

# D7.12: Reporting to the SCIS System 6

+CityxChange | Work Package 7, Task 7.3 & 7.4

Final delivery date: 14-06-2022



<b>Deliverable version</b>	v.13
<b>Dissemination level</b>	Public
<b>Authors</b>	Daniel Rood (FAC/KPMG FA), William Hynes (FAC/KPMG FA), Akshay Chiddarwar (FAC/KPMG FA), Anna Yankulova (FAC/KPMG FA), Jamie McGrath (FAC/KPMG FA), Mallika Singh (FAC/KPMG FA)
<b>Contributors</b>	Dirk Ahlers (NTNU), Terence Connolly (LCCC), Mladen Antolić (MPOWER), Mamdouh Eljueidi (4C), Tor Rune Skoglund (4C).

## *Article 29.5 Disclaimer*

This deliverable contains information that reflects only the authors' views and the European Commission/INEA is not responsible for any use that may be made of the information it contains.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 824260.

## Document Information

<b>Project Acronym</b>	+CityxChange
<b>Project Title</b>	Positive City ExChange
<b>Project Coordinator</b>	Annemie Wyckmans, Norwegian University of Science and Technology
<b>Project Duration</b>	1 November 2018 - 31 October 2023
<b>Deliverable Number</b>	D7.12: Reporting to the SCIS System 6
<b>Dissemination Level</b>	PU-Public
<b>License</b>	CC-BY4.0 Creative Commons Attribution, except where otherwise noted. <a href="https://creativecommons.org/licenses/by/4.0/">https://creativecommons.org/licenses/by/4.0/</a>
<b>Status</b>	Completed
<b>Due Date</b>	31-10-2021
<b>Work Package</b>	WP7 – Monitoring and Evaluation
<b>Lead Beneficiary</b>	FAC (KPMG FA)
<b>Contributing Beneficiaries</b>	NTNU, LCCC, TK, MAI, MP, SB, SMO, VORU, IESRD, POW, UL, EAP, R2M, ISOCARP, TE, ABG, 4C, MPOWER, (GoCar)

## Revision History

<b>Date</b>	<b>Version</b>	<b>Author</b>	<b>Substantive changes made</b>
14-09-2021	v.01	Daniel Rood	Setup of draft document structure
21-09-2021	v.02	Daniel Rood	Drafting in sections 2, 3, 4
23-09-2021	v.03	Daniel Rood	Drafting in sections 1, updates to section 4.2
30-09-2021	v.04	Daniel Rood	Drafting in sections 3, 4, 5, Annex
30-09-2021	v.05	Daniel Rood	Draft deliverable finalisation
29-10-2021	v.06	Akshay Chiddarwar	Draft deliverable with QA remarks addressed
24-11-2021	v.07	Akshay Chiddarwar	Draft deliverable with QA remarks addressed
17-12-2021	v.08	Akshay Chiddarwar	Draft deliverable with QA remarks addressed
17-12-2021	v.09	Akshay Chiddarwar	Additional comments
30-03-2022	v.10	Akshay Chiddarwar, Jamie McGrath	Draft deliverable with QA remarks addressed

29-04-2022	v.11	Jamie McGrath, Akshay Chiddarwar, Anna Yankulova	Additional comments from QA addressed
26-05-2022	v.12	Anna Yankulova, Akshay Chiddarwar,	Final draft for submission
14-06-2022	v.13	Anna Yankulova, Akshay Chiddarwar,	Final draft for submission

## Table of Contents

Table of Contents	2
List of Acronyms	3
Executive Summary	6
1 Introduction	7
2 M&E in +CityxChange	8
2.1 Recording impact in +CityxChange	8
3 Monitoring Data	11
3.1 MERT Data Submission	11
3.1.1 Automated Data Submission to the MERT	11
3.1.1.1 API Specification and API Endpoint	11
3.1.2 Manual Data Submission to the MERT	12
3.2 SRT Data Submission	12
4 Reporting Data to the SRT and MERT	14
4.1 SCM / SRT reporting	14
4.1.1 KPI feasibility for SRT reporting	14
4.1.2 Identified gaps and outcomes for SRT reporting	15
4.1.3 Final reporting to SRT	17
4.2 The +CityxChange MERT	18
4.2.1 KPI Calculations	18
4.2.1.1 KPI Calculation Status and Updates	18
4.2.2 Refinement of MERT functionality/features	27
4.2.3 Data Submissions to the MERT	29
4.3 KPI Performance Status at Month 36	31
LCCC: 5; TK: 4	33
4.4 Data Availability	35
4.5 Reporting Insights and Additional Information	35
5 Conclusion and Outlook	37
6 References	39
Annex I	40



## List of Acronyms

<b>API</b>	Application Programming Interface
<b>BCV</b>	Bold City Vision
<b>CEM</b>	Common Energy Market
<b>DPEB</b>	Distributed Positive Energy Block
<b>DPED</b>	Distributed Positive Energy District
<b>DER</b>	Distributed Energy Resource
<b>DST</b>	Decision Support Tool
<b>EC</b>	European Commission
<b>eMaaS</b>	eMobility as a Service
<b>FC</b>	Follower City
<b>FoA</b>	Fields of Action
<b>GHG</b>	Greenhouse Gases
<b>GWh</b>	Gigawatt hour
<b>ICT</b>	Information and Communication Technology
<b>IDP</b>	Integrated Planning and Design
<b>KPI</b>	Key Performance Indicator
<b>KPMG FA</b>	KPMG Future Analytics
<b>LCCC</b>	Limerick City and County Council
<b>LHC</b>	Lighthouse Cities
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MERT</b>	Monitoring and Evaluation Reporting Tool
<b>MWh</b>	Megawatt hour
<b>€M</b>	Euro in Millions
<b>NOX</b>	Nitrous Oxides
<b>OV</b>	Officinæ Verdi Group
<b>PEB</b>	Positive Energy Blocks
<b>QDWG</b>	Qualitative Data Working Group

<b>RES</b>	Renewable Energy Sources
<b>ROI</b>	Return on Investment
<b>SCD</b>	Sub-city District level
<b>SCIS</b>	Smart Cities Information System
<b>SCM</b>	Smart Cities Marketplace
<b>SRT</b>	Self-Reporting Tool
<b>UFA</b>	Usable Floor Area
<b>UI</b>	User Interface
<b>WP</b>	Work Package

## List of Tables

[Table 1: KPI Overview with Expected Impacts and Baselines](#)

[Table 2: KPIs to potentially report to the SRT, calculation approach](#)

[Table 3: Engagement on KPIs to report to SRT - showing identified gaps and latest outcome](#)

[Table 4: SRT Thematic Fields to which KPIs are capable in theory of being reported to SRT](#)

[Table 5: KPI Calculations Status for all KPIs in the MERT](#)

[Table 6: Summary of Progress](#)

[Table 7: Improvements to the MERT](#)

[Table 8: Captured KPI data and overall KPI performance](#)

[Table 9: Points to be addressed](#)

## Executive Summary

This report, *Deliverable 7.12: Reporting to the SCIS (6)*, is part of a series of bi-annual reports and is the sixth iteration in the series; being the subsequent revision of the previous version, *Deliverable 7.10: Reporting to the SCIS (5)*<sup>1</sup> submitted in Month 30 of the +CityxChange project.

During the reporting period WP7 has seen further engagement between all relevant KPI owners and KPMG FA; towards the refinement of KPI calculations, the resolution of data reporting issues, the pursuit of alignment in KPI data for the purposes of SRT reporting, and the further enhancement of MERT features and functionality - as feedback emerges through use.

As with prior periods, it has become necessary for KPI descriptions, scope and calculations to be reviewed and adjusted as and where necessary - due to changing circumstances in data availability and adapting to challenges encountered in conforming this data to reporting standards on an ongoing basis. This process has been facilitated within WP7, and is ongoing so that all KPIs can be captured and reported to the MERT and/or the SRT as compatible.

The MERT has undergone a number of updates and refinements to front- and back-end processes during the period in an effort to deliver a more efficient and functional dashboard and tool. Work on the MERT has included the adjustment of layout and design to improve the user interface experience, and the further testing of APIs to enable automated data sharing to the MERT.

As of writing of this deliverable, data for 14 KPIs had been submitted to the MERT, with a total of 19 KPIs having monitoring data reported. Proposals on potentially compatible ways to bridge the gap between KPI data headers / data points and SCM SRT have been developed with multiple SRT configuration options proposed to find a suitable and representative data capturing configuration that will be operable.

Within the reporting period, three KPIs were classified as potentially incompatible given their data issues and two KPIs were deemed theoretically compatible should data come on stream. Other KPIs are still subject to review. This collaborative process continues with KPI owners, however, WP7 may consider assessing the overall viability of aligning with SRT reporting in the next reporting period.

---

<sup>1</sup> D7.10 available at: <https://cityxchange.eu/knowledge-base/d7-10-reporting-to-the-scis-system-5/>

# 1 Introduction

The description of Task 7.3 (as set out below) and the framework for Monitoring and Evaluation (M&E) developed in Task 7.1 provides the basis for data capturing and reporting within WP7.

