



+

HANBURY

CONTROLLED ENVIRONMENTAL ROOM (CER) REFRIGERANTS: A CASE STUDY



HAYDEN LANE
NOVO NORDISK
Environmental
Engineer +
Sustainability
Partner



SARAH CORBITT
HANBURY
Senior Lab Planner
+ Architect



International Institute for
Sustainable Laboratories

LEARNING OBJECTIVES



Learn about a global company's cGMP facility sustainability roadmap to implement operational and design policies which are zero-Global Warming Potential (GWP) and zero-Ozone-Depleting Potential (ODP).



Describe the method of specifying, designing to, bidding, negotiating contracts, and building for more environmentally-friendly controlled environmental room refrigerants.



Compare common refrigerants which are available in non-major markets in the United States.



Identify common areas where Design Team members can affect CER refrigerant selection and specification, operations, and bidding and procurement.

The facility
1.4 million SF





**FOR circular
zero**

We are focusing on four **must-win** challenges

#1

Reach more patients

#3

Reduce CO₂ emissions



#2

Develop new business models for preventing obesity

#4

Reduce the plastic footprint from our products

Circular for Zero addresses the entire value chain with 7 strategic projects



1. Reduce supplier footprint
2. Ensure circular procurement



3. Get to Net Zero CO₂ from all our activities – scope 1, 2 and 3
4. Eliminate waste of energy, water and materials
5. Support affiliates going green



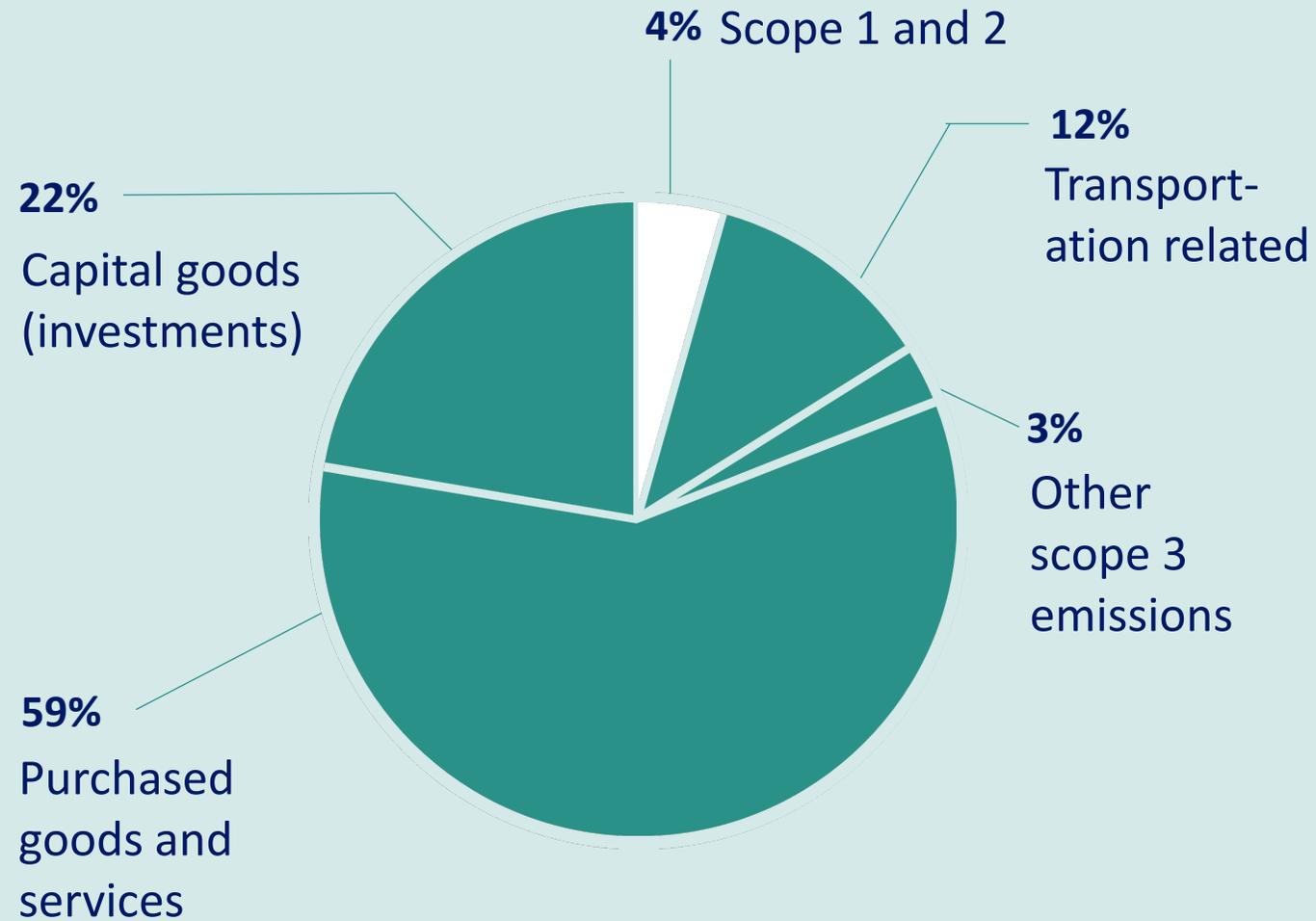
6. Design products for circularity
7. Solve product end-of-life challenge

Scope 1. Direct emissions from company-owned or controlled resources

Scope 2. Indirect emissions from purchased electricity, steam, heating & cooling for own use

Scope 3. Indirect emissions occurring because of activities not included in Scope 1 & 2

2022 Scope 1, 2 and 3 emissions



Zero impact
is our ambition

circular
FOR zero



LEED SCORE CARD

	LOCATION & TRANSPORTATION	2 / 16		INDOOR ENVIRONMENTAL QUALITY	11 / 16
	SUSTAINABLE SITES	8 / 10		INTEGRATIVE PROCESS	1
	WATER EFFICIENCY	8 / 11		INNOVATION	6 / 6
	ENERGY & ATMOSPHERE	20 / 30		REGIONAL PRIORITY	3 / 4
	MATERIALS & RESOURCES	11 / 13		TOTAL POINTS ACHIEVED	79 / 107

1 / 6 points for Innovation in Design:
LEED v5 Enhanced Refrigerant Management Exemplary Performance

LEED SCORE CARD

Summary

- All refrigerants in the project have 0 ODP, and the total weighted average GWP is 2.26.
- Since the project has achieved 0 ODP and GWP below 25, it qualifies for an innovation point per input from GBCI.

