

**ANALYTICAL RESULTS IN SUPPORT OF STAKEHOLDER NEGOTIATIONS ON  
AMENDED ENERGY CONSERVATION STANDARDS FOR DISTRIBUTION  
TRANSFORMERS**

**August 23, 2011**

The following analytical results have been generated by Lawrence Berkeley National Laboratory (LBNL) and Navigant Consulting, Inc. (NCI) to support stakeholder negotiations concerning amended energy conservation standards for distribution transformers. The analytical results presented here are based on inputs (e.g., manufacturer selling prices as a function of efficiency) and analytical tools which are still under review. Therefore, the following information may not reflect final results to be published in subsequent DOE rulemaking documents.

**1. Distribution Transformers Draft Trial Standard Levels**

Life-cycle cost (LCC), payback period (PBP), and national impact analysis (NIA) results were requested for the following draft trial standard levels.

**Table 1.1 Distribution Transformers Draft Trial Standard Levels for Liquid-Immersed Distribution Transformers**

Design Line	Base (2007 FR)	Draft Trial Standard Level				
		1	2	3	4	5
1	99.08	99.16	99.22	99.25	99.31	99.50
2	98.91	99.00	99.07	99.11	99.18	99.46
3	99.42	99.51	99.54	99.57	99.61	99.73
4	99.08	99.16	99.22	99.25	99.31	99.60
5	99.42	99.51	99.54	99.57	99.61	99.69

**Table 1.2 Distribution Transformers Draft Trial Standard Levels for Low-Voltage Dry-Type Distribution Transformers**

Design Line	Base (EPACT '05)	Draft Trial Standard Level					
		1	2 (NEMA Premium)	3	4	5	6
6	98.00	98.47	98.60	98.60	98.80	98.93	99.44
7	98.00	98.47	98.60	98.60	98.80	98.93	99.44
8	98.60	99.14	99.02	99.25	99.32	99.44	99.58

**Table 1.3 Distribution Transformers Draft Trial Standard Levels for Medium-Voltage Dry-Type Distribution Transformers**

Design Line	Base (2007 FR)	Draft Trial Standard Level				
		1	2	3	4	5
9	98.82	98.99	99.12	99.28	99.38	99.59
10	99.22	99.40	99.50	99.53	99.60	99.67
11	98.67	98.81	98.94	99.06	99.13	99.50
12	99.12	99.30	99.39	99.46	99.53	99.65
13A	98.63	98.76	98.85	98.92	99.10	99.48
13B	99.15	99.31	99.38	99.43	99.49	99.58

## 2. LCC and PBP Results

Life-cycle cost (LCC), and payback period results were requested for the following design lines.

### 2.1. LCC and PBP Results for Liquid-Immersed Distribution Transformers

**Table 2.1 LCC and PBP Results, Design Line 1**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.16	99.22	99.25	99.31	99.50
Transformers with Net Cost (%)	41.2	0.7	0.6	3.9	38.1
Transformers with Net Benefit (%)	40.9	83.8	83.9	84.4	61.8
Transformers with No Impact (%)	17.9	15.5	15.5	11.7	0.1
Mean LCC Savings (\$)	116	918	920	902	369
Median Payback (Years)	19.6	8.4	8.4	10.0	20.3

**Table 2.2 LCC and PBP Results, Design Line 2**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.00	99.07	99.11	99.18	99.46
Transformers with Net Cost (%)	15.0	5.5	6.4	10.4	66.7
Transformers with Net Benefit (%)	73.2	83.2	83.2	82.8	33.3
Transformers with No Impact (%)	11.9	11.3	10.4	6.9	0.0
Mean LCC Savings (\$)	467	574	562	528	-214
Median Payback (Years)	9.7	9.7	10.1	11.7	27.6

**Table 2.3 LCC and PBP Results, Design Line 3**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.51	99.54	99.57	99.61	99.73
Transformers with Net Cost (%)	4.9	1.7	1.2	1.6	27.1
Transformers with Net Benefit (%)	51.8	69.6	71.0	73.7	72.9
Transformers with No Impact (%)	43.3	28.7	27.8	24.7	0.0
Mean LCC Savings (\$)	2739	5371	5733	6748	7110
Median Payback (Years)	4.3	4.9	4.9	5.2	14.4

**Table 2.4 LCC and PBP Results, Design Line 4**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.16	99.22	99.25	99.31	99.60
Transformers with Net Cost (%)	3.9	0.0	0.0	0.0	49.0
Transformers with Net Benefit (%)	49.3	53.2	53.2	53.2	51.0
Transformers with No Impact (%)	46.8	46.8	46.8	46.8	0.0
Mean LCC Savings (\$)	1100	2545	2545	2545	755
Median Payback (Years)	11.4	5.4	5.4	5.4	22.7

**Table 2.5 LCC and PBP Results, Design Line 5**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.51	99.54	99.57	99.61	99.69
Transformers with Net Cost (%)	13.4	6.3	4.9	2.6	18.0
Transformers with Net Benefit (%)	77.3	86.3	88.9	96.0	82.0
Transformers with No Impact (%)	9.3	7.4	6.2	1.5	0.0
Mean LCC Savings (\$)	9465	12962	13728	18355	14473
Median Payback (Years)	7.4	7.4	7.5	8.4	17.1

**2.2. LCC and PBP Results for Low-Voltage Dry-Type Distribution Transformers****Table 2.6 LCC and PBP Results, Design Line 6**

