Energy solution: C-in.City

Piloting in: Copenhagen and Greater Paris

Introduction

C-in.City is the new generation of GHG information system. It's a first of a kind service to monitor and manage all urban emissions (housing, commercial, public institutions, transportation, industries, power production) at 3 actionable scales (city, district, building/street) that helps city managers, citizens, NGOs and businesses to better understand local emissions, take individual and collective action, and implement transparent and science-based impact monitoring. C-in.City bridges the time gap and adds a geographical component by bringing together the forefront of research on emissions monitoring and the widest panel of datasets available thanks to AI in one tool.

The AI deployed is used for two main purposes: extracting activity signals from AOIs (Areas Of Interests) and inferring CO2 emissions from these signals. In short, it means that C-in-City has developed algorithms that automatically detect when an industrial site is active (i.e. detecting fumes above a waste burning plant thanks to satellite imagery) and can infer from it the associated emissions.

The challenge

Moving from an ever-increasing emissions trajectory to one of halving emissions in just eight years requires In practice, connecting about 450 houses per year to a green energy source, 1800 people per year leaving internal combustion cars and 1200 energy efficiency renovation per year. Where do we implement these actions? How do we identify the lowest-hanging fruits? How do we track the carbon budget left? Today, the stakeholders of this transition in cities are facing these tremendous challenges with often nothing but outdated data in excel spreadsheets – meaning without maps – hence making this task astonishingly difficult. C-In.City proposes to bridge the time gap and add a geographical component to these tools by bringing together the forefront of research on emissions monitoring and the widest panel of datasets available thanks to AI in one tool.

The solution

C-in.City, as a tracking and targeting system, is designed to leverage data for a significant impact on CO2 emissions reduction. Taking CO2 reduction actions without reliable and up-to-date data can make you miss the point. Such an approach may lead to one-stop shops or subsidy systems failing to meet the GHG emissions targets. With C-in.City, the city stakeholders can easily pin the most emissive buildings or streets, and play action scenarios at the neighborhood level to assess the best CO2 reduction opportunities. For instance, in the Paris Region, 18% of homes account for 40% of the housing energy consumption. This indicates a very large variability in terms of emission reduction potential depending on the location. C-in.City helps prioritizing the areas needing the most building renovation through its targeting and simulating options. As a result, it has demonstrated that an efficient targeting system can lead to an emission reduction by 3.5.tCO2eq/per dwelling/per year CO2 Vs 2tCO2eq for the average operation without smart targeting.

Current CO2 emission reporting or monitoring is relying on spreadsheet-based tools such as GHG Protocol for Cities (GPC), Bilan Carbone and other ISO (14064-14069) compliant software. These self-reported inventory tools are based on costly handheld data collection that explains that most of city emissions inventories are outdated by at least 2 to 4 years. However, lagged reports and global figures are not appropriate to support concrete and located GHG reducton policies. By contrast, the C-in.City solution provides actionable information with greater precision and granularity of data, which is continuously collected on a near real-time basis. It is built around the three services below:

- Carbon budget tracker: Up-to-date monitoring dashboard, showing the emissions by sectors, to catch the current trends and track the objectives. This paves the way to new narratives to inform and educate city officials, NGOs, businesses and citizens. It's both a question of efficient climate policy steering and accountability toward stakeholders.
- Explore & target: In addition to the climate team, this carbon-centered digital twin service is intended for all the municipality's departments. Each city department (housing, mobility, public buildings, energy management) has a concrete vision of their challenges and potential from a carbon perspective. Depending on their own parameters, users can identify the hotspots and lowhanging fruits in their domain. This helps in delivering concrete CO2 information to mainstream the city planning tool chain**.**
- What-if scenario: The innovativeness of our service also lies in an interface that makes climate action simulation accessible to non-experts. The purpose is to empower city managers with a set of policy option simulations such as district heating development, insulation, or low emission zones. This could also help to unveil the high importance of behavioral changes (heating setpoint reduction) or to see the cost of inaction (energy poverty in specific areas)

C-in.City relies on 3 technical pillars:

- The collection, valorisation and harmonization of all the relevant and untapped open city datasets (25 data sources), enabled by the GeoAI algorithms developed by the consortium
- The collection and valorisation of massive unconventional datasets such as satellite imagery, geolocation or sensor data
- The climate expertise of our consortium, built with the involvement in multiple climate research initiatives including Carbon Monitor Cities, a macro-level emission inventory for more than 1000 cities in the world

C-in.City & AI4Cities

C-in-City has found AI4Cities three-phased PCP process to be a rich and challenging journey. Comparing the current solution in Phase 3 with the initial concept, it is clear that the Ai4Cities programme, with its user-centric approach enrolling engaged cities, has greatly contributed to streamline the service design and to pave the way to the broader European city market. The big challenge was to address at the same time the user expectations and the service design with the city departments, and to develop and test the AI-based algorithms to answer to the expressed needs.

Through interviews, a survey and co-design workshops, C-in.City, identified the currently existing challenges of tools aiming to estimate GHG emissions, and their pain points. They concluded that while most tools are quite suitable to raise the awareness of the stakeholders about the carbon footprint and can be adapted for setting targets and levels of ambition, they have structural disadvantages that make it harder to be used for the acceleration towards a low-carbon economy.

The major pain points highlighted by the city practitioners were firstly, the lack of updated data on emission trends; there is often a time lag of 1-4 years. Secondly, these tools often lack spatial dimension, thus there is no possibility to feed the city GIS for planning decisions. Furthermore, they have difficulties to identify emission hotspots and low-hanging fruits, thus failing to make the

most of the best opportunities. As a result public subsidies won't necessarily go to the best projects. Finally, there is a growing 'accountability gap' and transparency issue between cities, citizens and NGOs as these methods are not suitable for a continuous monitoring of the climate plan results and more detailed impact assessments.

C-in.City addresses these pain points by relying on major advances in near real-time (NRT) carbon emission quantification made under the Carbon Monitor R&D programme. The solution is made possible by extensive use of innovative datasets in combination with publicly reported municipal data. C-in.City makes use of near real-time data based on satellite imagery, geolocation data and meteorological data. Taking advantage of this data is now possible thanks to the structuring AI that the project team has developed to translate this raw data into activity signals. Combining those signals with publicly reported data (housing and road stock, energy deliveries...) makes it possible to compute CO2 emission levels at high frequency (from hourly data), wuth unprecedented resolution (from district to building level) and with detailed knowledge of driving factors (activity sub-sector, socio-economic profile, sensitivity to weather conditions, etc.).

The C-in.City prototype interface reflects exactly the philosophy and ambition that the cities expressed during the co-design sessions in AI4Cities: it is an action-oriented carbon emissions supervision system, open to all type of city departments users, freshly updated key indicators (deviation from goals), a multi-tiered hotspot mapping exploration and relevant levers to address the emission reduction opportunities. Combining data sourcing options with data science techniques enabled C-in.City to be the first near-real time carbon emission management system for all the city practitioners.

The consortium

C-in.City is a fruitful collaboration between Nexqt, Kayrros and La Javaness.

Nexqt's raison d'être is turning data and climate sciences into actions by addressing the barriers to fill-in the information gap for a systemic change.

Kayrros' mission is to create the data needed to decarbonize the economy and mitigate climate risks. Using AI with satellite and alternative data sources, Kayrros monitors the carbon value chain to support Net Zero targets.

La Javaness helps public and private organizations to transform with AI. Supported by its AI platform, La Javaness accelerates the industrialization of AI solutions and addresses key challenges of AI at scale.

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