Finnish Energy’s position on the features of next-generation electricity meters

Introduction
Finland is the first country in the world to have adopted smart electricity metering (hourly metering and remote reading) on a large scale. The consumption and production of electrical energy in almost every one of the 3.4 million electricity metering points are measured on an hourly level, and the validated metering data is available the next day for use by the customer, balance settlement and the electricity markets. The legislation on this first-generation smart metering came into force in 2009, and the transition period to hourly-level metering ended on 1 January 2014.

The local distribution system operator (DSO) is responsible for electricity metering and making the metering data available to the customer, balance settlement and the markets. Indeed, the commissioning of first-generation smart metering was a major investment and development project for all 80 DSOs in Finland, and also for the market actors.

The Energy Authority regulation model, which regulates the operation of the DSOs, sets a service life of 10-20 years for electricity meters. In practice, the technical service life of the meters is about 10-15 years. The design, procurement and commissioning of meters and metering systems is a process lasting several years. As the majority of DSOs have installed remotely read meters for most of their customers in 2009-2014, the designing and procurement of the next-generation meters and systems must in practice be started now or in the next few years at the latest. For this process, the DSOs require a clear vision of the criteria set on next-generation electricity meters in Finland.

Criteria for next-generation electricity meters must be defined now
This position paper describes the vision of Finnish Energy (ET) on the minimum qualities to be set on next-generation electricity meters in legislation. The DSO may require other additional functionalities from the meter. ‘Minimum qualities’ refers to those features that are defined in legislation and/or on the basis of which the unit price approved in the regulation model is set. The position is defined bearing in mind the developing needs of the customers and markets, as well as the anticipated European regulatory framework. It is desirable for consumers to take a more active role in the electricity markets in the future. This requires closer connection between the wholesale and retail markets, which also constitutes one of the objectives in the Commission’s Clean Energy package.

Basic features of the meter
The current provisions concerning meters and metering systems are set out in the Decree on metering. Under current legislation:

- The metering of electricity consumption and small-scale electricity production must be based on hourly metering and remote reading of the metering equipment (hourly metering obligation). The DSO may deviate from this obligation in at most 20 per cent of the metering points in its distribution network under the conditions set out in the legislation.

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The hourly metering equipment and the DSO’s data system processing the metering data must fulfil the following minimum criteria:

- The information recorded by the metering equipment must be readable from the equipment memory via the communications network (remote readability);
- The metering equipment must record the starting and ending times of a voltage-free period of more than three minutes;
- The metering equipment must be capable of receiving and implementing or forwarding load control commands sent via the communications network;
- The metering data and the information on voltage-free periods must be entered in the DSO’s data system that processes metering data. The hourly metering data must be stored in the system for a minimum period of six years and the data on voltage-free periods for a minimum period of two years;
- Appropriate data protection of the data system processing the metering data of the metering equipment and the DSO must be ensured.

ET takes the view that, in the main, the current criteria should also be applied to next-generation meters and metering systems. However, it is necessary to specify the criteria in greater detail and to improve them to better serve the developing electricity markets and customer needs.

Furthermore, the minimum metering period for electricity consumption and production should be based on the metering period corresponding to the balance settlement and trading period and the remote reading of the metering equipment. The current balance settlement period is 60 minutes (more accurately a full hour). However, the proposed European regulations would change this to 15 minutes. It is essential for Finland to ensure a sufficient transition period for the change (earliest 2025) in order to implement it cost-effectively. Nevertheless, future meters and metering systems must have the capability for the deployment of at least the balance settlement period in force (or known) at the time. Thus, it is expedient to tie the metering period to the balance settlement period, i.e. the metering period or the period made up of metering periods must begin and end exactly in accordance with the balance settlement period.

If the pricing structure in distribution is developed to be based on power more than at present, it can be required that the meters will also measure and register momentary power. Currently, it is still unclear as to what the power charge could be based on. It is therefore reasonable to require the meter to be capable of measuring momentary power in addition to the balance period mentioned above.

Current metering equipment must record the starting and ending points of a voltage-free period of more than three minutes. ET considers it useful for next-generation meters to record also shorter interruptions. The fault management tools used by the DSO include so-called fast reclosing operations (interruption of up to a few seconds) and delayed reclosing operations (interruption of up to a few minutes). The requirement of these being recorded by the meter would enable statistical recording and monitoring of such interruptions for each customer. As far as ET is aware, this would have no significant effect on the costs compared to the present.

