

Agent-Based Services for Building Markets in Distributed Energy Environments

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To incorporate the renewable energy sources in a safe way, as well as to exploit their full potential, recent works propose the formation of areas in the distribution grid capable of reacting on real-time to both availability of sources and demand. These cells require building intelligent global control systems able to insure energy balance in a dynamic way. In this setting, the adoption of centralized solutions is not recommended, as they are poorly reactive, they do not grant the autonomy required by the users, and they are not able to handle properly the large amount of information that entails the management of distributed energy devices. With the aim of accomplishing this task, the European research project CRISP describes a model where autonomous software agents bargain and make plans on behalf of the supply and demand devices. The model is called SDM (Supply and Demand Matching), and proposes the creation of energy micromarkets that are highly reactive, that are instantiated on demand, and that span a short time horizon (commonly shorter than 15 minutes).

Although Intelligent Agents (IAs) are considered a suitable technology for building these micromarkets, their adoption implies challenges that have not been properly considered. Regarding the structural aspect, the idea of running agents in local devices that represent users is far from shaping a flexible context, as agents are pieces of software that will require updating and debugging tasks that must be done by hand. On the technological side, experience from Virtual Organizations reveals that it is necessary to use models in which the partners are well known, and in which it is possible to previously certify their efficiency and skills. Furthermore, important tasks such as coordination, bargaining or accessing external weather forecast services, turn out complex and heavy for a local device that is supposed to be simple and installed on a large scale.

In order to free local agents from the complexity that would involve their direct participation in next energy micromarkets, this document put forward a new model called Agency Services for Energy Management.

This model proposes the instantiation of additional intermediary agents in the ICT infrastructure, which after being contracted as services will participate in energy micromarkets on behalf of users. These agents would work as advanced external brokers carrying out tasks related to planning, bargaining and cooperation. Furthermore, on the client side it would be instantiated a light agent capable of monitoring the activity of the local devices, and able to communicate with a broker agent of the ICT infrastructure. Broker agents negotiate on behalf of users in the energy market, and inform their corresponding local agents about the dispatch directives that have to be applied to the local devices. One of the most remarkable features of the new model is that the local agent is remotely transmitted and remotely loaded in the local device, so that it can be dynamically reloaded and configured when necessary.

The agency services can be provided by firms specialized in the energy sector, which we term Agency Services Provider for Energy Management (ASPEM). When a user contracts its services, the ASPEM is responsible for both providing the broker agent in the ICT infrastructure and remotely loading the local agent in the client. Furthermore, thanks to their technological means, ASPEMs can easily access vital external services, such as those related to the weather forecasts or the fuel cost. Likewise, ASPEMs can guarantee users' autonomy by providing powerful and secure web-based interfaces that clients can use for sending directives to the broker agent.

The Agency Services model frees the local devices from the complexity that entails the direct participation of autonomous agents in markets, provides solutions to the challenges that also implies their presence at the production and consumption points, and build a context able to interact with other useful services for energy management in distributed environments.