Distribution System Analysis Subcommittee

IEEE 13 Node Test Feeder

IEEE 13 Node Test Feeder

Overhead Line Configuration Data:

Config.	Phasing	Phase	Neutral	Spacing
		ACSR	ACSR	ID
601	B A C N	556,500 26/7	4/0 6/1	500
602	C A B N	4/0 6/1	4/0 6/1	500
603	C B N	1/0	1/0	505
604	A C N	1/0	1/0	505
605	C N	1/0	1/0	510

Underground Line Configuration Data:

Config.	Phasing	Cable	Neutral	Space ID
606	A B C N	250,000 AA, CN	None	515
607	A N	1/0 AA, TS	1/0 Cu	520

Line Segment Data:

Node A	Node B	Length(ft.)	Config.
632	645	500	603
632	633	500	602
633	634	0	XFM-1
645	646	300	603
650	632	2000	601
684	652	800	607
632	671	2000	601
671	684	300	604
671	680	1000	601
671	692	0	Switch
684	611	300	605
692	675	500	606

Transformer Data:

	kVA	kV-high	kV-low	R - %	X - %
Substation:	5,000	115 - D	4.16 Gr. Y	1	8
XFM -1	500	4.16 – Gr.W	0.48 – Gr.W	1.1	2

Capacitor Data:

Node	Ph-A	Ph-B	Ph-C
	kVAr	kVAr	kVAr
675	200	200	200
611			100
Total	200	200	300

Regulator Data:

Regulator ID:	1		
Line Segment:	650 - 632		
Location:	50		
Phases:	A - B -C		
Connection:	3-Ph,LG		
Monitoring Phase:	A-B-C		
Bandwidth:	2.0 volts		
PT Ratio:	20		
Primary CT Rating:	700		
Compensator Settings:	Ph-A	Ph-B	Ph-C
R - Setting:	3	3	3
X - Setting:	9	9	9
Volltage Level:	122	122	122

Spot Load Data:

Node	Load	Ph-1	Ph-1	Ph-2	Ph-2	Ph-3	Ph-3
	Model	kW	kVAr	kW	kVAr	kW	kVAr
634	Y-PQ	160	110	120	90	120	90
645	Y-PQ	0	0	170	125	0	0
646	D-Z	0	0	230	132	0	0
652	Y-Z	128	86	0	0	0	0
671	D-PQ	385	220	385	220	385	220
675	Y-PQ	485	190	68	60	290	212
692	D-I	0	0	0	0	170	151
611	Y-I	0	0	0	0	170	80
	TOTAL	1158	606	973	627	1135	753

Distributed Load Data:

Node A	Node B	Load	Ph-1	Ph-1	Ph-2	Ph-2	Ph-3	Ph-3
		Model	kW	kVAr	kW	kVAr	kW	kVAr
632	671	Y-PQ	17	10	66	38	117	68

IEEE 13 NODE TEST FEEDER

Impedances

Configuration 601:

```
           Z (R +jX) in ohms per mile
 0.3465  1.0179   0.1560  0.5017   0.1580  0.4236
                  0.3375  1.0478   0.1535  0.3849
                                   0.3414  1.0348
          B in micro Siemens per mile
            6.2998   -1.9958   -1.2595
                      5.9597   -0.7417
                                5.6386
```

Configuration 602:

```
           Z (R +jX) in ohms per mile
0.7526  1.1814   0.1580  0.4236   0.1560  0.5017
                 0.7475  1.1983   0.1535  0.3849
                                  0.7436  1.2112
         B in micro Siemens per mile
           5.6990   -1.0817   -1.6905
                     5.1795   -0.6588
                               5.4246
```

Configuration 603:

```
           Z (R +jX) in ohms per mile
 0.0000  0.0000   0.0000  0.0000   0.0000  0.0000
                  1.3294  1.3471   0.2066  0.4591
                                   1.3238  1.3569
          B in micro Siemens per mile
            0.0000    0.0000    0.0000
                      4.7097   -0.8999
                                4.6658
```

Configuration 604:

```
           Z (R +jX) in ohms per mile
 1.3238  1.3569   0.0000  0.0000   0.2066  0.4591
                  0.0000  0.0000   0.0000  0.0000
                                   1.3294  1.3471
          B in micro Siemens per mile
            4.6658    0.0000   -0.8999
                      0.0000    0.0000
                                4.7097
```

Configuration 605:

```
           Z (R +jX) in ohms per mile
 0.0000  0.0000   0.0000  0.0000   0.0000  0.0000
                  0.0000  0.0000   0.0000  0.0000
                                   1.3292  1.3475
          B in micro Siemens per mile
            0.0000    0.0000    0.0000
                      0.0000    0.0000
                                4.5193
```

