D7.10: Reporting to the SCIS System (5)

+CityxChange | Work Package 7, Task 7.3 & 7.4

Final delivery date: 30-04-2021

Deliverable version	v.08
Dissemination level	Public
Authors	Daniel Rood (FAC), William Hynes (FAC); Sheryl Lynch (FAC), Akshay Chiddarwar (FAC)
Contributors	Dirk Ahlers (NTNU), Terence Connolly (LCCC), Leendert Wienhofen (TK), Bjørn-Ove Berthelsen (TK), Pat Stephens (LCCC), Kjell Rune Molvik (TE), Klaus Livik (POW), Niall Kearney (MPOWER), Mladen Antolić (MPOWER), Nick Purshouse (IESRD), Torry Solem (SV), Erik Andre Bratseth (ABG), Mamdouh Eljueidi (4C), Tor Rune Skoglund (4C), Rob Kearns (GoCar), Vincenzo Cimini (OV), Filippo Giglio (OV), Giulia Carbonari (R2M).

Document Information

Project Acronym	+CityxChange
Project Title	Positive City ExChange
Project Coordinator	Annemie Wyckmans, Norwegian University of Science and Technology
Project Duration	1 November 2018 - 31 October 2023
Deliverable Number	D7.10: Reporting to the SCIS System (5)
Dissemination Level	PU-Public
License	CC-BY4.0 Creative Commons Attribution, except where otherwise noted. https://creativecommons.org/licenses/by/4.0/
Status	Complete
Due Date	30-04-2021
Work Package	WP7 – Monitoring and Evaluation
Lead Beneficiary	FAC
Contributing Beneficiaries	NTNU, LCCC, TK, MAI, MP, SB, SMO, VORU, IESRD, POW, UL, EAP, R2M, ISOCARP, TE, ABG, 4C, MPOWER, GoCar

Revision History

Date	Version	Author	Substantive changes made
25-02-2021	v.01	Daniel Rood	Setup of draft document structure
04-03-2021	v.01	Daniel Rood	Updates to structure
10-03-2021	v.02	Daniel Rood	KPI performance tracking tables updated
15-03-2021	v.03	Daniel Rood	Updates of text to Section 3, and Section 4.2
22-03-2021	v.04	Daniel Rood, Akshay Chiddarwar	Updates of text to Section 3, Section 4, Section 5
26-03-2021	v.05	Daniel Rood	Updates to KPI performance tables
26-03-2021	v.06	Daniel Rood	Final updates to measured KPI performance and preparation for submission to QA
27-04-2021	v.07	Daniel Rood	Updates to measured KPI performance, changes to layout in Section 4.2.1, update of references
30-04-2021	v.08	Daniel Rood	Updates to measured KPI performance, finalisation for submission.

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List of Acronyms

API	Application Programming Interface
BCV	Bold City Vision
DPEB	Distributed Positive Energy Block
DPED	Distributed Positive Energy District
DST	Decision Support Tool
EC	European Commission
eMaaS	eMobility as a Service
FC	Follower City
FoA	Fields of Action
GHG	Greenhouse Gasses
GWh	Gigawatt hour
ICT	Information and Communication Technology
KPI	Key Performance Indicator
LHC	Lighthouse Cities
M&E	Monitoring and Evaluation
MERT	Monitoring and Evaluation Reporting Tool
MWh	Megawatt hour
NOX	Nitrous Oxides
RES	Renewable Energy Sources
SCD	Sub-city District level
SCM	Smart Cities Marketplace
SRT	Self-Reporting Tool
UFA	Usable Floor Area

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Executive Summary

This report, *Deliverable 7.10: Reporting to the SCIS (5)*, is part of a series of bi-annual reports and is the fourth iteration in the series, being the subsequent revision of the previous version, *Deliverable 7.9: Reporting to the SCIS (4)*[1] submitted in Month 18 of the +CityxChange project. This deliverable provides an overview of the capturing and modelling of project data that is reported to the purpose-built +CityxChange Monitoring and Evaluation Reporting Tool (MERT) and the Smart Cities Marketplace[2] (SCM) Self-Reporting Tool (SRT).

The Key Performance Indicator (KPI) framework set out in *Deliverable 7.1: Approach and Methodology for Monitoring and Evaluation (D7.1)*[3] is used as the basis from which KPI performance is assessed, providing all the necessary prescriptions in the calculation of each KPI. As the project and interventions have evolved over the last two years, and data formats, frequency, and variables have become more apparent, some of the KPI calculations have had to be refined and adjusted. The refinements of these KPI calculations feed into the development and updating of the MERT, which is the main platform for the collection, processing and dissemination of KPI data for all 33 KPIs. A number of refinements and adjustments have been made to front- and back-end processes of the MERT in an effort to deliver a more efficient and functional tool. Further work on the MERT will include the adjustment of layout and design to improve the user interface, and the setup of APIs to enable automated data sharing to the MERT.

Data has been submitted to the MERT for 14 KPIs, with a total of 19 KPIs reporting measurements as of Month 30, subject to pending refinements of the calculation methods. As it stands, no KPI data has yet been reported to the MERT in the categories that align with the SCM SRT data capturing requirements and can therefore not be reported to the SCM. Other KPIs that potentially can report to the SCM do not have actual monitoring data as yet. Once it is clear what data is available and how it will be used in the calculation of a KPI, the KPI/data owners and WP7 will collaborate to determine whether it aligns with the SRT requirements and how it will be calculated in the MERT and SCM.

