STRATEGIC STAKEHOLDER FORUM FOR INCORPORATING CLIMATE RESILIENCE IN THE NATIONAL WATER RESOURCES POLICY ACTION PLANS 2014

NATIONAL WATER RESOURCES POLICY (NWRP) ACTION PLANS : CLIMATE CHANGE RESILIENCE

Dato' Seri Ir. Hj. Ahmad Husaini Sulaiman,
Director General, Department of Irrigation and Drainage, Malaysia

27 October 2014

OUTLINES

1. **Introduction – State of Water Resources**
2. Climate change finding (Global/ National)
3. Climate Change And Its Impact
4. Climate change in relation to Water-Food-Energy Nexus
5. Initiatives by the government
6. National Water resources Policy in Addressing Climate Change
   - Plan of actions under NWRP addressing Climate Change
7. Related immediate programs to be carried out by JPS
8. What Next ?
9. CONCLUSION

The Water Problem

Population increase

Increased economic activity

Finite, renewable, yet vulnerable water resource

Increased water use and increased pollution

Increased competition and conflicts (local, national, international)

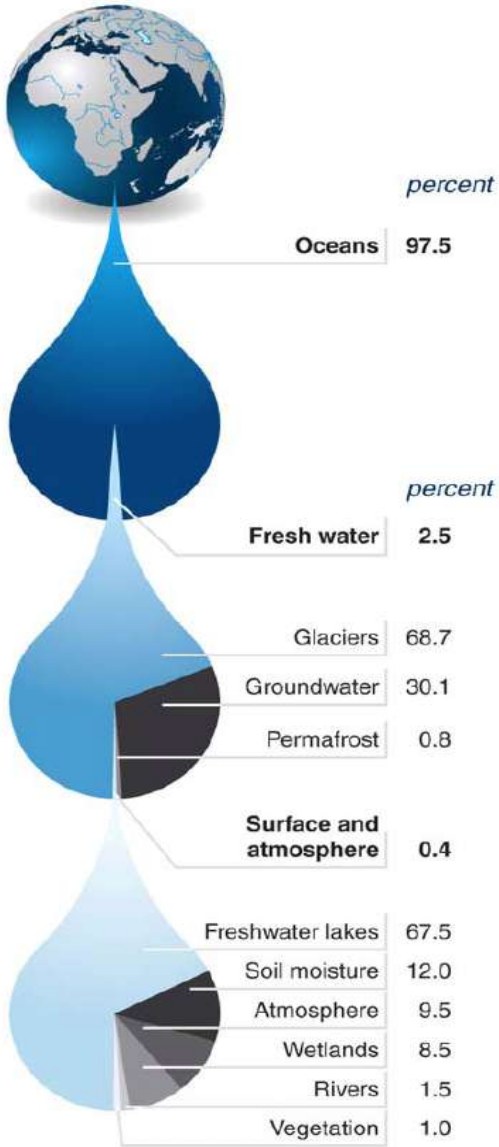
Sectoral and fragmented management

Impacts of climate change

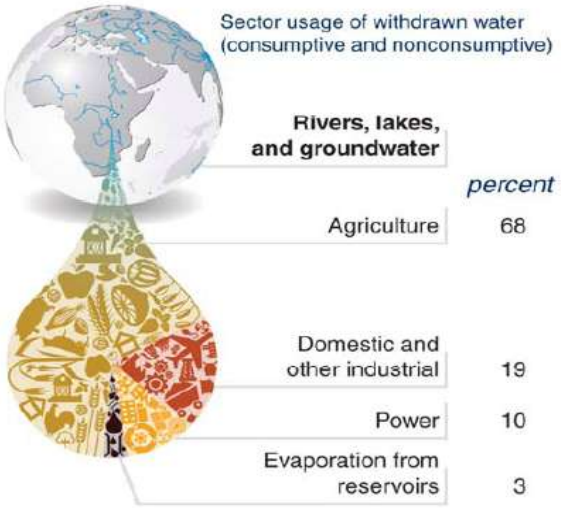
