January 27, 2025

Demo for R&D GREET® 1: Fuel Cycle Analysis

3:00-4:00 p.m. CT

Instructors

Gabrielle Olson, Great Plains Institute

Branden Leonhardt, Department of Energy

Argonne National Laboratory Subject Matter Experts

Longwen Ou, Uisung Lee

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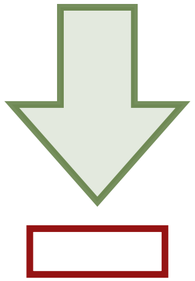

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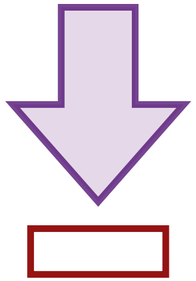
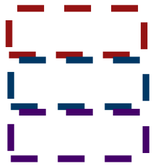


Right click

Type

Type the following text into a cell



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Note:

Instructions or notes

1

Step 1

Words

Simulation results label

Scroll

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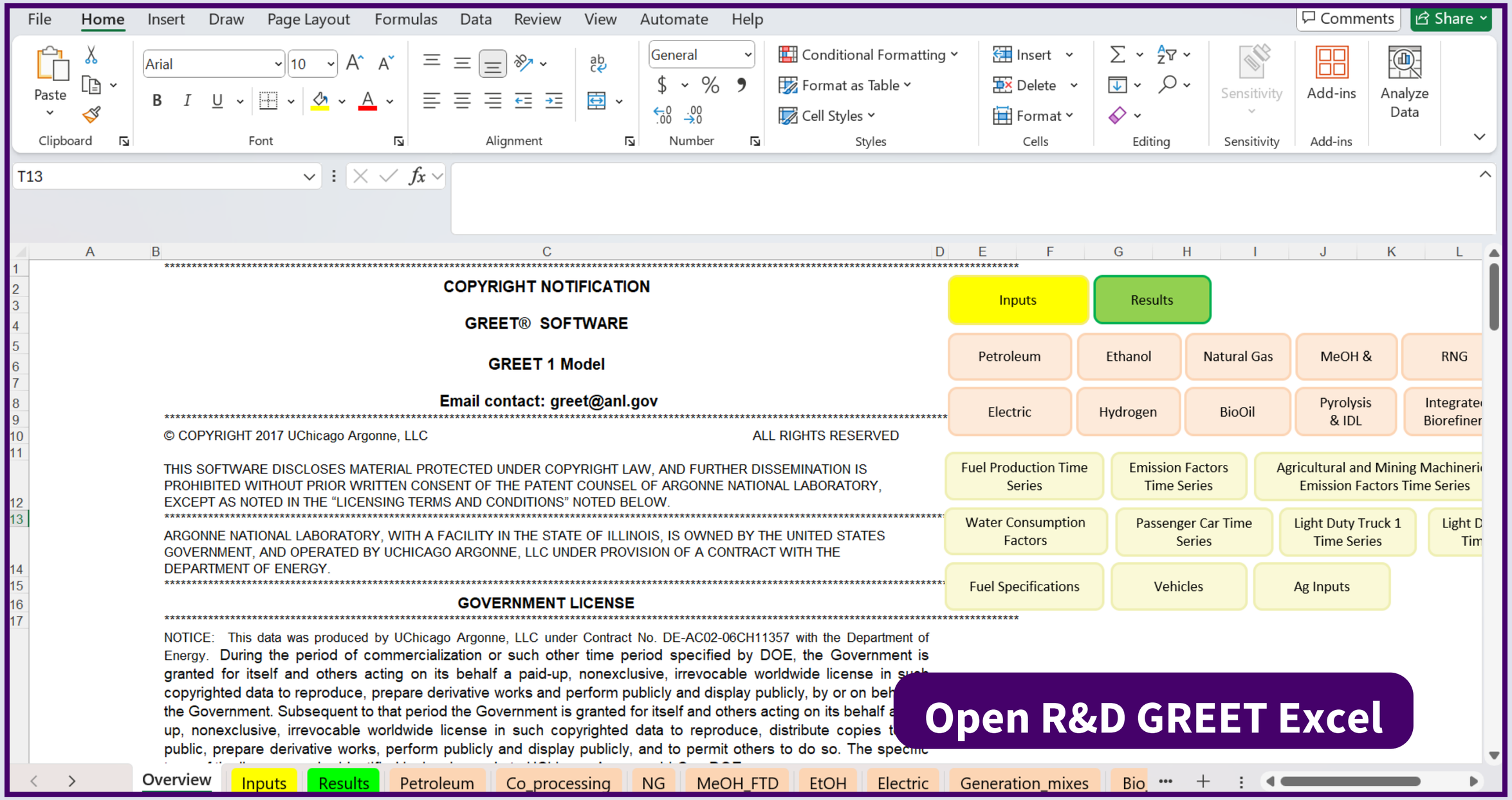
Equation

Review the Overview Tab



Open R&D GREET Excel

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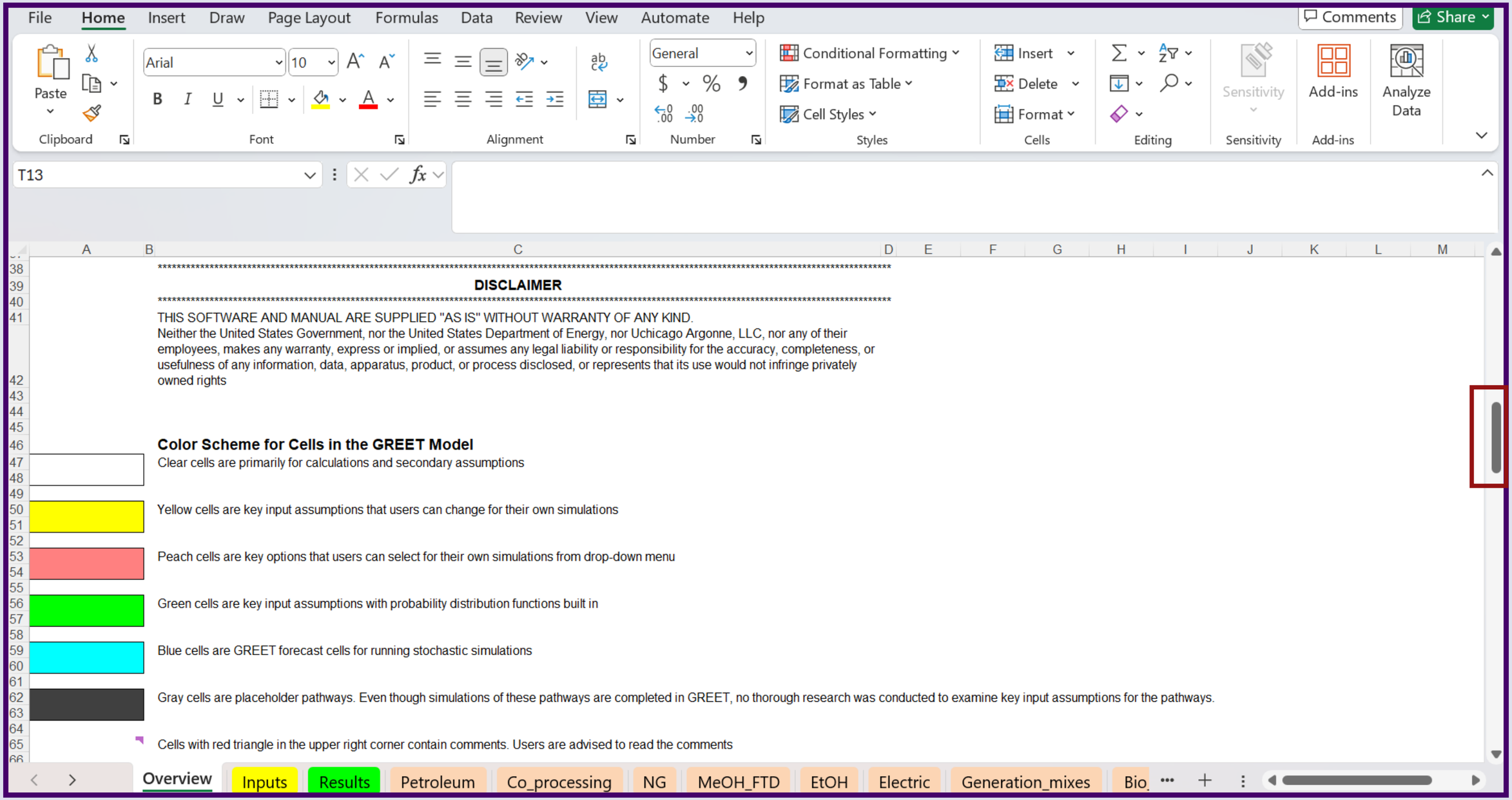
What Do the Different Color Cells in R&D GREET 1 Indicate?



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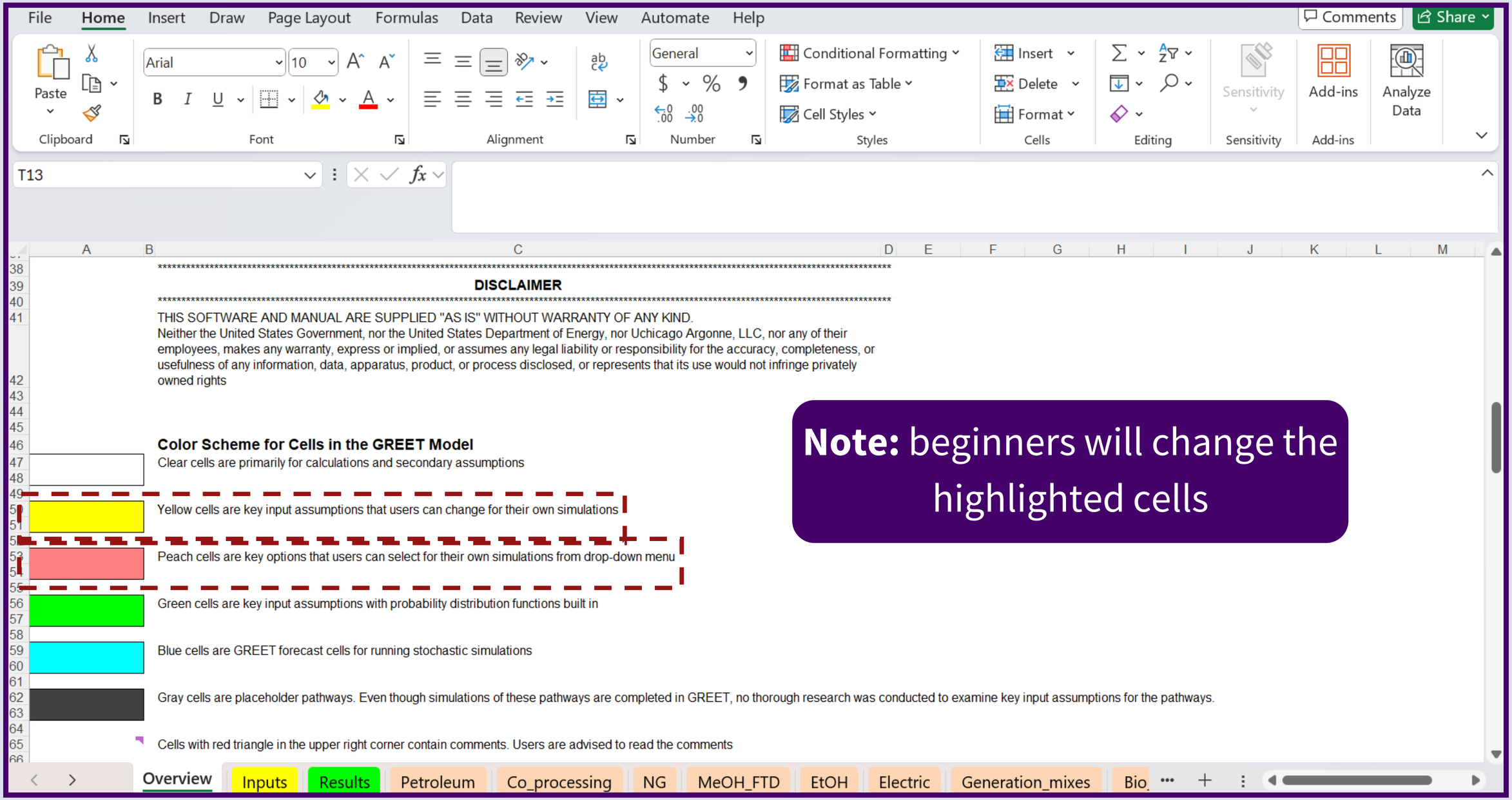

Note: beginners will change the highlighted cells

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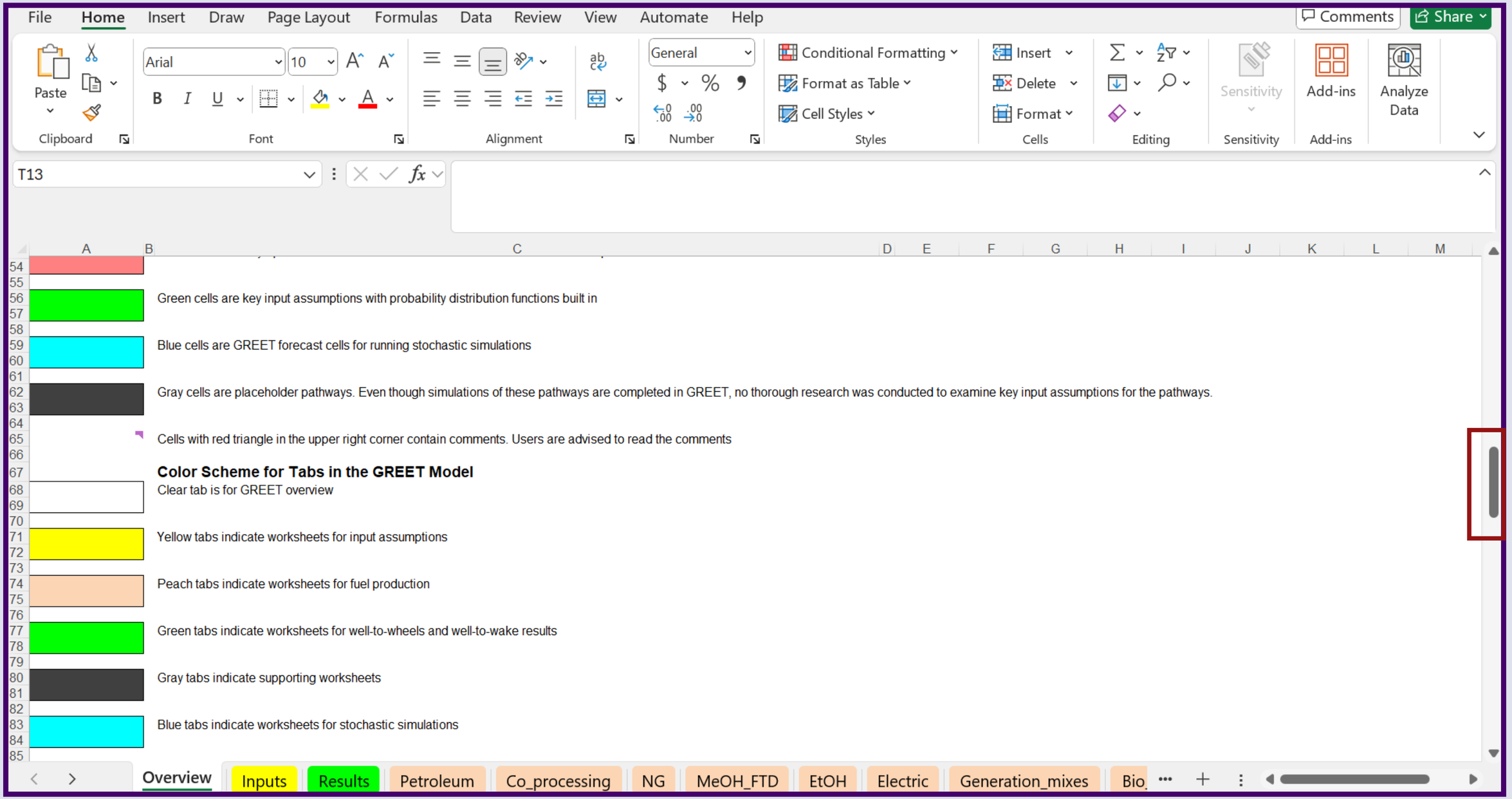
What Do the Different Color Tabs in R&D GREET 1 Indicate?



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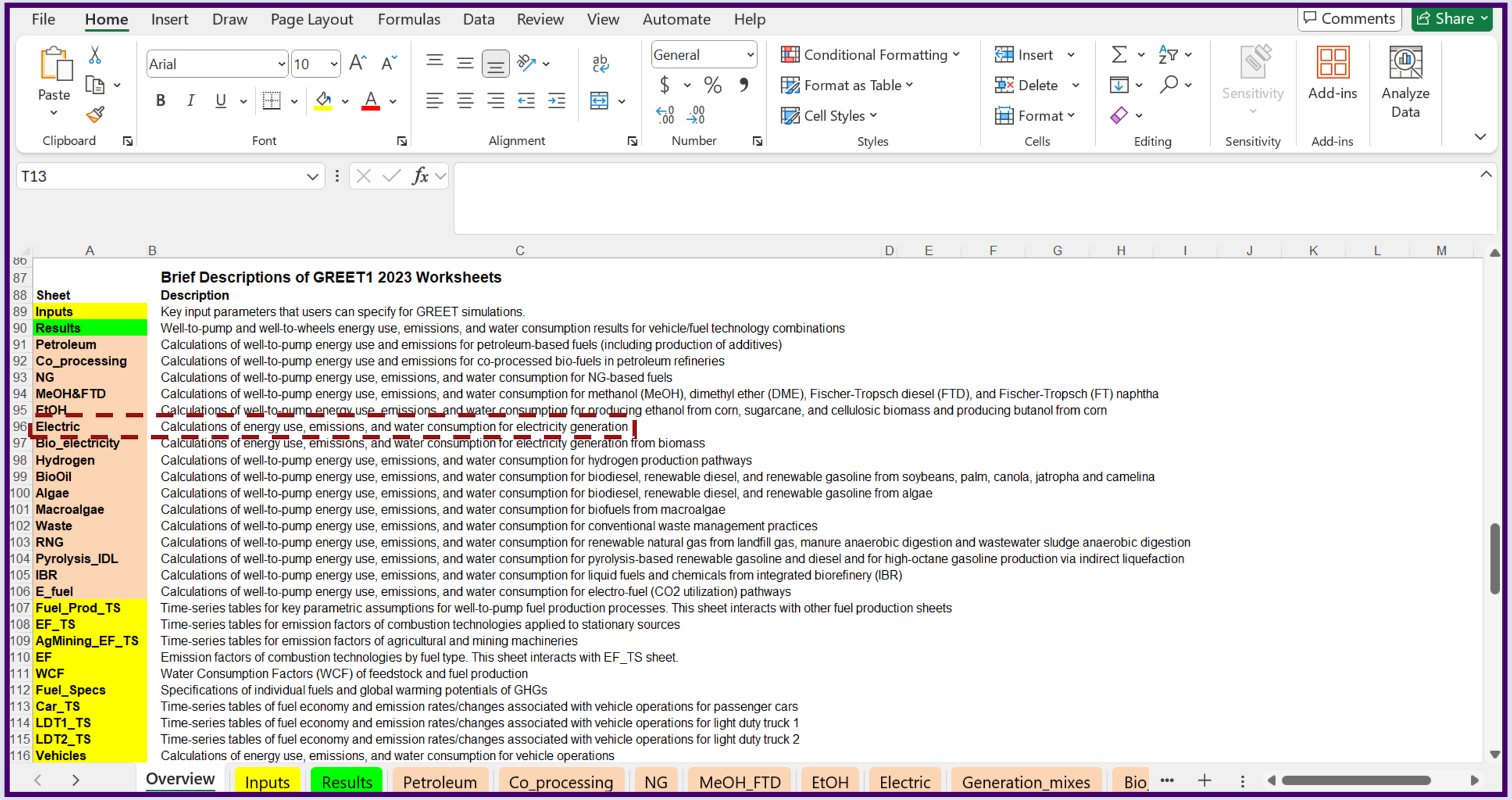
Describe the Electric R&D GREET 1 Tab



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Navigate in R&D GREET

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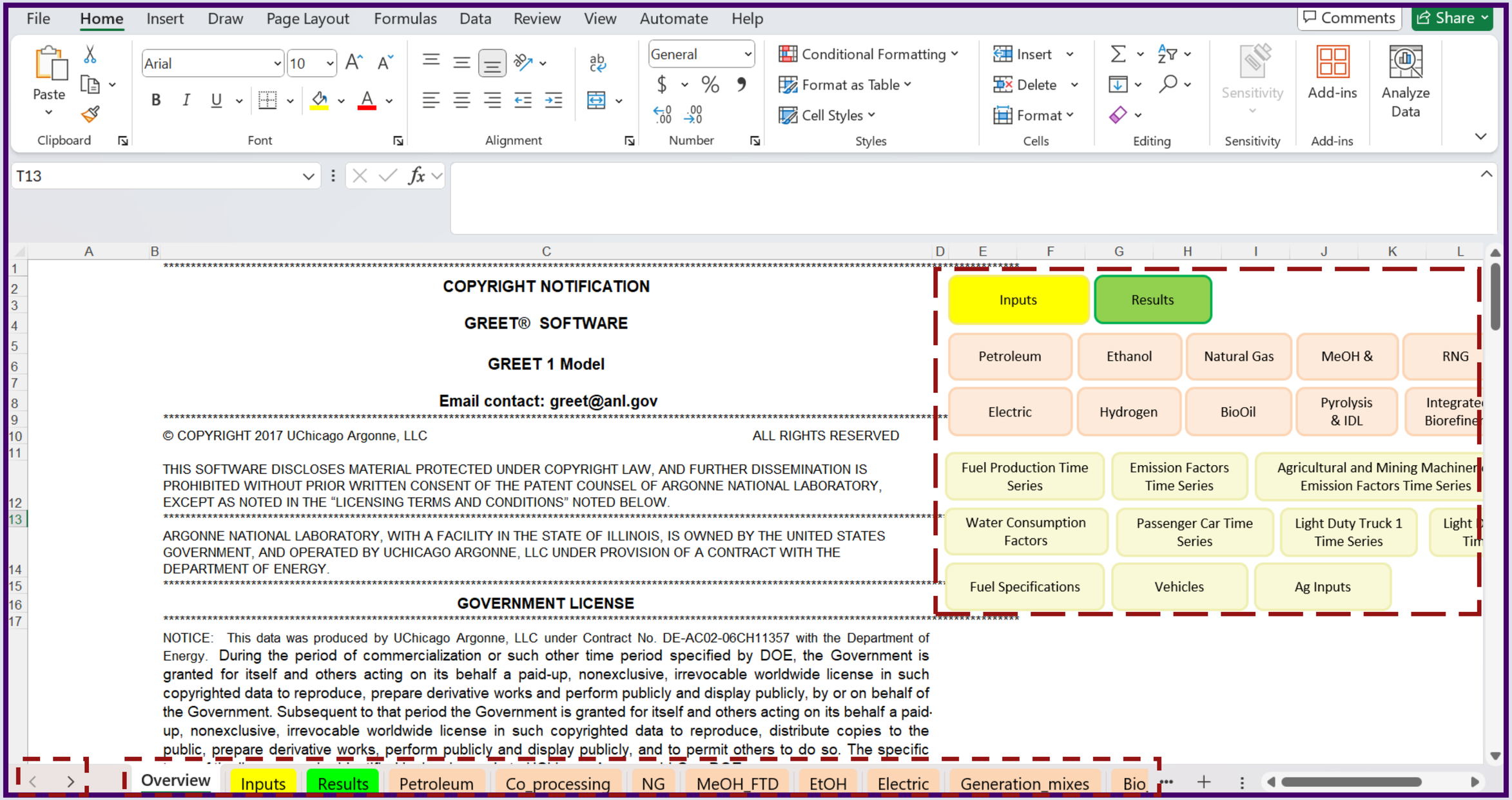

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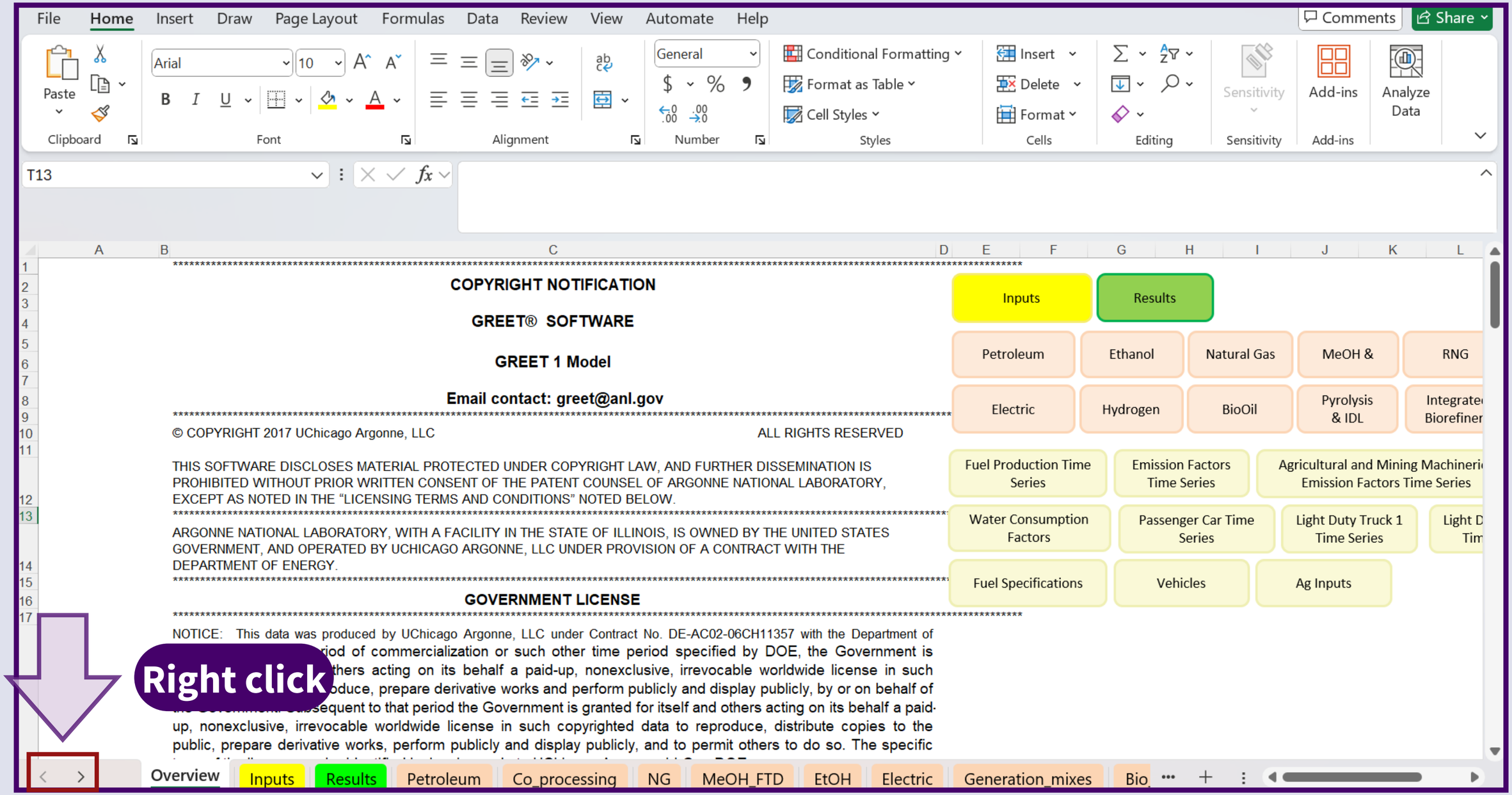