Although the COVID-19 pandemic has restricted physical engagement with stakeholders and curtailed the implementation of interventions, engagement has intensified using various online platforms, with every effort being made to collaborate with project partners where needed. WP7 will continue to liaise with partners to address the reporting of KPI data to the MERT and the SCM. This document is a continuation of the previous Deliverable D7.9 and repeats the main content from there. Changes are described in the Introduction.

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[1] D7.9 available at: https://cityxchange.eu/knowledge-base/d7-9-reporting-to-the-scis-system-4/
[2] Formerly known as the 'Smart Cities Information System (SCIS)
[3] D7.1 available at:
https://cityxchange.eu/knowledge-base/approach-and-methodology-for-monitoring-and-evaluation/

1 Introduction

A process has been underway in collaboration with KPI and data owners to refine KPI calculations, in an effort to ensure acceptable and accurate processing and calculation of measured KPI data. The ongoing work between WP7 and KPI/data owners is informing the setup of data capturing and processing within the MERT, and eventual transposing of data to the SRT. As different interventions are implemented in Lighthouse Cities (LHC) and Follower Cities (FC) at different times, and with delays brought on by COVID-19, the availability of 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 Deliverable 7.9, 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 as reported by KPI/data owners.

The following updates have been made to the D7.9 version:
- Changes to KPI baseline figures (Section 2.1)
- Refinement of KPI calculations through ongoing KPI workshops (Section 4.2.1)
- Updates to the MERT (Section 4.2)
- Work on data input field configuration of the SRT (Section 4.1)
- Update of KPI performance (Section 4.3)
- Review of data availability (Section 4.4)

2 M&E in +CityxChange

Section 2 provides an overview of the KPI framework as refined in *Deliverable 7.1*, with the KPI definition defining what is measured and the expected impact of each KPI over the 5-year project timeline.

2.1 Measuring impact in +CityxChange

The KPI framework is the main reference for KPI information, providing detailed description of the definition, calculation methodologies, intended scope and scale of monitoring and other relevant information for the M&E process.

The table below provides an overview of the KPI framework, with updated KPI baseline figures.

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 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[4]	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_2-equivalent emission reduction per year	12.801 tonnes/ year	0
	9	Air quality	Tonnes per year Nitrogen Oxides (NOX) emissions reduction	6.2 tonnes/ year	0

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[4] DPEBs/DPEDs - Distributed Positive Energy Blocks / Distributed Positive Energy Districts

	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 optimized 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/m² usable floor area (UFA) per year improved energy efficiency (final energy demand)	62 kWh/m² / 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 organized across all +CityxChange cities	15	0

	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

Each KPI has a specified KPI and/or data owner who is responsible for the capturing of monitoring data reported for each KPI they take ownership of. Depending on the complexity of the KPI calculation, different partners can be involved in the data processing and management process to ensure accurate data submission to the MERT and/or SRT.

3.1 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 is then transferred manually to the SCM SRT.

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.

WP7 has developed an API specification that has been shared with selected partners to undergo a testing period for the automated submission of KPI monitoring data to the MERT (see section 3.1.1.1 below). This API was captured in the API catalogue developed by WP1, along with API specifications and requirements from other partners. The standardised API specification allows the sharing of data between different portals and data platforms within the +CityxChange ICT ecosystem, without partners having to change functionality in their data portals and to be able to consume data directly from the API. WP7 is currently reviewing the API specifications submitted by other partners in order to align the KPI data API with partner APIs as part of the process to establish automated data sharing between the MERT and partner data repositories.

3.1.1.1 API Specification and API Testing

As the KPIs that these partners are owners of have different requirements, the API review will consider the various data points requested in the transfer, the frequency of the transfer, and other factors like aggregation level that determine whether the required data can be shared successfully. Each partner that has the capacity to share data through API will be requested to provide an API endpoint for configuration of the KPI data (API) and to establish the API connection. A trial period will be conducted with selected KPI/data owners to test the API data sharing before it is rolled out with all possible KPI/data owners. An API Catalogue with standard structures and requirements has been shared with all partners as part of Task 1.2. As part of MERT strategy to integrate partner APIs, partners are advised to follow the recommended KPI API structure defined in the API catalogue developed by WP1 and provide API endpoints to FAC. In turn, FAC will be developing logic for integration of

APIs into MERT and provide API endpoints to partners for integration within their systems (planned action for M36).

Initial thoughts on API specification helps different partners to provide KPI data in the same standard way and avoid complications in consuming the data. The API specification is divided mainly into two sections, first "meta" and second "kpi data". The "meta" section is an object of various Key-Value pairs that consist of KPi related information and as well some identifier information like unique partner_id, unit_of_measurement, scale_of_reporting etc. This information is more static and does not change over the period of intervention since it has started. In the "kpi data" section is an array of objects. Each object consists of data for the month a KPI/data owner wishes to report data. For each month the partner needs to provide data as per the data headers confirmed by the partner for aggregations or calculations. Please refer to the Annex for a JSON specification example of the API for KPI 18.

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. Partners submit KPI data through a link in the KPI individual interface, where data capturing sheets were designed according to the calculation procedure stated in D7.1 (or according to subsequent calculation amendments). KPI owners have been issued with login credentials to the MERT that enable them to input and edit data points in the MERT. All data currently captured in the MERT have been submitted through the manual data submission process. The ongoing engagement with KPI owners regarding the refinement of KPI calculations will inform the configuration of variables that are captured through the forms in the MERT.

