

# Applying Visionary Concept Design to Energy Efficient Residential Areas

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## INTRODUCTION

In the EU 40% of the energy consumption and 36% of CO<sub>2</sub> emissions are related to the buildings (European Commission). Therefore, the energy efficiency of the buildings, and broadly thinking residential areas, have a remarkable role when looking for solutions to the problems caused by climate change.

In this paper we will focus on energy efficiency of residential areas. By definition a residential area is a physical and functional entity containing building blocks and also public and commercial services, such as groceries, day nurseries, schools, parks and recreation areas within the walk distance. The case areas in this paper consist of three residential areas in Finland which are in different phases of their life cycle.

The framework for this paper consists of futures research combined to participatory design. The timeframe is reaching up to the future for the next 30 years. As a methodological tool we apply visionary concept design (Kokkonen et al. 2005; Meristö et al. 2009). The data collection for future scenarios forming the basis for the visionary concept design process took place in a futurology study course held for 25 MBA students in Laurea University of Applied Sciences during spring 2016. The students working in smaller groups collected data and created alternative scenarios and visionary concepts for all three residential areas.

This aim of this paper is to introduce the methodological process and its outcomes.. The results will open new views to the future when developing energy efficient residential areas from different perspectives including logistics, housing, energy, place and space, demographics, services, construction and safety & security. The results include also trends collected as background information for the scenarios. As a conclusion, a set of scenarios with visionary concepts will be presented.

## RESEARCH DESIGN

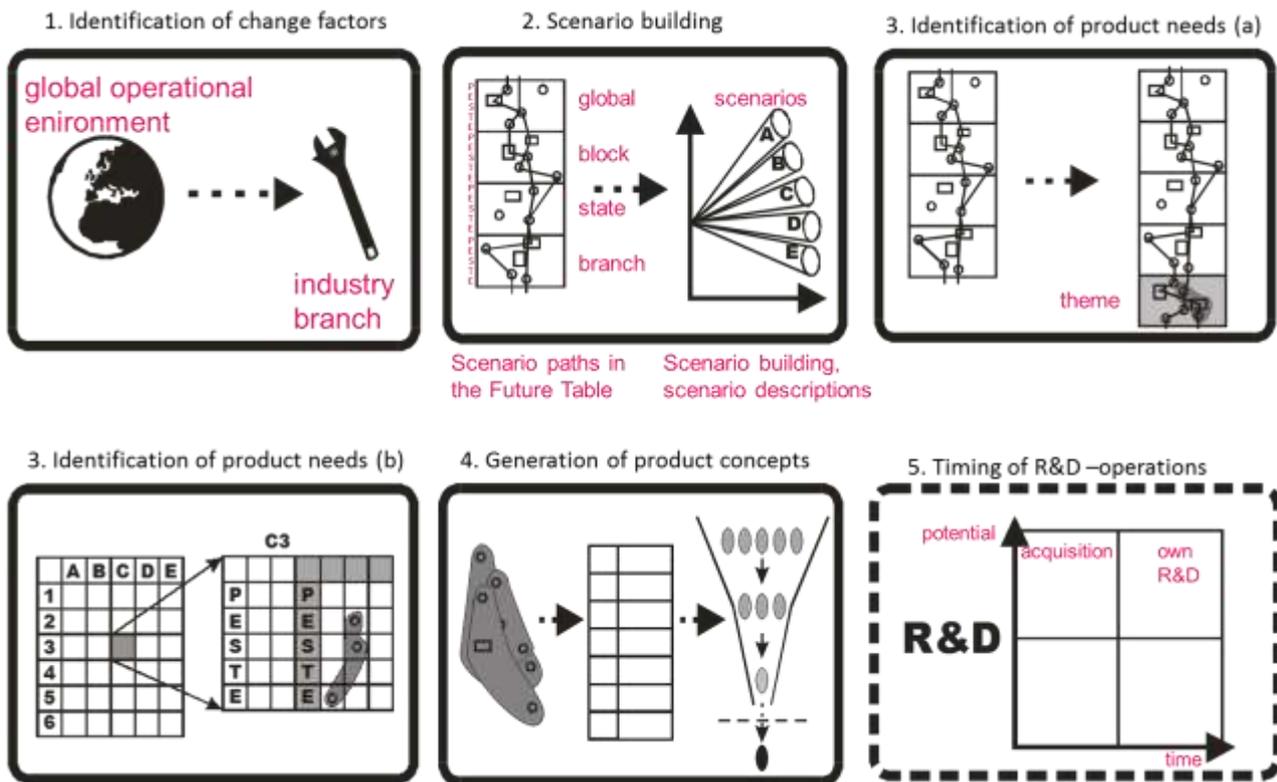
The framework for this paper consists of futures research combined to participatory design. The timeframe is reaching up to the future for the next 20 years. The focus of this paper is in three research questions:

1. What are the drivers formulating the future alternatives for energy efficient residential areas?
2. How can thematic scenario alternatives support the participatory design?
3. What are the concrete visionary concepts supporting energy efficiency in the case areas?

