

Tender Document 2: Functional Specifications

For Lot 1 (Mobility) and Lot 2 (Energy)

AI4Cities Request for Tenders

These functional specifications, designated as Tender Document 2, should be read in conjunction with other documents related to this Pre-Commercial Procurement (PCP), listed hereunder:

- Tender Document 1: Request for Tenders
- Tender Document 1: Forms A through G
- Tender Document 3: Framework agreement
- Tender Document 4: The Specific Contract Phase 1

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1. Glossary / Definitions

TERMS/ACRONYMS	DEFINITIONS
CO2	Including all greenhouse gases (GHG)
AI	Artificial Intelligence
Local	Referring to the pilot site

2. Introduction

Target

Target of the PCP is defined as: the design, development and piloting of digital solutions utilizing AI to help the cities to reduce CO2 and other GHG emissions in two domains: mobility (Lot 1) and energy (Lot 2).

AI

The purpose of AI4Cities is to design and deliver AI based solutions. In this project, the definition of artificial intelligence (AI) is following the mainstream of the research, knowing that there is not one official definition since there also is not a single definition on what is intelligence. The term is applied with digital systems that are endowed with intellectual processes, such as the ability to reason, discover meaning, generalize or learn from the past experience.

AI is a tool that can for example help to automate processes and perform mining on data. The basic principle being that it is a tool to conclude something and create a response to the conclusion. As such, AI can be used to read data, evaluate and categorize data to make it fit in a well-defined structure, thus joining data into information that can be acted upon.

Two important features or qualities for an AI to be considered real AI are:

Autonomy: the ability to perform tasks in complex environments by responding to situations based on data-inputs without constant guidance by a user.

Adaptivity: the ability to improve performance by learning from experience so that solutions aren't limited to the human imagination of appropriate response patterns but can improve beyond this.

However, AI-solutions are only as successful as the amount and quality data provided, thus there is a need to monitor the quality of the decisions the solutions make to ensure that it is capable of handling and making use of the data inputs. To account for this there is a need for a level of adaptability within the solutions to be capable of handling an increasing number of data-inputs while also having a clear strategy for integrating new data sources that might not be available as of now.

Even though the role of the AI in AI4Cities proposals needs to be elemental, it should be noted that the role of AI in the proposed solutions can be seen in many ways. AI does not need to solve everything and it can also be

supportive to the main function, e.g. to assess the security, detect anomalies or bias in the data before analyzing it and so on.

When it comes to reducing CO2 emissions there is a danger of two or more AI solutions interfering with each other (e.g. AI-task that suggests or makes a decision that interferes with another AI-task). In such cases AI provides added value with its capability to process a large amount of various data, and help create solutions, that may not be obvious. Thus, it would be a matter of having the AI-solution work on the various data sets and conclude which task is the better option based on simulations that would otherwise not be possible to conduct for a person. Looking into the AI4Cities challenges, the amount of data is significant, and it is not possible to identify and simulate on decisions without it. Thus, AI is a vital tool in achieving the goals of CO2 emission reduction in the fields of mobility and energy.

The core functionality of the piloted solution must be the same as in the commercially available version.

Must haves and nice to haves

The requirements that are described in the chapters 3 and 4 below, are expected to be a part of the end-solution, by the time the AI4Cities project finishes. The AI4Cities partners do not expect Suppliers to already have all these features in place when submitting their tender; this work is part of the R&D process. In the tender (via Form E), Suppliers need to make clear how they intend to achieve the must haves and how they will implement the nice to haves. Via the weighted award criteria, these explanations will be appraised by the Technical Evaluation Committee, assisted by a panel of external experts. The Technical offer (Form E) will not be evaluated on a pass/fail basis: failure to (sufficiently) describe the “must haves” mentioned in the chapters below is therefore not a reason to be excluded from this tender, but will merely lead to lower evaluation scores.

3. Requirements for Phase 1

3.1 Functional Requirements

The AI4Cities solution is expected to include following features:

FUNCTION 1: CO2 EMISSIONS REDUCTION

The solution has potential to reduce CO2 emissions in the city where it's deployed.

Requirements (must have):

- 1.1 The solution reduces CO2 emissions in the field of mobility and/or energy.
- 1.2 Methodology for measuring the emission reductions.

