

The Future of Work: Integrating Emerging and Cross-Cutting Technologies

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NEVC

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Preparing Technicians for the
FUTURE OF WORK
preparingtechnicians.org

CORD
*Leading Change
in Education* 

Project Goals



1. Empower community colleges to prepare technicians for the work of the future.

2. Promote regional collaboration between community colleges and industry to determine the technical demands of work of the future.

3. Support ATE Regional Networks focused on technician education for the work of the future.

4. Foster implementation of the cross-disciplinary STEM core to maximize impact on technician education

What's Happening?

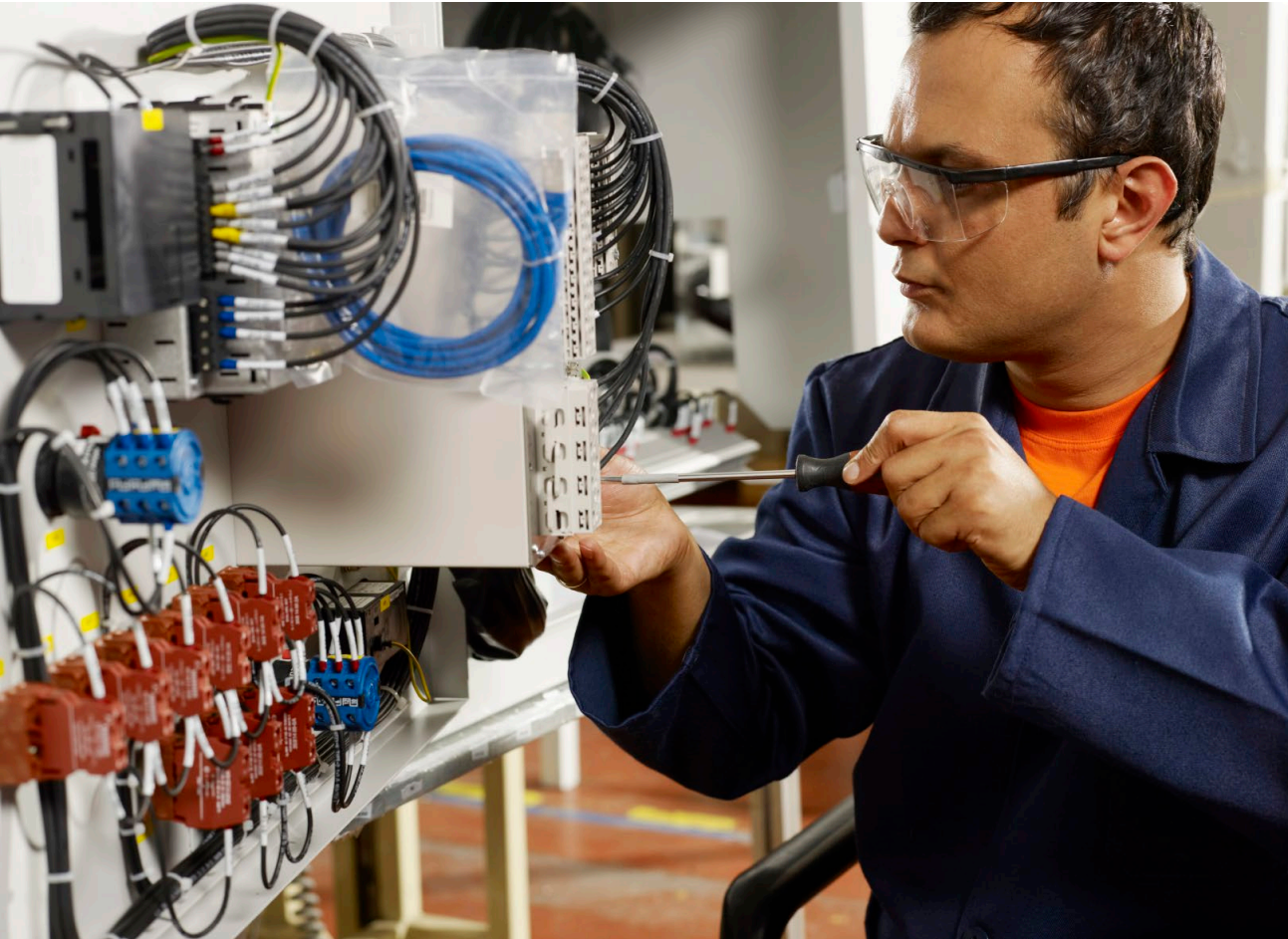
- Nature of work changing at unprecedented speeds
- Technology advancements in machine learning, AI, IoT, and robotics eliminating some jobs, creating others
- Technicians sit at the center of much of this disruption
- Education must keep up
- Our students' career paths will evolve

