



Carbon Footprint of Renewable Energy for ASEAN Countries

Status of Renewable Energy in Brunei Darussalam



Dr Wida Susanty Haji Suhaili

Assistant Professor

School of Computing and Informatics

Deputy Director for Centre of Innovative Engineering

Universiti Teknologi Brunei



Carbon Footprint of Renewable Energy for ASEAN Countries

Presentation Outline

- Brunei in a glance
- Forest Classification
- Department of Energy
- Brunei's Stand
 - BNCCP
 - Climate change



UTB offers help in peatland conservation
March 5, 2021
Universiti Teknologi Brunei (UTB) hopes to play a role in helping provide solutions to conserve the peatland ecosystem in the country through cross-cutting research...



UTB green project bags top Saudi award
October 4, 2019
Universiti Teknologi Brunei (UTB) received first prize under the category 'Best Non-Government Organisations (NGOs) Leading Practices' for the Kingdom of Saudi Arabia Award for...



DST, UTB join forces on Smart Environment, Farming
August 28, 2019
Wani Roslan Datastream Technology (DST) entered into a new collaboration with Universiti Teknologi Brunei (UTB) in line with the university's aim to develop Smart Environment...



UTB hosts dialogue session
January 29, 2019
A DIALOGUE session on Brunei-Networked ASEAN Peat Swamp Forest Communities (BRU-NAPC) under the ICT Virtual Organisation of ASEAN Institutes (ASEAN IVO) and National Institutes...



Fighting peat fires with technology
May 21, 2020
Izah Azahari Assistant Professor at the Universiti Teknologi Brunei (UTB) Dr Wida Susanty binti Haji Suhaili recently became the national finalist for Brunei Darussalam in...

Fighting peat fires with technology

An interview with Assistant Professor at the Universiti Teknologi Brunei Dr Wida Susanty binti Haji Suhaili, who recently became the national finalist for Brunei in the 2020 ASEAN-US Science Prize for Women.

Izah Azahari
Assistant Professor at the Universiti Teknologi Brunei (UTB) Dr Wida Susanty binti Haji Suhaili recently became the national finalist for Brunei Darussalam in the 2020 ASEAN-US Science Prize for Women.

Dr Wida Susanty
Assistant Professor at the Universiti Teknologi Brunei (UTB) Dr Wida Susanty binti Haji Suhaili recently became the national finalist for Brunei Darussalam in the 2020 ASEAN-US Science Prize for Women.

"I started my research on the [peat] as I worked with School of Computing, where my focus is more on Computer Network and Security (CNS), the said.

When she initially ventured into the research project on Peatland, the team felt was not correct yet and was more known as Wireless Sensor Network with the use of sensors to detect without wires to collect data.

"When a peatland catches fire it is different from a normal forest fire because it releases carbon," said Dr Wida Susanty. "When this occurred in 1995, everything closed down, children couldn't go to school because of the smoke. It really affects the economy, health of the people and everyday activities."

She also referred to the most recent fire in Indonesia that affected several neighbouring countries including Brunei, and if it is not controlled in the first place it can get to a really hot level.

Motivated by her CNS background, Dr Wida Susanty felt the need to understand the peatland and its impact on the environment. She also engaged an individual at Universiti Teknologi Brunei (UTB) which then led her to connect with the Forestry Department, Ministry of Natural Resources and Environment, Brunei Darussalam (MNRTE), where the research then turned into a final year project (FYP). Since 2018, the project has been evolving.

In 2019, Dr Wida Susanty said there was a call for proposal from the ICT Virtual Organisation of ASEAN Institutes and NCT (ASEAN IVO) in Japan where she had the opportunity to collaborate on a regional project with experts from Malaysia, Indonesia and Japan.

She shared that Brunei, Malaysia, Indonesia and Japan are looking into a project called the Networked ASEAN Peat Swamp Forest Communities (NAPC) concerning transboundary heat.

Brunei, although a small country, also contributes to the NAPC because a big portion of the Sultanate is covered in peatland. The contributing started off with lab-based research of making small samples that were connected to the field, but never tested in the real environment, which then evolved to securing more devices with the funding from NAPC.

"In Brunei, as far as disaster management, the first agency we actually contacted was the National Disaster Management Centre (NDMC) as we thought they were the ones who dealt with these things. They then directed us to other agencies," added Dr Wida Susanty.