**Task 7.3 - The monitoring data harvested according to the methods developed in T7.1-7.3 will be collected in a data repository as part of the M&E system. Where self-reporting features or automation are not implemented, data will be collected via data collection sheets, online surveys, or other appropriate measures.**

In accordance with the task description, the MERT offers a central repository where KPI data is captured, processed, and displayed. To ensure KPI data is captured efficiently and accurately, WP7 has been facilitating a collaborative process with KPI/data owners to refine and confirm KPI calculations. As more data becomes available throughout the project's timeline, this process will enable increased data submission to the MERT and eventual transposing of data to the SRT.

Due to different interventions being implemented at different stages in the Lighthouse Cities (LHC) and Follower Cities (FC) the flow of KPI monitoring data has been intermittent. As the implementation phase of the project continues, it is expected that more data will be available that will inform the confirmation of KPI data capturing processes and the calculation of KPIs.

This report provides an update on D7.10<sup>2</sup>, and the ongoing collaboration with KPI and data owners for the refinement of KPI calculations and the submission of KPI data to the MERT and the SRT. This report also provides an overview of the KPIs' performance at Month 36, as reported by KPI/data owners, and finally sets out further enhancements made and planned to the operation and usability of the MERT platform.

The following updates have been made to the D7.12 version:

- Work on data input field configuration of the SRT ([Section 4.1](#))
- Refinement of KPI calculations through ongoing KPI workshops ([Section 4.2.1](#))
- Updates to MERT features and functionality ([Section 4.2.2](#))
- Data submission to the MERT ([Section 4.2.3](#))
- Update on KPI performance ([Section 4.3](#))
- Review of data availability ([Section 4.4](#))

---

<sup>2</sup> D7.10: Reporting to the SCIS System (5), available at: <https://cityxchange.eu/knowledge-base/d7-10-reporting-to-the-scis-system-5/>



## 2 M&E in +CityxChange

This section provides a summary of the KPI type and definitions detailed in the KPI Framework (developed in D7.1<sup>3</sup>), with the baseline and expected impact over the 5-year period.

No changes have been made to this section with respect to the previous version of this deliverable (D7.10).

### 2.1 Recording impact in +CityxChange

The KPI framework provides a detailed breakdown of the definition, calculation methodologies, intended scope and scale of monitoring and other relevant information for the M&E process, and remains the main reference point for information on KPIs used to measure progress and performance of certain interventions in the project.

The table below provides an overview of KPI definitions and types.

Table 1: KPI Overview with Expected Impacts and Baselines

Theme	KPI ID	KPI Type	KPI Definition	Expected / Targeted Impact	Base-line
Integrated Planning and Design	1	Decision/ planning support	No. of APIs and systems connected to the Decision Support Tool (DST)	20	0
	2	Decision/ planning support	Number of use case stories in the Information, Communication Technology (ICT) Ecosystem repository	15	0
	3	Training and skills development	No. of municipal staff trained to use the DST	40	0
	4	Enabling DPEB/DPEDs <sup>4</sup>	No. of new DPEB/DPED-enabling prototypes	30	0
	5	Enabling DPEB/DPEDs	No. of study visits by regulatory authorities	60	0
	6	Enabling DPEB/DPEDs	No. of politically approved Bold City Visions (BCV) with guidelines, roadmaps, and action plans	7	0
	7	Impact on regulation	No. of changes in regulation	15	0
Common Energy Market	8	Greenhouse gas (GHG) emissions	Tonnes of CO <sub>2</sub> -equivalent emission reduction per year	12.801 tonnes/year	0

<sup>3</sup> D7.1 Approach and Methodology for Monitoring and Evaluation. Available at: <https://cityxchange.eu/knowledge-base/approach-and-methodology-for-monitoring-and-evaluation/>

<sup>4</sup> DPEBs/DPEDs - Distributed Positive Energy Blocks / Distributed Positive Energy Districts

Theme	KPI ID	KPI Type	KPI Definition	Expected / Targeted Impact	Base-line	
Community xChange	9	Air quality	Tonnes per year Nitrogen Oxides (NOX) emissions reduction	6.2 tonnes/year	0	
	10	RES share	The percentage of total Renewable Energy Sources (RES) self-supply	Limerick: 100 Trondheim: 75	0	
	11	RES Integration	Increase in new renewable energy system integration	4.538 GWh/year	0	
	12	District level optimised self-consumption	Percentage district level production versus total energy consumption	47.7 % new production	TBD	
	13	Replication	No. of new DPEBs realised	7	0	
	14	Energy efficiency	kWh/m <sup>2</sup> usable floor area (UFA) per year improved energy efficiency (final energy demand)	62 kWh/m <sup>2</sup> / year	TBD	
	15	RES efficiency	Net useful thermal recovery/year (GWh)	2.134 (GWh) net increase / year	TBD	
	16	Reduction in energy grid investment	€million reduction compared to planned investment	€20M	0	
	17	RES curtailment	Percentage of energy grid failures	<1%	0	
	18	RES traded	Percentage of the total Distributed Energy Resources (DER) capacity traded	10%	0	
	19	RES flexibility	Percentage of peak load reduction (<30 hours)	20%	TBD	
	20	RES storage	Increase in installed RES storage capacity	1.65 MWh	0	
	21	Increased uptake of e-mobility solutions	Percentage modal shift from fossil-fuel vehicles to eMobility as a Service (eMaaS) (vehicles/bikes)	24 % increase	TBD	
	22	Replication	No. of new or existing buildings participating in the energy markets	60	0	
	23	Investment	Total new investments generated (€M)	€40M	0	
	24	Investment	Percentage reduction in simple payback periods (years)	20% decrease	0	
	25	Investment	Annual return on investment (%)	10% annual ROI	0	
	26	Investment	No. of new jobs created	900	0	
	Community xChange	27	Community participation	No. community participation events organised across all +CityxChange cities	15	0



Theme	KPI ID	KPI Type	KPI Definition	Expected / Targeted Impact	Base-line
	28	Community participation	No. citizen observatories established	5	0
	29	Community participation	No. of community participation events/actions	55	0
	30	Innovation	No. of innovation labs/playgrounds contributing to the creation of DPEB	5	0
	31	Training and skills development	No. of Positive Energy Champions trained	20	0
	32	Behaviour influence	No. of organisations with new sustainable energy approaches	60	0
	33	Replication	No. of demonstration projects implemented in Follower Cities	35	0

\*Where baselines have not been established/finalised yet they have been left as TBD (to be determined), pending updates from applicable KPI owners.



## 3 Monitoring Data

The monitoring of KPIs can be best realised when all KPI owners are in a position to generate data points for reporting. Reporting data is two-fold: firstly, reporting to the MERT (via automated or manual means) and secondly, reporting to the SRT (responsibility of WP7 Lead). The latter channel requires alignment between KPI data fields and those required for reporting to the SRT.

This reporting period has seen further engagement by KPMG FA with partners to identify and test options to reconcile reporting challenges. Engagement with KPI owners over the months preceding this deliverable has focussed on further refinement of KPI calculation variables and methods. A specific focus however was put on KPIs in Theme 2: Common Energy Market, to determine if and how a selection of the KPIs in this theme could be configured appropriately to be able to report data to the SRT. The result is a list of KPIs that may be able to report the data to SRT (see section [4.1.1](#)).

In the interim, data reporting via automated and manual means to the MERT has progressed.

### 3.1 MERT Data Submission

The monitoring data captured by partners is submitted to the MERT where it is processed and displayed in the individual MERT KPI interfaces. The data can be submitted in two ways - manually, or through an automated process - which is described in more detail below. Where applicable, data will then be transferred manually by KPMG FA to the SCM SRT. At present there is no data being uploaded due to ongoing discussions with KPI owners to agree adjustments to allow for reporting.

#### 3.1.1 Automated Data Submission to the MERT

**Data submission is automated through the use of Application Programming Interfaces (API). The APIs enable a link between the MERT and live systems or online project data repositories specified by project partners (KPI/Data owners) from where data will be pulled and stored in the MERT repository.**

##### 3.1.1.1 API Specification and API Endpoint

As the primary intended means for data to be submitted to the MERT, further work in finalising the operation of the provisional API structures for the capturing and sharing of KPI data was undertaken by KPMG FA during the reporting period.

The application of the provisional API specification was tested during the period on further KPIs. The API specification previously provided in D7.10's annex (for KPI 18 as a sample) has



now evolved into an 'API endpoint'<sup>5</sup>. This API Endpoint is ready for consumption within the +CityxChange ICT Ecosystem. Partners, both KPI and Data owners, can consume these API Endpoints to load the data available from MERT into their own systems.

### 3.1.2 Manual Data Submission to the MERT

**Manual data submission process where KPI/data owners access data capturing sheets through the online MERT interfaces where monitoring data from each intervention is captured and stored to the specific KPI in the MERT repository.**

The work on the API specification and automated data sharing is in addition to the standard manual data sharing functionality of the MERT. As previously reported, the MERT still allows manual submission of data by the KPI/data owners through a dedicated data capturing form available through each KPI's individual MERT interface.

KPI owners have used the manual submission option during the reporting period to make multiple data submissions. These are summarised in section [4.2.3](#).

KPI calculations performed in the MERT are under review by KPMG FA as and when data submissions are made and relevant KPI/data owners will be engaged to ensure that data is captured and processed accurately. See Section [4.2.2](#) for further details on calculation refinements that are associated with KPI data reporting.

