

COOCK | OPEN STAD



VALUABLE ENVIRONMENTAL INSIGHTS  
THROUGH AN OPEN CITY APPROACH

**Healthy indoor quality of living**

20/4/21

## OVERVIEW

## ■ 10.00 – 10.05

Intro *Linus De Roo (UAntwerpen)*

## ■ 10.05 – 10.50

Sources of indoor air pollution and how to measure it *Marianne Stranger (VITO)*

## ■ 10.50 – 11.15

CO<sub>2</sub> sensing and analytics in smart buildings *Valerio Panzica La Manna (IMEC-NL)*

## ■ 11.15 – 11.40

Air purification technologies *Linus De Roo (UAntwerpen)*

## ■ 11.40 – 12.00

Questions

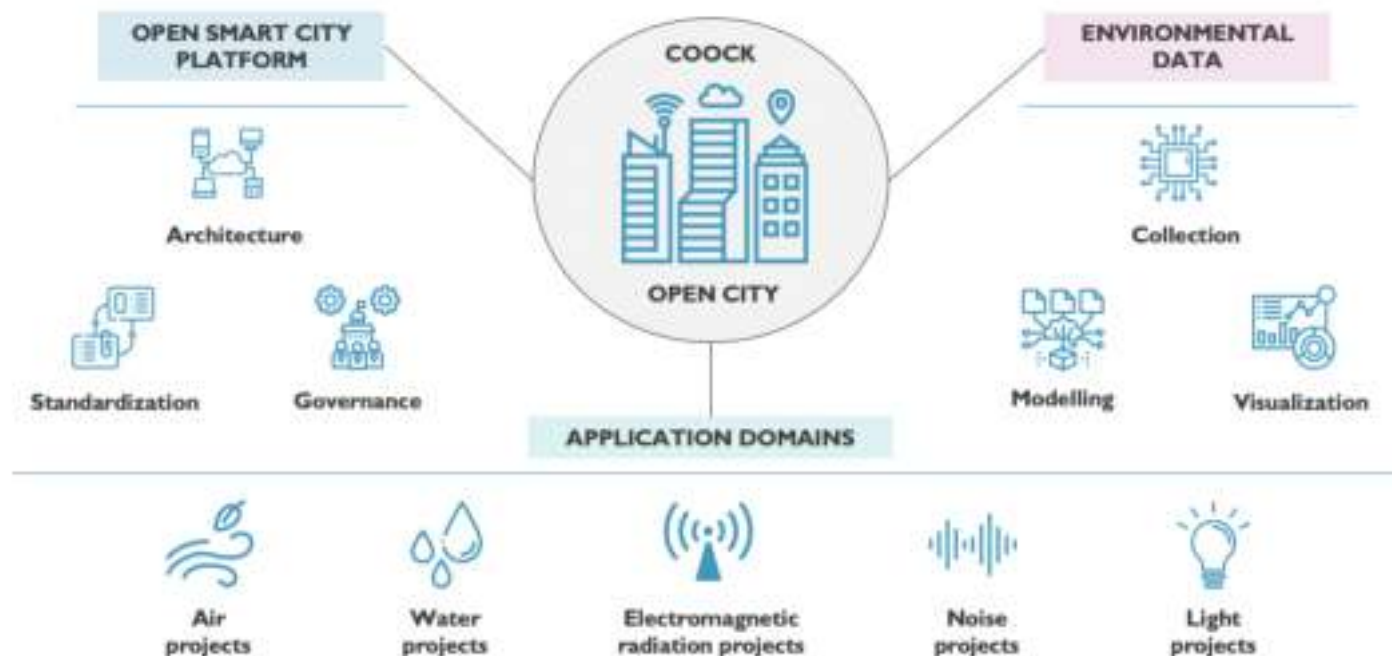
## In 't kort

AGENTSCHAP  
INNOVEREN & ONDERNEMEN

Projecten 'Collectief Onderzoek & Ontwikkeling en Collectieve kennisverspreiding/-transfer (COOCK)' richten zich op groepen van ondernemingen, met als doel het valoriseren van basisonderzoekresultaten door het versnellen van de introductie van technologie en/of kennis.



- The COOCK project **Open City** sets out to **document** the **knowledge** on data management, data disclosure and data standardization present in knowledge institutions, **translate** this knowledge into best practices for an open, data-driven society and **apply** it to concrete business cases.
- The project focuses on **environmental factors** as a basis for new business cases with **innovative value propositions and revenue models**.
- More concretely, the project's aim is to raise awareness about the importance of **standardization and (open) data sharing** in a **smart city context**.





