Robert Eller Associates LLC

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

POLYCARBONATE IN ASIA: IMPACT OF GLOBAL DEVELOPMENTS ON MARKETS AND APPLICATIONS

Roger Young
Vice President-Asia
Robert Eller Associates, Inc.
Phone: +64 21 725 745
rogeryoung@robertellerassoc.com
www.robertellerassoc.com

6TH Asia Phenol/Acetone Markets Conference
Shanghai
Centre for Management Technology
February 24-25, 2009

ANALYSIS TECHNICAL ECONOMIC MARKET Management DECISIONS

Robert Eller Associates LLC

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES

- Robert Eller Associates is a 15 year-old global plastics consulting company helping companies analyze technical, marketing and economic implications for their business to facilitate management in strategic decision making
- Offices in Akron, Ohio (home office), Paris, Shanghai, New Zealand
- Asia: Active in China, India, Middle East
- Key Focus areas: TPE's, ETP's, Polyolefins, Automotive, Compounding, and Foams
- Multi-client studies:
  - China TPE Market: 2006
  - North America/Europe TPE: 2006
- Single client studies
- Mergers and acquisitions:
  - Complete management service for small acquisitions
  - Due diligence
  - Technical Advisors

TODAY’S DISCUSSION

- Competing in the Asia PC Market
- A brief look at the major market segments and how they will fare in 2009
- The impact of the automotive downturn on the PC business
- BPA: what is the impact

POLYCARBONATE RESIN MANUFACTURERS

PC Manufacturer	Plant Locations	Capacity KT/yr	Tradename/Notes
Sabic Innovative Plastics	Spain	280	Lexan
	Netherlands	200	
	Japan	40	
	US	520	
	Saudi Arabia	260	Saudi Kayan (2009), Licensed Asahi Technology
	Total	1300	
Bayer	China	200	Makrolon China plant not yet at capacity (2008)
	Thailand	220	
	Belgium	240	
	Germany	330	
	US	260	
	Total	1250	
Teijin	Japan	120	Panlite/Multilon
	Singapore	200	
	China	160	
	Total	480	

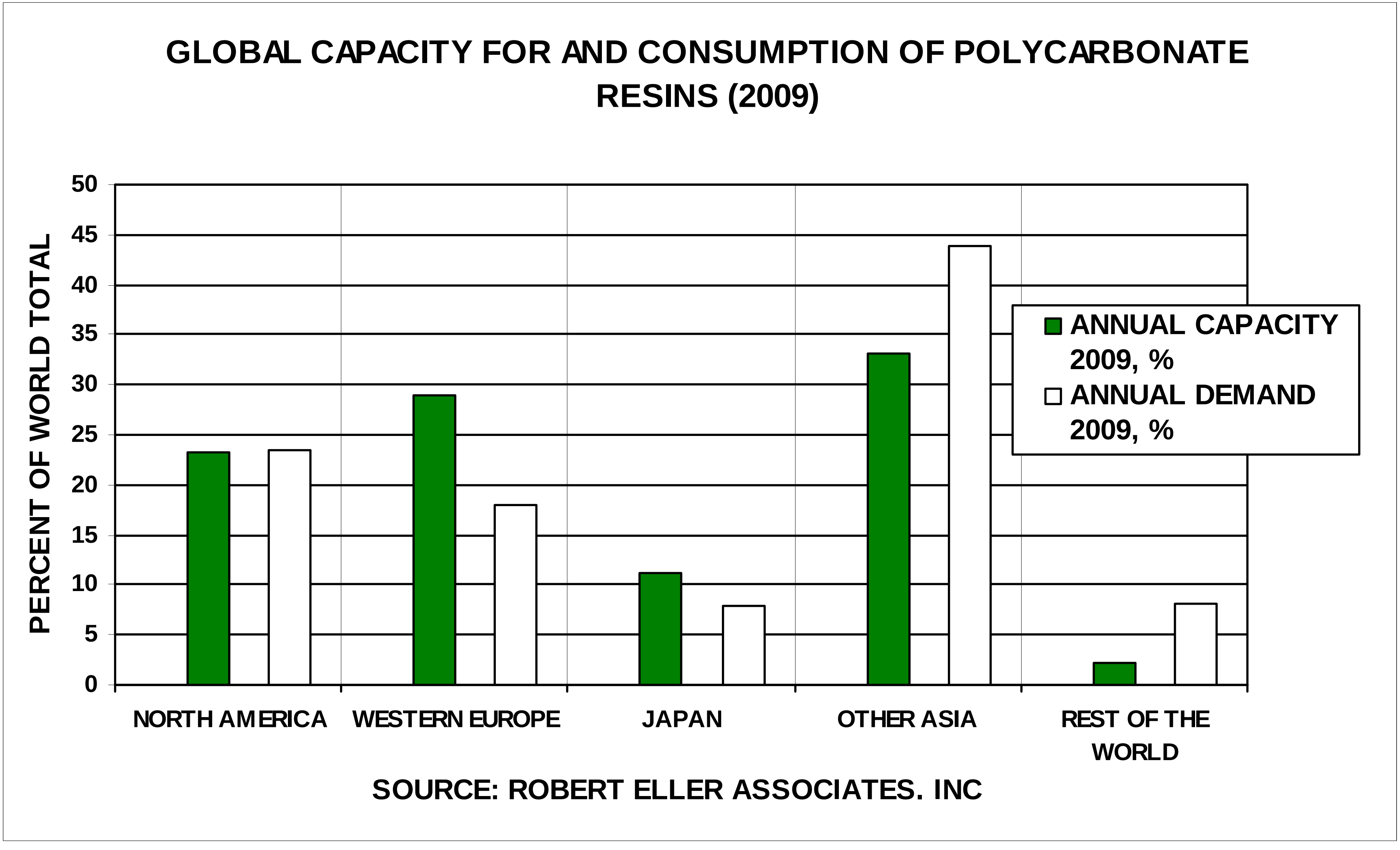
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

