

# Floating Green Buildings and Towns



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**Abstract** Earth is covered about 71% of water and the remaining 29% is earth surface, about 96.5% of all earth water is held by oceans. In present days, there is a lot of noticeable changes in weather and climatic conditions, Global warming is the reason for such changes. The Global Warming affecting glaciers mountains on the earth's surface is melting and fused into regular water bodies. This results in an increase in water percentage of earth and simultaneously the percentage of living land is decreasing. Apart from this, the population of the world is increasing day to day. For human being survival existence, we should have land, in the future, the ease of access to earth will be minimal. In these typical future circumstances, the Floating Cities and Towns are being developed. The most common type of offshore platforms are fixed platforms, compliant tower, FPSO and Tension Leg Platform, VLFS, etc. The floating structures are more economical and convenient than the conventional structures. They are very economical easy to construct and repair. The main concept of these floating cities and towns is to assist humankind in future and we do know that green buildings are also being more prior in civil engineering field to diminish the effect on environment and keep a balanced ecology. In this paper, I would like to mention an ideology work that can make sustainable floating structures more sustainable and eco-friendlier by fusing the green building practices in floating buildings.

**Keywords** Global warming · Floating structures · TLP · FPSO · VLFS · Green buildings

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## 1 Introduction

In present days, the investigation of moderation arrangements with respect to handling the rising ocean's challenges has drastically expanded. In last few decades, concentrates on very large floating structures (VLFS) have been pulling in Architects, urban and city organizers, and structural designers as it has risen as a successful answer for handling the challenges of the rising ocean. History instructs that in earlier days there is a concept of offshore structures, through it the idea of design of floating cities and towns is carried out. Basically, offshore structures are used for Drilling or Extracting crude oil from the ocean beds, Thermal Power plants, and for Military basis. The idea of the offshore structure of submerged oil well platforms is started in 1891. The first offshore well drilling was started on September 9, 1947 in Gulf of Mexico, nearly more than 2300 offshore platforms have been erected in the Gulf of Mexico. The most common type of offshore platforms are fixed platforms, compliant tower, FPSO and Tension Leg Platform, VLFS, etc. This is part of human inventions. After passing of several years there were boathouses and restaurants later with the architect's modification in the designs of offshore structures to meet the requirements of mankind. The ideological evolution of floating residential buildings, shopping malls, stadium, and cities are been developed later on. In earlier days, oil companies have begun to use free-floating platforms, which does not need legs and tied through tetherings. They can be dynamically positioned, with ballast and buoyancy control by numerous propellers. The same concept is being used in floating cities except for the usage of propellers in cities or residential buildings may be limited instead of propellers they've to use mooring lines that connect both the buoyancy chamber and seabed to make it in a constant position, so that it can hold the wave motion. Here are some Floating communities and residential buildings around the world IJburg city, built-in 2012 offers 18,000 homes in 120 floating structures for 45,0000 people and creates around 12,000 jobs. IJburg has been the first city to make the largest community of floating houses. Floating villa in Dubai is named sea horse. Dubai is one of the cities in UAE country with lot of fascinating structures to build. Venice is also one of the best examples for floating cities, in such place the people live with the presence of water 24/7. All the buildings and structures are floating on the water with the help of wooden piles up to a depth of 60 feet. Such kind of place with a rapid increase of sea rise level (SRL) can be very accommodative and reasonable.



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The main part which play role in floating structure or residential buildings is the buoyancy chamber which opposes unexpected waves and moments that occurred due to waves. Mooring lines or tethers help to keep the structure at a constant place.

The floating cities have different favorable circumstances and helpful results that we can state as they secure the biological system by not harming the living animals of marines, likewise making development on the ocean level is quicker and simpler.

Green Buildings are also one of the precedence in civil engineering. In the floating building concept, there are lot of things that can be used as alternative which can be a substitute in the construction by meeting the required properties and allowing the structure to make more sustainable and also by using renewable energy to make it as a green building.

