



Refrigerant Leak Detection Technologies

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Today's Host



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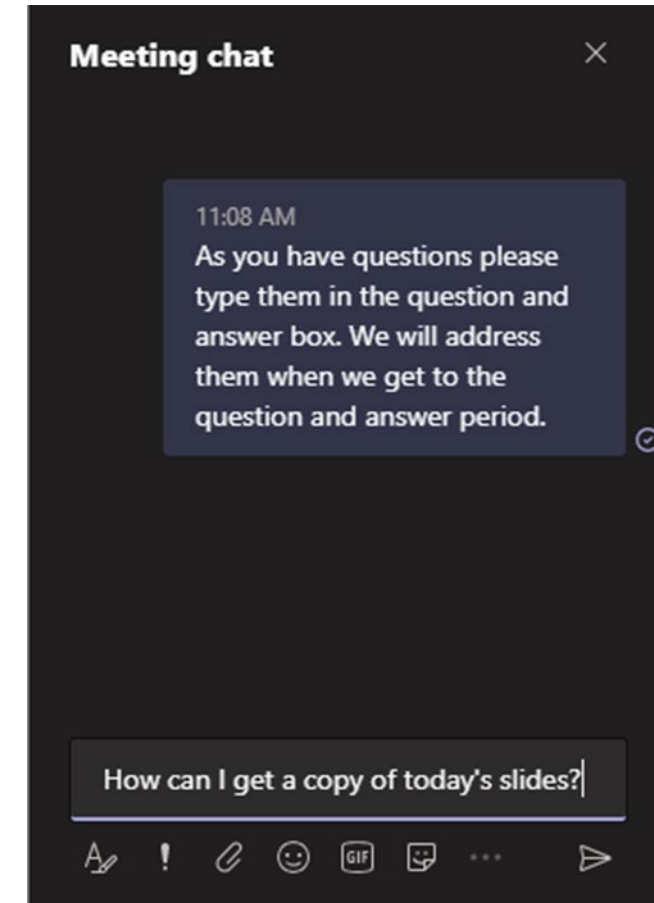
Annie is an Environmental Protection Specialist in the Stratospheric Protection Division (SPD) in EPA's Office of Atmospheric Protection, where she works on rulemakings under the American Innovation and Manufacturing (AIM) Act and partnership programs. Prior to SPD, she also worked on EPA's SmartWay program, which helps companies advance supply chain sustainability by improving freight transportation efficiency.

Questions



Question and Answer (Q&A) Session

- Participants are muted
- Questions will be moderated at the end
- To ask a question, enter your comment into the chat box



Webinar Feedback and Materials



Feedback Form

- We value your input!
- The link to a feedback form will appear in the chat window

Recording and Slides

- Webinar is being recorded
- Materials will be posted on the GreenChill website under Events and Webinars: www.epa.gov/greenchill
- To receive notification when materials are posted email: EPA-GreenChill@abtassoc.com

Program Overview



www.epa.gov/greenchill

GreenChill is a voluntary partnership program that works collaboratively with the food retail industry to reduce refrigerant emissions and decrease stores' impact on the ozone layer and climate system

GreenChill works to help food retailers:

- Lower refrigerant charge sizes and eliminate leaks
- Transition to environmentally friendlier refrigerants
- Adopt green refrigeration technologies and best environmental practices

Become a GreenChill Partner!



**Join your
Industry Peers!**

*GreenChill is
actively recruiting
new Food Retail
Partners*



Request a
partnership packet



Sign the partnership
agreement



Meet eligibility
requirements



Become a GreenChill
partner!

The GreenChill Partnership Process

epa.gov/greenchill/about-greenchill-corporate-emissions-reduction-program

Upcoming GreenChill Webinars

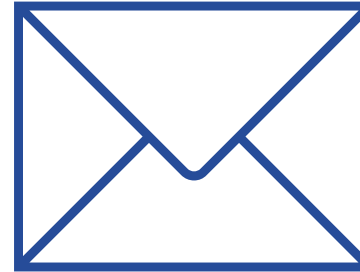


- **January 17**, 1 pm Eastern – Preparing for Technology Transitions: Guidance for Supermarkets with presenters from DC Engineering

We are planning GreenChill's 2024 webinar series. Have ideas for a webinar or would you like to present? Email GreenChill@epa.gov

To join our webinar invitation list, email EPA-GreenChill@abtassoc.com

Learn More



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Today's Speakers...

Gary Epright



Gary Epright

Title: US Technical Advisor

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Gary is an advisor leading technical aspects of Matelex US business including pilot installations and return on investment (ROI) analysis. As the Walmart Senior Manager, his team attained over twenty million dollars in savings using Building Automation and Refrigeration Systems remote reporting to identify energy savings opportunities. His IMS-Evolve team using Internet of things (IoT) solutions set the groundwork for significant energy savings, as well as tracking equipment's compliance to specifications. He is a firm believer in using data to make informed decisions. Gary oversaw all facility maintenance at Wild Oats Markets and has 20 years of experience working in the frozen food industry.

