



Briefing on EMFAC-HK Update

*Dr. Carol Wong and Mr. Louis Chan
Senior Environmental Protection Officer
Environmental Protection Department
Hong Kong SAR Government, China
December, 2017*

Outline

- Application of EMFAC-HK
- Timeline of updates of Vehicle Emission Model
- Changes made in EMFAC-HK update (V3.3.7 Beta)
- Comparison of emissions and fleet average emission factors (FAEF)
- Transitional Arrangement
- Meeting Air Quality Objectives

EMFAC-HK

- EMFAC-HK is a tool for estimating vehicle emissions with default vehicle emission factors and assumptions[#]. As the emission factors and assumptions may change over time due to new data collected, some default data become outdated. Also due to changes in policy, we will issue new version of EMFAC-HK in early part of the year when necessary .
- When using EMFAC-HK, users can apply other appropriate assumptions in estimating vehicle emissions to suit their projects/purpose. It is the user's responsibility to justify the assumptions used.
- The users should explain why the default values[#] of EMFAC-HK are applicable to their case and how robust their assessments are.

Outline

- Application of EMFAC-HK
- **Timeline of updates of Vehicle Emission Model**
- Changes made in EMFAC-HK update (V3.3.7 Beta)
- Comparison of emissions and fleet average emission factors (FAEF)
- Transitional Arrangement
- Meeting Air Quality Objectives

Timeline of updates of Vehicle Emission Model

- Updated default base year to 2015
- Updated Emission Factors ...

- Change compiler
 - some parts of GUI will be changed
- Allow more customized inputs
- Output cannot be used for any assessment.

- Under Development

EMFAC-HK
v3.3
Released:
Jan 2017

**EMFAC-HK
v3.4
To be
Released:
Jan 2018**

EMFAC-HK
V4.x Alpha
To be Released:
First Half 2018

EMFAC-HK
v4.x
To be Released:
Jan 2019

...

*Next Generation
Model
To be Released:
202X*

- Updated Euro VI schedule
- Fixed a bug on NOx for CAT-replaced taxis
- Updated PC & MC emission factors
- Applied A/C correction factors to High/Super emitters...

- Update emission factors, ...
- Output will be used for assessment.

Outline

- Application of EMFAC-HK
- Timeline of updates of Vehicle Emission Model
- **Changes made in EMFAC-HK update (V3.3.7 Beta)**
- Comparison of emissions and fleet average emission factors (FAEF)
- Transitional Arrangement
- Meeting Air Quality Objectives

Changes in v3.3.7 Beta

- Fixed a bug related to NOx emissions of those taxis with its catalytic converters replaced under the Subsidy Programme for the Replacement of Catalytic Converters and Oxygen Sensors on LPG/petrol taxi and LPG light bus
- Updated Euro 6/VI implementation schedule
- Changed population forecast of private cars (PC) (no growth in diesel)
- Updated PC & MC population growth rates obtained from TD
 - Their growths are slower in long term

Changes in v3.3.7 Beta

- Disabled the capability of changing the effect of the existing I/M program*
 - put its effects into the model.
- Added the capability for the user to move the fractions of high/super emitters to normal emitters
 - This allows users to customize possible future improvements due to any new I/M measures.
- Applied A/C# correction factors from only normal emitters to all emitters
- Updated basic emission rates (BERs) of PC and MC by making reference to EMFAC2014
- Revised forecast on the population distributions for taxi and public light bus (PLB)
- The Strengthened Emissions Control for Petrol and LPG Vehicles (an I/M program using remote sensing and dyno testing)
- # air conditioning

Changes in Implementation Dates of Vehicle Emission Standards

Current EMFAC-HK (V3.3)

Vehicle Class\ Fuel Type		Euro VI		
		LPG	Petrol	Diesel
Private Car		NA	1.7.17	
Goods Vehicle	<= 3.5t		1.1.18	
	>3.5 t			
Bus	<= 9 t	NA	No schedule	
	>9 t		1.1.18	
Light Bus	<= 3.5t	1.1.18		
	>3.5 t	No schedule		
Taxi		1.7.17		NA

EMFAC-HK update (V3.3.7 Beta)

Vehicle Class\ Fuel Type		Euro VI		
		LPG	Petrol	Diesel
Private Car		NA	1.7.17	1.10.17 [#]
Goods Vehicle	<= 3.5t		1.1.18	
	>3.5 t		1.10.18	
Bus	<= 9 t	NA	No schedule	
	>9 t		1.10.18	
Light Bus	<= 3.5t	1.1.18		
	>3.5 t	No schedule		
Taxi		1.7.17		NA

Emfac-HK homepage, Appendix III

Notes: [#] HK adopted California LEV 3 Standards on 1 October 2017.

Changes in Implementation Dates of Vehicle Emission Standards

Current EMFAC-HK (V3.3)

Vehicle Class\Fuel Type	Euro IV		
	LPG	Petrol	Diesel
Motorcycle	NA	1.1.2019*	

EMFAC-HK update (V3.3.7 Beta)

Vehicle Class\Fuel Type	Euro IV		
	LPG	Petrol	Diesel
Motorcycle	NA	No Schedule	

Emfac-HK homepage, Appendix III

Changes in Exhaust Tech Group

Descriptions are Changed on three Tech Groups:

Vehicle Class	Vehicle Emission Standards	Technology Group Index
Taxi	Euro 2 & 3	25
Taxi	Euro 2 & 3 CAT Replaced	19
Motorcycle	Euro 3- 4	277

Comparison of Current EMFAC-HK V3.3 & EMFAC-HK update(V3.3.7 Beta)

Emission Factor Related

EMFAC-HK V3.3	EMFAC-HK V3.3.7 (Beta)
ZMEFs and DRs of MC and start emissions only for PC are estimated by making reference to older versions of EMFAC, with ratio up/down according to emission standards.	Updated ZMEFs and DRs for <ul style="list-style-type: none">• PC start emissions for all gaseous pollutants and all PM emissions for PC by making reference to EMFAC2014• NOx for Euro 3 MC, by equalizing high and normal emitters (i.e. removed high emitters)
Only applied A/C correction factors to normal emitters	Applied A/C correction factors to all emitters.
Different NOx speed correction factors (SCFs) were used for normal and high emitters of Euro V goods vehicles of 5.5 – 15 t (HGV7) with SCR.	Revised NOx SCF of high emitters of Euro V HGV7 with SCR to be the same as those of normal emitters.