PC Manufacturer	Plant Locations	Capacity KT/yr	Tradename/Notes
Dow	Texas	84	Calibre
	Germany	134	
	Japan	55	JV with Sumitomo
	Korea	150	JV with LG
	Total	423	
Mitsubishi Engineering Plastics	Japan	110	Mitsubishi Chemical - Iupilon
	Japan	40	Mitsubishi Gas Chemical-Novarex
	Thailand	160	JV Iupilon/Novarex
	Korea	110	JV Samyang Advanced Material-Trirex
	China	80	JC MGC/Sinopec (2009)
	Total	420	
Asahi Kasei	Taiwan	150	JV with Chi Mei- Wonderlite
	Russia	65	Licensed OAO Kazanorgsintez
	Iran	25	Licensed NPC (KZPC)
	Korea	65	Licensed Honam Petrochemical
	Korea	65	Licensed Cheil Industries (Samsung)
	Total	305	Saudi Kayan Plant included in Sabic IP

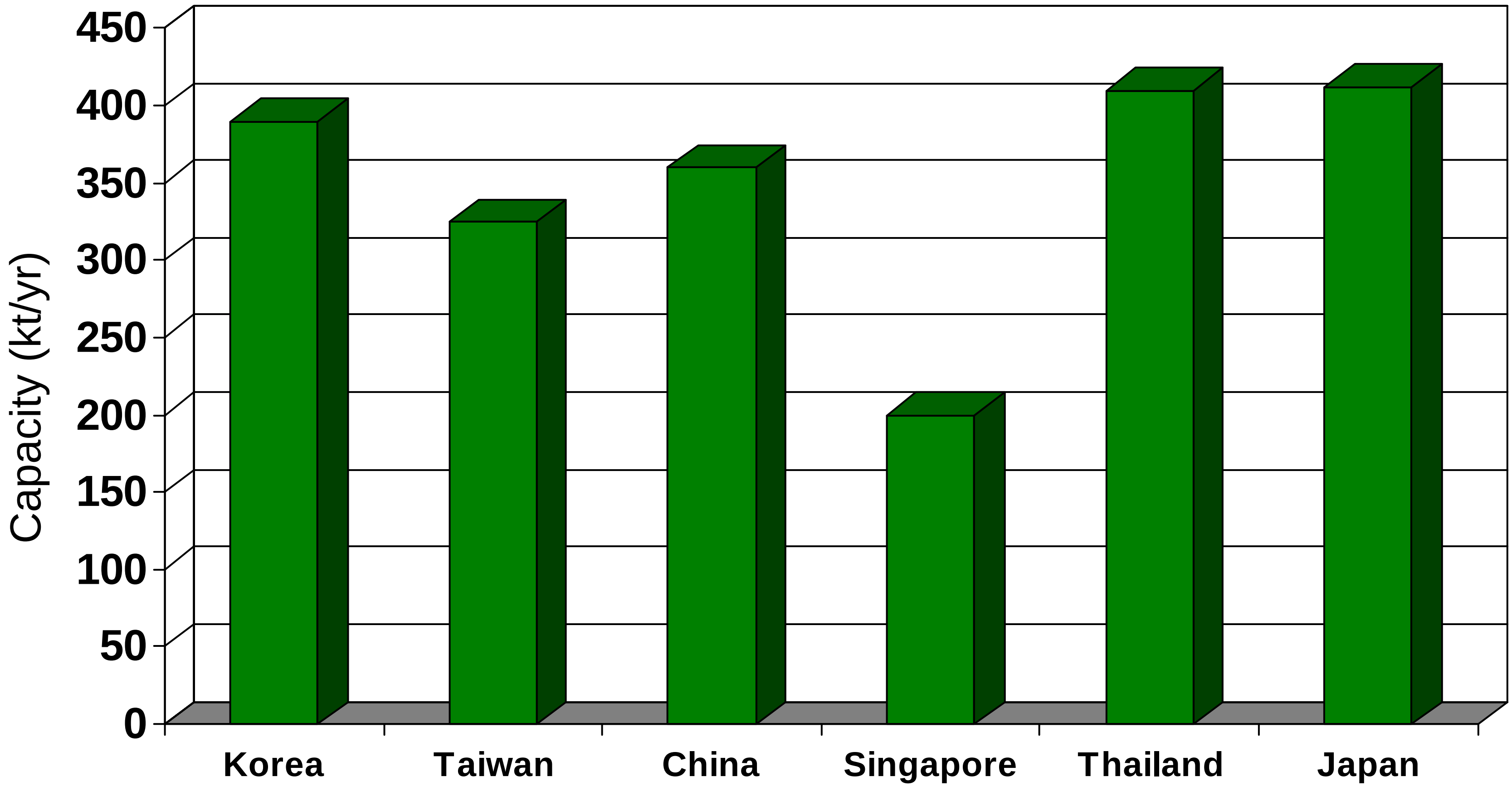
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

