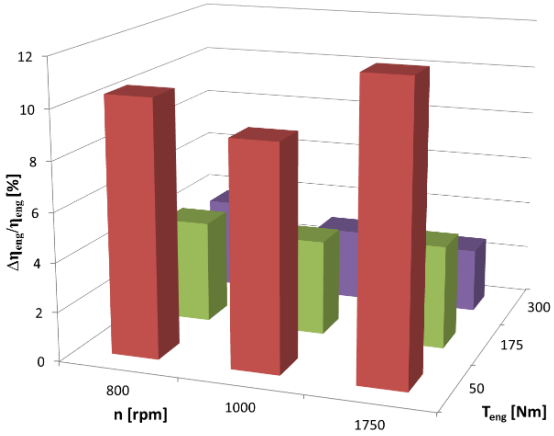

Figure 11. Engine efficiency increment for the engine operating points defined by the discretization grid, R601

4. CONCLUSIONS

An Organic Rankine Cycle bottoming a compression ignition engine installed on a passenger car has been investigated. The thermal power available for the ORC system has been measured when the vehicle was performing an RDE test, in order to consider realistic values. The working fluid selected for ORC calculations was n-pentane (R 601) and, only for comparison purposes, R134a has been chosen as reference.

ORC performance in terms of recovered power, Rankine cycle efficiency and engine efficiency increment have been evaluated in 10 points of a torque – engine speed grid, each one characterized by a residence time. The recovered power resulted between 0.5 and 2.5 kW, the Rankine cycle efficiency ranged between 11 and 12 % while engine efficiency increase varied from 2.5 to 12 %.

By considering the permanence time in each discretized operating condition the engine efficiency increment on the RDE test was around 6 %.

ACKNOWLEDGMENT

The authors acknowledge dr. Maria Vittoria Prati, *Istituto Motori CNR*, Napoli, Italy, for providing Real Driving Emission test data. The contribution of the students G. Pezone and M. Tesone is acknowledged.

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NOMENCLATURE

A	Area [m^2]
T	Torque [N m]
c_p	Specific Heat [kJ/(kg K)]
DOC	Diesel Oxidation Catalyst
DPF	Diesel Particulate Filter
EAS	Exhaust After-treatment system
ECU	Engine Control Unit
EGR	Exhaust Gas Recirculation
eng	Engine
HRSG	Heat Recovery Steam Generator
ICE	Internal Combustion Engine
LHV	Lower Heating Value [MJ/kg]
M	Mass [kg]
mfr	Mass flow rate [kg/s]
N	Engine speed [RPM]
P	Pressure [bar]
ORC	Organic Rankine Cycle
P_{ORC}	ORC Recovered Power [kW]
P_{sh}	Shaft Engine Power [kW]
RDE	Real Driving Emission test
SCR	Selective Catalytic Reduction
T	Temperature [K]
U	Overall heat transfer coefficient [W m^{-2} K^{-1}]
V	Speed [m/s]

Greek symbols

η_{eng}	Engine Efficiency [-]
η_{ORC}	ORC Efficiency [-]