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Communication technologies for smart heat/cooling metering

Content

Communication technologies for smart heat/cooling metering 3

- It's time to know 3
- To IoT or not to IoT 4
- First define your business needs. Then choose the technology 4

Base your decision on comparable facts 5

Explore the technologies here 6

The different wireless communication technologies in details 7

- What you need to know about linkIQ® 7
- What you need to know about NB-IoT 9
- What you need to know about Wireless M-Bus 11
- What you need to know about LoRaWAN® 13
- What you need to know about 2G/4G (Cellular communication) 15

Conclusion 17

Communication technologies for smart heat/cooling metering

IT'S TIME TO KNOW

Heating and cooling of buildings and industry account for 50% of the total energy consumption in Europe and is one of the most energy intensive demands in our society. Meeting climate and efficiency goals for heating and cooling calls for a sustainable strategy that combines increased use of renewable energy while efficiently ensuring the security of supply.

To optimise existing district heating networks for higher efficiency, and to integrate the growing number of fluctuating heat sources into the distribution network requires exact knowledge. Real knowledge based on ongoing insight into flow, temperatures, and actual system capacity. And real knowledge on how to maintain and utilise the assets in the best possible way.

To IoT or not to IoT

The "efficiency" knowledge is typically based on data from the district heating/cooling networks, and one of the more pressing issues during a utility's smart metering journey is that of wireless communication technology. There are multitude of options ranging from the well-known M-Bus based protocols to the hype-generating IoT newcomers. Finding your way through this jungle can be a daunting task, but if your business needs are the needle on your compass, you will end up in the right place.

On this page, we explore the pros and cons of different technologies to help you on your way.

First define your business needs. Then choose the technology

What are your requirements for battery lifetime, data frequency and network range? Do you only need data for billing? Or also for analytics to optimise operations? Do you want full control over your communication network? Or would you prefer to leave that responsibility to industry experts?

So really, what is the reality of your business? Now that's the question!

Base your decision on comparable facts

Different technologies work well for different purposes, and your choice of communication technology should match your needs. Common to all the technologies on the shelf today – next-generation, traditional or a combination – is that they each represent a means to an end rather than a goal in themselves.

It is important to highlight that all the mentioned communication solutions from Kamstrup – once released to a specific market - fully comply with all rules and requirements (international, European and/or national) on that specific market.

On the next page you can find our comparison of the most popular technologies and how they match different smart metering needs in a network of both main- and battery supplied meters.

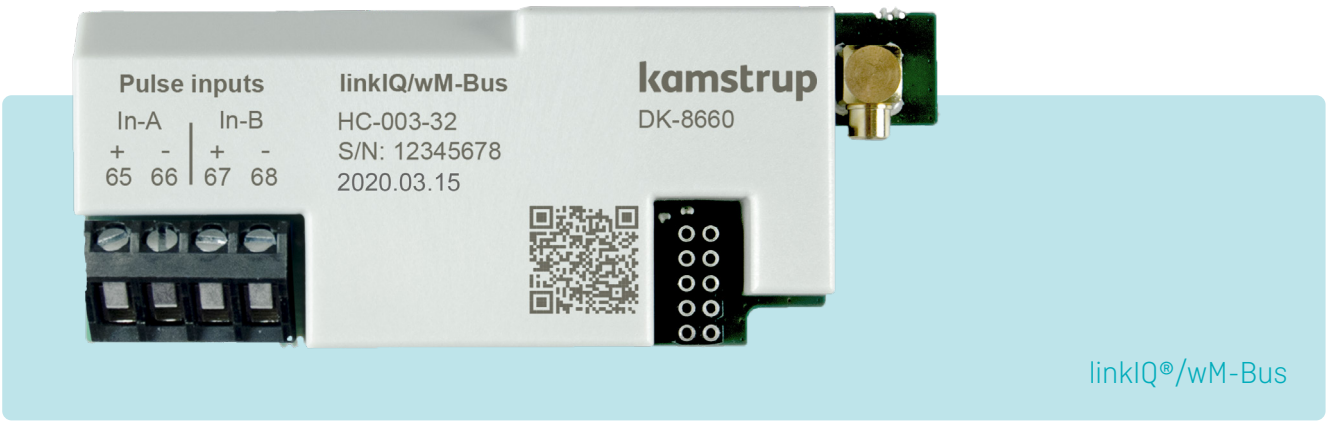
Explore the technologies here

The following table gives an overview of the different wireless communication technologies, that are currently being used in the smart metering eco system.

