TENAGA NASIONAL
Better. Brighter.

Illuminating Tomorrow, Today :

The ESG Journey of TNB 2024

33 Stories Lighting Up TNB's FY2024

INTRODUCTION

In FY2024, Tenaga Nasional Berhad significantly advanced its Environmental, Social, and Governance (ESG) commitments, as detailed in '**Illuminating Tomorrow, Today: The ESG Journey of TNB in FY2024**.' This e-book goes beyond more statistics, showcasing TNB's tangible efforts in pioneering renewable energy, empowering communities, and upholding robust governance. It highlights how ESG principles are woven into every aspect of TNB's operations, guiding us towards a resilient and sustainable future powered by purpose and responsibility.

ENVIRONMENT

- Carbon Management
- Water Management
- Biodiversity & Land Use
- Opportunities in RE
- Toxic Emissions & Waste

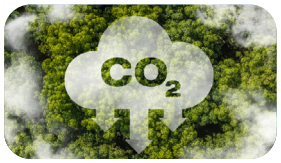
SOCIAL & GOVERNANCE

- Health & Safety
- Human Capital Development
- Labour Rights
- Supply Chain Management
- Community Relations
- Corporate Governance

Carbon Management

https://www.tnb.com.my/sustainability/esg-stories/

INVESTING IN A GREENER TOMORROW: PLANTING A SUSTAINABLE FUTURE WITH TNB'S MY BRIGHTER GREEN



CALLING FOR ACTION: THE URGENCY OF CARBON EMISSION MANAGEMENT FOR A SUSTAINABLE FUTURE

NURTURING THE ELECTRIC VEHICLE BATTERY ECOSYSTEM GROWTH THROUGH EV COALITION

ELECTRIFICATION OF TNB'S FLEET

PAVING THE WAY FOR GREEN MOBILITY

Carbon Management

INVESTING IN A GREENER TOMORROW: PLANTING A SUSTAINABLE FUTURE WITH TNB'S MY BRIGHTER GREEN

This article was first published on 10 October 2024, and updated on 30 March 2025.

In today's world, businesses are increasingly expected to operate with a conscience. At Tenaga Nasional Berhad (TNB), prioritizing environmental responsibility is deeply embedded in our values. In 2023, we allocated RM1.48 million to programs that promote eco-friendly practices, conserve biodiversity, and engage local communities. As part of this ongoing effort, TNB's environmental program, My Brighter Green, focuses on supporting biodiversity and fostering community involvement. Through our strategic framework, the Sustainability Roadmap 2050, TNB is committed to achieving Net Zero carbon emissions in Malaysia by 2050. This ambitious goal underscores TNB's dedication to long-term environmental sustainability and aligns with global efforts to combat climate change.

Our initiatives also align with the Malaysian government's Greening Malaysia Programme, led by the Ministry of Natural Resources and Environmental Sustainability (NRES). This national initiative aims to plant 100 million trees by 2025, emphasizing the importance of large-scale environmental conservation and fostering a shared responsibility for the planet. The campaign, which began in 2021, will conclude next year.

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Planting Seeds for a Sustainable Tomorrow

TNB's My Brighter Green programme emphasizes Goal 13 of the Sustainable Development Goals (SDGs), which is Climate Action. Addressing climate change is crucial as it impacts ecosystems, economies, and human well-being. Goal 13 urges urgent action to combat climate change and build resilience. Tree planting is a powerful tool in this effort, as trees act as natural carbon sinks, absorbing greenhouse gases and mitigating their harmful effects.

Launched on September 1, 2023, My Brighter Green focuses on planting two types of trees: mangrove trees (pokok bakau) and landscape trees. Each type provides unique environmental benefits.

Mangrove Restoration: Preserving Coastal Ecosystems

Sustainability management extends to coastal ecosystems as well. Healthy coastlines depend on healthy forests; mangrove roots stabilize shorelines while forests prevent soil erosion that can harm coastal areas. TNB's mangrove planting program, launched in 2021, reflects our commitment to both terrestrial and marine environments. In 2023, we planted 2,635 mangrove trees (covering approximately equivalent to 5.87 acres), reducing CO_2 emissions by approximately 105.4 tonnes annually and contributing to coastal ecosystem restoration.

Mangroves

Thriving in coastal wetland ecosystems, mangroves serve as nature's frontline defense against rising sea levels and powerful storms. Their intricate root systems trap and store excess rainwater, reducing flood risks. They also absorb wave energy, protecting coastlines from erosion. Additionally, mangroves support marine biodiversity by providing a vital nursery habitat for species like shellfish and crabs. For local communities, mangrove ecosystems offer sustainable food sources and income through fishing and handicraft production.

Landscape Trees

These trees benefit urban and inland areas by providing shade, which reduces ambient temperatures and creates cooler microclimates. This helps mitigate the "urban heat island effect," here dense building concentrations trap heat. Landscape trees also act as natural air filters, absorbing carbon dioxide-a major greenhouse gas—and releasing oxygen. Their root systems prevent soil erosion, particularly on slopes and unstable land.

The Nenggiri Hydroelectric Project

Large-scale development projects can have environmental impacts, but TNB's Nenggiri Hydroelectric Project demonstrates our commitment to balancing progress with responsibility. We planted 175,890 rubber trees (covering approximately 6,500 acres, approximately sequestering 7,035 tCO_2e annually) in the Orang Asli resettlement area. This initiative:

1. Provides Sustainable Livelihoods

Rubber trees offer the Orang Asli community a sustainable income source, promoting economic independence and improving quality of life.

2. Enhances Environmental Sustainability

These trees act as carbon sinks, contributing to carbon sequestration and demonstrating that economic development and environmental well-being can coexist.

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Commemorate our 74th Anniversary Through Tree Planting

To commemorate our 74th anniversary last year, we mobilized our workforce for a remarkable tree-planting drive. We planted 78,100 trees across 42 areas nationwide, reforesting approximately 174 acres and potentially sequestering 3,100 tonnes of CO_2 annually. In 2023, TNB planted a total of 267,104 trees (approximately equivalent to 6,700 acres and potentially sequestering 10,680 tonnes of CO_2 annually), earning the top spot in the goverment-linked company category under Greening Malaysia Programme. Through My Brighter Green, we achieved an estimated carbon offset of 1,718,200 kg CO_2 and produced 1,769,300 litres of oxygen.

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Holistic Environmental Approach

In addition to tree planting, TNB is broadening its sustainability management through various initiatives:

1. Combating Plastic Pollution:
In partnership with the Department of Environment (DOE), TNB addresses plastic pollution through beach clean-up activities,restoring the beauty of coastlines like Pantai Desaru.

2. Restoring Degraded Forests:
Collaborating with the Malaysian Nature Society (MNS) and Bentong Forestry Department, TNB revitalizes degraded forest areas through joint tree-planting programs, enhancing forest cover and biodiversity.

3. Protecting Endangered Species:
TNB works with NGOs like Sahabat Alam Sungai Tampik to develop and implement programs focused on protecting endangered tree species and overall forest health.

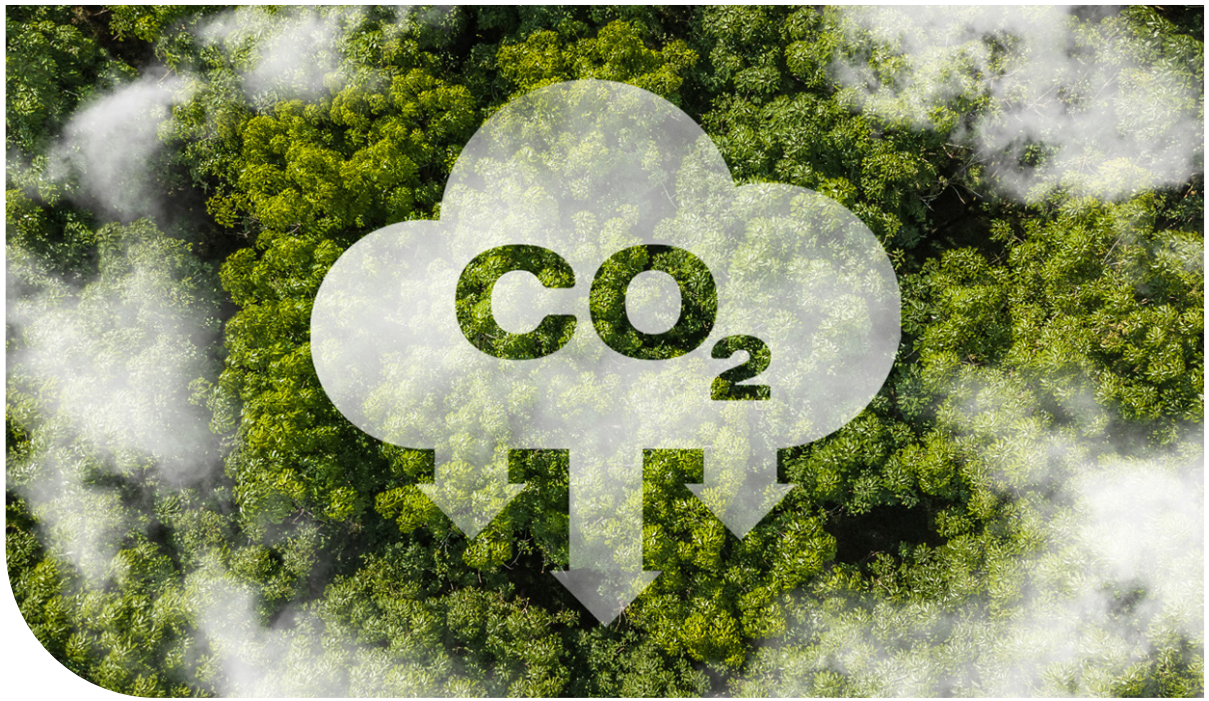
4. Fostering Innovation:
In collaboration with the Forest Research Institute Malaysia (FRIM), TNB supports research and development in sustainable forestry practices.

5. Building Community Engagement:
TNB partners with educational institutions, government agencies, and NGOs. An example is the UNITEN Tree Planting Programme, which saw 20,000 trees planted (approximately equivalent to 45 acres, approximately sequestering 800 tCO_2e annually) across five university campus locations in December 2023. This initiative not only increased green cover but also engaged students and staff in environmental action. Further partnerships with State Forestry Departments, UiTM Shah Alam, and TNB Research promote environmental awareness and empower local residents to become active stewards of the environment.

We target to plant 40,000 trees annually, covering around 89 acres and sequestering about 1,600 tCO_2e. In 2024, we planted a total of 49,214 trees, covering sequestering about 1,900 tCO_2e.Through our participation in the Greening Malaysia Programme and My Brighter Green initiative, we aim to continue making measurable contributions to environmental preservation and community well-being.

Revision History:
30 March 2025: Updated data on trees planted and emissions avoidance in 2024.

Carbon Management



CALLING FOR ACTION: THE URGENCY OF CARBON EMISSION MANAGEMENT FOR A SUSTAINABLE FUTURE

The urgency of managing carbon emissions cannot be overstated. The Paris Agreement, adopted by 196 countries in 2015, aims to limit global warming to well below 2°C, with efforts to cap it at 1.5°C. This international treaty underscores the critical need for immediate and sustained action to reduce greenhouse gas emissions.

Malaysia has committed to achieving net-zero emissions by 2050, aligning with the goals of the Paris Agreement. As part of its Nationally Determined Contribution (NDC), Malaysia aims to reduce its economy-wide carbon intensity by 45% by 2030 compared to 2005 level. This ambitious target is part of the country's broader strategy to combat climate change and promote sustainable development. The National Energy Transition Roadmap (NETR) is a pivotal component of this strategy. Launched in 2023, the NETR outlines a comprehensive plan to transition from fossil fuels to renewable energy sources, aiming for 70% renewable energy by 2050. This roadmap not only addresses climate change but also enhances energy security and economic resilience.

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Our Commitment Towards Carbon Emission Intensity reduction

In support of Malaysia's net-zero ambitions, we are committed to achieving net-zero emissions by 2050. This commitment is part of our broader sustainability pathway, which was announced in 2021. We aim to reduce our annual carbon emission intensity (Scope 1) by 5% each year from 2024 and steadfast in our commitment to achieve a 35% carbon emission intensity reduction by 2035 and net zero by 2050.

To achieve these targets, our efforts focus on reducing carbon emission intensity (tCO_2e/MWh) through our Carbon Management Strategy and Renewable Energy (RE) Capacity Expansion. Together, these initiatives enable us to reduce emission intensity from our operations and set the stage for long-term sustainability by integrating renewable energy and innovative carbon management technologies.

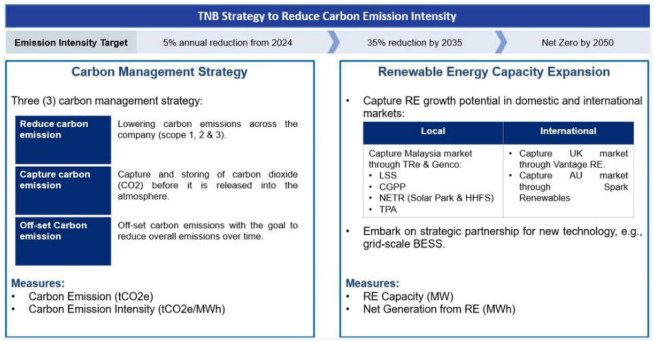

Figure 1: TNB Strategy to Reduce Carbon Emission Intensity

Our Carbon Management Strategy focuses on reducing, capturing, and offsetting carbon emissions (tCO_2e) from TNB's operations. We will continue to expand our renewable energy (RE) capacity both domestically and internationally. Domestically, this will be achieved through the development or acquisition of RE assets by TNB Power Generation Sdn. Bhd. (Genco) and TNB Renewable Sdn. Bhd. (TRe). Internationally, Vantage RE and Sparks Renewable will spearhead these efforts.

From Vision to Reality: Translating Strategy into Concrete Actions

Anchoring to the Carbon Management Strategy and Renewable Energy (RE) Capacity Expansion, we are actively reducing emission intensity and expected to make significant progress to achieve Net Zero by 2050 through concrete actions. The following are the details summarizing the expected reduction in carbon emission intensity (inpercentage) by 2050, compared to 2024:

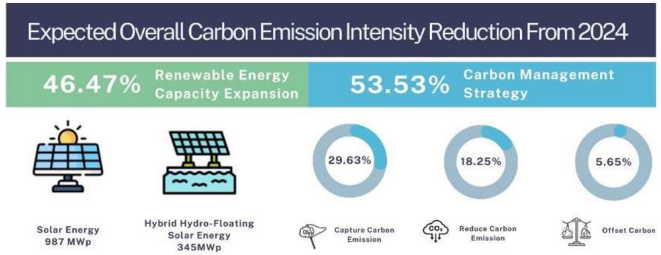

Figure 2: Expected reduction in carbon emission intensity (in percentage) by 2050

Carbon Management Strategy: Reduce, Capture, Off-Set

1. Reduce Carbon Emissions

In our relentless pursuit of a sustainable future, we are committed to achieving 18.25% reduction in emission intensity by 2050. This ambitious goal will be realized through a series of targeted measures, including:

- **Enhancing Power Plant Efficiency:** Implementing coal blending, periodic boiler cleaning, and compressor washing.
- **Leveraging Advanced Technology:** Monitoring plant efficiency through Digital Twin technology.
- **Transitioning Energy Sources:** Early retirement of coal power plants and switching from coal to gas as a transition fuel.
- **Innovative Co-Firing Solutions**: Co-firing of coal power plants with biomass and gas power plants with hydrogen.

Each of these initiatives represents a crucial step towards reducing our carbon footprint and fostering a cleaner, greener planet.

Carbon Management

2. Capture Carbon Emission

We are set to achieve a 29.63% reduction in emission intensity by 2050 through the implementation of advanced carbon capture and utilization (CCU) technologies. Our carbon capture and utilization strategy include:

- **Carbon Capture:** Development of bio-carbon capture (e.g., microalgae) or chemical carbon capture system to absorb and capture CO_2 efficiently.
- **Carbon Utilization:** Development of CO_2 utilization system through biological and hydrogenation pathways.

We embark on "Project Dragon" as a step to realize the potential of carbon capture technologies in our effort to reduce carbon emission intensity. Initiated in June 2024, the project aims to assess the technical and economic viability of integrating carbon capture and utilization (CCU) technology at our 2000MW Jimah East Power (JEP) coal power plant. The goal is to successfully implement and operate a pilot carbon capture and utilization system at the site, capable of capturing up to 5,000 kg of CO_2 annually for utilization through either biological or hydrogenation pathways.

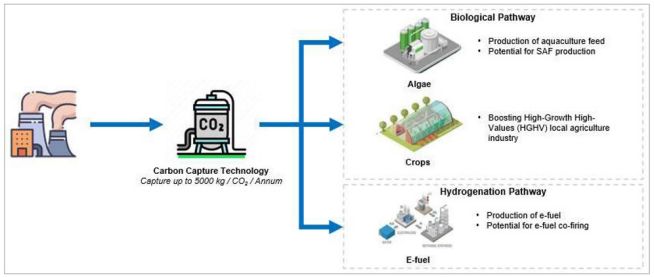

Figure 3: Conceptual Solution for Carbon Capture and Utilization

3. Off-Set Carbon Emission

In our pursuit of net-zero emissions, we invest in nature-based carbon offset initiatives like reforestation to tackle hard-to-abate emissions. These efforts help absorb and store carbon dioxide, contributing to a more sustainable future. We target to plant 40,000 trees annually, covering around 89 acres and sequestering about 1,600 tCO_2e. In 2023, we launched the My Brighter Green Programme to commemorate TNB's 74th Anniversary and planted a total of 78,100 trees at 42 designated areas across the country, approximately equivalent to 174 acres and approximately 3,100 tCO_2e sequestered.

Total number planted	Areas planted: Approximately	Sequestered: Approximately
78,100 trees at **42** designted areas across the country	**174 acres**	**3,100 tCO_2e**

Figure 4: Outcome of the My Brighter Green Programme

We will continue to explore and invest in both nature-based and technology-based carbon offset initiatives for the remaining hard-to-abate emissions (5.65% of emission intensity by 2050). Our commitment towards these efforts are crucial in addressing our carbon footprint and ensuring a sustainable future for generations to come.

Increasing Renewable Energy Capacity

In our ambitious drive towards sustainability, we are significantly increasing our renewable energy capacity both domestically and internationally. We aim to secure up to 5GW of RE capacity in Malaysia under various programs including Large Scale Solar 5 (LSS5), Corporate Renewable Energy Supply Scheme (CRESS) and Corporate Green Power Programme (CGPP). This bold initiative is projected to achieve a remarkable 46.47% reduction in emission intensity by 2050.

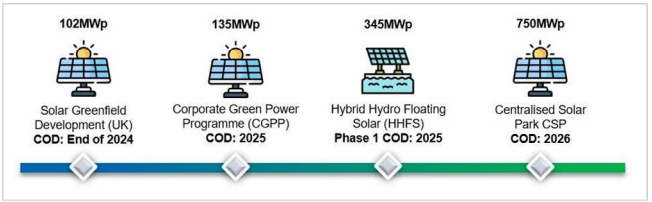

Figure 5: Key Renewable Energy Projects by 2026

These projects represent our unwavering commitment to expanding renewable energy sources and reducing our carbon footprint. By harnessing the power of the sun and innovative hybrid technologies, we are paving the way for a cleaner, greener future.

Carbon Management

For each of the above strategy, granular year-by-year initiatives have been identified to reduce carbon emission intensity to achieve set targets, as depicted in the following graph.

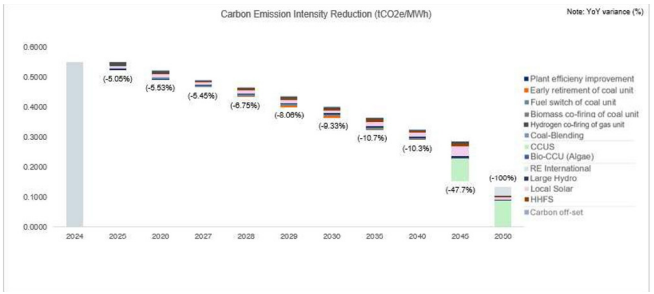

Figure 6: Emission intensity reduction initiatives

Visualising Our Progress Towards Net Zero Emission by 2050

Following an extensive target review process, the TNB Sustainability & Energy Transition Committee (SETC), chaired by President/Chief Executive Officer (CEO) of TNB had approved the Carbon Emission Strategy and RE Capacity Expansion. With both strategies in place, we are on a promising path to meet our long-term sustainability goals. Our immediate target is to reduce carbon emission intensity (Scope 1) by 5% annually and we can achieve beyond our 35% carbon emission intensity reduction target by 2035 and net zero by 2050.

Our emission intensity projection illustrates our confidences in achieving the emission intensity reduction targets. With concrete actions, we are confident to meet set targets.

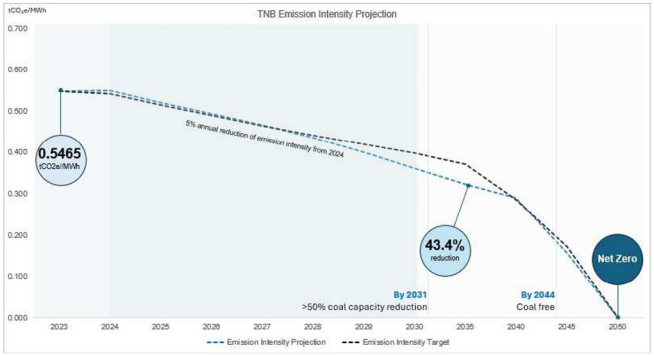

Figure 7: TNB Emission Intensity Projection 2024 to 2050

In conclusion, our Carbon Management Strategy and RE Capacity Expansion is not just a roadmap but a commitment to a sustainable future. By systematically reducing carbon emissions and expanding renewable energy sources, we are taking decisive steps towards achieving our Net Zero emissions target by 2050. This journey requires continuous innovation, collaboration, and dedication. Together, we can create a cleaner, greener world for future generations.

Carbon Management

NURTURING THE ELECTRIC VEHICLE BATTERY ECOSYSTEM GROWTH THROUGH EV COALITION

The Malaysia Zero Emission Vehicle Association or MyZEVA stands as a unified coalition dedicated to advancing battery electric vehicles (BEVs) as a solution to low-emission mobility. Established by eight founding members - MyEVOC, TNB,Volvo, BMW, PEKEMA, Bermaz, Toyota, and Charge'n'Go - and officially registered on December 1st, 2021, MyZEVA aims to bring together stakeholders across the BEV ecosystem, including Original Equipment Manufacturers (OEMs), Charge Point Operators (CPOs) and EV owners.

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MyZEVA operates as a collaborative platform, uniting stakeholders to advocate for policies and initiatives that drive the growth and acceptance of BEVs. By consolidating voices within the coalition, MyZEVA amplifies its influence in shaping regulatory frameworks and garnering essential support for the BEV industry. Maintaining continuous engagement with government agencies and industries such as Ministry of Investment, Trade and Industry (MITI), Ministry of Energy Transition and Water Transformation (PETRA), Ministry of Finance (MOF), Ministry of Education (MOE), Ministry of Transport (MOT), Ministry of Housing and Local Government (KPKT), Ministry of Works (KKR) and Ministry of Science, Technology and Innovation (MOSTI), MyZEVA also collaborates with entities like realestate developers, shopping malls, Joint Management Bodies (JMBs) and highway operators. This multifaceted approach ensures comprehensive involvement across key sectors to drive positive outcomes for the BEV industry.

As an active contributor to the EV market, MyZEVA coordinates marketing efforts, education campaigns, and events to underscore the benefits of BEVs. With a focus on becoming a regional and national thought leader in the industry, MyZEVA serves as a central hub for comprehensive research, data, and information, establishing itself as a trusted source of industry insights.

Through its initiatives, MyZEVA plays a pivotal role in shaping the discourse around electric vehicles, fostering increased consumer awareness, acceptance, and adoption of BEVs. With 47 registered members covering the main segments of the EV ecosystem, MyZEVA continues to drive positive change and propel the electric vehicle industry forward.

Power Utility

EV OEM / Importer

2 Wheelers Importer

Charging Point Operator

Truck, Bus and Light Vehicle Segment

EV Charging Station Contractor, Solution and Equipment Supplier

Research Institute

For more information about MyZEVA, please visit www.myzeva.org.

Carbon Management

ELECTRIFICATION OF TNB'S FLEET

TNB is making significant strides towards low-emission mobility by committing to electrify 30% of its operational fleet by 2030, marking a gradual transition of its 4,874-strong vehicle. This encompasses a diverse range, from pickup trucks and lorries to vans, passenger vehicles, and specialised units. The initiative aligns with TNB's overarching carbon management strategy, aiming to reduce Scope 1 emissions from its vehicle fleet while reaping substantial economic benefits.

Embracing a proactive stance, TNB has initiated the piloting of off-the-road electric vehicle (EV) usage for its operations. These efforts resulted in the deployment of 98 new units, comprising 78 electric pickup trucks and 20 electric vans, thereby increasing TNB's EV fleet to 127 units. With a targeted replacement exceeding 1,000 units, TNB's commitment echoes the Malaysian Government's ambition outlined in the National Energy Transition Roadmap (NETR) to achieve 20% adoption of 4W EVs by 2030.

