The ADAC EcoTest

„Can we prevent another dieselgate?“
FIA Foundation, London

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The players in consumer protection:

FIA partner clubs, EU, Federal Government, ICRT
ADAC emissions lab and low-temperature dynamometer

Emissions lab
- Temperature range: -10°C to +40°C
- max. speed 200 kph
- Simulation of uphill sections (up to 20%)
- CO, HC, CH₄, THC, NMHC, NOₓ, NO, NO₂, PM, PN, CO₂
- official type approval lab accredited by KBA

Low-temperature dynamometer
- Temperature range: -25°C to +30°C
- Horsepower up to 2 x 260 kW (2 x 350 hp)
- max. speed up to 260 kph
- OBD data interface
- Variable wheelbase: between 2.36 and 3.36 m
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ADAC EcoTest

- Since 2003 comprehensive consumer information regarding the eco-friendliness of vehicles
- Assessment of fuel consumption (CO\textsubscript{2} emissions) and pollutant emissions
- Based on specially developed real-life driving cycles, which go beyond the mandatory type approval test cycles
- Objective: innovation, light-weight design and fuel efficiency across all vehicle classes

Unlike under current legislation
- No bonus for diesel engines
- No bonus for particulate emissions of petrol DI
- Test of aggressive driving emissions (highway / off-cycle)
- Well-to-wheel assessment for better comparability of electric vehicles (electric cars not generally “zero CO\textsubscript{2} emission vehicles”)
EcoTest rating is more than CO₂ and fuel consumption

A car has to be:
- clean
- efficient
- tested under conditions near to reality

Additional information: Fuel consumption

**Pollutant rating** (absolut)

**CO₂ rating** (well-to-wheel, class dependent scale)
5-Star Vehicles in EcoTest:
- CNG e.g.:
  » Skoda Octavia 1.4 TSI G-TEC
  » VW Golf 1.4 TGI BlueMotion
  » Audi A3 Sportback g-tron S tronic
  » Mercedes E200 Natural Gas Drive
- Elektro e.g.:
  » VW e-up!
  » BMW i3
  » Nissan Leaf tekna
  » VW e-Golf
  » KIA Soul EV
  » Ford Focus Electric
- Hybrid e.g.:
  » Toyota Prius 1.8 Plug-In Hybrid
  » Mercedes S 300 BlueTEC Hybrid
  » Toyota Prius 1.8 Hybrid
- Diesel e.g.:
  » Mercedes C 220 BlueTEC
  » VW Golf 1.6 TDI BlueMotion
  » Skoda Octavia 1.6 TDI Green Line
ADAC EcoTest: NOx WLTC 2.0 (warm)
Euro 5 and Euro 6 diesel cars - tested since 2014

Maximum emission limit:
Euro 5: 180 mg/km
Euro 6: 80 mg/km

(*) homologized as Euro 5 test car while using Euro 6 Technology
(**) homologized as Euro 5 test car
ADAC EcoTest – Results

Fuel consumption in EcoTest vs. manufacturer’s specifications
Conclusion

- The ADAC EcoTest is the only popular eco-friendliness car rating, which is based on own measurements independent from car manufacturers.
- EcoTest measurements show already since several years
  - increased emission values off-cycle. Especially for NO\textsubscript{x} (Diesel) and PN (Petrol DI)
  - increased fuel consumption in comparison to the manufacturer’s information. The largest deviations are indicated for vehicles with electric and hybrid drive.

But, due to the new emission legislation (WLTP, RDE) and the actual dieselgate discussions, ADAC EcoTest will be adjusted once more in 2016.
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EcoTest 2016 – planned adjustments

Pollutants evaluation on emissions test bench (ETB)
- WLTP hot, WLTP cold, ADAC highway test
- HC, CO, NO$_x$, PM and PN
- across all classes
- Worst case across all

ETB CO$_2$ evaluation
- WLTP hot, WLTP cold, ADAC highway test
- WTW
- across all classes
- CF urban, extra-urban and highway

RDE
- Only vehicles having the potential for 4/5 stars on the ETB
  - 2.1 conformity factor -> confirms 4 stars
  - 1.5 conformity factor -> confirms 5 stars
EcoTest 2016 – additional ETB requirements