	Draft Trial Standard Level					
	1	2	3	4	5	6
Efficiency (%)	98.47	98.60	98.60	98.80	98.93	99.44
Transformers with Net Cost (%)	36.6	25.2	25.2	37.5	32.4	97.7
Transformers with Net Benefit (%)	62.0	74.5	74.5	62.5	67.6	2.3
Transformers with No Impact (%)	1.4	0.2	0.2	0.0	0.0	0.0
Mean LCC Savings (\$)	29	59	59	76	122	-952
Median Payback (Years)	15.4	13.4	13.4	16.3	15.6	40.0

**Table 2.7 LCC and PBP Results, Design Line 7**

	Draft Trial Standard Level					
	1	2	3	4	5	6
Efficiency (%)	98.47	98.60	98.60	98.80	98.93	99.44
Transformers with Net Cost (%)	0.5	18.5	18.5	10.9	10.1	69.8
Transformers with Net Benefit (%)	72.8	80.0	80.0	89.1	90.0	30.2
Transformers with No Impact (%)	26.7	1.5	1.5	0.0	0.0	0.0
Mean LCC Savings (\$)	826	849	849	1093	1328	-511
Median Payback (Years)	0.0	0.0	0.0	5.6	8.1	23.4

**Table 2.8 LCC and PBP Results, Design Line 8**

	Draft Trial Standard Level					
	1	2	3	4	5	6
Efficiency (%)	99.14	99.02	99.25	99.32	99.44	99.58
Transformers with Net Cost (%)	1.9	1.3	5.2	4.1	4.1	56.1
Transformers with Net Benefit (%)	94.8	91.6	94.9	96.0	95.9	43.9
Transformers with No Impact (%)	3.2	7.1	0.0	0.0	0.0	0.0
Mean LCC Savings (\$)	4253	3554	4999	5826	5844	-186
Median Payback (Years)	4.0	4.0	7.6	7.0	7.0	19.7

**2.3. LCC and PBP Results for Medium-Voltage Dry-Type Distribution Transformers****Table 2.9 LCC and PBP Results, Design Line 9**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	98.99	99.12	99.28	99.38	99.59
Transformers with Net Cost (%)	0.5	2.2	11.0	7.7	60.5
Transformers with Net Benefit (%)	88.3	96.3	89.0	92.3	39.5
Transformers with No Impact (%)	11.3	1.5	0.0	0.0	0.0
Mean LCC Savings (\$)	2761	3863	3700	5085	-673
Median Payback (Years)	1.8	3.1	9.3	8.9	20.6

**Table 2.10 LCC and PBP Results, Design Line 10**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.40	99.50	99.53	99.60	99.67
Transformers with Net Cost (%)	24.8	31.7	27.4	35.5	69.5
Transformers with Net Benefit (%)	75.2	68.3	72.6	64.6	30.5
Transformers with No Impact (%)	0.0	0.0	0.0	0.0	0.0
Mean LCC Savings (\$)	4329	4849	6311	5574	-5311
Median Payback (Years)	11.1	14.5	14.1	15.5	23.1

**Table 2.11 LCC and PBP Results, Design Line 11**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	98.81	98.94	99.06	99.13	99.50
Transformers with Net Cost (%)	27.1	46.4	16.6	14.0	57.8
Transformers with Net Benefit (%)	70.5	53.6	83.5	86.0	42.2
Transformers with No Impact (%)	2.5	0.0	0.0	0.0	0.0
Mean LCC Savings (\$)	810	497	2709	3121	-309
Median Payback (Years)	11.4	17.0	12.0	11.9	20.0

**Table 2.12 LCC and PBP Results, Design Line 12**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.30	99.39	99.46	99.53	99.65
Transformers with Net Cost (%)	13.0	24.6	24.3	25.6	64.7
Transformers with Net Benefit (%)	85.8	75.4	75.7	74.4	35.3
Transformers with No Impact (%)	1.3	0.0	0.0	0.0	0.0
Mean LCC Savings (\$)	8865	8644	8076	9726	-4210
Median Payback (Years)	6.7	10.6	13.5	13.7	21.7

**Table 2.13 LCC and PBP Results, Design Line 13A**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	98.76	98.85	98.92	99.10	99.48
Transformers with Net Cost (%)	27.6	28.9	41.1	30.9	87.5
Transformers with Net Benefit (%)	70.7	71.0	58.9	69.1	12.5
Transformers with No Impact (%)	1.7	0.1	0.0	0.0	0.0
Mean LCC Savings (\$)	855	1107	749	1701	-6331
Median Payback (Years)	10.5	12.6	15.9	15.4	29.3

**Table 2.14 LCC and PBP Results, Design Line 13B**

	Draft Trial Standard Level				
	1	2	3	4	5
Efficiency (%)	99.31	99.38	99.43	99.49	99.58
Transformers with Net Cost (%)	12.2	19.9	39.8	26.7	39.8
Transformers with Net Benefit (%)	87.7	80.1	60.2	73.3	60.2
Transformers with No Impact (%)	0.1	0.0	0.0	0.0	0.0
Mean LCC Savings (\$)	8668	8878	4642	9271	6033
Median Payback (Years)	9.0	11.6	16.1	14.5	16.8

### 3. National Impacts Analysis Results

National impacts and shipment results were requested for the following equipment classes.

