Main technological strategies of the world automotive industry to reduce air pollution caused by the use of the automobile: Restrictions for their use on the Mexican market

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OBJECTIVES

➢ To analyse the main technological strategies carried out by the world automotive industry to reduce greenhouse gas emissions caused by the use of vehicles.

➢ To point out the obstacles to generalize such solutions in the Mexican market.
CONTENTS

❖ General situation of automotive industry in Mexico

❖ Mexican vehicle fleet age

❖ Greenhouse gas (GHG) emissions in Mexico

❖ Technological strategies to reduce automobile GHG emissions

❖ Obstacles for electric and hybrid vehicles widespread use in Mexican market
THE AUTOMOTIVE INDUSTRY SETTLED IN MEXICO
KEY INDICATORS FOR MEXICO 2014

Worldwide producer of light vehicles (3.22 million units)\(^4\)

World’s largest vehicle producer in the world (3.39 million units)\(^5\)

Exporter of light vehicles\(^9\) (2.64 millions of units)

19 of the top leading automakers are located in 14 states of Mexico

Worldwide producer of heavy vehicles (168,882 units)\(^8\)

Exporter of heavy vehicles (124,015 vehicles)

More than 300 Tier 1 suppliers established in Mexico

Employed workers: 66,017\(^7\)

The automotive industry in Mexico accounts for:

- 3% of the National GDP\(^7\)
- 17% of the manufacturing GDP\(^7\)
- 20% of the Foreign Direct Investment\(^6\) (FDI):
- 32% of Mexican total exports\(^9\)

Sources:
- 4 Source AMIA
- 5 Source: OICA
- 6 Source: Ministry of Economics
- 7 Source: INEGI
- 8 ANPACT
- 9 ProMexico with information from Global Trade Atlas
LIGHT VEHICLE PLANT LOCATIONS IN MEXICO
MEXICAN VEHICLE FLEET AGE
TOTAL REGISTERED VEHICLES IN USE

MEXICAN VEHICLE FLEET AVERAGE AGE

- 2008: 15 years
- 2012: 17 years
- Vehicle fleet is getting older
DOMESTIC MARKET AND SECOND HAND VEHICLE IMPORTS (2005-2014)

Used vehicles imports have represented 80% of total new vehicle sales from October 2005 to December 2014.

43% of these vehicles were not mechanical or pollution checked up.
Mexico
Sources of greenhouse gas emissions (2010)

Not energy related sector 32.60%
Energy production, 33.00%
Energy consumption, 34.40%

Greenghouse Gas Emissions

Mexico
Fuel consumption emissions (2010)

Transport 166.83 MtCO2e 67%
Industry and services 57.27 MtCO2e 23%
Residential and agriculture 24.9 MtCO2e 10%

Technological strategies to reduce automobile GHG emissions
Technological options:

1. Alternative energies
2. New types of motors
3. Other technologies
4. Hybrid and electric vehicles
ALTERNATIVE ENERGIES

**BIOFUELS**
- Ethanol or ethylic alcohol (sugar cane, beet, wheat)
- Biodiesel or Diester (fats and vegetable oils)
- Biogas or methane gas
ALTERNATIVE ENERGIES

- BIOFUELS USAGE RESTRICTIONS:
  - Biofuels have to be mixed up to 10% with conventional fuels.
  - Specially designed engines are necessary for higher concentrations
  - The agriculture surface area is limited and the crops destined to produce biofuels could compete with food production.
ALTERNATIVE ENERGIES

- BIOFUELS USAGE RESTRICTIONS:
  - Forest areas could be needed to produce them, which could result harmful from the environment point of view.
ALTERNATIVE ENERGIES

- LESS POLLUTING FOSSILE ENERGY:
  - Propane or butane (LPG)
  - Natural gas for vehicles (NGV)

There are some commercial vehicles that use LP gas in Mexico.
**ALTERNATIVE ENERGIES**

- **HYDROGEN**
  
  It is an ideal fuel for the environment because when it burns, it releases water vapor.

- **USAGE RESTRICTIONS:**
  
  Automobile cost transformation is 25 000 Euros

  Special and safe infrastructure is needed for a generalized use.
THE ECO INNOVATION IN VEHICLE MOTORS

- The motor performance influences on the volume of polluting emissions, so as less fuel is used by one motor for a given power, its emissions could be less important.

- The more cylinders a motor has, the more polluting emissions it will produce.
THE ECO INNOVATION IN VEHICLE MOTORS

DOWNSIZING
The number of cylinders of a motor is reduced, preserving its performance through a turbocharger and a direct injection.

