Net-Zero and NDCs: Science-based climate policymaking and implementation in Malaysia cities

31st AIM international workshop
July 22-24 2025 NIES Tsukuba

Prof. TPr. Dr. HO Chin Siong and
TPr Chau Loon Wai

UTM-Low Carbon Asia Research Centre
Faculty of Built Environment and Surveying
Universiti Teknologi Malaysia
Johor Bahru, Malaysia

CONTENT

1. Background and Malaysia's NDC / LT LEDS 2050
2. Malaysia in the context of Asean Climate Change Strategic Action Plan 2025-2030 (ACCSAP2025-2030)
3. Update Climate Action Plan for Malaysian Cities
    1. Penang Island Carbon Action Plan 2030
    2. Seremban City Climate Action Plan 2035
4. Conclusion

Background

Pledge of Voluntary 40% reduction of CO_2 emission intensity by 2020 to 45% emission intensity by 2030 and now carbon neutral nation by 2050

Asian and Malaysia cities : Key Challenges

Size: 330,803 km²

Population: 32 .7mil. (2021) I 1.32%pa growth rate

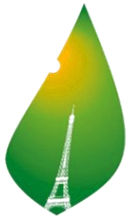
GDP: RM1.5 tril. or USD359bil (2021) 5% p.a growth rate

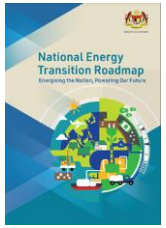
Issues

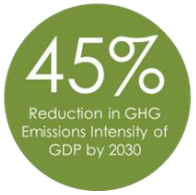
- Rapid urbanization and industrialization (5%pa)
- Rapid Increase in Data Centres in urban area
- Relatively high carbon intensity dependence on fossil fuel (80%^) and High private car ownership (15% public)
- Low density development and urban sprawl
- Global economic uncertainties

Government Policy Directions

- National Policy on the Environment
- National Green Technology Policy
- National Policy on Climate Change 2010
- Renewable Energy Act 2010
- SEDA Act 2010
- Green Neighborhood Planning Guidelines
- Low Carbon Cities Framework and Assessment Malaysia Smart City Framework 2018
- National Low Carbon Cities Masterplan 2022
- National Energy Policy 2022- 2040
- National Energy Transition Roadmap 2023







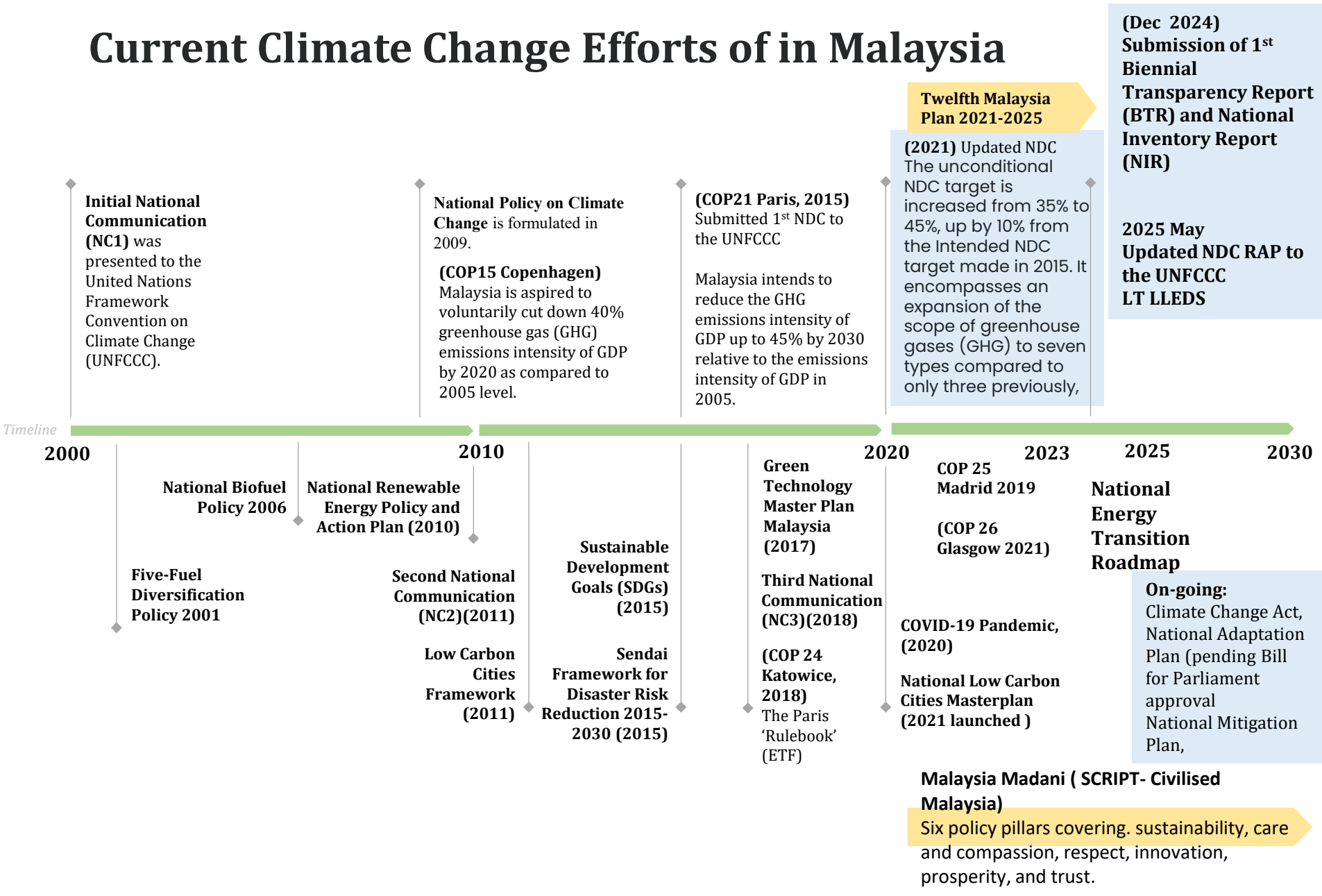
Collaborative efforts among Federal, state and local governments as well as the private sector and CSOs will be intensified to support the transition to a low-carbon nation

To address climate change across all GHG emitting sectors, namely energy, transport, IPPU, waste management, agriculture, forestry and land use.

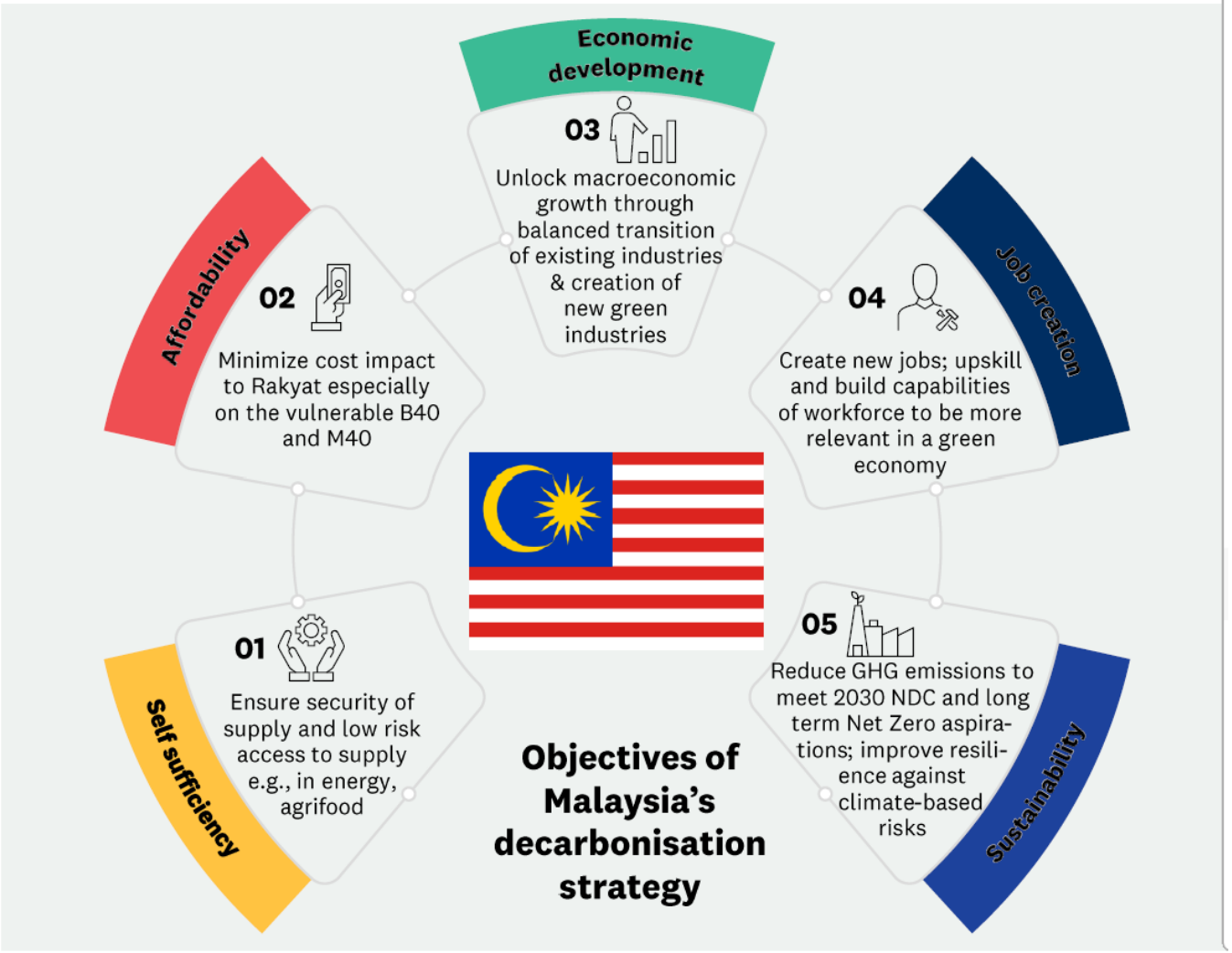
Malaysia's commitment to the Paris Agreement of the UNFCCC to reduce up to 45% GHG emissions intensity to GDP by 2030 based on emissions intensity in 2005, the focus will be on developing enabling instruments for climate action, including carbon pricing.

