



National Association of Regulatory Utility Commissioners

# Consumer protection performance standards in Connecticut

## Quat Nguyen Connecticut Public Utilities Regulatory Authority September 1, 2015







## TOPICS

- Electric Metering Regulations in Connecticut
- Voltage Regulations
- Samples





## **Advancement of Meters**

#### <u>Past – 40 years ago</u>

- Mechanical Meter
- Pedestrian meter routes
- Manual data entry
- Only recorded consumption

#### Recent Past – 20 years ago

- Transition from mechanical meters & manual data entry to remotely read meters
- Two different paths:

1) CL&P – AMR (Automated Meter Reading) driven by technology

- 2) UI outfit meters with cellular technology
- Transition achieves savings reduced labor costs
- Transition improves accuracy eliminates human error

#### Current – 2007 to Present

- Advances in technology provide opportunity for change
- Meters can collect significant data, and provide remote access for data retrieval & more
- Policy decisions drive the desire to install advanced meters
- Requires significant investment
- Need to select the 'right' technology

#### Connecticut Light & Power (CL&P)

- CL&P AMR meters do not easily adapt to new standard
- CL&P Only recently completed the AMR upgrade and would scrap many meters
- Decision to begin converting to advanced meters on hold

#### **United Illuminating (UI)**

Begins deployment as meters fail or new customers are added Reduces stranded investment Gradual deployment avoids consumer anxiety Gradual deployments spreads the cost – avoids rate shock (no pun intended

#### <u>Future</u>

Smart grid, etc.





# **Meter Types**

- Hybrid meters, also referred to as electro-mechanical meters, have a turning disc, bearings, gears and dials for a display that are retrofitted with an ERT.\*
- Solid state meters do not have any moving parts. The display is digital, and the ERT is built into the meter and is manufactured to a standard requiring greater accuracy than a hybrid meter. They have a 15-20 year life. Solid state installations began in 1999.

\*An electronic receiver and transmitter installed on a circuit board under the glass is referred to as an ERT. It allows the meter to be read remotely, including meters located indoors and within areas secured by fences.





## **Electric Metering Regulations**

- Electric meters are required to be within 1% for mechanical or 0.5% for solid state of true accuracy per PURA regulations.
- Three phase meters (industrial and commercial accounts) are required to be balanced within 2% of true accuracy, phase-to-phase.
- Meters with a demand component are required to have the demand component accurate within 2%.
- An electric distribution company must test a meter on request once per year at no charge.





## **Electric Metering (cont.)**

- If a meter is found to be over-registering by more than 1%, a refund is due to the customer.
- On request and receipt of a \$10 fee, the PURA witnesses a test of an electric meter.
- The electric distribution companies also periodically test electric meters per regulations.
- Electric distribution companies test meters on a selective testing program, in which meters are tested based on meter age and failure history.





## **Electric Metering (cont.)**

- The purpose of selective testing is to determine if any meter class is beginning to become inaccurate due to age or a generic problem.
- Selective tests involve testing a number of installed meters for each class of meter.
- The sample of meters tested in each class is based on the number of meters in operation during the previous year (10%).
- The results of meter tests are reported to the PURA each year.