KNOWLEDGE  
INSTITUTIONS



## WHAT DO WE OFFER?



State-of-the-art insights  
Seminars & workshops  
Articles & white papers  
Dedicated consultancy  
Publicly funded projects

- We offer **state-of-the-art insights and best practices** through online seminars and workshops, supported by articles and white papers to any company interested in participating in COOCK.
- We disseminate **insights** into the state-of-the-art and **best practices** from research and applied projects. This information will also be disseminated in the **VLOCA** knowledge hub.
- Our offering is structured into different tracks which relate to (a) the general expertise regarding **a smart open city platform**, and/or (b) general best practices and insights for data collection, modelling, and interpretation of **environmental parameters**, and/or (c) the specialized expertise gathered in the projects in the application domains of **air, water, electromagnetic radiation, noise and light**.

## WHAT DO WE ASK FROM YOU?

Concrete use cases  
Requirements  
Active involvement  
Access to data / insights  
Partnerships in projects



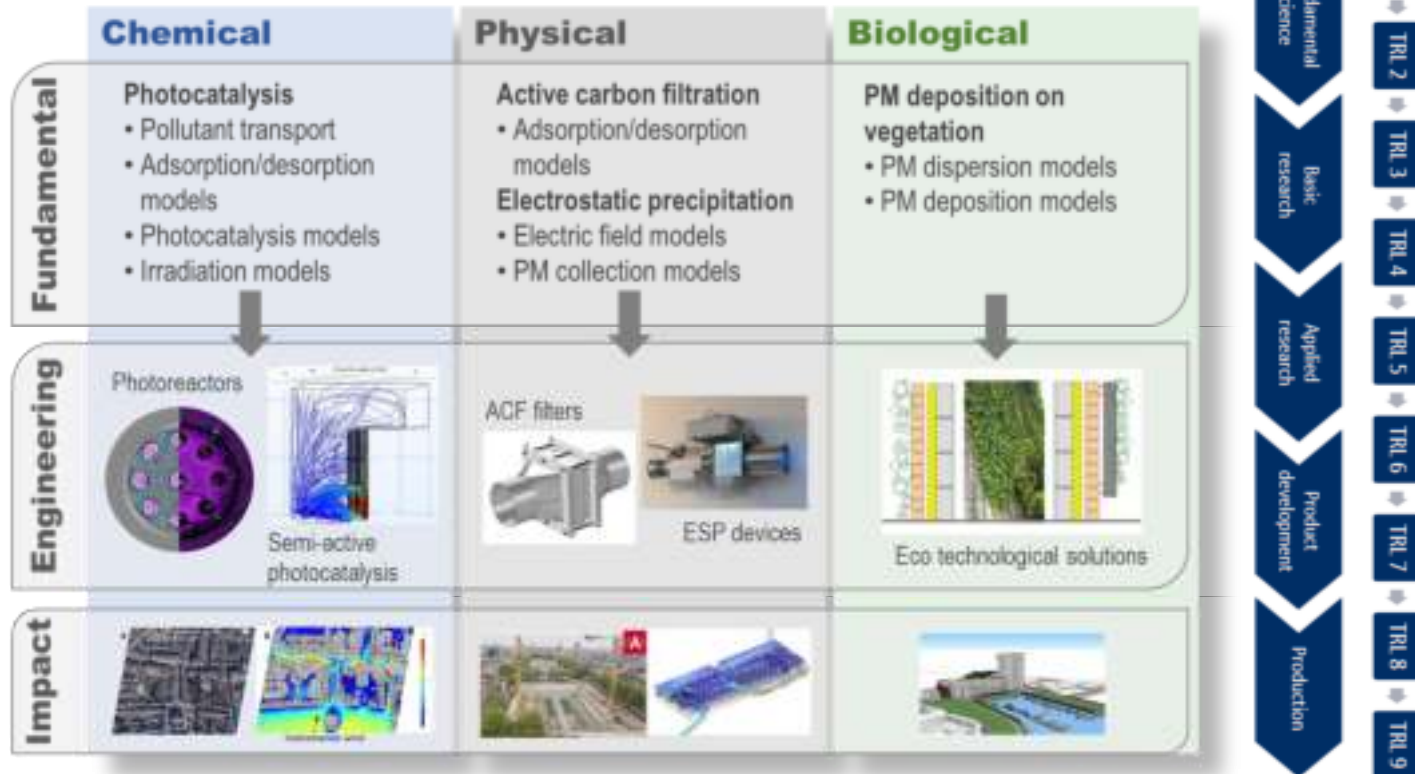
- We call for companies' active involvement to **give shape to new business cases with innovative value propositions and revenue models**. The objective is to match the **concrete challenges** provided by companies with the knowledge of academic institutions involved. We liaise with ongoing initiatives in cities to provide a **factual context**.
- To develop ideas into actionable projects, we ask you to provide us with concrete **challenges, use cases and business requirements**. As a next step, we organize workshops to explore collaboration projects, complementary partners and funding mechanisms.
- We invite you to **take ownership** of a project or partner in projects based on your business needs, ambitions and available (data) assets. We provide you 'ecosystem services' to jointly work towards an 'open city' during your projects.

