Training Exercises

Exercise Setup

- Folders for each Exercise
- Save input/output to folders for each Exercise
- Exercises require MS Office 2007 or above (Excel).

Exercise Overview

Basic

1. Burden mode
2. Emfac mode
3. Exhaust Technology Group (TG) fraction
4. Vehicle Kilometer Travelled (VKT)
5. Trips
6. Speed fraction
7. Relative Humidity

Advanced

8. Alternate Base Year
9. Bus retirement
10. Link example

Basic Exercises

Exercise #1: Daily Emissions Inventory

- This exercise will generate an average daily emissions inventory for Hong Kong at calendar year 2030 using BURDEN output formats

- Require 1 scenario for calendar year 2030

- Save input file as: HK_2030_Burden.inp

Exercise #1: Scenario input data

- Geographic Area: Hong Kong SAR (default)
- Calendar Years: 2030
- Alternate Baseline Year: Inactive (default)
- Season: Annual (default)
- Scenario Title for Reports: Default Title
- Model Years: All (default)
- Vehicle Classes: Modify (default)

Exercise #1: Scenario input data

- Scenario Type:

BURDEN – Area Emission Estimates

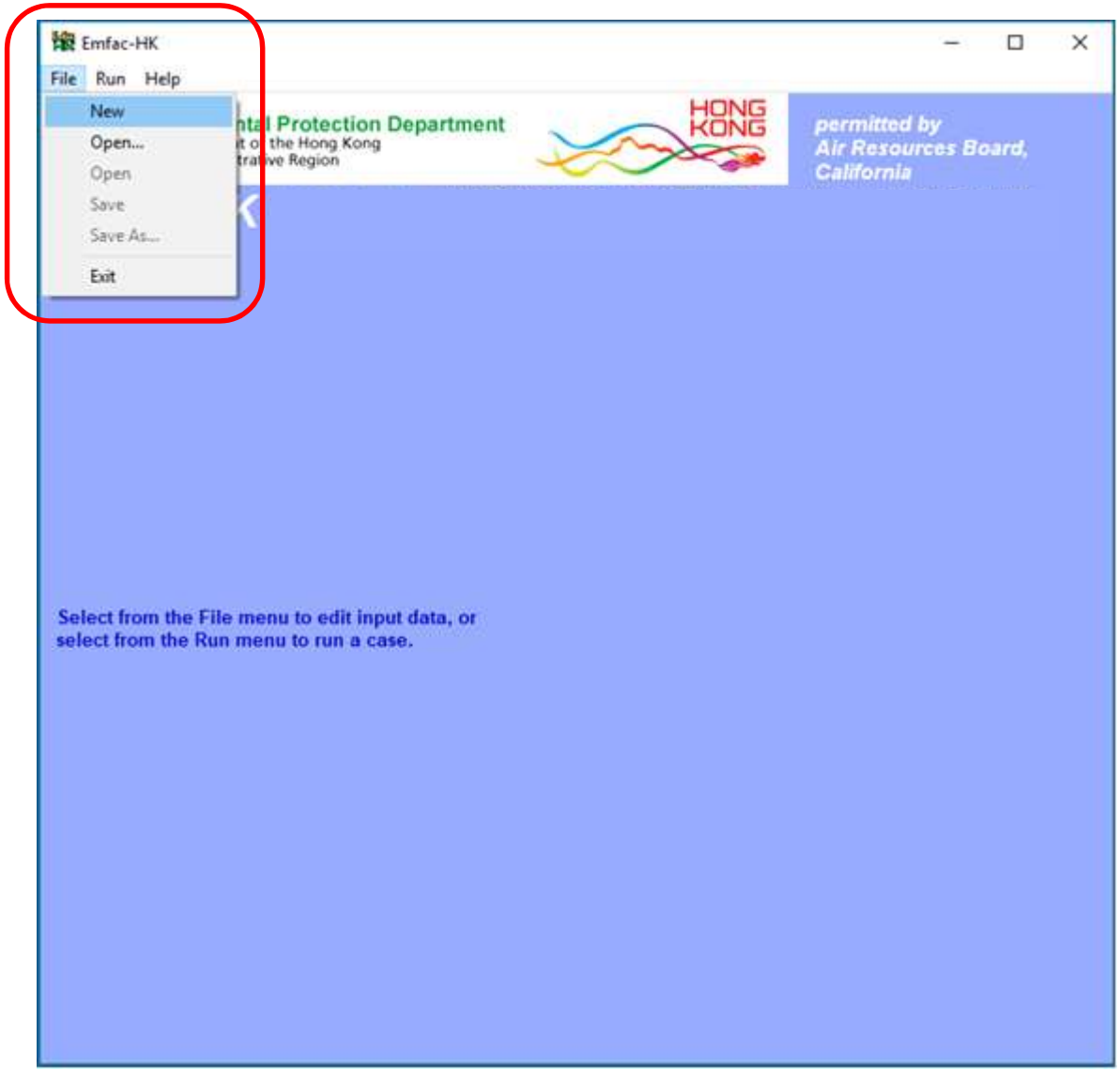
- Files and Reports:

1) Detailed Planning Inventory (CSV) (default)
2) Detailed Outputs (BDN)

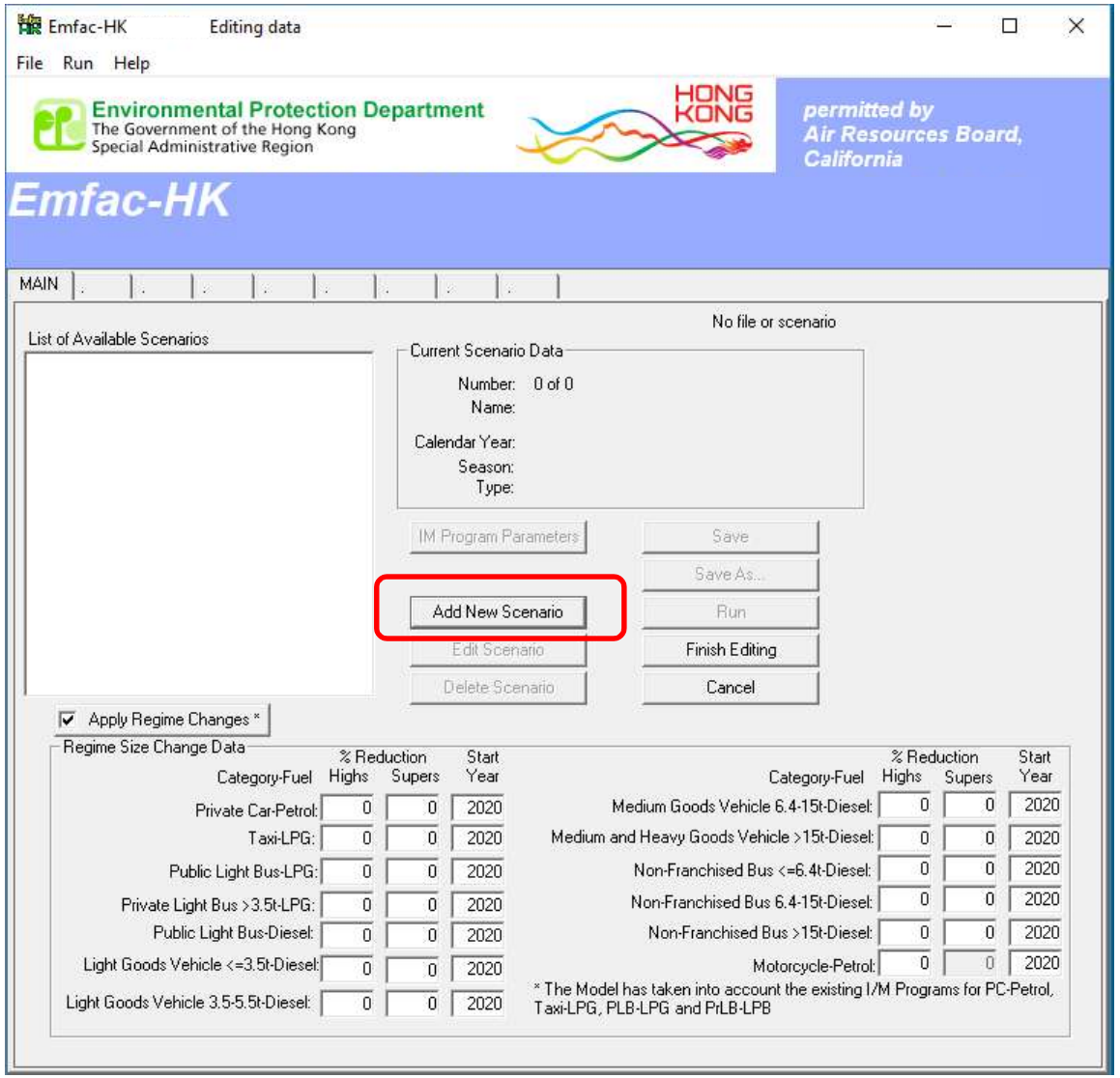
   - check Model Yrs & Tech Groups

- Output Frequency: Day (default)
- Output Particulate: PM_{10} PM_{25}(default)
- Output Hydrocarbons: VOC (default)

