Attractive, Acceptable and Affordable deep Renovation by a consumer orientated and performance evidence-based approach
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Prepared for:
TripleA-reno Consortium partners

Prepared by:
IVE
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28/05/2020
Revision and history chart:

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0 Executive summary

TripleA-reno project is focused on overcoming market barriers for deep renovation. The overall aim is to make acceptance and decision making on deep and nZE renovation attractive for consumers and end-users. TripleA-reno project achieves this aim by developing an open end-user centred gamified platform that:

- foster new consumer and end-user centered business models, using evidence-based performances that facilitate decision-making.
- improve performances of deep renovation by enhanced quality control, supported by targeted CPD and training.
- provide consumers and end-users of deep renovation projects with attractive, understandable, and personalized information of realized real performance; and
- demonstrate the benefits and evidence-based solutions in live demonstration cases.

WP5 is focused on the practical applications of the open gamified platform, the tools, apps, and information/communication services, demonstrating their usefulness, validity and practicability in real environments. The methodologies, tools, business and exploitation models will be demonstrated in real life operating conditions, in 6 cases with following main objectives: the demonstration and the illustration of the approach and methodologies that are used to develop the ICT-tools and services; the demonstration and validation of the usefulness and acceptance of the platform, tools and services; and the demonstration of the additional value of offering combined decision tools, information services and community building.

Therefore, TripleA-reno project objectives addressed by WP5 are:

- New consumer and end-user centered business models and decision support tools (objective 1).
- Improving performances of deep renovation by enhanced quality control, supported by targeted CPD and training (objective 2).
- Providing consumers and end-users of deep renovation projects with attractive, understandable, and personalized information of realized real performance (objective 3).
1 Introduction

The purpose of this task is to establish a common protocol to be applied in each of the demonstrators to validate the TripleA-reno platform. During this process, the TripleA-reno platform will be evaluated with respect to characteristics that can make a tool successful: reliability, usefulness, applicability, acceptance, user-friendliness, and transferability, etc.

Under this scope, this report starts tracing the road ahead for the platform evaluation in the different pilots, according to the users, roles and functionalities envisioned or developed by each partner or related umbrella organization. In this context, the gamification storytelling developed by each partner and reported on Deliverable 6.1 will also be used as an input to determine what functionality of the TripleA-reno platform will be used at which pilot site and when.

The subsequent protocol offers information about how to develop the evaluation of the platform by indicating the specific steps to be followed, the tools and methods that may be used and the results expected to get homogenous information from the different demonstrators. The methods to be used during the campaigns with end-users are surveys, workshops, competitions, etc.

This document is divided into 2 parts. First one on defining the possible evaluation paths for each demo case and/ or umbrella organization; and second one, addressing each specific topic to be evaluated, and their organizational and management matters. As Annexes, it provides a more detailed description on the potential evaluation paths and the questionnaires and templates to be used for the evaluation.
2 Evaluation paths

This report starts tracing the road ahead for the platform evaluation in the different pilots, according to the users, roles and functionalities envisioned or developed by each partner or related umbrella organization. In this context, the gamification storytelling developed by each partner and reported on Deliverable 6.1 is also used as an input to determine what functionality of the TripleA-reno platform will be evaluated at which pilot site and when.

2.1 Related project activities

The evaluation of the platform will be carried out through different experiments performed on each demo case, involving the functionalities and activities previewed in the tasks described below.

2.1.1 WP2 - Targeted information and communication to end-users

Findings of WP2 will be used for developing the platform in WP4, tailoring it to the requirements and needs of people living in different buildings with different social, cultural, historical, and economic backgrounds. The findings will enable to understand behaviour and habits of people from various perspectives and in different settings, especially since we will take into account the “native” point of view and will identify the motivation practices from a “bottom-up” perspective.

This includes qualitative approaches to better understand users’ attitudes and responses to products designed in the project in the context of their home environments. The task will evaluate response of occupants to the interventions done in their homes (sensors and other equipment), effectiveness of tools informing them about IEQ, and possibility for establishing relationships with other stakeholders (building managers, contractors) facilitated by the platform.

Task 2.6. User feedback M25-M36

2.1.2 WP3- Implementing Quality Control

Level 1 Design phase: foreseen functional requirements

- a proven measures WIKI / carrousel with functionality to interact on measures and concepts in the carrousel
- a back-office or data-connector for ‘suppliers’ (open standard)
- a morphological design tool for creating customized nZE renovation concepts
- design missions to train users of the TripleA-reno platform in designing successful nZE concepts
- design functionality to answer on design questions from other TripleA-reno platform users.
- Connection to other databases with experienced building and installation companies

The platform will be designed in a way that new functional requirements can be added later such as a Broker-system for setting up the value chain, links with e-Market places from other projects (e.g. P2Endure).

Level 2 Construction phase: foreseen functional requirements

- API Connection to the ‘self-inspection functionality’ of the BUILD UP Skills advisor app.
• Using the in BUS and CS projects developed qualification framework that facilitates narrowcasting and ‘social connections’ within the TripleA-reno ecosystem.

• **Awarding** of using inspection protocols, earning XP-points by contributing to the protocols, earning XP-points for sharing experience.

• Data-model to facilitate the **learning loops** and in-use experience dialogues.

