

**A study on the political, economic,
social and legal issues of air
pollution.**

Team Pasteur Paris 2017
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Preamble

The third Pasteur Paris team was gathered in January 2017. Our first meetings were focused on knowing each other and brainstorming on the subject we wanted to work on this year. This choice was hard to make because we would have to stick to that topic for almost a year. However, over our discussions, one topic always came back: we knew we wanted to work on pollution.

Indeed, in France we were in the middle of the presidential campaign and many of the political platforms were mentioning the topic of pollution. One of the candidates had even directly targeted the endocrine-disruptors.

Once our subject was chosen and the project had begun, we decided, as law students in our team, to make a report on air pollution and especially on how it affected our society in several aspects. Therefore, we decided to try to explain the political, economic, judicial and social issues linked with air pollution.

For the purpose of this report, we have met with some major players in the French fight against pollution, such as associations, but also people working for the French administration, such as mayors' and minister's counselors.

With our project *aether*, we hope to give a technical solution against air pollution, but we think that technical means cannot do it all. We believe that each and every one should understand what are the main issues related to air pollution.

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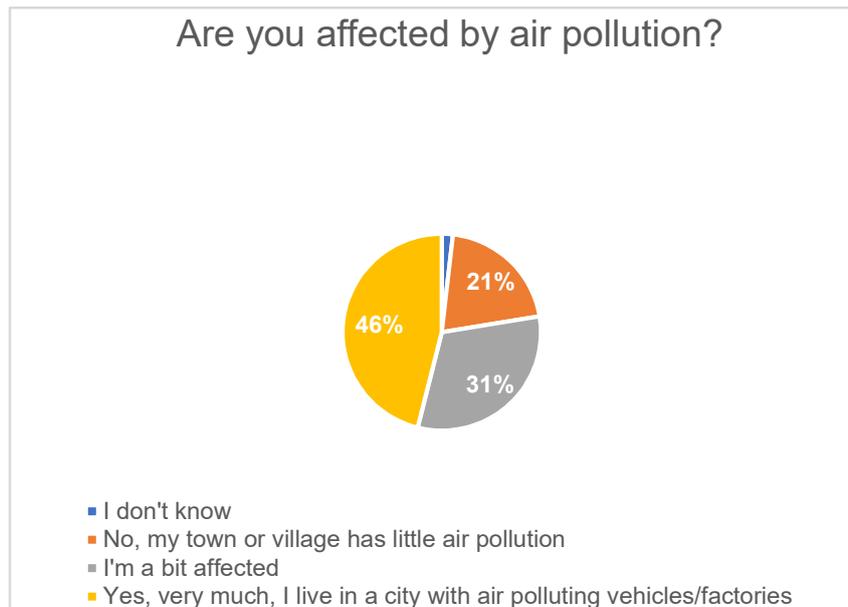
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The impact of air pollution on the society

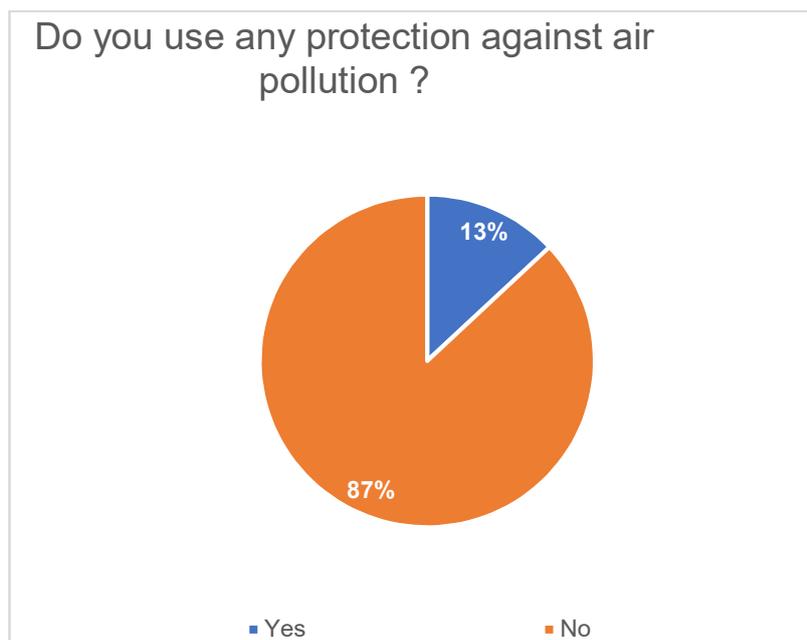


During the development of our project, we wondered what was the level of information, of interest and the reaction of the population when dealing with air pollution. To answer this question, we realized a survey for which we received more than 2300 answers from all around the world¹. This questionnaire allowed us to have a global vision of the understanding of people on air pollution, and sometimes of their lack of reaction. Let's watch at the charts hereunder.

