Electric Cars and Wind Turbines

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ABSTRACT: *The group of experts at Jozef Stefan Institute, the Department for Nanostructured materials has many years' experience in the field of permanent magnets for high energy applications such as electric vehicles and wind turbines. The author of this contribution is the Coordinator of 4 mio EUR European project on this subject. For electric vehicles and wind turbines only the magnets with highest energy products are appropriate and this is enabled with the addition of 11 wt.% of heavy rare earth (Dy, Tb), which are on the top of the list of critical raw materials (published by EC in 2014). With highly innovative process we decreased the amount of heavy rare earth to 0.6 wt. % for better performances and substantial savings on critical raw materials. Small wind turbines next to the smart house or in a small smart settlement would bring renewable energy and contribute to the environment TP E(E.2), Electric/hybrid vehicles would contribute to clean transportation in smart cities.*

Keywords: Electric Cars, Wind Turbines, Nano materials, Smart Vechicles, Magnets

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1. Introduction

The basic idea of the proposed project is focused on acquiring of clean energy with micro VAWT turbines (self-supply of small cottages, individual houses or small settlements) and silent and ecological transport in cities and settlements. The trend of electric cars is exponentially growing, but Slovenia as a European country is in using the electric or hybrid vehicles as well as wind turbines well behind the other European countries (Germany, France, Austria etc.). Natural conditions in Slovenia are favorable for the wind turbines, but also the development in the direction of electric vehicles is inevitable.

The main idea of the proposed project is to be involved in the frame of the initiative PaMetSkup (Smart houses and Smart cities)

and contribute in the direction towards **clean and cheap energy**. The basic components of electric motors (for electric vehicle and wind turbine) are high energy permanent magnets for which Slovenia has two producers: Kolektor Group d.o.o. and Magneti d.o.o. Ljubljana. Since the Department of Nanostructured materials has developed a new, much cheaper technology for production of high energy Nd-Fe-B magnets with 25 times lower content of critical raw material - heavy rare earth and put it into the pilot production of a factory in Germany (**TRL6**) we could easily do the same in Slovenia with Slovenian companies. The other important aspect is that Slovenian factory Iskra Zašcite developed a special protective element for wind turbines (**TRL6**) (protection against the lightening), which gives the added value to the producers of turbines. With the partnership of two other European companies, which of course would not be financed form Slovenian resources, but would participate with their own funds (e.g. Enercon GmbH for turbines and Valeo for cars) we could built a successful partnership in the production chain of small wind turbines (VAWT) and electric cars with high added financial and ecological value.

2. Project Background

Department of nanostructured materials at Jozef Stefan Institute has many year's experience in the field of permanent magnets for high energy applications and is currently involved in 5 European projects on renewable energy and mobility, two of which we coordinate:

ROMEO (Replacement and Original Magnet Engineering Options) (S. Kobe) (http://www.romeo-fp7.eu/romeo.htm)

MAG-DRIVE (New Permanent Magnets for Electric- Vehicle drive application) (M. Komelj) (http://mag-drive-fp7.eu/)

NANOPYME (Nanocrystalline Permanent Magnets Based on Hybrid Metal- Ferrites) (http://nanopyme-project.eu/)

REProMag (Resource Efficient Production of Magnets) (http://www.repromag-project.eu/)

DEMETER (Training Network for the Design Recycling of Rare-Earth Permanent Magnet Motors and Generators in Hybrid and Full Electric Vehicles) (http://etn-demeter.eu)

In the existing European projects we attracted two Slovenian industrial partners: Kolektor Group d.o.o. and Magneti Ljubljana d.o.o. The ROMEO project involves besides Slovenian company Kolektor Group d.o.o., also 3 industrial partners from Germany (Siemens, Daimler, and Vacuumschmelze) and 1 form France (Valeo). Kolektor and Vacuumschmelze are producers of permeant magnets based on rare earths; Valeo and Daimler are producers of motors and electric cars, Siemens is involved as the end-user for wind turbines.

Experts at Jozef Stefan Institute together with our Slovene industrial partners are highly qualified to produce magnets as the first link of the value chain. We have close connections with the end-users for electric cars and wind turbines outside Slovenia, but in the proposed initiative we are planning to attract a Slovenian or reginal partner for the wind turbines production. For the electric vehicle we have partner from France (Valeo), which already expressed interest.

3. Project Idea

Magnets production: Kolektor Group d.o.o.,

Motors production: Letrika d.o.o.

Over-voltage protection producers: Varsi d.o.o., Iskra Zašite d.o.o.

Electric car / Hybrid car producer: Valeo France Wind Turbine producer: if not in the region, Enercon GmbH

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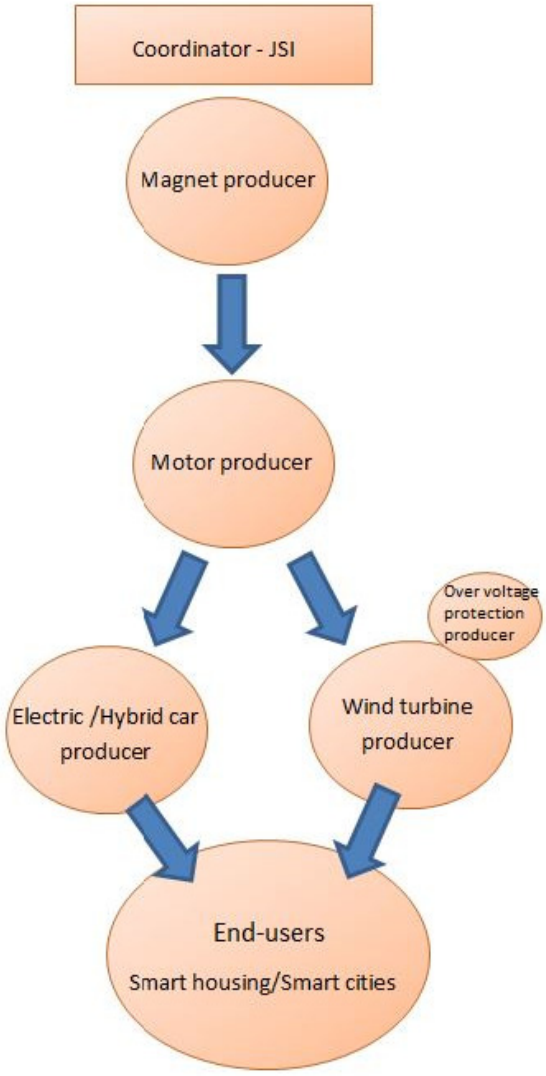

Figure 1. Schematic view of the project structure

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