How to Manage Sustainability at Existing Facilities

Best Practices for Leak Rate Reduction with Next Gen Technology Solutions

storeconnect® By HUSSMANN®

Powering innovation in the commercial refrigeration world.

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Who Am I?

Clay Rohrer

Portfolio Leader, Connected Solutions at Hussmann

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By the Numbers

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Service Sites

Using StoreConnect

650+
Leaks Detected

$3.23M
Saved in Refrigerant Costs

117k+
Lbs. of Refrigerant Saved

132k
GWP Savings in MTCO2e

+ 100s of Sites Utilizing this Solution with non-Hussmann Service Providers

Market Dynamics

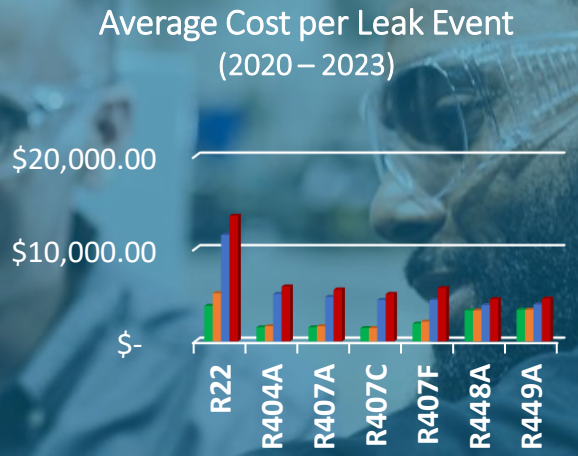
Material Inflation

AIM, CARB, State Level Regs

Impacting Refrigerant Cost & Availability

50%

Average Annual Refrigerant Increase, Weighted by Usage (2020-2023)



Cost of refrigerant and service calls continue to rise

225k

Technician Gap in 5 years (projected)

Source: Bureau of Labor Statistics and *Rob Falke, President of National Comfort Institute

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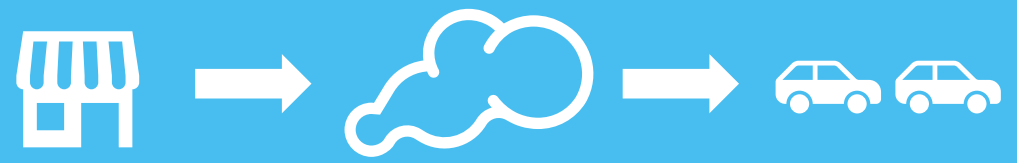
What Do Leaks Cost Annually?

- 25% (avg leak rate) x 2000 lb. = **500 lb** of refrigerant wasted each year.
- 500lb X $25 / lb for refrigerant = **$12,500**

Leaks undetected result in system failure or downtime, this can result in lost sales for a department for an entire day

~$10,000

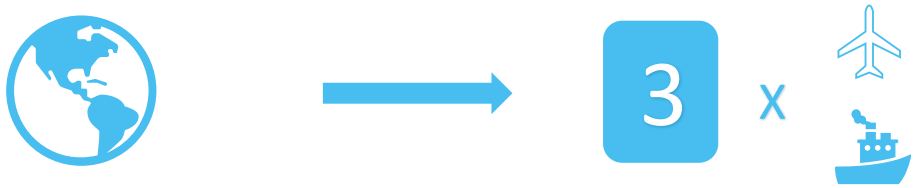
Scale of the Problem



According to the EPA the average Supermarket leaks 875 lbs. of r404A / year
SOURCE

This equates to the CO2 that 339 cars emit to the atmosphere in a year

This is the equivalent of 1,556 Metric Tons of CO2 Equivalent Emitted into the atmosphere



According to the Birmingham Energy (UK) Institute: Refrigeration and air conditioning cause 10% of global CO2 Emissions
(Energy + Refrigerant Emissions)
SOURCE

This is 3 TIMES the CO2 Emissions attributed to Aviation And Shipping combined
SOURCE

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The AIM Act and Leak Detection Requirements

Subsection H of the AIM Act
Authorizes EPA to establish standards for HFC management –
Servicing, Repair, Recovery, Recycle, Reclaim, etc

- Leak rates above the following will require leak repair
  - *20% in commercial refrigeration equipment w/ > 15 lbs
- Automatic leak detection systems will be required on HFC systems using more than 1,500 lb of refrigerant
  - Starting Jan. 1, 2026 for new systems
  - Starting Jan. 1, 2027 for existing systems installed after January 1, 2017

There are two classifications of Automatic Leak Detection.

1. **Direct System (Zone)**

   Automatically detects the presence of refrigerant leaked into the air with an alert is triggered at a specified concentration from a refrigeration system.

   This qualifies as an automation leak detection system ***only where the sniffer is located.***

2. **Indirect System (Complete)**

   Analyzes operating conditions (liquid levels, temperatures, pressures) and uses algorithms *to detect leaks anywhere in the system*, not just at the sensor location.