Technology characteristics	linkIQ®	Wireless M-Bus	LoRaWAN®	NB-IoT	2G/4G (230V)
Data transmission with low power consumption	++	++	+	++	÷
Coverage and communication range	++	+	+	++	++
Posibility to enhance coverage	+	++	++	÷	÷
Robust towards interference	++	+	+	++	++
Interoperability in full end-to-end solution	+	++	+	++	++
Interoperability in meters with support for mutiple vendors	+	++	+	++	++
Low cost of end service	++	++	+	+	+
Possibility to ensure a reliable performance at reasonable costs (houly rate)	++	+	+	++	++
Drive-by-fallback solution	+	+	÷	÷	÷

Suitability for different tasks	linkIQ®	Wireless M-Bus	LoRaWAN®	NB-IoT	2G/4G (230V)
Billing based (monthly data)	++	++	++	++	++
Basic analytics (hourly/daily data)	++	++	+	++	++
Advanced analytics with historical data	++	++	+	+	+
Support of near-real-time decision making (5 min. data intervals)	÷	++	÷	÷	++
Control of end-services via two-way decision making communication	÷	++	+	+	+

The different wireless communication technologies in details



linkIQ®/wM-Bus

What you need to know about linkIQ®

ABOUT LINKIQ®

Based on our vast standardisation experience with the Wireless M-Bus standard and in general wireless communication systems dedicated for meter reading, linkIQ® enables remote reading of smart heat and water meters with wireless communication through fixed networks. linkIQ® has been designed exclusively for smart metering purposes to create a robust network with a long range and few components that can support the data needs of modern utilities.

Just like the well-known standard Wireless M-Bus, linkIQ® uses the license free 868 MHz ISM frequency band, however the linkIQ® solution is designed to avoid interference from other units.

The linkIQ® solution from Kamstrup also supports the European standard for Wireless M-Bus communication, EN13757-4, mode C, which enables linkIQ® infrastructure to read meters that comply with this standard, regardless of manufacturer.

WHY CHOOSE LINKIQ®

linkIQ® offers 3 major benefits for utilities who wish to read their smart meters remotely through a fixed network:

1. *Long range and high coverage with few infrastructure components*

   The data collection units in a linkIQ® network offer long range and high coverage to enable high-performing data collection from heat meters with few infrastructure components, even when meters are spread across large geographical areas. This means less time spent on finding suitable antenna sites and negotiating the terms of use and thus shortens the time it takes to establish a network, and less time spent on improving the link for hard-to-reach meters. It also reduces the investment required to get started with remote reading through a fixed network.

   A Danish utility reduced the number of antenna sites by 70% by opting for linkIQ®.

   Read the case study here.

linkIQ® is a technologically future-proof and robust communication network

2. *Reduced risk of interference*

   linkIQ® is a technologically future-proof and robust communication network, where advanced coding of the transmitted signal enables the restoring of data in packages that are hit by interference. This reduces the risk of disruption from other devices to create a high data performance throughout the lifetime of the network.

3. *Smart data*

   For selected meters, linkIQ® offers smart data, which makes it possible to configure and choose between different data packages to match the needs of the individual utility without compromising on battery lifetime.

   In a linkIQ® network, data retrieval happens continuously, meaning that the meter readings will typically be available on an hourly basis. Moreover, robustness has been increased by including historical data in each data package to improve the performance over time.

POTENTIAL CHALLENGES

1. *Data collection down to hourly values only*

   linkIQ® offers hourly and daily values and it is not possible to collect data with a higher frequency. If additional data is needed, it is possible to collect priority data in 5-minute intervals from selected meters through the same network through the Wireless M-Bus protocol. However, any such meters must be configured accordingly and are also subject to the standard range of Wireless M-Bus which is significantly lower than linkIQ®.

