The Great Transition – Group Project

'AirQuality'
Our unique solution to empower citizens to monitor and react to the pollution conditions of Paris.

AIRQUALITY
LOOKING FOR PURE AIR

Our Team

Nabilla KOUKOUCH

Sinaya
MIRELMANN

Julia
GARNIER BRUN

Martin
MINE

Kristyna
GREGOROVA

Elana
MOVSHOVICH

Romane
GAUTHIER

Cyril
DI FAZIO

Thomas
MAISEY

Hubert
DESBONNETS

AIRQUALITY
LOOKING FOR PURE AIR

Report Outline ☑

Our pressing crisis

- An overview of the dynamics of pollution and its impact on public health.

The global movement

- A look at the growth of and lessons from ecological cities.

A focus on Paris

- What has been happening locally and where we need to go next.

Our proposal - AirQuality

- What is AirQuality?

- How can AirQuality help a difference in battle for a clear environment here in Paris?

- How does AirQuality stand above the current competition?

Contextual Review

Considering the pressing environmental challenges facing our planet and society today

Pollutants: the basics

- Since October 2013, pollutants have been classified as carcinogenic to humans by the International Agency for Research on Cancer.

- This demonstrates the increasing urgency of the air pollution issue.

- Pollutants are classified into different categories:
  - Particulate matter
  - Particle pollution, that make their way into liquid droplets and miniscule particles in the air that we then inhale.
  - PM2.5 and PM10: the most common size references

(Source: US EPA)

AIRQUALITY
LOOKING FOR PURE AIR
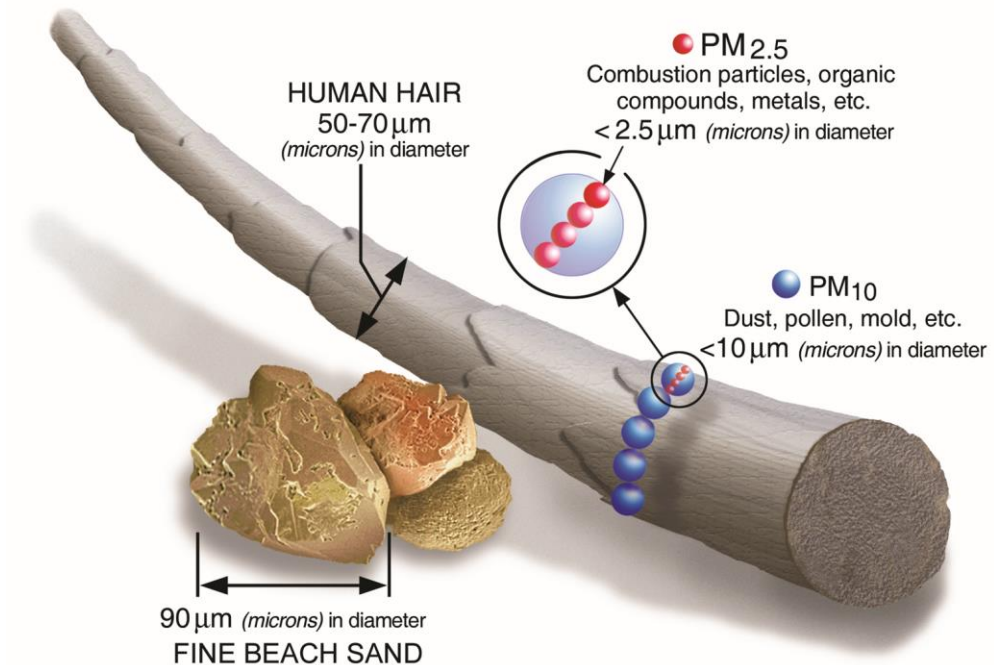
Breaking down the health impacts 💓

- Health consequences depend on particle size: Those with a diameter less than 10 micrometers are the most dangerous. They can enter deep into the respiratory system and potentially even the bloodstream.

- Correlation between fluctuations in gaseous/particulate pollutants and symptoms of cough, including nocturnal cough, chest wheezing, and the occurrence of bronchitis

Population particularly at risk and possible health consequences

Air Protection Plan (PPA)

RÉPUBLIQUE FRANÇAISE

Préfet de Région | **Préfet de Police**

Comité stratégique de pilotage

Acter, dans la concertation, les décisions importantes permettant la bonne marche du projet

- Collège État

- Collège Collectivités territoriales

- Collège des activités émettrices de substances

- Collège des associations et personnalités qualifiées

Comité technique

Assurer la bonne conduite du projet en veillant notamment à la qualité des productions et au respect du calendrier -suivi des travaux, préparation des COPIL-

- Directrice de projet
- SGAR   - ADEME
- DRIEE   - ARS
- DRIEA   - Airparif
- DRIAAF - Région
- DRIHL   - MGP

Selon les enjeux, d'autres experts pourraient être sollicités ponctuellement

ateliers sectoriels

Secrétariat assuré par services de l'État (indiqué entre parenthèses)
- industrie (DRIEE)
- transport routier, fluvial, ferrov. (DRIEA)
- transport aérien (DGAC)
- agriculture (DRIAAF)
- résidentiel / tertiaire (DRIHL)
- santé (ARS)
- collectivités (ADEME)

Commission de suivi

Suivre les mesures à travers les indicateurs pertinents préalablement choisis

- Représentant de l'État

- Représentant des collectivités territoriales

- Représentant des activités émettrices de substances

- Représentant des associations et personnalités qualifiées

AIRQUALITY
LOOKING FOR PURE AIR

A review of current standards

- **In France:** the first policy was the Convention on Long-range Transboundary Air Pollution signed in 1979 .

- The Law on Air and the Rational Use of Energy (LAURE Act) of 1996 lays down the modalities for the elaboration of an Air Protection Plan (APP) for all agglomerations of more than 250.000 inhabitants.

- The PDU (plan de déplacement urbain) sets the objectives and framework of the regional travel policy for all modes of transport.

