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0038 Analysis of optimal dynamic price control of heat pump houses with solar power

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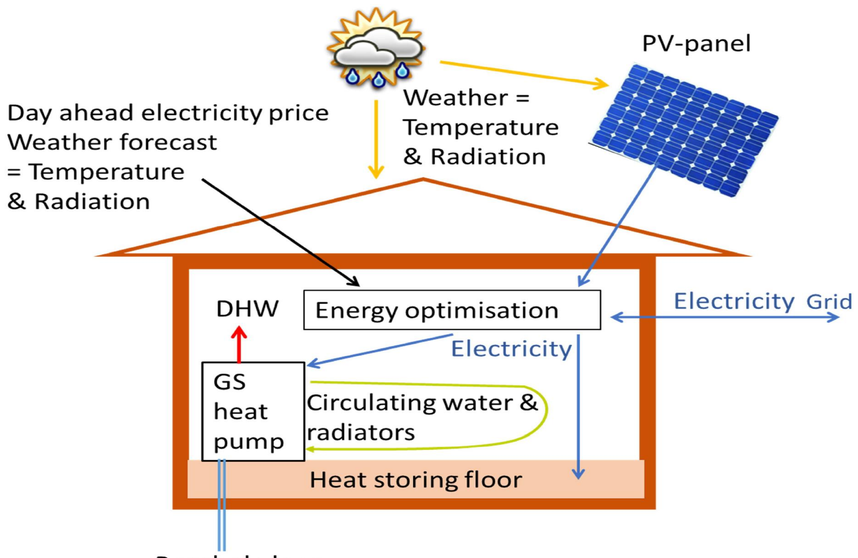
Introduction

More and more houses have heat pumps and solar panels. This contribution analyses and demonstrates by simulation the benefits of forecasting and optimisation in dynamic price control of such residential houses.

Test houses, input data, models and problem definition

Two test houses had been modelled using measurements. **The model is nonlinear** due to the coefficient of performance (COP) of the heat pump. The performance criterion includes quadratic terms for comfort etc. and the variable electricity cost.

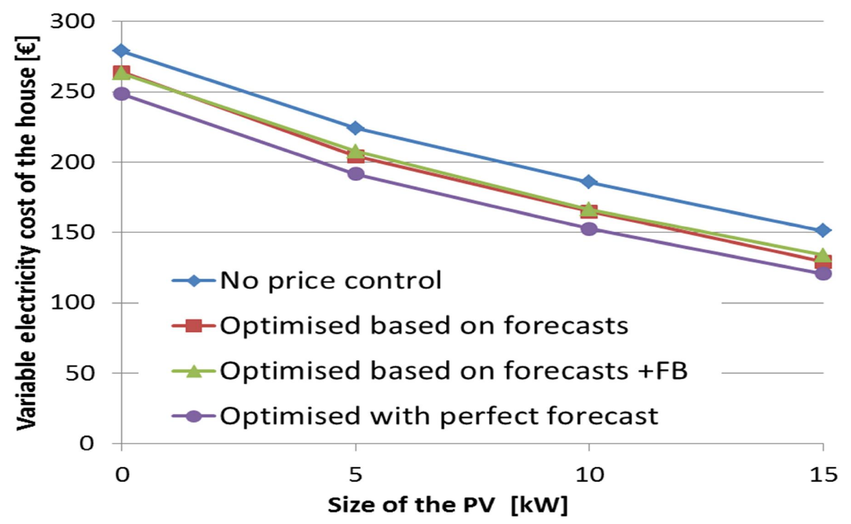


Methods

- Forecasting the PV output power.
- Dynamic thermal balance models applied in non-linear constrained optimisation with the principle of Pontryagin.
- Adjusting the optimisation solution with feedback control.

Benefits from optimisation

The following figure shows the variable electricity costs for eight weeks. Two weeks are in each of the four seasons.



Feedback (FB) keeps comfort acceptable with the optimisation based on forecasts. Extrapolation gives about 200 € annual benefit when optimised with perfect forecasts and 110€ with the actual forecasts.

Conclusions

1) Forecasting of solar power enables automatic optimisation of price control responses.
2) Improving forecast accuracy increases the benefits.
3) For price control of storage type electrical loads the nonlinear constrained optimisation applied with the principle of Pontryagin is a good approach for both operational on-line optimisation of price control responses and for off line studies for dimensioning and analysis.

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