

SMART-A

Smart Domestic Appliances in Sustainable Energy Systems

Project
Newsletter
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The main objective of the Smart-A project is to identify and evaluate the potential synergies that arise from coordinating energy demand of domestic appliances with local sustainable energy generation and with the requirements of load management in electricity networks.

Editorial

Dear reader,

The project "Smart Domestic Appliances in Sustainable Energy Systems (Smart-A)" aims at developing strategies showing how smart domestic appliances can contribute to load management in future energy systems. In order to do this, the project assesses the options for load-shifting by a variety of appliances across Europe and compares these with the requirements from energy systems both on the supra-regional and the local level.

The project also features a detailed assessment of the user acceptance of smart appliances operation, and an evaluation of the usability of available control technologies and communication standards.

The overall potential of smart appliances is assessed based on a model which takes into account the variations of appliance use and the framework conditions in energy systems.

With this second newsletter, the project team hopes share the project's first findings. Please visit the project website (www.smart-a.org) for more information and the possibility to give feedback to the project team. Have an enjoyable read!

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The Smart-A project brings together the following Partners:



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The University of Bonn has completed the analysis of the **synergy potential of 10 different domestic appliances**. The ten devices are:

- washing machine
- tumble dryer
- dishwasher
- oven and stove
- refrigerator
- freezer
- air conditioner
- water heater
- electric heating (storage unit)
- heating circulation pump.

Existing studies and data have been collected and summarised for each appliance with regard to their technical functionality, their penetration and impact on natural resources in Europe, as well as their specific power demand and load curves. Based on this data, the synergistic potential for a smarter use of each appliance has been investigated, while possible constraints were identified.

Synergy potentials were analysed with respect to:

- possibilities for a more efficient use of power and heat supplied by renewable energies,
- the ability to adapt their operation to the requirements set by the energy supply,
- technical possibilities for a more flexible use,
- additional costs of smart appliances as compared to conventional appliances and the
- additional energy consumption due to a smart operation.

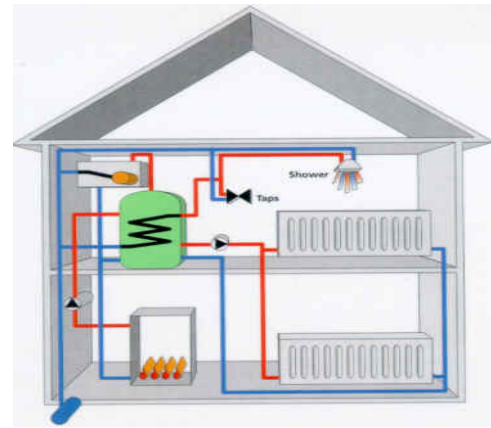
Moreover, the impact of smart appliances on load curves are shown in various simulation scenarios in which the estimated potential for load shifting as well as the time range in which the operation of the devices might be shifted were taken into account.

The appliances selected for each region are the ones which have the best potential to reduce energy consumption and to flatten the load curve as much as possible.

RESULTS

The example of connecting washing machines to a CHP, solar plant or district heating system in order to heat up the water shows that, considering an average load of 5 kg, the consumption of a wash cycle could decrease from 890 Wh to about 200 Wh, saving more than 77% of energy.

Full results will be published in the Synergy Report due in September 2008.



A local energy system is defined as a group of households and small enterprises within an area, with a typical distribution of heat demand, based on current technology. When it comes to electricity, only low and medium voltage levels are used at this scale. In other words, **a small village or a city quarter may be considered as a local energy system.**

In our methodology, solar heat, photovoltaic systems and small cogeneration plants are integrated in the local energy systems, while wind and other large scale renewables as well as conventional energies are external to them.