- **European level:** the Directives (2004/107 and 2008/50 / EC) lay down the health standards to be complied with. This translates into the obligation:
  - monitor the quality of the air.
  - to inform the population about the quality of the air.
  - to respect the health standards set;
  - to implement action plans in areas for which exceedances of health standards.

AIRQUALITY

The growing global response

Looking at promising responses to pollution across the globe

AIRQUALITY

Ecological cities: an emerging blueprint

- Developing countries and emerging economies have been active in creating ecological cities.
  - These *'ecological cities'* are characterised by specific design elements that consider and compensate for social, economic and environmental impacts that accompany urban living.
- In Asia there are several cases of considerate urban planning with significant outcomes for the environment.
  - Different neighbourhoods have been engineered to utilise a different approach to urban planning are mainly environmental considerations.
  - In our research we've tried to consider the lessons we could learn from these different contexts...

Ecological Cities - The Common Chinese Model

- In China there has been a range of disjointed government supported initiatives.

- Often these have ranged from from promoting the adoption of sustainable building methods, to the wholesale construction of water and sanitation routes.

- This model is characterised by direct government intervention in the design and implementation of response to colitmen change.

- Although many initiatives are taken at the level of the city, the real promotion of ecological innovations comes from the national level through subsidies

  - 30% subsidy of the construction cost is possible in the case of an ecological housing project

Ecological Cities - The Wuhan Case

- Interesting case of The Taiyue-Jinhe (Tai) Residential Project in Wuhan

- Began in 2006, and the residential building was completed and sold out in 2007.

- Private developers focused during the design stage on maximising water efficiency and minimise environmental impact through design.

➔ Growing movement to maximise city design and urban planning to deliver positive ecological solutions.

AIRQUALITY
LOOKING FOR PURE AIR

Ecological Cities - The Wuhan Case

However, many of the example of ecological cities, like these developments in China, are happening in environments free of major contextual barriers - unlike our situation here in Paris, where we need to develop answers that'll positively increase biodiversity with existing constraints (especially political, financial and legal).

Ecological Cities - Constrained Responses

- However, ecological improvements in planning and design have also emerged in cities that have had to managed the patterns and constraints of their current inhabitants.

- Portland, Oregon U.S was the first U.S city to enact a comprehensive plan to reduce CO_2 emissions and has push for green building initiatives.
→ Using mostly traditional solutions like light rail, buses and increased proportion of bike lanes to reduce the volumes of cars on the road.

- Rotterdam (in the Netherlands)
→ It takes part in the Clinton initiative and is currently considering storing carbon dioxide in its port area.
→ Rotterdam wants to become a climate proof city by 2020.

AIRQUALITY
LOOKING FOR PURE AIR

Ecological Cities - what about France ?

- In France, the greenest cities are Angers, Nantes, Strasbourg and Lyon.

- Budget allowed per year and per inhabitant for green space creation :
  - Angers: 67€
  - Nantes: 69€
  - Lyon: 60€
  - National medium budget: 46,5€

- Paris has a budget of 105,4€ per inhabitant for green space creation ; however the city is often pointed out for not being green enough.

- Only 3% of Paris' surface area dedicated to green spaces (compared to London 10%, Vienna 15%, Berlin 9%)

EN SYNTHÈSE

5 CHIFFRES-CLÉS À RETENIR

48 m²
C'est la **superficie** moyenne d'**espaces verts** par habitant dans les 50 + grandes villes de France.

5 millions d'euros
C'est la somme que chaque grande ville **investit** chaque année en moyenne, dans la **création de nouveaux espaces verts**.

46,50 €
C'est le **budget** moyen par **habitant** consacré aux **espaces verts** (création + entretien), par les 50 + grandes villes de France.

2/3
Des **grandes villes interrogées** déclarent avoir **recours à** l'**éco-pastoralisme** pour l'entretien de leurs espaces verts.

1 155 ha
C'est la **surface** moyenne d'**espaces verts urbains** dans les 50 + grandes villes de France.

www.observatoirevillesvertes.fr

AIRQUALITY
LOOKING FOR PURE AIR

Ecological Cities - what about France ?

The case of Angers - how did it become French greenest city?

- The city created more than 300 mini-gardens and 50 "green pods".

- The administration works hand in hand with the inhabitants.

- Like other cities, they developed eco-pastoralism in order to regulate the biodiversity.

- They only use local plants, adapted to the climate.

AIRQUALITY
LOOKING FOR PURE AIR

Revegetation: the common theme

- Revegetation is seen as a common means in different solutions being advanced today.

- What does it mean?
  - In essence it's a general expression used for the process of planting bare areas (raw mineral soils) to perennial plants and less often annual plants.

    (US Department of Agriculture, 2005)

- There are three primary levels to this approach
  - Rehabilitation – Simplest revegetation process.
  - Reclamation – Moderate simply revegetation process.
  - Restoration – Complex revegetation process.

AIRQUALITY

LOOKING FOR PURE AIR

Revegetation: impact on the climate

- Known positive contributions of increased vegetation - such a plants or trees - in maintaining environmental quality.

- However increasing urbanisation has had a negative impact on the population of these plants. Most notably trees, as they have been removed en masse overtime to make way for urban developments.

- High per-capita energy and material consumption patterns and large resource inputs have contributed to increased pollution levels in urban areas and emission of greenhouse gases and aerosols that contribute to climate change.

- Urbanisation as a key driver of pollution increase (Escobedo, et al. 2011)

Revegetation: impact on the climate

- Urbanisation acceleration means that by the end of the century 7 billion people will be living in cities.

- The WHO estimates that poor air quality led to 7 million deaths in 2012.

- Plants absorb sun's energy, provide shade and perform evapotranspiration - evaporation from the leafy parts of the plant - resulting in lower urban temperatures and cleaner air.

Percentage of reduction of pollutant concentration. Percentage change due to green walls.

