Plastic in Car
Trend, Application and Their Business

Mr. Kongsak Dokbua
Aug 29, 2014
“Partnership & Strengthening for Sustainability”
Contents

1. Automotive Industry Overview
2. Trend of Automotive Industry
3. Plastic In Automotive Industry
Total Production of Conversion
Value: 566,841 Million Baht (13,889 Million US$)
Volume: 4,795 Ktons

Source: PTIT Data, Modified by PITH, 3 July 2014, *Exclude PET and Nylon fiber
Global Light Vehicle Projection
Up to 2020
Source: IHS

Global Light Vehicle Production
Near-Term Volatility, Long-Term Growth Trajectory

2013-20 Global Growth Rates
Global Markets 3.6%
Developing Markets 5.7%
Developed Markets 1.2%

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Global Automotive OEM Market Share 2013

Source: Bloomberg

- Toyota, 12%
- GM, 11%
- VW, 11%
- Hyundai-Kia, 9%
- Reault-Nissan, 9%
- SAIC, 6%
- Fiat, 5%
- Honda, 4%
- PSA, 3%
- Other, 22%

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Global OEM Market Share Projection 2000 to 2020

Source: KPMG

Three out of four vehicles sold in 2020 will still originate from established OEMs

Key takeaways

At the turn of the millennium, almost 90 percent of all cars sold worldwide were made by established OEMs from North America, Western Europe and Japan.

Today, almost 80 percent of all car sales still originate from established OEMs, but the balance of power has changed considerably.

Every third vehicle sold now comes from a Japanese/Korean OEM, while back in 2000 the US ‘big three’ were responsible for the major chunk of global car sales.

The global market share of European OEMs has been around 25 percent ever since the 2000s, and will most likely remain at this level up to 2020.

Chinese and Indian sales groups have only slowly taken over market share from established OEMs. By 2020, around every fourth car sold is likely to originate from an establishing OEM. Chinese OEMs will make up the greatest proportion, taking a global market share of around 15 percent.

Source: KPMG research & analysis, LMC. ¹ For trans-regional sales groups (Fiat-Chrysler and Renault-Nissan) sales are split by brand origin. ² Includes Volvo (=Geely) sales in 2013 and 2020.

² Includes JLR (= Tata Motors) sales in 2013 and 2020. Please note: Sales volumes originating from trans-national joint ventures are assigned to established OEM.
Sales by Segment of Established and Establishing Market
2000 to 2020

Source: KPMG

Key takeaways

In 2020, the vast majority of vehicles sold in established and establishing markets will belong to the so-called sub-premium segment.

In the established markets, the premium segment will continue to grow, reaching 15 percent market share by 2020, equivalent to a total annual sales volume of 6.4 million vehicles.

In contrast, premium vehicles will only make up 5.5 percent of annual sales in establishing markets by this date. This equates to an annual volume of 4.1 million vehicles—well below the figure for the established markets of North America, Western Europe and Mature Asia.

The economy segment, on the other hand, will not play a significant role in the established markets until 2020. In establishing markets, however, almost one in every four cars will be an economy model, catering largely to price-sensitive middle class customers.
Areas of Investment in Auto Industries
Up to 2018

Source: KPMG

Areas of investment for OEMs and suppliers up to 2018

<table>
<thead>
<tr>
<th>Area</th>
<th>Improvement of safety</th>
<th>Logistics and distribution</th>
<th>New plants</th>
<th>Modele/Platform strategies</th>
<th>Power electronics for e-cars</th>
<th>Innovative business models (i.e. MaaS)</th>
<th>Lightweight materials</th>
<th>Battery technology</th>
<th>Marketing, brand management</th>
<th>E-motor production</th>
<th>Fuel cell technology</th>
<th>Connectivity, infotainment</th>
<th>Interfaces consumer electronics</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>75%</td>
<td>75%</td>
<td>71%</td>
<td>71%</td>
<td>66%</td>
<td>61%</td>
<td>66%</td>
<td>53%</td>
<td>68%</td>
<td>63%</td>
<td>73%</td>
<td>43%</td>
<td>34%</td>
</tr>
<tr>
<td>OEM</td>
<td>85%</td>
<td>80%</td>
<td>66%</td>
<td>82%</td>
<td>65%</td>
<td>80%</td>
<td>80%</td>
<td>88%</td>
<td>68%</td>
<td>73%</td>
<td>85%</td>
<td>70%</td>
<td>88%</td>
</tr>
<tr>
<td>Supplier</td>
<td>88%</td>
<td>71%</td>
<td>66%</td>
<td>61%</td>
<td>58%</td>
<td>61%</td>
<td>53%</td>
<td>68%</td>
<td>63%</td>
<td>73%</td>
<td>49%</td>
<td>47%</td>
<td>39%</td>
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</tbody>
</table>

