

Weight Reduction Potential in Automotive Sealing Systems with Thermoplastic Polymers



Author: Eric P. Jourdain

Speaker: Leander Kenens

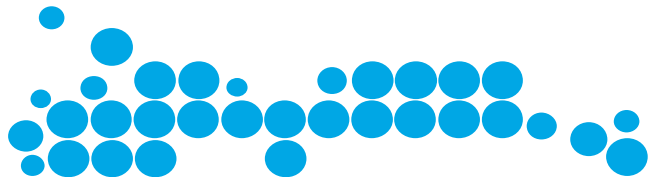
BPRI Nov 25, 09 seminar: new challenges for the polymer transformer

Brussels - Belgium

ExxonMobil
Chemical

Outline

- **Background**
 - Emission reduction in automotive
- **Weight and Fuel Consumption**
 - EU Regulations
 - Automotive materials
- **Weight reduction in Automotive Sealing Systems**
 - Description of weatherseal
 - Material opportunities for lower weight
 - Innovative solutions
- **Conclusions and Perspectives**



Kyoto target for greenhouse gas emissions

- **Reduction from 1990:**
 - 8 percent by 2012,
 - Up to 20 to 30 percent by 2020.
- **Transport worst performing sector**
 - Emission grown by 32 percent since 1990
 - Now contributes for 27% of CO2 emission, up by 6%.
 - Light vehicles contribute for half in the CO2 emissions.

