Commission Implementing Decision of 18 November 2014 on the approval of the battery charging Webasto solar roof as an innovative technology for reducing CO2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (Text with EEA relevance) (2014/806/EU)

COMMISSION IMPLEMENTING DECISION

of 18 November 2014

on the approval of the battery charging Webasto solar roof as an innovative technology for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council

(Text with EEA relevance)

(2014/806/EU)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emissions performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles[(1)], and in particular Article 12(4) thereof,

Whereas:

(1) The supplier Webasto Roof & Components SE (the 'Applicant') submitted an application for the approval of the battery charging Webasto solar roof as an innovative technology on 5 March 2014. The application was found to be complete and the period for the Commission's assessment of the application started on the day following the date of official receipt, i.e. 6 March 2014.

(2) The application has been assessed in accordance with Article 12 of Regulation (EC) No 443/2009, Commission Implementing Regulation (EU) No 725/2011[(2)] and the Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 (the Technical Guidelines)[(3)].

(3) The application refers to the battery charging Webasto solar roof. The solar roof consists of a photovoltaic (PV) panel which is installed on the vehicle roof. The photovoltaic panel converts ambient energy into electrical energy which, via a DC-DC-converter, is stored in an on-board battery. The Commission finds that the information provided in the application demonstrates that the conditions and criteria referred to in Article 12 of Regulation (EC) No 443/2009 and in Articles 2 and 4 of Implementing Regulation (EU) No 725/2011 have been met.

(4) The Applicant has demonstrated that a battery charging solar roof system of the kind described in this application did not exceed 3 % of the new passenger cars registered in the reference year 2009.

(5) In order to determine the CO_2 savings that the innovative technology will deliver when fitted to a vehicle, it is necessary to define the baseline vehicle against which the efficiency of the vehicle equipped with the innovative technology should be compared as provided for in Articles 5 and 8 of Implementing Regulation (EU) No 725/2011. The Commission finds that the baseline vehicle should be a vehicle variant that in all aspects is identical to the eco-innovation vehicle with the exception of the solar roof and, where applicable, without the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage. For a new version of a vehicle in which the solar roof panel is installed the baseline vehicle should be the vehicle in which the solar roof panel is disconnected and the change in mass due to the installation of the solar roof is taken into account.

(6) The Applicant has provided a methodology for testing the CO_2 reductions which includes formulae which are based on the Technical Guidelines with regard to a battery charging solar roof. The Commission considers that it should moreover be demonstrated the degree to which the overall energy consumption of the vehicle with regard to its transport function is improved compared to the energy consumed for the operation of devices aimed at enhancing the comfort of the driver or the passengers.

(7) In determining the savings it is also necessary to take into account the storage capacity of a single on-board battery or the presence of an additional battery dedicated for only storing the electricity generated by the solar roof

(8) The Commission finds that the testing methodology will provide testing results that are verifiable, repeatable and comparable and that it is capable of demonstrating in a realistic manner the CO_2 emissions benefits of the innovative technology with strong statistical significance in accordance with Article 6 of Implementing Regulation (EU) No 725/2011.

(9) Against that background the Commission finds that the Applicant has demonstrated satisfactorily that the emission reduction achieved by the innovative technology is at least 1 g CO_2/km.

(10) Since the CO_2 emissions type-approval test referred to in Regulation (EC) No 715/2007 of the European Parliament and of the Council[(4)] and Commission Regulation (EC) No 692/2008[(5)] does not take into consideration the presence of a solar roof and the additional energy provided through this technology, the Commission is satisfied that the battery charged Webasto solar roof is not covered by the standard test cycle. The Commission finds that the verification report has been prepared by the TÜV SÜD Czech s.r.o. which is an independent and certified body and that the report supports the findings set out in the application.

(11) Against that background, the Commission finds that no objections should be raised as regards the approval of the innovative technology in question.

(12) For the purposes of determining the general eco-innovation code to be used in the relevant type-approval documents in accordance with Annexes I, VIII and IX to Directive 2007/46/EC, the individual code to be used for the innovative technology approved through this Implementing Decision should be specified,

HAS ADOPTED THIS DECISION:

Article 1

1 The battery charging Webasto solar roof intended for use in M1 vehicles is approved as an innovative technology within the meaning of Article 12 of Regulation (EC) No 443/2009.

