Table 29 *(continued)*

No.	Type	Description
		Triggers: — The authorization of discharging has been completed and EVs are ready to transfer energy. — The charging loop is established and one of the interrupts occurs and the SECC or the EVCC has the necessity to renegotiate. If the result of the renegotiation is a bidirectional service then this use case can start.
7	End conditions	Success end conditions: — The EV supply equipment is transferring power within the maximum local limits of installation and according the conditions agreed during the renegotiations. — EVs will be charged according the mobility needs of the users. Failure end conditions: — The EV supply equipment is not able to transfer power due to contactor failure. — Negotiation between the EV and the EV supply equipment failed. — No power transfer between the EV supply equipment and the EV. — Flexibility contracts can't be assessed as valid by the SAs.

7.9 Energy transfer controlling and re-scheduling [F]

7.9.1 Energy transfer loop

Table 30 — Energy transfer loop

No.	Type	Description
1	Use case element name	Energy transfer loop
2	Use case element ID	F0
3	Objectives	Continue energy transfer process until success conditions reached and enable billing of transferred energy.
4	Description	This use case covers the basic energy transfer loop. The following information needs to be exchanged between the actors: The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC. From the EVCC to the SECC: EV status (as stipulated in ISO 15118-2 or ISO 15118-20). From the SECC to the EVCC: EV supply equipment status (e.g. maximum current, as stipulated in ISO 15118-2 or ISO 15118-20).
5	Prerequisites	— E1, E2, E4, E5, E6 or E7 target setting or energy transfer scheduling use cases shall be successfully established. — The energy transfer loop shall be active.
6	Requirements	— The EVCC shall send the SECC the current status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The SECC shall reply with no interrupt flag. — The EVCC and the SECC shall comply with traceability requirements.
7	End conditions	Success end conditions:

Table 30 *(continued)*

No.	Type	Description
		— The energy transfer loop continues. Failure end conditions: — The energy transfer loop will be stopped. — The energy transfer loop is terminated due to traceability check fails.

7.9.2 Energy transfer loop with metering information exchange

Table 31 — Energy transfer loop with metering information exchange

No.	Type	Description
1	Use case element name	Energy transfer loop with metering information exchange
2	Use case element ID	F1
3	Objectives	Continue the energy transfer process until success conditions are reached and enable billing of transferred energy.
4	Description	This use case covers the basic energy transfer loop with meter reading. For reliable control of the energy transferred, all SAs involved shall be able to prove that energy was transferred to or from a specific EV/customer. It is therefore mandatory for an EV to confirm that energy was transferred at a certain time and from or to a certain EV supply equipment. With respect to the communication between the EVCC and the SECC, one possibility is that the vehicle signs the meter readings from the SECC to confirm the reception of the meter record. The vehicle may perform a plausibility check between the EV supply equipment measured energy amount and the transferred energy amount to validate if there is an unexpected high-energy loss during the energy transfer process. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC. As stipulated in ISO 15118-2 or ISO 15118-20, the following information shall be exchanged between the actors: From the EVCC to the SECC: EV status, signed meter reading. From the SECC to the EVCC: EV supply equipment status, meter reading.
5	Prerequisites	— Target setting or energy transfer scheduling according to use case elements E1, E2, E6 or E7 shall be established successfully. — The energy transfer loop shall be active.
6	Requirements	— The EVCC shall send the SECC the current status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The SECC shall reply with no interrupt flag. — The SECC shall send a meter readout to the EVCC for signing. — The SECC shall send the signed meter readout to the EMSP. — The EVCC and the SECC shall comply with traceability requirements. — For AC connections, if no meter reading is provided during the charging loop control then the EV may stop immediately any reverse power flow.
7	End conditions	Success end conditions:

Table 31 *(continued)*

No.	Type	Description
		— The EVCC receives the metering information and creates a signature for it. — The SECC receives the signature of the metering information. — The energy transfer loop continues. Failure end conditions: — The validation of the information fails, e.g. the delivered energy amount is different from the received energy amount. — The SECC has not received the signed meter reading for a certain period or for a pre-specified amount of energy. — The EV supply equipment stops energy transfer as the EVCC validation was not received. — The energy transfer loop is terminated due to traceability check fails. — The energy transfer loop will be stopped.

