NET ZERO CITIES

Online Action Plan Scoping and Design Specifications

Deliverable D1.10

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Abbreviations and acronyms

Acronym	Description
AP	Action Plan
API	Application Programming Interface
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IP	Investment Plan
MEL	Monitoring, Evaluation and Learning
NZC	NetZeroCities
SGA1	Special Grant Agreement
SNAP	Support Needs Assessment Process
WP	Work Package

Summary

The Climate City Contract Action Plan (CCC AP) is a core component of the Climate City Contract as part of the Cities Mission. This document serves as an exploration into the prospect of enhancing the efficacy of CCC APs through digitalization and seamless integration with the Mission Portal. Drawing insights from the experiences of the NetZeroCities (NZC) consortium, the objective is to delineate the potential scope and technical specifications of an online iteration of the AP. This comprehensive examination encompasses key areas, including barriers, opportunities, and technical design specifications, with a focus on leveraging digital tools to streamline and enhance the functionalities of the CCC AP.

In contemplating the potential scope, this document delves into the multifaceted aspects of the CCC AP that could benefit from digitalization. This includes but is not limited to, the incorporation of dynamic features, data visualization tools, and logical connections with existing platforms. The aim is to create a more accessible, user-friendly, and collaborative platform that aligns closely with the goals of the Cities Mission.

Technical specifications form a critical aspect of this exploration to ensure that the online version of the CCC AP can meet the needs of users. This encompasses considerations related to data security, interoperability with other tools, and adaptability to diverse reporting requirements. By addressing these technical nuances, the envisioned online CCC AP can serve as a robust and reliable instrument for cities committed to the Cities Mission.

Key conclusions are that the online action plan can enable a more inclusive and systemic approach to climate action planning for Mission Cities. Moving forward, next steps involve consulting with city users to align the platform with practical needs and prioritizing integration efforts with existing tools for seamless interoperability. A UX design process, informed by iterative feedback loops, aims to enhance accessibility, while ongoing collaborative engagements with partners ensure the open API harmonizes with diverse digital ecosystems.

Keywords

Digitalisation, Climate Action, Climate City Contract, Net Zero Cities Portal

1 Introduction

The aim and title of this deliverable were modified. The SICAP (Social Innovation Climate Action Plan) Concept was deemed unsuited as an action plan framework for the CCC and was therefore abandoned early in the project in favour of a more comprehensive climate action planning approach. The Action Plan Template and supporting guidance were developed as part of the wider Climate City Contract and are currently in use by Mission cities. An Online Action Plan Template has been discussed with partners and cities already for some time, for its potential to enable a more efficient drafting, submission, and review process, among other factors. D1.10 now therefore outlines the scope and design specifications of the Online Action Plan Template, and assess its potential advantages and limitations, as a first step towards development and potential implementation on the Mission Platform.

The "100 Climate Neutral and Smart Cities by 2030" Mission (the Cities Mission) was created by the European Commission to support, promote and showcase 100 European cities in their systemic transformation towards climate neutrality by 2030 and enable these cities to become innovation hubs, benefiting quality of life and sustainability in Europe and beyond. It is a challenging and ambitious endeavour through which cities commit to transform the way they function, accelerate the climate transition and inspire other cities to follow their lead. The Cities Mission will involve local authorities, citizens, businesses, investors as well as regional and national authorities. It is linked to several high-profile EU initiatives designed to achieve a climate neutral Europe by 2050 with an emphasis on human and planetary well-being. Two core components of the Mission's Implementation Plan are the Climate City Contracts (CCCs) and the Mission Platform. This report will explore how to create further synergy between these two components, by **outlining the scope and design specifications of a potential online version of the CCC AP**, which will be hosted on the Mission Platform.

1.1 Climate City Contracts

A Climate City Contract (CCC) is an instrument to launch the journey to change for climate-neutrality. It builds on the knowledge, resources and experience cities already have, providing them with a framework to move forward as a whole city, rather than just as the city administration, to seize opportunities and overcome the barriers they face in meeting their 2030 climate-neutrality targets. The CCC process aims to enable cities to accelerate collaboration at all levels, horizontal and vertical.

The CCC is based on 3 elements: 2030 Climate Neutrality Commitments, supported and strenghtened by a 2030 Climate Neutrality Action Plan (AP) and a 2030 Climate Neutrality Investment Plan (IP). These are the documented results of an iterative co-creation process with multiple stakeholders at various governance levels and in the local ecosystem. Together the municipality and the local stakeholders commit to 2030 climate neutrality and establish new ways of working together that takes the form of Commitments. They identify lessons and gaps from existing efforts to create coordinated key actions in an AP and mobilise the resources to implement them in an Investment Plan. Building on these premises already defined within the NZC project, the focus of this document is **improving the usefulness of the CCC AP**, which identifies the strengths, insights and gaps of existing strategies, policies and plans, to progressively create, over successive iterations, a co-ordinated and measurable portfolio of interventions across multiple levers of change.

The current CCC AP template and guidance supports cities to create their portfolio of interventions inclusive of cross-sectoral impact pathways on Stationary Energy, Energy Systems, Mobility, Nature-Based Solutions and Waste, through collaboration and innovation with stakeholders at multiple governance levels. Additionally, an indicator set will be provided to cities to support the Monitoring, Evaluation and Learning (MEL) process for the AP implementation. These include required GHG indicators as well as a suite of indicators to choose from of recommended additional co-benefit indicators on Biodiversity, Economy, Environment/Public Health, Resource Efficiency and Social Inclusion. These are not yet finalised but provide a wide variety of measures by which cities could potentially monitor and report on the benefits and co-benefits of climate action.

The APs currently are developed by cities offline and submitted to the consortium in PDF format for review, which limits analysis, and further future refinements from stakeholders or from the cities

themselves. Needs for its digitalisation (Section 2.1), barriers (Section 2.2) and opportunities (Section 2.3) are outlined in this document. The deliverable finally addresses design specifications and recommendations (Section 4).

1.2 NetZeroCities Portal

The NetZeroCities Portal is the digital component of the Mission Platform, supporting delivery from all other NZC work packages/themes & connecting other initiatives supporting cities transition to climate neutrality. The portal is designed to have three main functions:

1. Enable cities to find resources and tools that are useful in their journey towards climate neutrality by 2030.
2. Support peer-to-peer collaboration. It is an online space for cities to interact and learn together.
3. Manage city data, connecting CCC Action and Investment planning with data reporting and visualisation.

The Portal is the space where cities submit their CCCs for feedback from NetZeroCities and review by the European Commission. For each Mission City, there is a City Dossier – a detailed dataset on the city's vision, GHG emissions, political status, investment needs, capacity building priorities, stakeholders, collaborations, skills, and barriers. This is updated with the CCCs submitted by the cities, including imports from third parties on GHG emissions, such as Covenant of Mayors and CDP/ICLEI.

1.3 Aim of Online Action Plan

The purpose of this document is to explore the potential scope and design of an online version of the CCC AP, for use on the NZC portal.

The aim of proposing an Online AP is threefold: (1) to help cities retrieve and feed data from their existing databases for a first systemic compilation of the AP; (2) to provide a way for more effective evaluation of the APs from the NZC consortium and the Mission Team; (3) to support monitoring and learning for cities once the AP is defined, providing a space for continuous data analysis and integration. These aims will contribute to the next level activities in which on renew digital tools will be developed.

An Online AP could **support cities connecting their CCC AP**, using an open API, to a range of development and reporting **services and initiatives within the public and private sector**. Practically, this would allow cities to **connect private and public partners to essential data** within their CCCs and other city-level datasets. This API would offer multiple benefits, such as enabling cities to **leverage digital tools** for AP development, **connecting planning and reporting** requirements, **streamlining greenhouse gas emissions reporting** across reporting platforms like MyCovenant and CDP/ICLEI, and offering flexibility in using various indicators.

