#### **DOE/OE Transmission Reliability Program**

# **FIDVR Load Modeling Tool**

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# **Project team**

- PNNL
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# **Project Objectives**

- Utilities have occasionally observed delayed voltage recovery following fault events in regions where a significant portion of the summer peak load is associated with residential air-conditioning.
- This phenomenon, called fault-induced delayed voltage recovery (FIDVR), is associated with motor that are prone to stalling.
- There is concern that as greater a fraction of on-peak load is associated with motors prone to stalling the FIDVR phenomenon could have more significant detrimental impacts and possibly cause generation tripping or even a blackout.
- The purpose of this project is to generalize the load model development and calibration methodology developed for WECC to address the FIDVR phenomenon in planning studies.





# **Composite Load Model**

- In 2000-2001, WECC used interim load model
- In 2005, WECC developed explicit load model
- In 2007, PSLF has the first version of the composite load model







## Past major accomplishments

- In 2010, PNNL started the work on load composition model
- Development was funded by DOE through ARRA program
- An Excel tool to create composite load model was developed in 2012.
- Load Model Data Tool to generate composite model data records was developed in 2013





# Load Model Data Tool (LMDT)

- LMDT generates the load composite model data records
- LMDT supports GE PSLF and Siemens PSSE formats
- LMDT 1.0 was released under an open source license in 2013
- LMDT is a stand-alone MS Windows application
- LMDT was developed in collaboration with Bonneville Power Administration (BPA) and WECC Load Modeling Task Force (LMTF)
- Development was funded by DOE ARRA
- LMDT is used by multiple utilities including: WECC, ERCOT, BPA, Dominion, SCE, PG&E, Seattle City Light.

0	pen Load Compositi	on Data	Open Motor D	ata	Open Powerflow	v Bus Data				
bad	Composition Data	Motor Data Powerfl	ow Bus Data							
	Bus_Number	Bus_Name	Base_kV	Load_ID	Area	Zone	Owner	Р	Q	١
•	31551	TRINTY	60	1	30	325	3006	4.75	0.213	1.
	54001	JUDY515S	69	31	54	546	76	0.3	0.2	1.
	54002	MAYERTH9	138	31	54	546	76	6.8	1.3	1.
	54002	MAYERTH9	138	99	54	560	76	1.4	0.3	1.
	54003	COLINTO9	138	99	54	547	76	6.7	0.6	1.
	54004	WESTLOC9	138	31	54	547	76	1.4	0.6	1.
	54004	WESTLOC9	138	99	54	547	76	4.3	1.8	1.
	54005	CLYDE 9	138	99	54	547	76	6.2	1.3	1.
	54007	BOYLE 9	138	99	54	547	76	8.1	1.4	1.
Set Vin	tings imum Load (MV	V) 5	(1)	Model Data E	mic Model Data File. irrors ad representation 03 "COLINTO9" 11		1/			[
Set Min Min Min	tings imum Load (MV imum Voltage tr imum Voltage (j imum power fac	V) 5 p add transform pu) 0.93 tor 0.82	er (kV) 40	Model Data E Model Data E #Composte loa cmpldw 540 "Sof" 0.08 " "Vmin" 1.025 "Fma" 0.2 "! "PFe" 1 "Vic "Pfs" 1 "Pie"	mic Model Data File. innrs ad representation 03 "COLINTOS" 11 at" 0 "Xfd" 0.01 " TftxHS" 1 "TftxLS" "Vmax" 1.04 "Td Fmb" 0.25 "Fmc" ( 11" 0.72 "Vd2" 0.5 "2 "P1c" 0 "P2e		1/ 0.9 "Tmax" 1.1 "ste mmp" 0 "Xcomp" 0 2 /	p" 0.00625 /		[





# **Technical Accomplishments FY15**

- LMDT is used be WECC to generate CLM records for WECC planning cases.
- Support of PSLF 19 was added to LMDT version 1.1 (this feature was requested by WECC).
- LMDT version 2.0 is under development.
  - Fully redesigned Graphical User Interface (GUI)
  - Advanced functionality
  - Database of load models for different climate zones
  - Generating .dyd and .dyr dynamic records
  - The tool development activity is coordinated with WECC MVWG, WECC LMTF, and BPA





