

Learning e-mobility plus

Lastenheft/Requirements manual

Training Model on e-Mobility


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6. Prerequisites

The prerequisites section defines the conditions that must be met before starting the project. It includes a list of prerequisites and a small diagram of a car.

1. Objective



Credits




5. Other requirements

Page 27 - 8 requirements

This section defines requirements about logo and graphic of models and manuals. The primary target is to highlight the project and partners logo and to make more interesting the material.


0.4 Abbreviations

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- MODEL: SE Model with a series hybrid technology
- MODEL: SP Model with a parallel hybrid technology
- RT: Technical requirements
- RF: Functional requirements
- RR: Performance requirements
- RQ: Quality requirements
- RO: Other requirements

2. Function and requirements



4. Quality requirements


Page 20 - 4 requirements



The requirements contribute to the project.

3. Performance requirements

Page 19 - 7 requirements



- Speed
- Acceleration
- Consumption
- Emissions
- Noise
- DCHL absorption

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6. Prerequisites

The reader should refer to the prerequisites section of the manual for more information on the prerequisites. The prerequisites section is divided into two parts: prerequisites for the project and prerequisites for the manual.

1. Objective




5. Other requirements


Page 27 - 8 requirements

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0.4 Abbreviations

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2. Function and requirements



4. Quality requirements

Page 20 - 4 requirements



3. Performance requirements

Page 19 - 7 requirements

- Speed
- Acceleration
- Consumption
- Emission
- Regenerative
- DC/AC conversion



Training Model on e-Mobility

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0. Introduction

0.1 Basic data

0.2 Version

0.3 Scope and application

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1. Objective

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2.1 necessary requirements

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2.3 Functional requirements

4. Quality requirements

3. Performance requirements

5. Other requirements

6. Prerequisites

0.4 Abbreviations

Pages from 6 to 8

- MODEL 1S Model whit a series hybrid technology
- MODEL 2P Model whit a paralel hybrid technology
- RD Didactical requirements
- RT Technical requirements
- RF Functional requirements
- RP Performance requirements
- RQ Quality requirements
- RA Other requirements



1. Objective

1.1 Model

Scheme ①

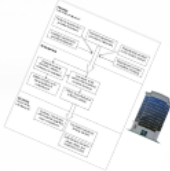
Scheme ②

1.2 Target

Primary target
Students of vocational training systems in the field of
Special needs could be paid separately to specific areas
training centers, including...

Secondary target
Citizens
Other vocational system (vocational training, further
education, basic education, for demonstration and to
improve the quality of the system for the employment of
Special needs, transparency...