   This is how StoreConnect works*—providing comprehensive leak detection by considering the conditions over time. And not just based on concentration in an exact location at a specific moment.*

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What It Means for Retailers

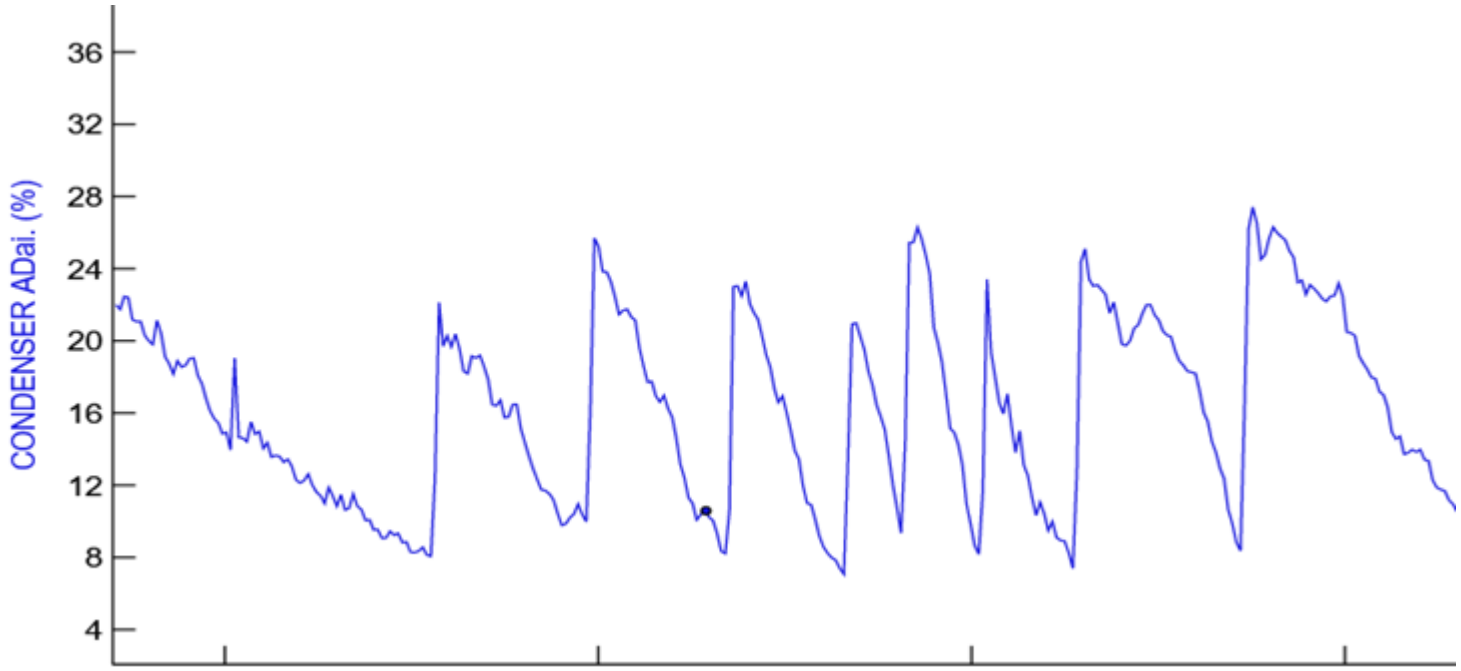
With Predictive Solution

- Reduce refrigerant usage 40% in Year 1 (avg)
  - Typical savings $
- Proactive alerts to fix leaks sooner
  - <20% year annual threshold
  - Reduce Overtime and Emergency Truck Rolls
- Periodic leak inspections waived
  - Savings range from $1,600 - $2,000
- Qualifies as ALD for whole system protection

Relying on Reactive Maintenance

- Industry average leak rate 25%/year
- Slower leak repairs = higher leak rate
  - >20% year annual threshold
- Periodic leak inspections after leak repair
  - Every 3 months for systems >500lbs
  - Every 12 months for systems 15-500lbs
- Mandatory ALD required on systems >1500lbs

So What's the problem?



Technicians have one of three problems typically:

1. The time to find all the leaks
   - Miles of pipes to check
   - Many emergencies to get fixed
   - Limits to how much time they can spend
2. Knowing how big the leaks are
3. The feedback that all major leaks have been found

Without having the proper data to drive improvement and root cause, our industry is always chasing leaks, but we aren't always fixing the right leaks

