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Carbon Accounting Explained to Drive Renewable Energy Transition and Decarbonisation of Mediterranean Cities

Riccardo M. Pulselli, Nicoletta Patrizi, Elena Neri and Federico M. Pulselli
Ecodynamics Group, Department of Earth, Environmental and Physical Sciences, University of Siena, Italy
riccardo@pulselli.it

Greenhouse Gas Inventories are consolidated methodologies for monitoring trends of nations in compliance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). Applications have also been implemented at the subnational scale. The Siena Carbon Free project (Bastianoni et al. 2016), referring to the area of the Province of Siena (Italy), has combined the expertise of three entities: the University of Siena performs the greenhouse gas inventory on yearly bases; an independent Certification authority validates the monitoring outcomes; the Monte dei Paschi di Siena Foundation currently supports the project and promotes the local Climate Alliance involving public administrations, private companies and citizens. Based on outcomes from the Greenhouse Gas Inventory, mitigation measures for decreasing emissions have been promoted including: decreasing of energy demand through a monitoring campaign of residential heating systems in order to avoid energy waste; increasing renewable energy through approving procedures for small size Photo Voltaic (PV) systems and an additional incentive fund of 2million euros, besides the national ones (since 2008, 70MW PV systems have been installed with an estimated investment of around 25M euros). Moreover, two additional issues concern strengthening of existing geothermal cogeneration plants and the optimization of the waste management system with the installation of a waste-to-energy plant. The total electricity demand is currently supported by renewable energy, generated within the Province of Siena (92.2% geothermal; 4.2% PV, 3.6% waste). Due to these accomplished best practices, the Province of Siena is an ISO14064 certified Carbon Neutral area since 2011, meaning that greenhouse gas emissions within the Province are fully compensated by the carbon uptake of local ecosystems.

Figure 1: Virtual road sign of the Siena Carbon Free project of the Province of Siena, ISO14064 certified carbon neutral area since 2011.

As demonstrated in Siena, the inventories of greenhouse gas emissions at sub-national level can be powerful tools to address choices, especially concerning the energy sector, and plan climate actions. The methodology estimates the emissions of carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) by multiplying inventory data by the specific emission/removal factors per unit. All greenhouse gas emissions other than CO2 are transformed into CO2 equivalents (CO2-eq), using 100-year Global Warming Potentials (GWPs) published in the IPCC 5th Assessment Report (IPCC, 2013). Similarly, carbon accounting procedures have been recently applied at the city scale. A decarbonisation scenario for the historical centre of Siena has been studied, hypothesizing a full transition to electric systems supplied by renewable sources (Marchi et al. 2018). The policies make it possible to significantly reduce emissions in the short term, in compliance with landscape constraints and requirements for heritage conservation, and to achieve a condition of carbon neutrality and full decarbonization in the long run. According to the estimated scenario, the electricity demand for building heating and cooling, based on heat pump systems, lighting and electric mobility, would be potentially fully supported by the installation of PV panels on available flat roofs, just outside the historic centre (Marchi et al. 2018).

The experience of Siena has inspired a number of initiatives in European cities. In particular, within the framework of the EU FP7 City-Zen project (2014-2019), a series of workshops, namely City-Zen Roadshows, have been conducted in Belfast (UK), Izmir (TR), Dubrovnik (HR) (van den Dobbelsteen et al. 2018), Menorca (ES), Sevilla (ES) (Pulselli et al. 2018), Roeselare (BE). The experience of Siena has inspired a number of initiatives

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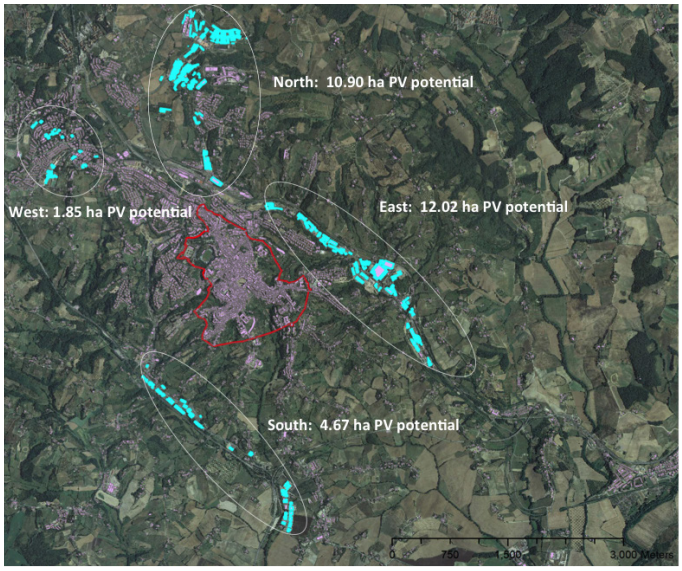

