Enable Ancillary Services by RES

D8.2

First Version of Risk Analysis

Distribution Level	PU
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Contents

Definition of Acronyms

AB	**Advisory Board**
AS	Ancillary Service
BESS	Battery Energy Storage System
CC	Central Controller
DDGM	Dynamic Distribution Grid Model
DRES	Distributed Renewable Energy Source
DSO	Distribution System Operator
EDM	Exploitation and Dissemination Manager
FRT	Fault-Ride Through
FSS	Fast Storage System
GA	Grant Agreement
ICA	Individual Control Area
ICT	Information and Communication Technology
IIPM	Innovation & Intellectual Property Manager
IPR	Intellectual Properties Rights
KPI	Key Performance Indicator
MPP	Maximum Power Point
MV	Medium Voltage
PC	Project Coordinator
PFR	Primary Frequency Regulation
PMB	Project Management Board
THD_V	Total Harmonic Distortion of voltage
TM	Technical Manager
TMB	Technical Management Board
WP	Work Package
µG	Microgrid

1. Executive Summary

The purpose of this first Version of Risk Analysis is to reevaluate the risk analysis initially presented in the EASY-RES proposal under the experience gained in the first six-months (M1-M6) of the project life. It follows the same risk quantification method used in the proposal-phase, but now addresses the possible risks at Task and Sub-Task level and proposes mitigation actions for the reduction or elimination of the risks.

This document is based on the terms and conditions established in the Grant Agreement and its Annexes, as well as in the Consortium Agreement specifications and requirements.

The use of the Risk Analysis ensures i) full understanding of the risks and possible obstacles the partners might face when carrying out their project task and ii) stronger collaboration among the consortium members, individuals and groups so that these risks are mitigated.

D8.2 is intended to be used by the project coordinator, the WP leaders and Task Leaders in order to monitor the identified risks and apply appropriate mitigation actions if necessary.

2. Introduction

As with every advanced research project, EASY-RES includes uncertainties and has to cope with them to a greater or lesser degree. EASY-RES identified and quantified some risks at an early stage (during the proposal stage) with these risks appearing in the GA (Annex 1, Section 1.3.5).

Using our experience in the first six months of the project those risks are updated in this document and presented in more detail, i.e. for every Task and Sub-Task rather than just per WP. In some cases, risks are identified at the level of individual tasks as they appear in the 1st version of the project management plan[1].

Risk analysis becomes more challenging when there are solutions that deal with more than one risk, or risks that need more than one mitigation action. Consequently, a risk management activity will be developed every six months within the project, following the principles described in this document.

This particular deliverable is based on the experience gained in the first six-months (M1-M6) of the project life.

[1] In section 3 and Appendix 3 of "EASY-RES, D8.1-First Version of Project Management Plan.pdf" a detailed split in individual tasks of the work to be done is presented. Available in *\owncloud\EASY-RES PROJECT\WP8\Versions of D8.1\ D8.1 First Version of Project Management Plan-Final.pdf*. The access to this deliverable is restricted to consortium members, EU and the reviewers assigned by EU.

3. Risk Analysis

Risk Identification is about uncovering risks before they turn into problems and is an iterative process. Participants in risk identification include subject-matter experts, WP leaders, the IIPM, the TM and the PC.

A risk statement involves the conditions that are causing concern for a potential loss to the project, followed by a brief description of the potential consequences of these conditions. The responsible WP leader must evaluate and report the risks at least every six-months as also mentioned in D8.1[2]. For all identified risks, efficient contingency plans (resource reallocation, fall-back, contingency measures) will be implemented as soon as possible.

Risk Analysis involves evaluating the risk attributes, and prioritizing (ranking) the risks. Evaluating attributes of a risk involves establishing values for probability (likelihood the risk event will occur) and the impact (an estimation of the consequence of a risk in terms of significance for the project). The following five-level scoring is used:

Probability (Prob)	Qualitative Impact (Im)
01 – 20 % = Remote (R)	1 = Insignificant
21 – 40 % = Unlikely (UL)	2 = Minor
41 – 60 % = Likely (L)	3 = Moderate
61 – 80 % = Highly Likely (HL)	4 = Major
81 – 99 % = Near Certainty (NC)	5 = Catastrophic

The PC has analyzed specific risks with the WP and Task leaders and tried to evaluate the potential overall risks of each task and work package. A list of risks and mitigation actions for each WP is presented in Table 1 as identified during M1-M6 of the project. This list will be continuously revised during project execution by the WP leaders and discussed on each PMB meeting.

[2] In section 8.5 of "EASY-RES, D8.1-First Version of Project Management Plan.pdf" a detailed split in individual tasks of the work to be done is presented. Available in \owncloud\EASY-RES PROJECT\WP8\Versions of D8.1\ D8.1 First Version of Project Management Plan-Final.pdf. The access to this deliverable is restricted to consortium members, EU and the reviewers assigned by EU.

