Watt Time & Frequency

Report Interpretation Guide

Understanding your half-hourly electricity analysis and what to do with it

1. Introduction

The Watt TF report analyses half-hourly electricity metering data and presents consumption, demand, operating-pattern and, where the required data is available, power-quality metrics. The standard view is designed for annual or rolling-period analysis. Depending on the version of Watt TF and the access level provided, a complete calendar month may also be selected for a more detailed monthly deep dive.

Benchmarks and indicative thresholds in this guide are intended to support interpretation, not replace professional judgement. Every site is different: results should be considered alongside the site's operating profile, equipment, tariff arrangements and the analysis window shown in the report.

Annual and monthly views

The report's annual view is intended to show the wider pattern across the selected analysis window, including monthly totals, seasonal behaviour, operating pattern, baseload and demand metrics.

Where monthly deep-dive functionality is available, select a complete calendar month to examine the data at daily resolution. In that view, monthly totals become daily totals, the heatmap represents the days and half-hour periods in the selected month, and operating-pattern and baseload measures are recalculated for that month.

Monthly deep dives are intended for complete calendar months. The available choices and report features depend on the version of Watt TF and the access level provided. Always use the displayed analysis window and labels as the definitive guide to the period being interpreted.

2. Consumption Metrics

Total Consumption (MWh)

The total active electricity imported from the network over the analysis period, expressed in megawatt-hours (MWh). This is the primary measure of energy use and forms the basis of most tariff cost calculations.

On its own, total consumption tells you the scale of the site's energy footprint. It is most useful when compared year-on-year, or benchmarked against similar site types (e.g. kWh/m² for commercial buildings, kWh/unit for manufacturing).

Average Daily Consumption (kWh/day)

The mean daily energy consumption across the analysis period. Useful as a quick normalising metric — for example, comparing weekday vs. weekend averages, or monitoring trend changes month-to-month.

> ***ⓘ A significant gap between weekday and weekend averages can indicate significant baseload (always-on equipment) or operational inefficiency on non-production days.***

Peak Day

The single highest-consumption day in the dataset. This may reflect a particularly busy operational day, extreme weather (heating or cooling), or an anomalous event. Worth investigating if it appears disproportionate relative to typical daily consumption.

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3. Demand Metrics

Demand metrics measure the rate at which electricity is used (kW), as opposed to the total quantity consumed (kWh). Demand is critical because many network and capacity charges are based on peak demand, not total consumption.

Peak Hourly Demand (kW)

The highest rate of electricity consumption recorded in any single one-hour window across the dataset, calculated by summing the two highest consecutive half-hourly readings and expressing the result in kW.

This figure is particularly important for sites on half-hourly settled tariffs, where Triad charges, capacity charges, and some DUoS components are driven by peak demand rather than total energy consumed.

> ***ⓘ UK industry benchmark: sites with peak demand above 100 kW are typically subject to half-hourly settlement and the full range of demand-related network charges.***

Average Hourly Demand (kW)

The mean rate of consumption across all hours in the dataset, calculated as total kWh divided by total hours. This represents the "typical" load the site places on the network over time.

Minimum Hourly Demand (kW)

The minimum one-hour demand recorded. A very low overnight minimum (close to zero) may suggest the site switches off almost entirely at night, which is positive from an energy efficiency standpoint. A persistently elevated minimum suggests significant baseload — always-on equipment that may be worth investigating.

> ***ⓘ Baseload investigation is often one of the quickest wins in an energy audit; motors, compressed air leaks, IT infrastructure, and heating kept on overnight are common culprits.***

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4. Load Factor

Definition

Load factor is calculated as:

Load Factor = Total kWh ÷ (Peak kW × Total Hours)

It expresses the relationship between average demand and peak demand as a percentage. A load factor of 100% would mean the site consumes at its peak rate continuously, a perfectly flat profile. In practice, load factors range from under 20% (very spiky) to 70%+ (very flat).

