ANYLINE
Capture Opportunities

# How mobile meter reading can help utilities reduce NTLs

A guide for utility providers,
brought to you by Anyline

# Introduction

Most electric distribution utilities are familiar with the concept of non-technical losses, or NTLs. These are revenue losses that result not from equipment glitches or network inefficiency, but from incorrect information on energy usage being reported to the utility, leading to customers being undercharged or wrongly billed. Utility providers take an economic hit because the true monetary value of the actual distributed energy was not recouped.

The problem is not rare or unique. Non-technical losses are leaving significant holes in the balance sheets of electricity distribution utilities worldwide. Research conducted by the World Bank found that utilities lose approximately $96 billion annually in NTLs. This figure is up from just a few years ago, when it stood at $85 billion, indicating that the problem is worsening.

NTLs are about more than an unpleasant revenue loss anecdote on an annual report. In many developing economies, the loss of revenue has a direct impact on the future development of energy distribution, leading to negative consequences for the utility, the customers, and the nation as a whole. Unfortunately, fighting NTLs with traditional methods is also costly. Utilities may rely on customers to make up the losses through tariff increases – which is unfair – or expend resources they do not have to try and pinpoint the root causes of the losses. In both cases, revenue that could be spent on grid improvements and wider availability of services is instead spent chasing losses, which reduces utilities' ability to compete.

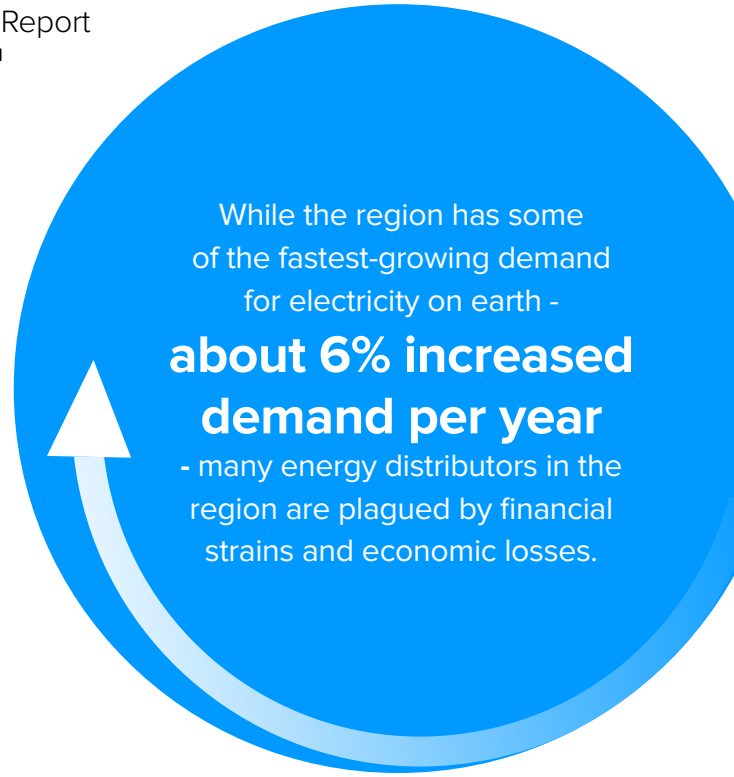
It is therefore imperative that utilities in emerging and developing nations find a viable toolkit to fight energy theft and fraud so they can better allocate their resources to develop their networks to accommodate future growth.

# Focus: How NTLs prevent growth in Southeast Asia

While Southeast Asia has made significant progress in its goal of achieving universal access to electricity by 2030, there are significant roadblocks to overcome, and non-technical losses are one of those roadblocks. While millions of people across the region have gained access to electricity, it is estimated that about 45 million people still lack power.

According to the World Energy Outlook Special Report entitled, "Southeast Asia Energy Outlook 2019,"[1] energy demand in Southeast Asia is expected to grow by 60 percent by 2040 as the population rises, particularly in urban areas.

This growth is expected to double the region's economy in the same time period, which makes solving the problems of NTLs even more urgent, so current losses do not also grow exponentially along with energy use and economic expansion.




# Technology answers the call to mitigate

In this guide, we will discuss how mobile data capture can be a solution for energy providers to reduce NTLs, fight fraud and reduce inefficiencies when utility workers are reading utility meters. We will also discuss how mobile meter reading can improve worker efficiency and save money in operations budgets.

