“เทคโนโลยีการผลิตเซลล์และการผลิตแบตเตอรี่”

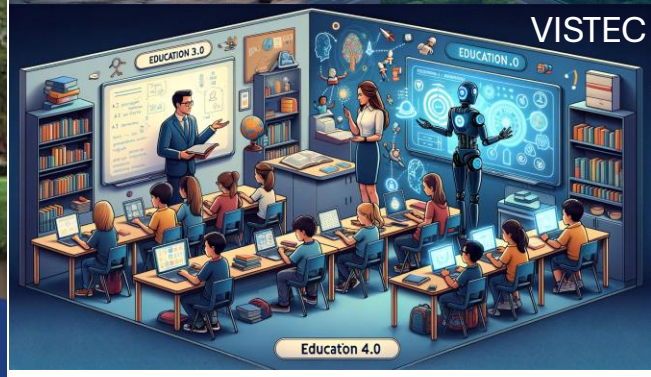
VISTEC VIDYASIRIMEDHI INSTITUTE OF SCIENCE AND TECHNOLOGY

CEST Centre of Excellence for Energy Storage Technology

Energy and Power X

Centre of Excellence for Energy Storage Technology (CEST)
Vidyasirimedhi Institute of Science and Technology (VISTEC)

Surasak Kaenket



CEST Centre of Excellence for Energy Storage Technology

Energy and Power X

Academic Excellence, Fundamental

Impactful

Roles of Energy Storage Technologies

1. Enable Efficient Use of Renewable Energy

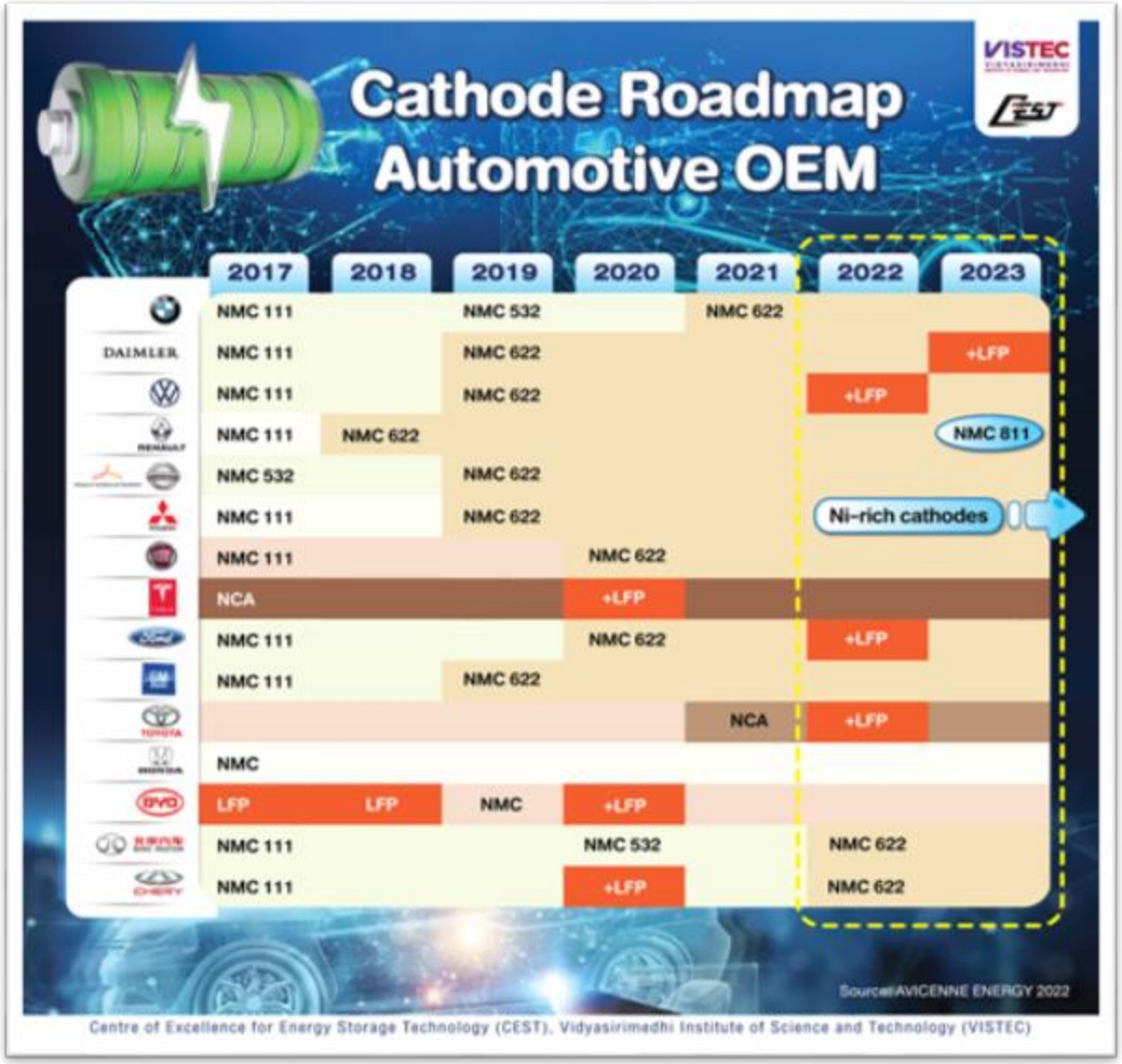
2. Improve Grid Stability and Reliability

