WHITE PAPER

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# Evaluating the three models for the provision of air-conditioning in Asia

By Dave Mackerness, Business Development Director at Kaer

In 1999 world leaders were polled by *Time* magazine regarding what they considered to be the technology that had made the most impact in the 20th century. Lee Kuan Yew, Singapore's leader at the time, chose air-conditioning. His belief was that the technology had transformed the working and sleeping habits of those in Asia to such a great extent that the region was able to compete on a global basis. Today, air-conditioning is taken for granted as being universally available, easily controllable and an expensive, but unavoidable cost by those that live and work in Asia. However, behind the scenes, for those tasked with the provision of this utility, air-conditioning continues to present challenges in terms of the latest technology, the maintenance and most of all the energy consumption and electrical cost.

In this paper, we look at the strengths and weaknesses of the different provision models that are available to those tasked with providing an air-conditioned environment for their users. This task falls to a wide range of personnel from building managers, energy managers and facilities managers to property developers, building owners and government bodies. Plus, the environments themselves are diverse and run the gamut from educational facilities to retail environments and from data centres to manufacturing facilities.

**The 3 Models:**

- Historical
- District Cooling
- Air-Conditioning as a Service (ACaaS)

## Historical Model

Air-conditioning in buildings, particularly older ones, is responsible for the bulk of many countries' rising energy costs. Across the whole of Asia there is a focus on this problem and in Singapore, the government is aiming for 80 percent of existing buildings to achieve the local energy efficiency standard, Green Mark certification, by 2030. These structures make up the majority of Singapore's building stock and new buildings will only add one percentage point to the total number of buildings each year. So, as can be seen, building owners need to find ways to maximize energy efficiency.

In the traditional model, building owners had to engage various consultants, contractors and operators to provide air-conditioning for their tenants. The design and installation of the equipment required significant capital investment and building owners had to manage unpredictable operating costs due to repairs and deteriorating system efficiency. Due to the fact that so many different parties were involved in delivering the original system, individuals would often be accountable only for specific equipment, but no one was responsible for the performance of the system as a whole. No single supplier was responsible for comfort, which was therefore left as a risk to the building owner.

Historically when building owners take on the task of owning and operating the air-conditioning systems, they have to come up with a relatively high capital expenditure. On top of this, measures to improve energy efficiency are often seen as expensive with long payback periods of approximately five to 10 years.

For example, a new chiller plant system can give an improvement in energy efficiency of between 50 to 60 percent. However, the typical payback period of seven years is seen as too long a timeframe for the return on investment for many building owners.

Although an investment in chiller plant replacement can make a great impact and produce immediate results, it is still viewed as an expensive option. Not that many building owners can summon up the money to undertake the project. So, this cost barrier is the single biggest hurdle to overcome if building owners are to make a significant impact in reducing energy consumption.

**Pros and Cons:**
While in the early years the obvious advantage was that people were able to, for the first time, keep cool during the hot weather that is predominant in Asia and this aided both productivity and comfort. However, as buildings got bigger and housed more people, the air-conditioning systems increased in size and soon became the most expensive portion of a buildings operating cost and a significant contributor to their carbon footprint. As energy efficiency has become more of a concern in recent times to all parties from property developers, to building owners to end users, air-conditioning has come under scrutiny. When this happened many people, including facilities managers and energy managers, have found that no single vendor has responsibility for the system and its overall performance and efficiency. The result was that air-conditioning systems operated at inferior energy efficiency levels and were maintained by a variety of vendors – none of whom were in communication. A dripping tap of cost to whoever was footing the bill.

## District Cooling:

The District Cooling model emerged in Singapore in the late 1990s and gained traction due to its ability to provide a reliable supply of chilled water to a buildings air-conditioning system with none of the hassles highlighted in the Historical approach.

District Cooling refers to the centralized production and distribution of cooling energy to multiple buildings and user organisations. Chilled water is delivered from a central plant via a network of underground pipes to numerous buildings within a 'district', close to the chiller plant.

**Pros and cons:**
There is much to recommend District Cooling over the Historical approach and the fact that it is a variant of the outsourcing model is a positive. Indeed, while District Cooling offers operational efficiencies on the Historical model, in that the system is built for scale, there is still a hefty upfront cost, known as a connection fee, to the building owner/ developer and operational costs are an ongoing responsibility too. However, the building owners are at least dealing with a single vendor that is responsible for the system and its maintenance.