[1] Southeast Asia Energy Outlook 2019 – Analysis (2019) IEA. [Online] [Accessed on 30th November 2021] https://www.iea.org/reports/southeast-asia-energy-outlook-2019

# Table of Contents

# What are Non-Technical Losses?

In electricity distribution, losses are generally grouped by technical and non-technical (with the latter sometimes labeled “commercial losses”). While some technical losses are inevitable due to physical factors inherent in electricity distribution, these losses can often be mitigated with grid modernization. In developing economies, however, expensive grid enhancements may be physically and financially impossible, particularly as these nations pursue their primary goal of bringing power to as many people as possible. Even if the resources for grid modernization were available, it is a long, slow process with a return on investment (ROI) measured in decades rather than years.

Essentially, non-technical losses result when utility customers are charged for less power than they consume, either by accident or by design, often due to energy theft via meter tampering or directly connecting to the grid and bypassing the meter. In many developing nations, grids and meters are often targeted for manipulation by energy thieves.


Beyond energy theft, there are other reasons for NTLs, including poor or outdated system designs, faulty equipment, inadequate control and security procedures, and uncalibrated or damaged meters.

Some losses are due to human error, including inaccurate reading of meters and erroneous data entry, poor work processes, outdated billing procedures, inadequate inspections, and inefficient management. In some cases, there may be internal fraud on the part of technicians or managers, who may be subject to bribery.

# Identifying NTLs

Losses by energy distributors may be the result of everyday fraud, regularized corruption, and organized crime. Fraud is a common cause of non-technical losses, but the good news is that it is among the easiest losses for utilities to mitigate. In the following section, we will outline how utility and energy providers can properly identify NTLs with a view toward reducing them and making revenue streams more resilient.

One of the most import and and accessible ways for NTL identification is taking a feature-based NTL detection approach. This uses machine learning algorithms, and is the most common approach in practice today.

With this approach, energy use data is examined, and several key data points are extracted to represent the most relevant aspects of each consumer. Using this information, customers are then classified as “honest” or “fraudulent” based on the analysis of the results.

## A few specific examples of the most common metrics used in determining the honesty of the customer include:

- **Max/Min, Standard Deviation, Average, Monthly kWh consumption**
  Energy consumption feature for a given period.
- **Load**
  The ratio of average load to the peak load over a given period.
- **Estimated readings**
  The number of estimated readings that are charged by the power distribution company because of its inability to obtain actual readings.
- **Reduction in energy consumption**
  The decrease in energy usage during a specified period compared to the previous reading of the same duration.
- **Seasonal consumption difference**
  Total energy usage by the customer in a particular season compared to the energy consumption in another season.
- **Predicted kWh**
  The difference between the observed active energy consumption value to the anticipated value.

By collecting and comparing this information, power distribution entities can more accurately determine if there are any NTLs taking place and where they are occurring. This will allow distributors to better understand where to focus their energy on mitigation strategies.

The existing methods for NTL detection are typically categorized into one of two ways: hardware-based and non-hardware-based.

Hardware-based solutions primarily focus on installing meters with specific equipment to enable power distribution companies to identify any malicious consumer activity. However, recent advances in communication and data processing of energy consumers' behavior have led to the development of non-hardware-based NTL detection methods. Following is a further breakdown of each method and how they can best be employed in utility operations.

### Hardware-based

These solutions are focused on the design and characteristics of the actual energy meters and other hardware involved in energy distribution. The primary issues associated with physical meters involve tampering with the devices to bypass the meter itself when drawing power, resulting in an incorrect meter reading relevant to what was charged.

Reducing hardware-based fraud requires new hardware, which is expensive and not easily available in developing markets. As a result, non-hardware-based detection is a better option for many energy distributors.

### Non-hardware-based

This approach involves theft detection based on the consumer's energy consumption data and is a much more approachable way for providers to reduce NTLs. This method employs machine learning techniques and solutions as well as data analytics.

Solutions such as **Anyline mobile meter reading** allow for operators to automatically authenticate the validity of the meter being scanned, identifying if the meter reading is fraudulent and notifying the energy worker in real time.

