

# Heat Management and Energy Scavenging at Small Scales

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In the 19<sup>th</sup> century, early power generation was local, inefficient and expensive. In the 20<sup>th</sup> century, the industry used the idea of the economy of scale and built centralized grids more efficient and cheaper than local ones that are serving us to date. In the 21<sup>st</sup> century, we are witnessing the arrival of portable, personalized, low-power electronics and the need for local off-grid power generation. Today, due to the lack of portable solid-state power generators, we rely on energy storage means, i.e. batteries. Thermoelectric, thermomagnetic and thermionic modules can convert thermal energy to electricity, hence, providing the possibility of local portable power generation. These modules are also used for refrigeration, active cooling of hot spots of electronics [1], and thermal regulation [2].

In this talk, I will review the basic operation of solid-state thermal to electrical power generators and solid-state coolers. I will then focus on two relatively new classes of thermoelectric materials: topological semimetals [3,4] and 2d Van der Waals layered materials [5]. I will review the latest work from our group relevant to these two classes of materials and their significance to heat management and power generation.

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