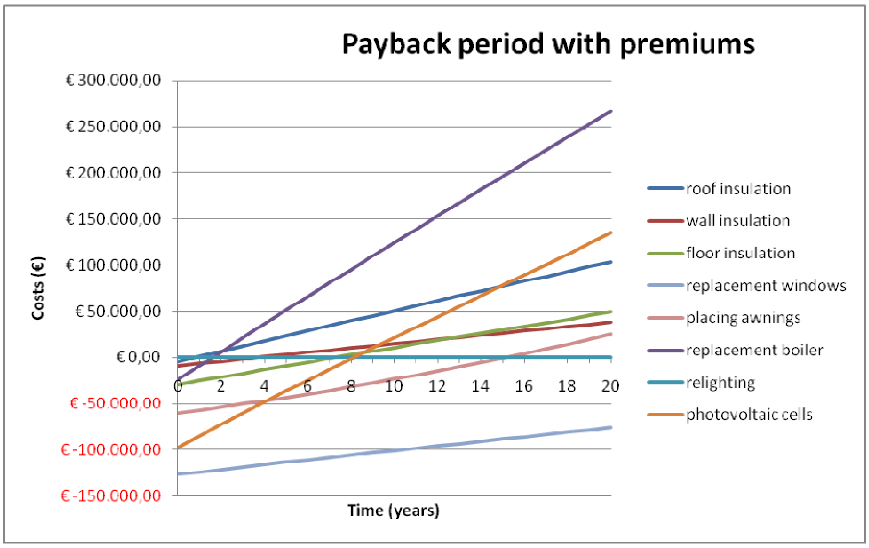

Figure 4: Payback period measures with premiums district house Antwerp

4.3. Combinations of measures

When all the measures are selected, the total investment cost is 364.724,73 euro. The total cash saving is 39.905,47 euro. Figure 5 shows the discounted payback time of this combination with and without taking into account the premiums. This figure shows that the payback period without contributions is approximately 10,5 years. After 20 years the income is 425.830,33 euro. With contributions the payback period is approximately 8,5 years. In this case, the income is 541.710,66 euro. The combination is advisable.

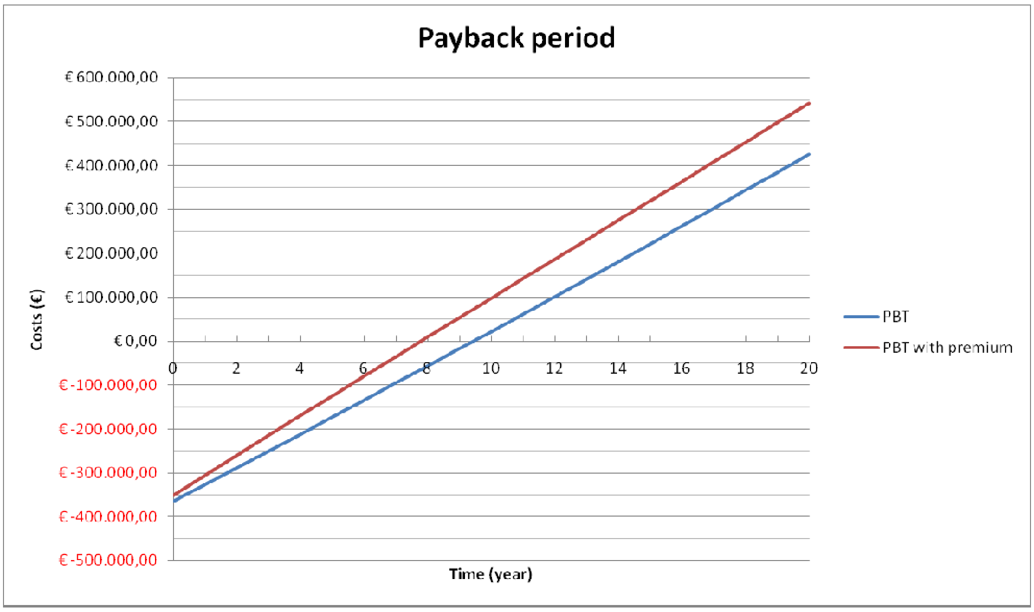

Figure 5: Payback period combination of all measures district house Antwerp

The economically most profitable combination is the combination of applying insulation to the building envelope and the replacement of the current boiler. This combination has the lowest investment cost and is 76.956,35 euro. The annual cash saving is 28.636,57 euro. Figure 6 shows that the discounted payback period is about 3 years. The financial aid has little effect on the payback time. The income after 20 years is 447.631,88 euro. The current gas consumption will be reduced by 24,5%.

