Deliverable 3.1:

RETAILER INCENTIVES FOR THE INTRODUCTION OF DYNAMIC PRICING AND ITS IMPACT ON WHOLESALE PRICES

Estelle Cantillon

Leticia Pieraerts de la Cuadra

Elise Viadere

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This note summarizes findings from the Demandflex project on retailer incentives to introduce dynamic pricing and its impact on wholesale prices. It partly builds on Leticia Pieraerts and Elise Viadere's 2026 paper on "Who benefits from the energy transition? Market power and flexibility in retail electricity market" (forthcoming in the ECARES working paper series) and ongoing work by Leticia Pieraerts on the Spanish wholesale electricity market.

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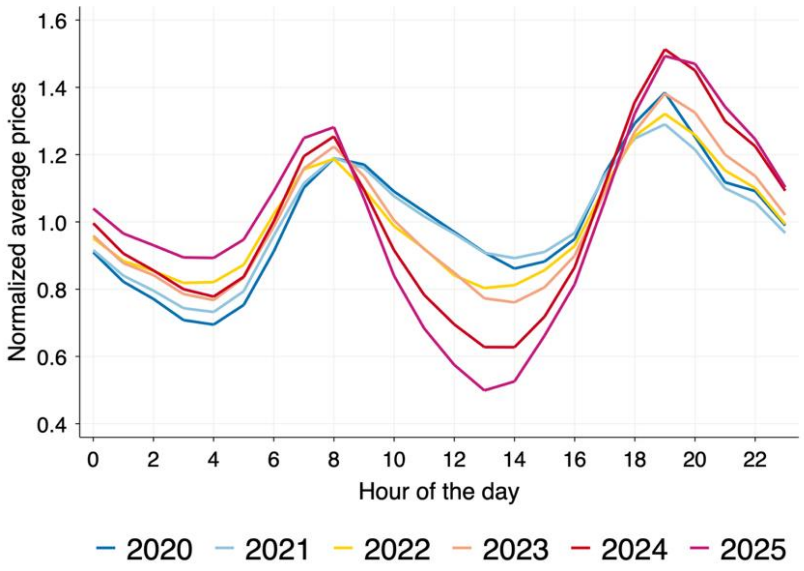
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1. Problem definition

Demand-side flexibility needs are growing. Intermittent renewable energy sources – a key channel for decarbonizing our energy - have grown rapidly in Europe over the past decade. In Belgium specifically, wind and solar power grew from 14% of the electricity mix in 2018 to 34% in 2025.[1]

As a result, wholesale electricity spot prices (the prices set on the power exchange the day before delivery, for each hour or quarter-hour of the next day) have become increasingly volatile, as they adjust to balance supply and demand at all times. Figure 1 illustrates this. It shows the average hourly price normalized by the average yearly price, for each year between 2020 and 2025 (the normalization facilitates the comparison across years). Wholesale prices have become increasingly variable across hours of the day, with increasing difference between the most and the least expensive hours of the day. This shape mirrors the so-called duck curve of net demand: the rise of intermittent generation, solar particularly, lowers the price during hours of peak solar generation (midday), while raising the price in the evening as thermal generation ramps up to follow the drop in intermittent generation. An extreme version of this price volatility is the appearance of negative prices, which were uncommon before 2018 but occurred 6% of the time in 2025.[2]

Figure 1 Normalized average wholesale electricity price by hour of day, Belgium, 2018–2025



Notes: The graph represents the average day-ahead price for each hour of the day, normalized by the average daily price for each year. Data sources: ENTSO-E transparency platform.

[1] Elia (2025, December 26), Electricity mix in 2025 [Press release], https://www.elia.be/en/newsroom/2025/12/20251226_press-release-electricity-mix (accessed October 27, 2026).

[2] Elia, ibidem.

Volatile prices, while reflecting normal market operation, have several undesirable consequences, including increased risks for market participants and inefficient and costly ramp-up and ramp-down of dispatchable generation. This has motivated the shift in the past 10 or so towards encouraging demand to adapt to changes in generation (demand-side flexibility).

What flexibility do we care about? Broadly speaking, we can distinguish two types of demand response or sources of flexibility. Explicit demand response refers to situation where consumers or third parties acting on their behalf, such as aggregators, offer to reduce their load on wholesale, balancing or capacity markets. Implicit demand response covers behavioral changes in demand by consumers facing price variation within the day.[3] Both sources of flexibility are important, but in this work package, we focus on implicit demand response.

At system level, the benefits of flexible demand are well documented: flexible demand leads to a more efficient allocation of (thermal) production within a day (Poletti and Wright, 2020), a better integration of intermittent renewables in the electricity market (Ambec and Crampes, 2021), and lower long-term peak capacity needs (Borenstein, 2005). Some of these benefits are less clear-cut. The emission effects of flattening demand depend on which technologies produce at the margin in peak and off-peak hours, so that real-time pricing lowers emissions in some systems and raises them in others (Holland and Mansur, 2008). Moreover, in a competitive long-run equilibrium, putting more consumers on real-time pricing does not necessarily reduce capacity investment (Borenstein and Holland, 2005).

To reap the benefits of demand-side flexibility, consumers must receive a signal that reflects actual system conditions and be able and willing to respond. This signal can come from two components of a consumer's electricity bill: the commodity (the focus of this deliverable) and the network components.

