MODEL OF BUILDING STOCK REFURBISHMENT FINANCING

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Summary

Energy consumption decreasing depends on the improvement of the existing building stock. The floor space in existing buildings in the Czech Republic is more than 400 million m^2. The improvement is complicated because of amount of potential projects and a lack of financial resources for the refurbishment. To find the strategy for solving described problem is the target of this research.

The paper seeks to find the solution by means of system dynamics. The dynamic model has been built that calculates the amount of refurbished floor space for three strategies. The model includes different modules. One of them is the finance module which deals with subsidy financing.

The model takes data from The Green Investment Scheme Programme that was performed in the Czech Republic during last four years. This programme was financed by selling Assigned Amount Units. It is one possible approach to problem but the developed model tests also strategies combining another resources. The goal is to find sustainable financing for long period.

Keywords: energy savings, building stock management, system dynamics, computer simulation

1 Introduction

1.1 Building stock in the Czech Republic

The total floor area in the Czech Republic in residential buildings and non-residential buildings is now about 450 million m^2, [1]. This figure includes 360 million m^2 area built before 2001, [2]. These buildings are characterized by high energy consumption compare to new-built buildings. The improvement of the building stock can be supported by different strategies usually based on decreasing investment costs for building owners.

1.2 Supporting programme

The Ministry of the Environment started in 2009 The Green Savings Programme. The programme was finished in 2012. Till the end of 2012 19 billion CZK has been spent, [3]. The financial funds were raised from the sale of emissions credits. The new programme will be launched in 2013 for eight years. The budget will be 28 billion CZK. The parameters of the past programme are valuable input for the next calculations.

2 Targets and methodology

The target of the research is to develop finance module that is part of the dynamic model describing dynamic behaviour of the building stock.

The solution is based on the system dynamics methodology that uses stock and flow elements. These elements create the whole system. The auxiliary calculations are performed in convertor elements.

3 Description of finance module in the dynamic model

The model represents the real situation where the subsidy system is used as the main approach for supporting investment activities, (**Fig. 1**). The subside is one tested strategy but the model uses another elements for testing the extended strategies – loans (returnable subsidy, without the interest and with the interest) instead of subsidy, the income from fuel tax and the combination of described strategies. The key element is the level of financial resources. Other parts of the model can be found in [4].

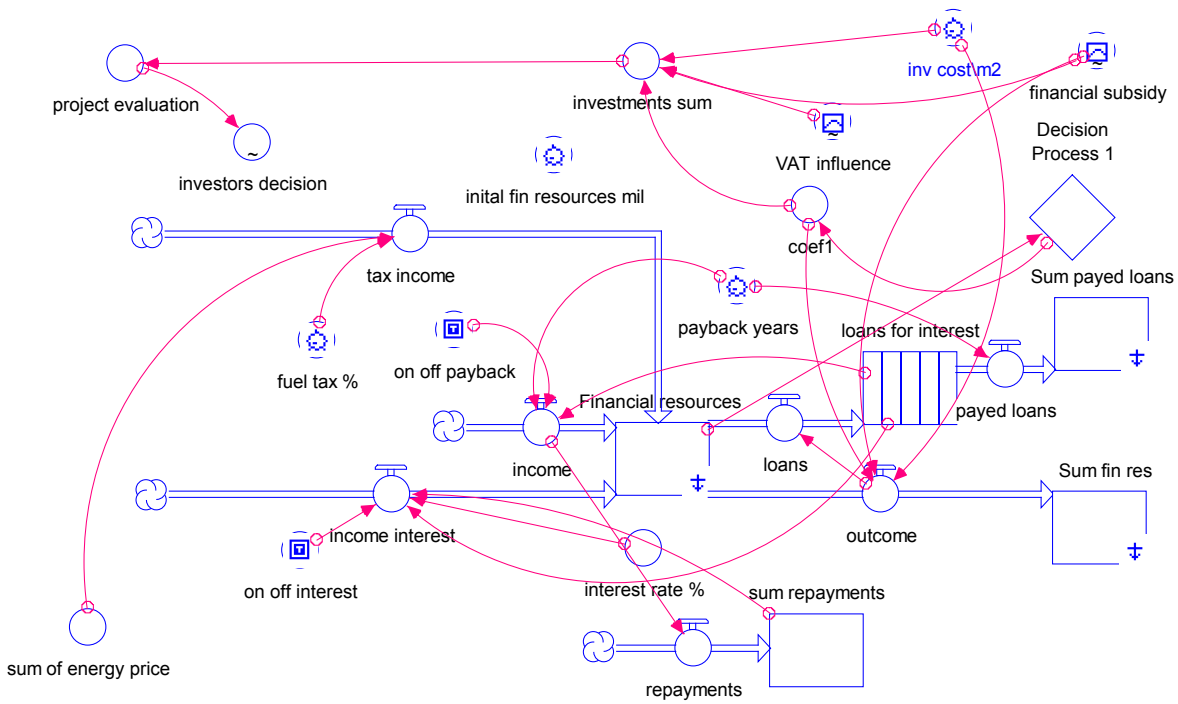

Fig. 1 *Dynamic model – Finance module*

4 Main inputs and results

The results are presented for limited number of possible strategies – subsidy only, subsidy + income from fuel tax, returnable subsidy. The simulation time is 10 years, fuel tax 0.5 %, interest rate for loans 3 %, the payback time is 10 years. The resultant values are depicted in graphs, (**Fig. 2**). The main output parameter is amount of realized projects during ten years and the state of the financial resources in the end of the period.