On the negative side District Cooling contracts are pretty prohibitive being long-term with various lock-ins and the threat of potential penalties for various reasons. On top of this, the efficiency of the system can be a challenge as typically water is generated at a lower temperature as compared to the Historical approach to accommodate for losses during the distribution of the water as well as losses at the heat exchangers within the buildings. This means that in order to provide a building with chilled water at 8˚C, it can leave the centralised plant at 5-6˚C which requires more energy than the Historical model. In addition to this, there is the extra power required to pump the water over long distances to the buildings.

Also, District Cooling is a 'one size fits all' solution. All buildings receive water at a certain temperature with no flexibility given for application. In the most part these differences can be handled by the air-side equipment, but can cause problems if the air-side system is incorrectly sized or has specific requirements to meet.

## Air-Conditioning as a Service (ACaaS)

The final model, ACaaS, was first seen in 2013 and is an example of the familiar concept of servitization. Rolls Royce famously no longer supplies jet engines but provides airline operators with 'power by the hour' – a phrase it coined over 50 years ago. Similarly, those that use ACaaS buy air-conditioning on a consumption basis without the need to invest in, maintain or operate any air-conditioning equipment.

The service provider assumes all financial and operational responsibility of the entire air-conditioning system (chiller plant and air-side equipment) to deliver the ideal environment for the building. Building owners simply dictate the temperature conditions they want to achieve, and the AcaaS provider is accountable for delivering this wherever and whenever required. The service is provided with no upfront cost and the building owner simply pays a fixed monthly fee or a pay-as-you-use $/RTH rate. The AcaaS provider is responsible for all costs associated with running the air-conditioning system including the electricity used by the chiller plant equipment.

ACaaS takes the responsibility of buying and operating the air-conditioning system, and reducing energy consumption away from building owners. It takes on all future costs related to operations and maintenance.

**Pros and Cons:**
This is a win-win business model. Building owners can reduce their electricity costs, allocate facilities management or maintenance staff to other activities and concentrate on their core business. The ACaaS provider is doing what they do best: delivering air-conditioning as a service and ensuring the system is always operating at its most efficient through constant monitoring and appropriate, well-timed maintenance.

Plus, similarly to any outsourcing model, ACaaS is provided on a flexible contract basis. If a building wishes to exit the agreement they can do so at any time.

Besides helping building owners reduce capital expenditure and recurring maintenance costs, ACaaS providers also undertake the responsibility of monitoring and controlling the system to maximize energy efficiency. The energy consumption of air-conditioning systems change all the time. For example, if the number of occupants in a building increases, or if the weather changes, or if there is a change of tenant mix from retail shops to F&B outlets, the energy used to provide more cold air is greater.

Building owners have to monitor these fluctuations constantly to ensure optimum comfort conditions, optimise energy efficiency and adhere to Green Mark requirements. Very often, energy efficiency will be compromised or overlooked, as the building owner is required to attend to more urgent operational issues.

Monitoring can also be a tedious, labour intensive process. ACaaS providers use real-time building monitoring and control systems to monitor, measure and track the energy efficiency of the systems. Building owners have full access to the data collected from the monitoring tools for reporting to investors or other stakeholders as well as for submissions to the BCA or NEA as and when required.