# Billing errors and data corruption

Utility meter reading technicians typically have quotas to fulfil, meaning they need to complete a certain number of meter readings each day. Workers often must spend a lot of time on site to read and record the data of every meter. If workers are too pressed for time on the job, many may rush the process to ensure they fulfill their daily quota, which can lead to mistakes.

These errors can then become a liability for the energy distributor. Rushing through meter readings often means employees are not recording the data correctly and customers are not billed properly, which can result in a significant number of non-technical losses.

Incorrect data recording may be due to several types of errors, including transcription ortransposition errors:


### Transcription errors

Transcription errors occur when information is put in the wrong way. Typos, repetition, and deletion are some of these types of errors. When workers rush transcription, they often hit the wrong keys, and the errors go undetected. For example, if an employee is typing in customer information, transcription issues can happen very easily.


### Transposition errors

Transposition errors occur when information is put in the wrong order. It tends to happen when workers type numbers rather than words. (For example: rather than typing 123, the worker enters 132.) It is a commonly occurring error for workers rushing the input of data.

One key change energy providers can make to avoid NTLs associated with traditional meter reading is to remove the need for manual data entry entirely.
This is where technology can play a critical role.

# Meter reading processes and fraud

Field workforces identify and scan utility meters at residential, commercial, and industrial locations using their mobile devices to monitor consumption and calculate billing. This often includes taking a verification photo of the meter reading.

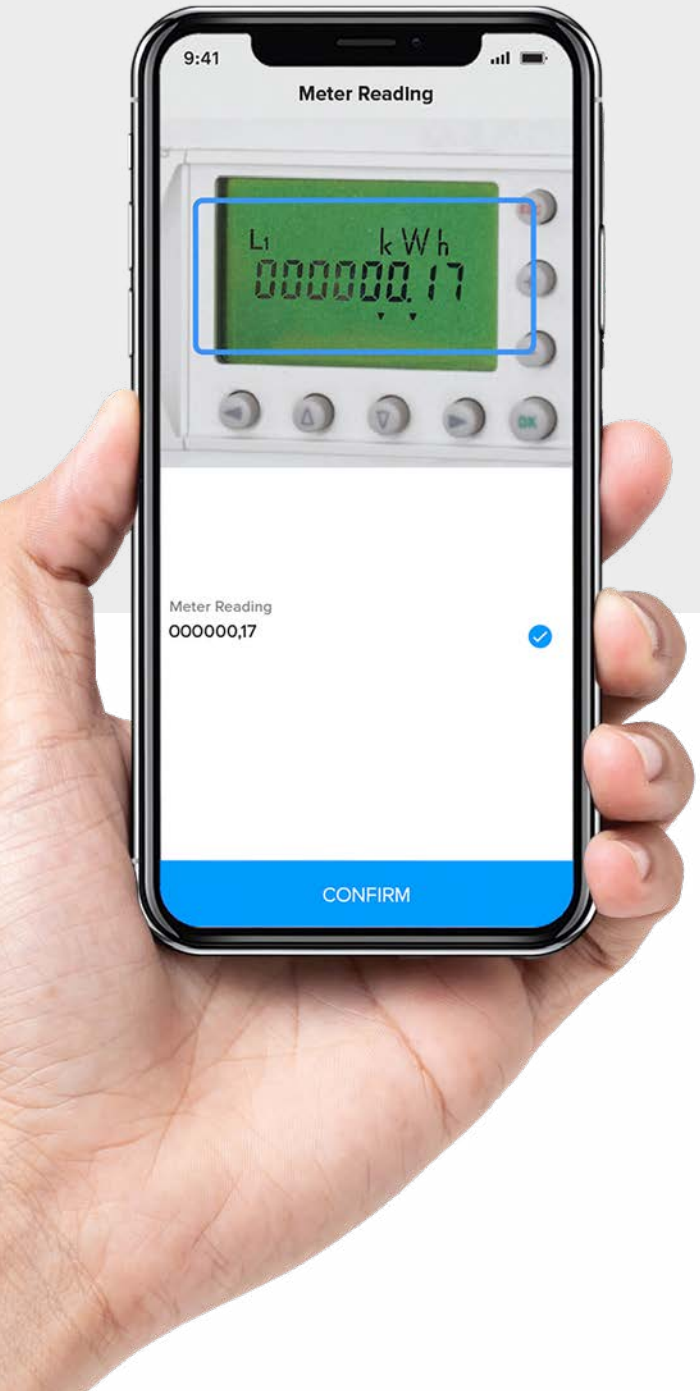
To reduce labor costs, many utilities outsource the task of meter-reading to a third party, but opportunities for errors and fraud remain.

