

Introduction to Cooling Outsourcing

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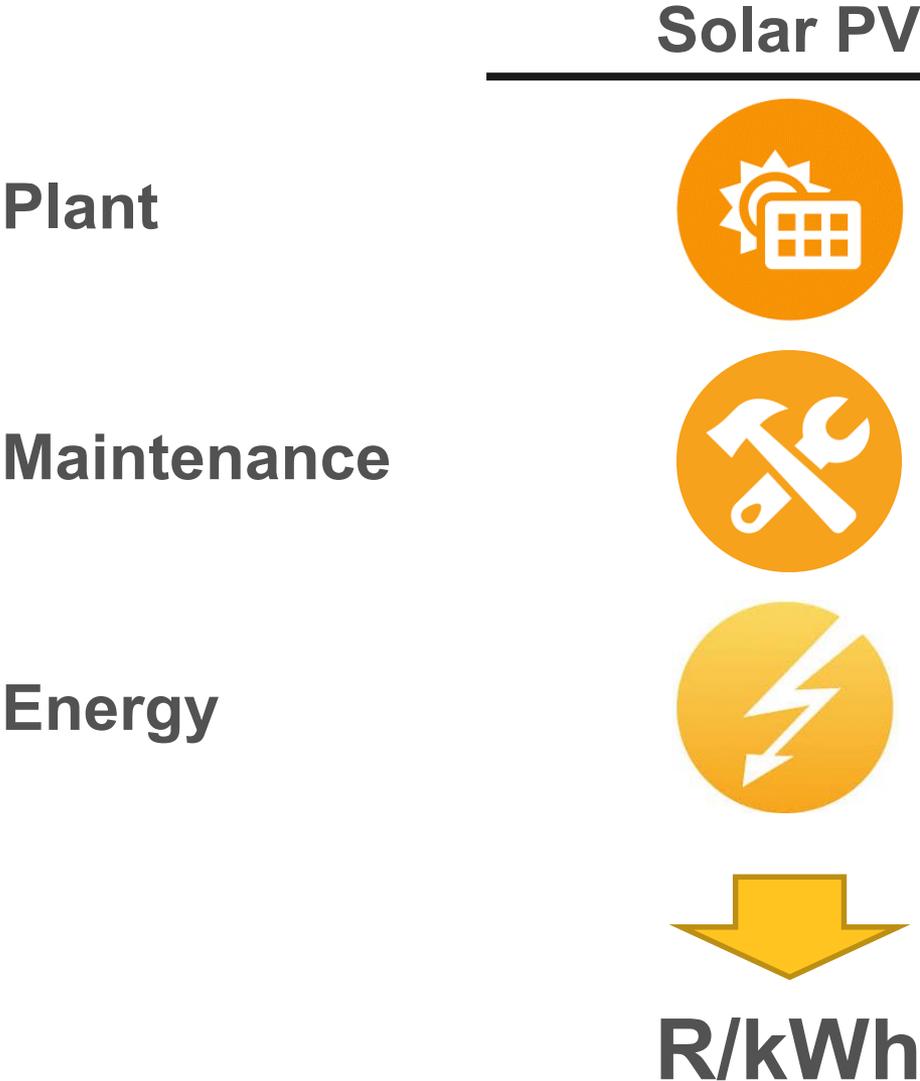
Executive Summary

- What is outsourcing?
 - The PPA model
- Why is outsourcing a good idea?
 - The new Service Level Agreement
 - Life Cycle cost
- The cooling meter
 - Use a single metric (R/kWh_R) to determine cost of Cooling
 - How does it work?
- Examples of outsourced plant
 - Retail
 - Industrial

What is outsourcing?

- An example of outsourcing often used is the private and independent generation of electricity which is then sold into the national grid, so called Power Purchase Agreements (PPA) between developers and government (ESKOM)
- Other examples is the production of steam in boilers and the selling thereof to one or more customers on a R/ton basis across the fence
- In short it means that the buyer is only interested, and pays only for, the measured output of the system, be it kWh's of electricity or tons of steam

PPA model for “Electricity Sales” for Solar (PPA)



Why is outsourcing a good idea?

