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# SAE J2847/2 DC V2X

## CEC Workshop

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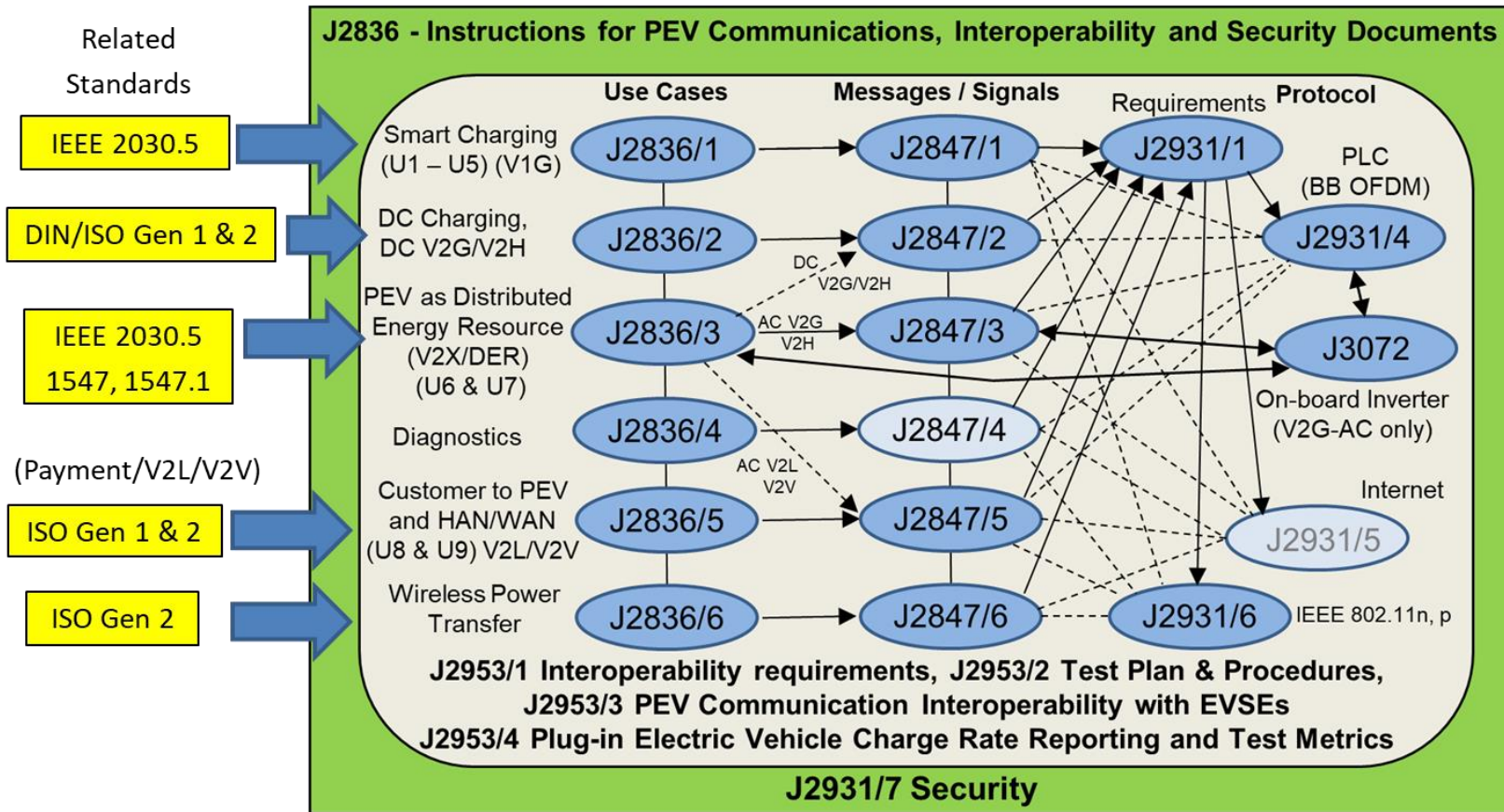
Chairman – SAE Hybrid Communication and Interoperability Task Force

