

## **Up-scalable emerging energy conversion technologies enabled by 2D materials: From miniature power harvesters towards grid-connected energy systems**

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*e-mail: [krogdakis@hmu.gr](mailto:krogdakis@hmu.gr) Up-scalable emerging energy conversion technologies enabled by 2D materials: From miniature power harvesters towards grid-connected energy systems*

### **Abstract**

An aggressive technological deployment will soon affect the planet's energy landscape, demanding a swift transformation from the predominant use of fossil fuels to that of renewable energy installations. With its concurrent arrival the Internet-of-Things (IoT) promises to create a largely distributed global network of wireless sensors and wearables connected to the “cloud”: Humankind is exploiting new technological platforms able to impact sustainable development and prosperity toward Industry 4.0 revolution. These platforms will create a robust demand of energy for their supply with power, making a battery-free operation mandatory together with low manufacturing cost and reduced environmental impact. Hereby, we will present recent research progress on novel energy conversion systems enabled by Graphene and other related two-dimensional materials (GRM). It is shown that layered GRM-enabled “harvesters” span across a wide range of scales. The demonstrated prototypes include self-powered miniaturized IoT devices, which convert electromagnetic radiation, heat, vibrations, solar power, and water-dynamics energy into electricity, to large scale renewable energy installations. A step further towards on-grid electricity generation in smart cities of the future is highlighted by a two-fold complementary approach: use GRM to establish large networks consisted of multiple, in-series-connected miniature energy harvesters or develop up-scaled multi-energy harvester systems. In addition, challenges and perspectives for future research are also highlighted towards energy sustainable communities.