THE EARTH'S WATER – A REMINDER

The Earth's Water

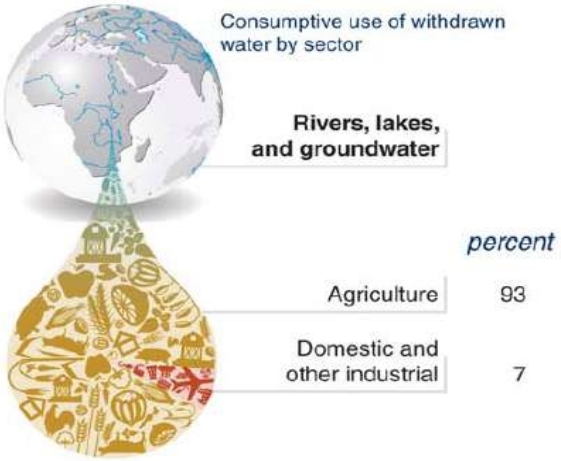
Water Distribution



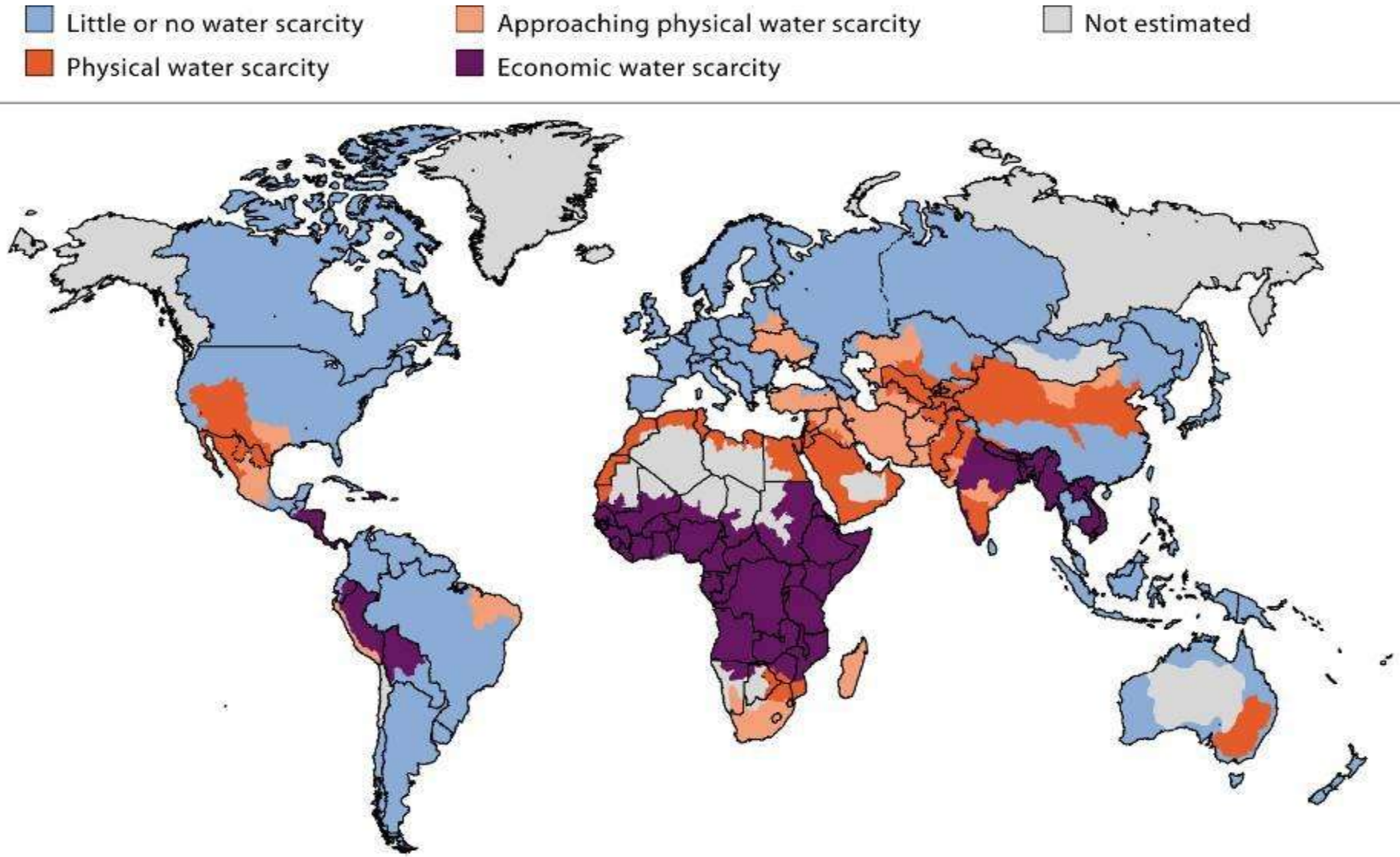
Freshwater Use



Freshwater Use



Water Scarcity Map



1/3 of the world's population live in basins that have to deal with water scarcity

Source: Comprehensive Assessment of Water Management in Agriculture, 2007

Water Supply Scenario

Water Supply Issues:

- **Infinite becomes a finite resource – spatially and temporally**
- **Rapid urbanization and population growth**
- **Inadequate infrastructure**
- **High non-revenue water (NRW)**
- **Low water pricing**
- **Water pollution**
- **Climate change – uncertainty**

Malaysia's Water Resource Scenarios - Total Water Availability versus Consumptive Water Demand

States	Land Area sq km	Total Consumptive Water demand (MCM)					Effective rain (MCM/Year)	Excess/deficit (MCM) - Unregulated Flows				
		2010	2020	2030	2040	2050		2010	2020	2030	2040	2050
Perlis	821	306	299	286	284	281	60	(246)	(239)	(226)	(224)	(221)
Kedah	9,500	2,922	2,976	2,842	2,873	2,876	1,070	(1852)	(1906)	(1772)	(1803)	(1806)