7.9.3 WF1: WPT charging loop

Table 32 — WPT charging loop

No.	Type	Description
1	Use case element name	WPT charging loop.
2	Use case element ID	WF1
3	Objectives	Continue the charging process until success conditions are reached and enable billing of transferred energy.
4	Description	This use case covers the basic energy transfer loop. The following information shall be exchanged between the actors: The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC. From the EVCC to the SECC: EV status (as stipulated in ISO 15118-20). From the SECC to the EVCC: EV supply equipment status (e.g. maximum wireless power, as stipulated in ISO 15118-20).
5	Prerequisites	— Target setting or charging scheduling according to use case elements WE shall be established successfully. — The energy transfer loop shall be active.
6	Requirements	— The EVCC shall send the SECC the current status in a specified time frame according to ISO 15118-20. — The SECC shall reply with no interrupt flag. — The EVCC and the SECC shall comply with traceability requirements.
7	End conditions	Success end conditions: — The energy transfer loop continues. Failure end conditions: — The energy transfer loop will be stopped. — The energy transfer loop is terminated due to traceability check fails.

7.9.4 Energy transfer loop with interrupt from the SECC

Table 33 — Energy transfer loop with interrupt from the SECC

No.	Type	Description
1	Use case element name	Energy transfer loop with interrupt from the the SECC
2	Use case element ID	F2
3	Objectives	Continue the energy transfer process until the SECC interrupts the energy transfer loop.
4	Description	The EVCC is the "client" and always requests information from the SECC. If an SECC wants to interrupt the energy transfer loop, for example with an updated charging schedule or new set-point for the load levelling, then this use case will describe the process. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC. The following information shall be exchanged between the actors: From the EVCC to the SECC: EV status (as stipulated in ISO 15118-2 or ISO 15118-20). From the SECC to the EVCC: EV supply equipment status (as stipulated in ISO 15118-2 or ISO 15118-20), SECC interrupt, new departure time provided by the USER. NOTE In case of a new departure time set by the USER and transmitted by the SECC, the corresponding SA takes care of a secured way of transmission.
5	Prerequisites	— Target setting or energy transfer scheduling according to use case elements of E shall be established successfully. — The energy transfer loop shall be active.
6	Requirements	— The SECC shall send the EVCC the current status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The energy transfer process interrupt flag set by the SECC/ secondary actor. — The EVCC shall initialize the energy transfer set-up process again. — The EVCC and the SECC shall comply with traceability requirements.
7	End conditions	Success end conditions: — The energy transfer loop interrupt occurred and either the energy transfer set-up or end of energy transfer process starts. Failure end conditions: — The energy transfer loop does not start again. — The energy transfer loop is terminated due to traceability check fails.

7.9.5 Energy transfer loop with interrupt from the EVCC or USER

Table 34 — Energy transfer loop with interrupt from the EVCC or USER

No.	Type	Description
1	Use case element name	Energy transfer loop with interrupt from the EVCC or USER
2	Use case element ID	F3
3	Objectives	Possibility for the EVCC or USER to interrupt the energy transfer loop.

