

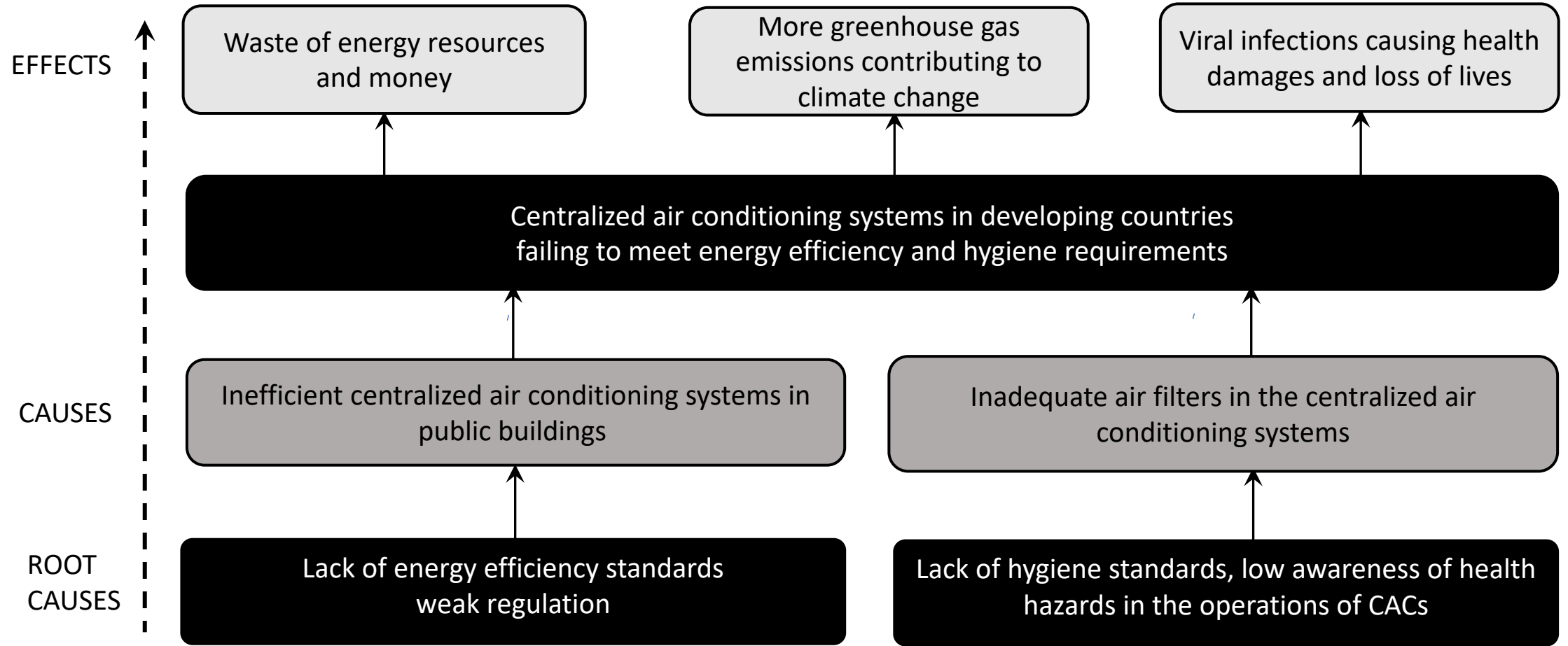
**TA 6563: Regional Support to build Disease Resilient and Energy efficient Centralized Air-conditioning Systems**

# **Disease Resilient, Smart, and Energy-efficient Centralized Air-conditioning (CAC) Systems for Public Buildings in Developing Member Countries**