Benchmarks

Load Factor	Profile Type	Typical Site Types
< 30%	Highly spiky	Event venues, EV charging hubs, some manufacturing with short process cycles
30–55%	Moderate	Offices, retail, light industrial — the most common commercial range
55–75%	Relatively flat	Data centres, cold storage, continuous process manufacturing
> 75%	Very flat	Pumping stations, some 24/7 operations

What a Low Load Factor Means

A low load factor means peak demand is high relative to average consumption. This matters because many charges — including capacity charges, some DUoS components, and reactive power penalties — are sized around peak demand. A site with a low load factor is effectively paying a premium for its network connection relative to how much energy it actually uses.

What Might Help

- Load shifting: Moving flexible loads (e.g. heating pre-heat, EV charging, batch processes) away from peak demand periods reduces peak kW without reducing output.
- Battery storage: A behind-the-meter battery can absorb peak demand spikes, effectively flattening the load profile. When paired with solar PV, the economics improve significantly.
- Demand-side response: Some suppliers and aggregators offer payments for load flexibility — a low load factor site with controllable loads may be well-suited to participate.
- Automated monitoring: Understanding exactly which loads create demand peaks (via sub-metering or process logging) is the first step to managing them.

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5. Power Factor

Definition

Power factor (PF) is the ratio of active power (kW — the power actually doing useful work) to apparent power (kVA — the total power drawn from the network). It is expressed as a number between 0 and 1, or as a percentage.

Power Factor = kW ÷ kVA = Active Import ÷ $\sqrt{(AI^2 + RI^2)}$

A power factor of 1.0 (unity) means all power drawn from the network is doing useful work. A lower power factor means the site is drawing more current than its kW consumption alone would suggest — the excess is reactive power, which is largely wasted as heat or magnetic flux in inductive equipment (motors, transformers, inductive ballasts).

> ***ⓘ Power factor data is only available when a Format B file (with the RI reactive import channel) has been loaded.***

Benchmarks

Power Factor	Assessment	Typical Implication
> 0.95	Good	Unlikely to attract reactive power charges from most DNOs or suppliers.
0.90–0.95	Acceptable	Within tolerance for most tariffs, but monitoring is worthwhile.
0.85–0.90	Marginal	Some DNOs begin applying reactive power charges at this level.
< 0.85	Poor	Reactive power charges are likely. PFC equipment is worth evaluating.

What a Low Power Factor Means

A poor power factor increases the kVA demand on the network and on the site's electrical infrastructure. Many DNOs and suppliers charge for reactive energy consumed (measured in kVArh) or impose a minimum power factor clause in the connection agreement. Persistently low PF can also increase losses in cables, switchgear, and transformers, reducing their effective capacity.

What Might Help

- Power Factor Correction (PFC): Capacitor banks installed at the main incomer (or at individual loads) counteract the reactive component of inductive loads, raising the effective power factor. Payback periods of 2–4 years are typical for sites with power factors below 0.90.
- Fixed vs. automatic PFC: Fixed capacitor banks suit sites with consistent load profiles. Automatic (switched) PFC panels respond to load changes and are better suited to variable loads.
- Voltage Optimisation (VO): Can improve power factor indirectly by reducing over-voltage — many UK sites receive supply above nominal voltage, and VO equipment (typically 10–15 V reduction) can improve PF while reducing overall consumption by 5–10%.

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6. Reactive Power — Import and Export

Reactive Import (kVArh)

Reactive Import is the reactive energy drawn from the network by inductive loads — motors, transformers, fluorescent lighting with magnetic ballasts, and similar equipment. It is measured in kilovolt-ampere reactive hours (kVArh). Reactive Import is the component of power that creates a poor power factor (see Section 5).

The total reactive import figure for the analysis period gives an indication of the overall reactive burden on the site. A large reactive import relative to active import (total kWh) confirms a low power factor and suggests PFC may be beneficial.