PC Manufacturer	Plant Locations	Capacity Kt/yr	Tradename/Notes
Idemitsu	Japan	47	Tarflon
	Brazil	15	JV with PC Brazil
	Taiwan	175	JV with Formosa
	Total	237	

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008


GLOBAL CAPACITY FOR AND CONSUMPTION OF POLYCARBONATE RESINS (2009)
PERCENT OF WORLD TOTAL
0
5
10
15
20
25
30
35
40
45
50
NORTH AMERICA
WESTERN EUROPE
JAPAN
OTHER ASIA
REST OF THE WORLD
ANNUAL CAPACITY 2009, %
ANNUAL DEMAND 2009, %
SOURCE: ROBERT ELLER ASSOCIATES. INC

2008 Asia PC Capacity by Countries



SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

CHINA/ASIA PC PRODUCER'S STRATEGIES

PC Manufacturer	Strategy
Bayer	•Strong manufacturing capabilities/compounding in an integtrated complex
Sabic IP	•Compounding regionally positioned in East/South China •Saudi Kayan plant to provide lower cost resin compared to Taragona, Spain •Chinese Production?
MEP	•JV with MGC/Sinopec •Korea/Singapore/Japan Position (All Asia manufacturing)
Dow	•K-Dow collapse, who's next? •Supply from Korea to Asia (other than Japan) •Dow Automotive presence low in China •Strong in blends
Teijin	•Strong in CD's •First Chinese plant
Asahi Kasei	•Licensing
Honan	•Focus on optical media and film/sheet markets

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

DEVELOPING A LOW COST MANUFACTURING FOOTPRINT

- ABS Model
  - Major Markets
    - Electronics, consumer electronics, appliances, automotive
  - Entrance of low cost Asian producers
  - Product Market Shift to Asia
  - Lack of Western companies developing local manufacturing in the late 1980's-1990's has led to the decline/impact of the western companies
    - Forced structural realignment of industry
      - Borg Warner->GE->Sabic
      - Monsanto->Bayer->Lanxess->Ineos
      - Bayer->Lanxess->Ineos
      - Dow-> closed NA other than auto, will rationalize Europe and NA plant through sale or JV
- Need for low cost manufacturing footprint to survive

ABS Industry Leaders

1980-1990	2008
GE	Chi Mei
Bayer	LG
Monsanto	Samsung
BASF	BASF
Dow	Cheil
	Sinopec
	Ineos
	Toray

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

THE ABS MODEL: HOW DOES PC COMPARE?

- Similar Markets to ABS:
  - Automotive, Electronics, Recreation, Housings, Power Tools
- Market Shift to Asia in primary markets (all but medical)
- Shift to Asian manufacturers:

  GE-> Sabic IP/Saudi Kayan

  Dow-> K Dow successor Asian?

  Mitsubishi -> Only produce in Asia

  Teijin -> Only produce in Asia

  Idemitsu ->Asia only other than small Brazilian operation

  Asahi Kasei -> Only produce/license in Asia
- Entrance of low cost Korean (Samyang, Cheil, Honan), Taiwanese (Chi Mei, Formosa) via partnering and licensing and Chinese (Bayer, Mitsubishi and Teijin) producers
- Will PC continue to structurally reorganize? Will Bayer remain the only non-Asian factor in PC like BASF is in ABS?
  - Bayer Shanghai plant does not follow the ABS model
  - When/where/if Sabic IP build a China resin plant?
- Focusing plants onto narrow applications: Honan, Teijin, Idemistsu (Formosa)

