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# Smart meter data into Swedish official statistics

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***Abstract***

*Statistics Sweden, like other Nordic national statistical institutes (NSIs), is advancing the integration of smart meter data into official energy statistics. This work is organized into three main strands:*

- *Access to smart meter data via a national hub or directly from Distribution System Operators (DSOs).*
- *Methods for integrating smart meter data into official statistics, mainly for use of electricity by type of user.*
- *Output into official statistics and the development of new statistical indicators.*

*The Swedish Energy Agency and Statistics Sweden have conducted a case study, Statistics from a future electricity register, in collaboration with the DSO Ljusdal Energi. The study tests automated data transfers from smart meters to an electricity register for official statistics. This presentation summarizes Sweden's experiences from the case study, highlights challenges within each work strand, and describes the work ahead.*

*The Nordic electricity market is closely interconnected, and we also see this presentation as an opportunity to share knowledge with other statisticians working with smart meter data, exchange ideas, and identify shared challenges.*

**Keywords**: smart meter data, case study, large-scale data collection, energy statistics.

## 1. Introduction

Electricity smart meter data open up new possibilities for the production of official energy statistics. This paper analyzes the potential for Sweden to integrate smart meter data into official energy statistics, based on a practical case study using data collected from a single *distribution system operator* (DSO).

Two principal challenges are highlighted. The first concerns the development of methods for linking smart meter data with other registers in order to enable detailed statistics on electricity consumption and production. The second challenge relates to the handling and visualization of highly granular data volumes.

The national project *Statistics from a future electricity register*, which this paper is based on, is conducted as a collaboration between the Swedish Energy Agency and Statistics Sweden. Cooperation has also taken place with other public authorities, including the Swedish Energy Markets Inspectorate and Svenska kraftnät (the Swedish transmission system operator), as well as with the DSO Ljusdal Energi.

In parallel with this project, the Swedish government has tasked the Swedish Energy Markets Inspectorate and Svenska kraftnät with resuming work on a previously paused proposal for a centralized electricity market data management system, similar to solutions already implemented in several other Nordic countries (Ministry of Climate and Enterprise, 2025).

It is not yet clear if future smart meter data for statistics will be collected directly from individual DSOs or via a centralized national data platform. Regardless of the solution, the data will need to be processed and linked with other registers in order to function as a comprehensive electricity register that is available for statistical output.

## 2. Case study with one DSO

To develop an electricity register, the project has adopted a small-scale approach, beginning with a single DSO and with the intention of gradually scaling up the register to include additional DSOs. The project collaborates with Ljusdal Energi, which provides the necessary data to test the register in practice.

Ljusdal Energi manages the local electricity distribution network in parts of the municipality of Ljusdal and is responsible for approximately 7,000 metering points for electricity production and consumption. The grid primarily supplies households and services, along with a limited number of larger industrial customers. Electricity production within the grid consists mainly of solar, hydropower, and gas based generation. While wind power production exists within the municipality, it is not connected to the distribution network operated by Ljusdal Energi.

Data collection started at full scale in February 2026 and is planned to continue throughout the entire year. Approximately 600,000 new measurement values are recorded daily, excluding revised values for previous time points. In total, an estimated 250 million values are expected to be collected by the time the project is completed.

### 2.1. Linkage of smart meter data with registers

The usefulness of the collected smart meter data can be significantly enhanced by linking it to other registers.

For households, personal identification numbers and addresses can be used to link smart meter data to the Population Register. This enables the inclusion of demographic and socioeconomic variables such as household composition, family size, and disposable income. The linkage provides a basis for more detailed descriptive statistics on electricity consumption patterns.

For enterprises, smart meter data can be linked to the Business Register using organization numbers and addresses. Variables such as *Nomenclature of Economic Activities* (NACE) classification codes and annual turnover can then be incorporated, enabling more detailed descriptive analyses and the identification of correlations between electricity use and business characteristics.

For both households and enterprises, smart meter data can also be linked to the Real Estate Register in order to obtain information on building characteristics, such as building type, usage and coordinates. This further improves the ability to classify and analyze electricity consumption. In addition, linkage to vehicle registers allows for analyses that combine electricity consumption with access to electric vehicles.

