PLEEC
European Energy Smart Cities – How to learn from Best Available Practices
Results from work package 2 („Smart City Profiles“)

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WP 2 („Smart city profiles“): Measuring basic conditions and energy efficiency in cities

- **WP 2.1: General Smart City profiles**
  - Evidence-based evaluation of a city’s „smartness“ (in 6 dimensions)
  - Evaluation of 77 cities (including the 6 PLEEC partner cities)

- **WP 2.2.: Typology of cities**
  - Classification: Defining groups of cities with similar profiles
  - Identification of potential partner cities

- **WP 2.3: Energy Smart City profiles**
  - Evaluation of local energy-relevant issues and potentials
  - Definition of an applicable set of specific indicators on energy efficiency

- **WP 2.4: Energy-efficiency monitoring**
  - Permanent monitoring of energy-relevant issues of city development
  - Regular update of data
WP 2.1 General Smart City profiles: Methodology (I)

Evidence-based evaluation of a city’s „smartness“

(1) in 6 „characteristics“ of smart city development

<table>
<thead>
<tr>
<th>Smart Economy</th>
<th>Smart People</th>
<th>Smart Governance</th>
<th>Smart Mobility</th>
<th>Smart Environment</th>
<th>Smart Living</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco_1 Innovative spirit</td>
<td>Peo_1 Level of qualification</td>
<td>Gov_1 Participation public life</td>
<td></td>
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</tr>
<tr>
<td>Eco_2 Entrepreneurship</td>
<td>Peo_2 Lifelong learning</td>
<td>Gov_2 Public and social services</td>
<td></td>
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</tr>
<tr>
<td>Eco_3 Economic image &amp; trademarks</td>
<td>Peo_3 Ethnic plurality</td>
<td>Gov_3 Transparent governance</td>
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<tr>
<td>Eco_4 Productivity</td>
<td>Peo_4 Open-mindedness</td>
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<tr>
<td>Eco_5 Flexibility of labour market</td>
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<tr>
<td>Eco_6 International embeddedness</td>
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</tbody>
</table>

(2) divided in 28 „factors“

<table>
<thead>
<tr>
<th>SMART ECONOMY (Competitiveness)</th>
<th>SMART GOVERNANCE (Administration and Participation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco_1 Innovative spirit</td>
<td>Gov_1 Participation public life</td>
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<tr>
<td>Eco_6 International embeddedness</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SMART MOBILITY (Transport and ICT)</th>
<th>SMART PEOPLE (Social and Human Capital)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mob_1 Local accessibility</td>
<td>Peo_1 Level of qualification</td>
</tr>
<tr>
<td>Mob_2 (Inter-)national accessibility</td>
<td>Peo_2 Lifelong learning</td>
</tr>
<tr>
<td>Mob_3 Availability of IT-Infrastructure</td>
<td>Peo_3 Ethnic plurality</td>
</tr>
<tr>
<td>Mob_4 Sustainability of the transport system</td>
<td>Peo_4 Open-mindedness</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SMART ENVIRONMENT (Natural resources)</th>
<th>SMART LIVING (Quality of life)</th>
</tr>
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<tbody>
<tr>
<td>Env_1 Environmental conditions</td>
<td>Liv_1 Cultural facilities</td>
</tr>
<tr>
<td>Env_2 Air quality (no pollution)</td>
<td>Liv_2 Health conditions</td>
</tr>
<tr>
<td>Env_3 Ecological awareness</td>
<td>Liv_3 Individual security</td>
</tr>
<tr>
<td>Env_4 Sustainable resource management</td>
<td>Liv_4 Housing quality</td>
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<td>Liv_5 Education facilities</td>
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<td>Liv_6 Touristic attractiveness</td>
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<td></td>
<td>Liv_7 Economic welfare</td>
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WP 2.1 General Smart City profiles: Methodology (II)