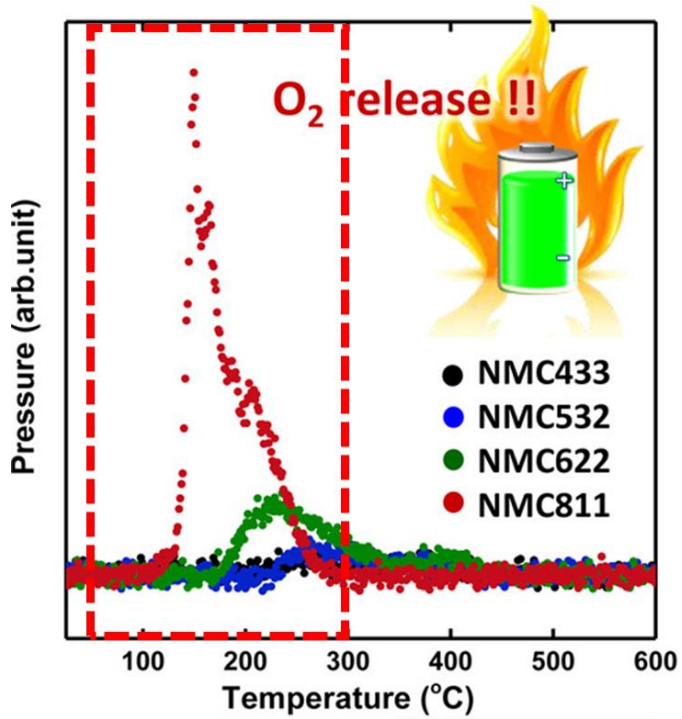
3. Support Electrification Efforts (EVs)

4. Facilitate Energy Access

5. Reduce Carbon Footprint

Key Energy Storage Tech.: Li-ion Batteries



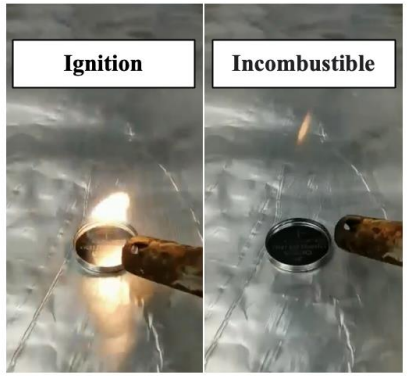


Safety Hazards


Unsafe
Safe

Our Non-Flammable Electrolyte

(a)