Linking smart meter data with registers at the local level using addresses constitutes a major challenge, and the quality of this linkage directly affects the quality of the resulting statistical indicators. An address is composed of four parts, including *postal code*, *street name*, *street number*, and *unit or apartment identifier*. It cannot be assumed that all these parts correspond exactly between the customer registers maintained by DSOs and national registers.

To address this issue, a hierarchical linking model can be applied to identify the most probable links between the datasets. Such models allow for partial matches and varying levels of precision in address information.

## 3. Results and new statistical indicators

Smart meter data are expected to replace, where applicable, the current survey-based data collection for electricity consumption and production, categorized by detailed usage types (often based on NACE codes) and production sources. However, the dataset currently available only spans from February to June, and it is too early to compare it with annual survey data. Instead, we will analyze the dataset on its own and consider the conclusions that can be drawn at this stage.

### 3.1. Data description

We begin by familiarize ourselves with the data collected from February to June. The results are divided into two sectors: smart meter measurements connected to households, identified by a personal identification number, and measurements connected to enterprises, identified by an organization number.

The data have daily, weekly and seasonal trends. Figure 1 presents the average 15-minute electricity consumption for households (left axis) and enterprises (right axis) on a typical Monday, June 1.

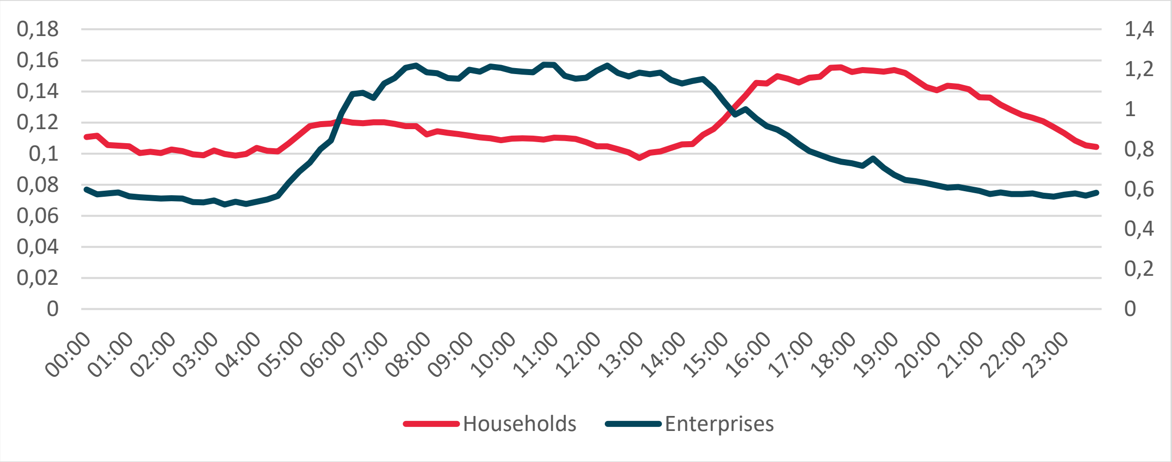


*Figure 1: Average electricity consumption of households (left axis) and enterprises (right axis) over one day, in kWh.*

Firstly, as expected, the average electricity consumption of enterprises is several times higher than that of households. The household consumption reaches its lowest point around noon and peaks in the evening, with a smaller peak in the morning. In contrast, enterprise consumption peaks during the daytime, from morning to afternoon.

Figure 2 shows the average electricity consumption in households and enterprises over a full week, with one measurement point per day, on June 1 to June 7.