City	Dim. PM 2.5 City / Dim. PM 10 City	Red. PM 2.5 Street / Red. PM 10 Street
Berlin H/W 1.20	0.35	15.94
	0.20	12.02
Hong Kong H/W 5.00	1.2	21.84
	0.82	14.26
London H/W 0.80	3.5	22.37
	0.82	15.39
Los Angeles H/W 0.25	0.09	12.02
	0.10	12.26
Melbourne H/W 2.46	0.87	> 20.00
	0.39	> 20.00

Dim. PM 2.5 City
Dim. PM 10 City
Red. PM 2.5 Street
Red. PM 10 Street
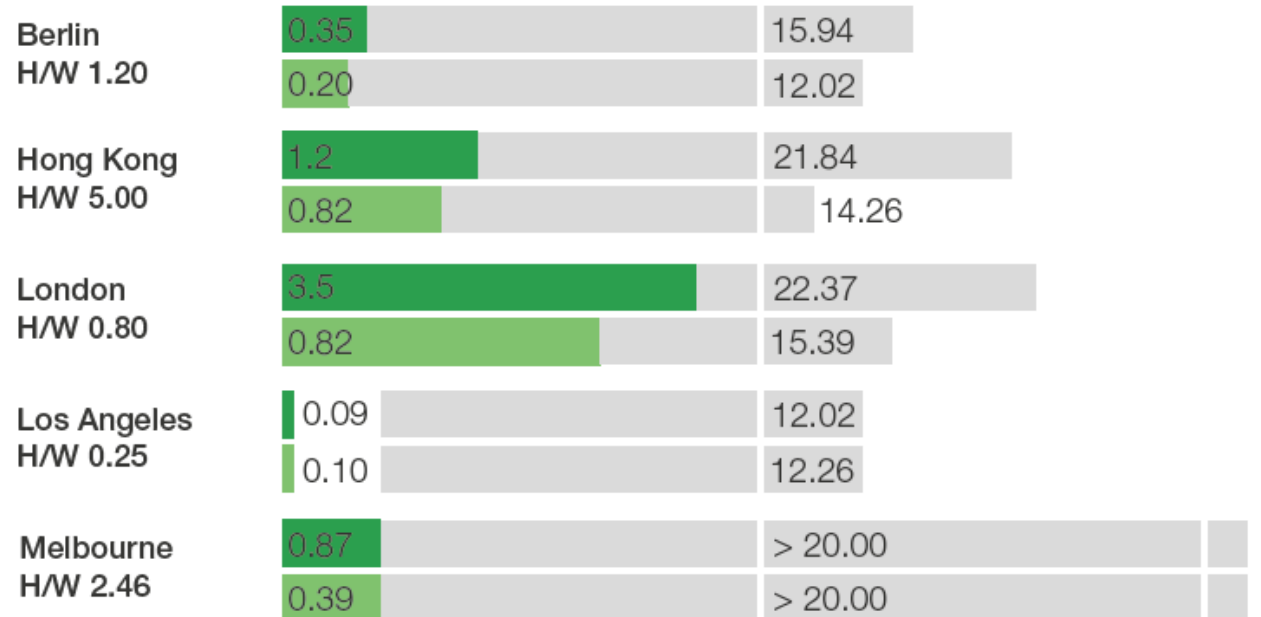
The urban air volume, considered when calculating the benefits of green façades, has been calculated with the atmospheric boundary layer height at each hour. The values in the table represent yearly average values.

No air volume above the building roofs has been considered. The values in the table represent yearly averaged concentration values.

(Cities Alive, ARUP)

AIRQUALITY
LOOKING FOR PURE AIR

Revegetation: impact on public health

- Studies show green cities are healthier, more prosperous and safer

- Studies from the Medical School of the University of Exeter believe householders living in greener urban environments are likely to have lower levels of mental distress and higher levels of wellbeing.

- Not only are greener cities more attractive but people living close to nice open spaces are also 50% more likely to walk more

- A greener work environment has also proven to boost productivity by 15%.

- Green spaces represent a key place for gatherings, therefore increase social cohesion

AIRQUALITY
LOOKING FOR PURE AIR

Revegetation: impact on public health

- Green infrastructure can reduce volatile fine and ultrafine particles by up to 60%, through deposition on the leaf surfaces.

- Vegetated roofs can remain close to ambient temperature during height of summer, whereas a conventional roof can be up to 50 degrees higher.

- Benefits of a distributed network of green infrastructure can be significant, and can be easily and cheaply achieved through favourable planning policies.

- Simply planting flower boxes in strategic locations could to some extent avoid the need for all this very expensive technical infrastructure by helping to retain stormwater (Cities Alive, ARUP).

AIRQUALITY
LOOKING FOR PURE AIR

Paris - localising these lessons.

looking at promising responses to pollution across the globe

AIRQUALITY

In focus: the Parisian Situation - a crisis?

- Here in Paris we asee 6,500 premature deaths each year.

- In the 'Grand Paris' life expected is reduced by 2 years as a result of inadequate air conditions and long term exposure to toxic pollutants.

- Paris ranks 13th for air quality, exceeding limits set by European regulations.

Population:	11.7 million
GDP per head, PPP:	€ 34,941
CO_2 emissions per head:	5.04 tonnes*
Energy consumption per head:	96.65 gigajoules
Percentage of renewable energy consumed by the city:	2.3 %*
Total percentage of citizens walking, cycling or taking public transport to work:	40.4 %
Annual water consumption per head:	109.5 m³
Share of waste recycled:	19 %