Promoting green and resilient cities and townships, enhancing green mobility and augmenting the consumption of low carbon energy as well as expanding the green market and GGP.

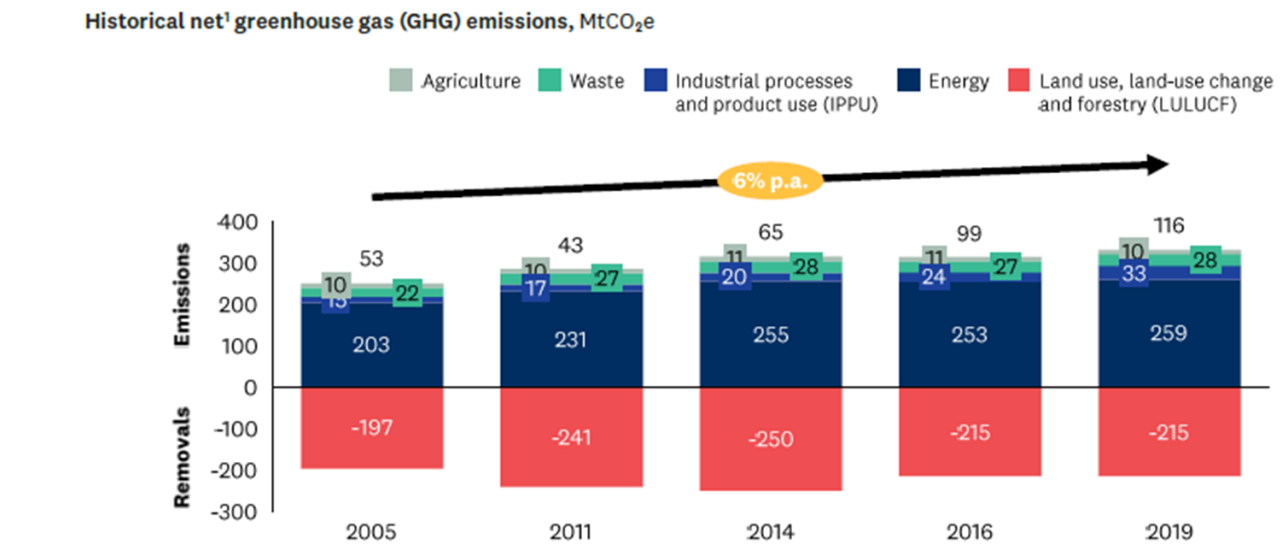
Current Climate Change Efforts of in Malaysia



Five Decarbonisation objectives (NDC RAP Malaysia 2025)



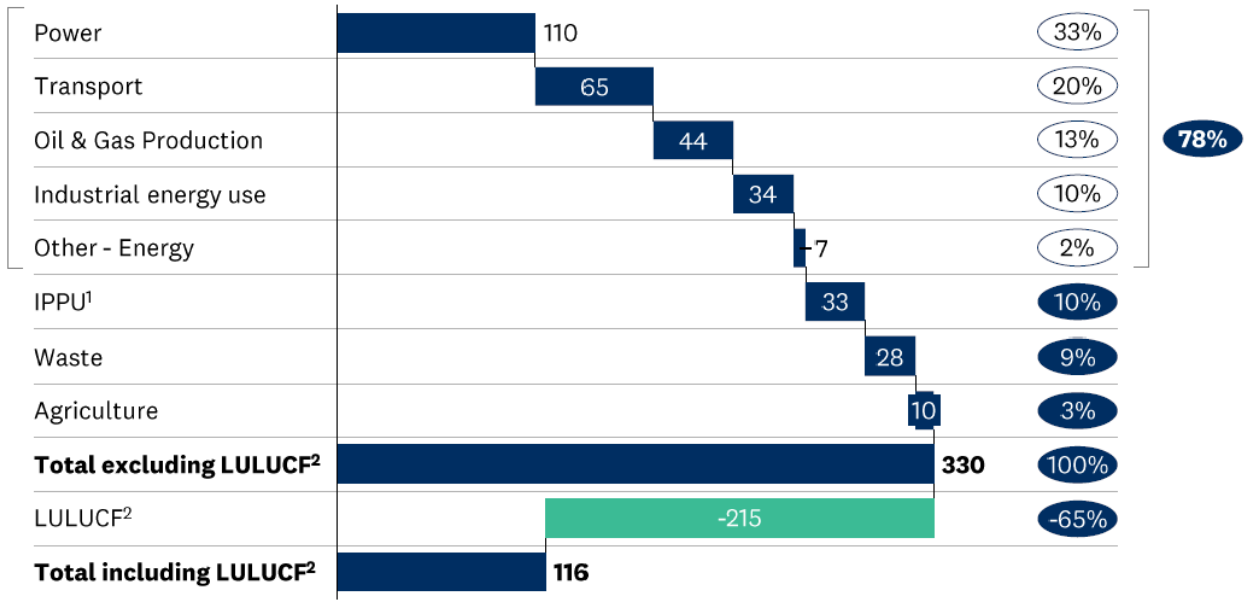
Malaysia GHG emission 2005-2019 and total emission 2019 by sector ($MtCO_2$ eq)



1 Net of Land Use, Land-Use Change and Forestry (LULUCF) removals

Source: Malaysia Fourth Biennial Update Report (BUR4)

Malay



1 Industrial Processes and Product Use
2 Land use, land-use change, and forestry

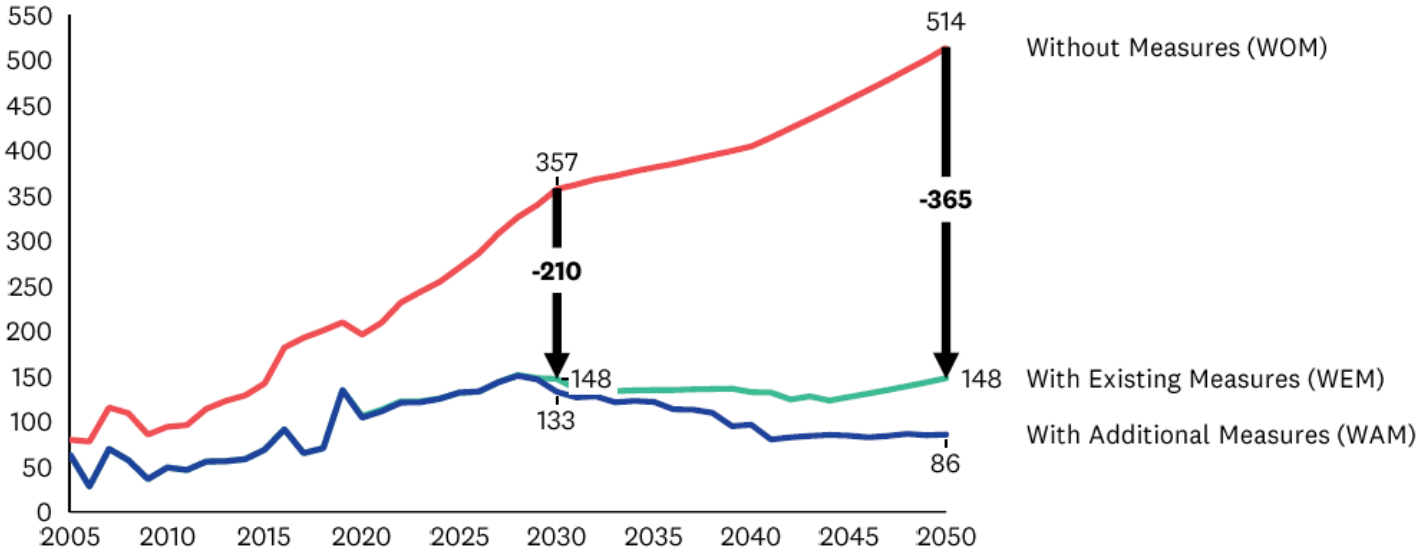
SOURCE: Malaysia Fourth Biennial Update Report (BUR4)

Three Malaysia Emission Scenarios

1 WOM
2 WEM
3 WAM

Malaysia's emissions for the three scenarios

Malaysia's net emissions[1] including Land Use, Land-Use Change and Forestry (LULUCF), $MtCO_2e$



