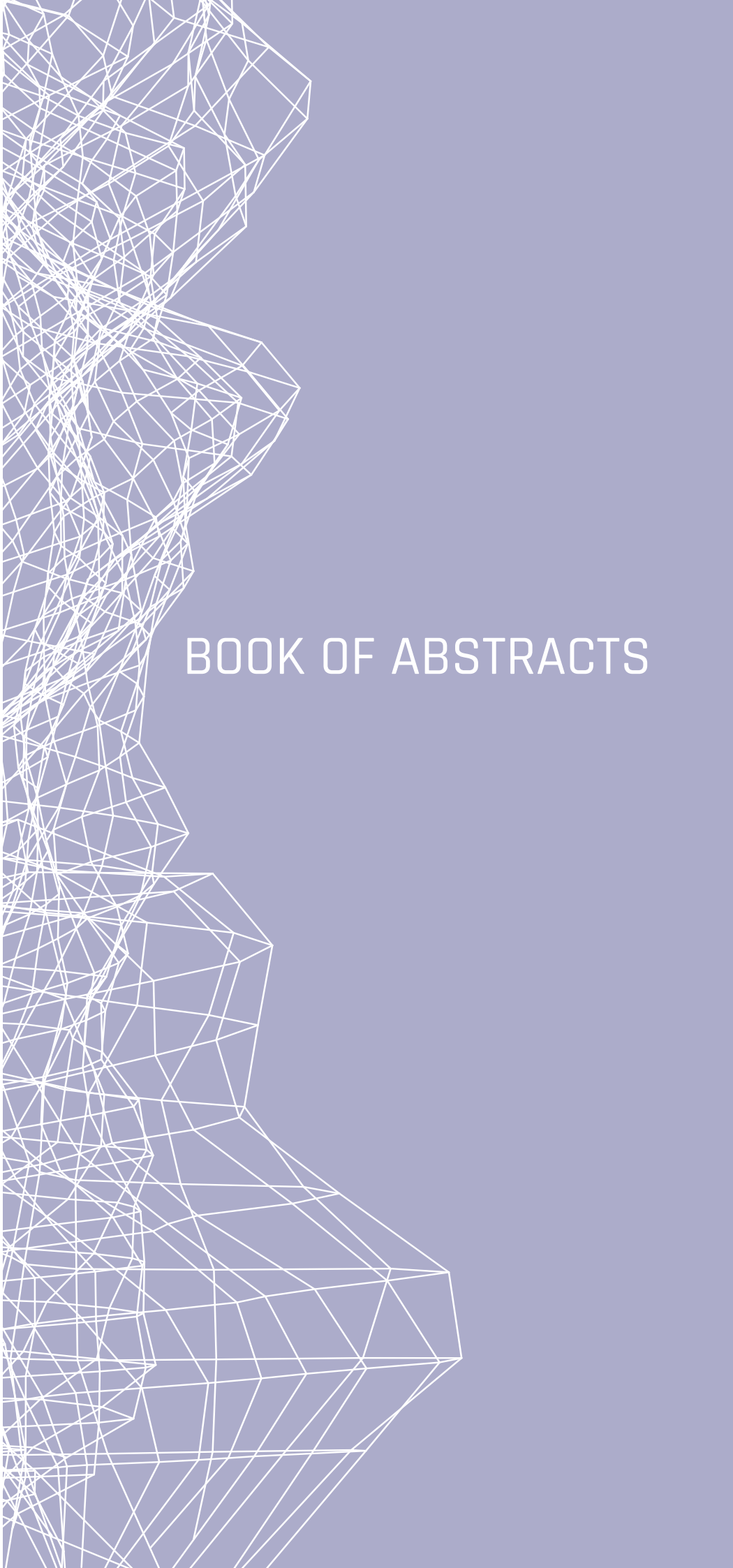
RSD7 2018

RELATING SYSTEMS THINKING AND DESIGN 7th SYMPOSIUM

CHALLENGING COMPLEXITY BY SYSTEMIC DESIGN TOWARDS SUSTAINABILITY



BOOK OF ABSTRACTS

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The use of water for technical development or technical development for the use of water?

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KEYWORDS
Urban ecology;
Systemic water management;
Clean blue energy;
Local resource.

Nowadays in the global context, the use of water resources for daily activities is one of the main topic discussed by the international community. This paper presents a required reflection on paradigm shift toward an aware water management. As we know, in the past, especially during the 18th and 19th centuries, water power plays a crucial role in early stages of industrialization. Waterwheels was applied in many industrial sectors, as in textile, iron and wood production, improving manufacturing processes and affecting economic, environmental, social and cultural structure of societies. Water power is one of the most known renewable energy and scientific and technological innovations lead toward the introduction of new machines. Many industrial sites and cities were developed near rivers, lakes and other watersheds and citizens improved technical solutions to manage water resources for producing hydroelectric power.

Considering the global goals of the Agenda 2030, especially the SDG 6, focused on providing sustainable management of water and on fighting water scarcity, and the SDG 7, focused on ensuring renewable and clean energy, we need to tackle some of main current issues to move toward sustainability. Many other examples suggest that we need to consider that the development of human communities depends by the availability of water resources and also to undertake considerable actions for a sustainable use.

Water power is considered one of the most ancient type of clean and sustainable energy and it provides many benefits for local citizens, as reducing water and air pollution and enhancing local resources. Hydroelectric power includes both large-scale hydroelectric dams and small run-of-the-river plants and the construction of hydroelectric power stations depends by the topography of the land. On the other hands the construction of new hydroelectric facilities might impact the environment in land use changing and also in preserve aquatic wildlife's ecosystems. In some cases in large water reservoirs the amount of nutrients and sediments might increase, changing habitats and conditions for animal and plant life and increasing greenhouse gasses emissions. On one way some targets expressed by the SDG 6 (e.g. 6.6) regards the protection and the restoration of water-related ecosystems, as rivers and lakes, and on the other way some of them focus on the development of innovative technologies for wastewater treatment (e.g. 6.A). We need to look at these issues in a systemic view and to apply the systems thinking approach in water management practices to sustain local communities.

