

Micro-Energy Technology

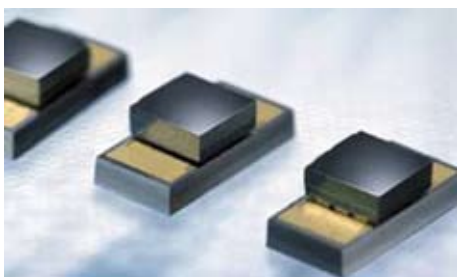
Power To Go



Fraunhofer Verbund
Energie



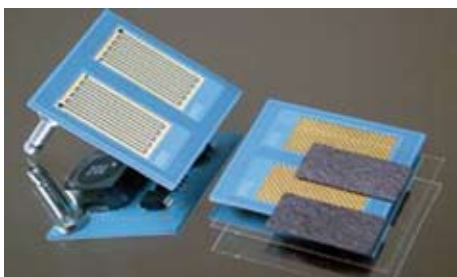
Highly efficient solar cell module.
Fraunhofer ISE.



Thermoelectric module.
Fraunhofer IPM, Micropelt GmbH.



Universal module for battery management and monitoring. Fraunhofer IIS.



Ceramic micro fuel cell. Fraunhofer IKTS.



Flexible film battery. Fraunhofer ISIT.

Micro-Energy Technology Perspective for future markets

With each new generation, portable electronic devices become increasingly powerful. In the meanwhile, mobile phones are used not only just as telephones but also as cameras, movie cameras, navigation devices or as mobile televisions.

All of these functions require additional energy. The demands of the energy-thirsty electronic products of today cannot be satisfied by the current battery technology. New, miniaturized energy systems that significantly prolong the operating time of portable devices are required.

Researchers from ten Fraunhofer Institutes are working together on solutions for the micro-energy technology. We develop energy converters including solar cells, thermoelectric devices, piezoelectric converters and fuel cells. Energy storage, like primary or secondary batteries and super capacitors remain in the focus of our development activities. We also concentrate on wireless energy transmission and join these different technologies together purposefully using energy management to create hybrid energy systems. Thus a customized energy supply for each device requirement is found.

The main requirements to be met in the development of these energy systems are high energy density and power density for longer operation times, further miniaturization to easily integrate the power supplies into the electronic devices and minimizing the waste heat.

Micro-energy technology is of interest for industrial applications such as fill level sensors in the chemical industry, positioning systems in logistics, smoke alarms and escape route signals in buildings or for measurement sensors in the field of transportation. Usually for these applications, a reliable energy supply is required that is guaranteed to continuously operate over a long period of time for arctic as well as desert climates. This is particularly necessary for Mount-and-Forget applications where, after installation, the systems are expected to operate without maintenance.

Are you interested?

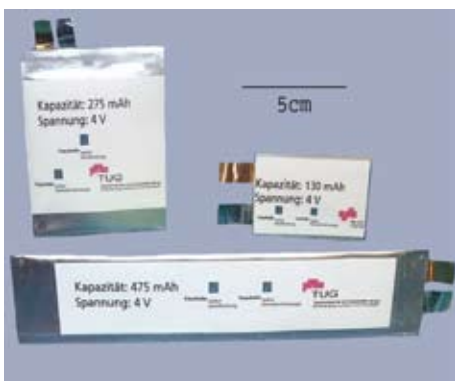
A comprehensive description of our activities is found under the keyword "Fraunhofer Micro-Energy Technology". Contact us!

Battery Technologies

The possibilities existing today for data recording and communication would not be conceivable without primary and secondary batteries. Secondary batteries for mass produced articles have been a standard for many years. For applications with high power requirements, standard batteries provide often only unsatisfying operation times.

Customized production concepts permit the manufacture of suitable secondary batteries. This is valid for the electro-chemical components as well as for the design aspect of the energy storage. The secondary battery becomes an electrically and geometrically optimized system component of a hybrid energy supply system.

In addition to the development, sample construction and system integration of suitable battery solutions, Fraunhofer offers consultation services and reliability investigations. Further, micro batteries are developed with the help of micro-system technology.



Film batteries in different formats. Fraunhofer ISC.