1 Pre-2020 data in the scenarios reflect actual historical emission figures

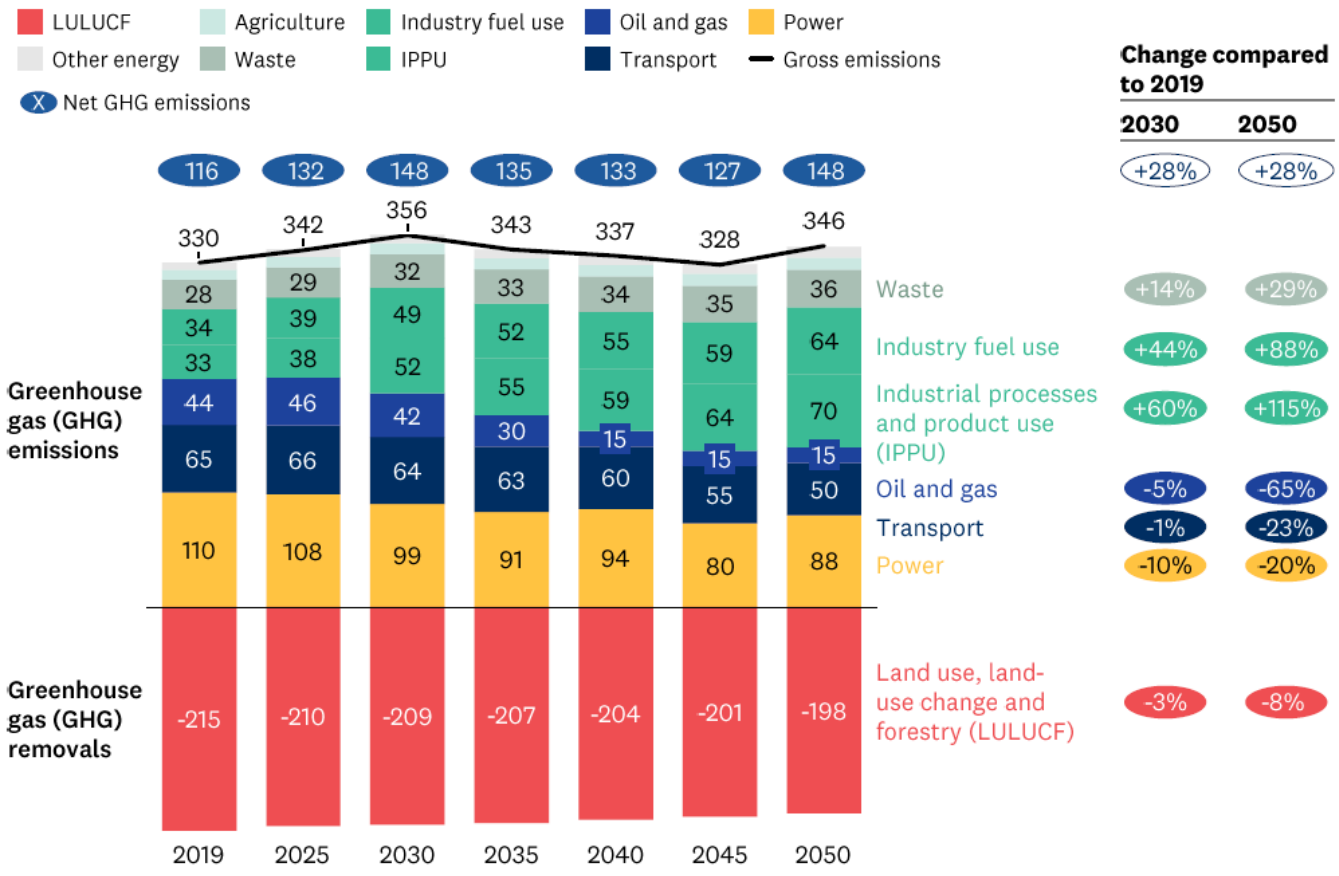
Source: Malaysia reports to United Nations Framework Convention on Climate Change (UNFCCC) (e.g., BURs, NCs), press search

Existing Measures Scenario WEM

+28%

With existing measures scenario

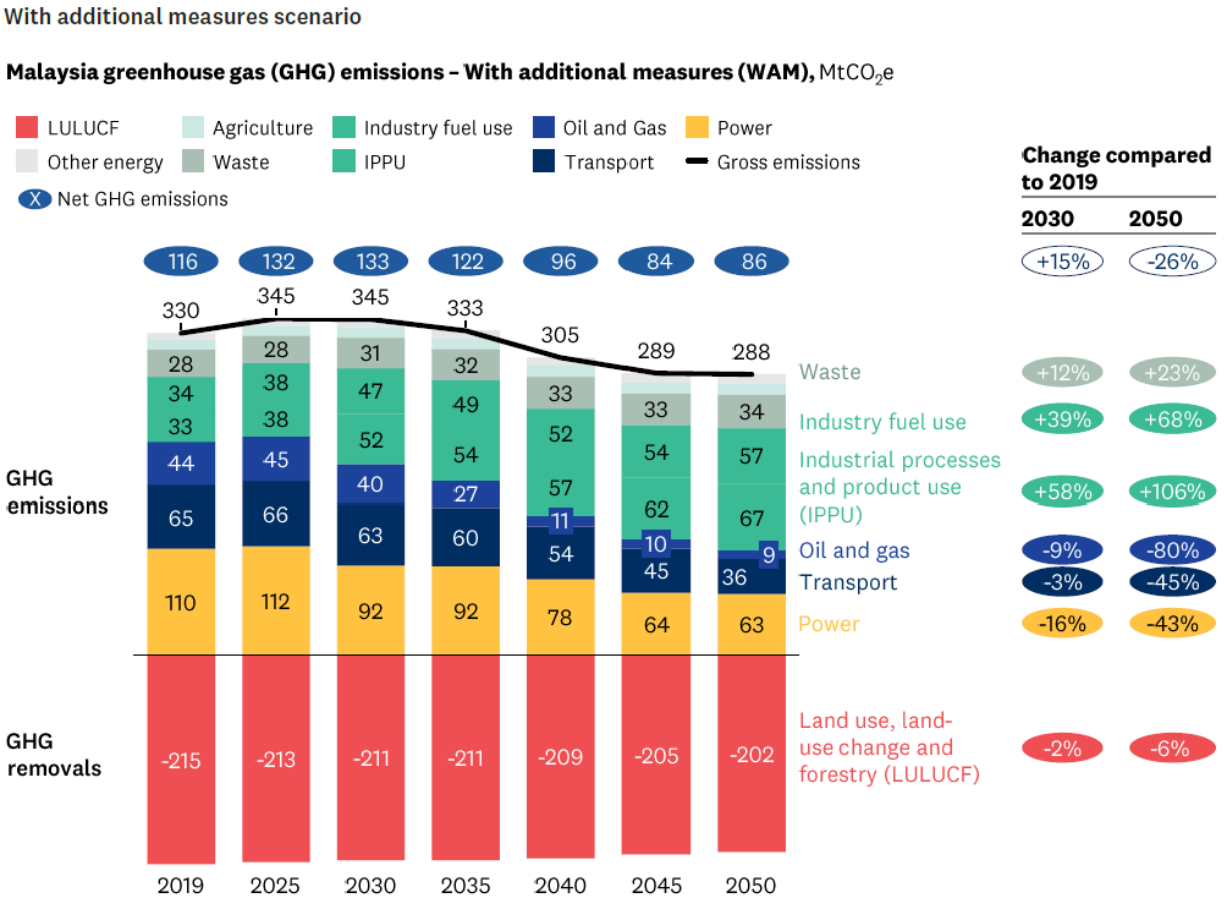
Malaysia greenhouse gas (GHG) emissions – With existing measures (WEM), $MtCO_2e$



SOURCE: SWG input across all sectors, publications and announcements by ministries and private sector players, industry association data,

Additional Measures Scenario WAM

+15% (2030)
-26% (2050)



SOURCE: SWG input across all sectors, publications and announcements by ministries and private sector players, industry association data, Ministry of Economy

Malaysia's transformational shift to Net zero by 2050

Key shifts identified to enable Malaysia's Transformational Shift to Net Zero by 2050

Rapidly **expand cleantech to 85%** of electricity generation capacity 2050

Scale up EV to achieve **80% vehicle sales** by 2040

Establish Malaysia as a **global lighthouse for CCS** (e.g., for gas plants, O&G, iron and steel)

Protect and/or restore ~18 Mn Ha of forests to maintain **at least 52% forest cover**

Scale up alternative fuels (incl. up to 2.5 MTPA of H^2 produced) and promote **circular economy**

