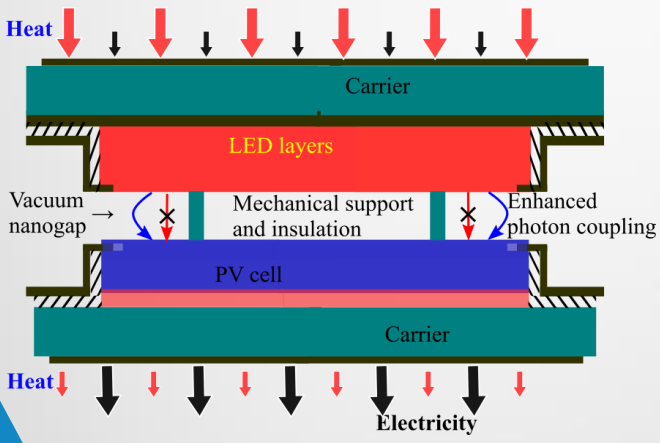
Waste Heat Recovery Through Near-Field Thermophotonics

Waste heat generated by industry, transport, data processing and other energy intensive processes form enormous energy streams that are typically hard to exploit. In TPX-POWER we aim to demonstrate a new approach to thermal energy recovery, allowing a large power density and a competitive energy harvesting efficiency even for low temperature energy streams. The approach hamesses the thermodynamics of electroluminescence (EL), near field (NF) photon transport and photovoltaic (PV) energy production to convert the very recent advances into a new heat engine technology. The NF thermophotonic heat engines use the superthermal emission from an electrically excited light emitting diode (LED) heated by waste heat, to illuminate a PV cell kept at ambient temperature. This configuration can enable a substantial performance boost compared to existing technologies. If successful, TPX-POWER demonstrates and sets on motion the development of a cost- and power-efficient heat energy harvesting technology with new possibilities throughout the sectors where waste heat is produced. In most optimal scenarios the technology could double the efficiency of combustion engines and provide a pollution free energy source substantially improving the process efficiency of any waste heat producing process, providing an essentially negative-emission energy source.



In TPX-POWER we investigate if reaching practical energy harvesting applications using thermophotonics is feasible with presently available and emerging technologies. To this end, we aim to demonstrate TPX power generation in an integrated device to validate its potential for next generation thermal energy harvesting at low-to-medium temperatures.

Key information:

Five organisations,
three European countries
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Topic:
Future and emerging technologies (EIC FET Proactive)
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Project web-page:
tpx-power-h2020.eu

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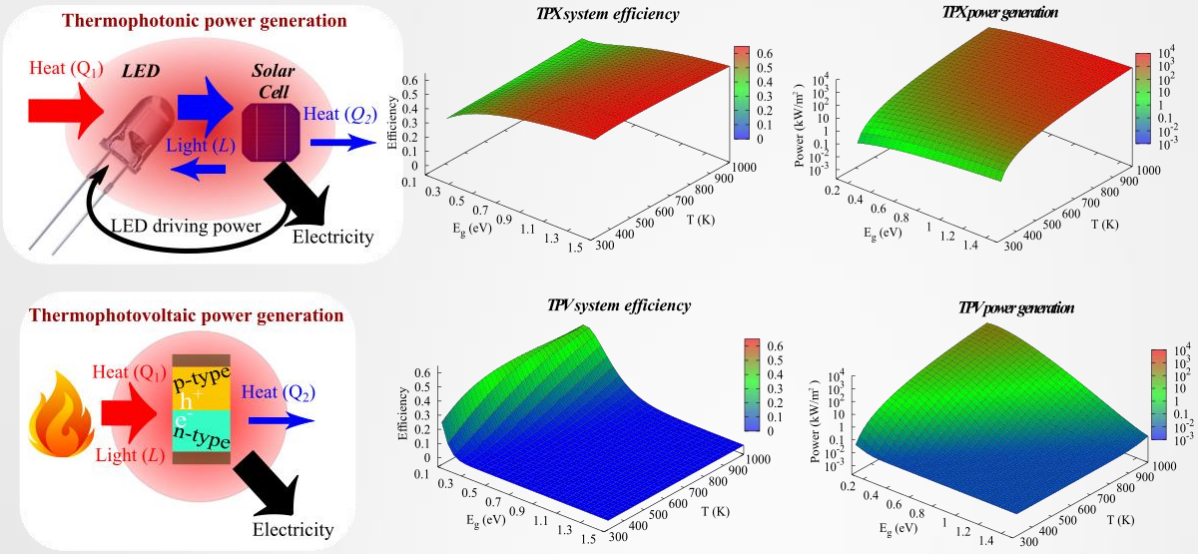

