Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

ENGINEERING PLASTICS IN A GLOBALIZING AUTOMOTIVE SUPPLY CHAIN

PRESENTED BY:

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PREPARED FOR:

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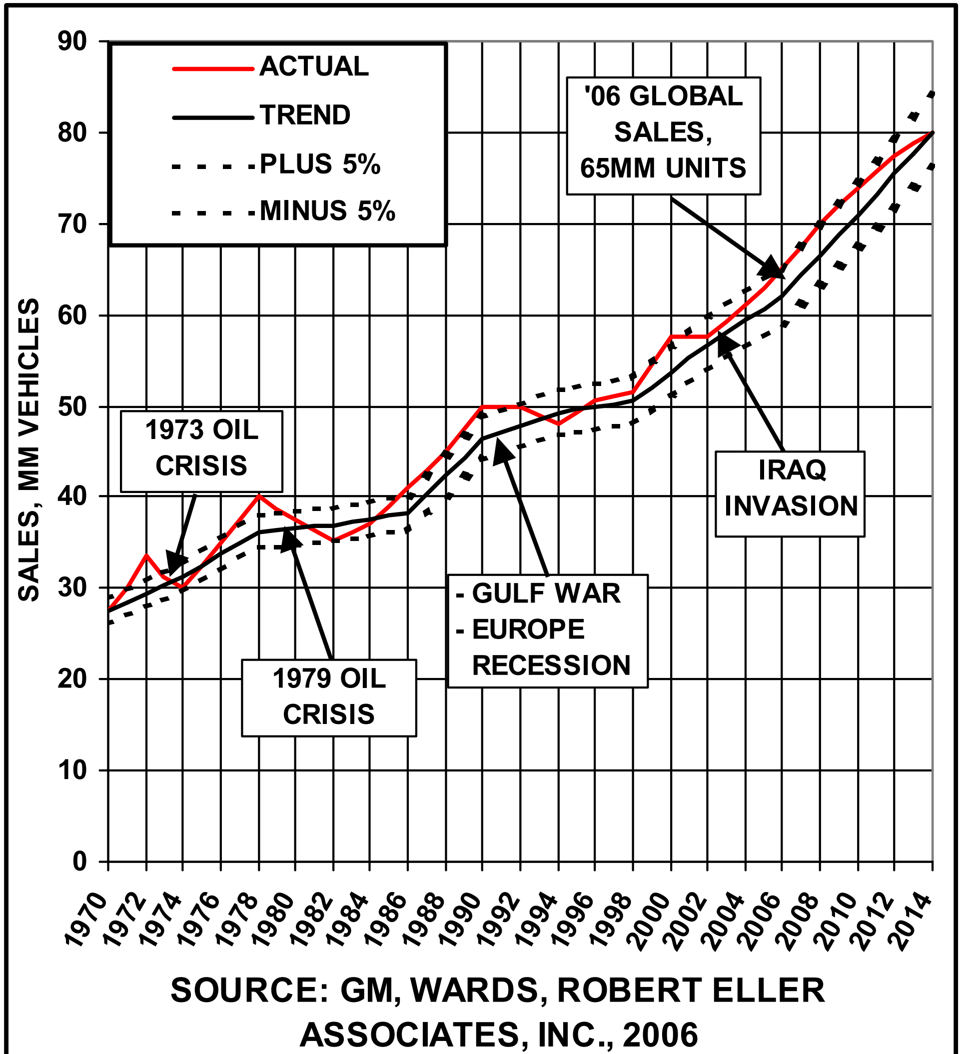
HIGHLIGHTS

- **OPERATING HYPOTHESES**
- **IMPORTANCE OF ASIA**
- **AUTO PLASTICS SUPPLY CHAIN RESTRUCTURE EFFECTS**
- **THE ETP/FABRICATION PROCESS COUPLE**
- **TARGET ETP SUBSTITUTIONS**
- **FUTURE VIEW**

KEY AUTO SECTOR HYPOTHESES

- **THE SUPPLY CHAIN WILL BE RESHAPED**
- **VEHICLE PRICE DECLINES CONTINUE**
- **"HIGH" N. AMERICAN FUEL PRICES CONTINUE**
- **VALUE OF WEIGHT SAVINGS WILL REMAIN HIGH**
- **NET TECHNICAL INFLOW TO U.S. CONTINUES**
- **U.S. AUTO INDUSTRY HAS 3-5 YEAR TECH. LAG**
- **MATERIALS/PROCESS TECHNOLOGY IS A PATH TO ADDING VALUE**
- **FLEET COMPOSITION ADAPTS TO ECONOMIC PRESSURES (E.G., DOWNSIZING STARTED IN U.S.)**
- **AUTO MANUFACTURING <u>GROWTH</u> SHIFT TO ASIA**