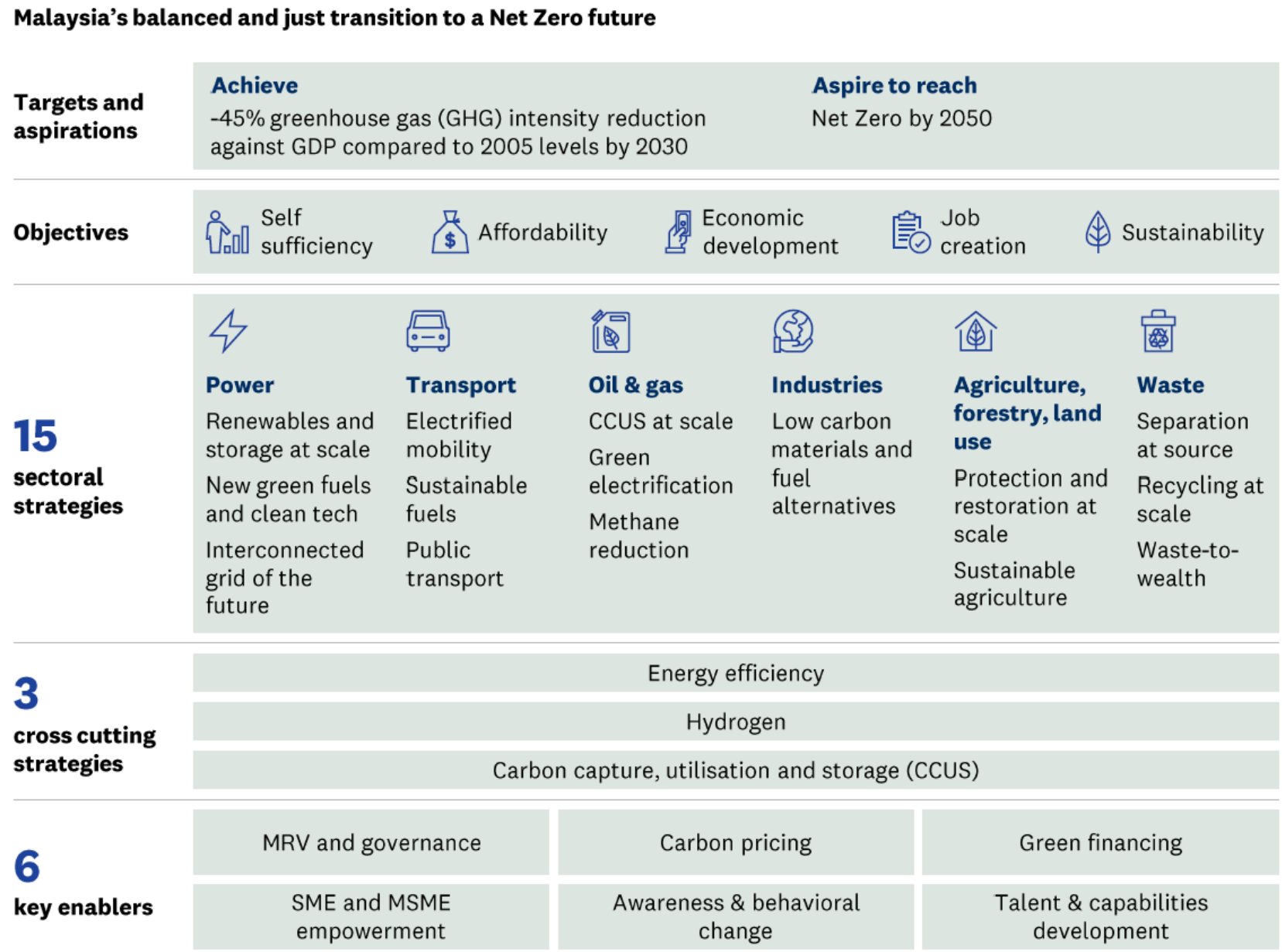
Attract RM 2 Tn of green financing via carbon markets, blended finance etc.

Foster sustainable behavioural change (e.g., EE, adaptation) and awareness amongst the Rakyat

Futureproof Malaysia's talent through upskilling, reskilling for 500K new jobs

>RM 1.2 tn in GDP | **>RM 2.3 tn** in investments | **Raise the ceiling** | MALAYSIA MADANI | **Raise the floor** | **500k jobs** created | **40 – 50% jobs** in high value STEM sectors

Malaysia balanced and Just transition to Net Zero future



Climate risk and Resilience and adaptation

Sectoral impact and Vulnerability a in NC3 and NC4

Sub-sector	Extreme Event			
	Flood	Dry spell	Wet	Sea level rise / coastal inundation
Reservoir Storage and Dam Security		✓	✓	
Flood risk management	✓			✓
Groundwater Security				✓
Coastal Erosions				✓
Rice	✓	✓		✓
Oil Palm	✓	✓		✓
Rubber	✓	✓	✓	✓
Cocoa	✓	✓		
Livestock	✓	✓		
Fisheries & Aquaculture	✓	✓		
Inland forest			✓	✓
Peat Swamp Forest			✓	✓
Mangrove Forest			✓	✓
Terrestrial Fauna (Birds, Orangutan, Elephant, Tiger, samba deer)	✓	✓		
Marine Ecosystem (Coral reefs, marine turtle, marine mammals)				✓
Cities	✓	✓		✓
Built Environment	✓	✓		✓
Road	✓			✓
Rails	✓			✓
Ports & Jetties	✓	✓		✓
Airports	✓	✓		✓
Solid waste Facilities	✓	✓		✓
Sewerage Facilities	✓			✓
Water supply Facilities	✓	✓		
Flood relief Centres	✓			✓
Electricity Generation, Transmission and Distribution	✓	✓	✓	✓
Oil & Gas	✓	✓		✓
Healthcare Facilities	✓			✓
Vector Borne Diseases (Dengue & Malaria)	✓	✓		
Food and water Borne Diseases	✓			
Leptospirosis	✓			
Heat Related Illness		✓		

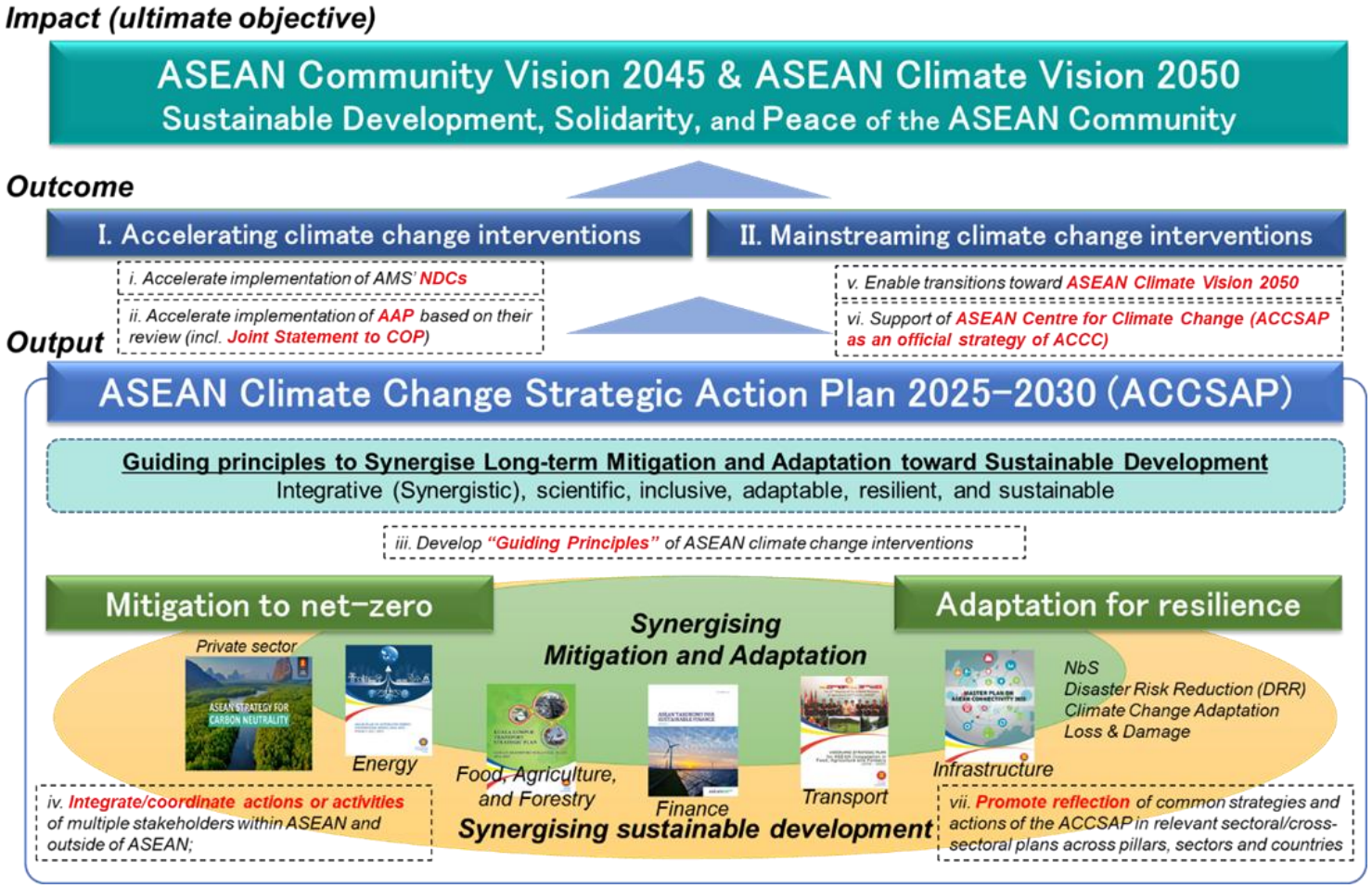
KEMENTERIAN SUMBER ASLI DAN KELESTARIAN ALAM

NATIONAL REPORT OF MALAYSIA

ASEAN CLIMATE CHANGE STRATEGIC ACTION PLAN (ACCSAP) 2025-2030

NATIONAL CONSULTATION WORKSHOP

20/5/2025 (Tuesday) The Everly Putrajaya Hotel



Overview of the impact, outcome, and output of the project.

