

SURFACE VEHICLE TECHNICAL INFORMATION REPORT	J2836™	DEC2024
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Superseding J2836 JUL2018		
(R) Instructions for Using Plug-In Electric Vehicle (PEV) Communications, Interoperability, and Security Documents		

RATIONALE

This SAE Technical Information Report has been updated to add the summary and references to the new documents now published and updates to existing documents for V2X Charge Rate Reporting and other features.

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Full document details: SAE J2836_202412

For more information on this standard, visit https://www.sae.org/standards/content/J2836_202412/

Documents



Standard, visit Sharing Hub

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1. SCOPE

This SAE Technical Information Report (TIR) establishes the instructions for the documents required for the variety of potential functions for PEV communications, energy transfer options, interoperability, and security. This includes the history, current status, and future plans for migrating through these documents created in the Hybrid Communication and Interoperability Task Force, based on functional objective (e.g., [1] If I want to do V2G with an off-board inverter, what documents and items within them do I need, [2] What do we intend for V3 of SAE J2953, ...).

1.1 Purpose

The purpose of SAE J2836 is to document the general information that is supported by SAE J2836, SAE J2847, SAE J2931, and SAE J2953 series and SAE J3072 for Plug-In Electric Vehicles.

1.2 Background

PEV charging and communications include several options, and the Communication and Interoperability Task Force determined how to separate these functions in their effort to keep the standards concise and targeted toward each of the objectives and generate various versions of the documents as the market matured and updated aspects could be added. Smart Charging was the initial approach, and Use Cases were generated that included interaction with the utility. These Use Cases were included in SAE J2836/1, and the messages added to SAE J2847/1. The communication protocol high-level requirements are in SAE J2931/1, and the specific median is SAE J2931/4. The task force soon followed with DC charging with the same approach and continued into six slash sheets of Use Cases and Messages. These are described in this TIR, and the objective is to identify the document path for all options that can be considered.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1634	Battery Electric Vehicle Energy Consumption and Range Test Procedure
SAE J1772	SAE Electric Vehicle and Plug-in Hybrid Electric Vehicle Conductive Charge Coupler
SAE J2836/1	Use Cases for Communication Between Plug-in Vehicles and the Utility Grid
SAE J2836/2	Use Cases for Communication Between Plug-in Vehicles and Off-Board DC Charger
SAE J2836/3	Use Cases for Plug-In Vehicle Communication as a Distributed Energy Resource
SAE J2836/4	Use Cases for Diagnostic Communication for Plug-in Electric Vehicles
SAE J2836/5	Use Cases for Customer Communication for Plug-in Electric Vehicles
SAE J2836/6	Use Cases for Wireless Charging Communication for Plug-in Electric Vehicles
SAE J2847/1	Communication for Smart Charging of Plug-in Electric Vehicles Using Smart Energy Profile 2.0
SAE J2847/2	Communication Between Plug-in Vehicles and Off-Board DC Chargers
SAE J2847/3	Communication for Plug-in Vehicles as a Distributed Energy Source

SAE J2847/5	Communication Between Plug-in Vehicles and Customers
SAE J2847/6	Communication for Wireless Power Transfer Between Light-Duty Plug-in Electric Vehicles and Wireless EV Charging Stations
SAE J2894/1	Power Quality Requirements for Plug-In Electric Vehicle Chargers
SAE J2931/1	Digital Communications for Plug-in Electric Vehicles
SAE J2931/4	Broadband PLC Communication for Plug-in Electric Vehicles
SAE J2931/6	Signaling Communication for Wirelessly Charged Electric Vehicles
SAE J2931/7	Security for Plug-In Electric Vehicle Communications
SAE J2953/1	Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)
SAE J2953/2	Test Procedures for the Plug-in Electric Vehicle (PEV) Interoperability with Electric Vehicle Supply Equipment (EVSE)
SAE J2953/4	Plug-In Electrical Vehicle Charge Rate Reporting and Test Procedures
SAE J2954	Wireless Power Transfer for Light-Duty Plug-in/Electric Vehicles and Alignment Methodology
SAE J2954/2	Wireless Power Transfer for Heavy-Duty Electric Vehicles
SAE J3072	Interconnection Requirements for Onboard, Grid Support Inverter Systems
SAE J3400	North American Charging System (NACS) for Electric Vehicles

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ANSI C12.20 Electricity Meters - 0.2 and 0.5 Accuracy Classes

2.1.3 Code of Federal Regulations (CFR) Publications

Copies of these documents are available online at <https://www.ecfr.gov>.

