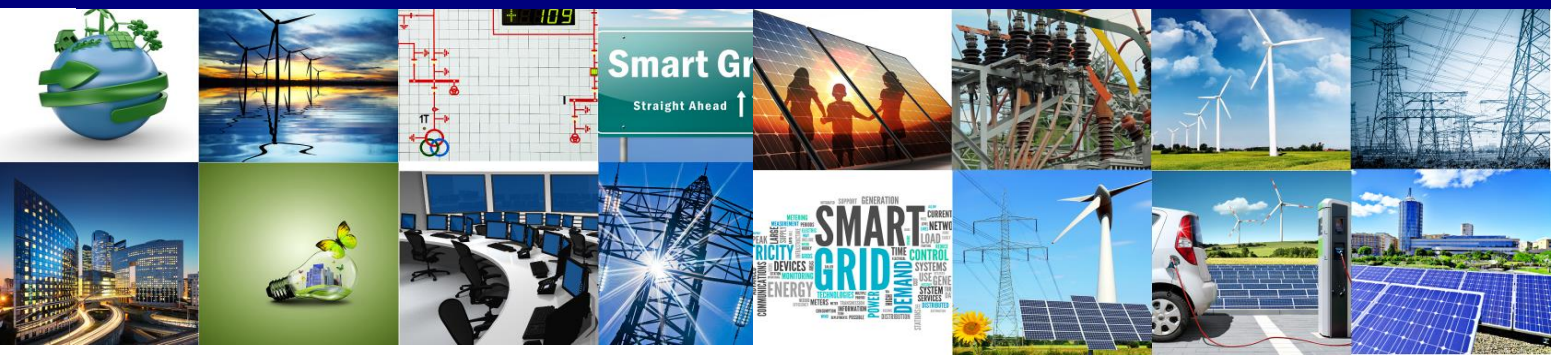
Project No. 609687

FP7-ENERGY-2013-IRP

ELECTRA

European Liaison on Electricity Committed Towards long-term Research Activities for Smart Grids



WP 11

Program Management and Reporting

Deliverable D11.1

Updated list of ELECTRA KPIs with initial values

27/04/2015

ID&Title	**D11.1** Updated list of ELECTRA KPIs with initial values	**Number of pages:**	28

Short description (Max. 50 words):

This deliverable describes the list of Key Performance Indicators (KPIs) developed to monitor the progress and the degree of achievement of each WP and to evaluate the performance of the whole project.

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V0.01	26/09/2014	First Draft
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Executive Summary

This document reports and describes a set of Key Performance Indicators (KPIs) defined within the ELECTRA project. The objective is to identify and evaluate a list of parameters to highlight and quantify the progresses and improvements of the Project.

The preliminary group of indicators - provided by the EERA Secretariat - has been revised and integrated by the ELECTRA Consortium. The main reason behind the update is to better fit the Project's results. Within the ELECTRA project different kind of activities are considered (i.e. Coordination Support Action (CSA), Research Technical Development (RTD)).

Based on the suggestions from the European Commission for a higher and better integration of European research activities, the vision in the matter of KPIs has been shared among ELECTRA, IRPWIND and STAGE-STE, three Integrated Research Programs (IRPs) launched by the European Energy Research Alliance Joint Program (EERA JP). Even if these IRPs are currently at a different stage and relates to different technology areas, an alignment in terms of common KPIs is a highly desirable outcome. However, this is still an ongoing activity resulting from the cooperation among them.

Finally, the current deliverable is aware that the definition and evaluation of KPIs is still a novel activity ELECTRA can further discover and strengthen. Hence, this is a document that, during the life of the Project, could be updated.

Terminologies

Acronyms

AB	Advisory Board
ADR	Automated Demand Response
AIST	National Institute of Advanced Industrial Science and Technology
BERA	Belgian Energy Research Alliance
BRICS	Brazil, Russia, India, China, South Africa
CA	Consortium Agreement
CEN	Comité Européen de Normalisation European Committee for Standardization
CENELEC	Comité européen de normalisation en électronique et en électrotechnique European Committee for Electrotechnical Standardization
CFS	Certificate on the Financial Statements
CSA	Coordination Support Action
CSP	Concentrated Solar Panel
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DERlab	European Distributed Energy Resources Laboratories e.V.
DOE	Department Of Energy
DoW	Description of Work
EC	European Commission
ECAS	European Commission Authentication Service
EEGI	European Electricity Grid Initiative
EERA	European Energy Research Alliance
EERA JP	European Energy Research Alliance Joint Program
EERA JP SG	European Energy Research Alliance Joint Program Smart Grids
ELECTRA	European Liaison on Electricity Committed Towards long-term Research Activity
EPRI	Electric Power Research Institute
ERI	Energy Research Institute (ERI) of National Development and Reform Commission;
ETP	European Technology Platform
ETSI	European Telecommunications Standards Institute
EU	European Union
EV	Electric Vehicle
FP7	Framework Program 7
GA	Grant Agreement
ICB	International Coordination Board
INCO	International Cooperation
IP	Intellectual Property
IRP	Integrated Research Programme
ISGAN	International Smart Grid Action Network

ITU	International Telecommunication Union
JP	Joint Programme
KPI	Key Performance Indicator
LoS	Letter of Support
MoU	Memorandum of Understanding
MS	Member States
NEDO	New Energy and Industrial Technology Development Organisation
NIST	National Institute of Standards and Technology
OGEMA	Open Gateway Energy Management Alliance
PC	Project Coordinator
PM	Person Month
R&D	Research & Development
RTD	Research Technical Development
SC	Steering Committee
SIRFN	Smart Grid International Research Facility Network
SJTU	Shanghai Jiao Tong University
SME	Small and Medium size Enterprises
SRA 2035	ETP Strategic Research Agenda for 2035
STAGE-STE	Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy)
TC	Technical Committee
TPC	Technical Program Coordinator
WP	Work Package

Abbreviations

MS	Milestone
R	Internal Report
D	Deliverable

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1. Introduction

1.1 Scope of the document

The ELECTRA Consortium selected a set of indicators to evaluate the excellence and results of the Project.

