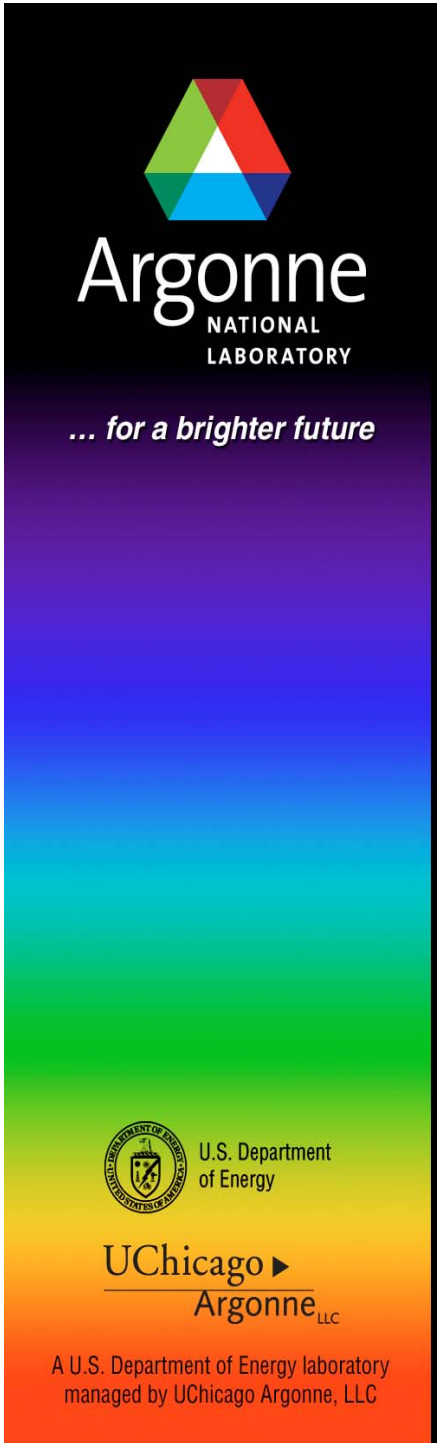


Demonstration of GREET 2.7

I. Vehicle-Cycle Simulations through the Excel Spreadsheet

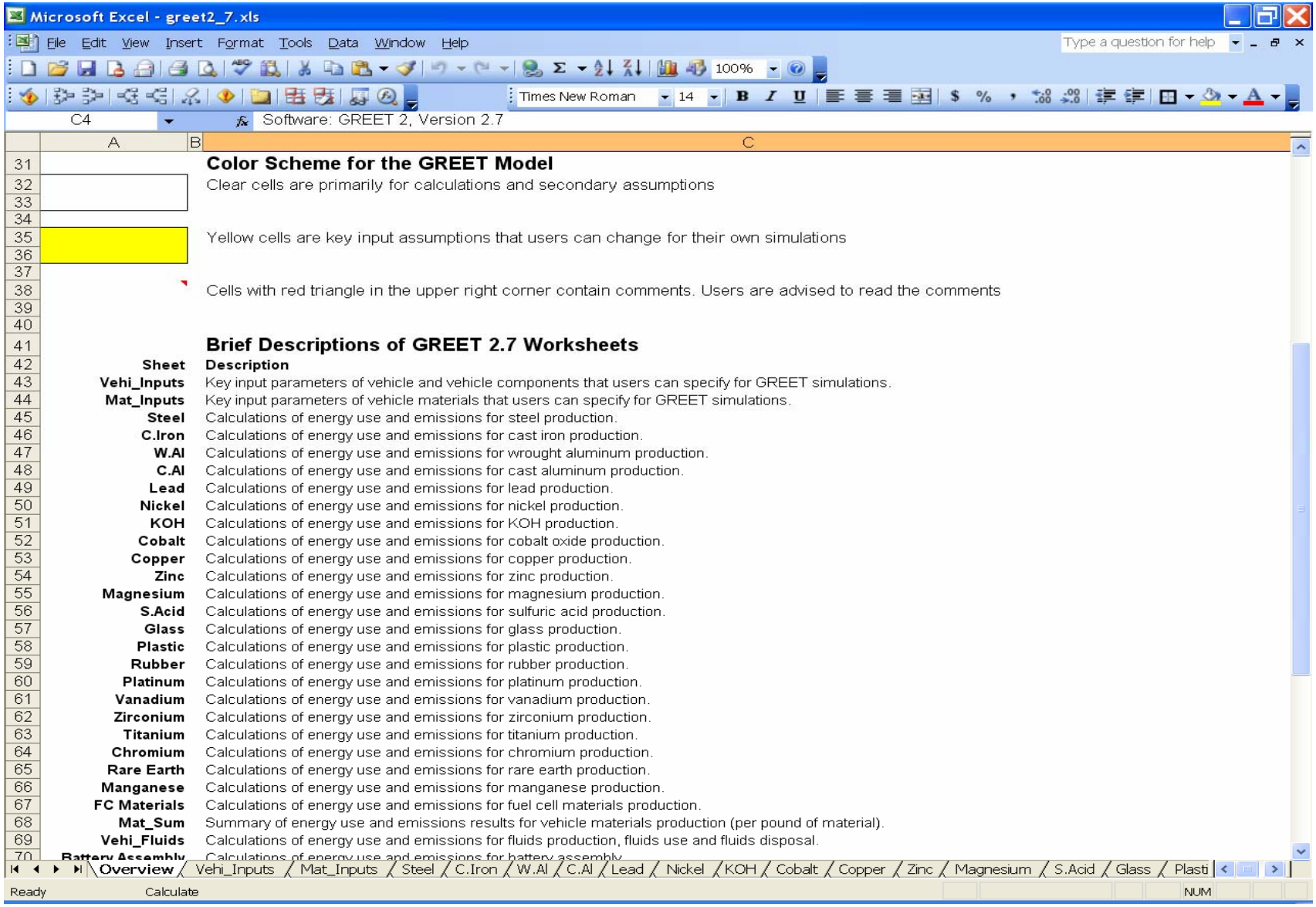
Andrew Burnham
Center for Transportation Research
Argonne National Laboratory

