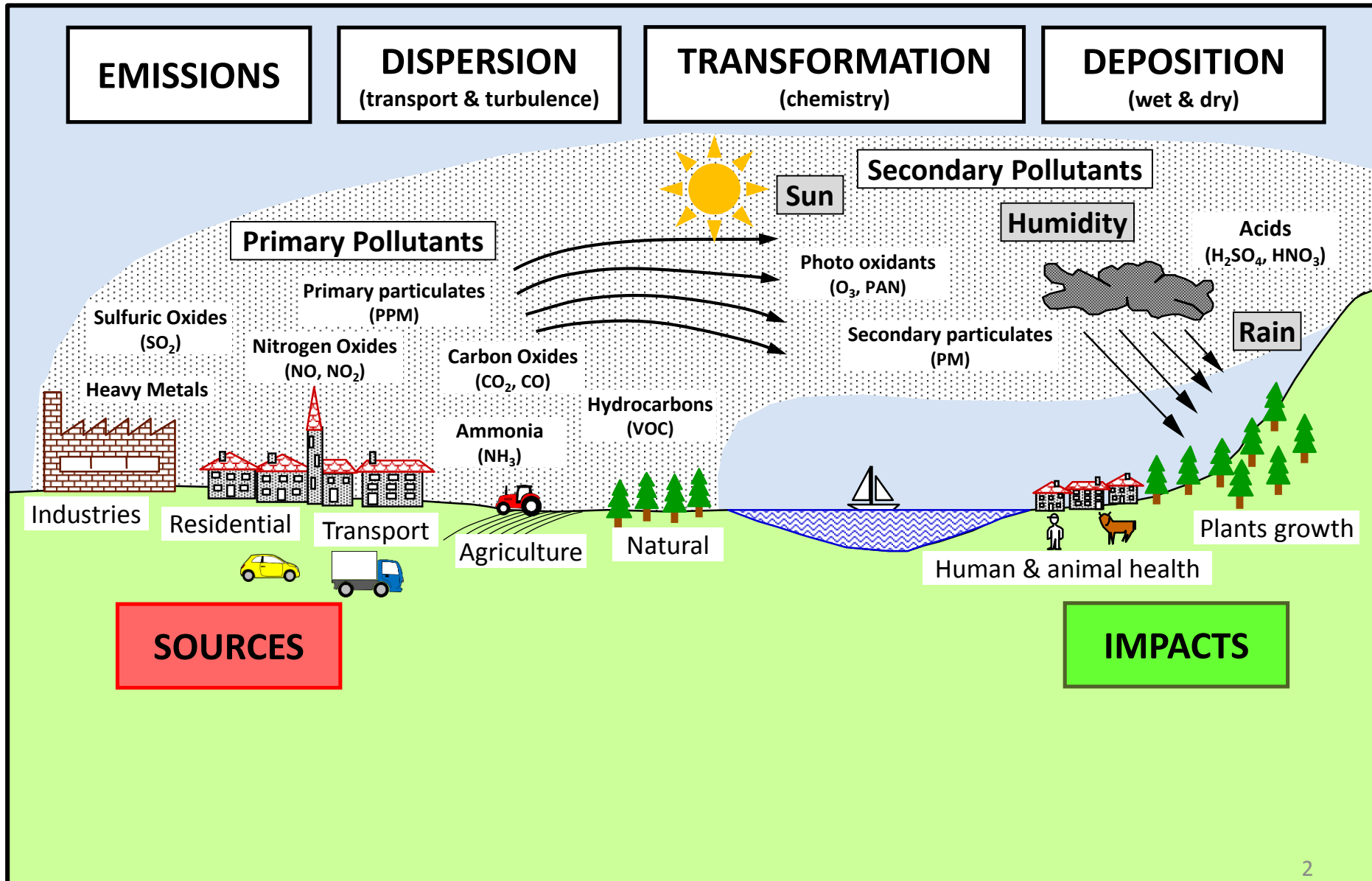


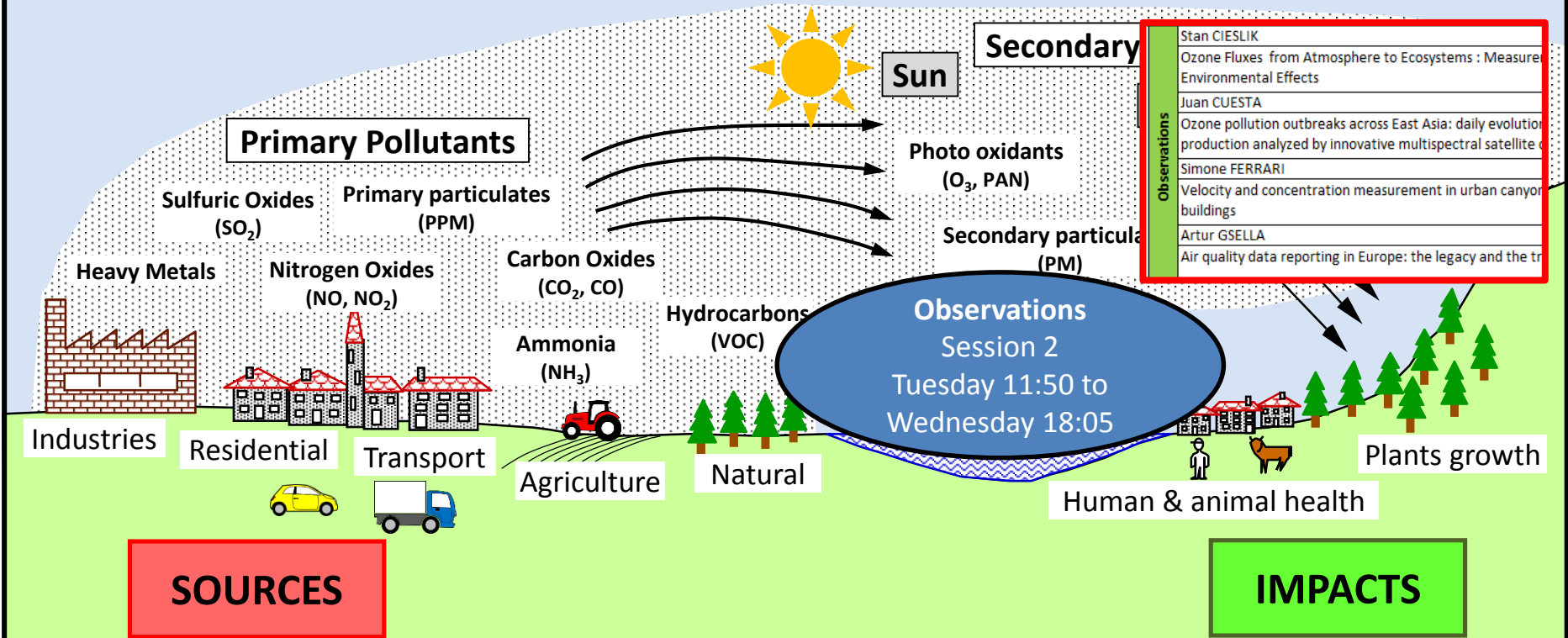
# Strategies to improve air quality

Clappier A.

