Empowering the Future Workforce

NSTDA Technology Showcase

National Science and Technology Development Agency
Ministry of Higher Education, Science, Research and Innovation

Contents

Thai Microelectronics Center : TMEC

ASEAN Regional Semiconductor Fabrication Training Center

TMEC drives Thailand's semiconductor ecosystem from People · Design · Fabrication · Technology Transfer · Real-World Impact Building capability. Creating innovation. Delivering value to Thailand.

1. Developing High-Skilled Semiconductor Workforce

TMEC develops the semiconductor and advanced electronics workforce for Thailand through comprehensive training programs at 3 levels.

Basic Level: Build foundation knowledge in semiconductor and electronics.

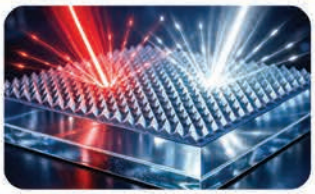
Intermediate Level: Strengthen practical skills in design and fabrication.

Train the Trainer Level: Develop experts and trainers to sustain the ecosystem.

Curriculum Coverage

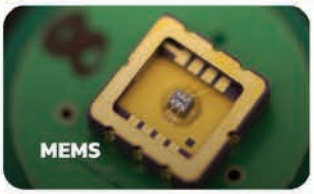
- Integrated circuit and device design
- Semiconductor device fabrication processes and manufacturing

2. Building Advanced Semiconductor Capabilities



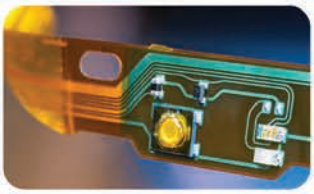
Silicon Photonics

- Collaborate with international partners on Silicon Photonics manufacturing using MPW (Multi-Project Wafer).
- TMEC works with Thai universities and experts for design capability development.
- Strengthen Thailand's design-fabrication ecosystem for photonics technology.



MEMS Technology Platform

- Collaborate with international partners on MEMS process technologies.
- TMEC develops MEMS technology platform for various applications (sensors, actuators, inertial devices, etc.).
- Promote technology transfer and local capability building.



Microfluidics & Lab-on-Chip

- Develop platforms for medical diagnostics and Organ-on-Chip.
- Collaborate with BIOTEC, NECTEC, NANOTEC, Chulabhorn Royal Academy, and Mahidol University.

3. Connecting TMEC with Thai Semiconductor Industry

Wafer Fabrication: TMEC collaborates with leading companies to develop workforce and connect knowledge across the semiconductor value chain.

Lumentum International (Thailand) Co., Ltd.: Connecting education, policy, and industry to develop talents and drive upskilling / reskilling in advanced technologies.

UTAC Thai Limited: Training programs linking wafer fabrication and packaging to improve quality analysis capability.

STARS Microelectronics (Thailand) Public Co., Ltd.: Training programs connecting wafer fabrication and advanced packaging technology as the company roadmap.

4. Driving "Chip Made in Thailand" to Real-World Applications

Design: Design and test MEMS pressure sensors using in-house technology.

Fabrication: Fabricate pressure sensors using MEMS technology in Thailand.

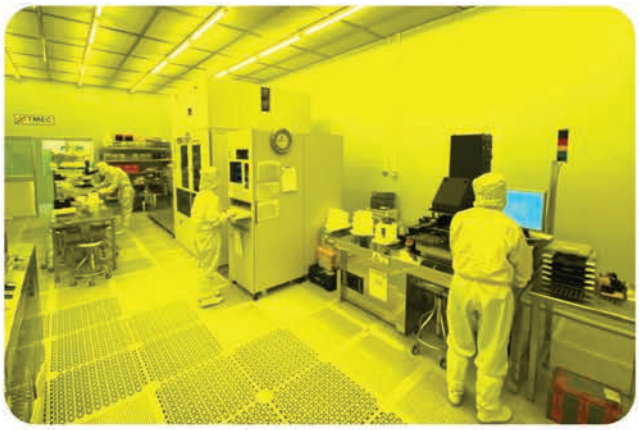
Device Development: Develop Smart Tensiometer for soil water potential measurement. *(Note: Product image is labeled "TMEC Smart Tensiometer")*

System Integration: Connect to precision agriculture system for smart water management.