3.1.3 Data Submission to the SRT

Recent engagement with KPI and data owners have included work on the configuration of the Fields of Action (FoA - criteria used in the creation of data collection fields in the online manual data collection pages of the SRT) that will be used for the capturing of KPI data in the SCM SRT. The FoA have been configured to capture data at city level, and a testing phase has begun for the LHC of Limerick and Trondheim. As the SRT's FoA do not align completely with the KPIs designed for the project (see Section 4), it is important to try to get the alignment of the FoA and the MERT as close as possible, as data captured in the MERT will be transferred to the SRT. The SRT can only accommodate annualised data, so the data submitted to the MERT is processed (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 is a manual process as the SRT does not accommodate automated data sharing through means such as API connections.

Through a recent round of intensive engagement and collaboration with KPI owners, the potential input of KPI monitoring data to the MERT has again been reviewed. As mentioned above, the general misalignment of the SRT input requirements and the KPIs set up for the project has proven to be a challenge for KPI owners to confirm if the required inputs are/will be available, the spatial scale, and the frequency in which it might be available. Partners are currently reviewing a set of configuration options for the SRT, which will be discussed in ongoing KPI calculation workshops. See Table 2 for more detail on the KPIs being discussed for potential data submission to the SRT.

4 Reporting Data to the SRT and MERT

As project interventions are implemented, monitoring data is generated and captured by KPI and data owners. Data is processed and submitted to the MERT and/or the SCM[5] SRT where it undergoes further processing and is displayed through various interfaces. An update on the usage of these data portals is provided in the subsections below.

4.1 The SCM SRT

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 stated in Section 3.1.3, tailoring of the SRT FoA to fit all the +CityxChange KPI data requirements is limited. Tables 2 and 3 provide an overview of ongoing work regarding the calculation refinements.

In Table 2, the 'Potential SRT option' column refers to the option of setting up SRT data capturing fields for the KPI. If marked as 'Potentially, TBC' the KPI has been identified as a potential option for reporting to the SRT, but that a review of the KPI's calculation methods in the MERT and SRT are still undergoing, and that the final KPI calculation method and variables are still to be confirmed. 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	Potential SRT option	Proposed calculation that could work in the MERT (from D7.1)	KPI/data owner input needed
12	Percentage district level production versus total energy consumption	MPOWER, SV, TE	Yes	Yes	Critical - input needed from KPI owner(s)
14	kWh/m² (UFA) per year improved energy efficiency (final energy demand)	MPOWER, SV, TE	Yes	Yes	Critical - input needed from KPI owner(s)
15	Net useful thermal recovery/year (GWh)	MPOWER, SV	Potentially, TBC	Yes	Confirmation

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[5] Smart Cities Marketplace: https://smart-cities-marketplace.ec.europa.eu/

16	€M reduction compared to planned investment	MPOWER, SV, TE	Potentially, TBC	Yes	Critical - input needed from KPI owner(s)
20	Increase in installed RES storage capacity	TE, MPOWER	Yes	Yes	Critical - input needed from KPI owner(s)
21	Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)	LCCC, ABG, TK	Yes	Yes	Critical - input needed from KPI owner(s)
23	Total new investments generated (€M)	MPOWER, SV, TE, all partners (tentative)	Potentially, TBC	Yes	Confirmation
26	No. of new jobs created	All 32 partners	Potentially, TBC	Yes	Confirmation

Table 3: KPIs to potentially report to the SRT, details on calculation gaps

KPI	KPI Definition	Calculation Gaps	Update (Feb/Mar 2021)
12	Percentage district level production versus total energy consumption	Need to confirm calculation and variables for modelling in the MERT; potential option for SRT - KPI owners need to confirm if SRT inputs are available and if it would work in the calculation of performance vs target. How can we use the SRT variables to calculate and display data in the MERT?	Ongoing engagement with KPI owners (LCCC and TK, and involvement of MPOWER and TE) on data availability and subsequent calculation method. Awaiting input from KPI owner for finalisation of capturing fields in MERT/SRT. SRT option presented, currently under review by KPI/data owners.
14	kWh/m² (UFA) per year improved energy efficiency (final energy demand)	Need to confirm calculation and variables for modelling in the MERT; potential option for SRT - KPI owners need to confirm if SRT inputs are available and if it would work in the calculation of performance vs target. How can we use the SRT variables to calculate and display data in the MERT?	Ongoing engagement with KPI owners. KPI owners to confirm preliminary acceptance of 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.
15	Net useful thermal recovery/year (GWh)	Need to confirm if SRT option will work and if it will work for the calculation of performance vs target	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. Need to confirm if 'net' or 'useful' generation will be considered in measurement of the KPI. Engagement with KPI owners is ongoing.
16	€M reduction compared to planned investment	Need to confirm if SRT option will work and if it will work for the calculation of performance vs target	Ongoing engagement with KPI owners. MPOWER confirms preliminary acceptance of proposed calculation method, pending confirmation once data variables become available (no monitoring data available yet). Awaiting input from other KPI owners for finalisation of capturing fields in MERT/SRT.
20	Increase in installed RES storage capacity	Need to confirm calculation and variables for modelling in the MERT; potential option for SRT - KPI owners need to confirm if SRT inputs are available and if it would work in the calculation of performance vs target. How can we use the SRT variables to calculate and display data in the MERT?	Ongoing engagement with KPI owners. MPOWER confirms preliminary acceptance of proposed calculation method, pending confirmation once data variables become available (no monitoring data available yet). Awaiting input from other KPI owners for finalisation of capturing fields in MERT/SRT.
21	Percentage modal shift from fossil-fuel vehicles to eMaaS (vehicles/bikes)	Need to confirm calculation and variables for modelling in the MERT; potential option for SRT - KPI owners need to confirm if SRT inputs are available and if it would work in the calculation of performance vs target. How can we use the SRT variables to calculate and display data in the MERT?	Ongoing engagement with KPI owners on suitable calculation method. New mobility partner, GoCar, is included in the engagement for Limerick. Awaiting input from KPI owner for finalisation of capturing fields in MERT/SRT. Options for SRT presented, currently under review by KPI/data owners.
23	Total new investments generated (€M)	Need to confirm if SRT option will work and if it will work for the calculation of performance vs target. If SRT option is not agreed, we need KPI/data owner input to confirm if proposed calculation is correct/relevant	Ongoing engagement with R2M. Checking source of data and working on a suitable calculation method with KPI owners . Awaiting input from R2M for finalisation of capturing fields in MERT/SRT.
26	No. of new jobs created	Determining the appropriate multipliers to be applied to calculate indirect/induced jobs created	Ongoing engagement with R2M. Working on a suitable calculation method to determine indirect and