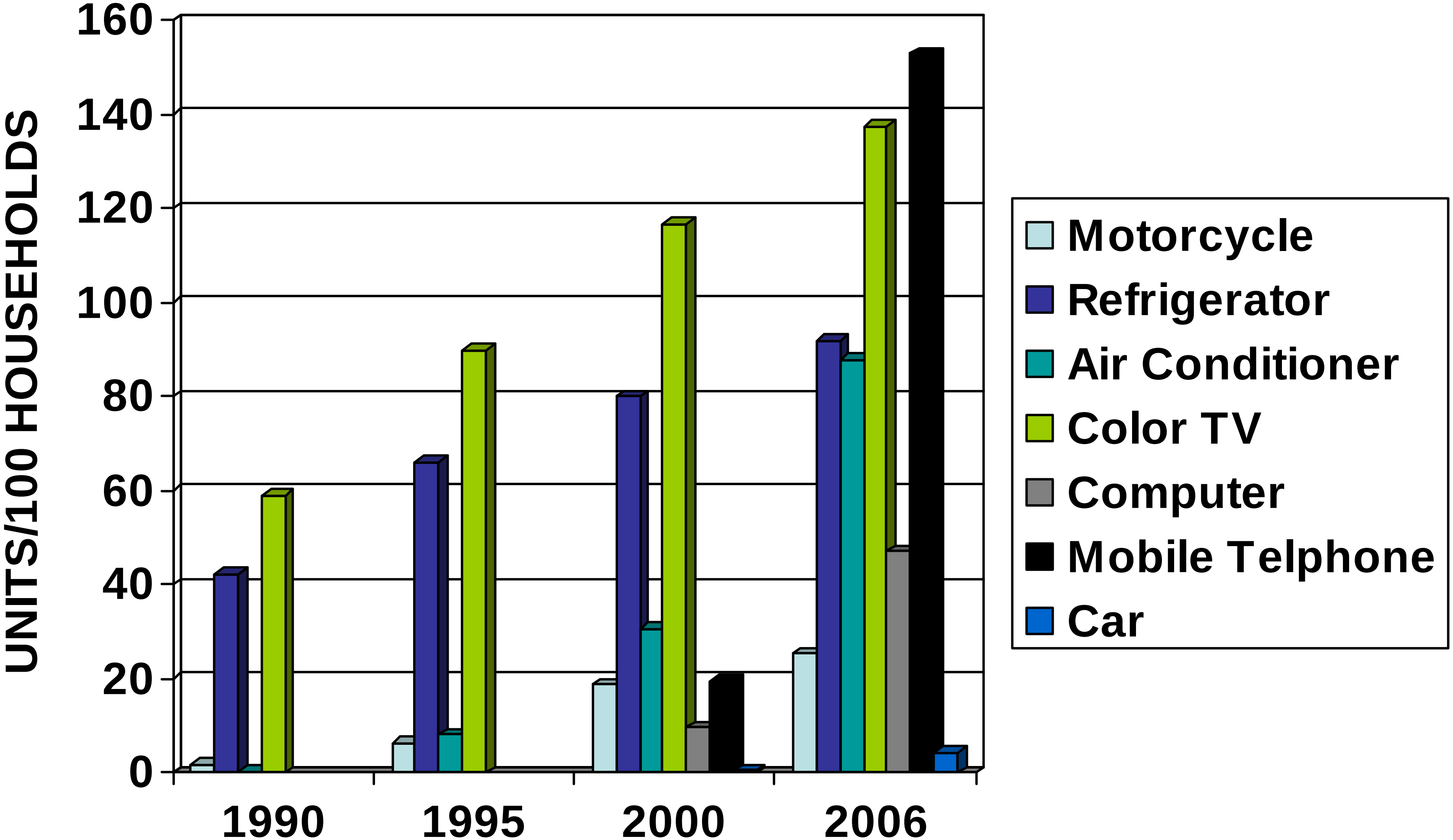
SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

THE EMPOWERED MIDDLE CLASS: TARGETING THE DOMESTIC MARKETS

- The number of urban households with income greater than 40000 RMB/year will triple in the next ten years and by 2025 will represent over 70 % of the forecast 400 MM urban households
- This buying boom is just taking off
- Has become the significant driving element of Chinese economy
- Shanghai/Beijing center of this Chinese buying spree, other urban centers are also growing but not as quickly.
- Buying cars, mp3 players, video games, computers, telephones
- Foreign brands popular and extract premiums over domestic products
- Happening all through Asia, not just China
- Intense PC applications

