**VEPCO Network Model
Reconciliation of LANL and MZA Model Data**

Purpose: The LANL DC load flow model of the VEPCO transmission network shows two hundred ten more substations than the AC load flow model produced by MZA Utility Consultants. MZA was requested to determine the source of the difference.

Summary: The AC load flow model used for this study utilizes two standard network algorithms (Decoupled or Newton). The solution time of each is affected by the number of substations. The more substations included, the longer the model will take to solve. In addition, the ability of the algorithms to converge to a solution is affected by line loadings and characteristics. Convergence is inhibited by numerous lightly loaded and electrically short lines.

The MZA model reduces the total substations to 343 by creating equivalent loads and generation. Most of the omitted substations are lightly loaded and rated at 115 kV. Appendix 1 lists omitted substations and the substation used as the equivalent.

The MZA model includes sixteen substations not included in the LANL model. These represent new generation including Non-Utility Generator (NUG) sites, additional substations and an intertie (Wake, to CP&L). Their connection to the LANL model is delineated in Appendix 2.

- Analysis:**
1. All generation was accounted for except VEPC-GS-0110 Cushaw 115 and VEPC-GS-0379 Reusens 138. Cushaw was not included in the model. It is a hydro facility with a rated capacity of 2 MW. It was used for approximately 17 GWh in 1991. No reference to generation at Reusens could be found. The LANL DC study rated it at 0 MW. It was not modeled.
 2. All Interties (VEPC-I-xxxx) are included as Substations (VEPC-SS-xxxx).

MASTER

~~DISTRIBUTION~~ OF THIS DOCUMENT IS UNLIMITED

DISCLAIMER

**Portions of this document may be illegible
in electronic image products. Images are
produced from the best available original
document.**

-
3. All substations listed on the LANL DC model were checked against the MZA AC model. For missing substations, the LANL listed transmission lines were reviewed to locate a connection to an MZA listed substation. A list of connections is included as Appendix 1. Finally, a check was made of MZA load against those of LANL. MZA's model shows higher values where several substations were combined .

VEPCO Network Model
Grouped Substations

Connecting Substation

Number	Name	Connection Substations
VEPC-SS-006 ALLIED 115		
VEPC-SS-0051	BURDETTE 02 115	0006
VEPC-SS-0008 ALTAVISTA 115/VEPC-SS-0009 ALTAVISTA 138		
VEPC-SS-0118	DOMINION 115	0008
VEPC-SS-0150	EVINTON D.P. (SSEC) 115	0008-0118
VEPC-SS-0189	GRIT (MEC) 115	0008-336
VEPC-SS-0208	HICKORY GROVE DP (MEC) 11	0008-0336-0189
VEPC-SS-0262	LEESVILLE (APCO) 138	0008-0009
VEPC-SS-0336	OTTER RIVER 115	0008
VEPC-SS-0379	REUSENS (APCO) 138	0008-0009
VEPC-SS-0023 BATTLEBORO 115		
VEPC-SS-0094	CONSOLIDATED STEEL 115	0023
VEPC-SS-0292	MAYO DUNBAR (EMEMC) 115	0023
VEPC-SS-0386	ROCKY MTN. (CP&L) 115	0023
VEPC-SS-0490	WHITAKERS 115	0023-0094
VEPC-SS-0033 BOWERS HILL 115		
VEPC-SS-0005	ALEXANDER CORNER 115	0033
VEPC-SS-0035 BOYKINS 115		
VEPC-SS-0287	NARGARETTSVUKKE 115	0035
VEPC-SS-0476	WATKINS CORNER 115	0035
VEPC-SS-0036 BRADDOCK 230		
VEPC-SS-0232	JOHNSON (NVEC) 115	0036
VEPC-SS-0039 BREMO 115/VEPC-SS-0040 BREMO 138/VEPC-SS-0041 BREMO 230		
VEPC-SS-0040	BREMO (APCO) 138	0039
VEPC-SS-0046	BUCKINGHAM (PSE&G) 230	0039-0041
VEPC-SS-0061	CARTERVILLE 115	0039-0227
VEPC-SS-0085	CLIFFORD (APCO) 138	0039-0040
VEPC-SS-0227	JAMES RIVER IND 115	0039
VEPC-SS-0239	KIDDS STORE (CVEC) 115	0039
VEPC-SS-0363	POWHATAN 230	0039-0041
VEPC-SS-0047 BUENA VISA 115		
VEPC-GS-0110	CUSHAW 115	0047-0026-0016
VEPC-SS-0016	BALCONY FALLS 115	0047-0226
VEPC-SS-0110	CUSHAW 115	0047-0226-0016
VEPC-SS-0226	JAMES LEE 115	0047

Attachment 1

VEPC-SS-0056 CANNON BRANCH 115

VEPC-SS-0248	LAKE GASTON 115	0056
VEPC-SS-0352	PLEASANT HILL 115	0056-0353
VEPC-SS-0353	PLEASANT HILL TAP 115	0056
VEPC-SS-0395	SEABOARD 115	0056
VEPC-SS-0498	WOODLAND 115	0056