### **Redesigned Graphical User Interface**

H LMD120	
Load Model Database	Composite Load Database

Com	mercial	Reside	ential	Inductive					
Climate	Day	Hour	Motor A	Motor B					
AISAIC	Normal Summ	LUEI	0 1001200	1000010					
NIMIC	Normal_Summe	HEL HER	0.1072523	74 0.0477929017					
NINAUC	Normal_Summe	LIE2	0.1075322	222 0.047952024					
NIMIC	Normal Summe	LUEA	0.1116419	000 0.052776552					
NIMIC	Normal Summe	LUES	01202783	0.062626790					
NIMIC	Normal_Summe	LICE	0.1202702	46 0.092242943					
NIMC	Normal Summe	HE7	0.1502875	51 0.106789351					
NIMC	Normal Summe	LICS	01662429	72 0121026213					
NIMIC	Normal Summe	LIED	0.1909220	77 0 128016444					
NWC	Normal Summe	HE10	0.2045902	268 0 133284945					
NWC	Normal Summe	HE11	0.2221338	845 0 135913167					
NWC	Normal Summe	HE12	0.2444923	237 0 138083263					
NWC	Normal Summe	HE13	0.244402	287 0 138378141					
NIMC	Normal Summe	HE14	0.2648366	55 0138386842					
NIMIC	Normal Summe	LUE15	0.2692129	501 0 127555876					
NIMIC	Normal Summe	LIE16	0.2626456	501 0 125901900					
NIME	Normal Summe	HE17	0.2030430	MA 0 126062381					
NINC	Normal Summe	HELP	0.2337230	02 0 110152246					
NIMC	Normal Summe	LUE10	01774177	248 0.001960296					
NIMC	Normal Summe	HE20	0.156720	116 0.078964001					
NIMIC	Normal Summe	HE20	0.134620	02 0.0709304001					
NIMIC	Normal_Summe	HE21	0.1340392	203 0.070630692					
NIMIC	Normal_Summe	LE22	0.1210002	42 0.054009156					
NIMIC	Normal_Summe	LIE24	0.1140230	504 0.046262591					
ABAGA	Normal_Summe	UC1	0.1079040	0.040303381					
NVVV V	Normal_Summe	LIC2	0.1230442	24 0.030899820					
AISA/S/	Normal_Summe	LIE2	0.1250010	001 0.055202035					
NVVV	Normal_Summe	EF HES	0.1219030	0.055044575					
NISARA /	Normal_Summe	LICS	0.1234000	171 0.064105856					
NIVEV	Normal_Summe		0.1323333	0.004103636					
NVVV V	Normal_Summe	EF MED	0.1415155	106 0.004342957					
	Normal_Summe	EF HE/	0.1513034	100 0/049/04995					
ADAD/	Normal_Summe	HE0	0.1052977	04 0.115905004					
NWW	Normal_Summe	ET HES	0.1892492	0.12083132					
NINAN	Normal_Summe	EF HELD	0.2103402	55 0 1220034005					
NINA/N/	Normal_Summe	UE12	0.250550.	151 0125122412					
BISA/S/	Normal_Summe	LIE12	0.2073074	0 12642672					
NIMAN	Normal_Summe	LUE14	0.2919154	0.13042073					
NISARI/	Normal_Summe	HELA	0.30/0229	0.137091032					
NINAD/	Normal_Summe	CL3M IS	0.3104108	0.132491/30					
IN WWW	Ivormal_Summe	OL3M 11	0.2955510	10/10/128042357					

