

Seventh Framework Programme



Call FP7-ICT-2009-6

Project: 247708 - SUDPLAN

Project full title:

**Sustainable Urban Development Planner
for Climate Change Adaptation**

**Deliverable D8.2.1
Czech Pilot**

Version 1 (V1)

Due date of deliverable: 31/12/2010

Actual submission date: 22/12/2010

Title	Pilot Description V1		
Creator	CENIA		
Editor	Vladislav Bizek		
Description	Brief description of the SUDPLAN Czech pilot implementation in version 1. The document does not have the status of a qualified report but will give an impression of the Czech pilot's capabilities to people who don't have access to the software.		
Publisher	SUDPLAN Consortium		
Contributors	CENIA		
Type	Text		
Format	application/msword		
Language	EN-GB		
Creation date	20-12-2010		
Version number	1.0		
Version date	21-12-2010		
Last modified by	VBi		
Rights	Copyright "SUDPLAN Consortium". During the drafting process, access is generally limited to the SUDPLAN Partners.		
Audience	<input type="checkbox"/> internal <input checked="" type="checkbox"/> public <input type="checkbox"/> restricted, access granted to: EU Commission		
Review status	<table border="0"> <tr> <td> <input type="checkbox"/> Draft <input type="checkbox"/> WP Manager accepted <input type="checkbox"/> PMC quality controlled <input checked="" type="checkbox"/> Co-ordinator accepted </td> <td> Where applicable: <input type="checkbox"/> Accepted by the PMC as public document </td> </tr> </table>	<input type="checkbox"/> Draft <input type="checkbox"/> WP Manager accepted <input type="checkbox"/> PMC quality controlled <input checked="" type="checkbox"/> Co-ordinator accepted	Where applicable: <input type="checkbox"/> Accepted by the PMC as public document
<input type="checkbox"/> Draft <input type="checkbox"/> WP Manager accepted <input type="checkbox"/> PMC quality controlled <input checked="" type="checkbox"/> Co-ordinator accepted	Where applicable: <input type="checkbox"/> Accepted by the PMC as public document		
Action requested	<input type="checkbox"/> to be revised by Partners involved in the preparation of the deliverable <input type="checkbox"/> to be revised by all SUDPLAN Partners <input type="checkbox"/> for approval of the WP Manager <input type="checkbox"/> for approval of the Quality Manager <input type="checkbox"/> for approval of the Project Co-ordinator <input type="checkbox"/> for approval of the PMC		
Requested deadline	31-12-2010		

Version	Date	Modified by	Comments
0.1	20-12-2010	VBi	
0.2	20-12-2010	LGi	Modifying structure to streamline with other pilots
0.3	21-12-2010	VBi	Revision, completion
0.3	21-12-2010	SSc	Technical review
1.0	21-12-2010	VBi	Final revision
1.0	22-12-2010	LGi	Co-ordinator approval

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1. Management summary

Note: This document does not have the status of a qualified report but should give an impression of a pilot's capabilities for a public without access to the software.

The objective of the SUDPLAN Czech Pilot is to check the hypothesis whether the state of the environment may influence migration of population from the Capitol City of Prague to adjacent districts in the future. Air quality has been selected as an indicator of the state of the environment for the first phase of the pilot. Air quality projections for the area of interest (square 100 x 100 km around Prague) which are not available in the Czech Republic are being developed with support of Common Services of the SUDPLAN project. Besides emission data, air quality projections (several different scenarios) will be based on climate scenarios used in other parts of SUDPLAN project.

As a first step, emission data for stationary air pollution sources in the area of interest as well as activity data (road network, traffic intensities, fuel consumption) for calculation of emissions from mobile sources have been collected, re-formatted and uploaded to the SMHI Airviro emission database.

Having the emissions available, concentrations of main pollutants (suspended particulate matter PM10, PM2.5, ground-level ozone and nitrogen dioxide will be calculated using the SMHI MATCH chemical transport model and compared with real data from monitoring stations operated in the area of interest. In the case of reasonable similarities between calculated and real data, the model system will be ready for the development of air quality projections.