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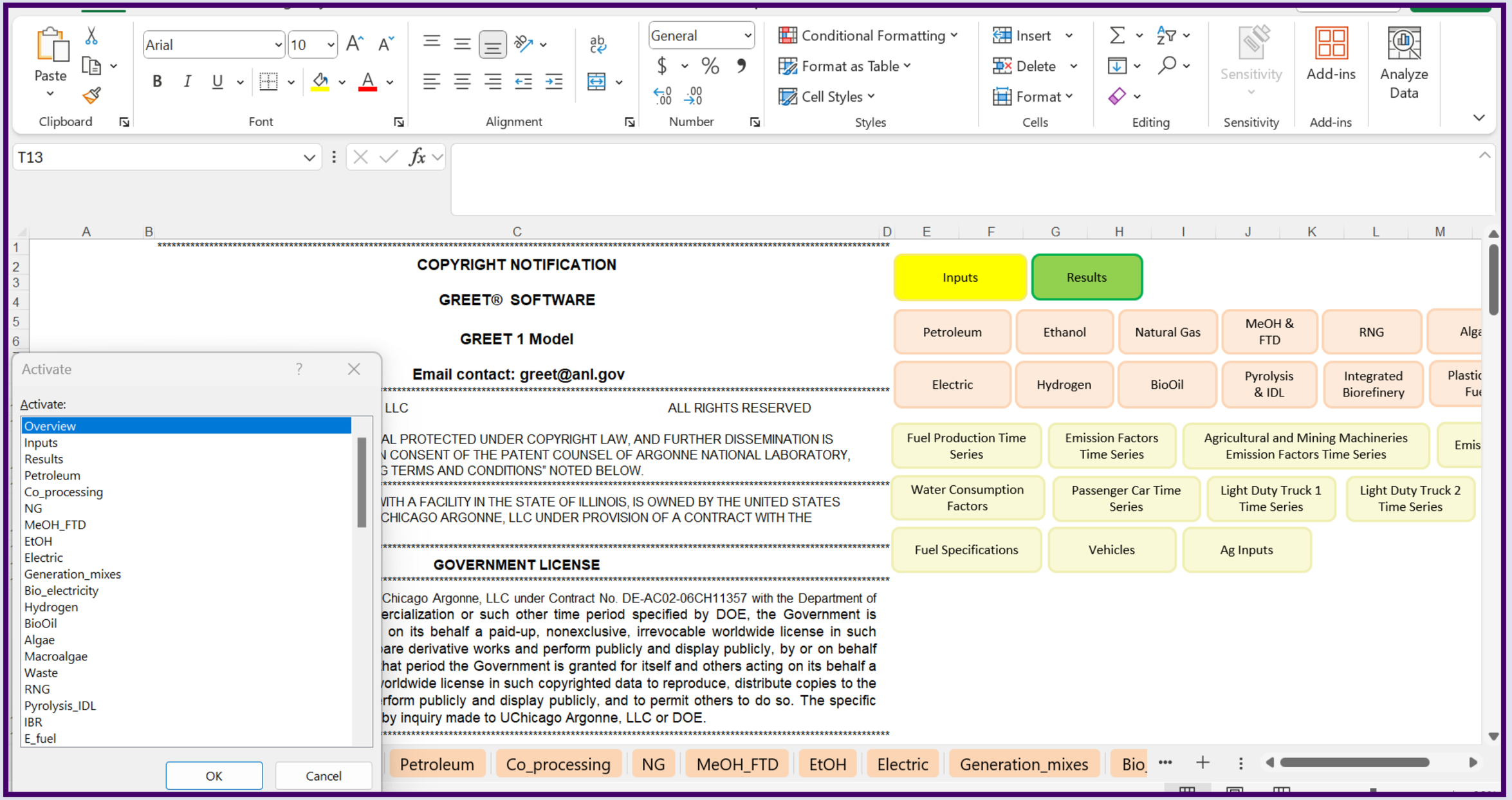

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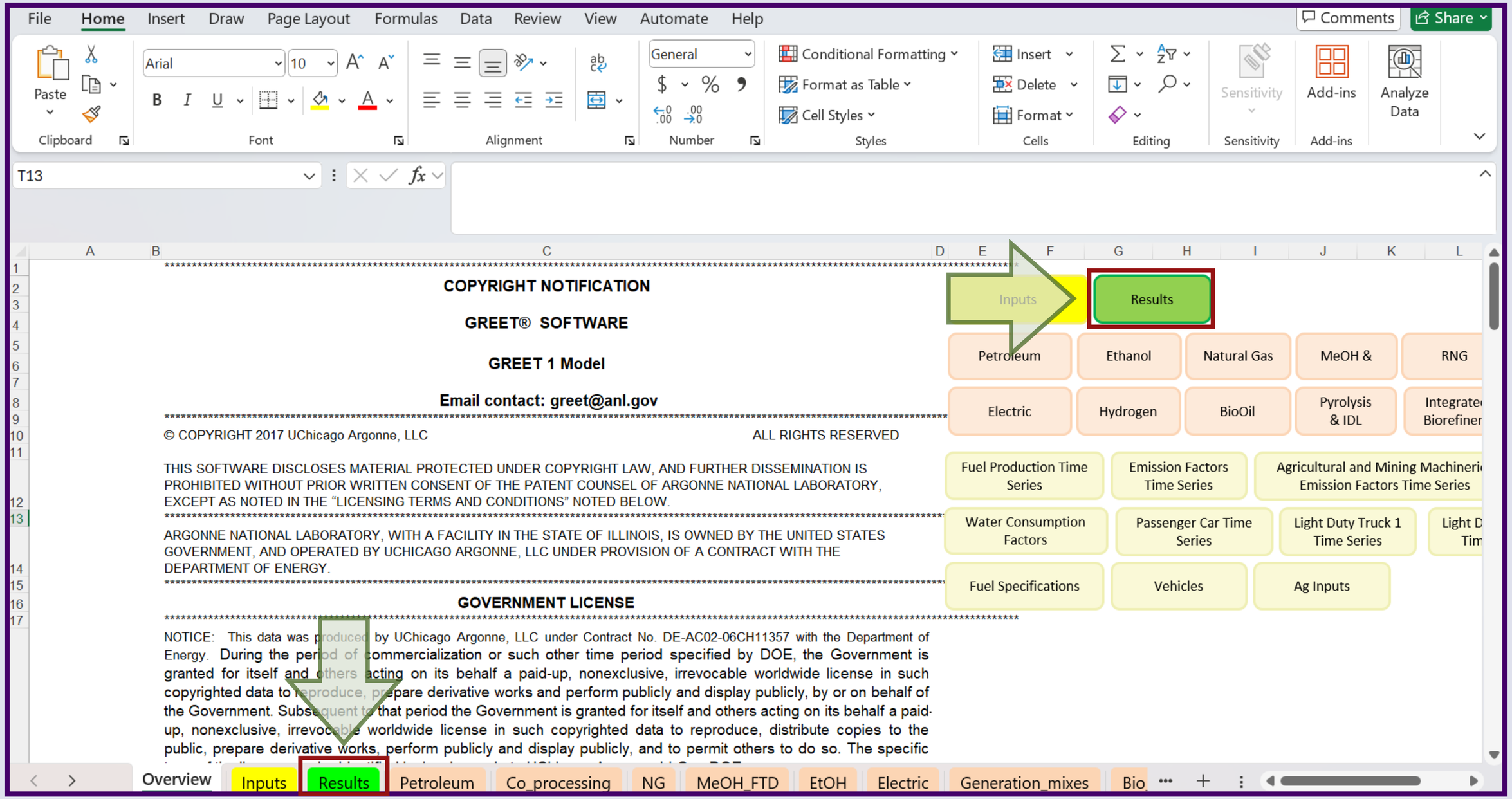
Results Tab Navigation



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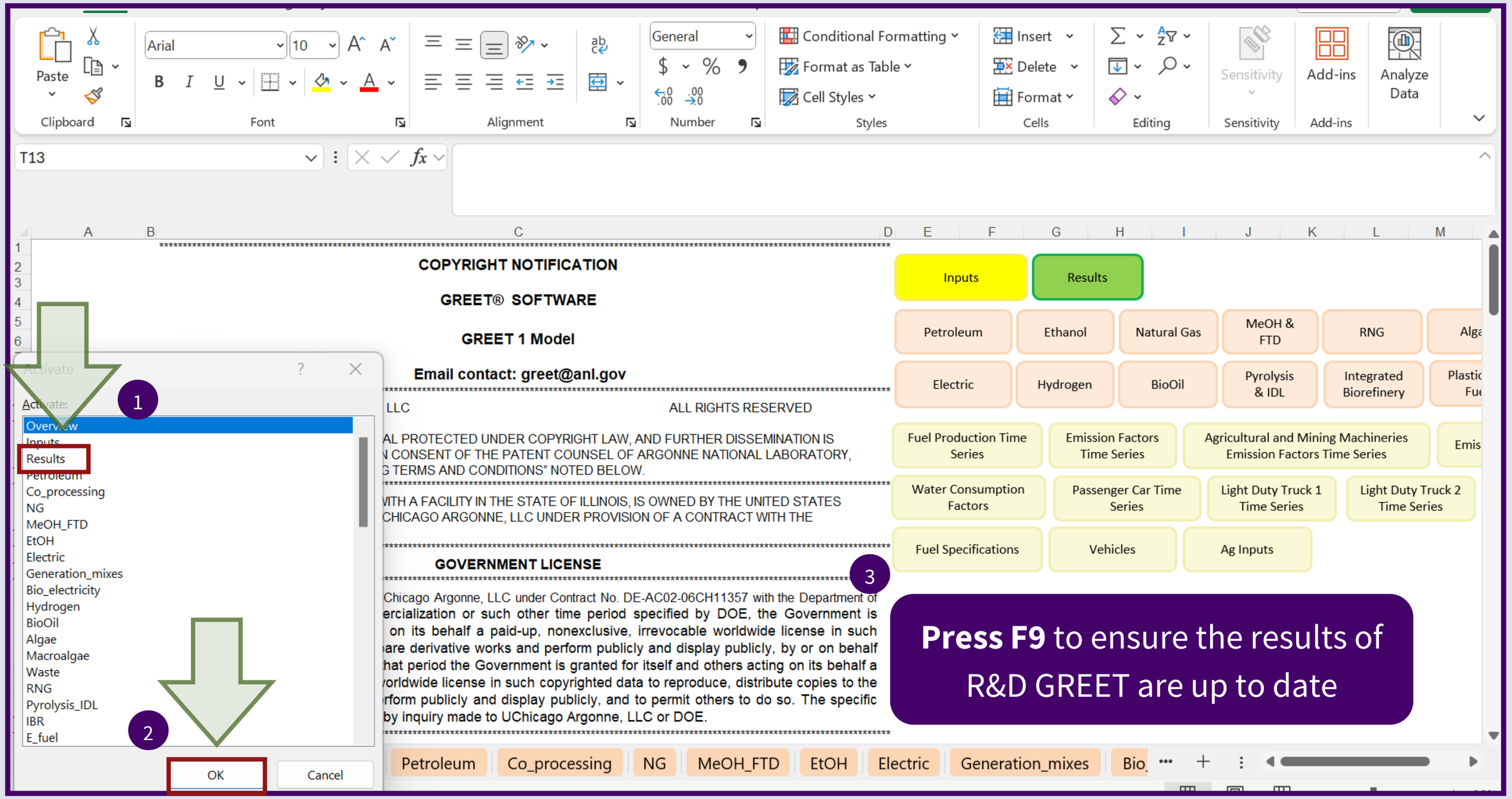

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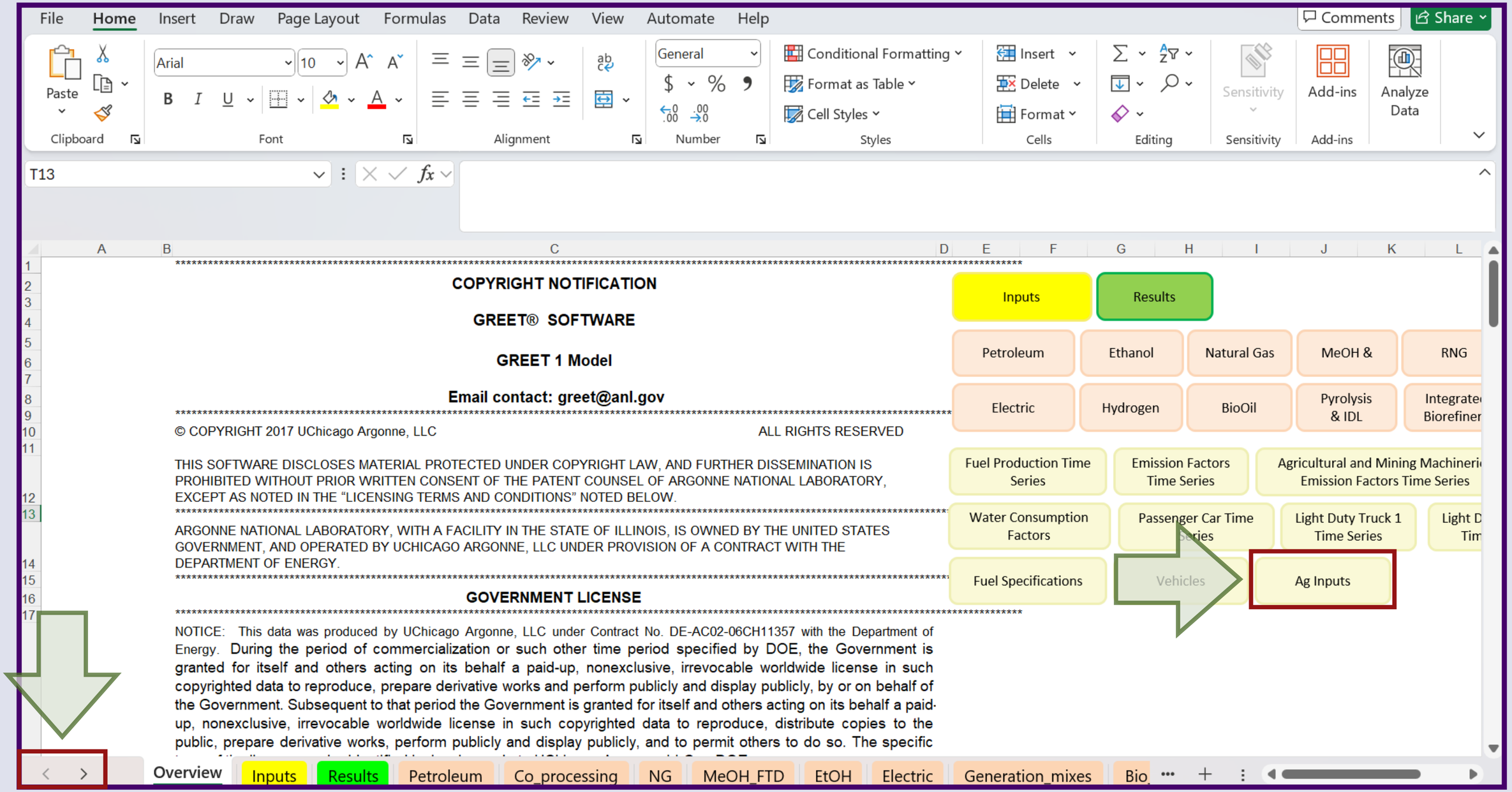
Ag Inputs Tab Navigation



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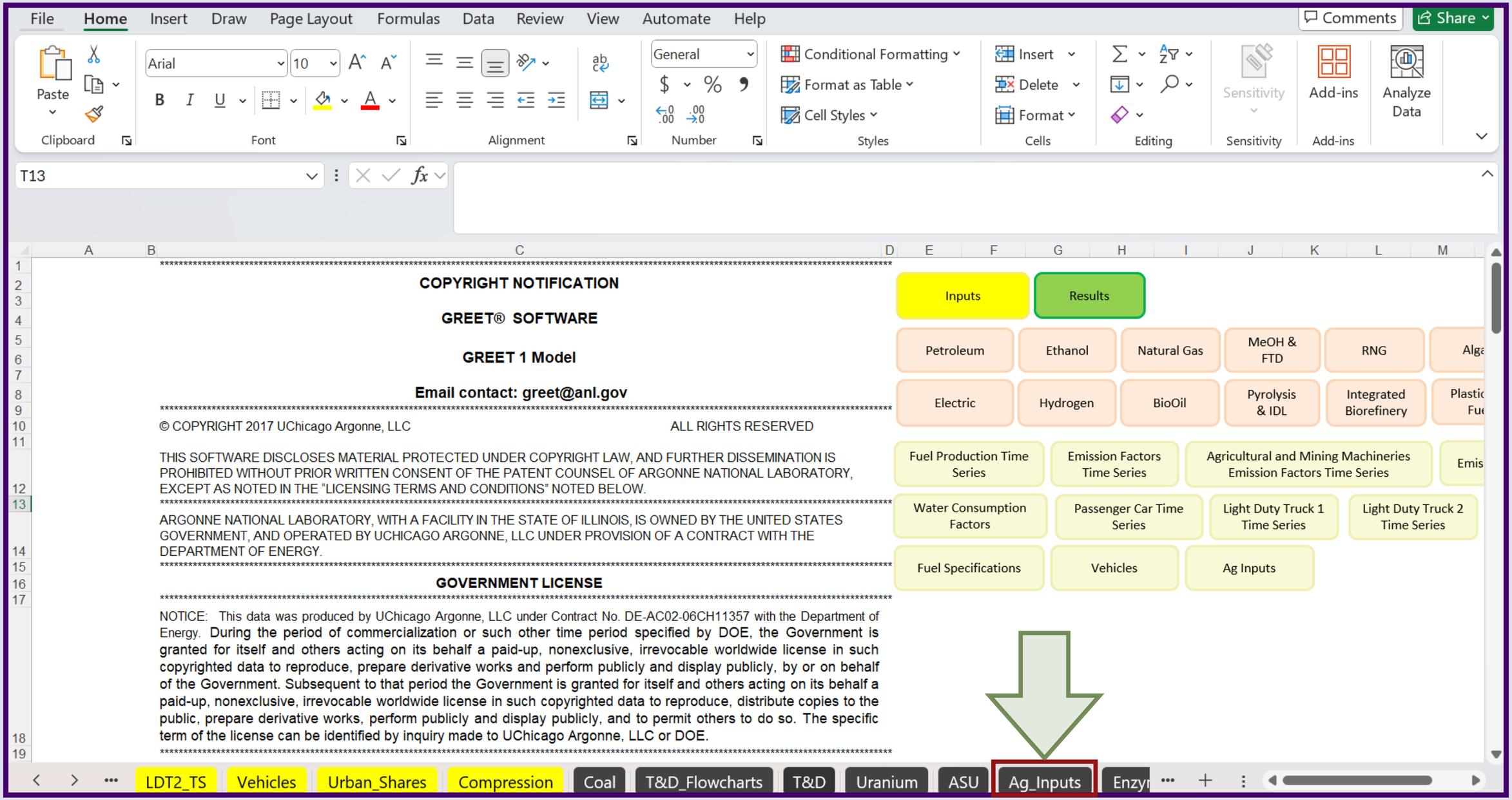

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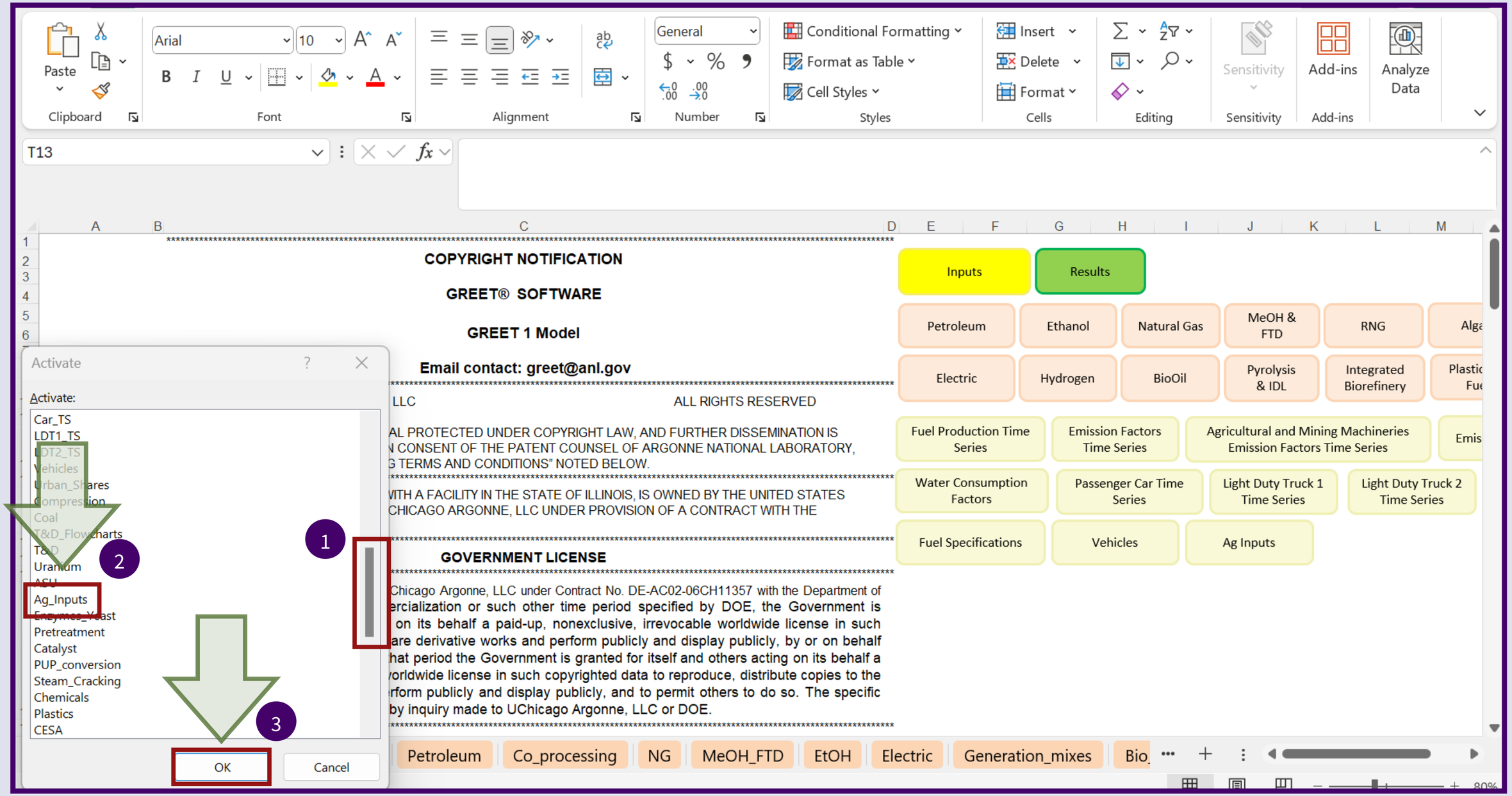

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Steps to Model a Scenario in R&D GREET 1

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Steps to model a scenario in R&D GREET 1

Go to the “Results” Tab

Are the results for your scenario generated by default?

Go to the “Inputs” Tab

Are the changes I want to make altered on this tab?

