



Cooling as a Service
Refresh the planet

Webinar: How Cooling as a Service is set to revolutionise the cooling industry.

Co-hosted by IEA and BASE.

(22nd of April 2020)

Questions from participants

Moderator:

- Vida Rozite, *International Energy Agency (IEA)*

Speakers:

- Thomas Motmans, *Basel Agency for Sustainable Energy (BASE)*
- Jim Maguire, *Sustainable Development Capital Limited (SDCL)*
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About Cooling as a Service

This webinar on Cooling as a Service hosted by the International Energy Agency (IEA)'s Super-efficient Equipment and Appliance Deployment (SEAD) initiative and the Basel Agency for Sustainable Energy (BASE). The webinar, featuring speakers from BASE and from Sustainable Development Capital (SDCL), helped participants to understand how the innovative pay-per-use business model "Cooling as a Service" overcomes the key market barriers for the commercial and industrial sectors.

Cooling as a Service (CaaS) is an innovative financial instrument to overcome key market barriers to clean and efficient cooling, without upfront investment, with integrated financial tools to recapitalise technology providers. Based on the servitisation concept, CaaS enables customers to base their investment decision on life-cycle cost rather than on the purchase price of the equipment, benefitting companies, governments and society at large.

BASE is leading the CaaS (CaaS) Initiative on behalf of the Kigali Cooling Efficiency Programme (K-CEP), with the objective to scale-up the demand for efficient, clean cooling systems, through the use and promotion of the innovative CaaS business model. Through the initiative, BASE is creating tools to enable the use of the model and is supporting the implementation of pilot projects in Latin America and the Caribbean, Africa and Asia.

For updates about the development and implementation of the CaaS model around the world, subscribe to our [newsletter](#) or visit our website: www.caas-initiative.org

Questions & Answers

1

Probably a client doesn't want to have the fuss of managing cooling. Would that be a major argument for choosing CaaS?

BASE: Correct - there are strong advantages for customers to choose CaaS by outsourcing to the service provider the handling and maintenance of the units. The CaaS model allows customers to focus onto their core business.

SDCL: Correct - but not only the "outsourcing" but also carving out construction, financing and operational risk which would be assumed up contract by SDCL.

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Does CaaS save money in the longer term or does the Life cycle cost remain constant ? It is, are investment cost increased and off set by reduced energy costs over the lifetime of an investment ?

BASE: The life cycle cost of more efficient equipment is lower than equipment that may be less expensive upfront but also less efficient. In the CaaS model, the solution with the lowest life cycle cost, thus with a high efficiency, is installed. Therefore CaaS saves money to the customer from day 1. A more in-depth analysis of the CaaS model compared to BAU is available in this analysis made by the Global Innovation Lab for Climate Finance and BASE: https://energy-base.org/app/uploads/2020/03/10.CaaS_Instrument-Analysis-Paper_FI-NAL_09.17.19.pdf

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What is the scale we are looking at for implementing CaaS, and what is the smallest size of the project that would be economically viable?

BASE: Transactional costs are higher for smaller projects (residential vs. commercial / industrial) so it is required to use financial structures that adapt to that need, such as bundling a series of projects which makes it more attractive to the investors. The actual minimum ticket size of an investment will depend on the investors' criteria, but by bundling projects it is possible to cover a number of smaller investments with a single investment vehicle by reaching a larger total investment.

SDCL: In Indonesia and Thailand, for example, SDCL has funded Investment Grade Audits in the Hospitality sector. The average size of the Energy Conservation Measures ("ECMs") developed from these audits is US\$350-500,000.00 per asset. By "bundling" and/or looking at the audits from a portfolio perspective, the financing process is both more efficient and cost competitive. Key issue to be evaluated, as well, is the counter-party creditworthiness of the host.

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Is CAAS only feasible for large customers with sizeable amount of cooling requirement as mentioned in the case study or is it feasible for residential consumers, for instance with a requirement of 1 tonne or 2 tonnes?

BASE: In general the CaaS model applies to any type of facility. The challenge is to create enough critical mass to justify the investment. Transactional costs are higher for smaller projects (residential vs. commercial / industrial) so it is required to use financial structures that adapt to that need, such as pooling a series of projects that make it more attractive to the investors. It would be possible to implement the model in a condominium format for a multifamily building for example. However, there are contractual complexities to be addressed. In any case, current technology allows to be able to monitor equipment remotely, therefore maintenance planning is facilitated and to prevent problems before they occur. This is very relevant when the application is at a residential level, since there will be many more units spatially scattered within a larger area.

SDCL: the Kigali Cooling Efficiency Grant is applicable only to C&I: we would not typically look at residential for many of the reasons enumerated in the BASE response.

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Can you imagine a CaaS Solution also for big users like supermarkets or industry?

BASE: Absolutely. In fact, at this stage CaaS is designed for commercial and industrial cooling users. We are working with Sphere Solutions in South Africa to implement CaaS in retail food and industrial refrigeration. More information here: <https://www.caas-initiative.org/news/working-to-implement-cooling-as-a-service-in-south-africa/>

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Can you share a typical CaaS contract agreement?

BASE: In Summer 2020, BASE will make publicly available a toolkit on the website of the CaaS initiative www.caas-initiative.org. This toolkit will include a standardized CaaS contract as well as a pricing model.