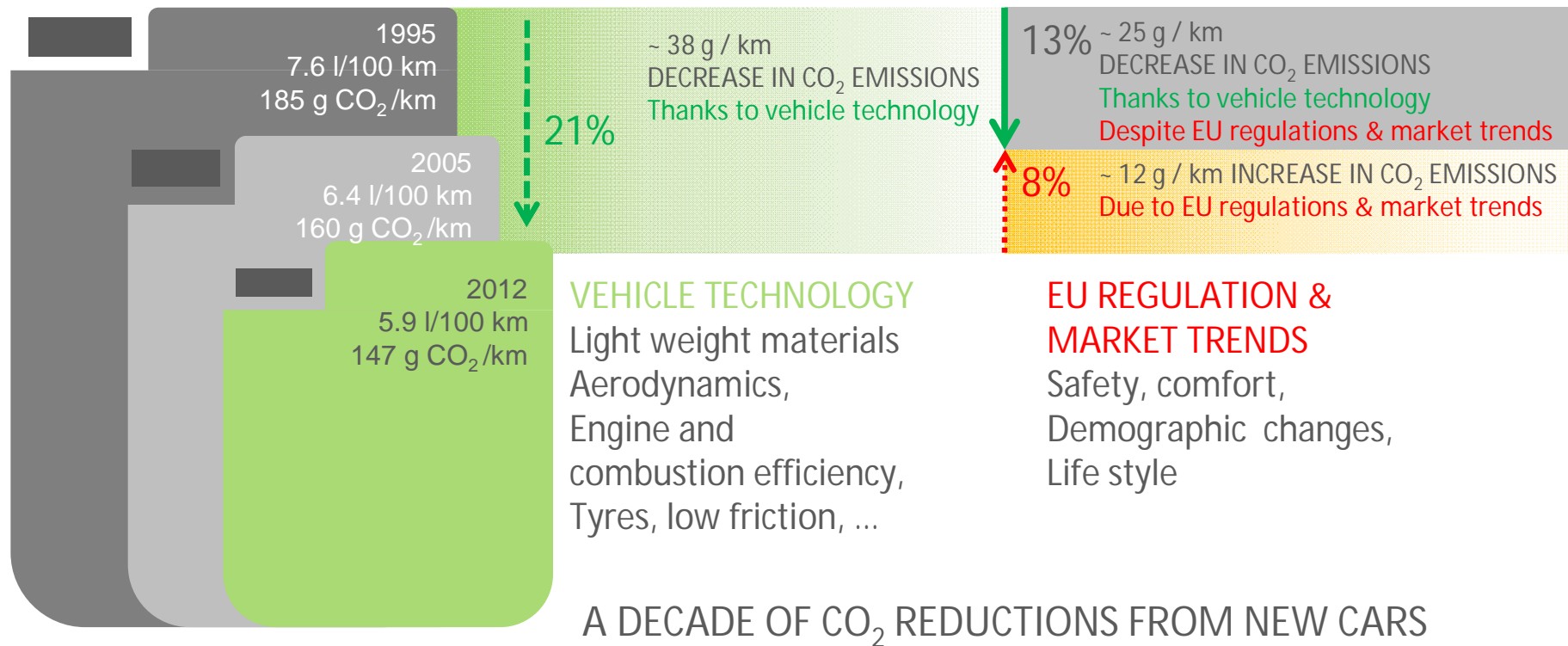


Emission Reduction in Automotive

- **European Commission and the automotive industry have set a 25% emission reduction for 2012,**
 - Average fuel consumption of less than 6 liter / 100km for 2012.
- **Strong relationship between the weight of a car and its fuel consumption.**
 - Short term, weight reduction of every part of the car,
 - Without impairing the ride of the vehicle, its comfort and its performance
 - Nissan promised an average weight reduction of its car models by 15 % over a period of 7 years
 - Would drive a 10% fuel economy.



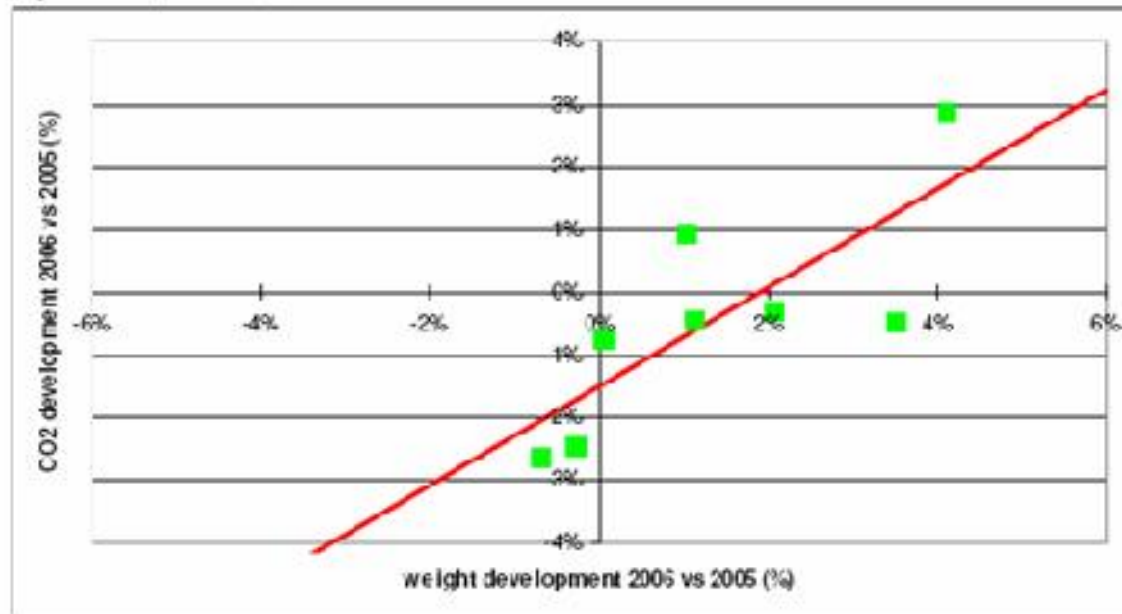
Car Weight and fuel consumption



- Fuel consumption has actually decreased since 1995
- Material technology counter balanced the negative effect on weight of safety and comfort market trends



Car weight and CO2 Emissions



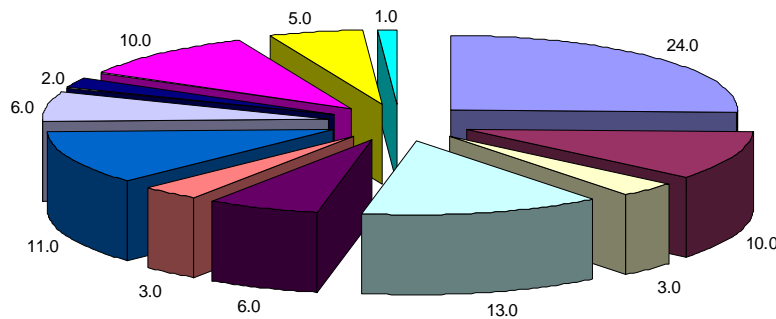
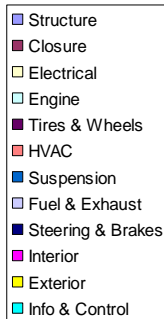
Note: the regression formula is: CO_2 development (in %) = 0.799 * weight development (in %) - 1.5%.
 R^2 , the coefficient of determination, is 0.61.