- The **commodity component** is set by retailers operating in a liberalized market. It is the price the consumer pays for the electricity itself. It depends on her total consumption and, with time-varying prices, on the hour when she consumes.
    - Flat-price contracts provide no incentive to shift consumption across hours of the day.
    - Under Time-of-Use (ToU) contracts instead, prices are pre-agreed, so they do not exactly reflect market conditions in real-time, but they vary across pre-defined blocks of hours that broadly capture periods of high and low wholesale prices. In Belgium, they take the form of night and day price. The systematic and predictable variation across hours nudges consumers to shift some of their loads to low price periods.
    - Dynamic prices are retail prices "*[…] that reflect the price variation in the spot markets, including in the day-ahead and intraday markets, at intervals at least equal to the market settlement frequency*" (Directive (EU) 2019/944, Art. 2(15)). Real-time pricing (RTP) is the most straightforward

[3] Wholesale prices vary over two very different time scales: within the day, as illustrated in Figure 1, and over months and years, as during the 2021–2022 energy crisis. Variation within the day is the object of interest for studying demand-side flexible as part of implicit demand response.

form of a dynamic contract: the energy price follows the spot price hour by hour. Dynamic prices send the most accurate signal about system conditions to consumers.
    - Critical peak pricing (CPP) combines the predictability of time-of-use pricing with responsiveness when market conditions are tense. It is a time-of-use pricing in which the retailer can declare a limited number of "critical" days per year, usually announced the day before, during which peak-hour prices jump to a much higher level, in exchange for slightly lower prices the rest of the time. It is used in France, Japan, the United States.
- The **network component** is set by regulators to cover the cost of the grid. Network tariffs can also encourage flexibility. In 2023, the Flemish network operator introduced a capacity tariff based on a consumer's monthly 15-minute peak demand for residential consumers. Ovaere and Vergouwen (2025) study a subsample of Flemish consumers between 2022 and 2024 and show that, on average, peak demand fell by 1–3% after the capacity charge was introduced. When individual peak demand correlates with system-level peaks, capacity charges can reduce grid peaks and use the grid more efficiently. Wallonia introduced a three-band time-of-use network tariff in 2026. The cheapest hours are between 1 am to 7 am (night) and between 11 am and 5 pm (solar hours).[4]

How much do consumers respond to intraday price variation? The response depends on whether consumers are aware of prices and equipped to respond. In Spain, where real-time pricing became the default contract for small consumers in 2015, Fabra et al. (2021) find no significant response of consumption to hourly prices, and suggest that potential savings were too small relative to the effort of following hourly prices and adjusting behaviour. Herrmann et al. (2026) find small but significant responses among Finnish households on real-time pricing, which roughly double during the energy crisis, when prices were higher and more volatile. In Flanders, Ovaere and Vergouwen (2025) find that households who chose real-time pricing shift consumption to low-price hours. These households own more batteries and electric vehicles than average, so their response is likely an upper bound for the wider population. More optimistic evidence comes from settings with automation or larger, salient price differences: in a Japanese field experiment, critical peak prices reduced peak consumption substantially and persistently (Ito et al., 2018), and automated thermostats considerably increase households' response to dynamic prices compared with information alone (Bollinger and Hartmann, 2020). Overall, household response to real-time pricing appears small on average, and concentrated among consumers who are aware of prices and own equipment that can shift consumption automatically, such as electric vehicles, heat pumps, batteries or smart thermostats (see work package 3.3. for simulation outcomes for Belgium). These are precisely the consumers for whom retailers' contract design matters most.

The retailer is the intermediate actor between the wholesale market and small consumers. The retailer decides what contracts to offer and at what price to her consumers (the energy component of the bill), de facto determining the extent of her consumers' exposure to market conditions. This raises the central question that this

[4] See deliverable 2.2. for an analysis of network tariffs and their innovation to encourage flexibility.

deliverable addresses: what incentives do retailers have to offer prices that reflect market conditions and elicit demand response?

We can distinguish three aspects of this question.

1. **Individual retailer incentives for offering time-varying tariffs**. Historically, small consumers could neither observe nor adjust their consumption over the day and signed flat-price contracts with their retailer. This price could be fixed over a period of time or indexed periodically, thereby protecting the retailer against increases in price levels. Because consumers have no incentive to adapt their consumption to market conditions, flat-price contracts expose retailers, if not properly hedged, to price spikes during system imbalances.
   A dynamic contract transfers most of the price risk to the consumer, thereby reducing hedging needs. It can lower procurement costs if customers shift their consumption away from expensive hours. But it also brings costs: investment in billing and data systems and the risk of mis-forecasting how customers will respond.
2. **Competition between contracts and retailers**. When retailers offer several contracts, they must also consider, when pricing them, how consumers will choose among them and the impact on revenue and costs. Customers who move from the retailer's existing flat-price contract to its new dynamic contract may pay less than before, so the dynamic contract partly takes margin away from the retailer's existing products instead of generating new revenue (product cannibalization). On the cost side, different contracts will also attract consumers with different consumption profiles, which, in turn, will impact the cost of serving these consumers (Ito et al., 2023). For example, flexible consumers may choose time-varying pricing, leaving inflexible consumers and those who prefer to consume during peak times with the flat-price tariff. An additional issue when retailers offer multiple contracts or several retailers compete with one another is that consumers can switch from one to another depending on market conditions.[5] This creates an additional quantity risk for retailers.
3. **Feedback to the wholesale market.** As dynamic contracts spread, consumer responses feed back into wholesale prices through multiple channels. First, retailers integrate the response of their customers when participating on the wholesale market, making demand more elastic. Part of the consumption is shifted away from evening peaks towards night or midday hours, lowering peak prices and possibly raising off-peak prices.[6] In turn, flatter intraday spreads can reduce the gains from flexibility (Borenstein and Holland, 2005). Second, flexible demand means that the market can more readily absorb unexpected generation

[5] Consumer switching is facilitated in many European countries, including Belgium, to encourage competition. Pébereau and Remmy (2023) show that, during the 2017 price spike in New Zealand, about one in five customers on real-time pricing left their contract, and only one quarter of them came back when prices returned to normal.

[6] Because the supply curve is upward-sloping (more expensive plants are needed to meet higher demand), shifting consumption from peak to off-peak hours lowers the price in peak hours and raises it in off-peak hours (Poletti and Wright, 2020).

shocks. For example, Herrmann et al. (2026) estimate that Finnish households on real-time pricing absorb about 2–3% of a 1 GW increase in wind generation by consuming more. Third, flexible demand on the wholesale market can constrain producers' ability to exercise market power, i.e., to raise prices above their competitive level. In simulations of the New Zealand market, Poletti and Wright (2020) find that accounting for generators' market power raises the efficiency gains from real-time pricing by 41%. Fourth, dynamic contracts change the risks that retailers bear, and therefore how they source their electricity and their hedging strategies. Under a flat-price contract, the retailer bears the risk that wholesale prices rise above the retail price. It can cover this risk by buying electricity in advance on forward markets or by owning generation, two alternative hedging strategies (Aïd et al., 2011). Under a dynamic contract, the price risk is transferred to consumers and the retailer needs to hedge less. Less forward contracting may in turn affect competition in the wholesale market (Allaz and Vila, 1993).