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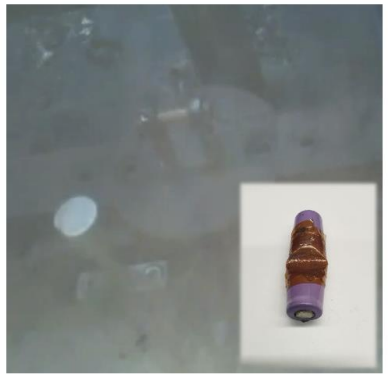
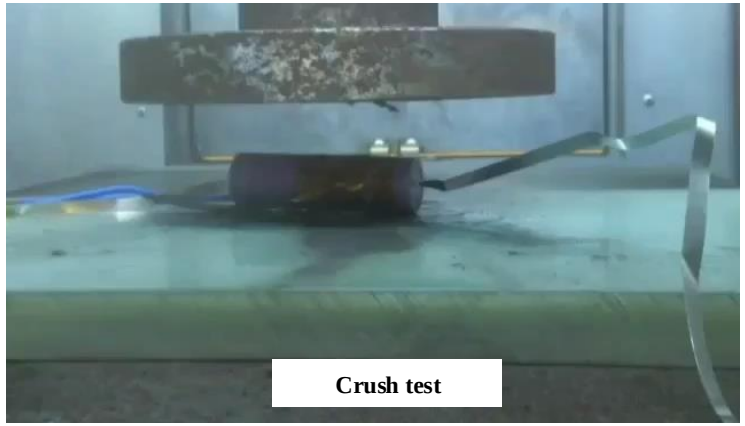
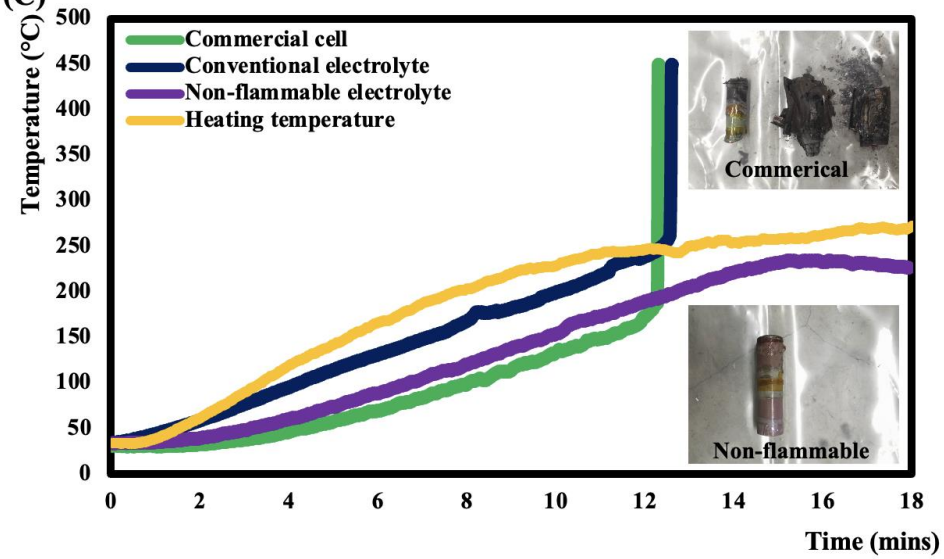
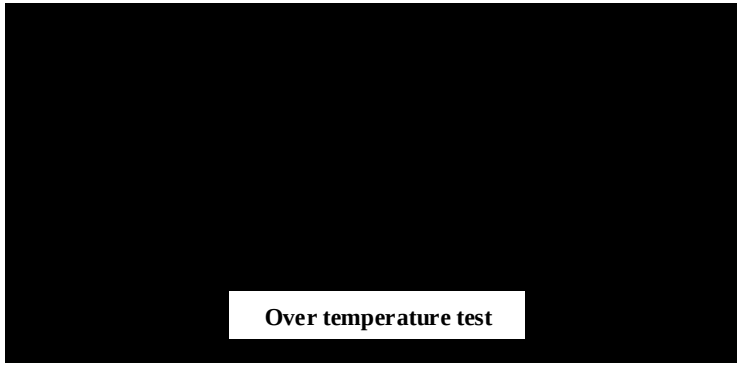
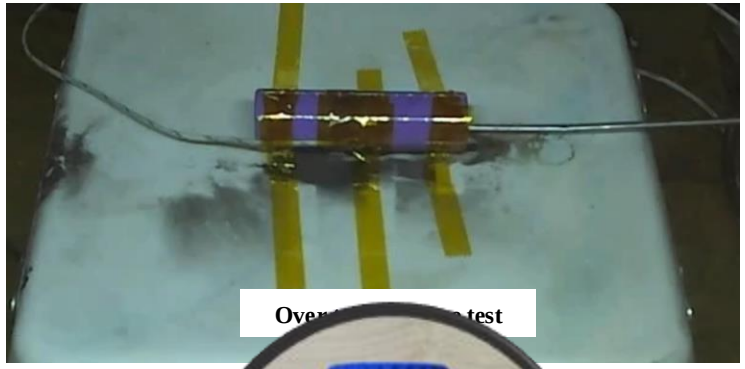