GREET User Workshop
Argonne, IL, June 25-26, 2007

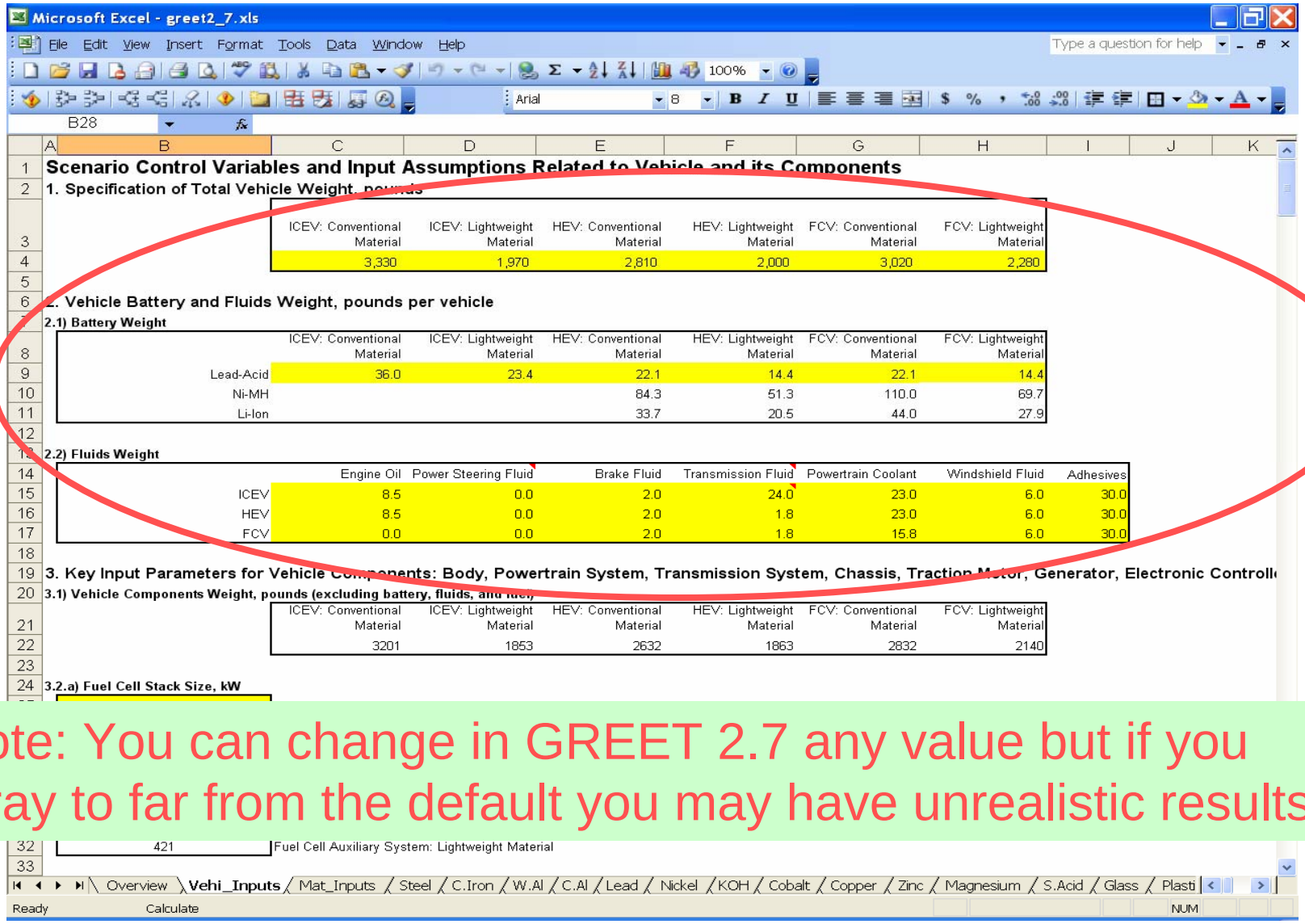
Two Cases Will be Demoed through the GREET Excel Spreadsheet Model

- Hybrid Electric Vehicle (Demo 1)
  - Vehicle Selection: HEV
  - Material Selection: Lightweight
  - Battery Selection: Ni-MH vs. Li-Ion
  - Motive Battery Replacement: 0 vs. 1 per lifetime
- Fuel Cell Vehicle (Demo 2)
  - Vehicle Selection: FCV
  - Material Selection: Conventional
  - Battery Selection: Li-Ion
  - Stack vs. Battery Size: 70 kW stack/30 kW Li-Ion vs. 100 kW stack/no battery
  - Platinum Allocation Method: Weight-based vs. market-based

Browse the Overview Sheet prior to the Specific GREET Simulation



Input Weights (Vehicle, Lead-Acid Battery, and Fluids) in the Veh_Inputs Sheet



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Scenario Control Variables and Input Assumptions Related to Vehicle and its Components

1. Specification of Total Vehicle Weight, pounds

ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
3,330	1,970	2,810	2,000	3,020	2,280

2. Vehicle Battery and Fluids Weight, pounds per vehicle

2.1) Battery Weight

	ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
Lead-Acid	36.0	23.4	22.1	14.4	22.1	14.4
Ni-MH			84.3	51.3	110.0	69.7
Li-Ion			33.7	20.5	44.0	27.9

2.2) Fluids Weight

	Engine Oil	Power Steering Fluid	Brake Fluid	Transmission Fluid	Powertrain Coolant	Windshield Fluid	Adhesives
ICEV	8.5	0.0	2.0	24.0	23.0	6.0	30.0
HEV	8.5	0.0	2.0	1.8	23.0	6.0	30.0
FCV	0.0	0.0	2.0	1.8	15.8	6.0	30.0

3. Key Input Parameters for Vehicle Components: Body, Powertrain System, Transmission System, Chassis, Traction Motor, Generator, Electronic Controll

3.1) Vehicle Components Weight, pounds (excluding battery, fluids, and fuel)

ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
3201	1853	2632	1863	2832	2140

3.2.a) Fuel Cell Stack Size, kW

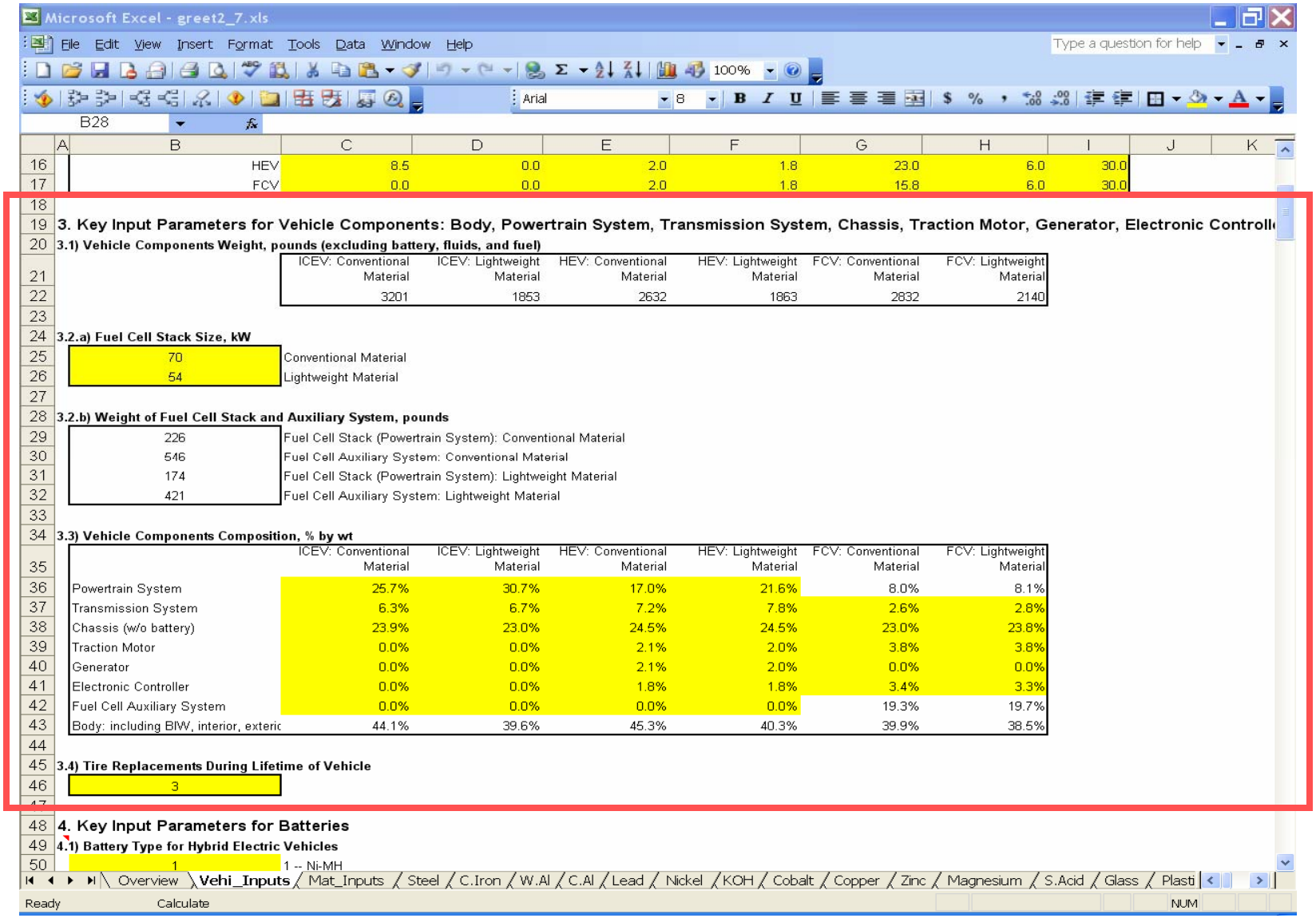
421	Fuel Cell Auxiliary System: Lightweight Material