Real-World Impact: Enhance agricultural productivity and sustainability with value-added "Chip Made in Thailand".

Building an End-to-End Innovation Value Chain From design → fabrication → testing → system application

5. Supporting Thai Industry with TMEC Infrastructure



TMEC provides access to silicon fabrication and advanced analysis & characterization facilities for industry, supporting technology development and generating sustainable revenue for the organization.

Key Facilities

- Wafer fabrication (MEMS, CMOS, etc.)
- Advanced analysis & characterization
- Reliability & failure analysis
- Prototyping and small-lot production
- Training and cleanroom facilities

Our Strengths

- National semiconductor infrastructure
- End-to-end capability
- Strong network with academia, industry, and international partners
- Workforce development and technology transfer
- Driving real-world impact for Thailand

Footer: TMEC Value Chain for Thailand

- **PEOPLE:** Develop highly skilled workforce
- **DESIGN:** Strengthen design capability
- **FABRICATION:** Manufacture chips and sensors in Thailand
- **TEST & PACKAGING:** Test, characterize, and package
- **INDUSTRY COLLABORATION:** Technology transfer and workforce development
- **APPLICATION & IMPACT:** Deliver innovation to society and economy

TMEC: From Semiconductor Infrastructure to Thai Innovation Building People. Creating Chips. Empowering Industries. Driving Thailand Forward.

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Smart Farming: Technology, Electric Machinery, and Standards for Next-Generation Agriculture

1. What is Smart Farming?

Smart Farming is the application of digital technology, automation, and data to improve agricultural productivity. It shifts decision-making from experience-based practices toward Data-Driven Farming. Data from sensors, such as soil moisture, temperature, pH, EC, weather conditions, and crop information, can be analyzed together with AI to optimize irrigation, fertilization, disease prevention, and machinery operation. This helps increase yields, reduce costs, lower resource and labor requirements, and improve the accuracy of farm management.

2. Technologies for Smart Farming

Modern farms integrate multiple technologies, including sensors and IoT for environmental monitoring, communication systems, Cloud platforms, AI for data analysis, Machine Vision, and automation. For large agricultural areas, agricultural drones can survey fields, capture multispectral images, monitor crop health, identify disease or water-stressed areas, and apply chemicals or fertilizers selectively. Electric tractors use batteries and electric motors instead of conventional engine-based drivetrains and can be further developed into autonomous tractors that navigate routes and perform tasks automatically. In the future, farm systems will increasingly integrate Sensor + IoT + Drone + Electric Tractor + AI + Solar + ESS into a connected ecosystem.