## Sample of Meter History Report

		Meter Histo	ry Report Transac	tions Print Preview	🖰 Print 🕉
Meter ID 890450932		Status as of 08/0	3/2015 7:18:38 AM		
Status 20 - RE	ECEIVED	Purchased	08/16/2004 6:49:14 AM	Program Id	KWHRF
Location 30 , EM	4L / CL <u>P</u>	Installed	09/01/2004	Pl Type	
Service ID		Removed	07/29/2015 11:01:53 AM	Pl Value	
ddress		Remove Reason	CC	AMR Type Code	V
own		Shipment ID	1571449	AMB ID	39971058
Stock Code 27013	238	Ship From/To	85 / 30	Physical Mtr Type	05
iroup		Test Group	SELECTIVE	Billing Mtr. Type	05
App. Code		Next Test Due		Register Model	R300
Afr. ITRON	1	Sample Group		KWH Dials	5
fr. Type C2SR		PKH		Dial Reading Rmv	49562
FM 2S		CTR		Dial Reading at Lest	00000
Class 200		VTR		Dial Reading Uut	00000
/oltage Range: 240 · 2	240	RR	100/000/001	Demand Dials	0
est Volts/Amps 240/3	30	Hs	1007001	Digits fit of Dec	0
Phase/Wires 1/3	spapevista di Sinta	NH Dial Constant	1	Bmd Full Scale	0
Mold Mole	ete	Billing Constant	1		
Comments	- <u>-</u> .	nung other			
Customer test, PURA witne:	ss. ert: display: I: R:				
·			· .		
	Challen A.	count or ServiceID	Location	Change	Ву
Date	) Status ) Au				- The second
Date 08/03/2015 7:18:38 AM	20-RECEIVED		30, EML / CL&P		
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM	20-RECEIVED		30 , EML / CL&P 30 , EML / CL&P	station_s	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM	20-RECEIVED 20-RECEIVED 20-RECEIVED 41-SHIPPED		30 , EML / CL&P 30 , EML / CL&P 85 , Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM	20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED		30, EML / CL&P 30, EML / CL&P 85, Cheshire 85, Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED 40-STOCKED		30, EML / CL&P 30, EML / CL&P 85, Cheshire 85, Cheshire 85, Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED 40-STOCKED		30, EML / CL&P 30, EML / CL&P 85, Cheshire 85, Cheshire 85, Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	J 20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED 40-STOCKED		30 , EML / CL&P 30 , EML / CL&P 85 , Cheshire 85 , Cheshire 85 , Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	I 20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED 40-STOCKED	und - % Regi	30 , EML / CL&P 30 , EML / CL&P 85 , Cheshire 85 , Cheshire 85 , Cheshire 65 , Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	20-RECEIVED 20-RECEIVED 41-SHIPPED 1-REMOVED 40-STOCKED As Fo	und - % Regis	30 , EML / CL&P 30 , EML / CL&P 85 , Cheshire 85 , Cheshire 85 , Cheshire 85 , Cheshire	station_s hanifm	seventeen
Date 08/03/2015 7:18:38 AM 08/03/2015 7:16:05 AM 07/30/2015 9:12:19 AM 07/29/2015 3:18:20 PM 08/25/2004 4:03:59 AM	Status         Attention           20-RECEIVED         20-RECEIVED           20-RECEIVED         41-SHIPPED           1-REMOVED         40-STOCKED           40-STOCKED         40-STOCKED           As Fc           Test Type           21-FACTORY TEST BF 1000	und - % Regis	30 , EML / CL&P 30 , EML / CL&P 85 , Cheshire 85 , Cheshire 85 , Cheshire 85 , Cheshire 85 , Cheshire 85 , Cheshire 100.09 PAP	station_s hanifm	seventeen





## Sample of Meter Lab Results

Meter Calib	oration Accu	iracy	Test Report				
MeterID: Meter Type: Form: Base:	890450932 C2SR 2 S	Tes Mo Sto Reg	t Setup Code: de: ck Code: j. Type:	077 Kwh 27013238 R300	Kh: Test Amp Test Volts	1 s: 30 s: 240	
Perc	ent Registra	tion					
<u>As Fo</u>	<u>und:</u>	FL: PF: LL: WA:	<u>Total</u> 100.08 99.91 100.05	<u>Phase</u>	<u>A Pha</u>	<u>se B</u>	<u>Phase C</u>
	Test Start	ed By: Time:	RUSSEML 08/04/2015 8:36:	32 AM	Test Code: Stop Time:	04 08/04/201	Board: 15 8:38:07 AM
<u>As Lei</u>	<u>ft:</u>	FL: PF: LL: WA:	<u>Total</u> 100.08 99.91 100.05	<u>Phase /</u>	<u>A Pha</u>	<u>se B</u>	<u>Phase C</u>
	Teste Start	ed By: Time:	RUSSEML 08/04/2015 8:36:	32 AM	Test Code: Stop Time:	04 08/04/201	Board: 15 8:38:07 AM
Comm	ients:		• • • • • • • • • • • • • • • • • • • •			. 14	An Alla An An An An An An Anna An An An An An Anna An

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#### Sample of Annual Meter Test Summary - Total