Table 1. Identified Risks and respective mitigation actions			
WP1 risks			
T1.1-Definition of Metrics for Quasi-Steady-State operation			
T1.1.1 - Metrics for the exchange of reactive power			
Risk	*Im*	*Prob*	*Mitigation Action*
R1.1: This subtask will be completed on M6 (31/08/2018). As the progress in this task is according to our plan, no risks are identified so far. However, there is the risk that the implementation of the developed metric proves to be quite costly or of lower accuracy when testing the converter prototypes in WP6 (M24 and later).	2	UL	The involved partners have a reasonable feeling of the cost-accuracy relationship in developing such metrics within a converter. In the unlikely event that this risk appears, the partners will revisit this subtask in an effort to settle in a reasonable compromise between complexity and implementation cost. The resources of the involved partners will be used. It is noted that the appearance of this risk does not affect other tasks in the project.
T1.1.2 - Metrics for the low-frequency power smoothing (low $\Delta P/\Delta t$)			
R1.2: Similar to R1.1.	2	UL	Similar to R1.1
T1.2-Definition of the Reactive Power Capability for converter-interfaced DRES/BESS			
The work in this task is according to our plan. We do not anticipate any risks here.			
T1.3- Voltage regulation within LV μGs			
R1.3: The voltage regulation algorithms based on the use of reactive power lead to unacceptably high losses on the feeders.	3	UL	Reasonable targets for acceptable losses will be set by the participating DSOs. Reevaluation of the permissible DRES penetration (avoiding feeder upgrades) might be necessary or alternatively analytical evaluation of the additional losses and comparison of their value with possible feeder upgrades.
T1.4 – Voltage regulation within MV grid			
Given that our research so far is very promising, we do not anticipate any risks in this task.			
T1.5 – Low-frequency power smoothing			
R1.4: The participating TSO and DSOs do not provide sufficient or of suitable quality data for correlating the power fluctuations with DRES penetration.	2	L	Apart from the already available measurements the DSOs will take additional measurements in parts of their grids with simultaneous recording of the DRES type and penetration level.

Table 1. Continued			
WP2 risks			
T2.1 – Metrics with respect to transient and dynamics response			
T2.1.1 - Metrics for inertial response			
The work in this task is according to our plan. We do not anticipate any risks here.			
T2.1.2 - PFR metric			
The work in this task is according to our plan. We do not anticipate any risks here.			
T2.1.3 - High-frequency power smoothing metric			
The work in this task is according to our plan. We do not anticipate any risks here.			
T2.1.4 - Harmonic mitigation metric			
The work in this task is according to our plan. We do not anticipate any risks here.			
T2.2 – Electric and thermal dynamic modelling			
T2.2.1 - Modelling of converters			
Risk	*Im*	*Prob*	*Contingency*
R2.1: The simulation models developed in T2.2.1 prove to be (after the validation tests) inaccurate.	3	UL	The involved academic partners have large experience in developing simulation models. Further iterations with additional lab testing will be done.
R2.1.2: The simulation in DigSILENT could not be accurate and fast enough.	3	L	Co-simulation unifying DigSILENT and other simulators or custom models written in C can be considered to solve this problem.
T2.2.2 - Modeling of BESS			
R2.2: Similar to R2.1	3	UL	As in R2.1
T2.2.3 - Modeling variable speed WECS			
R2.3: Similar to R2.1	3	UL	As in R2.1
T2.2.4 - Modeling variable speed WECS			
R2.4: Similar to R2.1	3	UL	As in R2.1
T2.3 – Development of dynamic functionalities			
T2.3.1 - Virtual Inertia Emulation			
R2.5: The method for measuring f and $\frac{df}{dt}$ seems to lead to over- or under- reaction of the inertial control.	4	UL	Filtering methods and Center-of-Frequency concept will be additionally investigated. Although sufficient resources have been allocated in T2.1 and T2.3, additional resources from other WPs might be transferred to support the additional effort.
T2.3.2 - PFR			
R2.6: The method for measuring f and $\frac{df}{dt}$ seems to lead to over- or under- reaction of the PFR control.	4	UL	As in R2.5

T2.3.3 - High-Frequency Power smoothing			
R2.7: The simultaneous control of high-frequency power smoothing, inertia and FRT using a single FSS and dc/dc converter does not prove effective.	4	L	Sufficient resources are allocated in T1.5, T2.3 and T3.2 for both the research experts and the industrial partner. However, since this risk has adverse effects on the implementation cost, the partners involved are strongly committed to solve it by putting additional effort on investigating alternative control methods.
T2.3.4 - Active Harmonic Filtering			
We do not anticipate any risks here so far.			
T2.4 – Real-time evaluation of overall ICA inertial and PFR capability			
R2.8: The optimization algorithms in T2.4 are too complicated for the DSO to handle in real time.	4	UL	End-users will be involved in the design process from the outset to ensure usability. Additional simplification assumptions will be made in correlation with the resulting accuracy. Although sufficient resources have been allocated to T2.4, the research team has large ambitions on this issue; thereby it will spend the required effort to achieve the set objective as it is one of the project cornerstones.
T2.5 – Development of the DDGM			
We do not anticipate any risks here so far.			