#### 3.1. NIA Results for Liquid-Immersed Distribution Transformers

**Table 3.1 NIA Results, All Liquid-Immersed Distribution Transformers**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	1.95	1.91	1.89	1.89	1.89	1.77
Equipment Cost (\$Billions)	63.08	-7.47	-10.08	-9.44	-10.61	-33.85
Operating Cost (Savings in ELs) (\$Billions)	83.72	11.20	16.16	18.07	22.65	35.25
Cumulative Source Savings 2044 (Quads)		0.691	1.01	1.13	1.44	2.25
Net Present Value at 3% Discount Rate (\$Billions)		3.73	6.08	8.63	12.04	1.40
Net Present Value at 7% Discount Rate (\$Billions)		-0.164	0.10	1.00	1.741	-6.51

**Table 3.2 NIA Results, Equipment Class 1**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.8005	0.7841	0.7794	0.7796	0.7769	0.7359
Equipment Cost (\$Billions)	44.9934	-4.8185	-6.2546	-6.1859	-7.0457	-21.6533
Operating Cost (Savings in ELs) (\$Billions)	39.2239	7.5275	11.1791	11.5948	12.9596	17.7591
Cumulative Source Savings 2044 (Quads)		0.4826	0.7190	0.7431	0.8223	1.0908
Net Present Value at 3% Discount Rate (\$Billions)		2.7090	4.9245	5.4088	5.9139	-3.8943
Net Present Value at 7% Discount Rate (\$Billions)		-0.0598	0.3834	0.5401	0.4983	-5.6247

**Table 3.3 NIA Results, Equipment Class 2**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	1.1540	1.1220	1.1090	1.1152	1.1118	1.0312
Equipment Cost (\$Billions)	18.0893	-2.6545	-3.8220	-3.2568	-3.5661	-12.1984
Operating Cost (Savings in ELs) (\$Billions)	44.4959	3.6762	4.9800	6.4756	9.6949	17.4895
Cumulative Source Savings 2044 (Quads)		0.2083	0.2884	0.3904	0.6142	1.1548
Net Present Value at 3% Discount Rate (\$Billions)		1.0216	1.1580	3.2188	6.1288	5.2912
Net Present Value at 7% Discount Rate (\$Billions)		-0.1043	-0.2800	0.4558	1.2430	-0.8822

### 3.2. NIA Results for Low-Voltage Dry-Type Distribution Transformers

**Table 3.4 NIA Results, All Low-Voltage Dry-Type Distribution Transformers**

	Draft Trial Standard Level						
	Base	1	2	3	4	5	6
Transformer Shipments 2015-2044 (Billion KVA)	0.617	0.668	0.675	0.661	0.667	0.583	0.534
Equipment Cost (\$Billions)	17.258	6.020	6.785	5.352	5.941	-5.449	-15.930
Operating Cost (Savings in ELs) (\$Billions)	23.309	11.937	12.836	12.698	15.456	8.634	13.093
Cumulative Source Savings 2044 (Quads)		1.233	1.326	1.312	1.596	0.895	1.352
Net Present Value at 3% Discount Rate (\$Billions)		17.957	19.620	18.051	21.397	3.185	-2.837
Net Present Value at 7% Discount Rate (\$Billions)		6.880	7.558	6.779	7.956	-0.057	-4.024

**Table 3.5 NIA Results, Equipment Class 3**

	Draft Trial Standard Level						
	Base	1	2	3	4	5	6
Transformer Shipments 2015-2044 (Billion KVA)	0.0216	0.0226	0.0228	0.0226	0.0224	0.0203	0.0186
Equipment Cost (\$Billions)	0.8040	0.1831	0.2031	0.1739	0.1410	-0.2653	-0.7703
Operating Cost (Savings in ELs) (\$Billions)	0.7156	0.2532	0.2984	0.2764	0.4116	0.2786	0.4100
Cumulative Source Savings 2044 (Quads)		0.0261	0.0308	0.0285	0.0425	0.0288	0.0423
Net Present Value at 3% Discount Rate (\$Billions)		0.4363	0.5015	0.4503	0.5526	0.0133	-0.3603
Net Present Value at 7% Discount Rate (\$Billions)		0.1744	0.1990	0.1770	0.2030	-0.0478	-0.2654

**Table 3.6 NIA Results, Equipment Class 4**

	Draft Trial Standard Level						
	Base	1	2	3	4	5	6
Transformer Shipments 2015-2044 (Billion KVA)	0.5957	0.6449	0.6524	0.6386	0.6446	0.5624	0.5153
Equipment Cost (\$Billions)	16.4536	5.8368	6.5817	5.1784	5.8001	-5.1836	-15.1595
Operating Cost (Savings in ELs) (\$Billions)	22.5931	11.6836	12.5372	12.4220	15.0440	8.3554	12.6833
Cumulative Source Savings 2044 (Quads)		1.2073	1.2954	1.2837	1.5538	0.8663	1.3094
Net Present Value at 3% Discount Rate (\$Billions)		17.5203	19.1189	17.6004	20.8441	3.1718	-2.4763
Net Present Value at 7% Discount Rate (\$Billions)		6.7055	7.3590	6.6019	7.7533	-0.0097	-3.7586

### 3.3. NIA Results for Medium-Voltage Dry-Type Distribution Transformers

**Table 3.7 NIA Results, All Medium-Voltage Dry-Type Distribution Transformers**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.223	0.222	0.219	0.214	0.213	0.197
Equipment Cost (\$Billions)	4.015	-0.075	-0.434	-0.912	-1.102	-3.264
Operating Cost (Savings in ELs) (\$Billions)	6.332	1.693	2.269	2.713	3.238	3.279
Cumulative Source Savings 2044 (Quads)		0.194	0.260	0.298	0.357	0.368
Net Present Value at 3% Discount Rate (\$Billions)		1.618	1.835	1.800	2.136	0.015
Net Present Value at 7% Discount Rate (\$Billions)		0.499	0.497	0.393	0.462	-0.635

**Table 3.8 NIA Results, Equipment Class 5**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
Equipment Cost (\$Billions)	0.0077	0.0015	0.0012	0.0006	0.0010	-0.0071
Operating Cost (Savings in ELs) (\$Billions)	0.0120	0.0048	0.0064	0.0072	0.0086	0.0058
Cumulative Source Savings 2044 (Quads)		0.0005	0.0007	0.0008	0.0009	0.0006
Net Present Value at 3% Discount Rate (\$Billions)		0.0063	0.0076	0.0078	0.0096	-0.0013
Net Present Value at 7% Discount Rate (\$Billions)		0.0023	0.0027	0.0026	0.0032	-0.0018

