Strengthening Private Sector Participation and Investment in Physical Infrastructure

Asian Development Bank Institute, 19-22 November 2007, Tokyo

"Bankable Deals" - What Does It Take?

Session 9 : Ports and Airports

Floating and Modular Infrastructure

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Introduction to Floating and Modular Infrastructure

What is floating and modular infrastructure ?

- Floating and Modular infrastructure might appear to be an anomalous subject in conference session on Ports and Airports
- However, there are several examples of floating ports and airports
- Floating Infrastructure is proposed not only for ports and airports but also for many other types of PPP projects for physical infrastructure :
  - central and distributed power generation,
  - housing, health and community services
  - manufacturing sites
  - storage sites
  - can even use floating bridges

Why should we re-think floating infrastructure in Asia ?

Confluence of critical factors and opportunities :

1) Environmental urgency of flood risk and of sea level rise
2) New marine technologies derived from 40 years offshore oil experience, including use of advanced concrete and off-site manufacturing speeds delivery and uses local capacities
3) New opportunities to apply conventional ship-financing structures

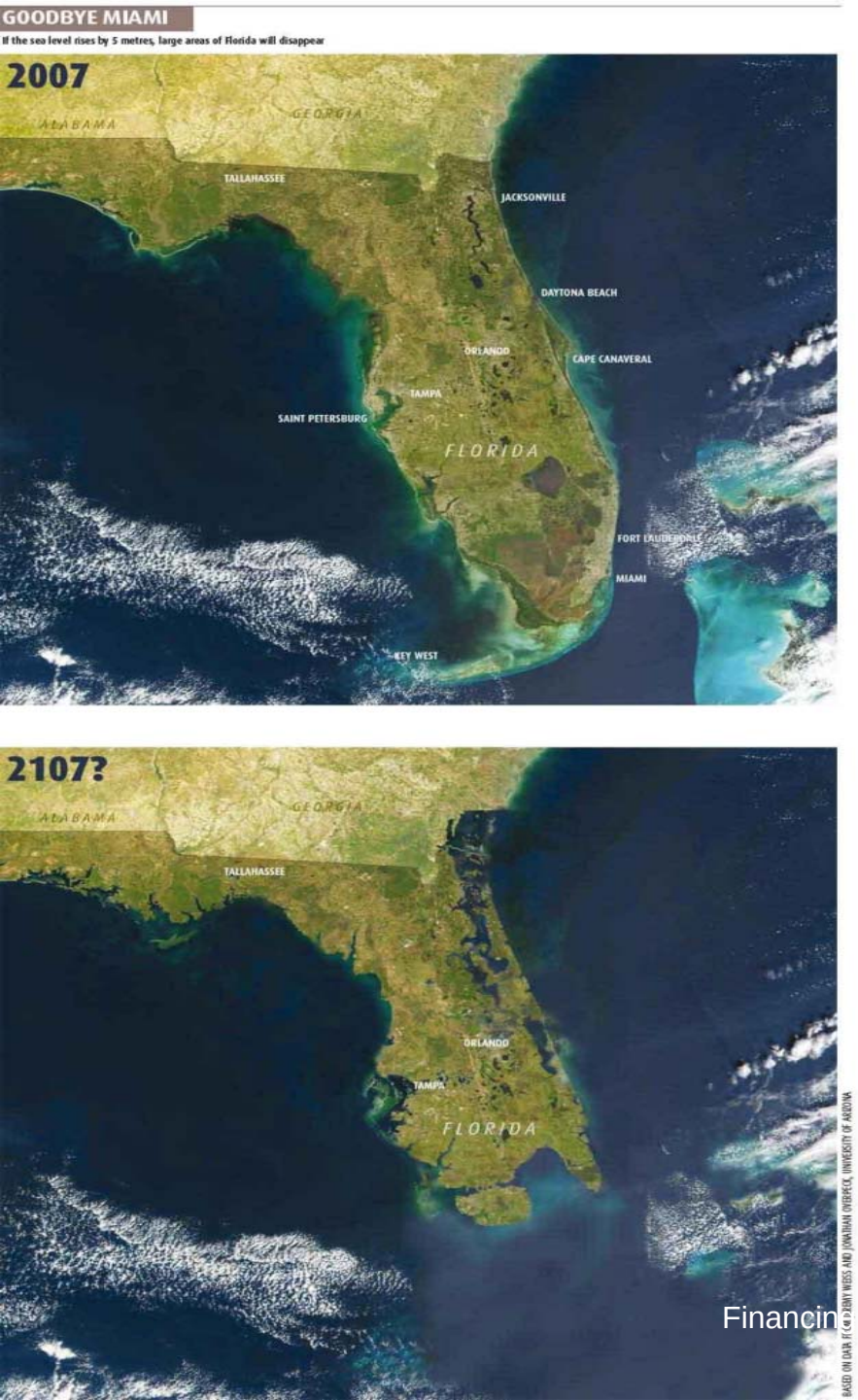
These changes enhance opportunities for PPP infrastructure projects