In this document, Chapter 2 describes the list of KPIs defined by the EERA Secretariat on the base of its goals. Moreover, explanation of the three (3) KPIs categories provided by the ELECTRA Consortium is provided:

- Technical KPIs;
- Impact KPIs;
- Program KPIs.

Technical KPIs aim to quantify the effects coming from the innovative voltage and frequency control solutions envisaged by ELECTRA and to be introduced in the electrical system to foster and allow a much higher penetration of Distributed Renewable Energy Resources (DRES).

Impact KPIs describe the skills ELECTRA has in steering smart grid industries towards the future. Finally, the Program indicators express the solidity of the ELECTRA Consortium in acting as a single unit towards the industry and its ability in aligning the Project's resources and activities.

The integration between the EERA KPIs list and the indicators initially provided by ELECTRA is outlined in Chapter 3 and has been carried out in accordance with the Description of Work (DoW). Additional and interesting contributions arrived from the cooperation ELECTRA had with other IRPs, such as IRPWIND and STAGE-STE. A comparison with their initial approach helped in the consolidation of the updated list of KPIs ELECTRA decided to define in this document and to lately adopt for its own progress evaluation.

Hence, seven (7) categories of KPIs resume the following aspects:

- The integration between national research programmes and Research & Development (R&D) strategy defined at European level;
- The quality of research performed within the Project;
- The characteristics of tests and sessions carried out;
- The quality of the researchers exchange;
- The innovation coming along with the ELECTRA project;
- The international cooperation in terms of actors and support provided by research institutes at international level;
- The knowledge transfer and dissemination activities.

Finally, Chapter 4 summarizes the most relevant information provided by the above listed KPIs.

2 Preliminary list of project Key Performance Indicators

2.1 EERA Key Performance Indicators

As reported in the ELECTRA DoW [1], the EERA Secretariat identified a number of indicators to monitor and evaluate the project progresses and the achievements of each foreseen activity, due to the project complexity and the large number of partners involved. The following Key Performance Indicators have been identified considering the following EERA objectives:

- To be able to manage and allocate resources more easily;
- To achieve an higher degree of integration in terms of infrastructures;
- To increase the alignment to EU policies and priorities;
- To increase the market/commercial impact of our results.

In the following, the draft list of KPIs, elaborated with the help of the EERA Secretariat and to be possibly applied to all the IRPs resulting from the EU FP7 2013 call is reported.

A) Integration

- Number of national research programmes contributing to the long-term R&D strategy defined at European level;
- Total budget from national research programmes contributing to the long-term R&D strategy defined at European level.

B) Quality of research

- Number of joint publications by IRP participants supported by EU funding accepted/published in peer-reviewed journals and/or proceeding of international conferences;
- Number of joint publications by IRP participants supported by national funding accepted/published in peer-reviewed journals and/or proceeding of international conferences.

C) Research facilities

- Number of tests carried out at the facilities of each IRP participant;
- Number of Round-robin sessions carried out at the facilities of each IRP participant;
- Number of joint tests carried out by two or more IRP participants;
- Total duration of joint tests carried out by two or more IRP participants;
- Number of cross tests carried out by two or more IRP participants;
- Total duration of cross tests carried out by two or more IRP participants;
- Number of jointly planned new research facilities at national level;
- Number of jointly planned new research facilities at international level;
- Number of Memoranda of Understanding (MoU) and agreements on the joint use and development of research facilities.

D) Exchange of researchers

- Number of exchange calls;
- Number of researcher exchanges;
- Number of researcher-weeks of international exchange;
- Number of Extra-EU partners involved in the exchange;
- Number of trained young researchers;
- Number of joint publications.

E) Innovation

- Number of agreements in the past two years between IRP participants and industry (among others: contract research, license agreements, cooperation agreements, etc.);
- Number of agreements in the past two years between at least two IRP participants and industry (among others: contract research, license agreements, cooperation agreements, etc.);
- Number of patent applications submitted in the past 2 years;
- Number of patent applications by at least two IRP participants submitted in the past 2 years;
- Number of IP assets entered into the web-based IP show case, maintained by the EERA Secretariat;
- Number of industry stakeholders involved in IRP R&D, or accessing IRP research facilities, or licenses of the IP generated within the IRP, or partners in the mobility programme.

F) INternational COoperation (INCO)

- Number of extra-EU countries represented in the International Coordination Board (ICB);
- Number of BRICS and developing countries represented in the ICB;
- Number of ICB meetings (web meetings or physical meetings);
- Number of extra-EU countries involved in INCO activity (including exchange of information);
- International organisations letter of support (extra-EU).

