Energy Loss Calculator

Fluke 1775 / 1777

AGENDA

1. What is Energy Loss Calculator?
2. Value Proposition
3. Application Notes
4. Key Personas
5. ELC Setup and Results Overview

What is Energy Loss Calculator (ELC)?

Measurement mode on Fluke 1775 and 1777 devices.

Helps identify where electrical energy is lost or wasted within a system.

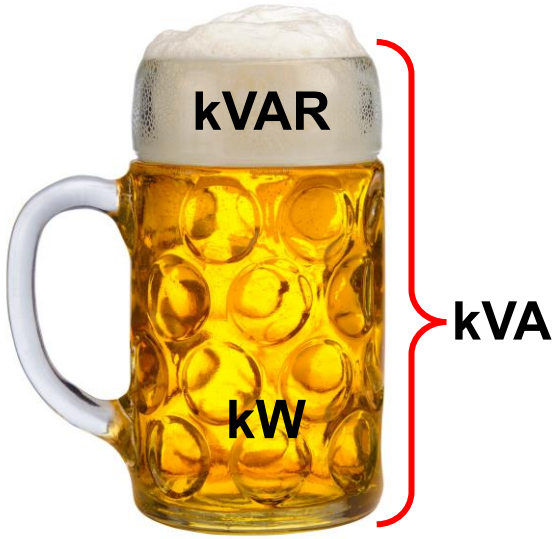
Allows users to quantify the cost of losses and implement mitigations for significant cost savings with minimal investment.

ELC detects system losses beyond just highlighting unnecessary operational loads. The measurements made show the losses inside loads and present in the electrical system.

How can PQ impact energy costs, losses and usage?

Consider this beer analogy:

- The mug capacity is the apparent power (kVA).
- The beer represents the active power (kW).
- The foam represents reactive power (kVAR).
- Power factor is the ratio between the beer (active power, KW) and the mug (apparent power, kVA).



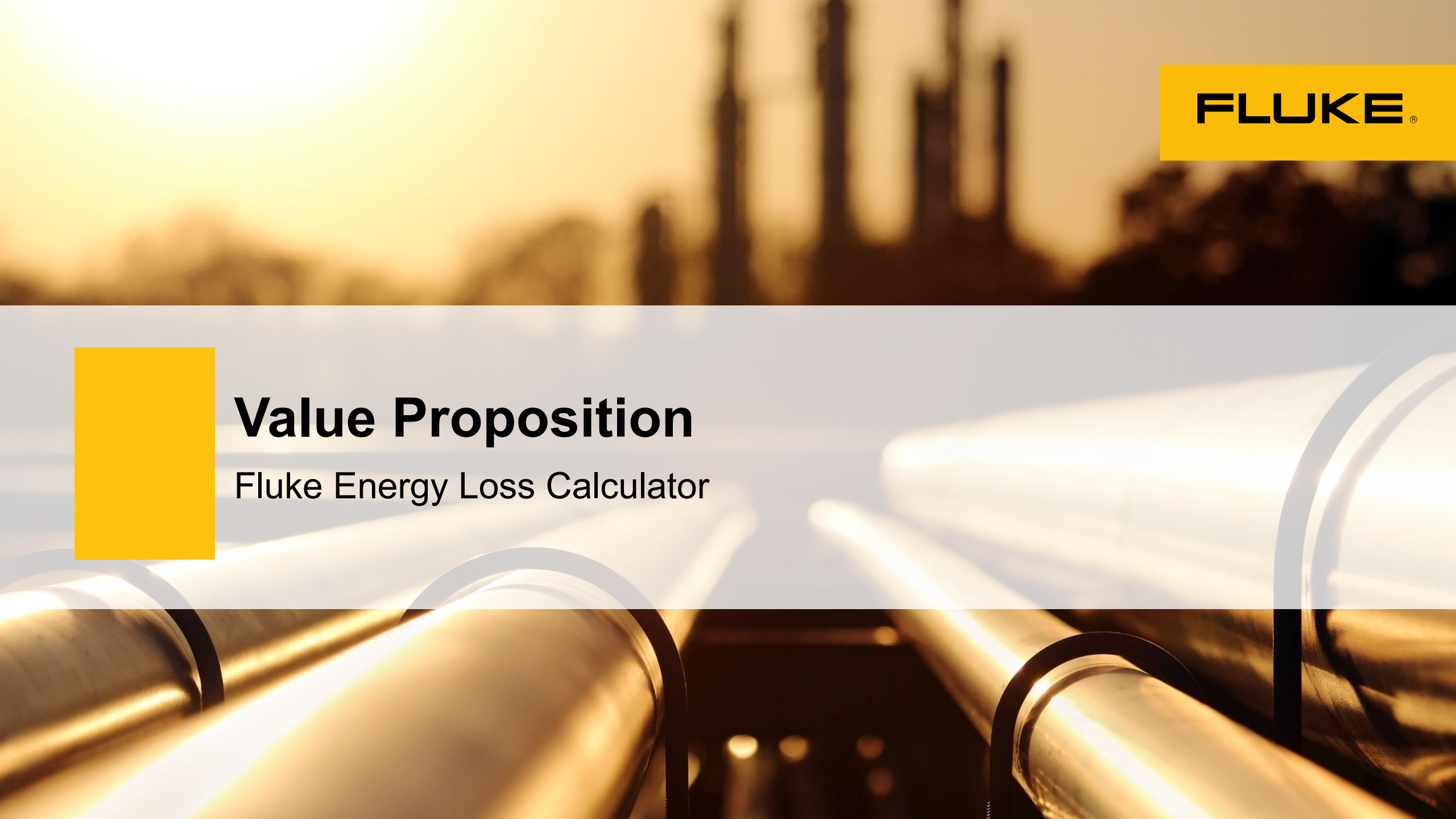
A lower power factor means less beer and more foam, for the same cost!

For energy, this means you're paying more for less usable power, leading to higher costs.

Energy consumption charges are typically broken into:

- Active power (kW) delivered by the utility
- Variances due to power factor
  - Typically levied when less than 0.9
- Variances due to peak demand
  - Demand cost set for highest power used during a 15min or 30min period. Assessed monthly.