**Table 3.9 NIA Results, Equipment Class 6**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.0329	0.0329	0.0320	0.0318	0.0315	0.0289
Equipment Cost (\$Billions)	0.5248	-0.0047	-0.0828	-0.1021	-0.1261	-0.4244
Operating Cost (Savings in ELs) (\$Billions)	0.8203	0.2258	0.3471	0.3862	0.4505	0.4079
Cumulative Source Savings 2044 (Quads)		0.0256	0.0384	0.0426	0.0500	0.0459
Net Present Value at 3% Discount Rate (\$Billions)		0.2211	0.2643	0.2841	0.3244	-0.0165
Net Present Value at 7% Discount Rate (\$Billions)		0.0693	0.0677	0.0702	0.0783	-0.0884

**Table 3.10 NIA Results, Equipment Class 7**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.0005	0.0005	0.0005	0.0005	0.0005	0.0004
Equipment Cost (\$Billions)	0.0124	0.0023	0.0019	0.0009	0.0018	-0.0107
Operating Cost (Savings in ELs) (\$Billions)	0.0181	0.0072	0.0090	0.0104	0.0122	0.0091
Cumulative Source Savings 2044 (Quads)		0.0008	0.0010	0.0011	0.0013	0.0010
Net Present Value at 3% Discount Rate (\$Billions)		0.0095	0.0109	0.0113	0.0140	-0.0016
Net Present Value at 7% Discount Rate (\$Billions)		0.0035	0.0038	0.0038	0.0048	-0.0026



**Table 3.11 NIA Results, Equipment Class 8**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.1731	0.1724	0.1696	0.1655	0.1643	0.1522
Equipment Cost (\$Billions)	3.1545	-0.0642	-0.3266	-0.7527	-0.8856	-2.5069
Operating Cost (Savings in ELs) (\$Billions)	5.0006	1.3387	1.7511	2.1283	2.5614	2.6974
Cumulative Source Savings 2044 (Quads)		0.1545	0.2024	0.2335	0.2833	0.3035
Net Present Value at 3% Discount Rate (\$Billions)		1.2745	1.4246	1.3755	1.6758	0.1905
Net Present Value at 7% Discount Rate (\$Billions)		0.3920	0.3881	0.2890	0.3583	-0.4311

**Table 3.12 NIA Results, Equipment Class 9**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Equipment Cost (\$Billions)	0.0022	0.0002	0.0002	0.0001	-0.0003	-0.0033
Operating Cost (Savings in ELs) (\$Billions)	0.0033	0.0012	0.0015	0.0017	0.0016	0.0003
Cumulative Source Savings 2044 (Quads)		0.0001	0.0002	0.0002	0.0002	0.0000
Net Present Value at 3% Discount Rate (\$Billions)		0.0014	0.0017	0.0017	0.0013	-0.0030
Net Present Value at 7% Discount Rate (\$Billions)		0.0005	0.0006	0.0006	0.0003	-0.0016

**Table 3.13 NIA Results, Equipment Class 10**

	Draft Trial Standard Level					
	Base	1	2	3	4	5
Transformer Shipments 2015-2044 (Billion KVA)	0.0164	0.0161	0.0160	0.0160	0.0159	0.0151
Equipment Cost (\$Billions)	0.3135	-0.0103	-0.0280	-0.0591	-0.0932	-0.3114
Operating Cost (Savings in ELs) (\$Billions)	0.4775	0.1156	0.1537	0.1789	0.2040	0.1586
Cumulative Source Savings 2044 (Quads)		0.0126	0.0170	0.0199	0.0212	0.0166
Net Present Value at 3% Discount Rate (\$Billions)		0.1053	0.1257	0.1198	0.1108	-0.1528
Net Present Value at 7% Discount Rate (\$Billions)		0.0314	0.0344	0.0264	0.0169	-0.1096

#### 4. Estimated Core Steel Demand for Certain Steel Grades

Estimated core steel demands were requested for the following equipment classes. This section provides estimated projected demands of certain core steels for each equipment category. These simple estimates are based on the fraction of each material type that was selected during the life-cycle cost simulation for each design line. These material type fractions were then scaled to the corresponding equipment classes and projected over the analysis period using the shipment forecasting model.

##### 4.1. Estimated Amorphous Steel Demand

**Table 4.1 Estimated Amorphous Steel Demand for Liquid-Immersed Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5
2016	25,293	102,555	147,049	145,838	149,316	169,282
2017	25,474	103,290	148,103	146,883	150,387	170,496
2018	25,691	104,169	149,363	148,133	151,667	171,947
2019	25,917	105,087	150,680	149,439	153,003	173,463
2020	26,142	105,997	151,984	150,733	154,328	174,965
2021	26,349	106,837	153,189	151,927	155,551	176,351
2022	26,566	107,718	154,451	153,180	156,833	177,805
2023	26,795	108,646	155,782	154,499	158,184	179,336
2024	27,055	109,701	157,295	156,000	159,721	181,078
2025	27,268	110,563	158,532	157,226	160,977	182,502
2026	27,495	111,485	159,853	158,536	162,318	184,023
2027	27,728	112,428	161,206	159,878	163,692	185,580
2028	27,989	113,489	162,727	161,387	165,236	187,331
2029	28,199	114,341	163,949	162,598	166,477	188,738
2030	28,461	115,401	165,468	164,105	168,020	190,487
2031	28,713	116,423	166,934	165,560	169,509	192,175
2032	28,976	117,489	168,462	167,075	171,060	193,934
2033	29,173	118,289	169,609	168,213	172,225	195,255
2034	29,409	119,245	170,981	169,573	173,618	196,833
2035	29,634	120,159	172,291	170,872	174,948	198,341
2036	29,882	121,163	173,730	172,299	176,409	199,998
2037	30,132	122,175	175,181	173,739	177,883	201,669
2038	30,383	123,196	176,645	175,190	179,369	203,354
2039	30,637	124,225	178,121	176,654	180,868	205,053
2040	30,893	125,263	179,609	178,130	182,378	206,766
2041	31,151	126,309	181,109	179,618	183,902	208,493
2042	31,411	127,364	182,622	181,118	185,438	210,234
2043	31,674	128,428	184,147	182,631	186,987	211,990
2044	31,938	129,500	185,685	184,156	188,548	213,761
2045	32,205	130,582	187,236	185,694	190,123	215,546