Figure: Schematic comparison of the basic principles and performance of a thermophotonic (TPX) and thermophotovoltaic (TPV) heat engines. Under ideal conditions the TPX system can operate at very high system efficiencies and powers over a broad range of temperatures and material bandgaps, whereas TPV systems typically require very small bandgap materials and high temperatures.

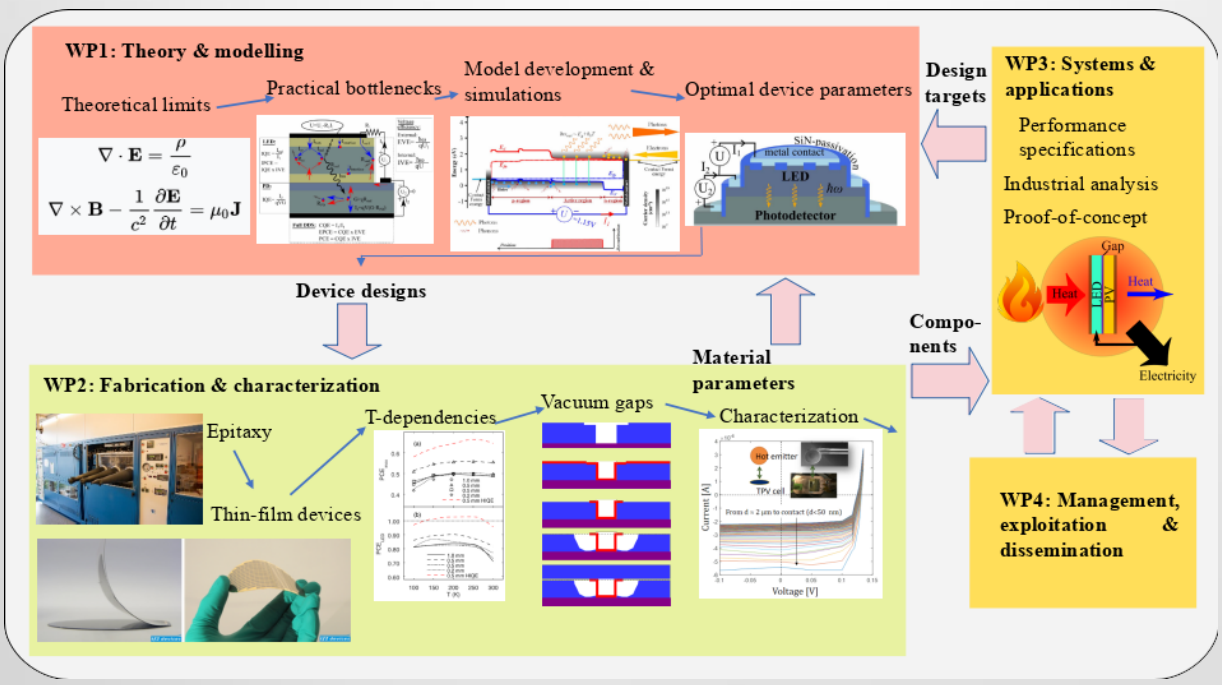

Figure: Overview of the work in the project.

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