Floating Infrastructure

1. Environmental Urgency for Floating and Modular Infrastructure

Environmental Urgency for Floating Infrastructure

- Look at Bangladesh suffering again
- UN Intergovernmental Panel on Climate Change (November 18) even more alarming than Stern report
- New UN policy to come from Bali Conference December 2007
- Problem not only flooding but also
  - land shortage and consequent high prices for public infrastructure in many cities and small island countries
  - seismic instability and consequent costs of land-based infrastructure (this has stimulated floating infrastructure R&D in Japan)
- ADB report warns mega-cities in Asia face serious disruption due to flooding from higher sea levels (e.g. Bangkok, Manila, Karachi, Djakarta, Calcutta, Dhaka, Ho Chi Minh City, Yangon, Shanghai)
- 2 % world's land surface is less than 10 metres above the mid-tide sea level - but, home to 10% of world's population and much higher percentage of valuable property, physical and institutional infrastructure
- 5-metre rise would inundate large parts of many cities (New York, London, Sydney, Vancouver, Mumbai, Shanghai, Tokyo) and leave surrounding areas vulnerable to storm surges. In Bangladesh, West Bengal, Asia-Pacific small island states, Florida, Louisiana, Netherlands, whole regions, cities and countries may vanish.


GOODBYE MIAMI
If the sea level rises by 5 metres, large areas of Florida will disappear
2007
ALABAMA
GEORGIA
TALLAHASSEE
JACKSONVILLE
DAYTONA BEACH
ORLANDO
CAPE CANAVERAL
TAMPA
SAINT PETERSBURG
FLORIDA
FORT LAUDERDALE
MIAMI
KEY WEST
2107?
ALABAMA
GEORGIA
TALLAHASSEE
ORLANDO
TAMPA
FLORIDA
BASED ON DATA FROM JEREMY WEISS AND JONATHAN OVERPECK, UNIVERSITY OF ARIZONA


GOODBYE TO THE LOW COUNTRIES
A 5-metre sea-level rise would submerge large parts of north-west Europe
2007
NETHERLANDS
ENGLAND
BELGIUM
FRANCE
2107?
BASED ON DATA FROM JEREMY WEISS AND JONATHAN OVERPECK, UNIVERSITY OF ARIZONA

Modular Infrastructure

Modularisation allows all types of structures to be constructed in an easily transportable, container compatible unit that can easily be built in a large number of locations and transported using standard gauge facilities.

This also allows the producers/owners/investors to retain ownership and therefore additional security and potential investment benefits in their own countries. This can be very important in producing additional risk mitigation and/or credit enhancement.

The direct ownership of the asset can indeed been insured by foreign direct investment or private investment corporation insurance (Opic in USA and other OECD and Chinese Credit Insurance Agencies.

The construction of modular assets can be undertaken in a number of locations so that multi national consortia can jointly construct major infrastructure and production units.- spreading risk and finance sources

Floating Infrastructure

2. New Marine Technologies for Floating Infrastructure

New Marine Technologies for Floating Infrastructure

- Offshore oil construction technology now has over 50 years experience in very aggressive and deepwater marine environments – this expertise can be harnessed for other forms of physical infrastructure

- Floating infrastructure has been used for many years (Mulberry Harbour 1944, power barges, hospital ships) but new technologies provide new frontiers for application to PPP infrastructure projects – extending but not replacing land-based infrastructure