Configuration 606:

```
           Z (R +jX) in ohms per mile
0.7982  0.4463   0.3192  0.0328   0.2849 -0.0143
                 0.7891  0.4041   0.3192  0.0328
                                  0.7982  0.4463
         B in micro Siemens per mile
          96.8897    0.0000    0.0000
                    96.8897    0.0000
                              96.8897
```

Configuration 607:

```
           Z (R +jX) in ohms per mile
 1.3425  0.5124   0.0000  0.0000   0.0000  0.0000
                  0.0000  0.0000   0.0000  0.0000
                                   0.0000  0.0000
          B in micro Siemens per mile
           88.9912    0.0000    0.0000
                      0.0000    0.0000
                                0.0000
```

Power-Flow Results

- **R A D I A L F L O W S U M M A R Y** - DATE: 6-24-2004 AT 15:33: 2 HOURS ---
SUBSTATION: IEEE 13;   FEEDER: IEEE 13

SYSTEM INPUT	PHASE (A)	PHASE (B)	PHASE (C)	TOTAL
kW :	1251.398	977.332	1348.461	3577.191
kVAr :	681.570	373.418	669.784	1724.772
kVA :	1424.968	1046.241	1505.642	3971.289
PF :	.8782	.9341	.8956	.9008

LOAD	(A-N)	(A-B)	(B-N)	(B-C)	(C-N)	(C-A)	WYE	DELTA
kW :	785.6	385.0	424.0	625.7	692.5	553.4	1902.1	1564.0
TOT :	1170.563		1049.658		1245.907		3466.128	
kVAr :	393.0	220.0	313.0	358.1	447.9	369.5	1153.9	947.7
TOT :	613.019		671.117		817.450		2101.586	
kVA :	878.4	443.4	527.0	720.9	824.8	665.4	2224.8	1828.7
TOT :	1321.367		1245.865		1490.137		4053.481	
PF :	.8943	.8682	.8045	.8679	.8397	.8316	.8550	.8553
TOT :	.8859		.8425		.8361		.8551	

LOSSES	(A)	(B)	(C)	TOTAL
kW :	39.107	-4.697	76.653	111.063
kVAr :	152.585	42.217	129.850	324.653
kVA :	157.517	42.478	150.787	343.124

CAPAC	(A-N)	(A-B)	(B-N)	(B-C)	(C-N)	(C-A)	WYE	DELTA
R-kVA:	200.0	.0	200.0	.0	300.0	.0	700.0	.0
TOT :	200.000		200.000		300.000		700.000	
A-kVA:	193.4	.0	222.7	.0	285.3	.0	701.5	.0
TOT :	193.443		222.747		285.276		701.466	

--- **V O L T A G E P R O F I L E** ---- DATE: 6-24-2004 AT 15:33:12 HOURS ----
SUBSTATION: IEEE 13; FEEDER: IEEE 13

NODE	MAG	ANGLE	MAG	ANGLE	MAG	ANGLE	mi.to SR
	A-N		B-N		C-N		
650	1.0000 at	.00	1.0000 at	-120.00	1.0000 at	120.00	.000
RG60	1.0625 at	.00	1.0500 at	-120.00	1.0687 at	120.00	.000
632	1.0210 at	-2.49	1.0420 at	-121.72	1.0174 at	117.83	.379
633	1.0180 at	-2.56	1.0401 at	-121.77	1.0148 at	117.82	.474
XFXFM1	.9941 at	-3.23	1.0218 at	-122.22	.9960 at	117.35	.474
634	.9940 at	-3.23	1.0218 at	-122.22	.9960 at	117.34	.474
645			1.0329 at	-121.90	1.0155 at	117.86	.474
646			1.0311 at	-121.98	1.0134 at	117.90	.530
671	.9900 at	-5.30	1.0529 at	-122.34	.9778 at	116.02	.758
680	.9900 at	-5.30	1.0529 at	-122.34	.9778 at	116.02	.947
684	.9881 at	-5.32			.9758 at	115.92	.815
611					.9738 at	115.78	.871
652	.9825 at	-5.25					.966
692	.9900 at	-5.31	1.0529 at	-122.34	.9777 at	116.02	.852
675	.9835 at	-5.56	1.0553 at	-122.52	.9758 at	116.03	.947

---------- **VOLTAGE REGULATOR DATA** ---- DATE: 6-24-2004 AT 15:33:16 HOURS --
SUBSTATION: IEEE 13; FEEDER: IEEE 13

[NODE]	[VREG]	[SEG]	[NODE]	MODEL	OPT	BNDW
650	RG60	632	632	Phase A & B & C, Wye	RX	2.00

PHASE	LDCTR	VOLT HOLD	R-VOLT	X-VOLT	PT RATIO	CT RATE	TAP
1		122.000	3.000	9.000	20.00	700.00	10
2		122.000	3.000	9.000	20.00	700.00	8
3		122.000	3.000	9.000	20.00	700.00	11