David Reitz



David Reitz

US Partnerships

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David has worked with the Dehon Group for 10 years, as an employee, advisor, and partner. He leads partnerships and business development for Matelex. Prior to Matelex, he was the Chief Executive Officer and Subsidiary Director for Inventec Performance Chemicals USA, where he led all aspects of the market's operations, including its effort to bring innovative sustainable manufacturing products to market and developed distribution partnerships. He previously spent a decade with Procter & Gamble in multiple senior general management, corporate finance, and marketing positions.



Refrigerant Leak Detection Technologies

Automatic Leak Detection (ALD) and remote supermarket refrigeration management

David Reitz

Matelex US Partnerships

Gary Epright

Technical Consultant

Matelex Introduction

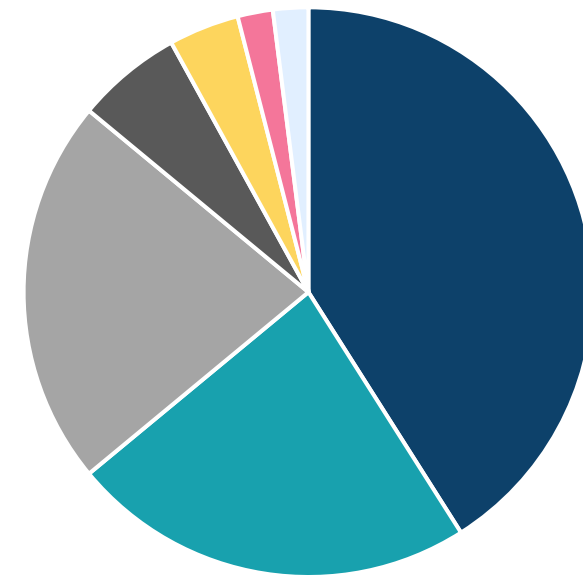


- 863 tons of refrigerants under supervision
- 1,649,274 tons of carbon dioxide (CO₂) equivalent monitored
- 4000+ install base
- 8% global leak rate (impacted by old equipment that is no longer maintained)

Matelex's offer:

- Equipment : leak detection & energy monitoring
- Web application (app) for centralized remote monitoring and maintenance
- 3 step approach : measure, analyze, optimize

Refrigerant Bank



■ R448A ■ R404A ■ R449A ■ R134A
 ■ CO2 ■ R407F ■ R507A

Matelex: some details



- Dehon Family (150 yrs in refrigeration).
- Checking entire volume in the system not point solution.
- System agnostic can be installed in any commercial refrigeration and any type of refrigerant.
- Ability to be installed and work on outside installations.
- Start with leaks and also experts on energy.
- Does not need to be customized; utilizing own sensors and ensure data quality.
- Also can utilize current data from sensors or cloud based data.
- Dedicated secure 4G does not need to interact with internal systems.
- Online platform to coordinate both end user and maintenance.
- Manager all facilities and apps for both end user and maintenance.

Importance



Why is Leak Management Important?

Top 10 solutions to climate change

Total gigatons of CO₂-equivalent emissions that could be reduced by 2050

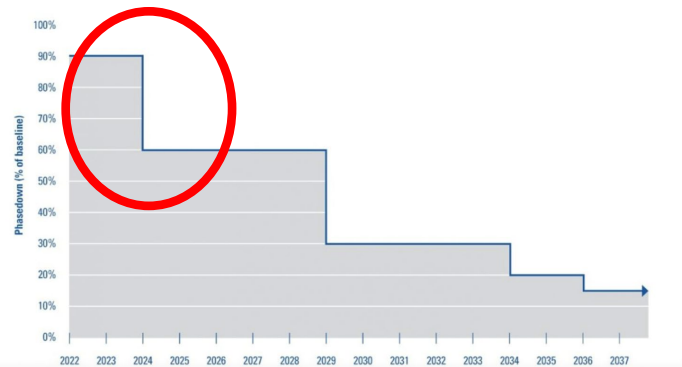
SOLUTION		PLAUSIBLE SCENARIO		DRAWDOWN SCENARIO		OPTIMUM SCENARIO
Refrigerant Management	1	89.74	2	96.49	3	96.49
Wind Turbines (Onshore)	2	84.60	1	146.50	1	139.31
Reduced Food Waste	3	70.53	4	83.03	4	92.89
Plant-Rich Diet	4	66.11	5	78.65	5	87.86
Tropical Forests	5	61.23	3	89.00	2	105.60
Educating Girls	6	59.60	7	59.60	8	59.60
Family Planning	7	59.60	8	59.60	9	59.60
Solar Farms	8	36.90	6	64.60	7	60.48
Silvopasture	9	31.19	9	47.50	6	63.81
Rooftop Solar	10	24.60	10	43.10	13	40.34

Source: Project Drawdown

Vex

Phasedown Schedule

The following illustrates the HFC production and consumption phasedown schedule as outlined in the AIM Act.



