

# Soot-free Tehran



United Nations  
Educational, Scientific and  
Cultural Organization



Sharif University  
of  
Technology



مرکز ملی کیفیت هوا  
و آلودگی

International workshop on solutions  
for eliminating diesel and gasoline  
emitted soot from urban air

Date: September 7<sup>th</sup>, 2016

Venue: Sharif University of Technology

Attendance is only by invitation

Registration is free

For registration and further  
information contact UNESCO chair office via  
email [unescochair@sharif.edu](mailto:unescochair@sharif.edu) or  
call +98-21-6616-4142



# Pollution Priorities: Immediate needs

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Director of UNESCO chair

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September 7, 2016

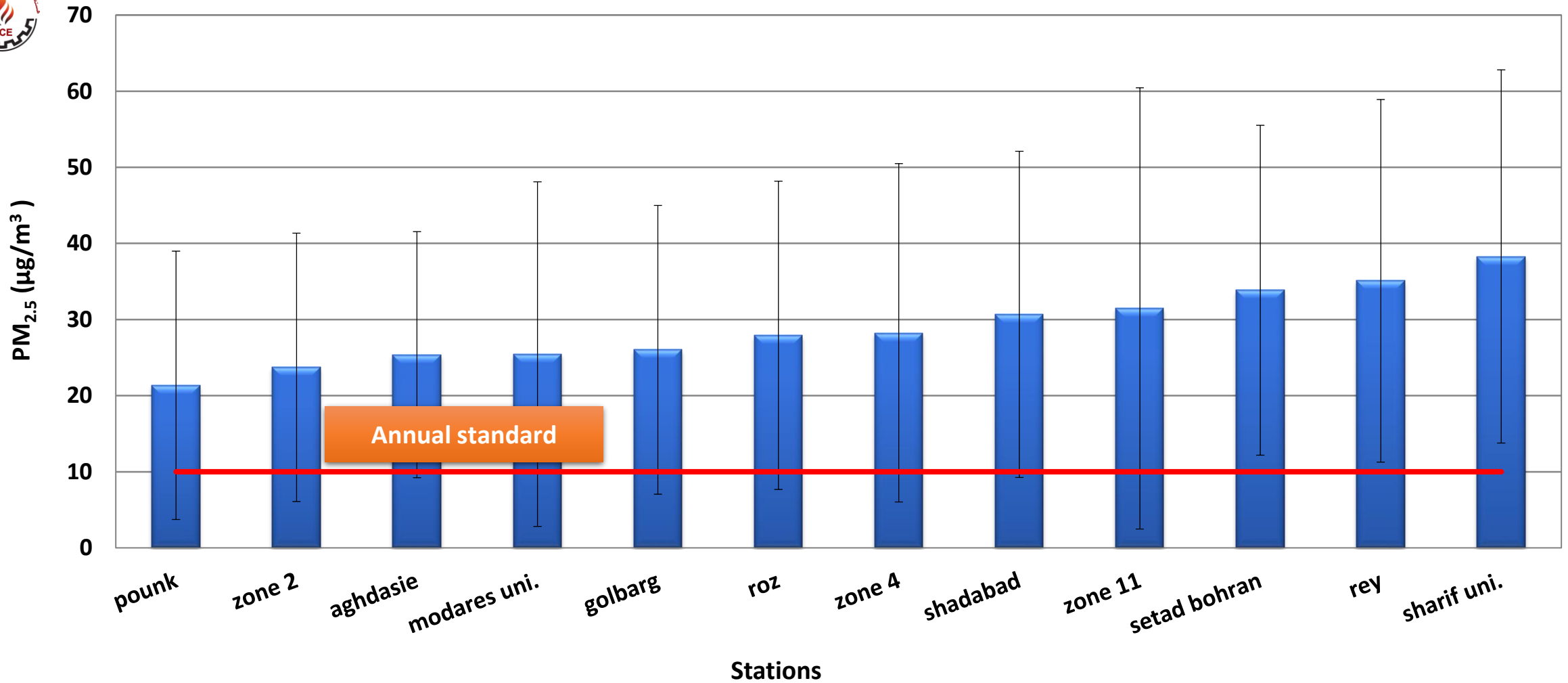