# Air Quality Problems

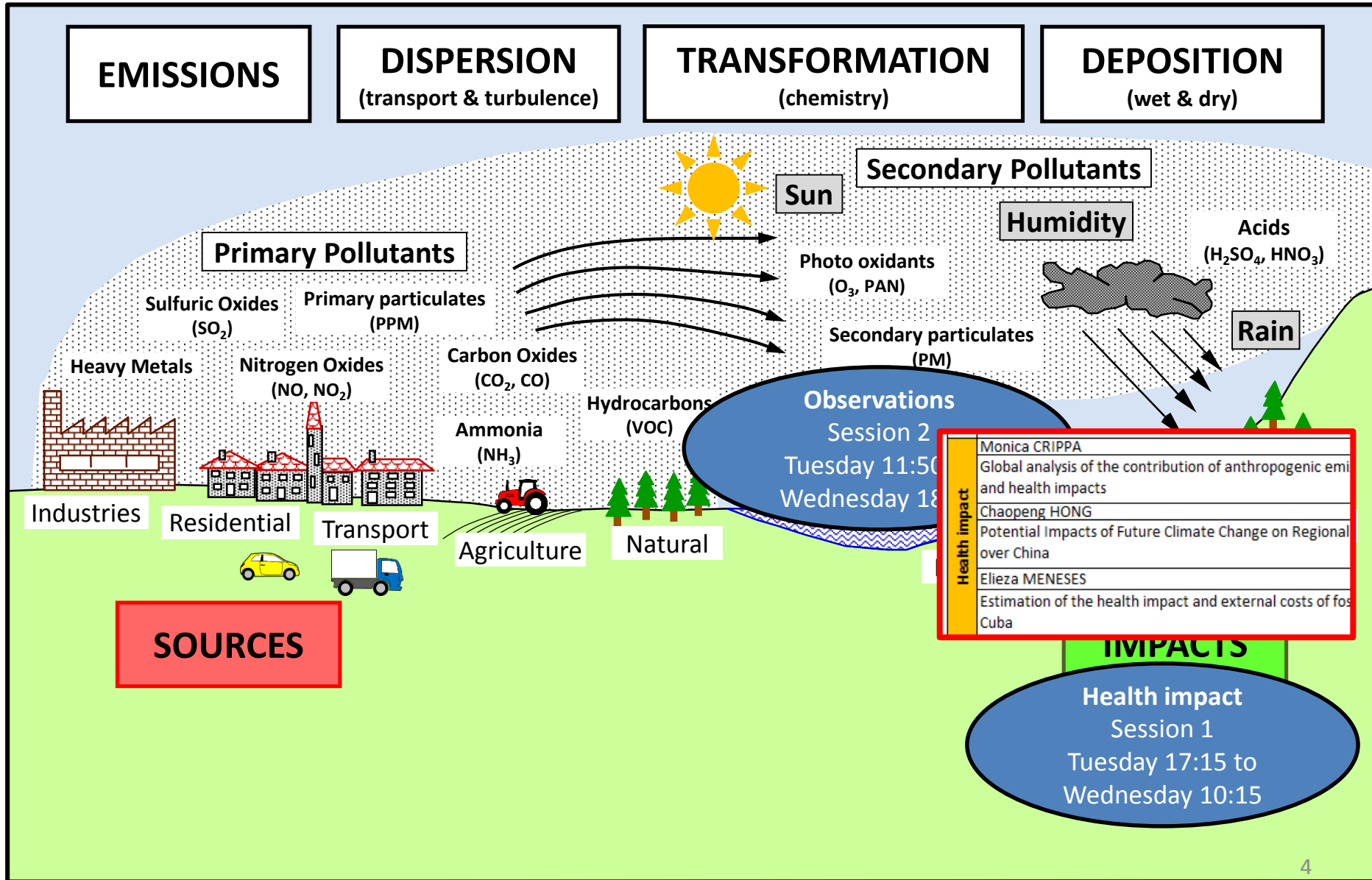


# Air Quality Studies



Observations	Stan CIESLIK
	Ozone Fluxes from Atmosphere to Ecosystems : Measurement and Environmental Effects
	Juan CUESTA
	Ozone pollution outbreaks across East Asia: daily evolution and production analyzed by innovative multispectral satellite data
	Simone FERRARI
	Velocity and concentration measurement in urban canyon and buildings
Artur GSELLA	
Air quality data reporting in Europe: the legacy and the future	

# Air Quality Studies



# Air Quality Studies

**EMISSIONS**

**DISPERSION**  
(transport & turbulence)

**TRANSFORMATION**  
(chemistry)

**DEPOSITION**  
(wet & dry)

**Primary Pollutants**

Sulfuric Oxides    Primary particulates (PM<sub>10</sub>)

Carbon Oxides (CO<sub>2</sub>, CO)

Ammonia (NH<sub>3</sub>)

Hydrocarbons (VOC)

Sun

**Secondary Pollutants**

Photo oxidants (O<sub>3</sub>, PAN)

Secondary particulates (PM)

Humidity

Acids (H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>)

Rain

**Observations**  
Session 2  
Tuesday 11:50 to  
Wednesday 18:05

Agriculture

Natural

Human & animal health

Plants growth

Emissions	Joana FERREIRA
	Improving emissions estimation from residential combustion
	Irena JEZEK
	Planning traffic emissions abatement strategies using a traffic model and measured black carbon apportioned to traffic
	Yun Fat LAM
Undated Regional Emission Inventory for Fine Resolution	
Jessie MADRAZO BACALLAO	
Design a low cost methodology to estimate vehicle emissions in Havana, Cuba	

