Information Modeling Distributed Energy Resources (DER) – Extending IEC-CIM

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Agenda

- Overview
- Definition of Distributed Energy Resource (DER)
- System Context
- Use cases
- Information model What is in CIM and what we extended
- Other Projects



Definition on DER

DERs are "Grid connected distributed generation resources such as energy efficiency, demand response, customer generation (e.g., rooftop solar), Whole sale Generation, energy storage, alternative fuel vehicles (e.g., electric vehicles)

Distributed Energy Storage



Distributed Generation



Electric Vehicles & Hybrid Electric Vehicles

Demand Response

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System Context





California Rule 21: Example Net Energy Metering Interconnection Agreements for a Distribution Provider

- Solar and Wind Generating Facility 10 kilowatt or Less
- Generating Facility
- Fuel Cell Electrical Generating Facility
- Generating Facility Multiple Tariff
 - Biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal or tidal current, and any additions or enhancements to the facility using that technology or other fuel cells
- Virtual Net Energy Metering for Multi-Tenant and Multi-Meter Properties
- Multifamily Affordable Solar Housing Virtual Net Metering



Example Form



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Example Form (continued)

Generating Info

Section 7 – <u>New</u> Generating Facility Description / Technical Information The information provided in this section is for the Generating Facility that this Application seeks to have interconnected to SCE's Distribution System or the Generating Facility that this Application seeks to modify (e.g., adding energy storage). Subsections A through D of Section 7 must be completed for all Generating Facilities. Subsections E through G are required, as applicable, only for those Generating Facilities that meet one or more of the following criteria: are sized larger than 10 kW; utilize a technology other than wind, solar or fuel cells that use renewable fuels; have a point of interconnection on the line side of the main circuit breaker (line side tap); require net generation output (NGO) metering; have additional generation on-site (including energy storage devices); and/or utilize non-certified equipment. Please complete a separate Section 7 for each new / modified Generating Facility that is seeking interconnection via this Application.

NOTE: Customers with >1 MW Generating Facilities may be subject to and have additional obligations pursuant to the California Independent System Operator (California ISO) tariff. These Customers should contact the California ISO for more information; SCE is not a party to the Customer's interaction with the California ISO.

A. Generating Facility	Description (see Appendix A)		
i. Number of Generate	rs		Τ
ii. Generator Manufac	turer		Τ
iii. Generator Model N	unber		Τ
iv. Generator Technolo	gy Type		Τ
v. Generator CEC-AC	Nameplate Rating (kW)		Τ
vi. Generator Gross AC Nameplate Rating (kW)			Τ
Required for Generators where the CEC-AC Nameplate Rating is not			
available / applicable	Marchine David and a series		-
vii. Generator Estimate	Monthly Production (kWh)		4
viii. Inverter Information	1 monatory plagra indicate "0" and "N/4"		
a Number of Inver	ters	1	-
h. Inverter Manufa	cturer(es)		-
c. Inverter Model N	umber(s)		-
ix Module Information			-
For Generators that don't i	se modules, please indicate "0" and "N/A"		
a. Number of Modu	les		1
b. Module Manufac	turer(es)		1
c. Module Model N	umber(s)		1
x. Mounting Method	□ Rooftop □ Ground □ Mixed	□ N/A	1
a. Average Standof	· · · · · · · · · · · · · · · · · · ·		1
vi Tracking Type	Eired* Single Aria Duel	Avia D Mired D N/A	-
an Hacking Type		Aris Divinced Div/A	-
	*If fixed, indicate:	Azimuui.	
D. L. C. L. O. L.		ng anays	-
B. Are System Output	Performance Monitoring and Repo	orting Services being utilized?	4
□ Yes □ No			4
If yes, please indicate who	is receiving the data (check all that app	dy):	hea
□ Customer □ Vend	or 🗆 Other		
If applicable, which vende	r is receiving the data:		۲

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Example Form (continued)

Generating & Interface Info

C. Is the Generator certified by a Nationally Recognized Testing Laboratory (NRTL) in				
accordance with Rul	e 21?			
□ Yes				
No – Please explain:				