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1																		
Load Mix	Res	Com	Ind	Agr	Data	Service		Normal_Summer										
NWC	2						ĥ.	Н	E2									
RES	0.75	0.23	0	0	0	0.02												
COM 0.2 0.73 0 0 0.0					0.05	0.02	Ξ				Upda	te Model						
MIX	0.48	0	0	0.05	0.02		Mot	otors file:	MotorDataP1test.csv									
RAG 0.4 0.2			0.15 0.2		0	0		Motors file:										
NWV	1							Bus	es file:	loads.c	\$V							
RES	0.75	0.23	0	0	0	0.02		Se	ttings									
COM	0.2	0.73	0	0	0.05	0.02		Minimum Load(MW)										
MIX	0.45	0.48	0	0	0.05	0.02			inimum .	oltana t	a add to	anthormas (h	40					
RAG 0.4 0.2			0.15	0.25	0	0		N1	inimum v	/oitage t	0 800 0	ansionner (a	.v)					
NWI								M	inimum v	voltage (	p.u.)							
RES	0.75	0.23	0 1	0	lo	0.02		M	inimum p	power fa	ctor							
COM	0.2	0.73	0	0	0.05	0.02												
MIX 0.45 0.48		0.48	0	0	0.05	0.02					Ger	nerate						
RAG	0.4	0.2	0.15	0.25	0	0												
urly Plots										0.05	0.0	Ci. 1 D.D	G-1 0					
eak Load	25		HOU	In M	fotor A Mote			Motor C Mot		D P.E.	D.G.	Stat. P Kes.	Stat. P					
eak Hour		•	HEL	0.	122	0.080	0.	024 0.101		0.15	0.000	0.357	0.105					
Climate	Zone		HEZ	0.	124	0.087	0.	016	0.110	0.15	0.000	0.321	0.1/7					
in the second se			HEA	0.	125	0.069	0.	017	0.113	0.16	0.000	0.297	0.190					
IWC			HES	0	131	0.092	0.	020	0.008	0.16	0.000	0.283	0.203					
Seaso	on		HEG	0	110	0.098	0.	026	0.082	0.16	0.000	0.318	0.196					
lormal_Sum	mer	•	HE7	0.	103	0.091	0.	033	0.062	0.14	0.000	0.373	0.188					
Load Mix			HES	0.0	092	0.082	0.0	037	0.050	0.16	0.000	0.402	0.173					
Residential	0.5	5	HE9	0.1	095	0.082	0.0	042	0.047	0.16	5 0.000	0.395	0.174					
			HEI	0 0.	103	0.081	0.0	048	0.045	0.16	0.000	0.386	0.170					
Commercial	0.5	2	HE1	1 0.	111	0.081	0.0	051	0.045	0.169	0.000	0.375	0.168					
Inductive	0		HE1	2 0.	123	0.083	0.0	052	0.045	0.171	0.000	0.356	0.170					
Agricultural	0		HE1	3 0.	130	0.087	0.0	051	0.052	0.17	0.000	0.337	0.172					
			HE1	4 0.	133	0.093	0.0	048	0.078	0.168	0.000	0.310	0.168					
Data 0		of the local division of	100	10100	and the second second	100	111111	In the second second	100000000	C. C. Statistics	1411 A 1015 St.	Contraction of the						

HE15 0.134

HE16 0.132

HE17 0.124

HE18 0.102

HE19 0.085

HE20 0.080

HE21 0.075

Service

0

Update Model

0.098

0.102

0.100

0.092

0.085

0.075

0.065

0.045

0.043

0.041

0.037

0.036

850.0

10.040

0.098

0.113

0.119

0.118

0.108

0.084



0.164

0.157

0.146

0.128

0.118

0.131

0.126

0.173 0.000 0.288

0.168 0.000 0.286

0.169 0.000 0.301

0.184 0.000 0.339

0.189 0.000 0.366

0.194 0.000 0.374

0.105 0.000 0.412



NCC COM 0.199400610288835 0.0931234387209698 0.03136990

Composite... Motor Data Powerflow... PSLF PSSE



- - -

Motor C

0.091207630609136 0.02862835

0.0771340310804133 0.02617563

0.0755700936445514 0.36147041

0.0759628312164063 0.02770416

0.0986831761950485 0.02793158

0.0860672703253064 0.02770307

0.0793810812650852 0.39627903 0.082888829466185 0.02864589

0.0883286843520908 0.03017135

0.0818704116536084 0.02929387

0.0800526209572898 0.41755441

0.0755787746524932 0.02357483

0.0981379300991599 0.02576470

0.0848557910943054 0.02479738

0.0789839142780429 0.34752200

Motor B

• # X

# LMDT 2.0 Database

- Different load type
  - Commercial
  - Residential
  - Inductive
  - Agricultural
  - Data
  - Service
- Climate zones
- Operating hours
- Seasons