Reactive Export (kVArh)

Reactive Export is reactive energy pushed back onto the network — a less intuitive concept. It occurs even at sites with no generation equipment, caused by capacitive loads such as:

- Variable speed drives (VSDs/inverters)
- LED driver electronics
- Power factor correction capacitors operating at light load
- Certain UPS systems and large IT infrastructure

Reactive Export is generally a neutral finding on its own. However, some DNO connection agreements include a minimum import power factor clause, and if the site is exporting significant reactive power at certain times, this could technically be in breach. It is worth checking the site's connection agreement if reactive export is significant.

> ***Reactive export does not mean the site is generating electricity. It is a power quality characteristic of certain load types, not an indication of on-site generation.***

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7. kVA — Apparent Power

kVA (kilovolt-amperes) is the measure of apparent power — the total electrical load placed on the network, combining both active power (kW) and reactive power (kVAr). The relationship is:

$$kVA = \sqrt{(kW^2 + kVAr^2)}$$

Many supply tariffs and network connection agreements are sized in kVA rather than kW. A site's Maximum Import Capacity (MIC) or Authorised Supply Capacity (ASC) is typically expressed in kVA — if peak kVA demand exceeds this figure, the site risks exceeding its agreed capacity, which can trigger Excess Capacity charges and may require a formal capacity upgrade.

The Watt TF report shows an average kVA half-hourly profile (when Format B data is available), which helps identify when apparent demand peaks occur and whether they align with DUoS high-cost periods.

> ***kVA data is only available when a Format B file (with the RI reactive import channel) has been loaded.***

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8. DUoS Bands — Red, Amber, Green

What Are DUoS Charges?

Distribution Use of System (DUoS) charges are levied by Distribution Network Operators (DNOs) for the use of the local electricity distribution network. They are passed through by suppliers and form part of the standing charges and unit rates on most half-hourly settled electricity tariffs.

DUoS charges are time-differentiated — the same unit of electricity costs significantly more to distribute during peak network demand periods than during off-peak times. The charging periods are colour-coded into three bands:

Band Definitions

Band	Typical Times (UK Average)	Relative Cost
Red	Weekdays, 16:00–19:00, November–February	Highest — typically 3–8× the green rate
Amber	Weekdays, 08:00–16:00 and 19:00–23:00 (winter); 07:00–23:00 (summer)	Medium
Green	Nights (23:00–07:00), all weekends, bank holidays	Lowest

> ***DUoS band times vary by DNO region. The times shown above are based on UK average band definitions (Ofgem). Exact timings for a specific site should be verified against the relevant DNO's published charging statements.***

Interpreting the DUoS Breakdown

The Watt TF report shows what percentage of total consumption falls in each band, alongside the absolute MWh consumed in each. This allows a quick assessment of the site's exposure to high-cost network periods.

- High Red band consumption (>10%): Significant exposure to peak network charges. Load shifting or battery storage to reduce consumption in the 16:00–19:00 winter window can reduce DUoS costs materially.
- High Green band consumption (>60%): A favourable profile — suggests the site operates heavily overnight or at weekends, keeping network charges relatively low.
- Predominantly Amber: Typical of standard daytime commercial operations. Opportunities exist around the edges of the red window.

What Might Help

- Battery storage: Charging overnight (Green band) and discharging during Red and peak Amber periods is one of the most direct ways to reduce DUoS cost exposure.
- Solar PV: Generation during Amber and some Red band hours offsets grid imports at the most expensive times. The combination of solar PV with battery storage maximises DUoS cost reduction.
- Load scheduling: Where process flexibility exists, scheduling high-demand activities outside 16:00–19:00 in winter months avoids Red band charges without capital investment.
- Time-of-use tariffs: Some suppliers offer tariffs that pass DUoS band pricing through directly — for sites already managing load well, this can be advantageous.

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9. Year-on-Year Comparison

When the dataset contains at least 13 months of data with overlapping calendar months across two years, the report shows a month-by-month comparison table indicating percentage change in consumption.

This metric is useful for identifying consumption trends — whether a site is becoming more or less energy-intensive over time — and for flagging months where consumption has changed materially.