GLOBAL LIGHT VEHICLE PRODUCTION TREND LINE



- 2011 GLOBAL SALES COULD REACH 75MM UNITS
- GLOBAL AAG = 3%/YR.
- ASIA PACIFIC GROWTH 12%/YR.?
- WESTERN SALES STAGNANT OR DECLINE
- GLOBAL FLEET SHIFT TOWARD SMALLER CARS
- VARIATIONS HAVE BEEN IN +/- 5% BAND SINCE 1970

GLOBAL OIL DEMAND WILL REMAIN HIGH

REGION	DEMAND MM BBLS/DAY		AAG, %/YR
	2003	2030	
OECD/NIE	48.9	63.7	1.0%
NON OECD, EX CHINA	25.4	56.0	3.0%
CHINA	5.5	18.7	4.6%
TOTAL	**79.8**	**138.4**	**2.1%**
TRANSPORTATION	46.3	83.0	2.2%
TRANSPORTATION	58.0%	60.0%	

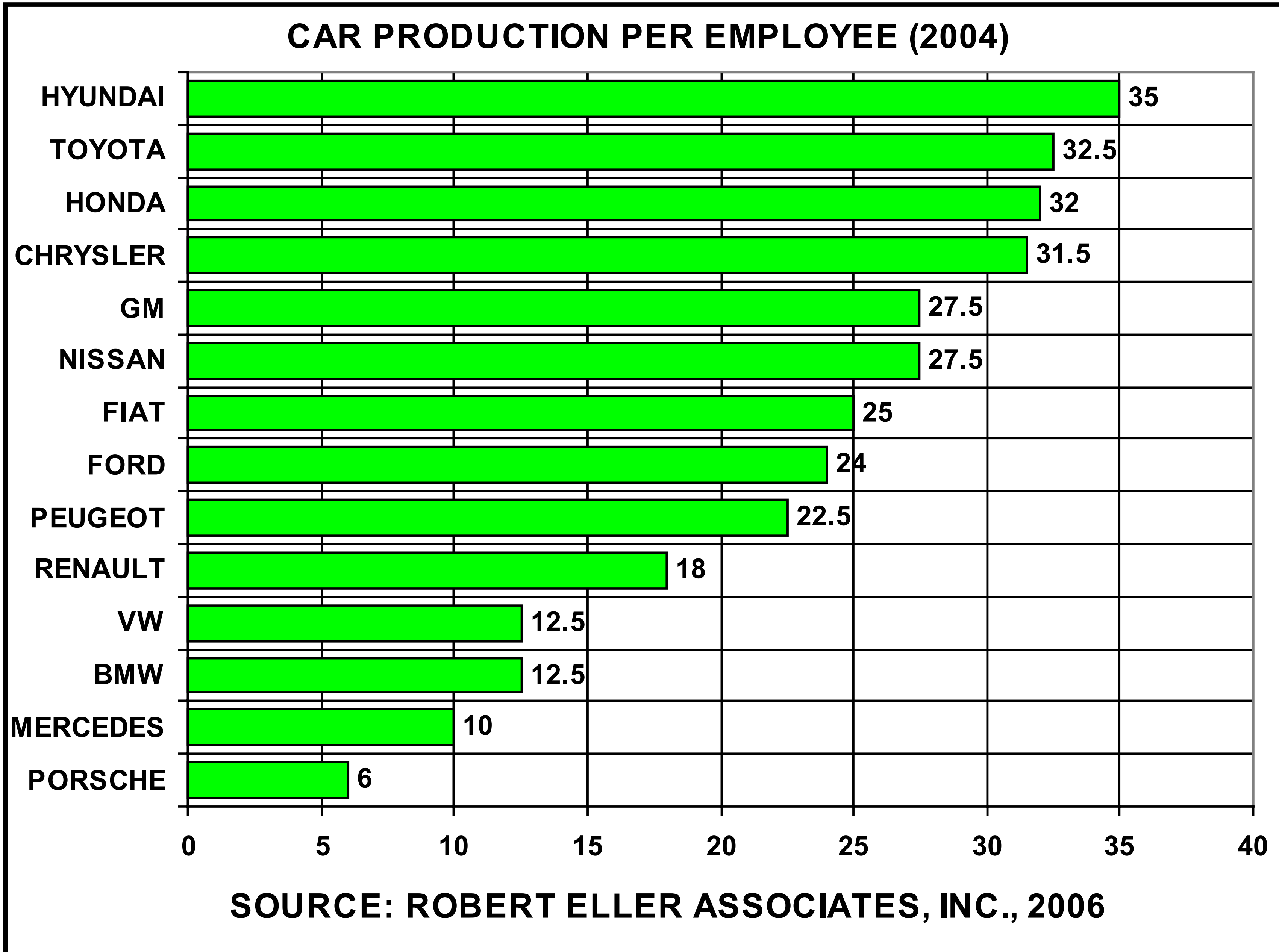
HIGH OIL PRICES:
FUEL PRICES REMAIN HIGH
PLACE PREMIUM ON WEIGHT SAVINGS
SHIFT FLEET TO SMALLER VEHICLES(FAVORS HARD TPOs)
US OEMs WILL CONTINUE TOO LOSE GLOBAL MARKET SHARE
OEMs KEEP PRESSURE ON TPE SUPPLIERS FOR COST REDUCTION

