



Minimal set of use case KPIs and measurement methods to perform the technical and economic analysis of the resulting definitions Version 1.0

Deliverable D2.2

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EXECUTIVE SUMMARY

As defined in the Description of Work, the scope of WP2.2 is the Definition of the Key Performance Indicators of the Project, which will allow measuring the success of the Project in relation to its overall technical objectives. The precise measurement methodologies and specificities will be DEMO specific. It should be noted that Interflex Project KPIs are those indicators that are common across at least two different DEMOs.

For this Deliverable, a template was created to define Key Performance Indicators. A similar template is also used in the DEMO specific KPIs. The template has been organized into four main sections:

- 1. Basic KPI Information General Project KPI Info (common to different DEMOs)
- 2. KPI Calculation Methodology Methodology for calculating KPI (DEMO specific)
- 3. KPI Data Collection Data required for calculating indicator (DEMO specific)
- 4. KPI Baseline Baseline for calculating KPI (DEMO specific)

Two types of KPIs have been defined; Technical and Social. Regarding the lack of economic KPIs, it was considered that at this stage of KPI definition, it is very difficult to foresee a measurable economic Key Performance Indicator. This will be considered later on if an economic translation of the technical benefits measured in the project future can be proposed, but at this stage of KPI definition, no economic indicator is defined. Furthermore, a reasonable economic indicator would be related to deployment activities where full cost-benefit analysis can be performed, and not only demonstration activities.

Interflex Project KPI	KPI ID	KPI TYPE	KPI Description		
Flexibility	WP2.2_KPI_1		Flexible power that can be used for balancing specific grid segment.		
Hosting capacity	WP2.2_KPI_2	Technical	Percentage increase of network hosting capacity for DER.		
Islanding	WP2.2_KPI_3		Capacity of the energy system to switch to islanding whilst keeping the power quality requirement.		
Customer recruitment	WP2.2_KPI_4	Social	Measure whether demos are managir to recruit enough customer bases in order to attain demo objectives.		
Active participation	WP2.2_KPI_5	συτιαι	Reflects how versatile the demos are in leveraging flexibility from different technologies.		

The list of Interflex Project KPIs is provided below:

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1. INTRODUCTION

1.1. Scope of the document

The aim of this document is to define a first set of Interflex Project KPIs which are defined as common indicators across different DEMOs. This means that different demonstration projects providing different solutions will use these same indicators to measure specific benefits brought about by tested solutions in the different demonstration projects. The methodology for measuring these indicators will vary from DEMO to DEMO, but the indicator definition could be common to the different demos. The deliverable is divided into chapters by individual indicators and their descriptions.

1.2. Notations, abbreviations and acronyms

The table below provides an overview of the notations, abbreviations and acronyms used in the document.

DER	Distributed Energy Resources
DSO	Distribution System Operator
ESCO	Energy Service Company
EC	European Commission
EC-GA	European Commission Grant Agreement
EU	European Union
EV	Electric Vehicle
GA	General Assembly
WP	General Work Package
KPI	Key Performance Indicator
PC	Project Coordinator
SC	Steering Committee
тс	Technical Committee
TD	Technical Director
WP	Work Package
WPL	Work Package Leader

Figure 1 List of acronyms

2. SUMMARY LIST OF INTERFLEX PROJECT KPIS

The five proposed KPIs are detailed below. Three indicators will monitor technical aspects of the DEMOs, while two will be "softer" indicators, measuring social aspects of the different DEMOs.

2.1. KPI description summary list

Interflex Project KPI	KPI ID	KPI TYPE	KPI Description		
Flexibility	WP2.2_KPI_1		Flexible power that can be used for balancing specific grid segment.		
Hosting capacity	WP2.2_KPI_2	Technical	Percentage increase of network hosting capacity for DER.		
Islanding	WP2.2_KPI_3		Capacity of the energy system to switch to islanding whilst keeping the power quality requirement.		
Customer recruitment	WP2.2_KPI_4	Social	Measure whether demos are managing to recruit enough customer bases in order to attain demo objectives.		
Active participation	WP2.2_KPI_5	JUCIAL	Reflects how versatile the demos are in leveraging flexibility from different technologies.		

Figure 2 Interflex project KPIs summary table

2.2. KPI formulas summary list

See below further details of measurement methodology of the different KPIs.

Project KPI	KPI Definition and formula					
Flexibility WP2.2_KPI_1	$\begin{array}{l} \mbox{Flexibility}_{\%} = \frac{\sum P_{Available\ flexibility}}{\sum P_{Total\ in\ area}} * 100 \\ \mbox{Flexibility}_{\%} & \mbox{Percentage\ of\ flexible\ power\ used\ available\ in\ reporting\ period.} \\ \mbox{P}_{Available\ flexibility} & \mbox{Power\ in\ MW\ of\ available\ flexibility\ in\ reporting\ period.} \\ \mbox{P}_{Total\ in\ area} & \mbox{Total\ power\ in\ MW\ used\ in\ DEMO\ grid\ segment.} \end{array}$					
Hosting capacity WP2.2_KPI_2	$HC_{SG} = \frac{HC_{SG} - HC_{Baseline}}{HC_{Baseline}} \times 100$ HC_{SG} HC_{SG} $HC_{Baseline}$ $HC_{Baseline$					
Islanding WP2.2_KPI_3	$\begin{split} I_{capacity} &= \frac{\sum D_{isl}}{\sum D_{req}} \times 100 \end{split}$ Where: I _{capacity} : the capacity of demo's islanding to last as long as required. D _{isl} : the duration of a single islanding. D _{req} : the required duration of an islanding, after an intentional or unintentional disconnection from the grid.					
Customer recruitment wP2.2_KPI_4	$CR_{\%} = \frac{CR_{successful}}{CR_{required}} \times 100$ $CR_{\%} \qquad \begin{array}{l} \mbox{Percentage of required customer base that use case was able to recruit.} \\ CR_{successful} \qquad \begin{array}{l} \mbox{Number of customers (installed capacity, energy volume) actually recruited.} \\ CR_{required} \qquad \begin{array}{l} \mbox{Number of customers (installed capacity, energy volume) needed to obtain enough flexibility in demo in order to verify use cases.} \end{array}$					

linter FLEX

Active	Parti	$cipation_{\%} = \frac{N_{leverage\ technology}}{N_{target\ technology}} * 100$				
participation	Participation _%	Percentage of technologies leveraged				
WP2.2_KPI_5	$N_{leverage\ technology}$	number of different technologies leveraged in DEMO				
	N _{target} technology	number of types of technologies initially targeted in DEMO				

