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DELTA

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Project Full Title:	**Future tamper-proof Demand rEsponse framework through seLf-configured, self-opTimized and collAborative virtual distributed energy nodes**
Grant Agreement:	**773960**
Project Duration:	**36 months (01/05/2018 – 30/04/2021)**

DELIVERABLE D8.11
DELTA Data Management Plan v2

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Executive Summary

DELTA is a H2020 research and innovation action funded by the European Commission's Directorate-General for Research and Innovation (DG RTD). The main objective of the project is to introduce a DR management platform that distributes parts of the Aggregator's intelligence into lower layers of a novel architecture, based on VPP principles, in order to establish a more easily manageable and computationally efficient DR solution with the ultimate aim to introduce scalability and adaptiveness into the Aggregator's DR toolkits.

The present report is the deliverable D8.11 corresponding to the second version of the project's Data Management Plan (DMP). Throughout the document, the initial versions of the produced datasets that were presented in D8.2 will be updated with new information including extra fields were needed. In overall, they will be presented along with the following information:

- Type and short description of the datasets to be produced, processed and collected;
- Management processes of research data during and after the completion of the project;
- Standards and formats concerning the metadata; and
- Information about data sharing, exploitation and preservation.

This document is the second version of the DELTA DMP and includes updated information as derived from the implementation processes of the DELTA s/w and h/w components up to M18. The final version of this deliverable will be delivered on M36.

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List of Acronyms and Abbreviations

Term	Description
BEMS	Building Energy Management System
DMP	Data Management Plan
DPO	Data Protection Officer
DS	Data Set
DVN	DELTA Virtual Node
FEID	Fog-Enabled Intelligent Device
IPR	Intellectual Property Rights
LV	Low Voltage
MV	Medium Voltage
NDA	Non-Disclosure Agreement
OA	Open Access
VPP	Virtual Power Plant
KPI	Key Performance Indicator
API	Application Programming Interface
DR	Demand Response
DSS	Decision Support System
WP	Work Package
EC	European Commission
EU	European Union
CA	Consortium Agreement
GDPR	General Data Protection Regulation
UML	Unified Modelling Language
ICT	Information Communication Technology
RAID	Redundant Array of Independent Disks
TCP	Tranmission Control Protocol
Q&A	Quality & Assurance
TRL	Technology Readiness Level
HTTPS	Hypertext Transfer Protocol Secure
SSL	Secure Sockets Layer
CAPTCHA	Completely Automated Public Turing test to tell Computers and Humans Apart
M2M	Machine to Machine
ETSI	European Telecommunications Standards Institute
SAREF	Smart Appliances REFerence
CoAP	Constrained Application Protocol
MQTT	Message Queuing Telemetry Transport
OpenADR	Open Automated Demand Response
OWL	Ontology Web Language

1. Introduction

1.1 Scope and objectives of the deliverable

This report is the second version of the DELTA Data Management Plan and aims to update the general principles and the necessary information as originating from the development of the various components up to M18. The mentioned principles and standards should be considered by DELTA partners during the collection, organization, storage and sharing of the generated datasets. These datasets have already been or will be produced within different project's activities.

As presented within the previous version, the DELTA DMP presents two types of datasets. The one is the datasets from the pilot sites' meters (raw data) and the second one is the (processed) datasets from the system's developed components. After proper evaluation and post-processing of the datasets (i.e. anonymization if needed), such data can be used for further research by third parties. In this context, the concept of Open Access is described briefly, as it is a quite important concept in research projects.

1.2 Structure of the deliverable

The document covers the following topics:

- Section 2 presents the general principles for Data Management Plan;
- Section 3 refers to the necessary information for the description of datasets according to Data Management Guidelines for H2020 programs and the corresponding template;
- Section 4 includes the initial version of the identified datasets within DELTA project; and
- Section 5 introduces the Data Management Portal that supports open access data.
- Finally, some general conclusions and closing remarks are provided in Section 6.

1.3 Relation to other activities in the project

The deliverable D8.11 is an outcome of Task 8.2 that is part of WP8 Dissemination, Communication and Exploitation activities. The provided information can be used as input for the respective tasks concerning the exploitation activities and the work packages related to components' development activities. The templates present various exploitable data that should be handled properly. In addition, the dataset type, along with the format, standards and data models can be used as input for the activities and deliverables related to development of specific components during WP3, WP4 and WP5.

2. General Principles

2.1 Participation in the Pilot on Open Research Data

DELTA participates in the Pilot on Open Research Data launched by the European Commission along with the Horizon2020 program. The members of the DELTA consortium embrace the concepts and the principles of open science and acknowledge the benefits of reusing and evaluating already produced data for promoting and supporting research and innovation projects at European level. The data generated during the project activities may be available in open access for further analysis and exploitation. Towards ensuring the proper usage of data, all the relevant principles for data handling should be described.

2.1.1 Data Availability and Handling

The term of **open access (OA)** concerns the free, online provision of re-useable scientific information to other users. The scope of publically funded research and innovation projects and incentives is to contribute to the improvement of different sectors within society serving environmental, economic and social needs and objectives. The benefits of open access to scientific outcomes are outlined in the "Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020" [2] and are described briefly below:

- Accessible existing scientific publications and results form the basis for efficient peer-to-peer knowledge exchange and improvement of the quality of research reducing the effort and eliminating the duplicated results;
- Connection between market and innovation actions becomes faster and seamless thanks to information flow; and
- Transparency during research is ensured, while facilitating the progress and the dissemination of ideas.

The processes for the identification and management of the exploitable results concerning IPR and patent issues and the individual exploitation plans of each partner will be presented and analysed in the first version of the deliverable DELTA Exploitation Plan in M24.

Data availability can be divided in three categories, as mentioned below:

- **Open Data:** Data that are publicly shared for re-use and exploitation
- **Consortium:** Confidential data that are available only to the members of the consortium and the EU Commission services and subject to the project Non-Disclosure Agreement (NDA)
- **Private:** Data that are retained by individual partners for their own processes and tests

Within the DELTA project, datasets will be subdivided as follows:

- Pilot sites generated datasets shared between the Consortium partners
- Pilot sites generated datasets that are used for individual partner purposes (Private)
- Pilot sites generated datasets shared to the public (Open Data)
- Research findings and outcomes that should be publicly disseminated (Open Data)

Shared datasets will be allowed between the consortium members for the purpose of fulfilling the project's objectives, For this reason, and under specified conditions, NDAs have been introduced and will be signed among involved data processors and controllers before distributing these data within the consortium members. Given the nature of the data, the NDA template that was presented in [5] has been updated and is delivered in ANNEX A. On the other hand, open access to the public may be granted on a fully anonymized dataset, under specified conditions by the consortium members.

DELTA has introduced two main roles concerning data handling activities; the data controllers and the data processors, already described in [5]. The data controllers are the ones imposing the purposes and rules of data processing, while the processors are the ones processing the personal data on behalf of the controller. In DELTA, the data controllers will be the Pilot Responsibles (KiWi, UCY and CERTH for the Lab –pre-pilot- deployment and tests) and the Data Protection Officers (DPOs), whereas the data processors will be all the technical partners who will need to analyze data from the pilot use cases. The DPOs for the DELTA project and for both the pre-pilot (CERTH) and pilot premises (KiWi & UCY) are:

- Mr. Ioannis Chalinidis (ivchal@certh.gr) from CERTH
- Mr. Dan Clarke (dclarke@kiwipowered.com) from KiWi
- Ms. Marina Petridou Sotiriadou (petridou.marina@ucy.ac.cy) from UCY

