



## Challenge statement

The Ministry of Environment and Food of Denmark wants to test the LCS (LowCostSensor) market and investigate whether there are air sensors capable of measuring the most relevant substances and particles of a quality that makes LCS applicable in the national air measurement program. At the same time, the Ministry wants to challenge the market and explore the possibilities of creating new and better services for citizens, businesses and authorities using data from LCS.

## Context

In Denmark, the Danish Environmental Protection Agency is responsible for monitoring air pollution. In practice, the task of monitoring is outsourced to the University of Aarhus, which, through the DCE - National Center for Environment and Energy, handles the national task of monitoring air pollution in Denmark.

Today, the University of Aarhus measures air quality at representative locations in major cities and in rural areas under the national surveillance program NOVANA. The University uses the measurements in mathematical air pollution models that can describe how air pollution is transported, converted and disposed of. The models go in detail from the local pollution in a street, across the nationwide to the global air pollution (see the models [here](#)). The university handles emissions calculations in relation to international conventions - the Climate Convention and the Geneva Convention on Long-range Air Pollution - as well as the EU.

## Technique

Map 1.0 (see following page) shows the existing measurement stations in the national air quality monitoring in Denmark in 2019. The measurement stations measure the air content of particles (PM 10, PM 2.5 and ultrafine particles), nitrogen dioxide (NO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), sulfur dioxide (SO<sub>2</sub>), lead, benzene, carbon monoxide (CO) and ozone (O<sub>3</sub>) as well as certain heavy metals.

Using the air pollution models, DCE continuously makes 3-day forecasts showing the development of the pollution locally around Denmark.

## Business case / development opportunity

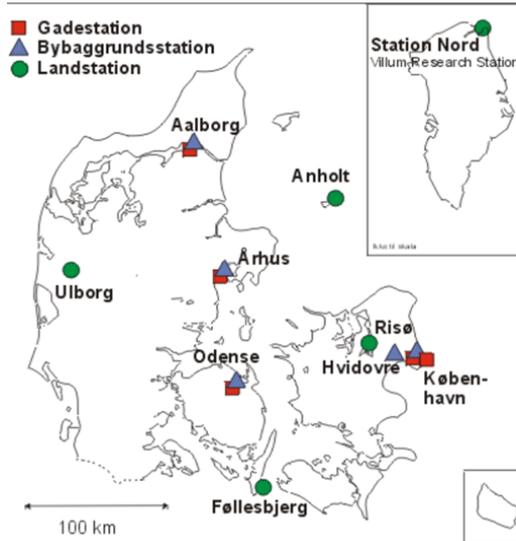
The Ministry of Environment and Food in Denmark wants to challenge the existing setup and explore the possibility of supplementing the existing infrastructure with low cost sensors. Can low cost sensors be used to evaluate current model calculations? Can we further develop the models with data from low cost sensors or can we create completely new models? What other uses have low cost sensors. Can you create new services for citizens, businesses or authorities?

If it turns out that the market can provide low cost sensors that can measure in sufficiently good quality over time, there will be a basis for creating a national network of air sensors with a large number of sensors. The potential for low cost, high-quality sensors is huge. Worldwide, air pollution is growing rapidly and the need to measure the pollution is central to the management of the pollution. The potential applies both to nations and cities (smart cities) and to individuals. The sensors will be used in cars, mobile phones, sportswear and wearables in a broad sense.

The Environment and Food Ministry wants to test where the market for low cost sensors stands in the year 2020.



**Map 1.0**



	Station ID	Neighborhood	Type	NO <sub>x</sub>	O <sub>3</sub>	SO <sub>2</sub>	SO <sub>4</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	Gasstationer	Busstop	Rail	Hotels	DO	Neighborhood	
Midlingstid (timer)				12	12	12	24	24	24	24	24	24	24	12	12	
Anholt	6001		Kyst	x			x			x						x
Frederiksborg	2002	x	Skov													
Hvidovre	2650		bybaggr. /forstad	x					x			x				
Føllesbjerg (Keldsnor)	9055/ 9005		langtr.	x	x		x	x		x				x		x
København	1103		gade	x	x	x		x	x	x	x	x			x	
København	1257		gade	x				x	x	x	x					
København	1259		bybaggr.	x	x			x	x	x					x	
Lindet	4002		landbrug				x			x				x		x
Odense	9155		gade	x				x							x	
Odense	9159		bybaggr.	x	x											
Odense-Albanisgade	9155	x														
Odense-Hunderupgade	9154	x														
Federsker	3021/ 3022		kyst													x
Rissø	2090		land	x	x			x	x	x					x	
Sæstrup	6064		land													x
Tange	6003		land				x			x						x
Ulborg	7005		skov	x	x		x							x		x
Aalborg	8151		gade	x		x			x	x					x	
Aalborg	8158		bybaggr.	x	x											
Århus	6153		gade						x	x	x					x
Århus	6160 (6159)		bybaggr.	x	x					x						