



Robert Eller Associates, Inc.

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

GLOBAL PERSPECTIVES ON TPE MARKETS, GROWTH TRENDS, AND THE RUBBER INTERFACE

PRESENTED BY:

Robert Eller, President

Robert Eller Associates, Inc.

Phone: 330-670-9566

E-mail: bobeller@prodigy.net

Web Site: www.robertellerassoc.com

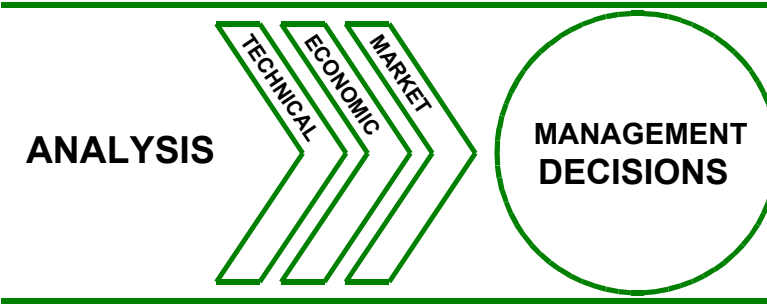
PREPARED FOR:

RMA/EPG ANNUAL MEETING

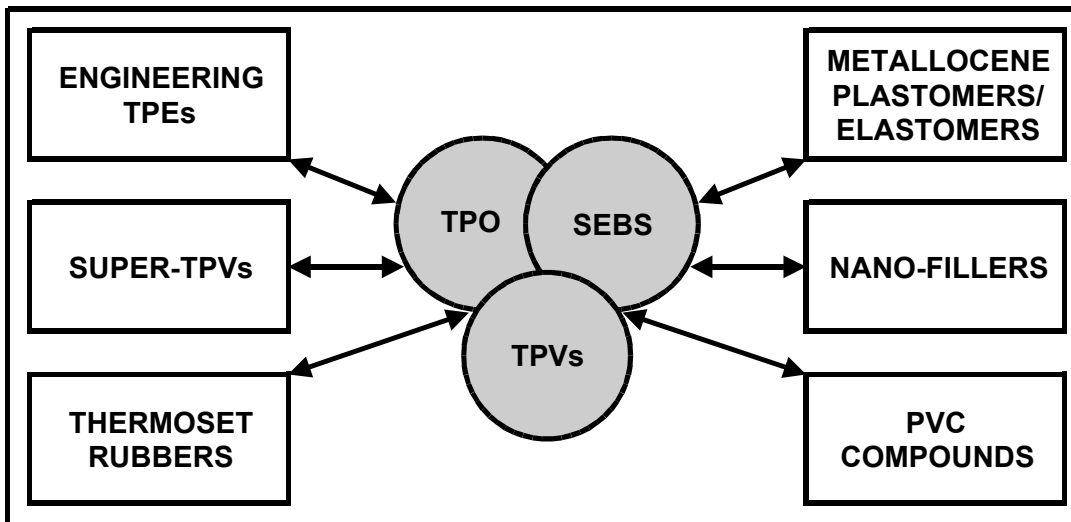
FEBRUARY 26, 2007

REA BACKGROUND

- **ESTABLISHED IN 1991**
- **ANALYSIS IN SUPPORT OF MANAGEMENT DECISIONS IN: PLASTICS, TPEs, ELASTOMERS, COMPOUNDING**
- **MULTICLIENT/PRIVATE STUDIES; MERGERS/ACQUISITIONS**
- **OPERATIONS IN U.S./EUROPE/ASIA**
- **MOST STUDIES ARE GLOBAL IN SCOPE**
- **POSITIONING STUDIES: MOST NEW TPEs ENTERING MARKET**
- **MOST ANALYSES ARE AT ADVANCED R+D/EARLY COMMERCIALIZATION INTERFACE**
- **OPERATE IN ALL MARKET SECTORS**



Specialty Thermoplastic Elastomers . . . Markets, Economics, Technology, Intermaterials Competition



A Europe/U.S./Japan Multiclient Industry Analysis

Completed January 2007

Robert Eller Associates, Inc.

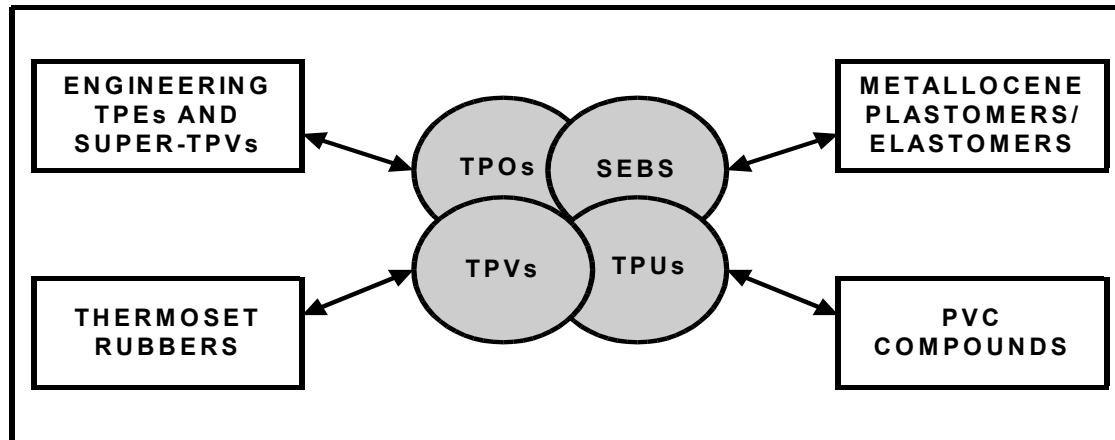
CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

ANALYSIS



MANAGEMENT
DECISIONS

Specialty Thermoplastic Elastomers . . . Markets, Economics, Intermaterials Competition, and Industry Structure in China



A Multiclient Industry Analysis

2006

Robert Eller Associates, Inc.
CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

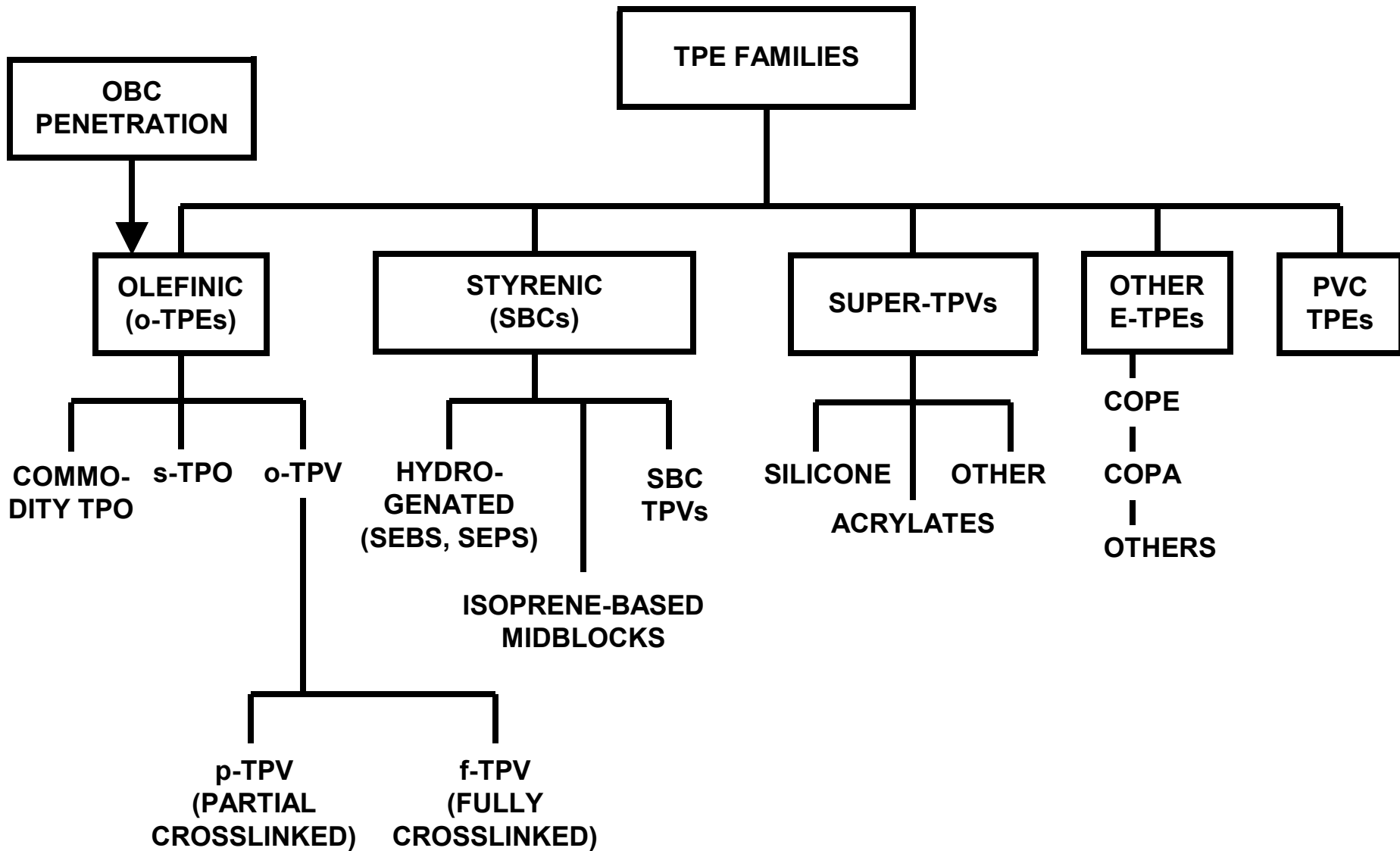
4000 Embassy Parkway, Suite 208, Akron, Ohio 44333-8328 USA
Phone 330-670-9566 / Fax 330-670-9844
Web Site: <http://www.robertellerassoc.com>
E-mail: bobeller@prodigy.net

USA · EUROPE · CHINA · JAPAN · SOUTH AMERICA

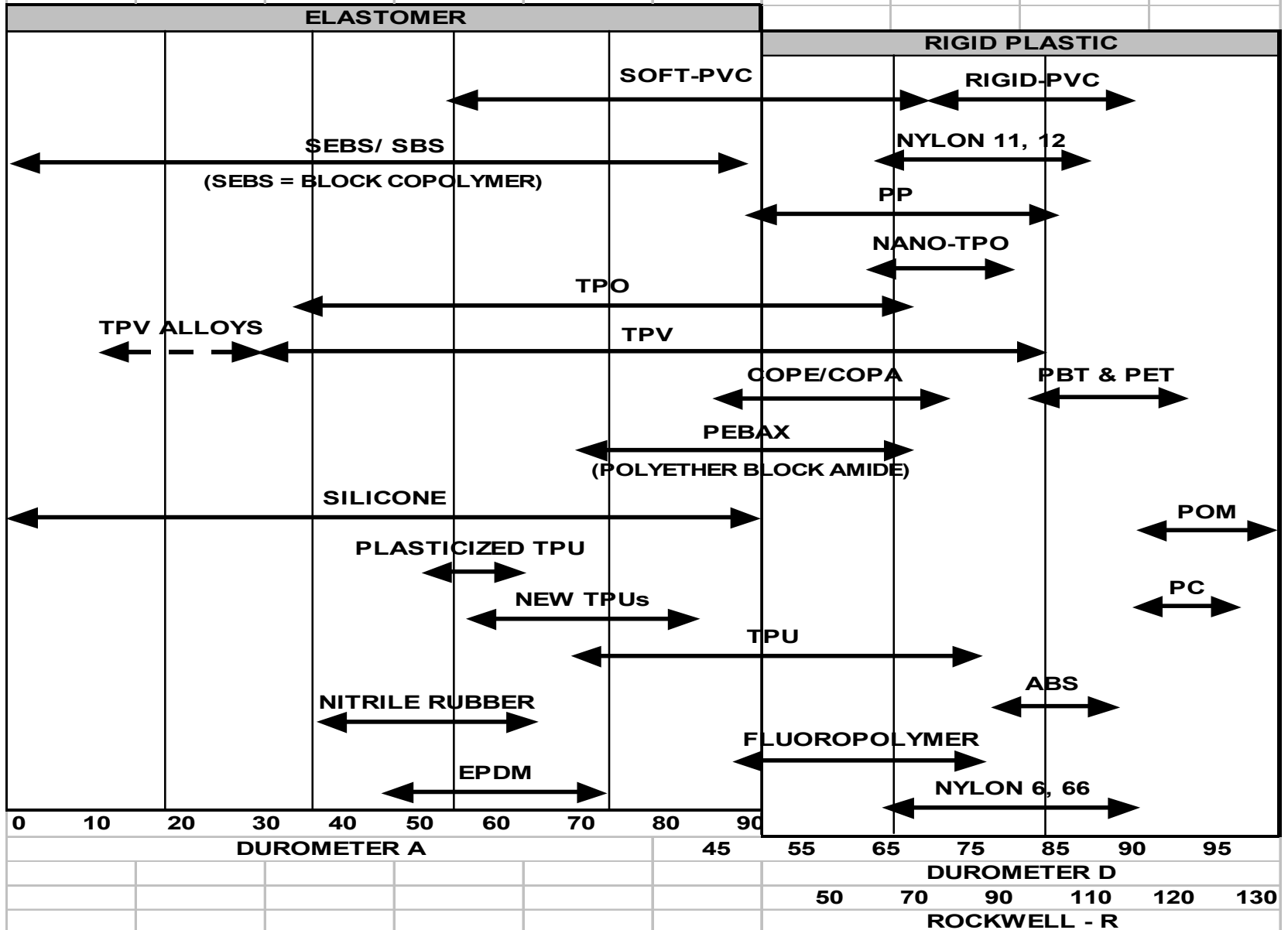
PRESENTATION OVERVIEW

- **TPE DEFINITIONS**
- **MARKET PERSPECTIVES/GLOBAL SHIFTS**
- **PATHS TO MARKET/INDUSTRY STRUCTURE SHIFTS**
- **MATERIALS TECHNOLOGY EFFECTS**
- **THE RUBBER INTERFACE**
- **FABRICATION TECHNOLOGY EFFECTS**
- **MARKET SECTORS**
 - **AUTO . . . WHY IT'S IMPORTANT**
 - **NON-AUTO**
- **CREATING/DESTROYING VALUE**
- **PROFITABILITY DRIVERS**
- **CHINA IMPLICATIONS**
- **FUTURE VIEW**