			2014 Total I	Meter Test Res	ults with Revi	sed Accuracy	Ranges			
Hybrid Meter Tests - 1	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed		
# Passed	2 736			1 160	1 576					
# Failed	42	9	23	1,100	.,010	6	3	1		
Total Tests	2.778	-		1		1				
% of Group Passed	98.5%			41.8%	56.7%					
% of Group Failed	1.5%	0.3%	0.8%			0.2%	0.11%	0.04%		
						-				
Solid State Meter Tes	sts - 0.5%	< 98% Failed	98% - < 99% Failed	99% - <99.5% Failed	99.5% - 100% Passed	>100% - 100.5% Passed	>100.5% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
# Passed	17.349		*****		3.428	13.921				
# Failed	16	5	0	4			5	0	0	2
Total Tests	17.365									
% of Group Passed	99.9%				19.7%	80.2%				
% of Group Failed	0.1%	0.03%	0.00%	0.02%			0.03%	0.00%	0.00%	0.01%
Solid State Meter Tes	sts - 0.2%	< 98% Failed	98% - < 99% Failed	99% - <99.8% Failed	99.8% - 100% Passed	>100% - 100.2% Passed	>100.2% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
# Deesed	4 4 4 4				0.17	2.007				
# Passed	4,144		0	44	247	3,897				
	4 169		0				۷	0	0	0
	4,100				E 00/	02 59/				
% of Group Failed	0.6%	0.26%	0.00%	0.26%	3.978	93.378	0.05%	0.00%	0.00%	0.00%
			2014 Tota	A Meters Tested S	Summary					
		Passed/Failed based on Revised		Passed/Failed	,	Passed/Failed				
		Accuracy Ranges		baseu on +/-1%		baseu on +/-2%				
# Passed		24,229		24,251		24,280				
# Failed		82		60		31				
Total Tests		24,311		24,311		24,311				
		00.70/		00.001						
% of Group Passed		99.7%		99.8%		99.9%				





## Sample of Annual Meter Test Summary - Selective

		2	2014 Selective	e Meter Test Re	esults with Re	vised Accurac	y Ranges			
Hybrid Meter Tests -	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed		
" D	0.40				0.40					
# Passed	640		4	300	340	0	1	0		
Falled	5	3				0		0		
	045			AG 59/	E0 70/					
% of Group Failed	0.8%	0.5%	0.2%	40.378	32.178	0.0%	0.2%	0.00%		
Solid State Meter Te	ests - 0.5%	< 98% Failed	98% - < 99% Failed	99% - <99.5% Failed	99.5% - 100% Passed	>100% - 100.5% Passed	>100.5% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
# Doopod	1 677	+			214	1 262				<u> </u>
# Failed	1,0//	0	0		314	1,303	2	0	0	0
Total Toete	1 679	J	<u> </u>				<u> </u>	0	0	
% of Group Passed	99 9%				18.7%	81.2%				ł
% of Group Failed	0.1%	0.00%	0.0%	0.0%	10.776	01.270	0.1%	0.0%	0.0%	0.0%
Solid State Meter Te	ests - 0.2%	< 98% Failed	98% - < 99% Failed	99% - <99.8% Failed	99.8% - 100% Passed	>100% - 100.2% Passed	>100.2% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
						1				
# Passed	27				11	16				· · · · · · · · · · · · · · · · · · ·
# Failed	0	0	0	0		1	0	0	0	0
Total Tests	27									
% of Group Passed	100.0%				40.7%	59.3%				
% of Group Failed	0.0%	0.0%	0.0%	0.0%			0.0%	0.0%	0.0%	0.0%
			2014 Select	ive Meters Tested	Summary					
		Passed/Failed based on Revised Accuracy Ranges		Passed/Failed based on +/-1%		Passed/Failed based on +/-2%				
# Passed		2,344		2,346		2,347				
# Failed		7		5		4				
Total Tests		2,351		2,351		2,351				
		00.7%		QQ 8%		99.8%				
% of Group Passed		33.176		33.070		33.070				