If Yes,

Make your changes and go to the “Results” tab to see your results

If No,

Go to the fuel-specific/vehicle-specific tabs for the fuel/vehicle you want to model

Dive into the formulas on the “Results” tab

Vehicle Operation Inputs

Go to the “Vehicles” tab

Fuel and Feedstock

Go to the “Fuel-specific” tab

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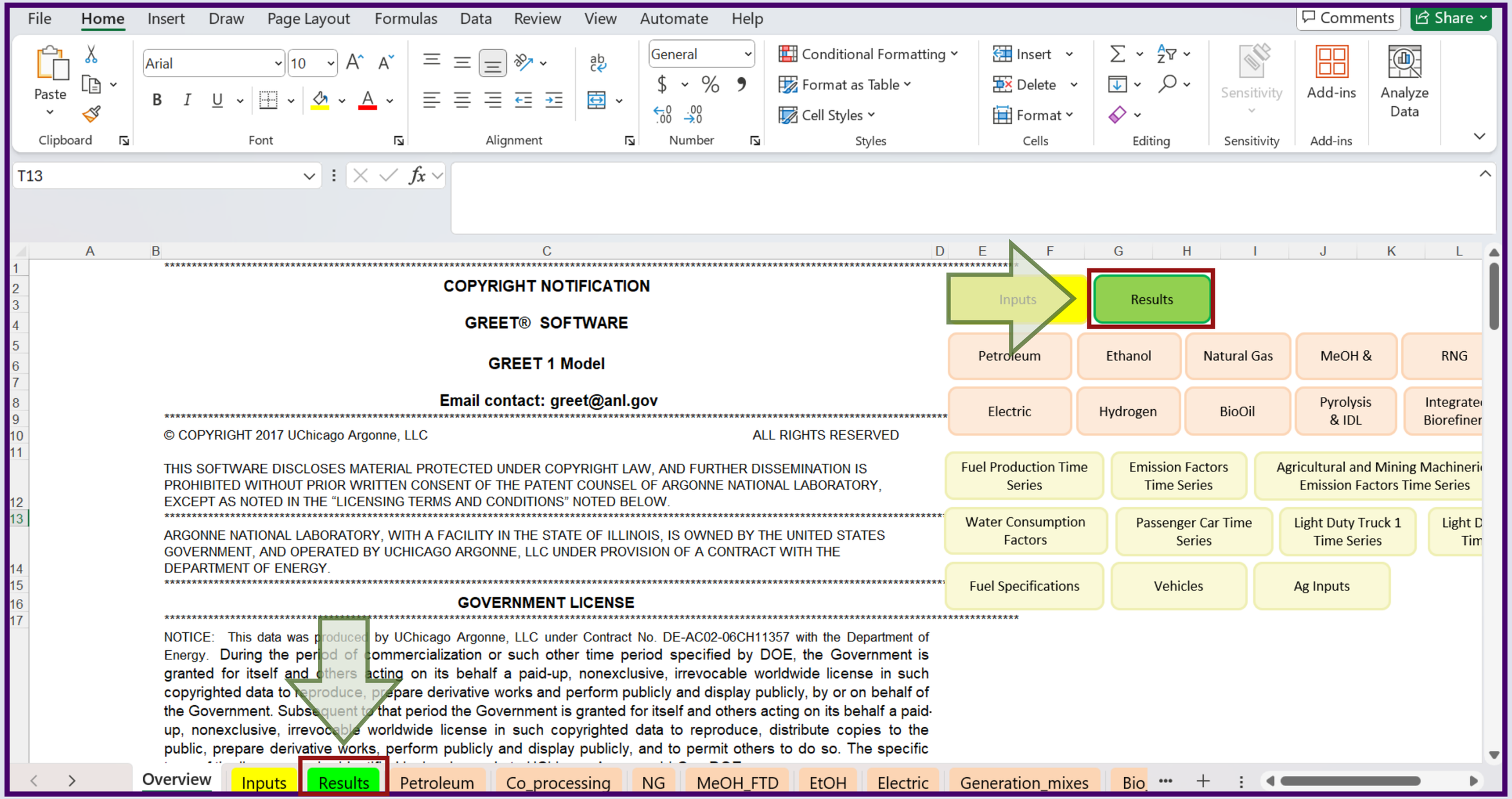
Light-Duty Vehicle Outputs



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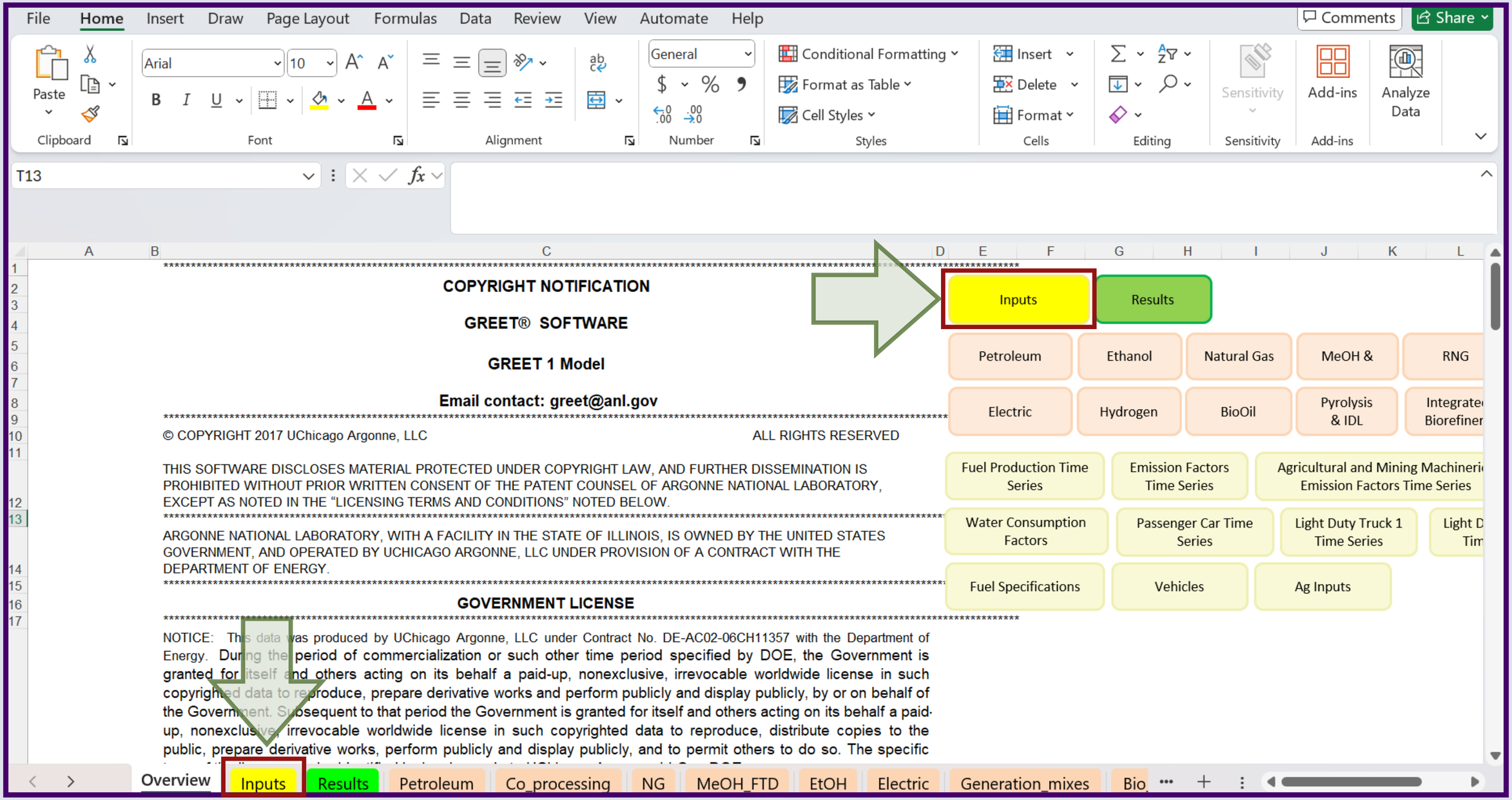
Adjust General Simulation Settings



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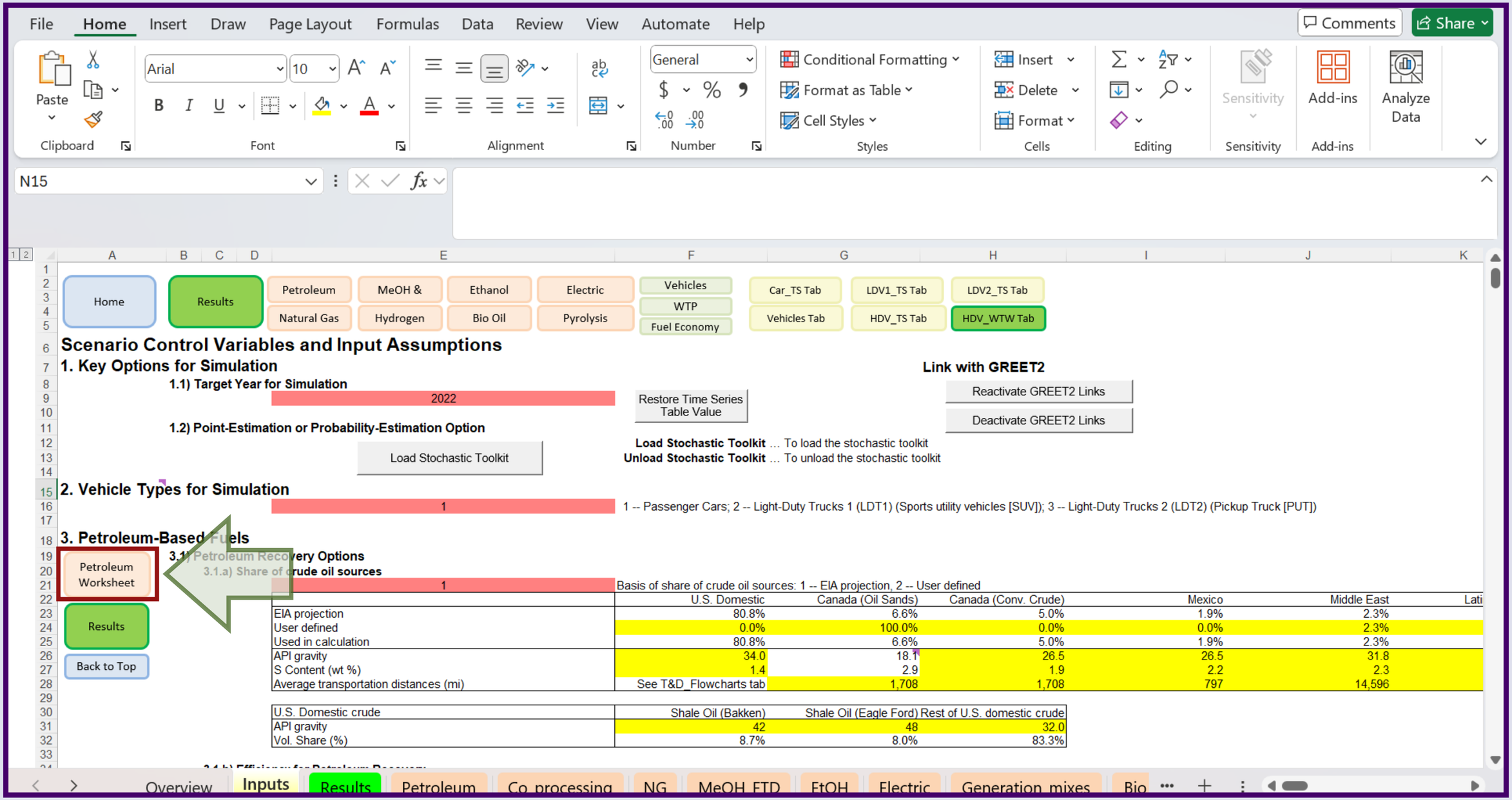
Adjust More-specified Simulation Settings



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Similarities Across Tabs

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Natural Gas to Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG)

1) Scenario Control and Key Input Parameters (from the *Inputs* sheet)

		Transportation Fuel Application	
LPG Production	Natural Gas	Crude Oil	Renewable NG
	86.6%	13.4%	0.0%
LNG Production	Natural Gas	Flared Gas	Renewable NG
	100.0%	0.0%	0.0%

Home | Inputs | Results

Natural Gas to Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG)

2) Shares of Combustion Processes for Each Stage

	NG Recovery	NG Processing	NG Compression	NG Liquefaction	LPG Production	Canadian NG Recovery	Canadian NG Processing	LNG Regasification
Resi. oil industrial or commerica	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%
Diesel commercial Boiler	25.0%	33.0%		33.0%	33.0%	25.0%	33.0%	0.0%
Diesel stationary engine	50.0%	33.0%	50.0%	33.0%	33.0%	50.0%	33.0%	0.0%

Natural Gas to Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG)

3) Calculations of Energy Consumption, Water Consumption, and Emissions for Each Stage

Natural Gas as a Processing Fuel (produced in North America)

Natural Gas to Compressed Natural Gas (CNG), Liquefied Natural Gas (LNG) and Liquefied Petroleum Gas (LPG)

4) Summary of Energy Consumption, Water Consumption, and Emissions: Btu or Gallons or Grams per mmBtu of Fuel Throughput at Each Stage

4.1) Energy Use, Water Consumption, and Total Emissions

	Natural Gas as Stationary Fuels	Natural Gas for Electricity generation	NGL to Oil Sands	NGL (based on Shale Gas) to Steam Crackers	Natural Gas to Liquefied Natural Gas (as an intermediate fuel)		Flare gas to Liquefied Natural Gas (as an intermediate fuel)		NG c
					Feedstock	Fuel	Feedstock	Fuel	Fe
Loss factor						1.017		1.019	
Total energy	112,491	96,953	87,461	78,172	83,867	122,871	79,182	125,549	

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Similarities across tabs

Key Input Parameters

Combustion/Technology Shares

Calculation Tables

Summary Tables

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Example Scenarios

Default Gasoline

Model a Spark-Ignition Internal Combustion Engine (SI-ICE) Vehicle Fueled by Gasoline

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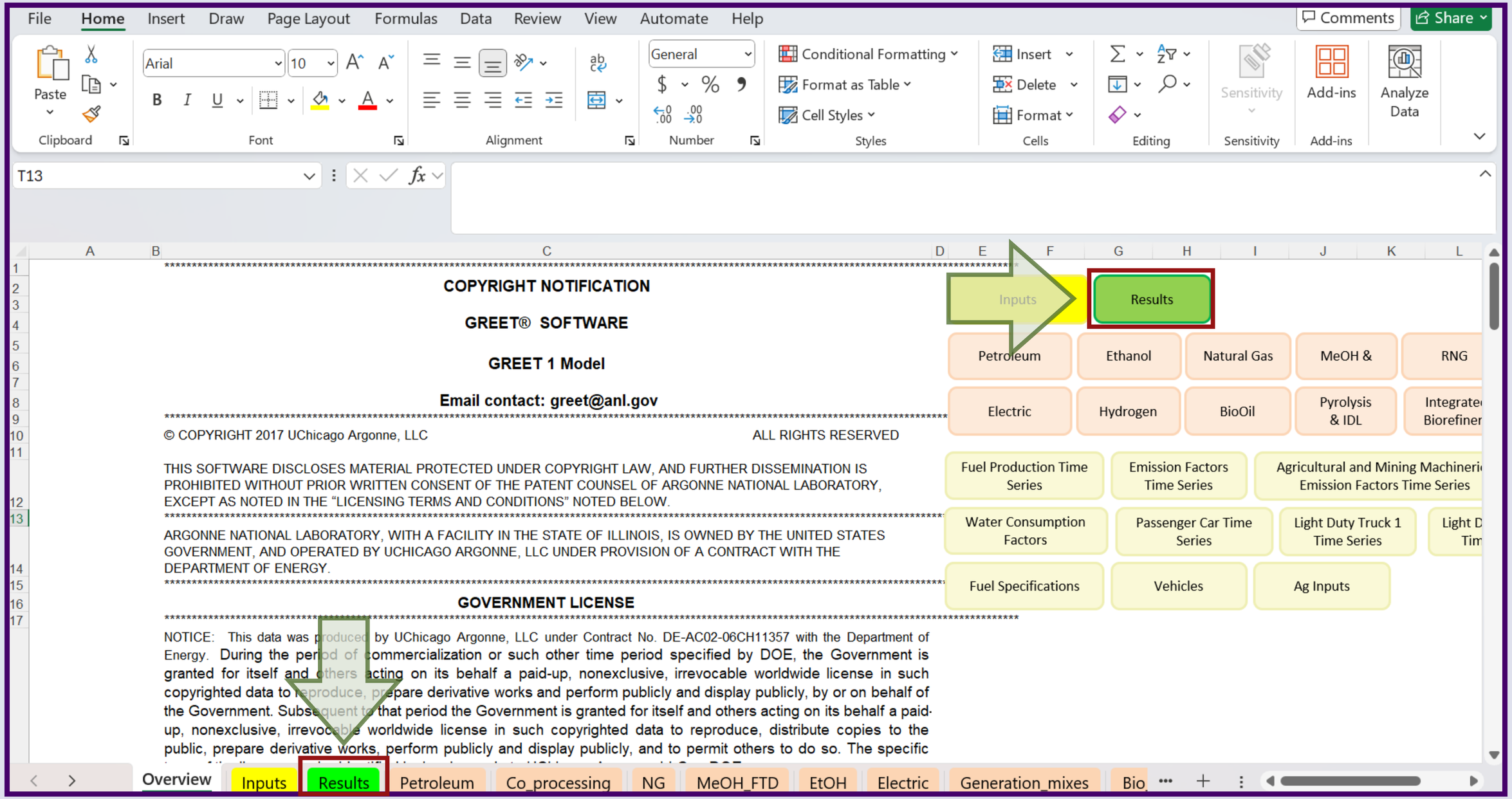
Review the Results Tab



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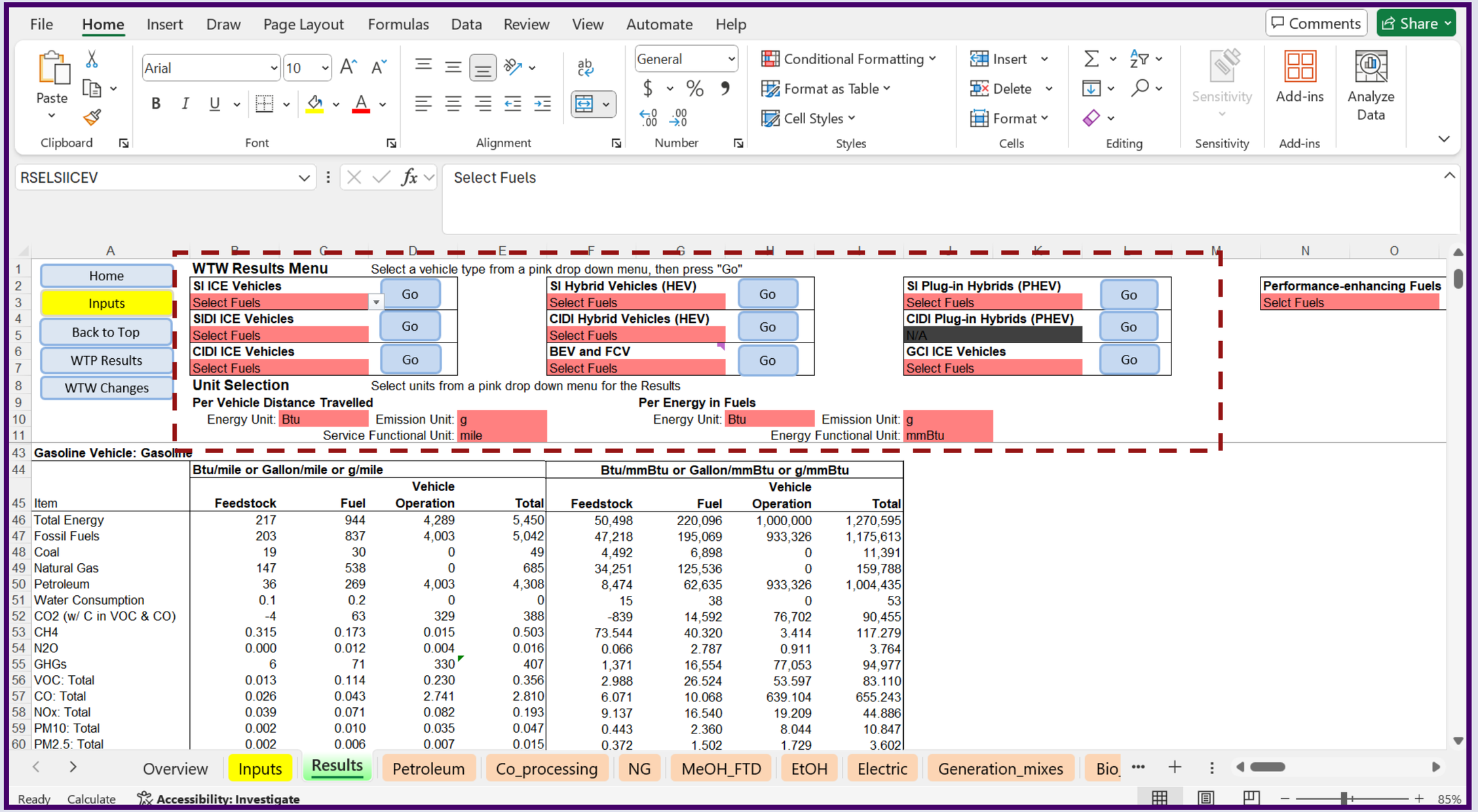

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Well-to-Pump (WTP) GHG Emissions

General formulas in R&D GREET

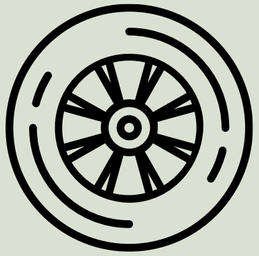
Well-to-pump (WTP) = [feedstock + fuel]

Well-to-wheels (WTW) = [feedstock + fuel + vehicle operation]

WTW = WTP + vehicle operations

A simplified WTW pathway example: *total fuel pathway*

Process Progression



Emissions

Emissions

Emissions

Feedstock Stages
Production, Transportation, and Storage

Fuel Stages
Production, Transportation, Distribution, and Storage

Vehicle Operation
Vehicle Refueling, Fuel Combustion/conversion, and Fuel Evaporation

Energy Materials

Energy Materials

---- **Well-to-Wheels (WTW) System Boundary**

WTP Stages **PTW Stage**

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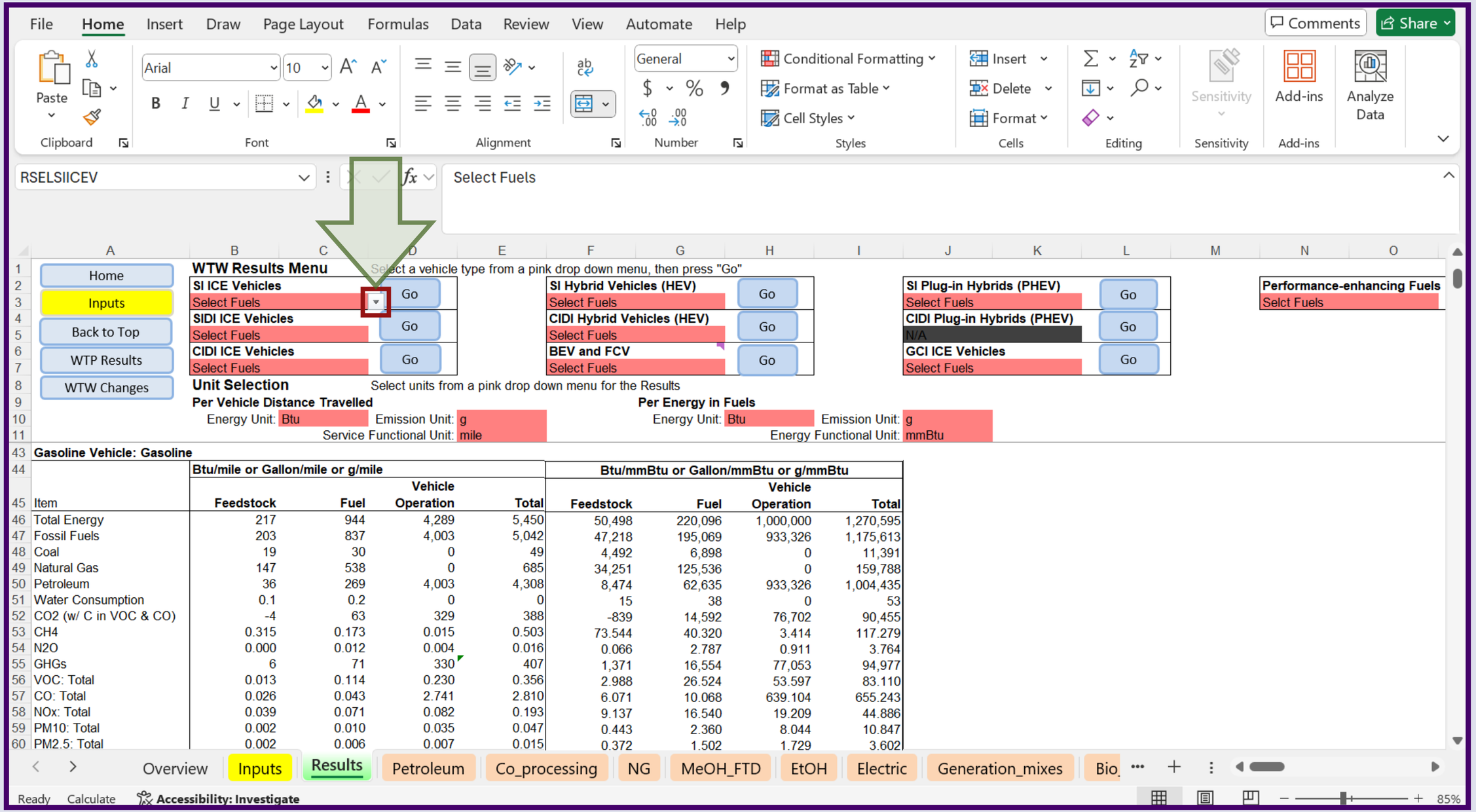

Item	Btu/mile or Gallon/mile or g/mile				Btu/mmBtu or Gallon/mmBtu or g/mmBtu			
	Feedstock	Fuel	Vehicle Operation	Total	Feedstock	Fuel	Vehicle Operation	Total
Total Energy	217	944	4,289	5,450	50,498	220,096	1,000,000	1,270,595
Fossil Fuels	203	837	4,003	5,042	47,218	195,069	933,326	1,175,613
Coal	19	30	0	49	4,492	6,898	0	11,391
Natural Gas	147	538	0	685	34,251	125,536	0	159,788
Petroleum	36	269	4,003	4,308	8,474	62,635	933,326	1,004,435
Water Consumption	0.1	0.2	0	0	15	38	0	53
CO2 (w/ C in VOC & CO)	-4	63	329	388	-839	14,592	76,702	90,455
CH4	0.315	0.173	0.015	0.503	73.544	40.320	3.414	117.279
N2O	0.000	0.012	0.004	0.016	0.066	2.787	0.911	3.764
GHGs	6	71	330	407	1,371	16,554	77,053	94,977
VOC: Total	0.013	0.114	0.230	0.356	2.988	26.524	53.597	83.110
CO: Total	0.026	0.043	2.741	2.810	6.071	10.068	639.104	655.243
NOx: Total	0.039	0.071	0.082	0.193	9.137	16.540	19.209	44.886
PM10: Total	0.002	0.010	0.035	0.047	0.443	2.360	8.044	10.847
PM2.5: Total	0.002	0.006	0.007	0.015	0.372	1.502	1.729	3.602

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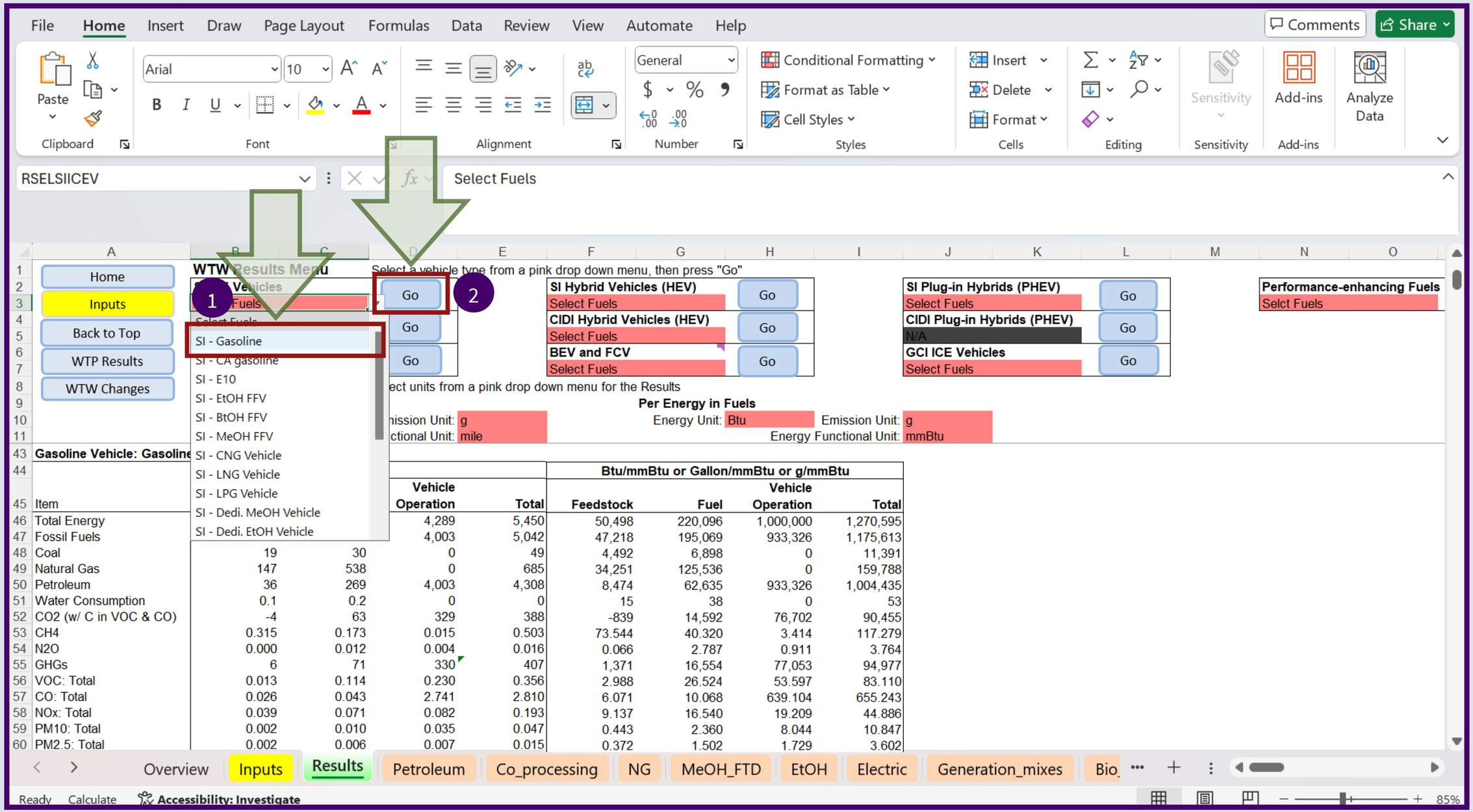

