

## Expert's Corner Paper 2019-03

### How the Megaprojects of the 21st Century Will Be Environmental Projects

by Sylvain Richer de Forges

*Since the industrial revolution, megaprojects have been largely synonymous with mining, transportation (e.g. tunnels, bridges, roads) and energy infrastructures. However, this is about to shift to an era where the next generation of Large Complex Projects will be environmental-related. This area is also where future (or imminent) significant funding and business opportunities will be generated. In this Expert Paper we investigate what this shift means for megaprojects in the 21<sup>st</sup> century.*

#### What is a Large Complex Project (LCP)?

While a multitude of construction projects are taking place around the world at any given time, a handful of them is large and complex. Typically, large complex projects would be defined as operating on very significant budgets (not uncommonly in the USD billion-dollar range), large in scale, technologically and logistically challenging. Currently, projects falling under this category may include large bridges, tunnels, energy power plants, petrochemical infrastructures, highways, railways, mining sites, piping installations, roads or, as a matter of fact, any other projects where complexity stems from their very large scale.

#### Why environmental megaprojects are set to increase significantly

It is a fact that environmental issues are on the rise and the consequences of inaction are becoming more and more apparent. While climate change negotiations have and still are lagging on global actions to take, the level of warnings is unequivocal.

Increased frequency of heatwaves, major storms, major drought... The signs could not be clearer and well in line with predictive climate models made over 20 years ago.

This increase in natural disasters which can only get worse as we progress throughout the century will also drive unprecedented demand for mega engineering projects, on a scale that has never been seen before, to cope with serious environmental risks.

The Panama Canal, the English Channel Tunnel or the Five Gorges Dam, all which have their names on the hall of fame of megaprojects, will seem small in comparison

to the scale of engineering mega projects that will be required to cope with global change throughout this century. If we are going to have to protect island nations or entire stretches of coastlines we are talking about projects that will be visible from space on the scale of the Great Wall of China!

#### Type of Environmental megaprojects that will be required

While the type of projects required will need to be adapted depending on the locations, there are obvious trends that we no longer can afford to ignore:

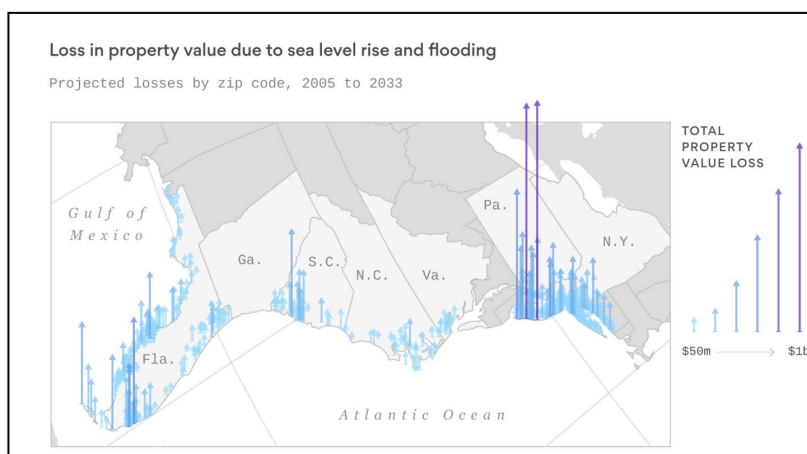
A common characteristic of those projects is that they do impact the community more than conventional megaprojects and therefore, stakeholder involvement and political considerations are more important.

#### Megatrend 1: protective infrastructures for sea level rising.

This element will be the main challenge facing many cities throughout the world. The threat originates on two fronts: first, as the climate continues to warm, thermal

expansion and ice melt will induce significant sea-level rise. Secondly, the global population is rapidly becoming predominantly urbanized. Both of these will drive a serious demand for large scale coastal cities protective actions. When we talk about sea-level rise preventive infrastructures it can relate to a diversified

range of solutions including giant sea walls, raising coastline highs through land reclamation, some dams and canal technologies, giant pumping stations...



**Source: [First Street Foundation](#) *Megatrend 2: Renewable energy mega factories.***

While the era of fossil fuels is coming to an end, the demand for alternative energies of various types is set to increase significantly in a race for a low carbon economy.

These projects will include gigantic solar farms, onshore and offshore wind farms and other types of lower carbon energy coming into the mix. It is expected that different countries will adopt different solutions which are most tailored to their needs and resources. Those projects often differ from current powerplant projects by their wider footprint and the need to integrate them better into the landscape

**Global environmental deteriorations will create significant risks, they will also create opportunities which in the end will become an integral part of the solution in the form of Megaprojects**

***Megatrend 3: subterranean infrastructures.***

It is expected that significant subterranean infrastructures will be required ranging from giant canals to drain water on a massive scale to the need for new urban energy efficient infrastructures. A good example is the flood prevention subterranean infrastructure of Kuala Lumpur which is already in existence. Improvements in tunnelling technologies learnt from current tunnel mega projects will be required.

***Megatrend 4: water and waste technologies and infrastructure.***

Access to freshwater, treatment of waste-water and adequate management and recycling of all sorts of waste will become a significant issue and protecting existing resources and accessing new ones through technology will require large scale and ingenious technology.

**A trend for national defensive actions rather than global collaboration**

While a clear failure can be observed to make the necessary changes on a global level through international political agreements, some governments are already taking actions into their own hands. For instance just last month the Prime Minister of the Republic of Singapore announced during his annual address to the nation that the cost of mitigating the impacts of climate change on the island from aspects such as sea-level rise would require the imminent set-up of an SGD 100 billion fund and that mega projects such as the constructions of dams, sea walls and land reclamation should start today and continue through a long term deployment plan that will span the next 50 years with annual reviews.

