

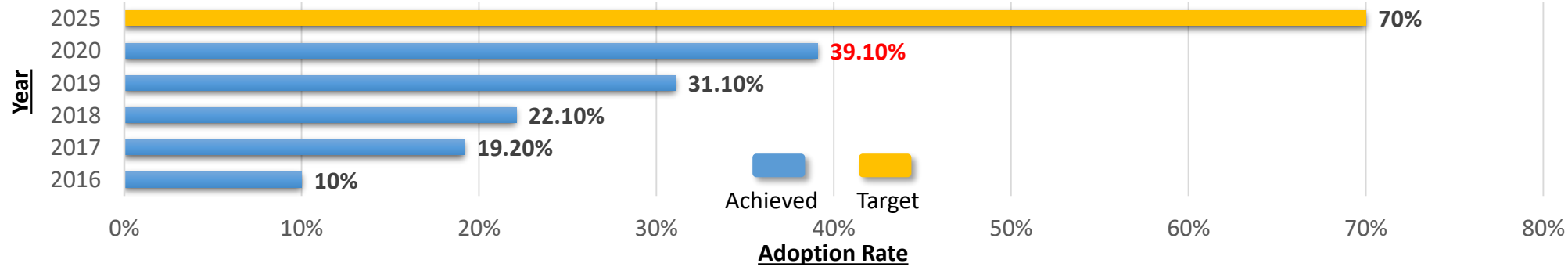
Our DfMA Journey – An Update

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Making the Innovations Possible

Annual DfMA Adoption Rate



- To achieve DfMA adoption rate of 70% by 2025, Singapore Government aim to make DfMA the default building method, especially large projects.
- Minimum buildability score for large commercial, institutional and industrial developments with GFA of at least 25,000m² to be raised in April 2022

Public Sector Taking the Lead - Adoption of DfMA technologies

PPVC (37 projects)



MET (16 projects)



Prefab MEP (16 projects)



Structural Steel (26 projects)



Specifying DfMA technology adoption in land tender conditions

Since 2014



Prefabricated Prefinished Volumetric Construction (PPVC)

46 GLS sites
(40 residential, 4 mixed developments, 2 hotel)



Structural Steel / Minimum Prefab Level

2 Commercial GLS and 62 Industrial GLS sites

*GLS refers to Government Land Sales (GLS)

Achievements

PPVC Project Highlights

In progress

Avenue South Residence

World's tallest concrete PPVC building upon its completion in 2022 (56-storey).

Government Land Sale (GLS) site with the adoption of **PPVC as part of the tender condition**

Estimated project productivity upon completion:
***43% productivity improvement** over 2010 level for private residential non-landed category

Progress:

- Currently **close to 65%** of the PPVC modules have been installed
- Target to complete all PPVC installation by early 2022 (approximately **22 months** to complete all PPVC installation)

**Productivity data to be verified with builders after project completion*



Source: www.avenuesouthresidence.com.sg

Achievements

MET Project Highlights

In progress

NTU Academic Building South

Asia's largest MET building upon its completion in 2021 (Gross Floor Area of approx. 40,000sqm)

MET comprises **more than 65%** of the project Gross Floor Area (GFA)

Also adopted **prefabricated MEP systems** such as plant modules and riser modules

Estimated project productivity upon completion:
***40% productivity improvement** over 2010 level for institutional and others category

Funding that NTU tapped on:

- **Public Sector Construction Productivity Fund (PSCPF)** to offset cost premium of adopting MET
- **Productivity Innovation Project (PIP)** funding to offset cost to adopt prefabricated MEP system