ACCSAP STRATEGIC AREAS/PROGRAMME

I **CROSS CUTTING/CROSS SECTORAL**

Sustainable Development Goals

1. Climate change interventions' synergies and trade-offs with sustainable development
2. Adaptation-mitigation integrated long-term planning for sustainable development (i.e. Guiding principles and framework for ACCSAP and AMS' roadmaps such as LTS, NDCs, NAPs, and sectoral plans)
3. Climate change and air pollution prevention
4. Climate change and circular economy
5. Climate change and nature conservation including land and ocean
6. Climate change and gender and social inclusion including children, vulnerable groups, women, and indigenous groups
7. Education and awareness raising for climate change issues (both mitigation and adaptation)
8. Reskilling workforce on climate change knowledge and actions
9. Sustaining climate actions through public-private-people- partnership (PPPP)

Climate change initiatives

10. Developing and implementing sub-national/city-level climate action plans

Adaptation Mitigation Integration

11. Climate actions and green transition in small and medium sized enterprises (SMEs) and social enterprises, including tourism
12. ASEAN's regional stocktake mechanism (e.g. stocktake of NDCs and BTRs, enhanced transparency frameworks for both adaptation and mitigation including their MRV and M&E)
13. Acceleration of NDC implementation with a focus on Means of Implementation (MoI) including financial mechanisms
14. Adaptation-mitigation synergies and trade-offs
15. Just energy transition synergistic with adaptation (e.g. synergies of renewable energy with resilience and adaptation aspects)

Just transition

16. Climate smart agriculture (including “vulnerability-smart agriculture" or "climate resilient agriculture" that highlights systematic changes of agriculture considering
17. Innovative climate finance for synergising adaptation and mitigation
18. Resilience of net-zero infrastructures on energy, building, transport, and nature

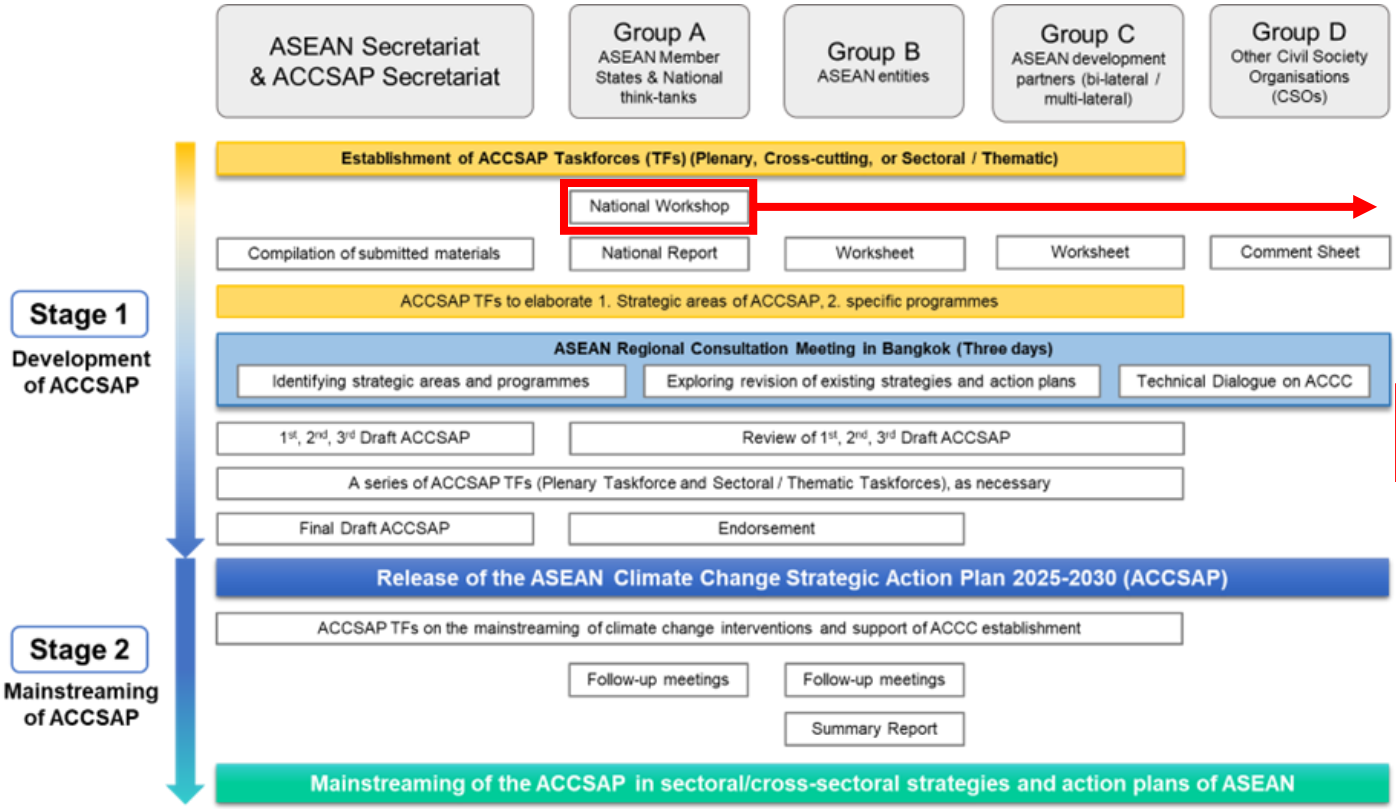
II ADAPTATION

19. Regional adaptation plan for transboundary risks
20. Socially-inclusive adaptation planning (goals and actions) (e.g. indigenous knowledge integration, locally-led adaptation)
21. Disaster risk reduction (DRR) and climate change adaptation (CCA)
22. Loss and damage
23. Vulnerability and climate risks assessment
24. Climate risk transfer system (e.g. insurance)
25. Technology access and diffusion (e.g. early warning system)

III MITIGATION

26. Private sector's decarbonising roadmap
27. Net-zero transition roadmap for financial sectors
28. Carbon pricing and market mechanism including carbon standard / framework (e.g. for mutually recognising carbon standard among AMS)
29. Sector-coupling and system integration of net-zero infrastructures and solutions on energy, building, transportation (e.g. coupling of EVs and solar PV)
30. Energy and power grid transition to penetrate variable renewable energy including micro-grid and batteries
31. Long-term modelling of ASEAN's all GHG emissions by Integrated Assessment Models (IAMs) and usage for policy planning
32. Decarbonising technology research, development, and transfer (e.g. innovative decarbonising technologies)
33. LULUCF's database, modeling and policy planning including afforestation programs
34. Methane in agriculture and waste (included by ASEAN Roadmap for Methane Reduction)

OVERALL PROCESS



Overall workflow of the project on development of the ACCSAP

NATIONAL CONSULTATION WORKSHOP FOR THE PREPARATION OF THE ASEAN CLIMATE CHANGE STRATEGIC ACTION PLAN (ACCSAP) 2025-2030

- Group A. ASEAN Member States and National Think-Tanks;
- Group B. ASEAN entities such as ASEAN Secretariat Divisions and Sectoral Bodies including AWGCC;
- Group C. ASEAN development partners (bi-lateral / multi-lateral international partners); and
- Group D. Other Civil Society Organisations (CSOs)

APPLICATION OF AIM – EXSS as modelling tool in MALAYSIA for GHG emission calculation baseline and future scenarios projection

45% REDUCTION IN INTENSITY BY **2030**

CARBON NEUTRAL BY **2050**

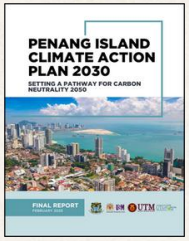
UTM-Low Carbon Asia Research Centre (UTM-LCARC) has been pioneering the Science to Action (S2A) approach to city-level climate policymaking in Malaysia since 2011.

The Extended Snapshot (Exss) tool under the Asia-Pacific Integrated Model (AIM) has been the main modelling tool used to **estimate base year greenhouse gas (GHG) emissions, as well as to project target year GHG emissions under the Business as Usual (BaU) and Countermeasure (CM) scenarios.**

The modelling results provide **a concrete base for effective communication with policymakers and stakeholders, as** well as a scientific basis for climate target setting and rational framework for climate strategy and plan formulation. **To date, UTM-LCARC has worked closely with 11 major cities and one special economic region in Malaysia** in science-based climate policymaking and climate action planning using the Asia-Pacific Integrated Model.