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Competitors in the market may choose to skimp out on certain mitigation measures in order to save costs (and offer better rates) - such as not properly monitoring the systems for optimum technology and efficiency performance. This results in poorly performing systems within 5-10 years, and is especially the case when most widely used chiller systems (the non-magnetic bearing types) can drop in performance really quickly. Are there any consumer protection laws existing that can ensure that CaaS providers abide by them, so that tenants (who are not completely aware of how the technology works) are protected too?

BASE: In the CaaS model, the technology provider is owning the system and is responsible for covering all operating costs, including electricity. For this reason, the technology provider has a direct incentive to properly monitor the system and achieving the highest possible efficiency performance. Indeed, the price paid by the customer depends on the cooling consumption, but not on the energy consumption. If the equipment consumes more than expected, the customer does not pay more. At the same time the provider is able to increase its margin by optimizing the operation and increasing the efficiency all the more.

SDCL: this is one of the main reasons why the CaaS model is beneficial to the host.

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Is the customer responsible for the electricity costs or is the CaaS service provider responsible for the electricity?

BASE: The way we define CaaS within the CaaS Initiative, we consider that the technology provider must bear the costs of electricity. Indeed, this creates a strong incentive for the provider to optimize the efficiency of the system. The price paid by the customer depends on the cooling consumption, but not on the energy consumption. If the equipment consumes more than expected, the customer does not pay more. At the same time the provider is able to increase its margin by optimizing the operation and increasing the efficiency all the more.

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Does electricity cost need to be included in the CaaS or can it only include maintenance ? How does the CaaS provider control 'abuses', e.g. client/user keeping equipment on more than necessary, or not doing adequate maintenance?

BASE/SDCL: Suggested combined answer: Including electricity price as a package to the end-user is not a pre-requisite, as long as the performance risk can be transferred from the end-user to the service provider. The easiest way to transfer this risk is by having the service provider pay for the electricity. Alternatively, this could be done for example, by guaranteeing a minimum level of efficiency of the cooling system within the terms of the CaaS agreement. Including electricity in the fixed rate per unit means that the provider is fully responsible for the costs of operating the system. Therefore, it is in the interest of the provider in installing the equipment with the highest efficiency, as well as offering excellent preventive maintenance to optimize the efficiency of the system and thus reduce the cost of providing the service.

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Is passive cooling without electricity (building physics modification) also viable and has it potential to energy saving?

It is not expected that the end-user will abuse the use of the equipment since the user still pays per unit of cooling, thus any abuse would translate into more expensive invoices.

In reference to maintenance, this is the responsibility of the service provider - who has the incentive to do proper equipment maintenance, otherwise the cost of operating the equipment will increase and reduce the operating margin of the service provider.

BASE: Absolutely, passive cooling has a very large energy saving potential as it can reduce the required cooling load significantly and in some cases even obviate the need for mechanical cooling. The advantage of Cooling as a Service is that it enables system thinking, in which a solution provider can include passive cooling or other components such as thermal storage in the cooling solution offered to the cooling user.

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I would like to understand more on the metering and monitoring of individual cooling levels – in the case study

BASE: Regarding the case study in Colombia, more information can be found on: <https://www.caas-initiative.org/case-studies>.

The metering and monitoring of the cooling provided was executed by installing measurement equipment at the output of the equipment - at the terminal interface point defined contractually between the service provider and the customer.

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Do you in this context see differences between CaaS and H(eating)aas. Similarly, developed/developing countries?

BASE: The concept is similar, there will be differentiation in the operation model and details in the contract. But indeed, as mentioned in the webinar, servitisation is being applied to several industries / products with high value to all stakeholders; the latter is also why it is successful.

SDCL: the bulk of our experience in the USA, Europe and the UK is in the heating efficiency sector and, yes, we see the transfer of this experience to CaaS as an advantage of engagement with SDCL.

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What is difference between outsourcing and CaaS?

BASE: Outsourcing is a more generic term - a business can outsource the selection of a cooling unit but still purchase it. CaaS is about having the equipment off-balance and paying solely for a service.

SDCL: agree. Outsourcing will not always involve the same level of risk transfer as CaaS - where the service provider is responsible for guaranteeing availability and performance and takes all capital and operating risk.

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Thank you for a very informative presentation! Can you please share some of the questions that MGM's customer asked before implementing the business model in Medellin? Is there a FAQ sheet for the same available?

BASE: More information about the case study in Colombia can be found on our website, under this link: <https://www.caas-initiative.org/case-studies>

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Is this only for new projects or even for existing projects - what happens with the legacy systems?

BASE: CaaS is applicable both for retrofit projects and for new projects. In the case of retrofits, CaaS can come in at any time when a retrofit will generate enough savings to make an offer attractive enough to the customer. What happens to the legacy systems is to be defined between the customer and the solution provider. Ideally the equipment should be removed and recycled or disposed correctly. In the case of new projects, CaaS should be integrated into the building design stage.

SDCL: typically, our experience with CaaS and within the Kigali grant is solely as respects retrofits. Legacy or plant and equipment that is replaced would be handled in accord with national regulations applicable to management of refrigerant waste.