Solar Cells

With enough available irradiation, watches or handheld calculators with solar cells operate today without an active energy input. Here the very flat solar module is directly integrated into the device housing and continually provides a sufficient battery charge.

The challenge for applications having a high energy demand and which are used under fluctuating radiation conditions is to achieve a high efficiency for all relevant irradiation levels.

Depending on the requirements, Fraunhofer offers different types of solar cells made out of monocrystalline silicon through to polymer materials. The current and voltage demand can be individually customized. A special module technology using a shingle construction makes optimal use of the available area.



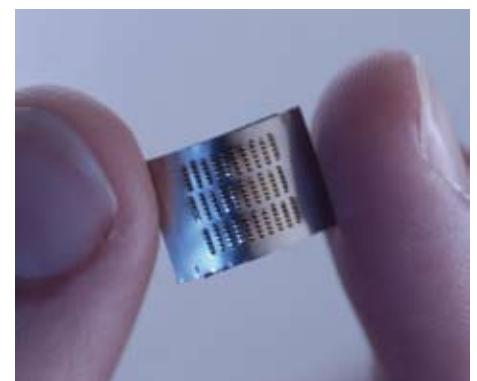
Organic solar cell. Fraunhofer ISE.

Fuel Cells

Fuel cells operating with hydrogen, methanol, ethanol or liquid gas make longer run times possible in the future as compared to conventional batteries. For portable small devices, so-called membrane fuel cells that operate at low temperatures are favored.

The present goals are to miniaturize fuel cells systems and to increase their reliability. A further challenge is to optimally tune the fuel cell for use with different fuels.

Fraunhofer has already proved the functionality of fuel cell systems for consumer products like laptops and digital camcorders. The Fraunhofer Institutes foster the development of fuel cell systems through improved fuel cell components, optimized control strategies and a coordinated system technology including peripheral devices.



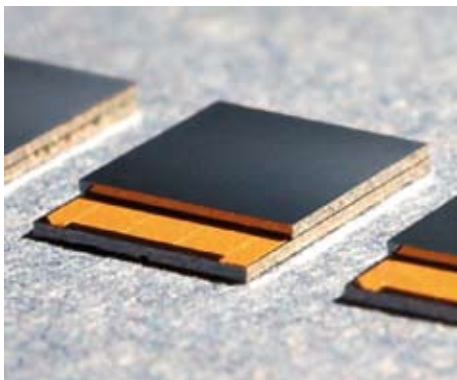
Planar micro fuel cell. Fraunhofer IZM.

Thermoelectric

In applications with a stable temperature differential, current can be generated thermoelectrically. Even small temperature differences of a few degrees Kelvin are sufficient. Examples of this are energy autonomous watches which are already on the market.

Material combinations that supply appreciable voltages and currents already at low heat fluxes are desired. Further, the ability to integrate the thermo-electric components in a power supply system is a main factor. Not least, economic factors in the processing procedure play an important role.

With its industrial partners, Fraunhofer has already worked on solutions that make a wafer-based production in thin film technology possible. Future developments will concentrate on the material optimization, system integration and processing technology.



Thermoelectric converter.
Fraunhofer IPM, Micropelt GmbH.

Wireless Energy Transmission

Wireless energy transmission enables new possibilities for system design for many applications. For this purpose, inductive processes are an established technology. Be it the electric toothbrush with a watertight, capped charging station or the chip as door opener, the technology permits a simple transmission of energy impulses.

In order to function reliably, the sender and the receiver must be properly matched. It is particularly important to avoid disturbing signals. Another challenge is the integration into miniaturized components like Smart Cards or plastic chips.

Fraunhofer develops solutions which are optimized and suitable for the market. The power supply is matched exactly to the specific boundary conditions of each application.



Smart Card with inductive energy transmission.
Fraunhofer IIS.

Power Management

The increasing energy consumption of portable devices often requires the use of hybrid systems made up of coupled and tuned energy converters and energy storage systems. In order to ensure optimal operation of the given converter or storage technology, a high efficient power or battery management strategy is necessary.