## COLLECTIVE KNOWLEDGE TRACK

Date	Topic
12/01/2021	Smart Towards a high quality living environment - a pioneering role for flanders
26/01/2021	Connecting and storing sensor data
09/02/2021	Open City and its Citizens
23/02/2021	Publishing and using sensor data as linked open data
09/03/2021	IOT and Air Quality in cities part 1 - Air Quality Sensing
23/03/2021	IOT and Air Quality in cities part 2 - Air Quality Mapping
<b>20/04/2021</b>	<b>Healthy indoor quality of living</b>
27/04/2021	Learnings from international and local smart city initiatives
04/05/2021	Mobile environmental sensing
18/05/2021	Value models in an open city context

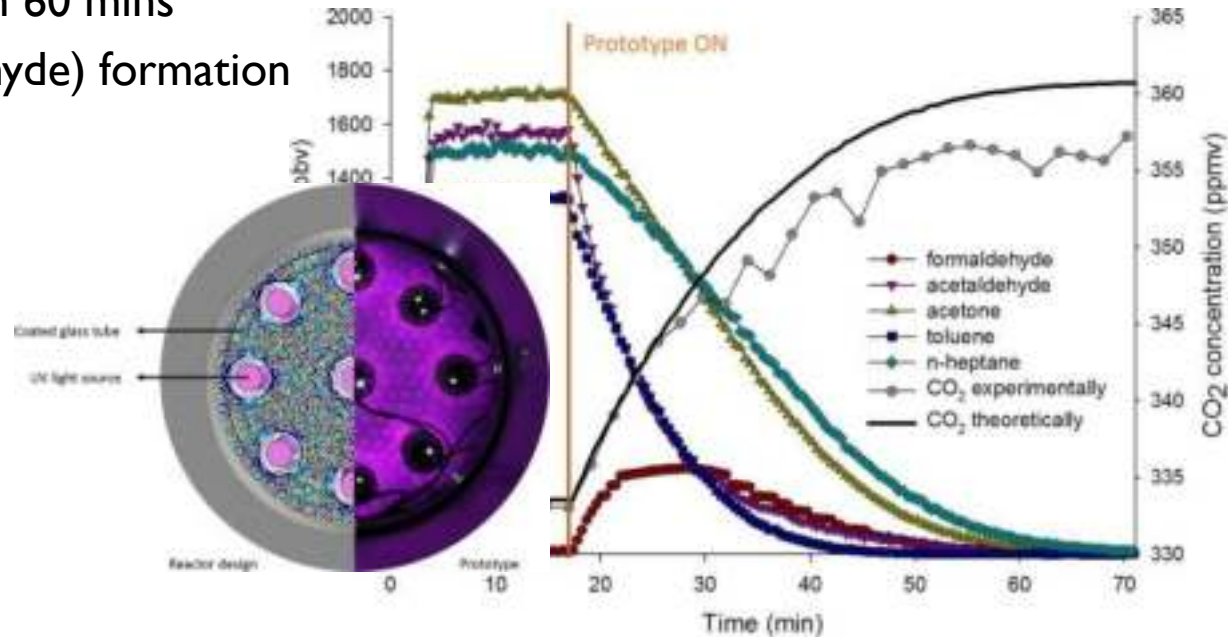
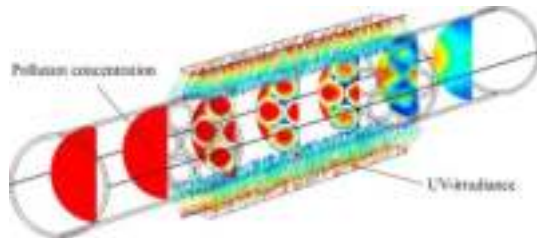