2. What do we already know about retailer incentives to introduce dynamic pricing?

The existing literature on dynamic prices has not focused on retailer incentives. In the literature, retailers are typically assumed to be price-takers in both the wholesale and the retail market, i.e., they cannot influence prices. The retailer sets the price of her contracts such that she recovers her costs exactly (Borenstein, 2005; Borenstein and Holland, 2005; Joskow and Tirole, 2006; Poletti and Wright, 2020; Ambec and Crampes, 2021). As a result, the gains from flexibility accrue entirely to consumers, through lower average spot and retail prices. Furthermore, the retailer is indifferent between the contracts offered, for instance between offering only flat-price contracts and offering only dynamic contracts, because each of them yields zero profit. In this setting, the retailer plays no active role.

What regulation and observed contracts tell us. Several observations suggest that, in practice, retailers do care about which contracts they offer. First, retailers decide which contracts to offer. Few retailers offered dynamic contracts before 2022. In New Zealand, real-time pricing was offered only by two new entrants (Pébereau and Remmy, 2023). Conversely, during the 2022 energy crisis in Belgium, all major retailers stopped offering fixed-price contracts in 2022. In December 2022, only one supplier still offered a fixed-price contract in Flanders (Vlaamse Regering, 2025). Second, European regulation has gradually imposed a minimum portfolio of contracts on large suppliers. Article 11 of the 2019 Electricity Directive requires Member States to ensure that final customers who have a smart meter can request a dynamic electricity price contract from at least one supplier, and from every supplier with more than 200,000 final customers (Directive (EU) 2019/944). After the energy crisis, the 2024 reform of the Directive added that all final customers can also request a fixed-term, fixed-price contract of at least one year from

these suppliers (Directive (EU) 2024/1711).[7] Such obligations would not be needed if retailers were indifferent between contracts, as the literature assumes.

A small but growing literature looks at retailers' contract offers. Ancel (2025) models competition between a retailer offering a time-varying tariff and one offering a flat tariff, and finds that competitive pressure from the flat tariff dampens the variation of the time-varying tariff relative to the real-time price. Monjoie and Duc (2026) show that the fact that consumers self-select into contract can make a fixed-price contract offered alongside real-time pricing unravel under perfect competition. These papers either assume perfect competition or take the set of contracts offered by each retailer as given. Our research as part of Demandflex (Section 4) instead studies how a retailer with market power chooses both which contracts to offer and how much of the wholesale price variation each contract passes on.

3. Dynamic prices in Belgium – retailer offers and take-up

To motivate and anchor our analysis of retailers' incentives for offering dynamic prices, we collected tariff offers by retailers between July 2025 and August 2026 and analyzed dynamic tariff adoption in Flanders and Wallonia.

Large suppliers must offer a dynamic contract. Belgium transposed this obligation of the Electricity Directive into federal law in 2022.[8] Since then, every supplier with more than 200,000 customers must offer a dynamic contract to any household that asks for one and has a suitable meter. Five suppliers are above this threshold: ENGIE, Luminus, Eneco, TotalEnergies and Mega (CREG, 2026).

Take-up is low and concentrated in Flanders. At the end of September 2025, suppliers reported 20,552 dynamic contracts, more than double compared to the previous year (8,337 dynamic contracts). Almost all (99.5% more precisely) were in Flanders (CREG, 2026). Dynamic contracts accounted for just 0.4% of Belgium's 5.2 million households (and roughly 0.6% of Flemish connection points),against 25% of fixed-price contract, and the remaining three quarters of variable contracts, whose prices are indexed every month or quarter on wholesale prices (CREG, 2026). This is very low and cannot be explained by the slow deployment of smart meters in Belgium (relative to the rest of the EU). Indeed, 85% of households in Flanders have a smart meter today (Vlaamse Nutsregulator, 2026), against 28% and 22% in Wallonia (CWaPE, 2026) and Brussels (Sibelga, 2026) respectively.

Contract offers. We web-scraped historical retailer offers, covering the period between July 2025 and August 2026 for 15 suppliers in Belgium (see the Appendix for details on the data collection method). Table 1 lists the products in our data. The resulting sample

[7] Directive (EU) 2019/944, Art. 11(1), as amended by Directive (EU) 2024/1711: "Member States shall ensure that final customers who have a smart meter installed can request to conclude a dynamic electricity price contract and that all final customers *can request to conclude a fixed-term, fixed-price electricity supply contract* with a duration of at least one year, with at least one supplier and with every supplier that has more than 200 000 final customers."

[8] The legal document is available here: https://etaamb.openjustice.be/fr/loi-du-23-octobre-2022_n2022033909.

is not exhaustive. For example, the sample does not include Eneco, despite its dynamic offer, nor the full portfolio of other large suppliers such as Luminus. These omissions reflect limitations in the historical offers recovered through our data collection procedure. Nevertheless, it provides useful evidence on the structure of dynamic price formulas and how retailers differentiate the contracts they offer.

Eight of the 15 suppliers offer more than one type of contract. Four combine a dynamic contract with a fixed-price contract (Bolt, Mega, OCTA+ and Trevion), three combine it with a monthly indexed contract (Frank Energie, Smappee and TotalEnergies), and ENGIE combines it with a time-of-use contract with three blocks of hours (Empower Flextime). For five suppliers, we observe only a dynamic contract, and for two only a monthly indexed contract.

The dynamic offer is growing. In our sample, the number of observed dynamic products in Flanders rose from 7 in July 2025 to 13 in April 2026. For comparison, CREG records 17 dynamic products in January 2025 and 28 at the end of 2025 (CREG, 2026). Although not exhaustive, our sample allows us to compare prices across the selected contracts, including within the same retailer.

For every product, we record the price formula of the commodity component of the bill, which takes the same form for all contracts: a price per kWh equal to $a + b \times$ index, where the index is a wholesale price, a an additive term and b a multiplier (CREG, 2026). The two contract types differ in the index: the hourly or quarter-hourly spot price for dynamic contracts, a monthly price for indexed contracts. Fixed-price contracts set a price per kWh for the duration of the contract.

