Cooling as a Service (CaaS)

KIGALI COOLING EFFICIENCY PROGRAM

This brief presents a new approach to cooling – Cooling as a Service. This approach can benefit companies, governments and society at large and is based on the servitization concept which is rapidly penetrating other marketplaces.

WHAT IS CAAS?

The standard business model of delivering cooling typically involves the manufacture, sale, use, and disposal of equipment. Higher production volumes generally support more sales and more profit. As a result, manufacturers can lack a strong incentive to voluntarily focus on minimizing the energy and resource use of cooling products. Alternative business models are possible – and can promote much more energy and resource efficient technologies.

CaaS in its purest sense involves end customers paying for the cooling they receive, rather than the physical product or infrastructure that delivers the cooling. Examples of the CaaS model include district cooling, where customers do not own the cooling infrastructure, and pay-per-service (PPS) models, where a technology provider installs and maintains the cooling equipment, and recovers costs through periodic payments made by the customer. These payments are fixed-cost-per-unit for the cooling service delivered (for example, dollars per tonnes of refrigeration, or cubic metres of cooled air), and are based on actual usage. The payment is not dependent on the savings (as with an ESCO model) but agreed in advance as a function of actual usage. This makes it easier and more transparent for the client. In a broader sense, customers may also view some ESCO-models as a form of CaaS as they also can involve a series of on-going service payments and avoid the upfront capital costs of cooling equipment.

WHY IS CAAS BENEFICIAL?

At the global-scale, the anticipated explosion of demand for cooling as developing countries become more prosperous, and as urbanisation and planetary warming increase, will lead to a rapid escalation of energy and resource use from cooling. The IEA projects that global annual energy use from space conditioning alone will triple to amount to 6,200 TWh in 2050 under a business as usual (BAU) scenario (IEA, 2018). There is an urgent need to reduce the energy intensity and cut pollution from cooling, and to ensure efficient cooling systems are affordable to all those who need them.

CaaS models benefit customers through lower energy and maintenance costs, the absence of upfront capital investments, industry-leading equipment, and a transparent and predictable pricing structure. The model effectively turns capital expense into an operational expense for clients, freeing up capital for other investment priorities. The model also reduces the perceived technology risk for the clients, as they are not required to invest in the technologies directly, and are not exposed to equipment failure.

CaaS gives technology providers a stronger incentive to increase their own profits by reducing their products' operating costs through innovation, helping overcome 'split incentives' between manufacturers and users. Some cooling technology providers are already offering CaaS, to differentiate themselves in the marketplace and compete against low quality, inefficient and low-cost cooling solutions.

CaaS can also increase the likelihood that cooling equipment is effectively serviced and maintained, lowering the risk of unplanned breakdowns and creeping inefficiency. Proper maintenance can deliver electricity savings up to 20% (K-CEP, 2018).

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SERVITIZATION CASE STUDIES

CaaS is an example of servitization – transforming a traditionally product-focused business model into a service-focused one. This typically requires a circular economy whole lifecycle approach to asset management, maximising the value of equipment and benefits provided by the asset throughout its operating lifetime, including at end-of-life (e.g. for re-use/re-sale, parts harvesting, etc.). While there are currently few examples of CaaS, there are many examples of servitization from other sectors. These are outlined below.

POWER-BY-THE-HOUR

UK-headquartered global power systems company Rolls-Royce was amongst the servitization pioneers with its 'Power-by-the-Hour' approach to engine maintenance management launched in 1962 (Rolls-Royce, 2012). The original system was operated through a Pay-as-you-go (PAYG) business model, and offered a complete engine and accessory replacement service paid for on a fixed-cost-per-flying hour basis. Rolls-Royce have since extended the model to include engine health monitoring, access to engines during off-wing maintenance to minimise downtime, and a global network of maintenance centres.

The experience of Power-by-the-Hour demonstrated that there can be a number of benefits of servitization. The model meant that the aircraft operator reduced the amount of capital it had tied up in assets, and avoided the uncertainty and costs associated with unpredictable breakdowns and repairs. Maintenance became more predictable and could be provided at a lower cost. Costs could be recorded off balance sheet as expenses rather than capital transactions, freeing up capital lines for other priorities.