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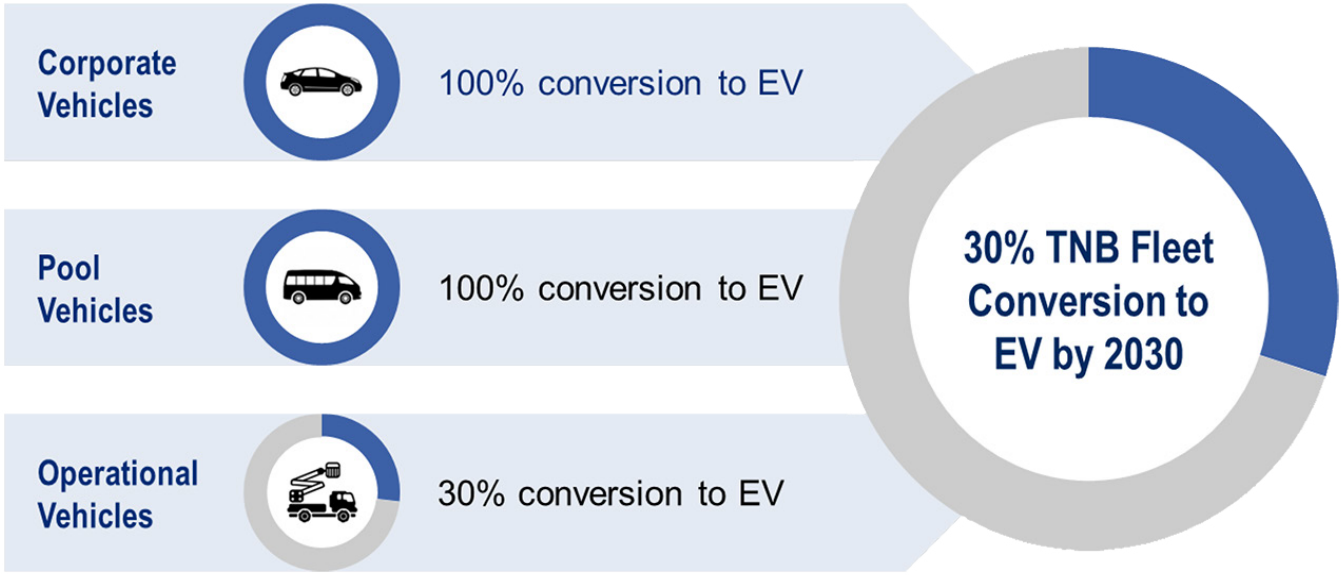
The deployment of the newly introduced 98 units is anticipated to yield a remarkable reduction of up to 23% in CO_2 emissions per vehicle. This translates to an annual reduction of 2,200 to 4,833 tonnes of CO_2 emissions, equivalent to the carbon offsets by approximately 36,000 to 80,000 tree seedlings (approximately equivalent to 119.2 acres - 264.9 acres) over a span of 10 years[1].

TNB's dedication to transitioning to electric vehicles not only advances its environmental objectives but also delivers substantial economic advantages. The integration of EVs into the end-of-useful-life replacement process is projected to generate significant cost savings. Repair and maintenance expenses are expected to plummet by 35% to 86%, while energy costs are foreseen to diminish by 25% to 70%, compared to conventional Internal Combustion Engine (ICE) vehicles.

Moreover, TNB envisions an annual reduction of fossil fuel expenditure by approximately 6% to 12% further underscoring the compelling economic rationale behind the company's commitment to EV integration. These figures highlight the dual benefits of TNB's transition to electric vehicles, aligning with its environmental goals while simultaneously bolstering its financial sustainability.



TNB Fleet Electrification Targets by 2030

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PAVING THE WAY FOR GREEN MOBILITY

The National Energy Transition Roadmap (NETR) underscores the importance of transport electrification as one of the key drivers in decarbonising Malaysia's greenhouse gas (GHG) emissions. According to the Malaysian Investment Development Authority (MIDA), with the automotive industry contributing a significant 4% of the country's GDP[1], and the land transport segment accounts for 55 $MtCO_2eq$ or 85% of total transport emissions[2], it's evident that action is needed to transition to greener mobility solutions.

Therefore, it is prudent for TNB to proactively promote both public and private transport electrification in line with our pledge to realise a coal-free nation by 2050. Embracing green mobility practices and technologies is paramount to mitigate the significant emissions burden posed by the transportation sector.

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Accelerating the development of Electric Vehicles (EVs) stands as one of the key initiatives outlined in the NETR, with specific targets:

Year	2030	2040	2050
Targets	• 20% of 4W fleet as xEVs • 20% of 2W fleet electrified	• 50% of 4W fleet as xEVs • 50% of 2W fleet electrified	• 80% of 4W fleet as xEVs • 80% of 2W fleet electrified

- xEV: Electrified vehicles, including plug-in hybrid electric vehicles (PHEV).
- 4W: four-wheel vehicles.
- 2W: two-wheel vehicles.

Electrification of the transport sector holds immense potential to clean our air and water, protect public health, and uplift the most vulnerable communities amidst the climate crisis. Despite xEV being the natural evolution for the transportation industry, challenges such as affordability, charging infrastructure, EV-friendly policies,and the local xEV automotive and auto component industry hinder widespread adoption in Malaysia.

The encouraging news is that with the right blend of government policies, incentives, and industry collaboration, these barriers can be overcome. At TNB, we stand ready to work closely with the Malaysian government to aid in the development and expansion of the EV ecosystem. We have identified four (4) keyfocus areas to support the proliferation of battery-electric vehicles (BEV) in Malaysia's automotive landscape:

1 TNB Fleet Electrification

Gradually electrify 4,874 vehicle fleets comprising pickup trucks, lorries, vans, passenger vehicles and other specialised vehicles, thus reducing scope 1 emission from TNB's vehicle fleet. TNB has mitigated 2.18 tCO_2e in 2022 through the EV implementation. To date, TNB has electrified 127 of vehicles in its fleet.

2 BEV Charging Infrastructure

- Ensure the electrical distribution network is ready to support the growing demand for EV charge points.
- Co-plan and co-deploy with Charge Point Operators (CPOs) to ensure optimisation of chargers. A fast-track process has been established to facilitate CPOs with supply applications. To date, 89 applications have been received and processed.
- Offer the convenience of charging experience via TNB Electron Chargers. To date, TNB Electron has a total of 36 charge points across Peninsular Malaysia.

3 EV Coalition

- Proactively advocate BEV proliferation via the local Malaysia Zero Emission Vehicle Association (MyZEVA).
- To date, MyZEVA has 47 members and has developed and formulated EV charging system safety guide with Suruhanjaya Tenaga, proposed incentives for EV car manufacturers and providing inputs in the preparation of Garis Panduan Perancangan Petak Pengecasan Kenderaan Elektrik (GPP EVCB).

4 Reskilling & Upskilling Programme

- Help prepare the nation's workforce for the energy transition in both MESI and the transportation & automotive sector.
- Establishment of an EV training hub and development of 6 comprehensive EV training modules at ILSAS. 197 participants have benefited from ILSAS EV program.
- 213 TNB employees have completed specialised EV training on EV technology and implementation since 2021.
- 15 TNB talents under the ongoing TNB Energy Transition (ET) Academy Cohort 1 have been assigned the responsibility of conducting due diligence and designing a robust business case for a self-sustaining EV business model.

These initiatives are aligned with the Environment, Social and Governance (ESG) principles and support the three key pillars of TNB's Energy Transition Plan: i.e., Deliver Clean Generation; Develop an Energy Transition Network; and Deliver Dynamic Energy Solutions to empower cross-sector electrification while enabling customer participation. TNB is taking a proactive approach to drive Malaysia's energy transition, with an investment commitment of RM90 million from 2022 to 2025 to bolster the BEV ecosystem. Together with our partners, we aim to accelerate the adoption of EVs, reduce emissions and create a sustainable future for generations to come.

Water Management

https://www.tnb.com.my/sustainability/esg-stories/

DRIP BY DRIP, WATT BY WATT
A FRIENDLY FIGHT FOR
A BETTER WORLD

SUSTAINABLE POWER PLANT
OPERATIONS THROUGH EFFICIENT
WATER CONSUMPTION

Water Management

DRIP BY DRIP, WATT BY WATT
A FRIENDLY FIGHT FOR A BETTER WORLD

This article was first published on 19 September 2024, and updated on 30 March 2025.

Unlike traditional competition, which often breeds a cutthroat environment, Tenaga Nasional Berhad (TNB), through its division TNB Global Business Solutions (TGBS), is igniting a different kind of rivalry among us that benefits everyone, especially the environment. To achieve this goal, we have introduced the "Drip by Drip, Watt by Watt" challenge, which engages 109 TNB-owned offices in promoting energy efficiency initiative through reduced electricity and water consumption.

The competition, now in full swing (January-December 2024), puts our TNB teams against each other in a friendly battle for water and electricity conservation supremacy. It presents an opportunity to showcase our resourcefulness and innovation while working alongside colleagues towards a shared objective.

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Water Management

Going Head-to-Head at the Battleground

TGBS is proudly leading the charge as the champion in the electric and water conservation competition under the ESG initiatives. With unwavering determination, they're not just competing-they're on a mission. Every drop saved, every watt conserved, is a step closer to TNB's ambitious goals. TGBS is driven by the conviction that their contribution isn't just important-it's essential. They're not just participants in this journey; they're the torchbearers, inspiring others and blazing the trail towards a more sustainable and responsible future for TNB.

The team at TGBS knows that this isn't just about meeting targets; it's about setting a powerful example. They're committed, they're passionate, and they're all in-because they believe that their efforts today will light the way for tomorrow.

Prior to the competition's commencement, a preparatory "prelude" phase (July-December 2023) equipped us with the knowledge and tools necessary for success. This crucial phase included receiving detailed data to identify areas for improvement in our buildings, as well as implementing targeted conservation measures.

While cost savings are a significant advantage, the programme's primary focus is on actively reducing our environmental impact. This includes lessening dependence on non-renewable resources and shrinking our carbon footprint. There are no fancy gadgets, just our trusty water-saving habits and electricity-saving techniques are the key weapons in this battle.

To make it a level playing field for all, three categories were created to ensure a fair fight:

Main Offices (24 Buildings)

These larger buildings hold the most potential for significant resource reduction.

Medium Offices (60 Buildings)

The most common building type at TNB, medium offices can collectively make a big difference.

Branch Offices (25 Buildings)

Showcasing water and electricity efficiency is just as important in our smaller locations.

And here's how everyone at TNB plays their role:

Building Owners and Tenants

Assemble their teams and organise activities to promote conservation within their offices.

The TGBS Community

Lead by example, ensure planned activities are implemented with gusto, and keep everyone informed about this eco-battle.

Everyone

The Leaderboard application is updated exclusively by the PIC in HQ, but the stat Business Support PIC will have access to view and share the leaderboard with local teams. Everyone's role is to make sure that the campaign is well-known and that every member is contributing to its success.

Reaping the Fruit of Our Labour

Since its rollout in July 2023, TNB's "Drip by Drip, Watt by Watt" competition has been closely monitored to track its impact on resource consumption. As of December 31, 2023, the programme has yielded impressive results. Electricity consumption has decreased by 870,063 kWh, leading to an estimated reduction of 659 tCO2e in Scope 2 GHG emissions (emissions generated from purchased electricity). The initiative has also resulted in significant cost savings, with an average reduction of RM12,300 in electricity bills and RM18,800 in water bills per month between July and December 2023.

Seven months into the battle, we are seeing stiff competitions and more great results. Below are the offices that are leading in the "Drip by Drip, Watt by Watt" challenge (as of June 2024):

Category	Electricity Reduction Leader	Water Reduction Leader
Main Offices	Wisma TNB Seremban (0.51% Reduction)	Wisma TNB Seremban (0.78% Reduction)
Medium Offices	Kuala Klawang (0.67% Reduction)	Grid Ipoh (0.98% Reduction)
Branch Offices	Sungai Siput (0.22% Reduction)	Bayan Baru (0.71% Reduction)

Since the launch, TNB buildings have achieved a combined 2.0% reduction in electricity consumption. The combined reduction in water and electricity consumption also translates to RM86,923.45 cost savings for TNB. This proves TNB's commitment to environmental responsibility and empowering our own people to be sustainability superstars.

Water Management

In 2024, our efforts have resulted in a reduction of 1,723,244 kWh in electricity consumption, equivalent to an estimated reduction of 1,333 tCO_2e in Scope 2 emissions and RM877,131.00 cost savings. We have also saved a total of 17,863 m^3 of water consumption, a reduction of 20.5% compared to the previous year.

By competing against each other in this friendly competition, we have not only reduced our environmental impact, but also fostered a culture of mindful resource consumption within the company.

Building Habits for Life

As employees weave water-saving and energy-efficient practices into their daily routines, the positive habits adopted during the competition can extend outside the office, further amplifying the environmental impact. This friendly competition within TNB is proving that a little healthy rivalry can go a long way in creating lasting change.

We're committed to continuous improvement. This friendly competition has shown us the power of collective action, and we're excited to see what we can achieve together in the future.

And the best part? The winners are part of us-TNB employees who have embraced the challenge wholeheartedly.

Participants have shared that the "Drip by Drip, Watt by Watt" initiative is supporting TNB's aspiration in terms of ESG and has provided knowledge on how to save electricity and water consumption. One participant noted.

"Electricity and water saving is not only applicable for home but workplace too," reflecting how the campaign has created awareness about our current baseline usage and how we can contribute to saving electricity and water to a desired level.

Take, for instance, the simple yet powerful act of setting the air conditioning to 24°C in the office. It may seem like a minor adjustment, but it's a shining example of our commitment to energy efficiency. Another participant shared, "From the campaign, I have started to save electricity by turning off my laptop charger when the battery is full and turning off the lights during lunch hour when there's no occupancy." These small but impactful actions demonstrate the tangible changes inspired by the competition.

The enthusiasm generated by the competition is contagious. Participants have gone above and beyond by sharing energy-saving tips with customers, especially during visits to Kedai Tenaga, where discussions about high bills often take place. One testimonial echoed the sentiment behind the campaign by quoting Zig Ziglar, a renowned American motivational speaker and author, who once said, "You don't have to be great to start, but you have to start to be great," perfectly capturing the drive and motivation behind the "Drip by Drip, Watt by Watt" initiative.

This collective effort doesn't just help in conserving energy; it also pulls the broader community into the mission of protecting our environment, ensuring a better world for today and tomorrow. As part of the grand TGBS initiative, "Earth Needs You, Be The Change Today," TNB's commitment to continuous improvement shines brightly. This friendly competition has shown us what we can achieve when we come together, and we're eager to continue on this journey of collective action and shared success.

Beyond Drip by Drip Watt by Watt

You don't have to work at TNB to make a difference. In truth, "Drip by Drip, Watt by Watt" is a mindset that anyone can adopt. Here are some simple tips that you can incorporate into your daily life, whether you're at the office or at home:

Turn off lights and electronics when not in use and utilise natural light whenever possible.	This simple step can significantly reduce energy consumption in both office and home environments.
Take shorter showers.	Every drop saved counts, regardless of location.
Report any leaky faucets or running toilets promptly.	Don't let those precious drops go to waste, be mindful of water usage in both your work and personal spaces.
Advocate for sustainable practices.	Talk to your colleagues or family about the importance of conserving resources. Encouraging others to join you can amplify the impact.
Invest in water-saving measures at home.	Consider installing low-flow showerheads and faucet aerators. Small upgrades can lead to significant water savings in the long run.
Embrace energy efficiency.	Wash clothes in cold water whenever possible, unplug electronics that are not in use, and consider energy-efficient appliances for your next upgrade. Every watt conserved adds up to a more sustainable future.
Think outside the box.	Explore rainwater harvesting for watering plants – a sustainable way to keep your garden flourishing. Innovative solutions can make a big difference.

Remember, every drop saved, and every watt conserved adds up. Together, we can build a more sustainable future for generations to come and the smallest changes can make a big difference.

Revision History:
30 March 2025: Updated data on reduction in electricity consumption and water consumption in 2024.

Water Management

SUSTAINABLE POWER PLANT OPERATIONS THROUGH EFFICIENT WATER CONSUMPTION

Tenaga Nasional Berhad (TNB), as a utility company with substantial water usage in power generation, we recognize our responsibility to manage this vital resource in a sustainable manner.

Despite the withdrawal of water from seawater, surface water and town water for our operations, 99.9% of the water withdrawal is discharged back to the respective sources. Therefore, our focus in managing water withdrawal is on optimizing the use of the 0.1% town water withdrawal, which is mainly used in power generation operated by TNB Genco, a wholly-owned subsidiary of TNB. By treating the wastewater, 0.013% of the 0.1% of town water we withdraw is safely discharged back into nature. Thus, the main efforts are concentrated on optimizing the use of the remaining town water withdrawal through operational excellence, technologies, and innovation.

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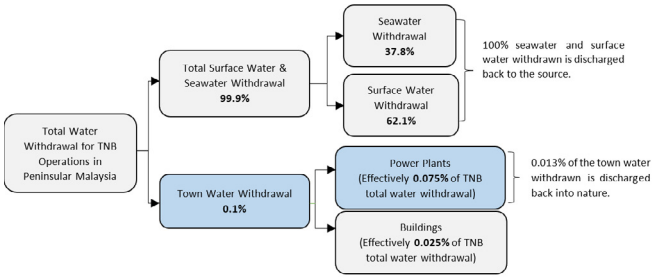
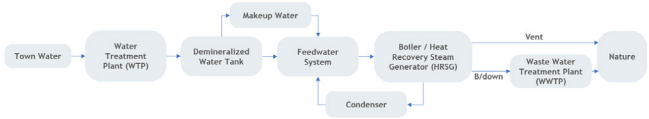
Water Management



Note: The diagram above includes Hydro Power Plant

Closed-Loop Steam Generation Process Helps to Optimize the Use of Town Water Withdrawal

As pioneers of 'Combine Cycle Gas Turbine' and 'Ultra Super Critical Boiler' technology in South-East Asia, we are dedicated to operational excellence. Water consumption plays a pivotal role in our steam generation process and operational efficiency, designed as closed-loop system aimed at minimising our reliance on town water sources. While make-up water is only needed to cover any losses due to blowdown or vent in maintaining water quality. This system is crucial for sustainable operations as it significantly reduces our water withdrawal from town water.



Simplified process of feedwater for steam generation

Effective management of makeup water and blowdown is paramount for ensuring optimal boiler performance, overall power plant efficiency, and safety. The careful control and quality assurance of makeup water are fundamental; any inadequacy or impurity in this supply may not only compromise efficiency but also pose significant safety hazards within our operations.

From 2023 to date, average Water Intensity (water consumption from town water source per net generation of respective plant) for our power plants are much lower than our counterparts using similar power plants technology. This is illustrated in the following table:

TNB Genco Thermal Power Plant Water Consumption Intensity[1]

No	TNB Genco Thermal Power Plant	Water Intensity, Liter/kWh		Steam-water Cycle
		TNB Genco Thermal Power Plants (Year 2023)	International Counterparts[2]	
1	TNB Janamanjung 1,2,3(JMJG GF1), TNB Manjung 4 (M4) & TNB Manjung 5 (M5)	0.161	0.36 – 0.52 (Ultra Super Critical Boiler	Closed-Loop
2	Jimah East Power (JEP)	0.097		Closed-Loop
3	Kapar Energy Ventures (KEV)	0.242	.41 – 0.57 (Sub-Critical Boiler)	Closed-Loop
4	Connaught Bridge Power Station (CBSB)	0.062	0.27 – 0.45 (CCGT)	Closed-Loop
5	Gelugor Power Station (SJ GLGR)	0.034		Closed-Loop
6	Prai Power Station (TNB Prai)	0.010		Closed-Loop
7	Tuanku Jaafar Power Station (TJPS)	0.068		Closed-Loop
8	Sultan Ibrahim Power Plant (SPG)	0.072		Closed-Loop

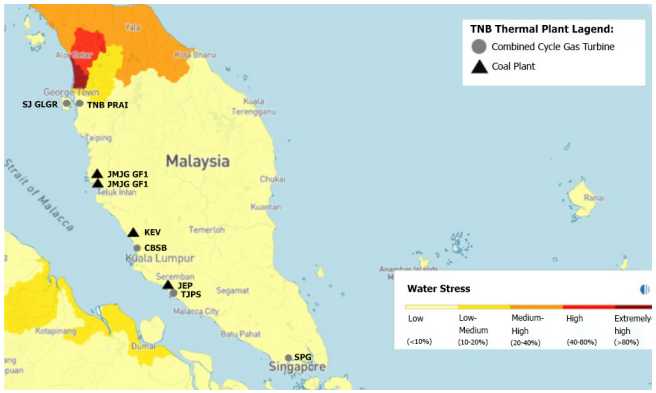
Table comparison of power plant water consumption intensity of TNB Genco Thermal Power Plants and International Counterparts

TNB Genco Thermal Power Plants Located at Low Water Stress Area

All our coal and combined cycle power plants are located in areas with low water stress, none of them are located in the water stress area, therefore zero (0) water withdrawals from water-stressed regions. This strategic placement highlights our commitment to sustainable resource usage and community harmony, preventing potential conflicts over water resources between industry and local communities. The process begins from planning and construction of the respective thermal power plants.

In addition, all of our coal and combined cycle power plants were built and continue to operate in accordance with global "World Bank Environmental and Social Standards" which were established based on the initial project bidding requirements. These standards include water consumption process which are archetypical of conventional high-efficiency thermal plants. Additional efforts at the operational level illustrate our commitment and unwavering dedication to responsible resource management underscoring our proactive efforts in fostering sustainability within our operations.

Water Management



Water Stress Mapping based on Aqueduct by World Resources Institute and location of TNB Genco Thermal Power Plants

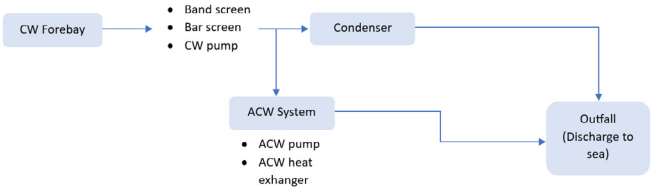
Alternative Water Sources for Power Plant Cooling System

Water plays a dual role in our plant operation, serving not only as a vital element in steam generation but also as a crucial component within our cooling systems. To reduce our dependence on town water sources, we implement alternative sources such as seawater or river water, effectively reducing our reliance on town water.

No	TNB Genco Thermal Power Plant	Capacity	Water source for cooling system
1	TNB Janamanjung 1,2,3 (JMJG GF1)	2,070MW	Seawater
2	Kapar Energy Ventures (KEV)	2,100MW	
3	TNB Manjung 4 (M4)	1,010MW	
4	TNB Manjung 5 (M5)	1,000MW	
5	Jimah East Power (JEP)	2,000MW	
6	Prai Power Station (TNB Prai)	1,000MW	
7	Tuanku Jaafar Power Station (TJPS)	1,411MW	
8	Sultan Ibrahim Power Plant (SPG)	1,440MW	
9	Connaught Bridge Power Station (CBSB)	375MW	River Water
10	Gelugor Power Station (SJ GLGR)	310MW	Not applicable (Air cooled)

Water source for cooling system 2023

Our cooling process, facilitated through the open circuit Main Cooling Water (MCW) system, operates efficiently by utilizing seawater or river water and subsequently discharging it back into the sea at the allowable discharge temperature and free chlorine level that meet DOE Standard. This ensures zero net water consumption, exemplifying our commitment to sustainable practices by minimizing environmental impact while maintaining operational efficiency. Our approach adheres to global water conservation standards set forth by Electric Power Research Institute (EPRI).



Simplified process of Main Cooling Water (MCW) system

Rainwater Harvesting as Alternative Water Source for Coal Yard Dust Suppression System

At TNB Janamanjung and Jimah East Power, rainwater is harvested as an alternative water source for the coal yard dust suppression system, reducing reliance on town water. The collected rainwater is stored in a pond before being directed to the water process tank for dust suppression. This initiative helps optimize the use of town water in our power plant operations.

The capacity of rainwater ponds are as below:

No	Rainwater Pond Location	Storage Capacity
1	TNB Janamanjung	1,375m^3
2	Jimah East Power	1,890m^3

The rainwater ponds allow the collection and reuse of rainwater, thus further helping to reduce the environmental footprint of our generation sites.

Water Management

Driving Innovation for Sustainable Operations

Through our proactive 'Operational Excellence' best practices and 'Business Turnaround Program' initiated in 2017, we persistently monitor and execute water conservation initiatives within power plant operations. Our comprehensive methodology allows us to meticulously identify, plan, and implement impactful strategies for conserving water resources. Furthermore, we specialize in state-of-the-art reverse engineering and plant upgrade initiatives, aligning with our dedication to achieve world-class operational performance in power plants. For instance, one or our Combined Cycle Gas Turbine (CCGT) plant which is Sultan Ibrahim Power Plant (SPG) has experienced an increasing trend in water consumption intensity from 2021 to the present. From 2021, a steady increase of water consumption intensity has been recorded rising from 0.02 Liter/kWh to 0.08 Liter/kWh. Although this remains lower than the average international counterparts in United State which range from of 0.27 to 0.45 Liter/kWh2, we are committed to further reduce town water consumption. To address this, we plan to install 100 units of Zero Leakage Valve at the Heat Recovery Steam Generator (HRSG) of SPG plant during plant maintenance inspection in August 2024. This exemplifies our ongoing commitment to sustainable operations and continuous improvement.

Role of TNB Sustainability and Energy Transition Committee (SETC) for Water Management Strategy and Performance

The TNB Sustainability and Energy Transition Committee (SETC) is chaired by the President/Chief Executive Officer (CEO) comprising TNB Top Management Team, to ensure executive-level responsibility for environment, social and governance (ESG) matters. TNB SETC plays the role of steering the development of sustainability and energy transition strategies and policies, and its implementation as well as providing oversight and input on opportunities and risk exposures.

At TNB, we recognize that water is a finite resource. Water management initiatives and performance are among the key focus areas that are presented and deliberated in the SETC, demonstrating our commitment to efficient water management in our operations. Our commitment to water efficiency is not just a responsibility but also a testament to our dedication to sustainable practices and resource conservation.

