Renault’s roadmap towards Environmental Life Cycle Management

Philippe Schulz, Senior Manager
Strategic Environmental Planning

Cheuvreux, London - October 28th, 2008
THREE MAJOR ENVIRONMENTAL CHALLENGES AT THE SAME TIME …

URBAN AIR POLLUTION

GLOBAL WARMING

RESOURCES DEPLETION
... THREE OPPORTUNITIES FOR RENAULT

- ENVIRONMENT & HEALTH
- TOP 3 CO₂
- LIFE CYCLE ...UP TO RECYCLING
Life Cycle analysis for industrial and commercial products
The tool selected by Renault: Life Cycle Analysis

1. International

2. Normalized

3. Renault is actor
Life Cycle Analysis results

New Laguna
2.0l dCi 130cv

Abiotic Depletion Potential
- Vehicle production: 13%
- Fuel production: 83%
- Vehicle use: 2%
- End of life: 2%

Acidification Potential
- Vehicle production: 33%
- Fuel production: 24%
- Vehicle use: 40%
- End of life: 4%

Eutrophication Potential
- Vehicle production: 22%
- Fuel production: 13%
- Vehicle use: 63%
- End of life: 2%

Global Warming Potential
- Vehicle production: 15%
- Fuel production: 9%
- Vehicle use: 73%
- End of life: 3%

Photochem. Ozone Creation Potential
- Vehicle production: 40%
- Fuel production: 20%
- Vehicle use: 37%
- End of life: 3%

Stéphane Morel

October 28th, 2008
From Laguna 2 to Laguna 3, a reduction of the environmental footprint

- Abiotic Depletion Potential: - 9%
- Global Warming Potential: - 10%
- Acidification Potential: - 35%
- Eutrophication Potential: - 40%
- Photochem. Ozone Creation Potential: - 1%

Ref 100% Total life cycle impact

Laguna II 1.9dCi110cv
Laguna III 1.5dCi110cv

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...Remember: The first commitment of a car manufacturer on the vehicle life cycle

Plants  Use  End of Life
Three Renault eco² criteria
*Measurable and auditable*

- **Plants**
  - ISO 14001 Plants

- **Use**
  - < 140 g CO₂ /km
  - Or Biofuels

- **End of Life**
  - 95% valorizable &
  - 5% of recycled plastics

Initiate the Dialog on Life Cycle with customers
Renault eco²: Use of best practices to develop affordable and ecological cars

1. MANUFACTURING PLANTS
2. ENERGY EFFICIENCY
3. RECYCLING
10 YEARS OF PROGRESS IN OUR MANUFACTURING PLANTS

- Energy consumption: -25%
- Atmospheric OVC emissions: -34%
- Waste production: -64%
- Water consumption: -61%
- Effluents: -47%
Examples of best practices: End of Life Vehicles

1. 95% RECYCLABILITY
   - 2008 HOMOLOGATION OF FUTURE MEGANE

2. USE OF RECYCLED MATERIALS
   - 2008: RENAULT - SITA (SUEZ) JV IN FRANCE
Recovered plastics
At least 5% of the vehicle’s plastic content comes from recycling

Modus 13%
Scénic 8%
Grand Scénic 8%
Clio III 10%
Mégane 9%
New Twingo 9%
Laguna 17%
Renault Commitment 2009
Be in the top three in terms of CO$_2$ emissions

2006
- 120 g/km
- 140 g/km

2007
- 120 g/km
- 140 g/km

2008
- 120 g/km
- 140 g/km
Fostering the progress from generation to generation (Laguna, Diesel engines)

<table>
<thead>
<tr>
<th>Model</th>
<th>Year</th>
<th>Engine Type</th>
<th>HP</th>
<th>Fuel Consumption (l/100km)</th>
<th>CO₂ Emissions (g/km)</th>
<th>NEDC Cycle</th>
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<td>2.2 dT</td>
<td>115</td>
<td>7.2</td>
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<td>110</td>
<td>5.6</td>
<td>150</td>
<td>NEDC cycle</td>
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<tr>
<td>NEW LAGUNA 2007</td>
<td>2007</td>
<td>1.5 dCi</td>
<td>110</td>
<td>4.9</td>
<td>130</td>
<td>-32%</td>
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</table>