Figure 3 Table of KPI formulas

2.3. Collecting KPI data and connection with Tasks 2.4 and 2.5

Deliverable 2.2 describes project KPIs. Task 2.4 will define database structure according to KPI definitions. Depending on the reporting period of every KPI, WPL will send the data and calculated KPIs to Enedis (Task 2.4 including Clearing House). Evaluation of WP and project KPIs will be included in Task 2.5 (ČEZ Distribuce).

2.4. KPI relationship to each DEMO

Related to the DEMOs for which these KPIs apply, this is detailed in the figure below:

Project KPI	Germany Avacon	Czech Rep. ČEZd	Netherlands _{Enexis}	Sweden E.ON	France Enedis
Flexibility WP2.2_KPI_1	~			~	
Hosting capacity wp2.2_KPI_2	~			~	
Islanding WP2.2_KPI_3				~	~
Customer recruitment wP2.2_KPI_4	~			~	
Active participation WP2.2_KPI_5	~			\checkmark	

Figure 4 Mapping Interflex Project KPIs applicable to each DEMO

3. RELATIONSHIP WITH INTERFLEX USE CASES

The table below summarizes the close relationship with the Interflex Use Cases and the defined Project Key Performance Indicators.

		DE			C	Z			NL				SE				FR	
	UC1	UC2	UC3	UC1	UC2	UC3	UC4	UC1	UC2	UC3	UC1	UC2	UC3	UC4	UC5	UC1	UC2	UC3
Project KPI	Feed In Management	Demand Side Management	Ancillary Services	Increase DER hosting capacity of LV distribution networks by smart PV inverters	Increase DER hosting capacity in MV networks by volt-var control	Smart EV charging	Smart energy storage	Improve grid flexibility	Improve grid flexibility	Usability of an integrated flex market	Use of DSR to optimize DSO operation by exploiting the interaction with different energy carriers	Use of an industrial Heat Pump to optimize DSO operation by exploiting the interaction with different energy	Technical management of a grid- connected Local Energy System that can run in an islanded mode with 100%	Micro Grid Customer Flexibility facilitated by a peer to peer market platform and enabled by Demand Side	Increased ability to observe and steer the operations of a micro-grid in response to distribution network	Automatic Islanding	Multiservice approach for centralized storage systems	Local flexibility mechanism
Flexibility WP2.2_KPI_1	*	~	~				*			~	~		1					
Hosting capacity WP2.2_KPI_2		~	~	~							~							
Islanding WP2.2_KPI_3																		
Customer recruitment WP2.2_KPI_4			~															
Active participation WP2.2_KPI_5			~								~							

Figure 5 Matrix Interflex Project KPI addressing Use Cases

4. INTERFLEX PROJECT KPIS IN DETAIL

This chapter describes in detail the list of proposed Interflex Project KPIs, with the detailed measurement methodologies and precise formulas applicable to each KPI. As described in Chapter 1, these are indicators that are common to different DEMOs, even though the specifics, measurement methodologies, baseline conditions, and precise data required collecting will be strictly related to the tested solutions, and will therefore vary from DEMO to DEMO.

4.1. Technical KPIs

4.1.1. Flexibility

	BASIC KPI INFORMATION								
KPI Name	Flexibility KPI ID WP2.2_KPI_1								
Strategic Objective	Flexible power that can be used for balancing specific grid segment.								
DEMO where KPI applies	GERMANYCZECH REPNETHERLANDSSWEDENFRANCImage: Second state stat								
Owner	Germany - Thorsten Gross (Avacon) Czech Republic - Stanislav Hes (ČEZ Distribuce) Netherlands - Marcel Willems (Enexis) Sweden - Anna Eriksmo, Luis Hernandez (E.ON) France - Thomas Drizard (Enedis)								
KPI Description	The available po allocated by the relation with the same period.	The available power flexibility in a defined period (eg. per day) that can be allocated by the DSO at a specific grid segment. Measured in MW. This in relation with the total amount of power in the specific grid segment in the same period.							
KPI Formula	$\begin{aligned} \text{Flexibility}_{\%} &= \frac{\sum P_{Available\ flexibility}}{\sum P_{Total\ in\ area}} * 100 \end{aligned}$								
Unit of measurement	% of flexible pow	/er							
Expectations	Germany - >0 Czech - Flexibilit Netherlands - Am on the LV netwo Sweden - Flexib WP8_3*: 10%) France - UC3 5%	ty in case of eme nount of power th rk ility from respor	rgency situations at can be used ir nsive technology	(WP6_3: 40 case of cong (WP8_1: 10)%, WP6_4: 20%) gestion problems)%, WP8_2: 20%,				
Reporting Period	Germany - At the end of each use case demonstration Czech Republic - At the end of each use case demonstration Netherlands - Once a month Sweden - At the end of each use case demonstration France - At the end of each use case demonstration								
Relevant Standards	None								
Connection / Link with other relevant defined KPIs	Sweden - Same a	IS WP8_KPI_N8_C	SR Potential						
Reporting Audience and Access Rights		INTERFLE PARTNER I	S DEMO PA	RTNERS	OTHER (please specify)				
OTHER (please specify)				.					