Table 34 *(continued)*

No.	Type	Description
4	Description	The EVCC or the USER interrupts the energy transfer process when e.g. the energy transfer schedule changes or an unpredictable event in the EV occurs or the USER returns and wants to leave. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC, USER.
		This use case covers the basic energy transfer loop with interrupt from the EVCC or USER. — The EVCC shall send an EV status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The SECC shall reply with an EV supply equipment status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The EV will continue either with the energy transfer set-up process or with the end of the energy transfer process. As stipulated in ISO 15118-2 or ISO 15118-20, the following information shall be exchanged between the actors: From the EVCC to the SECC: EV status, EVCC Interrupt, new departure time. From the SECC to the EVCC: EV supply equipment status.
5	Prerequisites	— Target setting or energy transfer scheduling according to use case elements of E shall be established successfully. — The energy transfer loop shall be active.
6	Requirements	— The EVCC shall send the SECC the current status in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The SECC shall reply in a specified time frame according to ISO 15118-2 or ISO 15118-20. — The EV or the USER shall re-schedule or terminate the energy transfer process. — The EVCC and the SECC shall comply with traceability requirements.
7	End conditions	Success end conditions: — The energy transfer loop interrupt occurred and either the energy transfer set-up or end-of-energy transfer process starts. Failure end conditions: — The energy transfer process does not start again. — The energy transfer loop is terminated due to traceability check fails.

7.9.6 Energy transfer control based on dynamic control mode

Table 35 — Energy transfer control based on dynamic control mode

No.	Type	Description
1	Use case element name	Energy transfer control based on dynamic control mode
2	Use case element ID	F4
3	Objectives	Continue the energy transfer process until success conditions are reached and enable fast responding services to the grid.

Table 35 *(continued)*

No.	Type	Description
4	Description	This use case covers both the AC and DC energy transfer loop. It covers also services related to reactive power compensation. This use case describes the situation where the SECC controls the amount of active and reactive power to be transferred during the energy transfer loop. The power shall be within the boundaries and target defined in E8 use case element. If not, the loop breaks and goes to end conditions. During the loop the SECC may change the power boundaries and the active and/or reactive power targets based on SA requirements and mobility needs. the EVCC will make its best efforts to follow the changes or break the loop if it is not possible to follow the new conditions specially according to mobility needs. During the charging loop, the EV may change the current and power boundaries. The SECC adapts its targets based on the information provided by the EVCC. During the loop, the EVCC updates its energy requests in relation with mobility needs. For example, if the EV is transferring energy to the grid, the total amount of energy needed to comply with mobility needs will increase. The involved actors are: — Primary actors: EV, EVCC, EV supply equipment, SECC. — Secondary actors: user, EMS, energy actors like EMS, DSO or flexibility operator.
5	Prerequisites	— Target setting or bidirectional power transfer based on dynamic control mode according to use case element E6 shall be established successfully. — The bidirectional power transfer loop shall be active.
6	Requirements	— The performance time and timeouts for the bidirectional power transfer loop messages in dynamic control mode shall be parameterized in order to ensure fast responding services. — During the control loop the EV and the EV supply equipment shall take into account all relevant local grid codes and if applicable, shall conform to EN 50549-1. — In case of three-phase energy transfer, the EV shall make its best efforts to balance the power among the three phases. — The EVCC and the SECC shall comply with traceability requirements. — In case of AC and if a dual channel architecture is used, the EVCC shall indicate the power flow direction to the SECC. The SECC is then able to perform the relevant contactor control by HLC. — In case of DC, the SECC should indicate to the EVCC the present current and voltage value. — In case of AC, the SECC should indicate to the EVCC the target set point of active and reactive power. — The SECC shall send an element to inform the EV that channel configuration (dual or single channel) change is ongoing or finished.
7	End conditions	Success end conditions:

Table 35 *(continued)*

No.	Type	Description
		— Bidirectional power transfer is done with appropriate active power and reactive power exchanges. Failure end conditions: — Bidirectional power transfer is done with inappropriate active power and reactive power exchanges. — Bidirectional power transfer loop messages have not been sent within timeouts defined in ISO 15118-20. — The energy transfer loop is terminated due to traceability check fails.