NEW MALAYSIAN CITIES WITH CAP – PENANG AND KUALA LUMPUR

PULAU PINANG

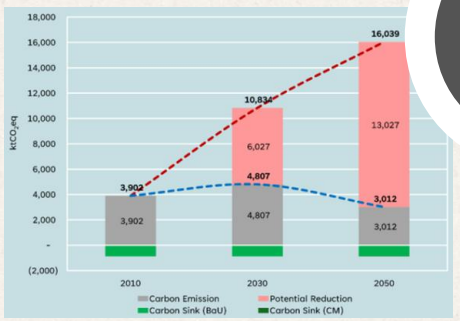


65% by 2030

NET ZERO 2050

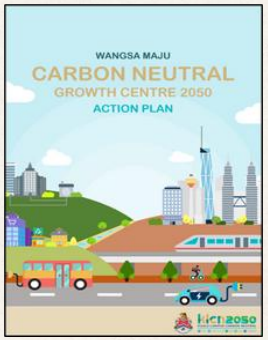
70% by 2030

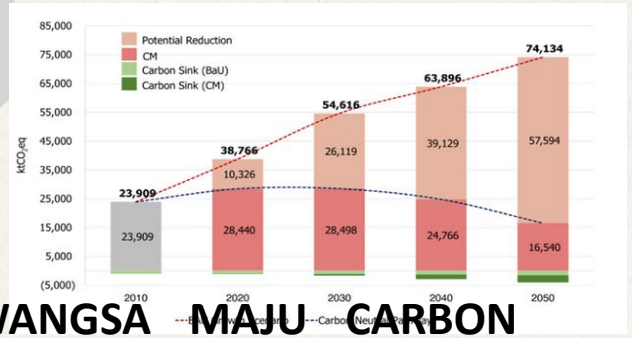
NET ZERO 2050



- PROJECT : **PENANG ISLAND CLIMATE ACTION PLAN 2030**
- POPULATION : **920,700 (2030)**
- GROSS DOMESTIC PRODUCTS : **RM 84,890 MILLION (2030)**
- ADMINISTRATION : **PINANG ISLAND CITY COUNCIL (MBPP)**

KUALA LUMPUR



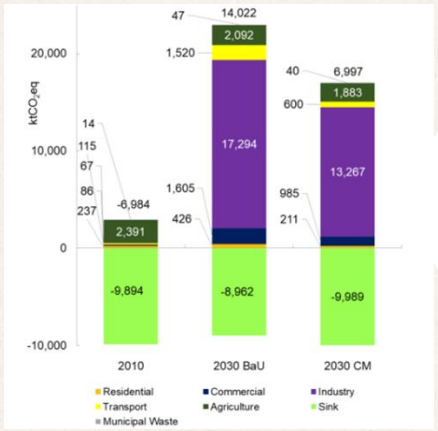


- PROJECT : **WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE 2050 ACTION PLAN & KUALA LUMPUR LOW CARBON SOCIETY BLUPRINT 2030**
- POPULATION : **1.98 million (2030)**
- GROSS DOMESTIC PRODUCTS : **RM 349,992 million (2030)**
- ADMINISTRATION : **KUALA LUMPUR CITY HALL (DBKL)**

PENGERANG, JOHOR

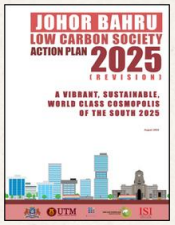
50% by 2030

NET ZERO 2050



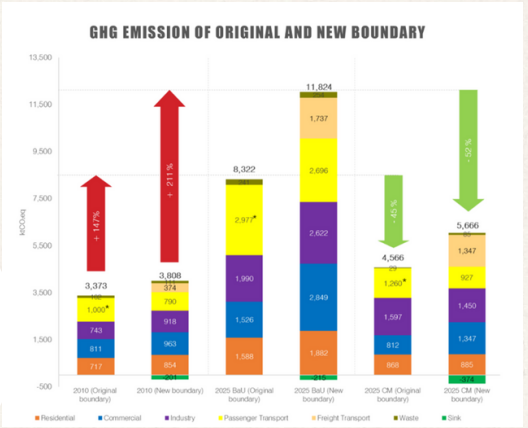
- PROJECT : **PENGERANG LOW CARBON SOCIETY BLUEPRINT 2030**
- POPULATION : **135,095 (2010)**
- GROSS DOMESTIC PRODUCTS : **RM1,321 million (2010)**
- ADMINISTRATION : **PENGERANG MUNICIPAL COUNCIL (MPP)**

JOHOR BAHRU, JOHOR



63% by 2035

NET ZERO 2050



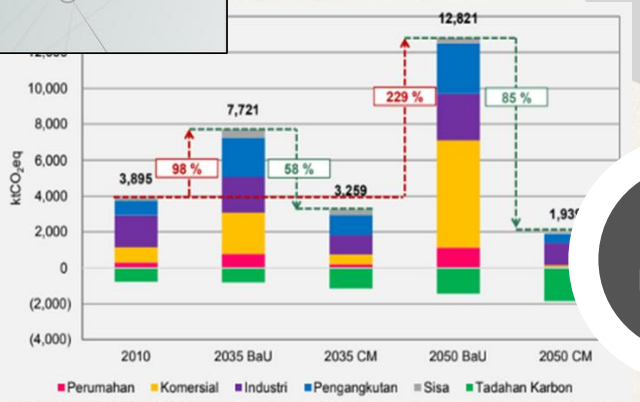
- PROJECT : **JOHOR BAHRU LOW CARBON SOCIETY ACTION PLAN 2025 (REVISION)**
- POPULATION : **1,374,900 (2025)**
- GROSS DOMESTIC PRODUCTS : **RM82,400 million (2025)**
- ADMINISTRATION : **JOHOR BAHRU CITY COUNCIL (MBJB)**

ISKANDAR PUTERI CITY HALL CLIMATE ACTION PLAN 2030

ISKANDAR PUTERI, JOHOR

58% by 2035

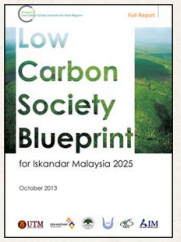
NET ZERO 2050

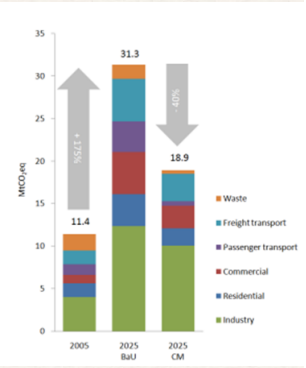


- PROJECT : **RANCANGAN TEMPATAN MAJLIS BANDARAYA ISKANDAR PUTERI**
- POPULATION : **286,958 (2035)**
- GROSS DOMESTIC PRODUCTS : **RM 23,096 million (2010)**
- ADMINISTRATION : **ISKANDAR PUTERI CITY COUNCIL (MBIP)**

ISKANDAR MALAYSIA

** Iskandar Malaysia is a special economic region that was established in 2006 at the southern end of Peninsular Malaysia. The economic region covers an area of 2,217 km2 and encompasses five local planning authorities that respectively govern Johor Bahru, Iskandar Puteri, Pasir Gudang, Kulai and part of Pontian. The first application of the Asia-Pacific Integrated Model (AIM) in Malaysia started in Iskandar Malaysia in 2011 under the SATREPS program funded by JICA and JST. Key project outputs include the seminal Low Carbon Society Blueprint for Iskandar Malaysia 2025 that was launched at the UNFCCC's COP18 in Doha in November 2012; the setting up of the UTM-Low Carbon Asia Research Centre (UTM-LCARC) in 2013; and the dissemination of the science-toaction (S2A) climate policymaking methodology to many Malaysian and Asian cities.*





70% by 2030

NET ZERO 2050

- PROJECT : **LOW CARBON SOCIETY BLUEPRINT FOR ISKANDAR MALAYSIA 2025**
- POPULATION : **921,806 (2020)**
- GROSS DOMESTIC PRODUCTS : **RM1,321 million (2010)**
- ADMINISTRATION : **ISKANDAR REGIONAL DEVELOPMENT AUTHORITY (IRDA)**

