Input for Steel Price Sensitivity Tool

Prolec GE offers this perspective for consideration on the range of core material price levels to use for additional price sensitivity analysis by DOE and Navigant.

For our analysis, we asked the question: How much of a core material price change ($/pound) would be required for the lowest cost DOE M3 design for each dEL (draft Efficiency Level) to match the lowest cost DOE Amorphous design for that dEL, and vice-versa? What would these price changes be in % of the material prices used in the DOE analyses?

Using the DOE design data from the 9/09/2011 spreadsheets and our simplified comparisons of only the lowest cost designs for a given dEL (provided previously), we calculated the difference in manufacturer's price for the lowest cost M3 and Amorphous units for a given dEL and divided those price differences by estimated core weights to get a $/pound price differential. We had to estimate core weights since the DOE spreadsheets do not provide that data. We then divided the resulting price changes by the DOE 2010 material prices to get a % material price variance.

The DOE design data results in the following core material price change ranges for M3 and Amorphous Distribution Transformer prices to be at parity:

Table 1: Core material price variance ranges for transformer price parity (by DL)

DL	Material	dEL1	dEL2	dEL3
1	M3	25%	-79%	-110%
	SA1	-21%	68%	96%
2	M3	-41%	n/a	n/a
	SA1	35%	---	---
4	M3	-32%	-160%	n/a
	SA1	22%	103%	---
5	M3	-61%	n/a	n/a
	SA1	48%	---	---

Table 2: Core material price variance ranges for transformer price parity (by Material)

Material	DL	EL1	EL2	EL2
M3	1	25%	-79%	-110%
"	2	-41%	n/a	n/a
"	4	-32%	-160%	n/a
"	5	-61%	n/a	n/a
SA1	1	-21%	68%	96%
"	2	35%	---	---
"	4	22%	103%	---
"	5	48%	---	---

Note: Where 'n/a' appears, that indicates there were no M3 designs for comparison for that combination of dEL and DL; '---' indicates there is no upper bound that can be calculated for Amorphous since there is no comparable M3 unit in DOE's design database. Since there were no M3 designs for comparison for dEL4 and dEL5, these efficiency levels were not included on the previous tables.

A positive percent variance indicates the % that the core material price can increase to match the manufacturer's price for the lower cost option. A negative percent variance indicates the % that the core material price has to decrease to match the manufacturer's price for the lower cost option. Please note that the DOE Amorphous designs for DL2 do not appear to be optimized for lower dEL's. The lowest price Amorphous design available was one that meets or exceeds dEL3. Our own data suggests that lower cost Amorphous designs are feasible if targeted at the dEL1 and dEL2 levels. We believe that this would reduce or eliminate the Amorphous unit's cost disadvantage versus M3 at dEL1 and would increase its advantage at dEL2. DOE may want to review their family of Amorphous designs for DL2.

For example, at dEL2, the lowest cost M3 design would need to have a reduction in M3 material cost of 79% to match the best Amorphous unit for Design Line 1. That value would be -160% for Design Line 5. There were no M3 designs in the DOE results at dEL2 for Design Lines 2 and 4. Conversely, the price of Amorphous material could increase 68% and still match the best M3 manufacturer's price for Design Line 1 at dEL2, and by 103% to match the best DOE M3 design for Design Line 5 at dEL2.

This simplified analysis suggests that the range of possible core material price levels used for DOE's next sensitivity analysis should be widened. Rather than using a maximum material price range of +/-25%, we believe the top range should be at least +/-50% given the above results. The price assumptions used for new dEL's will affect not only the positions of the design technology results, but also the fundamental LCC results.

We recognize that our analysis is simplified. We know that as material prices change, the optimum designs could change through redesign and reoptimization. We realize that the manufacturer's prices include some mark-ups that we have not reflected in our variance calculations. However, we believe the fundamental results would hold – that a more significant price change in core materials is possible than what DOE is currently proposing to analyze.

We also believe that our analysis of core material price versus dEL's provides similar results to those presented by AK Steel during last Thursday's session.