LIFECYCLE OF A LEAK

Before and After Advanced Leak Detection Technology

Reactive Approach

Critical Alarm

Critical Alarm

Months 1-2 | Months 3-4 | Months 5-6 | Months 7-8

Early Detection

Early Re-Alert

CONFIRMED

Scheduled Service

Follow-Up Service

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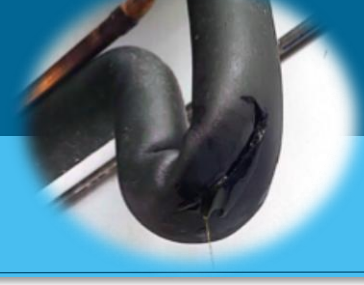
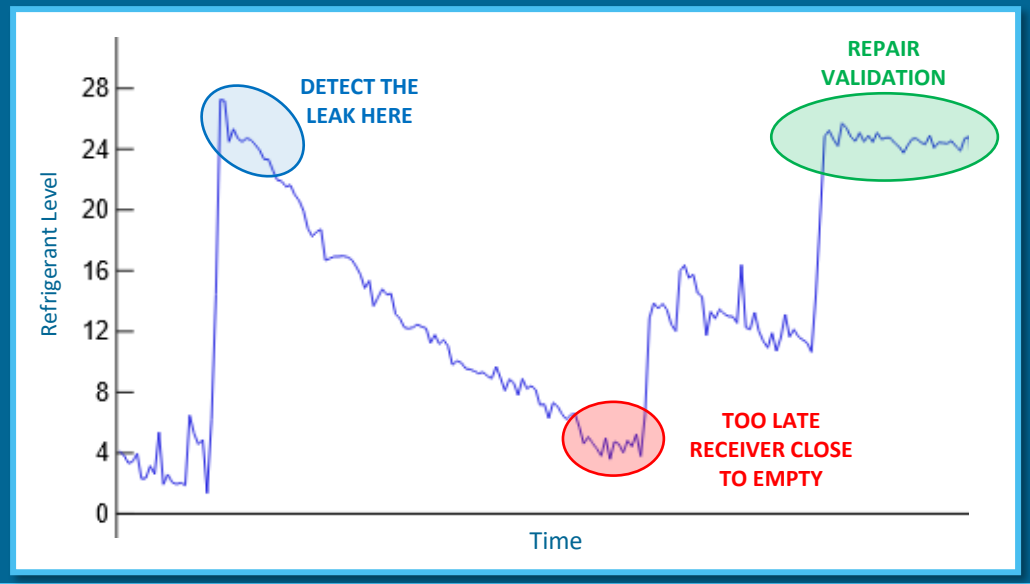
Advanced Refrigerant Leak Detection



Analytics & Automation Driven Receiver Level Leak Detection

Advanced Refrigeration Leak Detection has saved thousands of pounds of refrigerant from entering the atmosphere and saved thousands of dollars in costs for retailers and contractors.

- "Always on" Automated Detection Supplying Leak Rates and Priority Leaks for Work Orders
- Validation through trending ensures the right leak gets repaired.



>30%

Leak Rate Reduction, on average, for customers utilizing StoreConnect's ARLD Platform

8x

Faster, on average, for detecting leaks in receiver levels vs. standard methods

Features, Benefits, Advantages

Real Time multi-layer Trending Algorithms
Result: Quicker Detection, More Accuracy, Data Driven Leak Management

Calculated Risks and Priority Levels
Impact: Prioritized Work Orders with Known Timelines

Leak Repair Validation 24/7/365
Impact: You know you found the "right" leak

Complies with Regulations and Saves you Money
Impact: Labor Savings from Waived Leak Inspections

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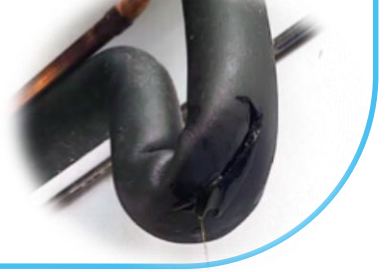
ADVANCED REFRIGERANT LEAK DETECTION



Case Study: National Retailer Experiencing High Leak Rates in Sites

Situation

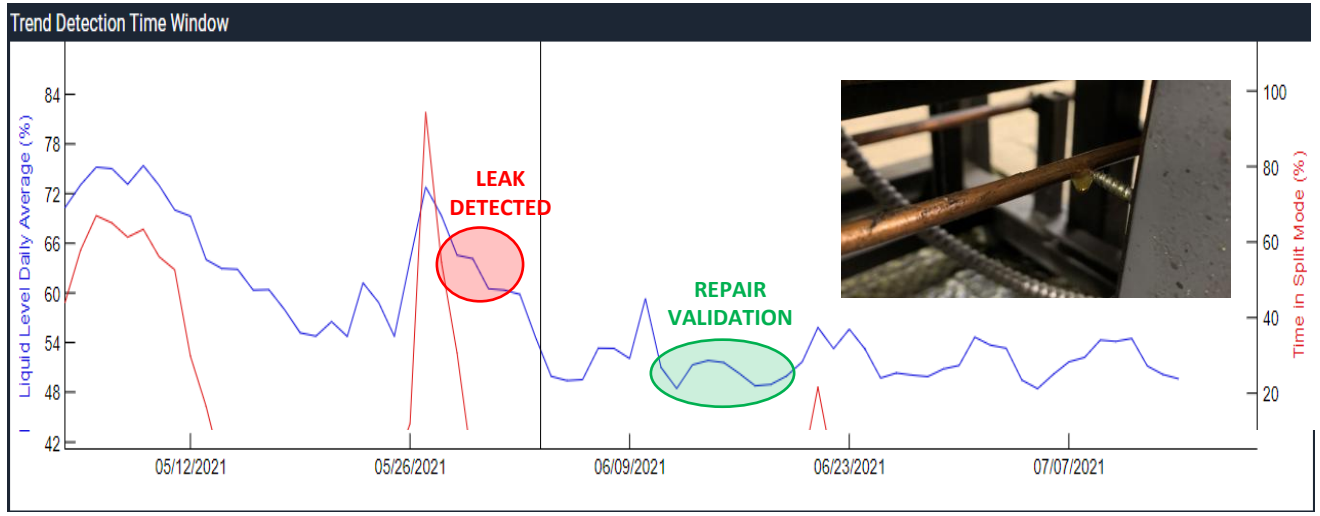
- Refrigerant Leak service events at 0-5% Liquid Level (critical alarms)
- High Refrigerant $$ Loss, high labor costs charging systems