2 The CO_2 emissions reduction from the use of the battery charging Webasto solar roof referred to in paragraph 1 shall be determined using the methodology set out in the Annex.

3 The individual eco-innovation code to be entered into type-approval documentation to be used for the innovative technology approved through this Implementing Decision shall be '7'.

Article 2

This Decision shall enter into force on the 20th day following that of its publication in the *Official Journal of the European Union*.

Done at Brussels, 18 November 2014.

For the Commission

The President

Jean-Claude JUNCKER

ANNEX

METHODOLOGY FOR DETERMINING THE REDUCTION IN CO_2 EMISSIONS DUE TO THE USE OF BATTERY CHARGING WEBASTO SOLAR ROOF

1. **Introduction**

The testing procedure and the testing conditions to be applied in order to determine the CO_2 reductions that can be attributed to the use of the battery charging Webasto solar roof in an M1 vehicle are set out in points 2 and 3.

2. **The testing procedure**

The peak power output (P_P) of the PV panel is to be determined experimentally for each vehicle variant. Measurements are to be done in accordance with the testing methodology specified in the international standard IEC 61215:2005[6].

A dismantled complete PV panel is to be used. The four corner points of the panel are to touch the horizontal measurement panel.

The measurements are to be done at least five times.

The lengthwise inclination angle and total storage capacity (or resulting Solar Correction Coefficient (SCC)) is to be supplied by the manufacturer of the vehicle.

The possible lengthwise inclination of the car roof is to be corrected mathematically afterwards by applying a cosine function.

3. **Formulae**

1. The standard deviation of arithmetic mean of the peak power output is to be calculated by formula (1).

Formula (1):

$$\Delta\bar{P}_P = \sqrt{\frac{\sum_{i=1}^{n}\left(P_{P_i} - \bar{P}_P\right)^2}{n(n-1)}}$$

Where:

$\Delta\bar{P}_P$	:	Standard deviation of arithmetic mean of the peak power output (Wp);
P_{P_i}	:	Measurement value of the peak power output (Wp);
$\bar{P}_P$	:	Arithmetic mean of the peak power output (Wp);
n	:	Number of measurements.

The gain of additional electric power depends on the available electric on-board storage capacity which must be verified. If the capacity is below 0,666 Ah per Watt peak power of the PV panel, the solar radiation arising on sunny and clear summer days cannot be used completely because of fully charged batteries. In this case the solar correction coefficient referred to in point 2 is to be applied to derive the usable share of the incoming solar energy.

2. The following input data for the calculation of CO_2 savings potential are to be used:

— mean solar irradiation $\mathbf{P_{SR}}$ specified in Chapter 5.7.1 of the Technical Guidelines[7], i.e. 120 W/m^2,

— usage factor/shading effect $\mathbf{UF_{IR}}$ specified in Chapter 5.4.2 of the Technical Guidelines, i.e. 0,51,

— efficiency of the solar system η_{SS} specified in Chapter 5.1.3 of the Technical Guidelines, i.e. 0,76,

— solar correction coefficient **SCC** specified in Table 1 and in Chapter 5.7.2 of the Technical Guidelines,

TABLE 1

Total available storage capacity (12 V)/ PV peak power (Ah/ Wp)[a]	0,10	0,20	0,30	0,40	0,50	0,60	> 0,666
Solar correction coefficient (SCC)	0,481	0,656	0,784	0,873	0,934	0,977	1

a The total storage capacity includes a mean usable storage capacity of the starter battery of 10 Ah (12 V). All values refer to a mean annual solar radiation of 120 W/m^2, a shading share of 0,49 and a mean vehicle driving time of 1 hour per day at 750 W electric power requirement.

— consumption of effective power for petrol $\mathbf{V_{Pe\text{-}P}}$ and diesel-fuelled vehicles $\mathbf{V_{Pe\text{-}D}}$ specified in Table 2 and in Chapter 5.1.1 of the Technical Guidelines,

TABLE 2

Type of engine	**Consumption of effective power V_{Pe} (l/kWh)**
Petrol ($V_{Pe\text{-}P}$)	0,264
Diesel ($V_{Pe\text{-}D}$)	0,22

— efficiency of the alternator η_A, specified in Chapter 5.1.2 of the Technical Guidelines, i.e. 0,67.