Continue to Page 14

Facts About Brunei

Where is Brunei ?
South East Asia

Land size
5,765 KM²

Population:
412,238

Main Industry:
Oil and Gas



FIGURE 1. THE 10-MEMBER NATIONS OF ASEAN

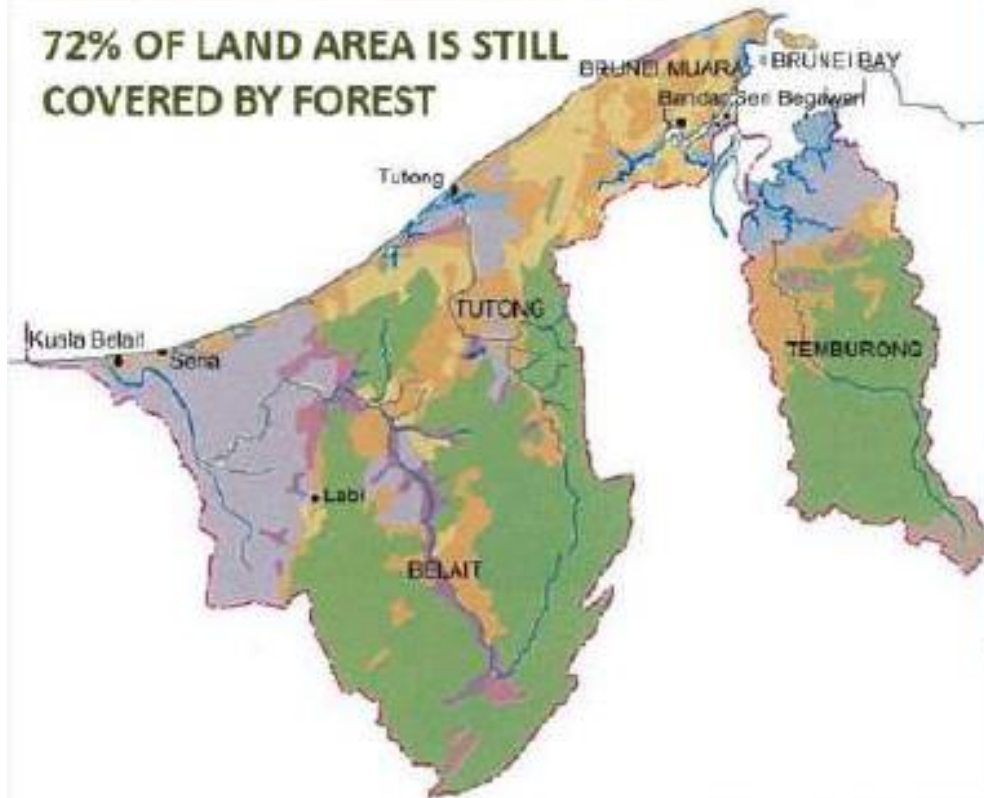


Public Universities in Brunei:

- **Universiti Teknologi Brunei**
- **Universiti Brunei Darussalam**
- **Universiti Islam Sultan Sarif Ali**
- **KUPPU SB – SBRT Universiti**



72% OF LAND AREA IS STILL COVERED BY FOREST





جابتن تنانگ
DEPARTMENT OF ENERGY
PRIME MINISTER'S OFFICE | BRUNEI DARUSSALAM

gov
.bn

ABOUT US

OUR LEADERSHIP

DIVISIONS

UNITS

DEPARTMENT

NEWS ROOM

OUR SERVICES

RESOURCES AND STATISTICS

CONTACT US

SEARCH

OUR LEADERSHIP

FOREIGN WORKER LICENSE (LPA)

SPECIAL AUTHORIZATION WORK PASS (SAWP)

PROFESSIONAL VISIT VISA (PVV)