**Table 4.2 Estimated Amorphous Steel Demand for Low-Voltage Dry-Type Transformers (tons)**

	<b>Total Base Case</b>	<b>Total dTSL1</b>	<b>Total dTSL2</b>	<b>Total dTSL3</b>	<b>Total dTSL4</b>	<b>Total dTSL5</b>	<b>Total dTSL6</b>
2016	-	-	-	3,754	6,215	42,024	71,343
2017	-	-	-	3,788	6,271	42,399	71,979
2018	-	-	-	3,823	6,329	42,794	72,651
2019	-	-	-	3,858	6,388	43,189	73,321
2020	-	-	-	3,895	6,448	43,599	74,016
2021	-	-	-	3,928	6,502	43,963	74,635
2022	-	-	-	3,955	6,548	44,271	75,158
2023	-	-	-	3,985	6,597	44,605	75,724
2024	-	-	-	4,016	6,648	44,948	76,307
2025	-	-	-	4,044	6,696	45,272	76,857
2026	-	-	-	4,072	6,741	45,579	77,378
2027	-	-	-	4,099	6,786	45,887	77,901
2028	-	-	-	4,128	6,833	46,202	78,436
2029	-	-	-	4,157	6,883	46,536	79,004
2030	-	-	-	4,191	6,938	46,908	79,635
2031	-	-	-	4,223	6,991	47,269	80,247
2032	-	-	-	4,252	7,040	47,598	80,806
2033	-	-	-	4,279	7,085	47,903	81,323
2034	-	-	-	4,309	7,133	48,228	81,876
2035	-	-	-	4,335	7,177	48,525	82,379
2036	-	-	-	4,365	7,227	48,862	82,953
2037	-	-	-	4,396	7,277	49,203	83,530
2038	-	-	-	4,426	7,328	49,545	84,111
2039	-	-	-	4,457	7,379	49,890	84,697
2040	-	-	-	4,488	7,430	50,237	85,286

204 1	-	-	-	4,519	7,482	50,586	85,880
204 2	-	-	-	4,551	7,534	50,938	86,477
204 3	-	-	-	4,582	7,586	51,293	87,079
204 4	-	-	-	4,614	7,639	51,650	87,685
204 5	-	-	-	4,646	7,692	52,009	88,295

**Table 4.3 Estimated Amorphous Steel Demand for Medium-Voltage Dry-Type Transformers (tons)**

	<b>Total Base Case</b>	<b>Total dTSL1</b>	<b>Total dTSL2</b>	<b>Total dTSL3</b>	<b>Total dTSL4</b>	<b>Total dTSL5</b>
2016	-	-	1,304	11,876	13,404	20,524
2017	-	-	1,316	11,981	13,523	20,707
2018	-	-	1,328	12,093	13,650	20,900
2019	-	-	1,340	12,205	13,776	21,093
2020	-	-	1,353	12,321	13,906	21,293
2021	-	-	1,364	12,423	14,022	21,470
2022	-	-	1,374	12,511	14,121	21,621
2023	-	-	1,384	12,605	14,227	21,784
2024	-	-	1,395	12,702	14,337	21,952
2025	-	-	1,405	12,793	14,440	22,110
2026	-	-	1,414	12,880	14,538	22,260
2027	-	-	1,424	12,967	14,636	22,410
2028	-	-	1,434	13,056	14,737	22,564
2029	-	-	1,444	13,151	14,843	22,727
2030	-	-	1,456	13,256	14,962	22,909
2031	-	-	1,467	13,358	15,077	23,085
2032	-	-	1,477	13,451	15,182	23,246
2033	-	-	1,486	13,537	15,279	23,395
2034	-	-	1,497	13,629	15,383	23,554
2035	-	-	1,506	13,713	15,477	23,698
2036	-	-	1,516	13,808	15,585	23,863
2037	-	-	1,527	13,904	15,694	24,029
2038	-	-	1,537	14,001	15,803	24,197
2039	-	-	1,548	14,098	15,913	24,365
2040	-	-	1,559	14,196	16,024	24,535
2041	-	-	1,570	14,295	16,135	24,705
2042	-	-	1,581	14,395	16,247	24,877
2043	-	-	1,592	14,495	16,360	25,050
2044	-	-	1,603	14,596	16,474	25,225
2045	-	-	1,614	14,697	16,589	25,400

**4.2. Estimated H-0 DR core steel Demand**

**Table 4.4 Estimated H-0 DR Steel Demand for Liquid-Immersed Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-
2021	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-
2023	-	-	-	-	-	-	-
2024	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-
2026	-	-	-	-	-	-	-
2027	-	-	-	-	-	-	-
2028	-	-	-	-	-	-	-
2029	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-
2031	-	-	-	-	-	-	-
2032	-	-	-	-	-	-	-
2033	-	-	-	-	-	-	-
2034	-	-	-	-	-	-	-
2035	-	-	-	-	-	-	-
2036	-	-	-	-	-	-	-
2037	-	-	-	-	-	-	-
2038	-	-	-	-	-	-	-
2039	-	-	-	-	-	-	-
2040	-	-	-	-	-	-	-
2041	-	-	-	-	-	-	-
2042	-	-	-	-	-	-	-
2043	-	-	-	-	-	-	-
2044	-	-	-	-	-	-	-
2045	-	-	-	-	-	-	-