The following figure summarizes the workflow NetZeroCities envisions for the online AP and its related services. The cities, especially City Transition teams, will be the main users to upload and edit their CCC, push/pull data from platforms or services connected to stakeholders (such as a possible iterative document where stakeholders make comments) and view CCCs of other cities for inspiration to encourage peer to peer learning. Furthermore, as part of the informal feedback phase and the CCC pre-validation review by the NZC consortium, the city could send a draft or a final version to the NZC reviewers to receive feedback. The review process (or parts of it) could also be automated using Artificial Intelligence. The access rights could be changed at any moment, (making it public, or private, or sharing with specific individuals when needed. Further details are provided in Section 4, elaborating the technical requirements of these envisioned features.

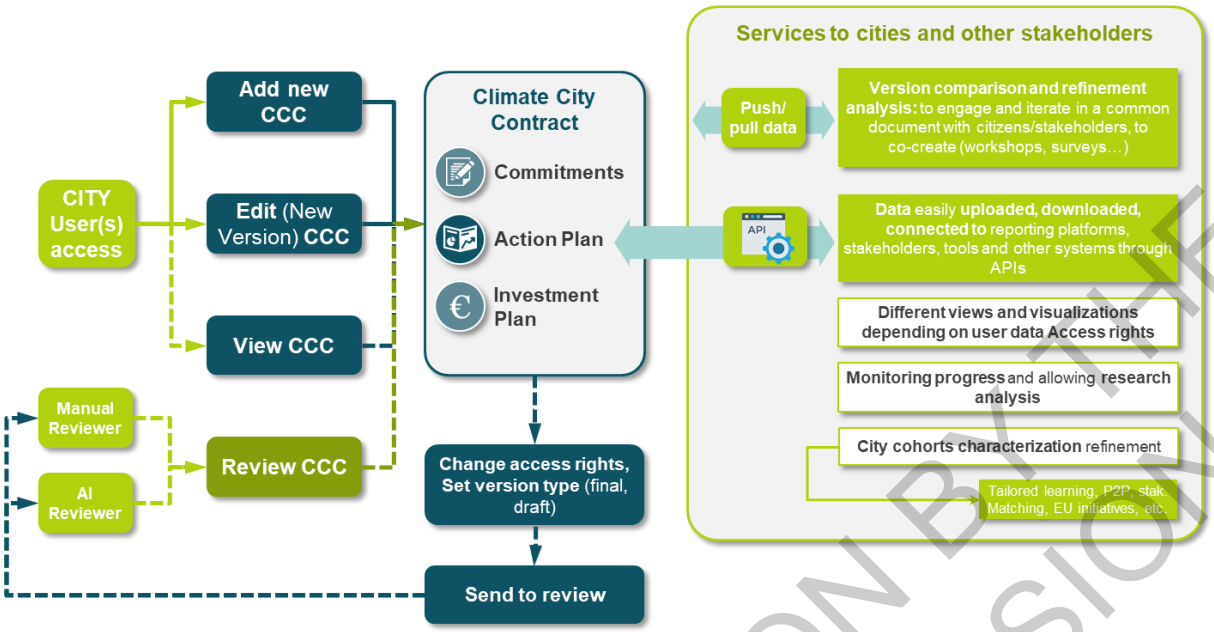


Figure 1 Overview of envisioned workflow for the online Action Plan and its related services[1].

2 Digitalisation of the 2030 Climate Neutrality Action Plan

2.1 Need for Online Action Plan

Over the course of the NetZeroCities project, several stakeholder workshops have been held exhibiting and informing the needs for an Online AP and its optimal scope. One such event was the Dashboard Module City Practitioners' Panel in May 2022. Key insights from this panel included:

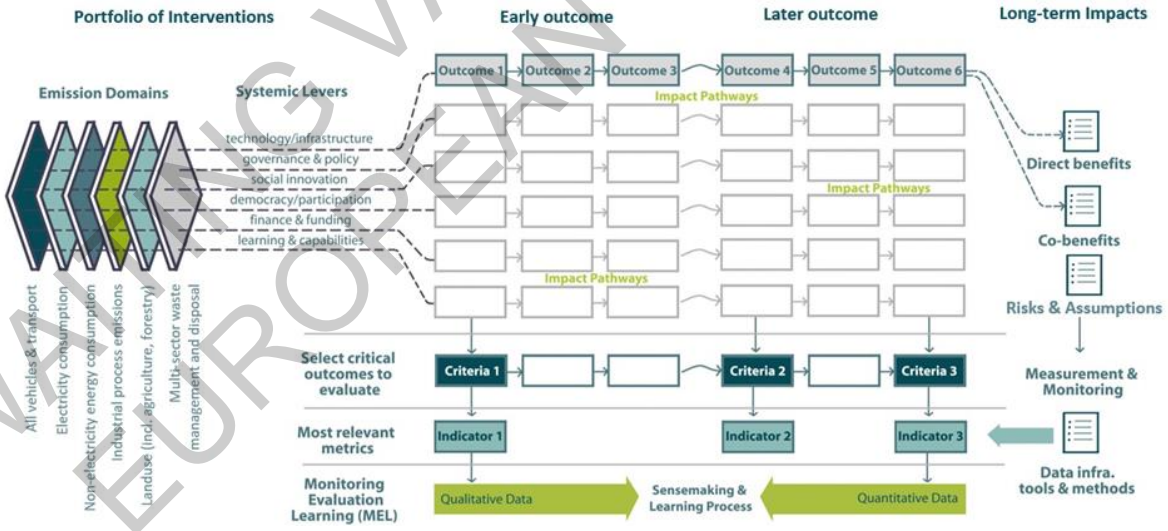
- Many cities already have multiple internal/offline dashboards, platforms or digital twins though may have issues with interoperability
- The cities use their dashboards for multiple reasons, split between internal use (decision making and insights) and external use (communications and reporting)
- There is fragmentation in climate actions across the city, and there is a need for a common assessment framework (indicators) for tracking systemic change
- Future action planning is still largely a manual + offline process that has limited accessibility
- There is need for a space for cities to consolidate their climate centric actions and impacts in one place
- Cities want to know the actions and processes applied in other cities towards climate neutrality

Additionally, the CCC review processes highlighted that:

[1] API icon: https://www.freepik.com/icons/api Icon by DinosoftLabs

- Many municipalities followed the NZC roadmap but found that the template-based process did not highlight the integration of different actions effectively. Moreover, the resulting CCCs were relatively technical and lacked a clear story of coherence in the portfolios of action. Hence, an online portfolio could support the development of linkages between different actions, as the current format is limited in developing and portraying such linkages.
- The iterative process needed for reflection and adjustment was sometimes missing in the overall strategy. An online AP could more easily highlight the iterative processes behind the overall strategy.
- There is a need to support cities in the development of capacities in relation to whichever model they choose. An online AP could support cities in highlighting the capacities needed to link the plan to the continuous development and update of the related resources.
- Moreover, an online AP could be more easily linked to the pre-submission checklist and the other CCC components that cities need to fulfil when they submit their CCCs to overcome the limitations of a PDF-based template.

Applying these insights to the scope of an Online AP shows that it can be advantageous to the Mission Cities for several compelling reasons. First, **the current state of action planning in cities is a largely offline, manual process**. Providing cities with **an online action plan tool** will make the content **accessible to** all actors in **their transition teams and other stakeholders**, supporting a **centralised system** for climate action planning. Furthermore, an online platform allows for **dynamic updates and interactive** features, ensuring that the climate AP remains current and adaptable to evolving circumstances. As the iterative nature of the CCCs is an integral aspect of the Mission process, using digital tools more consistently might also allow for more effective use of **maps and data visualisation** (carbon emissions, budgets, etc), making complex climate data more understandable and actionable. Having an online AP fosters collaboration and community involvement by providing a platform for **discussion and feedback**, encouraging collective problem-solving, and familiarising cities with the entire process through the lens of the NetZeroCities Theory of Change, co-created in WP2 (see figure below). The Theory of Change is the framework for the Monitoring, Evaluation and Learning (MEL) process that will inform iterations of the AP.