- Consistent increase across months: May indicate growth in operations, additional equipment, or deteriorating efficiency of existing plant.
- Consistent decrease: Could reflect successful energy efficiency measures, reduced production, or a change in occupancy.
- Isolated month spikes: Often point to a specific event — extreme weather, a breakdown requiring manual override, or a one-off operational change.

> ***ⓘ Year-on-year comparisons should always be contextualised against known operational changes (new machinery, building extensions, occupancy changes) before drawing conclusions about efficiency trends.***

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10. Site Parameters — Enhanced Report Metrics

When site-specific information is entered in the Site Parameters panel, Watt TF adds the following additional metrics to the report. All are optional — they supplement the core analysis without replacing it.

10.1. Out-of-Hours Usage

Requires: Opening Hours configured in Site Parameters

Out-of-Hours Usage % (stat card)

This stat card shows the percentage of total consumption that occurred outside the configured opening hours. For example, if the site is set to operate Monday–Friday 08:00–18:00 and 15% of consumption falls outside those windows, the card displays 15% out of hours.

A high out-of-hours figure at a site that should be dormant overnight or at weekends often signals:

- HVAC systems running unnecessarily
- Poorly scheduled water heating or process plant
- Equipment not being shut down at the end of the working day
- Security or IT infrastructure that may be larger than necessary

Occupancy Breakdown table

Beneath the stat card, the report includes a table showing:

Column	Description
Period	In-Hours / Out-of-Hours
Consumption (MWh)	Absolute energy for each period
Share (%)	Each period as a percentage of total consumption

This table gives an immediate, quantified view of how much energy is attributable to operational hours versus unoccupied periods.

Out-of-Hours Cost Estimate

If a tariff unit rate has also been entered, Watt TF multiplies the out-of-hours MWh by the applicable rate to produce an estimated cost for out-of-hours consumption over the relevant analysis period. This figure is displayed within the Site Parameters Summary block (see Section 10.4).

> ***ⓘ The out-of-hours cost estimate uses a single blended rate (single-rate tariff) or a weighted split across day and night rates (dual tariff), based on when out-of-hours consumption actually occurs across the half-hourly dataset.***

10.2. Energy Intensity

Requires: Floor Area (m²) entered in Site Parameters

Energy Intensity (stat card)

This stat card expresses consumption for the analysis period relative to the site's floor area:

Energy Intensity = Total kWh (annualised) ÷ Floor Area (m²)

The result is shown as kWh/m²/year — a standard benchmarking unit for commercial and industrial buildings in the UK.

Watt TF compares the calculated figure against indicative UK benchmarks and displays one of four commentary labels:

Label	Typical Range	Indicative Context
Excellent	Low end for site type	Well-managed site; minimal obvious efficiency opportunities
Good	Below average for site type	Reasonably efficient; targeted improvements may yield marginal gains
Moderate	Around or slightly above average	Some inefficiency present; an energy audit may be worthwhile
High	Significantly above average	Consumption is high relative to floor area; investigation recommended

> ⓘ ***Benchmarks vary significantly by building type — an office, a warehouse, and a food manufacturing facility have very different typical kWh/m² ranges. The commentary is indicative. Where the site type is known, it is worth comparing against sector-specific CIBSE or Carbon Trust benchmark data.***

10.3. Cost Estimates

Requires: Tariff rate(s) entered in Site Parameters

Est. Cost for Analysis Period (stat card)

The estimated electricity commodity cost for the selected analysis period, calculated by multiplying total consumption for the selected analysis period (kWh) by the unit rate(s) entered. For a single-rate tariff, this is a straightforward multiplication. For a dual tariff, day and night consumption are split using the configured night window and priced separately.

Est. Daily Cost (stat card)

The estimated average daily commodity cost, derived from the analysis-period cost estimate divided by the number of days in the selected analysis period. In a monthly deep dive, this is a month-specific average.

