

**19th Annual CMAS Conference**

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**Tehran emission inventory development using a new bottom-up  
emission inventory calculation and reporting system**

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**Mechanical Engineering Department**

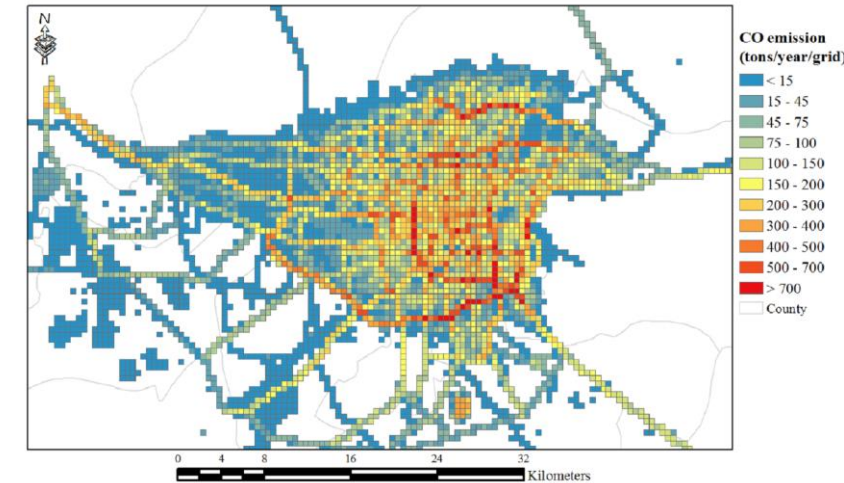
# Table of Contents

- History of Emission Inventory in Tehran
- Description of Emission Inventory System
- Methodology of Calculations
- Input Data
- Outputs
- A Case Study

# History of Emission Inventory in Tehran

# History of Emission Inventory in Tehran

- **1<sup>st</sup>: As a joint project between Japan International Cooperation Agency (JICA) & Tehran AQCC, (Base year: 1994)**
- **2<sup>nd</sup>: Tehran Air Quality Control Company (AQCC), (Base year: 2014)**
- **Developing Tehran emission inventory system (2016-Present)**
- **3<sup>rd</sup>: Current study, Funded by Tehran Air Quality Control Company (AQCC), (Base year: 2018)**

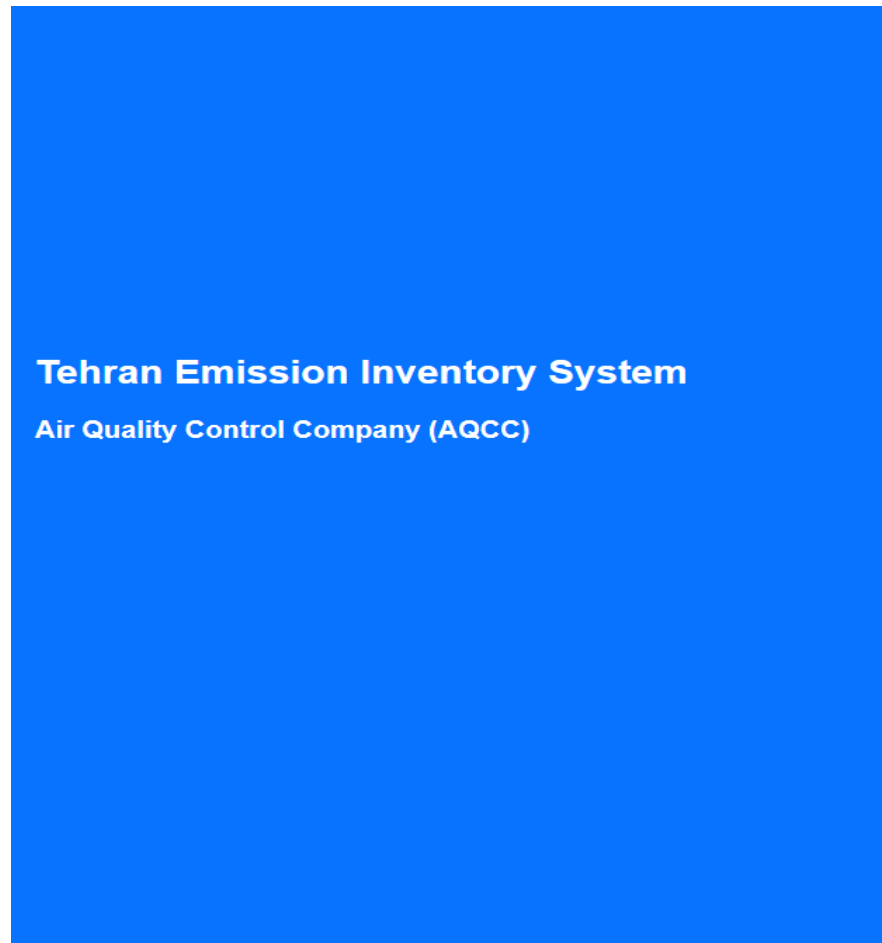


Shahbazi et al. (2016). A GIS based emission inventory development for Tehran, Urban Climate, 17, 216-229.

Shahbazi et al. (2016). The Relative Contributions of Mobile Sources to Air Pollutant Emissions in Tehran, Iran: An Emission Inventory Approach, Emission Control Science Technology, 2(1), 44-56.

# Tehran Emission Inventory System

# Web-based Emission Inventory System



Email Address

Password

I'm not a robot



Login

Secure log-in page for each airshed, city, industrial source to log-in for data input and report generation

# Emission Inventory System











## Main data input menu

### Home

Tehran Emission Inventory System (AQCC)



Breadcrumb: Home

 <b>Mobile Sources</b>	<ul style="list-style-type: none"><li>◦ IVE Technology Data</li><li>◦ Ambient Data</li><li>◦ Traffic Data</li><li>◦ Fleet Data</li><li>◦ IVE BER Adjustment</li><li>◦ Non-Exhaust Emission Factors</li><li>◦ Cold Start Activities</li><li>◦ Locations</li></ul>	 <b>Bus Terminals</b>	<ul style="list-style-type: none"><li>◦ IVE Technology Data</li><li>◦ Ambient Data</li><li>◦ Fleet Data</li><li>◦ IVE BER Adjustment</li><li>◦ Idling Time Data</li><li>◦ Terminals</li></ul>	 <b>Airports</b>	<ul style="list-style-type: none"><li>◦ ICAO Engine Data</li><li>◦ Flight Schedule Data</li><li>◦ Aircraft Type Data</li><li>◦ Airports</li></ul>	 <b>Railways</b>	<ul style="list-style-type: none"><li>◦ Locomotive Data</li><li>◦ Duty Cycle Data</li><li>◦ Activity Data</li><li>◦ Locations</li></ul>
 <b>Residential, General and Commercial</b>	<ul style="list-style-type: none"><li>◦ Population Data</li><li>◦ Land-use Data</li><li>◦ Fuel Consumption Data</li><li>◦ Emission Factor Data</li><li>◦ Locations</li></ul>	 <b>Power Plants</b>	<ul style="list-style-type: none"><li>◦ Fuel Characteristic Data</li><li>◦ Desulfurization Technology Data</li><li>◦ Emission Factor Data</li><li>◦ Temporal Profile Data</li><li>◦ Power Plants</li></ul>	 <b>Gas Stations</b>	<ul style="list-style-type: none"><li>◦ Emission Factor Data</li><li>◦ Sale Data</li><li>◦ Locations</li></ul>	 <b>Refineries</b>	<ul style="list-style-type: none"><li>◦ Refinery Data</li></ul>
 <b>Industries</b>	<ul style="list-style-type: none"><li>◦ Industry Data</li></ul>	 <b>Emission Inventory Reports</b>	<ul style="list-style-type: none"><li>◦ Defined Domains</li><li>◦ Source Attribution Reports</li><li>◦ Temporal Variation of Emission Reports</li><li>◦ Geographical Reports</li></ul>				