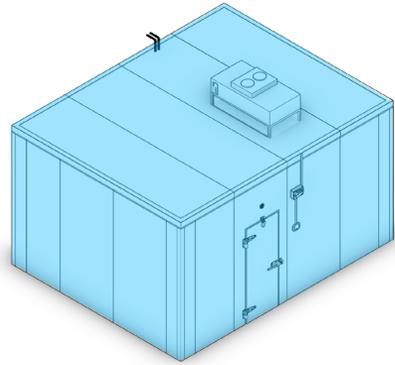
HVAC&R	Units	Qunit	Qunit	Refrigerant	GWPr	ODPr	Rc	Rc	Rc (kg) x GWP
Equipment Type		(tons)	(kW)				(lb/ton)	total lbs	
Split AC or heat pump	2	0.9	3.2	R-134a	1320	0	2.66	2.4	1433.3
Split AC or heat pump	1	3	10.6	R-454B	466	0	3.29	9.9	2086.1
Split AC or heat pump	1	1	3.5	R-454B	466	0	4.83	4.8	1020.9
* Reciprocating chiller +5C COLD (ASRS)	1	10298	36218.1	Ammonia	0	0	2.4	24715.2	0.0
Packaged AC or Heat Pump	2	6	21.1	R-410A	1890	0	1.58	9.5	8126.5
Split AC or heat pump	1	4.1	14.4	R-448A	1273	0	4.27	17.5	10108.2
Split AC or heat pump	1	8.3	29.2	R-448A	1273	0	8.58	71.2	41117.6
Split AC or heat pump	1	1.5	5.3	R-410A	1890	0	3.25	4.9	4179.0
* Split AC or heat pump -20C FREEZERS	1	40	140.7	Carbon dioxide	1	0	2.5	100.0	45.4
Walk-in refrigerator/freezer	1	3.87	13.6	R-448A	1273	0	4.13	16.0	9228.3

LEED SCORE CARD

Usage	Refrigerant Type	GWP	ODP	% of OVERALL REFRIGERANT
Chiller	NH3 / Ammonia +5C COLD (ASRS)	0	0	99.3%
Individual mechanical units	R-410a	1890	0	.07%
	R-134a	1320	0	.01%
	R-454B	466	0	.04%
	CO2 -20C FREEZERS	1	0	.4%
	R-448A	1273	0	.12%
Food service	R-448A	1273	0	0.05%

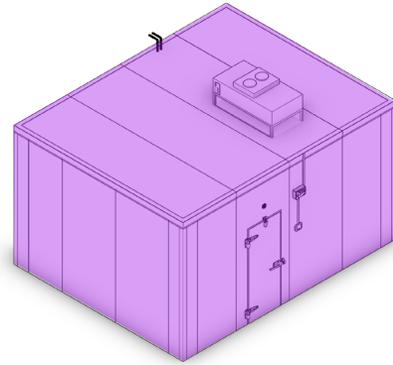
Individual refrigerators and freezers (equipment) provided by Owner are not included in the LEED submittal