2. *Reduced fallback options*

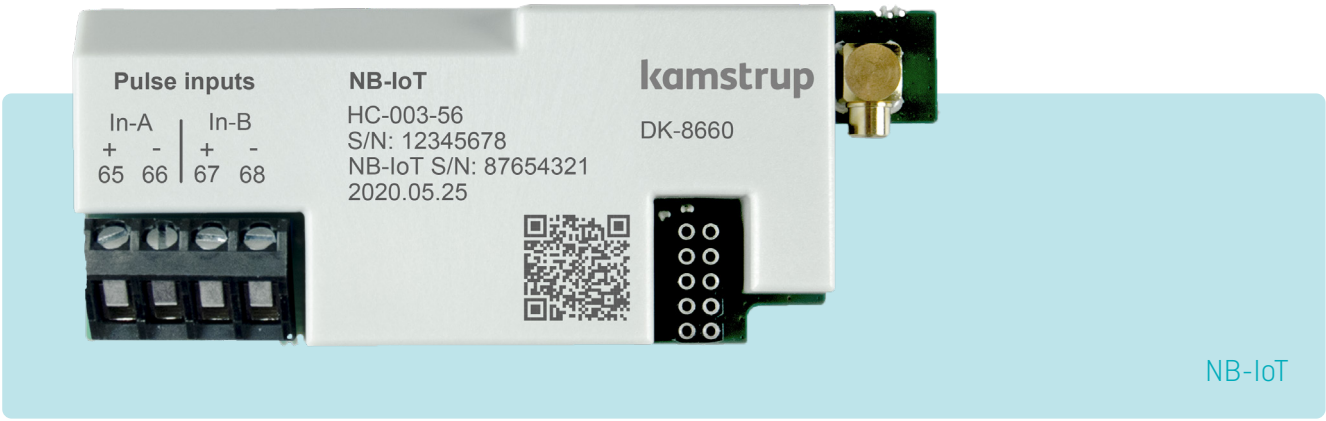
   The options for meter reading through drive-by are limited with linkIQ® as the transmission rate is too slow in the fallback-mode to support this for normal use cases.

3. *Full benefit only for Kamstrup meters*

   linkIQ® is designed, developed, and owned exclusively by Kamstrup. To get the most value from a linkIQ® network and benefit from the added range, increased performance and high data accuracy, you need compatible Kamstrup meters. However – a linkIQ® solution is compatible with the Wireless M-Bus standard, EN13757-4, mode C, meaning that a linkIQ® network can read all meters that comply with this standard. Meters in a linkIQ® network that communicate via Wireless M-Bus must be configured either in production or through a physical re-configuration. Moreover, the meters communicating via Wireless M-Bus will not benefit from the added range of a linkIQ® network and additional infrastructure components might be necessary to achieve the required quality of service.

HOW TO GET STARTED

You build a linkIQ® network where a number of data collection units are installed throughout your supply area. A data collection unit consists of one or more antennas that pick up the signals from the meters. The antenna is connected via cables to a concentrator unit, which sends data back to your Meter Data Management system via a secure mobile connection.



NB-IoT

What you need to know about NB-IoT

ABOUT NB-IOT

NB-IoT is point-to-point communication technology, developed as a cornerstone in telco 5G strategies and employing the existing infrastructure of telco-owned antenna sites for mobile communication (LTE). Optimised for excellent coverage and very small data amounts, NB-IoT is a good choice for remote reading of smart meters that are located underground in basements and other hard-to-reach places where other types of communication technology may fall short. NB-IoT can be used for two-way communication, which is necessary for some smart metering use case, such as firmware updates.

Although still a newcomer in smart metering, the technology is now past its infancy and fully rolled out in quite a few countries. Telecommunication providers worldwide are currently expanding the coverage and the number of vendors supporting the technology is also increasing by the minute.

WHY CHOOSE NB-IOT

1. *Excellent coverage*

   NB-IoT is interesting in a smart metering context because the coverage it provides makes it suitable for remote reading of heat meters in remote and hard-to-reach locations (e.g. basements). Based on the LTE network, NB-IoT use licensed frequency bands to ensure minimal interference from other devices.