**Productivity data to be verified with builders after project completion*



Source: RSP & Toyo Ito & Associates, Architects

Achievements

In progress

PPVC & MET Project Highlights

BCA Braddell Campus Phase 2

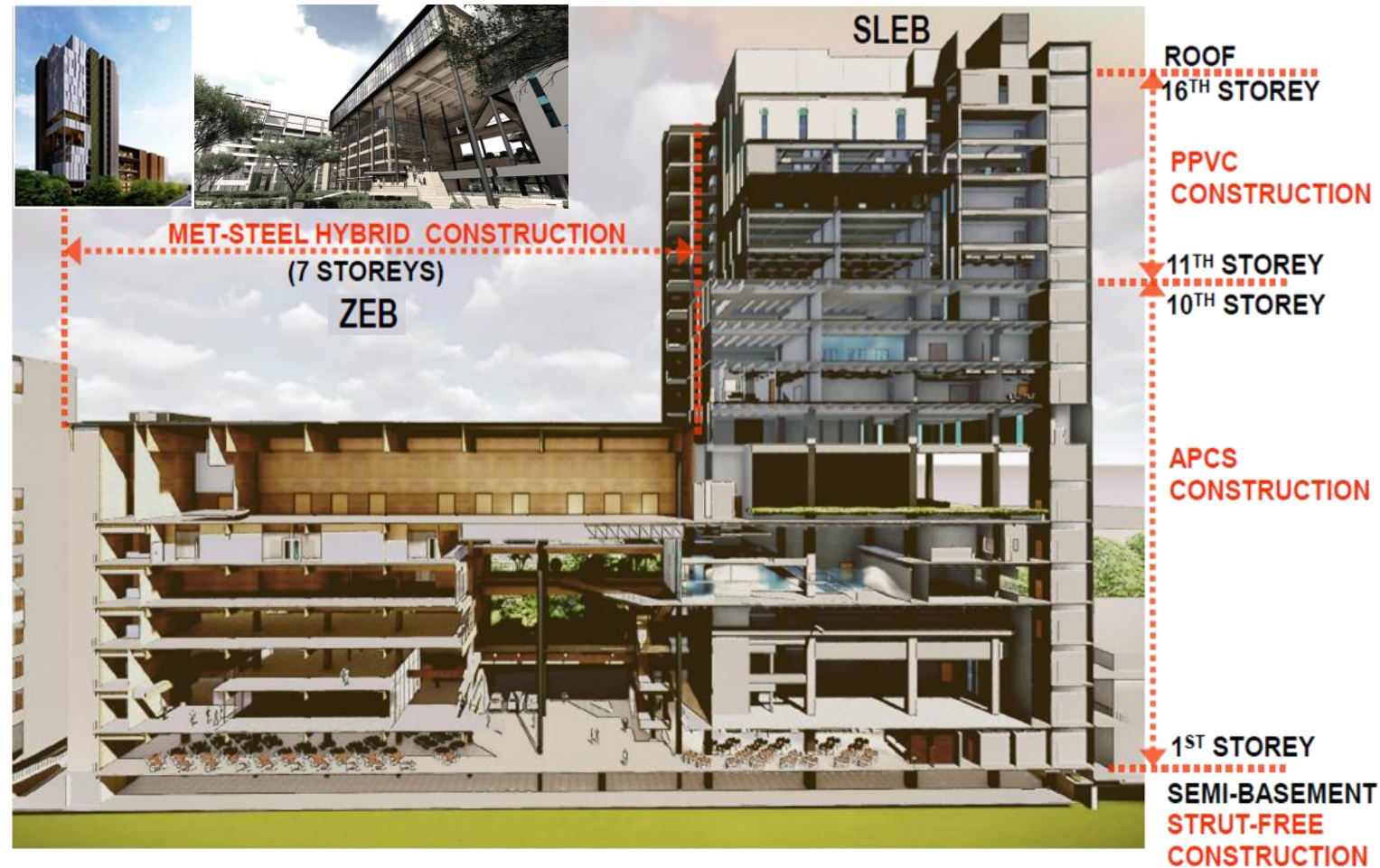
7-storey MET building will be a **Zero Energy Building (ZEB)** while 16-storey PPVC & APCS building will be a **Super Low Energy Building (SLEB)**

BCAA tapped on **Public Sector Construction Productivity Fund (PSCPF)** to offset cost premium of adopting MET and PPVC.

Progress:

- MET fabrication **started in Jun 2020 and 77% completed**
- Casting of precast elements of APCS **started in Oct 20 and 42% completed**
- PPVC shell casting **started in Dec 20 and 31% completed**
- Structural steel for MET **started in Feb 21 and 45% completed**

Target to achieve **more than 30% construction productivity improvement**



Achievements

Prefabricated MEP Systems Project Highlights

COMPLETED

Global Switch Data Centre

Extensive use of Prefabricated MEP Systems:

- Horizontal modules
- Raised floor modules
- Riser modules
- Pump skid and Header
- External façade and catwalk modules
- Roof air-conditioning pipe modules

Deployed approximately **350 MEP modules** throughout the entire project

Shorter construction time through **concurrent MEP (prefabrication off-site) and structural works**

Time savings: **1.5 months**
Manpower savings: **40% workers on-site**



Source: <https://www.globalswitch.com/>

Beyond DfMA and the Post Covid-19 Built Environment Sector

How do we gear up for the NEW NORMAL?

Question 1

Can we afford to stay Business As Usual (BAU) with huge number of foreign workers?

Question 2

What can Government and the Industry do to transit the BE sector to the Post-Covid 19 NEW NORMAL of a resilient industry with a lean workforce?

