

## **Horizon 2020**

### **Societal Challenge: Improving the air quality and reducing the carbon footprint of European cities**



#### **Project: 690105 – ICARUS**

Full project title:

**Integrated Climate forcing and Air Pollution Reduction in Urban Systems**

### **D8.12 Second report on outcomes of stakeholder interactions**


**WP8: Dissemination, communication and involvement of stakeholders**

Lead beneficiary: MESAEP

Date: November 2020


Nature: Report

Dissemination level: Public

	<b>D8.12</b> Second report on outcomes of stakeholder interactions		
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## 1 Executive summary

The aim of this report is to provide an overview of the outcomes of the ICARUS events targeted at key stakeholders organized in the last phase of the project and to reflect on achievements and to conclude with recommendations and key impacts arising from the interactions with the events participants.

Engagement activities carried out by the ICARUS team with local stakeholders took many forms, and were generally less ‘generic’ than the dissemination activities (for the latter see deliverable D8.14). At their core, the engagement activities concerned sharing of information or learning during an activity performed by key audience groups and therefore more interactive than the dissemination activities. In addition to more classical meetings, the ICARUS Project has hosted a range of ‘Slam’ events in the ICARUS cities to engage with local stakeholders and communities.


All these events helped us to understand different perceptions of environmental and health issues, while creating a forum for people to debate the challenges of using research findings to inform change and to advise policy makers. In several cases, ICARUS partners reported that ICARUS results have indeed influenced or contributed to either implement policies/measures at city level or obtained actionable ideas for new solutions/research questions. In other cases, they have still reported a greater understanding of the key audience perspective, as well as significant participant enjoyment of the ICARUS activities leading to a greater willingness to attend future events.

From the very practical-level presentations and discussions, cities gained a clear understanding of how they can directly benefit from ICARUS expertise, particularly in support of their city air quality and climate change planning on many levels.

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## 2 Meetings with local stakeholders in the ICARUS cities

- 1) On behalf of the ICARUS team, the Aarhus University organized a meeting with Vice Mayor of City of Roskilde on 1<sup>st</sup> of May 2018 and presented various ICARUS activities, which was followed by an in-depth discussion. This meeting concluded in political backing of our engagement with the city council which was also useful for disseminating our findings on municipality's various channels.
- 2) ICARUS members participated in the iSCAPE workshop "Urban air quality: designing and implementing effective control strategies" organized by the iSCAPE consortium in Bologna on 8-9/5/2018. In the working meeting "Urban air quality: designing and implementing effective control strategies" the methodology and the results of the ICARUS Project were presented, as well as possible synergies with the related iSCAPE project were examined.
- 3) On 5<sup>th</sup> of June 2018 in Stuttgart, ICARUS team has participated in a stakeholder meeting with members of Department for Environmental Protection of the City of Stuttgart. The objective of this meeting was to discuss the information about city measures and long-term vision. The follow-up meeting on the same agenda and with the same stakeholders were held on 28<sup>th</sup> of August 2018 (combined two events).
- 4) The RECETOX team participated in the Science Fair at the Academy of Science in Prague on 7-9 June 2018. During the event RECETOX gave presentation entitled "General introduction of the ICARUS project to the public awareness". ICARUS flyers and other communication material has been distributed to the participants.
- 5) The SWISSTPH team presented the ICARUS project at a local environmental awareness day on 10 June 2018 in Basel (*Basler Umwelttage*). In an interactive booth SWISSTPH team members presented the ICARUS concepts and explained the project to the visitors. To enhance awareness about air pollution the booth was placed next to a busy street and, in collaboration with the Air Quality Management Agency of Canton Basel-City and Canton Basel-Country, we provided live measurements of air pollution to the interested public. More information about the event can be found at [www.umwelttage-basel.ch](http://www.umwelttage-basel.ch)
- 6) During June- September 2018 ADDMA organized a series of informal communications with Athens city stakeholders including WWF, Greenpeace, Advisors on Cycling Cities and invited them to the Madrid Stakeholder Workshop. ADDMA regularly update them on the development of Athens visions for 2050 discussed.
- 7) The ICARUS team has participated in the meeting organized by the Carlos III Health Institute (ISCIII) on 12<sup>th</sup> of June 2018 at Madrid. The meeting was held to discuss the "*Elaboration and selection of future "visions" of Madrid city*".
- 8) To promote the work of ICARUS and the results obtained, on 30<sup>th</sup> June, 2018 the Aarhus University team participated in the *Roskilde Music Festival*. During this important event for the


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city the Aarhus team participated in the seminar on *Sustainability impact of Roskilde and long-term attitudes and citizens behavior*. Within the same event Dr. A Jensen (AU) interviewed the Director of Roskilde Music Festival Peoples College. Moreover, several interviews with local Roskilde businesses and local sustainability associations were carried out.

- 9) EUCENTRE has organized a meeting with the Municipality of Milan to discuss and gather available data about the emission inventory present and future for the city of Milan in the framework of the “Sharing Cities” project on 3<sup>rd</sup> of July 2018 in Milan. The collection of information on urban policies and measures and the discussion about the sensor campaign in Milan was also discussed in detail.



- 10) The ICARUS team has participated in a stakeholder meeting which was organized by Masaryk University, the Department of Health, together with the City of Brno on 14<sup>th</sup> of August 2018 in Brno. The objective of the meeting was to discuss the health impact of AQ and CG policies in the city based on the preliminary results of ICARUS.
- 11) On behalf of the ICARUS team, Masaryk University has organized the meeting with the transportation company and BKOM City on 10 September 2018 in Brno. The main aim of the meeting was to discuss about the available data for vehicle fleet composition needed to run the ICARUS emission model.
- 12) The ICARUS team organized a two-days participatory workshop for “Developing visions for Smart Green and Healthy Cities” with experts and stakeholders of ICARUS cities on 20-21 September 2018 in Madrid. The aim of the workshop was to identify the more relevant future trends, and to elaborate future narratives on green, smart and healthy cities from the point of view of key stakeholder and strategic sectors experts. The workshop was attended by several stakeholders of ICARUS cities that had the opportunity to share and exchange views and ideas


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on developing long term city visions from a green and healthy perspective. On the first day of the workshop, experts were encouraged to list future change factors and select the more relevant in the longer term, while on the second day, there was an experts' idea-sharing session followed by a discussion with stakeholders from ICARUS cities.



- 13) The SWISSTPH team organized an informal meeting with Basel city stakeholders on 18 October 2018 where the data available for emission modelling for Basel was discussed and collected.
- 14) EUCENTRE organized a meeting with the Municipality of Milan and AMAT (Agency for environment and mobility) on 23 October 2018 in Milan to discuss the Milan 2020-2030 potential policies and how these may affect air quality and carbon footprint.




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- 15) NCSR D and ADDMA organized on 25/10/2018 an online event entitled “Presentation of ICARUS sensors campaign in Athens to potential volunteers” where representatives of the Resilience Office and Sustainability (ORS) as well as of the City of Athens participated. NCSR D team members presented the ICARUS campaign and discussed about its implementation, recruitment strategy and timeplan. Information on the ICARUS sensors campaign has been included in online promotional material of the event (via social media).
- 16) On 29 October 2018, National Centre for Scientific Research “Demokritos” (NCSR D) organized a meeting in Athens with representatives of the General Director for Sustainable Development and Climate Change of the Region of Attica to discuss about air quality and health impacts. NCSR D presented the ICARUS methodology for Health impact assessment of policies and provided the preliminary results derived for Athens
- 17) Two follow-up meetings with the Milan Municipality were organized on 9 November 2018 and on 6 December 2018 in Milan. During both the meetings the sensor campaign organization in Milan and the recruitment of participants strategy were discussed in detail. These events allowed us to actively engage the Municipality of Milan in the sensor campaign and to exploit their official communication channels to enhance the visibility of the campaigns and to recruit volunteers.



- 18) The NCSR D team participated in a scientific workshop organized by Attica Prefecture Piraeus, in Athens on 21/11/2018 with a presentation entitled “Air Quality monitoring and source apportionment tools” and participated in the following round table. The audience of the workshop included representatives of the Attica Prefecture Piraeus, public authorities as well as representatives from private companies. Dr. Maggos (NCSR D) presented the main objectives and outcomes of ICARUS project to the invited stakeholders. Stakeholders main interest focused on ICARUS outcomes and on the practical implications for the city as well as on the ICARUS DSS tool.


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- 19) On 18 December 2018, the National Center of Environmental Health and National Center of Epidemiology organized a stakeholders meeting entitled “*ICARUS project Madrid city (WP3-5)*”. Representatives from the Madrid City Council, Air Quality Network and Public Health department participated in the meeting. Two main topics were discussed: 1) The study of health improvements due to the implementation of the Madrid Plan A and 2) Study of cardiovascular effects of pollution in Madrid city. These results were published in Environmental Research (2020), 183-109201 <https://doi.org/10.1016/j.envres.2019.109021>
- 20) The JSI team organized a working meeting with representatives from National Institute of Public Health in Ljubljana on 15 January 2019. Lessons learned from the ICARUS campaign with focus on the use of new sensing technologies in studies addressing exposure assessment at the individual level were discussed. The meeting was an opportunity for the JSI team to help and support colleagues from National Institute of Public Health to design a new study addressing exposure to air pollution of pupils in classrooms of elementary schools.
- 21) On 8 February 2019, ADDMA/AUTH organized the 3<sup>rd</sup> ICARUS Expert and Stakeholder Workshop in Athens entitled *Trends and challenges for smart, green and healthy cities 2050*”. The workshop programme included an introduction to the role of vision in urban development, guidelines on framing the visions and how visions are integrated across all urban areas and sectors, and was focused on groups working on developing and refining the ICARUS visions. Each group discussed the multifaceted characteristics and aspects of smart, green and healthy cities and developed synthesized ICARUS visions of their city. Experts and stakeholders from the participating cities were invited; more than 40 attendees participated in the event. A press release was issued by ADDMA. The press release can be found [here](#).
- 22) The ICARUS team participated on 6 March 2019 in the event entitled “3-year actions and projects of the Resilience Athens program” organized by The Office of Resilience and Sustainability (ORS) - City of Athens. The event was attended by over 200 stakeholders from the city, regional authorities, private companies, NGOs, ministries, etc. and was widely published in the local newspaper. Dr. Thomas Maggos (NCSRDI) was invited to speak about ICARUS to promote the Athens sensor campaign. In this framework, 500 copies of Resilience Athens third anniversary brochure were distributed to the audience in which ICARUS was referred in the EU research programs of the Office. The link to the event can be found [here](#).

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- 23) RECETOX organized a meeting on 2/4/2019 with city representatives of the city of Brno (i.e. two Deputy Mayors and directors of various city council departments) at the RECETOX premises where RECETOX members presented the main ICARUS results for the city of Brno. Strengthening the cooperation, new potential collaborative projects and discussion about

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needs of Brno towards the improvement of environment quality were the main topics discussed.



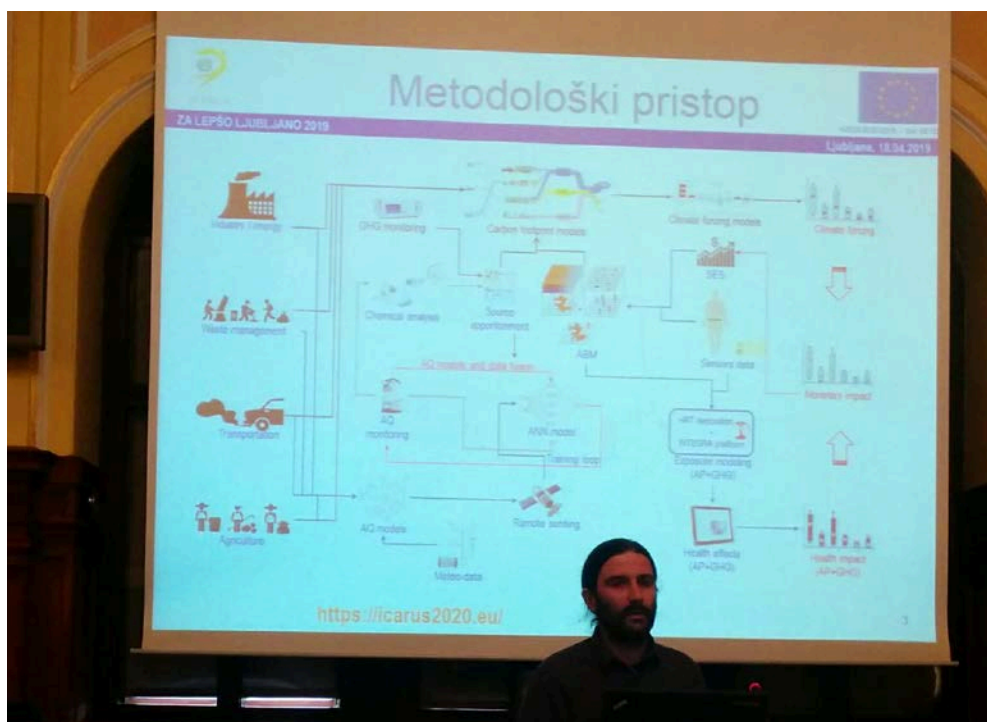
- 24) On 16-17/04/2019 RECETOX organized a working meeting with City representatives from the environmental department, local science community, and stakeholders from South Moravian region. During the meeting presentations about ICARUS sensor campaign and on the integrated assessment of air quality in Brno were given and discussed with the audience.