**SOURCES**

**Emissions**  
Session 1  
Tuesday 12:15 to 17:15

**IMPACTS**

**Health impact**  
Session 1  
Tuesday 17:15 to  
Wednesday 10:15

# Air Quality Studies

**EMISSIONS**

**DISPERSION**  
(transport & turbulence)

**TRANSFORMATION**  
(chemistry)

**DEPOSITION**  
(wet & dry)

**Primary Pollutants**

Sulfuric Oxides  
(SO<sub>2</sub>)

Primary particulates  
(PPM)

Heavy Metals

Nitrogen Oxides  
(NO, NO<sub>2</sub>)

Carbon Oxides  
(CO<sub>2</sub>, CO)

Ammonia  
(NH<sub>3</sub>)

Hy

**Atmospheric chemistry**  
Session 2  
Tuesday 9:25 to 10:40

Atmospheric chemistry	Cristian FOCSA
	Characterisation of propane-based CAST soot samples using spectroscopic and mass spectrometric studies
	Cornelia IRIMIEA
	Understanding the formation and chemical composition of secondary organic aerosols using laser-based techniques: from laboratory to field
	Hiroaki KONDO
Comparison of Dispersion of 137Cs from F1NPP: Monitoring and Assessment of Operational Air Pollution Monitoring	

**Secondary Pollutants**

Humidity

Acids  
(H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>)

**Rain**

Industries

Residential

Transport

Agriculture

Natural

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**Primary Pollutants**

**Air quality modelling**  
Session 1  
Monday 13:15 to  
Tuesday 12:15

**Atmospheric chemistry**  
Session 2  
Tuesday 9:25 to 10:40

Photo oxidants  
(O<sub>3</sub>, PAN)

Secondary particulates  
(PM)

**Observations**  
Session 2  
Tuesday 11:50 to  
Wednesday 18:05

Humidity

Acids  
(H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>)

**Rain**

Hydrocarbons  
(VOC)

Ammonia

Natural

Plants growth

Human & animal health

**IMPACTS**

**Health impact**  
Session 1  
Tuesday 17:15 to  
Wednesday 10:15

Air quality modelling

Meissam BAHALI
Adaptation of the Lagrangian module of a CFD code for atmospheric pollutants in complex urban geometries and comparison with observations
Antoine BERCHEZ
Simulating hourly NOx, PM10 and CO2 in the city of Zurich at different scales for two years
Bob BORNSTEIN
Observation and Simulation of Bifurcation of a Summer Convective Cloud in Beijing
Andy CHAN
A case study of the June 2013 Biomass-Burning Haze event using a sensitivity study and vertical transport of haze

SESSION 1  
Tuesday 12:15 to 17:15

# Air Quality Studies

**EMISSIONS**

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(transport & turbulence)

**TRANSFORMATION**  
(chemistry)

**DEPOSITION**  
(wet & dry)

**Primary Pollutants**

**Air quality modelling**  
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Monday 13:15 to  
Tuesday 12:15

**Atmospheric chemistry**  
Session 2  
Tuesday 9:25 to 10:40

**Secondary Pollutants**

**Humidity**

**Acids**  
( $H_2SO_4$ ,  $HNO_3$ )

**Rain**

**Secondary particulates (PM)**

**Source apportionment**  
Session 2  
Tuesday 18:05 to 18:05

Source apportionment

Jiwei LI	Multi-year variation of PM10 chemical composition and source apportionment in an industrialized urban area, Spain
Xin LI	Attribution of PM2.5 Exposure in Beijing-Tianjin-Hebei Region to Control Strategies
Magdalena REIZER	Source apportionment of urban PM using hourly resolved trace elements
Satoshi TAKAHAMA	Understanding the composition and sources of organic aerosols from seasonal monitoring network measurements

**Industries**

**Residential**

**Transport**

**Agriculture**

**Natural**

**Human & animal health**

**Plants growth**

**SOURCES**

**Emissions**  
Session 1  
Tuesday 12:15 to 17:15

**Source apportionment**  
Session 2  
Wednesday 9:00 to 10:40

**IMPACTS**

**Health impact**  
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**Humidity**

**Acids**  
( $H_2SO_4$ ,  $HNO_3$ )

**Photo oxidants**  
( $O_3$ , PAN)

**Secondary particulates**  
(PM)

**Rain**

**Observations**

Abatement strategies	Luis Carlos BELALCAZAR
	Towards a sustainable mobility in Bogota Colombia
	Arthur ELESSA-ETUMAN
	The impact of the urban spatial structure on air quality in the compaction vs urban sprawl
	Joana FERREIRA
Air quality for Portugal in 2030 under the revised NEC Directive	
Deshmukh GOPAUL	
A novel biologically engineered device to fight air pollution	