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Future-proofing STEM Technicians



The Cross-Disciplinary STEM Core:

Skill Area 1: Data Knowledge and Analysis

Skill Area 2: Advanced Digital Literacy

Skill Area 3: Business Knowledge and

Processes

**By Integrating the Cross-Disciplinary STEM Core
into Technical Programs**

A Framework for a Cross-Disciplinary STEM Core

Preparing Technicians
for the Future of Work

A Framework for a Cross-Disciplinary STEM Core



Preparing Technicians for the
FUTURE OF WORK



DATA KNOWLEDGE AND ANALYSIS

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

- Analytics tools
- Computational thinking
- Data analysis
- Data backup and restoration
- Databases
- Data fluency
- Data life cycle
- Data management
- Data modeling
- Data storage
- Data visualization
- Query languages
- Spreadsheets
- Statistics

ADVANCED DIGITAL LITERACY

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

- Artificial intelligence/machine learning
- Automation/robotics
- Basic programming
- Cloud literacy
- Digital fluency
- Digital twins
- Edge computing
- Function block diagram programming
- Human-Machine Interface (HMI)
- Internet of Things (IoT)
- Network architecture
- Network communication
- Security controls

BUSINESS KNOWLEDGE AND PROCESSES

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

- Business cycles
- Blockchain
- Communication
- Continuous process improvement
- Customer/stakeholder analysis
- Entrepreneurship
- Ethics
- Lean processes
- Supply chains
- Market trends
- Overall Equipment Efficiency (OEE)
- Return on Investment (ROI)
- Risk management
- Supply and demand
- Vertical and horizontal integration

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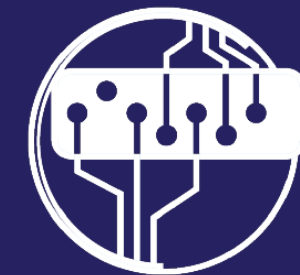
Overview

The National Electric Vehicle Consortium (NEVC), funded by the National Science Foundation, promotes the interaction of a critical mass of academic, agency, and industry experts across all EV disciplines to help secure the nation's EV workforce pipeline.



