the interviewed persons the biggest challenge of the city is above all the reduction of the consequences of city traffic (314 nominations). Associated therewith is the need for an improvement of air quality and a diminuation of noise, an improvement of public transport (45 nominations) and the cycling infrastructure (39 nominations).

Another big environmental challenge lies in the elimination of “illegal dump sites” (42 nominations). These are a real nuisance for the interviewees. In this context it is seen as a big challenge to further avoid the production of plastic waste in future.

Considering the background of these challenges the evaluations of the interviewees with regard to the efforts of the City of Essen to become more eco-friendly and more sustainable were quite cautious. Just over 30 percent (“more eco-friendly”) respectively just over 20 percent (“more sustainable”) valued the efforts of the city as “large” or “very large”.

Figure 2: Evaluation of the efforts of the City of Essen to become more eco-friendly and more sustainable

Source: Wuppertal Institut and UA Ruhr
4.2 Degree of popularity of the European Green Capital 2017 and the quality of its products

Statements made with regard to the level of information concerning the activities of the European Green Capital reveal how the project “reached” the citizens of Essen and was noticed by them.

Almost all participants of the survey said they were aware of the fact that Essen was the European Green Capital in 2017.

Figure 3: Degree of popularity of Essen as European Green Capital in 2017

The analysis of the degree of popularity with regard to events shows a different situation: Public events which have been announced professionally as, for instance, the opening ceremony in January 2017 or “Swimming in the Ruhr” reveal with more than 80 percent a high degree of popularity. The opening ceremony was recognised by more than 30 percent of the interviewees. Expert congresses and other events as, for example “Discussion forums in the Kreuzeskirche church” or “Mobility Week” as umbrella brand for a wide range of traffic-based single events or even urban district projects, however, had (naturally) a lower degree of popularity.

The monitoring of many events shows a relatively continuous pattern: On the one hand the events were a great pleasure for the participants and were valued as well-organised. However, on the other hand, the events only partly provided new information, what could have different reasons: One possible explanation may be that the public events were visited by persons with environmental interest, or at least with a specific affinity to environmental issues. In major parts, however, the participants were motivated to take part in further activities of the Green Capital. To sum up, the Green Capital had its own “fan community”. These findings are confirmed by various on-site interviews.3

3 Additional Analysis is found in the long version of the report.
Figure 4: Have you already heard of the following activities, projects and events in the city or read about it in the press?

As with the degree of popularity of the events, the analysis of the products of the Green Capital provides a similarly differentiated picture:

The best known products of the public relations were reports about the Green Capital in newspapers, radio and television. Over 50 percent of the respondents have seen, heard or used the reports, nearly 20 percent even regularly. Concerning regular usage, the social media channels achieved high results. These were used regularly by 20 percent of the respondents. Just 15 percent of respondents were unaware of the advertisement in the city. This could indicate a good placement of the advertisement in a city’s context. The product that was mostly unknown to the respondents was the children’s environmental newspaper: Over 80 percent of the participants did not know the product. This is not surprising insofar as the newspaper was handed out only to pupils from 4th to 7th grade.

The products were largely claimed to be appealingly designed. The evaluations rather appreciated the informational content of the products relating to the Green Capital than the content targeting a change in one’s own lifestyle.

Source: Wuppertal Institute and UA Ruhr
4.3 Expected impacts of the Green Capital

The survey revealed that many participants related something meaningful or positive to the Green Capital. Many developed great pride and acknowledged the chance from the “grey, stuffy past” to the “green, loveable city”. In addition, just around a third of all participants (31 percent) endorsed the title and supported that Essen could gain a more positive image through the title and that this could be felt beyond the borders of the Ruhr area. Moreover, the participants also hoped for an increasing attractiveness of Essen as an economic location.

On the other side, the impacts of the European Green Capital 2017 were viewed critically: Noticeably little support was received by statements that claimed the Green Capital did indeed contribute to an increase in quality of life in Essen. In addition, the statement: “The year of the European Green Capital seemed to me to be just a big marketing scheme” received high support of about 60 percent. Some participants emphasised, mostly in answering the open section of the survey, that the actions of the communal administration did not suit the title of Green Capital, as for instance the expansion of bike expressways does not happen quickly enough. Lack of information about events in the city districts or the removals of trees for the creation of new parking lots were critically mentioned as well.

Figure 5: Assessment of participants about positive impacts of the European Green Capital for the City of Essen

Source: Wuppertal Institute and UA Ruhr
4.4 Summary of survey results

The results of the online survey as well as the results of personal interviews during the public events, the conferences and the citizens’ projects show different nuances of impact of the activities for the European Green Capital:

Questions about quality of life in Essen and expectations for the Green Capital

- In the online survey it is made clear that the respondents have a high contentment regarding the quality of life in the city. A statistical relation between the evaluation of overall content of the inhabitants in Essen with their job perspectives or the exact place of residence within the city could not be recognised.

- The high level of popularity of the Green Capital comes from the mainly positive connotations that the inhabitants associate with the award.

- The respondents see the biggest challenges for the quality of life in Essen mainly in the transport sector with a lesser importance in the waste management sector. Here, the transport sector is a synonym for a series of subjectively felt restrictions of lifestyle in the city, as for instance noise, bad air quality and the low appeal of public areas.

Questions about products and events of the Green Capital

- Naturally, significant differences can be recognised with regard to the degree of popularity of the products of the Green Capital, since each product addresses different target groups. The well-known products were dominantly declared as attractively designed. The evaluations, however, rather referred to the general content of information of the products of the Green Capital and their design. New information on approaches with regard to a modification of the individual lifestyles could rarely be derived from the products.

- Similar results of the outcomes can be recognised with regard to the evaluation of events and other activities: On the one hand, the events were mainly a great pleasure for the participants. Besides, the events were judged as dominantly well organised. On the other hand, it becomes evident that the offered activities were only in part new for the participants or didn’t provide any information about how the participants themselves can improve the sustainability of the city.

Thus, the activities, events and products of the city as Green Capital are dominantly judged positively, while the expectations regarding the options of acting of the City of Essen and the long-term impacts of the Green Capital are judged more cautiously.
5 Impact analyses in four selected fields of action

While the interviews aimed at the perceptions and evaluations of the citizens of Essen with regard to the Green Capital, the accompanying research team conducted supplementary analyses in four selected fields of action to record possible impacts to the city. Due to the short-term nature of the Green Capital, the (naturally) limited range of single measures and the complexity of problems, however, impacts could only indirectly be measured and recorded accordingly. With regard to the analysis of individual action fields a structured procedure was chosen that

- discusses the meaning of an environmental indicator for the perspective of sustainability of the city,
- addresses the corresponding municipal objectives and the current problems in the city,
- explains the implementation approaches (instruments and actions to be taken) and discusses in qualitative terms possible impacts of activities implemented in association with the Green Capital and finally
- provides an evaluation and corresponding recommendations.

Within the scope of the present report (short and long version) four selected topics were analysed in more detail:

- “Green areas and climate change”
- “Local traffic and mobility”
- “Air quality”
- “Eco-innovation and employment”

In the long version of the report the basic methods for another eight fields of action (see table 1) are described in order to implement a comprehensive evaluation of the impacts of the Green Capital after a period of five years.
5.1 **Action field (1) “Green areas and climate change”**

5.1.1 **Introduction**

The action field “Urban green areas and climate change” should be seen as an exemplary one: Neither can climate change be reduced or restricted (specific consequences of climate change can at best be lessened by green areas) nor can (urban) green areas be considered as single factor with regard to the definition of possible measures to adapt to climate change. This is justified by the fact that in respect of the specific physical and ecosystem processes not only other field categories (as e.g. wood or moor areas) might be more important than green areas, but the efficiency of green areas for certain adaptation measures may depend on other landscape ecological factors as, e.g., the soil’s capacity to store water (for the reduction of direct runoffs in case of heavy rainfall), the specific geomorphological situation (for the flow of cold air or the supply of fresh air) or a possible connection of the site to ground water (for an increased cooling impact due to a higher evaporation performance). Besides, green areas can fulfill various ecological, social, economical and cultural functions or can contribute to the fulfillment of such factors.4

In this context it is of importance which targets are associated with the development and maintenance of green areas by the City of Essen itself. This can be learnt from the City’s application for the title European Green Capital 2017 (Essen 2015, p. 45ff).

Accordingly, the development of the city to a green city with a high quality of life and leisure activities shall in future be continued as a general objective. In supplement, it is explained that this shall be realised by the inclusion of the green planning to the city and regional planning. Furthermore, it is stated that green infrastructure measures are included in the city development process Essen 2030, KlimaExpo.NRW 2022 and are part of the plans regarding the International Garden Festival 2027.5

The following table presents an overview of targets defined by the City of Essen and differentiated according to the above mentioned general development objective and various sub-targets as well as the indicators for the monitoring concept under discussion.6

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5 Application of the City of Essen for the title “European Green Capital 2017”, p. 54.
6 The highlighted indicators are described in this short version. In the long version of the report the other not highlighted indicators are presented as well.
### Table 4: Sub-targets and indicators for the field of action “Green areas and climate change”\(^7\)

<table>
<thead>
<tr>
<th>Overall development target</th>
<th>Development of the city towards a green city with high standards of living and leisure time quality.</th>
</tr>
</thead>
</table>
| **Sub-target 1: Agglomeration of areas for leisure activities**  
  [resp. quality of life, public health, recreation] | |
| Indicator 1.1 | Provision of residential areas in the City of Essen with “public green areas” within a 300 m radius (corresponding map 6 “Catchment area of public green areas larger than 5,000 m²”) in Essen (2015) |
| Indicator 1.2 | Share of public green areas in urban districts |
| Indicator 1.3 | Green areas per inhabitants in the urban districts |
| Indicator 1.4 | Inhabitants in proximity to green areas below 15 minutes walking distance |
| **Sub-target 2: Improvement of the experienced quality of urban areas that have been changed due to green area development** | |
| Indicator 2.1 | Satisfaction with public green areas in urban districts in Essen |
| Indicator 2.2 | Relevance of high-grade green areas for the quality of life in Essen |
| Indicator 2.3 | Quality of stay, visual importance of green areas for experiencing the urban landscape |
| **Sub-target 3: Strengthening of private commitment** | |
| Indicator 3.1 | Cooperation of the City of Essen with private initiatives like civic associations or nature groups, the garden allotments in Essen as well as the horticultural and forestry sector |
| **Sub-target 4: Functions of ecosystems and climate change adaptation (see p. 57 of the bid)** | |
| Indicator 4.1 | Share of urban vegetation with relevance to the eco-climate |
| Indicator 4.2 | Share of urban vegetation with relevance for the water retention |

\(^7\) Targets and sub-targets taken from Stadt Essen (2015), p. 54f.
5.1.2 Sub-target 1: Agglomeration of areas for leisure activities [resp. quality of life, public health, recreation]

The agglomeration of areas for leisure activities [in respect to the quality of life, public health and recreation] is mentioned in the application of the City of Essen for the title of “European Green Capital 2017” (Stadt Essen 2015, p. 54) implicitly as first sub-target within the future planning of the City for topic 03 “Public green areas with comprehensive sustainable land usage”. In this context the necessity of continuity and accessibility of free areas is highlighted. The City of Essen predicts that the agglomeration of areas for leisure activities through closeness to nature, quietness and fresh air can contribute to the improvement of general well-being (Stadt Essen 2015, p. 55).

This means for the selection of indicators that above all those are to be prioritised for the monitoring that are on a wide scope sensitive enough to register small and larger degrees of agglomeration of areas for leisure activities as improvements. At the same time, these indicators must be sensitive enough to register small and larger degrees of reduction of public areas as impairment of the provision. As Zepp (2018) pointed out recently, the relatively large expansion of regional green corridors in the Ruhr area (mainly through the inclusion of areas in boundary areas) did not play out as an improvement of the provision of free areas on a local level in the past, especially in dense areas.8

5.1.2.1 Indicator 1.2: Area proportion of public green areas in urban districts in Essen

To conduct a specific evaluation of the developments of urban green areas, it is advisable to differentiate between different kinds of green areas. Within a monitoring it can be pointed out, for instance, in which urban districts a deficiency of forest areas exists or was addressed to in a specific length of time, or in what part of the city the provision of public green areas has improved or declined in a period of time. Due to their significant role, especially for the dense areas, this process is demonstrated using the example of public green areas. This category is defined by the AdV (2008, p. 98) and forms the basis of the object catalogue of the digital basis-landscape model.9 Herein high quality green areas like, for example, parks of different sizes are registered that fulfil a large number of different ecological, social, cultural and economic functions.10 In a spatial perspective the reference to the level of urban districts allows to make statements about the (in-)equality of distribution of public green areas throughout Essen. In a temporal perspective changes over time can be measured – as long as data for different points in time are available.

Underlying data and methodological approach

The ATKIS Basis-DLM (for the area of the City of Essen) provides the underlying data with information about public green areas, completed with information of the City of Essen about the outline of the city districts. In the following example by Weiz (2016) green areas with a size of 5 hectares or more were selected, the situations in 2009 and in 2015 were compared. In principle, the indicator is applicable in relation to other spatial categories (like forest area, agricultural land), in doing so the threshold value for the size of regarded areas as well as the regarded points in time can be handled variable.

Significance of ecological indicators

The significance of the indicator lies in the focus on high-quality green areas that can fulfil a multitude of functions. At the same time, differences in the urban district’s supply of green areas (share of different areas in percent from the city’s total surface) as well as changes over time, meaning improvements and declines, can be shown. Generally, it is a sensitive indicator whose sensitivity can be altered by changing the threshold value for areas under review. It has to be considered that a lower threshold value for areas seems to produce more exact numbers but shifts the ratio between small and large green areas considerably. As larger green areas generally do fulfil a broader spectrum of functions, a lower threshold value could lead to the statistics being in some way sugar-coated by less significant green areas.

Targets, status quo and development perspective

The target for the activities by the City of Essen was to intensify the existing grid of free areas further. A central element for this is the action programme “ESSEN.New ways to the water”. Alongside the reconstructed waters new green areas close to the urban districts are developed for the citizens of Essen. These green links are being used in combination with the project “Kinderwegenetz” (children’s path network) as safe ways to school and near nature playgrounds for children.

Activities and impacts

The planned activities, especially the action programme “ESSEN.New ways to the water”, will foreseeably contribute to an intensification of free areas. These impacts could be captured and demonstrated with the introduced indicator due to its sensitivity. In comparison with indicator 1.1 a stronger spatial differentiation and time dynamics are observable.

As demonstrated in figure 6, the share of green areas in northern districts of Essen in the base year 2015 was not only larger than in southern districts. Moreover, there has been a measurable increase of surfaces with according green areas between 2009 and 2015 (Weiz 2016, p. 51).

Evaluation

The target can be met by the planned activities, especially with the action programme “ESSEN.New ways to the water”, at least in the urban districts that are affected by the measures.

Policy recommendation

It is recommended that this indicator is used for the monitoring of other categories of area or area combinations, for example for forest, water, grove or swamp areas.