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

DURABLE GOODS OWNED PER 100 URBAN HOUSEHOLDS IN CHINA



SOURCE: CHINA NATIONAL BUREAU OF STATISTICS
ROBERT ELLER ASSOCIATES

GLOBAL PC MAJOR MARKET SEGMENTS

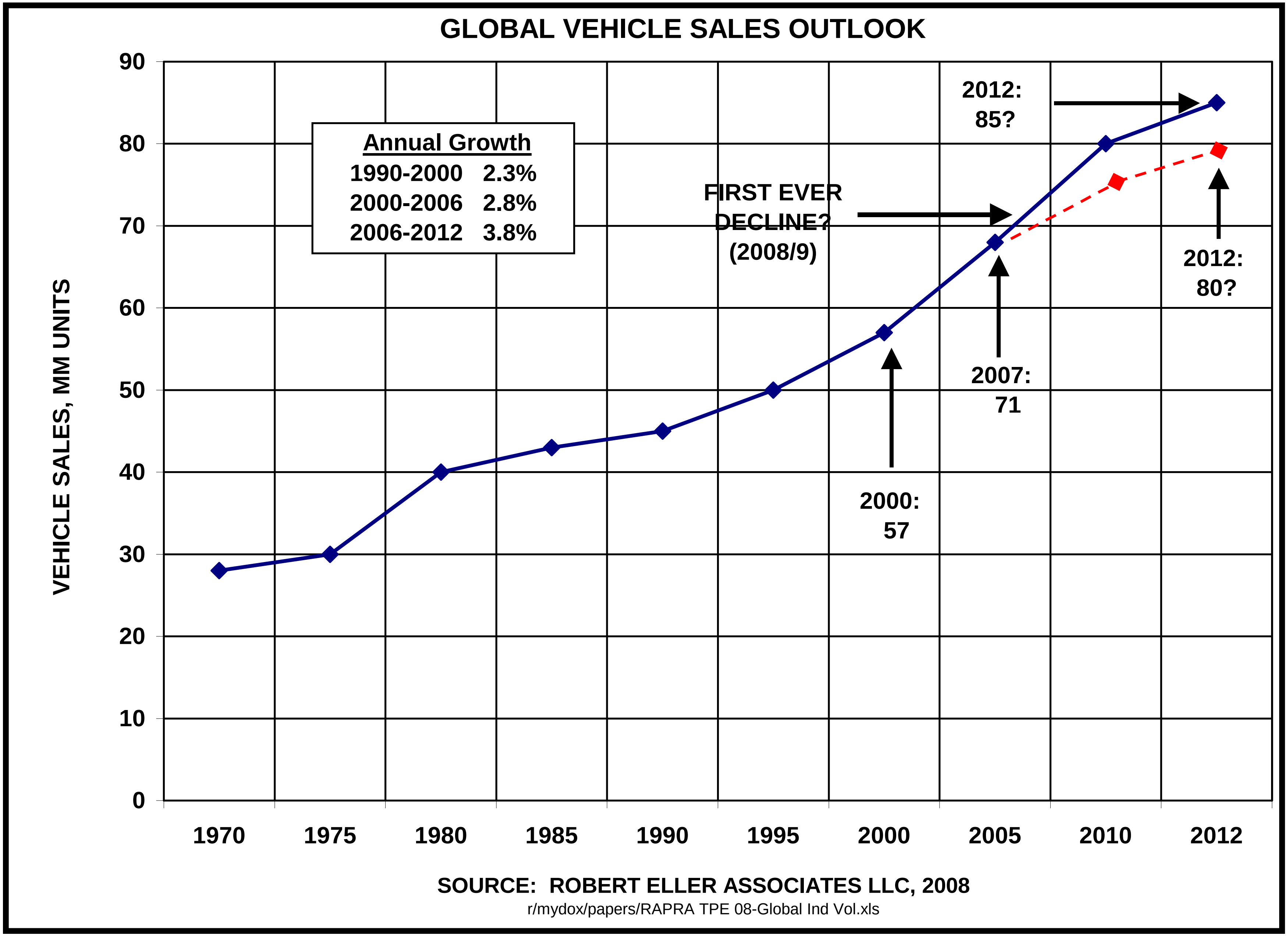
Market Sector	Share of PC Market	2009 Growth Rate (%/yr)	Notes
Electrical/Electronics	27	1	Global recession
Building & Const.	17	2	Driven by PC sheet in glazing and demand in Asia Home construction will be down Economic stimulus packages help
Optical Data Storage	15	0	Demand peaking Teijin major supplier, lowest price segment
Blends/compounds	13	-5	Automotive has a major impact
Automotive	12	-13	Impact of automotive production Glazing still not a major contributor yet
Medical	8	3	Aging demographics/BPA issues? Global recession even impacts medical
Water bottles	3	-25	BPA issues?
Other	3	3	
Films	1	8	New growing applications