16 CFR Part 309 Labeling Requirements for Alternative Fuels and Alternative Fueled Vehicles

2.1.4 DIN Publications

Copies of these documents are available online at <https://www.din.de/en/>.

DIN SPEC 70121:2014	Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System
DIN SPEC 70122	Conformance tests for digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System

2.1.5 EPRI Publications

Available from Electric Power Research Institute, 3420 Hillview Avenue, Palo Alto, CA 94304, Tel: 650-855-2000, www.epri.com.

Common Functions for Smart Inverters, Version 4, EPRI, Palo Alto, CA, 2016, 3002008217

Open Vehicle-Grid Integration Platform: General Overview, EPRI, Palo Alto, CA, 2016, 3002008705

Open Vehicle-Grid Integration Platform - Unified Approach to Grid/Vehicle Integration: Definition of Use Case Requirements, EPRI, Palo Alto, CA, 2015, 3002005994

EPRI's recently pre-published EV Charging Standards Guidebook document:

[An Electric Vehicle Charging Standards Guidebook for North America: First Edition \(epri.com\)](http://www.epri.com)

2.1.6 IEEE Publications

Available from IEEE Operations Center, 445 and 501 Hoes Lane, Piscataway, NJ 08854-4141, Tel: 732-981-0060, www.ieee.org.

IEEE 1547	Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
IEEE 1547.1-2020	Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems
IEEE 1547.3	Guide for Cybersecurity of Distributed Energy Resources Interconnected with Electric Power Systems
IEEE 2030.5-2018	Standard for Smart Energy Profile Application Protocol

2.1.7 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 15118-1	Road vehicles - Vehicle to grid communication interface - Part 1: General information and use-case definition
ISO 15118-2	Road vehicles - Vehicle to grid communication interface - Part 2: Network and application protocol requirements
ISO 15118-3	Road vehicles - Vehicle to grid communication interface - Part 3: Physical layer and data link layer requirements
ISO 15118-4	Road vehicles - Vehicle to grid communication interface - Part 4: Network and application protocol conformance test
ISO 15118-5	Road vehicles - Vehicle to grid communication interface - Part 5: Physical and data link layer conformance test
ISO 15118-6	Road vehicles - Vehicle to grid communication interface - Part 6: Physical layer and data link layer requirements for differential HomePlug Green PHY

- ISO 15118-8 Road vehicles - Vehicle to grid communication interface - Part 8: Physical layer and data link layer requirements for wireless communication
- ISO 15118-9 Road vehicles - Vehicle to grid communication interface - Part 9: Physical layer and data link layer conformance test for wireless communication
- ISO 15118-10 Road vehicles - Vehicle to grid communication interface - Part 10: Physical layer and data link layer requirements for single-pair Ethernet
- ISO 15118-20 Road vehicles - Vehicle to grid communication interface - Part 20: 2nd generation network layer and application layer requirements
- ISO 15118-21 Road vehicles - Vehicle to grid communication interface - Part 21: Common 2nd generation network layer and application layer requirements conformance test plan
- ISO 15118-23 Road vehicles - Vehicle to grid communication interface - Part 23: 2nd generation network layer and application layer requirements conformance test plan - DC charging

2.1.8 NFPA Publications

Available from National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471, Tel: 617-770-3000, www.nfpa.org.

NFPA 70®, National Electrical Code® (NEC®)

2.1.9 NIST Publications

Available from NIST, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070, Tel: 301-975-6478, www.nist.gov.

NIST Handbook 130 Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality

NIST HB44-3.40 Measurement Requirements for Electric Vehicle Fueling Systems

NIST IR 7628 Guidelines for Smart Grid Cybersecurity

2.1.10 UL Publications

Available from UL, 333 Pfingsten Road, Northbrook, IL 60062-2096, Tel: 847-272-8800, www.ul.com.

UL 1741 Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

UL 1741 SB Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources: Supplement SB

UL 1741 SC Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources: Supplement SC (Bidirectional Electric Vehicle Supply Equipment (BEVSE)/Interconnection Systems Equipment (ISE) for EVs with Bidirectional Onboard Inverters)

UL 2202 Standard for Safety for Electric Vehicle (EV) Charging System Equipment

- UL 2941 Outline of Investigation for Cybersecurity of Distributed Energy and Inverter-Based Resources
- UL 9741 Outline of Investigation for Bidirectional Electric Vehicle (EV) Charging System Equipment
- UL 61010-1 Safety Requirements for Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements

2.1.11 United States Code Publications

Copies of these documents are available online at <https://uscode.house.gov/>.

