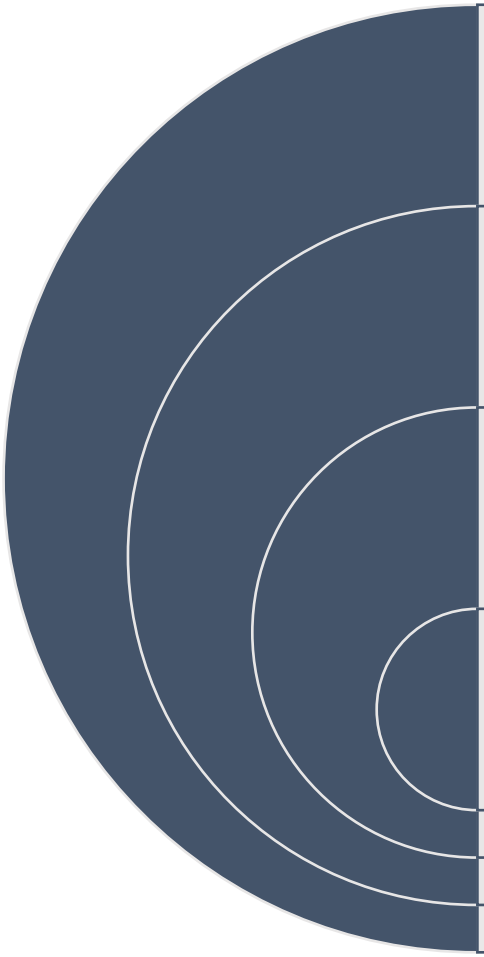
Peter Hopton

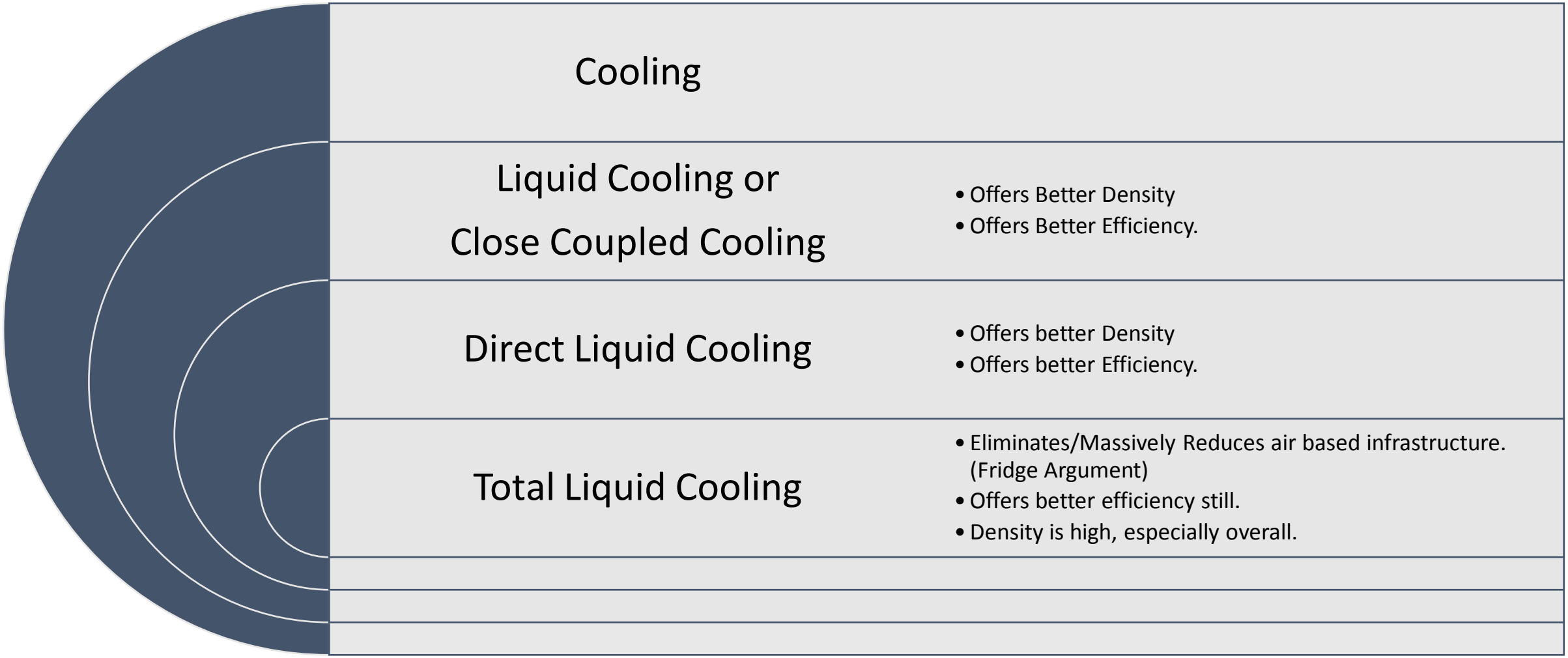
Founder & Chief Visionary Officer, Iceotope