ommerci	al Residential	Inducti	ve Agric	ultural Data	Service						
ommerei		maaca	ve   Agrie		Service						
Climate	Day	Hour	Motor A	Motor B	Motor C	Motor D	P.E.	D.G.	Stat. P Res.	Stat. P Cur.	St
NWC	Normal_Summer	HE1	0	0.023446837	0.011816935	0.090136807	0.052946361	0	0.302600529	0	0
NWC	Normal_Summer	HE2	0	0.023345433	0.005083716	0.090136807	0.048457548	0	0.247425536	0	0
NWC	Normal_Summer	HE3	0	0.023244029	0.002974515	0.090136807	0.047051413	0	0.219111311	0	0
NWC	Normal_Summer	HE4	0	0.023244029	0.00232553	0.090136807	0.046618757	0	0.212959474	0	0
NWC	Normal_Summer	HE5	0	0.023345433	0.002704104	0.090136807	0.04687114	0	0.22937564	0	0
NWC	Normal_Summer	HE6	0	0.023751049	0.007652615	0.090136807	0.050170147	0	0.309214317	0	0
NWC	Normal_Summer	HE7	0	0.025069299	0.020280782	0.090136807	0.058588925	0	0.491527277	0	0
NWC	Normal_Summer	HE8	0	0.026590358	0.035829381	0.090136807	0.114023061	0	0.670843187	0	0
NWC	Normal_Summer	HE9	0	0.026995974	0.045455992	0.090136807	0.120440802	0	0.694256223	0	0
NWC	Normal_Summer	HE10	0	0.026793166	0.056650983	0.090136807	0.127904129	0	0.706695102	0	0
NWC	Normal_Summer	HE11	0	0.026793166	0.06254593	0.090136807	0.131834094	0	0.691169037	0	0
NWC	Normal_Summer	HE12	0	0.027908609	0.061626535	0.090136807	0.131221164	0	0.645255601	0	0
NWC	Normal_Summer	HE13	0	0.031634443	0.055947916	0.101425551	0.128099462	0	0.602598357	0	0
NWC	Normal_Summer	HE14	0	0.046568576	0.052135129	0.155994108	0.128767519	0	0.560065051	0	0
NWC	Normal Summer	HE15	0	0.057862133	0.046348346	0.195081749	0.145236298	0	0.518849996	0	0
NWC	Normal Summer	HE16	0	0.067892062	0.04461772	0.226080546	0.145906005	0	0.515503667	0	0
NWC	Normal Summer	HE17	0	0.077161695	0.046483551	0.243461595	0.17521335	0	0.561326967	0	0
NWC	Normal Summer	HE18	0	0.086901364	0.049160615	0.251063248	0.249554661	0	0.671969897	0	0
NWC	Normal Summer	HF19	0	0.085419148	0.051729514	0.252919176	0.269403794	0	0.718841037	0	0
NWC	Normal Summer	HE20	0	0.06692371	0.053568304	0 211410634	0 268187975	0	0.695292796	0	0
NWC	Normal Summer	HE21	0	0.045754368	0.05475811	0 150812387	0.247389215	0	0.704790962	0	0
NWC	Normal Summer	HE22	0	0.02638755	0.055560342	0.090136807	0.217319842	0	0.7386486	0	0
NIMC	Normal Summer	LE22	0	0.024966492	0.045527115	0.090126807	0.165562297	0	0.660016871	0	0
NIMC	Normal Summer	4524	0	0.022852452	0.026581244	0.090126807	0.107857702	0	0.460204726	0	0
	Normal_Summer	LIE1	0	0.023032433	0.020301344	0.055010079	0.022212449	0	0.171051124	0	0
	Normal_Summer	HET	0	0.014196555	0.007211939	0.055010978	0.032313446	0	0.1/1031134	0	0
	Normal_Summer	1152	0	0.014140023	0.003102019	0.055010978	0.029373902	0	0.125188482	0	0
	Normal_Summer	HE5	0	0.014099514	0.001615502	0.033010978	0.028/13/3	0	0.123166462	0	0
NVVV	Normal_Summer	HE4	0	0.014099314	0.001419283	0.055010978	0.028451678	0	0.122052856	0	0
NVVV	Normal_Summer	HED	0	0.014148823	0.001650329	0.055010978	0.028605708	0	0.130144971	0	0
NWV	Normal_Summer	HED	0	0.014346863	0.004670432	0.055010978	0.03061911	0	0.1/1/82/8	0	0
NWV	Normal_Summer	HE/	0	0.014990491	0.0123//4/	0.055010978	0.035/5/136	0	0.266665/15	0	0
NWV	Normal_Summer	HE8	0	0.015/3314	0.021866864	0.055010978	0.069588887	0	0.3595/9256	0	0
NWV	Normal_Summer	HE9	0	0.015931179	0.027742036	0.055010978	0.073505668	0	0.372968928	0	0
NWV	Normal_Summer	HE10	0	0.016376528	0.0345744	0.056861829	0.078169451	0	0.381319594	0	0
NWV	Normal_Summer	HE11	0	0.030361945	0.038172117	0.104412248	0.083365013	0	0.374938321	0	0
NWV	Normal_Summer	HE12	0	0.047539354	0.037611005	0.16096377	0.086317499	0	0.35233431	0	0
NWV	Normal_Summer	HE13	0	0.071472501	0.034145314	0.241663136	0.088754059	0	0.330351923	0	0
NWV	Normal_Summer	HE14	0	0.097671336	0.03181835	0.332590843	0.092551438	0	0.308259515	0	0
NWV	Normal_Summer	HE15	0	0.116450234	0.028286645	0.396775764	0.104974747	0	0.286959264	0	0
NWV	Normal_Summer	HE16	0	0.131961887	0.027230434	0.448000382	0.10728382	0	0.285523478	0	0
NIM/M	Normal Summer	HE17	0	0.142334565	0.028369161	0.47636581	0.126214819	0	0.309376238	0	0



