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Electric vehicles' enhanced performance and integration into the transport system and the grid

electrific

Enabling seamless electromobility through smart vehicle-grid integration

Project Nº 713864

Electrific

D1.2 - Guidelines and Quality Assurance

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Executive Summary

Electric vehicle (EV) will become more and more important in the transportation system. The integration of EVs into the smart grid is a challenging process. The charging cycles of the batteries have to be matched with the available capacity in the grid. Electrific investigates this problem by developing novel technologies that aim to pave the road towards more sustainable energy consumption. The focus is on three layers: the grid, the charging stations, and the EV users. Power grids are designed for peak usage in terms of a stable grid. Looking beyond peak times, forecasts of available capacities allow charging stations to use this energy in an intelligent way to load EVs both grid- and battery-friendly. Seamless and ergonomic collaboration between all layers helps to make using EVs at least as convenient and attractive as combustion engine vehicles, all the while optimizing the grid, the EV infrastructure utilization and maximizing the use of renewable energy resources.

This document is the Quality Assurance Management Plan for the Electrific project.

The main purposes of this plan are:

- To define the means of satisfying the objectives for the quality assurance process, and to establish the activities and resources (human organisation, methods and tools) to carry out them, and
- To provide for monitoring all related activities to assure that the project will meet its specified requirements and will be fit-for-use.

This Plan defines the activities and resources necessary to ensure that the quality requirements of the project are met. It defines quality standards (based on ISO9000:2015 principles), quality requirements, quality assurance methods, quality assurance activities and configuration management. It also defines policies for identifying threats on the project and for implementing corrective actions.

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Table of Acronyms and Definitions

Abbreviation / Definition	Explanation
DoA	Description of Action document – Technical annex of the Grant Agreement
IPR	Intellectual Property Rights
ISO	International Organisation for Standardization
KOM	Kick-Off Meeting
TMC	Technical Management Committee
PM	Project Manager
PMB	Project Management Board
QA	Quality Assurance
QAP	Quality Assurance Management Plan
QMS	Quality Management System
SW	Software
V&V	Verification and Validation
WPL	Work Package Leader
WPLG	Work Package Leader Group
DO	Deliverable Owner
SIL	Scientific & Innovation Leader
Acceptance	The act of an authorized representative of the customer by which the customer assumes for itself, or as an agent of another party, ownership of existing and specified products tendered, or confirms satisfactory performance of specific services, as partial or complete performance of the contract on the part of the supplier.
Quality Record	Document (written or stored on any data medium) which provides objective evidence of activities performed or results achieved.
Validation	Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. (In design and development, validation concerns the process of examining a product to determine conformity with user needs)
Verification	Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. (In design and development, verification concerns the process of examining the result of a given activity to determine conformity with the stated requirements for that activity).

I. INTRODUCTION

I.1. Purpose

Quality assurance (QA) is part of quality management focused on providing confidence that quality requirements will be fulfilled[1]. This document is the Quality Assurance Management Plan (QAP) for the Electrific project.

This Plan has been generated according to the general GFI procedures, since GFI is the entity coordinating the project, which has been adapted to the necessities of Electrific. It summarizes the implementation of GFI Quality Assurance Policies, customizing the GFI QMS procedures and methodology (which are aligned to ISO 9001:2015 standard) on this project.

The main purposes of this plan are:

- Define the means of satisfying the objectives for the quality assurance process, and to establish the activities and resources (human organisation, methods and tools) to carry out them, and
- To provide for monitoring all related activities to assure that the project will meet its specified requirements and will be fit-for-use.

This Plan also defines the activities and resources necessary to ensure that the quality requirements of the project are met. It defines quality standards (based on ISO 9001:2015 principles), quality requirements, quality assurance methods, quality assurance activities and configuration management. It also defines policies for identifying threats on the project and for implementing corrective actions (risk management).

I.2. Scope

This Plan is applicable to the Electrific project from KOM milestone until the end of the project.

[1] ISO 9000:2005, Clause 3.2.11

II. MANAGEMENT

This Section describes necessary parts for the execution of Quality Assurance Management. It includes human resources, tasks, means of quality reporting, reporting to EC, responsibilities and finally project communication mechanism that ensures seamless exchange of information.

II.1. Human Resources

Human resources are accountable and responsible actors in Quality Assurance Management. Following chapters describe the organisation and identified roles for the proper execution of Quality Assurance tasks.

II.1.1. Organisation

Complete project organisation and details about the responsibility can be found in the Electrific Description of Action (DoA) Section 3.2 (Management structure and procedures).