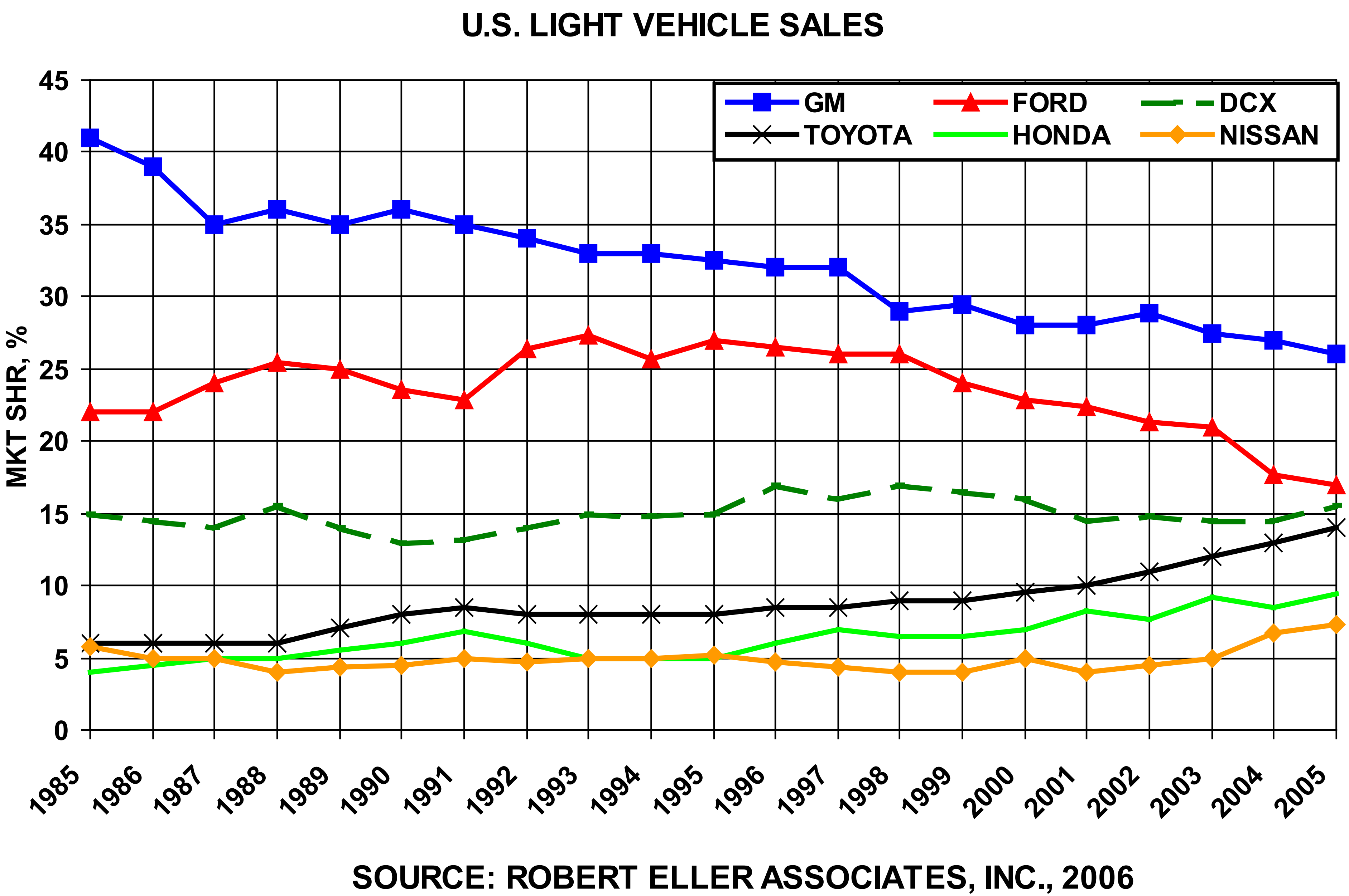
SOURCE: IMF,CLEAR VIEW ECONOMICS, ROBERT ELLER ASSOCIATES,.INC

NEW GENERATION SUPER/SUB COMPACTS

OEM	MODEL	NOTE
HYUNDAI	ACCENT	KOREA BUILT
GM	AVEO II	KOREA BUILT
DCX	CALIBER	US BUILT
FORD	REFLEX	STILL CONCEPT
HONDA	FIT	CHINA BUILT
NISSAN	VERSA	ALSO TIIDA
KIA	RIO	
GEELY	?	-TWO CANDIDATE MINICARS -CHINA BUILT
CHERY	QQ	-CHINA BUILT

SOURCE: ROBERT ELLER ASSOCIATES,INC., 2006


CAR PRODUCTION PER EMPLOYEE (2004)
HYUNDAI
35
TOYOTA
32.5
HONDA
32
CHRYSLER
31.5
GM
27.5
NISSAN
27.5
FIAT
25
FORD
24
PEUGEOT
22.5
RENAULT
18
VW
12.5
BMW
12.5
MERCEDES
10
PORSCHE
6
0
5
10
15
20
25
30
35
40
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006


U.S. LIGHT VEHICLE SALES
GM
FORD
DCX
TOYOTA
HONDA
NISSAN
MKT SHR, %
0
5
10
15
20
25
30
35
40
45
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

GLOBAL AUTO MARKET: ETP EFFECTS

AUTO CHANGE	ETP EFFECT
20-30% GLOBAL OVERCAPACITY	CUSTOMER/REGION SHIFT
SHARE GAIN BY NON-U.S. OEMs	U.S. COMPOUNDERS LOSE SHARE?
B-SEGMENT SHARE GAIN	- MODULES - PLASTICS SHARE GAIN - U.S. OEMs SLOW TO COMPETE
ASIA IS ONLY GROWTH REGION	DEMAND SHIFT TO ASIA
SEVERE AUTO PROFIT PRESSURES: STEEL, PLASTIC PRICE INCREASES	PRICE PRESSURE INTENSIFIES
FUEL PRICES	- WT SAVE DRIVES SUBSTITUTION
GLOBAL STANDARD (E.G., ISO/TS 16,949: 2002)	- ALIGNS US/EURO QUALITY STANDARDS - ELIM. MULTIPLE CERTIFICATIONS - CONSISTENT SUPPLY CHAIN QUAL. - STANDARDIZE ETP GRADES