# **Composite Load Model Settings**

- Load Mix
- Season
- Operating Hour

				_				
Load Mix	Res	Com	Ind	Agr	Data	Service		No
NWN	1						* (	HE
RES	0.75	0.23	0	0	0	0.02		
сом	0.2	0.73	0	0	0.05	0.02		
MIX	0.45	0.48	0	0	0.05	0.02		
RAG	0.4	0.2	0.15	0.25	0	0	I I I	oto
<b>NWI</b>							Bu	ise
RES	0.75	0.23	0	0	0	0.02		Set
СОМ	0.2	0.73	0	0	0.05	0.02		Mir
MIX	0.45	0.48	0	0	0.05	0.02		Mir
RAG	0.4	0.2	0.15	0.25	0	0		viii
RMN	1							Mir
RES	0.75	0.23	0	0	0	0.02		Mir
сом	0.2	0.73	0	0	0.05	0.02		
MIX	0.45	0.48	0	0	0.05	0.02		
RAG	0.4	0.2	0.15	0.25	0	0		
NCC								
RES	0.75	0.23	0	0	0	0.02		
сом	0.2	0.73	0	0	0.05	0.02		
MIX	0.45	0.48	0	0	0.05	0.02		
RAG	0.4	0.2	0.15	0.25	0	0		
NCV								
RES	0.75	0.23	0	0	0	0.02		
СОМ	0.2	0.73	0	0	0.05	0.02		
MIX	0.45	0.48	0	0	0.05	0.02		

HE2 Update Model Motors file: MotorDataP1test.csv	•
Update Model Motors file: MotorDataP1test.csv	
Motors file: MotorDataP1test.csv	
D CL loads say	
Buses file: IOdus.csv	
Settings	
Minimum Load(MW)	5
Minimum voltage to add transformer (kV)	40
Minimum voltage (p.u.)	0.93
Minimum power factor	0.82





# Composite Load Model and Dynamic Records

- Input
  - Composite
     Load Model
  - Motor Data
  - Power FlowData
- Output
  - dyd record
  - dyr record