ROOM TYPES + REFRIGERANTS



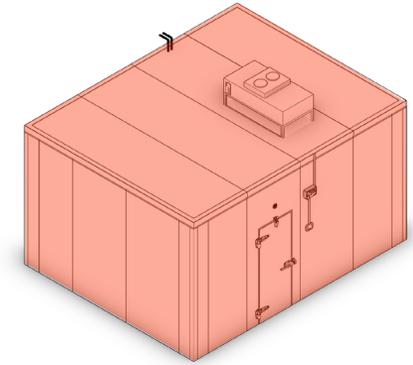
FREEZER

-20C



COLD ROOM

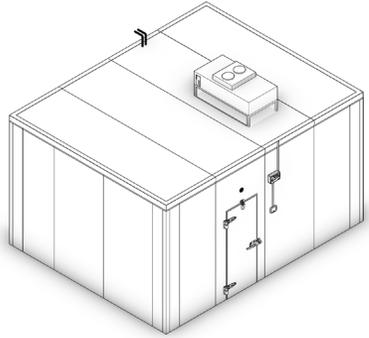
+5C



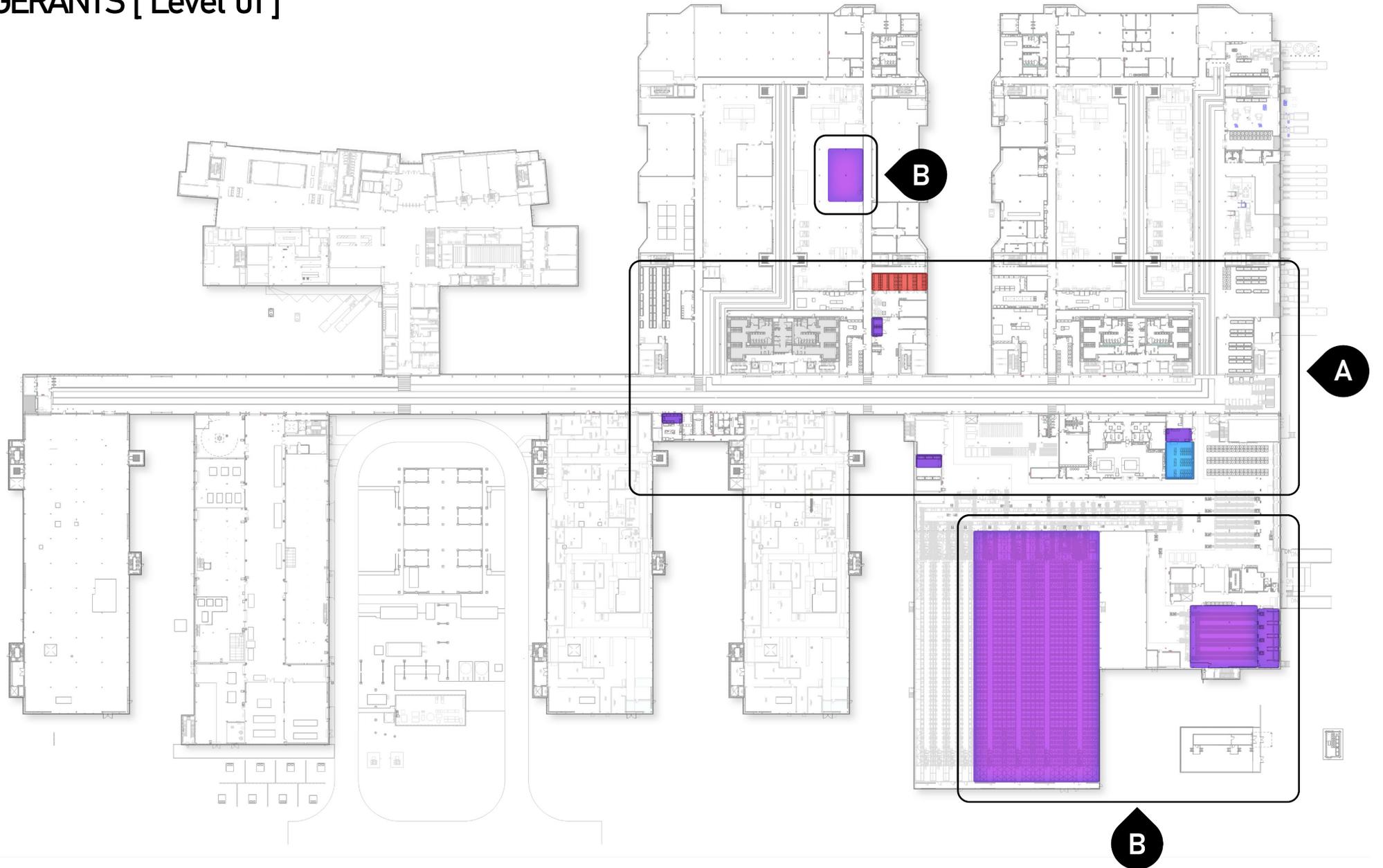
INCUBATOR

+20C to +35C

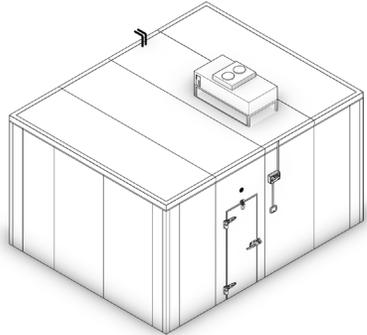
ROOM TYPES + REFRIGERANTS [Level 01]



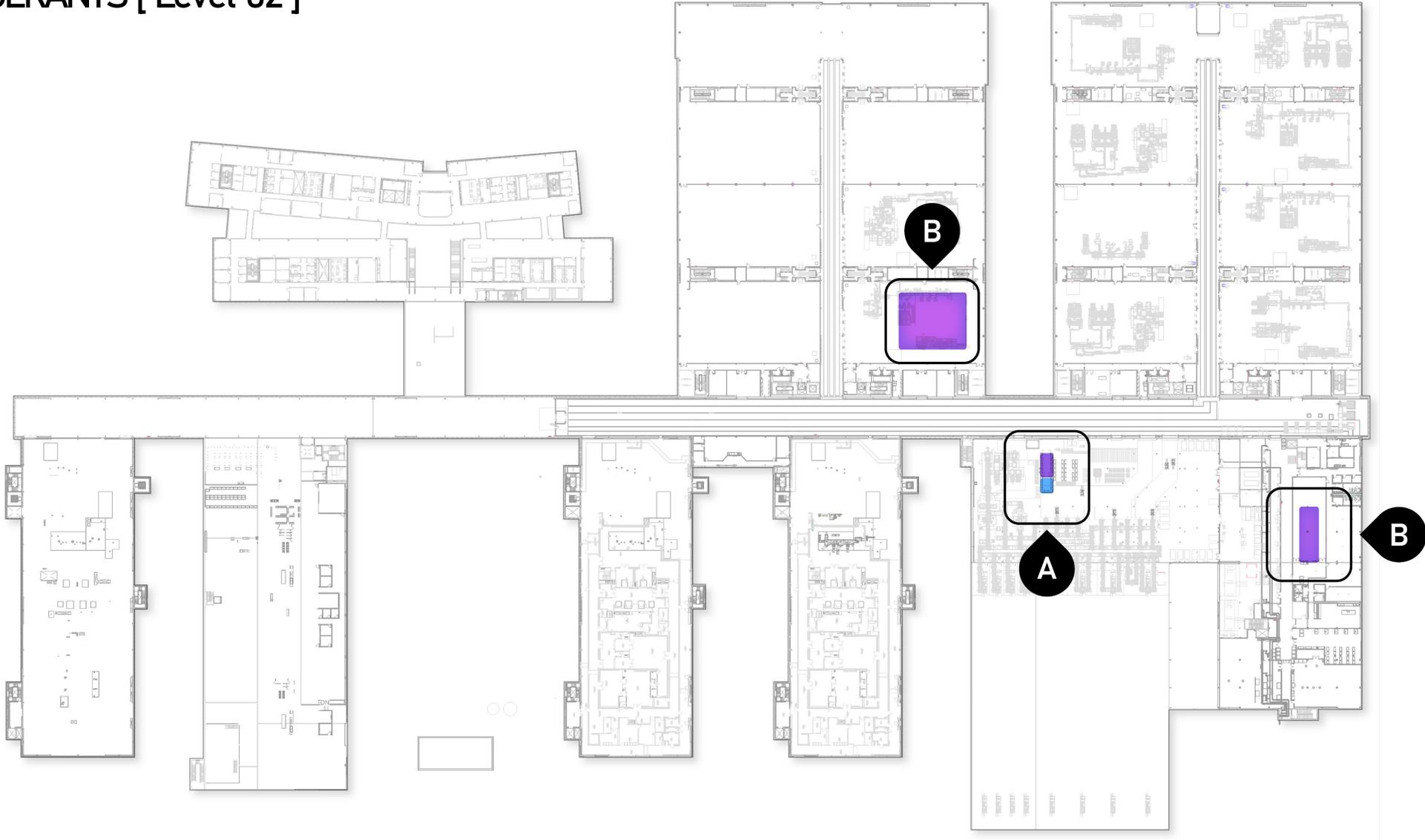
-  FREEZER
-  COLD ROOM
-  INCUBATOR



ROOM TYPES + REFRIGERANTS [Level 02]

