InterFlex

Unlocking the barriers to accelerate and scale up residential flexibility in Belgium

Work Package 2 Accelerated practical action on the ground

T2.1 Dynamic pricing

Deliverable 2.1.1.

Report on projected business model with integration of dynamic tariff v2.0

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Contents

List of acronyms

API	Application Programming Interface
DA	Day Ahead
DSO	Distribution System Operator
EMS	Energy Management System
POC	Proof of Concept
PV	Photovoltaic
RLP	Real Load Profile
SME	Small and Medium-sized Enterprises
SPP	Synthetic Production Profile

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1. Introduction

The InterFlex project aims to unlock the barriers to accelerating and scaling up residential flexibility in Belgium. This report, a deliverable of Work Package 2 'Accelerated practical action on the ground', Task 2.1 Dynamic pricing, focuses on the integration of dynamic pricing formulas. Specifically, it addresses the development and implementation of possible dynamic pricing strategies by Ecopower, a cooperative supplier and producer of green electricity, in collaboration with the University of Ghent (Ugent).

Dynamic pricing, a relatively novel concept in the household energy market, offers potential benefits for both consumers and energy providers by aligning electricity consumption with energy market conditions. To properly contextualize Ecopower's dynamic price research, the report begins in Chapter 2 with a review of Ecopower's pilot project on dynamic pricing and the lessons learned from this test project. In Chapter 3, Ecopower elaborates on subsequent iterations of the dynamic pricing model.

Rolling out a successful product or price signal starts with garnering ample support for the product. This involves demonstrating to customers the advantages of switching to, in this case, the dynamic product. Chapter 4 showcases Ecopower's developments to assist customers in their decision to adopt a dynamic pricing model, including the Dynamic Price Monitor and the Dynamic Price Simulator.

The deliverable concludes with suggestions for further research in Chapter 5 (Next Steps) and a final conclusion in Chapter 6.

Through this comprehensive analysis, we aim to provide insights into the practical application of dynamic tariffs, the challenges encountered, and the potential pathways for future enhancements. The findings and recommendations presented herein are intended to guide stakeholders in optimizing dynamic pricing models to achieve greater efficiency and sustainability in the energy sector.

2. Dynamic price v1.0 (pilot project)

2.1. Prologue

In Task 2.1 of the InterFlex project which addresses dynamic pricing, Ecopower focuses on the refinement of the signal and logic on which a dynamic price formula can be optimally composed. Can the logic be based on day ahead spot market prices, imbalance prices, ancillary services, CO2-emissions, balance between renewable production and consumption or a combination of (part of) them?

To properly contextualize Ecopower's dynamic price research, it is useful to first review the research conducted prior to the InterFlex project. Therefore, we begin this deliverable by detailing the insights gained from Ecopower's pilot project and subsequently describing how these lessons were incorporated into new versions of the dynamic price.

Between July 2022 and October 2023, Ecopower, a cooperative supplier and producer of green electricity, conducted a pilot project (Proof Of Concept, POC) on dynamic pricing with its customers. This initiative was carried out in collaboration with an external IT provider, responsible for part of Ecopower's systems such as billing and invoicing, customer management and meter data management. We refer to this party in this chapter as 'external IT provider'.

2.2. Methodology and results

Following a call to its cooperative members, Ecopower saw 235 households register for participation. This exceeded Ecopower's expectations, given that dynamic tariffs are a relatively novel concept in the household energy market. Ultimately, 24 customers voluntarily opted to be charged according to the dynamic pricing scheme from that point forward. This subset will be referred to as the "test group", with the goal of testing automatic price responsiveness with their devices. The majority, consisting of 146 participants, chose to only share their data via the DSO platform, myFluvius, without actively managing their assets, thus forming the "reference group". Ecopower analysed the data from the pilot project together with its external IT provider with two specific objectives in mind. Firstly, to determine the actual costs involved in supplying a group of customers whose actual offtake and injection needed to be forecasted, and then converting this information into a pricing formula for the final dynamic product. Secondly, to pinpoint which customers would benefit from a dynamic price, allowing us to advise some customers to opt in for this in the future. Also operationally, everything had to be put in place in the business processes of Ecopower in order to make real life invoices with this price formula.

Around the midpoint of the test project, Ecopower distributed a questionnaire to all participants, inquiring about their home situations and their behaviours concerning electricity market prices (whether they were managing consumption actively or not). The results from this survey were combined with quarterly data for analysis within the pilot project. Out of all participants, 143 completed the survey. Therefore, much of our analysis relies on these 143 responses. One question focused on identifying specific devices in their homes that could benefit from dynamic pricing. The graph below provides an overview of the presence of these devices among the participants.

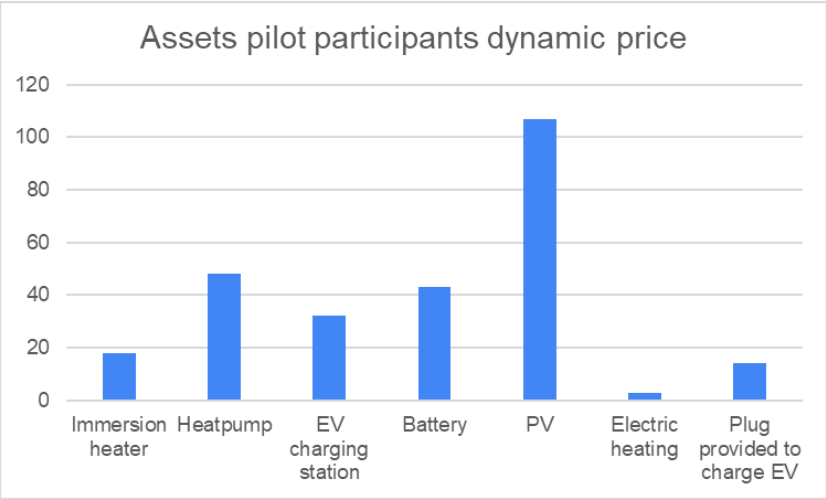

Figure 1 Assets pilot participants dynamic price

It is evident that the participant group is not representative of the Belgian or Flemish population, as they often possess relatively modern technologies in their homes. In the realm of dynamic pricing, it was crucial to determine if these participants successfully managed their devices. A total of 57 participants reported modifying their consumption patterns. Among them, 38 had manually adjusted their usage, such as timing car charging optimally. Despite the pilot project not primarily focusing on such consumption adjustments, it's notable that a considerable segment of respondents still sought to optimize their consumption.

Twenty-three respondents automated their consumption management. Upon further inquiry, 2 clarified that they manually control their consumption despite previously stating otherwise. Seven used an energy management system (EMS), and six employed custom-programmed systems. Others indicated various systems, some suggesting a ready-made EMS, while others pointed to self-developed solutions.

Ecopower provided APIs with a price signal through its external IT provider, without obligating participants to use it. Some utilized a publicly available API or an automatic system linked to their devices or integrated into their EMS. Analysis of participant consumption profiles, such as on 30 March 2023, revealed that one group successfully shifted consumption from high to low electricity price periods.

