ASHRAE® Singapore Chapter

History & Milestones

Air Conditioning & Refrigeration in Singapore

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Disclaimer

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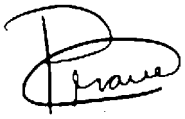
Foreword, Chapter President

For over a century, ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) has led the way in tackling the world's evolving challenges through the advancement of heating, ventilation, air conditioning, refrigeration, and their allied fields and its impact on the built environment. Climate change is already impacting every aspect of human wellbeing. ASHRAE has a bold vision to transform the built environment to become more adaptable, and resilient to climate change. Given, ASHRAE's international presence and members with deep expertise, the Society is uniquely positioned to be a catalyst for this transformation and address the future challenges in air-conditioning & refrigeration including decarbonization of built environment.

The history of ASHRAE in Singapore began when the first member from Singapore joined ASHRAE in 1955. On 9th April 1981, a consensus was formed among the ASHRAE members to initiate the formation of a Singapore Association of ASHRAE Members. The late Bill Sundberg was elected the first SAAM President and thus launched the beginning of our Association. Over the years, the number of ASHRAE members in Singapore grew and at present there are about 325 assigned members representing various stakeholders from the built environment.

ASHRAE Singapore Chapter (ASC) is immensely delighted to embark on this coffee-table book publication covering the History of Heating, Ventilation, Airconditioning and Refrigeration (HVAC&R) in Singapore and the contributions of the ASHRAE Singapore Chapter in advancing the arts and sciences of HVAC & R and their allied fields. I strongly believe that the history book shall inspire our young professionals to embrace the HVAC&R design and technologies and provide all professionals in the buildings industry the resources and knowledge to continually drive the innovative and strategic improvements needed during this revolution of our built environment.

I would like to extend my sincere gratitude to ASHRAE Singapore Chapter History book editorial team for your selfless service and putting your hardship to compile our 42 years of history and contribution to the built environment.



Praveen Hassan Chandrashekar
President, ASHRAE Singapore Chapter, 2023-24

Foreword, DRC

The Singapore Chapter (ASC) is the first Chapter to be chartered outside USA in 1984. We are inaugurated as the 142nd Chapter in ASHRAE.

In our continuously evolving landscape of modern engineering and sustainable technology in our HVAC world, the journey of ASHRAE Singapore Chapter has been a beacon of knowledge, fostering collaboration and driving progress; contributing significantly to the advancement of our local industry. Through decades of tireless effort and unwavering commitment of our members, ASC stands as a testament to the relentless pursuit of excellence and innovation in the realm of heating, refrigeration, and air conditioning.

As we delve into the annals of history, we uncover a rich tapestry woven with the dedication and expertise of the countless individuals who have shaped this esteemed organization into what it is today.

Since our initiation, we have grown from strength to strength and our members have been active locally, regionally and also at Society levels.

As we reflect on the past, let us also look to the future with optimism and determination. The legacy of ASC serves as an inspiration for generations to come, reminding us of the boundless potential that lies within our collective efforts to shape a more sustainable and resilient world.

This comprehensive history also serves as a tribute to the visionaries, leaders, and pioneers who have steered the course of our Chapter through the tides of change. It details and celebrates the milestones achieved, the challenges overcome, and the countless achievements that have marked this illustrious journey.

May our ASC history not only chronicle the past achievements, let us also look forward to the future with anticipation and enthusiasm. The legacy of the ASC serves as a beacon of inspiration, illuminating the path ahead and inspiring us to continue to push the boundaries of innovation and excellence in the pursuit of a better tomorrow with renewed sense of passion and purpose.

I extend my heartfelt gratitude to all those who have contributed to the creation of this history book, preserving our collective memory for generations to come. May it serve as a source of inspiration and pride for all members, past, present, and future, as we continue our journey of excellence together.

Yours truly,

Leong Cheng Wee
Director and Regional Chair (DRC), ASHRAE Region XIII 2022-2025
ASHRAE Singapore Chapter Past President 2000-2002

Acknowledgement

Our appreciation to the ASHRAE Singapore Chapter President, Mr. Praveen Chandrashekar, Board Of Governors (BOG) and ASC History Book Committee for supporting this publication when it was mooted by Director of Regional Chair XIII (DRC), Er. Leong Cheng Wee.

Profound thanks to each and every member of the ASC History Book Committee for their dedication, commitment and hard work; conceptualising the publication, naming book, planning contents, preparing guidelines, requesting write-ups from industry players, all were carried out in a year of daunting and voluminous tasks.

Special mentions and appreciated for the following committee members who have endeavoured to have the highest quality and eventual success of this publication, and they are:

- Er. Albert Sin Yew Tek, the Co-Chair of this ASC History Book Committee who conceptualise the contents, organised all meetings, compiled all write-ups, provided guidance at each process of this publication;

- Er. George Sze, the chief editor on the industry articles and it provides a seamless flow and interesting reading;

- Er. Tan Yong Hoa, the chief liaison with ASC past presidents for their respective contributions, and his personnal meticulous collection of ASC Annual Dinner magazines and photos which are essential for the success of this 42 years of ASC history publication;

- Mr. Gadam Sivakumar, the coordinator for ASC various committees articles who have been “engines” running several ASC activities; namely Chapter Technology Transfer Committee, Membership Promotion Committee, Student Activities, Young Engineers in ASHRAE (YEA), Research Promotion;

- Mr. Syed Mubarak Abdul Razaak, who had reached out to the industry players for articles and his essay in articulating “Aspirations of ASHRAE Singapore Chapter”.

- Dr. Yang Junjing, who had meticulously document the following:

- ASC contributions in the HVAC industry, such as ASC members involvement in developing various Standards and Guidelines,

- Signing of Memorandum of Understanding (MOU) with various Associations and Agencies for collaboration of future works and activities,

- Records of ASC members in achieving ASHRAE Honours and Awards for recognising members who had made great service and contributions to ASHRAE activities and for betterment of living environment and Sustainability.

We are also thankful to ASC Past Presidents and industry players for supporting and contributing to the success of this publication.

David Lau
ASHRAE Singapore Chapter
Chapter Historian (2023-2024)

ASC History Book Committee

From Left: Er. Albert Sin, Mr. Gadam Sivakumar, Er. Tan Yong Hoa, Er. George Sze, Mr. Syed Mubarak Abdul Razaak, Mr. David Lau, Dr. Yang Junjing (Standing).

Executive Summary

The development of HVAC&R industry in Singapore over the past decades is closely synced with the economic growth of the country. A wide spectrum of products and services in tandem with new technologies have been introduced to the markets by consultants, manufacturers, and suppliers.

Chapter 1 covers an interesting story of some enthusiastic members of ASHRAE led to the formation of the Singapore Association of ASHRAE Members (SAAM) way back in 1982, subsequently chartered as ASHRAE Singapore Chapter (ASC) in 1984. The selfless dedication of successive Chapter Presidents leading their respective Board of Governors and Committees have continuously cemented the success of ASC. Important milestones of ASC activities are documented.

Equally mesmerising is the history of establishing Region XIII which is the Far East region and the first region outside of North America. The formation of ASHRAE Region XIII describes perseverance of passionate ASHRAE members of Singapore Chapter, Hong Kong Chapter, Taiwan Chapter and Malaysia Chapter who went through the arduous process of preparing petition, motion, and justification to form Region XIII. Region XIII was formally formed in June 1998 at the ASHRAE Toronto meeting.

Chapter 2 provides an update on contributions of ASHRAE Chapter and collaboration with the industry, public sectors and institutions of higher learning. These include drafting of energy efficiency act, regulations, standards, codes of practice, energy efficiency guidelines.

Apart from providing expert advice and capacity building to the industry, some of our distinguished members played pivotal roles in organising ASHRAE's first Far East Conference on Air-conditioning in Hot Climates and 1st Asia Pacific Conference on CFC Issue and Greenhouse Effect. The mammoth tasks added values to relevant stakeholders of the industry and their untiring efforts continue unabated even today.

ASC various committees play active roles in organising activities to meet members quest of technology knowledge sharing and networking. These committees include Chapter Technology Transfer Committee, Membership Promotion Committee, Student Activities, Young Engineers in ASHRAE(YEA) and Research Promotion.

Chapter 3 shares brief history on air-conditioning and refrigeration development in Singapore. It pays tribute to some prominent and established HVAC&R manufacturers, contractors and specialist providers with illustrious history of development over the past decades. It records the humble beginning of these manufacturers, the challenges they endured and their eventual success in Singapore and globally.

Chapter 4 recognises the individual luminaries of ASC who have made contributions to ASHRAE and society. Their passions and undaunting drive in areas of green buildings, energy efficiency, and indoor air quality are commendable. ASHRAE Singapore Chapter salutes these great men and women of ASC. They have and continue to illuminate the landscape of HVAC&R in their subtle ways.

Chapter 5 charts the course for a Greener Tomorrow as the aspirations of ASC's strategic vision as following:

- Innovating sustainable built environment
- Driving decarbonisation in line with Singapore's 2030 Green Plan and 2050 Net Zero.
- Indoor Environmental Quality
- Enhancing Training and Development for Capacity Building
- Organisation Effectiveness
- Creating last values for our members
- Collaboration for Sustainable Future

Chapter 6 shares nostalgic memories of ASHRAE Singapore Chapter's photo gallery: 1984 to 2024.

Chapter's Materials

Chapter's souvenir magazine & newsletter

Chapter's VCD (Year 2000) & souvenir bag

Chapter's diary book, souvenir shoe bag & namecard holder

ASHRAE® Singapore Chapter

History of Milestones of ASHRAE Singapore Chapter (ASC)

1.1 History of ASHRAE Singapore Chapter

Charter
of the
Singapore Association
of ASHRAE Members
An Authorized Chapter of the
American Society of Heating Refrigerating
and Air-Conditioning Engineers, Inc.

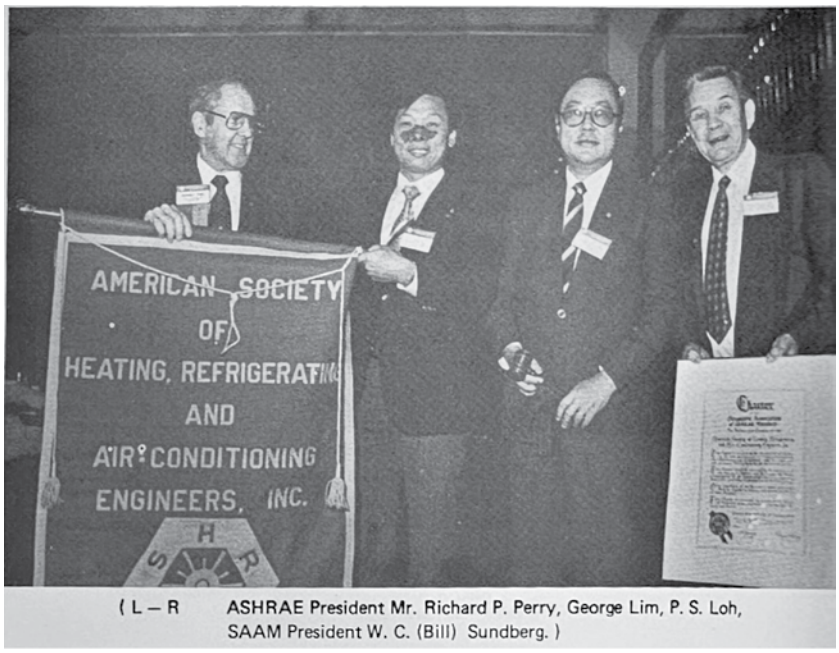
This Chapter is established for the purpose of advancing the arts and sciences of Heating, Refrigeration, Air-Conditioning and Ventilation, and the allied arts and sciences, for the benefit of the general public.

This Chapter shall be governed by the provisions of the Society's Charter and By-Laws, the Rules promulgated by the Board of Directors in harmony therewith, and any amendments to the foregoing.

Only members of the Society in good standing shall be eligible to become and remain members of this Chapter.

This Charter is revocable by action of the Board of Directors taken pursuant to the Society's By-Laws and Rules.

Granted this 30th day of January 1984



(L — R ASHRAE President Mr. Richard P. Perry, George Lim, P. S. Loh, SAAM President W. C. (Bill) Sundberg.)

The Beginning

Singapore Chapter began from the year 1980 when a group of ASHRAE members conducted a survey to establish whether there was any interest in the formation of a local organization of ASHRAE members. George Carmona, then an employee of Trane Singapore initiated the survey together with the late Bill Sundberg of Honeywell and some other interested ASHRAE members.

First Society Officer to visit Singapore

Encouraged by the good response resulted from the survey, a meeting of ASHRAE members was held on April 09, 1981 with the presence of Society Treasurer, Bob McDonald who spoke on ASHRAE goals and provided some guidance on the formation of a local organization along the lines of an ASHRAE chapter. That successful meeting resulted the drafting of a pro-tem committee from the participants that attended the meeting, to initiate the formation of the Singapore Association of ASHRAE Members, more popularly known as SAAM.

The Pro-Tem Committee Members

Members of this pro-tem committee were:- George Carmona (who shortly afterwards returned to USA); the late Bill Sundberg who was to become the Association's first president; Y.P. Chee (2nd and 24th past president); P.S. Loh (3rd past president); Sunny C.L. Tan (4th past president) and G.S. Tan (28th past president); D.K. Holloway; George Lim C.Y. Mok; Dick S.T. Ong; E. Stillman.

Registration under the Singapore Law – as a Society

The Pro-Tem Committee's first major task was to formally register the Association of ASHRAE Members with Singapore Registrar of Society without which no new members could be recruited. Drafting the Association's Rules and Regulations took many man-hours after which the submission to the Registrar met with many obstacles of corrections. Eventually, the Association was formally registered on August 21, 1981. On March 13, 1982, the first Annual General Meeting of the Association was held with a membership roll of 46. The late Bill Sundberg was returned as the first President of the Association and thus launched to the beginning of the Association of ASHRAE Members (SAAM).

How the Association became a chapter of ASHRAE

After the Association was formed, members met often and as early as 1983, the question of future development of the Association and in particular on the question of obtaining chapter status in ASHRAE which at that point in time, had only confined theirs chapters to within USA and Canada. Soon afterwards, the Association learnt that ASHRAE was begun to consider granting chapter status to organizations outside USA and Canada in Society's goal to internationalize ASHRAE. The Association's members on this matter and decided to petition to ASHRAE for chapter status. On January 30, 1984, ASHRAE President P.R. Perry presented the Chapter Charter to the Association's then president, the late Bill Sundberg at the Society's Winter Meeting in Atlanta the same year. Fellow members George Lim and P.S. Loh witnessed the historical ceremony of the Association receiving the Chapter Charter and Singapore Chapter became ASHRAE's 142nd Chapter and their first international chapter.

Singapore Chapter's Activities from its Inception

There were lots of activities such as organizing regular meetings for members in the form of technical talks, seminars and non-technical talks. There were the periodical visits to places of technical interest. Highlight of the chapter's yearly activities were the Annual Installation Dinner and Dance which the new incoming president and his board of council members would be installed.

The Singapore Chapter has always open its door to welcome new ASHRAE members from the tertiary institutions, consulting engineers as well as the other tradesmen in the air-conditioning, ventilation and refrigeration industry. Singapore Chapter provide a forum for academia and ACMV&R industries to meet and sharing of information.

Singapore Chapter as part of ASHRAE's Internationalization

Following Singapore, soon more chapters of ASHRAE were quickly chartered as in Hong Kong, United Arab Emirates, Malaysia, Taiwan, Saudi Arabia, Egypt, Lebanon, India, etc. in the 1980s.

Singapore Chapter as the Society's first International Chapter, will always have to strive and maintain high performance and to continue improving organized activities and meeting attendance. An important responsibility Singapore Chapter always bear in mind is to actively raise fund for Society's Research Promotion. In this, Singapore Chapter is proud to have scored the highest 1998-1999 Presidential Award of Excellence (PAOE) points in Region XIII. Besides, the Chapter also achieved the Full Circle Award after all its Board members also made their individual contribution.

Singapore Chapter joining Region X and subsequently the forming of Region XIII

In 1992, ASHRAE deliberated and decided to assign all their international chapters, also known as chapters-at-large, to Region X which consisted of its 14 chapters of the Pacific-brim states of Hawaii, California, Nevada and Arizona. Thus for the first time, Singapore Chapter as well as all the other international chapters no longer were chapters-at-large but being part of a Region. In Region X's Spring CRC – 1993, Singapore Chapter together with the other international chapters became legitimate participants in their Chapters Regional Conference.

After staying four years in Region X, Singapore Chapter and the other overseas chapters faced another change in ASHRAE's decision to group them into the Society's newly-formed International Committee. These chapters were again deprived of their 'voice and vote' as accorded to them in Region X. Not long after the International Committee met at the Society's Winter Meeting in 1997, the delegates from Singapore Chapter together with Hong Kong, Malaysia and Taiwan Chapters decided to work together towards forming a new ASHRAE region to comprise of the four chapters and to be effective possibly from the coming year.

In April 1997, the International Committee approved this East Asia Region formation during their meeting and at the subsequent Society's Annual Meeting in Boston that June, the Society's Regions Council and Board of Directors formally approved the Chapters of Hong Kong, Malaysia, Singapore and Taiwan to be grouped to become Region XIII, ASHRAE's newest and first Region outside the North America.

Vincent Tse of Hong Kong Chapter was officially installed as the Director and Region Chair (DRC) of Region XIII and ASHRAE's Board of Directors at the 1998 Annual Meeting in Toronto. Thus marked the beginning of Region XIII.

Immediately Region XIII was to have their first Chapters Regional Conference (CRC) and Singapore Chapter was unanimously elected to host the historical first CRC which was held at the Trader's Hotel on August 14-15, 1998.

In conclusion, Singapore Chapter commits to promote the goal of ASHRAE, which is to advance the arts and sciences of heating, refrigeration, air-conditioning and ventilation, the applied arts and sciences and related factors for the benefit of the general public.

Towards this goal, Singapore Chapter will continue to participate and organize activities on issues to protect the external environment, improve indoor air quality, conserve energy and provide continuing education to our members and others in the HVAC industry and to offer career guidance to students at the local colleges and tertiary institutions.

(Compiled by the Chapter Historian, 2024)

1.2 Formation of ASHRAE Region XIII

On 25 and 26 January 1997, Chapter officers from Malaysia, Hong Kong and Singapore, attended the International Committee meeting in Philadelphia, USA. Taiwan Chapter was not represented at that meeting. Informal discussion exploring the possibility of forming a Region in the Far East was held on Sunday 26 January 1997 when a group of ASHRAE members from Region I and Region X gathered with other members from the Far East countries. Joseph Ting hosted a Chinese dinner at the Imperial Restaurant in downtown Philadelphia. This informal get-together was a traditional event and thirteen members were present at this dinner gathering. The discussion was interesting and constructive enough that the participants decided to carry on further discussion at the Marriott Hotel after dinner.

Chapter officers present at the planning discussion on the proposed Region XIII formation on 26 January 1997

Region I	Region X
DRC Joseph K. Ting, P.E.	DRC Dean Bogers, P.E.
New York Chapter President William Ryan	DAL Milton Meckler, P.E.
Long Island Chapter TEGA Chair Harold Smith, P.E.	Marlys Meckler
Hong Kong Chapter	**Malaysia Chapter**
President Dr Philip Yu	President Yim Hon Wa
Past President Wong Wai Kwong	President-Elect Hing Fook Yong
Singapore Chapter	Vice President Foo Say Jan
President Vincent Tong	Past President Steven Toh

The discussions provided renewed enthusiasm among the Far East members to present a motion to the Regions Council. This was despite an earlier setback when the International Committee (IC) rejected their motion to form Region XIII when it was presented at the IC meeting on 25 January 1997. Philip Yu of Hong Kong Chapter was designated to be the official secretary arising from the informal discussion. Yu managed to prepare an excellent written motion in time for the Council meeting the following day on 27 January 1997. On behalf of the four Far East Chapters, Wong Wai Kwong of Hong Kong Chapter presented the motion at the Council meeting. Despite encountering some initial resistance from senior members prior to the meeting, Wong proceeded to present the well-prepared motion. It was so well presented that the Regions Council Chair Donald Holte complimented the Far East members for their patience and perseverance. The motion was moved by Dean Borgers and was seconded by Region IV DRC Minh Tran. It was then passed with a majority vote at the Regions Council and was referred subsequently to the Council's Planning Committee. The Planning Committee, in turn, assigned the IC to prepare all necessary documentation needed to petition the forming of a new region. The process of forming Region XIII has thus begun.

In the spring of 1997, IC Vice Chair Ronald Kessner requested Joseph Ting to help draft the said petition. Hong Kong Chapter was assigned to complete the petition. On April 19, 1997, Phillip Yu hosted the first regional meeting in Hong Kong and subsequently coordinated to complete the petition. The completed petition was then circulated for review and signed by all officers of the four Chapters before submission to the IC. On 2 May 1997, Ron Kessner convened the IC meeting in Tempe, Arizona. The motion to form Region XIII was presented and voted with an overwhelming majority. The motion was passed favorably with the exception of two negative votes (the former Region X DRC and the Lebanon Chapter President). At the close of the meeting, Yim Hon Wa thanked Ron Kessner for his full support.

At the Annual meeting held on 28 June to 2 July 1997 in Boston, the motion was voted at the Planning Committee and recommended for approval at the Regions Council meeting. At the Council's Sunday meeting on 29 June 1997, the motion was passed with a majority vote and was recommended to the Board for approval. The arduous journey finally paid off at the Board's Wednesday meeting on 2 July 1997 when the Board passed it with a majority vote to have the Far East region formed and to be officially chartered as Region XIII at the Toronto Annual meeting on 19-24 June 1998. In parallel development, at the Winter meeting on 17-21 January 1998 in San Francisco, Vincent Tse of the Hong Kong Chapter was nominated to be the first Director and Regional Chair (DRC) of Region XIII. Malaysia together with Singapore, Hong Kong and Taiwan Chapters became the founding Chapters of Region XIII. As depicted in Figure 1.1, Region XIII was formally approved and chartered at the Toronto Annual Meeting held on 19-24 June 1998.

Inaugural Region XIII Officers 1998

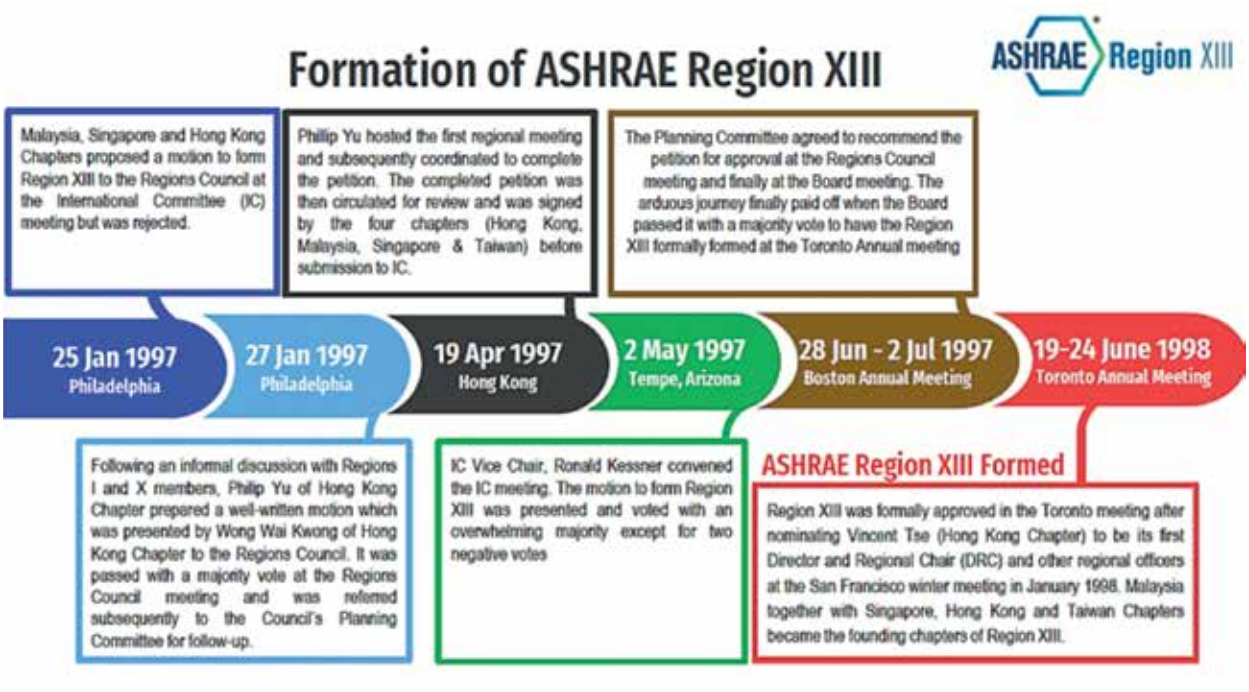
Hong Kong Chapter	**Singapore Chapter**
Director & Regional Chair: Mr Vincent Tse	RVC TEGA: Dr Raymond Wong
Assistant Regional Chair: Mr Wong Wai Kwong	Regional Historian: Mr Henry Lee
RVC Chapter Program: Dr Philip Yu	Nominating Member: Dr Ng Eng Hong
Malaysia Chapter	**Taiwan Chapter**
RVC Research Promotion: Datuk Ir. Prof Dr Ow Chee Sheng	RVC Student Activities: Dr Liang-Jyi Fang
RVC Refrigeration: Mr Bernard Loh	RVC Membership Promotion: Dr Jimmy Wang
Nominating Alternate: Mr Hing Fook Yong	

Region XIII comprises Chapters from Singapore (1982), Malaysia (1984), Hong Kong (1984) and Taiwan (1989), Philippines (1999), Thailand (2000), Indonesia (2007), Japan (2014), South Korea (2014) and Macao (2016).

Region XIII includes Guam Section of Philippines Chapter (2012), Kuching Section of Malaysia Chapter (2007), Myanmar Section (Singapore Chapter as Mentor) (2020), Penang Section of Malaysia Chapter (2018), Vietnam Section (Thailand Chapter as Mentor) (2020),

Presently, there are total of 10 Chapters and 5 Sections.

Milestone activities in the formation of ASHRAE Region XIII



Map of Region XIII

List of Region XIII Director and Regional Chairs

Region XIII Director and Regional Chairs (DRC)			CRC Meetings Held
1	1998 - 01 Mr Vincent Tse	Hong Kong Chapter	1998 - Singapore 1999 - Hong Kong 2000 - Kuala Lumpur, Malaysia
2	2001 - 04 Dr Raymond Wong	Singapore Chapter	2001 - Taipei, Taiwan 2002 - Manila, Philippines 2003 - Bangkok, Thailand
3	2004 - 07 Datuk Ir. Prof Dr Ow Chee Sheng	Malaysia Chapter	2004 - Singapore 2005 - Hong Kong 2006 - Kuala Lumpur, Malaysia
4	2007 - 10 Dr Robert Hu Yie-Zu	Taiwan Chapter	2007 - Taipei, Taiwan 2008 - Manila, Philippines 2009 - Bangkok, Thailand
5	2010 - 13 Mr Wichai Laksanakorn	Thailand Chapter	2010 - Singapore 2011 - Hong Kong 2012 - Kuala Lumpur, Malaysia
6	2013 - 16 Mr Edward Tsui Ka Cheung	Hong Kong Chapter	2013 - Jakarta, Indonesia 2014 - Taipei, Taiwan 2015 - Manila, Philippines
7	2016 - 19 Ir. Ng Yong Kong	Malaysia Chapter	2016 - Bangkok, Thailand 2017 - Singapore 2018 - Hong Kong
8	2019 - 22 Dr Apichit Lumlertpongpana	Thailand Chapter	2019 - Kuala Lumpur, Malaysia 2020 - No meeting, Covid 19 2021 - Jakarta, Indonesia
9	2022 - 25 Er. Leong Cheng Wee	Singapore Chapter	2022 - Tokyo, Japan 2023 - Taichung, Taiwan 2024 - Macao

1.3 ASC Milestones Activities

1987	ASHRAE's first Far East Conference on Air-conditioning in Hot Climates, 3-5 Sep 1987, Singapore Hyatt Hotel.
1988	Seminar on CFC Issues: New Technology in Air-conditioning Equipment, 19 Nov 1988.
1991	1st Asia-Pacific Conference on CFC Issue and Greenhouse Effect, 15-17 May 1991, Singapore Hyatt Hotel. Guest-of-Honour was Dr Ahmad Mattar, Minister for the Environment.
1993	2nd Asia-Pacific Conference on CFC Update and Indoor Air Quality", 2-3 Nov 1993, Orchard Hotel. Guest-of-Honour was Mr Abdullah Tarmugi, Minister of State, Ministry of Environment.
1995	3rd Asia-Pacific Conference: The Built Environment Trends and Challenges", 1-3 Jun 1995, Raffles City Convention Centre. Guest-of-Honour was Mr Tan Gee Paw, Permanent Secretary, Ministry of Environment.
1998	1st Chapters Regional Conference (CRC), 14-15 August, Trader's Hotel, Singapore
2000	Video CD production with 2 objectives: a) To record the achievements of the air-conditioning and refrigeration industry, and ASHRAE Singapore Chapter in past century b) To share a vision of the industry in the new millennium
2001	6th Asia-Pacific Conference on the Built Environment: Progress on Energy Efficiency and Indoor Air Quality", 14-17 Nov 2001, Novotel Apollo Hotel. Guest-of-Honour was Assoc Prof Koo Tsai Kee, Senior Parliamentary Secretary at the Ministry of National Development.
2005	7th Chapters Regional Conference (CRC), 20-21 August, Novotel Apollo Hotel, Singapore
2006	HVAC Asia 2006 Seminar, includes ASHRAE Distinguished Lecture Talk, "Overview of ANSI/ASHRAE/IESN A Standard 90.1" by Mr. Larry Spielvogel, 4 July 2006, Half-day Workshop "Energy Efficiency and Environmental Sustainability" by Mr. Larry Spielvogel, 5 July 2006
2007	ASHRAE Distinguished Lecture Talk, "Sustainable Office Buildings in Hot and Humid Climate" by Mr. T.L. Chen, 21 September 2007
2007	ASHRAE Distinguished Lecture Talk, "Chilled Ceilings in parallel with Dedicated Outdoor Air Systems" by Prof. Stanley Mumma, 15 November 2007
2008	ASHRAE Distinguished Lecture Talk, "Green Buildings, LEED and the proposed ASHRAE 189" by Prof. Thomas Lawrence, 5 June 2008
2008	ASHRAE Distinguished Lecture Talk, "International Ventilation and IAQ Standards" by A/Prof. Chandra Sekhar, 25 November 2008
2009	ASHRAE Distinguished Lecture Talk, Seminar on "Design Guide for Tropical Climate" by Mr. Terry E. Townsend, "Enhancement of the Envelope Thermal Tranfer Value Criterion for Improved Energy Performance of Buildings" by Prof. S.K. Chou, 6 March 2009
2009	ASHRAE Distinguished Lecture Talk "HVAC Systems for Airborne Infection Control Spaces in Healthcare Facilities" by Mr. Wei Sun, 12 November 2009
2010	ASHRAE Distinguished Lecture Talk, Seminar on "ASHRAE Standard 189 - High Performance Green Buildings" by Mr Gordon Holness and "Energy management in buildings" by Mr Vincent Tse, 5 April 2010.
2010	13th Chapters Regional Conference (CRC), 27-28 August, Holiday Inn Atrium, Singapore