- **R A D I A L P O W E R F L O W** --- DATE: 6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

```
   NODE      VALUE         PHASE A         PHASE B         PHASE C     UNT O/L<
                           (LINE A)        (LINE B)        (LINE C)        60.%
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 650       VOLTS:   1.000     .00   1.000 -120.00   1.000  120.00 MAG/ANG
kVll   4.160           NO LOAD OR CAPACITOR REPRESENTED AT SOURCE NODE

TO NODE RG60  <VRG>..:  593.30  -28.58  435.61 -140.91  626.92   93.59 AMP/DG <
<RG60  > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: RG60      VOLTS:   1.062     .00   1.050 -120.00   1.069  120.00 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE 650   <VRG>:  558.40  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<RG60  > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
TO NODE 632   .......:  558.40  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<632   > LOSS= 59.716:    ( 21.517)       ( -3.252)       ( 41.451)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 632       VOLTS:   1.021   -2.49   1.042 -121.72   1.017  117.83 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE RG60  .....:  558.41  -28.58  414.87 -140.91  586.60   93.59 AMP/DG <
<632   > LOSS= 59.716:    ( 21.517)       ( -3.252)       ( 41.451)    kW
TO NODE 633   .......:   81.33  -37.74   61.12 -159.09   62.70   80.48 AMP/DG
<633   > LOSS=   .808:    (   .354)       (   .148)       (   .306)    kW
TO NODE 645   .......:                  143.02 -142.66   65.21   57.83 AMP/DG <
<645   > LOSS=  2.760:                    (  2.540)       (   .220)    kW
TO NODE 671   .......:  478.29  -27.03  215.12 -134.66  475.50   99.90 AMP/DG <
<671   > LOSS= 35.897:    ( 10.484)       ( -6.169)       ( 31.582)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 633       VOLTS:   1.018   -2.56   1.040 -121.77   1.015  117.82 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll   4.160      CAP:             .00             .00             .00 kVR

FROM NODE 632   .....:   81.33  -37.74   61.12 -159.09   62.71   80.47 AMP/DG
<633   > LOSS=   .808:    (   .354)       (   .148)       (   .306)    kW
TO NODE XFXFM1.......:   81.33  -37.74   61.12 -159.09   62.71   80.47 AMP/DG <
<XFXFM1> LOSS=  5.427:    (  2.513)       (  1.420)       (  1.494)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: XFXFM1    VOLTS:    .994   -3.23   1.022 -122.22    .996  117.35 MAG/ANG
                  -LD:     .00     .00     .00     .00     .00     .00 kW/kVR
kVll    .480      CAP:             .00             .00             .00 kVR

FROM NODE 633   .....:  704.83  -37.74  529.73 -159.09  543.45   80.47 AMP/DG <
<XFXFM1> LOSS=  5.427:    (  2.513)       (  1.420)       (  1.494)    kW
TO NODE 634   .......:  704.83  -37.74  529.73 -159.09  543.45   80.47 AMP/DG <
<634   > LOSS=   .000:    (   .000)       (   .000)       (   .000)    kW
```

- **R A D I A L P O W E R F L O W** --- DATE: 6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION: IEEE 13; FEEDER: IEEE 13