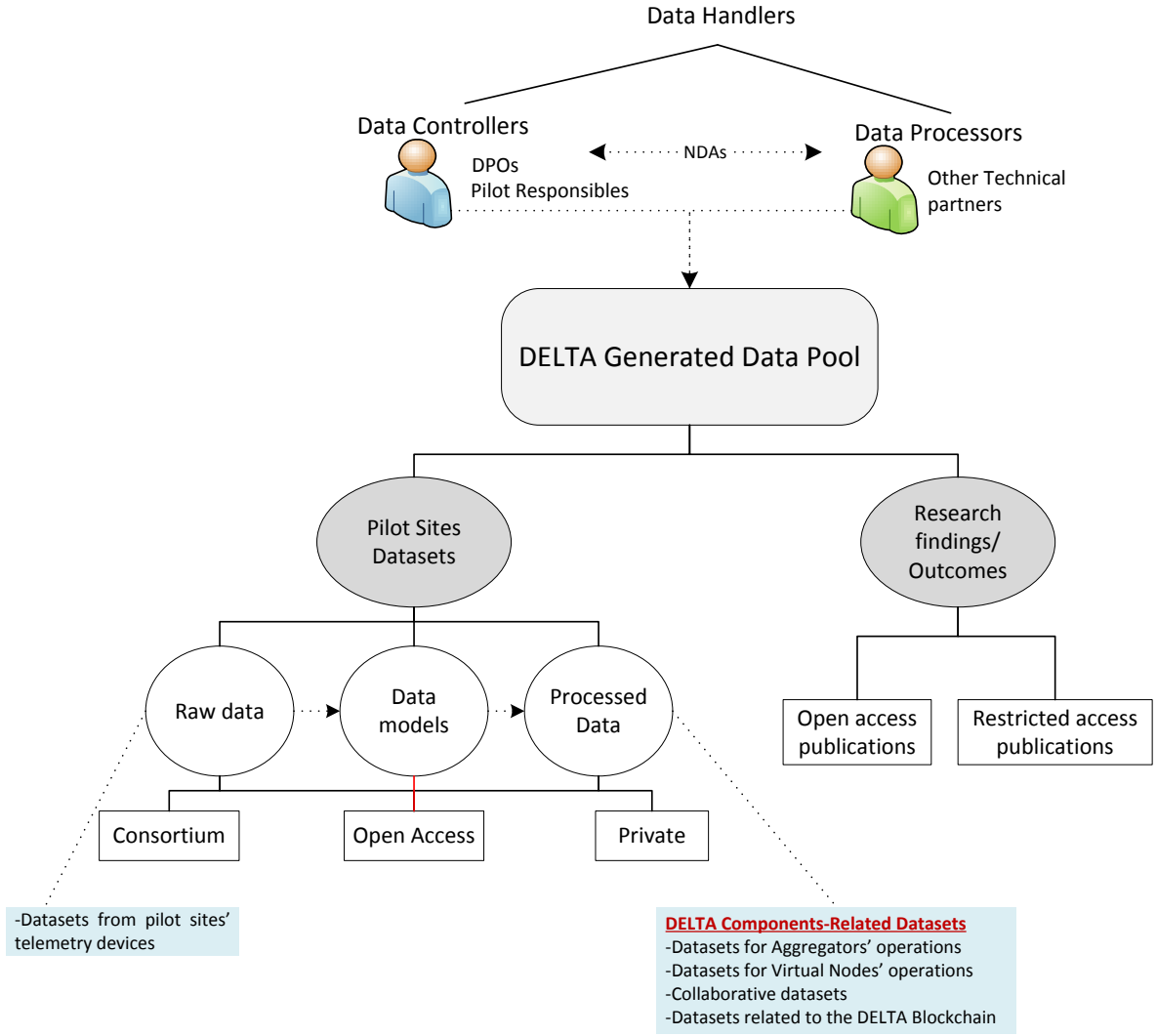

Figure 1 DELTA Data Handling

2.1.2 Open Access to Scientific Publications

Open access is defined so that each beneficiary must ensure free of charge online access, for any user, to all peer-reviewed scientific publications related to the results extracted from its scientific research. Partners may define the background needed in any manner, and may exclude specific background (not necessarily prior to signature of EC grant agreement). It is possible to grant exclusive licenses to background and foreground if the other partners waive their access rights and depending on previous agreements. The EC may object to exclusive licenses being granted to third parties established in non-associated third countries for ethical, competitiveness or security reasons (where appropriate, a

requirement to notify the EC will apply). Partners may agree to additional or more favorable access rights than those provided for in the consortium agreement. At a preliminary stage, partners agreed on open access publishing. However, in the future, partners may opt for gold or green access to peer-reviewed scientific publications, which might result from the project, depending on the type of information to be published.

2.1.3 Open Access to Research Data

There are four main aspects of open data summarized in the acronym FAIR [3]:

- **Findable:** Data has a unique, persistent ID, located in a searchable resource, and documented with meaningful metadata.
- **Accessible:** Data are readily and freely retrievable using common methods and protocols, metadata are accessible even if the data are not.
- **Interoperable:** Data are presented in broadly recognized standard formats, vocabularies, and languages.
- **Re-useable:** Data has clear licenses, and accurate meaningful metadata conform to relevant community standards and identifying its content and provenance.

As the project's pilots also concern residential buildings, the datasets from users should be checked if they require aggregation or anonymization for security or commercial reasons prior to release.

2.2 IPR management

Upon the completion of DELTA project, along with the integrated platform (WP6), a number of software and hardware technological components (WP3-5) will be extracted. During the development of these components, Intellectual Property will be generated that has to be protected through patents, yet made available for other partners for their own work in the project, and exploited outside of the project by appropriate licensing. The management of the project knowledge and IPRs are specified in the Consortium Agreement (CA) that is signed by partners. Its content reflects in some cases complement the terms and conditions defined in the Commission Contractual Rules. More specifically, the CA covers topics such as: Individual and Joint Ownership of the knowledge, Protection of knowledge, Publication of results, Use and dissemination of knowledge arising from the project, access rights, Open Source and Standards, etc.

DELTA projects, as a research and innovation action, addresses low-TRL technologies with the aim to provide market oriented solutions. The project consortium includes many partners from the academic and institutional sector (UCY, JRC, UPM, NTNU and CERTH), as well as private companies (HIT, KiWi, e7 and EAC). These partners will obviously have Intellectual Property Rights on their technologies and data. Therefore, the DELTA consortium should crosscheck with the concerned partners before every publication of data.

2.3 Data Protection & Ethics and Security

All the issues related to data protection, data management procedures, ethics and security are described in [5]. During the pilot site activities, all the required procedures will be followed in compliance with National and EU regulations and laws, including but not limited to the GDPR guidelines. For some of the activities to be carried out, there may be the need to collect basic personal data (e.g. name, contact details etc.). Such type of data will be protected in accordance with the EU Data Protection Directive 95/46/EC [6] concerning the protection of individuals with regard to the processing of personal data and on the free movement of such data. Several EU Member States implemented their national legislation on data protection transposing the EU Data Protection Directive 95/46/EC. The UK (https://ico.org.uk) and Cyprus (http://www.dataprotect ion.gov.cy) members have also transposed this directive on their corresponding national legislation.

Given some changes in the workforce of certain partners the Ethics Board has been updated as follows:

Table 1 DELTA Ethics Advisory Board

Partner	Person	e-mail
CERTH (Greece)	Dimosthenis Ioannidis (Ethics Director)	djoannid@iti.gr
KiWi (U.K.)	Dan Clarke (U.K. Pilot Responsible)	dclarke@kiwipowered.com
UCY (Cyprus)	Venizelos Efthymiou (Cypriot Pilot Responsible)	efthymiou.venizelos@ucy.ac.cy

2.4 Data Security

A holistic security approach will be followed, in order to protect the pillars of information security (confidentiality, integrity, availability). The security approach will consist of a methodical assessment of security risks followed by their impact analysis. This analysis will be performed on the personal information and data processed by the proposed system, their flows and any risk associated to their processing.

Security measures already include secure protocols (HTTPS and SSL), login procedures, and may be enriched with protection about bots and other malicious attacks, as for example CAPTCHA technologies. Moreover, the demonstration pilot sites apply monitored and controlled procedures related to the data collection, their integrity and protection. The data protection and privacy of personal information will include protective measures against infiltration as well as physical protection of core parts of the systems and access control measures.

3. Data Management Framework

3.1 Format of datasets

For each dataset the following characteristics will be specified [4]:

Table 2 Component Dataset Template

DS_XX_ Component	
Data Identification	
Dataset Reference / Name	<Summarized description of the dataset>
Dataset Description	<Mention the produced datasets with a brief description and if they contain future sub-datasets>
Source (e.g. which device?)	<From which device and how the dataset will be collected. Mention also the position of installation>
Relevant Architectural Component	<Mention the name of the architectural component which is linked with the metering device>
Partners services and responsibilities	
Partner in charge of the data collection (if different)	<Partner Name>
Partner in charge of the data analysis (if different)	<Partner Name>
Partner in charge of the data storage (if different)	<Partner Name>
WPs and tasks	<e.g. WP3, T3.4>
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation	<Provide the status of the metadata, if they are defined and their content>
Estimated volume of data	<Mention the potential data volume>
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	<Purpose of the data collection/generation and its relation to the objectives of the project>

3.2 Data modeling, Standards and meta-data

A semantic analysis of data from metering sensors and field devices will be applied to deliver an ontology, which will be implemented using the OWL ontology language (standardized by the W3C). During the development activities of the project, other relevant standard and generic ontologies will be taken into account, such as the W3C Semantic Sensor Network ontology, the ETSI SAREF ontology or the oneM2M ontology. Figure 2 summarises the steps followed to develop the DELTA ontology. The data exchange among DELTA components will follow such ontology using JSON-LD format.

The modelling language Unified Modelling Language (UML) will be used for the collection, analysis and processing of requirements as well as for the specification message exchanges and overviews of architecture and behavior specifications.