42 U.S.C. §17381 Statement of policy on modernization of electricity grid

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1715 Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology

2.2.2 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

- IEC 61851-1 Electric vehicle conductive charging system - Part 1: General requirements
- IEC 61851-23 Electric vehicle conductive charging system - Part 23: DC electric vehicle supply equipment
- IEC 61851-24 Electric vehicle conductive charging system - Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging
- IEC 62196-1 Plugs, socket-outlets, vehicles connectors and vehicle inlets - Conductive charging of electric vehicles - Part 1: General requirements
- IEC 62196-2 Plugs, socket-outlets, vehicles connectors and vehicle inlets - Conductive charging of electric vehicles - Part 2: Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories
- IEC 62196-3 Plugs, socket-outlets, vehicles connectors and vehicle inlets - Conductive charging of electric vehicles - Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers

2.2.3 Connectivity Standards Alliance Publications

Available from Connectivity Standards Alliance, 508 2nd Street, Suite 109B, Davis, CA 95616, <https://csa-iot.org/>.

Matter 1.3 and Later Releases - EVSE Management and Device Energy Management support - provides management of all loads and DER supplies (solar, Battery, EV) with NIST compliant ECC security.
<https://community.csa-iot.org/page/matter-resource-kit> Global Open-source standard. Overlay protocol on EVSE to talk to other devices in the home.

3. DEFINITIONS

3.1 BIDIRECTIONAL CONVERTER

A bidirectional converter is the term used for a device that can convert from AC to DC in one direction to serve as a battery charger and then be capable of being reversed and convert from DC to AC in the other direction to serve as an inverter.

3.2 CHARGER

The charger can either be on-board the vehicle or off-board. On-board chargers require AC energy transfer to the vehicle (either 120 V or 240 V single phase), and off-board chargers are within the EVSE and require DC energy transfer to the vehicle.

3.3 DISTRIBUTED ENERGY RESOURCES (DER)

A Distributed Energy Resource is a small generation source or energy storage system (ESS) that connects to the distribution grid. A rooftop photovoltaic (PV) system is one of the most common types of DER. The combined EVSE and PEV form an ESS type of DER.

3.4 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)

This is the generic term used to describe the device that is physically connected and provides energy to the vehicle. EVSEs may take several physical forms, and their logical function may likewise differ substantially. Physical forms include a mobile cordset used for 120 VAC charging, a fixed or wall-mounted 240 VAC charger, or an off-board DC charger. An EVSE may also support reverse power flow (discharging).

3.5 ENERGY MANAGEMENT SYSTEM (EMS)

An Energy Management System is a computer system that can communicate with a PEV or EVSE for the purpose of controlling the charging or discharging of the PEV battery. An EMS can exist at several tiers: customer premises, distribution level, or system level. These computer systems may go by other names, but the term EMS will be used generically in this document.

3.6 ENERGY PORTAL

Energy Portal is any charging point for a PEV. At a minimum, the Energy Portal is a 120 V, 15 A outlet but can also be a 240 V Electric Vehicle Supply Equipment (EVSE) outlet connected to the premises circuit. This needs to follow the nomenclature in SAE J1772 for L1 and L2 charging.

3.7 ENERGY TRANSFER STRATEGY

A strategy that accounts for all of the electrical energy needs of an EV and the present status of all on-board equipment, including the EV Storage Battery. It determines the rate that energy is to be transferred to the EV and how the ETS shall be operated to accomplish this.

3.8 FORWARD POWER FLOW (FPF)

Forward Power Flow means the direction of energy for Charging a Vehicle. While the term “forward” suggests a positive sign convention, care must be used with any communications because the convention for DER devices is to use a positive sign to designate energy produced (discharged) by the DER.

3.9 FOUR-QUADRANT CONVERTER

This term refers to an electronic device that can produce or absorb both active and reactive power. When a PEV is discharging, the device serves as an inverter converting DC current to AC current. It can displace the AC current waveform relative to the AC voltage waveform to generate or absorb reactive power, depending on whether it leads or lags the supplied current relative to the grid voltage. The device converts AC power to DC current to charge the PEV battery. It can also shift the consumed current relative to the grid voltage waveform to produce or absorb reactive power.

3.10 HOME AREA NETWORK (HAN)

A HAN is an energy related network, contained within a premise used for communicating with devices within the premises. HANs do not necessarily require connectivity outside the premises but may be connected to one or more external communication networks (e.g., Utility AMI, internet, cell phone network, etc.) using gateways, bridges, and interfaces.

HomePlug powerline adapters are an alternative solution for having your house completely networked using existing power lines. The advanced HomePlug powerline adapter is capable of transmitting data at up to 200 Mbps channel data rate. The HomePlug powerline adapter delivers maximum range and speed for voice, internet, video, and music throughout your home or office.