## Sample of Annual Meter Test Summary - Periodic

Hybrid Meter Tests - 1%         98% - < 99%			:	2014 Periodic	Meter Test Re	sults with Re	vised Accuracy	y Ranges			
# Passed       373       6       62       311       1       0       0         # Failed       8       1       6       1       0       0       0         % of Group Passed       97.9%       0.3%       1.6%       0.3%       0.0%       0.0%       0.0%         % of Group Passed       2.1%       0.3%       1.6%       0.3%       0.0%       0.0%       0.0%         Solid State Meter Tests - 0.5%       Failed       Failed       Failed       Passed       Passed       Passed       Pailed       Failed       F	Hybrid Meter Tests -	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed		
If Palado       0       1       6       00       1       0       0         We of Group Passed       981       1       6       00       1       0       0         % of Group Passed       97%       0.3%       1.6%       81.6%       0.3%       0.0%       0.0%         Solid State Meter Tests - 0.5%       98% - <99%	# Passed	373			62	311					
Total Tests         381         1         0         1         0         0           % of Group Passed         97.9%         0.3%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         0.0%         >100%-100.5%         >100.5%-101%         >101%-102%         >102%-104%         >102%-101%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-104%         >102%-101% <td># Failed</td> <td>8</td> <td>1</td> <td>6</td> <td>02</td> <td>011</td> <td>1</td> <td>0</td> <td>0</td> <td></td> <td></td>	# Failed	8	1	6	02	011	1	0	0		
% of Group Passed       97.9%       16.3%       81.6%       0.3%       0.0%       0.0%         Solid State Meter Tests - 0.5%       < 98%	Total Tests	381		0					0		
20 G Group Failed       21%       0.3%       1.6%       0100       0.3%       0.0%       0.0%         Solid State Meter Tests - 0.5%       < 98%	% of Group Passed	97.9%			16.3%	81.6%					
Solid State Meter Tests - 0.5%          98% - <99% Failed         99% - <99.5% Failed         99.5% - 100% Passed         >100% - 100.5% Passed         >101% - 102% Failed         Failed         Fa	% of Group Failed	2.1%	0.3%	1.6%	10.070	01.0%	0.3%	0.0%	0.0%		
Solid State Meter Tests - 0.5% $< 98\%$ $>98\% - < 99\%$ $99\% - < 99.\%$ $99\% - < 99.\%$ $Passed$ $>100\% - 100.5\%$ $>100\% - 102\%$ $>102\% - 104\%$											
# Passed       0<	Solid State Meter Te	sts - 0.5%	< 98% Failed	98% - < 99% Failed	99% - <99.5% Failed	99.5% - 100% Passed	>100% - 100.5% Passed	>100.5% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
Hailed       0 <td># Passed</td> <td>0</td> <td></td> <td></td> <td></td> <td>0</td> <td>0</td> <td><b> </b></td> <td></td> <td> </td> <td></td>	# Passed	0				0	0	<b> </b>			
Total Tests         0 <th< td=""><td># Failed</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td></th<>	# Failed	0	0	0	0			0	0	0	0
Notificities         Note	Total Tests	0	0	0				U U	0	0	
A of Group Failed       0.0%       0.	% of Group Passed	0.0%			+	0.0%	0.0%	<u>.</u>			
% of Group Pailed       0.0%       0.	% of Croup Failed	0.0%	0.0%	0.0%	0.0%	0.078	0.078	0.0%	0.0%	0.0%	0.0%
Solid State Meter Tests - 0.2% $< 98\%$ $>98\%$ - $< 99\%$ $99\%$ - $< 99.8\%$ $99.8\%$ - $100\%$ $>100.2\%$ - $101\%$ $>101\%$ - $102\%$ $>102\%$ - $104\%$ $>102\%$ - $102\%$ $102\%$ $102\%$ - $102\%$											
# Passed       1,045       58       987       0         # Failed       12       3       0       8       1       0       0       0         Total Tests       1,057       0       8       1       0       0       0       0         % of Group Passed       98.9%       0.0%       5.5%       93.4%       0.1%       0.0%       0.0%       0.0%         % of Group Failed       1.1%       0.3%       0.0%       0.8%       0.1%       0.0%       0.0%       0.0%         2014 Periodic Meters Tested Summary         Colspan="4">1,418         1,418       1,427       1,4	Solid State Meter Te	sts - 0.2%	< 98% Failed	98% - < 99% Failed	99% - <99.8% Failed	99.8% - 100% Passed	>100% - 100.2% Passed	>100.2% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
W Tassed       1,010       0 <t< td=""><td># Passad</td><td>1.045</td><td></td><td></td><td></td><td>58</td><td>087</td><td></td><td></td><td></td><td></td></t<>	# Passad	1.045				58	087				
Total Tests       1,057       0	# Failed	1,045	3	0	8		307	1	0	0	0
Normal Solution         Normal Sol	Total Tests	1 057		0	0			· · ·	0	0	
No of Group Fasied         30.3 %         0.0%<	% of Group Passed	08.0%				5 5%	03 /0/	ł			
Passed/Failed based on Revised Accuracy # Passed     Passed/Failed based on +/-1%     Passed/Failed based on +/-2%       # Passed     1,418     1,427     1,434       # Failed     20     11     4       Total Tests     1,438     1,438     1,438       % of Group Passed     98.6%     99.2%     99.7%	% of Group Failed	1.1%	0.3%	0.0%	0.8%	5.576	93.476	0.1%	0.0%	0.0%	0.0%
2014 Periodic Meters Tested Summary       Passed/Failed based on Revised Accuracy Ranges     Passed/Failed based on +/-1%     Passed/Failed based on +/-2%       # Passed     1,418     1,427     1,434       # Failed     20     11     4       Total Tests     1,438     1,438     1,438       % of Group Passed     98.6%     99.2%     99.7%       % of Group Child     1.40%     0.2%											
Passed/Failed based on Revised Accuracy Ranges     Passed/Failed based on +/-1%     Passed/Failed based on +/-2%       # Passed     1,418     1,427     1,434       # Failed     20     11     4       Total Tests     1,438     1,438     1,438       % of Group Passed     98.6%     99.2%     99.7%       % of Group Failed     1.40%     0.2%				2014 Periodi	c Meters Tested S	ummary	-				
# Passed         1,418         1,427         1,434           # Failed         20         11         4           Total Tests         1,438         1,438         1,438           % of Group Passed         98.6%         99.2%         99.7%			Passed/Failed based on Revised Accuracy Ranges		Passed/Failed based on +/-1%		Passed/Failed based on +/-2%				
# Failed         20         11         4           Total Tests         1,438         1,438         1,438           % of Group Passed         98.6%         99.2%         99.7%           % of Group Folded         1.4%         0.9%         0.2%	# Passed		1,418		1,427		1,434				
Total Tests         1,438         1,438         1,438           % of Group Passed         98.6%         99.2%         99.7%           % of Group Failed         1.4%         0.8%         99.2%	# Failed		20		11		4				
% of Group Passed         98.6%         99.2%         99.7%           % of Group Passed         1.4%         0.9%         0.9%	Total Tests		1.438		1.438		1.438	6			
7 of choop Folded 0.07/ 0.09/ 0.29/	% of Group Passed		98.6%		99.2%		99.7%				
	% of Group Failed		1 /1%		0.8%		0.3%	1			