**Task 3.2 - Functional design of the morphological design functionality M3-M12**

**Task 3.5. Integration of self-inspection protocols and gamified use M9-M18**

**MS3 - Supporting CPD and training, entire value chain for the quality control and labelling M18**

### 2.1.3 **WP4 - End-users centred business models**

The main features within the module are:

• using the results from the **morphological design tool** as a starting point;

• the **energy analysis of buildings and user behavior**, calculation of primary energy required for HVAC, lighting and other energy building requirements;

• the **economic evaluation** showing the return time of the intervention and economic, environmental and social benefits (including climate, health, comfort and security developed on the OGP platform);

• a **comparison** of deep renovation projects and construction of a ranking list based on different indicators of the attractiveness of the interventions, thereby stimulating the competitiveness of the end users among themselves towards potential investors;

• the deep renovation projects’ **publication** on a board accessible to potential investors to arise their interest for the more relevant projects;

• the opportunity given to **investors to directly bid** for the deep renovation realization of the most interesting/attractive projects;

• the possibility for **users to modify their project** in accordance with the offer of investors, to meet the investors’ demand and/or decide to financially contribute to the investment, thus making the project more attractive/competitive, able to “climb” the list of showcased projects and to engage more investors.

The modules will be structured in different workspaces:

1. **consultation** of realized deep renovated buildings
2. **creation** of new deep renovation projects
3. **new projects’ management**
4. showcase of deep renovation projects
5. investor **dashboard**, to track the evolution of their offers
6. certified consultants and professionals’ dashboard.

**Task 4.1. Design and architecture of the open gamified platform M1 – M18 (concept) M36 (final)**

**Task 4.4 Visualization of realized deep-renovated buildings M13 –M18**

**Task 4.5. Plug-in module for the creation of 3D models for new deep renovation projects M13 –M18**
Task 4.6 New project management module M19 – M36

MS4 - Initial version of the TripleAreno open end-users centred gamified platform M18

MS5 - End-user centred business models and plans M24

2.1.4 WP5 - Demonstration and validation of methodologies

WP5 is focused on the practical applications of the open gamified platform, the tools, apps and information/communication services, demonstrating their usefulness, validity and practicability in real environments. The methodologies, tools, business and exploitation models will be demonstrated in real life operating conditions, in seven cases with following main objectives:

1. The demonstration and the illustration of the approach and methodologies that are used to develop the ICT-tools and services by:
   a. The demonstration and evaluation of the open gamified platform during a decision-making process and/or for interactive following of overall performances (energy, IEQ and health) including end-user oriented communication after renovation.
   b. The validation of tools, services and measurements
   c. The improvement and optimization of the platform, tools and services
2. The demonstration and validation of the usefulness and acceptance of the platform, tools and services
3. The demonstration of the additional value of offering combined decision tools, information services and community building.

The results and analyses of the demonstrators will be used as feedback for WP 2, 3 and 4 to adjust and fine-tune the methodologies, tools, services and supporting business models. In the TripleA-reno scope and approach several specific themes are addressed and will be included in WP5:

- New consumer and end-user centered business models and decision support tools (objective 1)
- Improving performances of deep renovation by enhanced quality control, supported by targeted CPD and training (objective 2)
- Providing consumers and end-users of deep renovation projects with attractive, understandable and personalized information of realized real performance (objective 3)

Each demonstration will address at least one specific theme. For each case, a basic monitoring/information campaign will be devised that will be continued after the project duration. Per case, specific campaigns and validations can be added during the project duration. Finally, the results of the validation will be used for further recommendations, especially how to take into account ‘soft measures’ in energy performance regulations.

Task 5.2: Carrying out the monitoring campaigns M9 – M36

Task 5.5: Development of common protocols to evaluate the platform M13 – M24

Task 5.6: Overall evaluation, fine tuning and optimisation integrating occupants' feedback (M24 – M36)

MS6 - Deployment, demonstration and validation in the 7 cases M30
2.1.5 WP6 - Exploitation and EU wide replication

The TripleA-reno exploitation strategy is geared towards an EU wide replication, using the networks of the involved EU umbrella and interest organisations and the networks of their members. This should lead to the benefit of other Member States (not involved in TripleA-reno), and areas, while fostering further cross-border cross-sector developments on a lasting basis. The overall objective of WP 6 is to initiate and organize further exploitation and replication of the project results in order to increase the number of targeted end-users (and finally all end-users across the building value chain) through spill over effect. Implementation of the exploitation strategy facilitates:

- horizontal up-scaling of the methodology to other /new topics
- sustaining the used content within existing tools
- cross-country up-scaling of the methodology to other identified Member States by a free and open methodology, implementation services & a shared open development platform

Task 6.3 Promotion, awareness and exploitation campaigns by the involved EU umbrella organisations, throughout Europe – ‘The TripleA-reno Road Show’ M1–M36

2.2 Building blocks/ ingredients

2.2.1 The Demo cases

This document traces the road ahead for the platform evaluation in the different pilots, according to the users, roles and functionalities envisioned or developed by each partner or related umbrella organization. In this context, the Grant Agreement previewed the role of the different Demo cases end-users in the different levels of the TripleA-reno platform, as can be seen in Table 2.1.