Requirements (nice to have):

- 1.3 Estimation of how much the solution reduces CO2 emissions including a detailed description of what that estimation is based on.

FUNCTION 2: USE OF AI

The solution is supposed to use real AI that provides added value to the solution. By “real” is meant that the AI is autonomous and adaptive.

Requirements (must have):

- 2.1 The solution uses AI.
- 2.2 The AI is autonomous.
- 2.3 The AI is adaptive and can improve its performance by learning from experience.
- 2.4 The AI provides added value to the solution.
- 2.5 The solution is following the guidelines of trustworthy AI and the AI can be audited by independent third parties (For more about trustworthy AI, see e.g.: <https://ec.europa.eu/digital-single-market/en/news/assessment-list-trustworthy-artificial-intelligence-atai-self-assessment>.)

FUNCTION 3: TECHNICAL INNOVATIVENESS

The AI4Cities Pre-Commercial Procurement is specifically aimed to push innovation in the field of AI applications that reduce emissions in cities and applicable stakeholders. The proposed solution can build on existing technologies or applications, but has to go *beyond* the current State of the Art.

Requirements (must have):

- 3.1 The solution must encompass novel technologies or applications and/or apply to novel user cases.

3.2 Non-Functional Requirements

NFR 1: IMPACTS ON CITY AND CITIZENS

It is important to assess a solution's impact on cities or society. Creating AI solutions that reduce CO2 emissions in the fields of energy and mobility can bring additional benefits (or risks) to cities and their citizens (e.g. economic benefits, data for city management or other environmental benefits like better air quality).

Requirements (must have)

- NFR 1.1 Assessment of solutions other benefits (beyond CO2 emission reductions) that the solution provides for cities and their citizens including an explanation of how the solution provides them.
- NFR 1.2 Negative side effects and/or risks coming with the solution (if any) are addressed.

NFR 2: DISRUPTIVENESS

To what extent the solution could represent a shift in the market, creating room for new economic development.

Requirements (nice to have):

- NFR 2.1 The solution changes the status quo in business or market on some level.

4. Requirements for Phases 2 and 3

4.1 Functional Requirements

The AI4Cities solution is expected to include following features:

FUNCTION 1: CO2 EMISSIONS REDUCTION

The solution has potential to reduce CO2 emissions in the city where it's deployed.

Requirements (must have):

- 1.1 The solution reduces CO2 emissions in the field of mobility and/or energy.
- 1.2 Methodology for measuring the emission reductions.
- 1.3 Estimation of how much the solution (potentially) reduces CO2 emissions including a detailed description of what that estimation is based on.

FUNCTION 2: USE OF AI

The solution is supposed to use real AI that provides added value to the solution. By “real” is meant that the AI is autonomous and adaptive.

Requirements (must have):

- 2.1 The solution uses AI.
- 2.2 The AI is autonomous.
- 2.3 The AI is adaptive and can improve its performance by learning from experience.
- 2.4 The AI provides added value to the solution.
- 2.5 The solution is following the guidelines of trustworthy AI and the AI can be audited by independent third parties (For more about trustworthy AI, see e.g.: <https://ec.europa.eu/digital-single-market/en/news/assessment-list-trustworthy-artificial-intelligence-altai-self-assessment>.)

FUNCTION 3: TECHNICAL INNOVATIVENESS

The AI4Cities Pre-Commercial Procurement is specifically aimed to push innovation in the field of AI applications that reduce emissions in cities and applicable stakeholders. The proposed solution can build on existing technologies or applications, but has to go *beyond* the current State of the Art.

Requirements (must have):

- 3.1 The solution must encompass novel technologies or applications and/or apply to novel uses cases.

FUNCTION 4: SCALABILITY

The solution should be able to scale to big cities but should also be able to serve smaller cities.

Requirements (must have):

- 4.1 The solution is able to scale to both big and small cities.
- 4.2 A scenario of the scaling process.

Requirements (must have in phase 3):



- 4.3 Explanation of the solution's dynamic scalability.

FUNCTION 5: INTEROPERABILITY

Cities often have existing infrastructure with which the solution needs to integrate. Next to that, different organisations and companies can provide data (or datasets) to the cities. The solution should be able to communicate with existing and new data systems of the cities.