## SUSTAINABLE AIR PURIFICATION STRATEGIES AND TECHNOLOGIES



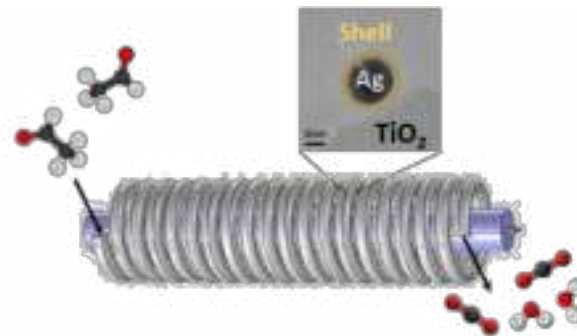
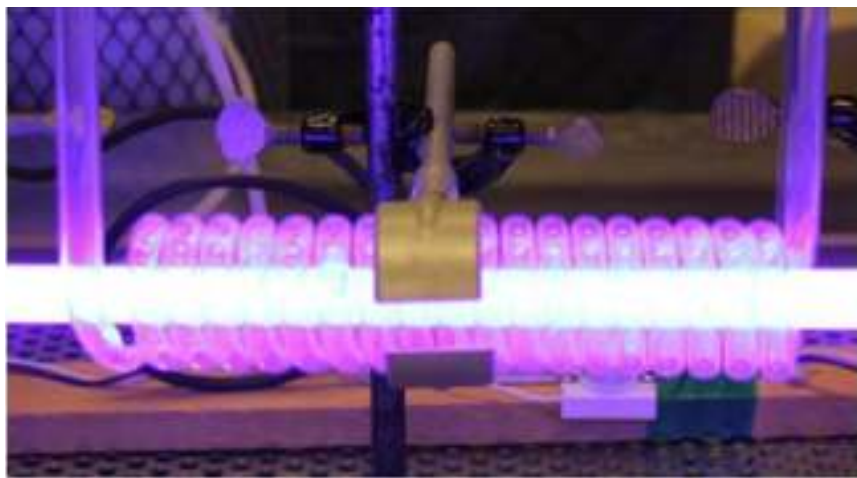
## MULTITUBE REACTOR (TRL 4)

- Photocatalytic reactor design for HVAC implementation
- Efficient VOC removal within 60 mins
- Initial by-product (formaldehyde) formation



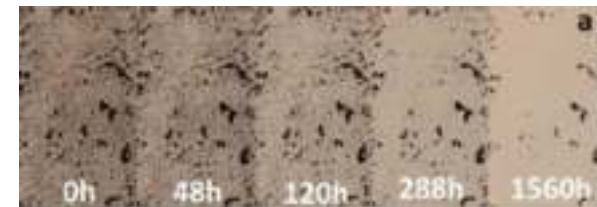
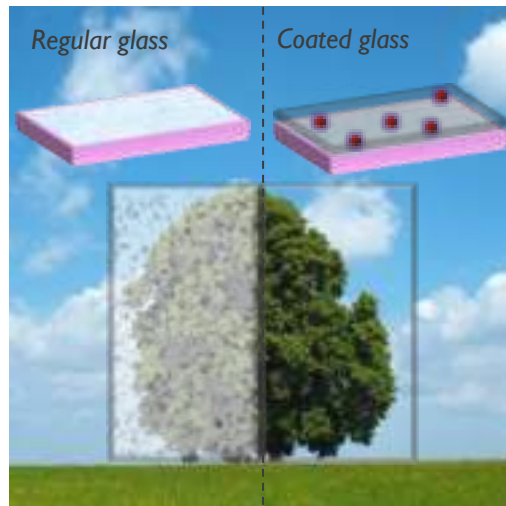
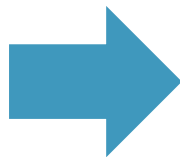
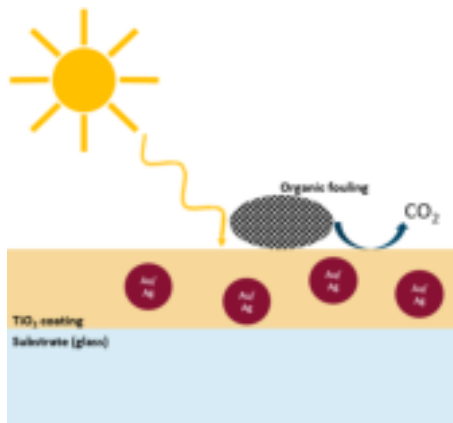
## GAS PHASE PHOTOCATALYTIC SPIRAL REACTOR (TRL 4)

- **Air purification reactor prototype** based on a photocatalyst coating with ultra-stable (plasmonic) silver nanostructures (patent PCT/EP2017/077132)
- VOC degradation efficiency of 100 % with reactor residence time < 60 sec