Note: Percentage of OEMs’ and suppliers’ respondents who plan to ‘begin’ or ‘increase’ investments.
Source: KPMGs Global Auto Executive Survey 2013
Expecting Global Market Share by Brand Up to 2018

Source: KPMG

Respondents expecting global market share to increase/decrease up to 2018

- **Volkswagen Group**: 81% increase, 3% decrease
- **BMW**: 70% increase, 5% decrease
- **BAIC**: 70% increase, 5% decrease
- **Toyota**: 66% increase, 7% decrease
- **Hyundai/Kia**: 61% increase, 14% decrease
- **SAIC**: 61% increase, 10% decrease
- **FAW**: 53% increase, 9% decrease
- **Geely**: 51% increase, 11% decrease
- **Nissan**: 50% increase, 14% decrease
- **Tata (incl. JLR)**: 50% increase, 20% decrease
- **Dongfeng**: 48% increase, 13% decrease
- **Changan**: 47% increase, 14% decrease
- **Chery**: 46% increase, 13% decrease
- **Ford**: 44% increase, 23% decrease
- **General Motors**: 44% increase, 23% decrease
Expecting Global Market Share by Brand (con’t)
Up to 2018

Source: KPMG

<table>
<thead>
<tr>
<th>Brand</th>
<th>Expected Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daimler</td>
<td>41%</td>
</tr>
<tr>
<td>Brilliance-Jinbei</td>
<td>40%</td>
</tr>
<tr>
<td>Fiat Group (incl. Chrysler)</td>
<td>37%</td>
</tr>
<tr>
<td>Honda</td>
<td>34%</td>
</tr>
<tr>
<td>Renault</td>
<td>33%</td>
</tr>
<tr>
<td>Avtoaz</td>
<td>32%</td>
</tr>
<tr>
<td>PSA</td>
<td>31%</td>
</tr>
<tr>
<td>BYD</td>
<td>31%</td>
</tr>
<tr>
<td>Suzuki</td>
<td>29%</td>
</tr>
<tr>
<td>Mazda</td>
<td>29%</td>
</tr>
<tr>
<td>Mitsubishi</td>
<td>23%</td>
</tr>
<tr>
<td>Subaru/Fuji Heavy</td>
<td>19%</td>
</tr>
</tbody>
</table>

Note: Percentage of respondents expecting market share to ‘remain stable’ are not shown
Source: KPMG’s Global Auto Executive Survey 2013
Automotive Industry

“Thailand: Automotive Hub of Asia”

9th largest automobile producer in the world in 2013

14 assemblers with a combined production of more than 2,500,000 in 2012

High Local content of up to 90%

Target of 3 million units in 2017

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Thailand Ranked #9
2013 Automobile Production

World’s Production: 87 Million
THAILAND: 2.53 Million
#9 in Worlds’ Automotive Production
#1 in ASEAN for Automotive Production

2013 No. 9
2,532,577 units
### ASEAN Automotive Industries

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>2,457,057 units</td>
<td>1,330,672 units</td>
<td>1-ton pick up car &amp; Eco-car</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,208,211 units</td>
<td>1,218,900 units</td>
<td>PPV car</td>
</tr>
<tr>
<td>Malaysia</td>
<td>601,407 units</td>
<td>655,793 units</td>
<td>Passenger car</td>
</tr>
<tr>
<td>Philippines</td>
<td>79,169 units</td>
<td>181,738 units</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>93,630 units</td>
<td>98,649 units</td>
<td>Motorcycle</td>
</tr>
</tbody>
</table>