¹ 1874 answers from Europe, 213 from Asia, 97 from North America, 71 from Africa, 24 from South America and 9 from Oceania



We can see that according to our questionnaire, 46% of the people believe they are affected by air pollution.



However, only 13% of the population uses protection against air pollution.

These statistics show that the population may have the information they need about air pollution but they do not really know how to fight against it. Consequently, it is important for the leaders of our world to raise awareness among the population through education and information by the media.

For our participation to the iGEM Competition, we have decided to collaborate with the UChile_OpenBio-CeBiB Team and they accepted to answer some of our questions about air pollution. One of them was “Is your country more aware of outdoor air pollution or indoor air pollution?”. They have answered that it was outdoor air pollution: most of people don’t know about indoor air pollution and use firewood heaters to warm their houses. Also, lots of people use kerosene for their heater. There is not much information about their risks, but the state is investing on education about the problems of contamination and the ways to heat our houses.

On our small-scale, we also tried to inform the population, mostly children, about air pollution. For example, on the French National Day of Air Quality, we organized a treasure hunt about air pollution and particulate matter. This event also allowed us to observe the shortcomings among the participants about this issue.

Indeed, most of the people had never heard about the associations that collaborated with us on this project: the Association Respire² (Inhale Association) and the Fondation du Souffle³ (Breath Foundation), although they are starting to be very influential in fighting against air pollution for the health of the citizens.

We believe that alerting the general public to air pollution is one of the most efficient solution against this plague. But in some countries, it is still complicated. Indeed, in developing countries such as China or India, the concern of economic development still overtakes the concern of environmental protection. However, those countries are starting to react and we can see that more and more, people claim their environmental rights.

Some cities have to use some emergency measures such as watering the streets so that the pollution can stick to the ground, instituting a moratorium for building works, closing schools in periods of pollution peaks⁴... The idea of installing some giant purifiers for the outdoor air is even contemplated in some cities.

However, these solutions, as well as being not that efficient, are really expensive for the local authorities. To support these costs, the authorities would probably have to impact the citizens themselves by increasing taxes. But are the citizens concerned enough with air pollution to pay more to breathe a better air? And

² Meaning ‘Breathe’ in English.

³ The Breath Fondation

⁴ All of these measures were used in New Dehli during the pollution peaks of Automn 2016

even if they do are concerned, does it mean that the rich would have less air pollution than the poor?

We can see that these differences of treatment between the rich and the poor is major when dealing with air pollution. Even if we are all equal regarding air pollution outdoor, the rich have the possibility to buy air purifiers for their houses so they can breathe clean air at least half of the time.

There is even a difference in the emissions of each other. Indeed, the rich are living in newer buildings that are equipped with filters and which are meeting the quality requirements. They also have money to buy hybrid or electric cars which are emitting less than old cars.

So how can we change these differences? Do we have to force people to pay for new cars and to have homes that meet the air quality standards? It may be difficult for the poor. But if they cannot pay, how could we reduce air pollution?

We can see in this section about air pollution and its impact on the society that there is no good solution to reduce the atmospheric pollution and that the only way to bring interest to the population is to inform them through education or the media. Things are starting to change, especially in developing countries where people are more and more concerned in claiming their environmental rights.

The legal issues of air pollution



The French Constitution, through the Charte de l'Environnement⁵ states that *Everyone has a right to live in a balanced and healthy environment*⁶. More precisely, the French law through the LAURE⁷ act says that *Everyone has a right to breathe an air that does not damage his health*⁸.

In France, the protection of the environment has a constitutional value, it means that it is one of the most important values protected by the French legislation in the same way as secularity or democracy. Indeed, the Charte de l'Environnement⁹ was given a constitutional value in 2005, and this value was implemented by the French supreme administrative court and the French constitutional court in 2008.

Many other countries gave the same value to the protection of the environment by writing it in their constitutions. For instance, the Chinese Constitution states that the State shall protect and improve the living and ecological environment and prevent and control pollution.