2011	ASHRAE Distinguished Lecture Talk “Cool Thermal Energy Storage In the Era of Sustainability” by Mr. William P. Bahnfleth, 7 March 2011, Jointly organised by ASHRAE Singapore Chapter and BCA Academy.
2011	ASHRAE Distinguished Lecture Talk “How to design Ammonia Plant Safe and Save?” and “Utilize Thermal Ice Storage to save your electrical bill?” by Dr Apichit Lumlertpongpan, 8 July 2011
2012	ASHRAE Distinguished Lecture Talk “The Green HVAC Concept: Renovation in Existing Building” by Professor Yang Kuan Hsiung, 2 July 2012
2012	ASHRAE Distinguished Lecture Talk “Effective Ventilation System for air borne infection isolation rooms & The Amoy Garden SARs Outbreak – The roles of Air flow and Ventilation” by Professor Li Yu Guo, 14 December 2012
2013	ASHRAE Distinguished Lecture Talk, Seminar on “How to implement demand control ventilation and comply with ASHRAE Standard”, “Using the retro-commissioning process for energy saving”, and “Commissioning energy recovery equipment” by Mr Hoy Bohanon, 11 March 2013
2013	ASHRAE Distinguished Lecture Talk, Seminar on “Dedicated Outdoor Air Systems and ASHRAE Standard 62.1 and Hospital Filtration Systems, and Airborne Contaminant Control.” By Mr. Brian Monk, 24 April 2013
2013	ASHRAE Distinguished Lecture Talk, Seminar on “Humidity Control Design – Current ASHRAE Guidance & Suggestions for Simpler Solutions”, “Diagnosing & Fixing Humidity Control Problems in Real-World Buildings – Tools, Techniques, Case Histories and Practical Suggestions” and “Better Buildings in Hot & Humid Climates – New ASHRAE Design Guidance”, 29 April 2013
2013	ASHRAE Distinguished Lecture Talk, “Ventilation & Pressurization Control: Technologies and Methods for Improved Energy Efficiency and IAQ”, 4 December 2013
2014	ASHRAE Distinguished Lecture Talk, “Commissioning for New and Existing Buildings in Hot and Humid Climates”, by Mr. Ron Wilkinson & Assoc Prof Chandra Sekhar, 11 February 2014
2014	ASHRAE Distinguished Lecture Talk, Seminar on “Environmental Control & Energy Performance in Hospital and Healthcare Facilities” by Mr. Brian Monk and A/Prof. Lee Siew Eang, 26 August 2014
2015	ASHRAE Distinguished Lecture Talk, Seminar on “Room Air Distribution for Enhanced IAQand Energy Efficiency”, by Prof. Chandra Sekhar and Mr. T.L. Chen, 3 February 2015
2015	ASHRAE Distinguished Lecture Talk, Seminar on “Integrated Design Modelling and Emerging ACMV Technologies for Energy Efficient Healthy Buildings”, by A/Prof. John Zhai and Prof. Chandra Sekhar, 7 April 2015
2015	ASHRAE Distinguished Lecture Talk, Seminar on “ASHRAE 90.1 Energy Efficient Windows and HVAC Creer Opportunities for Women” by Christopher Mathis and Julie Ferguson, 18 May 2015
2015	ASHRAE Distinguished Lecture Talk, Seminar on “Integrating Indoor Air Quality and Energy Efficiency in Buildings” by Prof. Bill Bahnfleth, 4 September 2015
2016	ASHRAE Distinguished Lecture Talk, Seminar on “Indoor environment quality and ventilation” by Dr Max H. Sherman and Prof. Bjarne W. Olesen, 23 February 2016
2017	ASHRAE Distinguished Lecture Talk, Seminar on “Airflow Management for Data Centres and Healthcare Facilities” by Dr. Kishor Khankari, 27 February 2017

2017	ASHRAE Distinguished Lecture Talk, Seminar on “High Performance Building Design and the Coming Age of a Smart Grid and Smart Buildings” by Dr. Thomas M. Lawrence, 9 March 2017
2017	ASHRAE Distinguished Lecture Talk, Seminar on “Active and Passive Beams and Energy Efficient Solutions for Commercial Kitchen Ventilation” by Dr. Andrey Livchak, 19 April 2017
2017	ASHRAE Distinguished Lecture Talk, Seminar on “ASHRAE Advanced Energy Design Guide and Underfloor Air Distribution Systems” by Mr. Daniel H. Nall, 17 May 2017
2017	20th Chapters Regional Conference (CRC), 25-26 August, Hilton Hotel, Singapore
2018	ASHRAE Distinguished Lecture Talk, Seminar on “The New Legionella Standard: ANSI/ASHRAE 1882015 ‘Legionellosis: Risk Management for Building Water Systems” by Ms. Patricia Graef, 28 February 2018
2018	ASHRAE Distinguished Lecture Talk, Seminar on “ASHRAE Building Energy Quotient (bEQ) and Retro-Commissioning for Energy Savings” by Mr. Hoy Bohanon, 25 April 2018
2018	ASHRAE Distinguished Lecture Talk, Seminar on “Moving Closer to Net Zero Buildings with IAQ Procedure of ASHRAE Standard 62.1 and Filtration Technologies in Cleanrooms” by Mr. Chris Muller, 23 May 2018
2018	ASHRAE Distinguished Lecture Talk, Seminar on “Clean Data Centre & Intelligent Buildings/ Building Automation” by Mr. Jim Vallort, 13 June 2018
2018	ASHRAE Distinguished Lecture Talk, Seminar on “Active and Passive Beams and Energy Efficient Solutions for Commercial Kitchen Ventilation” by Dr. Andrey Livchak, 12 July 2018
2019	ASHRAE Distinguished Lecture Talk, Seminar on “Fundamentals of Building Envelopes in Hot & Humid Climates and Humidity Control in Buildings” by Mr. Raymond E. Patenaude, 21March 2019
2019	ASHRAE Distinguished Lecture Talk, Seminar on “Green Design and Sustainability – Undefinable Success in a Defined World and Dealing with the Potential Liability Issues of BIM”, by Mr. E. Mitchell Swann, 24 April 2019
2019	ASHRAE Distinguished Lecture Talk, Seminar on “Leveraging Innovative Technologies for Life Cycle Operational Efficiency and Improved Indoor Environmental Quality and An Approach to Facilities Operational Improvements” by Dr. Om Taneja, 14 May 2019
2022	ASHRAE Distinguished Lecture Talk, Seminar on “Health and Wellness in the Built Environment” by Mr Dennis Knight, 21 February 2022
2022	ASHRAE Distinguished Lecture Talk, Seminar on “Sustainability and resiliency – a paradigm shift in HVAC system design and operation during a pandemic” by Prof. Chandra Sekhar, and “ASHRAE Standard 62.1-2022” by Mr. Hoy Bohnon, 13 December 2022
2023	NUS Master of Science (Environmental Management) Alumni and ASHRAE Singapore Chapter, joint Conference on “Carbon Net-Zero and the Built Environment”, 6 May 2023
2023	ASHRAE Distinguished Lecture Talk, Seminar on “V in HVAC – Energy Efficient HVAC Systems Design” by Dr. Marwa Zaatari, and “Grid Decarbonisation” by Mr. Derek Wong, 11 September 2023
2023	ASHRAE Distinguished Lecture Talk, Seminar on “The New Carbon Standards: Towards Net Zero Operational, Embodied, Upfront and Whole Life Carbon” by Mr. Luke Leung, 1 November 2023
2024	Air Infiltration & Ventilation Centre (AIVC) and ASHRAE Singapore Chapter, joint Technical Conference on Ventilation, IEQ, Energy Efficiency and Sustainability, 18 and 19 April 2024, Surbana Jurong Campus.

Mementoes & Plaques

"Sore Foot" Award to Singapore Chapter attending
Region III Richmond Virginia, CRC 1990

ASHRAE Singapore Chapter, 25th Anniversary, 2009

ASHRAE Singapore Chapter

ASHRAE Singapore Chapter's Contributions to the Industry

2.1 Airconditioning in Hot Climates Topic of ASHRAE's first Overseas Meeting

By J. Richard Wright ASHRAE Director of Technology

ASHRAE held a Far East Conference on Air Conditioning in Hot Climates in Singapore on September 4-5, 1987. This, ASHRAE's first-ever overseas conference, was attended by approximately 250 persons from 25 countries. In addition to more than 80 participants from Singapore and more than 35 from the United States, there were 10 or more participants from each of six other countries: Australia, India, Indonesia, Japan, Malaysia and Taiwan.

Subjects covered Subjects of special significance covered in the conference papers included:

- How to deal with high solar and latent loads;
- The need to carefully select glazings to reduce solar loads;
- The utilization of unique ventilating windows to reduce solar loads;
- Use of radiant thermal barriers in attics;
- The need for special care to prevent condensation within walls or within duet insulation;
- Techniques for indoor humidity levels in high reducing humidity climates under partial loads other than by the inefficient use of reheat and
- Techniques for conserving energy by using air-to-air heat exchangers and hybrid desiccant cooling systems for reduction moisture levels.

J. Richard Wright, left, ASHRAE Director of Technology, answers the questions of a conference attendee regarding an ASHRAE publication on display.

Hans O. Spauschus, right, ASHRAE Director-at-Large and Director of Energy and Material Sciences Laboratory, Georgia Tech Research Institute, Atlanta, Georgia, shares a table during one of the luncheons with Tanabe Shinichi, left, and Ken-Ichi Kimura, center, both with Wasedu University in Tokyo, Japan.

2.2 First Asia-Pacific Conference on CFC Issue and Greenhouse Effect

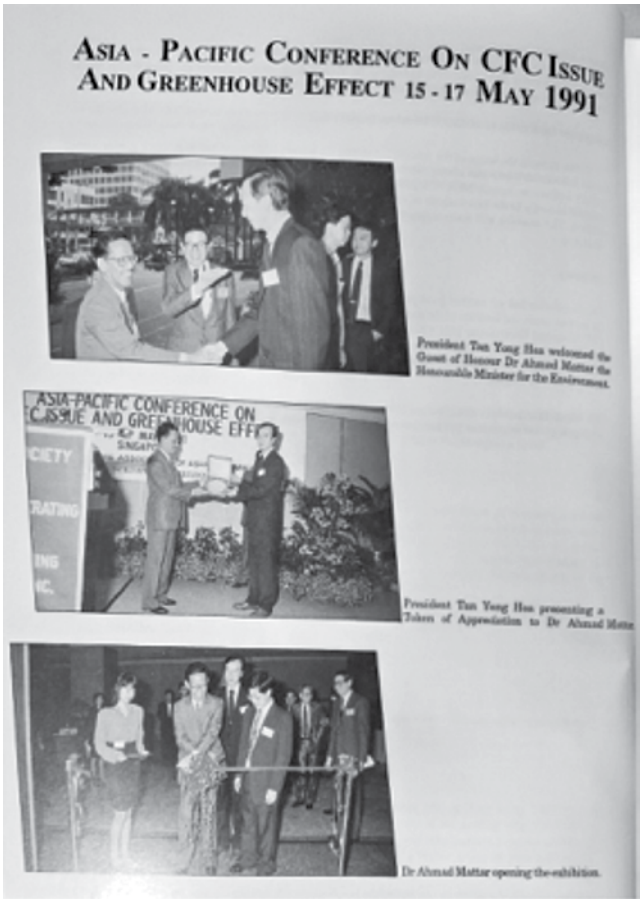
The two-day conference was opened by Dr. Ahmad Mattar, the Honourable Minister for the Environment on 16 May 1991. A total of 33 papers including keynote papers were presented and published in the Conference Proccedings.

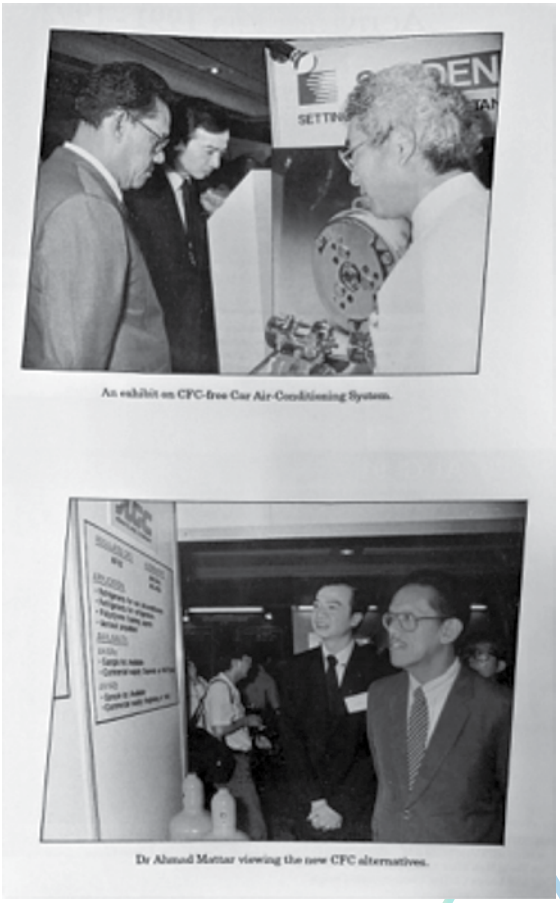
The keynote speakers were :

- Prof Tommy Koh, Singapore's Ambassador-at-Large and Director, Institute of Policy Studies;
- Dr Gracme Pearman of CSIRO Division of Atmospheric Research, Australia; and
- Dr V Ramaswamy of Geophysical Fluid Dynamics Laboratory at Princeton University, USA.

The other speakers were from Australia, China, France, Germany, India, Italy, Japan, New Zealand, Thailand, United Kingdom, United States of America and Singapore. The papers presented covered a wide range of topic which included revised Montreal Protocol, refrigerant recovery, CFC substitutes and issues on greenhouse effect.

An exhibition of CFC-related products was held in conjunction with the conference, Both local and foreiga companies participated in the exhibition. The response to the conference was overwhelming with over 220 participants. The conference itself was also very well received by the participants with very positive and encouraging feedbacks.





An exhibit on CFC-free Car Air-Conditioning System.

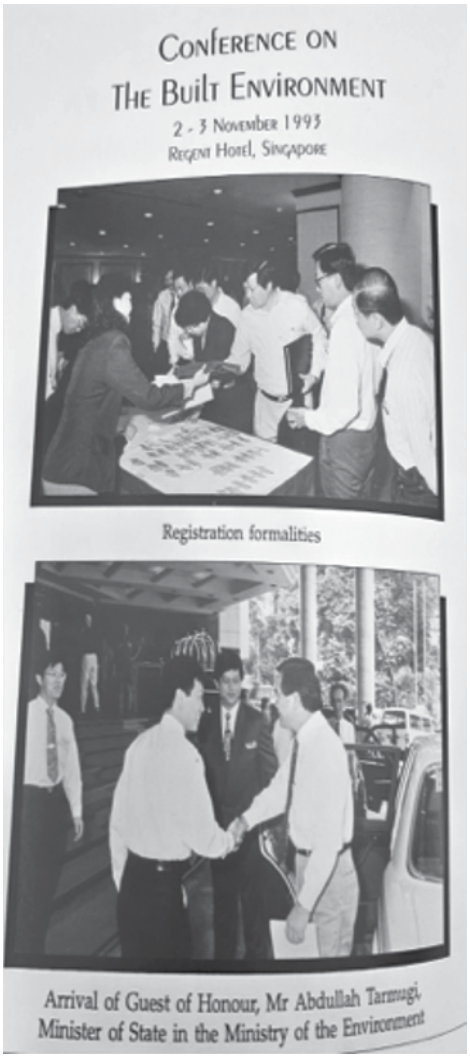
Dr Ahmad Mattar viewing the new CFC alternatives.

2.3 Second Asia-Pacific Conference on the Built Environment - CFC Update and Indoor Air Quality

The two-day conference was opened by Mr Abdullah Tarmugi, Minister of State, Ministry of the Environment on 2 November 1993. A total of 24 papers including keynote papes were presented and published in the Conference Proceedings.

The keynote address “Sick Building-A Valuable Insight for Project Managers” was by Mr Clive Broadbent, Consultant and formerly Chief Mechanical Engineer, Australian Construction Services. The other speakers and the papers presented covered a wide range of topics which included update on the Montreal Protocol. CFC substitutes, indoor air quality investigations in Singapore and the sick building syndrome.

In conjunction with the conference, a catalog exhibition of related products was held. Both local and foreign companies participated in the exhibition.The response to the conference was overwhelming with over 125 participants and overall it was well received with positive and encouraging feedback.



2.4 Third Asia-Pacific Conference on the Built Environment - Trends & Challenges

In conjunction with ASHRAE's Centennial Year celebrations, the Association jointly organised an Asia-Pacific Conference on the Built Environment on 1 - 3 June 1995 at the Raffles City Convention Centre, with the Malaysian Chapter and the Institute of Environmental Epidemiology, Ministry of the Environment. Issues of the built environment, namely, indoor comfort, energy-efficient systems and environment-friendly refrigerants, and the impact of engineering design on the health and well-being of the people within the built environment, were discussed at length.

The Conference was officially opened by Mr. Tan Gee Paw, Permanent Secretary, Ministry of the Environment. A total of 70 papers were delivered, and there were 4 prominent keynote speakers:

- Mr. Richard A. Charles (Presidential Member, AS HRAE),
- Prof. Takamoto Saito (University of Tokyo),
- Dr. Rudi Sloof (World Health Organisation, Geneva, Switzerland); and
- Dr. P Sherwood Burge (Consultant, Birmingham Heartlands Hospital, UK)

It was a huge success and was well attended by 218 local and international participants and speakers.

2.5 Sixth Asia Pacific Conference on the Built Environment (APCBE) 2001 - Progress on Energy Efficiency and Indoor Air Quality

The Sixth Asia Pacific Conference on the Built Environment (APCBE) 2001 was held on 15-16 November 2001 at the Novotel Apollo Hotel. It was jointly organised by the Singapore & Malaysia. It is a forum for presentation and discussion of new developments, and future aspects of the built environment.

A total of 48 papers were presented by speakers from 12 countries in the Asia-Pacific rim and Europe. About 100 participants took part in the event. The conference was opened by the Senior Parliamentary Secretary at the Ministry of National Development, Assoc Prof Koo Tsai Kee.

The keynote speakers were:

- Mr Jim Wolf, Vice President for Government Affairs, American Standard Inc, and former president of ASHRAE;
- Mr Tadashi Hirooka, Executive Director, Environmental Engineering Research Center, Yamatake Building Automation Ltd; and
- Dr Dieter Schwela of World Health Organization, Switzerland

A table exhibition was also organised for the event. The products and services on display attracted much interest. The conference and exhibition were widely publicised in the local media as well as televised in the prime time news.

2.6 HVAC&R and Associations

Over the years, ASHRAE Singapore Chapter has earned the respect and confidence of the industry to work together to promote and improve HVAC&R practices. Such collaborations include:

1) MOU with Malaysia ASHRAE Singapore Chapter on 2015, 2020
2) Agreement with Singapore Building and Construction Authority on 26th Jan 2018 to jointly conduct training course in the field of air conditioning, energy conservation and such other topics as Parties may agree.
3) MOU with SIFMA (Singapore International Facility Management Association) on 23rd Jan 2015 and 1st Dec 2020
4) Agreement with Ngee Ann Polytechnic to jointly conduct course on Smart Chilled Water Pumping System
5) MOU with Institute of Engineers Singapore on 21st April 2014
6) MOU with Singapore Building and Construction Authority on 8th April, 2009

ASHRAE volunteers are also actively involved in countless Working Groups (WGs) to develop:

1) SS553 Code of Practice for Air-conditioned and Mechanical Ventilation in Buildings 2009, 2016 & 2023
2) SS554 Code of Practice for Indoor Air Quality for Air-Conditioned Buildings 2009, 2016 &2023
3) SS 530 Code of Practice for Energy Efficiency Standard for Building Services and Equipment, 2006, 2013, 2022
4) National building environment design ISO TC 205
5) Green Built Environment Advisory Committee workstream 1: Passive design & active strategies
6) Technical committee on building management and maintenance 2020-2023, 2024-2026
7) Technical Reference - Autonomous Vehicles
8) Technical Reference - Hybrid Cooling
9) 9) CP 52 Code of practice for automatic fire sprinkler system 2004
10) SS 574 Specification for dual flush low capacity water closet up to 4.5/3.0 litres capacity - WC pans2012
11) SS 591 Code of practice for long term measurement of central chilled water system energy efficiency 2013
12) Technical Reference – Code of practice for passive displacement cooling system for air conditioning application

2.7 ASHRAE Singapore Chapter Technology Transfer Committee

The Chapter Technology Transfer Committee (CTTC) provides efficient and effective transfer of current and relevant information throughout the HVAC&R industry to and from the Chapters. CTTC develops and maintains high quality and readily available tools to enable Chapters to offer information and attractive industry-related information and programs to all segments within the HVAC&R industry. CTTC reports to the Members Council.

CTTC Major activities for the chapter members:

CTTC is dedicated to promoting sustainability, energy efficiency, and environmental responsibility within the HVAC&R sector.

Its objectives typically include promoting the following initiatives by ASHRAE Society:

- Research: Conducting and promoting research on the impacts of climate change on HVAC&R systems and vice versa.
- Standards Development: Contributing to the development of standards and guidelines aimed at mitigating the environmental impact of HVAC&R technologies and practices.
- Education: Providing educational resources and materials to professionals in the field to enhance their understanding of climate change-related issues and solutions.
- Advocacy: Advocating for policies and practices that promote sustainable and environmentally friendly HVAC&R technologies and practices.
- Collaboration: Collaborating with other organizations, institutions, and stakeholders to address climate change challenges collectively

Overall, the CTTC plays a crucial role in advancing the HVAC&R industry towards a more sustainable and resilient future in the face of climate change.

Three major activities for the members through individual chapters are 1) Programs 2) Awards and 3) Technical activities.

1) **Programs:**
Distinguished lecturers' (DL) program is one of the major activities CTTC conducts details of the program - https://www.ashrae.org/communities/chapters/distinguished-lecturers

Each chapter can choose from the pool of 87 experts (Current year 2024) from all over the globe to provide a conference lecture, workshop, panel discussions etc. with transportation funded by Society.

Singapore chapter has been able to conduct six DL events for the society year 2023-24 out of total 195 allocated visits funded by Society.

Tech Hour: Tech hour is sponsored by CTTC each quarter with a new interest topic
https://www.ashrae.org/professional-development/tech-hour-videos

2) **Technology Awards: The ASHRAE Technology Awards recognize globally outstanding achievements by members who have successfully applied innovative building design in the areas of occupant comfort, indoor air quality and energy conservation. Their designs incorporate ASHRAE standards for effective energy management and IAQ. Performance is proven through one year's actual, verifiable operating data.**

The following six categories are open for Tech awards for new, existing and existing building commissioning (EBCx) from each chapter.

1. Commercial Buildings 2. Institutional Buildings- Educational/Others 3. Health Care Facilities 4. Industrial Facilities or Processes 5. Public Assembly Facilities 6. Residential

Details of Tech awards can be found at https://www.ashrae.org/membership/honors-and-awards/technology-awards-program

Recent Tech awards for Singapore from Society & region : a) Society level honourable award and Regional merit award for SDE1 building by National University of Singapore b) Regional merit award for SMU Connextion by Singapore Management University c) Regional honourable award for SDE4 by National University of Singapore

3) Technical activities: Coordination of various technical activities initiated by Society.

a) Technology Council https://www.ashrae.org/communities/councils/technology-council
b) Standards and guidelines https://www.ashrae.org/technical-resources/standards-and-guidelines#stdsprjcom
c) Technical Committees https://www.ashrae.org/communities/committees/technical-committees
d) Position document https://www.ashrae.org/about/position-documents
e) Refrigeration activities https://www.ashrae.org/communities/committees/cttc-refrigeration-activities
f) ASHRAE task force for BUILDING DECARBONIZATION (Major drive by ASHRAE) https://www.ashrae.org/about/ashrae-task-force-for-building-decarbonization

Technical Guides released: i) Grid-Interactive Buildings for Decarbonization: Design and Operation Resource Guide ii) Building Performance Standards
Technical Guides under preparation: i) Decarbonizing Hospital buildings ii) A guide for applying Heat pumps iii) Building decarbonization retrofits iv) Whole life carbon.

ASHRAE Standards for Decarbonization released:

- Standard 90.1 -2022 Energy standards for sites and buildings except low rise residential buildings
- Standard 90.2-2018 Energy-efficient design of low rise residential buildings
- Standard 90.4-2022, Energy Standard for Data Centres
- Standard 100-2024, Energy and Emissions Building Performance Standard for Existing Buildings
- Standard 105-2021, Standard Methods of Determining, Expressing, and Comparing Building Energy Performance and Greenhouse Gas Emissions
- Standard 147-2019, Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems
- Standard 189.1-2023, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
- Standard 189.3-2021: Construction, and Operation of Sustainable High-Performance Health Care Facilities Xi) Standard 227P: Passive Building Design Standard
- STANDARD 228, STANDARD METHOD OF EVALUATING ZERO NET ENERGY AND ZERO NET CARBON BUILDING PERFORMANCE
- Standard 240P: Evaluating Greenhouse Gas (GHG) and Carbon Emissions in Building Design, Construction and Operation
- Standard 242P, Standard Method for Calculation of Building Operational Greenhouse Gas Emissions

2.8 Membership Promotion Committee

Membership (MP) role is crucial to attract new chapter members in all industry segments and retention to keep existing member engaged and prevents cancellation. Membership committee efforts is important and act as pillar for ASHRAE Singapore chapter to be able to continue to operate by getting more members.

MP Committee Responsibilities

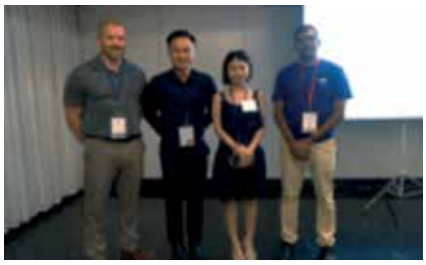
- Attracting new members who will be active in the Society, locally and/or at the Society level.
- Encouraging membership from all segments of the industry.
- Encouraging advancement to higher grades of membership when candidates' qualifications meet the specified requirements.
- In conjunction with the Secretary, ascertaining that all prospective Chapter members are bona fide members of Society.
- Reducing the number of member resignations or membership lapses.
- Advising the President and the Reception Committee when new members are elected or when members advance in membership grade, to ensure proper recognition at Chapter meetings and publications.
- Organizing and executing membership drives and encouraging participation from local consulting firms.
- Receiving from the Attendance Committee and/or Reception Committee a record of the names of people attending the Chapter meetings.
- Cooperating with and seeking advice from the Membership Promotion Regional Vice Chair
- Reviewing each member's status to select and recommend nominations for honors and awards.
- Collaborating with Student Activities Committee and Young Engineers in ASHRAE Committee to encourage students to retain their memberships when they graduate.

MP activities for the chapter members:

MP is dedicated to promoting and recruit from all segments of the industry especially in HVAC&R industry to join ASHRAE while keeping existing members. ASHRAE Singapore chapter have organise multiple event such as Membership night, recruitment drive during Exhibition & seminar, technical visit to site and showroom and engaging YEA and SA to organise Networking session and recruitment. With all this activity being done, ASHRAE Singapore chapter are able to retain the current member and also receive signup from new member that is interested to engage in the ASHRAE Community.







Number of ASHRAE members in Singapore from 2000-2024

There has been good representation of ASHRAE society members in Singapore starting from 500 plus members in 2001 to currently around 300 plus in recent years.

Lifetime Membership Status

ASHRAE members who have completed 30 years of cumulative membership and have reached age 65 are automatically members of Life Members Club. In ASHRAE Singapore chapter there is 39 member that have been converted to Life members/Fellow Life member. With the continuous support from them, ASHRAE Singapore chapter is able to grow. Following list is the ASHRAE Life members/Fellow Life member.

Last Name	First Name	Membership Grade	Chapter
Teo	Chin Chong	Life Member	Singapore
Yow	Kuan Yee	Life Member	Singapore
Chen	Siew Ik	Life Member	Singapore
Kwek	Matthew	Life Member	Singapore
Lim	Fatt Seng	Life Member	Singapore
Sze	George	Life Member	Singapore
Goh	Quee Seng	Life Member	Singapore
Ho	Kwok Lam	Life Member	Singapore
Yacob	Yusop	Life Member	Singapore
Yeo	Aik Teck	Life Member	Singapore
Teo	Kong Poon	Life Member	Singapore
Tan	Yan Kit	Life Member	Singapore
Chua	Kim Lian	Life Member	Singapore
Wong	Yew Wah	Fellow Life Member	Singapore
Yeo	Boon Ping	Life Member	Singapore
Ng	Eng Hong	Fellow Life Member	Singapore
Weng	Ho Mun	Life Member	Singapore
Loh	Albert	Life Member	Singapore
Kwa	Guan Sin	Life Member	Singapore
Chia	Kay Hua	Life Member	Singapore
Chou	Siaw Kiang	Fellow Life Member	Singapore

Last Name	First Name	Membership Grade	Chapter
Hui	Beng Hong	Life Member	Singapore
Ng	Chew Wai	Life Member	Singapore
Cheah	Beng Kin	Life Member	Singapore
Jua	Lim Tee	Life Member	Singapore
Chan	Pak T	Life Member	Singapore
Tan	Yong Hoa	Life Member	Singapore
Ng	Norman	Life Member	Singapore
Tan	Chow N	Life Member	Singapore
Koh	Lip Koon	Life Member	Singapore
Seng	Lim Hong	Life Member	Singapore
Kea	Goh Teng	Life Member	Singapore
CHEE	Yan Pong	Fellow Life Member	Singapore
Bong	Tet-Yin	Fellow Life Member	Singapore
Lulla	Ishwar	Life Member	Singapore
Yang	Ching F	Life Member	Singapore
Hng	Hung Chenh	Fellow Life Member	Singapore
Tan	Sunny	Fellow Life Member	Singapore
Tan	Gek Suan	Life Member	Singapore

For more information on Membership promotion activities of ASHRAE, please visit:
https://www.ashrae.org/communities/committees/standing-committees/membership-promotion-committee

2.9 ASHRAE Singapore Chapter Student Activities

The ASHRAE Singapore Chapter's Student Activities Committee plays a role in promoting and encouraging and HVAC careers for all levels of the education community. With the built environment playing a large role in decarbonisation efforts of the nation, the committee plays an important role in developing a pipeline of professionals with skills and expertise that align with the ASHRAE Society's vision and national sustainability goals.

At the Singapore Chapter, the following are the major activities for Chapter members:

Career Development

The committee connects students with prospective employers through events organised by the ASC. These events include conferences, members' nights, and Distinguished Lecture events. They provide students with education to enhance their understanding of technical concepts and solution that will benefit them when looking for employment prospects. The events also provide networking opportunities so students can connect with industry professionals.

Student Activities K-12

The K-12 program specifically promotes science and engineering education for younger education committee members. Not only is it to promote STEM subjects for primary and secondary school students, but to also provide education that connects traditional sciences with the built environment industry. This is achieved through support of new and innovative initiatives that will help improve content, knowledge, skills and of K-12 STEM teacher workforce and informal educators. Participating in classroom presentations of technical concepts to introduce how classical sciences connect with the built environment is also an important activity.

Student Activities Post-High

The ASC Student Activities Committee engages with Post-High School education community through Student Branches. Student membership is vital to the local chapter as they serve as a membership pipeline as well as industry professional pipeline. Students benefit through discounted membership to gain access to technical resources, society benefits, networking opportunities, professional development, and career exploration. The focus has expanded beyond engineering schools and into trade schools due to the forecasted labour shortage of skilled trades entering the built environment industry.