			induced jobs using multipliers. Awaiting input from R2M for finalisation of capturing fields in MERT/SRT.

There is ongoing engagement with KPI/data owners regarding the refinement of calculations and the matching of calculation variables to those required for data processing in the SCM. Notices have been forwarded to KPI owners to review the baselines to which KPIs are compared so that latest measurements can be used. Recent implementation of project interventions will generate data in the short term, specifically for energy related interventions implemented in Limerick City and County Council (LCCC). As more data becomes available, partners will be able to evaluate KPI calculations and provide feedback on the calculation refinements.

Currently, partners have confirmed that two KPIs, KPI 17 and KPI 19 (shown in Table 4), proposed calculations for the SRT have been accepted, pending confirmation once data becomes available (expected to be June/July 2021). Others are ongoing.

Table 4: SRT Thematic Fields to which KPIs are Reporting

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

Once the KPI owners are clear on data availability and the different variables used in the calculation, the MERT capturing fields will be adjusted according to the SRT FoA requirements, and start capturing data. Depending on the calculation requirements, the data will be processed in the MERT, after which the annualised data will be transferred to the SRT for further modelling and visualisation. Another SRT configuration option for collective data capturing on the Positive Energy District (PED)[6] solutions are being explored for use.

This PED FoA configuration has been shared with both LHCs and related partners for review and consideration on data availability, frequency, and aggregation. WP7 and the LHCs are combining efforts to determine whether the PED FoA can be used, and how its data requirements can be linked to the +CityxChange KPIs in order to ensure efficient data capturing and usage of variables across the SRT and MERT platforms.

To date, no KPI data has been reported to the SRT due to the lack of project monitoring data in the suitable categories or ongoing refinements of KPI calculations, without which

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[6] See SCIS Monitoring KPI Guide:
https://smartcities-infosystem.eu/sites/www.smartcities-infosystem.eu/files/document/scis-selfreporting_guide_feb2020.pdf

KPI/data owners cannot confirm whether the FoA in the SRT would be appropriate or not. Through the ongoing KPI calculation workshops, energy partners in particular have mentioned that more KPI monitoring data should become available between June and August 2021. Once data is submitted to the SCM, it will be processed and displayed in the 'Project Data Visualisation' section of the SCM website[7] according to the location (country, city, demosite), project (+CityxChange, or other projects reporting to SCM) and type of intervention (i.e. building level energy analysis, energy system integration, and mobility and transport). A continued collaborative effort between WP7 and KPI owners will be made to have more KPI calculations confirmed to report data to the MERT and the SRT.

4.2 The +CityxChange MERT

As developed by WP7 (and described in *Deliverable 7.4*) the MERT provides an online dashboard where the performance of the 33 +CityxChange KPIs are calculated and disseminated.

4.2.1 KPI Calculations

WP7 and multiple KPI/data owners have been involved in a collaborative effort to refine KPI calculations in order to prepare for data submission to the MERT (and, where relevant, the SRT). This focussed effort has included multiple KPI calculation workshops between Oct 2020 - Nov 2020, and Feb 2021- Mar 2021, where selected KPIs were discussed in further detail. These workshops aimed to get a better understanding of the KPI calculation requirements between all KPI/data owners, and to develop and confirm a calculation for each. Although more collaborative engagement and workshops are still planned, this subsection provides an overview of progress made in the refinement of KPI calculations.

4.2.1.1 KPI Calculation Status and Updates

As used in the previous deliverable D7.9 of this series, the table below now provides an updated status of the ongoing KPI calculation refinement. The status below confirms which KPI calculations have been agreed and confirmed, and which are still under review and refinement.

Table 5: KPI Calculations Status for all KPIs in the MERT

KPI	Status	KPI	Status	KPI	Status
1	Reopened for review	12	Under review	23	Under review
2	Confirmed	13	Confirmed	24	Under review
3	Confirmed	14	Under review	25	New proposed calculation to be approved
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	Confirmed, pending	29	Confirmed

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[7] SCM Project Data Visualisation: https://smartcities-infosystem.eu/scis-kpis

8	New proposed calculation to be approved	19	Under review	30	Confirmed
			review when data becomes available		
8	New proposed calculation to be approved	19	Under review	30	Confirmed
9	New proposed calculation to be approved	20	Under review	31	Confirmed
10	New Calculations Confirmed	21	Under review	32	Confirmed
11	New Calculations Confirmed	22	Confirmed	33	Confirmed

The recent series of KPI workshops have addressed the refinement of multiple KPI calculations, as listed in the points below. These KPIs were selected for this refinement process due to the complexity of their calculations, and the imminent expectation of monitoring data becoming available. Other KPIs listed as 'under review' in the table above will systematically also be addressed in ongoing KPI calculations workshops. Following the previous iteration of this report another round of engagement was undertaken where partners were invited to attend a series of recurring workshops, with regular email and verbal communication, follow-ups and discussions. A summary of the progress made since D7.9 and points discussed are also provided.