# Overview

- Options for V2H and V2G using SAE J2847/2, and how it is related to and different from ISO 15118
  - Security level requirements
  - PnC options
- What is ISO 15118-20, and what is its scope for use?
  - Added ISO 15118-20 Light to J2847/2

# SAE Standards Summary

- 1) J2847/2 – DC V2G/V2H MESSAGES
- 2) J2847/3 – AC V2G/V2H MESSAGES
- 3) J2847/5 – AC V2L/V2V
- 4) J2836/3 – V2X USE CASES



## **Objective:**

- SAE J2847/2 identifies how to apply ISO 15118-2 (Gen 1) for DC V2H/V2G
  - Allows vehicle OEMs and EVSE suppliers to use this existing DC Charging solution for BPT, while still implementing ISO 15118-20 (Gen 2).
  - ISO 15118-20 is published but still needs conformance standards to be finalized and published, along with additional test events and user groups work thru interoperability items.
- This requires no changes to the ISO 15118-2 schema, stages, messages or signals.
  - It's an Application-level software update only, meaning it could also be applied to existing vehicles using ISO 15118-2.
- There is no change to the EVSE Pilot signal, still uses the 5% PWM and 1kHz frequency.
- J2847/2 Includes the complete home system and additional requirements for V2H.

## **Targeted Customer:**

- Homes with 10-20kW DC EVSEs
  - AC V2G/V2H however, is included in SAE J2847/3 to meet J3072/IEEE 1547:2018 requirements.

## **Status:**

- DIN 70121:2014 is harmonized with SAE J2847/2:2015 and now adds the references to ISO Gen 1 & Gen 2 documents that were not published during the previous release.

## **Next Steps to be considered:**

- Add PV and ESS to home, add advanced grid functions (IEEE 1547 requirements) for the EVSE to meet.

# The Negotiation phase (ServiceDiscovery) adds a unique ServiceID and ServiceName

ISO 15118-2			
ServiceID	ServiceName	ServiceCategory	Description
0			Reserved by ISO/IEC
1	AC_DC_Charging	EVCharging	All charging services as defined by SupportedEnergyTransferMode in subclause 8.5.2.3.
2	Certificate	ContractCertificate	Service allowing to update or install Contract Certificates.
3	InternetAccess	Internet	Service for standard protocols like HTTP, HTTPs, FTP, etc.
4	UseCaseInformation	EVSEInformation	Service enabling the exchange of use case specific information about the EVSE.
28472	SAE J2847/2 V2H	OtherCustom	DC Vehicle-to-Home - V2H (EVSE inverter is grid forming).
28473	SAE J2847/2 V2G	OtherCustom	DC Vehicle-to-Grid - V2G (EVSE inverter is grid following).
5-60000			Reserved by ISO/IEC
60001-65535			Reserved for implementation specific use

- V2H (Grid Forming) sends 28472 and “1” (AC\_DC\_Charging)
- V2G (Grid Following) sends 28473 and “1”

# V2H

- Always initiated by the home thru the EVSE
- ATS signal to the EVSE that grid power is out and home is isolated
- EVSE triggers the EV (in Initialization stage) using negative signals that V2H is requested, instead of charging or V2G.

# V2G

- Can be initiated by home thru EVSE or customer thru EV
- The same negative signals are transmitted in Energy Transfer stage (instead of Initialization stage).