<table>
<thead>
<tr>
<th>Case</th>
<th>Project</th>
<th>Location</th>
<th>No. units</th>
<th>Floor area (m²)</th>
<th>End-user engagement with the TripleA-reno gamified platform</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Level 1</td>
</tr>
<tr>
<td>1</td>
<td>Multifamily building, student housing</td>
<td>Zografou, Greece</td>
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<td>2920 (heated area)</td>
<td>University of Athens as owner</td>
</tr>
<tr>
<td>2</td>
<td>Multifamily buildings, owned by social housing company EIGE</td>
<td>Almoradi (Alicante), Spain</td>
<td>51 (5 blocks)</td>
<td>3554,2</td>
<td>Housing company as owner</td>
</tr>
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<td>Multifamily building, owned by a social housing company ACER</td>
<td>Viale Magenta, Reggio Emilia, Italy</td>
<td>49</td>
<td>4260</td>
<td>Municipality as owner</td>
</tr>
<tr>
<td>3B</td>
<td>Multifamily buildings, publicly</td>
<td>Piazza da Verrazzano, Bologna, Italy</td>
<td>50</td>
<td>4219</td>
<td>Municipality as owner</td>
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<td>----------</td>
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<td>-------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>3C</td>
<td>Multifamily building, owned by a social housing company</td>
<td>Concordia SagitTripleA-renoia, Venice, Italy</td>
<td>Housing company as owner</td>
<td>21</td>
<td>Housing company tenants</td>
</tr>
<tr>
<td>4</td>
<td>Multifamily buildings, mixed ownership and mixed use</td>
<td>Zagorje ob Savi, Slovenia</td>
<td>Tenants and owners</td>
<td>51</td>
<td>4746</td>
</tr>
<tr>
<td>5</td>
<td>Single family dwellings, mixed ownership</td>
<td>Gerardusplein, Eindhoven, the Netherlands</td>
<td>Building construction company in co-creation with the owners</td>
<td>106,000 houses, 1435 dwellings, 20 unites</td>
<td>Building construction company</td>
</tr>
<tr>
<td>6</td>
<td>Multifamily buildings</td>
<td>Szigetszentmiklos (Pest County), Hungary</td>
<td>Condominium Owners</td>
<td>60</td>
<td>3887</td>
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Table 2.1. - Pilots, demonstration and validation phase

On the other hand, according to these data above-mentioned, we can distinguish a set of elements (building blocks) which combine to get the different stories and their related workflows, including who uses the platform, what do they do (or pretend to do) with the platform, and where they do it.
Figure 2-1.- TripleA-reno platform workflow mock-up – level 1 and 2

THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION’S H2020 FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION UNDER GRANT AGREEMENT NO 784972. The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.
Figure 2.2 - TripleA-reno platform workflow mock-up – level 3
To date, to get a clear perspective on the ingredients already on the table and functionality that needs to be developed, the workflow of the TripleA-reno platform mock-up developed on the TripleA-reno Gamification Task Force project on April 12th shows the three levels of the platform clearly distinguished from each other (see Figure 2-2). Inside each of them, already ‘working’ functionality has been shaded green and to be developed functionality has been shaded orange. It becomes clear that both the TripleA-reno portal and the gamification engine are the glue between the levels, while other functionalities are level specific or involve levels 1 and 2.

2.2.2 Users

- End-users (occupants, tenants, owners, municipalities…) – non expert users
- Investors – finally not addressed
- Facilitators (professionals, builders, resellers…) – expert users
- System administrator & focal point

2.2.3 Functionalities

- 1 Registration
- 1 Showcase of projects (candidate)
- 1 Creation of a new project (w/pre-evaluation)
- 1 Management of the project
- 1 Co-design a project (w/evaluation)
- 1 Find facilitator
- 1 Bid for a project
- 1 Investor dashboard
- 1 Facilitator dashboard
- 2 Showcase of projects (in progress)
- 2 Self-inspection
- 2 Formal inspection (w/evaluation)
- 2 Rating
- 2 Progress reporting
- 3 Showcase of projects (finished)
- 3 Asking/answering/grouping
- 3 Monitoring (sensors/evaluation)

2.2.4 Tools, apps & workspaces

- TripleA-reno portal:
  - showcase – carrousel

---

1 Definitions in D4.3: Description of the actions to be taken to communicate and extend the use of the business module
2 Level and functionality from Gamification Taskforce worksession II minutes
**Figure 2-3.** Carousel to finished projects

- **on boarding wizard:** questionnaire → AAA sticker + recommendations

**Figure 2-4.** Onboarding questionnaire (pop-up)

- **registration**
- **co-designer – design wizard with 3D and morphological design** → AAA label + renovation options
Figure 2.5 - 3D module

Figure 2.6 - Morphological design

- project and user(team) dashboards
- building Community – forum, feedback, messaging, rating… → gamification?
• **BUSkills advisory app**

![BUSkills app](image)

**Figure 2-7.- BUSkills app**

• **Board game**: The possibility of using gamified features of TripleA-reno off-line can reinforce the motivation and engagement of certain users

![TripleA-reno board game](image)

**Figure 2-8.- TripleA-reno board game**

• **Professional comfort labeling** tool → AAA label + recommendations and renovation options
2.2.5 The evaluation themes

According to Budapest Workshop outcomes & storytelling inputs from workshop in Rotterdam, the experiences and workflows to be evaluated according to each partner are described below.

- **On-boarding:** Getting users involved with the platform:
  - for the first time,
  - registered, and
  - navigating through the whole TripleA-reno journey

- **Decision making (design):** Helping users deciding on which renovation(s) undertake, by presenting understandable costs and benefits:
  - Getting friendly information about their homes/ buildings
  - Getting a renovation strategy (concepts, measures)
  - Getting tips and recommendations from the easier to the more costly implementation
  - Getting help designing the renovation

- **Quality assurance (realization):** Tracking the realization of the chosen renovation strategy to ensure improvements:
  - Self-inspection
  - Expert inspection and evaluation
  - Training

- **Follow-up:** Keep users involved with the TripleA-reno platform (Looping)
  - Expert assessment of after renovation
  - Sensor monitoring
  - Step by step strategies
  - News and reminders
  - Rakings, comparisons

2.3 Platform evaluation proposal

According to previous information, extracted from the project’s Grant Agreement and actual state of development, it was previewed that the platform evaluation carried out by each Demo Case should address at least one theme from one user role point of view, trying to cover all functionalities and levels provided by the platform. Ideally, all roles, themes and functionalities should be tested and evaluated, but it is to be noted that real implementation of the project, involvement of final users and work progress may lead to a more focussed evaluation just on the core functionalities of the TripleA-reno platform.