FUEL BATTERY
It works through gas hydrogen.
OTHER TECHNOLOGICAL INNOVATION

- Catalytic converters
- Transmissions
- Driving help systems
- New assembly technics
- New materials
- New designs
• Vehicle Aerodynamics: reduces the air resistance, which reduces fuel consumption and pollution.
THE ECO INNOVATION IN VEHICLE MOTORS

HYBRID VEHICLES

Their motor combines electrical and mechanical energy of a thermal motorization of fossil fuel. It has fuel savings that go from 4 to 25%.

USAGE RESTRICTIONS

- Vehicle’s high cost
- Battery cost
<table>
<thead>
<tr>
<th>Model</th>
<th>Brand</th>
<th>Price MXP</th>
<th>Price USA DLLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla Model S</td>
<td>Tesla Motors</td>
<td>$1,387,500</td>
<td>$75,000</td>
</tr>
<tr>
<td>Prius</td>
<td>Toyota</td>
<td>$339,700</td>
<td>$18,362</td>
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<tr>
<td>Civic Hybrid</td>
<td>Honda</td>
<td>$361,900</td>
<td>$19,562</td>
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<tr>
<td>BMW i8</td>
<td>BMW</td>
<td>$2,299,900</td>
<td>$124,319</td>
</tr>
<tr>
<td>Chevrolet Volt</td>
<td>Chevrolet</td>
<td>$657,800</td>
<td>$35,557</td>
</tr>
</tbody>
</table>
ELECTRIC VEHICLES

• ELECTRICITY

Electricity production forms could be nuclear, wind and hydraulic so it could be environmental friendly.

• USAGE RESTRICTIONS:

• Urban use; average autonomy from 100 to 150km.
• Freeway 90km.
• Complete recharge 8 hrs.
• Places of quick charge (2 hrs) are needed
# Electric vehicles

<table>
<thead>
<tr>
<th>Model</th>
<th>Brand</th>
<th>Price MX</th>
<th>Price USA DLLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMW i3</td>
<td>BMW</td>
<td>$ 749,000</td>
<td>$ 40,486</td>
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<tr>
<td>Nissan Leaf</td>
<td>Nissan</td>
<td>$ 545,400</td>
<td>$ 29,481</td>
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<tr>
<td>Spark EV 2015</td>
<td>Chevrolet</td>
<td>$ 399,000</td>
<td>$ 21,568</td>
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</tbody>
</table>
Are electric and hybrid vehicles affordable in Mexican market?
Vehicle demand in Mexico
Participación de mercado de vehículos por segmento, 2012 y 2013

- Subcompacto: 29.8% (2013), 31.1% (2012)
- Compacto: 29.4% (2013), 28.3% (2012)
- SUV’s: 19.0% (2013), 17.2% (2012)
- Pick-up’s: 13.8% (2013), 15.0% (2012)
- Lujo: 5.9% (2013), 5.7% (2012)
- Minivan’s: 1.6% (2013), 2.1% (2012)
- Deportivos: 0.5% (2013), 0.6% (2012)
### Los diez modelos más vendidos

<table>
<thead>
<tr>
<th>Posición</th>
<th>Modelo</th>
<th>Marca</th>
<th>Segmento</th>
<th>Unidades</th>
<th>% del Mercado</th>
<th>Variación 2015 vs. 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AVEO</td>
<td>GM</td>
<td>Subcompactos</td>
<td>76,696</td>
<td>5.7%</td>
<td>11,302</td>
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<tr>
<td>2</td>
<td>VERSA</td>
<td>Nissan</td>
<td>Compactos</td>
<td>64,454</td>
<td>4.8%</td>
<td>10,677</td>
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<tr>
<td>3</td>
<td>VENTO</td>
<td>VW</td>
<td>Subcompactos</td>
<td>53,096</td>
<td>3.9%</td>
<td>14,622</td>
</tr>
<tr>
<td>4</td>
<td>NUEVO JETTA</td>
<td>VW</td>
<td>Compactos</td>
<td>50,385</td>
<td>3.7%</td>
<td>15,331</td>
</tr>
<tr>
<td>5</td>
<td>MARCH</td>
<td>Nissan</td>
<td>Subcompactos</td>
<td>49,658</td>
<td>3.7%</td>
<td>13,093</td>
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<tr>
<td>6</td>
<td>TSURU</td>
<td>Nissan</td>
<td>Subcompacto</td>
<td>49,134</td>
<td>3.6%</td>
<td>3,610</td>
</tr>
<tr>
<td>7</td>
<td>SPARK</td>
<td>GM</td>
<td>Subcompactos</td>
<td>41,914</td>
<td>3.1%</td>
<td>5,435</td>
</tr>
<tr>
<td>8</td>
<td>SENTRA 2.0</td>
<td>Nissan</td>
<td>Compactos</td>
<td>35,996</td>
<td>2.7%</td>
<td>5,369</td>
</tr>
<tr>
<td>9</td>
<td>Chasis Largo</td>
<td>Nissan</td>
<td>Camiones Ligeros</td>
<td>31,700</td>
<td>2.3%</td>
<td>6,938</td>
</tr>
<tr>
<td>10</td>
<td>SONIC</td>
<td>GM</td>
<td>Subcompactos</td>
<td>29,606</td>
<td>2.2%</td>
<td>7,515</td>
</tr>
</tbody>
</table>