Service Category	Peak	KWh Usage
Power Factor Rate		
KVARH	General	1763483
Large General Service		
kW	ON PK	2032
	OFF PK	214
Maximum Demand for Billing Period		
kWh	ON PK	593445
	OFF PK	1224546
Standing Demand Charge		
Total kWh Consumption		3583720



Value Proposition

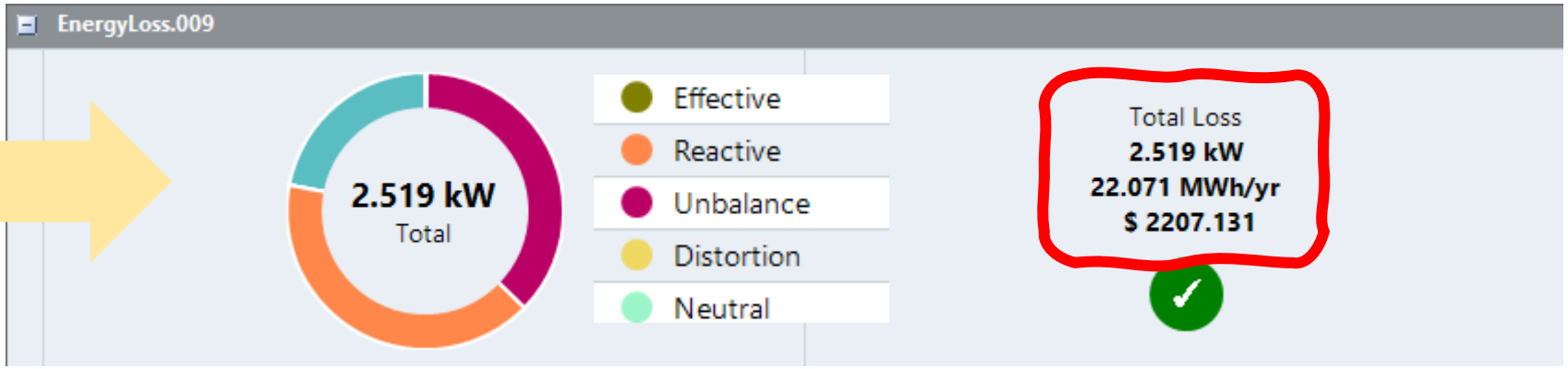
Fluke Energy Loss Calculator

Wasted Energy Monetized

Attach a cost value to the wasted energy (in FEA+)

Understand components of waste to identify sources of loss

Justify cost of mitigation actions

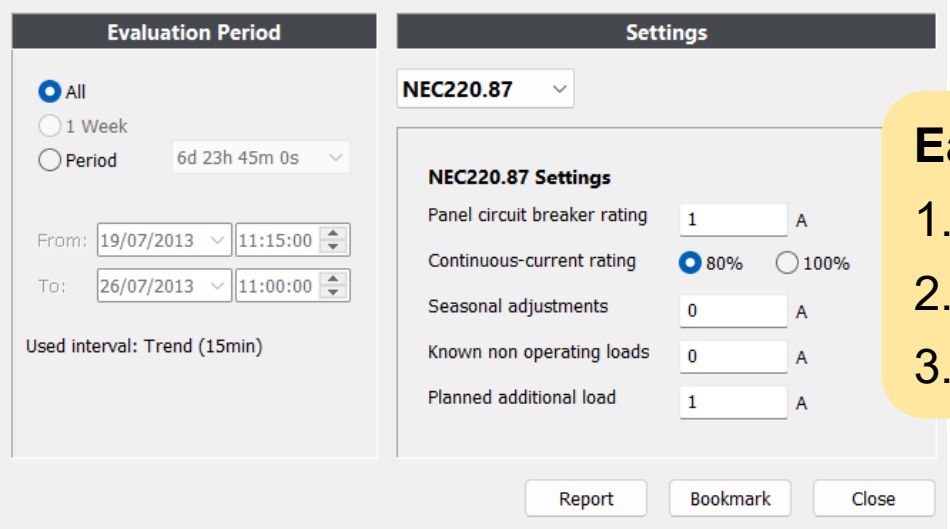


Mitigating Energy Losses

Loss Type	Loss Description	Potential Mitigations
Effective power	Heat is generated in the cable as power flows	Check cable sizing, if cables are close to size limit additional cables can be installed in parallel to reduce voltage drop and heating effects.
Reactive power	Not all consumed energy goes towards driving the load	Consider installing power factor correction. Active power factor correction can ensure the right amount of correction is applied under varying load conditions.
Unbalance losses	Wasted energy that the load cannot use	Check system phase loads, distribute loads more evenly; check electrical motors for faults (single phasing).
Distortion power	Harmonic power that drives load inefficiently; generating heat and possible overheating	Installation harmonic filtering.
Neutral losses	Current flowing in neutral due to unbalance causes heating	Increase size of neutral conductor to reduce heating and improve safety by decreasing the risk of overheating and destruction of conductor. It is standard practice to have the neutral conductor 2x the size of the phase conductor to minimise these losses.

Offer Enhanced Services to Clients

- Contractors can offer enhanced energy loss services creating a revenue stream from surveys and additional work for the installation of mitigation equipment
- Utilities can offer energy loss evaluations as a service which will save their customers money, reduce their energy usage, and help to keep the network stable.
- **Did you know:** Fluke's Energy Analyze Plus software can save you time with quick and automated report creation



Easy load study report creation:

1. Select evaluation period
2. Enter panel rating and additional details
3. Click "Report"

Application Notes

Fluke Energy Loss Calculator

Energy Waste You Didn’t Even Know About

Read application note

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- **Challenge:**
  - Rising energy costs and the need for energy-efficient solutions.
  - Facilities pay for energy they can't use due to poor power quality.
- **Solution:**
  - Quantify energy waste in kilowatts and calculate cost over time.
- **Case Studies:**
  - **Industrial Park: $14,000 savings per year**
    - Issue: Reactive power losses at night.
    - Solution: Time-controlled relays for capacitor banks.
  - **Automobile Plant: $50,000 savings per year**
    - Issue: Reactive power from discharge lamps and inefficient transformers.
    - Solution: Power factor correction and transformer rationalization.
- **Results:**
  - Significant energy savings and improved efficiency by addressing power quality issues.

*"**Seeing is believing**, and the fixing is easy."*

The Cost of Poor Power Quality

Read application note

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- **Challenge:**
  - Clean power is crucial for productivity and automation.
  - Power quality problems can cause equipment malfunctions and work stoppages.
  - Sources of problems: installation issues, operational errors, lack of mitigation, and maintenance problems.
- **Impact:**

Downtime:
- Revenue loss
- Additional costs for scrap, restart, and extra labour.

Equipment Problems:
- Excess harmonics can lead to equipment failures
- Low voltage can increase scrap rates

Energy Costs:
- Higher peak demand charges
- Penalties due to power factor

- **Solution:**
  - Direct measurement of waste due to harmonics and unbalance.
  - Quantifies energy waste and calculates cost based on utility rates.
- **Results:**
  - Justify investment in power quality solutions by comparing costs of prevention versus impact costs.