⁵ The Environmental Convention

⁶ Non-official translation

⁷ The LAURE act is the Law on the air and the rational use of energy adopted in 1996

⁸ Non-official translation

⁹ The Environmental Convention

But in some other countries, there is no such constitutional value. For example, in Canada, there is no explicit recognition of a free-standing environmental right in the Canadian Constitution. Does it mean that Canada cares less about pollution and the health of its citizens? Probably not. But the protection of the environment by the legislation is still in its infancy and the emergence of what we can call environmental law is relatively new.

Indeed, the application of the environmental legislation is not that easy. Let's take an example that was given to us by Sebastien Vray, founder of the Association Respire¹⁰. Let's think that we are on a highway in the north of Paris. There are a lot of houses near this highway. For this reason, the local authorities produced a regulation stating that the amount of particulate matter in the air cannot exceed 50 micrograms per cubic meter more than 35 days a year. Nevertheless, the analysis shows that these 35 days quota are already met on March the 17th and that the exposition to particulate matter is more of 140 days a year.

In this case, the local regulations are not observed. But who can be blamed? And who can blame those at fault? Who is the casualty of this pollution? The citizens whose health is in danger? The environment and the Earth itself? But how can the Earth claim for reparation of its own prejudice?

In most of judicial systems, to obtain reparation of a prejudice, you have to give the proof of three elements: that you suffer from a harm, that someone is at fault, and that your harm is caused by this fault.

Your harm can be easy to prove. But how to prove the fault of someone? And who's fault is involved in the case of air pollution? The State's because it does not meet its own objectives of environmental quality? The industry because it is responsible for a large amount of this pollution? But every one of us is responsible for air pollution. Indeed, in 2013, on average, one American produced 16 tons of carbon dioxide per year¹¹.

And even if you manage to prove the fault, how to prove that this fault is the cause of your harm?

Despite those questions, sometimes people succeed in bringing an action to obtain reparation of their harms. Indeed, in June 2017 a woman sued the French State for its breach in making the air quality norms respected. Her action is following the winter of 2016 during which Paris was very affected by air pollution. The plaintiff was diagnosed with a pericarditis attributed to air pollution by her cardiologist, she is asking for 142.000€ of damages for the reparation of her

¹⁰ Meaning 'Breathe' in English

¹¹ According to a study realized by the Global Carbon Project

harm. The case is very new and have no precedent in France, so we do not know what will be the reaction of the tribunal yet. As it was the first time the State was put at blame for its inefficacy in the fight against air pollution, this news made a lot of noise in France, and was highly voiced by the media. This exposure was even more important because the plaintiff was supported by influential French associations such as the Association Respire¹², and was defended by a well-known lawyer in the cases of environmental damages¹³.

The question of the allocation of damages is also complicated in the domain of air pollution. Indeed, several solutions are possible. First of all, some countries are wondering if the harm should be repaired by allocating damages proportionally of the plaintiff's loss. This solution has been chosen in China since the Special State Compensation Law. The payment of damages by calculation of the plaintiff's loss is deemed to be a good solution in China as it is very difficult to determine the damages, the relation between the cause and the effect, and the share of responsibilities. However, this solution implies that we can evaluate the cost of the harm, which may be difficult. Let's take the case of the French plaintiff, how can we know that 142.000€ is the good compensation for the harm she suffered from her pericarditis?

A second solution could be to impose damages in kind, for example by ordering to the offender to act in order to reduce air pollution.

Finally, in some countries like Canada, judges can allow costs but no damages, which means that the compensation paid for the fault is allowed to the State and not to the plaintiff. This situation may only apply in cases where some private parties, such as some industrial companies, are at fault but not when the State is. It is also the case in Chili where really important penalty fees can be given to pollutants. However, according to some Chileans, there have been lots of cases where industries and people have cheated the regulations, or payed a penalty fee and continue polluting. So, laws must be stronger and regulate a specific and accurate system for supervision.

Once all of these questions are set, a last one stays: what is the competent court and who is the competent judge to hear cases about air pollution? Indeed, the sources of the environmental law is multiple in most of countries. You can see an example of the multiplicity in the table thereafter with the case of France.

¹² Meaning 'Breathe' in English

¹³ Especially with the famous case of the asbestos' victims.