The following figure illustrates the structure of the project management organisation:

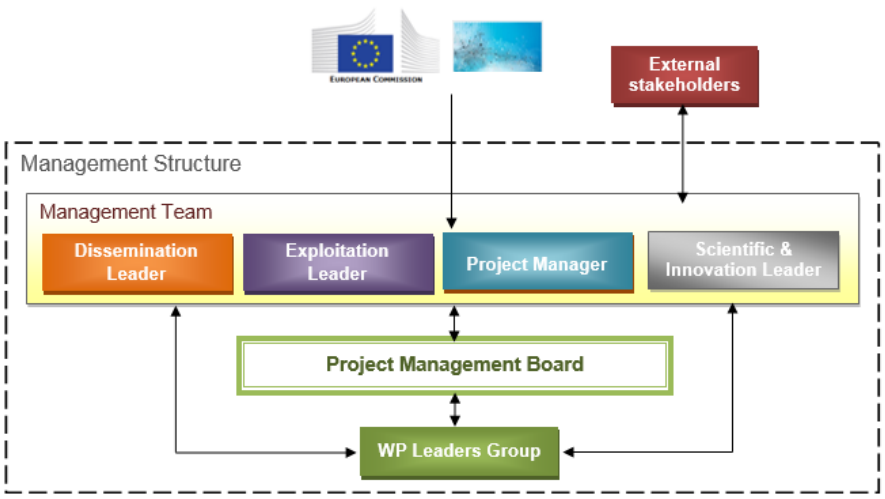

Figure 1. Electrific Management Structure.

Complete description of management structure from Figure 1 can be found in DoA Section 3.2.1. Besides management roles defined in DoA, Scientific & Innovation Leader (SIL) in context of QA process and activities has following roles:

- Defining technical standards and to track Software Problem Reports (SPR) and resolutions.
- Managing configuration of the software system (e.g. software components setup, system parameters, system improvements/amendments) and deciding on:
    - Implementation of suggested solutions only for problems encountered during acceptance testing.

- Final resolution of Software Problem Reports.

II.1.2. Roles and responsibilities related to Quality Assurance

This section describes roles and responsibilities related to Quality Assurance (QA).

It is worth to discriminate here the difference among QA control vs. Verification and Validation (V&V) control that shall be applied in the project.

In general terms, QA target is to verify that the software life cycle data and implemented processes are compliant with Quality requirements. This verification is based on random samples that provide the objective proofs to demonstrate that approved plans and applicable standards and Quality requirements are being followed properly.

Target of V&V is to verify that all software life cycle data applies to requirements in a systematic way.

Both QA control and V&V control are main responsibilities for all role levels described in this section. Scope of responsibility is described in each level. Quality fulfilment and quality assurance activities start at lowest level (4), and ends at highest level (1).

These are the roles in cotext of Quality Assurance classified in the levels according to the scope of responsibility:

1st level: The **Project Management Board (PMB),** scope of responsibility: whole project.

2nd level: The **Project Manager (PM),** scope of responsibility: whole project

3rd level: The **Work package Leader (WPL),** scope of responsibility: work package**.** Each **WPL** will have the responsibility for ensuring the quality of the Work Package(s) that **WPL** is accountable for.

4th level: The **Deliverable Owner (DO),** scope of responsibility: deliverable. Each DO will have responsilibty for ensuring quality of the deliverables that DO is accountable for.

II.2. Tasks

To perform Quality Assurance, certain tasks need to be defined. Tasks related to Quality Assurance are performed during the whole project life cycle. Following chapter describes tasks related to creation of project deliverables and creation of software components. In case of impediments occur during execution of any described tasks, accountable for task execution needs to apply conflict resolution procedure as defined in Chapter II.3.

II.2.1. Tasks for 1st level: The Project Management Board (PMB)

PMB has the overall responsibility for ensuring the quality of project results. Following actions ensure that the QA for the whole project will be maintained:

- Monitoring deliverable execution (in QA context) during PM/PMB meetings.
- Get and analyse QA reports from PM/WPL/DO for Project deliverables.
- Propose and enforce implementation of corrective organisational and (preventive) measures to align QA activities and Project deliverables match Project Quality standards.

II.2.2. Tasks for 2nd level: The Project Manager (PM)

The control of the deliverables processes will be done by the **PM** by means of the following actions to ensure that the quality level for the whole project will be maintained:

- Fortnightly meetings with the total consortium in order to:
  - Review the general state of the project regarding the delivery dates for the deliverables.
  - Solve internal issues/disputes scaled by each WPL.
  - Assist WPL and DO in ensuring delivery contributors are participating.
- Reporting for the meetings referencing new possible risks detected and including the risk owner.
- To review each final deliverable confirmed by the WPL in order to ensure that all the requirements are met before to be sent to the EC.
- To ensure reporting final deliverable to EC (e.g. uploading in Participant Portal) and ensure making public deliverables are available to public via Project website
- To review the reports provided every two weeks by the WPL to be assured that each work package is progressing according to plan.

II.2.3. Tasks for 3rd level: The Work package Leader (WPL)

The activities related with the deliverables regarding the **WPL** are:

- Periodical meetings (Timing stated by each WPL) with the rest of contributors of the WP.
- Reporting for each meeting including:

  - New risk detected and the risk owner.
  - WP plan update if needed.
- Internal Periodic WP Report, every 6 months.
- Periodic Report, to be delivered to the EC at the end of each project period.
- Assist DO in ensuring delivery contributors are participating.
- Detect and communicate risks/opportunities to PM in timely manner and/or during WP meetings

II.2.4. Tasks for 4th level: The Deliverable Owner (DO)

We recognise two types of deliverable owners:

- Non-technical
- Technical

Non-technical deliverable owners (e.g. GFI for D1.1) will have responsilibty to carry out non-technical tasks in QA context.

