

Interoperable solutions for implementing holistic **FLEXI**bility services in the distribution **GRID** 

## **FLEXIGRID KPIs Panel**

Deliverable 2.4 WP2

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## **Approvals**

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WP Leader	UNIZG-FER

## **Documents History**

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### **ABBREVATIONS**

A Current in Ampere

**BaU** Business as Usual

**DER** Distributed Energy Resources

**DSC** Demo-Sites coordinator

**EV** Electric Vehicles

**FG** FLEXIGRID

**KPI** Key Performance Indicator

M Month

**PV** Photovoltaic system

**R&D** Research and Development **RES** Renewable Energy Sources

RMS Root Mean SquaredTP Technical PartnerUCS Use Case supervisorV Voltage in Volts

WP Work Package



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### **EXECUTIVE SUMMARY**

This document sets out the guidance for the use of KPIs by the FLEXIGRID project during the deployment and testing phases. A monitoring plan and a contingency plan have been also developed.

During the execution of this task, a general list of KPIs was defined together with the leaders of the demos and the technology providers. To provide greater flexibility during the deployment stage, this list was divided into two large categories, corresponding to the central KPIs and the auxiliary KPIs. The first list covers the requirements indicated by the demo leaders, the second works as a quick backup during later stages.

The FLEXIGRID project has four defined demonstration sites (Spain, Croatia, Italy and Greece), each with particular needs to be covered, therefore four specific sets of KPIs are established, based on the KPIs panel list (see section 4 of this document), these four lists are shown in Table 1 below. If necessary, a set of auxiliary KPIs are also included for all demos, which are shown in Table 2.

Core KPI	CROATIA	ITALY	GREECE	SPAIN
Average estimation of savings per stakeholder (AeS)	Х		Х	
CAIDI		Χ	Х	Х
CO2 tonnes saved (CO2Sv)			Х	
Customer satisfaction (DR services) (CuSa)	Х			
Demand Flexibility Potential (DFP)(Baseline)	Х			
DR Delivery Deviation (DRDD)	X			
Energy Consumption (EC)			Х	
Exchange of Information with sub-DSOs (ExI)		Χ		
Fault cause detection for recurrent faults (FCD)				Χ
Fault location accuracy (on demo site) (FLA)				Χ
Forecasting Accuracy (FA)	Х	Χ	Х	Χ
Improved Interoperability (II)	Х			Χ
Increased RES Hosting capacity (RESHC)		Χ		
Investment return for secondary substation refit (IRSSR)				Χ
Island mode reliability rate (IMRR)		Χ		
Number of Grid Events (NGE)			Х	
Number of Voltage Limits Violations (VLV)		Χ		
Oversight variables available (OVV)				Χ
Peak load reduction (PLRed)	Х		X	
Protections tripping time improvement (PTT)				Χ
Rate of successful switching operations to reconnect to grid (SSG)		Χ		
Reactive Energy Consumption (RE)			Х	
SAIDI		Χ		
Self-Consumption Rate (SCRt)			Х	
Self-sufficiency ratio (SSRt)		Χ	Х	
Successful event reading index (SERI)			X	Χ
Successful meter reading index (SMRI)				Χ
Switching success ratio to islanded mode (SSR)		Χ		
Thermal discomfort factor (TDF)	Х			

Table 1. Core KPI List



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Name (ID)	Description
Demand Available	The amount of load that can be shifted temporally. Needs specification
Flexibility (DAF)	dependent on the method used to provide an incentive (RTP, remote
	operation of customer assets or other options)
Energy Consumption (EC)	Total energy consumed in a period
Energy not supplied (ENS)	The amount of energy that normally would be delivered, but which has
	not been supplied because of an outage
Flexibility actions taken	Number of flexibility actions taken to reduce demand, load control,
(FAT)	network configuration, etc. in a period
Generation Available	The amount of generation that can be shifted temporally
Flexibility (GAF)	
Grid investment deferral	Savings (avoided costs) by employing new proposed solutions vs
(GID)	traditional (e.g. line reinforcement)
Increased EV Hosting	The additional EV capacity that can be accommodated on the distribution
capacity (EVHC)	network after the deployment of the FLEXIGRID solution, compared to
	the EV capacity that can be accommodated on the distribution network
	without it.
Line overload occurrence	Number of line overloading events up to 15 minutes within a year
(LOO)	
Load curve valley filling	It is defined as the ability to shift load to valley hours, by means of the
(VF)	direct control of assets or by tariff strategy.
NADIR	Minimum frequency reached after a contingency event (by node)
Number of frequency out	Calculates times that the average value of the fundamental frequency
of range events (FOR)	measured over periods of 10 s goes out of the stated ranges (FCE).
Rate of successful	Number of successful reconnections to grid divided by number of all
switching operations to	attempts to reconnect to grid in a year
reconnect to grid (SSG)	
Reduction in Energy Losses	Amount of electrical energy lost on grid's conductors, transformers, etc.
(REL)	
Reverse Power Flow (RPF)	Power/energy flow from distribution feeder/system upward due to
	excess of RES power generation
ROCOF	Corresponds with the frequency gradient after an active power
	imbalance.
SAIFI	The System Average Interruption Frequency Index (SAIFI) indicates how
	often the average customer experiences a sustained interruption over a
	predefined period.
Voltage Unbalance Factor	Voltage unbalance is defined as the ratio of the negative sequence
(VUF)	voltage component to the positive sequence voltage component

Table 2. Auxiliary KPI List



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### 1 INTRODUCTION

The FLEXIGRID project contemplates the use of innovative solutions to provide flexibility under different use cases and configurations of electrical networks. Proposed solutions will allow the distribution grid to operate securely and stably when a large share of variable generation electricity sources is connected to low and medium voltage grids.

FLEXIGRID proposes a three-level approach aiming at Flexibility, Reliability, and Economic Efficiency through the development of innovative hardware and software solutions. These solutions will be demonstrated in four Demo-Sites across Europe ensuring their interoperability through its integration into an open-source platform able to harmonize the data flow between the FLEXIGRID solutions and the actual grid.

This document is part of the WP2 deliverables, the scope of WP2 consists of the definition of the baseline and key aspects for the proper development and subsequent deployment of FLEXIGRID solutions as well as to guide the monitoring process to be defined in WP6.

### **2** OBJECTIVE

This report brings together a specific set of KPIs defined in Task 2.3 (part of WP2) to evaluate the innovation and effectiveness of FLEXIGRID solutions over the duration of the project. These KPIs include a complete set of instructions needed to calculate them as well as the data required to do so.

In addition, solutions for monitoring and backup plans for KPI troubleshooting will be shown, based on procedures to be used during the demonstration stage.

### 3 KPI DEFINITION

### 3.1 Selection methodology

The first set of KPIs was launched at the beginning of WP2, based on earlier projects that focused on flexibility and smart grid control assets (see references). Feedback from all the leaders of the demonstration sites on this first KPI list was collected and analyzed, and each leader proposed new KPIs considering their specific needs.

As a result of the first iteration, a second list of KPIs was sent, this time to all technology partners (software and hardware solutions), analogous to the initial list, all responses were collected and taken into account to improve all aspects to be monitored.

Finally, the last iteration was carried out to eliminate redundant and less relevant KPIs and the complete KPIs Panel list was defined (see Annex A.2). The outline of the process mentioned above is shown in Figure 1.



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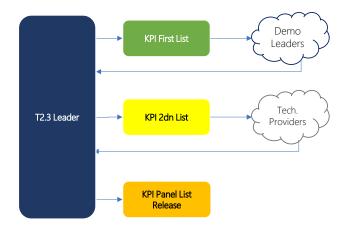


Figure 1. KPI Definition workflow

### 3.2 Categories and implementation

The FLEXIGRID project has four demonstration sites and eight solutions (two per demonstration) and an special solution (9th) shared ,as a result, there are a significant number of KPIs on the panel list, therefore, to provide an effective set of performance indicators for each demonstration the KPI Panel list was divided into several categories.

These categories correspond to two classifications: core KPI and auxiliary KPI. The core KPI contains a minimum number of essential indicators (usually less than 10) that will be measured in the testing stage following the strategies defined in the monitoring plan proposed in this document. In addition, a list of auxiliary KPIs will be established for rapid deployment if demonstration needs arise or change during the demonstration campaign activities. The general classification scheme of the KPI groups is shown in Figure 2.

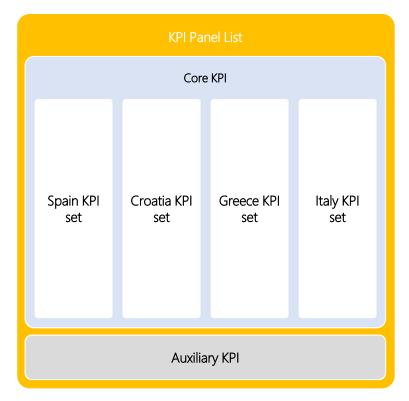


Figure 2. KPI Classification



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### **4 KPI PANEL LIST**

After following the procedure described in section 3.1, the KPI panel list is defined and contains both the core and auxiliary KPIs along with their names, IDs and a high-level description, as shown in **Error! Reference source not found.**.

Name (ID)	Description	Classification	HR	IT	GR	ES
Average estimation of savings per stakeholder (AeS)	Total savings from avoided energy consumption or purchase (depending on concerned stakeholder) over the sum of that avoided energy.	Core KPI	X		X	
CAIDI	The Customer Average Interruption Duration Index (CAIDI) represents the average time required to restore service.	Core KPI		Х	Х	X
CO2 tonnes saved (CO2Sv)	Amount of CO2 reduction due to substitution of fossil power generation by additional RES units inside the distribution network under analysis (Using FLEXIGRID solution)	Core KPI			X	
Customer satisfaction (DR services) (CuSa)	Satisfaction rating (define the rating range, e.g. from 1 to 5 with 5 being extremely satisfied and 1 being extremely dissatisfied) in Questionnaires	Core KPI	X			
Demand Available Flexibility (DAF)	The amount of load that can be shifted temporally. Needs specification dependent on the method used to provide an incentive (RTP, remote operation of customer assets or other options)	Auxiliary KPI	(1)			
Demand Flexibility Potential (DFP) (Baseline)	The amount of potential Demand Flexibility reflects the amount of energy consumption reduction participating Customers (i.e. End Users) could potentially accept and apply	Core KPI	X			
DR Delivery Deviation (DRDD)	The difference between the DR the Customer has committed to deliver and the DR that the Customer actually delivered	Core KPI	Х			
Energy Consumption (EC)	Total energy consumed in a period	Core KPI			Х	
Energy not supplied (ENS)	The amount of energy that normally would be delivered, but which has not been supplied because of an outage	Auxiliary KPI		(:	1)	
Exchange of Information with sub-DSOs (ExI)	Number of new information exchanges with sub-DSOs	Core KPI		Х		
Fault cause detection for recurrent faults (FCD)	It is the ratio between the number of fault events (with defined reason) and the total fault events	Core KPI				X
Fault location accuracy (on demo site) (FLA)	Accuracy in fault distance determination using FLEXIGRID solutions	Core KPI				Х
Flexibility actions taken (FAT)	Number of flexibility actions taken to reduce demand, load control, network configuration, etc. in a period	Auxiliary KPI		(	1)	

Table 3. KPI panel List



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Name (ID)	Description	Classification	HR	IT	GR	ES
Forecasting	Deviation between the forecasted values					
Accuracy (FA)	and the corresponding measurements for	Core KPI	Χ	Χ	Χ	
	the demand/generation by node					
Generation	The amount of generation that can be					
Available	shifted temporally	Auxiliary KPI		(:	1)	
Flexibility (GAF)						
Grid investment	Savings (avoided costs) by employing new					
deferral (GID)	proposed solutions vs traditional (e.g. line	Auxiliary KPI				
	reinforcement)	·				
Improved	Interoperability is the ability of a system (or					
Interoperability	product) to work with other systems (or					
(11)	products). This is made by exchanging					
( )	information and services to enable them to					
	operate effectively together (ISO/TS	Core KPI	Х			X
	37151). The indicator assesses the	55.5	,,			, ,
	improvement in interoperability in a					
	qualitative manner without going into					
	details.					
Increased EV	The additional EV capacity that can be					
Hosting capacity	accommodated on the distribution					
(EVHC)	network after the deployment of the					
(EVIIC)	FLEXIGRID solution, compared to the EV	Auxiliary KPI		(:	1)	
	· · · · · · · · · · · · · · · · · · ·					
	capacity that can be accommodated on the distribution network without it.					
Increased RES						
	The RES hosting capacity is the total					
Hosting capacity	installed capacity of RES that can be	Core KPI	X			
(RESHC)	connected without endangering system					
larra stan ant matrices	stability and reducing system reliability					
Investment return	Saved money due to the refit of non-smart					
for secondary	secondary substations. Avoided costs by					
substation refit	employing new proposed solutions vs	Core KPI				Х
(IRSSR)	traditional (e.g. reduction of energy not					
	supplied, improve time to restore service,					
	etc.)					
Island mode	Effective time operation in a islanded					
reliability rate	mode divided by period of time that should	Core KPI		Χ		
(IMRR)	had been operate in islanded mode					
	because a grid failure in a year					
Line overload	Number of line overloading events up to 15	Auxiliary KPI		(:	1)	
occurrence (LOO)	minutes within a year	,			<u> </u>	
Load curve valley	It is defined as the ability to shift load to				• \	
filling (VF)	valley hours, by means of the direct control	Auxiliary KPI		(:	1)	
	of assets or by tariff strategy.					
NADIR	Minimum frequency reached after a	Auxiliary KPI		(:	1)	
	contingency event (by node)	,			,	
Number of	Calculates times that the average value of					
frequency out of	the fundamental frequency measured over	Auxiliary KPI		(:	1)	
range events	periods of 10 s goes out of the stated	,, ,			-,	
(FOR)	ranges (FCE).				1	
Number of Grid	Number of events that change the					
Events (NGE)	network, as lines aperture, tripping of	Core KPI			Х	
	protection in substations, OLTC operation.					
NI	Number of times than voltage in a node					
Number of						
Voltage Limits	exceeds (under or over) the tolerance limit	Core KPI		X		
	exceeds (under or over) the tolerance limit (usually 5%) for more than 2 seconds in a period.	Core KPI		Х		

Table 3. KPI panel List (cont.)



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Name (ID)	Description	Classification	HR	IT	GR	ES
Oversight variables available	Oversight level of secondary substation for maintenance purposes. Number of signals	Core KPI	1111		OI.	X
(OVV)	to determine predictive and corrective maintenance actions.					
Peak load reduction (PLRed)	This KPI shows the reduction in the maximum electricity demand. The KPI is the difference between the two peaks, the power peak with respect to the baseline and the power peak with respect to the Demand Response event with the FLEXIDRIG solutions.	Core KPI	X		Х	
Protections tripping time improvement (PTT)	Effective reduction of tripping time by implementation of new algorithms	Core KPI				X
Rate of successful switching operations to reconnect to grid (SSG)	Number of successful reconnections to grid divided by number of all attempts to reconnect to grid in a year	Auxiliary KPI		(	1)	
Reactive Energy Consumption (RE)	Total reactive energy consumed in a period	Core KPI			Х	
Reduction in Energy Losses (REL)	Amount of electrical energy lost on grid's conductors, transformers, etc.	Auxiliary KPI	(1)			
Reverse Power Flow (RPF)	Power/energy flow from distribution feeder/system upward due to excess of RES power generation	Auxiliary KPI	(1)			
ROCOF	Corresponds with the frequency gradient after an active power imbalance.	Auxiliary KPI		(	1)	
SAIDI	It is the average duration of all interruptions per utility customer during the period of analysis. Here, the total customer minutes of interruption are added together and divided by the total number of customers in the system.	Core KPI		х		
SAIFI	The System Average Interruption Frequency Index (SAIFI) indicates how often the average customer experiences a sustained interruption over a predefined period.	Auxiliary KPI	(1)			
Self-Consumption Rate (SCRt)	It is the ratio of consumed renewable energy over the sun of all renewable electricity generated on site.	Core KPI			Х	
Self-sufficiency ratio (SSRt)	It is the ratio of total power provided by RES consumed locally and total power required by local demand in a period	Core KPI		Х	Х	
Successful event reading index (SERI)	This KPI has been defined to analyze if all the meters or IED's are sending their registers	Core KPI			Х	Х
Successful meter reading index (SMRI)	Indicator to evaluate the performance of the metering infrastructure, covering all kind of queries to request meter data	Core KPI				Х

Table 3. KPI panel List (cont.)