VEPC-SS-0068 CHARLOTTESVILLE 230/VEPC-SS-0069 CHARLOTTESVILLE 115

VEPC-SS-0229	JARVISBURG 115	0068
VEPC-SS-0108	CUNNINGHAM (CVEC) 115	0069

VEPC-SS-0070 CHASE CITY 115

VEPC-SS-0018	BARNES JCTN (MEC) 115	0070
VEPC-SS-0034	BOYDTON (MEC) 115	0070
VEPC-SS-0065	CENTRAL 115	0070
VEPC-SS-0170	GARY DP.P. (SSEC) 115	0070-0327
VEPC-SS-0235	KENBRIDGE 115	0070-0327
VEPC-SS-0324	NORTHVIEW (MEC) 115	0070
VEPC-SS-0327	NUTBUSH (SSEC) 115	0070
VEPC-SS-0390	S. HILL 115	0070-0324
VEPC-SS-0465	VICTORIA 115	0070-0327

VEPC-SS-0089 CLUBHOUSE 115

VEPC-SS-0042	BRINK D.P. (MEC) 115	0089-0295-0143-0447
VEPC-SS-0043	BRODNAX 115	0089-0259-0045
VEPC-SS-0045	BRUNSWICK 115	0089-0259
VEPC-SS-0143	EMPORIA 115	0089-0265
VEPC-SS-0144	EMPOIRA (MEC) 115	0089-0295-0143-0447
VEPC-SS-0228	JARRATT 115	0089-0369
VEPC-SS-0259	LAWRENCEVILLE 115	0089
VEPC-SS-0295	METCALF 115	0089
VEPC-SS-0369	PURDY 115	0089
VEPC-SS-0393	SAPONY 115	0089-0369
VEPC-SS-0447	TREGO 115	0089-0295-0143-0144

VEPC-SS-0102 CREWE 115

VEPC-SS-0165	FT. PICKETT 115	0102-0166
VEPC-SS-0166	FT PICKETT (SSEC) 115	0102
VEPC-SS-0212	HOOPERS D.P. (SSEC) 115	0102
VEPC-SS-0231	JETERSVILLE 115	0102-0212
VEPC-SS-0289	MARTINS D.P. (SSEC) 115	0102

VEPC-SS-0113 DEEP CRK 115

VEPC-SS-0172	GILMERTON 115	0113
--------------	---------------	------

VEPC-SS-0119 DOOMS 115

VEPC-SS-0156	FISHERSVILLE 115	0119
VEPC-SS-0300	MIDWAY (CVEC) 115	0119
VEPC-SS-0427	STUARTS DRAFT 115	0119-0156

Attachment 1

VEPC-SS-0124 DOW 115		
VEPC-SS-0290	MARTINS HUNDRED 115	0124
VEPC-SS-0130 DUMFRIES 115		
VEPC-SS-0096	COUNTRY CLUB (NVEC) 115	0130
VEPC-SS-0132 DUPONT 115		
VEPC-SS-0288	MARLBORO 115	0132
VEPC-SS-0133 DUPONT W 115		
VEPC-SS-0406	SHERANDO (SVEC) 115	0133
VEPC-SS-0134 EARLEYS 115		
VEPC-SS-0234	KELFORD 115	0134
VEPC-SS-0137 EDINBURG 115		
VEPC-SS-0425	STRASBURG (POTED) 115	0137-0445
VEPC-SS-0445	TIMBERVILLE 115	0137
VEPC-SS-0139 ELKTON 115		
VEPC-SS-0311	N. SHENANDOAH (AEC) 115	0139
VEPC-SS-0142 ELMONT 115		
VEPC-SS-0197	HANOVER 115	0142
VEPC-SS-0241	KINGS DOMINION (REC) 115	0142-0197
VEPC-SS-0149 EVERTTS 115		
VEPC-SS-0004	ALBEMARLE 115	0149
VEPC-SS-0031	BETHEL CAROLINA 115	0149-0492-0384-0341-0340
VEPC-SS-0157	FIVE POINTS 115	0149-0487
VEPC-SS-0184	GREENVILLE (CP&L) 230	0149-0487-0263-0185
VEPC-SS-0185	GREENVILLE (CP&L) 115	0149-0487-0263
VEPC-SS-0263	LEGGETTS 115	0149-0487
VEPC-SS-0264	LEGGETTS X ROADS 115	0149-0487-0263
VEPC-SS-0340	PARMELE 115	0149-0492-0384-0341
VEPC-SS-0341	PARMELE (EMEMC) 115	0149-0492-0384
VEPC-SS-0384	ROBERSONVILLE 115	0149-0492
VEPC-SS-0467	VOICE OF AMERICA 115	0149-0487-0203-0264
VEPC-SS-0487	WHARTON 115	0149
VEPC-SS-0492	WILSON ROBER. (EMEMC) 115	0149
VEPC-SS-0153 FARMVILLE 115		
VEPC-SS-0109	CURDSVILLE D.P.(CVEC) 115	0153
VEPC-SS-0303	MORAN D.P. (SSEC) 115	0153
VEPC-SS-0163 FREDERICKSBURG 115		
VEPC-SS-0309	N. DOSWELL (REC) 115	0163-0412-0499-0419
VEPC-SS-0412	SLABTOWN D.P. (REC) 115	0163
VEPC-SS-0419	ST. JOHNS 115	0163-0412-0499
VEPC-SS-0420	STAFFORD 115	0163