Comparison of Current EMFAC-HK V3.3 & EMFAC-HK update(V3.3.7 Beta)

Modelling Methodology Related

EMFAC-HK V3.3	EMFAC-HK V3.3.7 (Beta)
Population Forecast: <ul style="list-style-type: none">All except franchised buses used a smoothing function to mitigate sharp new sales in population forecast.	Population Forecast: <ul style="list-style-type: none">For Taxi & PLB, disabled the smoothing function in mitigating sharp new sales in population forecast.
Tech Group description: Taxi (TG25) is “Euro 3” Taxi (TG19) is “Euro 3 CAT Replaced” MC (TG277) is “Euro 3 & 4”	Tech Group description: Revised Taxi (TG25) to “Euro 2 & 3” Revised Taxi (TG19) to “Euro 2 & 3 CAT Replaced” Revised MC (TG277) to “Euro 3”

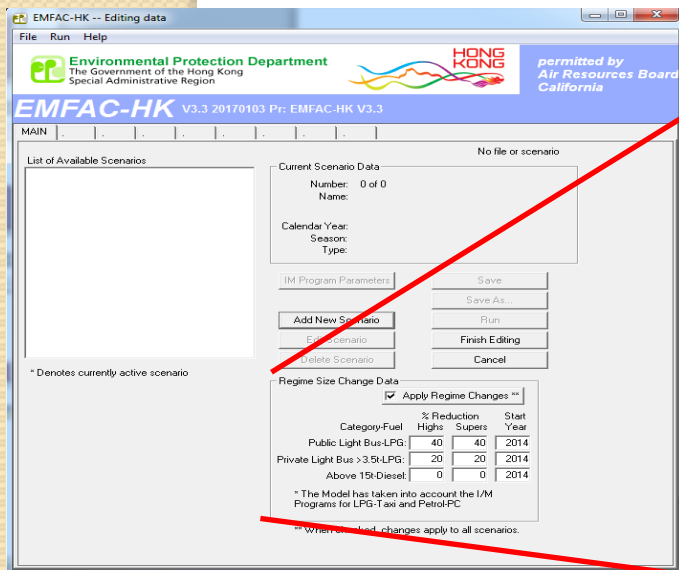
Comparison of Current EMFAC-HK V3.3 & EMFAC-HK update(V3.3.7 Beta)

Policy Related

EMFAC-HK V3.3	EMFAC-HK V3.3.7 (Beta)
Euro VI implementation dates are as of January 2017	Updated Euro VI implementation dates according to legislative amendments
For the existing I/M program (remote sensing and dyno testing), allowed users to modify the regime reduction parameters (default are 40% & 20% for light buses) from either GUI or input files.	For the existing I/M program (remote sensing and dyno testing), the default regime reductions are built-in to the model.
	Replaced GUI for the Existing I/M program by GUI for additional I/M programs defined by users. Defaults are zero reduction [#] .

[#]In the updated version, EMFAC-HK will not run with input files generated from EMFAC-HK v3.3, unless user chooses to accept the new default I/M values by clicking “OK” in a pop-up window.

I/M Editor in v3.3



Regime Size Change Data

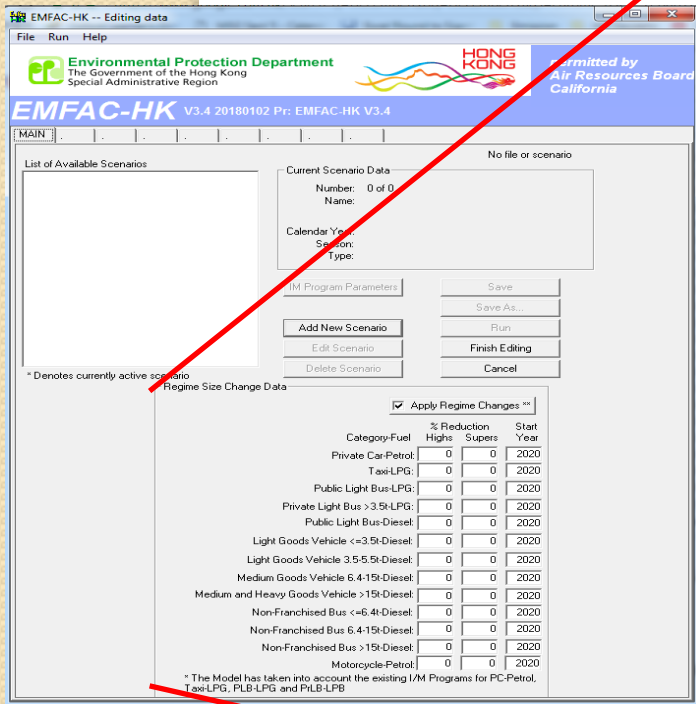
☒ Apply Regime Changes **

Category-Fuel	% Reduction		Start Year
	Highs	Supers	
Public Light Bus-LPG:	40	40	2014
Private Light Bus >3.5t-LPG:	20	20	2014
Above 15t-Diesel:	0	0	2014