2.2 ELECTRA Key Performance Indicators

In addition to the list above, the ELECTRA Consortium has developed three (3) main categories of KPIs to better fit the ELECTRA IRP specific results with respect to smart grids technical issues:

- A set of technical KPIs;
- A set of impact KPIs;
- A set of program KPIs.

2.2.1 Technical KPIs

Technical KPIs of the ELECTRA IRP aim at “finding solutions that allow the current electricity system to evolve towards a system that can maximize the penetration of renewable sources of electricity, while preserving the security of supply and allowing the evolution of an open market model where the responsibility for the electricity system is spread over multiple players” [1].

This type of KPIs cannot be easily quantified since a great number of factors influences the power system and some of them are not directly addressed by ELECTRA, such as storage or EVs. Therefore, the fulfilment of the Technical KPIs will be measured by the extent they meet the needs and expectations and the boundary conditions identified by the various smart grid stakeholder communities and market regulators.

The activities of the EERA Joint Program on Smart Grids (EERA JP SG) in the past years and the activities from the ELECTRA partners in numerous national and European funded research projects have provided the ELECTRA Consortium with an excellent view on these needs. This collective experience also provided us with a good view on state of the art solutions that address these criteria and on the missing links and/or drawbacks of the various solutions proposed so far. Thus, in general, the technical objective of the ELECTRA project is to propose solutions that overcome these technical drawbacks and fully meet the smart grid future needs.

Three main ELECTRA Technical KPIs have been identified to meet the technical objectives expressed:

KPI-T1: Improvements in coordination of different stakeholders within the context of a more integrated European energy market, for managing voltage and frequency in the future power systems

KPI-T1 indicates the extent to which ELECTRA addresses the technical drawbacks of the actual state of the art solutions and is able to fully meet the expectations of the various smart grid stakeholders.

KPI-T2: Increase of network observability through development of new concepts and methods as a vital basis for novel controls

This KPI shows the extent to which ELECTRA proposes and develops observability schemes that can fully support the control and information flows scheme.

The exact targets in terms of granularity, accuracy, synchronisation etc. will be determined by the high level functional description of the new control schemes as worked out in WP3. The target is not to improve observability itself, but observability as the enabler for the proposed new control schemes.

KPI-T3: Advances in coordination between the different control boundaries of the various smart grid stakeholders by the development of robust control schemes

KPI-T3 defines the extent ELECTRA is able in proposing new control schemes or adaptations to existing control schemes that fit with the required interworking among the various smart grid stakeholders and their internal needs.

These stakeholders include the residential or industrial electricity prosumers, DSOs, TSOs, retailers and aggregators. Hence, it goes broader than only the grid operators and also entails other economical entities such as retailers and aggregators.

In Table 1 a short description of how these KPIs relate to the level 2 KPIs of the 2010-2018 EEGI Roadmap [2] is provided.

Table 1 – ELECTRA contribution to 2010-2018 EEGI KPI Roadmap

EEGI KPI	ELECTRA contribution
Increased RES&DER hosting capacity	To propose control schemes that can work with any mix of centralised vs. distributed power generation, targeting to host a large part of RES and DER.
Reduced energy curtailment of RES and DER	The control of flexible demand and storage is a key to reduce the curtailment of RES/DER generation and this is inherently present in the control schemes ELECTRA intends to work out.
Power Quality and Quality of Supply	This is explicitly targeted through the control of frequency and voltage and new protection philosophies utilising flexible controls for fault detection and mitigation.
Increased flexibility from energy players	-
Extended asset life time	-
Improved competitiveness of the electricity market	We target to develop solutions for an open market model whereby any number of retailers or aggregators can operate and target to propose solutions that guarantee interoperability in such a way that vendors still maintain the possibility for competitive differentiation.
Increased hosting capacity for Electrical Vehicles and other new loads	The controlled flexibility by interworking between retailers/aggregators and grid operators that will be developed within ELECTRA particularly targets to enable a greater hosting capacity for EVs or other new loads.

2.2.2 Impact KPIs

In addition to the Technical KPIs, the success of ELECTRA should also be measured along the lines of a number of Impact KPIs. They indicate the ambition of the ELECTRA project to steer the course of the smart grid industry towards the future.

KPI-I1: Alignment with industrial players from the various smart grid stakeholder categories: TSOs, DSOs, retailers, aggregators, equipment manufacturers etc.

The lack of an agreed set of control mechanisms and information flows between the systems of the different smart grid stakeholders are the ones of the main reasons for the hesitation to invest in new systems to support smart grid functionalities.

Therefore, one of the main KPIs for this objective could be the extent to which ELECTRA will find a growing consensus among all smart grid stakeholders about the schemes proposed by the Project itself. These stakeholders include grid operators (TSOs and DSOs) but also electricity retailers, aggregators, equipment manufacturers (power grid and ICT) and regulators. A way to do this is to distribute the proposed schemes to these stakeholders, ask their comments and work with them for a common position. On the other hand, a way to measure the current KPI could be the amount of companies interested in supporting the proposed schemes or the extent to which these companies represent the different categories of stakeholders (e.g. it makes no sense to find an agreement among all TSOs, opposed by DSOs and retailers/aggregators).

The success cannot easily be expressed by one absolute number but rather by the fact that during the ELECTRA project a growing set of smart grid stakeholders declares their support for the proposed solutions.