Student Design Competition

The annual Student Design Competition recognises outstanding student design projects. Participation in the design competition encourages the practical application of academic concepts as well as promotes teamwork and other soft skills sought after in the professional industry. The role of the ASC Student Activities Committee to administer at the chapter level, the entry of student design projects to the competition and provide a network of mentors to students to advise on technical matters for their projects.

For detailed information please visit https://www.ashrae.org/communities/student-zone

2.10 ASHRAE Singapore chapter Young Engineers in ASHRAE committee

Young Engineers in ASHRAE (YEA) plays a pivotal role within the **American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)**, contributing to the organisation's mission of advancing the arts and sciences of HVAC&R for the benefit of society. Through its major activities and initiatives, YEA makes significant contributions to ASHRAE's objectives and fosters the growth and development of young professionals in the industry.

1. Professional Development Programs:

YEA offers a diverse range of professional development programs aimed at enhancing the skills and knowledge of its members. These programs include seminars, workshops, and webinars covering various topics such as energy efficiency, sustainability, building design, and HVAC&R technologies. Through these initiatives, YEA equips young engineers with the tools and resources they need to excel in their careers.

2. Networking Events and Opportunities:

Networking is a cornerstone of YEA's activities, with the organisation hosting numerous events and opportunities for members to connect with industry peers, mentors, and leaders. From local chapter meetings to regional conferences and international symposia, YEA provides platforms for young professionals to build meaningful relationships, exchange ideas, and establish valuable connections within the HVAC&R community.

3. Leadership Development and Volunteerism:

YEA fosters leadership development and volunteerism among its members through various initiatives, including committee involvement, leadership training programs, and volunteer opportunities at ASHRAE events. By empowering young engineers to take on leadership roles and contribute to the organisation's mission, YEA cultivates the next generation of industry leaders and advocates.

4. Advocacy and Outreach:

YEA is actively involved in advocating for the interests of young professionals within ASHRAE and the broader HVAC&R industry. The organisation engages in outreach efforts to promote the importance of careers in HVAC&R among students and emerging professionals, encouraging greater participation and involvement in the field.

5. Scholarships and Awards:

YEA administers scholarship programs and awards to recognise outstanding achievements and support the education of aspiring HVAC&R professionals. These initiatives provide financial assistance to deserving students pursuing degrees in related fields and honour individuals who have made significant contributions to YEA and ASHRAE.

6. Honours and Awards:

YEA recognises outstanding achievements and contributions within its membership through various honours and awards, including:

I. YEA Leadership Award: Presented to individuals who demonstrate exceptional leadership and dedication to the YEA community.

II. Outstanding YEA Chapter Award: Recognising chapters that have excelled in engaging members, organising events, and contributing to the overall mission of YEA.

III. YEA Scholarship Program: Providing financial assistance to deserving students pursuing studies in HVAC&R-related fields, supporting the next generation of engineers.

In summary, Young Engineers in ASHRAE (YEA) plays a vital role in advancing the mission of ASHRAE and supporting the growth and development of young professionals in the HVAC&R industry. Through its professional development programs, networking events, leadership development initiatives, advocacy efforts, and scholarship programs, YEA contributes to the success and sustainability of ASHRAE and empowers the next generation of engineers to make meaningful contributions to the field.

For more information on YEA's activities and contributions to ASHRAE, please visit: https://www.ashrae.org/communities/young-engineers-in-ashrae-yea

2.11 ASHRAE Singapore Chapter Research promotion activities

The Research Promotion Committee plans and implements programs within the Society to generate funds to support ASHRAE research, YEA, Education (ALI), ASHRAE Foundation, Scholarships, and the General Fund.

ASHRAE Research

Since 1960, ASHRAE has sponsored research studies at universities and research firms. The results of these studies have been used to prepare chapters in the ASHRAE Handbook series; as foundational material in special publications; in the formulation of standards; to train university students as they prepare for service in the HVAC&R industry; and to spread the knowledge gained through presentation at Society Conferences and publication in ASHRAE Transactions or conference proceedings.

ASHRAE Research is the largest program of fundamental and applied research supported by a technical society

- Currently 60+ active research projects, 40+ projects approved for further development
- 55 percent of research is conducted by universities
- 45 percent is conducted by private research or engineering firms
- Payments to active projects range between $2.5-3 million per year
- The total value of all active projects is $7,749,829
- The average duration is 20 months at an average cost of $131,353 for each project
- Since 1959, ASHRAE has sponsored 956 projects with a combined value of $81.3 million

The Lasting Effects of ASHRAE Research on the Industry

- ➢ Created a comfort zone chart in 1922
- ➢ Developed of the “effective temperature” scale to incorporate humidity and air movement in the equation for human comfort
- ➢ Created a new psychometric chart in 1961

- Published “Laboratory Design Guide”
- Prepared a toolkit for building load calculation
- Updated the tables of design weather conditions in the 2013 ASHRAE Handbook Fundamentals

Research Promotion (RP) raises funds to support Research, which come from:

- Donations from individuals, companies and organizations
- Income from AHR Exposition held
- Every dollar collected for Research is spent on research projects
- RP consistently raises over $2 million in funds every year
- Singapore chapter has been consistently raising funds from various activities and contributing to society RP funds
- Since inception of the chapter, Singapore has been contributing to Society and this year 2024 Singapore has contributed US$ 15,306.77 to Society RP funds

Free research reports available to members www.ashrae.org/freeresearch
Support RP at www.ashrae.org/contribute

ASHRAE® Singapore Chapter

Singapore HVAC&R Industry

3.1 Brief History of Air-Conditioning in the 90's

Dr. Lal Jayamaha

In hot and humid climates such as Singapore's, buildings need to be air-conditioned to provide a comfortable indoor environment for the occupants. Therefore, air-conditioning has become a necessity in the 90's. People now live in air-conditioned homes, work in air-conditioned offices, travel in air-conditioned buses, trains & cars and eat in air-conditioned food courts.

Air-conditioning has become one of the fastest spreading home improvements in the 90's and statistics show that the proportion of Singapore homes with air-conditioning increased 2.7 times in the last ten years from 19.4 % in 1988 to 53.1 % in 1997.

Buildings too have become increasingly sophisticated in the 90's and this has led to the development of air-conditioning systems and designs. One of the major building projects completed in the 90's in Singapore was the Suntec City Complex. Suntec City complex comprises of four 45-storey office towers, an 18-storey office block, a convention & exhibition centre and a retail & entertainment centre. The total installed cooling capacity is 22,742 refrigeration tons which is sufficient to cool about 22,750 HDB rooms.

District cooling systems have also become more popular due to the need for reduction in building construction and operating costs. District cooling has been a feature of some building complexes built in Singapore in the late 80's and 90'such as, Raffles City, Marina Square, Suntec City and Millennia.

Development of the building industry requires integrating air-conditioning systems with other systems such as building automation systems, fire alarm systems, security systems and communication systems resulting in "Intelligent buildings". In such buildings it is no longer necessary to run around to check one another's schedules, book meeting rooms and inform people about meeting dates. All this is done by computers, and once a room is booked, the lights and air-conditioning come on at the required time.

Air-conditioning in transportation systems too has developed over the years in Singapore. The first air-conditioned bus was introduced in 1962 (on Service 11 route) but was later discontinued due to poor reception on relative higher bus fares. Today, air-conditioned buses have become popular with passengers and almost all services are air-conditioned. MRT trains and all taxis are also air-conditioned and ancient battery-operated fans on the dashboard of taxis are things of the past!

Air-conditioning has become so popular that even the traditional hawker centres are gradually giving way to cool food courts all over Singapore. The advent of air-conditioning has also led to the disappearance of non-air-conditioned restaurants and with it the practice in the 50's and 60's where some male patrons used to remove their shirts before a meal.

With the increase in use of air-conditioning, energy consumed by air-conditioning systems has become a major concern. Generally more than 50% of the electricity used in commercial buildings is consumed by air-conditioning

systems. According to Singapore Power, air-conditioning has become the single biggest consumer of electricity in Singapore, guzzling one-third of it while refrigerators come next, consuming one-quarter of all electricity generated.

Many countries including Singapore agreed at the Kyoto conference in 1997 to cut down on “greenhouse gases” blamed for warming the earth. The emission of CO2 which is one of the greenhouse gases can be reduced by burning less fossil fuels which can be achieved through improved energy efficiency and minimising waste. Various products and design techniques such as high efficiency chillers, heat pumps, variable speed drives and heat recovery systems have been incorporated into the design of air-conditioning systems to minimise energy consumption.

Singapore was among the first countries in the Asia-Pacific region to accede to both the Vienna Convention and the Montreal Protocol on substances that deplete the ozone layer. Singapore stopped the import of ozone-depleting chlorofluorocarbons (CFCs) used in air-conditioning systems from January 1, 1996. This made it necessary for many refrigeration systems using common refrigerants R11 and R12 to be converted or replaced by systems using alternative refrigerants R123 and R134a.

With the increase in use of air-conditioning, natural ventilation of buildings has become a thing of the past. Indoor Air Quality (IAQ) has become a concern with an estimate of one in five office workers suffering from building health problems because of poor indoor air. Many of us spend an average 8 to 9 hours a day at our workplace. We need physical comfort and good office environment to ensure that we do our best at work. Good indoor air quality can lead to better work efficiency while the reverse can lead to productivity loss, because of physical discomfort or health related problems.

Air-conditioning has become a necessity in the 90’s but we should all keep in mind the environmental issues associated with air-conditioning to ensure that we can continue to enjoy the cool comfort of air-conditioning in the new millennium.

3.2 Cool Transformations: Tracing Singapore's Air Conditioning Revolution from 2000's Onward

Author: Syed Mubarak, Government Affairs Chair

Introduction: The Cooling Revolution

In the sweltering tropical climate of Singapore, air conditioning is not just a luxury; it's a necessity. The last few decades have seen transformative changes in this sector, with significant advancements in technology, increased adoption rates, and a strong move towards sustainability. Initially designed to improve manufacturing processes, air conditioning quickly found its way into residential and commercial spaces, transforming the way we live and work. This article explores the evolution of air conditioning in Singapore from the 2000s and beyond, highlighting key developments in ownership, technology, refrigerant transformation, and efforts towards decarbonization and efficiency.

Ownership and Adoption Trends

The 1990s marked the beginning of widespread air conditioner use in Singapore, primarily driven by rising incomes and the booming real estate sector. However, it was in the 2000s that air conditioning became a standard feature in both residential and commercial buildings. The government's initiatives to improve living standards contributed to this trend, making air conditioners more accessible to a larger segment of the population. By the early 2000s, air conditioning was no longer seen as a marker of affluence but as an essential part of urban living in Singapore. Statistics show that air conditioner ownership in Singaporean households jumped from around 50% in the late 1990s to over 80% by 2021, reflecting a broader trend towards urban comfort as the country's economy grew.

Technological Advancements

Technological innovation has been a cornerstone of the air conditioning industry's evolution. In the 1990s, the technology was largely inefficient by today's standards, with units consuming significant amounts of energy for moderate cooling. The 2000s ushered in a technological revolution characterized by the adoption of inverter technology, which adjusted the power used based on the temperature of the incoming air, drastically reducing energy consumption. Additionally, smart technology integration in the late 2000s allowed for better control of indoor climates and further energy savings, signalling a shift towards more intelligent and responsive systems. The progression in air conditioning technology over the years has been marked by several significant innovations and name a few here:

Variable Refrigerant Flow (VRF) Systems: Introduced in the early 2000s, VRF systems offered enhanced efficiency by allowing the precise control of refrigerant flow to multiple indoor units, reducing energy consumption for households while providing comfort.

Magnetic Bearing Chillers: These chillers, which became popular in the late 2000s, use magnetic bearing technology to reduce friction losses, significantly lowering energy use and maintenance costs.

Smart Thermostats and IoT Integration: The adoption of smart thermostats and IoT technology in the 2010s allowed for better climate control and further reductions in power usage through predictive analytics and remote management.

Intelligent Control Technologies: The advancement of intelligent control technologies has played a crucial role in the widespread adoption of HVAC systems and their efficiency. Modern control systems utilize advanced algorithms and sensors to optimize air conditioning operation based on real-time data such as occupancy, weather conditions, and energy prices. This adaptability not only improves user comfort but significantly reduces energy consumption, carbon emissions, and operational costs.

Refrigerant Use and Environmental Impact

The shift in refrigerant use is another critical area of progress. During the 1990s, the most common refrigerants were HCFCs (Hydrochlorofluorocarbons), which were later identified as ozone-depleting substances. Singapore, adhering to international environmental agreements Montreal Protocol and participating in Kigali Amendment, began phasing out HCFCs in the 2000s, transitioning to more environmentally friendly options like HFCs (Hydrofluorocarbons) and eventually towards low impact HFOs (Hydrofluoroolefins) and natural refrigerants which have lower global warming potentials. This move significantly mitigated the environmental impact of air conditioning systems in the country.

Efficiency Improvements and Decarbonization Efforts

Efficiency has seen dramatic improvements from the 1990s to the 2000s and continues to be a focus into the 2020s. The introduction of the Minimum Energy Performance Standards (MEPS) by the Singaporean government set mandatory energy efficiency levels for air conditioning units. These regulations spurred manufacturers to innovate further, leading to the development of ultra-high efficiency air conditioners. In addition, the Singapore 2030 Green Plan has increasingly emphasized decarbonization in all sectors, including HVAC. Efforts towards using renewable energy sources to power air conditioning systems are part of the broader strategy to reduce carbon footprints and combat climate change. Solar-powered air conditioners are becoming increasingly popular, particularly in regions with abundant sunlight. These systems harness the power of the sun to provide cooling, reducing reliance on traditional energy sources and lowering the overall carbon footprint.

In addition to these advancements, the air conditioning industry has also seen improvements in the areas of noise reduction, air filtration, and indoor air quality. Modern air conditioning units are designed to operate more quietly, minimizing disturbance in living and working spaces. Advanced air filtration systems have been developed to remove pollutants, allergens, and other airborne contaminants, ensuring a healthier indoor environment.

Conclusion: A Cool Future Ahead

As Singapore continues to develop its built environment, the air conditioning industry is poised to remain at the forefront of technological innovation and environmental stewardship. The progression from the 1990s through 2000's has set a foundation for a future where air conditioning systems not only provide comfort but do so efficiently and sustainably. With ongoing research and development, the integration of AI and IoT, and stringent environmental policies, the next few decades will likely see even greater advances, ensuring that the cooling needs of Singapore's residents are met in the most efficient and environmentally friendly manner possible.

3.3 A Brief History of Refrigeration in Singapore

Tan Gek Suan

The advent of refrigeration and air-conditioning in Singapore was in the year 1932. At that time both CARRIER and YORK were the two U.S. brands to arrive in Singapore. CARRIER was represented by United Engineers and YORK by Sime Darby. These were followed subsequently by WORTHINGTON represented by Jardine Waugh and CHRYSLER by Kian Gwan. These were mainly for Air-conditioning applications. Only YORK was strong in Refrigeration work and among the very early projects were the ice making plants.

The first being the Singapore Ice Works which was located at Sungei Road and this was followed by Alexandra Ice Works and Tuck Lee Ice Works in the 1950s, both in the Havelock/Alexandra Road area. Then in early 1960s, Jurong Ice Works started at Jurong Fishery Port. Some of these plants used Ammonia as the refrigerant but the majority use “Freon”.

All these plants were producing “block ice” which was the fashion in those days. Of the earlier three ice plants only Tuck Lee is still in business, but the old plant was totally replaced with MYCOM Compressors in a totally new facility. Tuck Lee no longer produces block ice. The new plant produces only tube ice that is subsequently crushed for use in wet markets or as ice cubes for homes. The old Singapore Ice Works at Sungei Road was demolished in the 1970s, and the plant re-located to a site near the Fishery Port, opposite to Jurong Ice Works.

Apart from ice making plants, the other major application for refrigeration in the 1930s was in refrigerated warehouses for food storage and distribution, and in the early 50s with the advent of Supermarkets. Refrigeration was required in the display cases and coldrooms in Supermarkets and food retail outlets, and for coldrooms in hotels and restaurants. Among the earlier users of refrigeration in food storage and distribution were Cold Storage, Fitzpatricks, Ben Food, and Malayan Refrigeration Company (MRCO). These were mainly food retailers and wholesalers.

In the 1950s, there were only 3 major supermarkets in Singapore, namely Cold Storage Supermarket, Fitzpatricks and the NAAFI Shop, all located along Orchard Road and catering mainly to the expatriate community. Cold

Storage was at the site of the current Centrepoint. The store had undergone a few re-models over the last 40 years to its present supermarket in a modern shopping centre.

Fitzpatricks was at the location where The Promenade is today, while the NAAFI Shop was at the site currently occupied by the Orchard Building. The NAAFI Shop catered mainly to the British forces and their dependents in those days. Then there is the Tay Buan Guan Supermarket in Katong, which was patronized by the well educated and the wealthier community living in the eastern part of Singapore.

It was not until 1973 when supermarket retailing in Singapore began its boom. It was NTUC, the union cooperative which started the first "Welcome" supermarket at Lorong 4 in Toa Payoh (subsequently re-named NTUC FairPrice), then came the "Supreme" supermarket in Supreme house and this was followed by "Yaohan" at Plaza Singapura in December 1973.

Since then, refrigeration for the supermarket industries has grown by leaps and bounds until today where we have more than 300 stores of all sizes in Singapore. Following the tremendous growth of the food storage/distribution and retail industries, it was natural for the food processing industries to take off too. In the early 1930s, the demand for frozen and chilled food was limited and consumed by expatriates. It was only in the 1950s that refrigeration played a very important part in our daily lives.

The availability of domestic refrigerators/freezers in the market such as Kelvinator, Frigidaire, Westinghouse, Philco, etc. gave impetus to the growth of processed food. These brands of household refrigerators have also been overtaken by technology and have phased out and replaced by new brands such as Midea, LG, Samsung, Hitachi which uses the more environmentally eco-friendly refrigerant R290, in keeping with climate change and the government green initiative.

The early pioneers in the food manufacturing industries were Singapore Poultry Processing in the early 1960s. This was followed by others such as Lee Poultry, Hellaby and Lee Meat Processing. Many of these were also overtaken by others and are no longer in existence today.

The beverage industry was another area where refrigeration played a major role in the early fifties. I remember the first Pepsi plant where they had a large refrigeration plant that was located at old Havelock Road and F&N at Alexandra Road, end of River Valley Road. Then there were the Amoy Canning (Green Spot) and Yeo Hiap Seng factories along Bukit Timah Road, Framroz in Jalan Besar and Sinalco (National Aerated Water Co.) along Serangoon Road. All had some kind of refrigeration plant with cooling tower or evaporative condensers. Other than Yeo Hiap Seng and F&N, both now re-located to their modern facilities, the rest had closed down or overtaken by new players like Malaysian Dairies, Australian Fruit Juices, etc.

Although the petrol chemical and the marine industries were among the early users of refrigeration in their processes, it was in food and beverage processing and distribution that saw the first application of refrigeration in Singapore and the focus of this story. After more than seventy years of refrigeration, it is no wonder that in any supermarket today, it is possible to find a whole range of all kinds of refrigeration processed food products ranging from ice cream to popiah skin to spring roll, curry puff, noodles, tofu, pau, etc. All these are made possible with the development of the total refrigerated food supply chain brought about by advancement of food technology and refrigeration.

3.4 Brief History Of HVAC&R in Marina Square Complex

1982 – 1987 Marina Square by Neil D. Woodcock MAPM, MSIArb, MCIArb, MCIBSE, MASHRAE, FCSA.

In 1982 I was appointed as MEP Co-ordination Manager by Hyundai Engineering and Construction for the building of Marina Square Complex. The project consisted of The Marina Mandarin a 22 storey hotel, The Mandarin Oriental a 22 storey hotel, The Pan Pacific a 35 storey hotel all located on a common 4 storey retail mall and car parks.

The project Architect was John Portman of Atlanta, Georgia and the project MEPF designer was Syska and Hennessy of New York. Local architectural representative was DPA and MEPF representative has since been swallowed up.

The whole of the area is reclaimed land.

In my own background, I had trained as an air-conditioning designer in the mid-sixties serving an apprenticeship with a design consultant in Birmingham. In the seventies I moved into working for main contractors on sites and thus learned about all services in the school of hard knocks in Saudi Arabia, Oman, Qatar and UAE before being invited to Singapore.

At the time of starting, the Fullerton Hotel was still the General Post Office, The Satay Club was on Elizabeth Walk, people were still living in bum-boats on the Singapore River at Boat Quay and the rest of the area around the site from Benjamin Shears Bridge to Nicol Highway was scrub-land awaiting development.

The two photographs, taken from the Pan Pacific give a good idea of the area.

Mandarin Oriental and construction offices

Marina Mandarin & Pan Pacific

In the late 1970's and early 1980's there was a fashion amongst designers to utilize direct sea-water cooling for large installations like Marina Square. Syska & Hennessy had form in this regard and most of the Hyundai MEP engineering staff had moved from the Sheraton Hotel and Conference Centre in Doha, Qatar at which we had all

experienced Syska & Hennessy designed direct sea water cooling of the centrifugal chillers. The pioneers in this regard, however, were all in Hong Kong where they had extremely deep water with strong currents close to where building was taking place.

For Marina Centre we built a sea-water intake chamber to accommodate the pumps and debris screens necessary on the land nearest the shore just beyond the Mandarin Oriental in the picture above. Also in this picture, if you look closely, you can see a brown line in front of the construction cabins. This was a deep trench to house the outfall pipe that ran from the chiller plantroom in basement 1 up to a discharge point under Benjamin Shears Bridge.

The big disadvantage of direct sea-water cooling is that all materials must be impervious to corrosion from sea water. Hence the sea-water pumps were phosphor bronze casings and impellors, the pipework was all glass reinforced plastic (GRP) and the chillers had cupro-nickel tubes. This all obviously adds cost to the installation, and in the case of GRP needs more careful handling when putting in the ground.

When it came to commission the system we discovered that the sea-water intake had silted up and no amount of excavation appeared to affect the depth of silt. I guess hundreds of years of depositing Singapore River silt has given quite a depth of soft bottom.

We were eventually forced to build a coffer dam to a level just above silt level to enable us to run the condenser water pumps without befouling the whole system and eroding our pump impellors.

This worked and we managed to commission the whole system, however, it was noticed that at low tide a huge vortex was formed within the coffer dam and this tended to skim all of the detritus on the surface of Marina Bay and deposit it in our travelling screens.

As may be seen from today's installation for Marina Square the seawater intake has been replaced by traditional cooling towers and the old sea-water installation presumably either buried or removed. It would not have worked in any event because of the damming of Marina Bay for use as a fresh-water reservoir.

The use of direct sea water cooling has been abandoned in most of the world due, in no small amount, to its effect on the marine environment. Coastal sea water in areas with greatest need for cooling, the tropics and Middle East, is generally already quite warm at 30-35^{o}C which means that the discharge temperature is 35-40^{o}C or more, and this is the temperature that kills, amongst other things, coral. Many jurisdictions have now banned this form of cooling.

My own opinion is, that a far more ecologically friendly and long-term solution would be to use sea water cooling towers so that the water returned to the sea is a little cooler than when it is extracted. By using simple electrolysis at the intake the sea water can be made self-treating by freeing the natural chlorides that will kill-off any algae, barnacle etc. in the system. In many parts of the world potable water is in short supply and expensively desalinated so there is little sense in desalinating sea water only to pump the desalinated water back into the atmosphere. To use indirect sea water the tower and pumping materials need to be impervious however the intervention of a plate heat exchanger enables the rest of the system to be closed circuit condenser water this using standard water treatment and materials.

3.5 ArmaLive at Armacell

Ad images: Andy ArmaFlex in 1950s

Continuing more than 20 years of commitment towards driving sustainability and energy efficiency in Singapore

Accounting for as much as 40% of total energy consumption in a building, air conditioning and HVAC systems are massive energy guzzlers (Muruganathan, 2020). As technical insulation is key to enabling optimal system performance and energy efficiency, **ArmaFlex®** insulation has been our key product offering since its invention in 1954. Our international sales grew steadily since, and distribution in Singapore began as early as in the 1990s.

As Singapore's economy progressed, population and building density intensified. People's disposable incomes improved and there are increased demands for better quality of life, better comfort and more sustainability. This is why we have also evolved to become a multi-material and multi-solution provider today. In addition to expanding our signature ArmaFlex elastomeric foam portfolio to include options with Microban® antimicrobial product protection, we are also developing low smoke solutions based on our patented **ArmaPrene®** technology. Our other thermal and acoustic solutions now also include **ArmaGel®** flexible aerogel insulation blankets, **ArmaComfort™** acoustic and vibration control solutions as well as **ArmaSound®** Industrial Systems.

In 2013, Armacell established our regional headquarters in Singapore with an initial team of eight dedicated individuals at Great World City. Fuelled by steady growth, we doubled our office space to 4,700 sq ft in 2017 and tripled our headcount. Despite the COVID pandemic situation, we made a conscious decision to invest further in 2022 to establish the ArmaLive Experience Centre (ArmaLive). In addition to housing Armacell's APAC regional headquarters, this 16,000 sq ft facility at 21 Ubi Road 1 now includes the first-of-its kind customer experience centre, a dedicated training facility as well as a fabrication workshop.

At ArmaLive, visitors can experience firsthand how our solutions are handled, installed and perform as compared to alternative materials. We will also showcase our latest solutions such as the **ArmaProtect™** passive fire protection range plus our partner products to illustrate where and how our products are used.

However, quality products can deliver long-term reliable performance only if they are properly installed. This is why Armacell is passionate about training and certifying installers who can deliver high-quality insulated systems. With our in-house trainers, we have developed a structured installer training programme designed for the local and regional market, and this can be conducted at ArmaLive or at the job-site. Customised training sessions can also be designed to meet specific project requirements.

Leveraging on our international experience and expanded portfolio, we are even better equipped now to support various stakeholders at different project stages. This can include technical support and prototyping efforts at the beginning of a project or conducting audit services and providing bespoke solutions for in-operation projects. Armacell has been part of the Singapore HVAC industry for over 20 years, and our focus on sustainable, profitable

growth goes hand in hand with our obligation to develop and manufacture products that positively affect our people, communities and the environment. ArmaLive is an embodiment of our commitment to drive sustainability and energy efficiency, to uplift the HVAC industry with skilled professionals, and to serve as a strategic networking venue for individuals striving towards proficiency and excellence in these areas.

ArmaLive Application Centre

ArmaLive Main Lobby

Armacell trainer, Mr Ric Matanguihan demonstrating the correct way to cut ArmaFlex insulation material.

Improperly managed material can result in poor installation and inadequate insulation.

3.6 Camfil's Journey: A Story of Innovation and Commitment

It all began in 1963. It was the year when Camfil embarked on a mission to safeguard people from polluted air. The genesis of this journey was sparked by the stringent requirements of nuclear power plants in Sweden. These facilities demanded air filters of the highest quality to meet the exacting standards set by the research center in Studsvik. Faced with this challenge, Gösta Larson, sought a solution from across the Atlantic, reaching out to the Cambridge Filter Corporation in the United States. Collaborating closely, they completed the stringent standards, birthing what would become known as Camfil AB.

The demand for air filters surged across Europe, propelling Camfil into a phase of expansion and innovation. Establishing a subsidiary in Germany and engaging agents in Switzerland, the company solidified its presence in the region. The significance and necessity of air filters continued to soar, leading Camfil to relocate its operations to a new factory in Trosa, Sweden, during the summer of 1968.

From its inception, Camfil demonstrated remarkable foresight, adapting swiftly to the evolving landscape of the times. The company's energy-efficient bag filters gained widespread popularity among businesses, prompting the establishment of a new manufacturing site in Unterägeri, Switzerland. Trosa, Reinfeld, and Unterägeri were the three factories supplying a range of filters, including the innovative AbsoluteTM filters.

The first pleating machine was developed in Trosa and later installed in Reinfeld. The folding of the filters was previously done by hand, but now it is done by machine. The thinner and more precise folding resulted in a greater filter area, which was an absolute innovation on the filter industry. Camfil's introduction of the first pleating machine revolutionized the industry, enhancing filter precision and efficiency, thus marking yet another milestone on its path to become the global market leader.

The year 1988 heralded a transition in leadership as Gösta Larson retired from his role as CEO, passing the baton to his son, Jan Eric Larson. This change in leadership ushered in a new era of intensified efforts to develop Camfil as a comprehensive air filter supplier on a global scale.

By 1999, Camfil had expanded significantly, boasting 12 production sites, 26 subsidiaries, and 41 agents spanning 54 countries. Additionally, Camfil established Camfil Component AB, with the sole purpose of constructing a fully automated production line for manufacturing filters destined for Philips.

During 2001 Jan Eric Larson handed over to Alan O'Connell who became the new CEO of Camfil and in 2019 Mark Simmons succeeded Alan O'Connell as Camfil's new President and CEO, carrying forward the company's commitment to innovation.

Camfil strategically expanded its footprint in the Asia-Pacific region, inaugurating its first factory in Malaysia in 1997. Over time, Camfil Malaysia has earned several accolades, including ISO 9001 certification, along with Eurovent, UL, IECEx and FM product certifications. To better serve its customers, Camfil has consistently invested in and upgraded its facilities, ensuring more efficient, advanced, and customized solutions. For instance, the Multipleater machine, used for pleating HEPA air filters, was installed between 2000 and 2005. In 2009, Camfil Malaysia moved to a new facility, where it established both an R&D center and Camfil College. The plant has

recently undergone further expansion, with Camfil investing MYR 50 million in Malaysia to further enhance production capacity. This strategic investment enables Camfil to address the growing global demand for air filters, catering to both particulate and molecular solutions, not only in the Asia Pacific region but also worldwide.

Camfil continually transform and innovate itself to be ready for the challenges ahead so as to reach greater heights. Air filter testing laboratory with ISO 10121, ISO 16890, and EN779 particulate test rigs, as well as an IAQ and HEPA laboratory and classrooms, was established as to reaffirm its core values.

In addition to its Malaysia Ipoh facility, Camfil operates another core manufacturing plant in Taicang, China, which opened its doors in 2023. This expansive facility represents a significant milestone for Camfil. Spanning over 40,000 square meters, it stands as one of the company's largest plants and serves as its inaugural integrated factory, producing all product lines across its four business areas. Additionally, the facility boasts a dedicated research and development center, where rigorous testing is conducted in alignment with ISO16890 standards. This ensures that the products designed here are not only efficient but also customized to cater specifically to the needs of China and the Asia Pacific market.

Locally in Singapore, Camfil Singapore Pte. Ltd. has played a pivotal role in delivering cutting-edge clean air solutions since its establishment in 2001. Notably, Camfil Singapore achieved the prestigious Green Building Product (SGBP) certification for five flagship air filters. Among them Camfil Opakfil ES, F8 (ISO ISO16890 ePM1 70%) & F9 (ISO ISO16890 ePM1 80%) lead the pack, earning the exclusive best-in-class 4 ticks certification. These filters exemplify commitment to environmental consciousness, energy conservation, and overall sustainability.

Ms. Florence Chan, Managing Director of Camfil Singapore Pte Ltd, reiterates this commitment, emphasizing the company's dedication to creating sustainable environments for future generations. "Camfil is dedicated and passionate about delivering clean air solutions for commercial and industrial buildings. Our goal is to improve air quality, boost productivity, and reduce energy usage. By creating more sustainable environments for future generations, we embrace a greener future," says Chan. Ms. Chan is not only an active member of the ASHRAE Singapore Chapter but has held important positions as Chapter President for the term 2019–2020 being the first lady president of ASHRAE Singapore Chapter.

