Cooling-as-a-Service and Africa's Cold Chain challenges.

A Climate

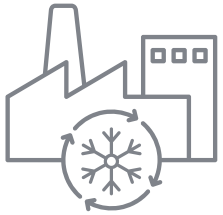
Resilient cold chain.

Samuel Jacobs

ENERGY PARTNERS REFRIGERATION

What is cooling-as-a-service?

TRADITIONAL OWNERSHIP MODEL



Industrial end-user pays for:

Cooling equipment

Operational costs

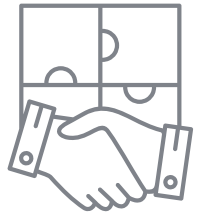
Maintenance costs

Electrical consumption

Repairs and upgrades

Risk Transfer

CaaS



Supplier pays for:

Cooling system

Operational costs

Maintenance costs

Electrical consumption

Repairs and upgrades

End-user pays for:

The cooling used...

at a fixed tariff rate...

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Benefits to clients

Risk mitigation

- EP assumes all risk, client free to focus on core business

Save money and on temperature

- Cooling efficiency guaranteed (best in class CoP)
- Temperature “supply” guaranteed (24/7/365 monitoring)

Zero client capital cost

- 100% off-balance sheet
- EP develops, finances, owns, operates and maintains asset – delivers cooling to client

Transparency

- Contracted cooling tariff

Compliance

- Shift all regulatory risk to EP

ESG

- Increased sustainability/ decreased environmental impact

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African context

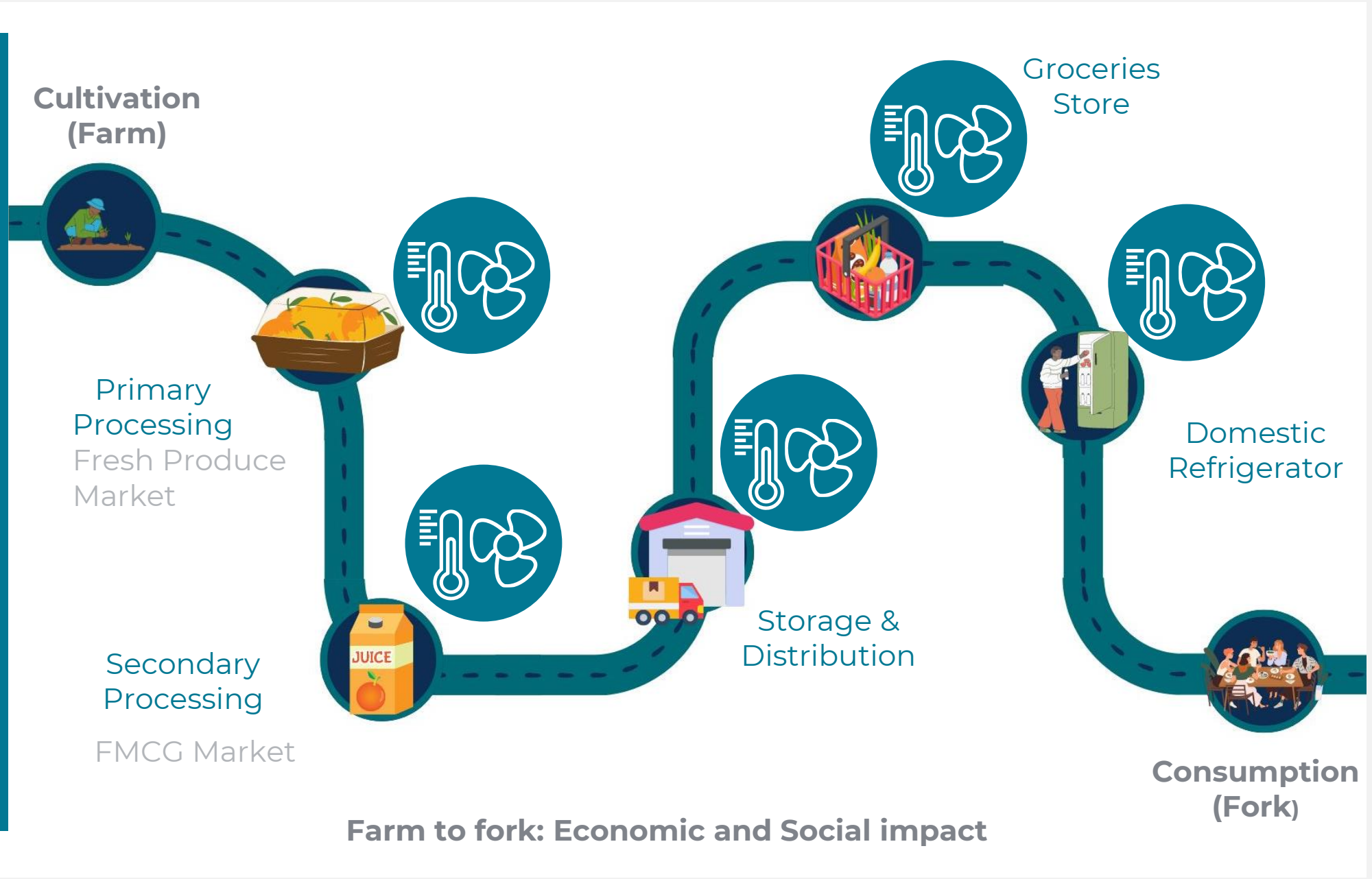
SSA has one of the Lowest GHG emission rates in the world, but when scratching the surface, we see that it's driven by **low levels of industrialisation** and **electrification**. Rural homes are at 25% and urban homes at 43% electrification compared to the global average of 90%.