Overview | Vehi_Inputs | Mat_Inputs | Steel | C.Iron | W.Al | C.Al | Lead | Nickel | KOH | Cobalt | Copper | Zinc | Magnesium | S.Acid | Glass | Plasti

Ready Calculate NUM

Note: You can change in GREET 2.7 any value but if you stray to far from the default you may have unrealistic results

Select Key Input Parameters for the Vehicle Components in the Veh_Inputs Sheet



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HEV	8.5	0.0	2.0	1.8	23.0	6.0	30.0	
FCV	0.0	0.0	2.0	1.8	15.8	6.0	30.0	

3. Key Input Parameters for Vehicle Components: Body, Powertrain System, Transmission System, Chassis, Traction Motor, Generator, Electronic Controll

3.1) Vehicle Components Weight, pounds (excluding battery, fluids, and fuel)

ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
3201	1853	2632	1863	2832	2140

3.2.a) Fuel Cell Stack Size, kW

70	Conventional Material
54	Lightweight Material

3.2.b) Weight of Fuel Cell Stack and Auxiliary System, pounds

226	Fuel Cell Stack (Powertrain System): Conventional Material
546	Fuel Cell Auxiliary System: Conventional Material
174	Fuel Cell Stack (Powertrain System): Lightweight Material
421	Fuel Cell Auxiliary System: Lightweight Material

3.3) Vehicle Components Composition, % by wt

	ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
Powertrain System	25.7%	30.7%	17.0%	21.6%	8.0%	8.1%
Transmission System	6.3%	6.7%	7.2%	7.8%	2.6%	2.8%
Chassis (w/o battery)	23.9%	23.0%	24.5%	24.5%	23.0%	23.8%
Traction Motor	0.0%	0.0%	2.1%	2.0%	3.8%	3.8%
Generator	0.0%	0.0%	2.1%	2.0%	0.0%	0.0%
Electronic Controller	0.0%	0.0%	1.8%	1.8%	3.4%	3.3%
Fuel Cell Auxiliary System	0.0%	0.0%	0.0%	0.0%	19.3%	19.7%
Body: including BIW, interior, exteric	44.1%	39.6%	45.3%	40.3%	39.9%	38.5%

3.4) Tire Replacements During Lifetime of Vehicle

3

4. Key Input Parameters for Batteries

4.1) Battery Type for Hybrid Electric Vehicles

1	1 -- Ni-MH

Overview | Vehi_Inputs | Mat_Inputs | Steel | C.Iron | W.Al | C.Al | Lead | Nickel | KOH | Cobalt | Copper | Zinc | Magnesium | S.Acid | Glass | Plasti

Ready Calculate NUM

Select Key Input Parameters for Battery and Fluids in the Veh_Inputs Sheet

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4. Key Input Parameters for Batteries

4.1) Battery Type for Hybrid Electric Vehicles

1	1 -- Ni-MH
	2 -- Li-Ion

4.2) Battery Type for Fuel Cell Vehicles

1	1 -- Ni-MH
	2 -- Li-Ion

4.3) Battery Size in Peak Battery Power, kW

	Ni-MH	Li-Ion
HEV: Conventional Material	23	23
HEV: Lightweight Material	14	14
FCV: Conventional Material	30	30
FCV: Lightweight Material	19	19

4.4) Battery Replacements During Lifetime of Vehicle

	Lead-Acid	Ni-MH	Li-Ion
ICEV	2		
HEV	2	1	1
FCV	2	1	1

4.5) Battery Specific Power	**W/kg**	**W/lb**
Ni-MH	600	272
Li-Ion	1500	680

5. Key Input Parameters for Fluids

5.1) Fluids Replacements During Lifetime of Vehicle

Engine Oil	Power Steering Fluid	Brake Fluid	Transmission Fluid	Powertrain Coolant	Windshield Fluid	Adhesives
40	0	3	1	3	20	0

5.2) Ratio of Waste to Product when Fluids is Disposed

Engine Oil	Power Steering Fluid	Brake Fluid	Transmission Fluid	Powertrain Coolant	Windshield Fluid	Adhesives
66.7%	66.7%	66.7%	66.7%	66.7%	0.0%	66.7%

Overview | Vehi_Inputs | Mat_Inputs | Steel | C.Iron | W.Al | C.Al | Lead | Nickel | KOH | Cobalt | Copper | Zinc | Magnesium | S.Acid | Glass | Plasti

Ready Calculate NUM

Select Key Assumptions for ADR and Vehicle Lifetime in the Veh_Inputs Sheet

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D101 =1+(0.0012*(((G4-H4)/G4*100)^2)+0.6877*((G4-H4)/G4*100)+0.0351)/100

	B	C	D	E	F	G	H
81	66.7%	66.7%	66.7%	66.7%	66.7%	0.0%	66.7%

6. GREET Default Key Assumptions for Vehicle and Vehicle Component Production

6.1) Energy Use of Battery Assembly: mmBtu per ton of battery

27.470	Lead-Acid
35.230	Ni-MH
30.690	Li-Ion

6.2) Energy Use of Vehicle Assembling, Disposal and Recycling: mmBtu per vehicle

0.234	Paint Production
0.956	Vehicle Painting
3.874	Vehicle Assembly
1.420	Vehicle Disposal

7. Lifetime VMT of a Vehicle, miles

ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
160,000	160,000	160,000	160,000	160,000	160,000

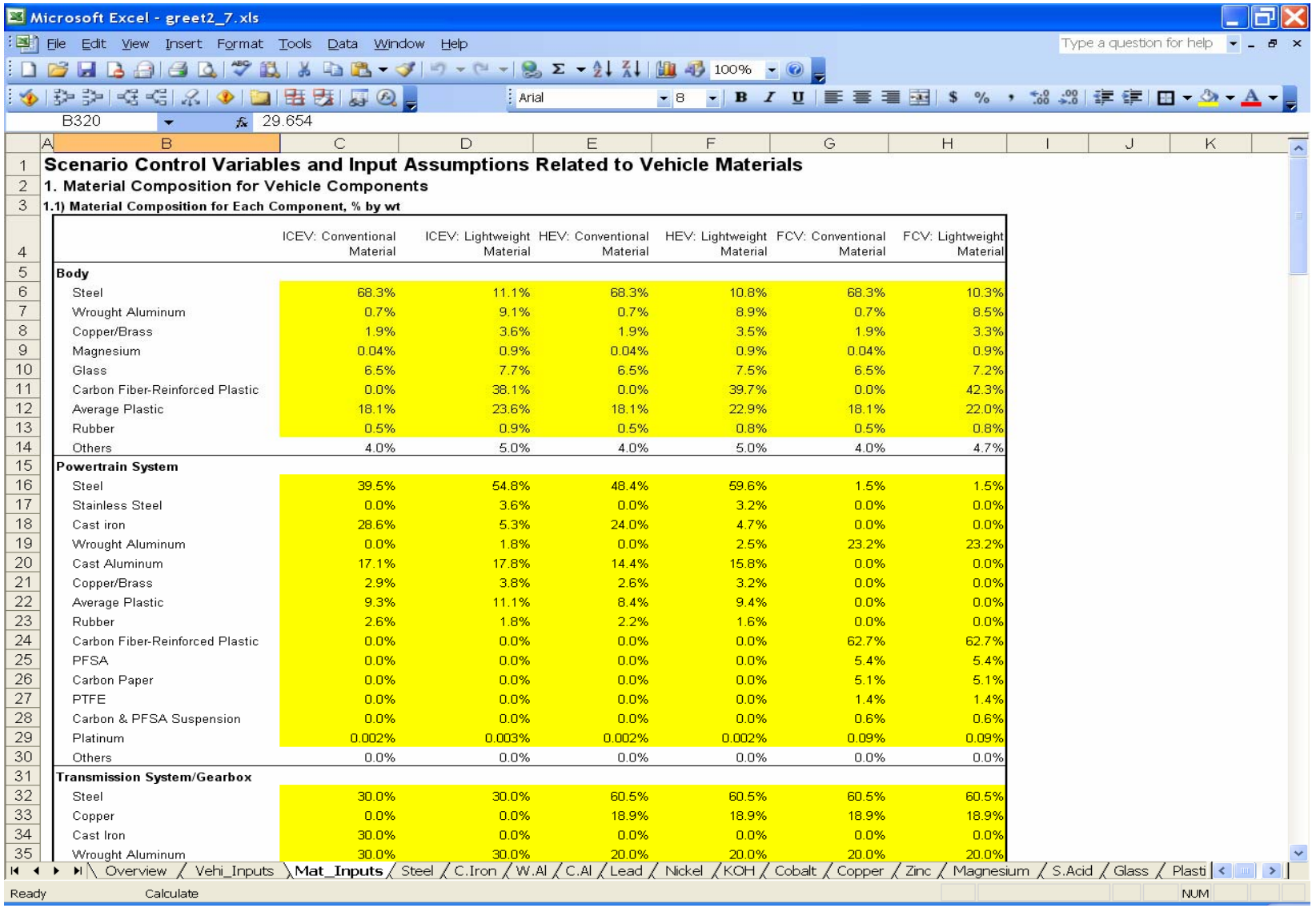
8. Ratios of Fuel Economy of Lightweight Material Vehicles Relative to Their Conventional Material Vehicles Counterpart