Tehran, Iran



# Pollution priorities in Tehran

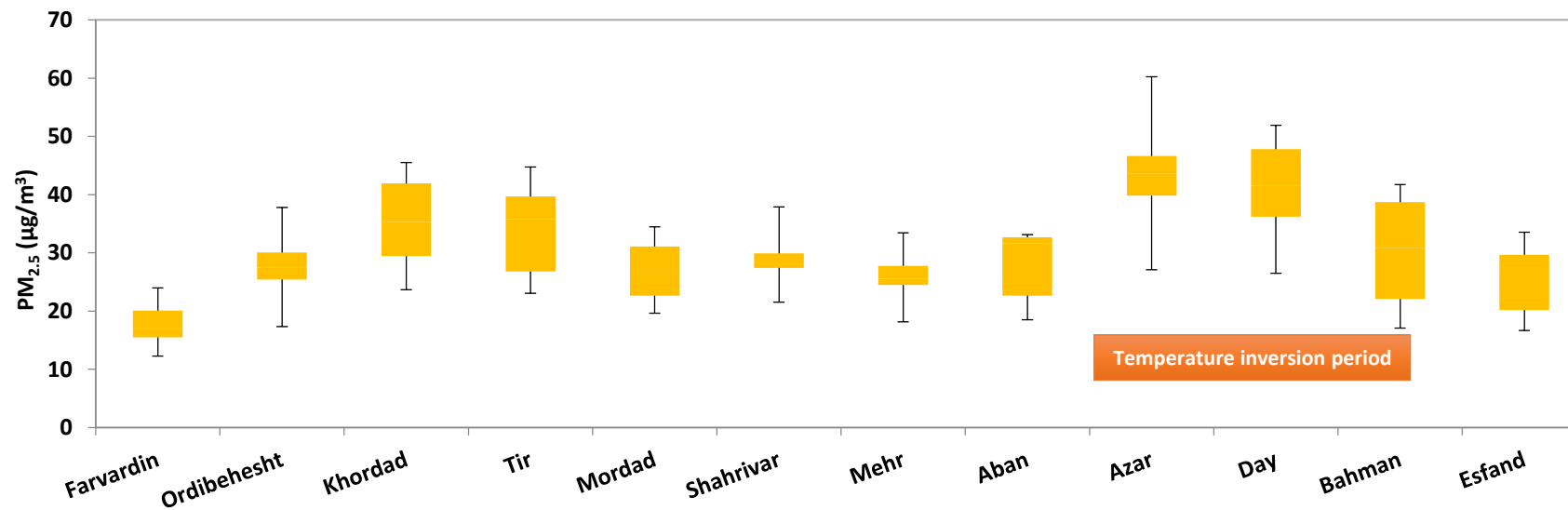
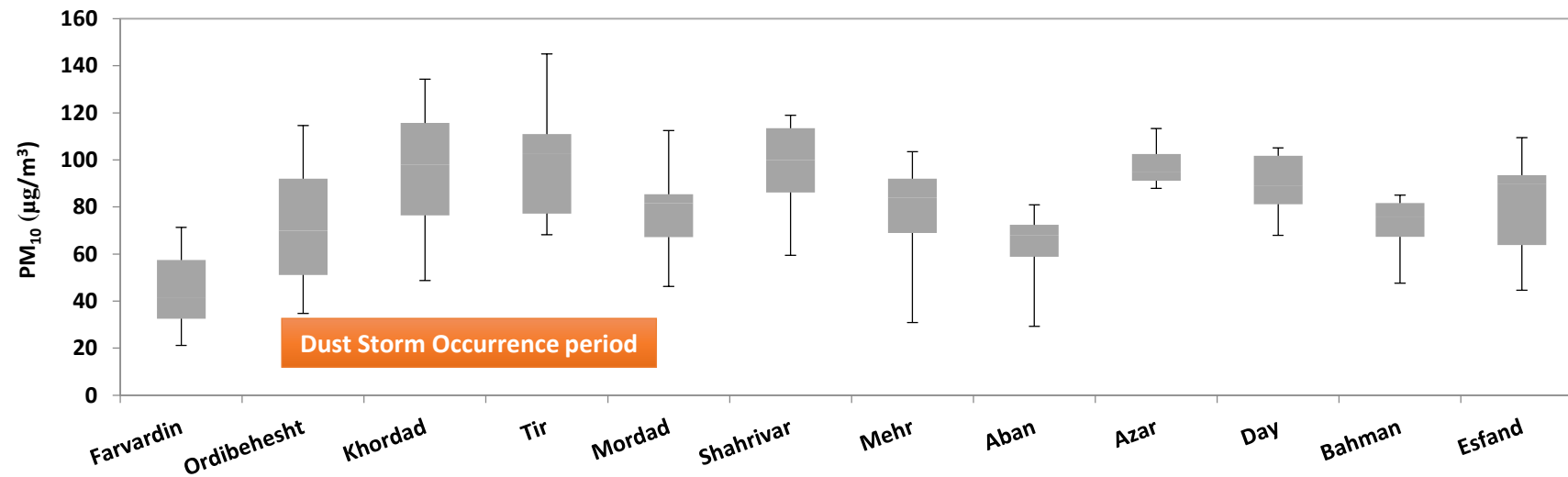


# Annual Concentrations of PM<sub>2.5</sub> in AQCC Stations in the City of Tehran 2015-2016 (1394)





# Monthly average concentrations of PM<sub>10</sub> & PM<sub>2.5</sub> 2015-2016 (1394)





# The longest air pollution episode in Tehran during the year 1394 (12th-31th Dec, 2015) all due to PM2.5

December 2015							
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<b>Hazardous</b> <b>&gt;301</b>			1	2	3	4	5
<b>Very Unhealthy</b> <b>201-300</b>							
<b>Unhealthy</b> <b>151-200</b>	6	7	8	9	10	11	12
<b>Unhealthy for Sensitive Groups</b> <b>101-150</b>	13	14	15	16	17	18	19
<b>Healthy</b> <b>51-100</b>	20	21	22	23	24	25	26
<b>Good</b> <b>0-50</b>	27	28	29	30	31		