Note
1. Water consumption based on municipal/ town water consumption
2. Average international counterparts water consumption intensity of United State depicted from report of "A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies in the United States" (March 2011) by NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC

Plant Technology	Water Consumption Factor or Intensity	
	Gallons/MWh	Liter/kWh (after conversion)
Coal Subcritical	90 – 125	0.41 – 0.57
Coal Supercritical	80 – 115	0.36 – 0.52
Natural Gas Combined Cycle	60 – 100	0.27 – 0.45

Biodiversity & Land Use

https://www.tnb.com.my/sustainability/esg-stories/

SOLAR FARMS AS HAVENS FOR WILDLIFE AND GREEN ENERGY

TNB'S SOLAR PARKS: ADVANCING CLEAN ENERGY WITH ENVIRONMENTAL RESPONSIBILITY

TNB'S BIODIVERSITY FRAMEWORK: A COMMITMENT TO SUSTAINABLE ENERGY GROWTH

TNB PLATINUM WINS GOLD AT THE EDGE MALAYSIA'S BEST MANAGED & SUSTAINABLE PROPERTY AWARDS 2024

STRENGTHENING ENVIRONMENTAL COMMITMENT THROUGH STRATEGIC VEGETATION MANAGEMENT AND TOWER ELEVATION INITIATIVES

Biodiversity & Land Use

SOLAR FARMS AS HAVENS FOR WILDLIFE AND GREEN ENERGY

When you think of solar farms, you likely picture rows of advanced solar panels, silently absorbing sunlight. But what if these solar farms could also serve as thriving habitats for wildlife?

Welcome to the world of agrivoltaics-a blend of agriculture and green energy where it doesn't just fuel our homes, but it revitalizes ecosystems.

Tenaga Nasional Berhad (TNB) is leading this innovative approach through its subsidiaries, Spark Renewables Pty Ltd (Spark Renewables) in Australia and Vantage RE Ltd (Vantage RE) in the UK. These initiatives seamlessly merge solar power with agriculture, transforming solar farms into vibrant ecosystems and advancing global sustainability.

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Sustainable Solar Farming with the Help of Grazing Sheep

You might wonder how sheep and solar panels could coexist, but it turns out they're an ideal combination. Solar farms provide excellent grazing grounds, and by naturally maintaining vegetation around the panels, sheep help the system operate more efficiently. This approach reduces the need for mowers and sprayers, further lowering the carbon footprint of these farms. In addition, the sheep improve soil health by trampling waste, promoting nutrient-rich land over time.

For our solar farms in Australia and Ireland, sustainability goes beyond generating green energy. For instance, 850 Merino sheep in our Australian solar farm roam and graze beneath the solar panels, playing a crucial role in land management.

Solar Farms that Give Back to People and Nature

TNB continues to support the local communities via its international platforms, where Spark Renewables set up the Bomen Solar Farm Community Fund (established under an agreement with Bomen Solar Farm and Westpac). Notably, the $1 million fund was the largest community fund of any solar farm developments in Australia, which supports local education and environmental efforts.

Additionally, Spark Renewables collaborates with Macquarie University through a three-year Australian Research Council Fellowship. This partnership seeks to develop regulations that promote agrivoltaics while ensuring energy justice. On top of that, a partnership with Charles Sturt University is researching "agrivoltaics" approach, trialing which pasture mixes grow best beneath solar panels and have higher resistance to bushfire risks.

For Vantage RE, its first solar greenfield developments include comprehensive biodiversity management plans. For instance, five acres of wildflower meadows, along with native-species hedgerows are being planted. These efforts ensure active habitat protection even after the farms become operational.

Vantage RE also supports the community though its solar farm in Ireland, providing a family that has farmed the land for three generations, a diversified income stream, which helps sustain their legacy.

The concept is simple but impactful-green energy projects that support both the people and nature.

The Bigger Picture

As the world faces the twin crises of climate change and biodiversity loss, these projects offer a promising way forward. These projects fulfill our energy needs while illustrating that green energy and nature can coexist harmoniously.

So the next time you pass a solar farm, think beyond the green energy it generates, and imagine a world where innovation and biodiversity thrive side by side.

Biodiversity & Land Use

TNB'S SOLAR PARKS: ADVANCING CLEAN ENERGY WITH ENVIRONMENTAL RESPONSIBILITY

Solar parks, or solar farms, are large-scale installations where photovoltaic (PV) panels convert sunlight into electricity. These facilities are essential in transitioning from fossil fuels to renewable energy. By producing clean electricity, solar parks help reduce carbon emissions and mitigate climate change. In Malaysia, where sunlight is plentiful, solar parks are a key part of the national strategy to diversify energy sources and decrease reliance on coal and natural gas. However, establishing these parks requires careful consideration of local ecosystems to maintain environmental health.

In Malaysia, the expansion of solar parks serves multiple purposes: it reduces carbon emissions, enhances energy independence, strengthens energy security, and fulfils international climate commitments. The government has set a target of 31% renewable energy capacity by 2025, and solar parks are central to achieving this goal. These installations are key to the country's renewable energy mix, helping to stabilise the national grid and reduce reliance on imported fossil fuels. At the same time, efforts are made to protect biodiversity in the areas surrounding these parks, ensuring that the shift to renewable energy does not harm local wildlife and habitats.

The development and management of solar parks across the country advance Malaysia's renewable energy objectives while maintaining a strong focus on environmental responsibility. For instance, the solar parks in Sepang and Bukit Selambau support the nation's clean energy goals while also addressing the ecological impacts of large-scale energy production. These efforts include measures to preserve biodiversity, finding a balance between ecological conservation and the country's energy needs.

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Protecting Bird Species at LSS Sepang Solar Park

The LSS Sepang Solar Park in Selangor is significant not only for its role in renewable energy production but also for its contribution to local biodiversity conservation. On 3 July 2023, TNB Renewables, in collaboration with Persatuan Rekreasi dan Bimbingan Alam Semulajadi Selangor (Sarang), launched a bird identification initiative during the "Hari Hargai Alam" event. This survey documented 28 bird species within the solar park, comprising 25 resident species, such as the White Throated Kingfisher and Crested Serpent Eagle, and 3 migratory species like the Pheasant Tailed Jacana.

The presence of species like the Crested Serpent Eagle, which requires a stable prey population, indicates a well-functioning ecosystem within the park. Migratory species, which depend on the park's wetlands during their journeys, emphasize the importance of these habitats. The project titled "Documentation of Avian Species at LSS Sepang," funded by TNB Sepang Solar Sdn. Bhd. (TSS), aims to capture high-resolution photos, identify species, and observe their activities. This initiative also seeks to develop a methodology that balances species preservation with the solar plant's operations, ensuring that the park functions efficiently while safeguarding biodiversity.

Managing Human-Wildlife Conflicts at Bukit Selambau Solar Park

In Kedah, the Bukit Selambau Solar Park faces distinct challenges due to its proximity to long-tailed macaque habitats. These adaptable primates have increasingly ventured into human areas, leading to conflicts, especially as they search for food. To manage this, TNB developed a Conflict Management Plan, which include detailed behavioural ecology studies and DNA metabarcoding.

The behavioural studies map the macaques' movement patterns, social structures, and food sources, providing TNB with essential data to modify the park's environment and reduce conflicts. DNA metabarcoding, which analyses the macaques' diet through their faecal samples, offers insights into their dietary habits. This information allows TNB to minimise the macaques' attraction to human areas and ensuring the solar park's operations are not disrupted.

Solar Park as Grazing Ground

LSS Bukit Selambau also serves as an alternative grazing ground for a nearby goat herder. The use of livestock for natural vegetation control is a method increasingly being adopted at solar farms abroad. In Bukit Selambau, approximately 30 Boer goats are introduced into the solar park per session, with two sessions held daily-one in the morning and one in the afternoon. This practice is currently being trialled and monitored to evaluate its long-term feasibility.

The approach of using livestock for vegetation management at solar parks has been successfully implemented in several countries. Grazing helps control overgrown vegetation, which is crucial for preventing shading over solar panels that could reduce energy efficiency. In addition to lowering the costs associated with traditional mechanical mowing, this method also minimises the environmental impact by reducing the need for chemical herbicides.

The solar park benefits from reduced vegetation management costs and an eco-friendly method of maintaining the land, while the local herder gains access to additional grazing land for his goats. The Boer goats used at LSS Bukit Selambau are well-suited for this environment due to their hardiness and grazing efficiency. This arrangement promotes a mutually beneficial relationship between renewable energy production and local agricultural practices

Biodiversity & Land Use

Environmental Impact and Contribution to National Goals

TNB's solar parks play a crucial role in Malaysia's strategy to reduce greenhouse gas emissions. The photovoltaic (PV) cells used in these parks convert sunlight into electricity without producing carbon dioxide (CO_2), in contrast to fossil fuel-based power plants. This clean energy production significantly reduces Malaysia's reliance on coal and natural gas, which still dominate the national energy mix. For example, each megawatt-hour of solar electricity generated by TNB's parks can prevent the emission of approximately 0.585 tCO_2e[1] ,depending on the fossil fuel being replaced.

Over their operational lifespan, which spans 25 to 30 years, these solar parks are expected to prevent millions of tons of CO_2 emissions. This directly supports Malaysia's goal of reducing greenhouse gas intensity by 45% by 2030, compared to 2005 levels. The clean energy produced by TNB's solar parks also enhances energy security by reducing reliance on imported fossil fuels and stabilising the national grid.

Alignment with National and International Environmental Goals

The initiatives at LSS Sepang and Bukit Selambau align with Malaysia's National Policy on Biological Diversity (2016-2025), which emphasises the conservation of the country's biological resources. By managing the interaction between solar park operations and local wildlife, TNB supports the objectives of this policy and contributes to the preservation of Malaysia's natural heritage. These efforts also support the Greening Malaysia Programme aimed at restoring critical habitats across the country.

On a global scale, TNB's solar parks contribute to the United Nations Sustainable Development Goals (SDGs), particularly SDG 7, which focuses on ensuring access to sustainable energy, and SDG 15, aimed at protecting and restoring terrestrial ecosystems. Additionally, these projects align with the principles of the Convention on Biological Diversity, which advocates for the conservation of biodiversity and sustainable use of natural resources. As we move foward, TNB will continue to advance Malaysia's renewable energy goals while protecting ecosystems that are vital to the country's environmental and cultural heritage.

Biodiversity & Land Use

TNB'S BIODIVERSITY FRAMEWORK: A COMMITMENT TO SUSTAINABLE ENERGY GROWTH

A Milestone in Biodiversity Management

In 2024, Tenaga Nasional Berhad (TNB) launched its Biodiversity Framework, a milestone that formalizes its continuous commitment to biodiversity management.

This initiative reflects TNB's recognition of the need to balance energy infrastructure development with environmental conservation, ensuring that operational growth does not come at the expense of biodiversity ecosystems.

The framework aligns with the targets and actions stipulated in the Kunming-Montreal Global Biodiversity Framework (KMGBF) and Malaysia's National Policy on Biological Diversity 2022-2030.

This alignment positions TNB as a player in sustainable development, balancing Malaysia's energy needs with conservation priorities

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Biodiversity & Land Use

Managing Biodiversity Ecosystem

The TNB Biodiversity Framework serves as a guideline for integrating biodiversity conservation into aspects of TNB's operations.

It ensures that the company addresses the environmental impacts inherent in energy projects while maintaining adherence to international and national sustainability frameworks.

Simply put, this is a systematic approach to managing biodiversity throughout TNB's project lifecycle-from site planning to decommissioning.

What It Means for TNB

TNB aims to minimize impact on biodiversity caused by its operations and protect the environmental ecosystem.

Environmental Responsibility

To further strengthen TNB's biodiversity commitment, the company aspires to achieve Net Positive Impact (NPI), particularly for new high biodiversity risk sites.

Operational Integration

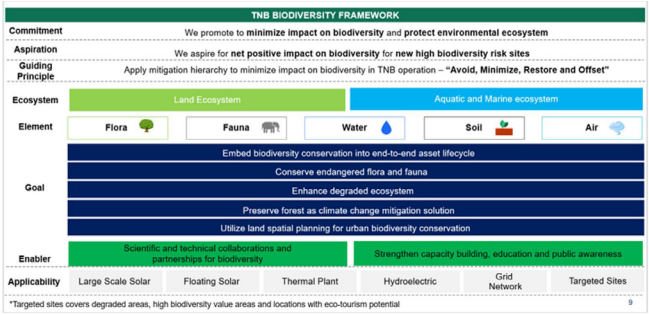
Biodiversity conservation is embedded into core business activities, including the development of large-scale solar farms, floating solar, thermal plants, hydroelectric projects, grid networks and other targeted sites, including degraded areas, high biodiversity value areas and locations with eco-tourism potential for other conservation efforts through Corporate Social Responsibility (CSR).

Long-Term Value Creation

Beyond compliance, the framework enables TNB to streamline biodiversity efforts to be more focused and ensure continuity beyond project completion.

This framework signifies TNB's commitment to a new operational paradigm-one where energy growth and environmental preservation coexist.

It places TNB at the forefront of sustainable infrastructure development in Malaysia and positions the company as a responsible corporate citizen in the global energy landscape.



An overview of TNB's Biodiversity Framework

Understanding Ecosystem Elements and Their Importance

TNB's biodiversity framework emphasizes that ecosystems are made up of five interconnected elements-flora, fauna, water, soil, and air-which function together to maintain balance.

Disruptions to any one element, such as soil degradation or water contamination, can have cascading effects on the rest of the ecosystem.

The company's operations interact with aquatic, marine, and land-based ecosystems, making it essential to adopt holistic environmental management practices.

The Mitigation Hierarchy

At the heart of TNB's biodiversity framework is the mitigation hierarchy, a guiding principle to reduce environmental impacts across project lifecycles.

This approach ensures biodiversity considerations are integrated from planning to decommissioning.

The four steps of the mitigation hierarchy are:

Avoid

Refrain activities that could cause irreversible harm to ecosystems. For example, TNB avoids constructing solar farms in protected areas by selecting low-yield agricultural land instead.

Minimize

Take mitigation steps to reduce impacts, such as establishing buffer zones and installation of physical barriers to prevent wildlife conflict.

Restore/Remedy

Rehabilitate ecosystems on-site, such as replanting native vegetation or rescue and translocation of wildlife.

Offset

Compensate for residual impacts through external conservation efforts, including mangrove restoration along coastal regions.

By following this hierarchy, TNB ensures that biodiversity management is effectively implemented across TNB operations.

Biodiversity & Land Use

TNB's Biodiversity Methodology

TNB employs a comprehensive methodology to operationalize its biodiversity framework across various sites.

This methodology is divided into three key phases:

Impact & Risk Assessments

Identify locations with high biodiversity value and quantify biodiversity impact metrics.

Implementing Biodiversity Action Plans (BAPs)

Tailor site-specific strategies to address identified potential impact according to the mitigation hierarchy to support meeting biodiversity goals.

Monitoring & Reporting

Assess and report the changes to the biodiversity ecosystem condition.

This methodology ensures that biodiversity efforts remain data-driven, adaptive with progress measured against defined metrics.

Notably, TNB recognizes and implements various biodiversity initiatives across our operations, contributing to positive impacts on biodiversity conservation and creating value to our environment. Our previous hydro development projects, such as the Ulu Jelai and Hulu Terengganu Hydro electric Projects, have already demonstrated significant environmental benefits. Building on this success, we continue to enhance and implement best practices through our initiatives such as the Nenggiri Hydroelectric Project, the Bukit Selambau Solar Farm, and the Sultan Azlan Shah Power Station conservation programs.

Nenggiri Hydroelectric Project: Mitigating Environmental Impact

The Nenggiri Hydroelectric Project in Gua Musang, Kelantan, embodies TNB's commitment to balancing renewable energy production with biodiversity conservation.

The project requires altering river flows and clearing forested land, potentially posing significant risks to land habitat.

To mitigate these impacts, TNB has implemented several biodiversity measures:

Wildlife Monitoring

GPS tracking collars and camera traps are used to monitor animal movements and identify potential conflict zones.

Fish Rescue Operations

Aquatic life is relocated to upstream areas before construction to ensure population survival.

Reforestation Efforts

Nurseries for native plant species have been established to restore forest areas affected by the project.

These efforts demonstrate TNB's ability to integrate conservation practices into large-scale infrastructure projects, striving for minimal impact to local biodiversity ecosystems.

Bukit Selambau Solar Farm: Renewable Energy in Harmony with Nature

At the Bukit Selambau Solar Farm in Kedah, TNB showcases how innovation can enhance biodiversity within renewable energy projects.

Key biodiversity actions include:

Naturalizing Detention Ponds

Ponds built for stormwater management are repurposed with fish and aquatic plants, forming vibrant ecosystems on-site.

Vegetation Management with Livestocks

TNB collaborates with a local goat farm to use goat grazing for vegetation control, eliminating the need for chemical herbicides.

Behavioral Studies on Macaques

By conducting research on macaque behavior, TNB is developing strategies to manage human-wildlife conflicts effectively.

These initiatives highlight TNB's commitment to enhancing biodiversity through renewable energy projects, demonstrating that energy and ecology can coexist harmoniously.

Biodiversity & Land Use

Sultan Azlan Shah Power Station: Offsetting Impacts with Long-Term Conservation

The Sultan Azlan Shah Power Station in Manjung, Perak, a coal-fired facility located in a man-made island, showcases TNB's commitment to offsetting environmental impacts through long-term conservation programs.

Biodiversity initiatives at this site include:

Mangrove Rehabilitation

Since 2013, nearly 20,000 mangrove saplings have been planted along coastal areas to strengthen marine ecosystems and protect shorelines from erosion.

Environmental Monitoring

TNB conducts regular air and water quality assessments within a 5 km radius, ensuring compliance with environmental standards

Ecological Studies

Every three years, TNB performs ecological assessments to track changes in aquatic and terrestrial flora and fauna.

These efforts demonstrate TNB's ability to integrate biodiversity offsets into its operations, ensuring long-term sustainability.

A New Era of Sustainable Energy Development

TNB's biodiversity framework represents a significant step forward, embedding environmental stewardship into energy infrastructure development.

By aligning with global and national policies, applying the mitigation hierarchy, and implementing site-specific action plans, TNB aims to adopt the framework in its operations.

This framework is not just a guideline; it is a strategic commitment to sustainable energy growth. TNB is setting a benchmark for sustainable infrastructure development in Malaysia.

The company's efforts ensure that as it powers the nation's future, it also protects its natural heritage for generations to come.

Biodiversity & Land Use

Protecting Bird Species at LSS Sepang Solar Park

The LSS Sepang Solar Park in Selangor is significant not only for its role in renewable energy production but also for its contribution to local biodiversity conservation. On 3 July 2023, TNB Renewables, in collaboration with Persatuan Rekreasi dan Bimbingan Alam Semulajadi Selangor (Sarang), launched a bird identification initiative during the "Hari Hargai Alam" event. This survey documented 28 bird species within the solar park, comprising 25 resident species, such as the White Throated Kingfisher and Crested Serpent Eagle, and 3 migratory species like the Pheasant Tailed Jacana.

The presence of species like the Crested Serpent Eagle, which requires a stable prey population, indicates a well-functioning ecosystem within the park. Migratory species, which depend on the park's wetlands during their journeys,emphasize the importance of these habitats. The project titled "Documentation of Avian Species at LSS Sepang," funded by TNB Sepang Solar Sdn. Bhd. (TSS), aims to capture high-resolution photos, identify species, and observe their activities. This initiative also seeks to develop an methodology that balances species preservation with the solar plant's operations, ensuring that the park functions efficiently while safeguarding biodiversity.

Managing Human-Wildlife Conflicts at Bukit Selambau Solar Park

In Kedah, the Bukit Selambau Solar Park faces distinct challenges due to its proximity to long-tailed macaque habitats. These adaptable primates have increasingly ventured into human areas, leading to conflicts, especially as they search for food. To manage this, TNB developed a Conflict Management Plan, which includes detailed behavioural ecology studies and DNA metabarcoding.

The behavioural studies map the macaques' movement patterns, social structures, and food sources, providing TNB with essential data to modify the park's environment and reduce conflicts. DNA metabarcoding, which analyses the macaques' diet through their faecal samples, offers insights into their dietary habits. This information allows TNB to minimise the macaques' attraction to human areas and ensuring the solar park's operations are not disrupted.

Solar Park as Grazing Ground

LSS Bukit Selambau also serves as an alternative grazing ground for a nearby goat herder. The use of livestock for natural vegetation control is a method increasingly being adopted at solar farms abroad. In Bukit Selambau, approximately 30 Boer goats are introduced into the solar park per session, with two sessions held daily-one in the morning and one in the afternoon. This practice is currently being trialled and monitored to evaluate its long-term feasibility.

The approach of using livestock for vegetation management at solar parks has been successfully implemented in several countries. Grazing helps control overgrown vegetation, which is crucial for preventing shading over solar panels that could reduce energy efficiency. In addition to lowering the costs associated with traditional mechanical mowing, this method also minimises the environmental impact by reducing the need for chemical herbicides.

The solar park benefits from reduced vegetation management costs and an eco-friendly method of maintaining the land, while the local herder gains access to additional grazing land for his goats. The Boer goats used at LSS Bukit Selambau are well-suited for this environment due to their hardiness and grazing efficiency. This arrangement promotes a mutually beneficial relationship between renewable energy production and local agricultural practices.

Biodiversity & Land Use

TNB PLATINUM WINS GOLD AT THE EDGE MALAYSIA'S BEST MANAGED & SUSTAINABLE PROPERTY AWARDS 2024

In the heart of Malaysia, where the sun's rays are a daily companion and the winds whisper through lush landscapes, Tenaga Nasional Berhad (TNB) is casting a future rooted in sustainability. Imagine waking up to a world where energy is not just abundant but also sustainable, where every flick of a switch supports a healthier planet. This is the vision we are tirelessly working towards, driven by a deep sense of responsibility to the environment and society.

Solar panels stretch across vast fields, absorbing the bright Malaysian sunlight, while wind turbines gracefully spin in the breeze. Hydroelectric plants harness the power of flowing rivers. These renewable energy projects symbolise TNB's commitment to reducing carbon footprints and driving the nation towards clean energy.

The ambition behind TNB's sustainable energy initiatives is reflected in our large-scale renewable projects as well as in the innovative design of their headquarters, TNB Platinum, where every detail serves a purpose. Completed in 2022, TNB Platinum is more than a workplace-it's a living example of what sustainable architecture can achieve.

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Biodiversity & Land Use

Located on a 13.6-acre site in Kuala Lumpur, TNB Platinum is a green oasis in the city. As reported by The Edge, The development features an arboretum forest with more than 1,380 forest plants, enveloping about 51% of the area. These plants form a multi-layer canopy that is carefully monitored for plant coverage, moisture, and nutrient levels. The tree species were specifically selected for their bird-attracting characteristics, which provide natural pest control and reduce the need for chemical interventions. Among the greenery are four office buildings that progressively step down from a 19-storey peak to the two-storey convention centre, named in honour of a former Tenaga chairman, Tan Sri Leo Moggie.

Water conservation is another important aspect of TNB Platinum's design. The building integrates advanced water management systems, including rainwater harvesting, greywater recycling, and condensate recovery systems. These systems are designed to maximise water efficiency throughout the site, ensuring that both consumption and sustainability are carefully balanced.

Educational signage around the premises not only helps visitors appreciate the importance of these systems but also deepens their understanding of the local flora, fostering a stronger connection with environmental conservation efforts. TNB Platinum epitomises a commitment to the overall well-being of its employees, not just in design but also in shaping workplace culture and future workplace development, a crucial foundation to achieve TNB's sustainability pathway goal of net zero emissions by 2050.

Employees are also contributing to the site's community garden, which is adorned with arches and netting to provide shelter from harsh weather while serving as climbing poles for vines and creepers. The garden features over 10 species of fruits, vegetables, and herbs, which employees are free to take and exchange.

The landscape design also includes extensive planting frames that harness the prevailing winds to naturally cool the buildings, which helps reduce air-conditioning costs by approximately 20%. The lush green areas are strategically placed to lower surface temperatures by up to 7 degrees Celsius. With around 50% of the site dedicated to green soft landscaping, the area acts as a natural heat exchange, allowing the winds to cool the ambient temperature as they pass through the site.

In addition, the choice of tree species with broad canopies was meticulously planned to create shaded areas that offer a respite from the heat, while still allowing sunlight to filter through. These shaded areas not only enhance the aesthetic appeal but also contribute to reducing the ambient air temperature.

The use of light-coloured pavements throughout the site further reduces the overall heat island effect, reflecting heat and helping to create a cooler microclimate by up to 20% compared with darker pavements.

Biodiversity & Land Use

To enhance the educational experience, the plant species across the site have been labelled for visitors and employees alike to learn more about the local flora.
[Source: The Edge Malaysia]

Recognising Excellence in Sustainability

These comprehensive efforts in sustainability have led TNB to being honoured with the Gold Award for Landscape Design at The Edge Malaysia-ILAM Sustainable Landscape Awards 2024, which reflects the meaningful impact of our green initiatives.

TNB integrates sustainability into its operations, from renewable energy initiatives to the design and function of its headquarters. TNB Platinum HQ Campus was designed to fulfill Green Building Index as Platinum rated building. TNB Platinum is re-assessed every three years to maintain GBI rating and ensure that the TNB Platinum is well-maintained. TNB Platinum's Green Building Index (GBI) Platinum certification is a clear indicator of our dedication to green building practices. The design and landscaping of TNB Platinum not only meet the highest environmental standards but also contribute to the well-being of the employees and the surrounding community.

As we continue its journey towards sustainability, we remain dedicated to pushing the boundaries of what is possible. The Gold Award is both a milestone and a motivation for TNB to continue driving the way in ESG practices. To read a feature on TNB Platinum, head over to The Edge Malaysia.

Celebrating this golden triumph, we welcome everyone to join in the journey towards a future where we can build a world where our energy choices today ensure a healthier tomorrow for all.

