

LEVERAGING TECHNOLOGY FOR YOUR ESG STRATEGY



ISRI ESG Webinar Series
February 29, 2024

2024 ESG Webinar Series

February 29- Leveraging Technology for ESG

May 16- Emissions Reductions

August 29- Employees & the Workforce

November 21- ESG Policies & Regulations

2023 Workshop Series available:

<https://videos.isri.org/category/video-library/esg-workshops/>

ISRI Anti-Trust Policy in Effect: isri.org/antitrust



PRESENTERS



Nate Springer
TRC Companies



Constantino Lannes
Sennebogen, LLC



Rey Banatao
Google



Ethan Steele
Google



Sujit Sanjeev
Google



Natalie Messer Betts
ISRI



Susan Robinson
ISRI Consultant



AGENDA

Introduction

Technology Overview

Operating Technologies

Artificial Intelligence

Data Management Technologies

ISRI Upcoming Events



Introduction

What is Sustainable Technology?

Sustainable technology is an umbrella term describing innovation that considers natural resources and fosters economic and social development.

Sustainable technology aims to aid in improving the environmental impact of societies, companies and households.

For companies willing to think broadly about how to advance their sustainability initiatives, technology can act as a major accelerant. Using advanced technologies and ways of working to enable profitable solutions can have a positive impact on [net zero](#) and other [environmental, social, and governance goals](#).



Sustainable Technology uses technology to reduce emissions. It is also technology that helps companies achieve their sustainability goals more efficiently.



OPERATIONS TECHNOLOGIES

1. Fleet, fuel & equipment
2. Artificial Intelligence (AI)
3. Recycling technologies

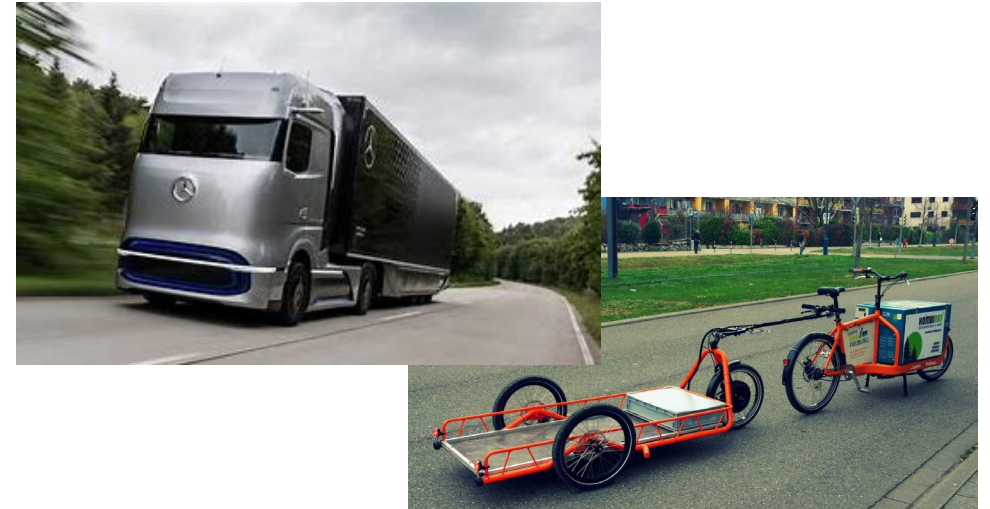
Fleet, Fuel & Equipment

Energy is at the core of sustainability, and renewable fuel is one solution to reduce GHG emissions.

- As technology evolves, **renewable energy technologies** and use are growing.
- **This includes fleet and fuel technology, which we will focus on today.** Investment, competitiveness, and demand are propelling growth in this industry.

Fleet/Equipment

Natural gas and electric vehicles require a transition away from internal combustion engines to new engines designed for their respective fuels.



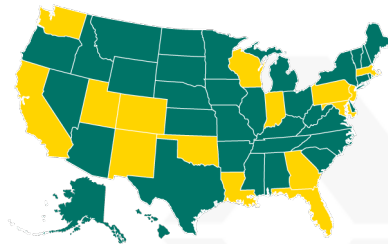
Technology advancements in alternative fuels used in **on-road and off-road, and stationary equipment** (electricity, CNG/RNG & hydrogen) are making significant inroads in reducing fleet and equipment emissions in the recycling industry

Nate Springer, Vice President, Market Development of TRC will share his expertise on the most recent trends in sustainable fleet and fuel advances.