- 25) On 18/04/2019 within the annual campaign "For a more beautiful Ljubljana" organized by the Municipality of Ljubljana to shed additional light on projects and measures that take care of air quality the ICARUS-JSI team gave a talk entitled "*Integrated Climate forcing and Air pollution Reduction in Urban Systems*" During the presentation the JSI team reported on the current results of policy integrated assessment for the city of Ljubljana. The event was an

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opportunity to networking with local stakeholders and with the sister project ClairCity. Relevant materials can be found [here](#).




- 26) RECETOX was invited in a Coordination meeting of the experts in the field of air quality organized on 24/4/2019 by the Department of Environment of the City of Brno. The audience was composed by representatives of the Czech Hydrometeorological Institute, the Transport Research Centre, South Moravian Region and City of Brno. Presentations and discussion about air quality were given. In addition, participants discussed about the content and the structure of the feedback report to be distributed to the citizens participating in the ICARUS sensor campaign.
- 27) The JSI team organized a working meeting with representatives from National Institute of Public Health in Ljubljana on 15 May 2019. During the meeting the main outcomes and lessons learned from the ICARUS campaigns were discussed and the applicability of the approach for exposure assessment to other urban environmental stressors, noise in particular were debated.

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- 28) The SwissTPH team organized a meeting with the Air Quality Authority of Basel (Lufthygieneamt beider Basel) on 22 May 2019 at the SwissTPH premises in Basel. The meeting entitled “*Chances and challenges of low-cost sensors to measure air pollution*” resulted in a useful and productive exchange of experiences on the use of low cost sensors to monitor AQ in urban areas in the context of a project planned by Air Quality Authority of Basel on Air Quality topic.
- 29) On 14 June 2019 the ICARUS team organized a meeting entitled “*Discussion on Air quality of Attika and Piraeus areas*” in Athens. Participants included stakeholders from the Attika and Piraeus regions, public authorities as well as representatives from private companies. The meeting focused on: a) presentation of ICARUS project and discussion on practical implications; b) the need of a regional network of air quality monitoring based on smart technology equipment. Interest was expressed by private companies in the Attika region to include ICARUS innovative tools for AQ assessment and monitoring in their respective activities.
- 30) On 26 September 2019 the JSI team met representatives of the NGO Greenpeace to illustrate the ICARUS objectives and show the current project results. The meeting was an opportunity to discuss about the air quality and climate change related to the various pollution sources in urban areas and to enhance ICARUS visibility among the NGOs community. The meeting indeed paved the way for a closer collaboration with Greenpeace in Slovenia and resulted in the organization of other three working meetings as reported hereinafter.
- 31) On 24 October 2019, the ICARUS team Organized a working meeting at the Regional Unit of Thessaloniki, Department of Environment and Hydro-economy to present and discuss the ICARUS DSS. During the event members of KARTECO had a real-time demonstration of the ICARUS DSS and illustrated to the city authorities the DSS functionalities and the results obtained for the Greater Area of Thessaloniki. The participants and Mr. H. Latsios, Head of the Department responsible for monitoring air-quality in the Regional Unit of Thessaloniki participated actively in the meeting and showed a strong interest in ICARUS DSS.


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32) A scientific workshop was organized by ICARUS in collaboration with National targeted research project (V3 –1722) focusing on air pollution and on potential effects on the health of the population on 11 November 2019 at the Reactor Center Podgorica near Ljubljana. Overall results of the integrated approach conducted in ICARUS in the light of urban air quality assessment and challenges related to assessing health impacts was presented and discussed with all relevant stakeholders from the respective field of research: governmental agencies (Slovenian Environmental Agency, National Institute of Public Health, Ministry of health - chemical office), academy (University of Ljubljana, Faculty of Health Sciences) and industry (Salonit Anhovo). The agenda of the workshop can be found [here](#).

33) The EUCENTRE team participated in the workshop entitled “*Health and urban environment (Salute e ambiente urbano)*” organized by the DASTU Department (Dipartimento di Eccellenza sulle Fragilità Territoriali) of the Milan Polytechnic on 28 November 2019. During the workshop Dr. A. Gotti gave an oral presentation entitled “*ICARUS and Air quality*” to present the final results of the ICARUS campaign and policies integrated impacts assessment with regard to the Milan application. The audience was composed by members of the Milan Municipality, SMEs active in the environment field (i.e. nature-based solutions), Health Institutes and Hospitals.



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Seminario e tavola rotonda organizzati nell'ambito del progetto DASTU, Dipartimento di Ecceellenza sulle Fragilità Territoriali

## Salute e ambiente urbano

Problemi e soluzioni per la costruzione di città salubri

Iniziativa a cura di CCRRLab / Laboratorio Cambiamenti Climatici, Rischio e Resilienza LABSIMURB / Laboratorio di Simulazione Urbana Fausto Curti

L'obiettivo del seminario è di svolgere un confronto approfondito tra esperti sugli approcci e sulle rispettive conoscenze relativi al rapporto tra la salute dei cittadini, la prevenzione, la cura delle malattie e l'ambiente urbano, in modo da condividere gli esiti delle analisi e delle valutazioni, le criticità e le soluzioni.

28 Novembre 2019

programma

14<sup>30</sup> Introduzione ai lavori  
**Eugenio Morello** / Laboratorio di Simulazione Urbana Fausto Curti, DASTU, Polimi

14<sup>45</sup> Relazioni  
**Stefano Capolongo** / Dipartimento ABC, Polimi  
*Qualità dell'ambiente urbano e salute*  
**Pierpaolo Mada** / Organizzazione Mondiale della Sanità  
*Alcune considerazioni dall'esperienza dell'OMS sui metodi e gli strumenti per promuovere la salute pubblica negli ambienti urbani*


15<sup>45</sup> Tavola rotonda  
modera:  
**Marcello Magoni** / Laboratorio Cambiamenti Climatici, Rischio e Resilienza, DASTU, Polimi  
**Donatella Panigada** / Istituto Neurologico Besta  
**Paolo Cortiero** / Istituto Nazionale dei Tumori  
**Alberto Gotti** / Progetto ICARUS, Evcentre  
**Marco Caccianiga** / Orto Botanico Città Studi, UNIMI  
**Lorenzo Bono** / Ambiente Italia  
**Francesca Putignano** / Di. Città Resilienti Comune di Milano

17<sup>00</sup> Dibattito




Politecnico di Milano, Sala Riunioni DASTU Edificio 29 'Carta' Piazza L. Da Vinci, 26

- 34) The Aarhus team members participated in the seminar entitled “*Future Roskilde Climate neutral vision*” on January 2020 organized by the City of Roskilde’s Climate Council. This seminar was the third one of a series of events focusing the “*Generation of post-carbon city vision*”. The audience included Roskilde City public administrators, Roskilde City Council, the Head of Technical & Environmental Department, the Department for City Culture and Environment, experts in energy, transport and built environment, including sustainable neighborhoods as well as local businesses in energy, transport and built environment. The first two events were organized in November 2018 and September 2019. During the three events the Aarhus team illustrated and updated the audiences about the project key findings contributing to enhance public administration awareness of Air Quality and Climate Change actions based on the ICARUS work.
- 35) On 21 January 2020 the JSI team organized a follow-up meeting with Greenpeace Slovenia representatives in Ljubljana to discuss their views regarding the potential for implementation and upscaling of the pollution and climate change reduction measures proposed for Ljubljana.

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- 36) Within the “Science-to-citizens dissemination, public awareness” event series in Brno, the RECETOX team gave a presentation for high school students entitled: “Air quality for high schools, using ICARUS outputs” respectively on 6/2/2020 at Sportovní Gymnázium Ludvíka Daňka, Botanická, Brno and on 14 September 2020 at the RECETOX University Campus.
- 37) KARTECO team members organized on 11 February 2020 a stakeholder meeting at Directorate of Management of urban Environment, Greece with Vice Mayor Sokratis Dimitriadis / Vice Mayor of Environment and Dr. Evangelos Matziris / Directorate of Management of Urban Environment. The objective of the meeting was to present the ICARUS DSS as a tool to support policies assessment. During the meeting a real-time presentation of ICARUS DSS was given and the key results obtained for the greater area of Thessaloniki were discussed in detail.
- 38) Two working meetings with representatives of Greenpeace Slovenia were organized in Ljubljana on 23 March 2020 and on 27 July 2020. Dissemination of results within the Greenpeace framework and related stakeholders as well as about applicability for policy revisions were the main topics discussed.
- 39) ADDMA organized two online meetings with the Department of Resilience and Sustainability, City of Athens on 7<sup>th</sup> and 23<sup>rd</sup> April 2020 to provide updates on ICARUS outcomes. Key findings and main outcomes of the ICARUS work concerning the city of Athens were presented to the team of Mrs. Elissavet Bargianni, who is in charge of the group for implementing the Climate Change Adaptation Plan for Athens and participates in the implementation of the Athens Sustainable Urban Mobility plan.
- 40) ADDMA organized an online meeting with the Department of Resilience and Sustainability (ORS), City of Athens on 30<sup>th</sup> June 2020 to provide an update *on ICARUS application*” (follow-

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up meeting). Details of ICARUS mobile app (downloadable from Google Play [here](#) and from Apple store [here](#)) were given and discussed with the audience.

- 41) The RECETOX team gave an oral presentation entitled “Air quality in Brno and around...” on 23 September 2020 at Knihovna Jiřího Mahena. Introduction to the air quality research and explanation of some issues based on the ICARUS work and results were discussed with the audience. Further information is available at [1](#) and [2](#).




- 42) The JSI team organized a working meeting with representatives of the Municipality of Ljubljana (MOL) Department of Environmental Protection on 2 October 2020 to discuss on the feasibility of the ICARUS approach with the focus on short to medium term policies/measures as assessed for Ljubljana by ICARUS.



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- 43) In order to update stakeholders on WP6 visions and on the sensor campaign in Athens, ADDMA has organized an '*informal communication channel*' with Athens city stakeholders and city advisors and the Office of Resilience and Sustainability (ORS). This is constantly open and allows the project team to interact continuously with Athens stakeholders both on an operational (e.g. sensor campaign) and on a strategic (assessment of long-terms urban development visions) level to ensure the resilient evolution of the city of Athens towards smart, green and healthy urban metropolis in the Mediterranean.

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## 2.1 ICARUS SLAMS

### Brno (Czech Republic)


As a stakeholder of ICARUS, the Department of Environment City of Brno has organized the meeting on “*Slam event with the presentations of experts in the field of air quality*”, at the Brno Observatory in the hall of the digital planetarium. The SLAM was held on 18/11/2019 in Brno (Czech Republic). Beside the City of Brno and RECETOX the meeting was attended by delegates from the Czech Hydrometeorological Institute, from the Transport Research Centre and from the South Moravian Region. During the meeting, presentations and discussion about air quality communication with the citizens and stakeholders of the city of Brno was discussed in detail. Online lectures have been recorded and can be seen at [YouTube](#).

The ICARUS Brno team presented the ICARUS results about the Health impacts assessment of policies and of the ICARUS sensor campaign.

Important *take-home* health impact recommendations for behavioural changes (e.g. cleaner households, ventilate homes more often especially during cooking, after shower and prior and after sleeping; use more sustainable forms of transport, etc.) collected from ICARUS campaign experiences, were shared with the audience. More information is [here](#).




ICARUS team members participating in Brno SLAM event on 18<sup>th</sup> Nov 2019 at the Brno Observatory in the hall of the digital planetarium

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ICARUS team members participating in Brno SLAM event on 18<sup>th</sup> Nov 2019 at the Brno Observatory in the hall of the digital planetarium. Link to video is [here](#).

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## Stuttgart (Germany)


University of Stuttgart and City of Stuttgart together organized a meeting/expert workshop on 26<sup>th</sup> Sep 2019 in Stuttgart. The ICARUS Stuttgart team took part in this meeting and discussed on “*Visionen für ein klima- und umweltfreundliches Stuttgart im Jahr 2050*”. In this meeting, ICARUS team has shared the improved visions for a climate and environmentally friendly city including feasibility of autonomous and shared vehicles. The meeting concluded in fruitful discussion with stakeholders about long-term visions and strategies towards a climate friendly and smart city with clean air as well as about improving their evaluation and the concept of integrated assessment.

## Aim

To present the main outcomes of the ICARUS project and the respective case study in Stuttgart and to initiate a discussion of possible implications with local stakeholders. The focus is on developing long-term visions of climate and environmentally friendly cities and the assessment of possible transition pathways.