[Source: The Edge Malaysia]

Biodiversity & Land Use

STRENGTHENING ENVIRONMENTAL COMMITMENT THROUGH STRATEGIC VEGETATION MANAGEMENT AND TOWER ELEVATION INITIATIVES

Grid infrastructure is vital. Without a reliable grid system, electricity supply and other services could be disrupted. But balancing the need for a stable and reliable electricity supply with environmental responsibility has always been a challenge. Tenaga Nasional Berhad's (TNB) division, TNB Grid, recognises the critical role a stable and reliable electricity supply plays in Malaysia's economic growth and social well-being, as well as how traditional vegetation management practices along transmission line easements often resulted in the clearing of trees andundergrowth to safeguard public safety and grid reliability. While necessary for safety reasons, these practices had unintended environmental consequences.

READ MORE

Biodiversity & Land Use

Clearing vegetation can lead to:

Reduced Carbon Sequestration

Forests play a vital role in absorbing carbon dioxide, a greenhouse gas contributing to climate change. Studies estimate a potential loss of up to 70 tons of CO2 per kilometre per year for high-voltage lines.

Increased Risk of Soil Erosion and Landslides

Forests in hilly terrain, where over 80% of Malaysia's forest reserves are located, offer crucial protection against soil erosion and landslides. Clearing vegetation in these areas can increase the risk of soil erosion and landslides, disrupting ecosystems and damaging infrastructure.

As a responsible national utility provider, TNB Grid considers environment, social, and governance (ESG) elements right from the outset of our planning stages. We are committed to embedding sustainability practices from the ground up within the organisation by prioritising biodiversity conservation.

Balancing Needs with Innovation with Tree Hyperspectral Identification System (THYSIS)

Balancing the need for a reliable power grid with environmentally-friendly vegetation management practices along transmission lines is a complex challenge.

This prompted the establishment of the Tree Hyperspectral Identification System (THySIS) - a remote sensing technology, specifically Light Detection and Ranging (LiDAR) and hyperspectral imaging, to identify the flora and fauna in an area as preservation of biodiversity during route selection.

The key benefits of THySIS include:

Compliance with regulations

THySIS empowers TNB Grid to adhere to the Malaysian Forestry Department's requirements by effectively avoiding areas with endangered species during route planning.

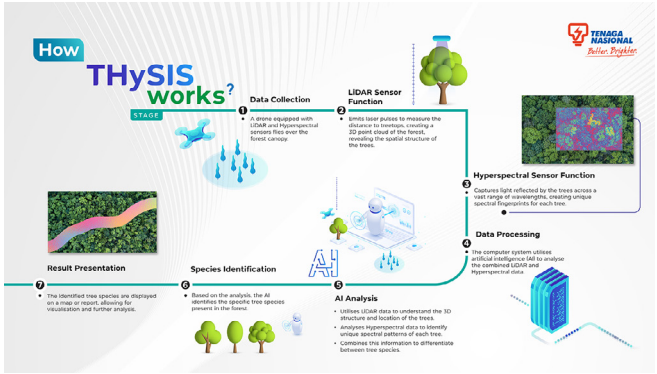
Preservation of biodiversity

This system plays a crucial role in safeguarding endangered forest species during the new route selection process.

Enhanced data management

The data obtained from THySIS can be systematically used for line maintenance and future environmental projects.

How THYSIS Works:



The key benefits of THySIS include:

1. Data Collection:
A drone equipped with LiDAR and Hyperspectral sensors flies over the forest canopy.

2. LiDAR Sensor Function:
Emits laser pulses to measure the distance to treetops, creating a 3D point cloud of the forest, revealing the spatial structure of the trees.

3. Hyperspectral Sensor Function:
Captures light reflected by the trees across a vast range of wavelengths, creating unique spectral fingerprints for each tree.

4. Data Processing:
The computer system utilises artificial intelligence (AI) to analyse the combined LiDAR and Hyperspectral data.

5. AI Analysis:
a. Utilises LiDAR data to understand the 3D structure and location of the trees.
b. Analyses Hyperspectral data to identify unique spectral patterns of each tree.
c. Combines this information to differentiate between tree species.

6. Species Identification:
Based on the analysis, the AI identifies the specific tree species present in the forest.

7. Result Presentation:
The identified tree species are displayed on a map or report, allowing for visualisation and further analysis.

Biodiversity & Land Use

Complementing THYSIS with a New Approach

Acknowledging the impact of traditional methods has led to TNB Grid overhauling its tree-cutting strategy. This new strategy, introduced in May 2024, incorporates a risk-based approach that works in tandem with innovative technologies like THySIS. The risk-based approach focuses on a thorough assessment of trees near power lines, considering several factors that influence the likelihood of a tree impacting the grid:

Tree Health

A comprehensive evaluation of the tree's health, including signs of disease, decay, or structural weaknesses that could pose a threat to power lines in the event of storms or high winds.

Slope Stability

The location of the tree relative to slopes and potential land movement risks. Trees on unstable slopes, such as those showing signs of erosion or located near past landslides, may pose a greater hazard if they fall.

Hillside Area

Trees located in hillside areas inherently have a higher probability of falling towards power lines due to gravity

By considering these factors, we can further refine our decision-making regarding tree management. This not only enhances the safety and reliability of the grid but also minimises unnecessary tree removal, ultimately preserving our valuable ecosystems. This move highlights our commitment to balancing the need for reliable electricity transmission with environmental responsibility.

Tree Categorisations

TNB Grid manages a total of 13,402 K1 and K2 trees (approximately 44 acres and approximately 536 tCO_2e sequestration annually) near power lines. The risk-based tree management approach assigns trees near power lines to one of three categories (K1, K2, K3) based on the thorough assessment considering tree health, slope stability, and location relative to hillsides. The breakdown of each category is as follows:

K1 Trees

These are trees identified as being in the most hazardous condition and pose a high risk of falling onto power lines. They typically exhibit severe signs of disease, decay, or significant structural weaknesses that could cause them to fail even under normal conditions. K1 trees are the highest priority for removal or mitigation.

K2 Trees

These trees are considered to be in a dangerous condition, but less so than K1 trees. They may have signs of disease, decay, or weak limbs that could pose a threat to power lines during severe weather events like storms or strong winds. K2 trees require close monitoring and may be scheduled for removal in the future.

K3 Trees

These are healthy trees that pose a low risk to power lines. They may undergo routine monitoring, but removal is unlikely under the new strategy. K3 trees are typically left undisturbed.

As of May 2024, 6,336 trees (approximately 21 acres and approximately 253 tCO_2e sequestration annually) were identified as K1 and K2 (danger trees), including in privately-owned land and those under the purview of the Forestry Department.

Despite not being permitted to cut trees on private properties that pose a threat to power lines, this new strategy, which requires a thorough assessment conducted by qualified Right of Way (ROW) engineers, has seen 4,085 high-risk trees successfully preserved (approximately 14 acres and approximately 163 tCO_2e sequestration annually), representing a 100% increase from previous practices.

These preserved trees include those exceeding 100 years old, such as the endangered and protected Chengal (neobalanocarpus heimii) hardwood tree, the Balak (Shorea spp.), and trees that provide vital buffering functions for the ecosystem.This shift in approach not only safeguards our valuable ecosystems but also upholds Malaysia's commitment to biodiversity conservation.

Elevated Transmission Towers

Other than introducing a risk-based approach, TNB is prototyping the use of elevated transmission towers in sensitive ecological areas like forests and nature reserves. These innovative towers boast a taller design that allows power lines to fly over the tree canopy, significantly reducing the need for vegetation removal.

Biodiversity & Land Use

Here are some of the key features of the elevated towers:

Tower Height	The elevated towers are approximately 90 metres tall. This increased height allows power lines to bypass the tree canopy, minimising deforestation needs.
Reduced Environmental Impact	We recognise the importance of minimising environmental disruption during tower construction. Several options are available to reduce our footprint, including: • **Minimal Footprint Clearing**: Vegetation is cleared only at the base of the tower, keeping the impact on the surrounding forest minimal. This targeted approach minimises disruption to the ecosystem. • **Reduced Access Road Width**: Opting for narrower access roads compared to traditional methods, while still ensuring necessary maintenance access. This reduces the overall area of land disturbed during construction. • **Replanting Initiatives**: In unavoidable instances where wider access roads are necessary, TNB Grid is committed to replanting the area with cultivated trees less than 30 metres tall. Replanting with native or compatible species promotes biodiversity and restores the ecological balance in the affected area.

The use of elevated transmission towers offers another sustainable solution for balancing the need for a reliable electricity grid with forest preservation. TNB Grid will continue to improve and be transparent in our environmental stewardship efforts by:

1. **Regularly reviewing and updating our tree-cutting strategy** based on learnings and feedback from stakeholders.

2. **Publishing annual sustainability reports** that detail our progress in environmental performance.

3. **Conducting public consultations** on major grid infrastructure projects to ensure community concerns are addressed.

4. **Investing in research and development** to explore further advancements in sustainable grid management practices.

We believe that our innovative approaches offer a promising path towards a more sustainable future for Malaysia's energy sector. By exploring these diverseapplications, we can leverage our technology to its fullest potential, ensuring grid reliability while minimising environmental impact.

Opportunities in RE

https://www.tnb.com.my/sustainability/esg-stories/

TNB BUKIT SELAMBAU SOLAR 2 : A STEP FORWARD IN MALAYSIA'S RENEWABLE ENERGY EFFORTS

INTRODUCTION OF CENTRALISED SOLAR PARK UNDER THE NETR - STRATEGIC DEVELOPMENT OF MALAYSIA'S CENTRALISED SOLAR PARK INITIATIVE

DRIVING CHANGE: ADVANCING EV ADOPTION WITH ENHANCED CHARGING INFRASTRUCTURE IN MALAYSIA

Opportunities in RE

TNB BUKIT SELAMBAU SOLAR 2 : A STEP FORWARD IN MALAYSIA'S RENEWABLE ENERGY EFFORTS

TNB Bukit Selambau Solar 2 (TBSS2) is part of Malaysia's Large Scale Solar (LSS) initiative, a competitive tender programme led by the Energy Commission of Malaysia. This initiative aims to develop large-scale solar photovoltaic plants across the country to boost renewable energy production and reduce dependence on fossil fuels.

The Energy Commission of Malaysia, or Suruhanjaya Tenaga, regulates the country's energy industry. It ensures that energy projects are developed and managed according to national policies and goals. For the LSS programme, the Energy Commission oversees the tender process, ensuring it is conducted fairly and that projects like TBSS2 meet all necessary technical and environmental standards. They are crucial in ensuring solar farms contribute effectively to Malaysia's renewable energy targets.

Tenaga Nasional Berhad (TNB), Malaysia's largest electricity utility company, plays a central role in this initiative. Through its wholly-owned subsidiary, TNB Renewables Sdn Bhd (TRe), TNB is responsible for developing, managing, and operating TBSS2. As a key player in the country's energy sector, we are committed to transitioning Malaysia's energy production towards more sustainable sources. By leading projects like TBSS2, TNB achieves its commercial objectives and aligns with national and international goals to combat climate change through renewable energy initiatives.

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Opportunities in RE

Project Overview

TBSS2, managed by TNB Renewables Sdn Bhd (TRe), is a key project under the LSS4 programme. The 50 MW solar farm covers 180 acres and contributes significantly to Malaysia's renewable energy capacity. The project successfully commenced commercial operations on 21 December 2023, ahead of its scheduled date, marking a significant achievement in TNB's renewable energy portfolio.

The construction of TBSS2 was completed in 14 months, beginning in October 2023 and concluding in December 2024. The project involved the installation of 131,490 Bi-Facial Monocrystalline solar panels, each with a capacity of 570W and 575W. These panels are connected to the grid through 8 inverters and are supported by 223 combiner boxes and 4,870 strings. The electricity generated by TBSS2 is transmitted via overhead cables across a 1.6 km distance from the TBSS station to the Bukit Selambau Main Intake Substation (PMU). The project is expected to reduce carbon emissions by 60,511 tonnes annually, equivalent to removing approximately 13,150 cars from the road each year.

Environmental, Social, and Governance (ESG) Agenda

Developing large-scale solar farms, such as TBSS2, offers numerous ecological benefits, aligning with Malaysia's sustainability goals and global environmental standards.

Firstly, TBSS2 leverages an unlimited energy source: sunlight. Solar farms utilise solar energy, a renewable resource, which reduces reliance on finite energy sources like coal and gas. This shift supports sustainable development and aids in lowering Malaysia's carbon footprint.

Secondly, solar energy is inherently clean and does not emit greenhouse gases during electricity generation. The TBSS2 project is expected to decrease carbon emissions by approximately 59,446 tonnes of CO_2 annually, contributing significantly to the fight against climate change.

Moreover, large-scale solar farms' operational costs are lower than traditional power plants that rely on coal and gas. This cost efficiency makes solar energy a more economically viable option long-term, further encouraging the transition to renewable energy sources.

Additionally, TBSS2 is important to Malaysia's energy transition programme by contributing to a cleaner and more sustainable national energy supply. This supports the country's broader efforts to move towards a greener economy.

Beyond environmental benefits, TBSS2 also provides substantial socio-economic advantages. The project has created local job opportunities during the construction and operational phases, fostering economic development in the surrounding areas.

Lastly, various legal frameworks and financial incentives support solar energy growth in many countries, including Malaysia. These measures promote renewable energy, making projects like TBSS2 more feasible and attractive to investors.

The development of TBSS2 has created numerous job opportunities for residents, ranging from professional roles in solar farm management to general positions such as security, cleaning, and maintenance. This has contributed to the local economy and improved the standard of living in the surrounding communities.

> "We are dedicated to creating a sustainable future through clean and environmentally friendly energy. As pioneers in solar farm development, we recognize our substantial responsibility in reducing carbon emissions and positively impacting the local community. This project goes beyond merely generating renewable energy; it is also about creating job opportunities and engaging the local community in various social initiatives. We want the community to feel a sense of ownership and involvement in this development."
>
> - Hanif Siraf, Chief Operating Officer of TNB Renewables -

Opportunities in RE

Corporate Social Responsibility (CSR) Initiatives - Supporting the Bukit Selambau Community

TNB and TRe are committed to improving the well-being of communities around our projects. In Bukit Selambau, our Corporate Social Responsibility (CSR) initiatives focus on key areas:

A. Community Welfare & Engagement

- Zakat Wakallah distribution to those in need.
- Donation to local mosques during Ramadan and Aidilfitri celebration to Kampung Bukit Selambau residents.
- Hosted a dialogue with local leaders through the Village Development and Security Committee (JPKK).

B. Education & Youth Development

- Organized a poster drawing competition in schools to encourage student creativity.
- Donated examination preparation materials to students at SMK Tanjong Puteri.
- Contributed to the construction of a surau at SMK Tanjong Puteri.

C. Sustainability & Energy Awareness

- Conducted the Malaysia Energy Literacy Programme (MELP) at SMK Tanjong Puteri to educate students on energy efficiency and sustainability.

Through these initiatives, TNB and TRe have not only contributed to the immediate well-being of the Bukit Selambau community but have also invested in the area's long-term social and educational development. This approach reflects TNB's holistic vision of corporate responsibility, where economic progress is intertwined with social upliftment and community empowerment.

A Major Step Towards a Sustainable Future

The TNB Bukit Selambau Solar 2 project is a significant step towards Malaysia's commitment to sustainable energy development. By harnessing solar energy, TBSS2 not only contributes to the national energy grid but also supports the global effort to combat climate change as outlined in the Paris Agreement. Through ongoing CSR initiatives and job creation, the project plays a vital role in the economic and social development of the local community while also helping Malaysia fulfil its international climate commitments.

"The development of this solar farm brings numerous benefits to the villagers. It not only supplies clean energy but also creates job opportunities for us. Furthermore, this project enhances the village's infrastructure and economy while preserving the environment for future generations."

- Shukor, Village Head of Bukit Selambau -

Opportunities in RE

INTRODUCTION OF CENTRALISED SOLAR PARK UNDER THE NETR - STRATEGIC DEVELOPMENT OF MALAYSIA'S CENTRALISED SOLAR PARK INITIATIVE

On August 29, 2023, the Prime Minister of Malaysia unveiled the National Energy Transition Roadmap (NETR), a detailed plan aimed at transforming the country's energy infrastructure. As Malaysia responds to the global demand for cleaner energy, the NETR is designed to accelerate the transition through a framework known as Responsible Transition. A critical component of this initiative is the Centralised Solar Park (CSP), a key project within the Renewable Energy lever that aims to increase the country's solar energy capacity significantly.

The CSP project, with a planned capacity of 500MWac, will involve the development of five ground-mounted solar power facilities across Peninsular Malaysia. Each of these sites will house a 100MW capacity solar plant designed to contribute to a more sustainable energy supply in Malaysia. The project is expected to deliver measurable environmental benefits by reducing carbon dioxide emissions by 95,000 tons annually for 25 years, equivalent to removing approximately 21,000 cars from the roads each year.

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Our Role in the Centralised Solar Park Initiative

TNB Renewables Sdn. Bhd. (TRe), a wholly-owned Tenaga Nasional Berhad (TNB) subsidiary has been appointed Master Developer for the CSP initiative. This appointment places us at the helm of the project, responsible for managing all aspects, from site selection to financing, and ensuring that the necessary equipment is procured efficiently. Our role is crucial in coordinating with State Related Entities (SREs) to finalise land and wayleave agreements, which are vital for the smooth execution of the project. Additionally, we are tasked with centralising the procurement of major components, a strategy aimed at reducing costs and ensuring that the project remains financially viable.

The CSP project is designed to foster participation from various stakeholders, including SREs, Small and Medium-sized Enterprises (SMEs), and cooperatives. TRe will hold a minimum of 51% stake in the Special Purpose Vehicle (SPV) set up for the project, with State Related Entities (SREs), SMEs and cooperatives to take the remaining shares. This inclusive structure is intended to ensure that local industries, particularly SMEs, gain valuable experience and opportunities within the solar energy sector.

The development of the CSP has been divided into specific packages to streamline the process. The first package covers site clearance, earthwork, fencing, road construction, and drainage.

The second package focuses on the installation of the solar photovoltaic (PV) plant, including major equipment and cabling works. Meanwhile, the third package is for the construction of the control building, perimeter lighting, and CCTV systems, essential for the security and management of the facilities. Lastly, the fourth package will cover the interconnection facility and solar power plant work at the main intake substation (PMU) side.

Beyond its environmental impact, the CSP project is expected to stimulate economic growth by attracting Foreign Direct Investments (FDIs) and creating jobs. The project's output of green energy will make Malaysia a more attractive destination for investors seeking sustainable energy options. The involvement of local companies, particularly SMEs, in the renewable energy sector is also expected to strengthen the industry and ensure that the project's economic benefits are broadly distributed across the community.

Opportunities in RE

DRIVING CHANGE: ADVANCING EV ADOPTION WITH ENHANCED CHARGING INFRASTRUCTURE IN MALAYSIA

This article was first published on 30 May 2024, and updated on 30 March 2025.

The development and widespread of Battery Electric Vehicle (BEV) charging infrastructure is paramount for driving the widespread adoption of electric vehicles and nurturing a sustainable transportation ecosystem. A robust BEV charging network cannot be overstated in overcoming the primary barriers of range anxiety and accessibility that hinder the mass acceptance of electric vehicles. By establishing a well-distributed and easily accessible charging infrastructure, electric vehicle owners can confidently plan longer journeys and seamlessly integrate electric vehicles into their daily routines.

In this endeavour, TNB plays a crucial role in bolstering the demand for BEV charge points. From ensuring the readiness of the grid and network to support this surge in demand to strategically placing TNB Electron stations to alleviate range anxiety, TNB is at the forefront of facilitating the growth of BEV charging infrastructure. Moreover, TNB enhances the charging experience by offering the convenience of a single mobile platform through TNBX, supported by the Go To-U app. Through these initiatives, TNB is not only spearheading the expansion of BEV charging infrastructure but also empowering the seamless adoption of electric vehicles across Malaysia.

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Grid & Network

A resilient and adaptive grid, coupled with strategic planning, is crucial to accommodate the growing demand for BEV charging. As the adoption of electric vehicles accelerates, proactive measures must be taken to upgrade and expand the existing electrical infrastructure. This involves investing in smart grid technologies that can efficiently manage the increased load, optimise energy distribution, and incorporate renewable energy sources.

Charge Point

Installing and maintaining charge points across diverse locations are imperative to address range anxiety and encourage widespread BEV adoption.

Home charging serves as the foundation, allowing EV owners the convenience of powering up their vehicles overnight. Destination charge points strategically placed in malls and hotels alleviate concerns about running out-of-charge during everyday activities. Rapid charging stations play a crucial role in dispelling range anxiety on highways, in city parking areas, and even at traditional petrol stations, offering quick and efficient recharging options. Additionally, integrating workplace charging facilities supports daily commuting and promotes sustainable practices within corporate environments.

Charging Platform

The BEV charging platform leverages geospatial technology, allowing users to reserve charging facilities based on their location through an intuitive interface, thus optimising the utilisation of charging infrastructure while addressing range anxiety.

On top of facilitating users' charging experience, the BEV charging platform has the potential to transform BEV into integral components of a dynamic and sustainable energy ecosystem. Through the platform's advanced functionalities such as vehicle-to-home and vehicle-to-load capabilities, the BEV serves as energy storage units, contributing to grid stability and supporting energy needs during peak demand periods.

TNB Electron Charging Stations

TNB is poised to expand its EV charging infrastructure, with plans to roll out over 200 Direct Current (DC) charge points nationwide by 2025. This ambitious expansion aligns with the country's green mobility agenda as set forth in the National Energy Transition Roadmap (NETR).

In 2024, TNB has already installed 66 charge points under the TNB Electron brand, laying the groundwork for a more sustainable and mobility future.

TNB Electron DC/AC Charging Station Location	
Summary: 48 DC charge points 18 AC charge points	14 DC charge points along PLUS Highway 14 DC charge points with AEON/ AEON Big 2 DC charge points with BHP along Arterial roads 4 DC charge points with Petron along Trunk Roads 14 DC charge point at TNB Premises 18 AC charge points at TNB Platinum

An overview of TNB's Biodiversity Framework

Types of EV Charger	Range	Application
Level 1 3.6 kW - 7 kW Single-phase AC	6 to 8 km or range per hour	• Single Family Homes • Multi-Unit Residential • Condiminiums
Level 2 22 kW Three-phase AC	40 to 60 km or range per hour	• Single Family Homes • Multi-Unit Residential • Workplace • Fleet • Public
Level 3 more than 50 kW DC Fast Charger	more than 270 km or range per hour	• Fleet • Public • Multi-Unit Residential • Highways

Table 2: Types of EV charger

Revision History:
30 March 2025: Updated data on DC charge points in 2024.

Toxic Emissions & Waste

https://www.tnb.com.my/sustainability/esg-stories/

SUSTAINABLE OPERATIONS IN ELECTRICITY GENERATION FROM COAL-FIRED POWER PLANTS: BALANCING ENERGY NEEDS AND ENVIRONMENTAL RESPONSIBILITY

ENSURING ETHICS WITH RESPONSIBLE HAZARDOUS WASTE MANAGEMENT

TNB'S SF6 GAS RECYCLING AND RECONDITIONING CENTRE AN INITIATIVE FOR SUSTAINABILITY

FOOD TO PLANET: TNB EMBRACES SUSTAINABLE FOOD MANAGEMENT

EMPOWERING SUSTAINABLE FUTURES: TNB'S SOLAR PANEL & BATTERY MANAGEMENT STRATEGIES

Toxic Emissions & Waste

SUSTAINABLE OPERATIONS IN ELECTRICITY GENERATION FROM COAL-FIRED POWER PLANTS: BALANCING ENERGY NEEDS AND ENVIRONMENTAL RESPONSIBILITY

This article was first published on 28 November 2024, and updated on 30 March 2025.

The global energy landscape is undergoing a significant transformation as countries strive to balance economic growth, energy security, and environmental sustainability. For many nations, coal-fired power plants remain a vital component of their energy infrastructure, supporting industrial growth, meeting increasing energy demand, and ensuring economic stability. However, as we navigate the transition toward a cleaner energy future, we recognize the critical need to align the operation of our existing coal plants with environmental stewardship and sustainable practices.

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Reducing Coal Generation Capacity

We have made a firm commitment: Our focus is solely on the operation of existing coal-fired power plants, not to build any new coal plants and no longer investing in greenfield coal plants since 2021. We are shifting from fossil fuels to greener sources. This decision underscores our dedication to transitioning toward a low-carbon energy system without expanding our reliance on coal. Instead, we are committed to deliver clean generation through renewable capacity growth, carbon management and coal generation capacity reduction.

Coal Combustion By-product and its Environmental Impact

Ash is the by-product of coal combustion, produced when coal is burned at high temperatures to generate electricity. It consists of fine particles or heavier residue, depending on the type of ash, and can either be disposed of or repurposed for construction applications. These ashes are considered hazardous waste and are strictly regulated under the Environmental Quality (Scheduled Wastes) Regulations 2005.

There are two main types of ash produced from coal burning to generate electricity: fly ash and bottom ash.

Fly ash is a fine, powdery material that rises with flue gases during combustion and is captured using filtration systems such as electrostatic precipitators or bag filters. It contains components like silica, alumina, iron oxide, and traces of unburnt carbon. Fly ash can be reused in construction materials like cement and concrete, where it improves the strength and durability of these products.

In contrast, bottom ash is heavier and settles at the bottom of the furnace. Although it has fewer applications than fly ash, bottom ash can be used in construction for road-based materials and structural fills.

