AI to unlock the next wave of renewable integration in ASEAN

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About Ember

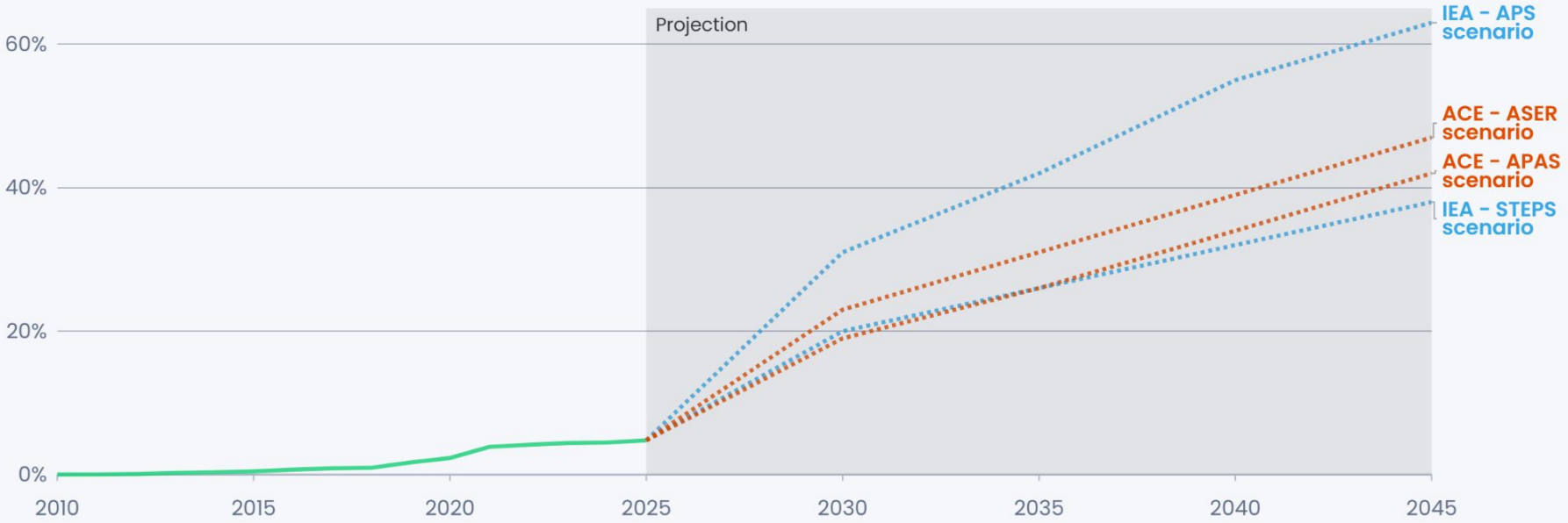
We are an independent energy think tank that aims to accelerate the clean energy transition with data and policy.

Our mission is to: **shift the world to a clean, electrified energy future**.

Our data is open, free, and easily downloadable.

ASEAN's variable renewable energy remains low today but is projected to grow rapidly by 2045

Share of variable renewable energy (VRE) in total generation (%)



Source: Ember Electricity Data, IEA, ACE

ASEAN's VRE share projections including solar and wind based on Stated Policies Scenario (STEPS), Announced Pledges Scenario (APS) from Southeast Asia Energy Outlook 2024 (IEA); and ASEAN Policy Aligned Scenario (APAS) and ASEAN Shared Energy Resources (ASER) from ASEAN Renewable Energy Long Term Roadmap (ACE).