2. *Supports high-res data needs for e.g. analytics purposes*

   NB-IoT can carry large amounts of data and transmit it as frequently as you need. For Kamstrup heat/cooling meters, this means detailed data down to 60 minute intervals (up to 32 registers), depending on power supply and choice of data package. The data is transmitted automatically every hour or once pr. day (daily transfer of hourly values).

3. *No infrastructure responsibilities or investments for the utility*

   NB-IoT is the right choice for utilities that do not want to invest in, and own, communication infrastructure as it offers data collection entirely without infrastructure responsibilities.

   Compared to a solution based on a traditional fixed network, NB-IoT requires no initial investment in the communication infrastructure. In many cases, this will make a start-up of remote reading cheaper.

   If you want to know the cost of communication in the long run, look for suppliers who offer this at a fixed cost as part of the package.

4. *Easier smart meter rollouts*

   NB-IoT meters communicate directly with your smart metering system via your local telco's NB-IoT network. This makes meter installation a lot simpler, as you can simply deploy the meters when and where you

NB-IoT is the right choice for utilities that do not want to invest in, and own, communication infrastructure

like without extensive planning. It's virtually plug and play.

5. *Future-proof P2P technology*

   A very wide range of companies is working to promote the technology and NB-IoT is a cornerstone in the mobile operators 5G strategies. Therefore, NB-IoT is likely to have a wide range of supported devices, platforms, and systems, which will benefit your utility.

POTENTIAL CHALLENGES

1. *Power consumption*

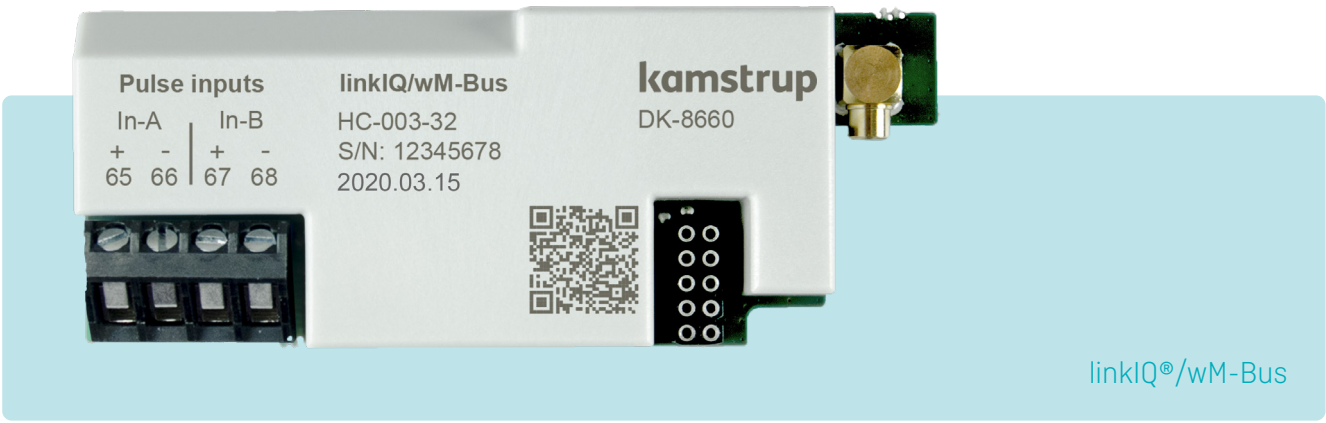
   The power consumption of NB-IoT is significantly lower than the previous cellular communication technologies such as 2G/3G or 4G. This makes it more suitable for battery-powered devices. However, compared to traditional fixed network solutions for smart metering, the power consumption with NB-IoT is still higher. This makes it a challenge to build a viable solution for meters with an expected lifetime of 16 years with the same battery. Therefore, the datagram size from a battery-powered device will be smaller than a datagram from a mains-powered device. But it is possible to obtain a battery lifetime of 16 years.