Manufacturing

**Operations,
Maintenance,
and Repair**



**Emerging
Technologies**

Infrastructure



**Fleet
Conversion**

Charging Infrastructure



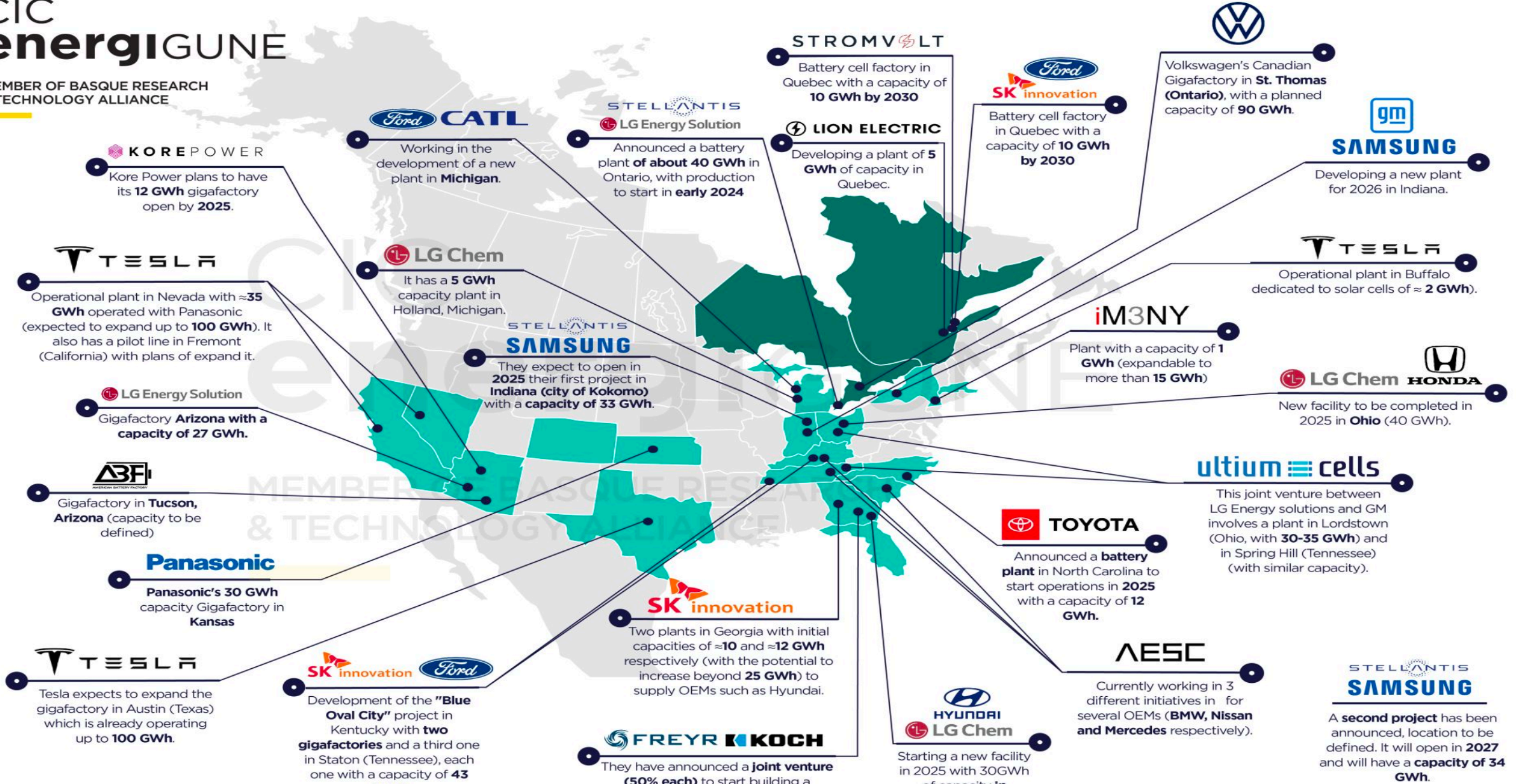
This project is supported by National Science Foundation grant DUE-2202050
3209 Virginia Avenue Fort Pierce, FL 34981 | 772-462-7546



NORTH AMERICAN BATTERY INITIATIVES

CIC energIGUNE

MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE



KORE POWER
Kore Power plans to have its **12 GWh** gigafactory open by **2025**.

TESLA
Operational plant in Nevada with **≈35 GWh** operated with Panasonic (expected to expand up to **100 GWh**). It also has a pilot line in Fremont (California) with plans of expand it.

LG Energy Solution
Gigafactory **Arizona** with a capacity of **27 GWh**.

ABF
Gigafactory in **Tucson, Arizona** (capacity to be defined)

Panasonic
Panasonic's **30 GWh** capacity Gigafactory in **Kansas**

TESLA
Tesla expects to expand the gigafactory in **Austin (Texas)** which is already operating up to **100 GWh**.

