Thermodynamics traditionally has described macroscopic systems. Recently due to rapidly developing experimental techniques one can manipulate single systems with high precision. For instance, a heat engine has been recently realised, whose working body is a single ion, with the heat baths are implemented by two lasers, alternately shining at the ion. This experimental development is accompanied with theoretical research aiming at understanding thermodynamics of microsystem. As a result, a new branch of science called Quantum Thermodynamics. In this project we want to develop Quantum Thermodynamics in two complementary directions. On one hand we shall deal with quantum open systems approach to thermodynamics – dynamical in spirit – where the quantum thermal machines are described by evolution continuous in time. The other approach we want to develop is so-called resource theory of thermodynamics – a very recent branch of Quantum Thermodynamics, kinematic in spirit, inspired by quantum information. The two branches are complementary – one is more suitable to direct description of physical thermodynamic systems – but often not tractable analytically, while the other one although further from physical realm, admit a great deal of analytical methods that allow to optimize thermodynamical processes. Within the project we want to challenge an open problem of obtaining proper thermodynamic behavior of two (or more) coupled systems, each of them interacting with a different bath. Surprisingly, there is no dynamical description that would correctly account of thermodynamics of such systems. We aim to solve this problem, by employing a new dynamical equation. Within the resource-theoretic approach, we want in particular to develop resource-theoretic fluctuation-dissipation relations (identified in most recent development), refine definition of work for quantum battery with ground state. Finally, we also want to seek for interconnections between the two field. Indeed the latter while rapidly developing, are quite separated from one another. We expect e.g. that the recent optimization of performance of resource-theoretic quantum engines, may inspire optimization of dynamical quantum heat engines. The project will be realized in International Centre for Theory of Quantum Technology (ICTQT), a recently founded vibrant institute gathering researchers from all over the world.