- OEMs fleet weight average decreased by 10 to 15 per cent for 2015.
- 100 kg weight reduction can yield to about 3 per cent of fuel economy
- Translates into a reduction of 3.5 grams of CO2 emission



each weight percent correlates with 0.8% CO2 emission

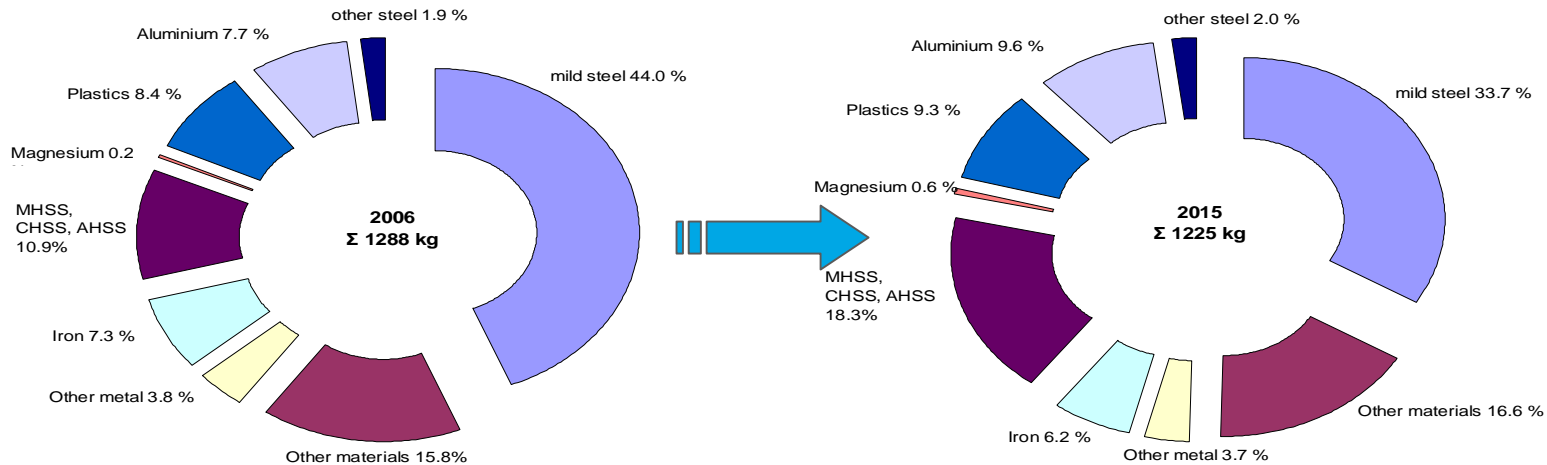
Material Selection for weight reduction



CO2 emission target set at 130 gram / km for 2015.

- 2020:95 grams / km

Source: Frost & Sullivan

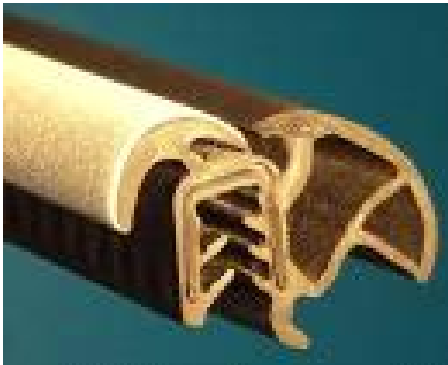


- New types of alloys and plastic combinations can have a strong impact on the weight decrease of chassis, exterior and engine
- A continuous growth of plastic use in automotive parts is observed.