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Name (ID)	Description	Classification	HR	IT	GR	ES
Switching success ratio to islanded mode (SSR)	Number of successful switching operations to islanded mode divided by the total number of switching attempts to islanded mode in a year	Core KPI		X		
Thermal discomfort factor (TDF)	Assessing people's satisfaction in regards to their thermal environment	Core KPI	Х			
Voltage Unbalance Factor (VUF)	Voltage unbalance is defined as the ratio of the negative sequence voltage component to the positive sequence voltage component	Auxiliary KPI	(1)			

<sup>(1)</sup> Auxiliary KPIs can be used in any demo that requires it

Table 3. KPI panel List (cont.)



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# **KPI DATASHEET**

#### 5.1 Common Format

A common data sheet format was developed for all KPIs. This data sheet defined the calculation process, the necessary data and those responsible for providing the information.

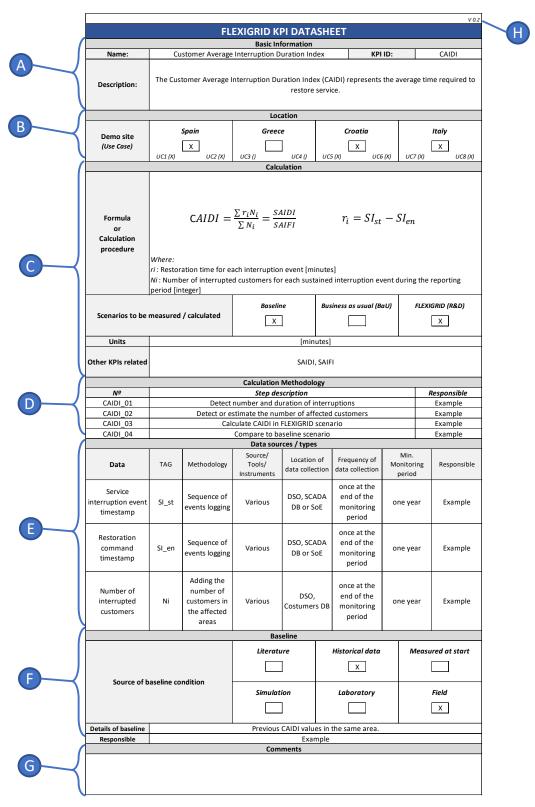


Figure 3. KPI Datasheet common format sections



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#### 5.2 Sections

The form includes all elements shown in Figure 3 and indicated as follow:

A. Basic information: where the short name (ID) and a brief description of the KPI will be indicated.

- B. Location: Demo sites and use cases where the performance indicator can be applied will be indicated. (It may change according to the criteria set out in the demonstration stage)
- C. Calculation: This section describes the KPI calculation process and indicates the scenarios to be calculated. At the beginning of the demonstration phase the baseline or business as usual will be calculated, and a final scenario based on the use of FLEXIGRID solutions will be calculated at the end of the demonstration phase.
- D. Calculation methodology: The methodology indicates the steps to perform the KPI calculation, including the necessary input data, the intermediate processes, and the final value, as well as the engineering units.
- E. Data sources/types: In this section the required data, its sources, and the way to obtain it, as well as the responsible for providing the data can be found. Information on the data collection period is also included.
- F. Baseline: This section defines the method used to determine the baseline conditions of the KPI, either through historical data, simulations, reference to literature or others.
- G. Comments: General section for comments and notes.
- H. Versioning: Indicates the version of the data sheet.

The blank form is shown in Annex A.1, the completed data sheets are in Annex A.2.

#### 5.3 Monitoring plan

During the demonstration campaign, the effectiveness of the different solutions proposed will be evaluated through all the previously defined KPIs. At the beginning of the demonstration campaign, an internal workshop will be held to define the definitive actions and procedures to be used during all the deployment and testing stages. As a guide for the mentioned workshop, this document provides the main actions and schedules considering the solution development periods as well as the internal milestones in WP6. At least once KPIs will be measured at the beginning and end of the demonstration phase by phase by the use cases supervisors and demosites coordinators (as mentioned in task T6.6 description) to assess the impacts achieved through the use of FLEXIGRID technologies and services at the four demonstration sites.

The proposed monitoring plan consists of the following steps:

 Internal workshop to discuss and define the common plan for demonstration and monitoring common protocols for demonstration activities, including reporting and data collection procedures. The key performance indicators defined in Task 2.3 (contained in this document) will be measured at the beginning and end of the demonstration phase by use case monitors and demonstration site coordinators to assess the effects achieved through the use of FLEXIGRID technologies and services at the four demonstration sites.



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2. Calculation of the baseline and BaU: This will allow to define the status of the demos before the implementation of the solutions proposed in the FLEXIGRID project, as indicated in the corresponding datasheet.

- 3. First evaluation of the KPI list: It is recommended to perform the calculation of all core indicators contained in the final KPI list. The objective is to determine the feasibility to perform the calculation without problems and make a first performance evaluation. If any drawbacks are detected in the calculation procedure, the problem-solving scheme shown in section six of this document should be followed.
- 4. Evaluation of the KPI in the medium term: at the discretion of the plan defined in the workshop, a follow-up analysis of the progress of the KPIs can be carried out. A review schedule can be followed every four months or in any other period defined in the WP6 workshop.
- 5. General evaluation of the KPIs (end of test): Calculate all indicators at the end of the test phase, this value will be used as input for task T6.6 to compare the progress made after the implementation of the FLEXIGRID project solutions.
- 6. Deliverable D6.6 (first draft): Following the main presentation scheme indicated in the proposal document, the first draft of the KPI assessment should be made at the end of M47.
- 7. Submission of deliverable D6.6.

An outline of the proposed monitoring plan is shown in Figure 4, with all steps and milestones considered as references that could be modified during the main workshop held at the beginning of WP6. Note that the period called 'KPI corrective actions' corresponds to the end of WP3 (M27), WP4 (M30) and WP5 (M36), considering possible interactions to solve KPI problems with the help of these WPs before they are completed.

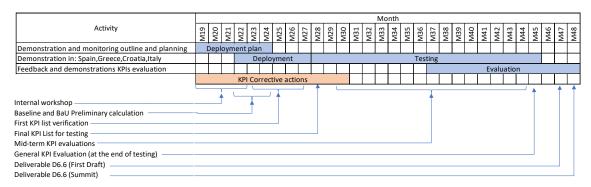


Figure 4. Monitoring plan: main scheme



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### 6 CONTINGENCY PLAN

Due to the nature of the project, problems could arise in the calculation or application of the original list of key performance indicators. To address this situation, three alternatives are proposed depending on the level of difficulty encountered.

#### 6.1 Auxiliary KPIs

Initially, only the base KPI will be calculated, but to address the need for a new performance indicator, there is the possibility to include an existing auxiliary KPI to the master list if required. The demonstration leader or solution provider can address this scenario during any stage of the deployment and test period by sending the request to the WP6 leader, pre-checking the availability of all inputs and the calculation procedure of the new KPI.

### 6.2 KPI Datasheet modification

Modification of an existing KPI (basic or auxiliary) is possible, this request comes from a demonstration coordinator or a use case supervisor. If the modification only affects the involved demonstration (the KPI is not used in another demonstration) the data sheet of the modified KPI can be updated to the final list (by increasing the version number), in case the KPI to be modified is also applied in another demonstration, the modified version is issued and it is indicated that it only affects to a particular demonstration the version number is changed and the suffix ES, IT, GR or HR is used according to the country concerned. For example, the modification of a datasheet with original version 0.2 for the Croatian demo gives as new version the 0.3HR, this code must be indicated in the section "G" of the datasheet.

The modification of the datasheet must be carried out by the applicant of the change, in which case he will check the availability of all data and the calculation process.

#### 6.3 New KPI procedure

There is an option to create a new KPI, this option will be limited to only the supervisor of the use case, who must present the new KPI, the calculation method and required data (datasheet filled) to the leader of the demo for approval. After that it is included in the main list indicating in the comments section that it is a new KPI attachment.

It should be noted that creating a new KPI may require the assistance of work packages 3, 4 or 5 depending on the type of KPI, the application should be requested before these packages are finalized (see monitoring plan in section 5.3), the general process for solving KPI calculation problems is shown in Figure 5.

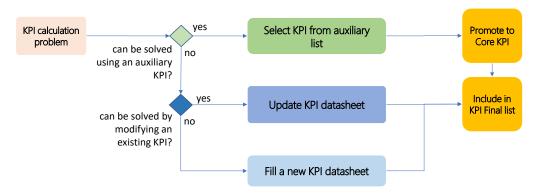


Figure 5. KPI troubleshooting procedure



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### 7 REFERENCES

BEST PATHS - BEyond State-of-the-art Technologies for rePowering Ac corridors and multi-terminal Hvdc Systems - D13.5 KPI (Levels 1&2) assessment and conclusion.

IDE4L - IDEAL GRID FOR ALL - Deliverable D7.1: KPI Definition

Dionysios Pramangioulis et al. - A Methodology for Determination and Definition of Key Performance Indicators for Smart Grids Development in Island Energy Systems - Energies 2019

UPGRID – Report about KPI analysis and methods of comparison.

inteGRIDy - integrated Smart GRID Cross-Functional Solutions for Optimized Synergetic Energy Distribution, Utilization & Storage Technologies - inteGRIDy Global Evaluation Metrics and KPIs.

John Van Gorp - Using Key Performance Indicators (KPIs) to Manage Power System Reliability - Schneider Electric

FLEXIGRID - Proposal 864579 - Horizon 2020 / Call: H2020-LC-SC3-2018-2019-2020



Author: CIRCE

Version: Final version
Date: 30/06/2020

### 8 ANNEXES

A.1 KPI Form Template

A.2 All KPI Datasheets filled



Author: CIRCE

Version: Final Version
Date: 30/06/2020

### ANNEXE A.1 KPI FORM TEMPLATE

V0.2									
		FL	<b>EXIGRID</b> KI	PI DATA	SHE	EET			
				formation					
Name:						KPI	ID:		
						•		•	
Description:									
			Loc	ation					
		Spain	Greec	•		Croatia			Italy
Demo site	,	<del>Spain</del>	Greec	_					ituly
(Use Case)									
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UCE	5 (X)	UC7 (X)	UC8 (X)
			Calcu	ulation					
Formula									
or									
Calculation									
procedure									
			Baselin	ne	Bus	iness as usual (B	aU)	FLEXIC	GRID (R&D)
Scenarios to be	measured	/ calculated					1	ı	
11									
Units									
Other KPIs related									
Other Kris related									
			Calculation	Methodolo	ogv				
Nº				scription	01			F	Responsible
			,						
								_	
			Data sour	ces / types					
			Source/	tcs / types	•				
Data	TAG	Methodology	Tools/			Frequency of			Responsible
2414			Instruments	collection	on	data collection	- 1	period	
			Bas	eline					
						titute de et de terr			
Source of b			Literatu	ire		Historical data		ivieasu	red at start
Source of b	aseline co	naition		1					
				_					
			Simulat	ion		Laboratory			Field
Sites to	be Calcula	ted	Simulati	_		Laboratory			rieiu
Jiles to	oc calcula	ica -		]					
Details of baseline									
Responsible									
			Com	ments					



Author: CIRCE

Version: Final version
Date: 30/06/2020

## ANNEXE A.2 All KPI Datasheets filled

Core (orange)

Auxiliary (blue)

		FLE	EXIGRID KF	PI DATA	SHE	ET			
	,			ormation					
Name:	Av	erage estimation	on of savings pe	r stakehold	ler	KP	ID:		AeS
Description:	Total sav	rings from avoid				:hase (dependir Dided energy.	ng on st	akeholde	er concerned)
			Loca	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	UC4 (X)	UC5	Croatia	5 (X)	UC7 (X)	Italy UC8 (X)
Formula or Calculation procedure	S_n: Savin n: Total nu AeS_fg: Av AeS_Bau:	AeS = $\sum_{i=1}^{\infty}$ age estimation gs in cathegory umber of catego verage estimation are also as a contract of the contract of	of savings [€] n [€] ories for savings ons savings in Fl tions savings in	LEXIGRID so			= 100	$\frac{AeS}{AeS}$	<u>-fg</u> BaU <sup>(*)</sup>
	( ) 55p.	ememon y remine	Baselin	10	Ruc	iness as usual (B	all)	EI EVI	GRID (R&D)
Scenarios to be r	measured ,	/ calculated	Buseiiii	]	Dus	X		FLEXIC	X X
Units	Ī								
Other KPIs related				-	-				
			Calculation I	Methodolo	gy				
Nº			Step des	scription				R	Responsible
AeS_01	Determine	e all categories t	to be included in	n savings					DSC
AeS_02	Define a B	aU scenario for	each category i	in AeS_01					DSC
AeS_03	Define a F	LEXIGRID scena	rio for each cate	egory in Ae	S_01				DSC
AeS_04	Perform c	alculation for Ba	aU and FLEXIGR	ID scenario	s (sav	vings)			DSC
AeS_05	Define a F	LEXIGRID scena	rio for each cate	egory in Ae	S_01				DSC
_				ces / types					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	lin. itoring riod	Responsible
Associated cost per category	AC	DWP6	DWP6	DWP6	5	once		-	DSC
			Base	eline			•		
Source of ba	!:	adiai a a	Literatu X	ire ]		Historical data		Measu	red at start
	aseime cor	idition	Simulat X	ion ]		Laboratory			Field
Details of baseline				LICE	/ Dsc				
Responsible			Comi	UCS / ments	יייייי				
DSC = Demo-Sites co UCS = Use Case supe			33.111						

									V 0.2
		FL	EXIGRID KI	PI DATA	SHE	ET			
			Basic Inf	formation					
Name:	С	ustomer Average			ex	KPI	ID:		CAIDI
Description:		stomer Average			x (CA	IDI) represents t		erage time	
			Loc	ation					
	l		LOC	ation			T		
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	Greec UC3 (X)	<b>e</b> ] UC4 (X)	UC5	Croatia	5 (X)	UC7 (X)	Italy  UC8 (X)
			Calcu	ulation					
Formula or Calculation procedure		CAIDI =	-	event [min					porting period
Scenarios to be	measured	/ calculated	<b>Baselin</b>	ne ]	Bus	siness as usual (Bo	aU)	FLEXI	GRID (R&D)
Units				[min	utes]				
Other KPIs related				SAIDI,	SAIF	I			
	<u>I</u>		Calculation	Methodolo	gv				
Nº				scription	781				Responsible
CAIDI 01		Detect	number and du	-	ntarri	intions			DSC
CAIDI_01			stimate the nur						DSC
CAIDI_03		Cai	culate CAIDI in			irio			UCS
CAIDI_04			Compare to ba						UCS
	ı			ces / types	3				T
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Mor	Min. nitoring eriod	Responsible
Service interruption event timestamp	SI_st	Sequence of events logging	Various	DSO, SCA		once at the end of the monitoring period	on	e year	DSC
Restoration command timestamp	SI_en	Sequence of events logging	Various	DSO, SCA DB or Si		once at the end of the monitoring period	on	e year	DSC
Number of interrupted customers	Ni	Adding the number of customers in the affected areas	Various	DSO, Costumer	s DB	once at the end of the monitoring period	on	e year	DSC
			Bas	eline					_
			Literatu	ıre		Historical data	T	Meac	ıred at start
			Literati			Thistorical data		ivicust	
Source of b	aseline co	ondition		]		Х			
			Simulat	ion		Laboratory			Field
				]					Х
Details of baseline			Previous			the same area.		·	
Responsible				UCS ,	DSC DSC				
			Com	ments					
DSC = Demo-Sites co	oordinator				_				
UCS = Use Case sup	ervisor								