The ontologies created within DELTA are available online[1] and will be retained also after the project lifetime for the research community (open-access data) to be able to further extend them in different or similar business scenarios.

[1] http://delta.iot.linkeddata.es

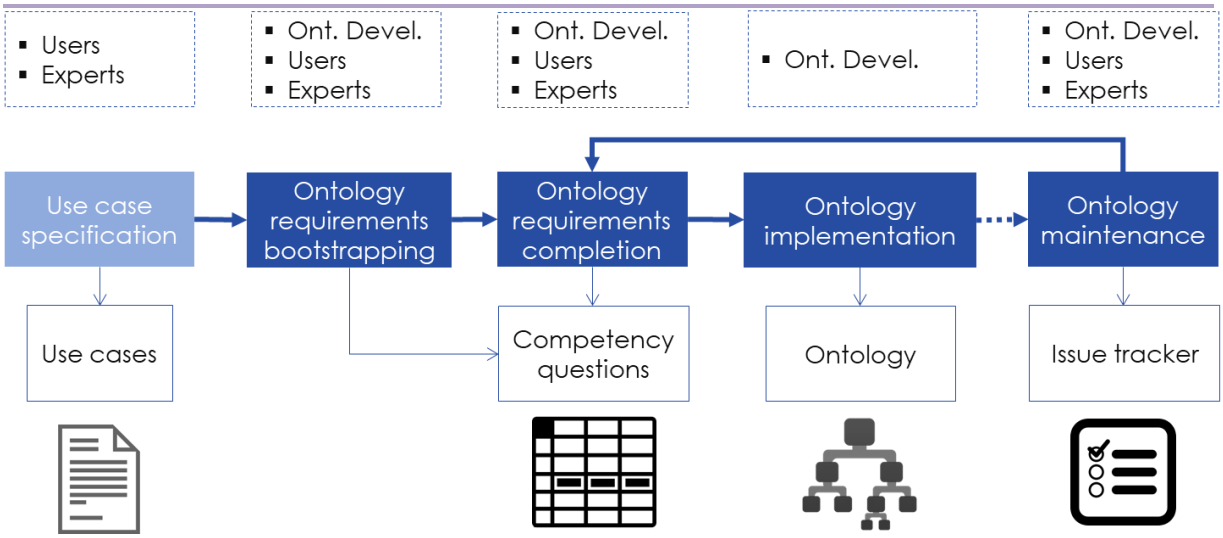

Figure 2 DELTA Ontology Development Process

3.3 Data Sharing

The DELTA partners can use a variety of methods for exploitation and dissemination of the data including:

- Using them in further research activities (outside the action)
- Developing, creating or marketing a product or process
- Creating and providing a service
- Using them in standardization activities

The main sharing enabler of the datasets to be produced within the pilot activities will be the DELTA Data Management Portal, created and maintained by CERTH, aligned with Europe's Digital Agenda for better exploiting the potential of Information and Communication Technologies (ICTs) to foster innovation, economic growth and progress[2]. To support there have been established different repositories to host both consortium (e.g. internal datasets) and public (open-access) datasets. In particular, data will be made available for researchers in a controlled environment, where authorization and authentication mechanisms will be used to get access to the data in the appropriate format (e.g. XML and/or JSON) through the DELTA SVN and FTP repositories. Open access data, available to any interested stakeholder are available through the Data Management Portal, as described in Section 5.

Secure application programming interfaces (APIs) have already been implemented for delivering a robust information flow among the various DELTA components, through common industry protocols such as CoAP, MQTT and HTTP(S). In case of public datasets, these APIs may also be provided to third parties. As DELTA is currently at the first prototype stage, there are different endpoints that are being used within the consortium to facilitate implementation and integration but may no longer be available upon the completion of the project. Thus, DELTA aims to support this functionality mainly through endpoints delivered by the DELTA CIM.

Towards data interoperability, the DELTA information exchange and specifically Demand Response related information are based on well-known DR-related protocols such as OpenADR (resulting in openADR-compliant data), or other –more general- energy standards such as ETSI SAREF and

2 https://ec.europa.eu/digital-single-market/en/europe-2020-strategy

SAREF4ENER (an extension of SAREF that was created in collaboration with Energy@Home and EEBus).

As for the data models/ontologies which are developed in DELTA, these are maintained and can be found through http://delta.iot.linkeddata.es/. As the DELTA project, strongly relies upon the OpenADR standard, an ontology of the standard has been already made available and bilateral communications with OpenADR Alliances have been initiated to include the ontology to their portfolio.

3.4 Archiving and preservation (including storage and backup)

Data will be stored in a secured form in servers (via a local instance of the DELTA Repository T1.3) indicated by the pilots or the technology providers. Descriptive metadata will be also stored/provided by such repository. To ensure data reliability, RAID and other common backup technologies may be employed. Local backups of the data, if needed, could be also established by the pilot responsibles (e.g. using their SharePoint infrastructure, managed by the Microsoft exchange and 365 servers).

3.5 Datasets List

The produced datasets are defined, describing certain initial interactions between the various modules of the DELTA architecture, as developed up to this point in the project's lifetime. These interactions are bound to change in a later stage of the project, when the tools will be further developed and finalized and the final description of the DELTA components interrelations will be available. More specifically, the datasets described in this section are subdivided, in accordance with Figure 1, into: i) datasets belonging to the architecture components of DELTA (DS_01 - DS_13 & DS_18 - DS_23), ii) Raw datasets from the pilot sensors/meters (DS_14 – DS_17), iii) data related with the data modelling activities of DELTA (DS_24).

Table 3 Delta Architectural Elements and Responsible Partners

DELTA Architectural Element	*Related Task*	*Task Leader*
DS_01_Energy Market Price Forecasting	T4.3	JRC
DS_02_Node Flexibility Data Monitoring and Profiling	T4.4	CERTH
DS_03_Energy Portfolio Segmentation & Classification (DELTA Nodes)	T4.2	HIT
DS_04_DR & Flexibility Forecasting	T4.3	JRC
DS_05_Grid Stability Simulation Engine	T4.1	UCY
DS_06_Self Portfolio Energy Balancing	T4.1	UCY
DS_07_Asset Handling Optimization	T4.4	CERTH
DS_08_Consumer/Prosumer Flexibility Data Monitoring and Profiling	T3.2	HIT
DS_09_Load Forecasting	T3.2	HIT
DS_10_Consumer/Prosumer Clustering	T3.3	CERTH
DS_11_Generation/Consumption Optimal Dispatch	T3.2	HIT
DS_12_Inter/Intra Node Energy Matchmaking	T3.2	HIT
DS_13_Lightweight Toolkit (FEID)	T3.4	CERTH
DS_14_UCY_Pilot_BEMS	T7.3, T7.4	UCY
DS_15_UCY_Pilot_Smart Meters	T7.3, T7.4	UCY
DS_16_KiWi_Pilot_IndoorQualitySensors	T7.3, T7.4	KiWi
DS_17_KiWi_Pilot_Energy Smart Meters	T7.3, T7.4	KiWi
DS_18_Aware-enabled Energy Behavioral Platform	T6.4	CERTH
DS_19_Social Interaction and Cooperation	T6.4	CERTH
DS_20_Demand Response Visualisation Kit	T6.3	CERTH
DS_21_DELTA Blockchain	T5.2	NTNU
DS_22_Smart Contracts	T5.2	NTNU

DS_23_Threat Mitigation	T5.3	NTNU
DS_24_DELTA Information Modeling	T1.3	UPM

4. Description of Datasets

4.1 Datasets for Aggregator's Operations

In this Section, the dataset comprising the information exchanged at the Aggregator's level is described. The Aggregator would have to communicate with market and grid stakeholders for certain business operations and long-term decision planning, as well as with its customers/prosumers, through the Virtual Nodes and FEIDs. Such information would be expressed through the Aggregator's toolkit components seen below.

DS_01_Energy Market Price Forecasting	
Data Identification	
Dataset Reference / Name	Sell price of the DR bids to the markets
Dataset Description	Input datasets: Demand historical data; season/day; weather forecast; fuel price; price elasticity; history of transactions Output datasets: Forecasted market price (day-ahead, intra-day, weekly)
Source (e.g. which device?)	In: To forecast the market price for a future time frame (out), historical and current data would be extracted from the database (Repository), Aggregator, web services, Market stakeholders
Relevant Architectural Component	Energy Market Price Forecasting
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilots Responsible Partners (KiWi, UCY, CERTH)
Partner in charge of the data analysis (if different)	JRC, Technical Partners
Partner in charge of the data storage (if different)	Pilots Responsible Partners (KiWi, UCY, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.3
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. regarding the process for energy market price evaluation).