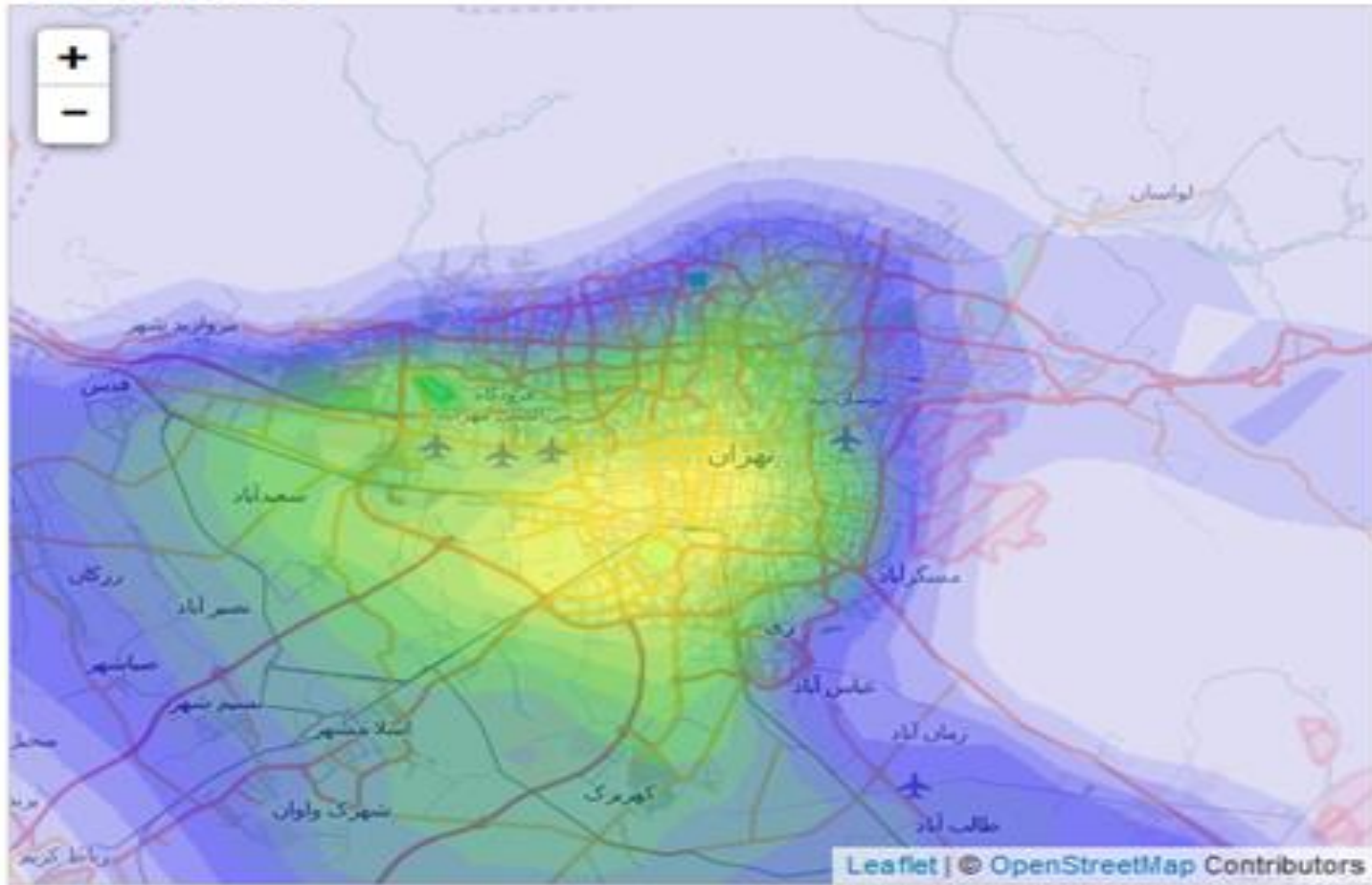




# The spatial distribution of the simulated mean daily PM<sub>2.5</sub> concentrations for 13 December 2015 over Tehran

## Average

Date: 2015-12-13

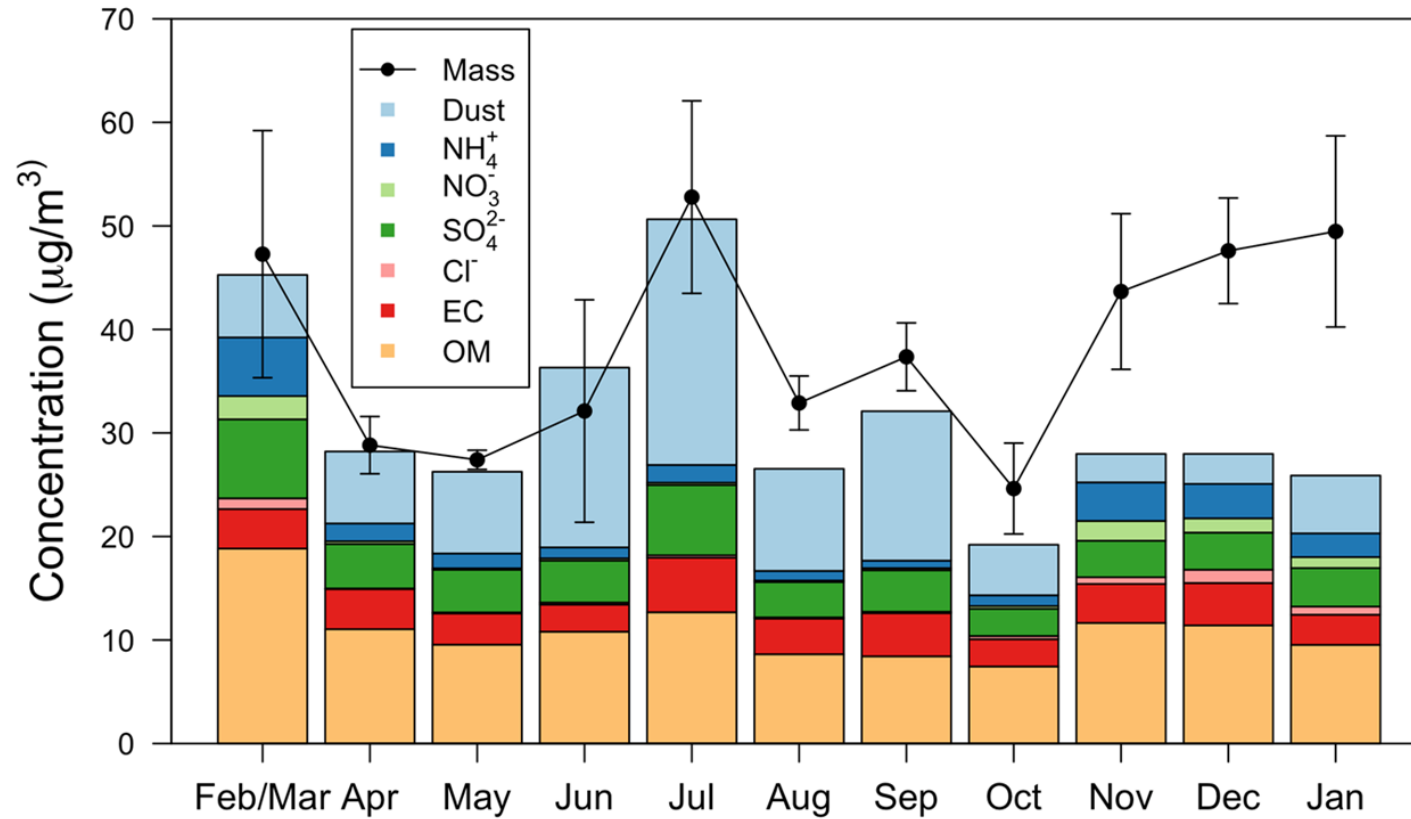


\*The combination of WRF model and CAMx was used to reproduce the spatial distribution of PM<sub>2.5</sub> concentrations for this episode.