The Stuttgart SLAM announcement

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## SLAM Agenda

	Topic	Presenter
13:30 – 13:45	<i>Welcome Session</i> Agenda and introduction round	Dr. H.-W. Zirkwitz, City of Stuttgart (AfU) M. Wacker, University of Stuttgart (ISV-VuV)
13:45 – 15:00	<i>Input Session 1</i> Introduction to the ICARUS project and urban visions	Dr. R. Friedrich, University of Stuttgart (IER)
15:00 – 15.25	<i>Input Session 2</i> Possible urban mobility visions for Stuttgart – main findings and insights	Dr. M. Friedrich, University of Stuttgart (ISV-VuV)
15:40 – 17:00	<i>Discussion</i> Visions for climate and environmentally friendly mobility in 2050	Everybody
17:15 – 17:30	<i>Closing session</i> Summary and Farewell	Dr. R. Friedrich, University of Stuttgart (IER)

## Welcome Session

Dr. Zirkwitz welcomed all participants to the ICARUS SLAM “Visions for a climate and environmentally friendly Stuttgart in 2050”, followed by a short introduction round.

Mr. Wacker took over with the moderation of the workshop and presented the agenda.

## Input Sessions


Introduction to the ICARUS project and urban visions

### *Presentation*

Dr. R. Friedrich introduced the ICARUS project and its main objectives:

- To determine and evaluate reductions in both GHG emissions and air pollution simultaneously in urban settings, achieved by short- to medium-term bundles of measures and policies
- To identify urban visions for climate and environmentally friendly cities in 2050 as well as potential transformation pathways

He also presented a short overview of the ICARUS methodology to evaluate measures and policies based on avoided health risks in the case of air pollution and marginal avoidance costs of greenhouse gases. These are used in a Cost-Benefit Analysis to compare quantitatively different measures and to evaluate their effectiveness and efficiency. The ICARUS vision aims at a city, in which the citizens’ needs are satisfied as much as possible, maximizing well-being and the city’s welfare. This includes climate-neutrality and air quality meeting the WHO limit/target values. Again, long-term visions are evaluated by a cost-benefit analysis of possible strategies. Benefits may include, for example, avoided health risks, better social cohesion or avoided climate forcing (reduced emissions). Costs may also include potential utility losses, e.g. through loss of time, in addition to any economic, monetary costs. Dr. Friedrich highlighted the focus of ICARUS visions on the supply of heating and cooling as well as urban mobility.

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This was followed by a presentation of possible developments in the areas of mobility and the heating sector as individual components to build a long-term vision.

#### *Discussion points*

Participants increasingly emphasized that links with other projects and “Masterplan 100% Climate Protection” in particular should be examined and that synergies can be used. With regard to the ICARUS aims, especially the topic of air pollution control and avoidance of air pollutants would be a useful addition to the project “Masterplan 100% Climate Protection”. Altogether, the ICARUS project - as a research project - should contribute to the current discussion and provide further insights by integrating climate protection and air pollution control and considering their implications simultaneously.

*Due to the discussion and the participants’ expertise in the respective areas, the remaining workshop was mainly concentrated on mobility. For heating and cooling supply the following points were shortly discussed:*

- *Long-term role of hydrogen and synthetic gases with natural gas as a bridging technology*
- *Whether hydrogen would require a separate infrastructure or could utilize existing gas networks (technical adaptations only at the end user)*
- *Increasing the renovation rate and modernization of heating systems in old buildings*
- *Restrict the designated building areas for single family houses in Stuttgart (only allow multi-family houses)*

#### **Possible urban mobility visions for Stuttgart – main findings and insights.**

##### *Presentation*

In the second input session, Dr. M. Friedrich presented the ICARUS mobility visions and main results for Stuttgart. To estimate possible effects, two extreme visions, both based on autonomous vehicles, were modelled (car sharing and ride sharing). Car sharing has the advantage of requiring less vehicles (compared to private cars) and less parking space, creating open and available spaces in the city. Ride sharing has the additional advantage of reducing vehicle kilometres since the occupancy rate approximately doubles.

Questions about the modelling and results have been included in the following discussion session.


#### **Discussion Sessions**

##### **Visions for climate and environmentally friendly mobility in 2050**


To facilitate a fruitful discussion, the question was posed, whether the scenarios presented constitute a meaningful and realistic vision regarding mobility in Stuttgart in 2050 and how participants would estimate their feasibility and acceptance within the general society.

This resulted in the following discussion points and contributions:


- Utilization of the traffic system, parking situation and autonomous driving:
  - o To which extend is it even possible to increase capacity in urban areas (without changing the occupancy rate), if autonomous vehicles conform with the rules at all times? Could rule-compliant behaviour lead to more traffic jams?
  - o How many vehicles and/or vehicle kilometres could be avoided with sharing concepts? Would cheaper public transport or an increase in sharing prices be sufficient to reduce traffic/congestion, especially in the city centre?

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- Comments on parking and idle vehicle routing:
  - Are the vehicles also in motion/on the road without passengers (constantly circling) or parked in a (central) location? Are parking spaces planned within or outside of the city?  
→ *Vehicles are not always in motion; idle routes are limited. Vehicles park in the immediate vicinity of a journey's destination; central parking possible but not yet implemented*
  - How many idle trips occur in the model?  
→ *relatively few if no competition assumed (a single provider offers better utilization of available capacities). To avoid idle trips, a critical mass of users is required (approx. 20% must switch to ride sharing to achieve a good "match" of routes)*
- Combining car- and ridesharing systems
  - Car- and ridesharing are modelled as two extremes to reveal specific effects. A mix of car- and ridesharing would also be feasible and logical.
  - Possible to control demand by different prices for car-/ridesharing. Ridesharing could be cheaper and/or the only available option at rush hours due to its additional environmental benefits
- Models and design of the system at different levels
  - Local level (local authority district)
    - To which degree is a municipal promotion of sharing vehicles planned? Can/does a city need to ensure a balance between preferences of different population groups ("fair system" for everybody)?
    - It's questionable which regulatory possibilities the City of Stuttgart has to promote car-/ridesharing. Integration in a federal or EU system seems necessary.
  - Service provider
    - Sharing providers need to be regulated. With too many providers, a high degree of idle routing can be expected, making the system unfavourable.
    - Is it possible to regulate the competition between different private sharing providers at the municipal level?
  - Pricing
    - Is it planned to have different process for the different systems (car-/ridesharing)?
    - How can the pricing be compared to the public transport; is there an optimum?
    - Should roads be priced differently (time/space)?
- Public acceptance to waive private cars
  - Both visions are based on very strong restrictions (no private cars to be used).
  - The social issue that people do not share their rides happily should be considered when developing a ridesharing vision; otherwise acceptance issues are to be expected  
→ *car sharing as an alternative*
  - Will specific population subgroups still desire their own, private car? Or is future mobility without individually owned vehicles imaginable? Is the perceived need for a private car only artificially created by the industry?
  - Private ownership of autonomous vehicles would result in an inefficient and more expensive systems (no reduction in vehicle numbers possible). A mixed system of private and shared vehicles is questionable.
  - Possible that sharing systems could be increasingly implemented in city centres, while private cars are increasingly used in rural areas; Park & Ride at the interface between city and rural areas.

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- Acceptance with regard to control and privacy (data protection)
  - o Monitoring of trips with their starting point and destinations could be problematic. Who has access to these data?
  - o Do individuals want to reside in such a controlled environment (in the case of smart, but no private vehicles)?
- Priority role of biking and walking in future mobility
  - o Should not a future vision rather focus on active mobility /promotion of walking and biking?  
*→ So far, the visions do not consider any political goals, but biking and walking are always available as an option. Favourable sharing systems lead to a reduced share of biking.*
  - o Reference should be given to the study “Mobiles Baden-Württemberg: Wege der Transformation zu einer nachhaltigen Mobilität“
  - o Infrastructure improvements regarding biking lanes could be supported by sharing concepts, since less vehicles on the road would result in open and available space (land reallocation in favour of non-motorized traffic).
- Bus Systems
  - o So far, the concept does not yet include any scheduled bus systems with vehicles for more than six passengers.
  - o How efficient would this system be in Stuttgart, e.g. to be used on interconnecting axes or the “last mile”? What happens during off-peak times?  
 Note: comparison to “SSB Flex” offer
  - o How strongly does eliminating bus lines affect routes in the city centre?
- Technological specifications of vehicles
  - o Feasible to have battery electric cars in urban areas and hydrogen vehicles in rural areas
  - o Level 5 autonomy is realistic in the city until 2050
  - o Shared vehicles may have a shorter lifetime and may need to be replaced earlier than privately owned vehicles
  - o Possible to automatically refuel hydrogen cars in 2050?
  - o There is a possible dependence on other regions/energy suppliers (fuel production, mainly true for electricity but also hydrogen)
- Future working environments
  - o Does the vision appropriately depict changes in working environments and their potential influence on mobility patterns?  
*→ So far, assumptions with regard to different groups of people and their destinations have not been changed. This is, however, has been already discussed within the project and resulted in additional scenarios.*
- Economic factors and added value
  - o Does a drastic reduction in the number of vehicles directly result in a drastic decrease in employment in the automotive industry? Where is the added value in the vision? Where is the workforce needed in the future?
  - o Should the relocation of jobs be considered in the evaluation of such a vision?
- Mobility in the 3<sup>rd</sup> dimension
  - o Mobility in the 3<sup>rd</sup> dimension (air taxis, cable cars etc.) is not yet considered in the vision.
  - o Air taxis are rather questionable as a means of mass transportation and could also result in additional noise exposure.
  - o Cable cars could play a role as a supplement to public transport, but potential routes are limited.


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- Integrated concept and assessment
  - What is the integrated concept for the city of Stuttgart? What exactly are the main objectives/driving forces (e.g. reduced emissions, more open space, preferences of different population subgroups)
    - *cost-benefit assessment from the perspective of the entire society (maximizing social welfare)*
  - To which extend are different population subgroups and their different preferences considered in the evaluation of the system?
  - What happens to the created open space?
  - How is the clean air aspect of the visions to be evaluated?
    - Compliance with limit values can already be anticipated with the currently developed powertrain technologies
    - Increased vehicle kilometres do, however, result in higher emission from abrasion. This needs to be limited by technical developments or appropriate regulations.
  - Life cycle perspective necessary to assess visions
    - Battery production is not CO<sub>2</sub>-neutral and associated with environmental impacts
    - Impact also depends on operation of vehicles (interface to power generation)




## Summary and Key Messages

Key messages include how to enhance modelling of ridesharing services in macroscopic travel demand models and the potential effect car-/ridesharing services, especially in combination with autonomous driving, have on the number of cars needed. It was shown that car-/ridesharing can reduced the number of cars in cities drastically if no private cars are allowed, which would have a great impact to improve air quality. These results were also discussed in a local podcast and newspaper article about future transport scenarios, advertising and introducing the ICARUS findings to non-scientific communities.

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Stakeholders mainly raised questions regarding potential acceptance issues if privately owned cars are banned completely. Other major discussion points comprised whether or not active transport such as biking should be prioritized more in such a vision, the establishment of additional line buses, the integration into an urban planning concept (especially with regard to newly created open spaces) as well as potential aspects of a comprehensive, integrated assessment and evaluations of such long-term visions. Such an evaluation should consider additional economic effects, such as changes in working environments and relocation of jobs, as well as potential impacts of up- and downstream processes.

Overall, it was highly appreciated that ICARUS could contribute to the current, ongoing discussion on how to design clean and green cities, especially by providing further insights through the integration of climate protection and air pollution control strategies. Stakeholders provided valuable feedback on the feasibility of the proposed visions and potential transition paths. The raised points may be used in the future to further develop the ICARUS visions and to propose concrete transformation paths for the city of Stuttgart.

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## Madrid (Spain)

Aiming at holding a SLAM meeting in Madrid, the National Centre of Environmental Health (CNSA), Institute of Health Carlos III (ISCIII), organized on October 15 2020 the workshop entitled “*Jornada de Presentación de Resultados del Proyecto H2020 ICARUS (Presentation day about the ICARUS project results)*” to present the main outcomes of the ICARUS project to the scientific community and Madrid’s stakeholders.

The meeting, celebrated in both virtual and face to face format, was divided into several talks and a discussion panel (see the agenda). The speakers were ISCIII members and “ICARUS participants”.



El principal objetivo del proyecto ICARUS es desarrollar herramientas y estrategias integradas para la evaluación del impacto urbano en apoyo de la calidad del aire y la gobernanza del cambio climático en los Estados miembros de la UE que conduzcan al diseño y la implementación de estrategias de reducción adecuadas para mejorar la calidad del aire y reducir la huella de carbono en ciudades europeas.

Con este trabajo se desarrollan políticas y medidas detalladas para la contaminación del aire y el control del clima a corto y mediano plazo (hasta aproximadamente 2030). Para la perspectiva a largo plazo (2050 y más allá), se desarrollarán proyectos de ciudades verdes y métodos para hacerlas realidad.