**17<sup>th</sup> June 2021**

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Team Lead  
**ADB TA 6563**

# Background



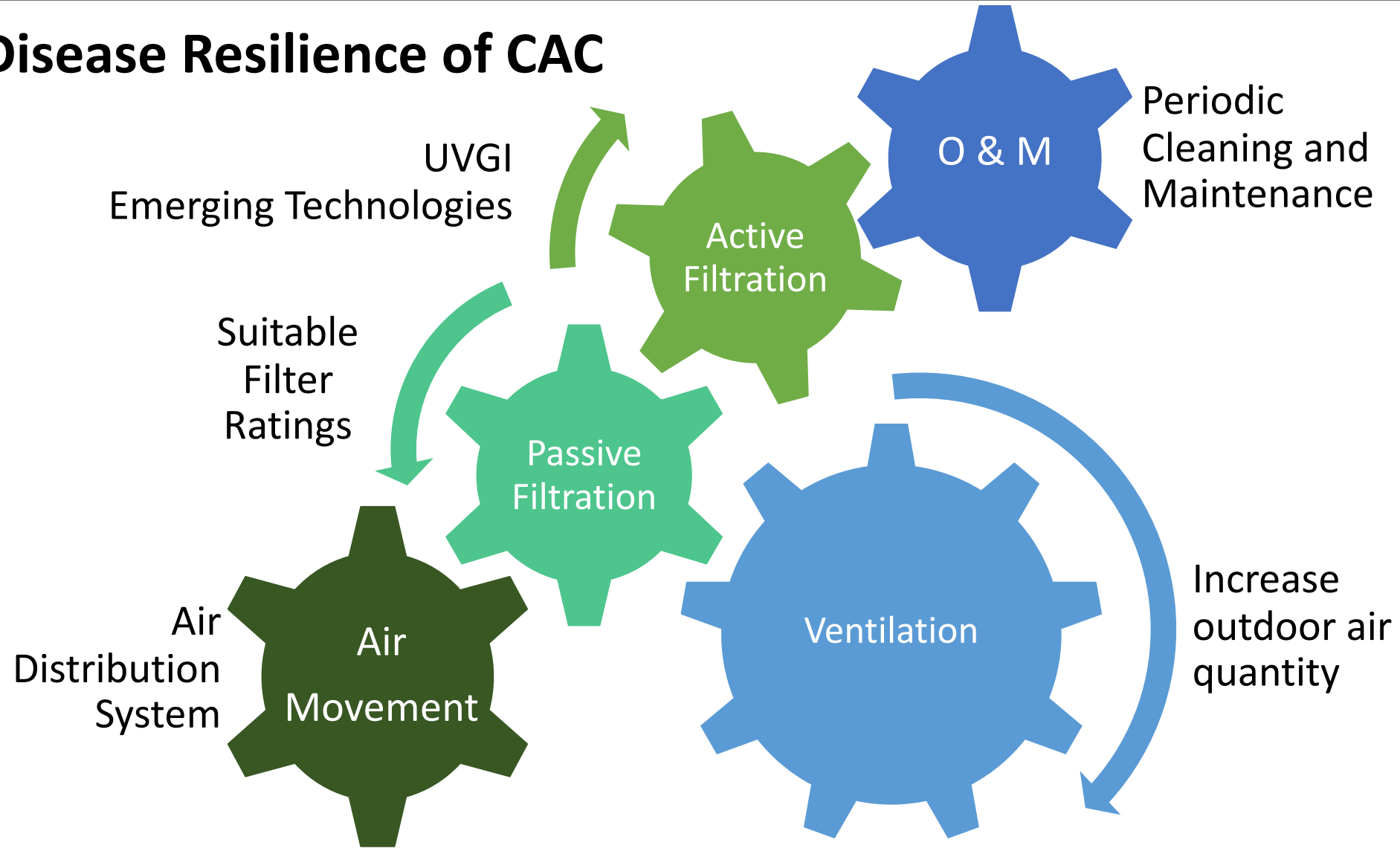
## Background

*“Disease resilient and energy-efficient centralized air-conditioning (CAC) systems with smart digital systems in Developing Member Countries”*

## Approach

- Pilot projects and demonstration through *Innovation Challenge*
- Knowledge products
- Awareness through videos and training workshops