CCW Energy Systems: Increasing Oilfield Profits

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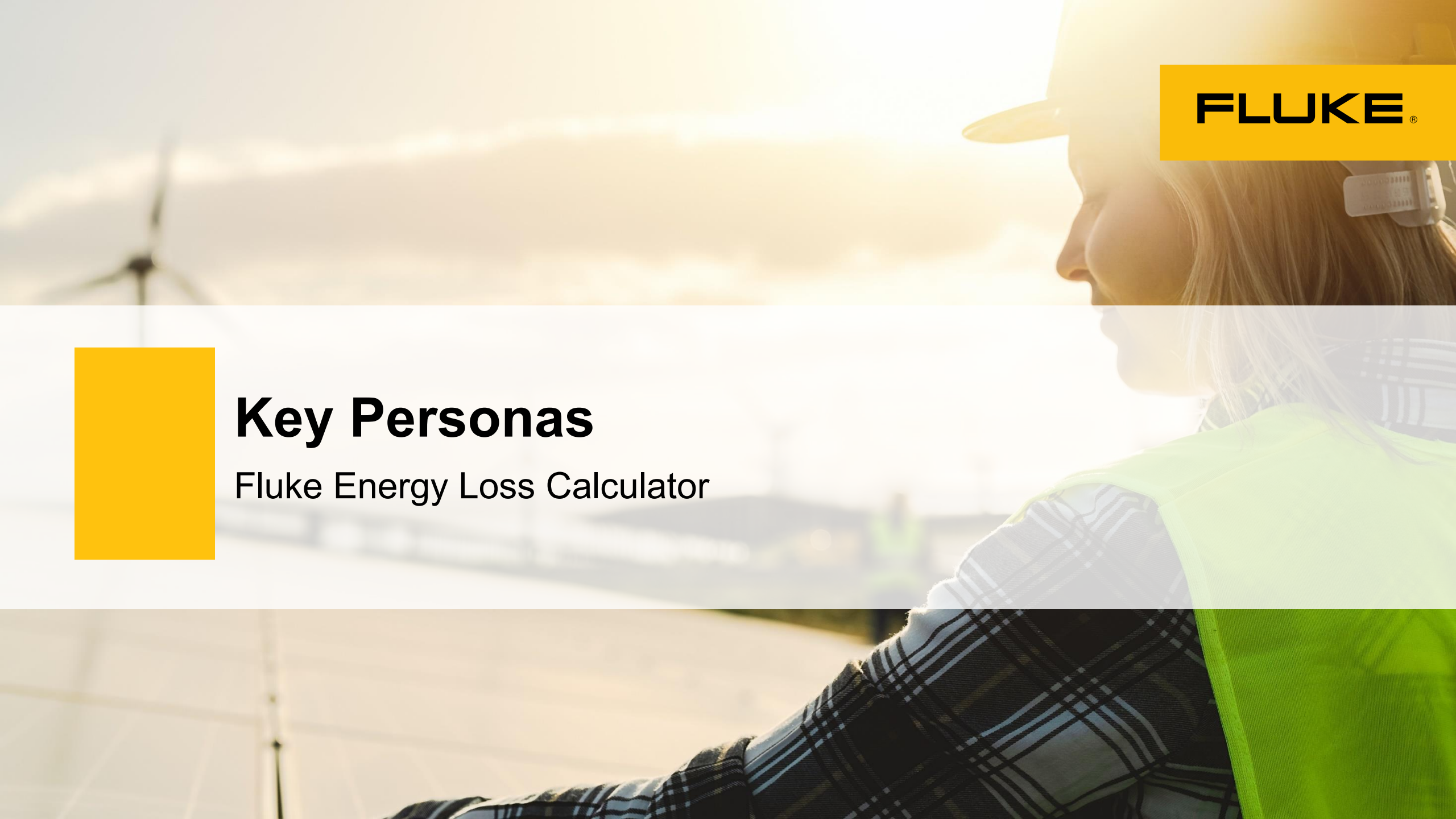
Read application note

- **Challenge:**
  - High energy consumption in oil field operations, accounting for up to 50% of operational costs.
- **Solution:**
  - Conduct energy assessments before and after installation to quantify energy loss and savings.
- **Key Benefits:**
  - Energy Savings: At least 15% reduction in electrical bills.
  - Efficiency: Reduced demand by up to 70% and consumption by up to 30%.
  - Economic Modelling: Demonstrates financial payback of energy-efficient solutions.
  - Quality Assurance: Ensures power quality and harmonics meet utility-grade interconnections.
- **Results:**
  - Significant savings in operational costs.

*"With the Fluke Energy Loss Calculator, **we can instantly show them how many dollars a month they are losing** because of inefficiencies within the system."*