1.3 Flow chart



1.1 Model

Scheme ①

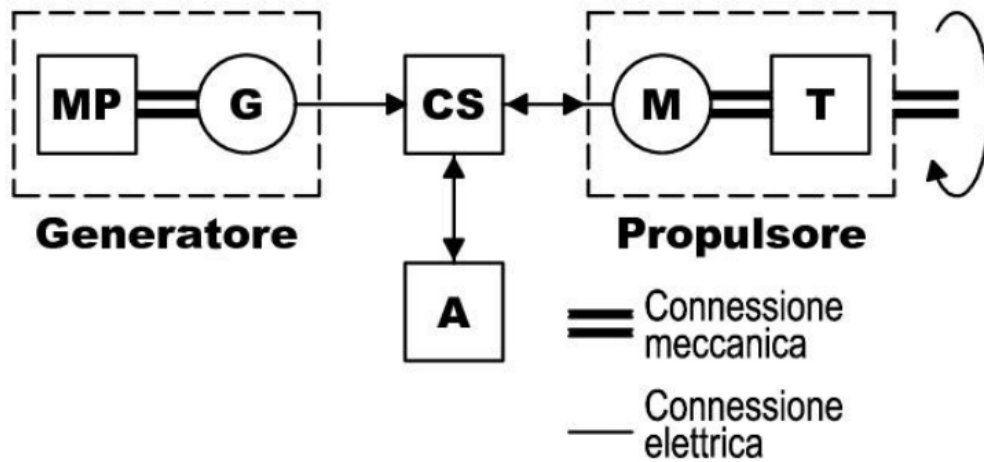


Scheme ②

Scheme

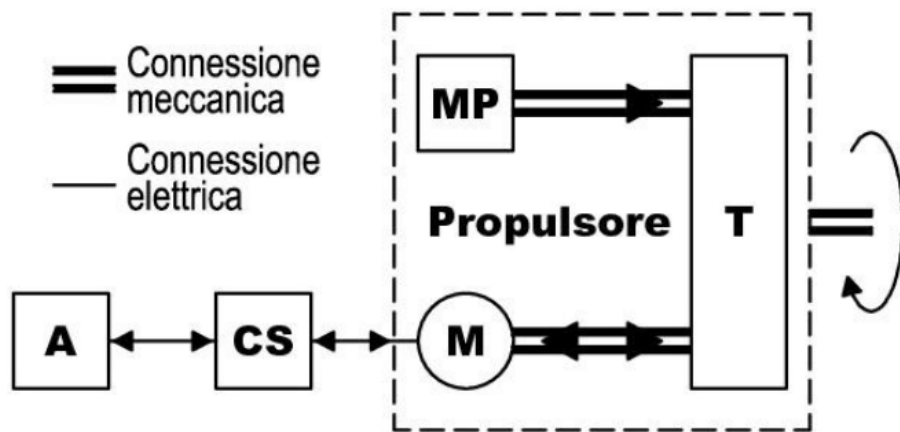


S





Scheme @2



- MP** motore primo(ICE)
- M** macchina elettrica (motore/generatore)
- CS** sistema di conversione statico
- A** sistema di accumulo
- T** trasmissione

1.2 Target



Primary target

Students of vocational training centers in the fields of automotive or electrics
Specific materials could be used separately in specific courses (evening courses, retraining,...)



Secondary targets

Enterprises
Other educational entities (vocational training, higher education, basic education), for dissemination and for orientation of younger students too.
Students families, to amplify diffusion

1.2 Targ



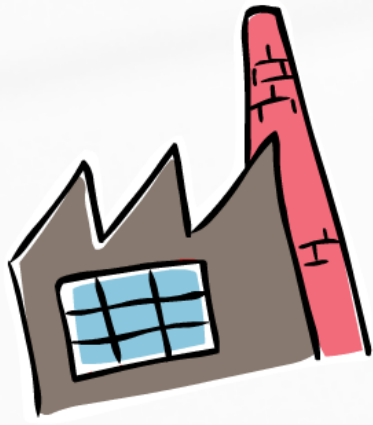
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Students of vocational training centers in the fields of automotive or electrics

Specific materials could be used separately in specific courses (evening courses, retraining,...)



Enterpr
Other



Secondary targets

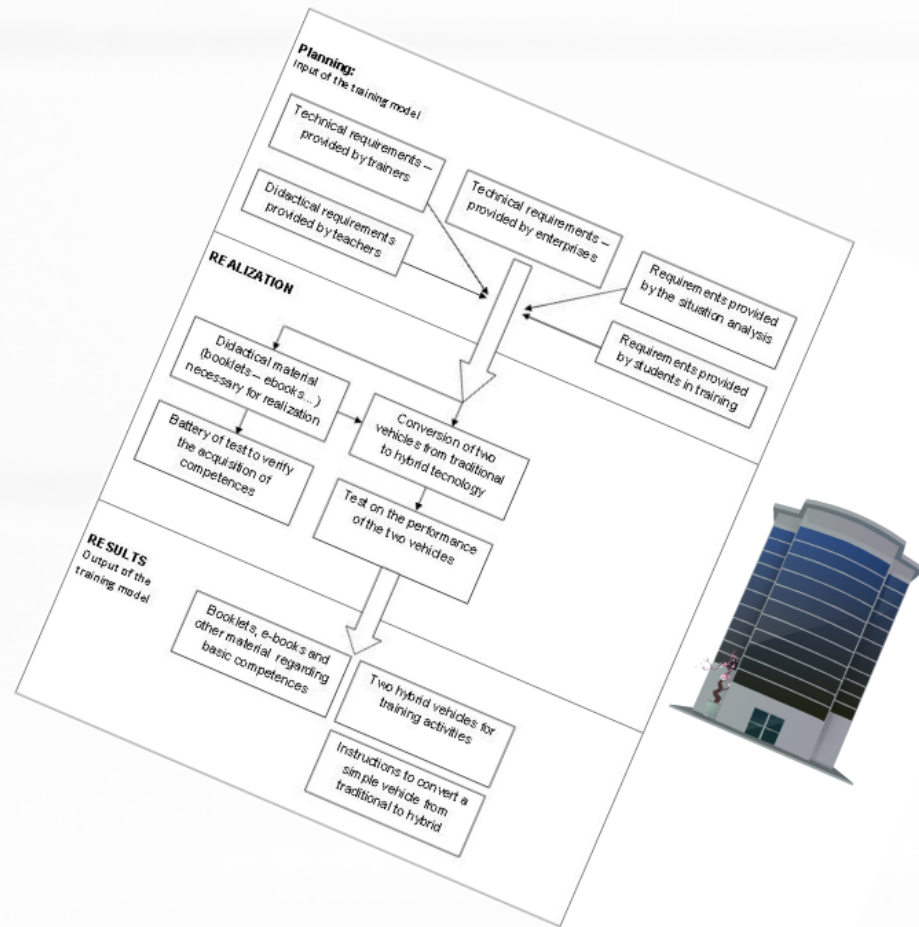
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Students families, to amplify diffusion