# Disease Resilience of CAC



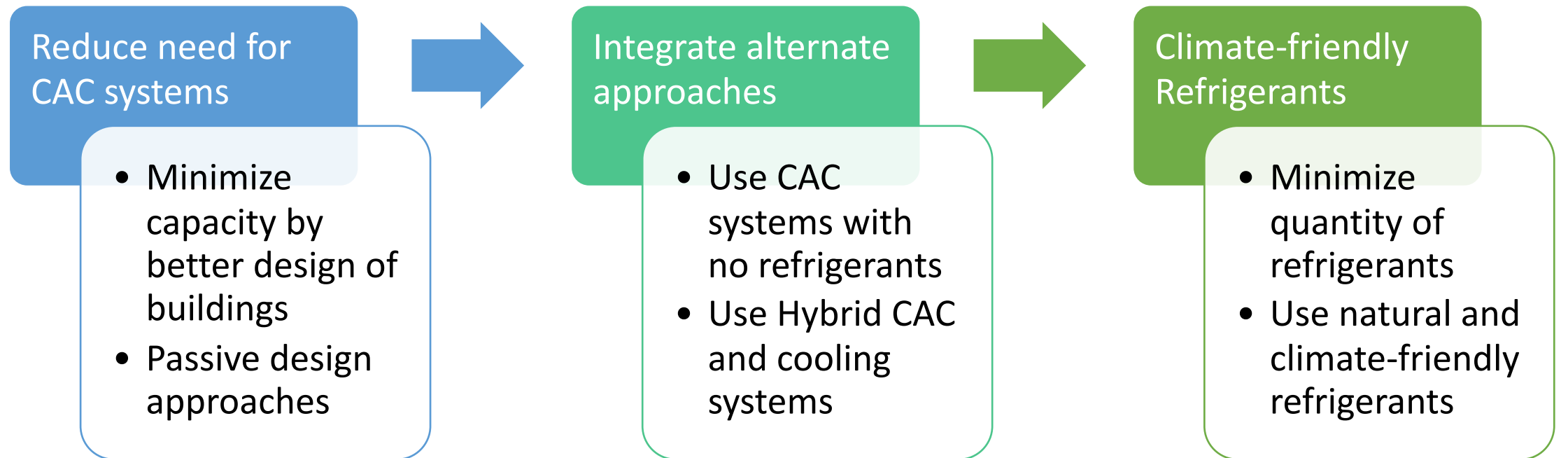
# Indoor Environmental Quality

Parameters	Units	Aspirational	Acceptable	Marginally Acceptable
		Classification		
		Class A	Class B	Class C
CO <sub>2</sub>	ppm	Ambient + 350	Ambient + 500	Ambient + 700
PM 2.5	µg/m <sup>3</sup>	<15	<25	<25
PM 10	µg/m <sup>3</sup>	<50	<100	<100
CO	ppm	<2	<9	< 9
TVOC * (equivalent to isobutylene)	µg/m <sup>3</sup>	<200	<500	<500
CH <sub>2</sub> O	µg/m <sup>3</sup>	<30	<100	-
SO <sub>2</sub>	µg/m <sup>3</sup>	<40	<80	-
NO <sub>2</sub>	µg/m <sup>3</sup>	<40	<80	-
O <sub>3</sub>	µg/m <sup>3</sup>	<50	<100	-
Total Microbial Count	CFU/m <sup>3</sup>	Indoor ≤ ambient	Indoor ≤ ambient	-
Occupant Satisfaction	%	90	80	-

ISHRAE Standard 10001:2016

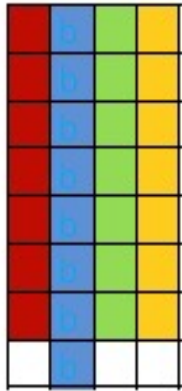
# Refrigerant Management in CAC

## Approach to Minimize Climate Impact of Refrigerant use in Centralized Air Conditioning Systems



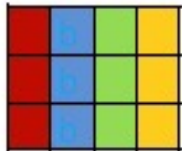
# Energy-efficiency in Buildings

A B C D



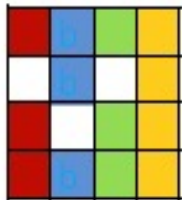
## Energy, heating & cooling source system

- BCHP
- Fuel Cell
- Ice storage
- Waste-Heat Absorption Heat Pumps
- Ground (water) source heat pump
- Water loop heat pump
- Condensing heat recovery of chiller/HP
- Evaporative cooling system



## Distribution sub-system

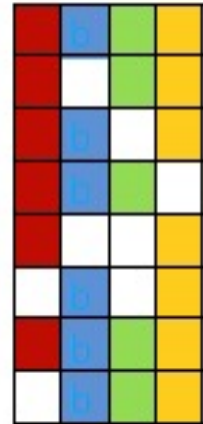
- Fresh air heat recovery
- Desiccant dehumidification system
- VFD of fans and pumps



## HVAC system terminals

- CO2 controlled ventilation
- Radiant systems, e.g. capillary ceiling, radiant floor
- DOAS stand-alone fresh air systems
- Displacement ventilation

A B C D



## Energy demand control via passive design

- Orientation and shape factor
- Microclimate environment
- Roofs, facades, glazing/Window-wall-ratio
- Shading
- Airtightness
- Thermal storage envelope
- Natural day-lighting
- Natural ventilation



## Internal gains

- Energy saving appliances
- LED lighting

A: Tropical  
 B: Dry  
 C: Temperate  
 D: Continental

## Koppen Climate Classification

# Innovation Challenge





# ASIA CLEAN ENERGY FORUM 2021

ACCELERATING THE LOW-CARBON TRANSITION IN ASIA AND THE PACIFIC

## Thank you

- **Dr. Yashkumar Shukla, Team Lead**
- Dr. Yanping Zhou, Air-Conditioning/Energy efficiency Expert
- Ms. Megan Huang,
- Mr. Richie Mittal, Health and Air Quality Expert