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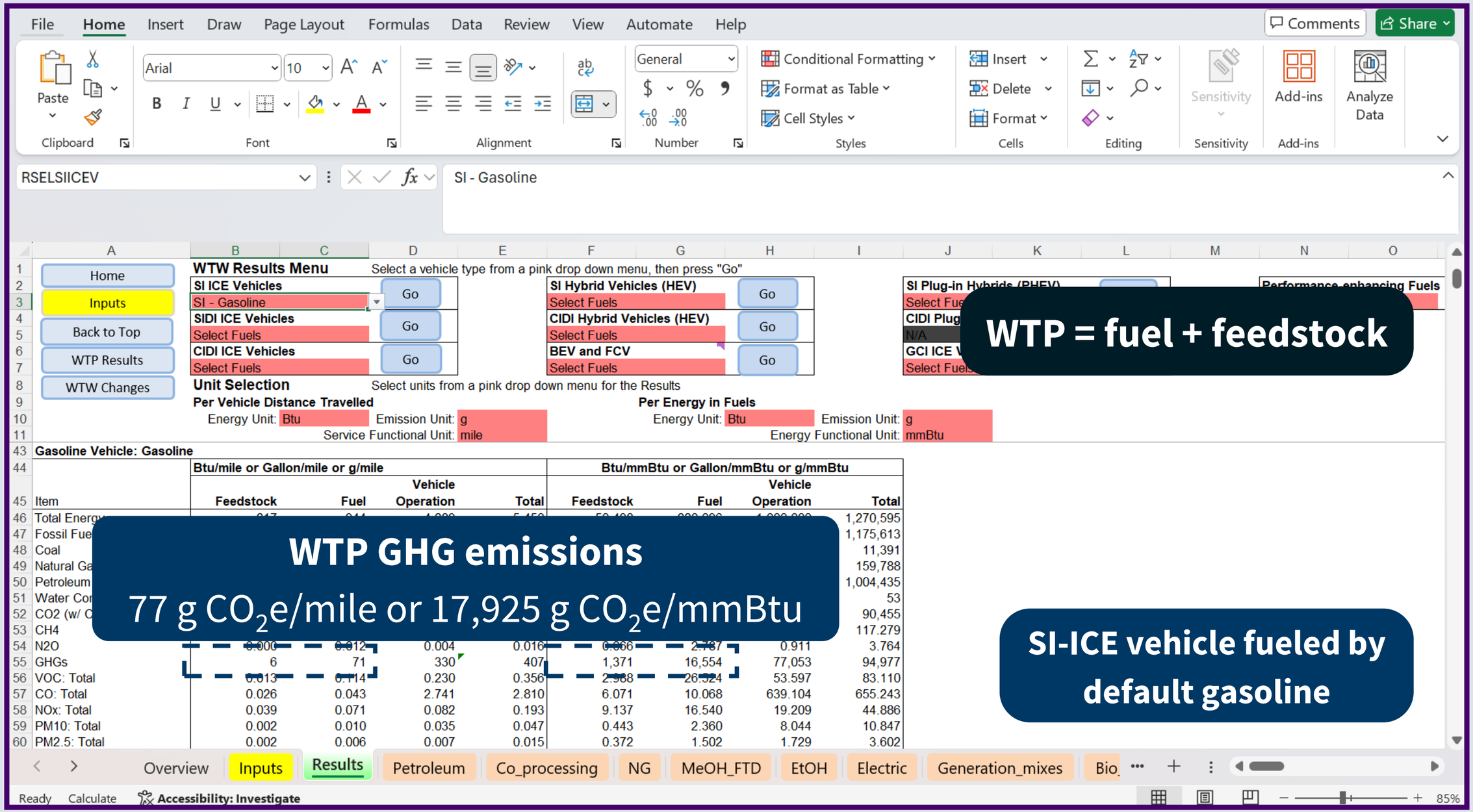

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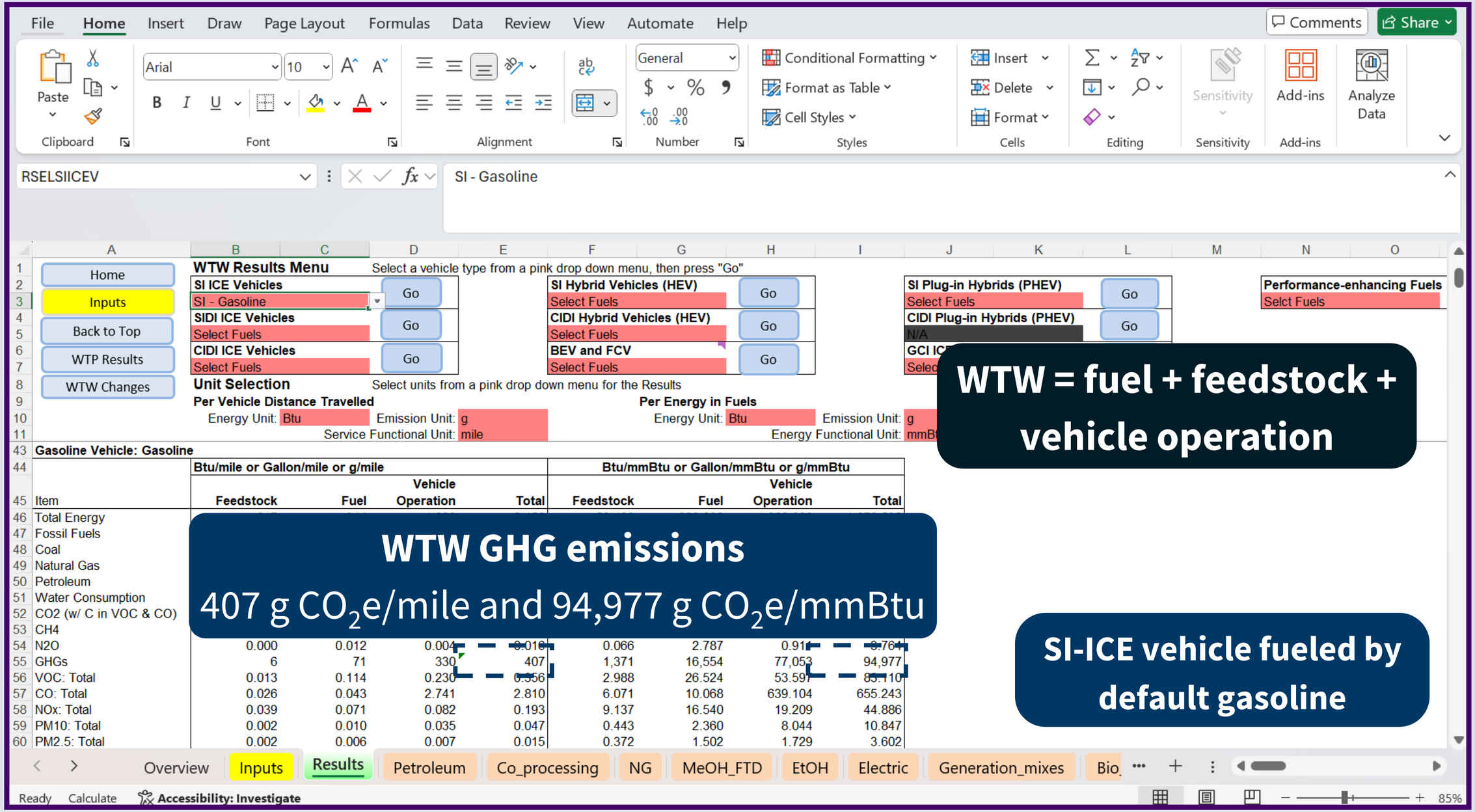
Well-to-Wheels (WTW) GHG Emissions



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Carbon Intensity

With the correct units g/MJ, the carbon intensity (CI) score is equivalent to the WTW GHG emissions

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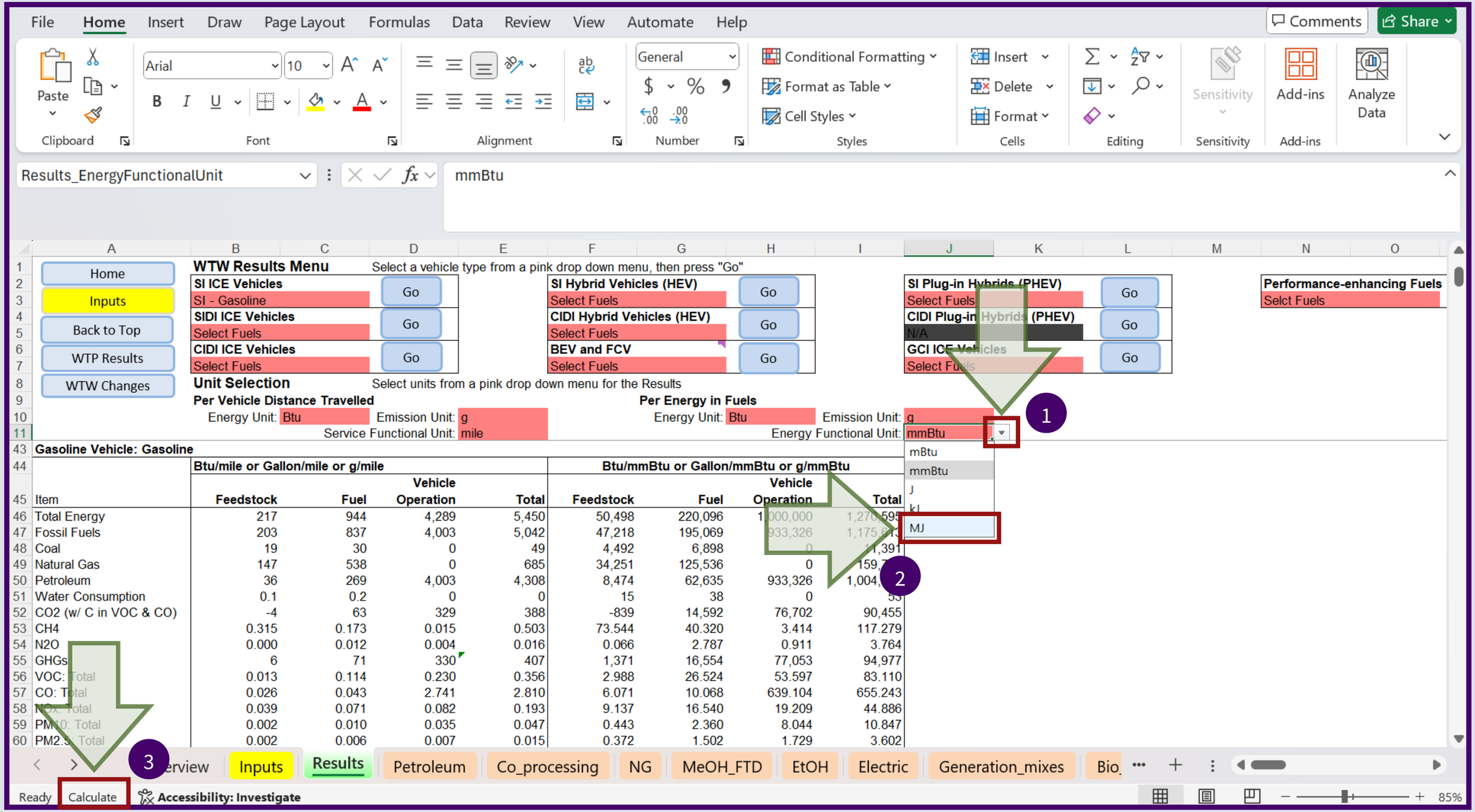

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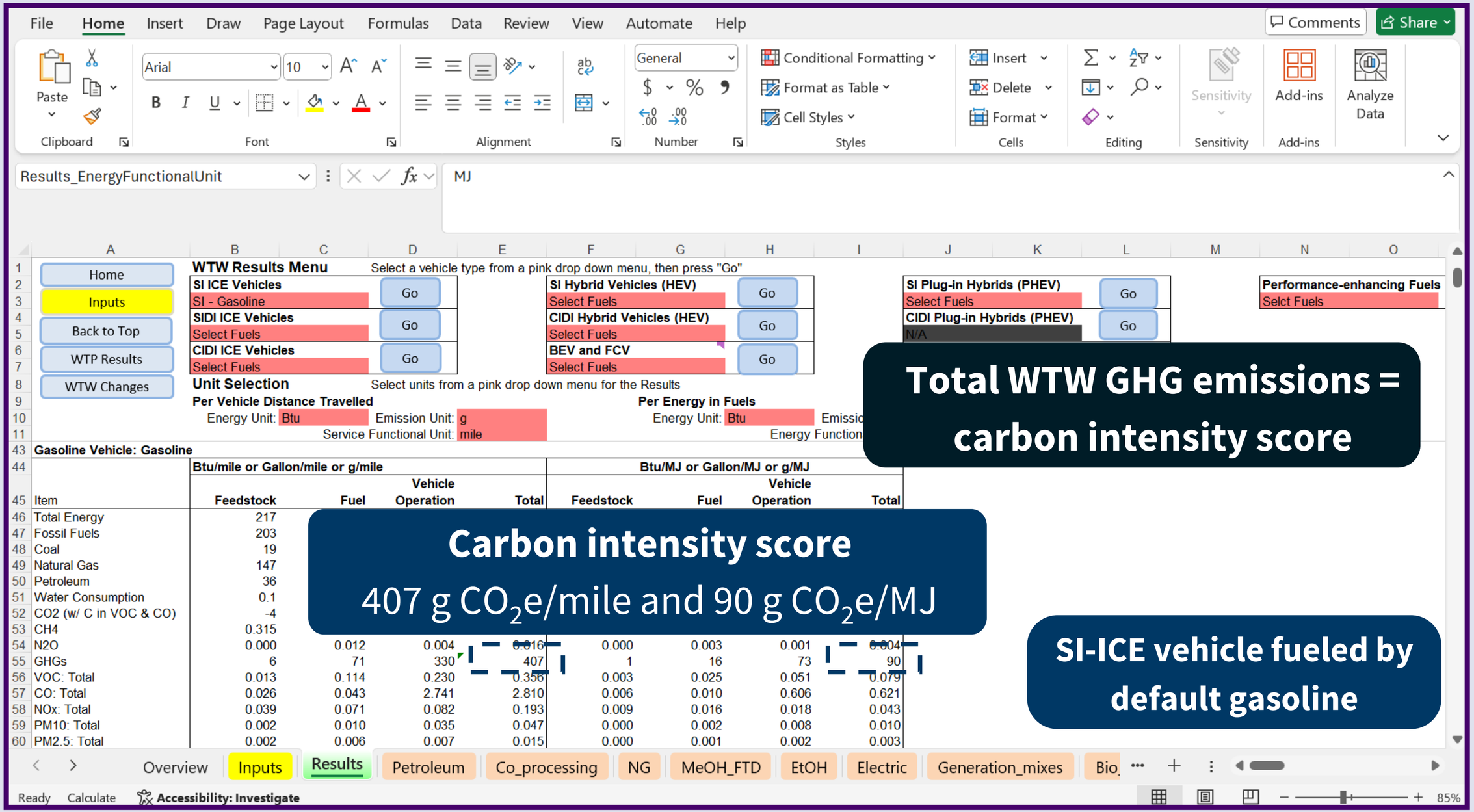

Item	Btu/mile or Gallon/mile or g/mile				Btu/MJ or Gallon/MJ or g/MJ			
	Feedstock	Fuel	Vehicle Operation	Total	Feedstock	Fuel	Vehicle Operation	Total
Total Energy	217							
Fossil Fuels	203							
Coal	19							
Natural Gas	147							
Petroleum	36							
Water Consumption	0.1							
CO2 (w/ C in VOC & CO)	-4							
CH4	0.315							
N2O	0.000	0.012	0.004	0.016	0.000	0.003	0.001	0.004
GHGs	6	71	330	407	1	16	73	90
VOC: Total	0.013	0.114	0.230	0.356	0.003	0.025	0.051	0.079
CO: Total	0.026	0.043	2.741	2.810	0.006	0.010	0.606	0.621
NOx: Total	0.039	0.071	0.082	0.193	0.009	0.016	0.018	0.043
PM10: Total	0.002	0.010	0.035	0.047	0.000	0.002	0.008	0.010
PM2.5: Total	0.002	0.006	0.007	0.015	0.000	0.001	0.002	0.003

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Change the Model Year

Model a Spark-Ignition Internal Combustion Engine (SI-ICE) Vehicle Fueled by Gasoline in 2017

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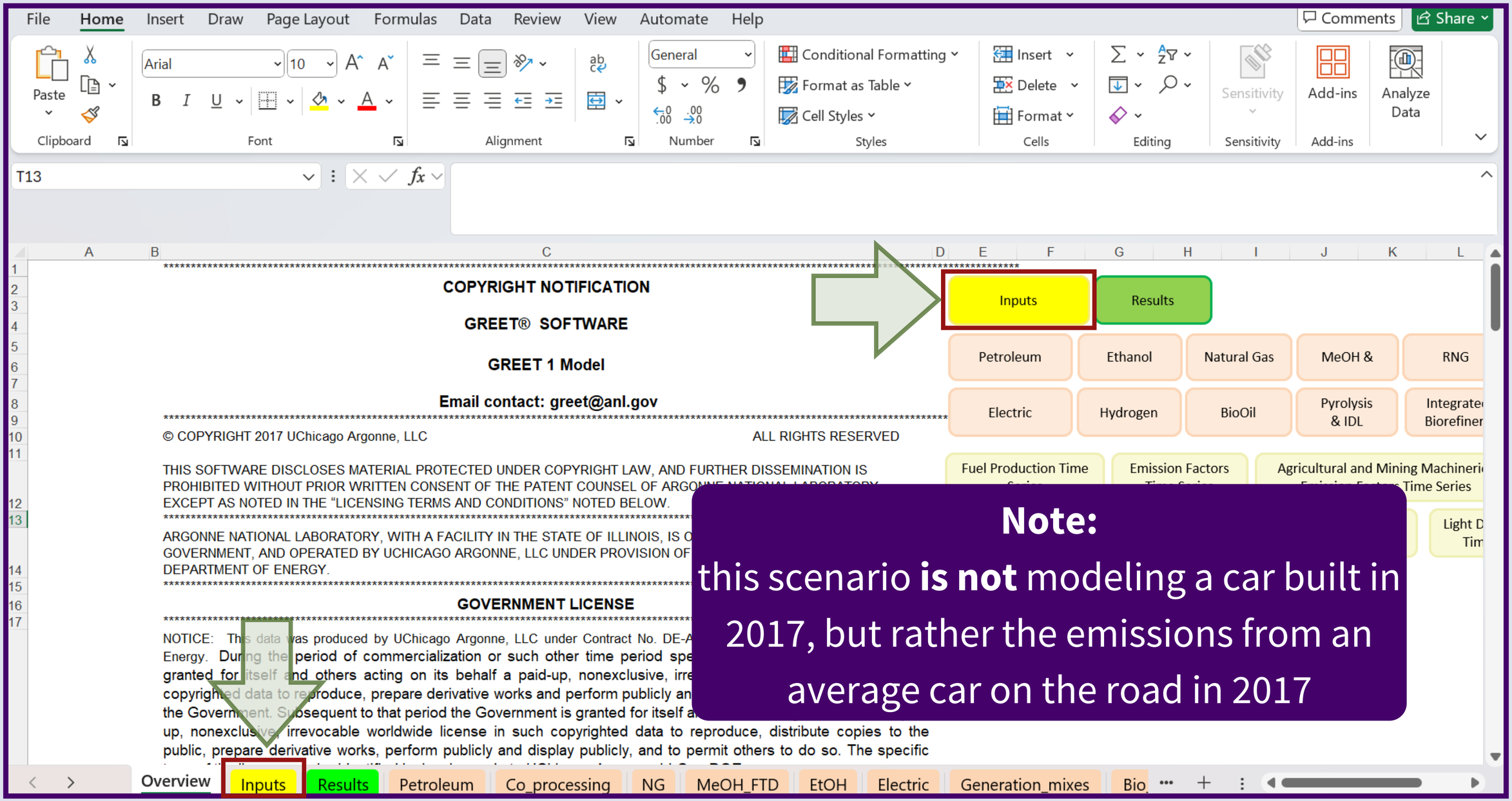
Review the Inputs Tab



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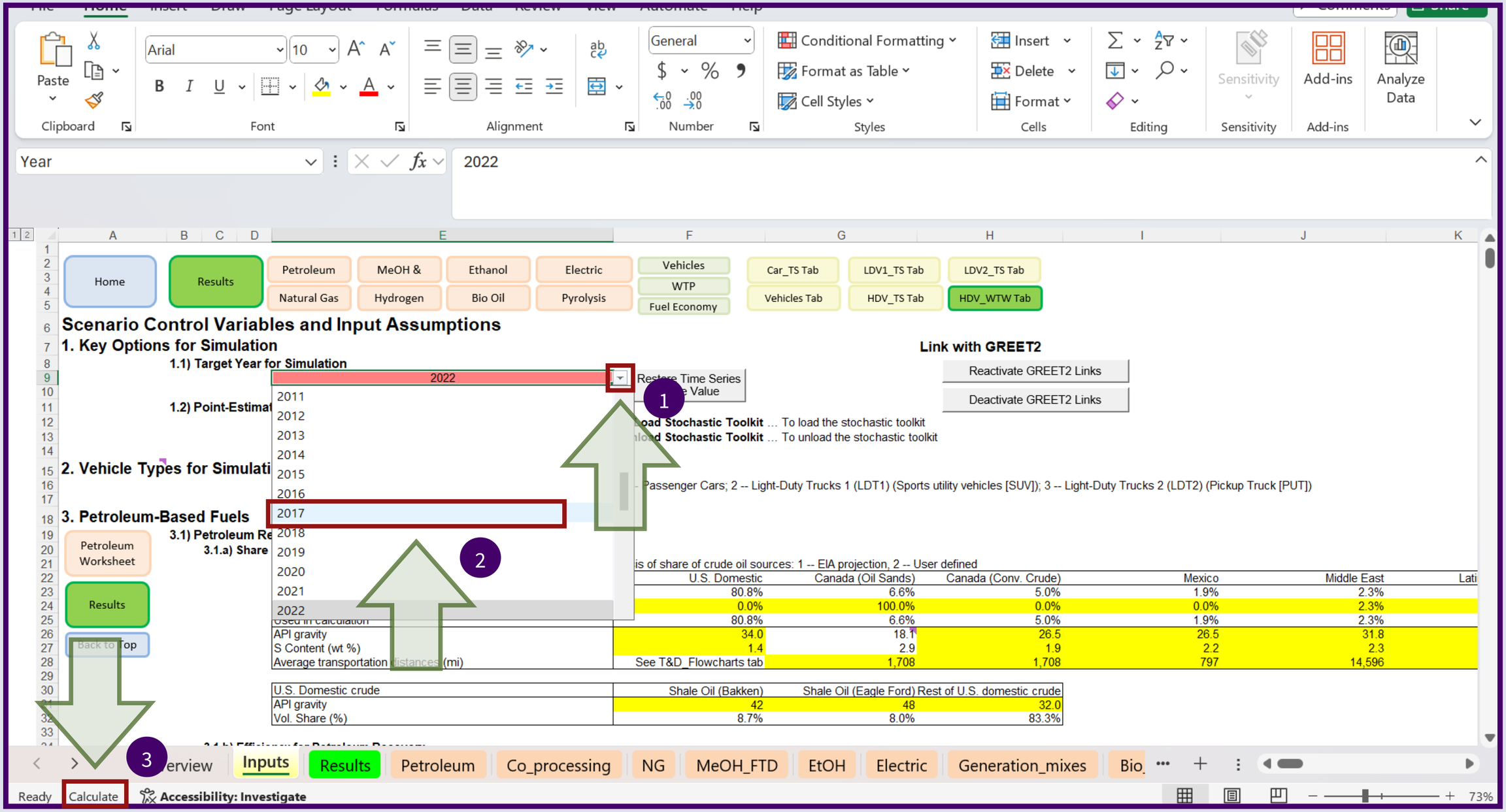

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Well-to-Pump (WTP) and Well-to-Wheels (WTW) GHG Emissions

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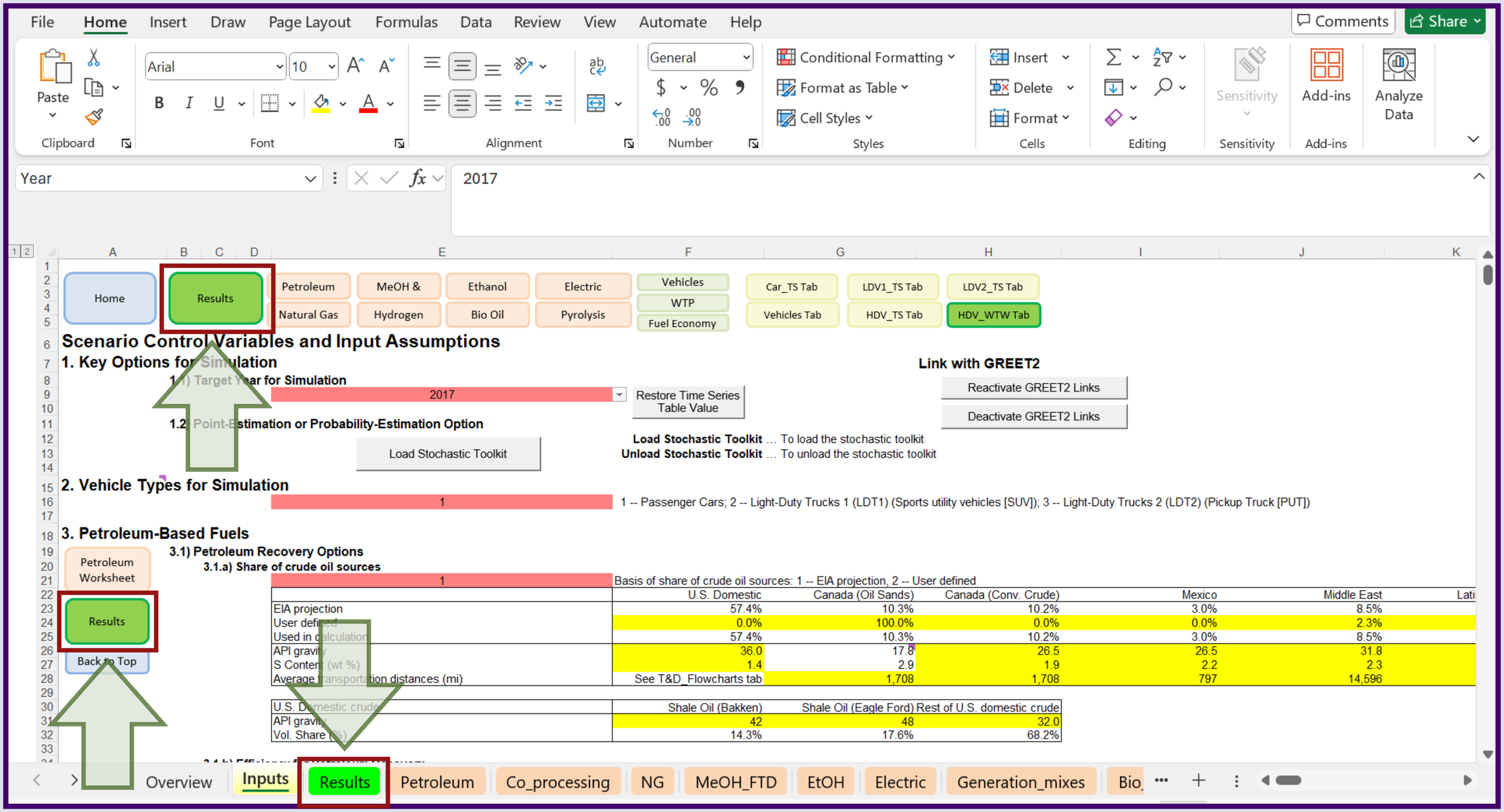

