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Deliverable 9.9

Second update of the Data Management Plan (DMP)

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Authors

Surname	First Name	Beneficiary
Bontekoe	Eelke	UU
Eriksson	Lina	RISE
Schade	Jutta	RISE
Tsarchopoulos	Panagiotis	CERTH
Lampropoulos	Ioannis	UU

In case you want any additional information or you want to consult with the authors of this document, please send your inquiries to: irissmartcities@gmail.com.

Reviewers

Surname	First Name	Beneficiary
Wahlström	Ulrika	IMCG
Purece	Cristian	ICEM

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0.2	10-03-2020	Report D9.9 to be discussed with WP9 team UU
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Executive Summary

The scope of this document is to provide the procedure to be adopted by the project partners and subcontractors to produce, collect and process the data from the IRIS demonstration activities. The adopted procedure follows the guidelines provided by the European Commission in the document Guidelines on FAIR Data Management in Horizon 2020.

This document is based on the Horizon 2020 FAIR Data Management Plan (DMP) template (Version: 26 July 2016) [1], which provides a set of questions that the partners should answer. Furthermore, the Horizon 2020 template from DMP online [2] is utilized to expand the questions and provide more detailed explanations. This third report on DMP, submitted at M30 (spring 2020) of the project, describes a plan for data production, collection and processing, and will be continuously updated until the end of the project, as part of work package 9, WP9 Monitoring and evaluation, activities. Specifically, the DMP will be updated again in M42 (D9.10: Third update on the Data management plan), and in M60 (D9.11: Fourth and final update on the Data management plan).

The development of the DMP is part of the work undertaken in T9.2 Defining the data model and the data management plan for performance and impact measurement (M4-M60). Since the DMP development started in M4 (spring of 2018) of the project, this third report of the DMP provides templates for data reporting and emphasises on the interactions of task 9.2, T9.2 Defining the data model and the data management plan for performance and impact measurement, with other work packages.

An important part of this document is the data management template (DMP). This template is supposed to be used by all partners who produce or handle datasets within the IRIS project. For example the partners responsible for the implementation of the measures in the Lighthouse cities. By making use of this template, it is ensured that the project research data will be 'FAIR', that is findable, accessible, interoperable and re-usable. This is achieved by:

- Making data Findable, including provisions for metadata
- Making data openly Accessible
- Making data Interoperable
- Increase data Re-use (through clarifying licences)

The template is accompanied by a chapter which describes all topics that are required to be filled in. Further on, 3 DMP examples are added to illustrate what is expected, in order to facilitate the task of providing the data.

Besides the Ethical aspects as defined in the DMP template for al 'sub'-projects, a separated chapter is written on these aspects on IRIS level.

After M30 the aggregation of data in the IRIS project will start to take place. Meaning that D9.10 (the third update of the data management plan) will be a version where the templates presented in this document will be largely filled in. Further on D9.10 will include the final template of data collection, which will be mainly defined by the experience built up during the collection of data during the project.

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List of Abbreviations and Acronyms

Abbreviation	Definition
CERTH	Centre For Research And Technology Hellas
CIP	City Innovation Platform
CSV	Comma Separated Values
DMP	Data Management Plan
DoA	Description of the Action
EU	European Union
FAIR	Findable Accessible Interoperable Reusable
FC	Follower City
GA	Grand Agreement
GDPR	General Data Protection Regulation
IMCG	IMCG Sweden AB
IPR	Intellectual Property Rights
IRIS	Integrated and Replicable Solutions for Co-Creation in Sustainable Cities
KML	Keyhole Markup Language
KPI	Key Performance Indicator
LH	Lighthouse City
M	Month (in project)
ORD	Open Research Data
RISE	Research Institutes of Sweden
SCIS	Smart City Innovation System
SCT	Municipality of Santa Cruz de Tenerife
T	Task
TIFF	Tagged Image File Format
TT	Transition Track
UNS	University of Nice Sophia Antipolis
USI	Utrecht Sustainability Institute
UTR	Municipality of Utrecht
UU	Utrecht University
UVA	University of Vaasa
VAASA	City of Vaasa
WP	Work Package

1 Introduction

The Data Management Plan (DMP) consists of a description of the data management life cycle for the data to be produced, collected, and processed, and will include information on the handling of data during and after the end of the project, i.e. what data will be produced, collected, and processed, which methodology and standards will be applied, whether data will be shared and/or made open access, and how data will be curated and preserved (including after the end of the project).

1.1 Scope, objectives and expected impact

The scope of this document is to provide the procedure to be adopted by the project partners and subcontractors to produce, collect and process the research data from the IRIS demonstration activities. The adopted procedure follows the guidelines provided by the European Commission in the document Guidelines on FAIR Data Management in Horizon 2020 [1].

This document has been built based on the Horizon 2020 FAIR DMP template (Version: 26 July 2016), which provides a set of questions that the partners should answer with a level of detail appropriate to the project. The DMP is intended to be a living document where more in-depth information is added through updates, as the implementation of the project progresses and when significant changes occur. As a minimum, the DMP should be updated in the context of the periodic evaluation/assessment of the project.

This third report on DMP, submitted at M30 (31th of March 2020), describes a comprehensive plan for data production, collection and processing, and will be continuously updated until the end of the project, as part of WP9 activities. The most important modification compared to the former versions is the upgrade of the DMP template, which is originally based on the horizon 2020 DMP, and described in the earlier version of the DMP; D9.1 and D9.8 [3] [4]. The main upgrade of this version (D9.9) is that the DMP template chapter has more explanations, to facilitate the users that provide the data. Further on the template itself is rearranged and rotated 90 degrees to make it more clear and better structured.

The next update D9.10 (third update on the Data management plan), which will be delivered in M42, includes a final revision of the information presented in D9.9. This revision will be mainly based on new insights that will arise when data is being managed. Further on D9.10 will be a version that includes the templates of D9.9 filled in with information about the data that is being delivered from the various demonstrator projects within the IRIS framework. D9.11 (M60) will mainly be a continuation of D9.10 which includes the details of all new datasets that will be gathered or aggregated in the period between D9.9 and the moment that each update is being delivered.

The availability and sharing of project data will increase the impact of IRIS **activities**, enabling access to a large number of stakeholders. The DMP considers (see Figure 1):

- Data Types, Formats, Standards and Capture Methods
- Ethics and Intellectual Property
- Access, Data Sharing and Reuse
- Resourcing
- Deposit and Long-Term Preservation
- Short-Term Storage and Data Management

Figure 1. Aspects considered in the data management plan.