Table 1 Electricity products in our sample, July 2025–August 2026

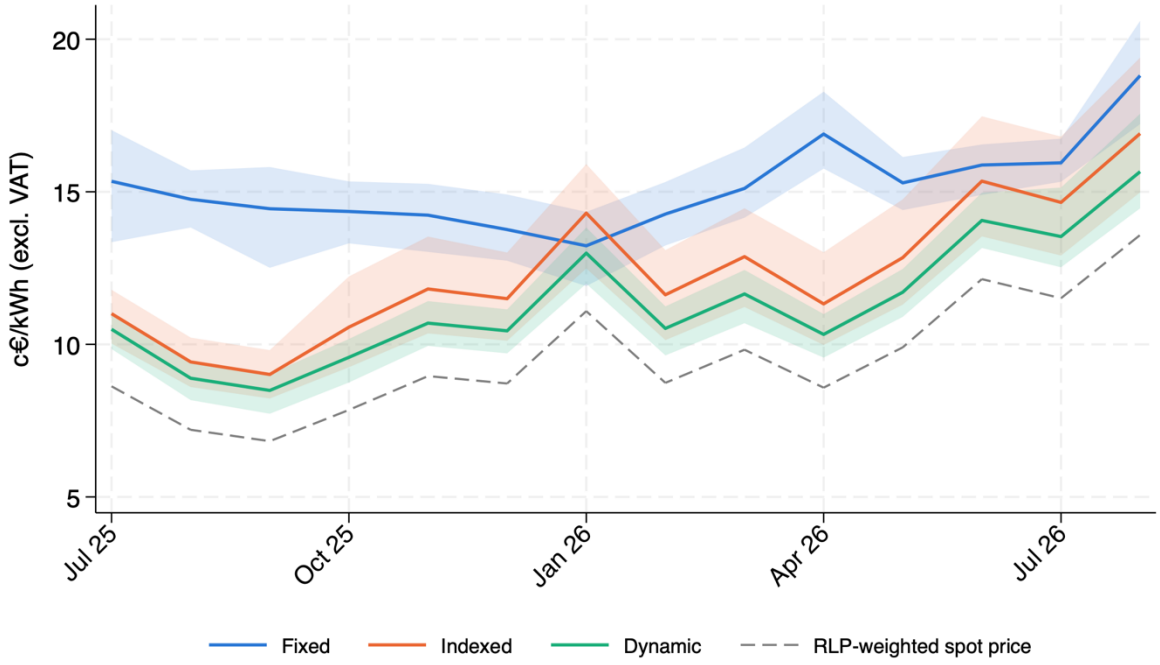
Supplier	Dynamic product	Other products in our data	Regions
Bolt	Bolt Variabel	Fixed: Bolt Vast	FLA
DATS 24	–	Indexed: Elektriciteit Groen Variabel	FLA
EBEM	Ebem Groen Dyn@mic	–	FLA
Ecofix Gas & Power	Motion Online	–	FLA, WAL
ENGIE	Dynamic	Time-of-use: Empower Flextime	FLA, WAL (Flextime also BRU)
Energy Knights	Agilior Online Green	–	FLA
evident energie	–	Indexed: Flexi	FLA
Frank Energie	Frank Energie Dynamisch	Indexed: Frank Energie Variabel	FLA
Luminus	Dynamic Online	–	FLA
Mega	DYNAMIC	Fixed: ONLINE FIXED	FLA
OCTA+	OCTA+ Eco Dynamic	Fixed: Fixed	FLA (dynamic also WAL)
Power2You	Flow	–	FLA
Smappee Smiles	Dynamic Lite	Indexed: Variabel Smiles	FLA
TotalEnergies	myDynamic	Indexed: myDrive	FLA (myDrive also WAL)
Trevion	ENERGREEN	Fixed: Groene Energie Vast	FLA

Note: FLA = Flanders, WAL = Wallonia, BRU = Brussels. Price comparisons focus on Flanders, although some product information is available for Wallonia. Brussels is excluded from the pricing analysis due to missing historical tariff data, although ENGIE's Empower Flextime has been offered there since October 2025. The sample is not exhaustive: Eneco's dynamic offer is not included, and other

suppliers' portfolios are only partially covered. For example, Luminus also offers fixed-price and indexed contracts that are not included in our data.

All dynamic contracts pass on at least the full variation of the spot price. The multiplier *b* of the dynamic contracts in our data ranges from 1.00 to 1.18, and it is never below one. Smappee and Trevion apply exactly the spot price variation ($b = 1$), ENGIE, Ecofix and Luminus stay close to it ($b \leq 1.04$), while EBEM (1.08-1.10), Bolt (1.10–1.17) and OCTA+ (up to 1.18) amplify it. With a multiplier above one, the price difference between an expensive and a cheap quarter-hour is larger on the retail bill than on the wholesale market. One possible reason is that the energy component is only part of the final bill: a multiplier above one partly offsets the dilution of the signal by network charges and taxes. The average price components for dynamic products in 2025 are $a = 12.9$ €/MWh and $b = 1.041$.[9]

Figure 2 Commodity price by contract type, Flanders, July 2025-August 2026



Note: c€/kWh, excluding VAT, fixed fees and network charges. Lines show the average price across suppliers for each contract type; shaded areas show the range between the cheapest and the most expensive supplier. The dashed line is the Belgian day-ahead price weighted by the Synergrid residential load profile (RLP) for Flanders. The average dynamic price is computed using the Synergrid RLP for Flanders.