TPE FAMILIES . . . CHANGING STRUCTURE

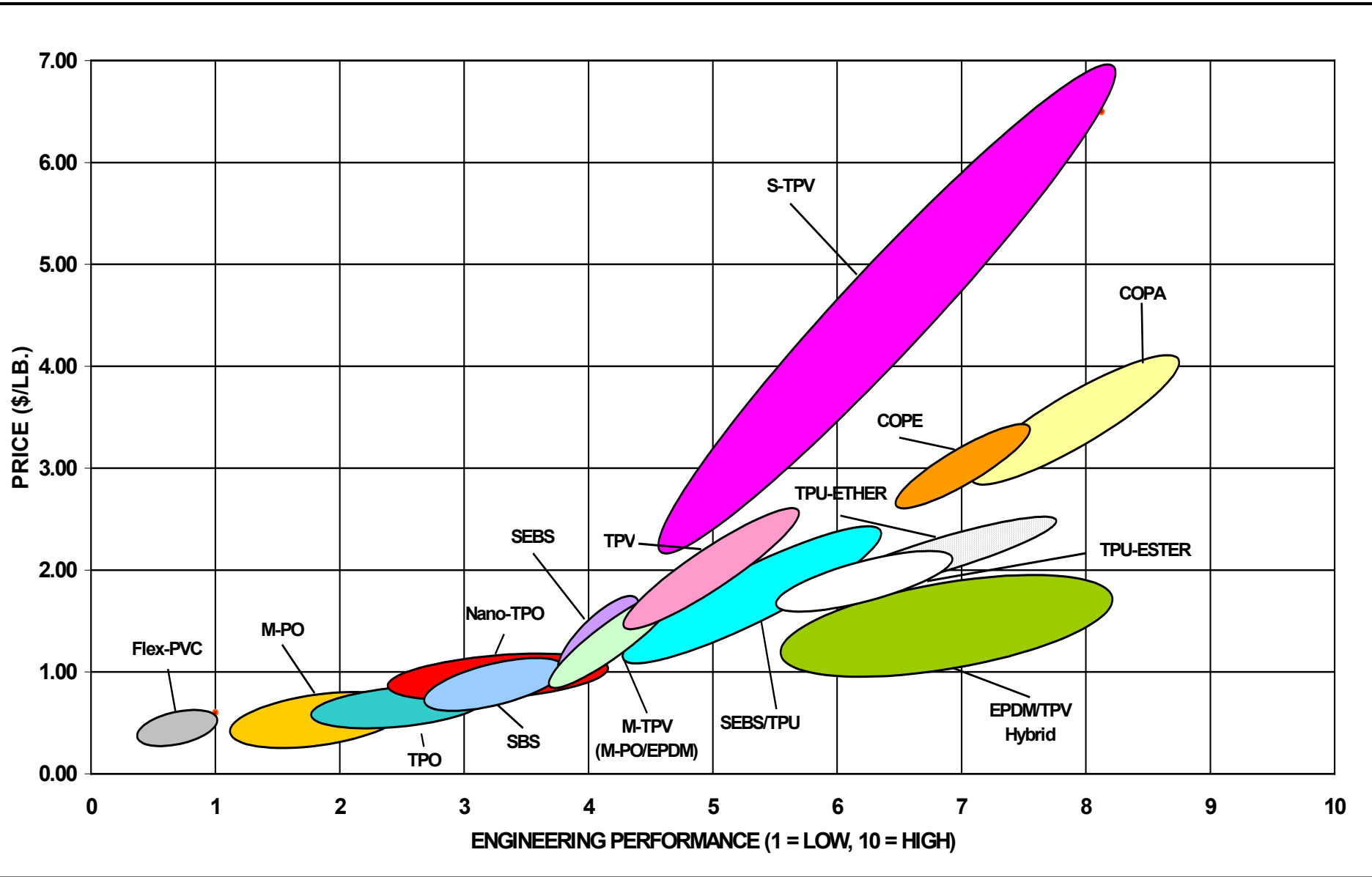


TYPICAL HARDNESS RANGES OF TPEs AND OTHER PLASTICS



SOURCE: BAYER, 2007

TPE PRICE/PERFORMANCE RANGES



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

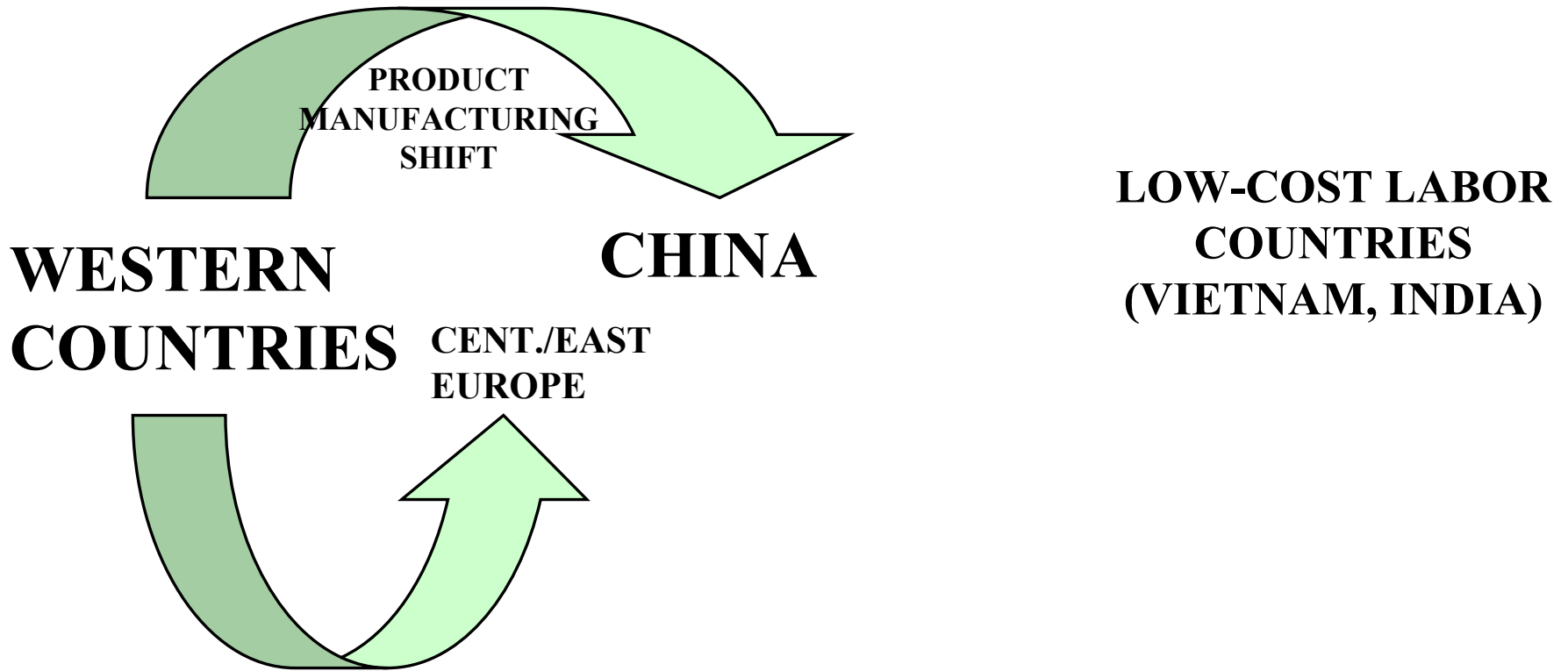
MKT. PERSPECTIVES (EUROPE/N. AMERICA)

- **TPE DEMAND GROWTH (ALL SECTORS):**
 - OVERALL 5-6%/YR. (EUROPE/N. AMERICA)
 - MAJOR RUBBER BREAKTHROUGH COULD SHARPLY ACCELERATE GROWTH
- **AUTOMOTIVE: 7%/YR. GROWTH BETWEEN 2006-2011**
- **FASTEST TPE GROWTH SECTORS WILL BE:**
 - THERMOFORMED SHEET
 - AUTOMOTIVE
 - BUILDING/CONSTRUCTION
 - FOOD/PHARMACEUTICAL PACKAGING
- **PROFITABILITY:**
 - CONTINUED EROSION?
 - MARKET SEGMENTING INTO COMMODITY/SPECIALTY

ASIA EFFECTS ON EUROPE/N. AMERICA TPE MARKETS

- **TPE DEMAND GROWTH IN WEST REDUCED BY CHINA SHIFT OF MARKETS:**
 - APPLIANCE/TOOL
 - CONSUMER/HOUSEWARES
 - PERSONAL CARE
 - SPORTS/LEISURE
 - ELECTRICAL-ELECTRONIC/PERSONAL COMMUNICATIONS
- **COMPOUNDER SHIFT TO CHINA ACCELERATING (RECENTLY)**
- **INVESTMENT STARTING TO FLOW FROM CHINA**
- **AUTO EXPORT: STARTING SLOWLY**
- **INDIA SHIFT: SLOWER THAN CHINA, CURRENT INTEREST**

MANUFACTURING DYNAMICS: THE SHIFT TO LOWER-COST LABOR



CHINA vs. EAST EUROPE:

- **MORE TECHNICAL APPLICATIONS IN EAST EUROPE**
 - **BETTER TOOLING BASE**
 - **IP PROTECTION**
 - **MORE CAPITAL INTENSE AUTOMATION**
- (PRODUCTIVITY IMPROVEMENTS vs. LABOR)**

TPE INDUSTRY STRUCTURE SHIFTS

- **TECHNOLOGY CONVERGENCE:** (EUROPE/U.S./ASIA?)
- **SHARE SHIFT IN U.S. END USE MARKETS:**
EUROPEANS, JAPANESE, KOREANS
- **JAPANESE TPE COMPOUNDERS:**
MAJOR SHARE GAIN IN N. AMERICA (o-TPEs)
- **PRIVATE EQUITY GROUPS ENTERING**
- **REACTOR TPO/METALLO-PLASTOMERS/OBCs:**
CAUSE MARKET SHARE SHIFT BETWEEN TPEs
- **COMPOUNDER PRODUCT LINES:** BROADENING
- **s-TPVs:** ATTRACTING NEW SUPPLIERS
- **SBC-TPV:**
COULD SHIFT COMPETITIVE POSITIONS
(STYRENIC vs. o-TPV)
- **IN-HOUSE COMPOUNDING:**
WILL CHANGE INDUSTRY STRUCTURE AND
PATH TO MARKET

NEW TPE MATERIALS TECHNOLOGIES

- **s-TPVs (SUPER-TPVs):**
 - ACRYLIC, NITRILE, AND SILICONE BASED
 - VERY SMALL CURRENT VOLUMES
(ZEON AND DuPONT ARE LEADERS)
 - MODERATE GROWTH POTENTIAL
 - AUTO UNDER-HOOD IS MAIN TARGET
 - HIGH PRICE LIMITS APPLICATION POTENTIAL
- **r-TPOs:**
 - BROADENING PROPERTY RANGE, NEW COMPETITORS
- **PLASTOMER/HMS PP: POOR MAN'S CROSSLINKING**
- **OLEFIN BLOCK COPOLYMERS:**
 - RECENT INTRODUCTION BY DOW SHIFTS TPE
COMPETITIVE INTERFACE

TPE/RUBBER SUBSTITUTION STATUS

APPLICATION	STATUS
BODY/GLAZING SEALS*	<ul style="list-style-type: none">- STARTED- WILL ACCELERATE- FOAMING REQUIRED?
HOSE*	<ul style="list-style-type: none">- NO SIGNIFICANT PENET. YET- REQUIRES PARADIGM SHIFT
BELTS	<ul style="list-style-type: none">- UNLIKELY PENETRATION IN AUTO- MAJOR TPV, TPU TARGET
BOOTS/ BELLOWS/ DUCTING*	<ul style="list-style-type: none">- SUBSTANTIAL PENETRATION.- SHIFT TO HIGHER PERF. TPEs?
GROMMETS, BUMPERS, GASKETS*	<ul style="list-style-type: none">- STARTED

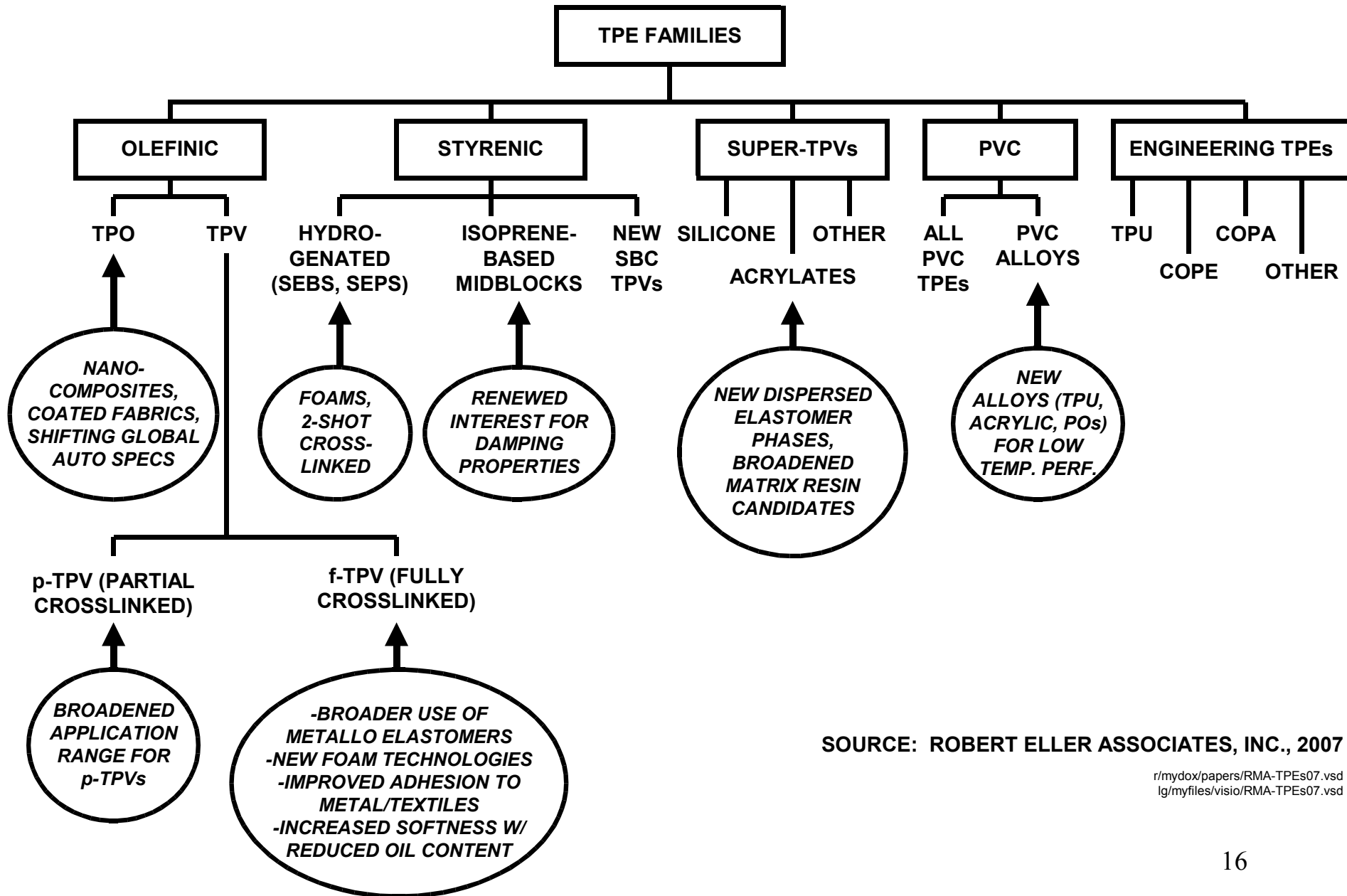
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