* The Model has taken into account the I/M Programs for LPG-Taxi and Petrol-PC

** When checked, changes apply to all scenarios.

I/M Editor in v3.3.7 Beta



Regime Size Change Data

☒ Apply Regime Changes *

Category-Fuel	% Reduction		Start Year
	Highs	Supers	
Private Car-Petrol:	0	0	2020
Taxi-LPG:	0	0	2020
Public Light Bus-LPG:	0	0	2020
Private Light Bus >3.5t-LPG:	0	0	2020
Public Light Bus-Diesel:	0	0	2020
Light Goods Vehicle <=3.5t-Diesel:	0	0	2020
Light Goods Vehicle 3.5-5.5t-Diesel:	0	0	2020
Medium Goods Vehicle 6.4-15t-Diesel:	0	0	2020
Medium and Heavy Goods Vehicle >15t-Diesel:	0	0	2020
Non-Franchised Bus <=6.4t-Diesel:	0	0	2020
Non-Franchised Bus 6.4-15t-Diesel:	0	0	2020
Non-Franchised Bus >15t-Diesel:	0	0	2020
Motorcycle-Petrol:	0	0	2020

* The Model has taken into account the existing I/M Programs for PC-Petrol, Taxi-LPG, PLB-LPG and PrLB-LPB

Comparison of Current EMFAC-HK V3.1.1 & EMFAC-HK update(V3.3.7 Beta)

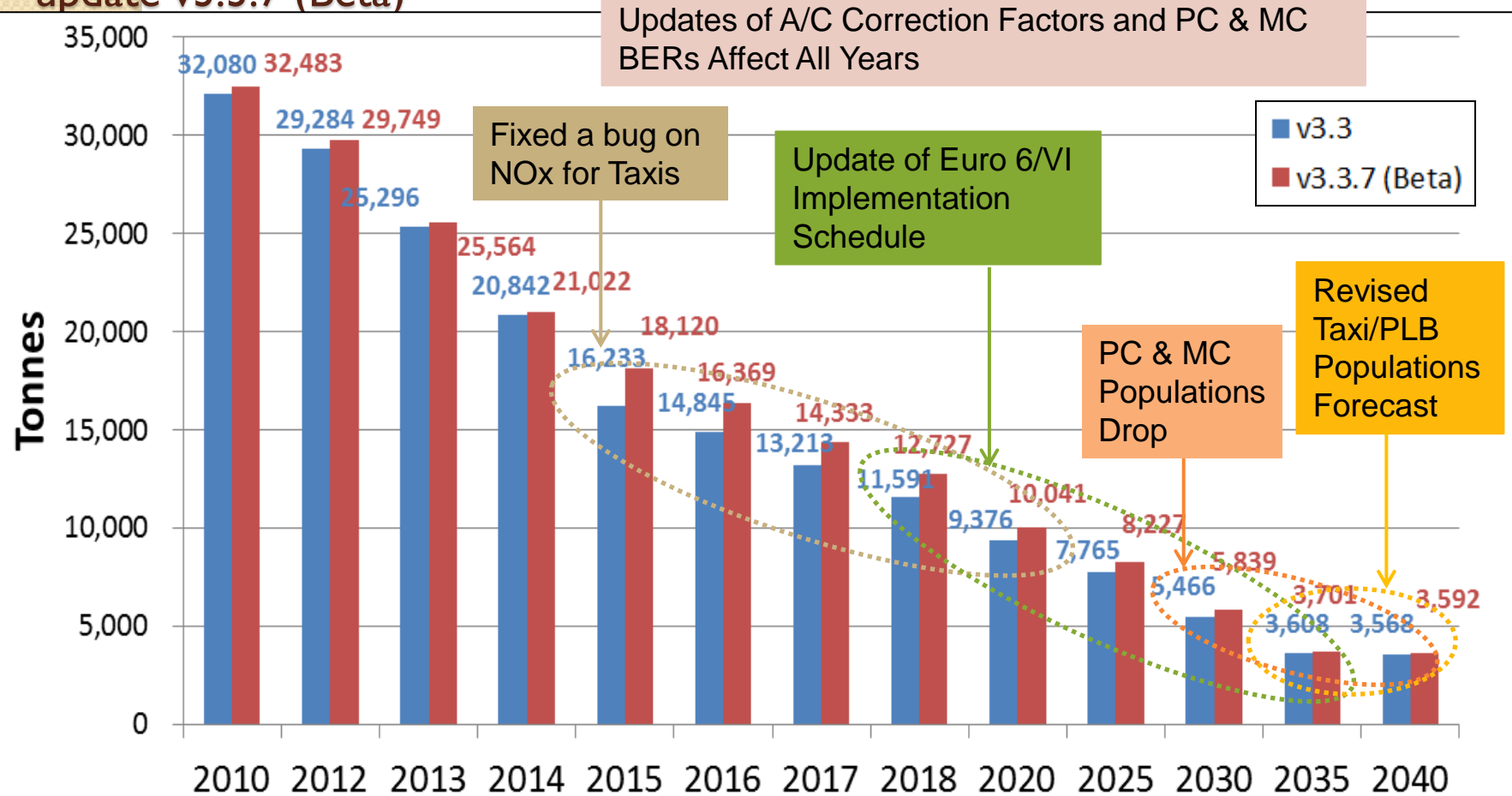
Activity Related

EMFAC-HK V3.3	EMFAC-HK V3.3.7 (Beta)
<p>Population</p> <ul style="list-style-type: none">• Used projected growth rates from TD as of August, 2015• Diesel PC new sales according to its fraction in 2015 model year	<p>Population</p> <ul style="list-style-type: none">• Updated projected PC & MC growth rates from TD as of September, 2017• Set zero growth for diesel PC