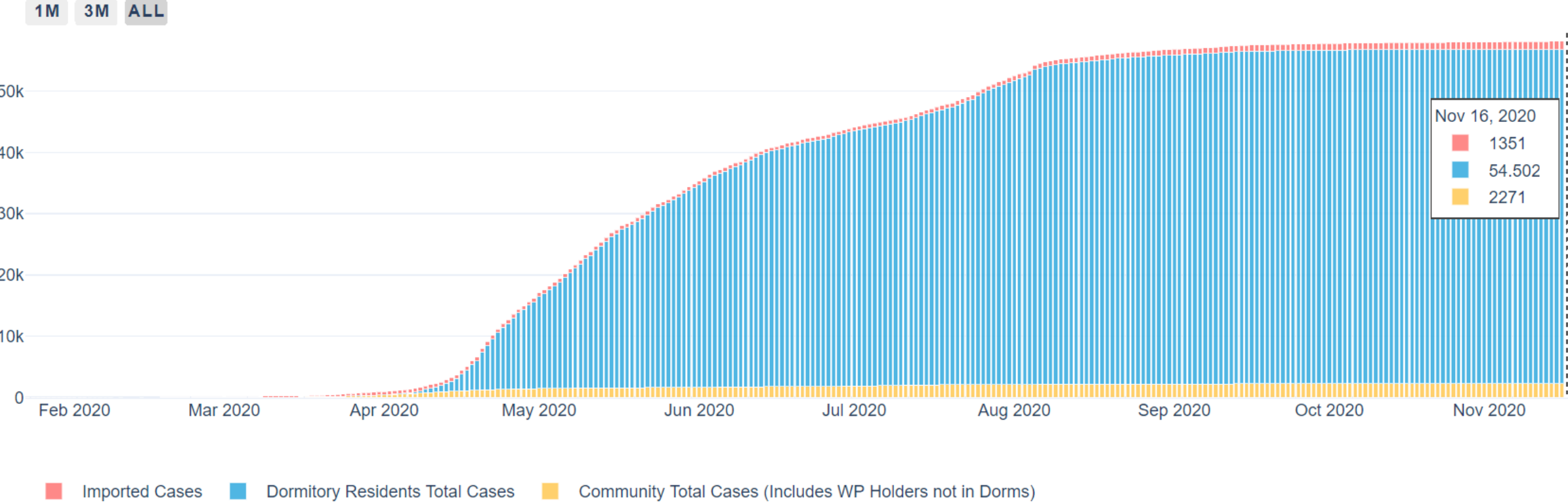


Beyond DfMA and the Post Covid-19 Built Environment Sector

Can we afford to stay Business As Usual (BAU) with huge number of foreign workers?

Total Cases

Sum of Community, Dormitory, Imported Cases



Source: MOH Website

Beyond DfMA and the Post Covid-19 Built Environment Sector

Can we afford to stay Business As Usual (BAU) with huge number of foreign workers?

Question 1

What is the solution? Build more spacious dorms with better facilities?

Question 2

What is the overall cost to the nation?



Question 3

Can we handle another pandemic of this scale in future if we stay BAU?

Question 4

Should we drastically cut down our over-dependency on foreign workers?

Beyond DfMA and the Post Covid-19 Built Environment Sector

ADMoRo from Concept Design to Facility Management



ICPH



Full Digitalisation of All Building Services



PPVC



Source: Technical University of Munich

Human-Robot Collaboration (HRC) Robots



Source: Sika Technology Centre

Architectural Feature 3D Printing



Source: <https://riskandinsurance.com/algorithms-and-artificial-intelligence-can-make-construction-more-efficient/>

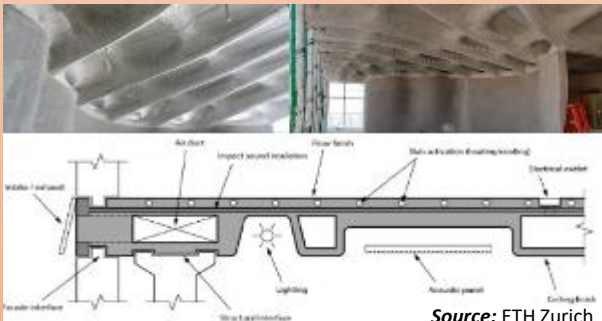
A.I. in Facilities Management



Mass Engineered Timber (MET) / Hybrid



Welding Robots



Source: ETH Zurich

3D Printed Slabs



Source: <https://www.roboticsbusinessreview.com/construction/komatsu-ai-construction-sites/>

A.I. in Construction Management



Modular MEP



Source: ETH Zurich

Robots for Digital Fabrication

Automation

Digitalization

Modularization

Robotization

Thank You