Control of connected load and requirements concerning the storage of metering data are addressed later in this position paper.

As for new required features of next-generation electricity meters, ET proposes that with the exception of current transformer meters, a mandatory feature should be the facility of remotely cutting off and connecting power to the metering point. This feature is already in use in about 60% of installed electricity meters. The remote cut-off/connection facility enables improvements to customer service, as well as harmonising operational processes e.g. in house move situations and reducing the operational costs of disconnections and connections carried out e.g. as debt collection measures.

The new meters must permit remote updating, so that new features may be taken up as the markets develop. Updating of the basic architecture of the meter itself, where the functionalities require changes in hardware, is not necessary. The applications used in the meter, on the other hand, such as metering calculations and data communication applications,
must be remotely updatable. Remote updating must take place without a visit to the meter; this has clear effects on improving operational efficiency.

Moreover, it is self-evident that the data protection and data security of next-generation metering equipment and the data systems processing the DSO’s metering data must also be properly ensured.

In defining the minimum requirements of the meter, only the realistic needs of the markets must be considered. The meter should not be loaded with excessive technical demands, as this raises costs and increases the risk of faults. Reliable metering of consumed (and produced) energy volumes and the remote connection and updating features detailed above are a priority. As previously stated, the minimum requirements must also cover the metering and registration of brief voltage-free periods.

### Providing metering data for use by customers and markets

Under the current Metering Decree, smart meters must be read at least once in every 24 hours. In addition, the DSO must, on the customer’s separate order, provide a standardised connection permitting real-time monitoring of electricity consumption.

The European Commission’s proposal for a Directive on electricity markets contains more specific and additional requirements to these criteria. The Commission’s proposal\(^3\) (Article 20 a) states: *metering systems accurately measure actual electricity consumption and provide to final customers information on actual time of use. That information shall be made easily available and visualised to final customers at no additional cost and at near-real time in order to support automated energy efficiency programmes, demand response and other services.*

The Commission’s proposal further defines ‘near-real time’ in its definitions: *the time, usually down to seconds, that elapses between data recording and their automated processing and transmission for use or information purposes.*

The Commission’s proposal is lamentably unclear. We do not currently know the meaning of the concept ‘visualised’, or how to interpret the requirement ‘down to seconds’. More precise specifications are expected as the preparation of the Directive progresses. The requirements of the Directive will naturally determine the features of the next-generation meter.

It is crucial to understand that the electricity meter makes information available via two routes: unvalidated real-time consumption data direct from the meter and data read and validated by the DSO via an agreed information exchange channel. At present, the unvalidated data is available in real time on the customer’s separate order (a physical connection to the meter). The validated hourly metering data is read, processed and provided for the use of the customer, balance settlement and market actors on the day following the electricity consumption. At the moment, the DSO sends the validated data via operators direct to market actors, and customers can access the information in the DSO’s online service. In future, this information will be available centrally in Datahub (planned deployment autumn 2019, project led by Finnish TSO Fingrid).

In general, the unvalidated data corresponds to the validated data with the exception of individual deviations.

The diagram below shows the two routes of metering data to the customer.

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\(^3\) N.B. Refers only to the Commission’s proposal dated 30 November 2016. Proposals are submitted by the Commission for subsequent consideration by the Parliament and Council. Many details are expected to change during the decision-making process lasting approx. two years. Thus, the final results are about two years away.
Validated data for the balance settlement period is required quickly, but not in real time, by electricity suppliers and for balance settlement purposes. Electricity suppliers deem it adequate if this validated data for the balance settlement period is available on the day after the supply date. ET does not deem it necessary to demand that validated data for the balance settlement period is provided more quickly than at present to market actors and for balance settlement purposes, or later to Datahub.

In the event of real-time customer billing becoming widespread, this would alter the situation. Therefore, when selecting reading technology, it is indeed good to make provision for a more frequent reading cycle than at present, but only if it is feasible at reasonable costs. It would be useful to design the reading technology and systems in such a way that they are modifiable also into entities implementing a higher-frequency reading cycle easily and at reasonable cost.