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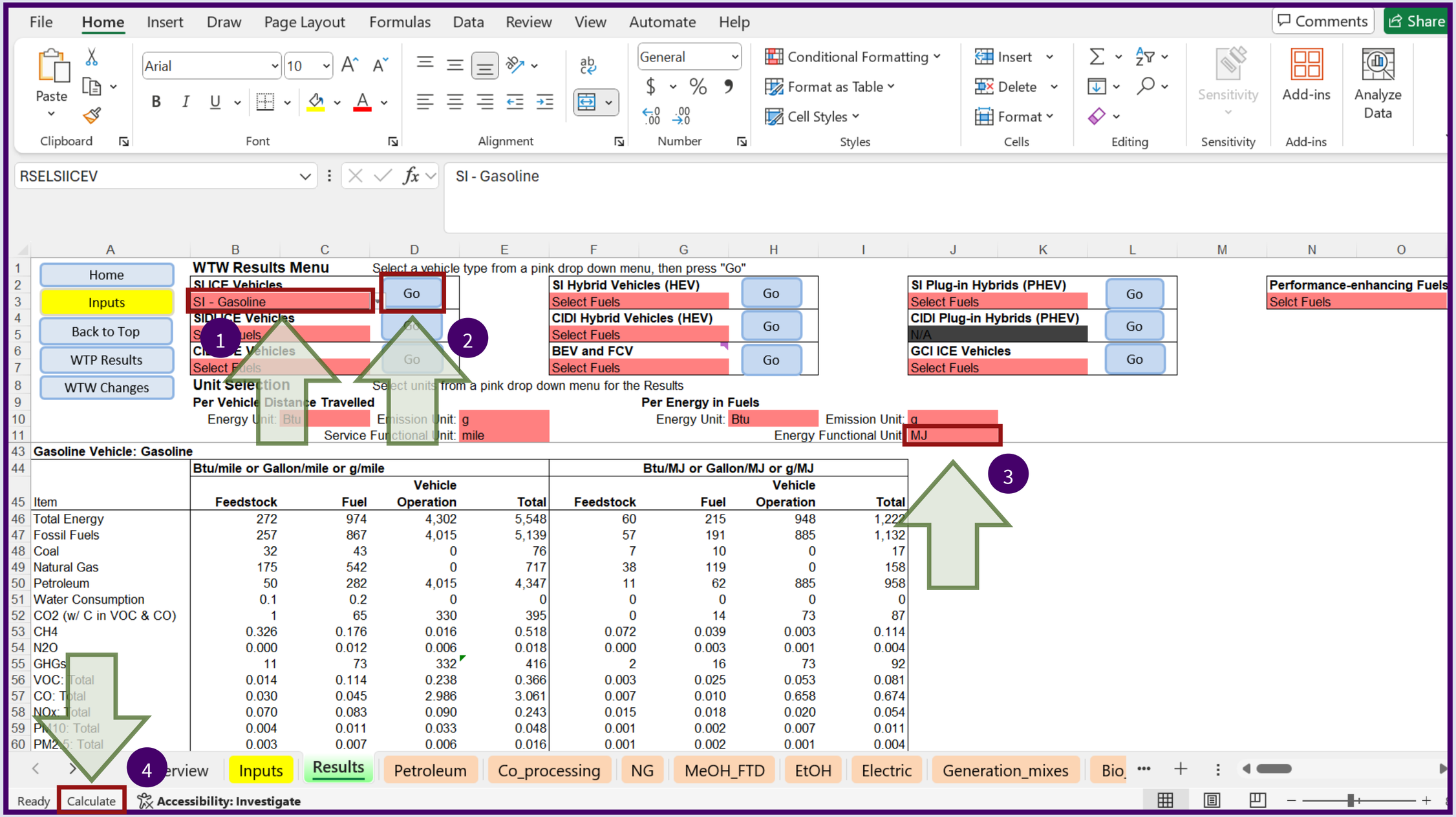

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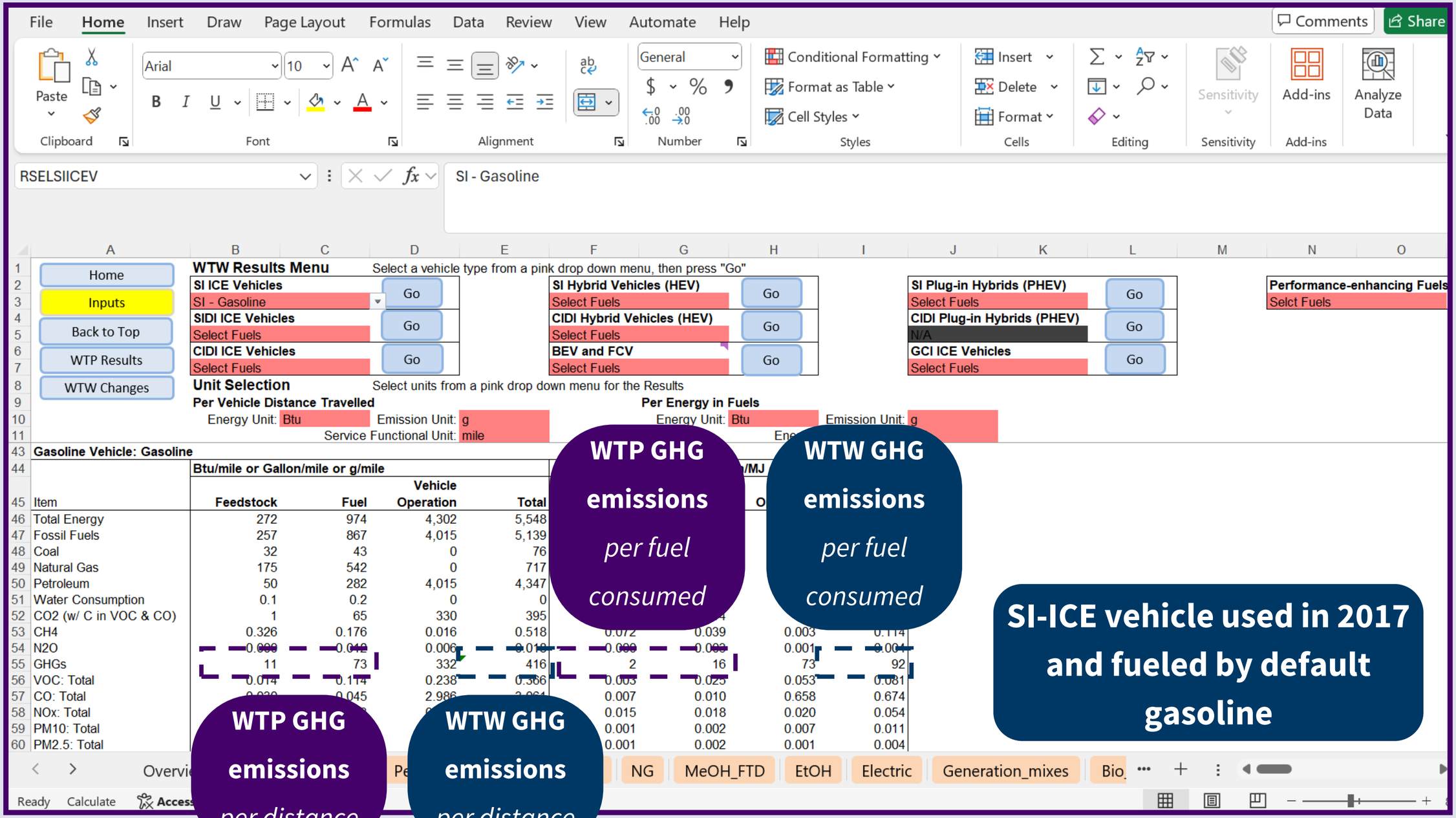

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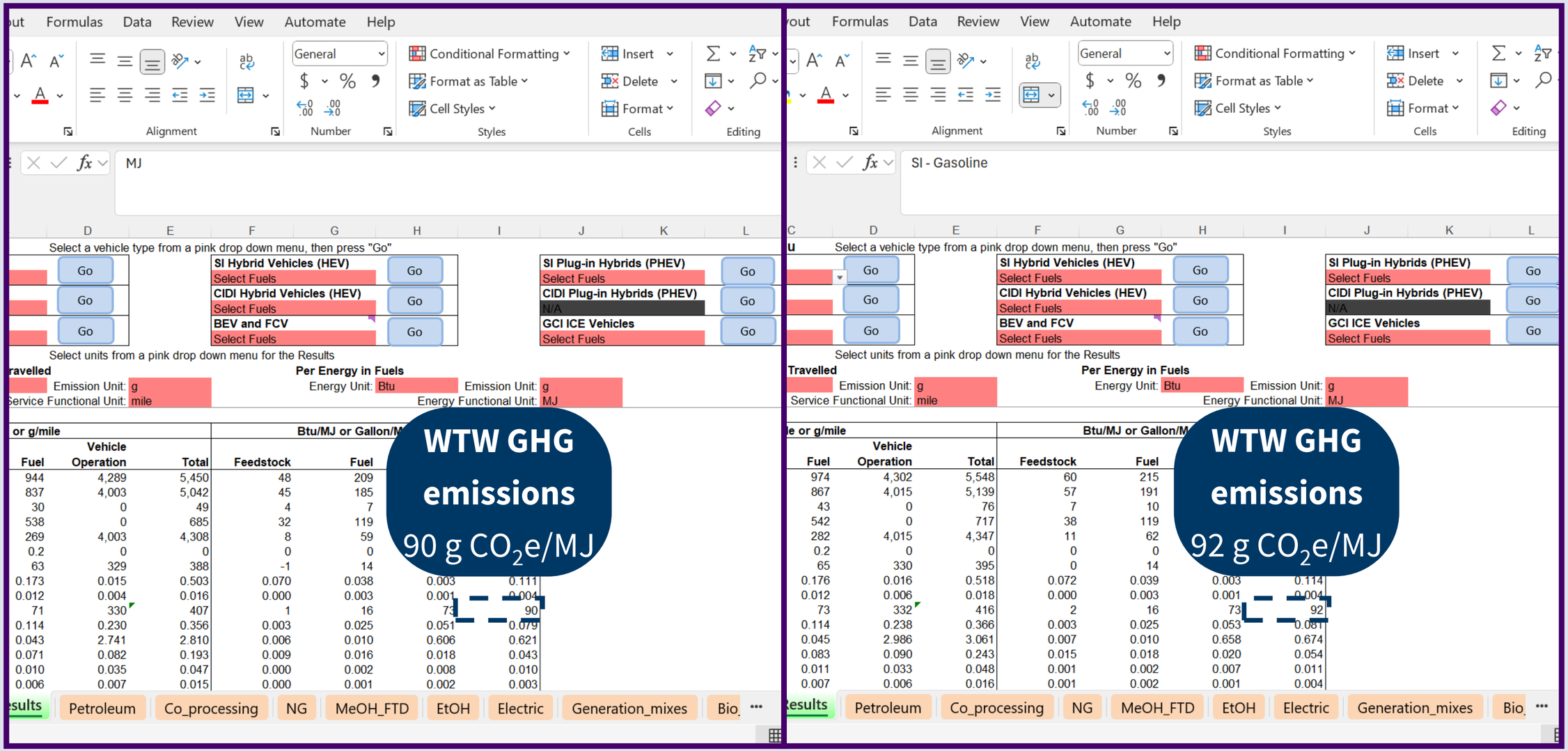
Default SI-ICE vehicle fueled by gasoline

SI-ICE vehicle fueled by gasoline and used in 2017



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Change the Model Location

Model a Spark-Ignition Internal Combustion Engine (SI-ICE) Vehicle Fueled by Gasoline with a U.S. Midwest Electricity Grid Generation Mix

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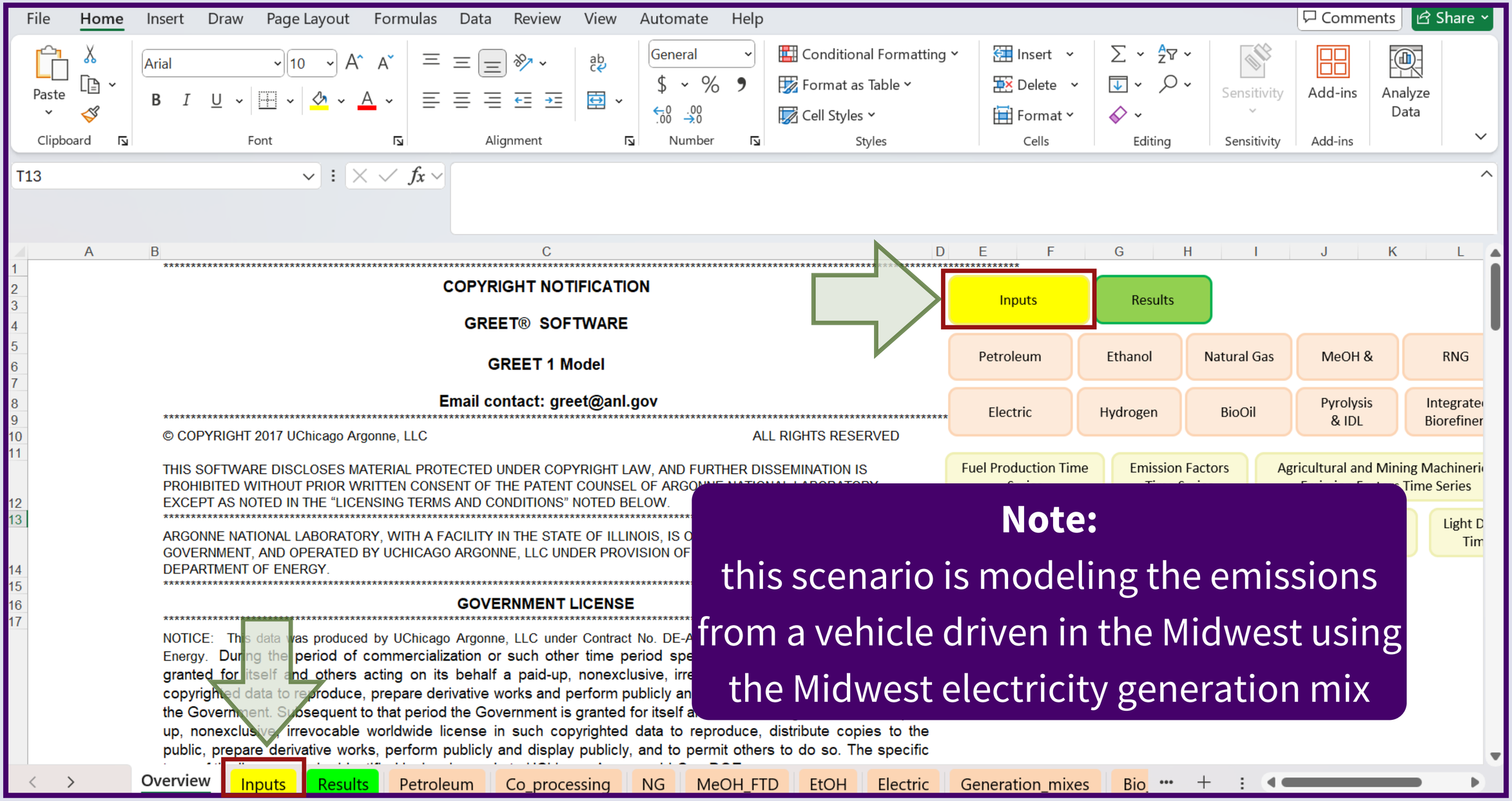

Note:

this scenario is modeling the emissions from a vehicle driven in the Midwest using the Midwest electricity generation mix

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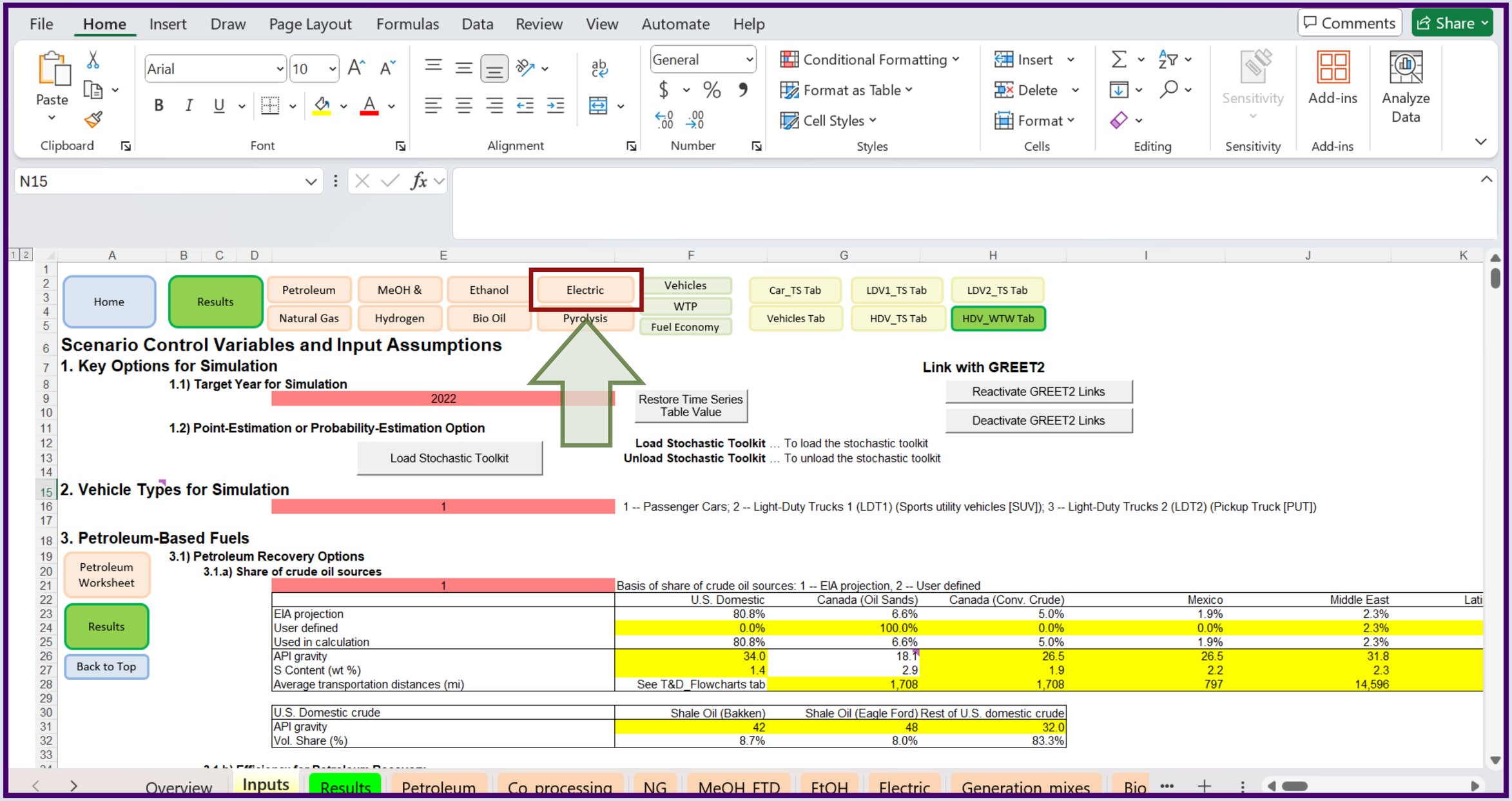

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Watch Window

Calculation Options — Calculation

L749

10. Electric Generation

10.1) GREET-Calculated or User-Inputted Emission Factors for Power Plants

Electric

2

1 -- GREET-calculated emissions factors via emission factors in EF Sheet
2 -- Emission factors based on EPA and EIA database in g/kWh

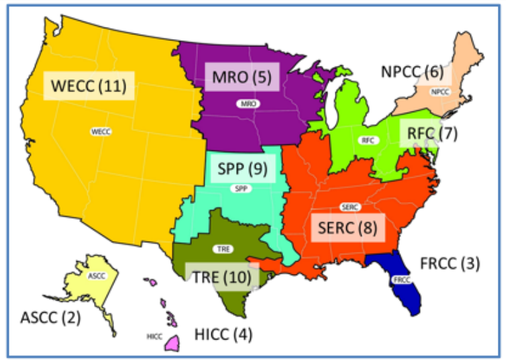
10.2) Electricity Generation Mix

Results

Back to Top

10.2.a) Selection of Electricity Generation Mix for Transportation Use

Mix for transportation use	1
Mix for stationary use	1



(U.S. EPA)

1 U.S. Mix
2 ASCC Mix
3 FRCC Mix
4 HICC Mix
5 MISO (former MRO) Mix
6 NPCC Mix
7 PJM (former RFC) Mix
8 SERC Mix
9 SPP Mix
10 TRE Mix
11 WECC Mix
12 CA Mix
13 User Defined Mix
14 NG Power Plants (transportation only)
15 Coal Power Plants (transportation only)
16 Nuclear Power Plants (transportation only)
17 Hydro Power Plants (transportation only)
18 NGCC Turbine (transportation only)
19 Geothermal (transportation only)

10.2.b) Electric Generation Mixes: Data Table for Use in GREET (From Annual Energy Outlook 2023)

	U.S. Mix		ASCC Mix		FRCC Mix
	Transportation	Stationary	Transportation	Stationary	Transportation
Residual oil	0.3%	0.3%	13.7%	13.7%	0.2%
Natural gas	38.5%	38.5%	46.7%	46.7%	71.3%
Coal	20.6%	20.6%	11.4%	11.4%	10.4%
Nuclear power	18.9%	18.9%	0.0%	0.0%	12.5%
Biomass	0.3%	0.3%	0.6%	0.6%	0.2%
Others	21.5%	21.5%	27.6%	27.6%	5.5%

10.2.c) Electric Generation Mixes for GREET Simulations

Overview | Inputs | Results | Petroleum | Co_processing | NG | MeOH_FTD | EtOH | Electric | Generation_mixes | Bio

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Transportation and stationary electricity generation

Transportation Mix

Users to switch the electricity generation mix for the vehicle-use phase of the life cycle assessment

Stationary Mix

Users to switch the electricity generation mix for the phases of the life cycle assessment outside of the vehicle-use (i.e., electricity for coal production)

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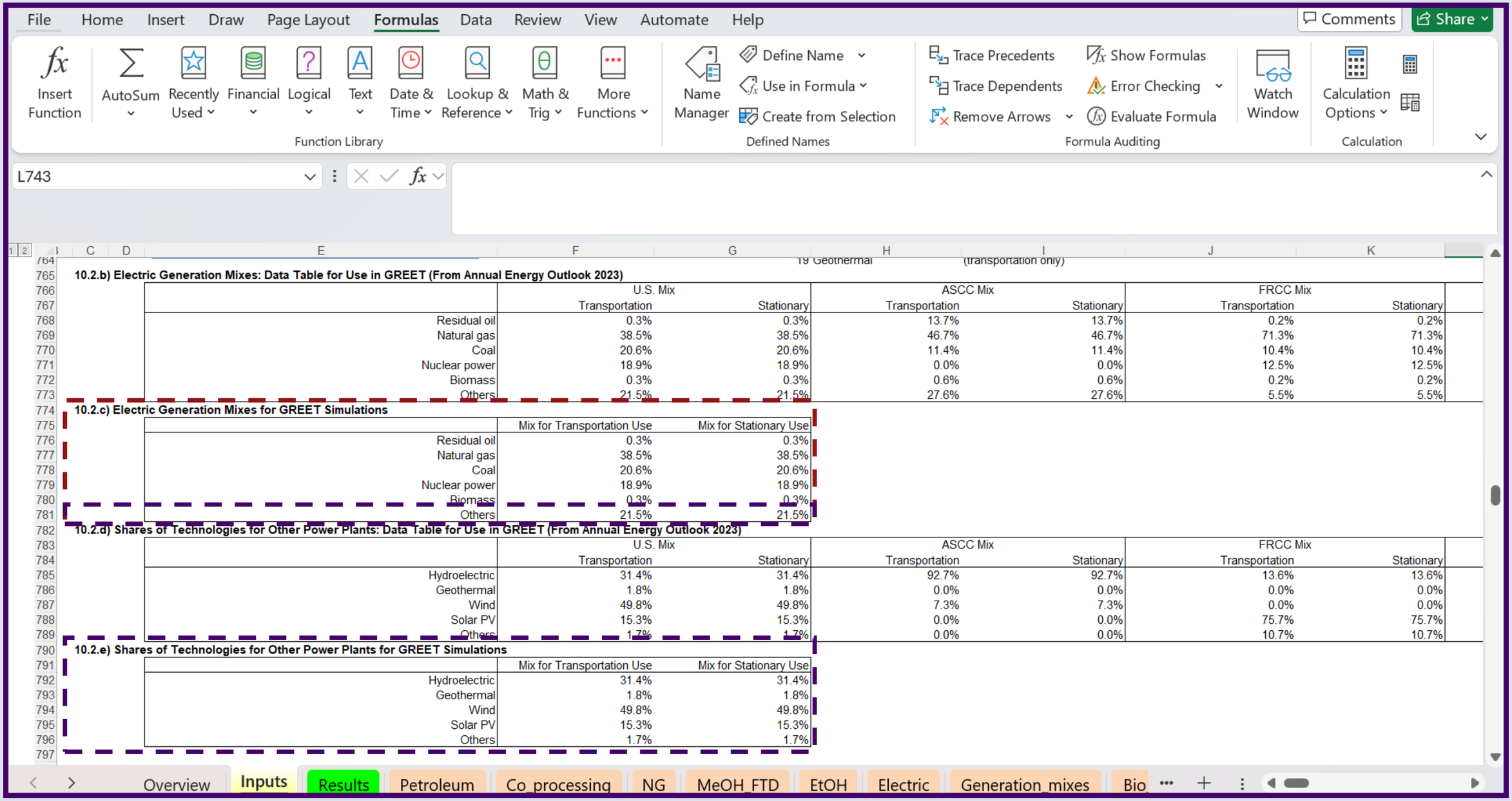

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Trace Precedents | Trace Dependents | Remove Arrows | Show Formulas | Error Checking | Evaluate Formula — Formula Auditing

Watch Window

Calculation Options — Calculation

L743

19 Geothermal (transportation only)

10.2.b) Electric Generation Mixes: Data Table for Use in GREET (From Annual Energy Outlook 2023)

	U.S. Mix		ASCC Mix		FRCC Mix	
	Transportation	Stationary	Transportation	Stationary	Transportation	Stationary
Residual oil	0.3%	0.3%	13.7%	13.7%	0.2%	0.2%
Natural gas	38.5%	38.5%	46.7%	46.7%	71.3%	71.3%
Coal	20.6%	20.6%	11.4%	11.4%	10.4%	10.4%
Nuclear power	18.9%	18.9%	0.0%	0.0%	12.5%	12.5%
Biomass	0.3%	0.3%	0.6%	0.6%	0.2%	0.2%
Others	21.5%	21.5%	27.6%	27.6%	5.5%	5.5%