ICEV: Lightweight Material	HEV: Lightweight Material	FCV: Lightweight Material
132%	119%	118%

Overview | Vehi_Inputs | Mat_Inputs | Steel | C.Iron | W.Al | C.Al | Lead | Nickel | KOH | Cobalt | Copper | Zinc | Magnesium | S.Acid | Glass | Plasti

Ready Calculate NUM

Select Material Composition for Each Vehicle Component in the Mat_Inputs Sheet



Microsoft Excel - greet2_7.xls

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Type a question for help

B320 29.654

Scenario Control Variables and Input Assumptions Related to Vehicle Materials

1. Material Composition for Vehicle Components

1.1) Material Composition for Each Component, % by wt

	ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
Body						
Steel	68.3%	11.1%	68.3%	10.8%	68.3%	10.3%
Wrought Aluminum	0.7%	9.1%	0.7%	8.9%	0.7%	8.5%
Copper/Brass	1.9%	3.6%	1.9%	3.5%	1.9%	3.3%
Magnesium	0.04%	0.9%	0.04%	0.9%	0.04%	0.9%
Glass	6.5%	7.7%	6.5%	7.5%	6.5%	7.2%
Carbon Fiber-Reinforced Plastic	0.0%	38.1%	0.0%	39.7%	0.0%	42.3%
Average Plastic	18.1%	23.6%	18.1%	22.9%	18.1%	22.0%
Rubber	0.5%	0.9%	0.5%	0.8%	0.5%	0.8%
Others	4.0%	5.0%	4.0%	5.0%	4.0%	4.7%
Powertrain System						
Steel	39.5%	54.8%	48.4%	59.6%	1.5%	1.5%
Stainless Steel	0.0%	3.6%	0.0%	3.2%	0.0%	0.0%
Cast iron	28.6%	5.3%	24.0%	4.7%	0.0%	0.0%
Wrought Aluminum	0.0%	1.8%	0.0%	2.5%	23.2%	23.2%
Cast Aluminum	17.1%	17.8%	14.4%	15.8%	0.0%	0.0%
Copper/Brass	2.9%	3.8%	2.6%	3.2%	0.0%	0.0%
Average Plastic	9.3%	11.1%	8.4%	9.4%	0.0%	0.0%
Rubber	2.6%	1.8%	2.2%	1.6%	0.0%	0.0%
Carbon Fiber-Reinforced Plastic	0.0%	0.0%	0.0%	0.0%	62.7%	62.7%
PFSA	0.0%	0.0%	0.0%	0.0%	5.4%	5.4%
Carbon Paper	0.0%	0.0%	0.0%	0.0%	5.1%	5.1%
PTFE	0.0%	0.0%	0.0%	0.0%	1.4%	1.4%
Carbon & PFSA Suspension	0.0%	0.0%	0.0%	0.0%	0.6%	0.6%
Platinum	0.002%	0.003%	0.002%	0.002%	0.09%	0.09%
Others	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Transmission System/Gearbox						
Steel	30.0%	30.0%	60.5%	60.5%	60.5%	60.5%
Copper	0.0%	0.0%	18.9%	18.9%	18.9%	18.9%
Cast Iron	30.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Wrought Aluminum	30.0%	30.0%	20.0%	20.0%	20.0%	20.0%

Overview / Vehi_Inputs / Mat_Inputs / Steel / C.Iron / W.Al / C.Al / Lead / Nickel / KOH / Cobalt / Copper / Zinc / Magnesium / S.Acid / Glass / Plasti

Ready Calculate NUM

Aggregated Material Composition for Components Will be Displayed in the Mat_Inputs Sheet

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	G	H
Carbon Fiber-Reinforced Plastic	25.7%	25.7%
Wrought Aluminum	16.7%	16.7%
Copper	9.6%	9.6%
Average Plastics	8.7%	8.7%
Rubber	1.5%	1.5%
Nickel	0.5%	0.5%
Others	0.5%	0.5%

1.2) Vehicle Material Composition Aggregated by Each Component: % by wt

	ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
Steel	61.7%	30.5%	65.2%	30.9%	56.4%	21.4%
Stainless Steel	0.0%	1.1%	0.0%	0.7%	0.0%	0.0%
Cast Iron	11.1%	4.2%	6.0%	3.7%	1.8%	2.6%
Wrought Aluminum	2.2%	6.9%	1.8%	6.3%	5.9%	10.3%
Cast Aluminum	4.7%	14.7%	5.1%	14.1%	3.2%	11.2%
Copper/Brass	1.9%	3.2%	4.3%	5.4%	4.8%	5.5%
Magnesium	0.02%	0.4%	0.02%	0.4%	0.02%	0.3%
Glass	2.9%	3.0%	2.9%	3.0%	2.6%	2.8%
Average Plastic	11.2%	14.0%	10.6%	12.6%	10.2%	11.7%
Rubber	2.4%	2.6%	1.9%	2.0%	1.8%	1.8%
Carbon Fiber-Reinforced Plastic	0.0%	15.1%	0.0%	16.0%	10.0%	26.4%
Glass Fiber-Reinforced Plastic	0.0%	2.3%	0.0%	2.4%	0.0%	2.3%
Nickel	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
PFSA	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Carbon Paper	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
PTFE	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Carbon & PFSA Suspension	0.0%	0.0%	0.0%	0.0%	0.05%	0.05%
Platinum	0.0005%	0.0009%	0.0003%	0.0004%	0.007%	0.007%
Others	1.9%	2.2%	2.2%	2.5%	2.2%	2.5%

1.3) Material Composition of Tire, % by wt

Rubber	Steel
66.7%	0.0%

2. Battery Material Composition, % by wt

Overview / Vehi_Inputs / Mat_Inputs / Steel / C.Iron / W.Al / C.Al / Lead / Nickel / KOH / Cobalt / Copper / Zinc / Magnesium / S.Acid / Glass / Plasti

Ready Calculate NUM

Aggregated Material Composition for Components Will be Displayed in the Mat_Inputs Sheet