From Air To Liquid



Cooling	
Liquid Cooling or Close Coupled Cooling	• Air is passed through servers and then through a rear door or in row air-water heat exchanger.
Direct Liquid Cooling	• Liquid is taken direct to some components • Fans are still needed.
Total Liquid Cooling	• All components are cooled directly by liquid. Air side losses are minimised. • Inside the DC, the system has no fans and breathes no air.

The Benefits of Liquid Cooling Technologies



ASHRAE Water Cooling

Table 5.1 ASHRAE Liquid Cooling Guidelines

Liquid Cooling Class	Typical Infrastructure Design		Facility Water Supply Temperature
	Primary Facilities Cooling Equipment	Secondary/Supplemental Cooling Equipment	
W1	Chiller / Cooling Tower	Water Side Economizer (with Dry Cooler or Cooling Tower)	2°C – 17°C
W2			2°C – 27°C
W3	Cooling Tower	Chiller	2°C – 32°C
W4	Water Side Economizer (with Dry Cooler or Cooling Tower	N/A	2°C– 45°C
W5	Building Heating System	Cooling Tower or Dry Cooler	>45°C

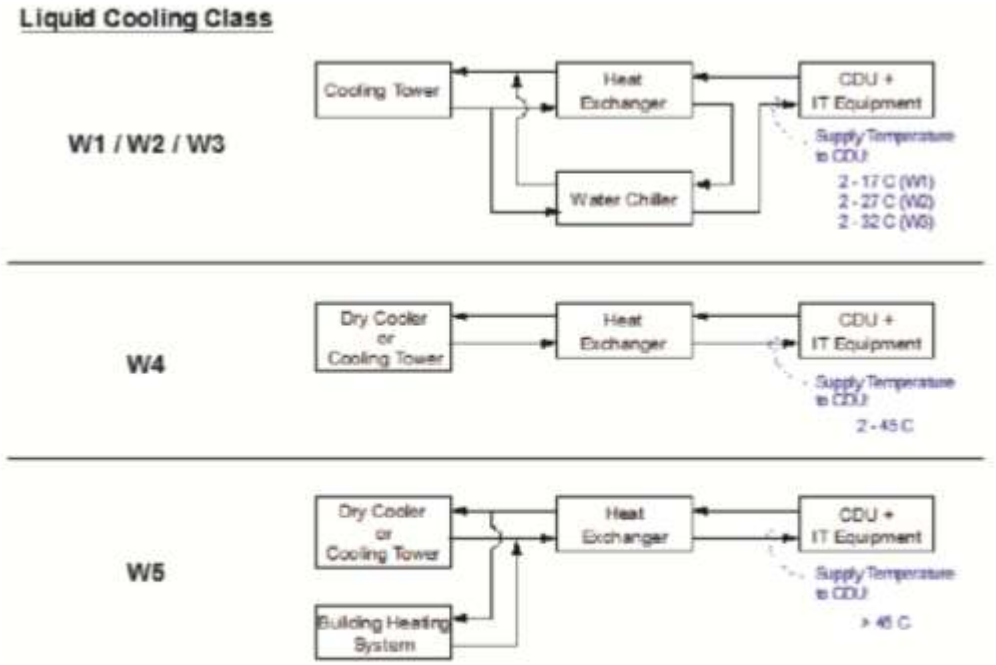
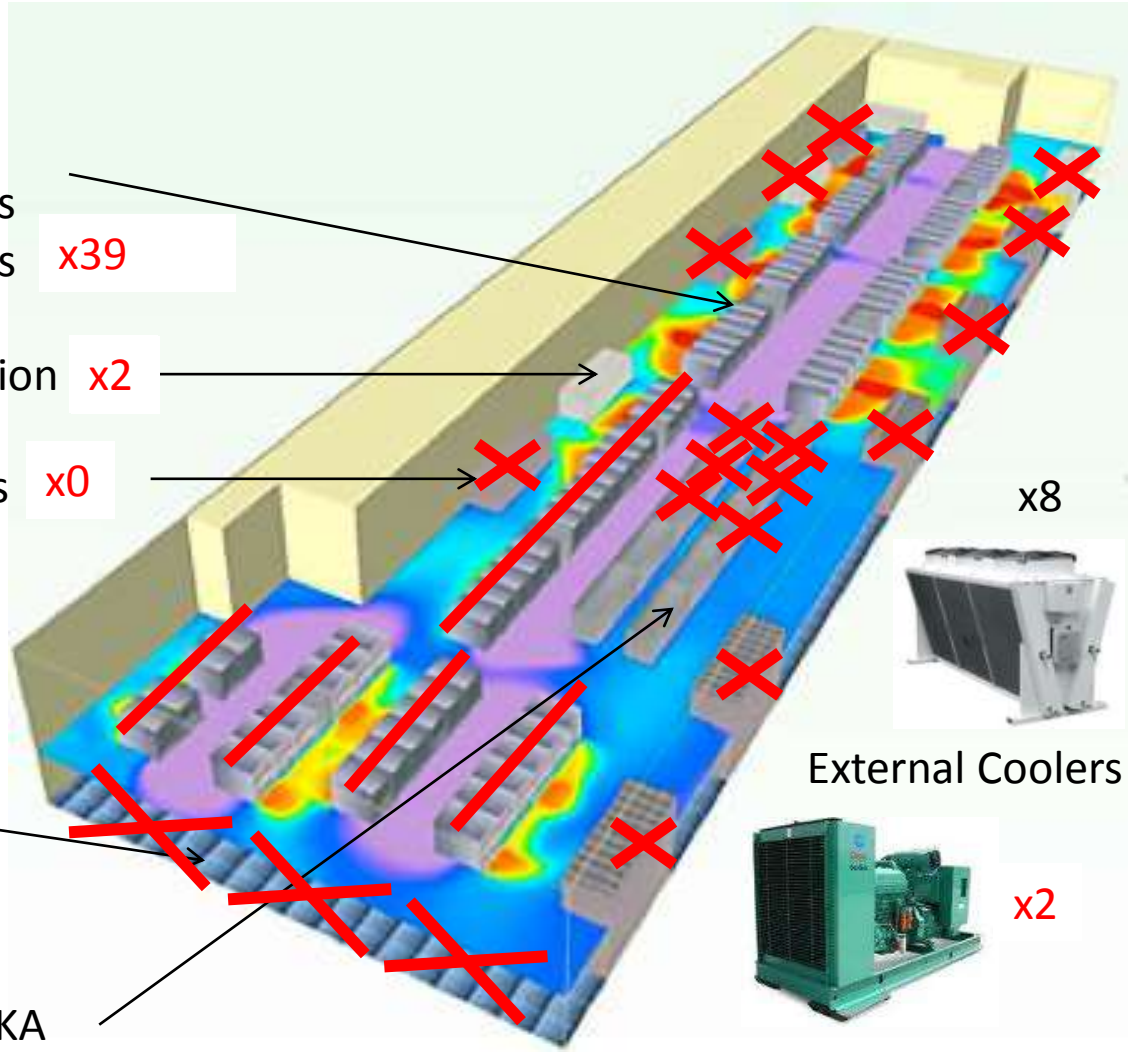


