Handling the Health Impacts of Extreme Weather Events

Jamal Hisham Hashim, ***PhD, MCIEH, Hon FAOEMM***
Honorary Professor, Universiti Selangor
Managing Director, Provenue Corporation Sdn Bhd

Presentation at the 9th National Environmental Health Action Plan (NEHAP) Conference 2023, Sepang, Selangor, 21 September 2023.

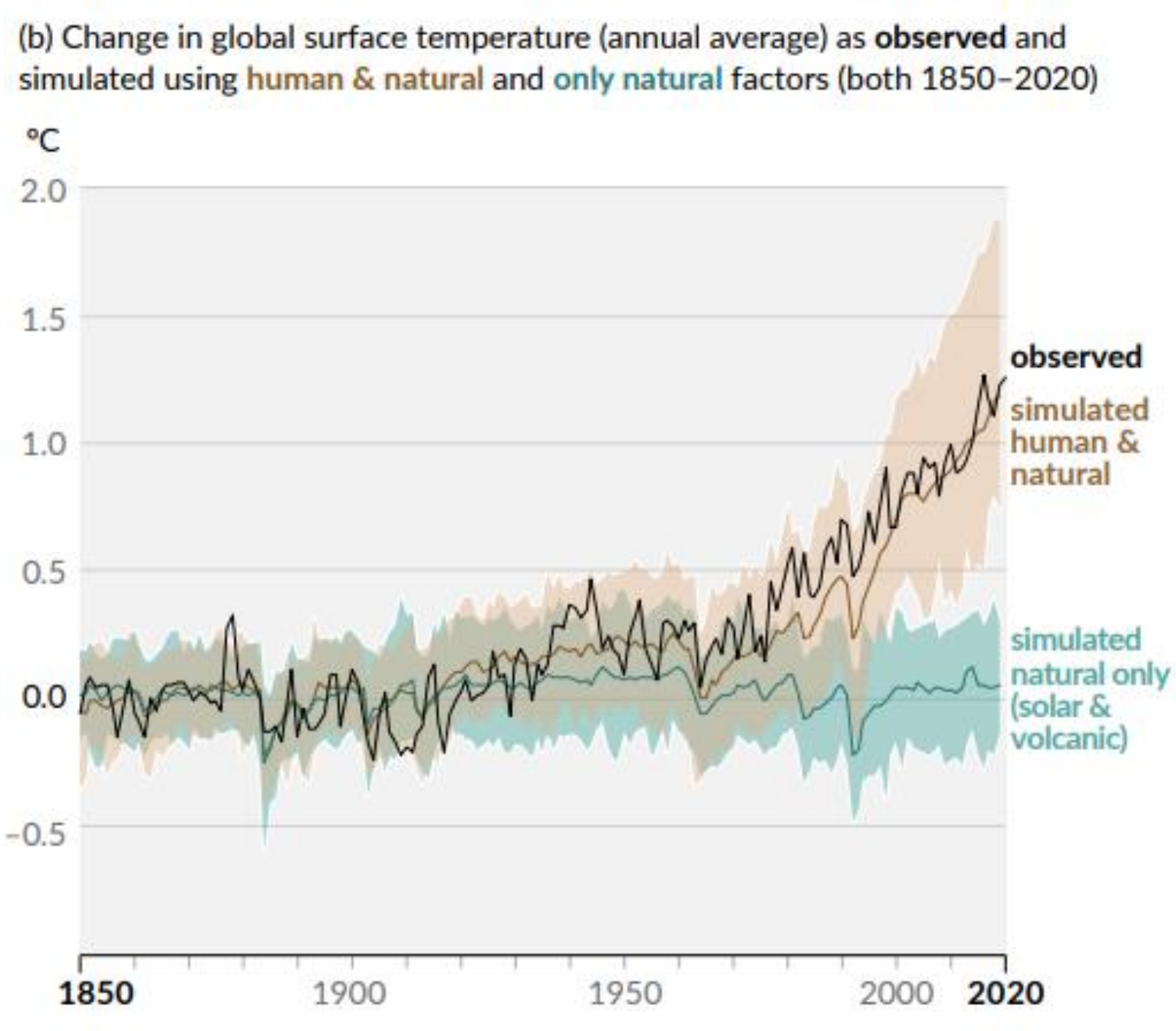
Outline of Presentation

- Global climate change scenario
- Malaysia's climate change scenario
- Climate change and extreme weather events
- Climate change and COVID-19: Lessons learnt
- Climate change mitigation and adaptation

IPCC's AR6 Findings

- Climate change is a threat to human well-being and planetary health.
- Human activities have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020.
- Human-caused climate change is already affecting many weather and climate extremes in every region across the globe.
- Vulnerable communities who have historically contributed the least to current climate change are disproportionately affected.
- Despite progress, adaptation gaps exist, and will continue to grow at current rates of implementation.
- Adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems, and deliver many co-benefits, especially for air quality and health.
- Finance, technology and international cooperation are critical enablers for accelerated climate action.

Source: Summary for policymakers. Synthesis report of the IPCC AR6

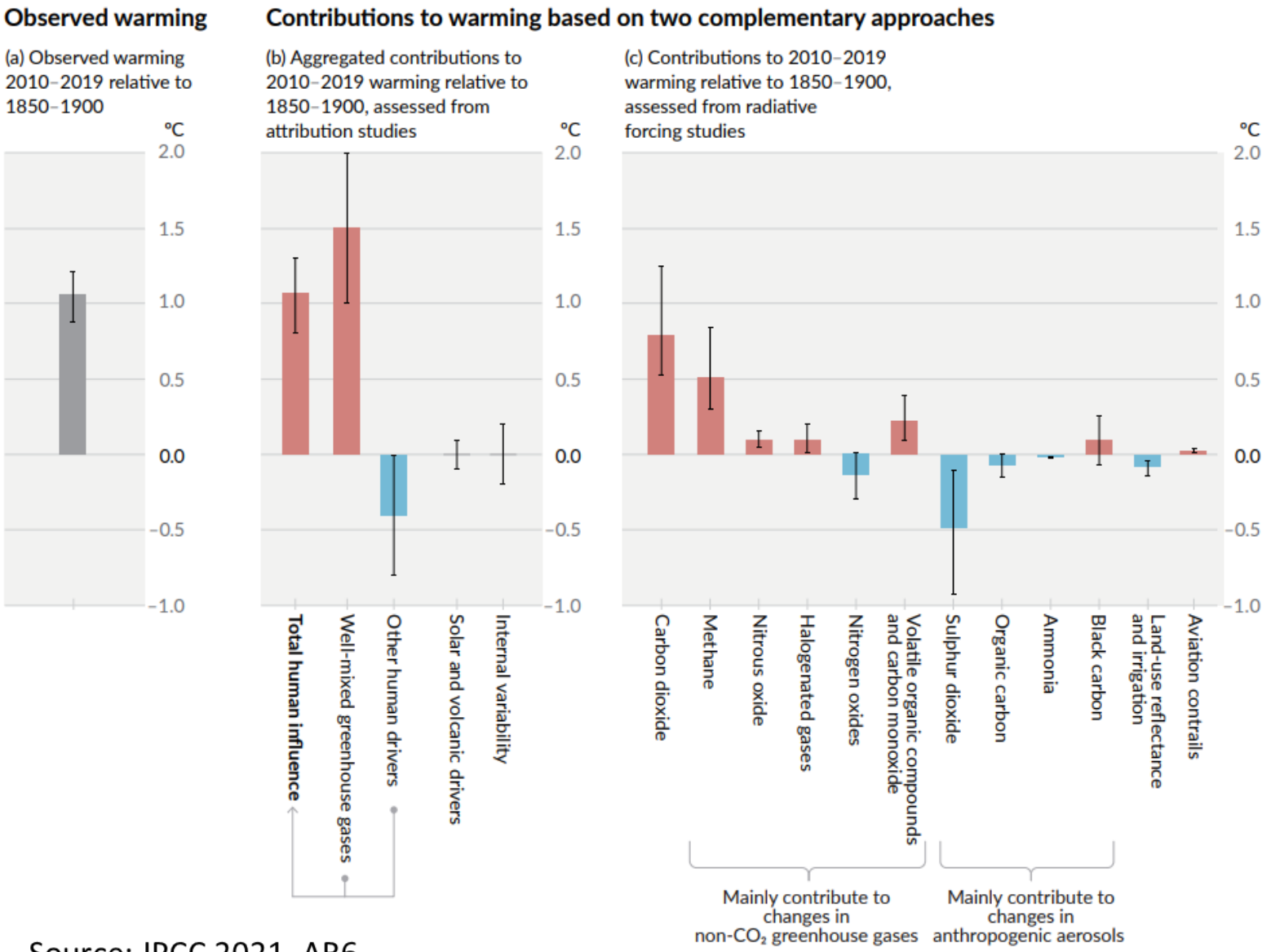


- Current global temperature has reached 1.1 °C above that in 1850-1900 (13.6 °C).
- CO^2 level in 1850 was 290 ppm. Current CO^2 level is around 420 ppm

Source: IPCC 2021. AR6

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Observed warming is driven by emissions from human activities, with greenhouse gas warming partly masked by aerosol cooling



Source: IPCC 2021. AR6

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

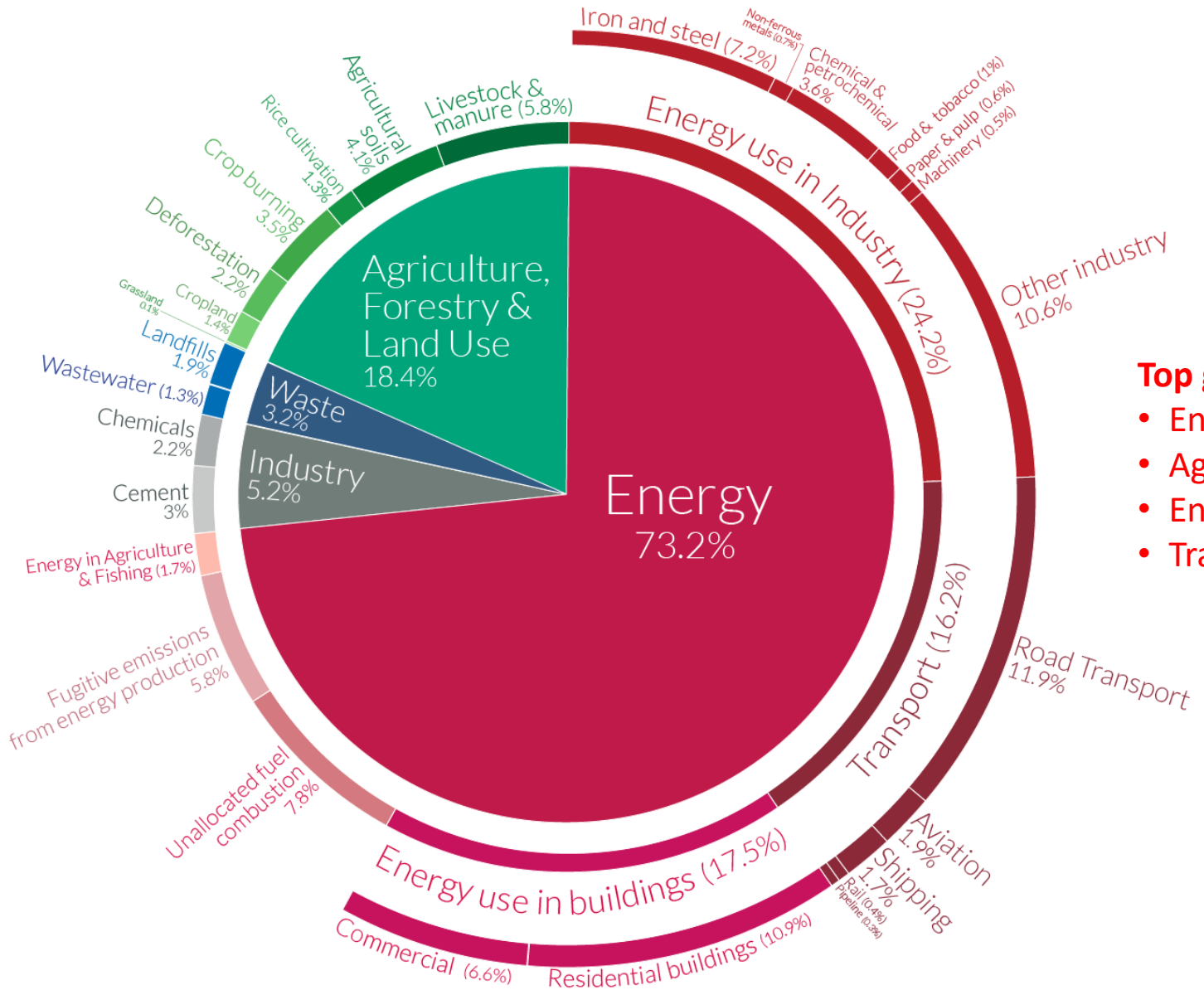
Five Takeaways from COP27 in Sharm el-Sheikh (Nov 2022)

- Established a dedicated fund for loss and damage from climate disasters.
- Maintain a clear intention to keep 1.5 ^{o}C within reach. This requires global GHG emissions to peak before 2025 and be reduced by 43% by 2030.
- Holding businesses and institutions accountable.
- Mobilising financial support for developing countries.
- Making the pivot toward implementation (walk the talk).