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12 Ibid., p. 55. The realisation is carried out by Grün und Gruga Essen.
13 Ibid., p. 55.
5.1.2.2 **Indicator 1.3: Proportion of green areas per citizen in urban districts of Essen**

This indicator is an advancement of indicator 1.2 presented before. While indicator 1.2 describes the relation of the green area to the total area of the corresponding urban district, this indicator (1.3) describes the relation of the green area of an urban district to its number of citizens so that statements can be made about the average supply of the citizens of Essen with green areas within certain urban districts in m²/citizen.

**Underlying data and methodological approach**

In addition to the underlying data in indicator 1.2, this indicator requires urban district specific data about the population, which can be learnt from an online survey of the City of Essen.  

In the following example of Weiz (2016) green areas are selected with a size of 5 hectares and more, while comparing again the situation with that of 2009 and 2015. In principle, the indicator in relation to other area categories (e.g. forest or agricultural area) can be applied, while, in turn, the threshold value for the size of areas to be included as well as reference data are variable.

**Significance of ecological indicators**

The significance of the indicator lies in the focus on high-quality green areas that can fulfill a multitude of functions. The differences between the urban districts with regard to the degree of supply, however, are now defined as relative supply in consideration of the number of citizens. Thus, the average proportion of green area in m² available for a citizen in the corresponding urban districts of Essen becomes obvious.

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Source: Weiz 2016, pp. 51

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14 [https://www.essen.de/rathaus/aemter/ordner_12/bevoelkerungsatlas.de.html](https://www.essen.de/rathaus/aemter/ordner_12/bevoelkerungsatlas.de.html) (last access 07.05.2018)
In this context, differences in the urban districts can be defined with regard to the degree of supply (m² green area/citizen) as well as modifications in time, i.e. improvements as well as deteriorations. As a whole, it is a very sensitive indicator whose degree of sensitivity can be modified by changing the threshold value for the minimum size of areas to be included. The remarks on indicator 1.2 should be considered.

Due to the area-based evaluation of Essen in the range of zero m²/citizen to more than 30 m²/citizen the indicator is better suited for the evaluation of future key activities than indicator 1.1.

**Targets, status quo and development perspective**

The target for the activities by the City of Essen was to further intensify the existing grid of free areas. A central element for this is the action programme “ESSEN.New ways to the water”. Alongside the reconstructed waters new green areas close to the urban districts are developed for the citizens of Essen. These green links are being used in combination with the project “Kinderwegenetz” (children’s path network) as safe ways to school and near nature playgrounds for children.

**Activities and impacts**

The planned activities, especially the action programme “ESSEN.New ways to the water”, will foreseeably contribute to an intensification of free areas so that also the proportion of green area per citizen will probably rise. These impacts could be captured and demonstrated with the introduced indicator due to its sensitivity. In comparison with indicator 1.1 a stronger spatial differentiation and time dynamics are observable.

As illustrated in the following figure, the average proportion of green area per citizen developed positively in many urban districts of Essen, which can be observed especially in the north of the city: While, for example, in the Karnap district the area available per capita has doubled from 10-20 m²/citizen (2009) to 30-40 m²/citizen (2015), the available area in the western part increased at least threefold from 0-10 m²/citizen (2009) to 30-40 m²/citizen (2015) (Weiz 2016, p. 53). This makes obvious that the indicator is suited best for the demonstration of where modifications have been done and where not.

**Evaluation**

The target can be met by the planned activities, especially with the action programme “ESSEN.New ways to the water”, at least in the urban districts that are affected by the measures.

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15 Essen (2015), p. 54. The realisation was carried out by Grün und Gruga Essen.
17 Ibid.
Policy recommendation

It is recommended that within the scope of monitoring the indicator shall not be used as alternative but in supplement to indicator 1.2. If necessary, this indicator can be used for other categories of area or area combinations, e.g. for forest, water, grove or swamp areas. It is to be pointed out additionally that the indicator may further be specified, e.g. with regard to special groups of population as children, single parents, retired persons or persons with immigration background. On such a basis it may be indicated that the intensification of the green area network has a positive impact also on special groups of population.

For Dortmund, for example, it could be determined by means of the indicator that 55 subdistricts out of 170 statistical subdistricts of the city are characterised by a lack of green areas for children and young people.18

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5.1.3 Sub-target 2: Improvement of the visual quality (value of experience) of the urban districts modified with regard to the green area supply

The improvement of the visual quality and the value of experience with regard to the urban districts whose green area supply has been changed is at best referred to in the application of the City of Essen (p. 54). Here it is defined that “The reconstruction of the river Emscher system offers the unique opportunity to integrate free areas alongside the river Emscher as well as the naturally designed tributaries to formerly inaccessible and less attractive districts”. While the first clause of the citation referring to the aspect of networking has been considered relevant already for sub-target 1, the second clause including the terms “naturally designed” and “less attractive districts” clearly refers to the visual quality, i.e. to the value of experience. It is not difficult to see that the City of Essen hopes to benefit from the natural structure of the Emscher river and its tributaries with regard to the visual quality of the concerned urban districts which are so far estimated as less attractive. Besides, by restructuring the Emscher river the strength of smell as a result of the open water supply system will disappear, a fact leading to a significant increase in the quality of life and value of experience for the residents as well as for the local tourism.

With regard to the selection of indicators this means that, above all, those indicators should be preferred for monitoring that consider the perception of people, in particular the aesthetic perception.\(^{19}\) This should be persons who are on site, i.e. people who live in Essen. Supplementary, however, people of different provenance might be considered as well, especially if socio-demographic differences in perception shall be examined.

In the following one indicator chosen from three indicators selected before is described in more detail and discussed with regard to its pros and cons.

### 5.1.3.1 Indicator 2.1: Satisfaction with public green areas in the districts of Essen

Within the scope of an online survey made in the autumn of 2016, 199 persons from Essen and other cities mostly living in Germany were interviewed with regard to their perception or respectively their satisfaction with the green areas in Essen (Weiz 2016, p. 72).

In the course of the online survey with regard to the Green Capital initiative in the autumn of 2017 (see chapter 4) taken as a basis for the preparation of this report, the perception of green infrastructure in form of parks, forests and gardens was assessed as well. In total, 1,885 persons took part in the survey.

**Underlying data and methodological approach**

With reference to the survey made in the autumn of 2016, 118 persons of 199 interviewees lived in Essen. The distribution of frequency regarding sex, age, profession, etc. indicates that the sample is probably not representative and, thus, merely trend statements can be assessed. The online survey was published via social networks and ran from 23 September 2016 to 24 October 2016.\(^{20}\)


\(^{20}\) According to the survey in autumn 2017, 84 percent of participants lived in Essen. The survey, however, cannot be seen as representative for the population of Essen due to the selectivity of the participation, although, a weighing along age and graduation of the sample was done.
Significance of ecological indicators

The indicator allows the assessment of subjective feedbacks regarding the different green area situations in the districts of Essen. However, due to the lack of a representative status merely trend statements can be established.

Targets, status quo and development perspective

As already described by the City of Essen, the target must be to further intensify the existing grid of free areas. A central element for this is the action programme “ESSEN.New ways to the water”. Alongside the reconstructed waters new green areas close to the urban districts are developed for the citizens of Essen. These green links are being used in combination with the project “Kinderwegenetz” (children’s path network) as safe ways to school and near nature playgrounds for children.

Further activities within the course of the Green Capital initiative as, for example, the planting of trees or shrubs, the expansion of viewpoints into the greenery, the Green Capital Day as well as various citizens' initiatives, will certainly have a positive impact on the perception and appeal of the green areas in Essen.

Activities and impacts

The planned activities, especially the action programme “ESSEN.New ways to the water”, will foreseeably contribute to an intensification of free areas so that it can be assumed that the satisfaction with the public green areas in the respective urban districts will tend to be higher.

- Thus, in 2017 100,000 bulbs and 50,000 shrubs were planted within the scope of planting activities. More than 1,100 trees could be planted. During the Green Capital Day the public green of at least one site was upgraded.
- The perception of the green areas in Essen was increased by the expansion of 29 viewpoints with information columns, information boards and seating areas.
- Finally, the Magistrale Vogelheim in the northern part of the city could be realised in the year 2017. Here it is referred to upgrading measures regarding the green stock alongside the Gladbecker Straße to create a representative entrance to the city.

The impacts of the described activities can be well recorded and described by the indicator presented here.

As defined in the following figure based on the survey of autumn 2016, the subsample of Essen’s population is in major parts satisfied (Weiz 2016, p. 83). It is remarkable that on sites where green areas are less represented (and often replaced by forest areas) as, for example, in the south of Essen, the satisfaction with public green areas seems to be lower than expected. This assumption, however, is subject to the above mentioned reservation.

The statements are strengthened by consistent replies of the interviewed persons to other questions in association with the green area topic. Approximately 66-67 percent of the interviewees are satisfied or very satisfied with the number of green areas in Essen and their own urban district. In this context, the degree of dissatisfaction is with 12 percent at the urban district level significantly higher than that of 5 percent at the general city level (Weiz 2016, p. 77).

The online survey implemented in autumn 2017 also indicates a high degree of perception of the green infrastructure within Essen. Thus, with a proportion of 82 percent of the interviewees a major part of the interviewees agreed with the statement “Essen is a

22 Ibid., p. 55. The implementation was carried out by Grün und Gruga Essen.
23 Ibid., p. 55.
city with many parks, forests and gardens. At least 58 percent of the interviewees often visit the green areas of the city.

Figure 8: Satisfaction with public green areas in the urban districts of Essen

Source: Weiz 2016, p. 83

Evaluation

It is rather probable that the targets can be achieved by those activities planned and already implemented in 2017, in particular with regard to the action programme “ESSEN.New ways to the water”, at least in the districts affected by the measures.

Policy recommendation

With regard to the activities of the City of Essen it is recommended to further develop the equipment of the green infrastructure in Essen. Especially the action concept “ESSEN.New ways to the water” offers good starting points. Next to this, the City of Essen should continue to make an effort in stabilising and strengthening the perception and sensitivity of its citizens regarding the green in the city. Approaches in communication (also in the field of social media like Facebook, Twitter and Instagram) and different campaigns that have been developed in context of the initiative of the European Green Capital provide a very good foundation.

Due to methodological uncertainties of the current survey data it is advised that the City of Essen should carry out similar surveys regularly and as representative as possible (for instance with support from relevant institutes of the University Alliance Ruhr).
5.1.4 Sub-target 3: Strengthening of private commitment

One of the essential tasks of the future in developing communal green areas is the encouragement of private commitment for providing and maintaining of green and free areas. Therefore, the City of Essen wants to strengthen models of cooperation and private initiatives like civic associations or environmental groups that already maintain public parks and playgrounds or oversee nature reserves. Also, the cooperation with the garden allotments of Essen as well as the cooperation with private horticultural and forestry sector shall be successfully continued.\(^{24}\)

The degree to which the City of Essen met its targets to encourage the private commitment in providing and maintaining green and free areas shall be measured by a separate indicator.

5.1.4.1 Indicator 3.1: Cooperation of the City of Essen with private initiatives like civic associations or nature groups, the garden allotments in Essen as well as the horticultural and forestry sector

Underlying data and methodological approach

A frequent survey among private initiatives like civic associations or environmental groups, the garden allotments of Essen as well as the horticultural and forestry sector (with regard to the various forms of ownership) is supposed to determine how the cooperative commitment of the City of Essen towards these groups is perceived. The survey can be carried out – with individual regard to the group in question – at relatively low cost as online survey amongst contact persons of the respective organisation.

Significance of the indicator

The indicator leads to a normative statement about the view of private initiatives concerning the cooperation with the City of Essen. Positive aspects as well as deficits in the cooperation can be discovered and the cooperation of the City of Essen with the different institutions can be optimised on the basis of this knowledge.

Targets, status quo and development perspective

An essential target of the City of Essen is the encouragement of private commitment in providing and maintaining of green and free areas, as permanently attractive and well maintained green areas are a condition for private investment.\(^{25}\) In the past, different projects of environmental education were supported to achieve this, like the project “Nature School” in the Gruga Park or the “Bachpatenschaft” (brook sponsorship) of the Emschergenossenschaft. Also, the cooperation with the garden allotments of Essen as well as with the private horticultural and forestry sector was pushed repeatedly.

Activities and impacts

Previous activities of the City of Essen in cooperation with civic associations or environmental groups, the garden allotments of Essen as well as the horticultural and forestry sector (regardless of forms of ownership) were intensified in the year of the Green Capital. Thereby, the starting of a new awareness for the “green in the city” could be created. One example lies in the multitude of citizens' initiatives about the topic “green/nature” that have been promoted by the City of Essen in 2017. In the educational sector especially activities of the “Biologisches Bildungszentrum Schule Natur” (ecological education centre ‘Nature School’) have been highlighted.

The contact to the 120 garden allotments with its roughly 9,000 members was extended. Many garden allotments contributed to the initiative with events. In one garden allotment, the first inclusive garden for mentally challenged people in Essen was opened. The extension of garden allotments for schools was initiated. The fruitful cooperation with the garden allotments has convinced the City of Essen to launch a garden allotment concept.

Another aspect of the cooperation concerns the promotion of community gardens that have existed in Essen since 2013. Through an active support of this movement by the City of Essen the number of these community gardens could be increased from ten to 18 in the year 2017. Among other things the community garden movement was made more popular by the campaign “Gemeinschaftlich Gärtnern in Essen” (joint gardening in Essen).

The agricultural sector of Essen was included in the activities of the Green Capital. This way the campaign “Sowing, Harvesting, Eating” could repeatedly draw attention to the worth of regional production of food and the possibilities to buy the products via local farm shops.

**Evaluation**

All in all, various fruitful contacts came up between civic associations and environmental groups, the garden allotments of Essen as well as the horticultural and forestry sector, while these contacts could be intensified considerably in the year of the Green Capital. This way, many positive impulses (inclusion garden, school gardens, community gardens) were pushed forward. Especially the commitment of the City of Essen to promote the garden allotments by introducing a garden allotment development concept is to be valued very positively.

**Policy recommendation**

In total, the City of Essen is on a good path with its many initiatives to promote cooperation with civil society and NGOs, the garden allotments of Essen as well as the horticultural and forestry sector. It is important that this cooperation is used sustainably in the future.

In order to continue the cooperation in a positive way the knowledge about perception and evaluation of the city’s initiatives concerning cooperation, generated by regular surveys among the private initiatives, is of a very high value.
5.1.5 Sub-target 4: Eco-system function and adaptation to climate change

Even if the green areas indicated in sub-target 1 and 2 fulfil many functions, it is recommended to consider the problem of adaptation to climate change from a comprehensive perspective and to include all areas which have an impact on our climate to the extent that they are significant for the bio-climate (indicator 4.1) and/or refer to water retention, the latter becoming more important due to the increasing number of heavy rainfalls and flash floods (indicator 4.2). The meaning of eco-system functions and the necessity of adaptation to climate change have been perceived by the City of Essen and considered in the application for the title Green Capital26.