Matter is a HAN protocol that support ethernet, Wi-Fi, and Thread via 802.15.4 using IPv6 network with encrypted security with a common application layer used to talk between all loads, all DER supplies (solar, battery, EVs) using common HMI interfaces - voice controls, cell phones, Amazon Echo/Google Look/Apple, Matter TV to common global home ecosystems.

3.11 INTEROPERABILITY

The condition where components of a system, relative to each other, are able to work together to perform the intended operation of the total system. Information interoperability is the capability of two or more networks, systems, devices, applications, or components to share and readily use information securely and effectively with little or no inconvenience for the user. As an example, a 10-mm box-end hand wrench and a 10-mm socket wrench are interoperable, relative to a 10-mm hex-head bolt. The wrench and the bolt are both parts of a fastening system. The fact that the system will perform as required with either wrench establishes the interoperability of the wrenches and the bolt.

3.12 INVERTER

AC power is generated from a DC source, such as a traction battery, using a device called an inverter. For operation as an off-grid, standalone power source, the inverter regulates the amplitude and frequency of the AC voltage, and the connected loads determine the AC current flow from the inverter. A grid-connected inverter (i.e., utility-interactive inverter) must act as a current source and synchronizes to the frequency of the grid voltage waveform. A bidirectional converter or four-quadrant converter are often just referenced as being an inverter.

Modern four-quadrant inverters can be grid forming, grid following, or both to add power factor correction and allow home to stay synchronized with grid when islanded when grid is down to allow reconnect when grid comes back up per IEEE 1547.

3.13 PLUG-IN ELECTRIC VEHICLE (PEV)

This is the generic term used to describe any vehicle that plugs in to receive electrical energy. This includes many different classifications of vehicles, such as Battery Electric Vehicle (BEV), Plug-In Hybrid Electric Vehicle (PHEV), Extended-Range Electric Vehicle (E-REV), and so on.

3.14 REVERSE POWER FLOW (RPF)

Reverse Power Flow means the direction of energy for discharging a Vehicle. While the term “reverse” suggests a negative sign convention, care must be used with any communications because the convention for DER devices is to use a positive sign to designate energy produced by the DER.

3.15 TIME CHARGE IS NEEDED (TCIN)

Time Charge Is Needed is the identification of the end of the potential charge session. This is when the customer wants to use their vehicle for the next drive cycle and the expected recharging is complete.

3.16 UTILITY-INTERACTIVE INVERTER

An inverter intended for use in parallel with an electric power system to supply common loads and sometimes deliver power to the utility. This is also called a grid-connected inverter.

3.17 VEHICLE GRID INTEGRATION (VGI)

This is a very broad term that encompasses the many ways in which a vehicle can provide benefits or services to the grid, to society, the EV driver, or parking lot site host by optimizing plug-in electric vehicle (PEV) interaction with the electrical grid. VGI includes both active management of electricity (e.g., bidirectional management, such as vehicle-to-grid [also known as V2G] or unidirectional management such as managed charging [also known as V1G]) and/or active management of charging levels by ramping up or down charging. VGI also includes passive solutions such as customer response to existing rates, design of improved utility rates (e.g., time-of-use [TOU] charges, demand charges, and customer fees), design of the grid to accommodate EVs while reducing grid impacts to the degree possible, and education or incentives to encourage charging technology or charging level (e.g., rebates for lower-level charging, modifying current allowance policy).

3.18 VEHICLE TO GRID (V2G)

When vehicle power is fed into the bulk electric grid or a microgrid, we refer to it as “Vehicle-to-Grid” power, or V2G. A PEV in V2G operation is considered by utilities to be a Distributed Energy Resource (DER). V2G is about bidirectional flow and not just reverse flow. The term V2G includes the special case where only the rate of charging can be dynamically controlled - sometimes, this is referred to as V1G. V2G-AC designates the use of an on-board inverter feeding AC power back through the EVSE. V2G-DC designates the use of DC current from the PEV battery with an inverter located in the EVSE.

3.19 VEHICLE TO HOME (V2H)

V2H describes the capability of a vehicle to act as a backup “generator” for selected critical loads in a home isolated from the power grid, for example, after the failure of the power grid. SAE defines two types. For V2G-EPP, the inverter is on-board the PEV and power is routed to an exportable power panel on the PEV. The PEV is connected to the same home backup power port used for portable generators. For V2H-DC, the inverter is in the EVSE and can change modes from a V2G-DC to V2H-DC when the home is disconnected (islanded) from the grid.

