A 1600 cc direct injected turbocharged Euro 5 diesel engine was operated on standard diesel fuel from a gas station in Denmark for evaluation of the test bench procedure. The NEDC (New European Driving Cycle), FTP-75 (Federal Test Procedure) and WLTP (World Harmonized Light Vehicle Test Procedure) driving cycles were simulated in the engine test bench in two ways: 1) by transient engine operation were the inertia of the vehicle during deceleration was simulated by addition of power from an electric motor mounted on the crank shaft, and 2) by steady state measurements where the total driving pattern was simulated from an integration of multiple steady state measurements. The mathematical model that calculates equivalent NEDC driving cycle vehicle emissions from the engine steady state measurements in the test bench, starting with warm engine, is presented. By applying this model any driving cycle emissions can be calculated from the presented tabulated steady state measurements, starting with warm or cold engine.

Both engine test methods showed acceptable agreement with measurement in an NEDC vehicle test on chassis dynamometer where the vehicle was equipped with a similar engine as the test bench engine. The two engine test bench methods gave very similar results, but the transient engine test procedure showed a little higher emission of CO2 and NOx, results that were closest to the vehicle measurements. This is interpreted as a result of extra emissions when the engine adjusts from one operating point to the next during transient operation. These extra emissions are not caught in the steady state method. Application of the two engine test procedures on the FTP-75 procedure and the newer WLTP showed that the steady state engine test method gave significantly lower emissions of NOx and a little lower CO2 emissions compared to the transient engine test. The results indicated that this was mainly an effect of the time delay on the engines EGR system adjustment, which is not caught in the steady state method.

The advantages and disadvantages of applying the different measurement methods and test procedures are discussed in relation to introduction of new test procedures in order to reduce engine/vehicle emissions.