Next generation Use Cases

Aggregated Use Case	Interconnect category (*)	Original Use Case	Source	Scope	Objectives	Narrative	Actors	Information exchanged	Requirements
Supply limitation by DSO	Grid stabilisation, Flexibility	Limitation of actual power consumption	VDE-AR-E 2829-6-1	The information exchange between the HES, smart meter and CEM (see CG-SM reference architecture)	* Grid stabilisation * Prevention of congestion * Obey contractual limits	The following mechanisms are utilized within this Use Case: a) Active Power Limit: The Active Power Limit allows to set a limit for the maximum active (real) power consumption or production of a Controllable System (CEM + controllable loads, generation units, storage). The Active Power Limit is typically used to improve grid stability by reducing the consumption or production of the Controllable System. The Active Power Limit may have a validity-duration of the limit. b) Failsafe Power Limits: If the Controllable System does not receive any Heartbeats from the Energy Guard for more than 120 seconds (e.g. due to interrupted connectivity), the Failsafe Power Limits are used as fallback. They are intended to prevent overloads in case of connectivity problems or during the soft-start after a (local) blackout situation. .	HES, Smart Meter, CEM	* Active power limit * Failsafe Power limits * Heartbeat * Contraints	* Heartbeats are exchanged every 60 seconds * If the Controllable System does not receive any Heartbeats for more than 120 seconds the Failsafe Power Limits are used as fallback. * After a restore of communication, a valid power limit will be send within 60 seconds to the CS.
		Grid stability via power limitation at Grid Connection Point	Interconnect D1.2 - par. 2.2.3	The information exchange between the HES, smart meter and CEM (see CG-SM reference architecture)		This use case enables the DSO to manage overload scenarios. A power limitation setpoint or power profile over time will be sent by the DSO to limit consumption of residential and commercial buildings.	Smart Meter, CEM,Cloud Service Platform		The smart meter allows to execute an action if a pre defined power (current) limit is exceeded (both directions) for a per defined time. Typical actions: - activate / deactivate the supply control switch - activate / deactivate load control outputs Depending on network condition and market situation power (current) limit may varies
		Near to power limit notification	Interconnect document D2.1	The information exchange between the smart meter and CEM (see CG-SM reference architecture)	Warn the CEM and consumer about reaching the power limit	Smart meter sends alert to living service provider platform (CEM) when the power consumption exceeds power limit set by contract with the utility	Smart Meter, CEM	Notification	The notification should reach the CEM within 1 second
Monitoring consumption, generation and power quality data	Monitoring	Monitoring of Grid Connection Point (incl. PV)	VDE-AR-E 2829-6-1:2020-12	Network monitoring at grid connection point (LV network and premises incl. PV)		Monitoring electrical measurands of the Grid Connection Point. A Grid Connection Point is defined as the point where the public electricity grid is connected to the internal grid of the premises e.g. a house. The public grid as well as the internal grid are AC electricity grids. The Actor "Grid Connection Point" represents the measured values of the physical Electricity Grid Connection Point.	Smart Meter, HES, SCADA	Monitoring: - (active) power consumption/production (P grid, mom) - Total feed-in energy (E feed-in, total) - Total consumed energy (E grid, total) - Momentary current consumption/production (phase-specific) (I grid, mom) - Voltage (phase-specific) - Frequency - PV feed-in power limitation factor (PLF PV, feed-in, max, pct)	Instantaneous values pushed by the meter every 10 s
		Exchange of NRTD	Netbeheer NL	The information exchange between the HES and smart meter (see CG-SM reference architecture)	Risk mitigation by enabling better control of the distribution network and having more detailed information (real-time data)		HES, Smart Meter	* Energy * Power * Voltahe * Frequency	Data should be send out by the Smart Meter at least every 5 minutes
		Exchange of load curves	E.DSO	The information exchange between the HES and smart meter (see CG-SM reference architecture)		The Smart Meter sends out periodically a load curve to the HES.	HES, Smart Meter	* 10 second energy values over 15 minutes ??	Load curves should be send out by the Smart Meter every 15 minutes
		Real Time Identification, Location, & Detection of Grid Faults	Sense	Information processed in the meter, or in a module connected to the meter via a "streaming port". Outputs then shared to appliances or the cloud via local WiFi	Reduce grid operating/maintenance costs	Identify & locate faults and anomalies on the grid (vegetation brush, faulty transfomers etc) using high resolution waveform data, helping to reduce maintenance costs on the grid. Further potential to provide high resolution waveform, current, voltage feed at grid edge in real time	Smart Meter or local module, cloud application	A minimum samples per second locally between the metrological function of the meter and the disaggregation function required OR raw analogue voltage/current signals into disaggregation function.	Requires grid edge computation (in the meter or module), wifi connectivity, and high resolution metrology (e.g. 15ksps +) or raw (analogue) voltage & current signals.
