Economic feasibility of organic rankine cycles (ORC) in different transportation sectors

Abstract:
This study defines a benchmark for ORC applications in the transportation sector and investigates the current situation for different transport applications. The economic impact of the ORC integration is evaluated in terms of fuel savings for the improved efficiency, including also the influence of mass and volume of the ORC. The ORC weight and volume compete with the transport capacity of the vehicle and lead to lower revenues from freight transportation or passenger tickets. In order to be economic, a maximum allowable change of transport capacity by mass and volume is determined for a typical city bus, a truck of 24-40 t of payload capacity, a middle-size freight train (1'000 t), an inland water vessel (Va RoRo, 2'500 t) and handysize-like vessel (25'000 t). Therefore, the present study shows a theoretical and practical approach for the economic application of ORC in the transportation sector. The maximum allowable mass and volume of the ORC are compared with weight and volume of a commercial ORC product. It appears that the situation in the maritime sector is highly favorable. A different result is obtained for road and rail vehicles. For trains, mass has to be reduced at least by 13% and volume by 59%. For trucks and busses, the necessary weight and volume reduction is even higher.