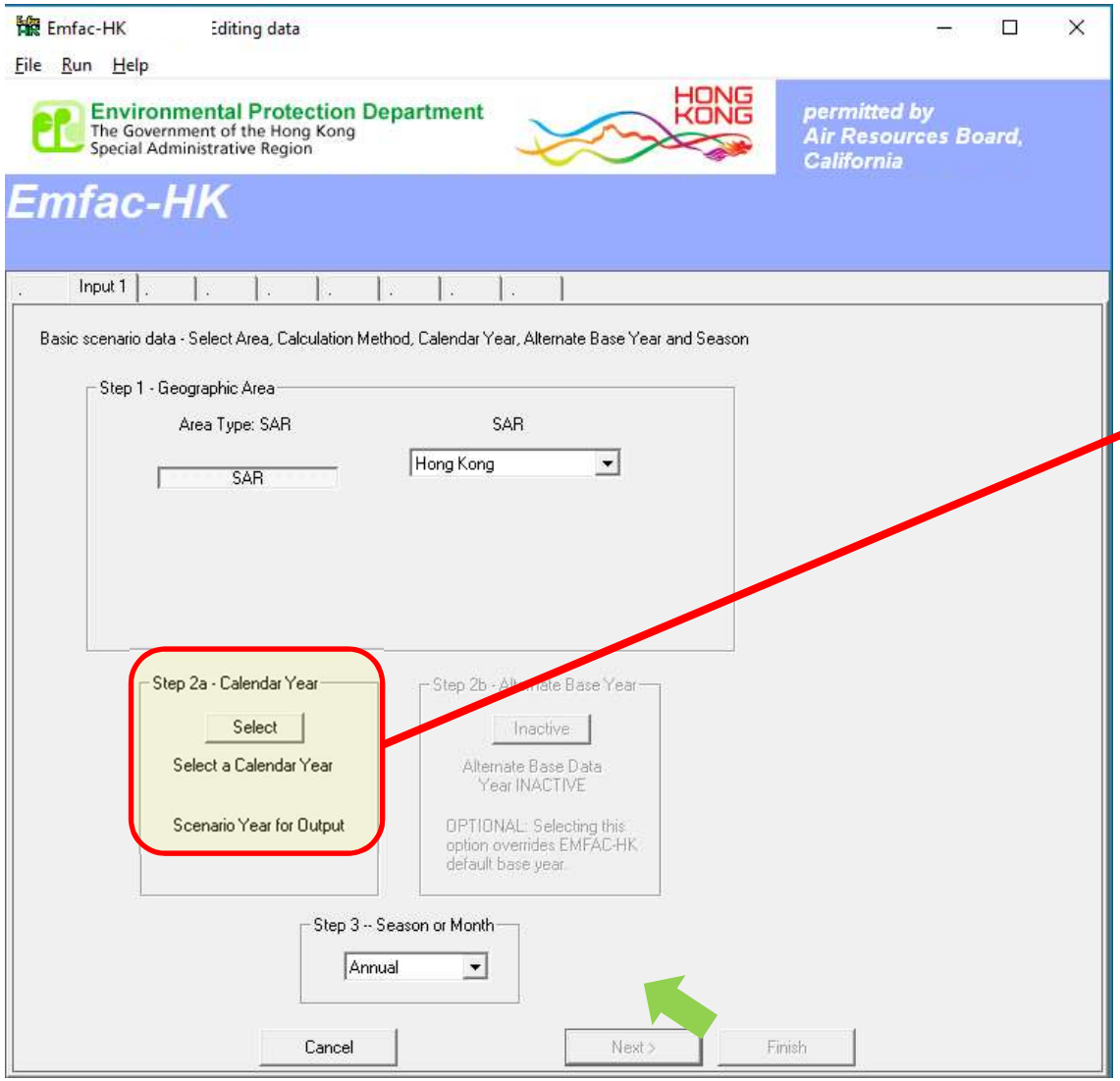
Exercise #1: New File

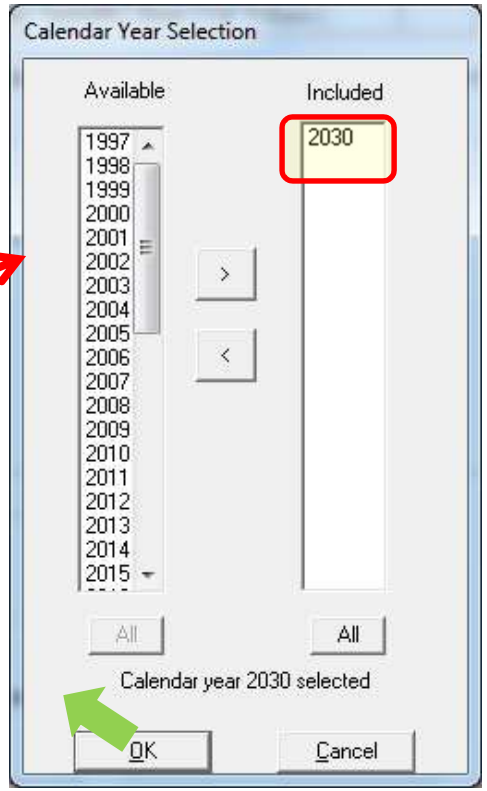


Exercise #1: Add New Scenario

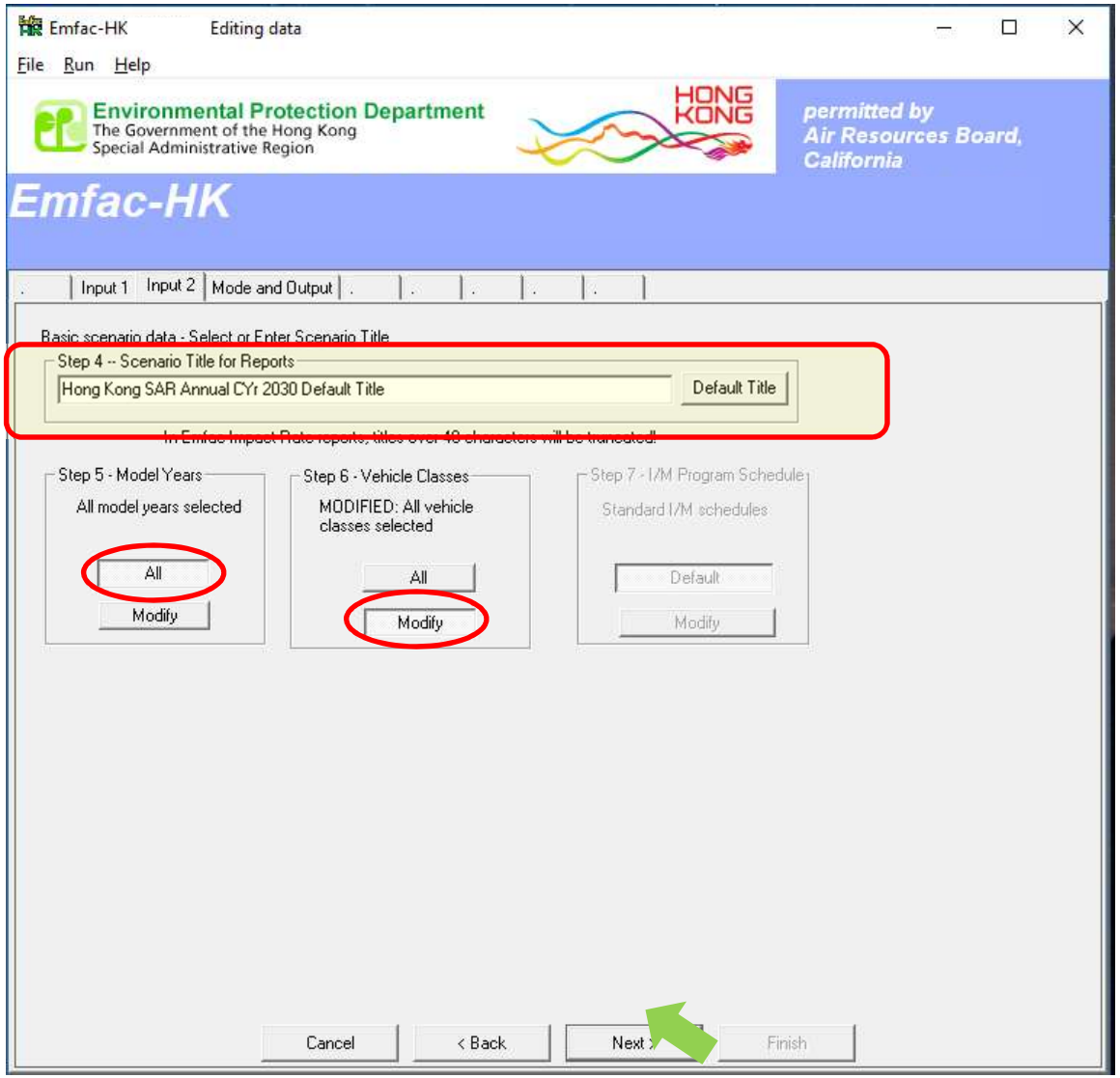


Exercise #1: Input 1 Tab

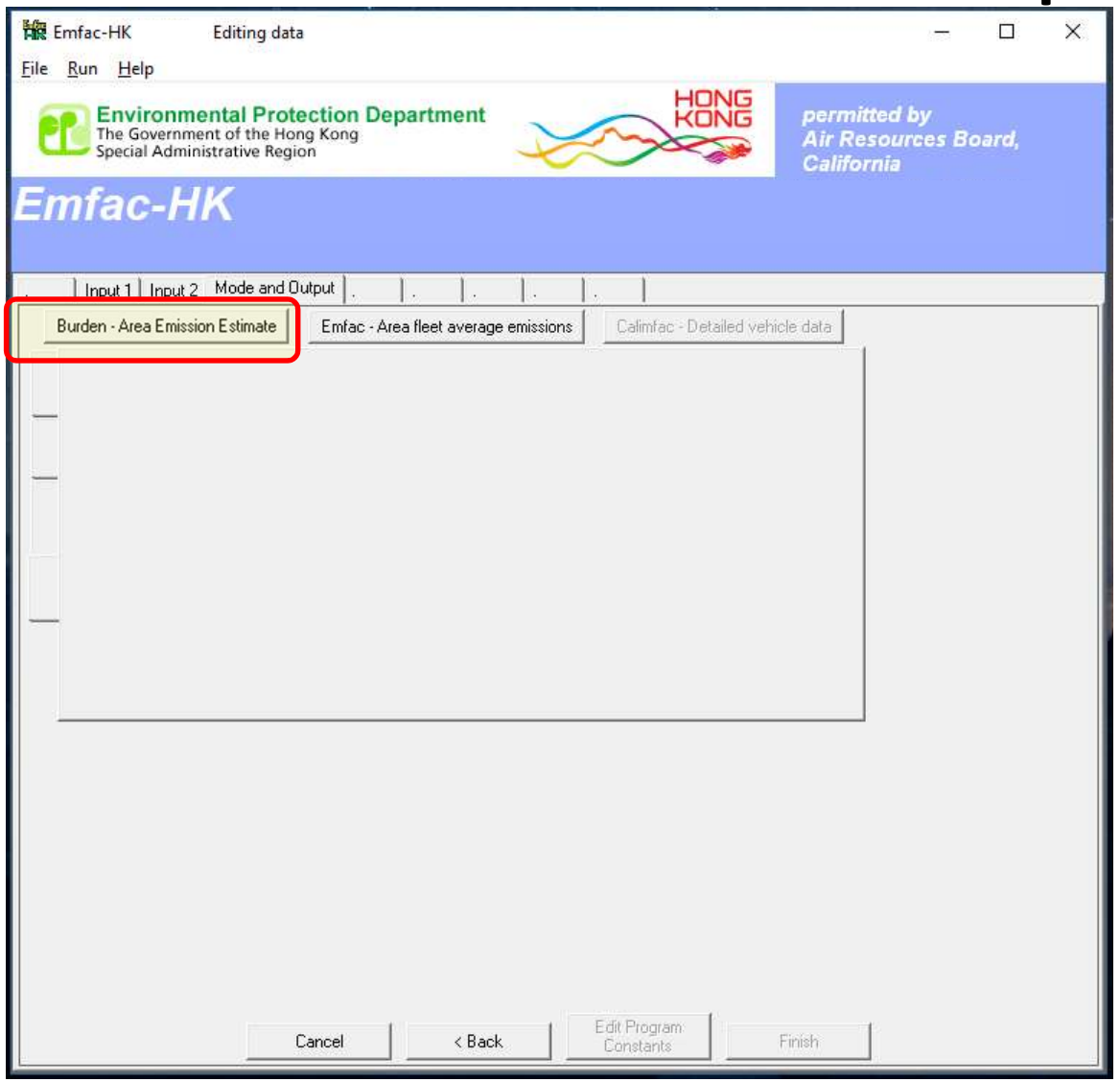




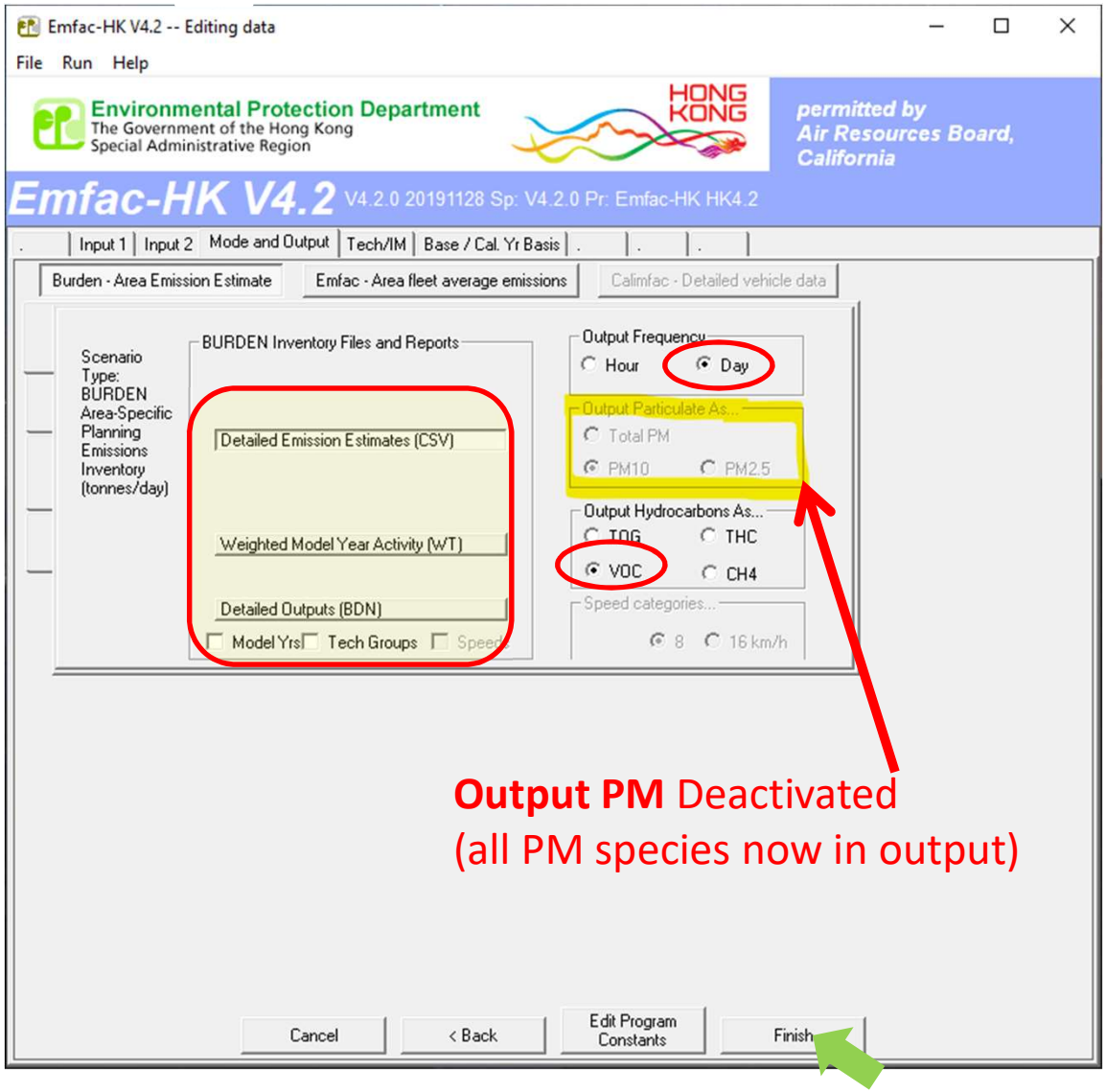
Exercise #1: Input 2 Tab



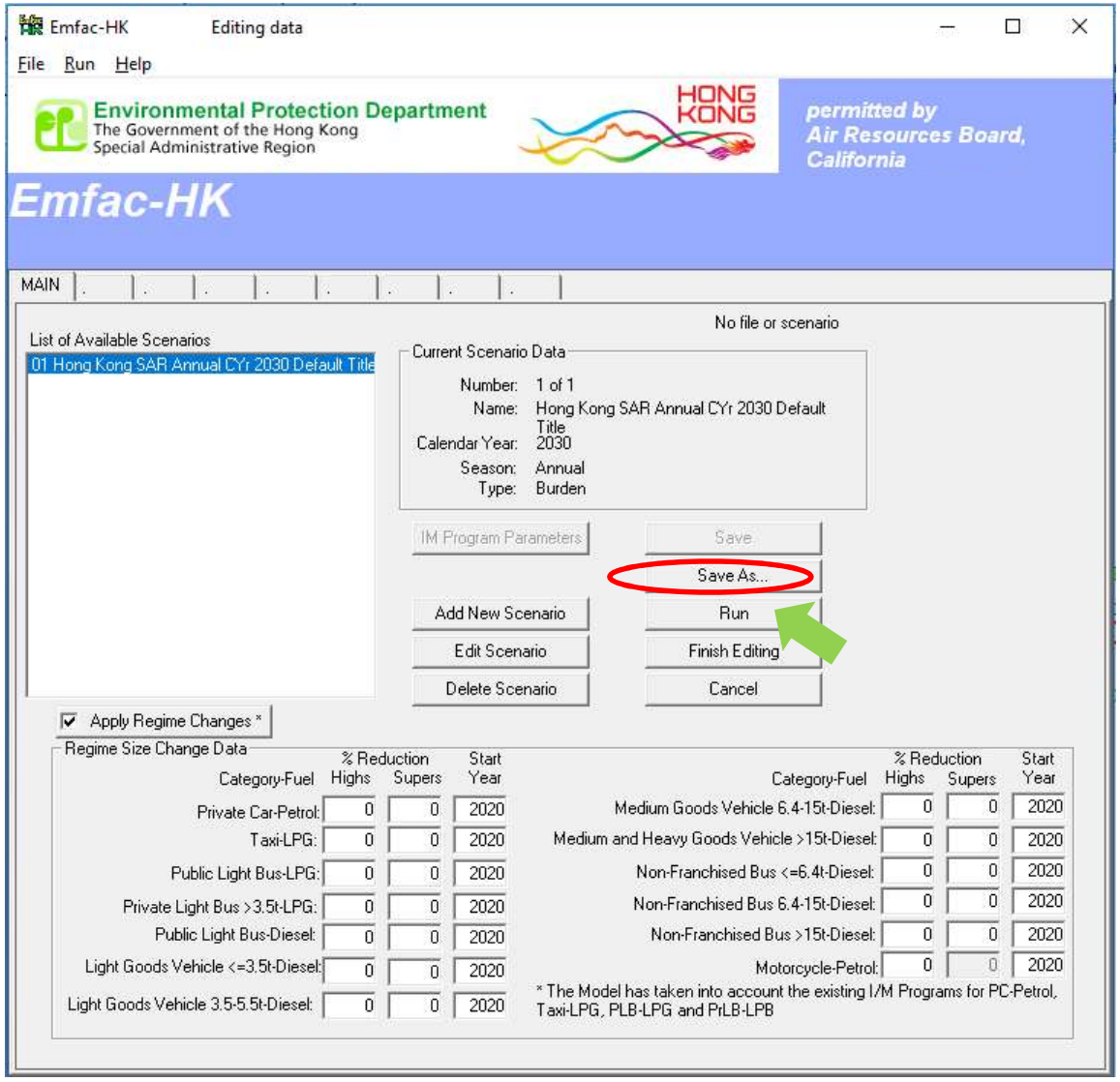
Exercise #1: Mode and Output Tab



Exercise #1: Mode and Output Tab

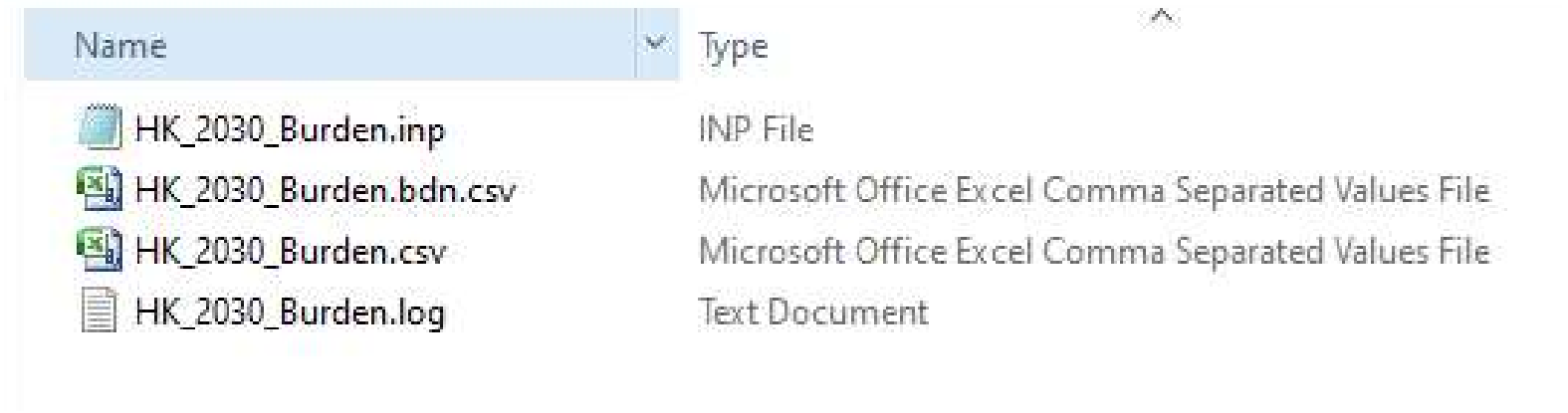


Exercise #1: Main Screen

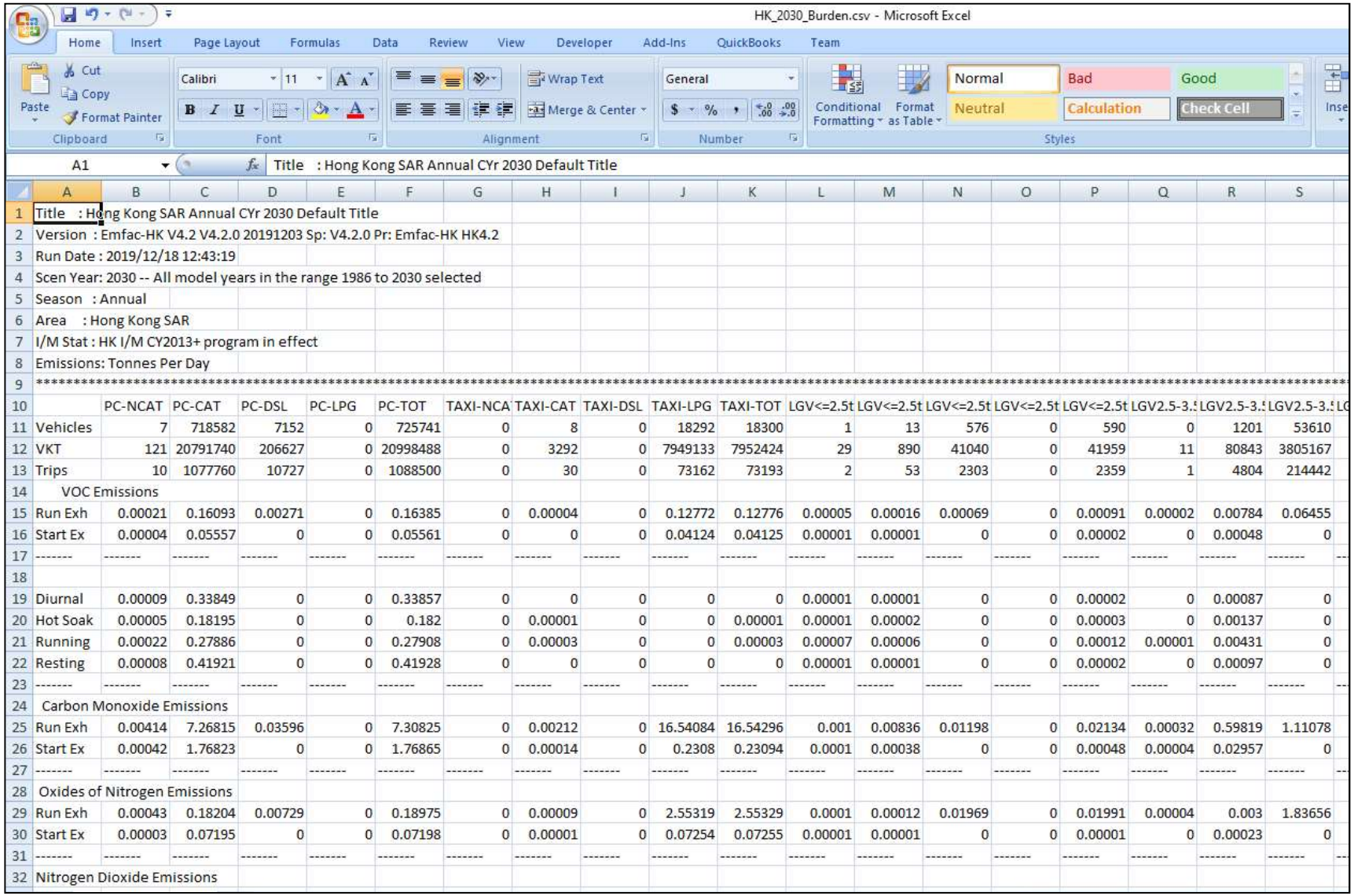


- Save input file as: HK_2030_Burden.inp and Run

Exercise #1: Output in Folder



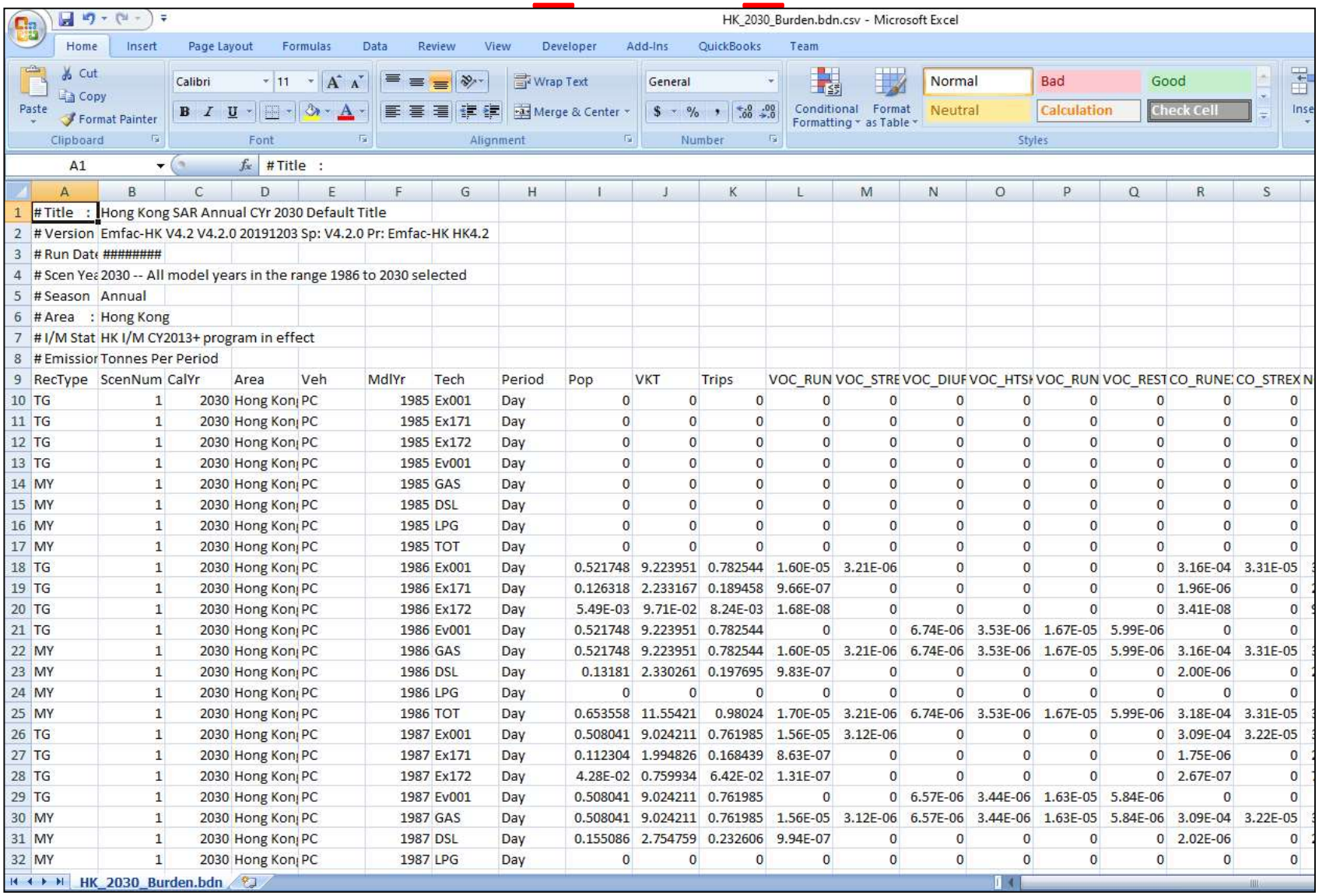
Exercise #1: HK_2030_Burden.csv



HK_2030_Burden.csv - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Title : Hong Kong SAR Annual CYr 2030 Default Title																		
2	Version : Emfac-HK V4.2 V4.2.0 20191203 Sp: V4.2.0 Pr: Emfac-HK HK4.2																		
3	Run Date : 2019/12/18 12:43:19																		
4	Scen Year: 2030 -- All model years in the range 1986 to 2030 selected																		
5	Season : Annual																		
6	Area : Hong Kong SAR																		
7	I/M Stat : HK I/M CY2013+ program in effect																		
8	Emissions: Tonnes Per Day																		
9	**********																		
10		PC-NCAT	PC-CAT	PC-DSL	PC-LPG	PC-TOT	TAXI-NCA	TAXI-CAT	TAXI-DSL	TAXI-LPG	TAXI-TOT	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV<=2.5t	LGV2.5-3.5	LGV2.5-3.5	LGV2.5-3.5	LG
11	Vehicles	7	718582	7152	0	725741	0	8	0	18292	18300	1	13	576	0	590	0	1201	53610	
12	VKT	121	20791740	206627	0	20998488	0	3292	0	7949133	7952424	29	890	41040	0	41959	11	80843	3805167	
13	Trips	10	1077760	10727	0	1088500	0	30	0	73162	73193	2	53	2303	0	2359	1	4804	214442	
14	VOC Emissions																			
15	Run Exh	0.00021	0.16093	0.00271	0	0.16385	0	0.00004	0	0.12772	0.12776	0.00005	0.00016	0.00069	0	0.00091	0.00002	0.00784	0.06455	
16	Start Ex	0.00004	0.05557	0	0	0.05561	0	0	0	0.04124	0.04125	0.00001	0.00001	0	0	0.00002	0	0.00048	0	
17	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	
18																				
19	Diurnal	0.00009	0.33849	0	0	0.33857	0	0	0	0	0	0.00001	0.00001	0	0	0.00002	0	0.00087	0	
20	Hot Soak	0.00005	0.18195	0	0	0.182	0	0.00001	0	0	0.00001	0.00001	0.00002	0	0	0.00003	0	0.00137	0	
21	Running	0.00022	0.27886	0	0	0.27908	0	0.00003	0	0	0.00003	0.00007	0.00006	0	0	0.00012	0.00001	0.00431	0	
22	Resting	0.00008	0.41921	0	0	0.41928	0	0	0	0	0	0.00001	0.00001	0	0	0.00002	0	0.00097	0	
23	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	
24	Carbon Monoxide Emissions																			
25	Run Exh	0.00414	7.26815	0.03596	0	7.30825	0	0.00212	0	16.54084	16.54296	0.001	0.00836	0.01198	0	0.02134	0.00032	0.59819	1.11078	
26	Start Ex	0.00042	1.76823	0	0	1.76865	0	0.00014	0	0.2308	0.23094	0.0001	0.00038	0	0	0.00048	0.00004	0.02957	0	
27	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	
28	Oxides of Nitrogen Emissions																			
29	Run Exh	0.00043	0.18204	0.00729	0	0.18975	0	0.00009	0	2.55319	2.55329	0.0001	0.00012	0.01969	0	0.01991	0.00004	0.003	1.83656	
30	Start Ex	0.00003	0.07195	0	0	0.07198	0	0.00001	0	0.07254	0.07255	0.00001	0.00001	0	0	0.00001	0	0.00023	0	
31	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	
32	Nitrogen Dioxide Emissions																			

Exercise #1: HK_2030_Burden.bdn.csv



HK_2030_Burden.bdn.csv - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	# Title :	Hong Kong SAR Annual CYr 2030 Default Title																	
2	# Version	Emfac-HK V4.2 V4.2.0 20191203 Sp: V4.2.0 Pr: Emfac-HK HK4.2																	
3	# Run Date	########																	
4	# Scen Yea	2030 -- All model years in the range 1986 to 2030 selected																	
5	# Season	Annual																	
6	# Area :	Hong Kong																	
7	# I/M Stat	HK I/M CY2013+ program in effect																	
8	# Emissior	Tonnes Per Period																	
9	RecType	ScenNum	CalYr	Area	Veh	MdlYr	Tech	Period	Pop	VKT	Trips	VOC_RUN	VOC_STRE	VOC_DIUF	VOC_HTSI	VOC_RUN	VOC_REST	CO_RUNE	CO_STREX	N
10	TG	1	2030	Hong Kon	PC	1985	Ex001	Day	0	0	0	0	0	0	0	0	0	0	0	
11	TG	1	2030	Hong Kon	PC	1985	Ex171	Day	0	0	0	0	0	0	0	0	0	0	0	
12	TG	1	2030	Hong Kon	PC	1985	Ex172	Day	0	0	0	0	0	0	0	0	0	0	0	
13	TG	1	2030	Hong Kon	PC	1985	Ev001	Day	0	0	0	0	0	0	0	0	0	0	0	
14	MY	1	2030	Hong Kon	PC	1985	GAS	Day	0	0	0	0	0	0	0	0	0	0	0	
15	MY	1	2030	Hong Kon	PC	1985	DSL	Day	0	0	0	0	0	0	0	0	0	0	0	
16	MY	1	2030	Hong Kon	PC	1985	LPG	Day	0	0	0	0	0	0	0	0	0	0	0	
17	MY	1	2030	Hong Kon	PC	1985	TOT	Day	0	0	0	0	0	0	0	0	0	0	0	
18	TG	1	2030	Hong Kon	PC	1986	Ex001	Day	0.521748	9.223951	0.782544	1.60E-05	3.21E-06	0	0	0	0	3.16E-04	3.31E-05	
19	TG	1	2030	Hong Kon	PC	1986	Ex171	Day	0.126318	2.233167	0.189458	9.66E-07	0	0	0	0	0	1.96E-06	0	
20	TG	1	2030	Hong Kon	PC	1986	Ex172	Day	5.49E-03	9.71E-02	8.24E-03	1.68E-08	0	0	0	0	0	3.41E-08	0	
21	TG	1	2030	Hong Kon	PC	1986	Ev001	Day	0.521748	9.223951	0.782544	0	0	6.74E-06	3.53E-06	1.67E-05	5.99E-06	0	0	
22	MY	1	2030	Hong Kon	PC	1986	GAS	Day	0.521748	9.223951	0.782544	1.60E-05	3.21E-06	6.74E-06	3.53E-06	1.67E-05	5.99E-06	3.16E-04	3.31E-05	
23	MY	1	2030	Hong Kon	PC	1986	DSL	Day	0.13181	2.330261	0.197695	9.83E-07	0	0	0	0	0	2.00E-06	0	
24	MY	1	2030	Hong Kon	PC	1986	LPG	Day	0	0	0	0	0	0	0	0	0	0	0	
25	MY	1	2030	Hong Kon	PC	1986	TOT	Day	0.653558	11.55421	0.98024	1.70E-05	3.21E-06	6.74E-06	3.53E-06	1.67E-05	5.99E-06	3.18E-04	3.31E-05	
26	TG	1	2030	Hong Kon	PC	1987	Ex001	Day	0.508041	9.024211	0.761985	1.56E-05	3.12E-06	0	0	0	0	3.09E-04	3.22E-05	
27	TG	1	2030	Hong Kon	PC	1987	Ex171	Day	0.112304	1.994826	0.168439	8.63E-07	0	0	0	0	0	1.75E-06	0	
28	TG	1	2030	Hong Kon	PC	1987	Ex172	Day	4.28E-02	0.759934	6.42E-02	1.31E-07	0	0	0	0	0	2.67E-07	0	
29	TG	1	2030	Hong Kon	PC	1987	Ev001	Day	0.508041	9.024211	0.761985	0	0	6.57E-06	3.44E-06	1.63E-05	5.84E-06	0	0	
30	MY	1	2030	Hong Kon	PC	1987	GAS	Day	0.508041	9.024211	0.761985	1.56E-05	3.12E-06	6.57E-06	3.44E-06	1.63E-05	5.84E-06	3.09E-04	3.22E-05	
31	MY	1	2030	Hong Kon	PC	1987	DSL	Day	0.155086	2.754759	0.232606	9.94E-07	0	0	0	0	0	2.02E-06	0	
32	MY	1	2030	Hong Kon	PC	1987	LPG	Day	0	0	0	0	0	0	0	0	0	0	0	

HK_2030_Burden.bdn

Exercise #1a:
Determine total NOx exhaust emissions from CSV output

- Hints:
  - Open CSV output file by Excel
  - Locate row “Run Exh” and “Start Ex” under “Oxides of Nitrogen Emissions”
  - Locate column “ALL-TOT”

Exercise #1a: Solution

	A	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD
1	Title : Hong Kong SAR Annual CYr 2030 Default Title																
2	Version : Emfac-HK V4.2 V4.2.0 20191203 Sp: V4.2.0 Pr: Emfac-HK HK4.2																
3	Run Date : 2019/12/18 12:43:19																
4	Scen Year: 2030 -- All model years in the range 1986 to 2030 selected																
5	Season : Annual																
6	Area : Hong Kong SAR																
7	I/M Stat : HK I/M CY2013+ program in effect																
8	Emissions: Tonnes Per Day																
9	**********																
10		FBSD-NCA	FBSD-CAT	FBSD-DSL	FBSD-LPG	FBSD-TOT	FBDD-NCA	FBDD-CAT	FBDD-DSL	FBDD-LPG	FBDD-TOT	MC-NCAT	MC-CAT	MC-DSL	MC-LPG	MC-TOT	ALL-TOT
15	Run Exh	0	0	0.00375	0	0.00375	0	0	0.09196	0	0.09196	0.17944	0.18185	0	0	0.36129	1.38262
16	Start Ex	0	0	0	0	0	0	0	0	0	0	0.0781	0.07791	0	0	0.15602	0.26457
17	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
18																	
19	Diurnal	0	0	0	0	0	0	0	0	0	0	0.1782	0.16872	0	0	0.34692	0.68655
20	Hot Soak	0	0	0	0	0	0	0	0	0	0	0.40951	0.12769	0	0	0.5372	0.7208
21	Running	0	0	0	0	0	0	0	0	0	0	2.27056	0.35402	0	0	2.62458	2.90877
22	Resting	0	0	0	0	0	0	0	0	0	0	0.18742	0.13119	0	0	0.31862	0.73907
23	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
24	Carbon Monoxide Emissions																
25	Run Exh	0	0	0.09102	0	0.09102	0	0	2.72045	0	2.72045	1.21411	1.0667	0	0	2.2808	43.34072
26	Start Ex	0	0	0	0	0	0	0	0	0	0	0.36366	0.57143	0	0	0.93509	3.11215
27	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
28	Oxides of Nitrogen Emissions																
29	Run Exh	0	0	0.055	0	0.055	0	0	3.30052	0	3.30052	0.0607	0.08764	0	0	0.14834	13.88506
30	Start Ex	0	0	0.00725	0	0.00725	0	0	0.47836	0	0.47836	0.01933	0.01635	0	0	0.03568	0.8731
31	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
32	Nitrogen Dioxide Emissions																
33	Run Exh	0	0	0.00704	0	0.00704	0	0	0.16545	0	0.16545	0.00303	0.00438	0	0	0.00742	1.81749
34	Start Ex	0	0	0.00128	0	0.00128	0	0	0.0373	0	0.0373	0.00097	0.00082	0	0	0.00178	0.09588
35	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
36	Carbon Dioxide Emissions (000)																

HK_2030_Burden

Exercise #1b: Determine Fleet-Average NOx Emissions Factor (grams/km) for PC

- Hints:
  - Use CSV output
  - Summation of total VKT and NOx (running exhaust)
  - Divide total NOx by total VKT
  - Convert units to obtain grams/km

Exercise #1b: Solution

Oxides of Nitrogen Emissions	ALL-TOT	VKT			
Run Exh	13.88506	43801416	0.3170	g/km	

Exercise #2: EMFAC Mode

- This exercise will generate fleet-average emission factors (grams/hour or grams/km) for temperature 25°C and relative humidity 40% at calendar year 2030.

- Temperature, relative humidity and average speed combination as specified by the user.

Exercise #2: Scenario input data

- Geographic Area: Hong Kong SAR (default)
- Calendar Years: 2030
- Alternate Baseline Year: Inactive (default)
- Season: Annual (default)
- Scenario Title for Reports: Default Title
- Model Years: All (default)
- Vehicle Classes: Modify (default)

Exercise #2: Scenario input data

- Scenario Type:

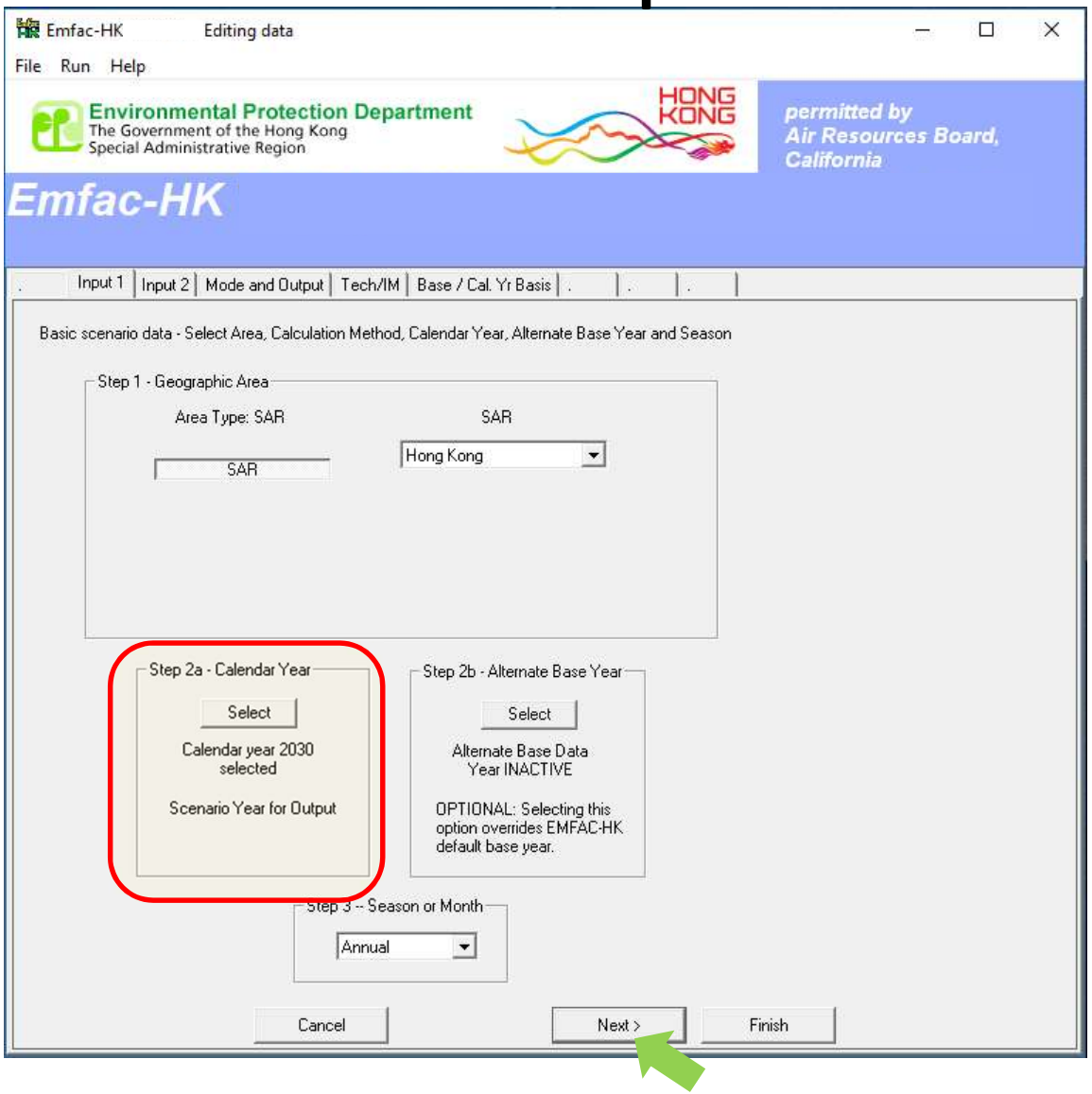
EMFAC – Area fleet average emissions

- Files and Reports:

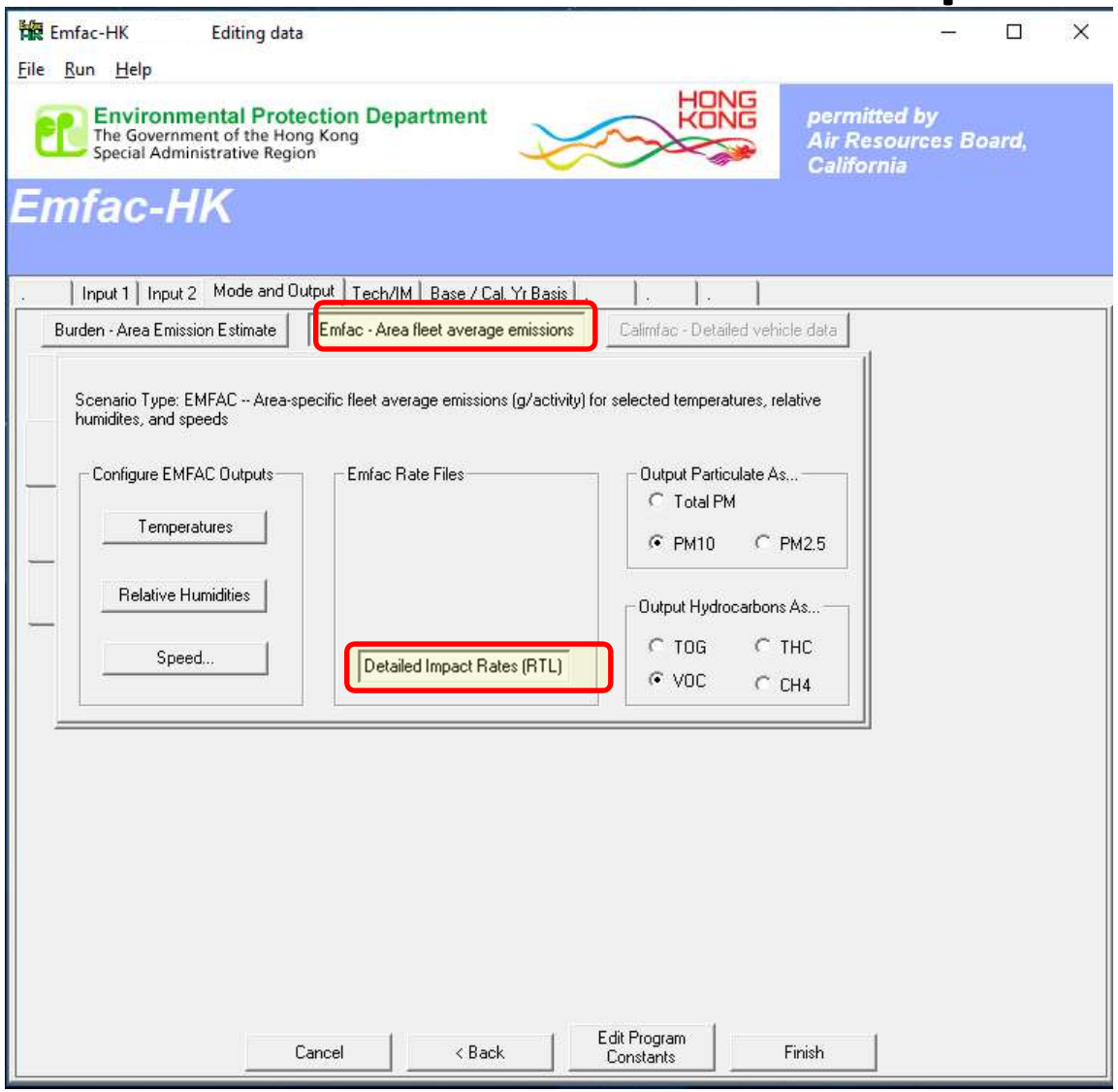
Detailed Impact Rates (RTL) (default)