- KPI 8 & 9
    - 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_2 and NO_x)
    - It has been decided by KPI owners that these KPIs would not be suitable for reporting to the SCM as no alignment could be found between the KPI (as designed for the project) and the SRT requirements
    - It has been highlighted again that there is disparity between the data readily available to TK and LCCC.
    - As such, an effort is made to keep the calculation as simple as possible, but still consider the complexity of the data needed to measure the KPI performance as accurately as possible.
    - Both LHCs agree to use the standard emission factors listed for building and mobility related interventions, as recorded in D7.1 KPI information tables
    - Baseline figures:
        - Initially, both LHCs agreed to calculate the emission baselines for both building and mobility related emissions using SECAP as a guideline for the calculation
        - Over the last series of workshops (from Oct 2020 to Mar 2021) an effort was made trying different approaches to the calculation of the KPIs, specifically using emission baseline figures for CO2 and NOx.
    - Although both TK and LCCC originally thought that this data would be available, further investigation and internal discussions with the city teams has confirmed that the baseline 'tonnes/year' figures are not available, and using the data that is available would not be suitable for this calculation.

- This leaves us with the option:
    - Suggestion made: Rather than using an emission baseline to calculate the savings and then compare the sum of the savings to the KPI target, can we not just directly calculate the 'savings' using the emission factors applied to the different variables and compare that directly to the target?
    - This assumes then that the renewable energy interventions used in the calculation replaces the use of any non-renewable energy sources.
    - The amount of savings calculated for the project is then reported as a percentage score against the target.
    - I.e:
        - Instead of:
            - Emission baseline (tonnes) - sum(RES kWh * 'g/kW' emission factor) = Emission reduction compared to baseline
            - Sum(emission reduction) / target emission reduction = percentage reduction achieved compared to target
        - We propose:
            - sum(RES kWh * 'g/kW' emission factor) = assumed reduction
            - Sum(assumed reduction) / target emission reduction = percentage reduction achieved compared to target
        - Another suggestion was made to adjust the 'KPI target per year', to account for a lower target in year 1, and a systematic increase in target over the 5-year period. For example:
            - Y1 = 5% of target
            - Y2 = 20% of target
            - Y3 = 40% of target
            - Y4 = 70% of target
            - Y5 = 100% of target
        - Later conversations with the LHCs confirmed that an emission baseline for current city emissions is in fact 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, and should only be calculated from the onset of the project (therefore at zero).
        - Data for this KPI has been captured using another similar method which is reflected in Table 8, but no further update for these KPI measurements have been provided post Month 25.
- City Limits
    - TK highlighted that the change in Trondheim's city limits should be noted

- Suggestion to use a calculation based on the new city limits, and view the new city limit as a combination of Trondheim and Klæbu
- Data for TK and Klæbu already combined from 2019, but is undergoing review
- Agreed to use data that is available and 'correct as of' a particular date, then update accordingly if/when revised figures are released
  - Variables used in the calculation
    - LCCC – New partner, GoCar, confirmed that data per trip is available (km)
    - LCCC to check with Bus Eireann regarding routes/trips/passenger/km travel data to see if data for Limerick City is available (granularity consideration for Limerick City)
    - TK – 4C can also get data per trip (km)
    - General assumption made that all trips using e-mobility solutions are regarded as trips taken from (instead of) fossil fuel vehicles
    - Each partner is reviewing the different variables used in the calculation (e.g. heat pump, solar, tidal, etc.) and confirming if these are in order.
    - LCCC might not be able to provide exact (kWh) measurement for each variable, but might be able to split a total measurement with percentages.
  - COVID
    - Both LHCs highlight that mobility data will be influenced by COVID due to peoples' way of commuting since COVID (i.e. more private, less public transport; lower traffic flows in general; etc.)
    - Should be addressed when data is submitted and reported.
  - Data Provision
    - It is agreed that data provision at monthly intervals would be hard to obtain
    - LCCC suggestion: that data be sourced at quarterly intervals, and submitted bi-annually. That will mean that four data points are available, and are submitted twice a year. This will also give the opportunity to provide some qualitative insight on the data points submitted.
    - As the KPIs report at 'City' level (the cumulative effect of all interventions in the block(s), the data points for these KPIs will need to be aggregated. Suggestion made that data be provided at 'block' level (1 block for LCCC, 3 blocks for TK), and then aggregated for 'City' level reporting.
  - All options are currently being reviewed by the KPI owners for finalisation.
- KPI 10
  - This KPI calculation has been confirmed by the LHCs and relevant energy partners, but WP7 and KPI/data owners will reconvene in approx. 3 months (May 2021) when energy partners expect reliable data to be available (TE currently has limited data available, while MPOWER do not yet (TBC)).
  - Energy partners confirm monthly data reporting should be possible