(C)







Graphite/NCA90 18650 cells with our electrolyte are completely safe in every conditions

PCT/IB2023/059083 and Journal of Power Sources 594, 234021.

Current Technology

LFP, NMC111,
NMC532,
NMC622,
NMC811,
NCA85

“Unsafe”

LMFP, NMC>80,
NCA90
Na-ion Battery
Li-S Battery
Anode-free
Supercapacitors
Hybrids

“Safe”

Centre of Excellence for Energy Storage Technology

Energy and Power X

Energy and Power X

Energy and Power X

Centre of Excellence for Energy Storage Technology

Company Highlights

9 Years of R&D
Founded in 2015

8 Years of Manufacturing Development
Pilot Production Facility Operational Since 2016

50+ Employees
Energy and Power X Team of Reseachers, Engineers, Planners, are Leaders in Energy Storage Technology.

Production Line Cells Validated by
Thai Industrial Standards Institute (TISI)
and Key Partners

Key Business Highlights

- Extensive IP Portfolio and Trade Secrets
- Project Consulting Services
- Proven Low-Cost Manufacturing Process at Pilot Scale
- Battery Laboratory Services
- Battery Testing Services
- Battery Production and Technical Services
- Graphene Production and Technical Services
- Characterization Services
- Chemical Services
- Organizing Training Workshops/Seminars
- Coaching Services
- Academic Training Services

Energy and Power X

ENERGY AND POWER X IS THE LEADER IN LI-ION BATTERIES IN SOUTH EAST ASIA

Location and Facilities

CEST, located in EECi, Wanchan Vallery, Wangchan, Rayong,Thailand, has:

- Fifty staff members with well over half of them having advanced degrees
- Over 60,000 square feet of labs for material synthesis including precursors
- A nearby pilot plant for advanced materials for energy storage devices
- Extensive cell fabrication and testing facilities
- Cyclers with 1,000+ channels and modern testing, imaging and characterizing instruments i.e. Operando XRD for pouch cell
- A new cell fabrication (pouch, 18650, 21700, etc.)

ENERGY AND POWER X IS THE LEADER IN LI-ION BATTERIES IN SOUTH EAST ASIA

From the beginning, the business model for Energy and Power X has been evolved early stage technologies to be de-risked, IP-protected and scale-up ready PRODUCTS, and then transition them to manufacturing partners with appropriate commercial arrangements or do limited production itself.

Early Stage Technologies (Internal and External Sources)

Energy and Power X Technology Processing

Technologies/Products for Rapid Adoption by Manufacturers
- De-Risked
- IP-Protected
- Scale-Up Ready

Low-Rate Initial Production at Energy and Power X

Transition to High-Volume Manufacturers

Manufacturing Partner Benefits:
- Accelerated Organic Growth
- Shortened Time to Market & Profitability
- Lower Risk & Cost
- New Business Areas
- Energy and Power X Staff Available for Interactive Technology Transfer

MANUFACTURING PROCESS

BUSINESS UNITS

VIS-CARBON Technology

- GO
- rGO
- AC
- C Composites
- CDC
- CB
- CNTs
- HCN
- AG
- MCMB
- Aerogels

VISDOM Ionic Liquid Technology

- VISDOM001 (Conventional)
- VISDOM002 (High-performance)
- VISDOM003 (Long lifespan)
- VISDOM004 (Non-flammable)