French law	<p>Four major laws are governing the environmental right in France:</p> <ul style="list-style-type: none"> ➤ The law for the protection of nature 1976. ➤ The law on the protected facilities for the protection of the environment 1976. ➤ The law for the reinforcement of the protection of the environment 1995. ➤ The Grenelle laws of 2009 and 2010. <p>Furthermore, those acts were codified in the Code de l'Environnement (Environmental Code) in 2000. Constitutional value with the Charte de l'Environnement in 2008.</p>
Regulations	Acts made by the government and the local authorities in their fight against pollution.
European law	As France is part a member of the European Union, it has to meet with the European directives and regulations.
International conventions	<p>France is a State member in two major conventions about environment:</p> <ul style="list-style-type: none"> ➤ The Berne Convention on the Conservation of European Wildlife and Natural Habitats 1979. ➤ The Aarhus Convention on access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters 1998.
Case law	Precision and application of the principles fixed by the laws, by the courts and tribunals.
Other dispositions	France is also considering some recommendations such as those of the World Health Organization (WHO) even if those ones are not mandatory.

The sources of environmental law in France

This multiplicity of sources can be problematic when dealing with the relevant judge. Indeed, there is no judge when a State breach an international convention. And even in each country, the procedural rules are different depending on the laws of the country.

The Congress of Cartagena organized by the International Association of Supreme Administrative Jurisdictions¹⁴ on the subject *The administrative judge*

¹⁴ IASAJ

*and environmental law*¹⁵ made a comparison of the application of environmental law in almost 50 different countries. Those countries answered a questionnaire about the sources of environmental law, the competence of the administrative judge in the administrative field, the proceedings when dealing with environmental cases and the enforcement of the court decisions. For the purpose of this report we have chosen to only work on three countries which seems to be different enough: China, France and Canada.

We can see that some countries do have specialized courts or tribunals to hear the cases in environmental matters. For example, in Canada, there are specialized administrative tribunals to hear appeals related to environmental compliance orders, but no specialized environmental courts. In the same way, for the Chinese authorities, trial of environmental cases shall be conducted in specialized way so there are special tribunals dedicated which have been approved by the Supreme Court. On the other end, there are no specialized courts nor tribunals in France and there is no exclusive competence of the administrative judge in environmental matters, which means that environmental cases can be heard in front of both a civil court and an administrative court.

We already saw in this document that the role of associations is major in environmental law. But do they have a right to bring action in an environmental case with or instead of the victim? The interest of an association suing for repairing of a damage would be that it is very media-friendly and that the case could be largely broadcasted. Here again, their right of bringing action varies according to the countries.

Indeed, in France, there is a certification procedure since 1976 to be a certified association for the protection of the environment. This associations can benefit from a presumption of interest in taking action if there is a direct effect between the decision and the objects of the association. Apart from this certification procedure, other associations can take action but they would have to bring the proof that they have an interest in taking this action. This interest is assessed according the purpose of the request and take into account the criteria of geographical proximity and neighborhood.

In China, those who can take action are individuals, NGOs and functional departments of a government. The last one has been recognized by judicial practices, their actions are called environmental suits for public interest. For example, the All-China Environment Federation often take action as plaintiff in some cases.

¹⁵ Congress of Cartagena April, the 11th 2013.

Finally, in Canada, the interest into taking action varies from statute to statute: it can be the person to whom the decision or order is directed or those that are directly affected. NGOs or legal persons can also take action if they have a sufficient interest but they do not benefit from a presumption of interest.

Even if they have a major role in environmental law, some associations ask for more and especially for more recognition of the importance of environmental damages. Indeed, the association “End Ecocide on Earth” is a grassroots initiative (citizens’ movement) aimed to recognize the crime of ecocide in international criminal law as a fifth crime prosecutable before the International Criminal Court in The Hague, in the same manner as the crime against humanity, genocide crime, war crimes or crime of aggression¹⁶.

¹⁶ For more information: <https://www.endecocide.org/ecocide/> (Accessed on the 28/10/2017).

The economic aspects of air pollution



If atmospheric pollution is a major plague for society, it can be considered as a gold mine for economic actors. Indeed, pollution “enables” them to increase their industrial activity.

Actors involved in air pollution

Three main sectors are concerned:

- Domestic sector

Human activity can be considered as one of the major source of pollutants. Domestic cooking and heating with solid fuel use generates indoor air pollution. It affects accommodations such as work places. Thus, people contribute to increase particulate matter’s concentration in the atmosphere.