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		G	H
70	Carbon Fiber-Reinforced Plastic	25.7%	25.7%
71	Wrought Aluminum	16.7%	16.7%
72	Copper	9.6%	9.6%
73	Average Plastics	8.7%	8.7%
74	Rubber	1.5%	1.5%
75	Nickel	0.5%	0.5%
76	Others	0.5%	0.5%

78 **1.2) Vehicle Material Composition Aggregated by Each Component: % by wt**

		ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
80	Steel	61.7%	30.5%	65.2%	30.9%	56.4%	21.4%
81	Stainless Steel	0.0%	1.1%	0.0%	0.7%	0.0%	0.0%
82	Cast Iron	11.1%	4.2%	6.0%	3.7%	1.8%	2.6%
83	Wrought Aluminum	2.2%	6.9%	1.8%	6.3%	5.9%	10.3%
84	Cast Aluminum	4.7%	14.7%	5.1%	14.1%	3.2%	11.2%
85	Copper/Brass	1.9%	3.2%	4.3%	5.4%	4.8%	5.5%
86	Magnesium	0.02%	0.4%	0.02%	0.4%	0.02%	0.3%
87	Glass	2.9%	3.0%	2.9%	3.0%	2.6%	2.8%
88	Average Plastic	11.2%	14.0%	10.6%	12.6%	10.2%	11.7%
89	Rubber	2.4%	2.6%	1.9%	2.0%	1.8%	1.8%
90	Carbon Fiber-Reinforced Plastic	0.0%	15.1%	0.0%	16.0%	10.0%	26.4%
91	Glass Fiber-Reinforced Plastic	0.0%	2.3%	0.0%	2.4%	0.0%	2.3%
92	Nickel	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
93	PFSA	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
94	Carbon Paper	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
95	PTFE	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
96	Carbon & PFSA Suspension	0.0%	0.0%	0.0%	0.0%	0.05%	0.05%
97	Platinum	0.0005%	0.0009%	0.0003%	0.0004%	0.007%	0.007%
98	Others	1.9%	2.2%	2.2%	2.5%	2.2%	2.5%

100 **1.3) Material Composition of Tire, % by wt**

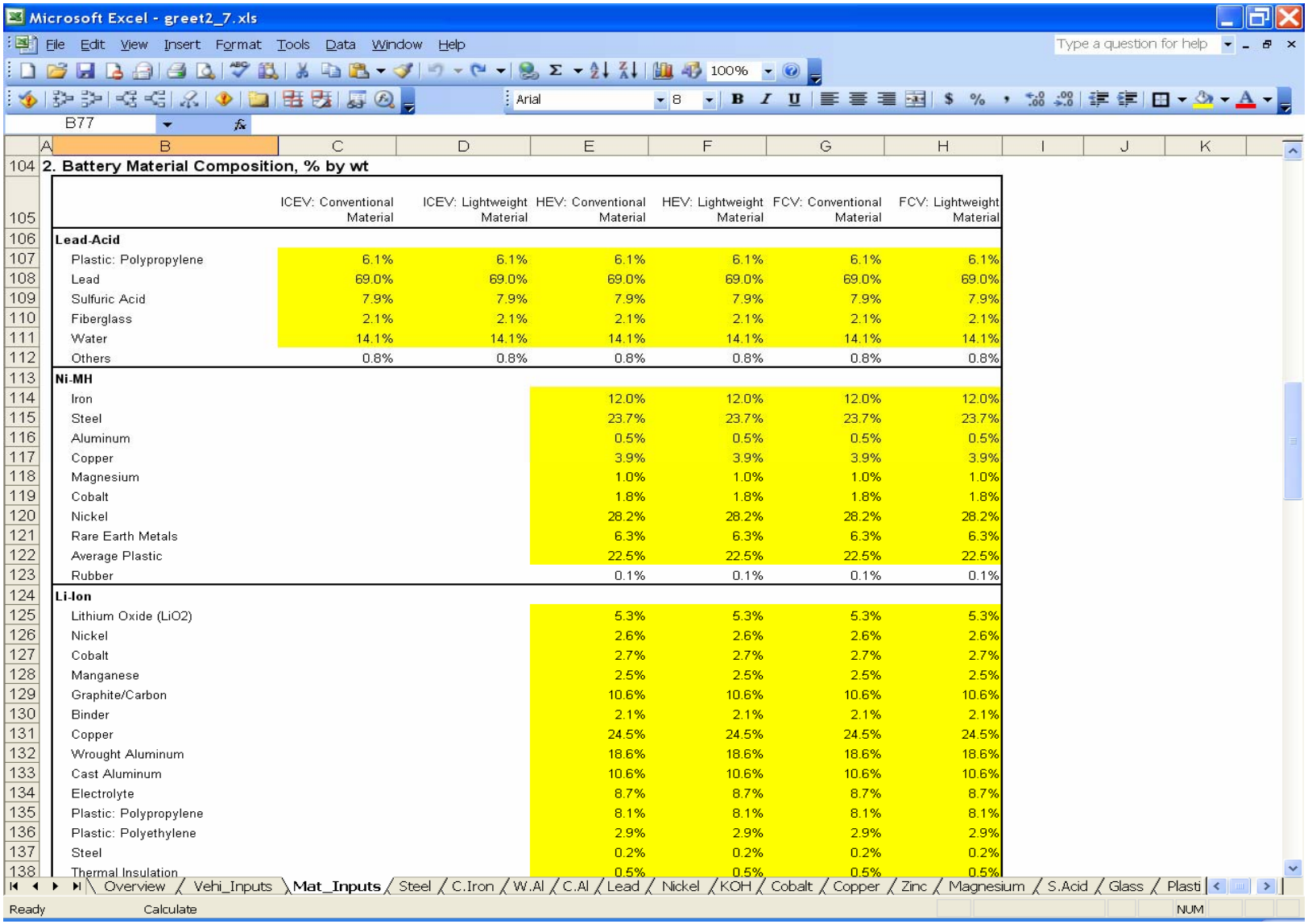
Rubber	Steel
66.7%	0.0%

104 **2. Battery Material Composition, % by wt**

Overview / Vehi_Inputs / Mat_Inputs / Steel / C.Iron / W.Al / C.Al / Lead / Nickel / KOH / Cobalt / Copper / Zinc / Magnesium / S.Acid / Glass / Plasti

Ready Calculate NUM

Select Material Composition for Battery in the Mat_Inputs Sheet



2. Battery Material Composition, % by wt

	ICEV: Conventional Material	ICEV: Lightweight Material	HEV: Conventional Material	HEV: Lightweight Material	FCV: Conventional Material	FCV: Lightweight Material
Lead-Acid						
Plastic: Polypropylene	6.1%	6.1%	6.1%	6.1%	6.1%	6.1%
Lead	69.0%	69.0%	69.0%	69.0%	69.0%	69.0%
Sulfuric Acid	7.9%	7.9%	7.9%	7.9%	7.9%	7.9%
Fiberglass	2.1%	2.1%	2.1%	2.1%	2.1%	2.1%
Water	14.1%	14.1%	14.1%	14.1%	14.1%	14.1%
Others	0.8%	0.8%	0.8%	0.8%	0.8%	0.8%
Ni-MH						
Iron			12.0%	12.0%	12.0%	12.0%
Steel			23.7%	23.7%	23.7%	23.7%
Aluminum			0.5%	0.5%	0.5%	0.5%
Copper			3.9%	3.9%	3.9%	3.9%
Magnesium			1.0%	1.0%	1.0%	1.0%
Cobalt			1.8%	1.8%	1.8%	1.8%
Nickel			28.2%	28.2%	28.2%	28.2%
Rare Earth Metals			6.3%	6.3%	6.3%	6.3%
Average Plastic			22.5%	22.5%	22.5%	22.5%
Rubber			0.1%	0.1%	0.1%	0.1%
Li-Ion						
Lithium Oxide (LiO2)			5.3%	5.3%	5.3%	5.3%
Nickel			2.6%	2.6%	2.6%	2.6%
Cobalt			2.7%	2.7%	2.7%	2.7%
Manganese			2.5%	2.5%	2.5%	2.5%
Graphite/Carbon			10.6%	10.6%	10.6%	10.6%
Binder			2.1%	2.1%	2.1%	2.1%
Copper			24.5%	24.5%	24.5%	24.5%
Wrought Aluminum			18.6%	18.6%	18.6%	18.6%
Cast Aluminum			10.6%	10.6%	10.6%	10.6%
Electrolyte			8.7%	8.7%	8.7%	8.7%
Plastic: Polypropylene			8.1%	8.1%	8.1%	8.1%
Plastic: Polyethylene			2.9%	2.9%	2.9%	2.9%
Steel			0.2%	0.2%	0.2%	0.2%
Thermal Insulation			0.5%	0.5%	0.5%	0.5%