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Could you comment on the potential of the initiative to foster not-in-kind cooling tech, i.e. non-vapour compression tech?

BASE: The CaaS model and the CaaS initiative are technology agnostic, as long as high GHG emissions can be reached, both directly (through the refrigerants used) and indirectly (through the electricity consumed). In fact, CaaS gives space to technological innovation because it enables a system thinking approach, in which the technology provider sells the outcome (cooling) and not a specific equipment. The provider thus has the freedom to include technological innovations to improve the quality and efficiency of the cooling system, for instance to reduce operating costs, as long as it improves the

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Thank you for your interesting presentation. Are CaaS suppliers primarily providing and operating cooling technologies, or are there any examples where they are making building efficiency improvements as well?

cooling service to the client. This may include different types of innovative mechanical cooling as well as passive cooling, thermal storage, or monitoring technology enabling to interact with the grid facilitating, for instance for peak load shaving.

BASE: For now the case studies we have are focusing on the cooling equipment. But companies that have the expertise to include building efficiency improvements as well could do so - it would need to be incorporated in the scope/cost/pricing scheme.

SDCL: we will look at the ECMs as developed in an Investment Grade Audit and determine the appropriate investment strategy and structure underpinned by the project's risk and return profile. In Asia, we are actively looking at LED lighting as well as cooling and energy efficiency projects.

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What are the steps of an equipment manufacturer has to take to venture into CaaS? They do need thorough knowledge on their clients? They need to have a state-of-the-art service policy?

BASE: The www.caas-initiative.org website described the steps to follow to implement CaaS. We will soon be making available tools that will enable the implementation of the model, such as a contract and a pricing model. The first step is to set up a "CaaS team" within your organisation, bringing together legal, financial, fiscal, technical and commercial knowledge. Once you identify projects you think could benefit from CaaS, you can explain the model to them and tailor the tools to their needs. You can contact the BASE and SDCL teams for support or ideas. Service providers that are eligible need to have EE equipment that are not using technologies which are being phased-out by K-CEP, and indeed the company needs to be able to service the equipment adequately.

SDCL: Agree and would add footprint in Asia and Africa, service capability and international and/or national certifications.

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What types of cooling services are covered in the business model?

BASE: Various cooling technologies are applicable to CaaS: HVAC (such as chiller systems or VRF/VRV), Refrigeration, Off-grid cold rooms, etc.

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Great topic. Interested in how quality and environmental impact can be controlled under high financial pressures. Also in whether/how this can result in net savings over BAU, especially if it is expanding into previously unserved areas/markets.

BASE: Indeed case studies show that CaaS impact BAU positively in that solution providers have the incentive to install the most efficient equipment and optimised its efficiency performance over the lifetime, and in that customers are more aware of the usage of the cooling. Since the equipment remains under the ownership of the technical provider, the operation and maintenance of the cooling system is optimised - which leads to lower energy consumption and, avoided corrective maintenance, and slower equipment performance degradation, and hence improved equipment life-cycle cost. It is a win-win for both the equipment provider and the business owner, while reducing the impact on the environment. A more in-depth analysis of the CaaS model compared to BAU is available in this analysis made by the Global Innovation Lab for Climate Finance and BASE: https://energy-base.org/app/uploads/2020/03/10.CaaS_Instrument-Analysis-Paper_FI-NAL_09.17.19.pdf

SDCL: For the previously mentioned Hospitality assets in Indonesia and Thailand, SDCL is currently looking at project financings amidst the Covid-19 crisis (which has severely impacted the hotel sector in these countries): key points to highlight are quality of counter-party credit and likely need for MLL, national government or other types of credit default support. In terms of the rationale for CaaS in underserved areas/markets, the economic argument to move this concept forward is readily seen.

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How do you select the best technologies, the best technology may vary according to how technology is used and location.

BASE: In the CaaS model, the technology provider owns and operates the system. Therefore, the technology provider has the incentive to select the technology that will be most appropriate and efficient for the specific conditions of the project. A key advantage of CaaS it that the technology provider is also the one "using" the technology, therefore eliminating the variable of "how the technology is used". The technology provider also has the freedom to change components or improve the system during the duration of the CaaS contract to improve efficiency or service quality.

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Do your figures on cooling requirements by 2050 include stand-alone domestic cooling, how is that expected to grow?

SDCL: we are a technology agnostic firm with no current global sales agreements with any OEM. The use of technology is bespoke and/or specific to the merits of the project investment and risk profile.

BASE: The data on energy use for space cooling presented in The Future of Cooling Report by the IEA cover residential and commercial buildings. Globally, most energy is used for ACs, though dehumidifiers and fans can also represent significant shares in some countries. Unless otherwise noted, final energy for space cooling in this report includes final electricity consumption for ACs, fans and dehumidifiers as well as natural gas use (mostly for chillers) in the buildings sector. More information here: <https://www.iea.org/reports/the-future-of-cooling>

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Could you give more information on the developments of CaaS taking place in India?

BASE: The CaaS team is currently working on the implementation of CaaS in India, both for commercial buildings and for cold storage for agricultural use. The partners with whom we are working on the implementation of CaaS in India are Smart Joules and Coolcrop. There is a significant potential for CaaS in India and we highly encourage local solution providers to look into the CaaS model. Case studies in India will be made available as soon as possible.