## Sample of Annual Meter Test Summary – Customer Requested

2014 Customer Requested Test Results with Revised Accuracy Ranges											
Hybrid Meter Tests - 1	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed			
j											
# Passed	1,388			652	736						
# Failed	23	3	13			5	2	0			
Total Tests	1,411										
% of Group Passed	98.4%	0.0404	0.000/	46.2%	52.2%	0.050/	0.4404	0.00/			
% of Group Failed	1.6%	0.21%	0.92%			0.35%	0.14%	0.0%			
		< 98%	98% - < 99%	99% - <99.5%	99.5% - 100%	>100% - 100.5%	>100.5% - 101%	>101% - 102%	>102% - 104%	>104%	
Solid State Meter Te	sts - 0.5%	Failed	Failed	Failed	Passed	Passed	Failed	Failed	Failed	Failed	
# Passed	1,059				167	892				ļ	
# Failed	0	0	0	0			0	0	0	0	
Total Tests	1,059				45.00/				ļ	ļ	
% of Group Passed	100.0%		0.000/		15.8%	84.2%			0.00/		
Solid State Meter Te	sts - 0.2%	< 98% Failed	98% - < 99% Failed	99% - <99.8% Failed	99.8% - 100% Passed	>100% - 100.2% Passed	>100.2% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed	
# Passed	75				2	73					
# Failed	0	0	0	0			0	0	0	0	
Total Tests	75				0 70/						
% of Group Passed	100.0%				2.7%	97.3%					
% of Group Failed	0.0%	0.0%	0.0%	0.0%			0.0%	0.0%	0.0%	0.0%	
			2044 Customer (	Samulaint Matana							
		Passod/Eailod	2014 Customer C	Joinplant weters	Testeu Summar	y	1				
		based on Revised Accuracy Ranges		Passed/Failed based on +/-1%		Passed/Failed based on +/-2%					
# Passed		2,522		2,522		2,540					
# Failed		23		23		5					
		2 545		2 545		2.545					
Total Tests		2,343		2,040							
Total Tests % of Group Passed		99.1%		99.1%		99.8%					