FABRICATION TECHNOLOGY SHIFTS

- **2-SHOT MOLDING**
- **IN-LINE COMPOUNDING?**
- **NEGATIVE FORMING/IN-MOLD GRAINING**
- **PROFILE EXTRUSION**
- **BODY/GLAZING SEAL TPE SUBSTITUTION***
- **IN-MOLD DECORATION**
- **INJECTION MOLDING ADVANCES (LOW GLOSS/FEWER FLOW LINES/FINE GRAIN)**
- **SHEET THERMOFORMING**
- **BROADEN BLOW MOLDING POTENTIAL***
- **CO-EX*; CO-BLOW***

*** = RUBBER CHALLENGE TECHNOLOGIES**

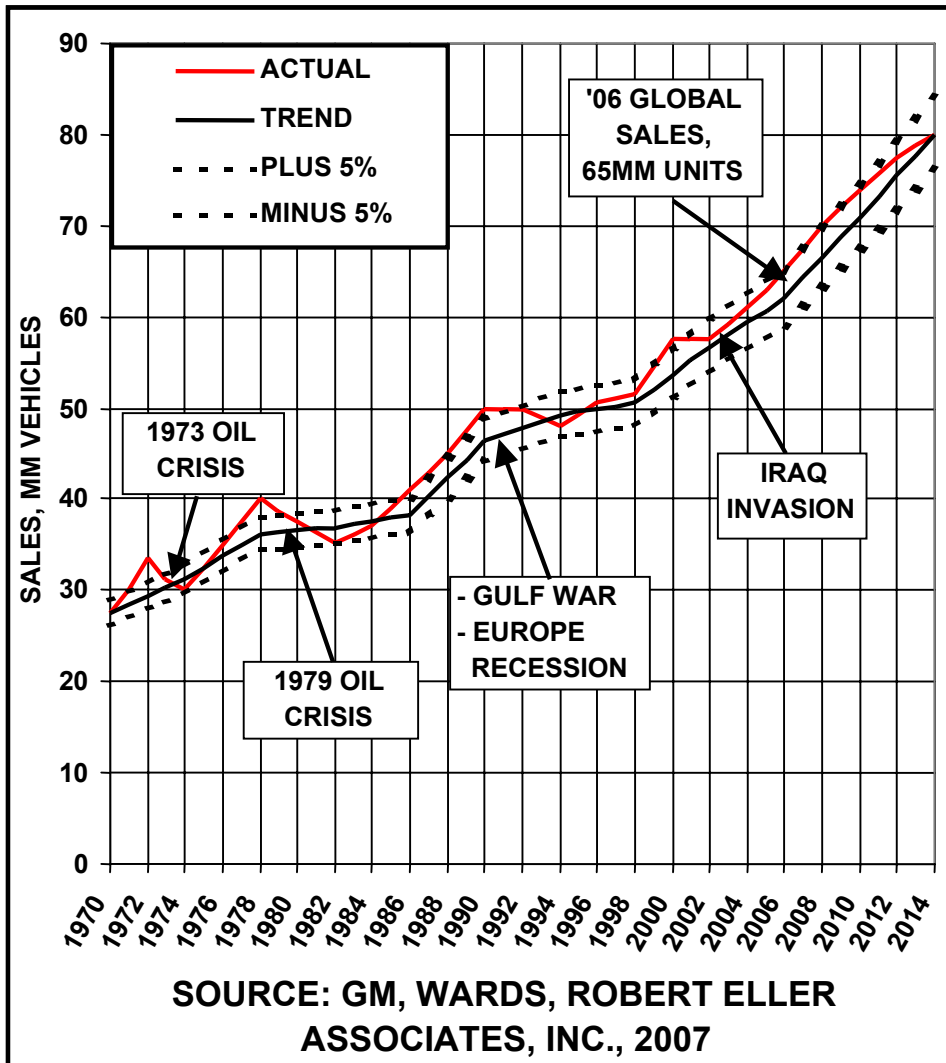
THE TPEs -- NEW FAMILY MEMBERS/BROADENED PERFORMANCE ENVELOPE, NEW TECHNOLOGIES



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

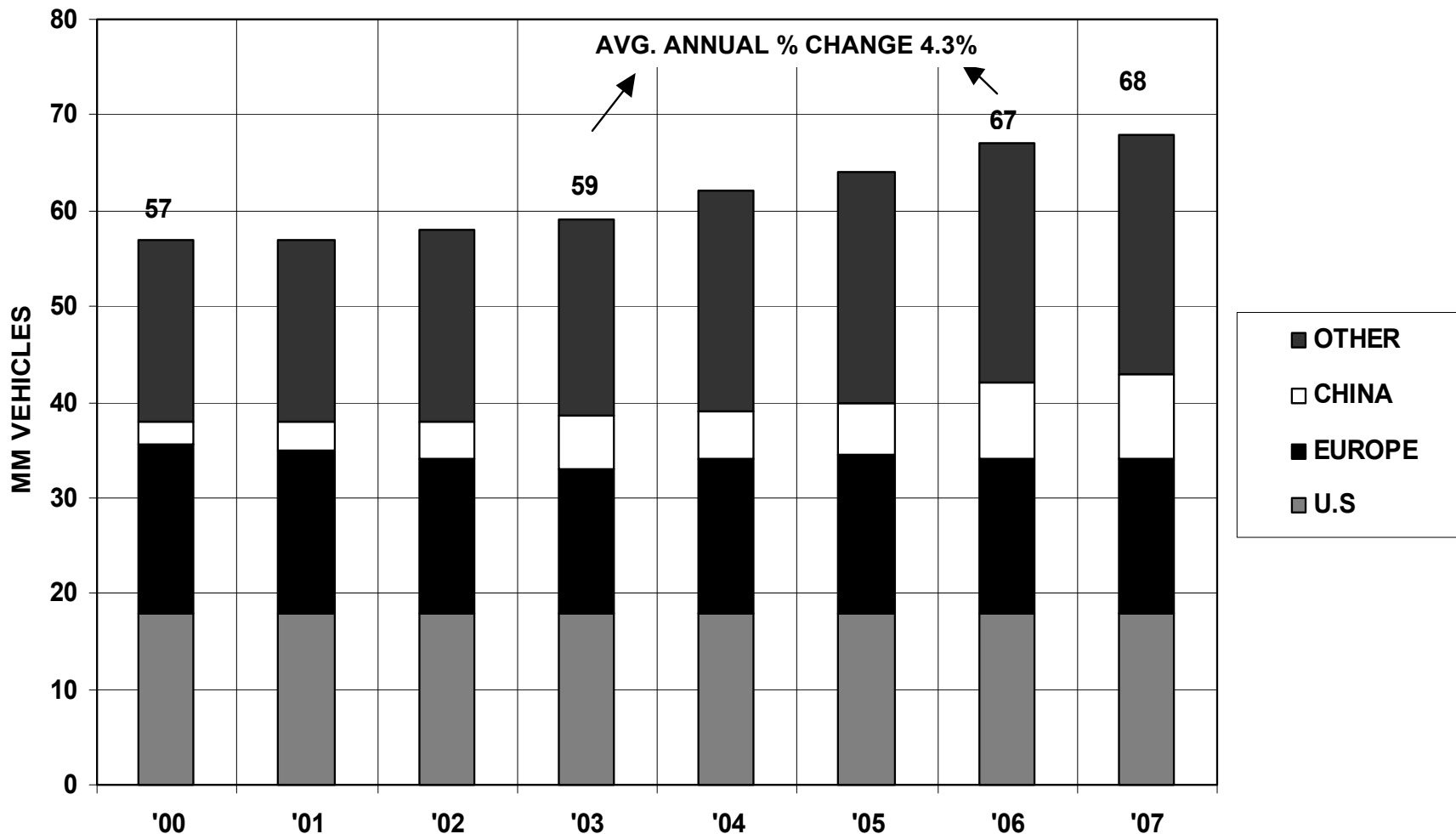
r/mydox/papers/RMA-TPEs07.vsd
lg/myfiles/visio/RMA-TPEs07.vsd

GLOBAL LIGHT VEHICLE PROD'N. TREND LINE



- 2011 GLOBAL SALES COULD REACH 75MM UNITS
- GLOBAL AAG = 3%/YR.
- ASIA-PACIFIC GROWTH 7.5-8.5%/YR.?
- WESTERN GROWTH STAGNANT OR DECLINE
- GLOBAL FLEET SHIFT TOWARD SMALLER CARS
- VARIATIONS HAVE BEEN IN +/- 5% BAND SINCE 1970

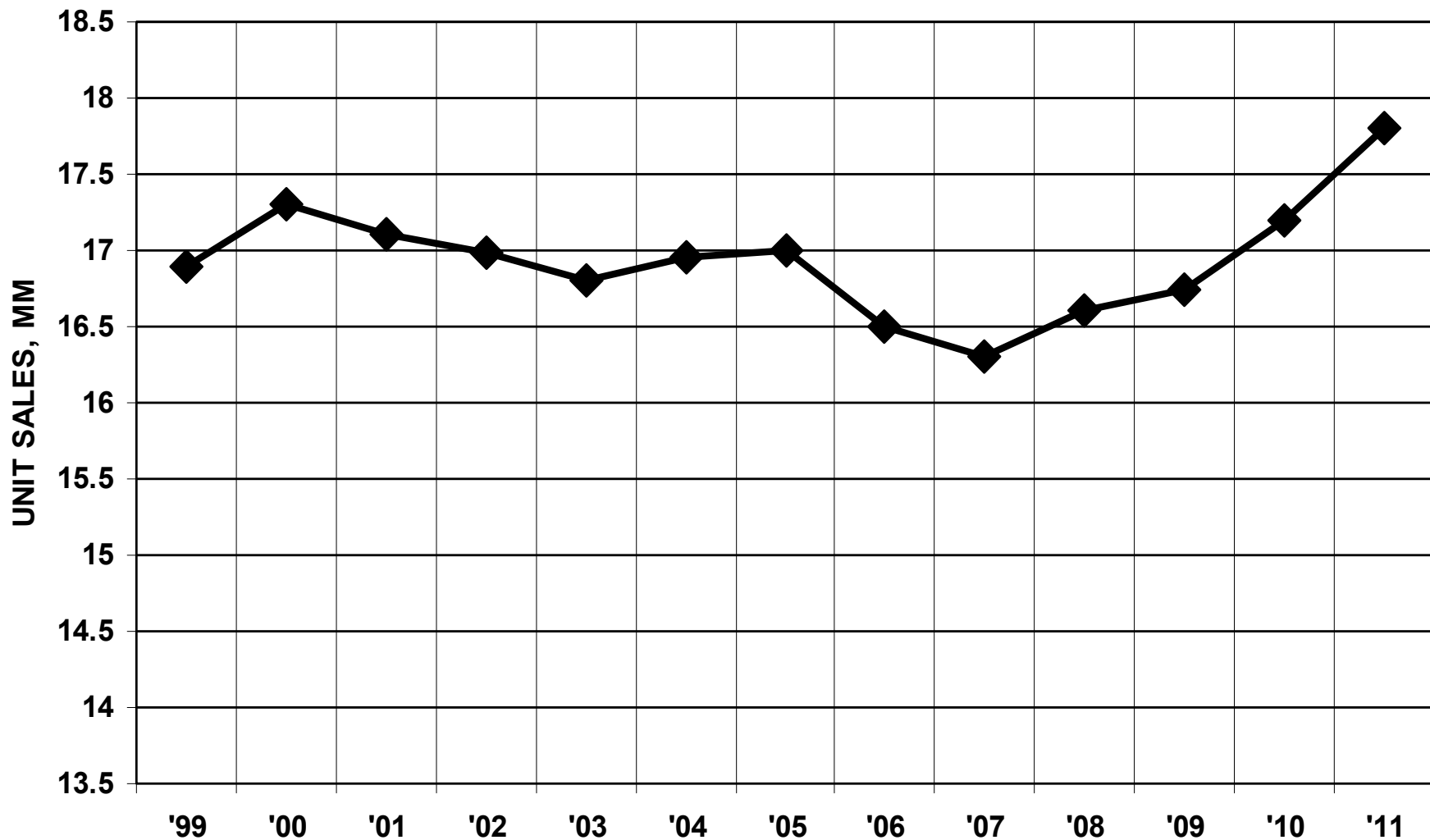
GLOBAL VEHICLE SALES . . . CHINA SHARE GAIN



NOTE: VEHICLE SALES INCLUDE HEAVY TRUCKS

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

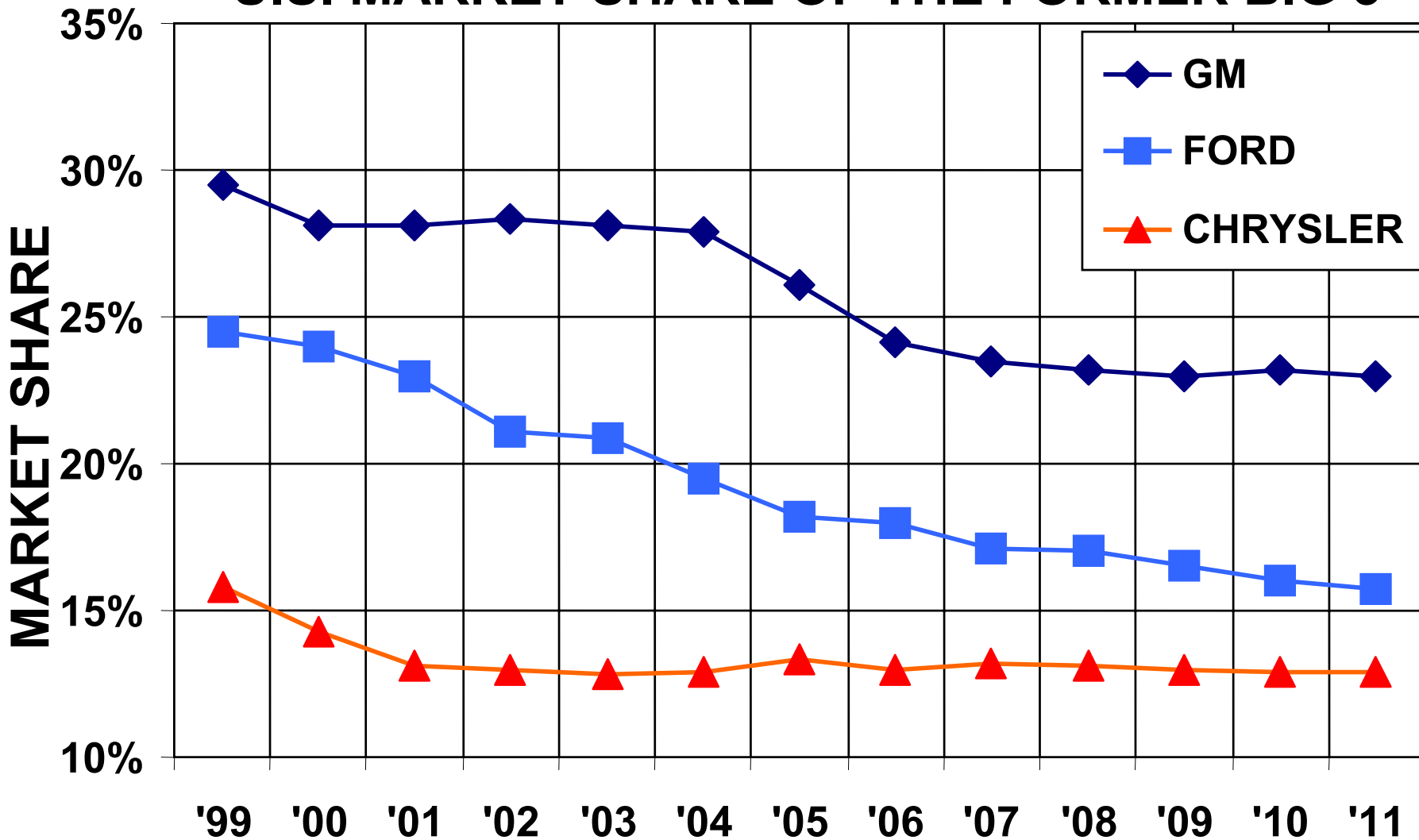
N. AMERICAN VEHICLE SALES (1999-2011)