- Output Particulate: PM_{10} PM_{25}(default)
- Output Hydrocarbons: VOC (default)
- Temperatures: 25°C
- Relative Humidity: 40%

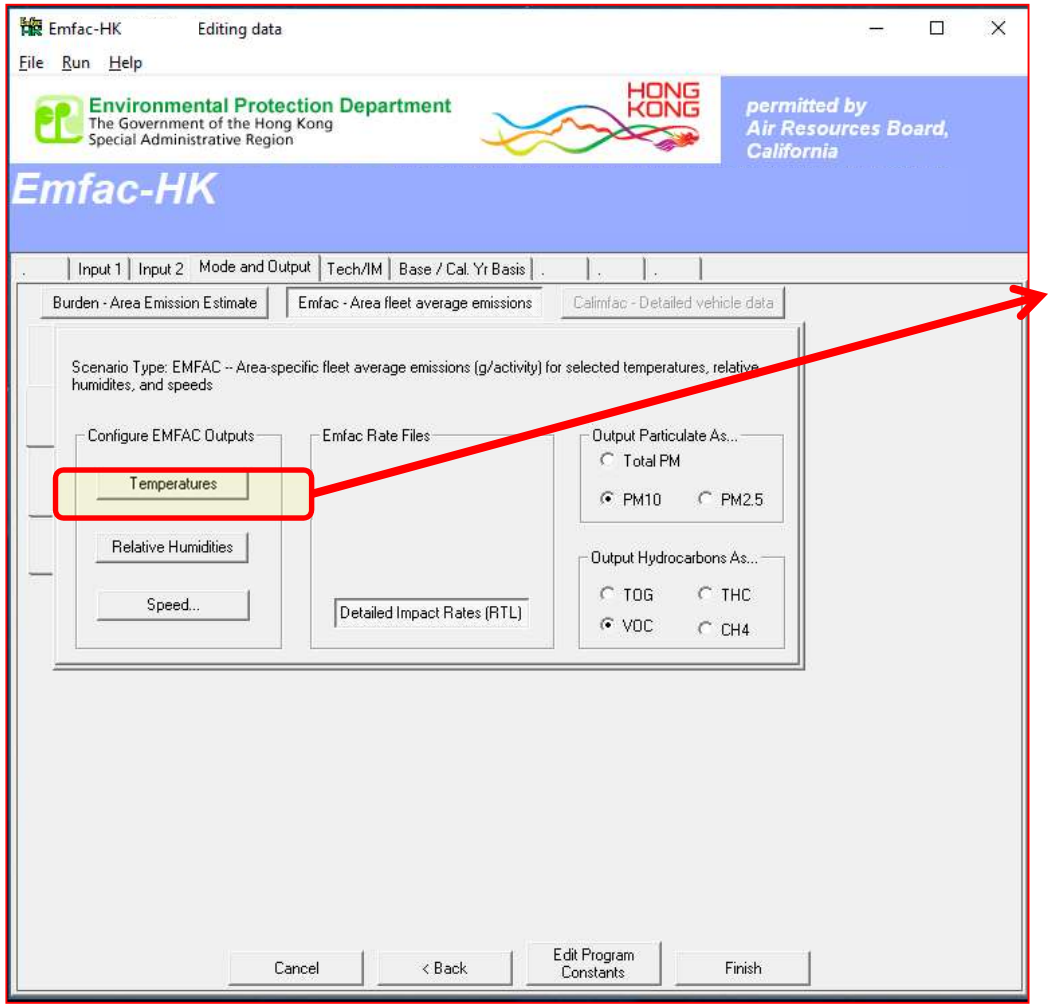
Exercise #2: Input 1 Tab

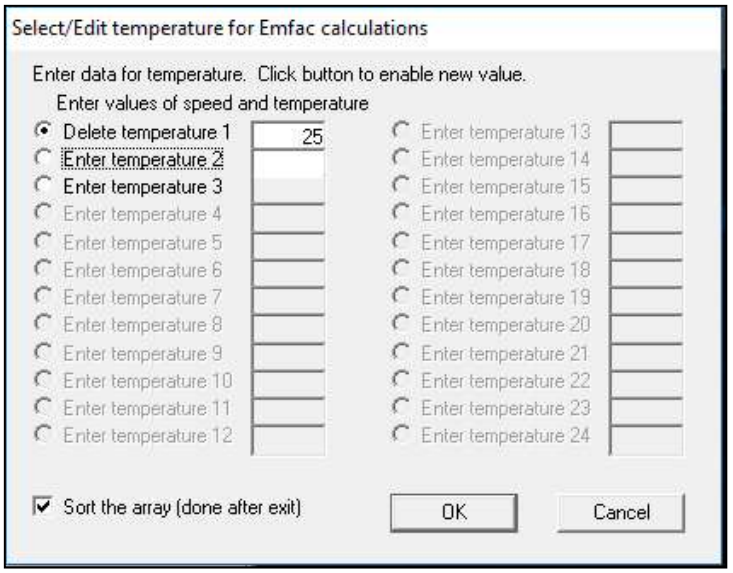


Exercise #2: Mode and Output Tab

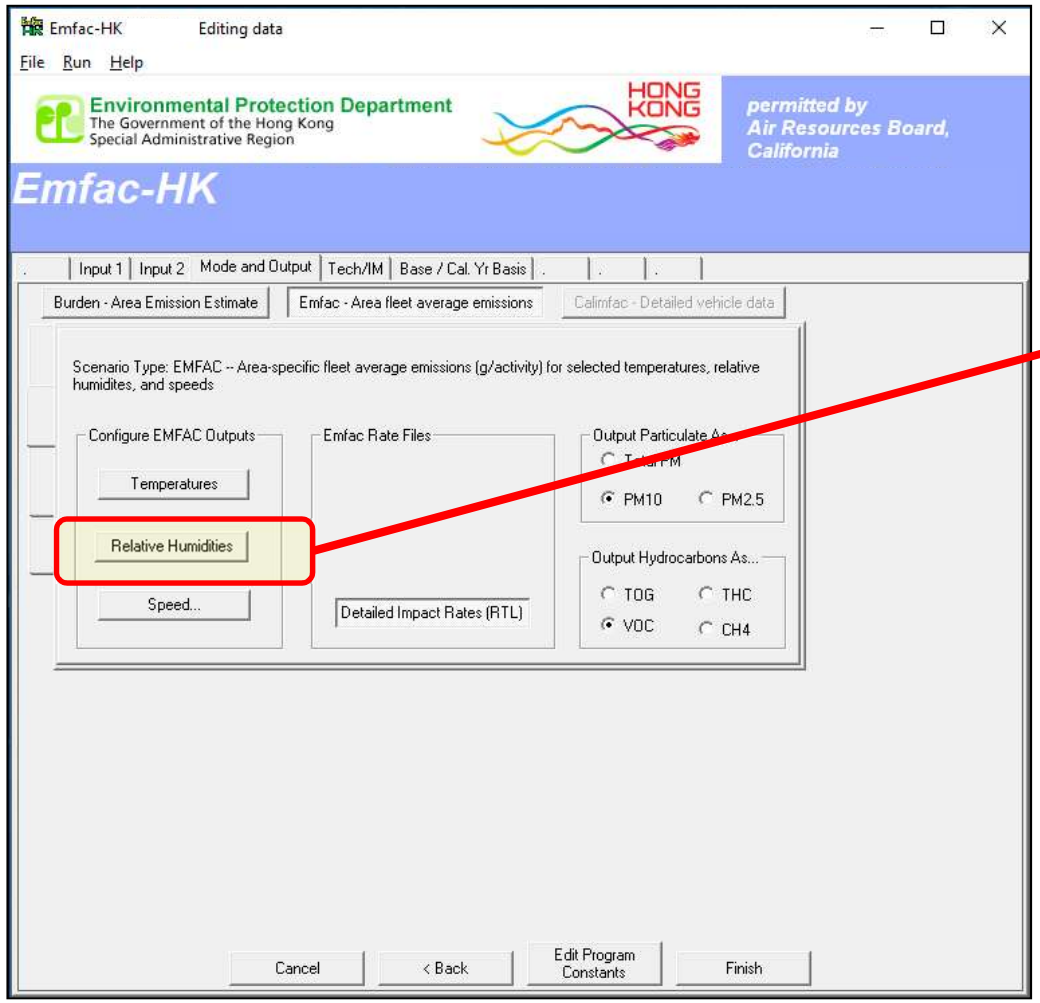


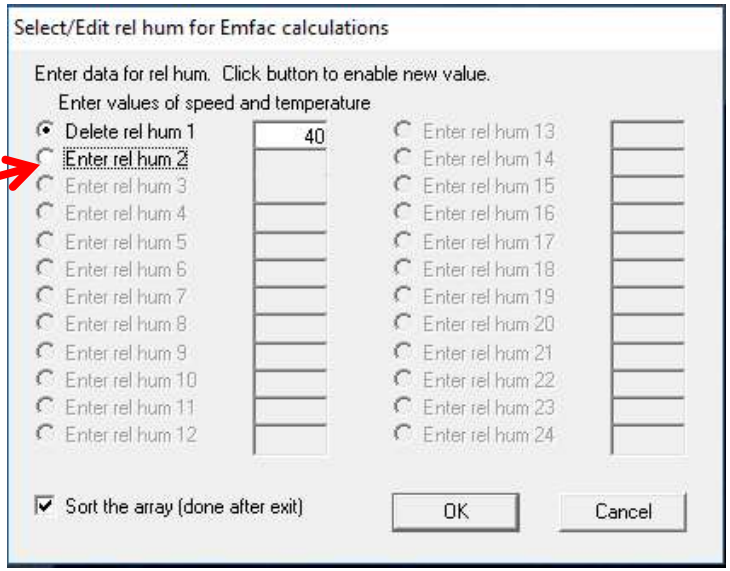
Exercise #2: Select/Edit Temperature (delete until just 1. set to 25°C)



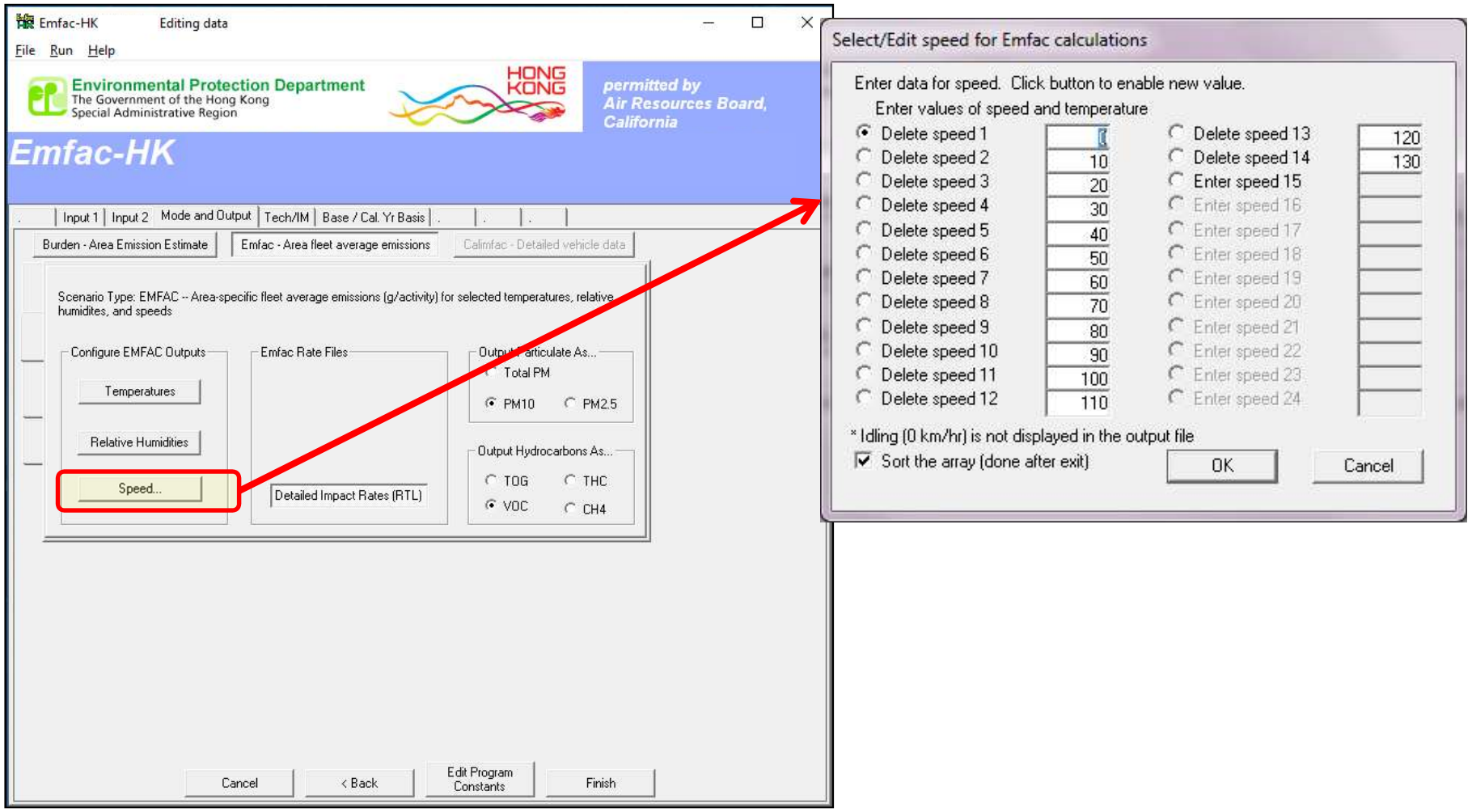


Exercise #2: Select/Edit RH (delete until just 1. set to 40%)



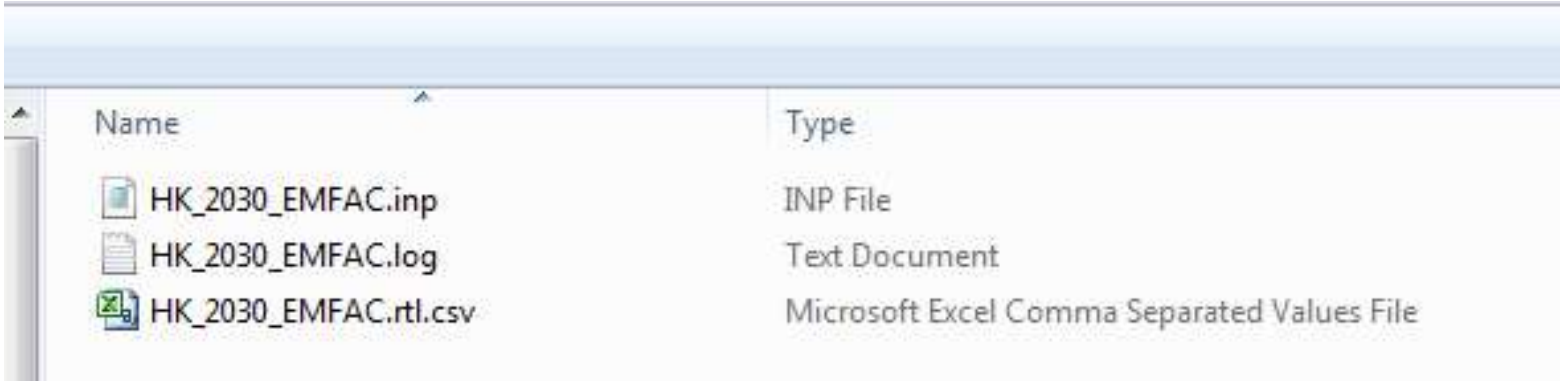


Exercise #2: Select/Edit Speed (default)

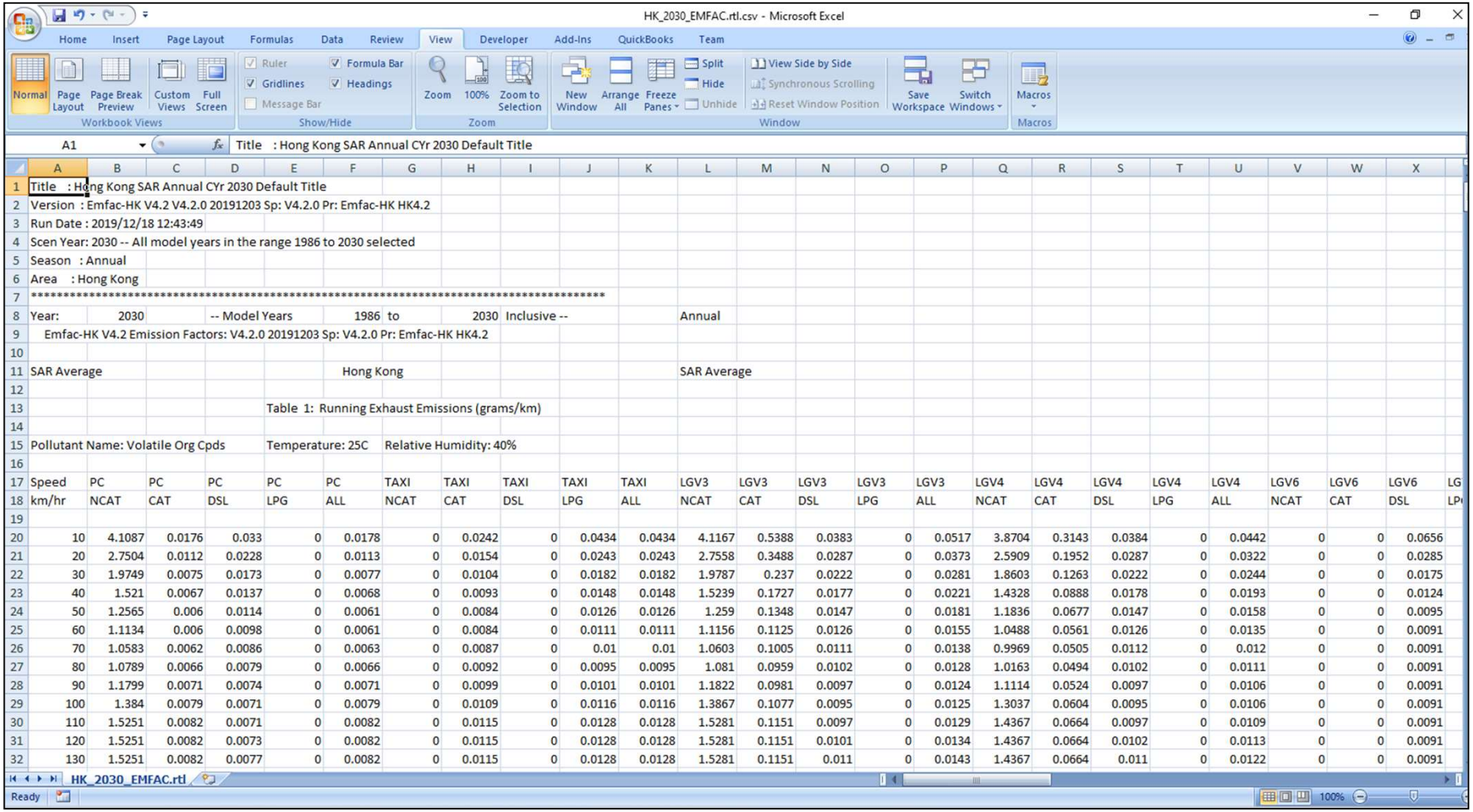


- Save input file as: HK_2030_Emfac.inp and Run

Exercise #2: Output Generated



Exercise #2: HK_2030_EMFAC.rtl.csv



HK_2030_EMFAC.rtl.csv - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	Title : Hong Kong SAR Annual CYr 2030 Default Title																							
2	Version : Emfac-HK V4.2 V4.2.0 20191203 Sp: V4.2.0 Pr: Emfac-HK HK4.2																							
3	Run Date : 2019/12/18 12:43:49																							
4	Scen Year: 2030 -- All model years in the range 1986 to 2030 selected																							
5	Season : Annual																							
6	Area : Hong Kong																							
7	**********																							
8	Year:	2030		-- Model Years	1986	to	2030	Inclusive --				Annual												
9	Emfac-HK V4.2 Emission Factors: V4.2.0 20191203 Sp: V4.2.0 Pr: Emfac-HK HK4.2																							
10																								
11	SAR Average					Hong Kong						SAR Average												
12																								
13					Table 1: Running Exhaust Emissions (grams/km)																			
14																								
15	Pollutant Name: Volatile Org Cpds				Temperature: 25C		Relative Humidity: 40%																		
16																								
17	Speed	PC	PC	PC	PC	PC	TAXI	TAXI	TAXI	TAXI	TAXI	LGV3	LGV3	LGV3	LGV3	LGV3	LGV4	LGV4	LGV4	LGV4	LGV4	LGV6	LGV6	LGV6	LG
18	km/hr	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LPG	ALL	NCAT	CAT	DSL	LP
19																								
20	10	4.1087	0.0176	0.033	0	0.0178	0	0.0242	0	0.0434	0.0434	4.1167	0.5388	0.0383	0	0.0517	3.8704	0.3143	0.0384	0	0.0442	0	0	0.0656	
21	20	2.7504	0.0112	0.0228	0	0.0113	0	0.0154	0	0.0243	0.0243	2.7558	0.3488	0.0287	0	0.0373	2.5909	0.1952	0.0287	0	0.0322	0	0	0.0285	
22	30	1.9749	0.0075	0.0173	0	0.0077	0	0.0104	0	0.0182	0.0182	1.9787	0.237	0.0222	0	0.0281	1.8603	0.1263	0.0222	0	0.0244	0	0	0.0175	
23	40	1.521	0.0067	0.0137	0	0.0068	0	0.0093	0	0.0148	0.0148	1.5239	0.1727	0.0177	0	0.0221	1.4328	0.0888	0.0178	0	0.0193	0	0	0.0124	
24	50	1.2565	0.006	0.0114	0	0.0061	0	0.0084	0	0.0126	0.0126	1.259	0.1348	0.0147	0	0.0181	1.1836	0.0677	0.0147	0	0.0158	0	0	0.0095	
25	60	1.1134	0.006	0.0098	0	0.0061	0	0.0084	0	0.0111	0.0111	1.1156	0.1125	0.0126	0	0.0155	1.0488	0.0561	0.0126	0	0.0135	0	0	0.0091	
26	70	1.0583	0.0062	0.0086	0	0.0063	0	0.0087	0	0.01	0.01	1.0603	0.1005	0.0111	0	0.0138	0.9969	0.0505	0.0112	0	0.012	0	0	0.0091	
27	80	1.0789	0.0066	0.0079	0	0.0066	0	0.0092	0	0.0095	0.0095	1.081	0.0959	0.0102	0	0.0128	1.0163	0.0494	0.0102	0	0.0111	0	0	0.0091	
28	90	1.1799	0.0071	0.0074	0	0.0071	0	0.0099	0	0.0101	0.0101	1.1822	0.0981	0.0097	0	0.0124	1.1114	0.0524	0.0097	0	0.0106	0	0	0.0091	
29	100	1.384	0.0079	0.0071	0	0.0079	0	0.0109	0	0.0116	0.0116	1.3867	0.1077	0.0095	0	0.0125	1.3037	0.0604	0.0095	0	0.0106	0	0	0.0091	
30	110	1.5251	0.0082	0.0071	0	0.0082	0	0.0115	0	0.0128	0.0128	1.5281	0.1151	0.0097	0	0.0129	1.4367	0.0664	0.0097	0	0.0109	0	0	0.0091	
31	120	1.5251	0.0082	0.0073	0	0.0082	0	0.0115	0	0.0128	0.0128	1.5281	0.1151	0.0101	0	0.0134	1.4367	0.0664	0.0102	0	0.0113	0	0	0.0091	
32	130	1.5251	0.0082	0.0077	0	0.0082	0	0.0115	0	0.0128	0.0128	1.5281	0.1151	0.011	0	0.0143	1.4367	0.0664	0.011	0	0.0122	0	0	0.0091	

HK_2030_EMFAC.rtl

Ready

Exercise #3: Changing Technology Group Fractions

- This exercise evaluates emission changes in 2030 if the Gov't introduces a tax incentive program by implementing Euro VI in 1.1.2019 for Non-Franchised Buses < 6.4 tonnes (i.e. NFB6).