### ASEAN

- **Population (2012):** 608.8 million
- **GDP (2012):** US$2,338.9 billion
- **GDP growth rate (2012):** 5.0%
- **Car production (2012):** 4.44 million units
- **Car total sales (2012):** 3.55 million units

Source: Automotive Summit 2013 & ASEAN Automotive Federation as of Mar 10, 2014

"Partnership & Strengthening for Sustainability"
## 2014 Thailand’s Automotive Industry

<table>
<thead>
<tr>
<th>Category</th>
<th>Production (Units)</th>
<th>Domestic Wholesales (Units)</th>
<th>Export (CBU) (Units)</th>
<th>VEHICLE</th>
<th>MOTORCYCLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>160,542</td>
<td>952,105</td>
<td>-29.07</td>
<td>-28.95</td>
<td>159,090</td>
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<tr>
<td></td>
<td>73,799</td>
<td>440,911</td>
<td>-30.39</td>
<td>-40.48</td>
<td>158,991</td>
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<tr>
<td></td>
<td>103,946</td>
<td>560,047</td>
<td>6.57</td>
<td>3.60</td>
<td>73,615</td>
</tr>
</tbody>
</table>

*Source: Thailand Automotive Institute as of Aug 14, 2014*
Thailand Automotive Industry Growth

Source: Automotive Intelligence Unit, as of Mar 10, 2014

Year 2013

Production = 2,457,057 Units +0.14%
Domestic Sale = 1,330,672 Units -7.36%
Export = 1,128,152 Units +9.88%
Structure of Thai Automotive Industry

Assembler
(17 car companies, 8 motorcycle companies)
100,000 workers

Tier 1
(Total 709 Companies)

Tier 2,3
(1,700 Companies)

LSEs

SMEs

Foreign J/V
Foreign Majority 54 %
Thai Majority 23 %
Pure Thai 23 %

Local Suppliers

Source: Thai Autoparts Manufacturers Association, OIE and BOI as of 2014

[* LSEs : Large Scale Enterprises  SMEs : Small & Medium Enterprises]
Thai Automotive Industry - OEM Location

Source: Thailand Automotive Institute
ASEAN Population per Sales Motor Vehicles 2012

Population and Sales

Population Per Sales

Source: OICA (2013) / World Bank

"Partnership & Strengthening for Sustainability"
Thailand’s Automotive Industry Overview

Thailand: 9th largest automobile producer in the world in 2013

Target: To manufacture 3,000,000 units in 2017

Output: 14 assemblers with a combined production of more than 2,000,000 in 2012

High local content: 80-90% for pick-up and 30-70% for passenger car

Thailand Automotive Industry Vision – Today and Tomorrow

Vision 2011

“Thailand is production base in Asia which creates more value added to the country with strong automotive parts industry”

Vision 2021

“Thailand is a global green automotive production base with strong domestic supply chains which create high value added for the country”

Source: Thailand Automotive Institute

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“Great Leap of Next Decade” for ASEAN Automotive Industry

Growth Factors of ASEAN Market

Relatively low penetration of vehicles

Market expansion due to Rise of Income Growth and Rise of Middle Class

Push to produce small cars by Low Cost Eco Car Policy (Eco Car and Low Cost Green Car Policy)

More market competition due to liberalization under FTAs

Market: 5 million cars by 2020-larger than Japanese market in 2012.
Production: Surpass 6 million cars through export growth by 2020.

Source: Automotive Summit (TAPMA) as of June 20, 2013
Key Automotive Trend up to 2025

Key automotive trends up to 2025

Percentage of respondents that rated a trend as ‘extremely important’ or ‘very important’

- **STANDARDIZATION**
  Increasing use of platforms and standardization of modules

- **ICE OPTIMIZATION**
  Downsizing and optimization of the internal combustion engine (ICE)

- **EMERGING MARKETS**
  Market growth in emerging markets
  - 85%

- **SELF-DRIVING CARS**
  - 14%

- **MOBILITY**
  Mobility-as-a-service
  - 49%

- **CONNECTIVITY**
  Connected car technologies (e.g. car-to-x communication)
  - 49%

- **URBAN VEHICLE**
  Innovative urban vehicle design concepts
  - 57%

- **FUEL CELL E-MOBILITY**
  - 69%

- **EUROPEAN PRODUCTION**
  Rationalization of production in Europe and shifting of production to emerging markets
  - 61%

- **BATTERY E-MOBILITY**

- **FINANCE & LEASING**
  OEM captive financing and leasing
  - 59%

Source: KPMG’s Global Automotive Executive Survey 2014.