*Estimate

AIRQUALITY
LOOKING FOR PURE AIR
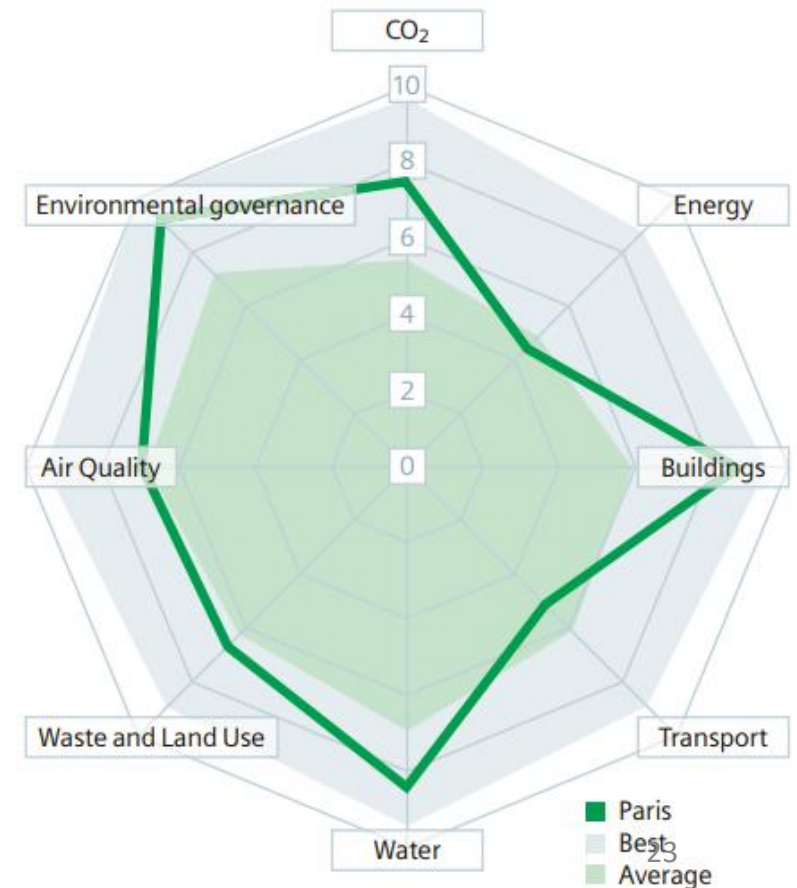
Green Spaces in Paris ...

Compared to Singapore…
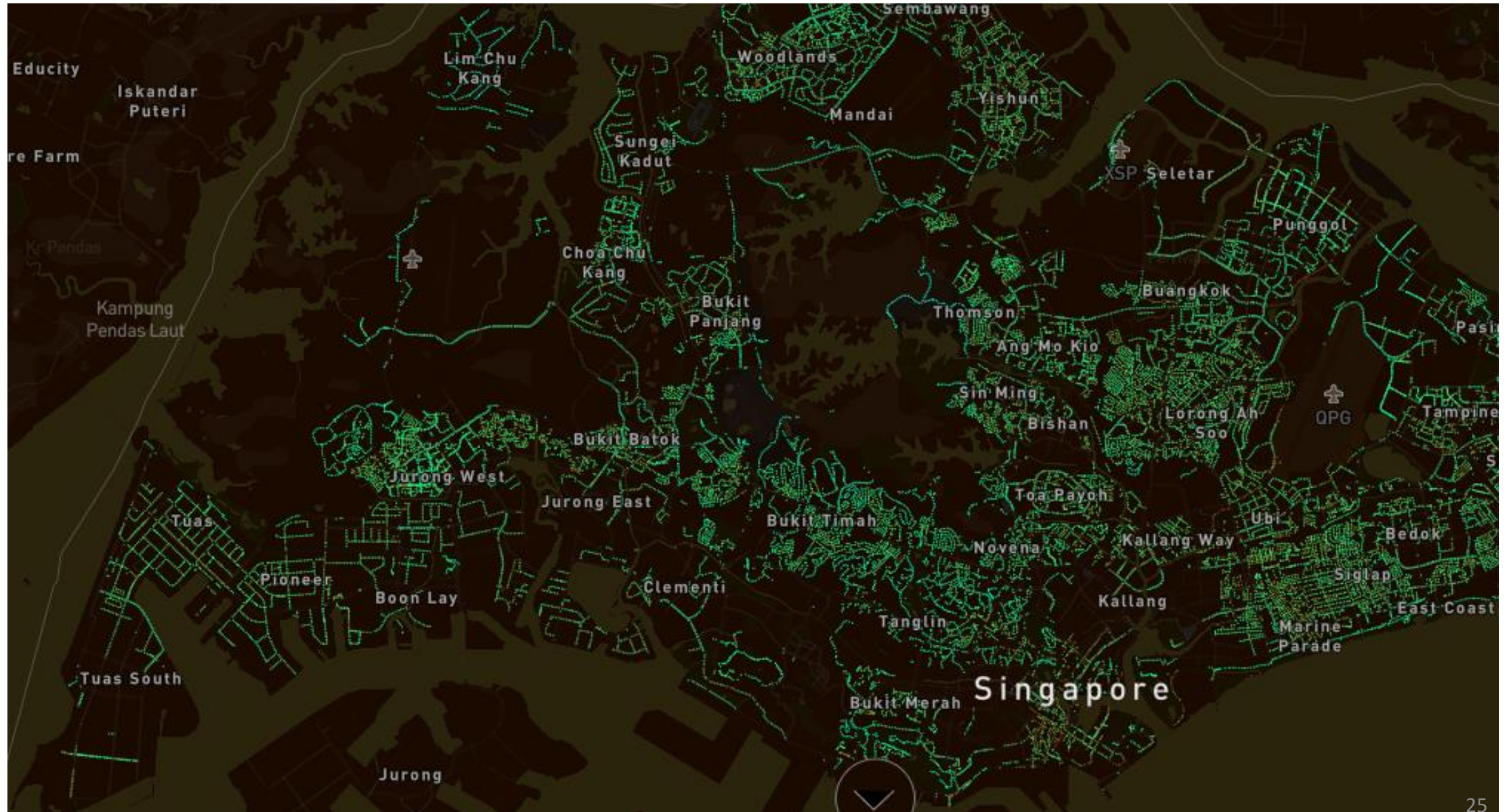
In focus: the Parisian Situation - quick fixes?
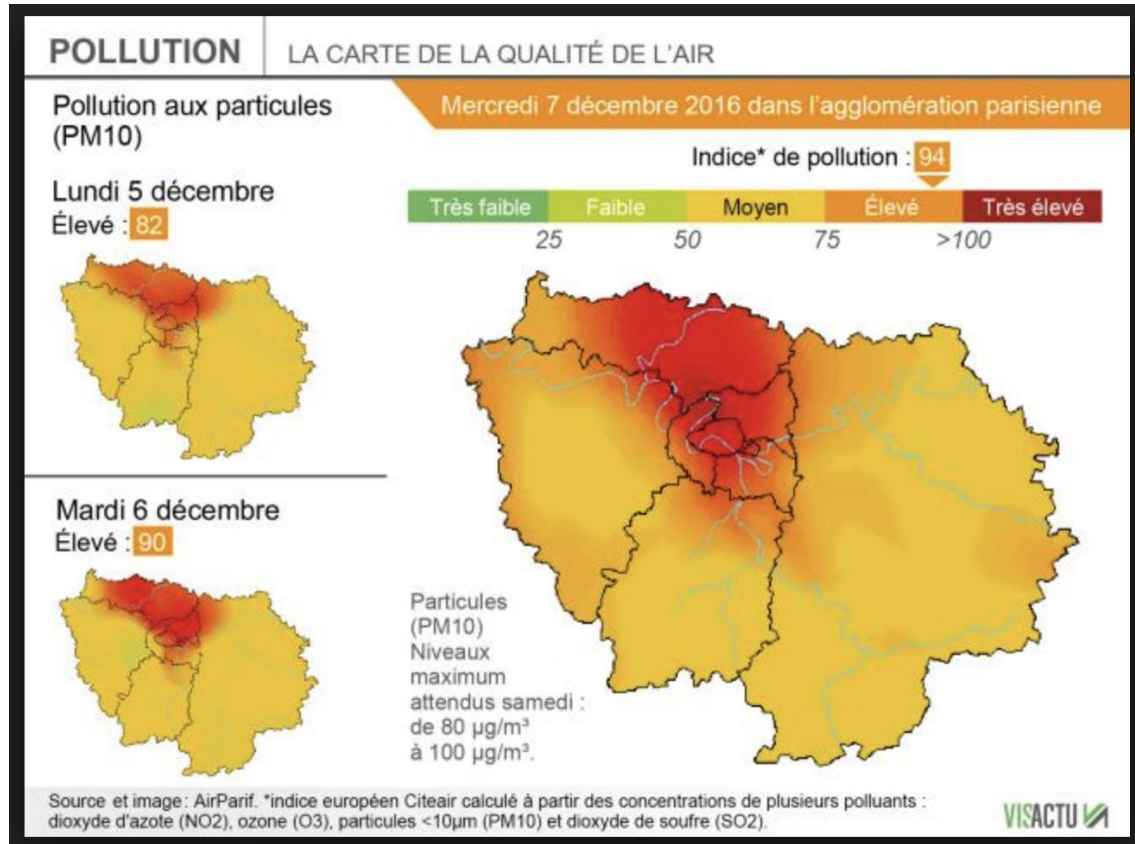
The results of the 'circulation alternée' plan