Attachment 1

VEPC-SS-0499	WOODPECKER DP (REC) 115	0163-0412
VEPC-SS-0177	GORDONSVILLE 115	
VEPC-SS-0364	PRATTA (APCO) 115	0177
VEPC-SS-0182	GREAT BRIDGE 115	
VEPC-SS-0090	COMMN WLTH NAT GAS 115	0182
VEPC-SS-0193	HALIFAX 115	
VEPC-SS-0060	CARTER FABRICS 115	0193-0374
VEPC-SS-0083	CLARVILLE 115	0193-0374-0334
VEPC-SS-0087	CLOVER 115	0193
VEPC-SS-0105	CRYSTAL HILL (MEC) 115	0193
VEPC-SS-0127	DRYBURG 115	0193-0087
VEPC-SS-0196	HALIFAX WORSTED 115	0193
VEPC-SS-0240	KINDERTON 115	0193-0374-0333-0383
VEPC-SS-0334	OMEGA D.P. (MEC) 115	0193-0374
VEPC-SS-0374	REEDY CRK 115	0193
VEPC-SS-0388	S. BOSTON 115	0193-0196-0411
VEPC-SS-0411	SINAI 115	0193-0196
VEPC-SS-0480	WLCO 115	0193-0196-0411
VEPC-SS-0194	HALIFAX 230	
VEPC-SS-0346	PERSON (CP&L) 230	0194
VEPC-SS-0198	HARMONY VILLAGE 115	
VEPC-SS-0491	WHITE STONE 115	0198
VEPC-SS-0201	HARRISONBURG 115	
VEPC-SS-0310	N. RIVER D.P. (SVEC)	0201
VEPC-SS-0202	HARROWGATE 115	
VEPC-SS-0471	WALTHALL 115	0202
VEPC-SS-0203	HARVELL 115	
VEPC-SS-0160	FORT LEE 115	0203
VEPC-SS-0211	HOLLYMEAD 230	
VEPC-SS-0063	CASHS CORNER (CVEC) 230	0211
VEPC-SS-0507	CASHS CORNER (CVEC) 115	0211-0063
VEPC-SS-0214	HONERTOWN 115	
VEPC-SS-0146	ENFIELD (HEMC) 115	0214-0195
VEPC-SS-0195	HALIFAX (REMC) 115	0214
VEPC-SS-0218	IBM 115	
VEPC-SS-0003	AIRPORT 115	0218
VEPC-SS-0055	CANNON BRANCH 115	0218-0003
VEPC-SS-0175	GOWIND (NVEC) 115	0218
VEPC-SS-0285	MANASSAS 115	0218-0003-0055

Attachment 1

VEPC-SS-0481	WELLINGTON (NVEC) 115	0218-0175
VEPC-SS-0500	WOODS 115	0218-0003-0055-0285
VEPC-SS-O219 ICI 115		
VEPC-SS-0147	ENON 115	0219
VEPC-SS-0230 JEFFERSON ST. 230/VEPC-SS-0231 JEFFERSON ST 115		
VEPC-SS-0268	LINDENDALE (NVEC) 115	0230-0414-0302
VEPC-SS-0302	MINNIEVILLE (NVEC) 115	0230-0414
VEPC-SS-0414	SMOKETOWN (NVEC) 115	0230
VEPC-SS-0237 JERR DAM 115		
VEPC-SS-0084	CLARKSVILL (MEC) 115	0237-0236-0224
VEPC-SS-0206	HENDERSON (CP&L) 115	0237
VEPC-SS-0224	ISLAND CRK (GOV. OWN) 115	0237-0236
VEPC-SS-0236	KERR D.P. (MEC) 115	0237
VEPC-SS-0269	LITTLETON (CP&L) 115	0237
VEPC-SS-0254 LANCASTER 115		
VEPC-SS-0169	GARNER D.P. (NNEC) 115	0254
VEPC-SS-0258 LANEXA 115		
VEPC-SS-0180	GRAFTON 115	0258
VEPC-SS-0317	NEWPORT RES. 115	0258
VEPC-SS-0260 LEBANON 115		
VEPC-SS-0159	FORT EUSTIS 115	0260-0261
VEPC-SS-0261	LEE HALL 115	0260
VEPC-SS-0506	YORKTOWN NAV. WPNS 115	0260
VEPC-SS-0266 LEXINTON (APCO) 500		
VEPC-SS-0508	CLOVERDALE (APCO) 500	0266
VEPC-SS-0272 LOCKS 230		
VEPC-SS-0460	UNIONVILLE (REC) 115	0272
VEPC-SS-0275 LONG CREEK 115		
VEPC-SS-0024	BAYSIDE 115	0275
VEPC-SS-0276 LOUDOUN 115		
VEPC-SS-0013	ARCOLA (NVEC) 115	0276
VEPC-SS-0064	CARHARPIN (NVEC) 115	0276
VEPC-SS-0106	CUB RUN (NVEC) 115	0276
VEPC-SS-0167	GAINSVILL 230	0276-0277
VEPC-SS-0286 MANCHESTER 115		
VEPC-SS-0291	MAURY ST. IND, 115	0286
VEPC-SS-0358	PORTER ST 115	0286
VEPC-SS-0298 MIDLOTHIAN 230		