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

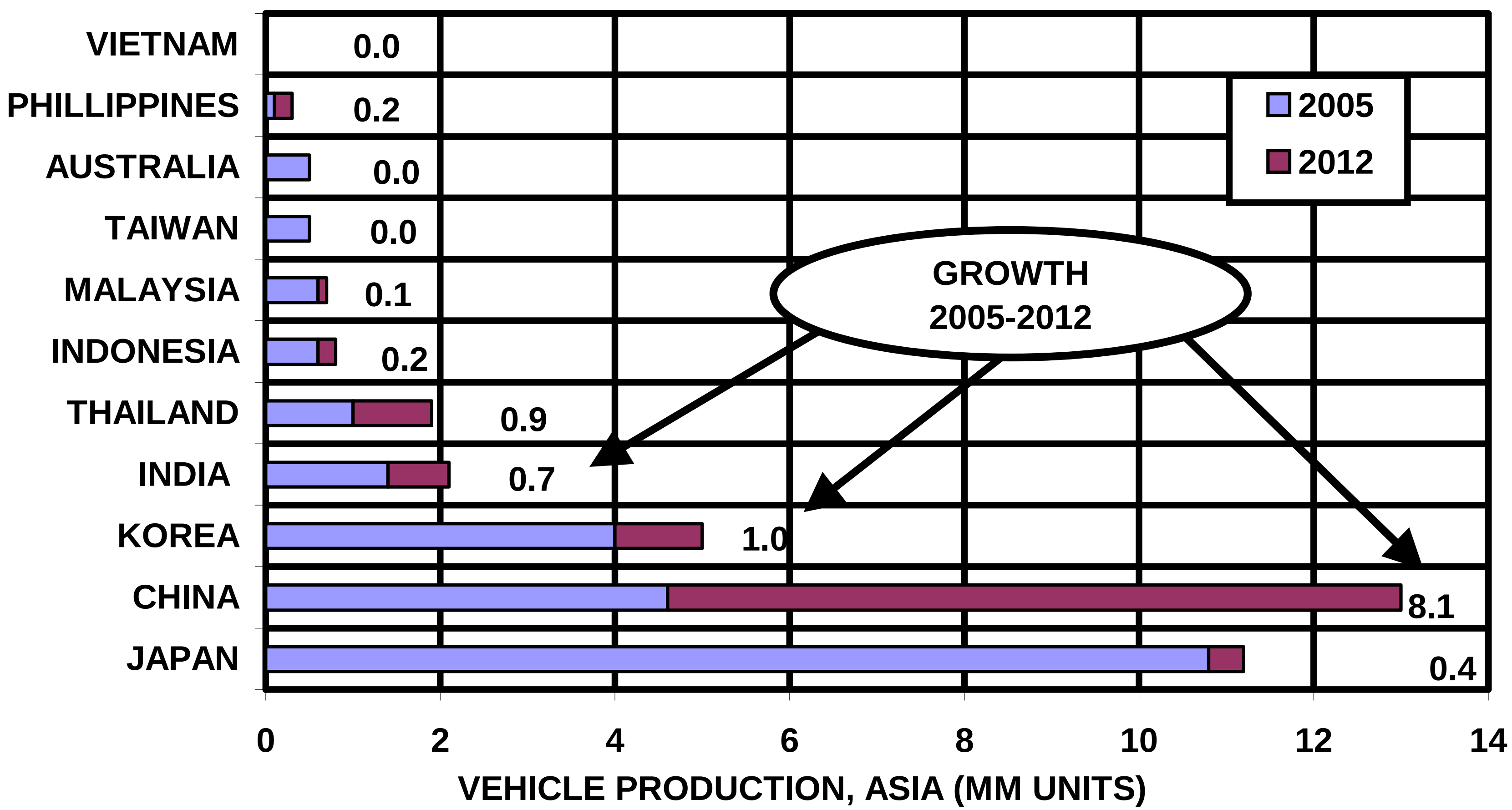
PC IN AUTOMOTIVE: APPLICATIONS

- Major Applications
  - Interiors:
    - Trim and instrument panels
      - Mature market
      - PP substitution/Small Vehicle trend (particularly in Asia)
  - Exterior
    - Headlights
      - Still growing
      - Aerodynamic, styling freedom
    - Glazing
      - Still developing/growth opportunity
- Blends:
  - PC/ABS:
    - interior trim, instrument panels, wheel covers, mirror housings
      - Mature business threatened with continued competition from lower cost PP compounds
  - PC/PBT:
    - body panels, bumper systems
      - Potential opportunity for weight savings
      - Will the drive to save weight open the door finally for wide use of plastic body panels

GLOBAL VEHICLE PRODUCTION DECLINE ?