Outline

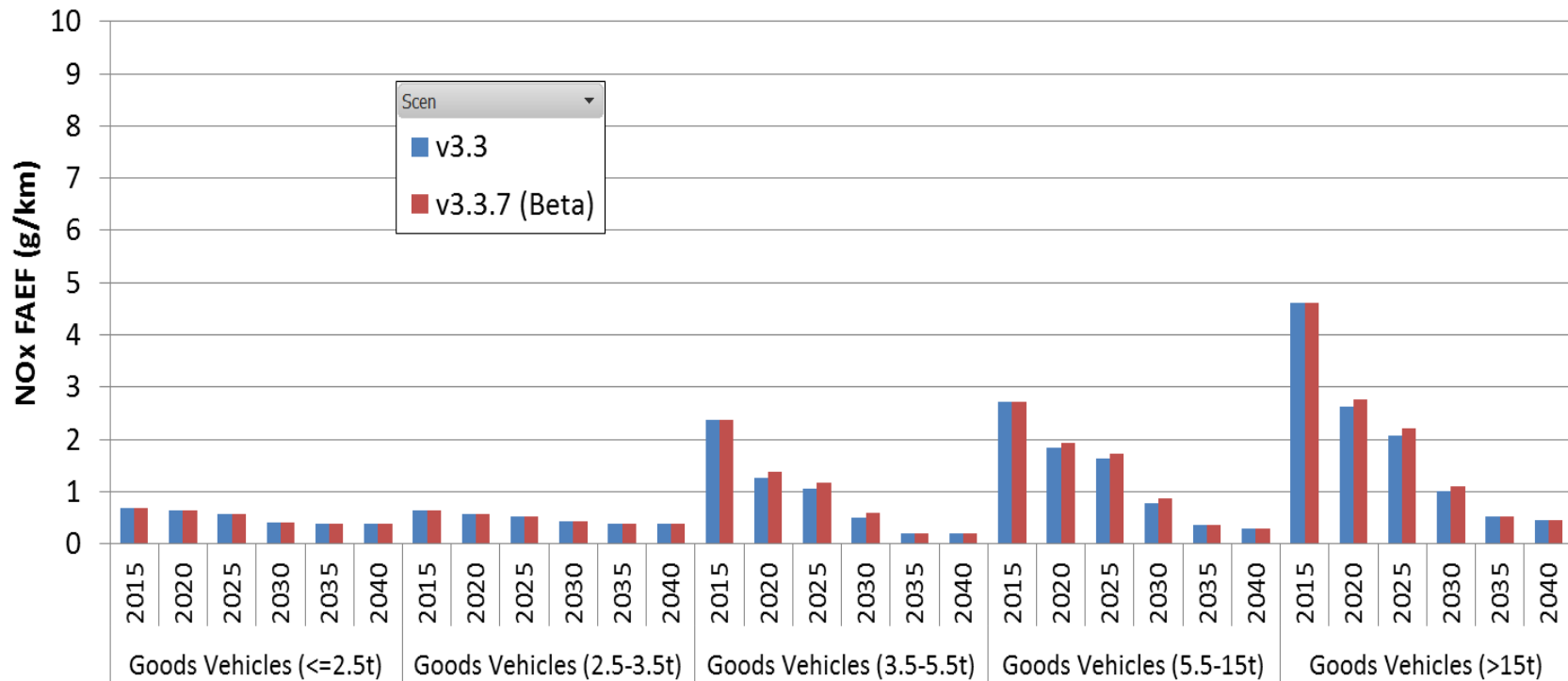
- Application of EMFAC-HK
- Timeline of updates of Vehicle Emission Model
- Changes made in EMFAC-HK update (V3.3.7 Beta)
- **Comparison of emissions and fleet average emission factors (FAEF)**
- Transitional Arrangement
- Meeting Air Quality Objectives

Comparison of Territory-wide NOx Emissions in Current (v3.3) and EMFAC-HK update v3.3.7 (Beta)