This includes an electronic with minimal stand-by losses. Similarly current or voltage matching for the individual electronic components is to be considered. Additionally an intelligent system regulation and control management provides a demand-oriented energy distribution.

Fraunhofer joins the separate technologies together and realizes the best-possible energy supply system as looked at from the economic and technological standpoints.



Transceiver for transmission of sensor data.
Fraunhofer TEG.

Energy from the device housing

For the integration of new energy technologies in electronic devices, a flat construction is required. Planar fuel cells are geared towards these requirements.

Picture: Fraunhofer ISE.

Use of ambient heat

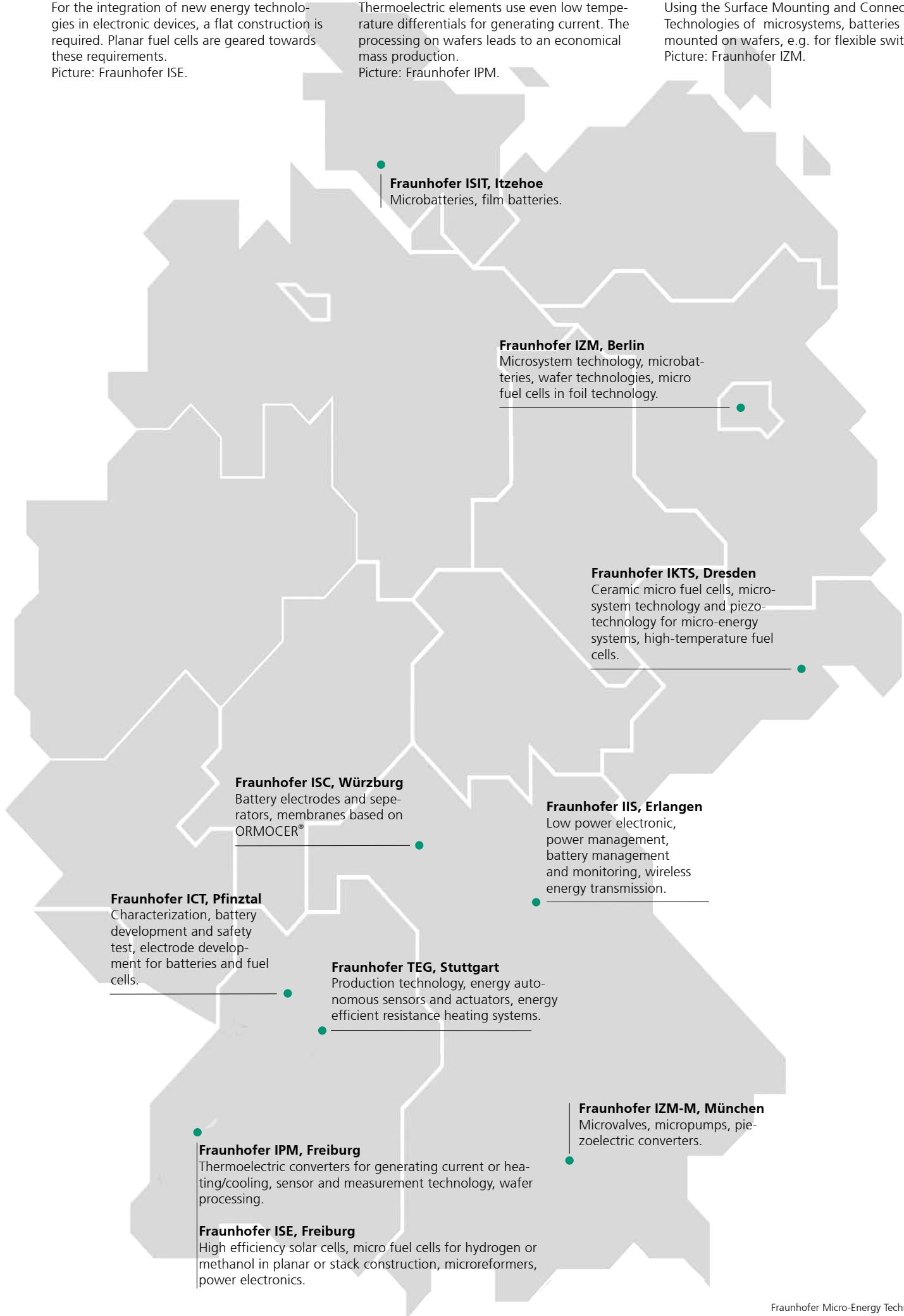
Thermoelectric elements use even low temperature differentials for generating current. The processing on wafers leads to an economical mass production.