- Hints:
  - Changes % of Euro V/VI from model year 2019 to 2020 for NFB6

Exercise #3: Changing TG Fractions

- Base Case (similar to Ex1):
  - Calendar Years: 2030
  - Scenario Type: BURDEN
  - Output File types: BDN
  - Pollutants: VOC

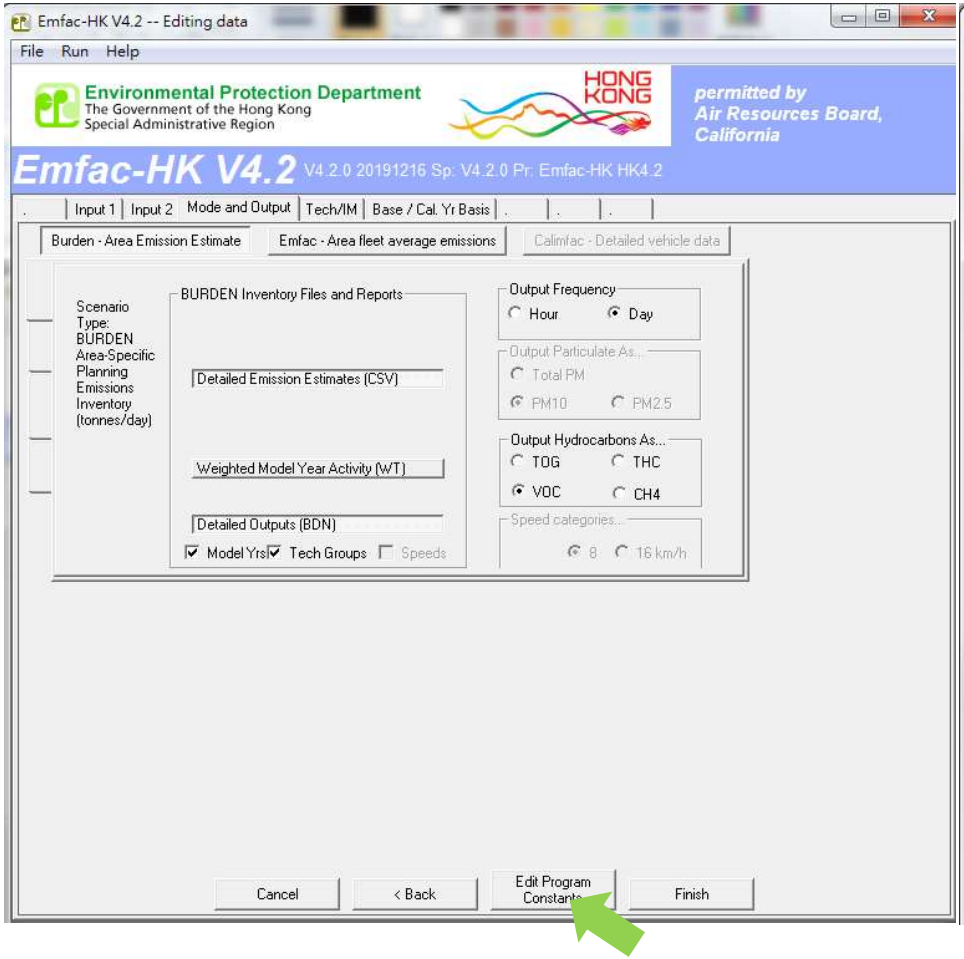
- Create a new case with same scenario data and edit TG fraction on NFB6

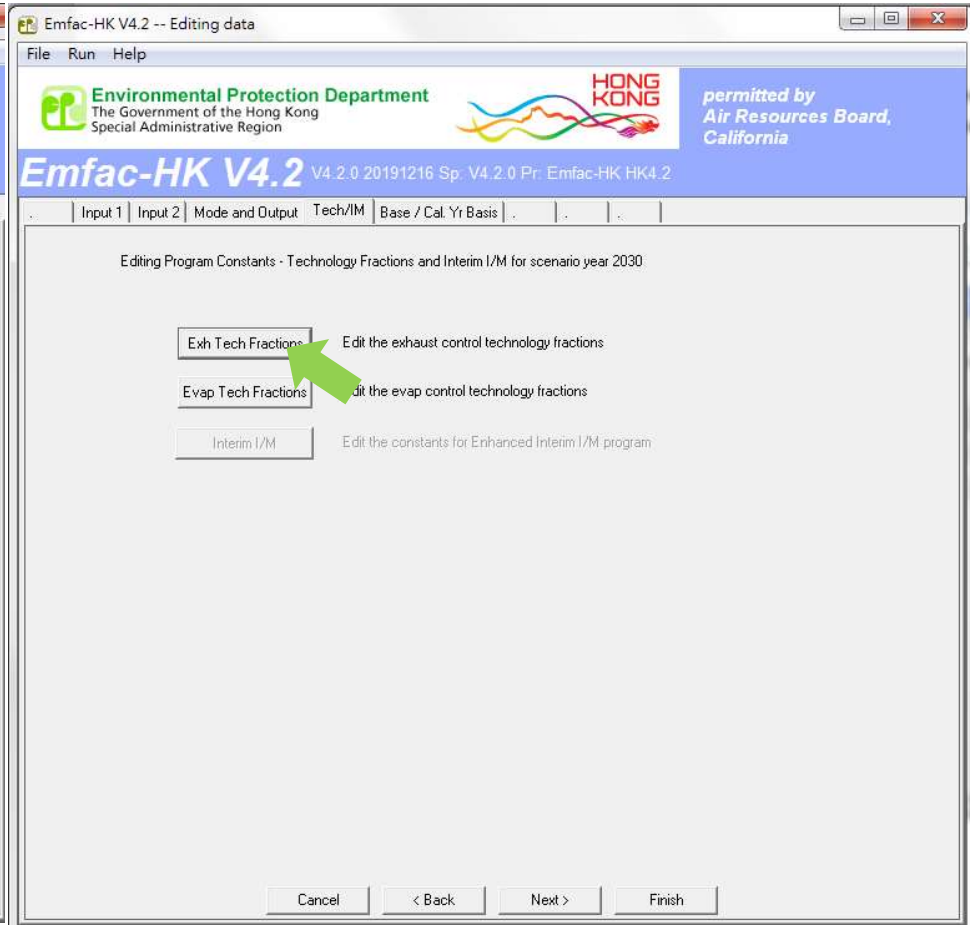
Exercise #3: Update TG fraction on NFB6

Case	Model Year	TG 103 Euro V	TG 104 Euro VI	Total Fraction
Base	2019-2020	100%	0%	100%
	2021	16.667%	83.333%	100%
New	2019-2021	0%	100%	100%

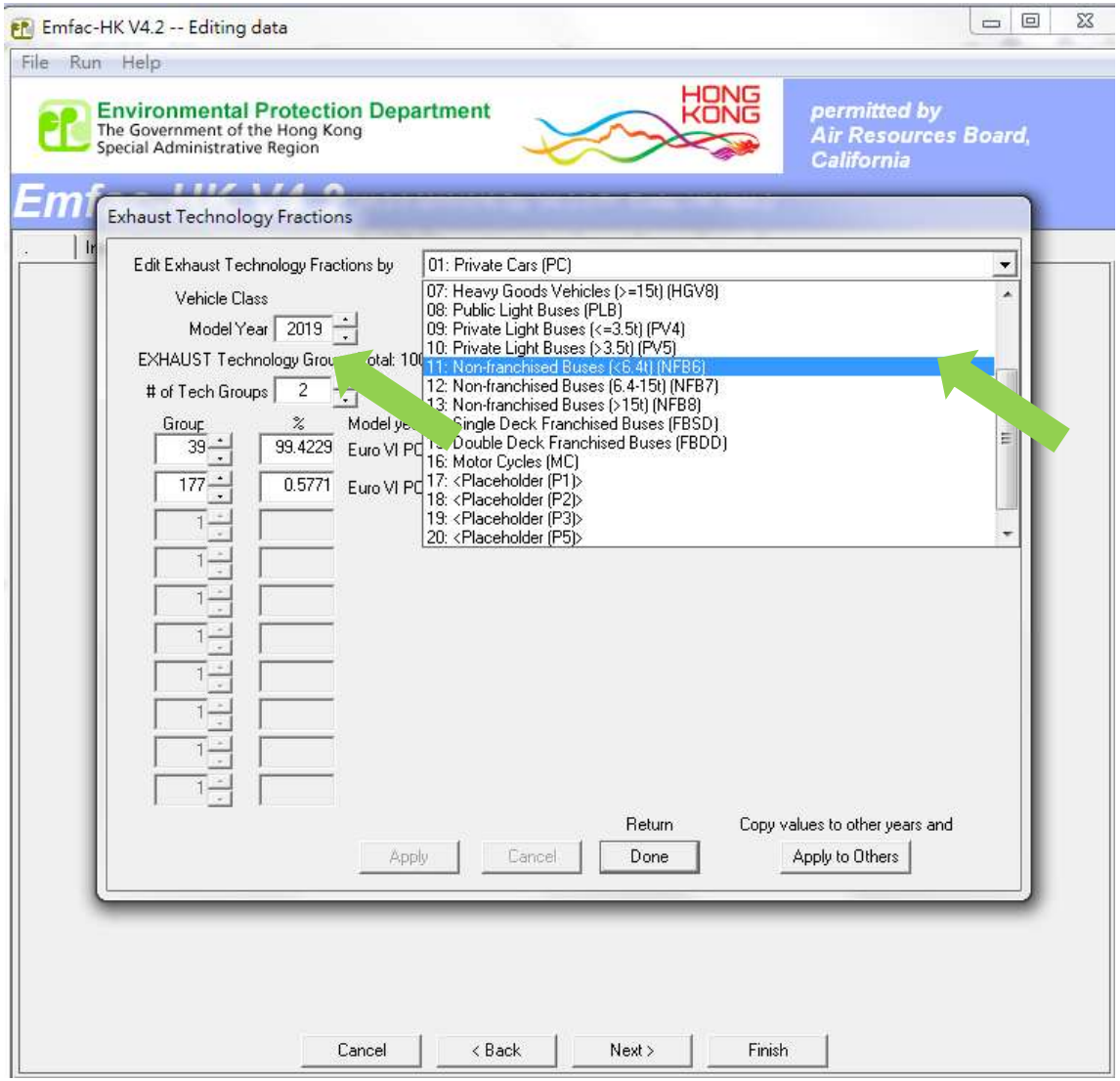
- Move 100% from TG103 to TG 104 for model year 2019
- Apply same fraction to 2020 and 2021.

Exercise #3: Update TG fraction on NFB6

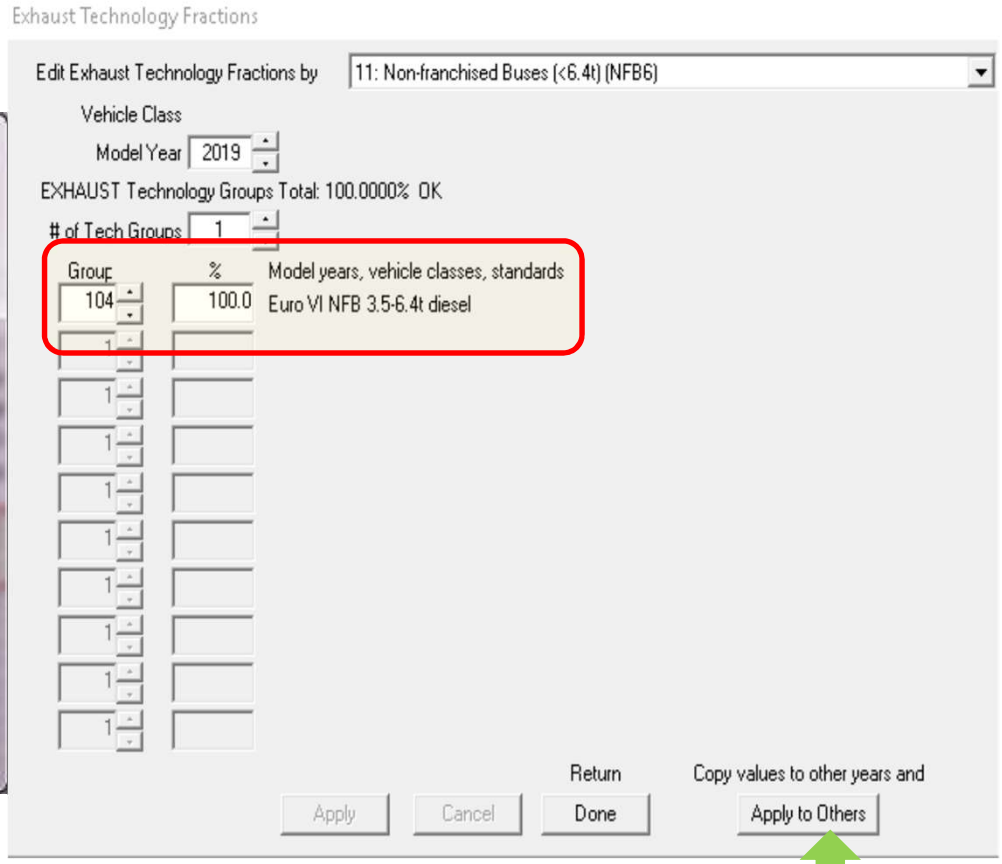




Exercise #3: Update TG fraction on NFB6



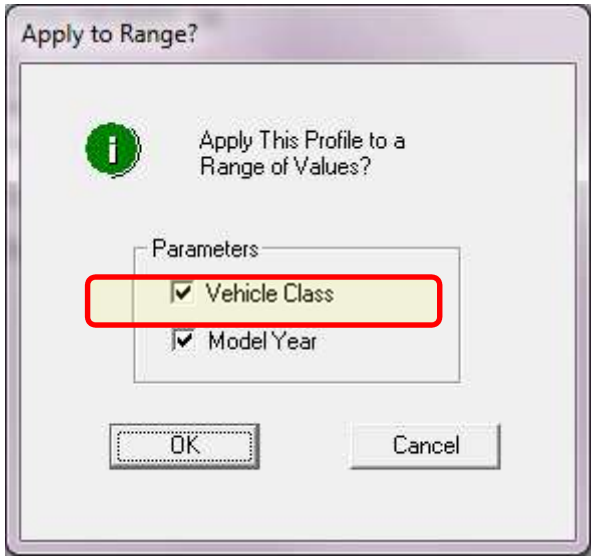
Exercise #3:



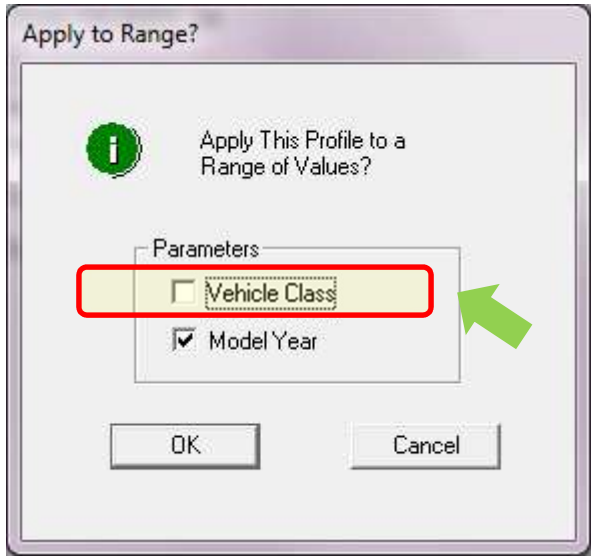
Click "**Apply to Others**"

Exercise #3:

Before Edit



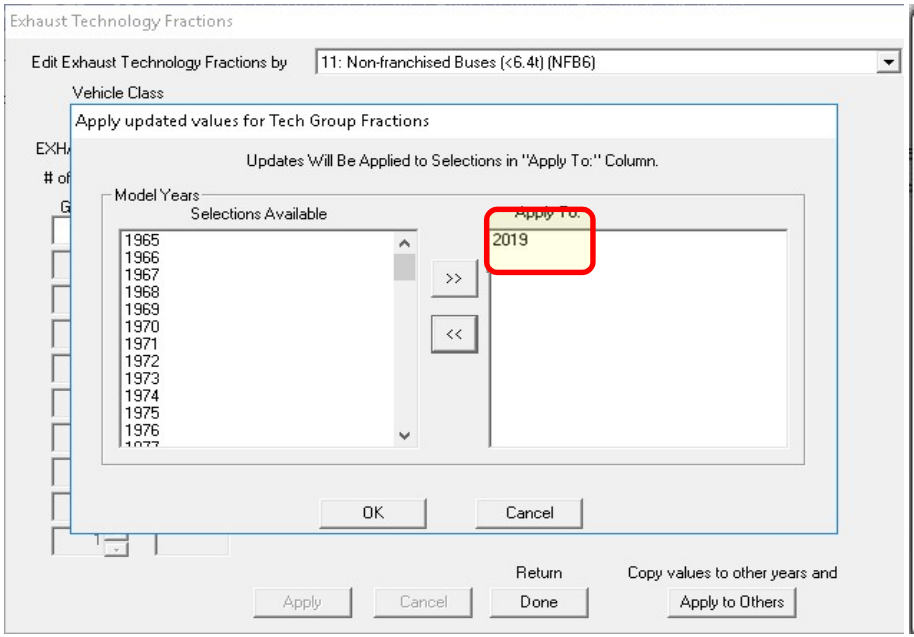
After Edit



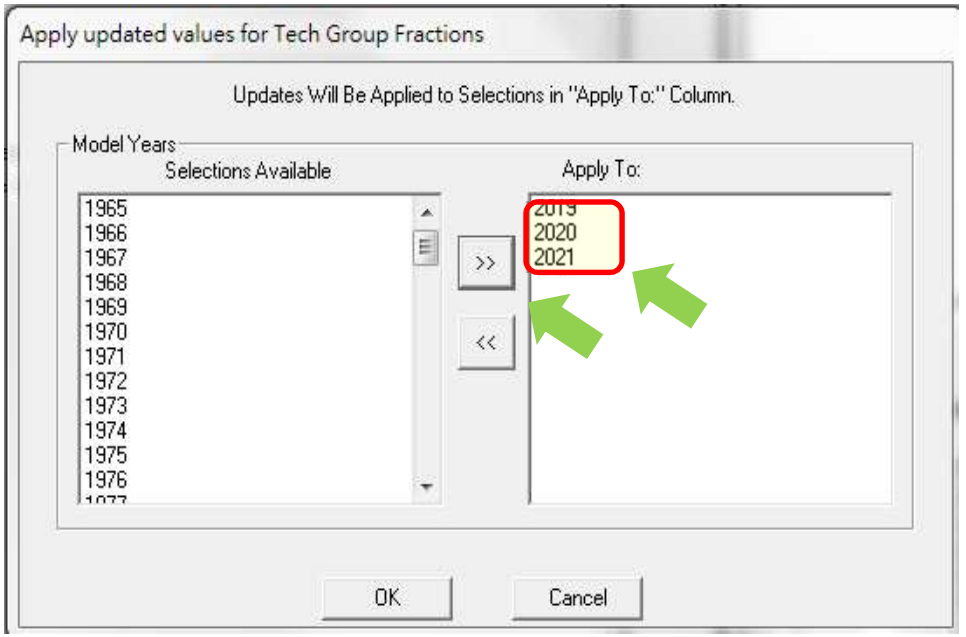
- "Apply to Others – Model Year Only"

Exercise #3:

Before Edit



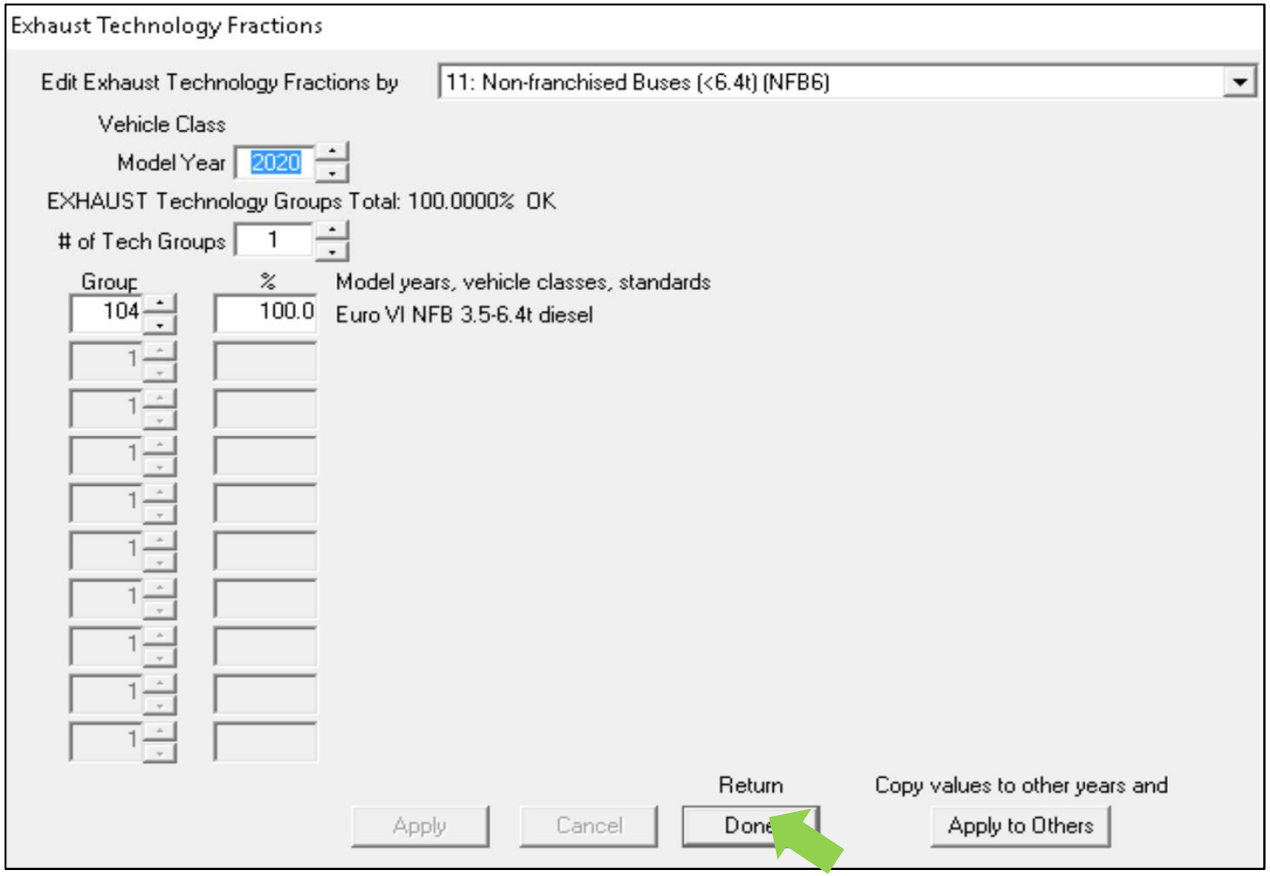
After Edit



- 2019 TG fraction same as 2020/2021

Exercise #3:

Verify that the TG fraction is changed correctly.



- Save input file as: HK_2030_NFB6.inp and Run

Exercise #3: Solution

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	# Title :	Hong Kong SAR Annual CYr 2030 Default Title														
2	# Version	Emfac-HK V4.2 V4.2.0 20191128 Sp: V4.2.0 Pr: Emfac-HK HK4.2														
3	# Run Date	#########														
4	# Scen Yea	2030 -- All model years in the range 1986 to 2030 selected														
5	# Season	Annual														
6	# Area :	Hong Kong														
7	# I/M Stat	HK I/M CY2013+ program in effect														
8	# Emission	Tonnes Per Period														
9	**RecType**	**ScenNum**	**CalYr**	**Area**	**Veh**	**MdlYr**	**Tech**	**Period**	**Pop**	**VKT**	**Trips**	**NOx_RUNEX**	**NOx_STREX**	**NO2_RUNEX**	**NO2_STREX**	**Case**
10	Vh	1	2030	Hong Kong SAR	NFB6	AllMYr	DSL	Day	2736	322208.8	10945.09	1.98E-01	5.30E-03	5.55E-02	1.48E-03	Base
11	Vh	1	2030	Hong Kong SAR	NFB6	AllMYr	DSL	Day	2736	322208.8	10945.09	1.67E-01	5.72E-03	4.66E-02	1.60E-03	Euro VI
12																

Exercise #4: Changing Vehicle Kilometer Travelled (VKT)

- This exercise estimates emissions for an area with known VKT of specific vehicle class.

- Two approaches to change VKT:
  1) adjust the population to match desired VKT (conformity adjustment: model will alter VKT and Trips)
  2) directly alter the VKT

Exercise #4: Changing VKT

- At year 2030, petrol private cars (Vehicle Class 1) has *forecasted* VKT of 1,609,000 km/day.

- This Exercise will be conducted in three phases:
  - 4 : base case
  - 4a: conformity adjustment
  - 4b: direct VKT adjustment

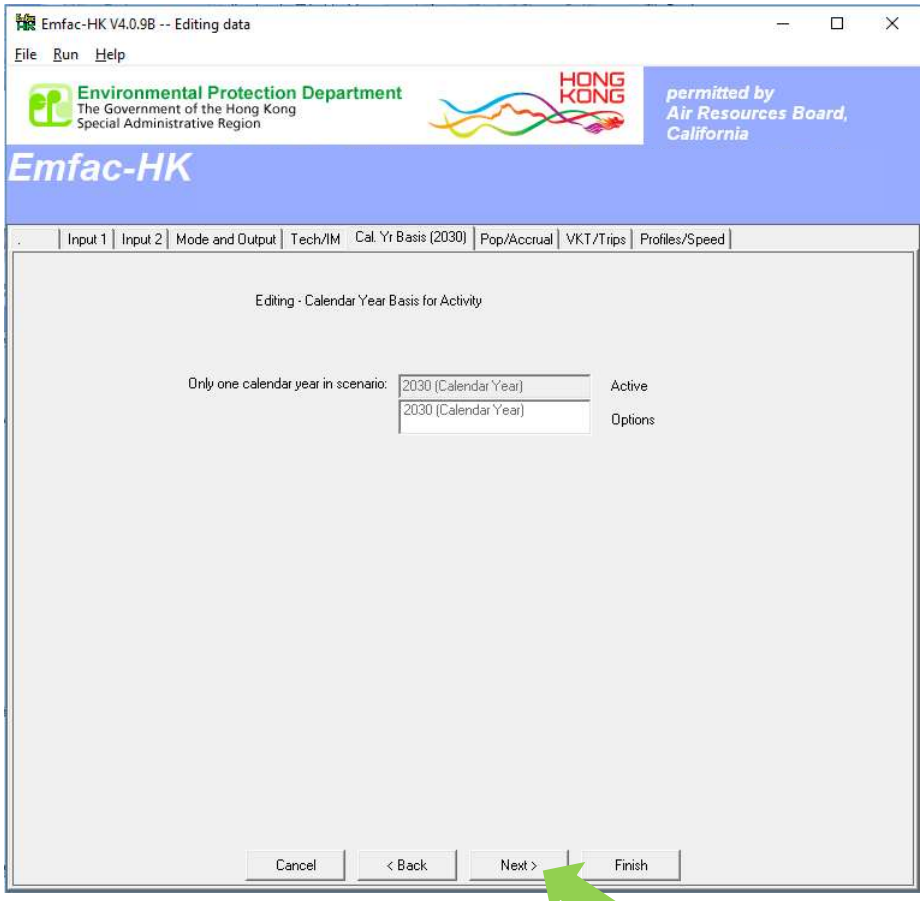
Exercise # 4: Base Case

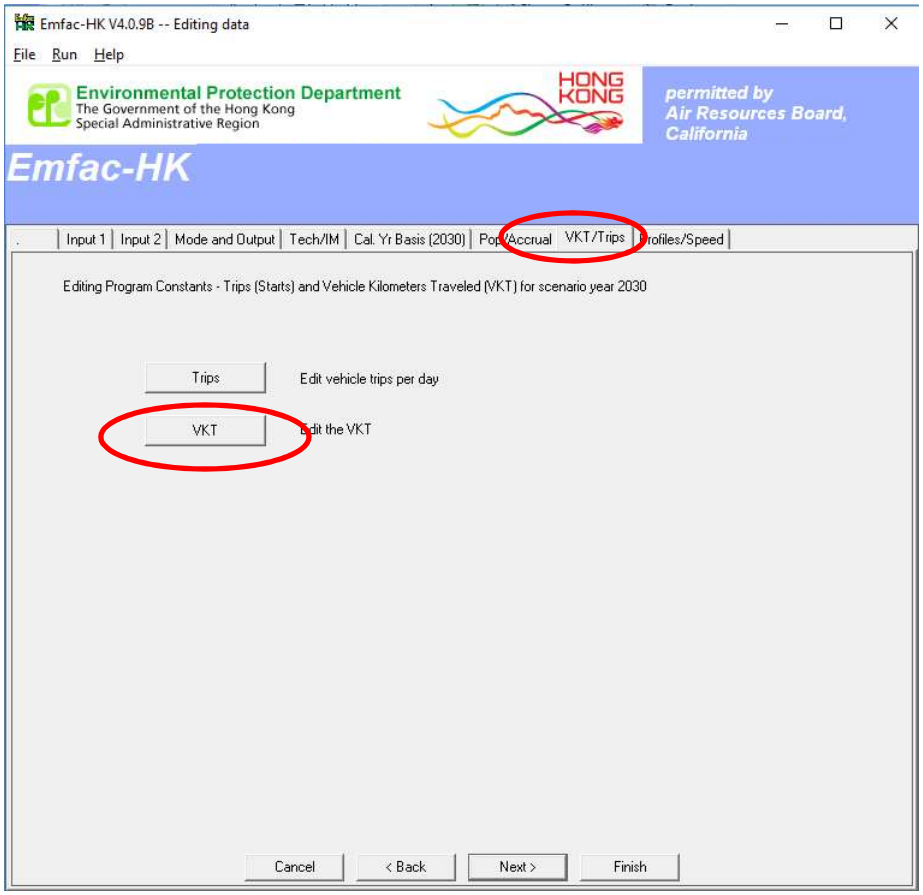
- Scenario data:
  - Calendar Years: 2030
  - Scenario Type: BURDEN
  - Output File types: Detailed Estimates (CSV)
  - Output Frequency: Day
  - Pollutants: PM10, PM_{25},VOC

Exercise # 4a: Conformity Adjustment

- Create a new case with same scenario data as base case
- Determine VKT adjustment factor
- Multiply population by above factor

Exercise # 4a:

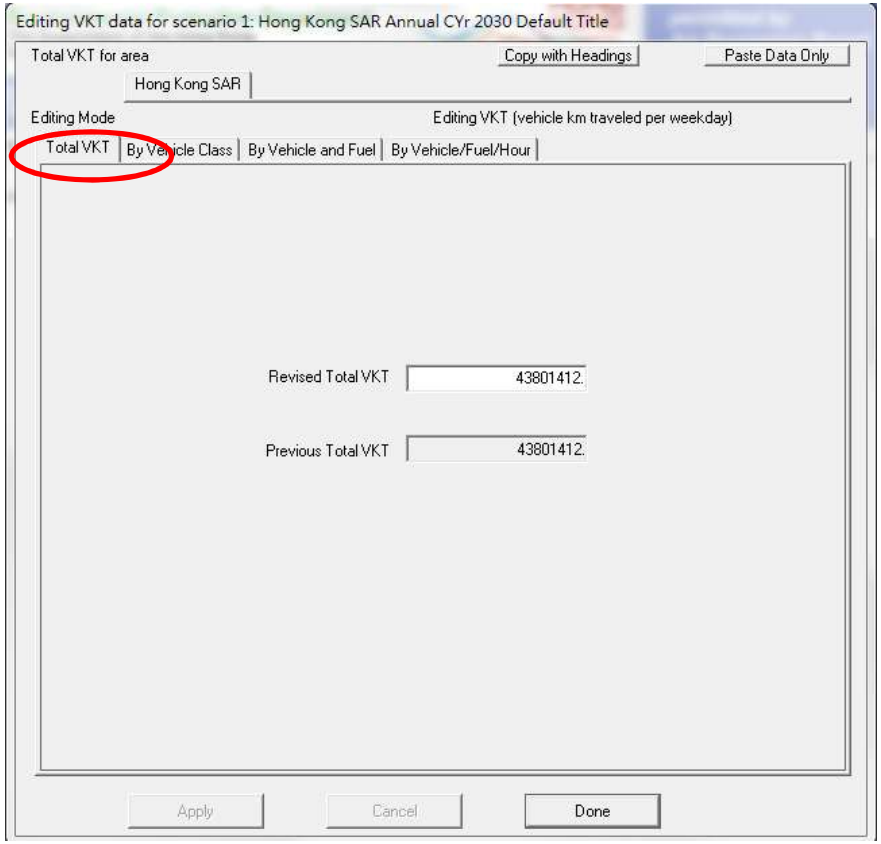




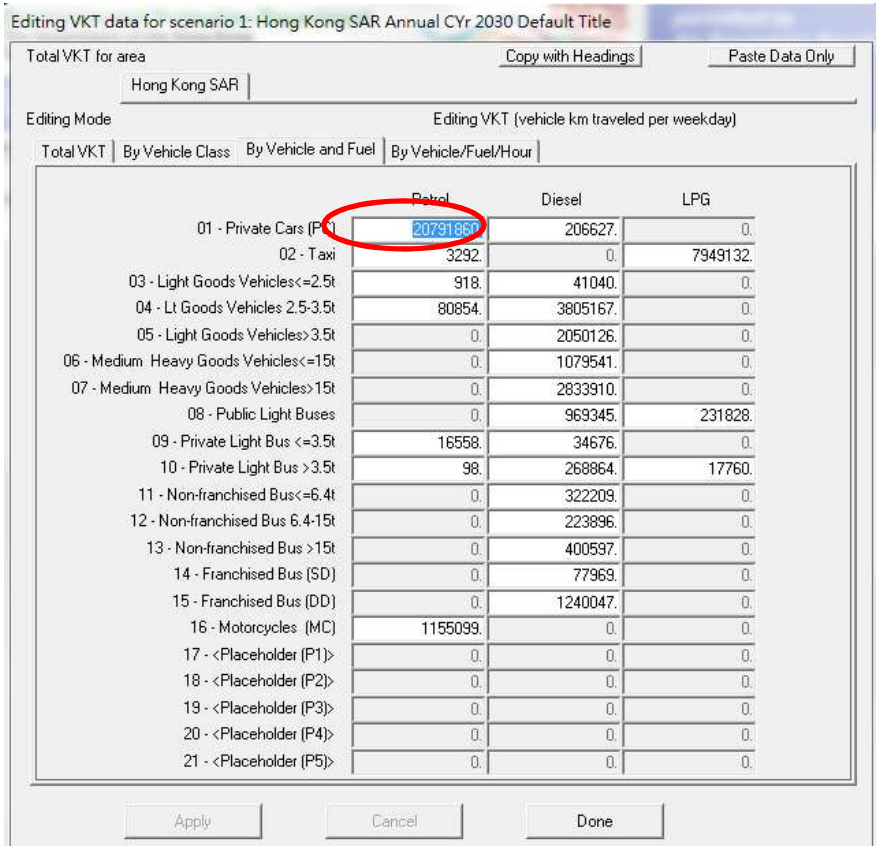
- Click Next until VKT/Trips tab

Exercise # 4a:

Total VKT tab



By Vehicle and Fuel tab

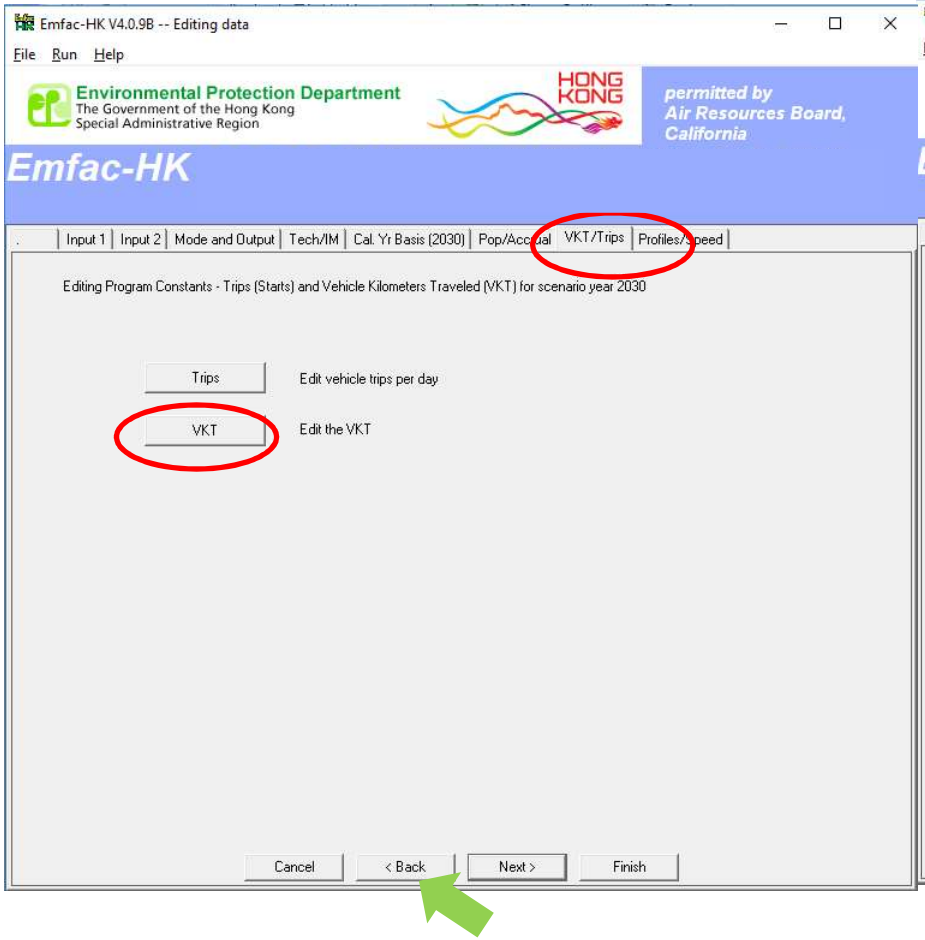


- VKT adjustment factor is :

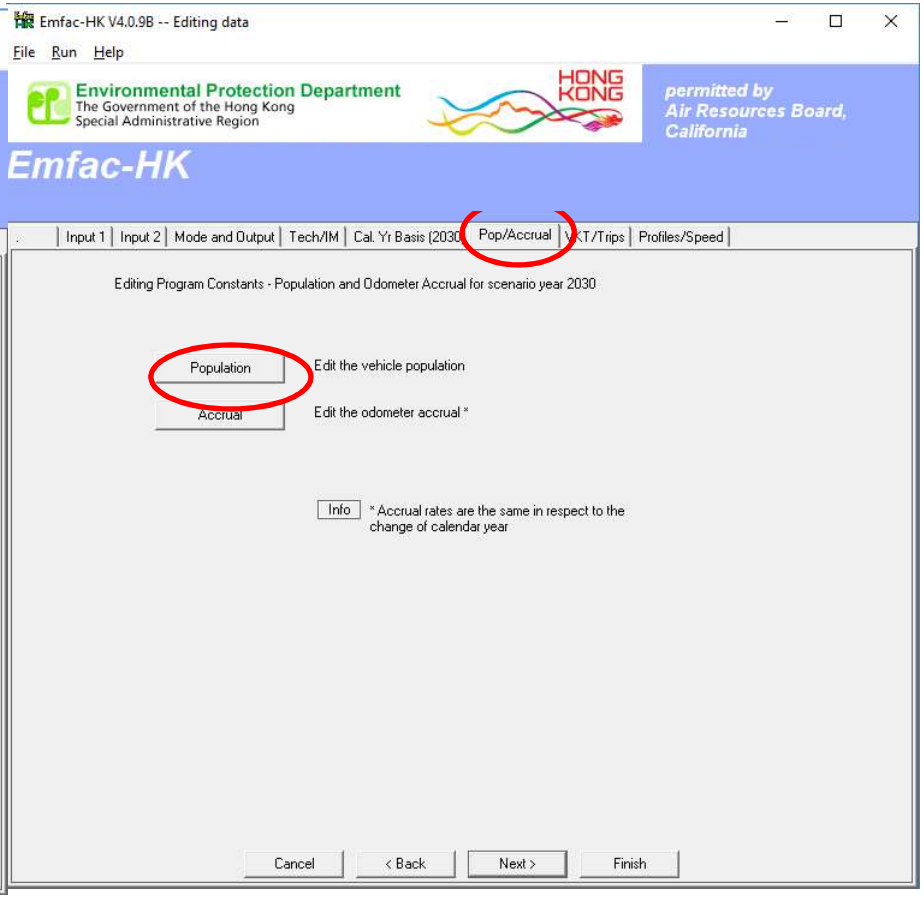
1,609,000 ÷ 20,791,860 = 0.077386

Exercise # 4a:

VKT/Trips tab



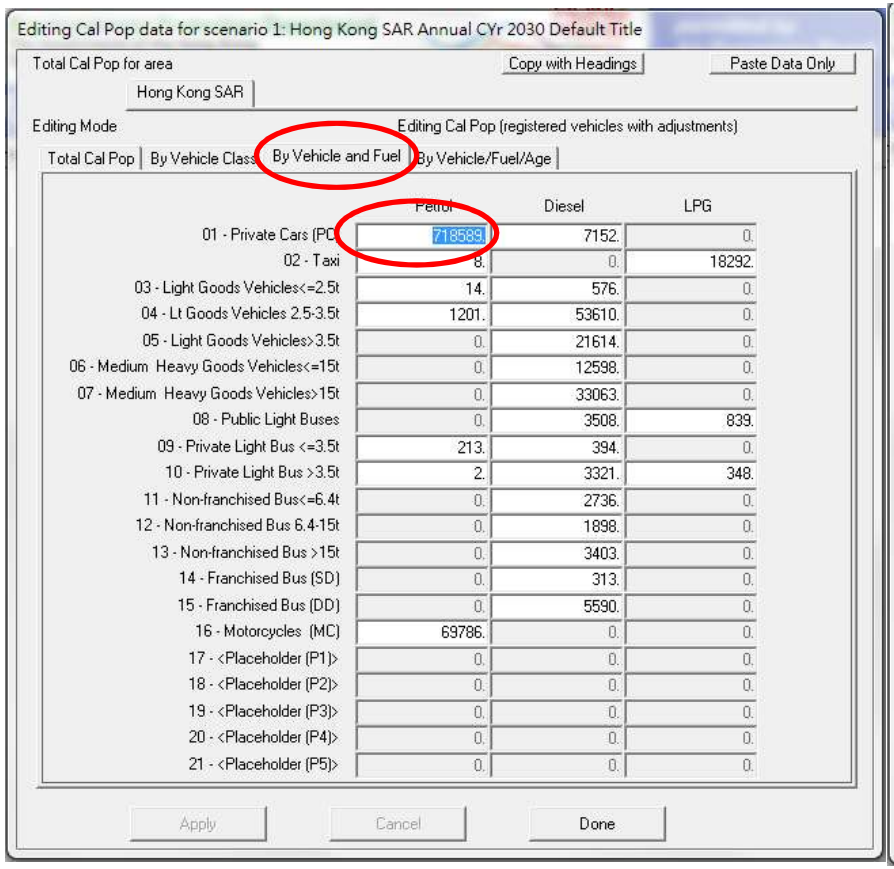
Pop/Accural tab



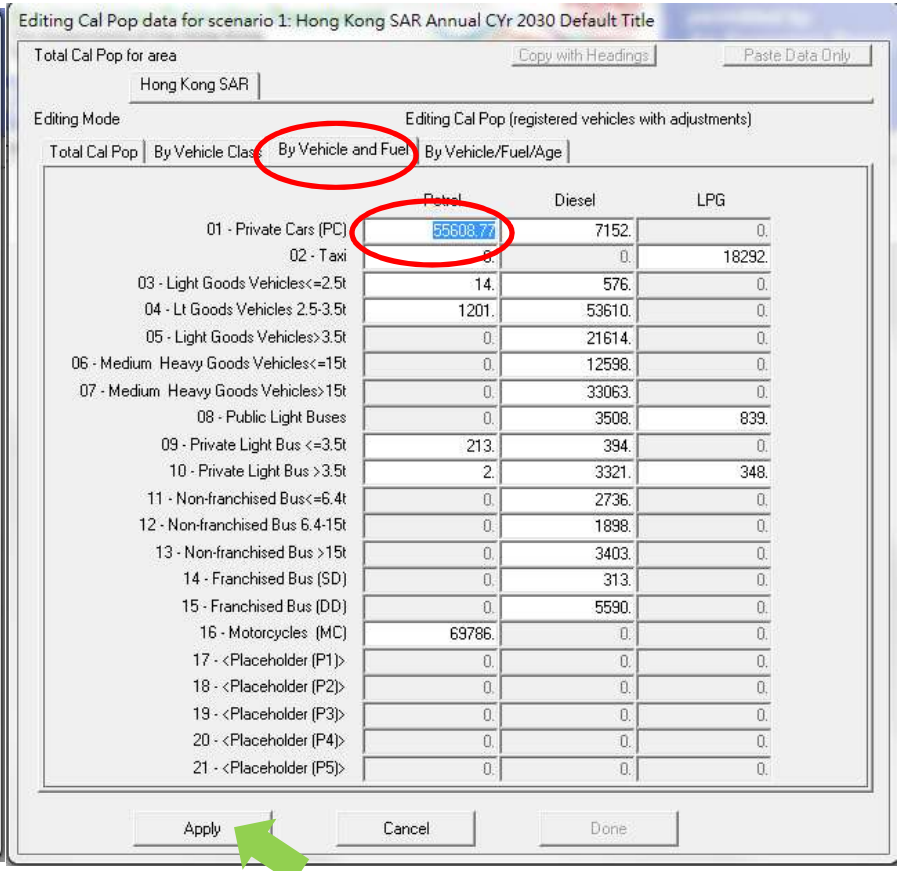
- Back to Population → By Vehicle and Fuel tab

Exercise # 4a:

2030 Population (Base Case)



2030 Population (Edited for VKT Match)

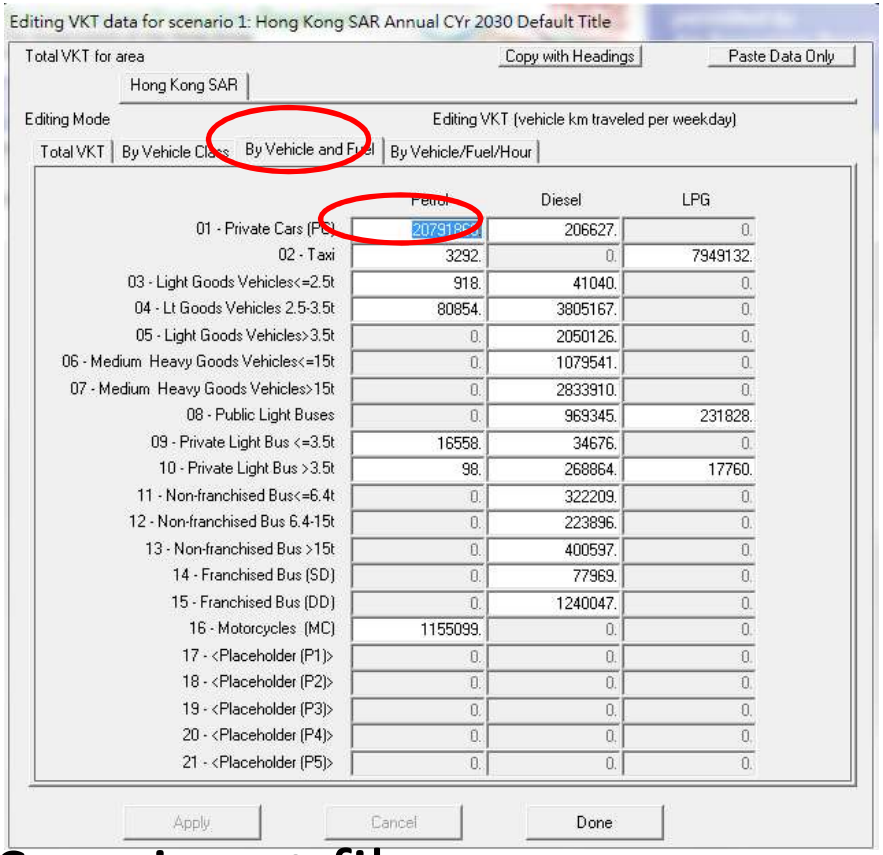


- Multiply population by factor:

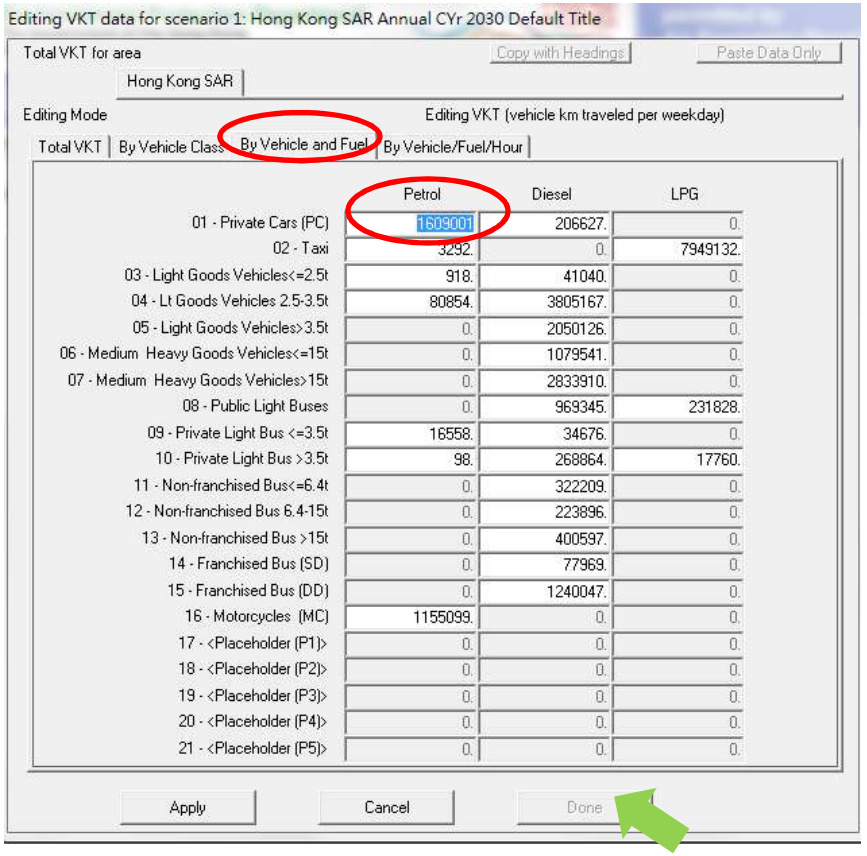
718,589 * 0.077386 = 55,608.77

Exercise # 4a: Verify VKT Adjustment

2030 VKT
(Base Case)



2030 VKT
(After Pop Edit)



- Save input file as

HK_2030_Burden_by_Hour_edit VKT (conformity).inp and Run

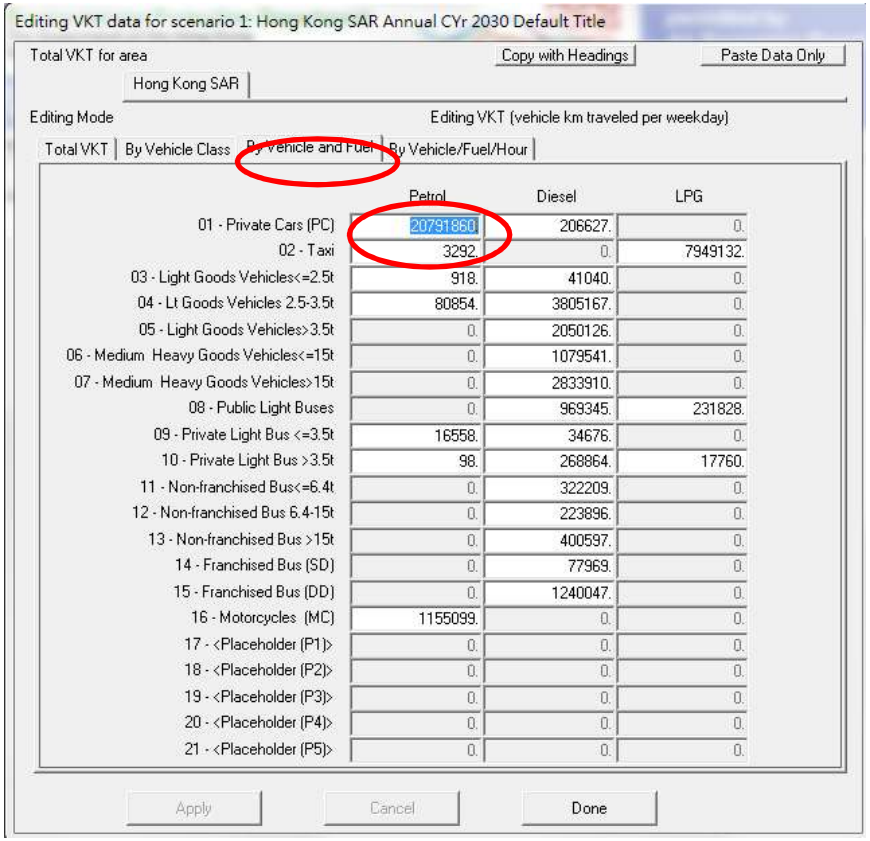
Exercise # 4b: Direct VKT adjustment

- Create a new case with same scenario data as base case

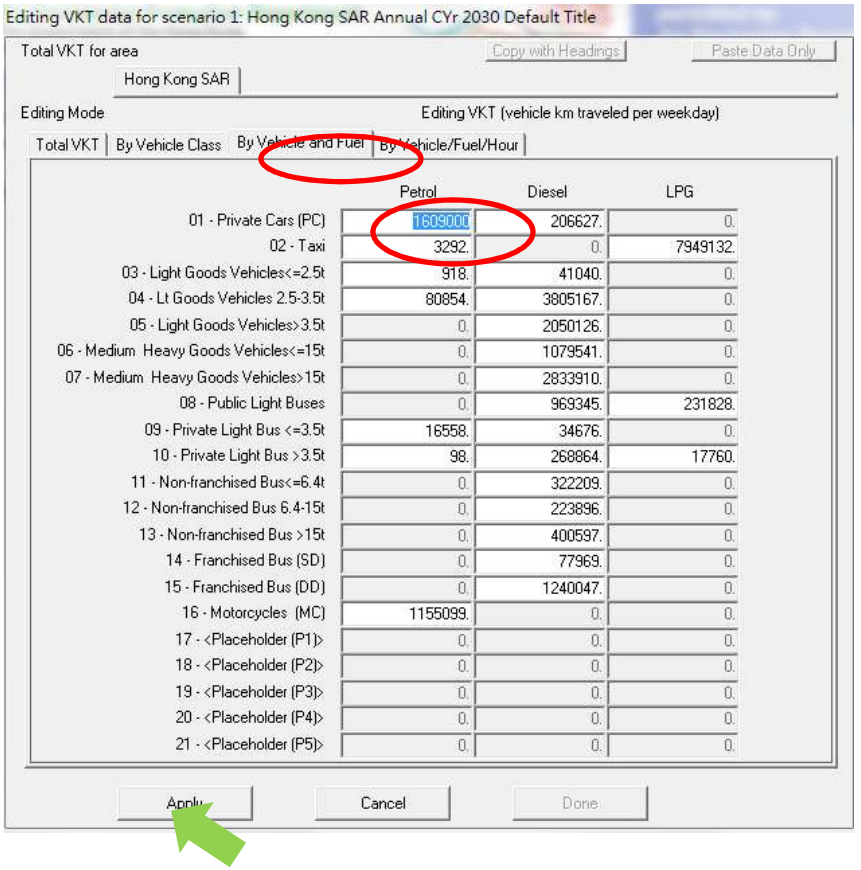
- Direct entry of new VKT for petrol private cars as 1,609,000 km/day

Exercise # 4b: Editing VKT Screen

2030 VKT
(Base Case)



2030 VKT
(After VKT Edit)



- Save input file as

HK_2030_Burden_by_Hour_edit VKT (directly).inp and Run

Exercise # 4: Solution

PC-NCAT & PC-CAT	Base	#4a: Pop-adjusted VKT	#4b: VKT direct
Population	718,589	**55,609**	718,589
VKT	20,791,861	1,609,001	1,608,999
Trips	1,077,770	**83,405**	1,077,770
NOx Run Exhaust (tonne/day)	0.1825	0.0141	0.01412
NOx Start Exhaust (tonne/day)	0.0720	**0.0056**	0.0720

Notes:

Results show how the model adjusted trips in Exercise #4a, thus, starting exhaust as well. Running exhaust emissions do not differ.

Exercise #4b shows it is possible to directly input VKT into EMFAC-HK; however, it is generally not recommended to do this independent of vehicle population because of the desire to properly estimate start and evaporative emissions tied to the size of the vehicle fleet.

Exercise #5: Changing Trips

- This exercise estimates the emission reduction when reduces trips for petrol Private Cars in 2030 to 250,000 trips per day.