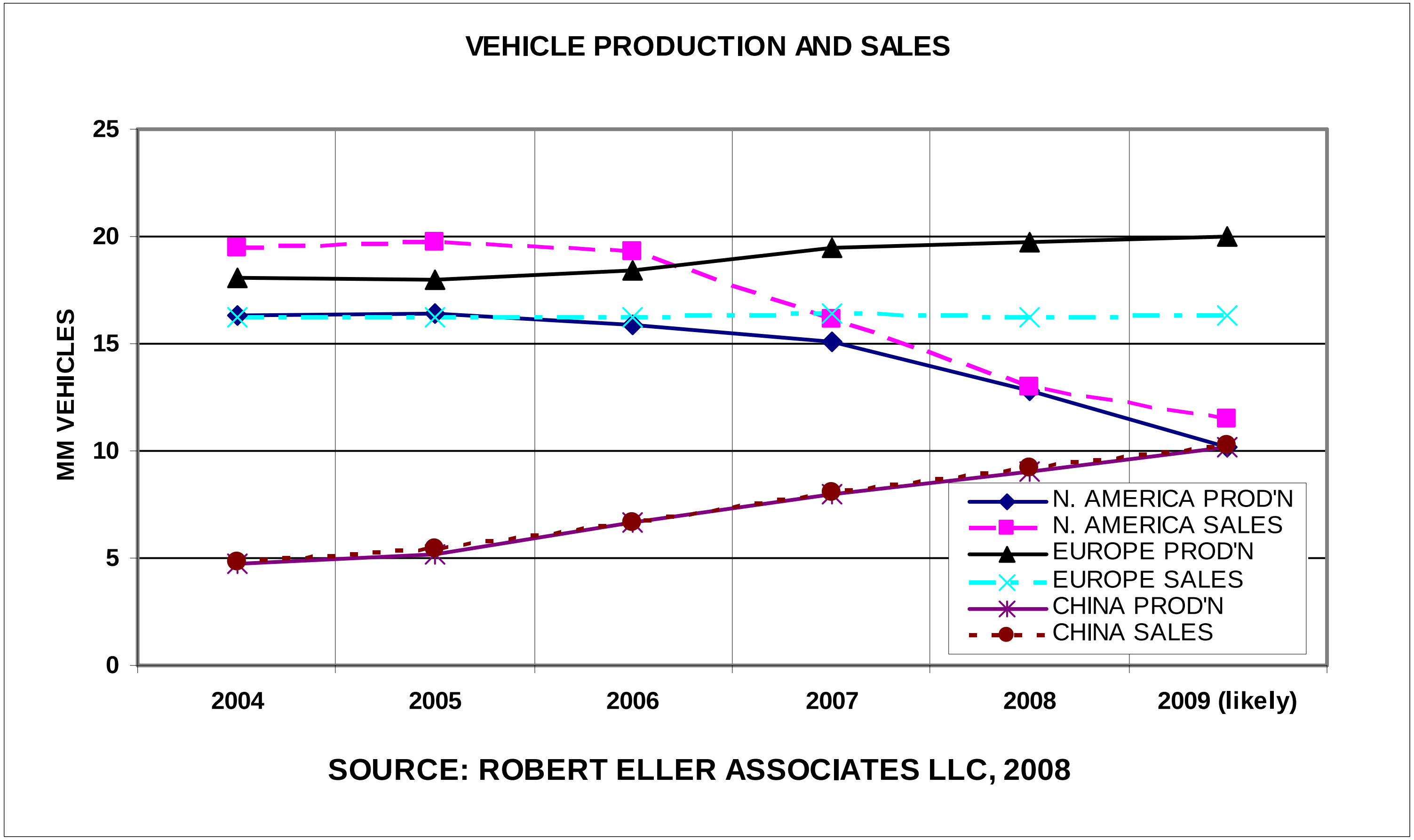
ASIA VEHICLE PRODUCTION: SLOWED BUT GROWING



SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

b/mydox/RAPRA 2008/rapra 2008.xls

AUTO: PRODUCTION/SALES BY REGION



**aerodynamic styling ……and lightweight
…..and lowers the center of gravity**

Photo courtesy Exatec

and allows for parts/system integration…….