2. *3rd party infrastructure*

   If you invest in a NB-IoT based solution, you do not own the infrastructure. Therefore, you are wholly dependent on your telecommunication partner to ensure that your requirements for the meter reading performance are met. In case of problems, you will have no options for improving the coverage. Therefore, it is important to find the right partners when committing to an NB-IoT solution.

3. *Different ITU regions*

   The different telecommunication providers use different frequency bands for their LTE communication in different parts of the world. Supporting NB-IoT worldwide requires a wide portfolio of modems to be fitted in the water meters according to which region they will be installed in.



linkIQ®/wM-Bus

What you need to know about Wireless M-Bus

ABOUT WIRELESS M-BUS

Wireless M-Bus is a widespread and standardized communications protocol for wireless meter communication and remote reading of heat, cooling, electricity and water meters. It is designed specifically to match the utility sector's need for quality of service and data frequency without compromising on battery lifetime.

Wireless M-Bus can be used to establish remote reading of smart water meters via a drive-by set-up or through a fixed network – and it is possible to combine the two methods of collecting data. A network is typically built and maintained by the utility by installing a number of data collection unit throughout the supply area. Wireless M-Bus communicates on unlicensed bands with different frequencies being prevalent in different parts of the world.

All our heat/cooling meters and smart devices for utilities can be set-up to transmit data via the Wireless M-Bus standard, supporting a wide range for frequencies.

WHY CHOOSE WIRELESS M-BUS

1. *Long battery lifetime*

   Being optimised to support large quantities of data without compromising on battery lifetime, Wireless M-Bus is suited for utilities who are looking to go beyond billing and use the data to optimise operations and maximise their data-utilisation through near real time analysis of the water loss and pressure in the distribution network. Wireless M-Bus supports daily or hourly values in a smart meter with an expected lifetime of up to 16 years.

2. *Network ownership*

   Wireless M-bus is also the right choice if you want control of your own network and do not want to depend on third party suppliers to ensure the right meter reading performance and quality of service. The initial investment in establishing a network is higher than other technologies, but the cost pr. meter will often be lower with integrated Wireless M-Bus communication than with other technologies.

3. *Flexible solution*

   Wireless M–Bus networks is best suited for urban areas to optimise the balance between meters read pr. data-collection units. If your supply area covers both rural and urban areas it is possible to establish a Wireless M-bus network in the densely populated areas and combine that with drive-by meter reading in the sparsely populated areas in order to ensure a high cost-benefit.

POTENTIAL CHALLENGES

1. *Ownership responsibility*

   With a network based on the Wireless M-bus protocol, you own the infrastructure

The Wireless M-Bus is designed specifically to match the utility sector's need for quality of service and data frequency without compromising on battery lifetime.

Wireless M-Bus

and must build and maintain the network to match your required meter reading performance and quality of service. Your business case for investing in a Wireless M-Bus network will be affected by several circumstances such as the size and geographical layout of your supply area.

2. *Rural coverage*

   Because of its reach, a Wireless M-Bus-based network will require more infrastructure to cover rural or sparsely populated areas. In such areas, a drive-by solution with Wireless M-Bus or a network based on a different technology can be an alternative unless you require large quantities of frequent data for advanced analytics.

HOW TO GET STARTED

You build a network based on Wireless M-Bus by installing a number of data collection units around your supply area. A large-scale data collection unit consists of one or two antennas that pick up the signals from the meters via Wireless M-Bus. Here, an antenna is connected via cables to a concentrator unit, which sends data back to your Meter Data Management system via a secure mobile connection. It is also possible to use smaller data collection units to collect data from a limited number of meters.

Normally, a data collection unit can read meters in a radius of 500 - 1000 m. It is, however, possible to achieve ranges of more than 3 km with special antennas placed, for instance, on chimneys, lattice towers or flagpoles. The antennas should be installed as high as possible to pick up the signals from as many meters as possible.

You can either build the network on your own or work with your solution provider to set-up the network and ensure the required performance.

Wireless M-Bus can also be used in a drive-by set-up where you drive around your distribution network reading the meters on the go with a small converter unit and an app on your Android smartphone or tablet.

