

Intense Interest in Energy Harvesting for Electric Vehicles

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Two forthcoming events in Germany reflect the intense interest in energy harvesting for electric vehicles. Energy Harvesting & Storage Europe 2011, 21-22 June covers many forms of harvesting for other applications as well and drills into the technology, investment and other aspects of harvesting in general. On the other hand Electric Vehicles Land, Sea & Air Europe 2011 in Stuttgart 28-29 June is entirely vehicle oriented. It covers a wide variety of future land, water and air electric vehicles and their needs, including many emerging forms of harvesting that are appropriate.

Here are some of the advances that will be announced at these events. Some will generate hundreds of watts to tens of kilowatts to provide significant power to traction batteries. Harvesting shock absorbers and active suspension, thermoelectrics and photovoltaics will be examples of this. On the other hand, harvesting will increase range in a more subtle fashion - by permitting myriads of small sensors and actuators to work wirelessly, monitoring more things to conserve energy and improve safety and eliminating the need for heavy copper wiring that reduces range. This is one focus of Energy Harvesting Europe which also has many presentations on the wireless sensors themselves.

Presenting at Electric Vehicles Land, Sea & Air Europe 2011, IDTechEx will give an overview of the benefits and problems of all forms of photovoltaic, dynamic and thermoelectric harvesting for vehicles and what comes next. Presenter asola Automotive will describe its record breaking 130 peak watts sunroof on the plug-in hybrid Fisker Karma sports car entering production this year. It is the largest and most powerful automotive solar sunroof in serial production.

Energy harvesting technologies for vehicles have traditionally focused on harvesting rotary kinetic motion. That includes regenerative braking, the propeller on a sea yacht reversing when under sail and the equivalent trailing of a pure electric light aircraft's propeller when soaring. Another focus has been micro-size vibration energy (e.g. piezoelectrics), and waste heat (e.g.thermoelectrics).

Currently, few commercial solutions exist for harvesting linear kinetic energy in the tens of watts to tens of kilowatts range but MIT spinoff Levant Power has cracked the problem with energy harvesting dampers that can generate ten kilowatts across a bus or truck. Applications being trialled include cars, trucks, military vehicles, construction vehicles and industrial and marine applications such as power for pure electric autonomous underwater vehicles AUVs. On land, its GenShock even improves ride control and handling by adjusting suspension damping dynamically.

Meanwhile, rotary dynamic power generation takes us to AUVs hinging to harvest wave power when they surface - usually in combination with photovoltaics - multi

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mode harvesting being increasingly favoured for all vehicles. It even leads to completely new markets, none more dramatic than the Valence - Bénéteau story. Previously seagoing yachts were not electric vehicles. They moved along under diesel power and even started the diesel engine to provide hotel facilities when moored. For many seagoing yachts that is very noisy, expensive and polluting.

Speaker Valence Technology, Inc. now has a multi-year supply agreement with BJ Technologie, a subsidiary of Bénéteau Group, the world's largest sailing yacht manufacturer with 22 production sites and 450 dealers in more than 50 countries. Under the multi-year agreement, Valence Technology will serve as the exclusive traction battery supplier for all new Bénéteau Group hybrid-electric vessels that incorporate the innovative ZF Marine regenerative hybrid drive systems.

Now the yacht can charge the battery by trailing the propeller when under sail, not just by using weaker solar energy. During normal operating conditions, a boat owner may never need to start the diesel engines to propel the boat and can leave port, sail and return to port completely powered by batteries or clean wind. The more capable lithium-ion battery can provide silent power when the boat is moored. Valence Technology will provide these modular, scalable energy storage systems that will be placed in new hybrid-electric yachts, sailboats and motorboats for Bénéteau its partners.

"This is a revolution, not an evolution, in marine propulsion, energy generation, storage and management," says Robert L. Kanode, President & CEO, Valence Technology who will speak at Electric Vehicles Land Sea Air. "Bénéteau is setting a new blue water standard for cleaner sailing yachts. Ports and harbors around the world will be cleaner, quieter and safer thanks to Valence Technology's safe, dynamic energy systems and the forward thinking of companies like Bénéteau Group, and ZF Marine, a pioneer in electric pod drives."

By contrast, at the event Energy Harvesting Europe 2011, the emphasis is more on powering small devices. Princeton University covers piezoelectric ribbons printed onto rubber for flexible energy conversion. ETH Zurich describes integrating electronics into woven textiles, smart fabric on car seats being an interest of Mercedes. Smartex announces sensor Integration in electronic textiles and CETEMMSA also looks at smart fabrics. For small devices, Marlow Industries discusses "Optimized, Low ΔT Thermoelectric Energy Harvesters for Water, Air or Solid Heat Sources and Sinks". More specific to vehicles is the Holst Centre/IMEC "Energy Harvesting for an Intelligent Tire" and, for high power output, the energy harvesting active suspension being developed by Eindhoven University of Technology is presented. Flexible and wafer supercapacitors are described for power handling in energy harvesting - perhaps part of the move to smart skin on vehicles, which will sense structural damage, harvest, store and convert energy.

The US Department of Energy DOE and Flexible Electronics Concepts are presenting at both events, The DOE is production testing its Thermoelectric Generators (TEG's) to harvest automobile engine waste heat directly to electricity with first commercial introduction in the Chevy Volt, Chevy Suburban, Ford Fusion and BMW X6. First generation TEG's will provide a 5% fuel economy gain, rather like the first

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generation vehicle photovoltaics. In addition, competitive contracts have been awarded to teams headed by Ford and GM to develop automotive thermoelectric air conditioner/heater (TE HVAC). This approach uses the zonal concept to maintain occupant comfort as opposed to cooling/heating the whole cabin. TE HVAC cools one occupant with 630 Watts while the compressed refrigerant gas systems use 3500 to 4500 Watts. The current refrigerant gas, R134a, has 1300 times the greenhouse gas effect as carbon dioxide, the primary greenhouse gas. The DOE, jointly with the National Science Foundation awarded nine contracts to universities teamed with an industrial partner to improve thermoelectric performance. On the other hand Flexible Electronics Concepts is pioneering printed and otherwise flexible electronics and electrics. It will describe how T-Ink reduces weight, space and cost of many systems in electric vehicles by up to 40%. Printed electronics and electrics also form part of that concept of smart skin for future electric vehicles - land, sea and air.

For Energy Harvesting & Storage Europe 2011 go to www.IDTechEx.com/Munich [1].
For Electric Vehicles Land, Sea & Air Europe 2011 go to www.IDTechEx.com/evEurope [2].

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[1] <http://www.IDTechEx.com/Munich>

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