## 3.2 SRT Data Submission

### 3.2.1 Thematic focus of engagement

A focus was also put on KPIs in Theme 2: Common Energy Market, in order to determine if and how a selection of the KPIs in this theme can report data to the SRT.

Ongoing engagement with KPI owners by KPMG FA has highlighted challenges for SRT reporting; including the provision of the required inputs (availability, format), the spatial scale, and the frequency in which data might be available. Section [4.1](#) provides further detail on the selection of KPIs being considered for reporting in the SRT, the proposals presented (see [Annex II](#)) to KPI owners and the status of ongoing engagement.

Between M30 and M36, KPMG FA has worked with KPI owners to develop and propose different KPI data reporting templates that reflect data field configurations which may be compatible for reporting to the SRT. These are based upon alignment with the SRT's Fields of Action (FoA)<sup>6</sup> and have been reviewed and debated with KPI owners through workshops throughout the reporting period, to determine the best way in which KPI data can be

---

<sup>5</sup> An API endpoint is a point at which an API -- the code that allows two software programs to communicate with each other -- connects with the MERT. APIs work by sending requests for information from a web application or web server and receiving a response.

<sup>6</sup> FoA - the criteria used in the creation of data collection fields in the online SRT manual

captured and integrated. Alignment seeks to better match available data with the reporting input fields sought by the SRT.

### 3.2.2 Spatial and temporal configuration

The latest proposals have been configured to capture data at city level, and testing of data capturing will commence once FoA inputs and KPI calculations have been confirmed as fully accepted by all KPI owners.

As noted in D7.10<sup>7</sup>, the SRT can only accommodate annualised data, so the data submitted to the MERT is aggregated (if necessary where KPIs reporting frequency is more regular) and then transferred to the SRT in 12-month cycles from submission. The transfer of data to the SRT does not accommodate automated data sharing through means such as API connections, therefore KPMG FA will perform this summarization when the reporting cycle is due.

---

<sup>7</sup> D7.10: Reporting to the SCIS System (5), available at:  
<https://cityxchange.eu/knowledge-base/d7-10-reporting-to-the-scis-system-5/>



## 4 Reporting Data to the SRT and MERT

Data generated by intervention implementation is captured by KPI owners and is submitted to the MERT for further processing and display through various interfaces. An update on the usage of these data portals is provided in the subsections below.

### 4.1 SCM / SRT reporting

As stated in previous iterations of this report, the data capturing configurations of the SRT are designed in a standardised way to accommodate data capturing across multiple European Commission (EC) Smart City projects using common themes in an effort to provide comparable results. As such, tailoring of the SRT FoA to fit all the +CityxChange KPI data requirements is a key objective of the project. However, efforts to pursue alignment have resulted in only a selection of KPIs potentially being able to report to the SCIS SRT.

KPMG FA has undertaken further engagement with KPI owners in this reporting period, with a view to finding appropriate methods to configure the SRT data reporting fields to best align with project KPIs. Tables 2 and 3 provide an overview of ongoing work regarding these efforts.

#### 4.1.1 KPI feasibility for SRT reporting

A number of KPIs are under examination by KPMG FA and KPI Owners for reporting to the SRT. In Table 2, the 'Status for SRT Reporting' column refers to the potential feasibility of capturing KPI data in a manner that is compatible for SRT reporting. If marked as 'Potentially, TBC', a review of the KPI's calculation methods in the MERT and SRT are still actively underway, and that the final KPI calculation method and variables are still to be confirmed by all parties. Table 3 provides more information on the calculation gaps and ongoing work on the KPI calculations.

Table 2: KPIs to potentially report to the SRT, calculation approach

KPI	KPI Definition	KPI owner	Status for SRT Reporting	Proposed calculation that could work in the MERT (from D7.1)	Action and Request
12	Percentage district level production versus total energy consumption	MPOWER, SV, TE	Potentially, TBC	Yes	KPMG FA has proposed further reporting options for consideration by KPI Owners and is awaiting responses.
14	kWh/m <sup>2</sup> (UFA) per year improved energy efficiency (final energy demand)	MPOWER, SV, TE	Potentially, TBC	Yes	KPMG FA has proposed further reporting options for consideration by KPI Owners and is awaiting responses.

KPI	KPI Definition	KPI owner	Status for SRT Reporting	Proposed calculation that could work in the MERT (from D7.1)	Action and Request
15	Net useful thermal recovery/year (GWh)	MPOWER, SV	Potentially, TBC	Yes	KPMG FA has proposed further reporting options for consideration by all KPI Owners.  Input received by SV on suggested changes to KPI criteria to best accommodate this.
20	Increase in installed RES storage capacity	TE, MPOWER	Potentially, TBC	Yes	KPMG FA has proposed further reporting options for consideration by KPI Owners and is awaiting responses.
21	Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)	LCCC, ABG, TK	Potentially, TBC	Yes	KPMG FA has proposed further reporting options for consideration by KPI Owners and is awaiting responses.

Workshops were undertaken with KPI owners for each of the KPIs listed above, resulting in proposed options for SRT reporting. These were issued for consideration by KPI owners. KPMG FA will move to conclude these options with partners in the next reporting period; as the finalisation of which KPIs can feasibly report to the SRT platform is pressing.

Additionally, sessions with owners of KPIs 16, 23, 26 concluded that current available data (or lack thereof) presented an insurmountable obstacle for their reporting via SRT.

#### 4.1.2 Identified gaps and outcomes for SRT reporting

Throughout the engagement undertaken in this period with KPI owners, KPMG FA and partners have identified various gaps and challenges in aligning KPI data flows with the reporting input requirements for SRT.

Table 3, below, sets out a summary of the identified gaps and latest outcomes for each KPI under examination for integration and reporting to SRT.

*Table 3: Engagement on KPIs to report to SRT - showing identified gaps and latest outcome*



KPI	KPI Definition	Calculation Gaps	Update (Sept 2021)
12	Percentage district level production versus total energy consumption	KPI/data owner inputs required: Need to confirm whether proposed calculation (from D7.1 and further revisions proposed) is viable, i.e. can they provide the data inputs required to perform the calculation; Need to confirm whether the calculation is accurate and provides the correct output; Need to consider the proposed SRT option, i.e. can they provide the data inputs required in the SRT FoA	Ongoing engagement with KPI owners (LCCC and TK, and involvement of MPOWER and TE) on data availability and subsequent calculation methods. Awaiting input from KPI owner for finalisation of capturing fields in MERT/SRT. SRT option presented, currently under review by KPI/data owners. Impact of potential changes to LCCC PEB and Glosaugen PEB on KPI description / scope / targets being reviewed.
14	kWh/m <sup>2</sup> (UFA) per year improved energy efficiency (final energy demand)	KPI/data owner inputs required: Need to confirm whether proposed calculation (from D7.1 and further revisions proposed) is viable, i.e. can they provide the data inputs required to perform the calculation; Need to confirm whether the calculation is accurate and provides the correct output; Need to consider the proposed SRT option, i.e. can they provide the data inputs required in the SRT FoA	Ongoing engagement with KPI owners. KPI owners need to confirm the proposed calculation method is viable, pending confirmation once data variables become available (no monitoring data available yet). Reviewing SRT configuration options. Impact of potential changes to LCCC PEB and Glosaugen PEB on KPI description / scope / targets being reviewed.
15	Net useful thermal recovery/year (GWh)	KPI/data owner inputs required: Need to confirm whether proposed calculation (from D7.1 and further revisions proposed) is viable, i.e. can they provide the data inputs required to perform the calculation; Need to confirm whether the calculation is accurate and provides the correct output; Need to consider the proposed SRT option, i.e. can they provide the data inputs required in the SRT FoA	Ongoing engagement with KPI owners. KPI owners confirm preliminary acceptance of the proposed calculation method, pending confirmation once data variables become available (no monitoring data available yet). Awaiting input from KPI owners for finalisation of capturing fields in MERT/SRT. Potential discrepancy in description of KPI is currently under review - calculation of 'net useful' energy needs to be defined, as all thermal energy generated is useful, but is not the 'net figure' as thermal systems consume energy. Proposal by TK on the change in KPI criterion to "useful thermal energy" should be reviewed, considered, and agreed upon by all KPI owners.
20	Increase in installed RES storage capacity	KPI/data owner inputs required: Need to confirm whether proposed calculation (from D7.1 and further revisions proposed) is viable, i.e. can they provide the data inputs required to perform the calculation; Need to confirm whether the	Ongoing engagement with KPI owners. MPOWER confirms preliminary acceptance of the proposed calculation method, pending confirmation once data variables become available (no monitoring data available yet). Awaiting input from other KPI owners for



KPI	KPI Definition	Calculation Gaps	Update (Sept 2021)
		calculation is accurate and provides the correct output; Need to consider the proposed SRT option, i.e. can they provide the data inputs required in the SRT FoA	finalisation of capturing fields in MERT/SRT.
21	Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)	KPI/data owner inputs required: Need to confirm whether proposed calculation (from D7.1 and further revisions proposed) is viable, i.e. can they provide the data inputs required to perform the calculation; Need to confirm whether the calculation is accurate and provides the correct output; Need to consider the proposed SRT option, i.e. can they provide the data inputs required in the SRT FoA	Ongoing engagement with KPI owners on suitable calculation methods. New mobility partner, GoCar, is included in the engagement for LCCC. Awaiting input from KPI owner for finalisation of capturing fields in MERT/SRT. Options for SRT presented, currently under review by KPI/data owners. Option to calculate the KPI as presented by 4C is to involve the PTA (using their passenger statistics), get traffic data and car sales data (el/fossile shares) from NRA and get data from bicycle and pedestrian counters from the municipality, plus any other source that could give time-series on transport modal shifts.