VISBAT BATTERY

- VISNMC001
- VISNMC002
- VISNMC003
- VISNCA001
- VISNCA002
- VISNCA003
- VISNCA004
- VISNCA005
- VISLFP001
- VISLFP002
- VISNMC004
- VISNMC005
- VISSODIUM001

RECYCLING BATTERIES

VIS-CoreShell Battery Technology

- NCA (Ni: 60 – 90%)
- NMC Ni: 50 – 90%)
- LFP, LMO
- NCA@C
- NMC@C
- LFP@C
- LMO@C
- S@C

VIS-ElectroCat Energy Conversion Technology

- MXene
- MnO_2 (Birnessite)
- Metal NPs
- Photo-electrocatalysts

VISCAP Supercapacitor

- VISCAP001 (80 F/cell)
- VISCAP002 (100 F/cell)
- VISCAP003 (120 F/cell)
- VISCAP004 (150 F/cell)

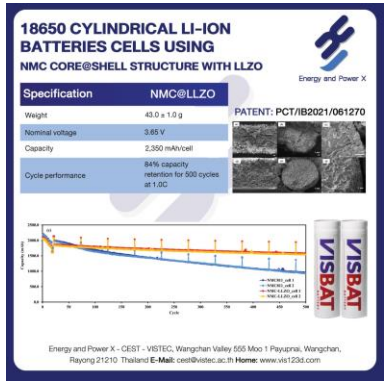
Energy and Power X

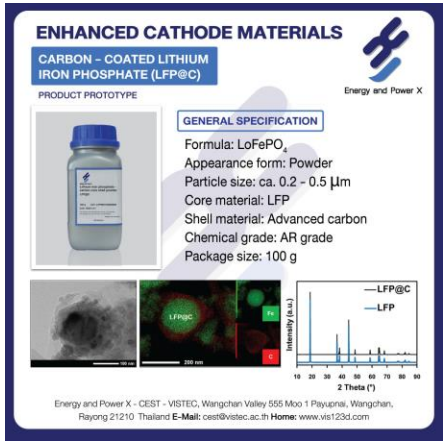
SOCIAL ENTERPRISE

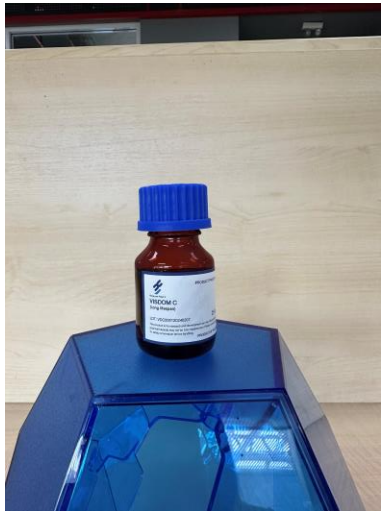
"The Light of Wisdom in the Remote Field Project"

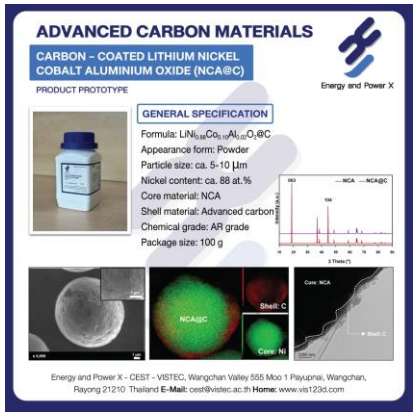
SOCIAL ENTERPRISE COMMUNITY

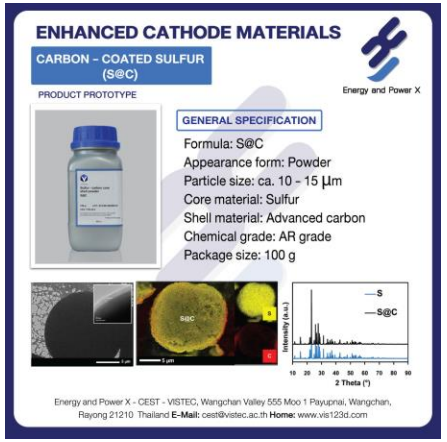
Confidential











The Biggest Part of The Cost is Raw Materials

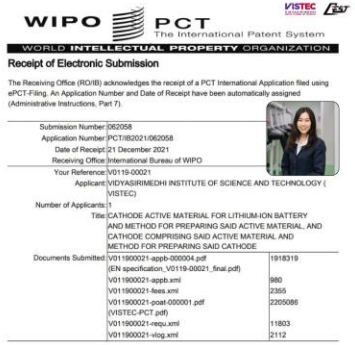
Average price structure of Li-ion cell-65 Ah NMC 622 pouch cells in 2022 – 160 $/kWh