# PM2.5 source apportionment study of Tehran for 2015



## Average composition:

Organic matter (**OM**):  
 $28 \pm 12\%$

**Dust**:  
 $22 \pm 19\%$

Sulfate ( **$\text{SO}_4^{2-}$** ):  
 $11 \pm 6\%$

Elemental carbon (**EC**):  
 $9 \pm 4\%$

Ammonium ( **$\text{NH}_4^+$** ):  
 $6 \pm 6\%$

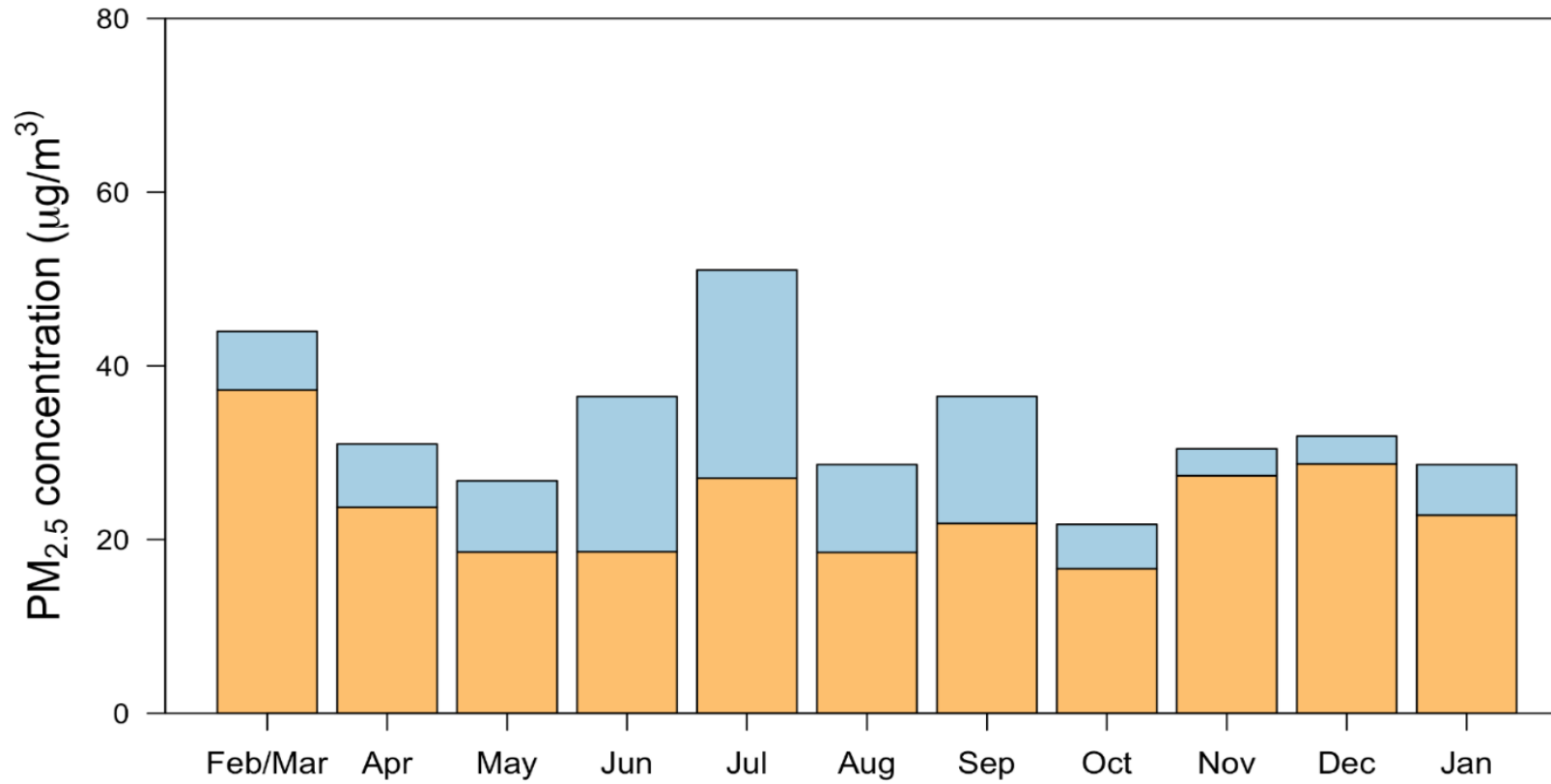
Nitrate ( **$\text{NO}_3^-$** ):  
 $2 \pm 3\%$

