SMART-A

Smart Domestic Appliances in Sustainable Energy Systems

Project Newsletter No. 4

May 2009

The main objective of the Smart-A project is to identify and evaluate the potential synergies that arise from co-ordinating 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)" has developed 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.

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 fourth newsletter, the project team presents the **findings on local energy generation systems and on regional energy networks**. It also includes an **invitation for an international Smart-A workshop in Berlin**. 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:

Öko-Institut e.V. – Institut für angewandte Ökologie – Institute for Applied Ecology; universität bonn; enerVision; Imperial College London; COGEN europe; ifz; EnBW; Miele; Manchester 1824

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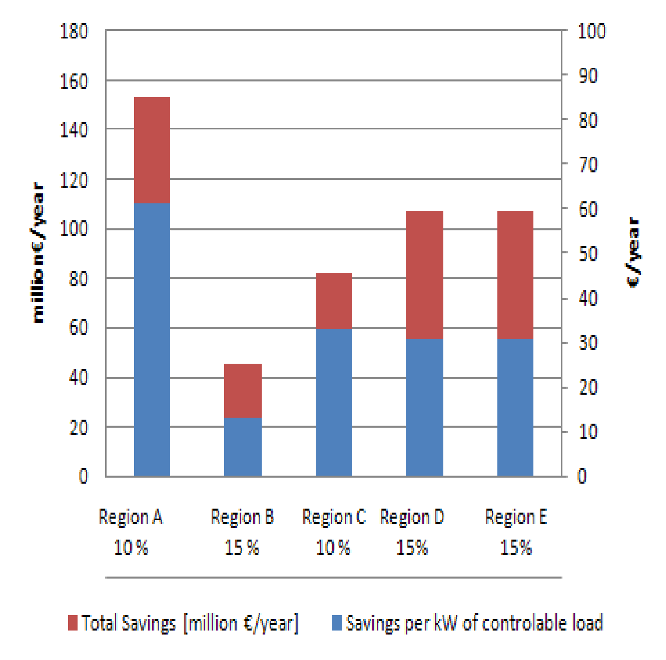
Intelligent Energy Europe

The aim of this project is to assess the **value of smart appliances** for electricity system operators based on the performance of different appliances under various framework conditions.

The assessment focuses on the role of smart appliances with regard to their potential to help **manage imbalances and congestions** in the transmission network and distribution networks (e.g. from passive to active distribution networks) and their potential to **support network operation**.

For the comparative analysis, the energy consumption per cycle and the different levels of flexibility for the different appliances have been taken into consideration.

The following table demonstrates the **value of demand side management on the provision of reserve services in different regions, under the assumption of a 30% wind share in electricity generation:**



The regions differ in their demand profile, their generation flexibility, and the installed intermittent generation.

The analysis of the different regions revealed that the highest savings can be achieved in region A which has its demand peak in the summer, low conventional generation flexibility, and medium but rising installed intermitted generation. Region A can reduce 3-6% in fuel costs measured in percentage of the total system fuel costs, and wind spillage – measured in percentage of the total wind spilled due to high wind and low demand – by 30-50%.

Region B in contrast, has high conventional generation flexibility, peak demand in the winter and low installed intermitted generation. The reduction in wind spillage is 0% and the reduction in fuel costs is similarly low.

Regions C and D have both medium levels of generation flexibility, both peak demands in the winter, and only differ in the degree of intermittent generation installed. While region C has low intermittent generation installed, region D has a high level. Whereas region C has a negligible potential to reduce its fuel costs (0.1 – 1%), the potential for reducing wind spillage ranges from 0 to 70%. Region D has a potential reduction in fuel costs of 3-5% and potential for reducing wind spillage of 36-70%.

Overall, the value of smart appliances from a system wide perspective is strongly related to the **flexibility** of the conventional **generation mix** and increases with higher penetration of wind. The flexibility offered by consumer behaviour also increases the potential of smart appliances.

With respect to network operation and management, smart appliances can **contribute to congestion relief** and consequently contribute to a reduction of congestion costs in particular by avoiding disconnecting loads entirely.

In order to assess the value of smart appliances to manage transmission network congestions, an example of a constrained transmission system with a lack of capacity connecting wind generation to the centres of demand was used. The value of smart appliances to support network management was examined by simulating demand side responses from smart appliances.

Smart appliances are especially useful in urban areas where space constraints hinder asset replacement.

Smart appliances can also help contribute to increase the **connection of new intermittent generation**, both at the transmission and the distribution level, and thus defer the need for network reinforcements.

Local Energy Generation Systems

The project looked at the possibility of using more renewable energy sources within a local generation system through the smart control of household appliances. A local energy system is defined as an agglomeration of households and smaller enterprises within an area. In order to examine the potential of smart appliances for households, a reference model without any smart activities is used.

The simulation matrix takes the regional profiles, especially meteorology and the assumed future penetration of appliances in the target countries into account, the flexibility of the generation system, the share of wind generation in the overall grid (20, 30 and 45%), as well the share of local renewables and micro-CHP in the systems.

The key results are the following:

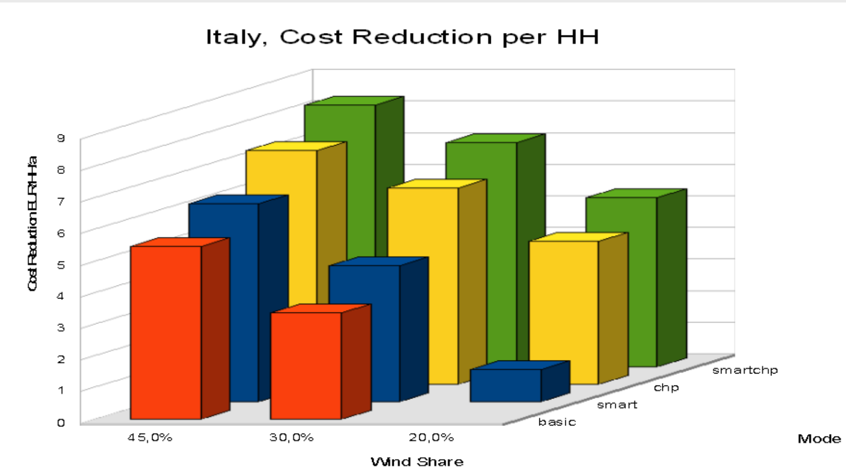
- The economical benefits of smart appliances strongly depend on the overall marginal costs of electricity production
- On average 1€ per household appliance per year can be saved purely with smart appliances (smart scenario)
- It is possible to reduce grid electricity imports by 5-20% of the local consumption, replacing it by onsite production

The comparison also revealed that the economic potential differs from region to region due to different stages of expected wind curtailment.

Due to the local use of renewable energy sources fewer supra-local energy flows are needed which supports the stability of the electricity grid. The intensive use of renewable energy sources, however, requires more flexibility on the consumer side (demand response).

Potential cost reductions per household in Italy

The Italian example demonstrates the impact of the amount of wind generation in the system and the specific household configuration on potential cost reductions. The configurations are: basic, smart (appliances), CHP and a combination of smart appliances and CHP.



By using smart appliances combined with CHP at 20% wind generation, it is already possible to save €5 per household and year. Overall, all the countries analysed show the same pattern: the use of smart appliances combined with CHP leads to considerable cost savings compared to the basic scenario, whereas the smart scenario offers only moderate savings. The higher the wind share, the higher the potential of savings per household.

Smart-A Workshop on 15 June 2009 in Berlin

In the workshop, the results of the Smart-A project will be presented and the proposed concept for smart appliances and their integration in the energy system will be discussed. The workshop is a side event of the 5th International Conference on Energy Efficiency in Domestic Appliances and Lighting (EEDAL'09), which takes place from 16 to 18 June. The workshop will take place on **Monday 15 June 2009 from 14.00 to 18.00, at the Estrel Hotel & Convention Centre Berlin, Sonnenallee 225, Room "Nizza"**. Participation in the workshop is free of charge, but **registration** is required by email to l.becker@oeko.de until 4th of June.

The Smart-A project is in its third year.
Check on the latest updates and information by visiting our Website: **www.smart-a.org**