Since fly ash and bottom ash are regulated as per the Environmental Quality (Scheduled Wastes) Regulations 2005 requirement, both types of ashes can cause a significant impact on the environment if not managed and disposed of properly. Fly ash, if released into the atmosphere, can contribute to air pollution, and poses health risks through inhalation. It can also contaminate water sources if it leaches into groundwater. Bottom ash, though less prone to becoming airborne, can still pose a risk through soil and groundwater contamination if not properly contained. Therefore, safely handling both fly ash and bottom ash is essential to prevent environmental harm.

Fly ash and bottom ash from our power generation operations constitute 99% of our total hazardous waste generated. The remaining hazardous waste is mainly used transformers, used lubricating oil, used batteries and e-waste.

Managing Ash the TNB Way, A Responsible Way

Our approach to handling the coal combustion byproducts such as fly ash and bottom ash reflects our commitment to environmental responsibly through circular economy principles and integration of technology:

1. Recycling and Reuse:
Fly ash is repurposed as a key ingredient in cement and concrete production, reducing the demand for virgin raw materials.

2. Safe Storage:
When recycling is not feasible, the ash is transported to secure, licensed landfill sites that adhere to environmental standards stipulated by the Department of Environment (DOE).

3. Integration of Technology:
Our ASH Management System utilises digital tools to streamline the process, making it easier to manage consignment notes and track the life cycle of the ash.

ASH Management System was designed to monitor and oversee the fly ash and bottom ash that our coal-fired power stations produce. We have implemented this system to ensure safe and efficient ash management in compliance with Malaysia's environmental regulations, particularly the Environmental Quality (Scheduled Wastes) Regulations 2005.

The Consignment Note Monitoring process is a key component of our ASH Management System. Each power station that generates fly ash or bottom ash issues a consignment note, which records ash production, transport, and disposal. This ensures complete traceability from the point of generation to its final disposal or recycling.

We closely monitor all ash produced to ensure it complies with regulatory requirements. This helps to maintain transparency and accountability in how we manage our ash. Through the ASH Management System, we track and document all movements of ash, ensuring that it is safely disposed of at approved landfills or approved recycling facilities.

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Ash contributes to the majority of the Scheduled Waste (SW) generated by TNB. As reflected in our internal tracking systems, this significant amount of ash is directed to a landfill or diverted to a recycling facility.

Fly ash has substantial potential for reuse, particularly in construction, and we actively explore opportunities to recycle this material. By using fly ash in the production of concrete and bricks, we can increase the amount of fly ash diverted from landfills, hence promoting a circular economy. In 2024, we collaborated with ten construction or cement companies to make use of the fly ash in the production of concrete and bricks. However, when recycling is not feasible, our system ensures that the ash is transported to secure, licensed landfill sites that adhere to environmental standards stipulated by the Department of Environment (DOE).

Integrating Technology for Efficient Ash Management

Our ASH Management System is vital to our broader strategy to enhance environmental sustainability. The system utilises digital tools to streamline the process, making it easier to manage consignment notes and track the life cycle of the ash. Powerplants are required to submit data electronically, allowing for real-time updates on ash movements. This digital integration ensures that we can monitor every stage of the ash management process efficiently.

The system was designed based on input gathered from coal power stations during the development phase from December 2023 to March 2024. This collaboration ensured that the system met the needs of those directly involved in ash management.

Figure 1: Login Page of ASH Management System

The system's go-live date occurred on 15 May 2024, during which users began inputting data. Any technical issues were addressed, and relevant personnel were trained.

The engagement and rollout phase commenced on 1 September 2024, ensuring all relevant users, including Health, Safety, and Environment (HSE) personnel, became familiar with the system. Since then, the ASH Management System has undergone continuous implementation to ensure long-term efficiency and effectiveness.

Verification and endorsement mechanisms are built into the system to ensure compliance with our internal policies and national regulations. Every step, from waste generation to final disposal, is carefully monitored to prevent environmental risks and maintain operational integrity.

Aligning with Our Scheduled Waste Roadmap Goals

Responsible fly ash management is part of our wider TNB Scheduled Waste Roadmap 2030, which outlines goals for improving waste management, increasing recycling rates, and minimising our operations' overall environmental impact.

Roadmap Component	Quick Wins (2023)	Targets for 2025	Targets for 2030
Scheduled Waste Management	Recycling data verification for scheduled waste.	30% recycling rate	50% recycling rate

Through the ASH Management System, we have taken significant steps to mitigate the environmental risks associated with its production while exploring ways to recycle and repurpose it. We remain focused on positively contributing to Malaysia's environmental goals as we continue to refine and enhance our processes. In conclusion, TNB has taken great steps to ensure the ash's life cycle is appropriately managed and proper disposal and recycling are conducted. This is in line with TNB's strong drive for sustainability and promoting a circular economy.

Commitment to a Sustainable Energy Future

While coal-fired power plants continue to play a role in meeting current energy demands, our long-term vision is aligned with global decarbonization goals. We are accelerating investments in renewable energy, energy efficiency, and emerging clean technologies to drive the energy transition forward. By operating our existing coal plants responsibly and reducing their environmental impact, we are demonstrating that economic growth and environmental responsibility can coexist.

This balanced approach reflects our commitment to the energy trilemma: delivering affordable, reliable, and sustainable energy. It is a journey that requires collaboration, innovation, and an unwavering focus on our shared future.

Revision History:
30 March 2025: Added data on fly ash and bottom ash constitution, and added details on collaboration with construction or cement companies in 2024.

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ENSURING ETHICS WITH RESPONSIBLE HAZARDOUS WASTE MANAGEMENT

This article was first published on 30 September 2024, and updated on 30 March 2025.

Hazardous waste is designated as scheduled waste, encompassing solid, semi-solid, liquid, or gaseous substances that pose significant risks to human health and the environment if not managed properly. According to the Malaysia Environmental Quality (Scheduled Wastes) Regulations 2005, scheduled waste includes waste listed in the First Schedule of the Regulation, which consists of 77 types of scheduled waste categorised into five groups:

SW 1: Metal and metal-bearing wastes.

SW 2: Wastes containing principally inorganic constituents, which may contain metals and organic materials.

SW 3: Wastes containing principally organic constituents, which may contain metals and inorganic materials.

SW 4: Wastes which may contain either inorganic or organic constituents.

SW 5: Other wastes.

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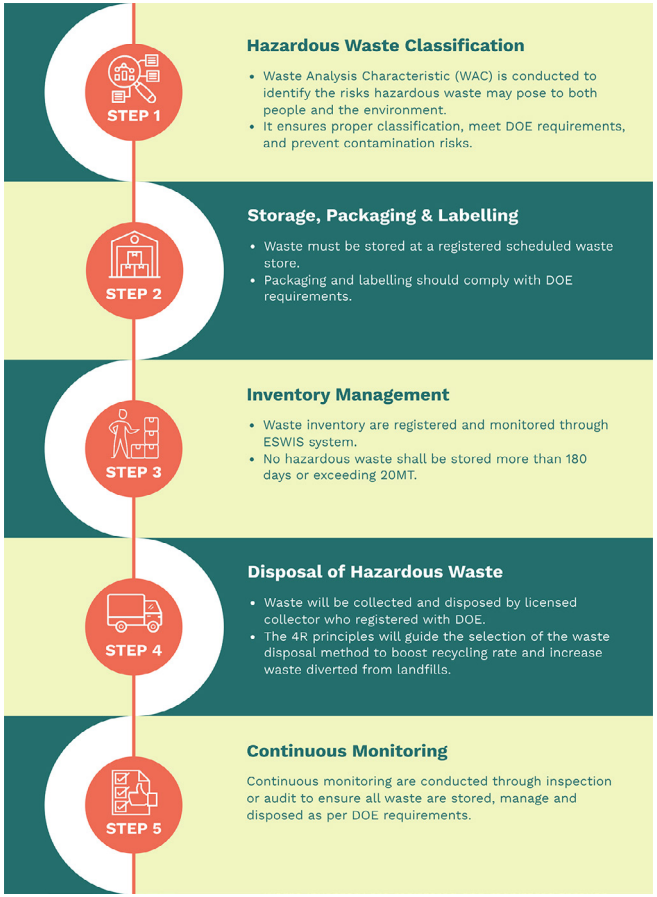
We are committed to adhere to ethical disposal practices for scheduled waste in our ongoing efforts to minimise environmental impact and support sustainable development goals.

Hazardous Waste Management Process and Method

At TNB, our primary principle is the prevention of waste generation, including hazardous waste. When hazardous waste is unavoidable in our operations, we manage it responsibly through the 4R approach-Reduce, Reuse, Recycle, and Recover. Together with our robust circular economy practices and proactive waste prevention initiatives, we are committed to minimizing environmental impact and promoting sustainable waste management.

We are dedicated to implementing responsible and diligent hazardous waste management across all levels of our operations. Our hazardous waste management practices fully comply with the Environmental Quality (Scheduled Wastes) Regulations 2005, under the Environmental Quality Act 1974, as enforced by the Department of Environment (DOE) Malaysia. The hazardous waste follows a standardized management process, as outlined below.

TNB Hazardous Waste Management Process



We collaborate with licence waste collectors to select the most appropriate and sustainable treatment method according to 4Rs approach with the aim to minimize environmental impact and promote sustainable waste management.

The table below provides a summary of the waste generated from TNB operations and the corresponding treatment methods, based on our initial engagement with the licensed waste collectors. These treatment methods shall be validated with data collected by the licensed waste collectors.

No	SW Code	SW Description	Method of Treatment
1	SW 104	Dust, slag, dross or ash containing arsenic, mercury, lead, cadmium, chromium, nickel, copper, vanadium, beryllium, antimony, tellurium, thallium or selenium excluding slag from iron and steel factory (Fly ash)	REUSE
2	SW 110	Waste from electrical and electronic assemblies containing components such as accumulators, mercury-switches, glass from cathode-ray tubes and other activated glass polychlorinated biphenyl-capacitors, or contaminated with cadmium, mercury, lead, nickel, chromium, copper, lithium, silver, manganese or polychlorinated biphenyl	60% RECYCLE/RECOVERY 30% NORMAL WASTE 10% E-WASTE
3	SW 305	Spent lubricating oil	RECYCLE
4	SW 306	Spent hydralic oil	RECYCLE
5	SW 421	Used Paper Insulated Lead Cable	RECOVERY
6	SW 422	A mixture of scheduled and non-scheduled wastes (Transformer)	RECOVERY & RECYCLE
7	SW 102	Waste of lead acid batteries in whole or crushed form	CEMENTATION / RECYCLE
8	SW 103	Waste of batteries containing cadmium and nickel or mercury or lithium	CEMENTATION / RECYCLE
9	SW 109	Waste containing mercury or its compound	PHYSICAL/CHEMICAL TREATMENT
10	SW 307	Spent mineral oil-water emulsion	INCINERATION (AQ)
11	SW 311	Waste oil or oily sludge	INCINERATION (BK)
12	SW 408	Contaminated soil, debris or matter resulting from cleaning-up of a spill of chemical, mineral oil or scheduled wastes	LANDFILL
13	SW 409	Disposed containers, bags or equipment contaminated with chemicals, pesticides, mineral oil or scheduled wastes	INCINERATION (ML)
14	SW 410	Rags, plastics, papers or filters contaminated with scheduled wastes	INCINERATION (BK)
15	SW 417	Waste of inks, paints, pigments, lacquer, dye or varnish	INCINERATION (ML)
16	SW 429	Chemicals that are discarded or off-specification (used Polybutene / grease)	INCINERATION (BK)

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Continuous Monitoring Through Pro-active Gap Identification

Our commitment to excellence extends beyond compliance; we proactively enhance our waste management processes through rigorous site inspections, external audits, and internal audits.

In 2023, TNB has registered 7 relevant operation entities within our divisions/departments/subsidiaries in obtaining ISO14001 full certification which required recertification by external independent auditors at least once every three years.

Internally, TNB has instituted annually Health, Safety and Environment (HSE) Corporate Audit which includes hazardous waste management to ensure the safe, responsible, and continuous adherence to hazardous waste regulations. Under the TNB HSE Corporate Audit, internal audit will be conducted by HSE Corporate at relevant operation sites to assess compliance with scheduled waste management requirement.

The Role of TNB's HSE Corporate in Hazardous Waste Management

TNB's Health, Safety, and Environment (HSE) team is critical in reviewing and approving proposed corrective actions for identified non-conformances. Their responsibilities encompass several focal points:

Evaluating Effectiveness

The HSE team ensures that proposed actions adequately address non-compliance and prevent future occurrences. They assess the feasibility and effectiveness of proposed solutions to ensure they effectively resolve the identified issues.

Compliance Verification

They confirm that actions align with relevant regulations and best practices, safeguarding continued compliance. The HSE team ensures that corrective actions adhere to established environmental regulations and industry best practices.

Future Goals and Sustainability of the Hazardous Waste Management

As part of TNB's broader efforts, the TNB HSE Corporate Audit actively contributes to minimising waste generation, maximising recycling opportunities, and adhering to the highest environmental standards. This is achieved through:

Compliance and Risk Management

The programme minimises environmental risks associated with waste management by ensuring adherence to regulations. Proper waste handling and disposal practices safeguard the environment and public health, reducing the likelihood of environmental contamination, accidents, and health issues.

Promoting Best Practices

The programme encourages continuous improvement and adoption of sustainable waste management practices throughout our operations. This includes initiatives like waste minimisation, segregation at source, recycling, and responsible disposal. Promoting best practices enhances our environmental performance and sets a positive example for other organisations.

Improved Waste Management

The programme leads to more efficient waste segregation, handling, and disposal, reducing the environmental impact of TNB's activities. Effective waste management practices minimise the amount of waste generated, ensure proper treatment and disposal, and contribute to a more sustainable waste management system.

Environmental Awareness

The programme raises employee awareness about responsible waste management practices, fostering a culture of environmental responsibility within TNB. Through training programs and communication initiatives, employees gain a deeper understanding of the importance of proper waste handling and their role in contributing to a sustainable future.

As of August 2024, the TNB HSE Corporate Audit has demonstrated a thorough verification process in managing hazardous waste. Key accomplishments include:

Programme Achievement	Description
Hazardous waste facility improvement	TNB's hazardous waste storage facilities are continuously being improved and upgraded based on audit findings to ensure full compliance with DOE requirements.
Enhance compliance on competency requirements	In 2023, TNB had 78 employees registered as Certified Environmental Professionals in Scheduled Waste Management (CEPSWaM). As of August 2024, this number increased to 106, highlighting the company's commitment to environmental sustainability and regulatory compliance on hazardous waste management.
Enhanced Environmental Protection Through Audit and Inspection	Minimised environmental risks associated with improper waste handling, leading to a safer environment for employees and surrounding communities.
Sustainable Waste Management Culture	Fostered a culture of continuous improvement and responsible waste management within TNB, enhancing the company's reputation as a leader in environmental stewardship.

In addressing non-compliance, we utilise a strategic approach to address non-conformances identified during inspections. This approach ensures timely reporting, investigation, and resolution of non-compliance issues through:

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Structured Non-Conformance Report (NCR) Management

A clear process ensures all non-conformances are reported promptly through eHSE-NCR system (an online HSE digital online platform designed specifically for raising, tracking, and monitoring NCRs). Dedicated personnel are responsible for logging and tracking each reported issue.

Root Cause Identification

Investigations thoroughly explore the root causes of non-conformances, enabling targeted corrective and preventive actions to prevent recurrence. Each nonconformance will be assigned to a dedicated person in charge, who is responsible for implementing the necessary corrective and preventive measures. All actions must be completed within the committed timeframe and will be monitored through the eHSE-NCR system.

All identified areas for improvement are promptly raised as Nonconformance Reports (NCR) and systematically logged in the eHSE-NCR system, an online platform designed specifically for raising, tracking, and monitoring NCRs. Each NCR will be assigned to a dedicated person-in-charge (PIC), responsible for implementing the necessary corrective and preventive actions. Once the root cause is identified, both corrective and preventive measures will be executed within the committed timeframe. This comprehensive system enhances accountability, enables timely resolutions, and promotes continuous improvement in our waste management practices.

Complementing TNB's Hazardous Waste Management

Since 2022, the Self Visual Report (SVR) has been implemented across all divisions, departments, and subsidiaries. SVR is a self-reporting visual report that consists of 24 elements, such as hazardous waste inventory records, competency records, labeling conditions, and overall pictorial assessments of store and waste conditions.

Each scheduled waste store submits this report on a monthly basis, covering key elements to ensure compliance with the Department of Environment's requirements. The report is prepared and submitted by a Certified Environmental Professional in Scheduled Waste Management (CEPSWaM) to the HSE Corporate team, and its submission is mandatory.

Inspection or audit conducted for Hazardous Waste	2022	2023	2024 (as of August 2024)
Inspection by HSE Corporate on hazardous waste at relevant operation site	8	15	6
Self-Visual Reporting (SVR) by division/department	736	948	640
Audit inclusive of Schedule Waste Management at relevant operation site	5	7	1

We have successfully reduced the amount of hazardous waste generated by 3.67% in 2024 (895,038 MT) compared to the previous year (929,123 MT). Of this hazardous waste, 55.58% (497,452 MT) was recycled.

Responsible Effluent Management

In mitigating legal and operational risks and ensuring that effluents meet quality standards to protect public health and the environment, we have developed the Industrial Effluent Treatment System (IETS) Management Guideline.

Industrial effluent treatment systems are fundamental in managing wastewater generated by TNB to safeguard the environment and ensure compliance with regulatory requirements. These systems encompass various stages and processes designed to remove contaminants from the effluent before its safe discharge into the environment.

By strengthening this programme, TNB remains committed to responsible waste management, environmental protection, and achieving our long-term sustainability goals. The programme plays a key role in ensuring our operations are conducted in an environmentally responsible manner.

Revision History:

30 March 2025: Added data on hazardous waste generated and recycled in 2024, and added details on Effluent Management.

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TNB'S SF6 GAS RECYCLING AND RECONDITIONING CENTRE AN INITIATIVE FOR SUSTAINABILITY

TNB Grid's SF6 Gas Recycling and Reconditioning Centre, a trailblazer in Southeast Asia's environmental efforts, redefines SF6 gas management. SF6, a potent greenhouse gas crucial for insulating electrical equipment like Gas Insulated Switchgear (GIS) and Circuit Breakers (CBs), poses a significant environmental challenge. With the highest Global Warming Potential (GWP) of approximately 23,500 and an atmospheric lifetime of around 3,200 years, SF6 necessitates a solution to reduce reliance on virgin gas and minimise its environmental impact.

Our rising SF6 consumption and the high cost of returning waste to its origin countries for incineration further emphasise the need for a solution. Incineration, the most common method, raises concerns due to potential greenhouse gas emissions during the process. Returning waste to origin countries like Germany, South Korea, and Australia is expensive, costing RM11.6/kg with an additional surcharge of RM232 for every 40kg bottle. Launched in October 2021, the centre tackles this challenge head-on, minimising environmental impact by embracing a circular economy approach and paving the way for a more sustainable future.

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A Circular Economy Approach: Reduce, Reuse, Recycle

The SF6 Gas Recycling and Reconditioning Centre embodies a circular economy approach, focusing on the 3R principles: Reduce, Reuse, and Recycle. This minimises reliance on virgin gas and reduces environmental impact.

Reduce

By effectively recycling SF6 gas, we minimise the need to purchase new gas cylinders, directly reducing overall SF6 gas acquisition.

Reuse

The recycled gas is meticulously reconditioned to meet the required standards, enabling its reuse within our operations for GIS and CB maintenance, extending the lifespan of valuable resources.

Recycle

The centre employs a meticulous four-stage SF6 gas handling process, with the first two stages (Recovery and Recycling) dedicated to collecting and reprocessing the gas for reuse.

The SF6 Gas Handling Process

The centre utilises a meticulous four-stage process to manage SF6 gas effectively, employing specialised equipment for each stage. Here's a table summarising the process:

Stage	Equipment	Function
1. Recovery	Service Carts	Collect and store SF6 gas extracted from electrical equipment during maintenance activities.
2. Recycling	Mini SF6 Gas Handling Unit (No. 1) Pre-Filter Unit SF6 Gas Handling Unit (No. 2)	Used for main storage pumping of received gas (liquid form) and storing it as a gaseous form inside the storage tank (with additional function of pump back storage from the measurement test set). Filters moisture and gaseous products from the input gas before pumping it into the SF6 Gas Handling Unit (No. 2). The main GHU pumps mixed gas from the Mixed Gas Storage Tank or from the Mini GHU to the Main Gaseous Storage Tank. It can also clean mixed gas bottles using N2 and a vacuum pump.
3. Treatment	SF6 Gas Separating Plant	This stage is used for higher purity requirements. It utilises low-pressure, high-pressure, and buffer tanks operating at low temperatures to remove impurities through a recycling process, resulting in high technical grade SF6. However, this process also generates a small percentage (10-20%) of waste gas.
4. Disposal (Minimal)	N/A	Any remaining unusable SF6 gas undergoes a safe and environmentally friendly disposal process that adheres to strict regulations. This minimises waste and ensures responsible environmental practices.

As of April 2024, the centre has processed a total of 11,114.83kg of SF6, contributing to cost savings of RM500,167.35 year-to-date (YTD) from January 2022 to April 2024. This represents an impressive 86% of the targeted cost avoidance for the facility.

To maximise the environmental and economic benefits, TNB has also stopped procuring new SF6 gas in bulk. By implementing a closed-loop system, the centre plans to incorporate the use of recycled SF6 gas for GIS rehabilitation, repair and refurbishment works.

Financial and Environmental Benefits

The TNB SF6 Gas Recycling and Reconditioning Centre offers a win-win situation. It reduces TNB Grid's environmental footprint by promoting SF6 gas reuse and minimising reliance on virgin gas, aligning with TNB's Sustainability Pathway 2050 and supporting national climate change mitigation efforts. Additionally, TNB Grid estimates potential savings of at least RM0.6 million annually.

Beyond internal use, there is a potential regional service. We envision the SF6 Gas Recycling and Reconditioning Centre becoming a key player in regional sustainability efforts. By offering our services to external parties, the Centre can benefits companies and utilities across Southeast Asia:

Support Large Power Consumers

Companies with industrial facilities that utilise SF6-insulated equipment can benefit from our recycling and reconditioning services, reducing their environmental footprint and contributing to regional sustainability goals.

Empower Neighbouring Utilities

We have the potential to partner with utilities in Southeast Asia, providing them with access to this eco-friendly solution for SF6 gas management. This can contribute to a collective reduction in the region's greenhouse gas emissions and support regional climate change mitigation efforts.

Through TNB's SF6 Gas Recycling and Reconditioning Centre, we promote circular economy and reduce the impact to environment.

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FOOD TO PLANET: TNB EMBRACES SUSTAINABLE FOOD MANAGEMENT

Food waste poses a significant national challenge in Malaysia. A recent report by the United Nations Environment Programme (UNEP) revealed that Malaysians discard a staggering 8.3 million metric tonnes of food annually. Tenaga Nasional Berhad (TNB) is taking an initiative exemplified by our actions during a recent Hari Raya gathering that serves as a springboard for TNB's broader commitment to responsible consumption. This initiative supports the reduction of non-hazardous waste, specifically by tackling food waste, a major contributor in TNB's operations. By addressing food waste, we aim to create a ripple effect that inspires broader behavioural change across the nation, tackling a significant national challenge.

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Knowing that change begins internally, TNB implemented strategies to minimise food waste at the Hari Raya event and for future events:

Portion Control

We collaborated with caterers to ensure appropriate serving sizes, reducing leftover food.

Menu Planning

By working together with caterers on menus, we minimised waste by considering expected guest numbers.

During the Hari Raya event on 29th April 2024, a composting machine was stationed, encouraging attendees to participate in waste management. The 270kg of food waste transformed into 50kg of nutrient-rich fertiliser is planned to be used within TNB's premises, promoting circularity. Additionally, surplus food was distributed among employees.

Our primary goal goes beyond composting or redistribution; it involves waste prevention and minimisation through the waste hierarchy principle (reduce, reuse, recycle). We strive to divert as much waste as possible from landfills while embracing sustainable practices at every level.

Beyond the Event

TNB's commitment to sustainability extends beyond one-time events. We are exploring a cafeteria food waste segregation program as a starting point for a comprehensive waste management system. We believe that individual action drives real change, thus we promote behavioural shifts within our workforce, emphasising personal choices for collective sustainability. By fostering conscious consumption and waste reduction, we empower employees to make a positive impact at work and at home.

This aligns with the Malaysian Housing and Local Government Ministry's circular economy approach to solid waste management. Their plan, implemented from 2021 to 2025, aims to accelerate the transition towards a sustainable model. The plan targets diverting 30% of waste from landfills by 2025 through initiatives such as developing a Circular Economy Blueprint for Solid Waste and establishing integrated solid waste management facilities.

We are also exploring additional solutions for ongoing waste reduction including:

Food Waste Monitoring

To track food waste generation at TNB premises. The food waste generation at TNB premises is reported in TNB Solid Waste Inventory (TESWI) system under the non-hazardous waste reporting.

Tech Partnerships

Collaborations with technology companies are being considered to develop innovative food waste management solutions.

Internal Circularity

We envision diverting food scraps to the TNB Research Anaerobic Digestion system to convert food scraps into biogas and nutrient-rich digestate, thereby reducing landfill waste and generating renewable energy (biogas).

By fostering a mindset of conscious consumption and waste reduction, we aim to empower our employees to make a positive impact both within the organisation and in their personal lives.

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EMPOWERING SUSTAINABLE FUTURES: TNB'S SOLAR PANEL & BATTERY MANAGEMENT STRATEGIES

Embracing the global call for sustainability, TNB has embarked on an ambitious journey towards renewable energy and energy transition. At the forefront of this movement are TNB's groundbreaking solar panel projects and innovative battery management strategies, driving Malaysia towards a greener, more sustainable future.

For decades, TNB has made significant strides in bolstering Malaysia's renewable energy capacity, marked by the successful commissioning of several Large-Scale Solar (LSS) projects. These ventures stand as pillars of TNB's commitment to sustainability, contributing towards Malaysia's goal of achieving 20% renewable energy in its electricity mix by 2025.