7.10 Value-added services [G]

7.10.1 Value-added services

Table 36 — Value-added services

No.	Type	Description
1	Use case element name	Value-added services
2	Use case element ID	G1
3	Objectives	VAS information exchange between the EVCC and the SECC.
4	Description	Optional services that may connect to the local network domain (EV supply equipment) or the internet using IP protocols. In addition to the function of pure charging of electric vehicles, which are described in the various use case elements, additional value-added services to maximize the customer convenience may arise in future applications and environments. EXAMPLE Reservation of a public charging site, spots availability along the journey, required energy for next usage. Scenario description: — The OEM or user requests VAS. — The SECC requests service from the EVCC. — The SECC routes information.
5	Prerequisites	— If required a suitable authorization method needs to be applied prior to using VAS. — The SECC should be online. — The EV and the EV supply equipment are capable of enabling value-added services in general.
6	Requirements	The EV supply equipment shall offer the value-added service. Trigger: — The USER has to request information.
7	End conditions	Success end conditions: — The USER or the secondary actor receives the requested information. Failure end conditions: — The USER or the secondary actor does not receive the requested information.

7.10.2 WG1: ACD system status check

This use case element is a selectable service where the EV/EV supply equipment can check the system status before, during and after energy transfer in parallel to the energy transfer procedure.

Table 37 — ACD system status check

1	Use case element name	ACD system status check
2	Use case element ID	WG1
3	Objectives	For the EV/EV supply equipment to check the system status at all times after establishment of HLC so that there will be no damage to both the EV and EV supply equipment due to unexpected conditions before/during/after the energy transfer process.
4	Description	This use case is a service which when selected will run in parallel to the energy transfer process. The actors involved are: — Primary actors: EV, EVCC EV supply equipment, SECC. Basic elementary use case description: — After HLC establishment, the EV can select the additional service which performs constant checking on the system status. — If the energy transfer involves ACD, the EV has to select the system status service, and can only charge or discharge at an EV supply equipment which provides this service. — The system status service may be used as soon as it was selected. — If selected, the EVCC shall support the system status service throughout the whole energy transfer process. — Messages are exchanged between the EVCC and the SECC to query and report on its system status. If an error occurs during checking of the system status, the energy transfer process shall be aborted. — In case of safety errors handled by another channel than ISO 15118 (e.g. IEC 61851-1 pilot wire) HLC is used only to inform communication controllers of the new state reached after the error.
5	Prerequisites	— HLC is established. — The system status service is offered by the EV supply equipment and selected by the EV.
6	Requirements	— If selected, the EVCC shall support the system status service throughout the whole energy transfer process. — Messages are exchanged between the EVCC and the SECC to query and report on its system status. If an error occurs during checking of the system status, the energy transfer process shall be aborted. Trigger — The EV initiates the system status service.
7	End conditions	Success end conditions: — The system status is reported whenever a query is made throughout the energy transfer procedure. Failure end conditions: — Either the EV or the EV supply equipment is not able to provide the system status service at any point of time after it is selected before the energy transfer procedure has ended.

7.10.3 Energy transfer details

Table 38 — Energy transfer details

No.	Type	Description
1	Use case element name	Energy transfer details
2	Use case element ID	G2
3	Objectives	Information supply of current energy transfer process to the vehicle user or secondary actor.
4	Description	This use case covers the exchange of information regarding the current energy transfer process to the SECC. Parameters like battery status and state of charge could be provided for the SECC. The SECC or secondary actor, aware of the status of its energy transfer process, delivers information to the vehicle user. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC, HMI. Scenario Description: — An SDR is requested. — The SECC requests a record from the EVCC. — The EVCC sends the record to the SECC after the request is accepted. — The SECC provides information for the secondary actor or HMI. The following information needs to be exchanged between the actors: From the EVCC to the SECC: EV charging and discharging details according to the requested list. It shall be indicated if the requested information is not available from the EV side. From the SECC to the EVCC: Authorization to request energy transfer details, list of requested energy transfer details.
5	Prerequisites	— Target setting or energy transfer scheduling according to use case elements of E shall be established successfully. — The energy transfer loop shall be active. — The EV is capable of delivering energy transfer details.
6	Requirements	— The USER/HMI or secondary actor has requested information. — The EVCC and the SECC shall comply with traceability requirements.
7	End conditions	Success end conditions: — The USER or secondary actor receives the requested information. Failure end conditions: — The USER or secondary actor does not receive the requested information.