Customers can be tempted to bribe third-party technicians into taking a photo of a falsified image, showing their meter at a lower usage level, or taking a photo of a different meter with a lower energy usage reading. In developing and emerging markets it's not uncommon for some workers to accept bribes to submit incorrect meter readings to save energy users money and supplement their own income.

In the following chapter, we will explain how mobile meter reading works, and explain how it can be used to reduce fraud which takes place during traditional meter reading processes.

# What is mobile data capture, and how does it work?

Data collection is not new to the power distribution industry, but in recent years, methods of collecting important data have changed to become less reliant on humans with pens and clipboards and more reliant on technology.Using any camera-enabled smartphone or mobile device, utility technicians can now use mobile data capture technology to automatically scan the meter readings.




Mobile data capture eliminates the need for many manual processes. Using a smartphone or tablet, workers can directly collect data at the source of its origin, which cuts down the amount of work – and room for error.

Mobile data capture eliminates wasteful paper trails and boosts the efficiency of personnel in the field by automating some of their work.

Mobile data capture solutions are built on Optical Character Recognition (OCR) technology. This innovation recognizes typed or handwritten characters and transforms them into a digital format.. It may involve scanning documents, labels, images or even subtext on a photograph.

# What are the benefits of mobile meter reading for energy providers?

For utility providers aiming to reduce NTLs, mobile meter reading offers a unique combination of tools which remove opportunities for fraud to take place, while also improving the accuracy of the readings collected by technicians, and enabling them to work faster.

In this section, we examine how these benefits work for utilities today.

## Preventing fraud

Corruption and bribes may tempt technicians to change the values of meters in their reports and falsify the readings. Mobile meter reading makes this impossible as the value is no longer entered by hand but scanned directly from the meter. **Mobile meter reading** from Anyline offers utilities a collection of tools for fighting fraud, including:

Authenticity verification, to ensure technicians are scanning a real meter and not a possibly falsified or outdated picture;

Meter barcode or serial number scanning, to ensure a reading from the correct meter was recorded, and;

2-in-1 meter reading and photo capture, linking the scanned data automatically with a proof photo rather than relying on a two-step system.

These features can be combined with:

Geo-localization, ensuring that the right meter has been read instead of a substitute from a different location, and;

Recording of the date and time the data was captured to ensure the information is current.

# Improved accuracy of data

Utilities can reduce billing irregularities by using mobile meter reading. Oftentimes, billing errors are caused by the process itself – either by human error, system issues or some combination of the two. In situations where the meter reading process can be automated, those instances of error can be eliminated, leading to more accurate billing.

Mobile meter reading is extremely accurate and optimized for use in challenging conditions, including low light and harsh weather. Utility workers can use the technology to scan energy meters, barcodes, or serial numbers. **It is up to 20 times faster than entering data manually** by typing on a computer or keying information into a smart device. This allows meter readers to work faster and more efficiently, with less margin for error.

It's important to recognize that everyone makes mistakes – it's part of being human.

Research has shown that, depending on the circumstances, error rates from the manual input of data can range from as low as 0.55 % to as high as 26.9 %.

Utilities can significantly reduce the error-rate of readings submitted, so utilities can avoid disputes with customers over bills and ensuring faster payments. More accurate data can also help energy distribution companies plan their resources better for the future.

# Empowering utility workforces

Utility workers are often expected to visit remote locations or reach inconvenient spots to access energy meters and record data. This can make it a significant challenge to meet daily goals or quotas. When pressed for time, workers may be tempted to speed through the most important feature of their jobs: reading meters and recording energy usage data accurately.
For utility providers, it is therefore critical that technicians have the right meter reading tools to complete their work both accurately and efficiently.

The biggest drain on the time and resources of meter reading workers is the process of manual data capture. When workers must write down or type in each meter reading, not only is precious time lost, but the company's valuable data is also put at risk.

Mobile meter reading technology offers significant benefits to utility workers and subcontractors. OCR technology installed on their smartphones and tablets automatically identifies the value displayed by meters and records it in milliseconds and with unmatched accuracy. It removes the need for workers to write down or type the information and eliminates data entry errors that are common when recording the amount of energy consumed by customers.