Figure 5.3 ASHRAE liquid cooling classification, typical infrastructure design schematics.

TOTAL LIQUID COOLING



IT Cabinets
AKA "Racks"
Each contains
10-20 Servers x39

Power Distribution x2

Air Conditioners x0

Raised Floor

Back Up
Batteries AKA
"UPS" x4

x8

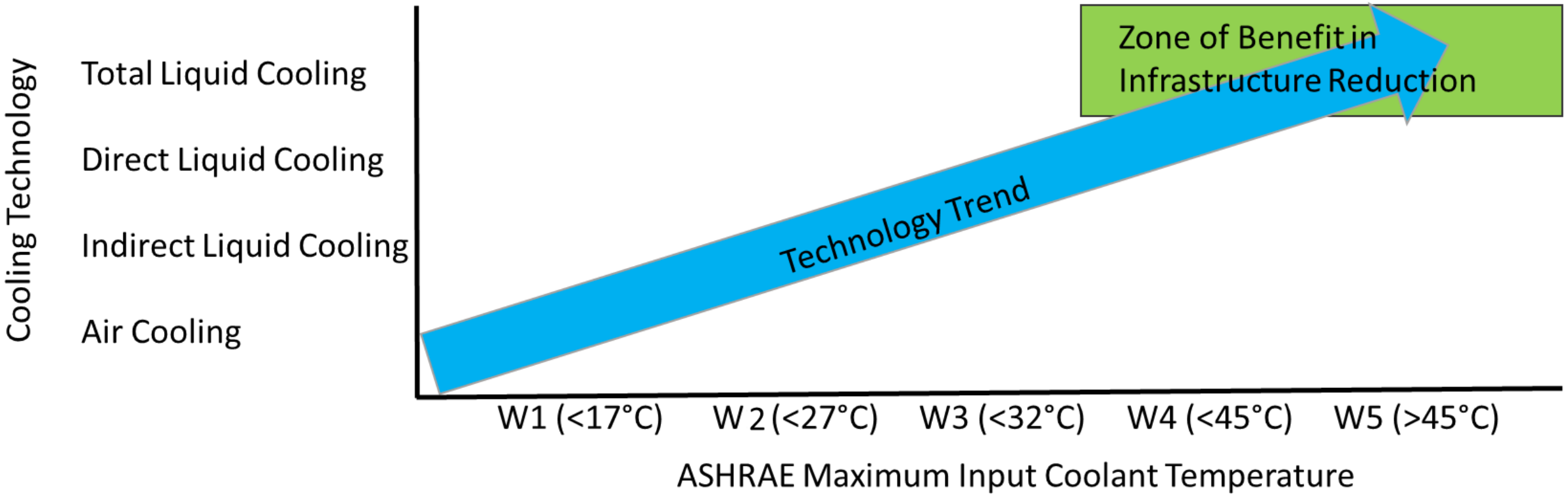
External Coolers

x2

Generators

1. TLC needs no A/C
2. No Airflow, no raised floor
3. TLC servers have no fans – use less power
4. No A/C, average and peak power consumption reduced
5. At least 2x as many servers per Cabinet

The Cost Reduction Oasis



Questions?