KPI CALCULATION METHODOLOGY							
	DEMO Germany						
KPI Step Methodology ID [KPI ID #]	Step	Responsible					
WP2.2_KPI_1_AVA_1 a	Determine rated, maximum and average feed in power that is available for Use Case demonstration in Use Case 1	Avacon					
WP2.2_KPI_1_AVA_1 b	Determine total rated, maximum and average feed in power during Use Case 1 period	Avacon					
WP2.2_KPI_1_AVA_2 a	Determine rated, maximum and average demand power that is available for Use Case demonstration in Use Case 2	Avacon					
WP2.2_KPI_1_AVA_2 b	Determine total rated, maximum and average demand power during Use Case 2 period	Avacon					
WP2.2_KPI_1_AVA_3 a	Determine rated, maximum and average demand and feed in power that is available for Use Case demonstration in Use Case 3	Avacon					
WP2.2_KPI_1_AVA_3 b	Determine total rated, maximum and average demand and feed in power during Use Case 3 period	Avacon					
	DEMO Czech Republic						
KPI Step Methodology ID [KPI ID #]	Step	Responsible					
WP2.2_KPI_1_CEZd_ 1a	Evaluation of EV charging station power will be checked from the device specification (manufactures datasheet).	ČEZd					
WP2.2_KPI_1_CEZd_ 2a	After smart solution implementation - evaluation of EV charging station charging power curtailment in case of under frequency or in case of under voltage or in case of DSO command will be evaluated by field tests.	ČEZd					
WP2.2_KPI_1_CEZd_ 1b	Evaluation of PV production peak will be checked from the PV systems specifications (sum of PV modules power under Standard Test Conditions).	ČEZd					
WP2.2_KPI_1_CEZd_ 2b	After smart solution implementation (smart charging of home energy storage) - evaluation of PV production peak will be secured by field measurements for PV systems.	ČEZd					
	DEMO Netherlands						
KPI Step Methodology ID [KPI ID #]	Step	Responsible					
WP2.2_KPI_1_Enexis _1	Inventory of available resources in the grid segment in a specific period	Aggregator					
WP2.2_KPI_1_Enexis _2	Inventory of available power the resources can deliver in the grid segment in a specific period	Aggregator					
WP2.2_KPI_1_Enexis _3	Forecast of expected load in the grid segment in a specific period	Enexis					
WP2.2_KPI_1_Enexis _4	Allocation of the expected amount of flexible power in the grid segment in a specific period	Enexis					
	DEMO Sweden						
KPI Step Methodology ID [KPI ID #]	Step	Responsible					
WP2.2_KPI_1_EON_1a	Calculation/estimation of the % of thermal flexibility available per connected customer (residential multifamily buildings).	r E.ON					
WP2.2_KPI_1_EON_2a	Calculation/estimation of the flexibility available in low temperature thermal grids.	V E.ON					

 \backslash

WP2.2_KPI_1_EO	N_3a	Calculation/est customer (sin technology.	timation of the flexibil gle family house) de	ity available epending o	e per connect n the install	ed ed E.O	Ν			
WP2.2_KPI_1_EO	N_3a	Calculation/est connected cust	timation of the % of the comer (single family hou	rmal flexibi se).	lity available p	er E.O	Ν			
WP2.2_KPI_1_EO	N_3b	Measurement o	of the RES Power in the	grid.		E.O	N			
			DEMO France							
KPI Step Methodology [KPI ID #]	' ID		Step			Resp	oonsible			
WP2.2_KPI_1_End 1	edis_	Calculation/est available	timation of the % o	of gas/elec	tric flexibility	GRDF				
WP2.2_KPI_1_End 2	22.2_KPI_1_Enedis_ Calculation/estimation of the % of storage available ENGIE/Enedis									
WP2.2_KPI_1_End	_Enedis_ Calculation/estimation of the % of residential flexibility available EDF									
WP2.2_KPI_1_End 4	edis_	- Calculation/estimation of the % of industrial flexibility available ENGIE/EDF								
KPI DATA COLLECTION										
			DEMO Germany							
Data	Dat a ID	Methodology for data collection	Source/Tools/Instru ments for Data collection n				Data collecti on respons ible			
Rated power of participating DER	RP_ DER	Database analysis	Data sheets of participating DER	Avacon	Once at beginning of DEMO		Avacon			
Rated power of participating flexible loads	RP_ FL	Database analysis	Data sheets of participating flexible loads	Avacon	Once at beginning of DEMO		Avacon			
Rated power and capacity of participating batteries	RP_ ES	Database analysis	Data sheets of participating energy storage systems	Avacon	Once at beginning of DEMO		Avacon			
Maximum feed in power during use case demo	MP_ DER		Data collection and documentation via smart metering devices, grid control and smart grid hub	Avacon	Continuou s during Use Case demonstra tion		Avacon			
Maximum demand power during use case demo	MP_ FL	Measurement	Data collection and documentation via smart metering devices, grid control and smart grid hub	Avacon	Continuou s during Use Case demonstra tion		Avacon			
Average feed in power during use case demo	AP_ DER	Measurement	Data collection and documentation via smart metering devices, grid control and smart grid hub	Avacon	Continuou s during Use Case demonstra tion		Avacon			
Average demand power during use case demo	AP_ FL	Measurement	Data collection and documentation via smart metering devices, grid control and smart grid hub	Avacon	Continuou s during Use Case demonstra tion		Avacon			