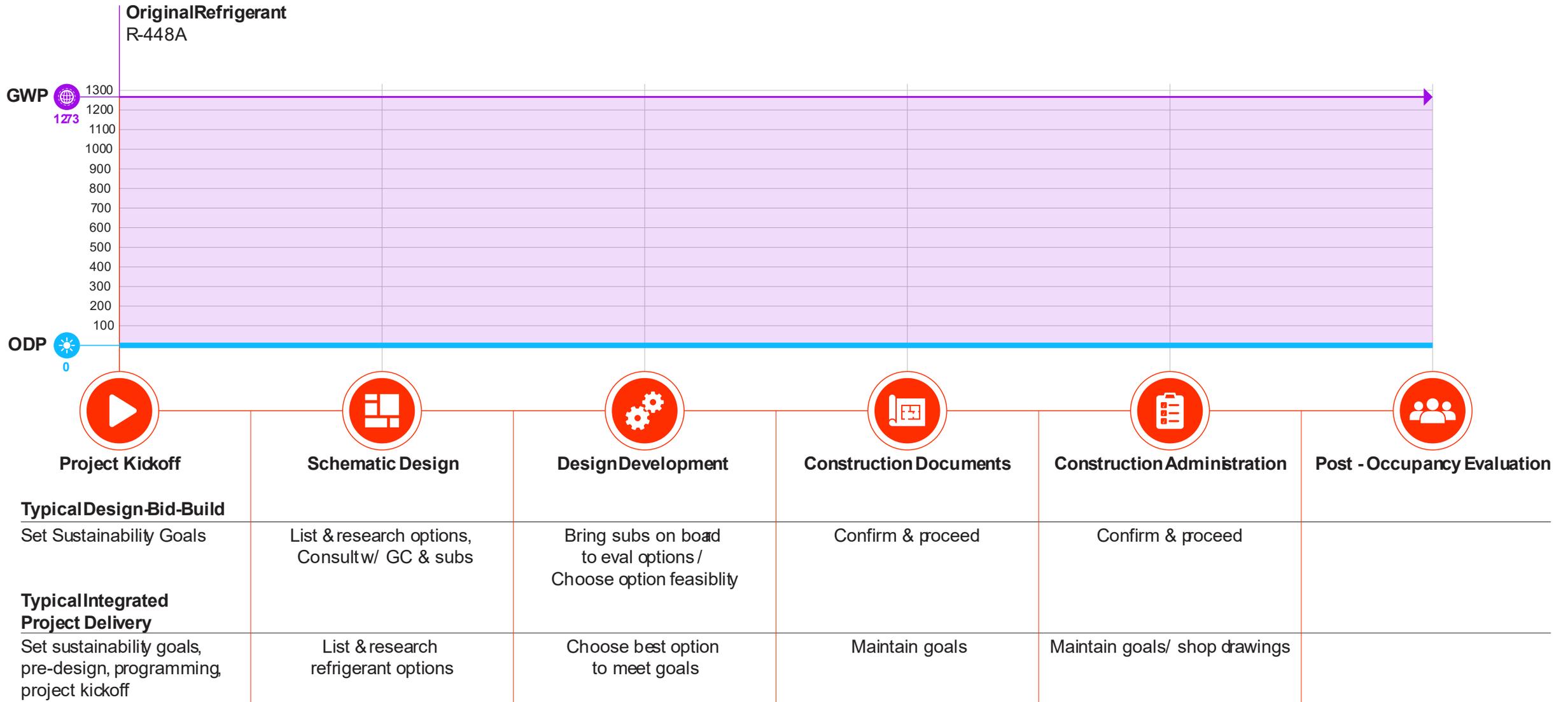


-  FREEZER
-  COLD ROOM
-  INCUBATOR



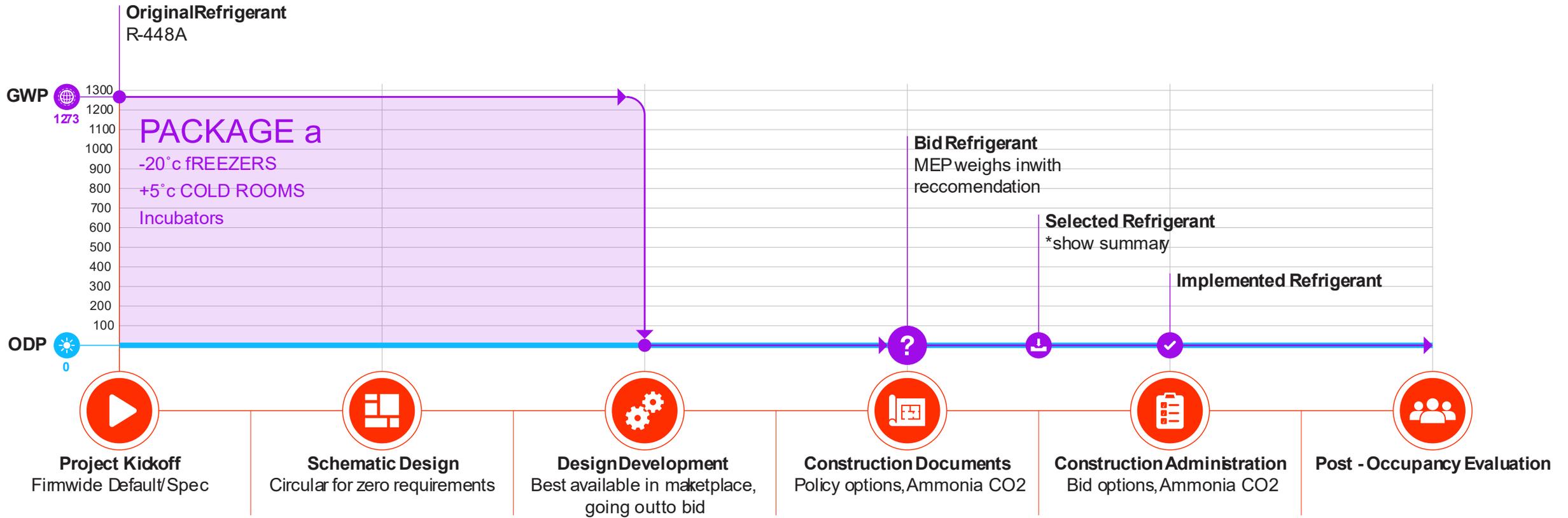
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