5.1.5.1 Indicator 4.1: Share of urban vegetation with relevance to the eco-climate

With regard to the increased intensity of heat waves due to climate change it seems to be reasonable to regularly balance and safe all areas which can be allocated to the urban greenery (i.e. green areas, forest areas27, water areas, agricultural areas, waste land, wood or swampland) and that are relevant to the eco-climate within the scope of an area monitoring. As relevant to climate can at least be considered all areas which produce or dispense cold and/or fresh air, serve for shading especially in densely populated areas as, for example, avenues. Due to a high potential evaporation (and, consequently, a high cooling impact) especially locations near groundwater (often in valleys) are of importance.

Underlying data and methodological approach

Underlying data can be the information included in the working map regarding the vulnerability “Urban climate and health factors”, here in particular the described area categories “climate balancing areas”, “air channels”, “fresh air supply” and “cold air flows”.

Significance of ecological indicators

In a total area overview this indicator allows to establish whether the City of Essen expands, reduces or at least saves the status of the agriculturally used areas.

Targets, status quo and development perspective

As target of the application for the title Green Capital regarding climate change (chapter 1, p. 20) the City of Essen defines that in order to limit the impact of climate change permanently more than 50 percent of the urban area shall be available as green, open or water areas.

Activities and impacts

In its application for the title Green Capital, with regard to climate change the City of Essen (chapter 1, p. 20) defines that in order to limit the impact of climate change, not only more than 50 percent of the urban area shall permanently be available as green, open or water areas, but that also the adaptation to the impacts of climate change shall be continued as an integral part of programmes, plans and measures within the scope of the “climate laboratory” of the City of Essen. The City’s concept of strategies and measures regarding the adaptation to climate change alone includes approximately 60 measures, to list all of them would go far beyond the scope of this article.

27  See Jay et al. (2016, p. 15).
Evaluation
Especially the long-term impacts of these measures are to be proved within the scope of a monitoring process. Principally, the ambitious target seems to be realistic. Currently, however, no statements can be made.

Policy recommendation
Monitoring should be permanent.
5.2 **Action field (2): “Public transport and mobility”**

5.2.1 **Introduction**
For the transformation of cities towards sustainability, the transport and mobility sector are key sectors. The distinguished targets, sub-targets and indicators try both to capture the specific problems and to allocate the city’s actions to it. A discussion of the effects of transport and mobility projects of the Green Capital is done in a qualitative way.28

### Table 5: Sub-targets and indicators for the action field “public transport and mobility”

<table>
<thead>
<tr>
<th>Overall development target</th>
<th>“Modal Split 25” and avoiding, relocation and optimising of traffic</th>
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<td></td>
<td>Reduction of emissions of greenhouse gases by 40 percent till 2020 in comparison to the base year 1990</td>
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#### Sub-target 1: Promotion of active means of transportation

| Indicator 1.1 | Walkability Index |
| Indicator 1.2 | Share of pedestrians in the modal split |
| Indicator 1.3 | Bicycle-friendliness |
| Indicator 1.4 | Share of cyclists in the modal split |
| Indicator 1.5 | Accidents involving pedestrians and/or cyclists |
| Indicator 1.6 | Use of rentable bikes (including cargo bicycles) |

#### Sub-target 2: Encouragement of public transport

| Indicator 2.1 | Accessibility of public transport |
| Indicator 2.2 | Availability of public transport |
| Indicator 2.3 | Quality and customer-friendliness of public transport |
| Indicator 2.4 | Degree of accessibility of public transport |
| Indicator 2.5 | Share of public transport in the modal split |

#### Sub-target 3: Promotion of multi-modality and E-mobility

| Indicator 3.1 | Use of mobile stations, P+R and R+B stations |
| Indicator 3.2 | Use of car-sharing |
| Indicator 3.3 | Use of charging stations for electronic vehicles |

28 The highlighted indicators are described in this short version of the report. The other indicators are elaborated in the long version.
Sub-target 4: Reduction of individual motor car traffic

| Indicator 4.1 | Density of motor car traffic (degree of motorisation) |
| Indicator 4.2 | Car park supply |
| Indicator 4.3 | Environmental priority zones and car-free areas |
| Indicator 4.4 | Share of individual motor car traffic in the modal split |

5.2.2 Sub-target 1: Promotion of active means of transportation

5.2.2.1 Indicator 1.1: Walkability Index

Underlying data and methodological approach

The “Institut für Stadtplanung und Städtebau” (Institute for city planning and city development) of the University Duisburg-Essen has, in the context of a research project, calculated a so-called Walkability Index, in which GIS-based walk-audits on both micro and macro level were combined, synchronised, weighted and aggregated to a comprehensive index. As the index consists of a multitude of single indicators the data collection is very work-intensive. Nonetheless, the high work load is justified by the high informative value.

An input that could influence the Walkability Index noticeably are investments in pedestrian mobility. The political will for promoting active means of transportation is manifested here. However, regarding the implementation of plans, no direct assumption can be made.

An output indicator with influence on the Walkability Index deals with the length and connectedness of the everyday routes for pedestrians as well as the mixed usages and building density (ISS 2017).

Significance of the indicator

The index allows for a judgement of the pedestrian-friendliness of a neighbourhood, district or a city.

Targets, status quo and development perspective

The “Ministerium für Gesundheit, Emanzipation, Pflege und Alter des Landes Nordrhein-Westfalen (MGEPA NRW)” (Ministry for Health, Emancipation, Care and Age of the State of North Rhine-Westfalia) asserted in 2016 that only 50 percent of the people in Essen reach an internationally recommended amount of exercise, 17 percent are physically in-active (MGEPA NRW 2016, p. 84). According to the City of Essen 22 percent of people walk regularly. This number is below average for the state of North Rhine-Westfalia (Stadt Essen 2012, p. 88). This outcome may have its origin in a lack of pedestrian-friendliness of public spaces.

Small-scale walkability data are not available for the whole city. In the centres of the city districts Altendorf, Altenessen North, Frohnhausen, Kettwig, Kray, Rüttenscheid and Werden average up to high degrees of walkability are achieved in a study of the Institute for city planning and city development (ISS 2017).

The last household survey about mobility in Essen for the year 2011 shows that 22 percent of all commutes were done by feet. In 2001 this value was at 27 percent, so a decrease can be measured (Stadt Essen 2012, p. 80). If the situation for pedestrians in public spaces should not improve, chances are that the share of pedestrians in the modal split will continue to decrease.
Activities and impacts

Previous activities or measures that are directed solely to promote walking do not exist. “The Department for Streets and Transports as responsible institution for the public easement of road networks within city limits does not pursue special or separate programmes for the promotion of pedestrian mobility.” (“Amt für Straßen und Verkehr” 2017 – own translation)

Evaluation

Fewer and fewer citizens of Essen go by feet. This negative development not only has consequences for the environment, as in many cases the car is used instead. It also affects the health of people in a negative way through deficient exercise. It is obvious that there exists a need for action at this point. Especially when it comes to multimodal mobility, i.e. the combination of different modes of transport within one journey, pedestrian mobility can be expanded and integrated better.

5.2.2.2 Indicator 1.3: Bicycle-friendliness

Underlying data and methodological approach

The indicator consists of length, connectivity and quality of everyday routes for cyclists. Crossings between walkways and cycle lanes were analysed according to number and closeness using GIS. Many of these data, as the cycle lane network, were available as maps. Other, rather subjective data had to be gathered additionally. A meaningful basis for subjective aspects of the indicators is the “ADFC-Fahrradklimatest” (test monitoring bicycle-friendliness by the General German bicycle club), a satisfaction index for cyclists. It is the largest survey of its kind worldwide (ADFC 2018).

Significance of the indicator

A high bicycle-friendliness mainly in the inner-city traffic is necessary to offer commuters an alternative option to move emission-free.

Targets, status quo and development perspective

Above all, the “Fahrradklimatest” (test monitoring bicycle-friendliness) highlights the good availability of bikes for rent, easy navigation and many one-way streets that are open for cyclists (ADFC 2016a, p. 1). Currently, 300 of 564 one-way streets in Essen are accessible in both directions for cyclists. In the course of roadworks (for instance the renewal of paving on the street “Büchelslohn” in the district Katernberg), the cycling infrastructure is renewed as well and one-way streets are opened both ways for cyclists (Stadt Essen 2017c, p. 2).

It should be observed that checks for parking violations and winter services on cycle lanes are only rarely carried out. In addition, the cumbersome traffic light circuits were criticised (ADFC 2016a, p. 1). In comparison to other cities with more than 200,000 inhabitants Essen comes off comparably badly. The city ranks 29th out of 39 nationwide (ADFC 2016a, p. 0) and in North Rhine-Westphalia ranks 11th out of 15 (ADFC 2016b, p. 6).

Furthermore, a negative trend can be detected regarding the infrastructure in comparison to the year 2014. When comparing the length of the street network of 1,500 km to the streets that have been refitted for cyclists, the results are very poor: only 118 km have their own cycle lane (107 km have cycle lanes on the pavement, on the roadside or separate cycle lanes, 11 km protected zones for cycling), meaning that only 8 percent of the 1,500 km existing roads are refitted to suit cyclists (Stadt Essen, 2018).
Activities and impacts
The development of a high number of one-way streets has a positive effect on the trafficability of the city for cyclists. Cycle lanes on old railway tracks like the “Radschnellweg Ruhr RS1” (Ruhr Bike Expressway) (planned between Duisburg and Hamm) make it possible to commute conveniently to neighbouring towns. Due to their routing, these lanes are of only limited use for the management of inner-city transportation by bike.

In the building programme “Radverkehr an Straßen 2015” (Cycling Along Streets 2015) measures are planned that shall close the gaps in the existing cycle lane network (Stadt Essen, 2015a). The priority is to close the gaps alongside main traffic routes. Additional cycle lanes are intended but with no high priority. Furthermore, the Regionalverband Ruhr (Regional Association Ruhr, short RVR) plans the connection of the cycle lanes to a regional network (Arbeitsgemeinschaft fußgänger- und fahrradfreundlicher Städte, Gemeinden und Kreise in NRW e.V. 2018).

Essen is member of the working group “Fahrradfreundliche Städte, Gemeinden und Kreise e.V.” (Bicycle-friendly towns, counties and parishes) and offers the free mobile app “ESSEN.Erfahren” with navigation, maps and details on cycle routes.

Evaluation
The investment in the everyday cycling transport is still not sufficient to achieve a positive trend concerning bicycle-friendliness. In most cases the strengthening of cycling transport leads to a weakening of the motorised transport. Currently, the political backing in the City of Essen for such a development is not strong enough. Nevertheless, opportunities exist to improve the situation for cyclists. The reduction of car speed or the conversion of parking spaces along streets can have a great impact.

The collection of data for this indicator should, if possible, happen regularly and in connection with collecting data for pedestrian-friendliness. This way synergies in collecting data can be used and the time needed for data acquisition can be reduced.

5.2.3 Sub-target 2: Encouragement of public transport

5.2.3.1 Indicator 2.1: Accessibility of public transport

Underlying data and methodological approach
Using GIS-Analysis the accessibility and location of public transport stops can be assessed in great detail. However, instead of the actual distance the distance between stops is measured in beeline. Here, solutions should be found to come closer to reality.

Significance of the indicator
The coverage with public transport stops of the whole area of the city is relevant for the accessibility and its usage. The actual use of public transport, however, is not measured which makes it not less important. The more citizens live in a comfortably walkable distance to a public transport stop, the better. Which distance shall be used to define this indicator has still to be discussed.

Targets, status quo and development perspective
Roughly 44 percent of the population of Essen are directly connected to the communal railway system. A third of all citizens only have a bus stop in their close living environment. In comparison to surveys from the year 2006 on the 2008 edition of the “Nahverkehrsplan (NVP)” (public transport plan), about 2,600 citizens more are connected (Amt für Stadtplanung und Bauordnung 2017, p. 112). Today, a total of 90 per-
cent of the population of Essen live in the catchment area of the public transport (Amt für Stadtplanung und Bauordnung 2017, p. 139).

This means that, in relation to the distance, 77.3 percent of all citizens of Essen live in 300 m distance to the next public transport stop or less. A negative example is the district of Frillendorf, in which a part of the population has neither a bus stop nor a railway station in less than 400 m distance (Amt für Stadtplanung und Bauordnung 2017, p. 114 and Hoxha et al. 2017, p. 20).

Activities and impacts

After reconstruction of a tram segment, the tram 109 from Steele to Frohnhausen was opened with a length of roughly 1.4 km and an investment volume of roughly 12 million euros on 20 October 2014. In the new public transport plan of the City of Essen from the year 2017 a key project for the development of the public transport is mentioned, the “Bahnhofstangente” (railway station tangent). With the new overground rails new users shall be connected to the main station and the transport capacity of tramlines in the surrounding of the main station would be increased (Amt für Stadtplanung und Bauordnung 2017, p. 1).

Relating to the spatial increase of the public transport network, the City of Essen sees the development as finished (Amt für Stadtplanung und Bauordnung 2017, p. 141). Uneconomical bus routes shall even be closed to transfer funds to more promising sectors (Amt für Stadtplanung und Bauordnung 2017, p. 273).

Evaluation

Regarding the junctions a great number of data has to be collected. Some data like the mapping of the public transport stops is already available. To be able to make more precise statements, this data is not enough. More information about the usage of single stops and the average real distance (not beeline) has to be measured.

With regard to current development and planning, the cancellation of bus routes can be criticised. This measure reduces the accessibility of public transport for some parts of the population of Essen. Profitability should not be an argument against services that benefit the greater good. But there are opportunities to connect to the public transport without a bus. Flexible solutions could be considered by the City of Essen to achieve an area-wide network.
5.2.3.2 Indicator 2.3: Quality and customer-friendliness of public transport

Underlying data and methodological approach
This indicator is built upon the subjective judgement of the public transport in Essen by its users and the whole of the citizens. The city administration has to discuss how the quality and user-friendliness should be measured. A great role in evaluating this could be the customer survey of the “Ruhrbahn” (local railway provider), which has been carried out in a two-year interval – in the past under the management of the EVAG (for instance 2010 or 2012) and currently under the management of the Ruhrbahn (for instance 2014 and 2016). Another data source is the quality report.

Significance of the indicator
It is not only the actual objective range of services of the public transport that is influencing its use. A great influence has the subjective opinion of the public about the public transport. Good services of public transportation are the basis for its usage. Subjective aspects like perception of and opinion about the public transport that can be measured by surveys can be linked to the design of stops, the cleanliness of vehicles, the friendliness of the staff and the comprehension and transparency of the tariffs.

The target should be to make the public transport look more attractive than one’s own car. The subjective perception plays an important role in that.

Targets, status quo and development perspective
Published evaluation of EVAG’s customer survey from the years 2010 and 2012 indicates a slight increase in average satisfaction with the services of the company (Stadt Essen 2017, p. 18). The evaluation of more recent customer surveys from the years 2014 and 2016 shows that the average satisfaction on the level of 2012 could be kept (Ruhrbahn 2018).