SDCL: Currently, SDCL has no on-the-ground platform in India and has not, within its Kigali Cooling Efficiency Program grant, actively investigated projects hence our knowledge of "CaaS providers in India" is limited.

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I suppose the equipment needs to be 'connected' for constant monitoring by the manufacturer? Is there a privacy issue?

BASE: Correct, the equipment needs to be constantly connected for adequate monitoring. There are no privacy issues.

SDCL: Agree that connections required: privacy/confidentiality/IP issues typically addressed by contract.

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I am the project leader of 'Gecko', research project in Kenya seeking to develop circular industrial parks in Kenya. I am interested in a critical discussion of servitization as part of a circular economy strategy in Africa.

BASE: The CaaS model supports a circular-economy model, by incentivizing technology providers to make their equipment modular, with parts being reusable/recyclable since the ownership of the equipment is never transferred to the client. We would be happy to discuss further.

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I would be particularly interested in viable and sustainable business models to stimulate private sector engagement for increased access to clean cooling. Any examples on ESCOs in developing countries?

BASE: You can have a look at our manual of financing mechanisms and business models for energy efficiency, available here: <https://energy-base.org/app/uploads/2020/03/11.Manual-of-Financing-Mechanisms-and-Business-Models-for-Energy-Efficiency-2019.pdf>. We can also recommend this knowledge brief by Sustainable Energy for All on Financing Access to Cooling Solutions: <https://www.seforall.org/sites/default/files/2020-03/FinancingCooling-SEforALL.pdf>

SDCL: SDCL is currently working with a number of regional, global and national ESCOs active in Malaysia, Indonesia, Singapore, Philippines, Hong Kong, Singapore and Thailand. Readily available information on in-country ESCOs is typically available via the sources highlighted in the BASE response and/or by searching national environmental sources.

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What is the typical duration of CaaS projects/ contracts?

BASE: Duration of the project is specific to each scenario. Typical contract durations are between 5 and 12 years.

SDCL: indicated range is about right - in UK, there is a 17 year tenor.

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How and where can building energy modelling companies fit in these business models?

BASE: Building energy modelling companies can fit in different ways; one of which is to partner with the service provider to provide them with highly accurate measurements of the usage and spread of cooling throughout the building.

SDCL: Agree with the BASE comment and would add that both in Asia and Europe, we are seeing the proliferation of specialist platforms focused solely on the data/analytics and plant and equipment performance; in other words, not necessarily an ESCO or contractor or OEM but rather a niche participant in the value chain of CaaS with a focus on software and performance analytics.

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Can you touch upon similar trends in the Western world as well? Are there any demo projects in the EU?

BASE: The projects that we support are all in the developing world covering Asia, Africa and Latin America as a response to the priorities of our donor. But CaaS certainly is applicable and delivers the same value in Europe and in other regions like North America. The model of servitisation has been adding value in Europe already beyond cooling - one example is the lightning of the airport of Schiphol in Amsterdam that pays lightning by the hour as a service to the solution provider Philipps. Regarding CaaS we have been approached by parties interested to get involved (in Spain, Greece, Holland, etc.). Many of the world leading providers of cooling equipment are members of the CaaS alliance (e.g. Daikin, Trane, Johnson Controls, Danfoss to name a few; all our partners are listed in the About page at www.caas-initiative.org/about-us), meaning they are currently or are interested in developing CaaS in the different markets where they have presence. We are also currently finalizing key tools that will facilitate the adoption of the model anywhere (e.g. contract, pricing model, etc.), all of which will be open source and available for all markets.

SDCL: The EIB and EBRD have both supported ESCOs in Europe with financing and technical assistance and details should be on their websites. The EU has run a number of programmes to support ESCOs and energy efficiency services over the years and details can also be found on the EU website.

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Which chances has the model of solar operated absorption refrigeration and cooling systems using water/LiBr/NH3 as a working fluids in the emerging markets of Africa and MENA where sunshine duration is more than 9 hours/day?

BASE: Yes the model is applicable. In fact off-grid solar powered cooling system have a very strong selling point as the system is not correlated to electricity price fluctuation. In addition if the system has a battery/Ice or similar to store the additional cold not consumed during the 9hr of sunlight, which can be used later on, this further optimizes the cost of operation.

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Very interest presentations. Are commercial banks in India and ASEAN already providing debt for these models? In Colombia which financial institutions were providing finance for this pilot? Could you also share more details on the India projects? Many thx

BASE: Regarding the second part of the question: in Colombia, the CaaS project presented during the webinar was funded by MGM Innova (more info on the case study can be found on: <https://www.caas-initiative.org/case-studies>)

SDCL: SDCL is not presently active in India: specific to ASEAN, SDCL is actively engaging with commercial banks and/or these institutions are now looking at cooling and energy

efficiency projects developed under or in a CaaS contractual framework. Additionally, there are non-bank institutions active in the debt market in Vietnam, Indonesia, Philippines and Thailand.

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SDCL: Slide 34, Can the main contractor be one entity for Construction, ESCO and O&M ?

SDCL: Yes.

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What are the opportunities for CaaS in the off grid energy sector?