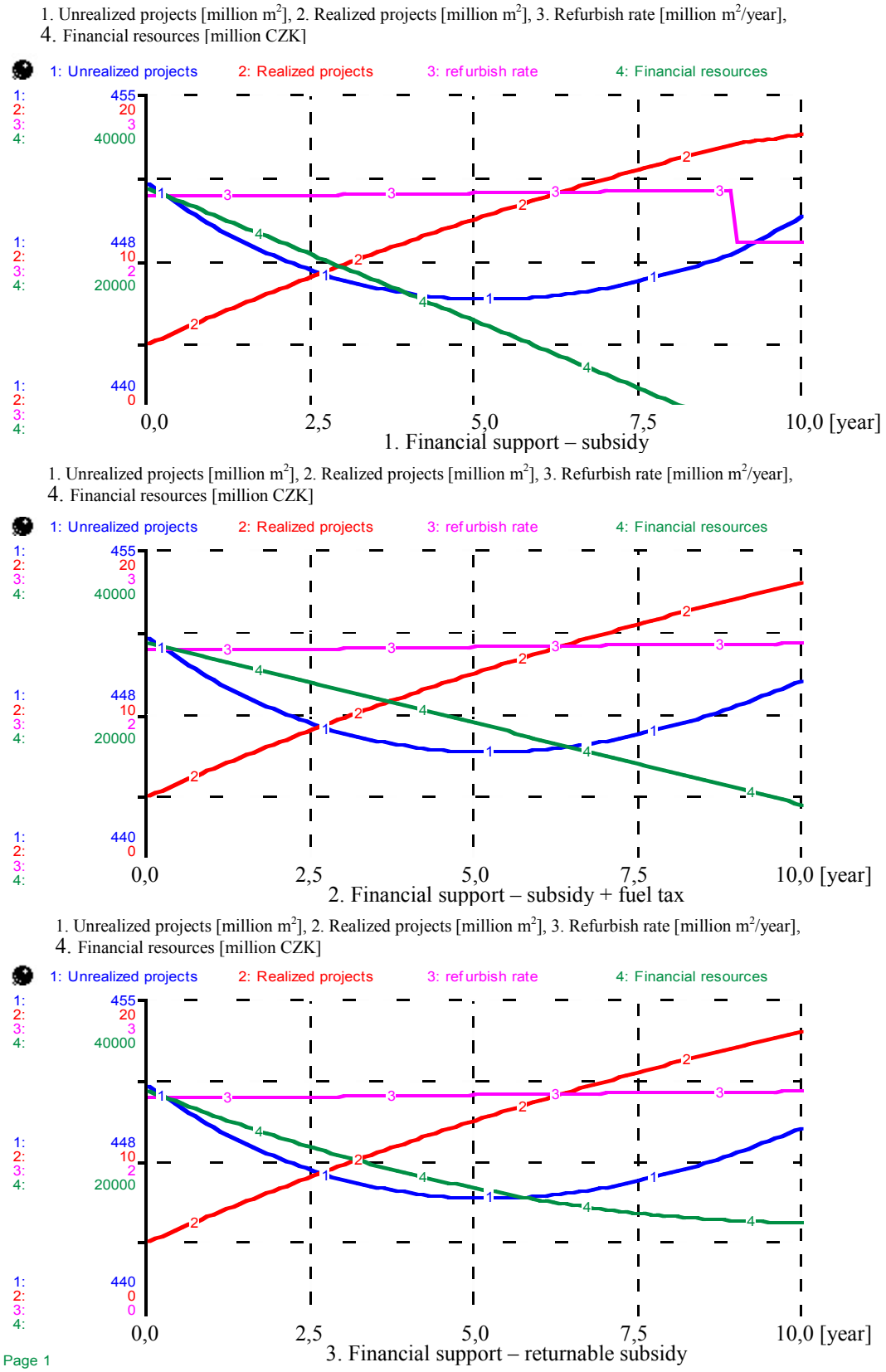

Fig. 2 *Output parameters for three cases of financial support – subsidy, subsidy + fuel tax, returnable subsidy*

The outputs for investigated strategies are in **Tab. 1**.

Tab. 1 *Resultant values*

Strategy	**Realized projects** [million m^2]	**Financial resources** [million CZK]
Subsidy	17,62	0
Subsidy + fuel tax	18,08	8946
Returnable subsidy	18,08	12370

The best strategy from presented cases is the *Returnable subsidy* (loans without applying interest rate) which keeps *Financial resources* on the level that allows providing money for future projects. In the first case, all financial resources are spent during nine years.

5 Conclusions

The finance module has been developed for testing the strategies in the building stock management model. The described cases are only examples of the results because there are many other combinations of basic strategies. The changed structure of the whole dynamic model can bring new possibilities.

The research wants to open the discussion how to reach the goals – decreasing energy consumption and production of green gases and, at the same time, to solve the problem of projects financing. The subsidy programme can improve the situation for certain time period but it is necessary to find the long-time solution.

Acknowledgement

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