For the conversion factors **CF** the data in Table 3 is to be used:

TABLE 3

Type of fuel	**Conversion factor (l/100 km) → (g CO_2/ km) (100 g/l)**
Petrol (CF_P)	23,3 (= 2 330 g CO_2/l)
Diesel (CF_D)	26,4 (= 2 640 g CO_2/l)

For the mean annual mileage the data in Table 4 is to be used (km/year):

TABLE 4

Type of fuel	Mean annual mileage (km/year)
Petrol (M_P)	12 700
Diesel (M_D)	17 000

With these input data the CO_2 savings for a petrol-fuelled vehicle are to be calculated by Formula (2).

The difference in mass between the baseline vehicle and the eco-innovation vehicle due to the installation of the solar roof and where relevant, the extra battery, is to be taken into account by applying the mass correction coefficient[8]. The baseline vehicle is to be a vehicle variant that in all aspects is identical to the eco-innovation vehicle with the exception of the solar roof and, where applicable, without the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage.

For a new version of a vehicle in which the solar roof panel is installed the baseline vehicle is to be specified as follows: it is the vehicle in which the solar roof panel is disconnected and the change in mass due to the installation of the solar roof is taken into account. In case the solar roof panel is made of glass a correction for the change in mass is to be introduced, i.e. an extra mass of 3,4 kg. In case the solar roof panel is made of low weight synthetic material no correction for the change in mass has to be made. On this change of mass the manufacturer must hand over verified documentation to the Type-Approval Authority.

Formula (2):

$$C_{CO_2} = P_{SR} \times UF_{IR} \times \eta_{SS} \times P_P \times SCC \times \frac{V_{Pe-P}}{\eta_A} \times \frac{CF_P}{M_P} \times \cos\Phi - \Delta CO_{2mP}$$

Where:

C_{CO_2}	:	CO_2 savings (g CO_2/km);
P_{SR}	:	Mean solar irradiation (W/m^2);
UF_{IR}	:	Usage factor/shading effect (-);
η_{SS}	:	Efficiency of the solar system (-);
P_P	:	Peak power output (Wp);
SCC	:	Solar correction coefficient (-);
V_{Pe-P}	:	Consumption of effective power for petrol vehicles (l/kWh);
η_A	:	Efficiency of the alternator (-);
CF_P	:	Conversion factor for petrol vehicles (100 g/l);
M_P	:	Mean annual mileage for petrol vehicles (km/year);
Φ	:	Lengthwise inclination of the solar panel [°];
ΔCO_{2mP}	:	CO_2 correction coefficient due to the change in mass following the installation of the solar roof and, where applicable, the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage for petrol vehicles (g CO_2/km).

The CO_2 savings for diesel-fuelled vehicles are to be calculated by Formula (3).

The difference in mass between the baseline vehicle and the eco-innovation vehicle due to the installation of solar roof and, where relevant, the extra battery is to be taken into account by applying the mass correction coefficient[8]. The baseline vehicle is to be a vehicle variant that in all aspects is identical to the eco-innovation vehicle with the exception of the solar roof and,

where applicable, without the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage.

For a new version of a vehicle in which the solar roof panel is installed the baseline vehicle is to be specified as follows: it is the vehicle in which the solar roof panel is disconnected, and the change in mass due to the installation of the solar roof is taken into account. In case the solar roof panel is made of glass a correction for the change in mass is to be introduced, i.e. an extra mass of 3,4 kg. In case the solar roof panel is made of low weight synthetic material no correction for the change in mass has to be made. On this change of mass the manufacturer must hand over verified documentation to the Type-Approval Authority.

Formula (3):

$$C_{CO_2} = P_{SR} \times UF_{IR} \times \eta_{SS} \times P_P \times SCC \times \frac{V_{Pe-D}}{\eta_A} \times \frac{CF_D}{M_D} \times \cos\Phi - \Delta CO_{2mD}$$

Where:

V_{Pe-D}	:	Consumption of effective power for diesel vehicles (l/kWh);
CF_D	:	Conversion factor for diesel vehicles (100 g/l);
M_D	:	Mean annual mileage for diesel vehicles (km/year);
ΔCO_{2mD}	:	CO_2 correction coefficient due to the change in mass following the installation of the solar roof and, where applicable, the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage for diesel vehicles (g CO_2/km).