**Table 4.5 Estimated H-0 DR Steel Demand for Low-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	-	-	-	-	6	-	-
2017	-	-	-	-	6	-	-
2018	-	-	-	-	6	-	-
2019	-	-	-	-	6	-	-
2020	-	-	-	-	6	-	-
2021	-	-	-	-	6	-	-
2022	-	-	-	-	6	-	-
2023	-	-	-	-	6	-	-
2024	-	-	-	-	6	-	-
2025	-	-	-	-	6	-	-
2026	-	-	-	-	6	-	-
2027	-	-	-	-	7	-	-
2028	-	-	-	-	7	-	-
2029	-	-	-	-	7	-	-
2030	-	-	-	-	7	-	-
2031	-	-	-	-	7	-	-
2032	-	-	-	-	7	-	-
2033	-	-	-	-	7	-	-
2034	-	-	-	-	7	-	-
2035	-	-	-	-	7	-	-
2036	-	-	-	-	7	-	-
2037	-	-	-	-	7	-	-
2038	-	-	-	-	7	-	-
2039	-	-	-	-	7	-	-
2040	-	-	-	-	7	-	-
2041	-	-	-	-	7	-	-
2042	-	-	-	-	7	-	-
2043	-	-	-	-	7	-	-
2044	-	-	-	-	7	-	-
2045	-	-	-	-	7	-	-

**Table 4.6 Estimated H-0 DR Steel Demand for Medium-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	8,092	9,039	9,823	1,283	0	-	-
2017	8,164	9,119	9,911	1,295	0	-	-
2018	8,240	9,204	10,003	1,307	0	-	-
2019	8,316	9,289	10,095	1,319	0	-	-
2020	8,395	9,377	10,191	1,331	0	-	-
2021	8,465	9,456	10,276	1,342	0	-	-
2022	8,524	9,522	10,348	1,352	0	-	-
2023	8,588	9,594	10,426	1,362	1	-	-
2024	8,655	9,668	10,506	1,372	1	-	-
2025	8,717	9,737	10,582	1,382	1	-	-
2026	8,776	9,803	10,654	1,392	1	-	-
2027	8,835	9,869	10,726	1,401	1	-	-
2028	8,896	9,937	10,800	1,411	1	-	-
2029	8,960	10,009	10,878	1,421	1	-	-
2030	9,032	10,089	10,965	1,432	1	-	-
2031	9,101	10,167	11,049	1,443	1	-	-
2032	9,165	10,238	11,126	1,453	1	-	-
2033	9,223	10,303	11,197	1,463	1	-	-
2034	9,286	10,373	11,273	1,473	1	-	-
2035	9,343	10,437	11,343	1,482	1	-	-
2036	9,408	10,510	11,421	1,492	1	-	-
2037	9,474	10,583	11,501	1,502	1	-	-
2038	9,540	10,656	11,581	1,513	1	-	-
2039	9,606	10,730	11,662	1,523	1	-	-
2040	9,673	10,805	11,743	1,534	1	-	-
2041	9,740	10,880	11,824	1,545	1	-	-
2042	9,808	10,956	11,907	1,555	1	-	-
2043	9,876	11,032	11,990	1,566	1	-	-
2044	9,945	11,109	12,073	1,577	1	-	-
2045	10,014	11,186	12,157	1,588	1	-	-



#### 4.3. Estimated ZDMH (mechanically-scribed core steel) Steel Demand

**Table 4.7 Estimated ZDMH Steel Demand for Liquid-Immersed Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	78,928	21,286	77	-	-	-	-
2017	79,493	21,439	77	-	-	-	-
2018	80,170	21,621	78	-	-	-	-
2019	80,877	21,812	79	-	-	-	-
2020	81,577	22,001	79	-	-	-	-
2021	82,223	22,175	80	-	-	-	-
2022	82,901	22,358	81	-	-	-	-
2023	83,615	22,550	81	-	-	-	-
2024	84,427	22,769	82	-	-	-	-
2025	85,091	22,948	83	-	-	-	-
2026	85,800	23,140	84	-	-	-	-
2027	86,526	23,336	84	-	-	-	-
2028	87,343	23,556	85	-	-	-	-
2029	87,999	23,733	86	-	-	-	-
2030	88,814	23,952	86	-	-	-	-
2031	89,601	24,165	87	-	-	-	-
2032	90,421	24,386	88	-	-	-	-
2033	91,037	24,552	89	-	-	-	-
2034	91,773	24,751	89	-	-	-	-
2035	92,476	24,940	90	-	-	-	-
2036	93,249	25,148	91	-	-	-	-
2037	94,028	25,359	92	-	-	-	-
2038	94,813	25,570	92	-	-	-	-
2039	95,605	25,784	93	-	-	-	-
2040	96,404	25,999	94	-	-	-	-
2041	97,209	26,217	95	-	-	-	-
2042	98,021	26,436	95	-	-	-	-
2043	98,840	26,656	96	-	-	-	-
2044	99,665	26,879	97	-	-	-	-
2045	100,498	27,104	98	-	-	-	-