Global greenhouse gas emissions by sector

This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO_2eq.

Our World in Data



Top global GHG emitters :

- Energy use in industry = 24.2%
- Agriculture & deforestation = 18.4%
- Energy in building = 17.5%
- Transport = 16.2%

Malaysia's National Policy on Climate Change

- Approved by the Cabinet in 2009.
- The policy recognised the need for mitigation and adaptation to be carried out in a balanced manner, consolidating economic, social and environmental development goals :
  - *Development on a sustainable path*
  - *Conservation of environment and natural resources*
  - *Coordinated implementation at all levels of development*
  - *Effective participation of stakeholders*
  - *Common but differentiated responsibilities and respective capabilities*

Source : MESTECC, 2018.

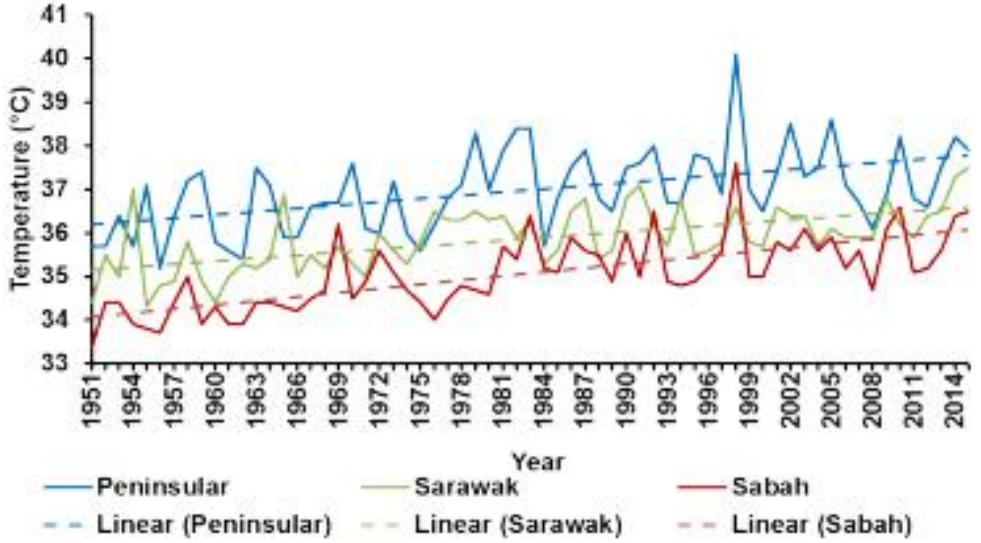
Rank	Top 10 Environmental Health Issues in Malaysia (Experts' FGD)	Total Score
1	Children environmental health (birth cohort study, impact of indoor environment). Formulate intervention strategies on how to manage, e.g. schools/homes/childcare centres.	169
2	Vector borne diseases (e.g. dengue and Aedes breeding in junk yards/abandoned places/no man's land; re-emergence of malaria).	168
3	Contamination of drinking water sources and emerging water pollutants [e.g. endocrine disrupting chemicals (EDCs), pharmaceutical drugs (antiseptics, antimicrobials)].	167
4	Urban health issues (housing and sanitation, poor drainage, air pollution, migrants, urban poor, crime and security, related diseases).	166
5	Climate change adaptation strategies and neglected health issues.	162
6	Food safety and contamination issues (e.g. recycled cooking oil, untrained food handlers especially foreigners, incomplete food labelling on food allergens, non-compliance to food standards).	160
7	Human exposure to pesticides[a] and other environmental chemicals[b] (e.g. e-waste, industries and lead in paint/consumer products).	155[a]/155[b]
8	Zoonotic diseases (use ecosystem approach on malaria (*Plasmodium knowlesi*), rabies, leptospirosis, melioidosis).	152
9	Exposure to ionizing and non-ionizing radiation[1].	144
10	More rigorous efforts to identify sources and means to reduce PM2.5 and ozone levels in Malaysia to assess the disease burden related to PM2.5 and ozone.	144

[1] Issue added during first FGD [a,b] Two issues combined

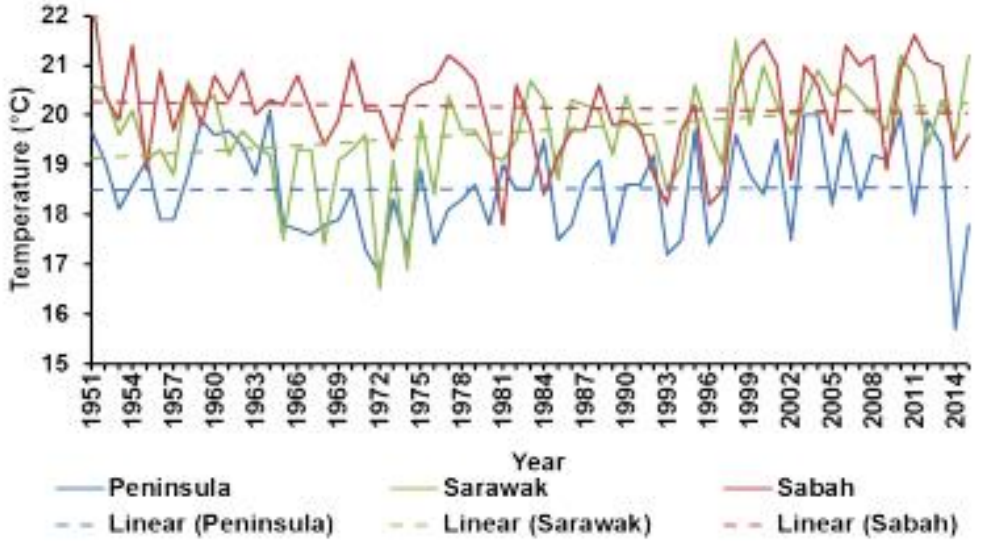
Source : Hashim J.H. *et al*. (2022). A priority list of environmental health issues for Malaysia. *Rev Environ Health*, https://doi.org/10.1515/reveh-2022-0030.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Figure 1.2: Highest Daily Maximum and Lowest Daily Minimum Temperature for Peninsular Malaysia, Sabah and Sarawak