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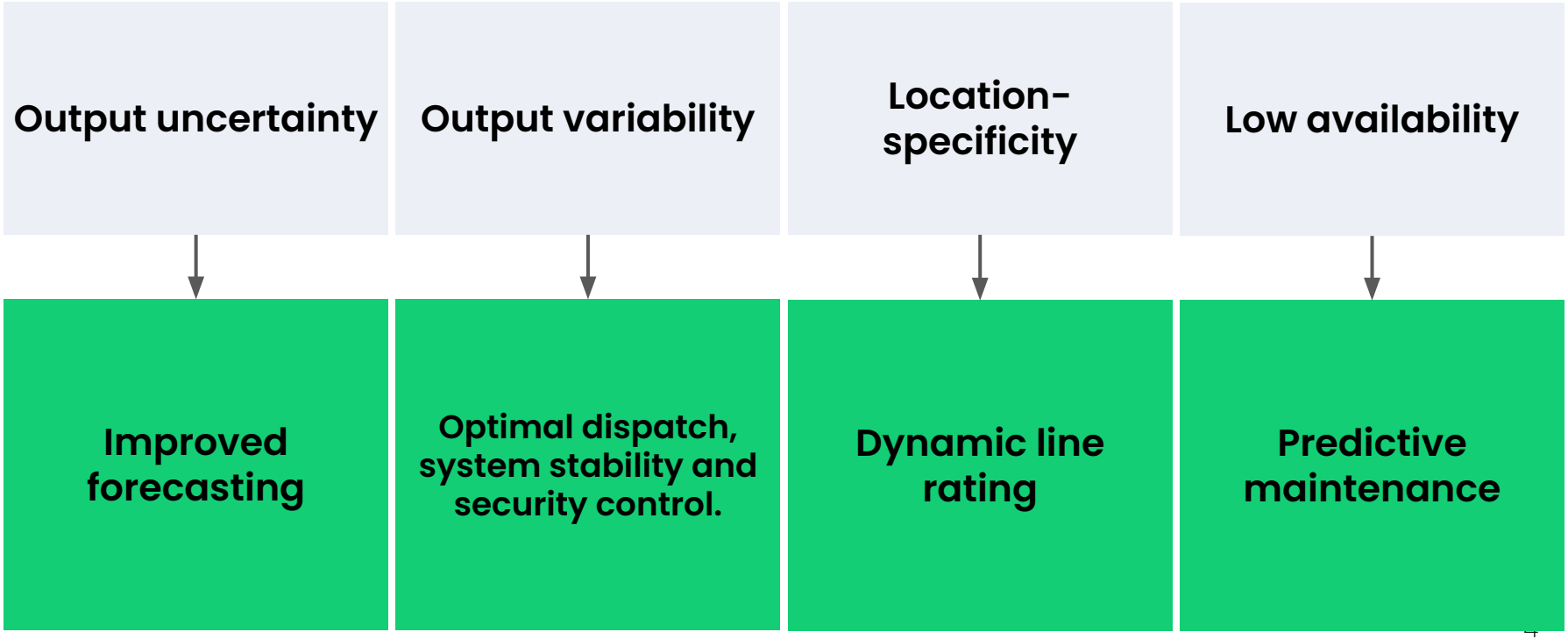
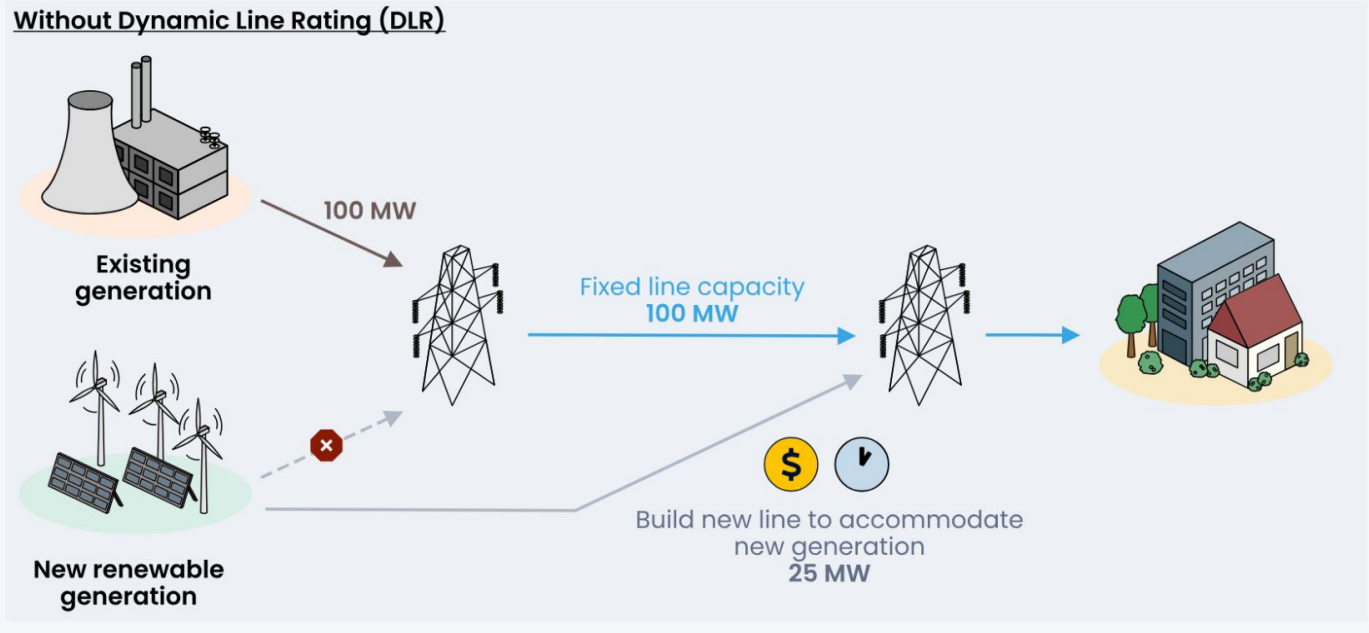
How AI enables higher VRE integration