Chemical analyses of PM2.5 samples done by Prof. James Schauer of University of Wisconsin, Madison, USA  
Sampling by Prof. Mohammad Arhami of Sharif University



# PM<sub>2.5</sub> source apportionment study of Tehran for 2015

## Variations in biogenic and anthropogenic sources during a year

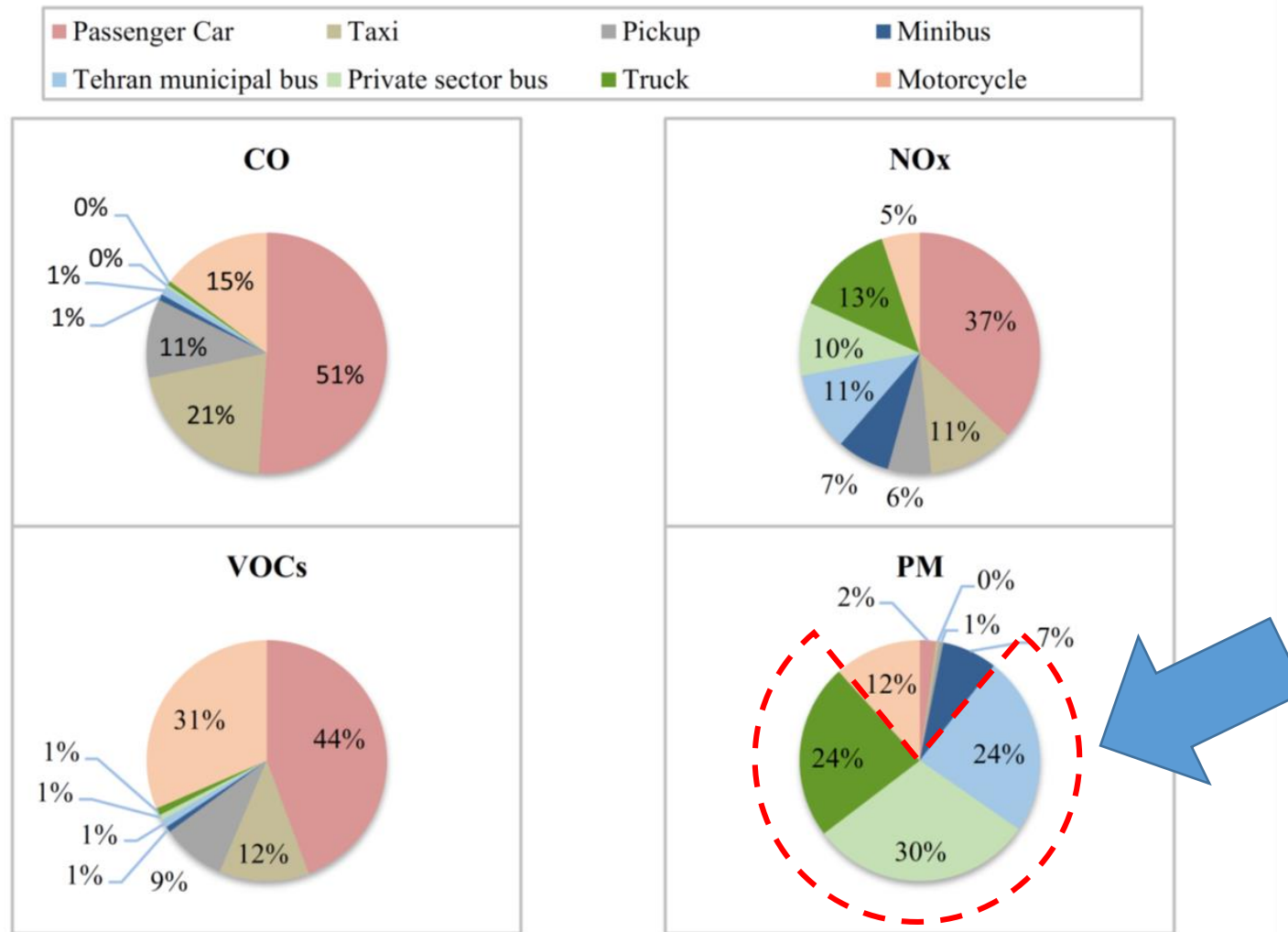


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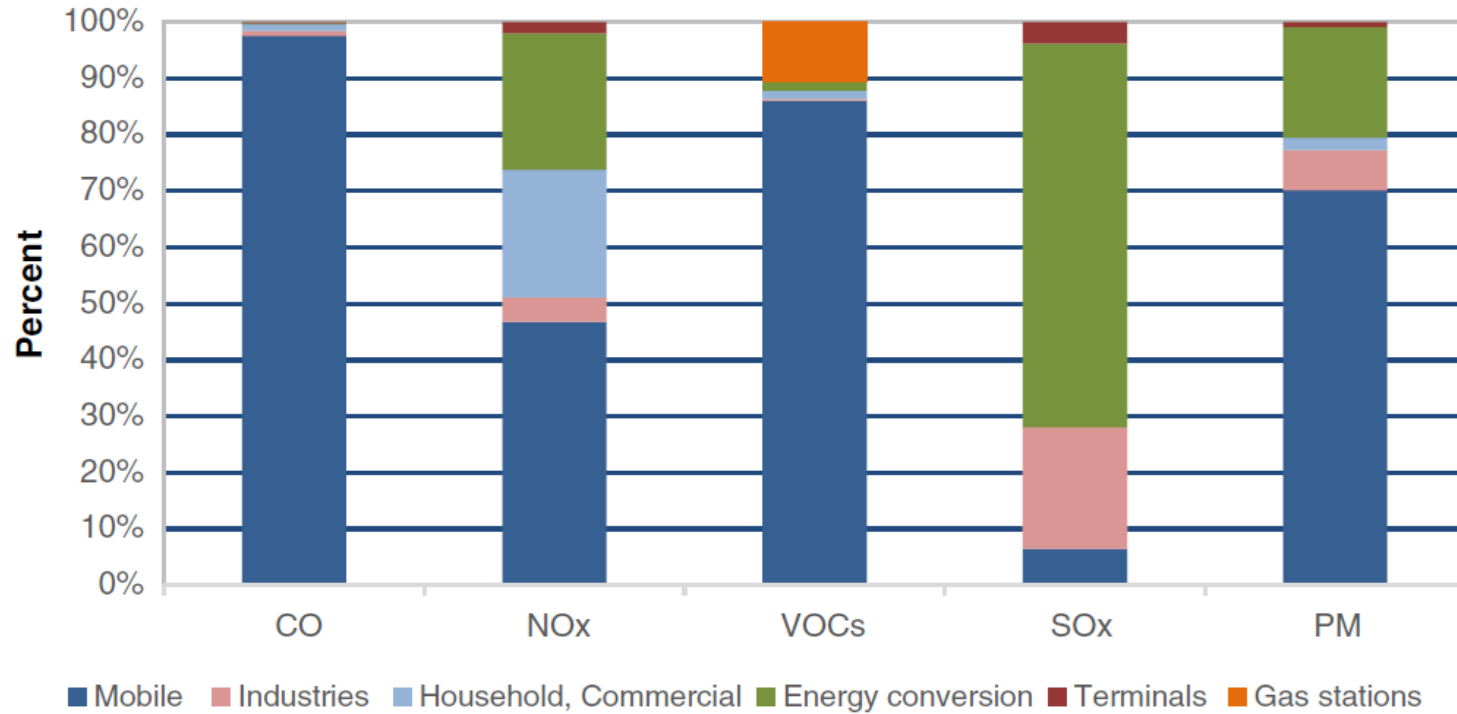
# Diesel share in Tehran PM is high based on emission inventory calculations