**Socios colaboradores:**

Madrid Salud - Ayuntamiento de Madrid

Área de Contaminación Atmosférica - Centro Nacional de Sanidad Ambiental  
Instituto de Salud Carlos III



**Integrated Climate forcing and Air pollution Reduction in Urban Systems**

**Jornada de Difusión de Resultados**

**15 octubre 2020**

Lugar:  
Aula 1 (local 53-00-0235)  
Centro Nacional de Microbiología


Organiza:  
Centro Nacional de Sanidad Ambiental  
Instituto de Salud Carlos III

Ctra. Majadahonda a Pozuelo km 2  
28220 Majadahonda (Madrid)



Comisión Europea | Proyecto financiado por el Programa Marco Horizonte 2020 de la Unión Europea - Nº 980195

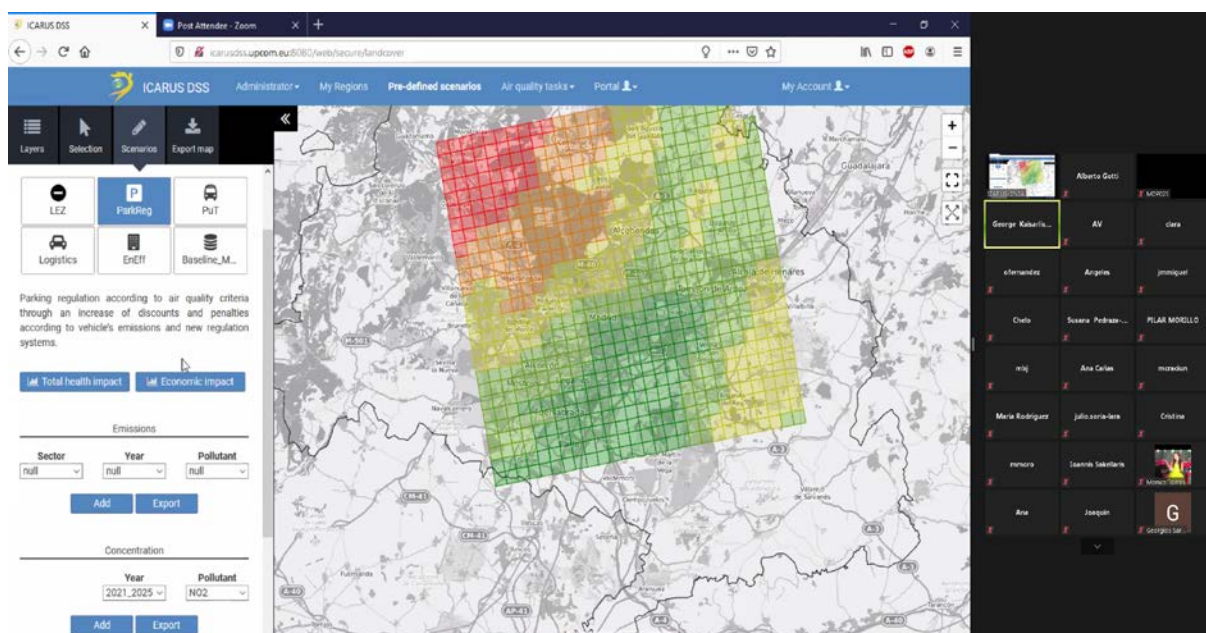
<p>Instituto de Salud Carlos III - Majadahonda, 2020 Aula 1 (local 53-00-0235) Edificio Centro Nacional de Microbiología</p>		
<p><b>AGENDA</b> <b>15 de octubre de 2020</b></p>		
<p><b>Jornada de Difusión de Resultados</b></p> <p>Jornada dirigida a las entidades públicas y privadas que trabajan en el sector de la Contaminación Atmosférica y el Cambio Climático con objeto de difundir los resultados del proyecto ICARUS.</p> <p>Organizador: Área de Contaminación Atmosférica Centro Nacional de Sanidad Ambiental Instituto de Salud Carlos III</p> <p>Contacto: Tel. +34 82 23512 / Tel. +34 82 23506 e-mails de contacto: bnunez@isciii.es / sgarcia@isciii.es</p>	<p>10:00-10:15   Registro</p>	<p>11:25-11:40   Importancia para los grupos de interés <b>Elena Boldo</b> Madrid Salud – Ayuntamiento de Madrid</p>
	<p>10:15-10:25   Bienvenida <b>Argelia Castaño</b> Directora del Centro Nacional de Sanidad Ambiental (CNSA) – Instituto de Salud Carlos III</p>	<p>11:40-12:00   Discusión con los participantes</p>
	<p>10:25-10:30   Resumen de los objetivos del proyecto <b>Saúl García</b> Centro Nacional de Sanidad Ambiental (CNSA) – Instituto de Salud Carlos III</p>	<p>12:00-12:15   Presentación del nuevo proyecto H2020 URBANOME <b>Pilar Morillo</b> Jefa del Área de Contaminación Atmosférica (CNSA) – Instituto de Salud Carlos III</p>
	<p>10:30-11:05   Presentación de los resultados del proyecto <b>Beatriz Nuñez</b> Centro Nacional de Sanidad Ambiental (CNSA) – Instituto de Salud Carlos III</p>	<p>12:15-12:25   Agradecimientos y fin de la reunión <b>Pilar Morillo</b> Jefa del Área de Contaminación Atmosférica (CNSA) – Instituto de Salud Carlos III</p>
	<p>11:05-11:25   “ICARUS tools for innovative engagement (DSS and mobile app)” <b>George Kaisarli</b> UPCOM</p>	

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The first speaker was Argelia Castaño, Director of the CNSA that acknowledged all the attendees and recognized the ICARUS project contributions. Then, Saul García, the Madrid's IP, briefly explained the main ICARUS objectives.


To follow up, Beatriz Nuñez (ISCI staff) introduced the main results and conclusions obtained in the work packages 3 and 4 (WP3 and WP4). The WP 3 was focused on the analytical determinations carried out by the ISCI. The results were relevant for the Madrid Air Quality (AQ) Network members (Madrid City Council), because some of the pollutants analysed such as organic carbon (OC) and elemental carbon (EC) are not usually measured in the urban areas. Regarding WP4 results, she reported the key outcomes of the sensor campaigns carried out in Madrid during 2019 aimed at collecting individual exposure data through low-cost sensors technologies. In the next talk, Elena Boldo, "Madrid-Salud" staff (Madrid City Council) explained the conclusions of the policies Health Risk Assessment conducted to evaluate the implementation of the Plan A, a municipal approach designed to control and reduce air pollution in Madrid.

The meeting continued with the virtual talks of Dr. George Kaisalris and Dr. George Sarigiannis (ICARUS team members) who respectively presented the ICARUS Decision Support System (DSS) and the ICARUS RQuality App. Dr. Kaisalris gave an online presentation of the ICARUS DSS executing a real-time demonstration of the DSS functionalities. The audience showed a great interest on the potential application of the tool in future AQ plans.



The ICARUS RQuality App presented by Dr. G. Sarigiannis was also very welcomed by the participants who directly downloaded the App in their mobile phones during the live presentation.

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The screenshot shows a presentation slide titled "About RQuality" with the ICARUS logo in the top right. The slide is divided into two main sections: "TRACKS AIR QUALITY IN REAL TIME" and "CALCULATES THE USER'S CARBON FOOTPRINT".

**TRACKS AIR QUALITY IN REAL TIME**

- Tracks air quality metrics of CO<sub>2</sub>, NO<sub>2</sub>, O<sub>3</sub> in real time at the user's area
- Tracks the user's inhalation rate of CO in real time based on their current activity such as walking, running, standing still, etc.


**CALCULATES THE USER'S CARBON FOOTPRINT**

- Users can fill forms in order to track their carbon footprint
- Tracks consumption patterns and lifestyle choices (energy / food / goods & services, etc.)
- Promotes individual wellness and environmental awareness

At the bottom right, there is a grid of participant names and a small video feed showing a person. The grid includes names like Alberto Cotti, George Kasaslis, MDH215, Alir, clark, christian Bos, Angelle, jordiquest, Chelo, Susana Pedraza..., PILAR MORELLO, mdj, Ana Carles, muelan, Maria Rodriguez, Julia Maria Lara, Cristina, mmmmm, Susanna SolerBarb, and Ana. At the bottom left, there is a reference number: Ref. /Mesa/2018/1512245 -30/03/2018 and the European Union flag.

The next speaker, Julio A. Lara from the University Politécnica of Madrid explained the Madrid's contribution to the WP6 long term ICARUS visions. The future visions were discussed by an heterogeneous expert panel about how the city of Madrid would be in 2030 and 2050. One of the most interesting part of the talk was the comparison between the 2018 visions and the current ones after the COVID-19 pandemic. To sum up some of the striking points, the e-working was not practically considered in 2018, the e-shopping were not a priority and the public transport and car-sharing were the main mobility choice for most of the citizens. Those visions have dramatically changed nowadays and led the speaker to stress the importance of having narratives about the future of cities that include disruptive events that allow the vision quickly adapt to unexpected new situations.

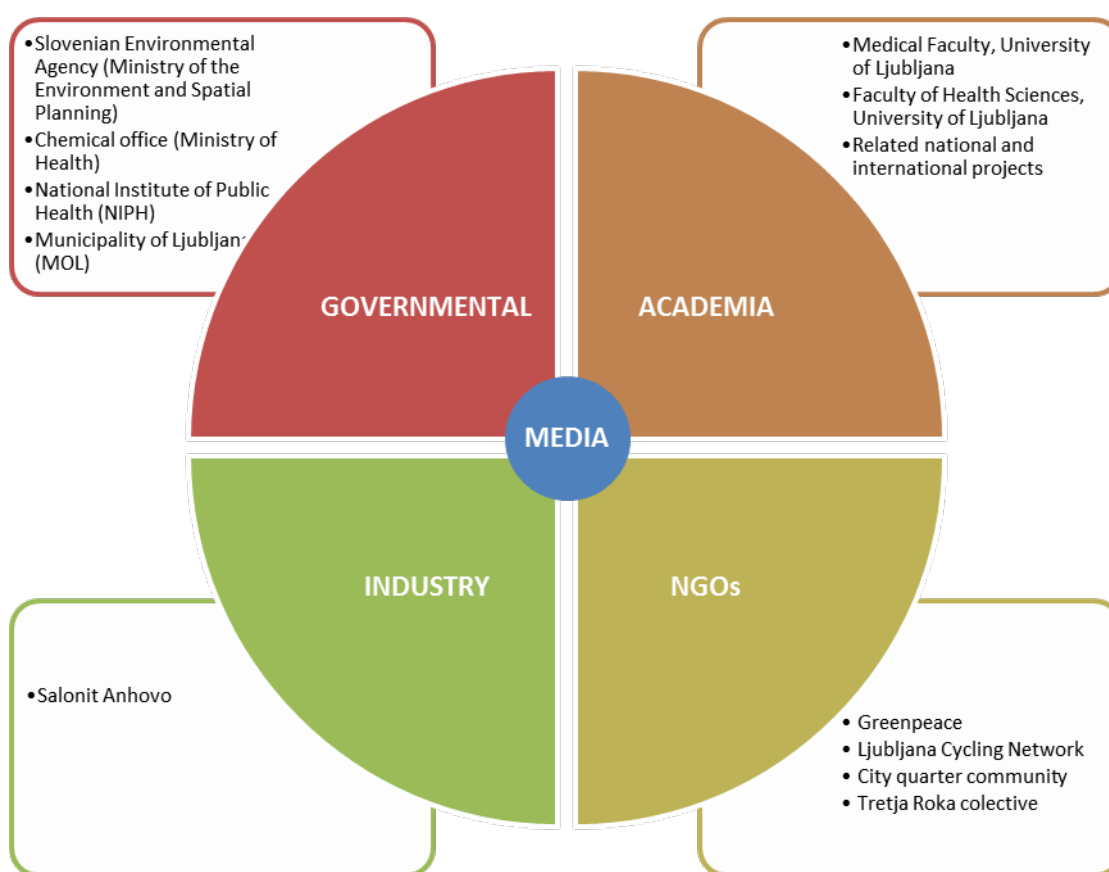
After a time dedicated to an interactive open discussion about the results and the main outcomes of the project, the meeting moved to the last part presented by Pilar Morillo, Head of the Atmospheric Pollution Area of the CNSA. She introduced the new proposal presented to the European H2020 Research Program, the URBANOME proposal which is a sort of ICARUS follow-up. The new proposal aims at achieving an enhanced institutional and citizen engagement. The decision to present the URBANOME proposal in this meeting was to explain the objectives and the needs for potential stakeholders involvement and to foster their participation and active collaboration as guaranty of URBANOME success.

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## Ljubljana (Slovenia)

In Ljubljana, the local ICARUS team members decided to organize multiple smaller SLAMs events to better reach a wide variety of local stakeholders to share and exchange ideas, technologies and key research findings, as obtained within the ICARUS Ljubljana Pilot rather than a single SLAM bigger event. To this end, different types of stakeholders were involved who are dealing with the topic of Air Quality and Climate Change in urban settings and who can be classified into four general groups (governmental, academia, industry and NGOs) as shown in the figure below.