Moreover, to ensure the interaction with the industrial stakeholders, ELECTRA foresees earlier milestones within WP3 to gather feedback from them. In addition to this, the institutes that will work together on the concepts of a new control architecture will actively work with their existing industrial stakeholders to ensure the right understanding of the issues faced by the different stakeholders. In this respect, it is interesting to consider the initiative of VITO – leading Task 3.2 – to work with industrial companies in an affiliation program with the prime target. The objective is to propose control architecture solutions that describe the interworking between prosumers, retailers, aggregators, grid operators etc. Hence, ELECTRA could intervene and play as the ideal means to have this discussion and alignment at European level.

KPI-I2: Contributions towards common solutions and standards with our peers in Asia and the USA

Over the past three years the EERA JP on Smart Grids (EERA JP SG) has actively worked with stakeholders in the US (DOE) and Asia (NEDO) to exchange results and experiences with respect to ongoing smart grid research works. During these sessions all partners expressed the willingness to develop common solutions and standards for smart grids, heavily supported by main industrial players who prefer a common market similar to the current situation of the telecommunications world.

Therefore, ELECTRA will quantify the extent to which an agreement on the proposed solutions and standards with various stakeholders in the US and Asia is found. For example, the US has launched the Open Automated Demand Response (ADR) standard which is increasingly being adopted by other countries around the world. On the other side, in Europe there are initiatives like OGEMA and Power Matcher. Finding a common ground with stakeholders in the US and Asia that positions these various initiatives will be an important performance indicator of the ELECTRA project.

The foreseen impact is towards those players that subsequently can bring this message in the various working groups of organizations like NIST or CEN/CENELEC/ETSI. As such, the ELECTRA activities will be at pre-standardization level through international contacts, rather than to actively participate to the technical working groups.

2.2.3 Program KPIs

ELECTRA also entails a number of Program KPIs, expressing the extent to which the Consortium is able to align its resources and activities, act as a single entity towards the industry and represent

Europe with a single voice at the international forums of smart grids. Some of these KPIs can be expressed in numbers, such as the number of researcher exchanges or the number of meetings with European and international organizations. However, there is clearly a wide quantity of qualitative KPIs that cannot easily be expressed by a number.

KPI-P1: Contributions to coordination of the research activities of the European research institutes on smart grids thus promoting their strategic specialization

One of the overall goal of the Project is to prevent that every national research institute is working on every single smart grid area on its own, and to promote their focusing and contribution in specific complementary areas of R&D. The success will be measured by the extent to which the research programs of the national institutes become influenced by a European research program on smart grids whereby national institutes start to work together on a structural basis and avoid to duplicate research work. Surely, a lot of overlap in terms of competencies among the different European research institutes on smart grids has been already identified. However, ELECTRA confirms its commitment to provide fruitful efforts to evolve towards a situation where research institutes further specialize and complement each other. These trends are clear for those partners already active in the EERA JP for the past years and their address is to carry on this propitious trend.

KPI-P2: Coordinated development and improved common use of research infrastructures

This KPI is very much related to the coordinated planning and development of research infrastructures and perfectly in line with the objectives of the DERlab initiative to promote the use of common research infrastructures and avoid duplications of equipment, laboratories etc.

KPI-P3: Promotion of single point of contact for European research on smart grids

The KPI measures the extent that European and international organisations recognize the EERA JP SG as the main point of contact for the European smart grid research community.

The fact EERA JP SG does not represent all institutes in Europe working on smart grids is well clear. However, it is evident that in the past years the EERA JP SG was asked several times to represent Europe towards a number of international organizations.

In the meantime, the representation of the higher number of countries is a leading light, offering the possibility to have associate members from all countries or to have a 2-level organization such as the Belgian Energy Research Alliance (BERA) organization whereby the Belgian EERA representatives have created a national organization of all R&D stakeholders working on smart grids to ensure a link with EERA. Surely, more work is needed to be as more representative as possible. Hence, together with the EERA secretariat a higher contribution in terms of representation is considered.

Table 2 provides a list of KPIs against which the ELECTRA IRP will be monitored for a 48-months period. A more comprehensive list of KPIs will be elaborated to be presented and discussed with AB members to improve and rationalise the IRP progress monitoring.

Table 2 - Preliminary list of KPIs

KPI		Number	
KPI ID		TARGET First 24 months	TARGET First 48 months
Over Arching KPIs			
OA1	No of SRA R&D topics covered by the IRP	**>18**	**>25**
OA2	No of SRA R&D topics covered by the EERA JP (including the IRP)	**>30**	**>35**
OA3	MS funding alignment/leverage factor	**6**	**>8**
OA4	National Funding Agencies Letter of Support	**14**	**16**
OA5	International Organisations Letter of Support	**4**	**10**
WP12 Knowledge Transfer and Dissemination			
KT1	Publications in (peer reviewed) scientific journals and/or in proceeding of international conferences	**>20**	**>60**
KT2	Publications in national and international technical magazines with dedicated target audience (e.g. CIGRE, CIRED)	**>6**	**>20**
KT3	Joint peer-reviews publications	**8**	**20**
KT4	No. of Invited presentation to International public events	**12**	**40**
KT5	Deliverables and Technical reports	**>25**	**>60**
KT6	Dedicated documents for grid stakeholders	**6**	**>15**
WP9 – Researchers Exchange			
WP9.1	No. of exchange calls	**2**	**6**
WP9.2	No. of researcher exchanges	**6**	**30**
WP9.3	No. of researcher-weeks of international exchange	**12**	**75**
WP9.4	No. of extra-EU partners involved in exchange	**2**	**15**
WP9.5	No. of trained young researchers	**4**	**21**
WP9.6	No. of joint publications	**6**	**45**
WP10 – Actions on International Cooperation			
W10.1	No. of Extra-EU countries represented in the ICB	**4**	**7**
W10.2	No. of BRICS and Developing countries represented in the ICB	**1**	**3**
W10.3	No. of ICB web-meetings	**8**	**22**
W10.4	No. of ICB physical Meetings	**2**	**4**
W10.5	No. of Extra-EU countries involved in INCO activity	**0**	**3**
W10.6	International Organisations Letter of Support	**4**	**8**
Technical KPIs			
WP1 – Coordination and Networking			
WP1.1	No. of Steering Committee Meetings	**6**	**12**
WP1.2	No. of Technical Committee Meetings	**8**	**16**
WP1.3	No. of technical Workshops	**2**	**4**
WP1.4	No. of International (extra-EU participants) Workshops	**1**	**2**
WP1.5	No. of EERA JP participants invited to WSs	**19**	**30**