		FL	EXIGRID KI	PI DATA	SHI	EET			
				formation					
Name:		Custo	mer satisfaction	n		KP	ID:		CuSa
Description:	Satisfa	ction rating (def				to 5 with 5 bei in Questionnai		nely sa	tisfied and 1
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greec UC3 (X)	UC4 (X)	UCS	Croatia	5 (X) U	JC7 (X)	Italy UC8 (X)
			Calcu	ulation					
Formula or Calculation procedure		Questi	onnaires with 1	to 5 scale,	anali	sys from psycho	ometric s	cale	
	1		Baselir	10	Rus	siness as usual (B	all)	FIFXI	GRID (R&D)
Scenarios to be	measured	/ calculated	X	]	Du.	Siness us usual (b		ILLXI	X
Units				Likert sca	le (1	to 5)	I		
Other KPIs related				-	-				
ALC:			Calculation		ogy				
Nº	Cuanta a a			scription	.: \			<del>- '</del>	Responsible
CuSa_01		questionnaire m						_	DSC
CuSa_02		ploy system (on	line, mail, etc) f	or each #C	u				DSC
CuSa_03		l feedbacks							DSC
CuSa_04	Perform o	calculation of res							UCS
		1		rces / type:	S	<u> </u>	l Mi		<u> </u>
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mii Monito peri	oring	Responsible
Customers to deliver the questionnaire	#Cu	Diffusion targeting	DSO DB	DSO		once	DW	'P6	DSC
Customers satisfaction	#CuSa	analisys from psychometric scale	CuSa_03	DWP6	5	DWP6	DW	'P6	DSC
			Bas	eline					
Source of b	oaseline co	ndition	Literatu	ıre		Historical data		Measu	red at start
	1		Simulat	ion		Laboratory			Field X
Details of baseline				HCc	/ Dsc				
Responsible			Com	UCS , ments	, שאנ				
DSC = Demo-Sites of	coordinato	r							
UCS = Use Case sup	pervisor								

		FL	EXIGRID K	PI DATA	SHI	EET			
	<u> </u>			ormation					
Name:		Demand	Flexibility Poter	ntial		КРІ	ID:		DFP
Description:	The an					e amount of ene			n reduction
			Loc	ation					
		See asia				Consultin			141
Demo site		Spain	Greece	e		Croatia			Italy
(Use Case)			<u> </u>	]					
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC	5 (X) UC6	5 (X)	UC7 (X)	UC8 (X)
Formula or Calculation procedure	Where:			$DAP = \int_{0}^{\infty}$	$\sum i$	$Df_n$			
		nand available fo nount of load tha			N/1N/1				
	<i>υ</i> <u>ς</u> Απ	ount of load tha						FI FVI	CDID (D8 D)
Scenarios to be	measured	/ calculated	Baselin	1 <i>e</i>	Виз	siness as usual (Bo	10)	FLEXIC	GRID (R&D)
		,	X_	]				ļ	Х
Units	I			[M	Wl				
Other KPIs related			Genera	tion Availat	ole Fl	exibility (GAF)			
			Calculation	Methodolo	gy				
Nº			Step des	scription				R	Responsible
GAF_01	Power grid	d assets characte	eristics (lines, tra	nsformers,	gene	eratos, etc.) #GD			DSC
GAF_02	Modeling	power grid for L	PF using #GD						DSC
GAF_03	Determine (Gf_n)	e potencial load	available to be s	shifted in a	basel	line scenario in n	ode		UCS
			Data sour	ces / types	;				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	in. toring riod	Responsible
Grid data	#GD	Power grid	DSO registers	DSO regis	ters	once		-	DSO
			Bas	eline			<u> </u>		
			Literatu	ire		Historical data		Measu	red at start
Source of b	acolino co	ndition	Х	]		X			
30urce or t	aseille co	ilaition	Simulati	ion		Laboratory			Field
			X	]				[	
Details of baseline							I		
Responsible				UCS ,	/ DSC	,			
500 5 -:			Com	ments					
DSC = Demo-Sites of UCS = Use Case supp									

		F	LEXIGRID K			T			
Name:		DR D	Basic In elivery Deviation	formation		KPI	ID:		DRDD
Description:	The diffe	rence between t	he DR requested		vered by delivered		er and the	DR that	the Customer
				cation					
Demo site (Use Case)		Spain	Greec	e 1		Croatia		,	Italy
(osc cusc)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS (X)	UC6	(X) UC	7 (X)	UC8 (X)
Formula or Calculation procedure	Where: AVED; Act DIFR; Dem The calcular The follow $\beta_i$ : The form $\beta_i$ : The	and Flexibility Re attion of ADFD, and ing times series a scasted baseline porecasted minimum and) orecasted maximum are series represent period they are the series of the series easure how much sted flexibility should be a series of the series to 1 indicating ful on (i.e. request to a series of the series of th	— DFR <sub>i</sub> bility Delivered by quested to be del d DFR <sub>c</sub> can be carr re assumed to be sower (blue line), an power (orange um power (yellow the flexibility which reference pow flexibility was activated by the signal that re lactivation). In w provide downwards flexibility at t to a control or the signal that re lactivation). In w provide downwards flexibility at t to a control or the signal that re lactivation). In w provide downwards flexibility at t to a control or the signal that re lactivation. In w provide downwards flexibility at t to the signal that re lactivation in (downwards flexibility at t to the signal that re lactivation).	ivered by the ied out usin available for which is the line) that c v line) that c	g the following the following the following the following the following the forecast and be appropriated to the forecast and be appropriated to the following the followin	time t  Lag and $a_{\tau}(P_{\tau} - P_{\tau})$	emand flex : : sset / custof ven no acti ding down ding upwar me period d in some period no no the signification and the signification the	mer prevation is vards flower prevation is the comparation of the comp	emise): s requested exibility bility (increased rwards in the red against, in of it should be cating no s to decreased for requests to
Scenarios to be Units	equal to at		<b>Baselin</b>		<b>Busines</b> Wh	ss as usual (Bo	aU)	FLEXIG	GRID (R&D)
Other KPIs related			E	nergy Cons		(EC)			
			Calculation						
Nº			Step des		ogy			R	esponsible
DRDD_01	forecasted		ponse requester and the forecas gnal				nultiply it		DSC
DRDD_02	Calculate provided		red Demand Res	sponse usin	ig the reli	evant formul	a		UCS
DRDD_03	The differ	ence between D	RDD_01 and DRI			Delivery Devi	ation		UCS
		1	Data sou Source/	rces / type			Min.		
Data	TAG	Methodology	Tools/ Instruments	Location data collec		equency of ta collection	Monitor		Responsible
Forecasted baseline power	#FBP	Historical data measured	Local meter (IED or other type of meter)	Custome premises Mains and controllal asset	s / d/or Ev ble	ery minute	Day		DSC
Forecasted minimum power	#FMIP	Thermal comfort model calculation based on customer preferences	Sensors installed at customer premises	Participat custome premise zones	er es' Ev	ery minute	Day		DSC
Forecasted maximum power	#FMAP	Thermal comfort model calculation based on customer preferences	Sensors installed at customer premises	Participat custome premise zones	er Ev	ery minute	Day		DSC
Actual power consumption	#APC	Measurement	Local meter (IED or other type of meter)	Custome premises Mains and controlla asset seline	s / d/or Ev ble	ery minute	Day		DSC
Source of b	paseline co	ndition	Literatu Simulati	re		x x aboratory			red at start  x  Field
Details of baseline									
Responsible			Con	UCS nments	/ DSC				
DSC = Demo-Sites co UCS = Use Case sup									

We assume that one activation can be requested only to one side (i.e. either upwards or downwards) at any given time t. We also assume that we either have available historical consumption data for the participating customers or we have allowed enough time before starting with any DR events to collect baseline consumption data.

		FL	EXIGRID K	PI DATA	SHE	ET			
	1			formation					
Name:		Exchange of In	formation with	sub-DSOs		KPI	ID:		ExI
Description:		ı	Number of new	informatio	n excl	hanges with sub	-DSOs		
			Loc	ation					
		Spain	Greec	e		Croatia			Italy
Demo site (Use Case)				- 1					<i>,</i>
(Ose cuse)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	5 (X) UCE	5 (X)	UC7 (X)	UC8 (X)
				ulation					
Formula or Calculation procedure	Where: I <sub>start</sub> : Availa	able informatio	n at the start of t	$ExI = I_{el}$		<b>I</b> <sub>start</sub>			
	I <sub>end</sub> : Availa	able informatior	n at the end of t	he project					
Scenarios to be	measured	/ calculated	Baselin	ne ]	Bus	siness as usual (Be	aU)	FLEXI	GRID (R&D)
Units				Nun	nber		1		
Other KPIs related			Imp	roved Inte	roper	ability (II)			
			Calculation	Methodolo	gy				
Nº			Step des	scription				F	Responsible
ExI_01	Evaluation	ı of I <sub>start</sub>							UCS
ExI_02	Evaluation	ı of I <sub>end</sub>							UCS
				ces / types	<b>.</b>			4.	
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Mon	∕lin. iitoring eriod	Responsible
Number of information (at the beginning)	ExI_01	count data type by engineering unit	SCADA systems / DSO database	SCADA systems / databas	DSO	once		of the	DSC
Number of information (at the end)	ExI_02	count data type by engineering unit	SCADA systems / DSO database	SCADA systems / databas	DSO	once	_	of the ng phase	DSC
			Bas	eline			1		
Source of b	oaseline co	ndition	Literatu	ire ]		Historical data		Measu	x X
			Simulat	]		Laboratory			<b>Field</b> X
Details of baseline	<u> </u>			LICS .					
Responsible			Com	UCS / ments	טאר				
DSC = Demo-Sites c	oordinator								
UCS = Use Case sup	ervisor								

		FL	EXIGRID K	PI DATA	SHE	ET				
				ormation						
Name:		Forec	casting Accuracy	'		KPI	ID:			FA
Description:	D	eviation betwee		d values an nand/gene			measu	reme	ents f	or the
			Loc	ation						
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece UC3 (X)		UCS	Croatia	(X)	UC7	[	UC8 (X)
Formula or Calculation procedure	Where: N: total n en: absolu fn: dema dn: dema	$= \sqrt{\frac{1}{N}} \sum_{n=1}^{N} ($ $\text{umber of nodes}$ $\text{ite error for fore}$ $\text{nd/generation fo}$ $\text{nd value from th}$	where have bot ccast in node n a orecasted value ne grid in node n	e <sub>n</sub> h a forecas It time t [W in node n a at time t [	(t) t and f at tim W]	e t [W]	$_{i}(t)$ ;	for	gen	
	gn: gener	ation value from	the grid in nod	e n at time	t [W]	1	1			
Scenarios to be	measured	/ calculated	<b>Baselin</b>	e [	Bus	iness as usual (Bo	aU)	ı	ELEXIO	GRID (R&D)
Units				[V	V]		i_			
Other KPIs related				-	_					
			Calculation	Methodolo	gy					
Nº	0 . 6		•	scription					R	esponsible
FA_01	Get foreca	ists for the N loa	id/production n	odes in a L	v net	work, generated	at tim	e		UCS
FA_02		railable measure ecasts in node n		data excha	ange :	system that corr	espon	d		DSC
FA_03	Calculate	the FA value of t	he total deman	d/generatio	on no	des in the grid				UCS
			Data sour	ces / types	3					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec	-	Frequency of data collection	Mon	∕lin. itorii eriod	_	Responsible
Forecasted demand/generation	fn	Calculated by forecast algorithm	Directly from forecast algorithm	Data ba	se	To be determined	;	24h		UCS
Measured demand/generation	dn; gn	Obtained from data base registers	IED, SCADA, DSC	Data ba	se	To be determined	;	24h		DSC
			Bas	eline						
Source of b	aseline co	ndition	Literatu X	ıre		Historical data		N	leasu [	red at start
			Simulati X	ion		Laboratory			[	Field
Details of baseline					155					
Responsible			Com	UCS / ments	/ DSC					
DSC = Demo-Sites co UCS = Use Case sup			Com	ments						

		FL	EXIGRID KI	PI DATA	SHI	EET			
Name	ı	Fault sauss dat	Basic Infection for recur	formation		I/DI	ID.		TCD.
Name:		Fault cause det	ection for recur	rent faults		KPI	ID:		FCD
Description:	It is th	e ratio between	the number of	fault event	s (wit	:h defined reaso	n) and th	he total	fault events
			Loc	ation					
Demo site (Use Case)		Spain	Greec	]		Croatia	200		Italy
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS	5 (X) UC6	(X) (	UC7 (X)	UC8 (X)
Formula or Calculation procedure		al fault cause de		$CD = \sum_{n'' \in I}$	∑ s	$FD_n$			
	3FU_II: 3U	iccessjui jaun co							
Scenarios to be	measured	/ calculated	Baselin X	7	Bus	siness as usual (Bo	aU)	FLEXI	GRID (R&D)
Units				[-	-]				
Other KPIs related			Fau	ılt location	accui	racy (FLA)			
			Calculation		ogy				
Nº				scription				+-'	Responsible
FCD_1			ed in demo site l					+	DSC
FCD_2	Obtain ef	ective cause for	fault event "n" i	n #TFD in a	base	eline scenario #S	FD_n	+	DSC
FCD_3	Obtain ef	ective cause for	fault event "n" i	n #TFD in a	FLEX	(IGRID scenario #	#SFD_n		DSC
FCD_3	Perforn ca	lculation of FCD	(compare base			IRD)			UCS
				rces / types	S		Mi		
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Monit	toring riod	Responsible
Total faults detections	#TFD	incidence reporting	Field / SCADA reporting	DSO DB registe		monthly	one	year	DSC
Efective fault cause detection	#SDF_n	incidence reporting	Field reporting	registe		monthly	one	year	DSC
			Bas	eline	I				
Source of b	paseline co	ndition	Literatu	ire		Historical data		Meası	ured at start
			Simulat	ion ]		Laboratory			Field X
Details of baseline				UCS ,	/ DSC				
Responsible			Com	ments	, 530				
DSC = Demo-Sites c									
UCS = Use Case sup (*) If needed / poss									

		FL	EXIGRID KI	PI DATA	SHI	ET			
	I	- III .:		formation		1/01	<u> </u>		F1.4
Name:		Fault location	accuracy (on de	emo site)		КЫ	ID:		FLA
Description:		Accura	cy in fault distai	nce determ	inatio	on using FLEXIGF	RID solu	tions	
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	UC4 (X)	UCS	Croatia	i (X)	UC7 (X)	Italy UC8 (X)
Formula or Calculation procedure	E_FLn: Es R_FLn: Re	It location accur timated fault loc eal fault location umber of faults	FLA =  acy [m]  cation in fault "n  in fault "n" [m]	$=\frac{100}{n}\sum_{n''[m]}$	$R_{FL}$	$\frac{1}{R_{FLn}}$			
Scenarios to be	measured	/ calculated	<b>Baselir</b> X	ne ]	Bus	siness as usual (Bo	aU)	FLEXI	GRID (R&D)
Units				[%	6]				
Other KPIs related					-				
	ı		Calculation		gy				
Nº			•	scription					Responsible
FLA_01	Indicate d	istance and char	acteristics of fa	ult in the te	ested	network (per ev	ent)		DSC
FLA_02	Determin	e estimated faul	t distance using	FLEXIGRID	solut	ions [m]			UCS
FLA_03	Perform c	alculation of tot	al accuracy in fa	ult distance	e esti	mation FLA			UCS
			Data sour	rces / types	6				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Moni	lin. itoring riod	Responsible
Distance to fault	RLF_n	real distance to fault	IED / DB	DSO regis	ters	per fault	per	fault	DSC
Estimated distance to fault	ELF_n	Estimated distance to fault	IED / DB	IED / D	В	per fault	per	fault	UCS
			Bas	eline					
Source of b	aseline co	ndition	Literati	ure ]		Historical data		Meası	x
			Simulat	ion ]		Laboratory*			Field X
Details of baseline				LICC	/ DCC				
Responsible			Com	UCS ,	י טאלי				
DSC = Demo-Sites co	oordinator		Com						
UCS = Use Case sup (*) If needed / possi									