- ○ Energy assets to be measured include
  - ■ TK: Solar, heat pump
  - ■ LCCC: Solar, heat pump, tidal, CHP (potentially) (NOTE: Although tidal generator is not geographically situated within the demonstration district, 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:
    - ● TE propose use of API connection for automated data sharing, although host still needs to be confirmed
    - ● MPOWER is also keen to use API, but will be confirmed.
- ○ KPI performance data currently captured for this KPI was done so using a different methodology and will be updated once the new proposed new calculation is applied.
- ● KPI 11
  - ○ KPI owners confirm that data should be available at building/asset level
  - ○ The tidal turbine will be included in the calculation of this KPI, even though it is not geographically located within the PEB.
  - ○ TE and SV are the main data providers for data related to TK
  - ○ MPOWER is the main data provider for data related to LCCC, although for data related to the tidal turbine, data may come from GKIN.
  - ○ Energy from battery storage will not be included in this calculation as it is not deemed an 'energy generator'
  - ○ Partners confirm that monthly data submission is suitable
  - ○ LCCC (MPOWER) will be implementing either heat pumps or CHP, but not both. MPOWER to confirm in approx. 1 month following currently ongoing discussion with partners.
  - ○ Monitoring data availability
    - ■ Partners provided an estimate on when actual monitoring data for this KPI should be available:
      - ● LCCC – approx. 3-4 months. MPOWER to confirm.
      - ● TK – approx. 3 months, maybe earlier, TE will confirm. SV to confirm.
  - ○ KPMG FA to update and circulate data capturing sheets and API spec for review.
  - ○ For now, KPI 11 calculation is agreed in principle, and will be checked again when data is available.
  - ○ KPI performance data currently captured for this KPI was done so using a different methodology and will be updated once the new proposed new calculation is applied.
- ● KPI 12
  - ○ 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 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
  - 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.
  - Refinement of KPI 15 is ongoing

- KPI 18
  - KPI title – although the KPI title refers to "...capacity utilized", it is however understood to be "capacity traded" as per the calculation methodology.
  - Currently the calculation mentions "building level" but this does not refer to buildings only, this is seen as any of the DER assets deployed by the project. The terminology has been adjusted as "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 is expected to be available in May 2021
    - 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 is expected to be available between June and July 2021
  - ○ For now, KPI 18 calculation is agreed in principle, and will be checked again when data is available.
- KPI 21
  - ○ 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 SCM SRT reporting structure (promoted for improved data sharing to the SCM)
      - 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 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.
  - ○ Refinement of KPI 21 is ongoing.
- KPI 24
  - ○ Note: Both KPI 24 and 25 will broadly use the same data.
  - ○ Calculation baseline:

- There is a need to determine what the 'standard baseline payback period' for different project interventions are, as it is needed to calculate the reduction in payback period.
        - The baseline should be per project intervention type (same as categorised for KPI 25), and can be aggregated with a weighted average for each city or project level.
        - For now, we can make use of the simulated design figures (that will show ROI 'by design'), and then monitor the actual data over time in the project, which will provide actual vs simulated data.
    - Refinement of KPI 24 is ongoing.
- KPI 25
    - 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 have 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 city level.
    - It has been proposed that the cities will supply the data inputs for the financial modelling to OV at a specified date - preliminary 1 month prior to data submission to the MERT.
    - Calculations have been proposed and are now being set up for tests in MERT. If all is in order, the calculation will be confirmed with the KPI owners.
    - Data for the KPI is expected to be available by June 2021.

Given that not all project interventions have been implemented, and that some are only planned for later in the project (mid to latter parts of year 3 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 main reference in the further refinement

of KPIs. As in this deliverable, any further changes and refinements will be reported on in subsequent deliverables in this series.

4.2.2 Operationalisation of the MERT

The MERT prototype released as part of *Deliverable 7.4: Monitoring and Evaluation Dashboard*[8] has undergone numerous updates to its user interface and back-end processing to improve user interface (UI) and functionality of the dashboard. The improvements made since the previous iteration of this report, and those in progress, are listed in Table 6.

Table 6: 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	Improvements in progress [M30-36]
Front-end	Fix designs	Fixing design issues on few pages (filtering data, button functionalities, descriptions)	In progress [M30-36]
Back-end	Graphs Presentation	Update Graphs for KPI to enhance KPI data representation. Supported by ISOCARP	Completed [M30]
Back-end	Application Dependencies	Updating application dependencies (manage bug fixes) and improve overall security of the application.	Ongoing (recurring) [M30-36]
Back-end	KPI Calculations	Update KPI headers in accordance with confirmed calculations (as in Table 5).	Completed [M30]
Back-end	API	Initial partner testing of API functionalities	In progress [M30-36]

The ongoing refinements to KPI calculations and the subsequent changes to UI features will require periodic updates to the MERT functionalities that would ensure efficient data capturing. It is envisaged that the updates and improvements being made to the MERT (as described in Table 6) will enable the MERT to go 'live' on the +CityxChange website (which is expected at the end of Month 30). WP7 is working closely with WP10 to ensure that data dissemination through the MERT is done correctly and that the MERT will be able to go 'live' once sufficient data is available and the necessary functionalities are in working condition on the MERT. Existing gaps in data, KPI calculations, and functionalities within the MERT will

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[8] D7.4 available at: https://cityxchange.eu/knowledge-base/monitoring-and-evaluation-dashboard/

be addressed as data becomes available, and as KPI calculations are resolved with KPI owners.

FAC has added a functionality to the MERT where KPI owners can leave additional comments or clarification notes related to the quantitative data while submitting data that is submitted. This functionality is intended to increase the level of submitted **qualitative information and context** associated with quantitative data, and to provide the KPI/Data Owners (users) with clarification on the numerical data displayed on the MERT. This will enable a better understanding of the data for users not related to the project or KPI specifically, and provide KPI owners with a way to keep track of the data submitted and to mitigate any potential data errors such as double-counting or confusion. In addition, it is proposed that the individual KPI interfaces will provide links to other data dashboards, websites or online platforms where users can find and view other information related to the KPI data submitted. These will include links to online platforms such as the Decision Support Tool (DST), individual visualisations or dashboards from the PEBs, Insight Limerick[9] (provides data on traffic, finance, planning and a dedicated +CityxChange link), and Stechome[10] (provides smart energy management solutions for commercial and/or residential buildings in Sestao).