In this context, based on partners’ description of their demonstrators, a first approach for the evaluation distribution is described below, but can be adapted by each Demo Case Team according to their actual needs, expectations and state of the works and projects.
2.3.1 Initial distribution

Pilot 1

According to Grant Agreement and actual state of development, the platform evaluation carried out by pilot 1 should address workflows related to users, roles, levels, themes and functionalities depicted in Table 2.2.

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<th>prt</th>
<th>user</th>
<th>name</th>
<th>role</th>
<th>level</th>
<th>theme</th>
<th>functionality</th>
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<tr>
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<td>R&amp;D</td>
<td>University of Athens</td>
<td>end-user</td>
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<td>on-boarding</td>
<td>Registration</td>
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<td>New project (w/pre-evaluation)</td>
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<td>Find facilitator</td>
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<td>follow-up</td>
<td>Asking/answering/grouping</td>
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Table 2.2.- roles, levels, themes and functionalities to be evaluated by pilot 1

Pilot 2

According to Grant Agreement and actual state of development, the platform evaluation carried out by pilot 2 should address workflows related to users, roles, levels, themes and functionalities depicted in Table 2.3.

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<th>role</th>
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<th>theme</th>
<th>functionality</th>
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Table 2.3.- roles, levels, themes and functionalities to be evaluated by pilot 2
Pilot 3

Platform evaluation carried out by pilot cluster 3 should address:

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<tr>
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<td>Registration New project (w/pre-evaluation)</td>
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Table 2.4.- roles, levels, themes and functionalities to be evaluated by pilot cluster 3

Pilot 4

According to Grant Agreement and actual state of development, the platform evaluation carried out by pilot 4 should address workflows related to users, roles, levels, themes and functionalities depicted in Table 2.5.

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Table 2.5.- roles, levels, themes and functionalities to be evaluated by pilot 4

Pilot 5

According to Grant Agreement and actual state of development, the platform evaluation carried out by pilot 5 should address workflows related to users, roles, levels, themes and functionalities depicted in Table 2.6.
Pilot 6

According to Grant Agreement and actual state of development, the platform evaluation carried out by pilot 6 should address workflows related to users, roles, levels, themes and functionalities depicted in Table 2.7.

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</table>

Table 2.6.- roles, levels, themes and functionalities to be evaluated by pilot 5

2.3.2 Workshop

During the meeting/workshop in Budapest, we intended to validate (and/or correct/modify) previous proposal by performing a ‘manual’ evaluation according to it, in order to verify tasks distribution and distil where to allocate missing roles and/or functionalities, if possible and/or needed. For doing so, we proceed as described below:

- Formed teams related to demos
- Distributed building blocks (post-its, chips, cards...) to each team, with all users, functionalities, and workspaces, in different colors and/or sizes, and some extra blank blocks to write on if necessary
- Distributed data sheet with building blocks summary

<table>
<thead>
<tr>
<th>team number</th>
<th>I am a...</th>
<th>acting as...</th>
<th>I want to...</th>
<th>for that I’d use...</th>
<th>in...</th>
</tr>
</thead>
<tbody>
<tr>
<td>pilot number</td>
<td>individual tenant</td>
<td>end-user</td>
<td>start using the platform</td>
<td>Registration</td>
<td>tAr portal</td>
</tr>
<tr>
<td></td>
<td>individual owner</td>
<td>investor</td>
<td>make a decision (design)</td>
<td>Showcase of projects (candidate)</td>
<td>co-creation app</td>
</tr>
<tr>
<td>country</td>
<td>condominium</td>
<td>professional</td>
<td>ensure quality on realization</td>
<td>New project (w/pre-evaluation)</td>
<td>dashboard</td>
</tr>
<tr>
<td>name</td>
<td>individual manager</td>
<td>builder</td>
<td>help other users</td>
<td>Management of the project</td>
<td>skills app</td>
</tr>
<tr>
<td>partners</td>
<td>public association</td>
<td>reseller</td>
<td>Co-design a project (w/evaluation)</td>
<td>Co-design a project (w/evaluation)</td>
<td>community portal</td>
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<tr>
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<td>private association</td>
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<td>Investor dashboard</td>
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<tr>
<td></td>
<td>private company</td>
<td>agency</td>
<td>Facilitator dashboard</td>
<td>Facilitator dashboard</td>
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<td>Showcase of projects (in progress)</td>
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<td>Showcase of projects (finished)</td>
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<td>Asking/answering/grouping</td>
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</tbody>
</table>

**Figure 2.9.- building blocks summary**

- Distributed board to arrange building block, write or paint
- Explained themes (experiments) that they should approach on-boarding/ decision-making/ improving process/ follow-up (loop)
- Teamwork:
  1. Select user (I am a...)
  2. Select role (acting as...)
  3. Select experiment (I want to...)
  4. Select functionalities according to experiment (I’d use...)
  5. Select workspace (in...)
  6. Design experiment: group/ include/ connect/ order (arrows) building blocks
- Showed platform scheme poster:
  1. Compare/ comment/ modify experiment

**2.3.3 Proposal**

As per all the above mentioned, we envision 6 evaluation paths, that will be distributed among the demonstrators according to their resources and project expectations and needs, considering the working session results.