The methods applied in this study are scenario approach and visionary concept design. Scenario working is a method within the field of futures research (Bell 1997, Masini 1993). Scenario working includes mapping alternative futures, identifying factors and development paths leading to different future outcomes. The action scenario approach (Meristö 1989) incorporates also the evaluation of the significance of the scenarios for the user. Finally, based on the evaluation necessary actions are suggested.

Scenarios are descriptions of different futures. Besides including the description of the competitive environment with factors like politics, economy, society, technology and environment the approach also incorporates the process of development. Scenarios are different from forecasts, as scenarios are usually not measured by their probability of occurrence (Schwartz 1996). Scenarios are not either exact descriptions of the future; they are rather verbal descriptions of both qualitative and quantitative nature. Our framework is based on a multiple scenario approach i.e. at least two alternative scenarios are constructed. Furthermore, each scenario leads to various possible choices of strategies and alternative visionary concepts based on need in alternative futures (Kokkonen et al. 2005).

The method for creating visionary future product concepts consists of five main steps (Figure 1). The first step is the identification of change factors, which forms basis for the second step i.e. scenario building. The third step is the identification of product needs in each scenario. The fourth step is the actual generation of future product concepts based on the market need identified in each scenario. The fifth and last step of the method is the timing of R&D –activities and operations. This step also includes other considerations concerning the contribution the visionary concepts might have to the company's business planning or strategy (Kokkonen et al. 2005).



**Figure 1.** The five main steps to create visionary concepts (adapted from Kokkonen et. al. 2005).

External change factors build up the framework for the scenarios and also for the visionary concepts. However, the factors are interrelated with the actors, and that's why pure objective knowledge about factors is not enough. Different actors have different interests, aims and needs. Therefore, it is important to take this actor-view into consideration when creating scenarios for the visionary concepts. It is preferable that the same group of people who are generating future concepts are also building the scenarios for the basis of the concepts phase. When people have involved into the process from the very beginning they have time to assimilate the content of the scenarios. This boosts group members to create more and better ideas in the phase of concept generation (Leppimäki et. al. 2008).

There are several ways to present and illustrate the visionary concepts. However, the concept description should include at least the main features of the concept, estimations on its market potential and technical feasibility. These are the main dimension of the concept by which also a picture of the future operational environment is depicted. Also illustrations, sketches, animations or other visual presentation material are excellent ways to communicate the concepts and related ideas (Leppimäki et. al. 2008).

The time perspective of the visionary concepts is long. Therefore, they are targeted to the markets of the future, realized with the technology of the future and guided by societal norms and legislation of the future. Consequently, some details and features of the concept are difficult to describe and are more or less a matter of imagination. Several benefits arise from the long time range which is essential feature in visionary concepts. To begin with, visionary concepts enable systematic examination of alternative future developments because future scenarios are illustrations of the operational environment in the future. It also takes into

account the driving forces (e.g. changes in values, technological breakthroughs and new markets) as well as market potential, uncertainty and challenges related to future in alternative scenarios. Moreover, visionary concepts enable product concept design and R&D for the future, over next product generation visualizes the future as products which are corresponding to the market needs (Leppimäki et. al. 2008).

## **CASE AREA DESCRIPTIONS**

This study is based on ongoing ELLI project financed by European Regional Development Fund ERDF. In the project there are three case residential areas which all are located in Southern Finland: Engelinranta in Hämeenlinna, Askonalue in Lahti and Peltosaari in Riihimäki.

Engelinranta in Hämeenlinna is located close to the city center by the lakeside. The size of the area is 47 hectares of which 23 hectares is land area and 24 hectares is water area. It has been planned to build apartments to about 2 600 inhabitants. Additionally, there will be spaces for the different business activities. The construction of Engelinranta is possible to carry out following the principles of the sustainable development because the area leans on existing community technical networks, services, street network, public transport and refreshment network.

Askonalue has a central location close to center of Lahti with good transportation connections. Askonalue is an old industrial area and its size is more than 30 hectares. A historical industry milieu and existing service & actor network of the area are a strong foundation for the regional development which is carried out in the cooperation with the town, inhabitants other actors.

