PREDICTION OF BUILDING ENERGY CONSERVATION MARKET

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Summary

The higher energy prices evoke the interest of building owners to implement the energy conservation projects in buildings. In the Czech Republic is big stock of buildings that have been built during past years. The paper is focused on issues concerning the implementation of existing technical solutions. The dynamic model was built on the basis of system dynamics method. The model predicts the number of realized project and includes all relevant elements influencing the system parameters.

Keywords: Computer simulation, dynamic behaviour, energy conservation, system dynamics

1 Introduction

The main motives for the implementation of the energy conservation projects in the buildings are:

- The buildings owners want to decrease the direct running costs in the buildings because of the rise in the prices of energies during past years. This jump was caused by energy raw materials increase but also by changes of the taxes. Another change can be expected in the near future by reasons of the possible introduction of the green taxes. Higher energy price means also better financial outcome from the implementation of energy saving projects.
- The government wants to decrease the energy consumption in the built environment. About 30% of the energy is consumed in the buildings and above all in the buildings built before 1990 that are the main part of the building stock in Czech Republic, [1]. The amount of the floor space is depicted in (**Fig. 1**). Additional issue is the decreasing of a greenhouse gases and current topic is also the question of the energy security. The reduction of the consumption of the imported raw materials is the important goal and an energy policy should reflect this fact. It means to develop and to implement the policy based on the understanding the behavior of this complex problem.

2 Method

The method for the prediction of the energy conservation market in the building sector is system dynamics. This method allows us to develop the model for the investigation of the dynamic behavior of the technical systems and especially socioeconomic systems. The detailed description of the method is in [2] and [3].

An example of the key subsystem in the model is in (**Fig. 2**). This part of the model depicts the supply chain where the element **Finished buildings/Unrealized projects** represents the stock of existent buildings. This stock of the future projects is still filled by the flow of new buildings. Their thermal properties correspond to the contemporary requirements but in the future their characteristics will be also improved. The changes of this stock are influenced by the construction rate and the rate of refurbishing.

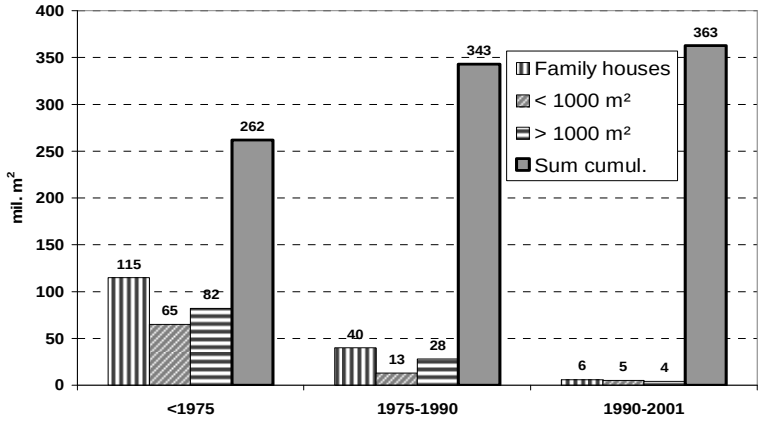

Fig. 1 Floor space built till 2001

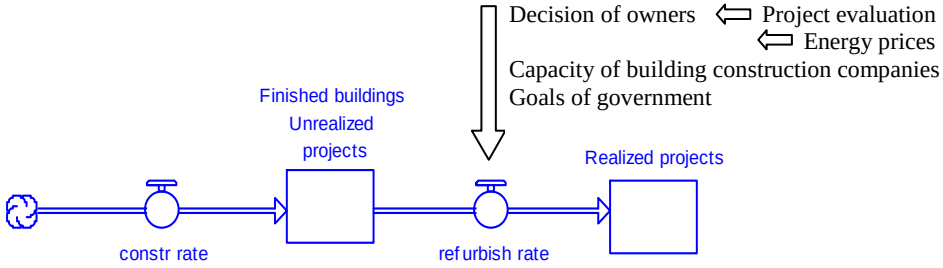

Fig. 2 Stocks of finished buildings and realized projects

3 Dynamic model

The used model is drawn in (**Fig. 3**). The model includes relevant elements that have the influence on the changes of the output variables. Economic growth in world is considered as the main driving force. This parameter is exogenous variable in the model. It is possible to set for the simulation the parameters such as price regulation for the energy, construction rate, changes of the capacities of the building sector companies and the support of the project implementation that will influence the rate of the refurbishing.

Projects are implemented according to the investor decision that is derived from the evaluation of the project.