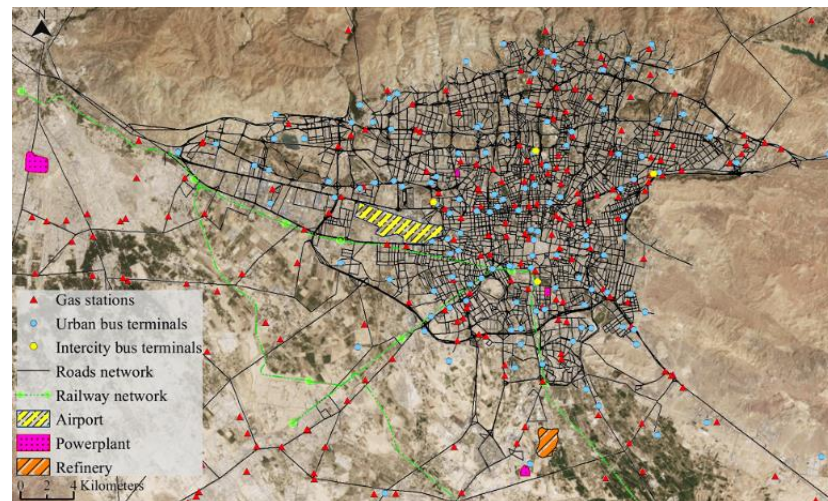
# Emission Inventory System

## *Air pollution sources*

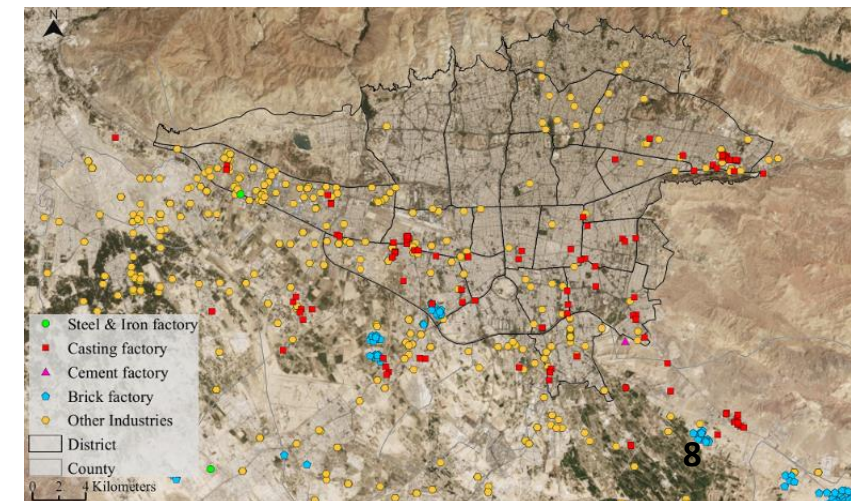
Air Pollution Sources Covered by Emission Inventory System:

- 1- Mobile Sources (exhaust, non-exhaust, evaporative and cold start emission)
- 2- Power plants
- 3- Bus Terminals
- 4- Airports
- 5- Residential, general and commercial
- 6- Refineries
- 7- Railways
- 8- Petrol Stations
- 9- Industries
- 10- Reporting tool

**Tehran pollution sources**



**Industrial units**





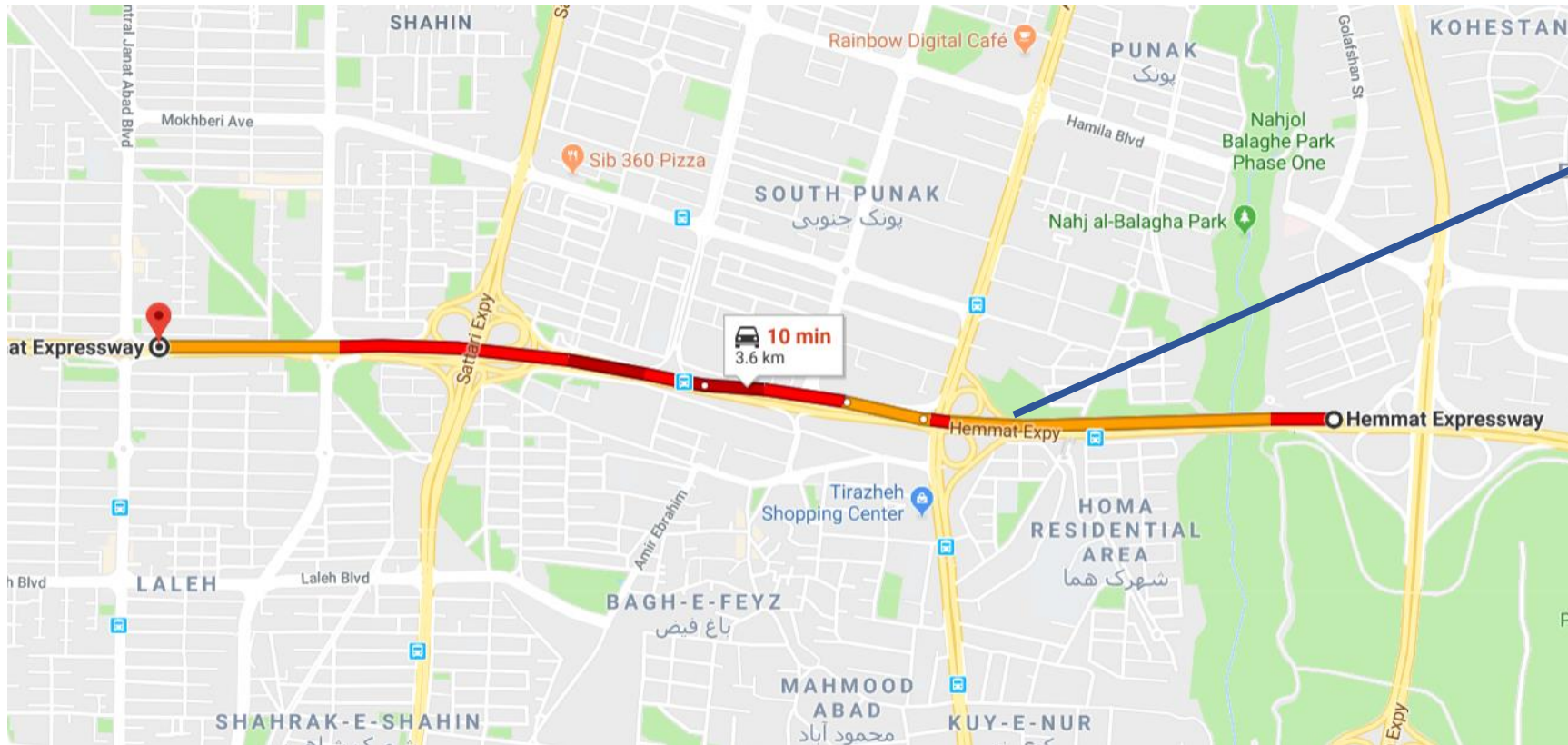
# Emission Inventory System

## *Applications*

- Tracking emission rates for regulatory purposes and policy making
- Running if-then scenarios
- Permitting and compliance
- Providing data for national programs
- Tracking GHGs and GHG mitigation activities
- Easy to use system with minimum technical background
- Capabilities of generating various types of reports
- Custom-made to regional and local needs
- Preparing emission input data for air pollution photochemical models

# Emission Calculation Methodology: Mobile sources

# Calculation Methodology



$$\text{Emission} = \text{EF} * \text{Activity}$$

EF (gr/km)

Activity (VKT)