D. Electrical Connection Method			
□ Load side connection □ Line side com	nection 🗆 Not	sure	
E. Additional Generating Facility Tech	nical Information	(see Appendix A)	
i. Prime Mover Type			
ii. Generator Software Version Number			
iii. Inverter Software Version Number			
iv. Gross Nameplate Rating (kVA)			
v. Gross Nameplate Rating (kW)			
vi. Net Nameplate Rating (RW)			
vii. Operating Voltage (Volts or kV)			
viii. Power Factor (PF) Rating (%)			
ix. PF Adjustment Range (%)	Maximum	Minimum	
x. Wiring Configuration (Choose One)	□ Single-Phase	□ Three-Phase	
xi. 3-Phase Winding Configuration (Choose One)	□ 3 Wire Delta	□ 3 Wire Wye	□ 4 Wire Wye
xii. Neutral Grounding Systems Used	□ Undergrounded [□ Solidly Grounded □	Ground Resistor
(Choose One)	Ohms		
xiii. Short Circuit Current Produced by			
Generator (Amps)			
xiv. Generator Design (Choose One)	Synchronous	Induction	□ Inverter
xv. For Synchronous Generators Only: (Gr	oss kVA Nameplate Ratin	ng must be provided above)
 Base kVA (if different from Gross Nameplate kVA above) 			
b. Synchronous Reactance (%)			
c. Transient Reactance (%)			
d. Subtransient Reactance (%)			
xvi. For Induction Generators Only: (Gross)	kVA Nameplate Rating m	ust be provided above)	
a. Base kVA (if different from Gross			
Nameplate kVA above)			
b. Locked Rotor Current (Amps) OR			
c. Stator Resistance (%)			
d. Stator Leakage Reactance (%)			
e. Kotor Kesistance (%)			
I. Kotor Leakage Keactance (%)			
Motor Only:			
a. In-Rush Current (Amps)			
b. Customer's Main Panel			
Continuous Current Rating (Amps)			

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Example Form (continued)

F.	Information Required for MASH-VNM/ST and NEM-V/ST Interconnection Requests
	Does your interconnection satisfy SCE's ESR?
	□ Yes □ No – Please explain:
i.	Is the current proposed tie-in point a result of restrictions placed on altering the existing panel
	or equipment within, as imposed by the local authority having jurisdiction?
	□ Yes □ No – Please explain:
ij.	Are there existing utility facilities in the vicinity of the proposed point of interconnection?
	Minimum clearances must be maintained from SCE facilities, as specified in SCE's ESR and/or Underground Structures
	Standards (UGS).
	Ves No Notsure

Energy Storage

G. Additional Information Required for Interconnection Requests that Include Energy						
 Storage Devices (e.g., batteries) Will an Energy Storage Device (ESD) be connected behind the same SCE meter as the Net Generating Facility? 						
 Ves, an ESD is currently interconnected (proceed to Section 6.D unless the ESD is being modified) Ves, an ESD will be interconnected as part of this Application (place complete the information below) 						
ii. ESD Type						
iii. Number of ESDs						
iv. ESD Manufacturer(es)						
v. ESD Model Number(s)						
vi. ESD Max Capacity (kWh)						
vii. ESD Rated Discharge (kW)						
viii. ESD Max Discharge (kW)						
ix. Please list the devices used to limit discharge (if any): (e.g., inverter, power control)						
x. Please describe the intended use of the ESD: For example, peak shaving, export to the grid, load shifting, back-up, etc. The intended use specified may be taken into consideration during any applicable study processes.						
xi. Energy Storage Charging Function						
a. Rated Charge Load Demand (kW)						
b. Estimated annual Net Energy Usage* of the ESD (kWh) *Net Energy Usage = (kWh input, including charging, storage device auxiliary loads, and losses) – (kWh output, including discharging)						
c. Will SCE's Distribution System be used to charge the ESD:						
□ Yes □ No						
If no: Provide technical description of control systems including:						
 Source of energy for charging: 						
Mechanism to prevent charging from the Distribution System:						

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Approach to Data Management is 'Model-Driven'



SCE's Layered Model Structure



Standards (CIM, GML), System Interface Specs

Common 'Lego Blocks'

SCE's Common Vocabulary

• Entities Precisely Defined With Coherent Relationships

Semantically Consistent Canonical Models Transformed to Implementation Artifacts: 1. Data-In-Motion 2. Data-At-Rest Energy for What's Ahead®

Object Data Modeling

 Potential multiple definitions of an entity in context (profile) modeling.
 Context 1



Concerns:

- 1. Attributes native to their classes
- 2. Potential duplicated attributes and data types
- 3. Potential mapping issue at attribute level

Semantic Data Modeling

- Single semantics (meaning) across entire model for both:
 - Class (Entity)
 - Attribute (Property)
- Semantic mapping can be made not only at entity level but also property level
 - Both classes and attributes are globalized as:
 - Entity class
 - Property class



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Some Key Patterns in the SCIM

MD3i SB Context Diagram







Up coming information modeling efforts (Using IEC-CIM)

Environmental Data model AMI network upgrade (Socket based Router)



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