Figure 2: Map of available flat roofs for solar panel installations in Siena that would fully supply the transition to electric systems of the historical centre (ref. Marchi et al. 2018).

participatory design processes involving international experts on city energy transition and urban design, together with local stakeholders. The workshops aim at assessing the impact of neighborhoods in terms of greenhouse gas emissions and evaluating site-specific mitigation scenarios in order to promote and kick-off de-carbonisation plans of the hosting cities. In particular, within the limited time-frame of 4 days (presenting the results on day 5), the city and the selected district are visited, studied and provided with solutions over a wide range of aspects. Results also include the carbon footprint measurement of a typical household in the neighborhood (around 7 t CO2-eq/yr per household as European average) that, if represented in terms of forestland grabbing, corresponds to an area covered by forests to absorb the emission of about 0.4 ha, equivalent to a football field. Saying that each household should have a backyard forest of the surface of a football field works well to raise the audience attention on the matter as reactions often showed us. This graphical approach contributes to drive the participative process during labs, raise awareness among administrators and citizens and proactively support initiatives for de-carbonisation of contemporary cities.

References:

IPCC, 2006. 2006 IPCC guideline for national greenhouse gas inventories. In: Eggleston, H.S., Buendia, L., Miwa, K., Ngara, T., Tanabe, K. (Eds.). IGES, Japan.

Bastianoni, S., Marchi, M., Caro, D., Casprini, P., Pulselli, F.M., 2014. The connection between 2006 IPCC GHG inventory methodology and ISO 14064-1 certification standard – A reference point for the environmental policies at sub-national scale. Environmental Science and Policies 44, 97-107.

Marchi, M., Niccolucci, V., Pulselli, R.M., Marchettini, N., 2018. Environmental policies for GHG emissions reduction and energy transition in the medieval historic centre of Siena (Italy): the role of solar energy. Journal of Cleaner Production 185, 829-840.

Van den Dobbelsteen, A., Martin, C.L., Keeffe, G., Pulselli, R.M., Vandevyvere, H., 2018. From Problems to Potentials - The Urban Energy Transition of Gruž, Dubrovnik. Energies 11(4), 922.

Pulselli, R., Maccanti, M., Marrero, M., van den Dobbelsteen, A., Martin, C., Marchettini, N., 2018. Energy transition for decarbonisation of urban neighborhoods. A case study in Sevilla. In Passerini G., Marchettini N. Sustainable Development and Planning (in press).

Biography:

Riccardo M. Pulselli (Post doc research fellow), architect and PhD in Environmental Chemistry, has collaborated with the MIT SENSEable City Lab (US, 2004-05) and the Wageningen University (NL, 2012). He is author of City Out of Chaos (WITpress 2009) and The Moving City (Laris 2011). He is co-founder and chairs INDACO2 srl, a spin-off company of the University of Siena dealing with sustainability and environmental accounting.

Nicoletta Patrizi (Post doc research fellow), natural scientist and PhD in Environmental Chemistry works on sustainability accountings. She has focused her activity on the LCA methodology applied at the process-product level. She collaborates with Ecodynamics Group for the realization of national and European projects as researcher.

Elena Neri (Post doc research fellow), Life Cycle Sustainability Analyst, MSc graduated in Ecotoxicology and PhD in Environmental Chemistry, has collaborated with the Luxembourg Institute of Science and Technology LIST (LU, 2012). She was awarded "Young Research Scientist LCA Award 2013" by the LCA Italian Network. Her research activity, within the Ecodynamics Group at the University of Siena, is focused on the implementation of environmental sustainability accounting methods and their application to production chains. She is co-founder and LCA Manager of INDACO2 srl.

Federico M. Pulselli (Associate Professor in Environmental and Cultural Heritage Chemistry) works on sustainability theory and indicators. His research focus on the application of the main systemic environmental accounting methods such as emergy, ecological footprint, LCA, GHG accounting and some ecological economic applications (e.g. ISEW, GPI). He also works on the input-state-output indicator framework to investigate the sustainability of national economic systems, sub-national and productive systems. He is author of two books and almost 130 international papers on international journals and collective books.

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