- **Air conditioning**: on during the hot test
- **Ambient temperature**: 22°C
- **Mass**: weighed mass + 250kg
- **Gear shift indicator**: on
- **2-axle operation**: on, no test bench mode (exceptions justified in writing)
- **Modes**: mode in which the car starts (if this mode remains active, then select “eco”)
- **Battery**: charge before cold start
EcoTest 2016 – ETB cycles

Previously: NEDC cold, WLTC hot, ADAC highway cycle

NEW:

✓ ▶ Warm up engine, adapt to load, coast (wheel friction curve taken from NEDC until WFC from WLTC is available)
✓ ▶ Conditioning run 3 minutes @ 50kph
✓ ▶ WLTC 5.3 (hot): with air conditioning, daytime running lights, gear shift indicator (serves as precon)
✓ ▶ Charge battery (necessary since engine bonnet open)
✓ ▶ WLTC 5.3 (cold): with air conditioning, daytime running lights, gear shift indicator
✓ ▶ Conditioning run 3 minutes @ 50kph
✓ ▶ ADAC highway cycle @ 130kph: with air conditioning, daytime running lights, gear shift indicator
EcoTest 2016 – ETB pollutant limits

Previously: Only NEDC cold and ADAC highway cycle, worst case PM separately

NEW:
- Stricter limits in line with ADAC call for 1.5 CF
- Worst case across all pollutants
- PN in all cycles
- PM and PN for all types of engines
- Ongoing CO and HC rating
- 0 points for exceeding Euro 6 limits
- All cycles taken into account
EcoTest 2016 – ETB pollutants weighting

Previously: 70% NEDC cold and 30% ADAC highway cycle

NEW:

- ADAC VEK: 1/3 urban, 1/3 extra-urban, 1/3 highway weighting remains valid
- Urban = Low (3km, 589sec) + Middle (5km, 433sec)
- Extra-urban = High (7 km, 455 sec) + Extra High (8 km, 323 sec)
- ADAC highway cycle (2 x 9.2km, 2 x 264sec)

Worst case NOx, HC, CO, PM, PN

Pollutant points
EcoTest 2016 – ETB CO₂ limits

Previously: Class-based system

NEW:

✓ No classes
✓ Ongoing WTW rating

- Average of WLTP hot, WLTP cold and ADAC highway cycle
- Fuel consumption in urban, extra-urban and highway cycles

<table>
<thead>
<tr>
<th>Vehicle class</th>
<th>50 pts @ [g/km]</th>
<th>10 pts @ [g/km]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>180</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
<td>180</td>
</tr>
<tr>
<td>3</td>
<td>90</td>
<td>195</td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>215</td>
</tr>
<tr>
<td>5</td>
<td>115</td>
<td>240</td>
</tr>
<tr>
<td>6</td>
<td>130</td>
<td>270</td>
</tr>
<tr>
<td>7</td>
<td>145</td>
<td>300</td>
</tr>
</tbody>
</table>
EcoTest 2016 – Results

Points vs. Pollutant rating

CO2 rating vs. Points

ADAC Autobahn

Pollutant rating

CO2 rating

Petrol

Diesel

Petrol hybrid

Diesel hybrid

Electric

LPG

CNG

Points

Punkte

Diesel

Meden

Gase

Benzin

Benzin-Hybrid

Diesel-Hybrid

Elektrik

LPG

CNG

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ADAC Autobahn

Pollutant rating

CO2 rating

Petrol

Diesel

Petrol hybrid

Diesel hybrid

Electric

LPG

CNG

Points

Punkte
EcoTest 2016 – RDE

Previously: No RDE

NEW:
- First lap (test run) in line with directive, possibly a 2nd lap driven faster outside the requirements of the directive; the final decision to be taken when the first test metrics are in.
- Not feasible for all 150 Autotest car reviews
- Only vehicles having the potential for 4/5 stars on the ETB qualify for RDE test
- 2.1 conformity factor -> confirms 4 stars
- 1.5 conformity factor -> confirms 5 stars
EcoTest 2016 – NO\textsubscript{x} compared across cycles

- **WLTC cold:** compared to all other cycles, significantly higher NO\textsubscript{x} emissions in DI petrol engines. Diesel behaviour varying
- **WLTC hot:** challenging for diesel engines
- **ADAC highway cycle:** diesel engines show very high NO\textsubscript{x} emissions
- **US 06:** more NO\textsubscript{x} than in WLTC hot