10.2.c) Electric Generation Mixes for GREET Simulations

	Mix for Transportation Use	Mix for Stationary Use
Residual oil	0.3%	0.3%
Natural gas	38.5%	38.5%
Coal	20.6%	20.6%
Nuclear power	18.9%	18.9%
Biomass	0.3%	0.3%
Others	21.5%	21.5%

10.2.d) Shares of Technologies for Other Power Plants: Data Table for Use in GREET (From Annual Energy Outlook 2023)

	U.S. Mix		ASCC Mix		FRCC Mix	
	Transportation	Stationary	Transportation	Stationary	Transportation	Stationary
Hydroelectric	31.4%	31.4%	92.7%	92.7%	13.6%	13.6%
Geothermal	1.8%	1.8%	0.0%	0.0%	0.0%	0.0%
Wind	49.8%	49.8%	7.3%	7.3%	0.0%	0.0%
Solar PV	15.3%	15.3%	0.0%	0.0%	75.7%	75.7%
Others	1.7%	1.7%	0.0%	0.0%	10.7%	10.7%

10.2.e) Shares of Technologies for Other Power Plants for GREET Simulations

	Mix for Transportation Use	Mix for Stationary Use
Hydroelectric	31.4%	31.4%
Geothermal	1.8%	1.8%
Wind	49.8%	49.8%
Solar PV	15.3%	15.3%
Others	1.7%	1.7%

Overview | Inputs | Results | Petroleum | Co_processing | NG | MeOH_FTD | EtOH | Electric | Generation_mixes | Bio

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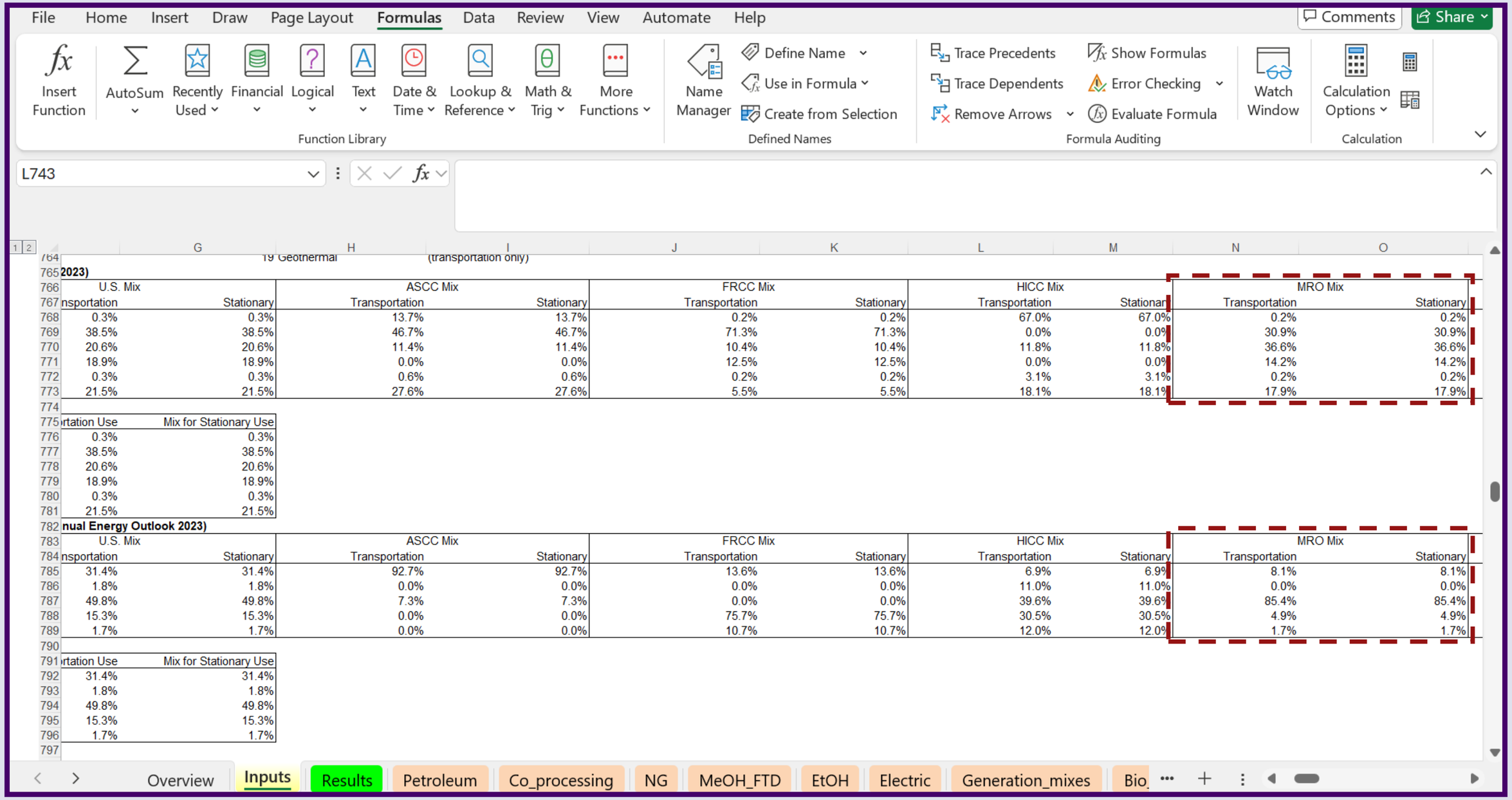

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Watch Window

Calculation Options — Calculation

Electric_Marginalmix_EVsnHEVs

1

10. Electric Generation

Electric Worksheet

Results

Back to Top

10.1) GREET-Calculated or User-Inputted Emission Factors for Power Plants

2

1 -- GREET-calculated emissions factors via emission factors in EF Sheet
2 -- Emission factors based on EPA and EIA database in g/kWh

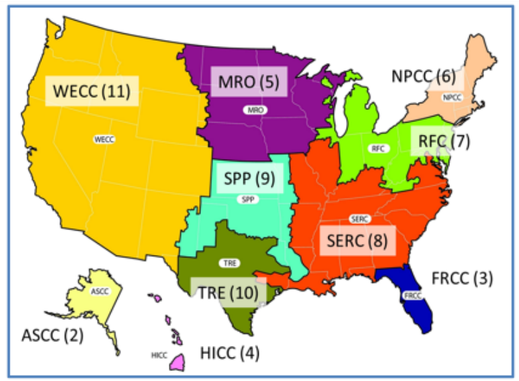
10.2) Electricity Generation Mix

10.2.a) Selection of Electricity Generation Mix for Transportation Use

Mix for transportation use	1
Mix for stationary use	

1
2

1 U.S. Mix
2 ASCC Mix
3 FRCC Mix
4 HICC Mix
5 MISO (former MRO) Mix
6 NPCC Mix
7 PJM (former RFC) Mix
8 SERC Mix
9 SPP Mix
10 TRE Mix
11 WECC Mix
12 CA Mix
13 User Defined Mix
14 NG Power Plants (transportation only)
15 Coal Power Plants (transportation only)
16 Nuclear Power Plants (transportation only)
17 Hydro Power Plants (transportation only)
18 NGCC Turbine (transportation only)
19 Geothermal (transportation only)



(U.S. EPA)

10.2.b) Electric Generation Mixes: Data Table for Use in GREET (From Annual Energy Outlook 2023)

	U.S. Mix		ASCC Mix		FRCC Mix
	Transportation	Stationary	Transportation	Stationary	Transportation
Residual oil	0.3%	0.3%	13.7%	13.7%	0.2%
Natural gas	38.5%	38.5%	46.7%	46.7%	71.3%
Coal	20.6%	20.6%	11.4%	11.4%	10.4%
Nuclear power	18.9%	18.9%	0.0%	0.0%	12.5%
Biomass	0.3%	0.3%	0.6%	0.6%	0.2%

Overview | Inputs | Results | Petroleum | Co_processing | NG | MeOH_FTD | EtOH | Electric | Generation_mixes | Bio

Ready | Calculate | Accessibility: Investigate | Display Settings | 75%

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Insert Function | AutoSum | Recently Used | Financial | Logical | Text | Date & Time | Lookup & Reference | Math & Trig | More Functions — Function Library

Name Manager | Define Name | Use in Formula | Create from Selection — Defined Names

Trace Precedents | Trace Dependents | Remove Arrows | Show Formulas | Error Checking | Evaluate Formula — Formula Auditing

Watch Window

Calculation Options — Calculation

Electric_Averagemix_FacilityUse

1

10. Electric Generation

Electric Worksheet

Results

Back to Top

10.1) GREET-Calculated or User-Inputted Emission Factors for Power Plants

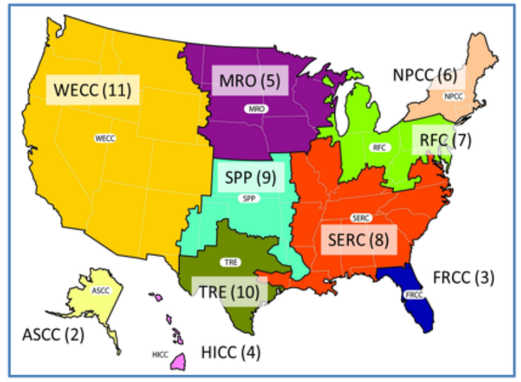
2

1 -- GREET-calculated emissions factors via emission factors in EF Sheet
2 -- Emission factors based on EPA and EIA database in g/kWh

10.2) Electricity Generation Mix

10.2.a) Selection of Electricity Generation Mix for Transportation Use

Mix for transportation use	5
Mix for stationary use	1



1 2 3 4 5 6 7 8 9 10 11 12

1 U.S. Mix
2 ASCC Mix
3 FRCC Mix
4 HICC Mix
5 MISO (former MRO) Mix
6 NPCC Mix
7 PJM (former RFC) Mix
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18 NGCC Turbine (transportation only)
19 Geothermal (transportation only)

10.2.b) Electric Generation Mixes: Data Table for Use in GREET (From Annual Energy Outlook 2023)

	U.S. Mix		ASCC Mix		FRCC Mix
	Transportation	Stationary	Transportation	Stationary	Transportation
Residual oil	0.3%	0.3%	13.7%	13.7%	0.2%
Natural gas	38.5%	38.5%	46.7%	46.7%	71.3%
Coal	20.6%	20.6%	11.4%	11.4%	10.4%
Nuclear power	18.9%	18.9%	0.0%	0.0%	12.5%
Biomass	0.3%	0.3%	0.6%	0.6%	0.2%

Overview | Inputs | Results | Petroleum | Co_processing | NG | MeOH_FTD | EtOH | Electric | Generation_mixes | Bio...

Ready | Calculate | Accessibility: Investigate | Display Settings | 75%

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Well-to-Pump (WTP) and Well-to-Wheels (WTW) GHG Emissions

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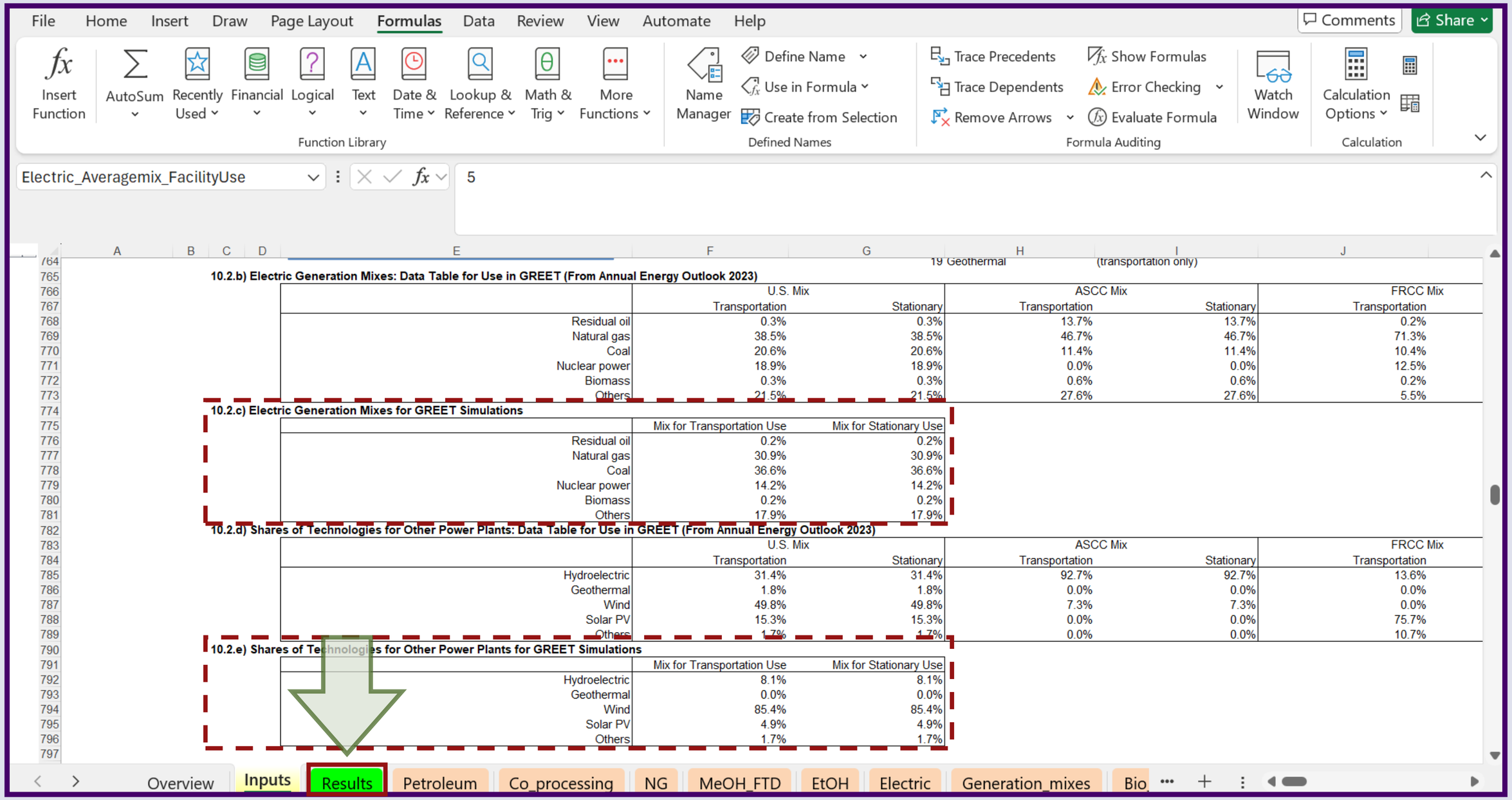

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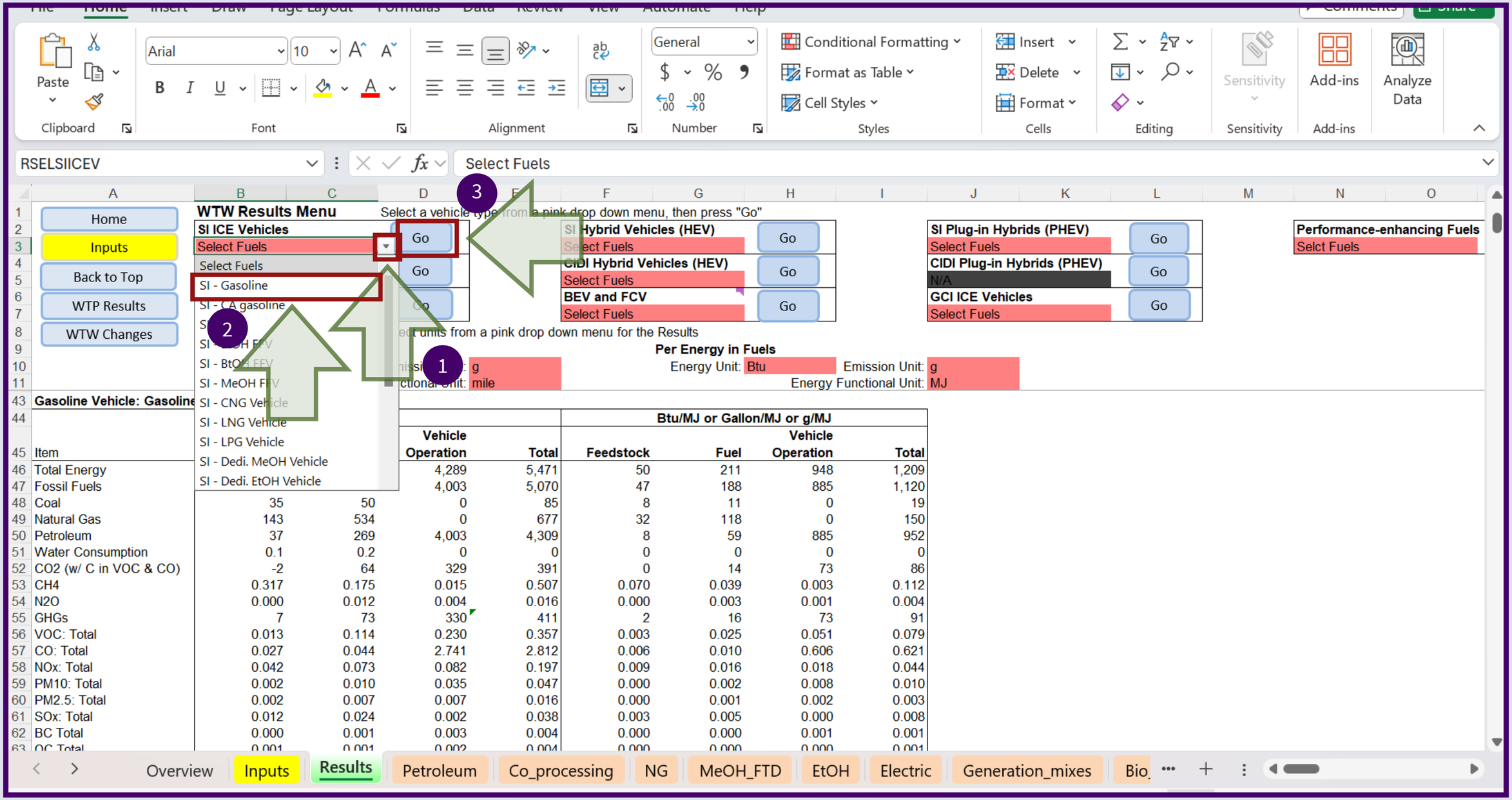

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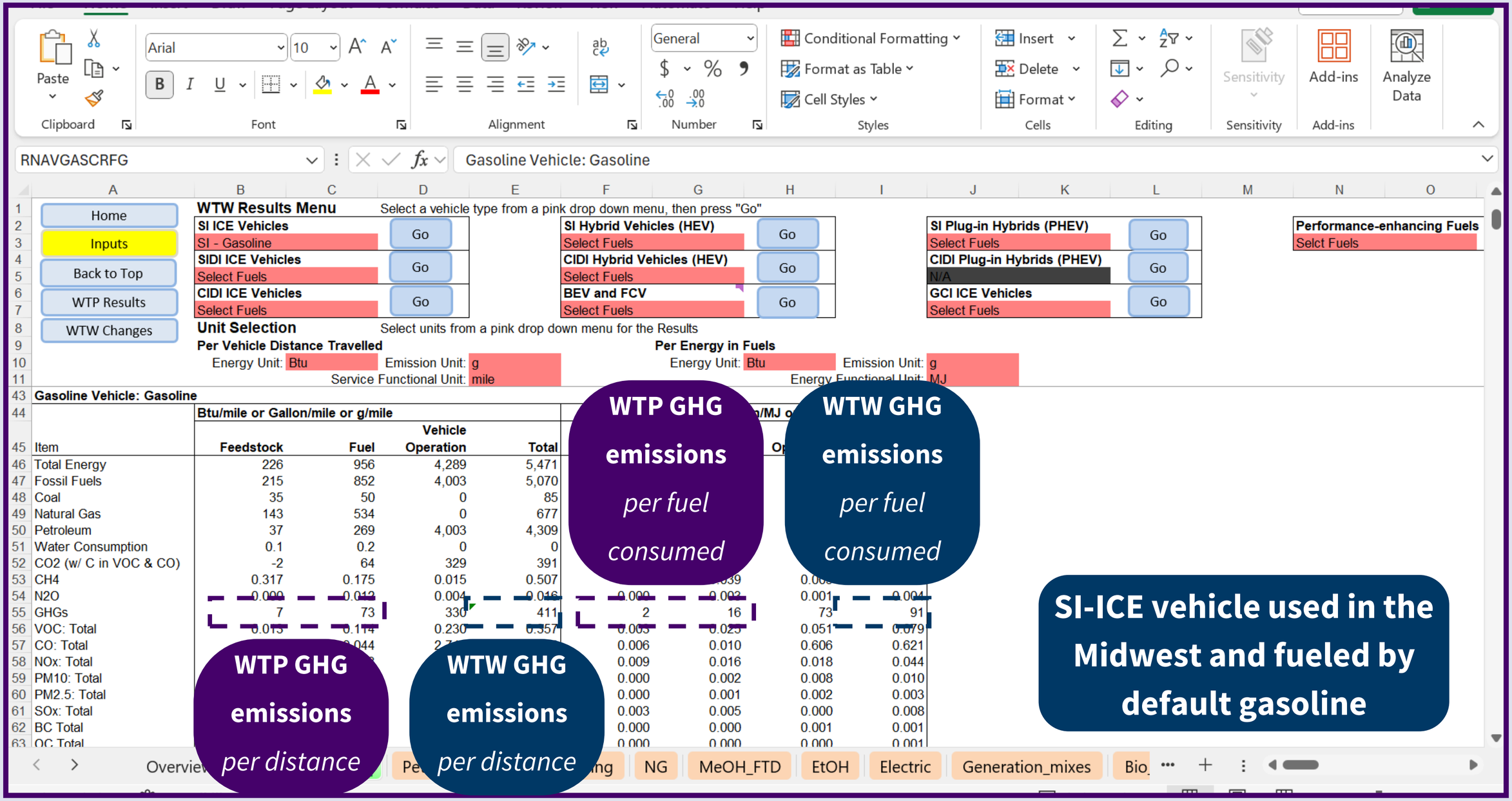
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Inputs
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WTP Results
WTW Changes
WTW Results Menu
Select a vehicle type from a pink drop down menu, then press "Go"
SI ICE Vehicles
SI - Gasoline
Go
SIDI ICE Vehicles
Select Fuels
Go
CIDI ICE Vehicles
Select Fuels
Go
SI Hybrid Vehicles (HEV)
Select Fuels
Go
CIDI Hybrid Vehicles (HEV)
Select Fuels
Go
BEV and FCV
Select Fuels
Go
SI Plug-in Hybrids (PHEV)
Select Fuels
Go
CIDI Plug-in Hybrids (PHEV)
N/A
Go
GCI ICE Vehicles
Select Fuels
Go
Performance-enhancing Fuels
Selct Fuels
Unit Selection
Select units from a pink drop down menu for the Results
Per Vehicle Distance Travelled
Energy Unit: Btu
Emission Unit: g
Service Functional Unit: mile
Per Energy in Fuels
Energy Unit: Btu
Emission Unit: g
Energy Functional Unit: MJ
Gasoline Vehicle: Gasoline
Btu/mile or Gallon/mile or g/mile
Item
Feedstock
Fuel
Vehicle Operation
Total
Total Energy 226 956 4,289 5,471
Fossil Fuels 215 852 4,003 5,070
Coal 35 50 0 85
Natural Gas 143 534 0 677
Petroleum 37 269 4,003 4,309
Water Consumption 0.1 0.2 0 0
CO2 (w/ C in VOC & CO) -2 64 329 391
CH4 0.317 0.175 0.015 0.507
N2O 0.000 0.013 0.004 0.016
GHGs 7 73 330 411
VOC: Total 0.015 0.114 0.230 0.357
CO: Total 0.044
NOx: Total
PM10: Total
PM2.5: Total
SOx: Total
BC Total
OC Total
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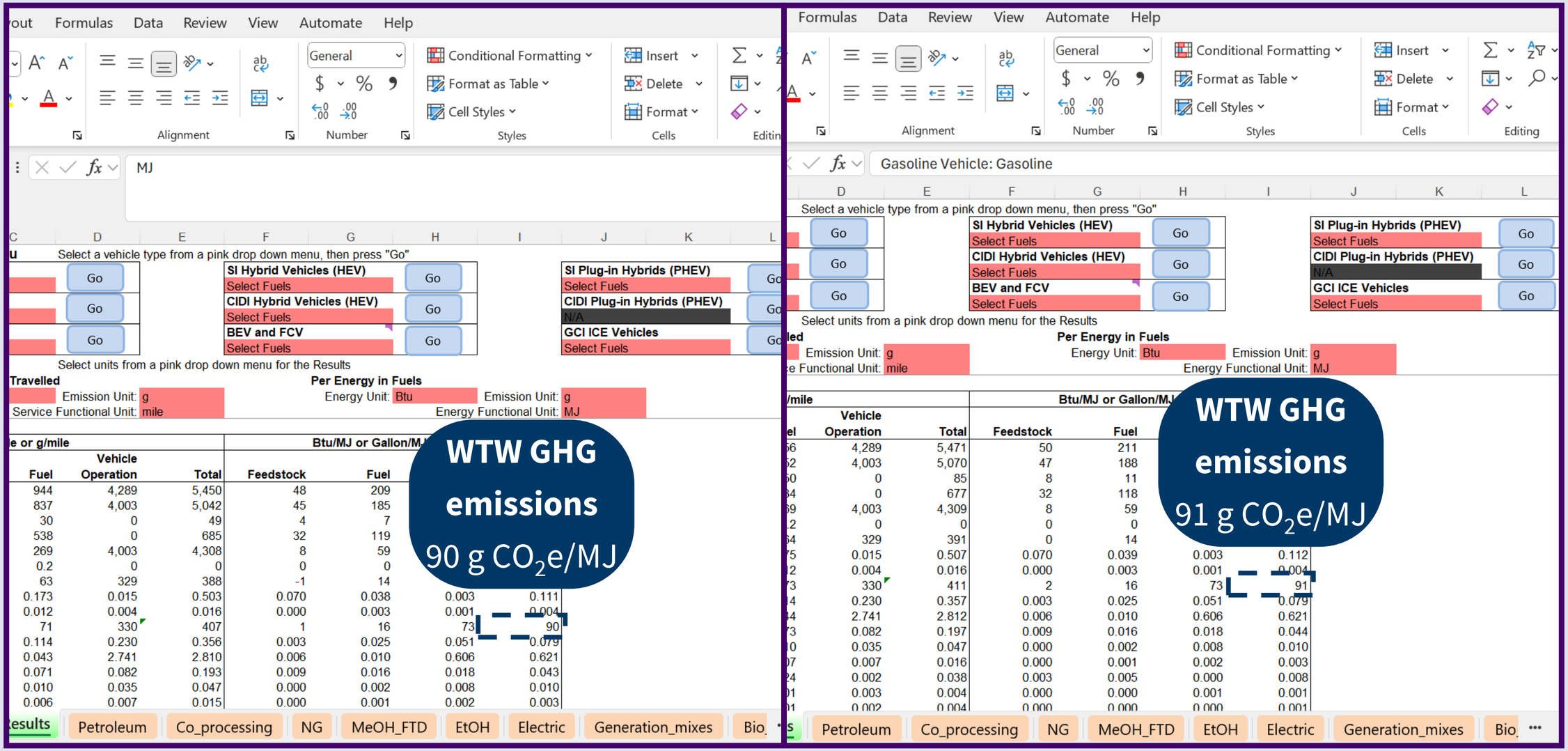
0.009 0.016 0.018 0.044
0.000 0.002 0.008 0.010
0.000 0.001 0.002 0.003
0.003 0.005 0.000 0.008
0.000 0.000 0.001 0.001
0.000 0.000 0.000 0.001
2 16 73 91
0.003 0.025 0.051 0.079
0.006 0.010 0.606 0.621
WTP GHG emissions per fuel consumed
WTW GHG emissions per fuel consumed
WTP GHG emissions per distance
WTW GHG emissions per distance
SI-ICE vehicle used in the Midwest and fueled by default gasoline
Overview
NG
MeOH_FTD
EtOH
Electric
Generation_mixes