# SAE/DIN vs. ISO 15118-2 Comparison

EV Signal Request: Green – V2H, Yellow = V2G, Blue = Common

Note: EVTargetCurrent is only V2G, not V2H

Add Service Negotiation (ISO -2)

Stages		Initialization														PreCharge		Energy Transfer			Shutdown			
<u>EV Signals &amp; Messages</u>	<u>Advanced (ISO Gen 1, ED 1)</u>	<u>Basic (DIN)</u>	SupportedAppProtocolReq	SessionSetupReq	ServiceDiscoveryReq	ServiceDetailReq (ISO only)	ServicePaymentSelectionReq (DIN only)	PaymentServiceSelectionReq (ISO only)	CertificateInstallationReq (ISO only - Install or Update)	ContractAuthenticationReq (DIN only)	CertificateUpdateReq (ISO only - Update or Install)	PaymentDetailsReq (ISO & PnC only)	AuthorizationReq (ISO only)	ChargeParameterDiscoveryReq	CableCheckReq (DC only)	Pre-ChargeReq (DC only)	PowerDeliveryReq	CurrentDemandReq (DC only)	ChargingStatusReq (ISO & AC only)	MeteringReceiptReq (ISO & PnC only)	PowerDeliveryReq	WeldingDetectionReq (DC only)	SessionStopReq	
	<u>Advanced (ISO Gen 1, ED 1)</u>	2.0	DC	X	X	X	X		X	0		0	0	X	X	X	X	X		0	X	X	X	
AC			X	X	X	X		X	0		0	0	X	X			X		X	0	X		X	
PnC			0	1	2	3		4	5		6	7	8	9	10	11	12	13	14	15		16	17	18
EIM			0	1	2	3		4					5	6	7	8	9	10	11			12	13	14
<u>Basic (DIN ED 1)</u>		1.0	0	1	2		X			Y				3	4	5	6	7			8	9	10	
EV Maximum Current Limit (DC only)		15												O MP				O MP						
	20													M				O M						
EV Maximum Power Limit (DC only)	22	16												O M				O M						
EV Target Current	28	22														M		M						



# SAE/DIN vs. ISO 15118-2 Comparison

EVSE Signal Response: Green – V2H, Yellow = V2G, Blue = Common

Note: EVSEMinimumCurrentLimit is only for V2H, not V2G.

Stages		Initialization														PreCharge		Energy Transfer			Shutdown			
<u>EVSE Signals &amp; Messages</u>	<u>Advanced (ISO Gen 1, ED 1)</u>	<u>Basic (DIN)</u>	SupportedAppProtocolRes	SessionSetupRes	ServiceDiscoveryRes	ServiceDetailRes (ISO only)	ServicePaymentSelectionRes (DIN only)	PaymentServiceSelection Res (ISO only)	CertificateInstallationRes (ISO only - Install or Update)	Contract AuthenticationRes (DIN only)	CertificateUpdateRes (ISO only - Update or Install)	PaymentDetailsRes (ISO & PnC only)	AuthorizationRes (ISO only)	ChargeParameterDiscoveryRes	CableCheckRes (DC only)	Pre-ChargeRes (DC only)	PowerDeliveryRes	CurrentDemandRes (DC only)	ChargingStatusRes (ISO & AC only)	MeteringReceiptRes (ISO & PnC only)	PowerDeliveryRes	WeldingDetectionRes (DC only)	SessionStopRes	
	<u>Advanced (ISO Gen 1, ED 1)</u>	2.0	DC	X	X	X	X		X	0		0	0	X	X	X	X	X	X		0	X	X	X
AC			X	X	X	X		X	0		0	0	X	X			X		X	0	X		X	
PnC			0	1	2	3		4	5			6	7	8	9	10	11	12	13	14	15	16	17	18
EIM			0	1	2	3		4						5	6	7	8	9	10	11		12	13	14
<u>Basic (DIN)</u>		1.0	0	1	2		X			Y				3	4	5	6	7			8	9	10	
EVSE Maximum Current Limit (DC only)		12												MP										
	22													O										
EVSE Maximum Power Limit (DC only)		13												MP										
	23													O										
EVSE Minimum Current Limit (DC only)	25	15												M										