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					DEM	0 Czecl	h Rep	ublic							
Da	ita	Da	ata ID	Methodo data co	ology for llection	Source ls/Inst nts for colled	e/Too rume ^r Data ction	Loca of D collec	tion ata ction	Frequ y of d collec	enc ata tion	Minin m monit ing perio	nu tor od	Data collecti on respon sible	
Nominal charging of EV ch station	power arging	CH/ INC PO base	ARG G WER line	Datasheet specification		Manufactur er of EV on charging station		Manufactur er of EV ČEZd charging systems station		ÉEZd in tl systems of t pro		nce ning t	N/A		ČEZd
Charging of EV ch station i emerger situatior during fi test)	g power arging n ncy n (or ield	CH/ INC POV basel SG	ARG G WER line	Field tes measure	t ments	Meg38 power quality device		ČEZd systen	ČEZd systems		est ry enc on	1 minut values	e s	ČEZd	
PV produ peak determin sum of P modules	uction ned as a V power	PV PEA eline	AK _{bas}	Datashee specifica	et tion	Manufactur er of PV modules		ČEZd systen	2d Only of in the beginn of the project		nce ning t	N/A		ČEZd	
PV produ peak aft smart ch of home storage impleme	uction er harging energy is ented	PV PEA eline	AK _{bas} 2 SG	Field measure	ments	Meg38 power d nts quality s device		ČEZd systen	Once a ns month		a 1 minut values		e s	ČEZd	
DEMO Netherlands															
Data	Data ID	,	Metho for collo	odology data ection	Source/Tools /Instruments for Data		Location of Data collection		Freq of colle	uency data ection	Min mo pe	imum nitori ng eriod	co res	Data ollection sponsible	
Power	Р	M	easure	ement	DA/Dali		Sub st	ations 15 mir		in	con	stant	Ene	exis	
Power	Р	M	easure	ement	Local measure t	emen	PV batter	and ry	and y 15 min		constant		Aggregato		
					0	DEMO S	wedeı	n							
Data	Data	a ID	Met y fo col	hodolog or data lection	Source/ nstrume Data col	Tools/I ents for lection	Loc of coll	cation Data ection	ation Freque Data y of d ection collect		Mir moi ı pe	nimu m nitori ng riod	co res	Data Illection ponsible	
RES Power i the system	n RES	5_P			equipme	ent	Subs	tation	5 miı	5 min		stant	t E.ON		
Availab flexibili	le Av_ ty >	Fle	Aggr	egation	DSR Plat	form	Plat	form	5 mii	า	con	stant	E.C	N	
						DEMO F	rance	;							
Data	Data	a ID	Met f	thodology or data ollection	Sourc rume co	e/Tools/ nts for I ollection	/Inst Data 1	Locatio Dat collec	on of a tion	Frequency of data collection	u / n	Minimu m nonitor ng period	i	Data collectio n responsi ble	
Residen al powe	ti Pr	es	Meas	surement	Linky	Smart M	eter	Resider premise	ntial es	30 min			E	Enedis	
Industri power	al Pir	nd	Meas	surement	Indust Meter	rial S	mart	Industr	Industrial premises		n		E	Enedis	

Storage power	Psto	Measurement	Industrial Meter of s storage met	Smart pecific er	Storage system	30 mir	1	ENGIE/EN EDIS		
	_		KPI B	ASELINE						
			DEMO	Germar	ny					
Source of Baseline Condition			VALUES	СОМ	PANY HISTOR VALUES	ICAL	VALUES M AT STA PROJ	EASURED RT OF ECT]		
Details of Baseline										
Responsibl	e									
			DEMO Cze	ch Rep	ublic					
Source of Baseline Condition		LITERATURE	СОМ	PANY HISTOR VALUES	ICAL	VALUES MEASURED AT START OF PROJECT				
Details of Baseline Baseline PV module power values under Standard Test Conditions and baseline EV charging stations charging power values could be simply checked from manufactures datasheets.										
Responsible Stanislav Hes, ČEZd										
DEMO Netherland										
Source of Baseline Condition			COMPANY HISTORICAL VALUES			AT STA PROJ	RT OF ECT			
Details of Baseline										
Responsibl	e									
			DEMO	Swede	n					
Source of Baseline Condition		LITERATURE	VALUES	СОМ	PANY HISTOR VALUES	ICAL	AT STA PROJ	EASURED RT OF ECT		
Depending on the source of flexibility, the baseline calculation will be do differently: UC1_multifamily building thermal inertia, company historical values at literature will be used. UC2_low temperature heating/cooling grid thermal inertia, literature will used. UC3_single family house thermal inertia, literature will be reviewed. UC3_hot tap water boiler, values measured throughout the project will be used. UC3_battery systems, values measured from the project.								ll be done alues and ure will be I. ill be used		
Responsible	e	L.UN/KWIH								

DEMO France									
Source of Baseline Condition	LITERATURE VALUES	COMPANY HISTORICAL VALUES	VALUES MEASURED AT START OF PROJECT						
Details of Baseline									
Responsible									

GENERAL COMMENTS

DEMO Czech Republic - KPI Flexibility will be evaluated for use cases WP6_3 and WP6_4. DEMO Sweden - KPI Flexibility will be evaluated for use cases WP8_1, WP8_2 and WP8_3. *KPI for use case WP8_3 depends on recruited flexibility: quoted KPI assumes recruitment of 5% of flexible heat demand. KPI estimations are based upon simulation of a representation of the DEMO energy system, using internal estimates of the flexibility accessible from each of the available technologies and illustrative demand and generation profiles.

4.1.2. Hosting Capacity

		BASIC KPI INFOR	RMATION							
KPI Name	Percentage increase of network hosting capacity KPI ID WP2.2_KPI_2									
Strategic	Increased DEF	R integration in dis	tribution grids							
DEMO where KPI applies	GERMANY	CZECH REP	NETHERLAND S	SWEDEN	FRANCE					
Owner	Germany - Th Czech Republ Sweden - Ann	orsten Gross (Avac ic - Stanislav Hes (a Eriksmo, Luis He	on) ČEZ Distribuce) rnandez (E.ON)							
KPI Description	This KPI will energy resour where no "sm give a statem thanks to S reinforcemen P [kW]	measure the poter rces with Smart Grin hart" actions are p ent about the addit formart Grid solut ts (i.e. new grid lin Before	Htial increase host d solutions compare erformed on the r tional DER that car ions without the hes).	ing capacit red to the b network. T n be installe e need f	HC _{Baseline}					
KPI Formula	HC _{SG} HC _{Baseline} <u>Note:</u> Positive value:	$HC_{\%} = \frac{HC}{m}$ Hosting Capacity fo should measure DE solution is implemented Hosting Capacity fo measure DER that of implemented.	$E_{SG} - HC_{Baseline}$ $HC_{Baseline}$ or DER with Smart Gi R that can be connected. or DER in Baseline sit can be connected to	× 100 rid solutions acted to the tuation (kW) the grid bef	(kW). This hosting ca grid after the Smart G . This hosting capacit Fore the Smart Grid sc					
Unit of measurement	% percentage	base								