1.2 Contributions of partners

The main project partners in T9.2 are Utrecht University (UU), RISE and CERTH. UU, as the leader in T9.2, is responsible for coordinating the activities related to the definition of the data model and the DMP for performance and impact measurement. RISE as the WP9 leader ensures that all activities are in line with other related WPs by establishing communication with the respective WP leaders. Part of this work entails cooperation with ongoing projects, initiatives and communities in WP2 (EU wide cooperation with ongoing projects, initiatives and communities), such as the H2020-SCC CITYKEYS project for smart city performance indicators, and facilitation for all performance data to be incorporated into the database of the EU Smart City Innovation System (SCIS).

In the course of the project, the project partners will be guided by the T9.2 leader and the WP9 leader on how to provide input and report on data to be generated or collected during the project by using the templates listed in this third update on the DMP.

1.3 Relation to other activities

In Figure 2, the timeline for the DMP development within the IRIS project is illustrated, pointing out interactions with other tasks and WPs. The DMP will be further updated in M42 (D9.10: Third update of the Data management plan), and in M60 (D9.11: Fourth and final update of the Data management plan).

WP9 (Monitoring and Evaluation) and WP4 (City Innovation Platform) activities are connected (including the linkage to activities in T4.3 'Data Governance Plan' which is meant to facilitate a smooth, secure and reliable flow of data, including the description of supporting processes and assets, and addressing privacy and ethical issues). The work in T9.2 will be performed in close and continuous collaboration with WP 5-7 (Lighthouse cities Utrecht, Nice and Gothenburg) to ensure that the DMP addresses data and relevant developments from the IRIS demonstration activities in the LH. Furthermore, with respect to ethical aspects each LH and FC will have its own Ethics Committee and

one person will be nominated per site as responsible for following the project's recommendations and the National and European legislations (See Section 4.2), thus linking WP9 to WP 5-7 and to WP8 (Replication by Lighthouse regions, Follower cities, European market uptake). Finally, T9.2 will also ensure privacy and security of sensitive information, for legal or ethical reasons, for issues pertaining to personal privacy, or for proprietary concerns linking to WP3.

The data management plan on a first glance might have some similarities with D9.5 (Data model and management plan for integrated solutions) and D9.5 (Report on monitoring framework in LH cities and established baseline). The main differences are that the data management plan and its updates have its primary focus on the definition of datasets while D9.5 defines the variables within these sets, and how these variables determine the KPIs.

1.4 Structure of the deliverable

Section 2 Methodology: How the Data management template is defined and updated. How data will be gathered from project partners.

Section 3 Data Management Template: Introduces and explains all topics that are mentioned in the Data Management Template. This chapter can also be used as a guide to fill in the template.

Section 4 Ethical aspects: Refers to the ethical aspects that arise during the production and utilization data in the IRIS project**.**

T2.3 CITYKEYS and SCIS (M1-M60)

WP5 Utrecht Lighthouse City demonstration activities

WP6 Nice Lighthouse City demonstration activities

WP7 Gothenburg Lighthouse City demonstration activities

T9.1 Specification of the monitoring and evaluation methodology and KPIs definition (M1-M12)

T9.3 Establishment of a unified framework for harmonized data gathering, analysis and reporting (M9-M24)

T9.2 Defining the data model and the data management plan for performance and impact measurement (M4-M60)

M6   M12   M18   M30   M42   M60

D9.1: First report on the DMP

D9.9: Second update on the DMP

D9.11: Fourth and final update on the DMP

D9.8: First update on the DMP

D9.10: Third update on the DMP

D9.3: Data model and management plan for integrated solutions

IRIS WP9 Workshops in March - April 2018 on Monitoring Strategy

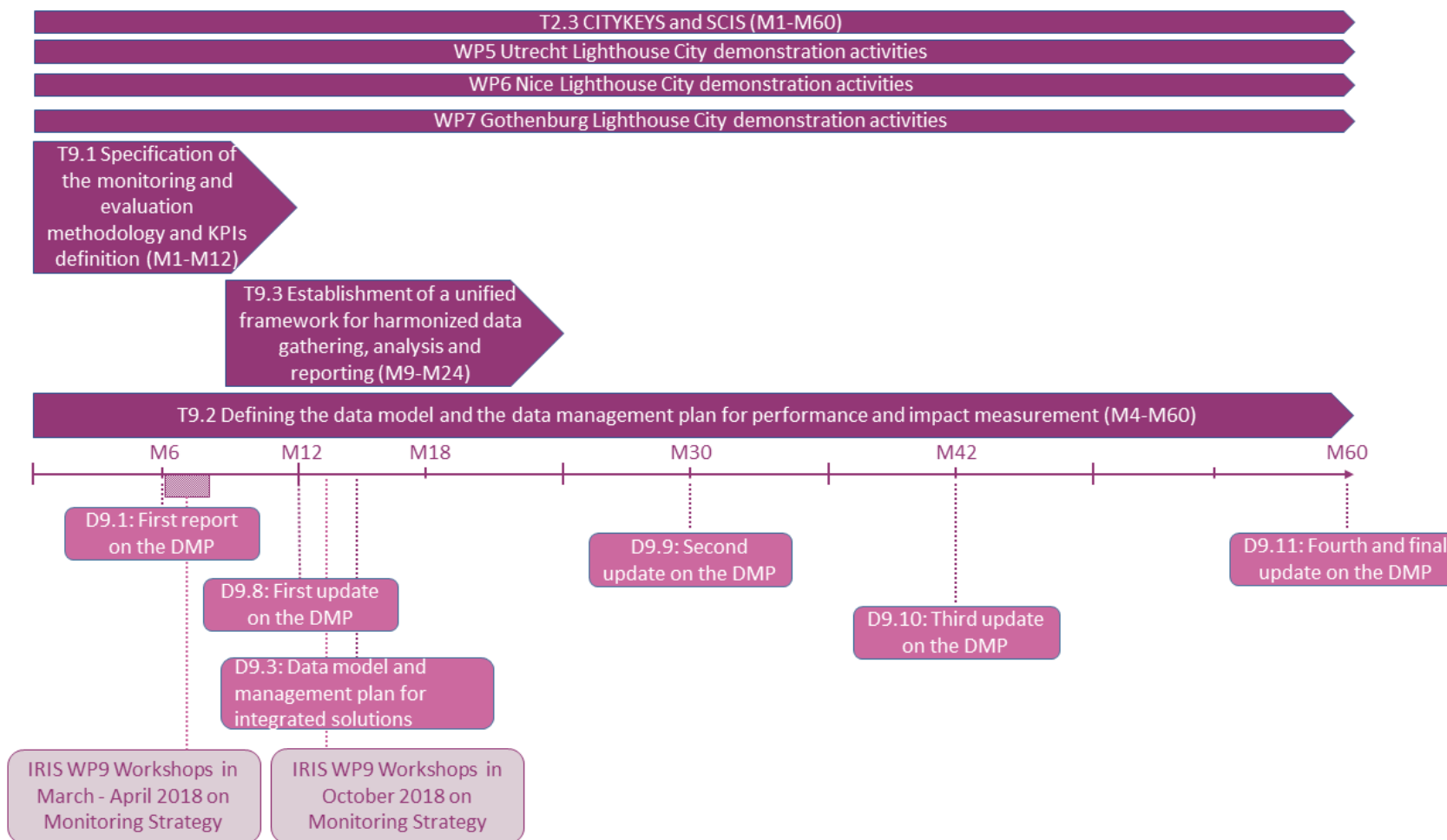IRIS WP9 Workshops in October 2018 on Monitoring Strategy

