**Supplementary Material 2: Main Equations of System Dynamics**

1. Actual Vehicle Carbon Emissions = ((Fuel Vehicle Ownership-Defective Vehicles \* 0.8) \* 259.67 + Defective Vehicles\*RANDOM TRIA(260, 620, 440) \* 0.8) \* Technological Progress Factor /1e+10
2. Annual Reveue= (Retail Price\*Fuel Vehicle Increment-Penalty-0.1\*Unit Recall Cost \* (Confirmed Defective Vehicles-Correction Factor-Unrecalled Vehicles)) / 10000
3. Collection Channels of Regulatory Agencies= 0.82 \* Vehicle Emission Inspection Frequency +0.18\*Consumer Complaint Reporting Level
4. Confirmed Defective Vehicles= if then else(Time=0, 1394, (0.556\*Information Collection Level \* Regulatory Intensity \* Vehicle Emission Testing Development Coefficient \* Manufacturer Investigation Intensity) \*Defective Vehicles\*RANDOM NORMAL(0.1, 1)\*TIME STEP )
5. Consumer Attitude= Degree of Publicity and Guidance\*(1 + Effect Degree of The Availability Heuristic)
6. Consumer Participation Level= Notification Rate \* (Consumer Attitude \* Perceived Behavioral Control + (1- Consumer Attitude \* Perceived Behavioral Control) \* Vehicle Emission Inspection Frequency)\*RANDOM NORMAL(1 , 0.05)
7. Defect Severity= 0.48+(Penalty/(DELAY1I( Annual Reveue , 1 , 3e+07 )\* 5))
8. Degree of Publicity and Guidance= 0.00075798\*The Number of Policies+0.0051\*Policy Draft Readings
9. Effect Degree of The Availability Heuristic= 0.3325\*The Proportion of Mainstream Media Coverage+0.6675\*Social Media Discussions
10. Emission Standards Increase Cost= 0.12 \* ("Policy/Emission Standards Intensity"-0.3)/0.1
11. Family Purchase Intent= WITH LOOKUP (Average Household Ownership, ([(0,0)-(0.4,10)],(0.015,10),(0.05 ,8),(0.085, 7.05),(0.15, 4.5),(0.25, 2),(0.35,1.8)))
12. Fuel Vehicle Increment= MAX(0, Fuel Vehicle Growth Rate)
13. Fuel Vehicle Ownership= INTEG (Fuel Vehicle Increment-Scrapped Fuel Vehicles, 2.7608e+08)
14. GDP= INTEG (GDP Change, 1.016e+14)
15. Information Collection Level= 0.5\*Collection Channels of Regulatory Agencies + 0.3 \* Manufacturer Emission Reporting Frequency +0.2\*Operator and Part Producer Reporting Frequency
16. Internal Combustion Engine Cost= Learning Effect \* Initial Combustion Engine Cost + Emission Standards Increase Cost
17. Learning Effect= (Fuel Vehicle Ownership/2.7608e+08) ^ (LN(Progress Ratio)/LN(2))
18. Manufacturer Cooperation Level= (1+Regulatory Intensity)\*EXP(-1.203\*10^(-6)\*Unit Recall Cost\*(Confirmed Defective Vehicles -Correction Factor))\* 0.650333
19. Manufacturer Investigation Intensity= 0.7-Defect Severity\*(1-Regulatory Intensity)
20. Natural Population Growth Rate = WITH LOOKUP ( Time, ([(0,0)-(10,10)],(0,2.8333e-05),(1,-0.000375402),(2,-0.00574464),(3,-0.00241515),(4,-0.00257811),(5,-0.0028139), (6,-0.00304442),(7,-0.00326258),(8,-0.00349726),(9,-0.00370531),(10,-0.00390832 ) ))
21. New Energy Vehicle Penetration Rate = WITH LOOKUP (Time, ([(0,0)-(10,1)], (0,0.062), (1,0.15),(2,0.2767),(3,0.36),(5,0.55),(10,0.8 )))
22. Notification Rate= 0.7\*LN(Manufacturer Cooperation Level+1)/LN(2)+0.3
23. Overall Utility= TFV Attractiveness\*Service Quality \* Warranty Duration \* Technology Maturity \* Family Purchase Intent \* (1-New Energy Vehicle Penetration Rate)
24. Planned Vehicle Carbon Emission Amount= WITH LOOKUP (Time, ([(0,0)-(10,10)], (0,0.9738),(5,0.798),(10,0.66) ))
25. Production Cost= Glider Cost + Base Fixed Cost + Internal Combustion Engine Cost
26. Regulatory Intensity= 0.5\*"Policy/Emission Standards Intensity"+0.5\*Defect Severity + 0.02\*Time
27. Retail Price= Production Cost\*(1+Price Markup)
28. Technology Maturity= INTEG (Technological Improvement, 0.65)
29. Technological Progress Factor = WITH LOOKUP (Time, ([(0,0)-(10,1)],(0,1),(1,0.97), (2,0.95),(3,0.937),(4,0.928),(5,0.921),(6 ,0.917),(7,0.9139),(8,0.9114),(9,0.9102),(10,0.9098)))
30. TFV Attractiveness= Total Cost of NEV/Total Cost of TFV
31. Total Population= INTEG (Natural Population Growth, 1.41178e+09)
32. Unrecalled Vehicles= (Confirmed Defective Vehicles-Correction Factor)\*(1-Vehicle Recall Completion Rate )
33. Vehicle Carbon Emission Target= Actual Vehicle Carbon Emissions/0.075/(GDP\*10\*1e-13)-Planned Vehicle Carbon Emission Amount