Inter **FLSX**

	Increase of DER ho	osting capacity								
Expectations	Germany - Increas	e of DER hosting cap	pacities > 0							
Expectations	Czech Republic - Sweden - Flexibili	WP6_1: +25%, WP6_2 ity from responsive	: +25%, WP6_4: +5% technology (WP8 1:	12%, WP8 2: 19%,						
	WP8_3*: 4%, WP8_	5: 10%)		, , , , , <u>,</u> , , , , , , , , , , , , ,						
Reporting Period	Germany - At the Czech Republic - Sweden - At the e	end of each use case At the end of each u nd of each use case	e demonstration ise case demonstration demonstration	on						
Relevant Standards	EN 50438:2013, EN	√ 50438:2013, EN 50160, BDEW MS-Richtlinie, VDE-4105								
Connection / Link with other relevant defined KPIs	inked with KPI Flexibility for use case WP6_4 (which evaluate decrease of PV roduction peak caused by PV + storage systems) and WP8_N5 which is called acrease of renewable penetration.									
Reporting Audience and Access Rights	PUBLIC INTERFLEX PARTNERS DEMO PARTNERS OTHER (please specify) Image: Display the system Image: Display the system Image: Display the system									
OTHER (please specify)										
(Produce of constraints)	KPI CAI	CULATION METHOD	OLOGY							
		DEMO Germany								
KPI Step Methodology ID [KPI ID #]	Step Res									
WP2.2_KPI_2_AVA_1	Determine hosting capacity in grid area before deployment of Smart Grid Hub by simulation in PowerFactory and with reference to technical guidelines (VDE - AR - 4105, DIN EN 50160)									
WP2.2_KPI_2_AVA_2	Determine hosting Use Case 1 by simi technical guideling	capacity in grid area a ulation in PowerFactor es (VDE - AR - 4105, DI	after implementation o y and with reference to N EN 50160)	of Avacon						
WP2.2_KPI_2_AVA_3	Determine hosting simulation in Powe guidelines (VDE - /	capacity after implem erFactory and with refe AR - 4105, DIN EN 5016	nentation of Use Case 2 erence to technical 0)	2 by Avacon						
WP2.2_KPI_2_AVA_4	Determine hosting simulation in Powe guidelines (VDE - /	capacity after implem erFactory and with refe AR - 4105, DIN EN 5016	nentation of Use Case 3 erence to technical 0)	3 by Avacon						
	C	EMO Czech Republi	c							
KPI Step Methodology ID [KPI ID #]		Step		Responsible						
WP2.2_KPI_2_CEZd_1	Evaluation of base DNCalc software b system according hosting capacity (s	line DER hosting capac by using baseline grid to to the standard rules fo standard approach).	ity by simulation in opology data from GIS or calculation of DER	ČEZd						
WP2.2_KPI_2_CEZd_2	After smart solution capacity by simular data from GIS syst calculation of DER physically connect implementation.	on implementation - ev ation in DNCalc softwar em (standard approach hosting capacity or ins ted to the grid after sm	valuation of DER hosting e by using grid topolog n) and with new rules for stalled power of DER nart solution	g 3y Ö ^r ČEZd						
		DEMO Sweden								

KPI S Methodo [KPI I	itep ology ID D #]					Step					Re	esponsible
WP2.2_KPI_	2_EON_1		Deter	mine hosting	сара	acity in grid b	y s	imulation			E.(N
WP2.2_KPI_	2_EON_2		Deter simul	mine hosting ation.	сара	acity after im	ple	ementatior	n of Use Case	1 by	E.(Л
WP2.2_KPI_	2_EON_3		Deter simul	rmine hosting ation.	сара	acity after im	ple	ementation	of Use Case	2 by	E.(ЛС
WP2.2_KPI_	2_EON_4		Deter disag	rmine hosting gregation of m	capa neas	acity after im ured data.	ple	ementation	n of Use Case	3 by	E.(ЛС
WP2.2_KPI_	2_EON_5		Deter disag	rmine hosting gregation of m	capa neas	acity after im ured data.	ple	ementation	n of Use Case	5	E.(ЛС
WP2.2_KPI_	2_EON_6		Deter imple	Determine hosting capacity of different levels of penetration after implementation of Use Case 1-3 and 5 by simulation.								Л
				KP	PI DA	ATA COLLEC		ON				
Data	Data II)	Meth data	nodology for a collection	DEMO Germany Source/Tools/ Instruments for Data collection			ocation of Data ollectio n	Frequenc y of data collection	Minir m moni ring perio	nu to g od	Data collection responsib le
Current hosting capacity	HC _{baselin}	e	Calcu hostii in kW guide AR - 4	Ilation of ng capacity / under Iline VDE - 4105	Grid model in PowerFactory, standard scenarios		A	vacon	Once during each use case demonstra tion			Avacon
Additonal hosting capacity	HC _{sG}		Calcu hostig kW at deplo Smart	llation of g capacity in fter pament of t Grid Hub	Gr Po sta sce	id model in werFactory, andard enarios	A	vacon	Once during each use case demonstra tion			Avacon
				DI	EMC) Czech Rep	ub	olic				
Data		I	Data ID	Methodolog for data collection	y	Source/Too s/Instrumer ts for Data collection	l n	Location of Data collectio n	Frequenc y of data collection	Mir mor i pe	nimu m nitor ng riod	Data collecti on respons ible
Number of E which are p to connect t grid before solution implementa	DER ossible to the smart tion	H	C _{baseli}	Download fro ČEZ Distribuo systems	om ce	GIS data		ČEZ Distribuc e systems	Only once in the beginning of the project	N/A		ČEZd
Number of I connected physically to grid after sr solution implementa hosting capa calculated v new rules for hosting capa calculation	DER o the nart tion or acity vith or DER acity	H	C _{SG}	Download fro ČEZ Distribuo systems	om ce	GIS data		ČEZ Distribuc e systems	Only once at the end of the project	N/A		ČEZd