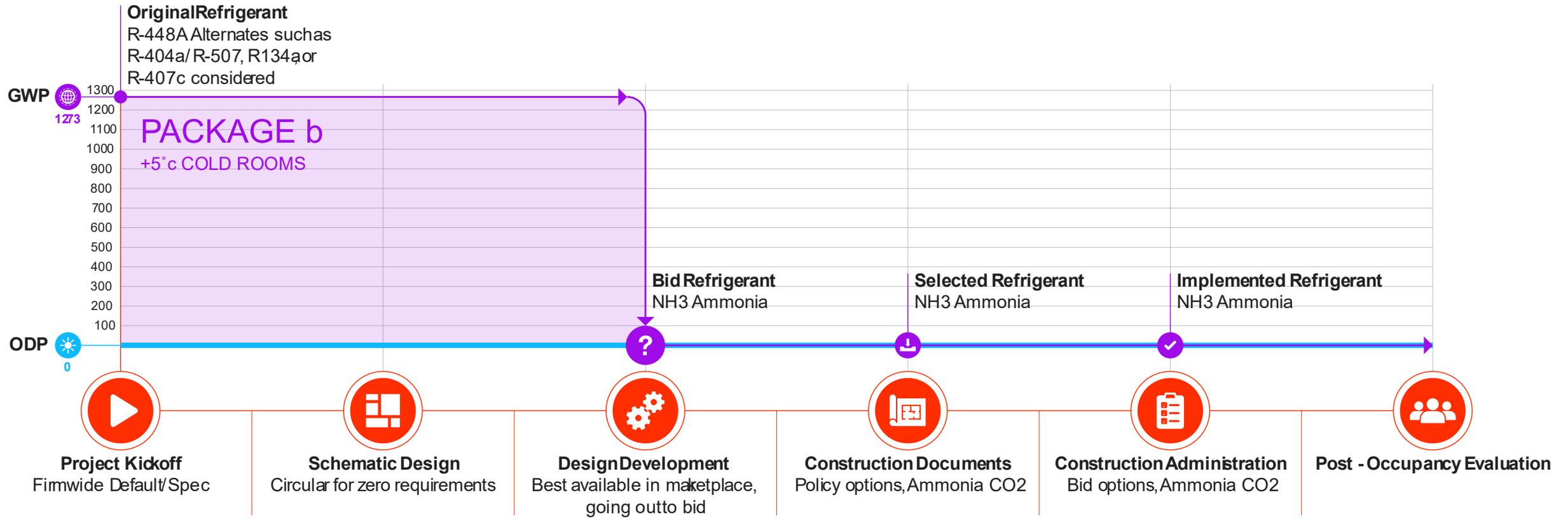
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



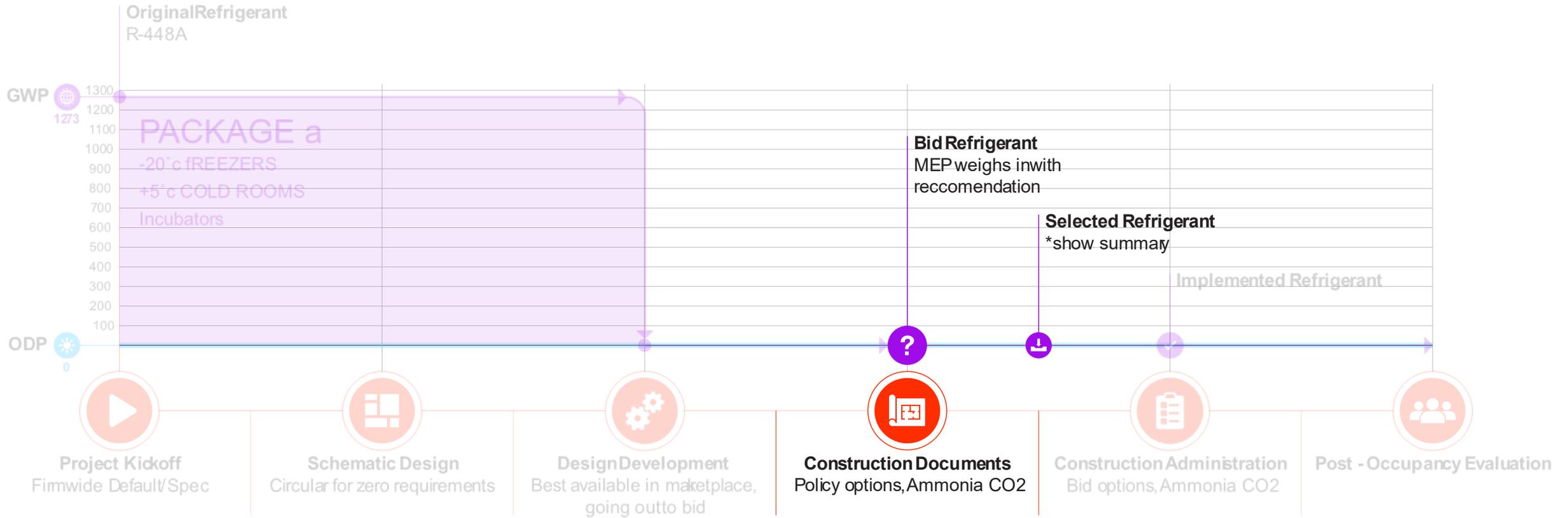
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