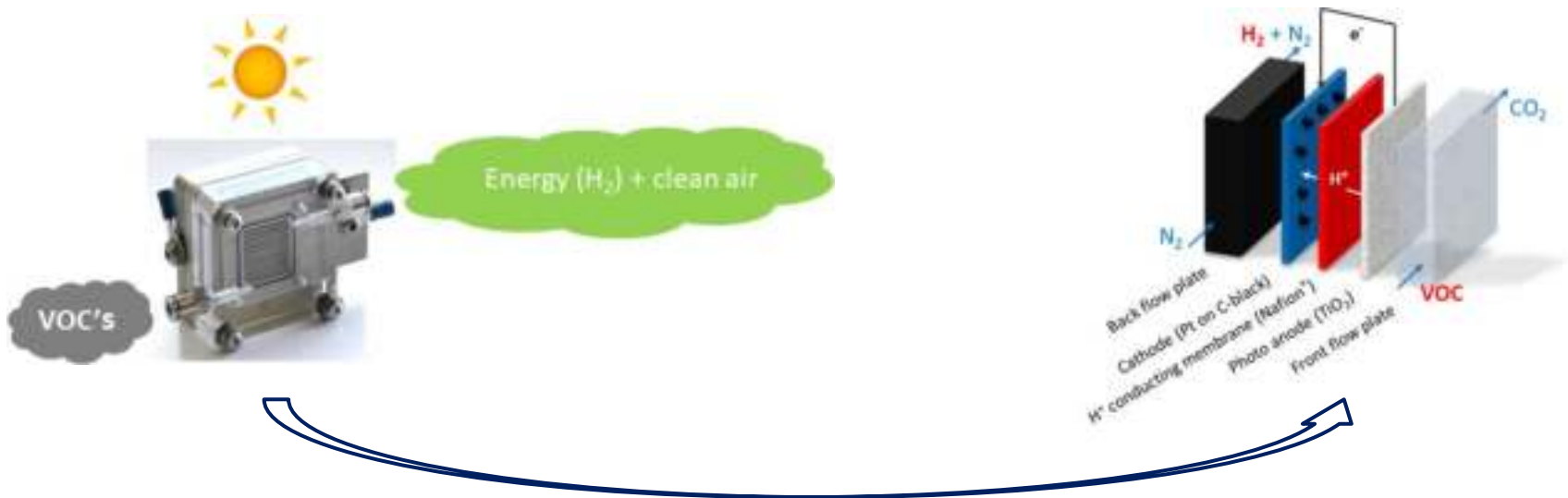
## PLASMON-ENHANCED PHOTOCATALYTIC SELF-CLEANING SURFACES (TRL 4-5)

- Coatings with **self-cleaning** and **anti-bacterial** activity
- Use of plasmonic particles enables activity under sunlight (patent PCT/EP2018/079983)