Sub-Saharan Africa (SSA) has an investment curve of **$120bn for the next decade** for infrastructure by 2035, more than double the total annual investment aid that was directed into the continent.

"A three-pronged problem driving deficits"

This, along with one of the world's **highest food loss** numbers due to absent and inadequate **cold chain** creates uncertainty around sustainability, food security, economic growth and investment.

The cold chain



Farm to fork: Economic and Social impact

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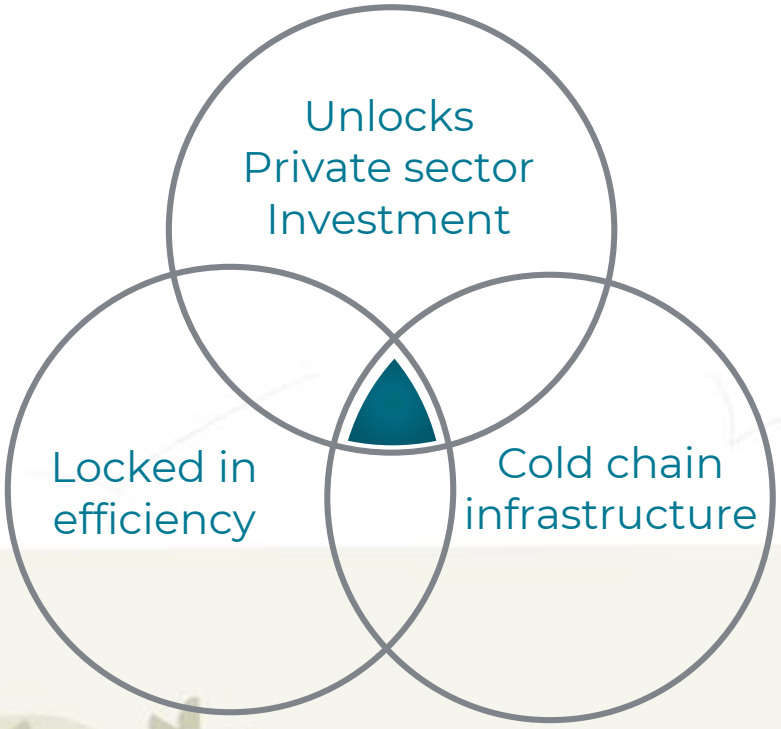
A three pronged problem addressed with CaaS

