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THE E-MISSION

ELECTRIC MOBILITY AS A DRIVER FOR LIFE CYCLE MANAGEMENT

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ABSTRACT

Electric mobility will change the car as we know it, the way it is used and the way it is manufactured. The emerging electric mobility further increases the necessity for life cycle management. The massive implications of electric mobility not only on the automotive industry but also on its supply chain, the customers, energy market and the recycling industry require a detailed and well-structured management instrument. The life cycle assessment methodology is used as a starting point to master the complex challenges in the field of electric mobility. This detailed holistic environmental stocktaking on electric mobility gives a detailed status-quo analysis. Challenges and opportunities associated with the electric car become apparent and therefore manageable. Future areas of activity can therefore be derived and justified.

INTRODUCTION

Electric mobility holds the key to long-term sustainable transportation. It will, however, change the car as we know it, the way it is manufactured and the way it is it is used. New resources and materials are required, from lithium for the batteries to neodymium for the electric motors. Production systems have to be restructured and employees have to be trained to work with new electric technology and components. The implications of electric mobility, not only on the automotive industry, but also on its supply chain, the customers, energy market and the recycling industry require a detailed and well-structured life cycle management instrument. Since environmental protection and corporate social responsibility have a long tradition in the Volkswagen Group and are central to the company‘s long-term policy it is even more important to apply life cycle management for electric vehicles at its best. life cycle assessment for environmentally sustainable product development is firmly anchored in our corporate principles and in the following the Volkswagen approach of managing the life cycle of a vehicle is shown using the electric vehicle as an example.

METHODOLOGY

The life cycle assessment methodology is used to master the complex challenges in the field of electric mobility at the Volkswagen Group. In order to enable an effective life cycle management each of the life cycle phases is subject to extensive research. In the following selected examples of Volkswagen´s challenges and solutions for each phase of the life cycle of an electric vehicle are presented.

Manufacturing

Growth in e-mobility will lead to increased demand for a variety of raw materials used in vehicles, which could potentially create market shortages. "Raw Materials Analysis" is a tool used by Volkswagen to assess the risks to its raw materials supplies. This early warning system helps to select the most appropriate technologies and safeguard long-term supplies. In order to obtain an early indication of corruption risks that could affect resource supplies, Volkswagen takes part in regular discussions and exchanges with the extractive industries transparency initiative (EITI). Additionally, Volkswagen installed environmental standards for suppliers. Our suppliers undertake to comply with VW standard 01155, VW standard 99000 and the Standard Components Specifications. Volkswagen requires its partners all over the world to deliver impeccable quality while also respecting environmental and social standards.

Our efforts to increase sustainability on the supply side are completed by our measures to continuously improve our Volkswagen Group sites. The goal for new factories of the future is clear: they must be resource-efficient and low-emission operations. But existing factories offer huge opportunities for reducing emissions, too. They are converted step by step to operate at similar levels of efficiency as a new factory. Of course, emissions reductions on this scale can only be achieved by adopting a holistic approach. The Volkswagen Group is aiming to make its production operations 25% more eco-friendly by 2018. In concrete terms, these cuts relate to energy and water consumption, emissions and waste.

In order to ensure a continuous improvement in production-related environmental protection environmental management systems are in operation at Volkswagen plants for many years. These systems are audited in line with the ISO 14001 (ISO 2009) standard and virtually all Volkswagen Group sites are certified using this standard. Since 1995, some of the European Volkswagen plants take part in the European Union‘s eco-management and audit scheme (EMAS) (European Commission 2009). In many respects the requirements for EMAS certification go even further than those for ISO 14001.

At the current state of the art, each electric car has generated 74 g CO_2/km when leaving the manufacturing site (Volkswagen Group 2012). With our green factory concept, we are aiming to reduce CO_2 emissions at our factories by 25% for every vehicle produced. And by collaborating with our partners in the supply chain, we can extend this goal to all stages of the production process.

Use Phase

For Volkswagen it is clear that the goal is to charge electric cars solely from regenerative sources. VW Kraftwerk GmbH made green power available for the German fleet trials of the electric Golf in 2011/2012. This 100% renewable electricity is sourced for example from hydroelectric power plants in the Alps. The Volkswagen now group offers special green electricity contracts for final customers. The green electricity is generated by waterpower plants in Germany, Austria and Switzerland and certified by TÜV Nord and labelled with the "ok power" eco-seal.

Based on the European generation mix, the carbon footprint of an electric vehicle is at an average of 88 g CO_2/km (Volkswagen Group 2012). With renewable electricity we can reduce this to 1 g CO_2/km (Volkswagen Group 2012).

End-of-Life

Electric vehicles are too valuable to be simply scrapped at the end of their useful life. Not only the battery but the rest of the vehicle as well is a source of raw materials which must be put to good use. Consequently, recycling techniques are a focus of ongoing development work at Volkswagen. One such technique is the Volkswagen SiCon process, which is used to recover raw materials from end-of-life vehicle shredder residues. With the aid of this multi-award-winning process, a 95% recovery rate can be achieved for end-of-life vehicles. Once the battery has been removed, the process is suitable for recycling e-cars too. Growth in electric mobility will result in increasing numbers of end-of-life lithium-ion batteries. Fortunately, high recycling rates are already achievable for the lithium, cobalt and other metals contained in these batteries. The feasibility of such recycling including a life cycle assessment (Buchert 2011) has been demonstrated by the LithoRec project, in which Volkswagen is a partner. Tests have shown that around 90% of the battery's raw materials can be recovered with the LithoRec processes – thereby helping to reduce dependence on imports of raw materials and ensure security of supply. The main focus for appropriate recycling is on systematic recycling of valuable metals. In the life cycle Assessment, recycling is offset against total life cycle emissions in the form of a recycling credit. Recycling of the lithium-ion battery according to our calculations brings an overall recycling credit of 10 g CO_2/km (Volkswagen Group 2012).

RESULTS

This holistic environmental stocktaking on electric mobility gives a detailed status-quo analysis. Challenges and opportunities associated with the electric car become apparent and therefore manageable. Future areas of activity can therefore be derived and justified. Over a life cycle of an electric car currently 162 g CO_2/km are emitted. By identifying hotspots and taking the measures described above these CO_2 emissions can be reduced to 56 g CO_2/km. This is an important step towards a true zero-emission vehicle.

CONCLUSIONS

Electric mobility can play an important role in the transition to sustainable transportation. In order to achieve the full potential towards sustainable mobility life cycle management is essential. In order to build cars as resource-efficiently as possible, it is crucial to analyse resource pathways in depth, to closely collaborate with suppliers and to train employees. With the aim of running cars in a sustainable way, electricity from renewable sources must be used. For the end-of life advanced recycling solutions for electric components need to be developed. Only by successfully applying life cycle management these vital steps toward sustainability can be identified and successfully implement.

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