Sustainability Goals

- A 90 Billion ton CO₂ equivalent opportunity and the #1 climate change action that companies can take
- Hydrofluorocarbon (HFC) phasedown slows global warming by 1.0° Fahrenheit
- Single facility can contribute tons of CO₂ a year (*variable dependent on leaks & refrigerant)

AIM Impact in 2024

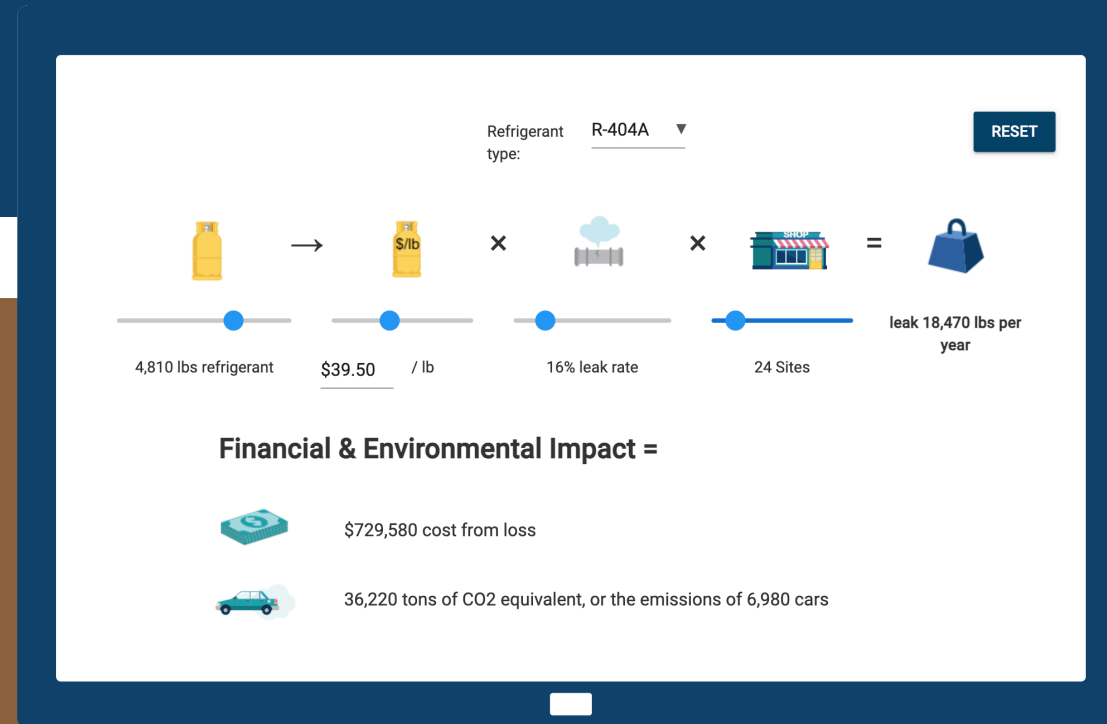
- Phase down decreases HFC supply by 40% in 2024 even as demand increases
- HFC price increase (x number of times)
- Availability issue of products & technicians
- Automatic leak detection requirements in proposed rule

Why is Leak Management Important?

Safety, performance, financial impact

Our Impact Calculator shows the financial and environmental impact of systems.
www.matelex.com/us/home/impact-calculator/

*Have more detailed analysis models available.



Leak Detection



CFC - HCFC - HFC
HFO - NH₃ - CO₂

?



Overview “Common” Leak Detection

	Temp sensors	Manual	Direct (ALD)	Indirect (ALD)
Description	Thermostat technology in the storage area can be.	Handheld leak detection requires technician time to check for point labels.	Detects gas particulate in air in specific areas.	Utilizes IoT & algorithmic learning to determine system leaks.
Best Use	Ok to have as last resort and as a visual check system is working.	Only way to check complex system when an issue not practical due to manual cost for daily checks.	Safety and simple cold storage facility without long refrigerants lines.	Commercial refrigeration installation.
Issues or Challenges	If temp alarm then most fluid has leaked.	Very costly to check, takes hours, not remote.	False alarms and many spots can not be checked.	Like all temp and direct need manual system to location
Costs	Relatively low cost, can be local or connected online.	Low cost devices, high cost of checks due to tech labor.	Highest cost of installation and maintenance.	Medium cost for set up.
Sensitivity	Lagging indicator.	Very good for location.	Very good for location.	Most sensitive to leaks for entire system.
Range	In cold storage areas.	Where there is a pipe and connection to check	Where sensors are installed	Entire system
Reporting	Not likely included.	Not included.	May be included.	Likely included.