In parallel, demographic data on migration into/outside Prague and other relevant information have been analysed. Recent opinion poll has indicated that more than one third of Prague residents is thinking about moving from Prague. From this total, 30 % presents the reason of environmental quality in general and 12 % the reason of air quality.

As a part of the next pilot phase, the specialized opinion poll will be carried out to get more detailed information on reasons for potential migration and its results will be confronted with air quality projections. In addition, another environmental indicator will be considered (hydrology).

2. Preparatory Work

The Czech pilot will demonstrate the Common Services (CS) air quality downscaling and how air pollution affects quality of life and migration patterns. CENIA will provide emission input and monitor data for model evaluation. From air pollutant concentrations, CENIA will develop indicators of quality of life, to be analyzed together with migration data. With input from climate scenario data, future quality of life indicators will be possible to map, if possible also linked to migration patterns.

The Czech pilot activities have been defined in the task analysis of Section 4 in the D8.1.1 Czech Pilot Definition Plan V1. The tasks have been listed under the main area “Migration Assessment”, reflecting the overall focus of the Czech pilot. The following table summarizes Section 4 in the D8.1.1 document.

Area: Migration Assessment

<i>Task</i>	<i>title</i>	<i>comment</i>
1.1	Gather data for air quality model input and validation	See Section 2.1 below
1.2	Assessing air quality in the Prague area	See Section 2.2 below
1.2.1	Model validation for a historical period	<i>Not initiated</i>
1.2.2	Assessment of air quality evolution for a selected future climate scenario	<i>Not initiated</i>
1.3	Development of the DPSIR indicator set	See Section 2.3 below
1.4	Gathering migration data	See Section 2.4 below
1.5	Assessment of Pilot hypothesis	<i>Not initiated</i>
1.6	Assessment of future migration scenarios	<i>Not initiated</i>
1.7	Analysis of the air quality and migration scenarios	<i>Not initiated</i>
1.8	Linking DPSIR indicators to GAINS and CS Air Quality output	<i>Not initiated</i>
1.9	Inclusion of the factorial analysis model into the Czech SUDPLAN pilot	<i>Not initiated</i>

The work performed during 2010 is described under these Task titles in the subsections below. The following persons have been actively engaged in the Czech pilot during 2010:

CENIA: Vladislav Bizek (emissions, monitor data, analysis, team leader of air quality work)
 Alzbeta Kodetova (emissions, air quality data analysis)
 Leona Matouskova (emissions, air quality data analysis)
 Jiri Hradec (team leader of the Czech pilot)
 Jiri Kvapil (GIS)
 Lenka Jiraskova (GIS)
 Radka Bezdekovska (demography, socio-economic analysis)
 Tereza Jagerova (demography, socio-economic analysis)

SMHI: Magnuz Engardt (MATCH model, climate scenarios)
 Lars Gidhagen (emission inventory using Airviro)

2.1. Gather data for air quality model input and validation

2.1.1 Emission data

For the purposes of the AIRVIRO emission database, relevant activity data (road network, traffic intensities, fuel consumption) and emission data have been collected and uploaded to the AIRVIRO database. Data on emissions from stationary sources for 2008 have been taken from the Czech National Emission Inventory REZZO, structured into three categories:

- Category I (combustion plants with thermal output of more than 5 MW, major technologies), more than 3 thousand point sources,
- Category II (combustion sources from 0.2 MW to 5 MW of thermal output, medium sized technologies, more than 30 thousand point sources,
- Category III (combustion sources below 0.2 MW/local heating, minor technologies), diffused sources, expressed as grids.