# Current and Power signals are “signed values” Use the Negative Value signal (instead of positive)

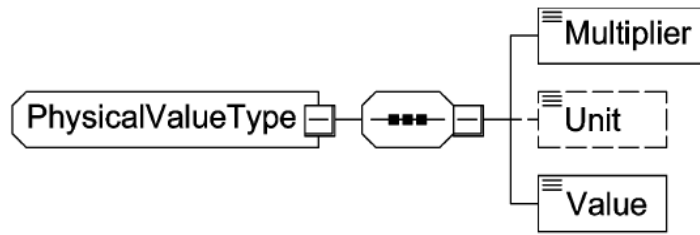


Figure 60 — Schema diagram – PhysicalValueType

EVSEMaximumCurrentLimit

Multiplier: 1

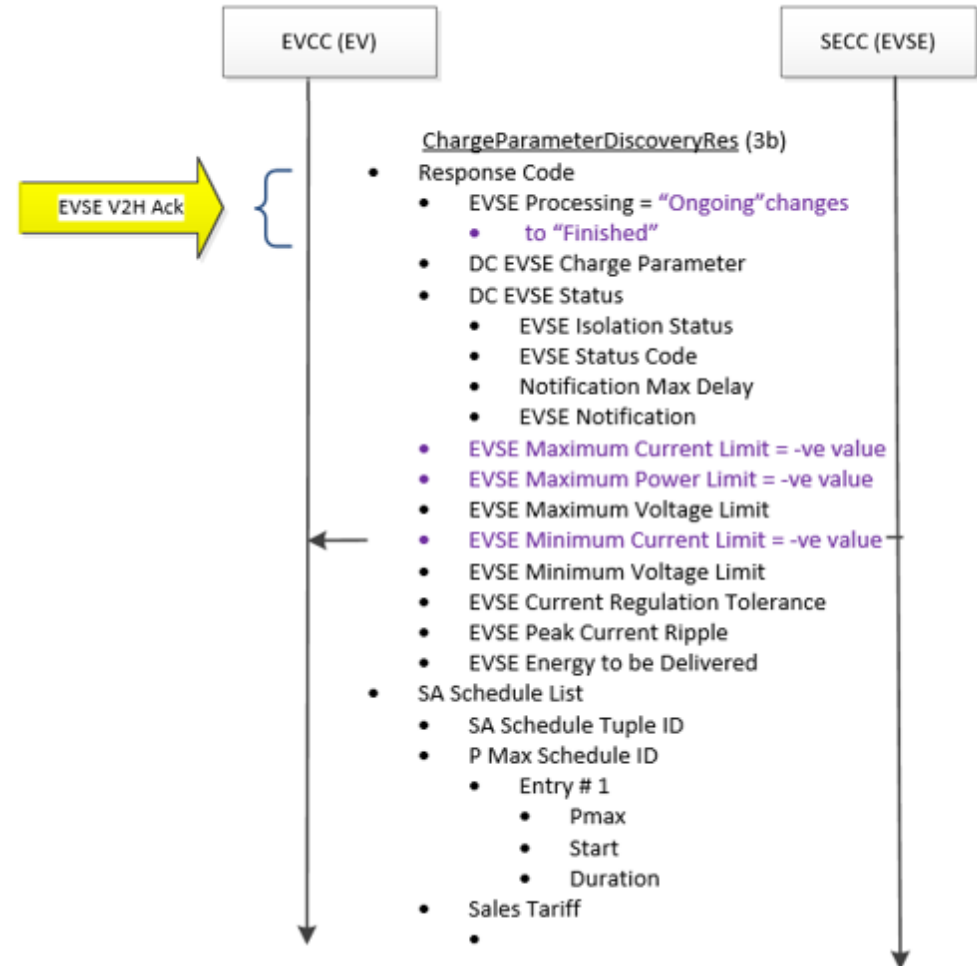
Unit: A

Value: -2

[EVSEMaximumCurrentLimit: -20]