Seremban Climate Action Plan 2035

Keluasan

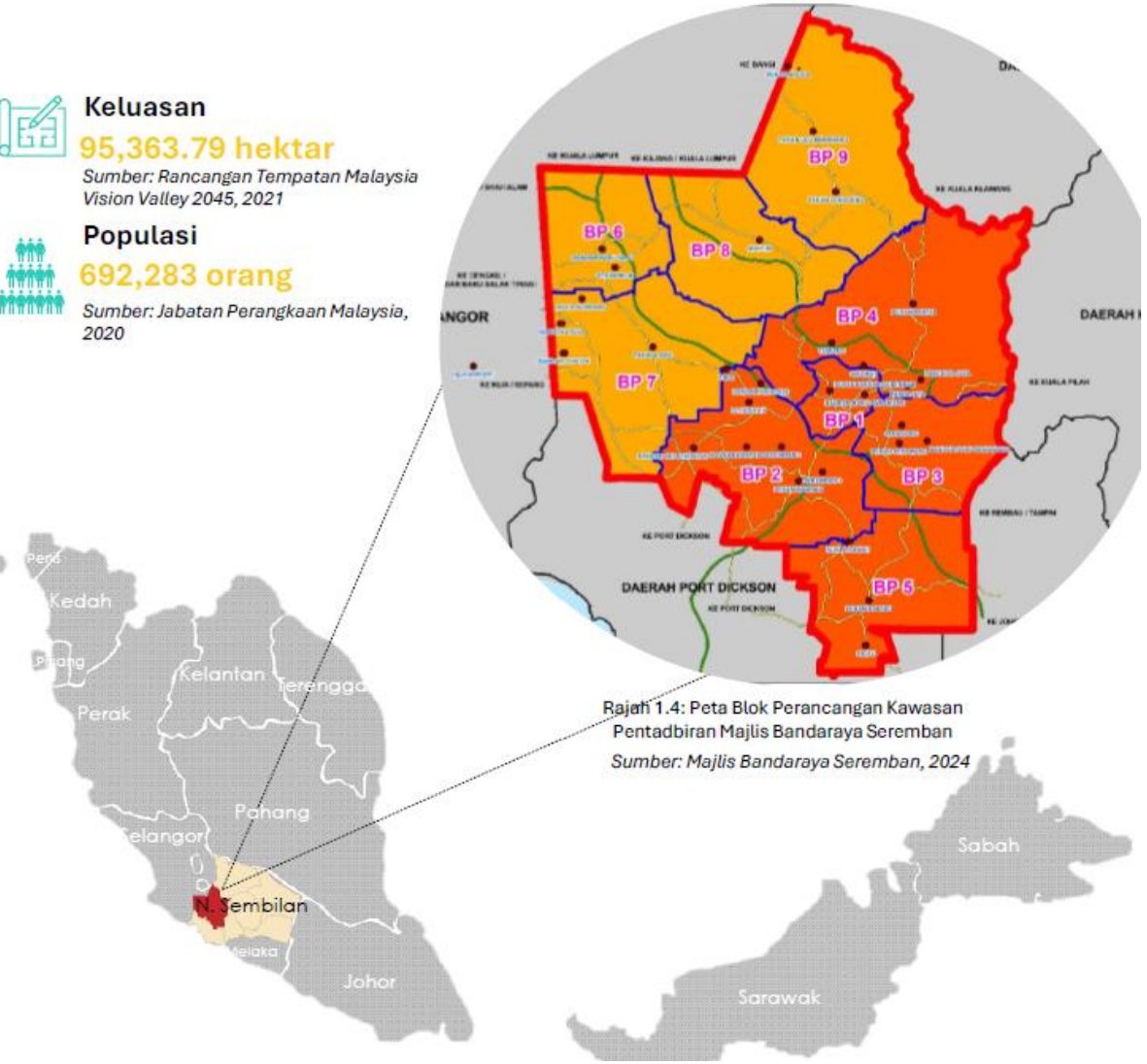
95,363.79 hektar

Sumber: Rancangan Tempatan Malaysia Vision Valley 2045, 2021

Populasi

692,283 orang

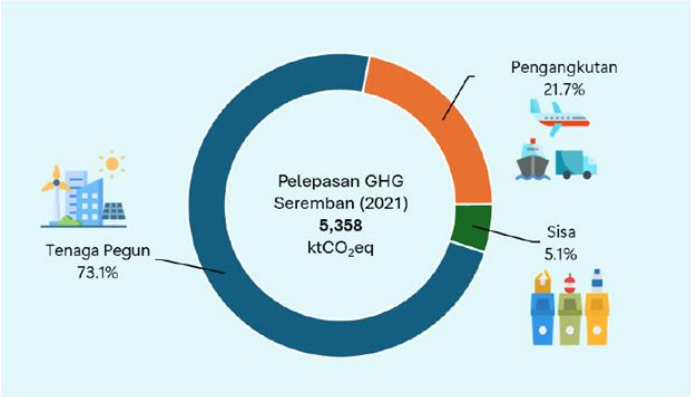
Sumber: Jabatan Perangkaan Malaysia, 2020



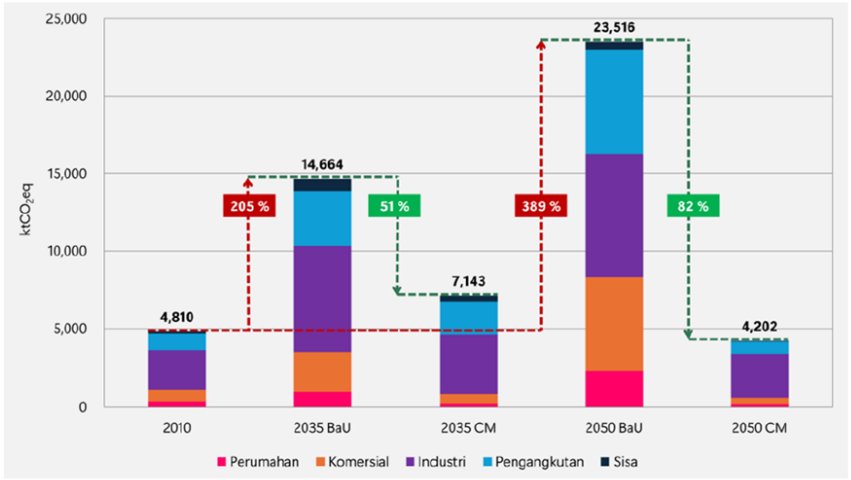
Rajah 1.4: Peta Blok Perancangan Kawasan Pentadbiran Majlis Bandaraya Seremban

Sumber: Majlis Bandaraya Seremban, 2024

Pathway Seremban city toward Zero Carbon 2050
- Important for GHG monitoring and report card to State government

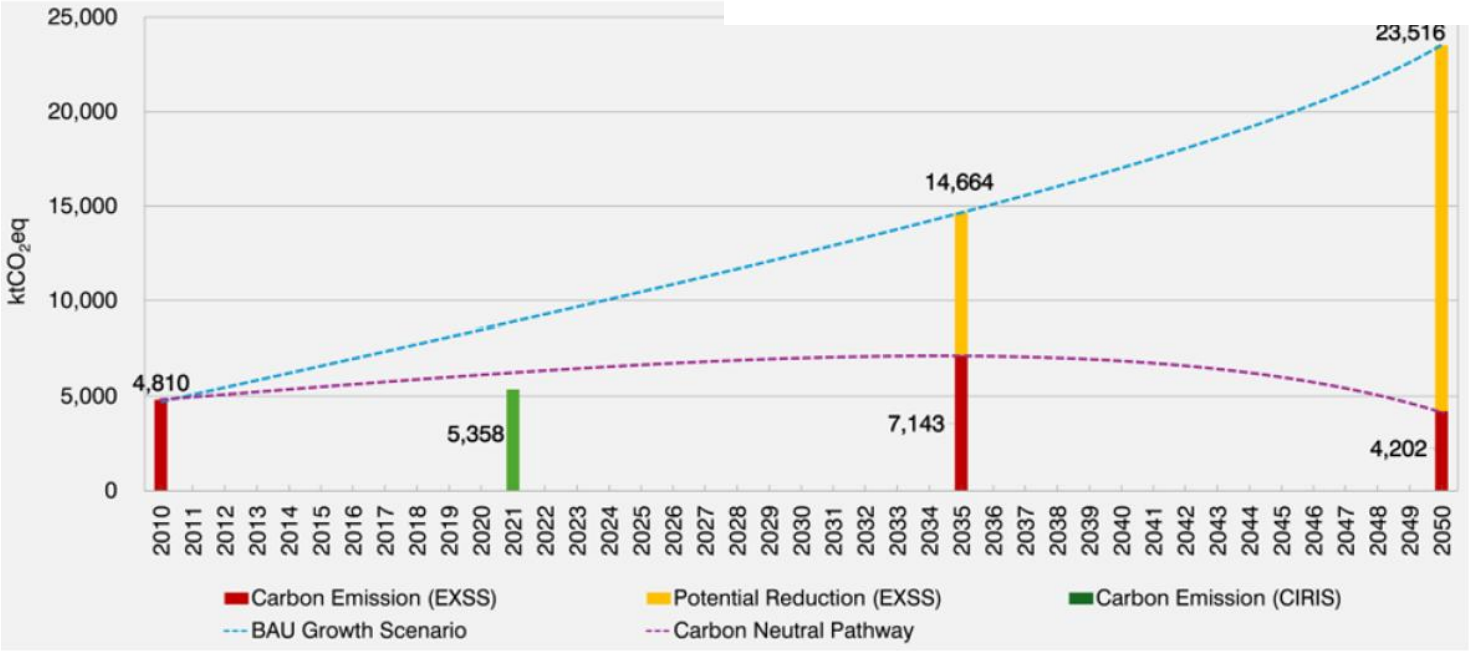


Penduduk	Pelepasan GHG per kapita	Pelepasan GHG per keluasan
696,100	7.70	5,619
Orang	tCO_2eq/orang	tCO_2eq/km2

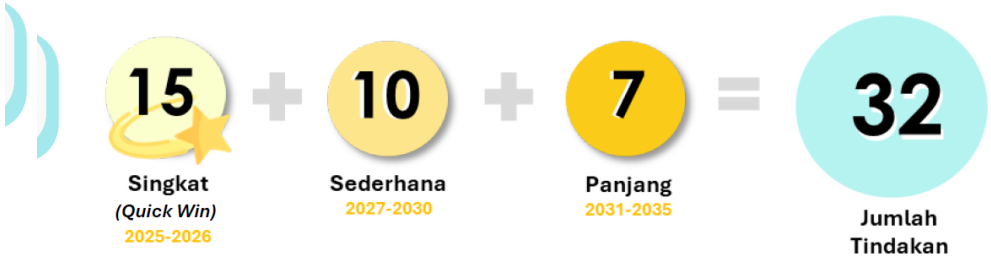


Perincian Sektor Pelepasan GHG Secara Mutlak Daerah Seremban bagi Tahun 2035 dan 2050