Certain countries like Singapore are now putting climate change on the same level as national security as highlighted by the fact that Singapore's National Climate Change Committee falls under the Prime Minister's

office, and this is a very significant mindset shift in itself! The latest is not the result of some sudden environment realization but strong policy resulting from years of impact research and a lot of government money spent. In other words, Singapore politicians seem to agree that action on climate change-related impacts to come are an absolute survival necessity. The Singapore case study should both serve as an example and a warning to the world. Countries do not plan this kind of funding and strategic development

without strong reasons...

Similarly, the city of Jakarta which is sinking has already established plans to build a giant sea wall megaproject as with Venice in Italy. Concurrently, Monaco is starting the construction of giant floating suburbs to extend its limited land but also to deal with rising sea levels. There are many other similar serious environmental engineering mitigation projects which are either already occurring or in the definition stage and this is just a beginning.

Preventing the worst effects of climate change, while still possible, through international policy in cutting down Greenhouse Gas emissions will no longer prevent very significant and impactful changes from occurring throughout the century. The only option is now adaptation which needs to start now, and this will only be possible through LCPs tailored to environmental engineering.

But how much is all this going to cost and who is going to fund these megaprojects?

**A possible funding mechanism**

As the cost of financing such projects will be tremendous and take a heavy toll on the global economy, it is expected that at some point this century most LCPs will be environment-related should it be in energy infrastructures (renewables), coastal engineering or others.

Funding this type of projects in the 100s of billion range over a relatively short period will be very challenging for global and national economies.

The strategies of trying to convince stakeholders to invest for future generations to prevent the impacts to come does not work well enough. Despite actions to date from a few development banks, the private sector and financial institutions still predominantly only provides funding for short terms and high return on interest projects.

**Case Studies**

Perhaps the solution is to find a way to finance projects for the long term while also benefiting current needs and generating profits. Below are some examples of this short-long term approach applied to LCPs:



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Case study 1: Singapore has developed a unique dam to close the Marina Bay: The Marina Barrage. This project has several benefits that include transforming the original bay seawater into a large additional freshwater reservoir and protecting the coastline against sea-level rise. While clearly planned for the long term (protecting the cost lines and providing additional water security), the project was also developed with many short terms benefits in mind which includes: a water history museum located within the dam regularly visited, playgrounds for family getaway, a range of facilities for food and beverages and shops. In other words, this long-term development has been integrated with facilities where activities prosper and overtime help to pay back the cost of the development.

Case study 2: *Cleveland City Planning Division* has developed ecological corridors to enable the migration of wildlife. While this project in itself would have been difficult to fund, the developer has incorporated a range of community infrastructures such as cycling lanes, children playground and sports facilities. The latest has driven a lot of interest and funding for the project considering that these infrastructures also benefit the needs of the current communities.

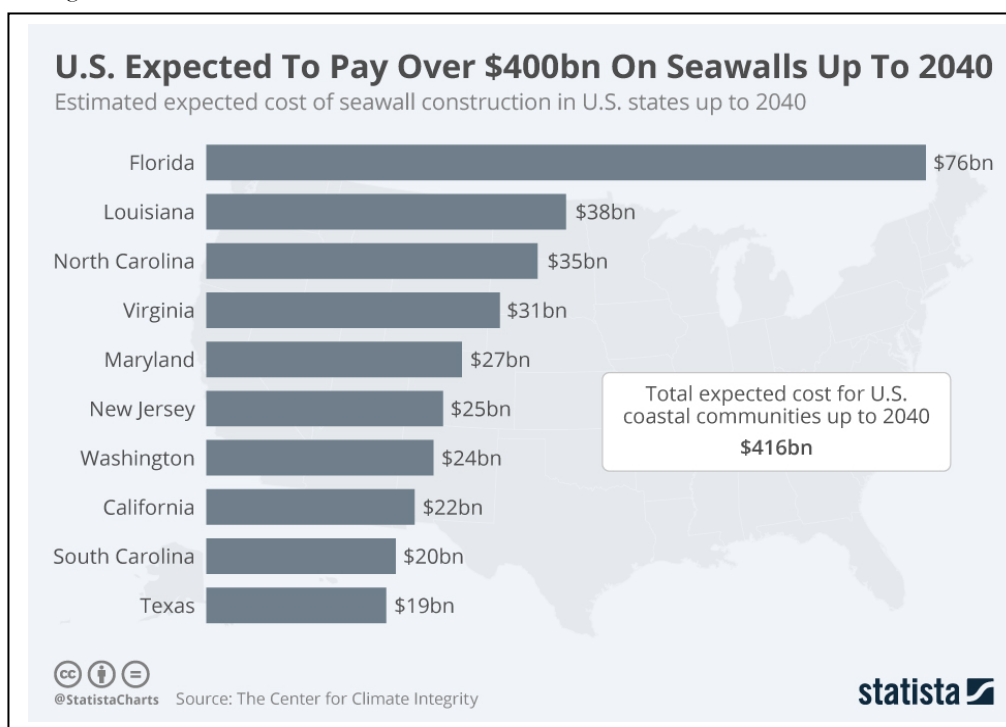
To fund projects of this scale it is primordial that short term goals be incorporated within the longer-term agenda.

### **Conclusion: A significant challenge but also an unprecedented opportunity**

In the end, while global environmental deteriorations will continue to occur throughout the century and create significant risks, they will also create opportunities which will become an integral part of the solution.

The LCPs that, for now, are mostly tailored at improving our way of life will shift at some point to become predominantly protective measures against mounting environmental risks.

The cost of financing these projects will be tremendous but if we start to incorporate a short-long term approach to financing these mega infrastructures this would give us a significant head start.



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