Local energy management by consumer	Flexibility, Monitoring	Dynamic tariff & usage management	Interconnect D1.2 - par. 2.1.3	The information exchange between the Grid Operatior and Energy Service Provider back office systems and CEM	* Economic optimalisation of energy usage * Reaction on requests from a grid operator to reduce consumption of generation	Enable the customer to be aware of his/her dynamic tariff . Enable the customer to manage himself his appliances in order to reduce energy cost. Enable the customer to understand the basis of the control of his/her appliances.	EVSE / EV , Heat pump, Water heater, Space heater, Washing Machine, Dishwasher, Dryer, CEM, Smart Meter		The utility sends tariff information through the smart meter consumer information interface to the consumer. Based on this information the consumer controls his energy usage and energy production (if available). (this is done by a "in-home" energy control system)
		Provide dashboard to inform user about status and stimulate to use opportunities	Interconnect D1.2 - par. 2.2.3	The information exchange between the smart meter and CEM (see CG-SM reference architecture)		Via the dashboard the user is able to monitor the behavior of the premises	CEM, EV/EVSE, HVAC, Smart Meter, PV-Inverter		
		Monitoring active power consumption	VDE-AR-E 2829-6-1 - par. 4.3	The information exchange between the HES, smart meter and CEM (see CG-SM reference architecture)		Within an overall energy management concept, it is important for the Grid Operator (HES) and energy manager (CEM) to know about the electrical power consumption or production of the whole home	HES, Smart Meter, CEM		Since the smart meter "sits" at the connection point of the premises to the el. grid, it is possible to measure in real time the electricity flow (import / export). This is an important information for energy optimization (energy usage versus production). Optimization: - In an consumer home the energy flow shall be minimal. - In a prosumer home the energy flow shall be 0
		Energy monitoring and management	Interconnect D1.2 - par. 2.3.3	From back-end platform to in home devices		On top of energy monitoring users can perform manual actuation for connected or unconnected devices at relay or plug-level, also for lights switches or other devices, e.g. A/C. Automatic energy management: In addition to manual management users can benefit from automated actuation based on rules/events both set by themselves or allowed/agreed upon to be performed by third parties e.g. in the context of DSF requests.	Sensors / Actuators, Smart Appliances, IoT Gateway, Back-End platform		
		Unified user interface	Interconnect D1.2 - par. 2.3.3	The information exchange between meter and CEM or In Home Display		A unified interface between the meter and the CEM or IHD.	Smart Meter, CEM, IHD		

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		Awareness and notifications	Interconnect D1.2 - par. 2.4.3	From meter to cloud applications and back of EM app.		Being connected to the Smart Meter and receiving its meter data over time, the EM App can show historical or real time data about consumption and performances regarding flexibility provision. The overall power consumption of a household is provided periodically or regularly from the smart meter to the Living Service Provider. The Living Service Provider provides the information on household consumption to the Energy Service Provider to build historical data about the overall energy usage.	Smart Meter, CEM, Cloud applications LSP and ESP, EM app		Consumption data for energy prediction modelling
		Monitoring energy consumption	Interconnect D1.2 - par. 2.7.3	From meter to cloud applications and back of EM app.		The end customer wants to monitor the whole system via Mobile App or provide the platform information about the flexibility for WG, EV together with forecast information and tariff together with power limitation on GRID level.	Smart Meter, CEM, Cloud applications LSP and ESP, EM app		