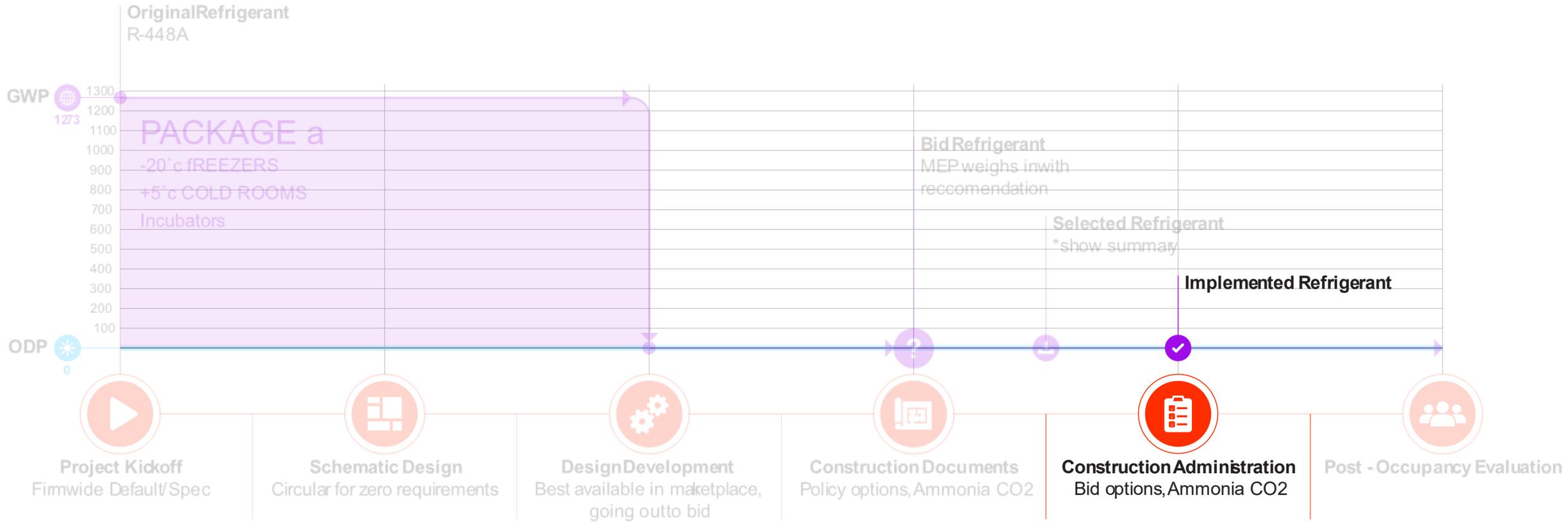
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



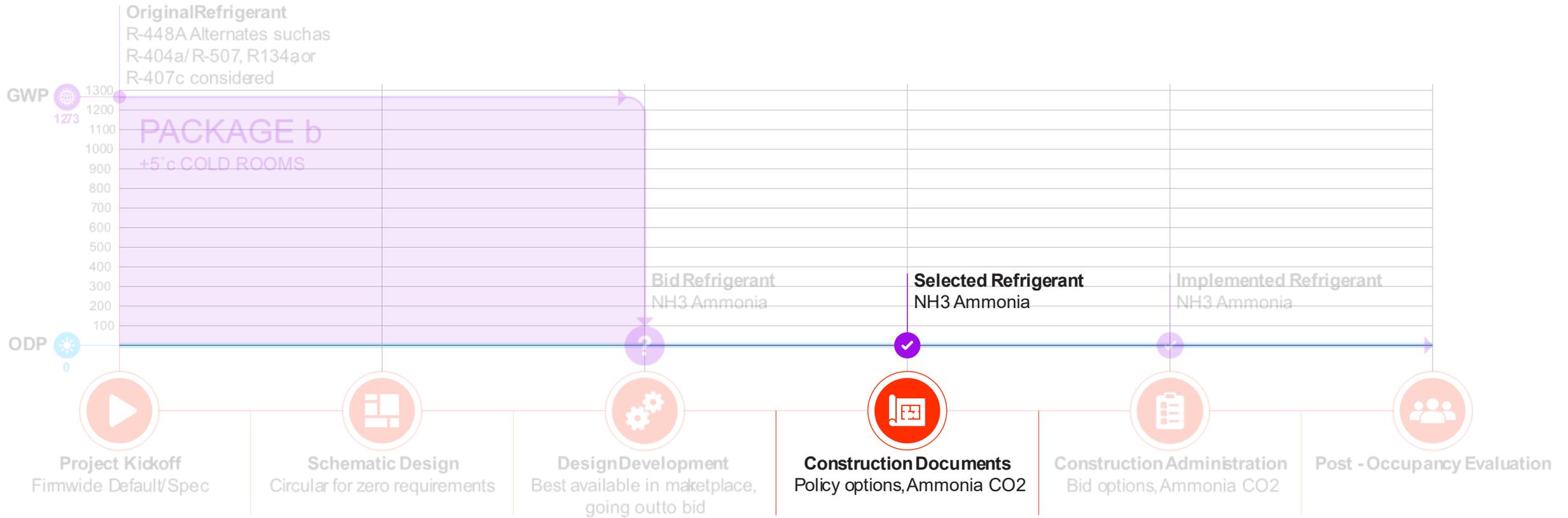
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