- Also used for emergency infrastructure for disaster relief (in 2000, Japanese government constructed three floating structures in Tokyo,Nagoya,and Osaka as part of package of disaster countermeasures, based on disruption to land route supplies after Kobe earthquake)

- Key technologies are :
  - Conventional steel and concrete barge-based infrastructure
  - New concrete technologies mean concrete is as strong as steel to extend use of concrete floating structures (and enable special financing structures)
  - New designs for steel and concrete barges and ships
  - New Very Large Floating Structure (Mega-Float) technology which forms new frontier for floating infrastructure

Very Large Floating Structure (VLFS) Technologies

VLFS are larger than biggest ships for offshore storage platforms, floating airports etc. Examples are :

-prototype floating airport Tokyo

-- proposed floating container terminal, Kamigoto

- oil storage facility, Nagasaki

- Shirasima oil storage facility at Kitakyusyu, Japan.

Very Large Floating Structure (VLFS) Technologies

VLFS are floating structures with at least one dimension greater than 60 m. typically consisting of :

- very large pontoon floating structure/s

- mooring facility to keep floating structure in place

- access bridge or floating road to shore

- breakwater (usually needed if the significant wave height is

greater than 4 m)

Very Large Floating Structure (VLFS) Technologies

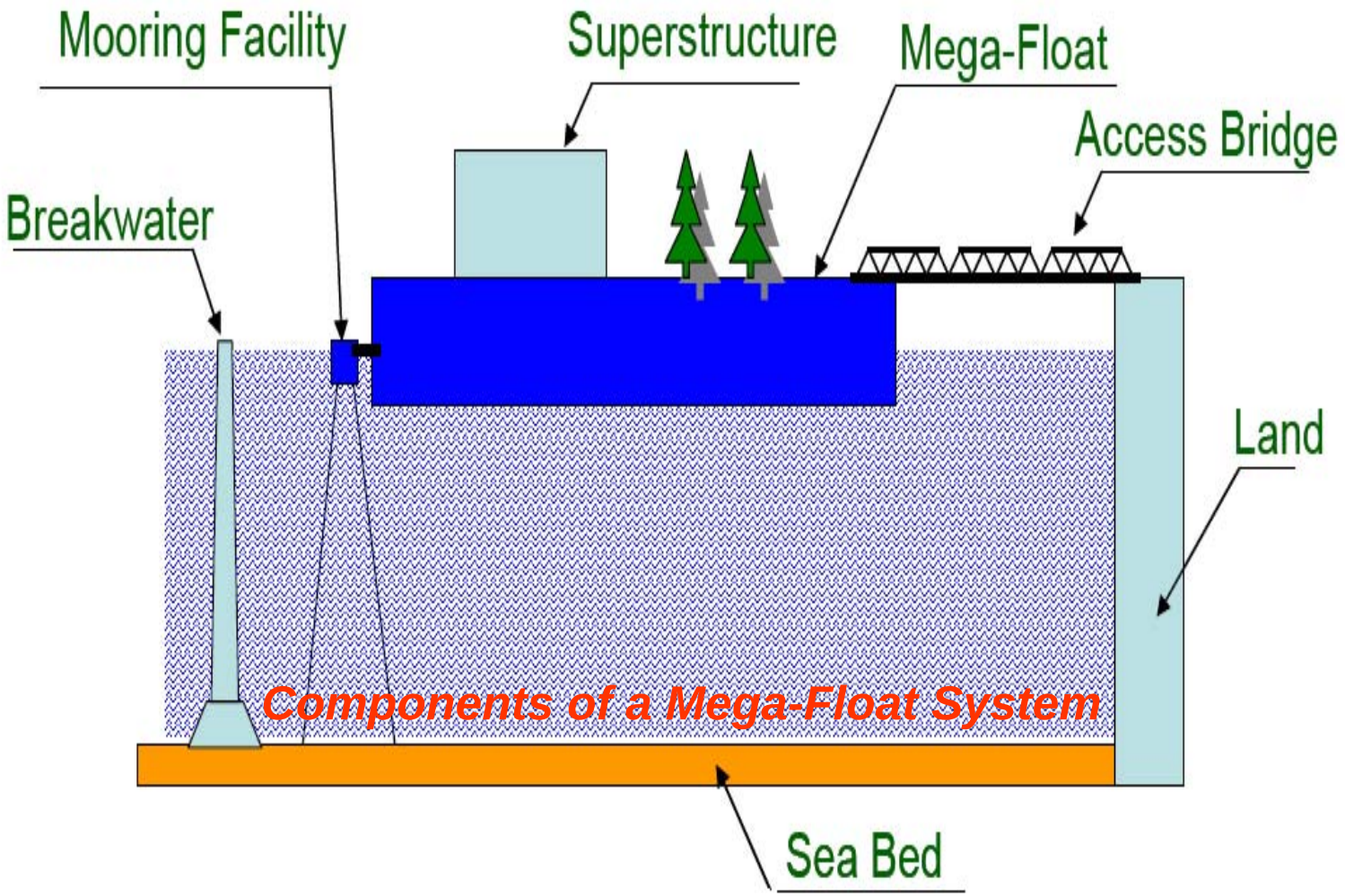
Special advantages of VLFS technology :