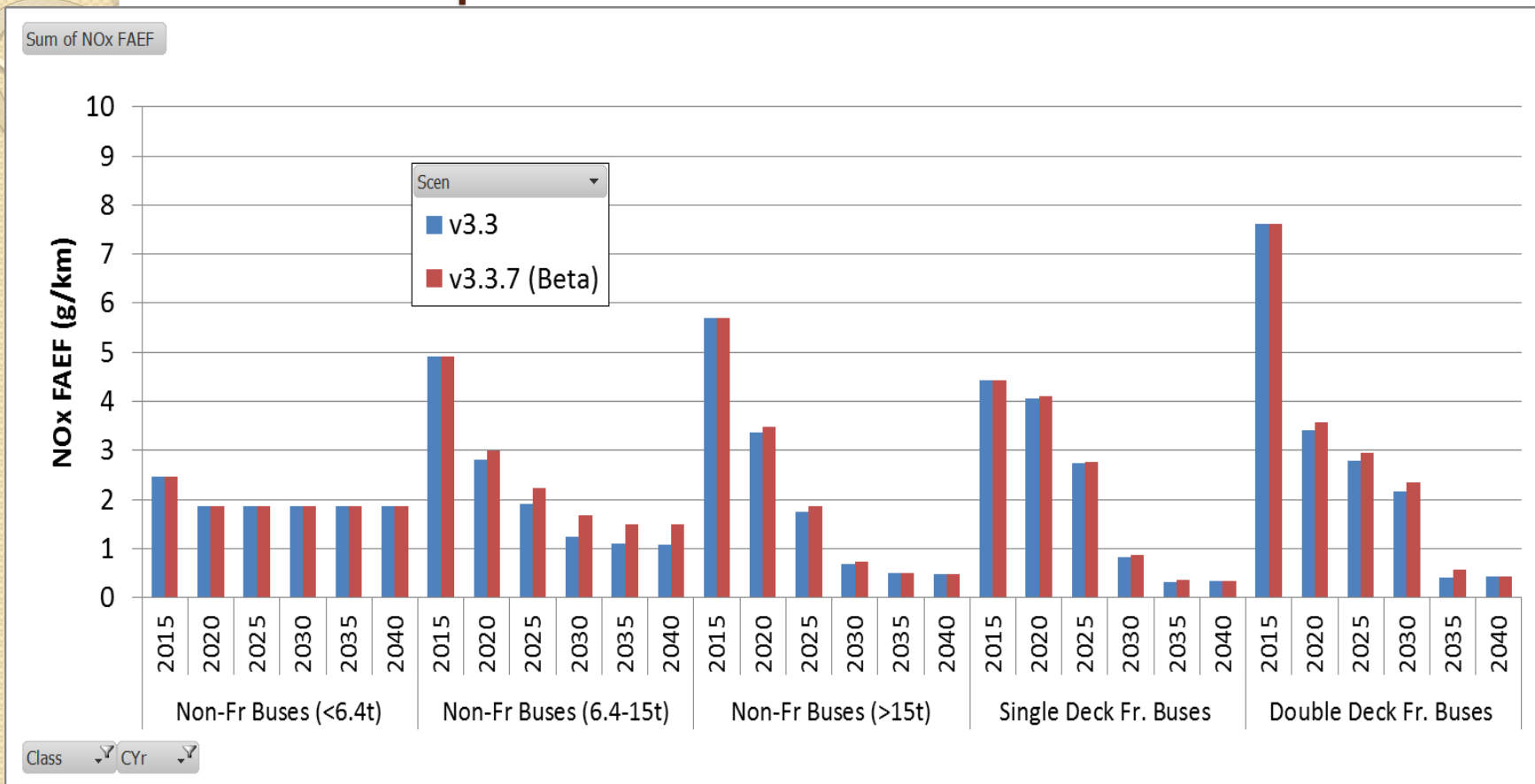
Comparison of NOx FAEF – Goods Vehicles

Sum of NOx FAEF

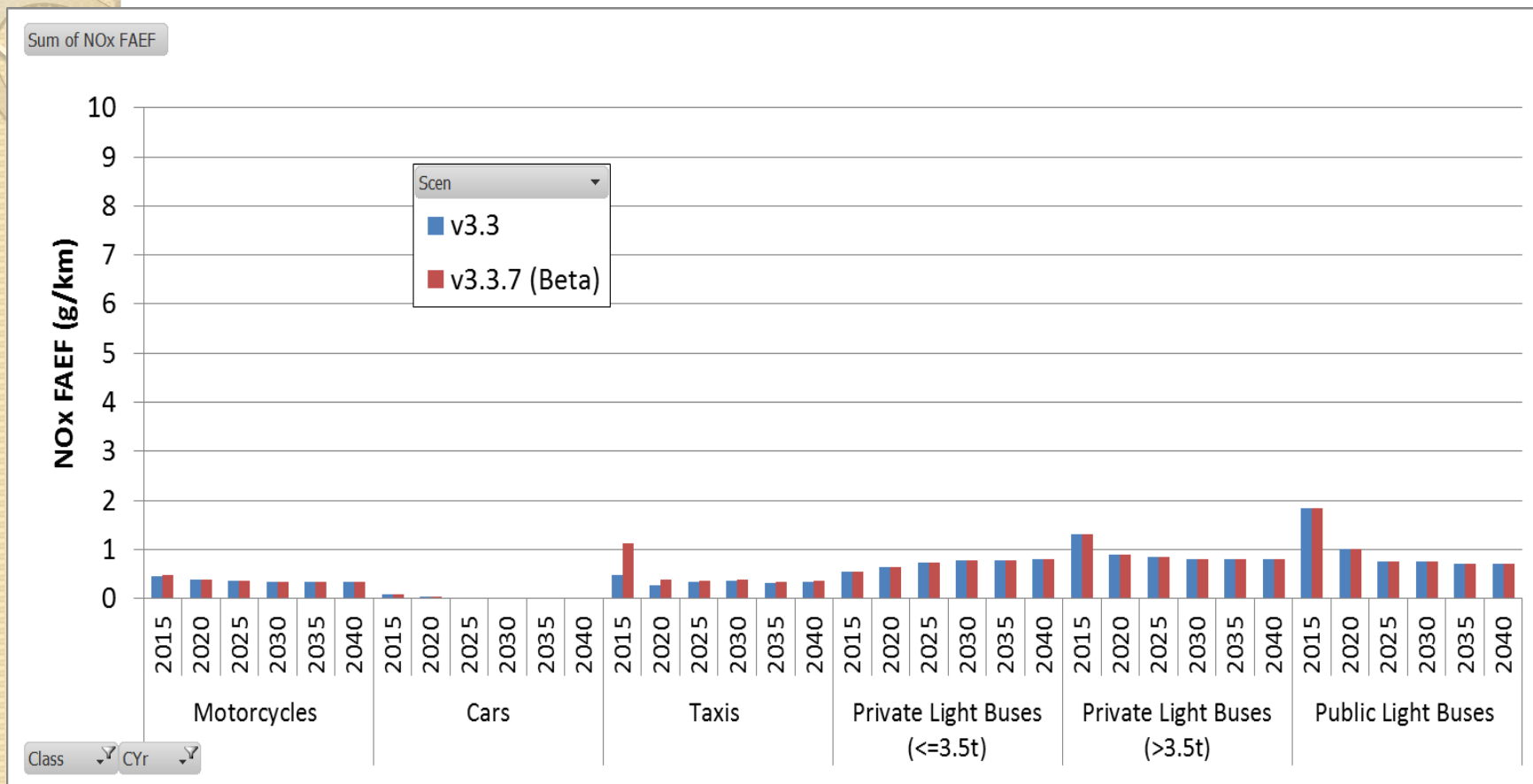