			DEMO	Sweden					
Data	Data	Methodolo gy for data collection	Source/Too ments fo collect	ls/Instru r Data cion	Locatio n of Data collecti on	Frequen cy of data collecti on	Minimu m monitori ng period	Data collection responsib le	
RES Power in the system	RES_P		Measuremen equipment	t	Substat ion	5 min	constant	E.ON	
Flexibility dispatched	Dis_Fle	Aggregatio n	DSR Platform		Platfor m	5 min	constant	E.ON	
System Load	Load_F	Measureme nt	Measurement Equipment		Substat ion	5 min	constant	E.ON	
			KPI B	ASELINE					
			DEMO	Germany					
Source of Baseline Condition			VALUES	СОМРА	NY HISTO VALUES	RICAL	VALUES MEA START OF	ASURED AT PROJECT]	
Details of Baseline	tails of selineVDE-AR-4105 allows a maximum voltage rise on critical voltage.						Il feeder of 2% nominal		
Responsible	•	Thorsten Gross							
			DEMO Cze	ch Repub	olic				
Source of Baseline Condition	Source of Baseline Condition				COMPANY HISTORICAL VALUES			NEASURED ART OF JECT	
Details of Baseline		Baseline grid to from GIS system	pology for u	se cases V	VP6_1, WI	P6_2 and	WP6_4 dow	nloaded	
Responsible	•	Stanislav Hes, Ò	ÉEZ Distribuc	e					
			DEMO	Sweden					
Source of Baseline Condition			VALUES	COMPA		RICAL	VALUES ME START OF	ASURED AT PROJECT]	
Details of BaselineBased on measured values from the project, a baseline model will be creat for the energy system. This will represent the case that when RES surplu higher than a set value, the RES would be curtailed. Hence, reducing penetration of renewables into the grid. This KPI will use this baseline and will compare against how much RES was curtailed by the activation of different sources of flexibility.							be created surplus is ducing the ES was not		
Responsible	2	E.ON							
			GENERAL	COMMEN	TS				
DEMO Czech Republic - KPI Percentage increase of network hosting capacity for DER will evaluated for use cases WP6_1, WP6_2 and WP6_4. DEMO Sweden - KPI hosting capacity will be evaluated for use cases WP8_1, WP8_2, WP8_3 WP8_5.						ER will be WP8_3 and			

Inter FLEX

4.1.3. Islanding

		BASIC KPI INI	ORMATION			
KPI Name	Capacity of	an islanding to	last		KPI ID	WP2.2_KPI_3
Strategic Objective	Evaluation wh	nether islanding	were success	ful		<u> </u>
DEMO where KPI applies	GERMANY	CZECH REP		DS SV	WEDEN	FRANCE
Owner	France - Thor Sweden - Luis	nas Drizard (Ene Hernandez (E.	edis) ON)			
KPI Description	This KPI wil required.	l measure the	capacity of	an islan	ding to	last as long as
KPI Formula	Where: I _{capacity} : the cap D _{isl} : the durati D _{req} : the requi disconnection	I _{cap} pacity of demo's is on of a single isla red duration of a from the grid.	$D_{Dacity} = \frac{\sum D_i}{\sum D_r}$ Islanding to last Inding.	sl eq as long as r r an intent	required. ional or ur	nintentional
Unit of measurement	% percentage	base				
Expectations	France - 100% Sweden - 100	6 %				
Reporting Period	Once a year					
Kelevant Standards	/					
Connection / Link with other relevant defined KPIs	/					
Reporting Audience and Access Rights	PUBLIC		EX RS DEA		ERS	OTHER (please specify)
OTHER (please specify)	/					
	KP	I CALCULATION	METHODOLC	GY		
		DEMO E	NEDIS			
KPI Step Methodology ID [KPI ID #1		Step			Resp	oonsible

WP2.2_KPI_3	3_Enec	lis_1	The assess opene	duration of the islan and from the moment and to the moment the sv	iding will the switc vitch close	be h is d.	Thoma	as Drizard		
WP2.2_KPI_:	3_Enec	lis_2	The calcul	lated as the minimum between: the duration of a customer's power cut if there were no islanding system. the maximum duration of an islanding depending on storage capacity.				Thomas Drizard		
DEMO E.ON SVERIGE										
KPI S Methodo [KPI	Step ology ID #]	ID		Step			Responsible			
WP2.2_KPI_3	WP2.2_KPI_3_EON_1 The duration of the islanding will assessed from the moment the switch intentionally or unintentionally opened the moment the switch is closed.					be h is d to	Luis Hernandez			
The duration of a required islanding is calculated as: - the duration of a customer's power cut i.e. the inability of theWP2.2_KPI_3_EON_2overlying power grid to source the village due to a planned or unplanned outage, or the planned duration of an islanding test (intentional disconnection from main grid).						ernandez				
			<u> </u>	ΚΡΙ ΠΑΤΑ ΟΟΙ Ι	ECTION	,				
	_	_	_			_	_			
Data	Dat a ID	Meth gy fo colle	odolo r data ection	Source/Tools/Instrume nts for Data collection	Locatio n of Data collecti on	Frequenc y of data collection		Minimum monitorin g period	Data collectio n responsi ble	
Duration of a single islanding	Disl	Differ betwo two instar data	rence een nts on	Collected data	At the storage level	For e islan atte	every ding mpt	/	Thomas Drizard	
Required duration of an islanding	D _{req}	Minim betwo two durat	ium een ions	Collected data	At the storage level	For e islan atte	every ding mpt	1	Thomas Drizard	
				DEMO E.ON SV	ERIGE					
Data	Dat a ID	Meth gy fo colle	odolo r data ection	Source/Tools/Instrume nts for Data collection	Locatio n of Data collecti on	Fre y o coll	quenc f data ection	Minimum monitorin g period	Data collectio n responsi ble	
Duration of a single islanding	D _{isl}	Down from stora	load cloud ge	Measurement data gathered by the microgrid controller.	Cloud storage	Cons	stant	Event length	Ingmar Leisse	
Required duration of an intentiona l islanding	D_{req}	Down from storag	load cloud ge	Data input into test schedules	Cloud storage	Cons	stant	N/A	Ingmar Leisse	