LBD REPORTING

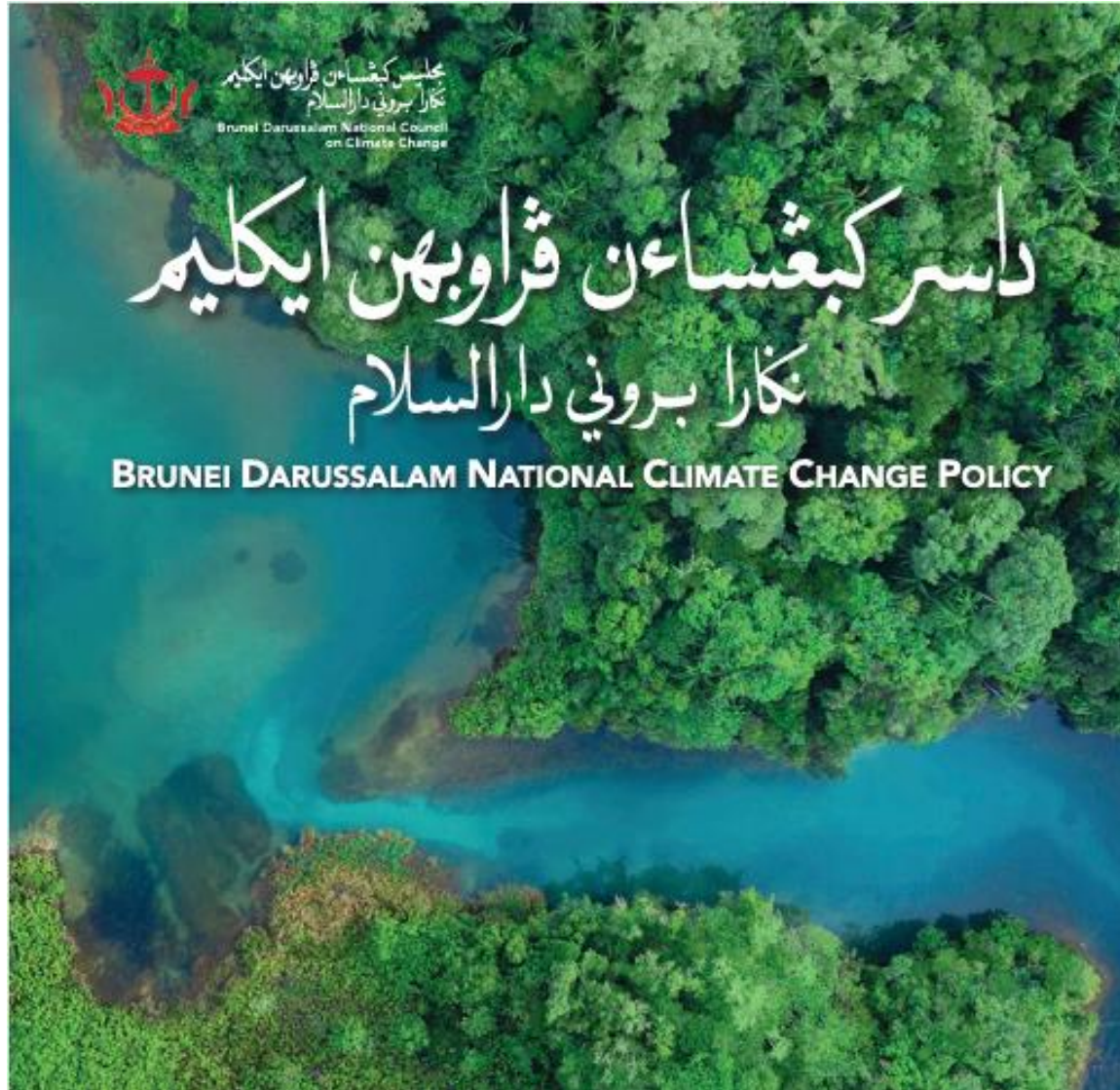
NET-METERING PROGRAMME

SOLAR PV CONTRACTOR REGISTRATION

VISIT TO TENAGA SURIA BRUNEI

ENERGY SAVING TALK

Published: July 2020
Brunei Climate Change Secretariat (BCCS): BNCCP



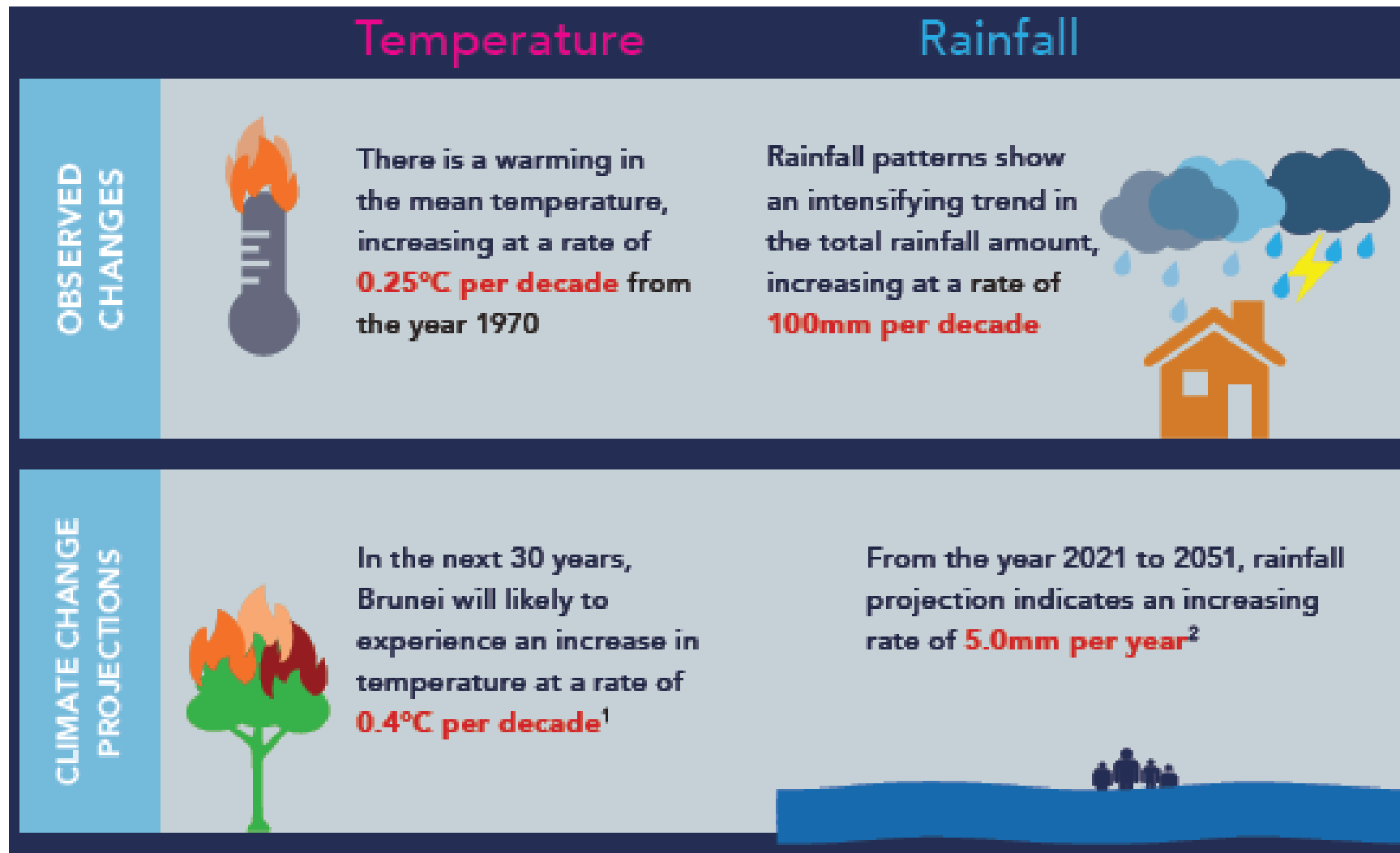
“Towards a low carbon and climate-resilient Brunei Darussalam”

Brunei adopts a Whole-of-Nation approach in addressing adverse changing climate patterns

- Effective policies, careful planning and management
- Brunei committed to pave-low carbon and climate-resilient pathways for sustainable nation
- The BNCCP underpins the principles, values and strategies to reduce carbon emissions, increase carbon sink and strengthen climate resilience nationwide.

Climate change impacts in Brunei Darussalam

- Brunei has an equatorial climate, experiencing year-round high temperature, rainfall and humidity. Change in climate patterns exacerbate weather-related disasters



PRECIS (Providing Regional Climates For Impact Studies)/ 20 System, report by BDMD (2020)

Climate Change

**How do we mitigate
the impacts of climate change
and build resilient?**

Early Evidence of Climate Change



ADAPTATION/ MITIGATION OF CLIMATE CHANGE

Flood Mitigation Project



Pumped Drainage



River wall



Damuan Detention Pond

Coastal Protection Project



كَمَنْتَرِين قُمْبَاغُونِن
Kementerian Pembangunan
Negara Brunei Darussalam

In the first quarter of 2019,
the Government has
implemented a coastal
protection project
approximately 56km from
the 161km coastline in
Brunei Darussalam

Project Cost for Climate
Adaptation

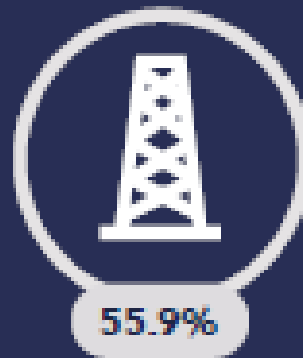
BND68.2million
(RKN 2015-2020)