Technical deliverable owners (e.g. FM for D3.1) will have responsibility to carry out technical and non-technical tasks is QA context.

II.2.4.a. Tasks for non-technical deliverable owners

In order to maintain QA of each deliverable (technical and non-technical), these activities must be performed by every deliverable owner:

- Ensure all the contributors are participating.
- Ensure all delivery requirements are met.
- Ensure all visual identity, stylguides are followed and Project templates are used
- Ensure that all public deliverables are published on Website
- Detect and communicate risks/opportunities to WPL in timely manner

II.2.4.b. Tasks for technical deliverable owners (software related)

The control of SW processes and data is done by means of the following planned and systematic actions to provide adequate confidence that the product conforms to its requirements:

- Produce and maintain this QAP and check that is being followed.
- Review all plans for consistency, completeness and adherence to standards.

- Review significant samples of technical documents (test specifications, test procedures and tests reports) to ensure that approved standards, methods and tools are used.
- Verify consistency of baseline definition.
- Ensure that traceability is maintained.
- Monitor project risk management by reviewing the periodic project progress reports.
- Check of phase output data (especially by means of reviews based on random samples of each software life cycle data). The results of each checking will be recorded, in accordance with internal procedures
- Support the project in QA topics.
- Report on QA activities.
- Co-ordination with customer quality assurance responsible.
- Production of Quality Records. As a result of QA activities done inside the project (not only by QA responsible) quality records will be produced.

II.3. Conflict resolution

As described in the document Description of Action Section 3.2.4 there will be attempts of arbitration in increasing order of authority:

WPL → WPLG → PMB → PM → EC Project Officer

A register with the following information will be created:

- Conflict description
- Date of the conflict start
- People involved
- Solution
- Date for the solution

II.4. Quality Reporting

The QA responsible in his in specific context (according to levels defined in Section II.1.2) informs of the performance of his/her activities in the periodic meetings. Contents of quality reports required by the European Commission, as customer, QA requirements will be:

- Quality assurance and Control activities performed during the period
- Planned QA activities for next period
- Summary of non-conformances, deviations, waivers status
- Major problems and open points

- QA organisation status
- Metrics analysis

QA activities will be reported upon specific requests from the customer.

II.5. Reporting to the EC

Reporting will be ensured by the Project Manager and will adhere to the practices of the ICT Office for the 8th Framework Programme (Horizon 2020). The consortium based its estimation of workload and costs on the following assumptions:

- If requested by the EC Project Officer, half-yearly status reports to the Project Officer via email or letter (financial statements are not included).
- Periodic management reports including cost statements and, if necessary, methodology and financial audit certificates.
- Periodic review meetings.

II.6. Project communication mechanisms

In addition to the physical meetings, the communication will be complemented by online-based meetings:

- Bi-weekly virtual meetings will be organised by the Project Manager with the participation of the Project Management Board (PMB) and Work Packages Leaders (WPL). WPL will report to the PMB the status of the work packages activities.
- During the project periods where the work package is active, the Work Package Leaders will organise virtual meetings in a weekly basis to be participated by at least one representative from each contributor.

The information flow will rely on the following mechanisms:

- For daily work and exchange of documents, the basic communication means will be electronic mail and WebEx and/or Skype conferences.
- An online platform, as the internal project collaboration tool, will be set-up with private access for consortium members to offer:
  - A project's library that contains all deliverables and documents relating to the project (project document repository).
  - Forums, news, wiki, calendar, issues management, etc.
  - A simple project management application allowing all participants to report online.
- A public Web server is being set up (location: http://www.electrific.eu/) to present the project and to publish on-line all public deliverables and relevant publications.

All deliverables shall be presented in documentary form and will be a valid representation of the outcome of the work in the project and provide tangible evidence of the achievement of the project objectives. They will be subject to quality control before being communicated to the European Commission as explained in Section II.2.1.

III. STANDARDS, PRACTICES AND CONVENTIONS

This Section defines standards in terms of documentation (how to distribute, which template to use, naming conventions). We also define information management procedures, software requirements and design descriptions and software creation specific standards such as for designing software, coding and testing.

III.1. Documentation

This section describes documentation standards in the project.

III.1.1. Documentation distribution procedures

If documentation is to be distributed, following procedures are followed:

- Authorisation given to specific person (working in the Electrific project) for the distribution and provision of project documents and results must be controlled.
- Distribution lists of any project material (including documentation) will be kept and controlled.

III.1.2. Documentation Standards

When creating documentation, all contributors are following these standards:

- All documentation generated in project is distributed among partners in Microsoft Office format (minimum version 2007 for compatibility).
- Public documentation will be distributed in PDF format.
- This project uses as document templates the Electrific ones for all deliverables. List of Templates is described in Section III.1.4.
- File extensions which are considered and allowed in the project are described in Table 1.