Tasks & Actions

- Installed StoreConnect and setup Advanced Refrigerant Leak detection to detect leaks far in advance of receiver levels reaching zero. Setup trends at 14 and 75 days.
- Setup Rules of Engagement with service provider to drive service events for leaks that are prioritized by leak rate and risk

Analysis & Results

- StoreConnect alerted service organization, potentially weeks to months in advance, within a few percent of loss to take corrective action
- Technician found leak and repaired at site.
- 14 days later StoreConnect confirms technician fixed the right leak



The Business Case

With refrigerant prices exceeding 200% inflation and continued high industry leak rates, the ROI on StoreConnect is less than 1 year. A 30% Leak Rate Reduction could save more then $6,500 annually.

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Additional Leak Detection Case Study

- ALDS Installed across three different customers ~200 stores

- Rules of engagement defined to roll trucks on critical leaks above 20% leak rate

RESULTS

40 %

Leak Rate Reduction across all 3 customers

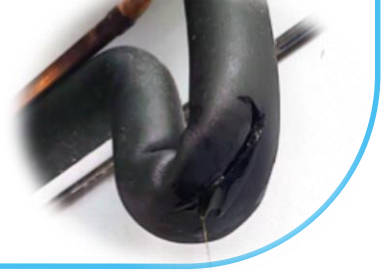
85 %

Leak rate accuracy – high performance in the industry

10 %

of trucks rolls were either other issues are software failures

ROI Tracking & Service Effectiveness



Legend
WO Open
Awaiting Confirmation
Not Confirmed / Recalled
Confirmed Fix

Total Refrigerant Loss Avoided	Total Refrigerant Dollars Avoided	Total GWP Avoided (CO2e)
12442 lbs	$ 348,399.95	23,883,592

Asset	Event Type	Severity	SC ELP Link	HSM WO Number	Receiver Percent at Time of Event	Refrigerant Loss Avoided	Refrigerant Dollars Avoided	GWP Avoided (CO_2e)	Refrigerant Added per WO	Leak Repair Description / Cancelation Notes	Receiver Percent at Time of Repair	Confirmed Fix Date
CONDENSER A	Long-Term Leak	Critical	Click Here		32%	351	$ 9,864.81	640,117		Cancelled, No Notes		
CONDENSER A	14-Day Leak	Notice	Click Here		23%	202	$ 5,692.50	369,380		workorder from hussmann)	15%	1/17/2023
CONDENSER A	14-Day Leak	Notice	Click Here	2209988	23%	152	$ 4,269.38	277,035		cycling.		
Condenser C	14-Day Leak	Notice	Click Here	2194746	19%	126	$ 3,198.23	503,505		SC still shows LL dropping, Re-		
Rack D Condenser	14-Day Leak	Notice	Click Here		6%	37	$ 1,028.67	66,749	375	discharge and suction	22%	12/8/2022
RACK A COND	Long-Term Leak	Critical	Click Here	2182019	24%	160	$ 4,488.75	291,270	200	ordered.	82%%	12/16/2022
CONDENSER B	Long-Term Leak	Critical	Click Here	2178101	65%	432	$ 12,157.03	788,856		discharge gasket, reading	65%	11/28/2022
CONDENSER B	Long-Term Leak	Critical	Click Here	2174414	19%	167	$ 4,702.50	305,140	0	Pump out valve on the		
RACK A COND	14-Day Leak	Notice	Click Here	2173172	26%	173	$ 4,862.81	315,543	0	leak meat cooler at txv stem & small leaking flare caps on rack	25%	11/27/2022
CONDENSER A	Long-Term Leak	Critical	Click Here	2161662	39%	414	$ 11,648.81	755,879	125	Repaired Ball valve above the	54%	11/11/2022
CONDENSER A	Long-Term Leak	Critical	Click Here	2151509	51%	449	$ 12,622.50	819,060	0	Liquid Level Sensor Error.	59%	11/11/2022

✓ **Shared Data Set** ✓ **Accountability** ✓ **Transparency** ✓ **Continuous Improvement**