---

1 Workspaces as previewed at that project stage
These are:
1. All user-roles start using the platform (levels 1, 2 and 3)
2. End-users’ Decision support system – basic version (level 1)
3. Facilitators Decision support system – advanced version (level 1)
4. End-users’ renovation quality assurance – basic version or assisted (level 2)
5. Facilitators renovation quality assurance – advanced version (level 2)
6. All user-roles networking and performance follow-up (level 3)

<table>
<thead>
<tr>
<th>pilot</th>
<th>role</th>
<th>theme</th>
<th>functionality</th>
<th>level</th>
<th>workspace</th>
</tr>
</thead>
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<td>end-user</td>
<td>start using the platform (onboarding)</td>
<td>Registration</td>
<td>1</td>
<td>carrousel</td>
</tr>
<tr>
<td>2</td>
<td>investor</td>
<td>make a decision (design)</td>
<td>Co-design a project (w/evaluation)</td>
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<td>onboard wizz</td>
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<tr>
<td>3</td>
<td>professional</td>
<td>quality assurance (realization)</td>
<td>Formal inspection (w/evaluation)</td>
<td>2</td>
<td>design wizz</td>
</tr>
<tr>
<td>4</td>
<td>builder</td>
<td>collaborating &amp; networking (follow-up)</td>
<td>Ask for projects</td>
<td></td>
<td>board game</td>
</tr>
<tr>
<td>5</td>
<td>reseller</td>
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<td>Investor dashboard</td>
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<td>label pro</td>
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<td>6</td>
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<td>BUSkills app</td>
</tr>
</tbody>
</table>

Figure 2-10.- roles, themes, functionalities and levels to be tested

Their schemes based on Figure 2-10 can be found on Annex 1: evaluation paths.

Therefore, each Demo Case Team should evaluate at least two paths: all of their related users’ roles start using the platform (1: carrousel/ onboarding wizard/ board game), and another one fitting their demo case specificities: either end-users’ or professionals (non-expert or expert users) decision support system (2,3: design wizard/ label pro), renovation quality assurance (4,5: BUS/ sensor connectivity) or performance follow-up (6: external software and/or hardware).
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<tr>
<td>2</td>
<td>1</td>
<td>Builders</td>
<td>Professional (expert)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Quality assurance</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>Condominium</td>
<td>End-user (non-expert)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Decision making</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>HVAC engineers</td>
<td>Professional (expert)</td>
</tr>
</tbody>
</table>

Table 2.8.- Evaluation paths proposal for each demo case
3 Evaluation process

The subsequent protocol offers information about how to develop the evaluation of the platform by indicating the specific steps to be followed, the tools and methods that may be used and the results expected to get homogenous information from the different demonstrators.

It is to be noted, that several planned meetings, events and even refurbishments can be postponed because of COVID-19 situation and therefore some parts of the evaluation process might be altered. A contingency plan is in preparation for this eventuality, including measures such as testing similar buildings in the neighbourhood which has been recently refurbished.

3.1 Internal aspects

The aim is to evaluate TripleA-reno System regarding those internal aspects that can make a tool successful such as reliability, usefulness, and user-friendliness and, and thus, applicability.

3.1.1 Reliability

The purpose is to establish a common protocol that each Demo case will follow to evaluate reliability of TripleA-reno platform. That means participants will evaluate Reliability of TripleA-reno tools through the demos cases’ buildings, by comparing expert inspections and monitoring results (in ex-ante and ex-post conditions, if possible) with prognostics from TripleA-reno system, for validation and fine-tuning purposes.

This is done through the Annex 2: **Questionnaire templates for Reliability**, which includes all the information that needs to be checked by comparing inspected and monitored results with prognostics from TripleA-reno platform, answering the questions:

Is the information....

- Complete? The information covers all aspects agreed.
- Consistent? There are no contradictions among different pieces of information.
- Precise? The information is not vague; there is a single interpretation; the meaning of each item can be understood; the terms used are well-defined and the information is enough.
- Accurate? The information is free from error or defect. The information is consistent with the monitored results of the renovated buildings. This comparison generates results with a tolerance <= a level of tolerance established in percentage.

3.1.2 Applicability

The purpose is to establish a common protocol that each Demo Case will follow to evaluate applicability of TripleA-reno tools. In this case, usefulness (whether the system helps the user to achieve their goals and whether the system incorporates the functionalities that the user needs) and user-friendliness of the system will be evaluated, for validation and fine-tuning purposes.
This is done through the Annex 2: **Questionnaire templates for Applicability**, including all the information that needs to be checked with respect to the applicability of TripleA-reno system. E.g.: Is the information provided by the system or the system...

- Relevant? The information provided is relevant to potential users. The information provided helps the user to achieve their goals regarding the development/implementation/following-up of a renovation.
- Useful or functional? The system incorporates the functionalities that the user needs to attain their goals. The system incorporates the functionalities that are key for the development/implementation/following-up of a renovation.
- User-friendly and ergonomic? The information provided is understandable by potential users. The interface between the user and the TripleA-reno system is well-designed; that includes, among others, the design of dialogs, inputs and outputs provided by the system. The system is easy to use avoiding confusion among users. The system provides an acceptable response time.

### 3.1.3 Testing Sessions

Near the end of testing the TripleA-reno project, participant partners will organise focus-group meetings on energy renovation. This activity corresponds to T2.6 but it will also be used to evaluate TripleA-reno System in T5.6. Task 2.6 will use qualitative approaches to better understand users’ attitudes and responses to products designed in the project in the context of their home environments. The task will evaluate response of occupants to the interventions done in their homes (sensors and other equipment), effectiveness of tools informing them about IEQ, and possibility for establishing relationships with other stakeholders (building managers, contractors) facilitated by the platform. 7 focus groups and 21 interviews will be conducted with people from case studies. Questions will be partly open, allowing the interviewees to open new topics of conversation. Recommendations for future improvement of the IT solutions will be prepared.

Therefore, when applicable, Demos Cases Leaders can use these sessions in order to also get the inputs for reliability and applicability verifications.