BASE: Opportunities include solar powered cooling systems (or other off-grid technologies) for various types of applications (such as cold rooms for agricultural or healthcare applications).

SDCL: we are actively looking at this topic in partnership with international organizations such as World Bank/IFC, USAID, UN with the focus being in the Cold Chain for agricultural and pharmaceutical cold storage as mentioned by BASE. Key point (s) remain the counter-party, available risk sharing guarantees and scalability.

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What's the process for a company or an individual to partner with SDCL for projects as a contractor or a single point of contact?

SDCL: Please contact us at: james.maquire@sdcl-asia.com; peter.hobson@sdcl-ib.com. Process moves more quickly when there is the possibility for financing projects at scale with good counter-parties. Key occupancies targeted in the SDCL Kigali Cooling Efficiency Program grant are: Hospitality, Healthcare, Manufacturing, Property/Real Estate.

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What a role does PV or solar thermal play in cooling?

BASE: PV or solar thermal allow for cooling to be off-grid partially or fully and hence also to be uncorrelated to electricity price fluctuations &/or supply shortages/volatilities.

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Any case studies on datacenters ?

BASE: Case studies on data centers are not yet available on BASE side.

SDCL: we have several European/UK data center project case studies and/or experience. In Asia, we have a Term Sheet out to fund an Investment Grade Audit for two Indonesian data centers and pipeline opportunities in Malaysia, Hong Kong and China. Growth in ICT sector in Asia requires that we move CaaS and/or cooling efficiency firmly into this sector.

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Are there any CaaS application in Dairy sector? Ammonia Refrigeration..... Current implementation

BASE: CaaS is currently applied in the retail and food sector. Solely on Dairy, we do not have a project yet, but the value of the model is applicable.

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Is the BASE Cooling as a Service offering grants for demonstration of projects? Our company designs and installs solar powered cold rooms and we are thinking of solar powered ice machines

BASE: the team is not offering grants. BASE is offering technical assistance for some projects to support the implementation of the CaaS model and can connect the service provider to our network of investors if the project and technologies fit the purpose of CaaS.

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From SDCL's risk analysis, "contract" risk did not appear to be as a critical risk. However, in developing countries, where contract risks are often large, and incidentally where cooling demands are also the greatest, is SDCL not seeing this as a challenge? This is one of the challenges that ESCOs have traditionally faced in these countries.

SDCL: Correct that contract risk is a concern in developing Asia and delineation between "significant" and "critical" is debatable. We mitigate contract risk by use of well tested (both in-house and with external counsel and/or advisors) and BASE standard wording.

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I would like to have a look on the online article that you mentioned discussing the market trend from some technologies such as the 1200 TR chiller.

BASE: You can find the article made by the Global Innovation Lab for Climate Finance and BASE on CaaS here: https://energy-base.org/app/uploads/2020/03/10.CaaS_Instrument-Analysis-Paper_FINAL_09.17.19.pdf

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What is the ROI for an investor

BASE: It depends on the project (size, potential of replicabilities.), country risk, contract currency, counterparty risk, etc.. Since the expected return is impacted by overall project risk it varies from country to country, project to project. The typical ROI we see is around 10-15% in US\$.

SDCL: Target ROI for Asia is in the range of 10-15% depending on occupancy, country, counter-party, technology and scalability.

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Typically O&M is not provided by a separate entity (ESCO/OEMs will do this). How are the 2 risks performance risks and O&M risks dealt with separately then? or is the expectation that O&M counterparty has to be different from the service provider?

SDCL: In Asia we are seeing specialist platforms utilizing software analytics to perform cooling technology optimization and acting as O&M contractor. SDCL is able to package the different risks through appropriate contractual arrangements between our project company and with ESCOs and OEMs (combining operational performance undertakings with warranties) into a single availability and performance guarantee to the host under the CaaS throughout its term.

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In order for you to expand more ambitiously to the lower income countries (e.g. GMS / Cambodia and Vietnam mentioned), what would be needed?

BASE: CaaS is currently focusing on emerging countries with low income - however it is important that the project executed is financially sustainable, with a valid business case.

SDCL: we have had an initial discussion with regard to Cambodia (Cold Storage) and Vietnam (C&I, Manufacturing). Key risk profile issues such as occupancy, technology, counter-party credit risk apply in the GMS as they would in Singapore, Hong Kong or Indonesia. There are specialist funds active in the GMS which we would look to partner with; in Vietnam, specifically, there is significant interest in distributed/onsite or rooftop solar so we would look to partner with a solar platform. Please contact Jim at: james.maquire@sdcl-asia.com.

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There are a lot of companies in this business and the concept as such is quite simple. Yet most of the companies applying the same business model are not able to make a real business out of it. What are the main reasons for your kind of players for failing / what are the main success factors?

BASE: Implementing CaaS is a major shift from BAU, since it is a shift from selling assets to selling services. This comes with some challenges but also significant opportunities. Thanks to significant energy savings that can be achieved with state-of-the-art technology, the business opportunity is definitely there. It requires innovative managers and decision-makers to lead the way towards implementation within the organisations. A more in-depth analysis of the CaaS mod-

el compared to BAU is available in this analysis made by the Global Innovation Lab for Climate Finance and BASE: https://energy-base.org/app/uploads/2020/03/10.CaaS_Instrument-Analysis-Paper_FINAL_09.17.19.pdf. The CaaS team has paid attention to make a reliable and effective contract, and a solid pricing model, which we will make available soon to facilitate implementation. It is important to recognize that CaaS will not be attractive for every scenario/customer. The solution should fit the needs and can deliver value to all the stakeholders involved.