(a) Highest Daily Maximum



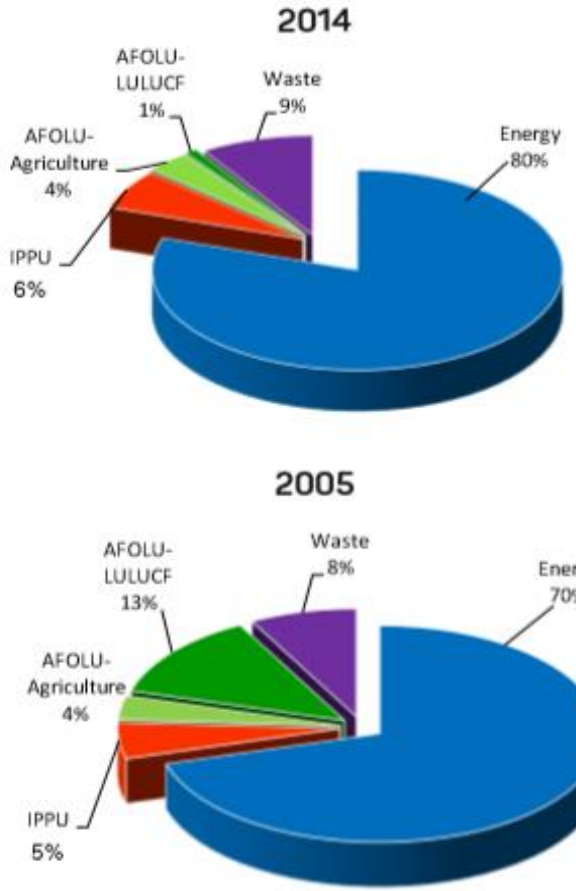
(b) Lowest Daily Minimum

Source : MESTECC, 2018.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

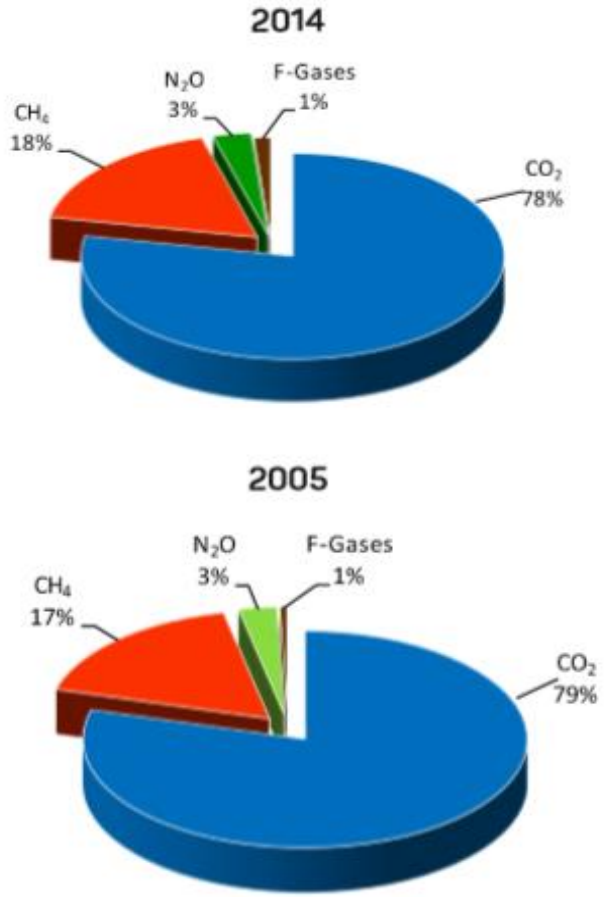
Past GHG Emissions for Malaysia

Figure 2.3: Percentages of Greenhouse Gas Emissions by Sector in 2005 and 2014



Note: AFOLU-LULUCF here represents the emissions part only

Figure 2.4: Percentage Emissions According to Greenhouse Gas in 2005 and 2014



Note: CO_2 total here included the AFOLU-LULUCF emissions part only

AFOLU - Agriculture Forestry and Other Land Use

IPPU - Industrial Processes and Product Use

LULUCF - Land Use, Land-Use Change and Forestry

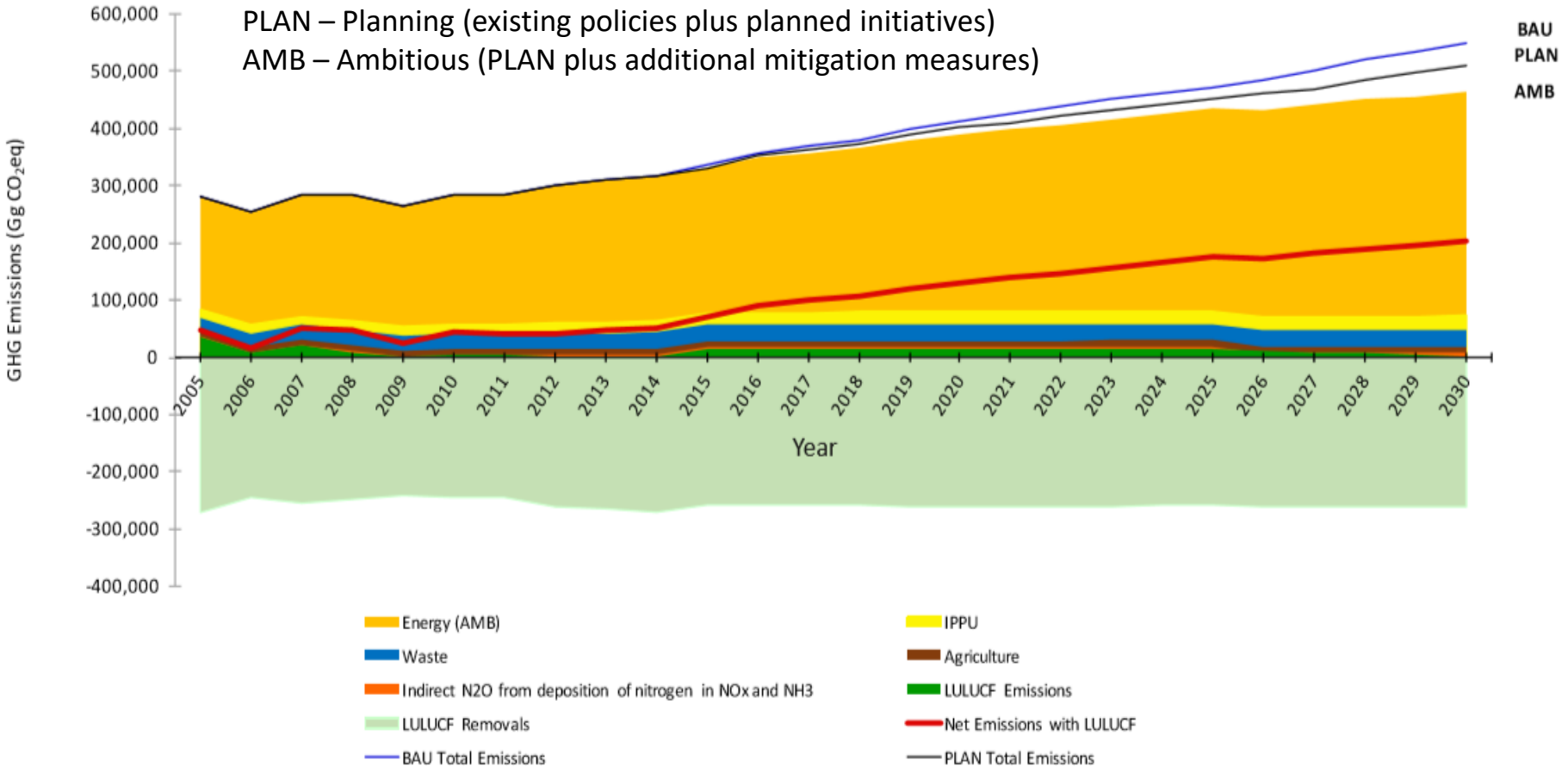
Source : MESTECC, 2018.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Historical and Projected GHG Emissions for Malaysia

Figure 3.1: Projected Greenhouse Gas Emission Time Series for BAU, PLAN and AMB Scenarios

BAU – Business as usual (no additional policy intervention)
PLAN – Planning (existing policies plus planned initiatives)
AMB – Ambitious (PLAN plus additional mitigation measures)

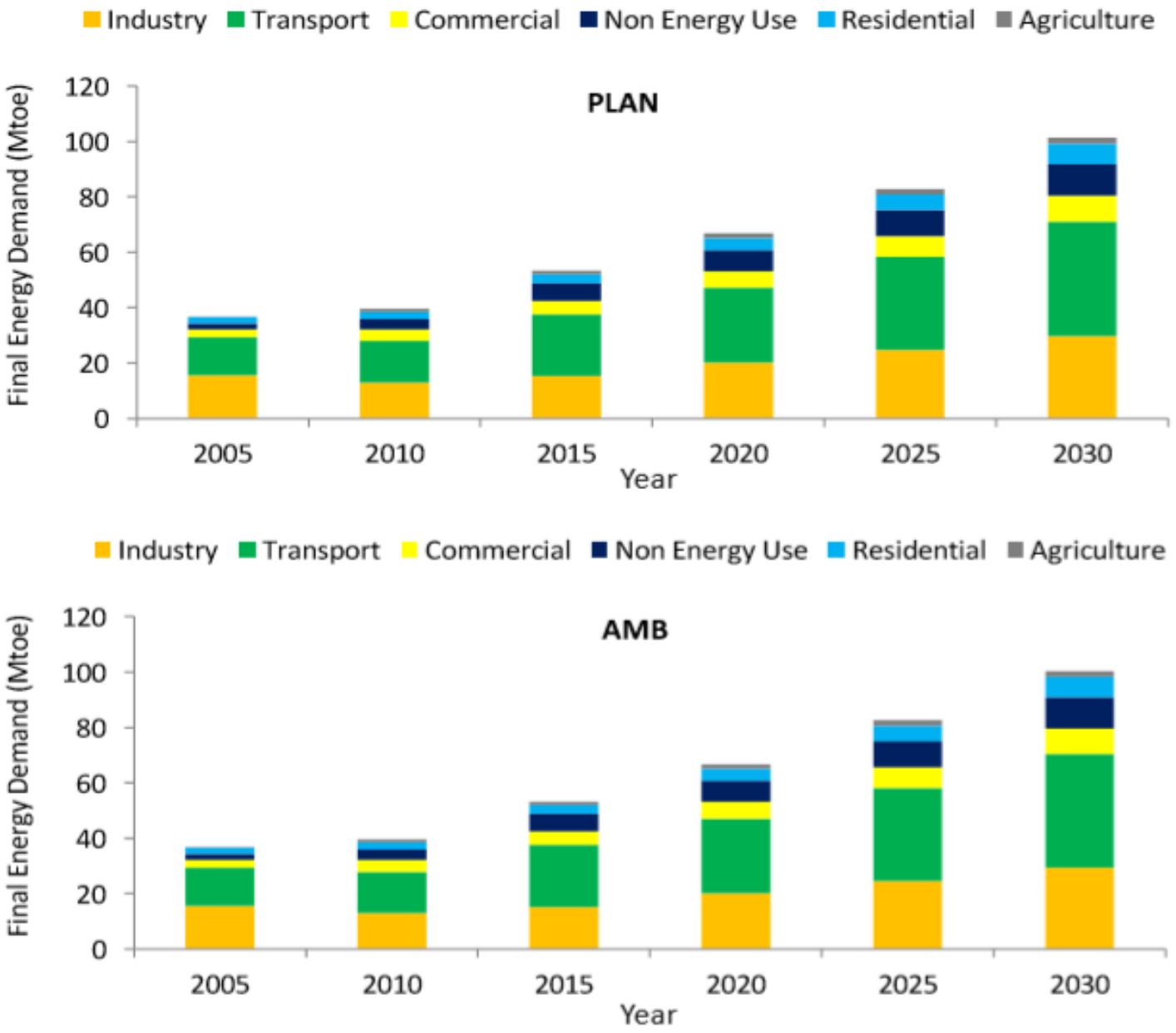


Note : LULUCF - Land Use, Land-Use Change and Forestry; IPPU – Industrial processes and product use

Source : MESTECC, 2018.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Figure 3.3: Final Energy Demand by Sub-Sectors under PLAN and AMB Scenarios from 2005 to 2030



The transport and industrial sub-sectors are major contributors within the Malaysian energy sector.

Source : MESTECC, 2018.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Malaysia's Commitment to Climate Change

- Malaysia's updated its Nationally Determined Contribution (NDC) submitted to the UNFCCC in July 2021.
- Malaysia is committed to reduce by 45% unconditionally, its GHG emissions per GDP by 2030, relative to its emission intensity in 2005.
- GHG coverage has been expanded to 7 greenhouse gasses (GHG): carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbon (PFCs), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3).

Source : KASA, July 2021.

Observed and Projected Annual Temperature and Rainfall for Malaysia

Parameter	Observed (1970 - 2000)	Projected for 2030	Projected for 2050
Average Annual Temperature			
Peninsular Malaysia	25.4 – 26.5 °C	26.0 – 27.4 °C (0.6 to 0.9 °C increase)	26.6 – 28.1 °C (1.2 to 1.6 °C increase)
Sabah	24.3 – 26.1°C	25.3 – 26.9 °C (0.8 to 1.0 °C increase)	25.7 – 27.4 °C (1.3 to– 1.4 °C increase)
Sarawak	24.8 – 26.2 °C	25.6 – 26.8 °C (0.6 to 0.8 °C increase)	26.4 – 27.5 °C (1.3 to 1.6 °C increase)
Average Annual Rainfall			
Peninsular Malaysia	1891 – 2619 mm	1998 – 2663 mm (1 to 6 % increase)	2068 – 2805 mm (7 to 11 % increase)
Sabah	2264 – 3532 mm	2338 – 3392 mm (-4 to 5 % increase)	2284 – 3549 mm (about 1 - 2 % increase)
Sarawak	3551 – 3907 mm	3597 – 4144 mm (1 to 6 % increase)	3574 – 4124 mm (1 to 5 % increase)

Source : MESTECC, 2018.

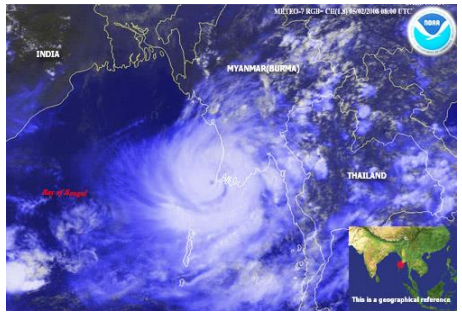
Observed and Projected Sea Level Rise for Malaysia

Parameter	Observed Rate (1993-2010)	Projected for 2030	Projected for 2050
Sea Level Rise			
Peninsular Malaysia	2.73 - 6.45 mm/year	0.03 - 0.10 m 0.05 - 0.10 m (West Coast) 0.03 - 0.07 m (East Coast)	0.11 - 0.21 m 0.11 - 0.21 m (West Coast) 0.11 - 0.15 m (East Coast)
Sabah	5.06 - 7.00 mm/year	0.11 – 0.15 m	0.21 – 0.62 m
Sarawak	3.82 – 5.11 mm/year	0.04 – 0.12m	0.15 – 0.22 m

Source : MESTECC, 2018.

Climate Change and Extreme Weather

- According to IPCC's AR5, more extreme weather events have been observed since the 1950s.
- Globally, from 1993 to 2012, more than 530,000 people died from almost 15,000 extreme weather events.
- Since 2000, 1.2 billion people in the Asia Pacific Region have been exposed to hydrometeorological hazards through 1,215 disaster events, with losses of more than US$2.5 trillion in PPP.
- Environmental hazards + human exposure + population vulnerability = health risk.



- Cyclone Nargis hit Myanmar in May 2008.
- Wind speed up to 134 mph.
- 138,366 fatalities.

Source : Hashim and Hashim (2016)

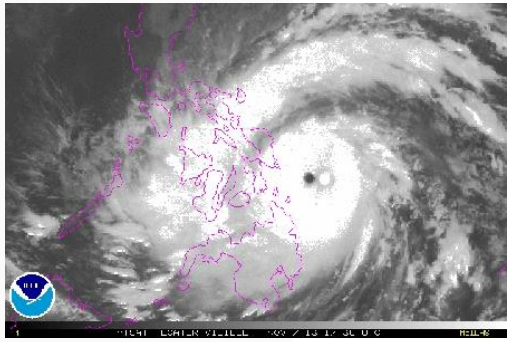
PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Where Extreme Weather Is Causing The Most Fatalities

Annual average fatalities per 100,000 inhabitants due to extreme weather events (1998-2017)

@StatistaCharts Source: Germanwatch

Extreme weather events in the form of hurricanes, typhoons, thunderstorms, and droughts are the main outcomes of climate change.