Estimated volume of data	• Volume of data will depend on the:
	  ○ data exchange intervals
	  ○ included meta-data
	○ Such data would be less than 10 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	Dataset will be used for defining the DR capacity to be sold to the market (through the Self portfolio balancing module T4.1)

DS_02_ Node Flexibility Data Monitoring and Profiling	
Data Identification	
Dataset Reference / Name	Energy flexibility-related data coming from Nodes and MV Assets & profiles' generation
Dataset Description	• Input Datasets: Available energy flexibility data ranges from each Node and consumption/generation

	data from MV Assets • Output Datasets: Profiling of Node clusters from the Aggregator's perspective.
Source (e.g. which device?)	• In: To evaluate and align the profiles of the Nodes and MV Assets from the Aggregator's perspective (out), data would be extracted from the Virtual Delta Nodes and the MV Assets (smart meters) as well (via implemented communication links/APIs)
Relevant Architectural Component	Node Flexibility Data Monitoring and Profiling
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.4
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Dataset will be accompanied with a detailed documentation of its contents. Indicative metadata may include: (a) description of the pilot setup (e.g. location, date, etc.) and procedure that led to the generation of the dataset, (b) specific event and state of this event, etc.

Estimated volume of data	• Volume of data will depend on the:
	  o Number of Nodes participating in DR
	  o data exchange intervals
	  o meta-data
	• Such data are expected to be in the range of 10-70 kb per transmission

Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for profiling purposes of the Aggregator.

DS_03_Energy Portfolio Segmentation & Classification (DELTA Nodes)

Data Identification	
Dataset Reference / Name	Clusters of Aggregator's portfolio into Nodes and groups of large customers
Dataset Description	• Input Datasets: Energy and Flexibility profiles from the Nodes and FEIDs. Geo-location and type of FEIDs are required as well. • Output Datasets: Initial allocation of FEIDs into Nodes Dataset for clustering that refers to the initial allocation of FEIDs into Nodes based on a simulation performed by the Aggregator at their premises. This allocation would be re-calculated at the Aggregator level, when a new customer is introduced into the system (addition of new customers and removal of customers that leave its portfolio (allocation of smart contracts etc.)

Source (e.g. which device?)	• In: To evaluate the portfolio segmentation (out), data would be extracted from the Nodes & FEIDs (energy patterns/profiles), Aggregator (KPIs-related)
Relevant Architectural Component	Energy Portfolio Segmentation & Classification
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	HIT, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. what is the process for allocation of FEIDs into Nodes)

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of FEIDs
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be less than 5 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for grouping existing and new customers into Nodes (large clusters of prosumers).

DS_04_DR & Flexibility Forecasting

Data Identification	
Dataset Reference / Name	DR & Flexibility Forecasting for all Assets into the Aggregator's portfolio
Dataset Description	Input Datasets: MV Assets generation/consumption data, Nodes flexibility data Output Datasets: flexibility capacity range for Nodes and MV Assets, seen from the Aggregator's perspective Produced dataset resulting from computing the MV Assets (existing portfolio) flexibility capacity range and the sum of them calculated by the Aggregator.
Source (e.g. which device?)	In: To evaluate the flexibility range for all Aggregator's portfolio (out), data would be extracted from the MV Assets (via smart meters' APIs) and Nodes
Relevant Architectural Component	DR & Flexibility Forecasting
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	JRC, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)

WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.3.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. what is the process for prediction of the portfolio's available flexibility capacity range).

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of Nodes and MV Assets
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be in the range of 1-10 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	Dataset will be used for the self-portfolio balancing (nodes and FEIDs unit commitment)

DS_05_Grid Stability Simulation Engine

Data Identification	
Dataset Reference / Name	Grid Stability Data
Dataset Description	• In: Smart meters and FEIDs data for frequency and voltage; grid topology information, load forecasts & historic data • Out: probability of grid instability based on flexibility capacity exchange on the grid bus, voltage constraints, line loading constraints, frequency constraints Responsible for monitoring the stability (e.g. voltage fluctuations) within the available portfolio and run background scenarios simulating issues that could occur based on current status.
Source (e.g. which device?)	In: Smart meters & FEIDs Data will be accessed from within the DELTA framework. Data from all components in the Aggregator's toolkit will be used for analysis.
Relevant Architectural Component	Grid Stability Simulation Engine
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	UCY, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.1.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. on which bus we perform the measurements, etc.).
Estimated volume of data	Assuming the data are collected at an aggregated and half-hourly timestamped level the data volume will be less than 1 MB per day, although this will scale

	linearly will the number of individual nodes if individual targets are specified as a requirement of the aggregator's communication protocol.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	Optimum load profiles at the aggregator level will be used to inform aggregator pricing and signaling strategies in response to market forces. Probabilistic predictions of grid level events that can influence market forecasts will also be provided and limitations of local participation from the flexibility and physical perspective defined. More specifically, the data regarding limitations of infrastrcutre to host physical demand/generation will be used to identify the likelihood of market calls.

DS_06_Self Portfolio Energy Balancing	
Data Identification	
Dataset Reference / Name	Energy flexibility capacity and Nodes commitment allocation
Dataset Description	• Input Datasets: Flexibility capacity range vs cost range per capacity & Smart Contracts' conditions; declared markets for operation, historic performance • Output Datasets: Total flexibility capacity bids, sell price and Nodes commitment allocation, to be sent to the Market Stakeholders. Also, price incentives, rewards and penalties per Customer for capacity delivered; prioretisation of dispatch and rerating of available flexibility based on performance.
Source (e.g. which device?)	• In: to evaluate the Nodes' flexibility capacity allocation, data will be extracted from the Virtual Delta Nodes, MV Assets included in Aggregator's portfolio & FEIDs The dataset will be collected from the services provided at Virtual Delta Node level and/or FEID-level information (e.g. smart contracts' constraints).
Relevant Architectural Component	Self-Portfolio Energy Balancing
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.1
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Dataset will be accompanied with a detailed documentation of its contents. Indicative metadata may include: (a) description of the pilot setup (e.g. location, date, etc.) and procedure that led to the generation of the

	dataset, (b) specific event and state of this event, etc.

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of Nodes and FEIDs participating in DR
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be in the range of 5-30 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for the evaluation of the energy assets' flexibility provision in the pilot sites. The effective prioritization, rerating and probalistic performance statistics of assets will be used to ensure that the commitments of the aggregator are of a more robust and reliable nature.

DS_07_Asset Handling Optimization	
Data Identification	
Dataset Reference / Name	Balancing result for excess or shortage of energy for large customers and Nodes
Dataset Description	○ Input Datasets: Energy flow from the Nodes and the MV Assets, DVN Reliability, DVN consumption, System Marginal Price ○ Output Datasets: Energy flow re-allocation, Real Time Pricing It will provide the DSS with assessments of the available energy (excess or shortage) within the Aggregator portfolio, targeting a balanced state where the use of available flexibility is maximized.
Source (e.g. which device?)	• In: MV Assets (e.g. smart meters via implemented APIs) and Nodes Data will be accessed from within the DELTA framework. Data from all components in the Aggregator's toolkit will be used for analysis.
Relevant Architectural Component	Asset Handling Optimization
Partners services and responsibilities	
Partner in charge of the data collection (if different)	CERTH
Partner in charge of the data analysis (if different)	UCY, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP4 and more specifically within activities of T4.4
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Timestamped projected standard and optimized flexibility profiles from analysis of T3.2 data. Presented at the aggregated level.
Estimated volume of data	This is dependent on the level of information available from T3.2. The format will be timestamped data on demand and flexibility projections as is with enhanced flexibility limits presented from the optimization procedure.

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The data will be used to identify asset-handling strategies that are appropriate given the projected profiles and flexibility calculations.

4.2 Datasets for Virtual DELTA Nodes' Operations

In this Section, the dataset comprising the information exchanged at the Nodes' (and FEIDs) level is described. The Node will be the intermediary virtual actor between the Aggregator and the customer, therefore each Node should handle information regarding Aggregator's requests and energy-related data from each prosumer, via the FEIDs. Such information would be expressed through the Nodes' toolkit components seen below.

DS_08_Consumer/Prosumer Flexibility Data Monitoring & Profiling	
Data Identification	
Dataset Reference / Name	Energy profiles' dataset at the Node level
Dataset Description	• Input Datasets: Historical consumption, generation and storage reports, forecasted baseline load, upwards and downwards flexibility from each FEID. Lastly, consumption, generation and storage capacities, customer type and geolocation of each FEID assigned to the DVN. • Output Datasets: Dynamically computed profiles of each FEID assigned to the DVN. Monitor data coming from FEIDs and create the Node-level profiles.
Source (e.g. which device?)	• In: Fog-Enabled Intelligent Devices (via implemented APIs) installed at consumer's/prosumers' side The dataset will be collected using FEIDs at consumer's/prosumers' side.
Relevant Architectural Component	Consumer/Prosumer Flexibility Data Monitoring & Profiling
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/ KiWi, CERTH)
Partner in charge of the data analysis (if different)	HIT, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP3 and more specifically within activities of T3.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata are yet to be defined by the solution provider.