**Table 4.8 Estimated ZDMH Steel Demand for Low-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	22800	19280	16063	17782	14532	111	0
2017	23004	19452	16206	17940	14662	112	0
2018	23218	19634	16358	18108	14798	114	0
2019	23433	19815	16508	18275	14935	115	0
2020	23655	20003	16665	18448	15077	116	0
2021	23852	20170	16804	18602	15202	117	0
2022	24020	20311	16922	18733	15309	117	0
2023	24201	20464	17049	18874	15424	118	0
2024	24387	20622	17181	19019	15543	119	0
2025	24563	20770	17305	19156	15655	120	0
2026	24729	20911	17422	19286	15761	121	0
2027	24896	21052	17540	19416	15868	122	0
2028	25067	21197	17660	19550	15977	123	0
2029	25249	21350	17788	19691	16092	123	0
2030	25450	21521	17930	19848	16221	124	0
2031	25646	21687	18068	20001	16346	125	0
2032	25825	21838	18194	20140	16460	126	0
2033	25990	21977	18310	20269	16565	127	0
2034	26167	22127	18435	20407	16677	128	0
2035	26327	22263	18548	20533	16780	129	0
2036	26511	22418	18677	20675	16897	130	0
2037	26695	22574	18807	20819	17014	131	0
2038	26881	22731	18938	20964	17133	131	0
2039	27068	22889	19070	21110	17252	132	0
2040	27256	23048	19202	21257	17372	133	0
2041	27446	23209	19336	21405	17493	134	0
2042	27637	23370	19470	21554	17615	135	0
2043	27829	23533	19606	21704	17737	136	0
2044	28023	23696	19742	21855	17861	137	0
2045	28218	23861	19880	22007	17985	138	0

**Table 4.9 Estimated ZDMH Steel Demand for Medium-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	192	136	127	0	-	-	-
2017	194	137	128	0	-	-	-
2018	195	138	129	0	-	-	-
2019	197	139	130	0	-	-	-
2020	199	141	132	0	-	-	-
2021	201	142	133	0	-	-	-
2022	202	143	134	0	-	-	-
2023	204	144	135	0	-	-	-
2024	205	145	136	0	-	-	-
2025	207	146	137	0	-	-	-
2026	208	147	138	0	-	-	-
2027	210	148	139	0	-	-	-
2028	211	149	139	0	-	-	-
2029	213	150	140	0	-	-	-
2030	214	151	142	0	-	-	-
2031	216	152	143	0	-	-	-
2032	217	154	144	0	-	-	-
2033	219	154	145	0	-	-	-
2034	220	156	146	0	-	-	-
2035	222	156	146	0	-	-	-
2036	223	158	148	0	-	-	-
2037	225	159	149	0	-	-	-
2038	226	160	150	0	-	-	-
2039	228	161	151	0	-	-	-
2040	229	162	152	0	-	-	-
2041	231	163	153	0	-	-	-
2042	233	164	154	0	-	-	-
2043	234	165	155	0	-	-	-
2044	236	167	156	0	-	-	-
2045	238	168	157	0	-	-	-

#### 4.4. Estimated M2 Steel Demand

**Table 4.10 Estimated M2 Steel Demand for Liquid-Immersed Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	1,389	40	-	-	-	-	-
2017	1,399	40	-	-	-	-	-
2018	1,411	41	-	-	-	-	-
2019	1,423	41	-	-	-	-	-
2020	1,435	41	-	-	-	-	-
2021	1,447	42	-	-	-	-	-
2022	1,459	42	-	-	-	-	-
2023	1,471	42	-	-	-	-	-
2024	1,486	43	-	-	-	-	-
2025	1,497	43	-	-	-	-	-
2026	1,510	43	-	-	-	-	-
2027	1,523	44	-	-	-	-	-
2028	1,537	44	-	-	-	-	-
2029	1,548	45	-	-	-	-	-
2030	1,563	45	-	-	-	-	-
2031	1,577	45	-	-	-	-	-
2032	1,591	46	-	-	-	-	-
2033	1,602	46	-	-	-	-	-
2034	1,615	46	-	-	-	-	-
2035	1,627	47	-	-	-	-	-
2036	1,641	47	-	-	-	-	-
2037	1,655	48	-	-	-	-	-
2038	1,668	48	-	-	-	-	-
2039	1,682	48	-	-	-	-	-
2040	1,696	49	-	-	-	-	-
2041	1,711	49	-	-	-	-	-
2042	1,725	50	-	-	-	-	-
2043	1,739	50	-	-	-	-	-
2044	1,754	50	-	-	-	-	-
2045	1,768	51	-	-	-	-	-

**Table 4.11 Estimated M2 Steel Demand for Low-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-
2021	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-
2023	-	-	-	-	-	-	-
2024	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-
2026	-	-	-	-	-	-	-
2027	-	-	-	-	-	-	-
2028	-	-	-	-	-	-	-
2029	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-
2031	-	-	-	-	-	-	-
2032	-	-	-	-	-	-	-
2033	-	-	-	-	-	-	-
2034	-	-	-	-	-	-	-
2035	-	-	-	-	-	-	-
2036	-	-	-	-	-	-	-
2037	-	-	-	-	-	-	-
2038	-	-	-	-	-	-	-
2039	-	-	-	-	-	-	-
2040	-	-	-	-	-	-	-
2041	-	-	-	-	-	-	-
2042	-	-	-	-	-	-	-
2043	-	-	-	-	-	-	-
2044	-	-	-	-	-	-	-
2045	-	-	-	-	-	-	-