> ⚠ ***These figures represent energy commodity cost only, based on the unit rate(s) entered. Standing charges, network charges, levies, and other non-commodity costs are not included. They should not be treated as a projection of the site's total electricity bill.***

10.4. Site Parameters Summary Block

When any site parameters have been entered, the report includes a Site Parameters Summary block. This consolidates the configured inputs and their associated outputs in one place for easy reference and reporting.

The block displays:

- The opening hours and active days (if configured)
- Floor area (if entered)
- Unit rate(s) entered (single or dual tariff)
- Night window start/end (dual tariff only)

For dual tariff configurations, the summary block also shows the consumption and cost split by day/night — the MWh and estimated cost attributable to each tariff window, based on when consumption actually occurred across the half-hourly dataset.

11. Automated Insights

At the bottom of each Watt TF report is an automatically generated insights section. This interprets the key metrics and flags observations that may be worth investigating. The insights are generated from the data and benchmarks described in this guide.

The insights are intended as a starting point for discussion, not a substitute for a full energy audit. They are structured to highlight:

- Metrics outside typical benchmark ranges
- Potential cost reduction opportunities
- Technology categories that may be relevant to the site's profile

Where site parameters have been configured, the insights section will also include commentary on:

- Out-of-hours consumption relative to total usage, and whether it warrants investigation
- Energy intensity rating with context for the calculated kWh/m²/year figure
- Estimated cost exposure attributable to out-of-hours consumption (where both tariff and opening hours are set)

Energy managers and consultants should use the insights alongside the full report charts to build a complete picture of the site's consumption behaviour.

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12. Technologies Worth Considering

The following technologies are referenced within Watt TF report insights. This section provides a brief, neutral summary of each — intended to inform rather than recommend.

Solar PV (Photovoltaic)

On-site solar generation reduces grid imports during daylight hours, primarily during Amber band periods. Savings depend on roof/ground space, orientation, shading, and the match between generation profile and consumption pattern. Sites with high daytime weekday consumption typically see the strongest business cases.

Battery Energy Storage Systems (BESS)

Behind-the-meter battery storage can shift consumption from high-cost to low-cost periods, reduce peak demand (and associated capacity charges), and support DUoS band optimisation. Batteries are increasingly deployed alongside solar PV, with the battery storing excess generation for discharge during evening peak periods. Standalone battery projects (without solar) are viable where arbitrage value between Green and Red/Amber band rates is sufficient.

Power Factor Correction (PFC)

Capacitor banks installed at the incomer or at individual load points raise the site's power factor by counteracting reactive power from inductive loads. This reduces reactive power charges, can lower kVA demand charges, and may reduce losses in the site's electrical infrastructure. Fixed capacitor banks are the simplest option; automatic PFC panels respond dynamically to load changes.

Voltage Optimisation (VO)

Most UK grid supplies deliver voltage slightly above the nominal 230V. Voltage optimisation equipment (typically installed at the main incomer) reduces supply voltage by 10–15V, which can reduce consumption across resistive and some motor loads by 5–10%. VO also has a secondary benefit of improving power factor in some cases. It is most effective at sites with older motors, heating elements, and lighting.

Load Management / Building Energy Management Systems (BEMS)

Automated control of HVAC, lighting, compressed air, and other controllable loads can flatten demand profiles, avoid peak periods, and eliminate unnecessary consumption outside operating hours. BEMS paybacks vary widely but tend to be strong at larger commercial and industrial sites with complex M&E systems.

Demand-Side Response (DSR)

Sites with significant flexible loads may be eligible to participate in demand-side response schemes, where they are paid to reduce consumption at specified times (typically National Grid ESO balancing events). Eligibility depends on load size, response time, and controllability. Aggregators can bundle smaller sites into DSR portfolios.

Using this guide with an unexpected result

If a metric or chart is absent, first check the input data format, the displayed analysis window and the optional Site Parameters entered. Power-quality sections require the relevant reactive-import/reactive-export data. Cost and out-of-hours outputs require the corresponding tariff and opening-hours inputs. Monthly analysis also depends on the version and access level provided, and is designed around complete calendar months.

For additional help, contact your Watt TF representative or email hello@watt-tf.com.