



1. DESCRIPTION OF WORK – (PRELIMINARY) RESULTS AND MILESTONES

In the period covered by this report (01/06/2018-31/05/2021), several activities were carried out generating some outputs and outcomes. We have worked in all WPs with several deliverables been developed. The last year (06/2020-05/2021) was dedicated to finalizing the data analysis in WP1-WP6 and focus on the interaction with cities. The last six months of the project (06/2021-12/2021) is totally dedicated to give back to the partner cities through the IFWEN project and the GOFWEN Pegasus Take-It Further Grant. We are also analyzing the data to finalize the papers for submission to different journals and books.

Until mid-2020, the leader of the Belmont Forum project had to work together with the other partners for dealing with several issues related to the research project and administrative problems that some of the partners had with the funding agencies. Various partners had delays in receiving the funds from the funding agencies, causing also delays in the project with implications to the research, which had to be adapted to the changes in the funding. The COVID-19 brought more management challenges, as we had to adapt our work to the pandemic situation. However, the project partners are engaged and committed to deliver innovative work in the area of FWE nexus in the end of the project.

We have had important progress along the project with the following landmarks:

- SUGI Projects Kick Off Meeting, London (UK), 11-12 June 2019. During this meeting the leaders of the 15 projects funded by the Belmont Forum got together to exchange research experiences and present their projects. During the two days the leaders discuss the best way to advance the knowledge about food-water-energy nexus in cities and were also briefed about the functioning of the Belmont Forum and funding issues. See Annex 2 for the presentations and program of the workshop.

- Kickoff Meeting of the Project IFWEN, New Haven (USA), 08-09 April, 2019, with follow-up meetings on 09-10 April. All the seven partners of the project met at the Yale School of Forestry & Environmental Studies to present the plans for their part of the research and fine tune the workplan of the project, once most of the administrative issues of the project was solved and we could advance in the research part. Several adjustments to the workplan and decisions were made regarding the project. We also had several bilateral meetings to discuss specific issues related to certain work packages of the project.

- Second Meeting of The Project IFWEN, Sao Paulo and Sao Jose dos Campos - SJC (Brazil), 23-25 September 2019. The partners presented the first results of the research, as well as to interact with the city stakeholder in SJC to understand better how we can apply the results of the project in practice.

- Literature Reviews. The partners in the project developed literature reviews on the topics of the project. We developed two reviews related to Green and Blue Infrastructure and FWE Nexus in cities, which are published as articles in the Journal of Cleaner Production (see outputs). The objectives of the reviews are two-fold. First, we wanted to know the state of the art of the discussions on the topic and identify the gaps in the literature. Second, we want the reviews to help future research in the area.

- Sessions in the The Nature of Cities meetings. A session titled “*Unpacking the meaning of innovation in the context of the nexus of food, water, and energy as well as blue and green infrastructure*” was organized and delivered during The Nature of Cities Summit in Paris on 23 May 2019. Outputs will contribute to shaping the IFWEN paper on innovation and capabilities of local governments that are required for innovation. They include a digest of the session and a first draft definition document for innovation that the IFWEN project has taken further. In 2021, we created sessions and invited mayors and other city officials to present and join in other engaging sessions at TNOC Festival.

- Selection of the cities to work in the project. As part of the WP1, led by FGV, we identified eight cities that are part of the project. We asked the specialists of one of the partners (ICLEI) to identify cities that have innovated in Green and Blue Infrastructure (GBI) and its impacts on water, food and energy. The cities selected are: São José dos Campos (Brazil), Florianopolis (Brazil), Johannesburg (South Africa), Lilongwe (Malawi), Antananarivo (Madagascar), Dodoma (Tanzania), Gangtok (India) and Nangpur (India). We are also conducting a broad survey on innovations in GBI using different databases and online surveys. The selection criteria included: Political stability: the city is not facing a situation of political instability or civil unrest. Elections: the city would not be electing a new administration within the project time- frame as elections may disturb/weaken the political commitment to the project. Efficiency: there are no identical city-level initiatives as well as other foreign-assisted projects, which may lead to inefficiencies or contradictions. Clear