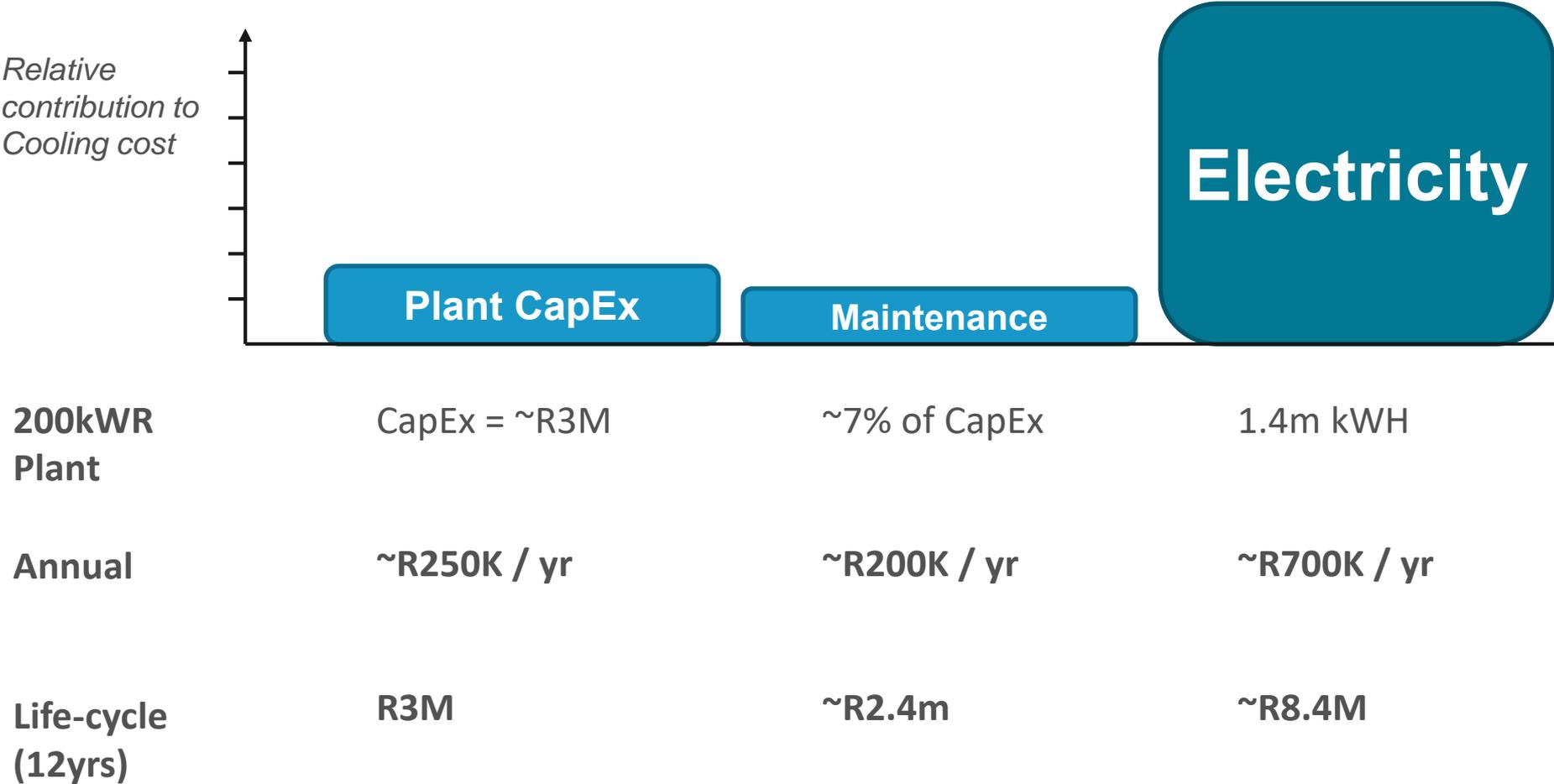
- In the traditional refrigeration system ownership model, the consumer of cooling specifies and acquires the plant, pays for it to be installed, pays for it to be maintained (in some cases) and then pays for the electricity consumed during operation
- The service level agreement (SLA) makes provision for planned maintenance actions, sometimes has a temperature specification (if recorded) and might also include unplanned maintenance
- There is almost never an energy efficiency metric to be adhered to
- **In short, the USER PAYS for everything and has to take all the risk with a relatively short guarantee period of 1 year**

Traditional model: Buy a plant, and pay for the maintenance and electricity consumed by the plant