AI dynamic line rating maximizes existing grid capacity

Grid development cannot keep pace with RE capacity expansion.

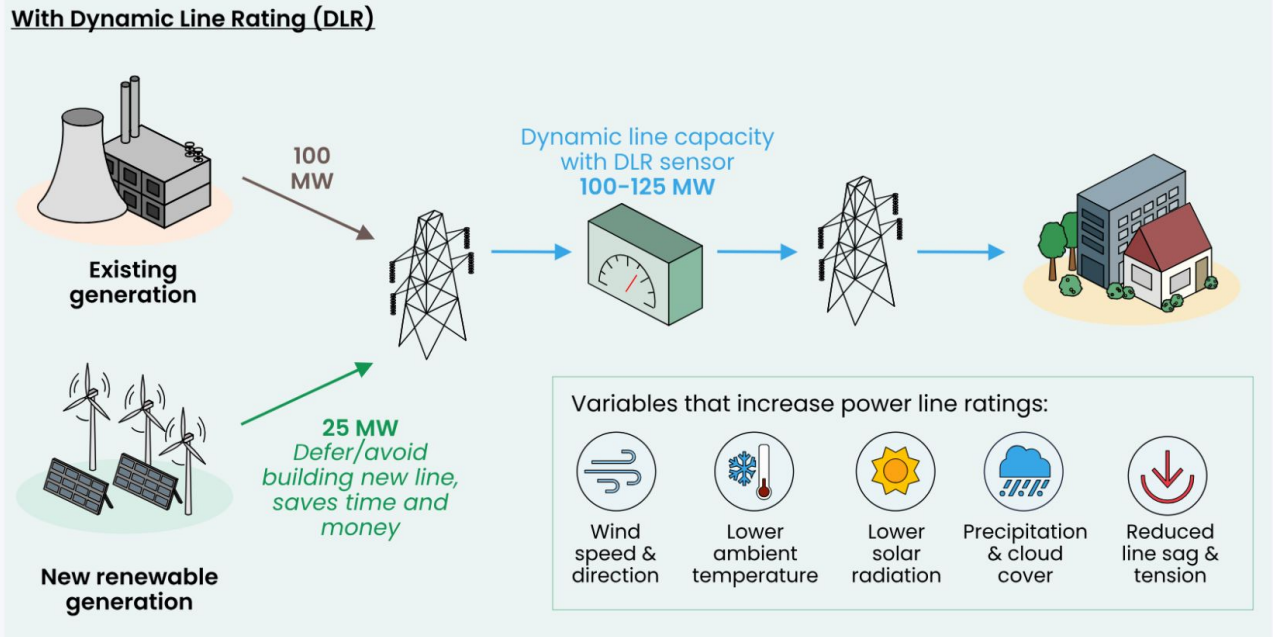
New RE generation typically requires tx upgrade or augmentation