Megatrends spark a decades-long energy transition



A draft **SEC rule** would require public companies to manage and disclose **climate risk, including greenhouse gas (GHG) emissions**.



Thirteen (13) states have adopted rules that require **vehicles sales to transition to 100% zero-emission** (electric or hydrogen). **California requires many fleet owners to purchase them.**



SCIENCE
BASED
TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

S&P companies setting science-based targets – aligned with global climate goals - **rose from 1% in 2016 to 42% in 2022**. 98% of S&P 500 companies publish annual sustainability reports.



Large brands like Walmart and Amazon are setting goals to transition to **zero-emission across their entire operations and supply chain**, many by 2040.

WHO IS ADOPTING NATURAL GAS VEHICLES AND WHY

Fleets with long asset lives, scheduled routes, and high energy demands drive adoption and continued growth of this leading clean vehicle technology for fleets.

FLEET TYPES LEADING CNG VEHICLE ADOPTION:



Estimated Medium- and Heavy-Duty in Operation

TENS OF THOUSANDS

THOUSANDS

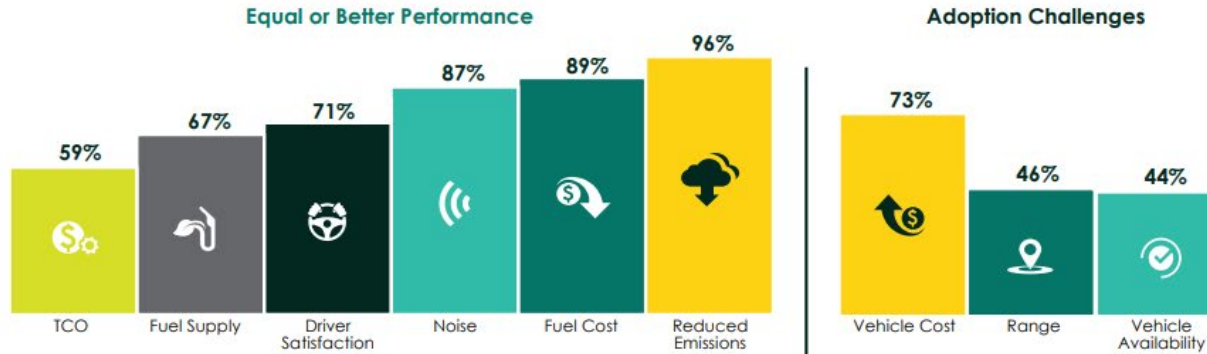
STATE OF PLAY

CNG averaged \$2.73 per diesel-gallon equivalent in 2023, RNG supplies grew, and a 15-liter engine enters the market this year.

State of Sustainable Fleets 2023 Analysis

WHAT FLEETS ARE SAYING:

CNG vehicles are both mature and near-zero emissions. Leading adopters see consistent and significantly reduced fuel costs and lower total cost of ownership. NGV cost remains the top challenge reported by more than two-thirds of fleets surveyed.



Source: Percent of surveyed early adopter fleets that have either piloted or purchased MD or HD CNG vehicles who cite a criteria as either equal/better or a challenge from the State of Sustainable Fleets 2022 survey.

"We are very happy with CNG. The main roadblock at first was the lack of infrastructure across our longer runs. Many more stations are available today, and we also purchased larger capacity fuel tanks to get us down the road farther between fueling."

— Daniel Shandy, Director Equipment & Maintenance, Matheson Trucking

Matheson

WHO IS ADOPTING BATTERY-ELECTRIC VEHICLES AND WHY

Fleets with daily return-to-base routes under 200 miles provide predictable access to charging and dominate early BEV adoptions.