Default SI-ICE vehicle fueled by gasoline

SI-ICE vehicle fueled by gasoline and used in the Midwest



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Fuel Efficiency in R&D GREET

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SI and SIDI ICE vehicles

SI = Spark Ignition
Internal Combustion Engine

SIDI = Spark Ignition Direct Injection
Internal Combustion Engine

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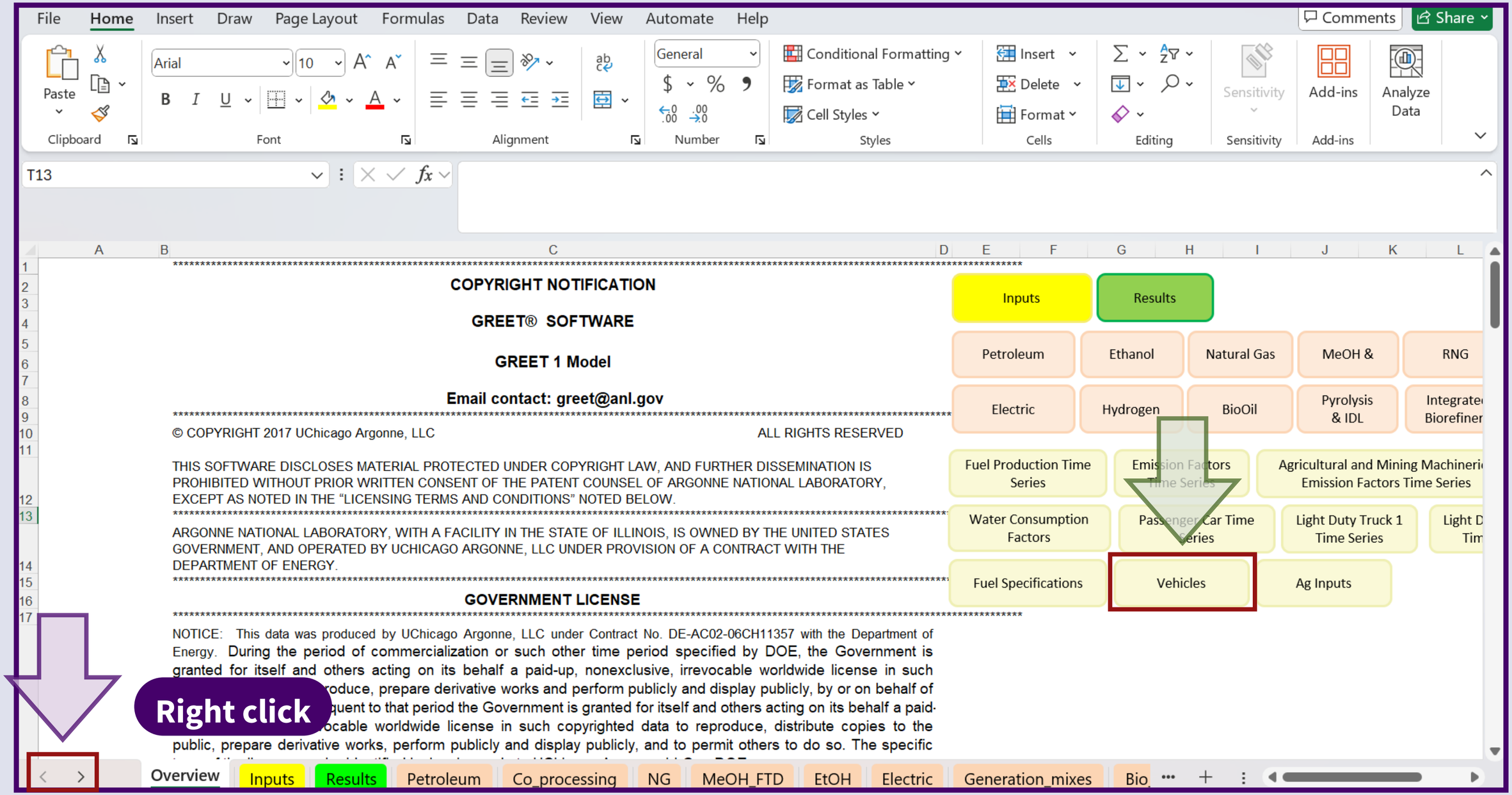
SIDI vehicles

Separates the fuel and air at the intake through direct injection

Improves fuel efficiency

Improves power

Review the Vehicles Tab



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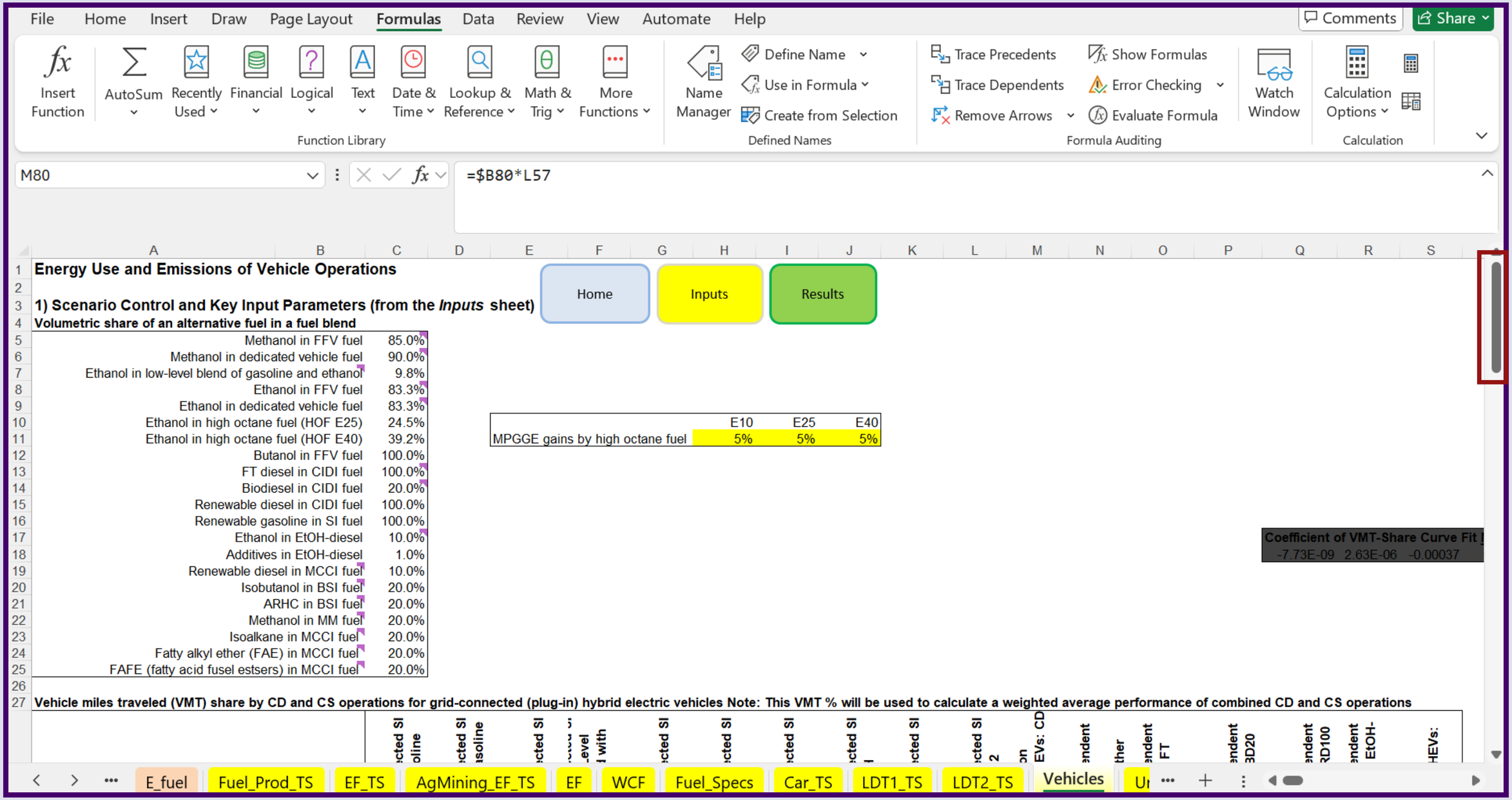

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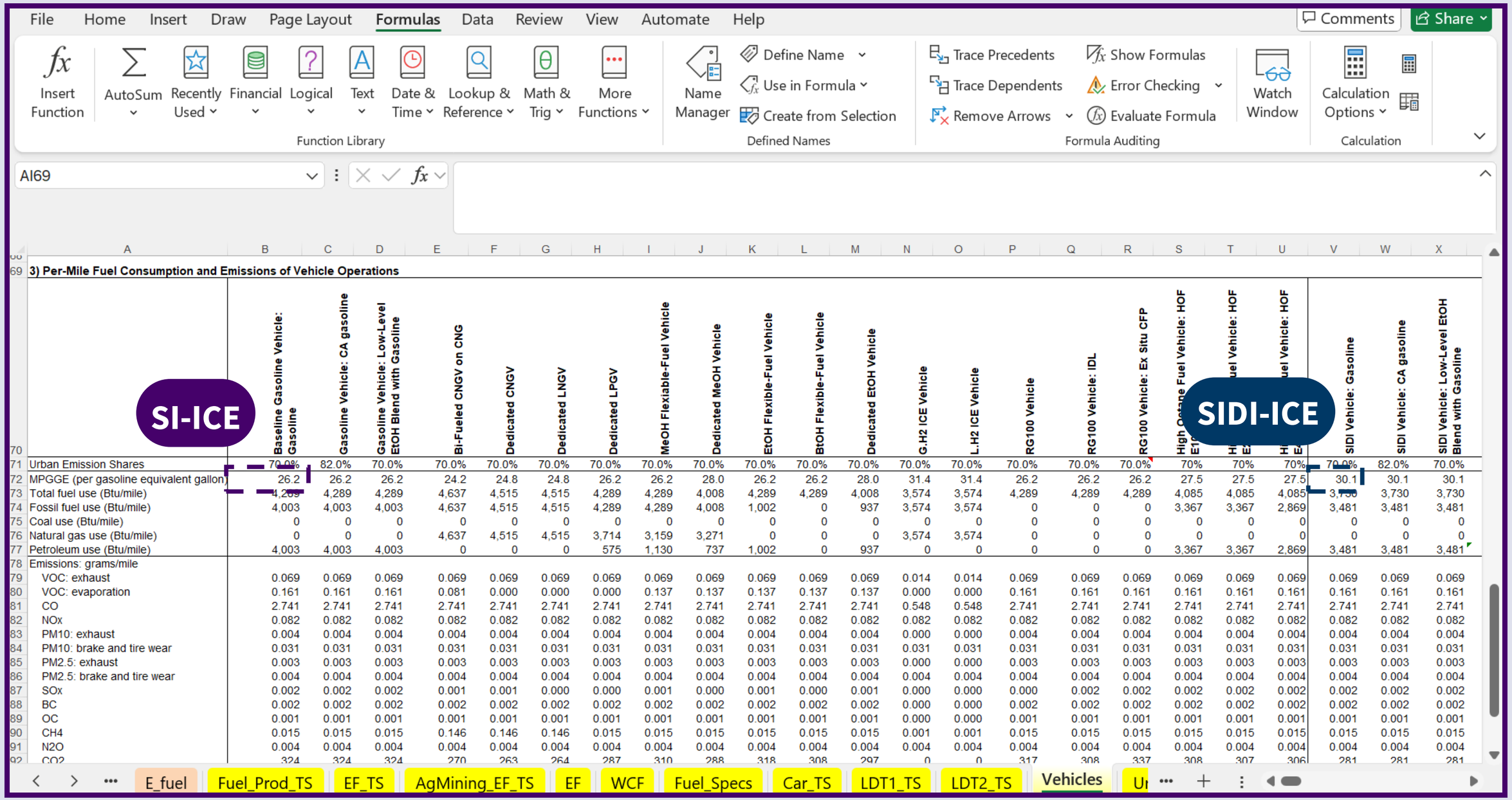

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Greenhouse Gase Modeling in R&D GREET

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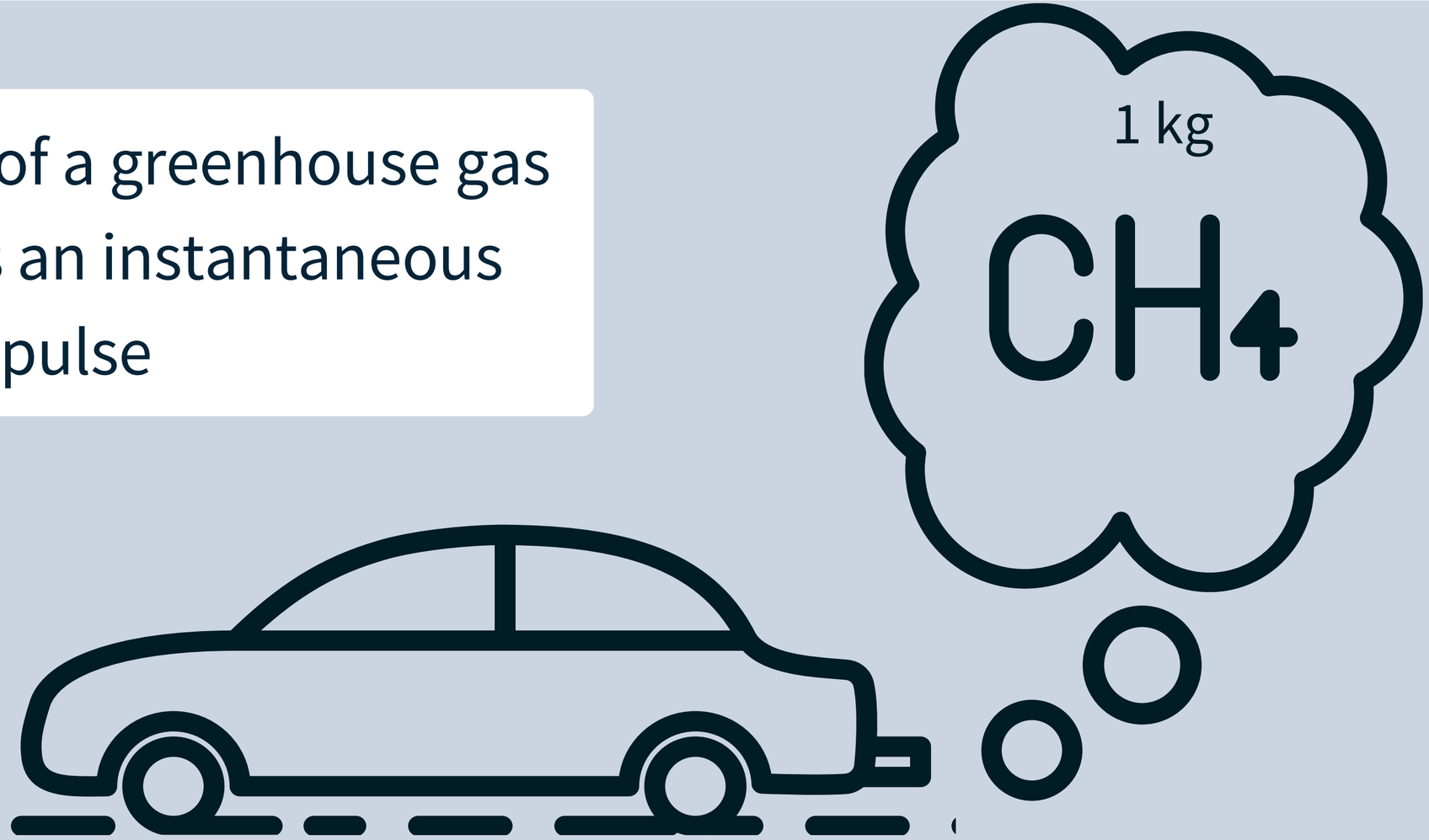
Global Warming Potential (GWP)

Global warming potential

1 kg, or 1 ton, of a greenhouse gas is emitted as an instantaneous pulse

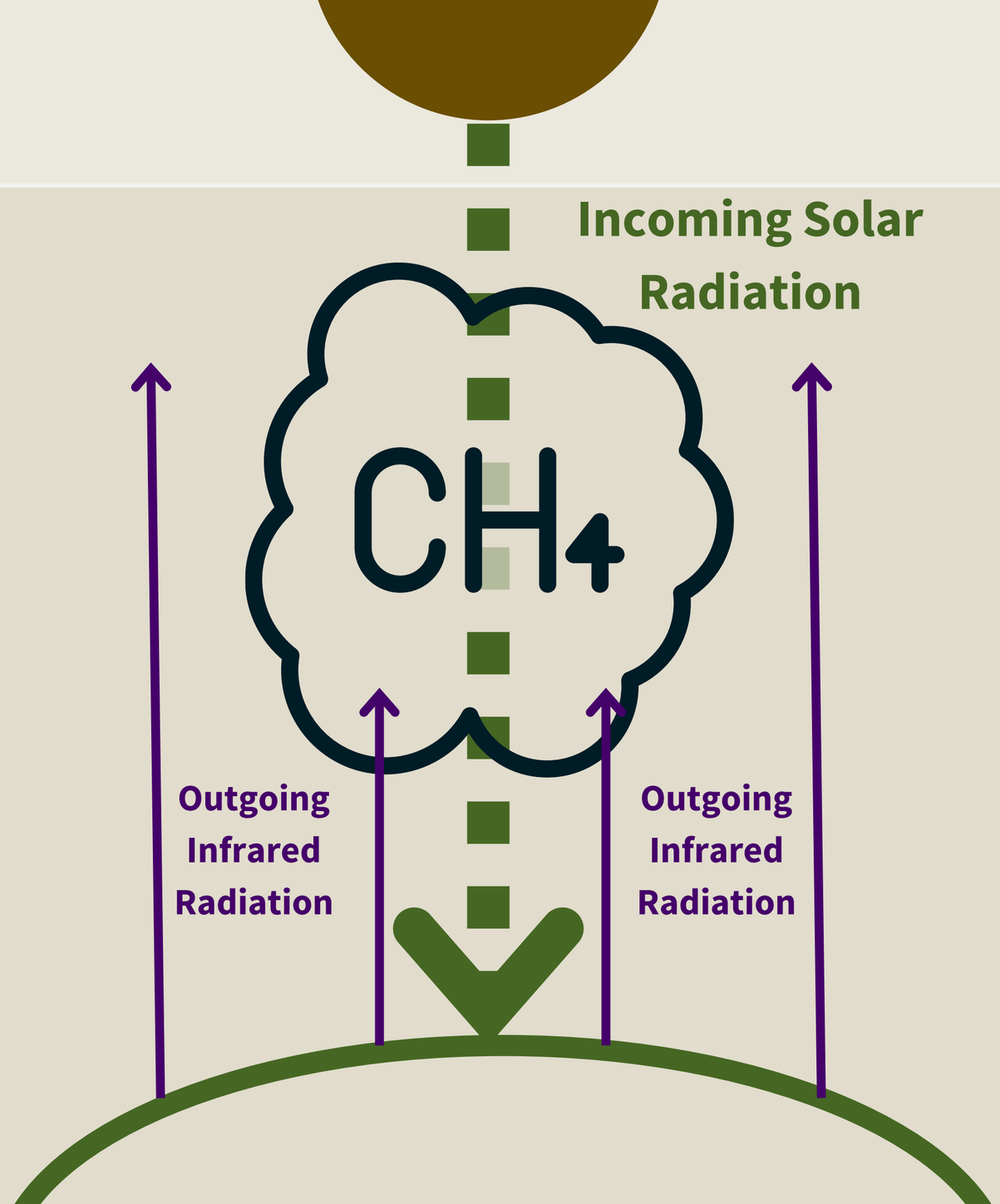
- Climate Change 2022 Synthesis Report | IPCC



Global warming potential

Over a period of time, these particles *absorb some* infrared radiation but *do not absorb* incoming solar radiation

This period of time is the **Time Horizon**



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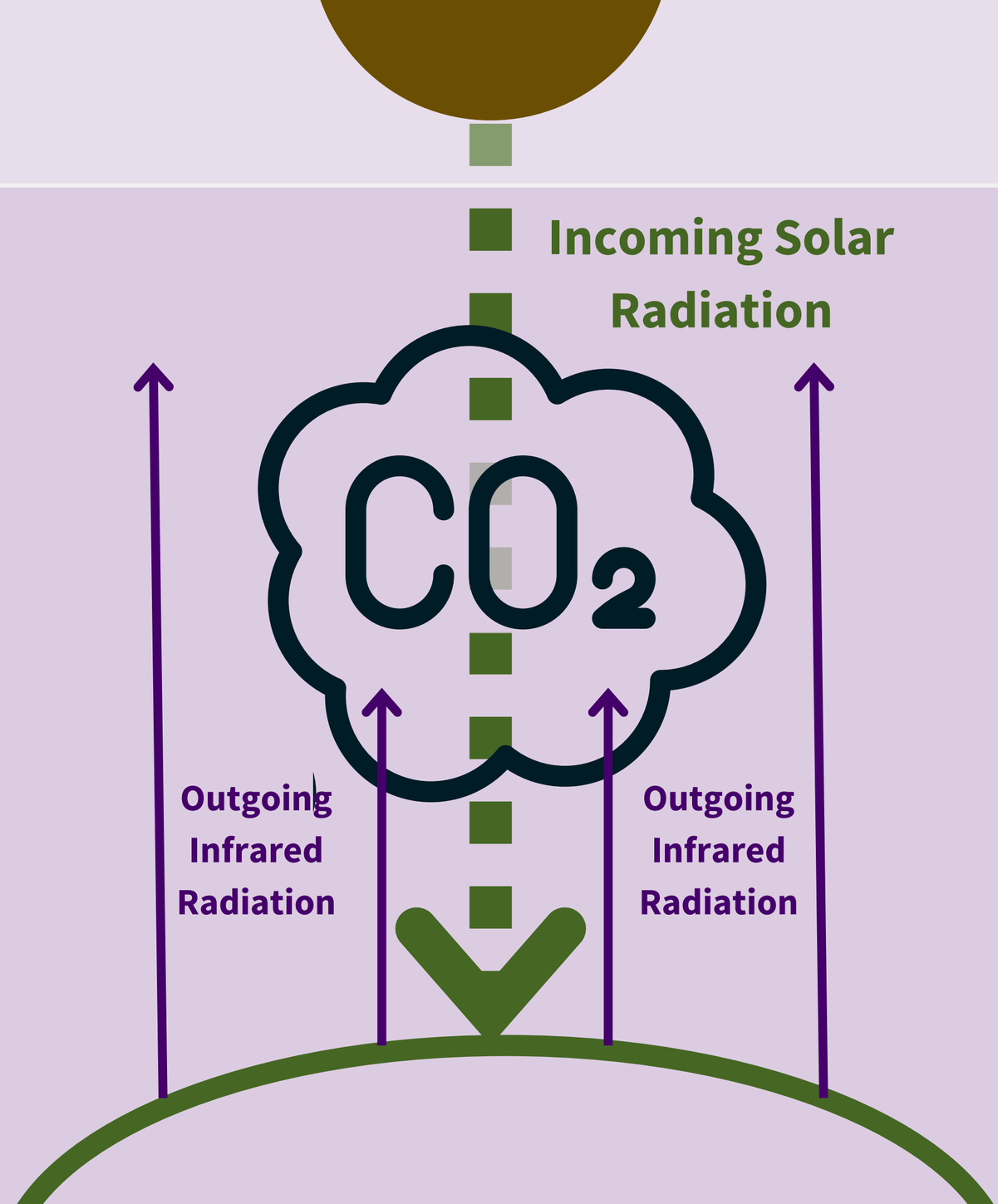
Global warming potential

Compare the amount of radiation absorbed by the greenhouse gas to the amount absorbed by 1 kg of CO_2



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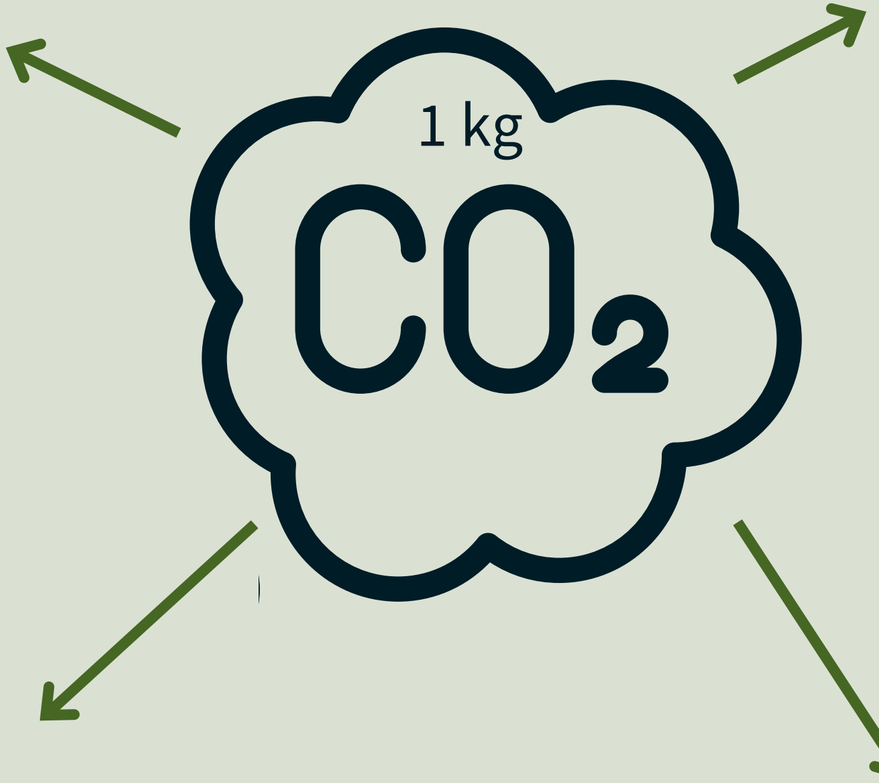
Global Temperature Change Potential (GTP)

Global temperature change potential (GTP)