- 1. Evolution** - Leak detection system has evolved over time from simple temperature gauges to powerful indirect technologies
- 2. Best use** – Each technology has it’s strengths
- 3. Other** - Cost, sensitivity to leaks, real time data, alerts, indication of severity, reporting and coverage (range) are important considerations

Leak Detection Methods

Locate the leak

Know if there is a leak

Direct Leak Detection	Indirect Leak Detection (best)
Portable leak detector	Expert systems, indirect technology
Room “sniffer” controllers	Classic low level
Foaming and soaping solutions	
Introduction of ultraviolet (UV) liquid or colorant	
Pressurization	

Leak Detection Methods

Direct Leak Detection

Pros	Cons
Locate the leak	A lot of sensors needed
Easy to use	Time consuming, expensive
For people safety	Note precise enough, no visibility of the refrigerant level
	No visibility of whether leak has occurred

Conclusion : indirect and direct detection are complementary.

Indirect Leak Detection

Pros	Cons
Detect leaks 60 days before traditional methods	No way of knowing where the leak is
Global visibility of the refrigerant and leak detection equipment performance	False or missed alarms due to incorrect use of alarms (recalculation vs. relearning, low level, etc.)
Can have a web app for global monitoring with centralized dashboard and alerts	
Reduced maintenance costs due to fewer false alarms, easier calibration and a better response based on fact based decisions	
Example: Detect leaks 60 days before traditional methods reducing refrigerant losses 80%	

Indirect Leak Detection with Web Platform



**You can't manage
what you can't
measure.**

- Leak detection with global remote monitoring of refrigeration units
- Visibility into the leak detector's performance (via [web app](#))
- Better understand event and leaks thanks to level curves ([daily or trend curves](#))
- Add additional and new data to improve the analysis
- Have a real time view on installations = have a technician onsite 24/7
- Optimize planning by prioritizing leak related maintenance according to the criticality
- Multiple teams can view the same data to discuss solutions with end user
- Fact based decisions

Application example





Matelex & Auchan

- 2014 : beginning of the partnership
- Greenhouse gas emissions/F-gas (FG) can represent more than half of carbon footprint of a shop
- Environmental approach
- Implementation of the European F-Gas regulation
- Wanted a precise follow-up of fluid quantities
- Need for reactivity in case of leaks
- Reduce unnecessary travel
- Need to support operators in reducing the impact of installations
- Direct detection was not sufficient (leak detection sensitivity, if there are still leaks, what quantities are lost, to refill, lost time...)

Auchan Key figures:

- Leader in Grocer, supermarkets
- 2,000+ locations
- Across Europe
- \$36B in sales
- 160k employees

Global objective : evaluate what exists to improve

Matelex & Auchan

Why Indirect Detection?

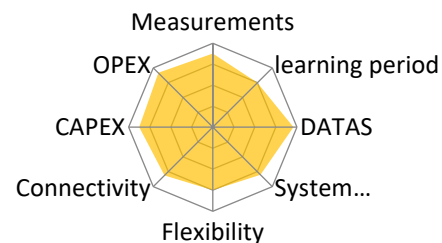
- Make visible what is invisible
- Control and monitoring of the volume of fluid present in the installations
- Knowing the ideal load to optimize the operation of the system and save energy
- Control and monitoring of the leakage rate + ENERGY
- Shared vision between operators, store managers and corporate social responsibility (CSR) for common objectives
- Real time monitoring and evolution thanks to the history

Other Technologies Tested

- Direct detection: requires additional staff, a lot of time, no guarantees, no global vision
- Other indirect: expensive, with dependence on the supplier, some lacked global platform, lack of control, not enough autonomy in management



Evaluation Criteria



Implementation of the Solution

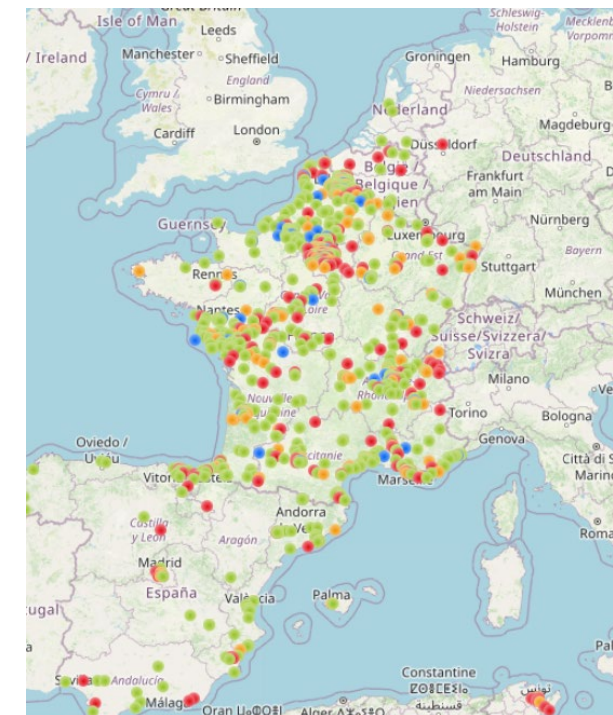
Overcoming challenges of deployment in stores and technicians

Technicians :

- Work with existing refrigeration companies
- Setting up of a schedule of conditions, procedures
- Framing the service with referenced prices
- Validate installation and condition of equipment

Store Managers:

- Create an understanding of the environmental impact of leaks
- Educate on compliance changes
- Impact of production stoppages, loss of merchandise
- Training on the tool (understanding the alert emails, triggering the intervention, reading the curves)
- Health risk and image linked to cold chain breakage



Earnings: Costs, Environment & Risks

- 37% drop in **refrigerant refills** through 2017 (original 109)
- Overall 18% in 2018
- Improvement of the coefficients of performance
- Better prepared interventions (information on the flow of the leak, access to the level curves)
- Better coordination efficiencies/pressure with maintenance

Pilot:

“109 supermarkets equipped with MATELEX in 2016. 13,700 tons of fluids refilled in 2016 = 28% reduction.”