3. Smart Farming, EMC, and Sensor Interference

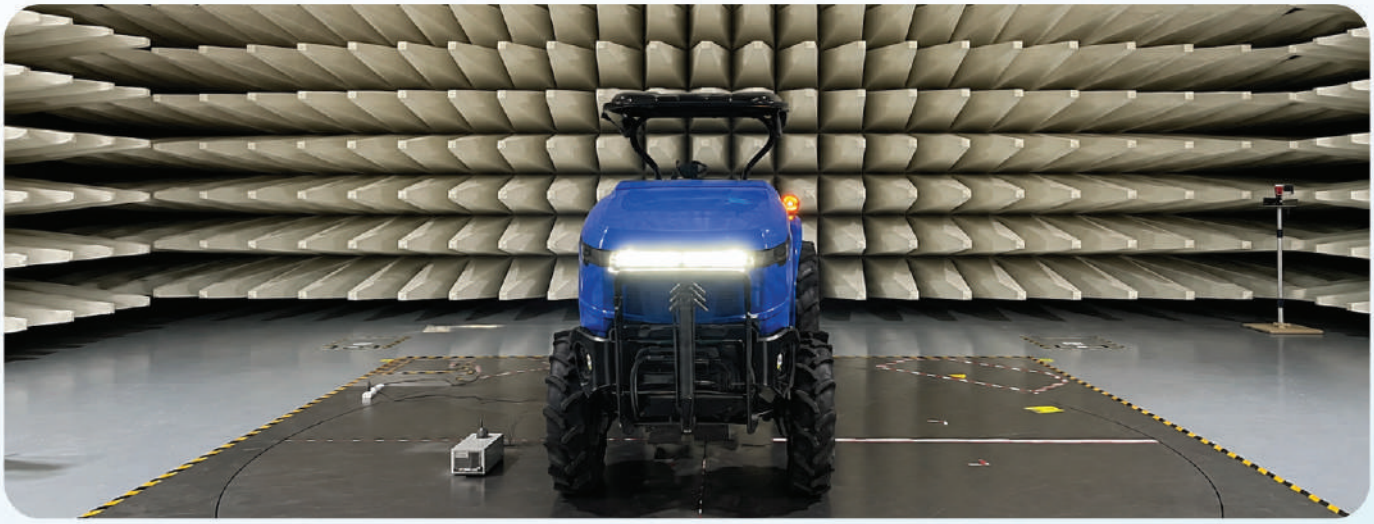
As agricultural machinery incorporates more electronic devices and communication systems, Electromagnetic Compatibility (EMC) becomes increasingly important. For example, inverters, motors, and high-power cables in electric tractors can generate electromagnetic noise that may interfere with sensors, causing position errors, incorrect sensor readings, or control-system malfunctions. Drones face similar risks because ESCs and motors can interfere with GPS, compasses, and communication systems. In autonomous machinery, sensor errors can become a safety issue. Smart Farming development must therefore consider EMC, Electrical Safety, and Battery Safety requirements.

4. Research and Development of Drones and Electric Tractors in Thailands

Thailand has strong potential to develop these technologies because of its agricultural, automotive, electronics, battery, and digital-technology industries. Drone research can cover flight-control systems, spraying systems, mapping, and AI-based image analysis. Electric-tractor R&D can range from battery-pack development to autonomous control, with designs tailored to Thai operating conditions such as heat, humidity, dust, water, mud, and vibration. Solar PV → ESS → Charging → Electric Tractor can also be integrated to support Smart & Low-Carbon Farms.

5. Tractor Testing for Smart Farming Applications

Electric and autonomous tractors should undergo systematic Testing & Validation before real-world deployment. Relevant standards include EMC requirements for agricultural machinery such as ISO 14982, agricultural machinery safety under the ISO 4254 series, Functional Safety under the ISO 25119 series, and highly automated agricultural machinery under ISO 18497. Testing should also cover batteries, electrical safety, temperature, humidity, dust, water, and vibration to confirm that the machinery can operate safely and reliably under actual environmental conditions.



Electric Vehicle Workforce Development Mechanism of the National Science and Technology Development Agency (NSTDA)

Briefing Note for the Visit of the ASEAN Plus Three Labour Ministers and Delegates of the 29th ASEAN Labour Ministers Meeting (ALMM) to the National Science and Technology Development Agency
Thursday, 27 August 2026, 15.00 – 16.30 hrs., Electrical and Electronic Products Testing Center (PTEC), Thailand Science Park, Pathum Thani




1. Conceptual Framework

The National Science and Technology Development Agency (NSTDA) implements a workforce development mechanism for the electric vehicle (EV) sector founded on the integration of three mutually reinforcing components: the development of human skills and competencies; research and technology development; and the utilisation of national science and technology infrastructure in support of the industrial sector. The mechanism is directed towards producing personnel with genuine operational capability, spanning system design, control, testing, and the application of battery and energy storage systems.