Table 1. List of file extensions.

Extension	Functionality
.doc/.docx	Word Processor
.xls/.xlsx	Spreadsheet
.ppt/,pptx	Presentations
.pdf	Documents for distribution
.zip	Compressed documents

- Electrific naming conventions shall be used as described in Section III.1.3.

III.1.3. Documentation Naming Conventions

This section describes naming conventions to be used for deliverables or other (non-deliverable) documents. This will ensure consistency, easier search, document referencing and collaboration among project team members.

III.1.3.a. Deliverables

All deliverables will use following naming conventions:

DX.Y - DELIVERABLENAME_vZ.W.EXT

Where:

- DX.Y, indicates deliverable number where X is the name of the work package that the deliverable belongs to and Y is the number of the deliverable within the work package. This reference will be indicated as “Document Reference”, using {Keywords from Properties} at document
- DELIVERABLENAME is the name of deliverable indicated in the DoA and will be indicated as “Title” at document. In case of an excessive length, an abbreviation will be considered.
- vZ.W is the document version; Z will be indicated by document editor who will be the document responsible, as W will identify other contributors. This information will be indicated as “Version”, at document
- EXT, is the file extension, and only indicated values will be considered.

III.1.3.b. Other Documents

Rest of documents will use following notation:

ELECTRIFIC - CONTEXT - TYPE DOCUMENTNAME_DATE_vZ.W.EXT

Where:

- TYPE, indicates document character. Following values will be considered:

Table 2. Document types.

Value	Type
Minute	For Minutes
Agenda	For agendas
Report	For reports
Presentation	For presentations
Template	For document templates
Internal	For Internal documentation

- CONTEXT, informs about information context. Following values will be considered:

Table 3. Document contexts.

Value	Context
WPx	For WorkPackages
Tx.y	For Tasks
PhC	For Conference Call
Meeting	For meetings

- DOCUMENTNAME, is the name of document (if needed)
- DATE - when strictly necessary - will indicate date information in YYYYMMDD format
- vZ.W is the document version; Z will be indicated by document editor who will be the document responsible, as W will identify other contributors.
- EXT, is the file extension, and only indicated values will be considered.

III.1.4. Templates

Document templates will be elaborated, and distributed among partners using project collaboration platform[2].

III.2. Information Management

To ensure QA, project team ensures appropriate information management. Information is going to be reviewed and stored in structured way. Following sections describe these topics in more detail.

[2] Location of templates : http://projects.electrific.eu/projects/electrific-cross-wp/dmsf?folder_id=57

III.2.1. Deliverables Process Review

To ensure the highest quality of the deliverables the following Quality assurance procedure will be implemented:

- Each deliverable has an owner (a partner), who is responsible towards the Electrific Project Management Board. The owner is appointed by the leader of the work package to which the deliverable belongs. The owner of the deliverable is formally announced to the Electrific mailing list at least two weeks before the Table of Content (ToC) draft should be created by the owner.
- The deliverable process review will be performed following these steps:
    1. Review by the partners with efforts in the work package.
    2. Preliminary approval by the technical leader.
    3. Final approval by the project manager.
    4. Once the deliverable is ready for submission, the Project Manager will upload deliverable to Participant portal of European Commission in pdf format.

Documentation Review

All documents shall be produced and reviewed internally within the Consortium partnership.

One or several of the following reviews criteria will be used in an internal document review:

- Consistency,
- Understand-ability,
- Uniform typing format,
- Trace-ability,
- Appropriate analysis, design and coding techniques used,
- Checking algorithms suitability and correctness,
- Appropriate allocation of sizing and timing resources,
- Adequate test coverage of requirements,
- Testability of requirements,
- Adequacy of test cases and procedures,
- Completeness of testing.

III.2.2. Repository

All project information will be hosted in a common repository with a login/password access per partner. The repository is hosted by the Project Manager.

The repository in use is part of the Project Collaboration tool set up by the Project Coordinator. Location of the project collaboration tool is:

- http://projects.electrific.eu/.

III.3. Software Requirement Specification (SRS)

The external standard IEEE Std 830-1998 (IEEE recommended practice for software requirements specifications) to create software requirement document ill be followed for each major module of the system. Each SRS will include a complete description of the behaviour of the module to be developed. It will include a set of use-cases (functional requirements) that describe all user interactions. Each use-case will also describe the non-functional (or supplementary) requirements.

The SRS will be included into the deliverables D3.1 and D3.4.

III.4. Software Design Descriptions (SDD)

IEEE Std 1016-1998 (IEEE recommended practice for software design descriptions) will be used for each major module of the system, providing an overview of the module, a complete description of its design and its main sub-modules. It will also include a comprehensive description of the module's interaction points with the other modules and the testbed. SDDs will be "live documents" and will be updated upon completion of design iteration of each of the testbed experimentation phases.

The SDD will be the deliverables D3.1 and D3.4.

III.5. Design Standards

The **design specifications** will include protocols, class-, system and sequence diagrams, user interface sketches & mock-ups, where necessary, as well integration and testing procedures. The overall design language used will be the Unified Modelling Language (UML) as specified by the Technical Management Committee (TMC).