Data are available for sulphur dioxide, nitrogen oxides, dust (TSP), carbon monoxide, volatile organic compounds (VOC) and ammonium. An example of the data from the REZZO emission inventory is presented in Figure 1:

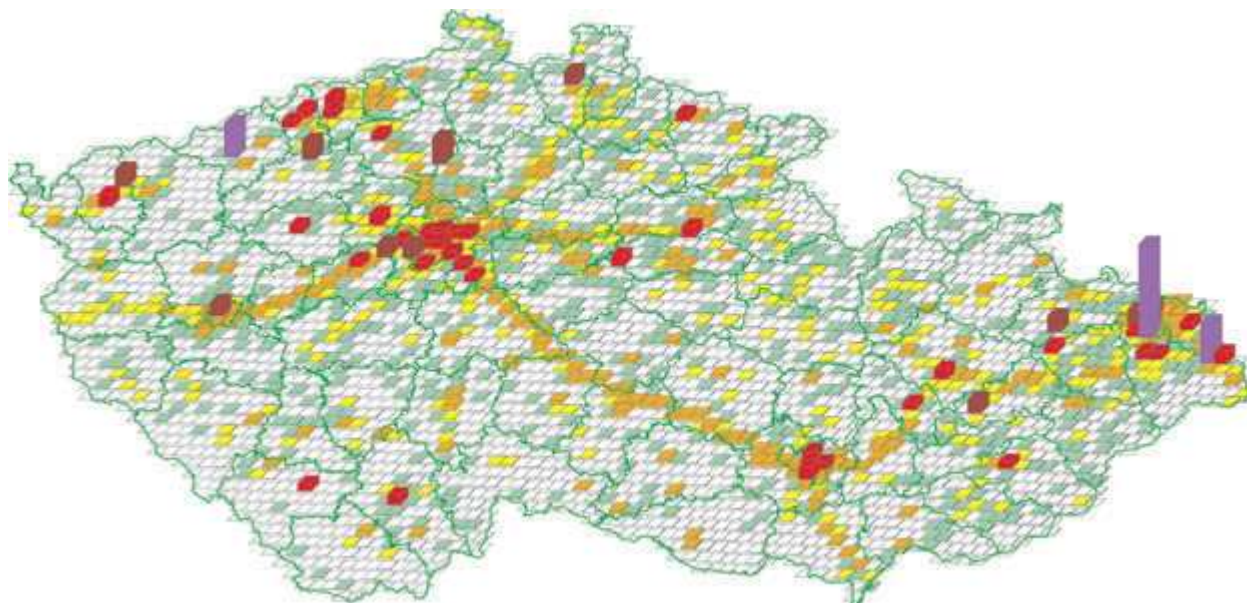


Figure 1: Emission densities (including the assessment of emissions from the transport sector) of dust in the Czech Republic in 2008 (grids 5 x 5 km)

Source: CHMI- 2010

The data were re-formatted and uploaded to the AIRVIRO database.

2.1.2 Air quality data

For the purposes of the MATCH chemical transport model, the air quality data have been collected from the background monitoring stations located within the area of interest (square 100 x 100 km around Prague). Data are available for PM₁₀, sulphur dioxide, nitrogen oxide, nitrogen dioxide, carbon monoxide, ground-level ozone and at certain stations also for PM_{2.5} and benzo(a)pyrene. The example of the data available is presented in Figure 2:

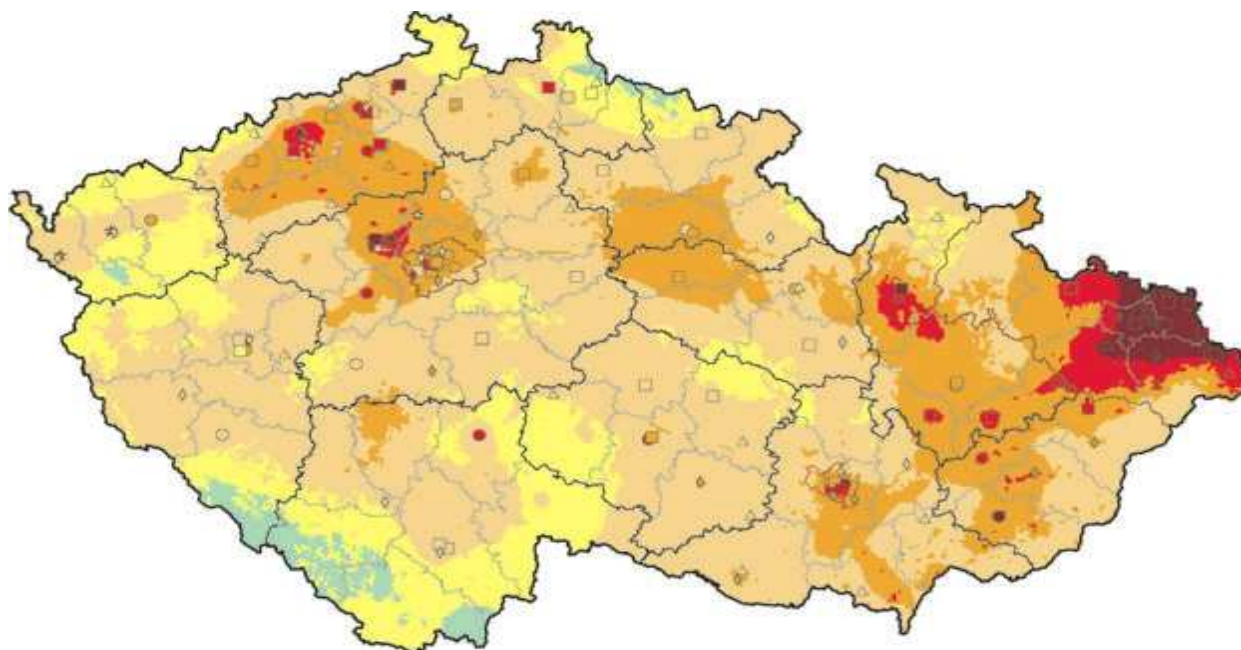


Figure 2: Air pollution by PM₁₀ in the Czech Republic in 2009 (red and dark red colour means non-compliance with the 24-hours limit value).

Source: CHMI -2010

The data from background stations were uploaded to the Airviro database, integrated in the MATCH model environment of Common Services.

In the next phase, the “downscaled” data from the MATCH model will be compared with existing monitoring data. If the difference between calculated and measured data will be reasonable, the CS modelling system (the Airviro emission database and the MATCH model) will be ready for the calculation of air quality projections (including climate scenarios).

2.2. Assessing air quality in the Prague area

For the purposes of air quality assessment in the Prague area, the zones with deteriorated air quality have been taken into account as officially established on an annual basis in accordance with legal provisions. The development of these areas is presented in the Table (in % of total area of the city on which air quality limit values/ target values are being exceeded), accompanied by annual emissions of dust (TSP) and nitrogen oxides:

Year	PM ₁₀ - daily	PM ₁₀ - annual	NO ₂ - annual	O ₃ – 8 hours	As - annual	BaP - annual	Dust emissions (t/year)	NO _x emissions (t/year)
2001	6.0	6.5	4.9	3.3	-	41.5	2.7	13.8
2002	66.7	13.0	1.6	n.a.	1.1	61.0	2.5	12.0
2003	86.3	29.0	14.5	99.8	-	60.5	2.6	12.3
2004	26.4	7.5	6.4	100.0	-	62.3	2.6	11.8
2005	99.0	4.0	7.0	65.0	-	63.0	2.4	11.4
2006	98.0	4.0	14.0	85.0	-	96.0	2.4	9.5
2007	48.0	-	8.1	79.7	1.2	87.7	1.1	9.0
2008	1.8	-	8.7	32.9	4.2	77.4	2.3	8.6
2009	1.2	-	1.9	0.2	-	33.4	n.a.	

Source: CHMI-web

It can be seen that the air quality in Prague can be taken as poor: At least three of the above stated air quality limit values are being exceeded every year. Having in mind the annual emissions of dust and nitrogen oxides, the decrease in the case of PM₁₀ between 2007 and 2009 can be explained rather by favourable meteorological conditions than by the decrease in emissions.