A systemic approach to hydroelectric power considers the impact in design practice of dams on natural ecosystems and urban contexts and it tries to reduce negative effects through the application of ecological principles. Ecological Engineering practice works to provide benefits for humans, to preserve natural ecosystems (Bergen, Bolton, Fridley, 2001) and it designs integrated systems (Mitsch & Jørgensen, 1989; Mitsch, 1996). In the ecological and systemic thinking, we shouldn't consider water only like a resource for human benefits, but it is also habitat for other species of plants and animals. In this paper we would present benefits provided by small-scale hydroelectric facilities through a case study made in the urban context. It underlines how a natural and local resource, as water of urban river, can be used in order to "produce" systemic services for human being, in a sustainable way. Some of these benefits are the protection of biodiversity of riparian ecosystem and the reduction of environmental impact and noise and air pollution.

Mini-hydro power presents many advantages as the dependence by natu-

ral flow of watercourse, the low relative cost of the system and possible applications in remote areas. It creates new opportunities for rural and isolated communities but also reduce the environmental impact in urban and suburban areas. The use of this local and natural resource for micro hydroelectric power contributes to increase urban metabolism, producing clean energy that can be used in the local context.

The case study here presented is a low heat hydroelectric power plant that was developed in Turin urban city center, in Regio Parco district, an historical interest area. During the 20th century in this district were established one of the oldest Italian manufacture, Manifattura Tabacchi, and the main lighting company of Turin. The small scale hydroelectric power plant is located in the Dora Riparia river, known for its importance, in 20th century, in generating hydroelectric power for local manufactures in Vanchiglia and Dora disctricts. The aim of the project is to recover the existing weir intake structure, that in XIX century was used to deflect a part of water's course into Regio Parco canal for energy supply of local manufactures. It was technically transformed in a inflatable weir used to produce hydroelectric power, placed in electric grid of the city, and to reduce the urban flood risk.

Figure 1: Location in the middle of the city of the mini-hydroelectric power plant. In this photos the system is completed and on the right side we can see the fish ladder.

Considering the purpose to preserve river ecosystem, the project has planned to establish a fish ladder in vertical slot to facilitate fishes' natural migration. It is also designed to reduce the environmental impact on landscape, local vegetation and urban noise. We need to apply systems thinking for providing benefits for humans and at the same time preserving ecosystems and enhancing historical pre-industrial heritage. Managing local resources and providing benefits for the whole context is important to promote sustainable urban metabolism, through the application of the holistic viewpoint. Urban context and natural river ecosystem are complex systems and design in-for-with them is a practice to undertake in a systemic view. Finally this paper's purpose is to show how systems thinking and ecological principles can be applied to face one of the most important challenge of our time: produce clean and sustainable energy in site and reduce its ecological footprint.

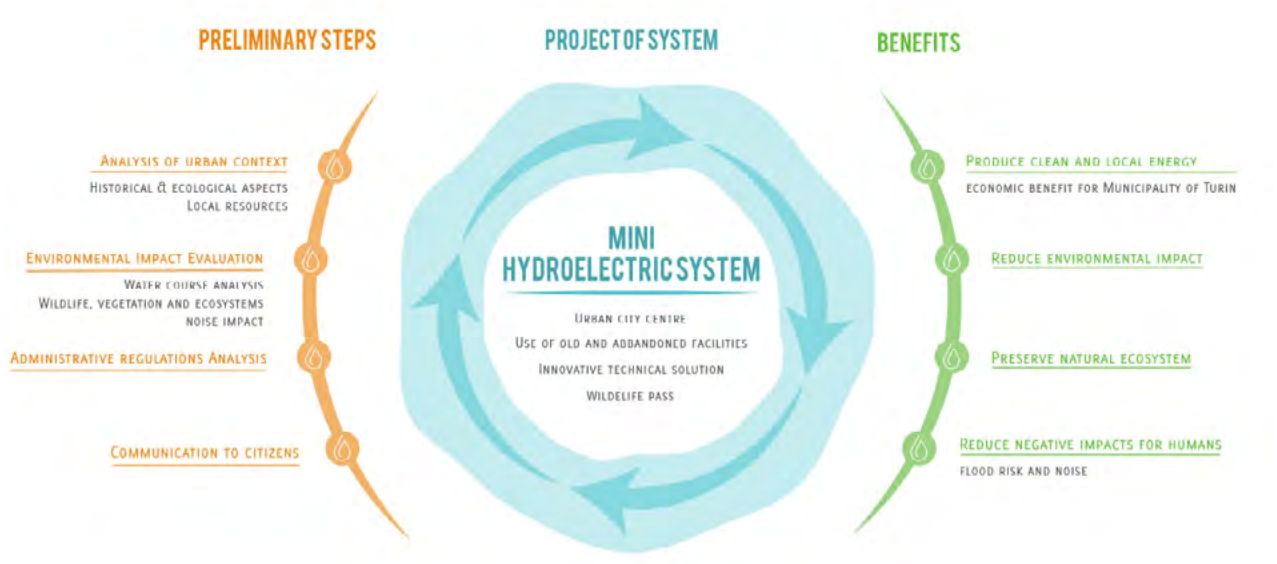

Figure 2: Graphical Abstract that shows main steps of research study and practical application.

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