Welcome to NTU!

NTU-DEYE Cooperation Meeting

26 JAN 2026

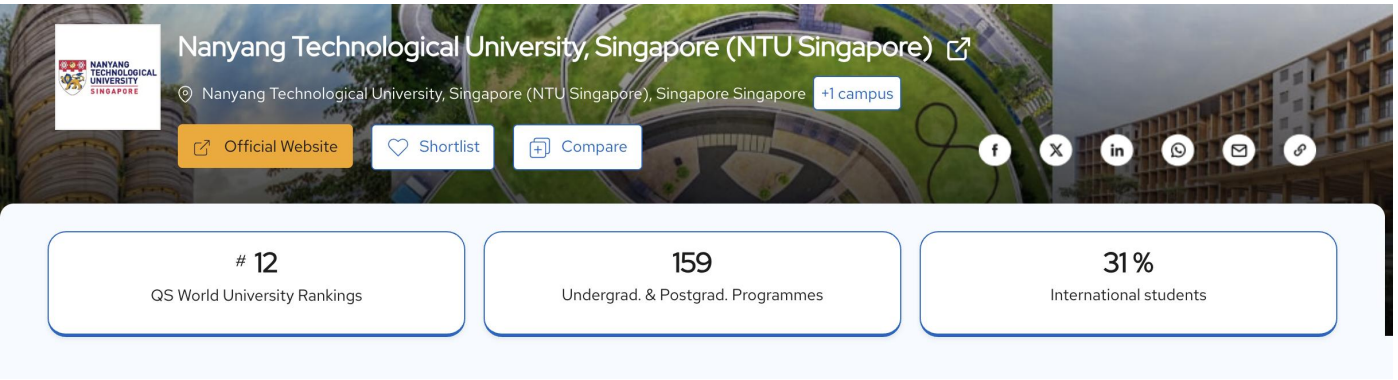
Nanyang Technological University

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

NTU-DEYE Cooperation

26 Jan 2026

About NTU 关于南洋理工大学



QS World University Rankings 2026: 12th GloballyQS2026
世界大学排名 全球第12

AI & Data Science: 5th Worldwide, 1st in Asia
人工智能及数据科学领域 世界排名第5，亚洲第1

World-leading in Data & Computing Science
数据与计算机专业全球排名领先

NTU的产业合作与转化成效

From Lab to Market: NTU’s Proven Track Record in Industrial Innovation

产业转化生态成熟度

年均孵化30+科技企业，累计超200家，14家估值破亿新币，有成熟和高效的产学研协作体系

全球创新影响力

全球PCT专利连续多年稳居全球大学Top 10，亚洲第1

头部企业信任度

50多个联合实验室，NVIDIA/阿里等密集布局

合作方	领域	合作成果
Rolls-Royce	航空制造	联合实验室（S $ 100M+投入），开发AI驱动的航空发动机预测性维护系统，降低非计划停机30%
Alibaba Group	互联网/绿色计算	基于时空图神经网络的路径优化模型，年减碳12万吨；成果发表于 NeurIPS 2023
Siemens	医疗影像	联合开发AI辅助诊断工具，提升肺结节检测敏感度至96%

当前分布式能源系统面临的技术挑战（共性问题）
Shared Technical Challenges in the Evolution of Distributed Energy Systems

01

高不确定性下的运行优化

- ✓ 光伏出力、用户负荷、电价信号波动加剧 → 传统确定性控制策略失效
- ✓ 需要概率预测 + 风险感知决策

02

分布式设备的运维成本与可靠性

- ✓ 海量户用设备部署后，维护响应慢、成本高
- ✓ 故障早期预警与寿命预测能力不足

03

新型市场机制下的合规与收益平衡

- ✓ 分时电价、需求响应、绿证交易等规则复杂
- ✓ 策略需同时满足技术可行、经济最优、监管合规

合作愿景 — 共塑全球能源转型的智能系统

Cooperation Vision — Co-creating Intelligent Systems for Global Energy Transition