Figure 2. Timeline for the DMP development within the project duration, indicating interactions with other work tasks and packages.

2 Methodology

The IRIS project is a large project, which consists of many smaller subprojects. Each subproject has its own plan for data management. The IRIS data management plan therefore is a combination of several plans. To make sure that these subplans contain all required information about the data the following methodology is developed.

The DMP template is originally based on the horizon 2020 DMP, and described in the earlier version of the DMP; D9.1 and D9.8 [3] [4]. New insights that arose from the continues work on the monitoring and evaluation (WP9), lead to the updates made in this report. Especially the development of the description of the monitoring plans of the measures in the lighthouse cities (D9.5: Report on monitoring framework in LH-cities and established baseline [5]) . The main upgrade of this version (D9.9) is that the DMP template has more explanation and examples, to facilitate the users with providing the data.

The figure below explains the methodology for updating the DMP and its template which is described in the following paragraphs.
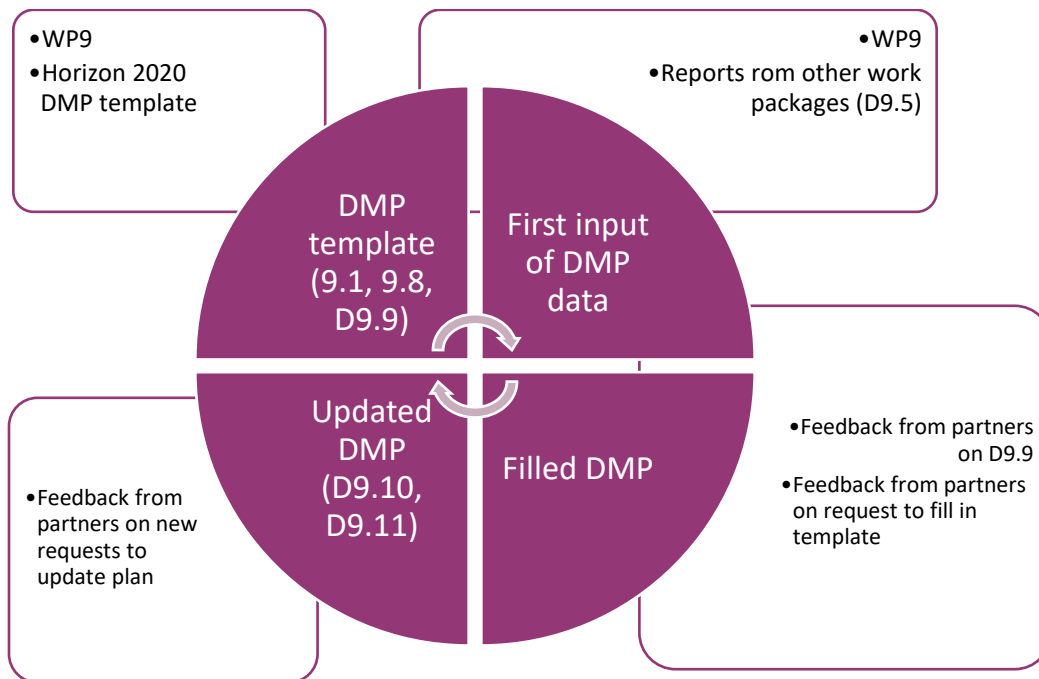
Figure 3 Methodology for updating DMP and DMP template

2.1 Development of DMP template

The first quarter of Figure 3 stands for the first versions of the DMP as it is developed by the WP9 team (D9.1, D9.8 and D9.9). Based on the Horizon 2020 template and DMP online. The explanations in the DMP template are partly acquired from DMP online [2], which is a website that is built to manage DMP-plans. Instead of making use of this website for creating plans for all subprojects, an Excel template is made to share with the project partners. This approach is chosen for the following reasons:

- Ease of use:
  - Partners are familiar with the use of Excel
  - Files are easy to share and update within the Emdesk repository (the IRIS project's internal portal), no new logins are required. Plans are saved together with all project data.
- Differences compared to online template:
  - In consultation with different partners that are dealing with data management of their projects, the IRIS DMP template has some additional questions.
  - Explanation of certain topics in the IRIS plan is more detailed / more related directly to the project.

The DMP template is included in this document in Appendix A4 and further described in chapter 3.

2.2 First input of DMP data

The next step in developing the template is illustrated with the second quarter in Figure 3. Different reports in the IRIS project already describe where and how certain datasets are generated. Especially D9.5 (Report on monitoring framework in LH cities and established baseline) provides a detailed overview of many data variables [5]. With this information at hand, a first compilation of DMP-subplans from several projects is obtained. This will be done by WP9 in the following months (M31, M32). Appendix A5 provides a few examples of a prefilled DMP subplan.

2.3 Revision of DMP data

As soon as the first input into the DMP template is done, project partners who are responsible for the development of datasets within the IRIS project, will be made aware of the template and the pre-filled data (3rd quarter in Figure 3).

With the request to:

- Check if prefilled data is correct
- Update blank fields as far as possible
- In case fields remain blank because the required input is still unknown, the partners provide information about if, how and when the input will be made clear.
- 3 months before the 3rd update of the DMP (M39), a new request will be sent out to the partners to update their data management plans. This will be the input for D9.10

2.4 Revision for DMP template

The DMP template is, just like the DMP itself, a working document. Even though a lot of effort has been put in the content, questions from partners or new insights will lead to further improvement of the plan. Each time a revision is made, the template file will be updated. D9.10 will therefore also include an updated version of the DMP template.