KPI		Number	
KPI ID		TARGET First 24 months	TARGET First 48 months
WP2 – Development of Joint Research Facilities			
WP2.1	No. of institutes represented in the DERlab infrastructure database	**30**	**40**
WP2.2	No. of common ELECTRA/SIRFN meetings/telephone conferences	**4**	**8**
WP3 – Scenario & Case Studies for Future Power System Operation			
WP3.1	No of SRA R&D topics covered by the WP activity	**1**	**2**
WP3.2	No of use case scenarios developed	**3**	**3**
WP3.3	No of technical workshops about EU E-markets considered	**1**	**1**
WP3.4	No. of publications in scientific journals	**1**	**2**
WP4 – Fully Interoperable Systems			
WP4.1	No of SRA R&D topics covered by the WP activity	**9**	**9**
WP4.2	No of contributions to standards	**1**	**2**
WP4.3	No. of publications in scientific journals	**>3**	**12**
WP5 – Increased Observability			
WP5.1	No of SRA R&D topics covered by the WP activity	**4**	**4**
WP5.2	No of scientific publications (articles and papers)	**2**	**4**
WP5.3	No of observables for local power balancing	**0**	**≥ 1**
WP5.4	No of observables for local power transmission capability	**0**	**≥ 1**
WP6 – Controllable Flexibility			
WP6.1	No of SRA R&D topics covered by the WP activity	**1**	**16**
WP6.2	New control algorithms	**0**	**5**
WP6.3	No. of publications in scientific journals	**1**	**3**
WP7 – Integration and Lab Testing for Proof of Concept			
WP7.1	No of SRA R&D topics covered by the WP activity	**0**	**10**
WP7.2	No. of publications in scientific journals	**0**	**4**
WP8 – Future Control Room Functionality			
WP8.1	No of SRA R&D topics covered by the WP activity	**4**	**14**
WP8.2	No of conference contributions and journal papers	**1**	**4**
WP8.3	No of control visualisations	**0**	**2**
WP8.4	No of decision support prototypes	**0**	**2**
WP8.5	No of workshops with stakeholders	**1**	**2**

3 Updated ELECTRA project KPIs

The list of KPIs expressed in Chapter 2 has been revised in agreement with the ELECTRA DoW [1] to develop KPIs that best fit to the smart grids technical area specificities and measure the quality of the Project. The purpose of this activity, as explained in Chapter 1, is to update the above list and review it considering a deeper analysis of the project objectives. This exercise led to a sharp simplification on the number of KPIs due to the several overlaps between the list developed by the EERA Secretariat and the preliminary list given by the ELECTRA Consortium.

Table 3 shows the result of such an harmonisation of indicators obtained also through the interaction with other two (2) IRPs, IRPWIND and STAGE-STE.

These KPIs can be used to assess the quality of the ELECTRA project. The KPIs are split in seven (7) groups (from A to G), considering the different fields of interest to be accurately monitored.

Table 3 – ELECTRA project KPIs

Project KPIs		Metric	Number TARGET Initial value	Number TARGET First 24 months	Number TARGET Total 48 months
(A)	**Integration / Impact**				
A1	Number of participants informed on Use Case Methodology through the project	No.	2	>10	>20
A2	Number of participants that adopted Use Case Methodology thanks to the project	No.	2	>5	>10
A3	Number of participants informed on existing EU framework and EU references documents through the project (e.g. SGAM, Role models, etc.)	No.	0	>8	>20
A4	Number of participants that started adopting existing EU framework thanks to the project	No.	0	>5	>10
A5	Number of data sources, information, models, tools, procedures and best practices developed by one member and shared with the consortium	No.	0	>2	>5
A6	Collaboration and live interaction with other ongoing EU projects	No.	0	>3	>6
A7	Analysis of main outcomes from other EU projects as inputs to the project	No.	0	>3	>6
A8	Number of grid stakeholders interested to the project with stable involvement and consultation	No.	0	>2	>5
A9	Consortium agreed positions and common comments on EU roadmaps and/or reference documents	No.	0	>1	>5
(B)	**Quality of Research**				
B1	Number of joint publications by IRP participants supported by EU funding accepted/published in peer-reviewed journals and/or in proceeding of	No.	0	>20	>60