Peltosaari residential area in Riihimäki has been built in the immediate vicinity of the city center during 1970 and the 80's. The strength of Peltosaari is its location being close to the city center and close to nature. The biggest problems are connected to the condition of the apartments and real estates, energy efficiency and to the social problems. The town of Riihimäki has committed itself strongly to develop Peltosaari to become attractive and ecological residential area.

In ELLI project these areas will be analysed in order to find new business opportunities for cleantech field. In practice, the areas are still in planning phase.

## **DATA AND PROCESS**

The data collection for future scenarios forming the basis for the visionary concept design process took place in a futurology study course held for 25 MBA students in Laurea University of Applied Sciences during spring 2016. The students working in smaller groups collected data and created alternative scenarios and visionary concepts for all three residential areas. The process is a combination of visionary concept design (Kokkonen et.

al. 2005) and action scenario approach (Meristö 1991). Students' process consisted of six steps which were as follows:

- I) Describing a residential area by core competence tree (adapted from Hamel & Prahalad 1996).
- II) Collecting future data (megatrends, wild cards, weak signals) for scenario building. Structuring collected data into market / technology / society perspectives according to scenario filter model (Meristo et al. 2009).
- III) Selecting drivers from market / technology / society perspectives and formulating alternative fourfold tables based on those drivers. Choosing one fourfold table for more specific processing and drafting alternative future scenarios by considering assumptions and consequences in each block.
- IV) Analysing a residential area by SWOT-analysis in alternative scenarios, i.e. recognizing strengths, weaknesses, opportunities and threats in each scenario.
- V) Developing offensive and defensive action alternatives in each scenario, i.e. what to do to avoid threats or vice versa, how to exploit opportunities.
- VI) Creating visionary concepts responding the challenges recognized in each scenario. Those concepts were related to products, services, business models as well as other action models concerning the development of case areas towards sustainability.

## RESULTS

In this paper the results focus on driving forces behind the scenarios and visionary concepts bases on the scenarios. As explained in the previous chapter, the student groups collected future data of megatrends, wild cards and weak signals. At first they applied PESTE approach for data collection, i.e. including political, economic, social, technological and ecological factors. Then, they structured the data into market / technology / society perspectives and chose drivers for the scenarios. The summary of the main drivers are introduced in Table 1. It is remarkable that drivers covered all the dimensions - i.e. market, technology and society – which ensured varied viewpoints about the future even though the general focus was in energy efficient residential areas.

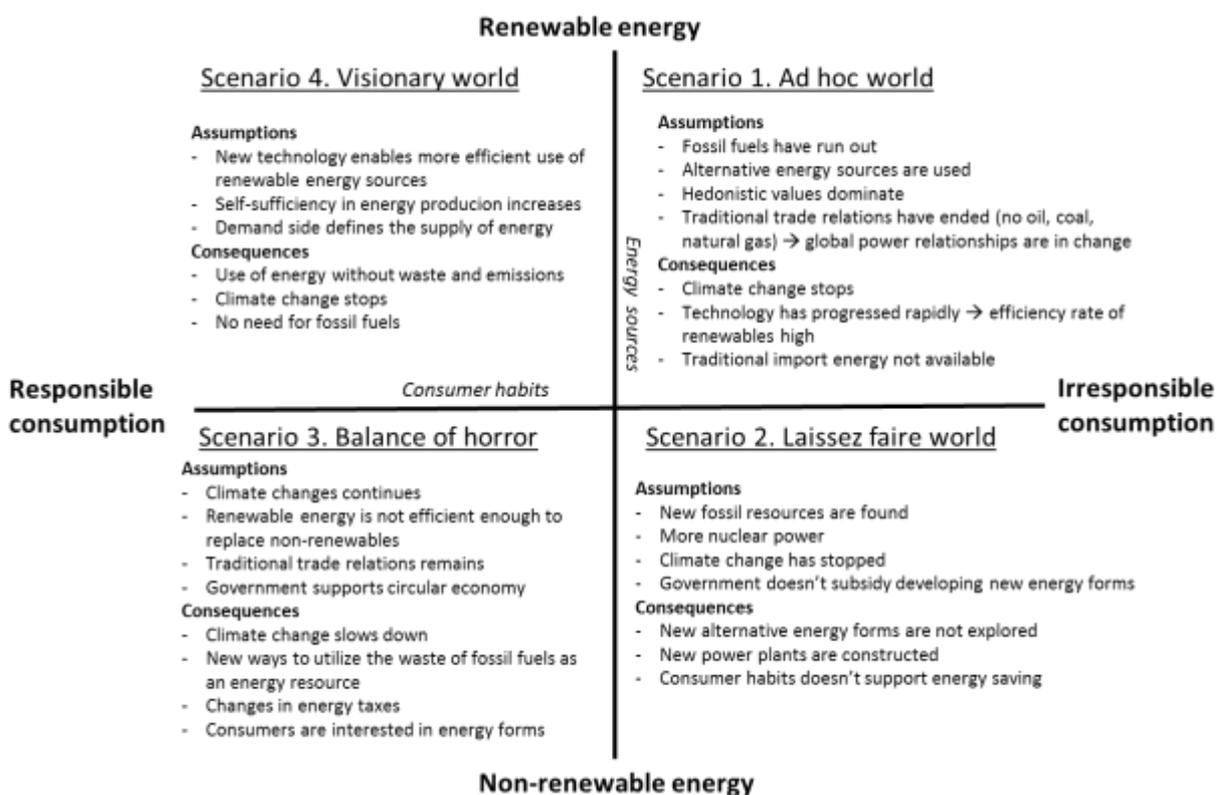
**Table 1.** Summary of the main drivers behind the scenarios (collected from Student Reports 2016).