AUTO DEMAND/ OPPORTUNITIES

65 MM UNITS / 3%/YR GROWTH

CONT'D HIGH FUEL COSTS

RADICAL RESTRUCTURING

AGGRESSIVE COST SAVE SEARCH

FLEET COMPOSITION SHIFT

REGIONAL SHIFT

CHINA/ASIA VEHICLE SHARE GAIN

SUPPLIER REDUCTION

ENABLERS

NEW PROCESS TECHNOLOGY

RENEWED WT SAVE INCENTIVE

THERMOPLASTIC ADVANTAGES

ETP/TPE COMBINATIONS

SYSTEMS COST SAVE POTENTIAL

METAL REPLACEMENT POTENTIAL

ETP CANDIDATES

POLYAMIDE
POLYESTER
PPS
PPA
ETC

SOURCE: ROBERT ELLER ASSOCIATES, 2006

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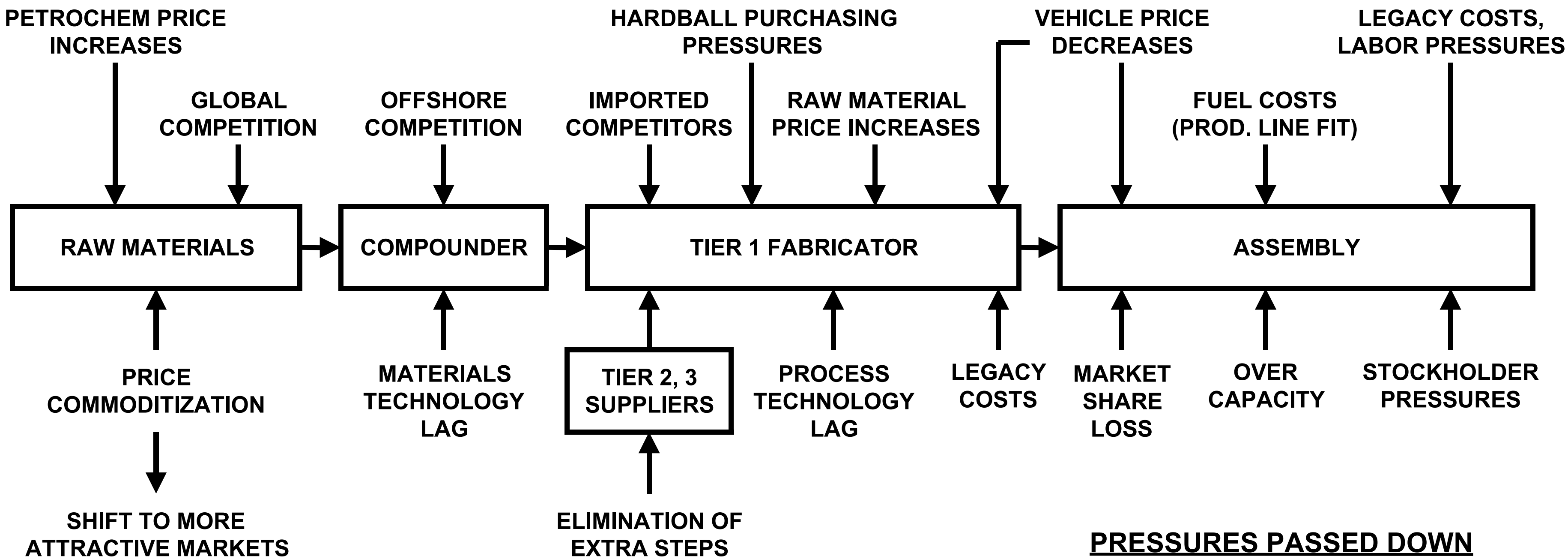
AUTOPLASTIC SUPPLY CHAIN IMPLOSION (N. AMERICA)



<u>PRESSURES PASSED DOWN THE SUPPLY CHAIN</u>:

- PRICING PRESSURES
- SUPPLY CHAIN "MANAGEMENT"
- DEMAND SLOWDOWN
- REVISED SPECIFICATIONS
- GLOBALIZATION PRESSURES

<u>ELIMINATE/REDUCE THE INEFFICIENCIES</u>:
-MULTIPLE STEPS
-EXCESSIVE LOGISTICS
-SCRAP GENERATION
-INEFFICIENT PROCESS TECHNOLOGIES
-SALES/MARKETING COSTS
-EXCESS LABOR COSTS
-OVER-GLOBALIZATION?

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2006

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ROLE OF THE ASIA SHIFT

- **CURRENT DEMAND ATTRACTS ETP RESIN & COMPOUND SUPPLIERS**
- **AUTOMOTIVE PLAYS KEY ROLE IN ACCELERATING ETP DEMAND**
- **LABOR COSTS ADVANTAGE ONLY ONE OF THE DRIVERS(DIMINISHING)**
- **PARALLEL SUPPLY CHAINS EVOLVING**
- **VEHICLE EXPORTS STARTING**
- **DOMESTIC DEMAND GROWTH**

ETP SUBSTITUTION DRIVERS

- **INCUMBENTS: GLASS, METAL,THERMOSETS**
- **NEW FABRICATION TECHNOLOGIES**
- **NEW MATERIALS COMBINATIONS**
- **KEY BENEFITS:**