- **cost effective when water depth is great (note cost of imported sand for land reclamation in some countries has risen significantly),**
- **environmental friendly (do not damage marine eco-system, nor silt-up deep harbours nor disrupt tidal/ocean currents,**
- **easy and fast to construct (components may be fabricated at different shipyards / construction yards then brought to site for assembly)**
- **easily removed (if sea space needed in future)**
- **or expanded (since they are modular form),**
- **protected from seismic shocks since inherently base isolated,**
- **do not suffer from differential settlement due to reclaimed soil consolidation,**
- **positions with respect to the water surface are constant facilitate small**

boats and ships to come alongside when used as piers and berths.

- **location in coastal waters provide scenic body of water all around, making them environmentally scenic and suitable for tourism areas.**

Very Large Floating Structure (VLFS) Technologies



Floating Infrastructure

3. New Opportunities for Financing Floating Infrastructure

Financing Floating Structures

The major new advance is that floating concrete structures (barges, rafts) can now be fully classified by the Classification Societies for Ships. This forms a new financing frontier especially for conventional floating structures like power barges. Now can be applied to many types of floating structures – even centre-spans of bridges.

Previously a concrete structure was not covered under the rules for ship construction, with the result that there was no procedure for registering them as ships during both the construction period and the post-delivery period.

The Classification Societies have now agreed to introduce a special classification for concrete vessels with the result that a large variety of the floating concrete structures can now be registered.

This will allow these concrete structures/vessels to be financed on the basis that they can be registered under the flag of an acceptable jurisdiction and therefore mortgaged. The ability to mortgage the vessel during construction and post delivery allows the vessels to achieve a much wider range of design capabilities than previously calculated.

In turn the ship can be registered for investment and tax purposed in a number of different jurisdictions with a number of attractive financing structures and possibilities, including export credit for construction, alternative location and use to reduce risk and insurance costs

Financing Floating Structures

Previously there was no structure for registering a mortgage where there were no deeds to the property on which the house/dwelling was built. If the structure was in steel it could have been registered as a ship - but not for concrete.
The pioneers of floating structures had to wait 2 – 5 years to raise finance. This is no longer necessary under the new classifications system because financing can be done under International law by registering the vessel under a flag of convenience such as Panama or the Cayman Islands or other appropriate registers.
This is an example of the necessity for regulatory flexibility and the importance of establishing a useful and workable legal environment to attract private investment.

Financing Floating Structures

- International Marine Flotation Systems, British Columbia, developed floating concrete island as the foundation for 500 homes.

- Previously could not get mortgages, insurance, building permits, environmental approvals, etc. for homes floating on water because building and regulating authorities did not understand the concept

- Developer succeeded in persuading more than 30 regulatory bodies, from building inspectors to fire departments, to mortgage lenders, that it could be done within their regulations
- This would no longer be necessary in this way with a simple internationally recognised registration system
- Such a system can be used to enhance infrastructure finance

FLOATING HARBOUR

In 1944 a complete “Mulberry” harbour was constructed out of 600,000 tons of concrete between 33 jetties, and had 10 miles (15 km) of floating roadways to land armies of men and vehicles on the Normandy beach