Auchan, 2016

Validate:

“Implemented Matelex on centralized refrigeration systems. They consist to detect leaks thanks to an alert system when a lost fluid threshold is reached. They were deployed on approximately 5/6 of French hypermarkets, with a **return on investment less than one year.**”

Auchan, 2017

Scale Across Geographies:

“To anticipate future regulations concerning fluids HFC, the Technical Department of Auchan Retail launched, in 2018, a vast project to decarbonize refrigeration systems in all of its host countries. This aims to install Matelex on refrigeration plants.”

Auchan report, 2018

Implementation

Set up a global strategy, to be coordinated with the refrigeration providers

1. Select pilot stores requiring priority action, and involve refrigeration staff in the process
2. Set up a deployment plan, with writing of the process and dissemination + training of refrigeration technicians (understanding of the objective and the system, mastery)
3. Reception and follow-up of the deployment, with: verification of the good installation, the connection of the system and its good exploitation
 - Identify key contacts and require reports from technicians
 - Precise checklist with measurements
 - Report and photos
 - Improve & document
4. Operation of the solution: require an intervention time in case of alert, verify after, set up a regular follow-up and ask for rigor



Matelex partners to build a program and will be able to tailor solution to needs.

2024 Projects

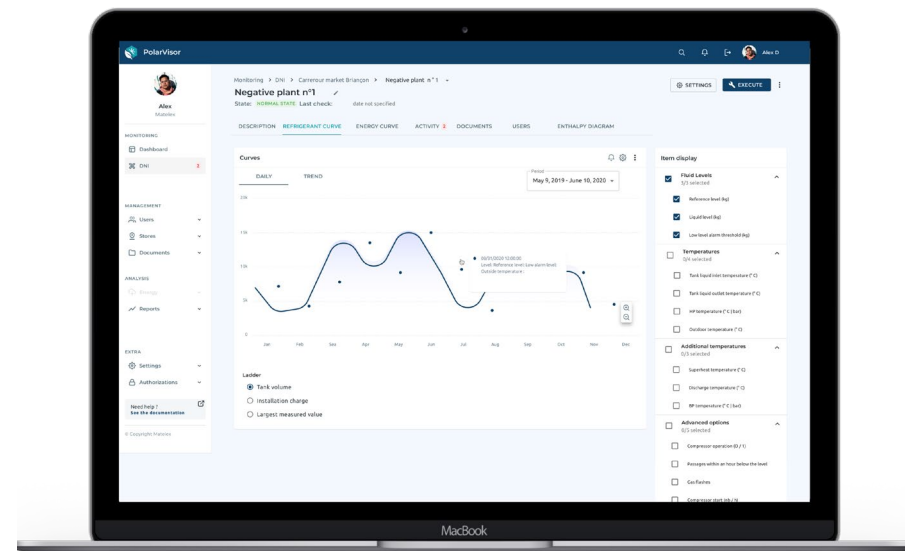


2024 US Program

Matelex technology program for operators and for facility owners to pilot in 3-5 facilities