	international conferences				
B2	Number of publications by IRP participants supported by national funding accepted/published in peer-reviewed journals and/or in proceeding of international conferences	No.	0	>25	>70
B3	Number of PhD-theses, master theses, awards etc.	No.	0	>2	>6
(C)	**Research Facilities**				
C1	Number of tests carried out at the facilities of IRP participants	No.	0	0	40
C2	Number of round-robin sessions carried out at the facilities of IRP participants	No.	0	>2	>5
C3	Number of joint and/or cross tests carried out by two or more IRP participants	No.	0	0	20
C4	Total duration of joint and/or cross tests carried out by two or more IRP participants	Days	0	0	>160
C5	Number of jointly planned new research facilities at national level	No.	0	0	1
C6	Number of jointly planned new research facilities at European/international level	No.	0	0	2
C7	Number of Memoranda of Understanding (MoU) and agreements on the joint use and development of research facilities	No.	0	1	3
(D)	**Exchange of Researchers**				
D1	No. of exchange calls	No.	0	2	6
D2	No. of researcher exchanges	No.	0	6	30
D3	No. of researcher-weeks of international exchange	No.	0	12	75
D4	No. of extra-EU partners involved in exchange	No.	0	2	15
D5	No. of trained young researchers	No.	0	4	21
D6	No. of joint publications	No.	0	6	45
(E)	**Innovation**				
E1	Number of agreements in the past two years between at least two IRP participants and industry (among others: contract research, license agreements, cooperation agreements, etc.)	No.	0	2	4
E2	Number of patent applications submitted in the past 2 years	No.	0	0	2
E3	Number of patent applications by at least two IRP participants submitted in the past 2 years	No.	0	0	2
E4	Number of IP assets entered into the web-based IP show case, maintained by the EERA Secretariat	No.	0	2	6
E5	Number of industry stakeholders involved in IRP R&D, or accessing IRP research facilities, or licenses of the IP generated within the IRP, or partners in the mobility programme	No.	0	2	6

(F)	INternational COordination activities				
F1	No. of Extra-EU countries represented in the ICB	No.	3	8	12
F2	No. of BRICS and Developing countries represented in the ICB	No.	1	2	3
F3	No. of ICB meetings (web-meetings or physical meetings)	No.	0	7	16
F4	No. of Extra-EU countries involved in INCO activity (including exchange of information)	No.	0	2	4
F5	International Organisations Letter of Support (extra-EU)	No.	6	10	14
(G)	Knowledge Transfer and Dissemination				
G1	Number of meetings/workshops with Grid stakeholder representatives	No.	0	>8	>12
G2	Number of meetings/workshops with relevant EU projects representatives	No.	0	>4	>12
G3	Number of meetings/workshops with relevant National projects representatives	No.	0	>6	>20
G4	Number of citations of the project in papers with authors external to the consortium	No.	0	>5	>20
G5	Number of visits per month for project website	No	0	>300	>500
G6	Number of registered users to access public project documents	No	0	>35	>70
G7	Number of links that refer to project website (referral number)	No	0	>35	>80
G8	Numbers of countries with more than 50 visits within a period	No	0	>20	>30

For the activities launched at the same time of the IRP, the initial KPI value has been set to zero. However, some indicators want to measure the enhancement ELECTRA gives to activities which had already been ongoing at the time of the IRP launch. Targets have been set to evaluate the performance of the IRP against a specific KPI positively or negatively after two (2) and four (4) years of activity. In this way, ELECTRA can be constantly evaluated throughout its duration, considering that the scheduled technical activities will be fully active in the second part of the IRP. In this sense, it is expected that technical results and achievements will be mainly reached in the last period of the Project, where a proper dissemination of them will take place.

3.1 (A) Integration

One of the main goals of the ELECTRA IRP is to enhance the cooperation among the European partners and strengthen the European research infrastructure support for realising the European SET Plan objectives, [3]. In this sense, KPI A1 to A4 measures the integration of the different research centres in terms of application of methodologies and frameworks proposed in the European context. An Index for measuring the real level of collaboration (A5), with effects also after the end of the project, is added. Moreover, indexes (A6 to A8) are included to measure the capitalization of previous positive experiences and results by other related EU projects and their valorisation towards the integration and harmonization of best practices. Finally, KPI A9 states the

commitment of the project, and its related EERA JP on Smart Grids, to compile comments and feedback on relevant strategy technical documents developed by EU grid stakeholders.

The KPIs of this section allow an understanding of the collaboration and integration grade of the partners and the convergence towards the improvement of a common European framework for the implementation of the SET Plan objectives. The objectives measured by these KPIs contribute also to the integration of the national-driven initiatives towards a fully integrated European R&D strategy.

3.2 (B) Quality of research

In order to measure the excellence of the research carried out within the IRP, KPIs B1, B2 and B3 have been introduced. Counting the number of publications on scientific journals (see KPIs B1 and B2), even if it is already common practice in the research field, can provide interesting and useful information regarding the quantity and quality of the research initiative. The Consortium expects that half of the joint publications will involve at least three (3) organizations. KPI B2 takes into consideration that, apart from the publications made by the European project support, additional papers will be submitted as outcomes from nationally funded activities coordinated through the EERA JP SG initiative. Finally, considering the PhD and masters theses associated and benefiting from the Project and the awards possibly recognized to the ELECTRA members, KPI B3 highlights the attention ELECTRA pays to young researchers' activities, seeing them as a key for a complete and successful evaluation of the Project.