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

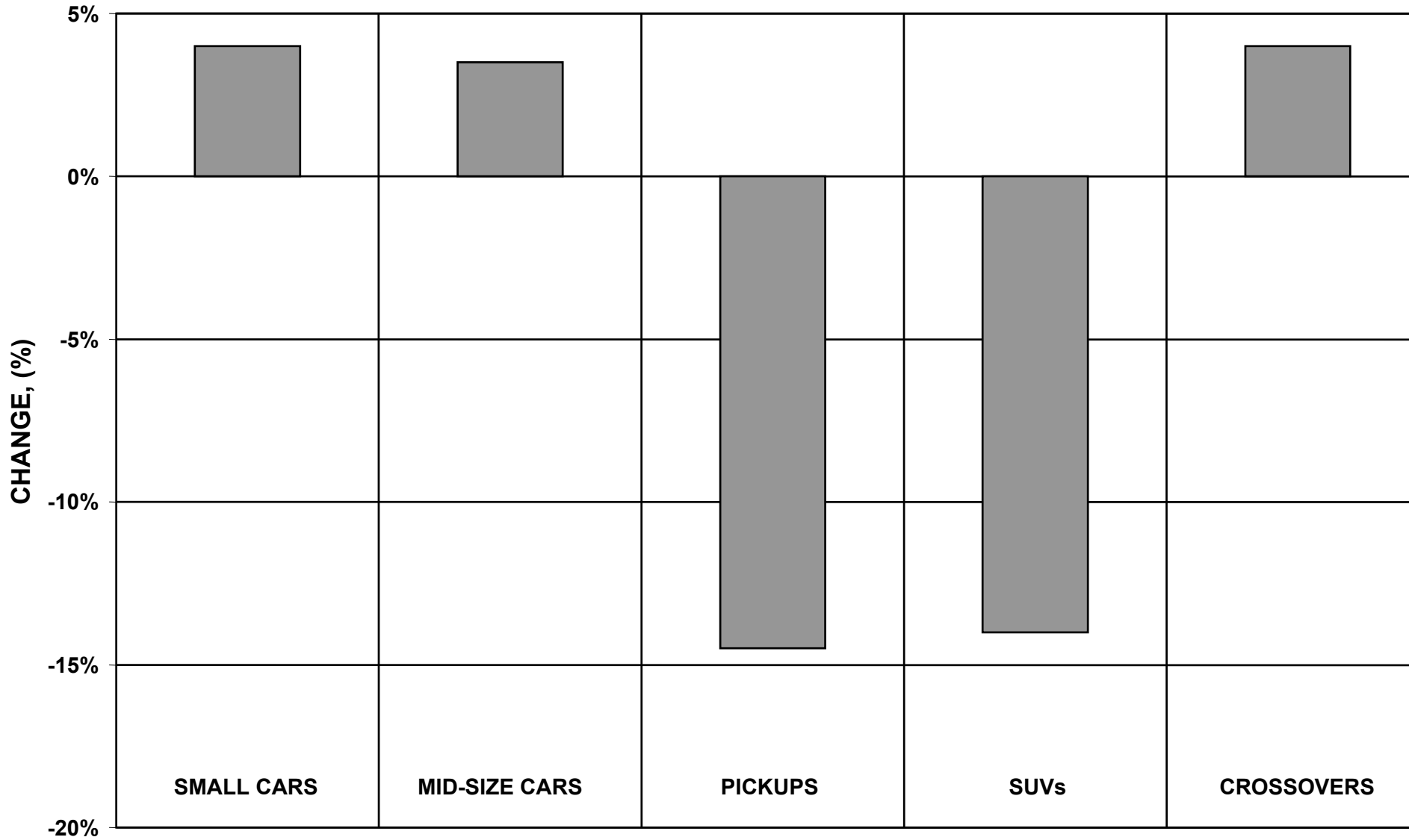
b/mydox/autoindustry/n.americanvehsales.xls

U.S. MARKET SHARE OF THE FORMER BIG 3



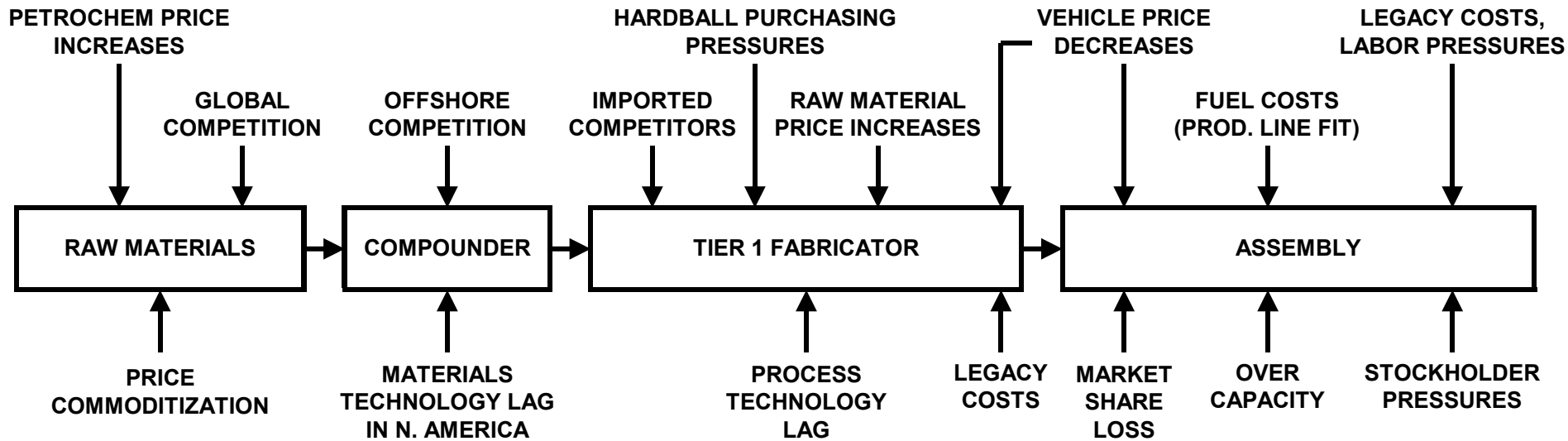
SOURCE: ROBERT ELLER ASSOC., 2007

SALES SHIFT FROM ('05-'06) BY VEHICLE TYPE IN NORTH AMERICA



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

AUTO SUPPLY CHAIN (N. AMERICA)



ELIMINATE/REDUCE THE INEFFICIENCIES:

- MULTIPLE STEPS
- EXCESSIVE LOGISTICS
- SCRAP GENERATION
- INEFFICIENT PROCESS TECHNOLOGIES
- SALES/MARKETING COSTS
- EXCESS LABOR COSTS
- OVER-GLOBALIZATION?

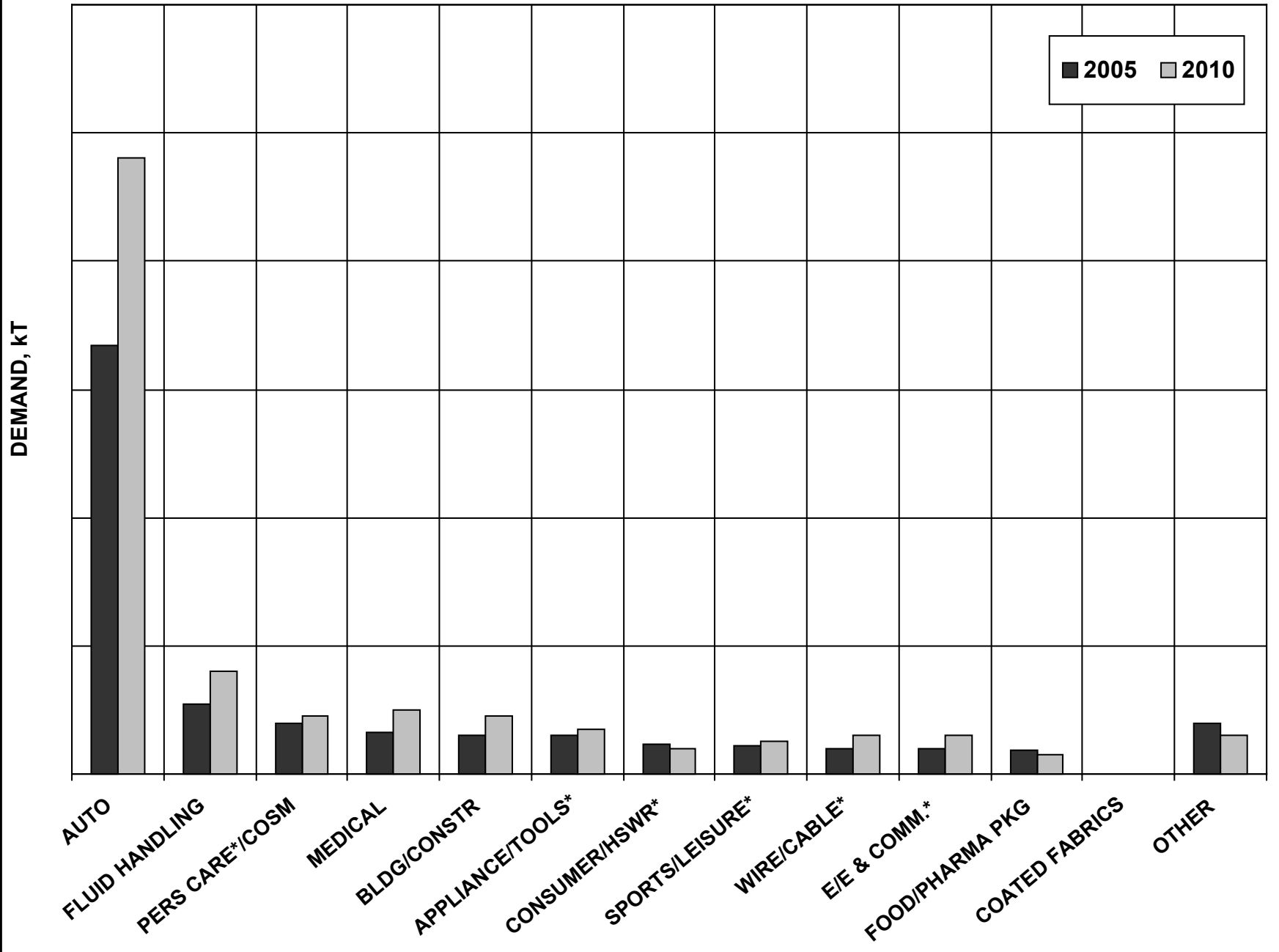
SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

b/mydox/papers/RMA-AutoSupChImplosion07.vsd
lg/myfiles/visio/RMA-AutoSupChImplosion07.vsd

PRESSURES PASSED DOWN THE SUPPLY CHAIN:

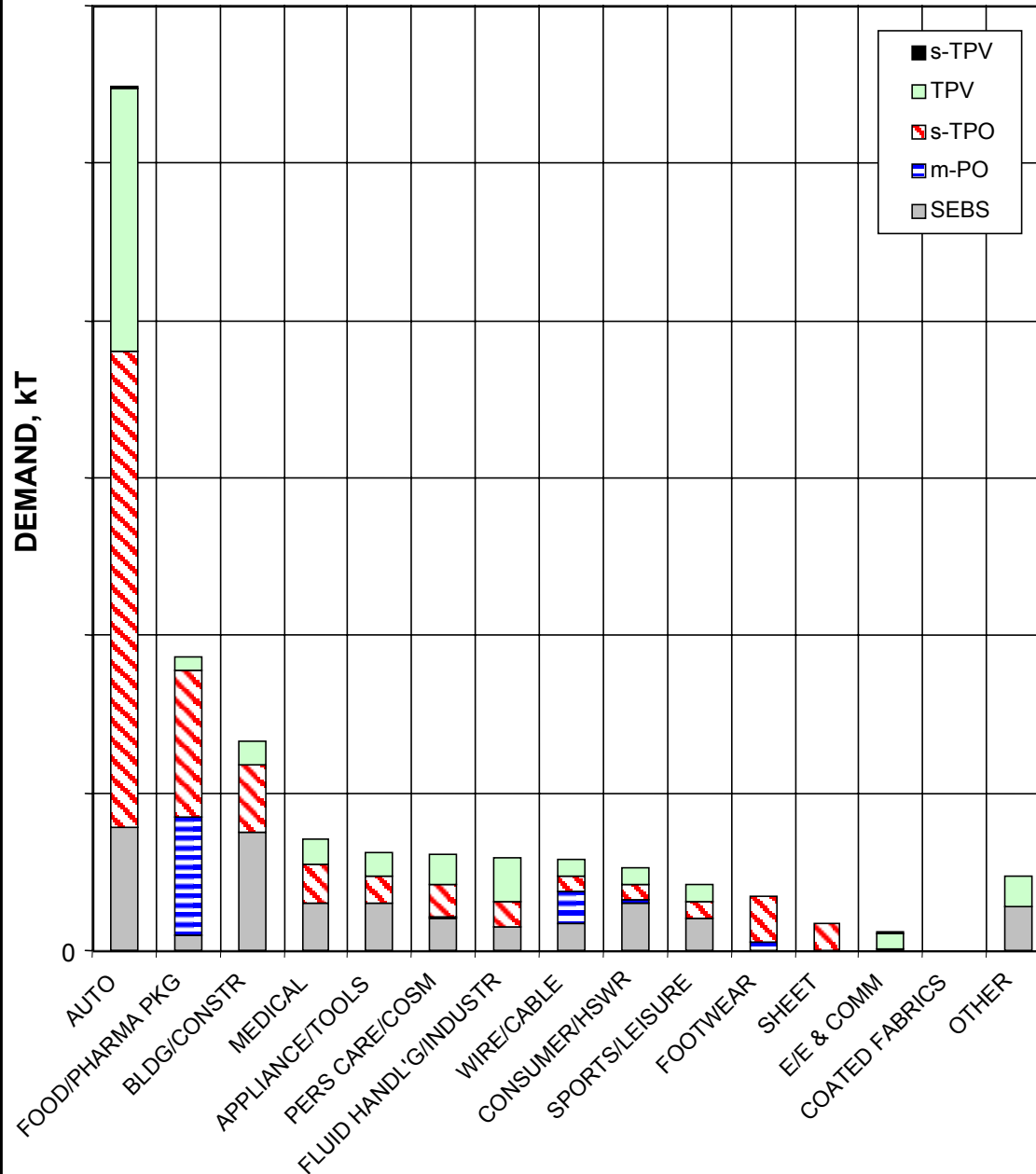
- ← PRICING PRESSURES
- ← SUPPLY CHAIN "MANAGEMENT"
- ← DEMAND SLOWDOWN
- ← REVISED SPECIFICATIONS
- ← GLOBALIZATION PRESSURES