Previous rounds of engagement with KPI owners have confirmed that the proposed configuration of SRT fields for KPIs 17 and 19 (as shown in Table 4) is compatible with available KPI data flows. These have been accepted by all parties, pending confirmation once data for the KPIs become available.

Table 4: SRT Thematic Fields to which KPIs are capable in theory of being reported to SRT

KPI	KPI Definition	KPI owner	SRT Thematic Field
17	Percentage of energy grid failures	MPOWER, SV, TE	Information and Communication Technologies
19	Percentage of peak load reduction (<30 hours)	MPOWER, NTNU, SV, TE	Information and Communication Technologies

### 4.1.3 Reporting to SRT

For KPIs that have had their alignment issues resolved and are ready to report data, KPMG FA will adjust the MERT capturing fields to correspond with the suitable SRT FoA configurations.



Depending on the KPI requirements, the data will be processed via the MERT, after which, the aggregated data will then be transferred to the SRT by KPMG FA for further modelling and visualisation.

To date, no KPI data has been transferred to the SRT due to the lack of confirmed SRT FoA configurations (in full; KPIs 17 and 19 notwithstanding). Such reporting is reliant on KPI owners being in a position to generate data points in accordance with confirmed KPI calculations for MERT. During the last Consortium Meeting that took place on October 18, 2021, data collection and existing WP7 processes were presented to the consortium to enhance KPI owners’ ability to formalise KPI calculations. In addition, we have organised meetings with partners to facilitate the process.

KPMG FA continues to collaborate and engage with the relevant KPI owners to confirm data input configurations to align both SRT and MERT. However, KPMG FA as WP7 lead will consider the overall viability of SRT integration in the next period.

## 4.2 The +CityxChange MERT

As developed by WP7 (and described in D7.4<sup>8</sup>) the MERT provides an online dashboard where the performance of the 33 +CityxChange KPIs are calculated and disseminated.

Changes in this reporting period have been highlighted under sub-section [4.2.1.1](#) and [4.2.2](#) with respect to the previous version of this deliverable (D7.10).

### 4.2.1 KPI Calculations

WP7 has facilitated several collaborative workshops and calls with multiple KPI/data owners in an effort to refine KPI calculations that would measure project intervention performance.

The collaboration and engagement have aimed to confirm KPI calculations that facilitate data capturing and processing in the MERT (and, where relevant, the SRT). Although focussed effort is still underway, the following subsections provide an overview of the progress made in the calculation refinement process.

#### 4.2.1.1 KPI Calculation Status and Updates

As illustrated in the previous deliverable of this series, the table below provides the latest calculation refinement status of all the KPIs. The status below confirms which KPI calculations have been agreed and confirmed since the prior deliverable, and which are still undergoing review and refinement by KPI/data owners.

Table 5: KPI Calculations Status for all KPIs in the MERT (changes highlighted in green underlined)

KPI	Status	KPI	Status	KPI	Status
1	<u>Re-Confirmed; no</u>	12	Under review	23	Under review

<sup>8</sup> D7.4: Monitoring and Evaluation Dashboard, available at: <https://cityxchange.eu/knowledge-base/monitoring-and-evaluation-dashboard/>



	<u>calculation changes</u>				
2	Confirmed	13	Confirmed	24	Under review
3	Confirmed	14	Under review	25	Under review
4	Confirmed	15	Under review	26	Under Review
5	Confirmed	16	Under review	27	Confirmed
6	Confirmed	17	Under review	28	Confirmed
7	Confirmed	18	<u>Confirmed</u>	29	Confirmed
8	<u>Confirmed</u>	19	Under review	30	Confirmed
9	<u>Confirmed</u>	20	Under review	31	Confirmed
10	<u>Confirmed</u>	21	Under review	32	Confirmed
11	<u>Confirmed, pending review once data is available</u>	22	Confirmed	33	Confirmed

Recent engagement and collaboration with partners through multiple KPI workshops have addressed various considerations in the refinement of KPI calculations. The KPI calculations that are still ‘under review’ will systematically undergo a refinement process with relevant KPI/data owners.

A summary of progress made and points discussed in the refinement process are provided in Table 6 below.

Table 6: Summary of Progress

Summary of Progress	
<b>KPI 1 - No. of APIs connected to the Decision Support Tool (DST)</b>	
o	Proposal made by KPI owner to amend KPI title, description and scope as the current KPI definition does not allow for the full scope of systems being connected with the DST and the data exchanged to be measured.
o	As such, the following amendments were proposed (amendments in <i>Italic text</i> ): <ul style="list-style-type: none"> <li>■ Proposed amended KPI title: Number of APIs <i>and systems</i> connected to the Decision Support Tool (DST)</li> <li>■ Proposed amendment to KPI description: This KPI tracks the integration of the DST with modelling functionality and data sources. The DST allows for the assessment of the energy network through hard and physical and behavioural and social models. Functionality and data will be connected to the DST directly and/or indirectly through <i>APIs within the +CityxChange ICT ecosystem, and/or other relevant external data systems</i> specified and provided by project partners.’</li> <li>■ Proposed amendments to KPI scope:                             <ul style="list-style-type: none"> <li>● Must have published documentation for usage.</li> <li>● All APIs and data systems/sources to be provided by project partners and/or relevant 3rd parties.</li> </ul> </li> </ul>



- KPI owner to review and test the use/functionality of specific APIs and data systems/sources that have been connected.
- KPI owner to keep a detailed log of connected APIs and data systems/sources.
- *Where the same API is used for different purposes/applications, each application of the API will be counted individually for the KPI performance.*

Proposed amendments have been reviewed by the Project Coordinator and submitted as a change request for formal approval.

Learning: The initial KPI definition did not allow the scoping of additional non-API connected systems that could be connected to the DST. The update also allows capture of such (mostly legacy) systems, as the KPI is intended to measure integration of data sources, with APIs being only the most used and most expected one. It is expected that systems should further shift towards API integration/ability in the future.

### **KPI 8 (Tonnes of CO<sub>2</sub>-equivalent emission reduction per year) & 9 (Tonnes per year Nitrogen Oxides (NO<sub>x</sub>) emissions reduction)**

- The proposed calculation for both KPI 8 and 9 are very similar, although different emission factors are applied in the calculation of the emission type (CO<sub>2</sub> and NO<sub>x</sub>)
- It has been decided by KPI owners that these KPIs would not be suitable for reporting to the SCIS as no alignment could be found between the KPI data headers (as designed for the project) and the Field of Action defined in SRT requirements.
- Both LHCs agree to use the standard (EU) emission factors listed for building and mobility related interventions, as recorded in D7.1 KPI information tables<sup>9</sup>
- Baseline figures:
  - Discussions with the LHCs confirmed that an emission baseline for current city emissions is not necessary in the calculation of the KPIs. This is because the 'baseline' is actually intended to be zero (0), because the measurement of emission reduction is based on +CityxChange interventions (in most cases specific ones as per BEST tables), and should only be calculated from the onset of the project (therefore at zero).

Proposed calculations have been prepared using the standard emission factors and baselines as zero. These calculations have also been integrated into the MERT and are awaiting data input to test functionality

### **KPI 10 - The percentage of total Renewable Energy Sources self-supply**

- This KPI calculation has been confirmed by the LHCs and relevant energy partners. KPMG FA and KPI/data owners will reconvene when energy partners expect reliable data to be available (TE currently has limited data available, while MPOWER does not yet have any).
- Energy partners confirm monthly data reporting should be possible

<sup>9</sup> D7.1: KPI 8 - Key Information Table - Scope (Page 102):

[D7.1 Approach and Methodology for Monitoring and Evaluation - +CityxChange](#)

- Energy assets to be measured include
  - TK: Solar, heat pump
  - LCCC: Solar, heat pump, tidal, CHP (potentially) (Note: The geographical area of the demonstration district has been extended to incorporate the changed location of the tidal generator (as presented in D4.4<sup>10</sup>) and all energy generated by the tidal turbine will be accounted for within the LCCC demonstration district)
  - Data to be reported at district level
    - LCCC: one district – Limerick City
    - TK: three districts – Brattøra, Sluppen, Gløshaugen
  - Data provision:
    - API data sharing from partners to be tested once data is available

Proposed calculation has been confirmed, integrated into the MERT and is awaiting data input to test functionality.

#### **KPI 11 - Increase in new renewable energy system integration**

- KPI 11 calculation has been agreed in principle with KPI Owners who will be revisiting the calculations once the data is available.
- Proposed calculation has been confirmed, integrated into the MERT and is awaiting data input to test functionality.