Training under this mechanism is delivered principally by the Career for the Future Academy (CFA), a unit under NSTDA whose mandate is to organise training programmes, develop skills, and enhance the capabilities of personnel in the industrial sector and in organisations more broadly, in step with technological change. A distinguishing feature of this arrangement is that the training is delivered by NSTDA's own researchers and conducted using NSTDA's scientific equipment and infrastructure, so that participants learn directly from practising researchers and gain hands-on experience with laboratory-grade instrumentation. During 2025–2026, more than 1,500 individuals completed EV-related training through CFA.

2. Training Based on Control-System Simulation and Model-Based Testing

The EV training curricula offered by CFA are designed to correspond to the critical competencies required across the EV value chain, with practice-based learning and control-system simulation serving as the central pedagogical approach. Participants are trained in the successive stages of the model-based testing workflow, namely Software-in-the-Loop (SIL),

Processor-in-the-Loop (PIL) and Hardware-in-the-Loop (HIL), encompassing the verification of models, control software, microcontroller code and physical hardware such as the Battery Management System (BMS) and the Electronic Control Unit (ECU), within controlled environments that closely approximate actual operating conditions. This approach reduces both the risk and the cost of testing, while strengthening participants' understanding of system functionality, safety and integration prior to deployment in production vehicles.

3. Competencies in In-Vehicle Control and Communication Systems

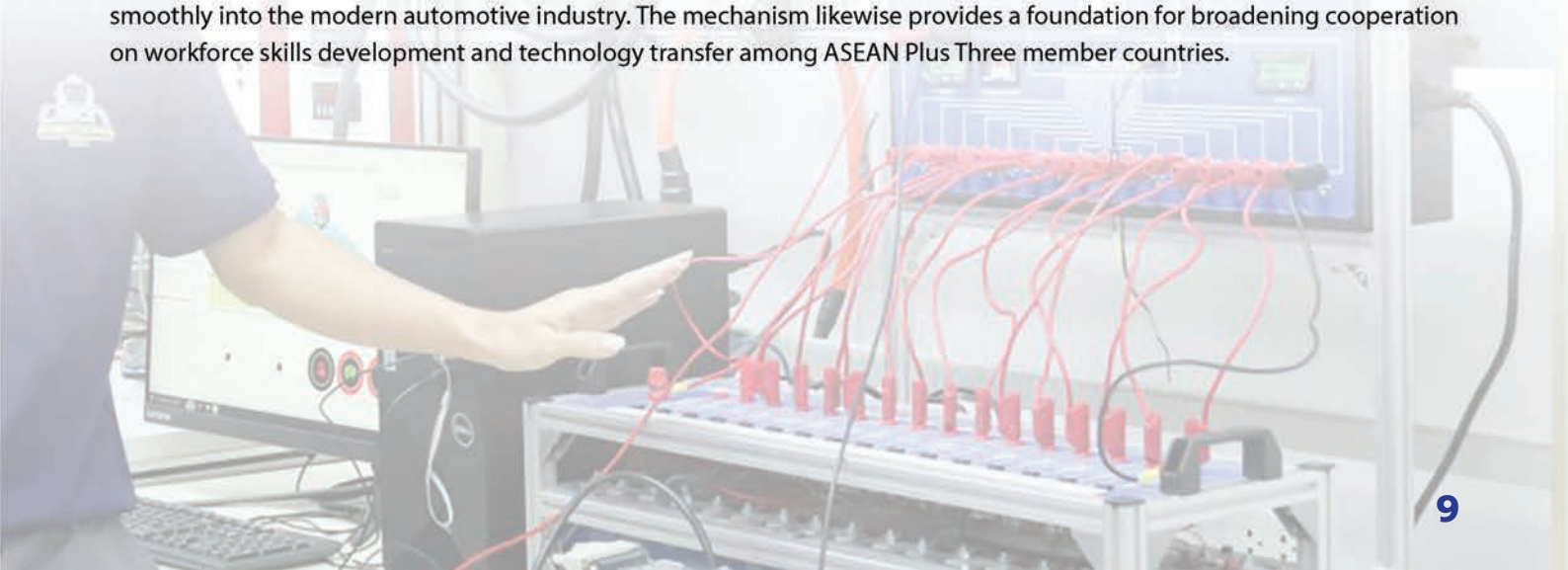
The curricula further encompass in-vehicle control and communication systems, including the operating principles of the Battery Management System (BMS), the Vehicle Control Unit (VCU) and the Motor Control Unit (MCU), together with the fundamentals and application of the CAN Bus network, from data transmission and reception to signal analysis and message decoding for control and diagnostic purposes. This mode of instruction enables participants to integrate knowledge of electrical engineering, electronics, software, control systems and testing, constituting the interdisciplinary skill set essential to upgrading the workforce across manufacturing, maintenance, and research and development.