Cathode cost	44%
Anode cost	10%
Electrolyte	9%
Separator	6%
Other materials	5%
Depreciation	10%
Direct labor	2%
Energy, utilies	4%
R&D	3%
Sales & Adm	2%
Warranty	3%
Profit	2%

Source: AVICENNE ENERGY 2022

Centre of Excellence for Energy Storage Technology (CEST), Vidyasirimedhi Institute of Science and Technology (VISTEC)

Acknowledgements: UWU. Program Management Unit for Competitiveness Enhancement (PMUC) ptt PTT Public Company Limited (PTT)



WIPO PCT The International Patent System

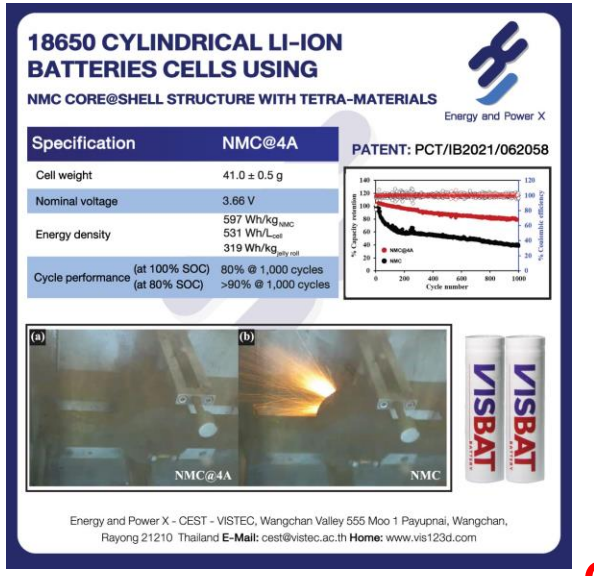
WORLD INTELLECTUAL PROPERTY ORGANIZATION

Receipt of Electronic Submission

The Receiving Office (RO/IB) acknowledges the receipt of a PCT International Application filed using ePCT-Filing. An Application Number and Date of Receipt have been automatically assigned (Administrative Instructions, Part 7).

Submission Number	062058
Application Number	PCT/IB2021/062058
Date of Receipt	21 December 2021
Receiving Office	International Bureau of WIPO
Your Reference	V0119-00021
Applicant	VIDYASIRIMEDHI INSTITUTE OF SCIENCE AND TECHNOLOGY (VISTEC)
Number of Applicants	1
Title	CATHODE ACTIVE MATERIAL FOR LITHIUM-ION BATTERY AND METHOD FOR PREPARING SAID ACTIVE MATERIAL, AND CATHODE COMPRISING SAID ACTIVE MATERIAL AND METHOD FOR PREPARING SAID CATHODE
Documents Submitted	V011900021-appb-000004.pdf (EN specification_V0119-00021_final.pdf) 1918319
	V011900021-appb.xml 980
	V011900021-ifwa.xml 2355
	V011900021-poat-000001.pdf (VISTEC-PCT.pdf) 2205086
	V011900021-requ.xml 11803
	V011900021-vlog.xml 2112

Journal of Power Sources, Volume 554, 232324, 2023



Showcasing research from Professor Montree Sawangphruk's laboratory, School of Energy Science and Engineering, Vidyasirimedhi Institute of Science and Technology (VISTEC), Thailand.

How uniform particle size of NMC90 boosts lithium ion mobility for faster charging and discharging in a cylindrical lithium ion battery cell

This study identifies particle size uniformity as crucial for lithium-ion battery efficiency, contrasting two cathodes, NMC80 and NMC90. NMC90, with uniform particle size, surpasses NMC80 in energy density, capacity retention, discharge capacity, and lithium diffusion efficiency, while producing less CO_2. This emphasizes particle size's role in optimizing future battery materials.