The value can be positive or negative

**The combination of a positive multiplier and negative value provides the format for BPT.**

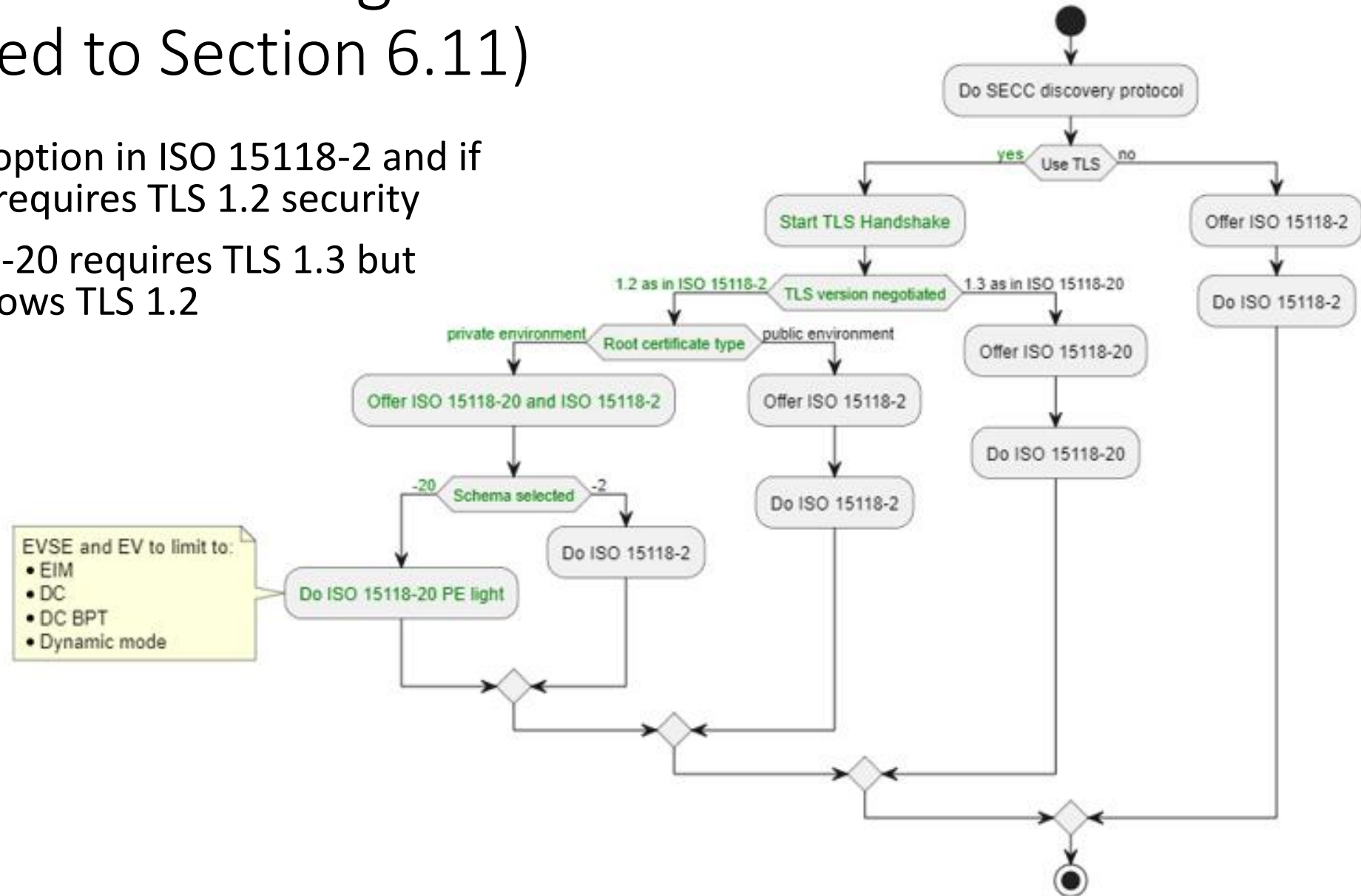


# Summary

- No change to schema or base software.
  - Vehicle level - Application layer software change only.
- Allows use of ISO 15118-2 communications as options for BPT, same as DC charging.
- Provides bidirectional DC EVSEs now, while ISO 15118-20 is being implemented.
  - ISO Gen 2 Conformance standards, test events, etc. can proceed while the customer's immediate needs for V2H can be met.