# Emission factors

## **Mobile Sources:**

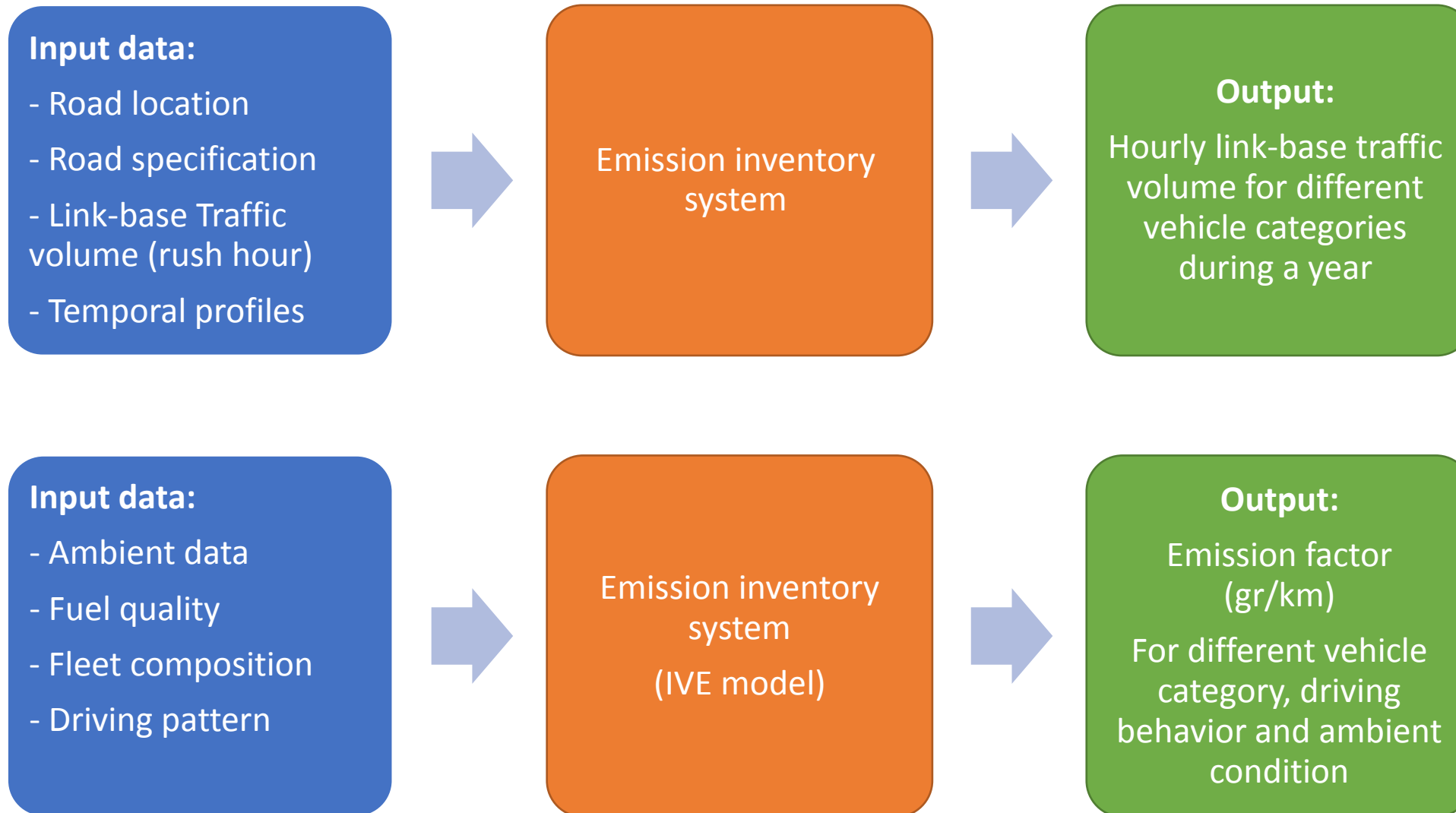
- Exhaust Emissions (Hot & Cold): IVE Model
- Evaporative Emissions: IVE Model
- Non-exhaust Emissions: European Emission Inventory Guide Book (COPERT model)

# Input Data

## Mobile Sources:

- Temporal Profile for Traffic Activity (easy input by xlsx files)
- Geographical Traffic Distribution (GIS shape file)
- Fleet Composition

# Calculation methodology: Mobile Sources



# Input Data: Mobile sources

# Mobile sources

## System required input data – (1) Ambient data

- Hourly average temperature and relative humidity for each month
- Altitude (in meter)

**Emission Inventory System** Home Calendar Air Pollution Sources Settings Logout vahid

### Ambient Data - Edit Database

Database: Tehran

Breadcrumb: Home / Mobile Sources / Ambient Data / Form

Database Name: Tehran Altitude (meter): 1200

Month: [Month] (highlighted as **Month**)

Tab 0 Tab 1 Tab 2 Tab 3 Tab 4 Tab 5 Tab 6 Tab 7 Tab 8 Tab 9 Tab 10 Tab 11 + Remove this tab

Month: [x Farvardin] (highlighted as **Hour**)

00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00
13.5	13.3	12.7	12.3	11.9	11.5	11.6	12.8
46.9	47.2	48.9	50.3	50.9	52.8	52.8	50.6
08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00
14	15	15.9	16.7	17.1	17.5	17.9	18.4
46.1	43	40	37.4	35.5	35.1	32.8	32.6
16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
18.5	18.1	17.5	16.7	16.2	15.4	14.6	14
32.1	33.2	34.5	36.4	38.5	40.8	43.5	44.5

Submit

Temperature (highlighted)

Relative humidity (highlighted)



# Mobile sources

## System required input data – (2) Traffic information

**Emission Inventory System** Home Calendar Air Pollution Sources Settings Logout vahid

Breadcrumb: Home / Mobile Sources / Traffic Data / Form

**Database Name**

Tehran traffic - 1396

**1- Road location information (Shapefile format)**

**2- Road information (Excel format)**

**Road Network Information**

Please upload road network data in shapefile and excel format (see attached template files)

Upload road's location in shapefile format

Upload road information file

Download uploaded file  
zip file included three files shapefile.shp, shapefile.dbf and shapefile.shx

Download uploaded file  
Download template file

**Template file**

**Important Tips:**

- A unique "Geocode" for each road have to be included in both shapefile and excel files.
- Coordinates should be in latitude/longitude format.

**Traffic Information**

Reference Month: Aban

Reference Day Type: weekday

Tab 0 +

Remove this tab

Reference Hour(s): 07:00

Upload link-base traffic data

Download uploaded file  
Download template file

**Template file**

**3- Traffic information (Excel format)**

# Mobile sources

## System required input data – (2) Traffic information

- Geocode is a unique code for each road which use for linking different file with each other

Road information

	A	B	C	D	E	F
1	Geocode	Road Grade	Road Type	Municipality District	Within Odd-Even zone	Within Traffic zone
2	10010196200001	downhill	شیرانی درجه ۱	12	1	1
3	10010196200002	downhill	جمع کننده	12	1	1
4	10010196200003	flat	شیرانی درجه ۱	12	1	1
5	10010196200004	flat	شیرانی درجه ۱	12	1	1
6	10010196200005	flat	شیرانی درجه ۱	12	1	1
7	10010196200006	flat	شیرانی درجه ۱	12	1	1
8	10010196200007	uphill	شیرانی درجه ۱	12	1	1
9	10010196200008	downhill	شیرانی درجه ۱	12	1	1
10	10010196200009	flat	جمع کننده	12	1	1
11	10010196200010	flat	شیرانی درجه ۱	11	1	1
12	10010196200011	flat	شیرانی درجه ۱	11	1	1
13	10010196200012	uphill	شیرانی درجه ۱	11	1	1
14	10010196200013	downhill	شیرانی درجه ۱	11	1	1
15	10010196200014	uphill	جمع کننده	12	1	1
16	10010196200015	flat	دسترسی محلی	12	1	1
17	10010196200016	flat	جمع کننده	12	1	1
18	10010196200017	flat	شیرانی درجه ۲	12	1	1
19	10010196200018	uphill	شیرانی درجه ۱	12	1	1
20	10010196200019	downhill	شیرانی درجه ۱	12	1	1

Traffic information

	A	B	C	D	E	F	G	H	I
1	Geocode	Motorcycle	Personal Car	Pickup	Taxi	Minibus	Municipality bus	Service Bus	Truck
2	10010196200001	1030.65	3504.67	171.324	780.614	32.7	5.95238	17.7438	3.2613
3	10010196200002	239.452	323.683	39.2363	130.596	10.7941	5.95238	1.12673	0.86723
4	10010196200003	796.075	1396.67	176.49	407.049	19.5388	0	10.3844	1.53702
5	10010196200004	196.589	286.149	38.5466	110	7.51761	0	0.40205	0.99465
6	10010196200005	0	0	0	0	0	0	0	0
7	10010196200006	2062.62	2975.03	491.184	722.378	45.4919	64.5374	25.9813	8.48929
8	10010196200007	1391.57	2606.38	410.117	734.371	50.1598	51.4276	28.8252	9.65333
9	10010196200008	85.4079	109.599	9.60043	51.1153	6.35026	51.4276	0.30029	0.0107
10	10010196200009	509.665	870.749	73.6181	232.859	10.8624	0	6.12575	1.3173
11	10010196200010	0	0	0	0	0	21.2736	0	0
12	10010196200011	412.868	983.071	82.3237	312.742	22.8712	21.2736	3.01799	4.56835
13	10010196200012	0	0	0	0	0	55.3568	0	0
14	10010196200013	533.132	1378.06	109.947	440.54	47.4687	21.2736	3.66915	4.46103
15	10010196200014	562.59	640.541	55.7167	222.486	26.4775	0	3.07477	0.04956
16	10010196200015	15.3381	14.6516	0.65133	11.1707	1.2215	0	0.02104	0
17	10010196200016	974.066	909.165	113.572	317.895	33.5465	0	5.77245	0.49444
18	10010196200017	390.989	2278.89	85.914	484.397	17.6056	10.5448	12.6412	0.73132
19	10010196200018	1118.51	1331	193.753	457.192	28.7981	17.9131	7.27601	0.77156
20	10010196200019	0	0	0	0	0	17.9131	0	0