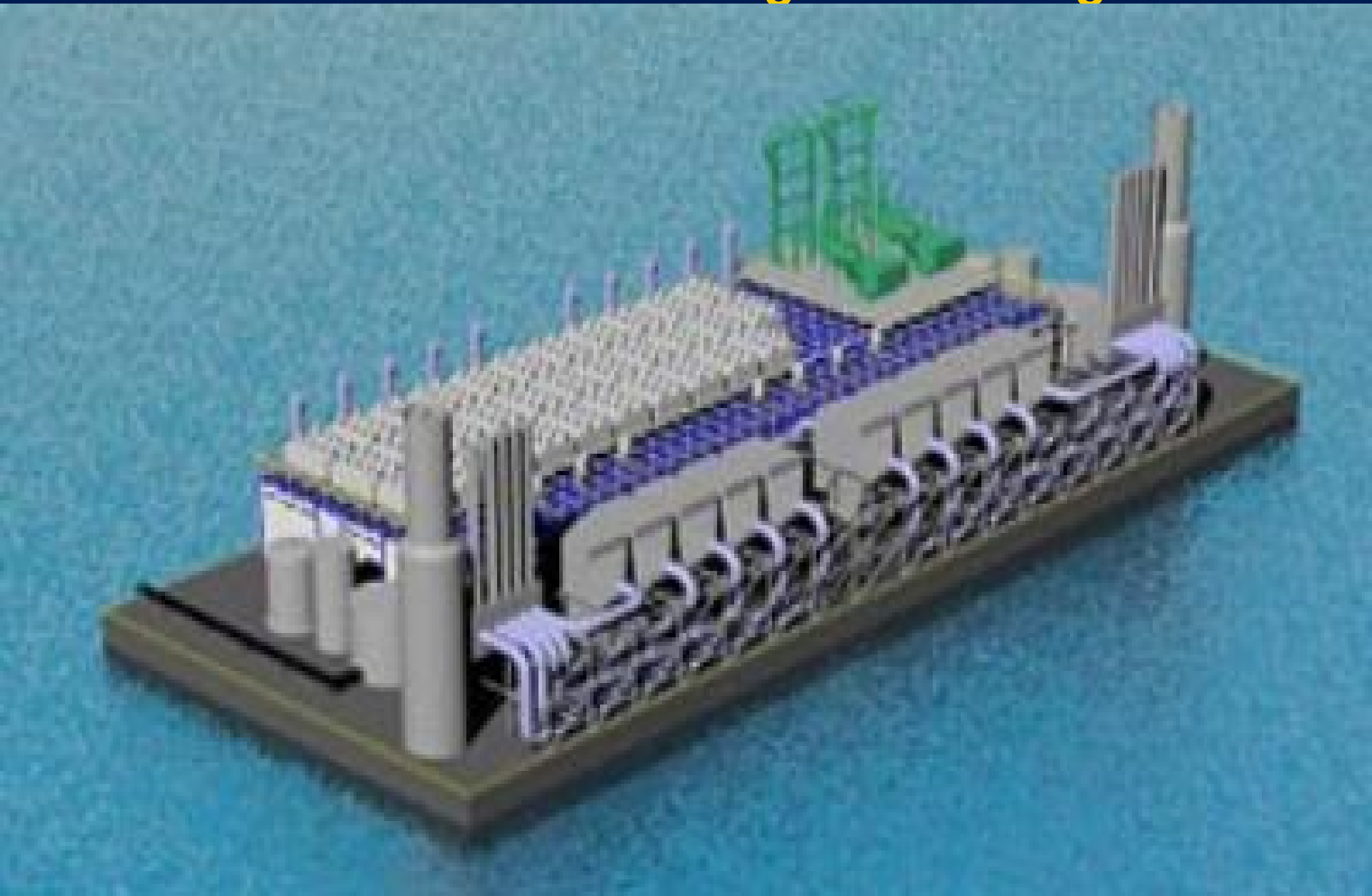
Most of the concrete caissons were manufactured on the River Thames and the River Clyde in some cases using hastily constructed dry docks.