Pulau Pinang	1,048	765	829	835	874	894	130	(635)	(699)	(705)	(744)	(764)
Kelantan	15,099	1,632	1,619	1,586	1,600	1,604	2,650	1018	1031	1064	1050	1046
Terengganu	13,035	884	975	970	999	1,026	3310	2426	2335	2340	2311	2284
Perak	21,035	1,949	1,923	1,798	1,801	1,811	3,140	1191	1217	1342	1339	1329
Selangor	8,396	2,238	2,491	2,570	2,760	2,922	960	(1278)	(1531)	(1670)	(1800)	(1962)
Pahang	36,137	726	946	897	911	959	6,460	5739	5514	5563	5549	5501
Negeri Sembilan	6,686	340	361	358	366	374	640	300	279	282	274	266
Melaka	1,664	323	366	376	409	439	140	(183)	(226)	(336)	(269)	(299)
Johor	19,210	715	881	1,033	1,164	1,301	3,290	2575	2409	2257	2126	1989
Pen Malaysia	132,631	12,800	13,664	13,551	14,040	14,488	21,170	8370	7506	7619	7130	6682
Sabah	73,631	912	1,356	1,392	1,442	1,469	16,210	15298	14854	14818	14768	14741
Sarawak	124,450	1,054	2,162	2,125	2,175	2,247	27,440	26386	25278	25375	25265	15193
WP Labuan	91	18	24	26	28	29	30	12	6	4	2	1
East Malaysia	198,172	1,985	3,541	3,542	3,645	3,745	53,190	51205	49649	49648	49545	49445
Total Malaysia	330,803	14,785	17,205	17,093	17,685	18,233	74,350	59565	57145	57257	56665	56117