**Table 4.12 Estimated M2 Steel Demand for Medium-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-
2021	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-
2023	-	-	-	-	-	-	-
2024	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-
2026	-	-	-	-	-	-	-
2027	-	-	-	-	-	-	-
2028	-	-	-	-	-	-	-
2029	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-
2031	-	-	-	-	-	-	-
2032	-	-	-	-	-	-	-
2033	-	-	-	-	-	-	-
2034	-	-	-	-	-	-	-
2035	-	-	-	-	-	-	-
2036	-	-	-	-	-	-	-
2037	-	-	-	-	-	-	-
2038	-	-	-	-	-	-	-
2039	-	-	-	-	-	-	-
2040	-	-	-	-	-	-	-
2041	-	-	-	-	-	-	-
2042	-	-	-	-	-	-	-
2043	-	-	-	-	-	-	-
2044	-	-	-	-	-	-	-
2045	-	-	-	-	-	-	-

#### 4.5. Estimated M3 Steel Demand

**Table 4.13 Estimated M3 Steel Demand for Liquid-Immersed Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	16,214	15,366	-	-	-	-	-
2017	16,330	15,476	-	-	-	-	-
2018	16,469	15,608	-	-	-	-	-
2019	16,614	15,746	-	-	-	-	-
2020	16,758	15,882	-	-	-	-	-
2021	16,891	16,008	-	-	-	-	-
2022	17,030	16,140	-	-	-	-	-
2023	17,177	16,279	-	-	-	-	-
2024	17,344	16,437	-	-	-	-	-
2025	17,480	16,566	-	-	-	-	-
2026	17,626	16,704	-	-	-	-	-
2027	17,775	16,846	-	-	-	-	-
2028	17,943	17,005	-	-	-	-	-
2029	18,077	17,132	-	-	-	-	-
2030	18,245	17,291	-	-	-	-	-
2031	18,407	17,444	-	-	-	-	-
2032	18,575	17,604	-	-	-	-	-
2033	18,702	17,724	-	-	-	-	-
2034	18,853	17,867	-	-	-	-	-
2035	18,997	18,004	-	-	-	-	-
2036	19,156	18,154	-	-	-	-	-
2037	19,316	18,306	-	-	-	-	-
2038	19,477	18,459	-	-	-	-	-
2039	19,640	18,613	-	-	-	-	-
2040	19,804	18,769	-	-	-	-	-
2041	19,970	18,925	-	-	-	-	-
2042	20,136	19,083	-	-	-	-	-
2043	20,305	19,243	-	-	-	-	-
2044	20,474	19,404	-	-	-	-	-
2045	20,645	19,566	-	-	-	-	-

**Table 4.14 Estimated M3 Steel Demand for Low-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	7,334	750	2,919	1	-	-	-
2017	7,400	757	2,945	1	-	-	-
2018	7,469	764	2,972	1	-	-	-
2019	7,538	771	3,000	1	-	-	-
2020	7,609	778	3,028	1	-	-	-
2021	7,673	785	3,054	1	-	-	-
2022	7,726	790	3,075	1	-	-	-
2023	7,785	796	3,098	1	-	-	-
2024	7,845	802	3,122	1	-	-	-
2025	7,901	808	3,145	1	-	-	-
2026	7,955	813	3,166	1	-	-	-
2027	8,008	819	3,187	1	-	-	-
2028	8,063	825	3,209	1	-	-	-
2029	8,122	831	3,232	1	-	-	-
2030	8,187	837	3,258	1	-	-	-
2031	8,250	844	3,283	1	-	-	-
2032	8,307	849	3,306	1	-	-	-
2033	8,360	855	3,327	1	-	-	-
2034	8,417	861	3,350	1	-	-	-
2035	8,469	866	3,370	1	-	-	-
2036	8,528	872	3,394	1	-	-	-
2037	8,587	878	3,418	1	-	-	-
2038	8,647	884	3,441	1	-	-	-
2039	8,707	890	3,465	1	-	-	-
2040	8,768	897	3,489	1	-	-	-
2041	8,829	903	3,514	1	-	-	-
2042	8,890	909	3,538	1	-	-	-
2043	8,952	915	3,563	1	-	-	-
2044	9,014	922	3,588	1	-	-	-
2045	9,077	928	3,612	1	-	-	-



**Table 4.15 Estimated M3 Steel Demand for Medium-Voltage Dry-Type Transformers (tons)**

	Total Base Case	Total dTSL1	Total dTSL2	Total dTSL3	Total dTSL4	Total dTSL5	Total dTSL6
2016	2,062	1,210	215	0	-	-	-
2017	2,080	1,221	217	0	-	-	-
2018	2,100	1,232	219	0	-	-	-
2019	2,119	1,243	221	0	-	-	-
2020	2,139	1,255	223	0	-	-	-
2021	2,157	1,266	225	0	-	-	-
2022	2,172	1,275	226	0	-	-	-
2023	2,188	1,284	228	0	-	-	-
2024	2,205	1,294	230	0	-	-	-
2025	2,221	1,303	232	0	-	-	-
2026	2,236	1,312	233	0	-	-	-
2027	2,251	1,321	235	0	-	-	-
2028	2,267	1,330	236	0	-	-	-
2029	2,283	1,340	238	0	-	-	-
2030	2,301	1,350	240	0	-	-	-
2031	2,319	1,361	242	0	-	-	-
2032	2,335	1,370	243	0	-	-	-
2033	2,350	1,379	245	0	-	-	-
2034	2,366	1,388	247	0	-	-	-
2035	2,381	1,397	248	0	-	-	-
2036	2,397	1,407	250	0	-	-	-
2037	2,414	1,416	252	0	-	-	-
2038	2,431	1,426	253	0	-	-	-
2039	2,448	1,436	255	0	-	-	-
2040	2,465	1,446	257	0	-	-	-
2041	2,482	1,456	259	0	-	-	-
2042	2,499	1,466	261	0	-	-	-
2043	2,516	1,477	262	0	-	-	-
2044	2,534	1,487	264	0	-	-	-
2045	2,552	1,497	266	0	-	-	-