2.2 Barriers to the Process

Achieving the vision of an Online AP presents several barriers to overcome. The first is ensuring **confidentially** as well as the possibility for **open access and cooperation** with other digital platforms. Striking a balance between ensuring the confidentiality of sensitive data in a city's AP while also promoting open access and cooperation with other digital platforms can be challenging. This barrier requires the **development of robust data sharing protocols** that protect confidential information and

facilitate collaboration when needed. Cities must establish clear guidance on data that can be shared openly and data or sections that require confidentiality.

Beyond data sharing, there are challenges around the data itself. The **lack of standardized data formats and structures** for the diverse range of information contained within submitted Action Plans is a significant barrier. Additionally, some areas of Action Plans, such as systemic innovation, governance, and social innovation, often **lack sufficient data** or are difficult to capture in a standardised way. In addition to diverse data formatting, there are **varying methodologies** for creating Action Plans and greenhouse gas (GHG) inventories, which complicates data integration. There is a need for integrating the CCC AP and approach with other existing tools and reporting platforms to collect data and monitor activities.

2.3 Opportunities

The digitalisation of an AP and its integration into a user-friendly online portal represents a transformative approach to city-level climate action. This approach would offer the opportunity to match cities with diverse levels of maturity to the specific and relevant support and digital tools. Accordingly, cities could access the Online AP with varying degrees of depth to meet their different and possibly evolving demands. For instance, a few cities might still need to understand their local resources more in-depth before engaging with other stakeholders, while other cities – that are more advanced in the process – might need to start from a broader collaborative approach. The Online AP might help meet these diverse needs, offering cities the possibility to access functions at three main levels:

L1. Basic: A basic digital version that integrates existing data and platforms as well as City Dossiers and the dashboard that are already part of or being built as part of the NetZeroCities project. In this case, one of the most relevant elements of the Online AP is its potential capacity for in-depth analysis. It can provide a comprehensive view of the city's progress, uncovering the underlying reasons behind successes and challenges. This analytical capability is invaluable in tailoring climate action strategies to meet the specific needs of the city, taking into account unique circumstances and evolving priorities. It will not be just a static document but a dynamic tool that initiates an iterative process rooted in ongoing conversations and partnership building. This flexible, adaptive approach ensures that the AP remains responsive to emerging information and insights, making climate action a continually evolving, agile process.

L2. Strategic: The digital version offers – beyond the integration of existing data and platforms – further support and resources (e.g. case studies, methods, pathways, etc.) to link the city strategy to the climate transition map ,the visual representation of the NetZeroCities approach to the climate neutrality journey

An Online AP underlines the systemic vision of climate action by portraying the intricate interdependence of diverse actions and objectives within the plan. It can aid cities to illustrate how various initiatives are interconnected and how they collectively contribute to broader sustainability goals. For example, it can highlight how engagement with diverse groups relates to specific actions and objectives. This systemic perspective is a powerful tool in helping cities understand the holistic impact of their actions and in crafting comprehensive, integrated strategies to climate neutrality.

L3. Collaborative: In addition to the functions explained in the previous two, the third layer offers collaborative functionalities (e.g. ways of integrating feedback from local citizens and stakeholders, crowdsourcing mechanisms, etc.). Linked to this last layer, an advantage of the Online AP is the ability to directly **involve a wide range of stakeholders**, from local communities and businesses to external partners. By breaking down traditional barriers to access, the platform – if correctly used – can foster a sense of shared responsibility and ownership among these diverse groups. Through open discussions, **real-time feedback, and active contributions**, this inclusive approach could not only enrich the quality of the AP but also empower a collective commitment to the city's climate goals.

Furthermore, the digitalised AP could **facilitate easy comparisons and visualisations**. Cities would be able to benchmark their progress alongside others, allowing for peer to peer learning and friendly co-opetition (cooperation between perceived competitors). Visualisations, such as interactive graphs,

charts, and maps, provide a clear and engaging overview of the data, making it easier for stakeholders to comprehend the city's climate initiatives and track their evolution. In essence, hosting the AP on the NZC Portal can help bring city-level climate action to life, fostering collaboration, enhancing understanding, and driving progress towards a more sustainable and resilient future.

Lastly, digitalising the AP presents an opportunity to **simplify the process for others to review it** and support the alignment of the AP with the city's overarching mission. Reviewers, whether local authorities, environmental agencies, or experts in the field, would be able to **access the plan online,** making their assessments more efficient. This would not only accelerate the review process but ensure that the city's climate initiatives remain closely in line with broader objectives and standards. Additionally, the review process undertaken by the NZC consortium would become more efficient, leading to a smoother CCC submission process for all involved and streamlining the CCC process within the Mission

3 Scope of Online Action Plan

3.1 A systemic approach to planning for climate neutrality

Achieving climate neutrality demands technological shifts that reshape how our society interacts with existing systems. However, the crises we currently face are also deeply rooted in our economic and financial structures, power dynamics, and the institutionalization, manifestation, and replication of these issues in human behaviours and values. What might appear as rapid technological solutions often involve intricate changes, whose implementation is often hindered by the way our societies are organized. Cities need to acknowledge these institutional, organizational, and cultural barriers in their approach to reaching and planning for their climate transition, for the transformations to occur at the necessary scale and pace.

Procurement regulations, responsibility structures, multi-level regulations, antiquated data tools and other factors contribute to and exacerbate this issue as none of these structures were established to support the scale of transformation necessary to achieve climate neutrality by 2030. As a way forward, cities require a transformation of their organizational structures, practices, and cultures. Top-down, single-actor leadership must give way to deep collaboration; disjointed plans and interventions must give way to portfolios of systemic interventions; and isolated emission analysis must give way to systems understanding.

Building on this, systemic innovation must be at the core of how cities plan to achieve climate neutrality, necessitating an alignment of the tools provided by NZC to facilitate this transition. Among these tools, **the AP should critically adhere to this approach, advocating for and facilitating a new perspective on climate transition**. This approach should encompass intelligent methods for data collection and analysis, for strategic decision making and for initiating collaborations, engaging stakeholders, and incorporating various forms of innovation to supplement technological advancements. It should help mobilize the local ecosystem, involving industry, media, the third sector, academia, and the general population.

In practical terms, the approach proposed by the AP should critically involve harnessing collective intelligence and utilizing diverse local data sources to construct a shared understanding of the magnitude of the necessary changes, encompassing both actions and resources. Adopting a systemic perspective toward climate neutrality enables the identification of intricate dynamics within the local emission system. This includes identifying patterns of interdependency, understanding power dynamics, tracking resource flows, recognizing needs, evaluating risks, and identifying opportunities for leveraging and pinpointing barriers.

Digitalising the AP could help reach these objectives to a greater extent. A well-designed digital AP could offer several advantages, particularly in overcoming the limitations outlined in the preceding sections (par. 2). Advantages might include embedding the principles of continuous iteration and continuous monitoring. A digital approach can allow for dynamic recording and reporting of changes, fostering an environment that welcomes iteration and continuous development. Additionally, digital tools – if appropriately used – can enable open collaboration, by making different versions of the document accessible for input from partners, stakeholders, and citizens. These versions can be tailored with diverse levels of granularity and permissions, facilitating a broader range of contributions. Furthermore, a digital AP could enhance transparency and accountability. By openly sharing a roadmap and inviting contributions, increased trust can be created, including a greater sense of ownership of the public value created.