Sustainability deficit

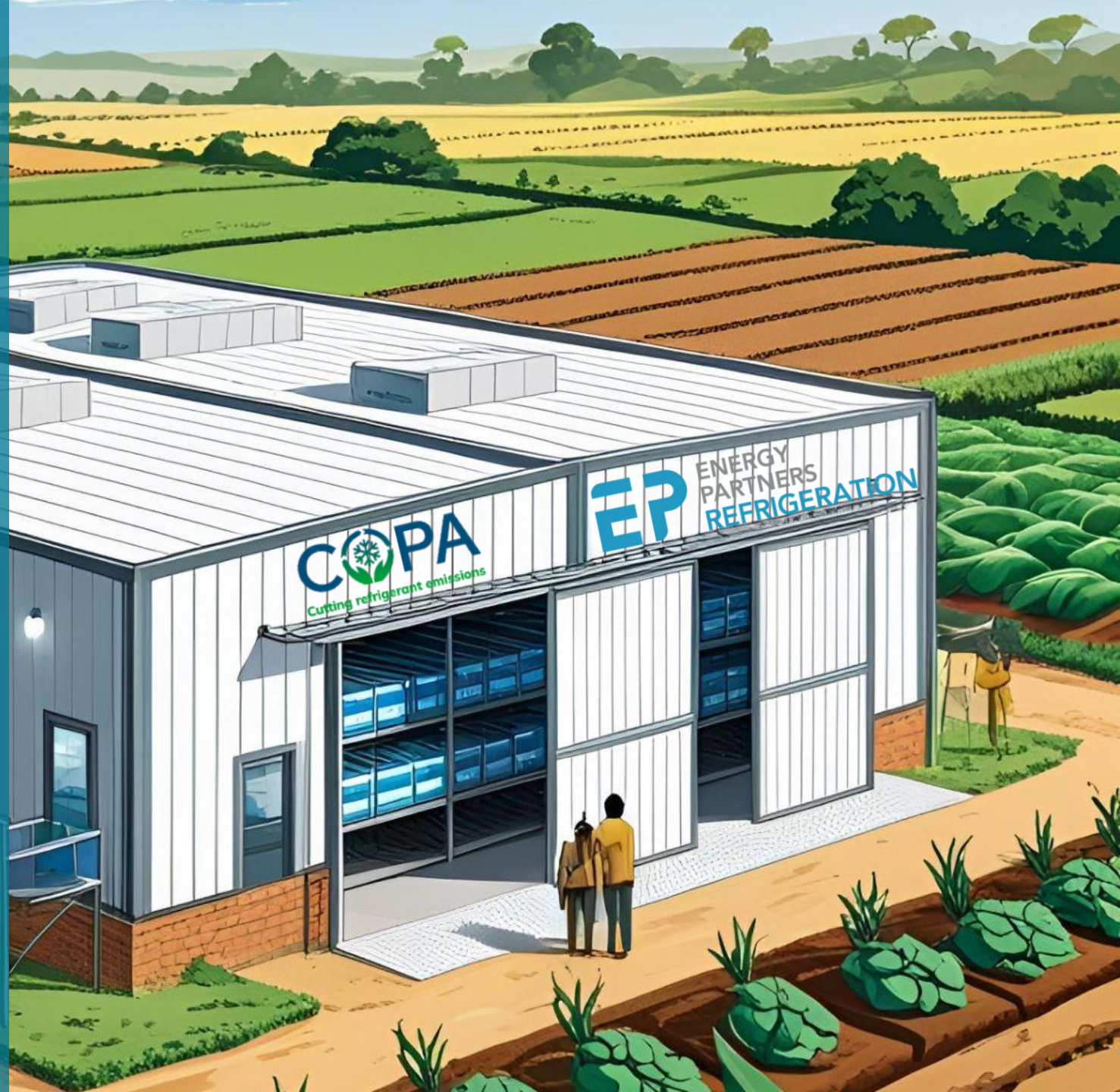
Infrastructure deficit

Investment deficit



Demonstration Pilot Project

High impact business model with Cooling as a Service (“CaaS”) for the agricultural sector in South Africa



Rationale - High impact business model with Cooling as a Service ("CaaS")
for the agricultural sector in South Africa