2 blocks of the Mulberry Harbour

each weighing 6,000 tons

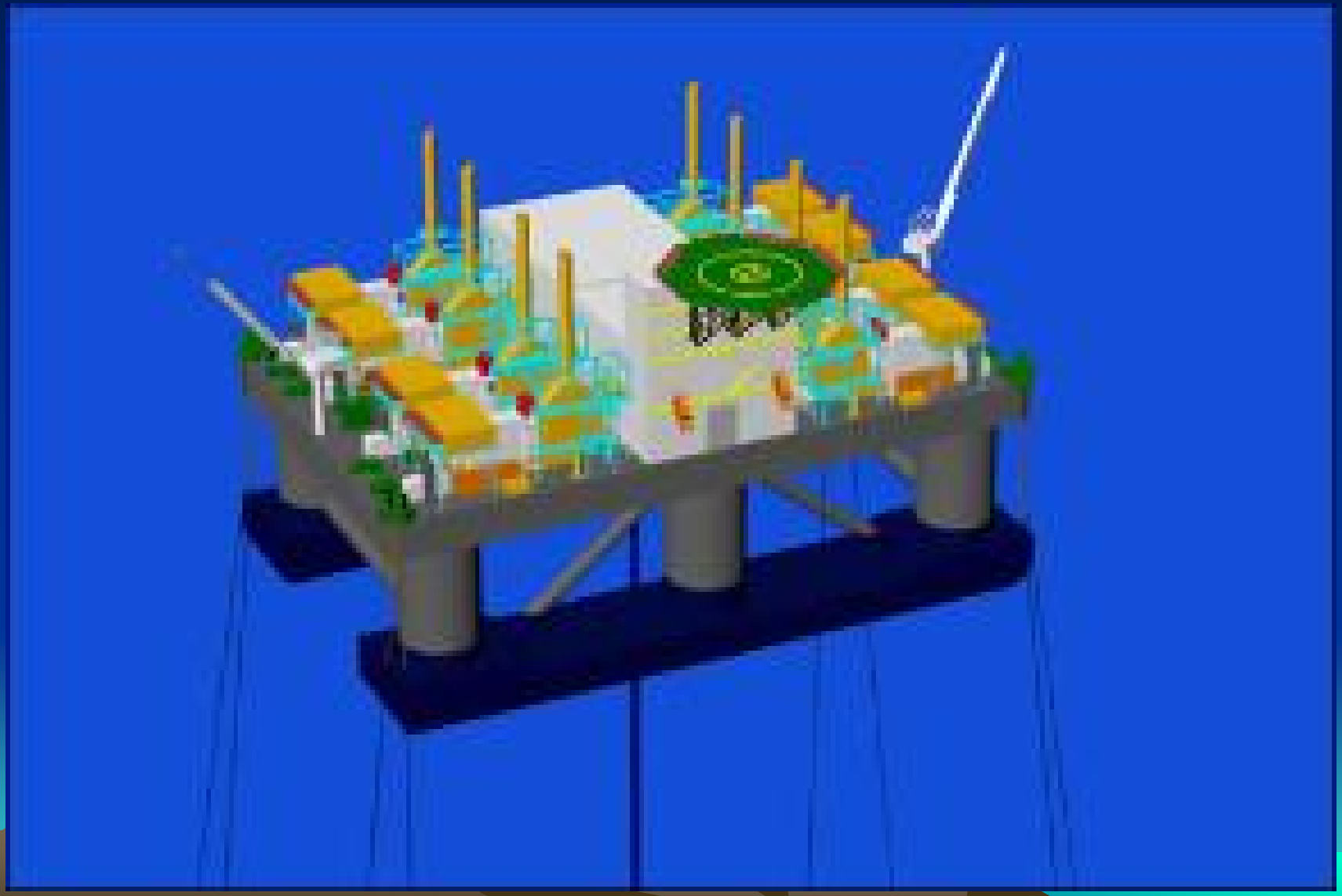
Floating Tokyo Airport

Conventional Floating Power Barge



Delivery of Large Floating Power Barge by Heavy Lift Float-On Float-Off (Flo-Flo) Ships

VLFS Power Plant based on Offshore Oil Rig



VLFS for industrial infrastructure

Visions of the Future - Floating City – Huangpu River - Shanghai

A team of Dutch designers recently revealed a plan to build a floating city on Shanghai's Huangpu River.

City will debut during World Expo Shanghai 2010.