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Solar Project Name	TNB Sepang Solar (TSS)	TNB Bukit Selambau Solar (TBSS)	TNB Bukit Selambau Solar Dua (TBSS2)
Capacity (MWac)	50	30	50
Commissioning Date	23 November 2018	8 September 2020	21 December 2023
PPA Term	21 years	21 years	25 years
End of PPA	22 November 2039	8 September 2041	21 December 2048
Number of Solar PV Modules	243,712 (double glass 325W polycrystalline)	134,880 (340W monocrystalline)	131,490 (mixed 570Wp and 575Wp bi-facial N-type)

Beyond large-scale initiatives, TNB's subsidiary, GSPARX, has championed renewable energy adoption among the solar rooftops industry in both residential and commercial segments. As of May 2024, with a total of 1,229 residential customers and 226 commercial and industrial customers onboard, TNB has empowered communities and businesses alike to embrace clean energy solutions, with cumulative install capacities of over 134.40 MWp.

Solar Project Type	Commercial Supply Agreement Renewable Energy (SARE)	Commercial Outright Purchase (OP)	Domestic/ Residential Outright Purchase (OP)
Capacity (MWp)	112.56	7.79	10.05
Total no. of plants has Commission as of May 2024*	199	27	1,229
Average PPA Term	20 Year to 21 Year	Not Applicable	Not Applicable
Average End of PPA	Year 2040 to Year 2043	Not Applicable	Not Applicable
Average PV modules Life Cycle	25 Years	25 Years	25 Years
Number of PV Modules	225,120 Pcs (Double glass 500W monocrystalline)	115,580 Pcs (Double glass 500W monocrystalline)	20,100 Pcs (Double glass 500W monocrystalline)

These projects signify a substantial increase in TNB's domestic and international RE capacity. As of fiscal year 2023 (FY23), our cumulative capacity reached 4,375 MW, marking a significant milestone on our journey to secure renewable energy pipeline of 8,300 MW by 2025. This progress aligns with the Government's ambition to achieve 20% of the nation's electricity generation mix from renewable sources by 2025.

Sustainable Practices in Solar Energy Management

Ensuring the longevity and efficiency of solar panels is paramount to TNB's sustainability ethos. Through meticulous monitoring and innovative solutions, TNB mitigates factors such as vegetation shading and panel degradation. Additionally, pioneering tools like automated grasscutters and machine-assisted cleaning exemplify TNB's dedication to minimising environmental impact while maximising solar energy output.

Recognising the need to further minimise environmental impact, TNB is developing tools such as automated grasscutters and machine-assisted panel cleaning. Prototyping is underway, and commercialisation plans will follow upon successful implementation.

Responsible for End-of-Life Management of Solar Panels

As our solar capacity expands, so does our commitment to managing the end-of-life stages of solar panels. We recognise the importance of responsible end-of-life management for solar panels within a circular economy framework. By adhering to strict regulatory guidelines and employing the 3Rs principle (Reuse, Repurpose, Recycle), TNB ensures minimal environmental footprint during decommissioning. Furthermore, TNB actively explores avenues for panel reusability and recycling, aligning with Malaysia's ambitious target of achieving 70% renewable energy by 2050.

Our approach to solar panel end-of-life management adheres strictly to the Environmental Quality (Scheduled Waste) Regulation 2005, entrusting disposal to licensed vendors under the vigilant supervision of the Department of Environment (DOE). This enables regulatory compliance.

A Streamlined Process for Responsible Disposal by Licensed Vendors

Storage of Damaged Solar Panels

Damaged solar panels will be stored at the warehouse of the licensed vendor for further disposal. Approximately 300 solar panels waste have undergone the disposal exercise with the vendor.

Segregation of Solar Panel Components

Damaged panels will be dismantled from their structures and separated. The glass and metal components for photovoltaic (PV) panels are typically first. The glass is broke down, and the metal frames are compressed into bundles.

Recycling and Disposal Process

Following segregation, the glass is disposed of at a designated industrial landfill. The compressed metal, meanwhile, is sold to a third-party for recycling.

Residential, Commercial, and Industrial Solar Panels

For solar panels installed for residential, commercial, industrial, and government clients, we prioritise recycling them for reuse at other TNB sites if there is a suitable site for re-installation, and the panels are still under warranty and in good condition.

This stringent approach ensures regulatory compliance but also mitigates the environmental impact of our operations.

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In alignment with our circular economy commitment, we proactively explore initiatives across the solar energy lifecycle, from procurement to end-of-life management. These initiatives serve as integral steps towards supporting Malaysia's target of achieving 70% RE capacity target by 2050.

Here's how:

Procurement

We consider the recyclability of solar panels during procurement. This means prioritising components with high recycled content and favouring vendors with responsible sourcing practices.

Product Lifespan Extension

We focus on extending the lifespan of panels through proper maintenance, cleaning, and potential repair programmes. This reduces the need for early replacements and associated waste generation.

Second-Life Applications

We explore opportunities for reusing panels that are no longer suitable for primary use. or example, repurposing panels in non-critical applications.

TNB through TNB Research continuously seeks solutions to enhance solar PV circularity potential. TNB Research has developed the Pilot Recycling System for PVs, which uses thermal treatment for material separation, supported by an optimised heat recovery design. The system is able to separate the PV samples into material components of clean glass, silicon wafer, metal, and other recyclable resources.

By embracing these circular economy principles, TNB aims to establish a closed-loop system for solar energy, effectively minimising waste and environmental impact while fostering a more sustainable future.

These proactive measures not only align with our environmental policy, but also serve as tangible demonstrations of our commitment to responsible environmental stewards which aims to:

- Raise awareness among internal and external stakeholders about sustainable environmental practices.
- Enhance our Health, Safety, and Environment Management System (HSEMS) to ensure the highest environmental safety standards.
- Invest in innovative technologies for environmental management.
- Ensure compliance with regulations and identify improvement opportunities.
- Maintain transparent reporting on environmental performance.
- Uphold strict compliance with environmental acts, regulations, and obligations to prevent adverse

Battery Management and Innovation

As our smart grid initiatives continue to progress, battery energy storage system (BESS) will emerge as a critical component in enhancing system flexibility, enabling seamless integration of intermittent renewable energy sources, electric vehicles, and other distributed energy resources, all while upholding grid reliability and security.

TNB will kick start a 400MWh BESS pilot project, marking Malaysia's first utility-scale battery storage project to address intermittency issues of RE.

This pilot project will be operated by Grid System Operator (GSO), and overseen by the Energy Commission.

In collaboration with Sime Darby Property Berhad, we have piloted 3 units of Community Energy Storage System (CESS) installed at Elmina Ilham Residence with battery capacities ranging between 76.8kWh to 170kWh. Green energy generated via rooftop solar panels will be stored in the CESS and utilized for localized community energy consumption while enhancing network stability. These units are currently operating in 3 areas in Elmina, Klang with potential to store a combined total of 0.4MW of green energy.

Such initiatives provide opportunities for homeowners to move into a home powered by green energy, able to sell excess energy to TNB under the Net Energy Metering (NEM) scheme and manage energy smarter, through smart meter and home energy management systems.

In managing the battery lifecycle, we actively benchmark best practices and collaborate with industry partners to:

- Optimise battery performance.
- Explore innovative second-life applications.
- Minimise environmental impact through responsible recycling.

We've also intensified collaboration with vendors who are capable, licensed, and have vast experience in recycling and recovery to process our waste batteries.

Our commitment to responsible battery management extends beyond environmental considerations; it encompasses minimising waste and educating stakeholders on sustainable practices.

Human Capital Development

https://www.tnb.com.my/sustainability/esg-stories/

UNLOCKING POTENTIAL: TNB CHAMPIONS EMPLOYEE GROWTH THROUGH ACADEMIC STUDIES

BUILDING MALAYSIAN SKILLED WORKFORCE: A CLOSER LOOK AT TNB'S PROTEGE-READY TO WORK PROGRAMME

SHAPING TOMORROW'S ENERGY LEADERS: A LOOK INSIDE TNB'S ENHANCED BETTER BRIGHTER INTERNSHIP PROGRAMME (BBIP)

SHAPING THE FUTURE OF ENERGY: TNB ENERGY TRANSITION ACADEMY EQUIPS WORKFORCE FOR LEADERSHIP IN ENERGY TRANSITION

PREPARING THE NATION'S WORKFORCE FOR ENERGY TRANSITION

Human Capital Development

UNLOCKING POTENTIAL: TNB CHAMPIONS EMPLOYEE GROWTH THROUGH ACADEMIC STUDIES

This article was first published on 12 September 2024, and updated on 04 July 2025.

TNB values employee's growth and is committed in investing in employees' education, ensuring employees acquire the essential skills needed for their current and future roles. Hence, TNB provides its employees in the Group with opportunities to further their academic studies to enhance their skills and knowledge to pursue further education.

By supporting employees in their academic pursuits, TNB not only enhance employees' capabilities, also build a more committed and capable team, fostering a culture of continuous learning and development.

READ MORE

Human Capital Development

Supporting Our Employees in ET-Related Academic Programs

One of the academic programs we offer our employees is sponsorship for Master and PhD studies related to Energy Transition (ET). These programs are part of the TNB High- Performance Culture initiative, designed to reward and develop outstanding talent, foster continuous improvement, and support TNB's goal of achieving Net Zero by 2050. By providing advanced education and training opportunities, we equip our workforce with the knowledge and skills necessary to drive the company's sustainability initiatives and innovation efforts. For this sponsorship program, we collaborate with Universiti Tenaga Nasional (UNITEN), TNB's tertiary educational institution founded in 1997.

For ET-related Master programs at UNITEN, we offer a Master's in Engineering by Research and a Master's in Energy Management by Coursework on a part-time basis. In January 2024, twenty (20) employees are enrolled, with a total investment of RM733,610.48. These programs help employees gain expertise in critical areas of energy transition, enabling them to contribute more effectively to TNB's sustainability projects.

The ET-related PhD program began in October 2023. By supporting advanced research, we aim to develop new technologies and solutions to help TNB lead in the energy transition and sustainability sectors. These research initiatives aim to create new technologies and solutions that will help TNB in the energy transition and sustainability sectors. They are critical for addressing complex challenges and finding innovative solutions that can enhance our operational efficiency and sustainability.

Meanwhile, our ET-related PhD program at UNITEN focuses on research areas including Home Modular Energy Storage with Smart Management System and Optimal Planning and Scheduling of Energy Storage System Towards High Penetration of Renewable Energy and Electric Vehicles in Distribution System. Ten (10) employees are involved in these research, supported by a total investment of RM394,540.

Additionally, three (3) of our employees are currently enrolled in the Global Energy Technology Policy Professionals Program (GETPPP), which started in March 2024 at Hanyang University in South Korea. This program is a full-time master program under the Ministry of Trade, Industry and Energy (MOTIE) of South Korea, with MOTIE covering RM544,236 of the costs and TNB contributing RM47,631. Such an international academic program exposes our employees to global best practices and innovative technologies.

Spearheading Academic Research for TNB's Energy Transition Goals

Participants of the above programmes are engaging in key research areas that align closely with TNB's ET agenda. These are as follows:

1. **Research into Renewable Energy Integration**

   The PhD candidates are involved in research projects that align with the company's decarbonization efforts. These include looking into projects such as developing smart, modular home energy storage systems that reduce dependence on fossil fuels and improve grid stability.

   Improving hydropower resilience amid climate change is another area being looked into, where hydrological impacts are assessed with the integration of machine learning, in order to ensure sustainable operations during certain climatic conditions.

   Last but not least, research is also being conducted into nuclear-hydrogen integration as a clean energy solution for the future.

2. **Advancing Sustainable Energy Technologies**

   The Master students are currently looking into technologies that include the higher use of renewables and electric vehicles in distribution networks, as well as machine learning for smart meter data for the improvement of grid reliability and the reduction of energy losses.

3. **Strengthening Policy and Consumer Engagement**

   The Master students are also getting expertise in the energy policy, economics and consumer behaviour, while coming up with actionable insights into energy-saving behaviour and designing energy efficiency campaigns as well as policies, as an example.

4. **Global Perspectives on Energy Transition**

   Meanwhile, the three staff at Hanyang University are currently being equipped with the best practices in energy policy and technology, allowing them to continue to be well-versed in the ET field.

Along with the above, these programmes help with TNB's Net Zero goals by:

- Optimizing costs,
- Ensuring grid reliability,
- Improving consumer engagement, and
- Aligning TNB's strategies with national and international sustainability targets.

TNB is committed to strengthening its staff capabilities and supporting their professional growth through continued education. According to our records, the company significantly increased its investment in staff scholarships or reimbursements for the furthering of studies, from just over RM160,000 in 2020 to a total of over RM1.76 million in 2024, proving TNB's commitment in this area.

Human Capital Development

Partnership of ILSAS with Universities to Develop Training Program for TNB Employees

TNB Integrated Learning Solutions Sdn Bhd (ILSAS) functions as our training arm that nurtures an inclusive environment that appreciates diverse perspectives and experiences. ILSAS collaborates/partners with Universities to provide training for TNB employees to continuously enhance employees' skills and capabilities, preparing them for future challenges and career growth. The details are as follows:

Universiti Tenaga Nasional

- Completed in 2020: Executive Degree Program in Engineering Technology (20 people) & Management (13 people)
- Ongoing programs: Executive Degree Program in Engineering Technology (20 people) & Energy and Business Management (20 people)

UKM Pakarunding Sdn. Bhd.

- Hydrogen Technology and Process Safety (24 people)

Uni-Technologies Sdn. Bhd. (UTSB), a subsidiary company of Universiti Teknologi Malaysia (UTM)

- Ammonia Production, Bioenergy and Carbon Emission (4 people)
- Hydrogen 101 (54 people)

Revision History:

4 July 2025: Updated on key research areas and related investment in 2024.

Human Capital Development

BUILDING MALAYSIAN SKILLED WORKFORCE: A CLOSER LOOK AT TNB'S PROTEGE-READY TO WORK PROGRAMME

Since its inception in 2011, Tenaga Nasional Berhad (TNB) has been driving talent development through its PROTÉGÉ-Ready to Work Programme (PROTÉGÉ-RTW). This initiative tackles a two-pronged challenge: addressing graduate unemployment and shaping knowledgeable & experienced workforce for Malaysia's burgeoning energy sector. For year 2023, three (3) PROTÉGÉ have been absorbed as part of TNB employees. Since year 2011, a total of 331 PROTÉGÉ have been absorbed as part of TNB employees.

While employment statistics remain a valuable indicator, we at TNB go beyond simple placement numbers to measure PROTÉGÉ's success. We gather insights into graduates' career trajectories through a comprehensive employability assessment conducted six months after programme completion. This assessment not only gauges employment status but also delves into areas like skill development and professional growth. This data allows us to continually refine the programme, ensuring it remains relevant and effective in equipping graduates for the demands of the ever-evolving electricity supply industry.

READ MORE

Human Capital Development

Equipping Graduates with Diverse Opportunities

PROTÉGÉ-RTW takes a holistic approach to graduate development. The programme combines technical skills training - delivered in collaboration with our subsidiary, TNB ILSAS Sdn. Bhd., a specialist in skills and training solutions - with the development of crucial soft skills. This balance ensures graduates not only possess the technical expertise necessary for success in specific roles but also have the communication, teamwork, and problem-solving abilities valued across various sectors.

Whether it's contributing to innovative engineering projects or spearheading strategic business initiatives, PROTÉGÉ graduates are equipped with the necessary skills and experience to make a significant impact.

Fostering Industry Collaboration

A key factor contributing to PROTÉGÉ's success is our commitment towards collaboration. The programme prioritises aligning trainee selection with our business operational needs, attracting graduates with backgrounds in engineering, Information Technology (IT), management, and other relevant fields. Placements primarily occur within our company, our subsidiaries, and the broader electricity supply industry. This focus on industry collaboration ensures graduates gain valuable exposure to real-world scenarios and contribute their skills to the continued development of the sector.

However, the programme's impact extends beyond immediate placements.

By fostering a network of skilled graduates, PROTÉGÉ contributes to a larger pool of talent readily available within the industry. This, in turn, benefits not only TNB but also our partners and stakeholders, fostering a collaborative ecosystem that drives innovation and growth within the electricity supply sector.

Investing in the Future

TNB recognises that a successful graduate programme requires ongoing investment and support. PROTÉGÉ participants receive comprehensive support throughout the programme and beyond. This includes access to:

Skills and Soft Skills Training

Delivered by TNB ILSAS Sdn. Bhd., this training focuses on a hybrid learning approach, combining theoretical knowledge with practical application.

Logistical Support

Accommodation, classroom facilities, and meals/ beverages (if available) are provided during training in Bangi, Selangor.

Financial Support

Participants receive monthly allowances for eight months, along with contributions to social security and employee insurance schemes.

Health and Safety

Medical claim coverage and personal protective equipment (PPE) for trainees in technical fields ensure their well-being throughout the programme.

Evolving to Meet the Need of Malaysia's Green Future

We envision PROTÉGÉ graduates as well-rounded professionals who leverage their acquired knowledge and soft skills to contribute significantly within the electricity supply industry. This could manifest in career opportunity within our company or our partners, fostering a vibrant ecosystem of skilled professionals driving the sector forward.

As TNB moves forward, we continuously evaluate the need for expansion, enhancements, and new initiatives. The goal is to ensure PROTÉGÉ remains adaptable to evolving industry needs and continues to empower graduates with the skills and experience they need to thrive in the dynamic landscape of the electricity supply industry.

By addressing graduate unemployment while simultaneously nurturing a skilled workforce, TNB's PROTÉGÉ-RTW programme plays a vital role in shaping a sustainable future for Malaysia's energy sector.

Human Capital Development

SHAPING TOMORROW'S ENERGY LEADERS: A LOOK INSIDE TNB'S ENHANCED BETTER BRIGHTER INTERNSHIP PROGRAMME (BBIP)

Tenaga Nasional Berhad (TNB) is building a future-proof workforce through the enhanced Better Brighter Internship Programme (BBIP). Launched in 2014, BBIP has been a cornerstone of TNB's talent development strategy. It is exclusively designed for students pursuing industry-related disciplines at any accredited training institute in Malaysia, including at TNB's wholly-owned subsidiary and education arm, Universiti Tenaga Nasional (UNITEN).

Since year 2020, a total of 147 interns have been absorbed into executive positions and 21 interns have been absorbed into non-executive positions at TNB and its subsidiaries. For year 2023, a total of 59 interns have been absorbed as part of TNB employees.

READ MORE

Human Capital Development

Expanding Opportunities for Diverse Talent

And in May 2024, TNB has further enhanced its internship program through BBIP 2.0 which signifies a notable programme expansion. Previously open only to UNITEN degree candidates, BBIP 2.0 now welcomes full-time students enrolled in certificate, diploma, degree, master's, or doctorate programmes. This broader scope allows TNB to tap into a wider, diverse talent pool, fostering a more inclusive and dynamic workforce.

BBIP 2.0 offers a tailored learning journey that is meticulously designed for an internship experience that caters to each student's needs and preferences. Students are placed in departments or locations aligned with their academic discipline and workplace of choice. Additionally, TNB considers student preferences for location and work duties whenever possible, ensuring a well-rounded and relevant internship experience.

Beyond classroom training, BBIP interns gain invaluable practical experience by:

Shadowing experienced TNB professionals

Interns gain firsthand insights into TNB's operational procedures and the intricacies of the Malaysian utility sector. They actively participate in departmental tasks, fulfilling institutional programme requirements while building core competencies.

Exposure to real-world projects

Interns are often involved in practical projects, applying their academic knowledge to solve real-world challenges TNB faces. This experience fosters critical thinking, problem-solving skills, and collaboration.

Site visits and industry exposure

BBIP 2.0 offers opportunities for students to visit key TNB facilities such as power stations and solar farms. This broadens their understanding of the energy sector and its vital role in Malaysia's future.

Testimonials from past BBIP participants highlight the programme's effectiveness in equipping them with essential skills for their future careers. Here are some examples presented in a table:

> *"The knowledge gained from the internship was spot on. It was 100% related to my course. I got to understand all the calculations I've learnt in class and apply them to real job situations."*
>
> **Nurfarahin binti Kamarul Azman**
> *— Bachelor Engineering (Hons) Electrical Engineering (Power System), Universiti Malaysia Pahang*
> *Skill Area: Technical Skills*

> *"Skills enhanced during the internship are, but not limited to, solar PV technical skills... as my responsibilities include many interactions with people."*
>
> **Megat Muhammad Khairul bin Kamarulzaman**
> *— Bachelor's in electrical & Electronics Engineering, University College London*
> *Skill Area: Technical Skills*

> *"During this internship, it helped me to increase my communication skills with people around the working area... This is because the working environment consists of supervisors, technicians and contractors that I'm not familiar with."*
>
> **Nur Athirah Binti Azahari**
> *— Bachelor's in Engineering (Electrical) (Hons.), Universiti Sains Malaysia*
> *Skill Area: Soft Skills*

> *"The ability to read diagrams and graphs better and make crucial decisions to achieve the best possible outcome. Other than that, it is important to have communication skills with coworkers and clients to have a smooth workflow when doing work."*
>
> **Rais Izzuddin Bin Abdul Rahman**
> *— Bachelor of Electrical Power Engineering (Hons), UNITEN*
> *Skill Area: Soft Skills*

> *"I have learned a lot during my Tuanku Jaafar Power Station (TJPS) internship. The staff here is very expert and friendly to the trainees... Firstly, I understand better about the operation of combined cycle and open cycle power stations where I am given direct exposure to the components and machines. I also learned about safety awareness and the ISO standards used in TJPS."*
>
> **Haris Syazani Bin Mohd Saflan**
> *— Bachelor of Aircraft Engineering Technology (Hons.), UNIKL Malaysian Institute of Aviation Technology*
> *Skill Area: Adaptability and Resilience*

Measuring Success and Continuous Improvement

We are committed to continuously enhance BBIP's effectiveness. The programme utilises a multi-pronged approach for evaluation from feedback surveys, where feedback is collected from interns, supervisors, and mentors to identify strengths, weaknesses, and areas for improvement; and benchmarking against industry standards to compares BBIP to industry best practices to ensure it remains competitive and delivers a high-quality learning experience.

Human Capital Development

Building a Future-Ready Workforce

By nurturing future energy leaders, TNB strengthens its workforce and ensures its future competitiveness in the evolving energy landscape. The programme equips interns with the skills and knowledge to contribute to Malaysia's sustainable energy transition.

Through BBIP 2.0, interns gain exposure to cutting-edge technologies like solar PV and smart grid systems, fostering a generation of professionals equipped to drive the adoption of these clean energy solutions. For instance, interns may be involved in projects focused on integrating renewable energy sources into the national grid or exploring energy efficiency solutions for buildings. They also have access to a dedicated Centre of Excellence for People Acquisition, where they can gain career development guidance and explore potential career paths at TNB.

Extending Talent Development Beyond BBIP Programme

The enhanced BBIP 2.0 programme exemplifies TNB's commitment to building a future-ready workforce. By providing a comprehensive learning experience that caters to diverse talent, BBIP equips interns with the skills and knowledge needed to lead the energy transition and contribute to a sustainable future for Malaysia.

Since 1990, the organisation has welcomed nearly 33,000 students to participate in various internship programmes. This dedication to fostering future generations of talent positions TNB as a workforce development and innovation leader.

Human Capital Development

SHAPING THE FUTURE OF ENERGY: TNB ENERGY TRANSITION ACADEMY EQUIPS WORKFORCE FOR LEADERSHIP IN ENERGY TRANSITION

Tenaga Nasional Berhad (TNB) is taking a pioneering step towards a sustainable future powered by human capital capability uplift through the establishment of the TNB Energy Transition Academy (TETA). Endorsed by TNB's Sustainability & Energy Transition Council (SETC) in March 2023 and later launched in November 2023, this collaborative initiative with Universiti Tenaga Nasional (UNITEN) -TNB's wholly-owned subsidiary and education arm - and the National Energy Centre (NEC) equips TNB employees with the knowledge and skills needed to navigate the continuously evolving energy transition landscape.

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Human Capital Development

Building Future Leaders in Energy Transition

TETA offers a comprehensive three-month programme designed to develop future TNB strategists in the energy transition arena. The objectives of TETA are:

1. To equip participants with essential ET technical knowledge including non-technical skill set in leadership/finance/policy related.

2. To educate participants on ET related topics in order to prepare them to diagnose, design and build business case solution based on the selected ET problem statements.

3. To prepare participants with capability skills to pitch business case solutions to TNB business leaders.

TETA learning modules are based on real problem statements related to ET faced by TNB. For TETA Cohort 1, the future strategists have to diagnose, design and build business case based on the following problem statements:

1. Self-sustainable electric vehicle (EV) business model.

2. Development of TNB Smart City.

To help them in building the business case, the future strategists are given exposure and knowledge through taught courses by industry leaders and academicians. The courses involved are:

1. Finance & Management - this is to equip participants with business acumen through topics like Data Science and AI for Businesses, Leading Business into Globalization, and Circular Economy & Sustainability Strategies.

2. Technical aspects of selected ET problem statements (Self-Sustainable EV Business Model and Development of TNB Smart City) - Participants are given industry exposure through sessions with experts on topics like Overview of Electric Vehicle Charging Infrastructure, Overview of Smart City and IOT, and National and International Policies related to EV and Smart City.

3. Leadership and presentation skills – this is to equip participants with necessary tools and skill to effectively pitch their business case solutions to TNB business leaders. It is also to develop their ability to analyse challenges, propose solutions, and communicate effectively with decision-makers.

A World-Class Learning Experience

TETA offers a unique learning experience that combines academic rigour with practical industry insights:

Renowned Faculty

Led by UNITEN faculty members, the programme benefits from guest lectures by visiting professors and industry professionals from esteemed universities and companies. These experts provide participants with cutting-edge knowledge and real-world perspectives.