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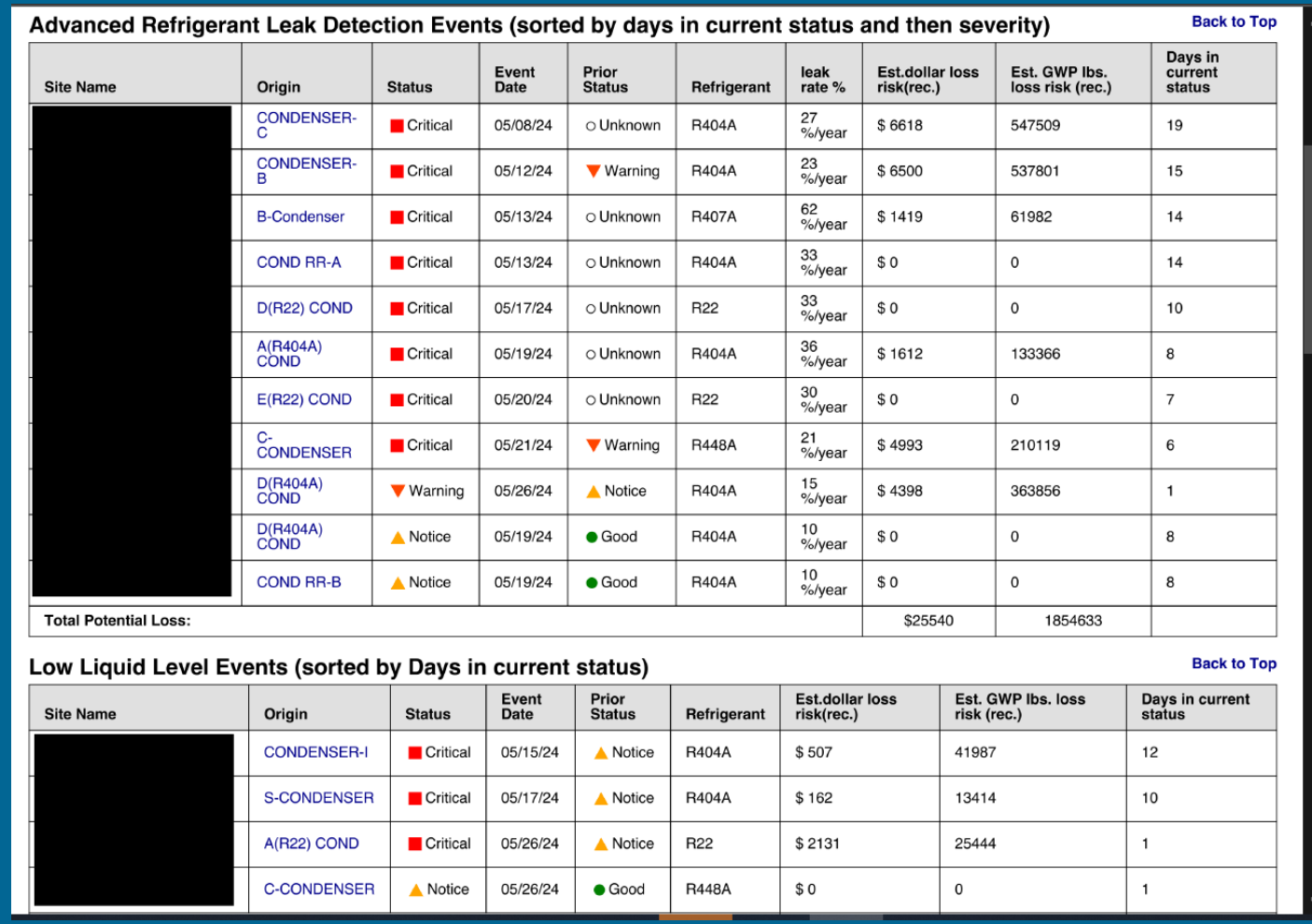
Sample of Refrigerant Reports

How Retailer Teams Interact with Data and Reporting

- Prioritized issues for the store by leak rate and age
- Refrigerant leak analysis, how many pounds loss since the last event
- Acts as a scorecard to use to drive continuous improvement



Advanced Refrigerant Leak Detection Events (sorted by days in current status and then severity) Back to Top

Site Name	Origin	Status	Event Date	Prior Status	Refrigerant	leak rate %	Est.dollar loss risk(rec.)	Est. GWP lbs. loss risk (rec.)	Days in current status
[redacted]	CONDENSER-C	Critical	05/08/24	Unknown	R404A	27 %/year	$ 6618	547509	19
	CONDENSER-B	Critical	05/12/24	Warning	R404A	23 %/year	$ 6500	537801	15
	B-Condenser	Critical	05/13/24	Unknown	R407A	62 %/year	$ 1419	61982	14
	COND RR-A	Critical	05/13/24	Unknown	R404A	33 %/year	$ 0	0	14
	D(R22) COND	Critical	05/17/24	Unknown	R22	33 %/year	$ 0	0	10
	A(R404A) COND	Critical	05/19/24	Unknown	R404A	36 %/year	$ 1612	133366	8
	E(R22) COND	Critical	05/20/24	Unknown	R22	30 %/year	$ 0	0	7
	C-CONDENSER	Critical	05/21/24	Warning	R448A	21 %/year	$ 4993	210119	6
	D(R404A) COND	Warning	05/26/24	Notice	R404A	15 %/year	$ 4398	363856	1
	D(R404A) COND	Notice	05/19/24	Good	R404A	10 %/year	$ 0	0	8
	COND RR-B	Notice	05/19/24	Good	R404A	10 %/year	$ 0	0	8
Total Potential Loss:							$25540	1854633	