Select Key Input Parameters for Material Use in the Mat_Inputs Sheet

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B152 Nickel

4. Key Input Parameters for Material Use

4.1) Share of Virgin and Recycled Materials Used in Vehicle, % by wt

	Virgin Material	Recycled Material
Steel	30.0%	70.0%
Wrought Aluminum	89.0%	11.0%
Cast Aluminum	41.0%	59.0%
Lead	27.0%	73.0%
Nickel	56.0%	44.0%

4.2) Tons of Intermediate Material Needed per Ton of Final Steel Product

	Ore Recovery	Ore Pelletizing & Sintering	Coke Production	Blast Furnace	Basic O2 Processing	Electric Arc Furnace	Sheet Production & Rolling	Stamping
Virgin Steel	5.200	1.860	0.531	1.180	1.420	0.220	1.340	1.000
Recycled Steel					0.090	1.530	1.340	1.000
Stainless Steel						1.610	1.340	1.000

4.3) Tons of Intermediate Material Needed per Ton of Final Wrought Aluminum Product

	Bauxite Mining	Bauxite Refining	Alumina Reduction	Scrap Preparation	Reverb Melt and Ingot Cast	Al Melting and Casting	Sheet Production & Rolling	Stamping
Virgin Wrought Aluminum	4.800	1.900	1.000			1.000	1.380	1.000
Recycled Wrought Aluminum				1.060	1.000	1.000	1.380	1.000

4.4) Tons of Intermediate Material Needed per Ton of Final Cast Aluminum Product

	Bauxite Mining	Bauxite Refining	Alumina Reduction	Al Melting and Casting	Al Casting	Al Recycling
Cast Aluminum	4.800	1.900	1.000	1.000		
Recycled Cast Aluminum					1.000	1.000

4.5) Tons of Nickel Needed per Ton of Nickel Hydroxide Product

0.633

4.6) Composition of Fiberglass, % by wt

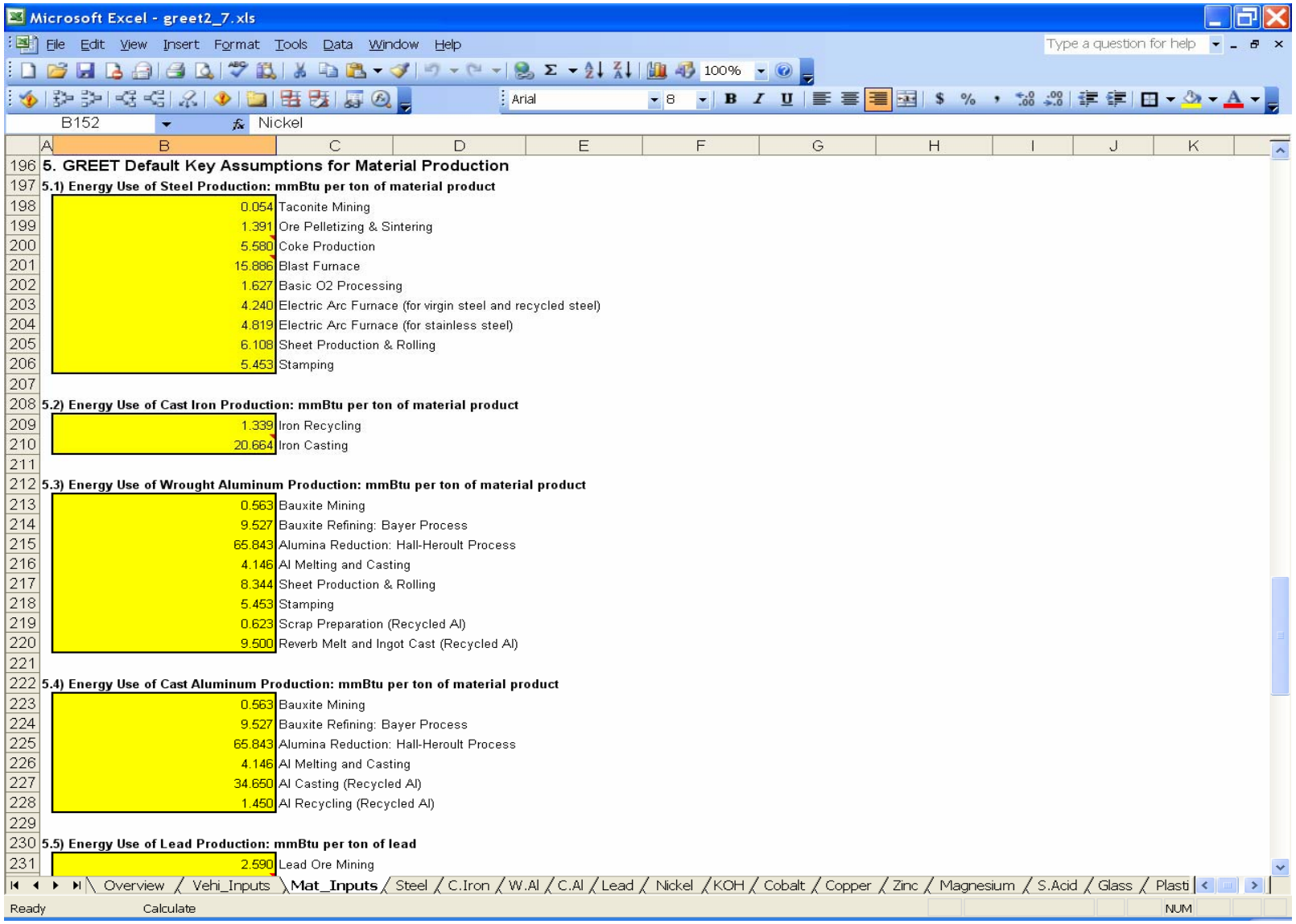
Glass	Glass Fiber
0.0%	100.0%

4.7 a) Shares of Individual Plastic in a Vehicle for Average Plastic Calculation, % by wt

Overview / Vehi_Inputs / Mat_Inputs / Steel / C.Iron / W.Al / C.Al / Lead / Nickel / KOH / Cobalt / Copper / Zinc / Magnesium / S.Acid / Glass / Plasti

Ready Calculate NUM

Select Key Energy Use Assumptions for Material Production in the Mat_Inputs Sheet