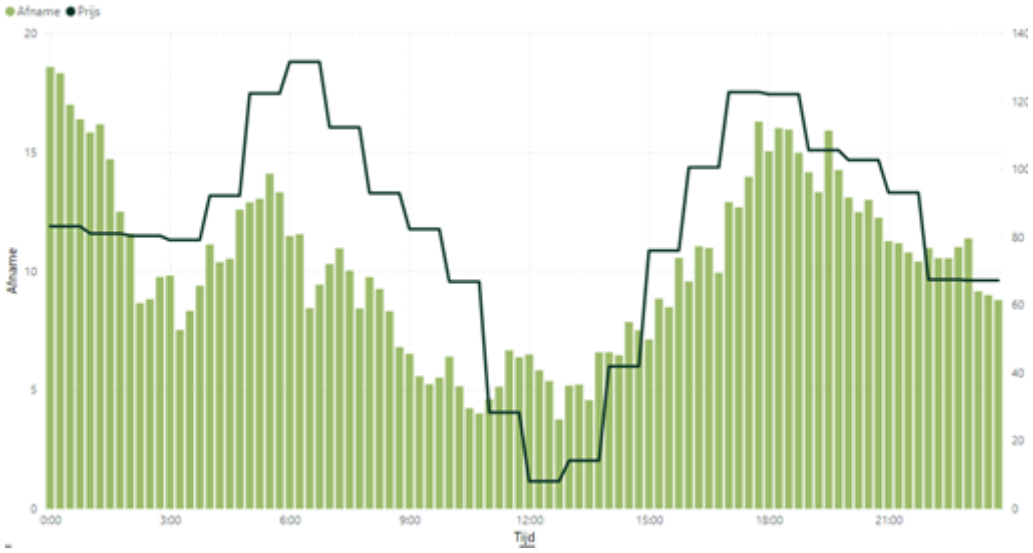

Figure 2 Participants that did not shift their consumption

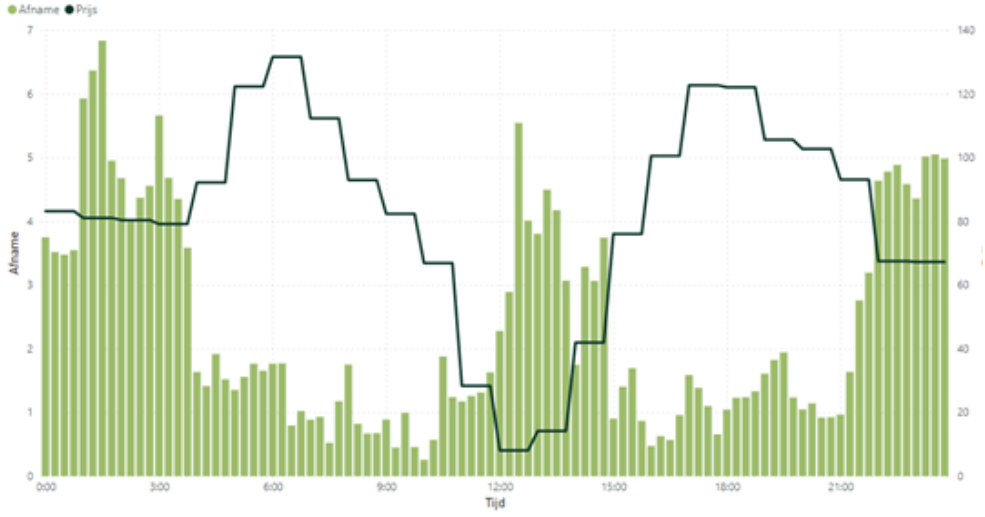

Figure 3 Participants that shifted their consumption

An analysis of the financial outcomes for the test group reveals a marginally positive financial gain from their project involvement. Participants who managed to adapt to fluctuating prices enjoyed a distinct advantage under a dynamic pricing scheme. The difference between the new dynamic formula and the RLP EPEX formula was about 10%.

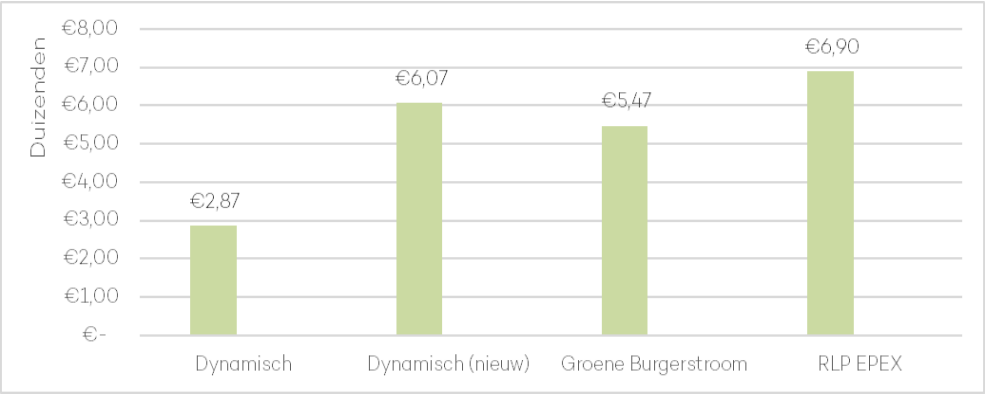

Figure 4 Financial results participants test group with different price formulas

A comparison of 4 different price systems was made:

- The 'normal' Ecopower price Green Citizen Power (and the fixed feed-in fee)

- The dynamic price for offtake and injection during the pilot project, "Dynamic"

- The new price for dynamic citizen power, applied to the past, "Dynamic (new)"

- The fictive variable price formula, with the RLP and SPP weighted average EPEX price for each hour entered into the dynamic formula, "RLP EPEX". RLP and SPP are predefined profiles used in the allocation and invoicing of yearly metered consumers in Belgium.

We found the comparison between the last two pricing systems most interesting, as it gives the best indication of the future.

2.3. Lessons learned

Despite initial delays, the pilot project's test group customers were in the end all regularly billed on a monthly basis. Some customers faced overdue invoices due to issues at DSO Fluvius. Our new pricing formula was established based on the pilot project results.

Comparing the regular "Green Citizen Power" formula with the "Dynamic Citizen Power" formula over a year or more doesn't reliably predict future benefits. The predetermined nature of Green Citizen Power means it stays relatively cheap when prices rise, unlike Dynamic Citizen Power, which spikes. A yearly comparison against a standardized variable price shows whether a customer's profile is suited to dynamic pricing.

Generally, dynamic pricing was not favourable for most customers, especially those with PV panels, as switching to quarter-hourly billing turned out to be disadvantageous in a lot of situations. The profile used to allocate PV injected electricity in the absence of quarterly-hour data provides a clear benefit over any realistic profile, and also for the residual offtake the predefined profile was beneficial. For customers with PV panels, profiting from dynamic prices was almost impossible without significant effort and adjustments. Customers without PV were underrepresented in the survey, but generally had a less clear disadvantage. Test group participants who automated responses to price signals did benefit on average, particularly those with batteries and EV charging stations. Participants with heat pumps did not fare better with dynamic pricing.

Surveys revealed no definitive attributes making dynamic pricing beneficial without doubt. Electric vehicles showed potential success, although without automatic steering, the advantage was minimal. Batteries without price control offered little benefit, and heat pumps were more likely to negatively impact. Behavioural factors, such as being home during the day, didn't yield clear conclusions.

Ecopower aims to deliver locally generated renewable power from community-owned facilities to its members. Green Citizen Power pricing covers all operational costs from the start, promoting reduced consumption. Dynamic Citizen Power aims to transmit market signals clearly. Forecasting consumption and injection for dynamic customers is challenging and incurs imbalance costs, particularly for solar injection. As dynamic customers' behaviour changes post-price announcements, prediction inaccuracies occur. These effects were not represented in the pilot project formula, and needed to be addressed if the pilot project were to be translated into a more permanent offering.