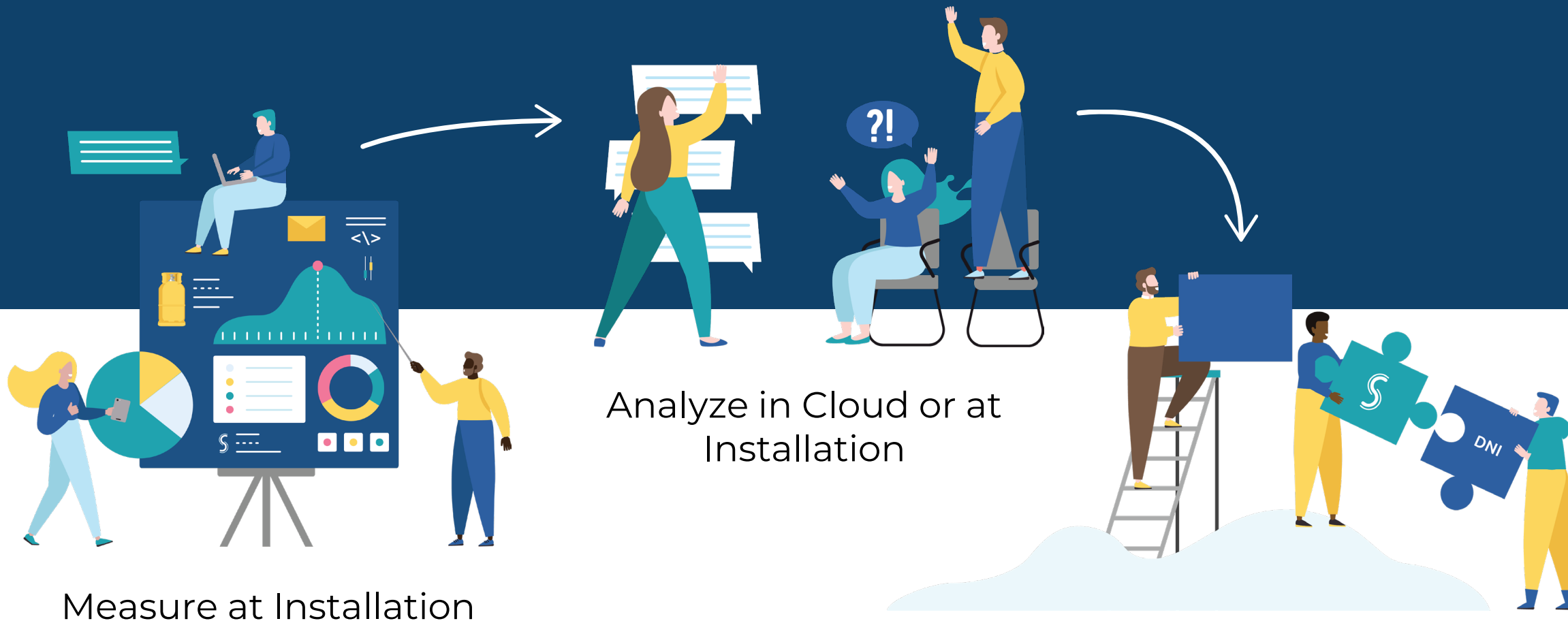
The overall goal of this program is to demonstrate the impact of Matelex technology for your company and for your maintenance partner to gain experience.

- Matelex to provide equipment, web technology, training and support on installation
- Installer/Maintenance Company - We will work with your maintenance provider on this project
- Duration from installation to reporting: 3-6 months
- Easy execution (identify locations)
- A final report will be provided to all parties, which will assess the results of the pilot. Included will be summary information and both an impact and ROI financial analysis



Data Intelligence for Refrigeration

Sustainable, Economical & Efficient



Measure at Installation

Analyze in Cloud or at
Installation

Optimize &
Communicate

How it Works: Indirect Leak Detection

Leak Detection

Connectivity :

WiFi

Ethernet/RJ45

4G



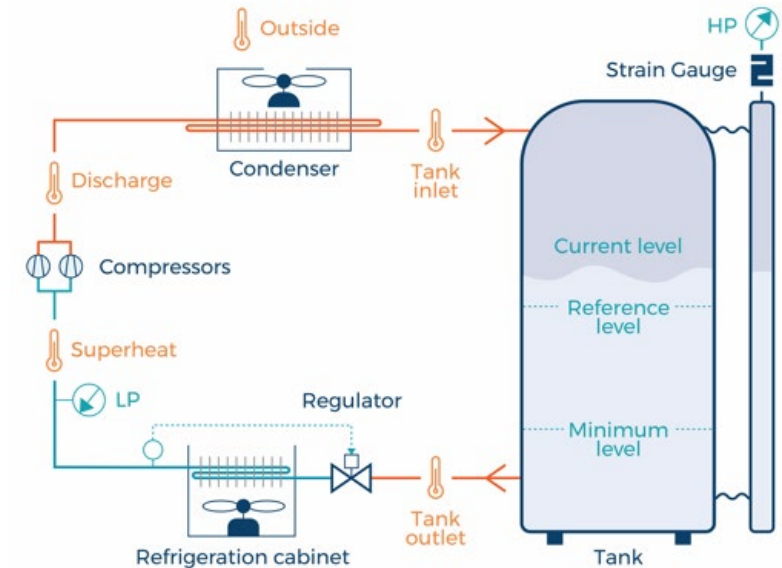
- Achieved with various platforms, technology and with differing levels of sensitivity and features
- Leak detection by indirect measurement method with expert system
- Utilize existing data, plus specific sensors and outside data

Algorithmic analysis of refrigeration system

Reference level determined at the end of the learning process

Leak detections done at intervals during each day (24/7)