**Fuente:** Elaborado por AMDA con información de AMIA

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### MOST WIDELY SOLD AUTOMOBILE PRICES

<table>
<thead>
<tr>
<th>Brand</th>
<th>Model</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM</td>
<td>Aveo</td>
<td>$149,900</td>
</tr>
<tr>
<td></td>
<td>Spark LS</td>
<td>$123,000</td>
</tr>
<tr>
<td></td>
<td>Spark LTZ</td>
<td>$198,100</td>
</tr>
<tr>
<td>Nissan</td>
<td>Tsuru</td>
<td>$140,700</td>
</tr>
<tr>
<td></td>
<td>Versa Sense</td>
<td>$222,500</td>
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<tr>
<td></td>
<td>Versa Exclusive</td>
<td>$222,500</td>
</tr>
<tr>
<td></td>
<td>Sentra 2.0 Sense MT</td>
<td>$236,800</td>
</tr>
<tr>
<td></td>
<td>Sentra 2.0 Exclusive</td>
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</tr>
<tr>
<td>Volkswagen</td>
<td>Vento Startline transmission manual</td>
<td>$169,900</td>
</tr>
<tr>
<td></td>
<td>Vento Highline transmission triptonic</td>
<td>$229,900</td>
</tr>
<tr>
<td></td>
<td>Nuevo Jetta 2.0 Manual</td>
<td>$229,900</td>
</tr>
<tr>
<td></td>
<td>Volkswagen Jetta TDI</td>
<td>$356,940</td>
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</tbody>
</table>
## AUTOMOVILE PRICE COMPARATION

<table>
<thead>
<tr>
<th>Category</th>
<th>Make</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>Most Expensive Fossil Fuel Auto</td>
<td>Volkswagen JettaTDI</td>
<td>$357,000</td>
</tr>
<tr>
<td>Cheapest Electric Automobile</td>
<td>Chevrolet Spark EV</td>
<td>$399,000</td>
</tr>
<tr>
<td>Cheapest Hybrid Automobile</td>
<td>Toyota Prius</td>
<td>$340,000</td>
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</tbody>
</table>
CUADRO 5
PERCEPTORES DE INGRESOS E INGRESO CORRIENTE MONETARIO TRIMESTRAL POR RANGOS DE SALARIO MÍNIMO, SEGÚN TAMAÑO DE LOCALIDAD, 2014
(Porcentajes)

<table>
<thead>
<tr>
<th>Múltiplos de salarios mínimos generales</th>
<th>Total</th>
<th>Tamaño de localidad</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Perceptores</td>
<td>Ingreso</td>
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<tr>
<td></td>
<td>Total</td>
<td>75 330 247</td>
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<tr>
<td>menor a 2.00</td>
<td>64.2</td>
<td>19.9</td>
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<tr>
<td>2.01 - 6.00</td>
<td>28.7</td>
<td>41.4</td>
</tr>
<tr>
<td>6.01 y más</td>
<td>7.0</td>
<td>38.8</td>
</tr>
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</table>
CONCLUSIONS

- Automotive industry is a very important activity for Mexican economy.
- Fuel automobiles produce the most greenhouse gas emissions during their use phase.
- Research and Development strategies have been implemented by automotive industry in order to mitigate these emissions.
Electric and hybrid vehicles are environmental friendly.

There is a lack of infrastructure for electric vehicle use in México.

Hybrid vehicles are the most possible option for Mexican market.
• Electric and hybrid vehicles are unaffordable for most Mexicans
• There are important restrictions for their use in Mexican market
¡Gracias!  Thank you!
Vielen Dank!  Merci beaucoup!