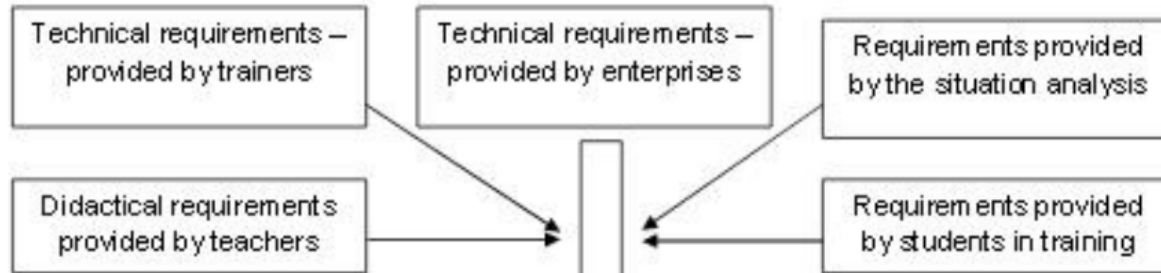


1.3 Flow chart

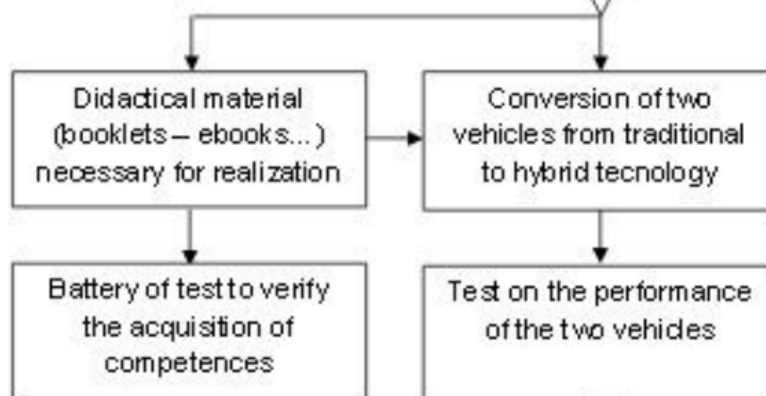


Planning:

Input of the training model

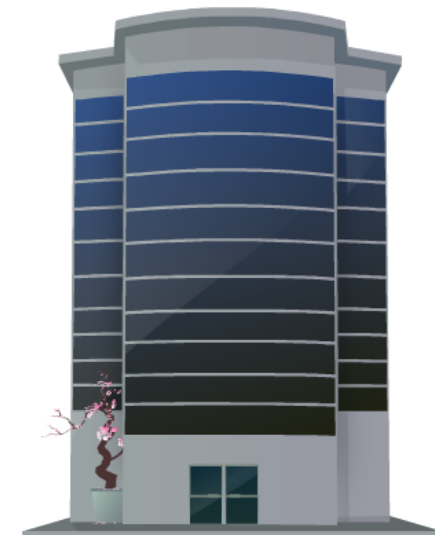
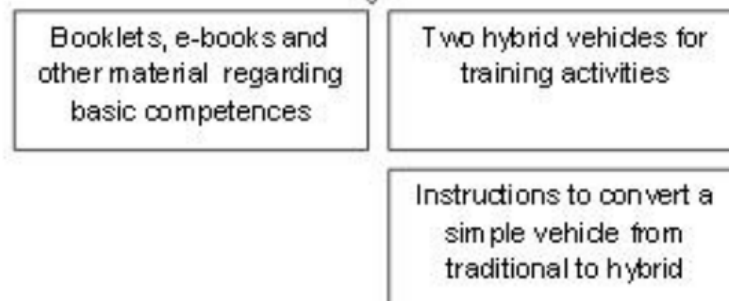