Estimated volume of data	• Volume of data will depend on the:
	  ○ A JSON-LD payload that reports one single measurement is, roughly, 1.4Kbytes.
	  ○ The overhead of each additional measurement in the same payload is, roughly, 400 bytes.
	  ○ The complexity of the transmitted data to a DVN is a linear function on the number of FEIDs assigned to it.
	  ○ The report time interval increases the complexity of the transmitted data linearly.
	  ○ The reports already encompass all data that are relevant to this component's functionality.
	• Produced FEID profile data is constant, roughly, 4.9Kbytes on JSON-LD format.

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used to later-on create the DVN's clusters

DS_09_Load Forecasting	
Data Identification	
Dataset Reference / Name	Dataset for day-ahead baseline, flexibility, storage and generation forecasts.
Dataset Description	• Input Dataset: FEID profiles and real-time, intra-day measurement reports of FEIDs, as well as, historical aggregated profiles of the DVN. • Output Dataset: forecasted energy & power consumption, generation, storage, flexibility and baseline load per DVN.
Source (e.g. which device?)	• In: Fog-Enabled Device (via implemented APIs) at customer's/prosumer's site and local data store of each DVN.
Relevant Architectural Component	Load Forecasting
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner, e.g., UCY/KIWI, CERTH
Partner in charge of the data analysis (if different)	HIT, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	WP3, T3.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g., different granularities, accuracy etc.)

Estimated volume of data	• Volume of data will depend on the:
	  ○ Refer to DS_08_Consumer/Prosumer Flexibility Data Monitoring & Profiling for FEID-related data.
	  ○ A load forecast JSON-LD payload for a 24hour ahead time period, assuming a report time interval value of 1 minute, is, roughly, 2.2Mbytes.

	○ The size of the payload scales linearly to the report time interval. ○ The report already encompasses all data that are relevant to the Aggregator's component that consumes it. • The size of the transmitted JSON-LD payload is not a function of the number of FEIDs that are assigned to the DVN.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The data exposed by this component are useful for the Aggregator in order to formulate a plan to service incoming DR events.

DS_10_Consumer/Prosumer Clustering	
Data Identification	
Dataset Reference / Name	Prosumers' clusters
Dataset Description	• Input Datasets: KPIs from DELTA's Repository, historical DR signals/events, transactions and FEID profiles stored at the local data store of the DVN. • Output Datasets: Customer/Prosumer clusters Classification of customers/prosumers into distinct cliques will be maintained & updated by the DVN.
Source (e.g. which device?)	• In: FEIDs, DELTA Repository, DELTA Blockchain The data will be collected from FEIDs at the customers/prosumers premises, from DELTA's Repository and DELTA's Blockchain.
Relevant Architectural Component	Consumer/Prosumer Clustering
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/ KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP3 and more specifically within activities of T3.3.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata are yet to be defined by the solution provider.
Estimated volume of data	• Volume of data will depend on the: ○ The number of FEIDs assigned to the DVN and, as an extension, the number of FEID profiles consumed by this component (refer to DS_08_Consumer/Prosumer Flexibility Data Monitoring & Profiling) for that. ○ Granularity of relevant historical DR events and their corresponding transactions. ○ • A cluster is represented as a collection of FEID identifiers, a timestamp, a label and a reliability

	metric. Consequently, its encoded size is linear to the number of FEIDs allocated to it. The remaining fields are less than 24 bytes long.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for grouping existing and new customers into distinct cliques that are maintained and updated by the DVN.

DS_11_Generation/Consumption Optimal Dispatch

Data Identification	
Dataset Reference / Name	Computed/Formulated plans to service incoming DR events.
Dataset Description	○ Input Dataset: FEID profiles, DR events, and FEID Clusters. ○ Output Dataset: DR Events targeted towards FEIDs assigned to the DVN, as well as, corresponding transactions posted on DELTA's blockchain.
Source (e.g. which device?)	• In: Aggregator and other DVNs (to facilitate the inter node matchmaking protocol).
Relevant Architectural Component	Generation/Consumption Optimal Dispatch
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
Partner in charge of the data analysis (if different)	HIT, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	WP3, T3.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. which clusters of FEIDs will follow the specific plan etc.).
Estimated volume of data	• Volume of data will depend on the: ○ The number of FEIDs assigned to the DVN. ○ The number of input DR events and signals. ○ • DELTA's OpenADR ontology is still pending, thus, we cannot provide accurate information regarding the volume of data. However, we believe that the exposed payloads will not exceed 5Kbytes, on average.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for computing the future state flexibility capacity range

DS_12_Inter/Intra Node Energy Matchmaking

Data Identification	
Dataset Reference / Name	Dataset for Energy excess / shortage per each Node
Dataset Description	• Input Dataset: DVN Profiles, FEID profiles, FEID

	Clusters, status signals of FEIDs & DVNs, DR Events and their corresponding transactions. • Output Dataset: DR Events and their corresponding transactions.
Source (e.g. which device?)	• In: DELTA's Blockchain, Aggregator and other DVNs,
Relevant Architectural Component	Inter/Intra Node Energy Matchmaking
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner e.g. UCY/KIWI
Partner in charge of the data analysis (if different)	HIT, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partner (UCY/KiWi, CERTH)
WPs and tasks	WP3, T3.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included.

Estimated volume of data	•
	• Externally, the communicated payloads on the P2P network will be OpenADR-compliant.
	• Internally, the data consumed by the components will be translated from pure OpenADR format to DELTA's OpenADR data format, which is based on JSON-LD.
	• Volume of data will depend on the:
	  ○ The number of FEIDs assigned to each DVN.
	  ○ The total number of DVNs.
	  ○
	  ○ The number of input DR events and signals.
	• DELTA's OpenADR ontology is still pending, thus, we cannot provide accurate information regarding the volume of data. However, we believe that the exposed payloads will not exceed 5Kbytes, on average.

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets can be used for facilitating self-balancing process within the Node.

DS_13_FEID	
Data Identification	
Dataset Reference / Name	Energy flexibility dataset at the prosumer side & actuation signals

Dataset Description	• Input Dataset: close to real-time LV Assets' (connected to FEIDs) energy measurements, prosumers' KPIs-related data (e.g. comfort) and actuation signals from the Nodes/Aggregator • Output Dataset: Available energy flexibility data & energy patterns/profiles to be delivered to each Virtual Node. Also, Actuation signals to prosumer's Assets Produced dataset will be used to support optimal DR requests' distribution to each Prosumer's Assets.
Source (e.g. which device?)	• In: LV Assets, Smart meters, sensors, BMS (via implemented APIs) at prosumers'-side The FEIDs will collect energy and related information from their linked Assets and systems at the building/facility level.
Relevant Architectural Component	Lightweight Toolkit per Customer and DELTA Fog Enabled Agent
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partner (UCY/ KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	CERTH, Pilot Responsible Partner
WPs and tasks	The data are going to be collected within activities of WP3 and more specifically within activities of T3.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	A detailed description of the dataset contents will be included (e.g. what is the process of energy flexibility evaluation).

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of Assets participating in each FEID-enabled cluster
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be less than 10 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for the evaluation of the energy assets' flexibility provision in the pilot sites.

4.3 Datasets from Pilot sites' telemetry devices

In this Section, the dataset comprising the information stemming from the Pilot sites is described. Such data will be made available from smart metering equipment and intelligent monitoring equipment (such as BEMS), seen below.

DS_14_UCY_Pilot_BEMS	
Data Identification	
Dataset Reference / Name	UCY BEMS Data
Dataset Description	• Input Datasets: FEID actuation signals & requests

	for data extraction • Output Datasets: Building monitoring data The UCY campus operates Building Energy Management Systems that automate the controls of building specific variable loads. The parameters from these systems will be extracted and stored as datasets for use in the DELTA project
Source (e.g. which device?)	Installed BEMS systems from Siemens, Honeywell and/or Johnson Controls, the actual BEMS candidates are yet to be finalized in the DELTA project. Source of data requests will be the FEIDs.
Relevant Architectural Component	Fog Enabled Agent
Partners services and responsibilities	
Partner in charge of the data collection (if different)	UCY
Partner in charge of the data analysis (if different)	UCY, Technical Partners
Partner in charge of the data storage (if different)	UCY
WPs and tasks	The data are going to be collected within activities of WP7 and more specifically within activities of T7.3, T7.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata will include building use type and occupancy information. Ongoing discussions are being held with the BEMS manufacturers for the exact specification of the available monitoring data. Time dependent set point and actual temperatures for heating and cooling control for user comfort requirements are the principle parameters.
Estimated volume of data	This will be confirmed once the discussions with the BEMS manufacturers are complete. It is an ongoing process.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The collected data will be used to document historic occupancy and comfort parameters, set point and actual temperatures. Associated load profiles will also be recorded. The data will be used to assert historic and extrapolate future demand and flexibility profiles of the buildings in question.

