Appendix 2: Comparison of Decentralized Energy Interconnection Standards
Existing and Proposed

Source: Decentralized Energy Management Advisory Council

a) Classifications

Category	BC Hydro	Alberta 25kV or less	Ontario	Massachusetts	New York	Texas	California	FERC NOPR	IEEE 1547
Classification	3 levels: *Green* Inverter ≤50kW Small <35kV Large >35kV	3 Levels: Small <10kW 10 – 200 kW 200– 500kW Med. 500– 2000kW 2 - 12.5 MW Large 12.5–50 MW	4 Levels: Micro ≤10kW[1] Small 500kW[2] ≤1MW Mid-Size <10MW >1MW Large ≥10MW	5 Levels: <10 kW 10kW - 60kW 60kW - 300 kW 300kW - 1MW Above 1 MW	4 Levels: less than 15 kW 15kW to 300kW < 300 kW - 2MW <2MW	2 Levels: < 300kW 300kW - 10MW Interconnection <60kV	2 Levels: Small 11kVA or Less Large above 11kVA More Stringent Protection Req'd for Larger Systems	2 Levels: Small ≤2MW Large >2MW-20MW	
If transmission Impacted Study/License Fees	Prelim $12-25,000 Impact $30-65,000	$10,000 if transmitter impacted	$20,000 if transmitter impacted	None Listed Interconnection Study Fees may apply	$350 Non-Refundable Applied to Cost of Interconnection No Fee for DG Rated <15kW	None Listed Interconnection Study Fees May Apply	No $ for Net Metered DG $800 All Others $600 Add'l for Supplemental Review $1400 Min.-If Cust Elects to Bypass Initial and Supplemental Review Steps	None Specified for Expedited Applicat'n $2000 to $50,000 for DG Rated 2MW to 20MW	
If only Distribution Fees	Green <5kW n/c >5kW $600 Prelim Sm $500-3k Lg $3k-6k Impact Lg $20k-40k	Not applicable	Initial consult n/c Engineering study varies			Rating@ < 500kW n/c Study Fee Utility Still May Need to Upgrade System			
Criteria for Expedited Application	Green inverter based requires net meter agreement only	<1 MW - simple one page application process the same	<10kW -not exporting to the system	*Radial* - DG <5% of Line Segment Peak Load *Network* – DG <7% of Site Minimum Load = Expedited Review	Capacity Rating <15kVA Connected to Radial Systems Network Systems Not Addressed	Minimum Threshold <500kW (Radial) <20kW (Network)	Capacity rating <15kVA connected to radial systems Network systems not addressed	Up to 2MW	

[1] 10KW or less –Load Displacement or Emergency Back-Up Generation, to sell power must have IMO licence and follow small generator connection process.
[2] And less than 15kV

a) Classifications

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Minimum Threshold of DG System Impacts for Expedited Review	≤50kW	<1 MW simple application\ process the same	no export <10kW simple 2-page contract	Capacity@ <10kW simple application no agreement req'd	May not be req'd if <50KVA on 1phase line or <150kVA on radial feeder	<500kW radial <20kW network	Radial <15% of line segment peak load	*Radial* – Aggregate May Not Exceed 15% of Circuit Peak or Design Capacity *Network* – 25% of Minimum Load Measured on Ckt Fault Current Contribution <25% of Max.	
Time for Utility to Respond to Application	Small -Preliminary: 3 – 5 wks Large -Preliminary: 5 – 8 wks	Not addressed	All within 15 days	45 Days Following Receipt of NOI	Within 5 business days	4 Weeks for Pre-Certified DG 6 Weeks for Non-Certified DG	3 Days to Issue Interconnection Agreement & 10 Days Once Application Received	Not specified	
Time for Utility to Perform Review and/or Study	Small Design 8 - 24 wks Large Impact 8 - 15 wks Facilities 8 - 15 wks	Not addressed	Micro 15 d Small a) 60 d b) 90 d Mid a) 60 d b) 60 d Large 90 d	90 Days for QF's and On-Site Generating Facilities (<60kW) No Specific Time Line provided for Non-QF's >60kW	30 days < 300kW 60 days 300kW to 2MW	4 Weeks-Radial Lines 6 Weeks-Network Systems	10 Days for Simple Interconnection 20 Days for Supplemnt'l Review Addit'l may be needed for InterconnectStudy	15 Days for Limited Feasibility Study	
Time Allowed for Utility to Interconnect DG to System	Green 14 dys Small 6 - 24 mths Large 12 - 24 mths	Not addressed	Micro 5 d Small a)60 d b) 180 d Mid & Large variable	Not Specified	14 Days Following On-Site Testing	4 Weeks After Receipt of Application for Pre-Certified DG 6 Weeks for Other DG Not Requiring System Upgrades 2 Weeks Following Utility Completion of System Upgrades	Not Specified	Not Addressed	