The documents will be organised following a common template:

- An initial section covering an unifying view of the specific subject of the document: This will serve the purpose of defining the common element that is shared across multiple work packages, with a horizontal view on the project.
- One section with the specifics related to the activities of each WP covered by the document.
- One section with ethics requirements specifics where each document explains how ethics issues are handled with respect to obligations and requirements defined in deliverables D10.1 and D10.2.

III.6. Coding Standards

Following conding stadards will be used:

- Open source software used and/or any custom software developed will be based on the Java™ programming language whenever possible.
- All custom source code will be managed in a central Source Control Management system e.g. GIT, mercurial, ...
- During component development, interfaces will be used to define the contact of each component. Depending components will rely on these interfaces rather than on the concrete component implementation classes. As a result, implementations are abstracted away, so component implementations can be easiliy swapped without influencing other components (e.g. by dependency injection).
- Using static analysis tools, coding standards and best practices will be checked and applied.
- A build tool (e.g. Maven) will be used to manage the lifecycle of all individual software artefacts (where possible).
- A central Maven Repository will be foreseen to host all released (custom) software artefacts.
- A Continuous Integration system will be foreseen to centrally build and release all components. Releases (and snapshot releases) will be published in the Central Maven Repository and will follow a “major.minor.bugfix” versioning scheme (e.g. foo.bar-01.00.1.jar).
- To track and verify adherence to standards, the static analysis tools will also be enabled in the Continuous Integration (CI) system. This allows for follow-up on standards compliance and regression detection. Releases will only pass if the defined KPI’s are reached.

III.7. Testing Standards and Practices

These are testing standards and practices which are going to be applied in the project:

- Test Description (TD) templates for each major module of the system will be included in the testing and evaluation of specifications and requirements.
- A suite of automated Unit tests will be written to verify the implementation of each unit of work and as such gradually implement a regression framework. Stubs (e.g. simulators) and/or test proxies will be foreseen to mimic external systems.

IV. MANAGEMENT PROJECT METRICS

Two metrics are defined for the project: cost and delivery. In the following section we define each of them in terms of target, follow-up, responsibility and data representing described metrics.

IV.1. Cost Precision

Cost involves all direct and indirect expenses of the project. Project costs are tracked on quarterly basis using standardised budget report templates. Table 4. Describes cost precision metric.

Table 4. Cost precision.

Indicator/Target	The project shall have at least a **80%** of project planning budget precision. From M1 to M36: (1 - | (Monthly actual cost - Monthly planned cost) / Monthly planned cost |) * 100
Follow-up	Project progress reports
Responsible	Project Manager (PM)
Data	Project Budget reports and manual calculation by means of Excel sheets/graphs (charts)

IV.2. Delivery Precision

Delivery involves invested and planned effort for delivery generation. Project efforts are tracked on quarterly basis using standardized Budget report templates and timesheets. Table 4. Describes delivery precision metric.

Table 5. Delivery precision.

Indicator/Target	The project shall have a 90% of project planning delivery precision. From M1 to M36: (1 - | (Actual duration - Planned duration) / Planned duration |) * 100
Follow-up	Project progress reports
Responsible	Project Management (PM)

V. RISKS MANAGEMENT

V.1. General

Risk management is a systematic and iterative process for optimizing resources in accordance with the project's risk management policy. It is integrated through defined roles and responsibilities into the day–to–day activities in all project domains and at all project levels. Risk management assists managers and engineers by including risk aspects in management and engineering practices and judgments throughout the project life cycle, including the preparation of project requirements documents. It is performed in an integrated, holistic way, maximizing the overall benefits in areas such as:

- design, manufacturing, testing, operation, maintenance, and disposal, together with their interfaces;
- control over risk consequences;
- management, cost, and schedule.

Within the risk management process, available risk information is produced and structured, facilitating risk communication and management decision making. The results of risk assessment and reduction and the residual risks are communicated to the project team for information and follow-up.

V.2. Principles

Risks will be ranked from **1 (high)** to **5 (low),** the ranking is based on impact on the project and likelihood of occurrence. All risks will be managed actively: *Rank 1* risks must be evaluated continuously and reported to the coordinator.

The responsible WP leader must evaluate and report the risks quarterly. For all identified risks, efficient contingency plans (resource reallocation, fall-back, contingency measures) will be implemented immediately.

The preliminary list of risks can be reviewed in the DoA Sections 3.2.3.1 to Section 3.2.3.8. in regards to risks identified in WP1 to WP9 and in D10.2 in Section III.3.3.b in regards to risks identified in WP10.

The probability and impact of occurrence for each identified risk is assessed by the project manager, with input from the project team using the following approach:

Probability

- High – Greater than <70%> probability of occurrence
- Medium – Between <30%> and <70%> probability of occurrence

- Low – Below <30%> probability of occurrence

Each major risk (those falling in the Red & Yellow zones) is assigned to a project team member for monitoring purposes to ensure that the risk is not forgotten.