Using this automated technology, workers are in a better position to meet their quotas and may be less likely to make mistakes when collecting and submitting meter readings.

# What are the other options?

Thankfully, there are a variety of different approaches that utility providers can take to reduce both fraud and energy theft. They include – but are certainly not limited to – processes such as:

### Field audits of meters

This is one of the best ways to identify energy fraud or theft, though it does require in-person visits and inspections at the homes of customers. The cost is significant, but the amount of fraud prevented may make the investment worth it.

### Reinforcing grid security

Protected cables are an effective way to prevent energy thieves from tapping directly into the grid. While it won't prevent meter fraud, it could still help mitigate risk – albeit at a cost of between $100 to $200 per customer.

### Reducing the ability of customers to tamper with meters

Prepaid meters are an effective solution to that end, especially when it comes to avoiding non-payment. It's not as effective as eliminating the issues of theft or fraud, but when combined with other solutions, it could prove to be a worthy investment. The cost of rendering meters tamper-proof ranges from between $90 to $120 per customer, on average.

### The installation of smart metering

This is one of the most effective solutions, as it is highly reliable, and it transmits relevant data to the utility provider automatically. It is also an expensive option: in emerging markets, the initial investment required for smart metering far outweighs the amount of revenue lost due to NTLs.

While all these solutions offer benefits to utility providers, they are dependent on significant investments and can take years to be deployed. For example, while smart meters are a powerful tool for stopping fraud and data input errors and reducing non-technical losses, the installation cost for each smart meter can reach several hundred dollars. In India, financial experts estimate that the country would need to invest around Ru1800 billion (USD $24.5 billion) to transition from traditional meters to smart meters.

In the following section, we present a brief case study explaining how one company increased the accuracy and speed of their meter-reading workflows using **Anyline mobile meter reading**.

# Use Case:
# How co.met Simplifies Utility Services with Mobile Meter Reading

co.met is a leading meter reading provider in Saarbrücken, Germany. The company provides meter reading services for both domestic and industrial uses, with over 240,000 meter points across the Saarland state capital, and millions more across Germany as a whole.
As a forward-looking company, co.met was determined to identify a cutting-edge solution that would help it instantly digitize meters with the highest degree of accuracy.

After testing with Anyline, it was clear that mobile meter reading was the solution co.met was seeking. By implementing **Anyline mobile scanning** for utilities into their workforce apps, co.met staff can now scan meters in seconds using only their mobile devices.

co.met now can now receive metering data remotely from its field workers, who collect readings on-site by simply scanning customer meters with their workforce app. This scan is then coupled with an additional photo for verification and is transferred to co.met's back-end system, along with additional data such as the GPS location. The result is a faster, more accurate work process that allows staff to work more efficiently.

The new process supports both meter fitters and reading personnel alike, who can nowrecord a meter reading in just one step and also document it with a photo. Manual typing of each meter reading can therefore be avoided. This saves valuable time, while at the same time avoiding transmission andreading errors and storing proof images for later checks.

**Thomas Hemmer, Managing Director of co.met.**

# Integration

One of the major benefits of mobile data capture is that energy providers can integrate the technology directly into existing systems or mobile apps that workers can use on their personal devices, such as smartphones or tablets.