Instructions on how to carry out the verification sessions are described below:

1. A number of participants (1-3 when interviews, 4-15 when focus groups) fitting the evaluation path user and role will be invited to perform the test on a place and date
2. They will be assisted by a TripleA-reno project representative (Demo Case Leader), who will:
   - Briefly present the project
   - Briefly present the tools to be evaluated
   - Communicate to participants that their participation will be anonymously reported and summarized and that some pictures will be taken.
3. If needed, teams will be formed, in order to distribute the tools to be evaluated
4. Participants will then:
   - First, navigate the tool without any other instruction
   - Then, try to perform a specific task (mission) provided by the TripleA-reno representative without help
   - Finally, perform the task step by step as TripleA-reno representative indicates
5. TripleA-reno representative will then briefly present the objective of the evaluation and distribute corresponding questionnaires from Annex 2: Questionnaire templates.
3.2 External aspects

The aim is to evaluate TripleA-reno System regarding those external aspects that can make a tool successful such as transferability and thus, replicability and exploitability.

3.2.1 Transferability

The purpose is establishing a common protocol that each participant partner will follow to work with different stakeholders (from public administrations and from private energy sector) in order to evaluate transferability of TripleA-reno tools. Partners will work on further provision for system’s applicability to other stakeholders outside the TripleA-reno project ecosystem. That means to collect their expectations and needs as potential users of TripleA-reno system in order to account for stakeholders’ views in the evaluation/fine-tuning process. This activity is connected with Task 2.6 and Task 6.3.

Near the end of testing the TripleA-reno project, participant partners will organise focus-group meetings on energy renovation. This activity corresponds to T2.6 but it will also be also used to evaluate TripleA-reno System in T5.6. Task 2.6 will use qualitative approaches to better understand users’ attitudes and responses to products designed in the project in the context of their home environments. The task will evaluate response of occupants to the interventions done in their homes (sensors and other equipment), effectiveness of tools informing them about IEQ, and possibility for establishing relationships with other stakeholders (building managers, contractors) facilitated by the platform. 7 focus groups and 21 interviews will be conducted with people from case studies. Questions will be partly open, allowing the interviewees to open new topics of conversation. Recommendations for future improvement of the IT solutions will be prepared.

Therefore, when applicable, Demos Cases Leaders can use these sessions in order to also get the inputs for transferability verifications.

On the other hand, TripleA-reno will also organise portability campaigns whose specific aim is to extend the experience of users’ interaction with project’s outputs beyond the partnership. This activity corresponds to Task 6.3 but it will be also used to evaluate TripleA-reno System.

Task 6.3 Promotion, awareness and exploitation campaigns by the involved EU umbrella organisations, throughout Europe – ‘The TripleA-reno Road Show’ aims to implement, exploit and promote the TripleA-reno results for end-users on a wide European scale, by the five involved European umbrella associations. They will organise awareness raising events throughout Europe and will promote TripleA-reno as an ‘ecosystem’ of suppliers and consumers where value chains are brokered with the suppliers to the consumers.

- 4 workshops aiming at awareness raising. The main aim is the promotion of the platform, promote and raise awareness on the labelling of total real (evidence-based) performances and get feedback of the members of the usefulness of these outputs
- 4 training workshops on how to use the gamified end-users’ platform
• 4 awareness raising events. The main aim is to promote the platform, the labelling schemes and raise awareness of controllable benefits of a renovation.
• 4 workshops. to discuss about the labelling and qualification schemes to be used in the gamified platform, in order to reach consensus and involve HVAC experts in the future exploitation of these schemes in other contexts.
• 1 international training workshop inviting representatives from Twenty Cities. During the event the participants will have the opportunity to test the gamified end-users’ platform and provide feedback

Also, every demo case holder made a video on each demo building and COVID-19 situation transformed the ‘Road show’ into a “Home-show” event, where 30’ interviews were made to each TripleA-reno partner. These videos are available on TripleA-reno’s social media channels, from which we could get valuable feedback.

3.2.2 Discussion Sessions

These will be done through a two-steps process: first, the Annex 2: Questionnaire templatesAnnex 2: for Transferability will be distributed among focus group meeting participants before carrying out these focus groups meetings, because:

• These meetings usually last one or two hours, so the time for questions is limited.
• This previous survey will give us information to guide the issues that will be addressed during the focus group meetings and will help to start the discussion if the group of participants is not very dynamic.
• Questions in this survey can be adapted depending on the participants’ profile

Then, the Transferability focus-groups Meetings will proceed within the next steps:

1. Several participants (4 to 15) fitting the evaluation path user and role will be invited to perform the test on a place and date
2. They will be assisted by a TripleA-reno project representative (Demo Case Leader), who will:
   - Present TripleA-reno project.
   - Present the pre-survey’s results focusing on summarizing the main issues that hinder the development of energy renovation at regional/ local scale.
   - Present TripleA-reno tools:
     - How TripleA-reno outputs confront issues identified,
     - TripleA-reno functionalities and how to use them.
     - Experiences and how TripleA-reno can facilitate realization of reliable and affordable renovations.
3. An open discussion will follow

Focus groups aim at a discussion instead of on individual responses to formal questions, and produce qualitative data (preferences, needs, etc.) as well as their ideas on how TripleA-reno tools could be improved. During the focus groups, open questions will be asked in an interactive group setting to obtain information not only about transferability, but also further information about reliability and usefulness of the tools.