TPV DEMAND BY MARKET SECTOR (EUROPE, 2005-2010)



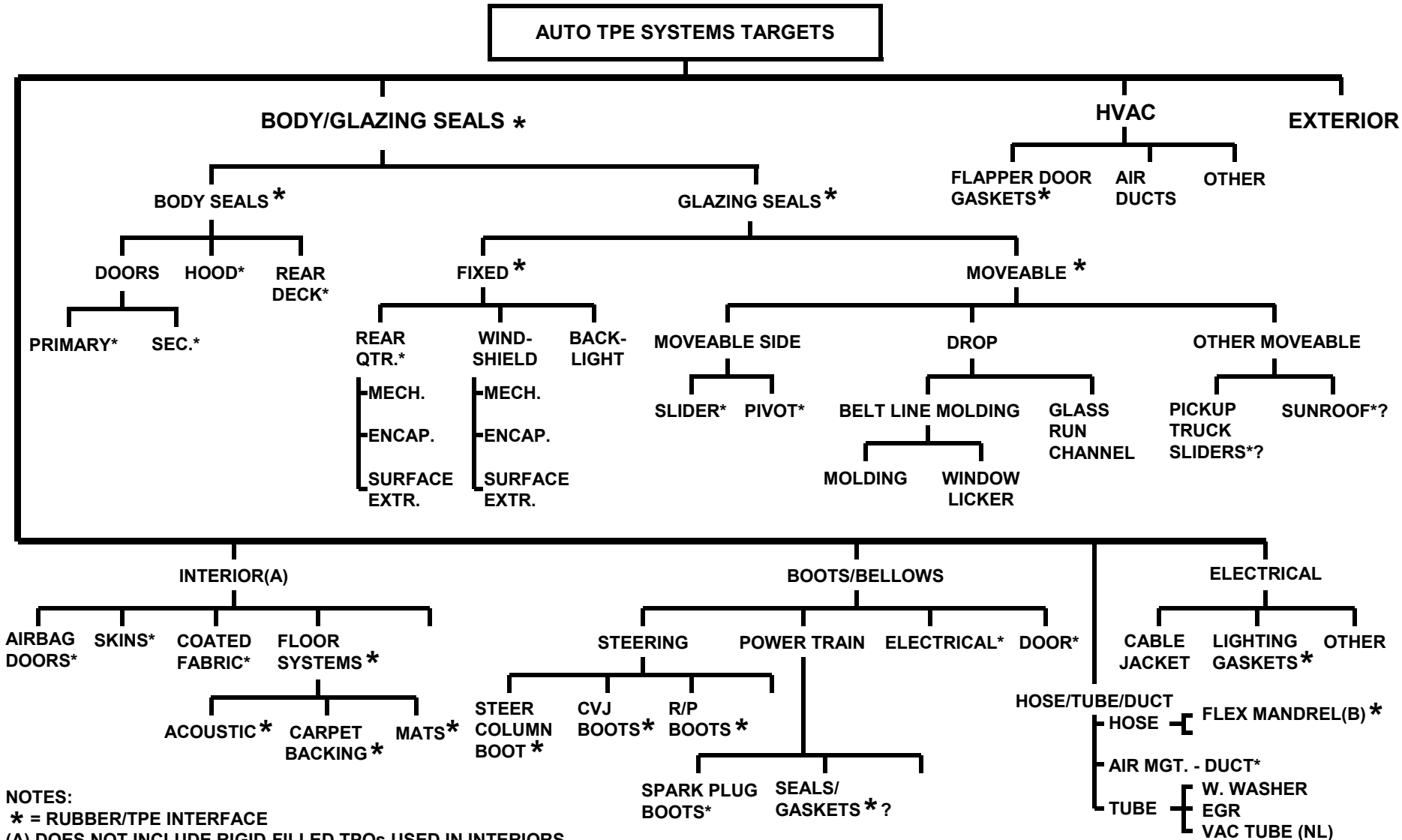
SOURCE: ROBERT ELLER ASSOCIATES, INC., TPE MULTICLIENT STUDY, 2007

DEMAND FOR TARGET TPE COMPOUNDS BY SECTOR (EUROPE, 2005)



SOURCE: ROBERT ELLER ASSOCIATES, INC., TPE MULTICLIENT STUDY, 2007

AUTOMOTIVE TPE TARGETS AND THE RUBBER INTERFACE



NOTES:

* = RUBBER/TPE INTERFACE

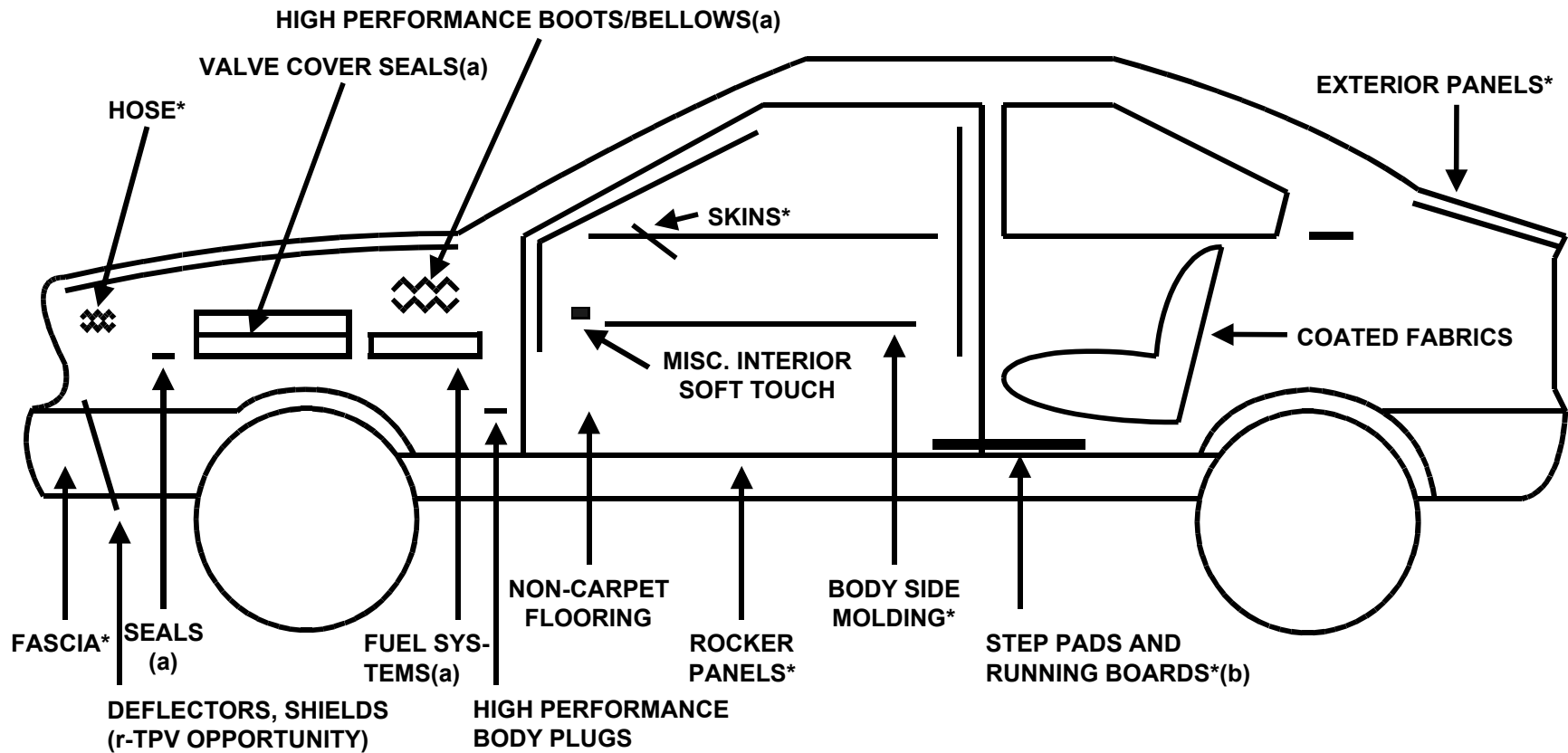
(A) DOES NOT INCLUDE RIGID-FILLED TPOs USED IN INTERIORS

(B) RE-USABLE MANDREL TO MFR. HOSE (TPVs COMPETING WITH NYLON)

(C) E.G., FUEL, COOLANT, OILS, OTHER HOSE

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

EXAMPLE AUTOMOTIVE APPLICATIONS FOR TPES



NOTES:

-DOES NOT SHOW BODY/GLAZING SEALS, A CONTINUING GROWTH OPPORTUNITY

* INDICATES NANO-TPE OPPORTUNITY

(a) s-TPV TARGET

(b) NOTE COMPETITION WITH LGF-PP

SOURCE: ROBERT ELLER ASSOCIATES, INC., TPE MULTICLIENT STUDY, 2007

INTERIOR SKIN DEVELOPMENT (2006 HONDA CIVIC)



- **PART: PASSENGER AIRBAG DOOR**
- **KEY FEATURES:**
 - SEAMLESS
 - NO PAINT
 - LOW GLOSS
- **MOLDER: VISTEON**
- **TPO SKIN SUPPLIER: OKAMOTO/O'SULLIVAN**
- **TPO SUPPLIER: MITSUBISHI CHEMICAL**
- **MOLDING PROCESS: VISTEON VLIM**

SOURCE: VISTEON, 2005

2-SHOT MOLDED DOOR MEDALLION



VEHICLE: DODGE CALIBER ('07)

MOLDER: LEAR

MATERIAL: THERMOPLASTIC ELASTOMER ON PP

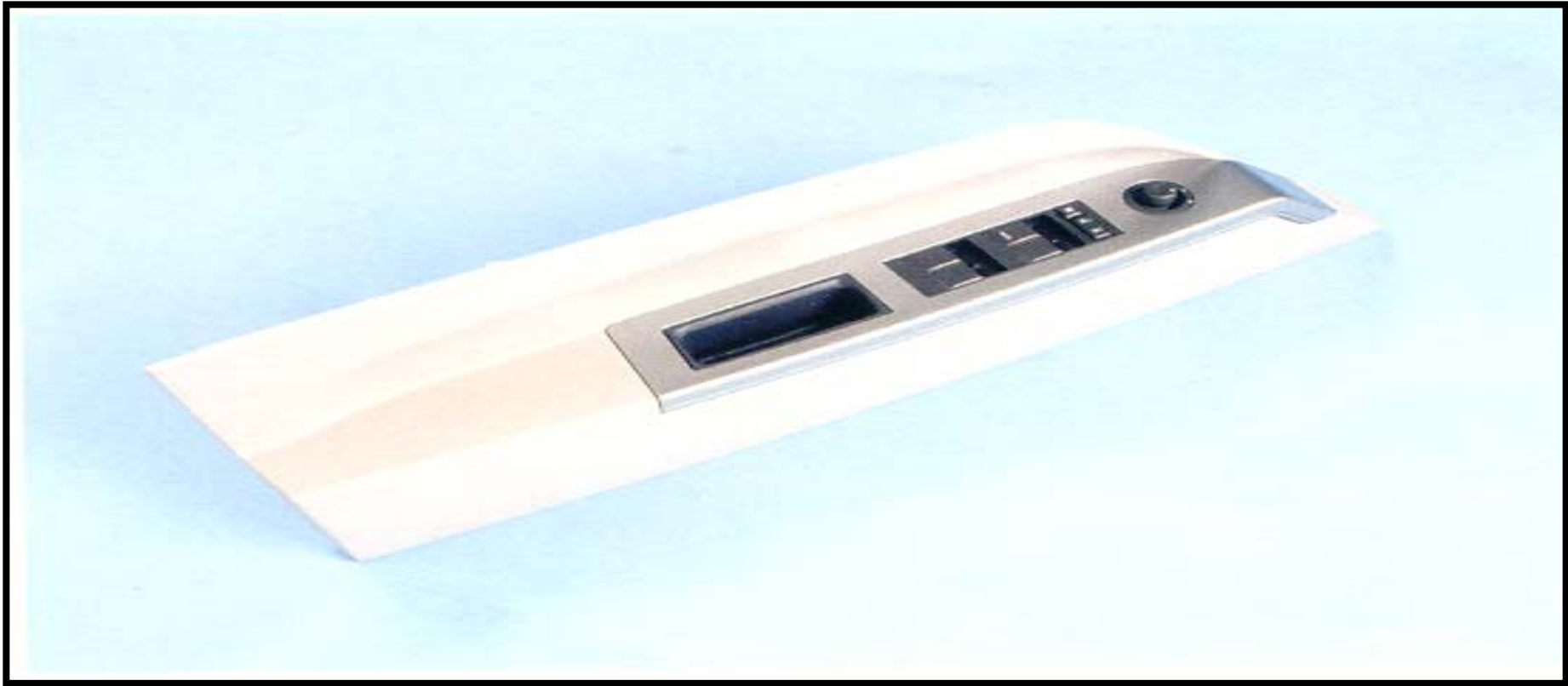
BODY/GLAZING SEALS: EPDM SUBSTITUTION ACCELERATES



- **2007 DCX DODGE RAM**
- **SUPPLIER: JYCO (COMPOUND, PROFILE, DESIGN)**
- **LITTLE GUY SCOOPS THE BIG GUYS**
- **MATERIAL: o-TPV**
- **FIRST o-TPV DYNAMIC BODY SEAL**

SOURCE: JYCO

2-SHOT MOLDING: GROWTH DRIVER FOR TPEs



- 2006 DCX CALIBER**
- SUPPLIER: LEAR**
- DOOR MEDALLION**
- 2-SHOT MOLDING: START SMALL, TRANSITION TO LARGE PARTS/CHALLENGE SKIN TECHNOLOGY**
- SEBS COMPOUND OPENS THE DOOR FOR TPOs/TPVs**



Vehicle: Toyota Tundra (2006), mid-sized pickup truck

REA Note:

- a. Example of New American mfr. entering U.S. auto OEM stronghold
- b. Growth target for exterior compounded TPO



Vehicle: Toyota Tundra (2006)
Part: Cargo box side rails
TPE Type: Compounded TPO (Sequel 1514)
TPE Supplier: SEP
Key Features: Scratch/mar resistance (5 finger test), low CLTE
Molder: Plastikon (also have plant in China)
REA Note: Domestic U.S. compounder/new American mfr.