For each major risk, one of the following approaches is selected to address it:

- Avoid – eliminate the threat by eliminating the cause
- Mitigate – Identify ways to reduce the probability or the impact of the risk
- Accept – Nothing will be done

V.3. Risk monitoring and reporting

The risk monitoring will be performed in the periodic meetings. When a risk is identified the identifier partner needs to report the risk without any delay 1) to the WP leader to which the risk belongs and 2) to the project manager. A register with the following information will be created for the risk:

- Risk description.
- Risk owner.
- Risk category.
- Risk response.
- Risk response owner.

The templates to report a risk are the following:

Table 6. Risk list template – part 1.

Risk ID [3]	Category [4]	Date Identified	Originator[5]	Risk Statement	Actual / Potential Impact on the Project	Effect (Level of Impact) [6]

[3] In the form Ri.j where i=WP number and j=1, n. Example R3.1 is Risk Nr 1 for WP3.

[4] for negative risks use:Threat, for positive risks use:Opportunity

[5] Name, organisation

[6] 3— high, 2— medium, 1— low

Table 7. Risk list template – part 2.

Probability [7]	Risk exposure [8]	Proposed solution / Mitigation strategy[9]	Status [10]	Status Date

And for each identified risk we need to keep list of actions performed and perform new assessment of the risk. Data for each risk reassessment iteration is kept in tables as described in Tables 8 and 9.

Table 8. Risk reassessment template – part 1.

Actions performed to decrease and/or eliminate Risk	New Impact	New probability	New Exposure

Table 9. Risk reassessment template – part 2.

Status Date	Comments	Closing date [11]	Approval [12]

In order to qualify risk and better visualize impact and risk severity, we use risk heat map that represents risk qualification by impact and probability. Template for such map is shown in Table 10.

[7] High – Greater than <70%> probability of occurrence; Medium – Between <30%> and <70%> probability of occurrence; Low – Below <30%> probability of occurrence

[8] High, Medium, Low

[9] Mitigate/Avoid/Accept/Transfer – for negative risks (Threats); Accept/Exploit/Share/Enhance – for positive risks (Opportunities)

[10] Identified, Monitored, Contained

[11] Date when related activity is completed

[12] WP Leader

Table 10. Risk qualification by impact and probability.

Impact	High			
	Medium			
	Low			
		Low	Medium	High
	Probability			

VI. REVIEWS AND AUDITS

VI.1. Reviews

Review term is understood here as synonym of contractual or formal review. It serves to provide a qualitative assessment of product correctness and to assure that Project life cycle processes are performed in compliance with approved plans.

According to Grant Agreement, Article 22, Agency or European Commission has right to carry out reviews and audits. Their reviews and audits can be performed on demand – during implementation of action or afterwards (up to two years after the payment of the balance). During implementation of action continuous reporting is foreseen through Participant Portal provided by European Commission.

According to Grant Agreement, Annex 1 (part A), Section 1.3.7, following formal but tentative schedule of project reviews is foreseen:

Table 11. Project reviews.

Review	Timing, month	Planned venue of review	Comments , if any
RV1	After project month 18	Brussels	-
RV2	After project month 36	Tentatively at trial sites (E-WALD, e-Šumava or Barcelona, TBD)	-

List and schedule of project milestones is defined in Table 12.

Table 12. Project milestones.

#	Milestone name	WPs involved	Expected date	Verification means
MS1	Kick-off meeting	WP1	M1	-
MS2	First definition of business requirements and use cases. Development and integration framework available, first version of the architecture	WP2, WP3	M6	D2.1, D3.1
MS3	Preliminary prototype: Passing technical components to integration	WP3, WP4, WP5, WP6, WP7	M8	D4.1, D5.1, D6.1, D7.1
MS4	Preliminary prototype: Integrated components ready for experimentation	WP3	M10	D3.1, D3.2
MS5	Preliminary prototype: Experiments results available	WP8	M12	D8.2
MS6	First set of metrics for EV performance, grid integration and rewards	WP2	M14	D2.3
MS7	Intermediate prototype: Passing technical components to integration	WP3, WP4, WP5, WP6, WP7	M19	D4.2, D5.2, D6.2, D7.2
MS8	Intermediate prototype: Integrated components ready for trials	WP3	M21	D3.3
MS9	Intermediate prototype: Trials results available	WP8	M24	D8.3
MS10	Initial exploitation actions: Market analysis, standardization actions and business models definition	WP9	M24	D9.2, D9.4
MS11	Final set of metrics for EV performance, grid integration and rewards	WP2	M26	D2.4
MS12	Final prototype: Passing final technical components to integration	WP3, WP4, WP5, WP6, WP7	M30	D4.3, D5.3, D6.3, D7.3
MS13	Final prototype: Integrated final prototype ready for trials	WP3	M32	D3.4, D3.5
MS14	Final prototype: Final Trials results available	WP8	M36	D8.4
MS15	Final exploitation actions: Final market analysis, exploitation and sustainability plan	WP9	M36	D9.6

VI.2. Audits

According to the EC financial guide, section 2 there is an audit foreseen for those partners exceeding 325,000€ of European Contribution for the whole project duration. In any case the EC has the right to perform audits at its convenience.