DS_15_UCY_Pilot_Energy Smart Meters

Data Identification	
Dataset Reference / Name	Building Power Generation, Usage & Quality
Dataset Description	• Input Datasets: FEID requests for data extraction • Output Datasets: monitoring data Dataset for energy profiling and power quality assessment. Timestamped current, voltage, frequency, real and reactive power and/or power factor measurements will be measured at various points in the pilot site (yet to be determined) will one meter

	installed per building. Data will be stored for analysis and communication with the DVN.
Source (e.g. which device?)	The data will be collected using Schneider Electric PowerLogic ION power quality meters communicating over Modbus TCP. Source of data requests will be the FEIDs.
Relevant Architectural Component	-
Partners services and responsibilities	
Partner in charge of the data collection (if different)	UCY
Partner in charge of the data analysis (if different)	UCY, Technical Partners
Partner in charge of the data storage (if different)	UCY
WPs and tasks	The data are going to be collected within activities of WP7 and more specifically within activities of T7.3, T7.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Each entry will be recorded minutely using average values determined from one second spot value measurements. The meters will be distributed throughout buildings the UCY campus that form part of the UCY pilot site.
Estimated volume of data	This will be confirmed once the full dataset, data format and communication protocols are asserted. At first approximation, it will be 256-bits per row, one row per minute, some overheads for metadata. Approximately 0.5 MB per day per meter. This will be confirmed once the meters have been installed and tested.
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The collected data will be used to document historic generation, consumption and quality profiles and to extrapolate from these future profile predictions.

DS_16_KiWi_Pilot_IndoorQualitySensors	
Data Identification	
Dataset Reference / Name	KiWi indoor quality data set
Dataset Description	• Input Datasets: FEID or DVN actuation signals & requests for data extraction • NOD devices: indoor comfort monitoring devices, providing data on Temperature, relative humidity, CO2, VOX and room occupancy • Output Datasets: Building monitoring data
Source (e.g. which device?)	Installed NOD devices (Moor House, Ernest Dence and other residential estates in Greenwich)
Relevant Architectural Component	Fog Enabled Agent
Partners services and responsibilities	
Partner in charge of the data collection (if	KiWi

different)	
Partner in charge of the data analysis (if different)	KiWi, Technical Partners
Partner in charge of the data storage (if different)	KiWi
WPs and tasks	The data are going to be collected within activities of WP7 and more specifically within activities of T7.3, T7.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata will include building use type and occupancy information. The area monitored via NOD equipment will be mapped out on building plans.
Estimated volume of data	As an estimate, a CSV file export containing energy consumption data on a minute by minute level for 365 days on a single metering point is around 9MB
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The collected data will be used to document historic occupancy and comfort parameters, set point and actual temperatures. Associated load profiles will also be recorded. The data will be used to assert historic and extrapolate future demand and flexibility profiles of the buildings in question.

DS_17_KiWi_Pilot_Energy Smart Meters	
Data Identification	
Dataset Reference / Name	Building Power Generation, Usage & Quality
Dataset Description	• Input Datasets: FEID or DVN requests for data extraction • Output Datasets: monitoring data Dataset for energy profiling and power quality assessment. Timestamped current, voltage, frequency, will be measured at various points in the pilot site (Moor House) for relevant energy intensive assets (e.g. 6 x chillers). Data will be stored for analysis and communication with the DVN.
Source (e.g. which device?)	Metering data sources will be: • KiWi Power Fruit – metering and communication device for all commercial and industrial assets (eg. Chillers @ Moor House) • Schneider sub metering system for HH data (entire building and sub-zones @ Moor House) • Hildebrand Glow CT clamps and data hubs for residential data (via Hildebrand & KiWi back end systems through dedicated APIs) Where feasible, source of data requests will be the FEIDs OR Virtual Nodes interfacing with KiWi Operations Management Platform via APIs
Relevant Architectural Component	-
Partners services and responsibilities	
Partner in charge of the data collection (if different)	KiWi

Partner in charge of the data analysis (if different)	KiWi, Technical Partners
Partner in charge of the data storage (if different)	KiWi
WPs and tasks	The data are going to be collected within activities of WP7 and more specifically within activities of T7.3, T7.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Each entry will be recorded minutely using average values determined from one second spot value measurements. Each metering point will have a unique identifier and the impact area mapped out on building plans
Estimated volume of data	As an estimate, a CSV file export containing energy consumption data on a minute by minute level for 365 days on a single metering point is around 9MB
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The collected data will be used to document historic generation, consumption and quality profiles and to extrapolate from these future profile predictions.

4.4 Collaborative datasets

In this Section, the dataset regarding the information exchanged between customers on a daily basis, through the DELTA collaboration services, as well as the demand response rewards exchange mechanisms are described.

DS_18_Award-enabled Energy Behavioral Platform	
Data Identification	
Dataset Reference / Name	Assign rewards to customers
Dataset Description	• Input Datasets: Demand flexibility profiles & Smart contracts' conditions and fulfillment rate • Output Datasets: Respective reward points to the customers (monetary or behavioral based) Datasets will be produced by the reward point system that will be integrated into the smart contracts framework. The indicators included in each smart contract will be the points earned/kW of DR enabled capacity.
Source (e.g. which device?)	• In: Customers' requested flexibility rate that has been fulfilled (gathered through FEIDs)
Relevant Architectural Component	Award-enabled energy behavioral platform
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of

	WP6 and more specifically within activities of T6.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	The reward points will be translated in social collaboration and awards-based gamification schemes.

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of customers
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be less than 10 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for enhancing key characteristics for identification of customers and improving end-user engagement.

DS_19_Social Interaction and Cooperation

Data Identification	
Dataset Reference / Name	Dataset for knowledge diffusion among customers (consumers/prosumers)
Dataset Description	• Input Datasets: Customers' related data (e.g. UserID) & Awards • Output Datasets: Exchange of relevant information between customers that are actively being engaged to DR services (including multimedia content/Q&A/chat/notifications etc.) Produced datasets will concern suggestions and incentives, timeline of customers activities, social connections among customers etc.
Source (e.g. which device?)	• In: Customers
Relevant Architectural Component	Social Interaction and Cooperation
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP6 and more specifically within activities of T6.4.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Profiles of customers and collaborative models will be generated indicating the dependencies from energy related events.

Estimated volume of data	• Format not yet defined (e.g. csv, XML, JSON etc.): to be delivered in DELTA Information Modelling T1.3
	• Volume of data will depend on the:
	  ○ Number of customers, activities and DR requests
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be less than 10 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for promoting best practices from customers and healthy competition among customers (that will be extensively researched regarding the impact to energy markets.

DS_20_Demand Response Visualization Kit

Data Identification	
Dataset Reference / Name	Visualized dataset of real-time and historical energy information
Dataset Description	• Input Datasets: Energy flexibility and profile data from FEIDs • Output Datasets: Real-time and historical energy information Produced dataset will include information for consumption, generation, flexibility, emissions and they will be accompanied by Demand Response information (e.g. available DR strategies, DR cost and energy estimations, rewards etc.)
Source (e.g. which device?)	• In: FEIDs at prosumer's side The dataset will be collected through FEIDs.
Relevant Architectural Component	Demand Response Visualization Kit
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	CERTH, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	The data are going to be collected within activities of WP6 and more specifically within activities of T6.3.
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Visualized dataset will be accompanied with detailed documentation (e.g. procedure that led to the generation of dataset, specific event and state of this event etc.) in order to inform properly the involved stakeholders.

Estimated volume of data	• Volume of data will depend on the:
	  ○ Number of customers
	  ○ data exchange intervals
	  ○ included meta-data
	• Such data would be less than 100 kb per transmission

Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used to present to each actor the respective information of DR events (e.g. customers will be able to see information about the DR applied on them, but not on the DVN etc.)

4.5 Datasets related to the DELTA Blockchain

In this Section, the data that is sent/logged via the DELTA blockchain network are described.