Ford CATL
Working in the development of a new plant in **Michigan**.

LG Chem
It has a **5 GWh** capacity plant in **Holland, Michigan**.

STELLANTIS SAMSUNG
They expect to open in **2025** their first project in **Indiana (city of Kokomo)** with a capacity of **33 GWh**.

SK innovation Ford
Development of the "Blue Oval City" project in **Kentucky** with **two gigafactories** and a third one in **Staton (Tennessee)**, each one with a capacity of **43**

STELLANTIS LG Energy Solution
Announced a battery plant of **about 40 GWh** in **Ontario**, with production to start in **early 2024**

FREYR KOCH
They have announced a **joint venture (50% each)** to start building a

STROMVOLT
Battery cell factory in **Quebec** with a capacity of **10 GWh by 2030**

LION ELECTRIC
Developing a plant of **5 GWh** of capacity in **Quebec**.

Ford SK innovation
Battery cell factory in **Quebec** with a capacity of **10 GWh by 2030**

SK innovation
Two plants in **Georgia** with initial capacities of **≈10** and **≈12 GWh** respectively (with the potential to increase beyond **25 GWh**) to supply OEMs such as **Hyundai**.

HYUNDAI LG Chem
Starting a new facility in **2025** with **30GWh** of capacity

VW
Volkswagen's Canadian Gigafactory in **St. Thomas (Ontario)**, with a planned capacity of **90 GWh**.

gm SAMSUNG
Developing a new plant for **2026** in **Indiana**.

iM3NY
Plant with a capacity of **1 GWh** (expandable to more than **15 GWh**)

TESLA
Operational plant in **Buffalo** dedicated to solar cells of **≈ 2 GWh**.

LG Chem HONDA
New facility to be completed in **2025** in **Ohio** (**40 GWh**).

TOYOTA
Announced a **battery plant** in **North Carolina** to start operations in **2025** with a capacity of **12 GWh**.

ultium cells
This joint venture between **LG Energy solutions** and **GM** involves a plant in **Lordstown (Ohio)**, with **30-35 GWh** and in **Spring Hill (Tennessee)** (with similar capacity).

AESC
Currently working in **3** different initiatives in for several OEMs (**BMW, Nissan and Mercedes** respectively).

STELLANTIS SAMSUNG
A **second project** has been announced, location to be defined. It will open in **2027** and will have a **capacity of 34 GWh**.

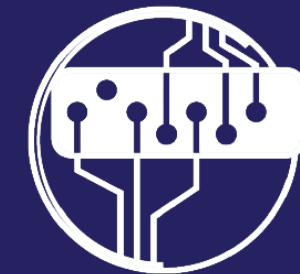
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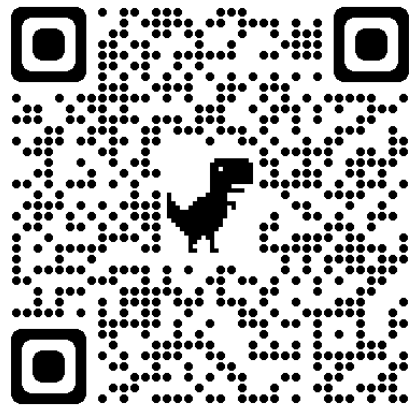
Emerging
Technologies

Infrastructure



Fleet
Conversion

**Thank You,
Kevin Cooper**
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At the Project Website: Preparingtechnicians.org

Tools and Resources to Help You Take Action

- Read and share *A Framework for a Cross-Disciplinary STEM Core*
- Download, share and implement cross-disciplinary instructional cards in your class
- Listen to podcasts featuring cutting-edge industry interviews
- Share recorded webinars

Cross-Disciplinary Instructional Cards

Data Knowledge and Analysis

Manipulating and interpreting data to resolve issues and using Excel and other common software proficiently to accomplish tasks

DATA KNOWLEDGE AND ANALYSIS
Data Visualization

For Students

What is Data Visualization?
Data visualization represents information in the form of a chart, diagram, picture, or infographic so that the data can be quickly and easily understood. Technicians use data visualization software to create graphics that communicate complex and relational information to a variety of audiences.