Table 7: KPIs for which Data Points have been submitted to the MERT

Theme	KPI ID	KPI Definition	Has data been submitted to the MERT? (Yes/No)	Number of data submissions[11]
IDP	1	No. of APIs connected to the Decision Support Tool (DST)	Yes	1
	2	Number of use case stories in the ICT Ecosystem repository	Yes	2
	3	No. of municipal staff trained to use the DST	Yes	3
	4	No. of new DPEB/DPED-enabling prototypes	Yes	3
	5	No. of study visits by regulatory authorities	Yes	4
	6	No. of politically approved Bold City Visions (BCV) with guidelines, roadmaps, and action plans	Yes	3
	7	No. of changes in regulation	Yes	3

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[9] 'Insight Limerick' information available at:
https://www.limerick.ie/smart-limerick/programme-5-data-analytics/insight-limerick-personal-dashboard
[10] 'Stechome' information available at: https://www.stechome.es/
[11] Number of data submissions in the MERT to date, may include multiple data submissions over time, or submissions by multiple partners

CEM	13	No. of new DPEBs realised	Yes	1
CXC	27	No. community participation events organized across all +CityxChange cities	Yes	3
	28	No. citizen observatories established	Yes	6
	29	No. of community participation events/actions	Yes	4
	30	No. of innovation labs/playgrounds contributing to the creation of DPEB	Yes	9
	31	No. of Positive Energy Champions trained	Yes	1
	32	No. of organisations with new sustainable energy approaches	Yes	3

Total Yes	14	46
Total No	19	

As of Month 30, data for 14 KPIs have been submitted to the MERT. All 14 KPIs' performance is tracked and disseminated in the MERT online dashboard.

4.3 KPI Performance Status at Month 30

Monitoring data submitted to the MERT (and through other channels) is compared to the expected impact (target) of each KPI to track its performance as the project progresses. The table below provides an overview of the KPI performance of 19 KPIs at Month 30 for which monitoring data is available at the time of writing (KPI data submitted through the MERT and through other internal correspondence).

Table 8: Captured KPI data and overall KPI performance

KPI ID	KPI Definition	Expected Impact (Target) / KPI Owner	Measured data (per KPI owner)	Performance vs Target (%) per partner	Overall Expected Target	Overall Achievement	Overall Performance
1	No. of APIs connected to the Decision Support Tool (DST)[12]	IESRD: 20	IESRD: 12	IESRD: 60%	20	12	60%

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[12] KPI 1 title and description currently under review to also include non-API data integration.

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: 3; TK: 22; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	LCCC: 20%; TK: 147%; MP: 0; SMO: 0	40	25	63%
4	No. of new DPEB/DPED-enabling prototypes	LCCC: 13; TK: 13; MP: 2; SMO: 2	LCCC: 7; TK: 0; MP: 0; SMO: 0	LCCC: 54%; TK: 0%; MP: 0; SMO: 0	30	7	23%
5	No. of study visits by regulatory authorities	LCCC: 20; TK: 20; MAI: 4; MP: 4; SB: 4; SMO: 4; VORU: 4	LCCC: 11; TK: 9; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	LCCC: 55%; TK: 45%; MAI: 0; MP: 0; SB: 0; SMO: 0; VORU: 0	60	20	33%
7	No. of changes in regulation	LCCC: 5; TK: 6; MP: 2; SMO: 2	LCCC: 3; TK: 0; MP: 0; SMO: 0	LCCC: 60%; TK: 0; MP: 0; SMO: 0	15	3	20%
8	Tonnes of CO_2-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: 43%	LCCC: 0; TK: 57%	-	-	LCCC: 0; TK: 57%*
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	1.17	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[13]; 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: 48,4	121%	40	48.4	121%
27	No. community participation events organized 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: 4	LCCC: 1; TK: 4	LCCC: 100%; TK: 100%	5	5	100%
29	No. of community participation events/actions	LCCC: 30; TK: 25	LCCC: 12; TK: 31	LCCC: 40%; TK: 124%	55	43	78%
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: 1	LCCC: 5%	20	1	5%
32	No. of organisations with new sustainable energy approaches	LCCC: 30; TK: 30	LCCC: 14; TK: 15	LCCC: 47%; TK: 50	60	29	48%

* Data as reported in Month 18, 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.

Since the last deliverable in this series, a number of KPIs have reached their expected impact (target). These are listed below, accompanied by some explanatory notes.

- KPI 2
    - 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 or as several smaller use case stories. Thus, it was possible to create a larger number of 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.

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[13] 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 29
  - As seen in the table, TK has exceeded its share of the KPI target, as more events than initially anticipated were held, as there were numerous other meetings, workshops, conferences, community events, etc. that +CityxChange decided to join or co-host in an effort to further promote the project.
  - More events are also being planned to increase the impact thereof 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 4 physical playgrounds in Trondheim and 1 digital playground (Decidim). There are 5 physical innovation labs and the 1 "Playable Trondheim" digital innovation lab.

4.4 Data Availability

As in previous iterations of this report, it should be noted that KPI data will not be available for all KPIs at the same time. As the project progresses further through the current implementation phase, it is expected that more KPI monitoring data should become available in the short term. KPI/data owners, in collaboration with WP7, will then be able to review the data and determine its use for KPI calculation. Through ongoing engagement with KPI/data owners the data will be reviewed and the calculations refined to ensure KPI performance can be tracked accurately and consistently. KPI monitoring data will hence be submitted to the MERT, and in certain cases the SRT, once variables and calculation methodologies have been confirmed and agreed.