FLEET TYPES LEADING BEV ADOPTION:



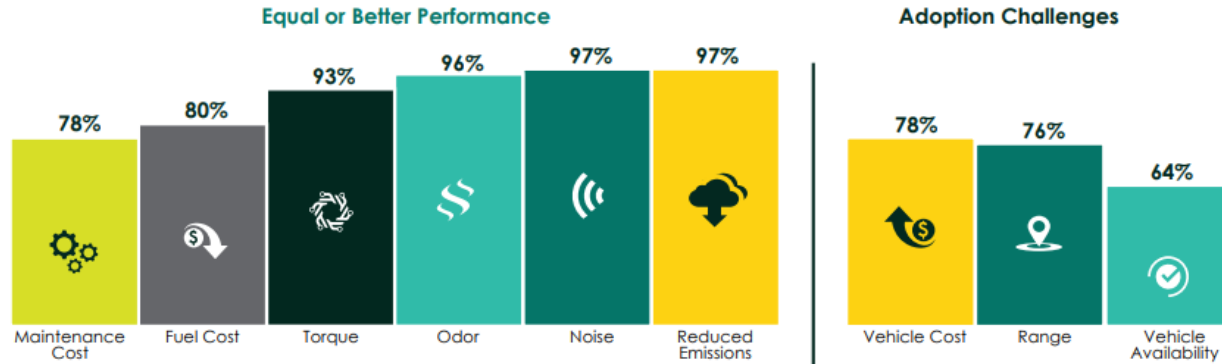
Estimated Medium- and Heavy-Duty Vehicles in Operation

LOW-THOUSANDS

HUNDREDS

WHAT FLEETS ARE SAYING:

Despite its early stage of commercial development, surveyed early BEV users report high satisfaction on many critical operational metrics compared to gasoline and diesel. Vehicle cost is the top challenge reported by more than three quarters of BEV users.



Source: Percent of surveyed early adopter fleets that have either piloted or purchased MD or HD BEVs who cite a criteria as either equal/better or a challenge from the State of Sustainable Fleets 2022 survey.

STATE OF PLAY

Interest and demand is high and broad, though infrastructure, supply, and cost challenges remain for this early commercial technology for fleets.

State of Sustainable Fleets 2023 survey

“To rapidly scale Class 8 BEV deployment, it’s crucial to work with external partners & be flexible with your timeline. Understand that you may not get it 100% right for the first deployment, but you will take the lessons learned along as you scale this technology.”

— Carlo Bertani, Sustainability and Decarbonization, Maersk





Advanced Clean Transportation Expo May 20 to 23, 2024 | Las Vegas Convention Center

GNA produces North America's largest advanced transportation and clean fleet event. www.actexpo.com

12,000+

Registered Attendees

2,700+

Fleet Operators

275+

Sponsors & Exhibitors



Electric Off-Road Vehicles & Equipment

Off-road Electric Vehicles in North America (2024)

- Heavier-duty off-road electric vehicles have been slower to develop in the U.S., with some of the same power and reliability challenges that on-road vehicles experience.
- Electric motors are less complicated than combustion engines. They are quieter, require less maintenance and can provide sufficient power for some applications. Examples of equipment that moved more quickly to electric power includes all-electric skid loaders and wheel loaders.



SENNEBOGEN®

Constantino Lannes, CEO of Sennebogen LLC, a manufacturer of off-road vehicles, will provide a deeper into the status of this category of electric vehicles.

Leveraging Technology for Sustainability

Constantino Lannes

President & CEO

February 29th 2024



ISRI

Voice of the Recycling Industry[®]

SENEBOGEN[®]

Goals for Today:

What new technologies are available industry-wide for on-site recycling equipment to help an operation reduce greenhouse gas emissions?

How different technologies compare to traditional equipment in terms of cost, impact and sustainability?

The factors that are driving decision making on new technology adoption—where and when are these technologies being used?

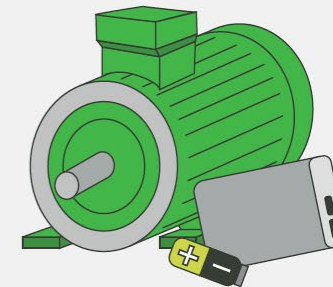
Who will pay for this new technology?

As most of the greenhouse gas emissions in the recycling industry are generated by Diesel engines, the obvious way to reduce the emissions is to eliminate the diesel engine

Alternative - Electric Drive

“I cannot have a fixed pedestal unit”!

	Small material handlers	Medium material handlers	Large material handlers
Electric motor power	up to 110 kW	up to 250 kW	up to 500 kW
Battery	✓		
Cable-fed	✓	✓	✓
Powerpack	✓	✓	✓
	✓		



How different technologies compare to traditional equipment in terms of cost, impact and sustainability?