(3) described in detail by 81 „indicators“

<table>
<thead>
<tr>
<th>Database:</th>
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<tr>
<td>81 indicators for 77 cities</td>
</tr>
<tr>
<td>Indicators on „endowments“ (local conditions, potentials) and „activities“ (actual use of the citizens)</td>
</tr>
<tr>
<td>Data coverage: 92%</td>
</tr>
<tr>
<td>Data on municipal, regional or national level</td>
</tr>
<tr>
<td>Data sources: Eurostat, Urban Audit, Eurobarometer, (individually completed by national statistics)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>WP 2.1 General Smart City profiles: Methodology (II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eco_1: Employment rate in knowledge-intensive sectors</td>
</tr>
<tr>
<td>Eco_1: Parent applications per inhabitant</td>
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<tr>
<td>Eco_1: R&amp;D expenditure in % of GDP</td>
</tr>
<tr>
<td>Eco_2: New businesses registered</td>
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<tr>
<td>Eco_2: Proportion of companies gone bankrupt</td>
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<tr>
<td>Eco_2: Self-employment rate</td>
</tr>
<tr>
<td>Eco_3: Importance as decision-making centre</td>
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<tr>
<td>Eco_4: GDP per inhabitant</td>
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<tr>
<td>Eco_4: Personal undeclarred activities</td>
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<tr>
<td>Eco_5: Proportion of employment in financial business activities</td>
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<td>Eco_5: Long-term unemployment</td>
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<td>Eco_5: Perception of getting a new job</td>
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<td>Eco_5: Personal flexibility</td>
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<td>Eco_6: Air transport of freight</td>
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<td>Eco_6: Air transport of passengers</td>
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<tr>
<td>Gov_1: City representatives per resident</td>
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<tr>
<td>Gov_1: My voice counts in the European Union</td>
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<tr>
<td>Gov_2: Participation in european elections</td>
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<td>Gov_2: Share of female city representatives</td>
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<td>Gov_3: Children in day care</td>
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<td>Gov_3: Employment public administration health education</td>
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<td>Gov_3: Personal attitude against corruption</td>
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<td>Gov_3: Satisfaction with fight against corruption</td>
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<td>Gov_3: Satisfaction with transparency of bureaucracy</td>
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<td>Env_1: Larger green urban areas (CORNHI)</td>
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<td>Env_1: Sunshine hours</td>
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<tr>
<td>Env_2: Fatal chronic lower respiratory diseases</td>
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<td>Env_2: Particulate matter</td>
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<td>Env_2: Summer smog</td>
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<tr>
<td>Env_3: Importance of protecting the environment</td>
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<tr>
<td>Env_3: Individual efforts on protecting nature</td>
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<td>Env_3: Paying more for environmentally friendly products</td>
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<tr>
<td>Env_4: Coverage rate of municipal waste collection</td>
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<tr>
<td>Env_4: Wastewater collection and treatment systems</td>
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<tr>
<td>PEE_1: Importance as knowledge centre</td>
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<tr>
<td>PEE_1: Population qualified at levels 5-6 ISCED</td>
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<tr>
<td>PEE_2: Promotion in life-long-learning in %</td>
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<tr>
<td>PEE_2: Participation in training courses</td>
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<td>PEE_3: Total book loans and other media per resident</td>
</tr>
<tr>
<td>PEE_3: Share of nationals born abroad</td>
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<tr>
<td>PEE_3: Share of Non-EU Nationals</td>
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<tr>
<td>PEE_4: Discrhimination</td>
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<td>PEE_4: European consciousness</td>
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<tr>
<td>PEE_4: Interest in scientific research</td>
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<tr>
<td>PEE_4: Internationality</td>
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<tr>
<td>Liv_1: Cinema attendance per resident</td>
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<td>Liv_1: Theatre attendance per resident</td>
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<td>Liv_1: Visitors to museums per resident</td>
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<tr>
<td>Liv_2: Doctors (practising physicians) per inhabitant</td>
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<td>Liv_2: Hospital beds per inhabitant</td>
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<td>Liv_2: Infant Mortality</td>
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<td>Liv_2: Life expectancy at given exact age (x) AGE: Less than 1 year</td>
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<tr>
<td>Liv_2: Mortality rate for 65 per year</td>
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<td>Liv_2: Quality of the health system</td>
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<td>Liv_3: Burglary rate</td>
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<td>Liv_3: Crime rate</td>
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<td>Liv_4: Affordable housing</td>
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<td>Liv_4: Living area per inhabitant</td>
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<td>Liv_4: Share of housing do not fulfilling minimal standards</td>
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<tr>
<td>Liv_5: Diversity of languages in master studies</td>
</tr>
<tr>
<td>Liv_5: Number of master studies</td>
</tr>
<tr>
<td>Liv_5: Satisfaction with access to educational system</td>
</tr>
<tr>
<td>Liv_5: Satisfaction with quality of educational system</td>
</tr>
<tr>
<td>Liv_5: Students per inhabitant</td>
</tr>
<tr>
<td>Liv_6: Importance as tourist location</td>
</tr>
<tr>
<td>Liv_7: Are you satisfied with the life you lead?</td>
</tr>
<tr>
<td>Liv_7: Earning Ratio</td>
</tr>
<tr>
<td>Liv_7: GDP per inhabitant - Purchasing Power Standard</td>
</tr>
<tr>
<td>Liv_7: Perception on personal risk of poverty</td>
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<tr>
<td>Liv_7: Personal job situation</td>
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<tr>
<td>Mob_1: Public transport network per inhabitant</td>
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<tr>
<td>Mob_1: Satisfaction with access to public transport</td>
</tr>
<tr>
<td>Mob_1: Satisfaction with quality of public transport</td>
</tr>
<tr>
<td>Mob_2: International accessibility</td>
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<tr>
<td>Mob_3: Internet access</td>
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<tr>
<td>Mob_3: Internet infrastructure</td>
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<tr>
<td>Mob_3: Personal internet use</td>
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<tr>
<td>Mob_3: Journeys to work by public transport</td>
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<td>Mob_4: Public transport ticket</td>
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<tr>
<td>Mob_4: Registered cars</td>
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<td>Mob_4: Road Safety</td>
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<tr>
<td>PLEEC</td>
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</tbody>
</table>
WP 2.1 General Smart City profiles: City Sample