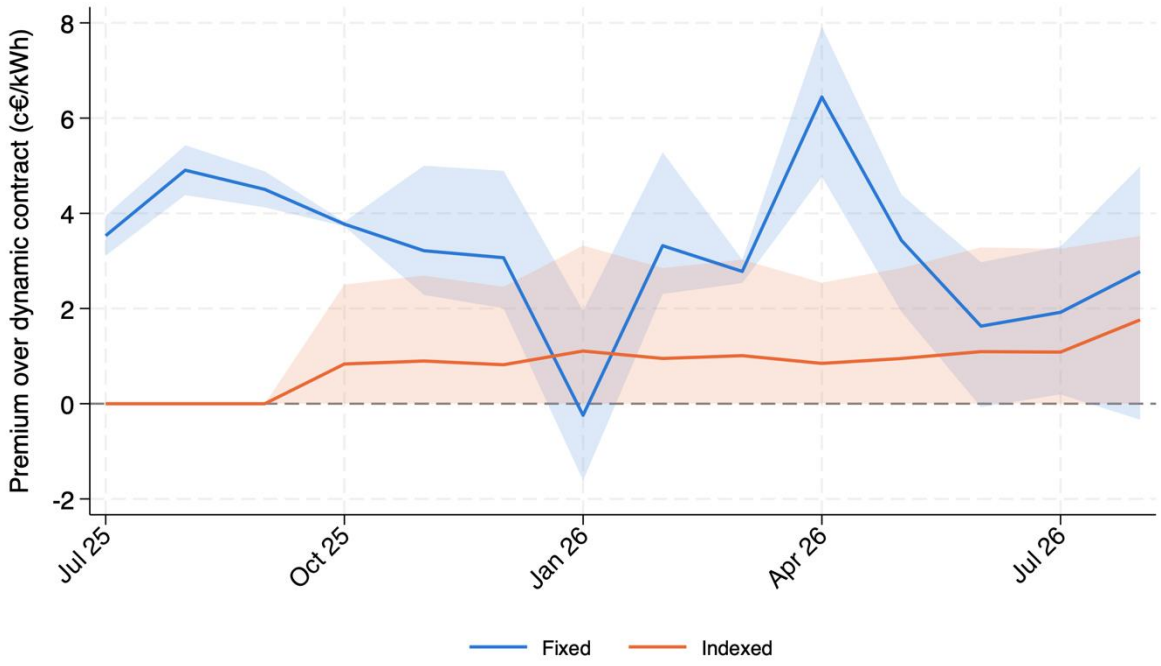
Dynamic contracts have the lowest commodity price in our sample. We estimate the cost of electricity under a dynamic contract using the reference residential profile published by Synergrid based on actual consumption data.[10] This gives us an average price per kWh consumed, absent fixed fee. Figure 2 shows how the contracts' commodity

[9] These numbers are close to those the CREG (2026) reports for all dynamic products in Belgium in 2025 (1.036 and 12.7 €/MWh).

[10] Synergrid (2026). https://www.synergrid.be/fr/centre-de-documentation/statistiques-et-donnees/profils-slp-spp-rlp (accessed August 20, 2026)

price evolves by contract type in Flanders between July 2025 and August 2026.[11] Ignoring fixed fees, fixed price contracts turn out to be the most expensive ex post during this period, and dynamic contracts the least expensive, with indexed contracts in the middle. January 2026, where high spot prices raised the prices of the dynamic and indexed contracts is the only exception. Prices also differ across suppliers within each type, and this range is narrowest for dynamic contracts.

Figure 3 Premium of fixed-price and indexed contracts over the same retailer's dynamic contract, Flanders, July 2025–August 2026



Note: c€/kWh, excluding VAT, fixed fees and network charges. Lines show the average premium across retailers over their own dynamic contract; shaded areas show the range between the lowest and the highest premium. The average dynamic price is computed using the Synergrid residential load profile (RLP) for Flanders. Only retailers that offer both contracts in a given month are included; the indexed premium is zero until September 2025 because the two retailers observed then apply the same formula to their dynamic and indexed contracts.

Within each retailer, fixed-price and indexed contracts cost more than dynamic contracts. Figure 2 compares averages across all suppliers, so differences between contract types partly reflect differences in which suppliers offer them (dynamic contracts are often offered by small entrants). Figure 3 removes this composition effect by comparing, for each retailer, the price of its fixed-price or indexed contract with the price of its own dynamic contract. It is therefore directly informative of the way retailers deal with product cannibalisation. The difference is the premium a reference household pays for the retailer's fixed-price (or indexed) contract rather than its dynamic contract. It includes the price of the insurance against price increases that the fixed-price contract

[11] We show Flanders only because it is the only region where our data cover all three contract types. The Walloon offers in our data are a subset of the Flemish ones, with identical price formulas in both regions.

provides. The fixed-price premium is positive in almost every month, but it varies a lot over time. Fixed prices are set in advance while dynamic prices follow the spot price, so the premium shrinks when spot prices rise, such as in January 2026. The indexed premium is smaller on average. No retailer in our data prices its indexed contract below its dynamic contract. So, within the same retailer, a reference household would, on average, have paid less on the dynamic contract, at the cost of bearing some price risk from one month to the next.

Summary insights on dynamic contracts from the analysis of contract offers in Belgium. Except for the small retailers, most retailers offer several contracts. Dynamic tariffs are offered by small entrant retailers and by incumbent retailers subject to the obligation to offer dynamic contracts. Over the period between July 2025 and August 2026 and ignoring fixed fees, they turned out to be cheaper for consumers than alternative tariffs, even with no change in behavior. Despite this, very few consumers choose a dynamic contract. Risk aversion is a natural explanation, but it is unlikely to be the whole story. Three-quarters of Belgian households already accept a variable contract whose price is revised monthly in line with wholesale prices. For a household that does not change its consumption profile, a dynamic contract adds relatively little month-to-month risk compared with such a contract. Limited awareness, the effort required to track prices, inertia, and the fear of rare but large price spikes are likely to matter as well (Fabra et al., 2021; Pébereau and Remmy, 2023). And because dynamic contracts were cheaper even for a household that does not shift any consumption, low take-up is not only a matter of consumers lacking flexibility. It is, however, an important hurdle for fostering demand response.

4. New insights from Demandflex research

As part of Demandflex, we investigated the incentives of a monopolist retailer to offer tariffs that vary within the day according to wholesale prices.[12] In our model, the retailer can offer flat-price or dynamic contracts. Offering dynamic contracts entails a one-time digitization cost (e.g., for billing and data management systems). Consumers in the model have an ideal timing for their consumption and dislike shifting their consumption over time. When faced with a flat price over the day, they would consume according to their ideal consumption profile. If prices differ within the day instead (in the research paper, we assume there are two periods in the day), they would shift some of their consumption from the high-price period to the low-price period, to different degrees depending on the cost of shifting.

