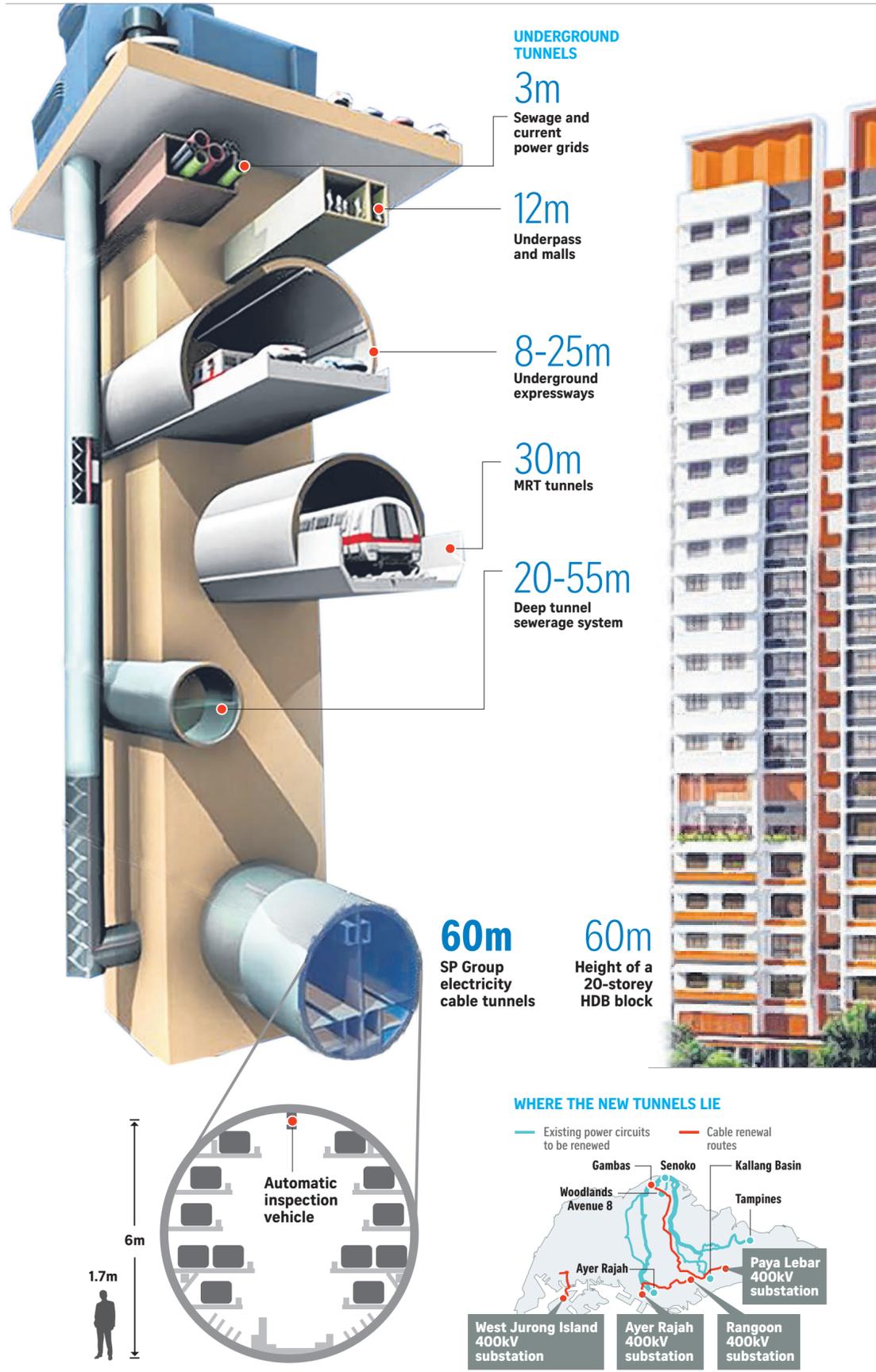


Singapore's deepest tunnel system

The Underground Transmission Cable Tunnel Project will safeguard Singapore's electricity supply network for the future. It will begin operations by the end of next year. ST illustrates the key points of this \$2.4 billion engineering feat.



Robots on the lookout for water leaks and fires

Automatic inspection vehicles will be traversing the length of the 40km tunnels

Jose Hong

Singapore's new electricity supply tunnels have the latest high-tech sensors to detect water seepage, fires and infiltration that could harm the electricity network.

Robots, or automatic inspection vehicles (AIVs), traversing the length of the 40km tunnels, will look out for changes in the colour of the concrete walls, a warning sign for water leaks.