Activities and impacts
The introduction of two electrobuses for tours around the mine of “Zeche Zollverein” were realised already (Stiftung Zollverein 2017). It is planned to provide a whole line with electrobuses. In 2020 the line 144 between “Kray” and “Stadtwaldplatz” shall be switched to electrobuses completely (Mücke 2017b). This would lead to an increase of quality of public transport as the noise exposure could be lowered by quieter engines.

In addition, a multitude of campaigns and user assistance for the public transport were introduced:

- “Abo-Ticket-Upgrade”: Extension of functions of subscription tickets to improve multimodal mobility (Stadt Essen 2018f, p. 4-5).
- New citizens marketing: public transport offers for free
- Introduction of cheap job tickets: currently used by around 18,430 employees from 130 companies
- Social ticket: cheaper monthly tickets for recipients of welfare benefits
- Bus training for people above 50 and children
- Extension of dynamic customer information systems at stations and stops
- Extension of sign posts to public transport in the city
- “Essen Mobil” (Essen mobile): App for route planning and transport information
Evaluation
The introduction of the night bus network was an investment that is regularly used by the citizens of Essen. However, with regard to the night network there are big supply gaps which shall be closed in future. In the local transportation plan of the City of Essen from the year 2017 it says: “Due to shorter cycle times and supply reduction in the night network, a connection is planned that becomes possible by the ‘Sternfahrt’ at Essen main station.” (Amt für Stadtplanung und Bauordnung 2017, p. 102).

Policy recommendation
To make the offer of the public local transportation more attractive it should be referred more thoroughly to the demands of the customers. The interviews regularly implemented by the Ruhrbahn offer a variety of approaches to improve the local transportation service. The information received in this context should be considered in an adequate catalogue of measures for the improvement of the local transportation service.

Beyond these measures for improvement an active way of communication is necessary also including the social media channels as, e.g., Facebook, Twitter and Instagram, in order to strengthen the citizens’ awareness of the possibility of using the public local transportation. Here, the existing approaches of the corresponding actors which have been evaluated positively already are further to be promoted and, if necessary, to be expanded.

5.2.4 Sub-target 3: Promotion of multi-modality and E-mobility

5.2.4.1 Indicator 3.2: Use of car-sharing

Underlying data and methodological approach
In the centre of Essen car-sharing is offered by four companies. The number and distribution of stations and vehicles is published on the website of the corresponding company:

- Projekt RUHRAUTOe (www.ruhrauto-e.de)
- Greenwheels (www.greenwheels.com)
- Stadtmobil (www.rhein-ruhr.stadtmobil.de)
- Drivy (www.drvy.de)

These companies are mentioned also on the City of Essen’s website with regard to the topic car-sharing. All 47 vehicle stations are exposed on the energy transition map Ruhr (Reicher 2018). Since some of the suppliers of car-sharing are active within the entire Ruhr area, it is not possible to state the real number of cars available for car-sharing in the centre of the Essen.

The information about number and distribution has limited relevance as an indicator, since they do not inform about the real use. The using data is available via the operators of the sites.

Significance of the indicator
The distribution of car-sharing stations in Essen can have an important impact on the use of car-sharing offers. The more evenly car-sharing vehicles are distributed in the urban districts, the more likely citizens will change their private car for a public car from a car-sharing offer. A change would lead to a reduction of the individual motor car traffic.
Targets, status quo and development perspective

The four suppliers follow different approaches to realise a car-sharing system:

The project RUHRAUTOe has a fleet of 45 cars in the entire Ruhr area which exclusively consists of electric vehicles. RUHRAUTOe has got 27 sites in the whole of NRW, seven thereof in Essen. These sites are directly linked with stops of the public local transport system (main station, Zweigertstraße, University, Rüttenscheider Stern, Kennedystraße, Ribbeckstraße and Norbertstraße). The target is to cooperate with the public local transport service. The public transport is not seen as a competitor.

The company Greenwheels has according to their own information a fleet of totally environmentally friendly cars (Greenwheels 2018) at six locations in Essen (Flora, Gira-detstraße, Rubensstraße, Schubertstraße, main station south and Leopoldstraße) and has been existing already for 20 years.

The company group Stadtmobil has got more than 1,500 vehicles all over Germany and is networked with other car-sharing suppliers. It has 31 sites in Essen at its disposal, above all in Rüttenscheid, Holsterhausen and the southern district. Almost half of it is operated by “stadtflitzer”, a so-called “free-floating” offer of Stadtmobil which allows a spontaneous use, since a registration is not necessary.

Drivy is a portal for private car rental. In Germany more than 6,000 cars are registered, approximately 20 thereof in Essen. With exceptions anyone aged over 21 years and a driving permission valid for at least two years may rent a car or register his car for renting.

Activities and impacts

Within the scope of the Green Capital programme, since 2017 Stadtmobil Rhein-Ruhr has been a partner in the GreenTicket project of the Ruhrbahn and established a location at the two new mobile stations in 2017 (Stadt Essen 2018f, p. 2).

As one of the key topics of the Green Capital programme the topic “car-sharing” has not only been actively communicated within the scope of the European Mobility Week. Important aspects in this context were the opening of the mobile stations (see indicator 3.1) and the granting of price advantages in association with the acquisition of a GreenTicket of the Ruhrbahn (further promoted by Ruhrbahn under the motto “Flexibel mobil”). Thus, the public perception of car-sharing could be increased significantly. Last but not least these activities led to the fact that in the year 2017 30 percent new customers could be registered (Final documentation EGC5 2018, p. 9).

Evaluation

In the ADAC Monitor (2017) 50 percent of the interviewees stated that car-sharing is not relevant for them or that they don’t have any information about it. Despite legal restrictions there is action needed in order to draw the citizens’ attention to the use of car-sharing as possible alternative, to make it more attractive and to increase free-floating offers and, as a consequence, the flexibility of use.

Policy recommendation

Car-sharing requires active communication and promotion through campaigns and measures in order to increase the degree of awareness and to help to improve the image of multimodal mobility. During the Green Capital programme successful approaches have been developed which should be deepened for the future development.

In the future there should be more references to multimodal mobility. Especially persons without a private car may profit from the advantages of public cars and integrate them in their mobility behaviour.
5.2.5 Sub-target 4: Reduction of individual motor car traffic

5.2.5.1 Indicator 4.2: Car park supply

**Underlying data and methodological approach**

The recording of public parking areas in Essen’s city centre is based on the mapping of the City of Essen. Additionally, this indicator also considers the parking areas in the urban car parks as, for example, the car parks of the shopping centres at Rathaus and Berliner Platz. On the basis of this data a development of the number of parking spaces and parking fees can be considered.

**Significance of the indicator**

A sufficient number of low-budget parking lots supports the use of a private car. Essen is one of the centres of the Ruhr area, both as place of work and as destination for leisure and shopping activities. Therefore, the available parking lots are not only used by the inhabitants but also by visitors of the city.

The company Inrix published the study “The Impact of Parking Pain in the US, UK and Germany”, in which Graham Cookson and Bob Pishue analyse the parking situation and the costs associated therewith especially in Germany. In this context, the data of the worldwide biggest database as well as the results of a worldwide survey of approximately 18,000 persons has been evaluated. In Germany, an average number of 599 persons of ten big cities have been interviewed (Cookson and Pishue 2017, p. 6).

In a German-wide view, merely in Berlin more people park their cars in public areas. There, 48 percent of all persons are looking for a parking lot, in Essen and Munich their share is 44 percent (Cookson and Pishue 2017, p. 17). Another result of the study was that the German car driver spends about 41 hours per year with the search for a parking lot. Essen is second in a nation-wide ranking with approximately 64 hours per person. First is Frankfurt on the Main with approximately 65 hours. Within North Rhine-Westphalia Essen is first in the ranking, followed by Dusseldorf with 61, Cologne with 60 and Dortmund with 57 hours (INRIX Research 2017).

In Germany the annual additional costs resulting from the search for a parking space amount to 42 billion euros, considering the time needed, the fuel consumed and the higher exhaust emissions (Cookson and Pishue 2017, p. 3). In Essen alone this amounts to 490 million euros per year. Allocated to the individual car driver there are additional costs of 1,390 euros per year for the search of a parking space (Cookson and Pishue 2017, p. 20).

In the leaflet “Parken ohne Ende?” (Parking without end?) created by the “Arbeitsgemeinschaft fußgänger- und fahrradfreundlicher Städte, Gemeinden und Kreise in NRW e.V.” (Working group of pedestrian- and bicycle-friendly towns and municipalities in NRW, short AGFS NRW) of the year 2012, the volume of traffic searching for parking spaces amounts up to 40 percent of the total traffic of a city (ADFS NRW 2012, p. 14).

If the proportion of individual motor car traffic is aimed to be decreased, also the parking facilities have to be reduced. The parking facilities in a city may, similar to the car density, be an indirect indicator of the vehicle use.
**Targets, status quo and development perspective**

Currently, according to the application of the City of Essen there are approximately 12,000 public parking lots which are controlled and directed by a parking system including more than 120 dynamic information panels. However, in this context the question arises in how far an intelligent parking system may reduce the individual motor car traffic, since as mentioned before a sufficient number of parking lots rather leads to more and more vehicles. The parking system has been introduced in order to reduce the traffic in search for parking spaces above all with regard to the competitiveness of Essen as a shopping centre within the Ruhr area.

**Activities and impacts**

One policy of the City of Essen which is also referred to in the application for the title EGC is the establishment of residential parking areas in the city’s centre and the urban districts “Ost-, Museums- und Sternviertel”. In this area parking is only allowed for residents with a resident parking permit. The missing public parking area may lead to the fact that fewer people travel by car if they don’t find a parking lot at their destination and, thus, are compelled to use different means of transport. The southern area of the district “Rüttenscheider Straße” is exemplary for this kind of development.

**Policy recommendations**

The more parking area is available the more people will use their cars for daily travelling as pointed out by the afore-mentioned study. In order to decrease the share of individual motor car traffic in the modal split the parking management can be addressed. Possibilities for this are, for example, the reduction of parking area alongside roads and the increase of parking fees in urban car parks.

In this context synergies are possible as well. If parking spaces are removed alongside roads there will be more space for other traffic participants as cyclists or trams which often run directly on the road.
5.3 Action field (3): “Air quality”

5.3.1 Introduction

The City of Essen defined the following targets and strategies in the action field “air quality”. The targets shall be achieved in a two-stage procedure in 2020 and 2035:

- In 2020 the annual average value of particulate matter of PM$_{10}$ shall be less than 29 g/m$^3$ and a comprehensive observance to the limit value of NO$_2$ shall be secured.

- For 2035 the significantly stricter requirements of the World Health Organisation (WHO) shall be adhered to, i.e. in case of PM$_{10}$ the observance of an annual average value of less than 20 μg/m$^3$ as well as the complete avoidance of an exceeding of the annual average value of PM$_{10}$ (from 50 μg/m$^3$). Simultaneously, it shall be secured that the WHO guide values for NO$_2$ are observed from 2035 on (annual average value of less than 40 μg/m$^3$, hourly average value of less than 200 μg/m$^3$ and less than 18 exceedings per year).

The strategies implemented in this context contain 13 subitems and refer above all to measures regarding traffic regulations which would support a decline of particulate matter and NO$_2$. The following evaluation of the selected indicators discusses the contents of individual strategies.

A complete evaluation of the development of air quality in Essen since the application’s beginning and the city’s later role as European Green Capital 2017 is not possible due to missing data in relation to the measurement of air quality. Nevertheless, key indicators$^{30}$ for the development goal to improve the air quality in the centre of Essen overlapping in the application as Green Capital could thoroughly be examined in accordance with the state of science and be compared with the contents of the City’s application as European Green Capital.

The indicators to be examined are first to be sub-divided into emission-side and immission-side indicators. While emission refers to the direct emission (gaseous or solid) of emitters, immission describes the impact of air pollution on the recipients. Besides, the EU-sustainability indicator and indicators with reference to the endpoints of measured effects have been evaluated.

“For air data analyses in the centre of Essen which are necessary for single evaluation levels, it has been referred to the measurement data prepared and documented in detail by the ‘Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen’ (Regional Office for Nature, Environment and Consumer Protection NRW, short LANUV) for four measurement stations in the area of Essen which served as a data basis for the determination of air quality indices and further indicators. However, the significance of these evaluations can just be indicative with regard to the entire district of Essen. For a binding statement further investigations at different stations would become necessary for a validation of the preliminary investigations.”

$^{29}$ Even though, formally related to this topic CO$_2$-emissions are dealt with in the action field 1 “Green areas and climate change”.

$^{30}$ The indicators were identified together with the project consortium.
Table 6: Sub-targets and indicators for the action field “air quality”

<table>
<thead>
<tr>
<th>Overlapping development goals</th>
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<tbody>
<tr>
<td>Improvement of air quality in the district of Essen including:</td>
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<tr>
<td>Observance of air quality standards</td>
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<tr>
<td>Protection of environment and population</td>
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### Sub-target 1: Improvement of air quality via emission-side indicators

**Indicator 1.1** Development of the annual quantity of emission of relevant pollutants

### Sub-target 2: Improvement of air quality via immission-side indicators

**Indicator 2.1** Air quality indices (short-term and long-term)

**Indicator 2.2** Temporary immission load of relevant pollutants

### Sub-target 3: Improvement of air quality via the EU-sustainability indicator

**Indicator 3.1** Immission load of population

**Indicator 3.2** Observance of EU-air quality standards

### Sub-target 4: Indicators with reference to the endpoints of measured effects

**Indicator 4.1** Integrated use of air quality data for forecasts and scenarios

#### 5.3.2 Sub-target 1: Improvement of the air quality via emission-side indicators

Emissions are caused by different emitters. In this context traffic, industry and agriculture play a major role, but also the citizens’ lifestyle is of importance (Bundeszentrale für politische Bildung 2009). Reasonable indicators for the evaluation of air quality improvements are:

a) The annual quantity of emissions of relevant pollutants in the district of Essen

b) A focused recording of traffic emissions which should be classified according to individual modes of transport

c) The annual per capita emissions of the citizens

None of the indicators can be evaluated, since the air quality investigations undertaken require thoroughly elaborated measurement data and, furthermore, no comparisons with the City of Essen’s application situation can be made. Thus, for the evaluation of emission-side indicators merely the indicator “Annual quantity of emission of relevant air pollutants” is taken into consideration in order to discuss in particular the targets defined by the City of Essen in this context and make appropriate recommendations.
5.3.2.1 Indicator 1.1: Development of the annual quantity of relevant pollutants

**Underlying data and methodological approach**

In the application of the City of Essen as Green Capital targets for the observance of the prescribed values for PM$_{10}$ and NO$_2$ have been determined and strategies have been defined to be taken as a basis for these targets. For the evaluation of this indicator further relevant air pollutants (e.g. NO, CO, SO$_2$, O$_3$) are considered which the WHO includes in the air quality analysis in order to prove whether the selected focus on the reduction of PM$_{10}$ and NO$_2$ is sufficient. Besides, the City’s strategies in relation to the target of reducing PM$_{10}$ and NO$_2$ are addressed and evaluated.