- There are two potential methods:

  1) Ex 5a: Adjust the population to match desired Trips (i.e., “conformity” approach)

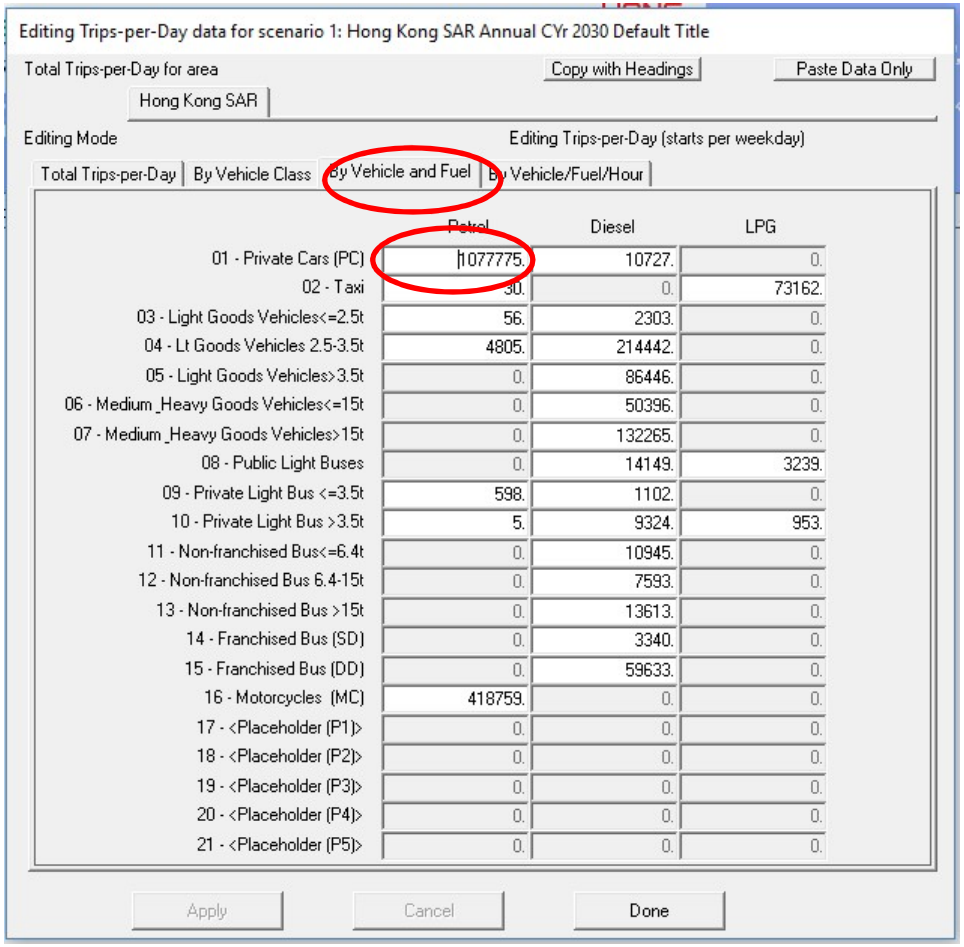
  2) Ex 5b: Directly alter the Trips

Exercise # 5a: Conformity Adjustment

- Base Case (2030, Burden, CSV outputs)
- New case with same scenario data as base case
- Determine Trips adjustment factor
- Multiply population by above factor

Exercise # 5a: Trips adjustment factor

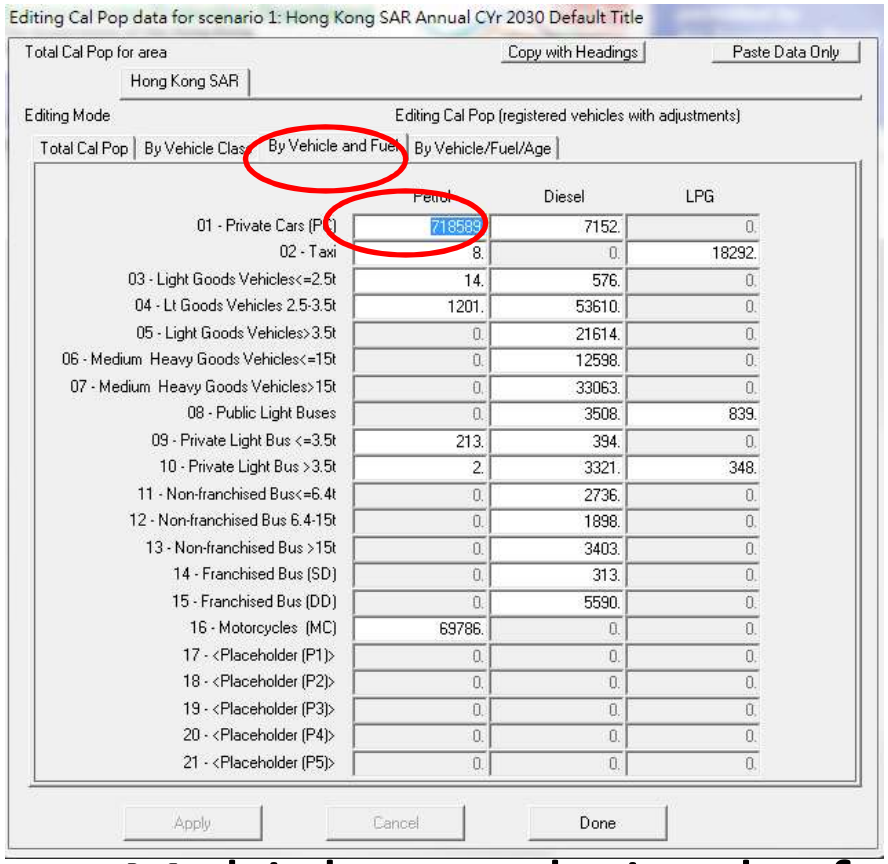
2030 Trips by Vehicle and Fuel of petrol PC



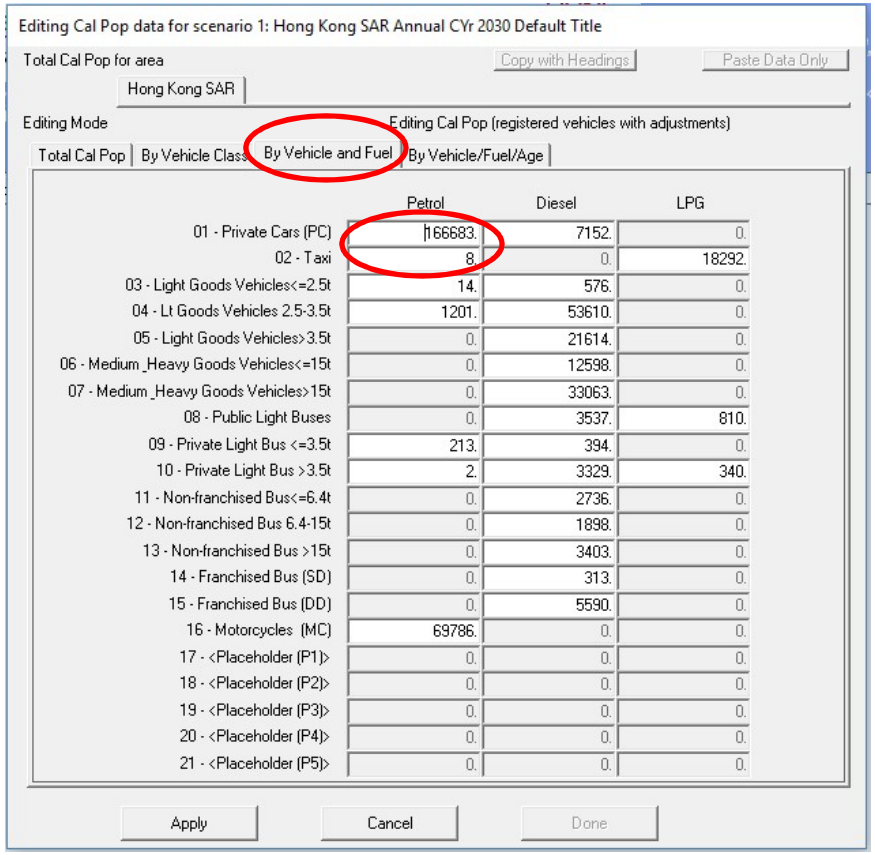
Factor = 250,000 ÷ 1,077,775 = 0.231959

Exercise # 5a: Population Edits

2030 Population (Base Case)



2030 Population (Edited for Trips Match)

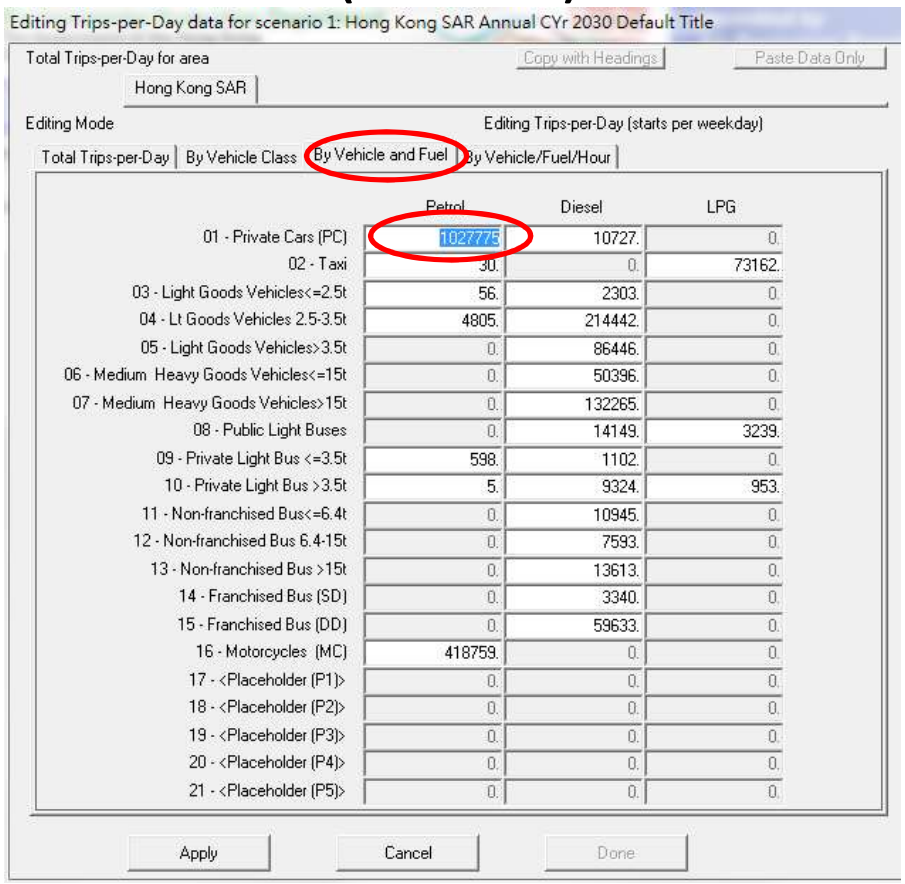


Multiply population by factor:

718,589 * 0.231959 = 166,683 vehicles

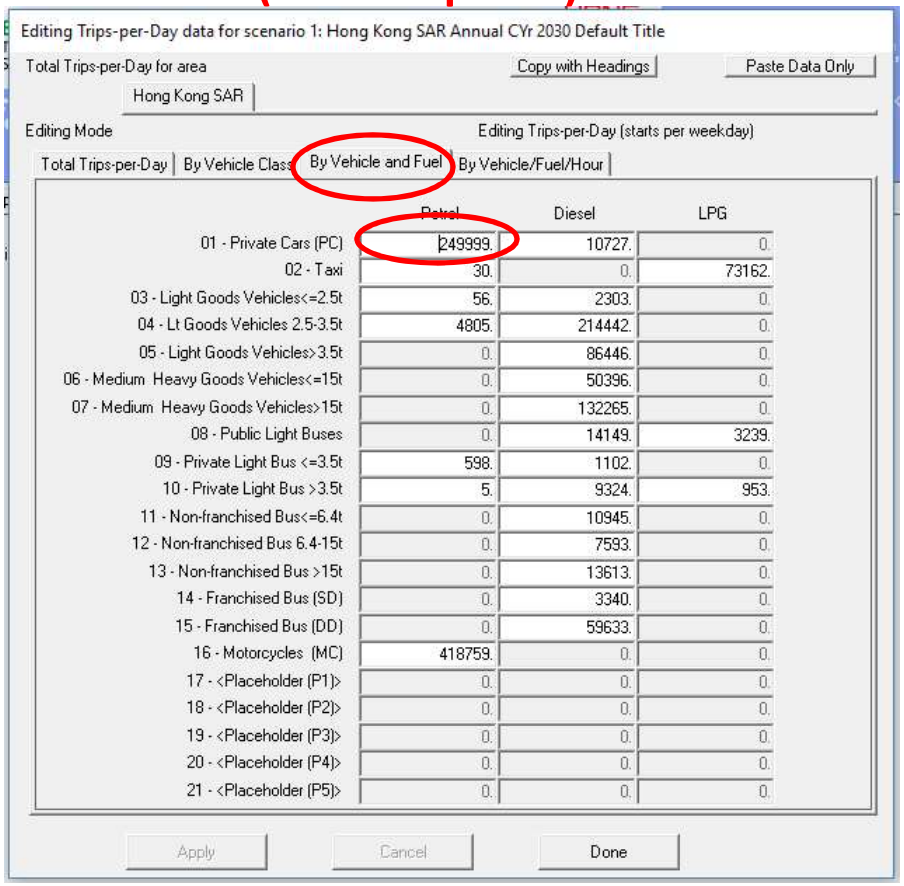
Exercise # 5a: Verify Trips Adjustment

2030 Trips (Base Case)



	Petrol	Diesel	LPG
01 - Private Cars (PC)	1027775	10727.	0.
02 - Taxi	30.	0.	73162.
03 - Light Goods Vehicles<=2.5t	56.	2303.	0.
04 - Lt Goods Vehicles 2.5-3.5t	4805.	214442.	0.
05 - Light Goods Vehicles>3.5t	0.	86446.	0.
06 - Medium Heavy Goods Vehicles<=15t	0.	50396.	0.
07 - Medium Heavy Goods Vehicles>15t	0.	132265.	0.
08 - Public Light Buses	0.	14149.	3239.
09 - Private Light Bus <=3.5t	598.	1102.	0.
10 - Private Light Bus >3.5t	5.	9324.	953.
11 - Non-franchised Bus<=6.4t	0.	10945.	0.
12 - Non-franchised Bus 6.4-15t	0.	7593.	0.
13 - Non-franchised Bus >15t	0.	13613.	0.
14 - Franchised Bus (SD)	0.	3340.	0.
15 - Franchised Bus (DD)	0.	59633.	0.
16 - Motorcycles (MC)	418759.	0.	0.
17 - <Placeholder (P1)>	0.	0.	0.
18 - <Placeholder (P2)>	0.	0.	0.
19 - <Placeholder (P3)>	0.	0.	0.
20 - <Placeholder (P4)>	0.	0.	0.
21 - <Placeholder (P5)>	0.	0.	0.

2030 Trips (After Pop Edit)



	Petrol	Diesel	LPG
01 - Private Cars (PC)	249999.	10727.	0.
02 - Taxi	30.	0.	73162.
03 - Light Goods Vehicles<=2.5t	56.	2303.	0.
04 - Lt Goods Vehicles 2.5-3.5t	4805.	214442.	0.
05 - Light Goods Vehicles>3.5t	0.	86446.	0.
06 - Medium Heavy Goods Vehicles<=15t	0.	50396.	0.
07 - Medium Heavy Goods Vehicles>15t	0.	132265.	0.
08 - Public Light Buses	0.	14149.	3239.
09 - Private Light Bus <=3.5t	598.	1102.	0.
10 - Private Light Bus >3.5t	5.	9324.	953.
11 - Non-franchised Bus<=6.4t	0.	10945.	0.
12 - Non-franchised Bus 6.4-15t	0.	7593.	0.
13 - Non-franchised Bus >15t	0.	13613.	0.
14 - Franchised Bus (SD)	0.	3340.	0.
15 - Franchised Bus (DD)	0.	59633.	0.
16 - Motorcycles (MC)	418759.	0.	0.
17 - <Placeholder (P1)>	0.	0.	0.
18 - <Placeholder (P2)>	0.	0.	0.
19 - <Placeholder (P3)>	0.	0.	0.
20 - <Placeholder (P4)>	0.	0.	0.
21 - <Placeholder (P5)>	0.	0.	0.

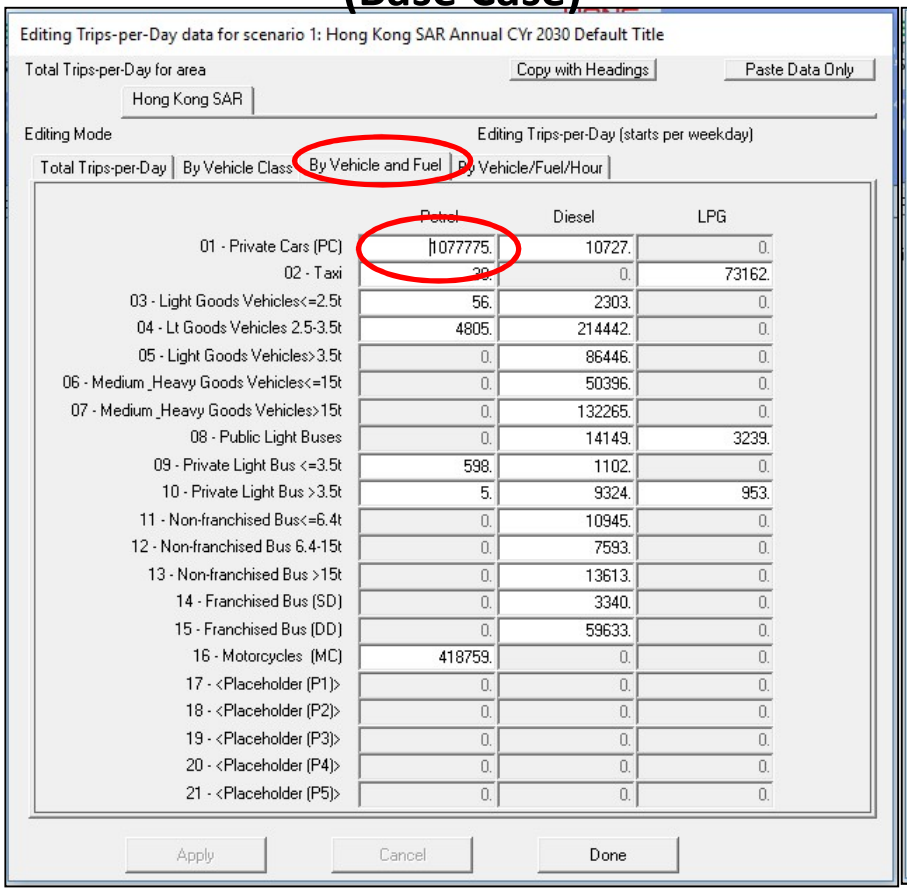
- Save input files as

HK_2030_Burden_edit Trips (conformity).inp and Run

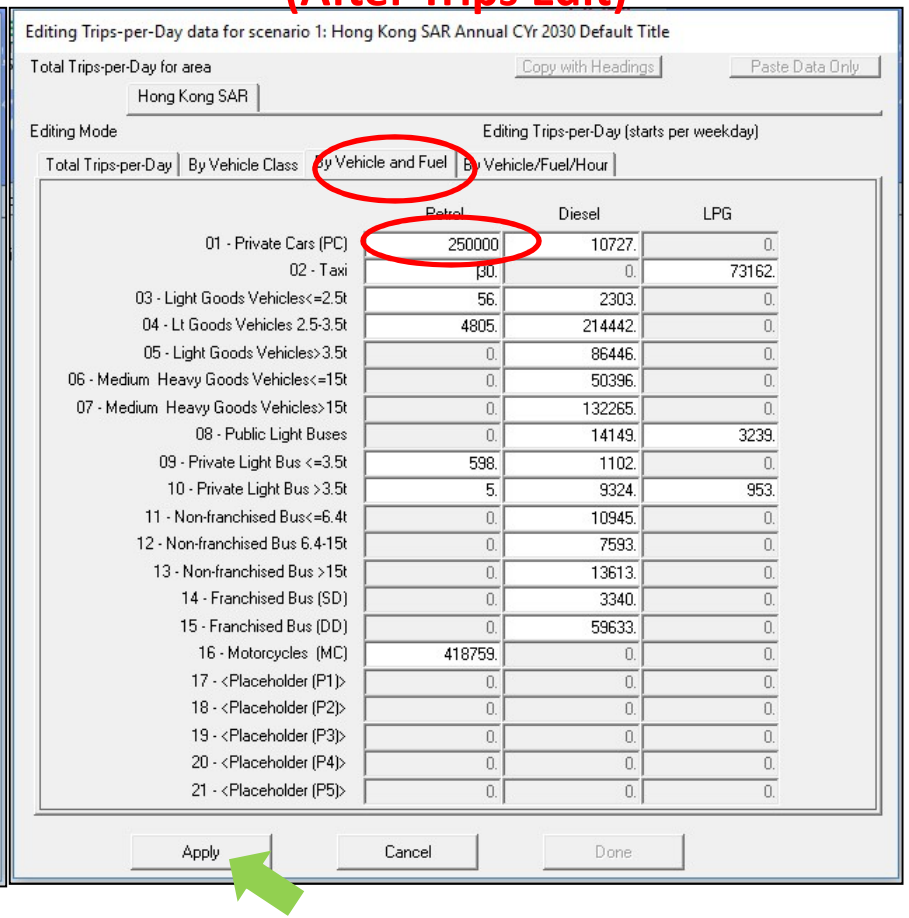
Exercise # 5b: Changing Trips (Directly)

- Create new case with scenario data same as base case

2030 Trips (Base Case)



2030 Trips (After Trips Edit)



- Save input files as

HK_2030_Burden_edit Trips (directly).inp and Run

Exercise # 5c: Solution

PC-NCAT & PC-CAT	Base	#5a: Pop-adjusted	#5b: Directly alter the Trips
Population	718,589	**166,683**	718,589
VKT	20,791,860	4,822,856	20,791,861
Trips	1,077,775	**249,999**	250,000
NOx Run Exhaust (tonne/day)	0.1820	0.0423	0.1820
NOx Start Exhaust (tonne/day)	0.0720	**0.0167**	0.0167

Notes:

Results show how altering trips via population (#5a) also alters VKT; thus, running exhaust is altered, as well.

Exercise #5b shows altering trips only reduces starting exhaust.

Exercise #6: Speed Distributions

- This exercise estimates NOx running exhaust emissions change when average speed of specific vehicle class at different time zone is altered.

- A new policy propose medium and heavy goods vehicles (HGV7 & HGV8) only travel at specific time zone and speed profile.

- 2 periods:
  - from midnight to 8 a.m.; and
  - from 10 p.m. to midnight

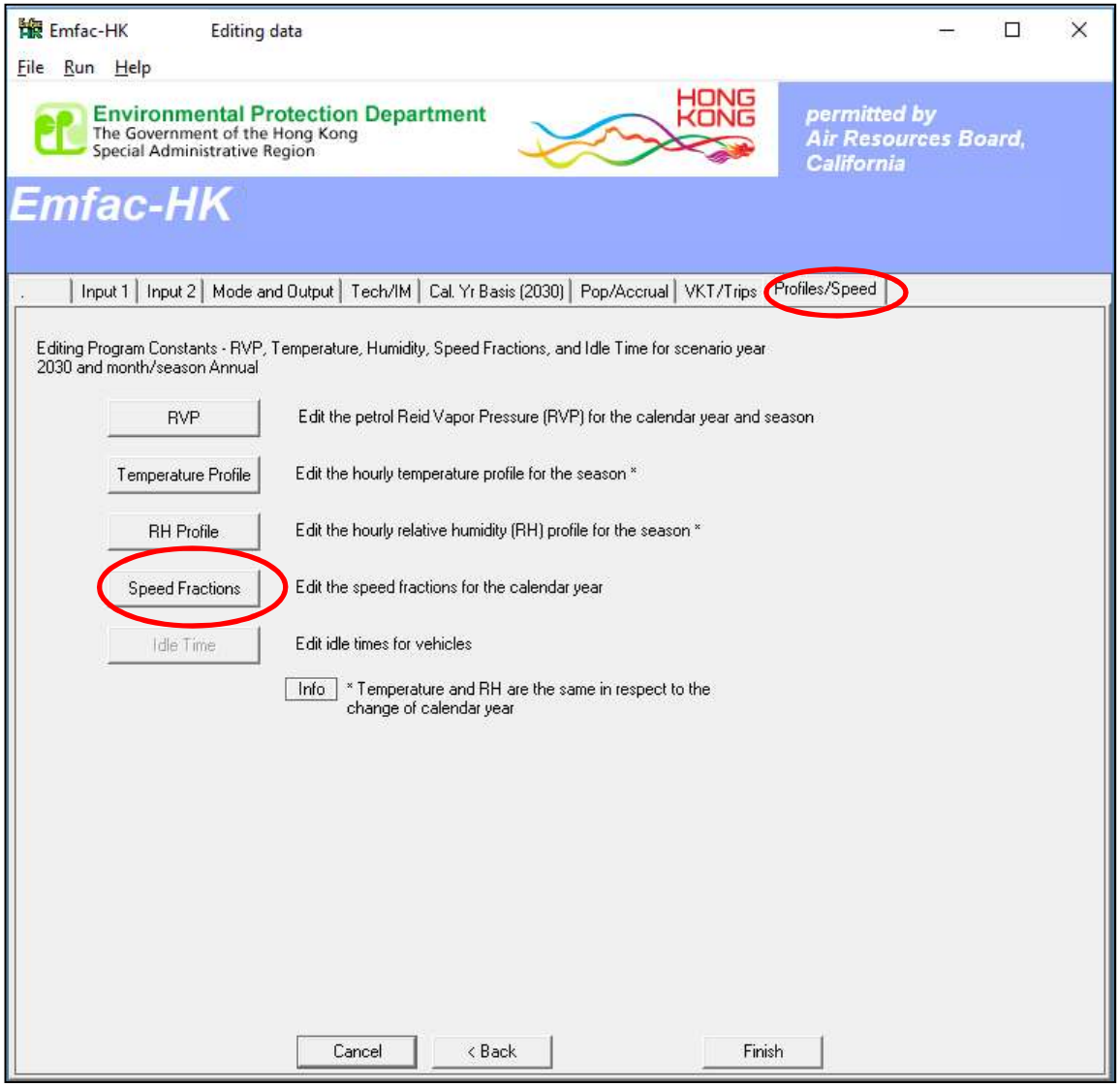
Exercise #6: Speed Distributions

- limited speed distribution:
  - 5% of the VKT occurs at average speed 1-8 km/hr (Speed Bin #1);
  - 25% at 24-32 km/hr (Speed Bin #4);
  - 20% at 48-56 km/hr (Speed Bin #7);
  - 25% at 56-64 km/hr (Speed Bin #8) and
  - 25% at 64-72 km/hr (Speed Bin #9).

Exercise # 6: Speed Distributions

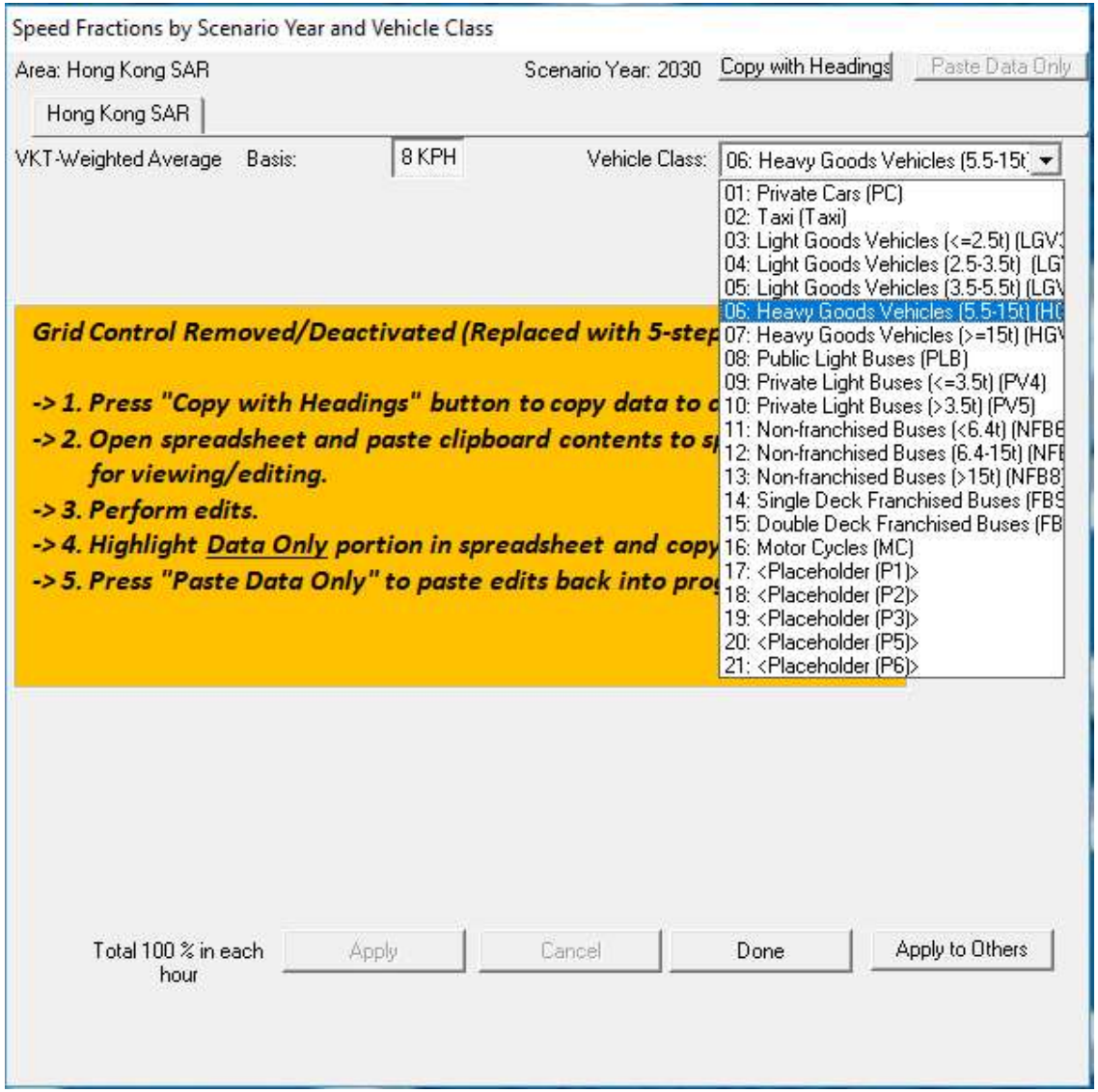
- Base Case (2030, Burden, CSV outputs)
- New case with same scenario data as base case
- Edit Speed Fractions for HGV7
- Apply same Speed Fraction for HGV8

Exercise # 6: Profiles/Speed Tab



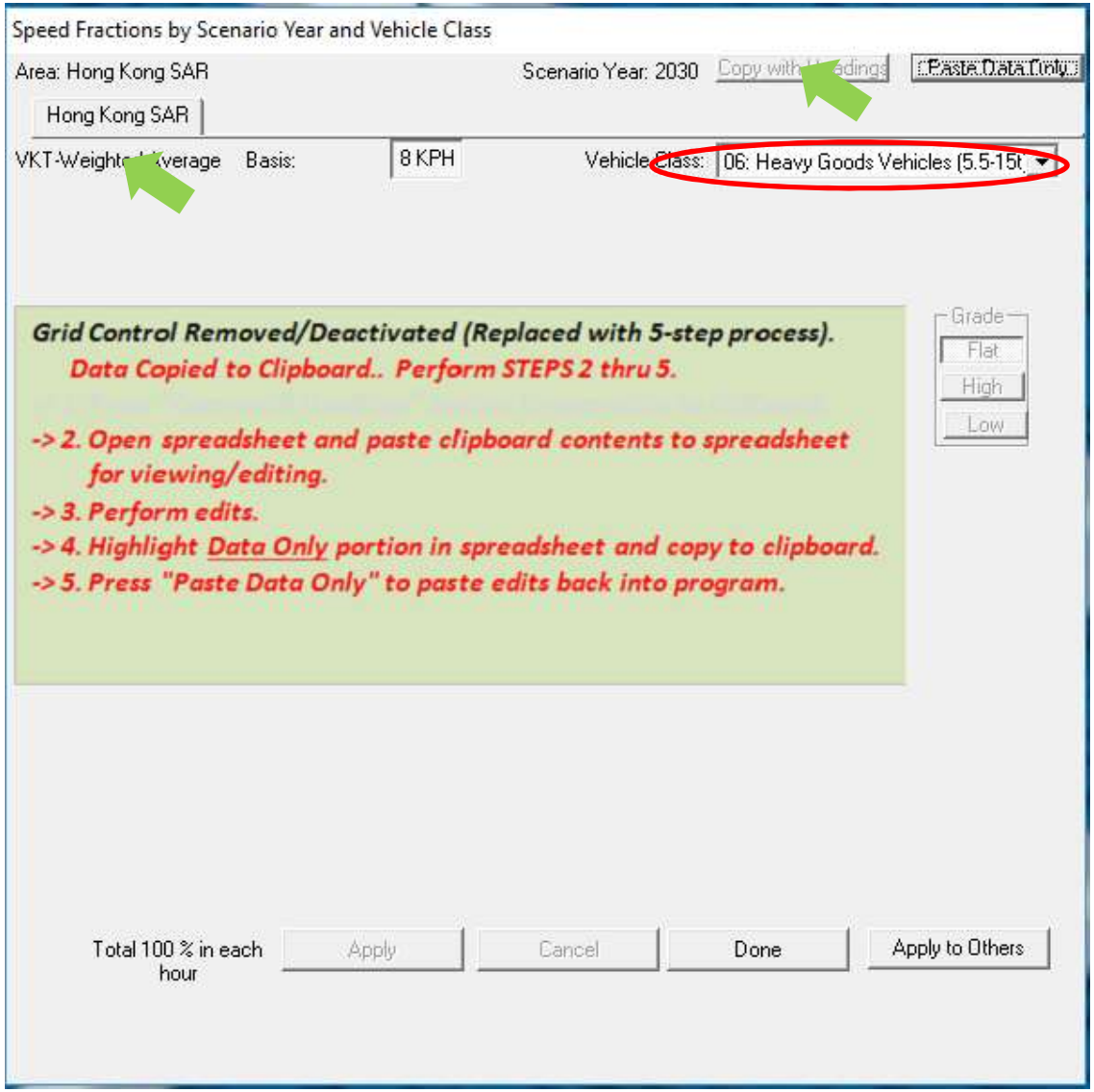
Exercise # 6: Editing Speed Fractions

1. Select Vehicle Class;



Exercise # 6: Editing Speed Fractions

1. Select Vehicle Class;
2. Click button “Copy with Headings”.
3. Open Excel worksheet and paste values



Exercise # 6: Editing Speed Fractions

Speed Bin:
1-8 km/hr
9-16
16-24
24-32
32-40
40-48
48-56
56-64
64-72
.
.
.