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Factors Influence to Consumers

Factors most likely to influence consumers' purchase decisions

Percentage of respondents that rated issues as 'extremely important' or 'very important'

- **92%**
  - Fuel efficiency

- **79%**
  - Safety innovation

- **79%**
  - Ergonomics and comfort

- **74%**
  - Vehicle styling/exterior

- **73%**
  - Environmental friendliness

- **70%**
  - Enhanced vehicle lifespan

- **69%**
  - Plug-in solutions for navigation, speech recognition and mobile internet devices

- **65%**
  - Vehicle-bound internet connectivity and built-in technologies

- **53%**
  - Telematics/personal assistance services

- **47%**
  - Use of alternative fuel technologies

Source: KPMG’s Global Automotive Executive Survey 2014.
Global Force to Driven Trends

**Global forces**

- **Key forces**
  - Environmental challenges
  - New technologies/Digitalization
  - Changing customer behavior
  - Growing urbanization
  - Growth and globalization

**Resulting trends**

- ICE downsizing
- Alternative powertrains
- Connectivity/car digitalization
- Mobility solutions
- Financial services
- Shift to emerging markets
- Internationalization
- Big data
- Autonomous cars
- Lightweight material
- Dealership concepts

**Key success drivers**

- ICE downsizing/hybrids
- Enhanced/differentiated vehicle lifespan
- Revenue generation
- Managing and intelligent use of ‘big data’
- Changing value chain
- New urban mobility solutions
- Flexibility/life cycles
- New dealer concepts
- Regional differences
- Brand management
- Expansion of the after sales – and spare part business
- Differentiated purchasing strategies
- Sourcing strategies
- Global footprint/expansion
- Module/platform strategies

**Overall market development**

**New business models**

Source: KPMG’s Global Automotive Executive Survey 2014.
Investment Areas in next 5 years

Main investments in powertrain technologies over the next 5 years

- 16% Plug-in hybrid fuel systems
- 11% Hybrid fuel systems
- 46% ICE downsizing and optimization
- 8% Battery electrified vehicles with range extender
- 10% Fuel cell electrical vehicles
- 9% Pure battery electrified vehicles

Percentage of respondents that chose the technology they plan to invest the most in.

Note: Percentages may not add up to 100 due to rounding.
Source: KPMG’s Global Automotive Executive Survey 2014.
Roadmap Global Technology Trend of Powertrain

Source: IEA, 2010
# The way forward of Thailand

## Automotive Technology Roadmap for Thailand

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Industry Structure</td>
<td>Strengthen &amp; Maintain as ASEAN production leader and localized R&amp;D</td>
<td>Expand to be R&amp;D hub in Asia</td>
<td>Actively participate in world D&amp;D</td>
</tr>
<tr>
<td>Automotive/Engine System</td>
<td>ICE</td>
<td>Hybrid &amp; Plug-in hybrid</td>
<td>Fuel cell</td>
</tr>
<tr>
<td></td>
<td>Exterior</td>
<td>Light weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interior</td>
<td>Auto electronics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brake &amp; Suspension</td>
<td></td>
<td>Modified Personalized atmosphere</td>
</tr>
<tr>
<td></td>
<td>Electronic</td>
<td>Integrated software</td>
<td>EMC</td>
</tr>
<tr>
<td>Production</td>
<td>QCDEE</td>
<td>Part design</td>
<td>System design</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Focus (Safety, energy, environment) /Localize</td>
<td>User comfort Reverse engineering Battery, Motor</td>
<td>Bio material</td>
</tr>
<tr>
<td>Actions</td>
<td>Knowledge/Infra/Interconnection</td>
<td>R&amp;D Centers</td>
<td>Centers of Excellence</td>
</tr>
<tr>
<td>Policy &amp; Standard</td>
<td>HRD-Infrastructure-Incentive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: MTEC*
The Reason of weight reduction in Vehicle