Acquisition cost:

Cable-fed machines: 15 to 25% above Diesel machines

Battery: 2 to 2.5 times Diesel machines

Maintenance cost:

Cable-fed machines: 50 to 70% below Diesel machines

Battery: 40 to 60% below Diesel machines – battery life?

Cost comparison between electric motor and Diesel engine

Operating data:

Working hours

Consumables Cost:

Engine oil [US\$/gal] Hydraulic oil [US\$/gal] Gear box oil [US\$/gal]

The calculation is a guideline only

Service cost:

Travel [US\$/trip] Labour costs [US\$/hr]

Energy cost:

Electricity [US\$/kWh] Fuel [US\$/gal]

Model:

Model:	Engine power	Energy consumption	Energy cost per working hour	Energy cost per 4,000 working hours	Service cost per 4,000 working hours
840E-Diesel	317HP	5.00 GPH	\$23.75	\$95,000.00	\$33,853.94
840E-Electric	225 KW	117.0 KWh	\$5.27	\$21,060.00	\$19,871.26
Service cost @ hours:	250	500	1,000	2,000	4,000
840E-Diesel	\$3,107.87	\$1,566.92	\$3,085.50	\$5,368.36	\$12,939.05
840E-Electric	\$3,107.87	\$0.00	\$1,259.97	\$3,542.84	\$10,700.62

840E-Diesel
840E-Electric

Energy and service cost per 4,000.00 hr
\$128,853.94
\$40,931.26

Difference Energy & service cost per 4,000.00 hr
\$87,922.68

68.2%

Where and when are these technologies being used?

Sennebogen 821 Electric with Pony Motor

On-board Powerpack: just unplug and go:

“The advantages of electric drive are widely known, but the next notable feature of this unit is more of a surprise. We require the machine to be driven quickly out of the recycling bay and relocated for other duties. When it’s time to move, the operator simply removes the large plug, rolls the power cable up on the drum and starts the diesel powerpack that’s built into the 821’s counterweight. **Then he just switches the motor to diesel mode and the waste handler is ready to roll.**”



What could your business look like?

Electric Sennebogen 840 Crawler Gantry unloads rail cars under the gantry or takes the material from the ground dumped from trucks and in both cases piles material high to feed steel mill.

Customer has also managed to increase capacity and improve traffic flow to minimize wait times.



Sennebogen 825 Battery Driven

CRONIMET currently uses the machine for feeding its scrap press, preparing material for the press and for sorting incoming goods. The battery-powered material handler runs on 100 percent certified green electricity and saves up to 125 tons of CO2 emissions per year in two-shift operation compared with the previous solution - and with the same freedom of movement.

“With this innovation project, we are taking a decisive step towards climate neutrality,”

Managing Director of CRONIMET

***A great highlight is that when charging, excess power being fed in simultaneously recharges the batteries. ***



CIMCO - 870 Crawler w/ Pylon



"They've been feeding the shredder with an 835 for 15 years; they know the cycle times. We were all impressed with how fast it is for a big machine, with so much stick out there. They got up in there and were amazed how fast it goes. It's been in operation since July (2022) and they're still ecstatic with it."

-Ron Brenny
Operations Manager

What could your business look like?

“The Sennebogen 895 has revolutionized the way we, and subsequently the entire industry, have and will load scrap into vessels. We’re loading vessels in less than half the time we were with our cranes. In addition, we’ve drastically reduced our operating costs. We no longer need “spotters” on the ground to guide skip pan, crane certified operators, crane OSHA inspections, cable/pulley/shives maintenance etc. Most importantly this is a much safer operation. We have full control of the load, can see clearly into the vessel, and can operate independent of wind. This will be a game changer for the entire industry, but we’re proud to be the first and will take the head start on all our competitors.”

James Dillman – Gateway Terminals







Artificial Intelligence- AI

Artificial Intelligence (AI)*

What is AI? Artificial Intelligence is the simulation of human intelligence process by machines, such as computers. It is the development of computer systems capable of performing tasks that historically required human intelligence

How can it be used to help our industry?