MOBILITY-AS-A-SERVICE (MAAS)

MaaS manifests in a number of ways, for example through on-demand private driver services like Uber, to ride-sharing, right through to platforms integrating multiple modes of transport in a single service accessible when a user needs them e.g. Whim app, UbiGo, Qixxit, Moovel (Goodall, Fishman, Bornstein, & Bonthron, 2017).

An example of a traditional automotive manufacturer developing a particular MaaS application is Daimler's Car2Go. Car2Go provides car sharing services in urban areas across Europe, North America and China. Customers can rent a Car2Go vehicle using a smartphone, and at the end of their journey park the car at any location within the appropriate area (Daimler, n.d.). The customer pays for the journey duration, charged per minute, per hour or per day. All parking, fuel and insurance costs are included in the price. Car2Go was launched in 2008 and now has three million members in 26 cities across eight countries (Saunders, 2018).

Daimler is far from alone amongst the big automotive manufacturers investing in MaaS: General Motors, Ford, and BMW also have their own ventures (Edelstein, 2018). MaaS is considered to provide all the benefits of the car without the need to own one, and where such a service is not needed full time, can be cheaper for the customer. It also frees up parking space, reduces the number of vehicles on the road and results in lower emissions.

LIGHTING-AS-A-SERVICE (LAAS)

LaaS involves selling lighting to end customers – often building users – rather than the physical infrastructure of lighting. The disruption caused by innovations such as LED lighting has been an enabler of the LaaS model, as the longer lifetime of LEDs meant the steady sale of bulbs, as per incandescent light bulbs, will no longer be a financially sustainable business model.

Philips Lighting recently announced an agreement with the SUSI Energy Efficiency Fund to roll out LaaS across Europe. The scheme will install energy-efficient LED upgrades and guarantee light levels, energy performance, and uptime, with customers repaying the projects over time from the energy savings, charged through regular bills (Signify, 2018).

There is a lot of crossover from LaaS to CaaS as both will be associated with achieving a desired level of service in a building. The experience of implementing LaaS has shown that the contracting process can be complicated, with stringent review requirements often imposed by investors and third-party certification entities in LaaS companies (Labrador & Ferrante, 2017).

CAAS CASE STUDIES

BASE – ENERGY EFFICIENCY IN COLOMBIA

The Basel Agency for Sustainable Energy (BASE) has been supporting the Swiss Government (SECO) to design a programme in Colombia to increase the demand and uptake of sustainable energy technologies through PPS contracts. The programme is targeting small and medium sized enterprises (SMEs) and prioritizes energy efficiency measures, including cooling systems.

A number of measures are being considered to promote the PPS contracts, such as a payment guarantee that will be used to cover part of the risk that an SME defaults on their payments to the solution provider when implementing a project under a PPS contact. The payment guarantee is a risk mitigation instrument that can help the PPS providers to reach higher risk market sectors. The payment guarantee also improves the risk assessment of a technology provider when requesting financing support.

SINGAPORE DISTRICT COOLING: MARINA BAY

Singapore District Cooling (SDC) supplies chilled water from a central production facility to customers via a 5 kilometer underground pipe network. It produces 600 tons of chilled water per hour in order to provide customers with air conditioning (Energy Market Authority, n.d.).

The Singapore District Cooling pipe network serves customers in Marina Bay Sands, the Marina Bay Financial Centre, and One Raffles Quay, which encompasses a variety of homes, offices, commercial and service buildings (Comfort Futures, Marina Bay, n.d.). Rather than each building having their own chiller, buildings share chiller capacity, and this is operated and maintained by a team of technical staff.

Benefits

The district cooling supplied by Singapore District Cooling has been shown to have a number of benefits:

- Constant and reliable supply of cooling;
- Support from technical staff who are accessible at any time of day;
- On-demand flexibility;
- Removes the need for customers' own chillers, saving space;
- Eliminates upfront capital costs as the customer no longer needs to purchase their own equipment (i.e. chiller);
- Customers are eligible for an energy assessment to assess their existing and potential energy savings;
- Energy savings are estimated to be >40% compared with customers who own and use standard air conditioning and chiller models (Othman, 2016).