GREENHOUSE GAS INVENTORY 2018

91.2%
CO₂

10.1
Mt CO₂e

Share of GHG
emissions by sector



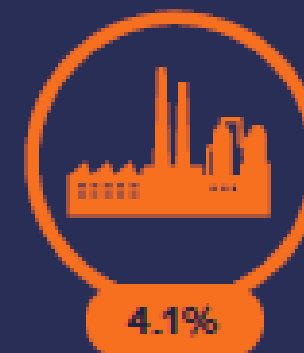
**Power
Generation**



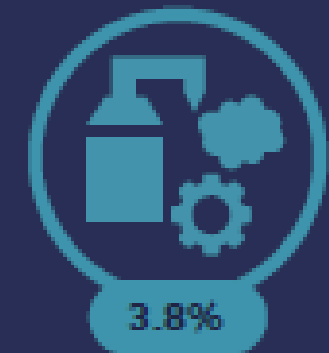
**Fugitive
Emissions**



**Land
Transport**



**Manufacturing &
Construction**

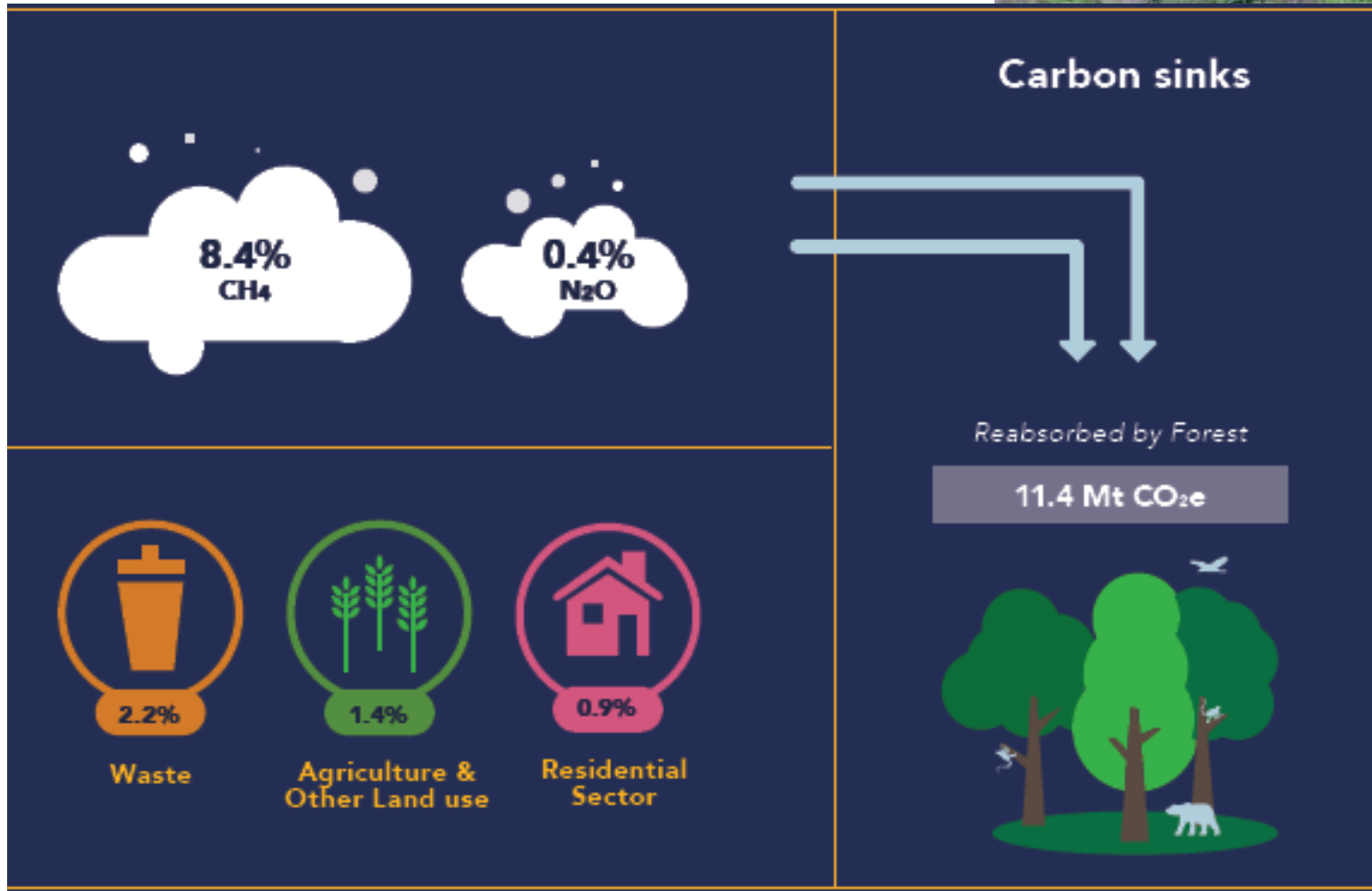


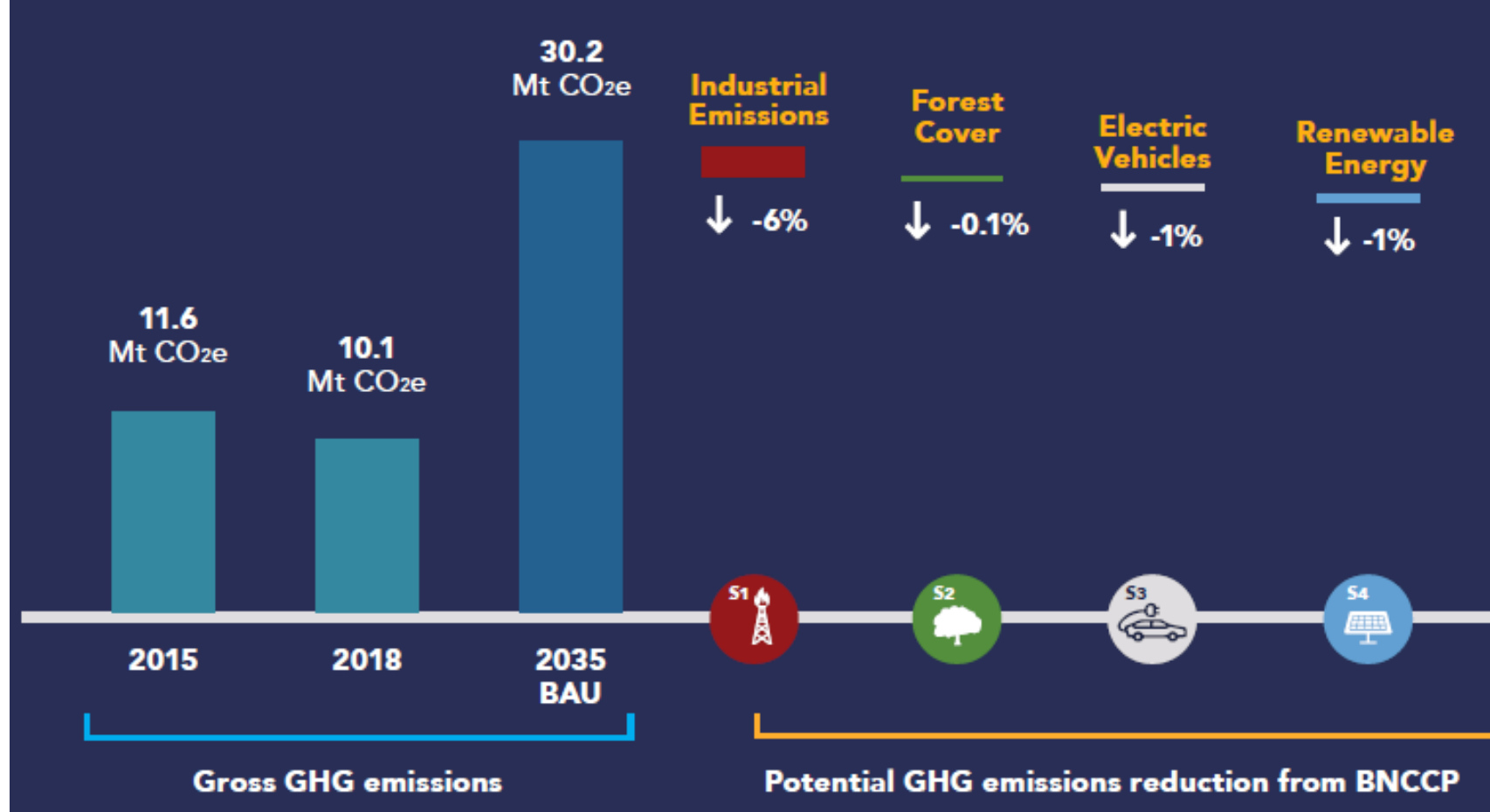
**Industrial
Processes**

Note: 1. Carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) are the only gases covered in inventory. Emissions of these GHGs are presented using a common metric, CO₂ equivalent (CO₂e), which indicates the relative contribution of each gas, per unit mass to a Global Warming Potential (GWP).

2. Units are presented in Million tonnes of CO₂ equivalent (Mt CO₂e).

Regeneration of vegetation in areas devastated by peatland forest fire due to high temperature and human negligence





Disclaimer: 1. The stated figures for the projection under BAU and BNCCP scenarios will be subject to revision and further updates and improvement to the methodologies used.
2. Carbon pricing (Strategy 6) is based on carbon removal scenarios.

