Due to their unique properties together with the ease of synthesis and functionalization, graphene-based materials have been showing great potential in energy storage and conversion. These hybrid structures display excellent material characteristics, including high carrier mobility, radiate recombination rate and long-time stability. In this talk, we will introduce the recent advances in synthesis and applications of graphene and its derivatives in the fields of energy storage (lithium ion batteries) and conversion (oxygen reduction reaction for fuel cells). For example, (1) Core-shell architecture of Co$_3$Sn$_2$@Co pin on NG was designed for the dual encapsulation of Co$_3$Sn$_2$ with adaptable apparels of Co and NG to address the structural and interfacial stability concerns facing tin-based anodes. (2) Nickel sulfides/NG composites were prepared as anode materials, which exhibited not only high reversible capacity but also extraordinary cyclic performance and rate capability. It is worth noting that Ni$_3$S$_4$/NG composites showed 98.87% capacity retention with a discharge capacity of 1323.2 mAh/g at 100$^{th}$ cycle. (3) A novel iron nitride/nitrogen doped-graphene aerogel hybrid, synthesized by a facile two-step hydrothermal process, there exist strong interactions between Fe$_3$N nanoparticles and graphene substrates, leading to a synergistic effect towards oxygen reduction reaction. This presentation further highlights the working principles and problems hindered the practical applications of graphene-based materials in lithium batteries and fuel cells.