



## Fraunhofer and The University of Michigan: Clean Transportation Innovation Cluster

Advanced electrification technologies are changing the automotive industry. Efficient electric drive systems with electrochemical energy storage promise new levels of efficiency and flexibility for the electric vehicle of the future. In order to make electric cars a part of everyday life, new vehicle designs and parts are needed.



New drive concepts, innovative electronic components, advanced electric drive systems and wheel hub motors will influence electro mobility. The most complex elements in the system, electrical energy storage devices, demand breakthrough innovation to meet a wide range of sometimes-conflicting requirements.

The **Clean Transportation Innovation Cluster (CTIC)** brings together the best automotive R&D competencies on both sides of the Atlantic: Fraunhofer and the University of Michigan. Building on a history of collaboration, this powerful partnership supports the technological advances needed to drive e-mobility by developing advanced electrical storage systems.



The CTIC focuses on the complete production process, incorporating innovative concepts for cell chemistry and design, module assembly and qualification. The U-M and Fraunhofer draw on their best-in-class competencies, facilities and experience to investigate and develop high-performance batteries. Together, the institutions' scientists test battery performance and devise the most efficient production processes. Ultimately, the CTIC will set new standards for hybrid and electric vehicles as the global automotive industry transitions to electro mobility.



## The CTIC Advantage

The Clean Transportation Innovation Cluster aims to build a strong alliance between researchers, OEMs, suppliers, and system integrators. The CTIC pursues specific R&D projects, uniquely conceived to meet customer objectives.

### CTIC Goals

- Accelerate new product and process development
- Align pre-competitive and contract research
- Improve networking along the value chain
- Strengthen transatlantic cooperation

### Technical Focus Areas

- Electromechanical Systems
- Cell Components
- Cell Production
- Module/Battery Pack
- Battery Management System
- Charging
- Testing
- Cost Assessment



*“From my perspective, the collaboration between the University of Michigan and Fraunhofer has been a tremendous success. Our complementary strengths enabled us to make significant advances in the demonstration of high performance supercapacitor and battery technologies. These energy storage technologies and the planned future collaborations will be important as we work to meet the challenges of developing tomorrow’s clean transportation systems.”*

— **Levi Thompson**, the U-M’s Richard E. Balzhiser Collegiate Professor of Chemical Engineering, Professor of Mechanical Engineering, and Director of the Hydrogen Technology Laboratory



*“Intelligent production methods such as the application of laser technologies will be essential to meet the cost-reduction and quality demands associated with future compatible electric vehicle production.”*

— **Prof. Reinhart Poprawe**,  
Director of the Fraunhofer Institute for Laser Technology (ILT) and Chair of the Department of Laser Technology LLT at RWTH Aachen University

## Advanced Technical Services

### Research and Development

- Experimental and modeling techniques to develop new energy storage materials and analysis of degradation mechanisms of existing and novel energy storage devices
- Development of novel battery management systems and associated power electronics architectures and devices

### Testing

- Evaluation of energy storage devices ranging from button cells to production size battery packs on state-of-the-art testing equipment according to appropriate standards, including cycle tests and failure analysis

### Manufacturing Implementation

- Analyze and refine cost efficient layer deposition and treatment as well as cutting and joining techniques for energy storage components
- Cost assessment of various storage technologies with associated manufacturing, assembly, and recycling strategies

## Transatlantic Assets to Drive Growth

The Clean Transportation Innovation Cluster is committed to cultivating technology that will spur market advancement and job growth. Its long-term success will draw on regional and national strengths, including:

- a robust, diversified vehicle research and development community in Michigan that features more than 200 automotive research and development facilities;
- a high concentration of battery OEMs in Michigan, capitalizing on more than \$5 billion in state and federal funding and incentives;
- the presence of several hundred German companies in Michigan, featuring an important collection of automotive suppliers that employ skilled engineers and technicians;
- a history of electro mobility technology development in the U.S. and Germany — nations that share a commitment to manufacturing quality, building new relationships, and promoting R&D cooperation.



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## **Fraunhofer and the University of Michigan: A Record of Productive Collaboration**

The Clean Transportation Innovation Cluster builds off of the successful Alternative Energy Technologies for Transportation program, a Fraunhofer/U-M collaboration launched in 2009 to support research that will satisfy increasing global demand for more efficient and sustainable transportation technologies. Among the five funded projects from this initial joint-program were explorations of lithium-ion batteries and supercapacitors. The collaborations have already resulted in patent applications, technical papers and support for a new spin-off venture.

The University of Michigan is one of the world's leading research universities with \$1.14 billion in research expenditures in 2009/'10. Its energy research is advanced through the Michigan Memorial Phoenix Energy Institute, whose faculty affiliates include experts in carbon neutral electricity sources, energy storage and utilization, transportation and fuels, as well as energy policy, economics and societal impact.

Fraunhofer is known for its application-driven research and development expertise, which is sought after by industrial partners in Germany and the U.S. With a staff of 18,000, the majority qualified scientists and engineers, Fraunhofer generates an annual research budget of €1.7 billion. Of this sum, more than €1.4 billion is earned through contract research projects.

### **Learn More**

**For further information on the advantages  
of working with the CTIC, contact:**

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