Typical Automotive Weatherseals

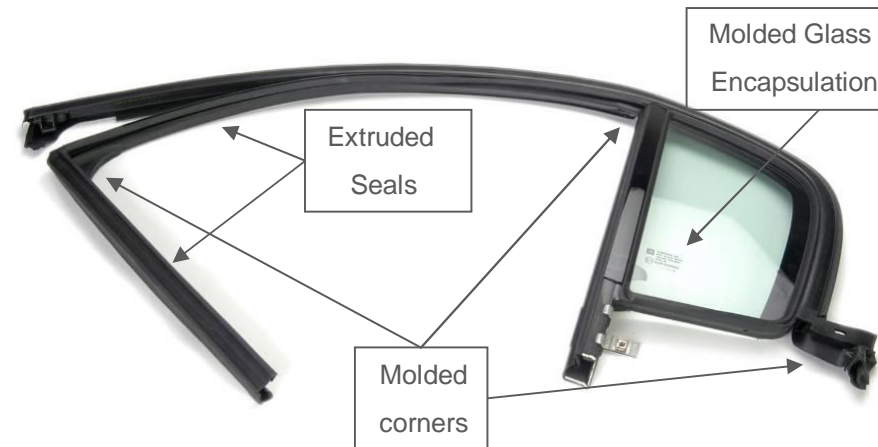
Primary Seals for Doors, trunk, hood



- Combination of Sponge profile and Dense metal carrier for attachment

- Noise insulation
- Water
- Door closing effort

Window Seals



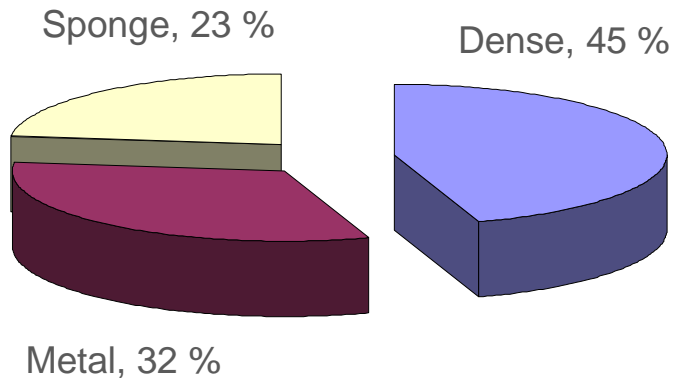
- Complex assembly of dense extrusion with slip coating, corner molding and direct glass encapsulation

- Glass window motion
- Water insulation
- Noise control
- Aesthetic

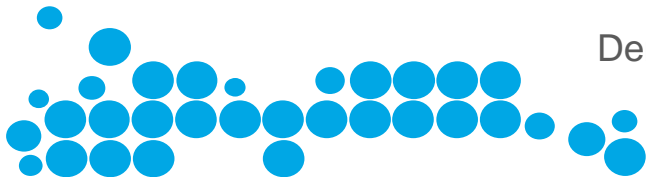
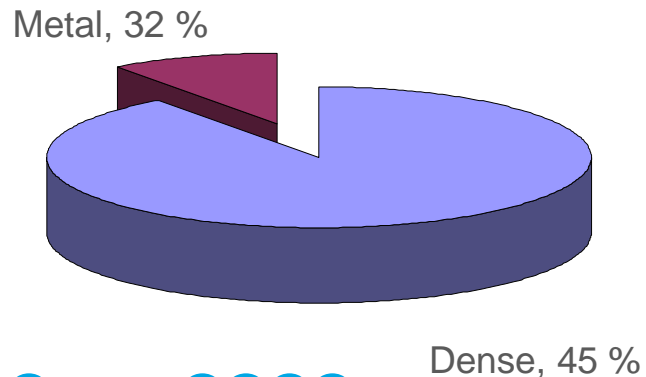


Automotive Sealing System

Dynamic weatherseals



Dense weatherseals



- **Elastomeric parts out of tires**

=> 15 to 25kg / car

- < 2% of the car weight.
- Weatherseal system = 75%

- **Dynamic weatherseal, for door, hood and trunk.**

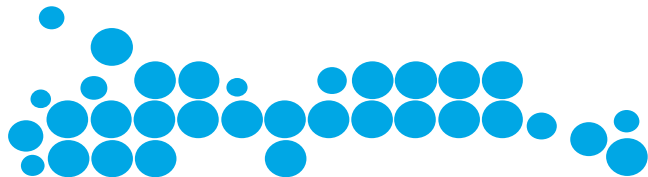
- Sponge foamed bulb of 0.6 density
- Metal carrier as attachment
- 7 to 8 kg per car

- **Dense weatherseal for window sealing**

- Glass Run Channel, belt line seal, glass encapsulation
- Mostly dense rubber, with some metal for attachment
- 5 to 8 kg / car