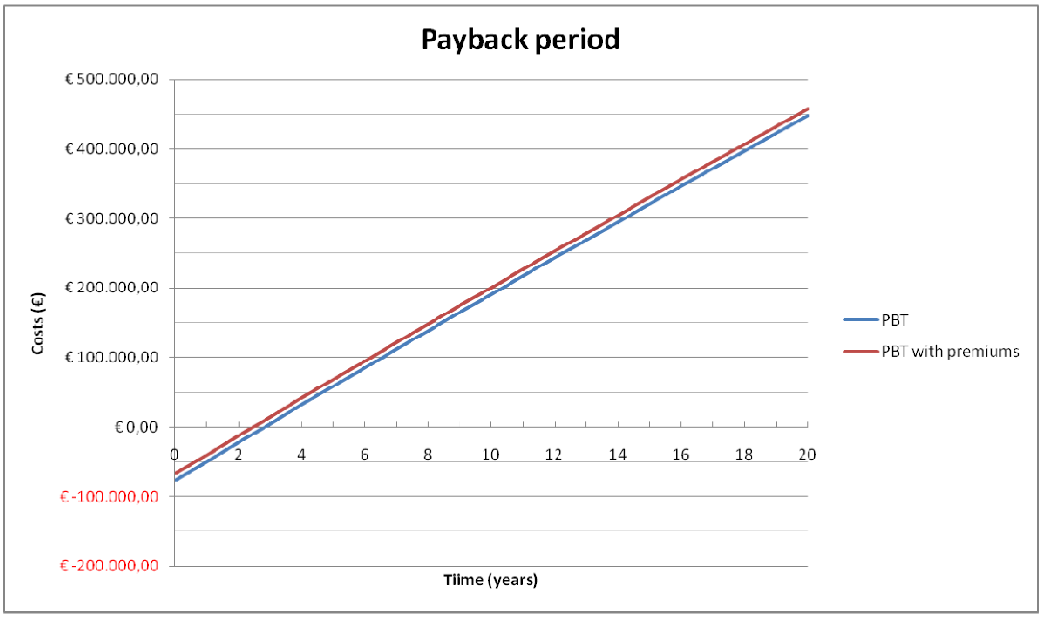

Figure 6: Payback period economically most profitable combination district house Antwerp

5 Conclusion

The mathematical model is based on an existing model prepared by Dotsenko V. [1]. This existing model offered no overview and was not user friendly. The new model is simplified compared to the previous calculation by setting the measures each on a separate tab. The fields to be filled, are colored gray. This makes the structure more clearly and keeps an overview for the user.

The calculations were adjusted and improved. A new selection of the most useful measures were made. In the future omitted measures can be added to complete the model. A further innovation is that the transmission loss through the building envelope can be calculated. Based on the transmission loss the boiler capacity is calculated. The investment in replacing the current boiler is dependent on that capacity. The lower the capacity, the lower the purchase cost. The boiler capacity should be well adjusted to the needs of the building. In this model, only the transmission loss is calculated. Ventilation and infiltration losses were not integrated in this model.

The discount rate and the evolution of the energy prices are future values and difficult to be predicted. Their impact, however, is big on the results. The price of gas and electricity have a positive impact on the payback period. When the prices rise each year, the cash savings will rise. On the other hand if the prices drop, the decrease has a negative influence.

The financial aid that is distributed over several years, has a major impact on the payback time. Because the green energy certificates are awarded over a period of 20 years, the installation of photovoltaic cells is viable.

In the renewed computational model, the financial support for the region of Flanders is integrated. This may be extended in the future to Belgium.

Replacement of double glazing in high-performance glass is economically not viable. The investment cost is very high and the annual energy saving is low. Insulating the building envelope - except the replacement of the windows - in conjunction with replacing the current boiler is economically the most profitable combination. The investment is low and the annual cash savings are large. Energy consumption decreases about 24,5%. The financial aid has no significant impact.

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