SDCL: great question that infers a “business case” type response but might be more efficiently addressed in a phone call or email. For SDCL, a number of points that are worth mentioning as to why now is different might include but not be limited to: more data publicly available as to “the Cooling Imperative”; National governments better understand the need for investment in cooling and energy efficiency, more active global awareness of the importance of cooling as a contributor to global warming, increased urbanization + warming climate creates fundamental challenges for local/provincial/national governments and, perhaps, most concretely, the Kigali “Halo” and/or the Kigali Cooling Efficiency Program represents a global network of committed stakeholders focused on improving cooling efficiency. CaaS simply represents a framework to deploy private or public capital to effect the needed changes.

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Which are the technology provider companies (Chiller manufacturers) you have partnered with in Asia?

BASE: The major manufacturers that have joined the CaaS Alliance and that are also active in Asia are Daikin, Johnson Controls, and Trane. See the members of our CaaS Alliance here: www.caas-initiative.org/about-us

SDCL: for the projects currently at finance stage, requests for proposals have been sent to Johnson Controls/York, Daikin, Gree, Haier, Carrier, Trane as examples.

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To what extent does the parent company guarantee / external guarantee requirement reduce the interest of the host companies? Can you elaborate on the deal rationale from the host company perspective.

SDCL: whether a parent guarantee or an 'external guarantee', the impact to borrowing costs is substantial as it mitigates the credit default risk to SDCL. The rationale underpinning use of guarantees (with parental or external) is the reduction in default or credit risk exposure to the investor. From a host perspective, there would be a need to determine the acceptable level of security and treasury commitment relative to the monthly service charge.

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Is there an impact assessment of the current COVID-19? Any changes to your business strategy?

BASE: On the one hand, the COVID-19 situation has caused delays and difficulties to advance with discussions and negotiations with potential CaaS adopters and implementing partners, because many business have closed at least partially and priorities have shifted to address the crisis. The technology providers themselves are also affected by the crisis. On the other hand, CaaS stands out as a very useful solution during this crisis, since many companies are now more than ever cash-constrained, needing to invest elsewhere, while at the same time looking for means to reduce their operating expenses.

SDCL: Covid-19 impact to Asia is substantial and definitively has slowed both the introduction of CaaS as a value added mechanism for businesses around the world and the capital investment process given stressed financial and corporate markets. If a hotel currently has 10% occupancy and unlikely to open until October 2020, determining a monthly service charge that is acceptable to the host whilst allowing a reasonable risk adjusted rate of return to SDCL can be challenging.

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What is needed to make CaaS a scalable model in a country like India?

BASE: The more applications are made with CaaS, the more data is shown on the ROI of the projects, the more the projects are appealing to investors. Setting up payment guarantees that can reduce the risk exposure of providers and investors offering CaaS would also significantly accelerate the scaling up of the mode.

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Geothermal heat pumps provide the most energy efficient means of heating, cooling and hot water for private dwellings, buildings and district heating systems. Do you forecast mass deployment in large public buildings or district heating & cooling systems?

SDCL: SDCL has no current operations in India but we anticipate that adoption of CaaS in the cooling efficiency sector will be “standard” in the not too distant future. In a recent Economist/Kigali Cooling Efficiency Program study, “The Cooling Imperative”, India is cited as potentially the most negatively impacted country in terms of Cooling Degree Days (181 per annum) - heightening the need for efficient contract frameworks to develop more efficient cooling technology solutions.

BASE: As the deployment of CaaS spreads, these are applications we foresee. Of course these applications require more investment and more time to be deployed, this is also the advantage of CaaS: it can be deployed to local buildings/businesses and does not require the larger infrastructure and sometimes complex permits that district heating or cooling needs.

SDCL: In Asia, geothermal heat-pump technology has been most actively developed in China to our knowledge though the market opportunity in Philippines and Indonesia is likely to be significant given the country profile. However, from an SDCL perspective, we would not anticipate “mass deployment in large buildings or district heating & cooling systems” in the near term given other renewable energy technologies and the points highlighted in the BASE response.

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Do you have case studies to share?

BASE: More information on case studies can be found on: <https://www.caas-initiative.org/case-studies>. We are working on preparing further case studies during the following weeks and months.

SDCL: Please see the SDCL website: www.sdcl-ib.com.

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How much tons of CO₂ will be saved per million dollar of investment?

BASE: The tons of CO₂ saved depend on the equipment installed, the scope of implementation and the application of the customer. An in-depth analysis of the CaaS model compared to BAU, including CO₂ emission reductions, is available in this analysis made by the Global Innovation Lab for Climate Finance and BASE: https://energy-base.org/app/uploads/2020/03/10.CaaS_Instrument-Analysis-Paper_FI-NAL_09.17.19.pdf.