RE ALIZATION

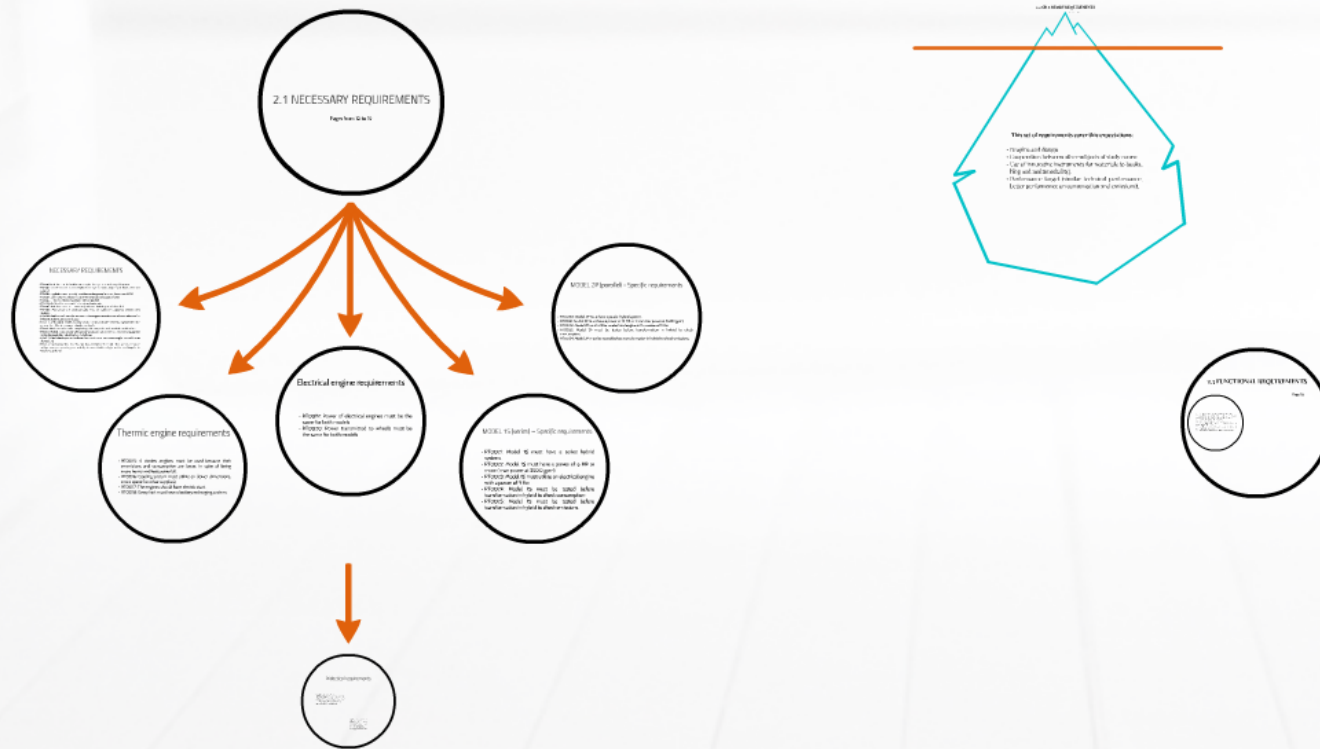


RESULTS

Output of the training model



2. Function and requirements



2.1 NECESSARY REQUIREMENTS

Pages from 12 to 15

NECESSARY REQUIREMENTS

- RT0001: Both karts are built with same engine, likely converted at hybrid system.
- RT0002: Models must wear in full hybrid, as they can work completely in 100% electric if required.
- RT0003: Applied current intensity must be not dangerous for users (lower than 50 V).
- RT0004: Both karts must be certified with a 10.000€ budget for karts.
- RT0005: Karts must be easily moved and transported.
- RT0006: Both karts chassis must have same dimensions.
- RT0007: Both karts must have same weight before hybrid system is installed.
- RT0008: Mechanical and electrical faults must be easily accessible to exercise safe students.
- RT0009: Both models must be returned to the original condition and all materials used for different drivers, given or chosen.
- RT0010: Both hybrid models must be clearly shown and understood by anyone interested in them (ie - electric schemes, limits, back kart).
- RT0011: Models must be built complying with safety rules and standard specifications.
- RT0012: Models must comply with aerodynamics and ground effect, in order to guarantee safety standards after hybrid system installation.
- RT0013: After hybrid system installation both karts must have same weight (max 400kg) allowed by law.
- RT0014: Two testing trials must be executed, an intermediate and a final one to be carried out to compare operating on e-mobility, to correct faults and give motivational impulse to occasional students.