Thanks For Listening

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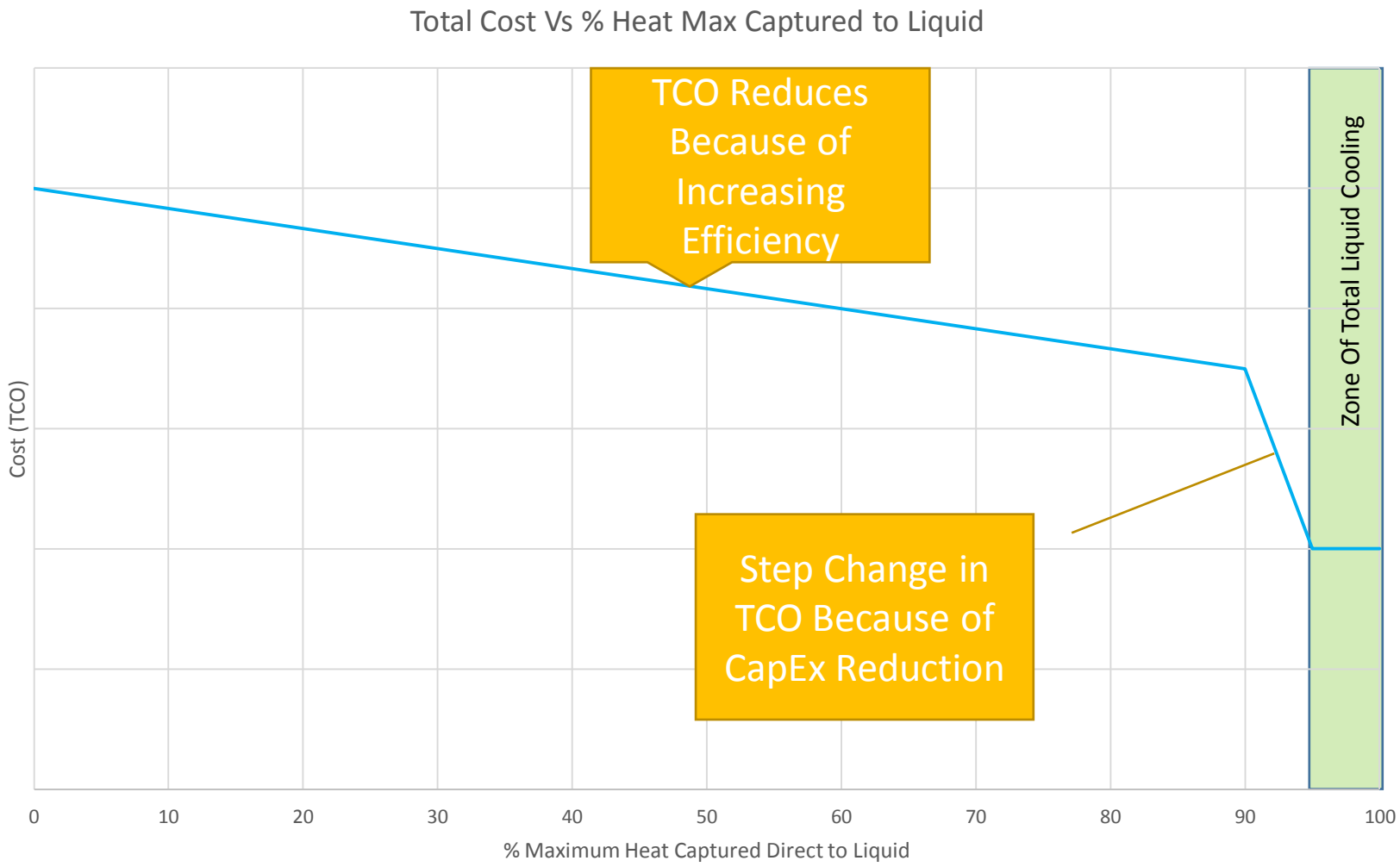
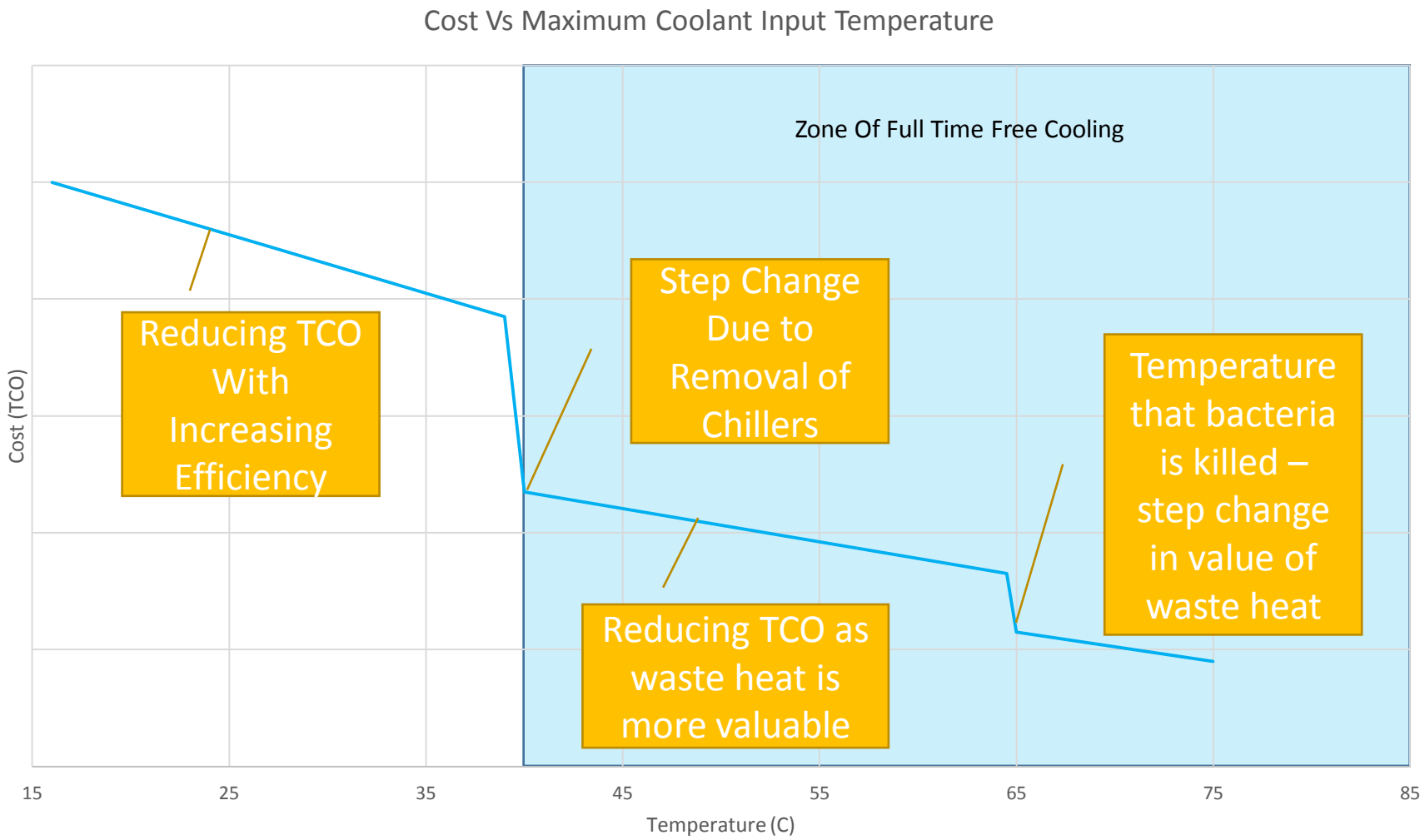
Reserve Slides

Cooling With Liquids



Not to Scale, general trend illustrated, situations may vary results

Hotter Coolants Reduce Cost



Not to Scale, general trend illustrated, situations may vary results

Who Will Adopt Early?