### Type and relationship between stakeholders involved in Ljubljana




General groups of stakeholders in Ljubljana

### Event #1

Name	Municipality of Ljubljana (MOL) "For green and beautiful Ljubljana event"
Place and date	Municipality of Ljubljana City hall, 18.04.2019
Stakeholders present	<ul style="list-style-type: none"> <li>Representatives of Municipality of Ljubljana</li> <li>Representatives of ClairCity project</li> </ul>

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	<ul style="list-style-type: none"> <li>• Media representatives</li> <li>• NGOs</li> </ul>
Number of people	26
Main outcomes and key messages arisen from the discussions	<p>Networking with the stakeholders in Ljubljana, including sister projects like ClairCity and others (URBforDAN, Ljubljana cycling network). The day was devoted to the presentation of projects and measures for better air quality in Ljubljana. Within the ICARUS presentation, beside illustrating the general overarching methodological framework and how this was applied in Ljubljana, the focus was on the outcomes of sensor campaigns conducted within WP4 and of the individual level of exposure assessment.</p> <p>The discussion that followed addressed aspects and communalities of approaches considered in the two sister projects, ICARUS and ClairCity, related to the exposure to air pollution at the level of individuals in contrast to classic approaches and what and how individuals can contribute. Accuracy, validity and fitness for purpose of data gathered by low-cost sensing technologies, advantages and disadvantages of such approaches, as well as ethical issues of citizen involvement were also discussed.</p> <p>The key message arisen from the debate was that there is a great public interest and concern regarding the AQ in Ljubljana, and that tools are available nowadays that can help citizens to get insight into AQ of their specific micro-environment without too much effort and over relatively short period of time. It was also recognized the need that Ljubljana would benefit from a denser regulatory AQ monitoring that among others would enable more autonomous use of new sensing technologies (e.g., automatic real-time calibration).</p> <p>In relation to the measures concerning air quality, situation arising primarily from transport, domestic heating and transport have been discussed. It has been shown, that still much room for improvement lies in the re-organisation of transport in favour of more sustainable means (increase in cycling and walking, reduction of personal car usage, increase of public transport usage) as well as further expansion of district heating systems. Specifically, the issue of individual domestic heating (wood, pellets, fuel-oil and coal) has also been discussed. The main goal of the city of Ljubljana in this regard is to provide education and regulation in order for the users to switch to the cleaner and more efficient heating technologies where the implementation of district heating systems is not an option.</p>
Various materials	<p>Event: <a href="https://www.ljubljana.si/sl/aktualno/za-lepo-in-zeleno-ljubljano-4/">https://www.ljubljana.si/sl/aktualno/za-lepo-in-zeleno-ljubljano-4/</a></p> <p>Agenda of the event: <a href="https://drive.google.com/file/u/1/d/1MMuMXjaVUSxHxe_44Z9Dy_2BePHlcbYg_/view?usp=drive_open">https://drive.google.com/file/u/1/d/1MMuMXjaVUSxHxe_44Z9Dy_2BePHlcbYg_/view?usp=drive_open</a></p>

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	<p>PPT shown at the event:  <a href="https://drive.google.com/file/d/1Ulpb935Pwzsa57m7o6AzeNBcdkHCeh3s/view">https://drive.google.com/file/d/1Ulpb935Pwzsa57m7o6AzeNBcdkHCeh3s/view</a></p> <p>Foto_1:  <a href="https://drive.google.com/file/d/1wqr3lQuASgu5KyRmcRqrPET6_5MmAVMy/view">https://drive.google.com/file/d/1wqr3lQuASgu5KyRmcRqrPET6_5MmAVMy/view</a></p> <p>Foto_2: <a href="https://drive.google.com/file/d/1JONysEPL42aWcB6-iNQW1tY6DV514ilm/view">https://drive.google.com/file/d/1JONysEPL42aWcB6-iNQW1tY6DV514ilm/view</a></p>
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#### Event #2:

Name	Workshop with stakeholders organised within the national Targeted Research Project V3-1722
Place and date	Reactor Center Podgorica, Jožef Stefan Institute, 11.11.2019
Stakeholders present	<ul style="list-style-type: none"> <li>• Slovenian Environmental Agency</li> <li>• National Institute of Public Health</li> <li>• Ministry of health - chemical office</li> <li>• Academy (University of Ljubljana, Faculty of Health Sciences)</li> <li>• Industry (Salonit Anhovo).</li> </ul>
Number of people	22
Main outcomes and potential impacts	<p>Overall results of the integrated approach conducted in ICARUS in the light of urban air quality and climate change assessment as well as challenges related to assessing health impacts was presented and discussed with all relevant stakeholders from the respective fields of research: governmental agencies, academy and industry.</p> <p>Discussion focused on feasibility and applicability of the ICARUS integrated methodology in the frame of national and regional-level health risk assessment. The overall conclusion was that the methodological framework has a great potential and that the ICARUS integrated policy assessment results have of high interest for the local stakeholders. There was a large consensus among the participants that we have to focus on measures that are actually effective as recognized by ICARUS.</p> <p>We need however to be aware that knowledge gaps in linking environmental policies and human health still exist, such as existence of site specific data that links exposure with the health outcomes, as well as synergistic effect of multiple stressors.</p>
Various materials	<a href="#">Agenda of the meeting</a> <a href="#">ICARUS PPT</a>


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#### Event #3:


Name	Focus group workshop with ICARUS sensor campaign volunteers
Place and date	Reactor Center Podgorica, Jožef Stefan Institute, 07.02.2020
Stakeholders present	<ul style="list-style-type: none"> <li>Volunteers involved in ICARUS WP4 campaign</li> </ul>
Main outcomes and key messages arisen from the discussions	<p>Conducting a focus group with ICARUS volunteers proved to be a crucial step in several aspects, mainly in getting their feedback and input about the report that every participant would receive. While providing them with some material, such as visualizations, questionnaires, structured discussions, our team also allowed the discussion to go wider and include several aspects of the ICARUS project - the overall concept and main findings.</p> <p>As we can only look through the eyes of a researcher, their involvement showed that we drafted some sections of the final feedback report in a way that was not entirely understandable to a layperson.</p> <p>A structured discussion opened more options than a regular online questionnaire would and allowed the participants to discuss their view in length and provide feedback to other issues where we did not even intend to hold a discussion. Accordingly, several sections of the feedback report were corrected, visualizations were modified in accordance with the suggestions of the participants and some text was rewritten. This information was then shared and agreed with the other ICARUS partners involved in the sensor campaign and a final common template for the feedback report was agreed.</p>
Various materials	Audio recording in Slovene

#### Event #4:

Name	Meeting with Greenpeace Slovenia
Place and date	Greenpeace- Slovenia office, Ljubljana; 05.10.2020
Stakeholders present	Katja Podbevšek, Katja Hus
Number of people	4
Main outcomes and key messages arisen from the discussions	<p>The meeting was organised with a purpose to present the ICARUS project methodology and the main results to the Greenpeace Slovenia representatives. Their interest arose from the fact that recently, their scope of work oriented towards environmental protection and climate change minimisation related primarily to transport and industry. As a result of this, the focus of the discussion was the evolution of the transport situation in Ljubljana in recent decades - what measures have already been implemented and what was their output in terms of air quality, mobility efficiency etc. According to the project results, it was agreed, that the cycling has the highest potential in achieving the set AQ goals. In terms of implementation the measures in the industry and household sector,</p>

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	<p>the discussion went in the direction, that the “reduction” principles are the key orientation for the future, in combination with the use of cleaner technologies.</p> <p>For the extensive and thorough analysis of various measures that could benefit the AQ, not only in Europe, but also in a broader geographical sense, ICARUS was considered as a great resource of information for potential transfer or upscaling of the measures to other areas.</p>
Various materials	<p>Foto:</p> <p><a href="https://drive.google.com/file/d/1xs6qEHLE4SWTIGYXcYfVXU7RQEkGorsV/view">https://drive.google.com/file/d/1xs6qEHLE4SWTIGYXcYfVXU7RQEkGorsV/view</a></p>

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## Milan (Italy)

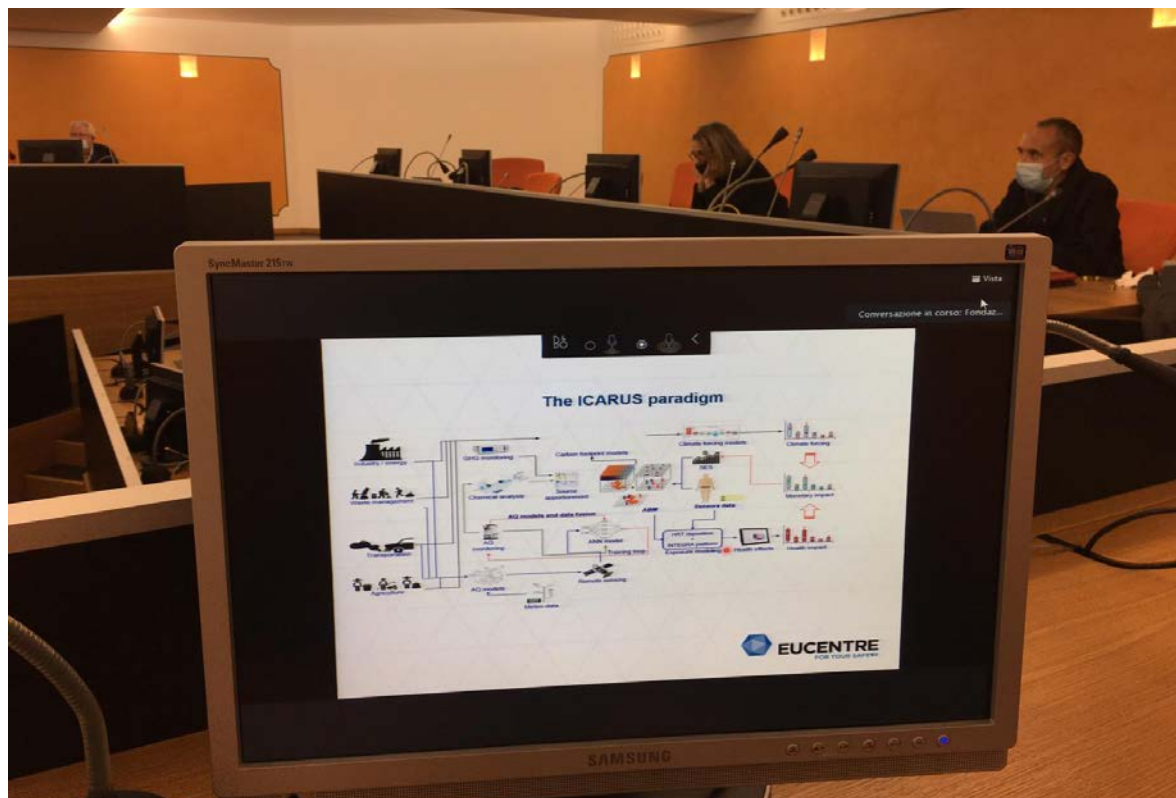
EUCENTRE organized the ICARUS SLAM in Milan on 29 October 2020. Due to the current restrictions related to the COVID-19 pandemic the workshop was organized in a mixed format partly in presence at the EUCENTRE premises and partly in virtual mode.


The Milan SLAM event was attended by a wide range of local stakeholders which encompassed representatives of the Milan Municipality, the Milan Agency for Mobility, Environment and Territory (AMAT), the Regional Agency for Environmental Protection (ARPA), the Polytechnic of Milan - Department of Architecture and Urban Studies (POLIMI-DASTU), the IRCCS National Cancer Institute Foundation, the IRCCS “Carlo Besta” Neurological Institute as well as the SME Ambiente Italia and the NGO Legambiente. Overall ca. 15 stakeholders attended the Milan SLAM.

The agenda of the meeting was the following:

- Introduction of the ICARUS project: presentation of the involvement / collaboration with the Municipality of Milan.
- Sensor Campaign: key outcomes and feedback.
- Results of the integrated assessment of the mitigation policies and actions for the Municipality of Milan (2020-2040)
- Milan 2050 vision: discussion of the identified visions and integration with others initiatives.
- Organization of potential future collaborations.

Dr. Gotti on behalf of the ICARUS team presented the ICARUS project, illustrating its main objective, the methodological framework and tools applied in order to identify and assess appropriate abatement strategies for improving the air quality and reducing the carbon footprint in urban settings. The ICARUS methodology was discussed and the several conceptual steps encompassing the framework were discussed and clarified with the audience.



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We then moved to present the Milan sensor campaign and its key outcomes. Lesson learnt from the citizen engagement were also discussed with the audience. Several stakeholders pointed out that lesson learnt would be useful to inform and to prevent others who want to follow the ICARUS approach from repeating the same experience by doing attempts that have been already explored by the project Consortium and proved to be fruitless.

Dr. Gotti reported that feedback from the Milan participants was in general very positive and that participants were happy to receive personalised feedback on their home/personal air quality measurements and were willing to provide their opinions.

Key feedback collected from the participants include:


- The majority of the participants were satisfied about the way the study was organized and would be keen to participate again in the future.
- The duration of the study (1 week in winter and 1 week in summer) was considered appropriate.
- They were very interested in getting back results / personal reports.
- The custom-built PM sensor was well accepted. Few complaints were reported about its size.
- In a few cases, participants forgot to charge the PM sensor.
- For many participants filling in the Time Activity Diary was a time-consuming process. A potential solution would be to move to digital forms to be filled with mobile smartphone apps.
- Many participants actively shared pictures on social media enhancing the visibility of the project and contributing to raise awareness about the environmental issues.