# Mobile source contribution to various criteria pollutants

*H. Shahbazi et al. / Urban Climate 17 (2016) 216–229*

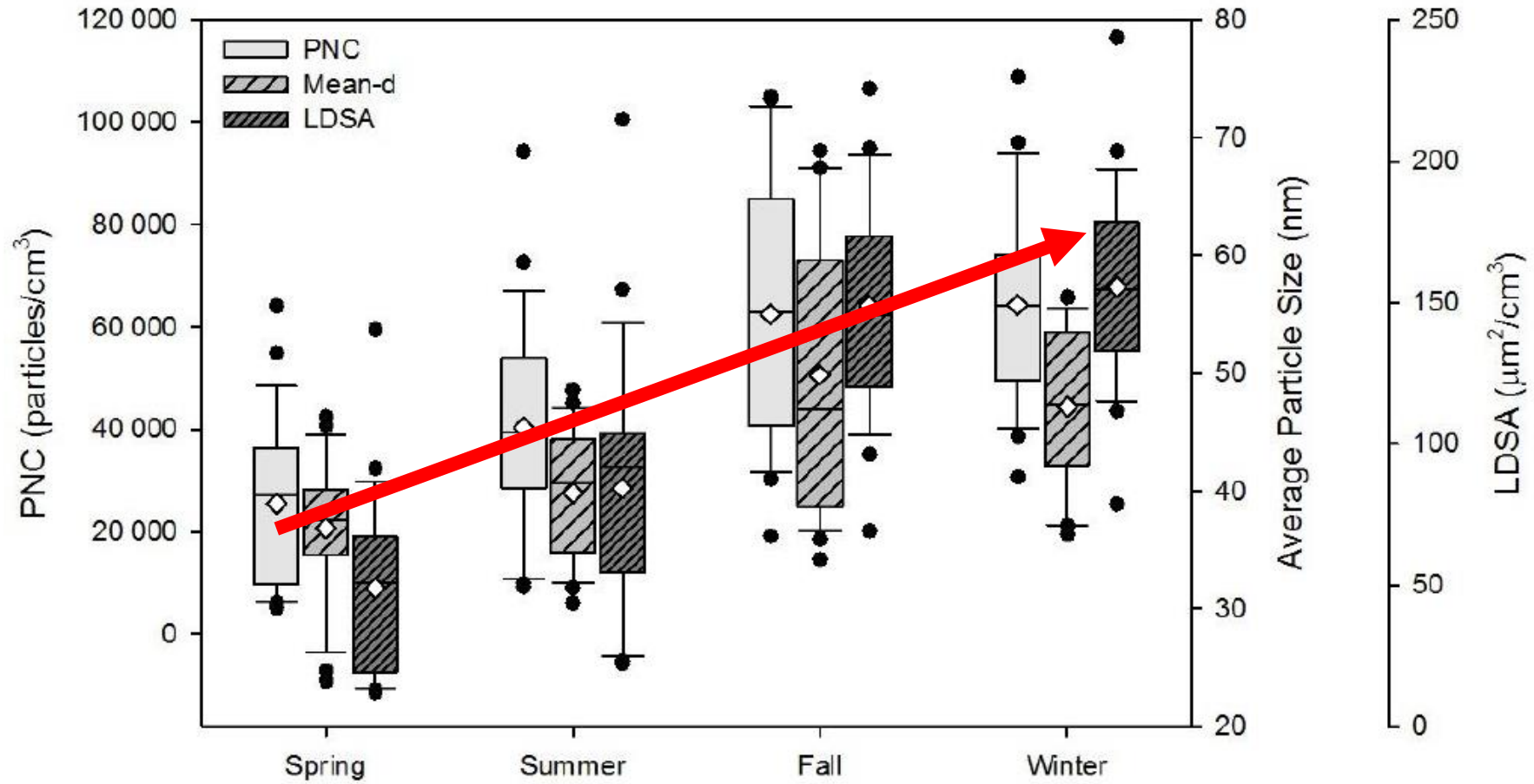


**Fig. 3.** Sectoral contributions to air pollution emission in Tehran for the base year of 2013.



# Increase of UFP (particle count) from Spring to Winter in Tehran

(measurement by M.J. Afroughi using DiscMini particle counter, 2015)





- Tehran particles is derived by mobile source particles
- UFP is a serious current and future concern
- National and local approaches to solve PM and PN problem:
  - Gasoline carburetors vehicles → Tehran LEZ
  - Gasoline carburetors motorcycles → Injector/catalyst equipped and electric motorcycles
  - Diesel vehicles → DPF retrofit and newfit, CNG vehicle, EVs



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# History of DPF legislation development in Iran





# The first draft of ministerial note

## April 30, 2013

خودروهای در حال حرکت		۲
۶ ماه	تعویض کاتالیزگر (کاتالیست) خودروهای عمومی درون شهری	۲-۱
۶ ماه	ارایه برنامه جایگزینی موتورسیکلت‌های برقی از سوی وزارت صنعت، معدن و تجارت به هیأت وزیران به نحوی که ظرف مدت معینی تعداد موتورسیکلت‌های بنزینی کاهش یابد	۲-۲
۲۴ ماه	استفاده از صافی (فیلتر) ذرات برای خودروهای دیزلی سنگین	۲-۳
۶ ماه	ایجاد ساختار یکپارچه معاینه فنی با بهره‌گیری از زیرساخت‌های الکترونیکی و انطباق با اطلاعات معاونت راهنمایی و رانندگی نیروی انتظامی جمهوری اسلامی ایران به منظور اعمال مقررات	۲-۴
۳ ماه	اصلاح حدود مجاز آلاینده‌گی در معاینه فنی	۲-۵
۶ ماه	اصلاح نرخ‌گذاری بیمه وسائط نقلیه با تأکید بر اهرم‌های تأثیرگذار بر کاهش آلودگی هوا و افزایش متناسب با سن خودرو با رعایت قوانین و مقررات مربوط	۲-۶
۳ ماه	ارایه برنامه اجرایی نوسازی ناوگان فرسوده حمل و نقل عمومی درون کلانشهرها	۲-۷