# ISO 15118-20 Light (Added to Section 6.11)

- PnC is an option in ISO 15118-2 and if included, requires TLS 1.2 security
- ISO 15118-20 requires TLS 1.3 but “Light” allows TLS 1.2

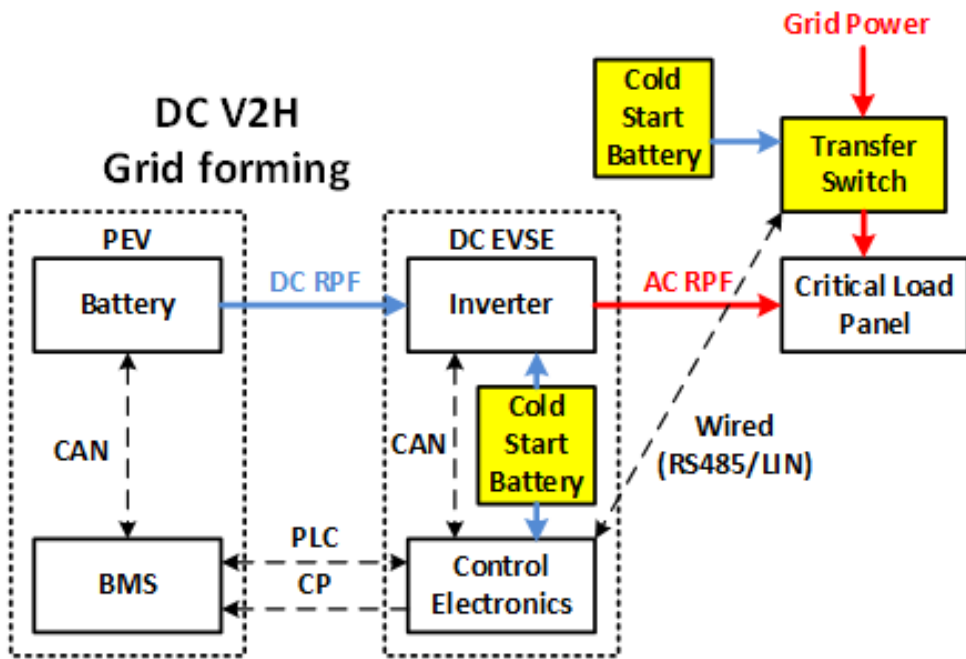


# Backup

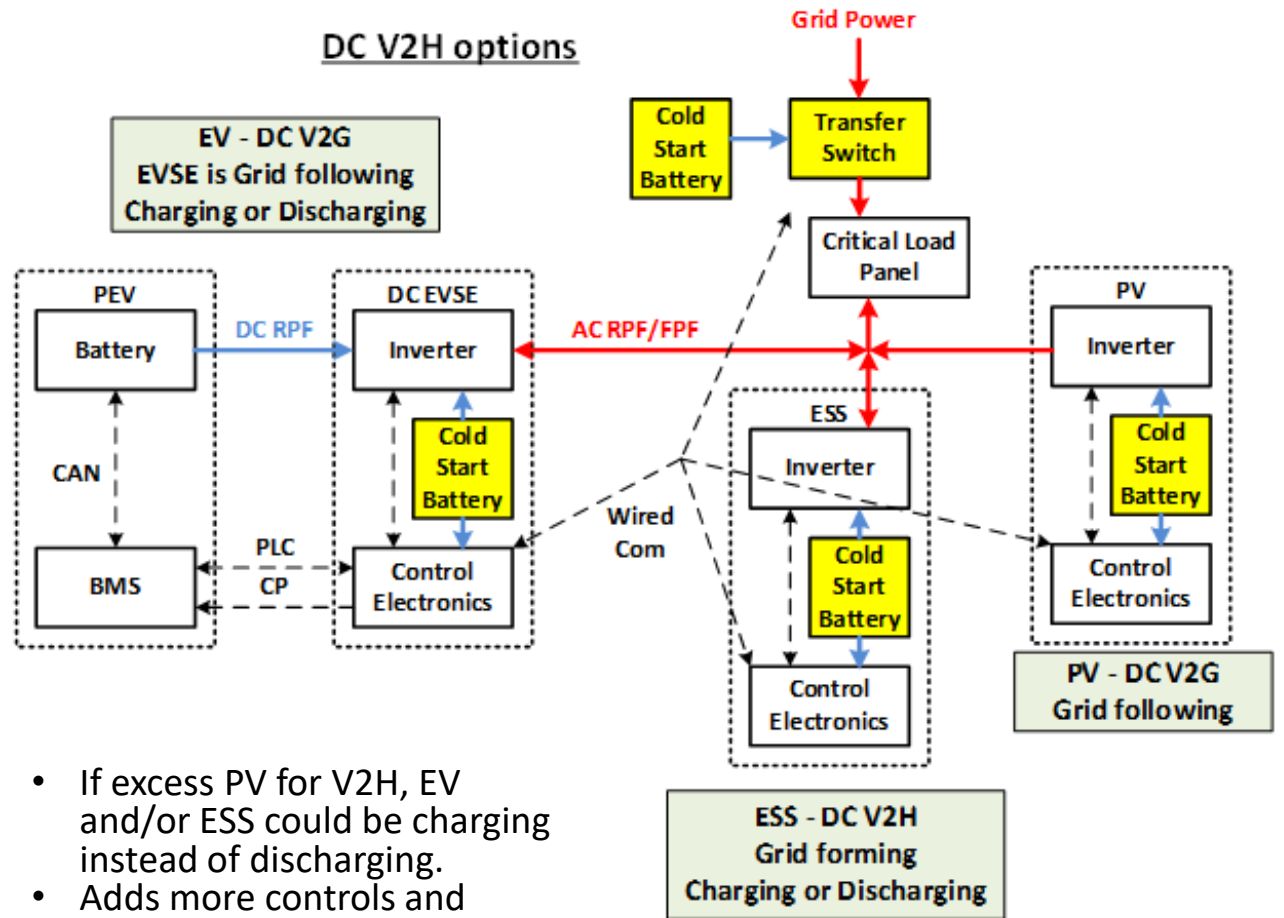
Details on implementation

# J2847/2 Next Steps

Now (2022): Basic Functions  
EV is only source for V2H



2023: Reopen for added Functions  
Include PV and/or ESS as sources



- If excess PV for V2H, EV and/or ESS could be charging instead of discharging.
- Adds more controls and complexity to HEMS

# V2H Additional items

- Automatic Transfer Switch (ATS) – isolates home when grid power is lost and prior to V2H session
  - Signals from ATS to EVSE (confirming home is isolated)
- Home balancing transfer (if not in DC EVSE) – balances 120/240VAC loads in the home
- Isolation monitoring – no change from charging
  - EVSE still needs to perform Cable check prior to precharge and closing EV contactors
- Precharge EVSE (V2H only)
  - Options: (1) home stable energy source device precharges EVSE or (2) EV precharges EVSE
  - If EV precharges EVSE, consideration needs to be included for 400V vs. 800V HV packs
- EVSE bi-directional inverter needs to accept both 400V or 800V power from EV
  - or 800V EV needs a buck/boost inverter to step down voltage
  - (EV requires a boost inverter for charging at legacy DC EVSEs that are only 500VDC max)
- Home cold start battery (stable energy source device)
  - Powers the ATS controls and DC EVSE controls. Supports DC EVSE during Cable check.

# System Schematic