Sample of 77 small and medium-sized European cities (criteria: size, data availability)

- Austria: Graz, Linz, Salzburg, Innsbruck
- Belgium: Gent, Brugge
- Bulgaria: Pleven, Ruse
- Czech republic: Plzen, Usti nad Labem
- Germany: Regensburg, Rostock, Göttingen, Trier, Magedburg, Kiel, Erfurt
- Denmark: Odense, Aarhus, Aalborg
- Estonia: Tartu
- Greece: Larisa, Patrai
- Spain: Santiago de Compostela, Oviedo, Pamplona, Valladolid
- Finland: Jyväskylä, Tampere, Turku, Oulu
- France: Dijon, Nancy, Potiers, Clermont-Ferrand, Montpellier
- Hungary: Gyor, Pecs, Miskolc
- Ireland: Cork
- Italy: Trento, Verona, Venezia, Padova, Trieste, Perugia, Ancona
- Lithuania: Kaunas
- Luxemburg: Luxembourg
- Latvia: Liepaja
- The Netherlands: Groningen, Enschede, Nijmegen, Eindhoven
- Poland: Rzeszow, Kielce, Bialystok, Suwalki, Szczecin, Bydgoszcz
- Portugal: Coimbra
- Rumania: Sibiu, Craiova, Timisoara
- Sweden: Eskilstuna, Joenkoping, Umeaa
- Slovenia: Maribor, Ljubljana
- Slovakia: Nitra, Banska Bystrica, Kosice
- UK: Leicester, Stoke-on-Trent, Portsmouth, Cardiff, Aberdeen
WP 2.1 General Smart City profiles: Comparison of profiles by characteristics
WP 2.1 General Smart City profiles: Profile by characteristics for Tartu (EE)
WP 2.1 General Smart City profiles: Comparison of profiles by characteristics for selected cities

City profiles: STOKE-ON-TRENT, ESKILSTUNA, TARTU

Key fields: STOKE-ON-TRENT
Key fields: ESKILSTUNA
Key fields: TARTU
Key fields Median (all cities)
WP 2.1 General Smart City profiles: Profiles by factors for Tartu (EE)
WP 2.1 General Smart City profiles: Relevance

- Comparable results of a city’s performance in different dimensions of smart city development in relation to other cities
- Empirical base for provoking discussions and learning processes in the cities (administration, stakeholders, economy)
- Date-based profiles need to be complemented by local knowledge and expertise
- Evidence on basic local conditions (strengths and weaknesses) as pre-conditions for energy-efficient city development
  - “Smart Economy”: economic structure, image, competitiveness,…
  - “Smart People“: education, flexibility, open-mindedness,…
  - “Smart Governance“: administration, planning system, participation,…
  - “Smart Mobility“: transport system, ICT system, accessibility,…
  - “Smart Environment“: resource management, pollution,…
  - “Smart Living“: quality of life, safety, public services,…
WP 2.2 Typology of cities: Approach and relevance