4. Extension to Energy Storage Systems Derived from Second-Life EV Batteries

In a complementary direction, the Electrical and Electronic Products Testing Center (PTEC), in collaboration with the National Energy Technology Center (ENTEC) and the National Electronics and Computer Technology Center (NECTEC), is preparing to introduce training activities on the development of Energy Storage Systems (ESS) derived from second-life EV batteries, with a view to enhancing resource efficiency and sustainability. This undertaking will generate both a body of knowledge and a practical learning environment for personnel in battery state assessment, system design, safety testing and application within clean energy systems, thereby giving rise to new employment opportunities and to competencies aligned with the circular economy.

5. Conclusion and Implications for Regional Cooperation

In summary, NSTDA advances EV workforce development through the guiding principle of "developing people through real technology, and developing technology to elevate people," realised through collaboration among national research centres, academic institutions and the industrial sector. The intended outcome is a cohort of work-ready engineers and technicians capable of supporting the expansion of the electric vehicle, battery and clean energy industries, as well as of enabling the reskilling and upskilling of workers in the conventional automotive supply chain so that they may transition smoothly into the modern automotive industry. The mechanism likewise provides a foundation for broadening cooperation on workforce skills development and technology transfer among ASEAN Plus Three member countries.



SMC ACADEMY

Industrial Skill Development Center under Sustainable Manufacturing Center (SMC)

NECTEC / NSTDA | Industry 5.0 Transformation

Objective

Focuses on transferring knowledge, cutting-edge technology, and practical expertise to elevate the capabilities of industrial personnel, empowering workforce transition toward a sustainable, next-generation industry.

Key Highlights

Expert Instruction

Taught directly by experienced researchers and industry experts.

Practical Application

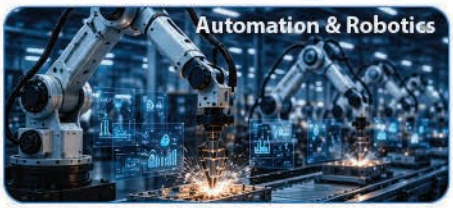
Hands-on, project-based learning built for immediate implementation.

Future-Ready Workforce

Systematic skill progression aligned with Industry 5.0 requirements.

Training & Course Categories

Flexible training programs designed to develop technical & operational skills for real-world industrial application:



Human Capability Framework (HCF)

An organizational assessment framework evaluating Personnel Development Systems & Personnel Capability to achieve human-technology balance.

- **Level 1:** System Readiness (PCA)
- **Level 2:** Workforce Readiness (DCA)
- **Level 3:** Human-Technology Balance
- **Level 4:** Capability Interpretation

Connecting 'System - People-Balance Strategy' to support optimal strategic decision-making.

Training Formats

- **Public Course:** Scheduled annual training roadmap
- **Private Course:** Tailored to specific enterprise goals
- **Bootcamp Course:** Intensive, continuous acceleration

Key Impact

Sustainably elevating the industrial workforce from foundational skills to Industry 5.0.