AI dynamic line rating maximizes existing grid capacity

AI turning raw, uncertain input into real-time limits that grid operators can actually use.

It might be a high impact solution given ASEAN's rainy seasons and strong wind resources.



AI predictive maintenance reduces unplanned outages

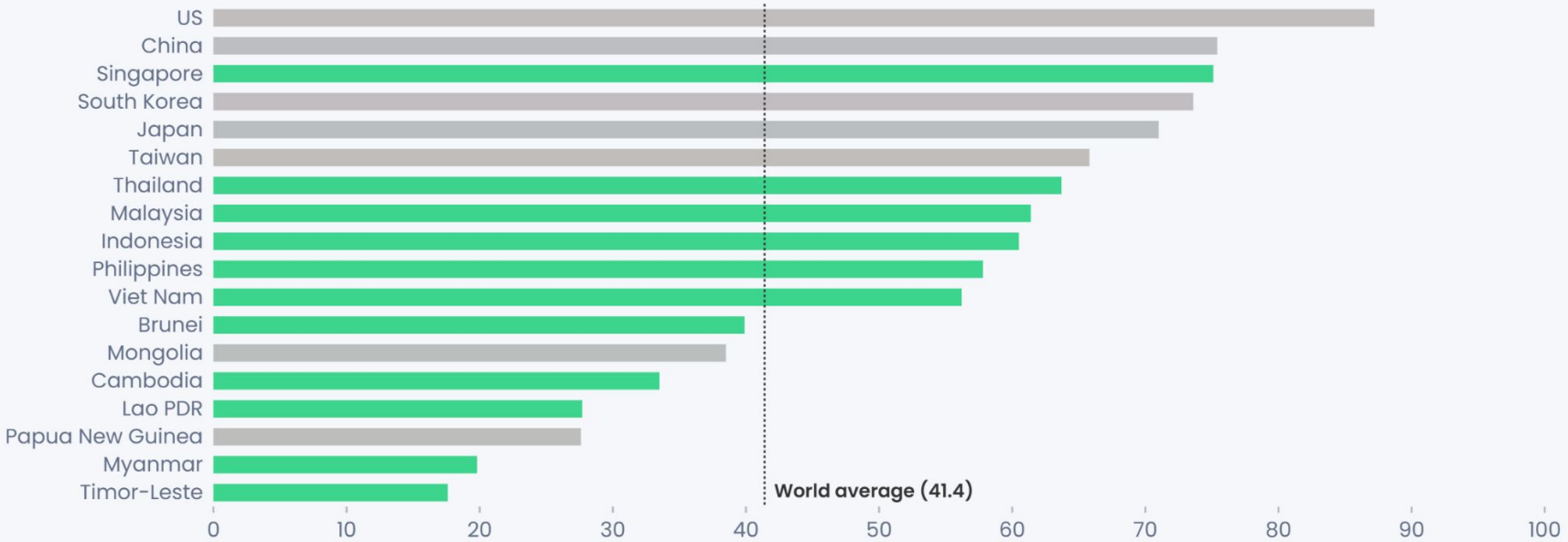
By detecting early degradation signs, allowing proactive maintenance.

Increasing reliability and availability of renewable generation and grid assets.