- **Classification of cities**
  - identifying groups of cities with similar profiles
  - statistical procedure (minimal deviation of values in the 6 “characteristics”)

- **Methodology**
  - Multiple Correspondence Analysis of 77 cities
  - Variables: categorical transformation of quantitative values of 6 characteristics

- **Relevance: Identification of potential partner cities for**
  - co-operation in energy-related matters
  - exchange of knowledge and experiences in energy-efficient development
  - technology transfer in energy production and use
  - best available practice sharing
WP 2.2 Typology of cities: Results

Spatial pattern of city clusters

Average cluster profiles

Profile Cluster 1
Profile Cluster 2
Profile Cluster 3
Profile Cluster 4
Profile Cluster 5
Profile Cluster 6
Development of a taxonomy on energy efficiency related issues

- **Scientific team**
  - Definition of 5 „key fields“ of energy efficiency
  - Sub-divided in 16 „domains“ of energy efficiency

- **PLEEC partners**
  - Discussion and agreement of all PLEEC partners

- **City stakeholders**
  - Final request in survey of stakeholders in all 6 cities
WP 2.3 Energy Smart City profiles
Survey on energy efficiency issues: Main issues

- Online survey among relevant city stakeholders (108 participants)
- General questions
  - How can energy efficiency be defined? („Energy efficiency means the use of less energy to provide the same service considering aspects of economic, social and ecologic sustainability and the life-cycle of materials.”)
  - Which „domains“ are most promising for improving energy efficiency in general?
- City specific questions
  - How strong are actual activities for improving energy efficiency in these „domains“?
  - Which „domains“ have a high potential for improving energy efficiency?
  - In which „domains“ actual and potential activities diverge most?
  - Which actors have the ability and the power to influence energy efficiency?
  - What kind of activities are suitable to influence energy efficiency?
WP 2.3 Energy Smart City profiles: Survey results
Relevance of domains and key fields

Question: “Please select 5 domains in the taxonomy which you consider to be most relevant for energy efficiency!”
WP 2.3 Energy Smart City profiles: Survey results
City-specific energy efficiency potentials by key field

Tartu (EE)

Questions: “How would you judge the current contribution of the domain “...” for energy efficiency in your city today?”
“How would you judge the innovation potential for energy efficiency in the domain “...” in your city in the near future?”
(1...very low, 2... low, 3... fair, 4... high, 5... very high)”
WP 2.3 Energy Smart City profiles: Survey results
City-specific energy efficiency potentials by key field

Eskilstuna (SWE)

a. Renovation and refurbishment
b. Innovative building technologies
c. Spatial structures and land-use
d. Public transport
e. Motorised private transport
f. Pedestrian traffic and cycling
g. Transport of goods
h. Waste, water and sewage management
i. Electric power grids
j. (District) heating and cooling grids
k. Public lighting
l. Renewable energy
m. Industry and commerce
n. Private and public services
p. Private households
r. Fossil and nuclear energy

Questions:
“How would you judge the current contribution of the domain “…” for energy efficiency in your city today?”
“How would you judge the innovation potential for energy efficiency in the domain “…” in your city in the near future?”
(1...very low, 2... low, 3... fair, 4... high, 5... very high)"
Questions: “How would you judge the current contribution of the domain “… for energy efficiency in your city today?”
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(1...very low, 2... low, 3... fair, 4... high, 5... very high)”
WP 2.3 Energy Smart City profiles: Survey results
City-specific energy efficiency potentials by key field

Jyväskylä (FIN)

Questions:
“How would you judge the current contribution of the domain “…” for energy efficiency in your city today?”
“How would you judge the innovation potential for energy efficiency in the domain “…” in your city in the near future?”
(1...very low, 2... low, 3... fair, 4... high, 5... very high)”
Questions:  “How would you judge the current contribution of the domain “…” for energy efficiency in your city today?”  “How would you judge the innovation potential for energy efficiency in the domain “…” in your city in the near future?”  (1…very low, 2… low, 3… fair, 4… high, 5… very high)"
WP 2.3 Energy Smart City profiles: Survey results
City-specific energy efficiency potentials by key field

Stoke-on-Trent (UK)

Questions:
“How would you judge the current contribution of the domain “...” for energy efficiency in your city today?”
“How would you judge the innovation potential for energy efficiency in the domain “...” in your city in the near future?”
(1...very low, 2... low, 3... fair, 4... high, 5... very high)"
Who can improve energy efficiency?

