



THE COLD STORAGE COMPARISON

-THREE APPROACHES

-SAME EXPECTATIONS

VIEWED THROUGH

A PHARMA 4.0 LENS

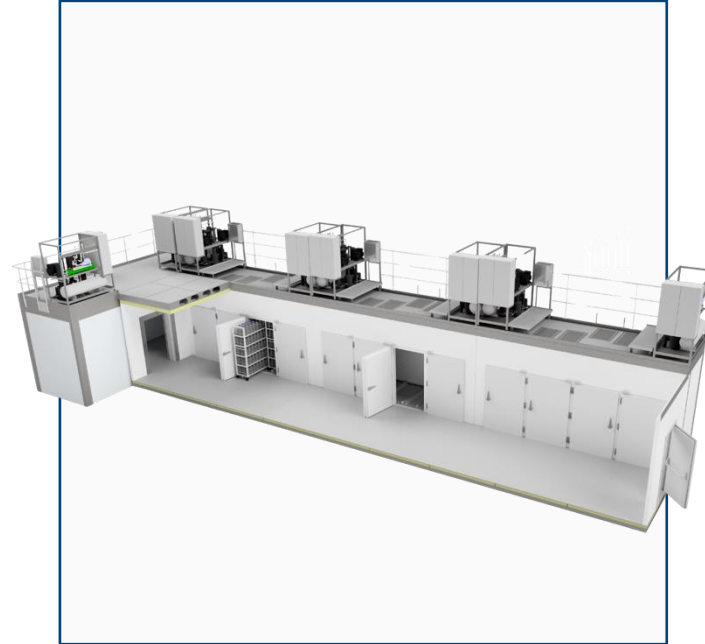


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WAYS TO BUILD COLD STORAGE CAPACITY



FREEZER FARM



**LARGE-SCALE
INTEGRATED**

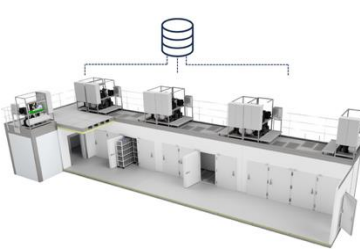


GMP COLD ROOM

CAN IT CONNECT & TURN DATA INTO INSIGHTS?

CONNECTED & DATA DRIVEN

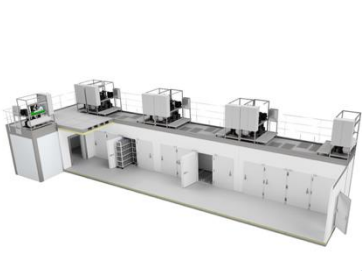


CONNECTED & DATA-DRIVEN IMPACT		 FREEZER FARM	 LARGE-SCALE INTEGRATED	 GMP COLD ROOM
 Connection with data ecosystem (ease of integration)				
 Consolidated number of data sources				
 Reduced monitoring burden				
 Reduced alarm-management burden				
 Predictive Maintenance Potential				

CAN IT ADAPT & PROTECT?

ADAPTIVE | RESILIENCE

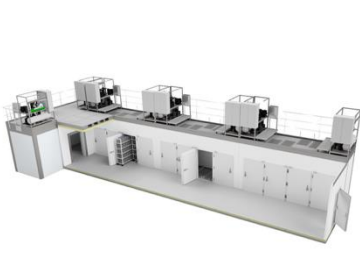


ADAPTIVE & RESILIENCE IMPACT				
		FREEZER FARM	LARGE-SCALE INTEGRATED	GMP COLD ROOM
	Ease of capacity expansion			
	Flexibility of set points/zones			
	Product-temperature uniformity			
	Build-in redundancy (if a unit falls)			
	Temperature Recover			
	Ability to accomodate future requirements			

CAN IT SCALE WITHOUT ADDING COMPLEXITY?

HUMAN-CENTRIC & RESOURCE EFFECTIVE

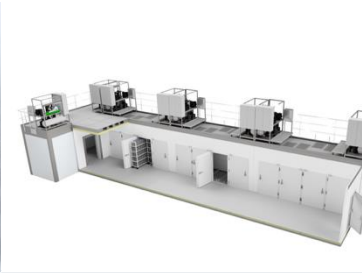


OPERATIONAL & RESOURCE IMPACT	  		
	FREEZER FARM	LARGE-SCALE INTEGRATED	GMP COLD ROOM
 Minimize floor space required			
 Minimize energy consumption			
 Minimize heat rejection			
 Minimize CO ₂ emissions			
 Minimize monitoring burden			
 Minimize maintenance burden			
 Minimize validation burden			
 Products be accessed without personnel entering ULT environment			

SO, HOW PHARMA READY ARE THE THREE APPROACHES?



PHARMA 4.0 PRINCIPLES



FREEZER FARM

LARGE-SCALE INTEGRATED

GMP COLD ROOM



CONNECTED

Can it connect storage with facility data eco-system to simplify overview?



DATA-DRIVEN

Can it enable data-driven decisions?



ADAPTIVE

Can it adapt to changing needs and conditions?



RESILIENT

Can it maintain temperature during normal operation.



HUMAN-CENTRIC

Can it reduce the operational burden on people?



RESOURCE-EFFECTIVE

Can it minimize space, energy and infrastructure requirements?





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