									V 0.2
		FL	<b>EXIGRID</b> KI	PI DATA	SHE	ET			
			Basic Inf	formation					
Name:		Improve	ed Interoperabil	lity		KPI	ID:		II
Description:	providing	operability is the g services to and hem to operate e intero	accepting serviceffectively toget	es from oth her (ISO/TS	er sy 3715	stems and to us	e the se r assess	ervices so ses the im	exchanged to
			Loc	ation					
Demo site		Spain	Greec	<b>e</b>		Croatia		ĺ	Italy
(Use Case)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	5 (X) UC6	(Y)	UC7 (X)	UC8 (X)
	001 (//)	σε2 (λ)		ulation	003	7(7)	(21)	007 (71)	000 (x)
Formula or Calculation procedure	1.Not at al 2.Poor: the 3.Somewh 4.Good: th	Itor provides a quality the project does lith the project she project she project increases the project increases the project increases.	ualitative measu es not increase tle to increase i omewhat increa ses interoperabi	ire and is ra interoperab nteroperabi ases interop lity sufficier	ility. lity. erabi ntly.	lity.	kert sca	le as follo	DWS:
Scenarios to be	measured	/ calculated	Baselin X	ne ]	Bus	siness as usual (Bo	ıU)	FLEXIO	GRID (R&D)
Units				N/	Ά		I		
Other KPIs related				N/	'A				
			Calculation	Methodolo	gv				
Nº				scription	<u> </u>			F	Responsible
II_01	Create a q	questionnaire mo	del (questions)	•					DSC
II_02	Gather all	feedbacks							DSC
II_03	Perform c	alculation of resu	ults						UCS
			Data soui	ces / types				Ť	
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collectio		Frequency of data collection	Mon	lin. itoring eriod	Responsible
Evaluation (at the end)	EV	qualitative measure and is rated on a five-point Likert scale	Form	UCS		once		of the g phase	DSC
			Bas	eline			1		
			Literatu	ıre		Historical data		Measu	red at start
	1.	15.5		]					Х
Source of b	iaseiine coi	naition	Simulat	ion		Laboratory			Field
									Х
Details of baseline					-				
Responsible				UCS /	DSC				
DCC 5 -::			Com	ments					
DSC = Demo-Sites co UCS = Use Case supe									

		r.	EXIGRID KF	TUATA	ЭПЕ	EI			
	1			ormation					
Name:		Island m	node reliability ra	ate		KPI	ID:		IMRR
Description:	Effective	time operation	in a islanded mo			eriod of time tha d failure in a yea		ld had be	een operate in
			Loca	ation					
		Spain	Greece	,		Croatia			Italy
Demo site			-	1					
(Use Case)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UC6	(X)	UC7 (X)	UC8 (X)
	0C1 (X)	0C2 (A)		lation	003	(1/) 000	(//)	0C7 (X)	000 (1/)
	IMRR	$= 100 \cdot \left(\frac{ET_i}{RT_i}\right)$				E	$T_{im} =$	$\sum D d$	$e_n - Ds_n$
Formula	Where:					D	TT.	$\nabla$	7
or Coloulation		and mode reliab		. d d - []-1		R	$I_{im} =$	$^{-}$ $^{-1}$	$e_n - Is_n$
Calculation procedure			erating in islande d has been opera			mode [h]			
procedure			t n start time [tii		iucu	mode [nj			
	Ds_n: Disc	connection even	t n end time [tim	nestamp]					
	_		time [timestamp	]					
	ls_n: islan	d event n end ti	me [timestamp] 						
			Baselin	e	Bus	iness as usual (Ba	iU)	FLEXI	GRID (R&D)
Scenarios to be	measured ,	/ calculated	Х						Х
	ı								
Units				%	ó				
Other KPIs related		Rate o	of successful swit Switching su			s to reconnect to anded mode (SS		SSG)	
			Calculation I	Methodolo	gy				
Nº			Step des					- 1	Responsible
IMRR_01			nts from main go			n, Ds_n)			DSC
IMRR_02 IMRR_03		alculation of ET		ide (le_II, IS					UCS
IMRR_04		alculation of IMI							UCS
			Data sour	ces / types					
			Source/	Location of		Frequency of	M	1in.	
Data	TAG	Methodology	Tools/ Instruments	collectio		data collection		itoring eriod	Responsible
Data  Disconnection grid event	TAG IMRR_01	Grid connection status	-	DSO SCAI	on		pe	itoring	Responsible  DSC
Disconnection grid		Grid connection	IEDs / Others IEDs / Others	DSO SCAI /DB DSO SCAI /DB	DA	data collection	one	itoring eriod	·
Disconnection grid event	IMRR_01	Grid connection status	IEDs / Others IEDs / Others	DSO SCAI	DA	data collection hourly	one	eriod eriod e year	DSC
Disconnection grid event	IMRR_01	Grid connection status	IEDs / Others IEDs / Others	DSO SCAI /DB DSO SCAI /DB	DA DA	data collection hourly	one	e year	DSC
Disconnection grid event  Islanded mode switching event	IMRR_01	Grid connection status Islanded mode status	IEDs / Others IEDs / Others Base	DSO SCAI /DB DSO SCAI /DB	DA DA	hourly hourly	one	e year	DSC
Disconnection grid event	IMRR_01	Grid connection status Islanded mode status	IEDs / Others IEDs / Others Base	DSO SCAI /DB DSO SCAI /DB	DA DA	hourly  hourly  Historical data	one	e year	DSC
Disconnection grid event  Islanded mode switching event	IMRR_01	Grid connection status Islanded mode status	IEDs / Others  IEDs / Others  Base  Literatu	DSO SCAI /DB DSO SCAI /DB	DA DA	hourly hourly Historical data	one	e year	DSC DSC
Disconnection grid event  Islanded mode switching event	IMRR_01	Grid connection status Islanded mode status	IEDs / Others  IEDs / Others  Base  Literatu	DSO SCAI /DB DSO SCAI /DB	DA DA	hourly  hourly  Historical data	one	e year	DSC  DSC  ured at start  Field
Disconnection grid event  Islanded mode switching event  Source of b	IMRR_01	Grid connection status Islanded mode status	IEDs / Others  IEDs / Others  Bas  Literatu  Simulati	DSO SCAI /DB DSO SCAI /DB eline ore	DA DA	hourly  hourly  Historical data	one	e year	DSC  DSC  ured at start  Field
Disconnection grid event  Islanded mode switching event  Source of b	IMRR_01  IMRR_02	Grid connection status Islanded mode status	IEDs / Others  IEDs / Others  Bas  Literatu  Simulati	DSO SCAI /DB DSO SCAI /DB eline	DA DA	hourly  hourly  Historical data	one	e year	DSC  DSC  ured at start  Field

		FL	EXIGRID K	PI DATASH	HEET			
	Γ.			ormation	1 1/2			IDCCD.
Name:	In۱	vestment return	for secondary si	ubstation refit	KPI	ID:		IRSSR
Description:					substations. Avoi gy not supplied, in			
			Loc	ation		-		
		Spain	Greec	e	Croatia			Italy
Demo site (Use Case)				İ			1	
(ose case)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X) U	IC5 (X) UC6	s (x) UC	7 (X)	UC8 (X)
			Calcu	lation				
Formula or Calculation procedure	SBau_n:		avings [€] gs by substation		n" in the grid as re			
	Sc_n: Am	nount of savings	by substation / o	cathegory "n" i	in the grid using Fl	EXIGRID s	olutio	ns [€]
			Baselin	е В	usiness as usual (Bo	aU)	FLEXIC	GRID (R&D)
Scenarios to be	measured	/ calculated			х		Î	Х
				l			L	
Units				[€]				
Other KPIs related			Grid	investment de	eferral (GID)			
			Calaulatian	Methodology				
	ı						1	
Nº			Step des				R	Responsible
<b>№</b> IRSSR_1	Define cat	tegories to be m	Step des	cription	to include in #SAC)		R	<b>Responsible</b> DSC
	Define ead		Step des onitored for pos e simulated or fi	scription sible savings (t eld data to det	co include in #SAC)		R	
IRSSR_1	Define ead BaU scena Define ead	ch category to be ario SBaU_n base	Step des onitored for pos e simulated or fi ed in #SAC inform	scription sible savings (t eld data to det nation		sts in a	R	DSC
IRSSR_1 IRSSR_2 IRSSR_3	Define ead BaU scena Define ead FLEXIGRID	ch category to be ario SBaU_n base ch category to be	Step des onitored for pos e simulated or fi ed in #SAC inforr e simulated or f	scription sible savings (t eld data to det nation	ermine saving/cos	sts in a	R	DSC DSC
IRSSR_1 IRSSR_2	Define ead BaU scena Define ead FLEXIGRID	ch category to be ario SBaU_n base ch category to be o scenario Sc_n	Step des onitored for pos e simulated or fi ed in #SAC inforr e simulated or f	scription sible savings (t eld data to det nation ield data to de	ermine saving/cos	sts in a	R	DSC DSC UCS
IRSSR_1 IRSSR_2 IRSSR_3	Define ead BaU scena Define ead FLEXIGRID	ch category to be ario SBaU_n base ch category to be o scenario Sc_n	Step des onitored for pos e simulated or fi ed in #SAC inforr e simulated or f	scription sible savings (teld data to detenation sield data to detenation sield data to de	termine saving/costermine saving/co	sts in a		DSC DSC UCS
IRSSR_1 IRSSR_2 IRSSR_3	Define ead BaU scena Define ead FLEXIGRID	ch category to be ario SBaU_n base ch category to be o scenario Sc_n	Step desconitored for pose e simulated or field in #SAC informe simulated or field simulated or field simulated or field source/ Tools/	scription sible savings (t eld data to det nation ield data to de	termine saving/costermine saving/costermine	sts in a sts in a Min. Monitor	ring	DSC DSC UCS
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4	Define ead BaU scena Define ead FLEXIGRID Perform c	ch category to be ario SBaU_n base ch category to be excended scenario Sc_n alculation of IRS.  Methodology determine cost	Step desconitored for pose e simulated or field in #SAC informe simulated or field simulated simulated or field simulated	sible savings (to eld data to det nation ield data to de ces / types  Location of data collection	termine saving/costermine savi	sts in a	ring	DSC DSC UCS UCS Responsible
IRSSR_1 IRSSR_2 IRSSR_3 IRSSR_4 Data	Define ead BaU scena Define ead FLEXIGRID Perform c	ch category to be ario SBaU_n base ch category to be o scenario Sc_n alculation of IRS.	Step desconitored for pose e simulated or field in #SAC informe simulated or field simulated or field simulated or field source/ Tools/	scription sible savings (teld data to detenation sield data to detenation sield data to de ces / types Location of	termine saving/costermine saving/costermine	sts in a sts in a Min. Monitor	ring	DSC DSC UCS UCS
IRSSR_1 IRSSR_2 IRSSR_3 IRSSR_4 Data Structure /	Define ead BaU scena Define ead FLEXIGRID Perform c	ch category to be ario SBaU_n base ch category to be excended scenario Sc_n alculation of IRS.  Methodology determine cost	Step desconitored for pose e simulated or field in #SAC informe simulated or field simulated simulated or field simulated simulate	sible savings (to eld data to det nation ield data to de ces / types  Location of data collection	termine saving/costermine savi	sts in a sts in a Min. Monitor	ring	DSC DSC UCS UCS Responsible
IRSSR_1 IRSSR_2 IRSSR_3 IRSSR_4  Data Structure /	Define ead BaU scena Define ead FLEXIGRID Perform c	ch category to be ario SBaU_n base ch category to be excended scenario Sc_n alculation of IRS.  Methodology determine cost	Step desconitored for pose e simulated or field in #SAC informe simulated or field simulated simulated or field simulated simulate	sible savings (to led data to det nation sield data to de ces / types  Location of data collection  DSO DB	termine saving/costermine savi	sts in a sts in a Min. Monitor perio	ring d	DSC DSC UCS UCS Responsible
IRSSR_1 IRSSR_2 IRSSR_3 IRSSR_4  Data Structure /	Define ead BaU scena Define ead FLEXIGRID Perform c	ch category to be ario SBaU_n base ch category to be excended scenario Sc_n alculation of IRS.  Methodology determine cost	Step desconitored for pose e simulated or field in #SAC informed simulated or field simulated simulated or field simulated simulated or field simulated	sible savings (to led data to det nation sield data to de ces / types  Location of data collection  DSO DB	termine saving/cost termine saving/cost Frequency of data collection	sts in a sts in a Min. Monitor perio	ring d	DSC DSC UCS UCS Responsible DSC
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informed simulated or field simulated simulated or field simulated simulated or field simulated	sible savings (to led data to det nation sield data to de ces / types  Location of data collection  DSO DB	termine saving/cost termine saving/cost termine saving/cost Frequency of data collection once	sts in a sts in a Min. Monitor perio	ring d	DSC DSC UCS UCS Responsible DSC
IRSSR_1 IRSSR_2 IRSSR_3 IRSSR_4  Data Structure /	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informed simulated or field simulated simulated or field simulated simulated or field simulated	scription sible savings (teld data to detention iteld data to detention of data collection data collection detection	termine saving/cost termine saving/cost frequency of data collection once	sts in a sts in a Min. Monitor perio	ring d	DSC DSC UCS UCS Responsible DSC
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informe simulated in #SAC info	scription sible savings (teld data to detention iteld data to detention of data collection data collection detection	termine saving/cost termine saving/cost termine saving/cost Frequency of data collection once	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC  rred at start
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informe simulated in	scription sible savings (teld data to detention iteld data to detention of data collection data collection detection	termine saving/cost termine saving/cost frequency of data collection once	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informe simulated in #SAC info	ceription sible savings (to eld data to detention detention detention) ield data to detention ield data to detention  Cees / types  Location of data collection  DSO DB  eline  Tre	termine saving/contermine savi	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC  rred at start
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost  Source of b	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informed in #SAC i	scription sible savings (to eld data to detention ield data to detention ield data to de data to de data collection DSO DB eline  UCS / DS	termine saving/contermine savi	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC  rred at start
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost  Source of b	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informed in #SAC i	ceription sible savings (to eld data to detention detention detention) ield data to detention ield data to detention  Cees / types  Location of data collection  DSO DB  eline  Tre	termine saving/contermine savi	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC  rred at start
IRSSR_1  IRSSR_2  IRSSR_3  IRSSR_4  Data  Structure / associated cost  Source of b	Define ead BaU scena Define ead FLEXIGRID Perform c  TAG  #SAC	ch category to be ario SBaU_n base ch category to be considered scenario Sc_n alculation of IRS:  Methodology  determine cost per cathegory	Step desconitored for pose e simulated or field in #SAC informed in #SAC i	scription sible savings (to eld data to detention ield data to detention ield data to de data to de data collection DSO DB eline  UCS / DS	termine saving/contermine savi	sts in a sts in a Min. Monitor perio	ring d	DSC  DSC  UCS  UCS  Responsible  DSC  rred at start

FLEXIGRID KPI DATASHEET										
	Basic Information									
Name:	Number of grid events KPI ID:							NGE		
Description:	Number of events that change the network, as lines aperture, tripping of protection in substations, OLTC operation.									
			Loc	ation						
	Γ,	Spain	Greec	e		Croatia	Croatia Italy			
Demo site (Use Case)		<u> </u>								
(Ose case)	UC1 (X)	UC2 (X)	UC3 (X) UC4 (X)		UC5 (X) UC6 (X)			UC7 (X) UC8 (X)		
	3 3 2 (1.7)	2 22 (17)		ulation		(1.9)	(-7	0.01 (1.9	2 2 2 (1.9)	
Formula or Calculation procedure	$NGE = \sum GE_n$ Where:  NGE: Total number of grid events [-]  GE_n: Grid event number n [-]									
	_		Baselin	10	Rus	Business as usual (BaU)			ELEVIGRID (P&D)	
Scenarios to be	measured ,	/ calculated	X		Business as usual (BaU)		FLEXIGRID (R&D)			
Units				[-	-]					
Other KPIs related										
A10	Т		Calculation		gy				D	
Nº	Objective			scription					Responsible	
NGE_01	Obtain eve	ent registers fror		oe rces / types					UCS	
	T		D.A.i.a.			T				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Мо	Min. initoring period	Responsible	
Registered event	NGE_01	IED extraction	IEDs / Others	DSO SCADA DB		monthly	one year		DSC	
			Bas	eline						
	paseline condition		Literature		Historical data			Measured at start		
Source of h					Х					
			Simulation		Laboratory			Field X		
Details of baseline	Hec / Bee									
Responsible	Responsible UCS / DSC Comments									
DSC = Demo-Sites coordinator UCS = Use Case supervisor optionally can be separated by zone and type of event										