DS_21_DELTA Blockchain	
Data Identification	
Dataset Reference / Name	Verified blockchain network data after blockchain implementation
Dataset Description	• Input Datasets: Transactions triggered by DELTA stakeholders • Output Datasets: Data stored on distributed ledger data along with non-functional metrics of blockchain network such us required processing resources, nodes energy consumption etc. Produced verified dataset will enable energy data traceability and secure access for stakeholders and will also facilitate the design of a scalable blockchain platform.
Source (e.g. which device?)	• In/Out: Data is going to be extracted by blockchain nodes holding the distributed ledger
Relevant Architectural Component	DELTA Cyber Security Services – Smart Contracts
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	NTNU, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	WP5, T5.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata are yet to be defined by the solution provider.
Estimated volume of data	• Volume of data will depend on the: o Number of customers/FEIDs o Number of DVNs o data exchange intervals included meta – data
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for designing usage tracking and aggregation of data for users and for producing an elaborate view for him/her. In addition, the produced dataset will be used for decision-making and risk assessment among stakeholders.

DS_22_Smart Contracts	
Data Identification	
Dataset Reference / Name	Dataset related to smart contract implementation and usage

Dataset Description	• Input Datasets: Parameters for the implementation of DR schemes such as who are the participants or what are the parameters for each signal • Output Datasets: Results of the DR signals through contract checking output (e.g. promised vs delivered flexibility) and rewards/penalties execution.
Source (e.g. which device?)	• In: DELTA Blockchain, FEIDs, DVNs, Aggregator
Relevant Architectural Component	DELTA Cyber Security Services – Smart Contracts
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	NTNU, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	WP5, T5.2
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Metadata are yet to be defined by the solution provider.
Estimated volume of data	• Volume of data will depend on the: o Number of customers/FEIDs/rules o Number of DVNs o data exchange intervals o included meta-data
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	The datasets will be used for improving DR strategies and enhancing end-user engagement.

DS_23_Threat Mitigation	
Data Identification	
Dataset Reference / Name	Dataset for cyber security in energy networks
Dataset Description	• Input Datasets: History of attacks, network vulnerabilities • Output Datasets: Threat mitigation rules
Source (e.g. which device?)	• In: FEIDs and monitoring devices The dataset will be collected through FEIDs and monitoring devices, and will be enhnaced with information extrracted through research on current literature and technical documnetation.
Relevant Architectural Component	DELTA Cyber Security Services – Threat Mitigation
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
Partner in charge of the data analysis (if different)	NTNU, Technical Partners
Partner in charge of the data storage (if different)	Pilot Responsible Partners (UCY, KiWi, CERTH)
WPs and tasks	WP5, T5.3

Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	Dataset will be accompanied with a detailed documentation of its contents. Indicative metadata may include: (a) description of the experimental setup (e.g. location, date, etc.) and procedure that led to the generation of the dataset, (b) specific event and state of this event, involved humans per time interval, etc.
Estimated volume of data	• Data volume In = Energy network conditions related data • Data volume Out = Risk Assessment (= Threat x Vulnerability x Impact)
Data exploitation	
Data exploitation (purpose/use of the data analysis)	The produced dataset can be used for supporting life-cycle components requirements in terms of updates etc. In addition, they will enable the safety- oriented management of the entire system.

DS_24_DELTA Information Modeling

Data Identification	
Dataset Reference / Name	DELTA Information Model
Dataset Description	This dataset contains the data required to model the information that is exchanged among components and abstract concepts used in the DELTA project.
Source (e.g. which device?)	Repositories that are present in the DELTA architecture and data sent among components.
Linked Architectural Component	DELTA Repository
Partners services and responsibilities	
Partner in charge of the data collection (if different)	Partners that need to model information
Partner in charge of the data analysis (if different)	UPM, Technical Partners
Partner in charge of the data storage (if different)	UPM
WPs and tasks	WP1, T1.3
Metadata and Expected Size	
Info about metadata (Production and storage dates, places) and documentation?	not yet available.
Estimated volume of data	several hundreds of bytes
Data exploitation and sharing	
Data exploitation (purpose/use of the data analysis)	Standardization and research purposes.

5. Data Management Portal

To ensure that the DELTA project complies with the FAIR principles as it participates in the Pilot on Open Research Data, DELTA has created a dedicated online portal for presenting material that is considered Open Data (see Section 2.1.1) to the general public. The DELTA Data Management Portal (https://opendata.iti.gr/delta/#/login) is completely accessible for any interested party and includes deliverables, presentations, publications, datasets, and other material that may be of interest for the research community.

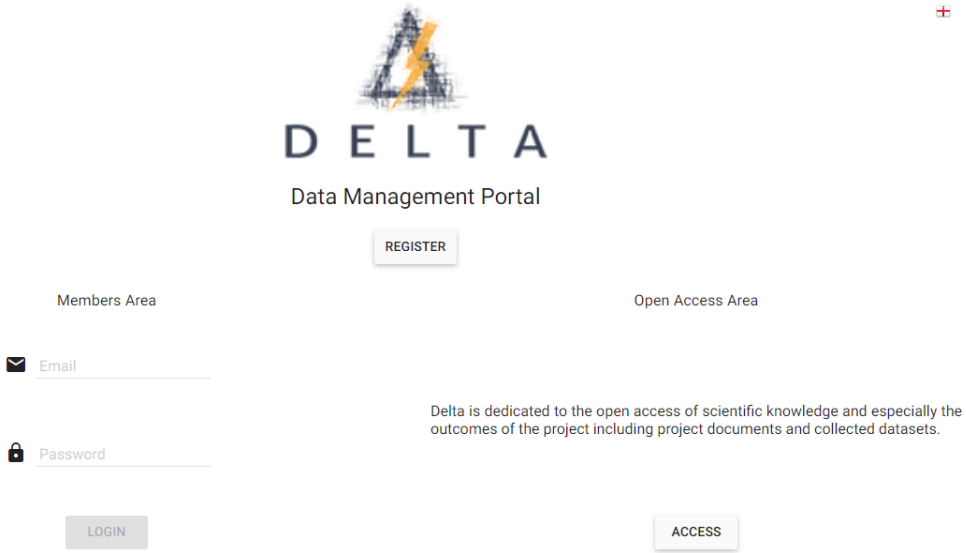

Figure 3 DELTA Data Management Portal

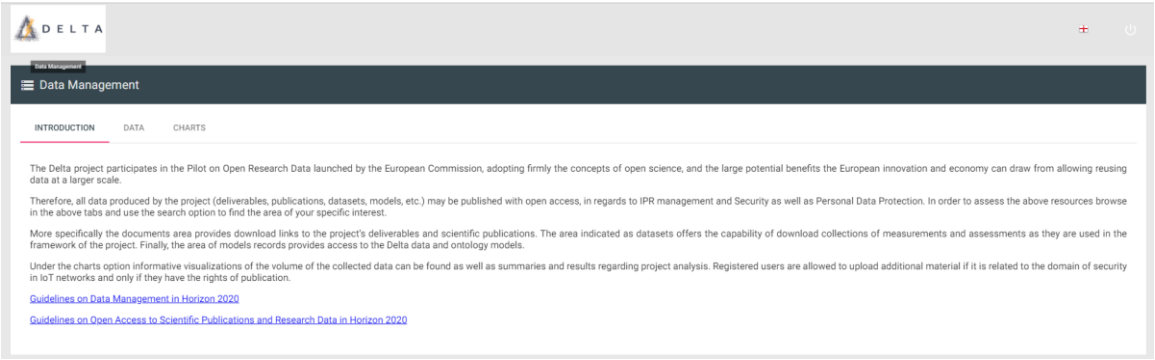

Figure 4 General Introduction and Objective of the portal

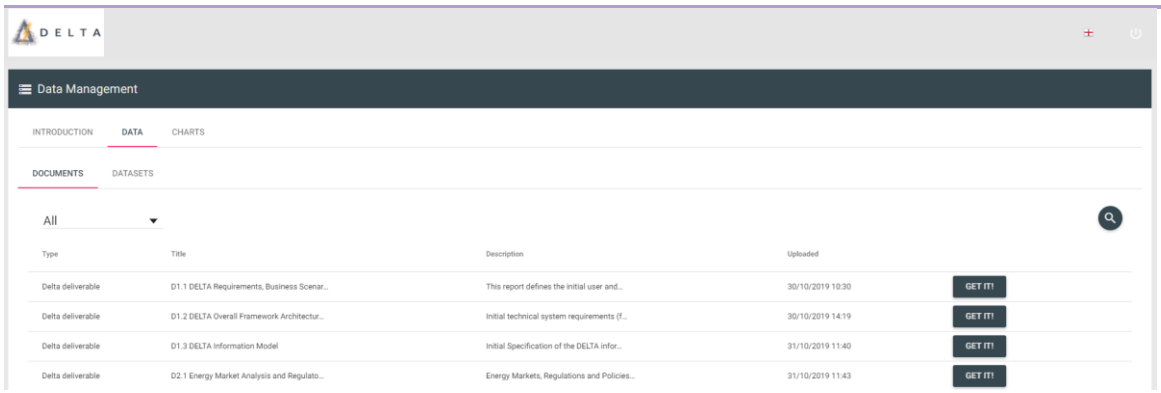

Figure 5 Free Access to Deliverables, Publications, Presentations, Datasets, and more

6. Conclusions

The DELTA DMP is based upon the datasets for procedures and infrastructure that are anticipated at this point in the project. The second version of this deliverable aims at providing the updated identified datasets and outlining a more complete version of the components specifications, based on the results of the implementation processes up to M18. Accordingly, the DELTA Data Management Portal has been updated with DELTA Open Data.