<b>Market</b>	<b>Technology</b>	<b>Society</b>
<ul style="list-style-type: none"> <li>- Ownership form of apartments</li> <li>- Citizen driven business</li> <li>- Sustainable economy</li> <li>- Sufficiency of space</li> <li>- Building types</li> </ul>	<ul style="list-style-type: none"> <li>- Robotics</li> <li>- Speed of adoption of new technology</li> <li>- Extent of technological exploitation</li> <li>- Humans vs. technology</li> <li>- Renewable vs non-renewable energy sources</li> </ul>	<ul style="list-style-type: none"> <li>- Services in residential areas</li> <li>- Community</li> <li>- Socioeconomic situation of consumers</li> <li>- Basic values</li> <li>- Consumer habits</li> <li>- Reputation of residential area</li> </ul>

Based on the drivers each group created alternative scenarios. After that, visionary concepts based on alternative thematic scenarios were constructed. E.g. from space & place

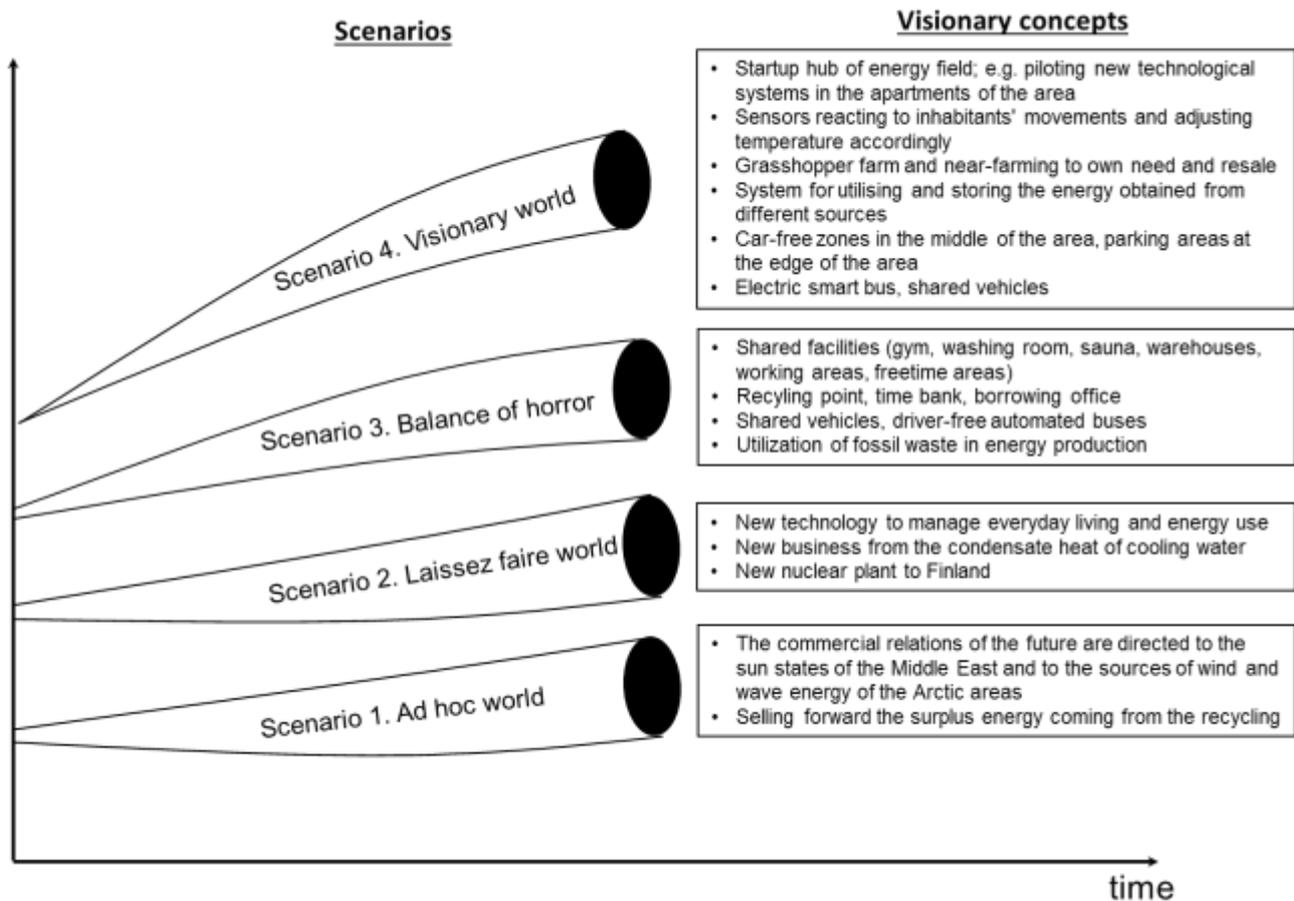
perspective the area with skyscrapers based on lego-type system was visioned, including the monorail transportation network above the roofs. On the other hand, a group focusing on living theme produced a concept “together we are stronger” by using sharing economy concept at the level of residential area. Construction theme focused mostly on concepts utilizing robotics as stuntmen in dangerous tasks. Groups with logistics and services themes had smart concepts in the web for different purposes, including safety & security services (Student Reports 2016).