MODEL 2P (parallel) - Specific requirements

- RT0050: Model 2P must have a parallel hybrid system.
- RT0051: Model 2P must have a power of 12 HP or more (max power at 3500 rpm).
- RT0052: Model 2P must utilize an electrical engine with a power of 9 Kw.
- RT0053: Model 2P must be tested before transformation in hybrid to check consumption.
- RT0054: Model 2P must be tested before transformation in hybrid to check emissions.

Electrical engine requirements

- RT0019: Power of electrical engines must be the same for both models
- RT0020: Power transmitted to wheels must be the same for both models

Thermic engine requirements

- RT0015: 4 strokes engines must be used because their emissions and consumption are lower, in spite of being more heavy and less powerful.
- RT0016: Cooling system must utilize air (lower dimensions, more space for other supplies).
- RT0017: The engines should have electric start.
- RT0018: Every kart must have a battery recharging system.

MODEL 1S (series) – Specific requirements

- RT0021: Model 1S must have a series hybrid system.
- RT0022: Model 1S must have a power of 6 HP or more (max power at 3500 rpm)
- RT0023: Model 1S must utilize an electrical engine with a power of 9 Kw.
- RT0024: Model 1S must be tested before transformation in hybrid to check consumption.
- RT0025: Model 1S must be tested before transformation in hybrid to check emissions.



2.1 NECESSARY REQUIREMENTS

Pages from 12 to 15

NECESSARY REQUIREMENTS

- RT0001: Both karts are built with termic engine, lately con verted at hybrid system.
- RT0002: Models must work in full hybrid, as they can work completely in 100% electric if required
- RT0003: Applied current intensity must be not dangerous for users (lower than 50 V)
- RT0004: Both karts must be carried out with a 10.000€ budget or lower.
- RT0005: Karts must be easily moved and transported.
- RT0006: Both karts chassis must have same dimensions.
- RT0007: Both karts must have same weight before hybrid system is installed.
- RT0008: Mechanical and electrical faults must be easily sim ulated to exercise whit students.
- RT0009: Both models must be restored to the original condition and all material reused for different students, groups or classes
- RT0010: Both hybrid models must be clearly shown and unders tood by anyone interested in them. (f.e - Electric schemes linked to each kart)
- RT0011: Models must be build complaining whit safety rules and standard specifications.
- RT0012: Models must comply with aerodynamics and ground effect, in order to guarantee safety standards after hybrid system installation.
- RT0013: After hybrid system installation both karts must have same weight (max difference allowed 5%).
- RT0014: Two testing trials must be executed, an intermediate and a final one to be carried out by companies operating on e-mobility, to correct faults and give motivational impulse to vocational students.

Thermic engine requirements

- RT0015: 4 strokes engines must be used because their emmissions and consumption are lower, in spite of being more heavy and less powerfull.
- RT0016: Cooling system must utilize air (lower dimensions, more space for other supplies).
- RT0017: The engines should have electric start.
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MODEL 2P (parallel) - Specific requirements

- RT0050: Model 2P must have a parallel hybrid system.
- RT0051: Model 2P must have a power of 12 HP or more(max power at 3500 gpm).
- RT0052: Model 2P must utilize an electrical engine with a power of 9 Kw.
- RT0053: Model 2P must be tested before transformation in hybrid to check consumption.
- RT0054: Model 2P must be tested before transformation in hybrid to check emissions.