As featured in: Chemical Science

See Montree Sawangphruk et al., Chem. Sci., 2024, 15, 2026

ROYAL SOCIETY OF CHEMISTRY

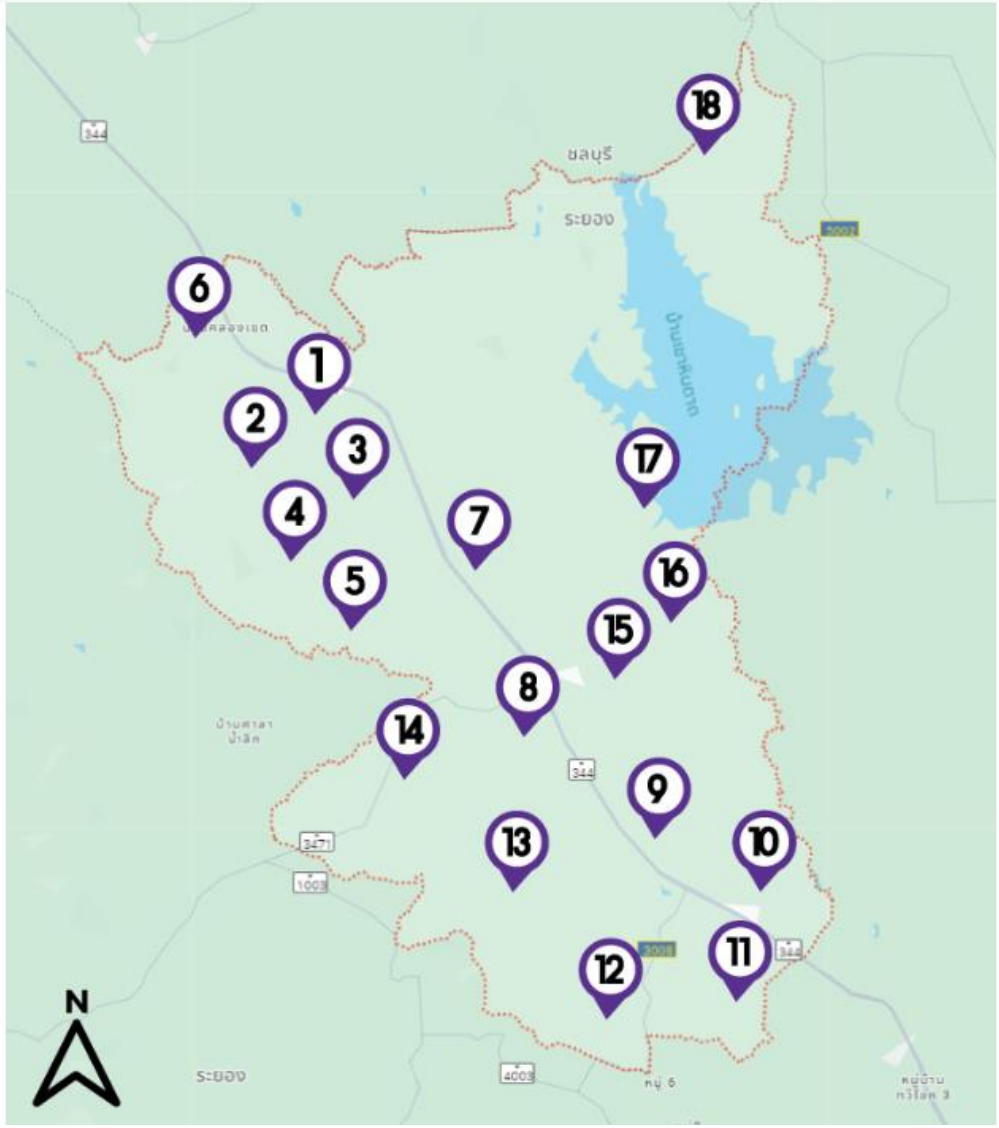
rsc.li/chemical-science


Centre of Excellence for Energy Storage Technology (CEST)
Vidyasirimedhi Institute of Science and Technology (VISTEC)

Source: Generative AI ChatGPT4

INTRODUCTION

Rural schools in remote areas often face significant challenges due to their small size and limited resources. These challenges are further exacerbated by government budgeting practices that allocate funds based on student enrollment, leading to insufficient resources for education. This, in turn, negatively impacts student learning outcomes, as evidenced by Thailand's performance on the 2022 PISA (Programme for International Student Assessment) test. The results showed that Thai students scored below the average in reading comprehension and achieved their lowest scores in math and science in two decades.