3. Dynamic price: new versions

3.1. Dynamic price v2.0

Based on the lessons learned of the proof of concept (POC) with dynamic price v1.0, a second version was launched in September 2023. This version of the Dynamic price is open to all Ecopower customers. Ecopower invested in intensive communication towards its customers on this new topic. Actions included the design and maintenance of a web page on Ecopower' website, a blog article in Ecopower's newsletter and a webinar to introduce the dynamic price on 3rd of October 2023.

The formula of dynamic price v2.0[1] for offtake and injection is:

Offtake	**Injection**
1,02 x $EPEX_{DA}$ + 4 EUR/MWh	0,85 x $EPEX_{DA}$ – 4 EUR/MWh

Table 1 Dynamic price v2.0

The $EPEX_{DA}$ component refers to the EPEX day ahead price for which prices are available from noon for the entire following day (day-ahead, 1 price per hour, 24 hours per day). In addition there is a surcharge and discount to cover imbalance costs (the difference between Ecopower's forecast and the actual consumption and injection each quarter-hour). To conclude, an admin fee of 5 EUR/month is needed to cover costs of customer service and other departments within Ecopower that support the implementation and follow-up of the dynamic tariff v2.0.

Much of the logic for this new pricing formula was deducted from the pilot project. Firstly it was decided to translate all non-energy related costs into a subscription fee. As the pilot project would scale up to a bigger sample, it would be very difficult to estimate the profile of customers that would self-select into the product. A high offtake fee would skew the population towards customers with high injection compared to offtake, without any relevance for the costs. Extra costs on the offtake formula also disturb the price signal sent to clients. In extreme cases a certain useful action could be lost because a threshold is not passed because of a fixed add-on. Moreover new market scenarios such as DGO facilitated energy sharing could diminish the offtake basis on which these costs are recuperated, opening up a gap between income and costs for the system.

Secondly, the pilot project seemed to indicate that imbalance costs were very different for offtake and injection. Specifically, PV injection forecasting errors tended to occur mostly in correlation to forecasting errors in the market, leading to significant imbalance costs. For offtake such a correlation seemed much less proven. Thirdly over the course of the pilot project average market price levels changed dramatically. It seemed that imbalance costs are also very much related to the hight of market prices, with higher market prices also increasing the spread between high and low imbalance prices, and therefore generating much more imbalance costs.

The newly adapted pricing formula also included provisions for energy sharing in Flanders. Energy sharing in Flanders allows customers and producers to administratively exchange electricity on their bills. In practice however, this does not change any of the actions or costs related to imbalance for suppliers. It also comes with an additional administrative burden. As the aim of the Ecopower dynamic pricing formula 2.0 was to reflect all costs, it was decided to introduce an

[1] All costs mentioned here are VAT excl.

administrative fee covering the extra operations, and a per kWh shared volume add-on, calculated based on the cost component for imbalance in the normal pricing formula.

Offtake	Injection
0,02 x $EPEX_{DA}$ + 4 EUR/MWh	0,15 x $EPEX_{DA}$ + 4 EUR/MWh

Table 2 Add-on for energy sharing in dynamic pricing formula v2.0

In the margin of these pricing decisions, Ecopower also decided to end support for its own price API. In the pilot many end-users turned out not to use the Ecopower API and instead to choose a more stable publicly available API, or a built in feature of their own devices. Keeping this feature online for a relatively small group of users was economically unreasonable. It also provided no additional value over a public API with only EPEX DA information. Moments with high or low prices can be deducted from these API as well as from a dedicated Ecopower API.

As was expected the uptake of the new pricing formula was limited at first. As prescribed by European law customers were advised to take caution with the dynamic price formula as theoretically customers could face higher costs if their offtake profile would favour high market price moments.

Ecopower also provided a tool to follow-up the dynamic pricing versus the “normal” Ecopower pricing. In parallel market prices went down significantly, and the new market situation prompted a lot of customers to install batteries and a lot of battery installers to advise customers to take a dynamic price. Gradually the adoption of the dynamic price accelerated, as shown in Figure 5.

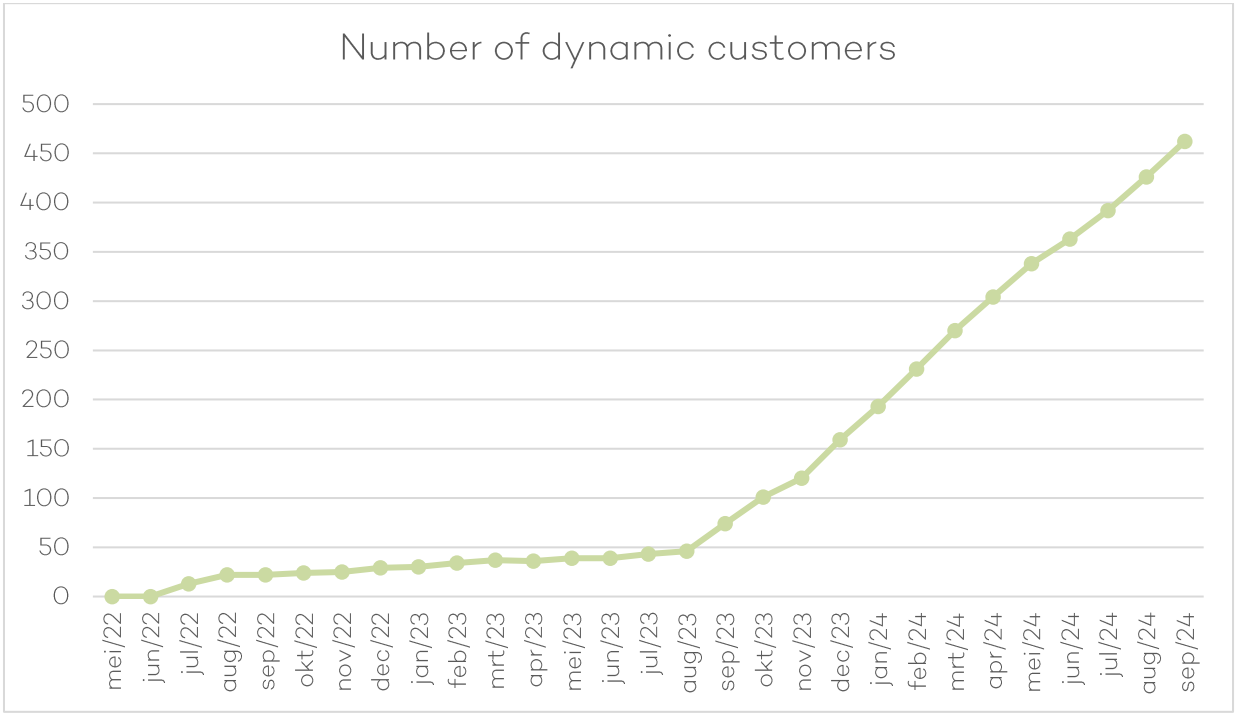

Figure 5 Number of dynamic customers v2.0

End of September 2024, Ecopower counted 462 customers with dynamic tariff v2.0, of which 423 households and 39 SME's. This group exceeds the size of a pilot group, but is still small enough to absorb any financial impact of scaling issues. Ecopower did not repeat the earlier survey, making it slightly harder to verify the earlier conclusions about beneficial profiles. The cooperative customers did provide a lot of feedback.

Firstly it was very clear customers were frustrated with the lack of guidance on whether they had a suitable profile to adopt a dynamic pricing formula. A lot of households have thus far invested in batteries, electric vehicles and heat pumps and are looking for some kind of indication that they would benefit from a dynamic price formula. Such tailored advice proved to be difficult. Some customers also asked for better support in knowing the prices beforehand, by means of an API or a reliable platform where DA prices could be viewed.