FLEXIGRID KPI DATASHEET										
Basic Information										
Name:		Oversigh	t variables avail	available KPI ID:			ID:	OVV		
Description:	Oversight level of secondary substation for maintenance purposes. Number of signals to determine predictive and corrective maintenance actions.									
Location										
Demo site (Use Case)	Spain  UC1 (X)  UC2 (X)		Greece  UC3 (X)  UC4 (X)  Calculation		Croatia  UC5 (X)  UC6 (X)		: (X)	Italy  UC7 (X)  UC8 (X)		
			Carco							
Formula or		OVV	$OVV_{avg} = \frac{\sum S_n}{n}  (*)$							
Calculation procedure	Where:  OVV: Total number of signals [-]  S_n: Total number of signals in substation "n" [-]  OVV_avg: Averagel number of signals [-]  n: Total number of substations (to be monitorized) [-]  (*) alternative KPI									
C		/ coloulated	Baseline		Business as usual (BaU)		ıU)	FLEXIGRID (R&D)		
Scenarios to be	measured / calculated		Х					Х		
Units	[-]									
Other KPIs related	Successful meter reading index (SMRI) Successful event reading index (SERI)									
	Calculation Methodology									
Nº	Step description Responsible									
OVV_1		Define substation signals to be monitored / available (TS_n)  DSC							DSC	
OVV_2	Define signals that can be used to make a maintenance plan from TS_n and determine S_n  UCS						UCS			
OVV_3	Perform c	alculation of OV	V in a baseline a	and a FLEXI	GRID	scenario			UCS	
			Data sour	ces / types	5					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	Min. litoring eriod	Responsible	
Signals to be monitored	TS_n	Determine the number of signals to transmit / receive		DSO DB Registe		once			DSC	
			Bas	eline						
			Literatu	ıre		Historical data		Measu	ıred at start	
Course of h	acalina ca	m ditio m	<u> </u>							
Source of baseline condition			Simulation		Laboratory			Field		
								X		
Details of baseline	I									
Responsible				UCS ,	/ DSC					
			Com	ments						
DSC = Demo-Sites co UCS = Use Case sup										

	FLEXIGRID KPI DATASHEET										
	ı			ormation							
Name:		Peak	Load Reduction			KPI	ID:		PLRed		
Description:		the two peaks,	the power peak	with respe	ct to	ry demand. The H the baseline and In the FLEXIDRIG	I the po	wer peal			
			Loc	ation							
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	UC4 (X)	UCS	Croatia	i (X)	UC7 (X)	UC8 (X)		
			Cuico	ilation							
Formula or Calculation procedure	$ \text{PLRed} = 100 \cdot \left(1 - \frac{PP_{R\&D}}{PP_{BL}}\right) $ Where: $ \text{PP\_BL: Peak load, evaluated during a Baseline scenario in a period [W]} $ $ \text{PP\_R\&D: Peak load, evaluated using the FLEXIGRID solutions in a period [W]} $										
	PP_R&D: I	Peak load, evalua	ated using the F	LEXIGRID so	olutic	ons in a period [V	<u>V]</u>				
Scenarios to be	measured	Baseline Business as usual (BaU) FLEXIGRID (R&D)  The assured / calculated X X X									
Units	%										
Other KPIs related											
			Calculation	Methodolo	gy						
Nº	- 6		•	scription				F	Responsible		
PLRed_01		e electrical boun							DSC		
PLRed_02	Obtain his	storical data of a	ctive power with	nin the zone	e def	ined previously			DSC		
PLRed_03	Obtain ne FLEXIGRID		power within th	ne zone defi	ined	previously after	using th	ne	DSC		
PLRed_04	Perform c	alculation of PLR							UCS		
	I	Ī		ces / types		Ι	N 4	in			
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	in. toring riod	Responsible		
Active power	Р	meters units lecture	IEDs / Others	DSO pow register		daily	one	year	DSC		
			Bas	eline							
			Literatu	ıre		Historical data		Measu	red at start		
Source of b	aseline co	ndition		I		X					
Jource of L			Simulat	ion		Laboratory			Field		
			Х	I					X		
Details of baseline			<u> </u>								
Responsible				UCS /	DSC						
DCC = Domo Citor	oordinsts.		Com	ments							
DSC = Demo-Sites of UCS = Use Case sup											

		FL	EXIGRID KI	PI DATA	SHE	ET			
	ı			formation					
Name:		Protections tri	pping time imp	rovement		КРІ	ID:		PTT
Description:		Effective re	eduction of trip	ping time b	y imp	lementation of	new alg	gorithms	S
	l		Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	e UC4 (X)	UC5	Croatia  (X) UCG	5 (X) L	JC7 (X)	Italy UC8 (X)
			Carce	ilation					
Formula or Calculation procedure	$PTT = M_{NTT} - M_{TT}$ $Where:$ PTT: Reduction of tripping time [ms] $M_{NTT}: \text{ Median of tripping time with FLEXIGRID algorithms [ms]}$ $M_{TT}: \text{ Median of tripping time in a baseline scenario [ms]}$ $Baseline Business as usual (BaU) FLEXIGRID (R&D)$ be measured / calculated								
			Raselir	1e	Rus	iness as usual (R	all)	FIFXI	GRID (R&D)
Scenarios to be									
Units	[ms]								
Other KPIs related									
Calculation Methodology  Nº Step description Responsible									
PTT_01	Ohtain co	nfigurations set		•	- (CO	NE)		<del>'</del>	Responsible DSC
PTT_02	Obtain tri	pping time in bay	seline condition	ns (Simulat	ion, C	peration regist	ers,		DSC
PTT_03	Obtain tri	pping time using	the new algor	ithms provi	ded h	ov FI FXIGRID			UCS
PTT_04	Perform o	alculation to de		-		-	ection		UCS
			Data soui	rces / types	;				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec	of	Frequency of data collection	Mi Monit per	oring	Responsible
IED configuration files	CONF	File	IEDs / Catalogs	IED Regis <sup>o</sup> Catalog standar	s,	DWP6	DW	/P6	DSC
Protection Operation time	ОТ	Tripping time from IED	IEDs / Simulations	IED Regis Seconda injection	ry	DWP6	DW	/P6	DSC
			Bas	eline					
Source of b	aseline co	ndition	Literatu X	T		Historical data		Measu	red at start
			Simulat X	ion		Laboratory X			Field
Details of baseline				1100	/ DCC				
Responsible			Com	UCS /	DSC				
DSC = Demo-Sites c UCS = Use Case sup		r	Com						

	FLEXIGRID KPI DATASHEET										
	1			ormation		1					
Name:		Reactive I	Energy Consump	otion		КРІ	ID:		RE		
Description:			Total reactive	energy cons	sume	d in a period of t	ime				
			Loc	ation							
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece UC3 (X)	UC4 (X)	UC5	Croatia	5 (X)	UC7 (X)	Italy UC8 (X)		
	1		Calcu	ılation							
Formula or Calculation procedure		Reactive Energy tive energy consu	[MVARh]	$E = \sum_{i} E_{i}$	$Eq_n$						
	Lqm. neac	tive energy const									
Scenarios to be	measured	Baseline Business as usual (BaU) FLEXIGRID (R&D)    X   X   X   X   X   X   X   X   X									
Units	[MVARh]										
Other KPIs related			Eı	nergy Consi	umpti	ion (EC)					
	1		Calculation		gy						
Nº	01		•	scription					Responsible		
RE_01		active energy cor alculation of total				ne minimum moi	nitoring	3	DSC		
RE_02	period								UCS		
			Data sour	ces / types							
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Moni	lin. itoring riod	Responsible		
Reactive energy	Eq	Power meters units lecture	IEDs / Others	DSO pow registe		monthly	one	e year	UCS		
			Bas	eline							
			Literatu	ıre		Historical data		Measu	ıred at start		
				1							
			X	ļ							
Source of b	of baseline condition  Simulation  Laboratory  Field										
			X	]		Laboratory			Field		
Details of baseline											
Responsible				UCS ,	/ DSC						
DSC = Demo-Sites co	oordinator		Com	ments							
UCS = Use Case sup											
·											

	FLEXIGRID KPI DATASHEET										
	1			formation							
Name:		Increased	RES Hosting cap	acity		KPI	ID:		RESHC		
Description:						lled capacity of lility and reducing			lity		
	l		Loca	ation							
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	Greece UC3 (X)	e ] UC4 (X)	uc	Croatia	; (Y) 110	7 (X)	Italy  UC8 (X)		
	<i>UCI (X)</i>	υς2 (λ)		ulation	UCS	5 (1)	(1/)	.7 (٨)	000 (1/)		
Formula or Calculation procedure	or alculation Where: RESHC: Is the enhanced hosting capacity of RES when FLEXIGRID solutions are applied [%] HC_FG: Is the additional hosting capacity of RES when FLEXIGRID solutions are applied with respect to currently connected generation [MW] HC_BL: Is the hosting capacity of RES in baseline scenario with respect to currently connected generation [MW]  Baseline Business as usual (BaU) FLEXIGRID (R&D)  Tenarios to be measured / calculated										
Scenarios to be	measured	asured / calculated									
Units			•	9	6		•				
Other KPIs related											
	Calculation Methodology										
Nº			Step des	scription				ı	Responsible		
RESHC_01	Get all de	mo site asset ch	aracteristics						DSC		
RESHC_02	Model the	power grid to p	perform OPF sim	ulations					UCS		
RESHC_03	Perform a	n OPF for a base	eline scenario to	obtain the	capa	city of the grid			UCS		
RESHC_04	Perform a	n OPF for a FLEX	KIGRID scenario	to obtain t	he ca	pacity of the grid	b		UCS		
RESHC_05	Perform c	alculation of RES							UCS		
			Data sour	ces / types	•						
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Min. Monito perio	ring	Responsible		
Demo assets characteristics	RESHC_01	Nominal values / specifications	Datasheets / Registers	DSO D	В	ones	1		DSC		
Hosting capacity	HC_FG/ HC_BL	OPF Simulation	OPF Simulator	DB					UCS		
			Bas	eline							
			Literatu	ıre		Historical data		Measi	ıred at start		
Source of b	oaseline co	ndition		]		X		vicust			
	Simulation Laboratory Field										
			X	J							
Details of baseline											
Responsible				UCS ,	/ DSC						
DCC 5 211	11		Com	ments							
DSC = Demo-Sites of UCS = Use Case sup											

		FLE	EXIGRID KI	PI DATA	SH	EET			
				formation		1.00			CAIRI
Name:	S	ystem Average i	nterruption Du	ration Inde	X	КРІ	ID:		SAIDI
Description:		verage duration al customer minu	ites of interrup		ded t	ogether and div	-		
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greec UC3 (X)	e UC4 (X)	UCS	Croatia	5 (X)	UC7 (X)	Italy UC8 (X)
Formula or Calculation procedure	<i>NT</i> : Total	ration time for ea number of custo per of interrupte	$=rac{\sum r_i N_i}{N_T}$	n event [mi or the area	[inte	ger]			reporting
Scenarios to be	measured	/ calculated	Baselir X	I		iness as usual (B	aU)	FLEXI	GRID (R&D)
Units				[mini	utes]				
Other KPIs related				CAIDI,	, SAIF	I			
Calculation Methodology									
Nº				scription				- 1	Responsible
SAIDI_01	Detect number and duration of interruptions DSC  Detect or estimate the number of affected customers DSC								
SAIDI_02									DSC
SAIDI_03		Cal	culate SAIDI in			ario			UCS
SAIDI_04			Compare to ba						UCS
		1		ces / types	•		N 4:		I
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mi Monit per	oring	Responsible
Service interruption event timestamp	SI_st	Sequence of events logging	Various	DSO, SCA DB or So		once at the end of the monitoring period	one	year	DSC
Restoration command timestamp	SI_en	Sequence of events logging	Various	DSO, SCA DB or So		once at the end of the monitoring period	one	year	DSC
Number of interrupted customers	Ni	Adding the number of customers in the affected areas	Various	DSO, Costumer	s DB	once at the end of the monitoring period	one	year	DSC
		1	Bas	eline					
			Literatu	ıre		Historical data		Measu	ıred at start
						Х			
Source of b	e of baseline condition								
	Simulation Laboratory Field								
				I					X
Details of baseline			Previous			the same area.			
Responsible				UCS /	/ DSC				
DSC - Domo Sitor -	oordinat-	r	Com	ments					
SC = Demo-Sites coordinator CS = Use Case supervisor									

		FLI	EXIGRID K	PI DATA	SH	EET			
Name		Calf Cana		ormation		L/DI	ID.	1	CCD+
Name:		Self-Consi	umption Rate (S	SCRt)		КРІ	ID:		SCRt
Description:	Is the rati	o of consumed	renewable ener	gy over th	e sun	of all renewabl	e electric	ity ger	nerated on site.
			Loca	ation					
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	Greece UC3 (X)	e UC4 (X)	UCS	Croatia	i (X) U	C7 (X)	Italy UC8 (X)
			Calcu	lation					
Formula or Calculation	SCR	$t = \frac{E_{C\_RE}}{E_{G\_RE\_tot}}$				$E_{G\_RE}$ ; $E_{G\_RE}$ ; $E_{G\_Lot}$ ;			
procedure	Eg_re_tot	the on-site renev : Total energy p tal electricity co	roduced by RES	locally	tion [	kWh]			
Scenarios to be	measured / calculated    Business as usual (BaU)   FLEXIGRID (R&D)								
Units				[-	-]				
Other KPIs related			Sel	f-sufficiend	y Rat	tio (SSRt)			
			Calculation		ogy				
Nº	Step description Responsible  Define the electrical boundary of the demo site to perform the energy flow DSC								
SCRt_01			•				ow		DSC
SCRt_02		nount of genera							DSC
SCRt_03		nount of consum		ily (within	tne b	ounas)			DSC
SCRt_04 		alculation of Ec_ alculation of SCI							UCS
3CK1_03	remonine	alculation of Sci		ces / types					003
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec	of	Frequency of data collection	Min Monito perio	ring	Responsible
Total energy generated by RES	E_res	meters units lecture	IEDs / Others	DSO regis	ters	hourly	one y	ear	DSC
Total energy consumed	E_con	meters units lecture	IEDs / Others	DSO regis	ters	hourly	one y	ear	DSC
			Bas	eline		•			
			Literatu	ire		Historical data		Meası	ıred at start
									Х
Source of b	rce of baseline condition  Simulation  Laboratory  Field								
	X X								
Details of baseline			-						
Responsible			Com	UCS , ments	/ DSC				
DSC = Demo-Sites c	DSC = Demo-Sites coordinator								
ICS = Use Case supervisor an be verified by simulation or field data									

	FLEXIGRID KPI DATASHEET									
	ı			formation						
Name:		Successfu	l event reading	index		KPI	ID:		SERI	
Description:	Tł	nis KPI has been	defined to anal	yze if all th	e me	ters or IED's are	sendir	ng their re	egisters	
			Loc	ation						
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	Greec UC3 (X)	<b>e</b>   UC4 (X)	UCS	Croatia	(X)	UC7 (X)	Italy  UC8 (X)	
	σει (λ)	0C2 (A)		ulation	OCS	7(1/) 000	(2)	007 (71)	0 CB (X)	
Formula or Calculation procedure	Where: SERI: Suc SPr: Succ FPr: Failu	$eI = 100 \cdot \left( \frac{S}{S} \right)$ excessful event recessful number of position of po	SPr T <sub>PR</sub> )  ading index [%] of polling reques olling request [-	rt [-]		SERI =	100	$\cdot \left(\frac{T_{PR}-T_{PR}}{T_{P}}\right)$	$\left(\frac{-FPr}{R}\right)(*)$	
Scenarios to be	1		Baselin X	ne ]	Bus	siness as usual (Bo	ıU)	FLEXIO	GRID (R&D)	
Units				[9	6]		<u>'</u>			
Other KPIs related	Other KPIs related									
	1		Calculation	Methodolo	ogy					
Nº			Step des	scription				F	Responsible	
SERI_01	Obtain nu	mbers of polling	g request to IED	's					DSC	
SERI_02	Obtain nu	mbers of succes	ss polling reque	st to IED's					DSC	
SERI_03	(alternativ	ve) Obtain numb	per of polling re	quest failu	re to	IED's			DSC	
SERI_04	Perform c	alculation of SEI	RI						UCS	
			Data sour	ces / type:	S					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	Ain. itoring eriod	Responsible	
Polling success indicator	PS	Watchdogs / polling request timeout	IEDs / Others	DSO D	В	monthly	one	e year	DSC	
			Bas	eline						
Source of b	aseline co	ndition	Literatu	ıre ]		Historical data		Measu	red at start	
			Simulat	ion		Laboratory			<b>Field</b>	
Details of baseline				1100	/ DCC					
Responsible			Com	UCS , ments	י טאל					
DSC = Demo-Sites o	oordinator	ſ								
UCS = Use Case sup	ervisor									