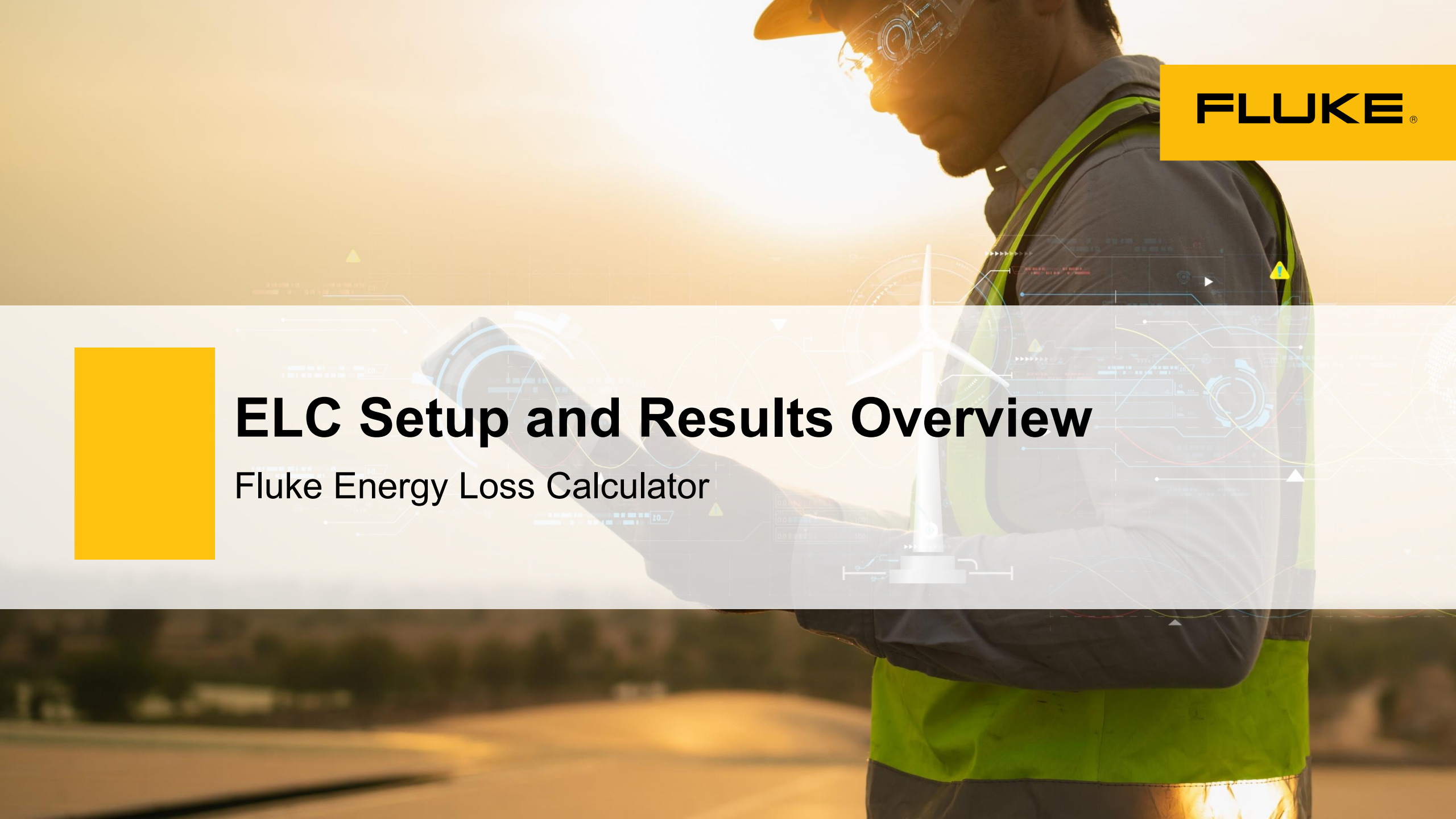


Key Personas

Fluke Energy Loss Calculator

Key Personas

Persona	Job Titles	Key Activities	How ELC Helps
Energy Manager	Energy Manager, Sustainability Manager	Monitoring energy usage, optimizing energy efficiency	Identifies energy losses, enabling cost-saving measures
Electrical Engineer	Electrical Engineer, Power Quality Engineer	Designing and maintaining electrical systems, ensuring reliability	Detects inefficiencies and losses in the system, allowing for targeted improvements
Facility Manager	Facility Manager, Building Maintenance Manager	Overseeing facility operations, managing maintenance	Uncovers hidden energy losses, optimizing operational costs
Industrial Electrician	Industrial Electrician, Maintenance Electrician	Performing electrical maintenance, troubleshooting issues	Provides insights into energy losses, aiding in effective repairs and upgrades
Utility Consultant	Utility Consultant, Energy Auditor	Conducting energy audits, recommending efficiency improvements	Quantifies losses, supports data-driven recommendations for clients



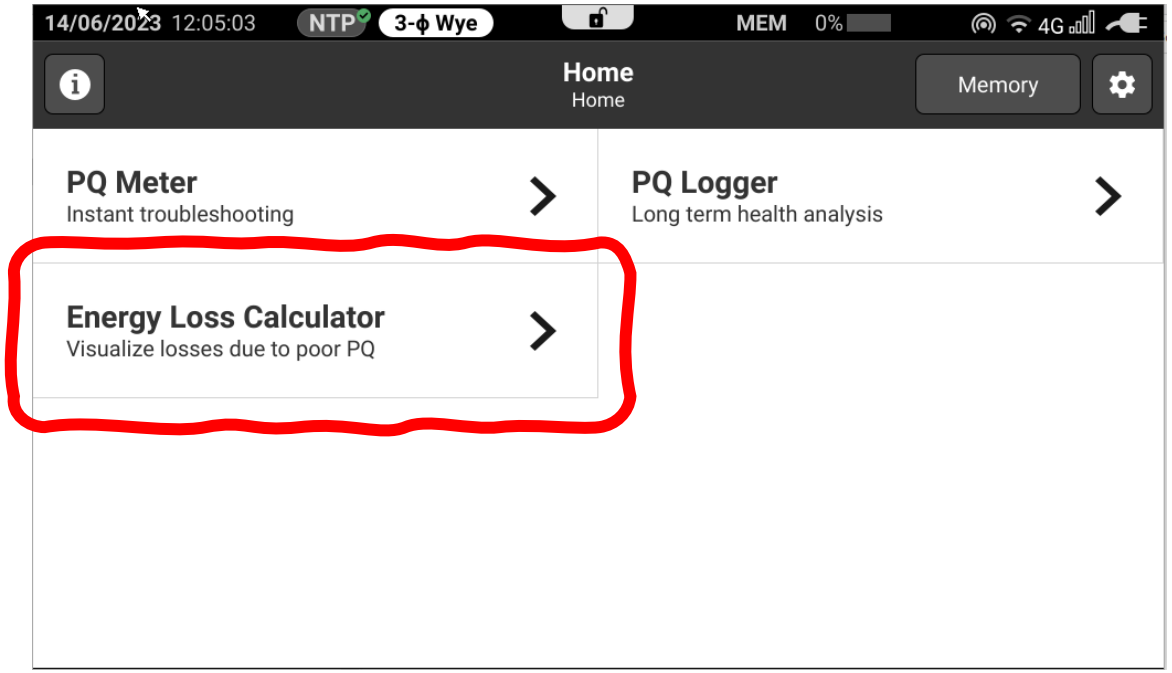
ELC Setup and Results Overview

Fluke Energy Loss Calculator

Energy Loss Calculator Setup

- Pre-requisites:
  1. Fluke 1775 or 1777 mainframe
  2. Firmware 3.1 or higher
  3. Only supports three phase configurations

- Firmware version can be checked on the Settings screen.
- Latest 177X firmware release can be downloaded from the Fluke website.

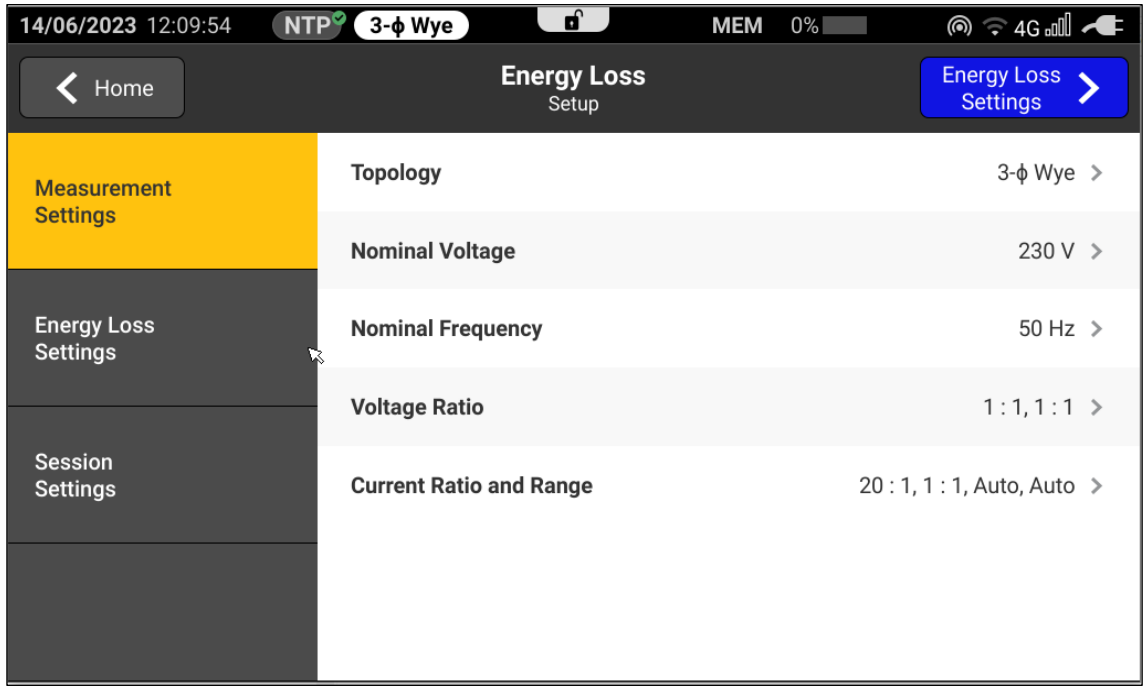


Measurement Settings

- These settings are required for any energy or power quality measurements.