**Industries**

**Residential**

**Transport**

**Ag**

**Human & animal health**

**Plants growth**

**SOURCES**

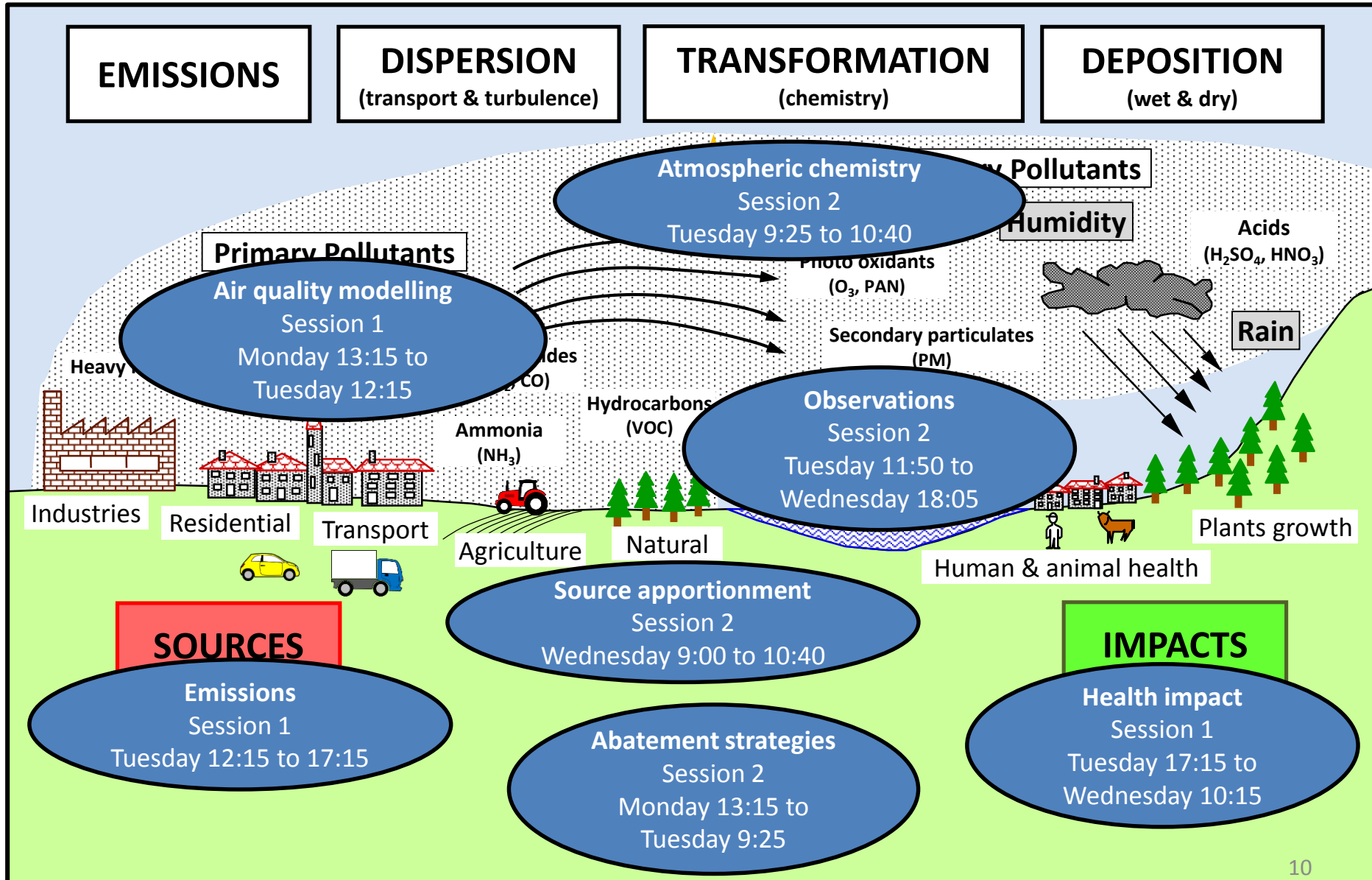
**Emissions**  
Session 1  
Tuesday 12:15 to 17:15