Performance & Fuel Efficiency

Every 10% reduction in vehicle weight results in 5% to 7% fuel saving

Reduce Carbon Emission

Every kilogram of vehicle weight reduction, there is the potential to reduce carbon dioxide emissions by 20kg

So the incorporation of the lightweight materials as Plastics in automotive is a necessity and our common need
About 600 pounds of petrochemical-derived plastics, composites, rubber, coating and textile products are used in the average vehicle accounting for about 15% of the total vehicle weight.
The global trends that are affecting the choice of materials:

- engine downsizing,
- light-weighting are the global trends that are affecting the choice of materials.
- A 10% reduction in vehicle weight results in a 5-7% fuel saving,
  - no compromise on safety and performance.
- Aluminum, Advanced High-Strength Steel (AHSS)
- Polypropylene (PP), polyamide (PA) and polyurethane (PU)
Automotive Plastics Market for Passenger Car

Source: Dallas, TX (PRWEB) April 27, 2012

**Component** | **Main types of plastics** | **Weight in av. car (kg)**
--- | --- | ---
Bumpers | PS, ABS, PC/PBT | 10,0
Seating | PUR, PP, PVC, ABS, PA | 13,0
Dashboard | PP, ABS, SMA, PPE, PC | 7,0
Fuel systems | HDPE, POM, PA, PP, PBT | 6,0
Body (incl. panels) | PP, PPE, UP | 6,0
Under-bonnet components | PA, PP, PBT | 9,0
Interior trim | PP, ABS, PET, POM, PVC | 20,0
Electrical components | PP, PE, PBT, PA, PVC | 7,0
Exterior trim | ABS, PA, PBT, POM, ASA, PP | 4,0
Lighting | PC, PBT, ABS, PMMA, UP | 5,0
Upholstery | PVC, PUR, PP, PE | 8,0
Liquid reservoirs | PP, PE, PA | 1,0

Total | | 105,0

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Plastics will account for 18% average vehicle weight by 2020, up from 14% in 2000.
Features of plastics is a drivers for their use in vehicles;
• light weight,
• lower tooling costs for high volumes
• be fabricated as a single complex component, eliminating the need for mechanical fasteners.

Weight ratio to car
• A typical passenger car's plastic content is 9% of vehicle weight.
• Europe leads at as high as 11% of vehicle weight.

Percentage for component
• Vehicle interior plastics occupy 48%,
• Exterior plastics account for around 27% and
• Under-hood plastics around 14% of the total plastics used.
• Electrical and cable materials occupy the remaining 11%.
UNDER THE HOOD

Under-hood components using PA6 and PA66 -light weight, temperature and chemical resistance

• Air intake manifolds
• Engine covers
• Radiator end tanks
• Valve covers
• Oil pan modules

Polyphenylene sulphide (PPS) performs better than PA
• Strong candidate OEMs as a metal replacement in order to reduce vehicle weight. (premium price)
Polyamide (PA) are found in under-hood components.
- In the interior segment,
  - door handles,
  - parts of air bag assembly,
  - instrument panels,
  - levers for seats and pedals use PA6 and PA66

The average content of PA is around 11kg and is expected to grow to 13kg by 2017, replacing polymers such as PPS for under-hood applications, for example in charge air ducts. In exterior applications, PA is used where the plastic does not need to meet Class-A (high aesthetic quality) surface requirements.
Polyurethane (PU) as seating applications
Flexible PU are common Rigid PU foams are used in niche applications
• noise, vibration and harshness materials and insulation.

PU Application
• seats,
• door skins,
• boot lining trays,
• parcel shelves,
• center consoles,
• dashboard trims,
• spare wheel trays,
• steering wheels,
• carpet backing and
• headliners.