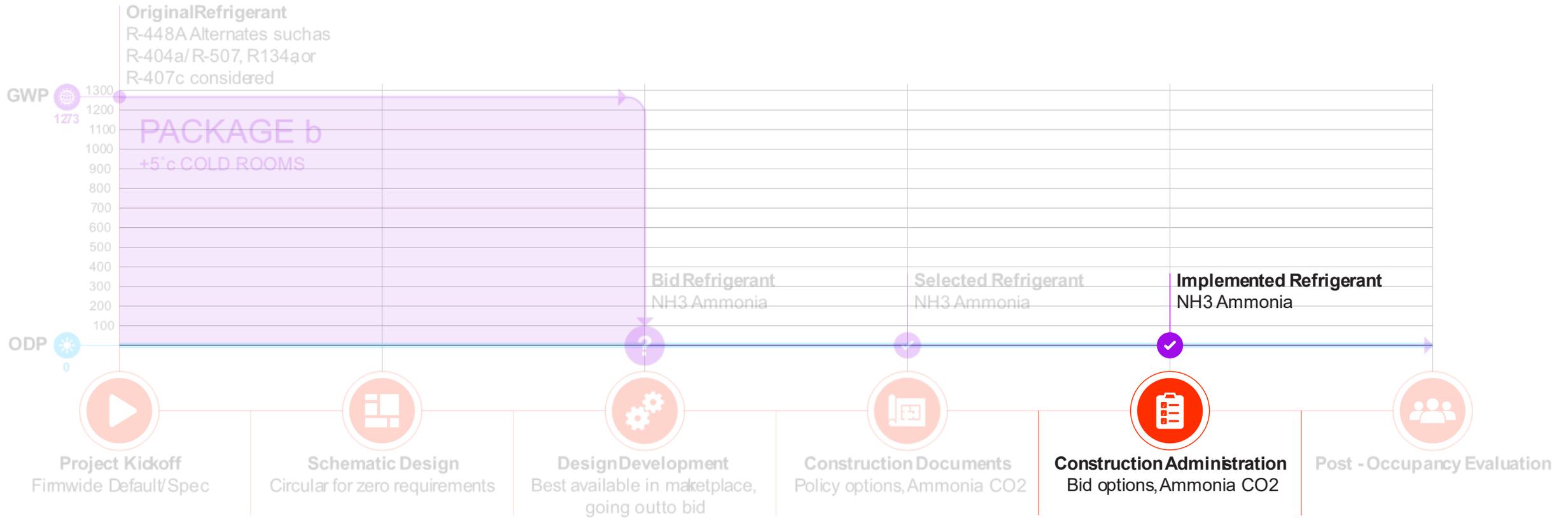
REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



REFRIGERANT SPEC TIMELINE

Typical Design-Bid-Build/ Integrated Project Delivery



REFRIGERANT BID SUMMARY

Original Refrigerant	R-448A	R-448A
Bid Refrigerants		
Bidder	Bid Refrigerant [Freezer]	Bid Refrigerant [Cold Room + Incubator]
1	R-448A	Process chilled glycol, building-supplied
2	R-448A	Process chilled glycol, building-supplied
3	Glycol	Process chilled glycol, building-supplied
4	R-744, aka CO2	Process chilled glycol, building-supplied
5	Did not specify	Did not specify
6	R-455a, option for glycol	R-455a, option for glycol

SELECTED REFRIGERANTS

Original Refrigerant	R-448A	R-448A
Bid Refrigerants		
Bidder	Bid Refrigerant [Freezer]	Bid Refrigerant [Cold Room + Incubator]
1	R-448A	Process chilled glycol, building-supplied
2	R-448A	Process chilled glycol, building-supplied
3	Glycol	Process chilled glycol, building-supplied
4	R-744, aka CO2	Process chilled glycol, building-supplied
5	Did not specify	Did not specify
6	R-455a, option for glycol	R-455a, option for glycol

FACILITY LIFESPAN



50-Year Lifespan



365 Days a Year / 30+ Years of Operation



Operation Costs & Maintenance



Topping Off of Refrigerants

CODE CONCERNS FOR REFRIGERANTS



Ammonia Code Concerns

EH&S Concerns

- PSM Facility (Process Safety Management Facility)
- Controls around the system, process hazard identification
 - Requires more permits
 - Increases security concerns.
- Using ammonia as a refrigerant was not to reduce overall cost.



CO2 Code Concerns

LESSONS LEARNED

- 01 Stick to your long-term goals and maintenance practicalities.
- 02 Start early. Be willing to work with your Authority Having Jurisdiction. Be flexible and willing to evaluate new ideas.
- 03 Plan for generous equipment sizes.
- 04 Start with higher ceilings than you anticipate in case equipment sizes are larger.
- 05 Consider your local market, although you may not know what you don't know about your local market.



+

HANBURY

CONTROLLED ENVIRONMENTAL ROOM (CER) REFRIGERANTS: A CASE STUDY

QUESTIONS?



HAYDEN LANE
NOVO NORDISK
Environmental
Engineer +
Sustainability
Partner



SARAH CORBITT
HANBURY
Senior Lab Planner
+ Architect



International Institute for
Sustainable Laboratories

LEED SCORE CARD



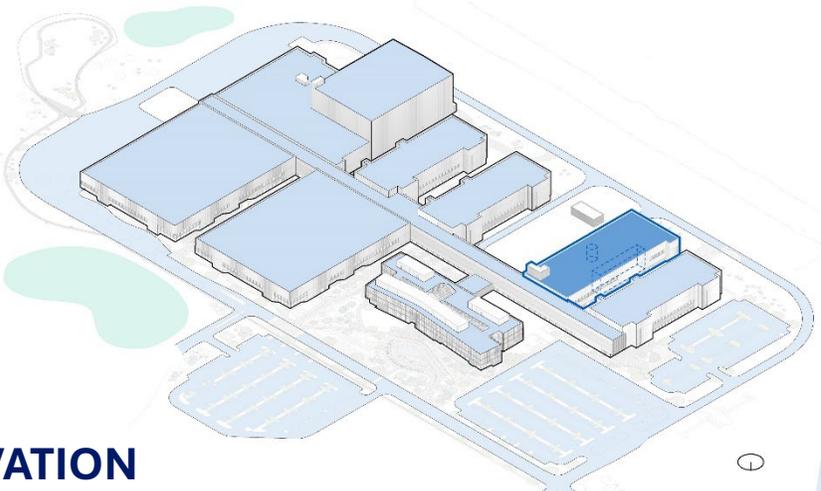
LEED v4 for BD+C: New Construction and Major Renovation Project Checklist