Project:	**Pilot to prove financial viability of the new CaaS model and get real data for mitigation baseline and future investors for roll-out.**
Problem:	• **Energy consumption** increase when cooling systems are not maintained, e.g. regularly cleaned or leakages repaired. Refilling leaked gas without repair will be costly for both the customer, the environment and a danger to the ozone layer. • **Cooling quality** goes down or become volatile when the cooling system is not optimized. This increase customer costs for electricity while creating loss in sale due to lower-quality products. • **Lack of awareness:** Customers is not aware of the negative impact of a non-optimized cooling system, because it is not their expertise. Cooling technicians focus on quick fixes, such as refill of refrigerants, as they are billed based on the amount of refilled refrigerant and for time spent on repairing systems, often not aware of climate and ozone impact or releasing the gases into the atmosphere.
Approach	**A sustainable CaaS business model that:** reduce emissions**,** serve the climate, protect the ozone layer, free up time for customers to focus on their own business, assure maximum energy efficiency and cooling quality, while supporting South Africa in its effort for food security and a sustainable development, create green jobs.
	Mitigation potential: • **Energy Efficiency (indirect):** Cooling systems assures maximum energy efficiency while providing the highest cooling quality. • **Cooling substance (direct)**: using gases with lower Global Warming Potential while assuring minimum leakage and sustainable end-of-life maintenance of system in accordance with Montreal Protocol.
Solution	Cooling as a Service through a Special Purpose Vehicle (SPV) that is a private partner, who owns sustainable and energy efficient cooling equipment, establish and manage contracts with Technical Provider and small to medium enterprises (SMEs) customers. Thereby freeing up time for SMEs (customers) to focus on their core business while securing quality cooling and climate friendly solutions through a one-stop shop.
Financial Performance	IRR =18% on an 8,6million ZAR investment in the commercial format of the model with a 12% weighted average cost of capital (wacc) at 5% equity.

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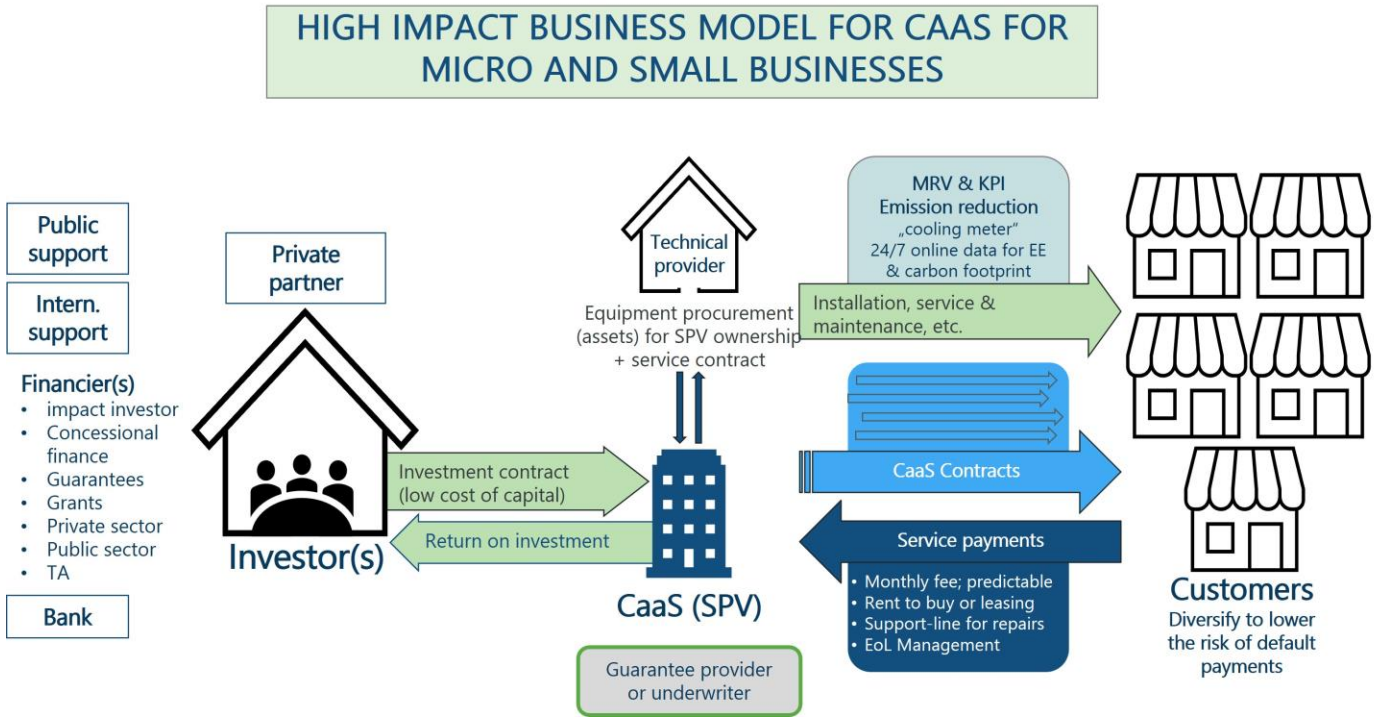
The CaaS Project Business Model