FLEXIGRID KPI DATASHEET											
	Ι	2 (1		ormation							
Name:		Successful	meter reading i	ndex		КРІ	ID:		SMRI		
Description:	Is a indica	ator to evaluate	the performance	e of the me request m		g infrastructure, data	covering	g all kind	d of queries to		
			Loca	ation							
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	Greece UC3 (X)	UC4 (X)	UC5	Croatia  (X) UC6	(X) L	IC7 (X)	Italy UC8 (X)		
	1		Calcu	lation							
Formula or	SMR	$2I = 100 \cdot \left(\frac{S}{I}\right)$	$\left(\frac{Pr}{r}\right)$			SMRI =	100 ·	$\left(\frac{T_{PR} - 1}{T_{PR}}\right)$	$\left(\frac{FPr}{r}\right)(*)$		
Calculation procedure	SPr: Succi FPr: Failu	cessful meter rec essful number of re number of po al number of pol re method	polling request lling request [-]	[-]							
	Baseline Business as usual (BaU) FLEXIGRID (R&D)										
Scenarios to be	measured ,	/ calculated	Х						Х		
Units				[9	6]						
Other KPIs related				-	-						
	1		Calculation		gy			<u> </u>			
<b>№</b> SMRI 01	Ohtain nu	mbers of polling	Step des					, A	Responsible DSC		
SMRI_02		mbers of success							DSC		
SMRI_03		e) Obtain numbe			to IEI	D's			DSC		
SMRI_04	Perform ca	alculation of SER							UCS		
	T			ces / types	;						
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Mii Monito peri	oring	Responsible		
Polling success indicator	PS	Watchdogs / polling request timeout	IEDs / Others	DSO D	В	monthly	one	/ear	DSC		
			Bas	eline			<u> </u>				
			Literatu	re		Historical data		Measu	red at start		
									Х		
Source of b	aseline coi	ndition									
			Simulati	ion		Laboratory			Field X		
Details of baseline				1100	/ DCC						
Responsible			Com	UCS , ments	טאר						
DSC = Demo-Sites co	oordinator		Com	iiieiit3							
UCS = Use Case sup											

		FL	EXIGRID K	PI DATA	SHE	ET			
				formation					
Name:		Switching succe	ess ratio to islan	ded mode		КРІ	I ID:		SSR
Description:	Number	of successful sw	attemp	ots to island		node divided by toode in a year	the total	numbe	r of switching
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	UC3 (X)	e UC4 (X) ulation	UCS	Croatia	5 (X) U	JC7 (X)	UC8 (X)
Formula or Calculation procedure	$SSR = 100 \cdot \left(\frac{\sum SS_n}{\sum S_m}\right)$ Where: $SSR: Successful switch to islanded mode ratio [%]$ $SS_n: Successful reconnection to the grid n [-]$ $S_m: Total attempts to switch to the grid m [-]$ Baseline Business as usual (BaU) FLEXIGRID (R&D)								
	_	-			Bus	siness as usual (Bo	aU)	FLEXIC	GRID (R&D)
Scenarios to be	measured	/ calculated	Х	]					Х
Units				9	6				
Other KPIs related									
	Calculation Methodology								
Nº	C-+ - II -++			scription	1	1 -			Responsible
SSR_01		empts to recone			moc	<u>16</u>		_	DSC DSC
SSR_02 SSR_03		ccessful reconetion		vents				_	UCS
3311_03	Tr Crioinir C	alculation of 5510		rces / types					003
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec	of	Frequency of data collection	Mir Monito peri	oring	Responsible
Number of attempts to switch to islanded mode	S_m	DSO register/ SoE	SCADA DB DSC	DSO datal	base	monthly	one y	year	DSC
Number of succsseful switch to islanded mode	SS_n	DSO register/ SoE	SCADA DB DSC	DSO datal	base	monthly	one y	year	DSC
Source of b	oaseline co	ndition	Literatu X	ıre ]		Historical data		Measu	ured at start
			Simulat.	ion ]		Laboratory			Field
Details of baseline									
Responsible				UCS /	/ DSC				
DCC = Domo Cite	oordinst-		Com	ments					
DSC = Demo-Sites co UCS = Use Case supe									

						ET			
	T T			ormation					
Name:		Self-s	sufficiency Ratio	1		KPI	ID:		SSRt
Description:	It's the rat	io of total powe	r provided by R	ES consume in a pe		cally and total po	ower requi	ired b	y local demand
			Loc	ation					
		Ci				Coor out in			141-
Demo site		Spain	Greec			Croatia			Italy
(Use Case)									
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS	5 (X) UC6	(X) UC	7 (X)	UC8 (X)
	Ī		Calcu	ılation					
Formula or Calculation procedure	SSF	$Rt = \frac{E_{C\_RE}}{E_{C\_tot}}$				$E_{G\_RE}$ ; $E_{G\_RE}$ ; $E_{C\_tot}$ ;			
	Where:								
		he on-site renev			on [k	Wh]			
	_	tal electricity co	· -	h]					
	Eg_RE: En	ergy produced b	y RES	1					
			Baselin	e	Bus	siness as usual (Bo	ıU)	FLEXI	GRID (R&D)
Scenarios to be	measured	asured / calculated X							
				ı					
Units				[-	]		, I		
Other KPIs related			Self	-Consumpti	on R	ate (SCRt)			
	Calculation Methodology								
Nº	Step description Responsible								
SSRt_01	Define the	e electrical boun	•	•	rforr	n the energy flo	N	<u> </u>	DSC
SSRt_02		ount of generat							DSC
SSRt_03	Obtain am	ount of consum	ed energy locall	y (within th	ne bo	unds)			DSC
SSRt_04		alculation of Ec_							UCS
SSRt_05	Perform c	alculation of SSF		/ *					UCS
	T		Source/	ces / types			Min.		Π
Data	TAG	Methodology	Tools/ Instruments	Location of collectio		Frequency of data collection	Monitor perior	_	Responsible
Total energy generated by RES	E_res	meters units lecture	IEDs / Others	DSO regis	ters	hourly	one ye	ar	DSC
Total energy consumed	E_con	meters units lecture	IEDs / Others	DSO regis	ters	hourly	one ye	ar	DSC
			Bas	eline					
			Literatu	ıre		Historical data	^	Леаsı	ıred at start
Saurea of h		andisi a a							Х
Source of b	aseline co	iidition	Simulat	ion		Laboratory			Field
				]					X
Details of baseline							<u>1</u>		
Responsible				UCS /	' DSC				
			Com	ments					
DSC = Demo-Sites of UCS = Use Case sup									

		FL	EXIGRID KI	PI DATA	SHE	ET						
				formation				1				
Name:		Therma	l discomfort fac	tor		KPI	ID:		TDF			
Description:		Assess	ing the people's	s satisfactio	n wit	th the thermal e	nvironm	ent				
			Loc	ation								
Demo site (Use Case)		Spain	Greec	]		Croatia			Italy			
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS	S (X) UCE	5 (X) L	JC7 (X)	UC8 (X)			
Formula or Calculation procedure		Questionnaires with 1 to 5 scale, analisys from psychometric scale  Baseline Business as usual (BaU) FLEXIGRID (R&D)										
Scenarios to be	measured	Baseline Business as usual (BaU) FLEXIGRID (R&D)  Likert scale (1 to 5)										
Units				Likert sca	le (1 <sup>-</sup>	to 5)						
Other KPIs related												
	Calculation Methodology											
Nº				scription				F	Responsible			
TDF_01		questionnaire mo							DSC			
TDF_02		ploy system (onl	ine, mail, etc) fo	or each #Cu					DSC			
TDF_03		feedbacks							DSC			
TDF_04	Perform o	alculation of res							UCS			
	1		Data sour	ces / types	•		1		ı			
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Mi Monit per	oring	Responsible			
Customers to deliver the questionnaire	#Cu	Diffusion targeting	DSO DB	DSO		once	DW	/P6	DSC			
Thermal discomfort factor	#TDA	analisys from psychometric scale	TDF_04	DWP6	<b>i</b>	DWP6	DW	/P6	DSC			
			Bas	eline			Т					
Source of b	oaseline co	ndition	Literatu	ire ]		Historical data		Measu	x			
			Simulat	ion ]		Laboratory			Field X			
Details of baseline				1100	/ 500							
Responsible				UCS /	DSC							
DSC = Demo-Sites co	oordinator		Com	ments								
UCS = Use Case sup												

	FLEXIGRID KPI DATASHEET									
	T			ormation						
Name:		Number of V	oltage Limits Vi	olations		KPI	ID:		VLV	
Description:	Numbe	r of times than v	-			or over) the toperiod of time.	lerance l	limit (us	ually 5%) for	
	l		Loca	ation						
		Spain	Greec	p		Croatia			Italy	
Demo site			G/2220	ī				r	——————————————————————————————————————	
(Use Case)										
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UC6	(X) L	JC7 (X)	UC8 (X)	
	l		Caicu	ılation						
Formula or Calculation procedure	$VLV = \sum e_{vlv}$ Where: $VLV$ : Total number of voltage limits violations in a period [-] $e_{vlv}$ : event of voltage limit violation [-]									
	Baseline Business as usual (BaU) FLEXIGRID (R&D)									
Scenarios to be		/ coloulated	Baselin	e	Bus	iness as usual (Bo	aU)	FLEXIC	GRID (R&D)	
Scenarios to be	iiieasureu	/ calculateu	Х					ſ	Х	
	ı									
Units				[integer	]/[tin	ne]				
Other KPIs related										
			Calculation	Methodolo	gy					
Nº			Step des					R	Responsible	
VLV_01		voltage limits vi		e baseline	scena	ario			DSC	
VLV_02		VLV to the basel		EL EVIERU	D /D0	5)		_	UCS	
VLV_03 VLV 04		voltage limits view VLV for the FLEX						_	UCS	
VLV_05		to baseline scena		(Silliulateu	OI IIE	iu uata)			UCS	
VLV_03	compare	to baseline seem		ces / types	;					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec	of	Frequency of data collection	Mi Monit per	oring	Responsible	
Voltage limit violation event	VLVe	Power meters units lecture	IEDs / Others	DSO So registe		daily	-	year	DSC	
			Bas	eline			1			
			Literatu	ıre		Historical data		Measu	red at start	
				Ī		Х		Ţ		
				Į.				Ĺ	<u> </u>	
Source of b	aseline co	ndition	<i>a.</i>							
			Simulati	ion		Laboratory		,	Field	
			Х						Х	
Details of baseline				HCC	/ DCC					
Responsible			Com	UCS , ments	טטע					
DSC = Demo-Sites co	oordinator		Collin							
UCS = Use Case sup										

	FLEXIGRID KPI DATASHEET									
	ı			ormation		1				
Name:		CO2	2 tonnes saved			KPI	ID:		CO2Sv	
Description:	Amount o				-	ower generation is (Using FLEXIG	-		RES units inside	
			Loca	ation						
Danie d'ha		Spain	Greec	2		Croatia			Italy	
Demo site (Use Case)				•						
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS	5 (X) UCE	(x) UC	7 (X)	UC8 (X)	
	I		Calcu	lation						
Formula or Calculation procedure	CO2_FG: CO2_BL:	CO2Sv: Reduction in CO2 emissions [%] CO2_FG: Total CO2 emissions under FLEXIGRID scenario[kg]* CO2_BL: Total CO2 emissions under Baseline scenario[kg] CO2_BL: Total CO2 emissions under FLEXIGRID (kg) CO2_BL: Total CO2 emissions under FLEXIGRID (kg) CO2_BL: Total CO2 emissions under FLEXIGRID (kg) CO2_BL: Total CO2 emissions under FLEXIGRID scenario[kg] CO2_BL: Total CO2 emissions under Baseline scenario[kg] CO3_BL: Total CO3 emissions under Baseline scenario[kg] CO3_BL: To								
			Baselin	e	Bus	siness as usual (Bo	aU)	FLEXI	GRID (R&D)	
Scenarios to be	be measured / calculated X									
				ļ					Λ	
Units				9	6					
Other KPIs related	,									
***	Calculation Methodology  Stop description  Responsible									
<b>№</b> CO2Sv 01	Step description Responsible  Result from demand shifting (A) DSC									
CO2SV 02	Result from demand snifting (A)  Equivalent coefficient of CO2 emissions (B)  DSC  DSC									
CO2Sv_03			of technical los	-					DSC	
CO2Sv_04	Result fro	m the incorpora		-		ting capacity (D	)	L	DSC	
	I	T		ces / type:	S	I				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Min. Monitor perio	ring	Responsible	
Reduction of CO2 from demand shifting	CO2Sv_01	Calculation demand shifting	KPI calculation (REL)	DWP6	5	DWP6	DWP	6	DSC	
Equivalent coefficient of CO2 emissions	CO2Sv_02	Public Values	Public Values	Public Va	lues	DWP6	DWP	6	DSC	
Reduction of CO2 from reduction of losses	CO2Sv_03	Calculation of reduction of losses	KPI calculation (REL)	DWP6	5	DWP6	DWP	6	DSC	
Reduction of CO2 from an increase of RES	CO2Sv_04	Calculation of increase in HC	KPI calculation (RESHC)	DWP6	5	DWP6	DWP	6	DSC	
			Bas	eline	ı					
			Literatu	ıre		Historical data	1	Леаѕі	ured at start	
			Х			Х				
Source of b	aseline co	ndition		•						
			Simulati	ion		Laboratory			Field	
			Х							
Details of baseline		Adap	tation must be			ch demo site and	dsolution	S		
Responsible			Com		/ DSC					
DSC = Demo-Sites c	oordinato	•	com	ments						
	CS = Use Case supervisor									

FLEXIGRID KPI DATASHEET										
Name:	I	Demand	Available Flexib	formation		KDI	ID:		DAF	
Name.		Demana	Available i lexib	ility		KFI	ID.		DAI	
Description:	The amou					s specification do of customer ass				
	<u> </u>		Loc	ation						
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greec UC3 (X)	UC4 (X)	UCS	Croatia	i (x)	UC7 (X)	UC8 (X)	
Formula or Calculation procedure		Calculation $DAF = \sum Df_n$ here:  AF: Demand Available for Flexibility [MW]  _n: Amount of load that can be shifted in node n [MW]								
	Dt_n: An	nount of load tha	at can be shifted	in node n	[IVIVV	]				
Scenarios to be	measured	/ calculated	Baselin X	ne ]	Bu	siness as usual (Bo	aU)	FLEXI	GRID (R&D)	
Units				[M	W]					
Other KPIs related	Generation Available Flexibility (GAF)									
			Calculation	Methodolo	gy					
Nº			Step des	scription				F	Responsible	
GAF_01	Power gri	d assets charact	eristics (lines, tr	ansformers	, gen	eratos, etc.) #G[	)		DSC	
GAF_02	Modeling	power grid for L	PF using #GD						DSC	
GAF_03	Determin	e load available	to be shifted in a	a baseline s	cena	rio in node (Gf_r	n)		UCS	
GAF_04	Determin	e load available	to be shifted in a	a FLEXIGRIE	) scei	nario in node (G	f_n)		UCS	
			Data sour	ces / types	3			<u> </u>		
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Mi Monit per		Responsible	
Grid data	#GD	Power grid parameters for modeling	DSO registers /DB	DSO regis /DB	ters	once		-	DSC	
			Bas	eline						
Source of b	aseline co	ndition	Literatu X	ire ]		Historical data X		Measu	red at start	
			Simulat.	ion ]		Laboratory			Field	
Details of baseline										
Responsible			0-	UCS /	/ DSC					
DSC = Demo-Sites c	oordinator		Com	ments						
UCS = Use Case sup										