Secondly some customers suggested different versions of the dynamic price formula. Interestingly these suggestions go both ways. One group would like to enjoy more general price stability from cooperative electricity. As such they request a semi-fixed formula where only half of the price is based on the pure day-ahead price. The other group would like to be able to access more energy markets, such as the imbalance market (even though this is not really a market) and other reserve markets. These suggestions mostly follow press articles where great potential gains from these markets are reported.

3.2. Dynamic price v2.1

An analysis of the first year of implementing the real-life dynamic tariff (v2.0) highlighted the necessity for specific adaptations to remain in sync with the changing energy market. These adaptations precede a more fundamental rethinking of the pricing formula (v3.0) that will be further researched within this project. The incremental change could not wait until further research on a potential overhaul was complete. More and more customers are changing to the dynamic price formula, increasing the impact of a pricing formula that is out of sync with the markets.

In this intermediary change only the injection formula was changed. The charges for imbalance simply do not correspond to the real life costs for imbalance. A part of this is due to lower average market price levels in general, decreasing the margin taken on the 0,85*EPEX (h) in the formula. This decrease in market levels, however, did not correspond to lower imbalance costs, as was predicted when making up this formula. A second part of the problem is the increased occurrence of negative price moments. At these times the 0,85 factor actually raises the price the end consumer gets for injection, while imbalance costs are just as high at these times.

The revision from v2.0 to v2.1 was communicated in October 2024. To explain the necessity of these changes, a free webinar will be organised on November 6, 2024. This event is open to everyone, including non-Ecopower customers and shareholders. It will be recorded and uploaded to YouTube, ensuring it remains publicly accessible. By the end of October 2024, 550 persons have already registered to attend this webinar.

	Period	**Offtake**[2]	**Injection**[3]
Dynamic price v2.0	01/09/2023-31/12/2024	1,02 x $EPEX_{DA}$ + 4 EUR/MWh	0,85 x $EPEX_{DA}$ – 4 EUR/MWh
Dynamic price v2.1	Starting from 01/01/2025	1,02 x $EPEX_{DA}$ + 4 EUR/MWh	0,98 x $EPEX_{DA}$ - 15 EUR/MWh

Table 3 Dynamic price v2.0 VS dynamic price v2.1

Ecopower decided to not (yet) provide price signals itself to control offtake and injection of customers. An own Ecopower API still offers little added value compared to a public API with market prices. After all, these are high and low at the same time. We do continue to see if an Ecopower API - with additional information - would add value over the public versions.

During the project Ecopower will further research potential changes to the dynamic pricing formula, catering to potential questions of customers, as well as trying to capture as much societal and economic benefits as possible with the steering potential. This research goes in different directions, that could result in one or more offerings in the third version of the pricing formula.

One potential direction is to offer price stability, characteristic of energy cooperatives with common investments in renewable energy, with a dynamic price formula. As customers of cooperatives usually value a certain security in their price, different weights of stability could be introduced into the pricing formula.

[2] Excl. 21% VAT for businesses and 6% VAT for individuals.
[3] Excl. 21% VAT for businesses, VAT not applicable for individuals.

A different route to a new formula is to simplify the formula by changing the price only in certain time blocks (for example only increasing prices in the evening and lowering them at noon). This could cater to a number of end-users who want to implement simple decision logic, both at the technical and the behavioural level.

A last route that will be investigated is how more value can be captured with the flexibility. Potentially prices could be adjusted in a compound signal to adjust for different market impacts. Alternatively the dynamic price formula could be accompanied by an offering of market flexibility that offers separate rewards.

4. End user tools

Rolling out a successful product or price signal starts with garnering ample support for the product. This involves demonstrating to customers the advantages of switching to, in this case, the dynamic product. Building on the insights gained from the pilot project with dynamic pricing v1.0, Ecopower has created two tools designed to assist and possibly encourage customers in their decision to switch to a dynamic pricing model; the Dynamic Price Monitor and the Dynamic Price Simulator. The Monitor supports customers that already have Ecopower dynamic price (Dynamic Citizen Power) and want to follow up on their result. The Simulator aims for customers that are not yet billed on the Dynamic Citizen Power, but wish to explore whether it could be beneficial for them to switch to this product. From a precautionary perspective, Ecopower aims to ensure that customers can clearly see the benefits before opting to switch to Ecopower's dynamic tariff (Dynamic Citizen Power).

4.1. Dynamic Price Monitor

4.1.1. Introduction

In year 1 of the InterFlex project, Ecopower further developed and finetuned the Dynamic Price Monitor in collaboration with IT provider EnergieID.

The basis of this development is derived from the lessons learned of the pilot project that was executed with dynamic price v1.0. The feedback of end-users in that pilot has been incorporated in bilateral meetings with EnergieID. Besides Ecopower, departments ranging from customer services, communications to financial services and market operations were involved in the co-creation process.

The target group of the Dynamic Price Monitor are customers that are already billed on Ecopower's dynamic price formula ('Dynamic Citizen Power') and wish to have a tool to follow up on its results. The tool makes a comparison between Ecopower's two possible price formulas: 'Green Citizen Power' and 'Dynamic Citizen Power'. The product Green Citizen Power is comprised of two parts; 50% fixed part to cover operational and administrative costs and 50 % variable. The variable part is based on the hourly price in the Belgian Electricity market, calculated using a theoretical consumption profile (RLP weighted average of the Day Ahead Baseload EPEX). The EPEX DA rate is the daily determined hourly price for electricity in Belgium.

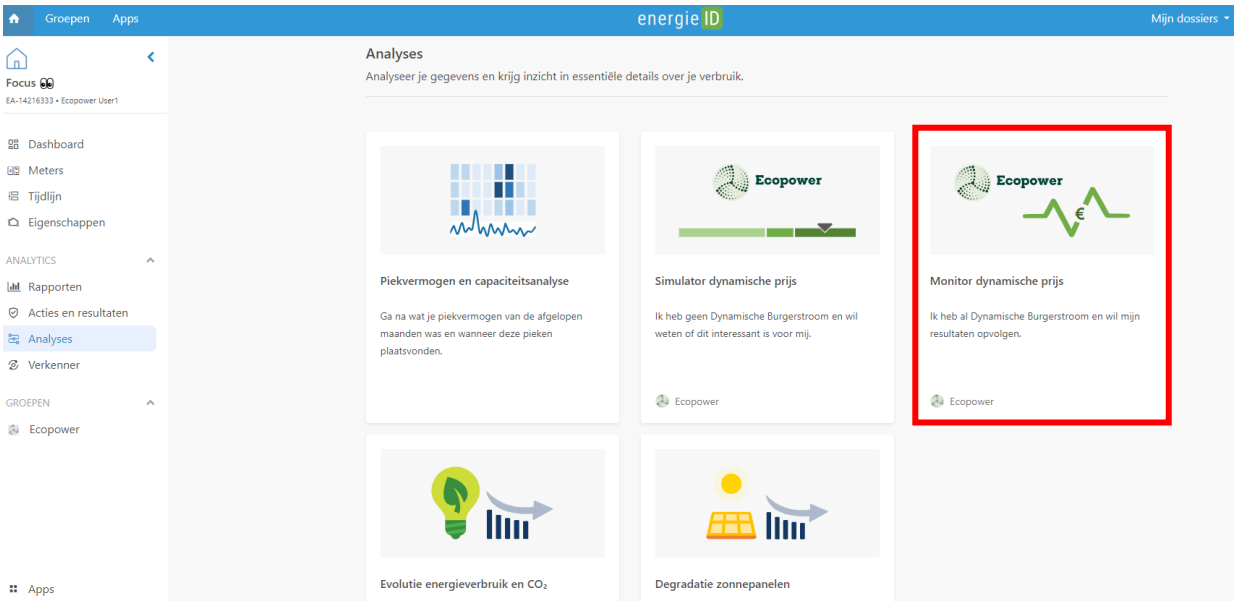

Figure 6 Dynamic Price Monitor in Analyses of EnergieID platform

4.1.2. Components

a) Evolution energy component

The first widget of the monitor dynamic price presents a comparison between what the result of the customer is based on the Dynamic Citizen Power price, and what the result would have been if the customer was billed on the Green Citizen Power price of Ecopower. Only the energy component is taken into account in this calculation. In Figure 2 the analysis is made for the offtake volume. A similar analysis is available for the injection volume.