Class CYr

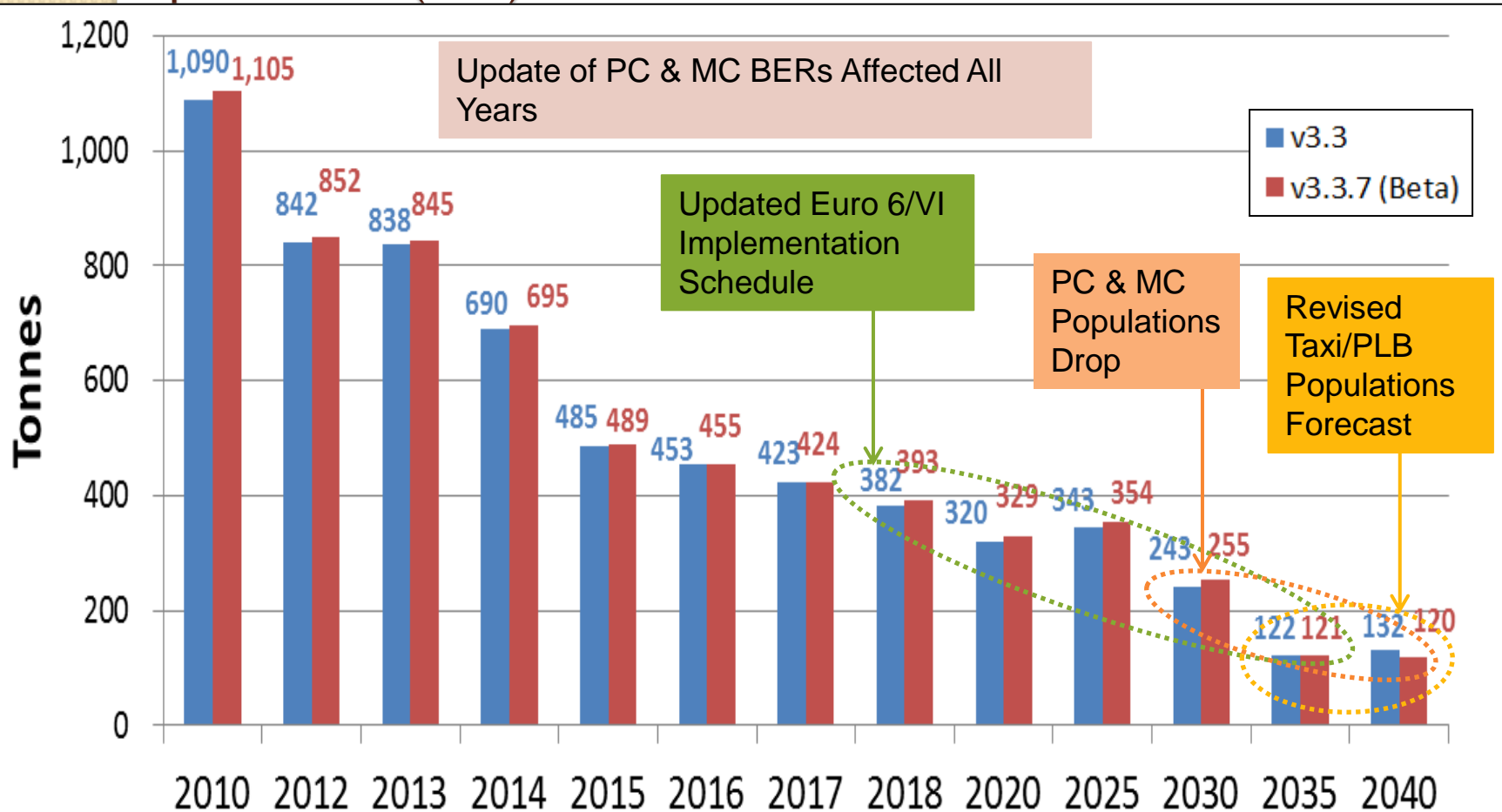
Comparison of NOx FAEF – Buses



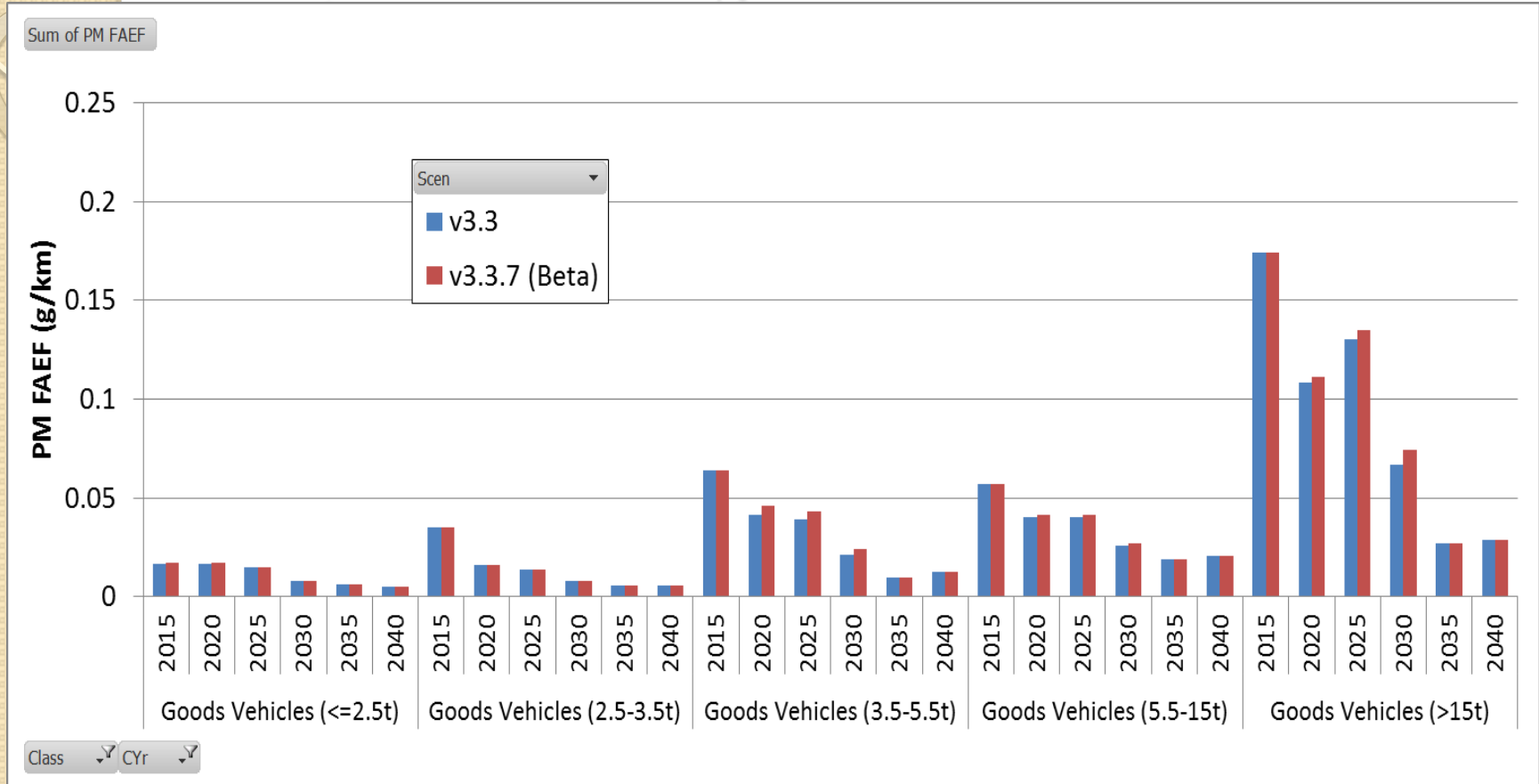
Comparison of NOx FAEF – Others