  -PARTS CONSOLIDATION

  -NET SHAPE FABRICATION

  -WEIGHT SAVE(RENEWED INTEREST)
- **ENLARGED PERFORMANCE RANGE(HP-PA)**

VALUE OF WEIGHT SAVINGS

PARAMETER	2002	2006
U.S.FUEL COST, $/GAL	1.65	3.00?
WEIGHT SAVE VALUE, $/KG	1.65	3.00?
MAJOR SUBSTITUTION DRIVER	NO	YES?(a)

NOTE:

(a) MANY ALTERNATIVE WT SAVE METHODS. NEW ETP AND FABRICATION TECHNOLOGIES SUPPLEMENT WEIGHT SAVE INCENTIVES

SOURCE: ROBERT ELLER ASSOCIATES,INC.,2006

SOME PREVIOUS ETP SETBACKS

- **EXTERIOR PANELS (RESTART?)**
- **ENGINE COVERS**
- **BUMPER FASCIA**
- **INSTRUMENT PANELS**
- **OIL SUMP(CADILLAC ’86)**
- **NYLON ROCKER COVERS(CADILLAC ’86)**

RECENT ETP SUBSTITUTIONS

- **OIL FILTER HOUSINGS**
- **TRANSMISSION PANS(BMW, FORD)**
- **ENGINE COOLING PIPE**
- **OIL SUMPS(DIPSTICK TUBE/OIL SENSOR)**
- **OIL/TRANSMISSION PAN**
- **WATER JACKET SPACER(NYLON, TOYOTA)**
- **ENGINE DIPSTICK TUBES**
- **FEMs (HYBRID VS LGF-ETP)**
- **PC/ACRYLIC GLAZING**
- **THROTTLE BODIES**
- **PARKING BRAKE COMPONENTS(PPS-VW)**

ETP/FABRICATION PROCESS COMBOs

- **ETP/TPE MULTI-SHOT MOLDING**
- **INJECTION MOLDED ETP/METAL HYBRIDS**
- **NYLON SUCK BLOW MOLDING**
- **WATER INJECTION(DIPSTICK TUBES)**
- **CO-INJECTION/WATER INJECTION(ENGINE COOL PIPES)**
- **ROTATING CORE INJECTION(THROTTLE BODIES-REDUCES KNIT LINES)**
- **LASER WELDING (INTEGRATED INTAKE MANIFOLD)**

ETP VALUE CREATION OPPORTUNITIES

- **TARGET SYSTEMS COST SAVINGS**
- **SEEK ROLE IN IMPLODED SUPPLY CHAIN**
- **ETP/PROCESS TECHNOLOGY COMBINATIONS**
- **ROLE IN MODULAR CONSTRUCTION**
- **FOLLOW OEM REGIONAL SHIFT**
- **ETP/TPE COMBINATIONS**
- **KEY ETP GROWTH TARGETS WILL BE:**
  - **ENGINE CRITICAL**
  - **DRIVE TRAIN**
  - **GLAZING**
  - **FEMs/EXTERIOR PANELS?**
  - **DOOR HARDWARE MODULES**

SOME NEW/OLD ETP COMPETITIVE INTERFACES

TARGET	COMPETITION	NOTE
FEM	LGF-PP	-STRONG FEM SHARE GAIN -ETPs(HYBRIDS OR LGF
GLAZING/ MODULE	GLASS	-PENETRATION WILL ACCELERATE -SEVERAL GLAZING POSITIONS -MODULE APPROACH KEY
ENGINE CRITICAL	METALS	-ACCELERATING
EXTERIOR PANELS	METAL,TPO	-COATINGS BREAKTHRUs NEEDED -MODULE INTEGRATION POTENTIAL -ROLE FOR THERMOFORMING? -NEW UV REQUIREMENTS(GM) -TPO IS STRONG COMPETITOR

SOURCE: ROBERT ELLER ASSOCIATES,INC.,2006

SUMMARY

- **NEW DRIVERS FOR ETP SUBSTITUTION**
  -ENGINE TECHNOLOGY
  -FUEL COSTS/TYPE
  -EMISSIONS CONTROL
  -WEIGHT SAVE
- **SYSTEMS COST SAVINGS POSSIBLE**
- **GLOBAL TECHNOLOGY CONVERGENCE**
- **REGIONAL DEMAND SHIFT**
- **PROCESS TECHNOLOGIES AID SUBSTITUTION**
- **MODULAR CONSTRUCTION INCREASE**