VII. PROJECT DEVELOPMENT LIFE CYCLE

Project combines **waterfall and agile methodologies** in order to organize development activities that will finally release iterative versions of the platform.

As defined in DoA, Section 3.1.1, the need to speed up the availability of results is especially critical such as to have early working elements usable in testing and evaluations. On the other hand, Electrific partners are also well aware of the challenges of collaborative and distributed projects, which indeed raise the bar of cooperation complexities in comparison with single organization settings. Electrific will apply Agile Development methods although that Agile Development for large distributed collaborative projects is indeed a challenge[13]. The Consortium will rely on an adapted version of Agile, in which development methods and techniques are combined with the structure necessary for a large and distributed collaboration effort[14].

Moreover, the Electrific methodology also incorporates the overarching principle of having final users (real-life trials scenarios) as active, participating actors during all the project duration. This is reflected in a project planning structured in 6 different development-implementation-testing-evaluation iterations. Given the size and the distributed nature of the project, the duration of the each iteration cycle has been fixed at six months average (within each cycle the Agile methodology will be applied with short term – few weeks based – Sprints). Each iteration has been defined based on a different scope and with different users' involvement:

- Iteration 1 – from M1 to M8 – deals with the technical assessment of the trial environments and of the available data that can be immediately collected from the trial sites (WP8). With this input the R&D work packages (WP3 to WP7) will start the definition of the data models, user profiling and mobility algorithms. In addition trials scenarios and target scenarios will be defined as well within WP2.
- Iteration 2 – from M8 to M12 - goes through the first experiments with preliminary technical components released by R&D WPs. Due to the complexity of the research and development, at this stage WP8 will experiment with integrated components to test whether the overall solution is being developed in the good direction. Users' involvement will be necessary but under controlled conditions, as their feedback is key for refinements in the following iterations (feedback loop from trials to R&D WPs). A preliminary market analysis is provided at the end of the iteration (WP9).

[13] http://www.cin.ufpe.br/~in1037/AllFinal/SE40%20Hossain%202009.pdf

[14] http://people.cs.aau.dk/~jeremy/SOE2011/resources/Boehm.pdf

- Iteration 3 – from M13 to M19 – refines and evolves the previously defined models, technical components and interfaces. The rewards schema of the solution is developed in this phase (as improvement within WP6), as implementation of the market analysis released in the previous iteration.
- Iteration 4 – from M20 to M24 – will extend the scope of experiments to real trials, involving a small amount of users to test the intermediate prototype in a real environment.
- Iteration 5 –from M25 to M30 – will be an enhancement of the tools allowing the refinement of results obtained so far. Once all the final technical components are built and evaluated Iteration 5 will integrate them into the final prototype.
- Iteration 6 – from M30 to M36 - will obtain the final accuracy results by the latest comparisons between the calculated predictions and the real energy consumption in the trials cases.

Visualisation of this process is shown in Figure 2.