#### Sample of Annual Meter Test Summary – Company Requested (Initiated)

Hybrid Meter Tests - 1%         Solid State Meter Tests - 1%         Solid State Meter Tests - 05%         Solid State Meter Tests - 02%         Solid Sta			2014 C	ompany Req	uested Meter T	est Results w	vith Revised Ac	curacy Range	es		
# Passed       96	Hybrid Meter Tests -	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed		
In Description         3         1         2         V         00         0         0         0         0           % of Group Passed         97.0%, % of Group Passed         2.0%         41.4%         55.6%         0         0         0         0           % of Group Passed         97.0%, % of Group Passed         1.0%         2.0%         41.4%         55.6%         0         0         0           Solid State Meter Tests - 0.5%          Second         Failed         99% - <99.5%, Failed         99.5%, -100%, Passed         >100%, -100.5%, Passed         >101%, -102%, Failed         >102%, -104%, Failed         >10           # Passed         40         11         29         0	# Passad	96			41	55					
Contact Tests         99         1         2         0	# Failed	30	1	2	41		0	0	0		
% of Group Passed       97.0%	Total Tests	qq		<u> </u>	+			1			
Sol Group Failed         31.0%         1.0%         2.0%         31.7%         0.0%         >100%-100.5%         >101%-101%         >101%-102%         >102%-104%         >10%         717%         0	% of Group Passed	97.0%			41.4%	55.6%		1			
Solid State Meter Tests - 0.5%            98%. < 99%         99%. < <99.5%         99.5% - 100%         Passed         Passed         Pailed         >101% - 102%         >101% - 102%         Pailed	% of Group Failed	3.0%	1.0%	2.0%		00.070	0.0%	0.0%	0.0%		
Solid State Meter Tests - 0.5%           98% - < 98% Failed         99% - < 99.5% Failed         99.% - < 99.5% Passed         99.% - < 99.5% Passed         99.8% - < 100% Passed         >100% - 100.5% Pailed         >101% - 102% Failed         >101% - 102% Failed         >101% - 102% Failed         >101% - 102% Failed         >102% - 104% Failed         >102% - 104% Failed         >102% - 104% Failed         >102% - 101% Failed         >102% - 104% Failed         Passed         Failed         Fail											
# Passed       40       1       1       29	Solid State Meter Te	sts - 0.5%	< 98% Failed	98% - < 99% Failed	99% - <99.5% Failed	99.5% - 100% Passed	>100% - 100.5% Passed	>100.5% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
Total Tests         1         1         0 <th< td=""><td># Passed</td><td>40</td><td></td><td></td><td></td><td>11</td><td>29</td><td></td><td></td><td></td><td> </td></th<>	# Passed	40				11	29				
Total Tests         41         - <t< td=""><td># Failed</td><td>1</td><td>1</td><td>0</td><td>0</td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td></t<>	# Failed	1	1	0	0			0	0	0	0
% of Group Passed       97.8%       2.4%       0.0%       >100%-100.2%       Failed       Failed <td< td=""><td>Total Tests</td><td>41</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	Total Tests	41									
Solid State Meter Tests - 0.2%            2.4%         0.0%         10%         Failed	% of Group Passed	97.6%				26.8%	70.7%				
Notic Group Partice       2.110       2.110       2.110       0.010       100.2%       1010.2%       101%-102%       102%-104%       Failed	% of Group Failed	2.4%	2.4%	0.0%	0.0%	20.070	1	0.0%	0.0%	0.0%	0.0%
Solid State Meter Tests - 0.2%         Failed         Failed<			~ 98%	98% - < 99%	99% - ~99 8%	99.8% - 100%	>100% - 100 2%	>100 2% - 101%	>101% - 102%	>102% - 104%	>104%
# Passed       14       2       12       14         # Failed       0       0       0       0       0       0         Total Tests       14       1       14.3%       85.7%       14       14.3%         % of Group Passed       100.0%       0.0% <td< th=""><th>Solid State Meter Te</th><th>sts - 0.2%</th><th>Failed</th><th>Failed</th><th>Failed</th><th>Passed</th><th>Passed</th><th>Failed</th><th>Failed</th><th>Failed</th><th>Failed</th></td<>	Solid State Meter Te	sts - 0.2%	Failed	Failed	Failed	Passed	Passed	Failed	Failed	Failed	Failed
# Failed       0<	# Passed	14				2	12				
Total Tests         14         14         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         14.3%         85.7%         15.7% <th< td=""><td># Failed</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td>0</td><td>0</td><td>0</td><td>0</td></th<>	# Failed	0	0	0	0			0	0	0	0
% of Group Passed         100.0%         0.0%         14.3%         85.7%         0.0%	Total Tests	14							-		
% of Group Failed         0.0% <td>% of Group Passed</td> <td>100.0%</td> <td></td> <td></td> <td>1</td> <td>14.3%</td> <td>85.7%</td> <td></td> <td></td> <td></td> <td></td>	% of Group Passed	100.0%			1	14.3%	85.7%				
Image: search of comparison of the search	% of Group Failed	0.0%	0.0%	0.0%	0.0%			0.0%	0.0%	0.0%	0.0%
2014 Company Requested Meters Tested Summary         Passed/Failed based on Accuracy Ranges       Passed/Failed based on +/-1%       Passed/Failed based on +/-2%       Passed/Failed based on +/-2%       Passed/Failed based on											
Passed/Failed based on Accuracy Ranges     Passed/Failed based on +/-1%     Passed/Failed based on +/-2%       # Passed     150     152       # Failed     4     4     2       Total Tests     154     154     154       % of Group Passed     97.4%     98.7%     98.7%				2014 Company	Requested Meter	rs Tested Summa	ary	1		1	
Ranges         150         150         152           # Passed         150         150         152           # Failed         4         4         2           Total Tests         154         154         154           % of Group Passed         97.4%         98.7%         98.7%			Passed/Failed based on Revised Accuracy		Passed/Failed based on +/-1%		Passed/Failed based on +/-2%				
# Passed         150         150         152           # Failed         4         4         2           Total Tests         154         154         154           % of Group Passed         97.4%         98.7%         98.7%			Ranges					J			
# Failed         4         4         2           Total Tests         154         154         154           % of Group Passed         97.4%         97.4%         98.7%           % of Group Failed         2.6%         1.3%         154	# Passed		150		150		152				
Total Tests         154         154         154           % of Group Passed         97.4%         97.4%         98.7%           % of Group Failed         2.6%         2.6%         1.3%	# Failed		4		4		2				
% of Group Passed 97.4% 97.4% 98.7%	Total Tests		154		154		154	1			
% of Group Failed 2.6% 2.6% 1.3%	% of Group Passed		97.4%		97.4%		98.7%				
	% of Group Failed		2.6%		2.6%		1.3%	1			