Even during the global outbreak of the Coronavirus, Camfil maintained the highest safety standards for customers, partners, and employees, highlighting their dedication to safeguarding well-being. Camfil's leadership in innovation is exemplified by their continual introduction of energy-efficient bag filters in the market. Their focus on environmental consciousness, low energy consumption, and cost reduction underscores their commitment to sustainable product development and contributing to a healthier future for all.

3.7 Carrier Singapore

Carrier's heritage in Singapore spans half a century - a heritage rich in successes, achievements and milestones. Innovators in air-conditioning and heating technology in America, Carrier has, since 1932, led the industry in Singapore.

Carrier Pioneered Airconditioning

In 1902, young Willis Carrier, an enterprising 26-year-old American, invented the first practical air conditioning system. For the young man, it was the first step in a brilliant career. For the rest of the world, it was a significant breakthrough in controlling the quality of the environment - keeping temperature, humidity and air quality at acceptable levels.

Carrier comes to Singapore

After the Great Depression of the 1920, world economies slowly but surely set out on the route of revival. Companies looked East for hitherto, relatively unexploited greener pastures.

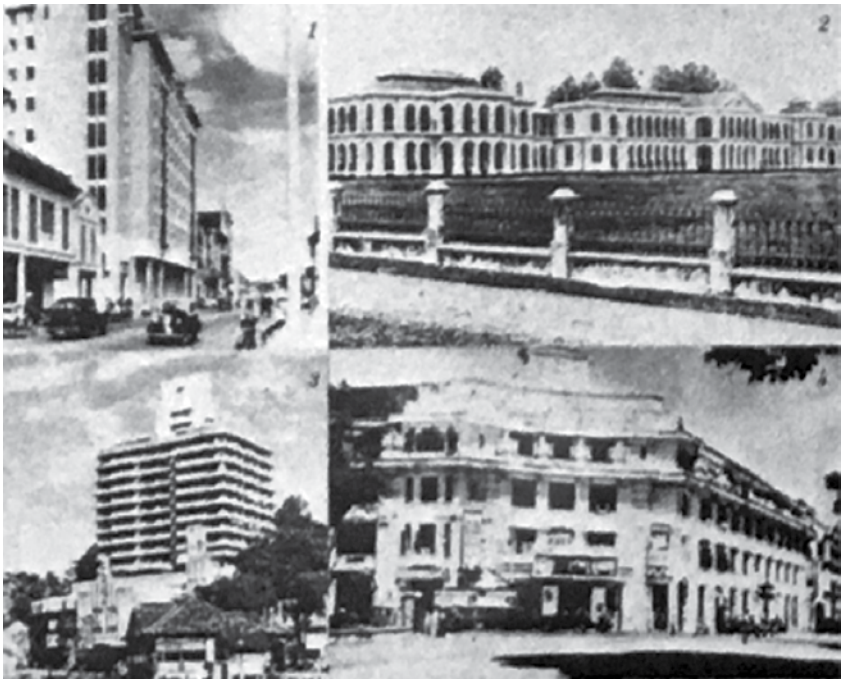
In 1932, the Carrier Corporation introduced air conditioning for the first time to Singapore and the South east Asian region. Distributors were appointed in key cities. In Singapore, Carrier was represented by United Engineers. Carrier-trained personnel were seconded to assist in sales, distribution, installation and servicing.

The Early Carrier Installations

In 1935, barely three years after Carrier made its debut in Singapore. a Carrier console room air conditioner, model 50D, was brought in and installed at the Chinese Club in Singapore.

The following year, the Framroz Ice Factory, one of the then larger aerated water manufacturers, was equipped with a Carrier ammonia compressor.

Two significant installations were carried out in 1937. A direct expansion system was installed in the X-Ray and Eye Clinics of the Singapore General Hospital. Another system was implemented for process cooling of latex.



1 McDonald House (1950's)
2 Singapore General Hospital (1930's)
3 Cathay Cinema (1960's)
4 Capital Cinema (1940's)

Growing affluence called for cooler and better-controlled environment in public entertainment areas. Airconditioning systems were installed in 1938 at Capitol and Cathay cinemas. Singapore's premier cinema-halls. The aeroplane instrument repair trade, too, benefited from a Carrier air conditioning system installed in 1939 to control temperature and humidity.

Further development was brought to a halt by the Second World War.

Formation of Carrier International Limited

Following a hiatus during the war years, Carrier Corporation resumed distribution in the region. Though post-war reconstruction was slow and arduous. Carrier was undaunted. With foresight and great business acumen, a subsidiary, Carrier International Limited, was formed in 1948 to further the growing development of the use of air conditioning equipment. An office was setup at McKenzie Road South-east Asia's First Centrally-Controlled Airconditioning System

The same year, South-east Asia's first Carrier centrally-controlled air conditioning system, the Weather Master, was installed at McDonald House.

Local Joint Venture – IAC Limited

In 1954, Carrier entered into a joint venture with local businessmen to form International Airconditioning Company Limited (IAC limited). This new joint-venture company took over the sale, distribution, installation and servicing of Carrier products in Singapore, Malaysia and the region. The Carrier headquarters moved to bigger premises at Leng Kee Road.

24-Hour Service

The inimitable "Carrier Man" service standard was set when 24-hour service was introduced in Singapore and Malaysia in 1956 and 1957 respectively.

Carrier Window Unit 51J

The first Carrier window unit, 51J, was introduced in Singapore during the 1950s.

More Carrier Installations

The fifties also saw an increase in air conditioning installations. The first centrifugal unit was installed at Robinson's former store at Raffles Place.

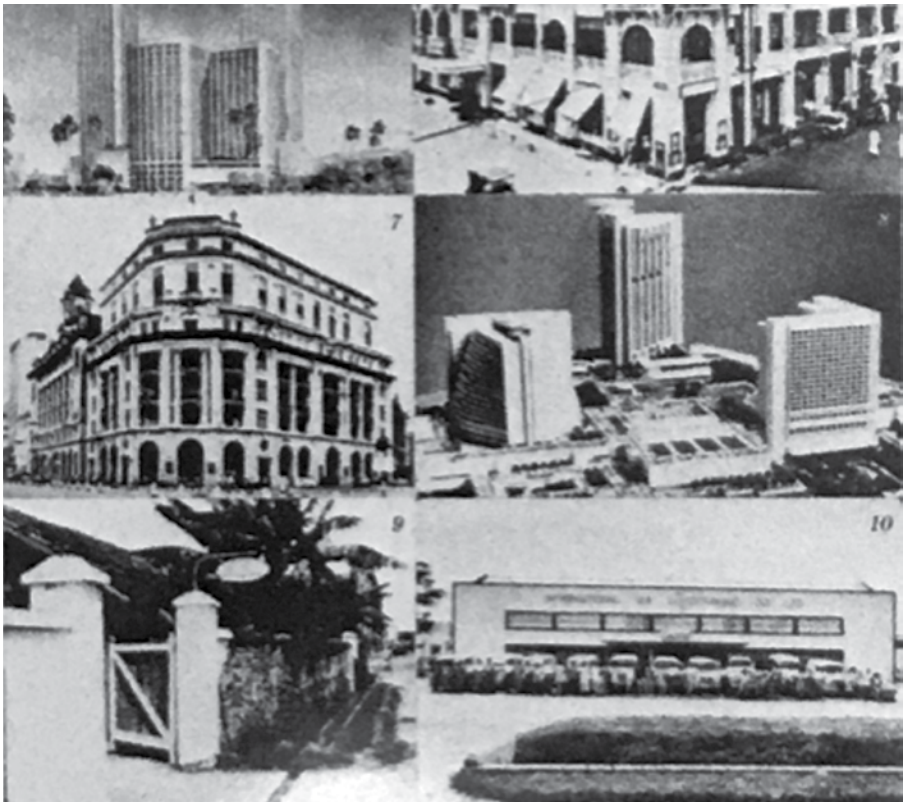
Radio Singapore enjoyed a complete air conditioning system and Tai Thong Restaurant became Singapore's first Chinese restaurant to be airconditioned. The Elizabethan Grill at Raffles Hotel and the Adelphi Grill followed suit. Carrier also installed air conditioning in some of Singapore's landmark buildings – the Hongkong Bank Building at Collyer Quay (since demolished and rebuilt), the Bank of China Building and the Goodwood Park Hotel.
The main stalwart government buildings are also Carrier domains. Carrier air conditioning systems were installed at the Supreme Court, Parliament House and the Istana.

Corporate Reorganization

In line with political and economic changes in South-east Asia, IAC Limited was reorganized in 1962 to give rise to three companies, IAC (Singapore) Pte Ltd, IAC (Malaysia) Sdn Bhd and IAC (Hong Kong)

Ltd, to look after Carrier's business interest in different marketing territories. These companies became wholly-owned subsidiaries of IAC (Holdings) Limited upon its incorporation in 1969.

In March 1971, following a restricted offer for sale of IAC shares through private placement, IAC was admitted to the Official List of the Stock Exchange of Singapore and Malaysia.



5 Raffles City
6 Adelphi Hotel (1930's)
7 Hongkong Bank (1950s)
8 Marina Centre
9 Carrier office at McKenzie Road
10 Carrier Headquarters at Leng Kee Road (1954)

Accelerated Growth

With the boom in the building and construction industry, the seventies saw a record number of installations which gave Carrier an added impetus in its rise to prominence.

The first Carrier'37 series variable Air Volume systems were installed in Singapore and Kuala Lumpur. The first Carrier 41CA Computer Air Conditioning System was introduced in Singapore.

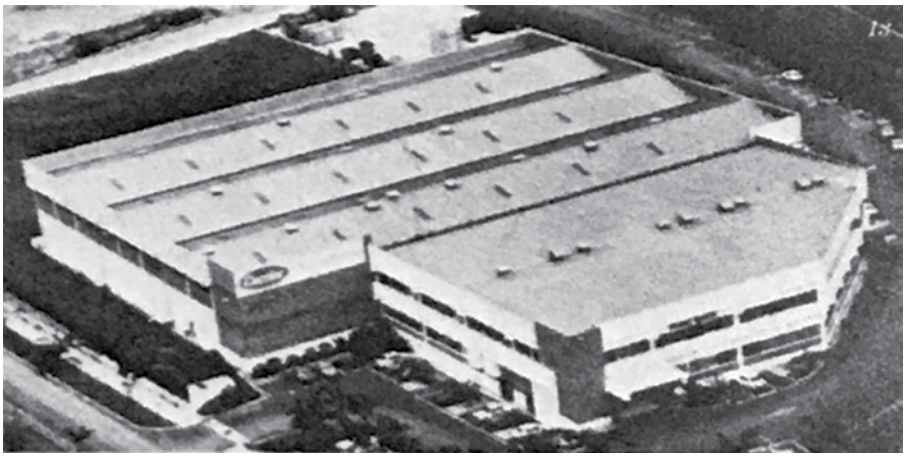
Multi-national and international companies "bought Carrier". They include Philips, Hewlett Packard and Siemens. Leading hotels like Marco Polo and Pavilion Inter-Continental Hotel and Royal Holiday Inn chose Carrier. The A&W fast food chain, too, adopted Carrier air conditioning.

New Carrier Offices

This upswing in business in Singapore necessitated another move – this time, to new and bigger premises at Upper Thomson.

On a land area of 24,127 square meters, the new S$8 million Carrier Centre houses both the Singapore and Asia/Pacific offices, a fully-equipped training centre, service workshops, warehouses and recreational facilities.

Carrier now operates from a 9,050 square meters office building with 3,597 square meters of warehousing facilities.



Carrier Centre at Upper Thomson Road

Phenomenal Growth Continues

The phenomenal growth continued into the eighties. Though it is barely three years into this decade. Carrier has more than 50 substantial contracts, filling even more of Singapore with Carrier air.

The Singapore Changi Airport main building, the Shell hydrocracker at Bukom and Lucky Plaza are some of the significant “Carrier landmarks”.

Condominium complexes like Ardmore Park and Draycott installed Carrier systems.

Flagship Projects

Carrier also won the two highly-prized projects that will change the skyline of Singapore – Marina Centre and Raffles City.

The S$1.2 billion Marina Centre project will be the first commercial development in Singapore to use a seawater-based Carrier air conditioning system when it opens in 1985.

Raffles City, Singapore’s ‘city within a city’. too, will become another Carrier landmark. It will have convention facilities, billed as the largest in the region, two hotels providing 2,100 rooms, and a 42-storey office tower.

Exclusive Distribution Network

Carrier’s extensive exclusive distribution network can be described as unique. Its 17 dealers sell only Carrier air conditioning systems. Carrier’s close working relationship with their dealers is one of the ingredients in their formula of success.

Carrier’s Golden Years

The awareness of living and working in a controlled environment has brought about this growing demand for efficient air conditioning resulting in Carrier being a way of life in Singapore. The 50 years have indeed, been Carrier’ Golden Years

3.8 Daikin Singapore
A Legacy of Innovation and Excellence

1. **Establishment:**

Daikin Airconditioning (Singapore) Pte Ltd is a subsidiary of Daikin Industries Ltd. In 2024, Daikin celebrates its 100th anniversary. As an air conditioning specialist, we have marked a full century of innovations in air. As The Only Japanese Aircon Specialist, we apply cutting-edge technologies to provide sophisticated air conditioning systems to thousands of Singaporean homes, educational and recreational needs. For more than 56 years, Daikin Singapore has been touching the lives of Singaporeans. Set up here in 1968, Daikin has mirrored the nation's growth and gone on to achieve many firsts in Singapore.


Multi-Split & VRV System

When the nation's Housing and Development Board (HDB) was paving the way to house Singaporeans of growing affluence, Daikin was the first to introduce multi-split air-conditioning systems to HDB homeowners. As businesses boomed, Daikin also introduced to the island in 1986, the world's first super-efficient VRV® Systems for commercial buildings.

2. **Expansion and Growth**

Daikin Singapore has acquired BMS Engineering & Trading Pte Ltd in 2021. The operation has been integrated into Daikin Singapore on 1st October 2021. We aim to play a much bigger role in being one of the leading Systems Integrator of Building Management Systems, Integrated Facilities Management systems and Energy Efficiency Solutions in the region.

Daikin Singapore offers comprehensive proposals for building-wide facilities and contracting services focused on cost reduction and service quality improvement.

3. **Technological Innovation:**

Product Solutions

- Daikin as the world's first R32 refrigerant and the only company in the world to manufacture both air conditioners and their refrigerants.
- Daikin's innovation iSmile Eco Series with zero ozone depletion and higher energy efficiency makes ECO the new way to go!
- By combining the technologies of Variable Refrigerant Volume (VRV), Variable Refrigerant Temperature (VRT) and Variable Air Volume (VAV), we have attained both energy savings and comfortable commercial air.
- Daikin achieved highest 5-ticks energy efficiency by National Environment Agency.

Smart Control Solutions

An all-in-one, cloud-based management service that offers real-time control and monitoring, advanced analytics, and customized support to address HVAC lifecycle concerns.

Daikin's Reiri Solutions is committed to deliver comfort, convenience, and efficiency to both residential and commercial users.

a) Reiri for Home household electronic devices and appliances seamlessly communicate with each other and with you.

b) Reiri for Office allow users to remotely monitor and manage air conditioning systems, energy consumption, smart lighting, and more through smart mobile devices.

c) Reiri for Hotel equips hotel managers with tools to enhance guest comfort by monitoring and controlling room temperature and reducing electrical consumption.

iPlantManager

- Enable automated, closed-loop control and optimization of the chiller plant room via a BMS, utilizing its analytical capabilities to carry out advanced diagnostics, efficiency verifications and then implement smart sequencing and dynamic setpoint controls to optimize system operations in real-time.

IAQ Solution

Healthy buildings with good indoor air quality improves performance and productivity. Having our customers breathe and stay healthily indoor is the first of our priorities. Towards this aim, Daikin can help them achieve good Indoor Air Quality by providing the following IAQ Service solutions.

4. **Market Leadership:**

Singapore's Largest Industrial District Cooling Plant

The plant, which was built in Daikin Singapore's main office in Ang Mo Kio, will supply chilled water to STMicroelectronics' TechnoPark. The network has the potential to reduce carbon emissions by up to 120,000 tonnes per year. That is the equivalent of taking 109,090 cars off the road.

This plant consists of 36000RT Cooling capacity where it uses 9 number of Daikin 4000RT Large Tonnage Centrifugal chiller with the potential of expansion.

Singapore's First Largescale Centralised Cooling System For HDB Residential Development

Tengah will be Singapore's and possibly the world's first public housing township to experience the benefits of centralised cooling, enabling residents to not just save money but also the planet by leading an eco-friendlier lifestyle.

Tengah Township Centralised cooling systems utilize Daikin Magnetic bearing modular chillers, fan coil units, and BMS System for efficient operation.

5. **Achievement:**

Reader's Digest

- Daikin has won the Reader's Digest Trusted Brand 2024 Platinum Award for Air Conditioners & Gold Award for Air Purifiers

Singapore Apex Corporate Sustainability Awards

- Daikin wins APEX Corporate Sustainability Award for our commitment to sustainable practices. We aim for net-zero emissions through our products' lifecycle using IoT, AI, and open innovation. We provide healthy air solutions while tackling global environmental challenges.

6. **Sustainability Initiatives:** Daikin Singapore's sustainability targets have been linked to seven Sustainable Development Goals (SDGs), enabling us to identify areas of positive impact within our business and supply chain and how it contributes towards global sustainability goals:

7. **Community Engagement:** Daikin For U represents our commitment towards giving back to the society and environment we care for. We hope that through our continuous efforts, we can build a close relationship with the community.

Plant a Tree
OneMillionTrees movement by
National Parks Board (N Parks)

Riding Under The Stars
Night cycling event to encourage
cycling as mode of transportation

Charity Golf Tournament
Supporting Community Chest

Daikin Rice for All Charity Drive 2022
Collaboration with Mediacorp Cares and Food Bank

Overall, Daikin Airconditioning (Singapore) Pte. Ltd. has a history of continuous growth, innovation, and commitment to customer satisfaction and sustainability in the Singaporean market. Its strong presence and reputation make it a trusted provider of air conditioning solutions for residential, commercial, and industrial customers in Singapore.

The environments that Daikin creates bring happiness to people worldwide. Based on our legacy of air conditioning technologies, Daikin creates the optimum air for each environment. And those are the environments we will strive to provide as we enter our next century. Our goal is to continue achieving our mission of “Perfecting the Air” for the next 100 years.

Daikin For Ü

3.9 Kruger Ventilation Group

Past, Present & Future

Since its establishment in Singapore in 1985, Kruger Ventilation Group has been at the forefront of providing energy-efficient ventilation solutions for residential, commercial, and industrial applications. As a proud subsidiary of Soler & Palau Ventilation Group, headquartered in Spain, Kruger has consistently upheld the highest standards of quality and innovation in the industry. With a strong presence in the Asia Pacific region, Kruger operates 18 business units, ensuring widespread accessibility and exceptional service to its customers.

At Kruger, our dedication to customer satisfaction is our driving force. We prioritize understanding our clients' needs intimately to exceed their expectations continually. Our product range exemplifies this commitment, providing top-tier solutions that not only meet international standards but also offer exceptional value. With a diverse portfolio spanning across eight key applications - including Air Conditioning, Car Park, Commercial Building, Manufacturing & Industrial, Kitchen, Residential, Transport, and Tunnel - we cater to a wide array of ventilation needs with precision and excellence.

However, we view this as just the beginning of our journey. Constantly striving for improvement, we are dedicated to enhancing both our products and services to ensure an unparalleled experience for our customers.

Central to our strategy is the recognition of our customers' importance and the acknowledgment of their evolving requirements. To meet these demands head-on, Kruger has established a dedicated research team tasked with engineering advanced fan systems. This initiative aims to expand our range of ventilation solutions, providing a wider selection to cater to diverse needs. Our team of engineers is resolute in their pursuit of developing the most effective solutions to address the ventilation challenges faced by our customers.

In 2016, Kruger's parent company, Soler & Palau Ventilation Group, further solidified its presence in Asia with the establishment of Ferrari Asia Ventilation Co., Ltd. (FAV) in Thailand. This new manufacturing base exemplifies our unwavering commitment to enhancing quality, service, and delivery for our customers. Leveraging the extensive network of Kruger Ventilation Group units across Asia, we are poised to deliver even greater value to our clientele in the region.

In conclusion, Kruger Ventilation Group stands as a beacon of excellence in the ventilation industry, driven by a steadfast dedication to customer satisfaction and continuous improvement. With a rich legacy of innovation and a global footprint, we remain poised to meet the evolving needs of our customers and exceed their expectations at every turn.

Company History

1985	Company founded by Mr. C F Yang.
1988	Joined partnership with Krüger Holding AG Switzerland.
1998	Established the Kruger Ventilation company in Singapore.
2003	Soler & Palau Ventilation Group acquired 25% of Kruger Asia Holding.
2004	Expanding plants across multiple countries in the Asia Pacific Region, and also establishing subsidiaries and manufacturing plants in 13 locations across the Asia Pacific Region.
2005	Launch of Kruger Research Group with the first AMCA Certified Laboratory in Asia
2007	Soler & Palau Ventilation Group acquired 25% of Kruger Asia Holding raising its stake to 50%.
2009	Soler & Palau Ventilation Group acquires Kruger Asia Holdings as a full subsidiary.
2015	Established new headquarters in Bangkok, with USD 50 million invested.

Our R&D centre approved by prestigious international organizations, to innovate the most suitable and efficient product.

Largest AMCA and ISO accredited aerodynamic and acoustic testing laboratory in the world, with the capacity Max Airflow 400,000 CMH and Max Static 5000 Pa.

ACCREDITATION & CERTIFICATIONS

Our Vision

We will be an innovative leader in the sustainable ventilation industry in Asia, regarded by customers, suppliers, employees, and shareholders. We embrace an uncompromising dedication to creating value and are committed to Total Excellence for our customers.

Our Mission

We are committed to organizing our strengths and resources through teamwork with sincerity, diligence and flexibility towards Total Excellence.

Our Quality Policy

Embarking on a journey of unrivalled Quality Excellence, we pave the way for unending customer satisfaction – the cornerstone of our ever-evolving business.

Our Commitment to Sustainability

We are focused on creating a better and more sustainable future for all, rooted in the principles of respect for human, labour, and environmental rights. We are committed to making a positive impact and contributing to a greener world.

Enhancing Engineering Insights: ACES-YPC Technical Seminar & Tour of Kruger Singapore Factory

On the 8th of October 2011, ACES-YPC organized a technical seminar and tour at the Kruger Singapore factory. Attended by 26 participants, this event aimed to enrich engineers' understanding of ventilation fan applications, system effects, tunnel ventilation, and MRT systems. The combination of informative presentations and a comprehensive factory tour offered invaluable insights into fan manufacturing processes and performance testing.

Seminar Highlights:

The seminar commenced with insightful presentations delving into various facets of ventilation systems. Engineers were briefed on ventilation fan applications, emphasizing the critical role they play in diverse environments. System Effect, an often overlooked but crucial consideration in ventilation design, was elucidated, providing attendees with a deeper understanding of its implications on system performance. Furthermore, discussions on tunnel ventilation and MRT systems shed light on specialized applications, broadening participants' knowledge base.

Factory Tour Experience:

Following the enriching seminar sessions, participants embarked on a tour of the expansive Kruger Singapore factory, spanning an impressive 24,000 square meters. This firsthand experience allowed engineers to witness the intricate processes involved in fan manufacturing. From raw material handling to precision engineering and assembly, attendees gained valuable insights into the meticulous craftsmanship behind each fan unit.

Dynamic Balancing and Performance Testing:

Of particular interest was the demonstration of dynamic balancing techniques employed during fan assembly. Engineers witnessed firsthand the precision and attention to detail required to achieve optimal fan performance. Moreover, the visit to the AMCA certified Laboratory provided a unique opportunity to observe air performance testing procedures. Witnessing these tests underscored the rigorous quality standards adhered to by Kruger Singapore, instilling confidence in the reliability and efficiency of their products.

Kruger Singapore's Prestigious Projects

At Kruger Singapore, we take pride in our role as leaders in providing superior ventilation solutions that enhance indoor environments across a spectrum of projects. With a rich history of excellence, we stand as a trusted partner in ensuring optimal air quality and circulation in various settings. From iconic landmarks to everyday spaces, our ventilation solutions play a crucial role in creating comfortable, healthy, and productive indoor environments, showcasing our expertise in ventilation solutions through the following projects:

1. The Downtown Line (DTL)

The product of Kruger General Ventilation and Powered Smoke Ventilators at The Downtown Line (DTL) marks Singapore's fifth MRT for public transport. The DTL extends to residential areas such as Bukit Panjang, Bukit Timah, MacPherson, and Bedok Reservoir, previously underserved by the MRT. Addressing the needs of a burgeoning city and its transportation demands, the existing 34 stations on the DTL provide an alternative commuting route, connecting residents to the city centre and facilitating intra-city travel.

2. Jurong Rock Caverns

Kruger's Tunnel Ventilation product at The Jurong Rock Caverns (JRC) is the first underground rock cavern for oil storage in Southeast Asia owned by Jurong Town Corporation. It is located at a depth of 130 metres beneath Banyan Basin on Jurong Island, covering an area of 61 hectares (150 acres). The JRC will store 1.47 million m^3 of liquid hydrocarbons such as crude oil and condensate.

Credit Image: Land Transport Authority in Singapore

3. The Gardens by the Bay

The Kruger General Ventilation and Powered Smoke Ventilators products installed at The Gardens by the Bay contribute to the functionality of this expansive nature park spanning 101 hectares (250 acres) in the Central Region of Singapore, adjacent to the Marina Reservoir.

3.10 Method Engineering Pte Ltd

Method Engineering Pte Ltd specialising in the field of Air-conditioning and Mechanical Ventilation System (ACMV) was established in 1971. Currently, we are registered under the L5 category for Air-conditioning, Refrigeration and Ventilation Works of the Building and Construction Authority (BCA). We are also registered for Fire Prevention & Protection Systems (L1) and Mechanical Engineering (L1) works. We have obtained our ISO 9001 certification on 17 July 2003 to provide added assurance to our Clients and Customers of our quality service and professionalism. Since August 2009, we have also been audited and recommended for certification in ISO 9001: 2015, ISO 14001: 2015 and ISO 45001:2018. We also obtained Bizsafe Level Star in April 2010. When we started off, we were doing work as a sub-contractor for ACMV system.

Back in the 1970s, there were not many competitors then and Singapore was developing very quickly. Many new office buildings along Shenton Way were being built (UOB Building, Shenton House, Marina House, etc), shopping centres in town areas (Peninsula Plaza, Parklane Shopping Centre) as well as hospitals (Mount Elizabeth Hospital) and recreational facilities (Chinese Swimming Club) and hotels (Mandarin Hotel, Orchid Inn Hotel). In addition, we have completed projects other different purpose groups such as offices, institutional, places of worship, industrial, etc. We are very active in the retrofitting, replacement and upgrading works for ACMV systems besides new built works. We also are active and participates in Statutory Boards and Government-related projects especially being the Term Contractor for CPG Facilities Management Pte Ltd (CPG), Singapore Telecom and Singapore Mass Rapid Transit System (SMRT) and Ngee Ann Polytechnic (NP).

All our key staff has been in the ACMV trade for many years and possess the necessary expertise and experience to meet the challenges encountered in ACMV project implementation. We are also able to provide our services for integrated M&E system installations should the need arises. We have the capability and knowledge to perform the overall M&E coordination works, individual system and combined system tests as required for obtaining the statutory approvals and to meet the Consultant's specification and Owner's requirements.

BCA Registration Head:

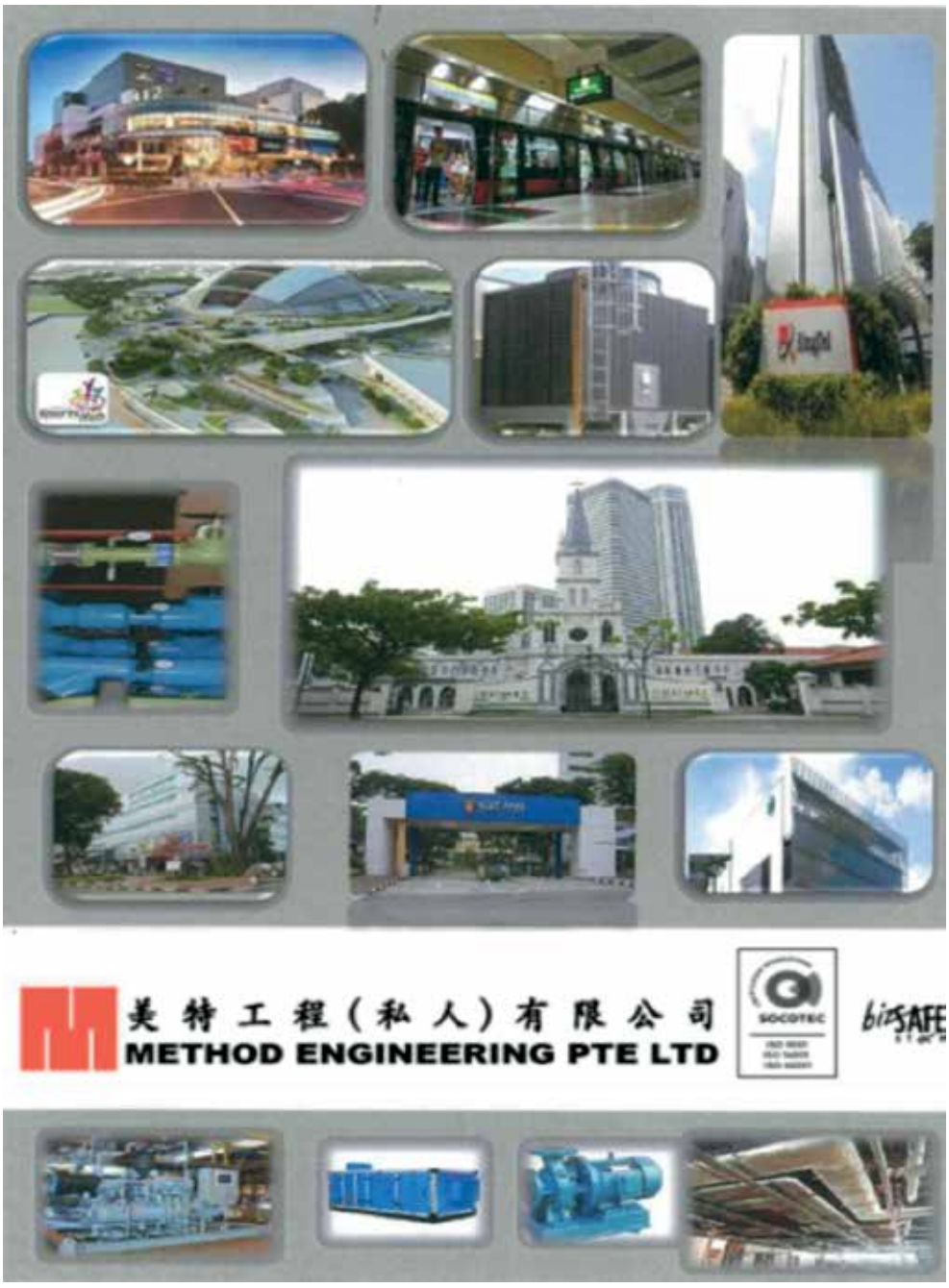
- ME01 Air-cond Refrigeration & Vent Works (L5 $10,000,000.00)
- ME06 Fire Prevention & Protection Systems (L1 $100,000.00)
- ME11 Mechanical Engineering (L1 $100,000.00)

External Registration:

- ISO 9001 : 2015 Quality Management System
- ISO 14001 : 2015 Environmental Management System
- ISO 45001 : 2018 Occupational Health & Safety
- BizSafe Level Star Certificate

Activities:

a) Air-conditioning, Mechanical Ventilation and Related Services
b) Electrical Installation
c) Fire Protection System
d) Water Distribution & Sanitary System
e) Compressed Air System
f) Builder Works



3.11 MULTISTACK CHILLERS

When it all started…

MULTISTACK invented the modular water chiller in late 1980s. It started with a radically simple idea: water chillers made up of modules that could be brought into the chiller plant room one at a time, through standard doorways and down elevators, to form a fully integrated water chiller system. The modular chiller idea launched a revolution and transformed MULTISTACK into a leader in the commercial water-chiller industry.

