Air quality and climate actions: analysis and perspectives in Lombardia Region

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Milano and Lombardia: Where and how many

- Po Valley: closed by mountains exceeding 2500 m a.s.l. on three sides (highest peaks exceeding 4000 m a.s.l.)
- Meteorological conditions often adverse to air pollution dispersion

Lombardia Region

- Inhabitants: 9.9 million
- Population density: 419 inab/km²
- 2017 GDP: 366 M Euro
- Per capita GDP 37,000 Euro

Milan conurbation

- Inhabitants: 3.6 million
- Population density: 3141 inab/km²

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Meteorological conditions often adverse to air pollution dispersion

Lack in wind
comparison 20 years annual average wind

Frequent very stable thermal conditions

MI-Linate December 2015
Monthly mean temperature and humidity at 12:00 GMT
Air Quality
Concentrations are decreasing but

- Widespread PM$_{10}$ daily limit exceedances (42-79 in Milan in 2018)

- NO$_{2}$ annual limit exceedances, especially in traffic stations (2018 worst annual mean 59 µg/m$^3$)

- B(a)P standard non achieved where wood burning is more diffuse (outside downtown)

- Widespread exceedances of both health and vegetation Ozone protection standards (above all leeward of the town)
- The scale of secondary PM is the whole basin
- Local actions alone are not very effective for secondary PM
- It is necessary to limit precursors emissions, s.a. NOx in basin and NH3, too
<table>
<thead>
<tr>
<th>Sector</th>
<th>NOx (%)</th>
<th>NH₃ (%)</th>
<th>PM10 (%)</th>
<th>CO₂eq (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy production and refineries</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>16</td>
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<tr>
<td>Residential combustion</td>
<td>9</td>
<td>0</td>
<td>43</td>
<td>20</td>
</tr>
<tr>
<td>Industrial combustion</td>
<td>17</td>
<td>0</td>
<td>9</td>
<td>17</td>
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<tr>
<td>Production processes</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Extraction and distribution of fuels</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
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<td>Solven use</td>
<td>0</td>
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<td>6</td>
<td>4</td>
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<td>Road Transport</td>
<td>53</td>
<td>1</td>
<td>25</td>
<td>25</td>
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<tr>
<td>Other mobile sources</td>
<td>11</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Waste treatment and disposal</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1</td>
<td>98</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Other sources and sinks</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>-7</td>
</tr>
</tbody>
</table>


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Wood combustion for domestic heating is the first source of BaP

Wood combustion is important also from a toxicological point of view

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Some important historical measures

- Coal and heavy oil ban for domestic heating from 2002
- Methane distribution network in 98% of territory
- Ban for low-efficiency households biomass burning (from 2007) Wood burning forbidden in stoves and fireplaces with a yield <63% or CO emissions > 0.5% (ref. 13% O2)
- Large-scale traffic limitations
- Authorizations and limits for all kind of plants not only large plants (from 1988) more stringent and undertaken before than European provisions.
- Thermal power plants only if fuelled by natural gas in combined cycle turbine power plants (NOx Emission limit of 30 mg/Nm3)
PRIA: Regional plan of actions on air quality

**TRANSPORT AND MOBILITY**
- Big LEZ: limitations up to euro 3 diesel cars
- Area C (an area in which you pay to enter) in Milan centre
- Bikes and car sharing
- 2 new underground lines
- Highway speed limits reduction (under study)

**STATIONARY SOURCES**
- Promotion of energy efficiency and rational use of energy
- Wood combustion rules and limitations
- Industrial plants and waste treatment: BAT and limitations to resettle of new plants

**AGRICULTURAL AND BREEDING SECTOR**
- Anaerobic digestion of manure and direct injection in the field
Emission reductions
Scenario - 2015

<table>
<thead>
<tr>
<th></th>
<th>NOx</th>
<th>VOC</th>
<th>CO</th>
<th>NH3</th>
<th>PM2.5</th>
<th>PM10</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLE 2020</td>
<td>-21%</td>
<td>-3%</td>
<td>0%</td>
<td>-2%</td>
<td>-8%</td>
<td>-9%</td>
</tr>
<tr>
<td>CLE 2025</td>
<td>-32%</td>
<td>-4%</td>
<td>0%</td>
<td>-2%</td>
<td>-13%</td>
<td>-14%</td>
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<tr>
<td>Update Regional Air Quality Plan PRIA</td>
<td>-38%</td>
<td>-7%</td>
<td>-25%</td>
<td>-26%</td>
<td>-48%</td>
<td>-44%</td>
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</table>

- To maintain the forecasting of NOx levels, it is very important that Euro6 diesel cars (and trucks) will register really the awaited decrease in NOx tailpipe emissions.