Attachment 1

VEPC-SS-0158	FLAT ROCK 115	0298-0299
VEPC-SS-0299	MIDLOTHIAN 115	0298
VEPC-SS-0349	PLANTATION 115	0298-0299
VEPC-SS-0315 NEWPORT NEWS 230		
VEPC-SS-0028	BENNS CHURCH 230	0315
VEPC-SS-0328 OAK GROVE 115		
VEPC-SS-0392	SANDERS D.P. (NNEC) 115	0328
VEPC-SS-0330 OAKWOOD 115		
VEPC-SS-0372	RED HILL (CVEC) 115	0330
VEPC-SS-0331 OCCOQUAN 230		
VEPC-SS-0332	OCCOQUAN 115	0331
VEPC-SS-0335 ORANGE 115		
VEPC-SS-0122	DOUBLEDAY (CVEC) 115	0335
VEPC-SS-0337 OX (PJM) 500		
VEPC-SS-0050	BURCHES HILL (PELEC) 500	0337
VEPC-SS-0339 PAMPLIN 115		
VEPC-SS-0373	RED HOUSE (SSEC) 115	0339
VEPC-SS-0389	S. CRK 115	0339
VEPC-SS-0454	TWITTYS CRK 115	0339
VEPC-SS-0344 PENINSULA 115		
VEPC-SS-0313	NASA (POR) 15	0344
VEPC-SS-0459	UNION CARBIDE 115	0344
VEPC-SS-0350 PLAZA 115		
VEPC-SS-0026	BELLWOOD 115	0350-0314
VEPC-SS-0044	BROWN-BOVERI 115	0350-0314-0026
VEPC-SS-0245	KINGSLAND 115	0350-0314-0044
VEPC-SS-0314	NAT CYL. GAS 115	0350
VEPC-SS-0380	REYMET 115	0350-0314-0044-0245
VEPC-SS-0355 PLYMOUTH 115		
VEPC-SS-0101	CRESWELL 115	0355-0283
VEPC-SS-0283	MACKEYS 115	0355
VEPC-SS-0357 POE 115		
VEPC-SS-0117	DISPUTANIA 115	0357
VEPC-SS-0225	IVOR 115	0357
VEPC-SS-0477	WAVERLY 115	0357-0117
VEPC-SS-0377 REMINGTON 115		
VEPC-SS-0221	IND HILL (NVEC) 115	0377-0418
VEPC-SS-0418	SOWEGO (NVEC) 115	0377

Attachment 1

VEPC-SS-0385 ROCKBRIDGE 115	
VEPC-SS-0054 BUSTLEBURG DP (BARC) 115	0385
VEPC-SS-0394 SCOTLAND NECK 115	
VEPC-SS-0391 SAMS HEAD (HEMC) 115	0394
VEPC-SS-0402 SHAWBORO 115	
VEPC-SS-0017 BARCO 115	0402
VEPC-SS-0368 PT. HARBOR 115	0402
VEPC-SS-0404 SHELLBANK 115	
VEPC-SS-0030 BETHEL (NVEC) 115	0404
VEPC-SS-0408 SHOCKOE 115	
VEPC-SS-0479 WECO 115	0408
VEPC-SS-0409 SHORT PUMP 115	
VEPC-SS-0188 GREENWOOD D.P. (REC) 115	0409
VEPC-SS-0422 STAUNTON 115	
VEPC-SS-0037 BRAND D.P. (SVEC) 115	0422
VEPC-SS-0099 CRAIGSVILLE 115	0422-0448
VEPC-SS-0178 GOSHEN 115	0422-0448-0099
VEPC-SS-0448 TRIMBLES MILL DP(SVEC)115	0422
VEPC-SS-0464 VERONA 115	0422
VEPC-SS-0486 WEYERS CAVE 115	0422-0464
VEPC-SS-0426 STRATFORD HILLS 115	
VEPC-SS-0066 CENTRALIA 115	0426
VEPC-SS-0430 SUFFOLK 115	
VEPC-SS-0210 HOLLAND 115	0430
VEPC-SS-0242 KINGS FORK 115	0430-0329
VEPC-SS-0308 MYRTLE 115	0430-0329
VEPC-SS-0329 OAK RIDGE 115	0430
VEPC-SS-0468 WAKEFIELD 115	0430-0329-0308
VEPC-SS-0431 SULLY 115	
VEPC-SS-0082 CLARK 115	0431-0128
VEPC-SS-0128 DULLES 115	0431
VEPC-SS-0432 SURRY 230	
VEPC-SS-0181 GRAVEL NECK 230	0432
VEPC-SS-0437 TARBORO 115	
VEPC-SS-0011 ANACONDA 115	0437-0435
VEPC-SS-0093 CONETONE (EMEMC) 115	0437-0438
VEPC-SS-0435 TAR RIVER 115	0437
VEPC-SS-0438 TARBORO (EMEMC) 115	0437

Attachment 1

VEPC-SS-0450 TROWBRIDGE 115	
VEPC-SS-0485 WEYERHAUSER 115	0450
VEPC-SS-0451 TUNIS 115	
VEPC-SS-0002 AHOSKIE 115	0451
VEPC-SS-0453 TWELFTH ST. 115	
VEPC-SS-0348 PIPELINE 115	0453
VEPC-SS-0458 UNION CAMP 115	
VEPC-SS-0162 FRANKLIN 115	0458
VEPC-SS-0469 WALLER 230	
VEPC-SS-0446 TOANO 115	0469-0470
VEPC-SS-0470 WALLER 115	0469
VEPC-SS-0473 WARRENTON 115	
VEPC-SS-0038 BRANDY (REC) 115	0473
VEPC-SS-0482 WEST POINT 115	
VEPC-SS-0400 SHACKLEFORD 115	0482
VEPC-SS-0494 WINFALL 115	
VEPC-SS-0075 CHOWAN 115	0494
VEPC-SS-0136 EDENTON 115	0494-0075