- Already some initiatives have been taken by the city of Paris to tackle the air pollution crisis.
- Mostly these have been top-down in this approach. That is they have been government interventions around city design or providing incentives to change the behaviour of citizens.
- Some major examples are:
  - Creation of the Parc Rives de Seine
  - Summit of the 1000 mayors for the COP21
  - 'Plan Vélo'
  - Pedestrian areas rehabilitated
  - Investments in public transports
  - Mandatory 'Vignette' on cars.

But none of these are both tacklings air pollution AND satisfying a key demand of Parisians…

For more than 8 out of 10 French people, the proximity of a green space is an important criterion in the choice of their home.
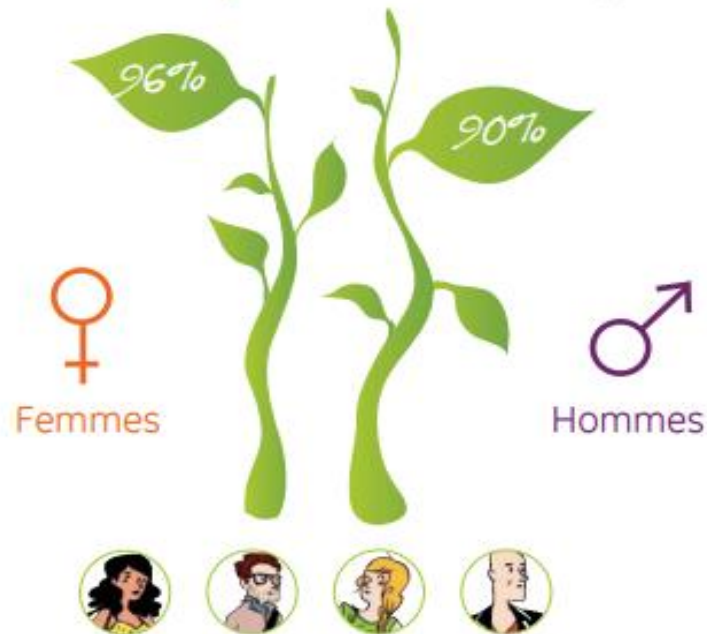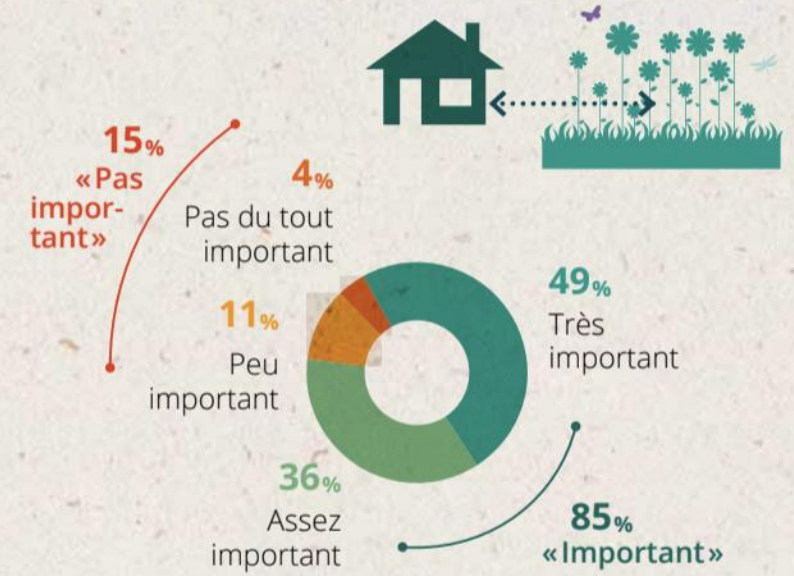
The deep demand for green space

- French people want more green spaces and are convinced of its benefits:
  - 7 out of 10 French people have a garden.
  - The garden: the second favorite space of French People.
  - Only 4 out of 10 Parisians have access to a private garden, compared to an average of 6 in 10 in the other regional capitals.
  - For 6 French out of 10 the creation of green space in their city is the number 1 priority.