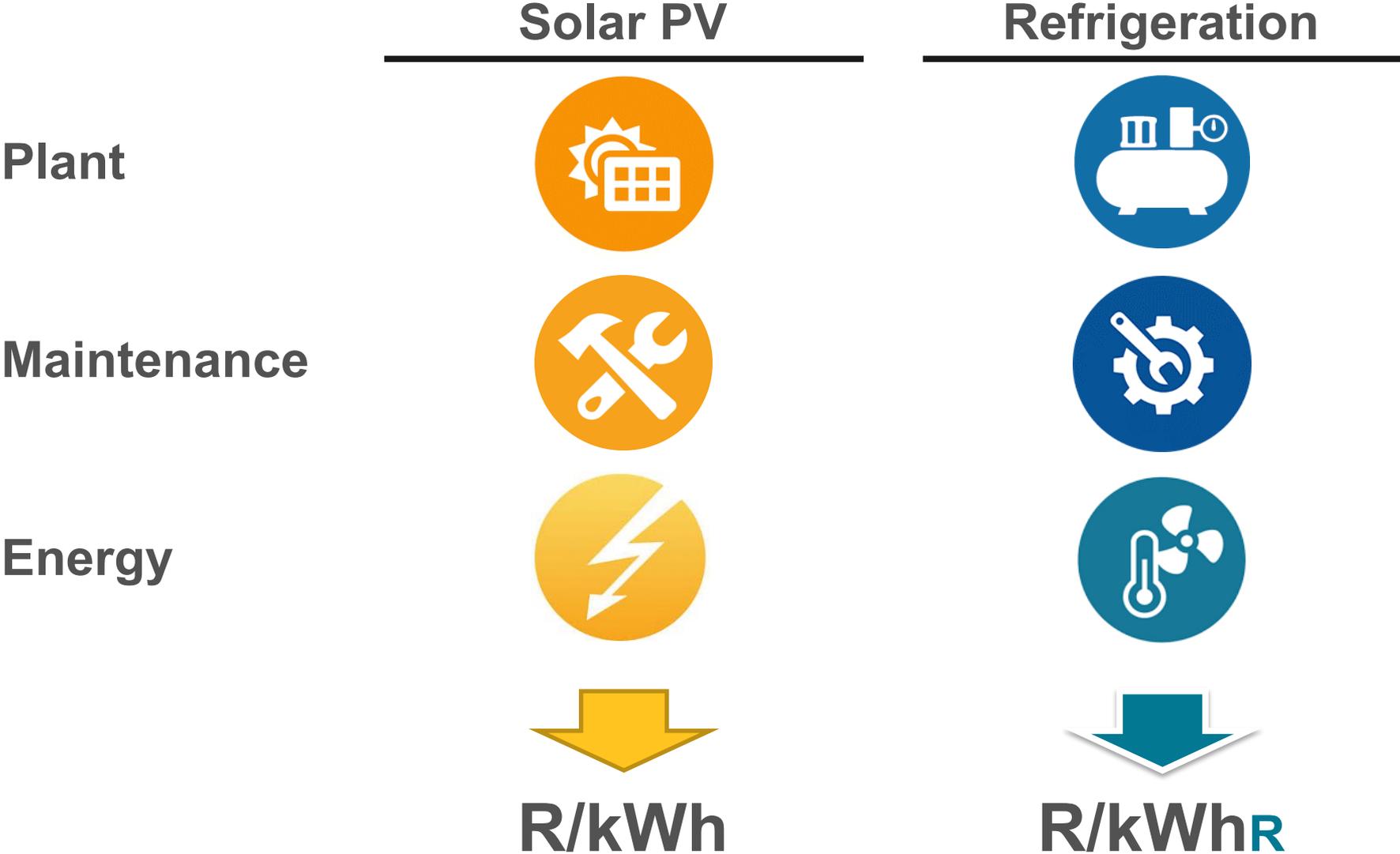
*No incentive for efficient conversion from
Electrical Energy to **Cooling Energy***

The lifecycle cost of a refrigeration plant* is dominated by the cost of electricity *(200kWR plant example)*



*Retail example

“Cooling Sales” model for Refrigeration is similar to the “Electricity Sales” model for Solar (PPA)



In an **Outsourced model**: Client only pays for the actual cooling produced by the plant.



THE NEW SERVICE LEVEL AGREEMENT:

Incentivise efficient conversion between **Electrical Energy** to **Cooling Energy**

Incentivise the optimisation for lifecycle cost: **CapEx vs. Maintenance vs. Energy**

A “cooling meter” is required to allow for a single metric to balance complex trade-offs

Plant:

- Optimise design for Life-cycle performance
- Need to evaluate in context of Maintenance & Energy
- R/kWh_R to benchmark



Maint:

- Optimise mix between preventative & reactive maintenance
- Ensure highest availability
- R/kWh_R to benchmark



Energy:

- Optimise control to obtain best COP*
- Ensure plant maintained close to design spec
- R/kWh_R to benchmark