#### **KPI 12 - Percentage district level production versus total energy consumption**

- As in D7.1 – This KPI measures the percentage of net (energy produced - energy consumed by RES system) RES energy supply as a fraction of the total electrical and thermal energy generation and the energy consumption over a period of time on SCD level. The degree of supply is separately determined for thermal (heating or cooling) energy and electricity.
- Two key points
  - KPMG FA and KPI owners agree that the data requirements of the SRT cannot be met at the moment and that further ongoing work by KPI owners and relevant partners will inform on data availability at a later stage.
  - KPMG FA ( with input from KPI owners) are to confirm with SCM/SRT why/how specific data points are required and discuss the level of aggregation or alternatives.
- Need to put further thought into the setup of Fields of Action for the KPI to explore other ways of how data at block/building level can be reported for this KPI.
- Need to confirm minimum data requirements
- Partners are to review the supplied SRT form options to confirm which data is available, and not available, and confirm whether the form is useful. If not, the SRT

<sup>10</sup> D4.4: Limerick DPEB Implementation Guide 1:

[https://cityxchange.eu/wp-content/uploads/2021/05/D4.4-Limerick-DPEB-Implementation-Guide-1-Final\\_Submitted.pdf](https://cityxchange.eu/wp-content/uploads/2021/05/D4.4-Limerick-DPEB-Implementation-Guide-1-Final_Submitted.pdf)

forms can undergo another phase of configuration in collaboration with the KPI/data owners.

- Partners suggest that it would be easier to report this KPI at 'city' level should the SRT format be used.
- Partners mentioned that not all data required for the SRT format is available in-house, and will need to consider how to get, and from where to get the required data.
- Refinement of KPI 12 is ongoing.

#### **KPI 15 - Net useful thermal recovery/year (GWh)**

- A discrepancy between the calculation and description of the KPI has been detected.
- The KPI description mentions the 'net useful' energy produced by the thermal generators, as the balance of energy when the energy consumption of the generator is subtracted.
- It is however stated that all the energy generated by a thermal system is deemed 'useful'.
- The energy consumed by thermal generators is specific in their application in each city, so each city will need to provide this figure individually, and no standard factor can be applied for consumption in this calculation
- The following needs to be considered:
  - If only the total energy generated by the thermal system(s) will be reported
  - If the consumption of the thermal system will be considered in the KPI calculation
  - If the consumption figure is to be included in the calculation of a 'net' figure, the KPI's expected impact (target) will need to be adjusted down, which will need to be agreed between all partners and the project coordinator.
- Feedback in August 2021 highlighted the following:
  - In the project preparation phase, the energy inventory and performed calculations, especially in the project description BEST tables, *focussed on a PEB balance*. That also means that INCLUDED in the total energy production was the energy to power heat pumps and potentially other thermal production. This of course means that we have already taken into account the energy consumed.
  - If we choose to include energy consumption and then report NET USEFUL thermal production, we end up counting energy consumption for thermal systems twice. Remember that basic calcs are based on the PEB calcs/inventory, which is crucial for +CityxChange.
  - If partners are to agree with this, we need to subtract energy consumption for running thermal systems from the total energy demand for the buildings involved.
  - In conclusion, a proposal was made to change the KPI description and scope to measure 'Useful thermal recovery'
  - Note that several heat pumps may not have individual (sub) meters, so it will be difficult to register the concrete energy consumption by the thermal system.
- Refinement of KPI 15 is ongoing.

**KPI 16 - €M reduction compared to planned investment**

- Proposed calculation to be reviewed by partners for suitability
- Once confirmed, KPI can be integrated into the MERT for data input and processing testing

**KPI 17 - Percentage of energy grid failures**

- As in D7.1 - This KPI shows the failsafe operation of deployed systems. The move towards highly-distributed RES and the subsequent declining contribution from large, controllable power plants can result in issues in demand-supply matching and concerns over future capacity adequacy. With the application of ICT measures, it is possible to correct potential misbehaviour of the system and avoid unexpected breaks in energy supply.
- KPI description was reviewed by KPMG FA/KPI owners to get an in-depth understanding of what exactly a 'failure' entails. No change to KPI description emerged at this time.
- Comments on what a failure entails based on the discussion with KPI Owners:
  - a failure suggests a break in the supply of electricity that leads to black-outs (brown-outs?) in the demonstration district(s)
  - Originally this KPI was supposed to measure that project interventions at least do not contribute to an increase in failures, and effectively decrease the number of failures due to innovations applied. The target should not be an issue to achieve.
  - TE confirms that at this level (failures as blackouts), data can be provided.
- KPI/data owners to confirm with relevant partners and/or energy suppliers are able to provide baseline data (i.e. 'before intervention' data point) for the KPI calculation in the MERT and the SRT.
- If the MERT calculation method is used:
  - KPMG FA to confirm with each LHC what the relevant levels of data aggregation would be for the KPI, as LCCC only has one sub-city district, and TK has 3 sub-city districts for which data is generated
- If the SRT calculation method is used:
  - All data should be reported at city level
- KPI owners confirmed that both calculation methods will be suitable to use.
- KPMG FA to do configuration of data capturing fields in the MERT once baseline data availability is confirmed.

**KPI 18 - Percentage of the total Distributed Energy Resources capacity traded**

- KPI title – although the KPI title refers to "...capacity utilised", it is however understood to be "capacity traded" as per the calculation methodology.
- The calculation mentions "building level", however it is held that DER assets deployed may also be taken into account by the project. The terminology has been adjusted to include a broader definition i.e. "building/asset level".

- The different DER variables have been elaborated on, and are now included in the calculation formula.
- Data is therefore reported at building/asset level, and then aggregated to district level.
  - LCCC: one district – Limerick City
  - TK: three districts – Brattøra, Sluppen, Gløshaugen
- POW:
  - Do not foresee any issue with data provision
  - Data was expected to be available in May 2021, is currently pending deployment
  - Prefers manual data submission for this KPI, but can explore the use of API as well
- MPOWER
  - Due to the capacity of planned implementation of DER interventions, it is not currently expected that large amounts of DER will be available for trade as most DER would be consumed by buildings in the PEB.
  - This will be monitored closely and adjustments will be made if/when available and relevant.
  - Data was expected to be available July 2021, is currently pending work revisions

For now, KPI 18 calculation is agreed in principle, and will be checked again when data is available.

#### **KPI 19 - Percentage of peak load reduction (<30 hours)**

- D7.1 - Peak load is the maximum power consumption of a building or a group of buildings to provide certain comfort levels. Through the establishment of DPEBs and the correct application of ICT systems, the peak load can be reduced to a high extent and therefore the dimension of the supply system (EU SCIS Monitoring KPI Guide, 2018). The indicator is used to analyse the maximum power demand of a system in comparison with the average power.
- KPI/data owners to confirm with relevant partners and/or energy suppliers are able to provide baseline data (i.e. 'before intervention' data point) for the KPI calculation in the MERT and the SRT.
- Need to confirm levels of data aggregation requirements for each KPI owner.
- KPI owners confirmed that both calculation methods will be suitable to use.
- KPMG FA to review configuration of data capturing fields in the MERT once baseline data availability is confirmed.

#### **KPI 21 - Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)**

- Each city is to confirm the different modes of transport used in the calculation of modal shift. This can include all e-mobility interventions from the project, but also the use of public transport options where available/relevant. A shift toward

- pedestrianisation is also being considered, but no confirmation of its calculation has been reached.
- It is noted that there is a lack of clear and accurate data on, particularly, public transport, and it will be investigated how data from modal uses associated with the project is used as opposed to uses of external mobility interventions.
  - Data flows:
    - The KPI owners are ultimately responsible to ensure that the KPI measurements are submitted, whether it comes directly from the KPI owner or from another partner providing the data.
    - The data should be provided in accordance with the agreed calculation method, i.e. all the data variables required for the calculation, at the agreed scale of reporting
    - Data can be provided manually or through API to the MERT.
    - Key data owners would be FourC, GoCar, TK, and LCCC
  - Calculation options:
    - As presented, there are three calculation option
      - Using the SCIS SRT reporting structure (promoted for improved data sharing to the SCIS)
      - Using 'km travelled per mode' as the main variable in calculation modal shift
      - Using 'number of trips per mode' as the main variable in calculation modal shift
  - Partners are to review the supplied SRT form (please refer to [Annex II](#)) options to confirm which data is available, and not available, and confirm whether the form is useful. If not, the SRT forms can undergo another phase of configuration in collaboration with the KPI/data owners.
  - Partner feedback received in August 2021 mentioned that to be able to accurately measure the KPI, partners should involve the PTA (using their passenger statistics), get traffic data and car sales data (el/fossile shares) from NRA and get data from bicycle and pedestrian counters from the municipality, plus any other source that could give time-series on modal shifts.
  - Refinement of KPI 21 is ongoing.

### **KPI 23 - Total new investments generated (€M)**

- R2M and the project management are maintaining a replication and investment tracker in the shared document repository. This contains all supporting evidence, and calculates the overall KPI value.
- Data can be extracted programmatically, or extracted manually into the MERT. Based on various consultations with the KPI Owner, it is concluded that API is not a viable option to submit the data. Hence, it has been decided that at reporting frequencies the data will be submitted manually to the MERT.
- The KPI collects a project-wide value. The data model of the MERT was designed to accept city- or sub-city-based values. In this case that model does not apply, as some projects are done outside the cities and by specific partners, or, in the case of wider replication projects, by other cities replicating solutions. These adaptations are

currently implemented. If needed, detailed disaggregation can be made available within the internal tracker and possibly shared into the MERT.

