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Towards a more energy efficient stormwater management in smart Mediterranean cities

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Water and wastewater facilities frequently represent the largest and most energy-intensive loads owned and operated by water utilities, representing up to 35% of municipal energy use (NRDC, 2009). The EU-MED Programme E²STORMED project (improvement of energy efficiency in the water cycle by the use of innovative storm water management in smart Mediterranean cities, www.e2stormed.eu) aims to improve water management and energy efficiency in the urban water cycle and in buildings by promoting the use of innovative storm water solutions such as Sustainable Drainage Systems (SuDS) in six Mediterranean cities.

The overall objectives of E²STORMED are: to promote innovative energy efficiency solutions for smart Mediterranean cities; to identify methods, public policies and exchange experiences; planning and implementation of “eco-quarters” and “smart cities” initiatives; to improve knowledge and competences concerning standards, quality requirements, technical aspects and needs in public administrations, and; to find out and overcome obstacles hindering cities when launching such initiatives. Specifically, E²STORMED should improve energy efficiency in the urban water cycle through the promotion of innovative stormwater solutions such as Sustainable Drainage Systems and provide tools that allow more informed decisions to be made.

The main principle of Sustainable Drainage Systems (SuDS) is capturing and reusing stormwater runoff before it flows into surface waters allowing its use onsite either to replenish groundwater supplies through infiltration or for grey-water uses such as landscape irrigation or toilet flushing. SuDS make use of common sense and simple technologies such as beds of native plants, rain barrels, green roofs and porous surfaces for car parking and roads (USEPA, 2013), (Woods-Ballard et al, 2007). In addition to reducing potable water use, the result is less water pollution from contaminated runoff, less flooding, replenished water supplies, and often more natural-looking, aesthetically pleasing cityscapes.

Currently, knowledge of sustainable stormwater management in the Mediterranean Region is very weak except in certainly limited number of countries, and stormwater is seen as a problem of waste and damage control. The EU Life+ programme AQUAVAL project (Perales-Momparler et al., 2013) started to address the weaknesses by retrofitting and monitoring seven new SuDS installations into two cities in the Province

of Valencia, Spain. Within the monitoring period, those SuDS which incorporated a storage volume achieved quantity performances close to 100%. This efficiency was close to 90% for the permeable pavement and slightly lower for the green roof (Perales-Momparler et al., 2014). These results show that SuDS can reduce runoff volumes and peaks flows drainage systems under Mediterranean climatic conditions.

E²STORMED capitalises on the results of AQUAVAL to quantify the benefits of SuDS in water management, especially the energy savings. Using SuDS can potentially reduce energy consumption in a city by (USEPA, 2013):

- Reducing the use of potable water. This will reduce the energy consumed in acquiring and treating drinking water which will be even higher where desalination is used.
- Reducing the inflow of stormwater into sewer systems, hence reducing the energy consumed in treating wastewater and pumping surface and foul water.
- Reducing local temperatures and shading of building surfaces. This will lessen the cooling and heating demand for buildings, reducing energy needs and decreasing emissions from power plants.

In order to quantify and to take into account these benefits, E²STORMED is developing a Decision Support Tool (DST) that includes energy efficiency and environmental criteria in urban stormwater management decisions. The DST quantifies the economic costs, savings, energy consumptions and CO_2 emissions of different drainage scenarios in order to include them in a multi-criteria analysis (Escuder-Bueno, 2013). Figure 1 shows the general concept of this tool. It includes costs, energy consumption and CO_2 emissions during construction and maintenance, stormwater pumping and treatment and rainwater reuse benefits.

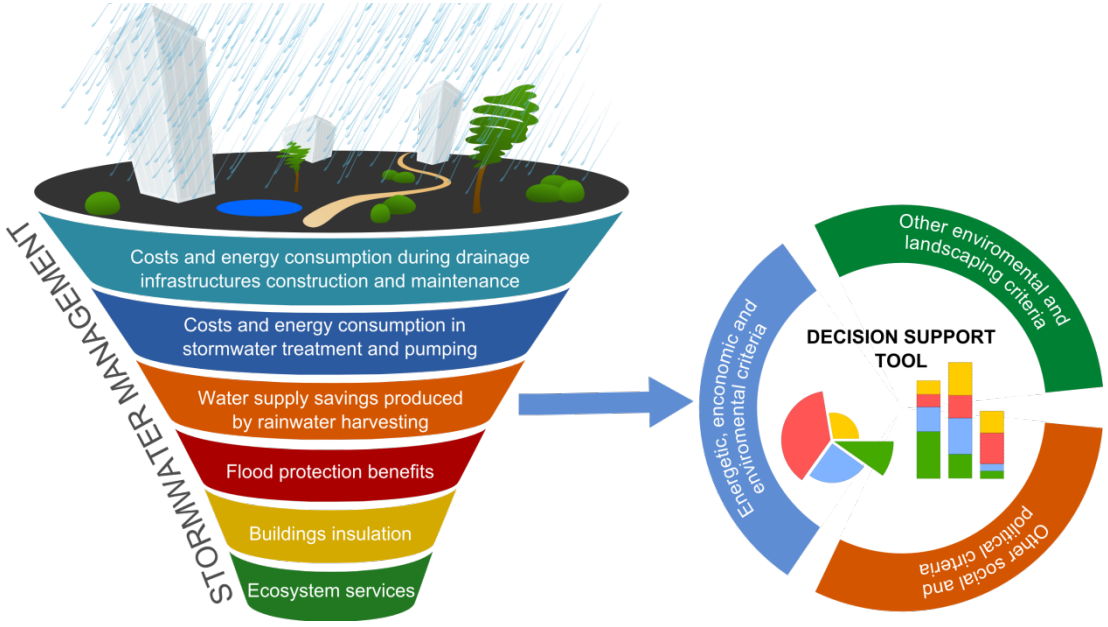

Figure 1. Conceptual scheme of the Decision Support Tool.

These results are used to develop decision criteria based on energy efficiency, economic costs and water management principles. They can be complemented with social and environmental criteria to support the decision-making process. These criteria are finally used to choose between different drainage scenarios.

The first version of the DST is already finished and it is being applied in six Mediterranean cities: Benaguasil (Spain), Pisa (Italy), Zabbar (Malta), Old Royal Capital Cetinje (Montenegro), Zagreb (Croatia) and Hersonissos (Greece). These pilot studies form a heterogeneous group representing the climatic, political and socioeconomic differences of the Mediterranean area. The DST is being used to compare and evaluate different scenarios of combining conventional drainage solutions and SuDS. The data obtained and suggestions made from applying the DST in these cities will be used to prepare a final version of the DST by the end of 2014.

Moreover, in each pilot city, a regional working group has been created to allow the participation of the main actors related to energy, water and urban planning (public as well as private) in the development and application of the DST. These groups will allow a transition towards more sustainable and energy efficient water management in each city.

Finally, the final version of the DST will be tested in a town in the Piedmont Region (Italy) to check its applicability in a Mediterranean city that has not participated in developing the tool.

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