**Significance of the environmental indicator**

For decision-makers of the cities and municipalities the annual average value for “relevant”, i.e. dominant and health endangering air pollutants, is an important recommended value to bring them into conformity with the emission limits defined by the WHO and the EU.

Due to the economic development, the urbanisation, the energy consumption, the development of dense traffic networks and the rapid growth of population air pollution has become a significant problem for industrial nations, especially for urban districts (EUA 2017).

For Essen there are many challenges with regard to the observance of air quality standards. In the strongly industrialised Ruhr area which is also a logistic reloading and transition region as well as a commuter region for many employees, the prevention of air pollution requires a greater level of attention than in regions with less traffic and which are less urbanised and industrialised.

For a better air quality the development of the annual emission of relevant air pollutants has to be examined and, according to the results, strategies for the improvement of the air quality have to be developed. Especially the observance of international standards that are classified according to single air pollutants is to be considered as an important and legally binding target for the cities. Relevant ingredients for the measurement of the air quality are – although the air contains many more ingredients – the air components carbon monoxide (CO), nitrogen dioxide (NO$_2$), ozone (O$_3$), sulphure dioxide (SO$_2$) and particulate matter (PM$_{10}$ and PM$_{2.5}$).

**Targets, status quo and development perspective**

The decline of anthropogenic air pollutants is a general trend of the air quality in Europe (EUA 2018). During the period from 1990 to 2015, for example, the emissions of nitrogen oxides declined by 52 percent throughout Europe (56 percent in the EU-28), the emissions of sulphur oxides by 83 percent (89 percent in the EU-28) and the emissions of particulate matter have declined by 28 percent since 2000 (until 2015) (26 percent in the EU-28).

The long-term trend of an improvement of the air quality also applies to Essen. Nevertheless, Essen has to face challenges with regard to the development of the air quality: Its road network is particularly a chronic road congestion so that the dense motorised traffic is an essential problem for the air quality in Essen.

To achieve the City of Essen’s targets regarding an improvement of the air quality, there are many points of reference. A very concrete and direct way of counteracting by the City is the smart route planning of the transportation sector, the promotion of electric mobility and other “green” transportation means. Due to international agreements German cities are obliged to observe the air quality standards. Accordingly, at best the development perspective of the City of Essen is associated with international rules on air quality improvement.
Activities and impacts

The City of Essen realised the traffic problem in association with the air quality and took respectively takes measures in order to achieve a long-term improvement of the air quality. In this context, the City of Essen focuses the following strategies which are largely manifested in the City’s clean air plan:

- General reduction of combustion processes to decrease greenhouse gases, which will also lead to a reduction of the background pollution triggered by PM\textsubscript{10} and NO\textsubscript{x}.
- The City of Essen’s own vehicle fleet will be configured to standards which are lower in emissions according to the EURO VI-standard for trucks (since 2013) and EURO 6-standard for cars (2014) until 2022. Besides, it is planned to increase the number of electric vehicles.
- The model “Modal Split 25” of the City of Essen until 2035 that endeavours a reduction of the individual traffic by 29 percent by the use of electric mobility, liquid and natural gas engines, a decrease of the commuter car traffic and other more rigorous measures for road traffic and industry which are not defined in more detail in the application.
- Extension of the cycling infrastructure
- Enlargement of the local public transport
- The “route concept for trucks” of the Ruhr Metropolitan Area including corresponding sustainable route recommendations
- Introduction of a “pilot zone electric mobility in daily life”
- Construction of a road bypassing the city centre “Berthold-Beitz-Boulevard” for vehicles and trams in order to relieve two much frequented roads (Hindenburg- and Hans-Böckler-Straße) and a moving of the A40 junction Essen-Frillendorf to relieve the hotspot “Hombrucher Straße”
- Introduction of a digital parking guidance system

The multi-tiered monitoring of four traffic stations (two traffic, two background) in Essen and the report for the action field “air quality” which has been expanded within the scope of this evaluation (see annex) underline the trend that the City of Essen endeavours a better air quality. Nevertheless, the report includes the following statements with regard to the air pollutor PM\textsubscript{10}:

- The PM\textsubscript{10}-exceeding of the daily average value has been below the EU directives since 2010 and has slightly increased between 2016 and 2017 at three of the four measuring stations. These inter-annual fluctuations are not seldom and may for example be a result of meteorological circumstances.
- The annual average value of PM\textsubscript{10}, which is below the EU-limit in Essen, has also slightly deteriorated at two stations and remained unchanged for one station.
Evaluation

Since the date Essen got the title European Green Capital the air quality has not significantly but continually improved. A connection between the City’s activities and their impact on the air quality, however, is not measurable within the scope of the current research programme.

Beyond concrete results, however, criticism may be allowed with regard to the “strategies” defined for improving the air quality:

- The assumption that a CO2-reduction automatically leads to a reduction of nitrogen oxides is only partially correct. For diesel engines applies the following: “Less CO2, more NO2”. The fine particular pollution won’t necessarily be reduced by a reduction of CO2. However, with regard to the decrease of combustion processes of all sectors of the city a correlation between the decline of greenhouse gases and a similar decline of air pollutors can be confirmed.

- The City of Essen’s strategies for better values of PM10 and NO2 have partly been implemented already at the date of application (e.g. environmental zones, rebuilding of roads) and can therefore hardly be allocated to the scheme “future strategy”.

The introduction of a temporary zone “Electric mobility in daily life”, however, is to be seen as a concrete strategy in order to reduce the car traffic and its emissions including the development of (fast) cycle lanes and the expansion of the public local transport system.

Besides, the planned targets regarding a reduction of the air pollution in the city indicate a further necessity to act:

Since the focus of the application is merely laid on the air pollutors NO2 and PM10, the City of Essen put an emphasis on the question whether the air quality measurements are within the spectrum of the EU directives. Air quality problems as a result of particulate matter 2,5 (PM2.5) and ozone-generating volatile organic compounds (VOC) which might become more significant in the future are not explicitly considered in relation to the air quality targets associated with the application for the title European Green Capital. Firstly, the values are not taken into account, since they are below the statutory EU limits.

Policy recommendation

For the monitoring of air quality measurements of air pollutors of the City of Essen additional, so-called air quality indices and indicators with reference to the endpoints of measured effects can be considered in order to verify actions for a better air quality and to imagine new scenarios. Besides, the City of Essen could anticipate future air quality problems by (further) indicating these risks and pursuing strategies for improvement which can be realised at city level. In this context WHO recommendations can be taken into account which pursue stronger air quality targets than the EU directives in relation to the observance of air quality.

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31 This trend is described in exceedings statistics of NO2 (figure 22 in the annexed report) and average values of PM10 (figure 24 to 26 in the annexed report) and the yearly average values of PM10 as well as selected air quality indices.
5.3.3 Sub-target 2: Improvement of air quality via immission-side indicators

5.3.3.1 Indicator 3.2: Observance of EU air quality standards

Underlying data and methodological approach
For the indicator’s evaluation an air quality index referred to in the action field’s report (see annex) has been taken into consideration as well as the history and current developments of the EU air quality standards.

Significance of the environmental indicator
The European Commission pursues the objective to improve the air quality in the way that there are no unacceptable impacts anymore for people and the environment (EUA 2017). The focus of legislation is the determination of limits in relation to the most important air pollutants (particular matters PM10 and PM2.5, sulphur dioxid, nitrogen dioxid, lead, carbon monoxid, benzol, ozone, arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons). The EU directives, however, orient towards the standards, guidelines and programmes of the World Health Organisation (WHO). The member states can develop their own strategies to what extent they realise the EU directives for air quality, they are obliged, however, to make the chosen strategy publicly available and to publish the measurements of air quality taken according to the EU regulations. If the air quality standards are not observed by the EU member states, there will be the risk of legal penalties (Official journal of the European Union Guideline 2008/50/EG as well as 2004/107/EC). The EU relies on air quality standards and appropriate emission control technologies.
Table 7: EU air quality standards of the most important air polluters from the directives 2004/107/EC and 2008/50/EG in relation to human health

<table>
<thead>
<tr>
<th>Luftschadstoff</th>
<th>Konzentration</th>
<th>Mitteleinsatzeitraum</th>
<th>Rechtsnatur</th>
<th>Erlaubte Überschreitungen pro Jahr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feinpartikel PM2,5</td>
<td>25 µg/m³</td>
<td>1 Jahr</td>
<td>Zielwert in Kraft getreten: 01.01.2010 Grenzwert in Kraft getreten: 01.01.2015</td>
<td>n/a</td>
</tr>
<tr>
<td>Schwefeldioxid SO₂</td>
<td>350 µg/m³</td>
<td>1 Stunde</td>
<td>Grenzwert in Kraft getreten: 01.01.2005</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>125 µg/m³</td>
<td>24 Stunden</td>
<td>Grenzwert in Kraft getreten: 01.01.2005</td>
<td>3</td>
</tr>
<tr>
<td>Stickstoffdioxid NO₂</td>
<td>200 µg/m³</td>
<td>1 Stunde</td>
<td>Grenzwert in Kraft getreten: 01.01.2010</td>
<td>18</td>
</tr>
<tr>
<td>Feinstaub PM10</td>
<td>50 µg/m³</td>
<td>24 Stunden</td>
<td>Grenzwert in Kraft getreten: 01.01.2005</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>40 µg/m³</td>
<td>1 Jahr</td>
<td>Grenzwert in Kraft getreten: 01.01.2010</td>
<td>n/a</td>
</tr>
<tr>
<td>Blei (Pb)</td>
<td>0,5 µg/m³</td>
<td>1 Jahr</td>
<td>Grenzwert in Kraft getreten: 01.01.2005</td>
<td>n/a</td>
</tr>
<tr>
<td>Kohlenstoff-monoxid (CO)</td>
<td>10 µg/m³</td>
<td>Maximale tägliche Stundenmittelwerte</td>
<td>Grenzwert in Kraft getreten: 01.01.2005</td>
<td>n/a</td>
</tr>
<tr>
<td>Benzol</td>
<td>5 µg/m³</td>
<td>1 Jahr</td>
<td>Grenzwert in Kraft getreten: 01.01.2010</td>
<td>n/a</td>
</tr>
<tr>
<td>Ozon</td>
<td>120 µg/m³</td>
<td>Maximale tägliche Stundenmittelwerte</td>
<td>Grenzwert in Kraft getreten: 01.01.2010</td>
<td>25 Tage über 3 Jahre gemittelt</td>
</tr>
<tr>
<td>Arsen (As)</td>
<td>6 ng/m³</td>
<td>1 Jahr</td>
<td>Zielwert in Kraft getreten: 31.12.2012</td>
<td>n/a</td>
</tr>
<tr>
<td>Cadmium (Cd)</td>
<td>5 ng/m³</td>
<td>1 Jahr</td>
<td>Zielwert in Kraft getreten: 31.12.2012</td>
<td>n/a</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
<td>20 ng/m³</td>
<td>1 Jahr</td>
<td>Zielwert in Kraft getreten: 31.12.2012</td>
<td>n/a</td>
</tr>
<tr>
<td>polyzyklische aromatische Kohlenwasserstoffe</td>
<td>1 ng/m³</td>
<td>Als Konzentration von Benzo(a)pyren angegeben</td>
<td>Zielwert in Kraft getreten: 31.12.2012</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: European commission (2008)
last update 22.09.2017
The most important political instruments against air pollution in the EU are the Air Quality Directives (EU, 2004, 2008) and the national emission limit (EU, 2016), for which recently a revision of the legislation has been decided within the scope of the Clean Air Policy Package. Since 2013 the “Clean Air Policy Package” has updated existing directives to reduce the impact of air pollution on human health. For this purpose, objectives for 2030 have been defined and means for cities, science and innovation and international cooperation have been provided.

The directive on national emission limits (National Emission Ceiling Directive, NECD) was revised by the EU in 2016 so that relative changes versus the emissions of the year 2005 are now specified. The directives contain comprehensive reporting obligations: Apart from the annual emissions reporting, in a two-year rhythm emission forecasts for air pollutants and in a four-year rhythm the National Air Pollution Control Programme have to be updated.

Among the agreements of the EU with regard to the protection of the air quality, the emission reduction commitments of the Gothenburg Protocol for 2020, which was updated in 2012, have a key role in relation to the determination of the percentage emission reduction commitments for the year 2020 and all following years. Besides, various legal instruments are used in order to reduce the environmental impacts or to support an environment-friendly behaviour and, thus, indirectly contribute to a reduction of air pollution.

**Targets, status quo and development perspective**

The City of Essen is legally subject to the EU directives implemented in German law via the BimSchG (Federal Imission Control Act) and its regulations. The non-compliance with the air pollution limits may be subject to penalty in case of an absent introduction of effective measures in relation to the reduction of air pollution. The high nitrogen dioxide burden in German cities and the diesel affair associated therewith lead to the fact that cities, in particular those of NRW, are under pressure to improve the situation (WAZ 2017).

In order to realise the application’s targets of the City of Essen as European Green Capital with regard to the air quality, the City of Essen has to reduce the burden of NO₂ until 2020 to be able to comply with the EU air quality standards. For 2035 the noticeably stricter requirements of the WHO shall be observed, i.e. with regard to PM₁₀ an annual average value of less than 20 µg/m³ and the total avoidance of exceeding the daily average value of PM₁₀ (from 50 µg/m³). The annual average value of 20 µg/m³ was exceeded at two stations in 2017. Simultaneously, until 2035 the WHO standard values for NO₂ shall be observed as well (annual average value below 40 µg/m³, hourly average value below 200 µg/m³ and less than 18 exceedances per year). The hourly average value of 200 µg/m³ has been exceeded once since 2010.

**Activities and impacts**

Some activities of the City of Essen were referred to already regarding indicator 1.1. A regional concept for the observance of the air quality standards is the Clean Air Plan Ruhr area of 2011, which is the central legal element in relation to a systematic achievement of the fresh air targets. The Clean Air Plan has to be maintained due to the constant exceeding of the limits.

Various small and large initiatives of the Climate Agency Essen (City of Essen) aim, in cooperation with other city actors, at the improvement of the air quality in Essen.
The City of Essen had already taken steps and considers jointly with the neighbourhood communities and other city actors appropriate measures to face the problem of air quality.

As proved afterwards, the legal measures for a limitation of motor-related emissions of vehicles were partly in vain. Based on this and contrary to the forecasts, the majority of traffic measures taken by the cities remained ineffective. Besides, it has become obvious that single local measures do not lead to the desired result. Especially in the Ruhr area, in which a regional approach has already been chosen, this approach has to be pursued, since the air pollution doesn’t stop at the cities’ borders.

Furthermore, the emission rules which are uniform throughout Germany and Europe have to be achieved. Other nationwide measures which have possibly been taken may also help to solve the problem.

The target of observing the air quality standard can hardly be achieved without the support at federal or state level. The monitoring project runs at a time, when a ban on diesel vehicles in Germany’s city centres is subject of discussion.