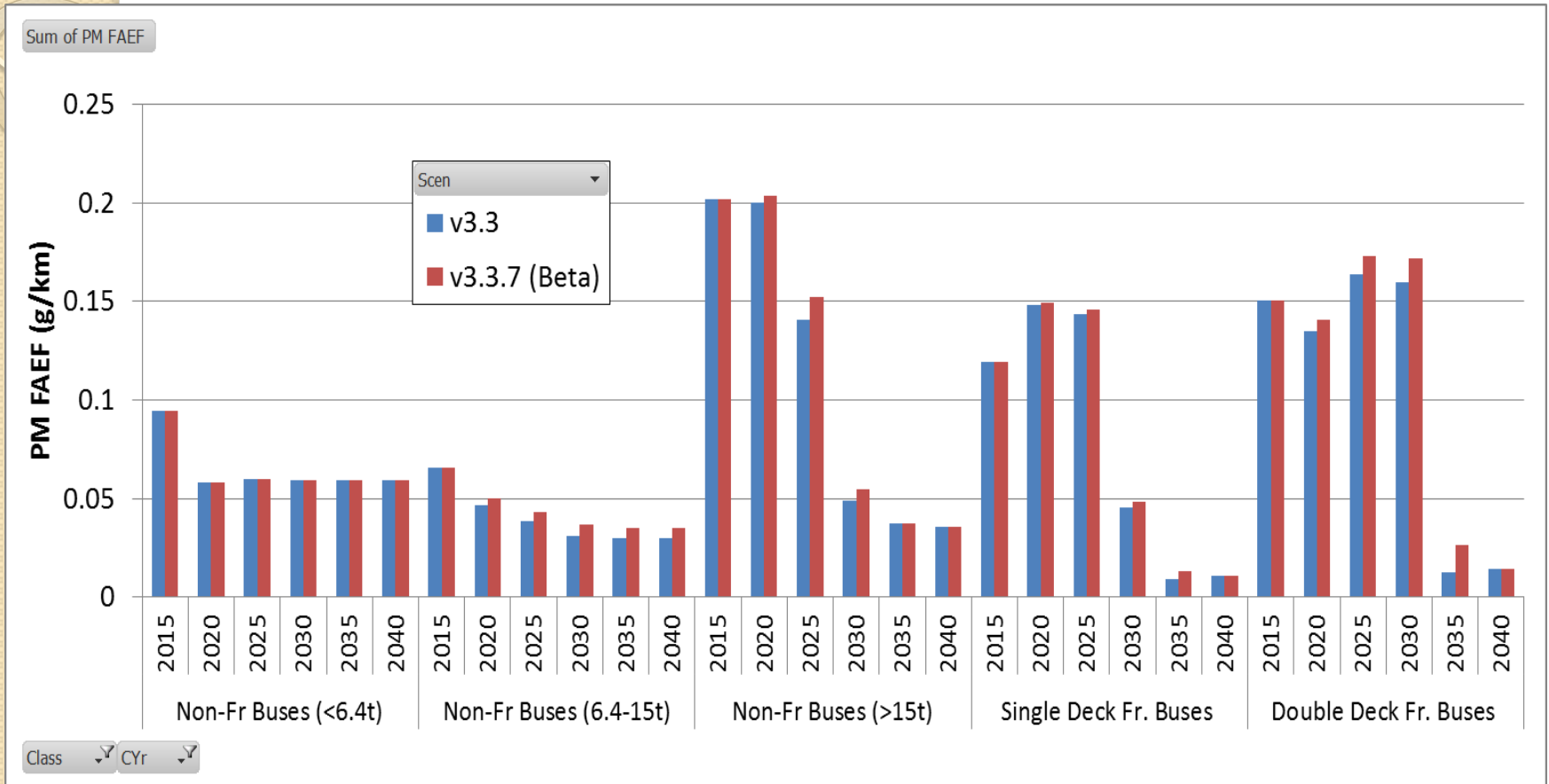
Comparison of Territory-wide PM₁₀ Emissions in Current (v3.3) & EMFAC-HK update v3.3.7 (Beta)