IN RED BOXES : WATER DEFICIT

Source: Review of National Water Resources Study 2015 - 2050

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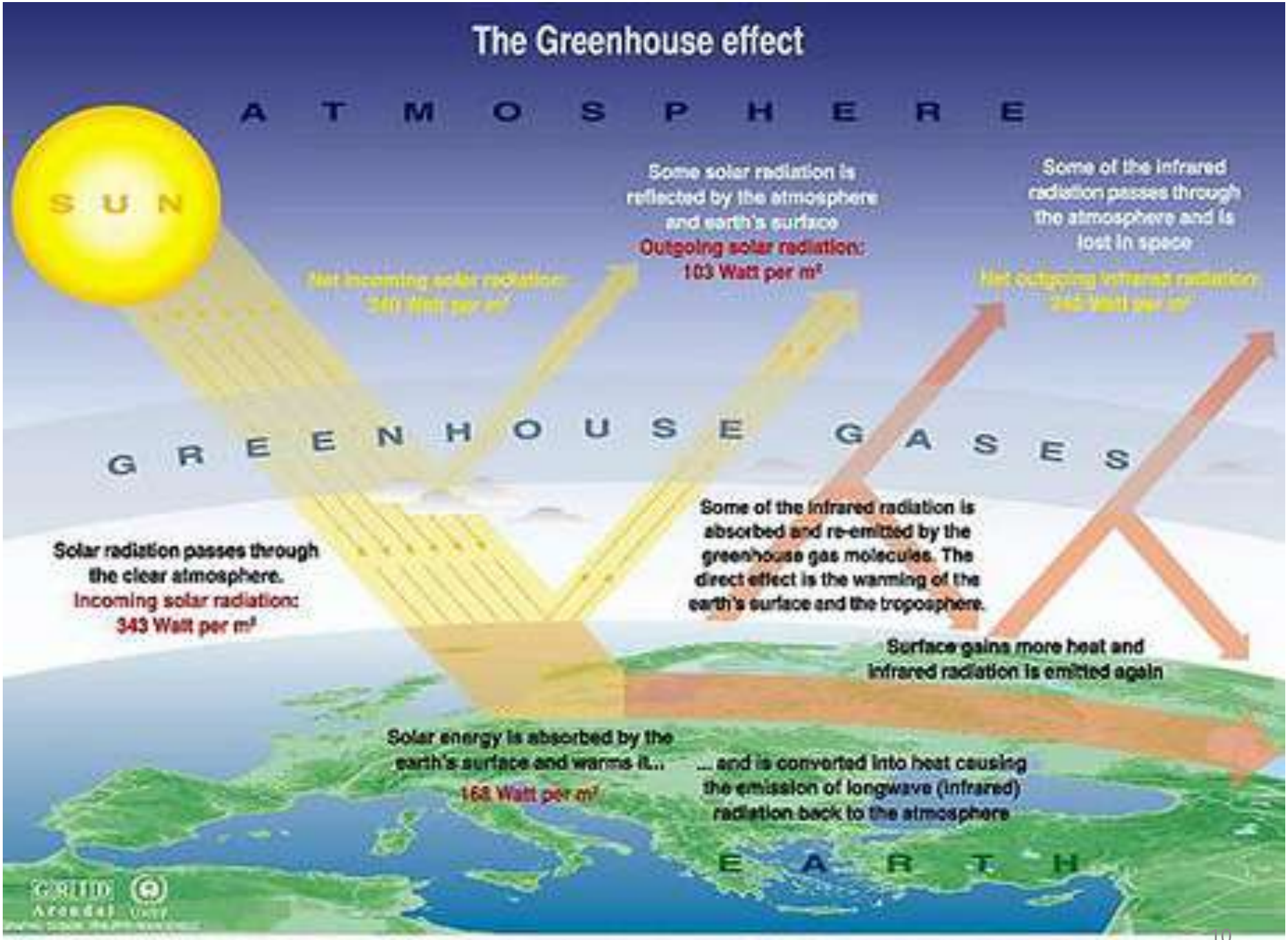
GLOBAL WARMING (CLIMATE CHANGE?)