**Policy recommendation**

The target of observing international standards fulfils its purpose, as communities and cities have to act in order to comply with the standards. In this context, the City of Essen should not be subject to the risk to consider all values below the EU limits as treated. Thus, it is to be supported that the City endeavours more ambitious targets of the WHO for air pollutants (as, for example, for PM$_{10}$ in 2035). Additionally, the regional cooperation for the achievement of common targets (e.g. Clean Air Plan Ruhr area, Lead City application 2017 or masterplan traffic July 2018) is an important factor of success which should be developed further.
5.4 Action field (4): “Eco-innovation and employment”

5.4.1 Introduction

Within the scope of the application as European Green Capital especially three targets proved to be important which refer to the action field “Eco-innovation and employment”: On the one hand there is topic 10 (eco-innovation and sustainable deployment/employment), on the other hand the supplementary topics 1 (climate change – mitigation and adaptation) and 11 (energy efficiency) are to be mentioned. Therefore, the analysis includes indicators which, strictly speaking, have only to be integrated in the subsequent evaluation 2022. This refers in particular to the application of supra-regional programmes in relation to climate change processes and the determination of their environmental impact and value-added effects. The relevant sub-targets for the action field “Eco-innovation and employment” in the application as European Green Capital are defined as follows:

- Development of environmental economics in Essen
- Participation in the project KlimaExpo.NRW
- Continuation of the project ÖKOPROFIT

Based on an extended understanding of eco-innovation, further sub-targets can be derived in addition to these general targets. Three development goals are thus considered within the scope of the monitoring:

1 | Development of environmental economics in Essen/support of sustainable business sectors
2 | Improvement of resource and energy efficiency in companies
3 | Development of alternative structures for regional economy

| Table 8: Sub-targets and indicators for the action field “Eco-innovation and employment” |

<table>
<thead>
<tr>
<th>Overlapping Development Targets</th>
</tr>
</thead>
</table>

| **Strengthening of eco-innovations and sustainable employment** |

<table>
<thead>
<tr>
<th><strong>Sub-target 1: Development of the environmental economy in Essen</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 1.1</strong> Employment in Essen in the field of environmental economy</td>
</tr>
<tr>
<td><strong>Indicator 1.2</strong> Projects and activities supporting the leading market (Leitmarkt) Resource Efficiency in Essen since 2012</td>
</tr>
<tr>
<td><strong>Indicator 1.3</strong> Value added through programmes supporting climate protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sub-target 2: Improvement of resource and energy efficiency in companies</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 2.1</strong> Eco-Profit certifications and/or certification with other environmental management systems</td>
</tr>
<tr>
<td><strong>Indicator 2.2</strong> Special area: promotion of sustainable tourism</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sub-target 3: Development of alternative structures for regional economy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator 3.1</strong> Support of initiatives for alternative business structures</td>
</tr>
</tbody>
</table>
5.4.2 Sub-target 1: Development of environmental economics in Essen/support of sustainable business sectors

5.4.2.1 Indicator 1.1: Development in Essen in the field of environmental economics

Underlying data and methodological approach

The analysis of employment in Essen in the field of environmental economics is based on the following information, data and literature references:

- Application as European Green Capital (Stadt Essen 2015)
- Economic Report on environmental issues of the state of NRW (MKULNV-NRW 2015)
- Economic Report Ruhr area (WMR 2014)
- Masterplan Industry for Essen (Stadt Essen 2014-1)
- Urban development concept Essen.2030 (Stadt Essen, without year).
- Interviews with the municipal business development of the City of Essen on 20.10.2017 (Interview I/2017)
- Interview with representatives of the Essen marketing company (emg.essen) on 02.03.2018 (Interview I/2018)
- Interview with both speakers of the Essen Environmental Round Table (RUTE) in Essen on 16.03.2018 (Interview II/2018 and Interview III/2018)

The underlying data and information can be labeled as very restricted to evaluate these indicators, as the City of Essen does not conduct an own communication on communal level for these indicators. A separate evaluation of regional studies (leading markets) resp. of nation-wide studies (environmental markets) could not be carried out in the course of the monitoring projects by the authors of the given studies.

Approaches to the monitoring by calculating indicators of creation of value in order to determine the share of environmental economy on a local level proved to be not feasible, due to missing data and high uncertainty of distinction.

Significance of the environmental indicator

The Ruhr area is seen as an example for a successful structural change from an industrial landscape dominated by mining and steel-production towards a diverse and differentiated economic structure stronger oriented at service and commerce. Meanwhile, productivity gains could be achieved by the industrial reconstruction to a degree that the Ruhr area can now come closer again to economically stronger regions. The service sector has increased throughout the region. Research and development at universities in the region give impulses for new processes and products.

For the City of Essen this change in the local economy and the employment structure can be traced as well:

- The share of employees in the tertiary sector has increased from 32.2 percent in 1952 to nearly 85 percent in 2016.\(^{32}\)
- The gross domestic product for each employee was 73,537 euros in 2015 and this way slightly above the average of NRW (which was at 70,542 euros in comparison), but also considerably lower than in the growing metropolises along the Rhine (Düsseldorf: 92,835 euros, Cologne: 84,616 euros).

\(^{32}\) [https://www.essen.de/rathaus/statistik/Statistik_Wirtschaft.de.html (last access: 31.07.2018)]
With RWE plc, the E.On SE, the thyssenkrupp plc, ALDI North, the HOCHTIEF plc and the Schenker plc five of 50 German companies with the largest turnover have their corporate headquarters in Essen.\textsuperscript{33}

The changed local economic structure shows itself with 12,750 small and medium-size businesses that provide 71 percent of all jobs contributing to social insurance.\textsuperscript{34}

Nevertheless, from a structural policy perspective there are still unresolved problems existing like for instance a substandard innovation activity compared to other regions and a comparably high level of unemployment. Above that an increasing social segregation within the city and its districts can be observed.\textsuperscript{35}

This is reflected for example in a local statistic of the City of Essen showing that its unemployment rate of 10.8 percent is higher compared to other municipalities in NRW (as comparison: average unemployment in NRW is 7.0 percent, in Düsseldorf 7.1 percent, in Cologne 8.2 percent and in Gelsenkirchen 11.8 percent).\textsuperscript{36}

### Targets, status quo and development perspective

In the course of structural change the environmental economy gained increasing importance in the Ruhr area in the last years. Statistical analyses predict that roughly 5.6 percent of all employees in the metropolitan Ruhr area work in this sector (for 2015). The similar goes for the environmental economy in Essen: Here 5.6 percent of the totally 226,668 jobs contributing to social insurance, meaning 12,755, were registered in the leading market Resource Efficiency.\textsuperscript{37}

The extension of the environmental economy is therefore one of the central targets of the business and structural development in Essen (INT 1/07). In this context, two of the City’s documents on development are relevant especially: the master plan industry for Essen (Stadt Essen 2014-\textsuperscript{38}) and the urban development concept of Essen 2030 (Stadt Essen, without year).

The following qualitative targets are named explicitly for the environment sector resp. sustainable economy in the master plan industry:

- Promoting of resource and energy efficiency in businesses
- Use and expand renewable energies in Essen more strongly
- Promoting and marketing of resource preserving product innovations in the industry by voluntary commitments

On the basis of a civil-society participation process the Urban development concept Essen 2030 presents a number of strategic targets affecting the development of the local environmental economy:

- To assume climate responsibility and to ensure an intelligent handling of resources
- To create innovative rooms for the Ruhr area
- To establish a networked location for innovation and science\textsuperscript{39}
Activities and impacts

The City’s activities, the corresponding evaluations and recommendations are described separately in the following indicator 1.2. However, there are restrictions in that the City of Essen due to its high degree of indebtedness, inter alia, have only little own capacities to control these processes. The “EWG-Essener Wirtschaftsförderungsgesellschaft mbH” (Business development society ltd, short EWG) owned by the City of Essen is organisationally responsible for the realisation of these targets. Besides, until the end of 2017 the Climate Agency of the City of Essen for the years 2013 to 2017 played a great role with regard to the coordination of entrepreneurial networks and sustainability approaches. With the termination of the Climate Agency and a new edition of the sustainability activities in 2018 the City of Essen has to face the challenge to ensure also institutionally a strong association between the climate protection activities of the City and the local business development.

It can be pointed out that within the scope of the Green Capital activities the City of Essen was successful in integrating a wide range of enterprises into the process and into projects, here above all the enterprises Ista, Trimet, Innogy and Nissan. In total, the documented image improvement and the increased number of visitors contributed to enhance the attractivity of the location.

Evaluation

The available knowledge on the employment structure and the regional value creation in relation to the environmental economy does not allow a differentiated evaluation of the City’s activities. This is, inter alia, based on the fact that different survey systematics and principles have been applied: While within the region the leading market concept is applied, the statistic surveys of the country are based on submarkets of the environmental economy. As a consequence, an impulse of the Green Capital to the environmental economy can (naturally) hardly be realised on the basis of available data and projects. However, with the integration of the local business development agency into a number of sustainable city development and restructuring projects, an explicit connection of the activities in order to strengthen the environmental economy and the Green Capital becomes obvious.

Policy recommendation

The recommendations are described in detail in the following indicator 1.2.
5.4.2.2 Indicator 1.2: Projects and activities supporting the leading market (Leitmarkt) Resource Efficiency in Essen since 2012

Underlying data and methodological approach

The Analysis of projects and activities of the leading market Resource Efficiency in Essen is, since 2012, based upon the following information, data and literature:

- Application for the European Green Capital (Stadt Essen 2015)
- Environmental economic report of the state of NRW (MKULNV-NRW 2015)
- Economic report Ruhr (WMR 2014)
- Masterplan Industry for Essen (Stadt Essen 2014-1)
- Urban development concept Essen.2030 (Stadt Essen, without year)
- Impulses for innovation for the Green Capital (RUTE 2015)
- Interviews with the communal business development of the City of Essen on 20.10.2017 (Interview I/2017)
- Interview with a representative of the Essen Marketing Company (emg.essen) on 02.03.2018 (Interview I/2018)
- Interview with both speakers of the Essen Environmental Round Table (RUTE) on 16.03.2018 (Interview II/2018 and Interview III/2018)

The underlying data and information can be labeled as very restricted to evaluate these indicators, as the City of Essen does not conduct an own communication on communal level for these indicators.

Significance of environmental indicator

The leading market Resource Efficiency is of high significance in the context of regional environmental economy.

Targets, status quo and development perspective

With the Masterplan Industry (2014-1) and the Urban development concept Essen.2030 (Stadt Essen, without year) a general target range for the City of Essen was formulated (see indicator 1.1). The activities of the City on environmental economy are, in this context, strongly project-oriented and mainly imbedded in regional resp. intercommunal projects.

Activities and impacts

When reviewing the activities of the City of Essen it is important to make a clear distinction between projects and activities that are, on the one hand, undertaken by the City of Essen alone, sometimes in cooperation with local businesses or research institutions, and, on the other hand, those carried out as regional and state-wide projects, in which the City participates and gets involved with technical and personal resources.

The Masterplan names especially four fields of action and project approaches:

- Continue to actively use ÖKOPROFIT®
- Working team “industrial waste heat usage”
- “Zero Emission” – sustainable commercial parks
- Market place energy services

40 https://media.essen.de/media/ewgde/ewg_inhalt/publikationen_1/Masterplan-Industrie.pdf (last access: 31.07.2018)
Additionally, the website of the EWG names other projects that are currently implemented in this context:

- **Cooling network Ruhr:**
  Between 2014 and 2016, in a project funded by the Mercator foundation and under the leadership of the EWG, a stakeholder register and a regional potential analysis for cooling services and demands in the region was generated. Case studies investigated concrete efficiency potentials to develop action focuses and strategies for the distribution of energy-efficient solutions for the cooling market Ruhr on that basis. In the context of an EFRE promotion this project is currently in implementation.

- **Climate protection subconcept city port Essen:**
  For the area of the city port of Essen approaches are developed under the leadership of the EWG to minimise the space and energy use, to increasingly use renewable energies and to use resources more efficiently. The project was funded by the federal ministry of the environment in context of the national climate protection initiative and is implemented in cooperation with the Stadtwerke Essen AG (public utilities Essen plc.), the department of environmental affairs of the City of Essen and the Climate Agency Essen until mid 2017.

Other projects where the City of Essen is participating:

- **GreenTec**
  coordinated by the business development Business Metropole Ruhr ltd. Target is the creation of a common trademark for climate and resource-friendly technologies.

- **Meotec-Project**
  as technology network for innovation that targets the linking of common solution competences of innovative technology businesses of the technology region Mülheim an der Ruhr, Essen and Oberhausen in the field of environment.42

- **KlimaExpo.NRW and klimametropole Ruhr 2022**
  as regional mobilising process for climate-friendly technologies and developmental processes.

- **Roll-out Innovation City:**
  Based on the Innovation City Ruhr Bottrop, in 2016 the state of NRW initiated a roll-out of these innovative concepts for integrated urban district development.

- **Routes of innovations – Route of the environmental economy:**
  klimametropole RUHR 2022 and the KlimaExpo.NRW lay focus on technological innovation as well as products and production processes favouring climate protection in and from the metropolis Ruhr.43

A comprehensive project portfolio of the City was provided by the business development, addressing the topic “environmental economy” resp. “eco-innovation” in Essen. This encompasses:

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41 http://business.metropoleruhr.de/handlungsfelder/leitmaerkte-projektentwicklung/greentechruhr/ (last access: 31.07.2018)
42 http://www.klimawerkstadtessen.de/klimawerkstadtessen_startseite_1/klimawerkstadtessen_klimaprojekte/meotec_1/meotec_1.de.jsp (last access: 31.07.2018)
Technologies and networks for a low-emission heating supply (among others projects like biomass heating plant Gruga, biomass combined heat and power Kettwig, green district heating)

Technologies and networks for a low-emission electricity supply (among others projects like AmpaCity, small wind power plants, virtual batteries)

Technologies and networks for a low-emission mobility infrastructure (among others projects like biomethanol, electromobility, natural gas taxi, freight infrastructure: rapid charge in the city centre of Essen, metropolis bike Ruhr, Mobil.Pro.Fit)

Water infrastructure and landscape design (among others projects like Emscher conversion, energy self-sufficient water treatment plant)

Overall/other networks and cooperations (among others projects like Carbon2Chem, energy factory Essen, Greentech.Ruhr, network “economy and environment”)  
Consultancy and information offers (among others projects like energy saving service Essen, energy forum Essen, environmental award Essen, bicycle-friendly employers, IDEE Altendorf, ÖKOPROFIT Essen)

District-related approaches (among others projects like InnovationCity Elting district, climate protection settlement Dilldorfer Höhe, south-east district44)

Evaluation

With regard to the target fulfilment, the existing underlying data on the environmental economy does not allow for a differentiated evaluation of the activities of the City of Essen. This is caused by:

- Different systems and foundations of the data collection were used: Where the concept of leading markets was utilised in the region, the statistical data collection of the state of NRW operate with sub-markets of the environmental economy. A statistical comparison between available data is hardly possible.