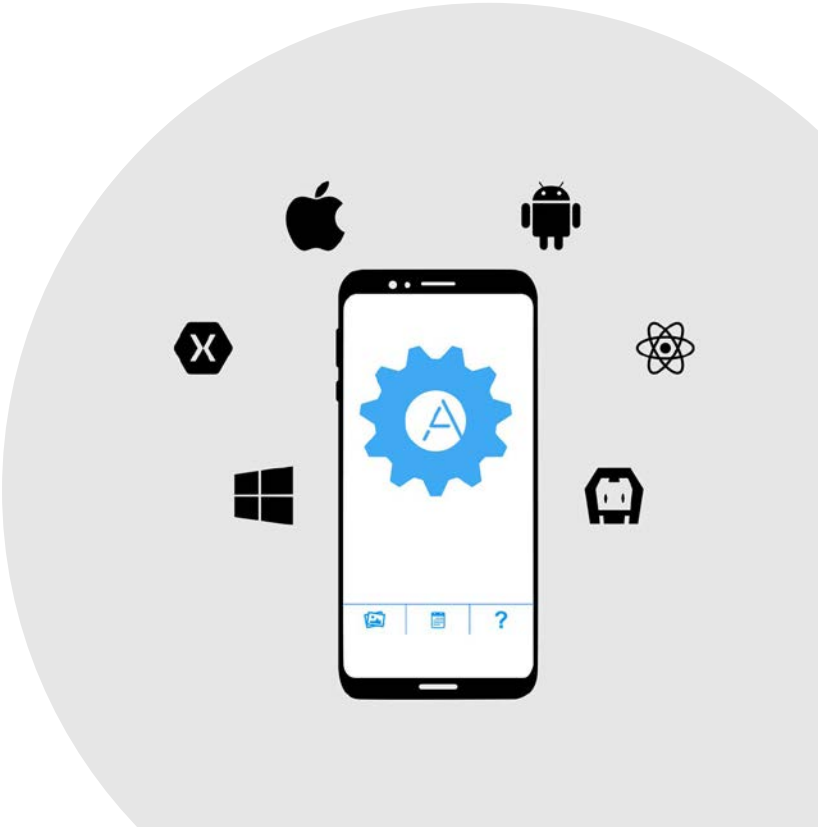
This reduces both the investment costs and total costs of ownership for the energy distributor, and makes it easier for workers to use, as they do not need to learn how to use a new device.

Anyline utility **mobile meter reading** technology can be easily integrated into existing apps and platforms thanks to its SDK (software development kit). The result is fast and secure transmission of meter reading data, allowing energy companies to quickly take advantage of the benefits of mobile data scanning.

Anyline Meter Reading offers an alternative to the traditional meter reading process. It's a state-of-the-art solution that is built from the top down to prevent typing and reading errors, among other issues. By eliminating data entry and even the need to log onto an online portal, it helps save time, allowing meter readers to scan more data during their work shifts.

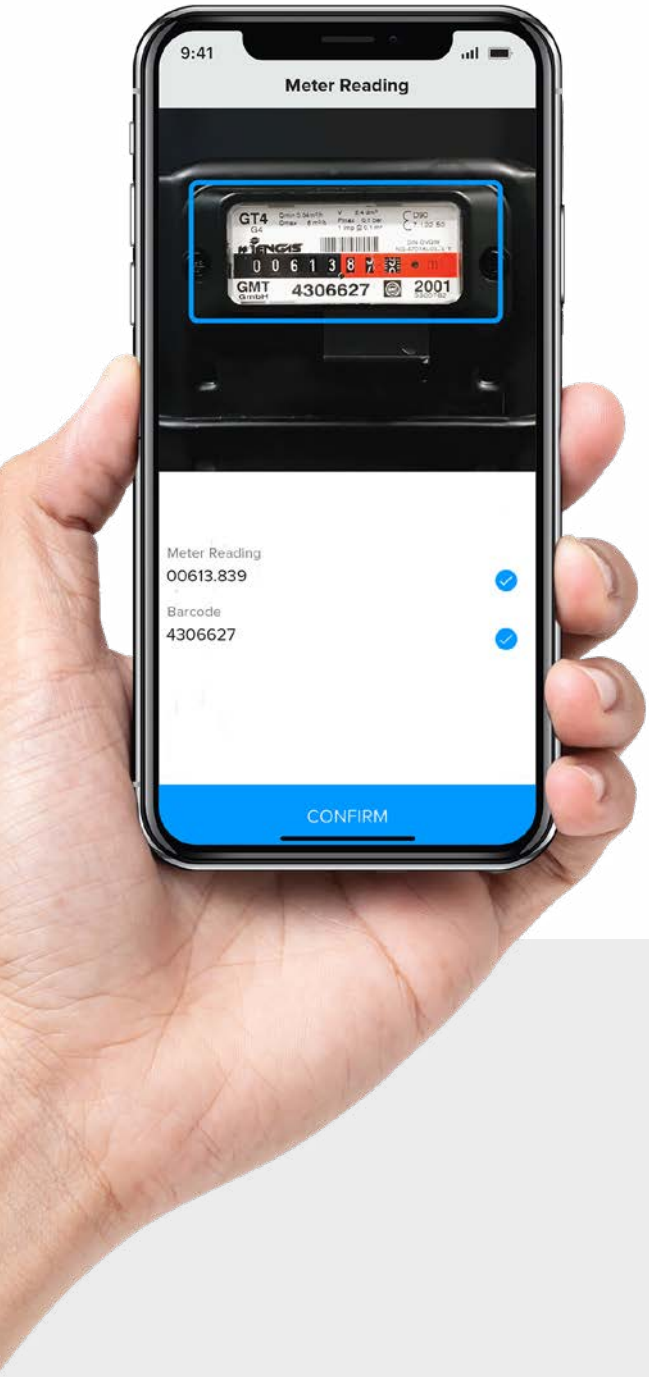
**Anyline's SDK** is easy to integrate and is backed up by hands-on support from customer service teams ready to help. Available for both Android and iOS smartphones, it offers support for common integration frameworks including Xamarin, React Native, Cordova, and Flutter.