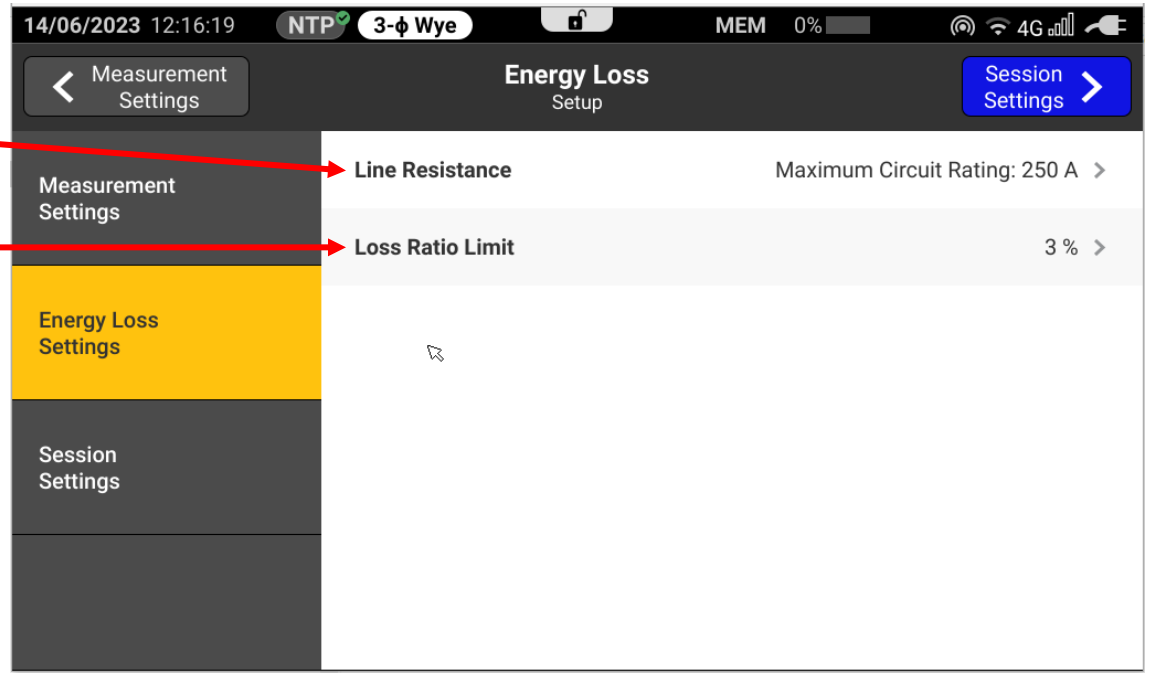
Warning: Failure to enter the correct nominal values when measuring power quality will create reports that are incorrect as the software application uses these values for comparisons and calculations.

Please note: ELC only supports three phase measurements.



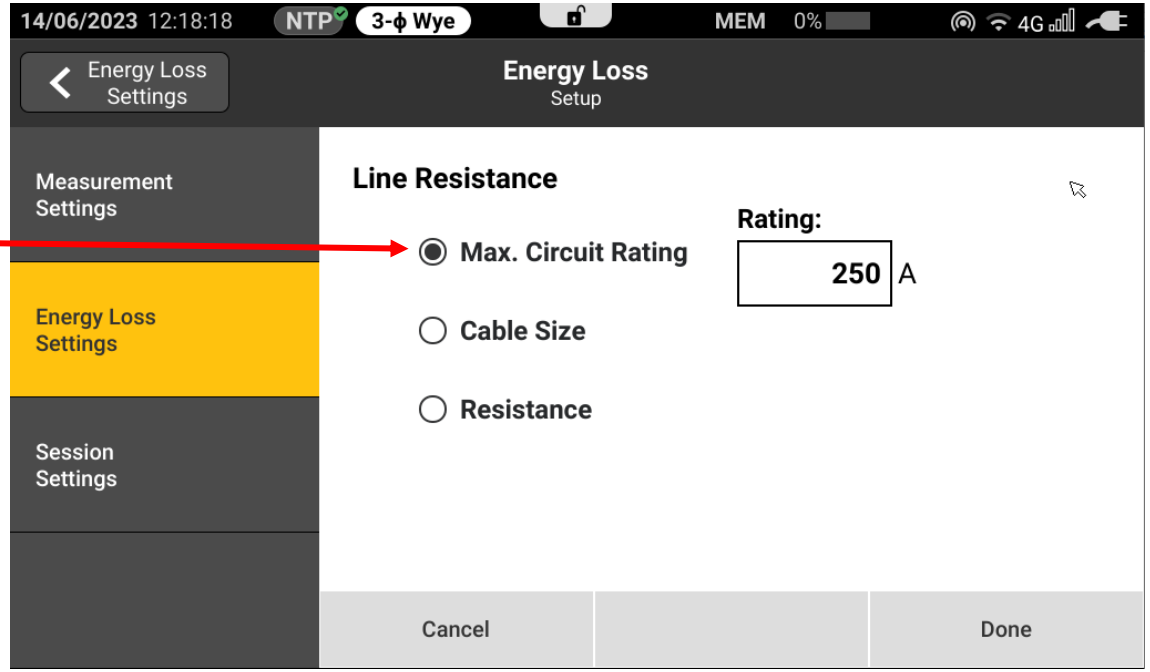
Energy Loss Settings

- These settings relate to the conductors connecting the load to the energy source.
- **Line Resistance**
  - (More details on next slide)
- **Loss Ratio Limit**
  - Defines the acceptable power loss and can be set up to 10%.
  - Set at 3% by default as a well-designed system that meets local standards will result in a system with losses <3%.
  - Losses >3% will start to generate excess heat and stress components over the life of the system resulting in failures and shorter life.