Dr. Gotti reported then the results from the integrated assessment of policies for the Milan case study. The policies/measures discussed more in detail concerned the transport sector namely “Area B” and “E-bus” scenarios respectively addressing the establishment of a Low Emission Zone with control and tracking of access into the city and compete ban up to Euro 4 diesel cars (Area B scenario) and the conversion of all public buses to electric ones by 2030 (E-bus scenario) as well as the Nature-Based Solution sector namely the “Trees” scenario which considers the greening of the city of Milan by planting over 3 million new trees by 2030.

The overall conclusion was that the ICARUS policy assessment results have a quite significant potential for the City of Milan. Access restrictions and ban (*Area B* scenario) have positive effects also on driver behaviour and increases pedestrian modal shares, thus leading to a significant reduction of pollutant emissions have allowing for a proportional increase of health benefits. Another strong argument for the implementation of low emission zones are also the results from CBA analysis, where it has been shown that relatively small net present costs can result in an extensive amount of benefits. The main drawback of such measures is, that access management is often unpopular with the public, both in financial and spatial terms. As a result, political support and excellent communication with the public are powerful drivers. Accurate measurement, up-to-date technology and good quality data are important drivers at the operational stage.

Moreover, public transportation fleets using electric buses (*E-bus* scenario) showed positive impacts on the emission levels. In particular, for electric technologies, the emission reduction potential is quite high, however, they have been proven costlier in terms of investment and operation.

The results support conclusions that the use of alternative fuels has great potential to reduce vehicle emissions except for fine particles where the reduction appears to be lower. In terms of air pollution and health benefit potential it could be anyhow concluded that the public transport fleet undergoing the changes usually represents a relatively small share of the emission sources originating from

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transport and therefore do not show to contribute so largely to the reduction of air pollution burden. Additionally, the investment costs are generally high, especially for the capital costs (vehicle purchase and charging infrastructure) as well as for electricity costs and battery replacement. Nonetheless, the *E-bus* scenario showed a high Benefit Cost ratio (even if lower than Area B) suggesting anyhow a good potential.

As reported by some stakeholders a major driver in this regard appears to be a strong political will to support and implement these measures together with a set of financial and organisational factors which inherently affect the real potential of the measure. Barriers are concentrated on technological gaps, absence of legislation, lack of political support and insufficient planning.

The *Trees* scenario does not show a significant impact in any of the impact categories, except in CBA results, which can be attributed primarily to the benefits related to indirect positive health effects, due to the refurbishment of public spaces, green and short distance mobility and the re-naturalization of the city.


Overall, it was agreed that the transport- related policies have the greatest potential in terms of improving AQ and reducing the health impacts in urban areas. Energy related policies may have also good potential but to become significant they need large-scale implementation. Measures are quite sensitive in terms of public acceptance, but may nonetheless generate positive reactions if not at the planning stages then certainly after the positive effects have become evident.



After a short break the ICARUS long-term visions of future cities that would be broadly sustainable, smart and healthy were extensively discussed and views were exchanged in order to enhance synergies and maximise the support of the present stakeholders.

Stakeholders explained how the development of narrative visions of the future along with description of pathways for the realisation of these visions in the next decades, can help them to think about what the city of Milan might look like in 2050.

The three general ICARUS visions and their attributes illustrated were:

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- Smart Tech City – The Smart Tech City has more emphasis on technology as a solution to environmental and health issues, with individualistic values being important.
- Connected Cobweb City – Connected Cobweb Cities consider a more dispersed, individualistic society, with more of a balance between technology and socially contingent solutions to the challenges facing our cities.
- Sharing Smart Communities – Sharing Smart Communities take the community at the center and consider interconnection to be an important driver for improved societies.

Being focused on creating a “city of sharing” that is resilient and capable of adapting to future changes and pressures, the discussion focused mostly on the last one (Sharing Smart Communities) as it was recognized to be more in line with the 2050 vision of the City of Milan.


Milan Municipality representatives explained how the City Resilience Framework (CRF) is a lens through which the complexity of cities and the numerous factors that contribute to a city’s resilience can be understood. The CRF indeed describes the essential systems of a city in terms of four dimensions: Health & Wellbeing; Economy & Society; Infrastructure & Environment; and Leadership & Strategy. Each dimension contains three “drivers,” which reflect the actions cities can take to improve their resilience. It was argued that it is a useful tool to help cities to explore the strengths and weaknesses of its systems.

The discussion moved to the 2050 green visions of the City of Milan and how this is could be integrated with the ICARUS visions. To this end it was underlined that narrative visions can be linked into modelling processes and can provide the target or may provide some ideas on parameters for key models. They are not projections but insights into how society may develop and help us to get there. In this perspective, the six primary sectors identified in the 2050 vision for Milan include social issues, mobility and transport, environment, land use, energy, and innovation and technology.

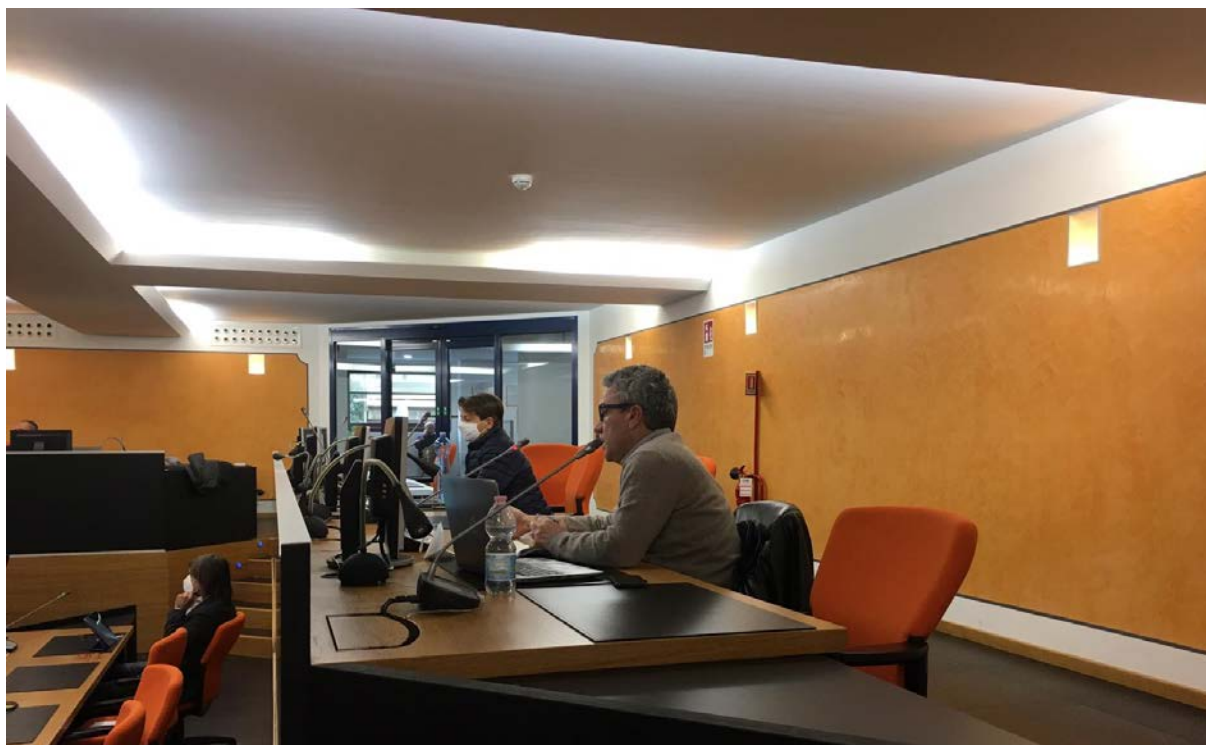
The 2050 post-carbon vision for Milan sees a city that is dense, spacious, green and rich in biodiversity, suitable for pedestrians, and uses carbon-free transport. The energy sources are renewable, with energy-efficient technologies employed. Milan has a green economy, with continuously improving economic, environmental, and social well-being. This success has been achieved by setting short-term goals: once one is achieved, the next goal is set, to limit costs and maintain momentum. In concrete terms, these climate action plans, will help cut emissions steeply over the next decade, and reach net-zero emissions by 2050. The plans will detail the wider social, environmental and economic benefits for all citizens, of taking climate action.


From the discussion emerged that reducing the carbon footprint and air quality in cities and urban areas is an extremely relevant hot topic for the public body responsible for environment and health management and potential further synergies and mutual benefits between the ICARUS work and the City stakeholders were identified. Enormous potential exists in replicating and adopting innovative solutions like the ones resulting from projects like ICARUS.

Moreover, mutual interest was expressed in keeping ‘alive’ the exchange of knowledge and the interaction between Milan authorities and the Project. To this aim, a future potential collaboration with the Milan Municipality and AMBIT has been discussed and resulted in a new research proposal in the frame of the H2020 Research Program. The URBANOME proposal which see both the Milan Municipality and AMBIT as formal partner of the consortium, addresses the call SC1-BHC-29-2020 on innovative actions for improving urban health and wellbeing in the perspective of equitable and sustainable urban transitions. In particular, the proposal addresses the combination of urban ambient air quality, noise, indoor air quality and housing conditions and how these are affected by policies

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addressing wellbeing, urban mobility and the built environment in cities while taking into account socio-economic and environmental determinants leading to health inequalities.



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### Thessaloniki (Greece)

A SLAM meeting has been held in Thessaloniki on October 21, which has been carried out virtually, due to social distancing restrictions resulting from COVID-19.

The speakers of the meeting were the senior ICARUS members of AUTH, including the project coordinator, Prof. Denis Sarigiannis, from KARTECO, as well as an IT expert from UPCOM who presented the ICARUS DDS and mobile application (Rquality app) as indicated in the following agenda. Every presentation lasted around 30 minutes, allowing a room of 15 minutes for discussion.


#### *Thessaloniki (Greece) SLAM Agenda*

	Topic	Presenter
14:00 – 14:15	<i>Welcome Session</i> Agenda and introduction round	Prof. Denis Sarigiannis (AUTH)
14:15 – 15:00	<i>Session1</i> The ICARUS project and urban transformations	Dr. Spyros Karakitsios (AUTH)
15:00 – 15.45	<i>Session 2</i> Measures and policies for Thessaloniki towards a green, healthy city	Dr. Manolis Tsiros (KARTECO)
15:45 – 16:30	<i>Session 3</i> Contribution of ICARUS in updating the Regional Plan for air pollution control	Dr. Marianthi Kermenidou (AUTH)
16:30 – 17:15	<i>Session 4</i> The ICARUS DSS and the ICARUS application (Rquality app) for citizens	Dr. George Sarigiannis (UPCOM)
17:15 – 18:00	<i>Discussion and closure</i> Summary of findings and ICARUS contribution	Prof. Denis Sarigiannis (AUTH)

The audience of the SLAM included representatives of the various municipality authorities of the Thessaloniki Metropolitan Area and more specifically the municipalities of Thessaloniki, Pavlos Melas, Oraioikastro, Themi, Kalamaria, Lagada, as well as industrial stakeholders, considered also as the main industrial polluters in the overall area, such as ELPEDISON (the company responsible for electricity production) and TITAN (the industry of cement production allocated in the western suburbs of the Thessaloniki Metropolitan Area). In addition, the SLAM participants included members of civic society organisations with particular activities on clean air issues, such as ΑΝΑΠΝΟΗ (Respiration in Greek) , a very active citizen group safeguarding citizens' right for clean air and improved environmental conditions active in the western part of the Thessaloniki Metropolitan Area (Evosmos area).

#### **Welcome session**

Prof. Sarigiannis, ICARUS project coordinator, welcomed everybody, presented the meeting agenda and the aims of the meeting, as well as he briefly described the concept, the aims and the vision of the ICARUS project.

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### ***The ICARUS project and urban transformations***

Dr Spyros Karakitsios, had the opportunity to present the overall methodological concept of ICARUS, and how different lines of evidence involving modelling, field measurements and chemical analysis, allow us to better understand what are the main sources of pollution in urban areas, what are the levels of exposure to the population and the related health effects. It has been also highlighted, that the refined methodology developed in ICARUS, allows the more precise understanding of the actual impacts, that are not precisely reflected in impact assessment methods solely base in monitoring station data; in these ways, changes in emissions under the various policy scenarios, are spatially and temporally resolved, while key air pollution characteristics such as PM size distribution and chemical speciation (affecting toxicity) are accounted for as well. Overall, from the presentation and the following discussion, it was clear to all participants that understanding of the actual impacts of specific policies and measures within an urban area, detailed analysis is needed, that has to take into account the spatial distribution of impacts and benefits, as well as the impact of SES on both policy acceptance, and the way that it amplifies or attenuates the impacts. This implies that citizen participation is a critical component of the ICARUS methodology, which is ensured with IT products towards both stakeholders (ICARUS DSS) and citizens (ICARUS mobile app).