		Appliance level real time energy consumption reduction	Interconnect D1.2 - par. 2.3.3, Sense	Information processed in the meter, or in a module connected to the meter via a "streaming port". Outputs then shared to appliances or the cloud via local WiFi	Reduce energy consumption Higher customer satisfaction	Customers able to see via app what is consuming power in their homes broken down to an appliance level in real time (as well as historically), to readily identify highest consuming appliances and/or behaviours and subsequently reduce consumption more effectively (a.k.a real time load disaggregation). Improve customer satisfaction by making it simpler to reduce demand and by providing broader smart home awareness benefits e.g. safety & reassurance that they have not left appliances on such as irons, stoves etc. Identify certain electrical faults in the home e.g. floating neutral.	Smart Meter or local module, cloud application	A minimum samples per second locally between the metrological function of the meter and the disaggregation function required OR raw analogue voltage/current signals into disaggregation function.	Requires grid edge computation (in the meter or module), wifi connectivity, and high resolution metrology (e.g. 15ksps +) or raw (analogue) voltage & current signals.
Remote Flexibility Management by DSO or ESP	Flexibility, Grid Stabilisation	Maximize flexible energy consumption in premises	Interconnect D1.2 - par. 2.2.3	From ESP applications to in-home appliances		The ESP provide the premises CEM the possible power consumption on the grid connection point to stabilize the grid via the EMS with their possibilities to reduce the smart devices as well via this UC.	CEM, smart meter, smart appliances		
		Time of use tariffs	Interconnect D1.2 - par. 2.4.3	From ESP applications to in-home appliances		Requests for load shifting (or peak shaving) are sent to the Living Service Provider for implementation through the Energy Service Provider and its Energy Manager (CEM). The EM looks at all the opportunities for shifting loads (e.g., programming the washing machine, dishwasher or tumble dryer to offer a flexible start until a selected time, when the laundry or dishes need to be ready) to meet the Aggregator's request and crosses those with end user's boundaries to identify where to send the command to shift start time.	CEM, smart meter, smart appliances		
		Flexibility provision	Interconnect D1.2 - par. 2.3.3	In-home		This use case describes how end-users can participate explicitly in demand response schemes. Through a web-based dashboard or through their mobile app the users will be able to monitor the current state of their home appliances, , and decide when they will participate in a demand response scheme and how much of their harnessed flexibility will be released in the system. In order to achieve the aforementioned goal, their consumption data should be collected by various installed smart meters and smart devices, and the collected data should be analyzed and visualized by a technology provider, in cooperation with their retailer.	CEM, smart meter, smart appliances		
		Manage peak load to avoid increases in the electricity invoice (peak shaving)	Interconnect D1.2 - par. 2.6.3	From ESP and/or GO applications to in-home appliances		Based on the prognosis, a set of steps are defined. These steps aim at limiting the consumption of the system at times when there is a high probability of utilizing more than the contracted capacity.	PV panels, Heat pump, EV charging, Washing machines, Dishwashers, Smart boiler, CEM		
		Peak shaving via direct control of heat pump	Interconnect D1.2 - par. 2.6.3	From ESP and/or GO applications to in-home appliances		The main objective is to Modulate power demand of a controllable heat pump (HP) by applying direct control in a dynamic manner. The heat pump is primarily managed to avoid for the local peak power demand (site level) to go above a certain capacity threshold. By managing the loading of the HP penalties are avoided, especially when the main supplying source of electricity is the distribution grid (e.g., at times of low RES generation or when RES generation	Heat Pump, Thermal storage		
		Flexibility aggregation of commercial buildings	Interconnect D1.2 - par. 2.7.3	From Flexibility Aggregator applications to building appliances		Make use of local flexibility of commercial stores towards the optimization of portfolio resources and the provisioning of flexibility services.	DSO / Flexibility Aggregator, CEM, Smart Appliances, PV system, HVAC		