Since its founding in the late 1980s, MULTISTACK has engineered, manufactured, and distributed an impressive array of modular air conditioning firsts: the first on-board strainer, the first modular automatic blow-down device, the first modular chiller for variable flow, the first modular heat- recovery chiller, the first modular air-to-water heat pump, and the first modular chiller to utilize Magnetic Levitated Bearing Oil Free Compressor technology

Fig. 1 – Singapore Customers of Multistack Equipment (SEA) Pte Ltd.

that MULTISTACK invented in the 1990s. It is now known as Maglev Compressor. With the Maglev Compressors, MULTISTACK manufactured and commercialised the Multiple Maglev Compressors chiller with very high energy efficiency and contingency.

In Singapore

Multistack Equipment (SEA) Pte Ltd was established in 1999 by Mr. George Ng as the sole distributor of MULTISTACK equipment in Singapore. The Maglev Modular Chiller design was first launched in a Solo Exhibition in Jakarta Indonesia in year 2002 as the launch pad for South East Asia region. The exhibition has generated tremendous interest but failed to gain traction as the new technology cost more than 3 times the price of a conventional chiller.

It was not until 2005 that MULTISTACK has it first Maglev Modular Chiller installation in Singapore, Mount Alvernia Hospital (Fig. 2) where an American engineer with United Engineers passionately pushed for the Maglev Modular Chiller in his quest for higher efficient chiller to replace an existing screw compressor modular chiller.

Fig. 2 – Mount Alvernia Hospital

The cost of Maglev modular concept, with multiple compressors and multiple independent heat exchangers was too high for engineers and developers to justify, even though the energy efficiency and contingency was unparallel. In its relentless effort to bring down the cost without compromising the performance of the chiller, MULTISTACK eventually develop the multiple Maglev Compressors with single condenser and single evaporator chiller that is much closer to the conventional type and with a much lower cost compared to the modular type. This design came in just in time when the Singapore Building and Construction Authority is pushing for the industry to adopt a more energy efficiency chiller with grant to push for building developers to vie for the Green Mark award.

In year 2011, MULTISTACK successfully tested and commissioned a multiple Maglev Chiller with IECO, a JV between Rolls-Royce PLC and SIA Engineering Company now known as SAESL (Fig. 3). The installation helped IECO secured an Energy Efficiency National Partnership (EENP) Awards given by NEA.

Fig. 3 – IECO, a JV between Rolls-Royce PLC and SIA Engineering Company

In 2014, MULTSTACK successfully tested and commissioned 4 numbers of 600RT Multiple Maglev Compressors chillers to replace 5 number of 700RT Carrier chillers for Singapore Management University (SMU) (Fig. 4) and SMU was awarded the Platinum Green Mark. The recorded performance of the chillers plant at the time of T&C was 0.48kW/RT. Beside the big saving in energy bill, SMU also saved from the reduced sustainable maintenance cost as there were no requirement for chillers to change oil, bearing and refrigerant.

Fig. 4 – Singapore Management University

In a separate project at SMU Hostel, installed with MULTSTACK Maglev chillers and MULTISTACK Passive Displacement Coil Units (Fig 5), SMU was awarded the Super Low Energy Platinum award in 2017.

Fig. 5 – SMU Hostel

Key advantages of Multiple Maglev Oil Free Compressors Chiller are as follows:

1.	Chiller plant room area can be reduced, releasing more area for commercial use to increase revenue.
2.	Reduced carbon footprint without the needs for lubrication oil.
3.	Higher energy efficiency with the magnetic levitated bearing.
4.	A more robust chiller plant design with higher contingency from the multiple compressor chiller.
5.	Enhancing the total system efficiency with the bigger range of energy efficiency load, from 20% to 100%.
6.	Lower maintenance cost without the need for annual overhaul or the need to replace the bearing and oil.
7.	The Maglev Compressor is very environment friendly with a GWP lower than 15 running on the R1234ze refrigerant.

MULTISTACK multiple Maglev Compressor Chiller (air cooled and water cooled) can be found in many new and old buildings in Singapore over the last decade. In hotels such as Goodwood Park Hotel, Royal Queens Hotel, Hotel Boss, Hotel MI, Hotel 81 (Fig. 6) and medical institutions such as the Eunos Polyclinic, Camden Medical Centre.

Fig. 6 – Singapore Hotels Equipped with Multistack Chillers

3.12 Pace Airconditioning & Engineering Pte Ltd and its Evolution

Pace Air-conditioning was started in 1970 and was incorporated in 1978 as PACE Airconditioning & Engineering Pte Ltd by Mr. Anthony Chia as a specialist contractor in airconditioning systems in Singapore. It was one of the pioneers in the design, supply and manufacturing of airconditioning systems for commercial, industrial, institutional and medical buildings.

In 1981, Mr Anthony Chia bought the first sheet metal CNC machine in South-east Asia from Lockformer, USA, and a computer ductwork take-off estimation computer system from the UK.

In 1994 Pace became a subsidiary of Sembawang Shipyard and had since built up its presence regionally. Pace had the resources to provide a comprehensive range of services - from turnkey air-conditioning system contracting to comprehensive maintenance and energy management services, and incorporating CAD/CAM, 3D coordination, and CFD .

Besides being certified for Air-conditioning, Refrigeration and manufacturing facilities for the Ventilation Works by the CIDB of manufacture of low leakage Singapore, Pace had achieved ISO 9002 certification by Det Norske Veritas.

Located at Senoko South Road and sitting on a gross land area of 9,500 sq m. Pace's premises offered 1,000 sq m. of airconditioned office spaces and a factory floor space of approximately 2,500 sq m. The workshop was equipped with the latest computer-aided ductings, customised fittings and sheet metal works. Pace had expanded into retrofitting and product sales to further capitalise on its resources. It aimed to achieve regional leadership in ACMV industry.

RESOURCE

Pace's philosophy was "Making It Right The First Time" and its Quality Objective was to achieve 100% on-time delivery of all projects. To achieve its goal to be the market leader, Pace had put in continual efforts to hone the following in-house resources to the highest attainable standards:

- **Computer-Aided Design and Drafting**

  Equipped with the most advanced programs to perform ductwork and pipework analysis, energy analysis, heat load calculation, and mechanical & electrical system analysis, Pace was one of the few contractors that produced 3-dimensional shop drawings.

- **Computer-Aided Manufacturing Facilities**

  Manufacturing facilities were supported by the 2,500 sq m. workshop in the factory and backed by advanced computerised equipment. CNC plasma cutting tables were used for optimal processing of sheet metal into various fitting blank segments.

- **Total Quality Management and Control**

  Having achieved the ISO 9002 Quality Management System, Pace's clients were assured that its products and services met the highest possible industry standards.

- **Professional Engineering Team**

  Pace's teams of highly experienced engineers and supervisors, each under the control of a project director and working with the latest design aids, produced innovative solutions to the complex problems of modern building services.

- **Comprehensive Maintenance Management System Programmes**

  Backed by a core team of specialists at the Head Office, its Maintenance Division, PASCO Pte Ltd, ensured that its clients' buildings were maintained and operated in the most energy efficient way. Computerised maintenance management software and energy management packages were used to achieve this end.

- **Training And Safety Programmes**

  Pace had entered into a collaboration with the Construction Industry Development Board (CIDB) to train and qualify ductwork workers in Singapore. Pace also collaborated with local universities and polytechnics to jointly develop and enhance its products and services. Its services also incorporated training and education programmes for its customers.

PROJECTS

CORPORATE HEADQUARTERS
Pace was able to meet the functional demands of such buildings by accommodating flexible M&E designs that incorporate office automation, space and energy conservation.

Sembawang Building, Singapore

Caterpillar Building, Singapore

FACILITIES MANAGEMENT

Pace had acquired an impressive track record in providing operational and building maintenance services. It recognised that reliable operations and cost effective maintenance require a complete understanding of complex service and monitoring systems used in the buildings.

Hankou Centre, Wuhan, PRC

Parkway Parade, Singapore

HOTEL AND COMMERCIAL COMPLEX

Pace was able to meet the engineering demands imposed to create a comfortable internal environment. This was achieved through the use of energy efficient systems which were controlled by state of the art building management systems.

China World Trade Centre, Beijing, PRC

REFURBISHMENT

The adaptation of existing and historic building to meet the needs of current business was shown by the conversion of an old warehouse and where the M&E scope of works can be extensive.

CMDC Warehouse, Singapore

INSTITUTIONS OF HIGHER LEARNING

The changing needs in Education required simple, flexible and economical engineering systems.

Ngee Ann Polytechnic, Singapore

Gleneagles Hospital, Singapore

HOSPITALS

Large scale retrofitting of M&E services in hospitals demanded a concerted effort in planning so as to ensure that there is minimal disruption to patients and no interruption to critical M&E services

INDUSTRIAL

Specialised industrial applications required sound air distribution and precise environmental control.

Caterpillar Factory, Singapore

Fisons Pharmaceutical Plant, Singapore

Fisons Pharmaceutical Plant, Singapore

LABORATORIES

The safety, functional and maintenance requirements of the users in pharmaceutical plants demanded precise airconditioningand ventilation systems with the need for detailed integration and co-ordination with other specialist services

Integrated Environmental Solutions Pte Ltd

In 1997, Mr Anthony Chia parted ways with Pace Air-conditioning and Engineering Pte Ltd, formed Integrated Environmental Solutions Pte Ltd with a core of professional engineers, technical and supervisory personnel. Pace Air-conditioning and Engineering Pte Ltd became dormant after Mr. Anthony Chia left Sembawang Shipyard.

Integrated Environmental Solutions Pte Ltd with Mr Anthony Chia at the helm embarked on the next evolution in the air-conditioning industry.

Some of the key highlights from Integrated Environmental Solutions Pte Ltd are as follows:

1. Inductive cooling systems at United World College at Dover Campus.

2. Displacement cooling systems at United World College at Dover Campus.

3. District heating and cooling systems at Beijing Riveria using absorption chillers and boilers to supply chilled water during summer and hot water during winter to this residential development. It comprises of 32km of underground pipes from the central plant room to the individual villas and semi-detached dwellings.

4. Chilled ceiling at former Premas office at Chai Chee.

5. The first token ring smoke curtain system installation at Causeway Point and KLCC which Integrated Environmental Solutions Pte Ltd was also the holder of the patented system.

6. First use of the pre-insulated ductwork (PID board) and using PPR pipes for chilled water systems.

7. Obtained the first Greenmark platinum certification for the National Library at Victoria Street, for our design and build in ACMV and Electrical works.

Around 2005, Integrated Environmental Solutions Pte Ltd became not economically viable and stopped its business.

Shinhan Tech-Engineering Pte Ltd

Shinhan Tech-Engineering Pte Ltd was formed in early 2010 by Mr Anthony Chia after an absence from the ACMV industry for about 5 years. Shinhan started off as specializing in ACMV to becoming a main builder for landed houses in 2017.

Some of the key highlights from Shinhan Tech-Engineering Pte Ltd are:

1. Use of PPR pipes instead of steel pipes for chilled water system, and pex pipes for final connection to FCU. Both products helped Shinhan to handover a 888 rooms hotel in 7 months.

2. Use of Gripple M&E support system over traditional threaded rod system to improve the productivity of site installation work for various hotels.

3. Received an award in 2017 from Singapore Institute of Architects for the House with a Sanctum (Good class bungalow). Additionally, the bungalow has a water-cooled chilled water system and a heated swimming pool using an air-sourced heat pump that supply cold air into the bungalow when the pool is heated in the morning.

4. In 2018, Shinhan completed the first SMU hostel in Singapore using passive displacement coil.

5. Received a BCA grant to further study the design and efficiency of the passive displacement coil jointly with SIT in 2021. The study is in its closing phase.

3.13 Tempcool Engineering (Singapore)

Tempcool Founded in 1973, Tempcool has been the leading provider of commercial air-conditioning, refrigeration and food equipment solutions in the Asia Pacific region. Under the leadership of Mr. Tan Gek Suan, the company has built an unmatched reputation in Singapore, Malaysia, Hong Kong and the Philippines.

Tempcool's principal business is to provide engineering consultancy, design, supply, installation and servicing of refrigeration and air-conditioning systems for commercial and industrial applications. In addition, the company represents leading brands in food processing, food service equipment and laundry equipment.

Tempcool's diversified business activities include the following:

- Air-conditioning for commercial & industrial buildings/ applications
- Process industrial refrigeration for food processing, food distribution centers and warehousing
- Commercial refrigeration for convenience stores and supermarkets/hypermarkets
- Equipment for food processing and food service applications for hotels, restaurants and food catering centers
- Equipment for laundry used in hotels, institutions, laundromats and self-service laundromats

For over 40 years, Tempcool's regional success has been achieved by its ability to provide integrated solutions through innovation and design. We seek to continuously expand our existing diversified business activities in North Asia and Southeast Asia in the near future.

COOL MILESTONES

1973 Tempcool Engineering (Singapore) is founded as an installer of industrial machinery equipment and mechanical engineering work

1974 Tempcool receives its first Hussmann's sales achievement award which would continue for a decade

1975 Tempcool Engineering (Malaysia) is incorporated

1980 Tempcool Holding Private Ltd is incorporated

1986 Joint venture between Tempcool and Hussmann. Appointed by Hussmann Corporation USA as its distributor for the Asia Pacific region. Hussmann Tempcool Singapore is incorporated

1987 Tempcool Engineering (Philippines) and Tempcool Engineering (Hong Kong) are incorporated

2008 Tempcool founder, Mr Tan Gek Suan is awarded the Public Service Medal (Pingkat Bakti Masyarakat – PBM) for his contribution to Singapore

2011 Tempcool initiates a management buy-out from Hussmann to focus on restructuring for the regional markets

2015 Tempcool builds a new management team to drive future growth

COOL SERVICE

INDUSTRIAL REFRIGERATION

- Food Processing
- Food Distribution Centres
- Refrigarated Warehouses
- Cold Storage Facilities & Ice Plants

COMMERCIAL REFRIGERATION

- Hypermarkets
- Supermarkets
- Restaurants & Bars
- Convenience Stores Chains

LAUNDRY EQUIPMENT

- Hotels
- Institutions
- Commercial & Industrial Laundromats
- Coin-Op Laundromats

AIR CONDITIONER

- Commercial Buildings
- Shopping Malls
- Hospitals
- Food Manufacturers

FOOD SERVICES APPLICATIONS

- Hotels
- Food Catering Centers
- Food & Beverage Set Ups
- Central Kitchens

COOL PARTNERS

- Ang Mo Supermarket
- Biro
- Cold Storage
- Frabelle
- Giant
- Han's F&B
- Hasegawa
- Hershey
- Hussmann Corporation
- Kannegiesser
- KK Women's and Children's Hospital
- Koxka
- Lavamac
- Nantsune
- Nanyang Technological University
- Ngee Ann Polytechnic
- NTUC
- Philippine Port Authority
- Prime Supermarket
- SATS Inflight Catering Centre
- Shanghai Highly Nakano
- Skope
- Wellcome
- Zanotti

Industrial Refrigeration

- Food processing
- Food distribution centres
- Warehousing
- Cold storage facilities
- Cold rooms
- Ice plants
- Partners include:
  1. Hasegawa
  2. CS Panel
  3. Frick / York
  4. Krack Hussmann

Commercial Refrigeration

- Supermarkets
- Convenience store chains
- Restaurants
- Bars
- Partners include:
  1. Hussmann/ Panasonic
  2. Skope
  3. Fricon
  4. Koxka
  5. Arneg/Oscartielle
  6. Nakano

Air-Conditioning

- Commercial & industrial buildings & applications
- Partners include:
  1. Daikin
  2. Carrier
  3. Mitsubishi
  4. LG

Trading

- Food processing & food service applications for:
  1. Hotels
  2. Food catering centres
  3. Food & beverage set ups
- Commercial laundry applications
- Partners include:
  1. Lavamac
  2. Kannegiesser
  3. Cold Line
  4. Nantsune
  5. Biro

SATS Catering

- Air-conditioning & mechanical ventilation system, design-&-built refrigeration system for Air flight Cargo Terminals 5 & 6
- Cold rooms and design-&-build refrigeration systems for SATS inflight catering centres 1 & 2
- Refrigeration system for Beijing Airport inflight kitchen

Kendang Kerbau Women's & Children's Hospital

- Air-conditioning & mechanical ventilation system for the whole building, including:
  1. Hot water system
  2. Clean room
  3. Operating theatre
  4. Mortuary
  5. Hydrotherapy Pool

KK Women's and Children's Hospital
SingHealth

Nanyang Technological University

- Air-conditioning system for staff quarters at:
  1. Nanyang Heights
  2. School of Humanities & Social Sciences
  3. School of Mechanical & Aerospace Engineering

Singapore Corporation of Rehabilitative Enterprise (SCORE)

- Laundry facility set up at Changi Prison Complex

Distribution

Phase 1 2016 - 2018

Builds on existing distribution channels + creation of new channels into markets we already have connections in

Phase 2 2018 – 2023

Creates new connections in new markets and establish new channels

3.14 Utopia Group

The Utopia Group of Companies had its humble beginnings in 1980 when its predecessor, Utopia Aire Pte Ltd was established as a one-man operation. And the person instrumental in the Group's transformation into a major national and regional organisation with more than 100 staff is founder and Chief Executive Officer Dr. Jeremy Chia.

He foresaw the potential market niche in the demand for offices and factories that are free from internal environmental pollution, micro contamination and organic contamination and are subject to controlled temperature and humidity, in the burgeoning computer and electronics market in the region.

WORLDWIDE NETWORK

Utopia has a global footprint of over 10 countries which includes USA, CHINA, MALAYSIA, THAILAND, INDONESIA, VIETNAM, PHILIPPINES, BANGLADESH, TAIWAN, and JAPAN.

Right from the beginning, the Group has seen the significance of expanding beyond the borders of Singapore. That was why within two years of inception, services for turnkey project management and site development for cleanrooms were offered from to Malaysia, Thailand, and Taiwan. Today, services for environmentally controlled room site preparation are offered all over Asia.

OUR SUBSIDIARIES IN SINGAPORE

- Utopia-Aire pte ltd (Sales and Marketing + Service Support)
- Airtech Equipment pte ltd (Technical Sales Support)
- Utopia Regional Manufacturers pte Ltd (Regional Sales & Marketing)
- Airgate International Pte Ltd (Engineering)

Clean Room Technologies and Standards in Singapore and Asia

An Asia Pacific Overview on Cleanroom Technology

Utopia-Aire Pte Ltd, Singapore, started controlled environment with the development of data center and clean room technologies setting standards in Singapore and Asia, with a focus on customized solutions, room pressurizations, clean room certifications, and energy conversation considerations from design to maintenance.

As a leading expert in Cleanroom Design and Build, understanding and leveraging these advancements can significantly contribute to maintaining the fitness of clean rooms and enhancing overall operational efficiency.

1. **Introduction**:

   Clean room technologies play a pivotal role in industries such as pharmaceuticals biotechnology, electronics, and healthcare by providing controlled environments essential for research, production, and testing. The continuous evolution of clean room standards and technologies in Singapore and Asia is crucial for ensuring compliance efficiency, and competitive advantages.

2. **Development of Clean Room Technologies:**

   2.1 Standards and Regulations: Singapore and Asia have been at the forefront of adopting and adapting international clean room standards. These standards, such as ISO 14644, IEST and GMP guidelines, ensure uniformity and consistency in clean room design, operation, and certification processes.

   2.2 Customized Solutions: As specialists in Cleanroom Design and Build, offering tailored clean room solutions is a unique advantage. Customized clean room designs address specific industry needs, optimizing processes and enhancing overall productivity. This personalized approach sets Utopia-Aire apart from competitors.

3. **Key Aspects for Maintaining Clean Room Fitness:**

   3.1 Room Pressurizations: Maintaining proper room pressurizations is crucial in preventing contamination. Utilizing advanced technologies for real-time monitoring and control of room pressurizations ensures a controled environment, minimizing the risk of airborne contaminants.

   3.2 Clean Room Review Certifications: Securing clean room review certifications is essential for regulatory compliance and industry credibility. Utopia-Aire specializes in providing comprehensive clean room review services, offering clients assurance and peace of mind regarding the fitness of their clean room environments.

4. **Energy Conservation in Clean Room Operations:**

   4.1 Design Perspective: Integrating energy-efficient design principles is essential for minimizing the environmental impact and reducing operational costs. Utopia-Aire emphasizes sustainable clean room designs that optimize energy usage without compromising performance.

4.2 Maintenance Perspective: Regular maintenance is critical for sustaining energy-efficient clean room operations. Utopia-Aire offers specialized maintenance services that focus on energy conservation, ensuring ongoing efficiency and compliance with sustainability goals.

5. **Conclusion:**

In conclusion, the development of clean room technologies and standards in Singapore and Asia presents opportunities and challenges for Utopia Aire. By offering customized solutions, prioritizing room pressurizations, delivering reliable clean room review certifications, and emphasizing energy conservation, Utopia-Aire can solidify its position as a leader in the industry. Staying abreast of advancements and consistently integrating them into your offerings will not only enhance operational efficiency but also contribute to the overall success of your business. Sharing serves as a foundation for strategic decision-making and emphasizes the importance of innovation and adaptability in dynamic field of cleanroom technologies, and controlled room related engineenng.

3.15 Development of EC Technology in Singapore

A Journey Toward Energy Efficiency and Sustainability

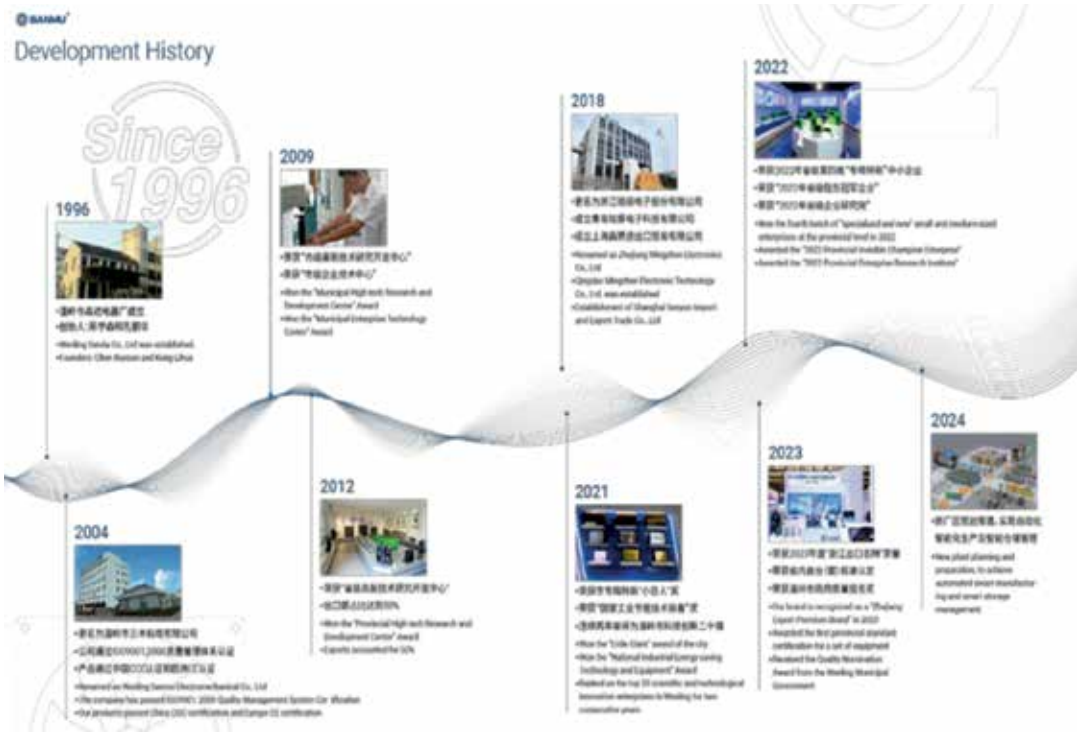
In the bustling city-state of Singapore, where technology and innovation are cornerstones of economic strategy, the development of Electronically Commutated (EC) technology in air distribution systems has marked a significant advancement. This article delves into the historical evolution and transformative impact of EC Plug fan technology specifically within Singapore's landscape.

The Genesis of EC Technology

The journey of EC technology in Singapore's air distribution systems began in 1996 with its first application in clean room for Fan Filter Units (FFUs). Traditional air distribution systems heavily relied on Alternating Current (AC) belt-driven fans, which were energy-intensive, noisy, and maintenance-heavy due to the mechanical wear and tear of belts. These systems operated at constant speeds, leading to inefficiencies in energy use and control over airflow. The introduction of EC technology revolutionized this scenario by introducing fans capable of variable speed control, ranging from 10% to 100% based on real-time demand. This not only allowed for significant energy savings but also reduced noise levels and minimized maintenance requirements compared to conventional AC belt-driven fans that were commonly deployed back then.

Impact on Singapore's Air Distribution Systems

The shift to EC technology brought about a drastic transformation in the air distribution industry in Singapore. EC Plug fans emerged as a more energy-efficient alternative, aligning well with the city's push towards sustainable development and reduced carbon emissions. The precise control over airflow enabled by EC Plug fans meant better air distribution, enhancing the overall system performance and occupant comfort in buildings.



Singapore's adoption of EC technology also mirrored its commitment to pioneering energy-efficient solutions within the Built Environment sector. This was part of a broader strategy to meet sustainability objectives, which include enhancing energy efficiency and reducing the environmental impact of its building sector.

Advancements and Future Directions

Beyond the initial adoption of EC Plug fans, Singapore has continued to innovate in the realm of air distribution technology. The integration of advanced sensors and Variable Air Volume (VAV) systems, smart zoning, and the use of computational fluid dynamics (CFD) for air diffuser designs are some of the key advancements. These innovations have further optimized energy usage and improved the comfort levels within buildings.

Looking ahead, the future of air distribution systems in Singapore appears to be driven by even more sophisticated technologies. The integration of Internet of Things (IoT) and Artificial Intelligence (AI) is set to offer real-time data analytics, predictive maintenance, and personalized comfort control. These advancements will not only enhance energy efficiency and sustainability but also cater to the growing demand for healthier indoor environments, a crucial aspect in densely populated areas like Singapore.

Conclusion

The evolution of EC fan technology in Singapore represents a key chapter in the city-state's environmental and technological advancements. As Singapore continues to lead in sustainable building practices, the role of EC technology and its continuous improvement will undoubtedly be pivotal in shaping a greener, more efficient future for air distribution systems. By embracing these advanced technologies, Singapore is setting a benchmark in the air distribution market, showcasing a commitment to innovation that meets the needs of a sustainable, user-centric built environment.

Article contributed by Coleman Lim, Managing Director of Sanmu (SG) Pte Ltd

About Sanmu (SG) Pte Ltd

Sanmu (SG) Pte Ltd is the Southeast Asia subsidiary of Zhejiang Mingzhen Electronics Co., Ltd (formerly Wenling Sanmu Electronic Co., Ltd). Zhejiang Mingzhen headquartered in Wenling, Zhejiang Province, China., was established in 1996. It is a renowned leader in the manufacturing of ventilation fans globally. With 500 employees, technologists and overseas experts account for more than 15%, our expertise lies in the research, development, and production of high-efficiency, energy saving AC/EC fans, aimed at delivering advanced and environmentally friendly air technology solutions to a global clientele for a wide range of ventilation applications such as Air Handling Units, Cooling Towers, Fan Coil Units in buildings and facilities for various market segments.

The company is ranked as one of the top 100 enterprises in Wenling City, Zhejiang, China for four consecutive years as well as the top 20 scientific and technological innovation enterprises for two consecutive years.

3.16 AI-enabled thermal optimization to improve Data Center Performance

Challenges facing data centers today

Out of necessity, data centers have continually evolved to keep up with customer demands and high-tech innovations. The challenges of staying in front of new trends and changing user requirements are significant. The constant question is: What's next?

In early 2020, Forbes Insights, the strategic research and thought leadership practice of Forbes Media, attempted to answer that question. In doing so it identified three major challenges facing the data center of the future:

Decentralizing IT:

The nature of data centers is changing. To be able to tap into a variety of new cost-cutting opportunities, data centers need to decentralize. They need to move data, processing, and resources away from the organization's local data hub to the edge (user devices) – moving aspects of processing to the devices used by end users.

Infrastructure challenges:

As 5G enables hyperconnectivity, more users and devices will enter the network, increasing traffic volume and bandwidth usage. To address this new demand, data center leaders need to incorporate smart infrastructure into their data centers plans, integrating automated systems supported by devices with built-in artificial intelligence capabilities that provide real-time maintenance, configuration, and resolution.

Staffing challenges:

Forbes Insights cites recent research that reports that one-third of the IT infrastructure workforce will be retiring over the next decade. In response, more than half of the executives surveyed stated that they expect staffing will be taken over by external cloud and service providers. Surprisingly, very few organizations surveyed were ready to rethink their data center strategies in preparation for the next five years. Just 11% of C-suite executives and 1% of engineers said their data centers are ahead of the curve and primed for higher data volumes, according to Forbes Insights.

Since the survey was taken, the world has changed due to the COVID-19 pandemic. While readiness, infrastructure and staffing remain areas of significant concern for the future, the main challenge facing data centers today is exponential growth. More people are working remotely, transforming workplaces, and adding a significant spike in demand on data center use. At the same time, online shopping and ecommerce have surged, further fueling the demand for data and data storage. In fact, ecommerce experienced the equivalent of ten years of growth in the space of 90 days due to COVID-19, according to an analysis conducted by McKinsey & Company. In the 10-year period between 2009 and 2019, U.S. ecommerce penetration grew from 5% to roughly 16%. In the first three months of 2020, ecommerce penetration doubled in the United States, growing from 16% to almost 35%.

AI's impact on data centers

Artificial Intelligence (AI) is part of the digital transformation and is poised to have a tremendous impact on data center management, productivity, and infrastructure. Several companies already are experimenting with the idea of fully automating data centers for periods of time, allowing a "lights out" operation. The theory is that a number of energy-efficient strategies can be implemented if data centers are built and optimized entirely based on IT considerations and monitored remotely via DCIM software. By using AI and robots to eliminate the need for employees in the physical space, data centers can lower oxygen levels to reduce fire risk, eliminate the need for lighting, create more efficient cooling designs, and increase rack heights.

But there are challenges. While leading organizations expect to double the number of AI projects over the next two years, according to the Gartner 2020 CIO Agenda Survey, most are struggling to implement them. Stakeholders face challenges that include transparency and "interpretability" around algorithmic decision-making, data quality and bias, safety and security, accountability, social and economic impact assessments, and governance. One of the biggest obstacles is scaling AI pilots into enterprise-wide production. AI can address many issues in a controlled environment; however, replicating the experience across an organization is fraught with difficulty. Due to these challenges, most companies question how quickly AI can provide a return on investment.