Energy Loss Settings – Line Resistance

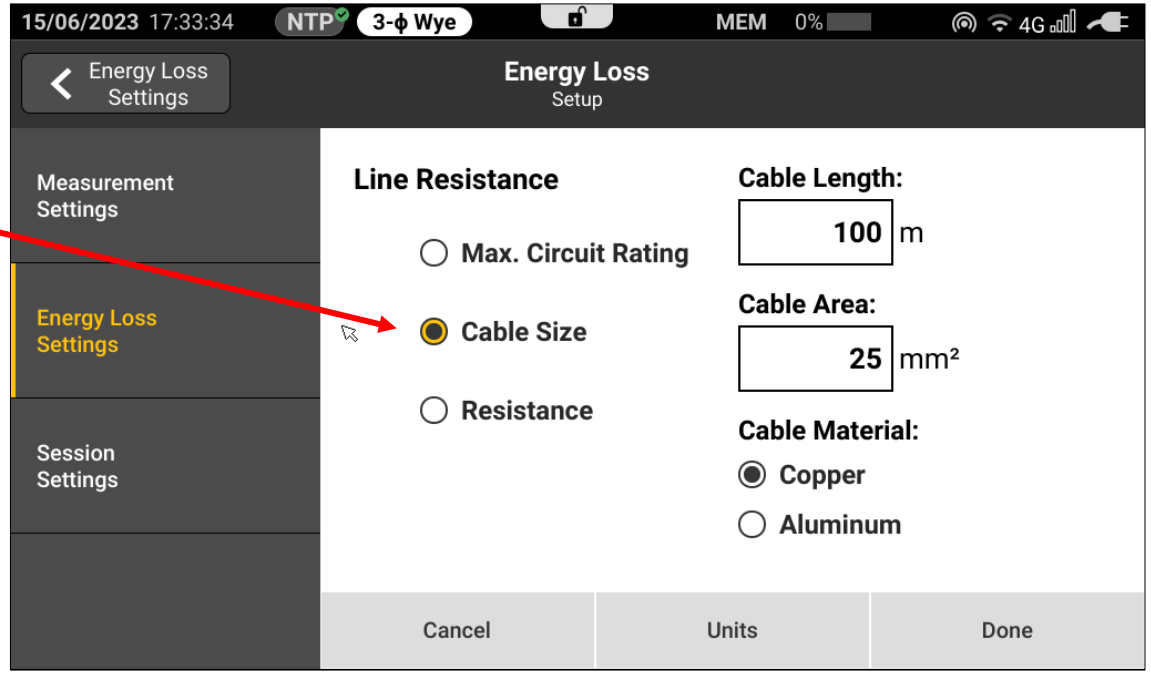
- ELC provides three options for entering line resistance:
  1. **Max. Circuit Rating**
     - The maximum current rating of the circuit or breaker rating
  2. **Cable size**
  3. **Resistance**
     - The resistance of the wiring from source to the panel



Remember: The Energy Loss Settings relate to the conductors connecting the load to the energy source.

Energy Loss Settings – Line Resistance – Cable Size

- Using the **Cable Size** option improves result accuracy as it takes into account potential losses in the cable.
- Information required:
  - Cable length
  - Cable area
  - Cable material
- Under-sized cables will increase losses, as will cable runs that are too long.



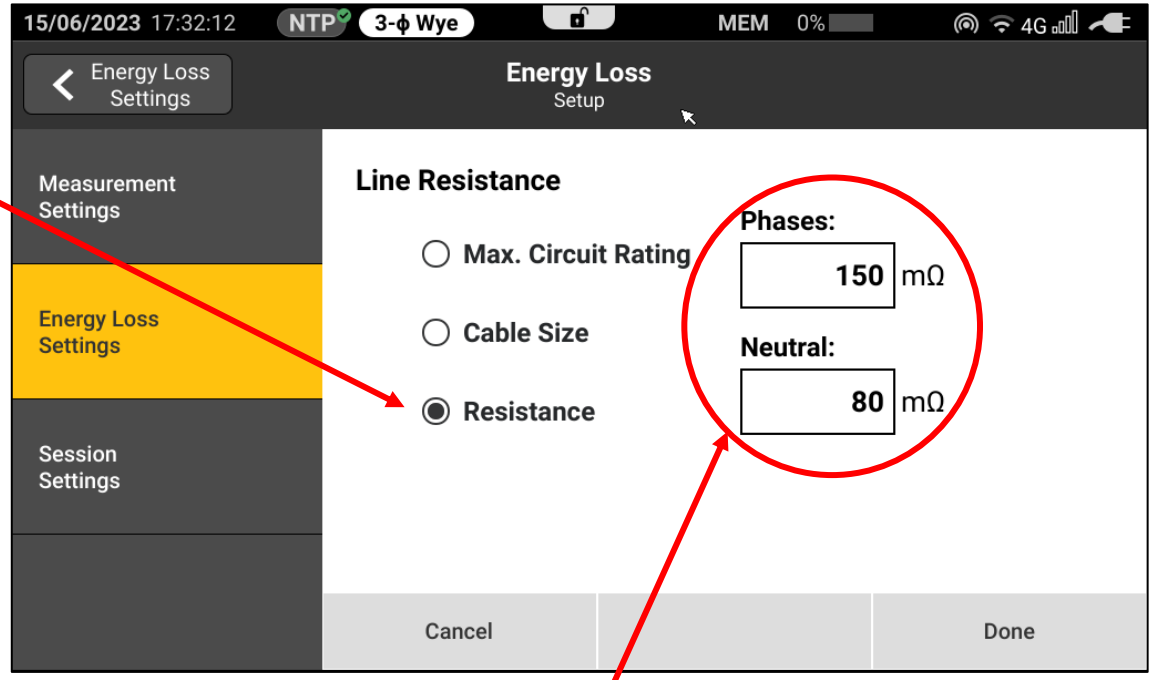
Remember: The Energy Loss Settings relate to the conductors connecting the load to the energy source.

Energy Loss Settings – Line Resistance – Resistance

- Using the **Resistance** option should provide better results than other methods as the calculations will use the actual measured resistance.
- Information required:
  - Resistance of phase conductor and neutral

Please note: Measuring cable resistance requires a digital low resistance ohmmeter (DLRO) due to very low resistance in current conductors. Use a four-wire connection: two wires carry current and two measure voltage, eliminating voltage drop errors.

- Lower resistance will reduce losses. Cable sizing according to code should be adhered to always for safety and loss minimization.



Please note: Values are in mΩ.
It is standard practice for the neutral conductor to be 2x the size of the phase conductor to minimize losses.