Recommendation: Expand the range for core material prices to at least +/-50% for sensitivity analysis on optimum designs and LLC results.

Details of our analysis are summarized on the next two pages.

Details on Core Material Price Ranges for DT Price Parity Analysis - M3 and SA1
Analysis based on design data from DOE 9/09/2011 Engineering Data file

DL1 - 50 kVA

	dEL0	dEL1	dEL2	dEL3
DT Price - M3	$1,960	$2,156	$2,715	$2,924
DT Price - SA1	$2,284	$2,284	$2,284	$2,284
DT Price Var - SA1-M3	$324	$128	($431)	($640)
DT Price Var %	17%	6%	-16%	-22%
Est Core Wt-M3	215	275	290	310
Est Core Wt-SA1	240	255	265	280
Price Chge Parity - $/lb-M3	$1.51	$0.47	($1.49)	($2.06)
Price Chge Parity - $/lb-SA1	($1.35)	($0.50)	$1.63	$2.29
DOE Base $/lb-M3	$1.88	$1.88	$1.88	$1.88
DOE Base $/lb-SA1 (core)	$2.38	$2.38	$2.38	$2.38
Parity Matl Chge %-M3	80%	25%	-79%	-110%
Parity Matl Chge %-SA1	-57%	-21%	68%	96%

DL2 - 25 kVA

	dEL0	dEL1	dEL2	dEL3
DT Price - M3	$1,314	$1,472	n/a	n/a
DT Price - SA1	$1,277	$1,342	$1,381	$1,434
DT Price Var - SA1-M3	($37)	($130)	---	---
DT Price Var %	-3%	-9%	---	---
Est Core Wt-M3	140	170	---	---
Est Core Wt-SA1	155	155	---	---
Price Chge Parity - $/lb-M3	($0.26)	($0.76)	---	---
Price Chge Parity - $/lb-SA1	$0.24	$0.84	---	---
DOE Base $/lb-M3	$1.88	$1.88	---	---
DOE Base $/lb-SA1 (core)	$2.38	$2.38	---	---
Parity Matl Chge %-M3	-14%	-41%	---	---
Parity Matl Chge %-SA1	10%	35%	---	---

DL4 – 150 kVA

	dEL0	dEL1	dEL2	dEL3
DT Price - M3	$5,362	$6,422	$7,854	n/a
DT Price - SA1	$6,033	$6,033	$6,033	$6,033
DT Price Var - SA1-M3	$671	($389)	($1,821)	---
DT Price Var %	13%	-6%	-23%	---
Est Core Wt-M3	565	650	605	---
Est Core Wt-SA1	740	740	740	---
Price Chge Parity - $/lb-M3	$1.19	($0.60)	($3.01)	---
Price Chge Parity - $/lb-SA1	($0.91)	$0.53	$2.46	---
DOE Base $/lb-M3	$1.88	$1.88	$1.88	---
DOE Base $/lb-SA1 (core)	$2.38	$2.38	$2.38	---
Parity Matl Chge %-M3	63%	-32%	-160%	---
Parity Matl Chge %-SA1	-38%	22%	103%	---

DL5 - 1500 kVA

	dEL0	dEL1	dEL2	dEL3
DT Price - M3	$24,853	$30,332	n/a	n/a
DT Price - SA1	$25,555	$26,557	$27,128	$28,862
DT Price Var - SA1-M3	$702	($3,775)	---	---
DT Price Var %	3%	-12%	---	---
Est Core Wt-M3	2860	3300	---	---
Est Core Wt-SA1	3045	3300	---	---
Price Chge Parity - $/lb-M3	$0.25	($1.14)	---	---
Price Chge Parity - $/lb-SA1	($0.23)	$1.14	---	---
DOE Base $/lb-M3	$1.88	$1.88	---	---
DOE Base $/lb-SA1 (core)	$2.38	$2.38	---	---
Parity Matl Chge %-M3	13%	-61%	---	---
Parity Matl Chge %-SA1	-10%	48%	---	---

dEL4 and dEL5 design databases have no M3 designs for comparison.