**KPI 24 - Percentage reduction in simple payback periods (years)**

- Note: Both KPI 24 and 25 will broadly use the same data.
- Calculations have been proposed for this KPI, using a weighted average to calculate overall performance vs target.
- OV to confirm with relevant partners whether they will be able to provide a 'benchmark' payback period for interventions, so that this can be compared to the +CityxChange payback period for interventions to calculate payback period reduction.
- This KPI has an updated KPI calculation now integrated into the MERT. Once benchmark payback periods have been confirmed, data input in the MERT can be tested.
- Percentage reduction in simple payback periods (years). Simple payback period could also be defined as the time needed, measured in years, to recover the investment. It's a metric indicator to assess EE and RES investments. The indicator gives a quick and intuitive value of the investment even if it doesn't include relevant elements like the value for money and related discount rate.
- The first step for KPI 24 calculation and implementation has been to determine and define the baseline. The applied methodology starts from the average time calculation needed to make the investment profitable and bankable related to the typology of energy assets and/or infrastructure, by reducing the Simple Payback Period during the project's duration. The baseline could raise from a benchmark with the average time needed for that kind of investment, for example, for PVs the necessary timing for cumulative profit of an investment to be equal to costs it's in a range and vary from 7 to 15 years, so the objective of +CxC is to reduce the indicator considering which is on average the timing to recover the investment, for the same kind of interventions and energy assets. The first typology of interventions foreseen in both LHs cities are Building retrofitting and EE interventions so the action has been to set a cut-off, a break even point for simple payback period according to previous experiences from similar interventions and projects, what already exists in literature (EU Deliverable, IEB, EC calculations, World Bank documents). In +CxC we aim at demonstrating that the investment is convenient and bankable and convince investors to invest. The implemented methodology for each kind of intervention matches an appropriate financial scheme (e.g. Bank loan, EPC for Building renovation) that reduces the simple payback period. The baseline has been settled, making reference to documents provided by the SEAI (Sustainable Energy Agency of Ireland), EIB, and other Deliverables from EU projects.

**KPI 25 - Annual return on investment (%)**

- It is noted that the project runs different activities/interventions at different times, so the ROI from each does not necessarily calculate from the same baseline.



- It is suggested that the ROI calculation should be done using a weighted average ROI across ROIs from different interventions. The 'weight' should be considered as the investment cost.
- Data collection:
  - WP7 can facilitate/assist in developing the *process* for data collection; Cities should help to pool the data required from the various partners/sources, at a specified deadline (1 month in advance).
  - Data is then put into the model/calculation developed by OV
  - Due to the complexity of the ROI calculation, OV suggested that the 'total investment' and 'ROI' figures are the main inputs into the MERT. The MERT will then perform the weighted average calculation for each city.
- Project intervention categorisation:
  - OV has developed a categorisation for investment in energy interventions, from which ROI calculations will provide the ROI per category. Categories include building renovation, RES generation, storage, local trading, eMaaS, community grid.
  - This is also classified at the city level.
- Proposed calculation has been prepared jointly by OV/KPMG FA
- Calculation uses weighted average calculation for ROI for each city. Data submitted can also be associated with PEBs and various intervention types.
- Calculation integrated in MERT and ready for testing with data submission.

Given that not all project interventions have yet been implemented, and that some are only planned for later in the project (mid to latter parts of year 4 and onwards) some KPIs do not have data available yet.

Ongoing engagement with KPI owners has indicated that a better understanding of KPI calculation requirements will only really be possible once partners have reviewed data generated, and can inform WP7 accordingly.

Despite the refinements mentioned above, the KPI framework developed in Deliverable 7.1 is still regarded as the reference point for KPI calculations, and is used as the main reference in the further refinement of KPIs. KPMG FA, as WP7 lead, may examine whether an update to this is necessary in the future to account for variances once all KPI calculations have been agreed.

#### 4.2.2 Refinement of MERT functionality/features

The MERT prototype released as part of D7.4 has undergone numerous updates. Recent updates to the MERT in this period have seen improvements to data visualisation and filtering capabilities in the KPI interfaces, as well as updates to how the KPI descriptions are displayed.

The improvements made and those in progress are listed in Table 7 below.

Table 7: Improvements to the MERT

Modification Type	Theme	Improvement	Status
Front-end	Mobile responsiveness	To improve the way the dashboard is viewed on a mobile device.	Ongoing (recurring based on further updates to UI) [M36 - 42]
Front-end	Update KPI details	Updated description for KPI 1	Completed [M36]
Front-end	Fix designs	Feature added for filtering data based on City and Year. Update data representations	Revision. Work in Progress[M42]
Front-end	Update to Graphs	1. Add a combination chart to represent the target line for each KPI and its baseline. 2. Update data representation 3. Fix data visualisations	Update [M42]
Front-end	Data Download	Fix issues Ensure downloads under open data principles	Reported error. Work in Progress[M42]
Back-end	Application Dependencies	Updating application dependencies (managing bug fixes) and improving overall security of the application.	Ongoing (recurring) [M36-42]
Back-end	API	Provisional API formats for Data sharing from the MERT are provided and need to be discussed with KPI and Data Owners.	Provisional formats provided [M36]
Back-end	API	Provisional API for Data accessing from MERT.	Provisional API Endpoints available [M36]

To better address the necessary development, KPMG FA will be changing to a development roadmap as a 'live document' form of handling progress on the above.

The ongoing refinements to KPI calculations and the subsequent changes to UI features will require periodic updates to the MERT functionalities, as and when calculations are finalised, and KPIs begin reporting. KPMG FA will continue to be flexible around this, however, this period has shown that driving further consistency in reporting form is necessary, i.e. how data is reported visually and ease of access to adjust data. Refinements such as these will be a focal point for the next period, where a copy of the latest roadmap will be set out.

Updates and improvements from the previous phase have enabled the MERT to go Live and is accessible to the public and partners through a link on the official +CityxChange



website<sup>11</sup>). Existing gaps in data, KPI calculations, and functionalities within the MERT will be addressed as the data becomes available, and as KPI calculations are resolved with KPI owners. The following table provides an overview of the KPIs for which data has been submitted in the MERT.

### 4.2.3 Data Submissions to the MERT

During this period KPI owners have been submitting data to the MERT by themselves or by liaising with KPMG FA. KPI data has been captured for 14 KPIs as of M36 within MERT.

Partners have an option to submit further granular data for each KPI irrespective of their reporting frequency, which is then reflected accordingly in the ‘Number of data entries’ column.

If the KPI has achieved its target, as per their task within the project, then they are noted below as ‘Yes’ in the ‘Target achieved’ column. Some partners have been able to overachieve in KPIs throughout the period, such as KPI 23: ‘Total new investment generated’, where the figure is more than double the target, or with actions undertaken in the number of innovation labs/playgrounds such as with KPI 30 at the end of M36. The data for these KPIs are processed and compared to the KPI target to provide the performance of each KPI.

It should be noted that there were no data submissions for 19 KPIs within MERT during this period; for a variety of reasons. These are detailed further in section 4.3.

Tracking activity and data entries is a subject for further iteration, and methods to enhance this will be examined in the next reporting period.

## 4.3 KPI Performance Status at Month 36

The table below provides an overview of the KPI performance of the 20 KPIs at M36 for which monitoring data is available at the time of writing.

Table 8: Captured KPI data and overall KPI performance

KPI ID	KPI Definition	Expected Impact (Target) / KPI Owner	Measured data	Performance vs Target (%) per partner	Overall Target	Overall Achievement	Overall Performance
1	No. of APIs and systems connected to the Decision Support Tool (DST)	IESRD: 20	IESRD: 20	IESRD: 100%	20	20	100%

<sup>11</sup> Official +CityxChange website: <https://cityxchange.eu/>



KPI ID	KPI Definition	Expected Impact (Target) / KPI Owner	Measured data	Performance vs Target (%) per partner	Overall Target	Overall Achievement	Overall Performance
2	No. of use case stories in the ICT Ecosystem repository	NTNU: 15	NTNU: 17	NTNU: 113%	15	17	113%
3	No. of municipal staff trained to use the DST	LCCC: 15; TK: 15; MAI: 2; MP: 2; SB: 2; SMO: 2; VORU: 2	LCCC: 20; TK: 29; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	LCCC: 133.33%; TK: 193.33%; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	40	49	122.50%
4	No. of new DPEB/DPED-enabling prototypes	LCCC: 13; TK: 13; MP: 2; SMO: 2	LCCC: 11; TK: 7; MP: 0; SMO: 0	LCCC: 84.62%; TK: 53.85%; MP: 0; SMO: 0	30	18	60%
5	No. of study visits by regulatory authorities	LCCC: 20; TK: 20; MAI: 4; MP: 4; SB: 4; SMO: 4; VORU: 4	LCCC: 22; TK: 9; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	LCCC: 110%; TK: 45%; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	60	31	51.67%
6	No. of politically-approved Bold City Visions (BCV) with guidelines, roadmaps, and action plans	LCCC: 1; TK: 1; MAI: 1; MP: 1; SB: 1; SMO: 1; VORU: 1	LCCC: 1; TK: 1; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	LCCC: 100%; TK: 100%; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	7	2	28.57%
7	No. of changes in regulation	LCCC: 5; TK: 6; MP: 2; SMO: 2	LCCC: 5; TK: 0; MP: 0; SMO: 0	LCCC: 100%; TK: 0; MP: 0; SMO: 0	15	5	33.33%
8	Tonnes of CO <sub>2</sub> -equivalent emission reduction per year	LCCC: 1.188; TK: 11.613	LCCC: 0; TK: 564	LCCC: 0; TK: 4.86%	12,801	564*	4%*
9	Tonnes per year Nitrogen Oxides (NOX) emissions reduction	LCCC: 1.5; TK: 4.7	LCCC: 0; TK: 0.62	LCCC: 0; TK: 13.2%	6.2	0.62*	10%*
10	The percentage of total Renewable Energy Sources (RES) self-supply	LCCC: 100%; TK: 75%	LCCC: 0; TK: 34%	LCCC: 0; TK: 45%	-	-	LCCC: 0; TK: 45%*