"Driving Toward Industry 5.0 Together — Your Partner in Workforce Transformation"

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AI for University

Driving Thai Higher Education Forward with Artificial Intelligence

MHESI / NSTDA / NECTEC

AI Education Transformation - Project Objectives

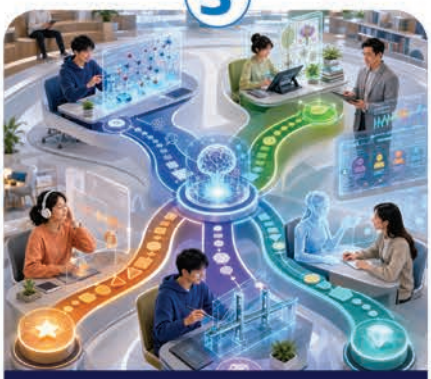
1

Promote Active Learning: Integrate AI tools to foster interactive, student-centered, and engaging classroom environments.

2

Cultivate Core AI Champions: Develop key university personnel and educators as lead champions to drive AI adoption.

3



Elevate Personalized Learning: Tailor educational experiences to fit individual student learning paces and specific needs.

Core Platform: ABDUL UNI

An AI-powered educational ecosystem designed for higher education management and instruction.

ABDUL UNI Key Capabilities

1 Build a Subject-Specific AI Tutor - Instructors design and create their own AI Tutor, tailored to their course content and teaching objectives

2 Guide and Support Each Student - The AI Tutor gives individual students advice and learning guidance based on how the instructor set it up

3 Manage the Whole Classroom - Instructors set up classrooms, upload learning materials, create AI Tutors, and track usage with a dashboard showing how students are engaging with the tool

4 Lighten the Instructor's Workload - Students can learn anytime, day or night, and revisit material as often as they need. This frees up instructors to spend more time on mentoring and research instead of repetitive Q&A

Target Groups & Outcomes

20+ Pilot Universities
Deploying and integrating AI platforms into actual academic curricula.

Nationwide Faculty Development
Training and upskilling university instructors across Thailand in AI-driven teaching methodologies.

Initiated by MHESI (Ministry of Higher Education, Science, Research and Innovation) & NECTEC / NSTDA

showcase.ai4uni.in.th

LEAD Education (NECTEC)

Personalized Learning Tracking, Analytics, and Evaluation Service Platform

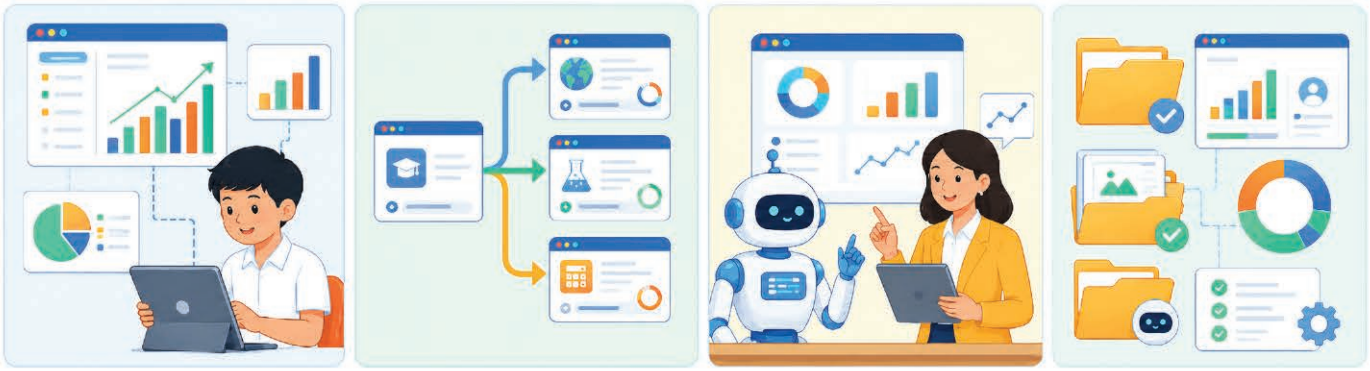
NECTEC / STDB | EdTech Innovation

Project Overview

Adaptive Education Platform to Reduce Educational Inequality and Transform Thai Classrooms into the Digital Era.