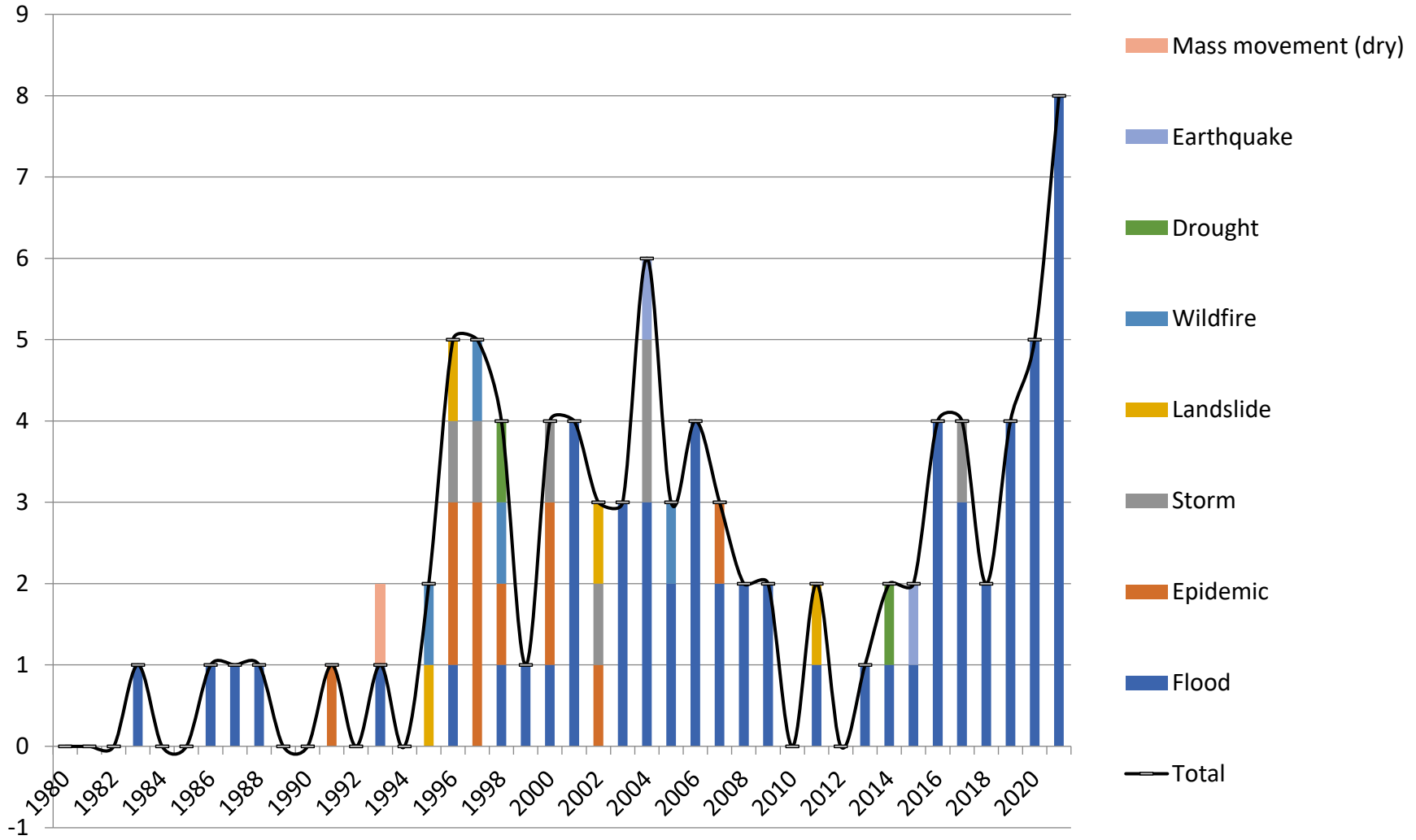


Category 5 Super Typhoon Haiyan or Yolanda that hit the Philippines in November 2013 claimed 6,352 lives with 1,771 missing.

statista

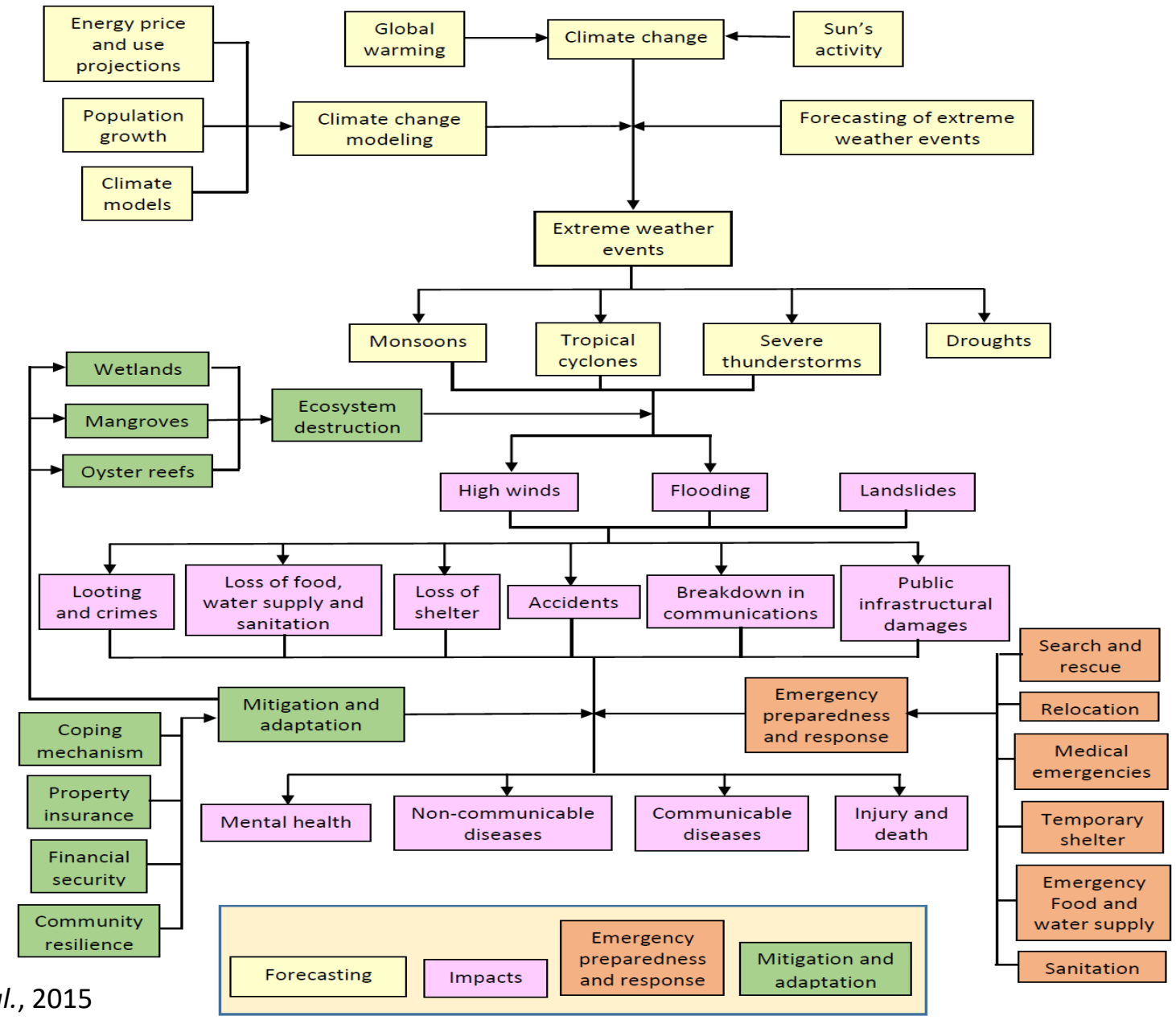
PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Occurrence of Disasters in Malaysia from 1980 to 2021(EMDAT, 2022)



PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Conceptual Framework on Health Impacts from Extreme Weather Events



Source : Hashim *et al.*, 2015

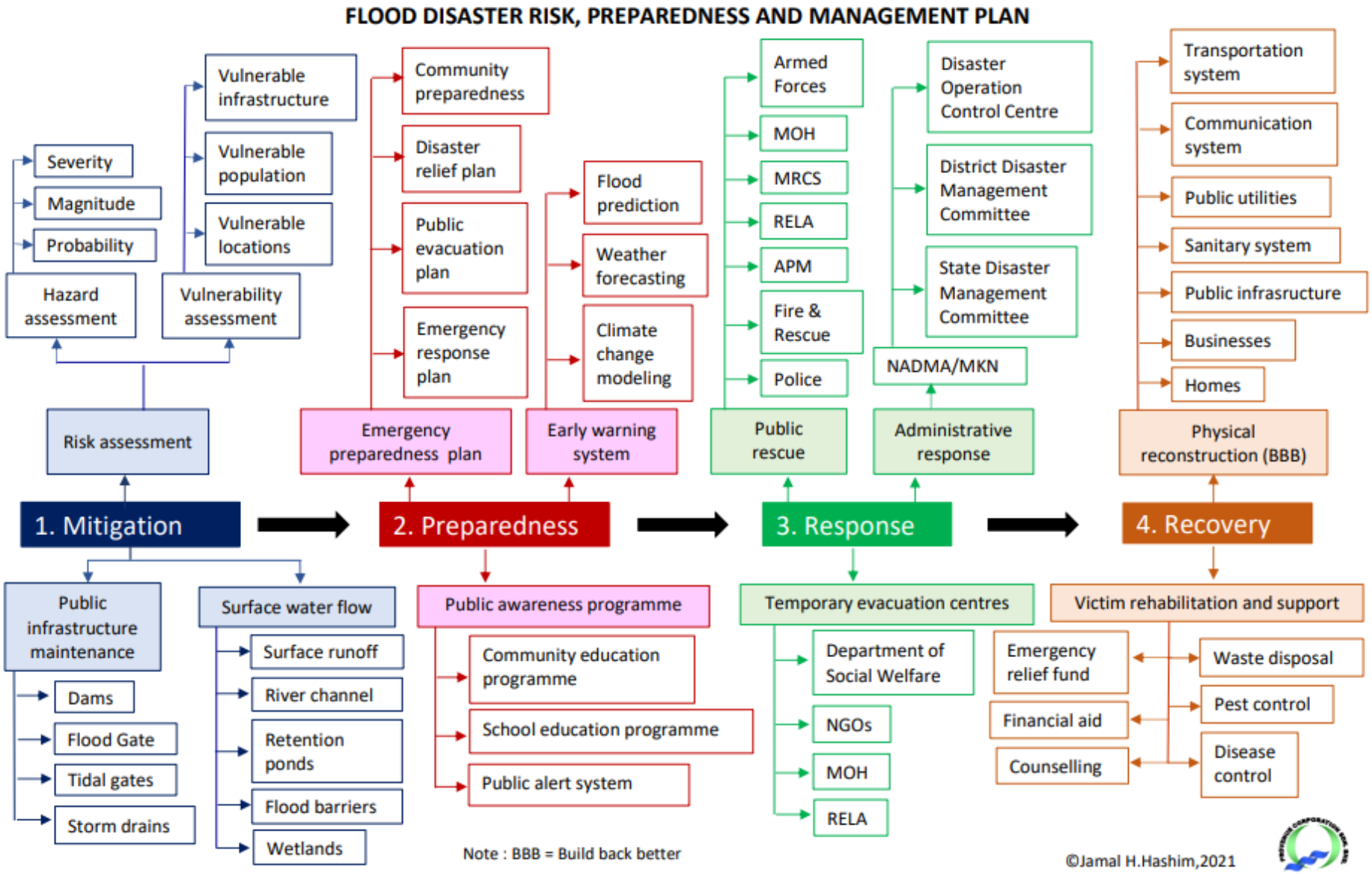
PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

December 2021 Malaysian Flood

- On 16 December 2021, Tropical Depression 29W made landfall near Kuantan, Malaysia bringing torrential downpours over 3 days.
- The resulting floods affected 8 states across Malaysia, displacing 125,490[1] residents, left at least 54 dead, and 2 missing.[2]
- One of the worst hit area was Taman Sri Muda in Shah Alam which recorded 14 deaths as of 22 December.[3]
- The SMART Tunnel operated for a record 22 hours and diverted 5 million m^3 of flood water.[4]
- The economic loss of this flood has been estimated to be between RM6.5[5] to RM20 billion[6].