Where can AI provide immediate results?

One area where AI can immediately deliver real benefits is data center cooling and control. As demand for data grows, so does the need to better manage cooling conditions in data centers.

Among the factors that make control challenging is the mix of legacy equipment from a variety of manufacturers found in many data centers, each with its own recommended settings that often deliver more cooling than is actually needed. Managing airflow is also complex, especially with the dynamic nature of data centers and the unpredictable demands of IT equipment. Added to this is the fact that, on average, 20% to 30% of servers in large data centers are unused or obsolete but still consume electricity. These "ghost" or "zombie" servers not only add costs to the electricity bill, but they also create excess heat and drive higher demand for cooling throughout the data center. As a result of all these factors, most data centers are overcooled, wasting valuable resources.

The answer: thermal optimization!

Thermal optimization is a comprehensive Siemens solution that eliminates the difficult challenge of trying to manually maintain the cool and consistent temperatures required to house data center equipment safely. Its benefits go beyond temperature control to include the optimizing of energy use and enabling personnel to better manage resources.

Thermal optimization features a package of facility improvement measures based on data collection and analysis. The performance of everything from the cooling tower to rack inlet temperatures is measured and optimized. The solution also applies intelligence about the density of IT workloads to regulate the cooling within a data center. The goal is to optimize primary and secondary cooling cycles as well as the temperatures in the "white space" where IT equipment resides.

AI-enabled Thermal Optimization

In this article, we define thermal optimization as the combination of Demand Flow® chiller optimization and White Space Cooling Optimization (WSCO).

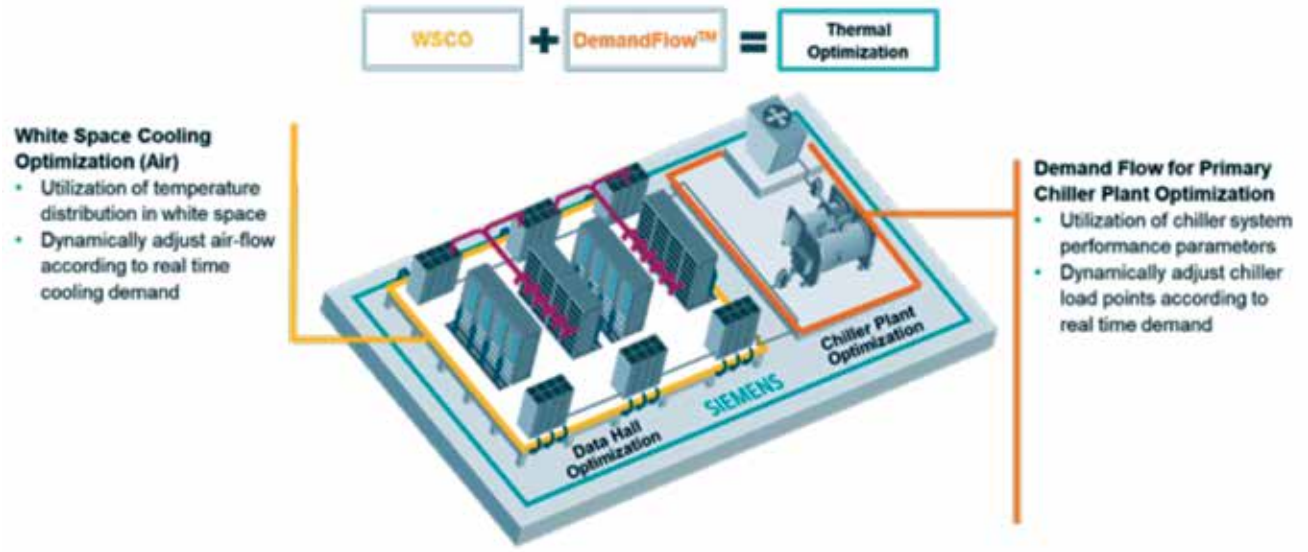
Demand Flow:

To reduce energy costs and ensure ongoing operational efficiency, Demand Flow takes a holistic approach that employs thermodynamic principles. It focuses on optimizing every subsystem of the chiller plant, including chillers, chilled water pumps, condenser water pumps and cooling towers. A powerful solution that provides immediate results, Demand Flow collects and analyzes data to deliver the proper amount of chilled water to meet the current cooling load.

White Space Cooling Optimization (WSCO):

Using a network of sensors, WSCO collects temperature and power data. Its AI Engine applies the data to algorithms and calculates the required adjustments for each cooling unit to maintain the correct temperature for air entering IT equipment. It goes beyond alerting human operators to temperature fluctuations and automatically adjusts itself. By automating the control of cooling units, including ON/OFF control and fan speed, it significantly reduces the risk of a thermal outage and maintains consistent air temperatures among server racks in the white space. It also reduces wasted energy by dynamically matching cooling to the IT load in real time, automatically responding to temperature changes and eliminating overcooling. At the same time, it gives the management team critical data that informs intelligent maintenance and supports future operational business decisions.

Figure-1: Siemens Thermal Optimization solution overview



Benefits of thermal optimization

By optimizing chilled water cooling (Demand Flow) and white space cooling (WSCO) together, thermal optimization can help a data center achieve more savings than using one or the other solution individually. The combination delivers many benefits, including:

1. Collecting facility environmental data in real time and providing valuable insights for making short- and long-term operational decisions
2. Freeing up capacity and better positioning data center workloads
3. Providing dynamic control and energy savings by managing thermal airflow
4. Enabling systems to adjust in real time to match facility cooling needs as IT loads change.
5. Maintaining optimal performance by dynamically controlling pumps, chillers, and fans
6. Optimizing central plant operations to help a facility achieve energy savings up to 50%

Figure-2: Benefits of Thermal Optimization solution overview.

Chiller optimization with Demand Flow

Demand Flow operates on the simple premise that we need to think differently about chilled water systems. It challenges the industry norm of pumping a constant volume of water through the chilled water system all year long with little regard for the varying load on the system.

Instead, Demand Flow takes a holistic approach that uses thermodynamic principles. It focuses on optimizing every subsystem of the chiller plant, including chillers, chilled water pumps, condenser water pumps, and cooling towers. Through the use of high-accuracy precision instrumentation and variable pressure curve logic, Demand Flow is able to dynamically adapt to load changes while maintaining optimal total system performance.

A Demand Flow solution typically includes installing variable speed drives on all chilled water pumps, condenser water pumps, and cooling tower fans as well as employing the high-accuracy controllers and instrumentation needed for proper control.

With Demand Flow, water flow varies through both the evaporator and condenser tube bundles in near-real time to perfectly optimize total system energy consumption in response to system load fluctuations. The effects of optimized flow through the chillers in near-real time produces significant energy savings at the chiller and can increase the nominal tonnage of a typical plant by as much as 20%.

White Space Cooling Optimization (WSCO)

AI is what makes White Space Cooling Optimization (WSCO) so effective at improving temperature control and cool air distribution with less staff support. WSCO's AI engine utilizes a type of machine learning known as supervised learning that enables the WSCO software to continuously get smarter based on the calculations of a series of algorithms. The software learns by continuously analyzing the sensor data for environmental changes. Past and current records of temperature control data are used as a basis for the algorithms and to establish baselines. The software quickly learns how to best respond to temperature variations.

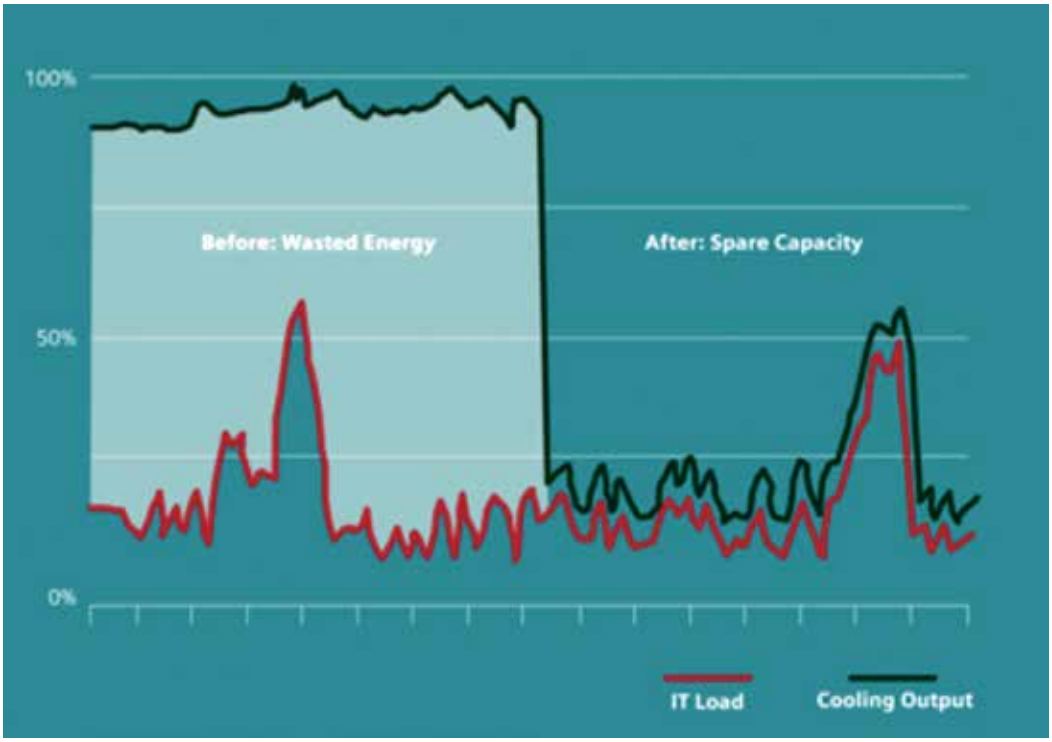


Figure-3: WSCO's ability to dynamically match cooling to the IT load

WSCO's key success factor is its ability to dynamically match cooling to the IT load in real time. The AI engine uses real-time data to feed algorithms that predict the cooling unit settings that will deliver the desired temperature at each sensor. And because most facilities are overcooled, it also delivers significant reductions in energy use.

The backbone of WSCO consists of a wireless mesh network with a dense array of sensors and controllers that fuel the powerful machine learning process and support dynamic cooling control. Rack-level sensors capture both top and bottom rack temperatures while cooling unit controllers provide data such as supply and return temperatures, status, speed, and cooling unit power. This data helps identify cooling influences on the racks so that WSCO's learning software can dynamically determine how much and where cooling is needed to meet temperature service level targets.

Leveraging data collected by the sensor network, WSCO's AI engine automatically creates a real-time model of the facility's thermal environment. The AI engine maps influences and determines the precise cooling influence of every Computer Room Air Handling (CRAH) unit, both individually and collectively, at every spot across the data center. In most facilities, the AI engine is able to measure cooling influences in less than 24 hours.

The WSCO system then takes dynamic control of the cooling units – turning them on and off, and ramping fan speeds up and down — to meet customer-specified temperature SLA targets in the most efficient manner possible. As the AI software learns the effects of control actions, it manipulates the cooling equipment by itself without requiring staff intervention, automatically optimizing cooling and balancing airflow in critical areas in the data center hall.

In the event of a system failure or when temperatures exceed a certain threshold, the WSCO system has a "guard mode" that activates cooling. The "guard mode" delivers added protection to the data center until the mechanical system returns to normal operation. WSCO solutions are cooling infrastructure agnostic, so they are immediately compatible with existing systems with minimal on-site configuration and setup.

The WSCO wireless architecture makes installation non-intrusive and flexible. Without the need to run hundreds of cables, even large sites can be up and running in a matter of weeks. And if a data center already has sensors and cooling controls deployed, WSCO can integrate with and leverage what already exists to optimize cooling.

Reference case: Thermal Optimization keeps financial data cool and safe

In 2009, a global financial firm invested heavily in the construction of a new data center that was classified as a Tier III facility by the Uptime Institute. Less than five years later, the firm realized it needed to increase the data center's cooling capacity while reducing its energy consumption. The data center was built with redundant mechanical plants for both chilled water and air handling. The chilled water plant used a typical primary/secondary loop chilled water system serving constant volume Computer Room Air Handling (CRAH) units in the data halls. While the data halls were built following typical data center design standards, their rack density underwent numerous changes that created hot spots. The hot spots caused chronic over-provisioning of cooling throughout many of the data halls. And like many other data centers, the facility ultimately lost its Tier III rating because it had to turn on what should have been redundant chillers, pumps and CRAH units to mitigate the hot spots. The data center also faced increased energy consumption and a loss of adequate cooling redundancy throughout.

The company hired Siemens Smart Infrastructure to implement a comprehensive thermal optimization strategy for the data center. The first step was to address the chilled water plants' inability to provide cooling to the farthest end of the secondary loop without running its redundant chiller systems. To help resolve this issue, Siemens implemented its Demand Flow solution for chilled water. The solution helped the data center accomplish two initial goals: it was able to reduce the total number of chillers needed to support the load and it was able to utilize the existing plate and frame heat exchanger longer. Awult, Demand Flow helped the data center achieved an immediate 37% reduction in annual energy usage. It received a $200,000 utility rebate and more than $200,000 in annual energy savings, which resulted in a simple payback in 2.75 years.

Second, after optimizing the chilled water plant, Siemens addressed the data center's airflow issue: it had to run all 72 of its CRAH units in order to satisfy the data halls' cooling needs. Each 30-ton CRAH was originally a constant air volume (CAV) unit. Siemens converted them to variable air volume (VAV) and used Modbus to integrate them to the data center's Building Automation System for greater visibility and control.

The third step was to deploy White Space Cooling Optimization (WSCO), which has built-in Artificial Intelligence (AI) for real-time learning and control. The WSCO solution employs wireless technologies to monitor rack inlet temperatures and CRAH units. Using AI-enabled predictive control algorithms, WSCO automatically manages cooling and delivers optimal airflow in the data center hall. The results were significant: WSCO reduced the need for operating CRAH units from 72 to 35, restoring the data center's Tier III rating. The solution also achieved a 71% savings in energy, from 241.7 kW to 69.1 kW. This generated $241,817 in annual savings, a utility rebate of $150,000 and a simple payback of less than two years. To top it off, an additional 5% in energy savings was realized at the chiller plant due to a reduction in required pumping after WSCO was completed.

3.17 ebm-papst Southeast Asia (SEA)

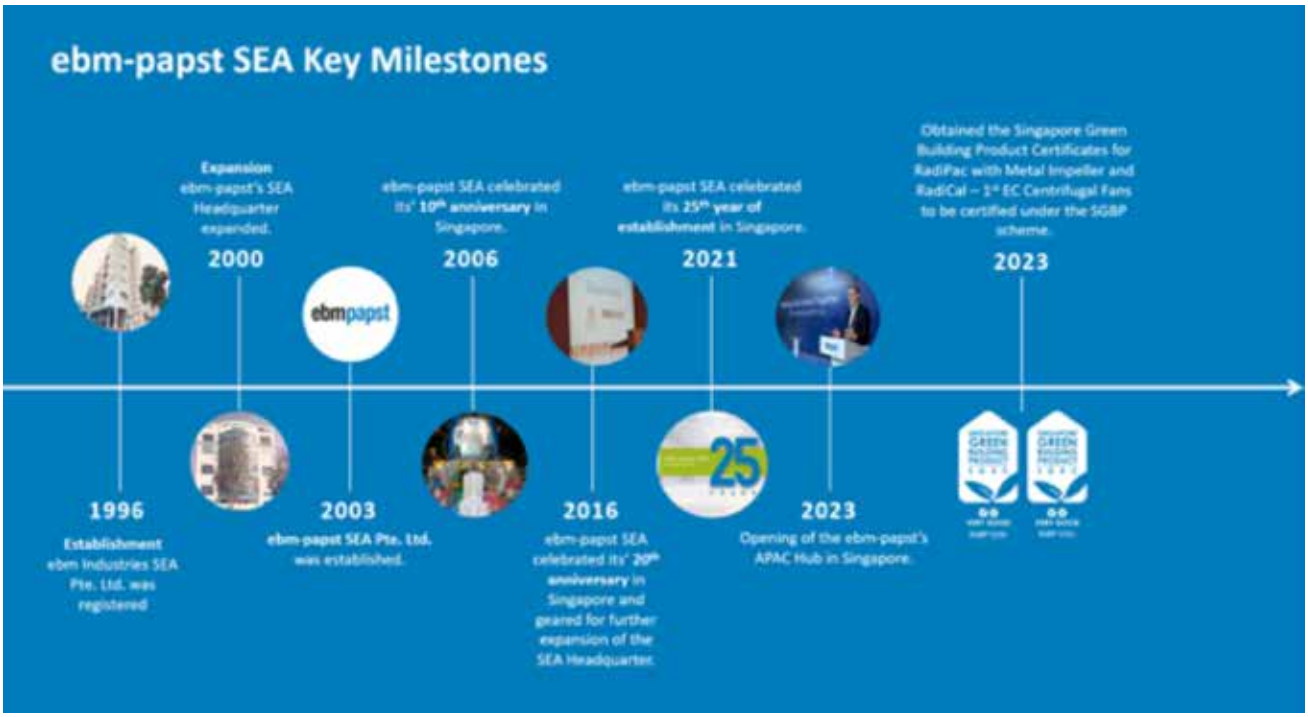
Brief introduction

Established in 1996 in Singapore, ebm-papst Southeast Asia (SEA) has been at the forefront of advancing energy efficiency within the HVAC sector for over 28 years. Globally recognized for our expertise in developing environmentally friendly products, we are particularly renowned for our innovations in HVAC systems, where we champion the adoption of EC (Electronically Commutated) technology.
Our EC motors, a hallmark of ebm-papst's product lineup, are celebrated for their superior efficiency and precise control compared to traditional AC motors. These advanced motors enable significant energy savings and operational benefits across various applications, including industrial ventilation systems, automotive cooling, and refrigeration.

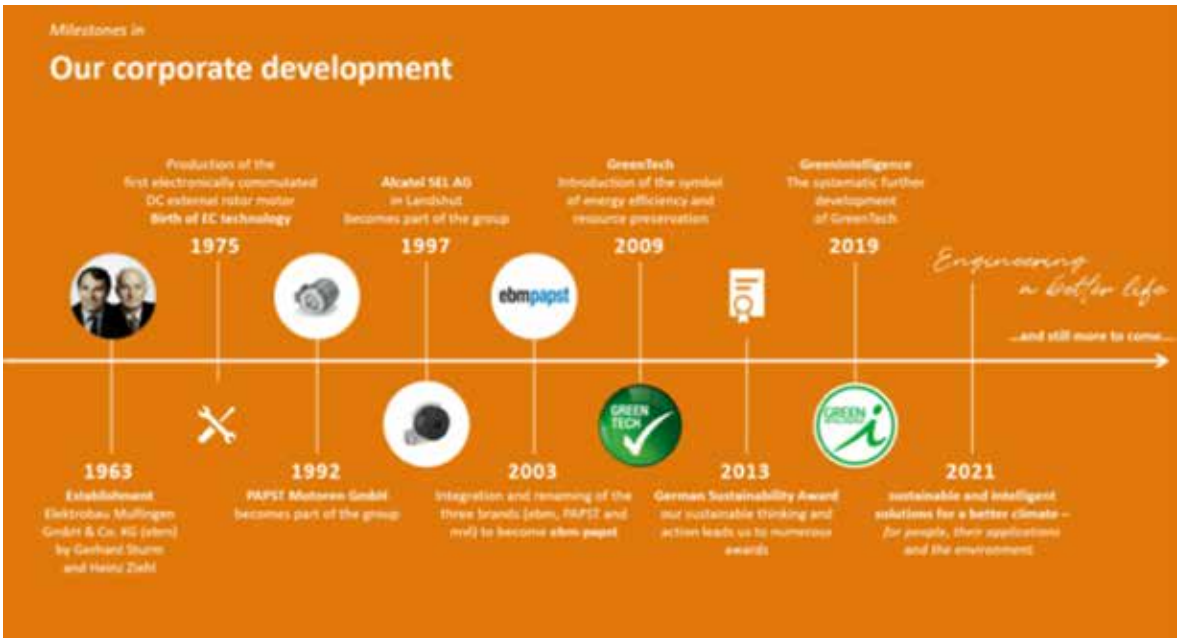
ebm-papst operations and key projects

In Southeast Asia, we collaborate closely with local businesses and industries to provide customized solutions that meet specific regional needs and standards. By leveraging our extensive experience and technological innovations, ebm-papst enhances energy efficiency and reduces environmental impact throughout the region. Committed to innovation and sustainability, ebm-papst SEA aims to play a pivotal role in shaping the future of energy-efficient HVAC solutions in Southeast Asia and beyond.

Key Milestones of ebm-papst SEA



Key milestones of ebm-papst and evolution of our technology:



1. Evolution of Air distribution technology

The evolution of air distribution technology spans centuries, driven by industry needs and advancements in engineering. A major milestone was the mid-20th century's adoption of HVAC systems, revolutionizing efficiency and comfort with innovations like centrifugal fans and modern ductwork.

In the digital age, automation and precision emerged, integrating smart technologies for control and energy efficiency. Computational fluid dynamics optimized airflow, while Building Management Systems enabled centralized monitoring.

Today, sustainability drives a new era, with innovations such as displacement ventilation promising improved air quality and reduced energy usage. Integration of renewables like solar power further mitigates environmental impact.

2. Latest development in the Air distribution system

In recent years, advancements in air distribution systems have revolutionized indoor environments, elevating standards across air quality, energy efficiency, comfort, and building management practices.

Smart Ventilation Systems stand at the forefront of this transformation, integrating IoT technologies to monitor and regulate air quality in real-time. These systems dynamically adjust ventilation rates based on occupancy levels, outdoor air conditions, and other variables, optimizing indoor air quality while minimizing energy consumption. This intelligent approach not only enhances the health and comfort of occupants but also contributes to sustainable building operations.

Energy efficiency has become a focal point in HVAC systems, driving innovations such as EC (electronically commutated) technology that reduce energy consumption without compromising comfort. These advancements in Heating, Ventilation, and Air Conditioning technologies are designed to adapt seamlessly to varying environmental conditions, ensuring the efficient distribution of cooled or heated air throughout buildings. EC technology specifically optimizes the performance of fans and pumps by adjusting their speed based on real-time demands, thereby enhancing overall energy efficiency and operational cost savings. This integration of EC technology exemplifies a forward-thinking approach in achieving sustainable building practices while maintaining superior indoor comfort levels.

In parallel, significant strides have been made in **Noise Reduction** within air distribution systems. Improvements in fan and duct designs have minimized operational noise levels, creating quieter environments that promote productivity and relaxation.

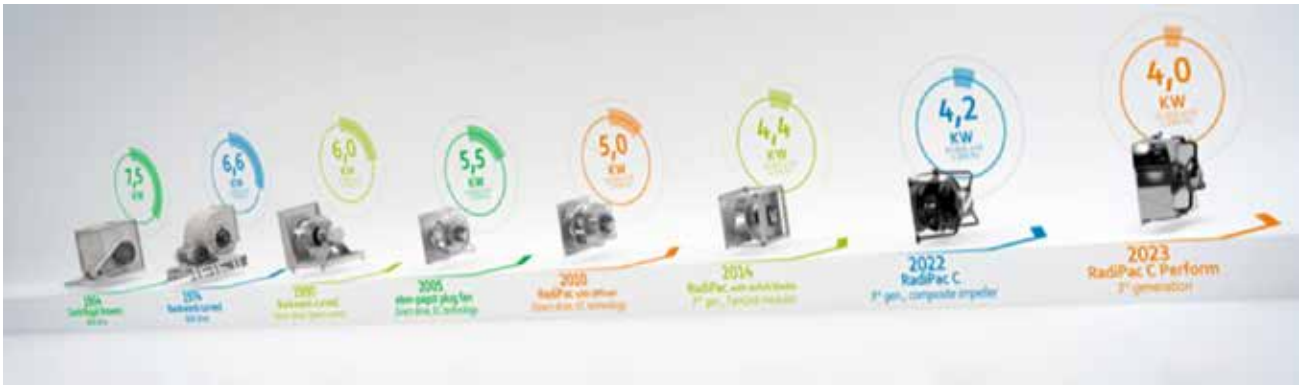
Integration with Building Management Systems (BMS) represents another leap forward. Enhanced connectivity and interoperability with BMS platforms enable centralized monitoring and control of HVAC systems. This integration facilitates proactive maintenance, optimizes operational efficiency, and enhances overall management of building environments.

Collectively, these advancements underscore a commitment to redefining indoor environments through technological innovation. By improving air quality, enhancing energy efficiency, optimizing comfort, and integrating seamlessly with modern building management practices, these systems are shaping the future of sustainable and healthy indoor spaces.

3. Engineering a better life is a promise we stand by.

ebm-papst was one of the first manufacturers to recognise the economic and ecological advantages offered by EC technology and was instrumental in promoting its development.

We drive innovation: Our sustainable and digital solutions help customers reduce emissions. We also focus on resource-efficient manufacturing of our products. The solutions themselves help reduce the carbon footprint of our customers' applications – day after day. In this way, our sustainable and intelligent solutions ensure a better climate – for people, their applications and our environment. It's how we work towards a better future.



4. Unlocking Active Sustainable Design with Energy-Efficient Ventilation Strategies

In Singapore's older buildings, AC motors power many fans, contributing to high energy consumption. Retrofitting with RadiPac C EC fans offers a swift solution. These Electronically Commutated fans operate in parallel, ensuring redundancy for fail-safe operation and an adaptable design to meet varying air performance needs.

The multiple small fans allow the fans to increase efficiency levels at every operating point. Featuring a composite impeller, these fans achieve higher static efficiency, reducing noise emissions and minimizing vibrations, thus providing an efficient upgrade for improved energy consumption.

Generation 3 Motor with Advanced Electronics:

The RadiPac C, featuring a Generation 3 motor with an energy efficiency level above IE5 efficiency requirements and advanced electronics, boasts a configurable control interface allowing a 0 to 10-volt DC (VDC) control signal for smoothly adjustable speed. With MODBUS RTU compatibility, seamless integration into building management systems is facilitated. The fans are standardly equipped with passive PFC while integrated active PFC versions are available as an option to further increase efficiency and decrease harmonics, functioning on both 50- and 60-Hz grids.

Key features encompass integrated resonance detection, protective measures like locked rotor and thermal overload protection, and environment-resistant cable glands, all contributing to enhanced operational reliability. Simplifying commissioning, the design separates the central terminal area from electronics, eliminating the need for programming.

A standard vibration sensor in each RadiPac centrifugal fan detects resonance, ensuring prevention of operation within critical ranges. During commissioning, a test start-up analyzes vibration severity across the speed control range, suggesting suppression of high vibration velocity ranges. Confirmation of these suggestions enables bypassing critical speed ranges during subsequent operations.

Equipped with an integrated vibration sensor, the RadiPac centrifugal fan monitors fan health, facilitates preventive maintenance, optimizes performance, and extends the fan's lifespan.

Digitalization – IoT Ready EC Fans:

Digitalization in connection with energy is a key and cutting-edge field for our ebm-papst Group and opens up new opportunities. As we lead air technology into the next generation, we spearhead innovation in air and IoT technology to create more value for our industry partners and customers.

Better Thermal Comfort: Mitigate hot and cold spots with heat mapping
Improved efficiency: Potentially save more on ebm-papst IoT solution with EC fan solution

Smooth integration to EC Fan Solution: Quick and simple integration to existing EC fan solution
Improved productivity: Improve productivity with process automation, reducing manual labour, and providing real-time data

Enhanced Customer Experience: Capability to collect data on customer behaviour and preferences, leading to refined energy usage for maximum optimization

Analytics and Machine Learning: Collect data for analysis paving the way for machine learning and AI technology to reduce energy usage, meet regulatory requirements and save costs.

5. Future Air distribution system

The advancements of future air distribution systems will be likely to be driven by the increasing focus on sustainability, energy efficiency and technological innovation in digitalization.

Smart and Connected Systems: Integration with smart building technologies will enable real-time monitoring and optimization of indoor air quality and energy consumption using AI and machine learning.

Modular and Flexible Designs: Evolution towards modular designs will facilitate easier adaptation to changing building layouts and usage patterns, enhancing occupant comfort and enabling simpler retrofitting.

Integration of IAQ: Standard inclusion of indoor air quality sensors will optimize ventilation rates, filtration systems, and airflow patterns for healthier indoor environments.

Human-Centric Design: Prioritization of human-centric design principles will enhance occupant well-being and productivity by focusing on factors like thermal comfort and personalized ventilation solutions.

Decentralized and Distributed Systems: A potential shift to decentralized systems will provide ventilation and conditioning at the point of use, offering greater energy efficiency and resilience, especially in multifunctional spaces.

"Each new product must surpass its predecessor economically and ecologically."
- Gerhard Sturm, founder of ebm-papst

Region XIII Chapters Regional Conference (CRC) Souvenirs

From Philippine, 2002

From Thailand, 2003

ASHRAE Singapore Chapter

Luminaries of ASHRAE Singapore Chapter

4.1 Honours and Awards List

S/N	Name	Year	Honours and Awards
1	Dr Bong Tet Yin	1989	Fellow Award
2	Er Hng Hung Chenh	1995	Fellow Award
3	Dr Ng Eng Hong	2000	Fellow Award
4	Dr Ng Eng Hong	2000	Regional Award of Merit
5	Mr Tan Chuan Long, Sunny	2000	Fellow Award
6	Mr Wong Yew Wah, Raymond	2001	Fellow Award
7	Mr Wong Yew Wah, Raymond	2001	Regional Award of Merit
8	Mr Tan Chuan Long, Sunny	2002	Regional Award of Merit
9	Er Chee Yan Pong	2003	Fellow Award
10	Er Chee Yan Pong	2004	Chapter Service Award
11	Mr Tan Yong Hoa	2004	Regional Award of Merit
12	Mr Wong Yew Wah, Raymond	2005	Distinguished Service Award
13	Dr Chou Siaw Kiang	2005	Fellow Award
14	Er Lek Siang Hwa	2006	ASHRAE Technology Award
15	Prof Chandra Sekhar	2007	Fellow Award
16	Er Sin Yew Tek, Albert	2008	Chapter Service Award
17	Mr Tan Yong Hoa	2008	Chapter Service Award
18	Er Chee Yan Pong	2009	Regional Award of Merit
19	Dr Ng Eng Hong	2010	Chapter Service Award
20	Prof Chandra Sekhar	2010	Distinguished Service Award
21	Mr Sivakumar Gadam	2011	Chapter Service Award
22	Mr Lau M H, David	2011	Chapter Service Award
23	Prof Chandra Sekhar	2013	Exceptional Service Award

24	Mr Francis Lee	2014	Chapter Service Award
25	Prof Chandra Sekhar	2014	Environmental Health Award
26	Mr Tan Gek Suan	2014	Chapter Service Award
27	Prof Chandra Sekhar	2015	Chapter Service Award
28	Er Leong Cheng Wee	2016	Chapter Service Award
29	Mr Lau M H, David	2016	Regional Award of Merit
30	Mr Tan Chuan Long, Sunny	2017	Distinguished 50-Year Member Award
31	Mr Abdul Razaak Syed Mubarak	2018	ASHRAE Technology Award
32	Er Hng Hung Chenh	2019	Distinguished 50-Year Member
33	Er Leong Cheng Wee	2019	Regional Award of Merit
34	Mr Liew Kwong Chin	2019	Chapter Service Award
35	Er Ngan Ping Leung, Matthew	2019	Fellow Award
36	Er Chee Yan Pong	2021	Distinguished 50-Year Member
37	Er Ho Kok Ann	2021	Chapter Service Award
38	Prof Chandra Sekhar	2021	E. K. Campbell Award of Merit
39	Ms Florence Chan	2022	Chapter Service Award
40	Mr David Edenburn	2022	Chapter Service Award
41	Dr Yang Junjing	2022	Chapter Service Award
42	Mr Abdul Razaak Syed Mubarak	2023	Chapter Service Award
43	Mr Wong Yew Wah, Raymond	2024	Exceptional Service Award
44	Er Leong Cheng Wee	2024	Distinguished Service Award
45	Dr Yang Junjing	2024	Distinguished Service Award
46	Prof Chandra Sekhar	2024	Louise and Bill Holladay Distinguished Fellow Award

4.2 Professor Chandra Sekhar, Ph.D.

(2024 Louise and Bill Holladay Distinguished Fellow Award)

National University of Singapore
Department of the Built Environment
College of Design and Engineering
4 Architecture Drive
Singapore 117566
bdgscs@nus.edu.sg

Chandra Sekhar, Ph.D., Fellow ASHRAE, ISIAQ and Engineers Australia (FIEAust), is currently a Professor and Programme Director (MSc-Building Performance and Sustainability) in the Department of the Built Environment at the National University of Singapore. He holds BE (Mechanical Engineering) from the University of Rajasthan (Malaviya National Institute of Technology), India; and PhD (Mechanical Engineering) from the University of Adelaide, Australia, in the area of energy efficient cooling and dehumidification systems.