Photo courtesy Exatec

Renault Megane R26

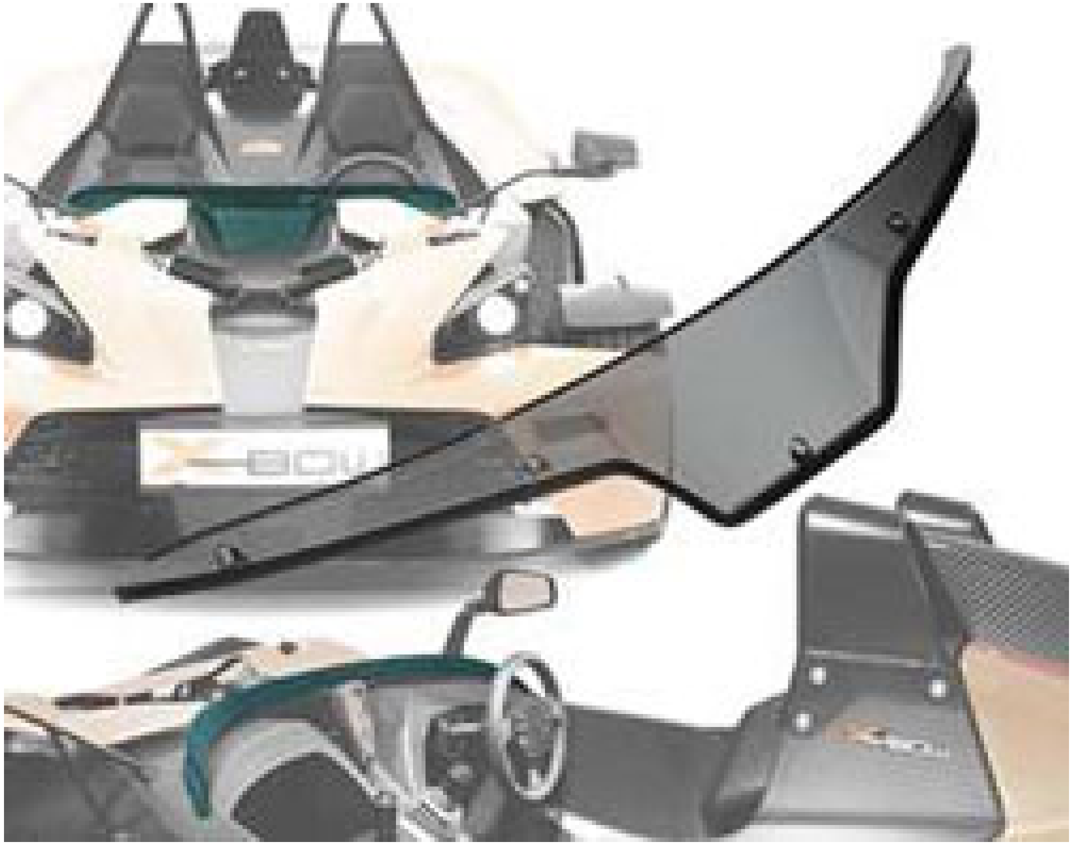
Rear and side windows

SOURCE: PLASTICS NEWS, 2008

Smart Minicar Panoramic Roof

SOURCE: BAYER MATERIAL SCIENCE, 2008

X-Bow from KTM



Wind Deflector

SOURCE: BAYER MATERIAL SCIENCE, 2009

AUTO GLAZING STATUS

- Getting lots of attention from the car companies, particularly with the pressure for higher mileage vehicles
- Still not a high sense of confidence from vehicle engineers
  - Concept Cars, but the production vehicles are traditional glass
  - Sunroofs
  - Proof of concept is slow because of the time aging factor
- Webasto (Germany) has doubled its production capacity with the purchase of an additional Kraus Maffei 2-shot molding machine and Eisenmann coating line
- Smart Minicar panoramic roof
- Renault Megane R26 Sports Vehicle rear and side windows
- Honda Civic European version lower portion rear window
- Chevrolet Corvette panoramic roof
- Two companies driving the concept
  - instead of the JV Exatec, Bayer (BayVision) and Sabic Innovative (Exatec) have separate efforts
  - Will this be more effective?
- Real potential is >8 years away
  - Patient dollars for a long term payout?

BPA IMPACT

- Last year we said the battle was lost and 2008 confirmed the loss: how far will it spread?
- Emotive vs technical logic
- Issue US/Canada driven
- Vulnerable Applications
  - Baby bottles
  - “Sport” Reusable Water bottles
  - Large 20+ liter water bottles
  - Medical Market
    - applications where heat is involved, not total market
    - Less impact on older people
- Alternative solutions:
  - Eastman’s Triton Copolyester
  - Transparent/Clarified PP
  - Acrylic, SAN and other clear amorphous material have either impact or heat distortion limitations

MARKET	STATUS	GLOBAL VULNERABLE VOLUME (KT)
Baby Bottles	Lost	10
Sport Reusable Bottles	Losing	20
Large Water Bottles	Competing	60
Medical Market (heat/respiratory applications)	Questions being asked	150

SOURCE: ROBERT ELLER ASSOCIATES LLC, 2008

POLYCARBONATE: A 2009 SUMMARY

- 2009 will be a tough year for Polycarbonate
  - Automotive off in North America, globally slow
  - Global economy impacting appliances, electronics, building and construction (houses), optical disks
  - Medical and Water Container market under attack from BPA migration
- Strengthening of Asia: slower growth
- Unanswered questions:
  - Dow ???
  - Sabic IP resin plant in China?
  - How far will BPA issue into medical market?

Thank You!

Robert Eller Associates LLC

CONSULTANTS TO THE PLASTICS AND RUBBER INDUSTRIES