Table 1. Continued			
WP3 risks			
T3.1 – Development of metrics for contribution to fault clearing and FRT of DRES/BESS			
We do not anticipate any risks here so far.			
T3.2 – Reaction of DRES and BESS during faults			
Risk	*Im*	*Prob*	*Contingency*
R3.1: Emulating the behavior of SGs by injecting adjustable subtransient, transient and steady-state currents proves to be too complicated.	3	L	The use of a reduced set of transient periods will be investigated and the associated limitation in the protection coordination will be reevaluated.
T3.3 – Methodology for detection of fault type and proximity			
R3.2: The method for detecting the distance to the fault leads to inaccuracies for some fault types and/or feeder impedances	3	L	Alternative fault impedance measuring methods (like the intentional injection of specific harmonic currents) will be investigated. The research team has large ambitions on this issue; thereby, it will spend the required effort to achieve the set objective.
T3.4 – Definition of the Base-line Scenario on protection coordination			
We do not anticipate any risks here so far.			
T3.5 – Protection Coordination in the LV μGs and ICAs			
We do not anticipate any risks here so far.			

Table 1. Continued			
WP4 risks			
Risk	*Im*	*Prob*	*Contingency*
R4.1: Interfacing between DRES and ICT infrastructure could be too complex, unstable or not provide timely access	4	UL	ICT has been able to interface with different systems, even if workarounds are sometimes required. The partners have experience in dealing with these situations and a working solution building on existing interfaces can be achieved.
R4.2: Accuracy and adaptability of Anomaly Detection (AD) algorithms to EASY-RES environment	3	R	The involved research partners have the background in developing and adapting these algorithms and the accuracy can be tuned, so that the solutions will be useful and adapted to the AD accuracy.
R4.3: ICT components are not released on-time.	4	UL	Software engineering processes and quality management will be applied. Platform components will be released regularly before the final one, containing an identified sub-set of the features. In case the platform components are not released on-time, a reinforced team will be working on it, while the integration in T4.4 can begin on a pre-release version.
R4.4: Emerging software technologies that are depended upon are not available.	3	UL	The research and development team develops backup solutions relying on existing technologies.
R4.5: Monitoring data volume exceeds ICT substrate capabilities (bandwidth and/or storage).	3	L	To counter excessive monitoring data accumulation, a combination of adaptive fidelity in data sampling and – if required – additional compression will be used. In case more storage capacity is required, additional capacity may be specified at appropriate locations.
R4.6: Inverter interfacing provides no standardized means for communication in cross-vendor environments.	3	L	If no standardized way of communication is available, suitable wrappers need to be created to translate between a unified internal representation of commands to vendor-specific APIs. We expect future inverters to accommodate native Ethernet or wireless interfaces instead of almost exclusive use of Modbus or serial connections.

Table 1. Continued
WP5 risks
T5.1 – Review of current AS-related Market Regulations and Proposal for regulatory changes
We do not anticipate any risks here so far.
T5.2 – Proposal for a portfolio of AS
We do not anticipate any risks here so far.
T5.3 – Development of AS cost-functions
We do not anticipate any risks here so far.
T5.4 – Identification of stakeholders and associated revenue streams
We do not anticipate any risks here so far.
T5.5 – Development of business models
We do not anticipate any risks here so far.

Table 1. Continued			
WP6 risks			
T6.1 – Physical implementation of converter prototypes			
Risk	*Im*	*Prob*	*Contingency*
R6.1: Difficulties are encountered in incorporating *simultaneously all* the developed functionalities in the converter prototypes.	3	L	The preparation of all tests will be carried out carefully early in the project. Sufficient resources have been allocated to the respective partners for the lab-test equipment. Eventually, additional prototypes can be made incorporating individual functionalities for testing.
R6.1.2: Difficulties in the acquisition of hardware such as ultracapacitors	4	UL	The acquisition of critical hardware will be carried out early in the project to mitigate delays.
T6.2 – Validation of converter functionalities via lab tests			
R6.2: Difficulties in carrying out the lab tests in T6.2.	4	UL	The preparation of all tests will be carried out carefully early in the project. Sufficient resources have been allocated to the respective partners for the lab-test equipment.
R6.3: Tests delayed or failed due to last-minute hardware failures in T6.1-T6.2.	4	R	Test planning will be closely monitored in order to avoid unnoticed failures, while special care will be given along the development of all project components in order to avoid such problems. Backup plans will also be developed as an alternative prevention measure. Some elements can be replaced by more costly but generic hardware already installed in the labs.
T6.3 – Validation via simulations			
We do not anticipate any risks here so far.			
T6.4 – Evaluation of project KPIs			
R6.4: (Evaluation of KPI_5). The participating DSOs cannot provide cases of protection malfunction due to high DRES penetration. Reason: Not high enough DRES penetration, or very few cases of faults recordings.	3	L	In such cases malfunction cases will be simulated in representative distribution grids so as to form the basis for comparison.

