Green Cooling Summit 2023

Cooling as a Service to drive sustainable cooling

Dawie Kriel

Energy Partners

Servitisation

Finance is sourced by the supplier and ownership remains with them

Takes the asset off-balance sheet for the end user – pay for outcome

Efficiency and uptime risk now remains with supplier

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Outcomes:

- **Life cycle cost** now drives decisions on capital cost, technology and service
- **Energy waste** is reduced (by at least 15%) over the full life of the system because someone (best suited) is accountable
- Product quality increase and losses reduce leading to higher **profits** for end-user
- **Sustainable** cooling is achieved

Life Cycle Cost

Refrigeration systems lasts 15 to 25 years!

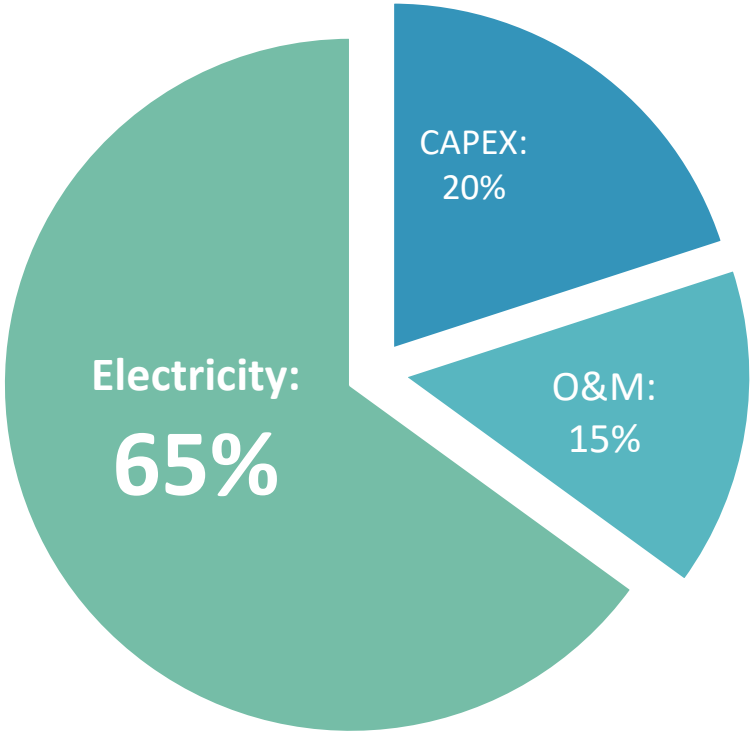
It’s a long-term driver of success or failure for users

Indirect costs can be an order of magnitude bigger than some of the direct costs (maintenance)

- **Life Cycle Cost** (LCC) analysis of refrigeration systems is the only way to ensure that all the cost elements have been considered for comparison
- Calculation of the **cumulative direct and indirect** costs over time is required
- Direct costs are:
  - Cost of energy used to generate cooling
  - Cost of capital investment/s
  - Cost of maintenance
- Indirect costs are:
  - Losses due to temperature security issues
  - Losses due to lack of management focus
  - Carbon emission impact

+65%
of direct LCC of
cooling is electricity

* Driven by both consumption and unit cost



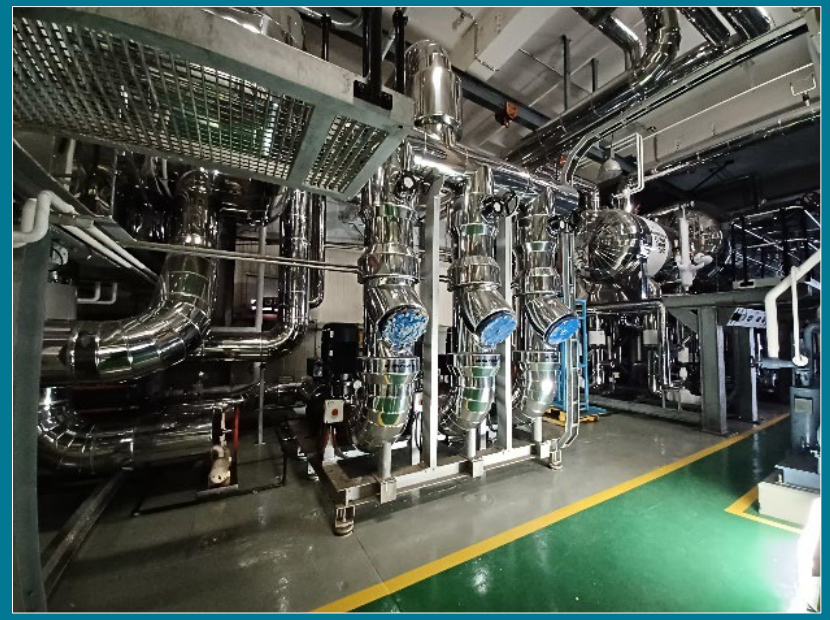
Electricity *drives the* ***cost of cooling****, yet in practice* ***only temperature*** *is measured*