#### Sample of Annual Meter Test Summary – Other Meters

			2014 Other I	Meter Test Res	ults with Revi	sed Accuracy	Ranges			
Hybrid Meter Tests -	1%	< 98% Failed	98% - < 99% Failed	99% - 100% Passed	>100% - 101% Passed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed		
# Passad	230			105	134					
# Failed	3	1	1	105	134	0	0	1		
Total Tests	242	· · · · · ·		1		1	1			
% of Group Passed	98.8%			43.4%	55.4%	1				
% of Group Failed	1.2%	0.4%	0.4%	40.470	00.470	0.0%	0.0%	0.41%		
Solid State Meter Te	sts - 0.5%	< 98% Failed	98% - < 99% Failed	99% - <99.5% Failed	99.5% - 100% Passed	>100% - 100.5% Passed	>100.5% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
# Passed	14 573				2 936	11 637				
# Failed	13	4	0	4	2,350	11,007	3	0	0	2
Total Tests	14 586		5	1			1			<del>-</del>
% of Group Passed	00.0%			1	20.1%	70.8%				
% of Group Failed	0.1%	0.03%	0.00%	0.03%	20.178	13.078	0.02%	0.00%	0.00%	0.01%
Solid State Meter Te	sts - 0.2%	< 98% Failed	98% - < 99% Failed	99% - <99.8% Failed	99.8% - 100% Passed	>100% - 100.2% Passed	>100.2% - 101% Failed	>101% - 102% Failed	>102% - 104% Failed	>104% Failed
# Passad	2 002				174	2 800				
# Falled	2,903		0		1/4	2,009	1			
# Falled	2 005	°	0	3				0	0	0
V of Group Boogod	2,995				E 00/	02.00/	+			
% of Group Failed	0.4%	0.27%	0.00%	0.10%	5.6%	93.076	0.03%	0.00%	0.00%	0.00%
78 OF OFOUP 1 alled	0.478	0.2778	0.0078	0.1078			0.0078	0.0078	0.0078	0.0078
			2014 Other	Meters Tested Su	mmary					
		Passed/Failed based on Revised Accuracy Ranges		Passed/Failed based on +/-1%		Passed/Failed based on +/-2%				
# Passed		17.795		17.806		17.807	I			
# Failed		28		17		16	1			
Total Tests		17.823		17.823		17 823	1			
% of Group Passed		99.8%		99.9%		99.9%	1			
% of Group Failed		0.2%		0.1%		0.1%	1			
/o or Group Failed		0.270		0.176		0.170	1			





## Voltage Regulations – Regs 16-11-115

## Voltage variations:

- The PURA's regulations require voltage to be maintained within -5% and +3% of nominal voltage which is typically 120V or 240V for residential service.
- Electric utilities rarely have difficulty complying with these voltage limitations, except in parts of the distribution system that have extensive distributed generation (e.g., solar and wind) interconnected.