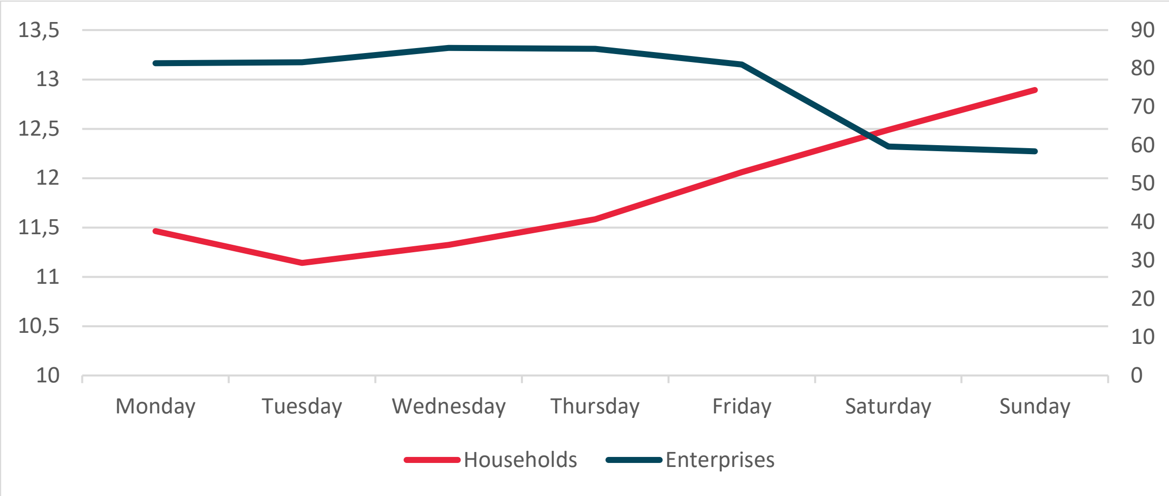


*Figure 2: Average electricity consumption of households (left axis) and enterprises (right axis) over a week, in kWh.*

Households have the lowest electricity consumption at the beginning of the week, and it steadily increases toward the end of the week. Enterprises, on the other hand, show relatively constant consumption during the week, with a reduction on weekends.

Figure 3 illustrates the seasonal changes in electricity consumption for households, comparing Monday, June 1, and Monday, February 23.

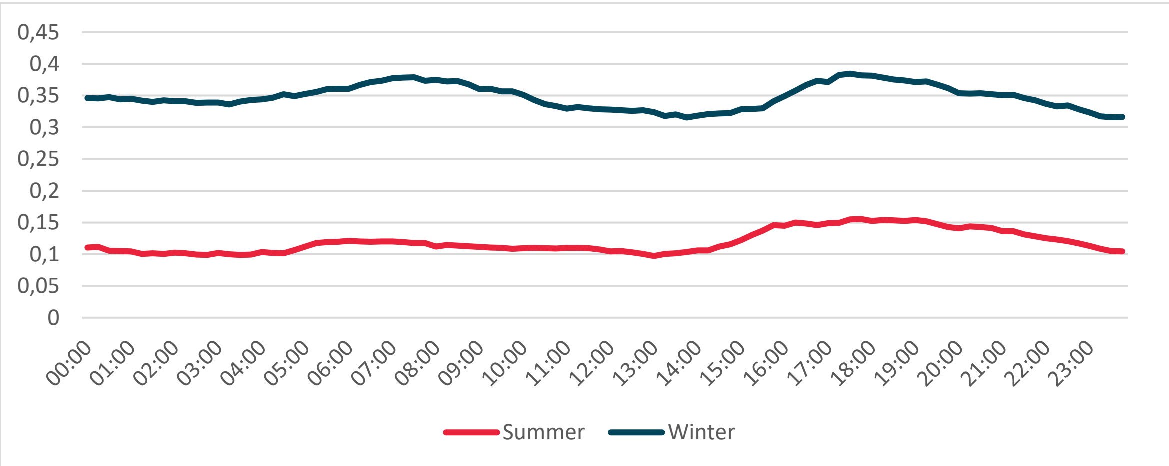


*Figure 3: Average electricity consumption of households in summer and winter over one day, in kWh.*

There is a clear seasonal trend in which electricity consumption follows a similar 15-minute pattern throughout the day in both summer and winter, but the overall level is significantly higher in winter. This difference can be explained by increased electricity use for space heating.

Based on these figures, three main trends can be identified in the dataset: daily, weekly, and seasonal patterns. The results also indicate that a large share of electricity consumption during winter is used for heating.

### 3.2. The soccer match between Sweden and Tunisia on June 15

To exemplify the usage of detailed smart meter data, we examine a recent soccer game. On June 15, from 04:00 to 06:00 local time, Sweden and Tunisia played in the FIFA World Cup 2026. Using smart meter data, we can investigate if the match influenced household electricity consumption in the municipality of Ljusdal during the early morning hours.