Industry Exposure

Participants gain valuable insights through technical visits and high-level business talks. For instance, Cohort 1 participants had the privilege of learning from Dr. Mazlan Abbas, a world-renowned Smart Cities expert, and other industry leaders on topics like Green Technology in the Digital Economy and EV Value Chain. They also had the oppotunity to learn on how to lead High Performance Teams from Matthew Gleeson, VP (Energy Transition & Water Conservation) from Oracle Energy & Water.

Networking Opportunities

Interaction with visiting professors and professionals fosters valuable networking connections, potentially leading to future collaborations and strategic partnerships.

Investing in a Brighter Energy Future

The TETA programme demonstrates TNB's commitment to its workforce and its vision for a future powered by human capital capability uplift. The inaugural cohort, consisting of 30 high-potential employees from various TNB divisions began their journey in February 2024. Upon graduation, these future energy transition strategists will be equipped to:

Drive Strategic Initiatives

Play a pivotal role in shaping and implementing TNB's energy transition strategies, contributing to achieving the organisation's Net Zero 2050 aspiration.

Contribute to National Energy Goals

The programme aligns with Malaysia's National Energy Transition Roadmap (NETR). Graduates can contribute to NETR flagship projects, like Future Mobility, leveraging their knowledge and skills for efficient project execution.

Champion Innovation Within TNB

Disseminate best practices, raise awareness about energy transition, and foster a culture of innovation throughout the organisation.

TNB's commitment to continuous learning and development, exemplified by the TETA programme, ensures a future workforce empowered to lead the energy transition and build a brighter energy future.

Human Capital Development

Empowering Malaysia's Energy Transition Journey

The TNB Energy Transition Academy (TETA) plays a critical role in supporting Malaysia's national energy transition goals outlined in the National Energy Transition Roadmap (NETR). By developing a future-proof workforce equipped with the necessary knowledge and skills, TETA contributes to Malaysia's progress in several ways:

Building Domestic Expertise

TETA fosters a pool of highly skilled energy transition professionals within TNB, a key player in the Malaysian energy sector. This domestic expertise is crucial for driving innovation and implementing successful national energy transition initiatives.

Accelerating Project Implementation

Graduates of the programme have the knowledge and competencies to contribute to flagship NETR projects, such as Future Mobility.

Human Capital Development

PREPARING THE NATION'S WORKFORCE FOR ENERGY TRANSITION

TNB Integrated Learning Solution Sdn Bhd (ILSAS), has been a cornerstone for developing human capital tailored to meet the evolving needs of TNB and the broader electricity supply industry for over 46 years. With the impending energy transition (ET), the integration of new green technologies becomes imperative for TNB and industry sustainability and that of the industry as a whole. In response to this, ILSAS has expanded its focus to encompass ET-related skill sets and technologies, including battery electric vehicles (BEV), battery storage, and on-grid floating solar PV.

With a specific focus on BEVs, ILSAS is committed to raising awareness and nurturing fresh talent within the BEV sector through innovative learning interventions. By forging strategic partnerships with industry stakeholders such as the Malaysian Green Technology and Climate Change Corporation (MGTC), PLUS Malaysia Berhad, iLatest Technology Sdn. Bhd. and Bermaz Auto Berhad, ILSAS has successfully implemented a range of initiatives:

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Human Capital Development

Deployment of internationally certified internal EV specialists	Establishment of an EV training hub	Development of comprehensive EV training modules
2 internal specialists successfully graduated with Level 3 certifications in Electric/Hybrid Vehicle System Repair and Replacement from The Institute of Motor Industry (IMI), United Kingdom.	The Electric Vehicle Training Hub @ ILSAS was formally officiated on 10 January 2023, by YB Nik Nazmi Nik Ahmad, the then Minister of Natural Resources, Environment and Climate Change.	6 training modules developed to date: • Electric Vehicle Technology Essential • Electric Vehicle Technology Essential for Driver • Electric Vehicle – First Responder • Familiarisation & Electric Vehicle Basic Care • AC & DC Charging System for Electric Vehicle • High Voltage Battery Technology System for Electric Vehicle

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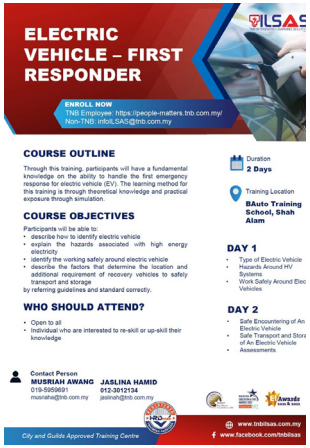

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Between 2022 and 2023, 197 participants benefited from the ILSAS EV program. As it looks to the future, ILSAS is determined to position itself as the leading EV training facility in Malaysia. Its goals include obtaining accreditation as a center for City and Guilds, and The Institute of the Motor Industry (IMI) certifications, specifically for EV charge point installer and EV competent personnel roles, respectively. For more information and to register for these programs, please visit tnbilsas.com.my.

Health & Safety

STRENGTHENING SAFETY AND ENVIRONMENTAL PRACTICES WITH TNB

Health & Safety

STRENGTHENING SAFETY AND ENVIRONMENTAL PRACTICES WITH TNB

This article was first published on 17 October 2024, and updated on 29 March 2025.

Health & Safety Governance and Oversight

We have strengthened our governance by enhancing the oversight and management of health and safety matters. In 2024, the Terms of Reference and membership of the TNB Health, Safety & Environment Committee (HSEC) has been enhanced with approving authority to drive the implementation of HSE across TNB. Chaired by the Chief Distribution Network Officer (CDNO) with members from the top management of key operations and corporate functions, the HSEC deliberates strategies and monitors performance of initiatives implemented across TNB Group. The Board Sustainability and Risk Committee (BSRC) and TNB Group Executive Management Committee (GEMC), chaired by the President/Chief Executive Officer, maintains oversight on the implementation of HSE strategies and initiatives.

The Health, Safety and Environment Management System (HSEMS) provides a framework for TNB Group to ensure the health and safety of employees, contractors and the public are managed holistically and systematically, based on the principles of ISO management systems.

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Health & Safety

Our business entities that are currently certified with ISO 45001:2018 Occupational Health and Safety Management Systems are:

No.	Business Entities Certified with ISO 45001:2018
1	TNB Power Generation Sdn. Bhd.
2	Grid Division
3	Distribution Network Division
4	Project Management & Control (PMC), PSD
5	Malaysian Transformer Manufacturer (MTM) Sdn. Bhd.
6	Tenaga Cable Industries (TCI) Sdn. Bhd.
7	Tenaga Switchgear (TSG) Sdn. Bhd.
8	Sabah Electricity Sdn. Bhd. (Generation, Transmission and Distribution Divisions)

Environmental Management System

Our environmental management system embedded in TNB HSEMS is applicable across TNB Group, as guidance for environmental management and in compliance with regulatory requirements. TNB HSEMS supports continuous improvement including setting policies and implementation of action plans to manage environmental hazards and minimise environmental risks.

We actively improve our environmental management through benchmarking, site inspections, external and internal audits. The annual internal audits are conducted by ISO 14001 certified internal auditors. In 2024, nine of our business entities were certified with ISO 14001:

No.	Business Entities Certified to ISO 14001
1	Grid Division
2	TNB Power Generation Sdn. Bhd.
3	Malaysia Transformer Manufacturing Sdn. Bhd.
4	Tenaga Cable Industries Sdn. Bhd.
5	Tenaga Switchgear Sdn. Bhd.
6	Stesen Janakuasa Patau-Patau, SESB
7	Stesen Janakuasa Sandakan, SESB
8	Stesen Janakuasa Tawau & Kubota, SESB
9	Jabatan Pengurusan Gudang & Logistik, SESB

TNB's Vendor Safety Initiatives: NTSP and NTSLP

In 2007, the NIOSH Tenaga Safety Passport (NTSP) was introduced to increase safety awareness among contractors. Since its inception, over 321,982 contractors have been trained, with a goal of reaching 380,000 by December 2024. The programme ensures contractors follow key occupational safety standards and comply with the Occupational Safety and Health Act (OSHA) 1994.

The NTSP aims to reduce the accident rate among Tenaga Nasional Berhad's (TNB) contractors by providing them with clear guidelines on safe work procedures and rules. It has standardised health and safety training across all contractors, ensuring uniformity in safety practices at our worksites. The programme also supports the enforcement of safety regulations, helping contractor workers meet occupational health and safety requirements consistently across all projects.

To further build on these efforts, the NIOSH Tenaga Safety Leader Passport (NTSLP) was launched in 2022. Managed by the National Institute of Occupational Safety and Health (NIOSH), the programme is specifically tailored for contractor personnel such as Supervisors, Project Engineers, Project Managers, Project Directors, and Project Coordinators who oversee work at our projects, installations, power stations, and premises owned or rented by us. It is designed to improve supervision and leadership in safety management. It aims to improve aspects of supervision and ensure that team leader and supervisors clearly understand their roles in providing and maintaining a safe and healthy work environment for all employees. So far in 2024, 9,574 contractor supervisors have undergone training, with a goal of surpassing 15,000 by year-end. With the ultimate goal of achieving zero accidents among TNB contractors, NTSLP equips supervisors with the skills to prevent accidents and manage safety more effectively.

Health, Safety & Environment (HSE) Symposium for Contractors

Collaboration with contractors on safety and environmental standards is essential to ensuring that our operations run smoothly and safely. The Health, Safety & Environment (HSE) Symposium serves as a collaboration platform between us, the Department of Occupational Safety and Health (DOSH), the Department of the Environment (DOE), and the Malaysian Energy Commission (ST). DOSH, DOE, and ST presented their respective working papers, sharing knowledge and experience to enhance contractor understanding of HSE requirements. In 2023, the symposium was held across four zones – East, South, Central, and North – and attracted 660 participants.

Health & Safety

These symposiums covered high-risk activities such as live installation diagnostics, working at heights, and confined space operations. Participants gained valuable insights into the latest safety regulations and environmental standards. Feedback showed that 88% of attendees were satisfied with the content, the presentations by speakers, and the overall success of the programme. This initiative ensures that our contractors stay informed and compliant with health, safety, and environmental standards.

The primary objectives of the symposium include improving the understanding of HSE requirements among TNB contractors' management, enhancing compliance with the latest regulations, reducing accidents involving contractors, and minimising legal actions against us. The symposium also aims to establish strong cooperation between TNB, DOSH, DOE, and ST to support HSE programmes at the national level.

The programme targets our contractors involved in high-risk work, such as live installation diagnostics, working at heights, high-voltage maintenance, and confined space operations. The outcome of this initiative is an increase in contractors' awareness of HSE legal compliance, directly improving safety practices and reducing accidents at our worksites.

Symposium Participation Overview:

Date	Location	Number of Participants
25 May 2023	Leo Moggie Convention Centre, TNB Platinum Bangsar, KL	220
27 July 2023	Dewan Cenderawasih, 15th Floor, Wisma TNB, Johor Bahru	150
08 August 2023	Dewan Tok Kenali, Level 10, Wisma TNB, Kota Bharu, Kelantan	100
06 Sept 2023	Dewan Mutiara, Level 4, TNB Ulu Kinta, Perak	100
26 Sept 2023	Dewan Level 2, TNB Jalan Anson, Pulau Pinang	90

Figure 1: Each symposium was held at key TNB locations, with strong participation across all four zones, ensuring that contractors in the North, South, Central, and East regions had access to critical health, safety, and environmental insights.

Public Safety Campaign: Padi Harvester Safety

Electrical installations near rural work environments, such as rice paddies, pose a unique risk to the public. The Padi Harvester (Jentuai) Safety Campaign, introduced in 2017, addresses the risks faced by operators of padi harvester machinery. Some rice paddy areas in Peninsular Malaysia are located near TNB's 11kV or 33kV voltage lines, which increases the danger of electrical accidents. As stipulated in Act 514 of the Occupational Safety and Health Act 1994 (Part IV, Section 17), TNB is responsible for ensuring the safety of all individuals working in or near its equipment or installations.

In 2024, the campaign engaged a total of 70 rice machinery operators and entrepreneurs, with a focus on raising awareness about the installations near rice fields. The goal is to prevent accidents and electrocutions during rice field activities, covering a total area of 96,558 hectares annually. The programme provides operators with the knowledge needed to understand electrical hazards and take necessary precautions. These sessions offer an opportunity for operators to increase their awareness of the risks posed by electrical infrastructure near their work environment, reducing the likelihood of accidents.

Employee Safety: Stop Work Policy and Life-Saving Rules

Ensuring that every employee and contractor can take immediate action when safety is compromised is fundamental to our operations. Through the Stop Work Policy and Intervention Stop Work (ISW) Programme, both employees and contractors are authorised to stop work in unsafe conditions, fostering a culture where safety is always prioritised. This programme builds confidence, allowing teams to perform their duties without fear, knowing the have the authority to halt work if conditions become unsafe. The ISW programme reflects our core value of Mindfulness, where taking proactive steps under ISW demonstrates a shared responsibility for the safety of colleagues and the protection of the environment.

The ISW initiative has been delivered through multiple platforms, including webinars and more than nine roll-down sessions conducted across divisions, departments, and subsidiaries. The key objectives of the ISW programme are:

1. Ensuring compliance with legal requirements.

2. Providing guidance to all Divisions, Departments, and Subsidiaries on implementing ISW at TNB.

3. Enhancing the management of HSE leading indicators at all organisational levels.

4. Raising awareness that all personnel have the right and responsibility to act against unsafe behaviours or conditions.

5. Cultivating a self-compliant, generative safety culture across the organisation.

To further assess and improve safety practices, we adopted the UK Energy Institute's five-stage safety cultural ladder, conducting safety culture assessments every two years. These assessments led to a score of 4.02 in 2021, which improved to 4.16 in 2023, demonstrating ongoing progress toward a more mature safety culture.

Health & Safety

The Life-Saving Rules (LSR), introduced on 21 August 2017, aim to safeguard lives by preventing serious injuries and fatalities among workers and contractors. Initially featuring nine rules, the LSR was revised in 2023 to focus on six critical safety practices. These rules apply to all divisions, departments, subsidiaries, and contractors, particularly those operating in high-risk areas such as installations, power stations, and construction sites.

The goals of the LSR include:

1. Maintaining legal compliance.

2. Saving lives and preventing severe injuries.

3. Achieving zero accidents.

4. Promoting a fully generative safety culture.

5. Improving overall occupational health and safety performance.

Non-compliance with the LSR may lead to termination, but the aim is always to protect lives rather than to punish. Since the implementation of the LSR, fatal accidents have significantly decreased. Enforcement of the LSR has been in place since 2017, covering LSR No. 1, 2, and 3. Subsequently, LSR No. 4 and 5 were introduced in July 2024, and LSR No. 6 is scheduled for implementation in 2025.

Six (6) Life Saving Rules

Quality Potential Incident (QPI) Management

The Quality Potential Incident (QPI) Management system is designed to detect potential incidents (PIs) early, aiming to prevent them from turning into accidents. Employees are encouraged to actively report any PIs they observe, fostering a heightened awareness of safety within the team. Every individual takes responsibility not only for their own well-being but also for the safety of those around them.

Once reported, potential incidents are carefully tracked and reviewed, allowing continuous monitoring of risks. Patterns and trends that emerge from this analysis inform the adjustments needed to improve safety measures. This proactive approach ensures that corrective actions are taken before an incident occurs, helping to prevent injuries or property damage.

QPI also reduces the financial impact of workplace accidents. Costs related to compensation, repairs, and lost productivity are minimised, as the system focuses on preventing incidents before they escalate. By encouraging employees to engage with the system and report potential hazards, TNB strengthens workplace safety while lowering operational risks.

Strategic Engagement with DOSH: SEP-25

The Strategic Engagement Plan (SEP-25) with the Department of Occupational Safety and Health (DOSH) has been a key factor in advancing our occupational safety and health (OSH) initiatives. The collaboration, which covers seven areas of cooperation, has been implemented annually and consistently improved results. Over the past two years, SEP-25 achieved 90% of its objectives in 2022 and 2023, with a target of 95% by the end of 2024.

The primary objectives of SEP-25 are to forge strong cooperation between DOSH and TNB in implementing OSH programs, position TNB as a model organisation in Malaysia's OSH landscape, and actively contribute to the National PPE Master Plan 2021-2025 (OSHMP25). This close bilateral cooperation with DOSH helps create a safe, healthy, and productive work environment, supported by high management commitment and a progressive workplace culture.

Our long-term goal is to strengthen self-regulation practices across all levels of the organisation by 2025, ensuring that safety is deeply embedded in our operations and culture.

Health & Safety

Strategic Engagement with DOE: SEP-30

To ensure our environmental practices align with Malaysia's Vision 2030 for Environmental Sustainability for Shared Prosperity, we partnered with the Department of Environment (DOE) through the Strategic Engagement Plan (SEP-30). This smart partnership focuses on increasing the effectiveness of TNB's governance to meet legal environmental frameworks while building a work culture that always integrates aspects of sustainability. Through three areas of cooperation between DOE and TNB, the plan has been implemented and refined every year.

The programme achieved 85% of its objectives in 2022, followed by 82% in 2023, and is expected to reach up to 90% by the end of 2024. The objectives of SEP-30 are to establish strong cooperation with DOE in implementing activities and training related to environmental conservation, positioning TNB as a leader in environmental management, and contributing to the success of the DOE Strategic Plan 2021-2030.

These efforts keep environmental sustainability a key part of our operations and ensure compliance with governance requirements while supporting national environmental goals.

Revision History:
29 March 2025: Added details on Added details on Health and Safety Governance & Oversight, and Environmental Management System.

Labour Rights

https://www.tnb.com.my/sustainability/esg-stories/

BEYOND PAYCHECKS TNB'S BID IN FOSTERING EMPLOYEE HAPPINESS WITH ENHANCED NON-SALARY BENEFITS

EMPOWERING ETHICAL PRACTICES: TNB LIGHTS THE WAY FOR FAIR LABOUR

Labour Rights

BEYOND PAYCHECKS TNB'S BID IN FOSTERING EMPLOYEE HAPPINESS WITH ENHANCED NON-SALARY BENEFITS

In today's competitive job market, employee benefits are not limited to merely paycheck. Many employers, including Tenaga Nasional Berhad (TNB), provide a range of benefits to support all their employees. However, we believe in going beyond the basics to create a supportive and thriving work environment. We know that a well-taken-care-of TNB family boosts morale and productivity and significantly reduces turnover rates. Our commitment is to meet our employees halfway by regularly reviewing and enhancing our policies to support them in every possible way. Below are the non-salary benefits provided to TNB Company Employees.

READ MORE

Labour Rights

Employee Regular Performance and Career Development Review

To support employees in achieving TNB's business strategic objectives and goals, we have developed TNB Performance Management as an integrated and continuous approach. It consists of performance planning (including individual KPI alignment to business requirement), performance monitoring and performance evaluation. These processes are to ensure and drive performance excellence mindset and culture of all TNB employees towards TNB aspiration and strategies.

Performance conversation plays a significant role throughout TNB Performance Management cycle, where all processes in the performance cycle require performance conversation between immediate managers and subordinates to achieve high performing culture. Annual structured performance conversations occur at least four (4) times, enabling employees to constantly strive and improve their performance, focusing on measuring progress and always working to be better. In year 2023, all 26,607 TNB company employees (100%) received regular performance and career development reviews.

Common and Basic Non-Salary Benefits

To ensure that our employees can maintain a healthy work-life balance, we offer a variety of essential benefits and ensure the benefits are compliance to Employment Act 1955 e.g Public Holidays, annual leave, sick leave, maternity leave and paternity leave. On top of that, TNB also provide other leaves which can accommodate for other occasions e.g. compassionate leave, marriage leave, study leave etc

TNB's Commitment to Enhanced Employee Benefits

While the common benefits form the foundation of our employee support, we understand that offering unique benefits can make a significant difference in the lives of our employees. These benefits are designed to address specific needs and challenges, providing additional support where it's most needed. Here are some of the ways we go above and beyond:

1. Flexible Working Arrangement (FWA) Policy
Our FWA policy allows eligible employees to work from home. This flexibility helps reduce commute time and increase productivity. Many of our employees have reported improved work-life balance and job satisfaction whilst working from home. By reducing the need for daily commuting, employees save on transportation costs and have more time to focus on their personal lives, leading to a healthier work-life balance.

2. Childcare Facilities (TNB Educare Programme)
We offer subsidised childcare for TNB employees with children between 2 months to 4 years old at selected locations, significantly easing the burden for working parents. This benefit allows their parents to focus on their work with peace of mind. Providing reliable childcare helps reduce absenteeism and tardiness, as parents are assured their children are in safe and nurturing environments close to their workplace. This supports our employees wellbeing and enhances their productivity and engagement at work.

3. Quarters
TNB provides quarters/board rental housing for eligible employees who are involved in core operations of the company.

4. Religious Leave
Recognising the importance of religious observances, we offer Pilgrimage Leave for Muslim employees and Religious Leave for non-Islamic faith. This special leave allows employees to participate in significant religious events without using their annual leave, fostering an inclusive and supportive work environment. By respecting and accommodating diverse religious practices, we create a workplace culture that values and supports all employees. This benefit demonstrates our commitment to diversity and inclusion, ensuring that all employees feel respected and valued.

5. Medical Benefits
The Company shall provide all Employees and Dependants with free medical treatment and medicine.

6. Holiday Accommodation
The Company provide holiday accommodation exclusively for its Employees at holiday resorts and major towns in Peninsular Malaysia with nominal rent.

7. Welfare Assistance
TNB provides welfare support (financial and non-financial) e.g disaster relief, death, prolonged sickness and injury.

Labour Rights

8. Long Service Award
Recognition given to employees who have completed a significant length of service with TNB. This is to acknowledge the employee's dedication, loyalty, and contributions to the company over an extended period. It serves as a token of appreciation and helps boost employee morale and retention.

9. Personal Accident Group Insurance Benefits
Where an employee dies or suffers permanent disablement due to accident, lump sum payment shall become payable under Company's Personal Accident Group insurance Benefits.

10. Housing/Car Loan (Loan Interest Reimbursable Scheme)
Where an employee dies or suffers permanent disablement due to accident, lump sum payment shall become payable under Company's Personal Accident Group insurance Benefits.

11. Majlis Anugerah Persaraan (Jasamu Dikenang)
Majlis Anugerah Persaraan (Jasamu Dikenang) is to recognize and honour the dedicated service and contributions of employees who have reached their mandatory retirement age of 60. This annual event serves as a platform to acknowledge the commitment, hard work, and achievements of retiring employees who have played a significant role in the growth and success of the company.

By celebrating their invaluable contributions, the company aims to foster a culture of appreciation and respect, reinforcing the importance of every individual's role in the organization.

Labour Rights

EMPOWERING ETHICAL PRACTICES: TNB LIGHTS THE WAY FOR FAIR LABOUR

At Tenaga Nasional Berhad (TNB), we uphold the principle of equal opportunities and a supportive work environment for all. Our commitment to fostering a workplace of mutual respect and providing the necessary resources for employee growth is unwavering.

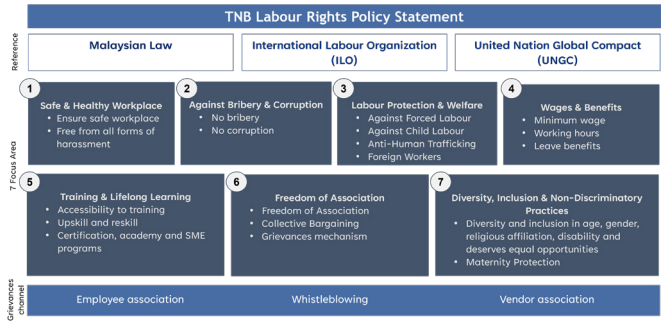
We believe in the power of diversity and inclusion, recognising that it enriches our organisation and drives innovation. Our ongoing efforts to enhance workplace inclusivity aim to empower employees from diverse backgrounds to leverage their unique perspectives and talents for the collective success of TNB and personal growth.

READ MORE

Labour Rights

Driving Ethical Workplace Practices

TNB's Labour Rights Policy Statement underscores our dedication to ethical, responsible, and sustainable practices across all facets of our business operations. We diligently adhere to relevant laws, including Malaysian law, standards set by the International Labour Organisation (ILO), and principles of the United Nations Global Compact (UNGC). This ensures our practices meet legal requirements and align with our values as a socially responsible organisation committed to driving positive change.



At TNB, our Labour Rights Policy Statement outlines our unwavering commitment to ethical and responsible practices in collaboration with our employees and vendors. We focus on seven key areas to ensure the well-being and fair treatment of all individuals within our sphere of influence:

1. Safe and Healthy Workplace	• Ensure so far as is practicable, the provision of a safe and healthy working environment to prevent work related injuries and occupational diseases among our employees and vendors. • Provide a safe work environment free from discrimination of any kind and from any form of harassment in the workplace by adopting a zero-tolerance policy.
2. Against Bribery and Corruption	Commit to conduct our business ethically and in full compliance with all applicable laws and regulations related to prevention of bribery and anti corruption practices in all our business operations.
3. Labour Protection and Welfare	• Prohibit any form of human trafficking, slavery, child labour and forced labour. • Ensure that our operations are in accordance with all applicable laws and regulations related to labour protection and welfare rights, including protection for foreign workers.
4. Wages and Benefits	Ensure our operations fully comply with applicable working hours, uphold the minimum wage rates, and provide paid leave as provided under all applicable laws and regulations.
5. Training and Lifelong Learning	Empower our workforce through training and lifelong learning, fostering continuous growth through comprehensive training initiatives.
6. Freedom of Association	• Uphold the right to freedom of association and collective bargaining, empowering employees to engage in organized activities for mutual support and representation. • Enhance and oversee the grievance mechanism, enabling effective communication and reporting of issues.
7. Diversity, Inclusion and Non-Discriminatory Practices	• Promote diversity and inclusion across age, gender, religious affiliation, and different ability, ensuring equal opportunities for all. • Provide protection against unfair dismissal including any unfair dismissal of female employee during pregnancy.