- This is also founded in the unresolved discrepancy between the overall target of strengthening the environmental economy in the city and the actual measures being put in place. As the activities of the City to strengthen the environmental economy are mostly project and not concept oriented, no binding action-guiding concept exists from which operationable targets or concrete approaches for action could be drawn. The significance of the Masterplan Industry and its projects targeting resource and energy efficiency (i.e. ÖKOPROFIT®, working group “industrial waste heat usage”, “Zero Emission” – sustainable commercial, market place energy services) is unclear in this context.

This way there is hardly any impulse detected of the Green Capital for the environmental economy on the basis of available data and projects. With the integration of the local business development within a number of sustainable urban development resp. reconstruction projects, however, an explicit link of activities to strengthen the environmental economy with the Green Capital becomes apparent.

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44 See tabular overview in the long version of the report.
Policy recommendation

For the future development of the environmental economy in Essen the following recommendations are made:

- It is recommended for the City of Essen to develop an actualised strategic concept of sustainable business development and promotion, if possible in close cooperation with the regional business development Business Metropole Ruhr. The target of such an activity would be:
  a) to imbed the existing activities more clearly in a conceptual frame and therefore
  b) realise a stronger link between developmental targets and projects, and
  c) investigate developmental perspectives, targets and demands of sustainable sectors within the city.

  Processes and projects of alternative business development should be adressed in such a concept (see Indicator 3.1).

- For the activities of business development, comparable to the implementation report in the action field climate protection, an annual obligation to report is to be introduced and being provided with funds and staff capacities accordingly.

- On regional level, an independent evaluation of the leading markets is to be carried out as a framework for the concept development of business development in the region.

- Since the adoption of the last climate protection concept in the City of Essen the framework conditions for communal climate protection have changed decisively, which is why there is demand for strategic actualisation of the climate protection concept – also in perspective of local business development and value creation. Examples for that are district-related approaches, the increasing interconnection of climate protection with questions of communal sustainability and sufficiency which results in a strong demand for integration into other technical planning processes, but also the awarding of the title of European Green Capital for the year 2017. This should result in an updated strategy of the City.

5.4.3 Sub-target 2: Improvement of resource and energy efficiency in companies

5.4.3.1 Indicator 2.1: ÖKOPROFIT® certifications and/or certification with environmental management systems

Underlying data and methodological approach

The analysis especially of the ÖKOPROFIT-certificate in Essen is based mainly on the following information, data and literature:

- Brochure ÖKOPROFIT (9th round, 2016/17) (Stadt Essen 2017-2)
- Brochure ÖKOPROFIT (8th round, 2013/2014) (Stadt Essen 2014-2)
- Brochure ÖKOPROFIT (2011/2012) (Stadt Essen 2012)
- Website of the City of Essen about ÖKOPROFIT

Significance of environmental indicator

ÖKOPROFIT® (ÖKOlogical PROject For Integrated environmental Technology – own translation) is an environmental consultancy and qualification programme for small and medium-sized businesses. Whereas larger companies are obligated by the European energy efficiency directive to implement an own environmental management system, ÖKOPROFIT® mainly aims at supporting small and medium-sized businesses to
lower their production costs and increase their eco-efficiency by efficient use of re-
resources and raw materials.

In the context of these programmes the following components resp. offers are brought
forward:

- In-plant individual consultancy
- Shared workshops of participating businesses
- Network creation of participating companies with the municipality with support by
  external experts

North Rhine-Westfalia is partly funding the services offered by ÖKOPROFIT as a sub-
sidy to municipalities via the state Ministry of Environment, Agriculture, Nature and
Consumer Protection since the year 2000. The consultancy costs for the municipalities
and the businesses can be kept relatively low this way. More than 1,500 companies
from the most diverse branches have already completed an ÖKOPROFIT project suc-
cessfully (by July 2016).\textsuperscript{46} For the state of NRW ÖKOPROFIT is a key instrument to
sensitise businesses for questions of energy and sustainability management and to mo-
tivate them to implement a systematic energy and sustainability management.

\textbf{Targets, status quo and development perspective}

The City of Essen is participating in ÖKOPROFIT programmes with several multi-
annual projects since 2002. The related website summarises the achieved results of the
yet nine completed projects (2002–2017) on the basis of own calculations:\textsuperscript{47}

- 93 ÖKOPROFIT\textsuperscript{®} businesses in Essen have participated in the programme and de-
  veloped resp. implemented own measures since 2002
- Among other results, the following points could be achieved in these businesses:
  
  - Cost reduction of more than 8.3 million euros
  - Emission reduction of 69,200 tonnes CO\textsubscript{2} annually
  - Energy demand reduction of 99.7 million kilowatt hours annually
  - Reduction in water consumption of 166,800 cubic metres annually
  - Reduction in waste production of 2,751 tonnes annually

The development of participation stays – as in all ÖKOPROFIT projects state-wide –
relatively restricted: 2011/2012 13 businesses participated in context of their first or re-
certification and 2013/2014 twelve businesses did the same. In the 9\textsuperscript{th} round
2016/2017 eight businesses participated in context of their first certification and three
more businesses in context of their re-certification.

\textbf{Activities and impacts}

In the 9\textsuperscript{th} round 2016/2017 eight businesses participated in context of their first certifi-
cation and three more businesses in context of their re-certification.

\textbf{Evaluation}

The City of Essen provides nine multi-annual projects of ÖKOPROFIT certification for
small and medium-sized businesses since 2002. The acquisition of new businesses is,
as in many other cities, very laborious and time-consuming.

\textsuperscript{46} https://www.umwelt.nrw.de/umwelt/umwelt-und-ressourcenschutz/ressourceneffizientes-wirtschaften/oekoprofit/ (last access: 31.07.18)
\textsuperscript{47} https://www.essen.de/leben/umwelt/Oekoprofit.de.html (last access: 31.07.2018)
Policy recommendation

The City of Essen should extend its activities in cooperation with the energy agency NRW to convince more small and medium-sized businesses for the ÖKOPROFIT project.

5.4.4 Sub-target 3: Development of alternative structures for the regional economy

Sub-target 3 is dedicated to the question in which way forms of alternative economy emerge in the city and, if possible, can be supported by the City of Essen. “Alternative economy” means that above others members of the civil society in the initiatives and projects set out to achieve:

- Closed regional production cycles, among other things including a regional shift in food supply
- The change in consumer behaviours of the citizens
- The mobilisation of capital for sustainability projects (like cooperatives)

This addresses local exchange trading systems, recycling meetings, repair cafés, urban gardening initiatives, but also businesses with urban agricultural production.

5.4.4.1 Indicator 3.1: Support of initiatives for alternative business structures

Underlying data and methodological approach

The underlying data for the analysis of this indicator has to be described as very limited. The most important data basis is made up of:

- Innovative impulses for Essen as Green Capital (RUTE 2015)
- Website RUTE
- Energy transition map Ruhr (Technical University Dortmund 2018)
- Interview with both speakers of the Essen Environmental Round Table (RUTE) on 16.03.2018 (Interview II/2018 and Interview III/2018)

Significance of environmental indicator

Even though most of the initiatives and projects are operated voluntarily and are very limited locally, they still create an important point of reference and of further efforts from the local economy for a sustainable urban development policy and business development (Kopatz 2015).

Targets, status quo and development perspective/activities and impacts

The institutional frame in which a multitude of likewise initiatives and projects is organised is presented by the “Runder UmweltTisch Essen” (Essen Environmental Round Table, short RUTE). Existing since 1993, it is constituting itself as non-partisan association of more than 30 independently acting environmental, nature protection and mobility organisations as well as initiatives of ecological and social urban development, of renewable energy supply and of climate protection. Its target is the coordination and enhancement of environmental affairs in Essen. RUTE presented in total 250 project proposals to the City of Essen for the Green Capital at the beginning of the Green Capital year (Interview II/2018).

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48 http://www.umwelttisch.de/ (last access: 31.07.2018)
The Essen Environmental Round Table and its stakeholders were themselves participants in a multitude of these projects.\textsuperscript{50}

RUTE and its speakers Dr. Horst Pomp and Dr. Dieter Küpper were also the central contact persons to get information about the initiatives and projects that have to do with alternative economy in the city.

Examples for this is found in areas like:

- Urban gardening, urban agriculture, diet (among other projects like Transition Town – Essen in transition\textsuperscript{51}, SoLaWi (solidarity agriculture)-Initiative Essen-Katernberg\textsuperscript{52}, Knocking-off market Weberplatz\textsuperscript{53})
- Local exchange trade systems, waste avoidance (among other projects like Repair Cafés Essen-Katernberg and Essen-Rüttenscheid)
- Social innovation in the field of energy (among other projects like Solar cooperative Essen\textsuperscript{54}, regional energy efficiency cooperative (REEG)\textsuperscript{55})

The city council of Essen has adopted a follow-up structure for the project office Green Capital on 21 February 2018 and by that laid the organisational foundation for the continuation of the technical targets and measures. In addition, a “Green Capital Agency” will combine the competences of the “klima|werk|stadt|essen” (climate workshop Essen) and the project office of the “European Green Capital – Essen 2017” and take up the strategic coordination and continuation of the targets of the European Green Capital in the City of Essen.

**Evaluation**

An evaluation of these indicators is hardly possible. Representatives of the Essen Environmental Round Table (RUTE) stress the good cooperation between the City (resp. the Green Capital project office) and themselves. Also a range of project proposals was included in the Green Capital year. In the context of the reorganisation of the “Green Capital Agency”, it cannot be predicted at this stage in what way the cooperation will continue. An interconnection with the activities of the City of Essen regarding business development has happened only scarcely until now.

**Policy recommendation**

From a methodological perspective, it is necessary to record the initiatives and projects from the view of regional business development and to understand them as part of the City’s sustainability policy. This can be expressed in terms of the provision of spaces, information or other support. From the perspective of the local economy it can be recommended to continue to support those initiatives.


\textsuperscript{51} https://transitiontown-essen.de/ and https://www.essen.de/leben/gruene_hauptstadt_europas_2017/mein_gruen.de.html (last access to both sites: 31.07.2018)

\textsuperscript{52} https://www.solidarische-landwirtschaft.org/fileadmin/media/solidarische-landwirtschaft.org/pdf/newsletter/Freihofbrief_15_01.pdf (last access: 31.07.2018)

\textsuperscript{53} http://genussbereit.blogspot.de/2017/03/erster-feierabendmarkt-in-essen-auf-dem.html (last access: 31.07.2018)

\textsuperscript{54} http://www.solargenossenschaft-essen.de/index.html (last access: 31.07.2018)

\textsuperscript{55} http://www.reeg-info.de/ (last access: 31.07.2018)
6 Conclusions and Recommendations

The project “European Green Capital – Essen 2017” started in Essen under aggravating circumstances: In the preparatory phase in summer/autumn 2016, the City of Essen had to make great effort to adequately manage the influx of refugees in a short period of time. Also, the project was initially planned to be regionally realised by many towns and cities in the Ruhr area but ended up as a purely municipal project for the City of Essen due to admission reasons during the application, with very little time beforehand. In addition, a large proportion of the preparatory time was taken up by the acquisition of funds. Only just before the start of the Green Capital the budget of roughly 16 million euros from the City of Essen, the state of NRW and the federal government was confirmed.

Despite these conditions the application as well as the preparation and realisation of the Green Capital project was continued. With the involvement of a wide spectrum of actors the project could constitute itself as the central reference point and leading project for all activities of sustainable city planning in Essen. New impulses could be gathered by citizens’ initiatives in the neighbourhoods and communal districts, and already running or planned projects were integrated in the overall scheme of the Green Capital. Similar to the European Culture Capital from the year 2010 the project is a milestone for Essen in two senses: the redefinition of the city within structural change inwards and outwards as well as the generation of impulse for a sustainable development of Essen. Meanwhile, with the coordination by the RVR a ‘Green decade’ has been launched for the whole region: in 2017 the European Green Capital in Essen was the starting point for ten years of ecological projects, actions and structures in the Ruhr area.

The great know-how and the stunning participation of what the Green Capital had to offer in 2017 can’t hide the fact that the city will still encounter great challenges to secure and expand the positive effects of the Green Capital organisationally, procedurally and above all in cooperation with the citizens of Essen in the long term. How can the impulses of the Green Capital be enhanced and transformed into city development, an integrated mobility concept, local structural policy and in an effective climate protection concept? More importantly: how can the citizens give up their accustomed behaviour patterns and be motivated to sustainable action? In context of the accompanying research some recommendations for action have arisen for the City of Essen, the state of NRW and for the selection procedure for the European Green Capital.

6.1 Recommendations for the City of Essen

The following recommendations follow the conclusions and recommendations that have been developed in the chapter about the four detailed topics.

6.1.1 Strategic continuity and consistency

The implementation of the aimed targets of the European Green Capital has been conducted in five superior programmes resp. topics in 2017: “My Paths”, “My Rivers”, “My Green”, “My Shopping”, “My Future”. These topics offered the fitting frame to integrate municipal projects that are in operation already, as well as activities that have been taken up in the year of the Green Capital. For the future, the programme groups should lay the foundation for a comprehensive sustainability concept, to be developed by the City promptly. The mentioned topic clusters intended to be cross-sectoral, oriented along central action fields of city development and present a good starting point for the communication to different target groups. Where required the list of topics should (at least) be completed with aspects of sustainable economy (“My Economy”).
Such a sustainability concept to be developed, on the one hand, offers a central strategic reference of sustainability-related actions in the city. On the other hand, it helps to stronger embed existing projects into an overall strategic line with operationalisable targets. Currently, most targets mentioned in the twelve action fields of the application for the title European Green Capital range on such a high temporal and thematic level of abstraction so that the (partial) fulfilment of nearly no target can be measured or no sub-target can be operationalised.

Next to the functional backup and development of the European Green Capital after 2017 in context of a sustainability concept, it is important to anchor topics of sustainability in the City in terms of organisation and centrally in terms of processes, especially after the annulment of the Climate Agency of Essen in the same year. The formation of the “Green Capital Agency” is a central starting basis here.

6.1.2 Recommendations for selected actions fields

6.1.2.1 Recommendations for the action field “green spaces and climate change”

It is recommended to regularly collect data on the accessibility of green spaces per capita in all districts of Essen. If possible, data on other categories of land usage or combination of those categories could be collected simultaneously, such as forest, water, wood or swamp areas. The data collection could even be further specialised to cover certain population groups (for instance children, single parents, pensioners or people with migration background). It might be possible to show that the agglomeration of green spaces benefits those or other specific groups. For the City of Dortmund, as example, it was possible to demonstrate that 55 of 170 statistical sub-districts of the city were short on green spaces for children and juveniles with such a data collection.

Concerning the activities of the City of Essen it is additionally recommended to further fund and promote green infrastructure in Essen. Especially the action programme “ESSEN.New ways to the water” offers a good starting point for this. Next to that, the City should also seek to secure and expand the good perception and sensitivity of the citizens of Essen towards green spaces. PR experiences (also via social media like Facebook, Twitter or Instagram) and campaigns that were developed in the context of the Green Capital form a good basis in this respect.