Hour : 00 01 02 03 04 05 06 07 08 09 10 .....

Book1 - Microsoft Excel

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Vehicle Class 06 Speed Fractions	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
2	Spd008	0	0	0	0	0	0	0	0	1.88E-03	1.88E-03	0	0	0	0	0
3	Spd016	0	0	0	0	0	0	0	0	6.64E-02	6.64E-02	0	0	0	0	0
4	Spd024	0	0	0	0	0	0	0	0	6.88E-02	6.88E-02	0	0	0	0	0
5	Spd032	0.268248	0.268248	0.268248	0.268248	0.268248	0.268248	0.268248	0.191458	0.173041	0.173041	0.191458	0.191458	0.191458	0.191458	0.191458
6	Spd040	3.74E-02	3.74E-02	3.74E-02	3.74E-02	3.74E-02	3.74E-02	3.74E-02	4.01E-02	8.15E-02	8.15E-02	4.01E-02	4.01E-02	4.01E-02	4.01E-02	4.01E-02
7	Spd048	0	0	0	0	0	0	0	0	0.192936	0.192936	0	0	0	0	0
8	Spd056	0.327716	0.327716	0.327716	0.327716	0.327716	0.327716	0.327716	0.257926	8.75E-02	8.75E-02	0.257926	0.257926	0.257926	0.257926	0.257926
9	Spd064	1.97E-02	1.97E-02	1.97E-02	1.97E-02	1.97E-02	1.97E-02	1.97E-02	3.10E-02	0.113836	0.113836	3.10E-02	3.10E-02	3.10E-02	3.10E-02	3.10E-02
10	Spd072	0.346919	0.346919	0.346919	0.346919	0.346919	0.346919	0.346919	0.479484	0.214092	0.214092	0.479484	0.479484	0.479484	0.479484	0.479484
11	Spd080	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Spd088	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Spd096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Spd104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	Spd112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	Spd120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	Spd128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Spd136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	Spd144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

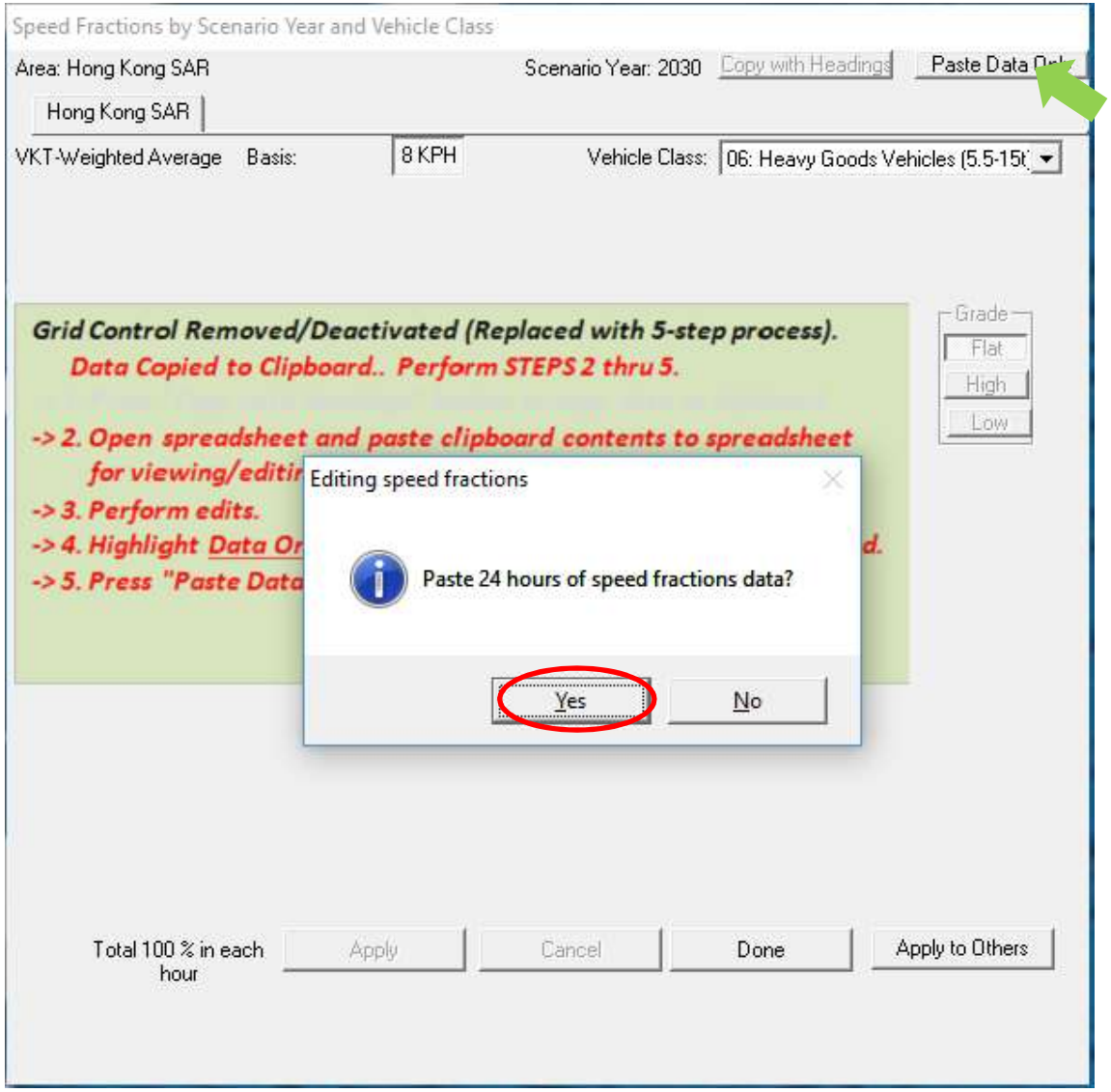
Sheet1 Sheet2 Sheet3

Ready Average: 60.57894737 Count: 475 Sum: 27624 100%

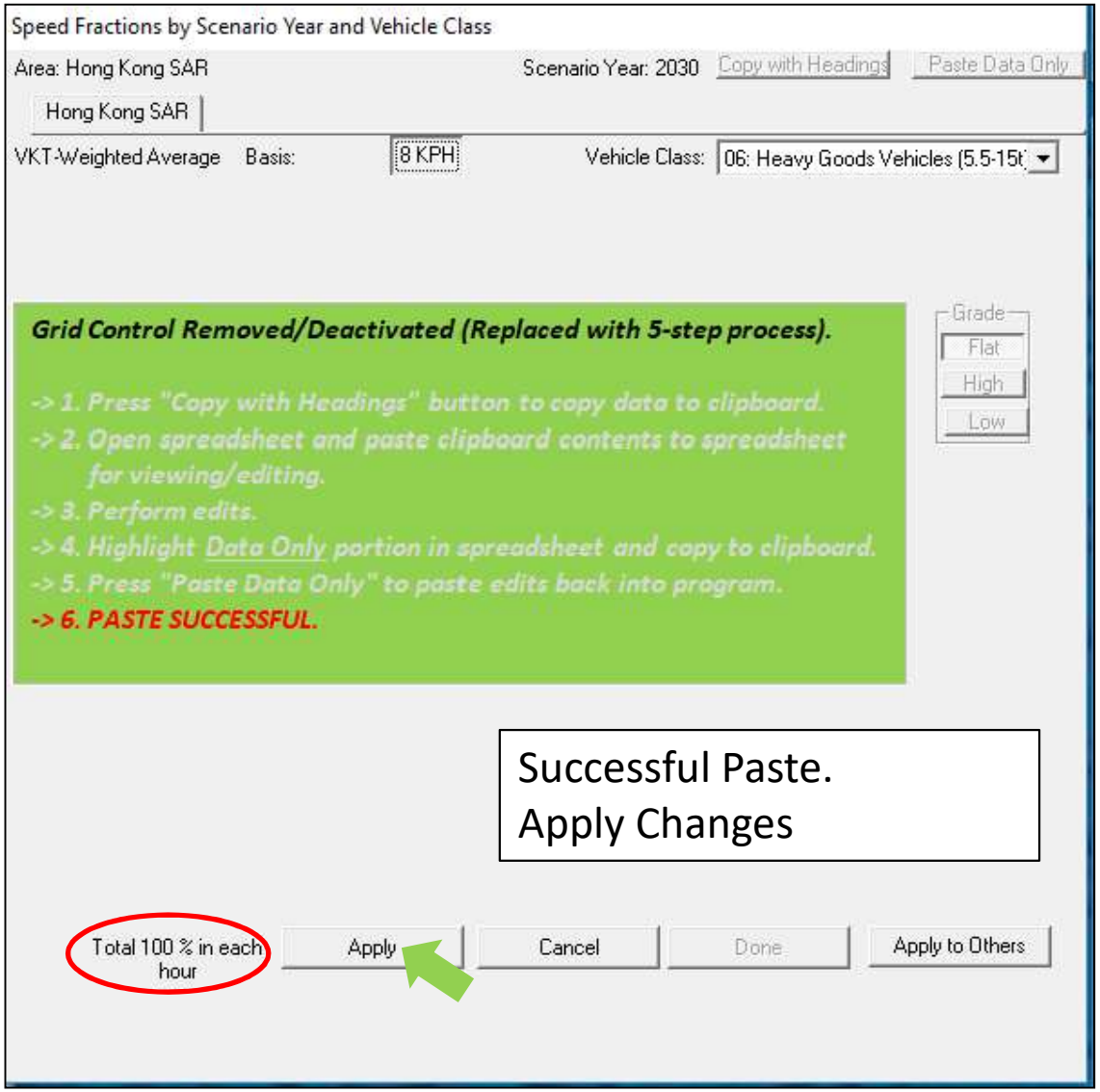
- From hour 00 to 07 (midnight to 8 a.m.) and hour 22 to 23 (10 p.m. to midnight)
- Speed Fractions:

  5% at Spd008 (1-8 km/hr); 25% at Spd032 (24-32 km/hr);
  20% at Spd056 (48-56 km/hr); 25% at Spd064 (56-64 km/hr) and
  25% at Spd072 (64-72 km/hr).

Exercise # 6: Editing Speed Fractions

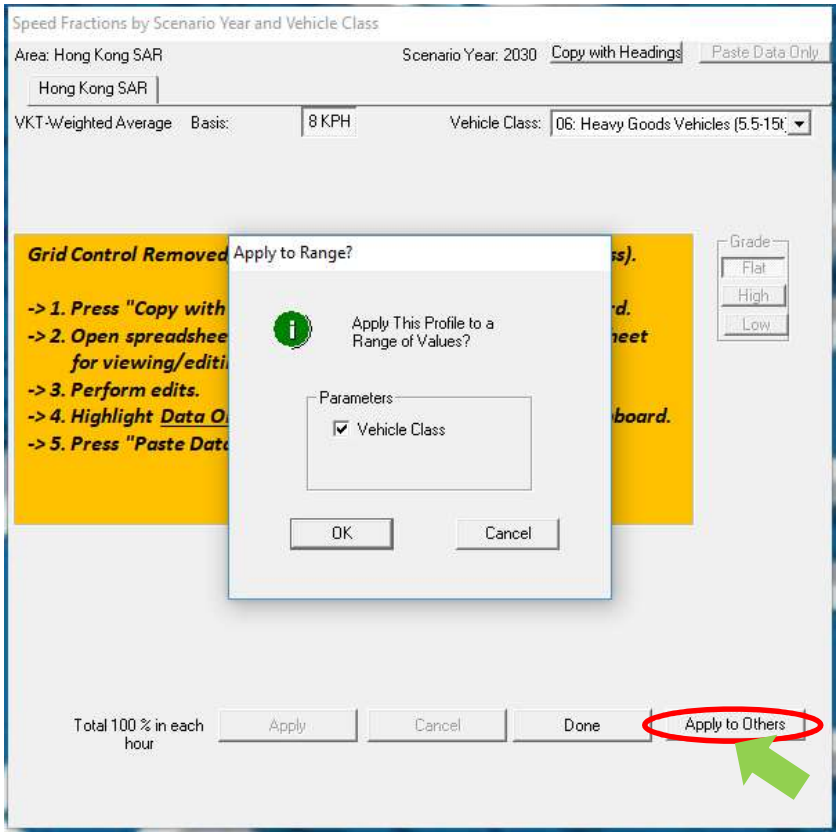


Exercise # 6: Editing Speed Fractions

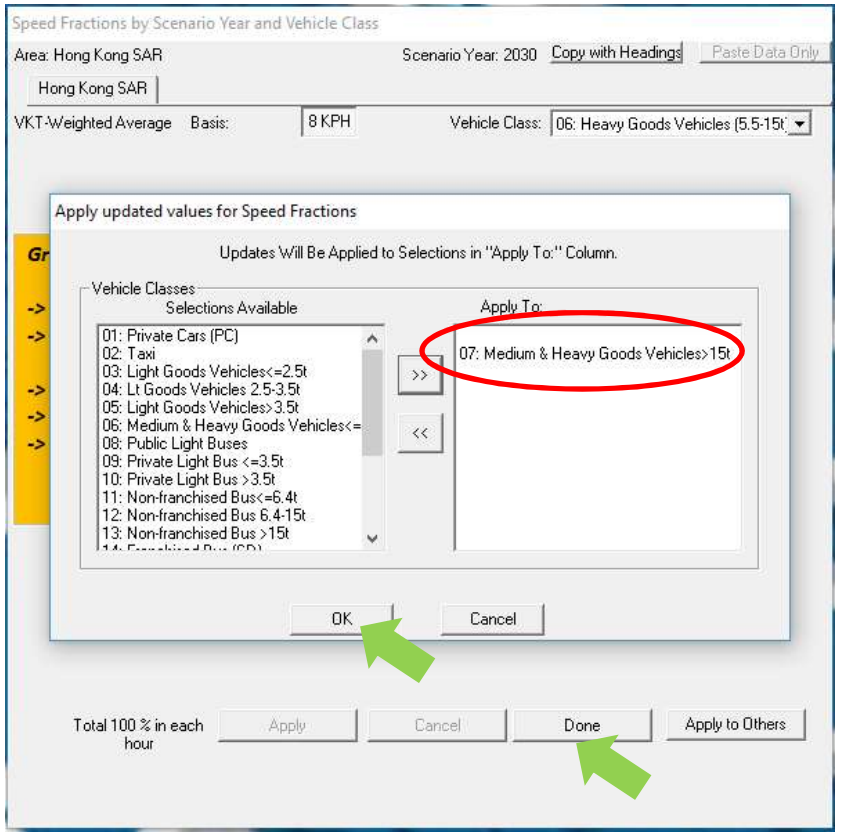


Exercise # 6: Apply Speed Fraction Edits to Other Vehicle Class

Apply to Others



Apply Edit to HGV8



Exercise # 6: Solution

Vehicle	Run Exhaust	Base	#6
HGV7	NOx	0.796	0.812
	PM	0.030	0.031
HGV8	NOx	2.523	2.604
	PM	0.171	0.173

Exercise #7: Changing Relative Humidity (RH)

- This exercise shows how to change the annual RH for individual month by editing the input file (INP).

- Monthly average RH of each hour is provided on RH.XLS.

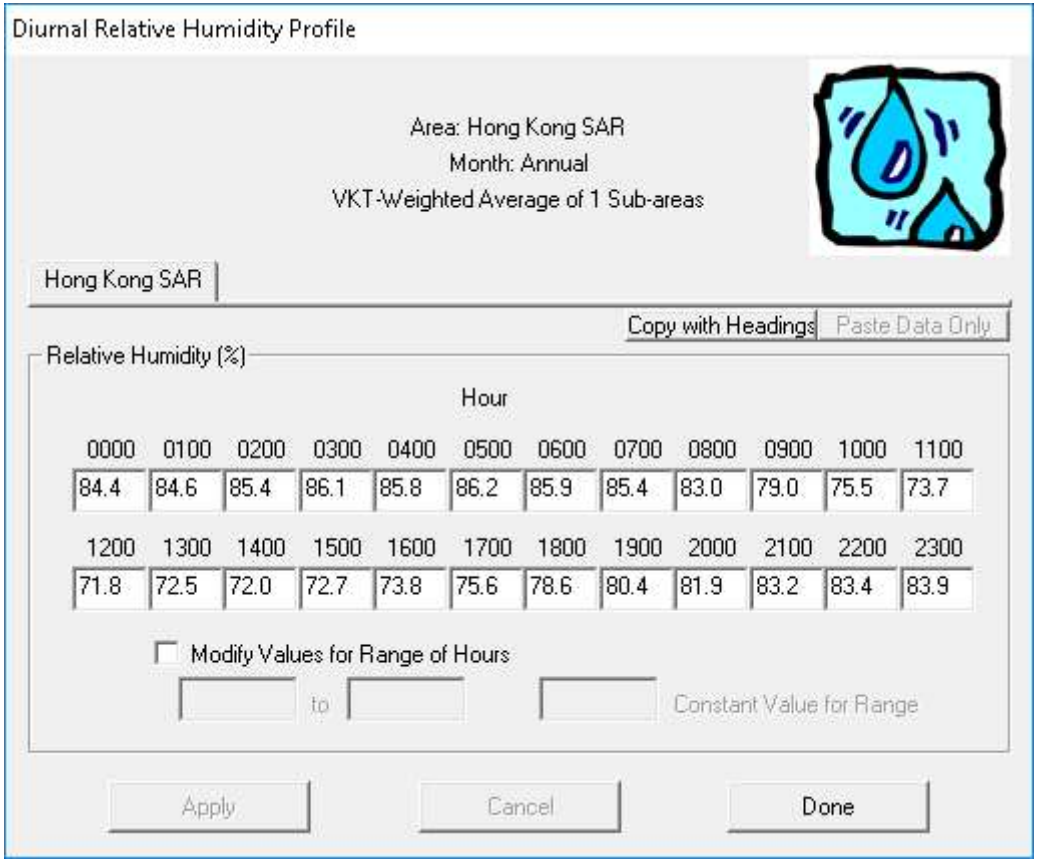
Exercise # 7: Changing RH

- Create a new case
  - Calendar Years: 2015
  - Scenario Type: BURDEN
  - Output File types: Detailed Emission Estimates (CSV)
  - Pollutants: PM10, VOC

- Alter one of the RH hour value in GUI and save as "HK_2015_Burden_edit RH.INP"

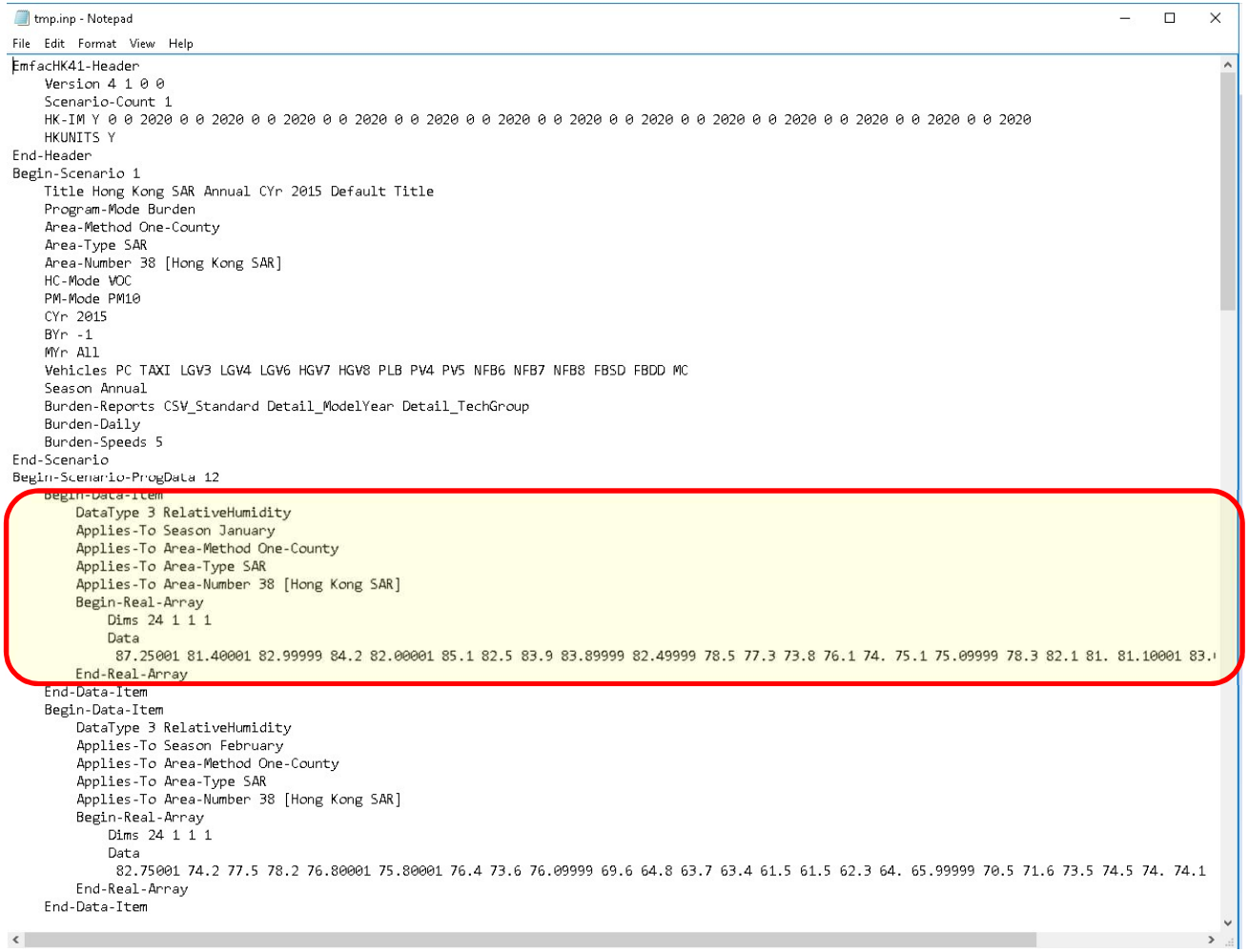
- Update RH for each month in INP

Exercise # 7: Changing RH



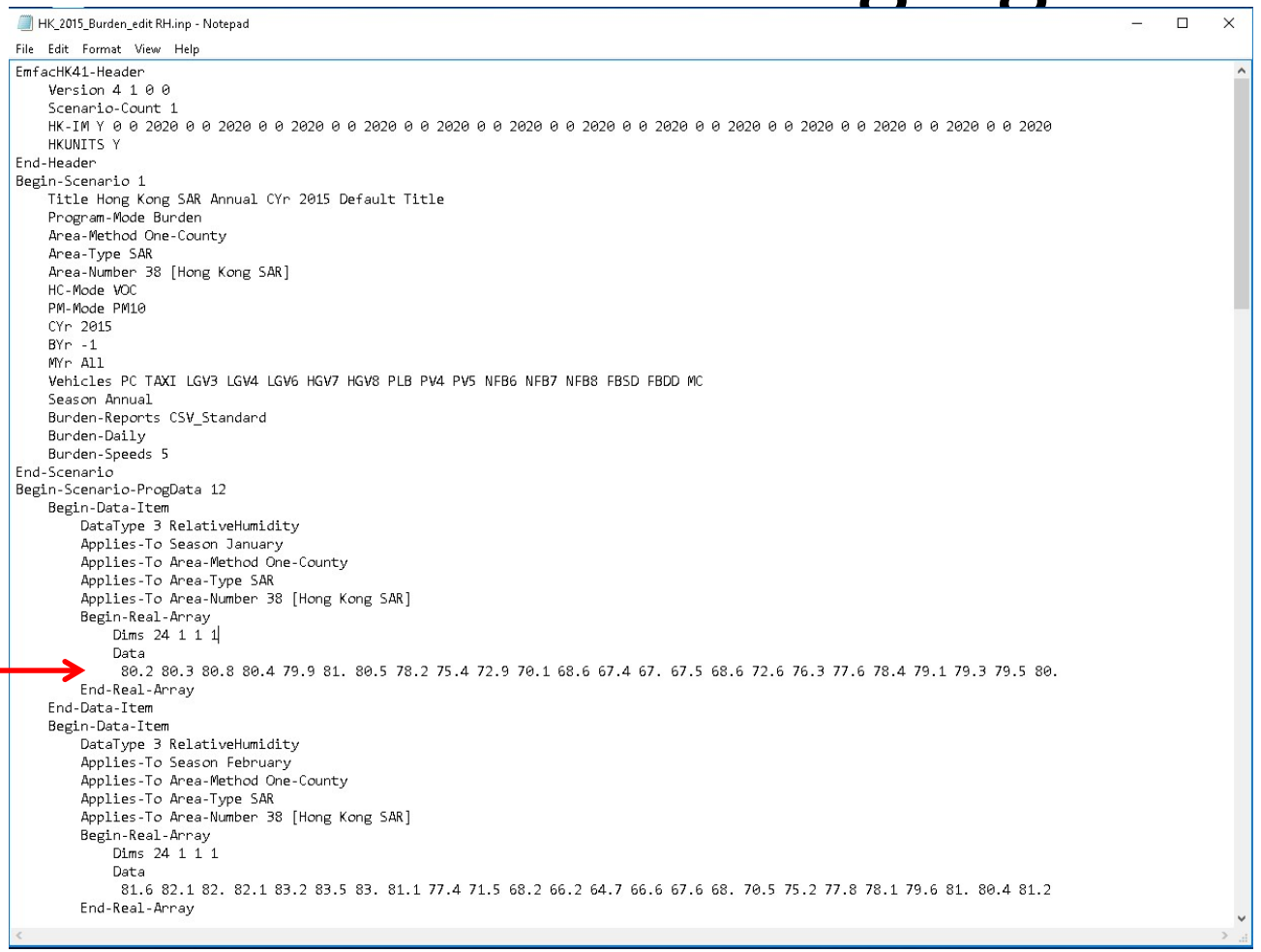
- **Alter RH to 90% at hour 0000**

Exercise # 7: Changing RH



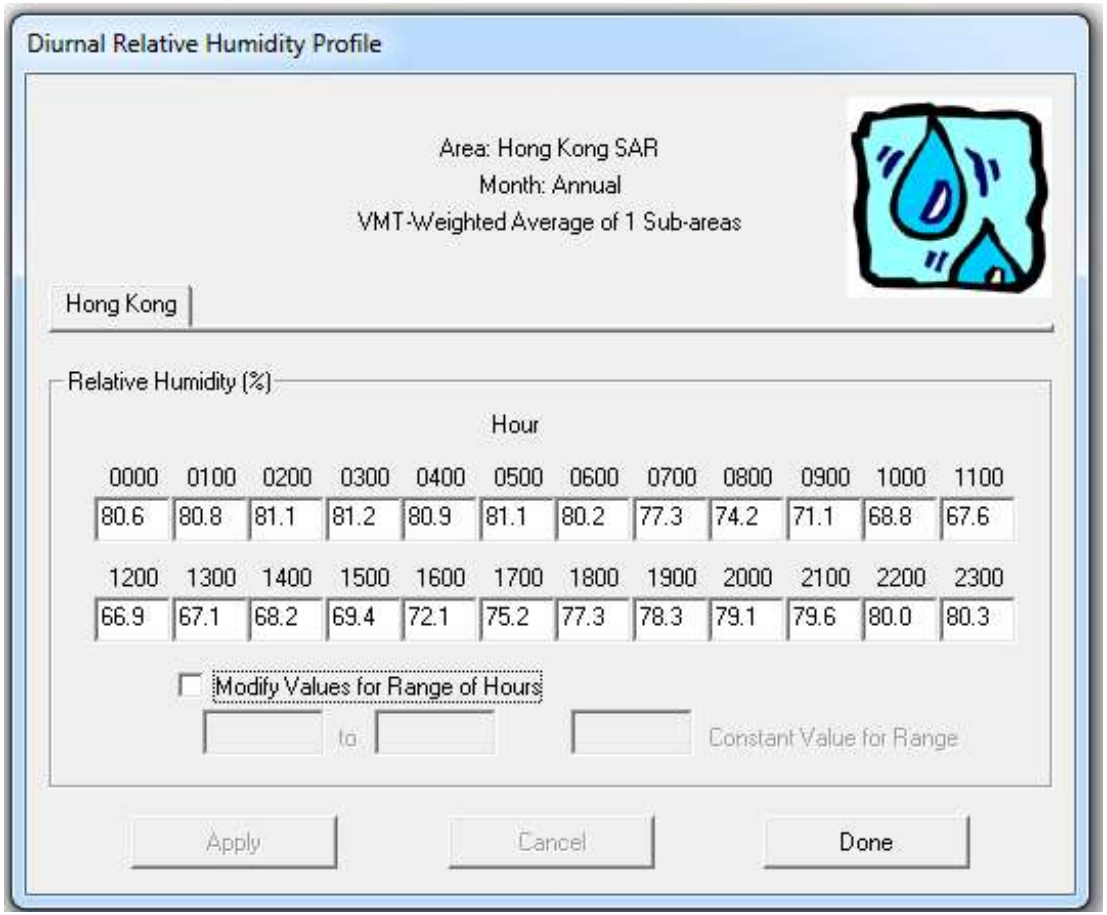
- **Update data row for each month from RH.XLS**