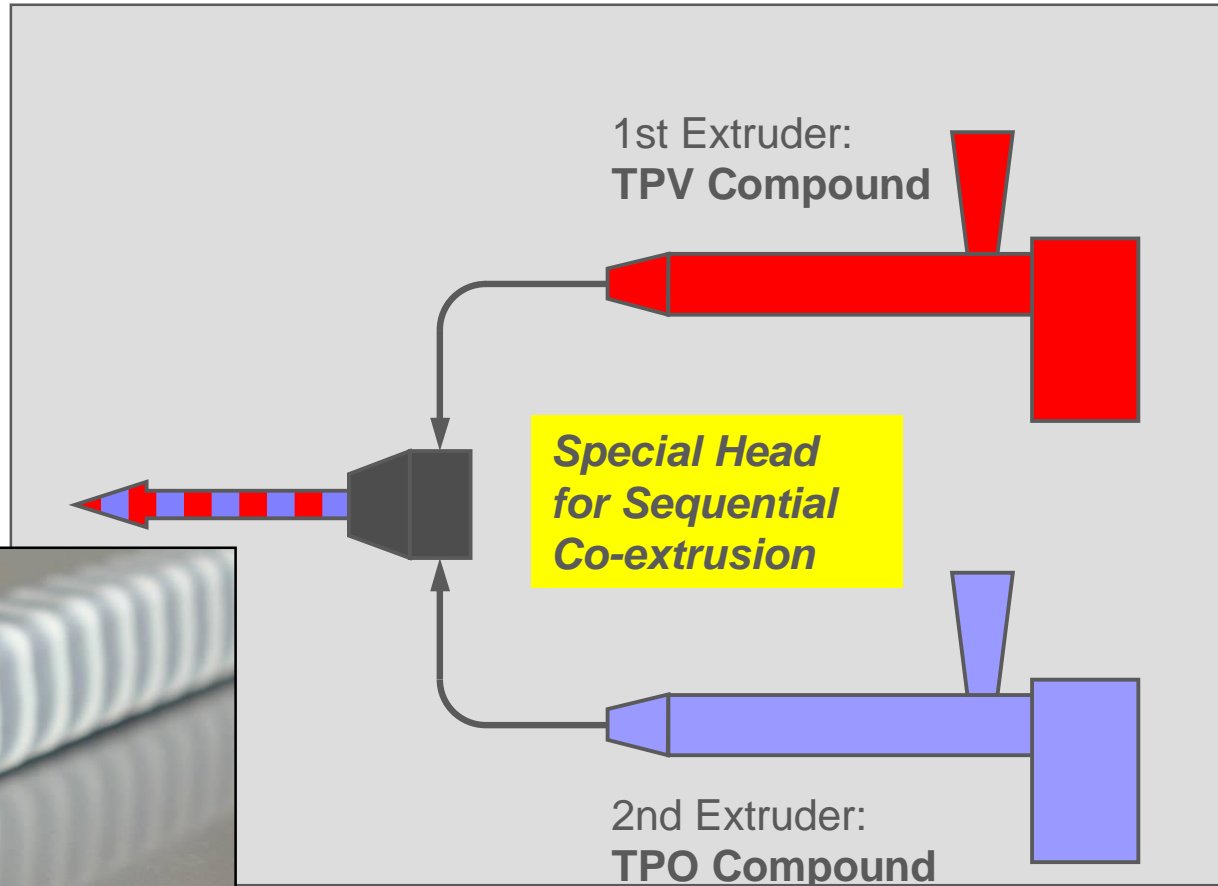
Material selection for lowering weight

- **TPVs proven to be attractive materials vs. EPDM**
 - 25% weight reduction by density effect
- **Combination with Thermoplastic to replace metal**
 - Similar functionality with redesign
 - Up to 50% weight reduction achievable
- **TPVs value offering**
 - Lower weight solution
 - Recyclability
 - Cost reduction opportunities
 - Function integration with multi-component materials
 - Increased productivity
 - Processing and engineering simplification



Mechanical Attachment with Hard - Soft Plastic

- This system produced by sequential co-extrusion
- It can replace metal in weatherseal attachment system



Developed and produced by Troester GmbH & Co.