AIRQUALITY
LOOKING FOR PURE AIR

Our dynamic approach to boosting vegetation and tackling air pollution from the bottom-up in Paris.

AirQuality: the mission

"We want to provide everyone in Paris with personalized information that is tailored to their lifestyles and provides them with the power to be aware and know how to act in response to the declining conditions of their environment"

'AIRQUALITY' - OUR UNIQUE SOLUTION TO EMPOWER CITIZENS TO MONITOR AND REACT TO THE POLLUTION CONDITIONS OF PARIS.

Air Quality

AirQuality: the means in brief

- We have developed a mobile application that will calculate in real time the exposure of the user to hazardous substances contained in the air.

- Our application will provide the user with real-time air quality information derived from micro filter sensors placed strategically around the city and via information collected with our key partners.

- Enables users to that have access to information and tips on how they can improve their health and contribute to reversing the trends via 'Rehabilitation Vegetation.'

AirQuality: the means in brief
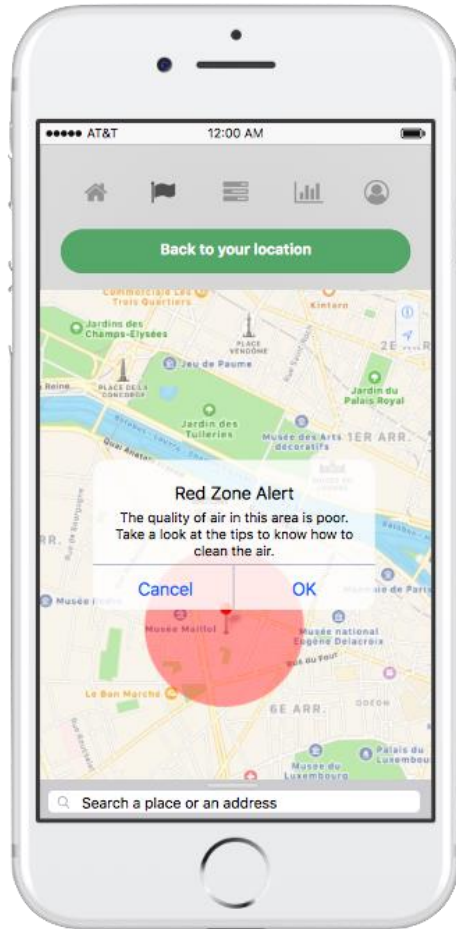
- Depending on your location, the application will allow you to estimate the air pollution of a given place.

- In addition, you can indicate your means of locomotion (pedestrian, cyclist or runner) and the application will generate an assessment of the air quality for the route taken by the GPS of your smartphone. By this way, you avoid all hazardous exposures to fine particles and different gases released by industries.

- Giving you what are the plants that have the greatest depolluting capacity to purify the surrounding air.