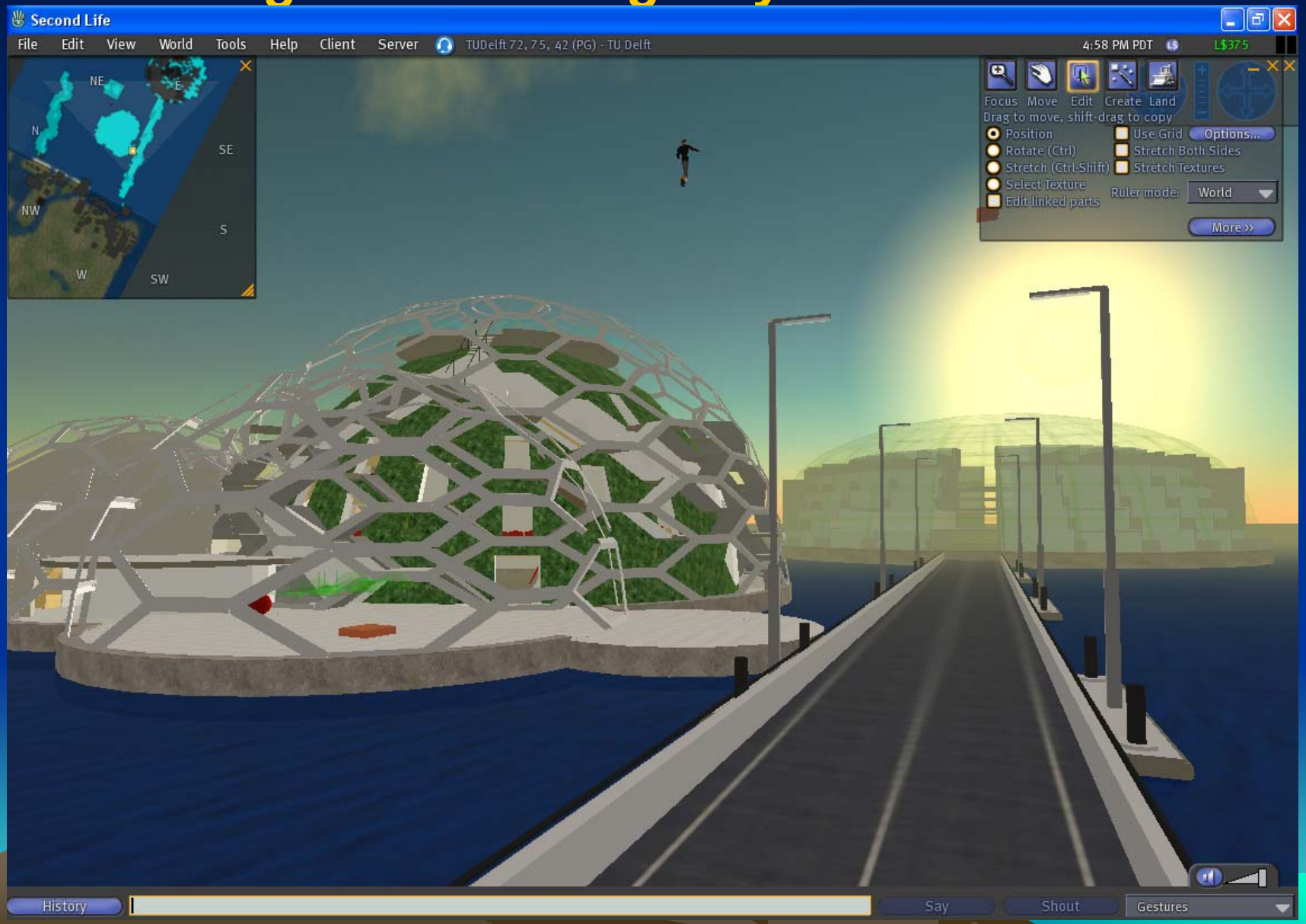
The floating city will have many green elements — it will use the water of the river for cooling and it the city will make use of renewable energy.

However sewage treatment and impact on the river environment must be addressed.

The model has five honeycomb-like balls, one big one surrounded by four smaller ones, functioning as a 3D cinema, pubs, a shopping mall and theater. The biggest honeycomb will have a restaurant at the top floor 80 meters above the river.

