**Nano-structured High-efficiency Thermo-Electric Converters**

**From** 2011-12-01 to 2014-11-30, closed project

### Project details

<table>
<thead>
<tr>
<th>Total cost:</th>
<th>Topic(s):</th>
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<tr>
<td>EUR 5 287 381,20</td>
<td>NMP-2010-1.2-3 - Thermoelectric energy converters based on nanotechnology</td>
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<tr>
<th>EU contribution:</th>
<th>Call for proposal:</th>
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<tr>
<td>EUR 3 750 000</td>
<td>FP7-NMP-2010-SMALL-4</td>
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<th>Coordinated in:</th>
<th>Funding scheme:</th>
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<tr>
<td>Liechtenstein</td>
<td>CP-FP - Small or medium-scale focused research project</td>
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### Objective

The NanoHiTEC project is focused on planar thermo-electric converters based on super-lattice quantum wells, which have shown on laboratory scale already a figure of merit \( ZT > 4 \) for a wide temperature range. The optimization of BiTe based layer systems as well as Si/SiGe and B4C/B9C lattices will be combined with the development of low cost/high throughput industrial deposition processes for multilayers. Direct p-n-junctions at the hot side of the converter promise further increase in performance and long term stability of the devices, but also simplified fabrication. As technologies for improved material performance multilayered nanowires and sintered nanopowders will be investigated.

A central point of NanoHiTEC is the optimization of the passive components (thermal and electrical contacts, substrates) and of new geometries for the layout of planar converters to maximize the system efficiency. In this field particular emphasis is given to the heat flow into the hot and out of the cold side of the active elements where actual devices show the most efficiency loss.

The developments in the project are backed by partners experienced in the qualification of thermo-electric materials and devices. Besides the parameters defining the thermoelectric performance - measured in a wide range of temperatures, pressures and magnetic fields - the microstructure, dopant distribution and the inner potentials will be investigated by scanning microscopy and TEM (holography).

A major part of the project is the simulation of electronic and phononic properties based on the material microstructure. Intense interaction of theoretical work and characterization results of fabricated systems will pave the way for further enhanced material efficiency and better producibility. A main target is the integration in automotive applications where the high efficiency of superlattice systems over a broad temperature range promises good adaptation to the varying conditions in vehicles.

### Related information

- **Result In Brief**: Waste heat to power cars
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EU contribution: EUR 531 535

EU contribution: EUR 370 328

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**EU contribution:** EUR 466 840

**EU contribution:** EUR 443 200

**EU contribution:** EUR 307 221

**EU contribution:** EUR 248 470