At the time of writing this position paper, no sufficiently detailed definition yet exists on the future requirements for the verification of aggregated regulatory and reserve sales. Therefore, the working group has been unable to determine the possible role of the DSO meter in the verification of these demand response sales. If such a role is set on the meters, it should be noted that the entire metering system (reading, Datahub etc.) must support verification.

Various energy service providers and also electricity suppliers are developing new services to fulfil changing customer needs, specifically on the basis of real-time consumption data. Such services include various home automation solutions, various controls, home displays, as well as possibly demand response verification for the reserve markets. Next-generation meters should provide real-time unvalidated consumption data (‘raw’ data) for market use more extensively than at present. For example, Norway has decided to use wired or wireless MBUS connections. Possible alternative connection methods should also be specified in Finland in sufficient detail. All new meters should include the facility of utilising unvalidated data obtained from the meter in real time and more efficiently, as well as distributing it to parties authorised by the customer on separate request.

Whichever method of connection is finally selected, it is crucial to establish its costs in relation to benefit to customers before setting statutory requirements, as well as subsequently ensuring that all operators follow the same procedures. It is also essential to ensure that real-time data supply can be initiated at the customer’s request by remote programming without the technician having to visit the site.

Ensuring data protection and data security is of prime importance in all dissemination of customers’ consumption data. Access to customer data must be possible only on the customer’s authorisation.

The European Commission’s proposal for an electricity market Directive suggests that metering data should be available to the customer in visual form almost in real time. ET takes the view that the various consumption reporting services should be allowed to develop in a way led by
the market, with the DSO offering a data exchange interface either directly or later via Datahub. The most important consideration for the legislation is to ensure that the party responsible for metering provides real-time data for use by the customer and any party authorised by the customer, but the legislation should not prescribe more detailed alternatives of implementing a reporting service (e.g. demanding a home display).

All the above applies to the recording and reading of power transfer from, and to, the distribution network.

**Role of the meter in market-led demand response**

Demand response refers to transferring electricity usage from the hours of high consumption and price to a more economical time, or making a temporary change of usage for the purpose of power balancing. More demand response is necessary with an increase of inflexible and variable power generation in the electricity system. New demand response solutions and services are being actively developed and piloted. There are many types of demand response and they may be applied in several different markets. The requirements of response solutions vary in terms of e.g. response times or the reliability and verification of response implementation.

Today, the DSOs control the loads in accordance with the clock and calendar (e.g. night-day control) for historical reasons. In the future, market-led demand response will replace these controls\(^4\). DSOs will continue to have the right to control customers’ loads in certain exceptional circumstances, but the current night-day control applied by the DSOs will give way as market-led demand response gains ground.

Market-led (i.e. activated by the supplier or other service provider) load control may be roughly divided into three categories:

1. **Time zone control** is a permanent, pre-determined, regularly repeated profile (similar to the current night-day control). The supplier may announce the time zone rules, repeated at set intervals, to the DSO, after which the DSO carries out the controls without separate requests for each control. The supplier is not expected to make frequent changes to its profile.

2. **Control based on market period** (currently hourly) is control ordered within the framework of a pre-agreed time limit for the next 24 hours. In practice, hourly control could be implemented by the supplier giving notice of its control requirements for the next 24 hours separately for each hour. Adoption of the model would require the sector to specify the method of notification and the time limits for the control measures (e.g. by 22.00) and a shared interface for submitting the control requests.

3. **Quick control** comprises individual control measures, response time minutes (<5 mins). A condition of quick control is that the DSOs use a standard interface, to which the supplier could submit the control request individually for each metering point.

Under the current Metering Decree, the metering equipment must be capable of receiving and implementing or forwarding load control commands sent via the communications network. An extensive demand response study\(^5\) estimates the meters to be currently connected with up to 1,800 MW in electric heating load. It would be possible to control these loads via a meter, but utilising this possibility extensively would demand considerable standardisation work on data exchange, response times and procedures. At the moment, response times vary depending on the reading technology (cf. PLC and GPRS data transfer), and current technology cannot fully ensure the controls being delivered.