Tropical Depression 29W

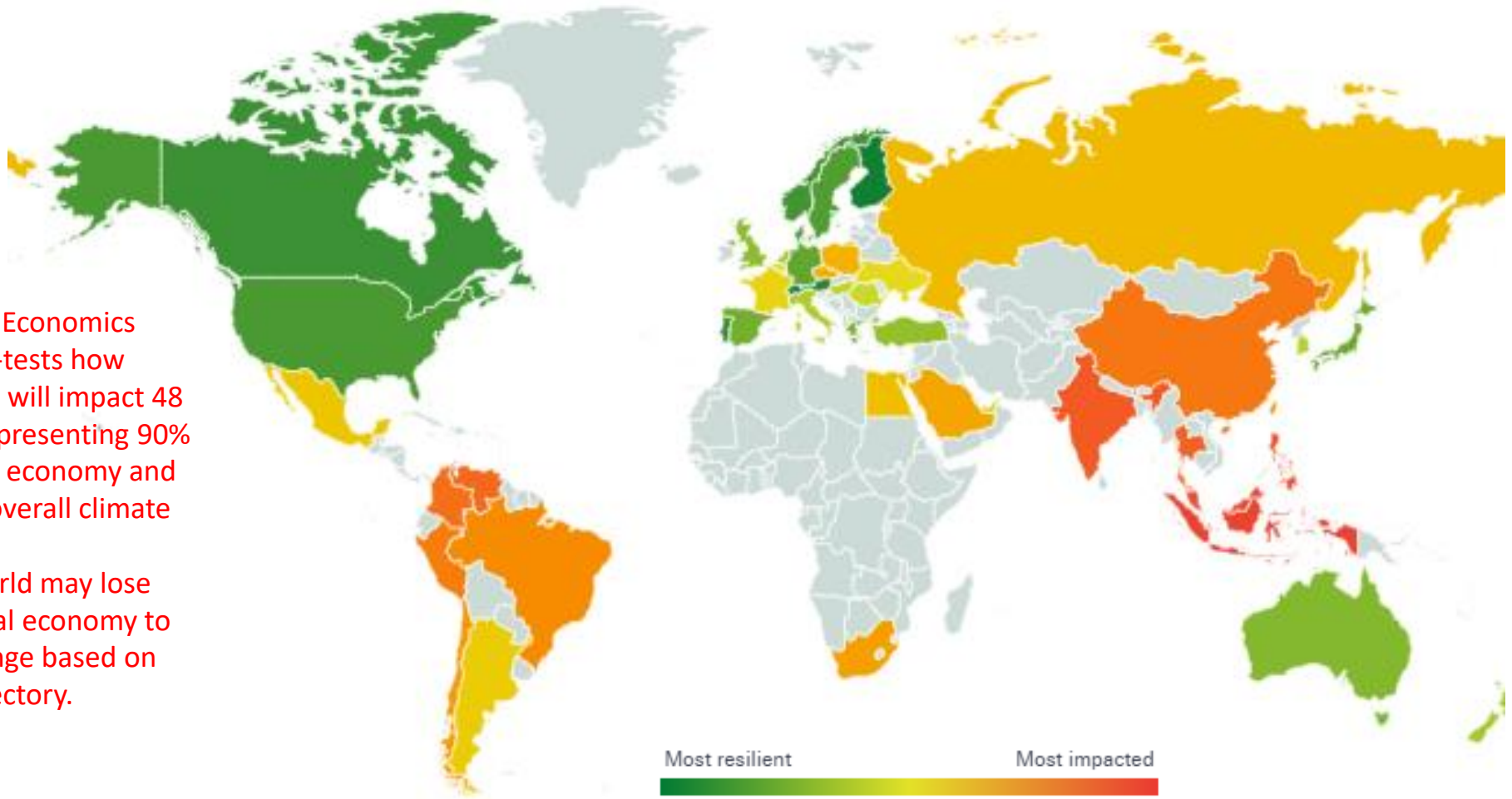
Flood Disaster Risk, Preparedness and Management Plan



PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Global Extreme Weather Economic Risks

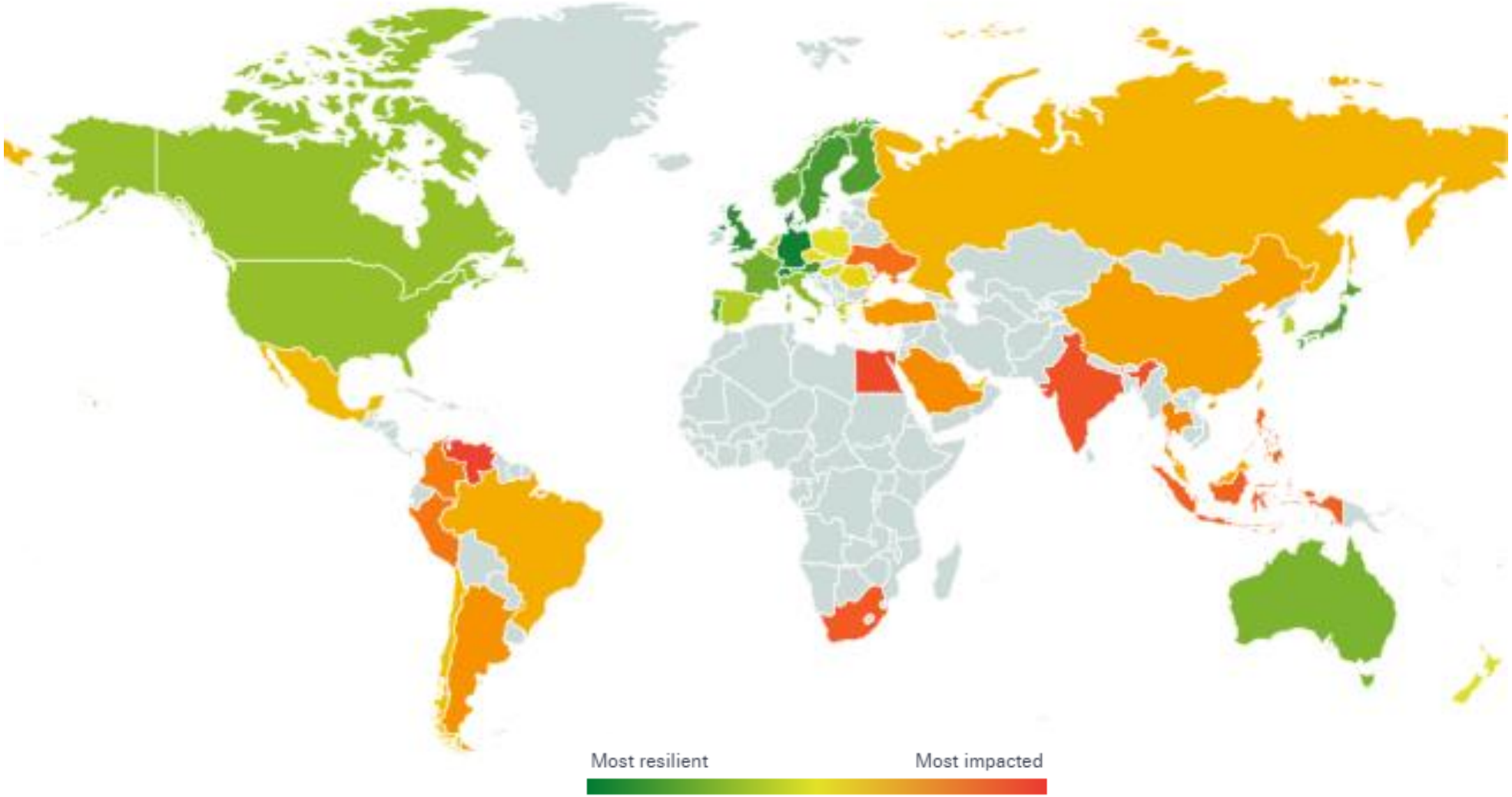
- The Climate Economics Index stress-tests how climate risks will impact 48 countries representing 90% of the world economy and ranks their overall climate resilience.
- By 2050, world may lose 10% of global economy to climate change based on current trajectory.



Source : Swiss Re Institute (2022)

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Global Climate Risk Adaptive Capacity

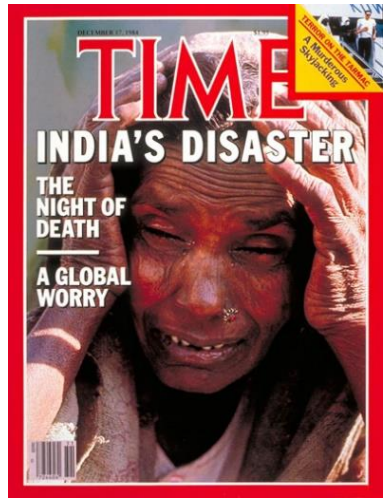


Source : Swiss Re Institute (2022)

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

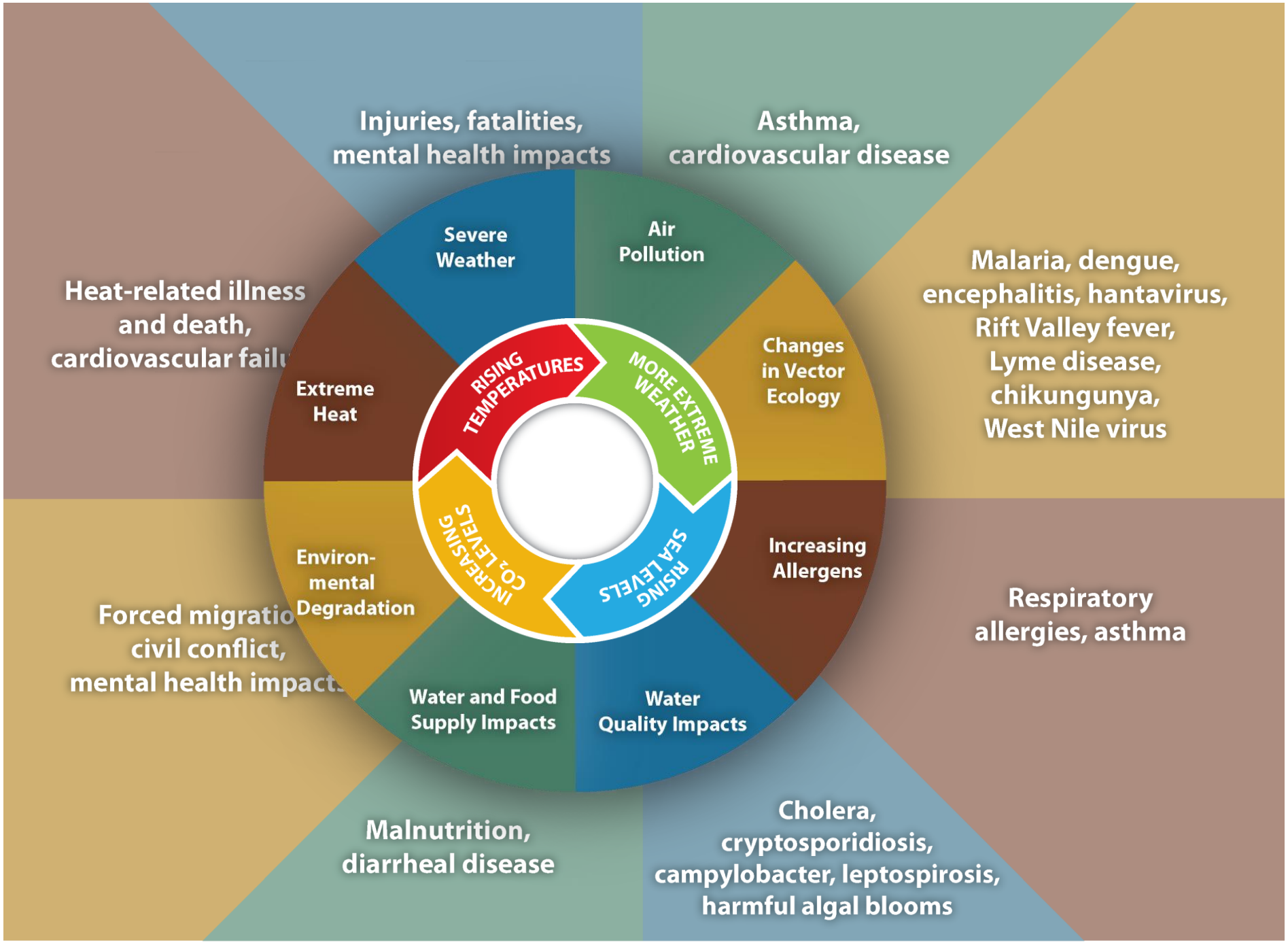
What is a Disaster

A disaster is a sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that exceed the community's or society's ability to cope using its own resources. Though often caused by nature, disasters can have human origins.