Low Liquid Level Events (sorted by Days in current status) Back to Top

Site Name	Origin	Status	Event Date	Prior Status	Refrigerant	Est.dollar loss risk(rec.)	Est. GWP lbs. loss risk (rec.)	Days in current status
[redacted]	CONDENSER-I	Critical	05/15/24	Notice	R404A	$ 507	41987	12
	S-CONDENSER	Critical	05/17/24	Notice	R404A	$ 162	13414	10
	A(R22) COND	Critical	05/26/24	Notice	R22	$ 2131	25444	1
	C-CONDENSER	Notice	05/26/24	Good	R448A	$ 0	0	1

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Service Costs & Equipment Lifecycle

Changing the Service Model and Bundling Events

StoreConnect's algorithms focused on high-cost assets and service enablement provides owners and contractors the competitive advantages to sustain and improve their service benchmarks.

StoreConnect's focus is on Proactive insight and work to remove and reduce reactive service events.

Asset / Key Function	Plan Maintenance Proactively
Systems and Cases	Superheat Adjustments Evaporator Coil Cleaning Filter changes TXV adjustments Watching Trends Fan Motors Blocked Air flow Defrost heater Condenser Coil Cleaning

10%

Target Service Cost Improvement for customer utilizing StoreConnect w/ preferred sensors.

2-8

Work Orders expected to be reduced for a retailer due to Proactive, bundled Service Events

Features, Benefits, Advantages

Algorithms Focused on High Cost/High Impact Assets
Result: StoreConnect provides deep insight

Remove/reduce the "Floodback" problem
Result: Compressor replacement savings (w/right sensors)

Reduce the Surprises with Rack Performance
Result: 24x7x365 voltage/amperage monitoring with SC

Focus on Efficiency with Coefficient of Performance
Result: Automated Calculations

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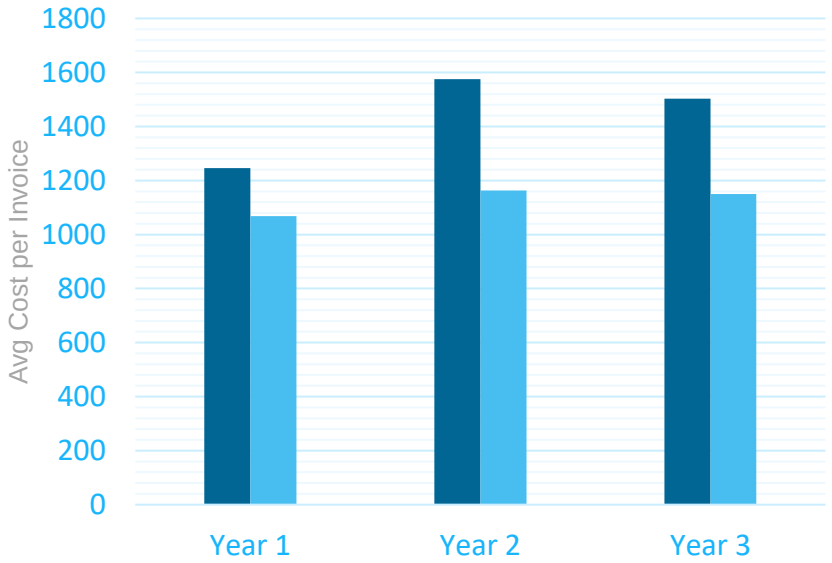
Condition Based Maintenance

$ Service Optimization: Reduce service calls while maximizing uptime

Situation

Like most retailers this regional retailer was only placing service calls when they became emergencies. Every emergency call meant higher repair bills, potential product loss, and service technicians racing to fix issues after hours.

As the customers store count grew, so did the pressure: How could they keep stores running smoothly without adding more costs or sacrificing quality?



Tasks & Actions

- Installed StoreConnect.
- Adjusted rules of engagement to manage their refrigeration and bundle service calls to avoid emergencies and proactively fix more issues per visit.
- Tracked service spend and calls between locations with StoreConnect and those without StoreConnect.

RESULTS

38% Decrease in refrigerant leaks

38% Decrease in the Number of service calls per year

22% In their average invoice cost

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Example Supermarket Economics

Project Type	Est. RCC Value per store
New Construction Naturals	$58K - $95K
HFC to Naturals	$40K - $60K
Leak Detection	$8K - $30K over 7 years
R448A Retrofit	$10K - $35K
HFC Reclamation	$15K - $35K
ODS Destruction	$15K - $25K