- In the decrease of PM10 and PM2.5 emissions due to PRIA, it is very important the contribution of the measures related to wood burning.
In 2025 a full respect of standards for PM and NO2 UE standards is foreseen.
Annual average temperature anomalies in Lombardia 1763-2012 (respect to 1971-2000)

Source: Maugeri et al 2013 ISAC/UNIMI
International Commitments of Lombardia Region

GHG emissions (not ETS):
- 20% (2020)
- 40% (2030) - baseline 2005

Total energy consumption = - 10%
Res / gross final consumption = 15.5%

Total GHG emissions - 80% (2050) baseline 1990

Global network to keep world of under 2°C of global warming and greater prosperity for all, without delay.

Adopt a regional plan or strategy on climate change adaptation within 2017

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Mitigation scenarios: Lombardia region GHSs

- 20% before 2020 (compared to 2005) Under Compact of States and Regions OK
- 40% before 2030 (compared to 2005) Under Compact of States and Regions HOW??
- 80% before 2050 (compared to 1990) Under 2MoU HOW??
Mitigation scenarios (examples)
Energy requalification of buildings
Lombardia

Average energy requirement of standard buildings: 250 KWh/m² year

Average energy requirement of buildings «almost zero»: 65 KWh/m² year

-74%

Residential area in Lombardy: 372 M m²

Possible energy savings:
5.5 M tep
8 M t of CO₂
Mitigation scenarios (examples)
Towards electric vehicles

<table>
<thead>
<tr>
<th></th>
<th>2017</th>
<th>2030 Low</th>
<th>2030 Medium</th>
<th>2030 High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Cars</td>
<td>14.647 (0.04% of stock)</td>
<td>2 mln (5% of stock)</td>
<td>5 mln (14% of stock)</td>
<td>5 mln (24% of stock)</td>
</tr>
<tr>
<td>Electric Light Duty Vehicles</td>
<td>4.454 (0.1% of stock)</td>
<td>202.763 (6% of stock)</td>
<td>350.265 (10% of stock)</td>
<td>630.478 (18% of stock)</td>
</tr>
</tbody>
</table>

Evolution scenario of electric vehicles in Italy

Source: Elaboration from The European House Ambrosetti, 2018
Mitigation scenarios (examples)  
Development of Renewable Energy Sources respect to Fossil Fuels

2005 and 2010: fossil fuel: +6% compared to 2000
2014 fossil fuel: -14% compared to 2000
2016 fossil fuel: -8% compared to 2000
Mitigation scenarios (examples)
Development of Renewable Energy Sources respect to Fossil Fuels

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# The Regulation of wood burning in Lombardia

## Identification of different emission classes of stoves and incentives for substitution of the worst ones

- Different PM10, NOx, CO and OGC classes of emissions are defined for wood stoves and fireplaces.
- Incentives to substitute the worst stoves with better performing ones.

## Rules on maintenance and control

- Regulatory measures for stoves and fireplaces regarding their maintenance and control: they must follow the same rules of all the other heating domestic systems and be registered **in Regional census database**.

## Rules for installation and use of the stoves and fireplaces step by step more ambitious

- Wood burning is forbidden from 15.10 to 15.4 in stoves and fireplaces with a yield <63% or CO emissions > 0.5% (ref. 13% O2) from 2006.
- The requirements for new stoves are step by step more ambitious in terms of number of stars required: 3 stars from 1.10.18 and 4 stars from 1.1.20.
- Progressive ban of the already installed stoves of the less performing classes, starting during high pollution episodes.
**Key implementation challenges**

**Cultural – INFORMATION is a KEY FACTOR**
- Wood burning is seen as “bio” “green” “environmental friendly”
- Mass media are often skeptical
- People don’t appreciate the impact of this source on air quality and health, so it is difficult to implement actions

**Legal:**
- In Italy it is very difficult to control inside private houses (the best way of action is to work on the rules for new appliances)

**Economical:**
- Now heating by wood costs half than by methane or light oil

**Technical – technological:**
- Methods to measures PM emissions must represent real emissions to avoid another. Dieselgate also in this field.
- It is necessary to go on in developing products really capatible with air quality
Number of wood stoves <35 kW vs. emissions

<table>
<thead>
<tr>
<th>Year</th>
<th>Innovative stoves</th>
<th>Pellets stoves</th>
<th>Traditional stoves</th>
<th>Traditional close fireplaces</th>
<th>Traditional open fireplaces</th>
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</thead>
<tbody>
<tr>
<td>2008</td>
<td></td>
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<td>2015</td>
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</table>
Adaptation

Methodological and technological measures

Economical and financial

Knowledge and capacity building

Areas of action, in relation to regional characteristics

1. Human health and air quality
2. Soil and territory protection
3. Water management and quality
4. Agriculture and Biodiversity
5. Tourism and Sport
Air vs. Climate change

Good for air quality

Best

Energy efficiency
Heat and energy from sun and renewable (not wood)
Nitrogen management in agriculture (with biogas production)
Hybrid and electric vehicles (if electricity by renewable)

Good for Climate

Bad for air quality

Growth in consumption
Use of fossil fuels

Bad for Climate

Worst

Wood burning for domestic heating
Use of biofuels for vehicles?
Thank you for your attention

Grazie per l’attenzione

谢谢你的关注