	Conventional maintenance	AI predictive maintenance
Repair trigger	Fix when broken	Fix before failure
Replacement strategy	Replace on schedule	Replace when needed
Work timing and safety	Emergency crew work overtime in dangerous conditions	Teams schedule repairs during safe, planned outages
Failure visibility	Equipment fails without warning	Machine signal distress weeks early
Detection method	Limited or periodic inspections	Real-time and continuous sensing monitor (vibration, temperature, electrical signals, etc.)
Failure recognition	Relies on human memory and manual analysis	Automated failure detection across large datasets
Catastrophic failures	More frequent - Reactive with failures	Rare - Detect degradation before failures
Cost impact	Repairs cost 3-5x more.	Costs stay predictable
Asset lifetime	Shorter or as of design	Extended due to improved conditions
Customer outcome	Customers lose power	Customers keep power

Most ASEAN countries outperform the global average in AI readiness and are well positioned for AI adoption

Government AI readiness overall score in 2025 (0-100)



Source: Government AI Readiness Index 2025

The Index derived from six pillars including Policy Capacity, AI Infrastructure, Governance, Public Sector Adoption, Development & Diffusion, and Resilience.

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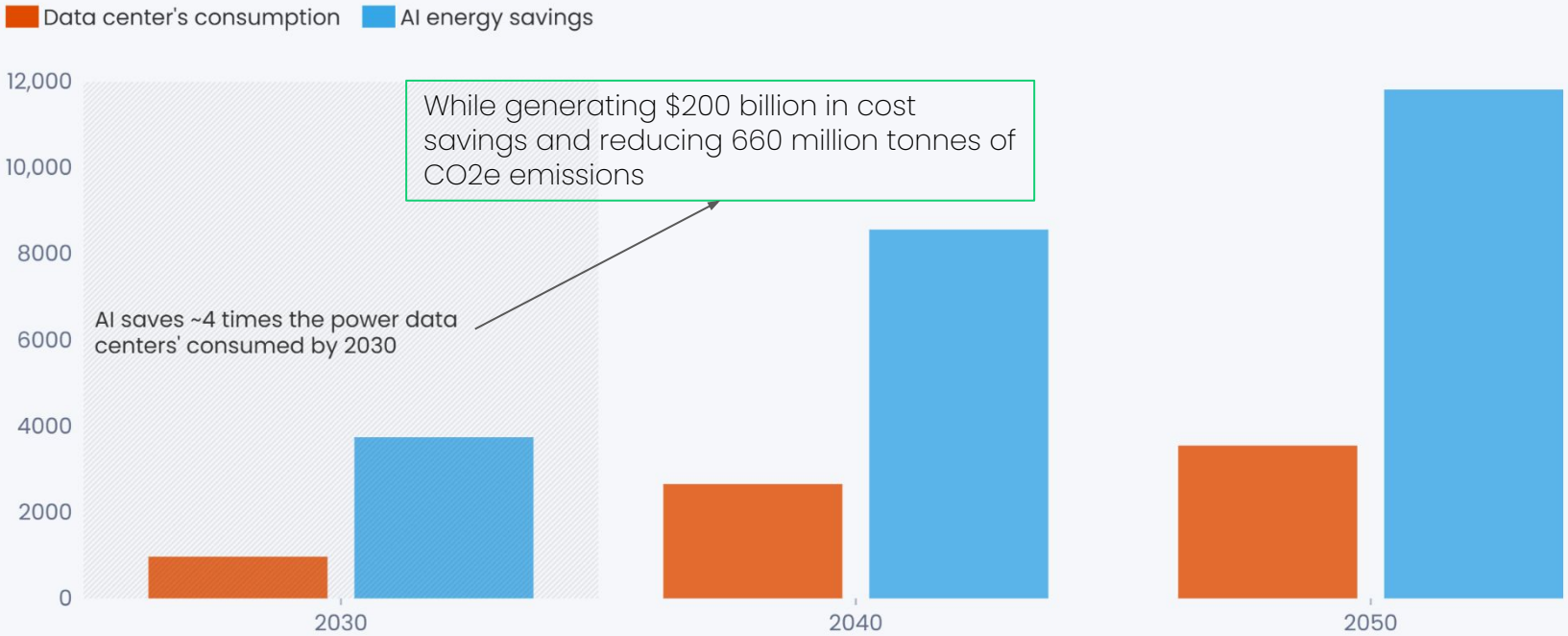
AI in the global energy sector cuts far more power than it consumes