We calculate a Z-score for each 15-minute interval on June 15 by comparing the observed average electricity consumption at that time to the mean and standard deviation of the same interval across the previous 14 days, as follows:

$$Z = \frac{X - \mu}{\sigma}$$

where

$X$ is the observed average consumption for a given 15-minute interval on June 15,

$\mu$ is the average consumption for the same 15-minute interval during June 1–14, and

$\sigma$ is the standard deviation for the same 15-minute interval during June 1–14.

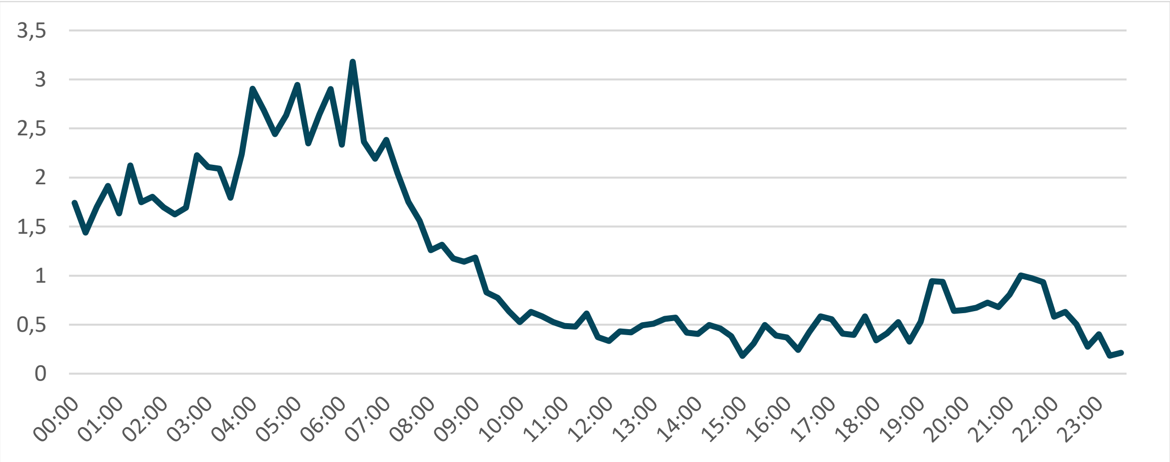


*Figure 4. Z-scores of electricity consumption at 15-minute intervals on June 15.*

Figure 4 shows the resulting Z-scores for each 15-minute interval on June 15. During the early morning hours (around 04:00–06:00), the Z-score approaches 3, meaning that the average electricity consumption was nearly three standard deviations above the typical level. Such deviations are statistically unlikely under normal circumstances and therefore suggest an increased consumption during the match period. During the remaining hours of the day, Z-scores remain between 0 and 1, meaning that electricity usage stayed within normal variation.

### 3.3. Visualization of granular statistics

*Figure 4: Electricity consumption for households in Ljusdal city aggregated to 10 meter × 10 meter squares. Higher cylinders represent higher levels of electricity consumption, with the areas of highest consumption marked in yellow.*

Electricity consumption measured by smart meters at 15-minute intervals, when linked using addresses to the Real Estate Register as described in Section 2.1 to acquire building coordinates, enable new forms of data visualization. Using QGIS, electricity consumption for households, aggregated to 10 meter × 10 meter squares, has been plotted for a snapshot on a satellite map, as shown in the figure above. The height of the cylinders represents the level of electricity consumption, with higher consumption marked in yellow.

Another way to visualize the data is through heat maps, where more intense colors (ranging from yellow to blue in the picture below) indicate higher electricity consumption. Using these types of maps, it is easy to pinpoint areas of high electricity use geographically. These images can also be used as a video with 15-minute snapshots, showing changes in electricity use over a day, week, or season.