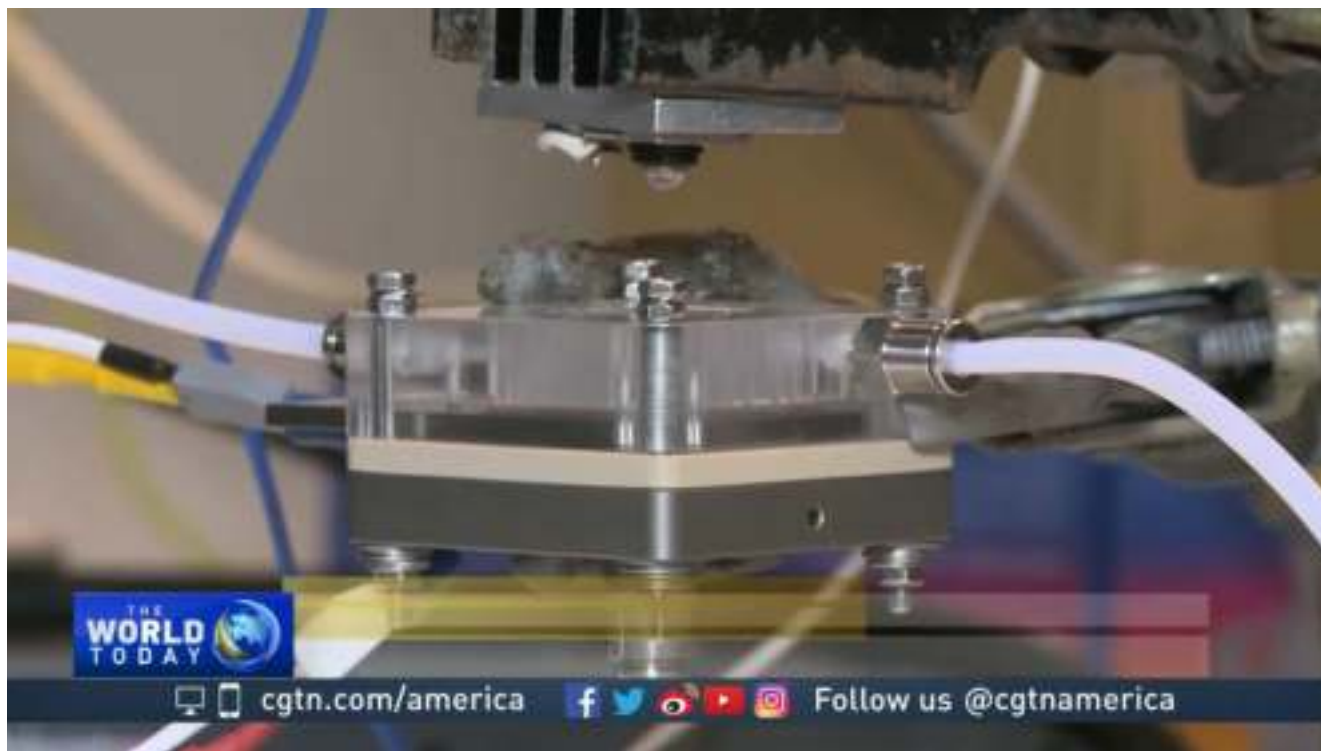


## PHOTOELECTROCHEMICAL CELL (TRL 3)

- Proof-of-concept on a photoelectrochemical device that enables simultaneous remediation of polluted air, while recovering energy as hydrogen gas



## PHOTOELECTROCHEMICAL CELL

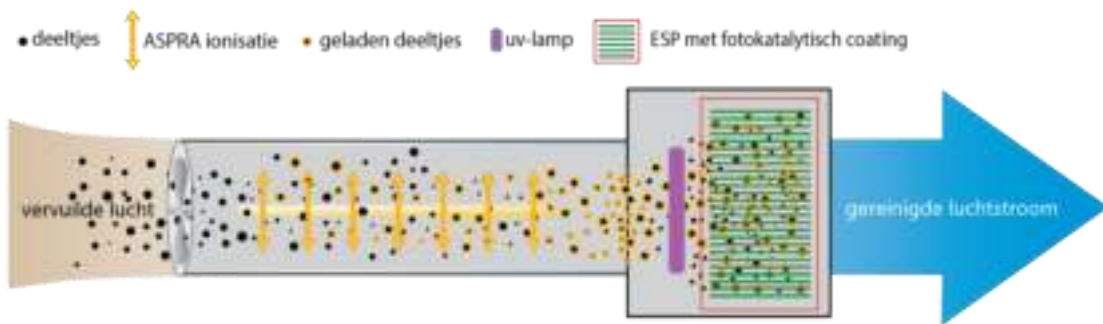




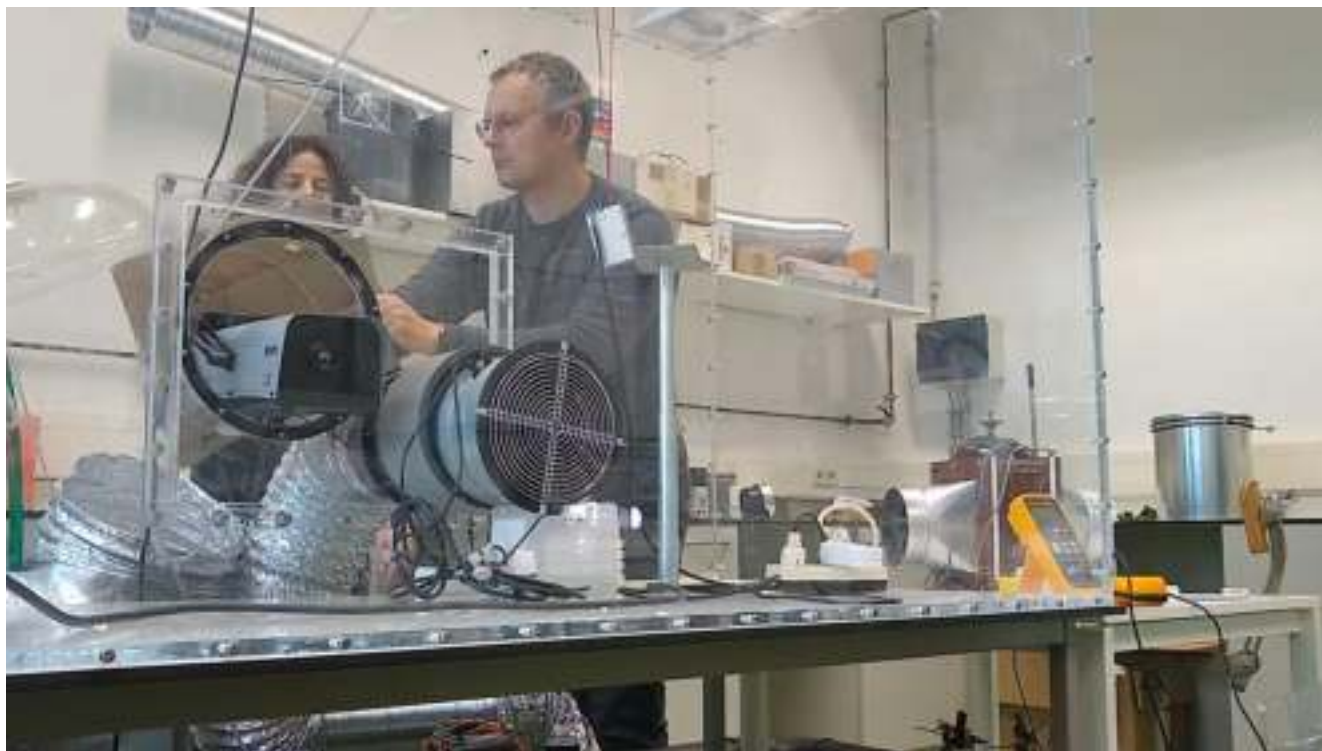
## ELECTROSTATIC PRECIPITATION + PHOTOCATALYSIS (TRL 4)