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How do you deal with the ownership rights of the equipment when it is installed in the host premises. Especially ownership and access to air handling units and piping installed throughout a building - and can be seen as a integral part of the building.

SDCL: typically the CO₂ savings, as BASE summarizes, would be evaluated/determined project by project and linked to occupancy, technology deployed/installed, operational regime and other factors.

BASE: The terminal point interface between the service supplier and the service buyer is defined within the contract between these parties; this defined the ownership and access rights to the equipment. The hardware considered as part of the service is clearly defined and marked by the service provider. Hence the latter is project specific; it can include or exclude piping or other components that are highly integrated into the building. It might be that these components do not form part of the CaaS contract, or it might be that these specific components are structured on-balance within the same payment structure.

SDCL: under the standard CaaS model the ESCO will own and operate the equipment, otherwise it cannot be off balance sheet for the host. This usually works alongside a lease from the host of the land required to install the equipment so the required property rights are in place.

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For the Asia fund, do you also address heating (e.g. process heating)

SDCL: Yes, the intention is to evaluate finance construct and own/operate supply and demand-side investment opportunities across cooling and heating and including distributed generation complimentary to the cooling and/or heating and/or energy efficiency project.

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How is CaaS different from district cooling, besides being able to handle the payments (for the provided cold) per single households rather than at aggregation of buildings (as in the case of district cooling)?

BASE: Indeed, CaaS is different than district cooling in that CaaS can be offered to single buildings, while district cooling is meant to offer cooling from one large cooling plant (often a cogeneration plant) to several buildings simultaneously. Although district cooling is often a highly efficient solution, it requires a large infrastructure, important investments and sometimes complex construction permits. CaaS on the other hand can be implemented more easily in that regards as it can be the outsourcing of cooling service for single buildings, or building complexes. If district cooling is available for a

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One of the problems routinely faced by District Cooling plants is the 'Low DeltaT' which results due to the design fault in 'Building' and will have a cost and efficiency implication on the ESCO . With the ESCO delinked from the Building Owner by having a SPV in between, how will the ESCO recover the extra cost incurred ?

building, that is usually the preferred option and CaaS is then not necessary.

SDCL: The commercial model cannot by itself resolve the physical conditions giving rise to a low delta T. However if the cause is sub-optimal operation by the client on the demand side it is possible that the ESCO can install the appropriate demand side technologies to monitor and control use of cooling water. This can be more complicated though from a commercial perspective and the host would need to accept it ultimately has to carry demand risk if the physical limitations mean insufficient savings can be generated.

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How can startups in Africa that focused on providing energy efficiency and cooling as a service solutions benefit?

BASE: The advantages of CaaS apply: access to customers, long-lasting relationship with client, better maintenance and operation of products, improved life-cycle costs. We are working with a start-up offering off-grid freezers for marketplaces in Nigeria. More information here: <https://www.caas-initiative.org/news/winners-of-the-caas-incubator/>

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What are the main differences in the ESCO model and the CaaS model?

BASE/SDCL: Both models offer common benefits to the user, namely, no up-front investment for the end-user and the systems are optimised to maximise efficiency. However, some of their features are different; the major of which is how energy savings are treated. CaaS, as developed by BASE and presented in the webinar, does not tie payments to energy savings and instead agreed in advance as a function of actual usage, including operating cost such as electricity. While Energy Performance Contracts (EPC) payments are dependent on energy savings. There are two major forms of EPC models: 1) the shared savings model in which the customer does not invest but instead pays a share of the energy cost savings to the project developer; 2) The guaranteed savings model in which the customer invests but is guaranteed that a certain amount of energy savings will be met.

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What if the load remains low for a New Construction? Is the billing purely on cost per TRH or is there a fixed component also?

BASE: There are several ways to minimize the risk of low cooling consumption due to exceptionally low occupancy, for instance during the construction period. Various arrangements can be met, including indeed the setting of a minimum fee per month (take or pay arrangement), which should be lower than the expected average demand of the building.

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Cooling equipment assets are normally transferred to the host entity at the end of typical ESCO performance contracts. How about CaaS -- are assets transferred in the same manner at the end of an "as-a-service" contract?

BASE: There are several exit options at the end of the contract. These include 1) the customer renews the CaaS contract, with the same equipment. The cost of the cooling service will likely be lower because the equipment will have been amortized by then for the solution provider, but this depends on the length of the original contract and the maintenance costs after such a duration. 2) The customer renews the CaaS contract, with a new equipment. The replacement of the equipment might reduce the cooling service due to higher efficiency of state-of-the-art technology or new functionalities reducing operating and maintenance cost. 3) the customer purchases the equipment and decides to operate the equipment by itself; 5) no extension of the CaaS contract is signed and the equipment is not sold either; the equipment owner (which may be the technology provider or the finance provider) can then decide to remove the equipment or leave it at the facilities depending on the market value of the equipment at that time and depending on the agreement with the client.

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Given the assessment of technology risk, how do new technologies break into this space? What is required for 'strong track record'?

BASE: CaaS gives space to technological innovation because it enables a system thinking approach, in which the technology provider has the freedom to include technological innovations to improve the quality and efficiency of the cooling system, for instance to reduce operating costs, as long as it improves the cooling service to the client. This may include for instance passive cooling, thermal storage, or monitoring technology enabling to interact with the grid facilitating, for instance for peak load shaving.