Didactical requirements

- RD0001: Hybrid transformation have to be realized totally by students.
- RD0002: An electric technology booklet must be produced, covering safety requirements and real materials and technology applied on cars.
- RD0003: Carrying out the activity some informations research and working out phases must be scheduled to point out technologies and building methods applied.
- RD0004: During the model setting, some specific moments to apply brainstorming and problem solving methods have to be scheduled.
- RD0005: In the projecting phase the components scaling (batteries pack, procelle parts, motor wheel...) must be scheduled.
- RD0006: During planning a technical design should be supplied showing electrical and mechanical devices.
- RD0007: During checking and testing phase, relevant test of electrical measures must be scheduled.
- RD0008: During checking and testing phase, relevant trial test must be scheduled to guarantee all mechanical components correct working together whilst the 100 electric running and on board recharging.
- RD0009: During the trial test a research of defects and faults of electro-mechanical devices should be scheduled.
- RD0010: During checking and testing phase, maintenance activity should be scheduled.

- RD0011: During checking and testing phase, emission control should be scheduled.
- RD0012: During checking and testing phase, energy loss control should be scheduled.
- RD0013: Supporting motivation a booklet on safety should be produced.
- RD0014: Supporting motivation a booklet on electric technology should be produced.
- RD0015: The technology booklet should include physics and chemistry knowledge required to fully understand the technology.
- RD0016: The technology booklet should include all mathematical tools needed to fully understand the technology.
- RD0017: Booklet should be easily divided to be provided separately to different persons.
- RD0018: If necessary, booklets should be easily joined in a unique support.
- RD0019: Lessons on safety should last 5 hours.
- RD0020: Lessons on electric and hybrid technology should last 10 hours.
- RD0021: Knowledge about safety rules should be reduced by a specific test.
- RD0022: Knowledge about technology applied in electric and hybrid vehicles should be realized by a specific test.
- RD0023: A practical test on safety should be scheduled, to check their ability to work with the technology.

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- RD0006: During planning a technical design should be suppli ed showing electrical and mechanical devices.
- RD0007: During checking and testing phase, relevant test of electrical measures must be scheduled.
- RD0008: During checking and testing phase, relevant trial test must be scheduled to guarantee all mechanical components corret working together whit the 100 electric running and on board recharging.
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- RD0010: During checking and testing phase, maintenance activity should be scheduled.

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- RD0015: The technology booklet should include, physics and chemistry knowledge required to fully understand the technology.
- RD0016: The technology booklet should include all mathematics needed to fully understand the technology.
- RD0017: Booklet should be easily divided to be provided separately for different purposes.
- RD0018: If necessary, booklets should be easily joined in a unique support
- RD0019: Lessons on safety should last 8 hours.
- RD0020: Lessons on electric and hybrid technology should last 20 hours.
- RD0021: Knowledge about safety rules should be realized by a specific test.
- RD0022: Knowledge about technology applied in electric and hybrid vehicles should be realized by a specific test.
- RD0023: A practical test on trainee should be scheduled, to check their ability to work with this technology.

2.2 SECONDARY REQUIREMENTS

This set of requirements cover this expectations:

- Graphic and design
- Cooperation between other subjects of study course
- Use of innovative instruments for materials (e-books, blog and multimediality).
- Performance target (similar technical performance, better performance on consumption and emissions).

2.2 SECONDARY REQUIREMENTS

Pages from 16 to 17 (21 requirements)



This set of requirements cover this expectations:

- Graphic and design
- Cooperation between other subjects of study course
- Use of innovative instruments for materials (e-books, blog and multimediality).
- Performance target (similar technical performance, better performance on consumption and emissions).