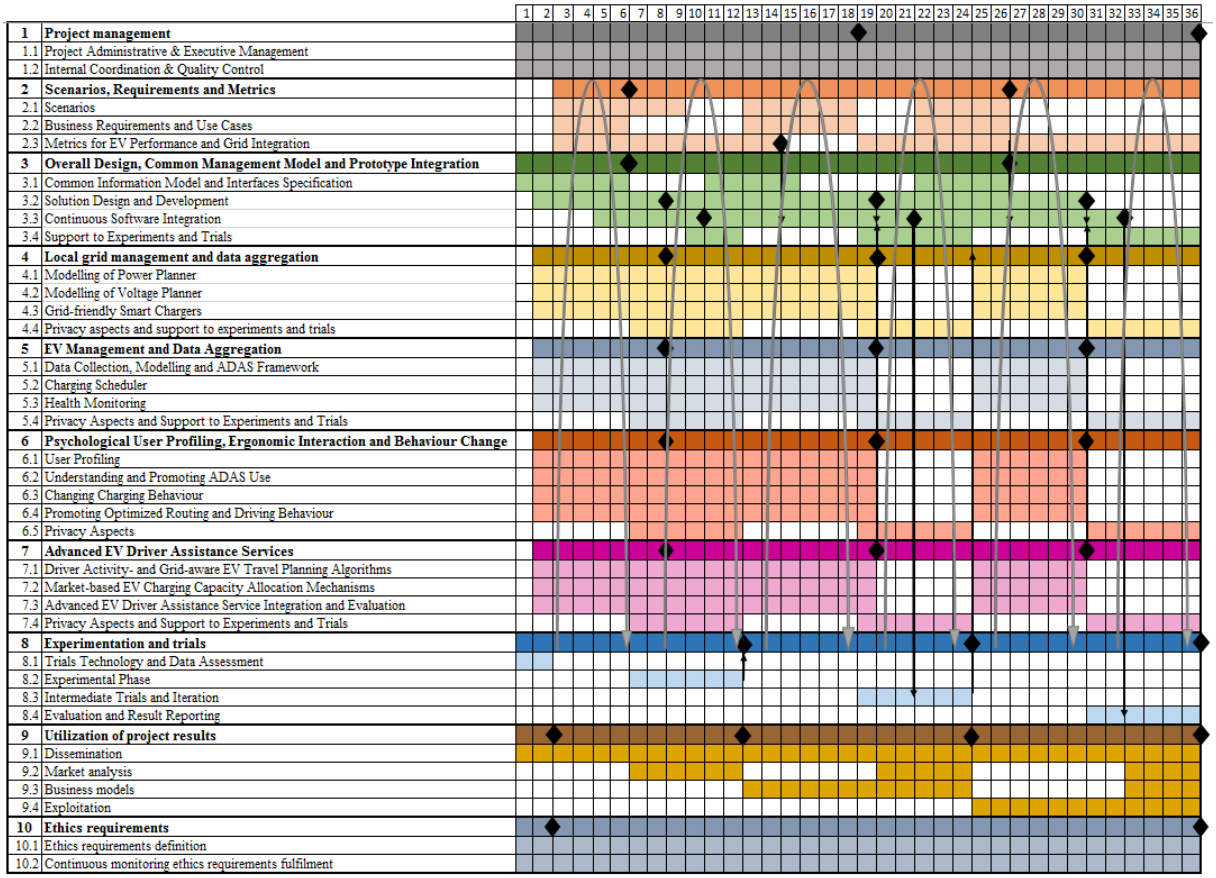

Figure 2. Electrific plan with combined waterfall and agile iterations.

VIII. Problem Reporting and Corrective Actions

This section describes means of problem reporting and corrective actions that need to be taken if problem occurs.

VIII.1. Problem reports

The objective of problem reporting, tracking and corrective action is to record process non-compliance with project plans and standards, to record deficiencies of outputs of project life cycle processes, to record anomalous behaviour of products, and to ensure resolution of these problems.

Problem Reports are used to record problems on Project life cycle data or on processes. Problem Reports may be raised against received or generated data.

General term **problem report** can be applied generically to documentation, code or processes.

The non-conformance (problem report) detection is followed by its classification: the non-conformance falls under the category of major (e.g. contractual requirement) or minors.

VIII.2. Software problem reports (SPRs)

Electrific shall use the **SPR** to report about anomalies on code. Major problems are always sent to the approval authority. A joint Configuration Control Board decides about the implementation of suggested solutions only for problems encountered during acceptance testing.

Formal code change procedure shall be applied to terminal software as described in the following paragraphs. For generated code, Problem Reports are raised for problems discovered after a product enters into system tests.

Summary of SPRs control procedure steps is the following:

1. **Detection:** For each problem detected in the software module already in system tests or the delivered configuration Item a SPR shall be generated, giving information about the symptoms and the operating environment. Evidence, such as listing of results, may be attached. When anyone detects the problem, it is reported in a SPR form. (Originator of SPRs during acceptance usually is the approval authority).
2. **Analysis:** The problem is analysed in order to find a solution that is recommended in the same problem report. In addition, an assessment of the change cost and its schedule impact may also be included in order to identify its gravity (major, minor) and criticality (urgent, routine…).

3. **Review and decision:**
    a. Scientific & Innovation Leader (SIL) periodically reviews the input forms (ad-hoc, monthly or at internal reviews).
    b. The SIL classify/confirm the SPR criticality (it may take values depending on its priority (critical, urgent and routine) and its contractual impact (major, minor)).
4. **Closure:** SPR formal closure is responsibility of SIL (or person designed by him) from SPR originator. It is necessary to have completed and signed by change verification authority the associated SMR (Software Modification Report) in order to be able to close any SPR, when SIL decided “corrective action”.

Each software modification is documented in a SMR, complete with items such as: Source code changes identifying affected modules with its version, Test Execution Reports, any other verification details, and documents to be updated and reviewed (if necessary).

Fulfilled SMRs are analysed by Scientific & Innovation Leader (SIL). Following resolutions shall be taken:

- Open (rework).
- Closed (agreed on change implementation).

Changes to the software shall be indicated in the module header with reference to the SPR and SMR related with the problem that provoked the modification. **SPRs** and **SMRs** are managed by the Scientific & Innovation Leader (SIL) and by the Project Manager (PM).

IX. RECORDS, COLLECTION, MAINTENANCE AND RETENTION

List of quality records (any “objective evidence” of quality activities, different of the major document are actually quality records):

- Internal reviews records (IRR)
- Audit reports
- Project Progress reports
- Change Requests
- Test execution records
- Meeting minutes

The **retention period** for the quality records in this project is established until the customer final acceptance, aligned with right to perform audits and reviews, as described in Section VI.1.and limited with certain time boundaries - as defined in Grant Agreement, Article 18.1. Article states that beneficiaries must — for a period of five years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible. In other words, this defines retention period for all project documentation (including QA related documentation) last up to five years after the payment of the balance from Customer (EC / Agency).

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