BARRIERS TO EFFICIENT, CLEAN COOLING, THE BENEFITS OF CAAS, AND ACTIONS FOR SCALING

There are relatively few examples of CaaS in action, particularly outside district cooling, and in comparison with LaaS and MaaS. The bespoke nature of many cooling solutions to different types of application may make it harder for CaaS to work, compared with office printing and copying services – where equipment has long established a leasing or PPS model, for example. However, CaaS presents an innovative way to overcome many of the current market barriers preventing a transition to more efficient, clean cooling. It is a market-based model that has been proven in other sectors. A summary of some of the key challenges to market uptake of efficient, clean cooling and how CaaS can help address these challenges is given in Table 1.

Table 1 - Barriers to market uptake of efficient, clean cooling and potential benefits of CaaS

Barriers to uptake of efficient, clean cooling	Benefits of CaaS
Uncertain energy cost savings weaken the appeal of businesses investing in more efficient, clean cooling.	Energy cost savings are made by the technology provider to increase their margins – but are either not part of the agreement with the end customer (if paid on a per unit cooling basis) or are guaranteed by the provider (some ESCO models).
High upfront capital costs, lack of internal capital resources and/or poor creditworthiness of end customers for borrowing to purchase more efficient equipment.	CaaS avoids the need for large outlay of capital expenditure upfront by end customers from either their own resources or borrowing.
Difficulty making a compelling business case to end customers without costly or unsustainable incentives, concessions, or rebates.	CaaS can be driven and sustained by the market – realigning existing incentives as a basis for supporting action rather than creating artificial incentives.
Optimisation and maintenance of cooling equipment often does not occur, leading to sub-optimal performance.	CaaS technology providers have a direct incentive to ensure their equipment operates optimally as this will increase their margin.
Unwillingness of customers to pay for new appliances / pay more for cleaner refrigerants.	Customers are not exposed to performance risks of new appliances or refrigerants, which are instead managed by the technology provider.

POTENTIAL ACTIONS FOR SCALING CAAS

Based on the understanding of other sectors and from what is emerging for efficient, clean cooling, CaaS faces many of the same challenges as other servitization models. Potential actions different stakeholders should take include:

Industry (technology suppliers & manufacturers)

- Collaborate with financiers to standardize and simplify replicable CaaS contracts;
- Work with financiers to raise awareness of CaaS and associated cost & energy savings;
- Pilot / demonstrate CaaS models;
- Set up appropriate monitoring, documentation, and billing procedures;
- Raise awareness of the need for equipment upgrades, to increase energy efficiency and support the transition to low global warming potential refrigerants;
- Provide technical assistance for audits, monitoring and verification, and complex projects / clients.

Government

- Raise awareness, provide technical support where the private sector is as yet unwilling, regulate the market, lead by example in public procurement, and act as a coordinating entity when other actors are unwilling or unable to demonstrate the available opportunities before transitioning responsibility to other actors.

NGOs

- Provide know-how, and demonstrate by doing to influence the market;
- Create alliances and support collaboration between technology providers, investors, cooling and customer associations;
- Like government, raise awareness, provide technical support, and act as a coordinating entity when other actors are unwilling or unable to demonstrate the available opportunities before transitioning responsibility to other actors.

Financiers

- Collaborate with industry to standardize and simplify replicable CaaS contracts;
- Increase investment into CaaS businesses;
- Consider finance mechanisms to support CaaS business models, such as guarantees, or sale-lease back models;
- Increase awareness of financial support available for suppliers / users of CaaS.

ABOUT K-CEP

The Kigali Cooling Efficiency Program (K-CEP) is a philanthropic collaboration launched in 2017 to support the Kigali Amendment of the Montreal Protocol and the transition to efficient, clean cooling solutions for all. K-CEP's program office, the Efficiency Cooling Office, is housed at the ClimateWorks Foundation.

CONTACT US

For more details please visit www.k-cep.org, follow us at @Kigali Cooling, or contact us at info@k-cep.org.

FEEDBACK ON THIS BRIEF

The Carbon Trust, BASE, and the Birmingham Energy Institute co-authored this brief with K-CEP. We would welcome any feedback on CaaS, including prominent examples, barriers, solutions, and ideas for future projects. Please contact us at: coolingefficiency@carbontrust.com.

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