Download our TNB Labour Rights Policy Statement here. (This Policy Statement was initially approved by the Sustainability & Energy Transition Committee (SETC) on 20 April 2024 and was last amended on 10 October 2024)

Grievances Channel

We take labour rights issues seriously and provide accessible grievance and whistleblowing channels to address concerns related to our employees or broader business activities. Our three channels include:

Employee Association

Providing a platform for employees to voice their concerns and seek resolution within the organisation.

Whistleblowing

Offering a confidential avenue for individuals to report misconduct or violations of ethical standards without fear of retaliation.

Vendor Association

Extending support to our vendors by offering channels for them to raise labour rights issues and seek assistance or guidance.

Moving Forward Together

As we continue to grow and evolve, our commitment to ethical labour practices remains steadfast. We believe by focusing on equal opportunities, supportive environments, diversity, and inclusion contributes to a positive employee experience where every employee feels empowered to reach their full potential and contribute to the collective success of the organisation.

By fostering a culture of integrity, inclusivity, and respect,we create a better work environment where every individual can thrive. We also encourage our vendors to embrace these principles, recognising that collective efforts drive positive change.

At TNB, our mission goes beyond providing electricity; we aspire to illuminate the path towards a brighter, more sustainable future for all.

Supplying Chain Management

https://www.tnb.com.my/sustainability/esg-stories/

P&SC GRIEVANCE PROCEDURE: TOGETHER, WE SHAPE A RESPONSIBLE SUPPLY CHAIN WITH VENDORS

ELEVATING PARTNERSHIPS: INTRODUCING TNB'S SUSTAINABLE PROCUREMENT CODE OF CONDUCT (SPCC)

Supply Chain Management

P&SC GRIEVANCE PROCEDURE: TOGETHER, WE SHAPE A RESPONSIBLE SUPPLY CHAIN WITH VENDORS

P&SC Grievance Framework Overview

At Tenaga Nasional Berhad (TNB), integrity and accountability are the fundamental values of our operations and partnerships. Our vendors play a crucial role in upholding these values, and we are committed to maintaining the highest ethical standards across our supply chain. In line with this commitment, we have implemented the Procurement and Supply Chain (P&SC) Grievance Procedure, which is in accordance with our Sustainable Procurement Code of Conduct, Labour Rights Policy, and Code of Business Ethics.

This procedure establishes a formal channel for employees, stakeholders, and the public to report grievances related to unethical vendor conduct and supply chain practices, including, but not limited to bribery, corruption, fraud, unfair labour practices, harassment, discrimination, health, safety and environmental concerns. To facilitate reporting and demonstrate openness, information about the grievance channel is publicly available on our website.

The P&SC Grievance Procedure outlines a structured and efficient process for addressing these grievances, ensuring accountability, and fostering continuous improvement-thereby reinforcing our core values in every interaction.

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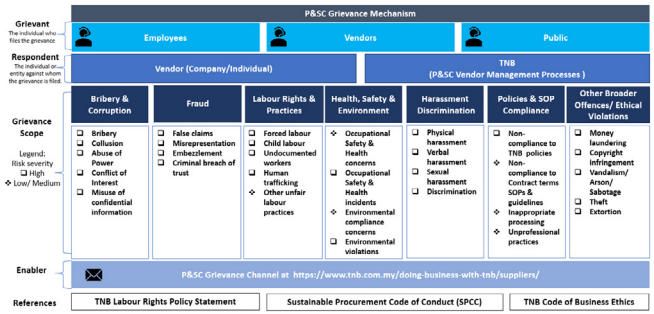
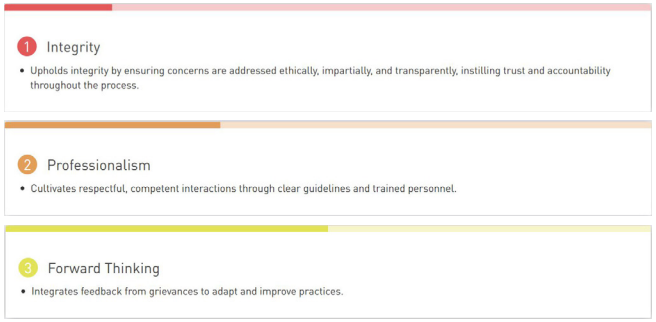
Supply Chain Management

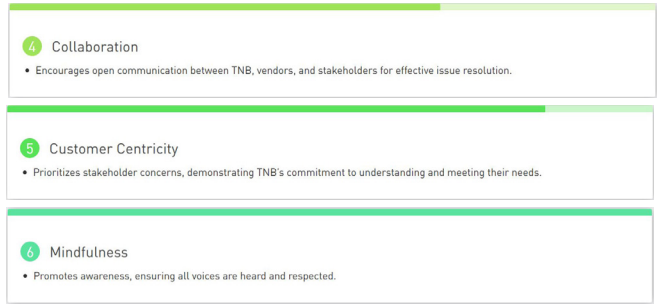


An overview of TNB P&SC Grievance Framework

Embracing Our Core Values through Grievance Procedure

The P&SC Grievance Procedure is designed to embody and promote TNB's core values, which are integral to our approach in addressing grievances:





Together, these core values foster an environment of openness and empowerment, encouraging individuals to raise concerns without fear and ensuring that issues are addressed fairly, responsibly and with accountability.

Key Components of the P&SC Grievance Procedure

To ensure the grievance procedure is both effective and efficient, these key components drive transparency, accountability, and continuous improvement:

- Clear Grievance Process: The procedure is outlined on our website, providing clear guidance for employees, vendors, and the public to report concerns. The grievance follows a structured process, including thorough investigation, evaluation, resolution, and ongoing monitoring, to ensure fair and equitable outcomes.

The P&SC Grievance Process

- Accessible Reporting Channel: Our dedicated P&SC Grievance channel allows confidential reporting, safeguarding anonymity while encouraging open communication.
- Grievance Committee and Oversight: The P&SC Grievance Committee, composed of experts from diverse backgrounds, along with the Board Integrity Committee (BIC), ensures rigorous oversight and upholds good governance, reinforcing our commitment to accountability and transparency.
- Continuous Improvement and Vendor Support: TNB maintains an open dialogue with vendors to address challenges, share best practices, and provide training and resources. This support helps vendors understand and meet our ethical standards.

As we move forward, TNB is dedicated to refining our grievance procedure and enhancing ethical compliance. We actively seek feedback to ensure our framework evolves in response to stakeholder needs.

In conclusion, the P&SC Grievance Procedure is central to TNB's commitment to ethical practices, accountability, and sustainability. It provides a formal and structured process for addressing grievances related to unethical vendor conduct and supply chain practices. This procedure ensures that concerns are handled transparently, ethically, and efficiently, leading to fair outcomes for all parties involved. Ultimately, this comprehensive approach strengthens the integrity of our supply chain and supports the development of sustainable, responsible business practices.

Supply Chain Management

ELEVATING PARTNERSHIPS: INTRODUCING TNB'S SUSTAINABLE PROCUREMENT CODE OF CONDUCT (SPCC)

Supporting National Aspirations and Empowering Sustainable Businesses

Tenaga Nasional Berhad (TNB) recognises the crucial role of sustainable vendors as integral partners in driving responsible business practices for a shared future. We are committed to supporting the goals we share, which include fostering a more sustainable and innovative business ecosystem. This encompasses driving innovation in clean energy technologies and empowering vendors across the entire value chain. By championing best practices, we're proud to introduce our Sustainable Procurement Code of Conduct (SPCC), fostering a collaborative environment where responsible businesses can thrive alongside TNB.

READ MORE

Supply Chain Management

Aligning Procurement with Shared Values

Established in 2006, the Procurement Code of Conduct (PCoC) primarily focused on ethical practices and supplier capabilities. Recognizing the growing importance of Environmental, Social, and Governance (ESG) considerations, our Procurement and Supply Chain (P&SC) division undertook a comprehensive review. The SPCC builds upon the PCoC's core principles of integrity, accountability, and capability declarations while expanding to encompass six additional sustainability elements that benefit both TNB and our vendor network.

Here are the key enhancements of the SPCC:

Environmental Responsibility

Suppliers and contractors are required to adhere to environmental regulations and are encouraged to adopt sustainable practices within their operations. This aligns with Malaysia's National Energy Transition Roadmap (NETR), which aims to reduce greenhouse gas emissions and promote renewable energy sources.

Prioritising Health & Safety

The SPCC emphasises compliance with occupational safety regulations and the creation of safe work environments that safeguard employee well-being. This aligns with TNB's commitment to providing a safe and healthy workplace for all.

Respecting Labour Rights

TNB is committed to upholding labour rights within our supply chain. The SPCC reflects this commitment by prohibiting modern slavery and child labour and fostering a diverse and inclusive culture, all in accordance with Malaysian law.

Fostering Innovation

The SPCC encourages collaboration with suppliers and contractors to support TNB's open innovation initiatives, driving value creation for a more sustainable future. This could lead to the development of cleaner energy technologies, further supporting NETR's focus on innovation in the energy sector.

Data Security and Privacy

The SPCC mandates that suppliers and contractors comply with relevant data protection laws and TNB's policies to safeguard personal data security. This ensures the responsible handling of sensitive information throughout the procurement process.

Protecting Information & Intellectual Property

The SPCC ensures transparency by requiring suppliers to provide necessary information for security vetting and fulfil reasonable requests for additional documentation. This protects TNB's intellectual property and minimises security risks.

Building a Sustainable Future, Together

The SPCC aligns with industry best practices, promoting responsible procurement within our supply chain. By emphasising environmental compliance, occupational safety, labour rights, and data protection, the SPCC creates a framework for sustainable and ethical procurement practices.

The introduction of the SPCC, approved in February 2024, signifies a significant step forward in our shared sustainability journey. This initiative demonstrates TNB's commitment to partnering with businesses that share our values, environmental leadership, social well-being, and strong governance.

Our SPCC establishes a benchmark for responsible procurement while reinforcing TNB's position as a sustainability leader. We remain dedicated to continuous improvement of our procurement processes, driving positive change for a more sustainable future.

Community Relations

https://www.tnb.com.my/sustainability/esg-stories/

PROVIDING HOMES FOR THE NEEDY, TNB'S EFFORTS FOR A BETTER MALAYSIA

LET'S ENERGISE MALAYSIA CLEAN FUTURE, TOGETHER WE CAN MAKE A DIFFERENCE IN ENERGY TRANSITION

Community Relations

PROVIDING HOMES FOR THE NEEDY, TNB'S EFFORTS FOR A BETTER MALAYSIA

Malaysia's B40 income group, representing the lowest 40% of earners, continues to struggle with housing insecurity. As of 2022, around 3.16 million households are part of this group, earning less than RM5,250 monthly. The pandemic has worsened these conditions, pushing over half a million middle-income households into this vulnerable category, further increasing the strain on affordable housing.

To address these pressing issues, we launched the Home For the Needy programme, focusing on providing secure and comfortable housing for underprivileged families, ensuring that more Malaysians have a safe place to call home.

READ MORE

Community Relations

Programme Goals and Actions

The Home For the Needy programme is an important part of our corporate social responsibility (CSR) strategy, which dedicates 1% of Profit After Tax (PAT) to community development. We target Malaysia's B40 income group specifically focusing on single parents, senior citizens, and differently-abled individuals who are most in need.

Since 2018, we have successfully provided 813 homes under Projek Baiti Jannati (PBJ) of the Better Brighter Home initiative, which were rebuilt, repaired, or purchased using zakat funds. Additionally, 119 homes were supported under Projek Mesra Rakyat (PMR), benefitting non-Muslim communities through CSR allocations. These efforts, totalling over RM40.2 million, mirror our commitment to supporting housing development for vulnerable families across Malaysia.

Through this programme, we have the opportunity to contribute to those in need of housing assistance and help to improve their living standards, ensuring that every family has a safe place to live. This demonstrates our dedication to promoting sustainability and socio-economic growth in society and we are honoured to support this effort, hoping it will continue to benefit communities across the nation.

> *"I am very grateful for this approval. Finally, I will be moving into my own home with my wife and daughter. I want to express my deepest appreciation to TNB and its staff for their tremendous help.*
>
> **Ahmad Rodzi Harun, 55**
> *— Baiti Jannati Programme @ Wilayah Persekutuan 2024*
> *'Baiti Jannati programme helps B40 communities', New Straits Times, 7 December 2024*

Category	Budget Allocation	Key Projects
Economic/Social	RM6.7 million (37%)	Better Brighter Home, Better Brighter Shelter & *Penyerahan Kenderaan Terpakai*
Sports	RM5.8 million (33%)	Sponsorship to Malaysian Hockey Confederation (MHC), TNB Thunderbolts & *Sumbangan Kayu Hoki*
Education	RM3.2 million (18%)	*Ceria Ke Sekolah*, Pintar Programme
Environment	RM2.3 million (12%)	Tree/Mangrove Planting, Eco Initiatives

We have already utilised RM12.94 million of the RM17.9 million CSR budget as of November 2024 and aim to fully allocate the remaining funds by December 2024. Our continued focus on education, housing, and environmental sustainability ensures that we provide tangible benefits to communities across Malaysia.

Ensuring Effective Implementation

We are actively working with local stakeholders and government agencies to ensure the efficient allocation of our CSR funds. For 2024, we aim to expand the Projek Baiti Jannati initiative and Projek Mesra Rakyat, with the goal of supporting B40 and asnaf families in every state. Our long-term objective aligns with Sustainable Development Goal 1 (No Poverty), ensuring that all Malaysians have access to secure housing and a better quality of life.

Through our collective efforts, we seek to bring about positive changes and create a better quality of life for Malaysians, reflecting our commitment to housing security for vulnerable populations.

Community Relations

LET'S ENERGISE MALAYSIA CLEAN FUTURE, TOGETHER WE CAN MAKE A DIFFERENCE IN ENERGY TRANSITION

Imagine a Malaysia bathed in sunlight, powered by the wind, and brimming with clean energy. This isn't a dream, it's a vision we can achieve, but it takes all of us. By transitioning to clean energy, we'll not only breathe easier with cleaner air, but we can also boost our economy and create a healthier future for all. Let's be part of the solution for a cleaner future.

READ MORE

Community Relations

Empowering Customer Empowerment via Malaysia Energy Literacy Programme (MELP)

While individual actions are crucial, knowledge is power. That's why Tenaga Nasional Berhad (TNB) is deeply committed to empowering Malaysians to make informed choices about energy use. Through the Malaysia Energy Literacy Program (MELP), launched in 2023, TNB offers a variety of programmes for different audiences, including schools and universities. These programmes equip future generations with the knowledge to become energy ambassadors, promoting sustainability on campus and beyond.

Target Audience	Programme Focus	Benefits
Schools & Universities	Building a foundation of energy knowledge through interactive programmes	• Educates future generations on energy use and sustainability • Creates a more informed and conscious society
University Students (Highlighted Programme)	Energy Literacy Module	• Equips students with the knowledge to become energy ambassadors • Promotes sustainability on campus and beyond
The Public	Learning about smart energy habits, electric vehicles, and the energy transition	• Empowers individuals to make informed choices about energy consumption • Drives energy efficiency and responsible consumption • Supports the national goal of achieving 70% renewable energy by 2050

Feeling the Heat? It's Not Just the Weather

Green house gases especially carbon dioxide, traps heat, causing climate change and making our air thick and smoggy. The result? More respiratory problems, a strain on healthcare systems, and honestly, just not feeling our best.

But here's the good news, by transitioning to clean energy and pursuing ambitious goals like net zero emissions, we can create cleaner air for all. Net Zero emissions is the ultimate goal in the fight against climate change, requiring a comprehensive approach that tackles all greenhouse gases, not just carbon dioxide (CO2). This goes beyond carbon neutrality, which focuses solely on operational CO_2 emissions. Cleaner air also means fewer asthma attacks, less coughing, and a healthier you. Plus, studies show it can even lead to lower healthcare costs. So, let's ditch the dirty air and embrace a brighter, breezier future!

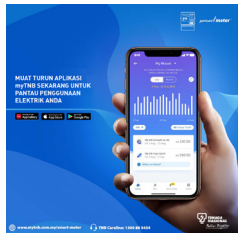
Small Changes, Big Differences

Ready to make a difference? It all starts at home. From switching to energy-efficient appliances to embracing sustainable transportation, small changes in your daily life can have a big impact on the environment. Dive in and discover how you can be a clean energy champion, both at home and in your community.

1. Embrace Energy Efficiency: Every little bit counts when it comes to saving energy. Here's how you can make a difference, starting with some easy wins at home:

- **Switch to LED bulbs -** Ditch those old, energy-guzzling light bulbs for bright and efficient LEDs. They'll light up your life and lower your electricity bill.
- **Utilise energy-efficient appliances -** Invest in energy-efficient appliances. They use less energy to get the job done, saving you money on your electricity bills and helping the environment.
- **Adopt responsible habits -** like turning off lights when not in use and air-drying clothes (weather permitting). When you're not using electronics, unplug them.
- **Adjust appliance settings -** Review your water heater temperature and use those eco-cycles on your dishwasher and washing machine. They might take a little longer, but they'll save you big on energy use.

Community Relations



2. Unleash Your Energy Saver

- **Track Your Energy Use -** Want to become an energy master of your own home? The MyTNB App empowers you to track energy usage patterns, identify areas for improvement, and set personalised goals for reducing your electricity bill. With this user-friendly tool, you can transform your home into a haven of energy efficiency, saving money and helping the environment

3. Embrace Sustainable Transportation:

- **Consider Alternative Modes -** For short trips, consider alternative modes of transportation that contribute to a cleaner environment. Walking and cycling are excellent choices that promote personal health while reducing reliance on personal vehicles and their carbon footprint.

- **Carpooling and Ridesharing -** When driving is unavoidable, carpooling or ridesharing services offer a more efficient use of fuel resources and reduce the number of vehicles on the road.

- **Maintain Your Vehicle -** Maintaining your vehicle regularly ensures optimal performance and minimises fuel consumption and emissions.

4. Spread the Green Message

- Share your knowledge with friends, family, and neighbours. Encourage them to embrace sustainable practices, engage on social media and lead by example. Together, your collective actions can create a cleaner future for all Malaysians.

5. Make Your Voice Heard

- Advocate for change by supporting renewable energy policies. Contact your lawmakers and state assembly members and voice your support for clean energy initiatives. Together, our voices can shape policies for a cleaner future for generations to come.

Want to make a significant difference? Explore these investment opportunities to maximise your clean energy impact:

Explore Electric Vehicles (EVs)

Explore electric vehicles (EVs). While the initial investment might be higher, you'll enjoy a quieter ride, a reduced carbon footprint, and the convenience of a growing nationwide charging network facilitated by TNB. Plus, with increasing affordability, EVs are becoming a more accessible option.

Smart Home for Sustainable Living

Make your home a champion of sustainability with smart thermostats and power strips. These technologies automate energy usage and optimise consumption patterns, saving you money and helping the environment.

Harness the Power of the Sun

Harness the sun's power with rooftop solar panels. Programmes like Net Energy Metering (NEM) and Supply Agreement for Renewable Energy (SARE) from TNB make it easier than ever. Contribute directly to the national green energy mix and enjoy the benefits of clean, renewable energy. If rooftop panels aren't an option, explore the Green Electricity Tariff (GET) programme. Remember, even small changes can make a big difference. By starting with the low-cost options and gradually incorporating others, you can significantly contribute to a better Malaysia.

Community Relations

TNB: Powering a Brighter, Greener Future with You

Individual actions are essential, but a robust infrastructure is the backbone of a clean energy future. At TNB, we're committed to making this vision a reality for Malaysia. Let's explore how we're paving the way for a cleaner, more sustainable tomorrow:

Investing in Renewables

TNB is committed to significantly increase renewable energy capacity, aiming for 8.3 GW by 2025. This means actively exploring and integrating solar, wind, and other clean energy sources into the national grid, for a cleaner and more sustainable future.

The Grid Gets Smarter

Integrating renewable energy requires a more flexible and intelligent grid infrastructure. TNB invests in smart grid technologies like Advanced Metering Infrastructure (AMI), which equips homes and businesses with smart metres, allowing for real-time energy consumption data for efficient grid management, and seamless integration of these renewable energy sources.

Expanding Grid Connectivity

As the clean energy mix grows, the grid needs to adapt. TNB is actively expanding capacity and developing interconnection projects, fostering cross-border energy sharing and enhancing grid flexibility and security

Energy Storage Solutions

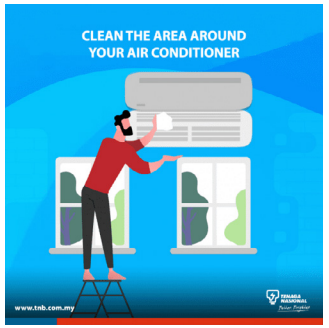
Renewable energy sources like solar and wind can be variable. Energy storage solutions like Battery Energy Storage Systems (BESS) and Community Energy Storage System (CESS) play an important role to manage this variability. Think of it as a giant energy bank, storing clean energy when it's abundant and releasing it when needed. Pioneering projects like Elmina City showcase how CESS technology can optimise clean energy use in smart townships, paving the way for a sustainable future.

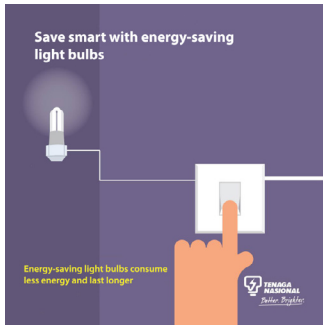
Together, We Can Light the Way

TNB remains steadfast in its commitment to supporting the national energy transition. This comprehensive approach includes developing a nationwide charging network for electric vehicles, implementing renewable energy programmes and smart grid initiatives, and exploring cutting-edge energy storage solutions. However, the success of these endeavours hinges not only on our commitment but also on collaborative action.

By embracing sustainable practices and actively participating in available programmes, we can all become key contributors to a cleaner and more secure energy future for Malaysia.

Together, we hold the power to make a difference.





Corporate Governance

PUTTING POLICY-DRIVEN SOLUTIONS IN MOTION TO ADVANCE SUSTAINABILITY

Corporate Governance

PUTTING POLICY-DRIVEN SOLUTIONS IN MOTION TO ADVANCE SUSTAINABILITY

At Tenaga Nasional Berhad (TNB), we believe sustainability isn't just a choice-it's a necessity. As a leading provider of energy solutions, we're committed to steering towards sustainability locally and internationally. With our eyes set on the TNB Sustainability Pathway, we're driving towards becoming a net zero company by 2050, propelling ourselves towards Environmental, Social & Governance (ESG) excellence.

In light of the pressing need for environmental action, it has become more evident than ever that adopting sustainable practices is crucial. TNB acknowledges this imperative and is taking proactive measures to tackle these challenges head-on.

READ MORE

Corporate Governance

Sustainable Commitments and Actions at TNB

TNB's Sustainability Policy is driven by a commitment to ethical, responsible, and sustainable practices. This policy sets a course for environmental, social, and governance excellence, aligning with legal requirements and international standards. Our aim is to drive positive change in the communities we serve, ensuring that our actions are sustainable and have a positive impact.

We prioritise multiple key areas to promote sustainability locally and internationally:

1 Environmental Goals

- We are committed to reduce emissions, promote energy efficiency, and seek opportunities in renewable energy in line with the TNB Energy Transition Plan.
- We are committed to optimise the utilisation of natural resources through effective land use and water management.
- We are committed to manage waste responsibly to minimise adverse effects on human health and the environment.
- We promote to minimise impact on biodiversity and protect environmental ecosystem.
- We strive to comply with environmental laws, regulations and obligations through our business operations.

2 Social Goals

(a) Employee:

- We are committed to safeguard labour rights of our employees based on the relevant legislation under the relevant law and align our business operation with the industry best practises.
- We strive to provide a compelling Employee Value Proposition and sustain a high performing culture with enhanced employee experience.
- We are committed in human capital development and fostering a culture of sustainability throughout the organisation.
- We are committed to advocate and enforce safety standards to promote the safety and long-term well-being of our workforce.
- We are committed to comply with relevant labour laws and we support the rights of freedom of association.

(b) Community:

- We are committed in supporting nation building by supplying reliable and affordable electricity and continuously contributing to community development programmes.
- We are committed to engage with the local communities in or near areas where we operate with the purpose of promoting their well-being and enhancing socioeconomic benefits.
- We are committed in safeguarding customer data and privacy from security breach.

(c) Vendor:

- We advocate sustainability practices across our supply chain ecosystem.
- We advocate for our vendors to embrace TNB shared values.

3 Governance Goals

- We strive to uphold high standards of corporate governance and business conduct.
- We are committed in adopting robust sustainability governance structure to facilitate oversight, strategic management, and implementation of sustainability strategies and initiatives.
- We are committed in embracing ethical business conducts through compliance with relevant regulations, TNB Integrity Policies and TNB Code of Business Ethics.
- We are committed in implementing best practices in our risk management and seizing opportunities.

4 Each TNB employee is accountable and responsible to:

- Integrate sustainability strategy into daily operations;
- Deploy and execute sustainability initiatives; and,
- Contribute to effective sustainability performance.

Going Above and Beyond

As the energy landscape evolves, TNB remains committed to taking charge of sustainability. Our Sustainability Policy is a testament to our dedication to creating a better world for future generations rather than just a set of guidelines. By embracing these principles, we promote environmental responsibility, foster social well-being, and uphold governance standards.

Join us as we build a sustainable future the TNB way: Better. Brighter.

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