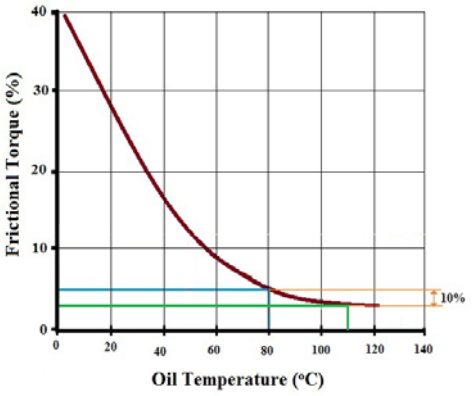

Figure 6. Advanced detailed cooling system model

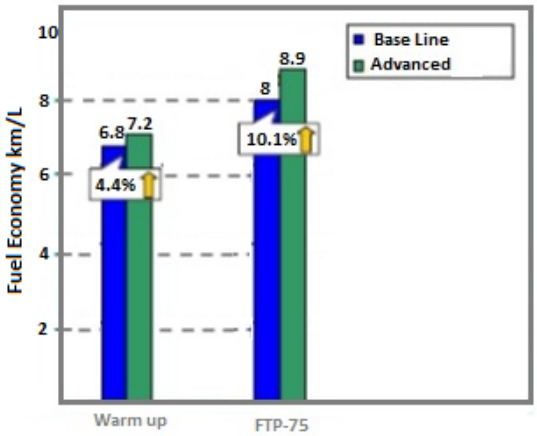

Figure 7. Advanced detailed cooling system model

The electric valve was used to raise the coolant temperature higher than with a conventional thermostat (from 90°C to 98°C) to improve the cold start and warm up process. In this manner the engine can run warmer than normal which can enhance combustion along the walls, improve heat flow and obtain higher combustion temperatures which enhance engine performance and reduce the fuel consumption.

VI. CONCLUSION

The detailed cooling system model for TCD 6V2015 diesel engine was configured with commercial code, GT-SUITE. The simulation results were compared with experimental data in order to validate the conventional cooling system model then a controlled cooling system model was conducted to study its effect on engine performance. The computer controlled cooling system met the objectives of increasing coolant temperatures to the optimum working temperatures which led to fuel saving

The main conclusions of this research are summarized as follows:

- Reducing the parasitic losses for pump and fan.
- Controlling the pump speed and fan speed to increase the engine thermal efficiency.
- Using electric thermostat to reduce the pressure resistance and increase its response.

In addition, the use of this detailed model will enable the investigation of more innovative control systems for both existing and proposed hardware, even using Hardware-in-the-Loop (HIL) simulations to prove new ideas.

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