# Mobile sources

## System required input data – (2) Traffic information

### Temporal profiles

**Emission Inventory System** Home Calendar Air Pollution Sources Settings Logout vahid

#### Mobile Sources - Traffic Temporal Profiles

Temporal profiles for Tehran traffic - 1396

Breadcrumb: Home / Mobile Sources / Traffic Data / Temporal Profiles

Motorcycle Personal Car Pickup Taxi Minibus Municipality bus Service Bus Truck

**Daily**

**Monthly**

Hourly Profile	Weekday	Semi-Weekend	Weekend
00:00	<input type="text" value="6956"/>	<input type="text" value="6956"/>	<input type="text" value="6956"/>
01:00	<input type="text" value="4409"/>	<input type="text" value="4409"/>	<input type="text" value="4409"/>
02:00	<input type="text" value="2634"/>	<input type="text" value="2634"/>	<input type="text" value="2634"/>
03:00	<input type="text" value="1888"/>	<input type="text" value="1888"/>	<input type="text" value="1888"/>
04:00	<input type="text" value="2338"/>	<input type="text" value="2338"/>	<input type="text" value="2338"/>
05:00	<input type="text" value="5479"/>	<input type="text" value="5479"/>	<input type="text" value="5479"/>
06:00	<input type="text" value="9703"/>	<input type="text" value="9703"/>	<input type="text" value="9703"/>
07:00	<input type="text" value="20295"/>	<input type="text" value="20295"/>	<input type="text" value="20295"/>
08:00	<input type="text" value="23728"/>	<input type="text" value="23728"/>	<input type="text" value="23728"/>

Daily Profile	Factor
Weekday	<input type="text" value="1512880.2"/>
Semi-Weekend	<input type="text" value="1449855"/>
Weekend	<input type="text" value="983030"/>

Monthly Profile	Factor
1	<input type="text" value="304542009.48"/>
2	<input type="text" value="361030127.92"/>
3	<input type="text" value="343076066.18"/>
4	<input type="text" value="367922131.17"/>
5	<input type="text" value="376648596.51"/>
6	<input type="text" value="368783884.74"/>
7	<input type="text" value="345834436.9"/>
8	<input type="text" value="347339820.76"/>
9	<input type="text" value="372318257.24"/>

**Hourly**

# Mobile sources

## System required input data – (3) Fleet composition

- 1300 vehicle technologies are supported (IVE vehicle technologies)

Fleet composition

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Category	System	Type	Model Year	Product	Total Numbers	AC Numbers	IVE Description	IVE Fuel	IVE Weight	IVE Air/Fuel Control	IVE Exhaust	IVE Evaporative
2	سواري	جيب	نامشخص	1338	Domestic	1	0	Auto/Sml Truck	Petrol	Heavy	Carburetor	None	PCV
3	سواري	پيڪان	1600	1346	Domestic	10	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
4	سواري	پيڪان	دولوكس	1346	Domestic	7	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
5	سواري	پيڪان	سادہ كار	1346	Domestic	4	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
6	سواري	پيڪان	كارلوكس	1346	Domestic	1	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
7	سواري	بيوك	بي ۲	1346	Domestic	1	0	Auto/Sml Truck	Petrol	Heavy	Carburetor	None	PCV
8	سواري	آريا	نامشخص	1347	Domestic	4	0	Auto/Sml Truck	Petrol	Heavy	Carburetor	None	PCV
9	سواري	پيڪان	1600	1347	Domestic	6	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
10	سواري	پيڪان	آونجر	1347	Domestic	1	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
11	سواري	پيڪان	دولوكس	1347	Domestic	11	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
12	سواري	پيڪان	سادہ كار	1347	Domestic	5	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
13			كارلو	1347	Domestic	1	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
14			شاہ	1347	Domestic	4	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
15			نامشخص	1348	Domestic	2	0	Auto/Sml Truck	Petrol	Heavy	Carburetor	None	PCV
16	سواري	پيڪان	1600	1348	Domestic	8	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
17	سواري	پيڪان	دولوكس	1348	Domestic	11	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
18	سواري	پيڪان	سادہ كار	1348	Domestic	16	0	Auto/Sml Truck	Petrol	Medium	Carburetor	None	PCV
19	سواري	جيب	آهو	1348	Domestic	2	0	Auto/Sml Truck	Petrol	Heavy	Carburetor	None	PCV
20	سواري	ژيان	نامشخص	1348	Domestic	1	0	Auto/Sml Truck	Petrol	Light	Carburetor	None	PCV

Different languages are supported

# Mobile sources

## System required input data – (4) Fuel quality

Fuel quality

**Fuel Characteristics**

**Gasoline**

Overall: Moderate/PreMix

Sulfur: Moderate

Benzene: Moderate

Oxygenate: 1%

Lead: None

**Diesel**

Overall: Moderate

Sulfur: Low

# Mobile sources

## System required input data – (5) Driving pattern

Driving pattern

### Driving Characteristics

Tab 0 Tab 1 Tab 2 Tab 3 Tab 4 Tab 5 Tab 6 Tab 7 Tab 8 Tab 9 Tab 10 Tab 11 Tab 12 Tab 13 Tab 14 Tab 15 Tab 16 Tab 17 Tab 18 Tab 19 Tab 20 Tab 21 Tab 22 Tab 23 Tab 24 Tab 25 Tab 26 +

Remove this tab

Month:  Farvardin  Ordibehesht  Khordad  Tir  Mordad  Shahrivar  Mehr  Aban  Azar  Dey  Bahman  Esfand

Day Type:  weekday  semiweekend  weekend

Hour:  00:00  01:00  02:00  03:00  04:00  05:00  06:00  07:00  08:00  09:00  10:00  11:00  12:00  13:00  14:00  15:00  16:00  17:00  18:00  19:00  20:00  21:00  22:00  23:00

Vehicle Type:  Motorcycle

Road Type:  شریانی درجه 1  جمع کننده  دسترسی محلی  شریانی درجه 2  رمپ  جاده فرعی

District:  District 01  District 02  District 03  District 04  District 05  District 06  District 07  District 08  District 09  District 10  District 11  District 12  District 13  District 14  District 15  District 16  District 17  District 18  District 19  District 20  District 21  District 22  District 23  District 24

Average Velocity (Km/Hr):

Slope Grade:  flat (%) 0  uphill (%) 2  downhill (%) -2

### Vehicle Spec. Power Distribution (%)

00	0	01	0.01	02	0.01	03	0.02	04	0.05	05	0.1	<b>Total: 100.00 %</b>
06	0.24	07	0.5	08	1.12	09	2.52	10	7.11	11	57.29	
12	18.91	13	7.49	14	3.05	15	1.09	16	0.22	17	0.07	
18	0.01	19	0.01	20	0	21	0	22	0	23	0	
24	0	25	0	26	0	27	0	28	0	29	0	
30	0	31	0	32	0	33	0	34	0	35	0.09	
36	0.06	37	0.03	38	0	39	0	40	0	41	0	
42	0	43	0	44	0	45	0	46	0	47	0	
48	0	49	0	50	0	51	0	52	0	53	0	
54	0	55	0	56	0	57	0	58	0	59	0	

# Calculation Methodology & Input Data: Other sources

# Input Data: Other Sources

## **Stationary Sources:**


- Residential / Commercial sector:
  - ✓ Geographical Location (area source)
  - ✓ Land use distribution (e.g. residential, commercial, hospital, ....)
  - ✓ Activity (e.g. Fuel Consumption)
  - ✓ Activity Temporal Profile for each Land use



# Residential, general and commercial sources

## System required input data

- Natural gas is the dominant fuel used in Residential, general and commercial sector in Iran