NODE	VALUE	PHASE A (LINE A)		PHASE B (LINE B)		PHASE C (LINE C)		UNT	O/L< 60.%
NODE: 634	VOLTS:	.994	-3.23	1.022	-122.22	.996	117.34	MAG/ANG	
	Y-LD:	160.00	110.00	120.00	90.00	120.00	90.00	kW/kVR	
kVll .480	Y CAP:		.00		.00		.00	kVR	
FROM NODE XFXFM1.....:		704.83	-37.74	529.73	-159.09	543.45	80.47	AMP/DG	<
<634 > LOSS= .000:		(.000)		(.000)		(.000)		kW	
NODE: 645	VOLTS:			1.033	-121.90	1.015	117.86	MAG/ANG	
	Y-LD:			170.00	125.00	.00	.00	kW/kVR	
kVll 4.160	Y CAP:				.00		.00	kVR	
FROM NODE 632 .....:				143.02	-142.66	65.21	57.83	AMP/DG	<
<645 > LOSS= 2.760:				(2.540)		(.220)		kW	
TO NODE 646 .....:				65.21	-122.17	65.21	57.83	AMP/DG	
<646 > LOSS= .541:				(.271)		(.270)		kW	
NODE: 646	VOLTS:			1.031	-121.98	1.013	117.90	MAG/ANG	
	D-LD:			240.66	138.12	.00	.00	kW/kVR	
kVll 4.160	Y CAP:				.00		.00	kVR	
FROM NODE 645 .....:				65.21	-122.18	65.21	57.82	AMP/DG	
<646 > LOSS= .541:				(.271)		(.270)		kW	
NODE: 671	VOLTS:	.990	-5.30	1.053	-122.34	.978	116.02	MAG/ANG	
	D-LD:	385.00	220.00	385.00	220.00	385.00	220.00	kW/kVR	
kVll 4.160	Y CAP:		.00		.00		.00	kVR	
FROM NODE 632 .....:		470.20	-26.90	186.41	-131.89	420.64	101.66	AMP/DG	<
<671 > LOSS= 35.897:		(10.484)		(-6.169)		(31.582)		kW	
TO NODE 680 .....:		.00	.00	.00	.00	.00	.00	AMP/DG	
<680 > LOSS= .000:		(-.001)		(.001)		(.000)		kW	
TO NODE 684 .....:		63.07	-39.12			71.15	121.62	AMP/DG	
<684 > LOSS= .580:		(.210)				(.370)		kW	
TO NODE 692 .....:		229.11	-18.18	69.61	-55.19	178.38	109.39	AMP/DG	
<692 > LOSS= .008:		(.003)		(-.001)		(.006)		kW	
NODE: 680	VOLTS:	.990	-5.30	1.053	-122.34	.978	116.02	MAG/ANG	
	-LD:	.00	.00	.00	.00	.00	.00	kW/kVR	
kVll 4.160	CAP:		.00		.00		.00	kVR	
FROM NODE 671 .....:		.00	.00	.00	.00	.00	.00	AMP/DG	
<680 > LOSS= .000:		(-.001)		(.001)		(.000)		kW	

```
- R A D I A L   P O W E R   F L O W  ---  DATE:  6-24-2004 AT 15:33:27 HOURS ---
SUBSTATION:  IEEE 13;   FEEDER:  IEEE 13
-------------------------------------------------------------------------------
   NODE      VALUE         PHASE A         PHASE B         PHASE C     UNT O/L<
                           (LINE A)        (LINE B)        (LINE C)        60.%
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 684       VOLTS:    .988   -5.32                    .976  115.92 MAG/ANG
                  -LD:     .00     .00                     .00     .00 kW/kVR
kVll   4.160      CAP:             .00                             .00 kVR

FROM NODE 671   .....:   63.07  -39.12                  71.15  121.61 AMP/DG
<684   > LOSS=   .580:    (   .210)                     (   .370)    kW
TO NODE 611   .......:                                 71.15  121.61 AMP/DG
<611   > LOSS=   .382:                                  (   .382)    kW
TO NODE 652   .......:   63.07  -39.12                                AMP/DG
<652   > LOSS=   .808:    (   .808)                                   kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 611       VOLTS:                                   .974  115.78 MAG/ANG
                 Y-LD:                                 165.54   77.90 kW/kVR
kVLL   4.160    Y CAP:                                          94.82 kVR

FROM NODE 684   .....:                                  71.15  121.61 AMP/DG
<611   > LOSS=   .382:                                  (   .382)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 652       VOLTS:    .983   -5.25                                MAG/ANG
                 Y-LD:  123.56   83.02                                kW/kVR
kVll   4.160    Y CAP:             .00                               kVR

FROM NODE 684   .....:   63.08  -39.15                                AMP/DG
<652   > LOSS=   .808:    (   .808)                                   kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 692       VOLTS:    .990   -5.31   1.053 -122.34    .978  116.02 MAG/ANG
                 D-LD:     .00     .00     .00     .00  168.37  149.55 kW/kVR
kVll   4.160    Y CAP:             .00             .00             .00 kVR

FROM NODE 671   .....:  229.11  -18.18   69.61  -55.19  178.38  109.39 AMP/DG
<692   > LOSS=   .008:    (   .003)       (  -.001)       (   .006)    kW
TO NODE 675   .......:  205.33   -5.15   69.61  -55.19  124.07  111.79 AMP/DG <
<675   > LOSS=  4.136:    (  3.218)       (   .345)       (   .573)    kW
---------------------*--------A-------*-------B-------*-------C-------*--------
NODE: 675       VOLTS:    .983   -5.56   1.055 -122.52    .976  116.03 MAG/ANG
                 Y-LD:  485.00  190.00   68.00   60.00  290.00  212.00 kW/kVR
kVll   4.160    Y CAP:          193.44          222.75          190.45 kVR

FROM NODE 692   .....:  205.33   -5.15   69.59  -55.20  124.07  111.78 AMP/DG <
<675   > LOSS=  4.136:    (  3.218)       (   .345)       (   .573)    kW
```

EMBED TurboCAD.Drawing.4

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