We studied the tariff a monopolist facing two types of consumers (consumers with low and high costs of shifting their consumption away from their ideal timing) would offer to maximize profits, assuming it does not observe consumers' flexibility type. Tariffs must therefore be designed so that consumers self-select in the tariffs that maximize their utility. Because a consumer's valuation of time-varying prices increases with her flexibility, the retailer can use the retail price spread (the difference between the peak and

[12] The monopoly assumption is a simplification (in reality, retailers compete for electricity consumers). It should be interpreted as a way to capture the idea that retailers have market power.

off-peak price) as a screening device to separate consumer types, i.e., design contracts so that each type of consumer prefers the contract intended for her. We solve for the equilibrium under four contract portfolios (a flat price alone, a flat and a dynamic contract, a single dynamic contract, and two type-specific dynamic contracts) and let the retailer choose among them.

In the model, once the digitization cost is sunk, offering a menu of dynamic contracts is always optimal for the monopolist. She never offers a flat price because even low-flexibility consumers can shift some consumption, and the retailer can capture the resulting gains. She offers two dynamic contracts. The most flexible consumers receive a contract that passes on the full intraday variation of the wholesale price: its peak/off-peak price difference equals the wholesale one, but the retailer adds a margin to the price level. In the notation of Section 3, this is a dynamic contract with $b = 1$ and $a > 0$. Less flexible consumers receive a contract that dampens the intraday variation of the wholesale price but still charges more in high-price periods than in low-price periods. If both contracts had the full spread, flexible consumers could choose the contract designed for less flexible consumers and keep more of their gains. Dampening the spread makes it less attractive to them, allowing the retailer to charge flexible consumers more. Before the digitization cost is incurred, the retailer introduces dynamic contracts only if the share of flexible consumers is large enough relative to that cost.

Allocative inefficiency. In the model, the partial price signal for the low-flexibility consumers creates allocative inefficiency: they consume more in high-price hours than is efficient. As the share of flexible consumers rises, the retailer distorts the low-flexibility contract further, so the inefficiency per consumer under that contract increases. Aggregate inefficiency nonetheless falls, because fewer consumers are on the distorted contract. This inefficiency results from the combination of market power and unobserved differences in flexibility: A monopolist facing a single type of consumer would offer real-time pricing and use the price level to capture the surplus, so consumption would be efficient.

The monopolist retailer captures most of the gains from flexibility. In the model, the retailer captures most of the flexibility gains. Flexible consumers retain part of their flexibility gains, which is the cost for the retailer of steering them away from the low-flexibility contract. These gains shrink as the share of flexible consumers grows: leaving rents to a larger group becomes more costly, so the retailer dampens the low-flexibility contract further to lower the rent she must concede to flexible consumers. By contrast, less flexible consumers retain none of their flexibility gains. These are fully captured by the retailer.

High flexibility consumers retain some of the gains from flexibility. This last result raises distributional concerns, especially when flexibility and access to enabling technologies (such as electric vehicles, batteries, or heat pumps) increase with income. High-income, more flexible consumers can keep part of their flexibility gains, whereas less flexible consumers keep pay more because they consume relatively more in high-price hours, and the retailer captures all their flexibility gains.

The model abstracts from several features of real electricity retail markets. First, most markets have more than one retailer. Adding competition would limit the profits electricity retailers make. The trade-off between extracting rents from flexible consumers

and encouraging less flexible consumers to shift should remain, but the size of the distortion may change. Second, consumers are typically risk-averse and dislike volatile, uncertain prices. With risk-averse consumers, passing on the full variation of the spot price also exposes consumers to price risk. A dampened price signal then also provides insurance, so it is no longer necessarily inefficient, and the welfare conclusions above would be mitigated. The Belgian offers are consistent with households valuing insurance against price increases, and they show that the risk is real. Third, dynamic prices vary not only within the day but also across days, and consumers on dynamic-price tariffs can end up paying higher prices overall than those who locked in fixed prices. In many countries, including Belgium, barriers to contract switching are very low. This creates a source of instability: retailers offering dynamic contracts gain consumers when prices are low and lose them when prices are high (Pébereau and Remmy, 2023). Fourth, in the model, the retailer buys all her electricity on the spot market, whereas in practice retailers also buy in advance to hedge.

How the model informs our reading of the Belgian data. Several features of the Belgian market can be read through the lens of the model. First, menus are the norm: most retailers in our data offer a dynamic contract alongside another contract. ENGIE's combination of a dynamic contract and a three-block time-of-use contract closely matches the menu predicted by the model, where the second contract keeps a time-varying signal but dampens it. Second, many retailers instead pair their dynamic contract with a fixed-price or indexed contract. In the model, such a menu is dominated by two dynamic contracts. Its prevalence in practice is consistent with features the model leaves out, in particular households' demand for insurance and, since 2024, the obligation to offer fixed-price contracts. Third, none of the dynamic contracts we observe dampens the intraday price signal: all have $b \geq 1$. The screening distortion highlighted by the model is therefore not visible in Belgian dynamic contracts today. Possible reasons are that take-up is still very small, that entry by specialized retailers disciplines the design of dynamic contracts, or that the dampening takes other forms, such as time-of-use contracts. Finally, in the model a household that does not change its consumption should pay at least as much under the dynamic contract as under a fixed-price contract, because the retailer uses the price level to capture flexible consumers' gains. The opposite holds in Belgium (Figure 3). This suggests that hedging costs and the risk premium built into fixed-price and indexed contracts, which the model leaves out, are an important driver of relative prices.