LoRaWAN®

What you need to know about LoRaWAN®

ABOUT LORAWAN®

The LoRaWAN® specification is a Low Power, Wide Area (LPWA) networking protocol designed to wirelessly connect battery operated 'things' to the internet in regional, national or global networks, and targets key Internet of Things (IoT) requirements such as bi-directional communication, end-to-end security, mobility and localization services.

LoRaWAN® network architecture is deployed in a star-of-stars topology in which gateways relay messages between end-devices and a central network server. The gateways are connected to the network server via standard IP connections and act as a transparent bridge, simply converting RF packets to IP packets and vice versa. The wireless communication takes advantage of the Long Range characteristics of the LoRa physical layer, allowing a single-hop link between the end-device and one or many gateways. All modes are capable of bi-directional communication, and there is support for multicast addressing groups to make efficient use of spectrum during tasks such as Firmware Over-The-Air (FOTA) upgrades or other mass distribution messages.

WHY CHOOSE LORAWAN®

LoRaWAN® is a newcomer and strongly promoted by the LoRaWAN® Alliance, and many vendors have LoRa products making to it easy to build cloud-based solutions to remotely read sensors and devices. Software for the Application server is also available for those who wants to have an complete solution.

1. *Long range and high coverage with few components*

   The LoRaWAN® is worldwide. It is possible to use existing LoRaWAN® network providers, alternatively you can build your own network starting with a single LoRaWAN® gateway to cover large areas with thousands of end-node devices.

2. *Reduced risk of interference*

   LoRa is a patented spread spectrum technology using the unlicensed sub-GHZ frequencies. The modulation ensures high performance and resilient to interference and high building penetration.

POTENTIAL CHALLENGES

Quality of service is depending on the network provider. If the radio coverage fails, the customer may face difficulties to get them solved.

The communication speed varies, having a long range is achieved by slowing down communication which in turn reduces battery lifetime.

Multiple fees may be involved. Subscriptions to cloud solutions, networks operator fees and Key and certificate fees. This make it hard up front to compare

The LoRaWAN® is worldwide.

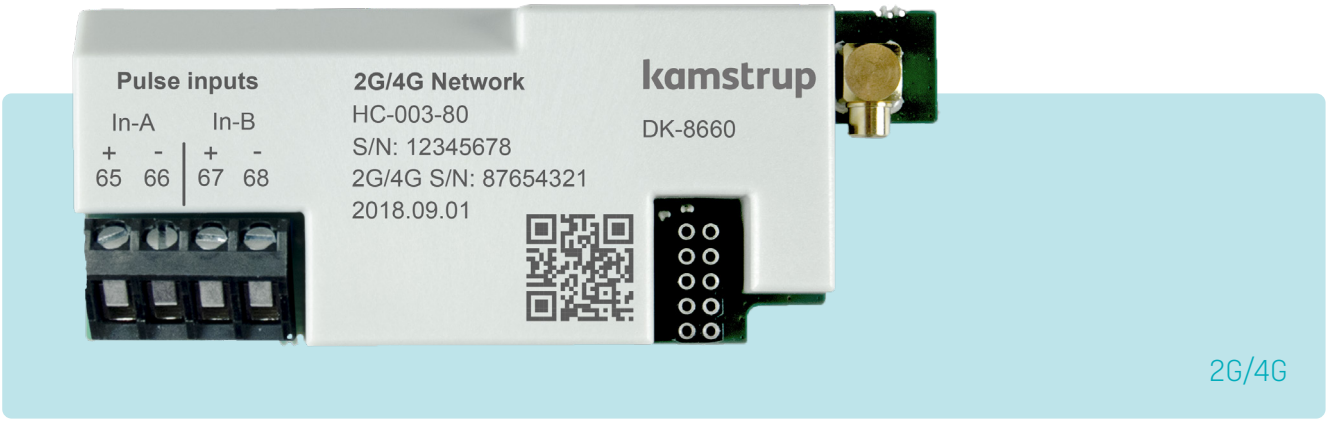
It is possible to use existing LoRaWAN® network providers.

LoRaWAN®

HOW TO GET STARTED

One way to start to build a LoRaWAN® application, you will team up with a LoRaWAN® network provider. Here you will subscribe to a cloud service where your data are stored. All your sensors and devices must be set-up to send data to that provider using several LoRa defined keys.