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Type a question for help

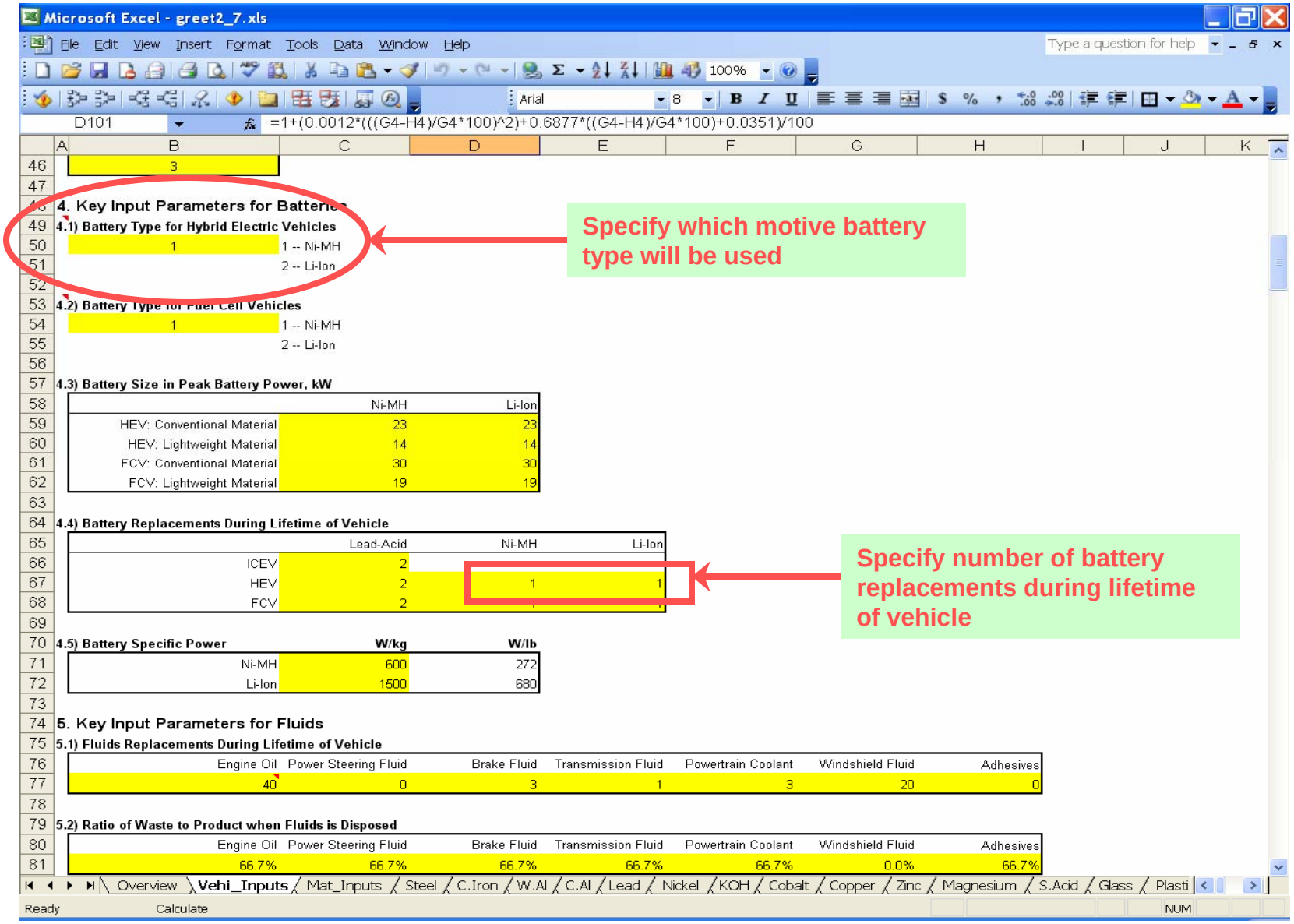
B152 Nickel

	A	B	C
196		**5. GREET Default Key Assumptions for Material Production**	
197		**5.1) Energy Use of Steel Production: mmBtu per ton of material product**	
198		0.054	Taconite Mining
199		1.391	Ore Pelletizing & Sintering
200		5.580	Coke Production
201		15.886	Blast Furnace
202		1.627	Basic O2 Processing
203		4.240	Electric Arc Furnace (for virgin steel and recycled steel)
204		4.819	Electric Arc Furnace (for stainless steel)
205		6.108	Sheet Production & Rolling
206		5.453	Stamping
207			
208		**5.2) Energy Use of Cast Iron Production: mmBtu per ton of material product**	
209		1.339	Iron Recycling
210		20.664	Iron Casting
211			
212		**5.3) Energy Use of Wrought Aluminum Production: mmBtu per ton of material product**	
213		0.563	Bauxite Mining
214		9.527	Bauxite Refining: Bayer Process
215		65.843	Alumina Reduction: Hall-Heroult Process
216		4.146	Al Melting and Casting
217		8.344	Sheet Production & Rolling
218		5.453	Stamping
219		0.623	Scrap Preparation (Recycled Al)
220		9.500	Reverb Melt and Ingot Cast (Recycled Al)
221			
222		**5.4) Energy Use of Cast Aluminum Production: mmBtu per ton of material product**	
223		0.563	Bauxite Mining
224		9.527	Bauxite Refining: Bayer Process
225		65.843	Alumina Reduction: Hall-Heroult Process
226		4.146	Al Melting and Casting
227		34.650	Al Casting (Recycled Al)
228		1.450	Al Recycling (Recycled Al)
229			
230		**5.5) Energy Use of Lead Production: mmBtu per ton of lead**	
231		2.590	Lead Ore Mining

Overview / Vehi_Inputs / Mat_Inputs / Steel / C.Iron / W.Al / C.Al / Lead / Nickel / KOH / Cobalt / Copper / Zinc / Magnesium / S.Acid / Glass / Plasti

Ready Calculate NUM

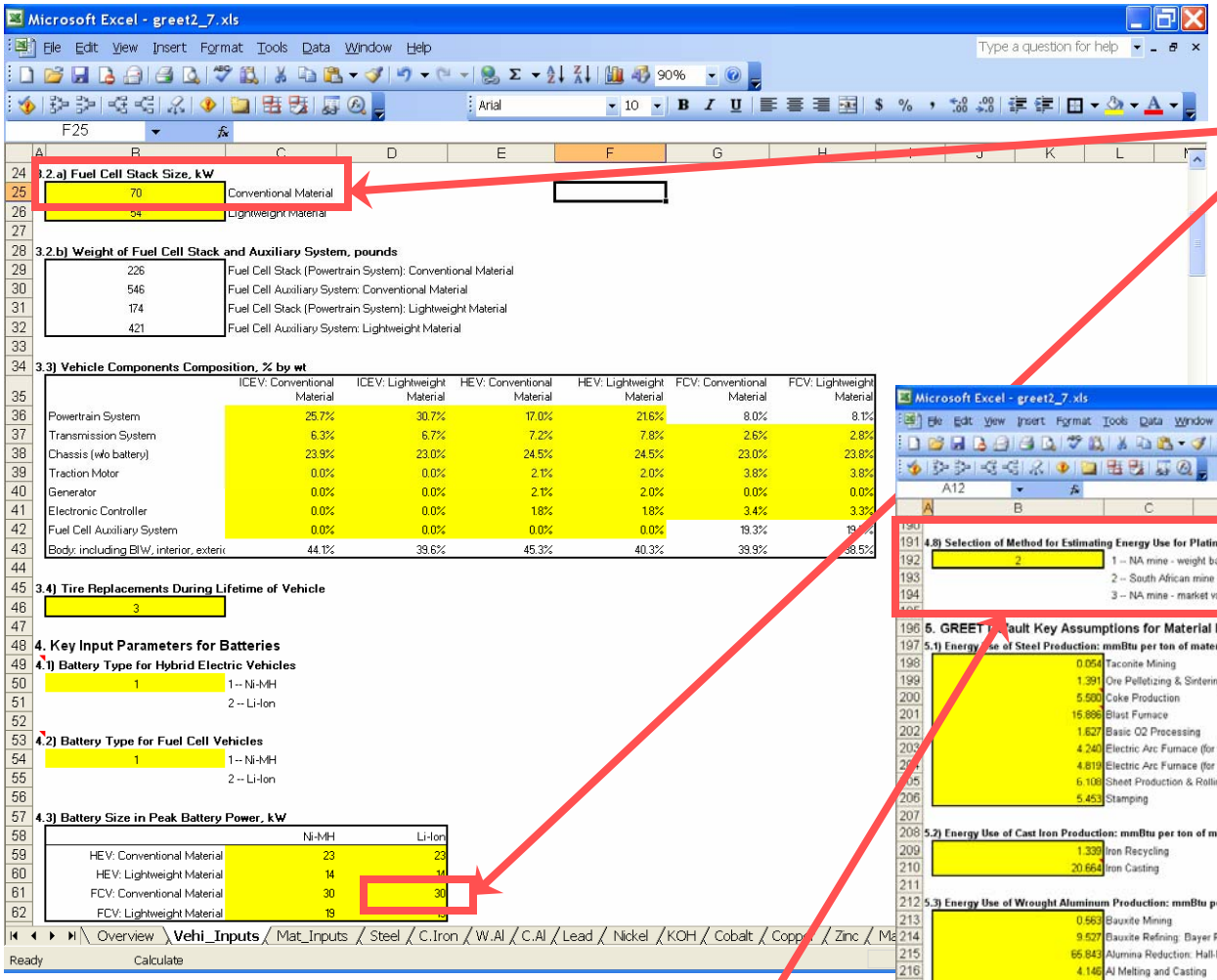
Select Key Input Parameters in the Vehi_Inputs Sheet: Hybrid Electric Vehicle (Demo 1)