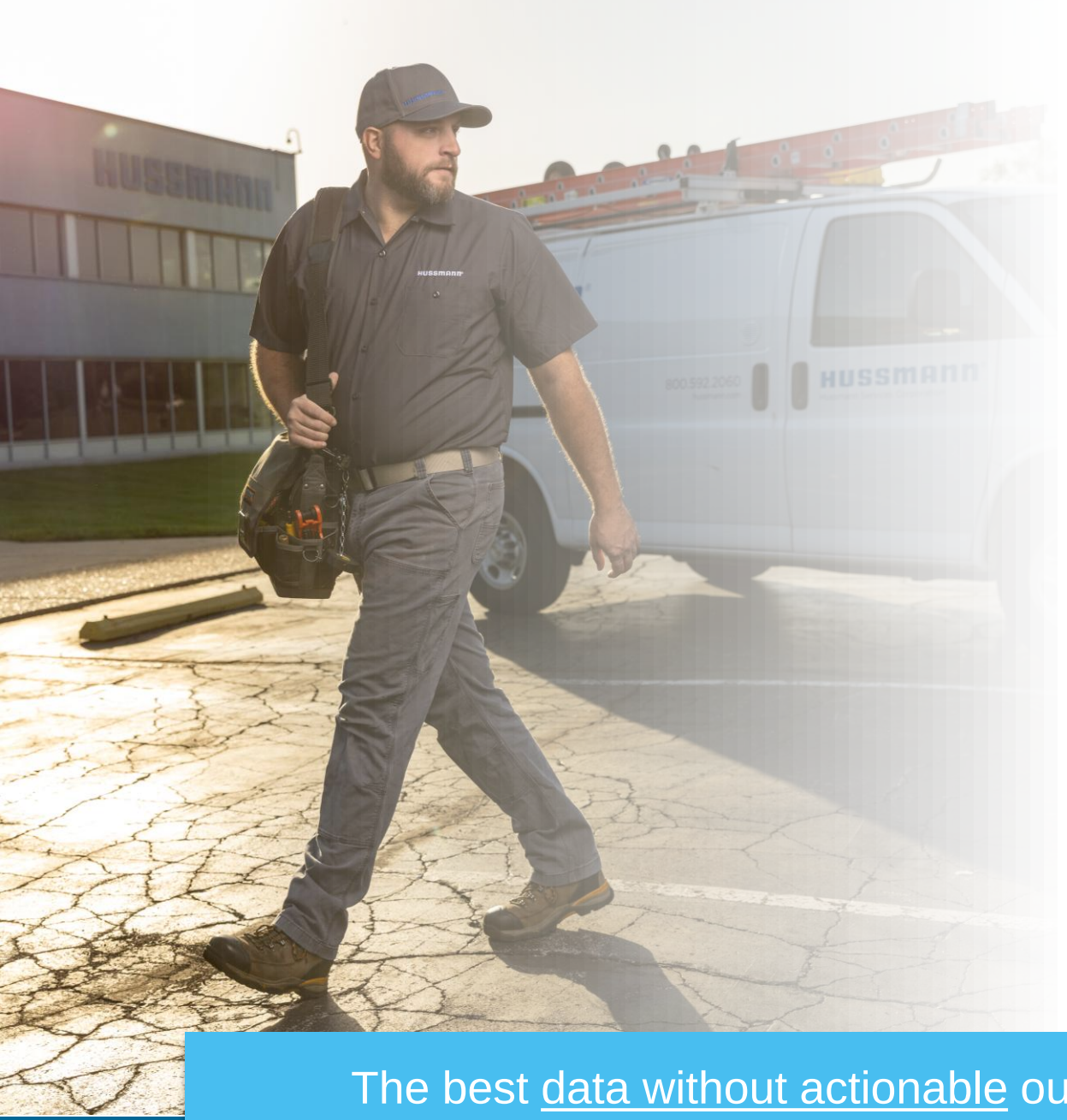
Carbon credits have a lookback period of 2 years.

Midwest Retailer A

- 4 separate retrofit projects
  - **$144,536.40** paid to customer
  - 12 more projects in progress
    - Est. total payout: $500k-600k

Midwest Retailer B

- 4 separate retrofit projects
  - **$140,231.40** paid to customer
  - 23 more projects in progress
    - Est. total payout: $850k+



Before You Begin…

- Understand there are "NO" identical stores & there are no standards in terms of how you can access the data from controllers
- There's limited standardization on sensors available in stores, e.g., temperatures, pressures, liquid levels, etc.
- Outputs or events derived from data must be actionable for a technician
- Those actions need to be tracked against the data to improve algorithms through machine learning and to improve condition-based maintenance processes and procedures
- The entire process must be automated and triggered via rules to create an embedded workflow
- Training for everyone involved in the process is required. Repairing things before failure, requires a different service approach

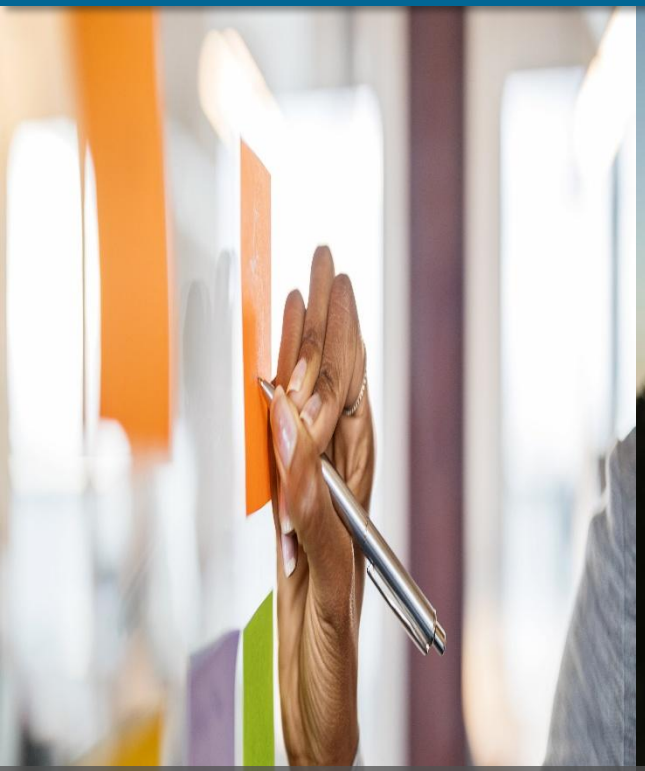
The best data without actionable outputs is similar to having a great strategy without execution.