Residential, General and Commercial

- Population Data
- Land-use Data
- Fuel Consumption Data
- Emission Factor Data
- Locations

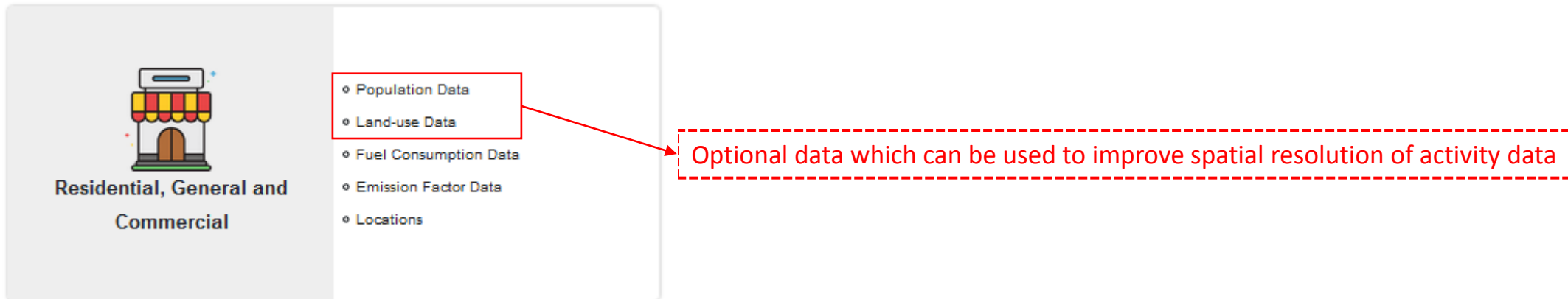
Spatial monthly fuel consumption  
(Shapefile + Excel file)

	A	B	C	D	E	F
1	geocode	usage	fuel type	unit	month	fuel consumption
2	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	1	56491603
3	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	2	29592689
4	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	3	17908978
5	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	4	15761051
6	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	5	15051607
7	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	6	16480547
8	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	7	23338285
9	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	8	47124895
10	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	9	81055794
11	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	10	94120495
12	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	11	92838178
13	98060610130000	خانگی بدون چیلر - 40	Natural Gas	m3	12	60152698
14	98060610130000	موتورخانه بدون چیلر - 41	Natural Gas	m3	1	214374
15	98060610130000	موتورخانه بدون چیلر - 41	Natural Gas	m3	2	124064

# Residential, general and commercial sources

## *System required input data*


- Natural gas is the dominant fuel used in Residential, general and commercial sector in Iran



# Residential, general and commercial sources

## *System required input data*

- Natural gas is the dominant fuel used in Residential, general and commercial sector in Iran



Residential, General and Commercial

- Population Data
- Land-use Data
- Fuel Consumption Data
- Emission Factor Data
- Locations

Should be imported by user

Tab 1 +

Technology: All Fuel Type: Natural Gas

Pollutant	Emission Factor	Unit
NOx	1.504	Unit
CO	0.64	Unit
CO2	1920	Unit
SOx	0.0096	Unit
VOC	0.176	Unit
PM2.5	0.019002	Unit

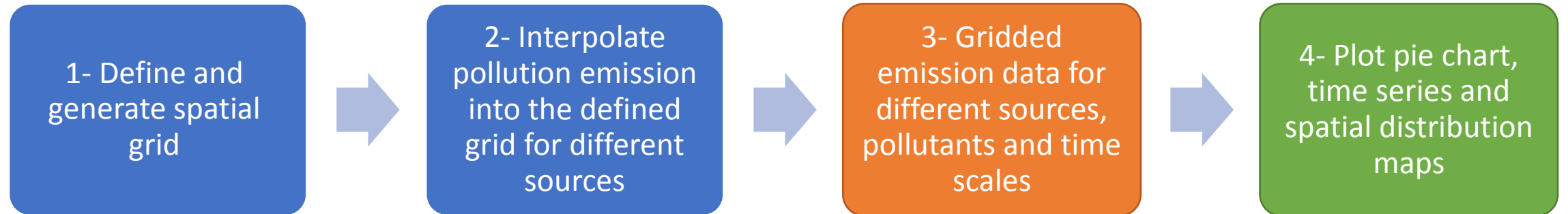
# Calculation methodology: Other Sectors

- ✓ Geographical Location (point source)
- ✓ Activity (e.g. fuel consumption)
- ✓ Temporal Profile for Activity
- ✓ Emission Factor (based on fuel consumption)

# Emission gridding and reporting tool

# Emission Inventory System

## *Reporting tool*



# Emission Inventory System

## Grid generation

**Emission Inventory System** Home Calendar Air Pollution Sources Settings Logout

### Emission Inventory Reports - Spatial Allocation Grid - List

The grids are listed as below

Breadcrumb: Home / Emission Inventory Reports / Spatial Allocation Grids

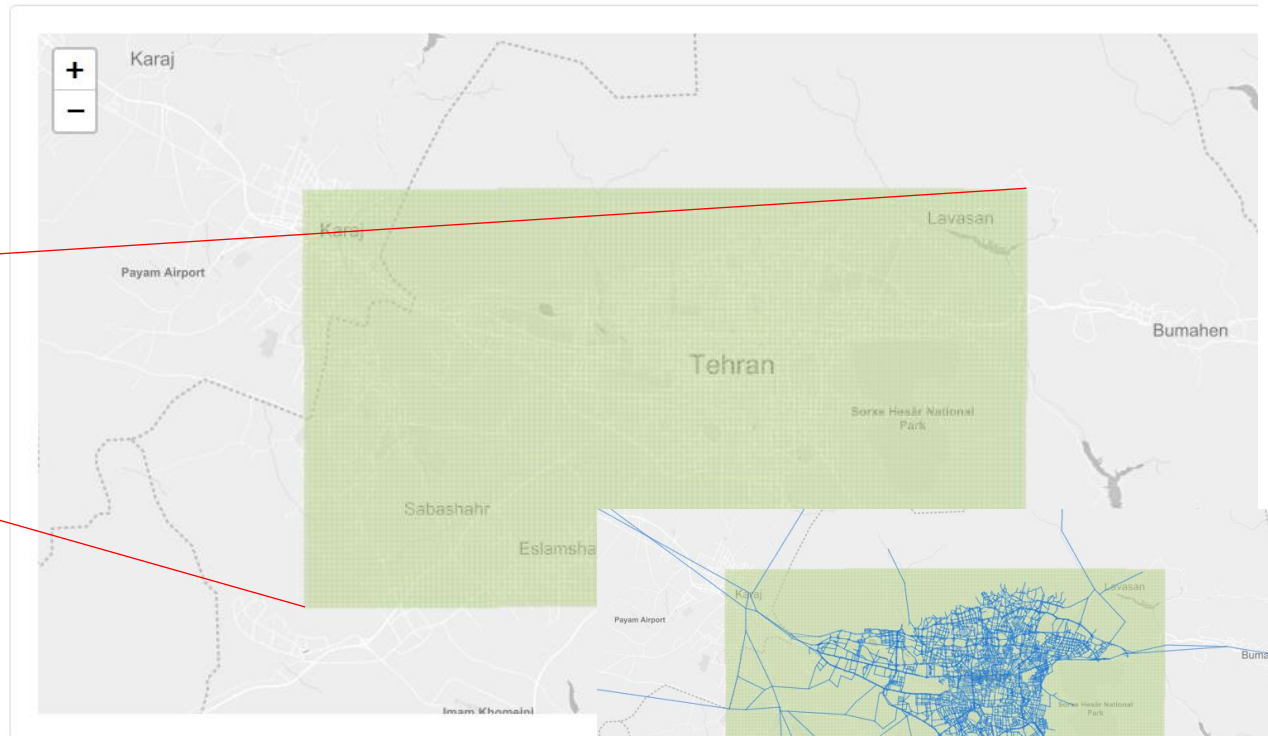
+ Create New Grid

**Tehran domain - 1396**

- Southwest Corner X (km): -39
- Southwest Corner Y (km): -22
- Delta X (m): 500
- Delta Y (m): 500
- Number of Cells (X direction): 132
- Number of Cells (Y direction): 76
- Central Latitude: 35.7
- Central Longitude: 51.4
- Status: cells\_generated
- Created at: 2019-04-14 08:45
- Updated at: 2019-05-19 09:44

