

*Critical Review  
of  
“Fluence and Fluence Z.E.  
Life Cycle Assessment  
October 2011”*

according to  
ISO 14040&44

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SOL 11-014.12

6 of January 2012

for

**Renault**

## 1 Introduction

Renault has requested Be-Linked to set a critical review (CR) panel in order to make the CR of a comparative Life Cycle Assessment (LCA) report prepared by Renault concerning Fluence and Fluence ZE. Be-Linked has set the CR panel in order to have an efficient CR panel with complementary competencies, and this panel has reviewed the report. The present report is the “Final CR report”, prepared by the CR panel under the direction of Philippe Osset (Solinnen). This CR report, excluding appendices, is dedicated to be integrated as a whole within the final report of Renault.

## 2 Composition of the panel

The CR panel consisted of the following members:

- Dipl. Eng. Philippe Osset (Solinnen). Philippe has acted as the chair of the Critical Review panel.
- Prof. Dr. Walter Klöpffer, Editor-in-chief, Int. Journal of Life Cycle Assessment, LCA Consult&Review.
- Dipl. Eng. ETH Hans-Jörg Althaus (EMPA), Senior Scientist in Unit Life Cycle Assessment & Modeling.
- Dipl. Eng. Pierre Gaudillat and Arne Richters (“European Federation for Transport and Environment”), Managers Clean Cars.

## 3 Nature of the CR work, CR process and limitations

The CR panel has worked according to the requirements of ISO 14040:2006 and 14044:2006 concerning CR. The work has started in April 2011 and ended up in October 2011.

During this period, different oral and written exchanges have been held between the CR panel and Renault, including clarification exchanges regarding the CR comments, and the production of two new versions of the report by Renault. Renault has taken into account most of the comments and significantly modified and improved its report.

The present CR report is the synthesis of the final comments by the reviewers. The detailed comments are provided as appendices.

The present CR report is delivered to Be-Linked and Renault. The CR panel cannot be held responsible of the use of its work by any third party. The conclusions of the CR panel cover the full report from Renault “Fluence and Fluence ZE Life Cycle Assessment October 2011” and no other report, extract or publication which may eventually be done. The CR panel conclusions have been set given the current state of the art and the information which has been received. These CR panel conclusions could have been different in a different context.

## 4 Conclusions of the review

According to ISO 14044, the critical review process has worked in order to check if:

- the methods used to carry out the LCA are consistent with ISO 14044 requirements,
- the methods used to carry out the LCA are scientifically and technically valid,
- the data used are appropriate and reasonable in relation to the goal of the study,
- the interpretations reflect the limitations identified and the goal of the study, and
- the study report is transparent and consistent.

A huge work has been done by Renault to present its report from the point of view of each of these points, and the final result has significantly improved as compared to the first one. Nevertheless, some issues remain uncovered by the modifications that Renault has done for each of these points. The key ones are listed in the following chapter.

As a whole, the CR panel considers the report as being of comparable quality level as other existing LCA reports covering the same goal: this report reflects the state of the art for LCA from vehicle manufacturers. However, the fact that this study is comparing battery-electric to thermal vehicles increases the complexity and the requirements from the ISO standards. The key limitations to the conclusion of that LCA work are mainly bound to elements that are not fully in the hands of Renault, such as:

- the quality and consistency of the background database used,

- the relevance of the impact assessment methods used to position the vehicles (note: other methods are available but have not been chosen).

The final conclusions of the report have to be used in the strict scope of the study. In that scope, most of the decisions that have been taken by Renault are conservative for the electric vehicle: the improvement of the database and an improved impact assessment would most probably not change the positioning of the electric vehicle.

## 5 Detailed comments

The following lines bring some highlights that a reader of the final LCA report may use to assist his reading and understanding of the report. They recap some critical comments which were not addressed or ignored due to lack of time or workforce to address them.

### 5.1 Consistency of methods used with ISO 14044 requirements

The structure of the report reflects the ISO standard. Some issues remain: the functional unit is now defined in detail, but the definition of reference flow remains fuzzy. Moreover, the method for EOL treatment is fully not in accordance with the recommendations of ISO 14044:2006 in order to be conservative, which is the decision of Renault.

### 5.2 Scientific and technical validity

The choice of impact assessment methods is not comprehensive: indicators for Human toxicity (including effects of PM emissions) and nuclear waste are lacking. Indeed, no compromise was indicated with regard to the impact categories in which the e-car would present different (and maybe lower) impacts as compared the cars with an ICE: noise and human toxicity (especially carcinogenicity by particulate matter (PM10)). Noise is considered in the text, but toxicity looks like to be difficult to assess for the car industry, especially when thinking of the diesel.

Additionally, the implementation of at least one relevant impact factor for POCP of NMVOC is not in accordance with original publication of the IA method, and no justification for changes is given in the report. Non-Exhaust emissions are not included even though these emissions from electric vehicles are reduced compared to ICE vehicles due to regenerative braking (the statement made in the report that there is no difference is wrong).

NEDC consumption for use phase is not a good basis for comparing ICE and electric vehicles, especially when electric heating is used. Cut-off of infrastructure for electricity generation is not in line with general cut-off criteria.

Data implementation has been checked in a first round. Substantial changes in data have been done afterward, which could not have been checked. The citations in the list of references could have been improved: volume and pages are still missing.

### 5.3 Appropriateness of data used in relation to the goal of the study

Foreground data (from Renault production) is detailed and carefully comprised. The supply chain - although still truncated – has been recognized by Renault as a problem and improvement is promised.

The list of emissions from ICE vehicles is not comprehensive (e.g. heavy metals or aromatic hydrocarbons are lacking). The correction factors considered for real-world emissions are relatively optimistic. While the order of magnitude (+15%) for CO<sub>2</sub> is only slightly underestimated, the real-world factor for pollutants and in particular NO<sub>x</sub> and PM (which are currently excluded) can be up to five or tenfold in real world usage, according to recent research at European level. This could have been reflected in a higher range for the sensitivity analysis or included in a future revision, when real-world EV efficiency will also be much better known.

LCI data on battery production is not provided within the report, since they are confidential. They come from a three years thesis which has been conducted by Renault. The approach has been presented and could be reviewed to validate the methodology used. The information that was made available hints at a carefully conducted study. Background data on active materials from PE is used but no documentation was found. Background database obviously does not respect cut-off criteria of foreground system (leading to inconsistencies). Quality and appropriateness of the background data can't be assessed since the Gabi database is not transparent enough to this aim.

#### ***5.4 Validity of interpretations in the scope of the limitations of the study***

The treatment of the e-car may be seen unfair from the point of view of the near zero emission at the streets which is an advantage of the e-car even if the energy mix for electricity production is predominantly fossil. It remains unclear if some of the results are “real” or due to artifacts (omission of important processes like emissions from tailing disposal in metal ore mining) in background data. Therefore, several conclusions are not in line with the results, or might be based on artifacts from omissions in background data.

#### ***5.5 Transparency and consistency***

Documentation of some LCI data remains rather weak.

## **6 Appendices**

The tables exchanged during the work are the appendices of the present CR report. They recap the detailed exchanges between the CR panel and Renault. Renault will keep track of them in order to improve in the future the first versions of its LCA reports.