The technical solutions of demand response are constantly developing as the markets develop. The market actors are actively developing the demand response control solutions, but to date, few domestic customers are using them. In ET’s view, controls effected through the meter will play a role in market-led demand response also in the future. The meter lends itself to a certain type of demand response suitable for limited usage needs. In practice, it is possible to

\(^4\) Finnish Energy's view on the role of the distribution system operator as facilitator of demand response, position paper, approved 8 March 2017

\(^5\) Kysynnän jousto - Suomen soveltuvat käytännön ratkaisut ja vaikutukset verkko- ja puhelinverkoihin [Demand response – practical solutions suitable for Finland and the effects on distribution system operators] (DR pool) Final report. Available at: [https://tutcris.tut.fi/portal/files/4776899/kysynnan_jousto_loppuraportti.pdf](https://tutcris.tut.fi/portal/files/4776899/kysynnan_jousto_loppuraportti.pdf)
effect control of electric heating loads via the meter either using time-zone control or market periods (alternatives 1 and 2 above) in response to requests submitted in sufficiently good time. These controls would provide a more advanced replacement for the present two-rate control. Thus, the meter is suitable, for example, for the spot-price control of the hot-water tank or two-rate control determined by the supplier.

Since the meter stock will be upgraded in the next few years and the spread of control solutions based on home automation is still uncertain, next-generation meters must still have the capacity to implement load control commands. Electricity meters already carry a 1,800 MW heating load. This potential may be realised without changes to end-customers’ electrical installations by including existing controls in market controls. This allows the DSO to give up night/day electricity controls in a customer-friendly way. The DSOs make the meter control functions available to the market parties. When the meter-controlled loads are offered for utilisation by the market parties, the volatility of the demand response market and available capacity will form the framework for the formation of a well-functioning market-led demand response market in the next few years. A condition of utilising the above-described control method in market-led demand response is that the control interface relaying the supplier’s controls is standard nationwide and comprehensively adopted by all DSOs. To make the controls feasible, data exchange concerning the demand response controls must be defined, along with procedures between market actors and DSOs. In practical terms, this requires standardisation of data exchange, interfaces and response times.

ET believes that the need for demand response via the meter will continue to exist through the period of next-generation meters. Modifying the meters to permit their utilisation will incur costs, but these are seen as worthwhile in furthering the demand response markets. At the same time, demand response effected via meters furthers the spread of other systems contributing to demand response, such as home automation systems.

Market actors are expected to actively develop other demand response control solutions alongside meter-based controls. Both existing and new electricity user sites will increasingly adopt various energy management and ‘smart house’ solutions that are completely independent of the DSO’s meter. As innovations like solar panels, electric vehicles and electricity storage facilities become more widespread, optimisation of the site’s energy usage, flexibility and costs – in addition to bought energy – will be increasingly achieved through the control of its internal energy flows and market price management, where the DSO’s meter is unlikely to play a part. The services detailed above, together with in itself increasing home automation (IoT) require the existence of some other (than an electricity meter) smart control instrument on the premises.

Essential features of the above services are quick response times of the controls, as well as their real-time two-way monitoring.

Thus, ET takes the view that many types of control solutions will be required in the future, both a time control that is slower than at present, and a faster, almost real-time control. These control methods can continue to operate in parallel. In years to come, the meter might have a role in time control similar to the present, but more finely tuned.

**Metering of microgeneration**

With the spread of small-scale electricity production, particularly that of solar electricity, the metering requirements of microgeneration have been much discussed. Under current regulations, the meter must be capable of hourly metering and registration of both the energy fed into the network and that taken from it. Thus, current regulations allow the recording of both consumption and production in the same hour.

Finnish Clean Energy Association\(^6\) has been one of the bodies advocating that in microgeneration sites, the total of input and output should be calculated (netted) within the hour. This requires computational processing of the read data in the DSO’s data systems. Calculation of the net result between exported and imported energy at the meter itself is not possible under current legislation, nor is it justified in the future in ET’s opinion.

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As an example, a pilot study was carried out in Oulu on the possibilities of housing companies making use of self-generated electricity beyond the connection point for the part exceeding the property’s electricity consumption, to reduce the imports from the network by individual apartments. This model was implemented by processing the calculations in the DSO’s data systems.