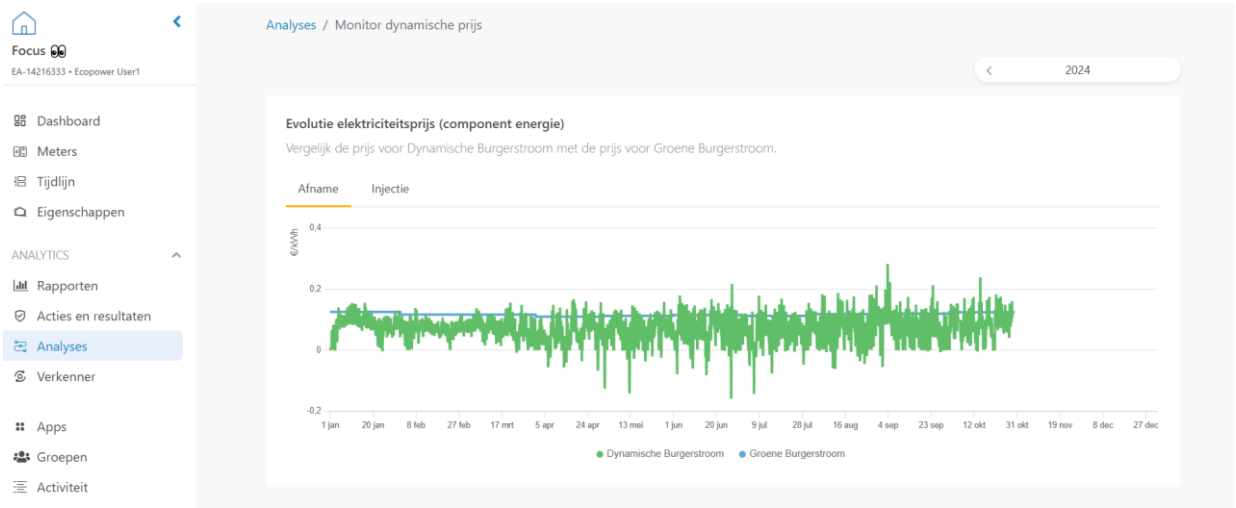

Figure 7 Comparison of offtake result between Green Citizen Power (blue line) and Dynamic Citizen Power (green line)

b) Monthly result

The monthly result graph indicates whether Green Citizen Power or Dynamic Citizen Power was most beneficial for the month concerned. At the right bottom a total of the energy component per product for the presented period is shown.

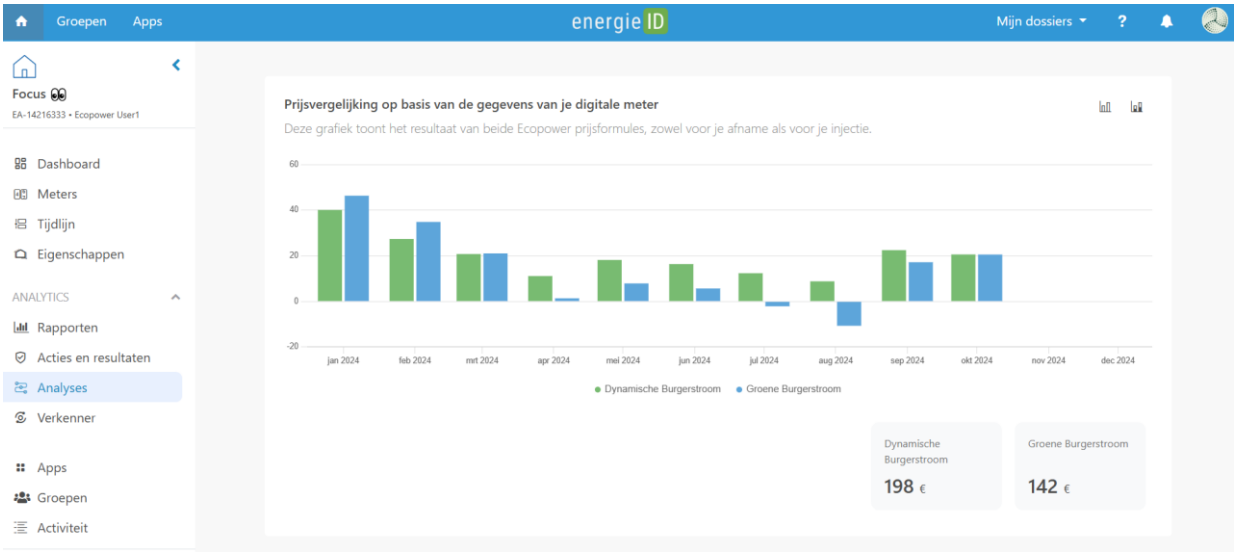

Figure 8 Dynamic Price Monitor - Monthly result

This analysis is based on historical data and does not guarantee future results. The comparison with Green Citizen Power is not a suitable indicator to estimate whether Dynamic Citizen Power is interesting for the customer. To answer this question, the customer can consult the Dynamic Price Simulator (discussed in the next section of this deliverable).

4.2. Dynamic Price Simulator

4.2.1. Introduction

In year 1 of the InterFlex project, Ecopower developed the Dynamic Price Simulator in collaboration with IT provider EnergieID. The simulator successfully went live in October 2024.

Frequent bilateral meetings with EnergieID occurred to determine the design, logic and user-friendliness of the simulator. Internally, several departments of Ecopower (customer services, communication, financial, market operations, etc.) were intensively consulted in the design process, amongst others during Ecopower's monthly internal dissemination event 'Powerpitch' and a focus group session. After the focus group, different iterations occurred to finetune the simulator. To conclude, different sessions were organized with University of Ghent to discuss the simulator (and dynamic price formulas in general).

The Dynamic Price Simulator is developed for customers of Ecopower that are not invoiced based on Ecopower's dynamic price formula' but who wish to discover whether the dynamic formula could be beneficial for them. They can now use the simulator to make an analysis of their personal profile to receive an indication whether, on average, they could make a financial gain in the future by switching to Ecopower's dynamic price formula called Dynamic Citizen Power.

The analysis is not a comparison to the normal Ecopower product: Green Citizen Power. The price for Green Citizen Power is half fixed, half variable. If market prices rise (and with them the variable part), the fixed part will mitigate the price. If market prices fall, on the other hand, the fixed portion does not fall with them and Green Citizen Power may potentially be a bit more expensive.

No one knows what market prices will do in the future. Therefore, it is of little use to base your choice on the comparison between the current price for Green Citizen Power and the price for Dynamic Citizen Power.