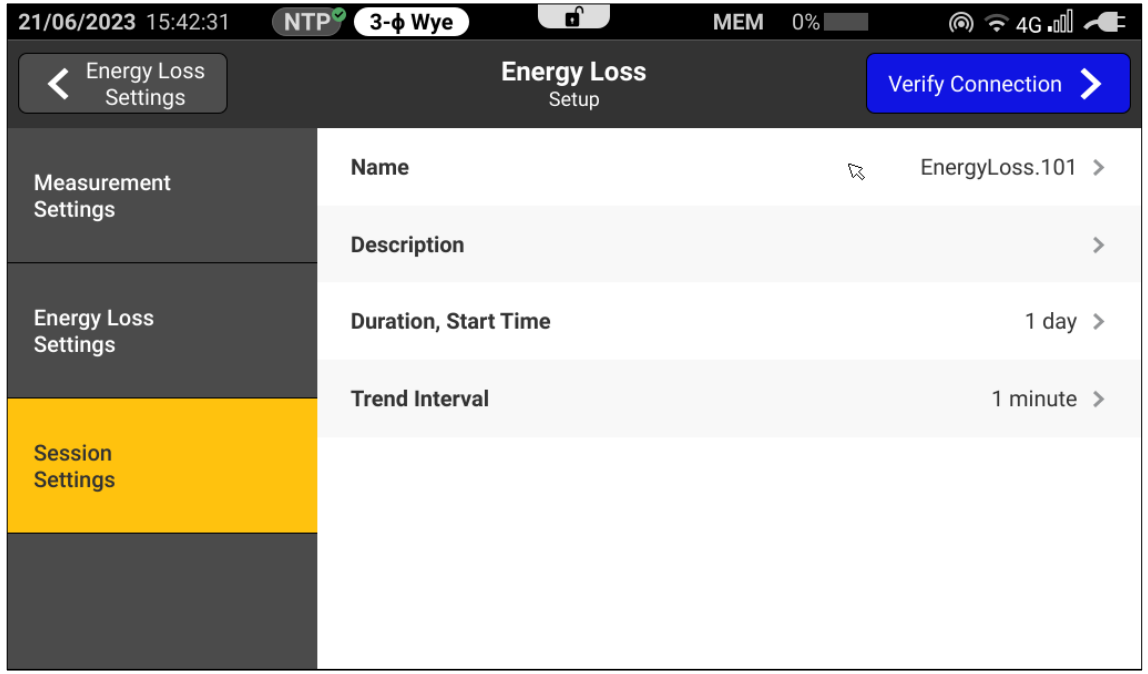
Remember: The Energy Loss Settings relate to the conductors connecting the load to the energy source.

Session Settings

- A **name** and **description** can be added for easier data management.
  - Note that the name cannot be changed in software later.

Best practice: Include detailed information for easier reporting. Extra effort upfront will result in more thorough reports that are easier to understand in the future.

- Describe location and temperature
- Take photos of connected equipment, electrical panels, nameplates, etc
  - Photos can be added to reports in Fluke Energy Analyze Plus software

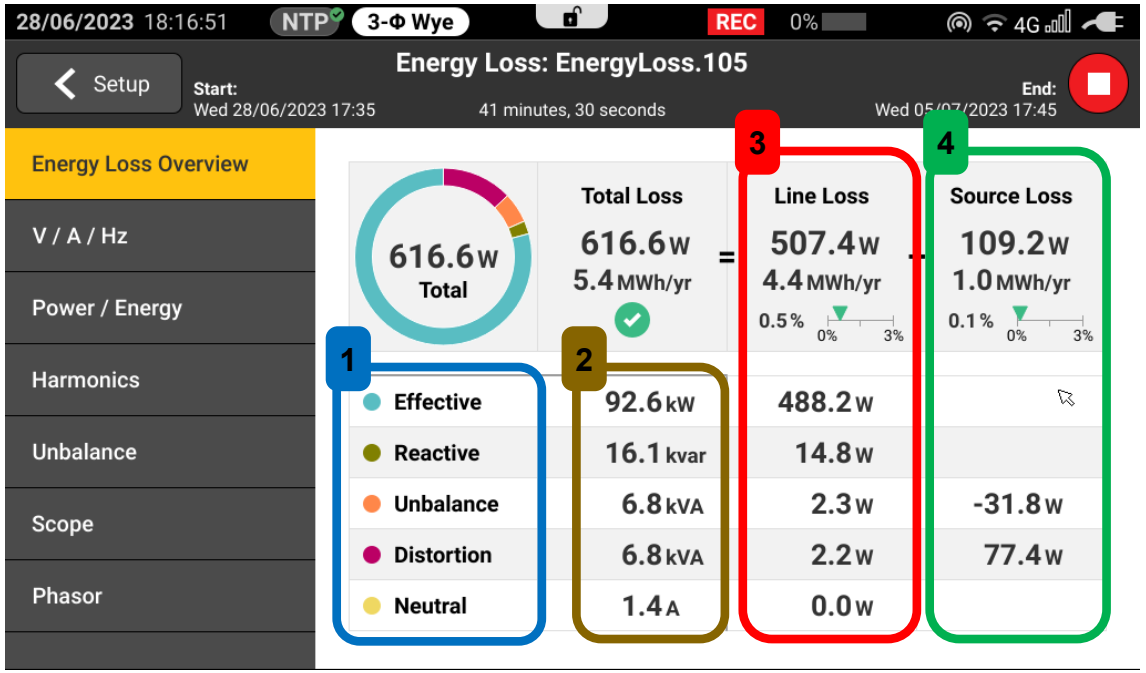


- **Duration** should be based on typical operation period of load being measured.
  - Ensure the recorded period is representative of normal use.

Please note: Energy Loss recordings will not contain event data such dips and swells or transients.

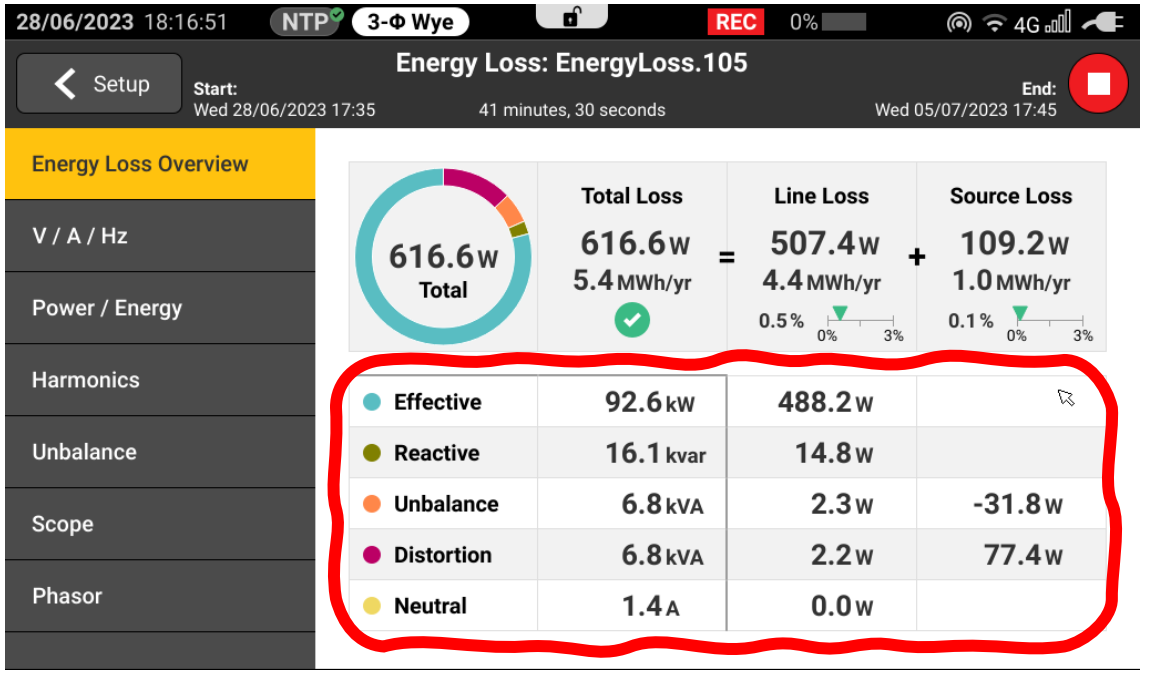
Energy Loss Calculator Results – Overview (1)