3 Data management template

The data management template (DMP) is supposed to be used by all partners who produce or handle datasets within the IRIS project. For example, the partners responsible for the implementation of the measures in the Lighthouse cities. The DMP provides short descriptions for each topic and an example. This information will most likely not be able to provide clarity in all cases, therefore this chapter contains a detailed description of all requested topics in the DMP template. When completing the template for a project, this description should be used in order to make sure that the proper data will be filled in.

The table below shows a small excerpt of the template, which consists of the first 4 columns.

- **Section:** The main theme of the underlying topics
- **Topic:** The requested topic of each dataset entry
- **Info:** Short description for each topic
- **DMP §:** Reference to the paragraph in the Data Management Plan (D9.9) for more info

The adjacent column(s) will be used by the project partners to provide the requested data. The full template is presented in appendix A4.

Table 1 Excerpt of the Data Management Plan Template

Section	Topic	Info	DMP §
Data summary			
	Title of dataset	Each dataset should have a unique name which is self-explanatory.	3.1.1
	City	Specify the relevant city for the corresponding data set.	3.1.2
	Transition track	Specify to which specific transition track(s) the data is mainly related. If this is not clear, leave blank.	3.1.3
	Integrated solution	Specify to which specific integrated solution(s) the data is mainly related. If this is not clear, leave blank.	3.1.4

Additional to the examples in this chapter, 3 DMP examples are added to illustrate what is expected in Appendix A5.

3.1 Data summary

The first section of the table summarizes identification information of the data to be generated or collected during the project. This table includes standardised items and lists as described below.

3.1.1 Title of data set

Each dataset should have a unique name which is self-explanatory.

When defining a name, keep the following in mind:

- There is no general rule of what data is covered per dataset. It could be all data being managed in one transition track of a city, but the dataset could also cover 1 integrated solution only. Datasets which are not clearly related to any transition track are also possible.
- If using abbreviations in the name, make sure that they are commonly understood.
- Since more information about the dataset is covered in later parts of the data management plan, it could be helpful to reconsider the title after having completed the full template.

3.1.2 City

Specify the relevant city (Lighthouse or Follower) for the corresponding data set.

3.1.3 Transition track

Specify to which specific transition track(s) the data is mainly related. If this is not clear, leave blank.

3.1.4 Integrated solution

Specify to which specific integrated solution(s) the data is mainly related. If this is not clear, leave blank.

3.1.5 Purpose

State the purpose of the data collection/generation.

Why is this dataset generated? What is it used for? Are there certain KPIs related to the data collection?

3.1.6 Relation to project objective

Select the objective of the project (1-8) that relates to the purpose of the data to be generated or collected:

- Objective 1: Demonstrate solutions at district scale integrating smart homes and buildings, smart renewables and closed-loop energy positive districts
- Objective 2: Demonstrate smart energy management and storage solutions targeting Grid flexibility
- Objective 3: Demonstrate integrated urban mobility solutions increasing the use of environmentally friendly, alternative fuels, creating new opportunities for collective mobility and lead to a decreased environmental impact
- Objective 4: Demonstrate the integration of the latest generation ICT solutions with existing city platforms over open and standardised interfaces enabling the exchange of data for the development of new innovative services
- Objective 5: Demonstrate active citizen engagement solutions providing an enabling environment for citizens to participate in co-creation, decision making, planning and problem solving within the Smart Cities
- Objective 6: Put in practice bankable business models over proposed integrated solutions, tested to reduce technical and financial risks for investors guaranteeing replicability at EU scale

- Objective 7: Strengthening the links and active cooperation between cities in many Member States with a large coverage of cities with different size, geography, climatic zones and economical situations
- Objective 8: Measure and validate the demonstration results after a 3-years large-scale demonstration at district scale within 3 highly innovative EU cities

3.1.7 Data type

Give a summary of the data you will collect or create, noting the content, coverage and data type, e.g., tabular data, survey data, experimental measurements, models, software, audio-visual data, physical samples, etc.

3.1.8 Data formats

Specify what data formats are used to store the data:

- Clearly note what format(s) the data will be in, e.g., plain text (.txt), comma-separated values (.csv), geo-referenced TIFF (.tif, .tfw).

- Explain why you have chosen certain formats. Decisions may be based on staff expertise, a preference for open formats, the standards accepted by data centers or widespread usage within a given community.

- Using standardized, interchangeable or open formats ensures the long-term usability of data; these are recommended for sharing and archiving.

- See UK Data Service guidance on recommended formats or Data ONE Best Practices for file formats [6] [7]

Examples of format[1] of data to be generated/collected:

- Geo-referenced TIFF (TIF, TFW)
- Hypertext Markup Language (HTML)
- Keyhole Markup Language (KML)
- MS Word (DOC/DOCX)
- MS Excel (XLS/XLSX)
- ASCII text-formatted data (TXT)
- CAD data (DWG)
- Comma-separated values (CSV)
- dBase (DBF)
- eXtensible Mark-up Language (XML)

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[1] **Note:** When choosing the right **format** for **open data**[1] it is recommended to start with comma separated values (CSV) files. CSV is perfect for tabular data and can be easily loaded into and saved from applications like Excel, making it accessible to users. For geospatial open data formats, formats to be considered are geoJSON (based upon JavaScript Object Notation - JSON) and Keyhole Markup Language (KML) which is based upon Extensible Markup Language – XML. These formats are specifically designed with usability in mind and can easily be imported and exported from specialist mapping tools like Open Street Map and CartoDB.

- MS Access (MDB/ACCDB)
- OpenDocument Spreadsheet (ODS)
- Open Document Text (ODT)
- Rich Text Format (RTF)
- SPSS portable format (POR)

- Tab-delimited file (TAB)
- Geospatial open data based upon JavaScript Object Notation (GeoJSON)

3.1.9 Re-use of existing data

Specify if existing data is being reused.

- For example, the use of weather data, or baseline data from other databases.
- If purchasing or reusing existing data, explain how issues such as copyright and Intellectual Property Rights (IPR), have been addressed. You should aim to minimize any restrictions on the reuse (and subsequent sharing) of third-party data.

3.1.10 Origin of the data

Specify in plain text the origin(s) of the data. For example, a smart meter, results of a survey. Or maybe a combination.

3.1.11 Expected size of the data

Specify the expected size of the data and add the appropriate units: Megabytes (MB), Gigabytes (GB) or Terabytes (TB).

- Indicate the proportions of raw data, processed data, and other secondary outputs (e.g., reports).

- Consider the implications of data volumes in terms of storage, access and preservation. Do you need to include additional costs?

- Consider whether the scale of the data will pose challenges when sharing or transferring data between sites; if so, how will you address these challenges?