**Abatement strategies**  
Session 2  
Monday 13:15 to  
Tuesday 9:25

**IMPACTS**

**Health impact**  
Session 1  
Tuesday 17:15 to  
Wednesday 10:15

# Air Quality Studies

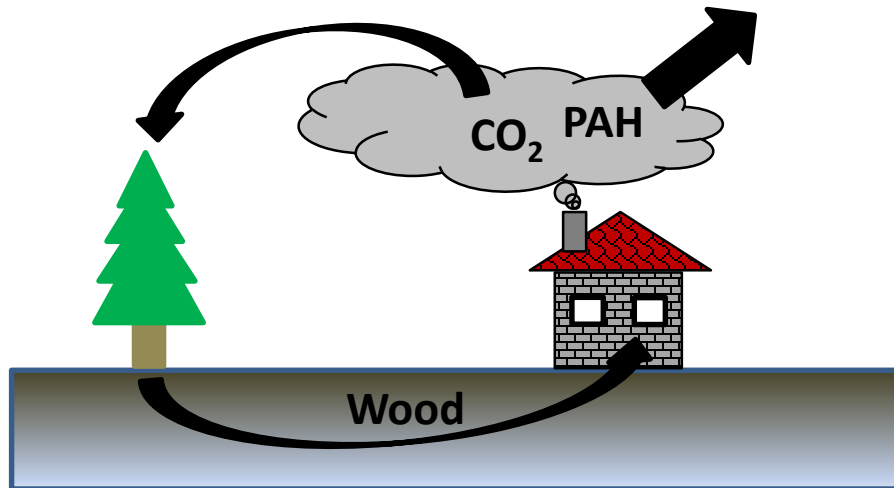
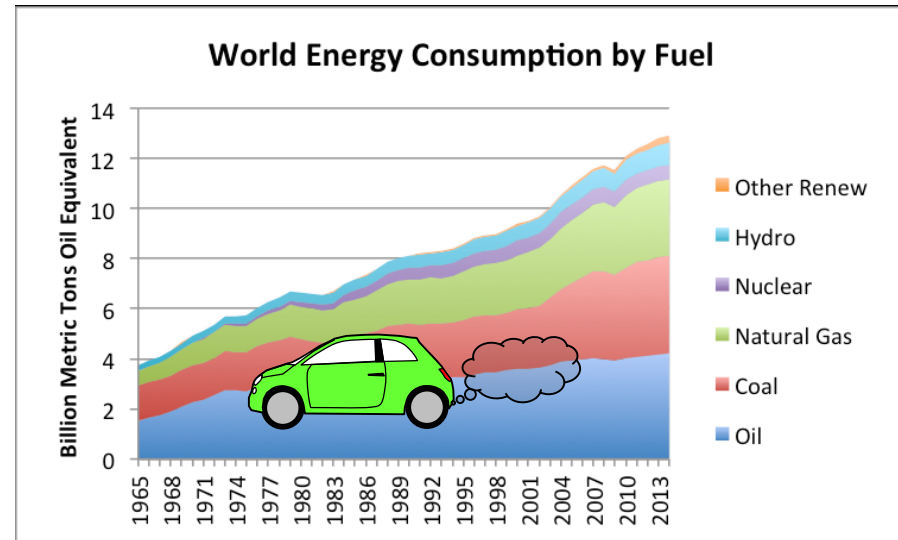


# Abatement Strategies: Targets

Level of pollutant concentration

Level of energy consumption

Level of greenhouse gas



# Energy, Air Quality and Climate Change are Key Global Issues

The global energy supply is a big part of our economy:

US\$ 15'000 billion per year representing **20-27% of the GWP**

in comparison, agriculture accounts for only 3% (US\$ 2'300 billion per year)

*Source World bank IAEA, 2013*

The massive use of energy resources has serious consequences for the environment:

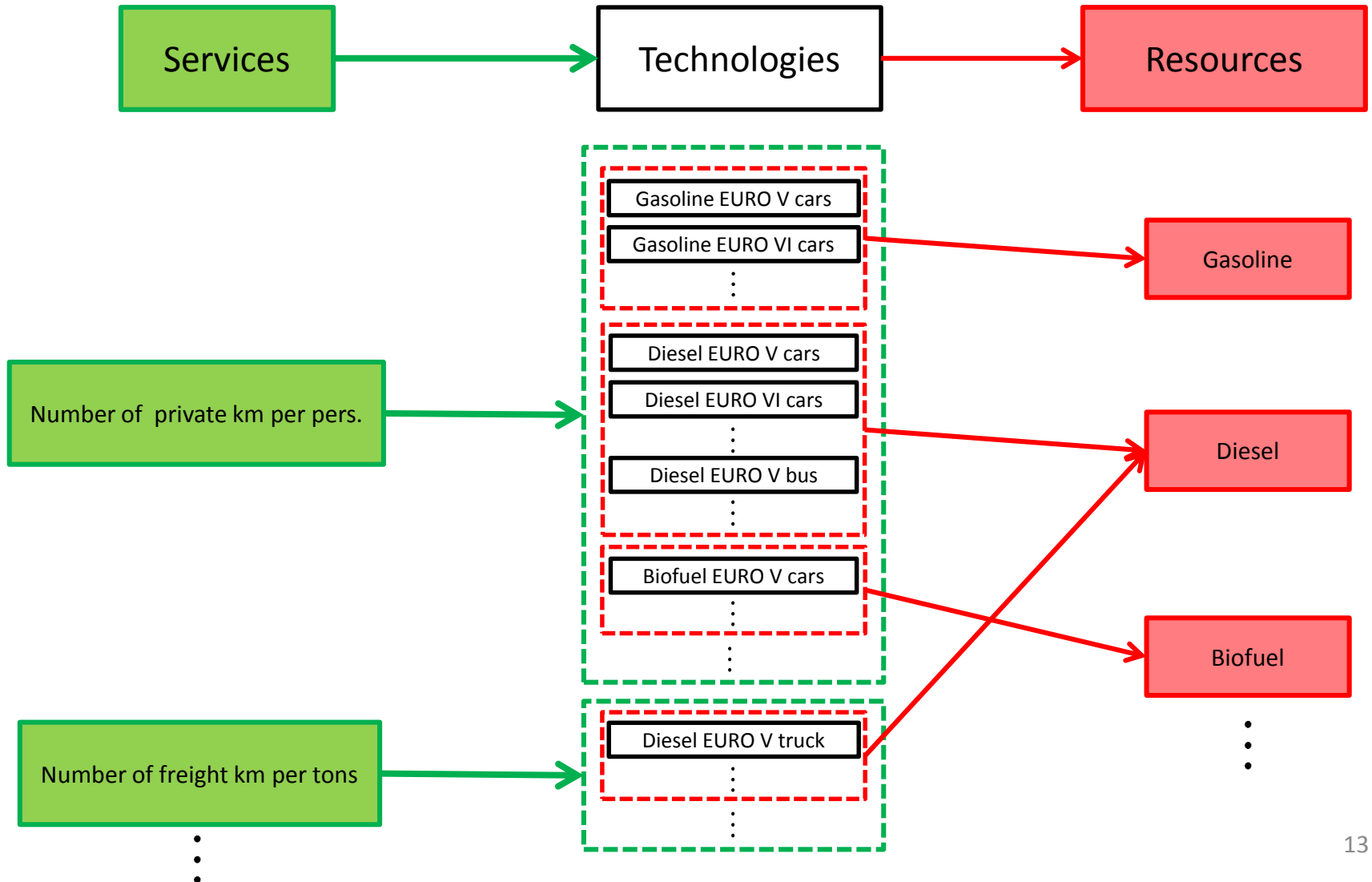
Air Pollution Deaths Cost Global Economy **US\$ 225 billion** per year

*Source World bank, 2013*

Since 2008, **21.5 million people** have been forcibly displaced each year by weather-related sudden onset hazards

*Source UNHCR, 2016*

# Technical Measures



# Technical vs. Non Technical Measures

Gasoline: Euro I



Gasoline: Euro VI



The technology changed  
but the resource remains the same

Gasoline



Electric



Technology and  
resource changed



Today: 17:30

Mark JACOBSON

Combating air pollution and global warming with 100% wind, water, and solar

1 passenger



2 passengers



Only the “technology use” changed

Private car



Public transport



Change in our way of live





# Example of CUBA

**1959:** Cuban socialist revolution succeed.

American trade embargo and support of Soviet Union are set up.

**1991:** Soviet subsidies and trade links are withdrawn.

Energy consumption drops for more than **40% in 4 years.**

(1772 kg equivalent oil/inhab. in 1989 to 1004 in 1993).