Composite Lo	ad Model																										<b>-</b> ↓	x
LID	Motor A		Motor B			Motor (	2		Motor	D		P.E.			D.0	G. Sta	at. P Re	s.		Stat. P	Cur.		St	tat. P P	ower.	Stat.	Q Rea	
NWC RES	0.058196225	7299157	0.067175	507723	41789	0.02342	31540	62073	8 0.1593	379290875	32	0.133907	2343	22453	0	0.4	460333	355295	082	0.1119	270242	68765	0			-0.50	00000	
NWC COM	0.188073408	621696	0.091207	763060	9136	0.02862	83562	89810	0.0404	6960286814	403	0.243945	9175	5841	0	0.1	372401	17587	813	0.2704	349664	64994	0			-0.50	00000	
NWC MIX	0.127238431	158409	0.077134	103108	04133	0.02617	56379	27699	9 0.0906	390034221	776	0.225036	0998	13742	0	0.2	659204	120431	232	0.1878	563761	66326	0			-0.50	00000	
NWC RAG	0.106595856	030381	0.075570	009364	45514	0.36147	04106	5343	0.0557	236290807	248	0.101145	3310	26857	0	0.2	0.219715143477197			0.0797795360868523 0						-0.50	00000	
NWV RES	0.092200084	0696639	0.075962	283121	64063	0.02770	41661	2348	6 0.1344	637386195	0.153919	7419	70613	0	0.3	0.353169212792718			0.162580225207586 0					-0.5		i I		
NWV_COM	0.212546613	769651	0.098683	317619	50485	50485 0.0279315827802641 0.0245634077455							3078	81551	0	0.0	0.0837171041239891			0.285943807503983 0					-0.5			
NWV MIX	0.163450498	233608	0.086067	727032	53064	0.02770	30738	5030	6 0.0627	791211192	055	0.258068	2068	43145	0	0.1	760449	97380	701	0.2258	868322	4773	0			-0.5		
NWV_RAG	0.122556766	371452	0.079381	108126	50852	0.39627	90305	9967	0.0374	033140755	508	0.105168	9431	66337	0	0.1	679230	062287	073	0.0912	878022	34813	9 0			-0.5		-
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											_																	_
Powerflow Bus	s Data									<b>-</b> ↓	×	Motor D	ata														<b>-</b> ↓	×
BusNumber	BusName	BasekV	LoadID	Area	Zone	Owner	Ρ	Q	Voltage	LID		# Type	ID	L.F.	P.F.	Ls	Lps	Lpps	Ra	Тро	Трро	н	Etro	Vtr1	Ttr1	Ftr1	Vrc1	
106	NORTH LD	115	1	1	1	0	1000	0	1.023064	NWC_MD		M3	MA	0.75	0.78	1.8	0.12	0.104	0.04	0.095	0.0021	0.1	0	0.7	0.02	0.2	1	
202	MIDWAY	115	1	1	1	0	300	150	1.018719	NWV_RA(		M3	MB	0.75	0.78	1.8	0.19	0.14	0.03	0.2	0.0026	0.5	2	0.6	0.02	0.2	0.75	Ξ
306	SOUTH LD	115	1	1	1	0	2700	0	1.030094	NWI_CON		M3	MC	0.75	0.78	1.8	0.19	0.14	0.03	0.2	0.0026	i 0.1	2	0.65	0.02	0.2	1	
102	NORTH G1	18	1	1	1	0	100	50	1	RMN_CO	=	M3	IA	0.85	0.89	3.1	0.2	0.165	0.01	0.8	0.0026	0.15	0	0.7	0.05	1	1	
104	NORTH G2	18	1	1	1	0	100	50	1	NWC_CO		M3	IB	0.85	0.89	3.1	0.2	0.165	0.01	0.8	0.0026	51	2	0.7	0.05	0.3	1	
302	SOUTH G1	18	1	1	1	0	100	50	1	NWC_RES		M3	IC	0.85	0.89	3.1	0.2	0.165	0.01	0.8	0.0026	ō 0.2	2	0.7	0.05	0.3	1	
304	SOUTH G2	18	1	1	1	0	100	50	1	NWC_MD	-	M3	PA	0.85	0.89	3.1	0.2	0.165	0.01	0.8	0.0026	0.15	0	0.7	0.1	1	1	I
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#Composite	load represer	ntation									-1 0 0.04 0.04 0.75 0 1 1 1 0 9 11												Ξ					