### ***Measures and policies for Thessaloniki towards a green, healthy city***

Dr. Manolis Tsiros (KARTECO), presented the measures that have been analysed for the city of Thessaloniki. These included different activity sectors, such as housing and buildings (insulation (M1)), transportation (promotion of cycling and walking (M2a), green vehicles (2b) and promotion of public transport (M2c)), waste (eco-friendly waste management (M3)) and industry (switch of combustion techniques / use of alternative fuel alternatives (M4)). Among the various scenarios investigated in Thessaloniki, the highest health benefits are associated with the implementation of the policy promoting green vehicles towards the gradual replacement of all old municipal and private vehicles with new electric ones ("M2B" scenario). Among the other policies analysed improved energy efficiency in the cement industry through the use of refuse derived fuels assuming the adoption of state-of-the-art effluent gas cleaning technologies ("M4" scenario), as well as the promotion of public transport and use of metro by building an integrated urban mobility system ("M2C" scenario) show

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the higher health benefits. Lower health benefits are linked to promotion of building insulation and renovation, green infrastructure and bioclimatic design of public buildings (“M1” scenario) and eco-friendly waste management (“M3” scenario). These findings were of particular interest and provided the input for further discussions in the last session of the SLAM. Some concerns have been expressed by the financial feasibility of electrification (promotion of green vehicles), however, everybody agreed that this is the best option for improving better urban air quality, since traffic comprise one major source of air pollution in Thessaloniki.

#### ***Contribution of ICARUS in updating the Regional Plan for air pollution control***

Dr. Marianthi Kermenidou (AUTH) presented the interplay between the Air Pollution Operational Action Plan and the ICARUS recommendations. The Air Pollution Operational Action Plan aims to capture, record and assess the current level of air pollution levels over the last five years, to assess the magnitude of the problem and the overruns where they exist. At the same time, possible pollution phenomena that contribute to the occurrence of high pollution values will be investigated, with the use of appropriate computer tools, the operation of the city will be recorded and analyzed (traffic regulations, schedules, movement of goods, etc.), assessment of the participation of these activities in pollution, but also a complete picture of the effects that may be caused by the construction of large infrastructure projects, or large-scale actions that are in progress or will be carried out in the near future by Ministries and the Local Government. Also, the effectiveness of the measures implemented to date will be evaluated, proposals for the implementation of alternative solutions and proposals for the search for alternative ways of financing from regional and sectoral NSRF programs will be drafted. In the framework of the preparation of the Operational Action Plan for the fight against air pollution, a detailed plan for the treatment of air pollution episodes will be defined, as well as an information-cooperation campaign of the citizens. All of these aspects have been successfully dealt up in ICARUS and specific suggestion for its update has been provided, regarding the sampling of representative points, the chemical speciation analysis that has to be carried out for source apportionment, as well as the periods of the year that monitoring efforts have to be further intensified. In addition, the work done by ICARUS in terms of source apportionment (accounting for seasonality effects), resulted in specific recommendations for combating air pollution (i.e. reduction of biomass use for space heating during wintertime).


#### ***The ICARUS DSS and the ICARUS application***

Dr. Georgios Sarigiannis (UPCOM) has presented two of the major products of ICARUS, namely the ICARUS Decision Support System (DSS) and the ICARUS RQuality App. After the introductory slides presented, an online demonstration of the ICARUS DSS took place. The audience were really impressed by the capacities of the DSS tool, especially by the fact that no particular specialized expertise is necessary to executing the scenario analysis. Similarly, people were enthusiastic about the ICARUS mobile app, considering that it allows the assessment of personal exposure, accounting for all real time conditions, including the current air pollution levels at the specific location encountered by the user and the respective activity (which in turn is reflected as real-time intake rate levels). After the demonstrations, it was highlighted by all the participants that tools like these, are ideal for involving both stakeholder active participation, as well as citizen involvement.

#### ***Discussion and closure***

ICARUS work had major impacts on the implemented policies in the region. This was the result of the active interaction with main stakeholders, including the ones that are considered as key polluters. More in detail:

- The results from the ICARUS study in Thessaloniki about the use of Refuse-Derived Fuel (RDF) in the cement industry has been implemented into the national legislation. In fact, the

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Environmental Licensing Directorate of the Ministry of Environment and Energy approved the amendment of the Decision of Approval of Environmental Terms (AEPO) of the cement production unit of the company "AE CEMENT TITAN", which operates in Lagadas, Thessaloniki in the municipality of Pavlos Melas.

According to the ministry in a relevant announcement, with the modification of AEPO, the cement industry can use the alternative fuels RDF-SRF in order to achieve the following objectives:


- dependence on conventional (fossil) fuels,
- reduction of carbon dioxide emissions,
- limiting the volume of landfill waste,
- reduction of energy costs but also waste management
- protection of the atmosphere and fight against Climate Change.

The above national directive amendment, is one of the main impacts of ICARUS project, where the outcomes of the project have been used directly for policy. At the same time, terms for proper operation conditions have been provided, so as to minimize potential side-impacts, such as dioxin emissions, ensuring that the use of RDF from cement industry is a win-win solution, in accordance to the ICARUS aims.


- Another very important outcome of the ICARUS analysis of scenarios, is associated with the transport sector electrification. Introduction of electric cars has been identified as a measure able to provide a significant impact on Thessaloniki urban air quality. However, in order to minimize carbon footprint of the overall GHG emissions of the city, it is critical, that the means for generating electricity are equally sustainable. Given the above, ICARUS team in Thessaloniki had a strong interaction with one of the main electricity producers, namely ELPEDISON, to investigate the benefits and the drawbacks for creating a new natural gas electricity production station within the Thessaloniki suburbs. Such a solution, provides two major advantages:
  - Decarbonisation of electricity production, considering that the new unit will have a power of combined cycle equal to 826 MWe; should this amount of power wan not generated by the new station, this would be produced by the lignite units in the nearby area.
  - Minimising long range transport of PM and NOx from the nearby lignite units

In addition, after consultation with the ICARUS team, ELPEDISON was happy to provide electric buses to the municipalities close to the new unit, so as to counterbalance any potential increase in NOx emissions compared to the current situation. In order to estimate the countermeasures (in terms of electric buses to be provided in the nearby municipalities) for balancing the increased NOx emissions, the health effect benefits from removing the old conventional buses from the reduction from all diesel combustion traffic emissions have been accounted for; this has resulted in a fair understanding by all involved stakeholders (polluter and the community), based on the methodological tools developed in WP4 and applied in WP5 of ICARUS.

Finally, the ICARUS project results and the scenario analysis for Thessaloniki, have been accounted for in updating the Air Pollution Operational Action Plan for combating air pollution. This is of particular importance, since Thessaloniki has been notified by the EU about the poor air quality indices and the excess of the limits set by the EU air quality directive, especially regarding PM. The outcomes of ICARUS were able to provide the short- and long-term pathways towards improvement of air pollution, highlighting the importance of car electrification and limiting the use of biomass burning for space

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heating. This has resulted in financial incentives for new electric car (as well as motorcycles and bicycles) buyers, as well as incentives for replacing biomass space heating and heating oil appliances with natural gas ones.



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## Basel (Switzerland)

Swiss TPH organized the SLAM event in Basel on November 11<sup>th</sup> from 10:00 to 12:00 AM. Due to COVID-19 restrictions the meeting was held as a virtual meeting via Zoom. Local stakeholders from the Department of Environment and Energy Basel (Amt für Umwelt und Energie des Kantons Basel-Stadt) and from the Air Quality Office Canton Basel-City and Basel-Country (Lufthygieneamt beider Basel) were invited for the event. The meeting was mostly held in German, inputs from Danielle Vienneau were held in English.

The agenda of the meeting was the following:

- ICARUS Overview (Benjamin Flückiger)
- Measurement campaign WP4 (Benjamin Flückiger)
- Results of atmospheric mercury measurements (collaboration with University of Basel, Stefan Osterwalder)
- Health Impact Assessment of different scenarios in Basel (Danielle Vienneau)
- Discussion / Feedback

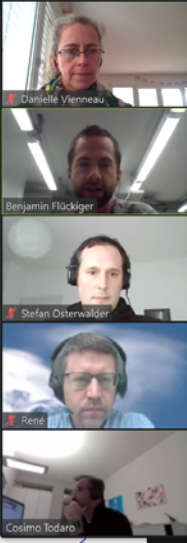



ICARUS Basel stakeholder meeting

H0028-SC5-2019 - GA 000000  
24/11/2019


### Ablauf:

- Projektübersicht (Benjamin Flückiger)
- Messkampagne zur individuellen Luftbelastung (Benjamin Flückiger)
- Resultate der Studie zur Konzentration von atmosphärischem Quecksilber in der Innen- und Aussenluft in Basel (Stefan Osterwalder)
- Gesundheitsfolgenabschätzung potentieller Massnahmen zur Luftreinhaltung/CO<sub>2</sub>-Reduktion (Danielle Vienneau)
- Feedback / Diskussion



The meeting started with a general introduction to the ICARUS project. Benjamin Flückiger explained the goals and ambitions of the project and showed the detailed steps in the different work packages. He presented the results from the project in form of published papers but also the software tools that were developed in the framework of ICARUS (Decision Support System and the RQuality App). As a next topic, Benjamin Flückiger presented the Basel measurement campaign (work package 4). This included a short overview of the study setup and a presentation of the different sensors. A special focus was put on preliminary results and the interaction with participants. At the end of the presentation, a discussion on lessons learned and especially on the use of low-cost sensors followed.


The measurement campaign in Basel also included additional atmospheric mercury measurements. This was a collaboration with the Department of Environmental Sciences from University of Basel.

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Stefan Osterwalder from the University of Basel presented the methodology and results of the atmospheric mercury measurements. The Air Quality Office Canton Basel-City and Basel-Country showed great interest in the methodology and is thinking of applying it for monitoring remediation sites.

You are viewing Stefan Osterwalder's screen. View Options


**Methods: Outdoor sampling (29 – 31 days; Nov 5 to Dec 7, 2018), 14**



The composite image displays a central map of Basel, Switzerland, with numerous colored dots (red, yellow, green, blue) indicating outdoor sampling locations. Surrounding the map are four photographs: top-left shows a street scene with a colorful mural; top-right shows a street view with buildings; bottom-left shows a foggy industrial area with a large building; bottom-right shows a mural on a building. A scale bar at the bottom of the map indicates 0, 1, 2, and 3 km. In the top right corner, there is a small video feed of Stefan Osterwalder.

Danielle Vienneau talked about the health impact assessment of different scenarios in Basel. First she explained how the integrated assessment in ICARUS worked, going from emission modelling, to pollution modelling, health impact assessment and finally to cost benefit analysis. Then Danielle Vienneau discussed the five scenarios for Basel. Two of the scenarios are already implemented, three scenarios were hypothetical. The results from the health impact assessment showed that replacing fossil heating technologies and small combustion of firewood has the biggest impact on health and is as well economically beneficial.

The last item on the agenda was a feedback and discussion round with the stakeholders. One of the main topics was the engagement of the city partners in the project. We discussed barriers and incentives for the city partners to engage in scientific projects like ICARUS. The city partners identified financial and resource restrictions as the main barriers to more engagement. In addition, the city partners have a long-term financial planning, they need to plan up to two years in advance. In general, the city partners are very interested in scientific projects and are always happy to share data and knowledge with academia.

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### 3 Key impacts

#### 3.1 Change in citizen behavior

The sensor campaigns represented an ideal opportunity to engage citizens and to raise their awareness about urban air quality and carbon footprint issues. Through the analysis of the questionnaires distributed to the recruited volunteers and the restitution report they expressed a high interest in ICARUS activities and outcomes and more in general on the environmental themes. This enhanced awareness had a significant impact on behavioral habits of many participants in the ICARUS campaign. From the analysis of the surveys, participants reported for example that they ventilate their homes more often especially during cooking, after shower and prior and after sleeping; use more sustainable forms of transport and avoid main transport corridors/busiest roads when cycling or walking. They reported they will also try to reduce their indoor exposure to air pollution e.g., by removing scented candles from home and using less aggressive cleaning products while committed to healthier lifestyles by increasing time spent outdoors. Some also reported to plan to stop smoking.


Furthermore, the science-to-citizen dissemination and communication activities resulted in future potential collaboration for a follow-up study. In particular, in Brno students from some high schools gave their availability and agreed to cooperate for future campaigns and new volunteers signed for the follow-up study.

#### 3.2 Enhanced collaboration with public authorities in the ICARUS cities

As a result of the interactions with city authorities in the ICARUS cities it appeared evident that a common immediate priority for the municipalities is to improve air quality and minimise health impacts due to air pollution. A longer-term priority is understanding the interlinks between air pollution and climate change and human health (win- win solution) so as to avoid taking measures which may generate a problem while trying to solve another one. A classic example could be the introduction of higher taxation on vehicles that produce GHGs to mitigate climate change that then causes people to purchase diesel vehicles that instead would reduce air quality.