۱۳۹۳/۲/۱۰

شماره ۱۲۷۸۲/ت ۴۹۹۵۲ هـ

### تصویب‌نامه در خصوص الزام دستگاه‌های اجرایی برای مقابله مؤثر با آلودگی هوا

وزارت صنعت، معدن و تجارت - وزارت نفت - وزارت کشور  
 وزارت راه و شهرسازی - وزارت امور اقتصادی و دارایی - وزارت نیرو  
 وزارت آموزش و پرورش - وزارت بهداشت، درمان و آموزش پزشکی  
 سازمان حفاظت محیط زیست - وزارت ارتباطات و فناوری اطلاعات  
 سازمان صدا و سیما جمهوری اسلامی ایران - سازمان ملی استاندارد ایران  
 معاونت برنامه‌ریزی و نظارت راهبردی رئیس‌جمهور  
 معاونت علمی و فناوری رئیس‌جمهور

خودروهای نو			۴
۱۳۹۴/۱/۱	سازمان حفاظت محیط زیست	معاونت راهنمایی و رانندگی نیروی انتظامی جمهوری اسلامی ایران	۴-۱



- 22 April 2015 (one year later), ministry of industry suggested the following
  - Euro VI or Euro IV+DPF
- Year-long stakeholder process with everybody in the meeting resulted in a draft legislation





# Draft legislation from stakeholder process was presented to DOE

IRAN IVa and IVb – „Náó (ÁzÁ vóÉ“óñÚ wÉ ðó ó						
N2, N3, M2 & M3 > Í”ñ É wáó ó, %				ðó ó, ðí“		
ÈÉÉÉ wóóÁ				ù É/ a · fi		
:DF ** y Ív±						
PN [-]	PM [-]	NMHC [-]	THC [-]	NO <sub>x</sub> [-]	CO [-]	ÇñÉ ó
1.0	1.1	--	1.05	1.05	1.1	ESC
1.0	1.1	--	1.05	1.05	1.1	ETC
FOEN/SN277206 «çñÉ ó ðóñ vñ» «Á vóx óá ùñ~ýðó.*						
‘ ðö ùÇ zéDF wÉ“óñÚ ýðóÇñÉ**						

IRAN IVa PEEV – „Náó (ÁzÁ vóÉ“óñÚ wÉ ðó ó							
-+, 1 Ú/Á		-± M3 -y É ÚÉ·fi			ðó ó, ðí“		
-+, 2 É ùw		N2, N3 < ·Í/É			wáñíúÉ		
		MÉÍúÉ ðÉ ùÉ·fiÉ ·zÉv			Ú/Á < vñv		
					ù É/ a · fi		
		§ Í·y· ·ÉÁ ù·á/			wáñíúÉ		
		óñ“ “ · +ppm ÚÉ			°áÿ Çó·		
%óñÚ úóá							
[m <sup>-3</sup> ], óð	PN [# /kWh]	PM [g/kWh]	NMHC [g/kWh]	THC [g/kWh]	NO <sub>x</sub> [g/kWh]	CO [g/kWh]	ÇñÉ ó
-	1E12	0.02	-	0.46	5.0	1.5	ESC
-	1E12	0.03	0.55	-	5.0	4.0	ETC
ÇñÍfyú	-	-	-	-	-	-	ELR



- Pilot tests for city of Tehran
- 10 buses with close to 2 years of successful operation with filter
- Compatibility with fuel and lab oil
- Low maintenance
- Low rate of failures





Time for technical reasoning have been past long ago, we need a political decision !



Euro V EEV (suggested by a few manufacturers) is not a device or filter, it is only a recommended level of emission.

The particle count remains relatively constant from Euro II to Euro V, the mass is reduced only.

That is why Euro VI has PNC that can be achieved ONLY with BAT closed filters.





Euro V EEV includes SCR catalyst which is sensitive to low sulfur content, only removes NO<sub>x</sub>, and does not have anything to do with particles.

- PM and PN reduction in Euro V EEV is just because of higher combustion temperature in the engine, no filtering afterward.
- Adopting Euro V EEV has even more complexity than DPF, we have a few SCR trucks imported to Iran, they use water instead of Adblue, black market emulators cheat the NO<sub>x</sub> sensor signal → the result: extremely high NO<sub>x</sub> emission and no benefit for particles



While the cost of ownership for DPF is high,

....

it is nothing compared to health cost !!

ه ز ی ن ه ت ح م ی ل ش د ه د ر  
ب ر ا ب ر ف و ا ی د ح ذ ف ک ا م ل  
د و د د ی ز ل و ج ل و گ ی ر ی  
ا ز م ر گ و م ی ر و س ر ط ا ن  
و ب ی م ا ر ی ه ا ی ق ل ب ی و  
ع ر و ق ی ه م و ط ن ا ن ، ن ا چ ی ز  
ا س ت !



Some of diesel manufacturers has listened to our needs and respected our laws. They invested on providing us a solution. Changing the legislation in the last minute in the favor of those that are not willing to support our environmental needs, give a very bad signal for future legislations.





ی ک ح ق ی ق ی ت ل خ  
 ت ا ر ی خ ی

ز ا ص ی خ ح ط س ه ک ن ا م ز  
 ی ط ی ح م ت س ی ز د ر ا د ن ا ت س ا



2

و ا ی  
 و ب و د !

و ا ی  
 و ا ه د

و ا ی  
 و ا خ

و ا ی  
 و ا ی

و ا ی  
 و ا ی









Thanks for your attention

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