VEPCO Network Model
MZA Unlisted Substations

MZA Substation

LANL Substation Number and Name

7645 BELLEMEADE 230
VEPC-SS-0021 BASIN 230

7961 COLINGTON 115
VEPC-SS-0246 KITTY HAWK 115 and VEPC-SS-0312 NAGS HEAD 115

7705 DARBYTOWN 230
VEPC-SS-0073 CHICKAHOMINY 230 and VEPC-SS-0321 NORTHEAST 230

7495 EDGECOMBE NUG 230
VEPC-SS-0387 ROCKY MTN (CP&L) 230 and VEPC-SS-0436 TARBORO 230

4798 ELIZABETH RIVER 230
VEPC-SS-0497 WOODBRIDGE 230

7127 GLEN CARLYNT 230
VEPC-SS-0151 FALLS CHURCH 230

7309 HALL BRANCH 115
VEPC-SS-0008 ALTAVISTA 115 and VEPC-SS-0193 HALLIFAX 115

7706 LIGHTFOOT 230
VEPC-SS-0244 KINGS MILL 230

7141 PENTAGON 230
VEPC-SS-0173 GLEBE 230

7436 ROSEMARY NUG 230
VEPC-SS-0215 HORNERTOWN 230

7455 SOUTHAMPTON 115
VEPC-SS-0035 BOYKINS 115 and VEPC-SS-0458 UNION CAMP 115

4755 SOUTH ANNA 230
VEPC-SS-0176 GORDONSVILLE 230 and VEPC-SS-0279 LOUISA 230

7111 STERLING PKT 230
VEPC-SS-0354 PLEASANT VIEW (PELEC) 230

7204 STUARTS HILL 115
VEPC-SS-0119 DOOMS 115 and VEPC-SS-0133 DUPONT 115

7187 VA. HILLS 230

VEPC-SS-0205 HAYFIELD 230 and VEPC-SS-0230JEFFERSON ST. 230

- 9 WAKE 500
 VEPC-SS-0059 CARSON (CP&L) 500

May 6, 1993

University of California
Los Alamos National Laboratory
Attn: J.F. Roach
Reference: 9-LY2-W6097-1
Mail Stop 299
P.O. Box 1663
Los Alamos, NM 87545

Dear Mr. Roach:

Subject: Transmittal of Duke Power Load Flow Model

Enclosed is a copy of the Duke Power Company AC load flow model and related database. The model was constructed from a Duke Power Company System Planning Department Operating Study and updated with information received from neighboring utilities and utility contacts.

We were unable to acquire transmission line information for the 115KV segments. The 115kV lines belong to interconnected utilities and the Duke model represents them as generation or load at the relevant Duke bus. A listing is enclosed as Appendix 1.

Several of the substations listed in the Los Alamos DC study have been combined. In general this was done to simplify configurations for substations that were taps or very close to a larger substation. A list of missing substations and the modeled substation is included as Appendix 2. Appendix 3 lists substations in the MZA database not included in the LANL database.

A copy of this letter and all attachments except the model, database and hand drawn diagram have been forwarded to Mr. Michael Pierotti.

If you have any questions, please contact me at (213) 299-7561.

Thank you;

Michele Wynne
Principal

Appendix 1

Modelling of 115kV Substations

0010 ASHVILLE CP&L	3152 HORSESHOE
0031 BUSH RIVER	3408 BUSH RIVER
0033 CAMDEN CP&L	3450 WATEREE
0036 CANTON CP&L	3130 PISGAH
0046 CLARK HILL	3175 CLARK HILL
0054 DAN RIVER	3151 DAN RIVER
0058 DAVIDSON RIVER DUM CP&L	3150 DAVIDSON RIVER
0091 HORSESHOE	3152 HORSESHOE
0168 PISGAH	3130 PISGAH
0171 RIDEWAY	3350 DAN RIVER
0182 SALUDA	3408 BUSH RIVER
0204 WATEREE	3450 WATEREE
0208 WESTMINSTER GAP	3150 WESTMINSTER

Appendix 2

LANL Substations not in MZA Model

0001 ABBOTTS CRK	3368 LEXINGTON
0019 BLACKSBURG	3404 SHELBY
0020 BLUE RIDGE COOP	2206 BLUE RIDGE 230
0021 BLUE RIDGE COOP	2206 BLUE RIDGE 230
0028 BURLINGTON	3371 MEBANE
0034 CAMPO BELLO	3153 HENDERSONVILLE
0035 CANE CRK	3161 E. GREENVILLE
0038 CEDAR CRK HYDRO	3451 GREAT FALLS
0042 CHESNEE	3123 PEACH VALLEY
0049 CLOVER	3405 PEACOCK
0057 P.H.GLATFELTER CORP	3450 DAN RIVER
0059 DEARBORN HYDRO	3451 GREAT FALLS
0060 DIXIE	3461 HILLTOP
0062 DURHAM PARK	3303 ENO
0065 EASLEY	2206 BLUE RIDGE 230
0070 FISHING CREEK HYDRO	3451 GREAT FALLS
0073 GRAND CREEK TAP	3315 BUCK
0075 GREENLAWN	2206 BLUE RIDGE
0079 GREER	3161 E. GREENVILLE
0085 HIGHTOWER	3161 E. GREENVILLE
0092 IDOLS TAP BENT	3257 POPLAR SWITCH
0099 LAUREN ELECTRIC COOP	3161 E. GREENVILLE
0100 LAURENS	3109 SHADY GROVE
0102 LEE STEAM PLT.	3109 SHADY GROVE
0109 MADISON	3350 DAN RIVER
0110 MARION	3250 BRIDGEWATER
0118 MIDWAY	3400 NEWPORT
0122 MOCKSVILLE	3257 POPLAR SWITCH
0128 MOTLEY	3350 DAN RIVER
0129 MT ISLAND HYDRO	3464 RIVERBEND
0136 NEWBERRY	3400 NEWPORT
0140 NEWTON	3258 HICKORY
0158 PICKENS	2206 BLUE RIDGE 230
0159 PINK HARRILL	3125 CLIFFSIDE
0160 PINNACLE	3260 BANNERTOWN
0163 AMERICAN THREAD	3151 DAVIDSON RIVER
0178 RUTLEDGE	3260 BANNERTOWN
0183 SANDY SPRINGS	3408 BUSH
0184 SENECA	3104 CENTRAL
0193 STATESVILLE	3257 POPLAR SWITCH