Mr Michael Chin, managing director of infrastructure and projects at energy utility company SP Group, said yesterday that water leaks are the most common problem in tunnels, and AIVs can detect concrete patches that suddenly turn a different colour.

He said the AIVs will also eventually be able to detect fires using infrared cameras.

Each of the three tunnels also has a firefighting system that uses a superior "water mist system", instead of sprinklers, said Mr Chin.

He explained that the system shoots very fine water mist which evaporates faster and removes heat quickly from fire. The water mist also displaces air and suffocates the flames.

Smoke particles will dissolve into the fine water droplets and sink, leaving a fine mist and making it safe for firefighters to enter the tunnel to put out the fire, said Mr Chin.

The system also sends an alarm signal to the Singapore Civil Defence Force.

Another set of sensors in the tunnels can detect pollutants and abnormal concentrations of gases.

Most parts of the multibillion-dollar Underground Transmission Cable Tunnel Project are about 60m beneath the earth, but some will be at 80m, making the electricity project one of the world's deepest.

The tunnels - named the North-South, East-West and Jurong Island-Pioneer tunnels - will be able to house 1,200km of extra-high-voltage cables. Singaporeans will begin tapping this source from next year, said SP Group yesterday.

About 500km of cables will be laid, which is less than half the capacity of the tunnels.

There will be 17 equipment buildings spanning the 40km network, and each of them will have two electric bicycles to allow staff to quickly move to parts of the tunnels that require attention.

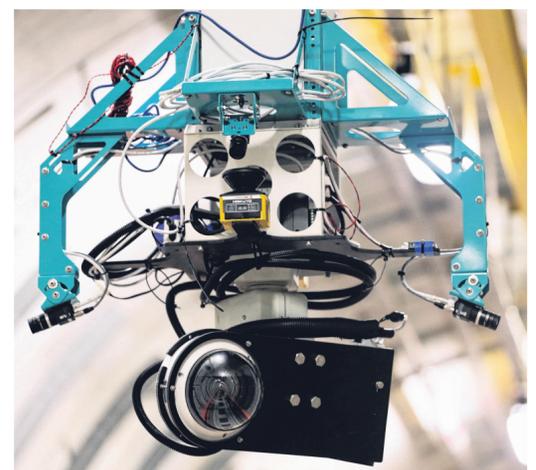
Mr Chin said that anyone trying to enter the tunnels will need to break through three layers of security at the equipment buildings.

"All these systems protect the cables and the people working in the tunnel and so, in the long run, maintain the reliability of the system," he said.

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SCAN TO WATCH
A walk through the underground tunnels.
<http://str.sg/tunnels>



A prototype of the automatic inspection vehicle that will be used to detect water seepage and fires in the tunnel system. PHOTO: LIANHE ZAOBAO

FACTS AND FIGURES

3 tunnels, 21 shafts, 40km long tunnel

60-80m deep

High-tech protection

There are only 17 entry points to the tunnel, and each of them has three levels of security and surveillance cameras. The tunnels also have systems that protect against fire and water seepage.

Long-term planning

There is space to lay 1,200km of cables in the tunnels - more than thrice the distance between Singapore and Kuala Lumpur. However, by 2022, SP Group will lay only around 500km of cables, leaving plenty of space for expansion.

Long-lasting supply

The tunnels are built to last 120 years. This refers to the concrete segments and the structural reinforcements.

Source: SP GROUP PHOTOS: ZAOBAO, HDB STRAITS TIMES GRAPHICS

Tunnel system replaces ageing network of the 1980s

Eight circuits of the power cable network, which were built in the 1980s, will soon become too old to maintain and will be left in place while being gradually replaced with the new tunnel system.

These cables were installed just below roads, and repairs and replacement work would cause traffic jams and increase the risk of accidents - problems that the new underground tunnel network will

avoid, said SP Group managing director of infrastructure and projects Michael Chin.

He added that the existing cables are so old that they need to be inspected once every three months, which adds to maintenance costs.

Singapore's land scarcity means that SP Group had "no choice" but to build the tunnel system 60m below ground, said Mr Chin.

He said that the 60m-deep tunnels mean that cable checks will not disrupt ground-level life.

Reflecting long-term planning,

Mr Chin said the 40km tunnel project is designed to last 120 years. This refers to the concrete segments and the structural reinforcements.

However, he said that there is no knowing what will happen once the system ends.

"I will not be around and you will not be around," he chuckled, adding that Singapore could end up with a completely different system of transmitting electricity.

Jose Hong