Title: Waste heat recovery using a novel high performance low pressure turbine for electric turbocompounding in downsized gasoline engines: Experimental and computational analysis

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Abstract: The development of a high performance LPT (Low Pressure Turbine) for turbocompounding applications in downsized gasoline engine is presented in this paper. The LPT was designed to fill the existing technology gap where no commercially available turbines can operate effectively at low-pressure ratios (1.05-1.3) to drive an electric generator with 1.0 kW power output. The newly designed LPT geometry was tested at Imperial College under steady-state conditions; a maximum total-to-static efficiency, ?t-s 75.8% at pressure ratio, PR ˜ 1.08 was found.The LPT performance maps were then used for a validated 1-D engine model in order to assess the effect of turbocompounding on BSFC (Brake Specific Fuel Consumption). Then a prototype of the LPT was tested in the post catalyst position on a 1.0 L gasoline engine for different operating conditions. The test results showed that reduction in BSFC of 2.6% could be achieved.With the post-catalyst position selected, a KP (key-point) engine speed/load analysis was performed in order to project an overall NEDC (New European Drive Cycle) fuel consumption benefit for the LPT in a mechanical turbocompounding configuration, as well as an overall power benefit calculation. Finally, a sensitivity study indicated what the power could be off-cycle.