1. ***Special Purpose Vehicle (SPV):***
   Private partner, owns equipment, establish and manage contracts with Technical Provider and customers, coordinate agreements and reporting towards investor(s), assure alignment with regulations and provide required certifications of the management of refrigerants, owner of the verified emission reductions in case of carbon market participation
2. ***Technical provider & service company:***
   Contractual agreement with SPV. Provide procurement for SPV. Provide service for the transport, installations, maintenance, and End-of-Life management of technical equipment towards the customers for the SPV. Provide the ***Monitoring, Reporting and Verification (MRV)*** *of installed system toward SPV. Provide a system helpdesk for customers.*
3. ***Customers / beneficiaries:***
   Contract with SPV, service of payment towards SPV. Contact with technical provider through helpdesk and issues related to installation, maintenance and end-of-life for any technical question and / or challenges of the installed cooling system.
4. ***Investor(s) and private partner(s):***
   Provide different types of investment(s) for the SPV. Receive reports on financial and technical situation.
5. ***Guarantee provider and / or underwriter for SPV:***
   Provide first loss or guarantee for the SPV to reduce the financial risk of the investors.
6. ***Public collaborator:***
   Provide public support and awareness campaigns of the environmental, economic and development benefits of the CaaS model, thereby confirming and manifesting the positive impact of the implemented pilot for the climate, sector, economy and individuals (e.g. health).
7. ***Donors / international support***
   Financing for the phase 1 pilot project to build market trust in the sustainability of the developed business model. International awareness campaigns of the environmental, economic and development benefits of the CaaS model, thereby confirming and manifesting the positive impact of the implemented pilot for the climate, agricultural sector, and economy.



Additionally, the pilot aim to establish **coordination and exchange with relevant national public stakeholder**, assuring that the HFC and indirect CO2eq mitigations are reported adequately e.g. towards the national GHG inventory. This will in turn support South Africa's high-quality reporting towards the Paris Agreement, NDC and NCP targets, SDGs and Montreal Protocol and its Kigali Amendment, thereby also facilitating carbon market activities building on the achieved emission reductions.

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Project commercial model

Years	-	1	2	3	4	5	6	7	8	9	10
Annual Cooling Percentage		100,0%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Annual Cooling Consumption (kWhR'000)		1694	1694	1694	1694	1694	1694	1694	1694	1694	1694
Electricity Unit Cost (R/kWh)		2,52	2,62	2,73	2,83	2,95	3,07	3,19	3,32	3,45	3,59
Cooling Sales Unit Cost (R/kWhR)		1,20	1,27	1,35	1,43	1,51	1,61	1,70	1,80	1,91	2,03
System efficiency rating offered to client		2,10	2,10	2,10	2,10	2,10	2,10	2,10	2,10	2,10	2,10
Estimated maintenance costs		952,93	1010,11	1070,71	1134,95	1203,05	1275,24	1351,75	1432,85	1518,83	1609,96
Construction costs (R'000)	-7700										
Refrigeration system	-7700										
Insulated panels & racking	0										
Civil & Structural	0										
Bridging finance to construct first assets (R'000)	-473										
Efficiency investment to retain efficiency rating	-490										
Total Investment (R'000)	-8663										
EP Cashflow and IRR		1	2	3	4	5	6	7	8	9	10
EPR Investment	-8663										
Cooling Sales (R'000)		2 033	2 155	2 284	2 421	2 566	2 720	2 884	3 057	3 240	3 434
Cooling Sales Electricity Cost (R'000)		-1 334	-1 387	-1 443	-1 501	-1 561	-1 623	-1 688	-1 755	-1 826	-1 899
Scheduled Maintenance cost (R'000)		953	1 010	1 071	1 135	1 203	1 275	1 352	1 433	1 519	1 610
Cost of asset manager (R'000)		-120	-127	-135	-143	-151	-161	-170	-180	-191	-203
Solar Saving Income (R'000)			-	-	-	-	-	-	-	-	-
Additional income (carbon credits, other savings, etc.) (R'000)		-	-	-	-	-	-	-	-	-	-
Additional costs (R'000)			-	-	-	-	-	-	-	-	-
Total Cash Flow (R'000)	-8 663	1 532	1 650	1 777	1 913	2 057	2 212	2 377	2 554	2 742	2 943
Investment IRR	18,61%										