The CO_2 correction coefficient due to the change in mass is to be calculated by Formulas (4) and (5).

Formula (4):

$\Delta CO_{2mP} = 0{,}0277 \times \Delta m$ for a petrol-fuelled vehicle

and

Formula (5):

$\Delta CO_{2mD} = 0{,}0383 \times \Delta m$ for a diesel-fuelled vehicle

Where:

Δm	:	Change in mass due to the installation of the solar roof and, where applicable, the additional battery and other appliances needed specifically for the conversion of the solar energy into electricity and its storage (e.g. 5 kg).

3. The error in the CO_2 savings should be calculated using Formula (6).

Formula (6):

$$\Delta\overline{C_{CO_2}} = \sqrt{\sum_{i=1}^{n}\left(\frac{\partial C_{CO_2}}{\partial P_{P_i}}\Delta\overline{P_P}\right)^2}$$

Where:

$\Delta\bar{C}_{CO_2}$	:	Error of the total CO_2 saving (g CO_2/km);

$\frac{\partial C_{CO_2}}{\partial P_{P_i}}$: Sensitivity of calculated CO_2 saving related to the measured during the test I;

n : Number of measurements.

In order to calculate the error in the CO_2 savings for a petrol-fuelled vehicle, the results of Formula (6) are to be applied in the Formula (2) in accordance with the following Formula (7):

Formula (7):

$$\Delta C_{CO_2}^{-} = P_{SR} \times UF_{IR} \times \eta_{SS} \times SCC \times \frac{V_{Pe-P}}{\eta_A} \times \frac{CF_P}{M_P} \times \Delta \bar{P} \times \cos\Phi$$

In order to calculate the error in the CO_2 savings for a diesel-fuelled vehicle, the results of Formula (6) are to be applied in the Formula (3), which leads to Formula (8). This is the error in the CO_2 savings for a diesel-fuelled vehicle.

Formula (8):

$$\Delta C_{CO_2}^{-} = P_{SR} \times UF_{IR} \times \eta_{SS} \times SCC \times \frac{V_{Pe-D}}{\eta_A} \times \frac{CF_D}{M_D} \times \Delta \bar{P} \times \cos\Phi$$

4. In order to demonstrate that the minimum threshold of 1 g CO_2/km is exceeded in a statistically significant way the following Formula (9) is to be used:

Formula (9):

$$MT \leq C_{CO_2} - \Delta C_{CO_2}^{-}$$

Where:

MT : Minimum threshold (g CO_2/km), i.e. 1 g CO_2/km;

C_{CO_2} : Total CO_2 saving (g CO_2/km);

$\Delta C_{CO_2}^{-}$: Error of the total CO_2 saving (g CO_2/km)

Where the CO_2 emission savings, as a result of the calculation using Formula (9), are below the threshold specified in Article 9(1) of Implementing Regulation (EU) No 725/2011, the second subparagraph of Article 11(2) of that Regulation shall apply.

(**1**) OJ L 140, 5.6.2009, p. 1.

(**2**) Commission Implementing Regulation (EU) No 725/2011of 25 July 2011 establishing a procedure for the approval and certification of innovative technologies for reducing CO_2 emissions from passenger cars pursuant to Regulation (EC) No 443/2009 of the European Parliament and of the Council (OJ L 194, 26.7.2011, p. 19).

(**3**) http://ec.europa.eu/clima/policies/transport/vehicles/cars/docs/guidelines_en.pdf (version of February 2013).

(**4**) Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 171, 29.6.2007, p. 1).

(**5**) Commission Regulation (EC) No 692/2008 of 18 July 2008 implementing and amending Regulation (EC) No 715/2007 of the European Parliament and of the Council on type-approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information (OJ L 199, 28.7.2008, p. 1).

(**6**) IEC 61215. Crystalline silicon terrestrial photovoltaic (PV) modules — Design qualification and type-approval. Reference number IEC 61215:2005(E).

(**7**) The Technical Guidelines for the preparation of applications for the approval of innovative technologies pursuant to Regulation (EC) No 443/2009 (version of February 2013).

(**8**) Chapter 5, par. 5.1 of the reference JRC study http://europa.eu/!qN68wc