Table 1. Continued			
WP7 risks			
T7.1 – Development & implementation of Dissemination Action and Communication Plan			
Risk	*Im*	*Prob*	*Contingency*
R7.1: Consortium ability to disseminate and exploit project knowledge	4	R	The consortium has been set up by academic institutions, one industrial partner, three DSOs and one TSO in order to ensure dissemination of results in research fora, electricity market regulatory authorities, grid-code developing bodies, DRES manufacturers and operators and lead to future market exploitation a number of the developed technologies. The first version of the plan has already been prepared. This is why the probability of this risk is set as Remote.
R7.2: Project facing technology replacement issues; project results become obsolete	3	R	Technologies used into EASY-RES concept continue to be developed at large speed and it is difficult to foresee their evolution. For this reason, the project will be engaged in a continual technology watch effort, which will last till the very end of the project throughout all WPs. This risk will be met by involving actively all research partners of the project into all design tasks ensuring that all designs are always kept in line with the most advanced developments. Moreover, the TM, the IIPM and the EDM of the project will always be in touch with the scientific community in order to ensure that possible future disruptive technologies relevant to our results could be rapidly adopted by the consortium. Additionally, our experience in the first six months of the project indicates that the objectives and methodologies of the project are still timely and innovative.
T7.2 – Project Portal			
We do not anticipate any risks here so far.			
T7.3 – EASY-RES dissemination materials			
We do not anticipate any risks here so far.			
T7.4 – EASY-RES dissemination events			
R7.3: Participation of interested stakeholders in the events is lower than expected.	3	R	The dissemination manager (ZdB) is very well networked and very experienced making the probability Remote. Through the network of ZdB, verification of participation will be politely asked before the timing of final organization of the events is fixed.
T7.5 – Coordination with other projects			
The project consortium is committed to seek collaboration with other relevant projects and participate in relevant project clusters. No risks are identified here.			
T7.6 – Development & implementation of Exploitation Plan and Business Case			
No risks are identified here so far.			

Table 1. Continued			
General and Management (WP8) risks			
T8.1 – Technical and Scientific Management			
Risk	*Im*	*Prob*	*Contingency*
R8.1: Some partners with responsibilities in a certain WP leave the project.	4	R	From a technical and scientific point of view, EASY-RES is internally capable of redistributing the work among the remaining partners. From a management point of view, this would require a variable effort for the remaining partners to hire the missing resources.
R8.2: A beneficiary has significant delay or failure to assign qualified personnel for a task or a deliverable.	4	L	Risk reduction by early communication between the PC, the involved beneficiary and the Project Officer. Distribution of the delayed work among other beneficiaries with proper reallocation of resources.
R8.3: An unclear project vision and goal develops or some of the research and development gets into a sidetrack	3	L	Short tele-conferences between the involved partners, the TM and PC take place immediately so that a common vision is obtained. Note: This situation has already been met several times within the first six-months of the project. It has been proved so far that this mitigation action is very effective.
T8.2 – Financial and administrative management of the project			
R8.4: There is a risk that the partners will not deliver reports, deliverables, cost statements, etc. in time.	2	L	Internal deadlines within the consortium are set well before the defined deadlines. Also, names and contact information of responsible research persons, financial persons and legal persons are collected from each partner, reminders will be sent to relevant persons before the internal deadlines. Note: This situation has already been met a few times within the first six-months of the project. It has been proved so far that this mitigation action is very effective.
R8.5: Work load significantly different than estimated in the proposal	3	UL	Realistic estimation and replanning of the deliverables. Reallocation of resources. Negotiation with INEA to solve long-term issues.
T8.3 – Quality Management and Control			
The first version of project management plan has already been prepared where quality issues with the deliverables description of roles, etc are mentioned and agreed among the partners. No risks are anticipated in this task.			
T8.4 – Project Internal Communication			
Apart from some minor communication issues that emerged early in the project life, the communication among the partners is working well. Although in most communication case the PC is directly involved, there are several cases where the partner communicated without his participation. No risks are anticipated in this task so far.			

4. Conclusion

This initial risk management plan has identified the possible risks at project as well as at WP and Task or Subtask level. Mitigation actions for the reduction or elimination of these risks have also been proposed.