4 Core Technologies

1. **Real-Time Tracking & Analytics** – Tracks individual learning behaviors and analyzes learning obstacles instantly for targeted support.
2. **Adaptive Content Recommendation** – Intelligently evaluates student performance and automatically recommends personalized learning content.
3. **AI Coach & Teacher Assistant** – Acts as a personal tutor guiding learners and assists teachers in monitoring overall learning progress.
4. **Student Portfolio Automation** – Automatically collects student achievements, summarizing skill progression and clear analytical statistics.



National Strategic Partners

Developed and deployed in collaboration with key national educational organizations:

- OBEC (Office of the Basic Education Commission)
- IPST (Institute for the Promotion of Teaching Science and Technology)

Practical Applications

- **Core Curriculum Tool for Secondary Schools:** Serves as the main teaching platform for 'AI and Ethics' courses across schools nationwide.
- **Digital Master Teacher Development:** Trains nationwide 'Master Teachers' in the digital era to apply and integrate the platform into classrooms.

Impact & Outcome: Sustainable Learning

"Making AI & Digital Science Education Simple, Engaging, and Accessible to Everyone."

Developed by National Electronics and Computer Technology Center (NECTEC) & STDB LEAD Education Platform

The Transition to Electric Vehicles: From the Energy Crisis to EV Batteries, Second Life, and a New Workforce

The automotive industry is undergoing a major transformation driven by oil-price volatility, environmental concerns, and greenhouse-gas reduction targets. Around the world, the transition from internal-combustion-engine vehicles to Electric Vehicles (EVs) is accelerating. This transition changes not only the vehicle itself, but also the industrial structure, workforce requirements, technology, safety, and battery management throughout the product life cycle.

1. Oil Prices and Energy Security

Oil-price volatility caused by economic and geopolitical conditions directly affects transportation, logistics, and production costs in countries that depend on imported energy. EVs therefore provide one pathway to reduce dependence on oil and strengthen energy security, because electricity can be generated from a variety of sources, including solar power and other forms of renewable energy.

2. EVs Are Transforming the Automotive Industry

EVs shift the core vehicle technology from Engine + Fuel System + Transmission to Battery + BMS + Inverter + Motor + Charger + Electronic Control System. The battery becomes a critical component that determines cost, performance, driving range, and vehicle safety. This transition creates a new supply chain covering Battery Cells, Modules, Packs, BMS, Power Electronics, Motors, Chargers, Software, and control systems.

3. The New Workforce Requires New Skills

As vehicle technology changes, workforce skills must change as well. Traditional expertise in engines and mechanical systems must expand toward Mechanical + Electrical + Electronics + Battery + Digital + Safety Skills. In particular, work involving high-voltage systems requires knowledge of High-Voltage Safety, Electrical Isolation, Lockout/Tagout, PPE, Battery Handling, and Emergency Response. Workforce development is therefore a key requirement alongside EV technology development.

4. Zero Emission and the Challenge of End-of-Life EV Batteries

Oil-price volatility caused by economic and geopolitical conditions directly affects transportation, logistics, and production costs in countries that depend on imported energy. EVs therefore provide one pathway to reduce dependence on oil and strengthen energy security, because electricity can be generated from a variety of sources, including solar power and other forms of renewable energy.

5. NSTDA's Role: From Used EV Batteries to ESS and Safety Workforce Development

NSTDA can integrate its research, engineering, testing, and safety expertise to develop processes for assessing used EV batteries through State of Health (SoH) evaluation, module selection, BMS and protection-system design, ESS assembly, and safety testing before reuse. At the same time, personnel can be trained in EV Battery and High-Voltage Safety, covering removal, transportation, storage, inspection, assembly, operation, and ESS maintenance.

The transition to EVs is therefore not simply a shift from fuel-powered vehicles to electric vehicles. It creates a new ecosystem connecting energy, vehicles, batteries, the environment, safety, and human resources. If NSTDA can develop technology, testing capabilities, and skilled personnel across this entire cycle, Thailand can reduce its dependence on fossil fuels, address the challenge of used EV batteries, support the Circular Economy, and create new high-value industries in a sustainable manner.

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