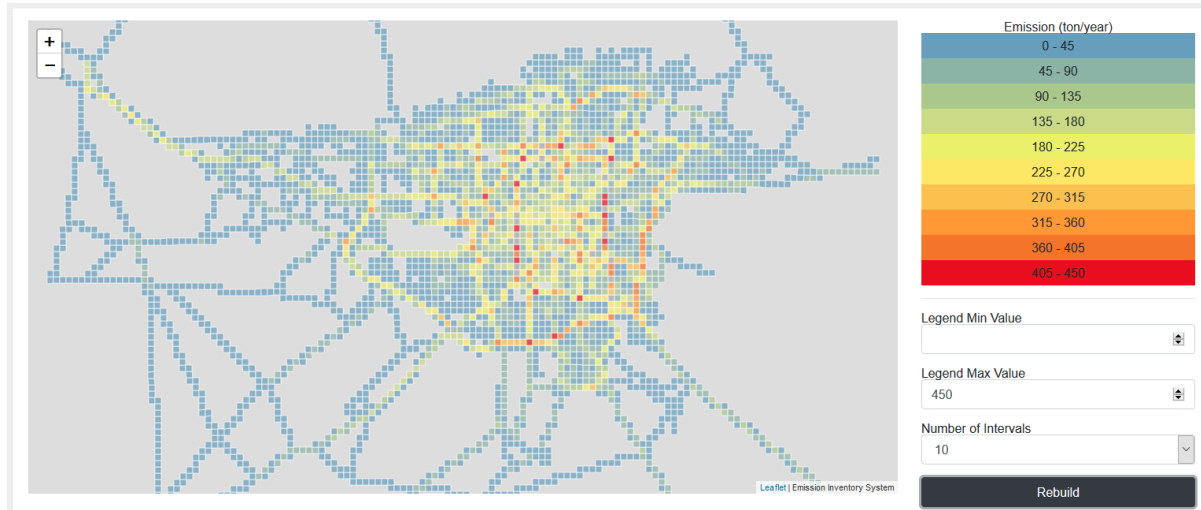
Emission Calculation

**Emission Inventory System** Home Calendar Air Pollution Sources Settings Logout

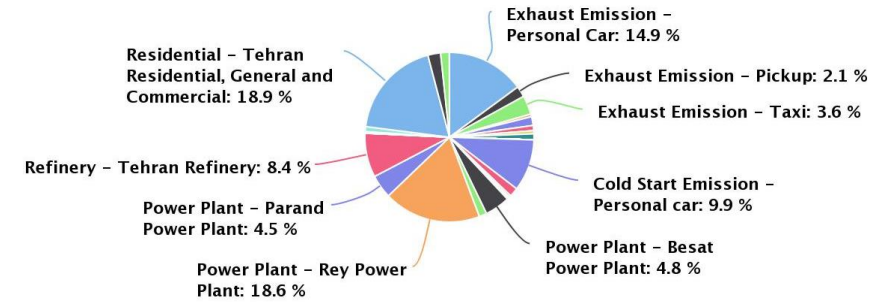


# Emission Inventory System

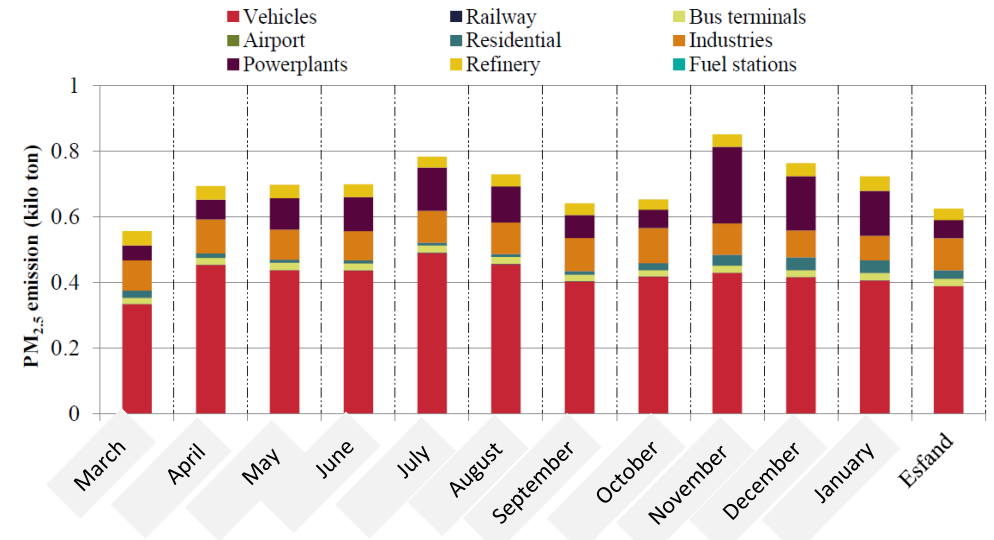
## Sample reports



Study case: Tehran, Year 2018, Annual VOC Emission (grid 500m × 500m)



Study case: Tehran, March 2018, Monthly NOx Emission



Study case: Tehran, Year 2018, Monthly PM2.5 from all anthropogenic sources

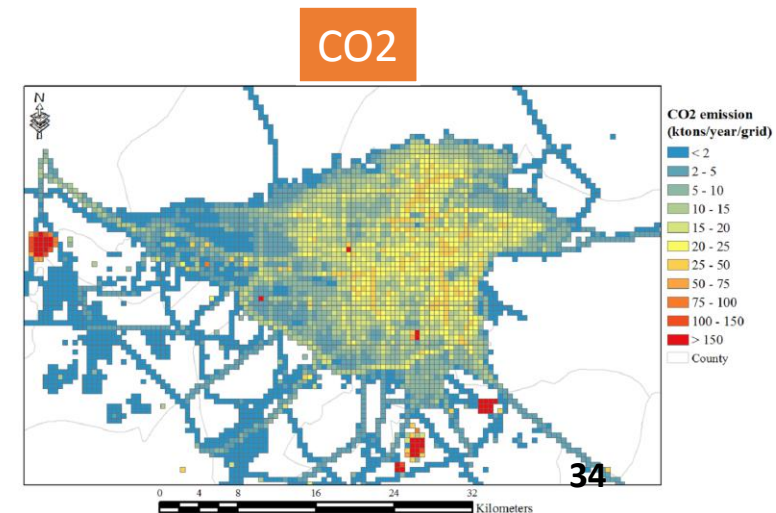
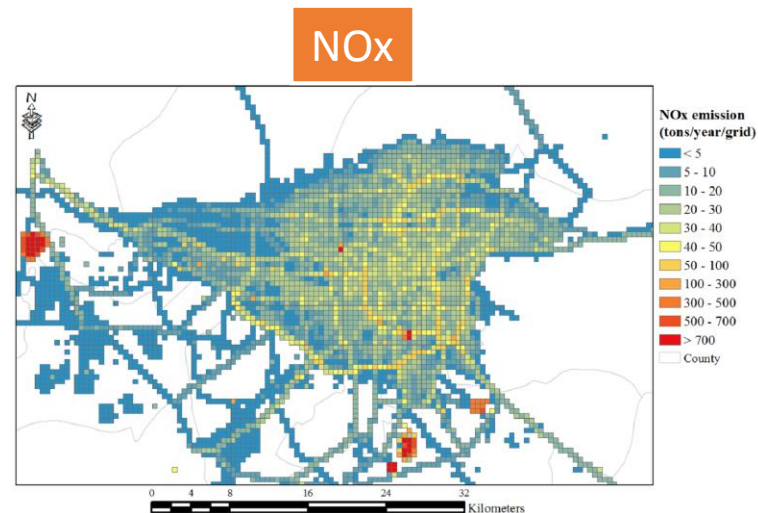
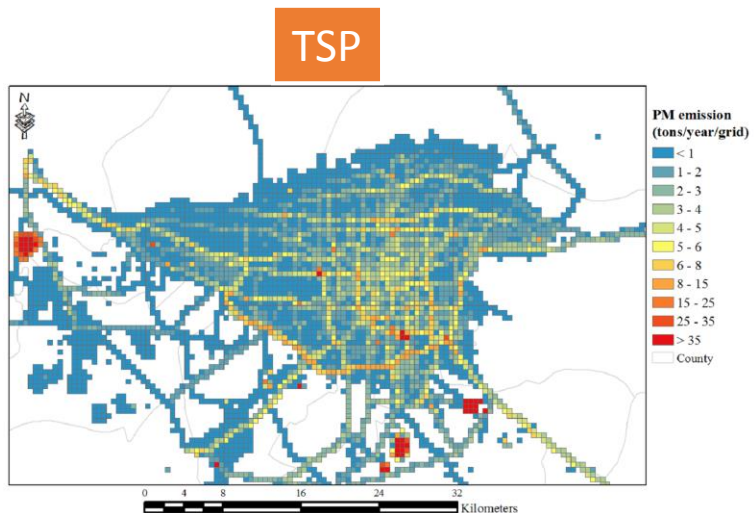