-32% reduction in CO₂ emissions.
Fostering the progress from generation to generation (Megane, Gasoline engines)

<table>
<thead>
<tr>
<th></th>
<th>MEGANE I 1996</th>
<th>MEGANE II 2002</th>
<th>MEGANE III 2008</th>
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<tbody>
<tr>
<td>Fuel consumption (l/100km)</td>
<td>2 l 16v</td>
<td>2 l 16v</td>
<td>1.4 l TCE 130</td>
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<tr>
<td>CO₂ emissions (g/km) NEDC cycle</td>
<td>8.4</td>
<td>8.0</td>
<td>6.6</td>
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<td>200</td>
<td>192</td>
<td>156</td>
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</table>

-22%
A WIDER OFFER UNDER 140 g/km CO₂ IS A MARKET OPPORTUNITY

1 million vehicles emitting less than 140 g/km CO₂ in 2008

1 million vehicles emitting less than 140 g/km CO₂ in 2008

1/3 emitting less than 120 g/km

16 versions

42 versions

333,333

48 versions

150 versions

European Union sales (thousand vehicles)

Emission level (g/km CO₂)

1/3 emitting less than 120 g/km

101-120

121-140
Each gramme of CO₂ saved per km has a customer value

1g CO₂/km
0,04 l/100 km

Average Customer value: 52 €/ g/km
Vehicle and powertrain roadmap

- **CO₂ emission reduction**
  - 0% 10% 20% 30% 40% 50%

- **Pollutant emission reduction (NOₓ+10PM)**

- **Euro6 D**
- **Euro4/6 G**
- **Euro5 D**

- **Bio-Fuels**
  - 1st Gen
  - 2nd Gen

- **EGR LP**
- **variable Swirl**

- **Extra Heavy downsizing**
- **Heavy downsizing**
- **Mild downsizing GDI**
- **Mild downsizing**

- **GDI**
- **Heavy downsizing**

- **Diesel**
- **Gasoline**

- **Hybrids**
  - **Plug-in hybrid**
  - **Battery EV**
  - **Battery EV + Fuel Cell + on-board H₂ ?**

- **Electrical**

- **Thermal energy conversion**
- **Bio-Fuels**
- **2nd Gen**
- **Electrical Plug-in hybrid**
- **Next gen.Battery EV**

- **Micro Hybrid**
- **Mild downsizing**
- **Mild downsizing**

- **e-drive**

- **2010**
- **2015**
- **2020**

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Downsizing....

Diesel engine

1.5 dCi

Gasoline engines

1.2 TCE 100

1.4 TCE 130
Eco-driving

(-20%)
Renault eco² Line-up

2007

Megane
Coupé-Cabriolet
Estate
Sedan
Scenic

2008

Clio Campus
Clio Grand Tour
Grand Modus
Kangoo
Kangoo Express
Laguna Estate

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Roadmap: EV as the ultimate Zero Emission Vehicle

CO₂ emission reduction
Pollutant emission reduction (NOₓ+10PM)

0% 20% 40% 60% 80% 100%

Diesel
Gasoline
Hybrids
EV

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Three main reasons for a massive deployment of electric cars during the next decade

- **1. Technology & Cost**
  - Advanced Li-ion batteries
  - High volumes production

- **2. Sociology & Market**
  - EV driving range (>> 100 km)
  - > 50 % of world population in cities (2006)
  - Suburban drivers: 87 % less than 60 km/day !

- **3. Regulations & Incentives**
  - Car ban or restriction in cities
  - CO₂ taxes on cars
# A complete Renault Electrical Vehicle Line-up

<table>
<thead>
<tr>
<th></th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<tr>
<td>e Sedan (Israel)</td>
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<td>e LCV (Fleets)</td>
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Mass production
Environment in the heart of Renault’s strategy

1. Vehicles
2. Powertrains
3. Technology
4. Environment
Sustainable Development Governance:
World class level acknowledgment

World Dow Jones Sustainability Index
Renault Score

Economics  Environmental  Social  Global

Renault Member
2006, 2007 & 2008 !