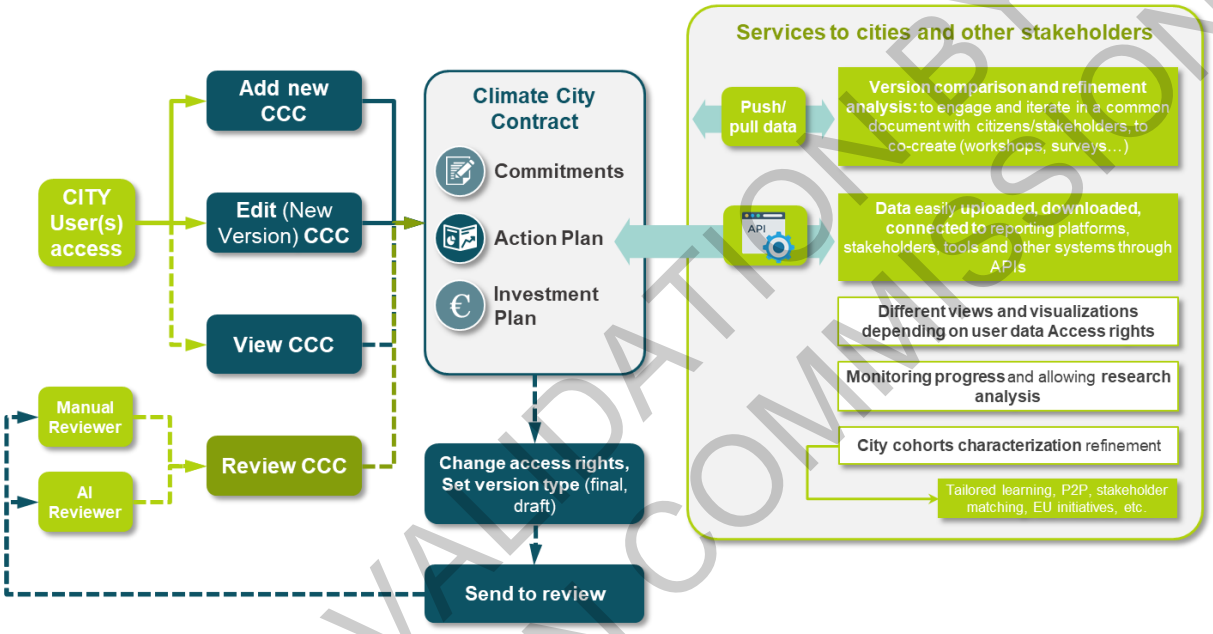


Figure 2 Systemic service to cities

To make this vision more practical, the following two sections outline two of the most prominent features of the Online Action Plan, while the following section describes more in detail the technical specifications.

3.2 Enhance Engagement and Accessibility

The Online AP should significantly **improve accessibility and interactivity** for cities and their partners compared to traditional static documents, which limit effective engagement and collaboration. A digital platform might remove barriers by offering a dynamic, user-friendly interface that can be accessed from any internet-enabled device.

This enhanced accessibility is about creating a more efficient and collaborative environment for cities and their stakeholders. The City Dossier, already available in the Portal and currently under further development provides a comprehensive overview of the city's climate initiatives, making it easily navigable for all stakeholders. Furthermore, the integration of the CCC AP and the actions portfolio table, which describes the interventions planned (Module B-2 of the AP template), would allow for the seamless **exportation of data**, which can then be **linked to other tools and reporting processes**. This integration streamlines collaboration among cities and their partners, enabling a more coordinated approach to climate action.

Through this digital platform, cities could open doors to a larger number of stakeholders. Local communities, businesses, NGOs, and research organisations would be able to actively engage with the Action Plan, contributing their insights, ideas, and expertise. The accessibility and interactivity of the Online AP should empower a broader array of stakeholders to participate in discussions, provide real-time feedback, and actively shape the city's climate initiatives. This would enrich the quality of the Action Plan, while ideally also fostering a sense of shared ownership and responsibility among these diverse groups, creating a collective commitment to the city's climate goals.

The Online Action Plan's enhanced accessibility should not only be about convenience but also about democratizing climate action. Therefore, it is important to consider how to best improve accessibility for different city contexts, for example through translation into local languages or linking to local government websites. It should equip all stakeholders with the tools they need to participate, collaborate, and contribute to meaningful change.

3.3 Improve Insights and Learning

The Online AP offers a valuable platform for enhancing insights and promoting continuous learning. It goes beyond traditional static documents, enabling cities to gain and present a more comprehensive understanding of their climate initiatives.

One key aspect contributing to this enhanced learning should be the City Dashboard , a dynamic feature designed to support progress reporting. It provides cities with **data visualisation** tools that can be customised to meet the specific requirements of their CCC AP and their communication needs. This feature will be instrumental **to understanding and presenting climate progress**. It links seamlessly to the Actions Portfolio and the indicators, offering a holistic view of the city's climate actions and their impact.

Figure 3 shows which aspects of the AP should be visualised:

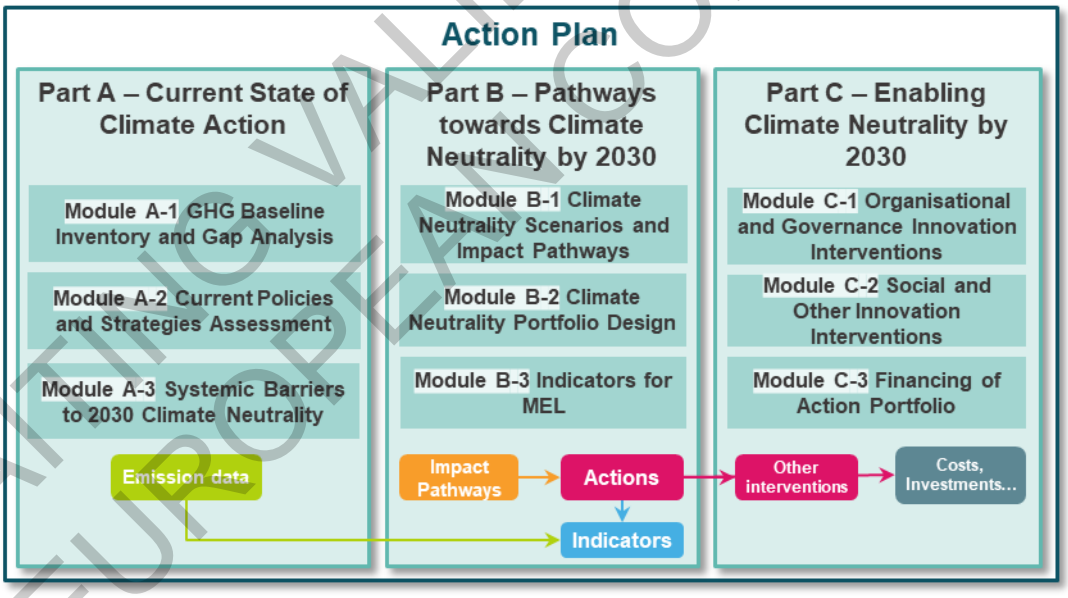


Figure 3 What to visualize in the action plan

Moreover, the Online AP should implement a **Barometer to aggregate data** from the City Dashboard, providing program-level insights across Mission Cities . A good example of this is the Hinku Finnish network GHG database:

