URBAN RIGGER AND FLOATING CITY SOLUTIONS FOR ECOLOGICAL TRANSFORMATION

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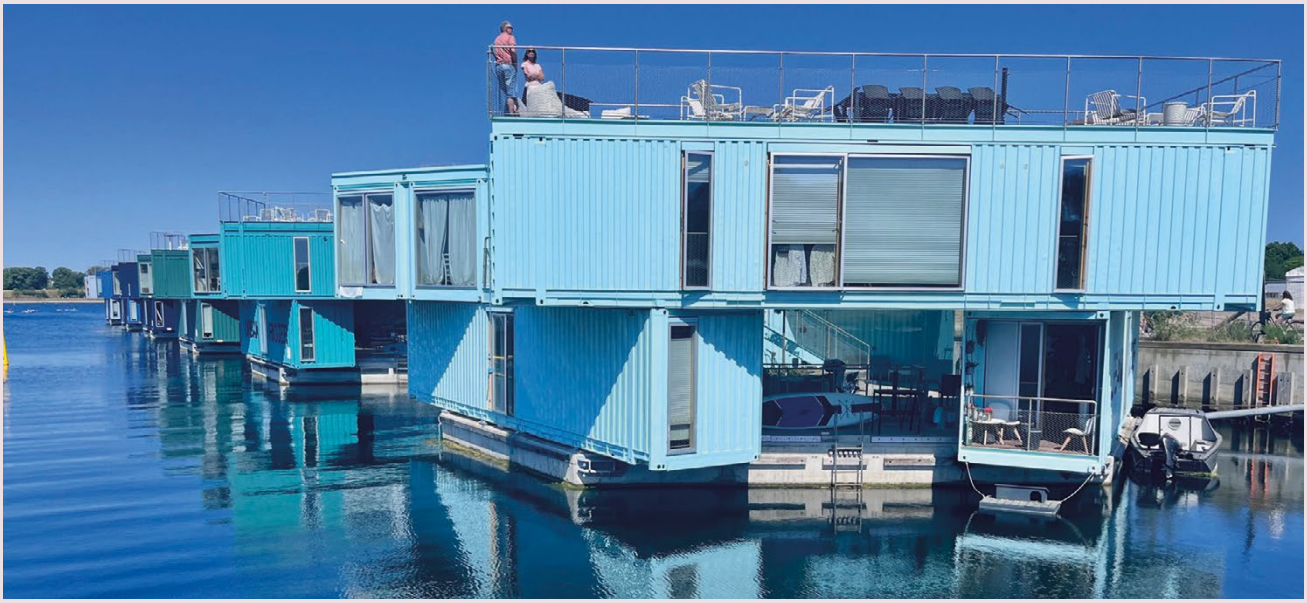

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The Danish capital of Copenhagen, a port city built on two islands, has piloted an affordable and sustainable housing solution that floats on its unused inner harbour. Completed in 2019, the Urban Rigger student housing complex is designed to be energy-efficient and built from upcycled shipping containers. The floating construction offers cities a way to extend their liveable area and address housing shortages while potentially increasing resilience to sea-level rise.

For centuries, people who live near and on water have constructed floating communities and infrastructure. These include the floating islands of Lake Titicaca on the border of Bolivia and Peru, built by the Uros people out of bundles of reeds; *kelongs*, the stilted fishing platforms of Malaysia and Indonesia; and floating agriculture in Bangladesh, where people raise vegetables on water-hyacinth beds in the flood-prone monsoon season.

Floating infrastructure can be adapted, too, to the needs of densely populated cities. It can serve as an innovative and equitable housing solution. It can be a means of climate resilience, given that more than a billion people in low-lying cities and settlements are at risk from coastal-specific climate hazards by 2050.[1] Designed well, it can also help to create a sense of community among residents.

The Urban Rigger housing complex was built with these objectives in mind. The first prototype 'Rigger' was developed in 2016 by Danish entrepreneur Kim Loudrup in close collaboration with the Bjarke Ingels Group, a Danish architecture firm, to address a dearth of student housing.

DESIGN AND COMMUNITY

Each Rigger consists of nine upcycled shipping containers stacked atop a floating concrete platform to create 12 apartments plus communal living spaces. The platform also has a basement which houses amenities such as storage rooms and laundry. The structure is prefabricated and towed to its site.

1 Dodman, D., B. Hayward, M. Pelling, V. Castan Broto, W. Chow, E. Chu, R. Dawson, L. Khirfan, T. McPhearson, A. Prakash, Y. Zheng, and G. Ziervogel, 2022: Cities, Settlements and Key Infrastructure. In: *Climate Change 2022: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 907–1040, doi:10.1017/9781009325844.008.

Urban Riggers are energy-efficient and use current energy technology. Each Urban Rigger gets about 75% of its heat from the surrounding seawater through pumps. It also generates electricity from rooftop solar panels, while its ventilation system recovers roughly 95% of heat.

The complex is designed to be a living community: communal spaces, a central open courtyard, annual investments to improve community welfare, and residents' meetings and a residents' app all help foster interaction. Altogether, some 100 residents live in its 72 apartments.

The complex is built at the disused industrial site of Refshaleøen, a former shipyard. Along with other public uses, such as events and festivals, art galleries and a street food market, it helps revitalise the space and brings conscious lifestyles to cities.

PUBLIC ENGAGEMENT AND SCALING UP

In theory, replicating the Urban Rigger design requires only a sheltered harbour with sufficient depth and open space. In practice, developing urban floating housing can mean navigating a maze of regulations about what is allowed to be built where, as well as technical requirements and safety standards for connecting to the electrical grid and sewer system. Making floating infrastructure equitable also means ensuring access to city amenities and ensuring that a diverse swathe of city residents has access to the infrastructure rather than creating wealthy enclaves.

While these regulatory and access requirements vary by location, in Copenhagen, the Urban Rigger complex rents harbour space from the municipality. The Urban Rigger team has engaged and continues to engage with city administrators, politicians, harbour-users and other citizens, and keeps abreast of current regulations.

Next, Urban Rigger plans to expand to other sites in Denmark and begin to build with wood as a more sustainable, renewable material. It has been cleared to rent apartments to seniors as well as students, to diversify its residential community. And in future, the Urban Rigger team also aims to design floating structures for other housing typologies.

FUTURE PLANS

Today, as the crises of sea-level rise and housing affordability become more urgent, there is growing global appetite for floating infrastructure as an adaptation to these twin challenges. Floating infrastructure can also offer a sustainable alternative to land reclamation and provide space for agriculture or solar energy.

In the Netherlands, cities such as Rotterdam are already home to floating homes, office buildings and even a floating farm as part of its adaptation and resilience measures against flooding. Other floating cities and developments are being planned in Busan, South Korea, and in the Maldives.

In its Sixth Assessment Report, the Intergovernmental Panel on Climate Change notes that Rotterdam's municipal government and private sector work directly together to create "an institutional environment that favours eco-innovation", and that the city and its construction sector are building a body of knowledge, experience, and expertise around the technologies, design and engagement for floating cities. With its existing complex as proof-of-concept, Copenhagen's Urban Rigger project joins this body of knowledge and expertise. Replicating and scaling floating infrastructure is a vital opportunity for cities and the private sector alike.

Floating housing such as Urban Rigger's is not a silver bullet against coastal climate hazards. But driven by the urgent need for climate adaptation and resilience, with some 0.7m of sea-level rise already locked in by the end of the century, it can be one of the innovative solutions that humanity needs for ecological transformation.