Lessons Learned

From Working with Variety of Retailers in 1000s of Sites

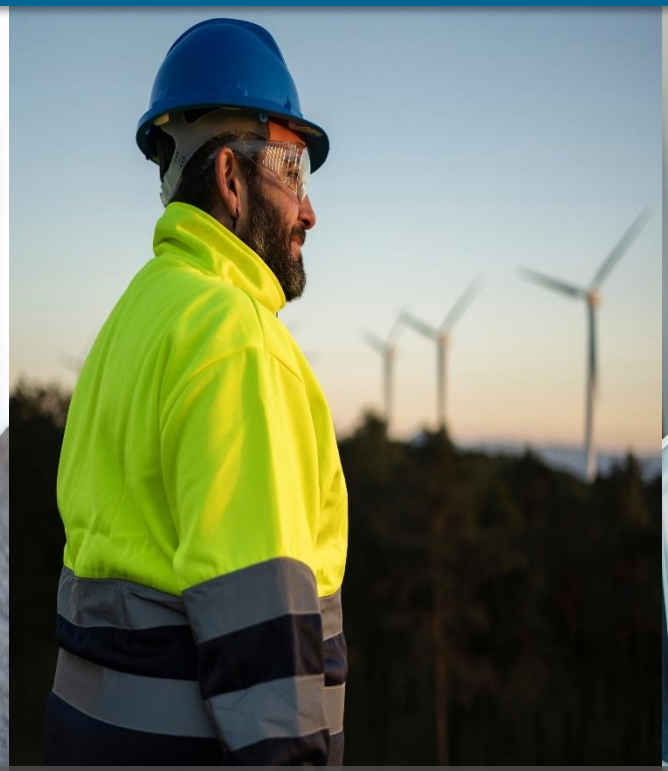
1. **Take Action – Measure Outcomes – Continuously Improve**
2. **Roll Trucks –** Hold the process and software accountable
   - Build ALDS into your standard process for rolling trucks
3. **Condition-based maintenance takes a little time** - Trust and Measure the data
4. **Training Contractors on what leaks and performance mean** – *a 15% leak is far different than a 50% leak*
5. **Feedback** to everyone involved and reporting is important to drive change through the organization
6. **Prioritize condition-based maintenance** and emergency truck rolls will drastically reduce

Other Considerations

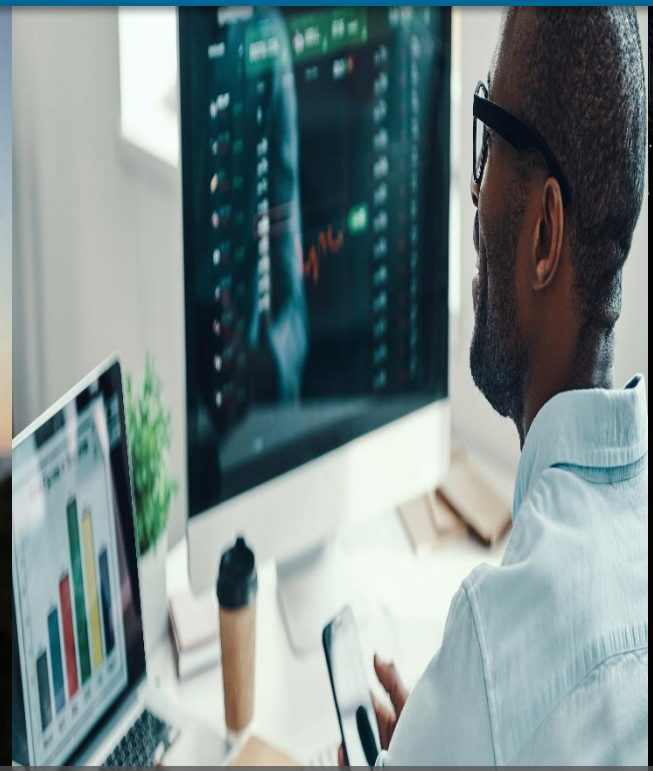


Leak Reduction and Condition Based Maintenance is about change management

Doesn't need to be difficult just needs to be managed



Energy can be focused on in parallel



Manage the process based on the time of the year

Focus in the off season to yield results in the summer

Engage across the organization to get buy in

Store personnel, management, food safety, energy, etc.

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