0196 TAYLORSVILLE
0201 BALDESE
0209 WILDCAT
0210 WILKES

3261 N. WILKESBORO
3251 BREEDEN
3464 RIVERBEND
3261 N. WILKSBORO

Appendix 3

MZA Substations on on LANL Listing

401 RICHMOND 500	0137 NEWPORT
2103 KEOWEE	0145 OCONEE
2106 SEPA HARTWELL	0007 ANDERSON
2107 SOUTHERN BIO	0007 ANDERSON
2302 BRASSFIELD	0068 ENO
2316 BOBWHITE	0165 PLEASANT GARDEN
2350 ROXBORO	0068 ENO
3174 CYPRESS	0088 HODGES

January 15, 1993

University of California
Los Alamos National Laboratory
Attn: J.F. Roach
Reference: 9-LY2-W6097-1
Mail Stop 299
P.O. Box 1663
Los Alamos, NM 87545

Dear Mr. Roach:

Subject: Transmittal of Italian Power Flow Model

Enclosed are three copies of the Italian State (ENEL) AC power flow model and related database. The model was constructed from data received from the Italian National Control Center (a sample map and hand drawn diagram of their mimic board are attached), and the western European reliability council, UCPTE (a two page intertie table is attached). The information was acquired during a 1978 business trip that included a day long visit to the ENEL national control center. The original model was refined during demonstrations performed for control center personnel in 1989 and 1990. The final model reflects data gathered during a short visit to the control center in 1991.

For simplification, 220 kV interties have been modeled into the 380 kV system. The Grande-Ile substation shown on the map is actually connected to the Albertville (F) substation. Laufenburg substation is included to represent power transfers from northern European systems.

The model will diverge using the decoupled (DSOLVE) algorithm. It will diverge after 6 iterations the first time the Newton (NSOLVE) algorithm is used but will converge quickly on the second attempt. I have found this to be an idiosyncrasy of the solution method not the model.

A copy of this letter and all attachments except the model, database and hand drawn diagram have been forwarded to Mr. Michael Pierotti.

If you have any questions, please contact me at (213) 299-7561.

Thank you;

Michele Wynne
Principal

(31 DECEMBER 1987)