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If a Caas provider is paid per unit of cooling used, is there a conflict with encouraging the users to reduce their overall demand for cooling.

SDCL: we are actively looking at new technology partners for projects financed within the SDCL grant and, indeed, the SDCL grant within the Kigali Cooling Efficiency Program specifically identifies the introduction of new technology focused on improving cooling efficiency and/or reducing the environmental impact of a host's operations.

BASE: There are several advantages of charging the customers per unit of cooling consumed. 1) It incentivizes customers to consume cooling in responsible manner (for instance, closing doors and windows when air-conditioning or refrigeration is being consumed). The technology provider has the responsibility to perform an audit to estimate the cooling demand of the building, and to not oversize the cooling system to adequately respond to this demand. 2) In many businesses, the use of cooling is correlated with the sales of the business (for example hotel rooms). With higher incomes, businesses can afford to pay higher fees for the cooling. With lower incomes, having operationalized the costs of cooling is an advantage. 3) It creates an incentive for the cooling solution provider to reduce the cost to deliver the cooling service, which translated into an optimization of the efficiency performance of the overall system 4) it facilitates the off-balance sheet accounting characterization of the contract.

SDCL: it is also possible for the customer to pay for availability of the equipment and its performance to agreed KPIs (ie efficiency standards). Either way can work.

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Since various hosts will have different credit risks, do you foresee varying tariffs for hosts (possibility for buildings next to each other). I would imagine the tariff agreements between SDCL and the contractor would be using a uniform tariff across projects as contractors would be taking on SDCL risk.

SDCL: Credit risks do vary from one client to another but this is usually managed through appropriate mitigation measures rather than seeking a higher return. In any event the service charge under a CaaS is a composite of several different inputs (capex, O&M, legal and technical due diligence etc) which aren't broken out so what one customer pays can't be directly compared to another.

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Would the “host” be the owner of the building or the tenant? In some Asia pacific countries the owners act more like silent partners and tenants (via tenant organizations) have a more direct say in the day to day operations of the project.

SDCL: The host can be either the owner or tenant but is usually whoever pays the energy bill. As SDCL would normally lease the actual site where the assets are situated the owner may have to be involved anyway on this aspect.

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Would the current low interest rate environment hurt the potential take-up of CaaS? Funding new chiller replacement etc. are cheaper now than ever before due to the economic downturn (lower equipment pricing) and rate cuts (lower cost of leasing/funding).

SDCL: Whilst it’s true that interest rates are very low it’s also the case that companies are increasingly capital constrained and banks are also more risk averse, so debt is not always readily available for every project. More importantly is that under a CaaS the operating risk is carried by the ESCO so chiller performance is guaranteed for the term of the contract. This operating risk issue is a crucial advantage as evidenced by the fact that so many chillers installed and operated under traditional arrangements do not run efficiently and frequently deteriorate with age, becoming less efficient and reliable as time passes.

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Does this platform have any approach which directly makes its standards readily recognizable by institutions such as LEED and WELL for certification fast tracking of any sort?

SDCL: Not formally. All projects that are funded by SDCL under its Kigali Cooling Efficiency Program grant are required by contract to collect and provide performance data (GHG reduction, kW hours saved, energy savings \$), to the IEA, the technical partner of the Kigali program.

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The new Accounting laws indicate that a contract that has over 1 year of commitment or duration is On the Books and not off the books. can you please explain

BASE: The IFRS16 accounting regulations have indeed evolved over the years and make it complex for a contract to be considered a service agreement rather than a lease. In the CaaS contract there is no equipment, there is an output from the installation of the equipment, and this is a fundamentally different proposition. The contracts must address country-specific accounting issues and address key aspects such as supervisory control and ownership of the equipment, the net present value of the contract compared to the value of the equipment, and the end of term conditions.

SDCL: we have direct experience with IFRS 16 and have worked with tax, accounting and legal advisors to ensure that SDCL contracts are in line with new accounting protocols.

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What are the client segments SDCL focuses on? Are these rather large or small clients? What kind of guarantees does SDCL require?

SDCL: Client segments are: Hospitality, Healthcare, Manufacturing and Property/Real Estate. Minimum project size to be considered would be US\$350,000 - US\$500,000.00. The SDCL grant is focused on financing transnational corporations and “replicating” projects: in other words, the focus is not necessarily one building, hotel or hospital but rather a multi-property real estate owner, a chain of hotels or a healthcare system.

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For SDCL, what is the average size of a project?

SDCL: For the current projects at financing stage average size breaks down as: C&I - US\$4.5 million; Manufacturing: US\$4 million; Hospitality: US\$450,000.00.

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What are the key challenges SDCL face in their sales process?

SDCL: There are a number of key barriers to accelerated deployment of CaaS in the Asia region including but not limited to: lack of familiarity with CaaS, Asia cost - sensitivity (ies), estimated contract values are typically too low to be on finance team’s radar, facilities management discipline in Asia is largely reactive not pro-active, disconnectedness between Sustainability, Finance and Engineering teams, cooling and energy efficiency OEMs focus is sales not solution, lack of ESG cognition, in-country lending rates.