AI tools are emerging as enablers of sustainability, improving resource management, production and consumption. Technology used in recycling equipment is an example of how our industry is currently using AI.

**And there is so much more!
Introducing Google: AI at the forefront**

Recycling Technologies

Materials Processing/ Facility Management: Artificial Intelligence enhances material processing. Using automation and AI technology, recycling facility equipment is can be operated via connected electronics that identify real-time operations, maintenance, performance activity at facilities.

- **Optical Sorters**

- Latest include machine learning and AI
- Linking NIR, camera, XRF and multi-sensor systems

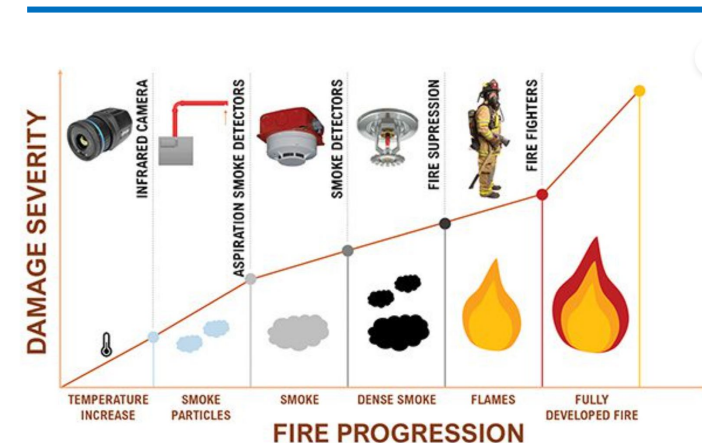
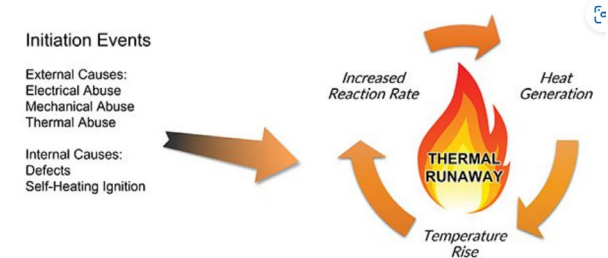
- **Robotics**

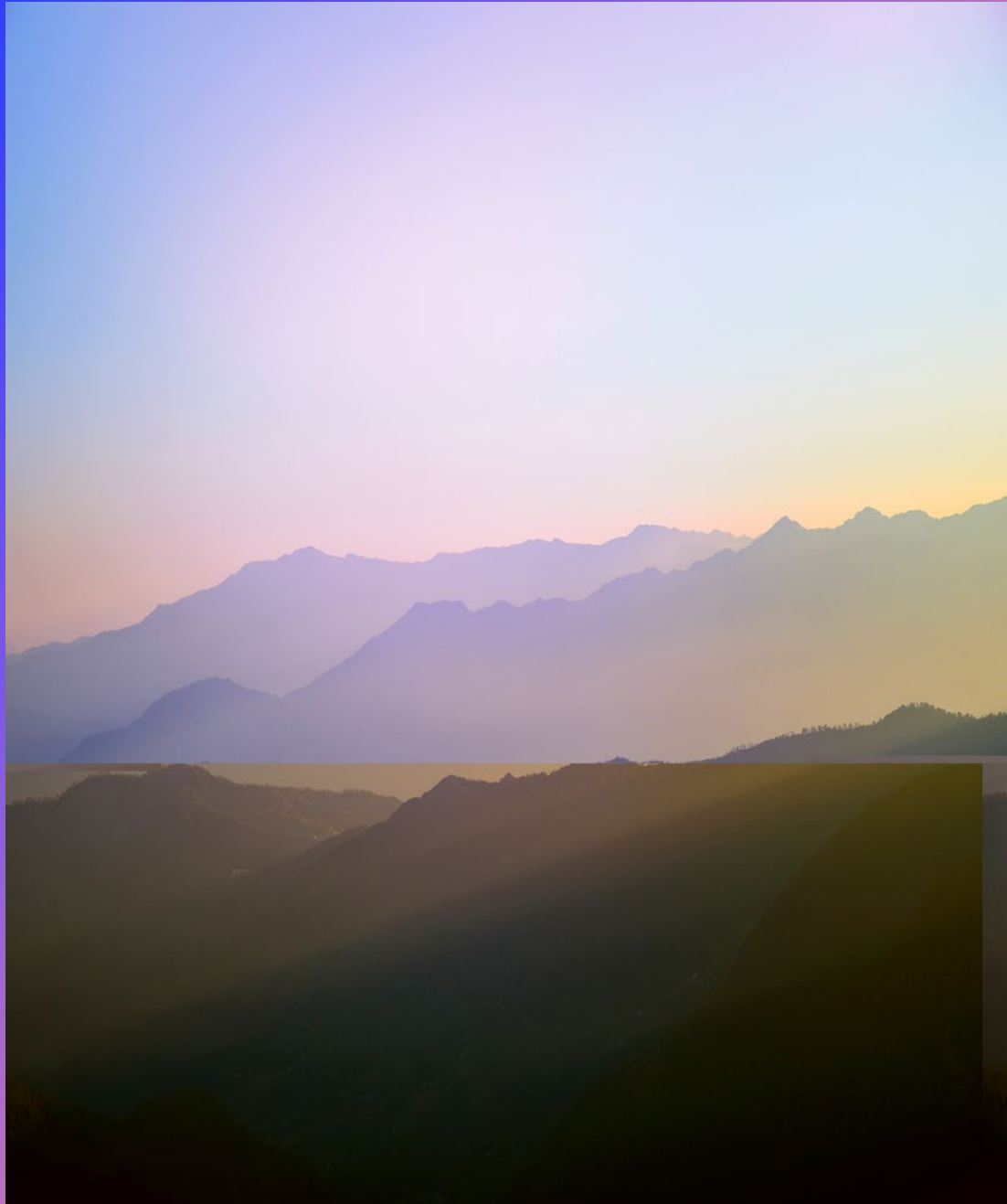
- Currently applied primarily at MRFs in quality control
- Combine Internet of Things, robotics and AI
- Can increase visibility into material flows