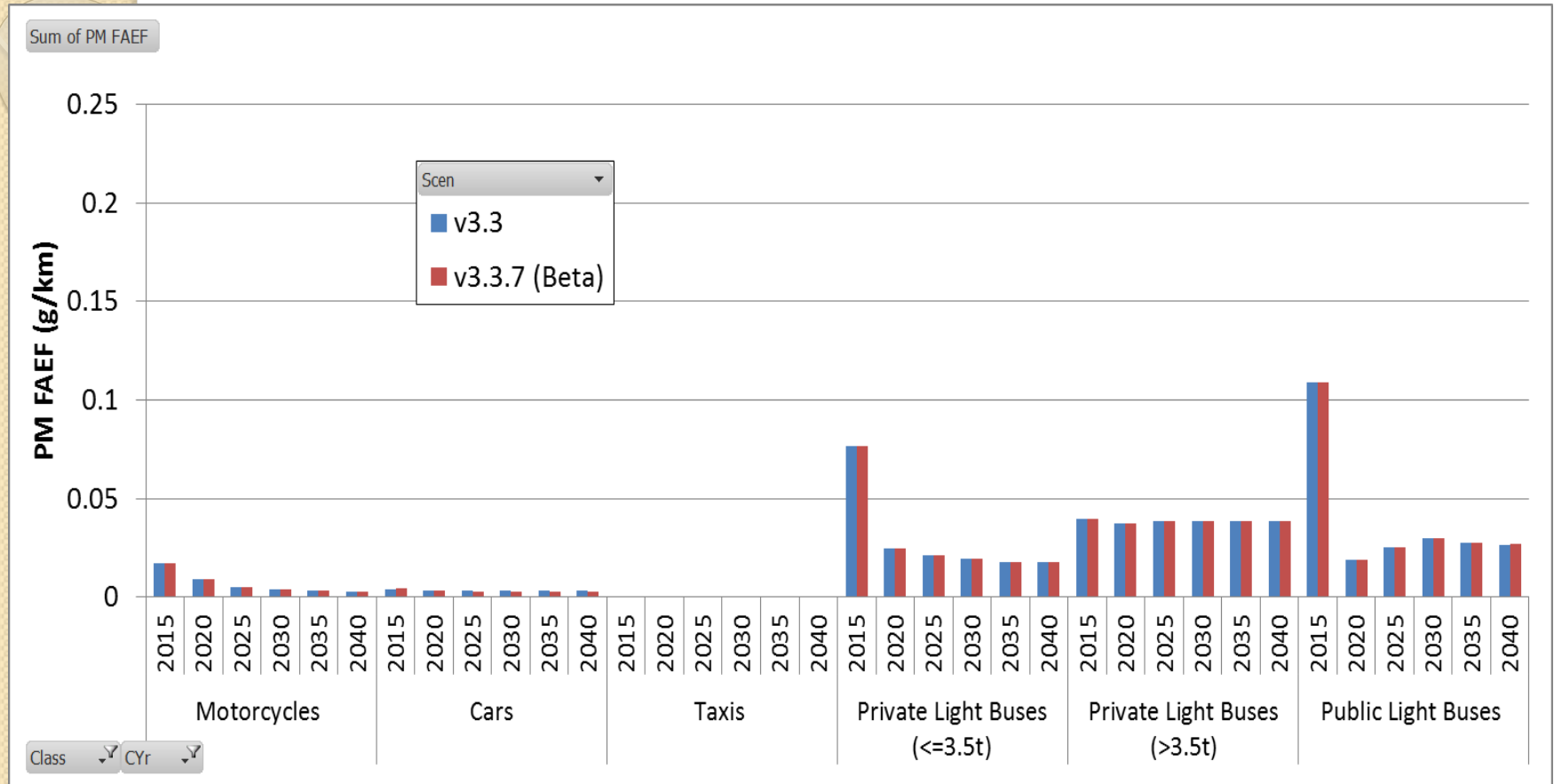
Comparison of PM₁₀ FAEF – Goods Vehicles



Comparison of PM₁₀ FAEF - Buses



Comparison of PM₁₀ FAEF - Others



Outline

- Application of EMFAC-HK
- Timeline of updates of Vehicle Emission Model
- Changes made in EMFAC-HK update (V3.3.7 Beta)
- Comparison of emissions and fleet average emission factors (FAEF)
- **Transitional Arrangement**
- Meeting Air Quality Objectives

Transitional Arrangement

- Provision of 6-month transition period for EIA studies being conducted for adaption to the new model and reduction of abortive work
- During the transition period, EIA reports submitted under Section 6 of the EIAO may continue to use the previous old model version for the air quality impact assessment. After the transition period, all EIA report submissions must use the new model version

Outline

- Application of EMFAC-HK
- Timeline of updates of Vehicle Emission Model
- Changes made in EMFAC-HK update (V3.3.7 Beta)
- Comparison of emissions and fleet average emission factors (FAEF)
- Transitional Arrangement
- Meeting Air Quality Objectives

Meeting Air Quality Objectives

- **Air Quality Objectives (AQOs) are the principal air quality standards** in determining the acceptability of air quality impacts of development projects
- Annex 4 of the Technical Memorandum on EIA Process (TM) issued under the EIAO sets out the criteria for evaluating air quality impact in EIA studies. The key criterion is that AQOs and other standards established under the Air Pollution Control Ordinance have to be met. The same criterion applies to non-EIAO case.

Meeting Air Quality Objectives

Project proponents need to demonstrate that, by means of various mathematical air quality assessment models, upon inclusion of the impacts caused by the project, the **cumulative air pollutant concentration** at identified air sensitive receivers would **comply with the AQOs** during the **construction and operation phases** of the project.

- Meeting the annual concentration standard of NO₂, i.e. 40ug/m³, is challenging in urban districts and at the vicinity of trunk roads
- Appropriate **mitigation measures** have to be adopted to **control and prevent non-compliance**, if necessary.

A busy Hong Kong street scene, likely in the Central district, showing a double-decker bus, taxis, and pedestrians. The bus is yellow and red, with the number 703 and route 6X visible. The street is crowded with people and vehicles, and the background features modern buildings with large windows and advertisements. A white text box with the words "Thank you." is overlaid on the center of the image.

Thank you.