Accounts for temperature change based on the radiative absorption



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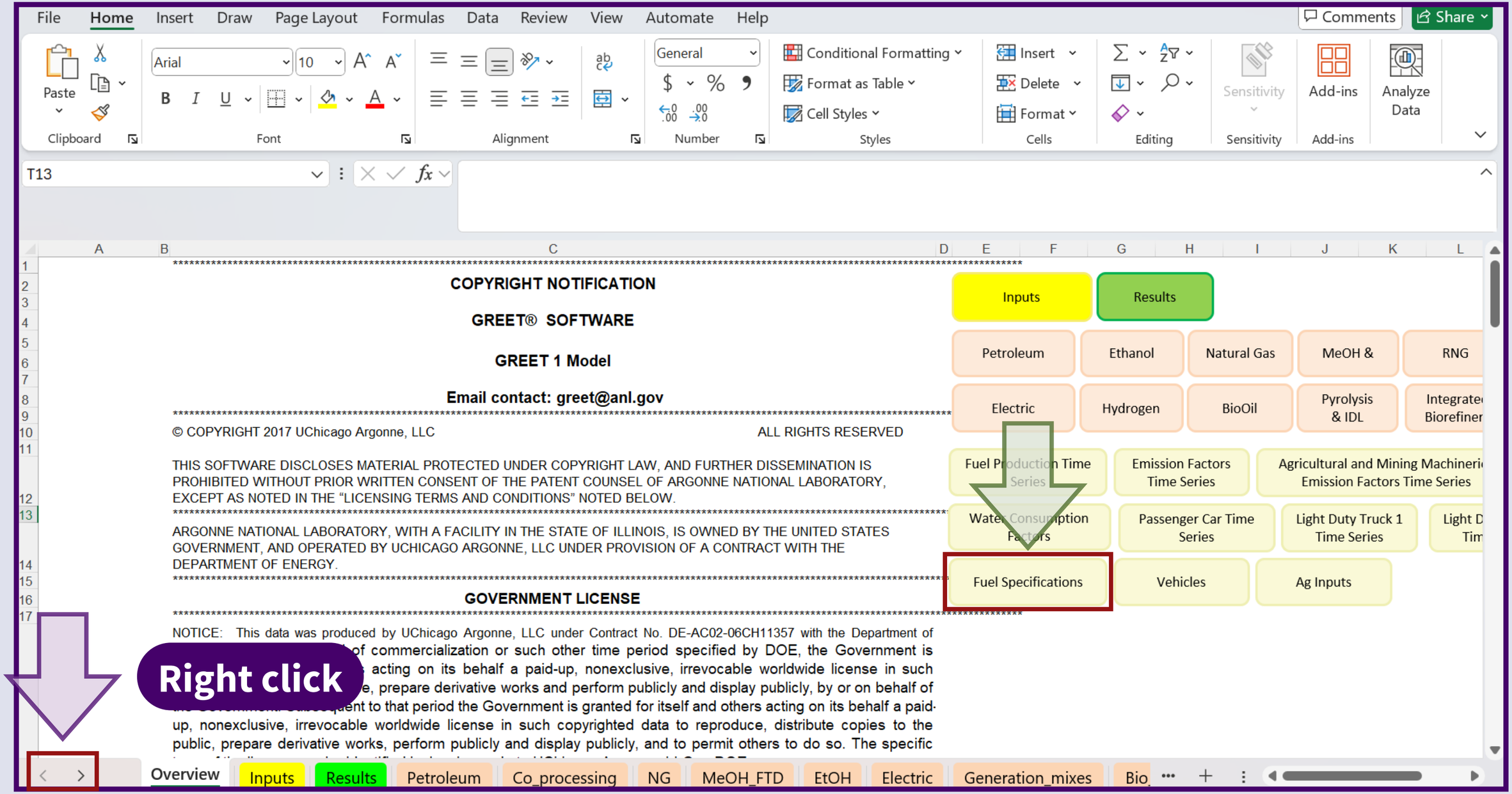
Review the Fuel Specs Tab



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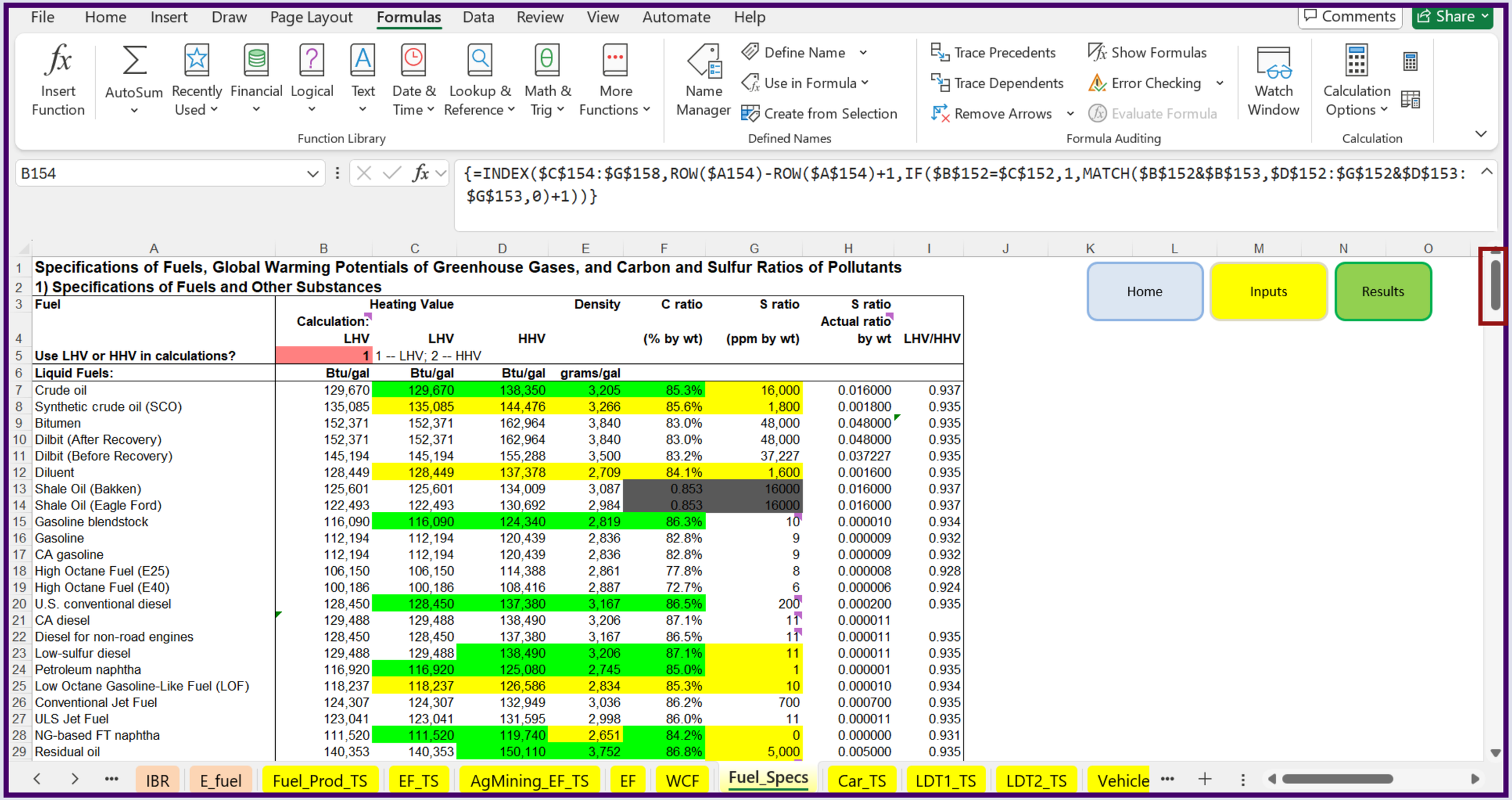

Specifications of Fuels, Global Warming Potentials of Greenhouse Gases, and Carbon and Sulfur Ratios of Pollutants

1) Specifications of Fuels and Other Substances

Fuel	Heating Value			Density	C ratio	S ratio	S ratio	
Calculation:	LHV	LHV	HHV				Actual ratio	
	LHV				(% by wt)	(ppm by wt)	by wt	LHV/HHV
Use LHV or HHV in calculations?	1	1 -- LHV; 2 -- HHV						
Liquid Fuels:	Btu/gal	Btu/gal	Btu/gal	grams/gal				
Crude oil	129,670	129,670	138,350	3,205	85.3%	16,000	0.016000	0.937
Synthetic crude oil (SCO)	135,085	135,085	144,476	3,266	85.6%	1,800	0.001800	0.935
Bitumen	152,371	152,371	162,964	3,840	83.0%	48,000	0.048000	0.935
Dilbit (After Recovery)	152,371	152,371	162,964	3,840	83.0%	48,000	0.048000	0.935
Dilbit (Before Recovery)	145,194	145,194	155,288	3,500	83.2%	37,227	0.037227	0.935
Diluent	128,449	128,449	137,378	2,709	84.1%	1,600	0.001600	0.935
Shale Oil (Bakken)	125,601	125,601	134,009	3,087	0.853	16000	0.016000	0.937
Shale Oil (Eagle Ford)	122,493	122,493	130,692	2,984	0.853	16000	0.016000	0.937
Gasoline blendstock	116,090	116,090	124,340	2,819	86.3%	10	0.000010	0.934
Gasoline	112,194	112,194	120,439	2,836	82.8%	9	0.000009	0.932
CA gasoline	112,194	112,194	120,439	2,836	82.8%	9	0.000009	0.932
High Octane Fuel (E25)	106,150	106,150	114,388	2,861	77.8%	8	0.000008	0.928
High Octane Fuel (E40)	100,186	100,186	108,416	2,887	72.7%	6	0.000006	0.924
U.S. conventional diesel	128,450	128,450	137,380	3,167	86.5%	200	0.000200	0.935
CA diesel	129,488	129,488	138,490	3,206	87.1%	11	0.000011	
Diesel for non-road engines	128,450	128,450	137,380	3,167	86.5%	11	0.000011	0.935
Low-sulfur diesel	129,488	129,488	138,490	3,206	87.1%	11	0.000011	0.935
Petroleum naphtha	116,920	116,920	125,080	2,745	85.0%	1	0.000001	0.935
Low Octane Gasoline-Like Fuel (LOF)	118,237	118,237	126,586	2,834	85.3%	10	0.000010	0.934
Conventional Jet Fuel	124,307	124,307	132,949	3,036	86.2%	700	0.000700	0.935
ULS Jet Fuel	123,041	123,041	131,595	2,998	86.0%	11	0.000011	0.935
NG-based FT naphtha	111,520	111,520	119,740	2,651	84.2%	0	0.000000	0.931
Residual oil	140,353	140,353	150,110	3,752	86.8%	5,000	0.005000	0.935

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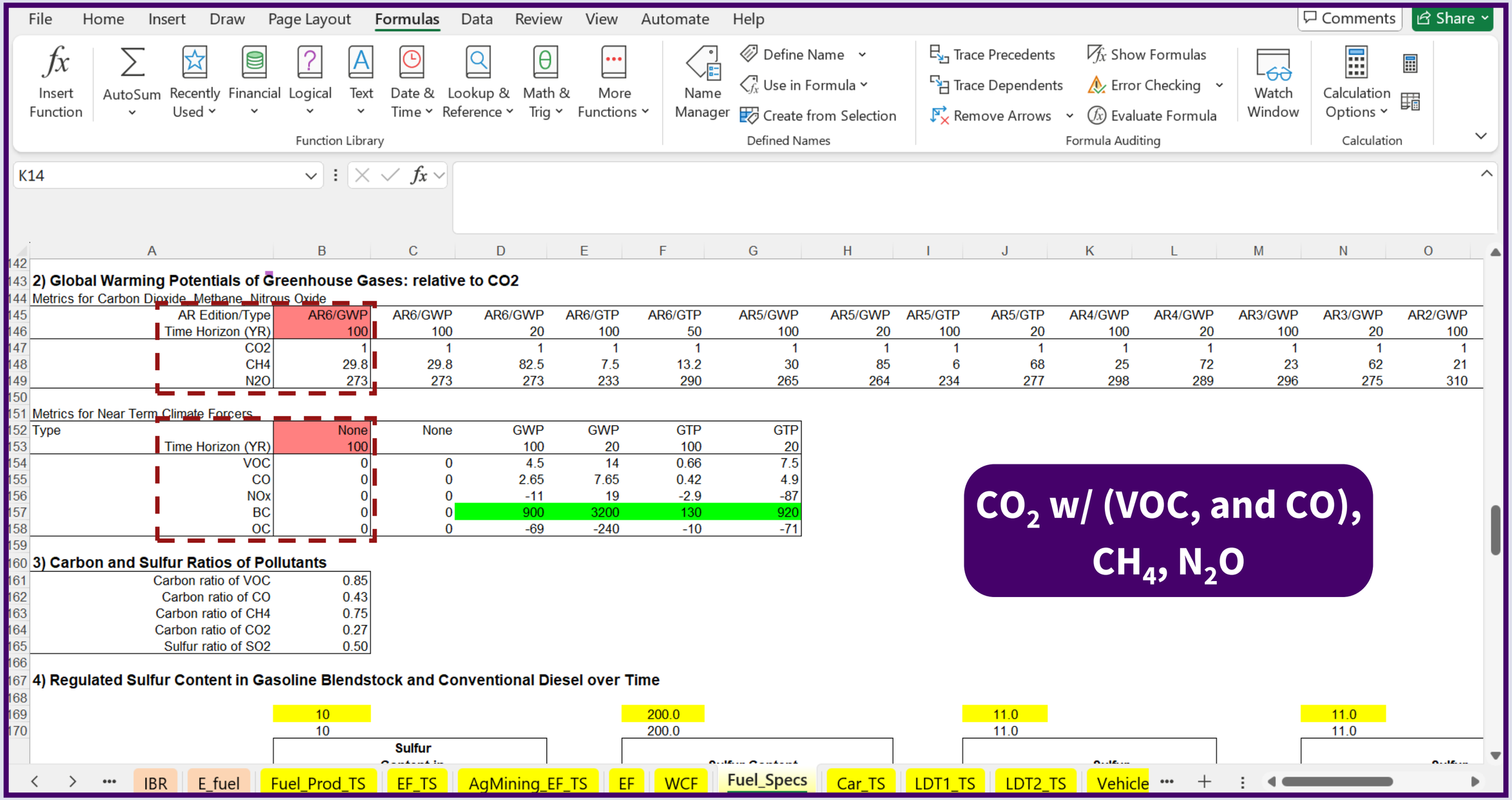

CO_2 w/ (VOC, and CO), CH_4, N_2O

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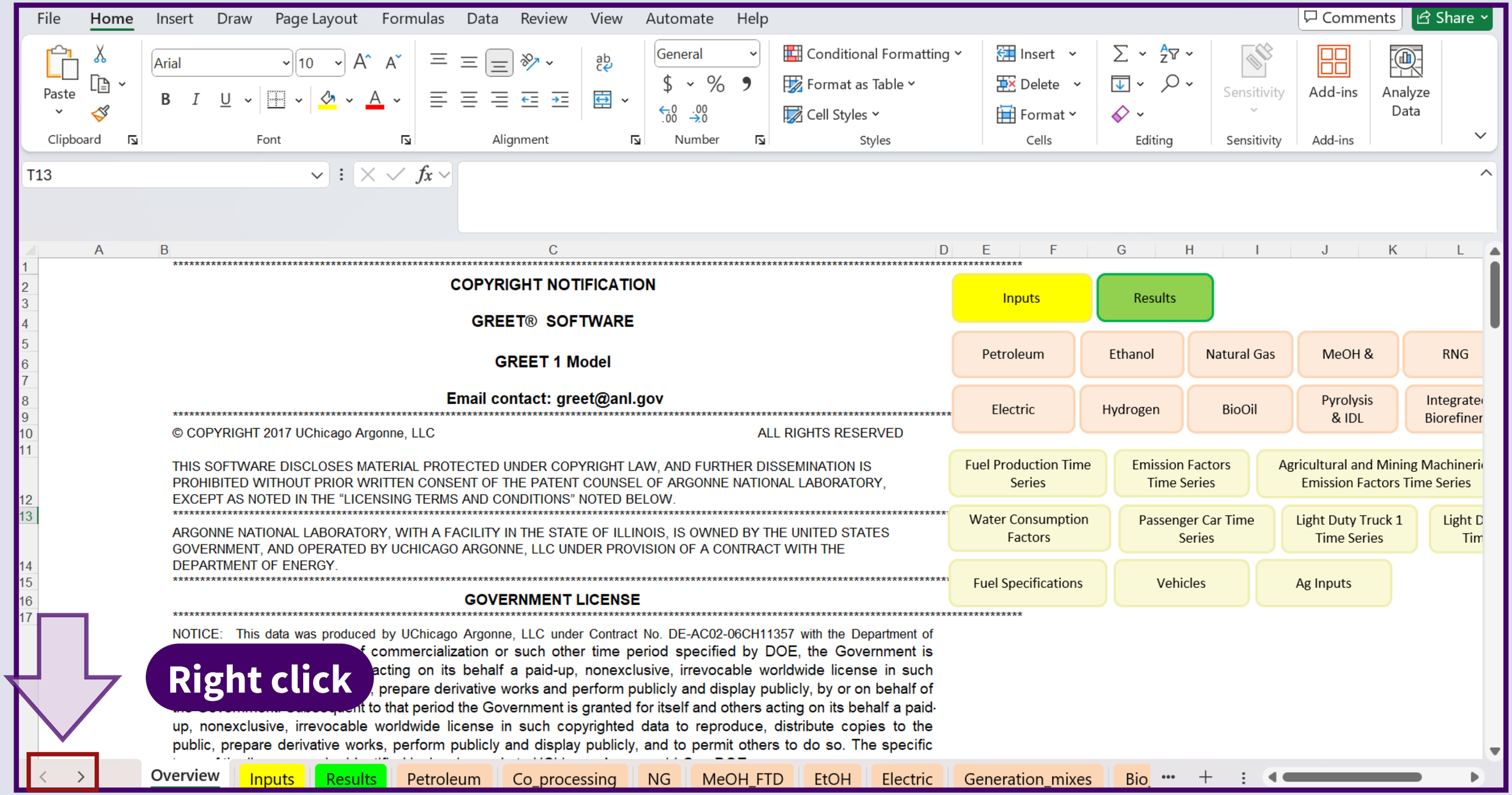
Review the T&D Tab



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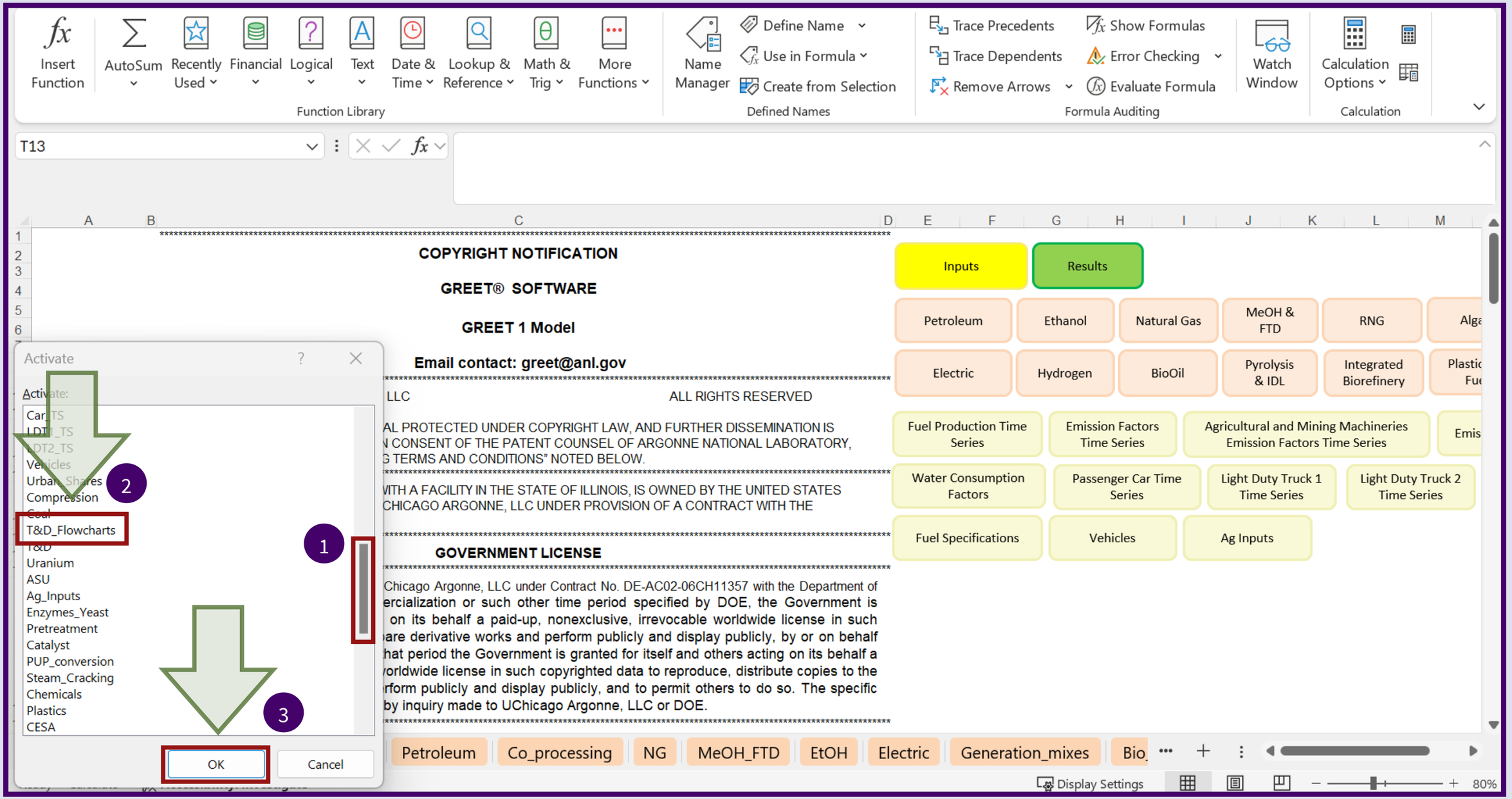

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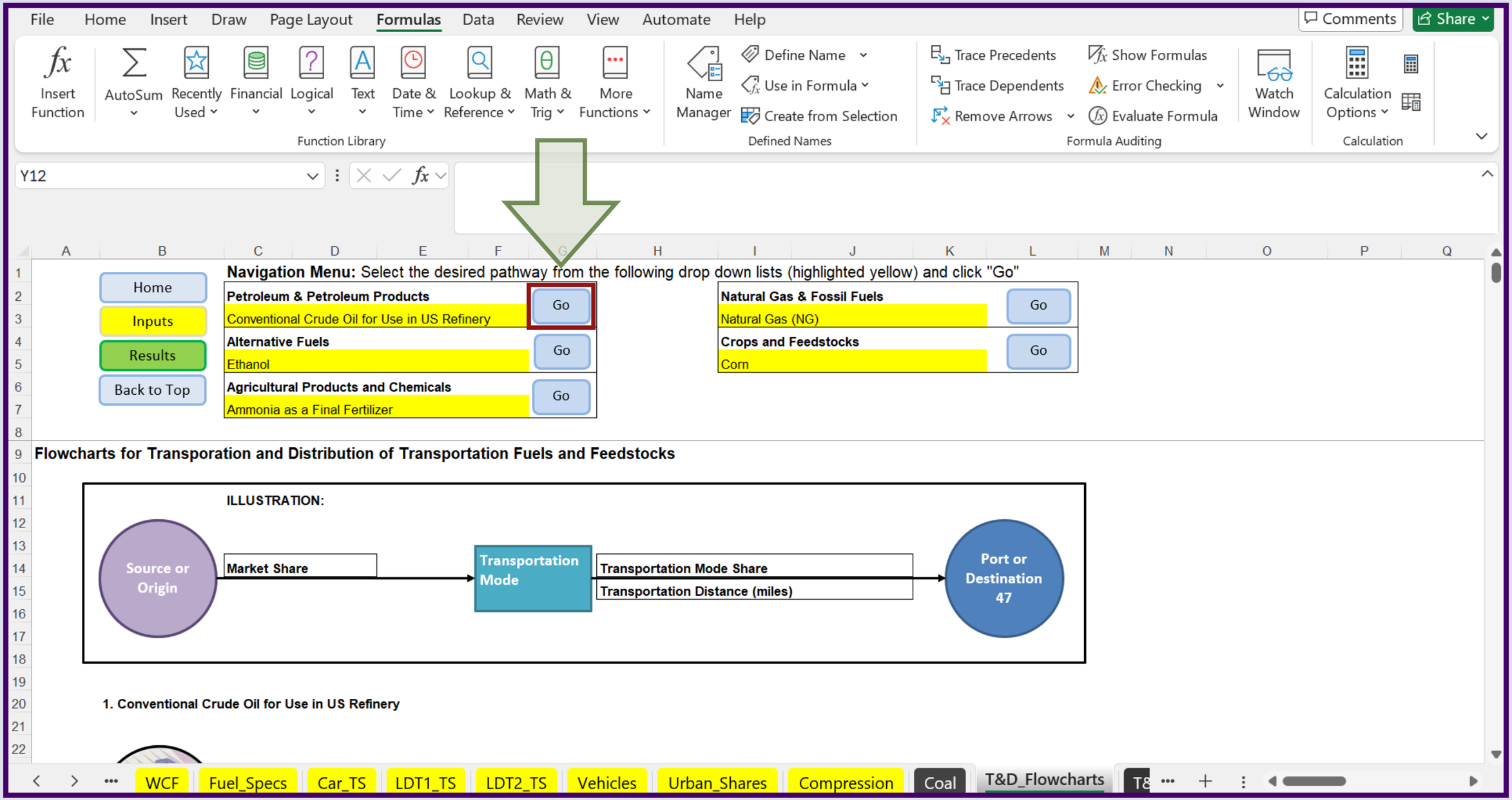

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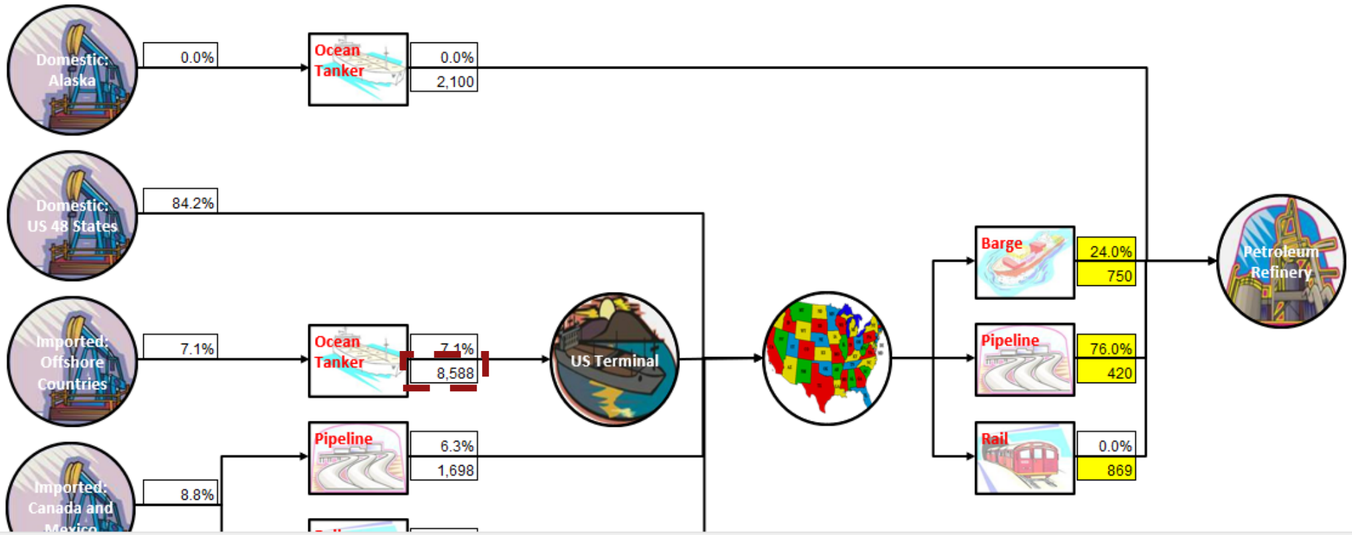
1. Conventional Crude Oil for Use in US Refinery



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