Inter **FLSX**

					ľ				
Required duration of an unintentio nal islanding	D _{req}	Elnät outage report	SCADA - OPS r	oom	Report archive	During outage period		Outage period	Demijan Panic
			K	PI BASELI	NE				
DEMO ENEDIS									
Source of LITERATUR Baseline Condition			RE VALUES COMPANY HISTORICAL VALUES			ICAL	VALUES MEASURED AT START OF PROJECT		
Details of Baseline		Baseline values not applicable to this KPI.							
Responsibl	e								
			DEM	O E.ON SV	'ERIGE				
Source of Baseline Condition		LITERATU [RE VALUES	COMPANY HISTORICAL VALUES MEASURED VALUES START OF PROJEC					JRED AT OJECT
Details of Baseline		Baseline val	ues not applic	able to th	is KPI.				
Responsibl	e								
	GENERAL COMMENTS								

4.2. Social KPIs

4.2.1. Customer recruitment

	B	ASIC KPI INF	ORMATIC	ON						
KPI Name	Customer recruitm	ent rate			KPI ID	WP2.2_	KPI_4			
Strategic Objective	Measure whether d to attain demo obj	emos are ma ectives	inaging to	o recruit	enough c	ustomer	base in order			
DEMO where KPI applies	GERMANY	CZECH REP	NETHE S	RLAND	SWE	DEN Z	FRANCE			
Owner	Germany - Thorste Sweden - Anna Eril France - Thomas D	n Gross (Ava Ismo, Luis He rizard (Enedi	con) ernandez is)	(E.ON)						
KPI Description	Customer engager measures if custon will have an in commercialization part, in the first pl	Customer engagement is a heuristic for the new energy system. This KPI measures if customers are prone to be more active in the new system and this will have an impact on how new solutions will be designed in a commercialization phase. A prerequisite for this is that they are willing to take part, in the first place.								
		$CR_{\%} = \frac{CR_{successful}}{CR_{required}} \times 100$								
KPI Formula	$CR_{\%}$ - percentage $CR_{successful}$ - number recruited $CR_{required}$ - number obtain enough flex	of required er of customer of customer ibility in den	custome ers (insta rs (install no in ord	r base th Illed cap ed capa er to ve	nat use ca bacity, en city, ener rify use ca	se was at ergy volu rgy volum ases	ble to recruit me) actually e) needed to			
Unit of measurement	Unit depends on U (#), installed capa	se Case desc city (MW), fle	ription, l exible ca	out shou pacity c	ld be eith ontracteo	ner custor I or Energ	mer numbers sy (MWh)			
Expectations	Germany - 100% Sweden - 100% France - 80%									
Reporting Period	Germany - at the e Sweden - at the er France - at the end	end of the read of the read of the read	cruitmen ruitment uitment p	t period period period						
Relevant Standards	N/A									
Connection / Link with other relevant defined KPIs	This KPI is linked prerequisite for ac	to the KPI of tive particip	f active ation of o	participa custome	ation. Red rs.	cruiting c	ustomer is a			
Reporting Audience and Access Rights	PUBLIC	INTER PART	RFLEX NERS	DEMO		S OTH	IER (please specify)			
OTHER (please specify)	Source of the data	is not to be	publishe	d.						
	KPI CA		METHOD	OLOGY						
		DEMO Ge	rmany							

KPI Step Methodo	ology ID	Step Bornonsible								
[KPI ID #]	0.		Step	Responsible						
WP2.2_KPI_4_AVA	_1 1	Determine num for successful d	nber of par emonstratio	Avacon						
WP2.2_KPI_4_AVA	_1	Determine KPI b	based on act	Avacon						
DEMO Sweden										
KPI Step Methodo [KPI ID #]	ology ID		Responsible							
WP2.2_KPI_4_E.ON	ا ا_1(8a) ر	Estimate neces order to obtain capacity (MW)	E.ON Sverige							
WP2.2_KPI_4_E.ON	ا ا_2(8b) ر	Estimate neces order to obtain capacity (MW)	E.ON Sverige							
		DE	MO France							
KPI Step Methodo [KPI ID #]	ology ID		Step			Responsible				
WP2.2_KPI_4_ENE	DIS_1 1	Determine nur Elexible capac demonstration	mber of ity needec	Enedis						
WP2.2_KPI_4_ENE	DIS_2 I	Determine KPI b	Enedis							
KPI DATA COLLECTION										
		A	LL DEMOs	•	•		-			
Data	Data ID	Methodolog y for data collection	Source/T ools/Instr uments for Data collectio	Locatio n of Data collecti on	Freque ncy of data collecti on	Minimu m monitor ing period	Data collection responsibl e			
Numbers of customer/installed capacity/energy volume/flexible capacity needed to obtain enough flexibility in demo in order to verify use cases	CR _{required}	Analysis during use case design phase	N/A	N/A	N/A	N/A	Avacon E.ON Enedis			
Numbers of customer/installed capacity/energy volume/flexible capacity recruited	CR _{successfu}	Records from recruitment activities (customer agreements if applicable)	N/A	N/A	N/A	N/A	Avacon E.ON Enedis			
		KP	I BASELINE							
ALL DEMOs										
Source of Baseline Condition	LITERAT		CO/ HISTORIO	COMPANY V HISTORICAL VALUES			ALUES MEASURED AT START OF PROJECT			
Details of Baseline	Baseline values not applicable to this KPI.									