# Study case: Tehran emission inventory

# Study case: Tehran, Year 2018

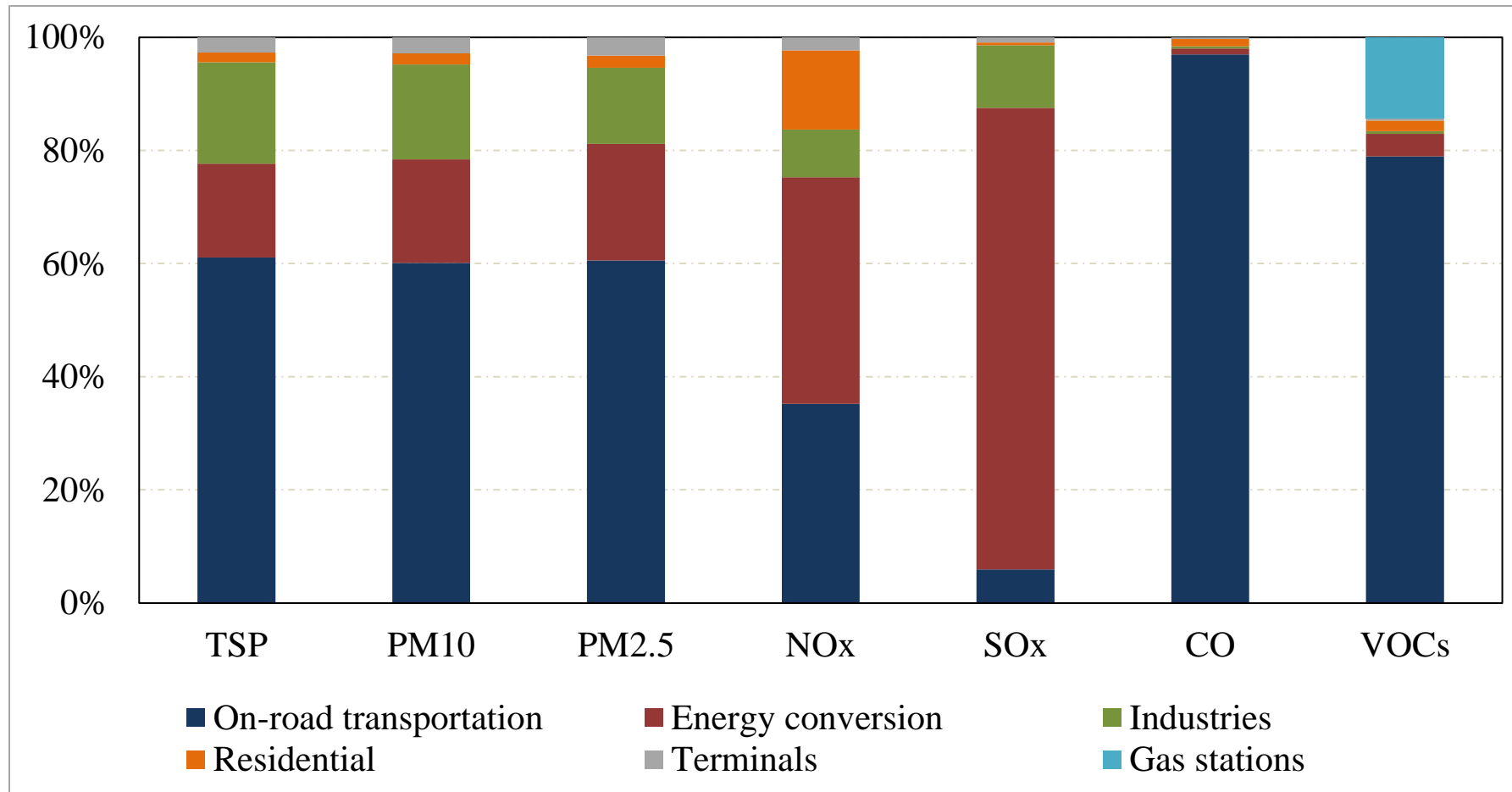
## *Yearly pollution emission*

Sector (tonnes/year)	TSP	NOx	CO	VOCs	CO <sub>2</sub>
On-road transportation	6338	36150	463446	71882	13384
Energy conversion	1721	41117	4916	3615	9215
Industries	1858	8639	1962	448	5781
Residential	182	14365	6113	1681	18339
Terminals	279	2407	1521	344	352
Gas stations	-	-	-	13071	-
<b>Total</b>	<b>10377</b>	<b>102678</b>	<b>477958</b>	<b>91041</b>	<b>47071</b>



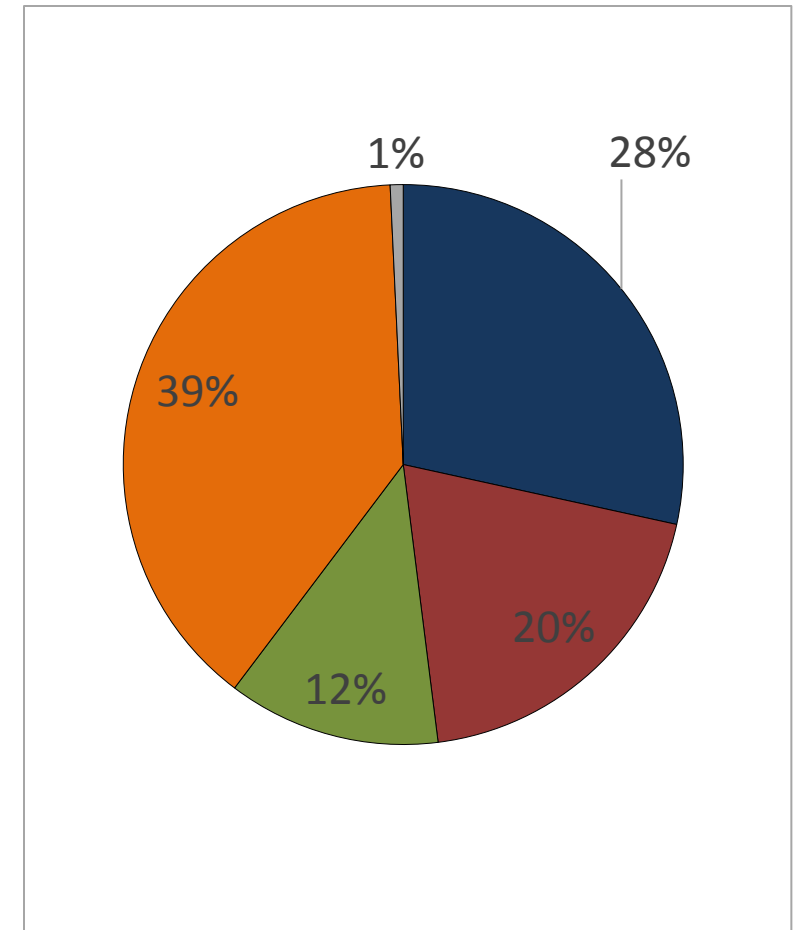
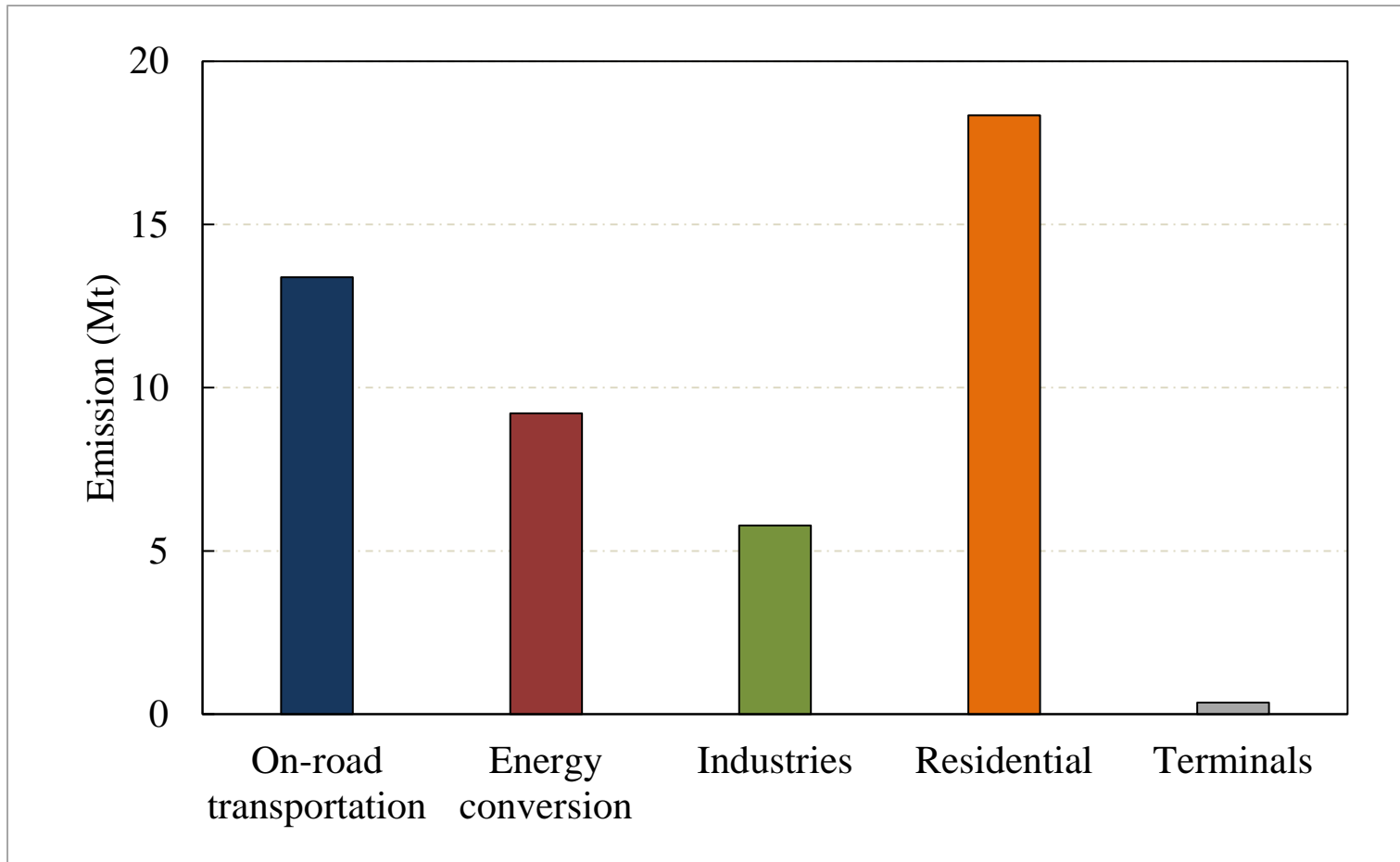
# Study case: Tehran, Year 2018