This information will be checked by Demo Case Leaders and sent to Task 5.6 (Overall evaluation, fine tuning and optimisation of the TripleA-reno Open Gamified Platform integrating occupants’ feedback) Leader by using the Annex 3: Report Template provided in order to fine-tune the TripleA-reno System.
A. Annex 1: evaluation paths

Figure A-1.- evaluation path 1: All user-roles start using the platform (levels 1, 2 and 3)

Figure A-2.- evaluation path 2: End-users’ Decision support system – basic version (level 1)
Figure A-3.- evaluation path 3: Facilitators Decision support system – advanced version (level 1)

Figure A-4.- evaluation paths 4 & 5: End-users quality assurance – basic version or assisted (level 2) & Facilitators quality assurance – advanced version (level 2)
Figure A-5. Evaluation path 6: All user-roles networking and performance follow-up (level 3)
B. Annex 2: Questionnaire templates

Pre-survey
(for reliability, applicability, and transferability)

Personal Information

Age

- □ 20-30
- □ 31-40
- □ 41-50
- □ 51-60
- □ >61

Educational Attainment

- □ Bachelor’s Degree
- □ Master’s Degree
- □ Doctoral Degree
- □ Other:

What is your profession:

Motivations

Rate below the level of causality (1-Not Existing, 5-Very High) for each decision factor motivating renovation

1. Financial savings (e.g. lower energy bills)
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

2. Improving aesthetic
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

3. Improving health, wellbeing, and indoor environmental quality
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

4. Increased value of the property after renovation
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

5. Environment (e.g. renewable energy, reducing CO2 emissions)
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

6. Other:

Barriers

Rate below the level of causality (1-Not Existing, 5-Very High) for each barrier against energy renovation

1. Achieving common and jointly agreed decisions (in household, building etc.)
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

2. Legal barriers
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5

3. Costs
   - □ 1
   - □ 2
   - □ 3
   - □ 4
   - □ 5
4. Other:

_____________________________________________________________________________________

**Triggers**

Rate below the level of causality (1-Not Existing, 5-Very High) for each *trigger that could spark an interest in energy renovation*

<table>
<thead>
<tr>
<th>Trigger</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real time visualization of energy and comfort performances</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Receiving warnings and recommendations when your performance trespasses</td>
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</tr>
<tr>
<td>Getting a one-time report on energy and comfort performance with different renovation strategies</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Getting information about other homes achievements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_____________________________________________________________________________________

**Challenges**

Rate below the level of causality (1-Not Existing, 5-Very High) for each *external reason that prevents energy upgrading of residential buildings*

<table>
<thead>
<tr>
<th>Challenge</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence of realistic and affordable political action plans for the energy upgrade of residential building stock</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of funding, financing, or subsidies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak cognitive level of buildings’ representatives (owners, managers, administrators...) for energy issues (project preparation / technical specifications, management, receipt, monitoring)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak cognitive level of builders and employees for energy performance issues</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Time-consuming and demanding management processes for the implementation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

_____________________________________________________________________________________

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Reliability Questionnaire

Think of your previous experience: what was explained to you; which mission you were entitled with; how did you accomplish it; and focus on the result you got (tables, stickers, labels, renovation strategies....)

Completeness
Rate below the level of accordance (1-Not at all, 5-Completely) with each of the statements below, related to the results you got (sticker, label, renovation strategy....)

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The information covered all the aspects explained in the project and tool presentation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. All the data fields were complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Consistency, Uniqueness & Validity
Rate below the level of accordance (1-Not at all, 5-Completely) with each of the statements below, related to the results you got (sticker, label, renovation strategy....)

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There were no contradictions among different pieces of information.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. If you had the chance to perform different missions on the same dwelling, there was a difference, when comparing the results (sticker, label, renovation strategy....).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. If you had the chance to repeat one mission, there was no difference, when comparing the results (sticker, label, renovation strategy....).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. If you had the chance to repeat the mission assigned to you, or correct it, your results (sticker, label, renovation strategy....) overwrote the previous one and got the same identifier</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Data were valid and conform to the syntax (units, format, type, range) of its definition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Accuracy

Rate below the level of accordance (1-Not at all, 5-Completely) with each of the statements below, related to the results you got (sticker, label, renovation strategy....)

1. The information provided was not vague; there was a single interpretation
   - □ 1  □ 2  □ 3  □ 4  □ 5

2. The meaning of each item could be easily understood
   - □ 1  □ 2  □ 3  □ 4  □ 5

3. The terms used were well-defined and auto descriptive
   - □ 1  □ 2  □ 3  □ 4  □ 5

4. The information and/or explanations were enough
   - □ 1  □ 2  □ 3  □ 4  □ 5

5. The information was free from error or defect
   - □ 1  □ 2  □ 3  □ 4  □ 5

6. The information was consistent with your previous knowledge about the dwelling (data correctly described the dwelling)
   - □ 1  □ 2  □ 3  □ 4  □ 5
Applicability Questionnaire

Think of your previous experience: what was explained to you; which mission you were entitled with; how did you accomplish it; and the result you got (tables, stickers, labels, renovation strategies....)

Relevance

Rate below the level of accordance (1-Not at all, 5-Completely) with each of the statements below:

1. The information provided during the process helped you to achieve your objective
   □ 1 □ 2 □ 3 □ 4 □ 5

2. The information provided in the result was of your interest
   □ 1 □ 2 □ 3 □ 4 □ 5

3. The information provided in the result helped you with the decision of undertaking a renovation
   □ 1 □ 2 □ 3 □ 4 □ 5

Functionality

Rate below the level of accordance (1-Not at all, 5-Completely) with each of the statements below:

1. The system incorporates the functionalities you needed to attain your mission goals.
   □ 1 □ 2 □ 3 □ 4 □ 5

2. The system incorporates the functionalities that are key for awareness of the need for a renovation
   □ 1 □ 2 □ 3 □ 4 □ 5

3. The system incorporates the functionalities that are key for awareness of the benefits of a renovation
   □ 1 □ 2 □ 3 □ 4 □ 5

4. The system incorporates the functionalities that are key for the design of a renovation
   □ 1 □ 2 □ 3 □ 4 □ 5

5. Evaluate the degree of difficulty in collecting/ finding the requested data for using the TripleA-reno tools.
   □ LOW □ MEDIUM □ HIGH

6. Evaluate the number of the items requested to be input into TripleA-reno tools to get an evaluation on a scale from 1-Prohibitively large to 5-Adequate
   □ 1 □ 2 □ 3 □ 4 □ 5