Common critical issues raised by most of the city authorities in the ICARUS cities included better monitoring strategies (including wider use of sensors); the need for more investments for implementation of advanced technologies and tools; refined and more reliable methods to determine actual exposure to air pollutants at high spatial and temporal resolution and the need to assess environmental policies in an holistic way which considers the impacts on several sectors including the health, social and economic sectors. In this perspective an integrated assessment of urban policies is considered crucial to take into account the multiple and indirect effects on the environmental and in particular AQ: for instance, work policies related to the promotion of home working in 2020 due to the COVID-19 pandemic impacted on AQ more than other direct mobility plans and incentives devoted to air pollutants reductions.

Stakeholders in addition raised the importance of a clear, effective and simple communication between policy-makers and the scientific community. Our efforts to communicate in such a way, for example reporting in heat maps colored with an intuitive scale ranging from green to red the extent of the benefits of the policies assessed in each sector, were considered appropriate in all the stakeholders meetings carried out. Local authorities showed great interest in the ICARUS DSS and

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recognized that it may be a useful tool in decision-making in order to improve public health and the citizen's well-being, providing at the same time additional air quality data that in many cases are not available in Municipalities.

City authorities asked to the scientific community to act as facilitators between the policy level and the citizens. In this perspective it was generally felt that policies and measures would not be very effective if they are decided and imposed from decision-makers (top-down). To bring more effective results these policies need to be discussed and understood by the citizens. To this end the scientific community may play a fundamental role contributing to better inform and educate citizen towards more environment friendly behaviors. In this context the development of the RQuality App has been considered a useful tool which added value to the project.

Dissemination activities in addition allowed us to establish diverse interdisciplinary network with both Research Organizations and Public Bodies responsible for managing air pollution, climate change, population health and urban planning across Europe. An international legacy that will continue to investigate health and the environment into the future.

In some cities (e.g., Milan and Madrid) this activity led to the signature of formal cooperation agreement between ICARUS partners and the city authorities which will allow us to further exploit ICARUS outcomes also beyond the project life.

In Brno collaboration of RECETOX with the Municipality led to a formal cooperation with the City on several other air quality related projects. In this light RECETOX started in September 2020 a project to monitor air quality in several kindergartens of the Brno municipality.


In Basel collaboration of SWISSTPH with the University of Basel allowed to include atmospheric mercury measurements in the ICARUS campaign. The results were published (Wohlgemuth L. et al., *Environmental Science & Technology Letters*, 2020).

The work on the integrated assessment of policies in the ICARUS cities had multiple concrete impacts contributing to enhance significantly the scientific basis for the elaboration of the urban resilience strategy and the assessment of the urban air quality strategies. Results of ICARUS were presented and discussed with local stakeholders in several SLAMs events.

In some cases, these interactions contributed significantly to the actual implementation of environmental policies/measures at city level providing the scientific background and evidence-based quantitative information of the their environmental, health and economic benefits, thus contributing their actual implementation.

By way of example in Thessaloniki ICARUS results on the use of Refuse-Derived Fuel (RDF) in the cement industry has been implemented into the national legislation. The Environmental Licensing Directorate of the Ministry of Environment and Energy approved the amendment of the Decision of Approval of Environmental Terms (AEPO) of the cement production unit of the company "AE CEMENT TITAN", which operates in Lagadas, Thessaloniki in the municipality of Pavlos Melas. The amendment of the national directive which states that cement industry can use the alternative fuels RDF-SRF represents a key impact of ICARUS, where the outcomes of the project have been used directly for policy.

A further example is represented by the "Madrid Health" (MH) which expressed true interest in the results obtained in the integrated impact assessment (Izquierdo R. et al., *Environmental Research*, 2020) carried out after the implementation of the "Plan A" for Air Quality and they expressed their

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interest to repeat the study to assess the implementation of the new “Madrid 360” Strategy. The same happened for Milan especially in relation to the implementation of transport policies such as the banning of old diesel vehicles from the whole municipality area as well as the replacement of all the buses fleet with electric vehicles.

As a further concrete impact, after consultation with the ICARUS team, ELPEDISON (main electricity producers in Thessaloniki) agreed to provide electric buses to the municipalities close to the new production unit, so as to counterbalance any potential increase in NOx emissions by the unit compared to the current situation.

In Athens and Thessaloniki, ICARUS results contributed to the coining of the Urban Resilience Strategies in the two cities. In particular, the Resilience Strategy for Athens 2030 was created in collaboration with ADDMA while AUTH actively contributed to the “Strategy for 2030” for the city of Thessaloniki.


The ICARUS project results and the scenario analysis for Thessaloniki, have been accounted for in updating the Air Pollution Operational Action Plan for combating air pollution. The outcomes of ICARUS were able to provide the short- and long-term pathways towards improvement of air pollution, highlighting the importance of car electrification and limiting the use of biomass burning for space heating. This has resulted in financial incentives for new electric car (as well as motorcycles and bicycles) buyers, as well as incentives for replacing biomass space heating and heating oil appliances with natural gas ones

Moreover, at the request of the Hellenic Ministry of the Environment, Energy and Climate Change ICARUS has supported the region of Western Greece and the region of Central Macedonia towards the development and evaluation of the regional climate change adaptation policy bundle. Using the modeling tools developed in the frame of the project and the prototypical ICARUS methodology we have made an assessment of the effects of climate change in the region, the respective societal, environmental and economic system vulnerability and we have helped identify potential adaptation strategies.

Based on the constant and fruitful collaboration with several municipalities ICARUS partners future collaboration opportunities have been established. In this context ICARUS partners together with several city authorities submitted two new research projects in the field of air quality in urban settings totaling over 15 million Euros.

At the time of writing this report we have been informed by the European Commission that one of these proposals has been evaluated successfully for funding within the call SC1-BHC-29-2020 on innovative actions for improving urban health and wellbeing in the perspective of equitable and sustainable urban transitions. The new project will build on the ICARUS outcomes and will further develop the collaborations with several municipalities which will be formal partners of the project (e.g., Milan and Athens). For other municipalities we received formal letter of support or the implementation of the project activities (i.e., Stuttgart, Madrid, Ljubljana, Paris and Aberdeen).

One further important impact of the project actions is related to participation of the Project Coordinator (Prof. D. Sarigiannis, AUTH) to several meetings of the Programme Committee for the specific programme implementing HORIZON 2020 – Societal Challenge 5 ‘Climate action, environment, resource efficiency and raw materials’. The main objective of these meetings was to inform the

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program committee on the developments of the project with regard to combatting air pollution and climate change in cities and, consequently, support the shaping of the future programme calls.

During these meetings the ICARUS Coordinator provided input to the multi-annual work programme based on the experience derived from ICARUS. One key outcome of these meetings was the introduction at European level of the health component in the environment agenda. The addition of human health dimension as a major criterion for evaluating the efficacy and the benefit (in the cost-benefit analysis) of policies and measures for combatting climate change and air pollution represents a major achievement of ICARUS which indeed contributed to raise the importance of human health inclusion at the policy-science interface.

Overall, it is important to underline that throughout the ICARUS project stakeholder engagement has been seen as key aspect for a successful implementation of the project and for the exploitation of the project outcomes and impacts. This was true for several reason as ICARUS project aimed to be of practical value, and stakeholders brought ‘practitioners’ knowledge’ to the project. Such knowledge helped us to value the possible economic, social and environmental costs and benefits of air pollution and climate change mitigation options within a urban context. Second, stakeholder engagement was important for the implementation of prioritized mitigation options within an urban or country context. One of ICARUS aims was to explore how contextual factors (economic, social, technical, political) shaping successful deployment and diffusion of mitigation options. Without stakeholder inputs, it would not possible to obtain a good understanding of possible contextual factors and identification of possible measures to address these factors.

### 3.3 Academic impacts

The work carried out in ICARUS was the main subject of two PhD theses. The first one was the Thesis of D. Chapizanis (AUTH) on emerging methodologies for environmental exposure measurements and the other of M. Persico (EUC) in collaboration with the University School for Advanced Study (IUSS) of Pavia on the results of integrated assessment of air pollution and climate change policies in Milan. In addition, the validation of low-cost sensors was the subject of the MSc thesis of R. Novak (JSI).

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## 4 Main barriers and concerns

As result of the regular meetings held with local stakeholders in the ICARUS cities the main barriers to policies/measures implementation as well as the main concerns were identified and below summarized.

There is a misalignment between the local decision and policy makers and the researchers. Different priorities and points of view indeed emerged during the meetings: while the formers are looking to apply the science through concrete, realistic, and economically achievable actions, the latter are sometime looking to improve and push the science as such. In general policy makers perceived researchers too far from concrete policy implementation problems. In this regard researchers need to better understand how to present scientific evidence to policy maker in a way that convinces them. Researchers need to find effective ways of communicating the outcomes such that citizens and policy makers understand them and their implications. In this regard too technical communication may represent a barrier and should be avoided.


Local decision and policy makers need to be ensured about the reliability of models results and the appropriate scale of analysis. At the same time project results should fit with municipality plans, strategies and policies.

The difficulty, experienced by scientists, to make decision makers aware about the fact that there might be no optimal solution in absolute terms, but that

- a) One alternative can be better than others considering some aspects but worse than others considering other aspects (as what usually happens with the results of comparative life cycle assessment studies). It implies that decision making cannot be based only on objective data but must necessarily involve a value judgment (e. g., the choice of the most preferable alternative is made also upon weighting of the aspects which are given priority by the decision maker).
- b) Results of the evaluation of the optimal alternative can deeply depend from site-specific conditions, such as higher vulnerability of an area compared to others (e.g., Po Valley is one of the most polluted areas in Europe especially on particulate matter (PM) concentration); hence, actions that imply significant PM emission can be excluded a priori, even if they could be preferable according to other criteria.

The communication between science and decision makers is not a structured activity but usually takes place only when public opinion raises some concerns about an argument or when there is a risk or an emergency to be managed. The main reasons for this are the following:

- a) Scientists and decision makers speak different languages and have different background knowledge, points of view, and priorities; these conditions hamper the possibility of an easy understanding of research results by decision makers.
- b) The organization of the scientific community is based on scientific publication as the main way to evaluate the research work; therefore, time spent in communication is perceived by scientists as time wasted and not useful for their career.
- c) Sometimes, politicians as decision makers are not always willing to refer to scientific knowledge in their decision process.


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- d) Sometimes, both scientists and politicians define research activities based on economic interests.

At the most basic level, environmental policy implementation at the local level is also constrained by the political, technical, and financial capacities of implementing authorities. Political capacity constraints can result from coordination difficulties due to a fragmented environmental bureaucracy, conflicting priorities within implementing agencies, and low bureaucratic status and authority granted to environmental bureaucracies. The main pertinent technical constraints include the lack of advanced technical equipment and insufficiently trained local staff.

Time is often seen as a key barrier. This includes time needed for the relevant decision makers and policy makers to meet and reach consensus, time taken to collect necessary data for policy analysis, time for municipality approvals to be obtained, time taken for public consultation.

Suggestions identified for municipalities on how to overcome these barriers include enhanced inter-departmental collaboration within municipalities, perform public awareness campaigns to engage and inform the public on policies/measures plans (e.g., co-creation and co-monitoring) and work more closely with scientific researchers in future partnership (e.g. in research projects).

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## 5 Take home messages

The main take-home messages from the interaction with key stakeholders in the ICARUS cities include:

- Work in close and regular contact with city authorities from the beginning of the project
- Identify municipality priorities and ensure the project addresses municipality priorities
- Identify which are the future plans of municipalities addressing air quality, climate change and population health
- Identify municipality capabilities and constraints
- Ensure that the project methodology has been validated, explained and accepted by the municipality
- Ensure the model results are reliable and based on validated data
- Be transparent with the accuracy and error margins of the results
- Provide support and guidance to lay people for interpreting the simulation results
- Provide effective communications (simple, transparent and clear) to policy makers
- Keep going to look for and maintain other appropriate contacts within the municipality
- Involving a wide range of municipality contacts. Multiple differing perspectives allows for a more holistic picture of the process to be developed
- The commitment with the local authorities and the definition of responsibilities cannot be underestimated. Look carefully at the local characteristics of your community; analyse and understand. Match long term goals of the project together with those of the community
- The municipalities need to increase transparency and provide more feedback to citizens in order to help them acquire more knowledge about what is being done with regard to urban environment improvement
- Explore future funding opportunities. Cities could build on their strategies and action plans to explore the best possible combination of monetary policy instruments and receive private funding to achieve the short, medium and long-term visions and goals that they have set
- The inclusion of citizens in policy co-creation, co-monitoring and co-management processes is beneficial for all stakeholders, as it promotes scientific education, improves relationships and increases confidence in public authorities
- The social dimension is crucial: establishing an environmental policy requires a “design” phase that takes into account the listening of people habits and social practices, needs and perceptions, taking into account multiple aspects, values and priorities in decision-making around daily routines. Social inclusion should be taken into account in policy design not only with the idea of simply educating people and aiming at generating behavioural change, but on designing services that meet people behaviours, values and needs
- Many of the “chronic” conditions of urban public health are related to transport. These include exposure to ambient air pollution, exposure to unsafe road systems and lack of physical activity.
- Population level (city wide) measures each working at a small scale but across a whole population can have a bigger effect overall impact than can complex interventions.