AirQuality: breaking down the interface
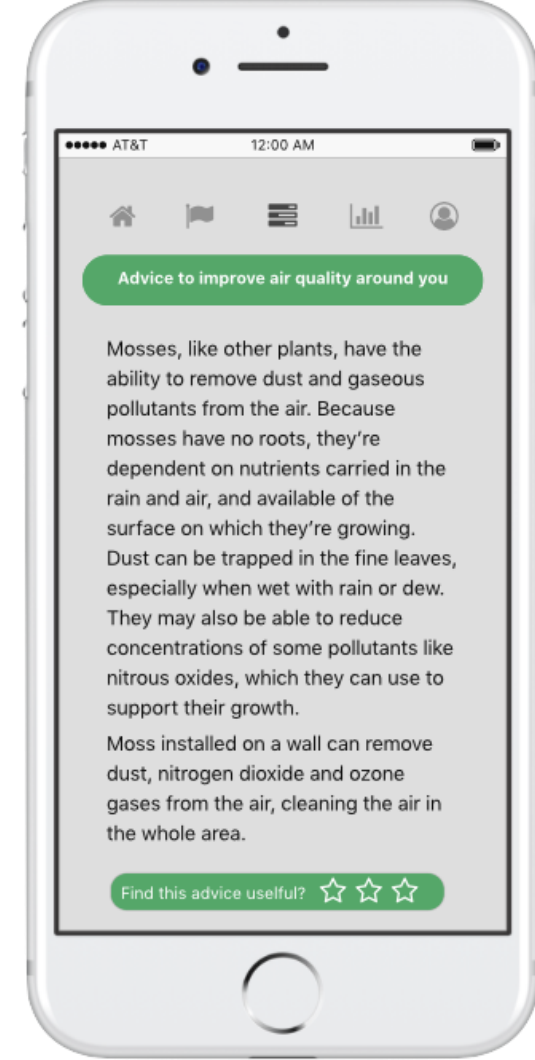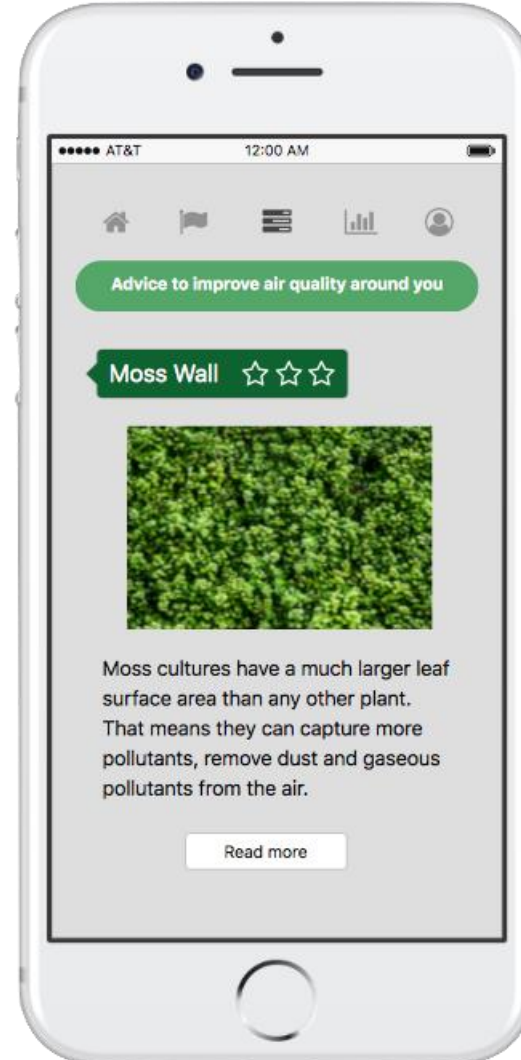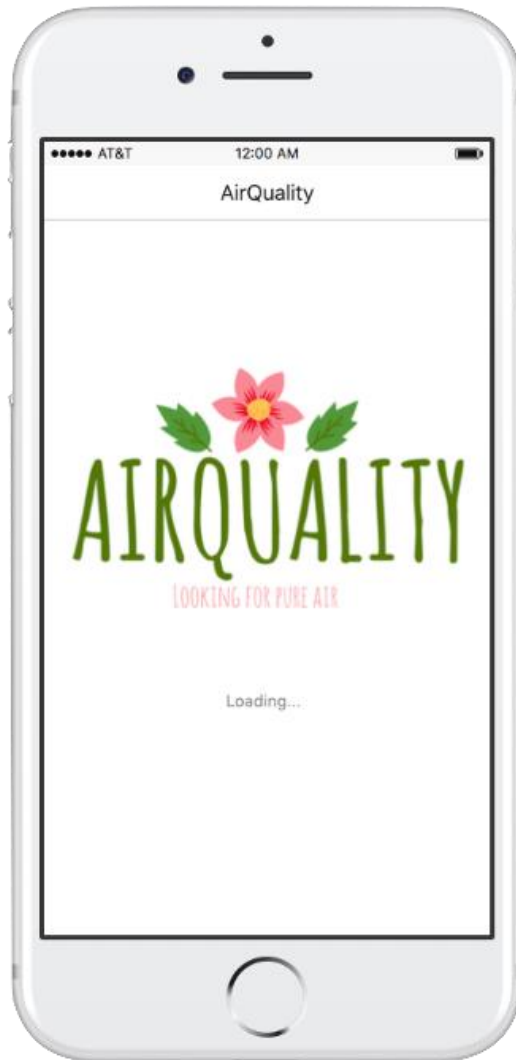
AirQuality: our strategic partners

In order to provide accurate information: cooperation with :

[AirParif - Association de surveillance de la qualité de l'air en Île-de-France](#)

- a non-profit organization accredited by the Ministry of Environment to monitor the air quality in Paris and in the Ile de France region
- in charge of four missions: To monitor air quality, to forecast pollution episodes, to assess the impact of mitigation measures and to inform the authorities, media and citizens
- it mainly uses AirParif website to inform the stakeholders. There is an opportunity to cooperate and create a win-win solution

and use of European Citeair index

- provides near real time air quality data for each city for the background (representing the general situation of the given agglomeration) and for the traffic (being representative of city streets with a lot of traffic)
- Simple and take into account the traffic pollution.
- To compare the current air quality across Europe.
- Suitable to measurement methods of each monitoring network.

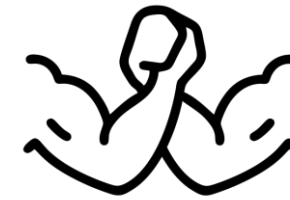| 0	25	50	75	>100
Very low	Low	Medium	High	Very high

AirQuality: competitive landscape

- **Plume air report : playful**

Gives the level of pollution hour by hour for the coming day in many French cities
Tells you if outdoor activities are recommended

- **Qualité de l'air: simple to use**

Allows live monitoring of the air quality in the nearest station of the user: A big green circle, the air is pure, a big red circle, it's very bad.

- **Pollution: diversified**

informs the user not only abut the air quality of the place where he is, but also about other sources of pollution that surround it. Air, water, soils, waves, each pollution is detailed, as well as its consequences for the user.

- **Allairgoo: Personalized**

A vibration and a notification on your phone: "pollution alert"
Paid application

- **Assistant air**

Provides access to the pollution indices' map in France and Europe.
Offers advice but the coverage is relatively small
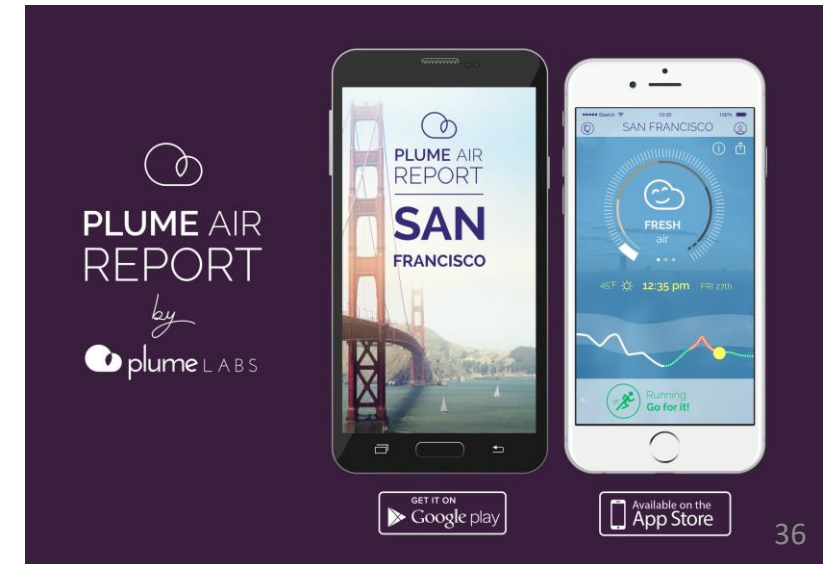
AirQuality: differentiation

ADDED VALUE: 'Rehabilitation Vegetation.'