As an illustrative example, we will present the scenarios and visionary concepts from the group focusing on the energy theme. The main drivers behind the scenarios were energy sources (vertical axis) and consumer habits (horizontal axis). As a result there are four alternative scenarios which are introduced in Figure 2.



**Figure 2.** Scenario examples based on group work with energy focus (Student Reports 2016, Lajunen et. al. 2016).

Scenarios 1. Ad hoc world and Scenario 4. Visionary world has the focus in renewable energy where as in Scenario 2. Laissez faire world and Scenario 3. Balance of horror the emphasis is on non-renewable energy. Additionally, consumer habits cause variety to the scenarios, depending whether consumers are responsible or irresponsible. Visionary concepts were created for each scenario (Figure 3).



**Figure 3.** Visionary concepts related to the energy theme (adapted from Student Reports, Lajunen et. al. 2016).

## CONCLUSION

Even if the focus of is in energy efficient residential area the drivers shaping the future can be very diverse. In this study the driving forces were divided according to the scenario filter model including market, technology and society dimensions. The market drivers include factors such as ownership form of apartments, citizen's role, sustainability in business, sufficiency of space and type of buildings. On the other hand, many of the drivers are related to technology. An essential driver regarding the future is the role between renewable and non-renewable energy forms. Other technology-related drivers consist e.g. of robotics, extent of technological exploitation, the speed of implementing new technological solutions and role between humans and technology. Additionally, society related drivers are notable including e.g. services provided in residential areas, communality, basic values and life styles.

This study was carried out by student groups and each group had their own thematic viewpoint. Thematic groups dealt with logistics, housing, energy, place and space, demographics, services, construction and safety & security. Alternative scenarios from each thematic perspective were constructed. The scenarios formed in each group shared a language and basis for concept design work. Timeframe to the future for the next 20 years

helped participants to get feet from the ground and think also unthinkable solutions and concepts.

Some of the concepts may be suitable only one certain scenario whereas some concepts may suit into several or all scenarios. For example shared facilities are a must in Scenario 3. Balance of horror, but they work well also in other scenarios. On the other hand, startup hubs in Scenario 4 require more sophisticated conditions to work.

The advantage of visionary concept design is that it enables systematic examination of alternative future developments. Future scenarios are illustrations of the operational environment in the future, which also takes into account the driving forces from different perspectives. Thematic focus of each group opened also new insights to residential areas and their energy efficiency, even more broadly, to their sustainable development in the future.

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