- Modelling of BNCCP shown above strengthened by targets outlined in Strategy 1 -7
- Potentially to reduce GHG emissions to more than 50% in 2035
- From 2015 - 2018, GHG emissions have declined at a pace of approximately 4% per year, driven mainly by the reduction of upstream emissions from flaring and venting

- Brunei's National Climate Change Policy is guided by the principles of achieving Wawasan Brunei 2035
- Promote Brunei's economic security, sustainability and prosperity through a low carbon approach in three key areas.

Oil & Gas Exports

To increase oil and gas production



Environmental Sustainability

To protect Brunei Darussalam's pristine environment



Economic Diversification

To increase downstream industry economic output contribution
&
Increase new non-oil and non-gas based industry activities



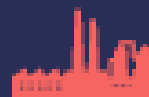
Brunei Darussalam National Climate Change Policy



Industrial Emissions



Electric Vehicles



Power Management



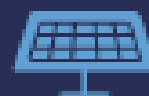
Waste Management



Carbon Inventory



Forest Cover



Renewable Energy



Carbon Pricing



Climate Resilience & Adaptation



Awareness & Education

The BNCCP will open New Opportunities



- **Green or Low Carbon Industries**
- **Local Business Development**
- **Local Employment and Competencies**
- **Digital Technologies**
- **Research and Development**
- **Foreign Direct Investment**

Fugitive emissions from oil and gas production, transportation, processing, venting and flaring declined by 65% over the period of 2010 to 2018. Substantial rejuvenation projects within the oil and gas industry facilities for GHG emissions abatement both onshore and offshore were the main driver for the reduction. Despite this, fugitive emissions still account for about 18.1% of Brunei Darussalam's total GHG emissions in 2018.



Brunei Darussalam is home to one of the most diverse and complex ecosystems in the world. Forest cover constitutes about 72%, or 380,000 hectares, of land area which plays a vital role in carbon sequestration. Brunei Darussalam aims to increase its forest reserve from 41% to 55% of the total land area. At present, 104,920 trees have been identified to increase the country's carbon sink through reforestation efforts.





Brunei's Stand on Forest and Biodiversity

- Brunei takes a **conservative approach** in forest exploitation to avoid overexploitation of forest resources
- Forestry sector may not be a major economic sector as such, but it has a **huge role in other sectors**
- Emphasize intrinsic values e.g. **ecological services**, as vital components in forest biodiversity management, apart from economic values
- Brunei applies **Sustainable Forest Management** in ensuring permanent Forest Reserves **at 55% of land area**

Forest Cover: Lead Agency (MPRT) Ministry of Primary Resources & Tourism

Nature-based solutions in Brunei

- To increase Brunei Darussalam's carbon sink through afforestation and deforestation programmes with a target of planting 500,000 new trees by 2035
- Forest cover constitutes about 72% or 380,000 hectares of land area which plays a vital roles in carbon sequestration
- Green Protocol: 26,000 tree planting campaign
- Blue carbon initiatives in conjunction with 37th National Day
- Cut 1, Plant 4 policy for logging
- Cut 1, Plant 1 policy for land development
- Increase forest reserves area from 41% to 55%



Electric Vehicle

Land transportation accounted for the third-largest share of GHG emissions in 2018. The total number of registered vehicles were over 426,000, and oil (gasoline and diesel) remains the primary fuel used in this sector. High car dependency, ownership and usage lead to an increase in the number of active vehicles on the road. The number of vehicles is expected to grow at a rate of 2% annually between 2018 and 2035. A shift towards electrification is a viable option for Brunei Darussalam because travelling is mostly short-distanced, and electricity is inexpensive for charging. This will significantly reduce fuel consumption and subsequently cut down GHG emissions in this sector.



Renewable energy accounts for just 0.14% of Brunei Darussalam's total electricity generation mix, which comes from a 1.2 MW solar PV demonstration power plant, Tenaga Suria Brunei in Seria, Belait District. In view of the country's significant solar radiance, solar PV offers the most practical option to meet domestic demand for electricity in terms of grid parity. However, Brunei Darussalam will continue to undertake resource assessment and feasibility of solar water heating, biofuels (diesel, gas, aviation fuels), and ocean (hydroelectricity).



Tenaga Suria Brunei in Seria Belat District, Renewable Energy

Target to increase total share of renewable energy to at least 30% of the total capacity in the power generation mix using mainly solar photovoltaic (PV) by 2035

Strategic Objectives

- 1 Establish local competencies towards a regional centre of excellence in renewable energy.
- 2 Facilitate seamless integration of renewable energy mix into the national power generation mix.
- 3 Establish financial mechanisms to support renewable energy research, development and deployment.
- 4 Establish attractive Foreign Direct Investment (FDI) packages for different types of renewable energy sources and technologies.
- 5 Establish a Renewable Portfolio Standard for Brunei Darussalam for energy-intensive industries.