Personal offtake and injection data are used to calculate the customer's electricity bill. Only the price of the energy component is considered, since certificates, grid tariffs and charges do not change much. On that data we apply the two possible price formulas:

- Hourly billing: a dynamic price that varies every hour and is applied to your offtake or injection of that hour.
- Billing per month: an average, variable price that varies each month and is applied to all your offtake that month, regardless of when you consumed. The same system with its own price is also applied to injection.

That average, monthly price is not a real price offered by Ecopower. However, it does provide a good reference that we use to easily show whether a dynamic price could be interesting for the customer. The price is actually built up of the same price components as the dynamic price, but uses a offtake and injection profile similar to the one that is actually used in the market for customers that do not have a dynamic contract. In that sense it gets very close to a realistic offering in the market.

It could be that the customer's profile is favourable at certain times of the year and not others. Ecopower is therefore most confident in the analysis when it is based on 12 consecutive months.

Customers of Ecopower receive a free EnergieID Premium account. With this account, customers can consult the Dynamic Price Simulator. After logging in in the EnergieID platform, the customer can go to 'Analyses' and click on the tile 'Dynamic Price Simulator). After clicking on the tile, the customer sees in the same web page the general indicator, a monthly result and an hourly results. We explain these components of the simulator with screenshots in the following section.

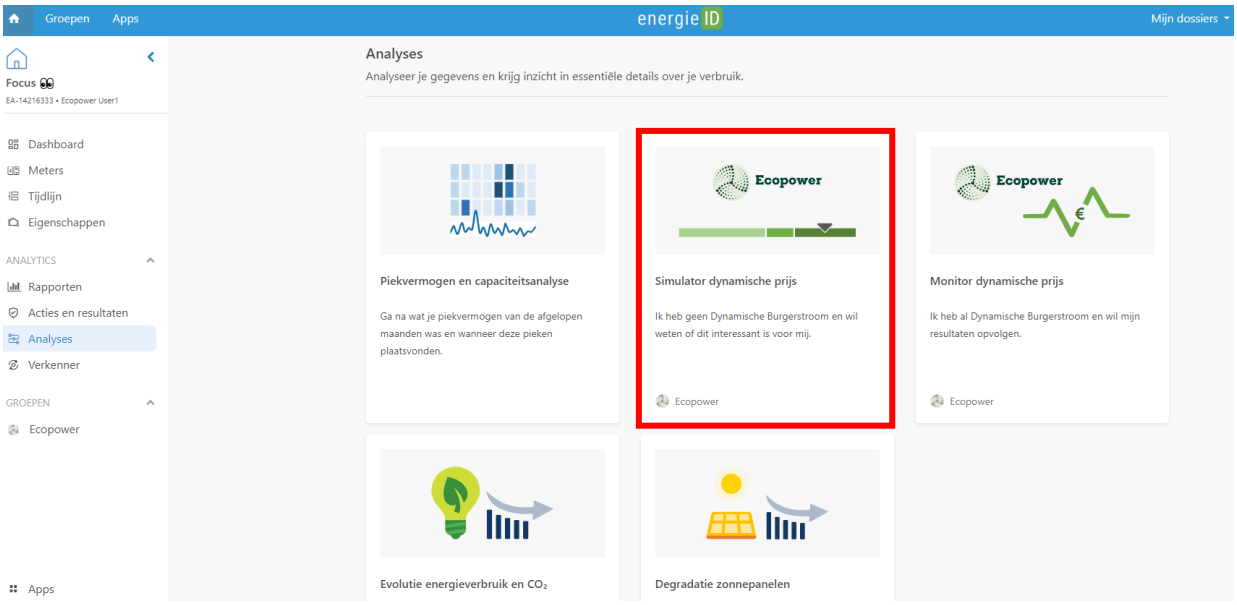

Figure 9 Dynamic Price Simulator in Analyses of EnergieID platform

4.2.2. Components

a) General indicator

The purpose of the dynamic price simulator is to make it clear to the customer at a glance whether the profile of the customer is interesting for a dynamic price or not.

- **Is the customer's result favourable (*gunstig*, in darkest green area of the bar)?**

  The customer's offtake and injection profile was better than the average market profile last year. Is the customer not planning to connect any new (wholesale) consumers in the coming year or change their behaviour substantially? Then a dynamic price may suitable for this customer. If the customer takes into account the fluctuations of the dynamic price, for example by automatically controlling a battery, the customer can increase its advantage.

- **Is the customer's result unfavourable (*ongunstig*, in the lightest green area of the bar)?**

  The customer's offtake and injection profile last year was not as good as the average market profile. Perhaps the customer can take actions to consume more at times with low prices.

Ecopower then recommends the customer to implement those actions first and only when the customer has a good view of their effect, possibly switch to Dynamic Citizen Power.

- **Is the customer's result not distinctly favourable or unfavourable (in the mid-section of the bar)?**

  The customer may still be able to achieve favourable results through relatively limited adjustments. Again, it is advisable to make another analysis after sufficient time after the adjustments have been made, before the customer switches over.

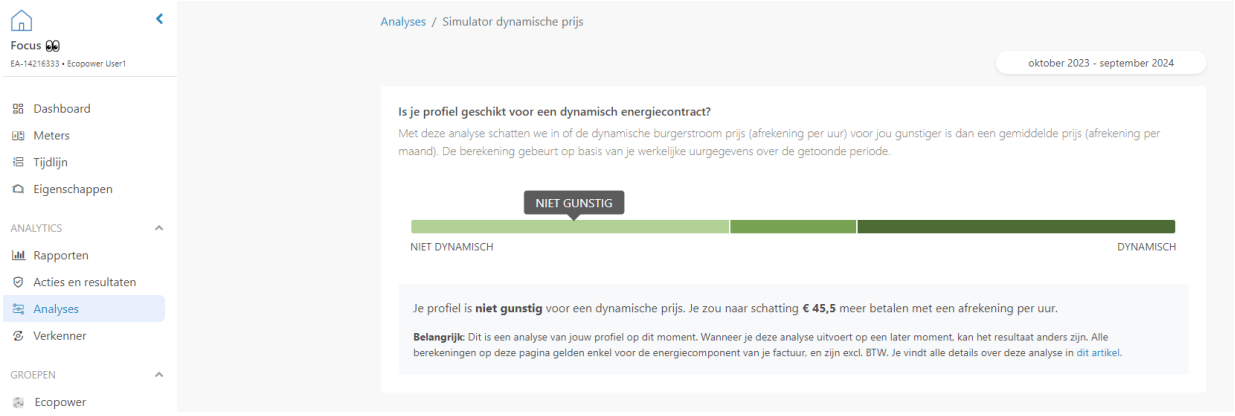

Figure 10 Dynamic Price Simulator - General indicator

b) Monthly result

If the customer wishes to receive more details than the general indicator result, it can scroll down to the monthly result graph. This graphs shows in which months the profile of the customer was favourable for a dynamic price or not.