Vehicle: Toyota Tundra (2006)
Part: Tailgate cover
TPE Type: Compounded TPO (Sequel 1514)
TPE Supplier: SEP
Key Features: Surface durability, low CLTE
Molder: Plastikon (also have plant in China)
REA Note: Domestic U.S. compounder/new American mfr.



Product Type:

Jeep rear tailgate seal

Note: Sponge w/dense EPDM



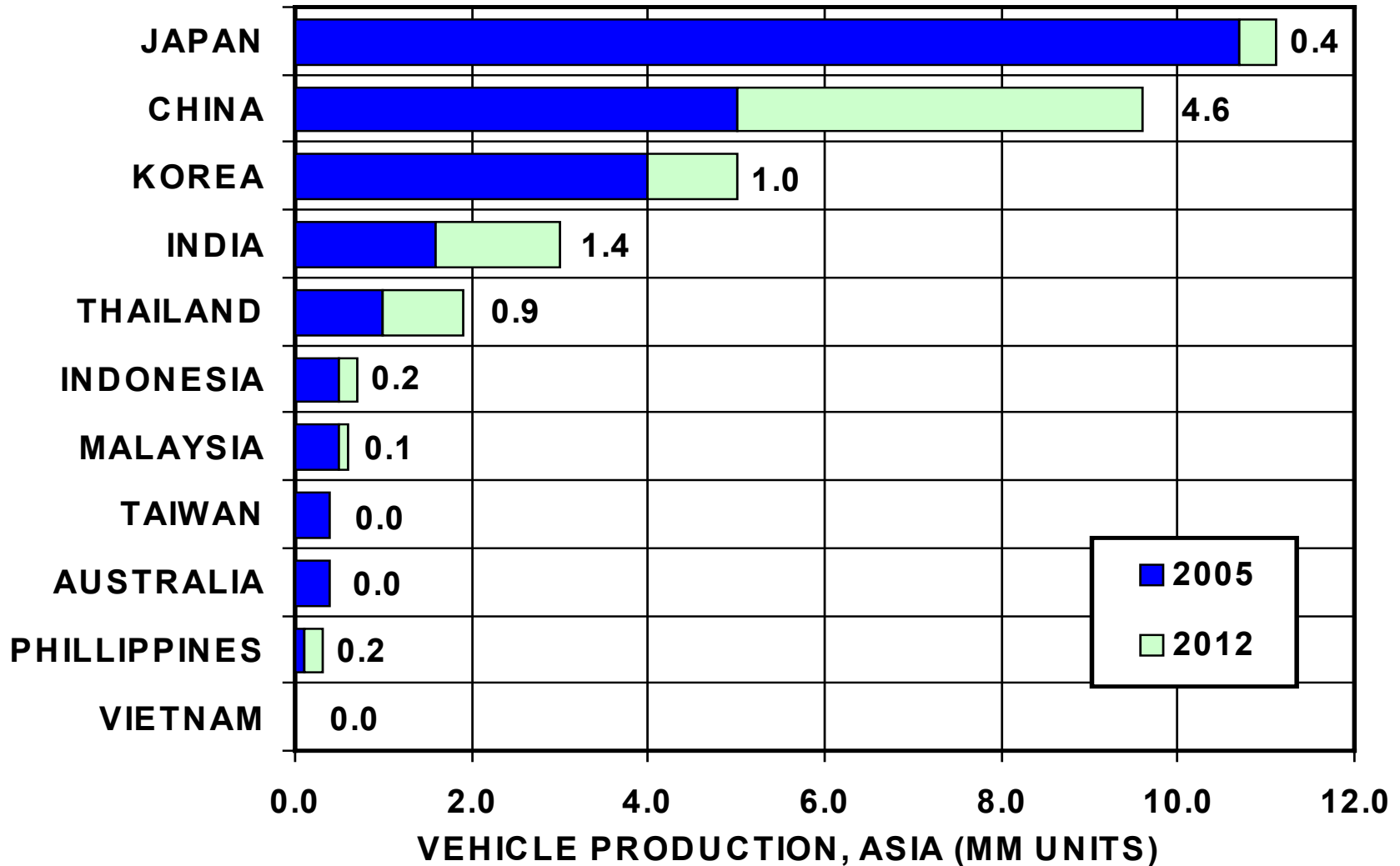
Manufacturer: Valeo

TPV Type: TPV

Mfr. Location: Europe

Note: Example of boots/bellows and EPDM replacement

PROJECTED AUTOMOBILE PROD'N. IN ASIA: 2005-2012



7 MM NEW VEHICLES ARE EXPECTED TO COME FROM CHINA, INDIA, AND THAILAND BY 2012.

AUTO BODY/GLAZING SEALS . . .

CHALLENGE TO EPDM

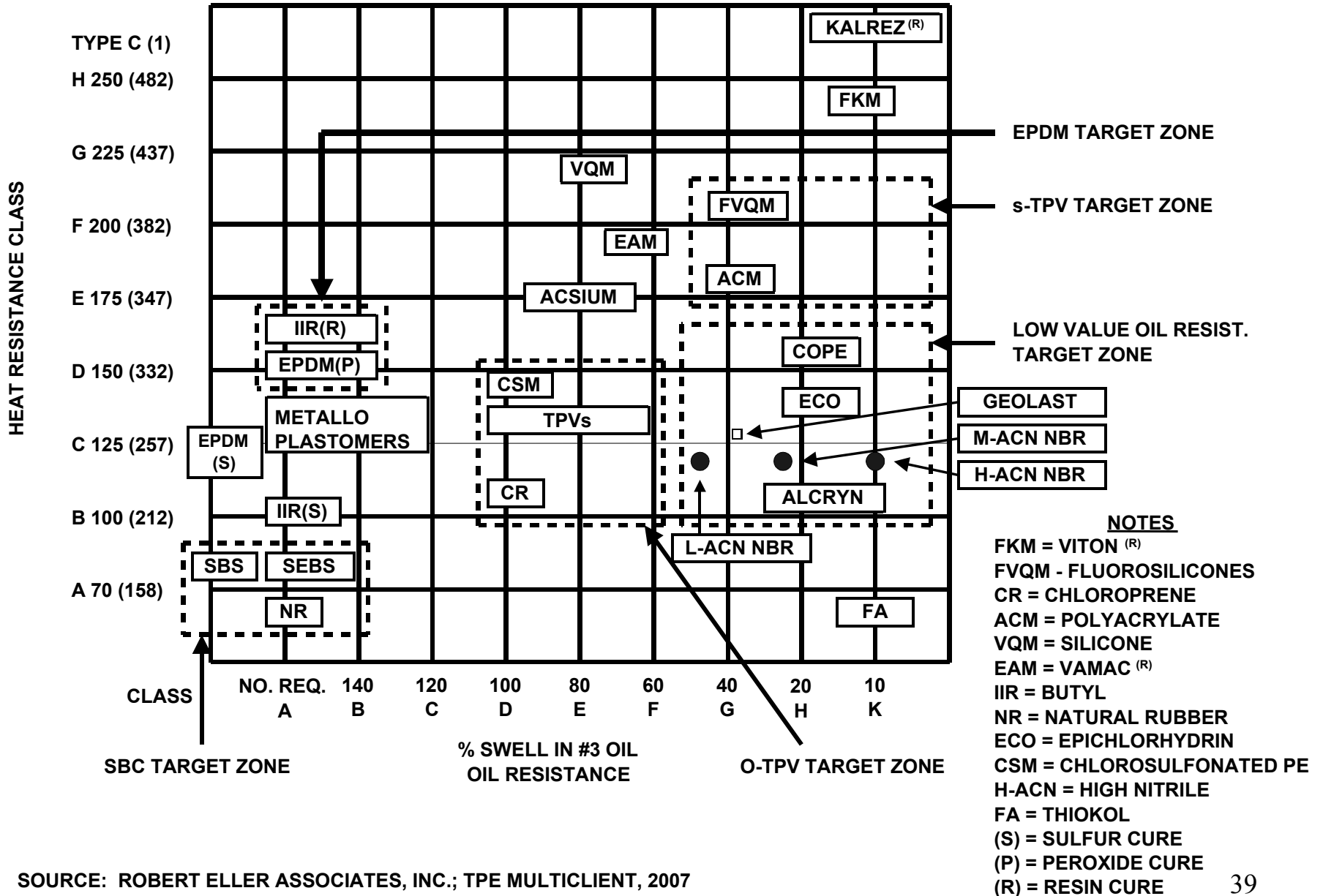
- **GLOBAL POTENTIAL IS 600 kT**
- **A TARGET FOR MAJOR TPE COMPOUNDERS**
- **GLASS-RUN CHANNEL/BELTLINE MOLDING PENETRATED**
- **U.S. HAS BEEN SLOWEST TO SHIFT TO TPEs (ACCELERATING)**
- **o-TPV AND RECENTLY SBC-TPV COMPETE WITH EPDM**
- **DYNAMIC TPE SEALS STARTING**
- **EPDM WILL LOSE SHARE**
- **PVC COULD RETAIN SHARE**
- **SOME BODY SEAL TIER 1s WILL COMPOUND IN-HOUSE**
- **START OF GLOBAL JOINT VENTURES (JYCO/INOAC)**
- **NEW FOAM TECH. COULD ACCELERATE PENETRATION**

THE SUPER-TPV CANDIDATES . . .

CHALLENGING HEAT AND OIL RESISTANT RUBBER MARKETS

GRADE NAME	ELASTOMER TYPE	MATRIX RESIN(S)	SUPPLIER
TPSiV	SILICONE	PA, TPU	DOW CORNING
	SILICONE	SEVERAL	WACKER
ZEOTHERM	POLYACRYLATE (ACM)	PP, PA, POLYESTER	ZEON
E-TPV	ETHYLENE ACRYLATE (AEM)	COPE	DUPONT
FLUORO- PRENE	FLUORO- ELASTOMER	FLUORO- POLYMER	FREUDENBERG- NOK

OIL RESISTANCE/HEAT RESISTANCE OF TPEs AND THERMOSET RUBBERS



SOURCE: ROBERT ELLER ASSOCIATES, INC.; TPE MULTICLIENT, 2007

NEW SUPER-TPV TECHNOLOGIES

- **ZEON AND DuPONT ARE LEADERS**
- **AUTO UNDER-HOOD IS KEY TARGET MARKET**
- **PENETRATION REQUIRES (HEAT, OIL RESIST., UV?)**
- **HIGH PRICES LIMIT PENETRATION POTENTIAL**
- **SOME COMPETITION WITH o-TPVs, CHLOROPRENE**
- **CV JOINTS, OIL FILTER, SOME HOSE APPLIC.**

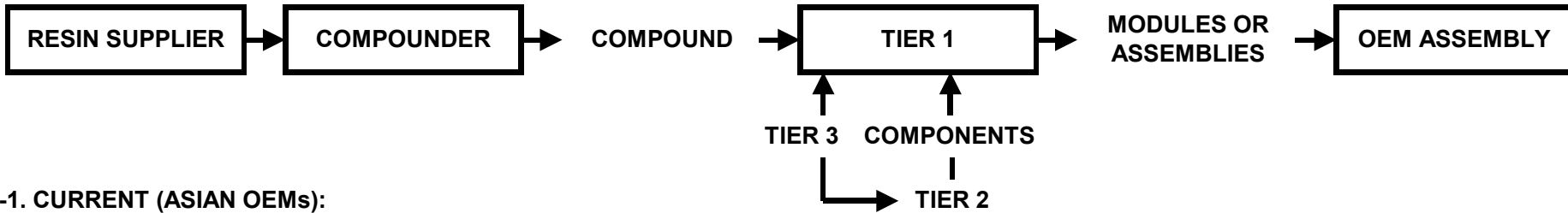
NEW SUPER-TPV TECHNOLOGIES (CONT'D.)

THE DRIVING FORCES FOR TPE SUBSTITUTION INCLUDE:

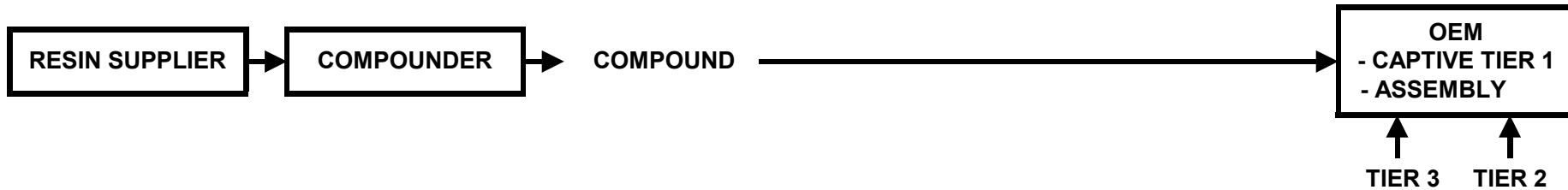
- INCREASED UNDER-HOOD TEMPERATURES**
- INCREASED FUEL EMISSIONS CONTROL
REGULATIONS**
- INCREASED REQUIREMENTS FOR DYNAMIC SEAL
PERFORMANCE AS WARRANTY PERIODS ARE
EXTENDED**
- POTENTIAL COST SAVINGS VIA INTEGRATION OF
THE CONNECTOR FUNCTION WITH THE BODY OF
THE PART**

TPE SUPPLY CHAIN RECONFIGURATIONS

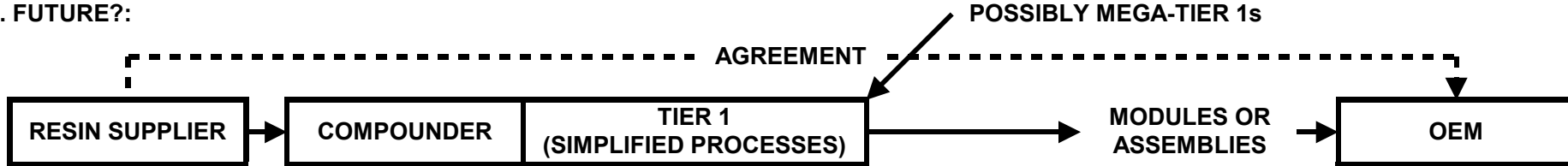
A. CURRENT:



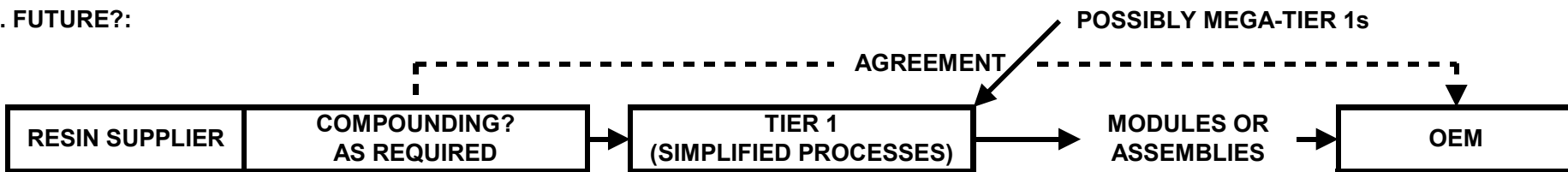
A-1. CURRENT (ASIAN OEMs):



B. FUTURE?:



C. FUTURE?:

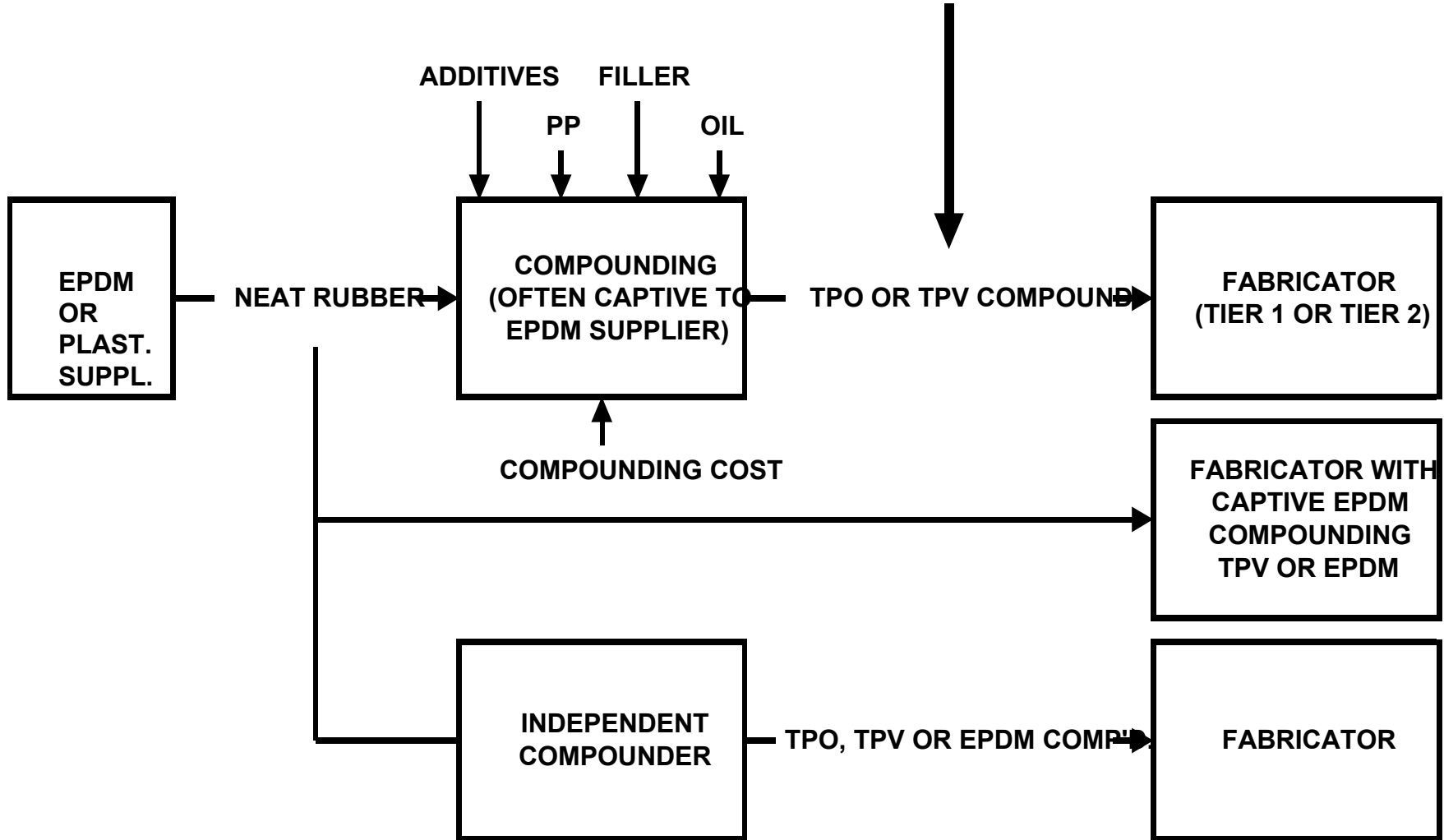


SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

EPDM AND PLASTOMER PATHS TO AUTO OLEFINIC TPE MARKET

COMPETITIVE ATTACK FROM:

- SEBS
- REACTOR TPOs
- PVC FORCING COMPOUND PRICES DOWN



NON-AUTOMOTIVE TPE MARKETS

**HIGHLY DIFFUSE/GLOBALIZING/SOME
COMMODITIZING:**

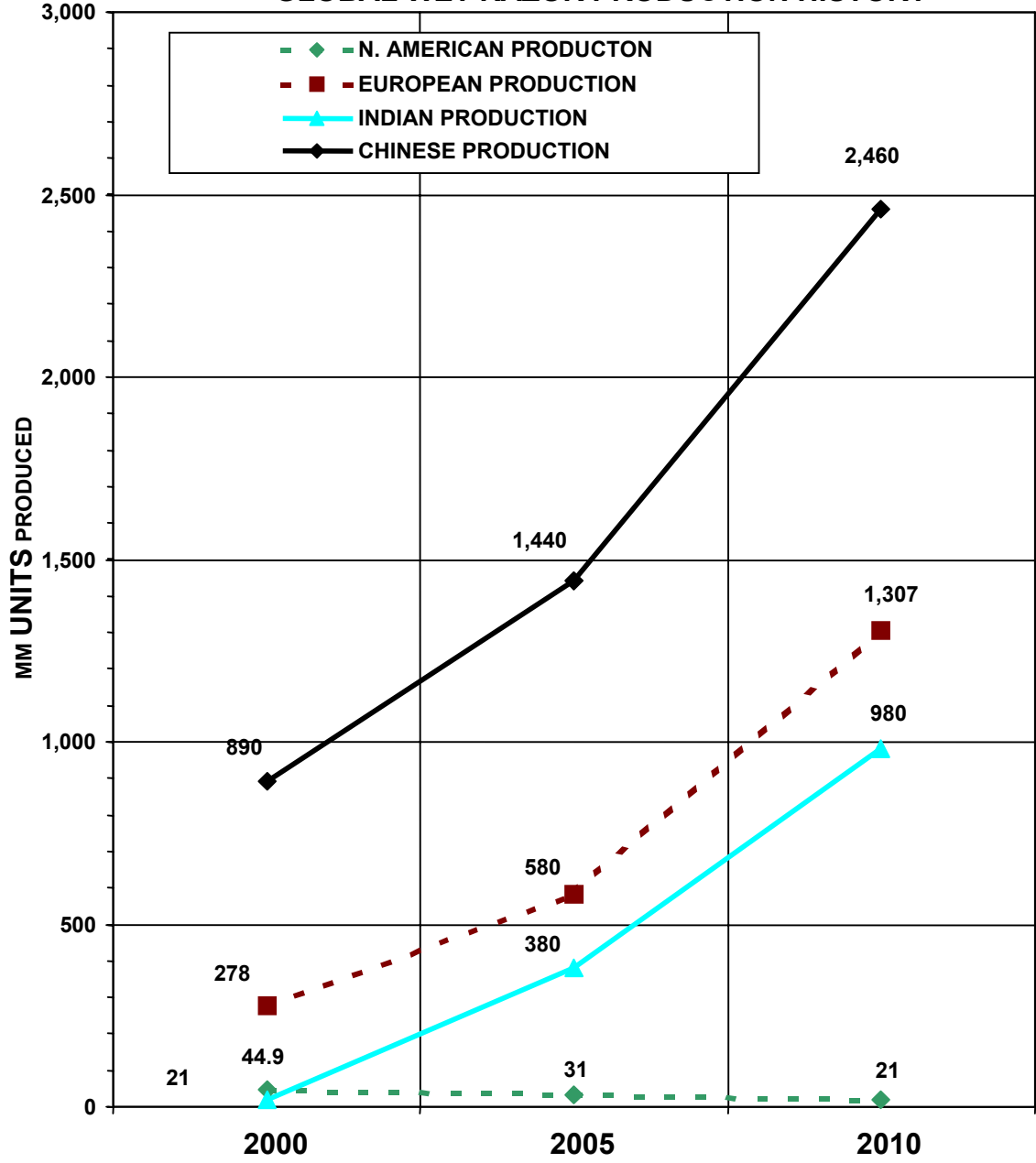
- APPLIANCE/TOOL**
- BUILDING/CONSTRUCTION**
- CONSUMER PRODUCTS/HOUSEWARES**
- ELECTRICAL/ELECTRONICS - PERSONAL COMM.**
- FOOTWEAR (TPU, SBS)**
- FOOD PHARMACEUTICAL PACKAGING**
- MEDICAL DEVICES**
- PERSONAL CARE/COSMETICS**
- SPORTS/LEISURE**
- WIRE/CABLE**
- FILM/SHEET/FIBER (NEW GROWTH SECTOR)**
- COATED FABRICS**

NON-AUTOMOTIVE TPE MARKETS (CONT'D.)

- **ABOUT 50% OF TPE DEMAND**
- **AFFECTED BY DEMAND SHIFT TO ASIA (CHINA)**
- **SHIFTS TPE GEOGRAPHIC DEMAND PATTERN**
- **INTRODUCES NEW COMPOUNDERS TO TPE COMPETITION (ESPECIALLY CHINA)**
- **TWO TIER QUALITY LEVELS? (CHINA?)**
- **FRAGMENTED, SMALL ORDER SIZES**
- **2-SHOT MOLDING WELL ESTABLISHED (SMALL PARTS)**

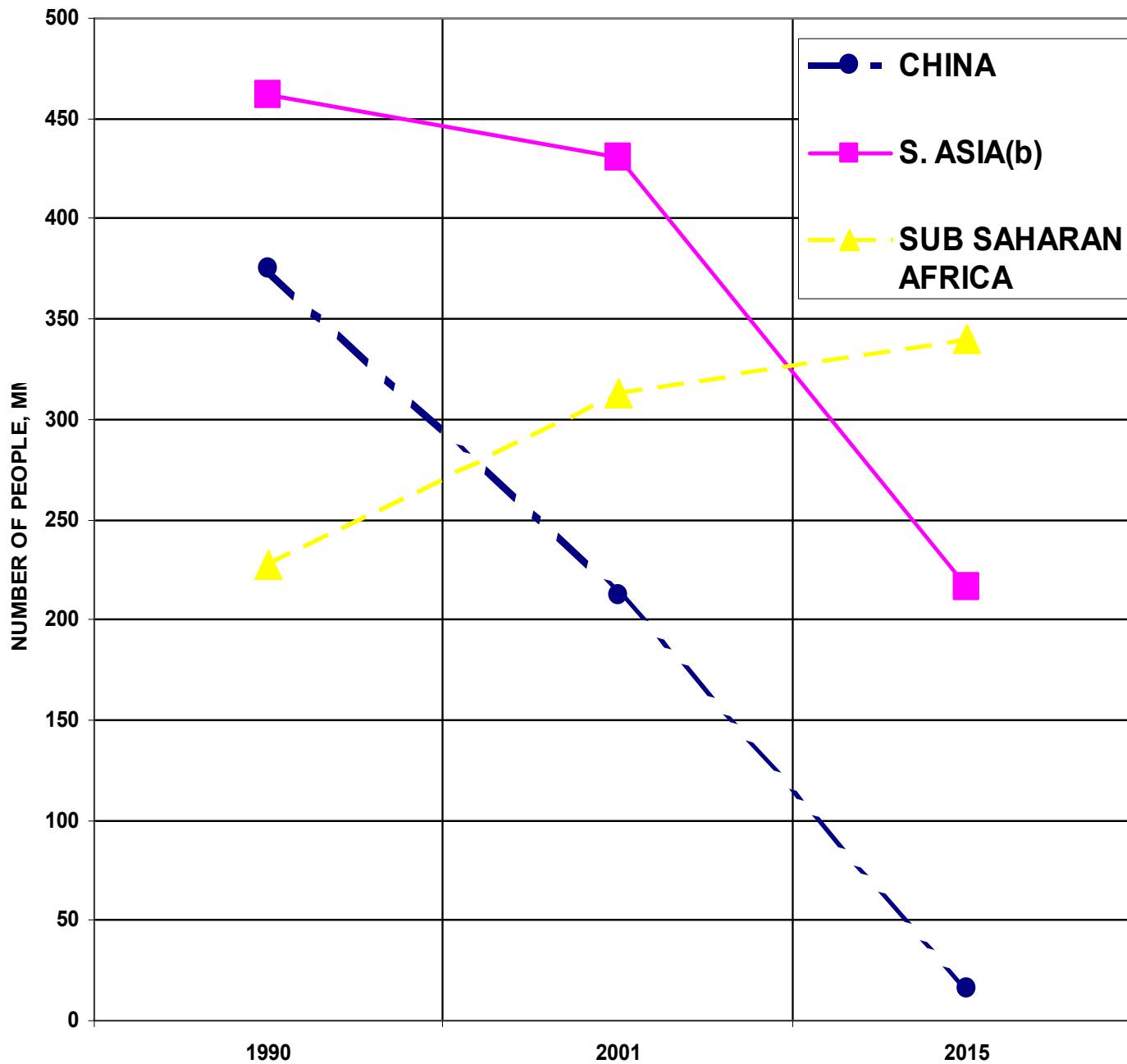
GLOBAL MARKET SHIFT EXAMPLES . . .
EFFECTS ON TPE_s