3.3 (C) Research facilities

Seven (7) KPIs are expressed to monitor the effective integration of the national laboratories within the EU research network. An important outcome of national research centres integration is the creation of a common European research infrastructure, providing an easier and more economical access to high-tech laboratories to all EU countries as well as an optimisation of allocated funds to finance innovative facilities which are not already present in other EU countries. The ELECTRA IRP constitutes the first example of the cooperation among national laboratories for a common R&D objective. Therefore, KPIs such as C2 to C7 measure the above goals and show the collaboration among the ELECTRA partners.

KPIs C1, C3 and C7 are related to the tests carried on during the Project to check the solutions proposed. KPI C1 is focussed on all the verifications carried out at the facilities of IRP participants. On the other hand, KPI C3 and C4 are related to the analysis performed by two or more IRP collaborators and allow the highlighting of the spirit of collaboration among the partners. The agreements on the joint use and development of research facilities are controlled also through the number of MoU, as depicted by KPI C7. These three parameters are still a very rough estimation since at the moment IRP does not know exactly the details of what will be tested and where. However, it is already clear that at least two (2) partners will perform tests.

Bearing in mind the resources (46 PM) allocated for Task T.7.3 - related to the evaluation and validation of the ELECTRA controllable flexibility concepts - at least two (2) research institutes will be involved, with about 40% of the resources dedicated just to the preparation of tests and the reporting (see KPI C4).

Finally, a more ambitious goal is expressed by C5 and C6: the IRP will try to propose the development of a common research infrastructure in terms of investments, both at national and

international level. Clearly, this is a very tough process started together with the IRP but represents the first initiative for common research infrastructure planning.

3.4 (D) Exchange of researchers

Another way to measure the effective and fruitful cooperation of research centres is offered by the exchange of researchers among the IRP partners. KPIs D1, D2 and D3 have been defined for this purpose and represent a way to count the number of researchers and the relative number of visiting weeks at other partners' premises and facilities.

Currently, the average number of exchange calls (KPI D1) is supposed to be two (2) for each year. Furthermore, KPIs D3 and D4 are based on the expected numbers and budget of international exchanges. KPI D4 demonstrates the ambition of the Project to involve extra-EU organizations through international exchanges.

The outcome of the exchange activity is measured by KPI D6 showing particular attention to the dissemination of the exchanges in terms of paper publications and dedicated technical workshops. The exchange also addresses the importance of contributing to the training of early career researchers (KPI D5).

3.5 (E) Innovation

The KPIs defined for the innovative solutions developed within the ELECTRA IRP target the contact point of the research activities with the industry. The goals are to foster possible collaboration and license agreements or patent applications to be developed thanks to a close and fruitful cooperation of the R&D activities serving the industry needs. In fact, patent applications and commercial solutions are hard to achieve for various reasons, including the difficulties in providing a commercial product based on control algorithms or the identification of topics of common interest with the industry. Anyhow, the major driver for this set of KPIs is the involvement of the industry in the IRP initiatives and proposals to steer the research towards their needs and try to find a meeting point for the two fields, raising the mutual cooperation and interest.

KPI E1 is a very difficult parameter to be reached within the IRP life since industry actors that should be invited during the test validation are utilities (typically reluctant or slow for their conservative approach), manufactures, energy service providers or SME (typically interested in close to market solutions). Since ELECTRA's main results will be control algorithms and/or software, patent applications will probably be difficult to achieve.

Regarding the number of IP assets entered into the web-based IP show case, mainly provided by the EERA Secretariat, further clarifications are necessary.

Finally, given that ELECTRA activities will mainly be kept at lab-level and that the direct involvement of industries in the ELECTRA R&D activities is not planned, KPI E5 could be difficult to evaluate. However, an alignment of the Project's approach/results with the industry stakeholders ideas will be considered.

3.6 (F) INternational COordination (INCO) activities

A list of KPIs have been identified for the promotion of INCO activities with extra-EU countries. The Project looks forward to share information and collaborate about common research topics, enlarging the viewpoint to the worldwide perspective and leveraging the European view on smart grids aspects at international level. For this purpose, the International Coordination Board (ICB)

has been set as the body for international activities and will be monitored through the number of organisations supporting ELECTRA initiatives (KPI F1) and the number of meetings (KPI F3).

At the time of the IRP proposal, several international organizations (i.e. AIST, CSIRO, EPRI, ERI, ISGAN, ITU, NEDO, SJTU) signed a letter of support and willingness to start an interaction with the ELECTRA IRP and the interrelated EERA JP SG.

Moreover, interactions with other potentially interested international organizations from counties including Brazil and India are also ongoing. A specific attention is given to the so called BRICS countries, addressed as the main target for INCO activities. Only China has already been in contact with ELECTRA even at the proposal stage, having organisations providing a Letter of Support (LoS) to the IRP proposal and being part of the ICB board. The other four BRICS countries mainly target at starting INCO initiatives (KPI F2). BRICS countries are addressed aiming at their full involvement in the IRP activities and at a privileged channel for the entire EU research. In general, KPI F4 counts the number of Extra-EU countries involved in INCO activity while KPI F5 expresses the Letters of Support received by international organisations for the IRP. Surely, given that more than one organization per country can participate in the INCO, KPI F5 can be higher than KPI E1.