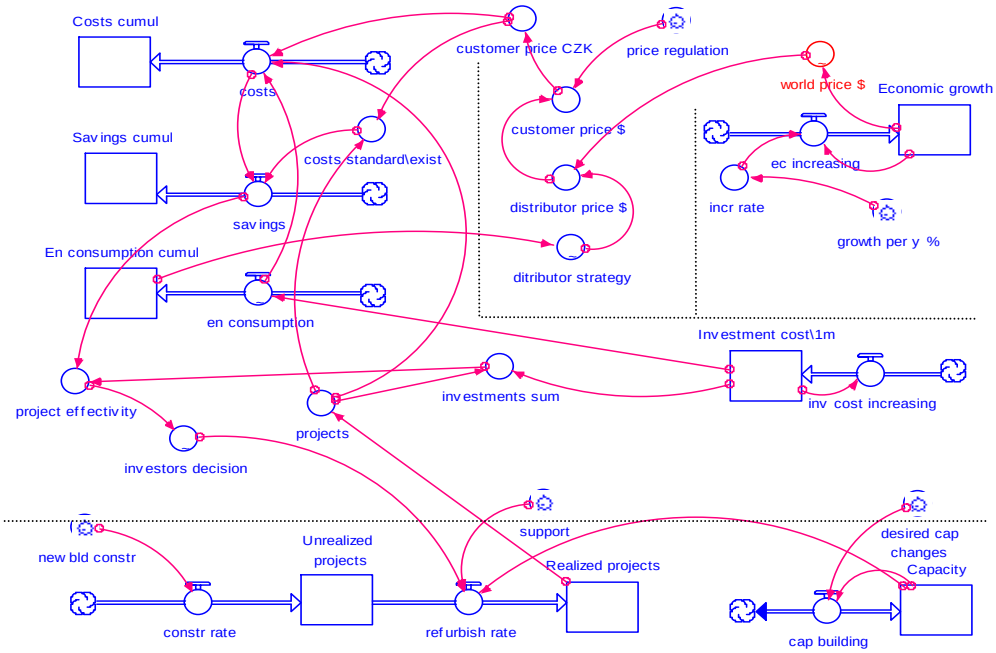

Fig. 3 Elements of dynamic model

4 Results

The computer simulation program calculates the value of all stock elements in the system. There are parameters that deal with energy raw materials price (oil price), project evaluation and realized (implemented) projects in millions m^2 of the floor space as the most important output parameter. The changes of the chosen parameter values during ten years are depicted in (**Fig. 4**).

The up to date construction rate was considered as the stable value 1.8 million m^2 of the floor space per year. Price regulation is 1.19, it means only VAT is added to the energy price. The economic growth is expected on the level of 3 % per year. The support element is 1, it means no support actions for the implementation of the projects are assumed.

The results shows still growing number of unrealized projects because of higher value of the construction rate than the rate of refurbishing.

5 Conclusions

The presented model helps to understand the dynamic behaviour of this complex problem. It can be used as the tool for:

- Prediction of the energy saving project market. The building owners will look for energy conscious design and they will want to improve the thermal characteristics of the buildings. It will create the demand for the construction works. The amount of the work concerns 363 million m^2 floor space in existent buildings. The calculated outputs can help also to estimate the required capacity of the building construction companies and the thermal insulation material suppliers as well.
- Policy testing. The model can test the changes of input parameters with the goal to find the solution ensuring energy consumption decreasing. It is possible also to change the structure, e.g. to use tax yield for the support of the investments. The initial investment is very often the barrier for starting new energy conservation projects. The support for

starting new projects can be realized by different ways but the most effective way is providing information for building owners about the economic profit.

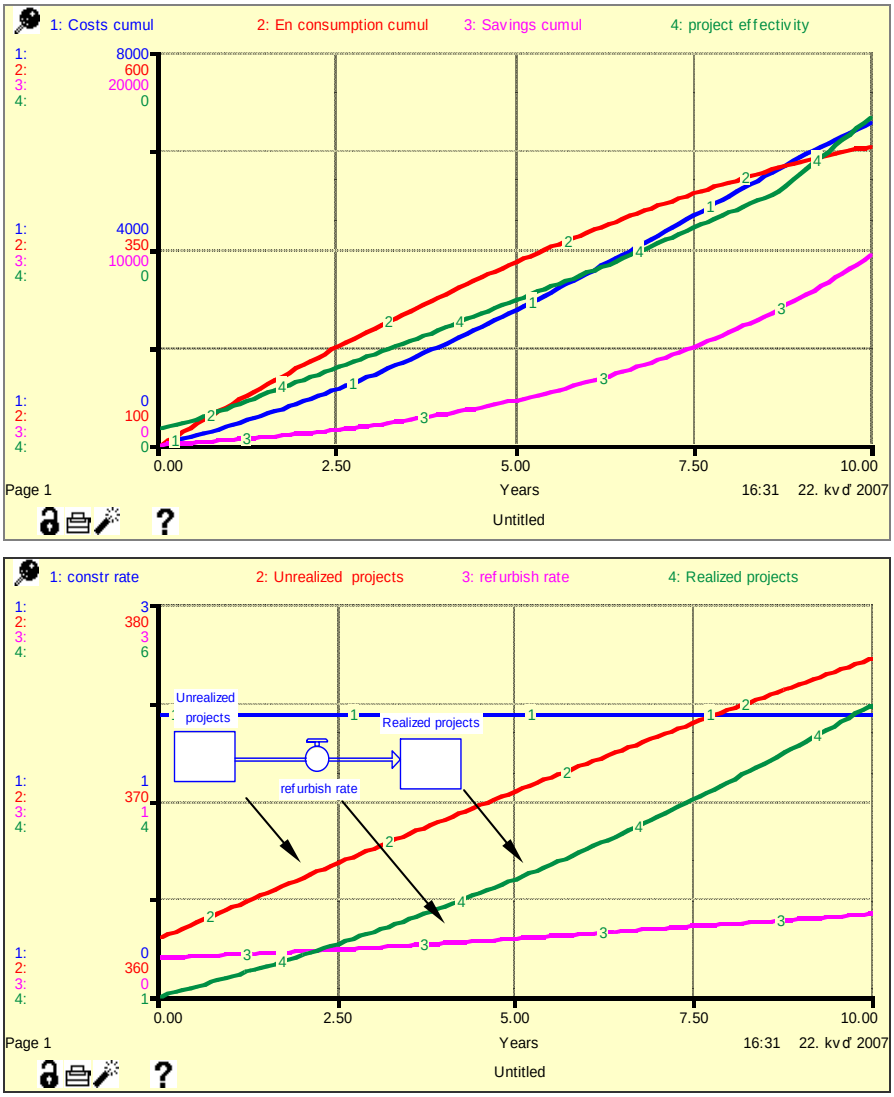

Fig. 4 Resultant values of main parameters

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References

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