demand: the city presents a clear demand for work on urban governance, and how to assess, govern and build green and blue infrastructure (GBI) and food-water-energy nexus (FWEN) solutions and policies - as evidenced by local climate and environmental challenges, and national climate strategies and projections. Clear leadership and engagement: the city presents a leadership role in its region ensuring commitment with the project activities as well as willingness for engaging with further dissemination nationally and internationally. Project attractiveness: consider a balanced mix of cities with some engaging with the issues for the first time and some that are already developing innovative FWEN and GBI work. This helps the knowledge transfer through capacity building from experienced to non-experienced city staff. Mapping of local and national stakeholders: involved in FWEN and GBI to minimize potential political risks and ensure the participation of a diverse group of stakeholders. Existing climate change commitments / Alignment to national policies and action plans: the explicit or implicit mention of FWEN or GBI in the selected countries' climate change policies and action plans to ensure project impact in the long term. Access to information: easy to access from a logistical perspective or geographically close to one of the consortium partners' headquarters/offices. Besides the eight cities, we have two associated cities where we are doing research: Kunming and Taipei. There are two research papers and a policy paper being prepared as result of this research.

-Development of the model to assess the impacts of the innovations. In the WP 2, led by Yale University, we are developing a model to assess the impacts of the GBI on the nexus in the cities selected in WP1. We have had several discussions along the project. We have developed the model for green roofs to be tested initially in one city (SJC). We are collecting the data to run the model for the city of Johannesburg.

-Survey on Capabilities in Cities. In order to implement WP3, WP4 and WP5, FGV, Stockholm Resilience Center (SRC) and ICLEI worked together to develop a survey to analyze the level of capabilities in the cities and also the learning mechanisms. A survey manual for each city was developed and ICLEI is applying the survey in the eight selected cities. The questionnaire was designed to (1) find out more about one specific initiative within the city that contributes to optimizing food, water, and energy elements (or some combination thereof); and (2) gain an understanding of food, water, and energy systems in general across the city. The interviews with cities were planned and took place during June and July 2019. These helped ICLEI Regional Offices and consortium partners to identify the capabilities cities need to have in order to advance changes in FWEN towards more sustainable urban processes. We finalized the policy paper and are working in two separate working papers for future submission. The first working paper was finalized.

- Engagement with cities ICLEI's Regional Offices (Africa, South America, and South Asia Secretariats) with coordination provided by the World Secretariat, conducted interviews, using the survey tool, with the most relevant city officials in all eight selected cities. ICLEI still liaising with the local governments' representatives and relevant stakeholders to collect further information about the FWEN and GBI in the project cities. The interviews with project cities conducted by ICLEI offices provided fundamental information for the consortium to understand: (i) What kind of capabilities these cities need to have to innovate in FWEN, (ii) What kind of intervention from city stakeholders allowed changes in FWEN to improve sustainability and what is the role of each different stakeholder; (iii) What are the main learning mechanisms used by the cities to build capabilities to work on FWEN, and (iv) What legal, administrative, political, cultural and economic factors may have enabled or hindered achievement of desired results in terms of FWEN in these jurisdictions.

-Case studies of selected cities. ICLEIs developed the case studies for Antananarivo (Madagascar), Dodoma (Tanzania), Johannesburg (South Africa), and Lilongwe (Malawi); ICLEI SAMS prepared the studies for São José dos Campos (Brazil), and Florianopolis (Brazil); and ICLEI SAS drafted the studies for Gangtok (India), and Nagpur (India) with contribution, and coordination provided by ICLEI WS. These contributed to discussion at our consortium meeting in Sao Paulo and identification of learning mechanisms that local governments employ for improving nexus application, as well as to development of a paper on how nexus innovation in each city is understood. The case studies were further developed with 10 interns, Masters' students in the University of Manchester (UK). They have written six reports on the cases and we are finalizing another two. Those report will serve as material for our research and publications.

-Analysis of nexus in urban spaces. MCU examined open-air edible greenspaces, including community gardens, rooftop gardens, and school gardens, in the Taipei Garden City program to understand the interconnection of food yield, water usage, and energy consumption. WP6, led by MCU, has accomplished first-hand data collection, including 18 site investigations; 11 in-depth interviews with stakeholders of Taipei Garden City program; and 130 questionnaire surveys into managers of garden sites, as well as second-hand data, including land use/land cover maps, water consumption of garden sites, and socio-economic data of Taipei and New Taipei cities. This information has been used to assess/estimate the material flows of and social influence on the FEW nexus of edible greenspaces in Taipei Garden City program. The initial results suggest the amount of electricity and water consumption is varied by the type of gardens, which is closely