5. What do we already know about how the introduction of dynamic pricing impacts the wholesale market?

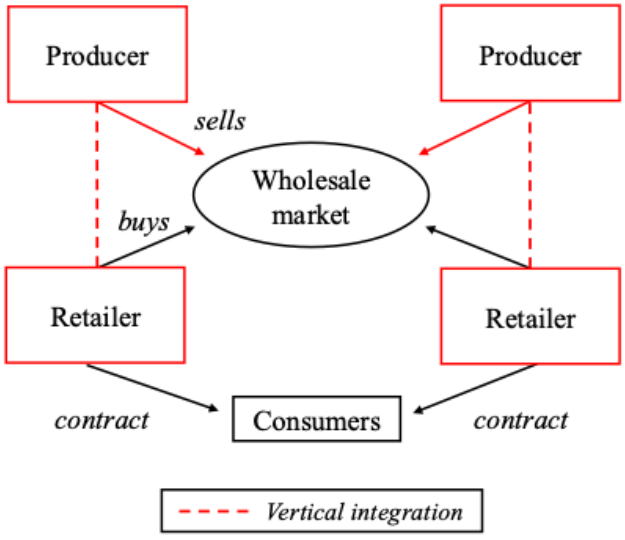
Large retailers tend to be vertically integrated with producers. In practice, the largest retailers often also own generation assets (Figure 4). In Belgium, three groups that are also among the largest retailers owned 87% of the installed generation capacity in 2024.[13]

[13] Elia. (2026). *Individual data of contracted technical units* (Dataset ods179) [Data set]. Elia Open Data Portal. Retrieved 29 October 2026, from https://opendata.elia.be/explore/dataset/ods179/information/

The type of retail contract these firms offer can affect their incentives to hedge and their behaviour on the wholesale market.

Fixed retail prices act as a forward commitment. Bushnell et al. (2008) show that the market's vertical structure is key to understanding how competitive wholesale electricity markets are. A vertically integrated firm that has committed to supply its retail customers at a fixed price before deciding how much to produce only benefits from a higher wholesale price on the part of its production that exceeds its retail commitments, i.e., on its net position in the wholesale market. Its retail commitments therefore play the same role as a fixed-price forward contract (a contract to sell electricity in advance at a fixed price), which is known to reduce firms' incentives to exercise market power (Allaz and Vila, 1993). The closer a firm's retail commitments are to its production, the closer its behavior is to that of a competitive firm. If its retail commitments exceed its production, the firm is a net buyer and even has an incentive to push wholesale prices down. These effects are not limited to vertically integrated firms. A producer that has sold part of its output in advance through forward contracts has less interest in raising wholesale prices (Allaz and Vila, 1993 and Wolak, 2000, for empirical evidence). Symmetrically, an independent retailer that has bought her electricity in advance has no incentive to push wholesale prices down, even if she has some buying power.

Figure 4 Organization of the electricity market



Dynamic contracts remove this commitment. When the retail price follows the spot price hour by hour, a higher wholesale price also raises the vertically integrated firm's retail revenues. The vertically integrated firm then benefits from a price increase on its entire production, as if it had no retail customers. Fabra and Imelda (2023) study the support scheme for wind producers in Spain, which switched between market prices and fixed prices between 2012 and 2015. They find that average day-ahead markups (the difference between price and marginal cost) were 2 to 4% higher when wind output was paid market prices. The reason is that the dominant firms owned a large share of the wind capacity on top of their conventional capacity: under market prices, higher wholesale

prices raised the revenue of both their conventional and their wind output. By the same logic, dynamic retail contracts can raise the markups of vertically integrated firms.

Dynamic contracts reduce the need to hedge. Under flat-price contracts, retailers need to buy electricity in advance at a fixed price, because they bear the price risk, and these purchases are the counterpart of the forward sales that discipline producers. Dynamic contracts pass most of the price risk to consumers, so retailers need less hedging. This may reduce forward contracting and, with it, one of the mechanisms that limit market power in the wholesale market.

Two opposite effects. The introduction of dynamic pricing therefore affects market power in the wholesale market through two opposite channels. On the one hand, it removes the commitment that fixed retail prices and forward contracts provide, which increases the incentives of large producers to raise prices. On the other hand, it makes demand more responsive to prices, which reduces the gains from withholding output (Poletti and Wright, 2020). Which effect dominates for dynamic retail contracts depends on the vertical structure of the market and on how flexible the consumers on dynamic contracts are.

What this means for Belgium. With a national market share of 0.4% of connection points in September 2025 (CREG, 2026), the effect of dynamic contracts on the wholesale market is still negligible today, but given the concentration of the wholesale market, it is important to understand how dynamic contracts may affect the spot price formation as the share of dynamic contracts grows.

6. New insights from Demandflex research

Empirical evidence from Spain. Spain offers an interesting setting to study these questions empirically and measure the net effect of dynamic prices on the wholesale market. Indeed, in 2015, the regulated default contract switched from a fixed price to real-time pricing. Only designated retailers can offer this contract, and they belong to the five vertically integrated incumbents that together serve about 90% of the Spanish retail market. The regulated contract accounted for about 13% of total load between 2014 and 2016, but its weight varied across the designated retailers, from about 25% to 55% of their portfolios.

A first descriptive analysis over the period from October 2014 to December 2016 finds that spot prices were higher after the switch, by about 1.96 €/MWh, controlling for system conditions and input prices. These results are preliminary and cannot yet be interpreted as causal effects: identifying the effect of the switch requires a credible counterfactual for spot prices and quantities, which is ongoing work. The next step is to exploit the variation across retailers, in their share of customers on real-time pricing and in their degree of vertical integration, and to connect it explicitly to the model.

Why this matters for policy. Strategic behavior in this case would also be hard to detect from retail prices alone: a vertically integrated firm could set a low margin on its real-time pricing contracts to appear competitive on the retail market, while restricting its supply on the spot market to raise total profits. New measures of wholesale concentration that account for the shape of retail contracts to monitor behavior on the wholesale market as dynamic contracts spread would be warranted.

7. Conclusions and remaining open questions

Demand-side flexibility is increasingly needed, and dynamic contracts send consumers the most accurate signal about system conditions. Yet, dynamic contracts account for a tiny share of retail contracts in Belgium.

Increased take-up of dynamic contracts or other contracts that expose consumers to market conditions requires that such contracts are offered and that consumers choose them.

At this stage, smart meter deployment and the effective offer of such contracts are no longer binding constraints in Belgium. Smart meter deployment, while still low by European standards, is magnitudes higher than the market share of dynamic contracts. European legislation mandates that large retailers offer such contracts, which they do as evidenced by the data in Table 1.

Consumer inertia and risk aversion are likely to play a role in this low take-up, but so do retailers' incentives to offer attractive tariffs to consumers. Many elements enter into consideration in this respect: fear of product cannibalization and market share erosion, degraded load profiles of consumers in default contracts, impact on wholesale prices and profit margins for vertically integrated retailers, etc. Scientific research is only starting to explore these issues systematically.