Question: “Referring to the following domain: To what extent can developments in your city be influenced by the following actors?”

- City administration
- Regional, national or European authorities
- Local companies
- International companies
- Interest / lobbying groups
- NGOs
- Public-Private-Partnerships
- Media
- Other: ...

Possible answers:

1... very low
2... low
3... fair
4... high
5... very high
How can energy efficiency be improved?

- Question: “Referring to the following domain: To what degree can developments in your city be influenced by the following activities?”
  
a. Subsidies and financial incentives  
b. User fees and penalties  
c. Public or private investment  
d. Public or private procurement (preference of energy efficient goods and services)  
e. General legal regulations (e.g. laws, directives)  
f. Private-law contracts (e.g. individual obligations)  
g. Information and lobbying campaigns  
h. Education of citizens  
i. Free market without political intervention  
j. Cooperation of different actors  
k. Other: ...

- Possible answers:
  1... very low  
  2... low  
  3... fair  
  4... high  
  5... very high
WP 2.3 Energy Smart City profiles: Survey results
Ways to improve energy efficiency in Tartu (I)

<table>
<thead>
<tr>
<th>Who?</th>
<th>How?</th>
</tr>
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<tbody>
<tr>
<td>“To what extent can developments in your city be influenced by the following actors?”</td>
<td>“To what degree can developments in your city be influenced by the following activities?”</td>
</tr>
<tr>
<td>1...very low</td>
<td>1...very low</td>
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<td>2... low</td>
<td>2... low</td>
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<tr>
<td>3... fair</td>
<td>3... fair</td>
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<tr>
<td>4... high</td>
<td>4... high</td>
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<tr>
<td>5... very high</td>
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<table>
<thead>
<tr>
<th>Actors</th>
<th>Activities</th>
<th>mean</th>
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<tbody>
<tr>
<td>Renovation and refurbishment (11 respondents)</td>
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<tr>
<td>regional, national or European authorities 4.18</td>
<td>Subsidies and financial incentives</td>
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<td>Public-Private-Partnerships 3.82</td>
<td>Public or private investment</td>
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<td>Media 3.82</td>
<td>Education of citizens</td>
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<td>General legal regulations</td>
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<td>Public or private procurement</td>
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<td>Information and lobbying campaigns</td>
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<td>Innovative building technologies (6 respondents)</td>
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<td>regional, national or European authorities 3.67</td>
<td>Cooperations of different actors</td>
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<td>Subsidies and financial incentives</td>
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<td>Public or private investment</td>
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<td>Public or private procurement</td>
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<td>Spatial structures and land-use (5 respondents)</td>
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<td>City administration 4.40</td>
<td>Cooperations of different actors</td>
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<td>Media 4.40</td>
<td>Private-law contracts</td>
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<td>interest / lobbying groups 3.60</td>
<td>Subsidies and financial incentives</td>
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<td>Public or private investment</td>
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<td>Public transport (9 respondents)</td>
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<tr>
<td>local companies 3.78</td>
<td>Public or private procurement</td>
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</tr>
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<td>NGOs 3.75</td>
<td>Public or private investment</td>
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<td></td>
<td>General legal regulations</td>
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</tr>
<tr>
<td></td>
<td>Information and lobbying campaigns</td>
<td>3.89</td>
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<tr>
<td></td>
<td>Education of citizens</td>
<td>3.89</td>
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</tr>
<tr>
<td></td>
<td>Cooperations of different actors</td>
<td>3.88</td>
<td></td>
</tr>
</tbody>
</table>
WP 2.3 Energy Smart City profiles: Survey results
Ways to improve energy efficiency in Tartu (II)

Who?
“To what extent can developments in your city be influenced by the following actors?”

1...very low
2... low
3... fair
4... high
5... very high

How?
“To what degree can developments in your city be influenced by the following activities?”