Visions for the Future - Floating City – Huangpu River - Shanghai

Design for Floating City - Netherlands

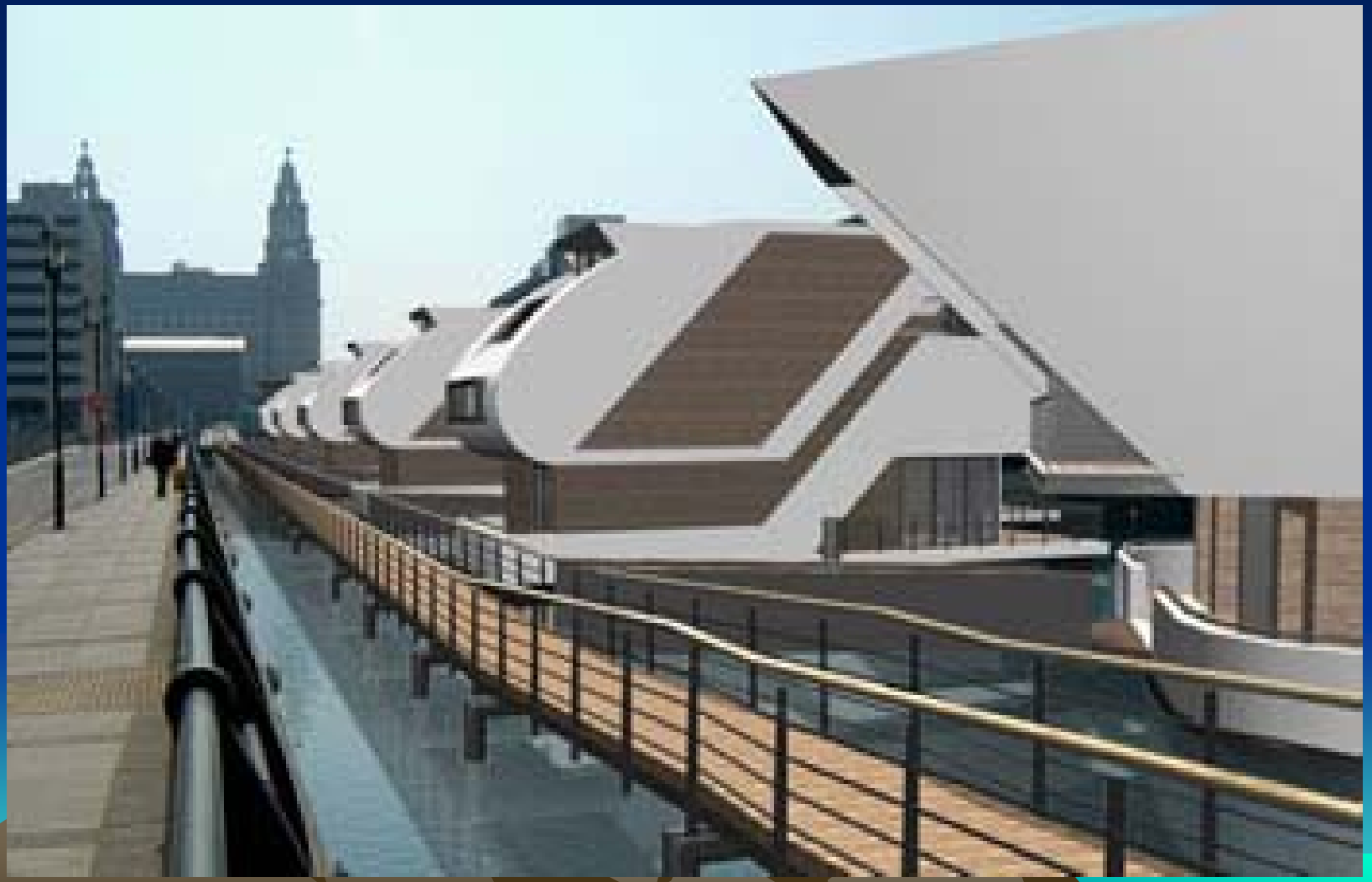


Visions of the Future – Floating Cities

Floating Community Infrastructure – Mosues in Dubai

Controversial but Feasible – Russian floating nuclear power plant

Floating Houses (executive quality)



Floating Housing (Residential and Tourist Development

The End

THANK YOU FOR YOUR ATTENTION, QUESTIONS AND COMMENTS

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