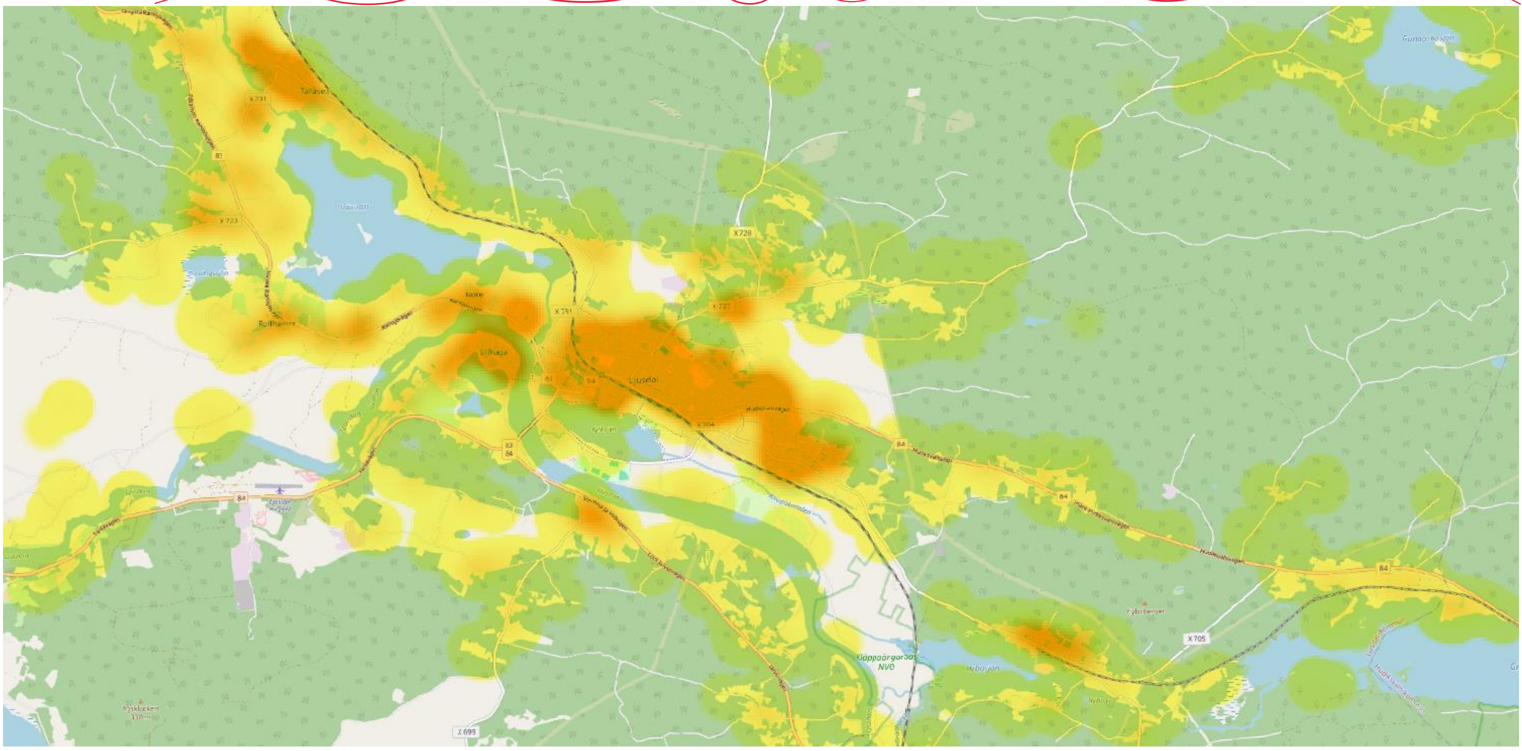

*Figure 6: A heat map illustrating household electricity consumption in the municipality of Ljusdal. Areas with more intense yellow and orange colors indicate higher consumption.*

## 4. Discussion

The case study with one DSO opens up new possibilities to replace parts of the current survey-based statistics and also enables the development of new, more granular statistical indicators.

Looking ahead, the first challenge to address is data collection for a larger share of the market. It is still uncertain whether a central data management system for the electricity market will be implemented in Sweden and, if so, whether data can be collected from this source, or whether the Swedish Energy Agency and Statistics Sweden will instead need to collect data separately from each DSO.

In parallel with data collection, there is also a need to continue developing methods for data linkage between registers, with a focus on improving address information, as well as developing new statistical indicators for official statistics.

However, once the foundational and legislative work is completed, the use of smart meter data for electricity will greatly enhance the production of official energy statistics.

## 5. References

Ministry of Climate and Enterprise (2025). Uppdrag till Energimarknadsinspektionen och Svenska kraftnät att ta fram förslag till ett centralt datahanteringsverktyg för elmarknaden. Available at: https://ei.se/download/18.4d413572199371e3b49b009/1758709082365/2025-103808.pdf (Accessed: 25 June 2026).

Statistics Sweden (2025). Statistik från ett framtida elregister (SCB2025/225).