1...very low
2... low
3... fair
4... high
5... very high

<table>
<thead>
<tr>
<th>Pedestrian traffic and cycling (7 respondents)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>City administration</td>
<td>4.43</td>
</tr>
<tr>
<td>Interest / lobbying groups</td>
<td>4.14</td>
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<tr>
<td>Regional, national or European authorities</td>
<td>3.86</td>
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</table>

<table>
<thead>
<tr>
<th>Waste, water and sewage management (2 answers)</th>
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</thead>
<tbody>
<tr>
<td>all actor groups except PPP</td>
<td>4.5</td>
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</table>

<table>
<thead>
<tr>
<th>Electric power grids (2 respondents)</th>
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</thead>
<tbody>
<tr>
<td>Regional, national or European authorities</td>
<td>4.0</td>
</tr>
<tr>
<td>Public/Private-Partnerships</td>
<td>4.0</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>(District) heating and cooling grids (8 respondents)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Local companies</td>
<td>4.13</td>
</tr>
<tr>
<td>international companies</td>
<td>3.75</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Public lighting (4 answers)</th>
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</tr>
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<tbody>
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<td>City administration</td>
<td>5.0</td>
</tr>
<tr>
<td>Regional, national or European authorities</td>
<td>4.75</td>
</tr>
<tr>
<td>Local companies</td>
<td>4.25</td>
</tr>
<tr>
<td>Interest / lobbying groups</td>
<td>4.0</td>
</tr>
<tr>
<td>Public/Private-Partnerships</td>
<td>3.75</td>
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</table>
WP 2.3 Energy Smart City profiles: Survey results
Ways to improve energy efficiency in Tartu (III)

### Industry and commerce (4 selections)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Regional, national or European authorities</td>
<td>4.25</td>
<td>Public or private investment</td>
<td>4.25</td>
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<tr>
<td>Local companies</td>
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<td>Public or private procurement</td>
<td>4.25</td>
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<tr>
<td>International companies</td>
<td>4.50</td>
<td>General legal regulations</td>
<td>4.25</td>
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<tr>
<td>Media</td>
<td>4.00</td>
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### Private and public services (5 selections)

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<td>4.0</td>
<td>Cooperations of different actors</td>
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<td>Regional, national or European authorities</td>
<td>3.8</td>
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<td>3.8</td>
<td>Subsidies and financial incentives</td>
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<td></td>
<td></td>
<td>Public or private investment</td>
<td>3.80</td>
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<tr>
<td></td>
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<td>Public or private procurement</td>
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### Private households (4 selections)

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</thead>
<tbody>
<tr>
<td>Interest / lobbying groups</td>
<td>4.25</td>
<td>Education of citizens</td>
<td>4.75</td>
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<tr>
<td>NGOs</td>
<td>4.25</td>
<td>Subsidies and financial incentives</td>
<td>4.50</td>
</tr>
<tr>
<td>Media</td>
<td>4.25</td>
<td>Public or private investment</td>
<td>4.25</td>
</tr>
<tr>
<td>Public-Private-Partnerships</td>
<td>3.75</td>
<td>Cooperations of different actors</td>
<td>4.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Information and lobbying campaigns</td>
<td>4.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public or private procurement</td>
<td>4.00</td>
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### Fossil and nuclear energy (2 answers)

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<tr>
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<th>Rating</th>
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</thead>
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<tr>
<td>all actor groups except city administration</td>
<td>4-5</td>
<td>all activities except user fees and free market</td>
<td>4-5</td>
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### Renewable energy (14 selections)

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<td>Subsidies and financial incentives</td>
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</tr>
<tr>
<td>Interest / lobbying groups</td>
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<tr>
<td>City administration</td>
<td>3.71</td>
<td>Public or private investment</td>
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<td>Public or private procurement</td>
<td>4.07</td>
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<tr>
<td></td>
<td></td>
<td>Cooperations of different actors</td>
<td>4.00</td>
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<tr>
<td></td>
<td></td>
<td>Information and lobbying campaigns</td>
<td>3.93</td>
</tr>
</tbody>
</table>
Energy-related indicators should...