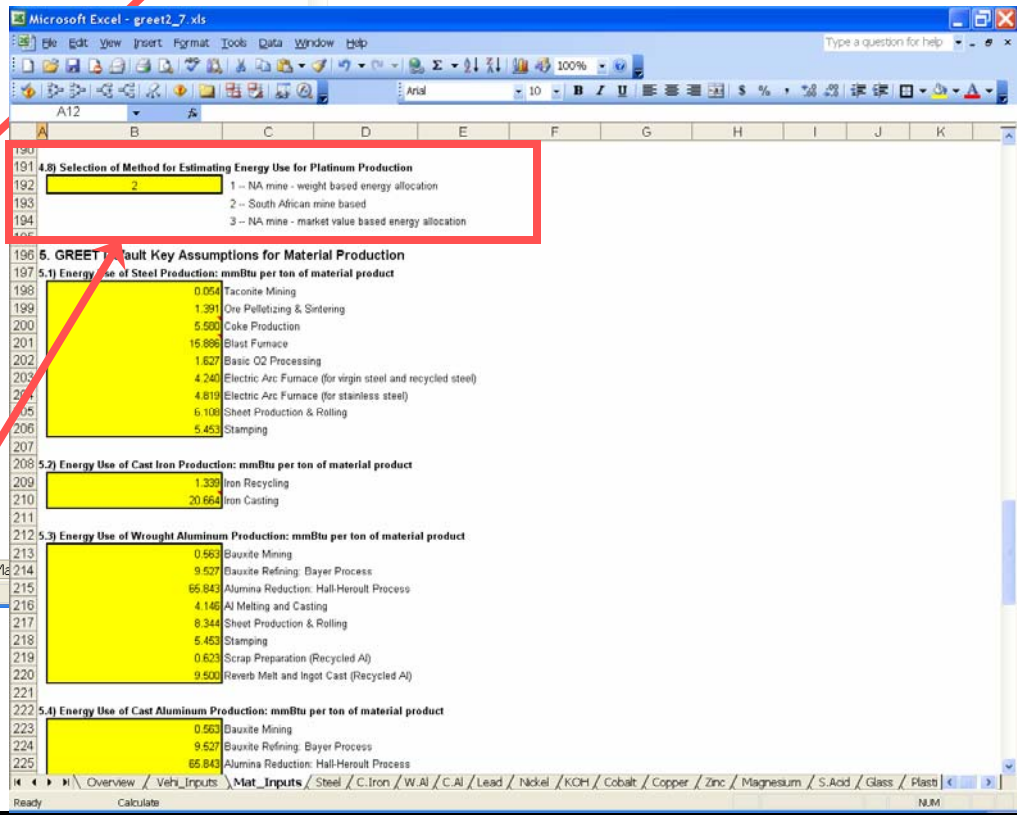
Specify which motive battery type will be used

Specify number of battery replacements during lifetime of vehicle

Select Key Input Parameters in the Vehi_Inputs and Mat_Inputs Sheet: Fuel Cell Vehicle (Demo 2)



Specify fuel cell stack and Li-Ion battery power



Specify platinum allocation method

The Vehi_Sum Sheet Summarizes the Vehicle-Cycle Results

Demo 1: HEV with Ni-MH battery → **Demo 1: HEV with Li-Ion battery**

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Arial 8

F65 =SUM(B65:E65)

	A	B	C	D	E	F
48	CO: Urban	254.459	43.323	11.785	94.879	404.447
49	NOx: Urban	811.995	154.617	42.071	452.452	1461.135
50	PM10: Urban	141.503	9.388	2.696	169.982	323.570
51	PM2.5: Urban	63.041	5.609	1.578	109.961	180.189
52	SOx: Urban	1201.095	344.651	93.417	631.009	2270.172
53						
54	**1.3) HEV: Conventional Material**					
55		**mmBtu or grams per vehicle lifetime**				
56		**Components**	**ADR**	**Batteries**	**Fluids**	**Total**
57	Total energy	61.4	12.7	16.9	10.7	101.7
58	Fossil fuels	58.6	11.5	15.1	10.6	95.8
59	Coal	21.5	6.3	9.6	0.5	37.9
60	Natural gas	27.5	4.7	4.0	2.0	38.3
61	Petroleum	9.6	0.4	1.4	8.2	19.6
62	CO2	4,880,685	1,039,264	1,374,092	659,420	7,953,461
63	CH4	8,526	1,624	1,976	1,073	13,198
64	N2O	57	15	19	5	95
65	GHGs	5,093,561	1,080,979	1,425,120	685,612	8,285,271
66	VOC: Total	1,327	2,230	136	29,211	32,904
67	CO: Total	34,014	767	1,089	226	36,096
68	NOx: Total	5,595	4,041	1,562	1,146	12,344
69	PM10: Total	8,261	2,261	1,873	431	12,826
70	PM2.5: Total	2,710	871	519	250	4,349
71	SOx: Total	17,580	5,673	12,100	1,349	36,702

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Arial

F65 =SUM(B65:E65)

	A	B	C	D	E	F
48	CO: Urban	254.459	43.323	11.785	94.879	404.447
49	NOx: Urban	811.995	154.617	42.071	452.452	1461.135
50	PM10: Urban	141.503	9.388	2.696	169.982	323.570
51	PM2.5: Urban	63.041	5.609	1.578	109.961	180.189
52	SOx: Urban	1201.095	344.651	93.417	631.009	2270.172
53						
54	**1.3) HEV: Conventional Material**					
55		**mmBtu or grams per vehicle lifetime**				
56		**Components**	**ADR**	**Batteries**	**Fluids**	**Total**
57	Total energy	62.5	12.7	9.0	10.7	94.9
58	Fossil fuels	59.6	11.5	8.1	10.6	89.8
59	Coal	21.9	6.3	4.5	0.5	33.2
60	Natural gas	28.0	4.7	2.5	2.0	37.2
61	Petroleum	9.7	0.4	1.1	8.2	19.4
62	CO2	4,964,938	1,039,264	721,159	659,420	7,384,781
63	CH4	8,672	1,624	1,092	1,073	12,461
64	N2O	58	15	10	5	87
65	GHGs	[illegible]	[illegible]	[illegible]	[illegible]	7,697,281
66	VOC: Total	1,340	2,230	69	29,211	32,850
67	CO: Total	34,625	767	213	226	35,830
68	NOx: Total	5,690	4,041	863	1,146	11,740
69	PM10: Total	8,411	2,261	1,029	431	12,132
70	PM2.5: Total	2,759	871	325	250	4,204
71	SOx: Total	17,905	5,673	4,325	1,349	29,252