Renewable Energy capacity in the total generation mix (in %)



No. of high impact R&D research initiatives (in Units)



Amount of FDIs on Renewable Energy projects (in BND)



No. of households participating in net metering scheme (in Units)



No. of local SMEs in Renewable Energy sector (in Units)

Power generation is dominated by fossil fuels and it is the largest source of GHG emissions in Brunei Darussalam, accounting for 55.9%. Largely driven by highly subsidized fuel and demand growth, electricity generation grew by 14.3% between 2010 and 2018. Department of Electrical Services (DES) and Berakas Power Company (BPC) are the two main power utilities, and jointly account for about 889 MW of total power capacity. At present, there are seven gas-fired power stations and one diesel power station.

Power Management



Electricity consumption at all sectors (in kWh)



No. of electrical appliances labelled with star ratings (in %)



Power plant efficiency (in %)



No. of street lights replaced with LED (in %)



Energy Intensity reduction (in %)

10 Key Strategies to shape Brunei Darussalam to a Low-Carbon and Climate-Resilient

Strategies

The Brunei Darussalam National Climate Change Policy shall adopt ten key strategies with 2035 as a general target year.

1

INDUSTRIAL EMISSIONS

Reduce overall emissions in the industrial sector through zero routine flaring and to As Low As Reasonably Practicable (ALARP).



2

FOREST COVER

Increase carbon sink through afforestation and reforestation with a target of planting 500,000 new trees.



3

ELECTRIC VEHICLES

Increase total share of Electric Vehicles to 60% of total annual vehicle sales.



4

RENEWABLE ENERGY

Increase total share of renewable energy to at least 30% of total capacity in the power generation mix.



5

POWER MANAGEMENT

Reduce GHG emissions by at least 10% through better supply and demand management of electricity consumption.



6

CARBON PRICING

Impose price on carbon emissions.



7

WASTE MANAGEMENT

Reduce municipal waste to landfills to 1kg/person/day.



8

CLIMATE RESILIENCE & ADAPTATION

Increase capacity to adapt to climate impacts and in achieving resilience.



9

CARBON INVENTORY

Mandatory monthly and annual reporting of carbon inventory.



10

AWARENESS & EDUCATION

Increase awareness and education surrounding mitigation and adaptation responses against climate change.



The policy in accordance to Brunei's 4 key national circumstances.



An Oil and Gas Economy

Brunei Darussalam is a developing economy with heavy reliance on oil and gas. Diversification efforts are currently focused on energy-intensive industries, mainly downstream oil and gas.



Forested Areas

Brunei Darussalam prioritises nature-based solutions for its mitigation and adaptation measure which limits land availabilities for others such as large-scale renewable energy projects.



Fossil Fuel Dependency

Energy prices are heavily regulated. Energy supply mix is almost 100% fossil fuel-based, with a very small share in solar photovoltaic.



Vulnerable to Low Carbon World

As the world seeks to move towards carbon neutrality by 2050, fossil fuel may no longer be an option for Brunei Darussalam's current buyers. The role as an exporter may be impacted.



Sungai Liang Industrial Park (SPARK)



- Nation begin to shift towards an energy sector that includes low-carbon downstream and upstream of oil and gas industries
- SPARK Industries

AHEAD



BRUNEI FERTILIZER
INDUSTRIES



Create Awareness

- Education
- MYCE
- Carbon calculator

Towards a Low Carbon and Climate-resilient Brunei Darussalam

Brunei Darussalam adopts a Whole-of-Nation approach in addressing adverse changing climate patterns. Through effective policies, careful planning and management, Brunei Darussalam is committed to pave low carbon and climate-resilient pathways for a sustainable nation. This Brunei Darussalam National Climate Change Policy underpins the principles, values and strategies to reduce carbon emissions, increase carbon sink and strengthen climate resilience nationwide.



Carbon Calculator

Protokol Hijau Launched 30th January 2021

Reduce Government's Carbon footprint across all public sector premises

- Energy Usage
- Water Usage
- Paper Usage
- Plastic Usage
- Solid Waste Disposal
- Management of Official Events
- Tree-planting



These commitment to safeguarding the welfare of our people and ensuring a clean, green and sustainable environment can be preserved for our future generation.



Carbon Footprint of Renewable Energy for ASEAN Countries

Thank You!



Dr Wida Susanty Haji Suhaili
Assistant Professor
Deputy Director for Centre of Innovative Engineering
Universiti Teknologi Brunei
Wida.Suhaili@utb.edu.bn



References

- <http://www.climatechange.gov.bn/SitePages/Pages/bnccp-goals.aspx>