		Nom	Exploité par	Nom	Exploité par	Prévue	Actuelle	Lignes	Temes	Prévue	Actuelle	à	
Land	Grenz- punkte	Verbindung zwischen:				Daten				Übertragungs- fähigkeit Leitung (therm.)		Beschränk- Transform (oder Schalt	
		Station		Station		Leitungsspannung		Zahl der					
		Name	Betreiber	Name	Betreiber	Vorge- sehen	Gegen- wartig	Lei- tungen	Strom- kreise	Vorge- sehen	Gegen- wartig	auf	
Paese	Punti di frontiera	Collegamento fra le:				Caratteristiche				Capacità (termica) di trasporto della linea		Limita- trasform (o apparec	
		Stazione		Stazione		Tensione della linea		Numero di					
		Nome	Esercita da	Nome	Esercita da	Prevista	Attuale	Linee	Terne	Prevista	Attuale	Potenza	
Land	Meelp. aan de grenzen	Verbinding tussen:				Lijngegevens				Transport- capaciteit lijn (thermisch)		Bepert transfor (of onder	
		Station		Station		Bedrijfsspanning		Aantal					
		Naam	Exploitant	Naam	Exploitant	Gepro- jecteerd	Thans	Lijnen	Circuits	Gepro- jecteerd	Thans	tot	
	Nr.					kV	kV			MVA	MVA	MVA	
1	2	3	4	5	6	7	8	9	10	11	12	13	
Österreich – Bundesrepublik Deutschland	111	Riedn Bürs Bürs Bürs Bürs	VKW VIW VIW VIW VIW	Lindau Herbertingen Herbertingen Dellmensingen Dellmensingen	VKW EVS RWE EVS RWE	— 380 380 380 380	110 220 220 220 220	1 1 1 1 1	2a) 1b) 1 2 2	— 1 185 390 1 700 —	180 330 330 985 493	— — — 380c) 380c)	
	112	Kufstein	TIWAG	Rosenheim	Innwerk	—	110	1	2d)	—	363	332	
	115	Braunau Ranshofen St. Peter St. Peter St. Peter	OBK OVG OVG OVG OVG	Pirach Neutotting Altheim Ering Oberberg – Eggling	Innwerk Innwerk Bayernwerk Innwerk Innwerk	— — — — —	110 110 220 110 110	1 1 2 1 1	2e) 2 2 2 1	— — — — —	203 183 610 304 105	180 166 — 228 —	
		St. Peter St. Peter Partensteln St. Peter	OVG OVG OKA OVG	Schärding f) Pirach Passau Pleinling	OBK Bayernwerk Bayernwerk Bayernwerk	— — — —	220 220 110 220	1 1 1 1	2 1 2 1g)	— — — —	613 526 183 526	458 476 138 476	
	116	Westtirol Westtirol	OVG OVG	Leupolz Memmingen	RWE RWE	— 380	380 220	1 1	1 1	— 1 590	1 590 920	1 000 760	
	117	Silz	TIWAG	(Habach) Oberbrunn	Bayernwerk	—	220	1	2	—	1 585	—	
	121	Airolo Gorduno Soazza Lavorgo	ATEL ATEL EGL ATEL	Ponte Mese Bovisio Musignano	ENEL ENEL ENEL ENEL	— — — —	220 220 380 380	1 1 1 1	1 1 1 1	— — — —	250 250 900 1 500	— — — —	
	122	Campocologno Robbia	KWB KWB	Poschiavino Sondrio	ENEL ENEL	— —	150 220	1 1	1a) 1	— —	80 263	42 —	
	123	Riddes Riddes Mörel	EGL EGL RHOWAG	Avise Valpelline Pallanzeno	ENEL ENEL ENEL	— — —	220 220 220	1 1 1	2 2 1a)	— — —	300 300 253	— — —	
	132	Lienz	ÖVG	Soverzene	ENEL	—	220	1	1	—	285	229a)	
	141	Dornbirn – Werben	VKW	Winkeln	NOK	380	220	1	1a)	1 372	777	518	
France – España	151	Cantegrit Mouguerre Pragnères	EdF EdF EdF	Hemani Arkale Biescas	Red Eléctrica Red Eléctrica Red Eléctrica	— — —	380 220 220	1 1 1	1 1 1	— — —	1 150 400 150	— — —	
	152	Luchon	EdF	Benos	Red Eléctrica	—	150	1	1	—	80	70	
	153	Baixas	EdF	Vich	Red Eléctrica	—	380	1	1	—	1 253	—	
Bundesrepublik Deutschland – Danmark	161	Flensburg Flensburg Aurdorf	PE PE PE	Aabenraa Kasso Kasso	ELSAM ELSAM ELSAM	— — —	220 220 380	1 1 1	2 1b)	— 2 760 —	333 333 1 380	190a) 285a) 800c)	
	171	Bisamberg	ÖVG	Sokolnice	CEZ	—	220	1	2	—	610	458a)	
	172	Dürnrohr	ÖVG	Slavetice	CEZ	—	380	1	1c)	3 028	1 514	550b)	
Österreich – Jugoslawija	181	Obersielach	ÖVG	Podlog	DEM	—	220	1	1a)	—	350	—	
Luxembourg – Bundesrepublik Deutschland	191	Vianden	SEO	Niederstedem	RWE	—	220	2	4	—	2 480	1 265	
	192	Heisdorf	CEGEDEL	Trier	RWE	—	220	1	2	—	980	950	
Jugoslawija – Italia	201	Divača Divača	SENG SENG	Redipuglia Padriciano	ENEL ENEL	— —	380 220	1 1	1 1	— —	1 625 350	— —	
Österreich – Magyarország	211	Wien Süd-Ost Neusiedl	ÖVG	Győr	MVM	—	220	1	2	—	613	496	
France – Great-Britain	221	Mandarins	EdF	Sellindge	CEGB	—	± 270a)	2b)	4	—	2 000	—	
España – Portugal	D	Las Conchas	UE-FENOSA	Lindoso	EDP	—	132	1	1	—	103	—	
	E	Aldeadavila	Red Eléctrica	Bemposta	EDP	—	220	1	1	—	400	—	
		Aldeadavila	Red Eléctrica	Pocinho	EDP	—	220	1	1	—	400	—	
		Saucele	Red Eléctrica	Pocinho	EDP	—	220	1	1	—	400	—	
	F	Cedillo	Red Eléctrica	Rio Maior	EDP	—	380	1	1	—	700	—	
Jugoslawija – Hellas	G	Dubrovo Bitola	Elektroprenos ELEST	Thessaloniki Ptolemais	PPC PPC	— —	380 110	1 1	1 1	— —	1 403 138	750a) 90b)	