Projected annual electricity consumption of data centers and savings of artificial intelligence (AI) in TWh



Source: Deloitte, widespread AI adoption scenario

Energy savings estimated across energy value chain including power sector, energy networks, industry, transport, building and, oil and gas.

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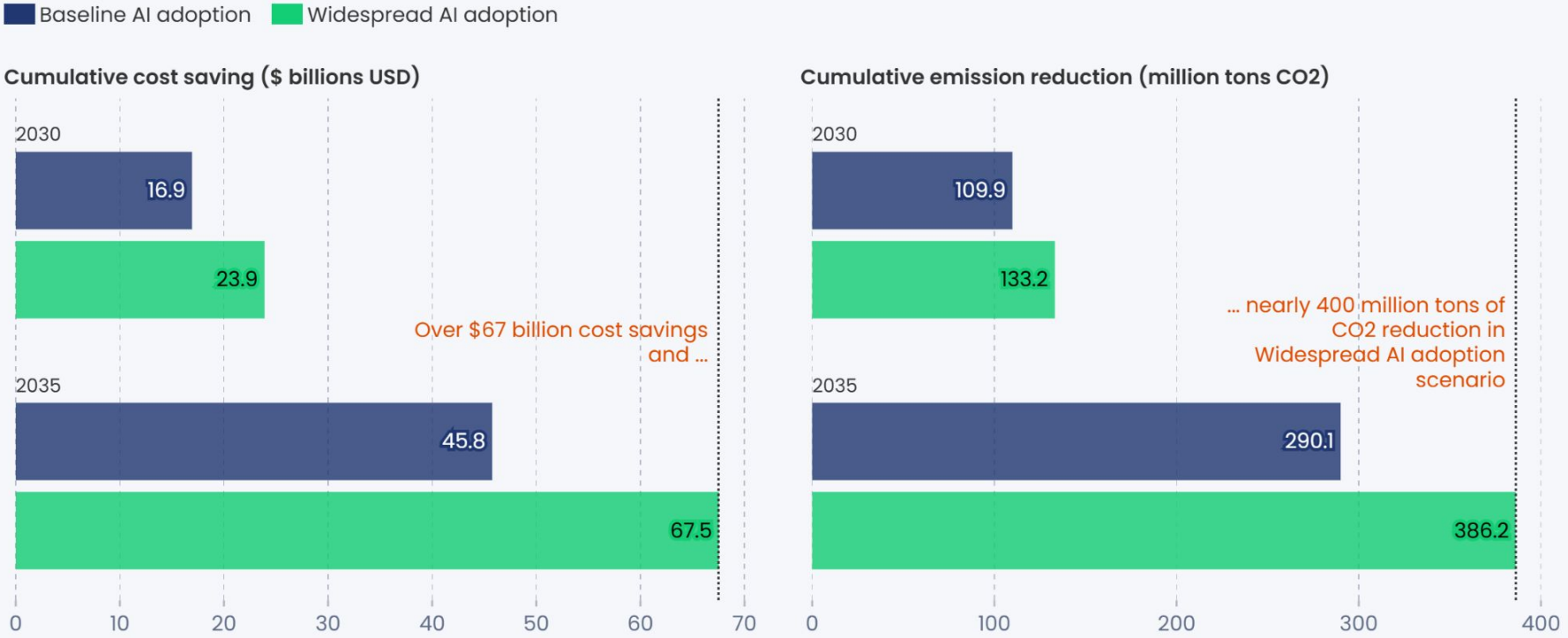
With widespread AI adoption in power systems, ASEAN could save over $67 billion USD and cut nearly 400 million tonnes of CO2 by 2035



Source: Ember analysis, details in methodology

Upper bound results. Cumulative cost savings of High VRE scenario and emissions reduction of Low VRE scenario.