3.1.12 Data utility

Specify at least the most important work packages (WP) or tasks (T) in the IRIS project to which the data is related.

- How might your data be reused in other contexts?
- To whom / which fields of research might your data be useful?

3.2 Fair data

The IRIS project partners will ensure that the project research data will be 'FAIR', that is findable, accessible, interoperable and re-usable.

For all the data produced and/or used in the project, the project partners will put effort in:

- Making data Findable, including provisions for metadata
- Making data openly Accessible
- Making data Interoperable
- Increase data Re-use (through clarifying licences)

More information about FAIR can be accessed through the FORCE11 community [8]. The following paragraphs cover all topics that should be treated for each dataset to make sure that FAIR data will be achieved within the IRIS project.

3.2.1 Metadata provision

Outline the discoverability of data (metadata provision)

- What metadata will be provided to help others identify and discover the data?

- Researchers are strongly encouraged to use community metadata standards where these are in place. The Research Data Alliance offers a Directory of Metadata Standards. Data repositories may also provide guidance about appropriate metadata standards [9].

- Consider what other documentation is needed to enable reuse. This may include information on the methodology used to collect the data, analytical and procedural information, definitions of variables, units of measurement, any assumptions made, the format and file type of the data and software used to collect and/or process the data.

- Consider how you will capture this information and where it will be recorded, e.g., in a database with links to each item, in a 'readme' text file, in file headers, etc.

3.2.2 Identifiability

Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers?

3.2.3 Naming conventions

Outline naming conventions used.

For example:

- Using of capitals letters to delimit words, instead of spaces
- Stating dates back to front: YYYYMMDDHHMM
- The meaning of abbreviations used in the datasets.

3.2.4 Search keywords

Outline the approach towards search keywords, for example:

- A table of keywords for the dataset has been developed by the project leaders.
- Keywords and their hierarchy were produced in consultation with ….
- Keywords will be reviewed and updated with each revision of the dataset.

3.2.5 Versioning

Outline the approach for clear versioning, for example:

- Including the version number in the file names and within the documents.
- A version control table to provide further details on changes to a document/ file.

3.2.6 Open Data

Specify which data will be made openly available. If some data is kept closed provide rationale for doing so.

Participating in the Open Research Data (ORD) Pilot does not necessarily mean opening all your research data. Rather, the ORD pilot follows the principle **"as open as possible, as closed as necessary"** and focuses on encouraging sound data management as an essential part of research best practice.

The EU Commission recognizes that there are good reasons to keep some or even all research data generated in a project closed. Where data need to be shared under restrictions, explain why, clearly separating legal and contractual reasons from voluntary restrictions.

Note that in multi-beneficiary projects it is also possible for specific beneficiaries to keep their data closed if relevant provisions are made in the consortium agreement and are in line with the reasons for opting out.

3.2.7 Availability

Specify how the data will be made available.

For example, by deposition in a repository. The Registry of Research Data Repositories provides a useful listing of repositories that you can search to find a place of deposit [10].

If you plan to deposit in a repository, it is useful to explore appropriate arrangements with the identified repository in advance.

3.2.8 Accessibility (software / method)

Specify what methods or software tools are needed to access the data. Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)?

3.2.9 Deposition / storage

Specify where the data and associated metadata, documentation and code are deposited.

- Where will the data be deposited? If you do not propose to use an established repository, the data management plan should demonstrate that the data can be curated effectively beyond the lifetime of the grant.

- It helps to show that you have consulted with the repository to understand their policies and procedures, including any metadata standards, and costs involved.

- An international list of data repositories is available via re3data and some universities or publishers provide lists of recommendations e.g., PLOS ONE recommended repositories. [11]

3.2.10   Access restrictions

Specify how access will be provided in case there are any restrictions.

For example, is there a need for a data access committee?

3.2.11   Interoperability

Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability.

Interoperability means allowing data exchange and re-use between researchers, institutions, organisations, countries, etc. (i.e. adhering to standards for formats, as much as possible compliant with available (open) software applications and facilitating re-combinations with different datasets from different origins.

3.2.12   Vocabulary

Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability. If not, will you provide mapping to more commonly used ontologies?

3.2.13   License

Specify how the data will be licensed to permit the widest reuse possible.

The EUDAT B2SHARE tool includes a built-in license wizard that facilitates the selection of an adequate license for research data [12].

3.2.14   When available? (embargo?)

Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is required.

Reasons for embargoes may include time to publish or seek patents. If an embargo is sought, specify why and for how long, bearing in mind that research data should be made available as soon as possible. Research funders expect timely release. They typically allow embargoes but not prolonged exclusive use.

3.2.15   Restrictions for use

Specify whether the data produced and/or used in the project is useable by third parties, after the end of the project. If the re-use of some data is restricted, explain why.

Who will be able to use your data? If you need to restrict access to certain communities or apply data sharing agreements, explain why.

Consider strategies to minimise restrictions on sharing. These may include anonymising or aggregating data, gaining participant consent for data sharing, gaining copyright permissions, and agreeing a limited embargo period.

3.2.16　Quality assurance

Describe data quality assurance processes.

- Explain how the consistency and quality of data collection will be controlled and documented. This may include processes such as calibration, repeat samples or measurements, standardised data capture, data entry validation, peer review of data or representation with controlled vocabularies.
- See the DataOne Best Practices for data quality. [7]

3.2.17　Preservation

Specify the length of time for which the data will remain re-usable.

3.3 Allocation of resources

Note that costs related to open access to research data are eligible as part of the Horizon 2020 grant (if compliant with the Grant Agreement conditions). [13]

Costs are eligible for reimbursement during the duration of the project under the conditions defined in the H2020 Grant Agreement, in particular Article 6 and Article 6.2.D.3, but also other articles relevant for the cost category chosen.

3.3.1 Costs for FAIR data

Estimate the costs for making your data FAIR. Describe how you intend to cover these costs

- Carefully consider and justify any resources needed to deliver the plan. These may include storage costs, hardware, staff time, costs of preparing data for deposit and repository charges.
- Outline any relevant technical expertise, support and training that is likely to be required and how it will be acquired.
- If you are not depositing in a data repository, ensure you have appropriate resources and systems in place to share and preserve the data. See UK Data Service guidance on costing data management.

3.3.2 Responsibilities

Clearly identify responsibilities for data management in your project.

3.3.3 Costs for preservation

Describe costs and potential value of long-term preservation. Consider who decides what data will be kept and for how long.

3.4 Data security

Address data recovery as well as secure storage and transfer of sensitive data. Also consider whether the data is safely stored in certified repositories for long term preservation and curation.