KPI ID	KPI Definition	Expected Impact (Target) / KPI Owner	Measured data	Performance vs Target (%) per partner	Overall Target	Overall Achievement	Overall Performance
11	Increase in new renewable energy system integration	MPOWER: 1.29GWh; SV: 1.99GWh; TE: 1.28GWh	MPOWER: 0 SV + TE: 1.17GWh	MPOWER: 0; SV + TE: 36%	4.538	1.170063*	26%*
12	Percentage district level production versus total energy consumption	MPOWER: 24.7%; SV: 46.5%; TE: 28.8%	MPOWER: 0; SV: 27%; TE: 7%	MPOWER: 0; SV: 58.1%; TE: 24.3%	47.7%	17.0%*	36%*
15	Net useful thermal recovery/year (GWh)	MPOWER: 0.143GWh <sup>12</sup> ; SV: 1.99GWh	MPOWER: 0; SV: 0.510	MPOWER: 0; SV: 25.6%	2.134	0.510*	24%*
23	Total new investments generated (€M)	Total contribution from multiple partners: 40	Sum of total contributions: 98.5	246%	40	98.5	246%
27	No. community participation events organised across all +CityxChange cities	LCCC: 8; TK: 7	LCCC: 5; TK: 4	LCCC: 63%; TK: 57%	15	9	60%
28	No. citizen observatories established	LCCC: 1; TK: 5	LCCC: 1; TK: 6	LCCC: 100%; TK: 100%	5	7	140%
29	No. of community participation events/actions	LCCC: 30; TK: 25	LCCC: 38; TK: 41	LCCC: 126.67%; TK: 164%	55	79	143.64%
30	No. of innovation labs/playgrounds contributing to the creation of DPEB	LCCC: 1; TK: 4	LCCC: 1; TK: 11	LCCC: 100%; TK: 275%	5	12	240%
31	No. of Positive Energy Champions trained	LCCC: 20	LCCC: 20	LCCC: 100%	20	20	100%
32	No. of organisations with new sustainable	LCCC: 30; TK: 30	LCCC: 24; TK: 15	LCCC: 80%; TK: 50	60	39	65%

<sup>12</sup> Clerical error corrected. Expected impact (target) for MPOWER was previously stated as 1.43GWh, but now corrected to 0.143GWh. Overall KPI target is not affected.



KPI ID	KPI Definition	Expected Impact (Target) / KPI Owner	Measured data	Performance vs Target (%) per partner	Overall Target	Overall Achievement	Overall Performance
	energy approaches						

**\* Data as reported by Month 36, but since the initial report, the KPIs calculations are undergoing another review and refinement process, and therefore are subject to change once calculations have been confirmed. Hence they are not actively shown or visualised in the Online System - MERT.**

A number of KPIs have reached their expected impact (target). These are listed below, accompanied by some explanatory notes.

- KPI 1
  - Following the amendments in KPI description and scope, the number of connections to the DST could accurately be represented, and has achieved the target of 20 connections.
- KPI 2
  - The initial target has been exceeded, with a higher number of scenarios developed.
  - Due to the nature of the work - i.e. descriptions of ICT ecosystems to realise a service or a part of an ICT system, the ecosystems could be described as one complicated use case and/or as several smaller use case stories.
  - Based on feedback by partners it was decided that multiple use case stories should be developed to explain ecosystem services in order to simplify the descriptions.
  - An overall use case story for the whole project was also developed, combining the 3 thematic areas, as advised by the project management.
- KPI 3
  - Partners from TK and LCCC both have put in extra efforts to train their staff where TK has exceeded the goal by training additional 9 members of their team.
- KPI 23
  - This KPI target has been exceeded, including spin-off, replication and scale-up projects from LHCs and FCs. The number is likely to increase with upcoming replication projects specifically in FCs.
- KPI 28
  - As seen in the table, TK has exceeded its share of KPI target for creation of additional observatories due to a separation of some functions into multiple locations (see D5.8<sup>13</sup>).
- KPI 29

<sup>13</sup> D5.8: +Trondheim Citizen Observatory: <https://cityxchange.eu/wp-content/uploads/2021/11/D5.8-Trondheim-Citizen-Observatory.pdf>



- As seen in the table, TK and LCCC have exceeded their share of the KPI target, as more events than initially anticipated were held. There were numerous other meetings, workshops, conferences, community events, etc. that +CityxChange decided to join or co-host to engage additional stakeholders and further promote the project.
- More events are also being planned to deepen the cooperation with and increase the impact on participating stakeholders.
- KPI 30
  - As seen in the table, TK has exceeded its share of the KPI target by quite some margin.
  - TK has set up more innovation labs and playgrounds than expected as the LHC wanted each "Playground" to have at least one location (physical or digital) where activities could be located. TK has established 5 physical playgrounds in Trondheim and 6 digital playgrounds. There are 5 physical innovation labs and the 6 "Playable Trondheim" digital innovation labs.
- KPI 31
  - The number of Positive Energy Champions trained is 20, which was achieved in April 2021 (M30). Covid meant that all meetings and the training had to take place online and the network operated partly hybrid.

## 4.4 Data Availability

As mentioned in previous iterations in this series of reports, more KPI data becomes available as the project progresses and more interventions are implemented. As such, KPI data is not available at the same time for all KPIs. It is expected that more data will be available in the short term as the project moves through the current implementation phase.

A collaborative effort will see WP7 and KPI owners review data and refine KPI calculations to ensure accurate measurement of KPI performance. WP7 has maintained its intensity and frequency of online engagement with KPI owners to refine KPI calculations and updates and improvements to the MERT and SRT that would assist in efficient data capturing and processing in the coming months and years of the project. This process will continue for KPIs still under review, with a higher degree of intensity in the next reporting period, until all KPI configurations are able to capture and process data.

The data captured and disseminated through the MERT is available to the public presently (through a link to the MERT from the official +CityxChange website<sup>14</sup>). This is in accordance with data sharing guidelines developed in the project's data management plan.

## 4.5 Reporting Insights and Additional Information

As mentioned previously in this series of deliverables, the data and information generated by the project is shared through various platforms, such as the +CityxChange web page, the

---

<sup>14</sup> Official +CityxChange website: <https://cityxchange.eu/>



MERT and the Smart Cities Marketplace (SCM). The MERT and SRT provide a platform for the majority of the data captured is quantitative, although the MERT allows partners to comment on data submissions, and the SCM provides a 'Insights' section where solutions and stories on different project interventions can be shared.

In conjunction with the quantitative data captured for KPIs, WP7 is in regular collaboration with partners through the Qualitative Data Working Group (QDWG) to source qualitative information from partners regarding their feedback, insights, experience, lessons learnt, and recommendations on different project interventions. This process is supported through the Qualitative Evaluation Framework developed in D7.8<sup>15</sup> and aims to provide insights and guidelines from experience, consolidated into suitable categories such as DPEBs, Community Engagement, Governance, etc. (categories are not yet defined and under development by the QDWG). Quantitative and qualitative data will be used in conjunction to provide additional context and insights on information reported for the project.

---

<sup>15</sup> D7.8: Data Collection and Management Guideline Report, available at: <https://cityxchange.eu/knowledge-base/d7-8-data-collection-and-management-guideline-report/>



## 5 Conclusion and Outlook

An ongoing process over this period has seen multiple KPI calculations being reviewed and confirmed, which includes the calculations for KPIs 1, 8, 9, 10, 11 and 18. WP7 will continue to facilitate close engagement and collaboration between KPI/data owners in order to get agreement and confirmation on the calculation of KPIs. Once confirmed, the agreed methodology will be set up in the MERT, and partners will be able to submit data for processing. Engagement with KPI/data owners will also focus on the alignment of the project's KPIs and suitable configurations of the SRT's data capturing fields in order to get KPI data submitted to the SCM.

The MERT has undergone various phased updates to improve efficiency of use, processing and display of KPI data. These updates will continue to be made in a phased approach as more KPI calculations and SRT configurations are confirmed.

WP7 will continue to work closely with KPI/data owners to ensure any issues related to the capturing or sharing of KPI data are addressed, and will ensure that the MERT and SRT data capturing systems are developed and in place when data becomes available.

The following table provides a summary outlook of the points WP7 will be addressing over the 6-month period toward the next iteration of this deliverable.