FLEXIGRID KPI DATASHEET											
	1			ormation							
Name:		Energ	gy Consumption			KPI	ID:		EC		
Description:			Total ener	gy consum	ed in	a period of time					
	ı		Loc	ation							
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece UC3 (X)	UC4 (X)	UCS	Croatia	(X)	UC7 (X)	Italy  UC8 (X)		
	1		Calcu	ılation							
Formula or Calculation procedure		Energy [MWh]		$C = \sum_{i} c_i$	$Ep_n$						
		,	Baselin	_	ρ	sim and manual (Ba	)	FLEVI	CDID (DOD)		
Scenarios to be	measured	Baseline Business as usual (BaU) FLEXIGRID (R&D)  Reasured / calculated X									
Units	[MVARh]										
Other KPIs related			Reacti	ve Energy (	Consu	mption (RE)					
			Calculation		gy						
Nº				scription				F	Responsible		
EC_01	Obtain en	ergy consumptio	n in all nodes in	volved					DSC		
EC_02	Perform c	alculation of tota	al energy accord	ing to the n	ninim	um monitoring p	period		UCS		
	1		Data sour	ces / types	3			Ü			
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Moni	in. toring riod	Responsible		
Energy	Ер	Power meters units lecture	IEDs / Others	DSO pow registe		monthly	one	year	DSC		
			Bas	eline							
			Literatu	ıre		Historical data		Measu	red at start		
			Х	]							
Source of b				J		<u> </u>			<u> </u>		
Source of t	aseime co	nation	Simulat	ion		Laboratory			Field		
			Х	]							
Details of baseline			<u> </u>								
Responsible				UCS ,	/ DSC						
			Com	ments							
DSC = Demo-Sites co UCS = Use Case supe											
oco – ose case supi	C1 V13U1										

FLEXIGRID KPI DATASHEET												
		_		formation								
Name:		Ener	gy not supplied			KPI	ID:		ENS			
Description:	The	amount of ener	gy that normally	y would be	delive	ered, but now is	not be	cause of a	an outage			
			Loc	ation								
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greec UC3 (X)	e ] UC4 (X)	UCS	Croatia	: (X)	UC7 (X)	Italy UC8 (X)			
	552 (1.9	5 5 2 (1.7)		ulation			11.7					
Formula or Calculation procedure		Pi: Power interrupted for interruption "i" [MW]  Di: Duration of interruption "i" [H]  Baseline Business as usual (BaU) FLEXIGRID (R&D)  neasured / calculated										
Scenarios to be												
Units		[MWh]										
Other KPIs related				SAIDI, CA		AIFI						
	I		Calculation		gy							
Nº FNS 01	Step description Responsible											
ENS_01 ENS_02	Detect number and duration of interruptions   DSC											
ENS_02		alculation of ENS		mterrupte	eu			$\overline{}$	UCS			
ENS_04		to baseline scena							UCS			
				rces / types	5							
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	Ain. litoring eriod	Responsible			
Service interruption event timestamp	SI_st	Sequence of events logging	Various	DSO, SCA		monthly	one	e year	DSC			
Restoration command timestamp	SI_en	Sequence of events logging	Various	DSO, SCA DB or S		monthly	one	e year	DSC			
Power interrupted	Pi	Define power bloc disconected	GIS / IED / Meters	DSO, SCA DB or S		monthly	one	e year	DSC			
			Bas	eline								
			Literatu	ıre		Historical data		Meası	ıred at start			
				7								
				1		X			X			
Source of b	aseline co	ndition					_					
	Simulation Laboratory Field  X											
Details of baseline							ļ					
Responsible				UCS	/ DSC							
			Com	ments								
	SC = Demo-Sites coordinator ICS = Use Case supervisor											

FLEXIGRID KPI DATASHEET									
	ı			ormation					
Name:		Increased	EV Hosting cap	acity		KPI	ID:	<u> </u>	EVHC
Description:					city t	the distribution hat can be accorut it.			
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece UC3 (X)	UC4 (X)	UCS	Croatia	(X) UC	7 (X)	Italy UC8 (X)
	l		Calcu	lation					
Formula or Calculation procedure $RESHC:$ Is the enhanced hosting capacity of EV when FLEXIGRID solutions are applied [%] $HC_FG:$ Is the additional hosting capacity of EV when FLEXIGRID solutions are applied with respect to currently connected generation [MW] $HC_BL:$ Is the hosting capacity of EV in baseline scenario with respect to currently connected generation [MW]									
	[[]				_				
Scenarios to be	e measured / calculated    Baseline   Business as usual (BaU)   FLEXIGRID (R&D)								
Units	%								
Other KPIs related Increased RES Hosting capacity (RESHC)									
			Calculation	Methodolo	gy				
Nº			Step des	cription				F	Responsible
EVHC_01		mo site asset ch							DSC
EVHC_02			erform OPF sim						UCS
EVHC_03			eline scenario to						UCS
EVHC_04	Perform a	n OPF for a FLEX	(IGRID scenario	to obtain tl	he ca	pacity of the gric	l		UCS
EVHC_05	Perform c	alculation of EVI	HC						UCS
			Data sour	ces / types	S				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Min. Monitor perio	ing	Responsible
Demo assets characteristics	EVHC_01	Nominal values / specifications	Datasheets / Registers	DSO D	В	ones			DSC
Hosting capacity	HC_FG/ HC_BL	OPF Simulation	OPF Simulator	DB					UCS
			Bas	eline					
			Literatu	ire		Historical data	^	Леаsu	ıred at start
Source of b	aseline co	ndition							
			Simulati X	ion		Laboratory			Field
Details of baseline					1551				
Responsible			^-	•	/ DSC				
DCC - Dama Cita	oordinat-		Com	ments					
DSC = Demo-Sites c UCS = Use Case sup									

	FLEXIGRID KPI DATASHEET											
	ı			formation								
Name:		Flexibi	lity actions take	n		КРІ	ID:		FAT			
Description:	Number o	f flexibility action	ns taken to redu	ice demand	l, load	l control, netwo	rk confi	guration,	etc. in a period			
			Loc	ation								
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	UC3 (X)	UC4 (X)	UC5	Croatia	5 (X)	UC7 (X)	UC8 (X)			
	1		Calcu	ulation								
Formula or Calculation procedure	$FAT = \sum FA_n$ Where: FAT: Number of flexibility actions taken [-] FA_n: An event in the grid that involves a change in generation or demand behavior [-]											
Scenarios to be	measured ,	measured / calculated  Baseline  Business as usual (BaU)  X  X										
Units	ı	%										
Other KPIs related												
			Calculation	Methodolo	gy							
Nº				scription				R	esponsible			
FAT_01	Determine	e characteristics	of a flexibility ac	tion					UCS			
FAT_02	Obtain all	flexibility actions	taken in the gr	id					DSC			
FAT_03	Perform d	ata calculation o	f total flexibility	actions tak	en				UCS			
			Data sour	ces / types	3							
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of collection		Frequency of data collection	Moni	lin. itoring riod	Responsible			
flexibility actions taken	FAT_02	determine number of flexibility actions	IEDs / Simulations	DSO pow registers Simulati	s /	hourly	one i	month	UCS			
			Bas	eline								
			Literatu	ıre		Historical data		Measu	red at start			
				1		Х						
Source of h	acolina co	ndition		1								
Source of b	Source of baseline condition  Simulation  Laboratory  Field											
			Х	]					Х			
Details of baseline							•					
Responsible					/ DSC							
DSC = Demo-Sites co	oordinata-		Com	ments								
UCS = Use Case supe												
Can also be calculate		ating each type	of event									

	FLEXIGRID KPI DATASHEET									
			Basic Inf	formation						
Name:		Number of freq	uency out of ra	nge events		КРІ	ID:		FOR	
Description:	Calculat	es times that the				ntal frequency m ranges (FCE).	easure	d over p	eriods of 10 s	
			Loc	ation						
		Spain	Greec	•		Croatia			Italy	
Demo site			Greec	_		Croatia			ntury	
(Use Case)										
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UC6	(X)	UC7 (X)	UC8 (X)	
	1		Calcu	ılation						
Formula or Calculation procedure		al number of fre ent of voltage li	quency out of ro	$R = \sum e$		period [-]				
Secure vice to be	. —		Baselin	ie	Bus	siness as usual (Ba	ıU)	FLEXI	GRID (R&D)	
Scenarios to be	measureu	/ calculated	Х						Х	
Units				[integer]	]/[tin	ne]	•			
Other KPIs related										
			Calculation	Methodolo	gy					
Nº			Step des					F	Responsible	
FOR_01		frequency out o		om the bas	eline	scenario			DSC	
FOR_02		FOR to the base							UCS	
FOR_03				om the FLE	XIFRI	D (R&D) scenari	0		DSC	
FOR_04		FOR for the FLEX							UCS	
FOR_05	Compare	to baseline scen							UCS	
	ı	1		ces / types						
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	lin. itoring riod	Responsible	
Frequency out range event	e_for	Power meters units lecture	IEDs / Others	DSO Sol registe		daily	one	e year	DSC	
	<u> </u>	1	Ras	eline						
			Literatu	ire		Historical data		Measu	red at start	
			Х	Ī						
			X	1						
Source of b	aseline co	ndition								
			Simulat.	ion 		Laboratory			Field	
				+		<b>└</b>			<u> </u>	
Details of baseline										
Responsible				UCS /	DSC					
			Com	ments						
DSC = Demo-Sites c		•								
UCS = Use Case sup	ervisor									
optionally can be di	scriminate	d by over and ur	nder frequency	events						

FLEXIGRID KPI DATASHEET											
	T			ormation							
Name:		Generatio	n Available Flexi	bility		KP	ID:		GAF		
Description:		ТІ	ne amount of ge	neration th	at car	n be shifted ten	nporally				
			Loc	ation			_				
		Spain	Greec	e		Croatia			Italy		
Demo site (Use Case)				Ī							
(000 0000)	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UC	6 (X)	UC7 (X)	UC8 (X)		
			Calcu	llation							
Formula or Calculation procedure		$GAF = \sum Gf_n$ Where:  GAF: [MW]  Gf_n: Amount of generation that can be shifted in node n [MW]									
	GI_II: AII	iount of general									
Scenarios to be	measured	/ calculated	Baselin	e	Bus	iness as usual (B	aU)	FLEXI	GRID (R&D)		
		,	X						Х		
Units	1			<u> </u> 'M]	Wl						
Other KPIs related	Demand Available Flexibility (DAF)										
	Ī		Calculation		gy						
Nº			Step des						Responsible		
GAF_01	Power grid	d assets characte	eristics (lines, tra	ansformers,	, gene	eratos, etc.) #GE	)		DSC		
GAF_02	Modeling	power grid for L	PF using #GD						DSC		
GAF_03	Determine	e generation ava	ilable to be shift	ted in a bas	eline	scenario in nod	e (Gf_n	)	USC		
GAF_04	Determine (Gf_n)	e generation ava	ilable to be shift	ted in a FLE	XIGRI	D scenario in no	ode		USC		
			Data sour	ces / types			,				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	lin. itoring riod	Responsible		
Grid data	#GD	Power grid parameters for modeling	DSO registers /DB	DSO regis /DB	ters	once		-	DSC		
			Bas	eline	l				1		
			Literatu	ıre		Historical data		Measu	ıred at start		
			Х			Х					
Source of b	asalina co	ndition		ı		<u> </u>					
30urce or b	aseille co	ilaition	Simulati	ion		Laboratory			Field		
			Х	Ī							
				I.							
Details of baseline				•	/ = = =						
Responsible			Com	UCS / ments	DSC						
DSC = Demo-Sites co	oordinator		Colli								
UCS = Use Case sup											

FLEXIGRID KPI DATASHEET											
			Basic Inf	formation							
Name:		Grid in	vestment deferi	ral		KPI	ID:		GID		
Description:	Savings	(avoided costs)	by employing n	ew propose	ed so	lutions vs traditi	onal (e.g.	line re	inforcement)		
			Loc	ation							
Demo site		Spain	Greec	e		Croatia			Italy		
(Use Case)				1				ſ			
(333 333,	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC	5 (X) UCE	5 (X) U	C7 (X)	UC8 (X)		
		,		ulation			( /	. ,	,		
Formula or Calculation procedure	$ extit{GID} = \sum Sc_n$ $ extit{Where:}$ $ extit{GID:}$ Total grid investment deferral $[\mathbf{\epsilon}]$										
	GID: Tota	al grid investme	nt deferral [€]								
	Sc_n: An	nount of investm	ent deferral by	node/cath	egory	//element "n" in	the grid [	€]			
Scenarios to be	measured	Baseline Business as usual (BaU) FLEXIGRID (R&D)  easured / calculated X									
11.11.	ı										
Units	€										
Other KPIs related	Peak load reduction (PLRed) Load curve valley filling (VF) Line overload occurence (LOO)										
			Calculation	Methodolo	ogy						
Nº			Step des	scription				R	Responsible		
GID_01		mo site asset ch							DSC		
GID_02		e power grid to p							UCS		
GID_03		n OPF for a BaU							UCS		
GID_04		n OPF for a FLE					ID_03		UCS		
GID_05	Determin	e investments re	equired by GID_0	04 and GID	_03 t	o define SCn			UCS		
			Data sour	ces / types	5						
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Min Monito perio	ring	Responsible		
Demo assets characteristics	GID_01	Nominal values / specifications	Datasheets / Registers	DSO D	В	once			DSO		
			Bas	eline							
			Literatu	ıre		Historical data		Measu	red at start		
				1				1			
				]		X					
Source of b	aseline co	ndition									
			Simulat	ion		Laboratory			Field		
				7				ľ			
			X	]							
Details of baseline					150						
Responsible				UCS ,	/ DSC						
DSC - Domo Sitor -	oordinata		Com	ments							
DSC = Demo-Sites c UCS = Use Case sup											

FLEXIGRID KPI DATASHEET									
			Basic Inf	ormation					
Name:		Line ov	erload occurent	ce		KPI	ID:		LOO
Description:		Numbe	er of line overlo	ading event	ts up	to 15 minutes w	vithin a	year	
			Loc	ation					
		Ci	C	_		Cun matin			It as les
Demo site		Spain	Greec	-		Croatia			Italy
(Use Case)									
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UCS	5 (X) UC6	(X)	UC7 (X)	UC8 (X)
	I		Calcu	llation					
Formula or Calculation procedure		al lines overload vent of line overı	events in a peri	$=\sum_{c}Lc$	$OE_n$				
	LOL_II. e	vent of line over	ouu n [-]						
			Baselin	e	Bus	siness as usual (Bo	aU)	FLEXIC	GRID (R&D)
Scenarios to be	measured	/ calculated	Х	Ī					х
				1				ļ	
Units	[integer]								
Other KPIs related	ed								
A10	I		Calculation		gy				
<b>№</b>	Dofino lin	es to be monitor	Step des	cription					Responsible DSC
LOO_01							.:!		DSC
LOO_02	coordinat	es, etc.)				metry, geograph			DSC
LOO_03 LOO_04		rrents values for				e nominal curre	nt		UCS
LOO_04		e number of ove			попп	torea			UCS
100_03	Determini	e number of ove		ces / types					003
			Source/	(CC) / () (CC)			N	1in.	
Data	TAG	Methodology	Tools/ Instruments	Location data collec		Frequency of data collection	Mon	itoring eriod	Responsible
Line	e_for	Power meters units lecture	IEDs / Others	DSO So registe		daily	one	e year	DSC
			Bas	eline					
			Literatu	ire		Historical data		Measu	red at start
				Ī		Х		1	
				l					
Source of b	aseline co	ndition		_					
			Simulati	ion		Laboratory			Field
			Х						Χ
				<u>.                                    </u>					<u> </u>
Details of baseline			<del></del>						
Responsible				UCS /	/ DSC				
DCC Daws Six			Com	ments					
DSC = Demo-Sites co UCS = Use Case sup									
oco – ose case sup	C1 V13U1								