- Transport sector

It is probably the most known one. It “provides” the highest NO_x concentration.

- Power sector

In our developing world, we need more and more energy. We mainly use electric power generation that can be bad for the environment. Industrial combustion contributes as well to most of the SO_2 present in the atmosphere. $\text{PM}_{2.5}$ originates mostly from this sector, particularly in manufacturing industries.

Everyone is responsible for pollution: citizens (for a small part) and firms (for a huge part). But why do they pollute? Is it by choice? Are they, at least, aware of being sources of pollution? Is it better, economically, to pollute?

Undoubtedly, there is an important relationship between economics and pollution. Both are linked. In major cases, economic development goes along with increasing pollutants concentration. It is a fact that air pollution is generally worse in developing countries. How to deal with this issue? How to develop the economy while preserving health and environment?

Costs of air pollution

Pollution may be considered by industrials, as a citizens' category, as the cheapest way to achieve something. Indeed, some activities that require energy or use of fuel will be dealt according to financial resources in most of the cases. People seem to value money more than environmental or health impact. It is probably because they are not aware of these issues. A study in China shows that awareness may vary by education level and work environment (inside or outside). Correlatively, those attributes refer to living conditions. Therefore, we cannot really speak of a choice between money and pollution in the citizen situation (See our integrated Human Practice sections).

In this paper, we will rather focus on the industrial scale. Why are big companies polluting? Is there a right to pollute?

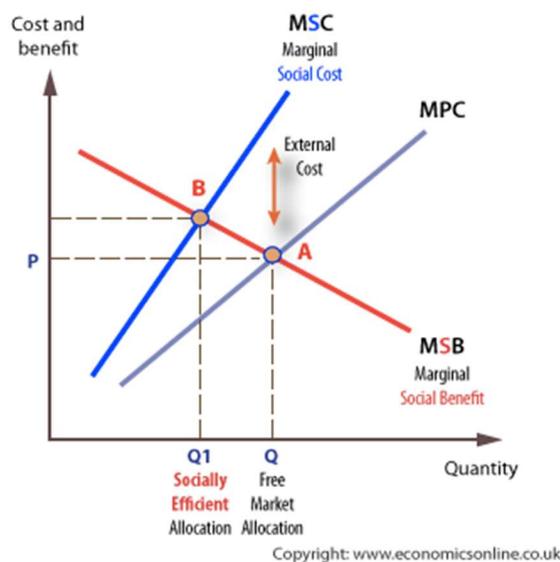
Financially, it is more profitable for industrials to use cheap compounds, that might be pollutants. It is obvious: an affordable product will enable them to make a better profit. But at which "price"? Certainly not a monetized one! Here, it is their morals that is impacted!

Industrials pollute. It is a fact. Even if economic measures are taken, they continue to do so. Why? It is simple: they buy the right to pollute. Indeed, sometimes, they make more benefits by continuing using pollutants and paying the ecotax (that sanction them) than by trying to reduce their pollutant activity and thus not contributing to the tax. There are also some fiscal systems that allow companies to pay less taxes in order to benefit from abatement when they finance associations fighting air pollution. We should thus reinforce the law and increase taxes. However, it is really hard to make these measures coercive. In fact, there is a huge industrial lobbying on governments about air pollution. In Chili, for example, the UChile_OpenBio-CeBiB told us that *"There has been a stir in the approval of some thermoelectric plants and the use of selected firewoods. As part of our human practices project, we are working with Los Maitenes community, in Puchuncaví (declared zone of contamination). There the villagers told us that the municipality help the thermoelectric plants and doesn't give any compensation to them for the damage produced."* Another

problem leads in financial aid from the State itself. Governments help developing economy to increase GDP. Nevertheless, these subventions might benefit to detrimental activities for environment and health.

What about the cost of pollution? It is really complicated to calculate it. How to evaluate its impact on health and the environmental prejudice? How to monetize such “goods”? Some people may argue that it is possible to calculate the cost of pollution by collecting data during pollution peaks, such as the number of people going to the doctor. It would help economists to measure the value people give to health (direct costs and indirect ones); and then to compare it with depollution costs. Nevertheless, in this blurring, an economic market of pollution tends to grow.

Pollution is also the best illustration of negative production externalities. This phenomenon is described by the website www.economicsonline.co.uk as “an external cost that is suffered by a third party as a result of an economic transaction”. Environmental degradation affects adversely every sector of the economy.