- describe the city by **one comparable value** (independent from the city size)
- cover all **5 key fields** of energy efficiency (+ basic indicators)
- reflect on all **3 perspectives** of energy efficiency (technology, behaviour, structures) without being clearly attributed
- be **applicable** in practice and supply **relevant information**
- be easy to **understand** and to **communicate**
- be **policy-related** and reflect energy-relevant issues which can be influenced and steered
- have a realistic chance to be **provided** by a majority of cities over a longer period of time
### WP2.3 Energy Smart City profiles: Energy-related profiles

**Set of indicators on energy efficiency**

<table>
<thead>
<tr>
<th><strong>Basic data</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>BA.01</td>
</tr>
<tr>
<td>Number of inhabitants</td>
<td>BA.02</td>
</tr>
<tr>
<td>Settled area</td>
<td>BA.03</td>
</tr>
<tr>
<td>Number of households</td>
<td>BA.04</td>
</tr>
<tr>
<td>Number of dwellings</td>
<td>BA.05</td>
</tr>
<tr>
<td>Number of residential buildings</td>
<td>BA.06</td>
</tr>
<tr>
<td>Average annual household net income</td>
<td>BA.07</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Basic energy data</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Import dependency</td>
<td>BE.01</td>
</tr>
<tr>
<td>Export dependency</td>
<td>BE.02</td>
</tr>
<tr>
<td>Primary energy consumption</td>
<td>BE.03</td>
</tr>
<tr>
<td>Final energy consumption</td>
<td>BE.04</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Green buildings and land-use</strong></th>
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</thead>
<tbody>
<tr>
<td>Share of annual thermal renovations</td>
<td>GB.01</td>
</tr>
<tr>
<td>Share of dwellings in low- (zero-) energy buildings</td>
<td>GB.02</td>
</tr>
<tr>
<td>Share of public low- (zero-) energy buildings</td>
<td>GB.03</td>
</tr>
<tr>
<td>Population density</td>
<td>GB.04</td>
</tr>
<tr>
<td>Share of detached houses</td>
<td>GB.05</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mobility and transport</strong></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Transport performance in public transport</td>
<td>MT.01</td>
</tr>
<tr>
<td>Energy demand in public transport</td>
<td>MT.02</td>
</tr>
<tr>
<td>CO2 emissions in public transport</td>
<td>MT.03</td>
</tr>
<tr>
<td>Cost of a monthly ticket for public transport</td>
<td>MT.04</td>
</tr>
<tr>
<td>Transport performance in motorised private transport</td>
<td>MT.05</td>
</tr>
<tr>
<td>Energy demand in motorised private transport</td>
<td>MT.06</td>
</tr>
<tr>
<td>CO2 emissions in motorised private transport</td>
<td>MT.07</td>
</tr>
<tr>
<td>Cost of petrol</td>
<td>MT.08</td>
</tr>
<tr>
<td>Parking fee</td>
<td>MT.09</td>
</tr>
<tr>
<td>Level of motorisation</td>
<td>MT.10</td>
</tr>
<tr>
<td>Transport performance in bicycle transport</td>
<td>MT.11</td>
</tr>
<tr>
<td>Transport performance in pedestrian transport</td>
<td>MT.12</td>
</tr>
<tr>
<td>Length of bicycle network per inhabitant</td>
<td>MT.13</td>
</tr>
<tr>
<td>Transport performance in transport of goods (freight)</td>
<td>MT.14</td>
</tr>
<tr>
<td>Energy demand in transport of goods (freight)</td>
<td>MT.15</td>
</tr>
<tr>
<td>CO2 emissions in transport of goods (freight)</td>
<td>MT.16</td>
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<table>
<thead>
<tr>
<th><strong>Technical infrastructure</strong></th>
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<tbody>
<tr>
<td>Waste generation</td>
<td>TI.01</td>
</tr>
<tr>
<td>Recycling of waste</td>
<td>TI.02</td>
</tr>
<tr>
<td>Waste collection fee</td>
<td>TI.03</td>
</tr>
<tr>
<td>Share of smart-meters</td>
<td>TI.04</td>
</tr>
<tr>
<td>Share of district heating</td>
<td>TI.05</td>
</tr>
<tr>
<td>Share of energy efficient lamps</td>
<td>TI.06</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Production and consumption</strong></th>
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<tbody>
<tr>
<td>Energy demand in industry</td>
<td>PC.01</td>
</tr>
<tr>
<td>CO2 emissions in industry</td>
<td>PC.02</td>
</tr>
<tr>
<td>Share of companies with energy management</td>
<td>PC.03</td>
</tr>
<tr>
<td>Energy demand in service sector</td>
<td>PC.04</td>
</tr>
<tr>
<td>CO2 emissions in service sector</td>
<td>PC.05</td>
</tr>
<tr>
<td>Energy demand in private households</td>
<td>PC.06</td>
</tr>
<tr>
<td>CO2 emissions in private households</td>
<td>PC.07</td>
</tr>
<tr>
<td>Share of household income spent on petrol</td>
<td>PC.08</td>
</tr>
<tr>
<td>Share of household income spent on electricity</td>
<td>PC.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Energy supply</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy supply - solid fuels</td>
<td>ES.01</td>
</tr>
<tr>
<td>Energy supply - gas</td>
<td>ES.02</td>
</tr>
<tr>
<td>Energy supply - crude oil and petroleum products</td>
<td>ES.03</td>
</tr>
<tr>
<td>Energy supply - nuclear</td>
<td>ES.04</td>
</tr>
<tr>
<td>Electricity tariff - traditionell mix</td>
<td>ES.05</td>
</tr>
<tr>
<td>Energy supply - wind</td>
<td>ES.06</td>
</tr>
<tr>
<td>Energy supply - biomass</td>
<td>ES.07</td>
</tr>
<tr>
<td>Energy supply - solar</td>
<td>ES.08</td>
</tr>
<tr>
<td>Energy supply - hydropower</td>
<td>ES.09</td>
</tr>
<tr>
<td>Energy supply - tide, wave, ocean</td>
<td>ES.10</td>
</tr>
<tr>
<td>Energy supply - geothermal including heat pump</td>
<td>ES.11</td>
</tr>
<tr>
<td>Energy supply - waste</td>
<td>ES.12</td>
</tr>
<tr>
<td>Electricity tariff - renewables mix</td>
<td>ES.13</td>
</tr>
</tbody>
</table>