Responsible

GENERAL COMMENTS

DEMO Sweden - KPI customer recruitment will be evaluated for use cases WP8_1, WP8_3 and WP8_4.

4.2.2. Active participation

		E	ASIC KPI IN	FORMATIO	N							
KPI Name	Active participation of all kinds of flexibility KPI ID WP2.2_KPI_5											
Strategic Objective	Verification whether demos are leveraging all types of flexibility they initially declared. This KPI reflects how versatile the demos are in leveraging flexibility from different technologies.											
DEMO where KPI applies	GERMANY	CZ	ECH REP		SWEDEN	FRANC	CE					
Owner	Germany - Thorsten Gross (Avacon) Sweden - Anna Eriksmo, Luis Hernandez (E.ON) France - Thomas Drizard (Enedis)											
KPI Description	The DEMOs aspire to make use of flexibility from different technologies. If and how different types of technologies can actually be accessed and utilized during the DEMO phase depends on the number of different technologies that are available in the region of the DEMO as well as on the general capabilities of the DEMO. DEMOs have declared a number and types of technologies they are targeting during DEMO phase and will be measured against their initial aspirations.											
	$Participation_{\%} = \frac{N_{leverage technology}}{N_{target technology}} * 100$											
	Sources of Flexibility: Technologies initially targeted											
	Demo	PV	Wind Generator	Battery Storage	Residen al Load	Industria ti Municipal s Commerci Loads	f, & al Mobility	Total				
	Avacon	Х		Х	Х		Х	4				
	E.ON	Х		Х	Х			3				
KPI Formula	Enedis	Х		Х	Х		Х	4				
Ki i i officia	Sources of Flexibility: Technologies <u>actually leveraged</u>											
	Demo	PV	Wind Generator	Battery Storage	Resident al Loads	Industria ti Municipal s Commerci Loads	, & al Mobility	Total				
	Avacon											
	E.ON Enedis											
	Participation _% - Percentage of technologies leveraged $N_{leverage \ technology}$ - number of different technologies leveraged in DEMO $N_{target \ technology}$ - number of types of technologies initially targeted in DEMO											
Unit of measurement	% of technologies leveraged											

Expectations	Gern Swed Fran	Germany - 100% Sweden - 100% France - 100%								
Reporting Period	End	End of DEMO								
Relevant Standards	/	/								
Connection / Link with other relevan defined KPIs	nt /	/								
Reporting Audience and Access Rights	1	PUBLIC	:	INTERFLEX PARTNERS	DEMO PARTNERS			THER (please specify)		
OTHER (please specify)										
KPI CALCULATION METHODOLOGY										
				ALL DEMOs						
KPI Ste Methodolo [KPI ID	p gy ID #]			Responsible						
WP2.2_KPI_5_	5_all_1 Define number and type of technologies to be leveraged WPL during DEMO							۳L		
WP2.2_KPI_5_	_all_2	Deter lever	rmine number and type of technologies actually WPL raged during DEMO							
WP2.2_KPI_5_	_all_3	Determine KPI in [%] based on the numbers given above							۲L	
KPI DATA COLLECTION										
				DEMO Germany	,		1			
Data	Data	Data ID By colle		Source/Tools/ Instruments for Data collection	Locatio n of Data collecti on	Frequen cy of data collectio n	Minim monit ng perio	um ori od	Data collectio n responsi ble	
Number of flexibility technologies targeted	N _{target te}	chnology		Project planning	Avacon	End of each use case			Avacon	
Number of flexibility technologies actually leveraged in demo	N _{leverage}	technolog		Technical information from participants	Avacon	End of each use case			Avacon	
DEMO Sweden										

Data	Dat	Data ID Methodol gy for data collectio		nodolo 7 for ata ection	Source/Tools/ Instruments for Data collection	Locatio n of Data collecti on	Frequen cy of data collectio n	Minimum monitori ng period	Data collectio n responsi ble
Number of flexibility technologies targeted	N _{target}	echnology			Project planning	E.ON	End of each use case		E.ON
Number of flexibility technologies actually leveraged in demo	N _{leveras}	ge technolog	technolog		Technical information from participants	E.ON	End of each use case		E.ON
DEMO France									
Data	Data ID	Methodolog Source y for data en collection		e/Tools/Instrum hts for Data collection	Locatio n of Data collecti on	Frequen cy of data collectio n	Minimum monitori ng period	Data collectio n responsi ble	
Number of flexibility technologies targeted	N _{target}		Projec		t planning	Enedis	End of each use case		Enedis
Number of flexibility technologies actually leveraged in demo	N _{levera}		Techni from p		ical information participants	Enedis	End of each use case		Enedis
KPI BASELINE									
DEMO									
A baseline for this KPI is not applicable.									
GENERAL COMMENTS									
DEMO Sweden - KPI active participation will be evaluated for use cases WP8_1, WP8_2 and WP8_3.									

5. REFERENCES

5.1. Project Documents

- [GA] Grant Agreement (list of all demo KPIs)
- [D6.1] Design of Solution

5.2. External Documents

- [1] Standard EN 50160 Voltage Characteristics in Public Distribution Systems
- [2] EN 50438:2013 Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks
- [3] BDEW MS-Richtlinie Technische Richtlinien für Erzeugungsanlagen am Mittelspannungsnetz
- [4] VDE-4105 Power generation systems connected to the low-voltage distribution network