In France, the principle “*pollueur-payeur*” applies. The polluter has to give money to the State (through taxes) because of his polluting activity. In fact, industrials emit pollutants that will spread in the air. In a property rights aspect, air is a common good. Thus, it belongs to no one or it belongs to everyone. People might then be affected by these pollutants: it will have an impact on their environment, on their health and thus on their well-being.

This tax is however limited. First of all, as it is really complicated to identify polluters, this tax is based on a declaration system. The company fill a form and detail all pollutants that it emits. Secondly, it is really complicated to define an optimum level of pollution.

Costs of air depollution

Governments are proactive in the development of environmental policies. They create taxes to regulate the market and to protect health and environment. These measures are fighting air pollution on both aspects: sources and spreading. They encourage industries not to pollute (by dissuasive means) and they will punish those who did.

Environmental policies can be achieved by:

- governmental measures

They benefit to companies that adopt less polluting technologies. If they do not, they would be exposed to financial sanctions. However, this modernization of technology has a cost for companies and can be difficult to implement.

- economic measures

They modify prices, increase taxes and encourage new production organizations in order to diminish pollution. Thus, taxes seem to be the perfect tool to achieve an environmental policy. To evaluate the amount of taxes, the principle “you pollute, you pay” should apply.

However, depollution generates costs as well: costs of control (air quality needs to be measurable), such as costs for companies (their benefits can be impacted either by economic sanctions or by forced inducement to change their way of production). A failure in the incorporation of measures in economic policies causes losses in GDP and also creates many health and environmental problems.

Air pollution reduction strategies must then be applied in respect of an appropriate balance between economic activities and the protection of air pollution.

Remedies to reinforce economic measures, and more specifically taxes, without interfering the market and economic development

Depollution is justified when its costs are lower than its benefits. Thus, we can think about some technical solutions, like the one proposed by a study in

Pakistan¹⁷: regulating the use of energy by finding alternatives to pollutants (such as the utilization of cleaner fuels) and organizing emission control measures through end-of-pipe systems.

The writers of the study offer alternative to pollutants with natural gas resources to substitute them in each sector.

- *“Liquefied petroleum gas for polluting fuels in the domestic sector*
- *Natural gas to substitute coal and oil in the power plant sector*
- *Compressed natural gas to substitute diesel and gasoline in the transport sector”*

However, these cleaner alternatives need to aim at providing the same level of energy services to industry and households as it is assumed in a business-as-usual scenario. Only then it will be possible to create a working system.

“On the basis of a detailed assessment of air pollution mitigation strategies in Pakistan, it is observed that continuation of the current practices in the implementation of emission controls standards, paired with the progressing increase in energy consumption that accompanies the rapid economic development, will lead to a significant increase in air pollution levels throughout Pakistan.” It is then necessary to react in order to manage future emissions of air pollutants.

Other remedies exist. Government can intervene through taxes or direct controls and regulations.

- The most obvious one relies on taxing polluters. However, we have seen its limits (How to identify the polluter? A right to pollute remains. etc...)
- Grants should be offered to citizens or firms to be non-polluters (financing home insulation improvements for example).
- In order to banish the right to pollute, the government could try to regulate it by selling permits to pollute. A risk still exists: polluters trading it.
- Polluters could also be forced to pay direct compensation to those who suffer.
- Perhaps the most useful remedy is information. Public awareness can be so powerful and have a real influence towards more effective decision making.

¹⁷ Pallav Purohit, Tahira Munir & Peter Rafaj (2013) Scenario analysis of strategies to control air pollution in Pakistan, Journal of Integrative Environmental Sciences, 10:2, 77-91, DOI: 10.1080/1943815X.2013.782877

At an individual scale, another study in China¹⁸ shows that people are willing to pay for a reduction in particulate matter (42\$ per year per person for a 1% reduction in PM_{2.5}). The writers used data from 2004, referencing people's answers about happiness. Then they crossed the results by geographic zone with pollution peaks that occurred at the same time. They discovered a correlation between local concentration of particulate matter and individual happiness. The study explains that the concentration of particulate matter is negatively associated with people's hedonic happiness. Thus, people are more willing to pay for depollution.

A monetary value of better air quality seems thus to exist. But evaluating it is a great challenge. We need to find a "balance between monetary value of better air quality and the cost of environmental regulations". The writers of the survey made an equation to evaluate the money metric value of air quality, the "willingness to pay". It represents the amount of annual income that people, on average, are willing to pay for one-unit improvement in daily air pollution. Surprisingly, "although people in the U.S. seem to be willing to pay a much higher amount in absolute terms, Chinese residents are more willing to pay a larger share of their income for air pollution mitigation than their US counterparts."

