# Combating climate change: can naval architects do more?

Complex floating structures are the answer to the global climate change crisis, argues Lim Soon Heng, founder and president of the Singapore-based Society of Floating Solutions


'Oceanix City', a floating city concept unveiled at the UN last year, is designed to accommodate 10,000 people at sea

Engineers, in the ultimate analysis, are the culprits of climate change. The industrial revolution of the last 200 years has had the unintended consequences of polluting the world with greenhouse gas. True, engineers deserve credit for inventing the steam/gas turbine and the internal combustion engine but unwittingly they also have let the genie out of the bottle: the dire consequence of global warming.

The evidence of a hotter planet is clear: raging fires, melting polar ice caps and permafrost, exceptional floods, droughts, and hurricanes. Life on land and in the ocean has been decimated, biodiversity compromised, and food security endangered. Yet even as the world gets warmer, engineers are at the forefront of hydrocarbons extractino from the earth's crust and ocean bed to feed those machines.

One way to get out of this conundrum is to build in the sea what man has been building on the land. Floating complexes, be it offices or industrial estates, abodes or institutions, are environmentally more sustainable.

However, it is not in the DNA of homo sapiens to live on floating structures. Perhaps it is because their evolution took them along a path of hunting, gathering and tilling; fishing was a marginal activity. But there is also something in their psyche that links water with danger and drowning. It is a primordial instinct.

Naval architects are the best people to explain that such fear is irrational and living, working and playing on floating surfaces on the sea can be just as safe as on land, perhaps even safer. With cruise ships, offshore oil rigs and FPSOs to testify to their achievements, their assurance would carry more weight than any other profession.

## Living sustainably

There are many reasons why living on the surface of the sea is more environmentally sustainable. Floating cities need no highways and bridges. That helps to reduce the enormous carbon footprint of the building material industry, which according to World Green Building Council amounts to 39% of global energy related carbon emissions.

What do you do with a building after it has served its purpose? Knock it down, cart away the debris, re-do the foundation and build a new one in its place. On the water you tow it away, repurpose and give it is a new lease of life. Extending the life of a building is a 'greener' option that wastes less energy.

Water transport is more energy efficient. To move 1000tonnes of material from A to B would require about 50 trips by truck but only one by a medium size barge with the power of one truck.

The phenomenon known as the Urban Heat Island (UHI) effect is the blight of many cities. Air conditioners suck in the heat ejected by other air conditioners. On a floating structure, the heat of air conditioners is ejected directly into the water on which it floats. As the heat absorbing capacity of water (specific heat and thermal conductivity) is much higher than air, the physiological discomfort is less and the need for air conditioning reduced. The effect of large water bodies on UHI has been studied extensively and proven to be salutary.

While land architects and engineers are dabbling with floating simple abodes (essentially glorified boat houses), few have the credibility to develop working designs of complex mega floats with a waterplane area exceeding half a hectare and air draft higher than 25m. For seasoned naval architects, these dimensions are anything but challenging.

Below are some examples of floating structures that could result in lowering carbon emissions…

## Data Centre

The Internet of Everything will one day soak up 10% of all the energy produced in the world through data centres, just to keep the servers from overheating. These data centres eject heat into the atmosphere causing its own heat island, and guess what? Others around the heat island will attempt to counteract by having larger air conditioning systems, leading more heat emission.

For this reason, data centres floating in the sea make sense. Dumping heat into the sea by pumps and heat exchangers is more efficient than into the atmosphere with fans and cooling towers.

The technology is embryonic; like oil rigs in the 1970s. Much can be done. The market is enormous if such systems become the norm as the demand for data storage grows exponentially.

One idea fascinates me. I would recommend RINA form a task group to investigate the possibility of using the waste heat from data centre to generate electricity through the process known as Ocean Thermal Energy Conversion (OTEC). Possibly a data centre mounted on a spar over deep water? Who knows; such a hybrid OTEC-DTEC, to coin a new acronym, could be a net power producer instead of consumer?

Keppel's concept design for its 'floating data centre park'

## Floating nuclear power plant

Floating nuclear power plants are common. The US alone has 83 nuclear-powered ships, 72 submarines, 10 aircraft carriers and one research vessel. Russia commissioned its floating nuclear energy power plant in December 2019. The Massachusetts Institute of Technology (MIT) is working on a spar hull Offshore Nuclear Power Plant. These are forerunners of a new energy system inspired by the need to reduce carbon emission.

Nuclear energy is the cleanest base load energy system there is, but the image of the Fukushima nuclear disaster is still seared in the minds of too many for it to be taken seriously. All three nuclear reactor meltdowns the world has witnessed, Fukushima, Chernobyl and Three Mile Island, would not have occurred if the cooling water supply had not failed.

A floating nuclear reactor sitting below the water line can hardly experience a meltdown as the cooling water system does not require external energy input to activate it.

However, nuclear engineers need the best advice there is for the design of appropriate hull forms and mooring systems. Perhaps RINA can play the role of linking up naval architects with designers of nuclear reactors and explore how their resources can be combined to design safer floating nuclear plants.

## Others

The superior sustainability of floating structures is not confined to energy related assets. Farm produce is more sustainable when grown on floating structures. Wind, sun and current are energies that can be harvested to support such farms and transporting farm produce in bulk is more energy efficient with barges than with trucks. Moreover, floating farms with water stored below deck are more resilient to floods and droughts.

Industrial plants and warehouses should be erected offshore so that they need not compete for land, especially in high density urban areas. For the same reasons, infrastructures such as ports and airports, shipyards, cruise centres, golf courses and university campuses are also good candidates for offshoring.

Urban decay, a pressing problem in cities from New York to Bombay, would be more manageable when cities are afloat than on land because structure can be removed, relocated and repurposed sustainably without resorting to the wrecker's ball or explosives. No building can be greener than one that is floating as it can last twice as long.

## Conclusion

A community that lives on the surface of water is more carbon neutral than its counterpart on land. Naval architects can and must expand their vision beyond their conventional horizon. They are well placed to take the lead in a movement to make better use of the seas around the world, as well as to combat climate change. *NA*

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