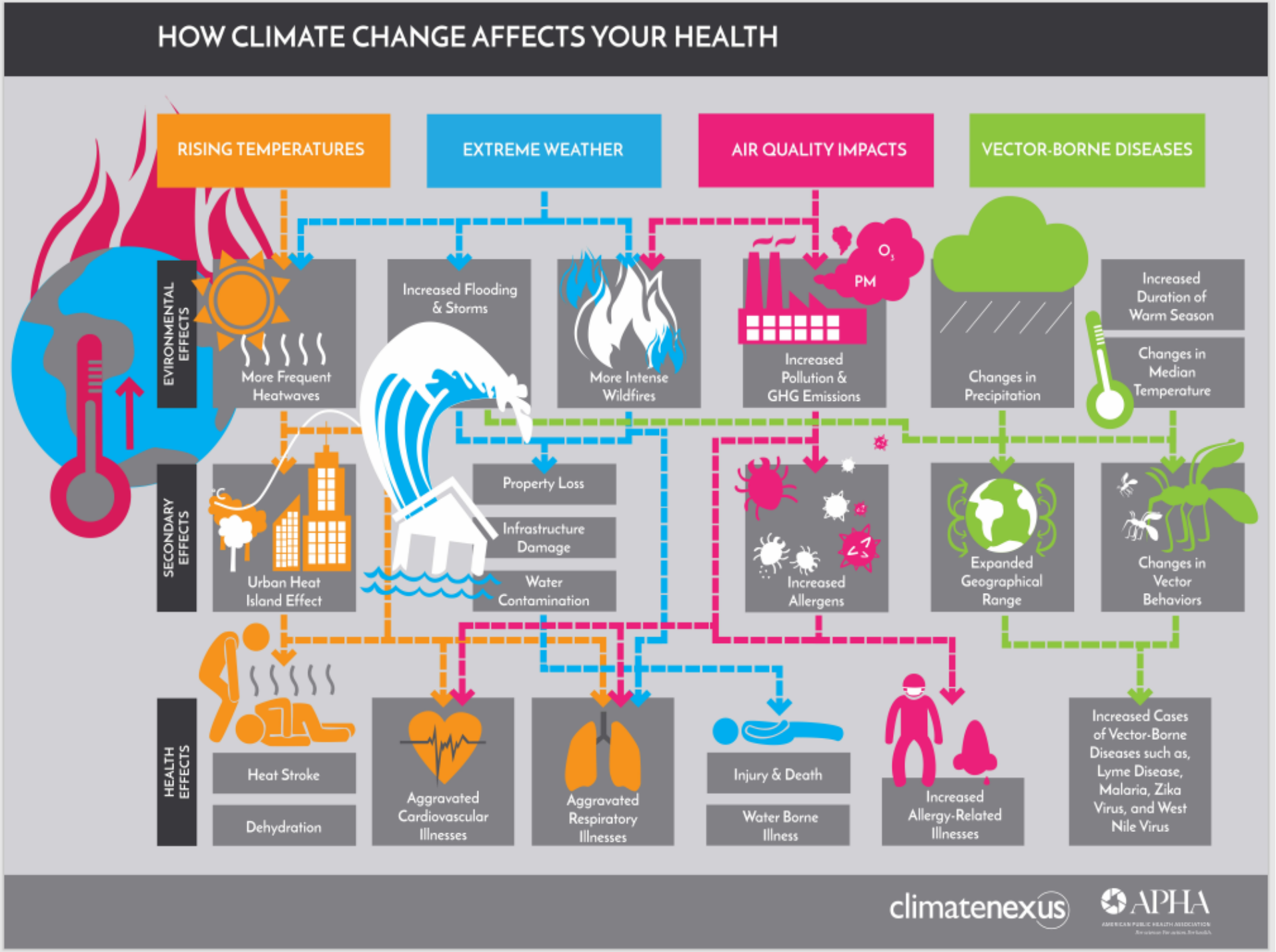


(VULNERABILITY + HAZARD) / CAPACITY = DISASTER

Source: International Federation of Red Cross and Red Crescent Societies. https://www.ifrc.org/en/ (accessed 26 July 2015).



PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant



Am. J. Trop. Med. Hyg., 98(5), 2018, pp. 1281–1295
doi:10.4269/ajtmh.16-0922

Leptospirosis Outbreak After the 2014 Major Flooding Event in Kelantan, Malaysia: A Spatial-Temporal Analysis

Mohd Firdaus Mohd Radi,[1,2] Jamal Hisham Hashim,[1,2*] Mohd Hasni Jaafar,[1] Rozita Hod,[1] Norfazilah Ahmad,[1] Azmawati Mohammed Nawi,[1] Gul Muhammad Baloch,[3] Rohaida Ismail,[4] and Nur Izzah Farakhin Ayub[1]

[1]*Department of Community Health, Faculty of Medicine, National University of Malaysia, Kuala Lumpur, Malaysia;* [2]*United Nations University-International Institute for Global Health, Kuala Lumpur, Malaysia;* [3]*School of Medicine, Taylor's University, Subang Jaya, Selangor, Malaysia;* [4]*Kelantan State Health Department, Kota Bharu, Kelantan, Malaysia*

Abstract. Severe floods increase the risk of leptospirosis outbreaks in endemic areas. This study determines the spatial-temporal distribution of leptospirosis in relation to environmental factors after a major flooding event in Kelantan, Malaysia. We conducted an observational ecological study involving incident leptospirosis cases, from the 3 months before, during, and three months after flood, in reference to the severe 2014 Kelantan flooding event. Geographical information system was used to determine the spatial distribution while climatic factors that influenced the cases were also analyzed. A total of 1,229 leptospirosis cases were notified within the three study periods where incidence doubled in the postflood period. Twelve of 66 subdistricts recorded incidence rates of over 100 per 100,000 population in the postflood period, in comparison with only four subdistricts in the preflooding period. Average nearest neighborhood analysis indicated that the cases were more clustered in the postflood period as compared with the preflood period, with observed mean distance of 1,139 meters and 1,666 meters, respectively (both at $P < 0.01$). Global Moran's I was higher in the postflood period (0.19; $P < 0.01$) as compared with the preflood period (0.06; $P < 0.01$). Geographic weighted regression showed that living close to water bodies increased the risk of contracting the disease. Postflooding hotspots were concentrated in areas where garbage cleanup occurred and the incidence was significantly associated with temperature, humidity, rainfall, and river levels. Postflooding leptospirosis outbreak was associated with several factors. Understanding the spatial distribution and associated factors of leptospirosis can help improve future disease outbreak management after the floods.

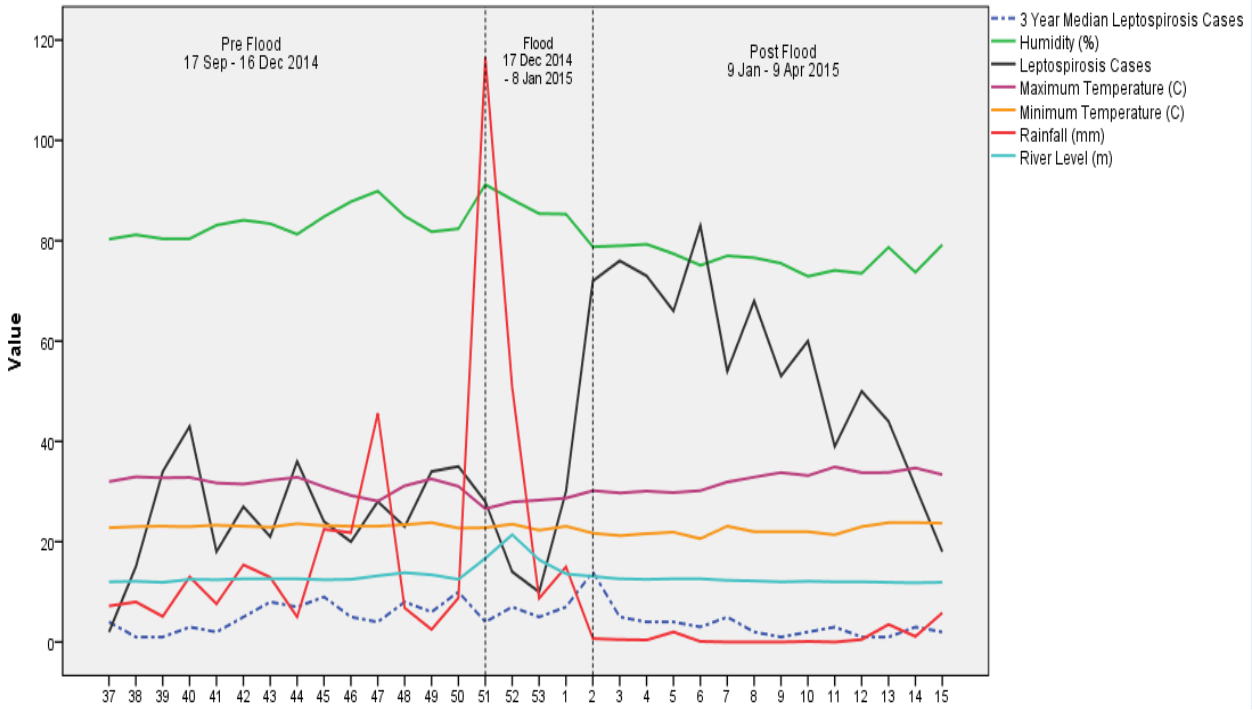
PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

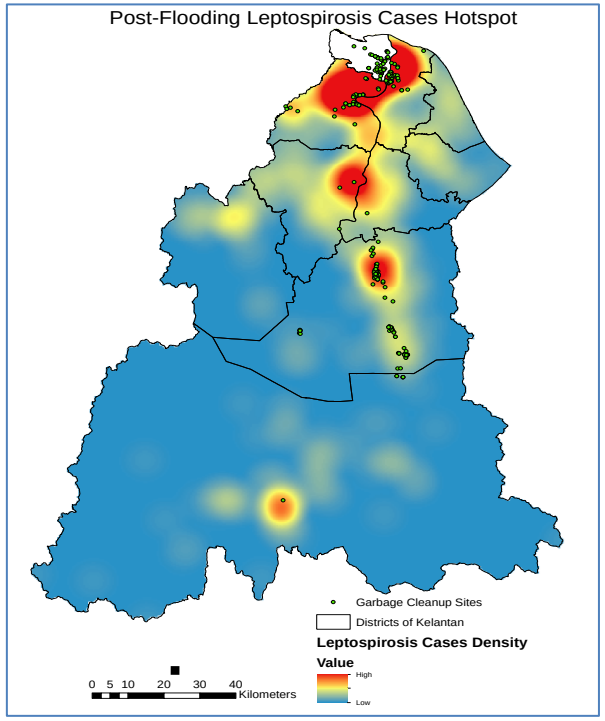
Am. J. Trop. Med. Hyg., 98(5), 2018, pp. 1281–1295
doi:10.4269/ajtmh.16-0922

Leptospirosis Outbreak After the 2014 Major Flooding Event in Kelantan, Malaysia: A Spatial-Temporal Analysis

Mohd Firdaus Mohd Radi,[1,2] Jamal Hisham Hashim,[1,2*] Mohd Hasni Jaafar,[1] Rozita Hod,[1] Norfazilah Ahmad,[1] Azmawati Mohammed Nawi,[1] Gul Muhammad Baloch,[3] Rohaida Ismail,[4] and Nur Izzah Farakhin Ayub[1]

[1]Department of Community Health, Faculty of Medicine, National University of Malaysia, Kuala Lumpur, Malaysia; [2]United Nations University-International Institute for Global Health, Kuala Lumpur, Malaysia; [3]School of Medicine, Taylor's University, Subang Jaya, Selangor, Malaysia; [4]Kelantan State Health Department, Kota Bharu, Kelantan, Malaysia





PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

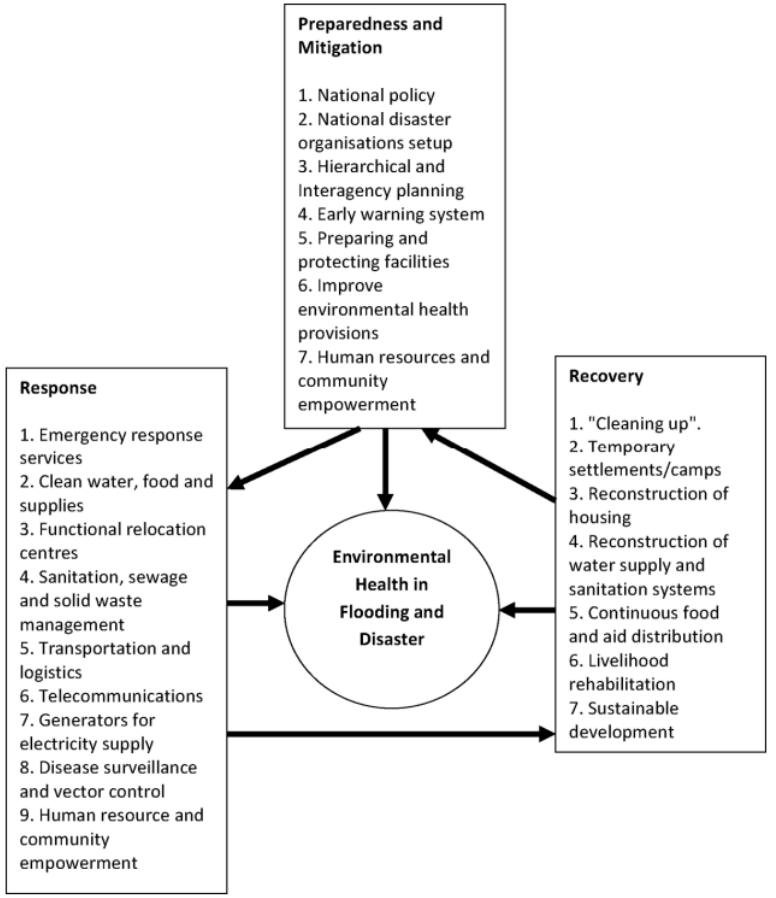
International Journal of Emergency Management
> 2019 Vol.15 No.1