- Email or other alert in case of refrigerant leaks



All refrigerants - all types of tanks

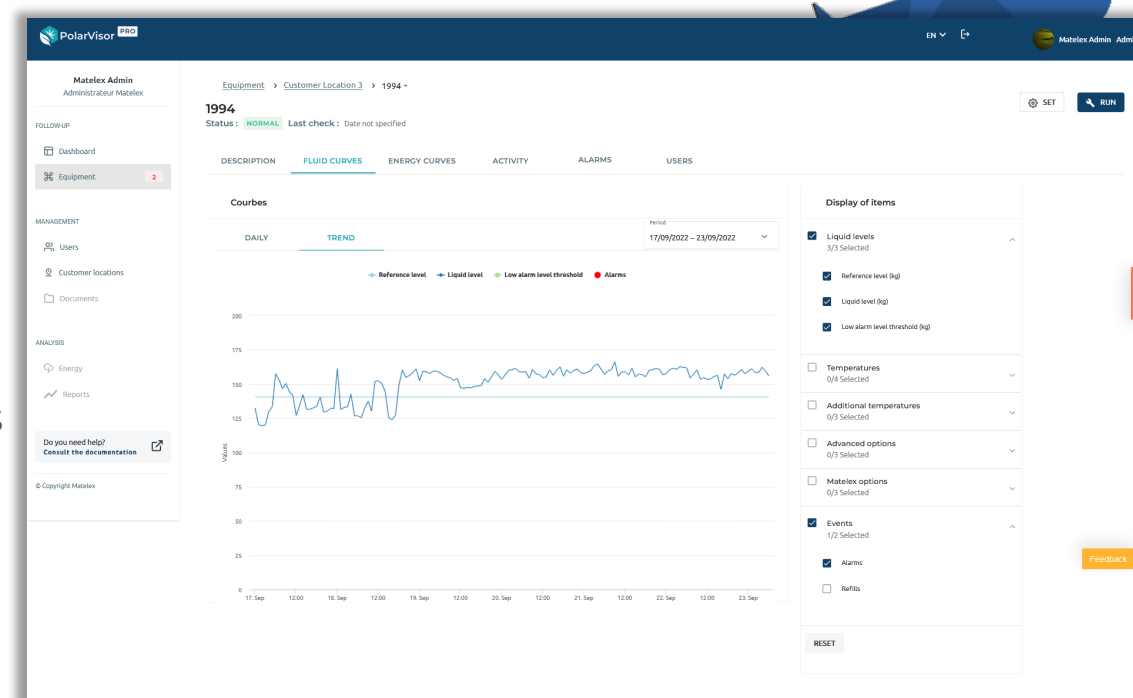
Measuring & Analyzing

Refrigeration Expert Systems

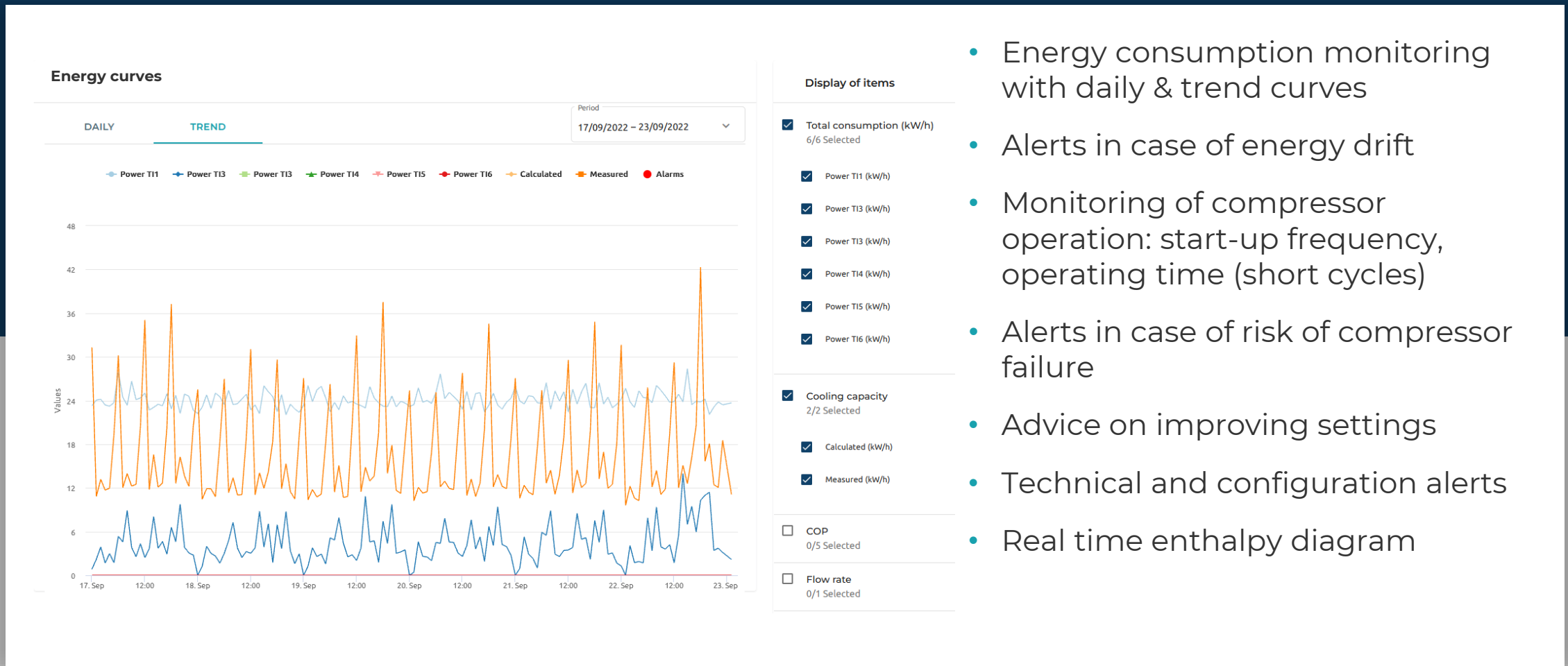
- Measuring for learning
- Analyzing data to understand
- Identifying variations and alarm conditions
- Exception reporting that is intuitive