Exercise # 7: Changing RH



- Copy each RH values for each month from Excel and paste into INP file accordingly
- Save the INP and run

Exercise # 7: Changing RH



Advance Exercises

Exercise #8: Alternate Base Year

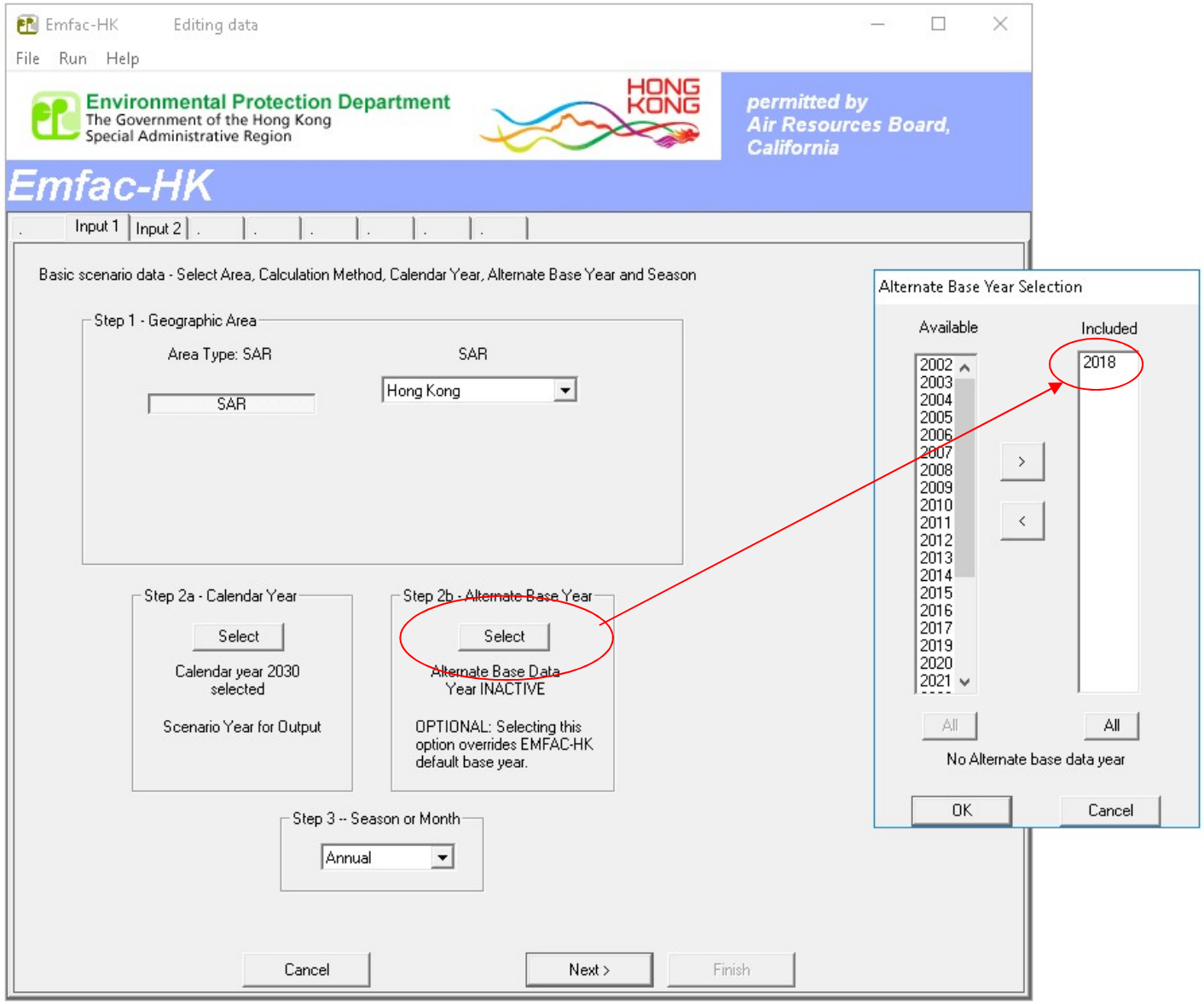
- This exercise shows how to change the alternate base year with new population; then, perform a forecast of these data.

- Scenario data:
  - Calendar year : 2030
  - Alternate base year : 2018
  - Burden; CSV output; Day; PM_{10}; VOC;

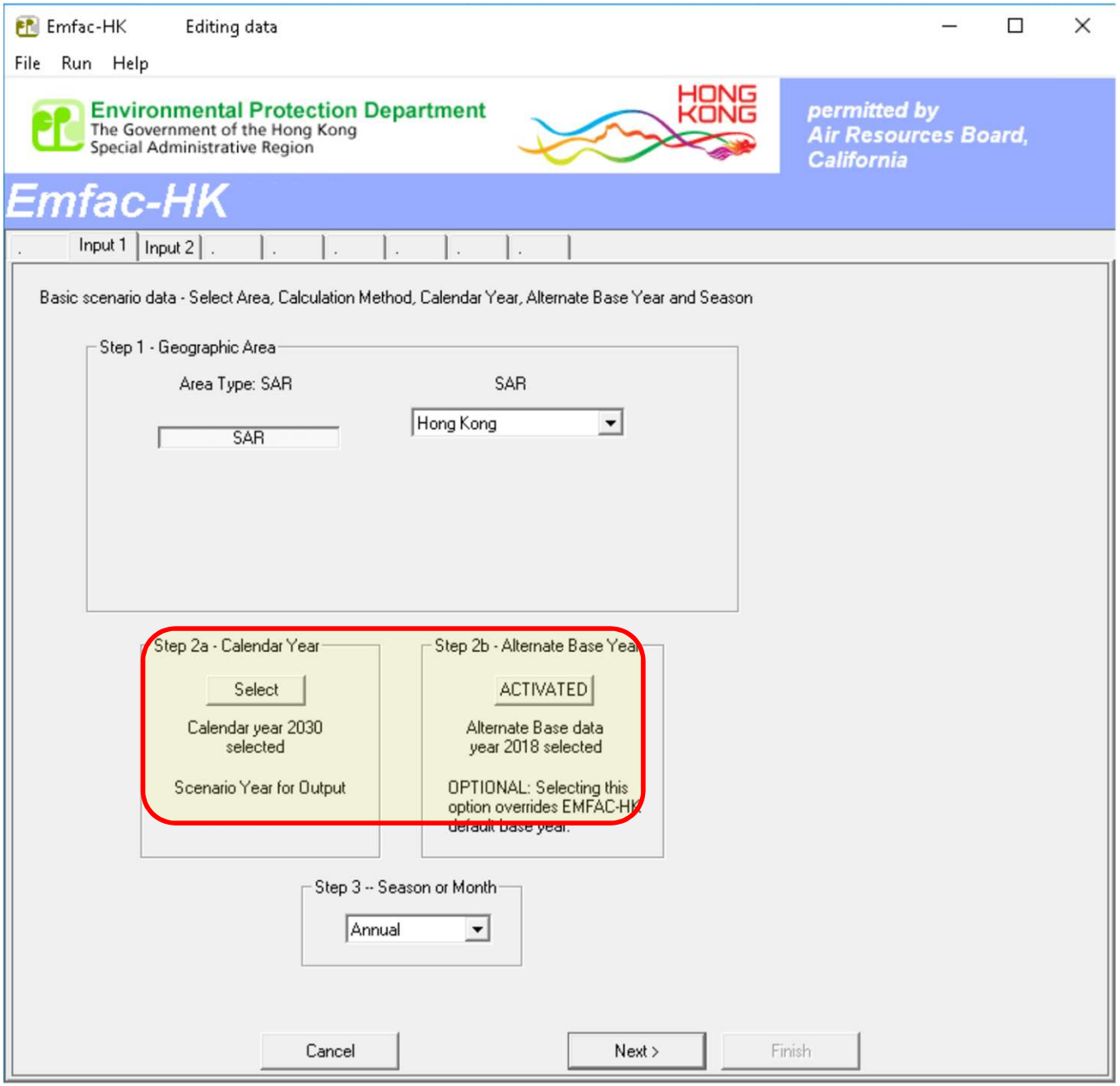
- Alter alternate base year population by 2018_Pop.XLS

Exercise # 8: Alternate Base Year

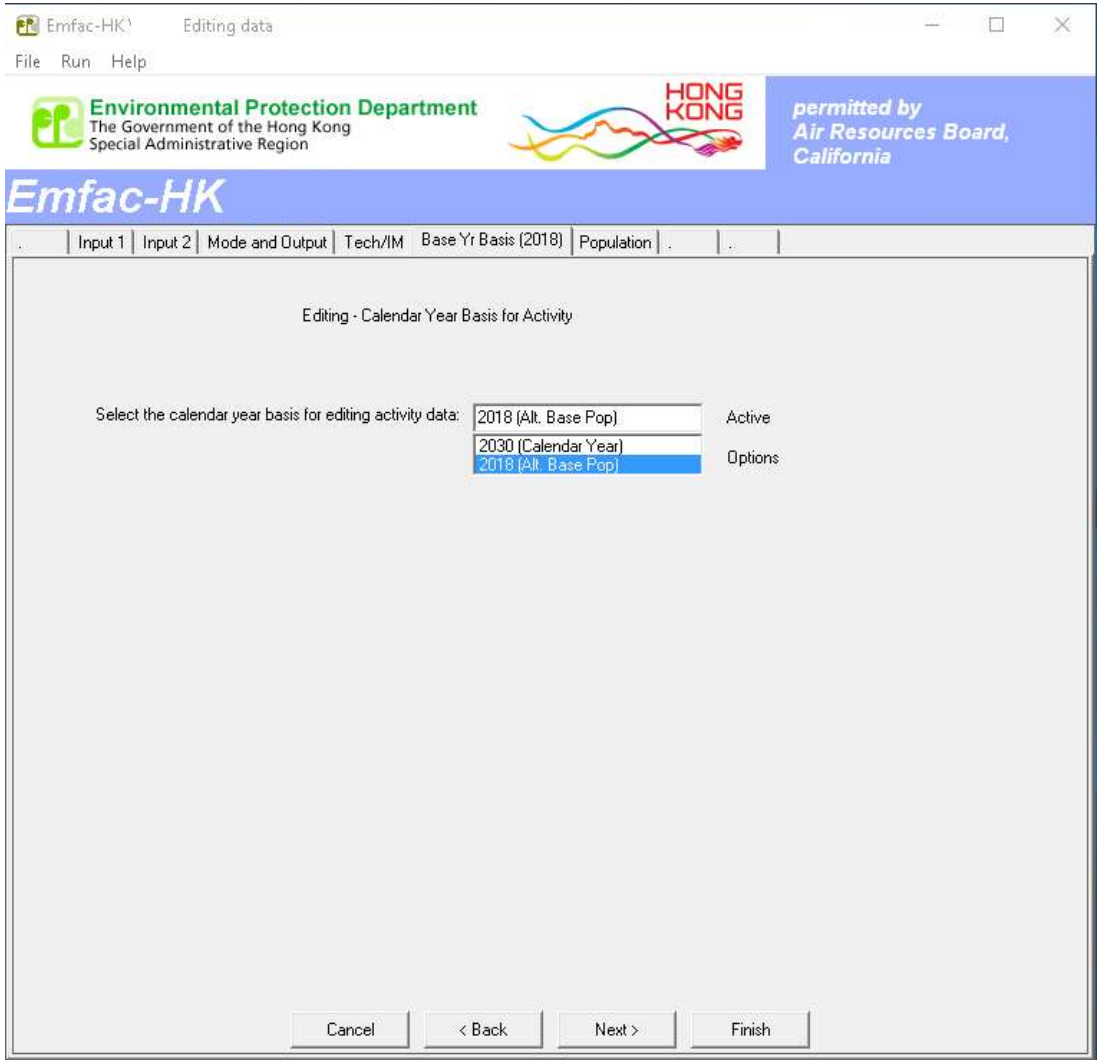
- Alternate Base Year Selection: 2018



Exercise # 8: Alternate Base Year

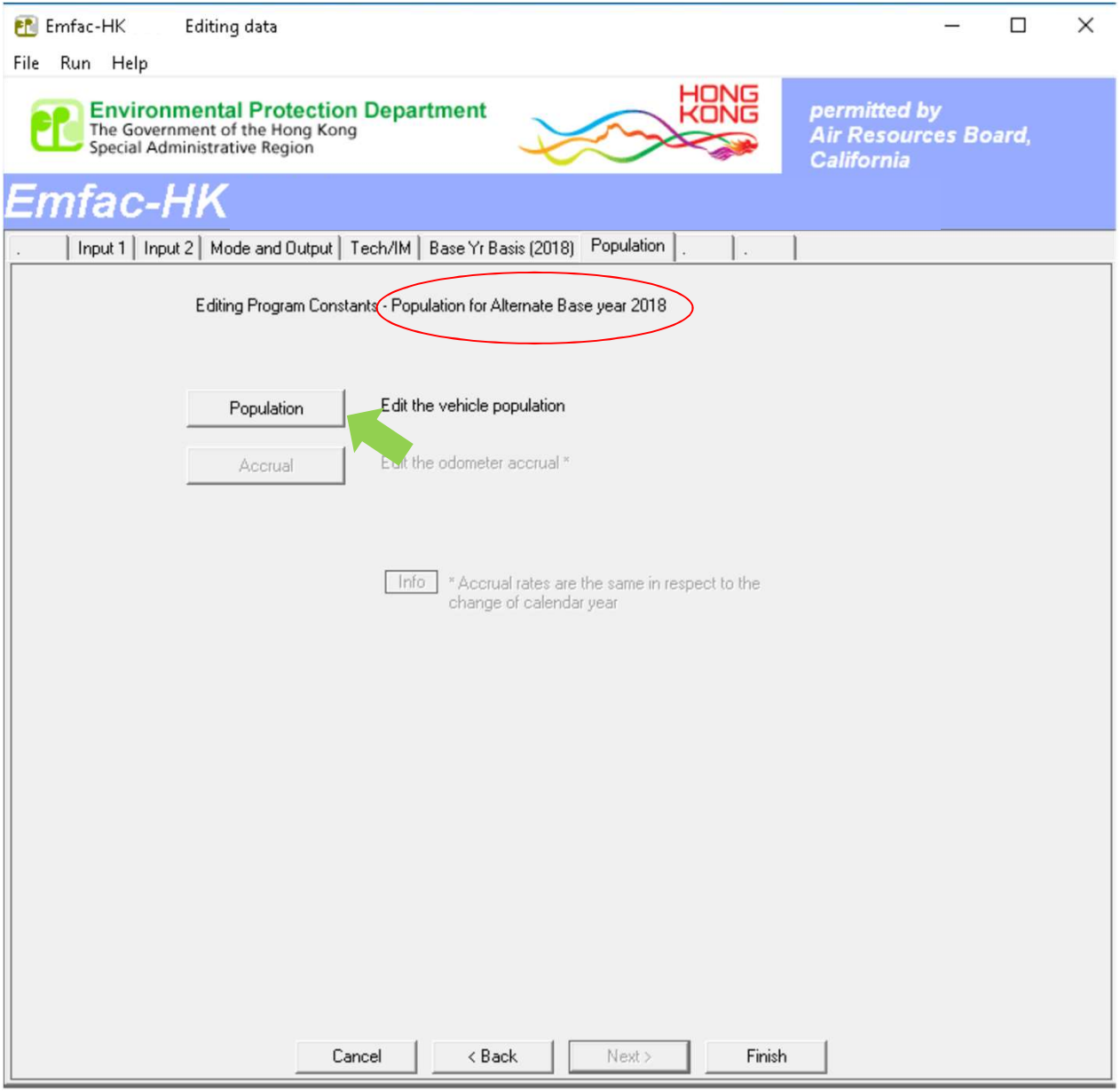


Exercise # 8: Alternate Base Year

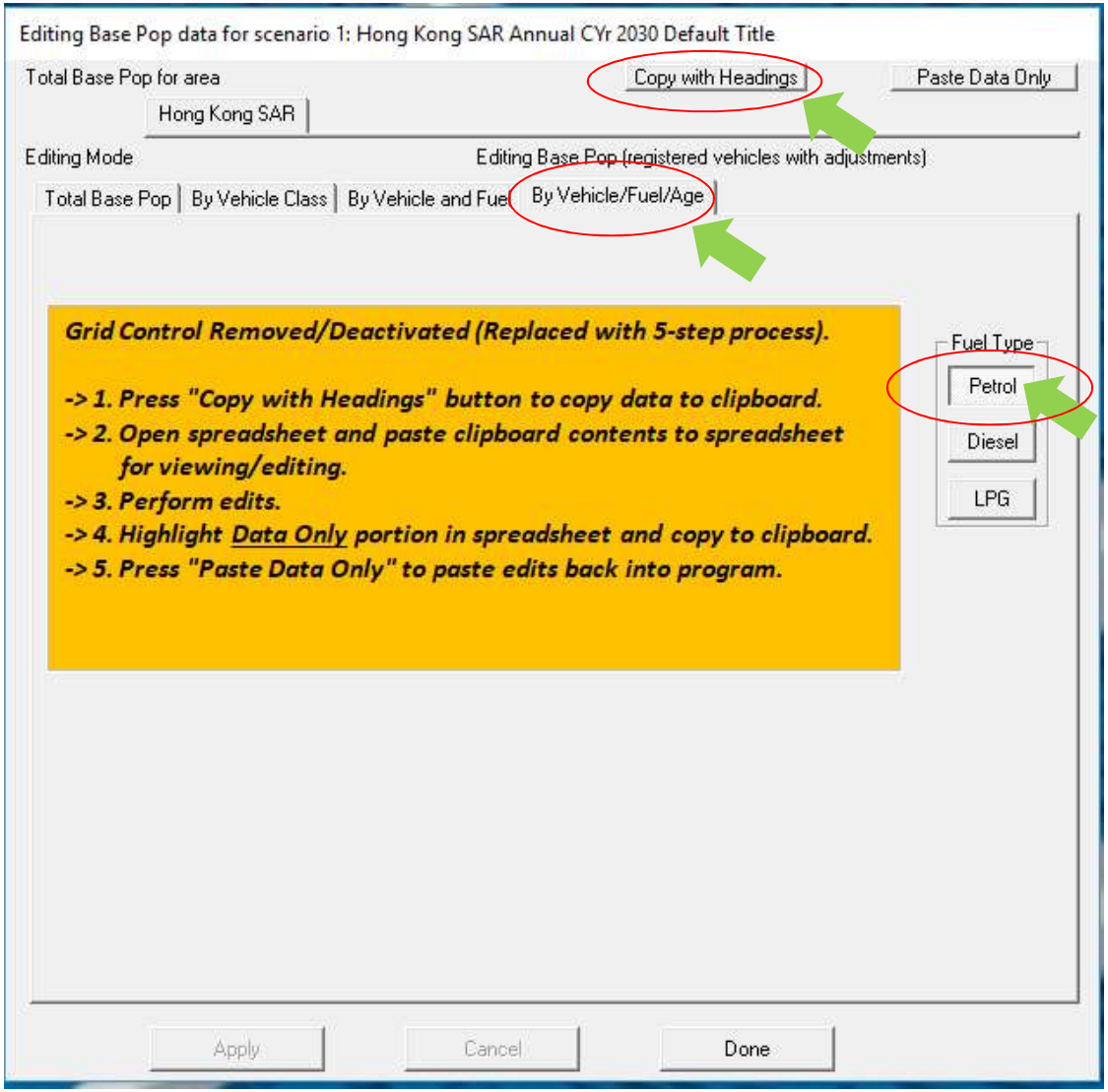


- Select “2018 (Alt. Base Pop)”

Exercise # 8: Alternate Base Year

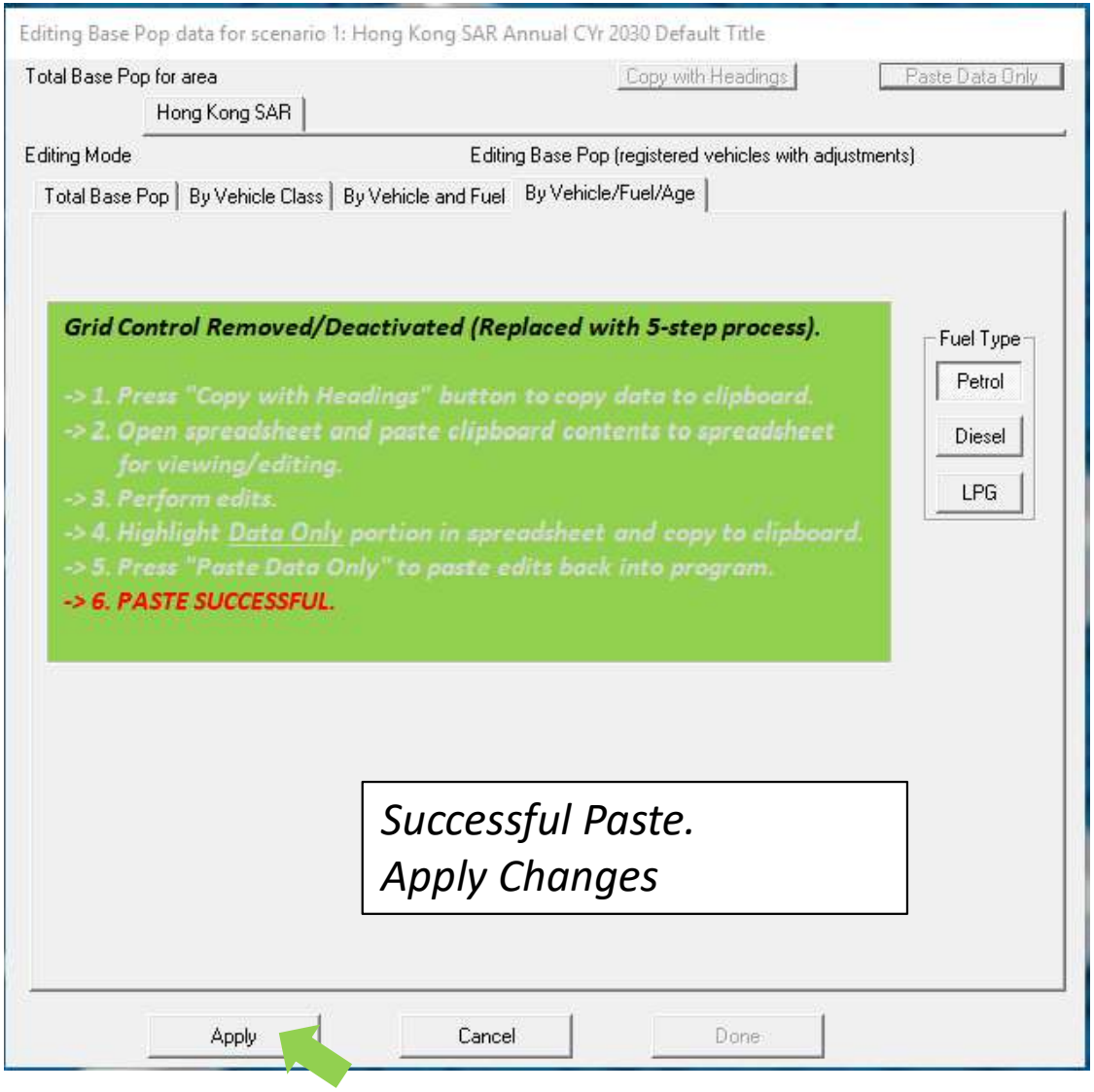


Exercise # 8: Alternate Base Year



- Select Fuel Type, Click “Copy with Headings”
- Paste value from 2018_Pop.XLS by individual fuel type

Exercise # 8: Alternate Base Year



- Repeat for the rest fuel type
- Save as HK_2030_AltBYr_2018_Burden_edit Pop.inp and run

Exercise #9: Buses Retirement

- This exercise evaluates emission changes franchised double-deck buses older than 15 years are retired from the fleet and replaced with newer buses.

- Two policies to replace retired buses:
  1. All buses older than 15 years old are replaced with brand new
  2. All buses older than 15 years old replaced with 1-5 yr-old buses

Exercise #9: Buses Retirement

- Base Cases (2035, Burden, CSV outputs)
- Copy out FBDD populations by fuel/age from GUI to worksheet and calculate the bus no. for replacement
- 2 New cases with same scenario data as base cases
- Implement different policies

Exercise #10: Link Example

- This exercise compile NOx running exhaust emission for a road using EMFAC mode.
- Create a Base case at 2030 using EMFAC mode
  - Output File types: RTL
  - Temperature: 20^{o}C
  - Relative Humidity: 70%

Exercise #10: Link Example

- Given the link information obtained for two links:
  - Compile NOx running exhaust emission factor for each vehicle class at target speed bin from RTL output;
  - Calculate the emission in gram;

Note that in this example, only running exhaust emission is calculated for simplicity. In similar fashion, other types of emissions e.g. start emissions and evaporative emissions can also be calculated with the emission factors in RTL output.

Thank you