People are aware of air pollution and its damages. They are willing to fight it by economic ways: paying to depollute. What about firms? If they do not act on their own, economic sanctions can induce them to do so. Thus, economic measures happen to be a good solution in order to preserve health and environment. It remains however a political concern.

¹⁸ Xin Zhang, Xiaobo Zhang, Xi Chen "Valuing Air Quality Using Happiness Data : The Case of China", *Ecological Economics* 137 (2017) 29-36

Air pollution and politics



Politics is the process of making decisions that apply to members of a group while air pollution is a major plague that affects health and environment. Thus, to fight it, decisions should be taken by politics.

Political actors involved in fighting air pollution

If everybody pollute, is everybody involved in depollution as well?

The State can be seen as the first actor in this fight. It has resources, power and means to target polluters and regulate air pollution through law or economic measures. To apply these policies locally, cities represent the best option. They benefit from great power to diminish air pollution as they are the most concerned by it. Citizens are also involved in this process. They are directly touched by air pollution. They have power through vote and representation in public institutions.

Non-public actors can also be identified. On one hand, organizations dealing with air quality (such as associations or NGOs) represent an important impact on environmental policies. Through information and public engagement, their actions may influence politics. In France, Respire Association is one of the main actors denouncing air pollution. We had the opportunity to meet its president Sebastien Vray. He explained to us the important role they can have in different fields. For instance, they took part in a case where a victim was attacking the State because of health problems due to air pollution. They also inform people

about damages resulting from this plague on their website. And they work actively with the AirLab. They invited us to join their Airlab activities. On the other hand, firms can also influence environmental policies through lobbying. Their action, in this case, is much more discreet. With strong relationship with powerful politics, these economic actors may obtain taxes less high than they are supposed to be.

The situation in Chile, as described by UChile_OpenBio-CeBiB, is significantly the same: “The main actors fighting air pollution are the State, with the Ministry of Energy and Environment. The internal revenue service (SII) regulates the carbon bonds. Recently, some municipalities and industries are starting to regulate and cut their emissions. There are some NGOs that fight against this.”

International aspect of air pollution policies

Air pollution is worldwide. Every State is concerned. Some more than others. China, United States, India, Brazil, Indonesia, Russia, Japan, Germany, Iran, Saudi Arabia, South Korea and Canada represent the biggest polluters in the world. If industrial countries have enough resources to fight air pollution, it is not the case for developing ones. They tend to focus more on economic development than on environmental protection. But pollution does not know boundaries. Thus, transboundary air pollution is the responsibility of everybody! For instance, China pollutes Hong Kong’s atmospheric territory: 60 to 70 % of particulate matter come from China. Treaties have been signed but they are not enforced as authorities deny the problem and citizens are not aware of it. Another example can be seen here in France. Ruhr coal factories, in Germany, pollute the French air; much as the French industries pollute Spanish air or British one (depending on the winds).

In order to regulate this transboundary air pollution and to insure a “European responsibility”, European commission has joined international treaties such as Geneva convention, Stockholm convention and Kyoto protocol.

Kyoto Protocol from 1997 introduces limit values for greenhouse gas that are mandatory for industrial countries. European Union applies the Kyoto system of trading for greenhouse gas quotas.

It also adapted this system to firms in order to allow them to create a “depollution market”.

Other international texts organize the regulation of air pollution, such as the directive on ambient air quality and cleaner air for Europe (from 2008). According to this text, national authorities must establish actions plans to reduce air pollution.

These texts provide ways and means of forcing countries to abide by international rules of environmental law.

However, the World Health Organization recommendations on air quality are not mandatory. Nevertheless, the threshold they determine are taken in account by every State to establish its own threshold.

The article 2 of the Code de l'Environnement (Environmental Code) refers to these concentrations limits and adapt them according to two criteria: surface area and population.

National aspect of air pollution policies

Government agencies are often called upon to implement environmental regulations in order to reduce air pollution.

The former French government has been criticized by the Conseil d'Etat (State Council) for its incapacity to deal with air pollution. Nicolas Hulot, the new French Minister of Ecological and Solidary Transition presented therefore a "climate plan". He will also implement processes about air quality in order to deal with all pollutants (by adapting rules according to each territory). Furthermore, he developed a project of measures to fight endocrine disruptors thanks to transparency about the products concerned, financial independence of agencies for their studies, consumer information and research.