		Convenient smart EV charging at commercial buildings	Interconnect D1.2 - par. 2.7.3	From ESP and/or GO applications to EV charging stations		Take advantage of the existing infrastructure to foster e-mobility within urban areas where public charging may be limited. Simplified approach to foster the access to mobility services – making it available when using existing parking infrastructures. *Similar approach can be applied for residential charging.,*	EV Charging Manager, EVSO/EV, Mobile app		
		Appliance level real time behaviorial demand side response	Sense	Information processed in the meter, or in a module connected to the meter via a "streaming port". Outputs then shared to appliances or the cloud via local WiFi	Access flexibility behind the meter at scale	Access flexibility and shift load in domestic homes using appliance level real time nudge messaging to householders. By providing appliance level messaging based on actual current usage, greater participation and load per home can be accessed during TOU tariff changes, demand/stabilisation events, or when approaching capacity limits. Customers are directed to turn down/off those appliances in use that will have most impact on load and least disruption to their daily lives. Does not require smart connected devices. Improves customer acceptance/uptake of flexibility interventions. Whilst customers retain agency over choice of load, across large number of households, total load under management becomes predictable and reliable.	Smart Meter or local module, cloud application	A minimum samples per second locally between the metrological function of the meter and the disaggregation function required OR raw analogue voltage/current signals into disaggregation function.	Requires grid edge computation (in the meter or module), wifi connectivity, and high resolution metrology (e.g. 15ksps +) or raw (analogue) voltage & current signals.
		Flexibility management for distribution grid support	Interconnect D1.2 - par. 2.7.3			This use case will describe how the DSO can develop an interfacing mechanism that will enable to perform local and regional congestion management & voltage control based on the interconnection to both commercial and residential flexibility pools – rules-based or agreement solutions.	Prosumer / building manager / DSO, CEM, Smart devices (EV, PV, HVAC, etc)		
		Monitoring security	Thales	The information exchange between the Smart Meter and the HES	* Early detection of cyber-attacks	The Smart Meter / Gateway monitors the status of the wide are network connection in order to identify potential security breaches. The Smart Meter monitors the data traffic pattern (frequency and amount of data exchanged) between the Smart Meter and the HES is able to identify anomalous communication patterns.	Smart Meter / Gateway	Connections, ports, IP addresses used, data traffic pattern	Direct alarm message

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Monitoring communications and security	Monitoring	Monitoring the Wide Area communication Network	Thales	The information exchange between the Smart Meter and the HES	* Prevention of connectivity outages * Troubleshooting of connectivity outages / issues	The Smart Meter / Gateway monitors the wide area network connection in order to identify potential connectivity outages as early as possible. The Smart Meter regularly reports to the HES the status of the wide area network connection used. The Smart Meter notifies of events (such as low coverage situations, temporary network outages, etc.) that might lead to (or might have lead to) a disruption of the wide area network connection. The Smart Meter stores a local history of communication-related events and makes it available for authorised technicians to read it over a local interface, and reports this list to the HES.	Smart Meter / Gateway	Link quality, signal strength, available bandwidth, radio channel(s), access technology	Refresh time down to 15 minutes
Other	Other	Update individual functions	Itron	Information exchanged between the smart meter and HES and/or other device/software	* Allows for ease in updating functions within the meter without necessarily updating the meter's entire binary image	The Smart Meter enables its functions to be updated in isolation (like an traditional user based OS) without affecting its other functions.	Smart Meter, HES, Other Devices	ALL	Meters legally relevant functions should not be changed/altered unless firmware update is within Welmec and MID regs.

Interconnect category (*)

Flexibility
Grid stabilisation
Monitoring
Comfort
Self-Consumption
Other