For all the data produced and/or used in the project, the project partners will ensure data security. For each described dataset the partners will state the provisions taken for data security. This includes data recovery as well as secure storage and transfer of sensitive data. Further on, it defines how long-term preservation and curation in certified repositories will take place.

3.5 Ethical aspects

Consider whether there are any ethical or legal issues than can have an impact on data sharing. For example, is informed consent for data sharing and long-term preservation included in questionnaires dealing with personal data?

- Investigators carrying out research involving human participants should request consent to preserve and share the data. Do not just ask for permission to use the data in your study or make unnecessary promises to delete it at the end.

- Consider how you will protect the identity of participants, e.g., via anonymization or using managed access procedures.

- Ethical issues may affect how you store and transfer data, who can see/use it and how long it is kept. You should demonstrate that you are aware of this and have planned accordingly.

- See chapter 4

- See UK Data Service guidance on consent for data sharing.

- See ICPSR approach to confidentiality and Health Insurance Portability and Accountability Act (HIPAA) regulations for health research.

3.6 Other

Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any).

- Consider whether there are any existing procedures that you can base your approach on. If your group/department has local guidelines that you work to, point to them here.

List any other relevant funder, institutional, departmental or group policies on data management, data sharing and data security.

4 Ethical aspects on project level

Apart from the ethical aspects as described in 3.5 for each subproject within IRIS, ethical aspects are also considered on IRIS level, these are briefly described in this chapter. More information can be found in the ethics deliverables D12.1: H - Requirement No. 1 and D12.2: POPD - Requirement No.2 [14] [15]

For all the data produced and/or used in the project, the project partners will take into account ethical aspects. Specifically, the project partners will address all obligations as described in the Description of the Action (DoA), in ARTICLE 34 'ETHICS AND RESEARCH INTEGRITY' [13]. Thus, the IRIS project will assure the investigation, management and monitoring of ethical and privacy issues that could be relevant to its envisaged technological solution and will establish a close cooperation with the Ethics Helpdesk of the European Commission. The consortium is aware that several privacy and data protection issues could be raised by the activities (in WP5, WP6 and WP7) to be performed in the scope of the project. The project involves the carrying out of data collection in all LHs and FCs in order to assess the effectiveness of the proposed solutions. For this reason, human participants will be involved in certain aspects of the project and data will be collected. This will be done in full compliance with any European and national legislation and directives relevant to the country where the data collections are taking place, as well as with the EU General Data Protection Regulation (GDPR), which replaces the Directive 95/46/EC, with enforcement date the 25th May 2018 [16].

4.1 IRIS Ethical Policy

IRIS will follow the opinions of various expert committees in the field (e.g. the European group on ethics in science and new technologies to the European Commission. In addition, all national legal and ethical requirements of the Member States where the research is performed will be fulfilled. Any data collection involving humans will be strictly held confidential at any time of the research. This means in detail that:

- All the test subjects will be informed and given the opportunity to provide their consent to any monitoring and data acquisition process that all the subjects will be strictly volunteers and all test volunteers will receive detailed oral information.
- No personal or sensitive data will be centrally stored. In addition, data will be scrambled where possible and abstracted in a way that will not affect the final project outcome.

In addition, they will receive in their own language:

- A commonly understandable written description of the project and its goals.
- The planned project progress and the related testing and evaluation procedures.
- Advice on unrestricted disclaimer rights on their agreement.

On the other hand, an Ethics Helpdesk will scrutinise the research, to guarantee that no undue risk for the user, neither technically nor related to the breach of privacy, is possible. Thus, the IRIS consortium shall implement the research project in full respect of the legal and ethical national requirements and code of practice. Whenever authorisations must be obtained from national bodies, those authorisations shall be considered as documents relevant to the project. Copies of all relevant authorisations shall be submitted to the EU Commission prior to commencement of the relevant part of the research project.

4.2 IRIS Ethics Helpdesk

All used assessment tools and protocols within IRIS' LHs and FCs will be verified beforehand by its Ethics helpdesk regarding their impact to business actors and end users before being applied to the sites. The helpdesk takes responsibility for implementing and managing the ethical and legal issues of all procedures in the project, ensuring that each of the partners provides the necessary participation in IRIS and its code of conduct towards the participants. Each LH and FC will have its own Ethics Committee and one person will be nominated per site as responsible for following the project's recommendations and the National and European legislations.

4.3 Data to be collected within IRIS' LHs and FCs

Data will be both manually and automatically collected by smart sensors and other proprietary equipment installed at selected areas during the execution of the demonstration activities and will be further investigated by WP5, WP6 and WP7. In most cases the collected data will be data needed for monitoring the contextual conditions of the pilot areas (energy consumption, energy production, temperature, humidity, weather etc.). Since some of the collected data in the latter case may involve sensitive personal data, all provisions for data management will be made in compliance with national and EU legislation: Including the European Network for Information and Security Agency[2] security measures to minimise the risk to data protection arising from smart metering and the British Sociological Association's Statement of Ethical Practice as described in the following paragraphs.

The project research data will be collected in two phases:

- Before the implementation of the demonstration activities in the LH (for baselines, references and design data).
- After the implementation of the demonstration activities in the LH (for evaluation purposes).

The consent procedure for the pilot use case realisation at each of the selected pilot sites will make use of a template of a consent form, to be adopted as required per pilot use case. Such a template is included in Consent form template. These templates are provided in English, but should be translated into the most important spoken languages of the related Lighthouse Cities in order to be understood by the associated persons.

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A1. Summary Table

Table 2 provides a summary of all the issues to be covered in the DMP and will be used as a checklist for all reported datasets in the update of the DMP.

Table 2 Summary table - FAIR Data Management at a glance.

DMP component	Issues to be addressed
1. Data summary	• State the purpose of the data collection/generation • Explain the relation to the objectives of the project • Specify the types and formats of data generated/collected • Specify if existing data is being re-used (if any) • Specify the origin of the data • State the expected size of the data (if known) • Outline the data utility: to whom will it be useful
2. FAIR Data 2.1. Making data findable, including provisions for metadata	• Outline the discoverability of data (metadata provision) • Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers? • Outline naming conventions used • Outline the approach towards search keyword • Outline the approach for clear versioning • Specify standards for metadata creation (if any). If there are no standards in your discipline describe what type of metadata will be created and how

2.2 Making data openly accessible	• Specify which data will be made openly available? If some data is kept closed provide rationale for doing so • Specify how the data will be made available • Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)? • Specify where the data and associated metadata, documentation and code are deposited • Specify how access will be provided in case there are any restrictions
2.3. Making data interoperable	• Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability. • Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability? If not, will you provide mapping to more commonly used ontologies?
2.4. Increase data re-use (through clarifying licences)	• Specify how the data will be licenced to permit the widest reuse possible • Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed • Specify whether the data produced and/or used in the project is useable by third parties, after the end of the project? If the re-use of some data is restricted, explain why • Describe data quality assurance processes • Specify the length of time for which the data will remain re-usable
3. Allocation of resources	• Estimate the costs for making your data FAIR. Describe how you intend to cover these costs • Clearly identify responsibilities for data management in your project • Describe costs and potential value of long-term preservation
4. Data security	• Address data recovery as well as secure storage and transfer of sensitive data
5. Ethical aspects	• To be covered in the context of the ethics review, ethics section of DoA and ethics deliverables. Include references and related technical aspects if not covered by the former
6. Other	• Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any)

A2. Further support in developing the DMP

The Research Data Alliance provides a Metadata Standards Directory that can be searched for discipline-specific standards and associated tools.