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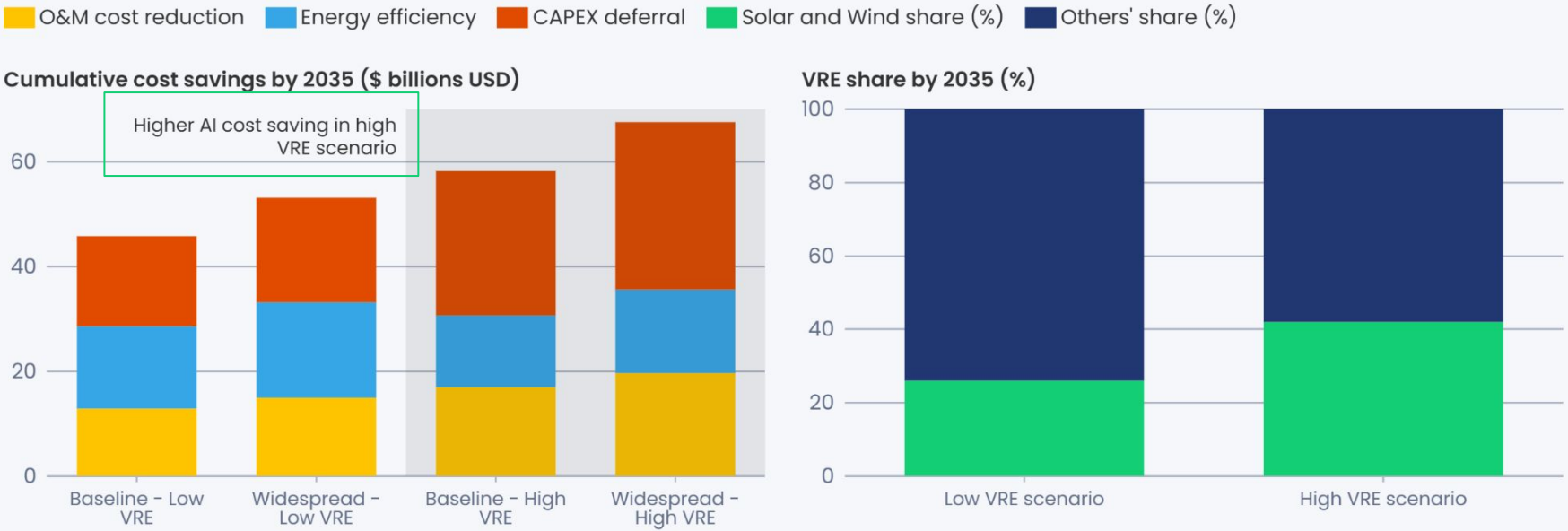
AI becomes more valuable as renewables penetration rises in ASEAN

Cumulative cost saving from artificial intelligence (AI) adoption in power sectors and VRE share in total electricity generation by 2035



Source: Ember analysis

VRE stands for variable renewable energy. Cost savings estimated for Baseline and Widespread AI adoption scenarios, and two policy pathways including Low VRE (Stated Policy Scenario) and High VRE (Announced Pledge Scenario) from IEA Southeast Asia Outlook 2024.

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Challenges and risks

Data limitation

Regulatory uncertainty and liability risks

Cybersecurity

Organizational and cultural barriers

Recommendations

Mandate VRE forecasting

Strengthen data and model governance

Embed data protection and cybersecurity

Build workforce

Phased roll-out, close monitoring & plan additional budget

Thank you!

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