To determine if mobile meter reading is the right solution for your utility, download the Anyline **Energy & Water Demo App** to test its capabilities



# Takeaways

Utility providers and energy distributors in particular are facing many challenges that can result in revenue and efficiency losses. If technical losses are inevitable, they also require tremendous financial resources as well as time to be reduced, and it's almost impossible to eliminate them. However, it can be easier, quicker and cheaper for energy providers to fight and reduce NTLs, which contribute to billions of dollars in losses each year.




Identifying NTLs and removing them benefitsutility companies by increasing their revenueand giving them more resources to work with. These savings can be passed on to customers who won'thave to pay the price of energy theft and fraud.

**Non-technical losses can result from multiple parameters:**

- Users connected directly to the grid, bypassing any meter,
- Altered or tampered energy meters,
- Inaccurate meter reading, which results in recording consumption wrongly,
- Alteration of the meter value recorded, often by bribing workers

**Some solutions are available for energy providers to reduce those losses:**

- Reinforcing grid security,
- Field audits of meters,
- Tamper-proof energy meters,
- The installation of smart meters.

Mobile meter reading allows utility workers to scan meters with their own smartphone to instantly record meter data, which can be transmitted to the energy company in order to issue accurate and efficient billing.

**Mobile meter reading offers the following benefits:**

- Authenticity verification, to ensure technicians are scanning a real meter and not a possibly falsified or outdated picture;
- Meter barcode or serial number scanning, to ensure a reading from the correct meter was recorded;
- 2-in-1 meter reading and photo capture, linking the scanned data automatically with a proof photo rather than relying on a two-step system.
- Geo-localization, ensuring that the right meter has been read instead of a substitute from a different location, and
- Recording of the date and time the data was captured to ensure the information is current.
- Human error can be eliminated, leading to more accurate billing.
- It is up to 20 times faster than entering data manually by typing on a computer or keying information into a smart device.

# About Anyline

Anyline makes data capture simple. By easily integrating our SDK into an app or website, our data capture solutions enable users to instantly scan and digitize analog data in the real world using any camera-enabled mobile device. It's simple to use: technicians point their device's camera at the data they want to capture. Using state-of-the-art mobile OCR technology, Anyline processes the characters in real-time, delivering instant and accurate digital data.

Clients use Anyline to scan and digitize dozens of data points: from IDs and passports to barcodes and utility meters, and even license plates, tire numbers and more. Not only does Anyline deliver industry-leading performance and accuracy, it works offline, ensuring the greatest convenience and security for any use case.

Anyline was founded by Lukas Kinigadner, Daniel Albertini, David Dengg and Jakob Hofer in 2013. Having originally focused on meter reading scanning for clients in the utility industry, the company has expanded its scope to offer a wide range of OCR and barcode scanning solutions.

Since 2013, Anyline has grown to approximately 100 employees based in Vienna, Austria and Boston, Massachusetts, USA, bringing together some of the greatest minds in machine learning to bridge the digital divides holding businesses back, and redefining the possibilities of mobile data capture.

# The Author

**Ebin Thomas**
Senior Sales Manager
ebin.thomas@anyline.com

# Imprint

Copyright & published by:
**Anyline GmbH**
Zirkusgasse 13/2b
1020, Vienna
Austria

www.anyline.com

Version 1.0
December, 2021

**Anyline GmbH**
Zirkusgasse 13/2b
1020, Vienna
Austria

Version 1.0
December, 2021