Because ***you only control what is measured****, the* ***misplaced focus*** *on Capex and O&M savings drives the cost of electricity higher in the long term*

EXAMPLE *(What <u>should</u> happen)*

Ammonia plant: 1000 kWR/0°C:

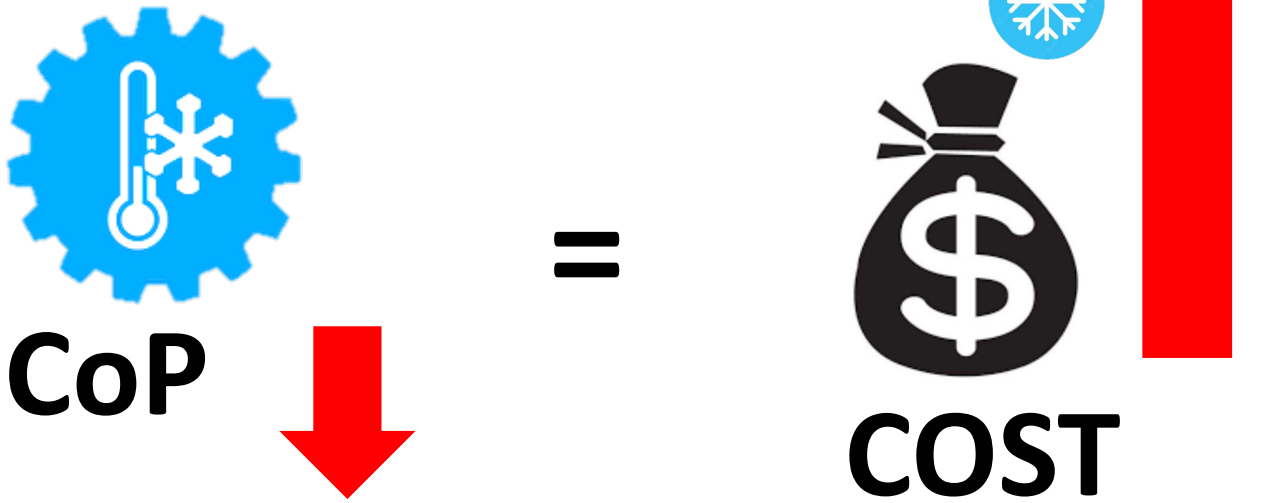
- **CAPEX:** $1,5M
- **CoP:** 3
- **Electricity:** ~$4M (NPV, 20 yrs)
- **O&M:** 3% x CAPEX/yr



EXAMPLE *(What <u>does</u> happen)*

- **Low-cost** technical solution saves 15% Capex
- **CoP degradation:**
  - 3-4%/ year (reduce maintenance by 50%)
  - CoP = ~1,8 after 20 years
- Electricity: $6m *(increase of $2m)*
- Maintenance “reduced” by $200k

- **Lifecycle cost is $1,6m higher**



Opportunity to combine other servitised technologies

Example done here was for Solar PV and BESS

Solar PV doubles the savings and supplies 20% of the electricity per year from the sun, this can be more if feed-in tariffs are favorable

Battery energy storage increases the cost of self generation, but saves significantly on diesel in countries with poor grid reliability

Note that additional Bess savings in terms of temperature security will be realized