实现硬件与可验证、可审计智能算法的深度协同

构建以可信身份与分布式智能为核心的能源设备新体系

定义支持安全交互与自主协同的下一代全球能源设备规范

NTU与DEYE的互补能力矩阵

Complementary Technical Capabilities for Building Trusted, Intelligent Energy Devices

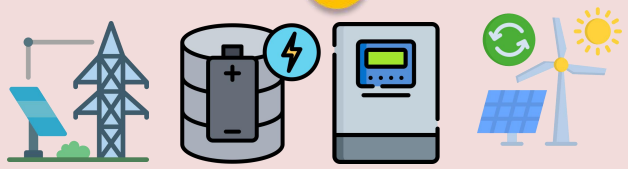
能力维度	NTU 的核心能力	DEYE 的核心能力
智能算法与建模	• 概率预测与不确定性量化（时空图神经网络） • 轻量化边缘AI模型（<5MB，支持MCU部署） • 多智能体仿真与市场策略优化	• 高效MPPT与并网控制算法 • 嵌入式实时操作系统（RTOS）开发 • 电力电子拓扑与热管理设计
设备可信性与数据治理	• 区块链底层协议研究（零知识证明、轻节点验证） • 设备级数字身份（Device DID）与可信数据上链 • 隐私保护计算（联邦学习 + 安全多方计算） • 符合 ISO/IEC 27001 的安全审计框架	• 全球数百万台逆变器/储能设备的物理部署与联网能力 • 设备唯一标识（UID）与固件安全启动机制 • 真实运行环境下的高频率电气数据采集（电压、电流、温度等）
系统集成与验证	•区块链-能源耦合测试床（已对接新加坡EMA VPP试点）	• 产品级固件集成与OTA升级体系 • 全球多国并网认证（UL, CE, CEC, GB等） • 客户现场反

合作内容总体架构与项目意义
Overall Framework and Project Significance

WP 1
AI-driven Operational Management for Profit Improvements

Cloud Cognitive Digital Twin for Lifecycle Fault and Safety Management

WP 2



Focus on Energy Applications and Devices

Data

Blockchain-Supporting Mechanism

WP 3

Data

Participation-Constrained Mechanism

WP 4

Market participants and regulations

Focus on System Risk Control and Resilience

Joint-Lab addresses the challenges

1. AI-Driven Prediction Models and Optimization for Energy Devices and Power Systems
2. Cloud-based Digital Twin Diagnostics and Predictive Maintenance for Energy Devices
3. AI-Driven Performance Dynamics and Risk Analysis in Blockchain-Supported Energy Systems
4. Simulation- and AI-Based Allocation and Valuation Signals under Restricted Participation

WP 1 & 2: AI-driven Management for Digital Energy Assets

WP1: AI-Driven Prediction Models and Optimization for Energy Devices and Power Systems

Importance — Intelligent AI models that empower autonomous renewable generation and load forecast to further enable smart operation schedule for profit maximization and accurate profit prediction.

- **AI-driven Probabilistic Renewable Generation/Load consumption/Electricity Price Prediction**
- **Physics-AI Models for Energy Devices Modelling (e.g. inverter, UPS)**
- **Bi-level Optimization and Control for Devices in Power Systems**

WP2: Cloud Digital Twin Diagnostics and Predictive Maintenance for Energy Devices

Importance — Cloud-based digital twin with edge intelligence to achieve safe and reliable operation for distributed devices and systems. This significantly contribute to reduce downtime, failure possibility and corresponding financial losses.

- **Physics-AI Digital Twin on Cloud for Device Health State Diagnostics with Self-evolving Capabilities.**
- **Early Warning, Failure Forecast and Smart Predictive Maintenance Schedule using Probabilistic AI models**
- **Lightweight Edge Computing Models for Offline and Fast-response Device Safety Management**

WP 3 & 4: AI & Simulation for Risk and Decision Signals in Constrained Energy Systems

WP3: AI-Driven Performance Dynamics and Risk Analysis in Blockchain-Supported Energy Systems

Importance — Large-scale energy asset programs require a deep understanding of performance variability and downside risk under uncertainty, rather than point predictions or deterministic assumptions.