The EUDAT B2SHARE tool includes a built-in license wizard that facilitates the selection of an adequate license for research data.

Useful listings of repositories include: Registry of Research Data Repositories

Some repositories like Zenodo, an OpenAIRE and CERN collaboration), allow researchers to deposit both publications and data, while providing tools to link them.

Other useful tools include DMP online and platforms for making individual scientific observations available such as ScienceMatters.

A3. Consent form template

IRIS
Integration and Replication for Sustainable Cities

Consent Form

Project Purpose
- *A commonly understandable written description of the project and its goals even for people that are not familiar to the project scope (2-3 paragraphs)*

Project Progress Schedule
- *The progress schedule of the project and the related testing and evaluation procedures (1-2 paragraphs)*

Disclaimer Rights
- *Advice on unrestricted disclaimer rights on their agreement.*

Voluntary Participation Form

1. General Information
   - *Participant basic information*
   - *ID (reference code) of the participant, which will be used throughout the pilot trial execution)*
2. Study Information
   - *Details about the Demonstration*
3. Participant's Questionnaire
   - *has been fully informed on the purpose, duration, procedures of the study;*
   - *has been informed on the rights to deny participating or to quit from the study and about the corresponding consequences.*
   - *has been informed on the contact person in case that I have questions and queries about the study.*
   - *had adequate time to make my decision concerning my participation in the study.*
   - *comprehend that he/she can quit from the study at any time without having to justify his/her decision.*
   - *has been informed about potential effects, difficulties and dangers.*
   - *has been informed about the sensors equipment that will be used to collect data.*
   - *has been informed about the security of the study data and results.*
   - *has been ensured about the confidentiality of his/her personal information. Publications of the study results do not allow the personal data recognition, due to the principle of anonymity. Always under the confidentiality principles.*
4. Signed Consent to Participate
   - *A signed consent of the participant allowing the study responsible to examine and inspect the data collected during the study.*

A4. Data management plan template

Section	Topic	Info	DMP §
Data summary			
	Title of dataset	Each dataset should have a unique name which is self-explanatory.	3.1.1
	City	Specify the relevant city for the corresponding data set.	3.1.2
	Transition track	Specify to which specific transition track(s) the data is mainly related. If this is not clear, leave blank.	3.1.3
	Integrated solution	Specify to which specific integrated solution(s) the data is mainly related. If this is not clear, leave blank.	3.1.4
	Purpose	State the purpose of the data collection/generation	3.1.5
	Relation to project objective	Select the objective of the project (1-8) that relates to the purpose of the data to be generated or collected (check sheet 'project objectives' or D9.9 for full list)	3.1.6
	Data types	Give a summary of the data you will collect or create	3.1.7
	Data formats	Specify what data formats are used to store the data	3.1.8
	Re-use of existing data	Specify if existing data is being reused.	3.1.9
	Origin of the data	Specify in plain text the origin of the data. For example, a smart meter, results of a survey,	3.1.10
	Expected size of the data	Specify the expected size of the data and add the appropriate units:	3.1.11
	Data utility	To whom will the data be useful? Specify at least the most important work packages (WP) or tasks (T) to which the data is related.	3.1.12
FAIR data			
Findable	**Metadata provision**	Outline the discoverability of data (metadata provision)	3.2.1
	Identifiability	Outline the identifiability of data and refer to standard identification mechanism. Do you make use of persistent and unique identifiers such as Digital Object Identifiers?	3.2.2
	Naming conventions	Outline naming conventions used	3.2.3

Section	Topic	Info	DMP §
Available	**Search keywords**	Outline the approach towards search keywords	3.2.4
	Versioning	Outline the approach for clear versioning	3.2.5
	Open data	Specify which data will be made openly available? If some data is kept closed provide rationale for doing so	3.2.6
	Availability	Specify how the data will be made available	3.2.7
	Accessibility (software / method)	Specify what methods or software tools are needed to access the data? Is documentation about the software needed to access the data included? Is it possible to include the relevant software (e.g. in open source code)?	3.2.8
	Deposition / storage	Specify where the data and associated metadata, documentation and code are deposited	3.2.9
	Access restrictions	Specify how access will be provided in case there are any restrictions	3.2.10
Interoperable	**Interoperability**	Assess the interoperability of your data. Specify what data and metadata vocabularies, standards or methodologies you will follow to facilitate interoperability.	3.2.11
	Vocabulary	Specify whether you will be using standard vocabulary for all data types present in your data set, to allow inter-disciplinary interoperability? If not, will you provide mapping to more commonly used ontologies?	3.2.12
Reusable	**License**	Specify how the data will be licensed to permit the widest reuse possible	3.2.13
	When available? (embargo?)	Specify when the data will be made available for re-use. If applicable, specify why and for what period a data embargo is needed	3.2.14
	Restrictions for use	Specify whether the data produced and/or used in the project is useable by third parties, after the end of the project. If the re-use of some data is restricted, explain why	3.2.15
	Quality assurance	Describe data quality assurance processes	3.2.16
	Preservation	Specify the length of time for which the data will remain re-usable	3.2.17
Allocation of resources			
	Costs for fair data	Estimate the costs for making your data FAIR. Describe how you intend to cover these costs	3.3.1
	Responsibilities	Clearly identify responsibilities for data management in your project	3.3.2

Section	Topic	Info	DMP §
	Costs for preservation	Describe costs and potential value of long-term preservation	3.3.3
Data security		Address data recovery as well as secure storage and transfer of sensitive data	3.4
Ethical aspects		To be covered in the context of the ethics review, ethics section of DoA and ethics deliverables. Include references and related technical aspects if not covered by the former	3.5
Other		Refer to other national/funder/sectorial/departmental procedures for data management that you are using (if any)	3.6