Building your own network is also possible, and will like any radio-based system require knowledge on how to place the gateways and antennas to get the full coverage of all sensors and devices in the network. For the data reading system, you need to have internet connected servers to run your own cloud solution.



What you need to know about 2G/4G (Cellular communication)

ABOUT 2G/4G

2G/4G is a well-known and well-proven point-to-point communication technology, using the existing mobile infrastructure of telco-owned antenna sites for mobile communication. Optimised for excellent coverage and very large data amounts, the 2G/4G is a good choice for remote reading of smart heat/cooling meters that are located in rural and other hard-to-reach places where other types of communication technology may fall short.

2G/4G can be used for two-way communication, which is necessary for some smart metering use case, such as firmware updates.

Although 2G/4G communication has been around for a long time, it is still valued in smart metering area, and fully rolled out in most countries in the world.

WHY CHOOSE 2G/4G

1. *Excellent coverage*

   2G/4G is interesting in a smart metering context because the coverage it provides makes it suitable for remote reading of heat/cooling meters. It uses licensed frequency bands – owned by the mobile operators to ensure minimal interference from other devices.

2. *Supports high-res data needs for e.g. analytics purposes*

   2G/4G can carry very large amounts of data and transmit it as frequently as you need. For Kamstrup heat meters, this means detailed data down to 5 minute intervals (up to 32 registers)

   The data is transmitted automatically every 5/15/60 minutes directly to the Meter Data Management system.

3. *No infrastructure responsibilities or investments for the utility*

   2G/4G is the right choice for utilities that do not want to invest in, or own, communication infrastructure as it offers data collection entirely without infrastructure responsibilities.

   Compared to a solution based on a traditional fixed network, 2G/4G requires no initial investment in the communication infrastructure. In many cases, this will make a start-up of remote reading more price optimal.

   If you want to know the cost of communication in the long run, look for suppliers who offer this at a fixed cost as part of the package.

4. *Easier smart meter rollouts*

   Meters with 2G/4G communicate directly with your smart metering system via your local mobile operators network. This makes meter installation a lot simpler, as you can simply deploy the meters when

Meters with 2G/4G communicate directly with your smart metering system via your local mobile operators network. You can simply deploy the meters when and where you like without extensive planning..

2G/4G (Cellular communication)

and where you like without extensive planning. It's virtually plug and play.

5. *Future-proof P2P technology*

   Even if the 2G communication has been around for many years, and is facing end of life within the near future, the combination with 4G still makes it a future proof technology, as 4G is part of the overall 5G strategy.

POTENTIAL CHALLENGES

1. *Power consumption*

   The power consumption of 2G/4G is significantly higher than e.g. the NB-IoT communication technology, hence it is not suitable for battery-powered devices, but is designed for mains supplied devices.

   However, many utilities have main supplied meters, or a combination of main- and battery supplied meters and 2G/4G is suitable for meters, where a lot of data is required frequently.

2. *3rd party infrastructure*

   If you invest in a 2G/4G based solution, you do not own the infrastructure. Therefore, you are dependent on your telecommunication partner to ensure that your requirements for the meter reading performance are met. In case of problems, you will have no options for improving the coverage. Therefore, it is important to find the right partners when committing to a 2G/4G solution.

3. *Different ITU regions*

   The different telecommunication providers use different frequency bands for their LTE communication in different parts of the world. Supporting 2G/4G world wide requires a wide portfolio of modems to be fitted in the heat/cooling meters according to which region they will be installed in.

Conclusion

As mentioned, there are multitude of options ranging from well-known and well-proven technologies to the hyped IoT newcomers that promises to change the world as we know it.

It is worth mentioning that all of them will comply to the existing national and European laws and regulation, such as MID, RED and EED. However it is equally important that the chosen technology also comply to your current and future business needs.

There is a huge demand for increasing the energy efficiency, and a fully optimized heat/cooling solution is necessary to support the “green transition wave washing across the world “and data from the network will help ensuring that district heating/ cooling will stay more sustainable, more efficient and more profitable, competitive and relevant in the future.

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