related to the purpose of gardens and operation. A closer insight into the difference in the operation of gardens shows that stakeholders, including landscape consultants, NGOs, and garden managers, play an important role in determining the innovation and the sustainability of resource use. This WP is developed based on empirical study, which combined quantitative and qualitative research methods. It enables the assessment of policy influence on the nexus of food yield, energy use, and water consumption. Although the result provides important picture regarding FEW impacts from the decision of implementing small urban farms/gardens in cities, it might not be generalizable to cities with different climate and governance structure. The multiple case study from different countries of the other WPs will help to address this difference.

-Exchange of researcher. In 2019, the postdoc researcher Rodrigo Bellezoni spent the months of March and April in Yale University, to interact with Dr. Fanxin Meng and other researchers from Yale University. During the month of September Yale University's postdoctoral researcher Fanxin Meng was in FGV EAESP in São Paulo as a visiting scholar. She interacted with FGV's team to develop the WP2 and the literature reviews. The exchange was very fruitful, and we have been able to advance the project in many aspects, besides the researcher having the opportunity to interact with the broader research team of FGV EAESP.

-Organization of a special issue in the Journal of Cleaner Production. The partners are organizing a special issue of the Journal of Cleaner Production on the topic of the research for 2021. This will be an opportunity to put together some of the research of the project. The deadline for paper submission is over in 06/2021 and the special issue is planned for the end of 2021.

-Interaction with the other SUGI projects. The PIs of the five SUGI projects of FAPESP (METABOLIC, CITYFOOD, WASTE FEW ULL, GLOCULL) have interacted with FGV group along the projects. We have had three meetings to discuss the results of our projects and collaboration among our research team. The last meeting was in ESALQ/USP in Piracicaba on 06 September 2019, and we were planning another meeting in 2020, which was canceled due to Covid-19. We plan a meeting in the second half of 2021.

- Website (ifwen.org). Website was completed for the project consortium. It includes the basic information of the project and after testing it will be available to the public.

-Public Event and Book. We completed one public engagement event in Sao Jose dos Campos (SJC) in Brazil in partnership with the city government and other stakeholders in September 2019. We completed a report and map book from the event and published this on both the TNOC platform and the project website. We completed an essay on the themes and topics of the project. Completing the first public event was a milestone for the project as it was our first moment to take the results and work of the research teams in the project and connect this with the public. The event was inspiring and engaging and we received excellent feedback for the event.

- Virtual IFWEN workshop in June 2020. The one-week workshop with the consortium partners was planned to be held in Cape Town in April 2020, but it was done remotely on 18 and 23 June 2020. The results of this workshop informed continuation of the work in a remote form, including the work the consortium is committed to, particularly the next stage of transforming the research into a useful tool. The consortium managed to carry the work forward through the calls and scheduling two days of virtual workshops to ensure the project work remains on track. We have deviated slightly from the number of roundtables and essays we had expected to have published by this time. This is partly because of an early delay in the project for the research teams, which meant we did not have material and findings to produce public engagement content.

-Collective Intelligence Challenge "IFWEN-MIT POST-COVID-19 CITY CoLab Challenge THE POST-COVID-19 CITY". The IFWEN team, led by TNOC, ran a colab, as a multidisciplinary collective intelligence challenge, with a team of the Massachusetts Institute of Technology (MIT). We received dozens of submissions for the challenge and selected four of them for winning a USD 1,000 prize. More information at: <https://www.pandemicresponsecolab.org/challenges/2020/the-post-covid19-city>

-Conference Action Session at RISE Africa. ICLEI and TNOC organized a session called "Mapping Voices: What's the story of Food, Water and Energy in your City?". The session was hosted at ICLEI RISE Africa to support the promotion of IFWEN and GOFWEN. The session is recorded for the public at: <https://riseafrica.iclei.org/riseprogramme2021/mapping-voices-food-energy-water-security/>

-Several Essays developed by The Nature of Cities (TNOC) platform. TNOC developed a series of essays on the Project, such as (i) "Financer des villes plus vertes pour l'avenir que nous voulons. Financing Greener Cities for the Future We Want". This essay was published on TNOC following the completion of a research milestone for the whole project team;