**Set of indicators:**
- 53 indicators in 7 (5+2) key fields of energy efficiency
- Data provided by the 6 PLEEC cities → test of practical applicability
- Proposed additional indicators by the cities → amendment of the set of indicators
WP2.3 Energy Smart City profiles: Energy-related profiles
Reliability and comparability of energy-related data

Comparability of data

- Eskilstuna
- Jyväskylä
- Santiago
- Stoke
- Tartu
- Turku

Legend:
- missing value
- different spatial level
- alternative definition
- implausible value
- estimated value
- reliable value
WP 2.4 Energy-efficiency monitoring:
Objectives

- Establishing a permanent monitoring of energy-relevant issues of city development
  - Regular update of data
    - for general smart city profiles
    - for energy-related indicators
  - Continuous execution of online surveys
    - Update of existing questions (change of attitudes and views)
    - Evaluation of other relevant issues

- Improving targeted publication and dissemination of results
  - Comprehensible preparation and illustration of results
  - Selection of target groups for dissemination
  - Development of applicable and user-friendly tools for users
WP 2.4 Energy-efficiency monitoring: Example

Example: Monitoring of developments

- CO2 emissions in motorised private transport
- Parking fee
- Transport performance in public transport
Conclusions: Problems and limits of data collection on energy efficiency on the city level (I)

- General city profiles (based on aggregated and general data from European statistical sources)
  - lack of specific and meaningful data
  - limited comparability of data (different ways of data acquisition)
  - different spatial definition of cities (core city? metropolitan area? agglomeration?)
  - difficult weighting and aggregation of data (same relevance?)
  - impossibility to describe complex local conditions (soft factors: social climate, institutional structure,...) by quantitative indicators

- Typology of cities (for finding partner cities for cooperation)
  - classification by very general categories (6 characteristics of “smartness”)
  - neglect of different political strategies of cities
  - ignorance of the competitive situation between similar cities
Conclusions: Problems and limits of data collection on energy efficiency on the city level (II)

- **Online survey for city stakeholders**
  - limited representativeness of the sample (stakeholders invited by planning department: relevant actors missing?)
  - restricted transferability of results (high deviations due to singular phenomena)
  - limited knowledge of the respondents on the over-all situation of a city (biased point of view on energy matters)
  - language barrier (no precise translation in local language)

- **Energy-related profiles and monitoring**
  - incompleteness of wanted data
  - inflexibility of the set of indicators (same indicators for all cities: unable to reflect single requirements)
  - comparability of available data across cities (→ monitoring instead of benchmarking!)
Thank you for your attention!

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