7. Would you add other functionalities?

---

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Usefulness

1. Evaluate the adequacy of the descriptions and characteristics of the Demo case buildings from the carrousel allowing to relate to your own building.
   □ ADEQUATE □ RELATIVELY ADEQUATE □ NOT ADEQUATE
2. Evaluate the utility of TripleA-reno tools, in particular the renovation options and recommendations provided, in relation to the management needs of your building and the need of a realistic and cost-effective plan for its gradual energy upgrading, on a scale from 1-not useful to 5-Totally Useful.
   □ 1 □ 2 □ 3 □ 4 □ >5
3. Evaluate the usefulness of the step by step strategy, from small scale renovation to deep renovation on a scale of 1-No Usefulness to 5-Great Usefulness.
   □ 1 □ 2 □ 3 □ 4 □ >5
4. Evaluate the usefulness of the combined label / sticker, including energy, comfort and indoor environmental quality, on a scale of 1-No Usefulness to 5-Great Usefulness.
   □ 1 □ 2 □ 3 □ 4 □ >5
5. Do you consider that the proposed parameters for filtering building’ renovation strategies are sufficient to support decision making?
   □ NOT ENOUGH □ FAIR □ TOO MANY
6. Report other possible shortcomings and suggest possible improvements to the proposed applications:
   …………………………………………………………………………………………………………………………………………………………………………

User-friendliness

1. Evaluate the usability of TripleA-reno tools on a scale from 1-very difficult to use to 5-very easy to use.
   □ 1 □ 2 □ 3 □ 4 □ 5
2. Do you identify the elements and colours for TripleA-reno tools with the concepts of decision making, residential buildings and energy renovation?
   □ YES □ PARTIALLY □ NO
3. Do you think the philosophy of TripleA-reno tools is clear and easy to understand, avoiding confusion among users?
   □ YES □ PARTIALLY □ NO
4. Do you consider that the required input data are sufficient and adequate to properly prioritize renovation strategies and energy upgrade scenarios?
   □ YES □ PARTIALLY □ NO
5. Evaluate the ease of understanding of the requested input elements in the tools on a scale from 1-not understandable to 5-Fully comprehensible.
   □ 1 □ 2 □ 3 □ 4 □ 5
6. Evaluate the **correctness** of TripleA-reno tools language and dialogs on a scale from 1-Not correct to 5-Absolutely correct.

   □ 1 □ 2 □ 3 □ 4 □ 5

7. Do you feel that **TripleA-reno tools talk to you**? (consider your age, profession, gender, income level, house typology, etc....)

   □ YES □ PARTIALLY □ NO

8. Evaluate the **ease of understanding of the results** of TripleA-reno tools on a scale from 1-Unclear to 5-Fully understandable.

   □ 1 □ 2 □ 3 □ 4 □ 5

9. Evaluate the **response time** of TripleA-reno tools on a scale from 1-Unacceptable to 5 Adequate.

   □ 1 □ 2 □ 3 □ 4 □ 5

**Transferability Questionnaire**

(questions to be answered as focus group conclusion)

**Potential**

*From your point of view, which obstacles can be overcome by implementing TripleA-reno tools for the energy upgrade of residential buildings?*

   □ Absence of realistic and affordable political action plans for energy upgrade of residential building stock
   □ Lack of funding, financing, or subsidies
   □ Weak cognitive level of buildings’ representatives (owners, managers, administrators...) for energy issues
   □ Weak cognitive level of builders and employees for energy performance issues
   □ Time-consuming and demanding management processes for the implementation

Report other obstacles that you think can be overcome by implementing TripleA-reno tools:

**Adoption**

*To what extent would you adopt the TripleA-reno tools as part of your role for the energy upgrading of residential buildings?*

   □ Not at all
   □ For designing each energy upgrade building project
   □ For designing the energy performance plan of the residential building stock
   □ For monitoring the performance indicators and benefits of energy renovation in implemented projects
   □ For showcasing the energy performance indicators and benefits of energy renovation on my regional/local residential stock

Other:

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**Sample Missions**

<table>
<thead>
<tr>
<th>n</th>
<th>paths</th>
<th>mission</th>
<th>tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Find a project/ building which is/ has...</td>
<td>Carrousel</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Start an evaluation</td>
<td>On boarding Wizard</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Share your pre-evaluation</td>
<td>On boarding Wizard</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Compare results if you were to change something...</td>
<td>Board Game</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>Find a renovation strategy which accomplishes...</td>
<td>Design Wizard</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>Design a renovation strategy which accomplishes...</td>
<td>Design wizard</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>Get an estimated AAA label</td>
<td>Label pro</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>Compare renovation strategy results with actual results</td>
<td>Design wizard &amp; Label pro</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>Find a training for you</td>
<td>BUS app</td>
</tr>
<tr>
<td>10</td>
<td>4</td>
<td>Check work done at your home...</td>
<td>BUS app</td>
</tr>
<tr>
<td>11</td>
<td>5</td>
<td>Find a training program fitting...</td>
<td>BUS app</td>
</tr>
<tr>
<td>12</td>
<td>5</td>
<td>Check your work...</td>
<td>BUS app</td>
</tr>
<tr>
<td>13</td>
<td>6</td>
<td>Find a peak energy consumption and/or discomfort situation and try to find out what were you doing...</td>
<td>External sensor dashboards</td>
</tr>
</tbody>
</table>

Table B.1.- Sample Missions according to evaluation paths

Each Demo Case Leader should complete and adapt the chosen missions and test them before the evaluation session. If any material is needed, it should be prepared for distribution at the corresponding step of the evaluation session.
C. Annex 3: Report Template

(each partner should deliver a document describing their evaluation activities according to the scheme below)

Presentation

Pilot & Team
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Materials handled
Hard copies & Transcriptions
Photographic report
References