Despite the delays and inability to attend and host in-person engagement events, WP7 has increased its intensity of online engagement and remains on track with its goals and milestones and have progressed with KPI/data owners in the refinement of 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. Efforts will continue to engage with partners through regular online conference calls, workshops, and other forms of electronic interaction to progress with the needed KPI calculation, MERT and SRT refinements and data collection.

The data captured and disseminated through the MERT will be made available to the public (through a link to the MERT from the official +CityxChange website[14]) in accordance with data sharing guidelines developed in the project's data management plan.

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[14] +CityxChange website: https://cityxchange.eu/

4.5 Reporting Insights and Additional Information

The project aims to report on the quantitative and qualitative data and information through various platforms such as the MERT and the SCM SRT. SCM provides guidelines in its Monitoring KPI Guide (SCIS, 2018) for the capturing, modelling and sharing of KPI data, but also provides a 'Lessons Learned' section where qualitative information related to the quantitative data can be captured. The feedback received provides contextual information on partners involvement and actions in the implementation of demonstration projects, and is reviewed alongside quantitative data captured for the KPIs. Furthermore, a framework for the collection, revision and interpretation of qualitative information has been developed by WP7 in collaboration with WP8, WP9 and KPI/data owners that will set out a process and methodology for the qualitative evaluation of project actions and the dissemination thereof in following annual deliverables. In accordance with Task 7.4, the comments and context provided will be used in the assessment of ICT, mobility, energy, social, and regulatory interventions trialed in the project, which will be elaborated on in other WP 7 deliverables (such as *Deliverable 7.8 - Data Collection and Management Guideline Report* and annual iterations thereof).

WP7 and the SCM will continue engagement on how the captured information can be uploaded to the SCM's Lessons Learned section in the most efficient manner and format, with KPI data submission to the SRT providing further insight into +CityxChange project interventions.

5 Conclusion

Although limited, results from the last reporting period indicate progress in the submission of KPI data as the number of KPIs with actual monitoring data submitted to the MERT increased from 13 to 14, with the addition of KPI 1. Although not all KPI calculations have been confirmed, KPI owners have captured and processed KPI data in their own repositories, and shared through means of KPI workshops and internal discussions, in an effort to test and refine the KPI calculation process. Engagement with project partners over the last reporting period has focussed on the refinement and confirmation of KPI calculations in the MERT and the SRT, using the KPI framework developed in *Deliverable 7.1* as a reference to work from. Progress has been made, specifically with the refinement of calculations for KPIs 8, 9, 10, 11, 18 and 25. Due to the unavailability of actual monitoring data for many KPIs and the ongoing implementation of interventions, there is however still uncertainty regarding the KPI calculations as listed in Table 5. This has been compounded by the limitations to engagement and intervention implementation brought on by COVID-19, causing delays and difficulties in the collation and submission of monitoring data.

WP7 will continue to work closely with KPI/data owners to ensure KPI calculation issues are addressed and the MERT and SRT data capturing systems are developed and in place when data becomes available.

Other points to be addressed for the next revision of this deliverable are tabled below.

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 definition. Ongoing process as more data becomes available.
	Collection of qualitative information	Further development of the MERT functionality (or other data repositories) to accept submission of qualitative data/comments from KPI owners. Collection and analysis of data and

		supporting information from KPI owners.
	MERT operationalisation	Improvement of mobile responsiveness. Explore the use of different chart types. Design and layout refinements
	Data Exports	Standardise data sharing license annotation to MERT data exports (in line with DMP specifications). Enable detailed data export.
SCM	General collaboration	Ongoing engagement with the SCM to discuss improvements in the SCM data monitoring capabilities, changes to the SRT, reconfiguration of SRT data input fields, data visualisation options in the SCM
	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 to the SCM. Engage with SCM to configure the most efficient way and format of sharing qualitative feedback, lessons learned, or other formats.

The points mentioned above will be addressed in the next six-month reporting period by M36 as part of ongoing engagement with the relevant project partners and the SCM to ensure efficient capturing, management and exchange of data to the MERT and the SRT.

6 References

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

Annex

This Annex contains the following parts:

- Provisional JSON data format (based on FIWARE framework) for API specification for KPI 18 as set out below.

```json
{
  "meta": {
    "kpi_id": "18",
    "partner_id": "xxxxxxxxxx",
    "unit_of_measurement": "kwh",
    "aggregation_data_resources": [
      {
        "type": "level",
        "value": "Sub-City"
      }
    ],
    "calculation_period": "monthly",
    "date_of_commissioning": "01-01-2019"
  },
  "label": "Capacity Traded",
  "name": "Capacity_traded",
  "kpidata": [
    {
      "month": 1,
      "data": {
        "der": {
          "Solar PV": "",
          "Battery": "",
          "Heat pump": "",
          "Demand response": ""
        },
        "total": {
          "Solar PV": "",
          "Battery": "",
          "Heat pump": "",
          "Demand response": ""
        }
      }
    },
    {
      "...": "..."
    },
    {
      "month": 60,
      "data": {
        "der": {
          "Solar PV": "",
          "Battery": "",
          "Heat pump": "",
          "Demand response": ""
        },
        "total": {
          "Solar PV": "",
          "Battery": "",
          "Heat pump": "",
          "Demand response": ""
        }
      }
    }
  ]
}
```