Vocabulary

- **Dataset** - a collection of data, often organized in a spreadsheet or database
- **Chart** - a graphic representation of data, examples are charts, pie charts, histograms, line graphs for example
- **Scale** - marks on a visualization that indicate the range of data values presented. A scale on a graph reflects the magnitude of the data presented.

Common Types of Data Visualization

- A pie chart uses "pie slices" to show relative sizes of data.
- A histogram uses bars of different heights to group data into ranges.
- A scatter plot uses points plotted on an XY axis to show the relationship between two sets of data.

How will a technician use data visualization?
Evan Garcia is a technician for Green Mountain Power Company. He is responsible for tracking increased system outages over time across a metropolitan network, collects outage statistics, including system logs, environmental information, and helps to determine the cause. Evan stores the data in an Excel workbook, then imports data into SAP, Tableau, or MS Power BI visualization tools and creates a dashboard to present to management. The data dashboard provides an interactive geographical heat map showing outage details and other graphical representations of his data analysis of the event. The heat map allows management to make real time decisions and troubleshoot problems.

A heat map uses a scale to color code specific data values by color.



Instructional Activity Cards:

- Data Visualization
- Data Literacy/Fluency
- Spreadsheets
- Analytics Tools

Advanced Digital Literacy

Understanding digital communications and networking, cybersecurity, machine learning, sensors, programming, and robotics at a higher than introductory level

Advanced Digital Literacy
Network Communications - Internet of Things (IoT)

For Students

What is the Internet of Things (IoT) and how is it related to network communications?
The Internet of Things (IoT) consists of physical devices connected to the network. IoT devices are a combination of sensors, software, and electronics that connect to a central location locally in the cloud. They are often connected through a wireless network through which they communicate with one another and feed information to a user's mobile device or computer. Through the device, the user can monitor a condition or control a process through a control panel or dashboard. An example is the human Machine interface, internet connected devices, thermostats, weather systems and wearable fitness trackers are everyday examples of IoT devices. In industry, a variety of sensors monitoring quality and machine operational parameters for preventative maintenance.

Vocabulary

- **Smart sensors** - devices that measure and process data before sending to a centralized server. Fire sensors used to measure water and natural gas usage - smart meters - use an example
- **Cloud computing** - delivery and storage of data over the internet rather than on-site. Google's gmail is an example.
- **Information security** - processes used to protect information from unauthorized access, modification, or destruction. Helping someone only to access devices and content is an example.

How will technicians use network communications and IoT technologies?
Network Communication Technicians familiar with IoT technologies will install, monitor, and maintain the IoT devices and the network's communication software that connects them to ensure proper operation. This includes tasks such as installing software updates, developing procedures to detect and prevent system logging, testing the network for malware, and troubleshooting system malfunctions. This job often requires creative problem solving, as in this example:
A customer that manages large parking garages wanted to reduce the time an customer spent parking for their parking spots. Some places used several minutes locating up and down multiple floors to find an open parking spot. The desired system means for open parking spots are also a benefit for other uses and applications. A network technician is engaged to investigate a customer. After reviewing several options, the network technician decided to implement an IoT solution that includes sensors, wifi, and a mobile app. IoT sensors were installed to monitor the status of each parking spot. The status of each parking spot was sent to a centralized computer. If a spot was available, signs throughout the garage would provide direction to the exact location on the garage floor to the open parking spot. The status of each parking spot was also available on a mobile app. In the app, users could view the garage how many spots were available and on what floor. This IoT solution reduced customer wait times, increased safety, and increased parking garage profits.