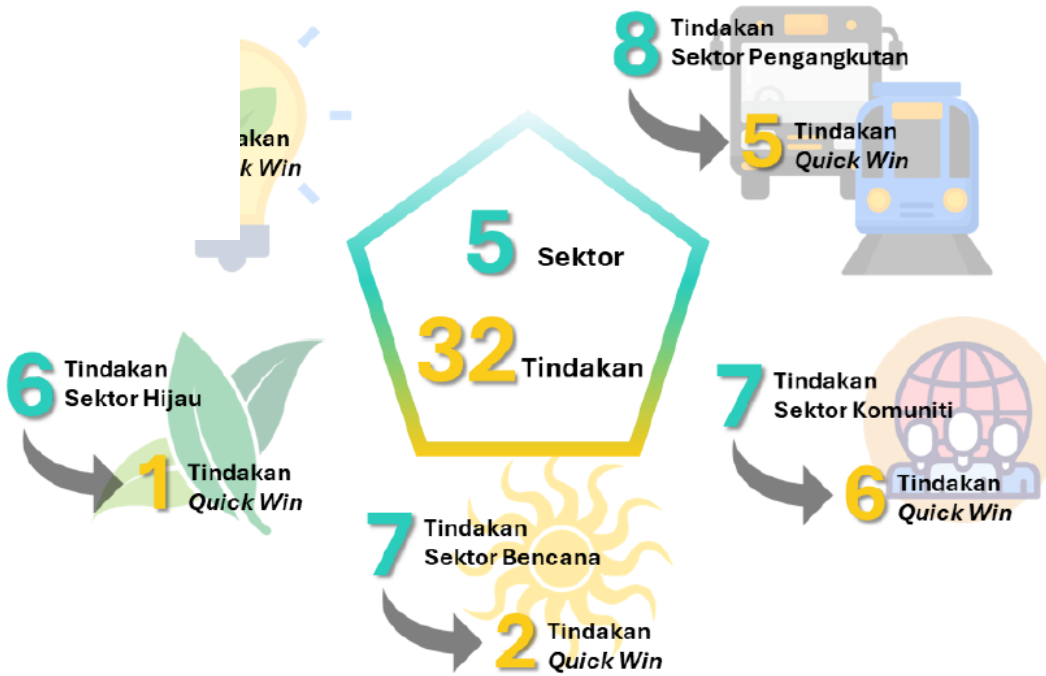
Sektor	2010	2035 BaU	2035 CM	Perubahan 2035 BaU/ 2010	Perubahan 2035 CM/ 2035 BaU	2050 BaU	2050 CM	Perubahan 2050 BaU/ 2010	Perubahan 2050 CM/ 2050 BaU
Perumahan	366	999	239	173%	-76%	2,280	190	522%	-92%
Komersial	761	2,466	590	224%	-76%	6,054	399	695%	-93%
Industri	2,491	6,844	3,791	175%	-45%	7,911	2,760	218%	-65%
Pengangkutan	1,055	3,576	2,108	239%	-41%	6,742	810	539%	-88%
Sisa	136	779	415	472%	-47%	530	42	289%	-92%
JUMLAH ($ktCO_2eq$)	4,810	14,664	7,143	205%	-51%	23,516	4,202	389%	-82%



Planned actions- Seremban City

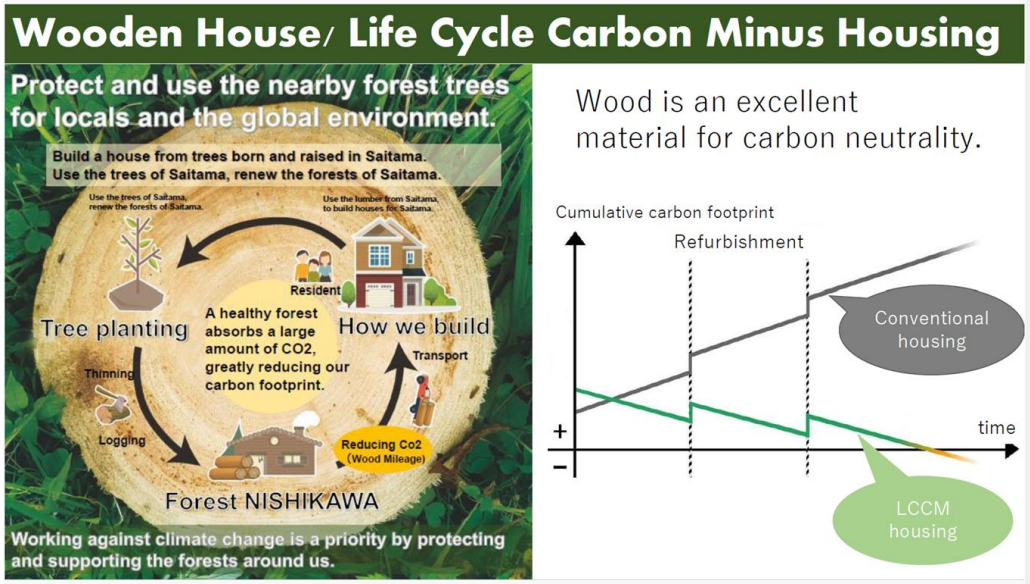


Planned actions by sectors- Energy, Transport, Green, Community and Disaster



Planned actions by mitigation and adaptation pillars-

Saitama City Hall (Takasago) – Johor State (JSC) Collaboration on Sustainable Timber Construction



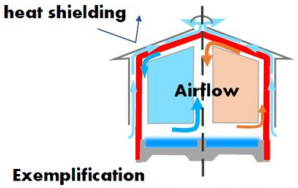
Reference information for the idea of a smart house in Malaysia

Priority measures.

- **Insulate the perimeter of the house to improve heat shielding.**

caution

- **Since the cooling temperature is close to the dew point, there is a risk of condensation and mold formation inside the highly moisture-permeable insulating material.**
- **Plastic foam insulation is recommended.**



Exemplification

Outer insulation + double ventilation

What to expect.

- **Outer insulation →reduce cooling energy.**
- **The ventilation layer →promoting drying in the unlikely event of condensation inside the wall.**

Key considerations for Malaysian cities to Achieve Net Zero

1 Energy Transition in Urban Areas

- Malaysian cities need to transition toward renewable energy sources, moving away from fossil fuels to Renewable Energy

2 Sustainable and Low-Carbon Mobility

- Transportation is a significant emissions source in Malaysian cities, where cars and motorbikes are the primary modes of travel.

3 Net Zero Buildings and Energy Efficiency Standards.

- Malaysian cities could benefit from introducing net zero building standards, setting benchmarks for new and existing buildings to minimize energy consumption.

Key considerations for Malaysian cities to Achieve Net Zero

4 Waste Management and Circular Economy Initiatives

Moving toward net zero requires us to address urban waste through a circular economy approach, emphasizing waste reduction, reuse, and recycling.

5 Leveraging Data and Technology /Smart city technology for Science-Based Implementation

Malaysian cities need **robust data systems and technology**. For example, using Geographic Information Systems (GIS) and sensor networks, cities can monitor real-time emissions, identify areas with high pollution levels, and adjust interventions accordingly.

6 Building Coalitions and Partnerships to Support Science-Based Climate Action

- Achieving net zero will require cooperation across different levels of government, the private sector, and local communities. National support is essential for cities to access funding and technical resources for climate initiatives.

CONCLUSION

In closing, achieving net zero cities in Malaysia is a **complex but achievable goal**.

Science-based policy-making provides us with a foundation for making informed, effective decisions that can drive urban transformation. By setting measurable targets, leveraging data, building partnerships, and ensuring that our **policies are inclusive, we can create a pathway** for Malaysian cities to lead in climate action.

Let us move forward with both ambition and a commitment to science-based policy-making, creating urban spaces that are **not only net zero but also resilient, equitable, and sustainable.**

Together, we can help ensure that Malaysian cities are key players in the fight against climate change and contribute meaningfully to a net zero future.

.

UTM-LCARC PARTNERS

Sponsors

Ministry of Higher Education Malaysia

JICA

JST

SATREPS
Science and Technology Research Partnership for Sustainable Development Program

Clients

seda Malaysia

NIKKEN
NIKKEN SEKKEI RESEARCH INSTITUTE

Perbadanan Putrajaya

ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

Majlis Perbandaran Kulai

Pbt Pengerang

北九州市
CITY OF KITAKYUSHU

ECO-IDEAL CONSULTING SDN BHD

Research Partners

CARBON TRUST

E KONZAL

GreenTech Malaysia

法政大学
HOSEI University

ICLEI
Local Governments for Sustainability

IGES
Institute for Global Environmental Strategies

慶應義塾
Keio University

KMUTT
King Mongkut's University of Technology Thonburi

京都大学
KYOTO UNIVERSITY

UNIVERSITY OF LEEDS

MiGHT
Malaysian Industry-Government Group for High Technology

National Institute for Environmental Studies

OECD

岡山大学
OKAYAMA UNIVERSITY

RITSUMEIKAN UNIVERSITY

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

TOKYO METROPOLITAN GOVERNMENT

早稲田大学
WASEDA University

iBEC

PLANMalaysia

Research Alliances

LoCARNet
Low Carbon Asia Research Network

LCS·R Net

United Nations University

RCE
REGIONAL CENTRE OF EXPERTISE ON EDUCATION FOR SUSTAINABLE DEVELOPMENT

ProSPER.Net
Promotion of Sustainability in Postgraduate Education and Research

THANK YOU!

UTM-Low Carbon Asia Research Centre
Block B12, 02-04-01
Faculty of Built Environment & Surveying
Universiti Teknologi Malaysia
81310 UTM Johor Bahru
Johor, MALAYSIA

T: +60-7-5557359
M: +197768823
Email:ho@utm.my
W: www.utm.my/satreps-lcs