Basic EV model development to validate acceleration specification

An EV is operated on a flat road and defined by the following model parameters

- r_w = 0.4 m
- M_v = 1620 kg
- C_d = 0.29
- C_r = 0.01
- A_v = 2.75 m^2
- P_{e_max} = 80 kW
- v_{base} = 30 MPH
- η_{tw} = 80% (tank to wheel efficiency)

a) Solve the approximate accelerate time t_a from 0 to 60 MPH.
b) Solve the approximate total energy required from the battery to accelerate from 0 to 60 MPH, taking into account the tank to wheel efficiency, η_{tw}.
c) Verify the analytical results of (a) via simulation using the following steps
   - Build the basic EV Simulink simulation model described in the "Intro to MATLAB/Simulink" supplementary lecture (posted online with the course lectures)
   - Simulate the model with the parameters above and show the resulting plot with speed v [mph] and tractive propulsion force F_v [N] and the solved acceleration time t_a.
d) Verify the analytical results of (b) via simulation using the following steps
   - Modify the basic EV model to include the following signals
     - Vehicle tractive power P_v
     - Battery power, $P_{batt} = P_v / \eta_{tw}$
     - Total battery energy used, E_{batt} (integral of battery power)
   - Modify the PlotEVData.m file to add two additional subplots with the signals
     - P_v and P_{batt}
     - E_{batt}
   - Simulate the model and compare with results from (b)
   - Turn in images of your modified model with brief comments describing each of the added components