## Source attribution - Pollutants



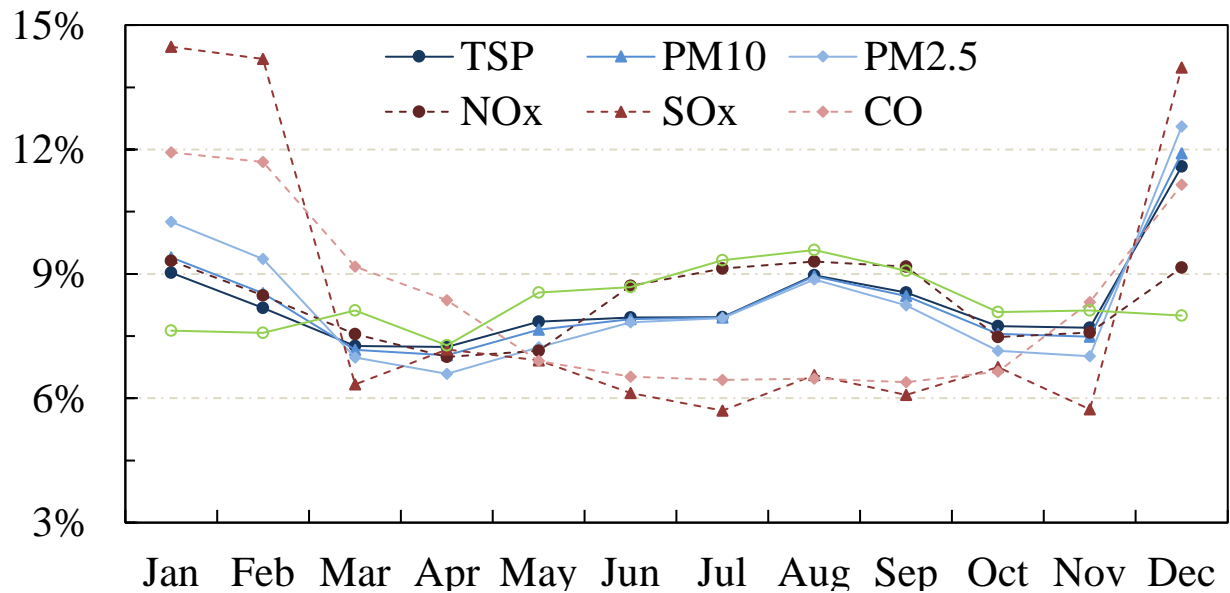
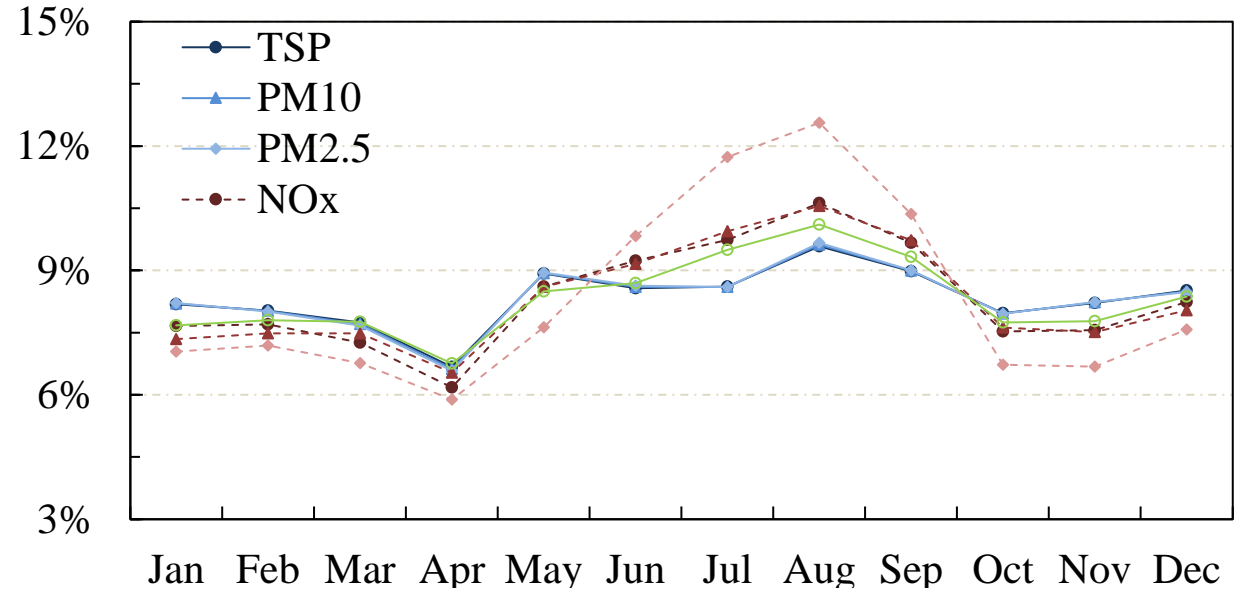
# Study case: Tehran, Year 2018

## Source attribution – CO<sub>2</sub>



Study case: Tehran, Year 2018  
*Monthly emission variation*

Mobile sources



Stationary sources

# Acknowledgement

Development of this system was supported by Iranian DOE and Tehran AQCC

**Thank you for your attention**