As part of Demandflex, we have investigated the incentives for contract design for a retailer with market power. One main insight is that the issue is not whether to offer a dynamic contract or a flat-price contract (or both). Rather, a retailer with market power will want to offer a menu of contracts, with different strengths of connection to the wholesale prices. The most flexible consumers will choose real-time contracts, whereas less flexible consumers will choose a contract that partially insulates them from intraday wholesale price variation. We expect such contract innovations to develop as the market matures.

We are also investigating the impact of the switch to real-time pricing for regulated contracts in Spain in 2015 on wholesale prices. Preliminary results suggest that the policy change led to a slight increase in wholesale prices, confirming that contracting in the retail market feeds back to the wholesale market.

Several questions remain open. How would competition between retailers change their incentives to differentiate contracts? How would uncertainty about future wholesale prices and consumers' ability to switch suppliers affect contract design? How do retail and spot markets interact when the same vertically integrated firm designs its contract portfolio and bids on the spot market? And will consumer flexibility, driven by electric vehicles, heat pumps and batteries, grow enough for dynamic contracts to matter at scale? Answering these questions would help determine whether the distortions identified in our research persist in real electricity markets.

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Appendix: Data sources for section 3

Data collection

We constructed a monthly panel of Belgian residential electricity offers covering July 2025 to August 2026. The objective is to document the structure of retail electricity contracts, with a particular focus on dynamic pricing and on the differences between contracts offered by the same supplier. The database is intended to provide descriptive evidence on retailers' contract design rather than an exhaustive overview of the Belgian market.

Data collection relied on a semi-automated web-research procedure. We first identified relevant contracts and verified their characteristics using official publications from the federal energy regulator and electricity suppliers. We then recovered historical versions of individual offers, primarily through the product histories available on Energyprices.be, supplemented by supplier documentation where available.

For each identified product version, we extracted information on the supplier, product name, region, contract duration, pricing structure, wholesale reference index and retail price formula. Historical versions were subsequently organised into monthly observations. The collection procedure combined automated retrieval of web information with verification and interpretation of the extracted tariff characteristics. The accompanying collection documentation describes the reproducible workflow, including the source-retrieval and data-processing procedures.

Sample coverage and limitations

The resulting panel contains 287 product-month observations, corresponding to 23 distinct products offered by 15 suppliers. It covers dynamic contracts alongside selected fixed-price, indexed and time-of-use alternatives. Coverage differs across suppliers and months, depending on the availability of historical product information.

The sample is not exhaustive. Some suppliers and products could not be recovered through the collection procedure, and the full portfolios of the suppliers included in the database are not always observed. In particular, Eneco, a provider of dynamic contracts, is absent from the panel. Similarly, the database records Luminus's dynamic offer but not its other fixed-price or indexed products. More generally, the ability to recover historical prices differs across products, and certain offers may be missing even when they were commercially available.

Geographical coverage is also uneven. Most tariff observations concern Flanders, with some additional information on products available in Wallonia.

The resulting selection should not be interpreted as representative of the distribution of contracts across Belgian suppliers or consumers. In particular, the number of products observed in the database cannot be used to infer market shares or the relative prevalence of different pricing arrangements. These are better measured using regulatory statistics.

Nevertheless, the data remain informative about the structure of the observed contracts. They document how dynamic contracts relate retail prices to wholesale prices, how these formulas evolve over time, and how selected retailers differentiate their dynamic offers from other contracts. Comparisons within the same supplier are particularly useful

for illustrating product differentiation, although they are limited to the contract pairs for which historical information is available.

Contract classification and price formulas

For each product, we distinguish the commercial contract type from the price signal faced by the consumer within the day. Fixed-price contracts guarantee a price level over a specified period, whereas variable or indexed contracts periodically revise that level according to a wholesale reference index. Either type may apply a single price throughout the day or different prices across predetermined time blocks. Dynamic contracts instead expose consumers to wholesale price variation at hourly or quarter-hourly frequency.

The database separately records the frequency of price-level adjustment and the presence of within-day price variation. This distinction allows us to identify flat, time-of-use and dynamic price signals without relying exclusively on suppliers' commercial labels.

Dynamic retail prices typically follow a formula of the form:

$$p_t = a + bP_t^{spot}$$

where (P_t^{spot}) is the wholesale spot price, (a) is an additive component and (b) determines the sensitivity of the retail energy price to wholesale price changes, after accounting for the relevant unit conversion. The raw formula parameters were retained where they could be verified.

Data verification and treatment of missing observations

Historical price formulas and product characteristics were retained only where supporting source information could be identified. Each observation includes a source URL and an accompanying field documenting the available evidence or any relevant caveat.

Where a product's existence and contract structure could be verified but its precise historical price formula could not, the missing parameters were left unreported. Similarly, missing historical months were not filled through interpolation.

The resulting panel reflects the historical information that could be recovered and verified, rather than a balanced census of every product available in each month.

Finally, the price comparisons in Section 3 focus on the commodity component of electricity contract. They exclude network charges, taxes and fixed annual subscription fees. The latter may vary across contracts and suppliers and can therefore affect the ranking of total household electricity costs. The results should be interpreted accordingly.

Main data sources

The principal sources used to construct and validate the database are:

- **CREG (2026):** *Annual report on the main developments in the market for dynamic electricity-price contracts in 2025*, Report RA3159. Used for regulatory context, market-wide product counts, take-up and characteristics of dynamic contracts. https://www.creg.be/fr/publications/rapport-ra3159

- **Energyprices.be:** Historical electricity product pages and successive tariff versions, used to recover product-level price formulas and their periods of validity. https://energyprices.be/contracten
- **Electricity suppliers' official websites and tariff documentation:** Used to verify commercial product characteristics, price structures and availability. These include ENGIE's documentation of its dynamic contracts and Empower Flextime product, as well as supplier tariff cards where available. https://www.engie.be/fr/empower/
- **Synergrid:** Residential load profiles used to calculate the average commodity price paid by a reference household under dynamic contracts. https://www.synergrid.be/fr/centre-de-documentation/statistiques-et-donnees/profils-slp-spp-rlp

The underlying monthly panel retains observation-level source references and verification notes, allowing individual product characteristics to be traced to their supporting documentation.