Requirements (must have):

- 5.1 The solution can be integrated with the existing infrastructure and data systems of the cities necessary for the solution to operate.

Requirements (nice to have):

- 5.2 The solution is respecting the principles of Minimum Interoperability Mechanisms (MIMs).
 5.3 The solution is at some level open source and the data the solution generates is accessible.
 5.4 The solution is able to integrate to future systems and infrastructure of the cities.

FUNCTION 6: USABILITY

While the usability as a concept has been defined in ISO standard, a consensus has not been reached in the scientific community about the specific meanings. Usability stems from the research in ergonomics and evolved into a definition of quality in use. The ISO 9241-11:2018 states that usability is the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use. Typically, a high level of usability is the outcome of user-centric design that includes participatory methods, e.g. service design, design system and so on.

Requirements (must have):

- 6.1 The solution is easy to use by applicable users and easy for the cities to adopt.
 6.2 The solution is accessible to all applicable stakeholders. (For more information on accessibility, see e.g.: [https://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603973/EPRS_BRI\(2017\)603973_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2017/603973/EPRS_BRI(2017)603973_EN.pdf))

Requirements (nice to have):

- 6.3 Applicable end users with different user profiles will be involved in the design process.

FUNCTION 7: SUPPORT AND MAINTENANCE

Requirements (must have):

- 7.1 The software of the solution is regularly updated as per user feedback.
 7.2 If the solution includes any physical equipment or infrastructure, it has to be maintained regularly.
 7.3 Supplier ensures that the solution stays online and provides help desk support for users.

FUNCTION 8: PILOTING

The providers are expected to pilot the solution in at least two different Buyers Group cities in Phase 3.

Requirements (must have):

- 8.1 At least two pilots per Supplier in two Buyers Group cities in Phase 3.
- 8.2 Existing barriers to deployment (if any) are addressed.
- 8.3 Cost of infrastructure change (for the piloting and to return to status quo after piloting has ended) is covered by the deploying company (if applicable).
- 8.4 The offer must include all the necessary parts, accessories and measures to setup, deploy and operate the solution (if applicable).

4.2 Non-Functional Requirements

NFR 1: IMPACTS ON CITY AND CITIZENS

It is important to assess a solution's impact on cities or society. Creating AI solutions that reduce CO2 emissions in the fields of energy and mobility can bring additional benefits (or risks) to cities and their citizens (e.g. economic benefits, data for city management or other environmental benefits like better air quality).

Requirements (must have):

- NFR 1.1 Assessment of solutions other benefits (beyond CO2 emission reductions) that the solution provides for cities and their citizens including an explanation of how the solution provides them.
- NFR 1.2 Negative side effects and or risks coming with the solution (if any) are addressed.

Requirements (nice to have):

- NFR 1.3 The Supplier carries out at least one future user expectation survey in order to clarify the customer journey. **(Phase 2 only)**
- NFR 1.4 The Supplier carries out at least one user satisfaction / acceptance survey among users of their solution during the piloting. **(Phase 3 only)**
- NFR 1.5 Involving stakeholders and citizens, together with the Buyers Group when the piloting takes place. **(Phase 3 only)**

NFR 2: DISRUPTIVENESS

To what extent the solution could represent a shift in the market, creating room for new economic development.

Requirements (nice to have):

- NFR 2.1 The solution changes the status quo in business or market on some level.

NFR 3: SAFETY AND TECHNICAL MATURITY

Requirements (must have):

- NFR 3.1 The solution must be safe and secure by design.
- NFR 3.2 The data that the solution collects or accesses is well protected.

NFR 4: LEGAL MATURITY (For Phase 3 only)

The solution is expected to fulfil the legal framework of piloting cities. It is the responsibility of the suppliers to comply with EU and local regulations such as GDPR and to acquire possibly required licenses and insurances for their activities and piloting operations. The pilot sites' experts can contribute to this process from previous experience, but the ultimate responsibility to be able to acquire license and insurance is on the company.

Requirements (must have):

- NFR 4.1 The solution must comply with applicable, EU and country-specific legislation.
- NFR 4.2 All data used/reused and produced should be handled according to legislation (such as GDPR).



The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 871914.

AI4Cities Form A for Suppliers