French law is also referring to air quality. The article L 125-2 of the Code de l'Environnement stands for a right to information about air quality and its effects on health and on the environment. The State is the warrantor of this right.

The article L 221-1 of the same Code defines the air quality control and establish a role for technical coordination on air quality surveillance. Thus, this body should check substances generated and spread by firms and citizens.

The Code du Travail (Labor Code) refers also to air quality. It establishes a right for workers and employees to breathe a pure air. A norm (XP X43-401) from December 1998 organizes air quality audit on offices and meeting rooms. Whereas indoor air pollution is often regulated in workplaces, it is not the case in private accommodation.

Local aspect of air pollution policies

Air pollution is easier to deal with on a local scale as cities are the most concerned by this phenomenon (outdoor air pollution).

In Chile, for instance, “air quality is measured in several stations around the city. Depending on the classification of the air, some things are forbidden. For example, the circulation of specific vehicles, depending on the numbers with which their number plates end.”

In Paris, it is AirParif that will measure air quality every day through several stations implemented in all the region Ile-de-France. According to the rate, measures can be taken by the city or/and by the region. They participated with us for the particulate matter chase this year.

Preventive aspects of air quality policies

On a long run, governments will organize different thresholds (limit values, alert values, information values) for the principal pollutants in order to deal with them. In case of a pollution peak, measures have to be taken urgently. Thus, local actors are the most concerned.

Every measure should respect the precaution principle. It means public actors should create a frame in order to respect security while depolluting.

Repressive aspects of air quality policies

To be applied by firms and people, most of the measures need to be mandatory. They should then provide sanctions for those who do not respect them. In almost all cases, this punishment will be financial. Nevertheless, indoor air pollution is rarely raised, so are its sanctions. Most people just do not talk about it (even if there are some studies) and measures targeting this pollution are uncommon.

However, targeted policy interventions seem to be a good solution. For instance, the French region Ile-de-France is very polluted due to both wood combustion (for heating) that represents 26% of the concentration in particulate matter and transportation (28 %). Consequently, outdoor combustion has been forbidden, such as the use of unfiltered fireplaces. The most important measures concern nevertheless traffic.

Policy initiatives and technical measures

Different means can be used to implement environmental politics, more often on local scales:

- Restricted traffic area
It is the case in Germany with their “Umweltzone” and since January 2017, in Paris with the “Crit’Air” sticker.

- Urban gates (London, Stockholm, Oslo, Göteborg, Dublin, Milan)
- Alternating traffic (Lyon, Paris, Bruxelles, Athènes)
- Forbidden traffic (Bruxelles)
- Lower higher speed (Bruxelles)
- Freedom for public transportations (Bruxelles, Paris)
- Incentive measures for electric cars (Oslo)
- Financial helps to replace polluting heaters (Grenoble)

What about the future?

Climate policies have a huge impact on air quality when they are respected! A continuation of the current situation, regarding the implementation of environmental policies and laws and national environment quality standards, would not be suitable for health and environment. Thus, we need to change our current system by controlling emission of pollutants. Policy interventions could then benefit for the coming generations.

CONCLUSION

WHICH SOLUTION TO FIGHT EFFECTIVELY AIR POLLUTION?

It is possible to control air quality by different means. Our iGEM project has tended to apply them.

- First of all, pollution need to be dealt at its sources. Thus, we think legislation and economic measures are essential. However, in France, law does not really frame activities as far as indoor air pollution is concerned. The LAURE law edicts “a right for everyone to breathe an air that is not harmful for oneself”. We would like to add some requirements about indoor air pollution, that is often forgotten, and sanctions because this law need to be mandatory. Thus, the law should offer “a right for everyone to breathe an air, both inside and outside, that is not harmful for oneself. If someone purposely pollute a pure air, he shall be sanctioned by paying 100 euros to each person that has been harmed by one’s action.”
- A cultural solution may also be implemented through education and information. Therefore, we organized several events and met people to talk about air pollution, its sources, its effects and ways to fight it: at school, during our Particulate Matter Trap Day, with associations, through our questionnaire, etc...
- If such a prevention does not work, technical means should be used. With *aether*, we provide this support: our system captures and destroy air pollutants.

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