Title: Lessons on environmental health and disaster preparedness, response and recovery from the severe Kelantan flooding in 2014

Authors: Mohd Firdaus Mohd Radi; Jamal Hisham Hashim; Mohd Hasni Jaafar; Rozita Hod; Norfazilah Ahmad; Azmawati Mohammed Nawi; Gul Muhammad Baloch; Rohaida Ismail; Nur Izzah Farakhin Ayub

Abstract: Flood is a natural disaster that occurs annually in Malaysia causing devastating effects and damages to property and lives. This study looks into our environmental health and disaster preparedness, response and recovery management throughout the severe 2014 Kelantan flooding. We conducted three focus group discussions (FGDs) with healthcare, rescue and welfare workers, and community representatives involved throughout the disaster. The unprecedented severe flooding affected our environmental health and disaster management leading to various prominent issues. State level officers faced greater challenges in inter-agency communication, coordination and collaboration. District level staff faced more complications during disaster and emergency response. Meanwhile, community representatives faced issues pertaining to their livelihood mainly during and after the disaster. Recommendations include improved coordination, effective communication, improved human resource management, accessible early warning system, community empowerment and awareness, and prioritisation of continuous environmental health services. We hope that these recommendations can improve our future disaster management.

Figure 1 Theoretical framework on environmental health provisions in different disaster management phases



PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Malaysia's Adaptation to Climate Change

- Upgrading climate modelling capacity.
- Monitoring and forecasting of extreme weather events.
- Training on adaptation of agriculture to climate change.
- Improve public health response to extreme weather events such as heat waves, drought and flooding.
- Improve national disaster response mechanism (NADMA).

Source : MESTECC, 2018.

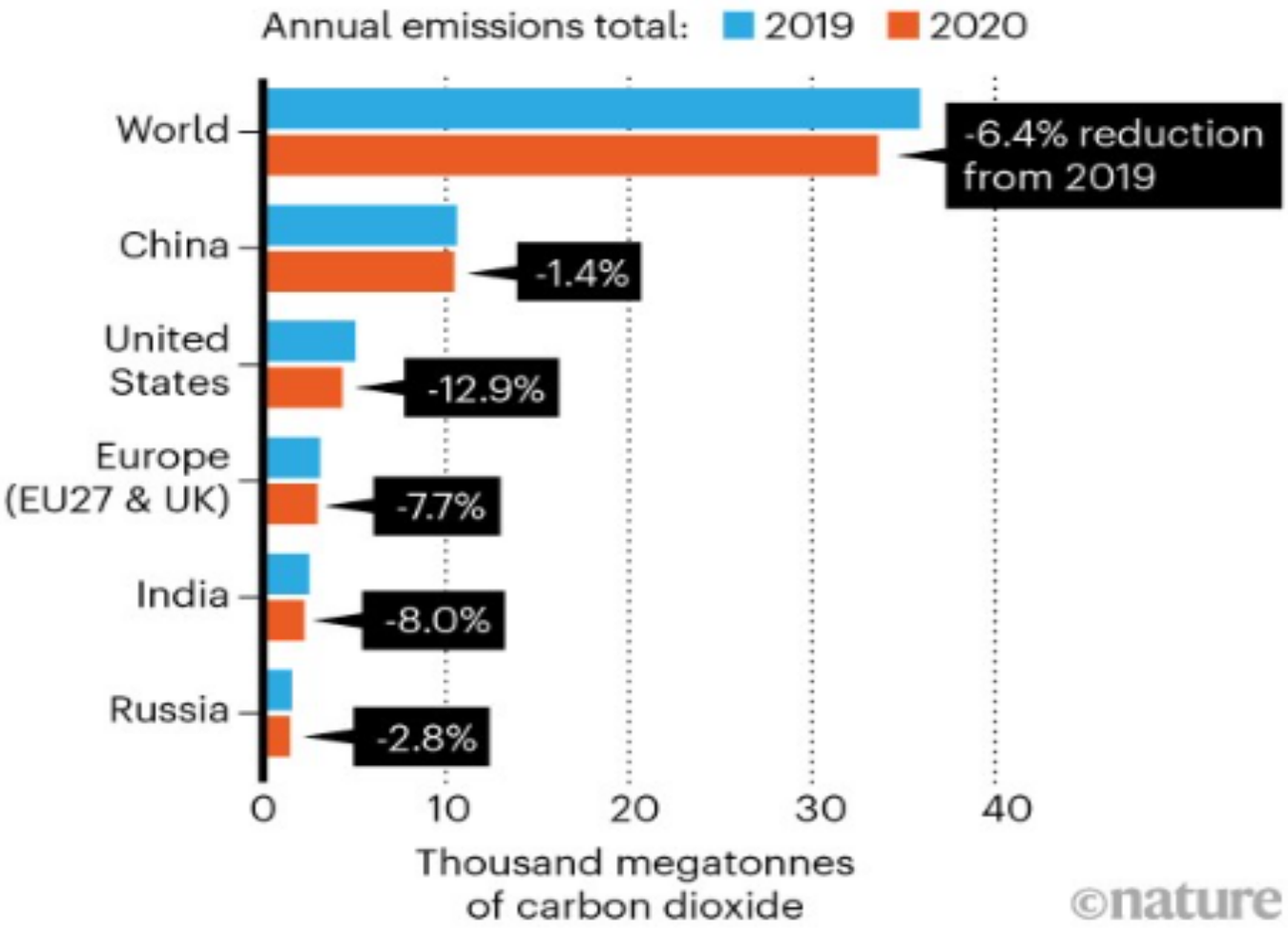
COVID-19 and Climate Change

- Worldwide lockdowns, travel restrictions and economic slowdown due to COVID-19 have curbed carbon emissions globally.
- Global carbon dioxide emissions fell by 6.4%, or by 2.3 billion tonnes in 2020, compared to 2019 (equivalent to twice Japan's yearly emissions).
- Carbon emission from the aviation sector fell by 48%.
- UNEP estimated that we need to cut carbon emissions by 7.6% per year for the next decade to limit global warming to 1.5°C above pre-industrial levels.

Source : Tollefson (2021)

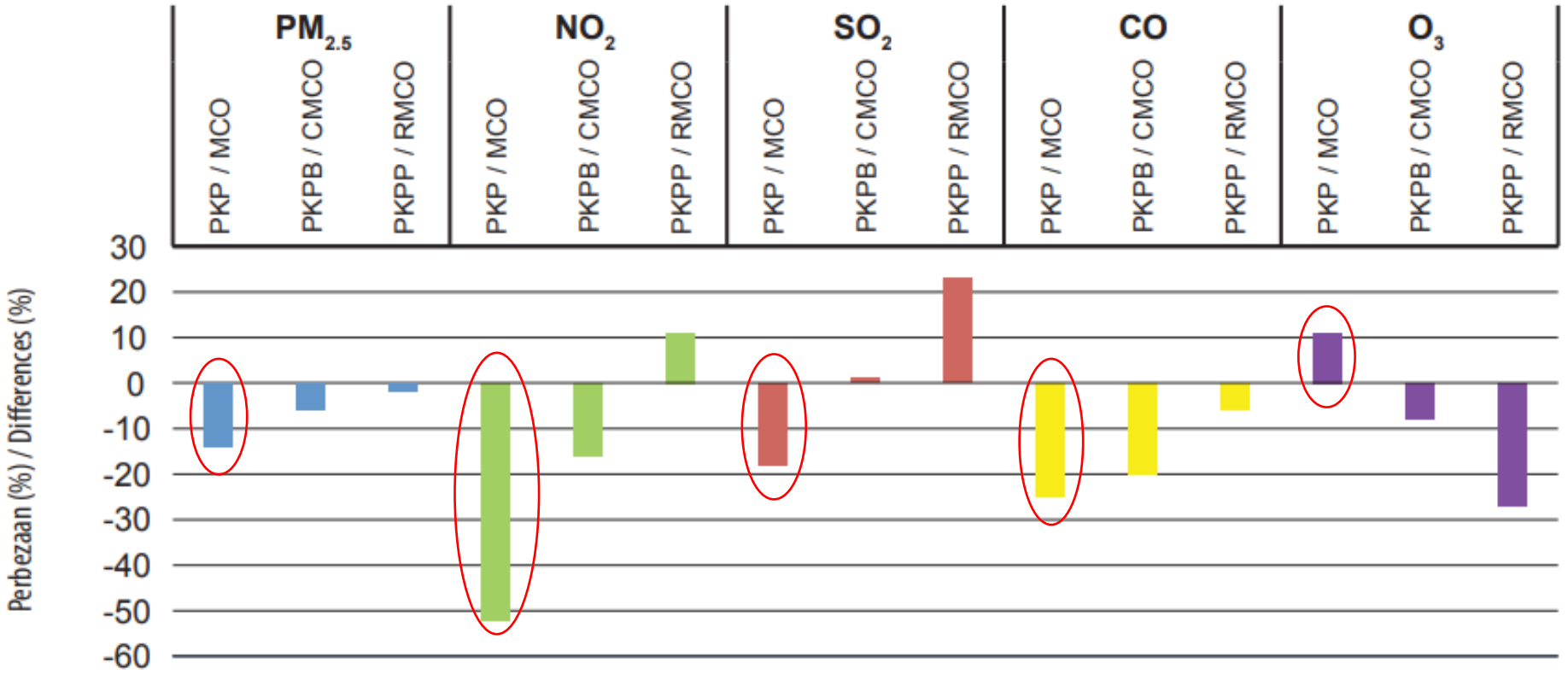
CARBON CUTS

The COVID-19 pandemic took a bite out of CO_2 emissions in many countries, but trends varied. China saw a minor decrease because its economy recovered after outbreaks in early 2020. The United States tallied the largest reduction, driven by outbreaks lasting throughout the year.