Optimising the use of locally produced electricity by means of smart reacting household appliances should have two effects:

- 1/ **it lowers transmission losses**, as well as fluctuations, which otherwise would have to be compensated by the high voltage network grid;
- 2/ by shifting the demand to times of high availability of local renewable energies, there **might be a slight rise in the total electricity consumption of the appliances.**

RESULTS

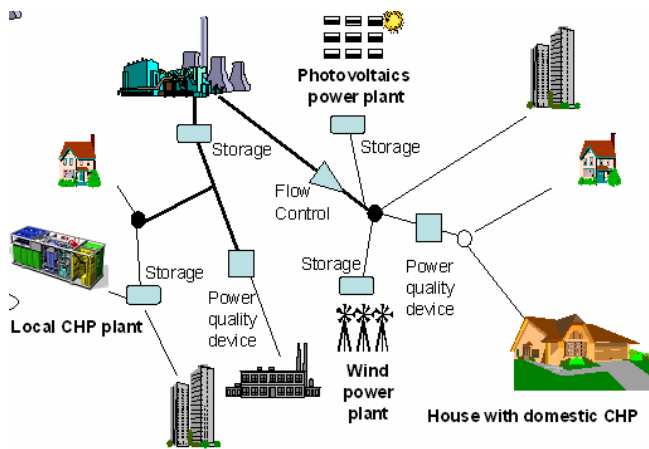
The simulation prepared by Smart-A has conducted to quite mixed results. Using a Smart approach with lifted bands can bring to an overall improvement of the import/export balance, thanks to an energy import reduction that can reach over 10%, but it also leads to an increase of total energy consumption of around 5%. Nevertheless, using a Smart approach on the same band as the conventional control leads to a reduction both in total energy consumption and in energy imports from the grid of about 1-2%.

Work on the role that energy networks will play in optimizing local and regional energy systems started in April 2007 and, since then, significant progress had been achieved.

Two models have now been implemented.

The first model is a **yearly generation scheduling model** that evaluates the potential benefits of Smart appliances in power reserve provision for systems with large penetration of intermittent generation (for example, regions with large amounts of wind).

The second model is a **congestion management model** where Smart appliances can be used to alleviate congestion and optimise the use of existent network capacity.



A set of case studies, based on the regional European classification defined for this project, were conducted. **The results point out that there are economic benefits for Smart appliances participation both on reserve provision and congestion management. These benefits are system-specific and results highlight that they are particularly interesting for systems with low flexible generation and high wind penetration.**

RESULTS

Case studies based on the UK example, in a future scenario of 25% of wind generation with 26 GW of wind energy installed capacity, show that using Demand Side Management and System Balancing could lead to an improved wind energy utilization, a reduction in conventional energy generation (up to 8.5 TWh/year) and, consequently, a decrease of CO₂ emissions (up to 4.5 Mt/year).

Qualitative interviews with 16 experts from different European Countries and from the white goods industry, sensors and smart metering producers, market research, university and consumer representatives gave insights in perceptions about consumer needs and expectations.

Consumer acceptance (in this case individual households) emerged as being linked to two factors: the possibility to receive a **financial gain** and the **individual contribution to environmental sustainability**. An important prerequisite was that smart appliances should also **increase the user's comfort**.

Regarding the acceptance of smart appliances, experts expected few problems for refrigerators and freezers, given the food quality is preserved. For washing, dish washing and tumble drying which could be set back to night hours, readiness of consumers is expected to hinge on the nature and importance of the incentives. An interesting result concerning heating and air conditioning was that people would not accept even small deviations from the desired room conditions.

Moreover, the consumer will anyway insist upon the possibility to override the external control and put the appliance into operation immediately.

RESULTS

The consumers' survey has been completed for the UK and Slovenia, and altogether more than 400 interviews were conducted. The results for the two countries are similar and confirm the expectations. 73% of the respondents would postpone the start of the washing machine for financial and ecological reasons; this figure amounts to 70% for tumble dryer, 72% for dishwasher and 47% for air conditioner. Furthermore, around 70-75% of the respondents would accept, for the reasons above, to set their domestic devices into a "smart operation mode", where breaks in operation of two minutes maximum may occur.

The same survey was recently finished in Germany and Austria with 2.263 interviews and the results will soon be available. For Italy the survey is in the preparation phase.

The Smart-A project has entered its second year.
Expect much more results in the coming months!

Check on the latest updates and information by visiting our Website: www.smart-a.org