3.20 VEHICLE TO LOAD (V2L)

V2L describes the capability of a PEV with an on-board inverter to provide power to tools or other loads which are not connected to a home or the grid. The inverter regulates the amplitude and frequency of the AC voltage, and the power is routed to NEMA receptacles on an exportable power panel.

4. ABBREVIATIONS

A	Amperes
AC	Alternating Current
ADR	Automated Demand Response
AGC	Automatic Generation Control
AMI	Advanced Metering Infrastructure
ANSI	American National Standards Institute
APP	Customer Wireless Application
BA	Balancing Authority
BESS	Battery Energy Storage System
BEV	Battery Electric Vehicle

BMS	Building Management System
BPT	Bidirectional Power Transfer
BTM	Behind-the-Meter
CAISO	California Independent System Operator
CARB	California Air Resources Board
CCS	Combined Charging System
CEC	California Energy Commission
CFR	Code of Federal Regulations
CPP	Critical Peak Pricing
CPUC	California Public Utilities Commission
CSO	Charging Station Operator
DC	Direct Current
DER	Distributed Energy Resources
DERMS	DER Management Systems
DG	Distributed Generation
DIN	German Institute for Standardization
DLC	Direct Load Control
DMS	Distribution Management System
DR	Demand Response
DRLC	Demand Response Load Control
DRP	Distribution Resources Plan
DSO	Distribution System Operator
ECP	Electrical Connection Point
EM	Electricity Meter
EMS	Energy Management System
EPP	Exportable Power Panel
EPRI	Electric Power Research Institute
EPS	Electric Power Systems
ESCO	Energy Services Company

ESI	Energy Services Interface
ESS	Energy Storage System
EUMD	End Use Measurement Device
EV	Electric Vehicle
EVBS	Electric Vehicle Battery System
EVCC	Electric Vehicle Communication Controller
EVSE	Electric Vehicle Supply Equipment
EVSP	Electric Vehicle Services Provider
FERC	Federal Energy Regulatory Commission
FPF	Forward Power Flow
FTC	Federal Trade Commission
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Positioning Satellite
HAN	Home Area Network
HEMS	Home Energy Management System
HFRT	High Frequency Ride Through
HVRT	High Voltage Ride Through
Hz	Hertz
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IFOM	In-Front-of-Meter
IOT	Internet of Things
IOU	Investor-Owned Utility
IRP	Integrated Resources Plan
ISB	International Standards Body
ISO	Independent System Operator
ISO	International Organization for Standardization

kV	Kilovolt
kW	Kilowatts
LCR	Local Capacity Requirements
LDA	Local Distribution Area
LFRT	Low Frequency Ride Through
LMP	Locational Marginal Price
LSE	Load-Serving Entity
LVRT	Low Voltage Ride Through
MOS	Method of Sale
MW	Megawatt
MWh	Megawatt Hour
NAESB	North American Energy Standards Board
NCWM	National Conference on Weights and Measures
NDA	Non-Disclosure Agreement
NEC®	National Electrical Code®
NEM	Net Energy Metering
NEMA	National Electrical Manufacturers Association
NERC	North American Electric Reliability Corporation
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NMV	Net Market Value
NPV	Net Present Value
NQC	Net Qualifying Capacity
NRTL	Nationally Recognized Testing Laboratory
NSB	National Standards Body
NSP	Network Service Provider
NTEP	National Type Evaluation Program
OBW	Operational Bandwidth
OCA	Open Charge Alliance

OCP	Open Charge Point Protocol
OEM	Original Equipment Manufacturer
OVGIP	Open Vehicle Grid Integration Platform
PAP	Priority Action Plan
PCC	Point of Common Coupling
PEV	Plug-In Electric Vehicle
PFE	Power-Flow Entity
PHEV	Plug-In Hybrid Electric Vehicle
PLC	Power Line Carrier
POU	Publicly Owned Utility
PUC	Public Utilities Commission
PV	Photovoltaic (solar)
PWM	Pulse Width Modulation
RP	Recommended Practice
RPF	Reverse Power Flow
RPS	Renewables Portfolio Standard
RTD	Real-Time Dispatch
RTM	Real Time Market
RTO	Regional Transmission Organization
RTP	Real Time Pricing
SCADA	Substation Control and Data Acquisition
SDO	Standards Development Organization
SECC	Supply Equipment Communication Controller
SEP2	Smart Energy Profile 2.0
SGIP	Smart Grid Interoperability Panel
SI	International System of Units
SLAC	Signal Level Attenuation Characteristics
SOC	State of Charge