LCC simulation done with digital twin model

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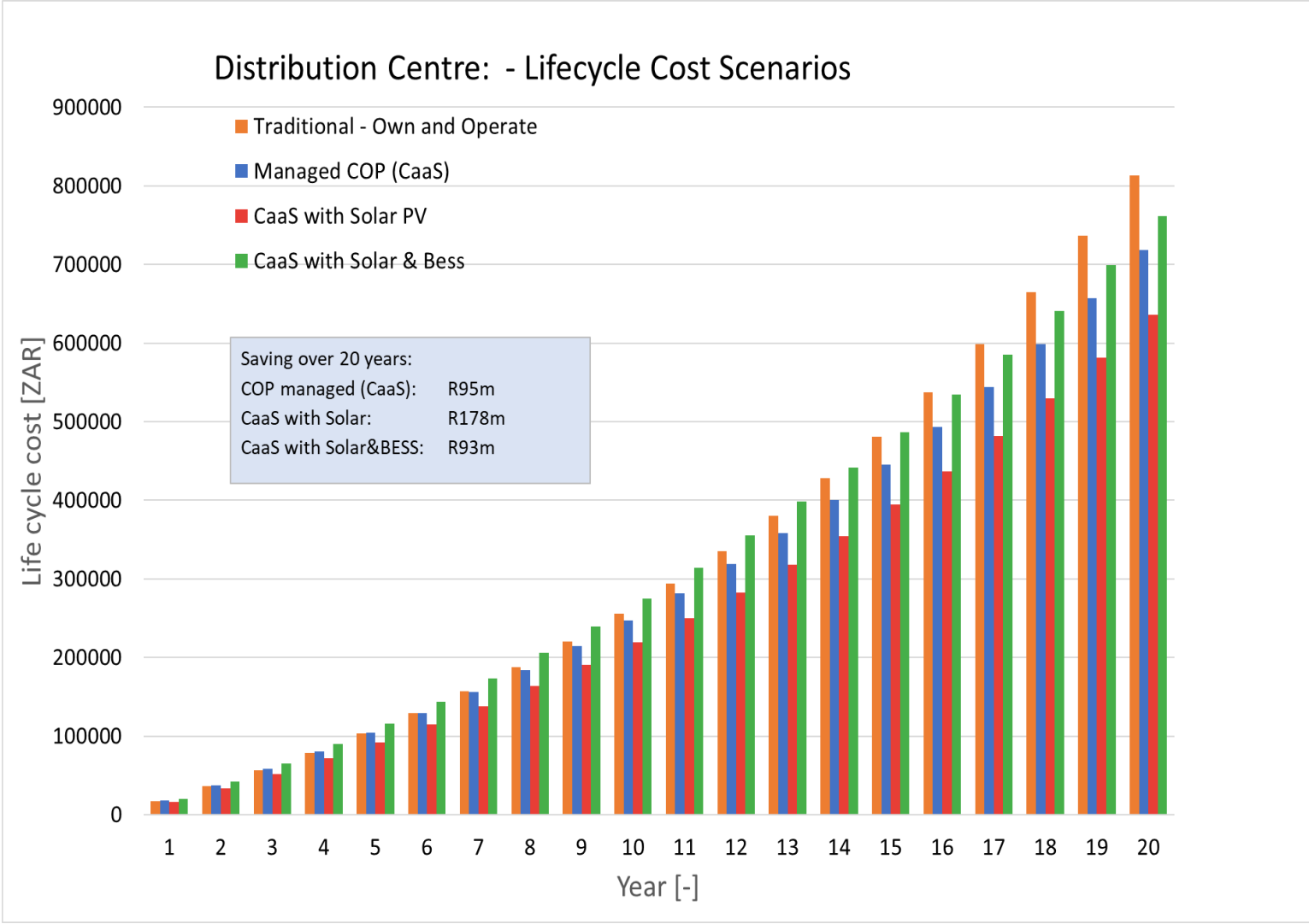

- **Clover Queensburgh (2022):**

- **R330m** – total project value
- **Zero client capital** – EP made full investment
- **Integration** of:
  - **10MWR Refrigeration** system (ammonia)
  - **50MWth Steam**
  - **1.5MW solar**
- **CaaS Premium** contract
- **R70m (NPV)** – savings resulting from CaaS contract over 20 years
- **1800 kWp solar system**

CaaS

New CaaS Plant Efficiency (CoP) increase

40%

Emission avoidance (MT) over 20 Years

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Solar-Assisted CaaS – Energy supplied through Solar

16%

- **Dawie Kriel**
- General Manager Refrigeration
- Dawie.kriel@energypartners.co.za