The next actions will be to focus further on semantics and further clarification of procedures, participant and stakeholder engagement and identifying areas that need special attention. The Data Management Portal will be constantly be updated, initial datasets from pilot deployment will be included and changes to the datasets may occur after systematic studies on pilots' activities.

The DELTA Data Management Plan will focus on providing the necessary infrastructure for the appropriate collection, publication and storage of metadata, especially during pilot execution. As DELTA components are still under development, certain aspects may still change within the foreseen in technical (WP3-WP5), integration (WP6) and pilot execution (WP7) activities. Each technical partner and pilot coordinator are responsible for following the guidelines presented by the Data Management Plan. The final version of this deliverable is expected on M36.

7. References

[1] D8.2 Data Management Plan v1, DELTA project, Public Deliverable, WP8, 2018.

[2] European Commission, 2017: Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020, version 3.2.

[3] European Commission, 2016: H2020 Programme – Guidelines on FAIR Data Management in Horizon 2020, version 3.0.

[4] European Commission 2015: Guidelines on Data Management in Horizon 2020, version 2.0.

[5] D10.1 NEC – Requirement No. 1, DELTA project, Confidential Deliverable, WP10, 2018

[6] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31995L0046&from=en

ANNEX A: Non-Disclosure Agreement (NDA) for Data Sharing

Non Disclosure Agreement

CONFIDENTIAL DISCLOSURE AGREEMENT
(Example with CERTH/ITI)

THIS AGREEMENT dated DD/MM/YYYY, by and between
Centre for Research and Technology Hellas/ Information Technologies Institute (CERTH/ITI), located at 6th klm. Charilaou - Thermi Road, 57001 Thessaloniki, Greece,
and
……., located at ……, .

WHEREAS, CERTH/ITI and ……., for the purpose of establishing a cooperative relationship and pursuant to the research related to DELTA project, anticipate that CERTH/ITI may disclose or deliver to …….. energy and security related data from the CERTH/ITI's SmartHome infrastructure, data that may include raw measurements, drawings, schematics, sketches, specifications, and other materials derived from CERTH/ITI's SmartHome dataset, both written and oral, of a secret, confidential or proprietary nature, including without limitation any and all information relating to marketing, finance, forecasts, research, prepared or filed by or on behalf of CERTH/ITI, in any jurisdiction, and any amendments or supplements thereto (collectively, "Proprietary Information"); such "Proprietary Information" shall be explicitly marked as "Proprietary" at the time of disclosure, or when disclosed orally shall be identified as proprietary at the time of disclosure and shall be confirmed and designated in writing within 15 calendar days from oral disclosure at the latest as proprietary information by CERTH/ITI; and

WHEREAS, CERTH/ITI, desires to assure that the confidentiality of any Proprietary Information is maintained;

NOW, THEREFORE, in consideration of the foregoing premises, and the mutual covenants contained herein, CERTH/ITI, hereinafter referred to as "the Discloser" and ……, hereinafter referred to as "the Recipient" hereby agree as follows:

1. Under this Agreement the Recipient undertakes: **(i)** to hold in trust and confidence and not disclose, without the express prior written consent of the Discloser, to any third party (including a Recipient's Affiliate) or others or use for the Recipient's own benefit or for the benefit of any third party or others, any Proprietary Information, in any form, which is disclosed to the Recipient by the Discloser at any time and **(ii)** to carry out all necessary and appropriate measures to ensure that the Proprietary Information is protected against any access by third parties or others. The Recipient shall disclose Proprietary Information received under this Agreement to person(s) within its organization only if such persons **(i)** have a need to know and **(ii)** are bound in writing to protect the confidentiality of such Proprietary Information under the same terms as this Agreement. This paragraph 1 shall survive and continue for a period of five (5) years after the termination of this Agreement and shall bind the Recipient, its employees, agents, representatives, successors, heirs and assigns.

In compliance with the European Union's General Data Protection Regulation, the Recipient agrees to adhere to the confidentiality expectations as outlined in the EU General Data Protection Regulations (GDPR) and require the same of any subcontractors that perform services in conjunction with this Agreement.

In the event that the Recipient is required by mandatory law or regulation or by order of a court, government department or agency or recognized stock exchange to disclose any Proprietary Information, the Recipient shall provide the Discloser with prompt notice of such requirement – to the

extent that such notice is permitted by law or regulation – so that the Discloser may seek a protective order or other appropriate remedy or waive compliance with the provisions of this Agreement. Whether or not such protective order or other remedy is obtained, or whether the Discloser waives compliance with the provisions of this Agreement, the Recipient shall disclose only that portion of the Proprietary Information which is legally required to be disclosed and comply with the Discloser's reasonable instructions to protect the Proprietary information.

The undertakings and obligations of the Recipient under this Agreement shall not apply to any Proprietary Information, if and in so far as the Recipient can show that such Proprietary Information: **(a)** is disclosed in a printed publication available to the public, or is otherwise in the public domain through no action or fault of the Recipient; **(b)** is generally disclosed to third parties by the Discloser without restriction on such third parties, or is approved for release by written authorization of the Discloser; or **(c)** was developed by the Recipient completely independently of any such disclosure by the Discloser or was already known to the Recipient prior to disclosure.

2. Title to all data, information material or other property received by the Recipient] from the Discloser, including all Proprietary Information, shall remain at all times the sole property of the Discloser, and this Agreement shall not be construed to grant to the Recipient any patents, licenses, publication rights or similar rights to such property and Proprietary Information disclosed to the Recipient hereunder.

3. The Recipient shall, upon request of the Discloser, return to the Discloser all documents, drawings and other materials, including all Proprietary Information and all manifestation thereof, delivered to the Recipient, and all copies and reproductions thereof. Unless required otherwise by mandatory law, the Recipient shall destroy all copies of any Proprietary Information. Upon the Discloser's request the Recipient shall confirm compliance by the Recipient with the obligations under this paragraph 3 in writing.

4. The Proprietary Information is provided without any representation or warranty, express or implied, as to its accuracy or completeness. Each Party hereby agrees that the Recipient will assume full responsibility for all conclusions that the Recipient derives from the Proprietary Information. The Discloser shall have no liability with respect to the Proprietary Information, errors therein or omissions there from in any manner and on any legal ground.

5. The parties further agree to the following terms and conditions:
    a. The Recipient agrees to be fully responsible and liable to the Discloser for any actions or failures to act which result in a breach of this Agreement. Any breach by the Recipient of any of the Recipient's obligations under this Agreement will result in irreparable inquiry to the Discloser for which damages and other legal remedies will be inadequate. In seeking enforcement of any of these obligations, the Discloser will be entitled (in addition to other remedies) to preliminary and permanent injunctive and other equitable relief to prevent, discontinue and/or restrain the breach of this Agreement.
    b. If any provision of this Agreement is invalid or unenforceable, then such provision shall be construed and limited to the extent necessary, or severed if necessary, in order to eliminate such invalidity or unenforceability, and the other provisions of this Agreement shall not be affected thereby.
    c. No delay or omission by either party in exercising any rights under this Agreement will operate as a waiver of that or any other right. A waiver or consent given by either party on any one occasion is effective only in that instance and will not be construed as a bar to or waiver of any right on any other occasion.
    d. This Agreement shall be binding upon and will inure to the benefit of the parties hereto and their respective successors and assigns.
    e. All disputes arising in connection with the present Agreement shall be amicably solved

between the Parties. If they cannot be so amicably solved, they shall be finally settled by the court of the Discloser's country applying the laws of Discloser's country, but excluding the conflict of law regulations, if the Recipient raised the dispute; by the Court of the Recipient's country applying the law of the Recipient's country, but excluding the conflict of law regulations, if the Discloser raised the dispute.

f. This Agreement is in addition to any prior written agreement between the Discloser and the Recipient relating to the subject matter of this agreement; in the event of any disparity or conflict between the provision of such agreements, the provision which is more protective of Proprietary Information shall prevail.

This Agreement may not be modified, in whole or in part, except by an agreement in writing signed by the Discloser and the Recipient.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first above written.

The Discloser
By: Centre for Research and Technology Hellas/ Information Technologies Institute
Signature

_____
Printed Name
Dimitrios Tzovaras

The RECIPIENT
By: _____
Signature

_____
Printed Name
_____