Novasol Living Lab:
Holiday houses with pools

ABOUT THE LIVING LAB:

Holiday houses in Blåvand - a tourist town in southwest Jutland – will be able to reduce CO2 emission and electricity costs significantly by controlling heating according to the production of wind energy.

The living lab incorporates data from 10 holiday houses with swimming pools and dehumidifiers. The living lab investigates how green energy can be utilized for intelligent heating of the swimming pools when the production from e.g. wind turbines and solar power cells is high and overall consumption is low.

Using the developed concepts for flexibility the holiday houses related balance responsible will be able to provide flexibility to the electricity markets and reduce the electricity cost of operating the holiday
Facts about the living lab:

Type of Living Lab: Building (holiday houses)

RESULTS:

- ✓ Project proves that there is a domestic household demand for demand side flexibility.
- ✓ Methods for forecasting of day-ahead and balancing power prices
- ✓ A new method for wind power forecasting in the price-area DK has reduced the uncertainty with 20%.
- ✓ The project proofs increasing interest from public and stakeholders to integrate and automate flexibility into hard ware and insert it into an ecosystem on larger scale
- ✓ Optimized heating schedule based on forecasts. A scheduled heating during the 6 cheapest hours reduces the cost by 29%.
- ✓ The project proves the technological feasibility of controlling and optimizing the economy of pool heating in response to varying prices and in a fully automatic and centralized manner.
- ✓ Besides, it proves a stabile data platform, including two-way middleware protocol have been established and thoroughly tested and monitored.

PERSPECTIVES FOR THE FUTURE:

- ✓ Introducing industry standards for demand side flexibility is vital as rental houses have yearly churn between agencies.
- ✓ We are liaising with Holiday Home Association to introduce national standard in order to scale up.
- ✓ The setup with pool holiday houses will be used in ongoing and leading European projects like ebalanceplus and CitCom.ai.

NOVASOL centerdenmark intelligent energy ENFOR DTU ELECTRICITY MAPS centrica

Publications related to the living lab can be found at www.flexibleenergydenmark.com/further-information/knowledge-bank/publications/

TECHNICAL SETUP:

- ✔ No consumer involvement needed for this – a prototype automatic solution is established.
- ✔ ENFOR is providing forecasts of prices, renewable generation and load.
- ✔ Electricity Maps will be able to provide real time estimates of the forecast of both average and marginal CO2 footprint of the electricity mix.
- ✔ Sensors and controller installed in houses are connected to the cloud and smart grid eco system.
- ✔ Center Denmark is the central hub of the data eco system.

MODELS:

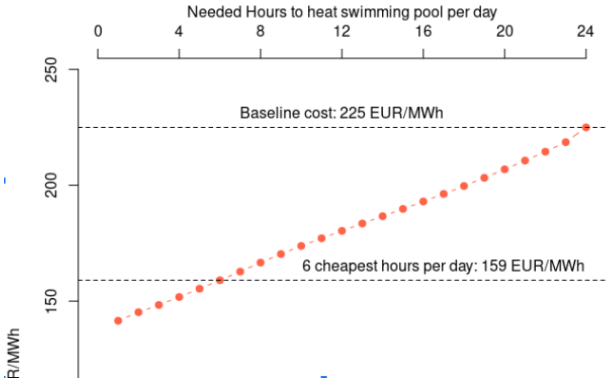

Figure 1 shows the average price when heating the swimming pools equally in all hours, compared to only heating it during the cheapest hours.

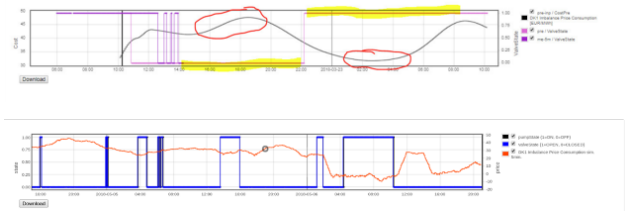

Figure 2 shows an example from the operation of the swimming pools in which the prices were negative. In this case the controller turned on heating until the temperature of the swimming pools reached their maximum allowed values.

Figure 3 shows regular operation of the swimming pools, in which the controller plans to heat mostly during the cheap hours.

FED is a Danish digitization project, funded by Innovation Fund Denmark, aimed at turning Danish power consumption flexible to enable utilization of excess power from wind turbines and solar cells.

The project brings together Denmark's foremost researchers, organizations, supply companies, software companies and a number of living labs that provide data for the project.

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