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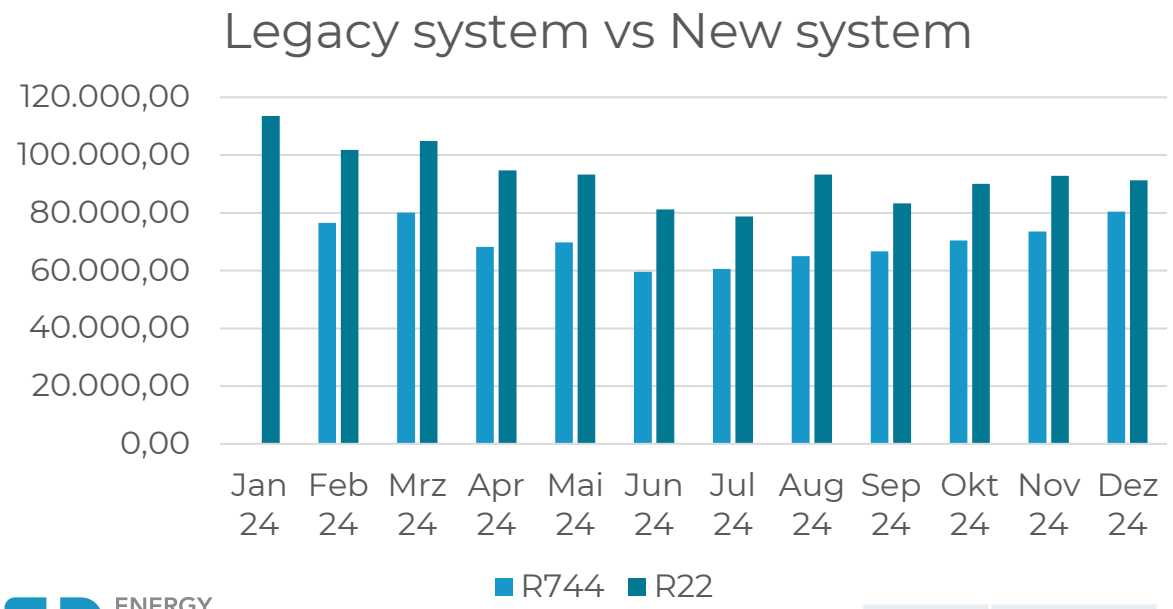
Expected results: Impact on environment

Typical HFC system under 500kWr–

Technical details of existing system

- System capacity _ 255kWr MT and 49kWr LT (estimated)
- Energy efficiency _ 2,21 (estimate)
- Estimated monthly Consumption _ 152 625 kWh
- Refrigerant monthly leakage rate _16kgs
- Evaporating and condensing _ -9/+45°C MT and -36/+45°C LT
- Control philosophy _ On/off
- Control system _ Rack controller
- Installation date _ 2011
- Refrigerant charge (R22) _500kgs



Saving	234 288,00
	23,31%

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The design, therefore, is based on one CO2 transcritical rack with 4 MT, 2LT & 2 parallel compressors providing a total of 284kWr with 240kWr @ -9°C and 43kWr @ -36°C with all necessary components.

One new gas cooler will be installed in existing condenser area, sized for 530kWr @ 93,7bar transcritical. The leading compressors on MT & LT will be speed controlled with a variable speed drive and the lag compressors cycled on and off to maintain constant suction pressure. The new CO2 evaporators will be installed in each room, general cold, liquor store cold room and general freezer room will have two blower coils all other rooms will have one.