Benefits of Plastic Attachment System

Metal elimination

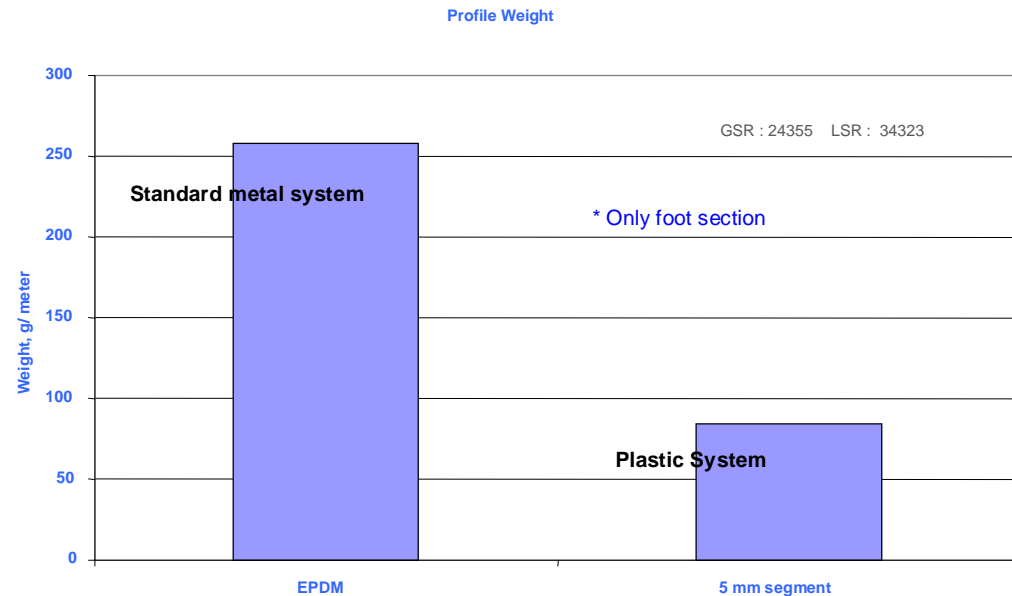
- Weight reduction
- Cost reduction
- No corrosion
- Enhanced recycling

Process simplification

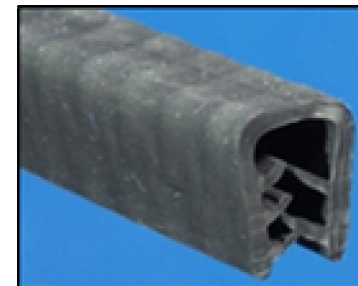
- No more metal rolls and feeding system
- Improved process control