7.11 End of energy transfer process [H]

7.11.1 General

The EVCC should end the energy transfer process by sending a request to the SECC and the SECC should respond by switching off the power in case of charging and releasing the locking feature (if implemented). All or single steps of this shutdown sequence may only be necessary if the energy transfer process is still in progress when the user initiates the end of the process.

If the system is equipped with a locking feature and it has been activated at least once during the current energy transfer session, it shall not be deactivated before the state transition from "C" (or "D") to "B" according to IEC 61851-1 occurs.

NOTE If the physical connection between the EV and the EV supply equipment is impaired by an unexpected disconnect or other error, impacting the electrical safety of the energy transfer system, the procedures of IEC 61851–1 apply.

7.11.2 End of energy transfer process

Table 39 — End of energy transfer process

No.	Type	Description
1	Use case element name	Ending energy transfer process
2	Use case element ID	H1
3	Objectives	Closing down the energy transfer process in a safe and secure way whilst exchanging all relevant information required for subsequent procedures.
4	Description	This use case covers the basic ending energy transfer process. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC, USER Basic elementary use case description: — The USER returns to the EV or EV supply equipment and initiates the end of energy transfer process. — Usually the USER requests the end of the energy transfer process on the EV side and the EVCC will tell the SECC that the energy transfer process will end. — For specific scenarios where the USER is indicating this on the EV supply equipment side, e.g. using authentication by alternative means, the SECC will request the EVCC to end the energy transfer process. NOTE 1 The SECC Indicates the end of the charging session by setting the notification parameter according to ISO 15118-2 or ISO 15118-20. — The EV switches to state B according to IEC 61851-1. — The EV supply equipment opens main switches according to IEC 61851-1. — If an SDR is generated on the EV supply equipment side, it will be transferred to authorized secondary actors. — If applicable, the EV supply equipment releases the connector on the EV supply equipment as soon as it detects state A according to IEC 61851-1. Between the EVCC and the SECC the information end energy transfer process is exchanged. NOTE 2 The exact sequence and nature of each step depends on the preceding use cases.
5	Prerequisites	Charge controlling and re-scheduling according to use case elements F2 or F3 or F4 shall be established successfully; or End of energy transfer according to conditions defined in ISO 15118-2 or ISO 15118-20.
6	Requirements	The SDR may be generated according to traceability requirements and sent to authorized secondary actors. Trigger: The energy transfer loop shall be completed. The USER, the EV supply equipment or the EV initiates the end of energy transfer process.

Table 39 *(continued)*

No.	Type	Description
7	End conditions	Success end conditions: — The process is terminated and the billing procedure is terminated normally. — The SDR is sent to the authorized SA. Failure end conditions: — The procedure is not terminated normally and information is lost. — The EV does not respect the indication of the EV supply equipment and the sequence as for IEC 61851-1:2017, Annex A.

7.12 WPT end of charge WH1

7.12.1 General

The EVCC should end the charging process by sending a request to the SECC and the SECC should respond by switching off the power and releasing the locking feature (if implemented). All or single steps of this shutdown sequence may only be necessary if the charge process is still in progress when the user initiates the end of the process.

If the system is equipped with a (wheel) locking feature and it has been activated at least once during the current charging session, it shall not be deactivated before the state transition from "WPT_S_STO" to "WPT_S_SB" according to IEC 61980-2.

NOTE If the physical connection between the EV and the EV supply equipment is impaired by an unexpected unlock or other error, impacting the electrical safety of the charging system, the procedures of IEC 61980-2 apply.

7.12.2 WPT end of charge WH1

Table 40 — WPT end of charge

1	Use case element name	WPT end of charge
2	Use case element ID	WH1
3	Objectives	Closing down the charging process in a safe and secure way whilst exchanging all relevant information required for subsequent procedures.
4	Description	This use case covers the basic ending charging process. The actors involved are: — Primary actors: EV, EVCC, EV supply equipment, SECC, USER Basic elementary use case description: