Case Studies

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ANNEX 57 — Flexibility by implementation of heat pumps in multi-vector energy systems and thermal networks

Demo No.: 20	**Location/City:** Breda	**Country:** The Netherlands

Project name (short and full title): Jouw Energie Moment 2.0 (JEM2.0)

Quotation:

Pilot smart heat pump 39 houses.

- the development of a clearing system based on dynamic tariffs
- the development of a profitable business model for energy flexibility services
- the integration of storage options into the business model and settlement system demonstration in a realistic test environment

JEM 2.0 offered the opportunity to see on a small scale whether the business model for more energy flexibility in households works and is profitable. It was decided to implement two variants of the proposition in the pilot. A variant in which equipment (heat pump and battery) is smartly controlled (automatic demand management) and a variant in which residents could respond to the rates themselves based on insight into the dynamic rates (manual demand management). This made the pilot a good basis for solutions on a larger scale. The results of JEM 2.0 should ultimately contribute to the development of new services in the field of dynamic electricity tariffs

Schedule of the demo project (research study):	**Year of realisation:** 2019

Leader organisation (owner, constructor, solution developer, research inst., etc.):

- **'S-HERTOGENBOSCH**

Enexis Netbeheer B.V.

Participating organisations – demonstration project part (involved other organisations):

- **AMSTERDAM**

Capacity Energy Storage B.V.

- **EINDHOVEN**

Hezelaer Energy Services

- **GOUDA**

Technolution B.V.

- **THE HAGUE**

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TNO

- **AMSTERDAM**

Vandebron Energie B.V.

Budget of the demo (invest/monitoring etc.):

€ 492.000,00

Heat pump

Provide consumers with clear information about how the smart heat pump works, how they can influence the operation of the heat pump and what the consequences are. Make that information available through a display or app, too. This way you also have the opportunity to support participants in case of problems or questions after the installation of equipment. Give residents feedback on the savings achieved with smart control. Advise participants on how best to ventilate the house to avoid dissatisfaction with their heat pump and to ensure that they can make optimal use of the heat pump. Also, give participants advice on what to do best in the event of a weather change or if the seasons change. (Smartly choose which rooms you heat.) Offer them alternatives and mention what effect they have on the comfort in the house. Provide clear insight into how the home battery works, which charging strategies are used and which settings the resident can adjust himself. Provide unambiguous and intuitive feedback that matches the motivations (e.g. 'going green') and ambitions (e.g. 'becoming as self-sufficient as possible') of the participating households and the underlying service.

Tariffs and informative bill

For this pilot, a settlement system and a settlement process have been designed that make it possible to provide attractive price incentives. In addition, the design makes it possible to distribute the proceeds fairly between all parties involved. During the pilot, the settlement system was partially implemented. Households received a settlement based on the dynamic rates. The settlement between parties in the chain has not yet been realized, because this was not yet an issue within the pilot context.

It is important that the further development of the settlement system is open and scalable. The role demarcation of the network operator and the fixed rate of energy tax and ODE were another obstacle in ensuring more flexibility through dynamic tariffs. For example, multiple aggregators and suppliers for one household (read a connection) must be possible.

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Determine in advance what the function of the 'information bill' is. Both the provider and the customer must be clear about their purpose. Providing a simple cost overview or an incentive for behavioural change, for example. This should guide the information on the 'information bill'.

Storage

During this project, home batteries and a neighbourhood battery were technically integrated into the set-up of the business model and the settlement system. Various revenue models are possible for the operation of a battery. In this pilot, it was decided to combine two revenue models, namely demand management based on dynamic tariffs and the use of the batteries in the participating districts as FCR on the primary reserve market for balancing the energy grid.

Keep battery capacity available (i.e. not fully charge or discharge) for times when network congestion may occur. Only in this way can the batte queues help prevent grid reinforcement in the longer term. Ensure sufficient variation in the delivery and feed-in rates. A network price spike can be a good way to provide additional dynamism in tariffs and can therefore be used for network management. In order to use demand management with dynamic tariffs, it is also important that an accurate prediction of the grid load is made, so that the right incentive can be given at the right time. Use aggregated batteries distributed over different districts for use as FCR. The provision of FCR services can even increase the total grid load during peaks. By using aggregated batteries spread over several districts, it is possible to use only the batteries in those districts that are not currently experiencing a peak load on the grid. Conduct further research into the ideal customer propositions for batteries in combination with business models that have a positive impact on the low-voltage grid.

During this project it became clear that it is essential to develop an attractive customer proposition. When choosing a battery system, therefore, also take into account costs that are not directly related to the technical functioning, such as the costs for effective customer service and customer loyalty, administrative processes and the development of 'user interfaces' that meet the needs of the consumer.

The focus of the project was on the economic benefit and the technical implementation. However, the ideal business model must also meet the needs of households in their daily practice. As a sector, we must therefore look further. Unburdening could be the key word here. For example, by means of

'energy-as-a-service' or 'heating-as-a-service'. This also requires an investment from households (directly or indirectly via a service model). An extra hurdle to take. Furthermore, the service must be designed in such a way that households want to (partially) hand over control. Confidence in the proper functioning of systems and alignment with the goals of households is essential for this.

Offer participants information about their consumption and generation, energy tariff, energy storage and heat/cooling supply in one place. Make the information viewable at a glance, without people having to perform additional actions. Make sure that the flexibility service becomes part of the energy management in a household. Integrate it into an energy platform or Home Energy Management System (HEMS) or make it compatible via APIs, for example, so that the service can be integrated into existing systems. Participants often checked the monitoring tool before going to bed. Absolute values (kWh, euro cents) say little to participants without context. Relative values are more insightful; A curve with a peak and a trough is easy to understand. Help participants prioritize that align with their interest or motivation. If saving energy is your goal, what steps should you take? If sustainability is important to you, is it best to opt for solar panels or insulation? Consumers often do not know the impact of an investment here versus an adjustment in consumption there. Use an energy platform (Home Energy Management System) to make an intuitive first link with energy experts and providers of services and products. Consumers like to learn (and tell) about the peculiarities of their smart heat pump, the fluctuations in the price of electricity, their generation and storage, etc. A display or tablet that is easily accessible to every resident seems to work better than an individual app.

Results

Smart heat pump

The interviews showed that the heat pump as a heating system in a well-insulated home still takes some getting used to, despite the fact that many residents have had one in their home for a few years. It is sometimes too hot or too cold. On the one hand, because the system reacts slowly to weather changes. On the other hand, because the temperature sometimes ended up just outside the comfortable bandwidth due to the smart control. Participants did not gain insight into the consumption and control of the heat pump via the (web) app. Only the total consumption of the house was displayed. Several participants indicated that they wanted to know more and to have insight into the extent to which the smart control also led to savings. The response to the questionnaires also showed that participants generally consider it important to have control over the control of the heat pump. Finally, they expected benefits from the smart control of the heat pump

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Recommendation:

Provide consumers with clear information about how the smart heat pump works, how they can influence the operation of the heat pump and what the consequences are. Make that information available through a display or app, too. This way you also have the opportunity to support participants in case of problems or questions after the installation of equipment. Give residents feedback on the savings achieved with smart control. Advise participants on how best to ventilate the house to avoid dissatisfaction with their heat pump and to ensure that they can make optimal use of the heat pump. Also, give participants advice on what to do best in the event of a weather change or if the seasons change. (Opening a window, buying an electric heater, smartly choosing which rooms to heat.) Offer them alternatives and mention what effect they have on the comfort in the house.

Pilot project is finished. Follow up actions needed. The dynamic electricity tariffs applied during JEM 2.0 are not (yet) permitted by law. Research into this new way of looking at energy, with the associated regulations and business case, seems to be becoming increasingly opportune.

Published articles (paper, article etc.):

24.01.2018
Publication 2017: Flexible electricity tariff? Flexible energy taxation, Energeia (TESG114004)

23.03.2018
Publication 2018: New business models with dynamic flexibility, JEM 2.0 consortium (TESG114004)

23.03.2018
Publication 2018: Settlement of dynamic flexibility, JEM 2.0 consortium (TESG114004)

06.02.2019
Final report JEM 2.0 2018 (TESG114004)

06.02.2019
Publication 2018: Legal perspective, JEM 2.0 consortium (TESG114004)

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