3.7 (G) Knowledge Transfer and Dissemination

KPIs belonging to the group G aim at describing the knowledge transfer and dissemination of the ELECTRA activities outside the Project boundaries. In fact, KPI G1 describes the relation ELECTRA has with grid stakeholder representatives in terms of meetings and/or workshops. It is expected that after two and four years eight (8) and at least twelve (12) meetings/workshops will be held with grid stakeholders, respectively. KPI G2 and G3 expresses the same meaning but with respect to the relevant EU and national programs representatives. A number of national research programmes had already been contributing to the long-term smart grids R&D strategy defined at European level before the beginning of ELECTRA. Therefore, the IRP's goal is to enhance this trend. With respect to KPI G1, at the end of the Project life (i.e. after forty-eight months) a higher number of meetings/workshops with relevant EU and national programs is expected (>20). These parameters are useful since they emphasize the alignment between the ELECTRA's and the grid stakeholders' points of view.

KPI G4 indicates the relevance of the project as source of new ideas and activities, measuring both the value of the results and the knowledge transfer effectiveness. Moreover, KPIs related to the project website, G5 to G8, help in the assessment of the intensity and the widespread of the dissemination of project results.

4 Conclusions

In this document a list of KPIs is developed to assess the quality of the ELECTRA IPR.

Since an alignment among the different IRPs is necessary, the approach followed in the matter of KPIs has been shared with other IRPs (i.e. IRPWIND and STAGE-STE) even if they are at a different stage and relates to different technology areas. In this matter, ELECTRA aims at providing a good reference for future activities related to KPIs.

The evaluation of different kind of activities is carried on introducing a set of indicators. At this stage, ELECTRA - together with other European projects (e.g. Grid+, IGREENGrid etc.) – is trying to analyse and put the bases for a wide aspect as the KPI definition. Of course, since KPIs definition is still an unusual activity, updates and improvements of the current ELECTRA list could be possible during the Project life.

Given that CSA and RTD activities are considered within the Project, the harmonization of the available lists led to the definition of seven (7) categories.

The “Integration” KPIs (A1, A9) describe the ability of the Project in enhancing the integration and collaboration between the EU partners and in strengthening the EU research infrastructure support for the realization of the SET Plan goals. Furthermore, looking at these indicators under a different point of view, the impact the SET Plan objectives have on the national research strategy and the integration of the national-driven initiatives towards a fully integrated EU R&D strategy can be evaluated.

KPIs related to the “Quality of Research” (B1 to B3) aim at quantifying the quality of the Project in terms of publications on scientific journals, theses etc. It is expected that, within the ELECTRA IRP, half of the joint publications will involve at least three (3) organizations.

With the KPIs belonging to the “Research facilities” group (C1 to C7) the effective integration of the national laboratories within the European research network can be quantified. Among them, some are “more traditional” some others are more difficult to be evaluated. Anyhow, it can be stated that at least two (2) researchers will be involved in the evaluation and validation of the ELECTRA controllable flexibility concepts. Furthermore, 40% of the resources will be dedicated to tests preparation and reporting aspects with at least two (2) partners performing the tests. Finally, the ability in developing a common research infrastructure at national and international level can be quantified.

The set of indicators related to the “Exchange of Researchers” (D1 to D5) evaluates the future interactions and collaborations between the R&D institutes. These KPIs put an emphasis on details such as the number of exchange calls or the days spent by the researchers at other partners’ premises. At a first glance, the expected yearly number of exchange calls is two (2). Moreover, an estimation of the expected number and budget of international exchanges can be obtained. Finally, about 67% of the exchanges will get a joint publication issued in time, as depicted by KPI D6.

The five (5) “Innovation” KPIs (E1 to E5) describe the alignment between the research activities and the industry sector. Hence, in spite of the fact that ELECTRA activities will be mainly at laboratory-level, the Project is open to suggestions and drivers from the industry to develop ideas useful also outside the research scope. However, since the ELECTRA outcomes will be control algorithms and/or software, patent applications will be hardly reached. Finally, a deeper analysis of the IP assets included into the web based IP show case is necessary.

The “International Coordination” indicators with extra-EU nations are evaluated within the group of KPIs belonging to group F (F1 to F5). The information and knowledge sharing at worldwide level

for smart grid aspects is of great interest for the Consortium. At the time of the Project proposal, several international entities decided to support and carry on a collaboration with ELECTRA IRP and EERA JP SG. Moreover, further interactions with other international organizations (such as from Brazil or India) are currently ongoing. This puts an emphasis on the ELECTRA intention to grow keeping an eye also at emerging economies, as the BRICS ones.

Finally, the knowledge transfer and dissemination activities are considered in terms of meetings/workshops the ELECTRA Consortium will have with grid stakeholder representatives and EU and/or national programs exponents and through the project website (KPI G1 and G8).

5 References

[1] ELECTRA Description of Work – Annex I

[2] https://www.entsoe.eu/news-events/announcements/announcements-archive/Pages/News/entso-e-and-edso-sg-publish-eegi-roadmap-2010-2018-and-implementation-plan-2010-12.aspx

[3] http://ec.europa.eu/energy/en/topics/technology-and-innovation/strategic-energy-technology-plan

[4] ELECTRA Consortium Agreement

[5] ELECTRA Grant Agreement

[6] http://ec.europa.eu/research/participants/portal/desktop/en/home.html (EU Participant Portal)

6 Disclaimer

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