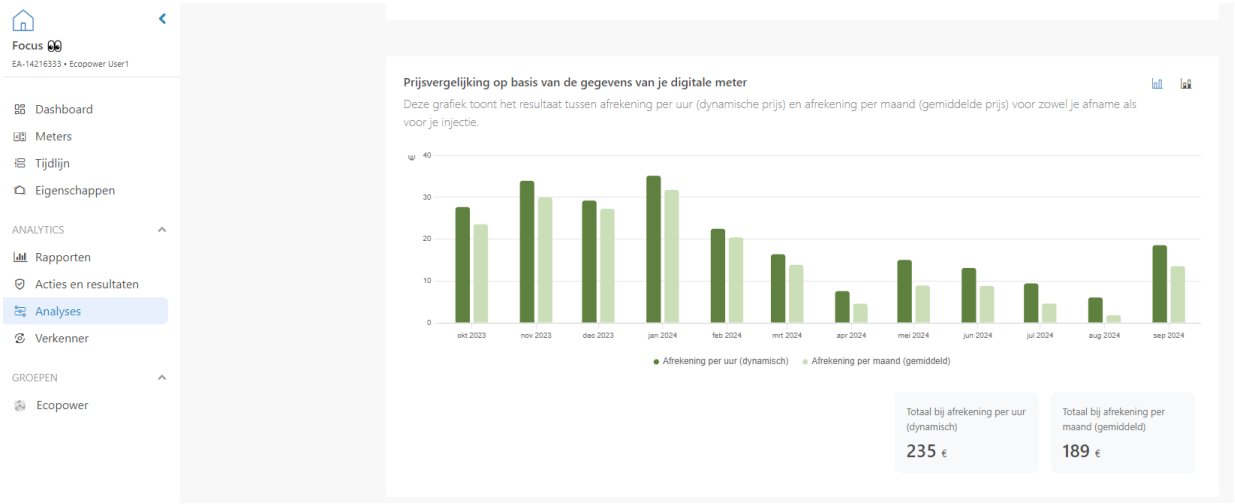

Figure 11 Dynamic Price Simulator - Monthly result

c) Hourly result

At the bottom of the simulator, the third and last visual is visible. The customer can see for each month at which times (hours) their profile was favourable and at which times it was not favourable for a dynamic price. The customer can see the explanation for each box by hovering the cursor over it.

A green box means that at that time (hour) the customer's profile was more favourable to a dynamic price than the average market profile. This can have one of the four reasons:

- The customer consumed more than average and the price is relatively low (Figure 5)
- The customer consumed less than average and the price is relatively high
- The customer injected more than average and the price is relatively high
- The customer injected less than average and the price is relatively low

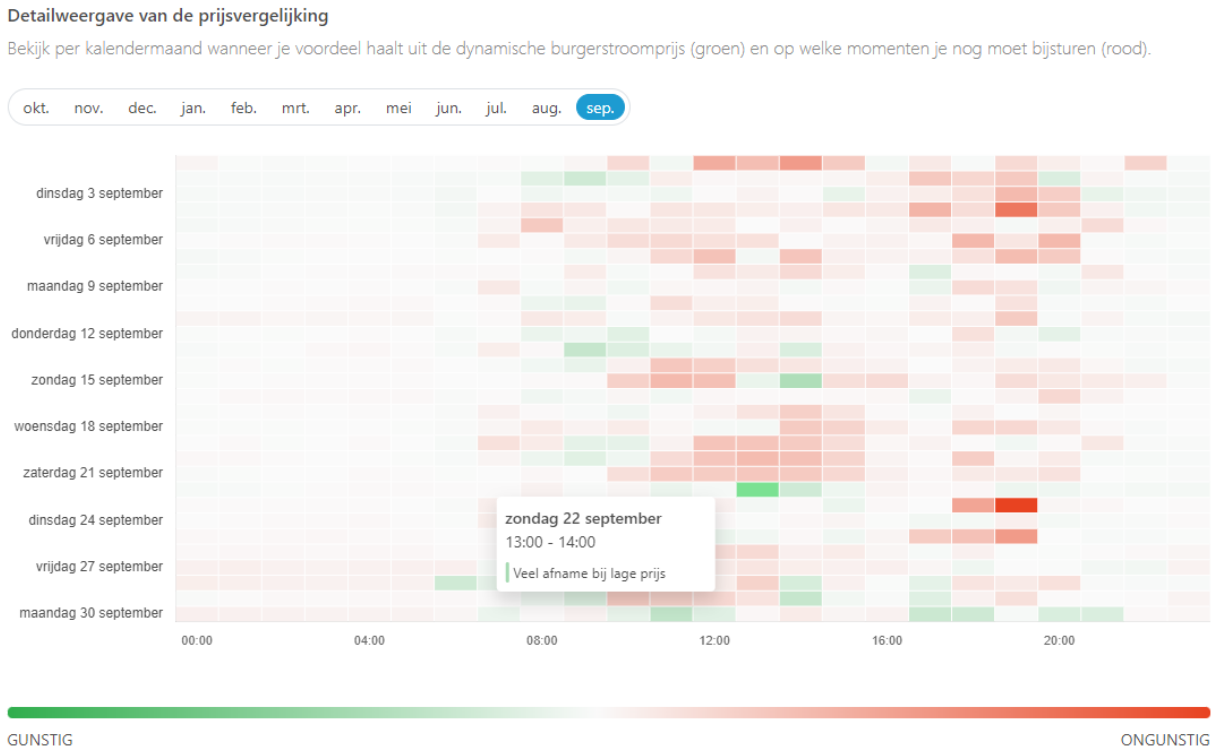

Figure 12 Dynamic Price Simulator - Hourly result (green box)

The reverse is true for the red boxes, for which one of the 4 following reasons can apply:

- The customer consumed less than average and the price is relatively low
- The customer consumed more than average and the price is relatively high (Figure 6)
- The customer injected less than average and the price is relatively high
- The customer injected more than average and the price is relatively low

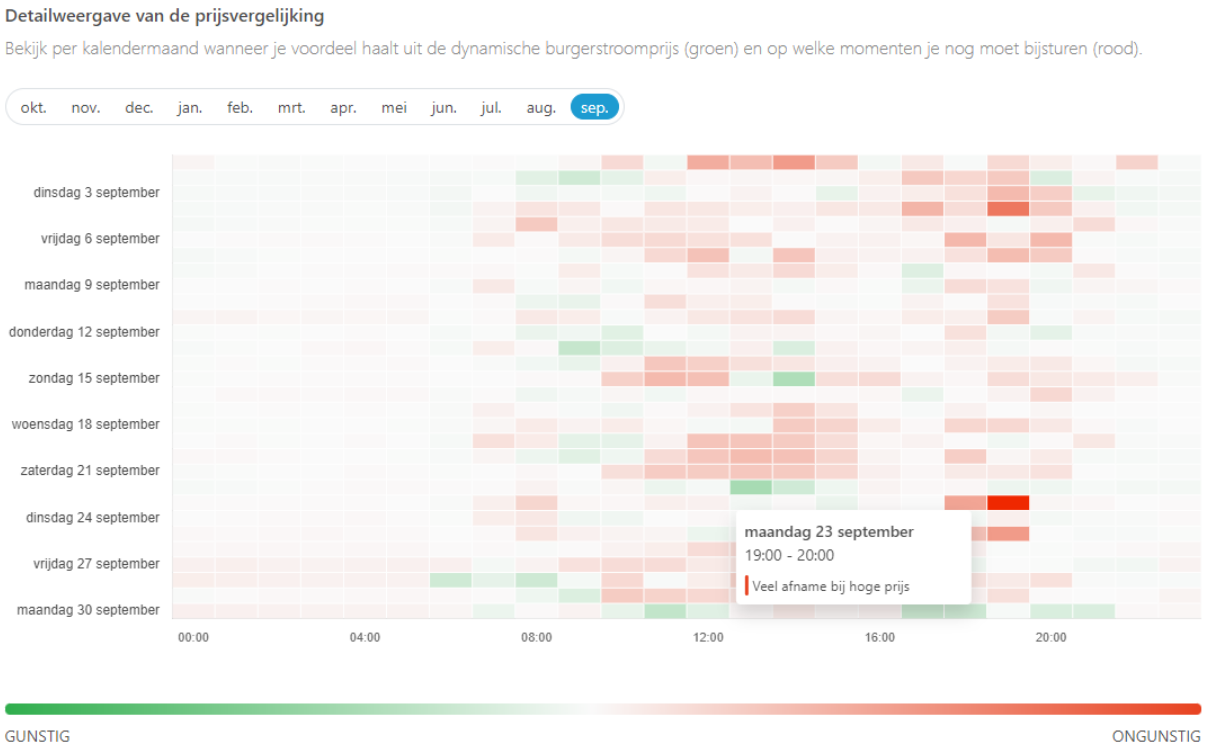

Figure 13 Dynamic Price Simulator - Hourly result (red box)