**Internal net metering of balance settlement period**

An essential criterion of all computational post-processing of metering data is that the customers, balance settlement and market actors all use the same metering data. ET is against net metering beyond the balance settlement period because of issues leading to skewing of the markets and unequal treatment of customers. If, however, the DSO is obliged to net data within the balance settlement period or computationally transfer energy exported by one metering point to another (utilising microgeneration in apartment blocks), the following principles must be ensured:

- Netting and other computation is carried out in the DSO’s data systems or centrally in Datahub. The DSO or Datahub subsequently only delivers this computational information to the customer, balance settlement and market actors.
- The real-time consumption data obtained directly from the meter is different from the computationally processed data. The data shown on the meter display is also different from the computationally processed data. This must be understood and accepted. In particular, it must be ensured that computation and use of computed data is permitted under the metering legislation on the meter display and in terms of the criteria applied to metering data used as the basis of billing.
  - In accordance with the Measuring Instruments Directive, the reading of the meter display is the measurement result that serves as the basis for the price to pay. The current interpretation would mean that the metering data should not be computationally netted/processed for billing use. Netting/computational processing demands at least a change in this interpretation.

ET takes the view that the DSOs’ new data systems handling metering data should be designed in such a way as to contain the readiness for cost-effective implementation of the netting/computational measures detailed above, if necessary.

ET believes that if there is a political will to enable netting within the balance settlement period, this should be effected in the DSOs’ data systems or preferably centrally in Datahub, thereby making the metering data available to the markets. Before amending the legislation, however, it must be ascertained that the legislation on metering instruments permits this.

**Momentary inter-phase net metering**

Meters from different manufacturers handle the recording of produced energy in different ways. Some meters add the phases together (net metering) momentarily before recording the data, some meters do not carry out netting momentarily between phases. This means that, depending on the meter supplier, the metering result differs in microgeneration sites depending on the balance between consumption and production phases.

All new meters to be installed in Finland should handle the electricity imported from the network and that exported into it between phases in the same uniform manner. Regardless of whether or not the net result of the metering data is calculated in the DSO’s data systems, the DSO needs the actual data for each phase as a tool for distribution system management.

With many DSOs, the meter functions partly as a monitoring and control instrument of the electrical installations and electricity network. Therefore, the solutions regarding the metering principle should also be evaluated on the basis of factors related to safety and the quality of electricity. Data for each phase permit the DSO to spot the backfeed situations in single-phase production plants and any inter-phase asymmetry. The meter must not ‘lose’ this information.

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Inter-phase net metering causes voltage asymmetries and problems for the production in remaining connected to the grid when the voltage in one phase exceeds the standard value. The situation is even worse if the customer already has existing inter-phase asymmetry.

ET takes the view that all new meters should handle the electricity imported from the network and that fed into it between phases in the same uniform manner. ET recommends a metering method where the data is not netted, even momentarily, between phases before its registering in the meter memory. All commercial netting taking place within the balance settlement period should be carried out in the systems only.

The netting may be centralised or decentralised, either in the DSO’s or service provider’s system; in the future possibly in Datahub.

**Meter display**

The appendix of the Metering Instruments Decree\(^9\) stipulates that the electrical energy meter must be equipped with a metrologically controlled display which is visible to the consumer easily and with no need for tools. The reading of this display is the measurement result that serves as the basis for the price to pay. This specification comes directly from the European Directive on measuring instruments\(^10\).

The requirement of a separate display is problematic and not relevant to customers’ needs after the deployment of remotely read meters. Customers rarely have an actual opportunity of monitoring the meter display (e.g. in apartment blocks). The DSO is obliged to verify that the meter has functioned correctly, if the customer so requests. Removing the display in no way reduces the customer’s legal protection with regard to the reliability of the metering.

ET considers that the removal of the specification on the meter display detailed above from the Directive on measuring instruments should be proposed. If the display requirement is not removed, it and its interpretation should be made more specific so that the data on the display is the metering result currently in force, and there is no need to show the historical data recorded by the meter on the display.

**Development of Datahub**

The next major step forward in the electricity retail market is the adoption of the Datahub\(^11\) in autumn 2019. The hub will store the data moving between electricity consumers, suppliers and DSOs (incl. metering data), from which they will be equally available to all market actors.

The development of the Datahub has raised wishes and needs concerning metering data:

**Recording of data in DSO’s systems**

Under the current Metering Decree, the metering data and the information on voltage-free periods must be entered in the DSO’s data system that processes metering data, in which the hourly metering information must be held for a minimum period of six years and the data on voltage-free periods for a minimum period of two years.

In the future, the metering data for each balance settlement period will be entered and stored in the Datahub. In ET’s opinion, when the Datahub is imposed with an obligation to store metering data, the corresponding obligation should be removed from DSOs.