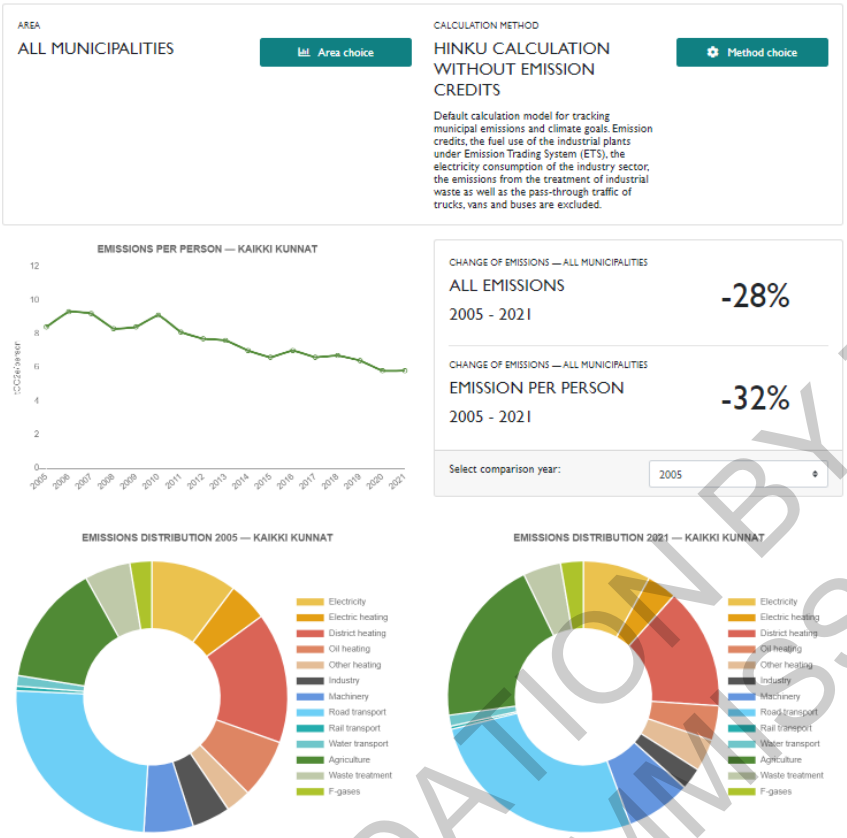


Figure 4 Hinku emissions evolution over the years (includes all municipalities). Source: https://paastot.hiilineutraalisuomi.fi

The **NZC Barometer** aims to **offer** a consolidated **view of progress**, allowing cities to gauge the effectiveness of their climate initiatives on a broader scale. This functionality **promotes a shared learning** experience among Mission Cities, enabling them to identify best practices, trends, and opportunities for improvement.

In summary, the Online Action Plan's commitment to improving **insights and learning** is underpinned by the innovative City Dashboard and the aggregating capabilities of the Barometer. These features empower cities to gain a deeper understanding of their climate progress, customise data visualisation to meet their unique needs, and assess program-level insights across the Mission Cities, collectively fostering a more informed and effective approach to climate action.

4 Design Specifications of Online Action Plan

Design specifications are detailed descriptions of the requirements, constraints, and features that a product, system or project must meet. In this case, the design specifications of the Online AP will include the technical and design requirements for including digital features of the AP and MEL indicators on the Portal.

4.1 Technical Requirements

As outlined in the needs and opportunities sections, a digitalised version of the AP would generally allow:

- Monitoring the progress of the cities;
- Version comparison and refinement analysis;
- Visualisation/comparison;

- Building on /refining current city dossiers and cohort classification based on the data included in the AP.

To accommodate these needs, one of the main technical requirements is the adoption of an existing ontology[2] (or a Knowledge Graph[3]), a formal, explicit, and conceptual representation of knowledge in a specific domain, such as the AP. Currently, SAREF4City Ontology could be a good basis for this, but extensions might be needed to allocate different GHG accounting methodologies and AP data. An ontology can provide semantic information to city data, as well as an agreed vocabulary and metadata. The latter features can allow any external user to understand the data and assumptions behind the data. The ontology (if its development is coordinated or performed by the NZC consortium) should be aligned with existing ontologies such as SAREF. This would ensure consistency and compatibility with wider data standards.

Another reason to use ontology based data Integration is that it can allow data transformations to different formats and can automatize API for different tools, platforms and formats.

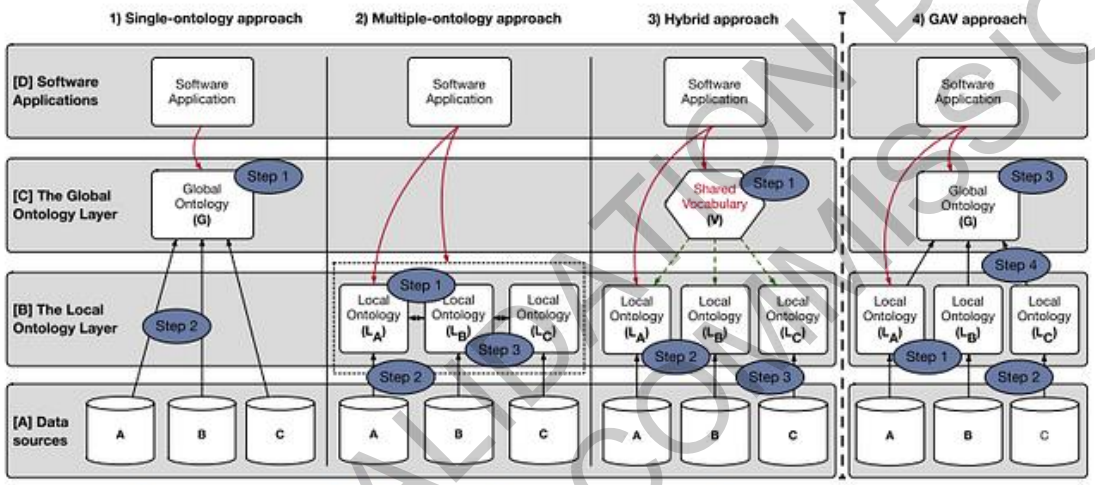


Figure 1: Three variants of OBDI from [75]: (1) single-ontology, (2) multiple-ontology, (3) hybrid, and an additional OBDI variant (4) Global-as-View (GAV).

(Explanation: Red arrows indicate access from an application to data, black arrows represent transformation/virtual access to the data; dotted green arrows represent implicit relations between involved ontologies, and numbered items show the sequence of system development. The dotted rectangle refers to the federation of local ontologies. Section 5.1 explains the additional OBDI variant (4) *Global-as-View* (GAV).)

Figure 5 Ontology based data integrations and different variants around in multidisciplinary engineering environments (MDEEs). [4]

[2] An ontology is a formal, explicit, and conceptual representation of knowledge in a specific domain (in this case a GHG inventory or an AP). It serves as a structured model that defines the entities, concepts, relationships, and rules within that domain. Ontologies are used to organize, classify, and standardize information in a way is understandable for many parties. SAREF is the European reference ontology, and has extensions for many applications: List of SAREF ontologies (etsi.org)

[3] A knowledge graph is an organization of a knowledge base as a graph having nodes and links between the nodes. It is created when you apply an ontology to a set of individual data points. Knowledge graphs resemble ontologies, but they are not the same. Ontologies are more general, while knowledge graphs are more specific. Knowledge graphs are dynamic and can provide new inferences and remodel themselves with the addition of new data over time.