## 2 Literature Review

Numerous scientists had performed experiments on various elements of Floating structures and which helped to make improvements in the floating structures. Out of which some researches I would like to include in this paper.

Watanabe [1] gives a brief explanation about very large floating structures (VLFS), its application and considerations for various components like Mooring system, Breakwaters, floating body, and its working importance. Also mentioned about various load conditions, load effects, safety factors that to consider while designing the VLFS and also mentioned a few VLFS around the world which help to have a brief idea about VLFS.

Wang [2] in this paper scrutinizes VLFS developments regarding Human habitation that featured and discussed the hydroelastic response, structural integrity, and steady drift forces. The technological development of tethering system is explained and technological improvements to minimize the effects due to motion are discussed. All the improvements and developments made in VLFS resulted in reducing the hydroelastic response in the VLFS.

Kaviani [3] in this paper scrutinizes floating cities and energy supply. Various floating cities and different experimental works carried out on different countries in the world are described. And discussed various types of floating structures and suitability according to the requirement and local conditions. Authors also mention energy supply to floating cities and discussed conversational methods which help in energy supply like usage of turbines, conversion of ocean thermal energy into a potential source of energy supply.

EI-Shihy [4] in this paper discusses the Architectural design concept for floating structures and proposed various solutions for sea level rise (SLR) impacts. In this paper, authors showed the importance of design in the framework of self-sustaining, also mentioned two different architectural models of interconnecting platforms.

### **3 Floating Cities and Residential Plots Overview**

The intention of designing floating living hood is been so inevitable and fascinated about it. The importance of floating structures is gradually increasing with a gradual increase in sea level, increase in population and the availability of land is fewer at a particular area. All these factors are pushing mankind to perceive an alternate to sort out the issues. The floating structures were perceived, as way out and hence adopted the design of VLFS for the residential building from earlier days [5, 6]. While looking at its working principles, the whole structure is based on a ballast and buoyancy chamber with a moored line to minimize the unwanted moments. On exploring more in history there is the free-floating platform which being begun to use by oil companies, wherein they have use propellers to avoid the legs and mooring lines, which is very helpfull in cost-cutting and work synonyms to other. The advantages of a free-floating platform are that it can run like a ship, positions themselves as off structure.

### **4 Methodology**

The main aspect that needs to be considered before the designing of floating structures is to study deeply about the sea or ocean data about waves and sea rise levels and drops for the past few years. Then on the basis of analysis of available data and understanding the client's need, one shall go for design of residential floating building. One needs to keep in mind that VLFS design process may not be exactly applicable while designing the small structure like residential floating building. In residential floating building, the aspects to be considered are structure type, platform size and keep building closure to the shore. Also being a smaller platform the wave motion effect on the structure can be more, so its effect could be avoided by wave-motion breakwater [1].

The main governing parts of the floating structures are pontoon, legs, and mooring lines. Some to cut the cost of the structure they used propeller as an alternative for legs. As we see some time there will be practical differences in carrying out the work according to the design, in such cases, the propeller can be used. By using propellers, the floating structure can be dynamically positioned.

## 5 Discussion and Future Scope of Work

Floating structures are sustainable and eco-friendly structure as an offshore structure. Once we use the floating structure as residential building then there will be a lot of payout need for constructions, electricity, ventilation, etc. Since the erection of structure is carried on the sea, the cost of construction of floating buildings will be high, carrying electricity and some other necessary facilities will be a tough job and also the maintenance of it can be difficult.

Hence to make floating building structure self-sustainable and eco-friendly, the inclusion of various practices of green building is helpful like utilizing the renewable power and using recycling materials in the design. There are various alternatives like using waste material which can meet the requirements in constructions of floating buildings, Eco-wave powering, rainwater harvesting, etc., which can be utilized to make floating building as sustainable structure.

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