THE LIGHT OF WISDOM IN THE REMOTE FIELD PROJECT

Bringing solar lights and educational resources to rural schools in Rayong,Thailand, aiming to improve access to education and clean energy in these communities.

1. Wat Pa Yup School
2. Kamnoetvidya Science Academy (KVIS)
3. Payupnai Community
4. Innovative Agricultural Learning Center
5. Ban Yup Ta Neng School
6. Thairat Wittaya Ban Khlong Khet School
7. Ban Bueng Takat School
8. Ban Khao Talat School
9. Ban Phlong Ta Iam School
10. Ban Chongkho School
11. Ban Chumnum Nai School
12. Ban Wang Chan Community School
13. Ban Khlong Bang Bo School
14. Ban Khao Ta in School
15. Ban Chum Saeng School
16. Ban Khlong Phai School
17. Ban Kaeng Wai Ard Ratbamrung School
18. Bannongmuang School

The Light of Wisdom in the Remote Field Project

Wat-Payup School

CEST Team and Energy and Power X ขอขอบคุณผู้สนับสนุน (both in kind and in cash) ได้แก่ VISTEC, TSRI, PMUC-IRPC, UMICORE และ PTT Group

The Light of Wisdom in the Remote Field Project

KVIS

KAMNOETVIDYA SCIENCE ACADEMY

KVIS

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The Light of Wisdom in the Remote Field Project

ชุมชนตำบลป่ายุบใน
อำเภอวังจันทร์ จังหวัดระยอง

CEST Team and Energy and Power X ขอขอบคุณผู้สนับสนุน (both in kind and in cash) ได้แก่ VISTEC, TSRI, PMUC-IRPC, UMICORE และ PTT Group

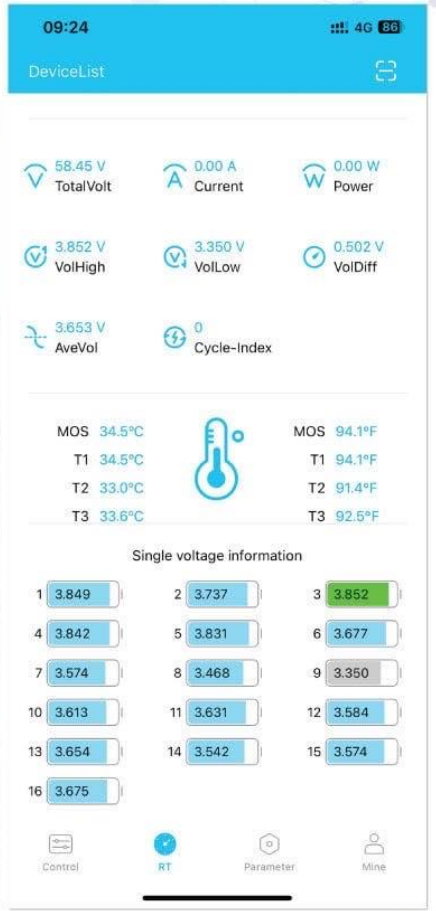
“Field Testing in Market-needed Applications"

- **Energy storage system (ESS)**

- **Electric vehicles (EVs)**

VISBAT Being Used in Electric Motorcycles

การทดสอบแบตเตอรี่ภาคสนามในรถจักรยานยนต์ไฟฟ้า



โครงการเพิ่มนักปฏิบัติการด้านการผลิตแบตเตอรี่ให้กับประเทศไทย

Source: Generative AI ChatGPT4

"Project to Increase Battery Production Operators for Thailand"

โครงการเพิ่มนักปฏิบัติการด้านการผลิตแบตเตอรี่ให้กับประเทศไทย