

# Uncovering the Underground



Source: Jurong Rock Caverns

“We have to see how to make good use of underground spaces. Having been involved with underground space development, I see the challenges. Without a clear plan, it’s going to be a struggle in time to come. Right now, we’re already facing a struggle, not (for) engineering solutions, but because you have to spend more and the risks are higher when you have to navigate a new structure amid the existing structures.”

**- Prof Yong Kwet Yew**

Could Singapore become more liveable if transport networks, industries and infrastructure were shifted underground? This future prospect was raised by civil engineering professor Yong Kwet Yew at the recent CLC lecture and panel discussion “Uncovering the Underground”.

Outlining his vision of Singapore in the next 50 years, the National University of Singapore professor imagined a city where many developments have moved below the surface, including roads, services, reservoirs and even commercial spaces.



Prof Yong believes that Singapore currently has the capability and technology to shift heavy and pollutive industrial utilities underground to free up land above for living and recreation.  
Source: Jurong Rock Caverns

"It's all about liveability. At some point, we're going to run out of (surface) space. If you want a better quality of life, put environmentally unfriendly, polluting, noisy industries and infrastructure underground," explained Prof Yong who co-chairs the Ministry of National Development-National Research Foundation's research and development committee on land and liveability.

While underground space development was a key strategy put forward by Singapore's 2008 Inter-Ministerial Committee on Sustainable Development, Prof Yong noted that the city was "far behind the global curve" in using them.

"From an engineering perspective, there's really no limit to underground space (construction), including areas under the seabed. The limit often lies in the economic and commercial viability of the project," he said.

But this is a matter of perspective. "Bear in mind though that when land prices get expensive, it makes sense to go as high as you can and as low as you can. The higher costs are also compensated by savings on facades, and studies have shown that (underground spaces) can have lower energy consumption as well," added Prof Yong. "We should see the higher costs as a trade-off with a better environment."

While Singapore already uses underground tunnels for many of its infrastructure and services, this can be done even more efficiently with a "mother of all tunnels" instead of housing them separately today. "You would only need to find the right depth that meets all the requirements and do the tunnelling once. But this needs to be done early, at the planning stage, even before we need it," he explained.

Over the last decade, the Singapore government has been gearing up for the development of underground spaces. Fellow panellist Adele Tan, who is the group director of strategic planning at the Urban Redevelopment Authority (URA), shared that the government has been organising data on the city's underground spaces and geology, including building virtual models. Its aim is to put things underground where it is "meaningful and feasible". For instance, when it helps optimise the use of the city's limited land, improve the quality of the urban environment above-ground or enhance connectivity. Other reasons include if it is safer or makes the infrastructure more resilient.

"Broadly, we are prioritising (for underground spaces) utilities, transport, storage and industrial facilities," said Tan. "Our priority is to make sure that the above-ground is a very good quality living environment for people to enjoy, and we put the infrastructure underground to make the city work."

This shift in planning is being felt on the ground, said panellist Peter Stones from engineering firm Arup. The senior engineer has encountered an increasing number of new estates and business district that require considerations for their underground spaces.

"(Technologically), we're at that tipping point where we can handle the complexity of underground space, such as the geology, the existing structures, the interwoven mess of utilities," said Stones. We can start to handle and visualise it, and that's a key differentiator now versus 10, 15 years ago. We're at an opportune moment in our path of underground space use."

The social and ecological impact of underground space development was also discussed during the panel moderated by Dr Hossein Rezai of the Singapore-Milan Research Lab. Prof Yong noted the importance of hearing diverse perspectives before embarking on a project and cited the recent proposal for an underground rail line to go under Singapore's Central Catchment Nature Reserve. Discussions with environmentalists and groups like the Nature Society opened up another dimension regarding the impact of an underground space on nature and wildlife.

"We learned about the flora and fauna that was important to protect, and it was through that dialogue that we start to see how to do things better and try to protect the environment through engineering solutions," he said.



Source: Centre for Liveable Cities

### About CLC

The Centre for Liveable Cities was set up in 2008 by the Ministry of National Development and the Ministry of the Environment and Water Resources, based on a strategic blueprint developed by Singapore’s Inter-Ministerial Committee on Sustainable Development. Guided by its mission to distil, create and share knowledge on liveable and sustainable cities, the Centre’s work spans four main areas - Research, Capability Development, Knowledge Platforms and Advisory. The CLC Lecture Series is a platform for urban experts to share their knowledge with other practitioners. For more information, please visit us at <http://www.clc.gov.sg>

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