**Meter location details as coordinates**

If necessary, this information may be entered in the Datahub. The information is optional in the current Datahub specifications. The DSOs have the coordinate details available, but delivering and maintaining them in the Datahub incur operational costs. Before a possible decision to make the coordinate details a mandatory item, the need for such information and the costs of providing it should be assessed.

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Utilising metering data in network management

Alongside the electricity markets, the meter and metering systems play a constantly increasing role also in network operation. By utilising the meters, the status of the network may be monitored down to each metering site. Furthermore, the metering data may be utilised in optimising the network. Customers also expect the DSOs to make good use of metering data and bring cost benefits to their customers.

Examples of potential utilisation of the meter in the DSO’s operation include various measurements of the quality of electricity, outage management, improvements to customer communications, and various real-time alarms concerning the network status. In years to come, the meter may also be used in dealing with various claims. With new electrical instruments, it may also be necessary to meter reactive power.

Local generation creates an occupational safety risk in maintenance situations, even though the possibility of backfeeding should be eliminated in all cases. Safety can be improved by adding a feature to the meter to prevent power injection to a voltage-free network.

ET deems it important that DSOs are not prevented from utilising the meter as widely as possible in fulfilling their statutory obligations (such as improving security of supply and ensuring electrical safety).

The DSO should be able to meter consumption and production over a period shorter than the balance settlement period, if this data would aid the improvement of e.g. monitoring of electricity quality and electrical safety. Naturally, customer data protection must be ensured at the same time.

All regulations concerning metering must be reviewed. As an example, the setting of in-use verification of meters must allow for flexibility for possible new in-use checking methods. The electricity meter of the future should be capable of self-monitoring its metering accuracy. This would truly allow for pinpointing faulty metering units, not just relying on statistical results as is the case in the current sampling method. Manufacturers already have patented solutions for monitoring metering accuracy. The meter could also contain self-diagnostics, so that it would evaluate the reliability of its own operation.

In ET's view, there could be a variety of meters in the network of the future. All metering points must have a ‘basic’ meter, which fulfils the basic criteria set by the electricity markets and customers. In addition, metering points located in certain parts of the network might have special, more versatile and costlier meters, which facilitate network management and improve electrical safety.

Metering and data security

Meters collect detailed information of a person’s energy consumption. Metering data is personal data when it can be connected (even indirectly) to a natural person. A company handling metering data must design the treatment of such data and the systems in which the data is stored and processed in such a way as to comply with the data protection legislation (privacy by design and default). This also includes ensuring data security when handling metering data.

A further reason for paying special attention to data security is that, in future, meters may control the electricity usage of all Finnish people. The legislation may confer special obligations regarding data security to certain DSOs. On the other hand, the precondition of remote meter functions is the use of public networks. In the case of data security, it should be noted that the operators cannot be required to provide better data security than that provided by these public networks. Moreover, data security (and insecurity) is a field changing even faster than equipment technology. This may reduce the service life of meters even more than at present. Also, customers may want the meter linked to their other devices, which presents additional demands on the meters and data security.

Means of ensuring data security include both technical (firewalls, screens, encryption etc.) and organisational (instructions, user rights and logs etc.) methods. As well as energy sector businesses, meter manufacturers and data system suppliers must design their products and services to comply with the standards of data protection and data security.
Regulation increasing the specific data protection and data security requirements in the energy sector should be avoided. However, if regulation is unavoidable, it must not lead to provisions overlapping or contradicting general regulation.

ET believes that in the near future, the general conditions in the sector should also briefly define liability distribution in data security.

Summary

The features of the next-generation electrical energy meters have in most parts been agreed by the ET smart network group. In the main, the current criteria should be applied also to next-generation meters and metering systems. However, it is necessary to specify the criteria in greater detail and to improve them, to better serve the customer needs and the developing electricity markets.

Notable new criteria include:

- Facility for a shorter balance settlement period
- Registration of short outages (fast reclosing operation)
- Possibility of remote disconnecting and connecting of power (does not apply to meters connected via current transformer)
- Possibility of remote updating of meters, for example, due to changes in the balance settlement period
- Capability of utilising unvalidated metering data in real time
- Inter-phase netting is not allowed, instead the meter records consumption and generation data for each phase
- Closer attention must be paid to the data security of meters