1. Each of the losses is broken down into different types (more details on next slide)
2. Active measurements
3. Losses due to the transmission of power from source to load. This uses Fluke's patented Unified Power calculation developed by the University of Valencia.
4. Losses from the source at the power system service entrance.



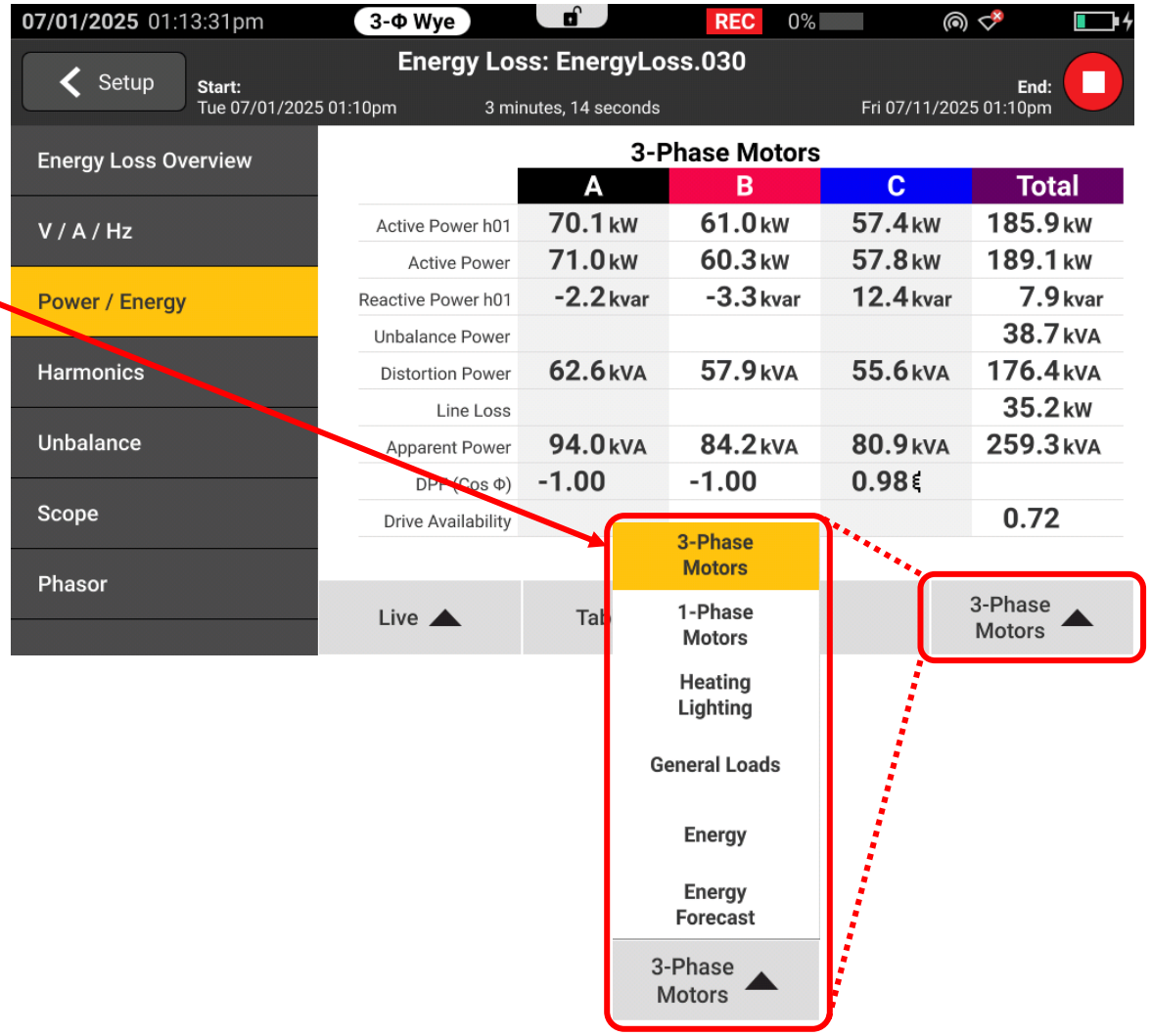
Energy Loss Calculator Results – Overview (2)

- **Effective losses**
  - Inefficiencies in the use of active power, for example due to cables heating as power flows
- **Reactive losses**
  - Power that is the effect of phase difference, or poor power factor
- **Unbalance losses**
  - Power lost due to unbalance that causes overheating and inefficient operation of motors and other equipment
- **Distortion losses**
  - Power wasted in generating harmonics that cause load inefficiencies and overheating
- **Neutral losses**
  - Current flowing in the neutral, typically due to unbalance and harmonics, causes heating



Energy Loss Calculator Results – Power / Energy

- Options to select application specific views to show only the relevant power values
  - Energy Forecast shows estimated 1yr forecast
- All other results screens as per PQ Logger mode



FAQ: How does ELC work?

- ELC uses Fluke's patented Unified Power calculation to detect losses.
- The calculation uses IEEE1459 as the basis, on top of which runs an algorithm designed at the University of Valencia which splits the individual phase power into different components.
- Unlike the older classical method of summing three phase power, this method takes into account vectorial mathematics and results in a more accurate calculation.


FLUKE
Thank You

Fluke Energy Loss Calculator

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WHAT?

- Measurement mode on Fluke 1775 and 1777 devices
- **Helps identify where electrical energy is lost/wasted within a system**
  - Goes beyond just highlighting unnecessary operational loads
  - Shows losses inside loads and present in the electrical system

WHY?

Quantify cost of wasted energy

Understand where energy is lost

Justify cost of mitigation actions

Significant cost savings for minimal investment

Offer enhanced services to clients

Additional revenue stream through surveys and mitigation work

WHO?

Key personas:

- Energy Managers, Energy Auditors
- Electrical Engineers, Industrial Electricians
- Utility Consultants, Facility Managers

Key activities:

- Monitoring energy usage, optimizing efficiency
- Managing maintenance, troubleshooting issues
- Conducting audits and recommending efficiency improvements