[4] https://medium.com/@soumyamulgund/ontology-based-data-integration-rundown-cd65c1166cc9

Particularly for **Part A, module A-1,** (see Figure 3) the online AP will show an overview of GHG baseline and future emissions of the city (and its targets, linking with table A-2.3). The Portal will need to make available features to ease upload, download and connecting to stakeholders, to existing reporting platforms or tools, and other systems, through Application Programming Interfaces (APIs). The database (ideally based on an ontology) will need to accommodate:

- Data at different levels of detail, ranging from aggregated data by sector to subsector.
- Different scopes (1,2,3) depending on the sector.
- Consistent vocabulary and metadata: In dealing with different levels of activity and sub-sectors, it's important to establish a consistent vocabulary. This ensures that data remains understandable by other parties using the data, even if the city uses different terminology for certain elements
- Integrate different scenarios: such as Business as usual (BAU), 2030 scenario with current strategies and 2030 scenario with CCC plans and actions. For each scenario, different actions across levers could be included with its associated co-benefits, KPIs and impacts.
- Levels of activity/sub-sectors: should accommodate and translate different ways of nomenclature (vocabulary) that can be used by cities when disaggregating data. The translation scripts should make this match of nomenclatures in an automated way to the extent possible. When not possible, manual checking processes by the city and the portal team should be considered.
- Various measurement approaches, such as those used by IPCC, GHG Protocol, Covenant of Mayors (CoM), and others as well as different methodologies within sectors and subsectors based on the city activity data available.
- The co-benefits that different cities may want to check and that could have been mapped per action or systemic lever.

These are the minimum technical requirements for part A1, summarized in Figure 6.

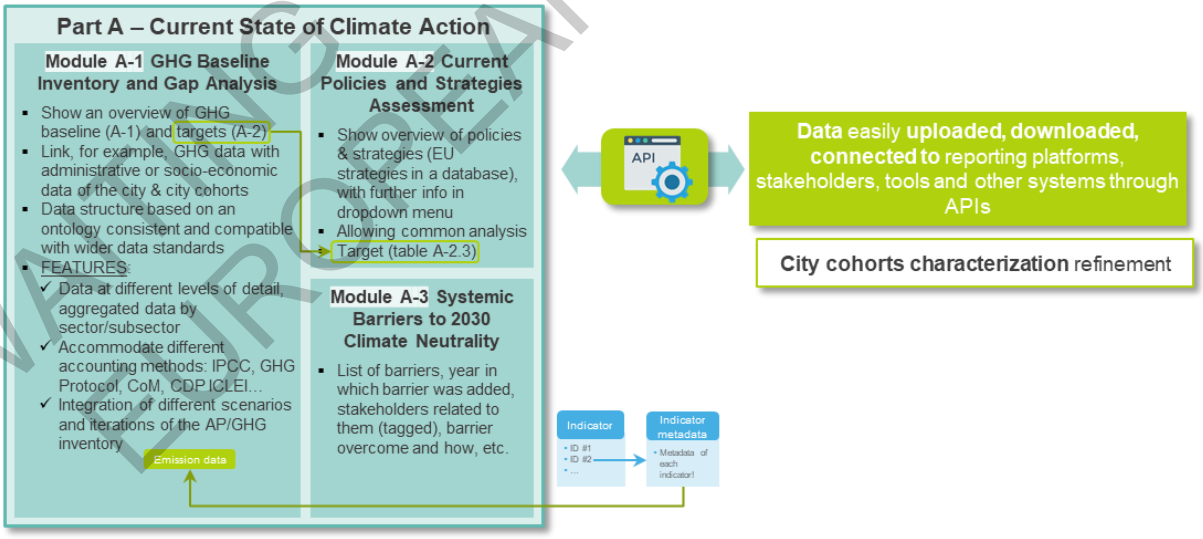


Figure 6 Features to be considered in the Part A of the Online Action Plan as well as API services. In blue part B3 connection to emission data.

The semantic data that can be included in the ontology allows to link, for instance, GHG data with administrative (GHG boundary, developer of the AP, stakeholder participants in the AP) or socio-

economic data of a city (GDP, demographics). To do that, categories included in S4Cities. could be considered, such as topology, administrative area, city object, events, etc.

In S4Cities ontology geospatial objects are included, for instance. Incorporating geospatial objects into the database allows to integrate location-based information with other non-spatial data. This can be especially useful in applications like asset management, land use planning, environmental monitoring, and more. In this way PostGis and similar tools could be used for data transformation and analysis.

Furthermore, these administrative data could also include new concepts/categories that are useful for NZC and portal management, such as data governance information on the city groups/ecosystems (to know the stakeholders part of the CCC, individuals included in internal teams with skills, etc.), and/or a Cohort profile. The latter is now a result of the Support Needs Assessment Process (SNAP) of the City Advisors, that can be refined with the use of the city readiness self-assessment tool (upcoming service in the portal). Linking administrative data, with geospatial objects and with user profile information allows for analytic opportunities and future refinement of the portal for better user orientation.

Lastly, another feature that can be included is socioeconomic data: including statistical data that can help the analysis of cohorts such as GDP, population, population density, income, energy poverty, or other KPIs that NZC/Mission or cities or other stakeholders could find useful.

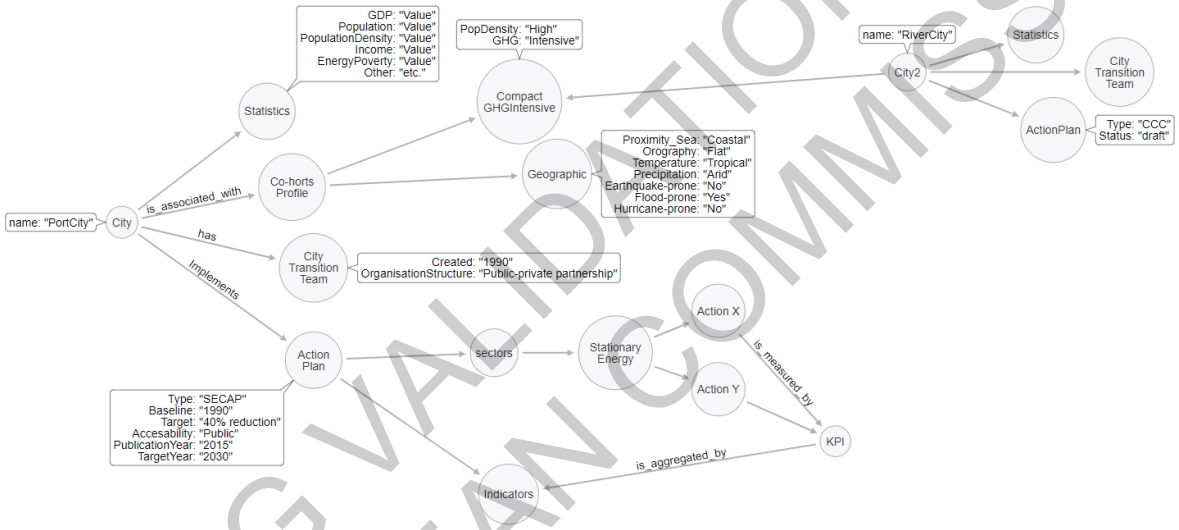


Figure 7 Simplified example of graph representation of City data that could be performed. City and City2 are connected via the same co-hort profile (Compact city that is GHG intensive). A P2P service learning could be deployed thanks to that connection.

These aspects of semantic data are also relevant and could be fed with data coming from other modules of the AP. Particularly, **Module A2** could provide an overview of current policies and strategies at different administrative levels (EU, national, regional, local) and how these strategies affect the city (is it an opportunity or a barrier?). **Module A3** can also add general barriers and connect them with stakeholders, sectors, etc. enriching the city data with possible reasons corresponding with the city development (e.g. why and how a city is progressing well? why not? why are some actions not being considered?) for a systemic analysis.

Regarding **part B** – Pathways towards climate neutrality by 2030, impact pathways visualizations could be inserted in the AP if data is inserted in a structured way (per field of action, associating systemic levers, etc.). **Module B2** could also add list of actions linked to field of action (in module B-1). Each action could be linked to **module B3**, by indicators. **Part C** could have similar features, e.g. organisational structure in the city, social interventions, innovative governance interventions, policy interventions, among others. Module C3 could link all actions (technical, non-technical) and link them with its associated cost. Figure 8 summarizes the features to be considered in part B and C.