- **Thermal Imaging**

- Early detection of thermal runaway from batteries or other thermal events
- Can include automated activation of fire extinguishing systems

Thermal Imaging for Fire detection





Data Management Technologies

IT Technology: Data Management

Use of Technology to facilitate Sustainability Reporting

Fighting fire-with-fire. As investors and reviewers are using increasingly sophisticated technology tools to evaluate companies' sustainability reports and other sustainability data, it is becoming more important to use and understand technology to ensure that your sustainability reporting is evaluated accurately by AI-powered tools.

There are many companies poised to help with this effort – whether it is helping to set up the data platforms, or to prepare your report:

- ***Consulting Companies.***
- ***Accounting Firms.***
- ***Service Providers (e.g. Schneider Electric).***

Before enlisting outside support for data management, **take time to evaluate your needs so that you don't under, or over-spend on a new platform or consultant.**

Watershed Technology recently raised \$100 million in funding, valuing the software company at \$1.8 billion.

Watershed helps businesses track their greenhouse gas emissions and other environmental impacts via specific software.

Once emission hotspots are identified, Watershed works with clients to mitigate impact.

[Current customers](#)

[include](#) Walmart, BlackRock, General Mills, Stripe and Bain Capital.



Summary

Sustainability technology covers a broad range of categories:

- Technology investment to reduce environmental impacts
- Technology that can streamline our sustainability efforts – from staff time to equipment maintenance; and
- Data management tools to use and share information about the company's sustainably progress.

While each of these has a unique role, they are all intertwined – ultimately working together to achieve our goals of reducing the environmental impacts of our companies.

Understanding that the landscape is changing is perhaps as important as understanding the details of the changes.

As technology becomes more complex, experts can help guide us to the optimal level of investment for our unique operations.

Q&A



ISRI CALENDAR

Virtual Events

- Workforce Wednesdays: March 6, 13, 20
- Revolutionize Your Safety Program: March 20th
- Sorting Scrap Efficiently with Vanta Handheld XRF: March 27th

In-Person Events

- EV Safety Technician, Columbus, OH: March 10-12
- ISRI2024 Convention, Las Vegas, NV: April 15-18
- ISRI Spring Safety & Environmental Conference (ISRI), Indianapolis, IN: June 4-6

<https://www.isri.org/events-training/>

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THANK YOU

Natalie Betts
nbetts@isri.org