"Bee" 0 "B	00 NORTH L fdr" 0.04 "¥f	44" 0.04	1 : #1 "Eb" 0.7"	mva=	-1/							0,0062	15 1	0.9 1	1.04	30	5											
"Xxf" 0.08	"TfixHS" 1 "T	fixLS" 1	"LTC" 1	"Tmin	" 0.9 '	"Tmax"	l.1 "st	ep" (	.00625 /			0 0	0.12	27 0.0	077	0.026	Ĩ											
"Vmin" 1.0	25 "Vmax" 1	.04 "Tde	" 30 "Tt	ap" 5	"Rcom	p" 0 "X	comp"	0/			0.091 0.225 1 0.7 0.5																	
"Fma" 0.12	7 "Fmb" 0.0	77 "Fmc"	0.026 "	Fmd" (	0.091 '	'Fel" 0.2	25 /			-0.999 2 0.586 1 0.414 0																		
"PFel" 1 "\	/d1" 0.7 "Vd	2" 0.5 "F	rcel" 1 /									2 -0.	5000	00029	07323	1 1	1.500	000002	90732	23 -1								
"Pts" -0.99	9 "Ple" 2 "P	TC. 0.28	0 "P2e"	1 "P2c	0.414	4 "Ptreq"	0 /		Ofree" 1	1		3 0.7	) C	1.04 1 121 0	1.8 (	).12 ) 07	0.104											
"MtnA" 3	"MtpB" 3 "M	tnC" 3 "	'MtpD" 1	/	Q2C 1		529073	22	Qued -1	/	0.095 0.0021 0.1 0 0.7																	
"LfmA" 0.75	5 "RsA" 0.04	"LsA" 1.	B "LpA"	0.12 "	LppA"	0.104 /					0.02 0.7 0.7 0.1																	
"TpoA" 0.09	95 "TppoA" (	).0021 "H	IA" 0.1 "	etrqA"	0 /						3 0.75 0.03 1.8 0.19 0.14																	
"Vtr1A" 0.7	"Ttr1A" 0.02	"Ftr1A"	0.2 "Vrc	1A" 1	"Trc1A	99999	1				0.2 0.0026 0.5 2 0.6																	
"Vtr2A" 0.5	"Ttr2A" 0.02	"Ftr2A"	0.7 "Vrc	2A" 0.	7 "Trc2	2A" 0.1/						0.02	0.2	0.75	0.05	0.5												
"ItmB" 0.75	"TopoR" 0.03	"LsB" 1.8	5 "LpB" (	0.13 "F	ррв" ( /	).14 /						0.02	0.3	0.65	0.05	10	0.14											
"Vtr1B" 0.6	"Ttr1B" 0.02	"Etr18"	0.5 etr	40 Z IB" 07	/ /5 "Tro	18" 0.05	1					02 0	002	5 01	o u	0.65	0.14											
"Vtr2B" 0.5	"Ttr2B" 0.02	"Ftr2B"	0.3 "Vrc	2B" 0.6	5 "Tro	2B" 0.05	1				0.02 0.02 0 0.1 2 0.03																	
"LfmC" 0.75	5 "RsC" 0.03	"LsC" 1.8	B "LpC"	0.19 "l	.ppC"	0.14 /					÷	0.02	0.3	0.65	0.1													-





# **Hourly Analysis**

- Climate Zones
- Seasons
- Load Mix



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## **Deliverables FY15**

- LMDT version 1.1 and tool documentation available at: https://svn.pnl.gov/LoadTool
- Initial prototype version of LMDT 2.0 was provided to a limited number of users for testing

#	Milestone/Deliverable	Target Date
1	Tool Requirements	May 2015
2	Tool specification	September 2015
3	Tool prototype	December 2015
4	Final tool release	September 2016





# **Industry Outreach**

The LMDT application has been presented at several industrial events including:

- WECC Modeling and Validation Work Group (MVWG)
- WECC Load Modeling Task Force (LMTF)
- North American Transmission Forum (NATF) Dynamic Load Modeling Working Group
- Webinars for western and eastern interconnection utilities.





## **Risk factors**

- Risk factors are low.
- Feedback and guidance from industrial users are very important for the success of the project.





## **Future plans**

- Expanding analytical capabilities to meet user requirements.
- Model Calibration.
- Industry outreach.