Project Name: Novo Nordisk Clayton, NC
Date: 8/7/2025

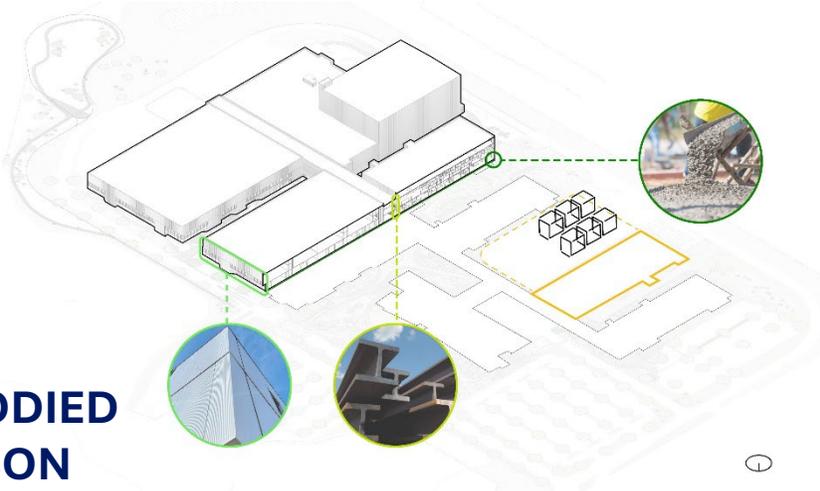
Y	MY	MN	N			
1				Cred	Integrative Process	1
2 15 Location and Transportation 16						
			1	Cred	LEED for Neighborhood Development Location	18
			1	Cred	Sensitive Land Protection	1
			2	Cred	High Priority Site	2
			5	Cred	Surrounding Density and Diverse Uses	5
			5	Cred	Access to Quality Transit	5
			1	Cred	Bicycle Facilities	1
1				Cred	Reduced Parking Footprint	1
1				Cred	Green Vehicles	1
8 2 Sustainable Sites 10						
Y				Prereq	Construction Activity Pollution Prevention	Required
1				Cred	Site Assessment	1
			2	Cred	Site Development - Protect or Restore Habitat	2
1				Cred	Open Space	1
3				Cred	Rainwater Management	3
2				Cred	Heat Island Reduction	2
1				Cred	Light Pollution Reduction	1
8 3 Water Efficiency 11						
Y				Prereq	Outdoor Water Use Reduction	Required
Y				Prereq	Indoor Water Use Reduction	Required
Y				Prereq	Building-Level Water Metering	Required
1			1	Cred	Outdoor Water Use Reduction	2
4			2	Cred	Indoor Water Use Reduction	6
2				Cred	Cooling Tower Water Use	2
1				Cred	Water Metering	1
20 5 Energy and Atmosphere 30						
Y				Prereq	Fundamental Commissioning and Verification	Required
Y				Prereq	Minimum Energy Performance	Required
Y				Prereq	Building-Level Energy Metering	Required
Y				Prereq	Fundamental Refrigerant Management	Required
6				Cred	Enhanced Commissioning	6
7	8		3	Cred	Optimize Energy Performance	18
1				Cred	Advanced Energy Metering	1
			2	Cred	Demand Response	2
1				Cred	Enhanced Refrigerant Management	1
5				Cred	Renewable Energy	2
9 2 Materials and Resources 13						
Y				Prereq	Storage and Collection of Recyclables	Required
Y				Prereq	Construction and Demolition Waste Management Planning	Required
2	1		2	Cred	Building Life-Cycle Impact Reduction	5
2				Cred	BPDO - Environmental Product Declarations	2
1	1			Cred	BPDO - Sourcing of Raw Materials	2
2				Cred	BPDO - Material Ingredients	2
2				Cred	Construction and Demolition Waste Management	2
10 5 Indoor Environmental Quality 16						
Y				Prereq	Minimum Indoor Air Quality Performance	Required
Y				Prereq	Environmental Tobacco Smoke Control	Required
2				Cred	Enhanced Indoor Air Quality Strategies*	2
3				Cred	Low-Emitting Materials	3
1				Cred	Construction Indoor Air Quality Management Plan	1
2				Cred	Indoor Air Quality Assessment	2
			1	Cred	Thermal Comfort	1
1			1	Cred	Interior Lighting	2
			3	Cred	Daylight	3
			1	Cred	Quality Views	1
1				Cred	Acoustic Performance	1
6 Innovation 6						
5				Cred	Innovation**	5
1				Cred	LEED Accredited Professional	1
3 Regional Priority 4						
1				Cred	Regional Priority: Reduced Parking Footprint	1
1				Cred	Regional Priority: Heat Island Reduction	1
1				Cred	Regional Priority: Renewable Energy Production, 1 point	1
1				Cred	Regional Priority: Optimize Energy Performance, 9 points	1
57 12 31 TOTALS Possible Points: 107						
Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110						
<p>Y Prerequisite/Credit awarded during Preliminary Design Submission</p> <p>* One (1) point awarded during Preliminary Design Submission</p> <p>** One (1) Innovation Point awarded during Preliminary Design Submission</p>						

SITE CLAYTON OVERVIEW

WATER CONSERVATION



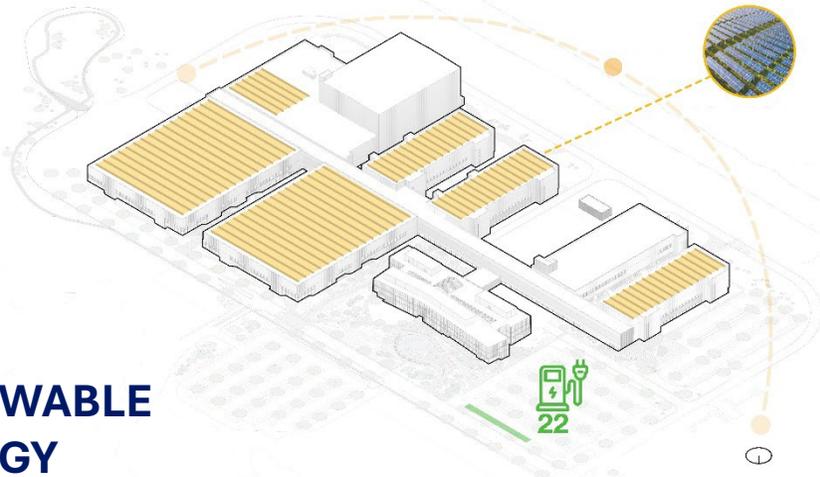
EMBODIED CARBON



WELL-BEING



RENEWABLE ENERGY



SITE CLAYTON