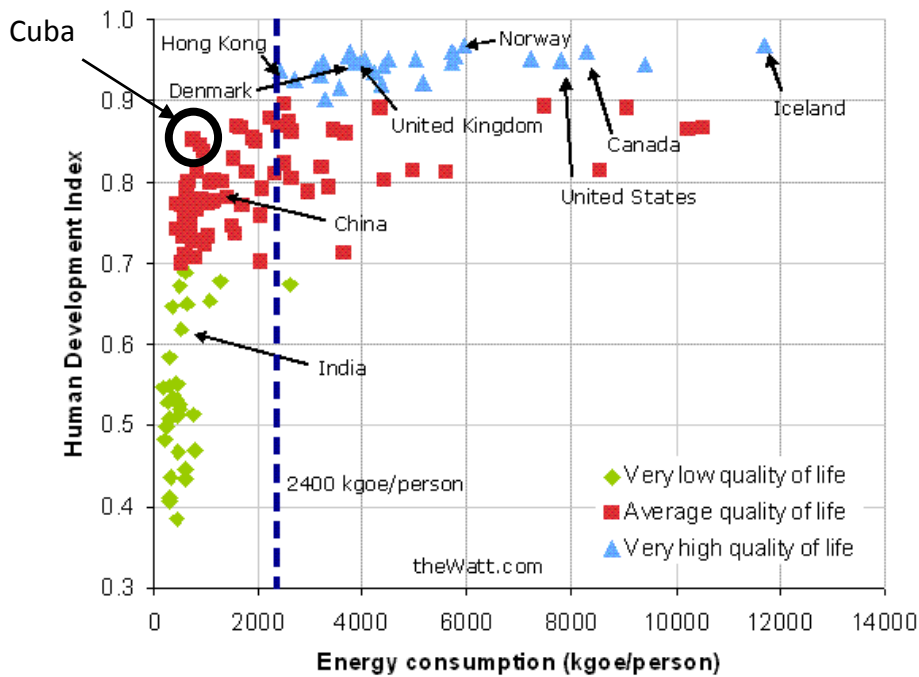
Energy supply by Cuban resources becomes an essential issue for the country.

**2006:** Cuban Energy Revolution starts:

Increase energy efficiency and renewable energy production.



# Example of Cuba

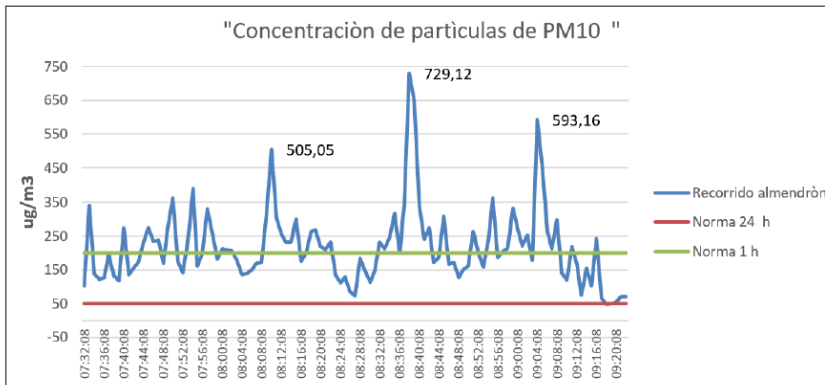


**TABLE 1. KEY DEVELOPMENT AND SUSTAINABILITY FOR CUBA AND THE USA**

	Cuba	US
Life expectancy	77.7	77.9
Literacy rate	99.8	99
Infant mortality rate (per 1000 live births)	6	6
% children with low birth rate	5	8
% of children enrolled in primary school	97	92
Public expenditure on education (% GDP)	9.8	5.9
Electricity consumption per capita (kWh)	1,380	14,240
CO <sub>2</sub> emissions per capita	2.1	20.1

SOURCE: DATA FROM THE UNITED NATIONS HUMAN DEVELOPMENT INDEX REPORT 2007/2008

But obsolete technologies generate environmental problems:  
example of air quality



An aerial photograph of a European city street. The street is lined with multi-story buildings, some with half-timbered facades. A large, prominent church spire is visible in the background on the right side. The text "MERCI DE VOTRE ATTENTION" is overlaid in the center of the image in a bold, red, sans-serif font.

**MERCI DE VOTRE  
ATTENTION**