Source : Tollefson (2021)

Impact of COVID-19 Lockdown on Air Quality in Malaysia, 2020



Rajah 1.14 : Perbezaan Peratus Pencemar Udara Semasa PKP, PKPB dan PKPP di Lembah Klang

Figure 1.14 : Percentage Differences of Air Pollutants During MCO, CMCO and RMCO in Klang Valley

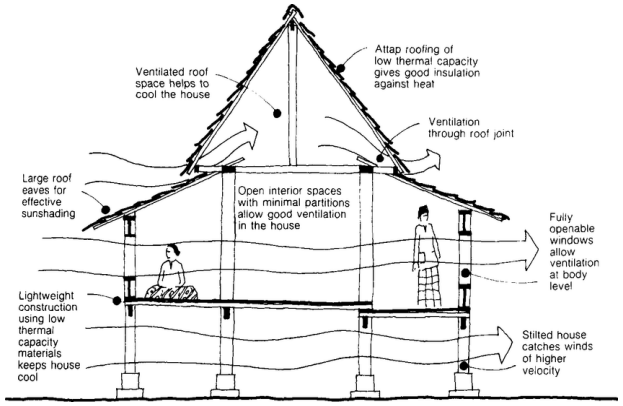
MCO = Movement control order
CMCO = Conditional movement control order
RMCO = Recovery movement control order

Source : DOE, 2021.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

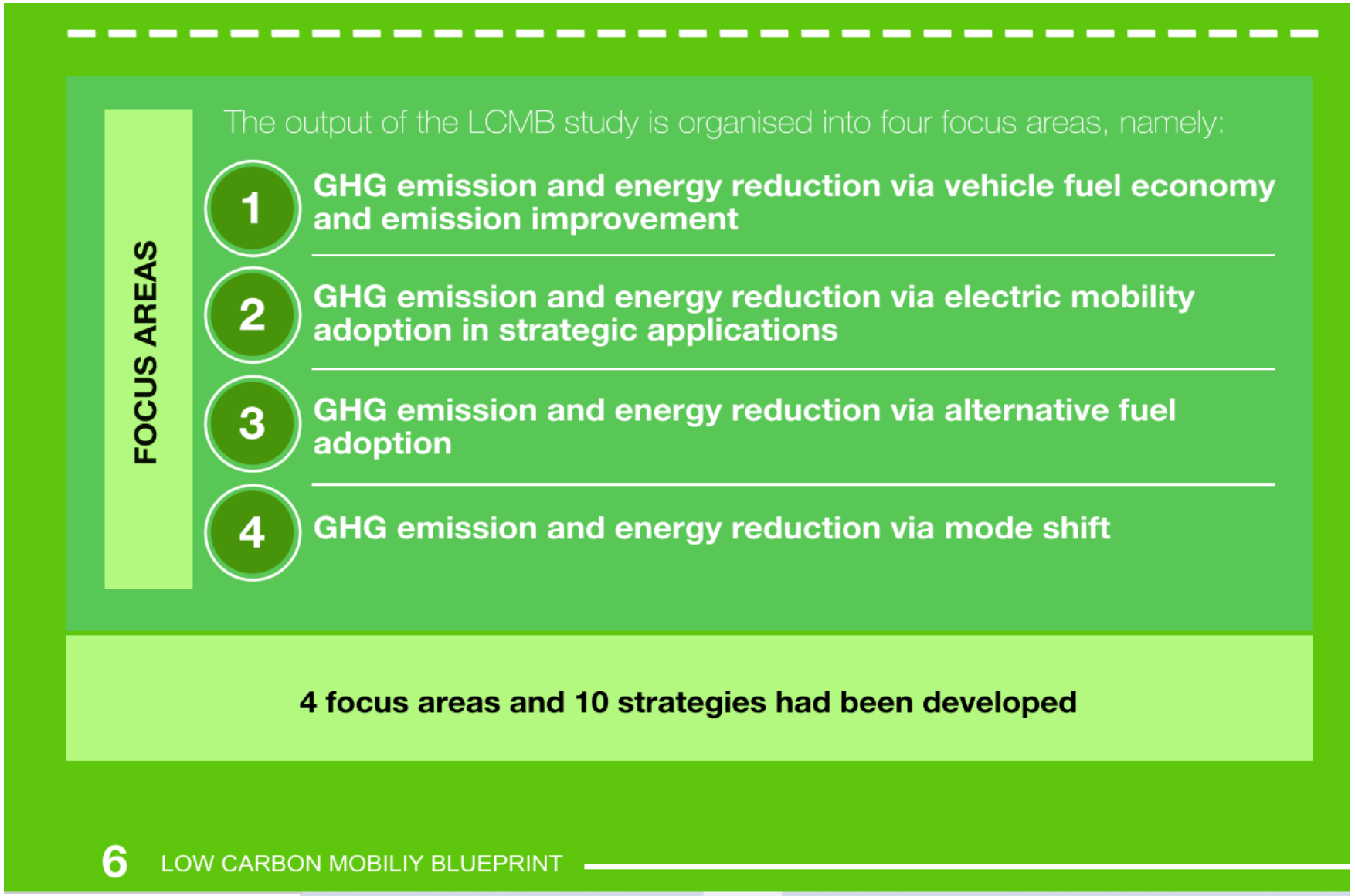
Post Pandemic Adaptation Strategy

- Increase green cover
- Promote renewable energy use
- Work remotely (work from home, SoHo)
- Promote active transport (walking, bicycling)
- Re-invent public transportation
- Electrification of personal transport
- Re-introduce eastern architecture
- Energy efficient smart building
- Increasing agricultural yields
- Flood mitigation



PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Malaysia's Low Carbon Mobility Blueprint 2021-30



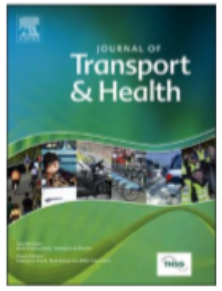
PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Journal of Transport & Health 6 (2017) 187–200

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth



The carbon savings and health co-benefits from the introduction of mass rapid transit system in Greater Kuala Lumpur, Malaysia

Soo Chen Kwan[a,b,*], Marko Tainio[c,d], James Woodcock[c], Rosnah Sutan[b], Jamal Hisham Hashim[a]

[a] United Nations University-International Institute for Global Health, Kuala Lumpur, Malaysia
[b] Department of Community Health, National University of Malaysia, Kuala Lumpur, Malaysia
[c] MRC Epidemiology Unit, University of Cambridge, Cambridge, United Kingdom
[d] The Systems Research Institute (SRI), Polish Academy of Sciences, Warsaw, Poland

Focus Area 4 : GHG emission & energy reduction via mode shift

S6: Shifting private transport to public transport
S7: Promoting public transport through land-use development
S8: Improving traffic flow
S9: Shifting freight mode from road to rail
S10: Promoting active and micro mobility

- Malaysia targets 40% of modal share for public transport in all cities by 2030.

The Star ONLINE

News Business Sport Metro Tech Lifestyle Opinion Videos Property Jobs Autos More

TOPICS 1MDB | True or Not | Star Golden Hearts Award | Star Empowerment

MRT expected to reduce fatalities in road accidents

NATION

Saturday, 17 Jun 2017

PETALING JAYA: The first two MRT lines in the Klang Valley will not only reduce environmental pollution, but are also expected to prevent about 200 deaths from road accidents in each year of operation.

A study by the International Institute for Global Health of the United Nations University (UNU) estimated that the MRT Sungai Buloh-Kajang and the Sungai Buloh-Serdang-Putrajaya lines would avert 183 deaths and 9,604 disability-adjusted life years (DALYs) every year.

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Table 2
CO_2 eq (tons/year) and PM2.5 emissions (g/day).

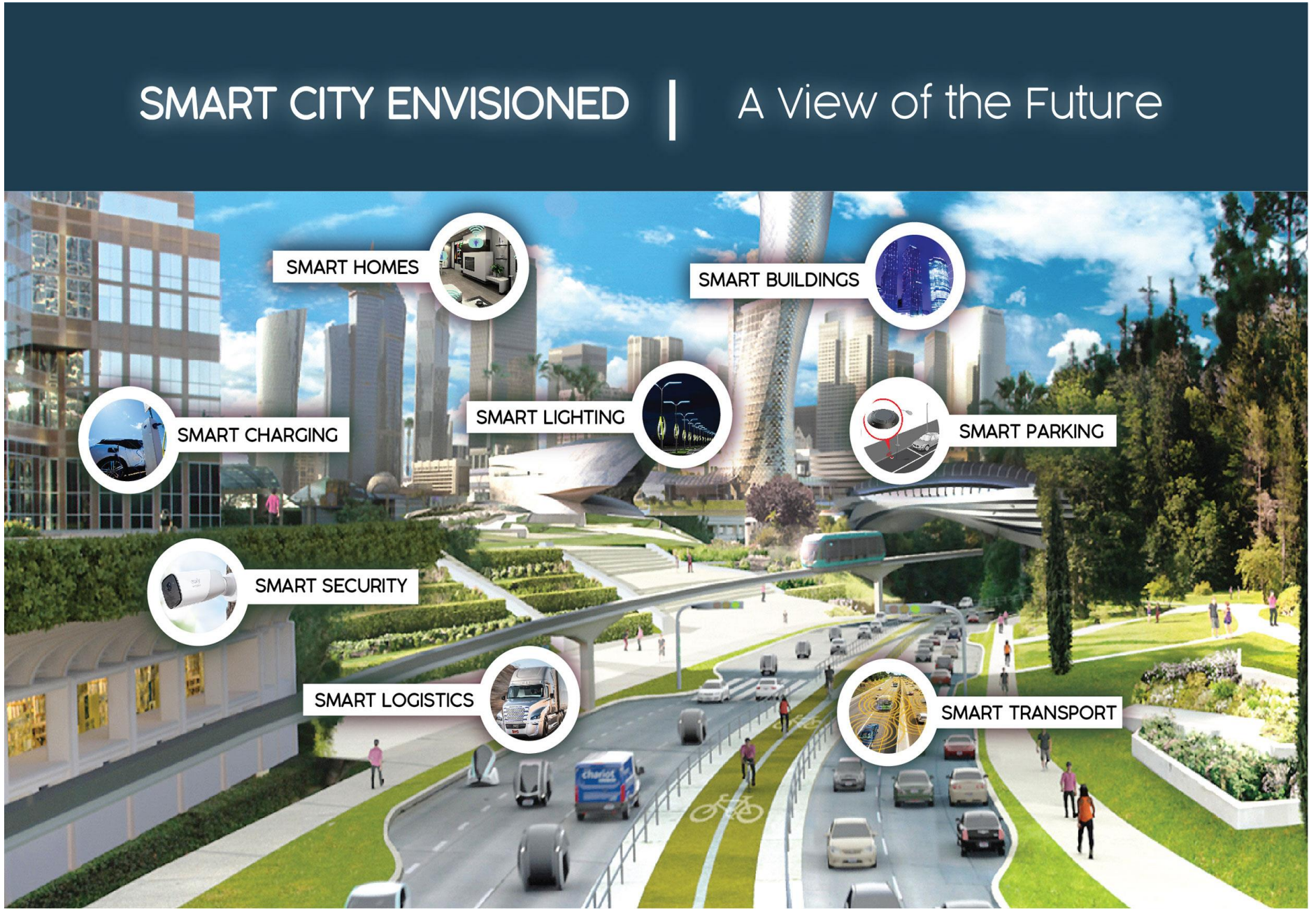
	MRT(SBK)			MRT (SSP)			Total
	PC	MC	Subtotal	PC	MC	Subtotal	
CO_2 eq (tons/year)							
Line haul	−114,848	−38,306	−153,155	−138,493	−46,193	−184,687	−337,842
Access-egress	40,484	2867	43,353	48,819	3458	52,279	95,632
Net total	−74,364	−35,439	−109,802	−89,674	−42,735	−132,408	−242,210
PM2.5 (g/day)							
Line haul	−20,751	−18,693	−39,444	−25,024	−22,541	−47,565	−87,009
Access-egress	7301	1400	8701	8805	1688	10,493	19,194
Net total	−13,450	−17,293	−30,743	−16,219	−20,853	−37,072	−67,815

PC: passenger car, MC: motorcycle

Table 3
Mortality and DALYs avoided by the two MRT lines per year.

	MRT (SBK)		MRT (SSP)		Total	
	Death	DALYs	Death	DALYs	Death	DALYs
Air pollution[a]						
Line haul	−2	−44.2	−4	−88.9	−6	−133.1
Access-egress	0.4	9.7	0.9	19.5	1.3	29.2
Net total	−1.6	−34.5	−3.1	−69.4	−4.7	−103.9
Traffic injuries[b]						
Line haul	−73	−4424	−88	−5335	−161	−9759
Access-egress	33	1568	40	1891	73	3459
Net total	−40	−2856	−48	−3444	−88	−6300
Physical activity[b]	−41	−1443	−49	−1740	−90	−3183
Net total	−83	−4334	−100	−5253	−183	−9587

[a] Population of impacts: MRT (SBK) = 1.2 million; MRT (SSP) = 2.0 million.
[b] Population of impacts: MRT (SBK) = 442,000; MRT (SSP) = 553,000.



Smart homes, smart workplaces, smart cities.

Source: Energy Watch (2021)

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Green and Smart Building Concept

- Intelligent approach to energy efficiency (e.g. intelligent lighting, temperature control, ventilation, solar panels, inverter air-conditioning and LED lights).
- Efficient water use (e.g. rain water harvesting, dual-flushing toilets).
- Minimising wastes and maximising reuse (e.g. promote waste recycling).
- Promoting health and well-being (e.g. good indoor air quality and health monitor).
- Greening the environment (e.g. urban farms).
- Resilient structures (e.g. heat and flood resistant).
- Connecting communities and people (e.g. promote active transport, high-speed internet).
- Reducing impacts in buildings life-cycle (e.g. use of recycled materials).

FIRST STEPS FOR GREENING YOUR HOME

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Picture: a graphic showing how the modern office may function, showing perspex screens, automated reception and one-way systems

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant

Thank you

PROVENUE CORPORATION SDN. BHD.
Environmental, Health & Safety Consultant