Table 9: Points to be addressed

Topic	Points to be addressed	Actions needed
Data availability	Partners to provide the data points required by the SRT/MERT	Ongoing engagement with KPI/data owners to confirm whether they will be able to provide the data required for KPI calculation in the SRT.
MERT	Refinement of MERT data headers to allow data capturing formats in line with the SRT	Updates to the manual data submission pages of the MERT according to SRT data requirements as soon as SRT configurations have been agreed.
	Modelling of data points in the MERT to display the KPI data in the MERT interfaces	Ensure that the MERT performs KPI calculations and visualisations as per agreed calculations. Completion of baseline data. Ongoing process with KPI/data owners as more data becomes available.
	MERT operationalisation	Improvement of mobile responsiveness. Explore the use of different chart types. Design and layout refinements. Updates to visualisations. Bug fixes to graphs and overall KPI pages and ensuring full KPI data is visible. Ensuring data export under FAIR principles. Ongoing process (M36-42)



Topic	Points to be addressed	Actions needed
	KPI calculation refinements	Ongoing engagement with KPI owners to confirm suitable calculations. Following calculation confirmation, the MERT's data processing will be updated accordingly. Completion of agreements on baselines.
	API development	Partners to confirm API structure in which data will be shared from their data portal. Partners to provide API endpoints.
SCM	General collaboration	Engagement with KPI owners over the months has focussed on further refinement of KPI calculation variables and methods (such as KPI 21 as noted in <a href="#">Table 6</a> , under <a href="#">section 4.2.1.1</a> ). A specific focus was put on KPIs in Theme 2: Common Energy Market, to determine if and how a selection of the KPIs in this theme can report data to the SRT. There are significant challenges in matching the data available to the data fields required by the SRT FoA - as raised by KPI owners and acknowledged by KPMG FA. KPMG FA will continue to engage further on developing options for partner consideration with respect to SCM integration and will continue to discuss improvements in the SCM data monitoring capabilities, changes to KPI data capturing fields, reconfiguration of SRT data input fields (FoA), and data visualisation options within the SCM. Renewed focus on finalising SRT submissions together with the SCM team will be aimed for.
	SRT data capturing	Ongoing engagement with project partners to get alignment on the SRT FoA and the proposed calculation method of KPIs in the MERT. Review of the proposed PED FoA with LHCs.
	Submission of qualitative information	Using the qualitative information capturing framework as detailed in D7.8 to develop content to share with the SCM. Engage with SCM to configure the most efficient way and format of sharing qualitative feedback, lessons learned, or other formats.



## 6 References

EU Smart Cities Information System (2018). Monitoring KPI Guide, D23.1 [PDF File].

Retrieved from:

[https://smartcities-infosystem.eu/sites/www.smartcities-infosystem.eu/files/document/scis-monitoring\\_kpi\\_guide-november\\_2018.pdf](https://smartcities-infosystem.eu/sites/www.smartcities-infosystem.eu/files/document/scis-monitoring_kpi_guide-november_2018.pdf)

Hynes, W. Rood, D. Chiddarwar, A. (2021). D7.10 Reporting to the SCIS (5). [PDF File].

Retrieved from:

<https://cityxchange.eu/knowledge-base/d7-10-reporting-to-the-scis-system-5/>

Hynes, W., Sweeney, J., Lynch, S., Rood, D., Chiddarwar, A. (2019). +CityxChange Project.

Deliverable 7.1: Approach and Methodology for Monitoring and Evaluation. [PDF File].

Retrieved from:

<https://cityxchange.eu/knowledge-base/approach-and-methodology-for-monitoring-and-evaluation/>

Rood, D., Chiddarwar, A., Hynes, W., Gall, T. (2019). +CityxChange Project. Deliverable 7.4:

Monitoring and Evaluation Dashboard. [PDF File]. Retrieved from:

<https://cityxchange.eu/knowledge-base/monitoring-and-evaluation-dashboard/>



## Annex I

This Annex contains the following parts:

- Recalling the provisional JSON data format (based on FIWARE framework) for API specification as set out in D7.10<sup>16</sup>; illustrating data structure for KPI 18 (as an example):

```
1 {
2   "meta": {
3     "kpi_id": "18",
4     "partner_id": "xxxxxxxxxx",
5     "unit_of_measurement": "kwh",
6     "aggregation_data_resources": [
7       {
8         "type": "level",
9         "value": "Sub-City"
10      }
11    ],
12    "calculation_period": "monthly",
13    "date_of_commissioning": "01-01-2019"
14  },
15  "label": "Capacity Traded",
16  "name": "Capacity_traded",
17  "kpidata": [
18    {
19      "month": 1,
20      "data": {
21        "der": {
22          "Solar PV": "",
23          "Battery": "",
24          "Heat pump": "",
25          "Demand response": ""
26        },
27        "total": {
28          "Solar PV": "",
29          "Battery": "",
30          "Heat pump": "",
31          "Demand response": ""
32        }
33      }
34    },
35    {
36      "...": "..."
37    },
38    {
39      "month": 60,
40      "data": {
41        "der": {
42          "Solar PV": "",
43          "Battery": "",
44          "Heat pump": "",
45          "Demand response": ""
46        },
47        "total": {
48          "Solar PV": "",
49          "Battery": "",
50          "Heat pump": "",
51          "Demand response": ""
52        }
53      }
54    }
55  ]
56 }
```

<sup>16</sup> D7.10: Reporting to the SCIS System, available at: <https://cityxchange.eu/knowledge-base/d7-10-reporting-to-the-scis-system-5/>

- Provisional JSON data format (based on FIWARE framework) for API specification for accessing data for KPI 1 (as example) from the MERT as set out below.

The screenshot shows a REST client interface with the following components:

- URL:** `https://mert.cityxchange.eu/api/mert/data/1`
- Method:** GET
- Buttons:** Send, Preview, Add to collection, Headers (0), STATUS 201 Created, TIME 146 ms, Cookies (undefined), Headers (0), JSON, XML, Raw, Preview, Pretty.
- Response Body (Pretty):**

```
1 {
2   "kpi_number": 1,
3   "kpi_definition": "# of APIs connected to the DST",
4   "kpi_type": "decision/planning support",
5   "kpi_description": "This KPI tracks the integration of the DST with modeling functionality and data sources. The DST allows for the assessment of the energy network through hard and physical and behavioural and social models. Functionality and data will be connected to the DST directly and/or indirectly through various APIs specified and provided by project partners.",
6   "kpi_data": [
7     {
8       "month": 29,
9       "connected": 6,
10      "comments": "Submitted by KPIIG-FA as confirmed via email from IES (12/03/2021)"
11    },
12    {
13      "month": 30,
14      "connected": 6,
15      "comments": "Submitted by KPIIG-FA as confirmed via email from IES (30/04/2021)"
16    },
17    {
18      "month": 35,
19      "connected": 8,
20      "comments": "Submitted by KPIIG-FA as confirmed via email from IES (17.09.2021)"
21    }
22  ]
23 }
```

## Annex II

This Annex contains a copy of the associated KPI 21 SRT Fields of Action (FoA). Note where significant divergence is present in terms of the particular data fields sought. Alignment with data captured for KPI 21 is subject to further discussions.

### +CityxChange Limerick: Kpi 21 Percentage Modal Shift From Fossil Fuel Vehicles To Emaas Vehicles Bikes (VEHICLES cluster)

**General data**

---

**Technology used**

Electrical vehicles ▼

**Description of the intervention**

**Date of commissioning**

#### KPIs

##### Number of biofuel/electric/hydrogen vehicles deployed in the area

Title	Unit	Baseline situation	After intervention	Improvement (%)
Number of cars	<input type="text" value="number"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>



Title	Unit	Baseline situation	After intervention	Savings (%)
Final Energy Consumption	kWh/a	xxxxxxx		

**Environmental KPI**

Title	Unit	Baseline situation	After intervention	Savings (%)
Total CO2 Emissions	kgCO2eq/a			
Total Primary Energy Demand	kWh/a	xxxxxxx		

**Economic KPI for the mobility action**

Title	Unit	Intervention
Total Investments (excl. VAT)	€	xxxxxxxxx
Grants	€	xxxxxxxxx
Net energy savings/value of improvements	€/a	xxxxxxxxx
Total Operating costs	€/a	xxxxxxxxx
Dynamic Payback Period	a	
Return on Investment	%	xx

**Social KPIs**

**Citizens directly involved**



Title	Unit	Baseline situation	After intervention	Improvement (%)
Number of buses	<input type="text" value="number"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Bikes	<input type="text" value="number"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Others	<input type="text" value="number"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Clean mobility utilization

Title	Unit	Baseline situation	After intervention	Improvement (%)
Number of kms	<input type="text" value="km/a"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Number of trips	<input type="text" value="trips/a"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Modal split

Title	Unit	Baseline situation	After intervention	Improvement (%)
Public and collective transport	<input type="text" value="%"/>	<input type="text" value="xx"/>	<input type="text"/>	<input type="text"/>
Private vehicles	<input type="text" value="%"/>	<input type="text" value="xx"/>	<input type="text"/>	<input type="text"/>
Biking and walking	<input type="text" value="%"/>	<input type="text" value="xx"/>	<input type="text"/>	<input type="text"/>
Average occupancy	<input type="text" value="%"/>	<input type="text" value="xx"/>	<input type="text"/>	<input type="text"/>

Energy consumption

--	--	--	--	--