A5. DMP examples

Example 1

Section	Topic	Example 1
Data summary		
	Title of dataset	EnergyDataToon
	City	Utrecht
	Transition track	Mainly related to TT1, also partly related to TT5
	Integrated solution	1.1, 1.4, 1.5
	Purpose	Data is collected through the HEMS Toon device for the following purposes: -Calculation of the annual energy production of the installed solar panels -Calculation of the Electrical energy consumption of the households before, after and during renovation -Calculation of the Thermal energy consumption of the households before, after and during renovation
	Relation to project objective	Objective 1: Demonstrate solutions at district scale integrating smart homes and buildings, smart renewables and closed-loop energy positive districts
	Data types	The data mainly consists of tabular data with floating point numbers
	Data formats	The data is stored in CSV files, metadata in ODF files
	Re-use of existing data	Non-reuse of existing data
	Origin of the data	Toon is a Home Energy Management System (HEMS) which uses a smart meter as input
	Expected size of the data	For the whole project this will not exceed 10 GB
	Data utility	WP9, WP5. The data is useful for people interested in: -NZEB refurbishment -Energy use of households -PV production -Home Energy Management Systems -Smart electric heat pumps
FAIR data		
Findable	**Metadata provision**	The dataset description on the CIP will include a readme file (in ODF) format, which provides specific information about the dataset

Section	Topic	Example 1
Available	Identifiability	Not known yet
	Naming conventions	No naming conventions
	Search keywords	
	Versioning	Each time the dataset is saved or updated, the date and time will be added to the name in the form: YYMMDD
	Open data	15 minute data, aggregated per apartment building will be made openly available. Aggregation up to this level must be done to protect privacy
	Availability	The data will be made available through the CIP
	Accessibility (software / method)	The use of CSV makes it accessible without special tools
	Deposition / storage	Raw data will be stored on servers of Qubie
	Access restrictions	Access to aggregated data can be done through the data market of the CIP
Interoperable	Interoperability	
	Vocabulary	
Reuseable	License	CC
	When available? (embargo?)	The data is available as soon as it is connected to the CIP
	Restrictions for use	Use of aggregated data is free to reuse
	Quality assurance	Quby automatically deletes extreme outliers from the dataset
	Preservation	The data will remain available until 2030
Allocation of resources		
	Costs for fair data	Costs for fair data are expected to be around 5k € for the whole project, this is being paid partly from the project budget and partly from the general costs for IT services
	Responsibilities	Eneco is the owner of the data and has the responsibility towards its customers to respect their privacy. It has the responsibility towards the IRIS project to make data available for scientific research. Quby is the …. And ….. Civity is the dataplatform and ... and ....
	Costs for preservation	Costs for storage of 1GB of data for 10 years are negligable
Data security		Sensitive data is only accessible through a username and password.

Section	Topic	Example 1
Ethical aspects		All privacy sensitive data will be protected as described in XXX. Acces and utilization of the data is only allowed as described in XX
Other		

Example 2

Section	Topic	Example 2
Data summary		
	Title of dataset	BRF Viva EMS data
	City	Gothenburg
	Transition track	TT1 and TT2
	Integrated solution	1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.4
	Purpose	Data is collected to the advanced energy management system of Brf Viva to: -Implement intelligent control of the installations in order to optimize the use of them -Follow up and evaluation of performance of the installations
	Relation to project objective	Objective 1: Demonstrate solutions at district scale integrating smart homes and buildings, smart renewables and closed-loop energy positive districts. Objective 2: Demonstrate smart energy management and storage solutions targeting Grid flexibility.
	Data types	The data mainly consists of floating-point numbers.
	Data formats	Data is delivered to IRIS in XLS files? Or CSV?
	Re-use of existing data	
	Origin of the data	In Brf Viva there are smart meters gathering data to the energy management system.
	Expected size of the data	Expected to be some MB.
	Data utility	WP9, WP7. The data is useful for people interested in: - Advanced energy management system to optimize storage and utilization of renewable energy
FAIR data		
Findable	Metadata provision	The dataset will include a readme file providing specific information about the dataset
	Identifiability	Not know yet
	Naming conventions	No naming conventions
	Search keywords	

Section	Topic	Example 2
Available	**Versioning**	Each time the dataset is saved or updated, the date and time will be added to the name in the form: YYMMDD
	Open data	All data is stated to be confidential.
	Availability	
	Accessibility (software / method)	Data will be available online, but requires authentication.
	Deposition / storage	
	Access restrictions	Acces to data requires authentication.
Interoperable	**Interoperability**	
	Vocabulary	
Reuseable	**License**	
	When available? (embargo?)	
	Restrictions for use	Confidential data
	Quality assurance	
	Preservation	
Allocation of resources		
	Costs for fair data	?
	Responsibilities	Brf Viva and Göteborg Energi.
	Costs for preservation	Negligable
Data security		The data is confidential and only available after authentication
Ethical aspects		
Other		

Example 3

Section	Topic	Example 3
Data summary		
	Title of dataset	HSB living lab data
	City	Gothenburg
	Transition track	TT1
	Integrated solution	1.7
	Purpose	Data is collected at HSB living lab to evaluate the Building Integrated Photo Voltaics (BIPV) in the facade.
	Relation to project objective	Objective 1: Demonstrate solutions at district scale integrating smart homes and buildings, smart renewables and closed-loop energy positive districts.
	Data types	The data mainly consists of floating-point numbers.
	Data formats	Not know yet
	Re-use of existing data	
	Origin of the data	In HSB living lab there are smart meters gathering data.
	Expected size of the data	Expected to be some MB.
	Data utility	WP9, WP7. The data is useful for people interested in BIPV.
FAIR data		
Findable	**Metadata provision**	The dataset will include a readme file providing specific information about the dataset
	Identifiability	Not know yet
	Naming conventions	No naming conventions
	Search keywords	
	Versioning	Each time the dataset is saved or updated, the date and time will be added to the name in the form: YYMMDD
Available	**Open data**	All data is stated to be confidential.
	Availability	
	Accessibility (software / method)	Data will be available online, but requires authentication.
	Deposition / storage	
	Access restrictions	Acces to data requires authentication.
Interoperable	**Interoperability**	
	Vocabulary	

Section	Topic	Example 3
Reuseable	**License**	
	When available? (embargo?)	
	Restrictions for use	Confidential data
	Quality assurance	
	Preservation	
Allocation of resources		
	Costs for fair data	
	Responsibilities	
	Costs for preservation	
Data security		The data is confidential and only available after authentication
Ethical aspects		
Other		