In 2010, at 9 out of a total of 15 monitoring stations in Prague the daily limit value for PM₁₀ has been exceeded; the highest daily concentrations were between 103 and 155 µg/m³.

2.3. Development of the DPSIR indicator set

Air quality assessment results (both existing monitoring results and projections developed under Common Services) will be interpreted using the indicator set reflecting the DPSIR framework:

- Driving forces (activities – mainly transport intensities),
- Pressures (emissions of air pollutants and GHGs),
- State (air quality – expressed in terms of PM₁₀, PM_{2.5} and ground level ozone),
- Impacts (health effects, potential impact on migration),
- Response (policy options).

Selected policy options will be converted to the projections of driving forces and pressures, including climate scenarios, and will be uploaded to particular models (under Common Services) to assess their impact on air quality projections.

2.4. Gathering migration data

The data on migration from/to Prague are available but the “environmental” reasons for migration are not observed explicitly (are “hidden” within “other reasons”).

From the recent ad hoc opinion poll (see DEMA-2010), 37 % of Prague residents is thinking about migration from Prague to the adjacent districts. From this total, 30 % presents the reason of better environment in general while 12 % the reason of better air quality. As a result, 4.4 % of Prague residents is thinking about migration from Prague due to poor air quality (total number of Prague residents is about 1.2 million).

In the next phase of the Czech Pilot, specialized opinion poll is expected to be carried out to get more precise information.

3. Pilot Design

The Czech Pilot will use the same Common Services as in the Stockholm pilot, although for different purposes. Therefore the use-cases are the same as in Stockholm pilot, through which the mockup process has been coordinated. Please refer to D5.2.1 Stockholm Pilot report V1 for further details.

3.1. Visualize air quality model results

No work performed during 2010, awaiting integrated SMS and user interface implementation for Common Services.

3.2. Execute air quality downscaling

No work performed during 2010, awaiting integrated SMS and user interface implementation for Common Services.

4. Implemented Use Cases

Without the implementation of the pilot software it is not possible to fill this section in present document (V1), instead it will be presented in the following documents (V2 and V3).

4.1. Use Case UC-XX1 [name]

See explanation above.

4.2. Use Case UC-XX2 [name]

See explanation above.

5. Conclusions

During this phase of the project, design and preparatory work has been carried out to check the model system and get it ready for the development of air quality projections (several scenarios) and analysis of potential relation between state of the environment (expressed in terms of air quality) and migration of population from the City of Prague (expressed in willingness to move away due to environmental reasons).

6. References

CHMI-2010: Air Pollution in the Czech Republic in 2009; Czech Hydrometeorological Institute, Prague, 2010,

CHMI-web: Website of the Czech Hydrometeorological Institute: <http://www.chmi.cz>

DEMA-2010: Dema Agency; <http://www.dema-praha.cz>

D8.1.1 Czech Pilot Definition Plan VI

D5.2.1 Stockholm Pilot report VI

7. Glossary

<i>technical term</i>	<i>Explanation</i>
PM ₁₀	'PM10' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM10, EN 12341, with a 50 % efficiency cut-off at 10 µm aerodynamic diameter;
PM _{2.5}	'PM2,5' shall mean particulate matter which passes through a size-selective inlet as defined in the reference method for the sampling and measurement of PM2,5, EN 14907, with a 50 % efficiency cut-off at 2,5 µm aerodynamic diameter;

8. Acronyms and Abbreviations

<i>acronym / abbreviation</i>	<i>Definition</i>
BaP	Benzo(a)pyrene
CHMI	Czech Hydro-meteorological Institute
MATCH	Multiple-scale Atmospheric Transport and Chemistry modelling system, a CTM developed and used by SMHI.
REZZO	Register of Air Pollution Sources – National Emission Inventory of the Czech Republic
TSP	Total Suspended Particulates
VOC	Volatile organic compounds