All in all, the city is on a good path for cooperative collaboration with civic associations and nature groups, the garden allotments of Essen as well as the horticultural and forestry sector. It is important that this collaboration is developed sustainably. The knowledge about civic associations and the support of their activities is of inestimable value.

6.1.2.2 Recommendations for the action field “public transport and mobility”

The participants of the online survey done in autumn 2017 exhibit a high level of quality of life in the city. However, the high environmental pollution is criticised, mainly caused by the traffic and its emissions of noise and pollutants. The mobility sector with all its facettes is in the city – as in many other cities as well – a key sector to improve air quality noticeably and reduce the level of emissions considerably.

The following recommendations can be formulated for this sector:

- An active communication and promotion of walking by the City should aim at raising awareness within the public. However, it needs a constant improvement of the walkway network and pedestrian infrastructure, to which a positive communication can be linked. Altogether, future activities in the field of pedestrian mobility should be combined into an overall pedestrian strategy (comparable to the example Berlin). The systematic link with other modes of transport, especially public transport, is important in this context. An increase in the number of stopovers and a resulting decrease in distance between home and stopover, especially in districts with wide-
meshed stopover networks, can incentivise commuters to keep their car in the garage and to walk to the stop and use the public transport more regularly.

- Cycling should be respected more while planning new main streets to promote the bicycle as an everyday mode of transport. “Respect” very precisely means to give priority to cycle lanes in the planning of streets. As long as the individual motor car traffic remains in the focus of inner-city space, an increase in cycling is hardly realistic. Next to the efforts for a continuing improvement of the cycling infrastructure, it is still important to communicate the advantages of cycling and to promote it steadily and emphatically. Under the condition of limited road space within the cities, an increase of cycle lane infrastructure means a (possibly contested) reduction in space available for individual motor car traffic. Experiences in other cities show that a restrictive inner-city parking space management does not impede the buying power. The (self-)image of Essen as “Shopping City” is not threatened by this.

- Car-sharing also needs an active communication and promotion by campaigns and measures to increase its popularity and to give multimodal mobility a positive image. In the year of the Green Capital successful approaches could be generated which are to be taken up in future.

- The more (inner-city) parking spaces are offered, the more people will use the car for their daily commute. To decrease the share of individual motor car traffic in the modal split the parking space management is a central field of action. Options for action are among others the continuing and timely structured shortage of parking spaces and the increase of parking fees in context of an inner-city parking space management. Possibilities for synergies show up here as well: If parking spaces are rationed, more space is available for other traffic participants.

- The modal split of 25 percent for each mobility mode (individual transport, public transport, cycling, walking) is a political objective, but is not respected enough in the actual policies. A strategy of avoiding, shifting and technical improvement in the transport sector is necessary to keep the target within the bounds of possibility. It is important that this kind of strategy prioritises on innovation and preservation of mobility using the digitalisation and integrated modes – and to improve the quality of life in the city at the same time.

6.1.2.3 Recommendations for the action field “air quality”

As a field of policy and planning, air quality is highly linked to other fields of action (e.g. transport, energy, industry/business). This is the reason why the recommendations in this area rather target to the increase of reference points and benchmarks than to policies and measures. Predominantly policy recommendations rather can be found in the second field of action “transport and mobility”.

- In order to realise the application’s targets of the City of Essen as European Green Capital with regard to the air quality, the City of Essen has to reduce the burden of NO\textsubscript{2} until 2020 to be able to comply with the EU air quality standards. For 2035 the noticeably stricter requirements of the WHO shall be observed, i.e. with regard to PM\textsubscript{10} an annual average value of less than 20 µg/m\textsuperscript{3} and the total avoidance of exceeding the daily average value of PM\textsubscript{10} (from 50 µg/m\textsuperscript{3}). The annual average value of 20 µg/m\textsuperscript{3} was exceeded at two stations in 2017.

- Simultaneously, until 2035 the WHO standard values for NO\textsubscript{2} shall be observed as well (annual average value below 40 µg/m\textsuperscript{3}, hourly average value below 200 µg/m\textsuperscript{3} and less than 18 exceedances per year). The hourly average value of 200 µg/m\textsuperscript{3} has been exceeded once since 2010.
6.1.2.4  Recommendations for the action field “eco-innovation and employment”

For the coming development in the action field “eco-innovation and employment” the following recommendations are made:

- It is recommended to develop an updated strategic concept of the sustainable economic development and economic promotion, if possible together with the regional business agency Business Metropole Ruhr. The goal of such an activity would be,
  a) to distinctly integrate the existing activities in a conceptual frame and therefore
  b) to link more strongly the developmental targets and projects of economic promotion and technology policy and
  c) to investigate distinctly the developmental perspectives, targets and the needs of sustainable sectors in the city.

- There is an annual obligation to report for the city council to be introduced for the activities of local economic development just like with the implementation report in the action field of climate protection.

- On a regional level an independent evaluation of strategic leading markets is to be carried out to prepare for the conceptualisation of economic development in the region. Accordant funds would have to be allocated on the regional level. A synchronisation of data collection and systematisation of leading markets (Ruhr region) and sectors of the environmental economy (countryside) is recommended.

- Since the adoption of the City of Essen’s latest climate protection concept the conditions of communal climate protection have changed so much that there is a high demand for a strategic update of the climate protection concept – also with regard to local economic development and local creation of value. Examples for that are district-related approaches, the increasing interconnection of climate protection with questions of communal sustainability and sufficiency that among other things results in a strong need for integration with other departmental plannings, but also the awarding of the City of Essen to be European Green Capital for the year 2017. The plan of action of 2009 does not reflect this development adequately, even if a number of measures from the former concept are still in implementation. These new developments should be reflected in an updated climate protection scheme of the City that creates a direct link to a concept of sustainable economic development.

6.1.2.5  From Green Capital to innovative Smart City Essen

The European Green Capital – Essen 2017 has highlighted the element of the “green” in its marketing activities quite strongly. The sector of economic development may be integrated in a number of projects but in the communication to the public it didn’t play a noticeable role, even though a wide range of businesses was involved as cooperation partners and sponsors in the year of the Green Capital. In the subsequent year, we recommend on the basis of the given analysis to develop and follow the paths of innovation of urban development that address the quality of life in Essen and to use the potential for a determined economic and technical structural change found below:
Table 9: Proposals and descriptions for innovation paths in Essen

<table>
<thead>
<tr>
<th>Nr.</th>
<th>path of innovation</th>
<th>targets and measures</th>
</tr>
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</table>
| 1.  | urban structures  | **target:** development and rebuilding of the city as environmentally friendly and socially compatible  
**example projects:** IC Ruhr – part project Elting district, ThyssenKrupp district, University district Essen |
| 2.  | economic structures | **target:** strengthening of the environmental economy, sustainable industrial development  
**example projects:** leading market strategy “resources efficiency in the region”, GreenTec, Meotec etc. |
| 3.  | infrastructure    | **target** for the energy sector: rebuilding of existing energy infrastructure decentrally, interlinked and sustainable  
**example projects:** ThyssenKrupp district, decarbonisation of district heating etc.  
**target** for the mobility sector: avoiding, shifting and technical development  
**example projects:** Essen 51, creation of sustainable traffic infrastructures. Expansion of cycle lanes and pedestrian infrastructure, expansion and improvement of quality in public transport, restrictive parking space management, expansion of e-mobility etc. |
| 4.  | green and free areas | **target:** high quality of life and recreational value through interlinked green infrastructure  
**example projects:** Emscher conversion, “Grüne Inseln” (Green Islands), “Freiheit Emscher” (Liberty Emscher), qualitative development of existing parks etc. |
| 5.  | image and identity | **target:** from “grey” to “green” and “blue” |

6.2 Recommendations to supra-local actors

6.2.1 Recommendations to the state of North Rhine-Westfalia and other municipalities

6.2.1.1 From leading project to communal leading strategy “sustainability”

The “festivalisation of policies” forces cities and regions to position themselves in the (inter-)national competition increasingly. Culture, art and sport events but also the participation in publicity-effective competitions offers cities and regions the opportunity to distinguish themselves in the (inter-)national competition, to show “difference” and to produce a positive image. The competition of the Green Capital gave the city of Essen the opportunity to position itself publicity-effective on the path from “grey” to “green” and “blue” within the city, in the region and in the national context, but also in an international context. The indications that have been found by the accompanying research of the city-wide surveys, which can also be found in the international media coverage, point to a positive image of the city about and through the Green Capital. Essen presents itself as a city that seems to have made the structural change already.

In such a context, on the other hand, the risk exists to only go from project to project and to neglect the necessity of strategic resp. organisational ties with other planning and policy processes in the city. How does a competition like the Green Capital go along with other action approaches in the city? Is such an event systematically
“docked” to other sustainability activities in a city or does such a project remain a hard-
ly linked foreign body? With regard to support mechanisms from the state of NRW a
condition should be to pay attention to the fact that a technical respectively organisa-
tional integration is realised in the city but also that a transfer to other municipalities
can be ensured.

The reorganisation of sustainability topics intended in Essen by the “Green Capital
Agency” forms the starting point for a redefinition of strategic responsibility on the city
administration. But it has to be shown in the evaluation of the Green Capital in the year
2022 that it worked to keep impulses from the Green Capital and to implement the ac-
tion approaches tackling the manifested problems and set targets, for instance in the
action fields of (integrated) urban development policy, climate protection and climate
adaptation, mobility, sustainable business and industrial development or a socially just
city.

6.2.1.2 Sectoral forms of exchange and learning processes

The support by the state of NRW for the Green Capital Essen was, next to the federal
financial aid, a significant condition to extend the scope of action in Essen. For future
project resp. competition supporting promotion approaches by the state of NRW it is
recommended to pay stronger attention to sectoral formats of exchange between mu-
icipalities in NRW. The following examples for such formats of exchange can be rec-
ommended:

- Establishing of an accompanying advisory board with selected NRW municipalities
- Organising of sectoral workshops about the four examined fields of action (i.e. green
  areas, air quality, traffic, eco-innovations).

6.2.2 Recommendations to the EU

The following recommendations can be given to the EU as conductor of the competi-
tion of the European Green Capital:

1 | Critical factor: time

Essen was elected as European Green Capital in June 2015. Until the beginning of the
project year of the Green Capital only 18 months remained. Irrespective of the hinder-
ing frame conditions of planning such a project (see above) the following tasks had to
be addressed with only short lead-time:

a) Acquisition of funds for such a project within the municipality, from enterprises,
   from possible sponsors but also from the state of NRW or on the national level
b) Assembly of personal and organisational capacities
c) Development of a thematic concept and a market approach as well as to activate
   relevant actors
d) Setup of an event and project plan

Concerning the especially timely tensed preparatory process, the European Commis-
sion is recommended to prepone the awarding of Green Capital by at least half a year, if
possible even a full year to allow the elected city more time for the project develop-
ment.

2 | Critical factor: money

Until 2018 the awarding of the title of European Green Capital was not endowed with
noteworthy funds. This is, on the one hand, restricting the number of applying towns
and cities, as only towns with a certain size and a minimum of financial scope are able to participate in the competition. On the other hand, this forces awarded municipalities to raise own and third-party funds already during the application period. The recommendation to the European Commission is, therefore, to endow the award of title of European Green Capital with a considerable financial appreciation to make e.g. upcoming organisational tasks of project preparation manageable in short term. The designated 350,000 euros for Oslo by the EU for the project year of Green Capital 2019 are a first step. In the case of the City of Essen it would have been impossible to develop and implement such an ambitious programme without the raising of own funds and the support by the state of NRW resp. the federal government.

6.2.3 Outlook

Beyond social and technical innovation there is a great demand in Essen for images of urban life for a socially just and sustainable urban development in the coming years. The examples of ambitiously integrated urban development concepts like in Kiel, Leipzig, Ludwigsburg, Plauen, Schwerin, Speyer, Stuttgart, but also the concept of the Innovation City Ruhr of the town of Bottrop demonstrate the opportunities of existing instruments to combine spatial and urbanistic developments with social and infrastructural developments of the municipality into positive visions. Quantitative targets are an important point of reference for political and planning actions, but these have to be underpinned with qualitative (leading) motives of urban development. The question, however, which qualitative leading future images for urban development and urban reconstruction go along with e.g. a substantial reduction of greenhouse gases in the long run, is an underexposed topic not only in Essen. How does a decarbonised Essen look like in 2050? How do people live, dwell, work and move in the city? What commercial structures could exist in the city? What commercial structures could exist in the city? The translation of abstract quantitative (environmental) reduction targets in positive visions of urban life is therefore an important starting point to raise social acceptance for urban development for sustainability and foster a lead-bearing culture of implementation. There is still such a leading motive to be devised for a livable, resilient and “smart” city, free of CO₂ and with high environmental quality also for Essen. – For a city that will be a sustainable industrial location with high quality of life.
7 Annex

7.1 Used literature

7.1.1 Action field: “Green areas and climate change”


Marks, Robert et al. (1989): Anleitung zur Bewertung des Leistungsvermögens des Landschaftschaushaltes (BA LVL). Forschungen zur deutschen Landeskunde 229. Leipzig

Moser, Julia (2017): Gesamtstädtische Grünflächenanalyse der Stadt Essen. MSc-Arbeit Lehrstuhl Landschaftsökologie und Landschaftsplanung, Fakultät Raumplanung, TU Dortmund


Rocks, Kaja (2017): Wieviel Grün braucht die Stadt? Untersuchung der Trends der Grünflächenentwicklung in europäischen Großstädten sowie der Grünflächenwahr-
7.1.2 Action field: “Regional transport and climate protection”


Cookson, Graham; Pishue, Bob (2017): Die Folgen der Parkplatzproblematik in den Vereinigten Staaten, Großbritannien und Deutschland. Kirkland


Stadt Essen (Ed.) (2017): Park & Ride in Essen. Essen


Tran, Minh-Chau; Manz, Caroline; Nouri, Fatemeh (2017): Messung und Erfassung der Fußgängerfreundlichkeit von Stadträumen. Eine GIS-basierte Analyse gemischt genutzter Quartiersgebiete am Fallbeispiel Essen mit Hilfe des integrierten Walkability Audits auf Mikroebene (IWAM). Essen

7.1.3 Action field: “Air quality”


7.1.4 Action field: “Eco-innovation and employment”


Stadt Essen (Ed.) (2015): Bewerbung der Stadt Essen um den Titel „Grüne Hauptstadt Europas 2017“. Essen


Interviews

Interviews have been conducted with representatives of the
- local business promotion of the City of Essen on 20 October 2017 (Interview I/2017)
- Interview with a representative of the “Essener Marketing Gesellschaft” (emg.essen) on 2 March 2018 (Interview I/2018)
- Interview with both speakers of the Essen Environmental Round Table (RUTE) on 16 March 2018 (Interview II/2018 and Interview III/2018)