Picture: Fraunhofer IPM.

Lots of energy with the smallest space

Using the Surface Mounting and Connecting Technologies of microsystems, batteries can be mounted on wafers, e.g. for flexible switching.

Picture: Fraunhofer IZM.



Fraunhofer ISIT, Itzehoe
Microbatteries, film batteries.

Fraunhofer IZM, Berlin
Microsystem technology, microbatteries, wafer technologies, micro fuel cells in foil technology.

Fraunhofer IKTS, Dresden
Ceramic micro fuel cells, microsystem technology and piezotechnology for micro-energy systems, high-temperature fuel cells.

Fraunhofer ISC, Würzburg
Battery electrodes and separators, membranes based on ORMOCER®

Fraunhofer IIS, Erlangen
Low power electronic, power management, battery management and monitoring, wireless energy transmission.

Fraunhofer ICT, Pfinztal
Characterization, battery development and safety test, electrode development for batteries and fuel cells.

Fraunhofer TEG, Stuttgart
Production technology, energy autonomous sensors and actuators, energy efficient resistance heating systems.

Fraunhofer IPM, Freiburg
Thermoelectric converters for generating current or heating/cooling, sensor and measurement technology, wafer processing.

Fraunhofer IZM-M, München
Microvalves, micropumps, piezoelectric converters.

Fraunhofer ISE, Freiburg
High efficiency solar cells, micro fuel cells for hydrogen or methanol in planar or stack construction, microreformers, power electronics.

Small Groups – Big Service

Use the potential of the Fraunhofer Institutes for your products and a successful market entry. We gladly will assist and support you exclusively in turning various innovations into market-ready products. In many cases, you can also benefit from the co-operative work of the Fraunhofer Institutes with partners in the industry.

We assist you in selecting a suitable energy supply and energy storage as well as in developing customized system solutions. Our services range from advising you in the areas of technology and marketing through to actual component development, power and control electronics, system simulation and up to the final system integration.

Would you be interested in more information?

Please feel free to contact us!

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Fraunhofer Micro-Energy Technology in the Fraunhofer Energy Alliance

The Fraunhofer Energy Alliance EST stands for innovative energy systems and technologies. It offers industry, policy makers and the services sector a direct access to the competences of the Fraunhofer Gesellschaft.

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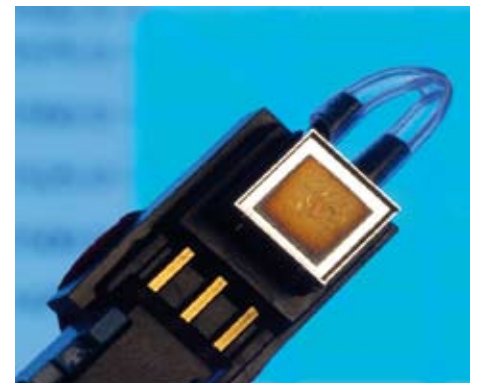
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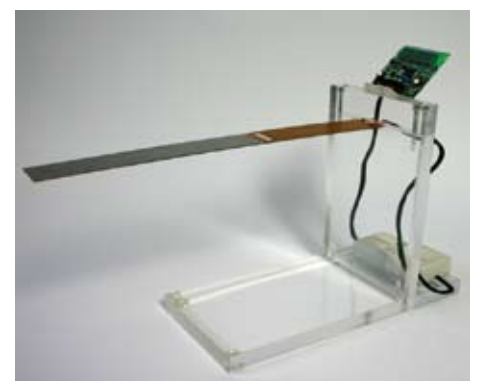
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Low-temperature high-power secondary battery.
Fraunhofer ICT.



Micro membrane pump. Fraunhofer IZM-M.



Piezo-converter. Fraunhofer IKTS.