2.3 FUNCTIONAL REQUIREMENTS

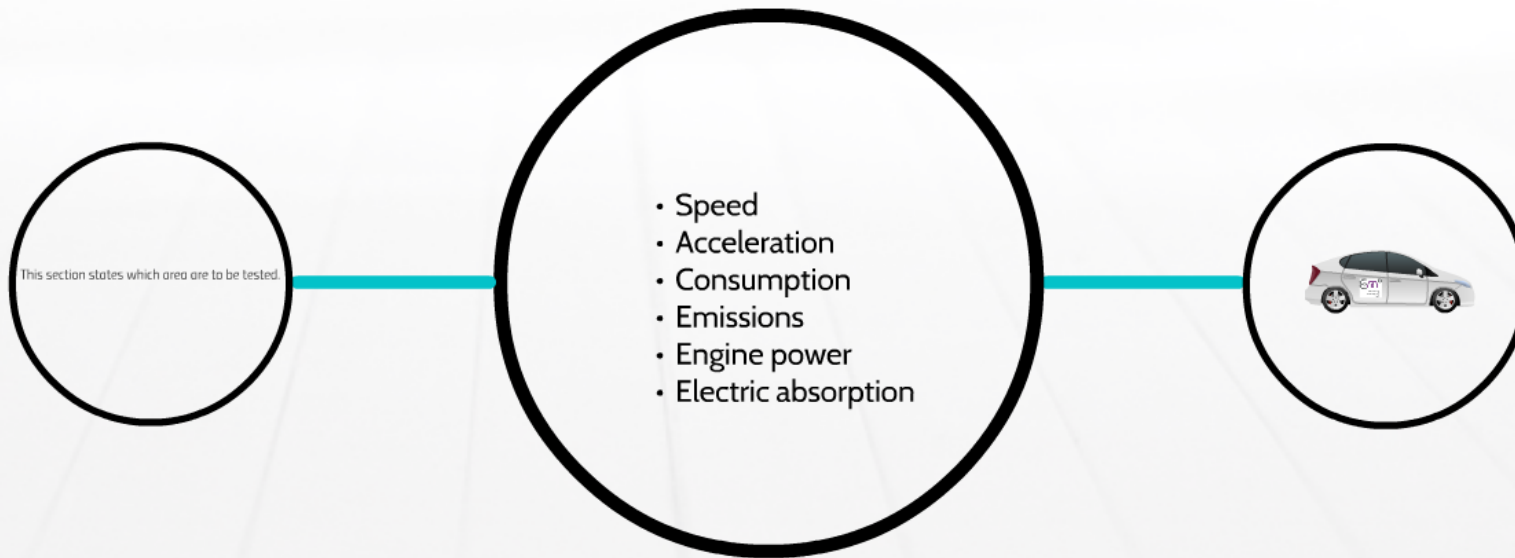
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- RF0001: Utilized Batteries should be Lithium-ion batteries.
- RF0002: Electric induction engines should be used, because costs are lower, reliability is good and performance higher.
- RF0003: Primary engine should be thermic.
- RF0004: Accumulation system should be used.
- RF0005: The kart should work 100% electric if required, and autonomy should be tested.
- RF0006: The kart should work 100% electric if required, and powerfulness should be tested.
- RF0007: Minimum power to work in hybrid should be defined.

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3. Performance requirements

Page 19 - 7 requirements





This section states which area are to be tested.

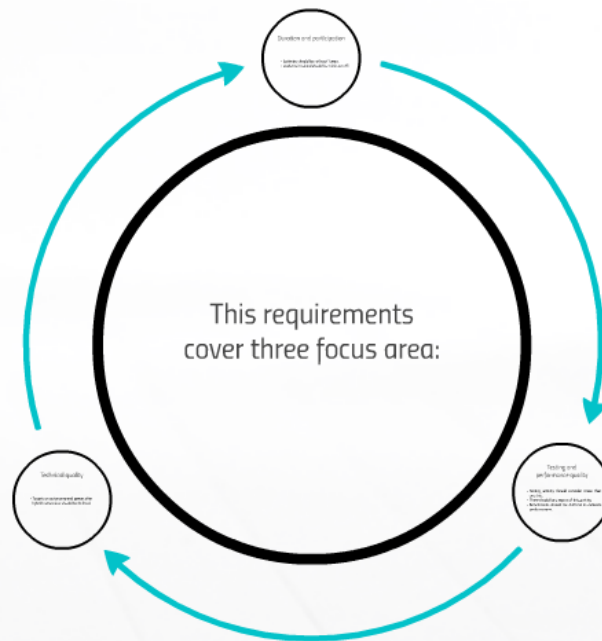
- Speed
- Acceleration
- Consumption
- Emissions
- Engine power
- Electric absorption



em⁺
Learning
e-Mobility
Plus

4. Quality requirements

Page 20 - 9 requirements



This requirements
cover three focus area:

Technical quality

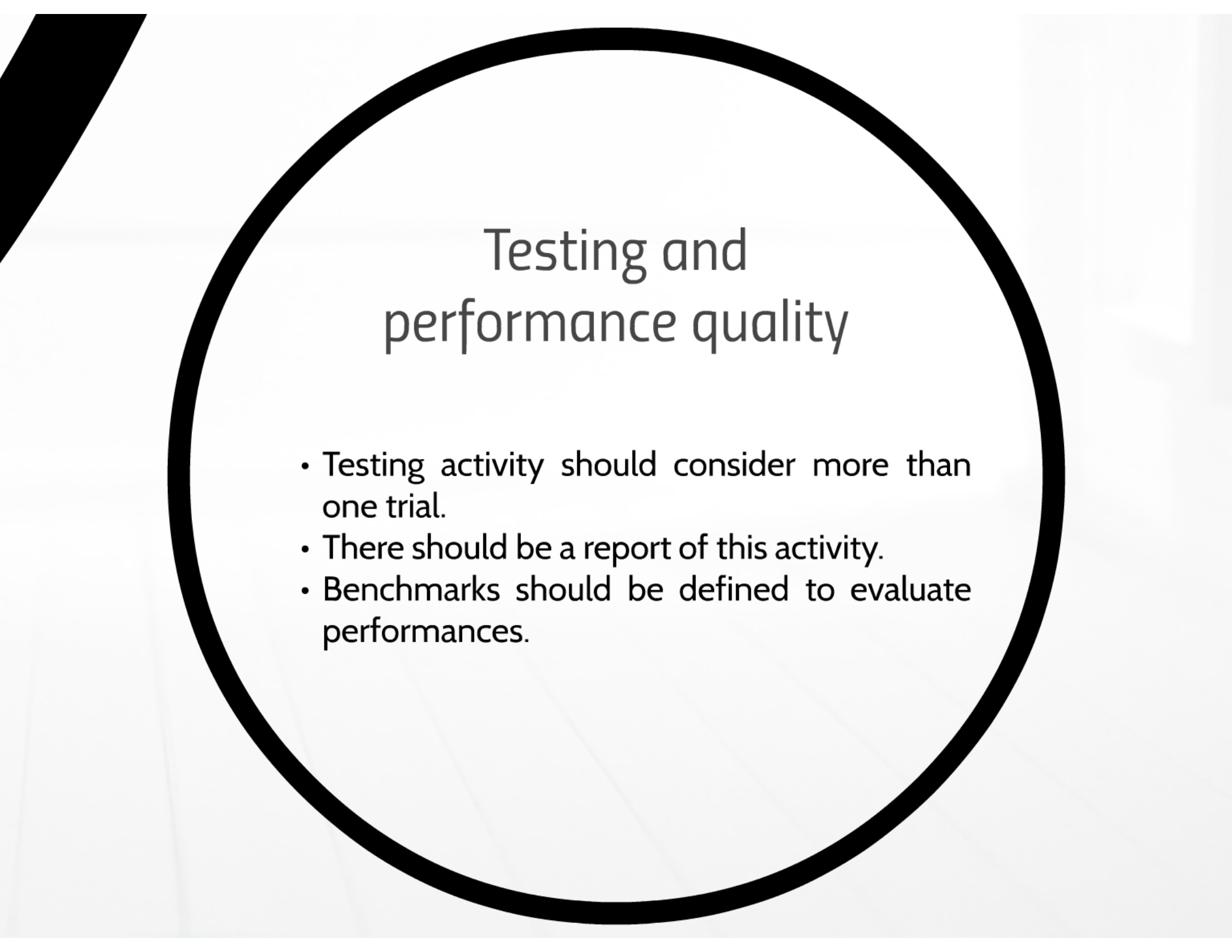
- Targets on autonomy and power after hybrid conversion should be defined.

Testing and
performance quality

- Testing activity should consider more than one trial.
- There should be a report of this activity.
- Benchmarks should be defined to evaluate performances.

Duration and participation

- batteries should last at least 1 years
- students involved should be minimum 15



Testing and performance quality

- Testing activity should consider more than one trial.
- There should be a report of this activity.
- Benchmarks should be defined to evaluate performances.

Technical quality

- Targets on autonomy and power after hybrid conversion should be defined.

5. Other requirements

Page 21 - 6 requirements

This section defines requirements about logo and graphic of models and manuals.

The primary target is to highlight the project and partners logo and to make more interesting the material.

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6. Prerequisites

- This section defines which requirements are needed to successfully participate at this training activity.
- Basic competences in technology of traditional engines (acquired for example during first year of vocational training course)
- Electric background is not requested, requirements would be supplied during activity.



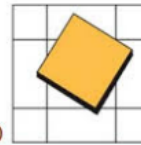
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Credits



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Mauro Marzegan



PIA SOCIETÀ SAN GAETANO