- Project ZULU: child day-care experiment
- Removal of particles by ESP
- Cleaning of ESP plates with PCO

Interreg  
Vlaanderen - Nederland  
PROJECT ZUIVERE LUCHT  
European Regional Development Fund



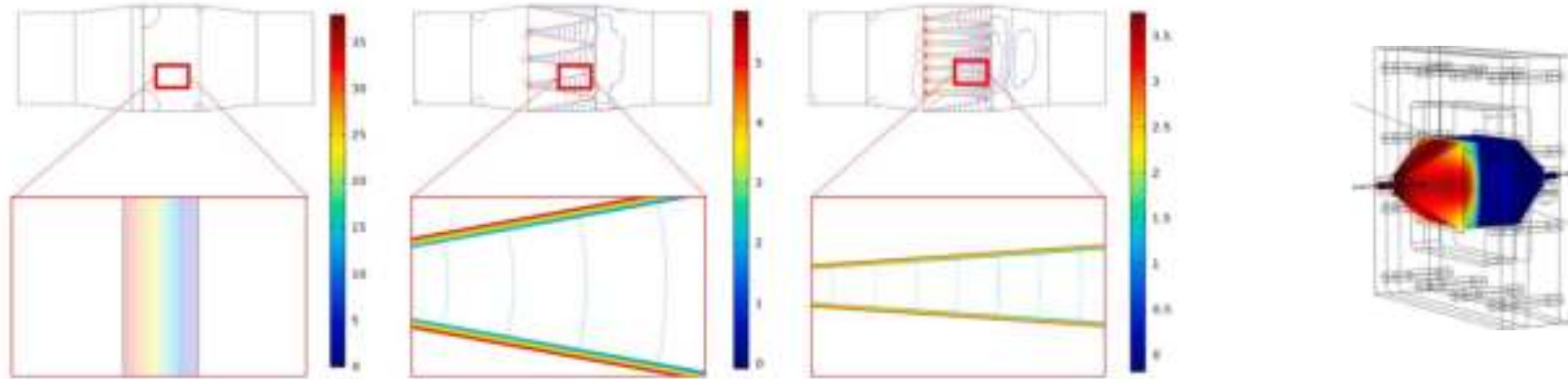
## ELECTROSTATIC PRECIPITATION + PHOTOCATALYSIS





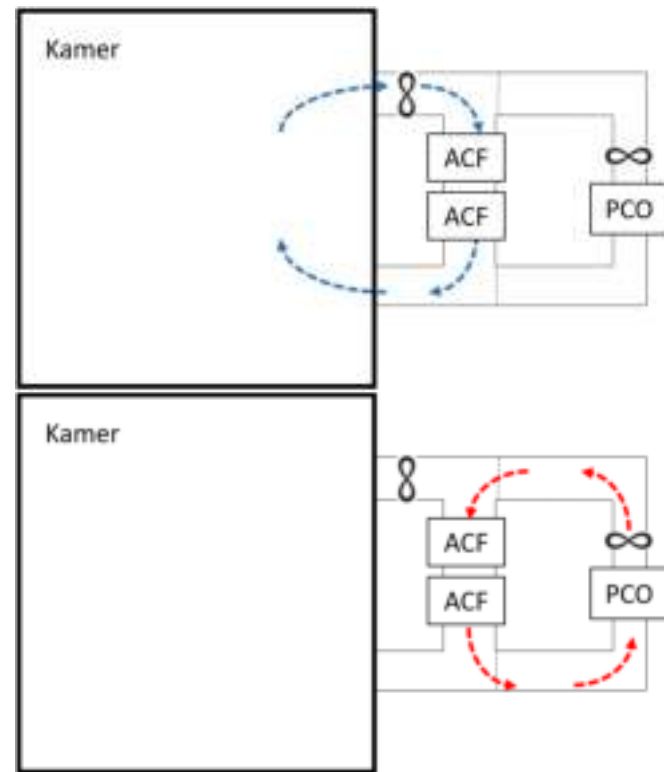
## ACTIVATED CARBON FILTRATION (TRL 4)