To make their profile more favourable for a dynamic price, the customer would have to reduce the red boxes. This can be done by moving their consumption more from times of high prices to times of low prices. Although this is often easier said than done. In general, Ecopower recommends that large consumers - e.g., electric vehicles, heat pumps and batteries - be controlled automatically through the manufacturer or through an energy management system (EMS). Those handy enough can also program themselves. Ecopower underlines that manual actions or trying to change your behaviour takes a lot of effort with little result.

Many modern appliances (heat pumps, charging stations) have a built-in control system. In addition, there are a lot of control system providers on the market. These offer advantages but, of course, also have a price. Ecopower does not currently provide advice on how best to set up that steering, nor does Ecopower recommend certain providers or products. We are continuing to explore how we may be able to help customers with that in the future.

d) Limitations of the simulator

Ecopower launched the simulator with a disclaimer that the customer cannot be 100% sure that they will benefit by switching to a dynamic price. We hereby list some limitations and uncertainties:

- **It cannot be predicted whether future market prices will be high or low**

With Ecopower's Green Citizen Power's pricing formula, we always try to keep the price stable. We do not make that promise for Dynamic Citizen Power. Those hourly prices follow 100% the vagaries of the market. If like in 2022, prices go through the roof, Dynamic Citizen Power and you may be doing a detriment.

- **We do not make assumptions about prices throughout the year.**

The analysis uses the movement of prices through the previous year. Ecopower chooses not to use predictions of prices of the future. After all, these often assume higher prices in winter (no sun and much offtake for heating) and lower prices in summer (much sun and little offtake for heating). If we adopt that assumption in the analysis, it no longer reflects the relationship between the customer's behaviour and actual prices. If the analysis has sufficient data, these kinds of effects are also relatively unimportant.

- **A customer's profile may evolve**

It could be that a customer's profile changes compared to the last year. For example, because a customer replaced a large consuming device with a more efficient device. The analysis bases itself on the past, and thus does not take this into account. Investments such as solar panels, batteries, heat pumps and electric cars are only taken into account once they actually generate off-take and injection. If the customer thinks its consumption profile in the coming year will be different from the previous one, it's best not to rely on the simulator to determine whether to switch or not.

The simulator is also limited to the situation as-is for the customer. It cannot take into account effects of adding new technologies, such as an investment in a battery system or buying an electric vehicle. It also cannot take into account the effects of steering a current setup of such technologies. We could reasonably assume that a residential customer with a PV system and a battery currently only cares about increasing its self-consumption. This might be suboptimal from the point of view of the dynamic price. Calculating the gain of such an optimalisation is currently beyond reach of the simulator.

5. Next steps

With the development of the Dynamic Price Monitor and Dynamic Price Simulator, we hope to familiarize customers with the dynamic tariff in the most reliable and effective way possible. This could be one of the initial steps in involving customers to help achieve an optimal balance between consumption and injection within Ecopower's cooperative's portfolio of production assets and customers.

In particular the Dynamic Price Simulator could be the basis for more detailed analysis. Ecopower will research further expansions to this tool to account for potential flexible assets customers already own, but do not steer based on the market prices. It could also include a simulation of new investments, such as batteries, EV's and heat pumps. In the second year of the InterFlex project, we will explore the feasibility of expanding the dynamic price simulator with these capabilities.

In the second year of the InterFlex project, Ecopower plans to develop a societal barometer that indicates when there is an excess or shortage of electricity within the cooperative. This barometer should familiarize people with the concept of a time value of electricity. Customers not currently taking part in dynamic prices could already use this barometer as a guide when consuming electricity has the lowest societal cost. By internalizing this concept, customers could mentally prepare for a dynamic price further down the road. It could also provide interesting baseline information for when they are contemplating changing to a dynamic price later.

Furthermore, we will explore further improvements or changes to the dynamic price. These changes could go in different directions. One way could be to simplify the formulas so they translate better to customer logic. A second way is to introduce a stable element in this formula, reducing the market risk from this type of formula. A last way is to introduce different elements into the formula, reflecting imbalance costs and other operational gains and losses other than pure EPEX DA listings. Reflecting these costs in a compound signal could incentivize customers to lower overall costs.

6. Conclusion

The InterFlex project aims to unlock the barriers to accelerating and scaling up residential flexibility in Belgium. This report, a deliverable of Work Package 2 'Accelerated practical action on the ground', Task 2.1 Dynamic pricing, focuses on the integration of dynamic pricing formulas. Specifically, it addresses the development and implementation of possible dynamic pricing strategies by Ecopower, a cooperative supplier and producer of green electricity, in collaboration with the University of Ghent (Ugent).

Launching a successful product or price signal begins with securing substantial support for the product. This requires showcasing to customers the benefits of switching to the dynamic product. Leveraging the insights from its pilot project with dynamic pricing v1.0, Ecopower has developed two tools to assist and potentially encourage customers in their decision to adopt a dynamic pricing model: the Dynamic Price Monitor and the Dynamic Price Simulator.

The Monitor is designed for customers already using Ecopower's dynamic price (Dynamic Citizen Power) and helps them track their results. The Simulator is intended for customers not yet billed under Dynamic Citizen Power but who wish to explore its potential benefits. By developing the Dynamic Price Monitor and Dynamic Price Simulator, Ecopower has aimed for familiarizing customers with the dynamic price in the most reliable and effective manner. This initiative could be a crucial step in engaging customers to help achieve an optimal balance between consumption and injection within Ecopower's cooperative portfolio of production assets and customers. To further enlarge the engagement level of customers, Ecopower will research other initiatives such as expansion of the simulator with more functionalities and a societal barometer, indicating when there is an excess or shortage of electricity within the cooperative. This barometer should familiarize people more with the concept of a time value of electricity.

After one year of offering the dynamic price to all its customers, it is evident that there is significant interest, as shown by the directly proportional increase in the number of customers who have switched to Ecopower's 'Dynamic Citizen Power' product (dynamic price v2.0), counting 462 customers at the end of September 2024.

In the second year of the InterFlex project, Ecopower will further investigate potential changes to the dynamic pricing formula, addressing customer queries and aiming to capture as many societal and economic benefits as possible through steering potential. This research will explore various directions, potentially resulting in one or more offerings in the third version of the pricing formula. One potential direction is to offer price stability, a characteristic of energy cooperatives with common investments in renewable energy, within a dynamic price formula. As cooperative customers typically value price security, different levels of stability could be integrated into the pricing formula. Another approach is to simplify the formula by adjusting prices only during specific time blocks. Lastly, the research will explore how to capture more value through flexibility. Prices could be adjusted in a compound signal to account for different market impacts. Alternatively, the dynamic price formula could be paired with an offering of market flexibility that provides separate rewards.