Similar seal and metal sheet design

- No design change needed on car body metal flange



Current System



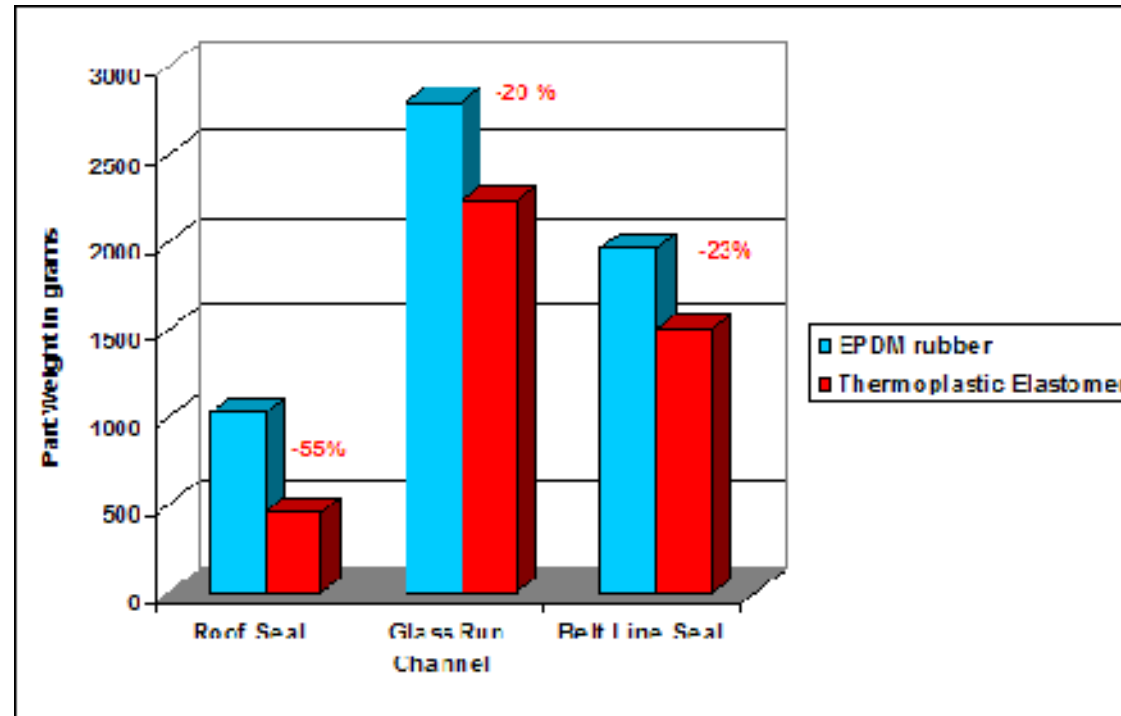
Novel Technology



1-3 kg weight saving / car achievable!

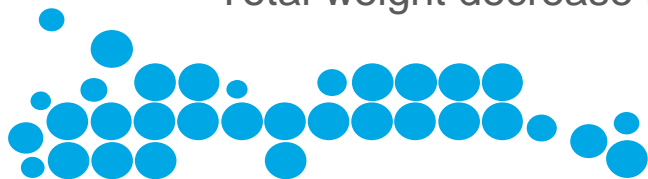
ExxonMobil
Chemical

Dense Weatherseal Weight Reduction Potential



- Lower density thermoplastic elastomer in semi dynamic applications:

- Total weight decrease from 1 to 2 kg per car.

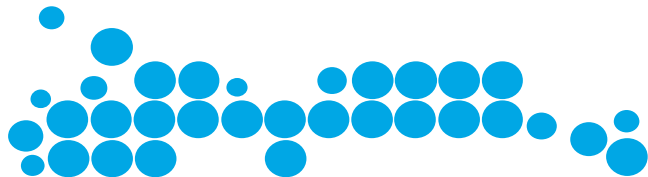


Conclusions

- **Benefits of a conversion from the current metal and rubber material to a combination of hard and soft thermoplastic**
 - Weight reduction potential of the system by about 30%.
 - Relatively large potential for a functional system
 - Can contribute more than the 15% weight reduction target set automotive industry.

- **Direct weight reduction of sealing system is one part of the contribution to the energy efficiency and reduce the CO2 emission.**

=> Supply chain of the component benefits from this material change



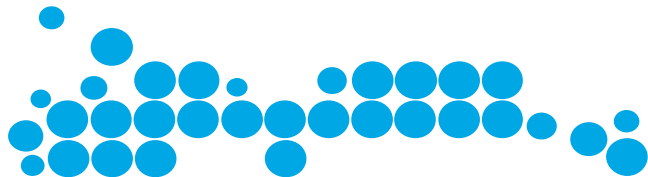
Perspectives

- **Supply Chain Efficiency**

1. Less raw material weight is transported by the supplier to the transformer.
2. Transformer does not use energy to:
 - mix the rubber compound,
 - vulcanize the profile through long hot air line (up to 300°C heat is necessary)
3. Finished part is lighter to move to the OEM assembly line.

- **Major conversion of EPDM weatherseal component into TPE's materials will be observed**

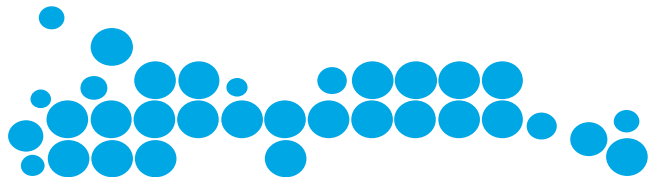
- Already initiated by several new car model projects for 2011 – 2012.





Thanks for your attention!

©2009 ExxonMobil. Use of this information is limited to the specified recipient. While the information is accurate to the best of our knowledge and belief as of the date compiled, it is limited to the information as specified. No representation or warranty, expressed or implied, is made regarding the information, or its completeness, merchantability, or fitness for a particular use. The user is solely responsible for all determinations regarding use and we disclaim liability for any loss or damage that may occur from the use of this information. The terms "we", "our", "ExxonMobil Chemical", or "ExxonMobil" are used for convenience, and may include Exxon Mobil Corporation, ExxonMobil Chemical Company, or any of its stewarded affiliates.



ExxonMobil
Chemical