His research interests include thermal comfort, ventilation and IAQ, airborne infection control, energy efficient HVAC systems and building energy analysis. He has more than 300 publications in these fields in international journals and conferences.

He has delivered several Keynote talks in international conferences around the world. Dr. Sekhar serves on the editorial boards of several reputable peer-reviewed journals: former Associate Editor of ASHRAE Science and Technology for the Built Environment (STBE) journal (2009 2023); Regional Editor (South East Asia) Indoor and Built Environment and an editorial board member of Energy and Buildings, Building and Environment, and International Journal of Sustainable Built Environment.

He is a co-inventor and holds 3 US and other patents in the area of energy efficient air conditioning system with zonal ventilation control for enhanced IAQ. He is an International Scientific Committee member of several IAQ and energy conferences. He was the Steering Committee Chair for ASHRAE IAQ2010 conference in Kuala Lumpur in 2010 and continued to be on the steering committee of subsequent ASHRAE IAQ conferences (Vancouver, 2013; Alexandria, USA, 2016; Athens, 2021/2022). He has been an ASHRAE Distinguished Lecturer since 2006 and is regularly invited as a DL speaker around the world (more than 100 DL presentations).

He has been recognized through several awards, including: E.K. Campbell Award of Merit, Environmental Health Award, Exceptional Service Award and Distinguished Service Award from ASHRAE; Uichi Inouyi Memorial Asian International Award from SHASE, Japan; SPRING Singapore Merit Award, ASEAN Energy Award and The Enterprise Challenge (TEC) Award of the Prime Minister's Office in Singapore.

He is currently ASHRAE Vice President and Board Member (2023-2025), a member of SSPC241P (Control of Infectious Aerosols) and TC2.1; and a consultant of Planning Committee and SSPC62.1. He is a past DAL (2018-2021) and past Chair of Environmental Health Committee (2012-2013). He was also a Vice Chair (2022-2023) and member (2021-2023) of Residential Buildings Committee, Position Document Committees (such as Infectious Aerosols, Indoor Carbon Dioxide, Resiliency in the Built Environment), IEQ-Global Alliance Ad Hoc Committee (2013-2017), EHC (2006-2012 & 2016-2018) and TC4.3.

He has served the ASHRAE Singapore Chapter in various capacities, including as its President during 2010-2011 and as a BOG member, and is also actively involved in local standardization activities in Singapore.

During the COVID-19 pandemic, Dr. Sekhar was an active member of two teams (Residential and Applications) of the ASHRAE Epidemic Task force. He is also a member of the WHO Environment and Engineering Control Expert Advisory Panel (ECAP) for COVID-19 that published the "Roadmap to improve and ensure good indoor ventilation in the context of COVID-19" in March 2021.

In December 2023, he received the MNIT Life Time Achievement Award 2023 from his _alma mater,_ Malaviya National Institute of Technology, Jaipur, India.

4.3 Er. Chee Yan Pong (2021 Distinguished 50-Year Member Award)

(Er. Y. P. Chee – PE0572)

ASHRAE Singapore Chapter (ASC)

Had served as President for 2 terms:
1984-1985 as 2nd Chapter President
2007-2008 as 25th Chapter President

In 2004, Chairman for ASHRAE 13th Chapters Regional Conference (CRC).

ASHRAE Honors and Awards

Had received the follow:
2003 Fellow Award
2004 Chapter Service Award
2009 Regional Award of Merit
2010 Life member
2021 Distinguished 50-Year Member Award

ASC Nomination Committee, Chairman:

a) 2007 to 2008
b) 2010 to 2011
c) 2011 to 2012
d) 2013 to 2014
e) 2015 to 2016
f) 2017 to 2018
g) 2021 to 2022

ASC Constitution 2020
2020 – Member of ASC Constitution Committee
2021 – Advisory Service to ASC President with regard to registering to the Registrar of Society, Singapore (ROS).

Honorary Auditor
2024 to 2025

Er. Chee had initiated the following HVAC systems into Singapore projects:

1) High-velocity Variable Air Volume system to medium air velocity ductwork.

2) Built-up high-velocity Air handling units to serve multiple floors in High Rise Office Buildings.

3) Use of Chillers in series-series-parallel configuration.

4) Use of higher temperature differential for chillers, to effect enhanced energy efficiency.

5) Use of Chilled water storage tanks for good electricity savings, to reap the benefits from off-peak electricity tariffs.

6) First attempt on use of Variable Air Volume (VRV) Air-conditioning systems on air conditioning in all classrooms in school, to improve study and teaching environment.

7) Providing advisory service to a School for retrofitting of existing air-conditioning system to combat against the implications of Covid-19 virus and the anticipation of much higher outside-air temperature possible, due to Global Warming effect and the advent of Green Technology.

8) Represented ASC, as lecturer on the ASHRAE teach-in-series topic, for a period of 3 to 4 years: - “Fundamentals of Air-Conditioning System Design”

9) Contributed professional service as a Specialist Mechanical Professional Engineer in providing as an Engineering Expert Witness (EEW), for Air-Conditioning and Mechanical Ventilation (AC&MV) and other specialist Mechanical Engineering works.

4.4 Er. Leong Cheng Wee

(2024 Distinguished Serviced Award)

LEONG Cheng Wee; P Eng, M Eng, BSc Eng
Director of M/s Method Engineering Pte Ltd
Director of M/s MJ Air Tech Asia Pacific Pte Ltd
Director of Leong CW & Associates Pte Ltd
Director of Advanced Heat Pipe Pte Ltd

Blk 1 Ang Mo Kio Industrial Park 2A
#01-03 AMK Tech 1, Singapore 568049

Qualified Person - Mechanical Engineer

- Diploma in Marine Engineering, Singapore Polytechnic, 1983
- Bachelor of Science (Honours) in Mechanical Engineering, University of Aberdeen, 1988
- Master of Engineering, University of Singapore, 1996
- Graduate Member of the Institution of the Mechanical Engineers, United Kingdom (IMechE)
- Member of the Institution of Engineers, Singapore (IES)
- Member of the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), U.S.A
- Member of the ASHRAE Singapore Chapter, Singapore
- Member of the Institution of Fire Engineers
- Certified Safety Officer
- Green Mark Professional
- Certified Energy Manager (SCEM)
- Certified Safety Officer
- Green Mark Professional
- Certified Energy Manager (SCEM)
- Certified Lift and Escalator Inspector (LEI)

Experience Summary

Upon my graduation in 1988 from the University of Aberdeen in Scotland, I was employed as a Manufacturing Engineer in Hewlett Packard Singapore. In 1990, I was granted a scholarship by the National University of Singapore to carry out research work leading to my Masters Degree in Mechanical Engineering.

Since May 1992, I have been engaged in the Building Services consultancy work. I have completed and was involved in a wide variety of projects such as Offices, Warehouses, Wafer Fab Plant, Pharmaceutical Plant, Residential Developments, Institutions, Hotels, Brewery, Clubhouses, Resorts, etc. Besides new developments, I have also completed retrofitting and upgrading projects.

My roles includes liaison with the Project Managers/Owners on the design briefs, conducting of feasibility studies, development of conceptual design for Clients' approval, detailed development of the building services design, contract administration works, submission of plans to the Authorities, supervision, testing and commissioning of the building services for compliance, hand over to the Operation and Maintenance Personnel and preparation of the Statement of Final Accounts.

In Murray-North (SEA) Pte Ltd, I was the Division Manager of the Building Services Division. He was responsible for the overall operation of the Building Services Division. My duties included the business development of the company, M&E design reviews and approvals, staff and equipment resources and ISO 9002 implementation.

I am now responsible for the business development and overall operation of the companies.

I have been involved in ASHRAE since 1990. I served as the President of the Singapore Chapter in 2000-2002. I was the Research Promotion Regional from 2013 to 2016, and Region Members Council Representative from 2016 to 2019. I volunteered as the CRC Chair in 2017 when the Singapore Chapter was the Host. I was a member of the ASHRAE Training and Education Committee member from 2019 to 2022. I was appointed as the Assistant Regional Chair in 2021 and currently serving as the Director Regional Chair from 2022 to 2025.

I am very active in serving other professional bodies (IES, FPAS, ARA and STAS). I am also a member of the Institution of Fire Engineers (IFE) and Singapore Institute of Safety Officers (SISO). I am a registered Mechanical Professional Engineer and a Qualified Safety Officer. I am a member of several Working Groups for updating of our local Codes of Practices and Singapore Standards. I am also a Certified Lift and Escalator Inspector.

Associations

i. ASHRAE Member from 1990 till to-date
ii. ASHRAE Singapore Chapter President from 2000-2001
iii. ASHRAE various committees
    - Served as Region XIII Regional Vice Chair for Research Promotion from July 2013 till June 2016
    - Served as Region XIII Regional Members Council Representative from July 2016 till June 2019
    - Serving as Region XIII Assistant Regional Chair from July 2019 till to-date
iv. Serving as ASHRAE Society's Training and Education Committee Member from July 2019 till to-date
v. IES (Institution of Engineers, Singapore) M&E Committee Member from 2002 till to-date
vi. SISO (Singapore Institute of Safety Officers) Member from 2018 till to-date
vii. Member of the Institution of Fire Engineers from 2019 till to-date
viii. President of Air-Conditioning and Refrigeration Association from 2019 till to-date

Working Group/Taskforce

Member of Working Groups for Singapore Standards/Code of Practices:

1. CP 52 : 2004 “Code of Practice for automatic fire sprinkler system”
2. SS 574 – Part 1 : 2012 “Specification for dual flush low capacity water closet (WC) up to 4.5/3.0 litres capacity - WC flushing cisterns”
3. SS 574 – Part 2 : 2012 “Specification for dual flush low capacity water closet (WC) up to 4.5/3.0 litres capacity - WC pans”
4. SS 591 : 2013 ”Code of practice for long term measurement of central chilled water system energy efficiency”
5. Member of BCA GreenMark Version 5 Environmental Quality Taskfore
6. SS 553 : 2016 “Code of practice for air-conditioning and mechanical ventilation in buildings”
7. SS 554 : 2016 “Code of practice for indoor air quality for air-conditioned buildings”

Current Member of Working Groups for Singapore Standards:

1. SS 591 : 2013”Code of practice for long term measurement of central chilled water system energy efficiency”
2. SS 553 : 2016“Code of practice for air-conditioning and mechanical ventilation in buildings”
3. SS 554 : 2016“Code of practice for indoor air quality for air-conditioned buildings”
4. TR 102:2022 Code of practice for Passive Displacement Cooling (PDC) System for Air-Conditioning Application
5. Domain Expert for development of the national specification for the iNPQS (intelligent National Productivity and Quality Specification) IT Platform for Air-Conditioning and Mechanical Ventilation System
6. SS 574-1 : 2012 Specification for dual flush low capacity water closet (WC) up to4.5/3.0 litres capacity – WC Flushing Cisterns
7. SS 574-2 : 2012 Specification for dual flush low capacity water closet (WC) up to4.5/3.0 litres capacity – WC pans
8. WG Observer for review of SS 626 : Code of practice for design, installation and maintenance of escalators and moving walks

4.5 Mr. Tan Chuan Long, Sunny

(2017 Distinguished 50-Year Member Award)

Mr. Sunny Tan served as Chapter President for 1986-1987. He held several ASHRAE Regional Officer posts in Region XIII. He received the following Honors and Awards:

2000 Fellow Award
2002 Regional Award of Merit
2004 Life member
2017 Distinguished 50-Year Member Award

Mr. Tan Chuan Long, Sunny obtained his BSc. from United States of America. He had specialty training in Air-conditioning, Refrigeration, and Ventilation. He had worked in Jardine and Guthrie Airconditioning Division for 20 years.

Subsequently, he joined the United Project Consultants as partner for another 20 years. He had successfully completed Mechanical & Electrical services in large hotels, shopping malls, and high-rise offices in Singapore, Malaysia, China, and Vietnam.

In 1982, Mr. Sunny was one of founding members of the Singapore Association Airconditioning Members (SAAM), which later was renamed as ASHRAE Singapore Chapter in 1984, first ASHRAE Chapter outside USA. He was elected as the 4th president of Singapore Chapter in 1985.

Soon, several countries outside USA formed local Chapters, and ASHRAE International Chapters were incorporated. In 1997, ASHRAE Asia Pacific Region XIII was formed. He was elected as a regional officer to serve Region XIII in the Students Activity Committee for 7 years. He continued to serve in Region XIII's Nomination Committee for 2 years.

He expressed much gratitude to have opportunity to serve the ASHRAE community, and he was recognised with several honours and awards. He said he always feel at home among ASHRAE members whom they affectionately address him as Uncle Sunny.

4.6 A/P Raymond Wong Yew Wah

(2024 Exceptional Service Award)

ASHRAE Singapore Chapter (ASC)
1992-1993 as 11th Chapter President

In 2010, Chairman for Region XIII Chapters Regional Conference (CRC).

ASHRAE Honors and Awards

Had received the follow:

2001 Fellow Award
2001 Regional Award of Merit
2005 Distinguished Service Award
2024 Exceptional Service Award

Raymond Wong Yew Wah is an educator and researcher, and a Professional Engineer registered in Singapore. He was Associate Professor in Mechanical Engineering in Nanyang Technological University (NTU), and in 2016, Deputy Director and currently consultant with the Smart Sustainable Building Technology Programme in the Energy Research Institute, NTU.

His initial work as a mechanical engineer designing building M&E services sparked his interest in efficient energy performance in non-residential buildings. He joined ASHRAE as Member in 1984. Thus began his work on building energy studies through simulations, energy monitoring and audits in buildings in NTI/NTU in collaboration with the ASEAN-US and ASEAN-Australia components of the ASEAN Non-Conventional Energy Research Programmes. His expertise led him to work with the Building and Construction Authority (BCA)'s forerunner, the PWD Building

Control Department to develop nascent energy guidelines in air-conditioning Standards and Codes for Singapore. He was invited to advise on the early development of the BCA's GreenMark building rating system especially toward the energy modelling requirement for the highest Platinum Rating Award grade.

He was elected ASHRAE Fellow in 2001 in recognition to his contribution to raising building energy efficiency in the industry. His experience with Greenmark led him to service on ASHRAE EQ Ad-Hoc Committee in 2008. He was member on BCA Greenmark Advisory Committee 2005-2018 and a member on the BCA International Panel of Experts on Sustainability of the Built Environment in 2008, 2009 and 2013 leading to the formulation of BCA's 1st , 2nd and 3rd Green Building Masterplans.

He was Member on the Expert team in APEC Peer Review of Energy Efficiency of member economies of Chile in 2008 and Vietnam in 2009. His research on system efficiency contributed to the publication of first GreenMark Data Centre Rating System in 2012 and Zero Energy (ZEB) and Super Low Energy (SLEB) rating in the GreenMark system in 2017.

Raymond has published more than 40 journal articles and 50 conference papers on a wide range of subjects covering non-residential building and data centres energy efficient performance, chilled ceiling and beams in air-conditioning systems, refrigerated container systems, fire safety pressurisation ventilation systems, and artificial organs. He co-authored three patents on heat sink and depth probes.

Raymond's participation in many activities at the ASHRAE grassroots level began with his service on various committees at the Singapore Chapter culminating in 1992 as Chapter President. There after he was called upon to represent Singapore Chapter in 1995 on discussions on feasibility of a new ASHRAE Region, and later in 1996 a consultant at the planning meeting of an International Committee. When Region XIII was finally a reality with the four founding chapters of Singapore, Malaysia, Hong Kong and Taiwan in 1998, he was Regional Vice-Chair (RVC) TEGA 1998-2001, and also host committee member in their inaugural(1998) Chapters Regional Conference (CRC) in Singapore.

He was elected the second Region XIII Director and Regional Chair (DRC) and was a Board of Directors(BOD) member in ASHRAE Society Board from 2001-2004 with the expanded family of chapters now including Thailand and Philippines Chapters. He continues service at Society level post 2004 on the Training and Education Committee, Honor and Awards Committee, Certification Committee, and Publications Committee.

He was awarded the Distinguished Service Award in 2005 and Exceptional Service Award in 2024 in recognition for his service to ASHRAE and industry.

4.7 Dr. Yang Junjing

(Distinguish Service Award 2024)

Senior Scientist, Head
(Built Environment Branch)
Environmental Health Institute
National Environment Agency

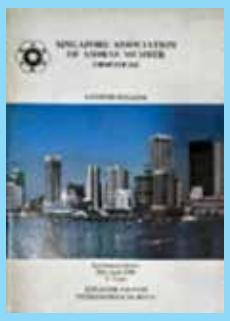
Yang Junjing, Ph.D. is currently a Senior Scientist leading the built environment branch at Environmental Health Institute at National Environment Agency. She obtained BEng(Engineering) from Tongji University, China, MSc(Intelligent Building) from the University of Reading, UK and PhD (Built Environment) from National University of Singapore in the area of engineering solution for infection control.

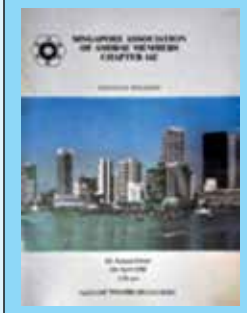
Her research interests include indoor air quality, ventilation, airborne infection control, bioaerosol science, and energy efficiency. She has more than 50 publications in scientific journals, conference proceedings and chapters in books. Dr. Yang has been invited for talks or guest lectures both locally and overseas and has served as guest editors and editorial board members for several international scientific journals.

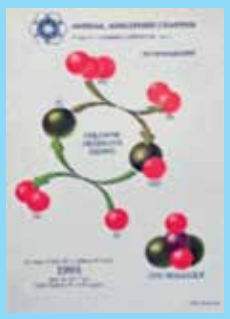
She has been recognized through several awards, including ASHRAE Distinguished Service Award, ASHRAE Chapter Service Award, Singapore National Award - Commendation Medal, and Singapore National Award for COVID-19 Resilience.

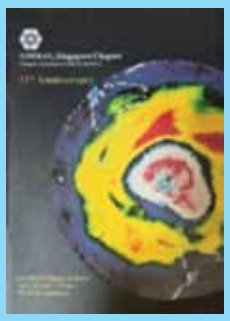
Dr. Yang is currently a consultant member of ASHRAE SSPC241P(Control of Infectious Aerosols), voting member of SGPC 10(Interactions affecting the achievement of acceptable indoor environments), consultant member of ASHRAE SSPC 62.1(Ventilation and acceptable indoor air quality). Member of ASHRAE SSPC 170(Ventilation of Health Care Facilities) and ASHRAE SSPC 185.3 (Method of testing commercial and industrial in-room air cleaning devices and systems for microorganism bioaerosol removal or inactivation in a test chamber). She was the voting member of ASHRAE Environment Health Committee (2020 – 2023) and was the program subcommittee chair of TC 2.1. She has served ASHRAE Singapore Chapter in various capacities, including the representative of Singapore Chapter in steering committee for ASHRAE Asia Pacific Conference in Built Environment during 2017 – 2023; vice chair of ASHRAE Asia Pacific Conference in Built Environment 2025, President of ASHRAE Singapore Chapter 2022-2023. She is also actively involved in local standards and technical reference working groups in Singapore. During the COVID-19 pandemic, Dr.Yang was actively involved in the application working group of the ASHRAE Epidemic Task force and has led the development of guidance and advisory locally in Singapore.

4.8 Past President

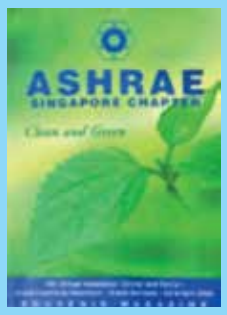
S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
1	 **Mr. Bill Sundberg** (Deceased) 1982-1983 *Extract from 1983 Souvenir Magazine;* Our first year of activity for the Singapore Association of ASHRAE Members has been a challenge - to establish our identity and credentials within the air-conditioning industry and technical community in Singapore.		
2	 **Mr. Bill Sundberg** (Deceased) 1983-1984 *Extract from 1984 Annual Dinner Magazine;* Our second year of activity for the Singapore Association of ASHRAE Members has been charcterised by a major change in our affiliation with ASHRAE. Our name remains the same but we have now achieved chapter status.	Shangri-la Hotel 	**Mr. I B Lulla** (Deceased) 
3	 **Mr. Chee Yan Pong** 1984-1985 *Extract from 1985 Annual Dinner Magazine;* Our first year of activity as a Chapter-at-Large of ASHRAE has indeed been one of challenges – a challenge to establish our close identity with ASHRAE (USA) and the credibility of our standing in the air-conditioning and refrigeration industry in Singapore.	Singapore Pavilion Intercontinental hotel 	**Mr. W P Lee** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
4	 **Mr. Loh Peng Sum** 1985-1986 *Extract from 1986 Annual Dinner Magazine;* The Singapore Association of ASHRAE Members' Annual Dinner and Dance has become the social event for the air-conditioning industry over the last few years. It has brought together developers, contractors, suppliers, engineers, architects and academicians who are all closely involved with the industry under a convivial atmosphere. I am sure that this evening will be no exception.	Neptune Theatre Restaurant 	**Dr. Jeremy Chia** 
5	 **Mr. Sunny Tan C. L.** 1986-1987 *Extract from 1987 Annual Dinner Magazine;* Many air-conditioning trade in Singapore has been very busy updating their skill and knowledge of the latest airconditioning technologies through monthly technical talks and seminars organized by the Chapter.	Hilton International Singapore 	**Er. Tan Yong Hoa** 
6	 **Mr. Henry Lee H. S.** (Deceased) 1987-1988 *Extract from 1988 Annual Dinner Magazine;* Our Chapter gained valuable experience in having assisted ASHRAE to organize their first Far East Conference which, considered …a great success.	Marina Mandarin Singapore 	**Mr. Peter Koh** 
7	 **Mr. Chan Phang Fei** 1988-1989 *Extract from 1989 Annual Dinner Magazine;* Out of the total of twelve monthly technical meetings, there were three "heavy weights": a joint seminar with Institution of Engineers and Singapore Fire Services on "Smoke Control in Buildings", a joint seminar with Singapore Polytechnic on "Refrigeration System and Control" and a forum cum catalog show on "New Technologies on Airconditioning Equipment" presented by five major manufacturers.	Pan Pacific Singapore 	**Mr. Henry Lee H. S.** (Deceased) 

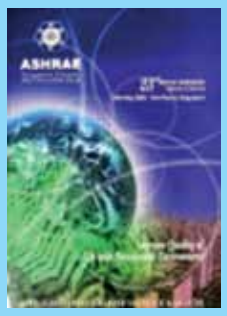
S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
8	 **Dr Bong Tet Yin** 1989-1990 *Extract from 1990 Annual Dinner Magazine;* …Scientists are very concerned over the state of our living environment. According to reports, more people are expected to get skin cancer because of the ozone hole in the stratosphere. Next is the problem of global warming, the so-called greenhouse effect. Will it cause flooding in Singapore …	Mandarin Singapore 	**Mr. Sunny Tan C. L.** 
9	 **Dr Bong Tet Yin** 1990-1991 *Extract from 1991 Annual Dinner Magazine;* …We are concerned over the environmental problem faced by the World today because of the use of CFCs, a group of chemicals very much used for refrigeration and airconditioning industry. We are doing our part …by organising an Asia Pacific Conference this year, and we hope to get your strong support.	Hyatt Regency Singapore 	**Mr. Tan Gek Suan** 
10	 **Mr Tan Yong Hoa** 1991-1992 Joined SAAM in 1985 and served through the years, in the BOG from 1985 as Chairman Program, Treasurer, Secretary and President in year 1991-1992. In 1987 tasked to serve as Chairman 5th Annual Dinner Organising Committee. During my tenure, ensured SAAM Organisation and activities are in compliance with the Constitution approved by Registrar of Society. SAAM Book Prize for the 4 Tertiary Institutions was 1st awarded in 1990. Appreciation Certificate in Recognition of 10 year Memberships were created. Subsequent years served as Chapter Historian, Chapter Administrator and at Regional level, served as Regional Historian & RVC Membership Awards Certificate of Appreciation - 1991-1992 Gold Ribbon For History - 1994-1995 Regional Award of Merit - August 2004 Chapter Service Award - August 2008	Shangri-La Hotel Singapore 	**Mr. Sunny Tan C. L.** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
11	 **A/P Wong Yew Wah** 1992-1993 *Extract from 1993 Annual Dinner Magazine;* The Association (Chapter) actively participated in the Asia-Pacific Conference on the Phasing Out of Ozone Depleting Substances …A short course on Smoke Control Systems organised to explain this important aspect of ventilation systems… Work is under way for the Association (Chapter) to support a big event on Intelligent Buildings…	Mandarin Singapore 	**Dr. Jeremy Chia** 
12	 **Dr. Ng Eng Hong** 1993-1994 Dr Ng Eng Hong is a Life Fellow Member of ASHRAE. He was the Director of School of Mechanical and Aeronautical Engineering, Singapore Polytechnic. Dr Ng was most active in training the technical personnel of many local companies and government organisations in Refrigeration & HVAC. Besides training the local technical personnel, he had trained over 100 technical personnel from the developing countries in HVAC under the Singapore-United Nation Development Program (UNDP) framework for Technical Co-operation among Developing Countries (TCDC). In addition, Dr Ng was a member of the technical workgroup of the Singapore Green Labelling Scheme under the Ministry of The Environment, Singapore that drafted the qualifying criteria for the domestic refrigerator-freezer and air-conditioner for the Green Label; and a member of the workgroup that drafted the CP 13 'Mechanical Ventilation and Air-Conditioning In Buildings' under SPRING Singapore. Dr Ng joined ASHRAE and the Singapore Chapter of ASHRAE in 1988 and was elected into the Board of Council of the Singapore Chapter the same year. He had been actively promoting ASHRAE and Refrigeration & HVAC since then. In his years of service with ASHRAE and the local chapter, he had served in various capacities as Chair of Program, Education, Research Promotion and Nominating Committees; Honorary Secretary; President-Elect and the President of the Chapter in 1993. Among his notable contributions to the chapter, he started the biennial Asia Pacific Conference on the Built Environment and the bilateral meetings with the ASHRAE Malaysia Chapter to create greater promotion and cooperation in the HVAC in the region. At the regional level, he was involved in the formation of Region XIII and was a member of the organising committee of the first CRC of Region XIII held in Singapore. He had also severed as the Nominating Committee member, RVC TEGA, Regional Historian and ARC of the Region. For his contributions, he was awarded the Regional Award of Merit by ASHRAE in 2000.	Hyatt Regency Singapore 	**Mr. Tan Gek Suan** 

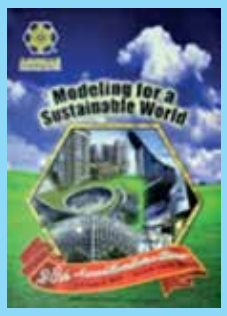
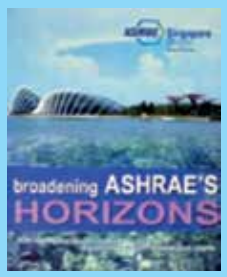
S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
13	 **A/P Leong Kai Choong** 1994-1995 *Extract from 1995 Annual Dinner Magazine;* The Education Committee organised two very successful courses on "Airconditioning (Testing, Balancing and Commissioning)" jointly with the Mechanical Engineering Department of Ngee Ann Polytechnic, and a short course on "Noise and Vibration Control in Buildings" with the Centre for Continuing Education of Nanyang Technological University.	Westin Stamford & Westin Plaza, Singapore 	**Mr. Henry Lee H. S.** (Deceased) 
14	 **Mr. Lee Siew Kee** 1995-1996 *Extract from 1996 Annual Dinner Magazine;* The Asia-Pacific Conference on the Built Environment - Trends and Challenges, on 1-3 June 1990 at the Raffles City Convention Centre, was jointly organised by the Singapore Association of ASHRAE Members (Singapore ASHRAE Chapter), ASHRAE Malaysia Chapter and the Institute of Environmental Epidemiology, Ministry of the Environment, in operation with the World Health Organisation.	Mandarin Singapore 	**Mr. Steven Chan** 
15	 **Mr. Vincent Tong** 1996-1997 *Extract from 1997 Annual Dinner Magazine;* The Association (Chapter) is honoured to be invited by CIDB (Construction Industry Development Board)to participate in a committee to study feasibility of incorporating the assessment of M&E works into the Construction Quality Assessment System (CONQUAS)	Marina Mandarin 	**Dr Ng Eng Hong** 
16	 **Mr. Jimmy Loon** 1997-1998 The most significant event in that year was the formation of Region XIII, the first region to be formed outside of North America. He and the Committee established new ties with the Hong Kong and Taiwan Chapters, as part of Region XIII together with the Malaysian Chapter. He and the Committee also co-organised, with the Malaysian Chapter, the 1997 Asia Pacific Conference on the Built Environment, which was held in Kuala Lumpur in November.	Neptune Theatre Restaurant 	**Mr. Tan Gek Suan** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
17	 **Dr. Teh Soo Lee** 1998-1999 *Extract from 1999 Annual Dinner Magazine;* The topics were timely and presented by distinguished speakers: • Integrated Fire Alarm System • Managing & resolving disputes: Mediation as a viable alternative • Facing Year 2000-The Millenium Bug • Clean Technology	Orchard Hotel 	**Mr. Philip Chua** 
18	 **Er. Chen Siew Ik** 1999-2000 *Extract from 2000 Annual Dinner Magazine;* The Publicity Committee produced a video CD on "ASHRAE Singapore Chapter: Air-conditioning and Refrigeration Development in Singapore". The successful production is testimony that the Association (Chapter) enjoys the support of many organisations and sponsors.	Grand Copthorne Waterfront Hotel 	**Dr. Jeremy Chia** 
19	 **Er. Leong Cheng Wee** 2000-2001 Er. Leong Cheng Wee was ASC President from 2000-2001. He was elected as the RP RVC from 2014-2017. From 2017-2020, he was elected as the RMCR. He was the CRC General Chair in 2018. He was also the Region ARC from 2021-2022. He served in the Society TEC from 2019-2022. He is currently the Region XIII DRC (2022-2025).	Pan Pacific Hotel 	**Mr. Norman Ng** 
20	 **Mr. Steven Chan** 2001-2002 *Extract from 2002 Annual Dinner Magazine;* ASHRAE Singapore Chapter's activities: • 3 Technical Talks • 1 Non-technical Talk • 1 Technical Visit • Family Day at Kukup • Membership's Night • 3 social golf events	The Neptune 	**Mr. James Ong Lay Thiam** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
21	 **Dr. Jeremy Chia** 2002-2003 *Extract from 2003 Annual Dinner Magazine;* ASHRAE Singapore Chapter's activities: • 2 Seminars • 7 Technical Talks • 1 Technical Visit to KLCC and Purajaya Airconditioning Plant • Family Day cum Christmas Party • Membership's Night • 2 social golf events	Grand Copthorne Waterfront Hotel 	**Er. Albert Sin Yew Tek** 
22	 **Er. George Sze** 2003-2004 Er. George Sze held various senior positions including Senior Executive Engineer (Air-conditioning), Chief Mechanical Engineer and Director (M&E) in PWD Singapore as well as Senior Vice President (M&E) and Senior Consultant (Mechanical) in CPG Consultants Pte Ltd. He is a Fellow of Institution of Engineers, Singapore (IES) and served as IES council member for 10 years. Er. Sze was actively involved in energy conservation studies and improvement of indoor air quality. He presented a number of technical papers locally and in the region on these subjects which included "Singapore Case Studies Parametric Energy Analysis Using DOE-2 Computer Code" at ASEAN Conference on Energy Conservation in Buildings in Singapore in May 1984, a Country Paper on "Energy Standards and Development in Singapore" at Regional Seminar on Energy Efficiency Standards for Commercial Buildings in Asia and Related Legislation in Bangkok in November 1996 and "Application of Air Flushing System to Improve Indoor Air Quality" at Asia Pacific Conference 2003 on Built Environment in Hong Kong in November 2003. The Air Flushing System was awarded Singapore Building and Construction Authority's Best Practice Award in 2002. He co-authored with Er. Lek Siang Hwa an article on `Hospital HVAC Design: A Challenge for IAQ, Energy Recovery and System Reliability' which was published in Air Conditioning and Refrigeration Journal of Indian Society of Heating, Refrigerating and Air Conditioning Engineers (Vol. 5 No. 3, July - September 2002).	Novotel Apollo Singapore  	**Er. Leong Cheng Wee** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
23	 **Er. Chua Kim Lian** 2004-2005 *Extract from 2005 Annual Dinner Magazine;* In July 2004, ASHRAE Singapore Chapter supported the HVAC Asia 2004, largest HVAC exhibition in Asia at the Singapore Expo. The 7th Chapter Regional Conference (CRC), gave a big bang in August 2004 with record numbers of participants from Singapore, Malaysia, Thailand, Hong Kong, Taiwan and Philippines.	Pan Pacific Singapore 	Mr. Wang Yih Chyuan 
24	 **Er. Albert Sin Yew Tek** 2005-2006 Er. Albert Sin was ASC President from 2005 - 2006. • Received "Gold Ribbon Award 2000-2001, VideoCD on "ASHRAE Singapore Chapter: The development of Air-conditioning and Refrigeration in Singapore" • Received Chapter Service Award, 2008 • Chapter Historian, 2010 - 2013 • Grassroot Government Activities Committee (GGAC) Chair, 2013 – 2015 • Chapter Board of Governors, 2015 – 2016 • Region XIII Regional Vice-Chair (Government Affairs), 2021-2024 • Region XIII, RVC for Government Affairs Committee, 2021 - 2024		
25	 **Mr. Steven Leong Choon Kid** 2006-2007 Mr. Steven Leong was ASC President from 2006 - 2007.		