	FLEXIGRID KPI DATASHEET									
Name:	Minim	um frequency re	Basic Inf eached after a c	ormation	/ eve	nt <b>KPI</b>	ID:		NADIR	
Hume.	141111111	ann nequency n	cacrica arter a c	ortingene	y CVC	ic Ki i	10.		WADIK	
Description:		Minim	um frequency r	eached aft	er a c	ontingency eve	nt (by n	ode)		
			Loca	ation						
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	UC4 (X)	UC5	Croatia	5 (X)	UC7 (X)	Italy UC8 (X)	
Formula or Calculation procedure	-	$NADIR = min(f(t)_n)$ $mere:$ ADIR: [Hz] $t)_n: Frequency function in a event of inertial/load/generation variation in node n [Hz] masured / calculated								
Scenarios to be	measured	/ calculated		e	Bus	iness as usual (Bo	aU)	FLEXIO		
Units				[H	lz]		•			
Other KPIs related										
	Calculation Methodology Ston description Responsible									
Nº	Step description Responsible									
NADIR_01	Modeling	of power grid, i	ncluding inertia	l compone	nts of	f generation and	load		UCS	
NADIR_02	Define sce	narios to evalu	ate (different in	ertia, load	and g	generations sche	emes)		UCS	
NADIR_03	Perform c	alculation of NA	DIR for the base	eline scena	rios /	nodes			UCS	
NADIR_04	Perform c	alculation of NA	(DIR for the FLE)			s / nodes			UCS	
				ces / types	5					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	in. toring riod	Responsible	
Network data	NADIR_01	Modeling power grid	DSO DB / Registers	DSO DB Registe		once		-	DSC	
Frequency function	NADIR_03 / 04	Simulation	Simulated COMTRADE, Oscillographyc register	DSC		once		-	DSC	
			Bas	eline						
Source of b	aseline co	ndition	Literatu	ire		Historical data		Measu	ired at start	
			Simulati X	ion		Laboratory			Field	
Details of baseline				LICC	/ DCC					
Responsible			Com	ments	/ DSC					
DSC = Demo-Sites c UCS = Use Case sup										

FLEXIGRID KPI DATASHEET										
Name:	1	Peductio	Basic Information in Energy Los	formation		KDI	ID:		REL	
Nume.		Neddelie	on in Energy Los	363		Kill	ю.		NLL	
Description:		Amount o	f electrical enei	rgy lost on	grid's	conductors, tra	nsform	ers, etc.		
			Loc	ation						
Demo site		Spain	Greec	e		Croatia			Italy	
(Use Case)				]						
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	(X) UC6	5 (X)	UC7 (X)	UC8 (X)	
			Caicu	ulation						
Formula or Calculation procedure	$REL=100\cdot\left(rac{\sum EL_{BL}-\sum EL_{FG}}{\sum EL_{BL}} ight)$ Where: REL: Total reduction in energy losses [%]									
	Baseline Business as usual (BaU) FLEXIGRID (R&D)									
Scenarios to be	measured	/ calculated	X	1	Dus		,	,	x	
Units	%									
Other KPIs related	ted									
***	ı		Calculation		gy					
Nº	Demo site	e network data #	•	scription	atach	neets namenlate		, K	Responsible	
REL_01	databases	s, etc.)							DSC	
REL_02	_	demo site netwo							DSC	
REL_03		calculation of LPF to obtain REL	to estimate en	ergy losses	in a l	baseline and a F	LEXIGRI	ID	UCS	
	1	1		ces / types	3					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Moni	lin. itoring riod	Responsible	
Network data for modeling	#ND	characteristics of devices for modeling	datashhets, DB, nameplates	DSO regis	ters	once		-	DSC	
			Bas	eline			1			
			Literatu	ıre		Historical data		Measu	red at start	
Source of b		disio	X	]		Х			X	
Source of b	aseille co	maition	Simulat	ion		Laboratory			Field	
			Х	1						
				4						
Details of baseline Responsible				UCS ,	/ DSC					
- Sharrana	L		Com	ments	. 30					
UCS = Use Case sup	OSC = Demo-Sites coordinator  ICS = Use Case supervisor  Can be divided by type (lines, transformers)									

FLEXIGRID KPI DATASHEET										
	1			ormation						
Name:		Rate of C	hange of Freque	ency		KPI	ID:		ROCOF	
Description:		Correspond	ds with the frequ	uency grad	ient a	after an active po	ower i	mbalance	2.	
			Loca	ation						
		Spain	Greec	•		Croatia			Italy	
Demo site			G/CCC			Croutiu				
(Use Case)										
	UC1 (X)	UC2 (X)	UC3 (X)	UC4 (X)	UC5	5 (X) UC6	(X)	UC7 (X)	UC8 (X)	
	Calculation Perturbation start									
						-	1			
Formula	$ROCOF(t) = \left(\frac{df(t)}{dt}\right)$									
or		ROCOF(t)	$)=\left(\frac{1}{2t}\right)$			띭		- \-~	YNE .	
Calculation			( ut )			frequency		/		
procedure										
•										
	Where:					1		Time	si	
	ROCOF: 0	Gradient of freq	uency [Hz/s]						-	
		-	n a event of iner	tial/load/g	enera	ation variation [I	Hz]			
		•				_		E1 EV	ICDID (DOD)	
Casmanias ta ha		/ and and at a d	Baselin	e	Bus	siness as usual (Bo	(טונ	FLEX	IGRID (R&D)	
Scenarios to be	measurea	/ calculated	Х						Х	
				•						
Units	[Hz/s]									
Other KPIs related	Minimum frequency reached after a contingency event (NADIR)									
	l		Calculation	Methodolo	gv					
Nº Step description Responsible										
ROCOF_01	Modeling of power grid, including inertial components of generation and load USC									
ROCOF_02	Define scenarios to evaluate (different inertia, load and generations schemes) USC									
ROCOF_03	Perform ca	alculation of RO	COF for the base	eline scena	rios /	nodes			USC	
ROCOF_04	Perform ca	alculation of RO	COF for the FLEX	KIGRID scer	narios	s / nodes			USC	
				ces / types	3					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Мо	Min. nitoring period	Responsible	
Network data	ROCOF_01	Modeling power grid	DSO DB / Registers		DSO DB / Registers once		-		DSC	
Frequency function	ROCOF_03 / 04	Simulation	Simulated COMTRADE, Oscillography register	DSC	DSC once - DSC				DSC	
			Bas	eline						
			Literatu	re		Historical data		Meas	ured at start	
				ı						
			X							
Source of b	aseline co	ndition								
Simulation Laboratory Field							Field			
	X									
Details of baseline							-			
Responsible				UCS ,	/ DSC					
			Com	ments						
DSC = Demo-Sites c UCS = Use Case sup										

		FL	EXIGRID KF	PI DATA	SHI	EET				
	ı			ormation						
Name:		Reve	rse Power Flow			KPI	ID:		RPF	
Description:	Power/e	nergy flow fron	n distribution fe	eder/syster	m up	ward due to exc	cess of R	ES pow	er generation	
			Loca	ation						
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece UC3 (X)	UC4 (X)	UC5	Croatia	(X) U	Italy		
	l		Calcu	llation						
Formula or Calculation procedure	$RPF = \frac{\sum R_{POW}}{year}$ Where: RPF: Total reverse power flow [kWh/year] R pow: reverse power energy [kWh]									
			Baselin	P	Bus	siness as usual (Bo	(Ur	FLFXI	GRID (R&D)	
Scenarios to be	Scenarios to be measured / calculated		X			Business as usual (BaU)		X		
Units				%	,					
Other KPIs related										
Calculation Methodology										
Nº	Step description Responsible  Modeling of power grid, including inertial components of generation and load									
RPF_01		of power grid, i from PG_dat	nciuumg mertia	Componer	115 0	i generation and	ı ıoau		UCS	
RPF_02			ate (different lo	ad and gen	erati	ons schemes)			DSC	
RPF_03			ad flow for the b						UCS	
RPF_04	Determine	e R_pow for the	baseline scenar	rios / nodes	5				UCS	
RPF_05			ad flow for the F			rios / nodes			UCS	
RPF_06	Determine	R_pow for the	FLEXIGRID scen						UCS	
				ces / types		ı				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location of data collect		Frequency of data collection	Min. Monitoring period		Responsible	
Power grid data	PG_dat	data collection	DSO DB / registers	DSO DB register		once		DSC		
Reverse power flow in a substation feeder	R_pow	Simulated value	LPF simulator	LPF softw	are	once			DSC	
			Bas	eline						
Source of b	ndition	Literature		Historical data		Measured o		ured at start		
	Simulation Laboratory Field  X					Field				
Details of baseline				:						
Responsible			Com	UCS /	DSC					
DSC = Demo-Sites c UCS = Use Case sup			Comi	ments						

FLEXIGRID KPI DATASHEET									
				ormation					
Name:	S	ystem Average II	nterruption Fred	quency Inde	ex	KPI	ID:		SAIFI
Description:	The Sys	stem Average Int experien		-		FI) indicates how er a predefined p			age customer
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	Greece  UC3 (X)  UC4 (X)		UCS	Croatia		Italy UC7 (X) UC8 (	
			Calcu	ılation					
Formula or Calculation procedure	$SAIFI = \frac{\sum N_i}{\sum N_T}$ Where: Ni : Number of interrupted customers for each sustained interruption event during the reporting periol [integer] NT: Total number of customers served for the area [integer]							porting period	
			Baselin				-11)	ELEVI	ICDID (D&D)
Scenarios to be measured / calculated			X		БИЗ	siness as usual (BaU)		FLEXIGRID (R&D)	
Units				9	6		ı.		
Other KPIs related	CAIDI, SAIDI								
			Calculation		gy				
Nº		Datastas	· · · · · · · · · · · · · · · · · · ·	scription	41				Responsible
SAIFI_01 SAIFI 02								UCS	
SAIFI 03		Ca	Compare to ba			110		-	UCS
			•	ces / types					
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	fin. itoring eriod	Responsible
Service interruption event timestamp	SI_st	Sequence of events logging	Various	DSO, SCA		once at the end of the monitoring period	one	e year	DSO
Restoration command timestamp	SI_en	Sequence of events logging	Various	DSO, SCA		once at the end of the monitoring period	one	e year	DSO
Number of interrupted customers	Ni	Adding the number of customers in the affected areas	Various	DSO, Costumers DB		once at the end of the monitoring period	one	e year	DSO
			Bas	eline					
			Literatu	ıre		Historical data		Measi	ured at start
				- T					
				l		Х			
Source of b	aseline co	ndition					-		
	Simulation Laboratory Field X								
Details of baseline			Drovious	CAIDLyalu	os in t	the same area.			
Responsible			i revious		/ DSC				
			Com	ments					
DSC = Demo-Sites coordinator UCS = Use Case supervisor									

FLEXIGRID KPI DATASHEET									
Name:	Rate o	of successful switch		formation o reconnect	to gri	d <b>KPI</b>	IID:		SSG
Description:		Number of successful reconnections to grid divided by number of all attempts to reconnect to grid in a year							
			Loc	ation					
Demo site (Use Case)	UC1 (X)	Spain  UC2 (X)	UC3 (X)	UC4 (X)	UCS	Croatia  5 (X)  UC6	5 (X) U	C7 (X)	UC8 (X)
Formula or Calculation procedure	$SSG = 100 \cdot \left(\frac{\Sigma SS_n}{\Sigma S_m}\right)$ Where: SSG: Successful switching to grid ratio [%] SS_n: Successful reconection to the grid n [-]								
Scenarios to be						siness as usual (BaU)		FLEXIGRID (R&D)	
Units		[%]							
Other KPIs related	Island mode reliability rate (IMRR) Switching success ratio to islanded mode(SSR)								
			Calculation		gy				
Nº				scription				-	Responsible
SSG_01		empts to recone			ı moc	<u></u>		_	DSC
SSG_02 SSG_03		alculation of SSG		/ents					UCS
_			Data sour	rces / types				_	
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mir Monito peri	oring	Responsible
Number of attempts to reconect to the grid	S_m	DSO register/ SoE	SCADA DB DSC	DSO datak	oase	e monthly one year			DSC
Number of succsseful reconections to the grid	SS_n	DSO register/ SoE	SCADA DB DSC	DB DSO database monthly one ye		/ear	DSC		
			Bas	seline					
			Literatu	ıre	1	Historical data		Measu	ured at start
Source of b	ndition				Х				
	Simulation Laboratory Field  X								
Details of baseline Responsible				UCS /	/ DSC				
пеэропэне			Com	ments					
DSC = Demo-Sites co UCS = Use Case supe									

FLEXIGRID KPI DATASHEET										
	I			formation						
Name:		Load o	curve valley fillin	g		КРІ	ID:		VF	
Description:	It is def	It is defined as the ability to shift load to valley hours, by means of the direct control of assets or by tariff strategy.								
			Loc	ation						
Demo site (Use Case)	UC1 (X)	Spain UC2 (X)	UC3 (X)	UC4 (X)	UCS	Croatia	(X) L	IC7 (X)	UC8 (X)	
			Curce	ilution .						
Formula or Calculation procedure	$VF=100\cdot \left rac{V_{BL}-V_{FG}}{V_{BL}} ight $ Where: VF: Load valley filling [%] V_BL: Total demand in valley with baseline scenario [MW]									
	V_FG: To	tal demand in va	alley with FLEXIO	GRID scenar	io [N	1W]				
		Baselin	ie	Business as usual (BaU)			FLEXIGRID (R&D)			
Scenarios to be measured / calculated			X					X		
Units	%									
Other KPIs related				-	-					
A/0	I		Calculation		gy			Τ.		
Nº			Step des	scription				+ '	Responsible	
VF_01*		ad curve from de						os	DSC	
VF_02		calculation of mid V_BS and V_FG	nimun of demar	id (valley)	for ba	aseline a FLEXIG	RID		UCS	
VF_03	Perform o	calculation of VF							UCS	
				ces / types	3			•	T	
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mi Monit per	oring	Responsible	
Demand	#LC	Power meters units lecture	IEDs / Others	DSO pow registe		DWP6 C		DWP6 DSC		
	ļ		Bas	eline						
			Literatu	ıre		Historical data		Measu	ıred at start	
				Ī		Х			Х	
Source of b	aseline co	ndition		l .						
Source of L	aseille co	maition	Simulati	on*		Laboratory		Field		
			Х	Ī					Х	
				<b>.</b>		<u> </u>				
Details of baseline Responsible				UCS /	/ DSC					
Kesponsible			Com	ments	المحاد					
DSC = Demo-Sites c		r								
UCS = Use Case supervisor *Alternatively can be calculated using simulations										

		FL	EXIGRID KI	PI DATA	SHI	EET				
				formation						
Name:		Voltage	Unbalance Fac	tor		KPI	ID:		VUF	
Description:	Voltage	unbalance is def		o of the neg uence volta			ge com	iponent t	o the positive	
			Loc	ation						
		Spain	Greec	e		Croatia			Italy	
Demo site (Use Case)		<u></u>		т						
(Ose cuse)	UC1 (X)	UC2 (X)	(X) UC3 (X) UC4 (X) UC5 (X) UC6 (X)				(X)	UC7 (X) UC8 (X)		
	1 552 (1.9	5 5 = (1.9	` ′	ulation		. (19)	1-7		2 22 (1.7)	
Formula or Calculation		VUF	$=100\cdot\left(rac{V_{Ne}}{V_{Po}} ight)$	$\left(\frac{g}{ds}\right)$					$\frac{c}{c} + aV_{ca}$	
procedure	Where:							a =	= 1(120°)	
procedure		tage unbalance f	actor in sample	k					1(120)	
	V_neg: N	legative sequenc	e voltage comp	onent [V]						
		ositive sequence								
	Vab,Vbc,	Vca: Line to line	voltage magniti	ude [V]						
		Baseline		Bus	Business as usual (BaU)		FLEXIGRID (R&D)			
Scenarios to be measured / calculated			Х					Х		
						<u> </u>			<u> </u>	
Units				9/	6					
Other KPIs related				_	-					
			Calculation		gy			,		
Nº				scription				F	Responsible	
VUF_01		oltage samples in							DSC	
VUF_02		positive and neg		nt for each	node	e / sample			DSC	
VUF_03	Calculate VUF for each node / sample					UCS				
VUF_04	Calculate	average VUF for				g period			UCS	
	<u> </u>			ces / types	<u> </u>	1				
Data	TAG	Methodology	Source/ Tools/ Instruments	Location data collec		Frequency of data collection	Mon	lin. itoring eriod	Responsible	
Voltage fasor	Vabc	Power meters units lecture	IEDs / Others	DSO pow register		WDP6	one	month	DSC	
			Bas	eline						
			Literatu	ıre		Historical data		Measu	red at start	
			Ziterati	7	Historical data			weasurea at start		
				]		X				
Source of b	oaseline co	ndition								
			Simulat	ion		Laboratory			Field	
								Х		
				_						
Details of baseline										
Responsible				UCS /	DSC					
DSC = Demo-Sites o	oordinato	r	com	ments						
UCS = Use Case sup										