- **AI-Based Distributional Performance Analysis (Multi-Source Learning)**
- **ML-Enabled Quality-Aware Aggregation and Benchmarking**
- **AI-Assisted Rule Learning for Auditable Risk Mitigation**

WP4: Simulation- and AI-Based Allocation and Valuation Signals under Restricted Participation

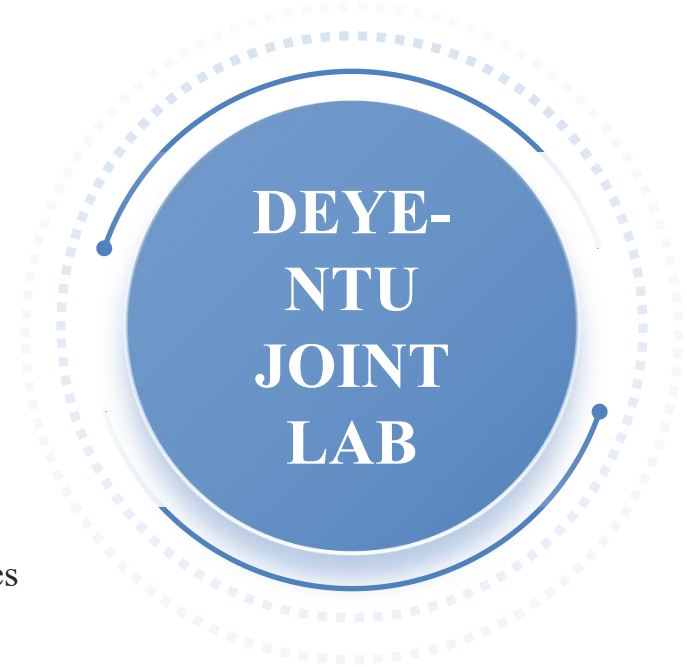
Importance — Under compliance or governance constraints, conventional market-based signals become unreliable. Robust allocation logic and valuation signals must be derived from system behavior rather than unrestricted interaction.

- **Simulation- and AI-Based Valuation Stability Analysis**
- **LLM-Based Compliance Interpretation and Audit Intelligence**

Joint Lab定位与目标

定位 Positioning

- ✓ 聚焦全球分布式能源设备的智能化与可信交互需求 Target the global demand for intelligent and trusted interaction of energy devices
- ✓ 开展前沿关键技术研究 Tackle cutting-edge key technologies
- ✓ 支撑 DEYE 下一代产品创新 Empower DEYE's next-generation product innovation



目标 Objectives

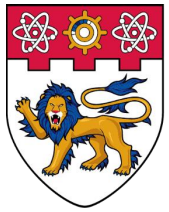
- ✓ 技术产出 Technology Outputs
- ✓ 能力建设 Capability Building
- ✓ 人才培养 Talent Development
- ✓ 等 etc.

后续工作思路

联合实验室筹建路线图

Action Plan to Launch the DEYE-NTU Joint Laboratory

阶段	关键行动	责任方	交付物
Phase I	• 成立Work Group • 双方签署保密协议（NDA） • 确认联合实验室章程（Terms of Reference）	双方法务等部门	签署版NDA ToR草案（含IP、治理、退出机制）
Phase II	• 召开首次指导委员会预备会 • 确定首年研究重点，明确DEYE首笔经费拨付流程	双方领导层，各研究方向负责人等	签署版ToR 首年工作计划（含预算分配）
Phase III	• **举行联合实验室成立仪式** 全面启动研究工作，人才培养等协作内容	双方领导层，各研究方向负责人等	联合实验室正式成立



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Thanks