For Real-time Remote Monitoring

- A global and shared vision between participants
- Complete leak detection every hour
- Continuous energy monitoring
- Web-based facility management platform
- History since ALD system commissioning



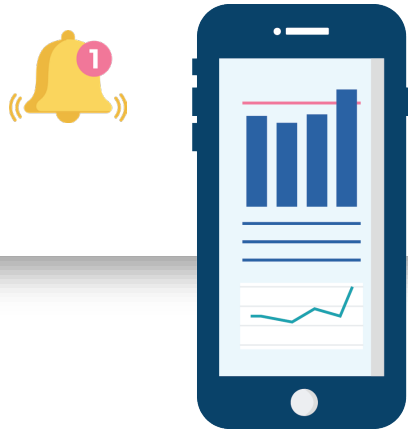
How it Works – Energy Monitoring



Optimize & Reduce

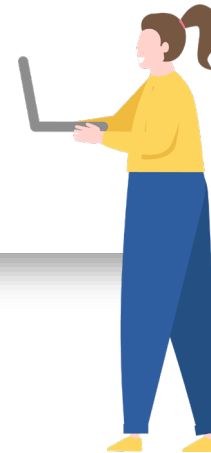
Intervene as quickly as possible thanks to a panel of alerts:

- Refrigerant leaks: email alert with estimates
- Energy drift
- Risk of compressor failure
- Technical alerts



Monitoring and setting up your installation :

- Improved settings
- Management dashboards
- Reminders and regulatory information
- Technical support in intervention



Somethings to consider:

- Does it work on all tanks
 - Will work with all refrigerants and compressors
 - Sensitivity
 - How is data shared and configured
- All tanks (High Pressure)**
 - All refrigerants
 - New or existing installations

Measuring & Analyzing

Power of web-applications

- Remote monitoring web platform, accessible 24/7
- Centralized tracking for continuous facility monitoring
- Summary dashboard with facilities map
- List of installations with leaks, energy and technical alerts
- Refrigerant level and energy monitoring curves
- Monitoring of fluid refills
- Summary scorecards, tips and reminders
- Help in prioritizing interventions
- Follow-up of performances in real time



Achievable Results

Responsive: saves up to 80% of refrigerant

- Indirect measurement methods with a connected device
- Algorithmic learning for automatic leakage email alerts
- Remote management via web app

Lowers bills: 20% energy savings

- Real coefficient of performance (COP) calculation
- Energy drifts & compressors' failure alerts
- Settings tips for optimization



Visibility of system: saves time & money

- Online dashboard with facilities map and visual alerts
- List of installations with alarms : leak, energy, technical
- Refrigerant level curves
- Energy monitoring curves
- Remote settings
- Recommendations and reminders



Case Study: Impact of Technology

- 6 systems monitored on 4 stores
- 6 months study
- Refrigerant: R404A
- During the 6 month, 1 of the 6 system had no leak

Showed average of

79% leak

& 60 days average more responsive

Store	Installation	Sale Surface (m ²)	Tank Capacity (l)	Total Refrigerant (kg)	Cooling Power (kW)	Leak Rate (kg/day)	Refrigerant which could have been saved	(%) Savings	Number of days needed for the technician to detect the leak	Number of days needed for the DNI to detect the leak	Number of Days Saved
1	+	9000	400	850	404 (-12°)	41,7	208	83%	6	1	5
2	+	9000	2*250	900	412 (-12°)	5,7	143	71%	35	10	25
2	-	9000	145	225	36 (-38°)	0,2	24	79%	131	28	103
3	-	9600	220	350	42 (-38°)	No leak	No leak		No leak	No leak	
4	+	9600	145	210	100 (-12°)	2	97	83%	59	10	49
4	-	1400	145	350	20 (-38°)	No refill	No refill		164	45	119
								79%			60.2

Leadership Remote Management

With 4,000+ installations and 10 years experience, Matelex is a world leader in IoT based advanced leak detection and energy management technology.



Research

Currently working a research with Yale Carbon Containment Lab to analyze Matelex's 3.5 Terabytes of data to better understand leaks and leak-energy relationships in commercial installations.

Contacts



Speakers

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GreenChill

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Upcoming Webinar

January 17, 2024
1:00 PM Eastern
DC Engineering

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