The average vehicle content of PU is around 23kg. PU foams occupy around 55% while rigid PU occupies 45% rest.
PP applications

- interiors
  - dashboard,
  - dashboard carriers,
  - pillar cladding,
  - door pockets,
  - door panels,
  - consoles and chairs

- Exterior
  - Bumpers,
  - bumper spoilers,
  - roof/trunk spoilers,
  - lateral sidings,
  - rocker panels,
  - body panels
  - wheel arch liners

PP accounts for around 64kg of vehicle content and this is expected to grow to 84kg by 2017,

- as reinforced PP is expected to replace metals in some under-hood and exterior parts (such as tailgates).
- It is also replacing PU foam in seating applications, where hybrid PU-PP foams are being used.
Acrylonitrile butadiene styrene (ABS) finds applications largely in interiors, such as:

- interior grills,
- trims,
- headliners
- center consoles
- Exterior/interior mirror

Facing a significant substitution threat from PP.
The average ABS content is therefore expected to fall from 10.5kg to 9.5kg.

ABS will remain the plastic of choice in applications where paintability or adhesion to other surfaces is required.
- grow more slowly than the vehicle production rate.
Others Plastics Applications

Table: Plastics’ use by type and weight in an average car

<table>
<thead>
<tr>
<th>PART</th>
<th>MAIN PLASTICS TYPES</th>
<th>WEIGHT IN AVERAGE CAR (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bumpers</td>
<td>PP, ABS, PC</td>
<td>10.0</td>
</tr>
<tr>
<td>Seats</td>
<td>PUR, PP, PVC, ABS, PA</td>
<td>13.0</td>
</tr>
<tr>
<td>Dashboard</td>
<td>PP, ABS, PA, PC, PE</td>
<td>15.0</td>
</tr>
<tr>
<td>Fuel systems</td>
<td>PE, POM, PA, PP</td>
<td>7.0</td>
</tr>
<tr>
<td>Body (including body panels)</td>
<td>PP, PPE, UP</td>
<td>6.0</td>
</tr>
<tr>
<td>Under the bonnet components</td>
<td>PA, PP, PBT</td>
<td>9.0</td>
</tr>
<tr>
<td>Interior trim</td>
<td>PP, ABS, PET, POM, PVC</td>
<td>20.0</td>
</tr>
<tr>
<td>Electrical components</td>
<td>PP, PE, PBT, PA, PVC</td>
<td>7.0</td>
</tr>
<tr>
<td>Exterior trim</td>
<td>ABS, PA, PBT, ASA, PP</td>
<td>4.0</td>
</tr>
<tr>
<td>Lighting</td>
<td>PP, PC, ABS, PMMA, UP</td>
<td>5.0</td>
</tr>
<tr>
<td>Upholstery</td>
<td>PVC, PUR, PR PE</td>
<td>8.0</td>
</tr>
<tr>
<td>Other reservoirs</td>
<td>PP, PE, PA</td>
<td>1.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>105.0</td>
</tr>
</tbody>
</table>

Graph: Materials used in European automobile production 1998

HDPE: Fuel Tank
PVC, POM: wire harness
PC: Headlight
PMMA: Taillight

"Partnership & Strengthening for Sustainability"
## Glass Fiber Thermoplastic Composite Feature

Composites offer:
- Strength
- Lightness
- Corrosion resistance
- Insulating Material

Values of Composites over Traditional Materials (wood, steel, Al...)

at reasonable cost

### Weight and Cost comparison

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness [mm]</th>
<th>Weight [kg]</th>
<th>Material cost / Part</th>
<th>Invest</th>
<th>Total cost per assembled part</th>
<th>Integration of functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>0.8</td>
<td>8.7</td>
<td>80%</td>
<td>160%</td>
<td>120%</td>
<td>Low</td>
</tr>
<tr>
<td>Aluminium</td>
<td>1.5</td>
<td>5.9</td>
<td>100%</td>
<td>200%</td>
<td>140%</td>
<td>Low</td>
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<tr>
<td>Magnesium</td>
<td>2.0</td>
<td>5.2</td>
<td>180%</td>
<td>240%</td>
<td>210%</td>
<td>Low</td>
</tr>
<tr>
<td>GMT</td>
<td>2.5 – 3.5</td>
<td>4.5</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>High</td>
</tr>
</tbody>
</table>

Ref: Owen Corning
Structural Parts

• Body parts
• Chassis parts

Plastic composite is a very competitive substitution in near future.

• Long glass fiber composite
• Nano clays composite
• Carbon fiber-epoxy composite