## Voltage Regulations (cont.)

- Regulations allow deviations from these limits as follows:
  - Voltage excursions above the upper limit shall not exceed one minute.
  - Providing voltage below the lower limit shall be limited in extent, frequency and duration. Corrective action shall be promptly taken whenever deviations result from other than temporary conditions.
  - Temporary conditions, such as automatic switching to supply interrupted feeders, should not exceed 24 hours where practical. American National Standards Institute (ANSI) Standard c84-1 shall be used to determine the lowest temporary voltage excursions permissible.





## **Voltage Variation Waiver**

- National Standard ANSI C84.1 establishes the nominal voltage ratings and operating tolerances for 60-Hz electric power systems above 100 volts (steady-state voltage levels only).
- ANSI C84.1 tolerances for 120-600 V service is also plus/minus 5%.





## **Voltage Variation Waiver (cont.)**

- Twice a year, the Independent System Operator (ISO) conducts a test to determine the reduction in load that can be achieved by implementing a 5% reduction of normal voltage.
- This test causes the voltage on some parts of distribution circuits to fall below the minimum voltage threshold allowed by Reg. 16-11-115(a).
- Therefore, this test requires approval by the regulatory agency.





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## **Sample Letters**



107 Selden Street Berlin, CT 06037

Joaquina Borges King Senior Counsel

860-665-3678 joaquina.borgesking@eversource.com

February 25, 2015

Mr. Nicholas E. Neeley Acting Executive Secretary Public Utilities Regulatory Authority 10 Franklin Square New Britain, CT 06051

Re: Request for Temporary Waiver of or Exemption from CT Agencies Regs. §16-11-115(a)

Dear Mr. Neeley:

On Tuesday, May 5, 2015, ISONew England, Inc., ("ISO-NE") proposes to conduct a test to determine the reduction in load that can be achieved by implementing a five percent reduction of normal voltage. The Connecticut Light and Power Company d'b/a/ <u>Exersource</u> Energy ("<u>Exersource</u>") intends to participate in the test that is scheduled to commence at 10:00 a.m and conclude at 10:30 a.m. In the event that system conditions exist that prevent the test from occuring on May 5th, ISO-NE has set an alternate date of Wednesday. May 6, 2015.

Except as otherwise already permitted by the Public Utilities Regulatory Authority ("PURA" or "Authority"), Eversource is currently providing service to customers within the voltage variation limits prescribed by CT Agencies Regs. §16-11-115(a), that is within a range of from three percent (3%) above to five percent (5%) below the standard voltage. A voltage reduction of five percent (5%) of normal voltage will cause the voltage on some limited portions of distribution circuits to fall below the minimum voltage permitted by the regulation. However, Eversource believes that such voltage for the half-hour periods of the test will cause no inconvenience to customers or damage to their electrical equipment or systems.

In order to carry out the test Eversource, acting pursuant to CT Agencies Regs. §16-1-3, respectfully requests a waiver of, or an exemption from CT Agencies Regs. §16-11-115(a) to permit it to reduce normal voltages by five percent (5%) (with the exceptions noted above) for the period of the ISO-NE test. The last such test was conducted on October 28, 2014, pursuant to the Authority's October 27, 2014 approval (reference ISO Waiver: EN:ILB). If you require a dditional information in considering this request, please do not hesitate to contact me.

Sincerely yours,

Joaquina Borges King Joaquina Borges King







#### STATE OF CONNECTICUT PUBLIC UTILITIES REGULATORY AUTHORITY

March 3, 2015 In reply, please refer to: ISO Waiver:<u>EN:SMC</u>

- Joaquina Borges King, Esq. Senior Counsel Eversource Energy P. O. Box 270 Hartford, CT 06141-0270
- Re: Request for Temporary Waiver of, or Exemption from, Regulations of Connecticut State Agencies Section 16-11-115(a)

Dear Ms. King:

The Public Utilities Regulatory Authority is in receipt of a letter from The Connecticut Light and Power Company d/b/a Eversource Energy (CL&P) dated February 25, 2015, requesting a waiver of, or exemption from, the Regulations of Connecticut State Agencies (Conn. Agencies Regs.) §16-11-115(a) voltage requirements to accommodate a voltage reduction test by ISO New England, Inc. (ISO-NE). Approval is hereby granted for a temporary exemption from Conn. Agencies Regs. §16-11-115(a) as required for CL&P to participate in the voltage reduction test proposed by ISO-NE to be conducted on May 5, 2015. In the event conditions exist that prevent the test from occurring on May 5, 2015, the test may be performed on May 6, 2015.

Sincerely,

PUBLIC UTILITIES REGULATORY AUTHORITY

Nicholas E. Neeley Acting Executive Secretary

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