R/kWh_R

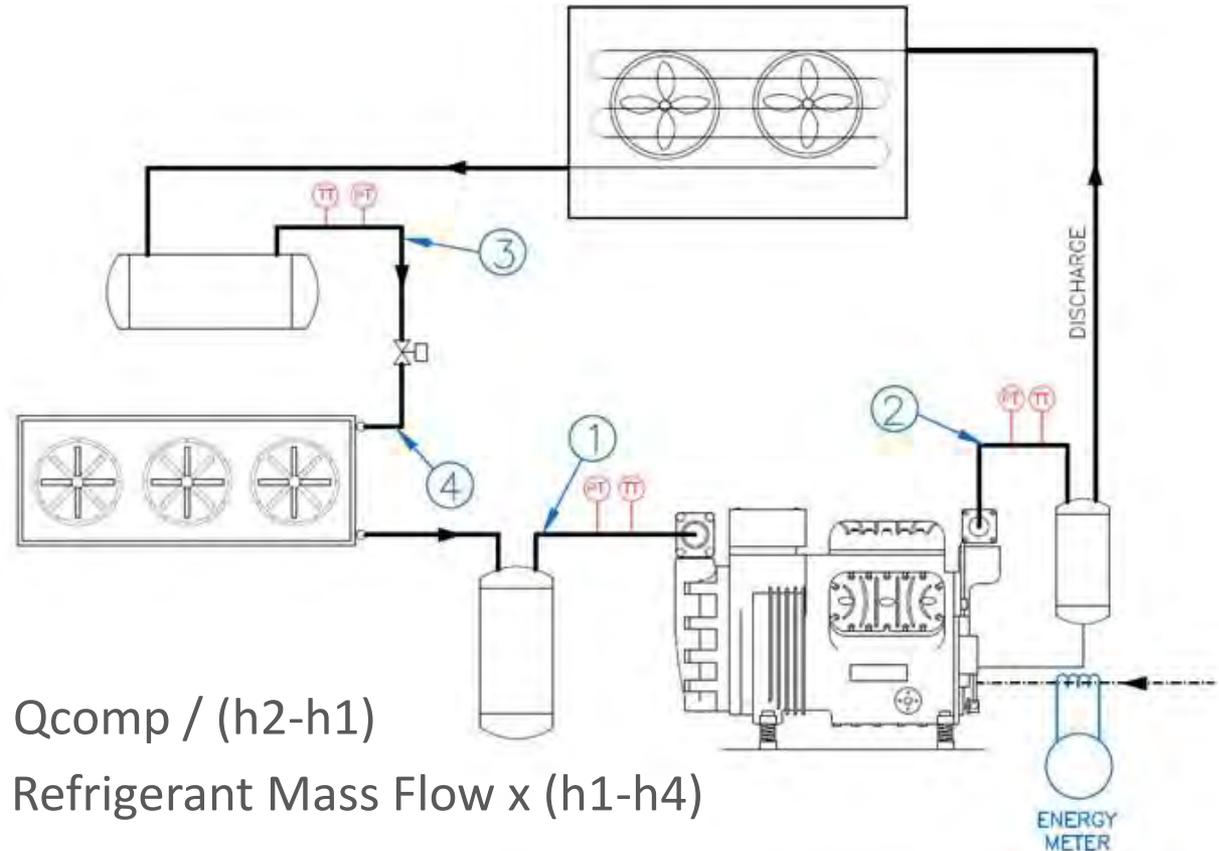
A single metric to balance complex trade-offs

How does the cooling meter work?

Accepted and proven method of refrigeration performance measurement under field conditions:

Other users of this method include:

- Nordtest
- ASERCOM
- ClimaCheck
- Various OEMs



$$\text{Refrigerant Mass Flow} = Q_{\text{comp}} / (h_2 - h_1)$$

$$\text{Cooling Performed} = \text{Refrigerant Mass Flow} \times (h_1 - h_4)$$

Where:

h = Enthalpy (calculated from pressure and temp. measurements)

Q_{comp} = Compressor energy input, less heat loss from compressor.

Examples of applications in the field

- Pick n Pay family store, Darras
 - New refrigeration plant installed in March 2017 with store upgrade
 - Supplies an average of 50 900 kWhR per month with a 37% saving in energy cost
 - Client receives weekly temperature and energy dashboards to assist in management of cooling use and temperature monitoring



Examples of applications in the field

- GWK abattoir, Kimberley
 - New CO₂ heat pump system installed to provide hot water at 85°C
 - Client is billed a fixed monthly fee for the supply of hot water
 - Approximately 50% saving on electrical generated hot water



Benefits of Outsourced Cooling model

End user benefit from:

- Cash in hand today (***“Clean-up your Balance Sheet”***)
- Eliminating headaches as supplier take full responsibility for delivering cooling (***“Transfer management/risk responsibility”***)
- Better temperature control and improved maintenance (less unplanned surprises) as service provider is correctly incentivised (***“Get better product at lower cost”***)
- Guaranteed efficiency locked into the cost of cooling as profitability of service provider depends on this (***“Optimised life cycle cost”***)



Thank you!

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