(ii) “Making Spaces for Edible Gardens in Compact Cities: the Taipei Case”. This essay was published on TNO following the completion of a research milestone in the Taipei working group; (iii) “The Art of Designing Meaningful Public-Science Collaborations”. This essay was published on TNO following the Sao Jose dos Campos Public Event. (iv) “The Challenges for Innovating in Green and Blue Infrastructure: The Case of an Innovative Drainage Approach in Belo Horizonte, Brazil”. This essay was published on TNO following the completion of a research milestone in the Brazil working group. (v) “What Can Policymakers Do to Enhance Nature-based Solutions for Sustainable Cities?” This essay was published on TNO following the completion of a research milestone in the Yale/New Haven working group. This essay facilitated the transdisciplinary engagement with the IFWEN research project bringing together multiple disciplines to work together. There was a widespread public engagement with IFWEN themes and concepts beyond the project partner through The Nature of Cities. With an audience of more than 30,000 per month a broad public audience was reached.

-IFWEN Workshop at Daring Cities 2020 - *From Nexus Thinking to Nexus Action in Food-Water-Energy Waste Management*. Daring Cities 2020 was a virtual, global forum on climate change for urban leaders tackling the climate emergency, especially in the context of the Covid-19 pandemic. Daring Cities 2020 ran from 7-28 October 2020, and offered a combination of high-level and visionary speaking sessions, a series of informative workshops, resources like an email boot camp and podcast series, and personal networking opportunities. Over a three-week period, attendees had access to a variety of virtual formats to accommodate different topics, time zones, internet bandwidth limits, and languages. The event helped to set the course for COP 26, Daring Cities 2021, and beyond. The objectives of the IFWEN Workshop were for participants to gain an improved understanding of the potential that the Nexus approaches and, more specifically, the Food-Water-Energy Nexus approach might have for creating new pathways through which sustainability issues such as climate change mitigation and adaptation, resource efficiency, and human well-being could be addressed across sectors at the local-level.

-ICLEI’s Workshop on “how to co-design the Decision Support Tool (also known as policy guide for cities)” with the IFWEN consortium partners on 18 June 2020. ICLEI designed and led a workshop surrounding the Decision Support Tool. The Policy Guide, a key deliverable of the project, has been co-developed by the IFWEN consortium through instruction and contribution by ICLEI. During the workshop, ICLEI presented their expectations to the partners, and also strategized and guided research partners on the content of the Policy Guide, and provided a structure for the Policy Guide. The key ICLEI questions that surrounded these discussions were as follows: 1) How research/expertise of partners can contribute to the application of the nexus for measuring nexus and GBI interactions, as well as implementing GBI-based nexus approaches. 2) How policy makers can make use of partners’ insights & findings in developing policies. 3) How GBI-based innovations in the context of FEW nexus can be mainstreamed in cities.

-SUGI Virtual Mid-Term Meeting by Belmont Forum on 15 and 16 June 2020. ICLEI and FGV presented the IFWEN project, answered the questions from the audience, and also actively engaged and contributed to discussions and knowledge exchange across two days of the event.

- Guide for GBI and innovation in FWEN. Based on the research results, FGV with support of other partners led the development of a guide to support local governments to deploy GBI for improving FWEN. The first draft was produced in June 2021. The first version of the guide will be used for the training packages and dissemination efforts ICLEI is planning in WP 9 and 10 during the last 6 months of the project. The results are expected to support city leaders, representatives, decision-makers, and other stakeholders to understand, assess, and better plan for changing and innovating nexus approaches in the context of FWE through GBI. The cross-linking and coupling of infrastructure (FWEN) contributes to resource efficiency, improving the sustainability of systems to minimize resource extraction, consumption, and disposal while also increasing their resilience. A final version of the guide will be produced by all partners in the end of the project.

-SRI 2020 Meeting. Working with relevant colleagues (including the ones from Future Earth, Belmont Forum, and JPI Urban Europe) to co-organize the first SUGI-workshop (Think like a Mayor) at SRI2021, which was a virtual meeting. ICLEI represented IFWEN in the meeting, which took place on 14 June 2021 with an audience of experts, policymakers and students.

Engagement with city officers has been hampered by Covid-19, but there is still enthusiasm for engaging around nexus ideas and applications as the project progresses. This will be helpful for co-designing and testing the ‘decision toolkit for implementation of nexus’, which we will discuss with cities in the last months of the project.