- AirQuality gives access to information and tips on how they can improve their health and contribute to reversing the trends
- Enables its users to be active participants of the change
- Personalized account with warnings but mainly tips for "Vegetation and Air Rehabilitation"

TIPS AND RECOMMENDATIONS:

- Giving you what are the plants that have the greatest depolluting capacity to purify the surrounding air

- Sending friendly reminders of behaviors you can adopt in your daily life: send you a little notification in the morning to make sure you switched off the lights before leaving, turned the heater off, or transports you can take closeby instead of the car and always quantify the positive impact it would have to make it more rewarding for the user

AIRQUALITY
LOOKING FOR PURE AIR

AirQuality: objectives

In the short term:

- Higher level of vegetalisation/greener city
- Higher awareness concerning ecological disaster in Paris
- Empower citizens by providing a tool to change behavior
- Increased well-being for citizens
- Employee satisfaction and productivity rise
- Increase incentive for landlords to create environmental friendly apartments or improve the street vegetation

In the long term:

- Mitigated pollution and improved health
- Replication effect : More and more users for our app and other cities take example
- Nicer landscapes in urban environment
- Higher attractivity for Paris for tourism and business

AIRQUALITY
LOOKING FOR PURE AIR

AirQuality: why this, why now?

Today, pollution is a real subject and is likely to become a worn out topic to some people as they don't know how to personally decrease it. Apps are a way to "personalize" theoretical concepts of ecology, or in our case pollution. Airquality's app can add to the realness of air pollution by making it into something citizens can act upon and quantify. Having their smartphone with them all the time, people will easily contribute in their scale to the fight against pollution and as Van Gogh said *"great things are made of a series of little things put together"*.

Resources & appendix

- Reports

Observatoire des villes vertes, "Les villes les plus vertes de France Palmarès 2017", 2017
http://www.observatoirevillesvertes.fr/wp-content/uploads/2017/04/infographie-A4-Palmar%C3%A8s-des-villes-vertes-2017.pdf

UNEP-Ipsos, "Jardins et espaces verts, l'exception culturelle française ?", 2013
http://www.gre-mag.fr/site/wp-content/uploads/2014/12/dp_unep_ipsos_2013.pdf

Siemens, European Green Cities Index, 2009
https://www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_en.pdf

World Health Organization Health effects of particulate matter
http://www.euro.who.int/__data/assets/pdf_file/0006/189051/Health-effects-of-particulate-matter-final-Eng.pdf

Ministère de l'environnement, de l'énergie et de la mer Plan de surveillance de la qualité de l'air ambiant
http://www.lcsqa.org/system/files/ressources/pnsqa_vf-avril2016.pdf

AIRQUALITY
LOOKING FOR PURE AIR

Resources & appendix

- ## Articles

Thomas Ducres, "Quelles sont les 5 villes françaises les plus écolos ?", Canal +, 24/05/2017
https://detours.canalplus.fr/5-villes-francaises-plus-ecolos/

"Angers, la ville verte", Angers.fr, 05/04/2017
http://www.angers.fr/actualites/60753-angers-la-ville-verte/index.html

Laetitia Van Eeckhout, "Angers, Nantes et Strasbourg sacrées les villes les plus vertes de France", Le Monde, 16/03/2017
http://www.lemonde.fr/smart-cities/article/2017/03/14/angers-nantes-et-strasbourg-sacrees-villes-les-plus-vertes-de-france_5094491_4811534.html

Jeremy Coles, "How nature is good for our health and happiness", BBC, 16/04/2016
http://www.bbc.com/earth/story/20160420-how-nature-is-good-for-our-health-and-happiness

Oliver Balch, "Garden cities: can green spaces bring health and happiness?", The Guardian, 20//04/2015
https://www.theguardian.com/sustainable-business/2015/apr/20/garden-cities-can-green-spaces-bring-health-and-happiness

AIRQUALITY
LOOKING FOR PURE AIR

Resources & appendix

"Why should you care about the power plant", Stop Medway Peaker Project, 2015
https://nomedwaypeakerproject.wordpress.com/community-concerns/

Tass Mavrogordato, "Offices are turning their roof into edible gardens and bees sactuaries", The Guardian, 13/08/2013
ttps://www.theguardian.com/sustainable-business/offices-roofs-edible-garden-sustainable-cities

"Paris manque d'espaces verts", Le Monde, 20/03/2005
http://www.lemonde.fr/a-la-une/article/2005/03/20/paris-manque-d-espaces-verts_628704_3208.html

United States Environmental Protection Agency
https://www.epa.gov/pm-pollution/particulate-matter-pm-basics#PM

Mairie de Paris Agir pour la protection de l'atmosphère
https://www.paris.fr/air#agir-pour-la-protection-de-l-atmosphere_14

DRIEE Ile de France Le plan de protection de l'atmosphère (PPA)
http://www.driee.ile-de-france.developpement-durable.gouv.fr/le-plan-de-protection-de-l-atmosphere-ppa-r781.html

Resources & appendix

Ministère de la transition écologique et solidaire 2017
https://www.ecologique-solidaire.gouv.fr/politiques-publiques-reduire-pollution-lair

Air Parif : la polution de l'air en île de France
http://www.airparif.asso.fr/

Business Insider France About 80% of all cities have worse air quality than what's considered healthy — here are the 15 with the worst air pollution 2016
http://www.businessinsider.fr/us/the-cities-with-the-worlds-worst-air-pollution-who-2016-5/

AIRQUALITY
LOOKING FOR PURE AIR