Environmental impact

Baseline emissions from physical leakage of the refrigerant is estimated as follows (scope 1):

$BE_y = Q_{ref,BL} \times GWP_{ref,BL}$

Where:

BE_y	= Baseline emissions from physical leakage of refrigerant from the baseline equipment in year y(tCO2e/y)
$Q_{ref,BL}$	= Average annual quantity of refrigerant used in the baseline to replace the refrigerant that has leaked (tonnes/year)
$GWP_{ref,BL}$	= Global Warming Potential valid for the commitment period of the baseline refrigerant (tCO2e/t refrigerant)

= 0,192 x 1780*
= 341,76 tCO2e

*GWP information obtained at:
https://wedocs.unep.org/bitstream/handle/20.500.11822/28246/7789GWPRef_EN.pdf?sequence=2&isAllowed=y

The South African Treasury benchmarks the emissions intensity based on the UNIDO Global Industrial Energy Efficiency index. An indicative value of 0,94 tCO2e/MWh has been derived.

Baseline emissions from annual consumption savings are calculated as follows (scope 2):

Annual consumption saving = 234,288MWh

Baseline emissions avoided from consumption savings = 234,288 x 0,94
= 220,23 tCO2e

The total scope 1 and 2 emissions avoided is 341,76 + 220,23 = 561,99 tCO2e

Project target segment

New and efficient technology is generally aimed at premium markets leaving base markets behind and creating new forms of inequality as countries and industries look to become more sustainable.

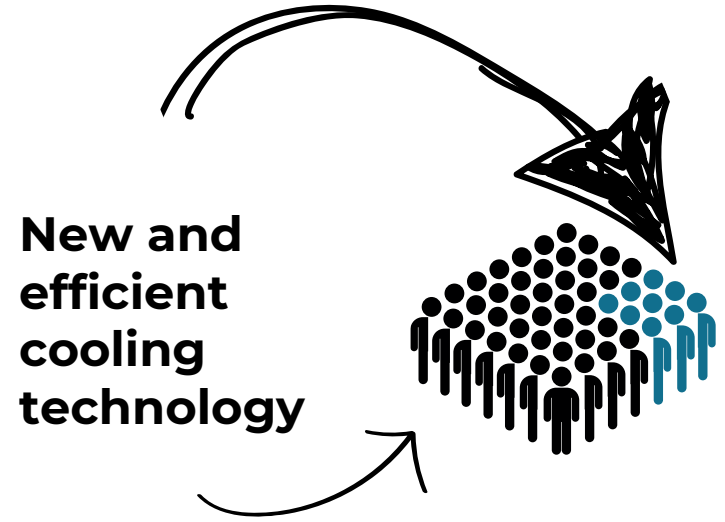
The pilot will test the developed business model for Cooling as a Service in South Africa. The pilot is the first phase of a 3-step approach, testing the financial model in an agricultural environment. The second step will be an urban pilot, and the third phase will be the full roll-out and scale-up of the model in South Africa.

By supporting an agricultural business such as a small dairy processor with an energy and efficiency optimized cooling-system provided as a service (under 500 kWr systems, with at least 240.000 kw/h per year consumption), real data will be collected to assess the economic and technical viability as well as the environmental impact of the model.

The cooling system will be monitored through a 24/7 online built-in MRV system, a “cooling-meter”, assuring maximum energy and quality efficiency is met for the customer. **The efficiency of the system will reduce monthly energy costs while maximizing high equipment performance, enabling the customer to produce quality output to a lower energy price and reduced CO2 emissions compared to BaU (Business as usual).** This will free up customer resources and capacity to pay a monthly fee for the cooling as a service.

In the commercial format of the model, the CaaS provider will be set up as an SPV, owning the equipment and managing the customer contracts, the technical service provider and reporting to the investors based of the MRV data. The procurement, installation, maintenance, and service of the equipment will be done by the technical provider, sub-contracted by the SPV. The cooling equipment installed will be serviced in alignment with the highest environmental standards, minimizing emissions from the system, including sustainable end-of-life management of both the previous (if any) and the newly installed cooling appliances / system. Thereby enabling emission reductions for hard-to-abate sectors and companies with small balance sheets, while providing a return on investment, making the model financially sustainable.

Traditionally aimed at Premium Markets



Our proposal to aim at Base Markets

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Closing

To scale CaaS, we must **CHANGE THE WAY** we think about how the environment is impacted by legacy cooling systems in base markets. Without transitioning base markets, we cannot **secure a future with efficient, affordable, and reliable cooling energy** to feed Africa's growing population

Afterall, it's a global narrative because Africa's energy future will impact global sustainability goals.

Let’s collaborate, connect and change our future together. We are standing at the edge of doing something great.

thank you!