Instructional Activity Cards:

- Network Communications – Internet of Things
- Automation/Robotics/HMI
- Basic Programming-Python
- Digital Twins
- Network Architecture

Business Knowledge and Processes

Understanding the value chain and business practices of an enterprise and applying principles of ethical adoption of new technologies

Business Knowledge & Processes
ENTREPRENEURSHIP

Student Resource

What is Entrepreneurship?
Entrepreneurship is the concept of developing and launching a new business for profit, identifying needs, a company and finding the an entrepreneur by asking "How can we improve this process?" is just an example. Entrepreneurship means finding beyond troubleshooting or problem solving. It involves taking care after that adds potential new products, services or processes.

Vocabulary

- **Entrepreneur** - the individual who starts a new business venture. Typically, the individual who takes on most of the risk and develops the business concept.
- **Venture** - a business enterprise in which the expectation of gain is accompanied by the risk of total failure.
- **Capital** - The wealth or assets available to invest in a business.
- **Business Model** - A description of how a business will be able to create and deliver value and become profitable.
- **Market Research** - Research data that helps demonstrate market potential for a business venture.
- **Intellectual Property** - Rights or inventions that are the result of creativity to which one has rights and can apply for a patent, copyright or trademark.

How will an entrepreneurial mindset be used in the workplace?
An industry 4.0 technician of tomorrow needs creative entrepreneurial thinking as a new, marketable skill. John Graham is an industrial technician at Advanced Auto Safety Labs and he has been experiencing several customer complaints regarding repair times. Using an entrepreneurial mindset, John identified the problem and then considered possible solutions and their value propositions. He asked questions like: How much is customer satisfaction and repair speed worth? How much time and money can be saved through more accurate diagnosis and efficient repair? He then researched the equipment that a potential solution he has researched that will provide better customer service, shorter wait times, and faster service by the technicians, resulting in higher profits for the business.
In another example, Cassi Sanders is a robotics technician at Cooper Botworks, an automated filling and packaging company. Over the last several days, a robot gripper had been dropping every fourth bottle. The fault affected everything from the line, to the point at which several boxes shipped to a customer were short in the case. This is clearly not an acceptable business practice. Cassi applied troubleshooting skills to



Instructional Activity Cards:

- Entrepreneurship
- Communication
- Lean Processes
- Supply and Demand

Podcasts



Episode 38: Technicians in the New Blue Economy

Podcast Guest: Justin Manley,
President of Just Innovation, Inc.
April 2022 |

[Read More »](#)



Episode 37: Incorporating the Internet of Things

Podcast Guests: Kristine
Christensen, Director of Faculty
Development, Professor of MIS,
Moraine

[Read More »](#)



Episode 36: Supply Chain Automation In Transition

Podcast Guest: Phil Gilkes, Regional
Maintenance Manager, Dollar Tree
Distribution Centers February 2022

[Read More »](#)

What Should Educators Know and Do about Preparing Technicians for the Future of Work?

Podcast Interviews Provide Direction

www.preparingtechnicians.org/podcasts

- i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**
- ii. **Podcasts: Digital Skills, Digital Mastery. Digital Twins, Simulation**
- iii. **Podcasts: Industry, Factory, and Education Trends**
- iv. **Podcasts: New Skills, New Generations of Students**

- i. **Podcasts: Automation, Robotics, and Advanced Manufacturing**

AUTOMATION, ROBOTICS, AND ADVANCED MANUFACTURING

Topic and Episode(s)	Discovery	Recommended Action
1. A Robot for Every Technician? PC13 and PC22	A robot for every technician is an emerging trend in the workplace.	Ask yourself if it is possible for you to consider something similar in your education and training space? A robot (or an automated system) for every student, in every learning situation?

Recordings of This Webinar Series



1. Preparing Technicians Using the Cross-Disciplinary STEM Core
2. Professional Development and Instructional Resources
3. Future of Work: Integrating Emerging Technologies

<https://www.preparingtechnicians.org/webinars/>