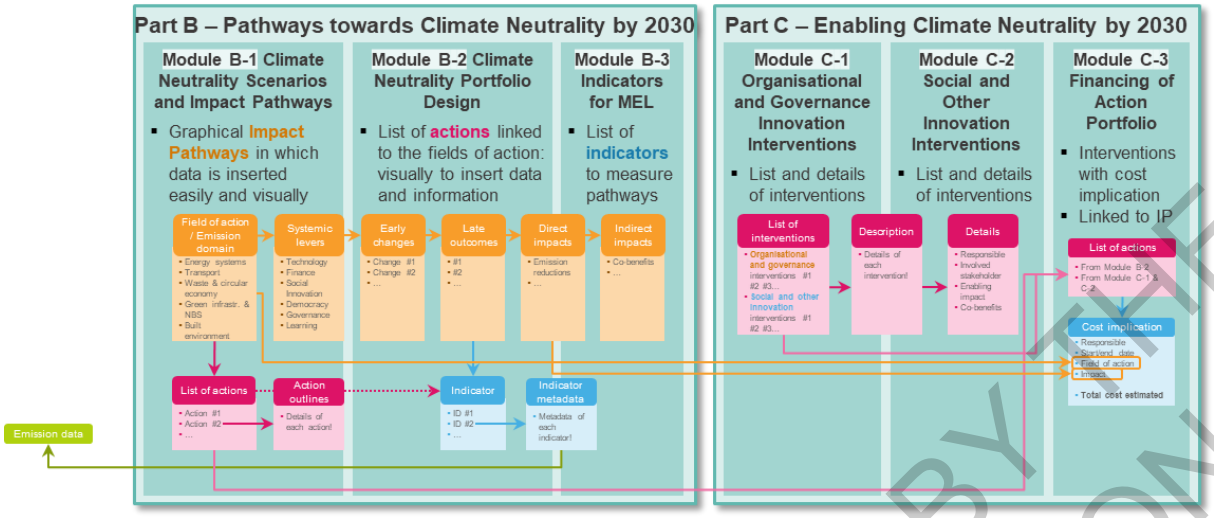


Figure 8 Features to be considered in Part B and C of the Online Action Plan

Aspects of **data accessibility and security** need to be considered for all modules. Depending on the type of users (company, researcher, NZC consortium, other cities) the access to the data needs to be regulated, permitting different ways of visibility. Data licensing needs to be introduced to ensure users use the data for specific, permitted purposes (research, local commercial purposes, tec.) only. These levels of **data access rights and licensing** could be changed at any time according to city needs. The features could also allow providing access to the data only to reviewers of the CCC, as well.

The creation of APIs for data sharing should consider the rights and privileges of users too. Different stakeholders may have varying levels of access and authorization, so the system should be designed to accommodate these distinctions and access rights. A **questionnaire within the digital AP** portal can help define the **type of data that the city allows sharing and with whom.** This includes options for sharing detailed inventory data, aggregated data per sector, and other data types. It should also specify the **target audience for this shared data**, such as researchers, consultants, the general public, or specific individuals.

The digitalisation of the AP should also **facilitate cities and reviewers' work**. For instance: the city may want to know the progress status of their AP (on-going revision by NZC consortium, on-going revision by Mission team, etc.). The city may wish to deliver a digitalised draft version of the AP while remaining anonymous and not public, for other reviewers to check. AI could be used to analyse part of the AP to automatically match cities that are similar and refine cohorts.

To allow these technical requirements to be accepted by the cities as main users of the digitalised version of the AP, the way of providing inputs to this version should be as **user-friendly** as possible via questionnaires and making it possible to import data from different platforms and formats (excel, json, xml, etc.) considering that not all city teams will have the expertise to use APIs. Figure 8 summarizes all the technical requirements to be considered.

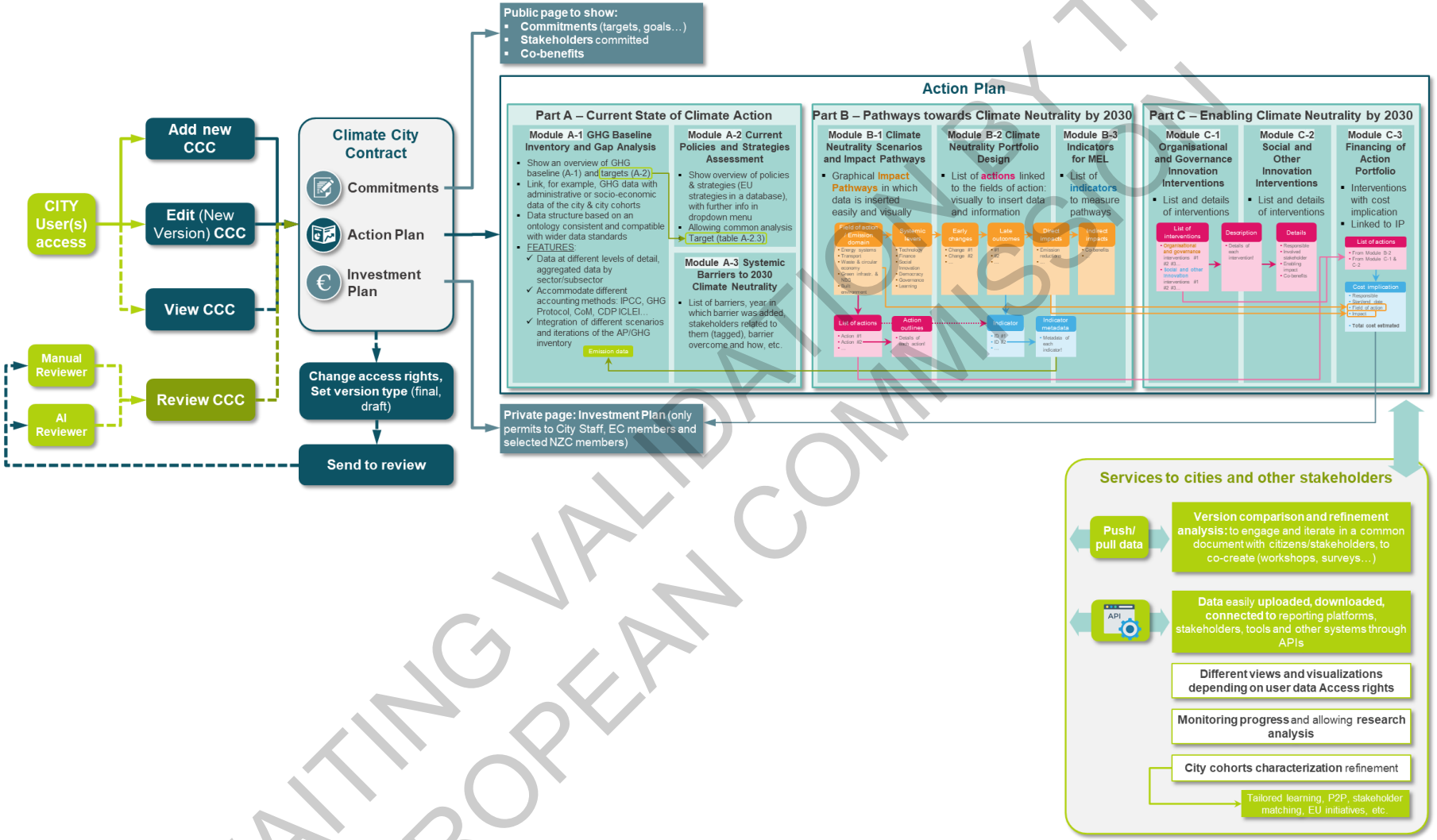


Figure 9 Summary of technical specifications

4.2 Design specifications for indicators

The requirements of the NZC indicator framework create potential to assess a number of variables that may impact a city's climate neutrality journey, and making use of various data sources. The digitalisation of indicators within the framework should allow for a digital representation of indicator's information and related metadata in a manner that is clear and understandable to the framework's users. In doing so, the digitalized indicators offer the possibility to analyze and monitore of the city's climate neutrality journey and thus offers decision makers the evidence to take informed actions. However, cities, as dynamic entities that are defined through their physical, social, and economic environmental properties, are constantly changing. Consequently, an indicator framework requires certain specifications to ensure its usability and maximise its impact:

- **UX:** As cities change over time, a dynamic setup of an indicator framework, allowing the capturing of relevant indicator data in a dynamic and easy to use manner for data providers is highly recommended. Therefore, an online interface or application is suggested to be developed, following the principles of UX (user experience) guidelines, which will allow an easy way to upload data representing indicators.
- **Linking to other platforms:** To maximise the framework's impact, it is important to respect and link to other already existing frameworks. Existing reporting platforms, such as MyCovenant[5] and CDP ICLEI-Track[6], have been used successfully bymany cities and offer indicators and detailed information relevant to the framework. To support efficiency and impact, it is important to integrate the indicator framework into such existing reporting platforms not to re-invent the wheel.
- **Meta data:** To allow data comparability within a framework and between different frameworks, it is important to capture metadata of various indicators and their relevant data sources. Metadata should preferably align with metadata from existing reporting platforms, such as MyCovenant and CDP-ICLEI Track, allowing for comparisons between platforms.
- **Standards**: Established through a bottom-up approach, existing reporting platforms over time develop their own standards, requirements, and specifications. This multitude of standards and lack of unity might lead to challenges when implementing the indicator framework within this established platform landscape as different standards follow different procedures to report.
- **Data Accessibility**: Cities and nations differ on how they govern data accessibility. Data sets that represent an indicator might be openly accessible in one city, but not in another due to data access restrictions. Therefore, the indicator framework intends to be flexible allowing for the use of various data sources using both bottom up and downscaled data. A potential solution to this is the current ongoing development and establishment of a European Data Space that aims to unify the availability and accessibility to data within the European Union, by providing technical and governance guidelines for use case developers and data providers[7]. It is recommended to primarily focus on the inclusion of indicators and relevant data sets that are situated within the European data space, to avoid such limitations.

[5] MyCovenant: https://mycovenant.eumayors.eu/signatory-registration
[6] CDP ICLEI-Track: https://www.cdp.net/en/cities
[7] Data Space for Smart and Sustainable Cities and Communities (*DS4SSCC*): https://www.ds4sscc.eu/

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- **Architecture compatibility**: To deploy the digitalised version of the AP, an IT architecture building on the current one should be considered. ITU-T reference architecture and others could be considered, especially the layers related to security, services (such as visualization), interoperability layer (considering the ontology and data structures of the APs), and the knowledge layer to make analytics of the data included in the AP.

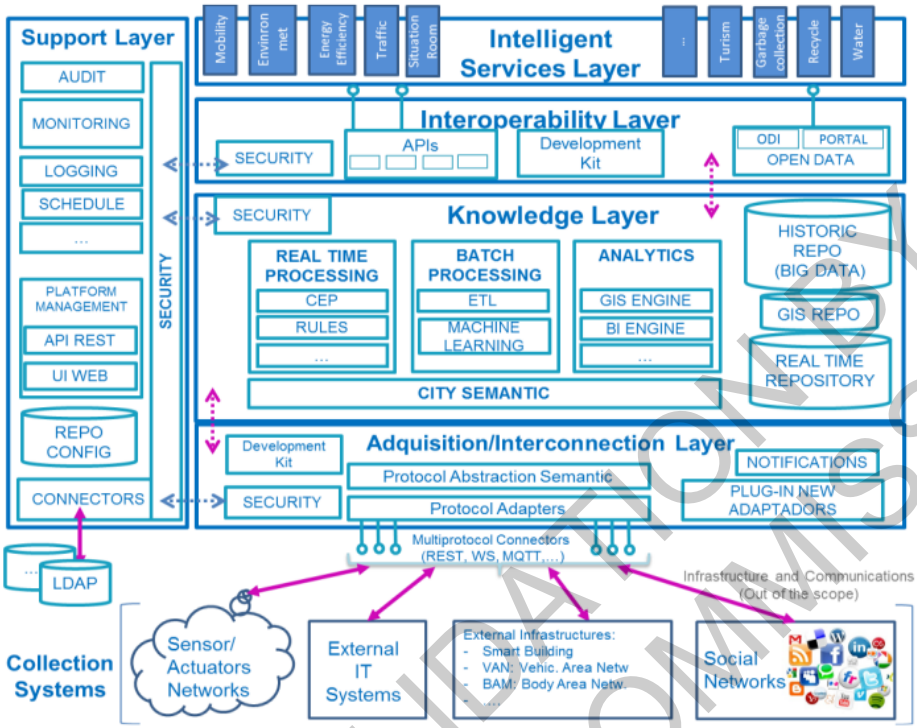

Figure 10: ITU-T reference architecture. Source: Hernández, J.L.; García, R.; Schonowski, J.; Atlan, D.; Chanson, G.; Ruohomäki, T. Interoperable Open Specifications Framework for the Implementation of Standardized Urban Platforms. *Sensors* **2020**, *20*, 2402. https://doi.org/10.3390/s20082402

5 Conclusion

This preliminary scoping exercise underscores the compelling potential of integrating an online version of the AP within the Cities Mission, presenting opportunity for a substantial improvement in the action planning process despite identified barriers such as data interoperability and heterogeneity. By embracing digitalization, the Online AP emerges as a dynamic and accessible platform, reshaping how Mission Cities can approach their climate initiatives and surmount the outlined challenges.

The proposed features of the City Dashboard and the Barometer, as highlighted in this initial assessment, stand out as critical elements that would significantly elevate the depth of insights and learning available to cities. The City Dashboard, with its customizable data visualizations linked to the Actions Portfolio and indicators, can foster inclusivity in the planning process, breaking down barriers and encouraging active stakeholder engagement. Simultaneously, the Barometer, with its capacity to aggregate data across Mission Cities, promises program-level insights that contribute to shared learning experiences, enabling cities to identify best practices and trends.

Furthermore, the Online AP would go beyond conventional climate action documents by providing cities with an open API to the NetZeroCities portal. This would allow cities to establish vital connections with their public and private partners, creating a collaborative ecosystem that leverages various digital tools and streamlines planning and reporting requirements. Translating into greater efficiency and effectiveness in climate action, simplifying cities process on reporting greenhouse gas emissions and adapt to evolving data needs.

Looking ahead, there are potential next steps to build on this scoping exercise. If taken forward, direct consultations with city users would be pivotal, gathering insights that ensure the platform aligns closely with practical needs. Simultaneously, integration efforts with existing tools should be prioritized for seamless interoperability. A thoughtful UX design process would enhance accessibility and usability, informed by iterative feedback loops. Collaborative engagements with public and private partners would need to be ongoing, ensuring the open API harmonizes with diverse digital ecosystems.

In summary, this report outlines the potential scope and design specifications of an online Climate City Contract Action Plan. By overcoming barriers and embracing digitalization, this feature of the NZC platform can be a vital tool for how Mission Cities approach, implement and report on their climate initiatives. It is a forward-looking tool that not only enhances efficiency but also fosters collaboration, setting the stage for accelerated progress towards the ambitious climate neutrality goals of the European Commission.