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Contact		Both utility and DG owner must specify "Operating Authority"	Not specific to individual	Utility Assigns Account Manager	Utility assigns staff point of contact	Utility Contacts Are Listed in Appendix of Interconnection Manual	Utility Assigns staff ngle Point of Contact	Not Addressed	
Credit for DG		Not addressed	Under review	Not Addressed		Utility must assess benefits if study need for upgrade		Transmission Owner Should Apply Credits for Network Upgrades Paid by Customer	
Dispute Resolution	Per power purchase agreement	Not addressed	Yes, to OEB	None indicated	Yes Good Faith Resolution Up to 10 Days Mediation for up to 90 Days Referral to NYPSC if Not Resolve	Yes. PUCT Contact Informal or Formal Resolution w/in 20 Days for Informal Disputes; 35 Days for Formal	Yes Parties Must Meet to Resolve 45 Days Following Applicant's Written Dispute Unresolved Disputes are forward to CPUC	Yes FERC's alternative Dispute Resolution Process	
Assessment Charges		Customer Pays	Customer Pays		No PSC Recommends Self Coverage	None specifi'd	Customer Pays	None Specified	None specifi'd
Insurance Requirements		Not addressed	Wilful misconduct liability outlined	Yes All DG<10KW and Net Metered DG <60kW Exempted					
Trip Transfer		0.6 secs of breaker, 6 secs on communication loss	IEEE1547 4.2.2						

c) Additional Facility Requirements

Category	BC Hydro	Alberta 25kV or less	Ontario	Massachusetts	New York	Texas	California	FERC NOPR	IEEE 1547
Visible Disconnect	Yes (checking on green)	Yes lockable & within 5 m of PCC*	Yes, lockable, "visable" "readily accessible"	Yes, Except for DG < 10kW that Meets UL 1741	Automatic disconnect device sized to meet all applicable codes	Yes, with Flexibility as to Type of Disconnect Switch	Yes, Except for DG w/ Inverters Rated <1kW (*1kW Limit May be an Error*)	Not Specifically Addressed. Must Meet Codes and Standards	yes
Telecommunication	Yes	Yes, for metering data >5MW*	for interval meter, customer pays	Mandatory for DG > 5MW Remote Access of Meter Data for DG > 60kW Involving 3rd Party Sales	Not Addressed for DG<300	Mandatory for DG>2 MW	250kW for Interconnection <10kV 1MW for Systems Above >10kV	Not Addressed	Yes for 250 kVA or larger monitoring required
Metering	Green RS1289 Bidirectional	Bi-directional meters are permitted	Bi-directional permitted $600-700 Interval meter up to $2500	Net Metering Up to 60kW Bi-Directional for DG Rated 60kW to 1000kW. Remote Access Req'd for Export Sales Bi-directional, Interval w/ Remote Access for DG>5MW; Telemetering Req'd Over 5MW	Case-by-Case Consistent with NYPSC Metering Requirements	Case-by-Case Consistent with CPUC Metering Requirements	Net Metering Allowed All Metering Must Comply w/ Utility Tariffs & Manuals	As Needed	As Needed
Verification and Testing	Annual verification Protection Tests Every 2 Years	Annual verification	Mid and Large require verification and testing	Protective Relay Test at Least Every 4 Years	<15kw can connect for 2hrs for test annual for 1 phase <15kVA	Functional Test Required. Utility May Witness Tests Owner Must Maintain Logs of O&M, Which Utility May Inspect	Protection Tests Every 4 Years	Not Addressed	
Validation Notification Requirements	Green 14 days Other 10 days	Min. 10 working days notice	Micro 5d if meter change	Utility has option to view test – One Week Notice req'd	Utility has option to view test				

d) Performance Criteria

Category	BC Hydro	Alberta 25kV or less	Ontario	Massachusetts	New York	Texas	California	FERC NOPR	IEEE 1547
Voltage Fluctuation Allowances	3 levels: *Green* Inverter ≤50kW Small <35kV Large >35kV	< 60 volts Instantaneous 60Volts-108volts (120 cycles) 127-144 volts (30 cycles) >144 (Instantaneous)	IEEE P1547, cls 4.1.1 1000V - 50kV CSA CAN3-C235-83 clause 5 5% normal 8%extreme	IEEE 1547 Standard	+5% to –10% (2 Seconds) <–50% (6 Cycles)	+5% to –10% (30 Seconds) +10% to –30% (10 Cycles)	+10% to –12% (Small DG) <60 volts (10 Cycles) 60 Volts-106 volts (2 Seconds) 132-165 volts (2 Seconds; 0.5 for DG>11KVA) >165 volts (6 Cycles)	Current National Standards and Codes Apply	Not Addressed
Voltage Flicker	Meets IEEE 519 3.3 % once per hour - many customers 6.5% once per hours – few customers	IEEE Std. 519	IEEE Std. 519	Meets IEEE 519	Meets IEEE 519	3% Voltage Drop Per IEEE 519 at PCC	Meets IEEE 519	Current National Standards and Codes Apply	Meets IEEE 519
Harmonics	IEEE Standard 519	IEEE Standard 519	IEEE 1547/D10 Table 3	IEEE Standard 519	Meets IEEE 519	Follows IEEE Standard 519 5% THD @ 60 Hz 3% for Each Harmonic	Meets IEEE 519 DG Will be Evaluated in Same Manner as Loads at DG Site	Current National Standards and Codes Apply	Meets IEEE 519
Frequency	59.7-60.2 Hz	59.7-60.2 Hz	59.7-60.2 Hz	-0.7Hz to +0.5 Hz Deviation from 60Hz Base	-0.7Hz to +0.5 Hz Deviation from 60Hz Base (6 Cycles)	-0.7Hz to +0.5 Hz Deviation from 60Hz Base 15 Cycle Clearing Required for Deviations	-0.7Hz to +0.5 Hz Deviation from 60Hz Base 10 Cycle Clearing Required for Deviations	Current National Standards and Codes Apply	59.7-60.2 Hz
Power Factor	Synchronous - .9 lagging to .95 leading	± 0.9 at PCC	0.9 lag and 0.95 lead	Not Specified	0.9 Leading or Lagging	0.9 Leading or Lagging Acceptable	Not Addressed		

PCC – Point of common coupling

* - unless otherwise approved by Wires Owner