		Nom	Exploité par	Nom	Exploité par	Prévue	Actuelle	Lignes	Termes	Prévue	Actuelle	à	(tens
Land	Grenzpunkte	Verbindung zwischen:				Daten				Übertragungs-fähigkeit Leitung (therm.)		Beschränkt durch Transformatoren (oder Schaltanlagen)	
		Station		Station		Leitungsspannung		Zahl der					
		Name	Betreiber	Name	Betreiber	Vorge-sehen	Gegen-wärtig	Lei-tungen	Strom-kreise	Vorge-sehen	Gegen-wärtig	auf	(Üb-setzt
Paese	Punti di frontiera	Collegamento fra le:				Caratteristiche				Capacità (termica) di trasporto della linea		Limitata da trasformatori (o apparecchiature)	
		Stazione		Stazione		Tensione della linea		Numero di					
		Nome	Esercita da	Nome	Esercita da	Prevista	Attuale	Linee	Terne	Prevista	Attuale	Potenza	(tra
Land	Meelp. aan de grenzen	Verbinding tussen:				Lijngegevens				Transport-capaciteit lijn (thermisch)		Beperkt door transformatoren (of onderstationen)	
		Station		Station		Bedrijfsspanning		Aantal					
		Naam	Exploitant	Naam	Exploitant	Gepro-jecteerd	Thans	Lijnen	Circuits	Gepro-jecteerd	Thans	tot	(tr-ve
	Nr.					kV	kV			MVA	MVA	MVA	
1	2	3	4	5	6	7	8	9	10	11	12	13	
Bundesrepublik Deutschland – Nederland	11	Diele	PE	Meeden	SEP/EGD	380	220	1	1	—	500	—	—
	13	Siersdorf Rommerskirchen	RWE RWE	Maasbracht	SEP SEP	— 380	380	1	2	— 1 500	1 500	1 300 1 300	—
	14	Lathen	PE	Musselkanaal	EGD	—	110	1	1	—	120	64	(110/
	15	Gronau	VEW	Hengelo	IJC	380	220	1	1	1 650	610	475	—
Belgique – Nederland	22	Eisden	EBES	Lutterade	PLEM	—	150	1	2	—	270	—	—
	23	Gramme Massenhoven Zandvliet Zandvliet	CPTC CPTC CPTC CPTC	Maasbracht Maasbracht Geertruidenberg Borssele	SEP SEP SEP SEP	— 380 380 380	380	1	2	— 1 320 1 320 1 650	1 320 1 320 1 650	— 450	—
	24	Maldegem	EBES	Oostburg	PZEM	—	150	1	1	—	60	—	—
Belgique – Luxembourg	41	Aubange Aulange	UNERG UNERG	Belval Belval	SOTEL SOTEL	— 220 150	220 150	1 1	1 2	— 400 350	400 350	— 2 x 100	(150/
France – Belgique	51	Chooz Avelin Mazures	EdF EdF EdF	Jamolle Avelgem Achene	UNERG CPTC CPTC	— 380 380	220 380 380	1 1 1	1 1 1	— 400 1 320 1 320	400 1 320 1 320	295 — —	(220/
	52	Mouline Herseange	EdF EdF	Aubange Aubange	UNERG UNERG	— 220 150	220 150	1 1	1 1	— 400 90	400 90	— —	—
Bundesrepublik Deutschland – France	71	Uchtelfangen Ensdorf	RWE RWE	Vigy St.-Avoird	EdF EdF	— 380 220	380 220	1 1	1 1	— 1 300 275	1 300 275	— —	—
	72	Eichstetten	Badenwerk	Vogelgrün	EdF	380	220	1	1a)	1 700	500	—	—
	74	Kühmoos	Badenwerk	Sierentz	EdF	—	380	1	1	—	1 300	—	—
Schweiz – France	81	Bassecourt Laufenburg Bassecourt	BKW EGL BKW	Sierentz Sierentz Mambelin	EdF EdF EdF	— 380 380	380 380 380	1 1 1	1 1 1	— 1 320 1 320 1 320	1 320 1 320 1 320	— — —	—
	82	Verbois Verbois La Bâtiâz Rudes La Bâtiâz	EOS SIG ESA EGL ESA	Génissiat Chancy-Pougny Cormier Génissiat Valorcine	EdF SFM C-P EdF EdF ESA	— 220 130 220 220 220	220 130 220 220 220	1 1 1 1 1	2 1 2 1 1	— 600 60 300 300 300	600 60 300 300 300	— 42 — — —	(11/
	83	Gösgen	ATEL	Sierentz	EdF	—	380	1	1	—	b)	—	—
France – Italia	91	Albertville	EdF	Rondissone	ENEL	—	380	1	2	—	3 000	—	—
	92	St.-Dalmas Lingostière	EdF EdF	Garessio Camporosso	ENEL ENEL	— 150 220	150 220	1 1	1 1	— 90 340	90 340	50 —	(130/
	93	Villarodin	EdF	Venaus	ENEL	—	380	1	1	—	900	—	—
	94	Lucciana	EdF	S. Dalmazio Codrongianus	ENEL ENEL	—	± 200b)	1	2	—	200	50	—
Schweiz – Bundesrepublik Deutschland	102	Laufenburg	EGL	(Alb-Nord) Gurtweil	Badenwerk	—	220	1	2	—	380	—	—
		Laufenburg	EGL	(Alb-Süd) Kühmoos	Badenwerk	—	220 220 220	1 1 1b)	1a) 1	—	380 490 490	— 380 380	—
		Laufenburg	EGL	Kühmoos	Badenwerk	380	380	1	1	—	1 700	1 260	—
		Laufenburg	EGL	Kühmoos	Badenwerk	—	380	1	1	—	1 700	1 260	—
		Laufenburg	EGL	Kühmoos	RWE	—	380	1b)	1	—	1 600	1 230c)	—
		Laufenburg	EGL	Tiengen	RWE	—	380	1	1	—	1 100	—	—
		Laufenburg	EGL	Breitenmatt	KWL	—	110	1d)	1	—	200	—	—
		Laufenburg	EGL	Breitenmatt	KWL	—	110	1e)	1	—	200	—	—
	103	Beznau Beznau Klingnau	NOK NOK AWAG	Tiengen Tiengen Tiengen	RWE RWE RWE	380	380 220 110	1	3f)	—	1 300 340 53	860g)	—
	104	Gösgen	ATEL	Kühmoos	Badenwerk	—	380	1	1	—	h)	—	—
	105	Laufenburg	EGL	Engstlatt	EVS	—	380	1	1	1 800	1 150	950	—