- High adsorption capacity for VOCs
- Newly developed pleated design:
  - Decreased pressure drop
  - Thermo-electrical regeneration



## MULTITUBE REACTOR + AC FILTRATION (TRL 3)

- ACF purifies room air, PCO purifies regeneration air
  - Energy-efficient: PCO reactor only active in regeneration mode
  - Higher purification efficiency: multiple passages + higher VOC concentration
  - Intermediate pollutants remain in recirculation



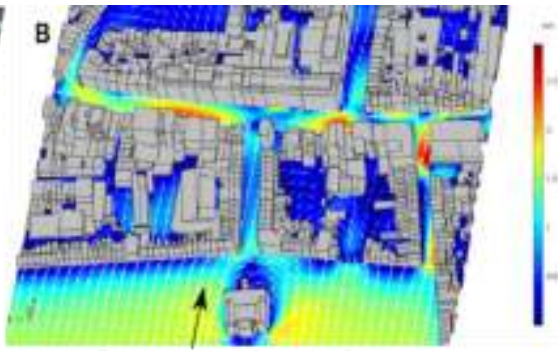
## CLEAN INCOMING OUTDOOR AIR: GREEN WALLS (TRL 3-4)

- Modelling and experimental validation of particulate matter deposition on vegetation
- Experimental wind tunnel for ultrafine ( $< 0.1 \mu\text{m}$ ), fine ( $< 1 \mu\text{m}$ ) and coarse ( $< 10 \mu\text{m}$ ) PM



## CLEAN INCOMING OUTDOOR AIR: SEMI-ACTIVE PHOTOCATALYSIS (TRL 3)

- Photocatalytic coating on window shields
- Increased efficiency by creating passive convection along the surface
- Use of air pollution dispersion models to select interesting location (e.g. in street canyon)

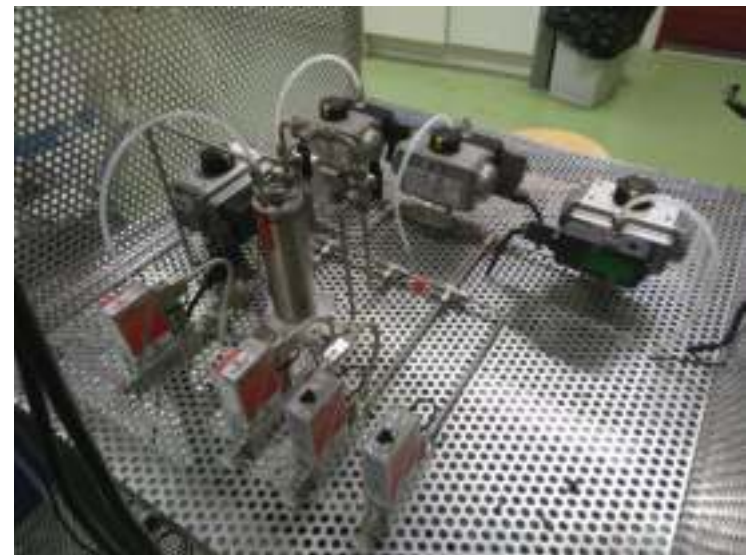


Instromende wind



## SCIENTIFIC KNOWLEDGE PARTNER (TRL 1-?)

- Dedicated test environment: climate chamber, wind tunnel, gas setup
- Modelling (CFD/Multiphysics): upscale verified lab experiments, optimize reactor design
- ISO testing of photocatalytic surfaces:
  - ISO 27447:2019 Antibacterial activity
  - ISO 27448:2009 Self-cleaning activity
  - ISO 22197-1:2019 Air purification activity NO<sub>x</sub>
  - ISO 22197-2:2019 Air purification activity Acetaldehyde





## WHAT WE NEED FROM YOU

- Let research climb on the TRL ladder: Impact
  - Real-life test environments
  - Industry standards required for purification technologies (flowrate, energy consumption,...)
  - ...
- What are your struggles?
  - Experimental validation
  - Technological design
  - Fundamental principles
  - Purifying efficiency
  - ...



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## QUESTIONS?

Do not hesitate to contact us!

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Next webinars

- **Tuesday 27/04** Learnings from international and local smart city initiatives
- **Tuesday 4/05** Mobile environmental sensing
- **Tuesday 18/05** Value models in an open city context