![Graph showing NO\textsubscript{x} emissions across different cycles for various vehicles.](image-url)

477-647 mg/km
EcoTest 2016 – CO₂ compared across cycles

- **WLTC cold**: higher CO₂ emissions compared to WLTC hot
- **WLTC hot**: higher than NEDC cold
- **ADAC highway cycle**: high CO₂ emissions
- **US 06**: varying
Conclusion

- EcoTest rating will be improved once more by planned adjustments in 2016.
- EcoTest offers more realistic emission and fuel consumption data for consumers, based on car manufacturer independent measurements.

EcoTest can be used as a basis for the new Green NCAP protocol and roadmap.

Regarding WTT a conclusion for energy sources in different countries has to be developed to drive clean vehicle technology (efficient, clean), as well as clean energy production and energy supply.
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Green NCAP

- Green NCAP is a common Project of the Global New Car Assessment Program (GNCAP) and the Global Fuel Economy Initiative (GFEI).

- Partner of GFEI (Green Fuel Economy Initiative)
  - FIA Foundation
  - IEA
  - International Transport Forum
  - UNEP
  - ICCT
  - IST UC DAVIS.

- Aim
  - Development of a new rating system regarding the environmental friendliness of cars based on emissions and energy efficiency.
  - Implementation of a independent platform similar to Euro NCAP (rating system for vehicle safety)
Global NCAP Cars, EcoTest Results in Detail

Ford Fiesta 1.0 Trend
Suzuki Alto 1.0 Basic
VW Polo 1.2 Trendline
Tata Nano
Hyundai i10 1.1 Classic
## Global NCAP Cars, EcoTest Results in Detail

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Power [kW]</th>
<th>Engine/ fuel</th>
<th>FC [l/100km]</th>
<th>CO₂ EcoTest</th>
<th>Pollution Score</th>
<th>CO₂ Score</th>
<th>EcoTest Score</th>
<th>EcoTest Stars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ford Fiesta 1.0 Trend</td>
<td>48</td>
<td>Gasoline</td>
<td>8,14</td>
<td>210,94</td>
<td>25</td>
<td>4</td>
<td>29</td>
<td>*</td>
</tr>
<tr>
<td>Hyundai i10 1.1 Classic</td>
<td>51</td>
<td>Gasoline</td>
<td>6,85</td>
<td>186,00</td>
<td>43</td>
<td>10</td>
<td>53</td>
<td>***</td>
</tr>
<tr>
<td>Suzuki Alto 1.0 Basic</td>
<td>50</td>
<td>Gasoline</td>
<td>5,70</td>
<td>151,69</td>
<td>31</td>
<td>21</td>
<td>52</td>
<td>***</td>
</tr>
<tr>
<td>Tata Nano</td>
<td>28</td>
<td>Gasoline</td>
<td>4,30</td>
<td>120,95</td>
<td>49</td>
<td>34</td>
<td>83</td>
<td>****</td>
</tr>
<tr>
<td>VW Polo 1.2 Trendline</td>
<td>51</td>
<td>Gasoline</td>
<td>7,12</td>
<td>195,78</td>
<td>43</td>
<td>11</td>
<td>54</td>
<td>***</td>
</tr>
</tbody>
</table>
The best vehicle is the Tato Nano with 83 points in the EcoTest, the fuel consumption is 4.30 l/100 km or 25.32 mpg (US), resulting in CO₂-emissions of 121.0 g/km (WTW).

The worst vehicle is the Ford Fiesta with 29 points in the EcoTest, the fuel consumption is 8.14 l/100 km or 47.93 mpg (US), resulting in CO₂-emissions of 210.9 g/km (WTW).
EcoTest as a Phase-in for a Green NCAP Roadmap

Funding
- Write a Funding Scheme for a Funding Request by Global NCAP, Green NCAP

High Awareness
- Develop a brand based on ADAC 150 Europ. cars + Latin NCAP, Global NCAP

High Quality
- Develop an partnership scheme and accreditation / quality scheme for partner and labs

Best Tests Roadmap
- Develop a roadmap for further investigations, RDE, worldwide rollout or cities
Thank you for your attention!