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
26	 **Er. Chee Yan Pong** 2007-2008 *Extract from 2007 Annual Dinner Magazine;* This year, ASHRAE is putting its efforts in "sustainability in the building environment"; and is promising us a "sustainable future". If we want something tomorrow, we must plan for it today. If we do not go green now, we may turn red financially in the future. Choice, not chance, determines our destiny.	Furama Riverfront Singapore 	**Mr. Tan Gek Suan** 
27	 **Mr. David Lau** 2008-2009 David was the chapter President for the term 2008-2009 after serving Singapore chapter in various roles since 2004. During his presidential term he signed bilateral cooperation MOU with BCA and ASHRAE Society President. He is currently the General Manager of Kruger Engineering Pte Ltd. Received Regional Award of Merit, 2016 Received Chapter Service Award, 2011 Region XIII Assistant Regional Chair, 2016 - 2018 Region XIII Nominating Committee, 2012 - 2016 Chapter Historian, 2016 - 2024 Chapter EC Chair, 2010 - 2015 Chapter Board of Governors, 2009 - 2010	Orchard Hotel 	**Mr. Ken Lim** 
28	 **Mr. Gadam Sivakumar** 2009-2010 Sivakumar was the chapter President for the term 2009-2010 after serving Singapore chapter in various roles since 1994. During his presidential term he initiated bilateral cooperation MOU with ISHRAE (Indian ASHRAE association) and conducted bilateral partnership meeting with Malaysia chapter. Led ASHRAE Singapore chapter contingent for the Chapter Regional conference held at Bangkok. Sivakumar is currently serving ASHRAE Society as Regional Vice Chair Chapter Technology transfer committee for the term 2022-25.	Meritus Mandarin 	**Mr. Victor Tan** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
29	 **Prof. Chandra Sekhar** 2010-2011 *Extract from 2010 Annual Dinner Magazine;* We spend more than 90 percent of our time in indoor environments and the performance of a building relates naturally to the comfort, health and productivity of its occupants… This knowledge is vital in the design, construction, operation and maintenance of buildings in the 21st century that confronts mankind with irreversible effects of climate change…	Novetel Clarke Quay 	**Mr. Henry Yeo** 
30	 **Mr Tan Gek Suan** 2011-2012 *Extract from 2011 Annual Dinner Magazine;* Today's often heard catch word is "Sustainability". This is especially poignant in a field such as airconditioning and refrigeration that can significantly contribute to a more sustainable earth - with emphasis on innovation and technologies to harness and adopt more efficient sources of energy to power our built environment.	Grand Copthorne Waterfront Hotel 	**Mr. K C Liew** 
31	 **Mr. Francis Lee** 2012-2013 *Extract from 2012 Annual Dinner Magazine;* The challenges of the industry have evolved to include all facets of the building design, construction, reconstruction and operation. ASHRAE has and still meeting these challenges…and the theme for this year is "broadening ASHRAE's Horizon".	Grand Copthorne Waterfront Hotel 	**Mr. Palaniappan** 
32	 Dr. Uma Maheswara 2013-2014 *Extract from 2012 Annual Dinner Magazine;* Today, built environment is a fragmented assembly of multiple specialists targeting at a single objective - a healthy and efficient building. Shaping the next… is probably moving away from our comfort zone, putting ourselves into the shoes of our fellow professionals and users, thinking beyond, thinking together and targeting and efficient built and healthy environment.	Fairmont Singapore & Swissotel The Stamford 	**Mr. Kristopher Ho** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
33	 **Er. Matthew Ngan** 2014-2015 Er Ngan was elected as the Chapter President in 2014-2015. He was the M&E Consultant of many prominent building and infrastructure projects in Singapore, Hong Kong and Macao.	Orchard Hotel 	**Ms. Phoebe Tan** 
34	 **Mr. Henry Yeo** 2015-2016 *Extract from 2015 Annual Dinner Magazine;* By expanding our network and establishing relations, we aim to achieve our mission: Shape Tomorrow's Built Enviornment Today, faster and sooner. Our objective is to slow down global warming, reduce carbon footprints and enable our future generations to enjoy their lives in sustainable built environments.	Orchard Hotel 	**Mr. Ken Teo** 
35	 **Mr. Liew Kwong Chin** 2016-2016 *Extract from 2016 Annual Dinner Magazine;* ASHRAE is a global leader in supporting research and advancement of heating, ventilating, airconditioning and refrigerating system and design. Many of the ASHRAE design standards were widely used or referred to in various climatic conditions globally. In Singapore… local Standards have references to ASHRAE Standard 90.1: Energy Standard for Buildings, and Standard 189.1: Design of High Performance Green Buildings.	Orchard Hotel 	**Mr. David Lau** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
36	 **Mr. Patrick Ho** 2017-2018 *Extract from 2017 Annual Dinner Magazine;* We will continue to provide relevant topics on upcoming seminars, by ASHRAE Distinguished Lecturers and industrial guru to share their knowledge with our members to create a sustainable world.	Raffles City Convention Centre 	**Ms. Swen Tan** 
37	 **Mr David Edenburn** 2018-2019 *Extract from 2018 Annual Dinner Magazine;* There are over 6000 ASHRAE publications and standards that deal with energy efficiency; • ASHRAE standard 100 for energy and emissions building performance standard for existing buildings; • ASHRAE standard 90 "family" for energy efficiency in all types of new buildings	Orchard Hotel 	**Ms. Florence Chan** 
38	 **Ms. Florence Chan** 2019-2020 Extract from 2019 Annual Dinner Magazine; The ASHRAE Society and its members focus on building systems, energy efficiency, indoor air quality and sustainability within the industry. The Society theme for term 2019-2020 is "Building for People and Performance - Achieving Operational Excellence".	Orchard Hotel 	**Mr. K C Liew** 
39	 **Dr. Peter Cheng** 2020-2021 Dr. Peter Cheng served as ASC President from 2020-2021. He held various posts include Chapter Technology Transfer Chair, Chapter Publicity and Chapter Board of Governors from 2016-2023.	Covid 19	

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
40	 **Dr. Yuichi Takemasa** 2021-2022 Dr. Yuichi Takemasa is currently working as Deputy Director of Kajima Technical Research Institute (KaTRI), Kajima Corporation, based in Tokyo, Japan. Dr. Takemasa was General Manager of Kajima Technical Research Institute Singapore (KaTRIS) when he was 39th ASHRAE Singapore Chapter President and served for the term 2021-2022. Dr. Takemasa signed MOU with IBPSA Singapore (International Building Performance Simulation Association Singapore Chapter). It was unfortunate that ASC Annual Dinner and MP/RP Chinese New Year Cerebration were canceled due to the COVID-19 pandemic, but Dr. Takemasa and the BOG team were influential in disseminating the arts and science of ASHRAE to its members by organizing 6 DL/technical webinars and 1 in-person technical seminar. Dr. Takemasa and the BOG team also provided government officials with important information from ASHRAE on the COVID-19 pandemic, district cooling, etc. and promoted communication and friendship with ASHRAE Malaysia Chapter through the bilateral meeting between the 2 chapters.	Covid 19	
41	 **Dr. Yang Junjing** 2022-2023 *Extract from 2022 Annual Dinner Magazine;* This year, the Society's theme is "Securing Our Future". Everyone of us understands how much the pandemic has changed our lives and the industry over the past two years. Although with some negative impacts, the pandemic nonetheless has brought a learning opportunity for the industry to build a more resilient Built Environment… leverage Relationships, Knowledge and Change … with Diversity, Equity and Inclusion.	Orchard Hotel 	**Ms. Angie Ng** 

S/N	Name / Term of Presidency	Dinner magazine	Dinner Chairman
42	 **Mr. Praveen Hassan Chandrashekar** 2023-2024 Praveen Hassan Chandrashekar is currently working as the Director, Sustainability & Resilience office at Surbana Jurong Consultants Pte ltd. Praveen was the 41st ASHRAE Singapore chapter president and served for the term 2023-24. Praveen and the BOG team were instrumental for wider industry engagement and continuing the tradition of ASHRAE on thought leadership and spreading the arts and science of ASHRAE. Praveen together with other BOG members were instrumental in successfully conducting a 2-day Technical conference in collaboration with Air Infiltration & Ventilation Center (AIVC) which was centered around Indoor Environmental quality, Ventilation, and Sustainability.	Orchard Hotel 	**Mr. Vijay Venkatsubramanian** 
43	 **Mr. Ivan Liew** 2024-2025 We stand at a pivotal juncture in the battle against climate change. The society's theme for this year – "Empowering our workforce: Building a sustainable future" is reflective of the need to leverage on human capital to effect change. With the climate crisis speeding towards critical thresholds, technology advancement and workforce expectations must keep up. Empowering our workforce is not merely a human resource initiative, it is the cornerstone of creating a sustainable future for our businesses and communities.	Orchard Hotel 	**Ms. Florence Chan** 

ASHRAE Singapore Chapter

Aspirations of ASHRAE Singapore Chapter

5.0 Charting the Course for a Greener Tomorrow: ASHRAE Singapore Chapter's Strategic Vision

ASHRAE Singapore Chapter was established in 1982 as a learned society to advance the arts and sciences of heating, ventilation, air-conditioning, and refrigeration to serve humanity and promote a sustainable world. As the Chapter celebrates four decades of significant contributions to the HVAC&R industry, we reflect on our storied past with pride and look ahead with purpose. With the launch of our history book at the 42nd Annual gathering event, we stand at a pivotal juncture, reflecting on a legacy of engineering excellence and steering towards future aspirations. Over the past four decades, our chapter has been at the forefront of advancing the arts and sciences of heating, ventilation, air conditioning, and refrigeration to ensure healthy and sustainable environments. Our mission going forward is to drive innovation in the built environment, contribute decisively to Singapore's 2030 Green Plan, and elevate our commitment to training, development, and members value.

Looking forward, the ASHRAE Singapore Chapter is committed to leading the charge in innovative building technologies and sustainable practices. Our vision for the next decade is rooted in seven core aspirations:

1. Innovating for a Sustainable Built Environment

The next chapter in our journey emphasizes groundbreaking advancements in HVAC&R technologies. Our focus is on helping to develop systems that are not only energy-efficient but also integral to constructing sustainable buildings that contribute to the well-being of their occupants and the environment. By pushing the boundaries of what's possible, we aim to lead the charge in transforming Singapore's built environment into a model of sustainability.

We aim to push the boundaries of what is possible in HVAC&R systems, focusing on energy efficiency and integration with smart technology. Our goal is to lead by example, demonstrating how innovative systems can significantly reduce environmental impact while enhancing system performance and comfort.

ASHRAE's Research Promotion (RP) has been actively involved in raising funds and supporting vast research works to promote innovation across HVAC industries and institutions. ASC has been active and forefront here in Singapore to support the RP related engagements with likeminded institutions.

2. Driving Decarbonization in Line with Singapore's 2030 Green Plan and 2050 Net Zero

Aligned with Singapore's ambitious 2030 Green Plan and 2050 Net Zero, our chapter is set to play a pivotal role in the national strategy for decarbonization. We will champion the adoption of best practices and cutting-edge technologies that reduce carbon footprints across industries and specifically to the built environment sector. Through collaborative projects and advocacy, we aim to influence policy and practice, making a tangible impact on Singapore's environmental targets.

3. Indoor Environmental Quality

A cornerstone of ASHRAE Singapore Chapter's commitment moving forward is to enhance indoor environmental quality (IEQ), recognizing its critical impact on health, comfort, and productivity. Our focus will be on fostering collaboration with government agencies, institute of higher learning (IHLs) and industry players to share our international expertise through DL (Distinguish Lecture) talks, ASHRAE Standards that shall be integrated into Singapore Standards to promote better IEQ as well as actively support in developing and promoting cutting-edge HVAC&R solutions that not only maintain but improve air quality, temperature, and humidity control. By leveraging our international expertise, established standards as well as local industry players technical capabilities (such as advanced sensors and control systems), we aim to create adaptive environments that respond in real time to occupant needs and external environmental conditions. This initiative will ensure that buildings in Singapore are not only energy efficient but also holistically optimized for the well-being of every individual. There are several standards that had been developed and continuously enhanced to meet the changing needs of the IEQ. Some of the relevant standards are ASHRAE 62.1, 241, etc.

4. Enhancing Training and Development for Capacity Building

Recognizing that our strength lies in our knowledgeable membership, we are dedicated to enhancing training and development opportunities. Our strategy includes comprehensive workshops, seminars, and e-learning courses tailored to the evolving needs of the HVAC&R sector. By investing in capacity building, we empower professionals to stay at the forefront of industry developments, ensuring that they are equipped to lead and innovate.

As technological advancements are changing at a rapid pace, we are dedicated to providing our members, local engineering and professional communities with continuous education and professional development opportunities. By staying at the cutting edge of industry developments, our members can lead and innovate in their respective fields, contributing to Singapore's reputation as a hub for technological excellence.

ASC has been organizing technical seminars, conferences, networking engagements, workshops and technical tours to our members to benefit from inter-disciplinary knowledge and experience sharing among everyone. We regularly invite ASHRAE's Distinguished Lectures (DLs) and local experts for such events to share their knowledge and experience.

5. Organization Effectiveness

As we advance, the ASHRAE Singapore Chapter is dedicated to enhancing our organizational effectiveness to better serve our members and the community. We strongly believe in collective efforts among members to leverage the best to serve the community. We will continue to build our platform and we encourage local members to actively engage and participate at various events organized by ASC to learn and share.

We are implementing strategic planning and leveraging through available resources to streamline our operations and increase our impact. Key initiatives include enhancing collaborations with like-minded organizations, organizing relevant programs and events, improving internal communication, and strengthening leadership capabilities across all levels of the organization. These steps will ensure that our chapter remains agile, responsive, and aligned with our mission to promote sustainable and innovative practices within the HVAC&R industry. Through this reinforced organizational framework, we are poised to meet future challenges and achieve our goals more efficiently.

We believe that students and young engineers are very important, and we will continue to inspiring their passions in meeting sustainable goals and motivating collective efforts to solve climate change crisis.

6. Creating Lasting Value for Our Members

Our commitment to our members is unwavering. To bolster our aspirations, we strive to create significant value through more than just professional development opportunities. Networking events, technical tours, and international conferences are designed to foster a sense of community and provide platforms for collaboration and growth. Additionally, we will enhance our communication channels and member services to ensure that our members have the resources and support they need to excel.

By enhancing member engagement, we aim to harness the collective expertise and enthusiasm of our community, empowering each member to contribute to our shared goals. This strategic focus on building capacity will not only enrich our members' professional lives but also ensure that our chapter continues to thrive and lead in innovation and sustainability within the HVAC&R industry.

7. Collaboration for Sustainable Future

The challenges of tomorrow require more than individual effort; they require collective action. We will continue to strengthen our collaborations with industry partners, government bodies, and educational institutions to develop holistic solutions that address the pressing environmental challenges of our times. ASC has made several collaborations in the past with Building Construction Authority (BCA), Singapore International Facilities Management Association (SIFMA), Institution of Engineers (IES) and other institutions.

Conclusion

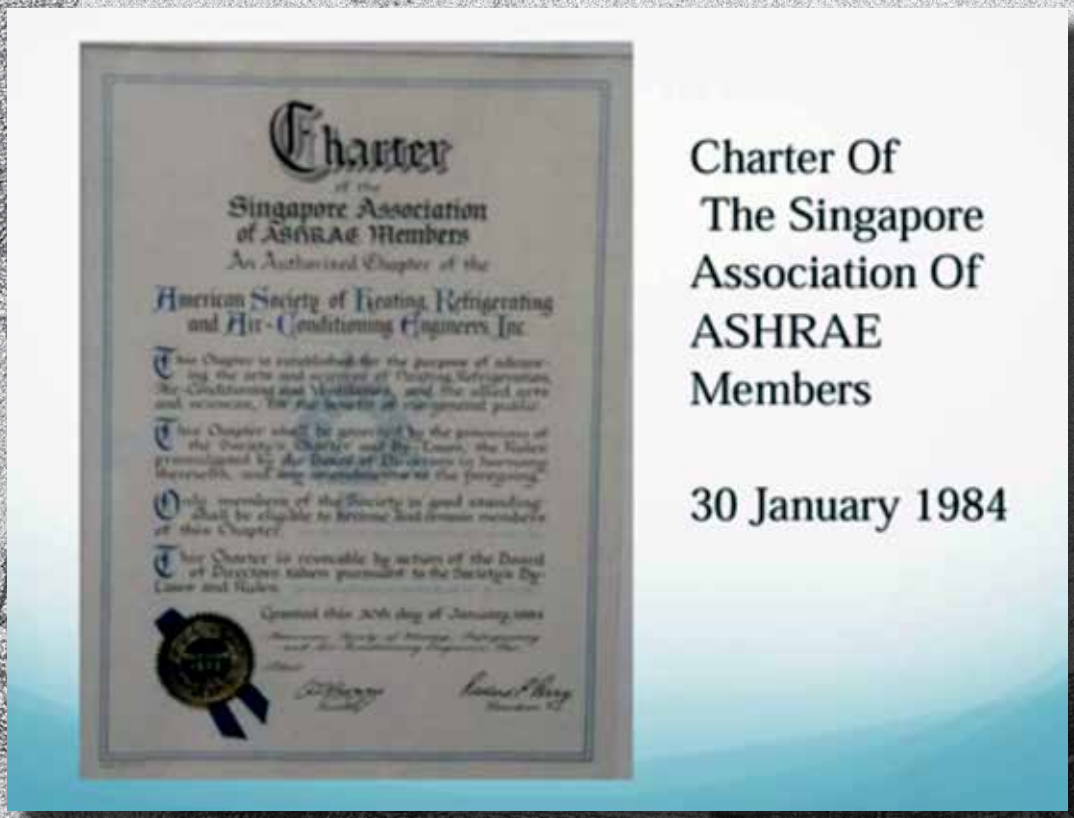
As we stand on the shoulders of our 40-year legacy, the ASHRAE Singapore Chapter is enthusiastic about the future. Our aligned goals of fostering a sustainable built environment, supporting Singapore's decarbonization efforts, and enhancing the professional capabilities of our members are more than just objectives; they represent our pledge to the future of our planet and profession. Together, we will continue to innovate, inspire, and lead by example, ensuring a cooler, greener, and more sustainable tomorrow for Singapore and beyond. In every endeavor, our members are the driving force behind our success. As we embark on this ambitious journey, we continue to foster a community of professionals who are not only skilled but also committed to ethical practice and environmental stewardship.

As we look to the future, we are excited about the opportunities to further our impact, ensuring a healthier and more sustainable environment for generations to come. Together, we are setting the blueprint for a cooler, greener, and more sustainable Singapore.

In conclusion, as we celebrate our past achievements, we also embrace the challenges and opportunities of the future. We invite all members and stakeholders to join us in this exciting journey, as we continue to make significant contributions to the HVAC&R industry and to the well-being of our community in Singapore and beyond.

Photos Gallery: 1984 to 2024

ASHRAE Singapore Chapter Early Days ...
Singapore Association of ASHRAE Members 2nd Installation Dinner (1984)



SAAM 1st and 2nd President
Mr William C Sundberg (Deceased)

Installation of 3rd Board of Council (1984)

Installation of 4th Board of Council (1985)

Let's have fun together ...

Let's dine together ...

SAAM 3rd President: Er Chee Yan Pong

Asia-Pacific Conference on The Built Environment (1985)

ASHRAE Society (US) President Addresses ...

Seminar On
Air-Conditioning In
Hot Climate (1987)

Seminar On
CFC Issue
(1989)

Prof. Bong Tet Yin
(8th & 9th President)
Addressing the Seminar

ASC 10th President: Mr Tan Yong Hoa

10th Annual
Dinner & Dance
(1992)

We are very COOL ...

13th Annual Dinner & Dance (1995)
ASHRAE Society Centennial Celebration

Installation Of 14th Board Of Council (1995)

We danced well ...

We play Hard ...

We are FRIENDS...

Technical Talk (1995)

SAAM At Trade Show (1995)

Singapore & Overseas Friends Of ASHRAE(1995)

18th Annual Dinner & Dance (1998)

1st CRC in Singapore
14-15 August 1998
Traders Hotel
CRC Chair: Mr Henry Lee

Day 1 Afternoon Business Meeting in session showing the head table (L to R) Carolyn Kettering ASHRAE staff, Vice-President Donald Colliver, President George Jackins, DRC Vincent Tse & Gen Chair Henry Lee. (CRC Secretary Cheng-Wee Leong cannot be seen)

1st CRC Activities

Technical Talk by
Mr Richard Charles, Society
Presidential Member

Business session

Banquet Dinner

Delegates received souvenirs

Hong Kong

Malaysia

Singapore

Taiwan

The Society Officers, Staff and Guests as well as special guest Mr Silvestre Pecasales, President of Philippine Society of Ventilating, Airconditioning & Refrigerating Engineers, our DRC and the Hong Kong Chapter Delegates

CRC
Group photos

Installation Of 17th Board Of Governors

Happy Times Again...

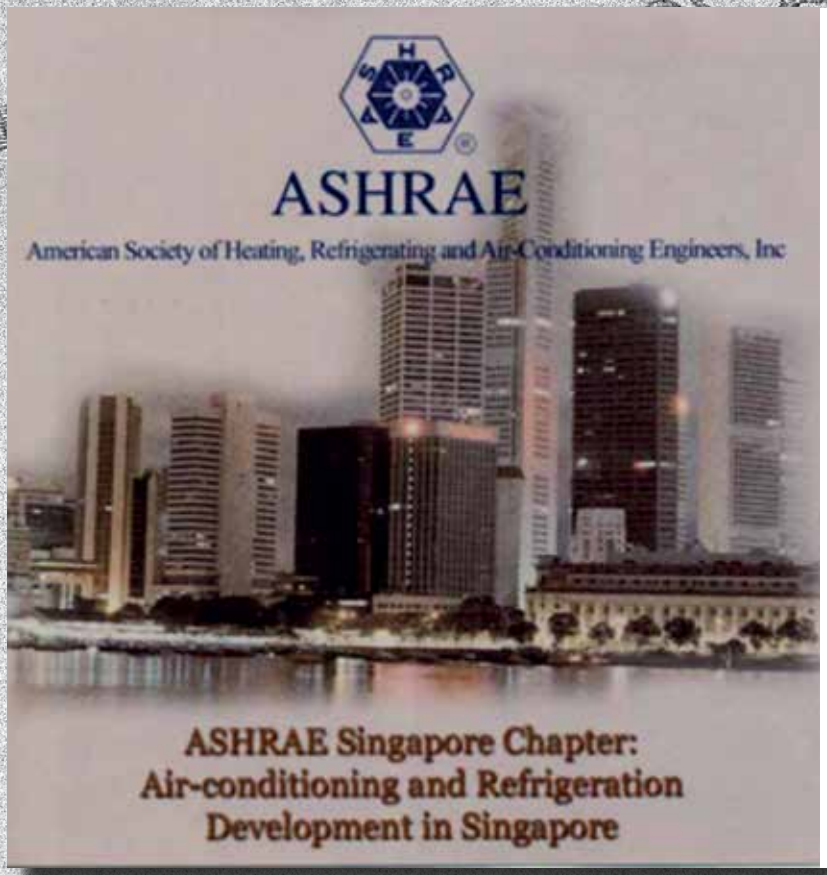
Who Is The Fairest Of All ... ?

Multiple Handshakes ...

Feed Me Faster …Lah!

Members Night (1999)

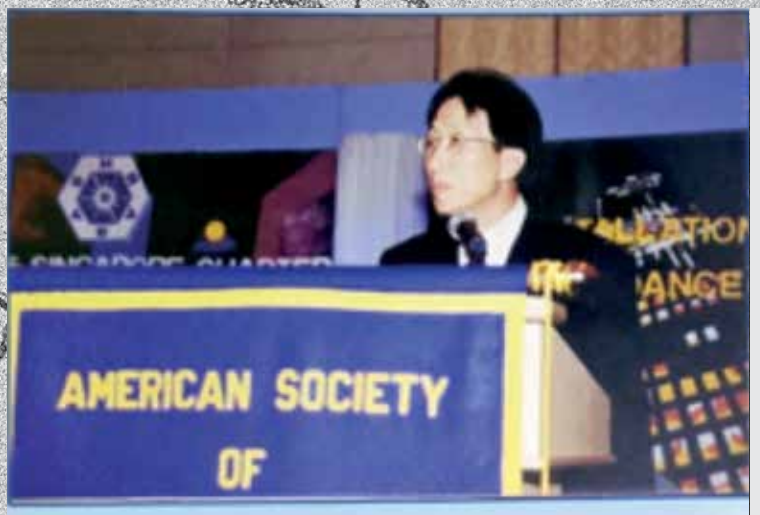
Members networking



VCD (2000)

https://youtu.be/Pdbu0JZ065c

Family Day



(2001)

19th Dinner & Dance
Guest-of-Honour,
Mr Lim Swee Say,
Acting Minister for Environment

ASHRAE Longest queue ...

(2002)

Chapter training workshop

Members Nite ... Chinese New Year celebration

(2003)

21st Dinner & Dance
Happy Birthday cake

Past Presidents
cutting birthday cake

(2004) 22nd Dinner & Dance
Watch my move ...

Now our moves ...

(2005) 23rd Dinner & Dance
Installation of 23rd Board of Council

We are ready ...

7th CRC in Singapore
20-21 August 2004
Apollo Hotel
CRC Chair: Er Chee Yan Pong

(2006) Members Nite
Dr C Sekhar shared his experiences at
ASHRAE Winter Meeting 2006, Chicago

HVAC 2006 Seminar
"Sustainability for the Built Environment"

(2009)

New BOG team, Lim ah!

Our GOH – Dr Amy Khor

Miss, beware of buayas!
Better open your eyes when you laugh!

(2010)

New team, old faces

I must control...

What have I gotten myself into now?

(2012)

AMCA talk by Ms Bek Swee Hup

YEA / Members night - All bowled over

Student Activities (2013)

Technical Visit to Clean Tech One Building – 10 Dec 2013

ASHRAE Singapore 32nd Annual Installation Dinner 2014

The ASC 32nd Annual Installation Dinner 2014 was held on the 3rd July 2014 at the Orchard Hotel. Together with Guest of Honour Er Dr Lee Bee Wah and over 800 guests, it was a joyous occasion to celebrate the annual event with fun and networking with VIPs, members and other professionals in the HVAC industry.

(2014)

Annual Chapter Members Night 2015 & Lunar New Year Celebration

(2015)

On 3rd March 2015, ASHRAE Singapore Chapter (ASC) invited all ASC members to join a celebration to usher in the Year of the Goat at SPGG.

In conjunction with the celebration, a seminar on "Managing Low Delta T Syndrome in HVAC System" was held after the celebration dinner.

The event was sponsored by Belimo Actuator Pte Ltd.

(2016)

MEMORIES FROM 33rd INSTALLATION DINNER

SIEMENS

CHAPTER TECHNOLOGY TRANSFE COMMITTEE

(2017)

ASHRAE DL Seminars

A total of 3 ASHRAE DL Seminars were conducted.

a) Dr. Kishore Khankari on "Airflow Management for Data Centers and Healthcare Facilities" on 27 F

(2019)

(2020-2022)

YOUNG ENGINEER IN ASHRAE (YEA) SINGAPORE CHAPTER ACTIVITIES

(2023)

February 1st, 2023: Chinese New Year Dinner / MP RP Night

The Membership Promotion and Research Promotion committee organized the ASC Chinese New Year Dinner to promote ASHRAE RP and MP. This event was sponsored by Camfil, more than 60 members gathered together to celebrate the year of Rabbit. Ms. Florence Chan gave a technical talk on "The voice of Clean Air". ASHRAE Region XIII DRC Er. Leong Cheng Wee also delivered a speech on the ASHRAE Research Promotion.

(2024)

AIVC- ASC Technical Conference
Ventilation, IEQ & Sustainability

ASHRAE®

MISSION

To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.

VISION

A healthy and sustainable built environment for all.