GLOBAL WET RAZOR PRODUCTION HISTORY



SOURCE: ROBERT ELLER ASSOCIATES, INC., TPE MULTICLIENT STUDY, 2007

POPULATION LIVING IN EXTREME POVERTY



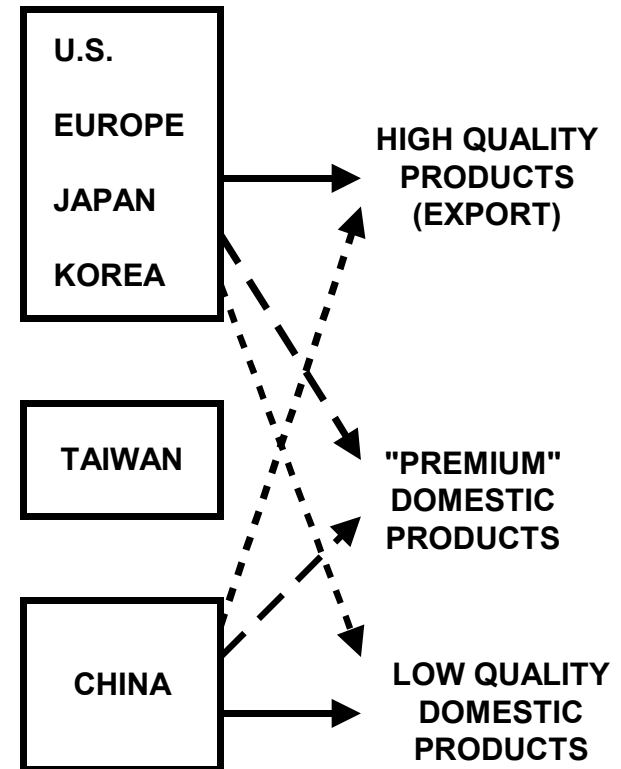
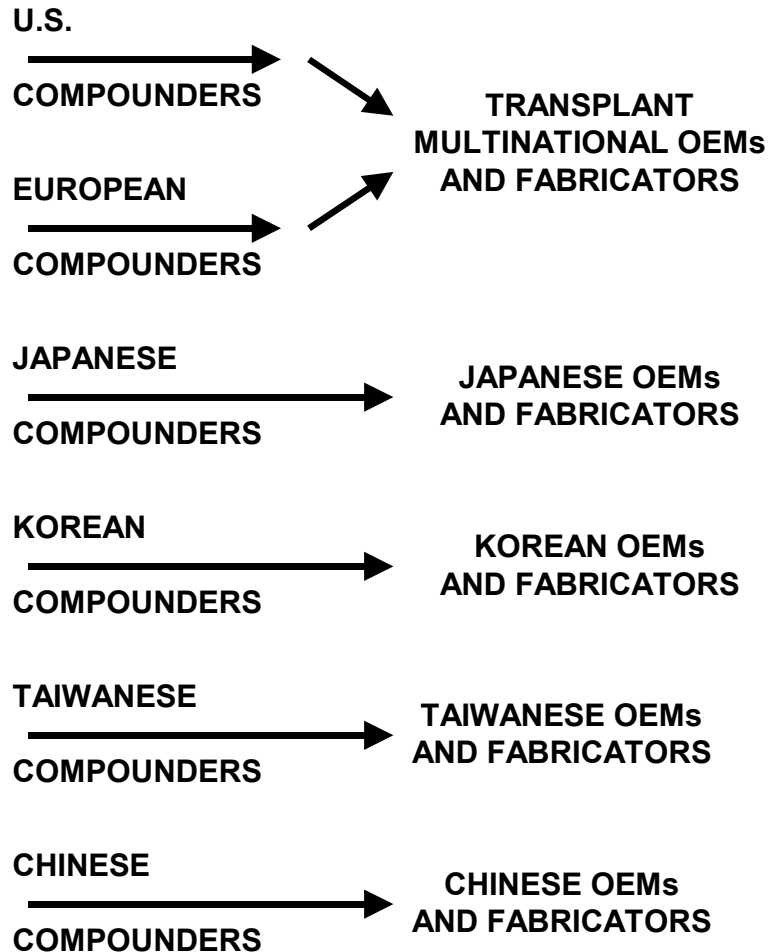
**THE CHINA FACTOR IN TPEs:
MARKET AND INDUSTRY STRUCTURE
IMPLICATIONS**

CHINA SHARES OF GLOBAL PRODUCTION

MARKET SECTOR	GLOBAL MARKET SHARE %	NOTE/TPE IMPORTANCE
CAMERAS	50	GRIPS/SOFT TOUCH/BUTTONS
FANS	50	MINOR
DVD READERS	54	GRIPS/SOFT TOUCH/BUTTONS
TELEPHONES	50	
TV SETS	30	
MOBILE PHONES	28	GRIPS/SOFT TOUCH/BUTTONS
LAPTOP COMPUTERS	12	PADS/BUTTONS/SOFT TOUCH
AUTOMOBILE	5	

PARALLEL SUPPLY CHAINS IN CHINA TPE MARKETS

NATIONALITY BASED



——— PRIMARY PATH
 - - - SECONDARY PATH
 . . . MINOR PATH

SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

O-TPVs IN CHINA

SUPPLIER	POSITION
EXXON MOBIL	<ul style="list-style-type: none"> -DOMINATES(VIA EXPORT FROM US) -50% SHARE -NAME RECOGNITION/PREMIUM
OTHER WESTERN COMPOUNDERS	<ul style="list-style-type: none"> -HAVE BEEN SLOW TO INVEST(STARTING) -STARTING TO SERVE DOMESTIC MARKETS
TAIWAN/KOREAN COMPOUNDERS	<ul style="list-style-type: none"> -MINOR ROLE VIA EXPORT
LOCAL DOMESTIC COMPOUNDERS	<ul style="list-style-type: none"> -PRIMARILY SMALLER TPV COMPOUNDERS -STRONG PRESENCE IN p-TPVS -PARALLEL SUPPLY CHAIN -COST ADVANTAGES(30%) - RECYCLATE USE?
JAPANESE	<ul style="list-style-type: none"> -PRIMARILY SERVE JAPANESE AUTO OEMs -MORE FOCUS ON INDIA -MITSUI IS LEADER -SHIFT POSSIBLE IN FUTURE?

CHINA vs. INDIA

CHINA

- 1.3 BILLION PEOPLE
- AGGRESSIVELY BUILDING INFRASTRUCTURE AROUND ECONOMIC DEV'MENT ZONES, FACILITIES OFTEN IN PLACE WAITING FOR NEW PLANTS
- CONTINUITY TO A PLAN, A SENSE OF CONSTANCY
- EXCELLENT CENTRAL PLANNING = STRENGTH
- BECOMING VERY BUSINESS FRIENDLY
 - CONTINUALLY OPENING UP FOR MORE FOREIGN INVESTMT
 - FLOATING OF THE YUAN
 - BONDED WAREHOUSING
- CORRUPTION EXISTS, BUT FOCUSED ON A FEW PEOPLE
- WILL DOMINATE GLOBAL MANUF. PARTICULARLY MANUF. FOR EXPORT FOR THE NEXT 10 YRS.

INDIA

- 1.0 BILLION PEOPLE
- ROADS/PORTS/LOGISTICS POOR
- GOLDEN QUADRANGLE A HELP, BUT ONLY A START
- DEMOCRATIC GOV'T CHANGED FREQ. (ELECTIONS EVERY 4 YEARS)
- NEW GOV'TS MEANS A STOP-START
- BUREAUCRACY THAT IS NOT HIGHLY BUSINESS FRIENDLY
- CORRUPTION EXISTS BROADLY
- WILL DOMINATE SERVICE CENTER AND SOFTWARE COMPANIES THAT CAN TAKE ADVANTAGE OF QUICKLY BUILT ELECTRONIC HWYS

POT'L DOMESTIC
MARKETS
INFRASTRUCTURE

GOVERNMENT

BUSINESS

THE ECONOMIC WAR IS OVER?

- **MANUFACTURING FOR MANY TPE END PRODUCT SECTORS HAS ALREADY SHIFTED FROM WEST TO EAST**
- **YUAN REVALUATION:**
 - **TOKEN GESTURE?**
 - **AGAINST A MARKET BASKET (U.S. DOLLAR EQUALLY WEIGHTED WITH OTHER CHINESE TRADING PARTNER CURRENCIES)**
 - **U.S. DOLLAR POWER WEAKENED/LIKELY TO CONTINUE**
 - **SUBSTANTIAL ASIAN COST ADVANTAGE CONTINUES**
- **CHINESE U.S. BOND INVESTMENT SLOWS U.S. RETALIATION POT'L.**
- **ASIAN TPE MARKET SIZES DWARF U.S. AND EUROPE MARKETS**
 - **MARKET POWER OF 3BN NEW CONSUMERS**
 - **1.5BN NEW WORKERS**
- **ASIA PULLING AHEAD IN TECHNICAL EDUCATION LEVEL AND NUMBERS**



Manufacturer: Gillette
Product Name: Mach 3, Grip
TPE Type: SEBS
Bond Type: Physical
Manufacturer Location: China
Note: Grip and head with different TPEs

Manufacturer: Gillette
Product Name: Venus 3
TPE Type: SEBS
Bond Type: Chemical
Manufacturer Location: Poland



Manufacturer: Black and Decker

TPE Type: SEBS

Bond Type: Chemical

Mfr. Location: China



Manufacturer: P&G

Product Name: Pantene

Notes:

- TPEs expensive vs. incumbents
- Plastomers entering competition with EVA cap liners



Manufacturer: Moen
Product: Faucet Mounting Plate
TPE Type: TPV
Bond Type: Physical
Mfr. Location: USA
Note: 2-shot nylon-bonding TPV, replaces EPDM



Manufacturer: Stanley
TPE Type: SEBS
Bond Type: Chemical
Mfr. Location: China
Note: 2-color



Manufacturer: Tupperware
Product Type:
TPE Type: SEBS
Note: Sold in Europe

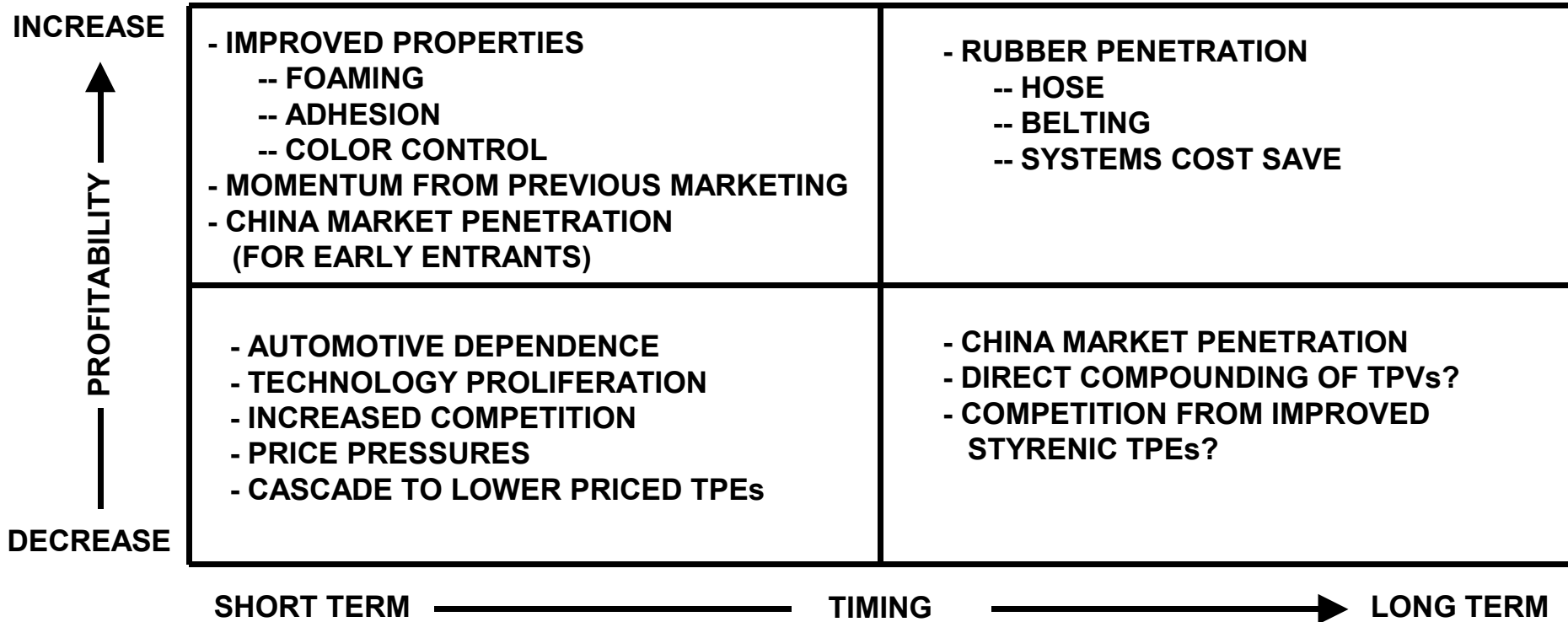
TPE COMPOUND VALUE KILLERS

- **ANY COMMODITY APPLICATION VIA EXTENDED SUPPLY CHAIN**
- **COMPETITION WITH PVC**
- **DIRECT 1:1 COMPETITION WITH EPDM**
- **CASCADE TO LOWER VALUE TPEs**
- **MOST AUTO APPLICATIONS (NOT ALL)**
- **COMPETITION WITH CHINESE COMPOUNDERS**
- **FABRICATOR IN-HOUSE COMPOUNDING**
- **MULTIMATERIALS CONSTRUCTION**
- **MULTI-STEP FABRICATION**

TPE RESIN/COMPOUND VALUE CREATORS

- **SYSTEMS COST SAVINGS POTENTIAL**
- **MONOMATERIALS CONSTRUCTION POTENTIAL**
- **IMPROVED ADHESION**
- **2-SHOT MOLDING (ESPECIALLY LARGE PARTS)**
- **FOAMING**
- **CO-PROCESSING**
- **GLOBAL SPECIFICATIONS**
- **ELIMINATION OF CROSSLINKING**
- **MASTERBATCHES**
- **CONTROLLED RHEOLOGY**
- **SPECIALTY NICHEs (IN-MOLD DECORATION)**
- **IMPROVED ACOUSTIC PROPERTIES**

o-TPV PROFITABILITY DRIVERS



SOURCE: ROBERT ELLER ASSOCIATES, INC., 2007

r/mydox/papers/RMA-oTPVprofitDrivers07.vsd
lg/myfiles/visio/RMA-oTPVprofitDrivers07.vsd

SUMMARY

- **SUPPLY CHAIN SHIFTING (AUTO, NON-AUTO)**
- **TPE MARKET IS GLOBALIZING**
- **TPE PROPERTY ENVELOPE BROADENING**
- **MORE RAPID MATERIALS/FABRICATION TECHNOLOGY SHIFTS THAN FOR RUBBER:**
 - **CREATES VALUE**
 - **CREATES GROWTH**
 - **CASCADE TO LOWER VALUE TPEs**
- **IN CHINA:**
 - **ECONOMIC WAR IS OVER**
 - **DOMESTIC COMPETITION STARTING**
- **EUROPE/N. AMERICA: STAGNANT MARKETS**
- **RUBBER SUBSTITUTION IS POTENTIAL BREAKTHROUGH**

SUMMARY (Cont'd.)

- **U.S. AUTO MARKET:**
 - **BIG 3 → BIG 6**
 - **SEVERE SUPPLY CHAIN RESTRUCTURING**
 - **TPE SUPPLY BASE SHIFT**
 - **EUROPEAN/JAPANESE TECHNOLOGY TRANSFER**
 - **CONSOLIDATED CUSTOMER BASE WITH INCREASED PURCHASE POWER**
 - **SALES DOWNTURN IN 2007**
 - **FLEET SHIFT TO SMALLER VEHICLES**