## Transforming air-conditioning from a product to a service

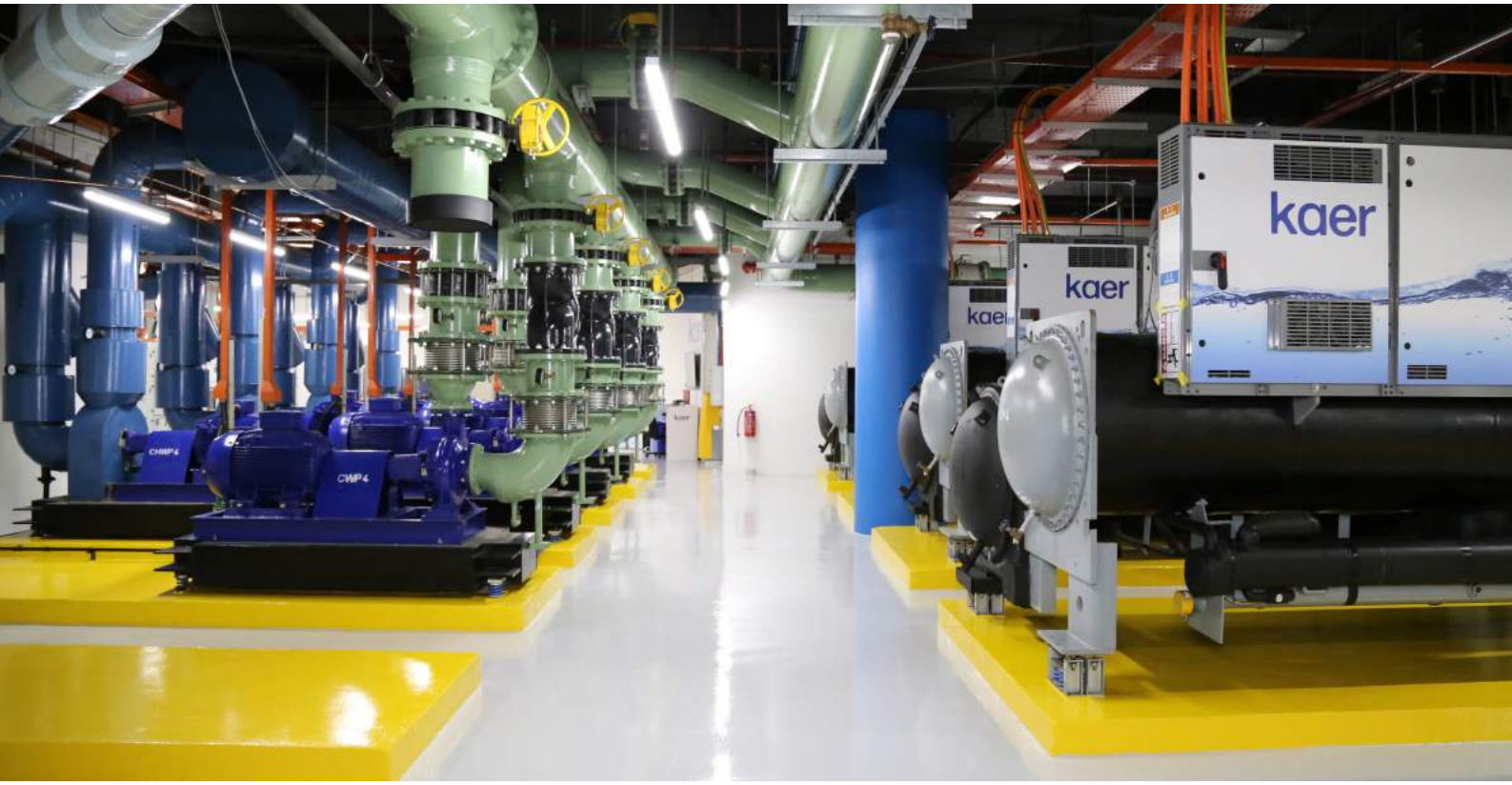
In Singapore, Kaer has pioneered the use of ACaaS. Kaer offers two ACaaS solutions: Kaer Water and Kaer Air. Clients of Kaer in Singapore include INSEAD Business School, the 7000AMK Data Centre, the newly renovated Chinatown Point and most recently the Paya Lebar Quarter multifunctional development by Lendlease.

**Kaer Water** entails the outsourcing of the chilled water production to Kaer. Kaer will design, install, pay for, own, monitor and operate the chilled water plant system within the building. Also, as part of the solution, Kaer will guarantee compliance with the Green Mark Platinum standards.

**Kaer Air** includes everything that Kaer Water provides, but in addition building owners outsource the operations of the air-side systems to Kaer. Building owners buy from Kaer at a fixed rate on a Pay Per Use basis. Utilizing a "Product-as-a-Service" model, Kaer then shifts the responsibility of reducing energy consumption away from building operators and owners by taking over and optimizing a building's air-conditioning system. It takes on all future costs related to operations and maintenance, including electricity, and repair bills. In the process, Kaer cuts costs to building owners, while potentially increasing their profit by lowering the rate of energy consumption using a remotely operated monitoring and verification system.

### About the Author

Dave Mackerness is a Director at Kaer Pte Ltd where he is responsible for delivering and expanding their regional Kaer Water and Kaer Air business. With over a decade of experience in the energy efficiency sector, Dave specialises in creating customised solutions for commercial and industrial buildings to deliver against their short-term and long-term strategic goals. This includes advising on the financial and operational impacts of M&E upgrading programs as well as green certification and compliance planning. He also works with asset management teams to improve the performance and return on investment for their critical building systems.



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