WHAT ?

- Rise in the average temperature of earth's atmosphere and ocean since in the late 19th Century and its projected continuation.

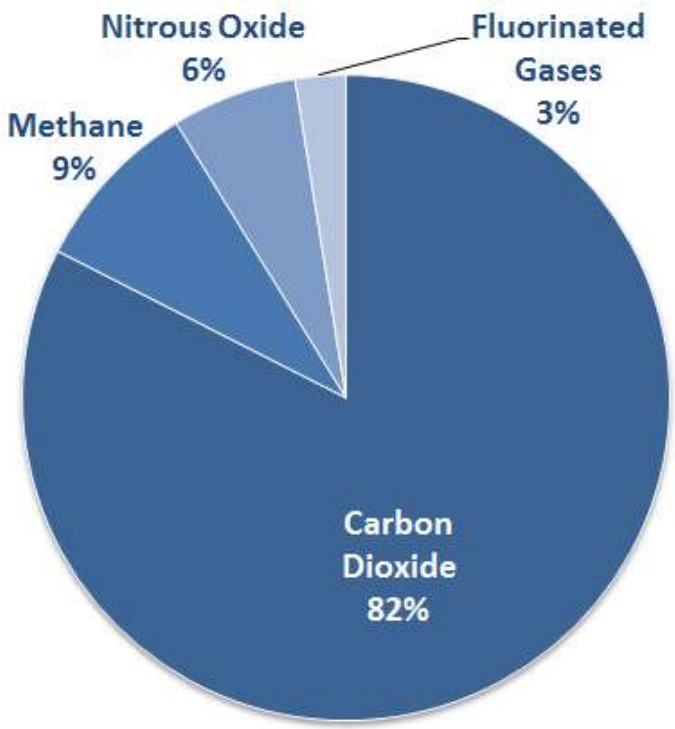
WHY?

- caused by increasing concentration of greenhouse gases produce by human activities such as the burning of fossil fuels and deforestation.

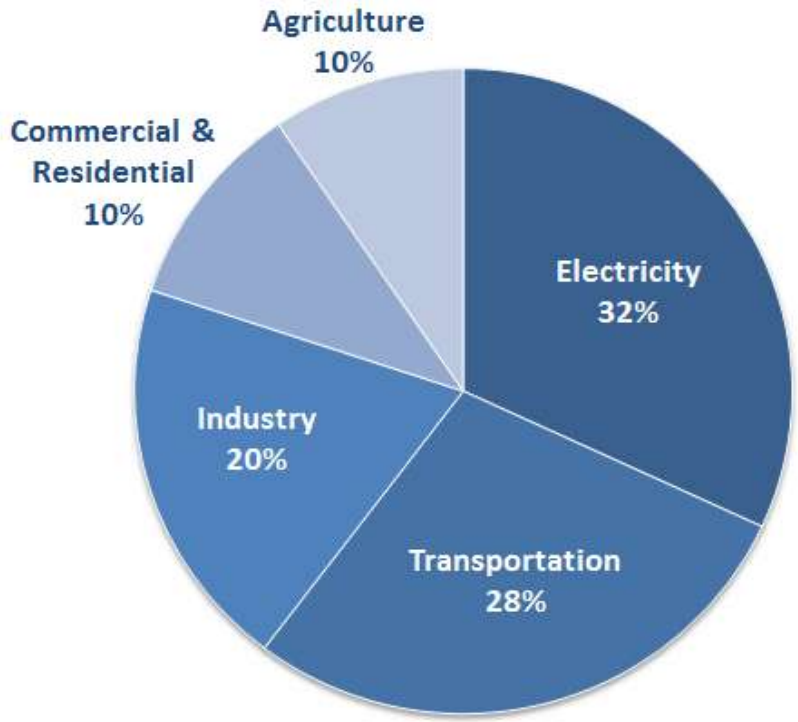


Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington, Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

Major sectoral contribution to global warming

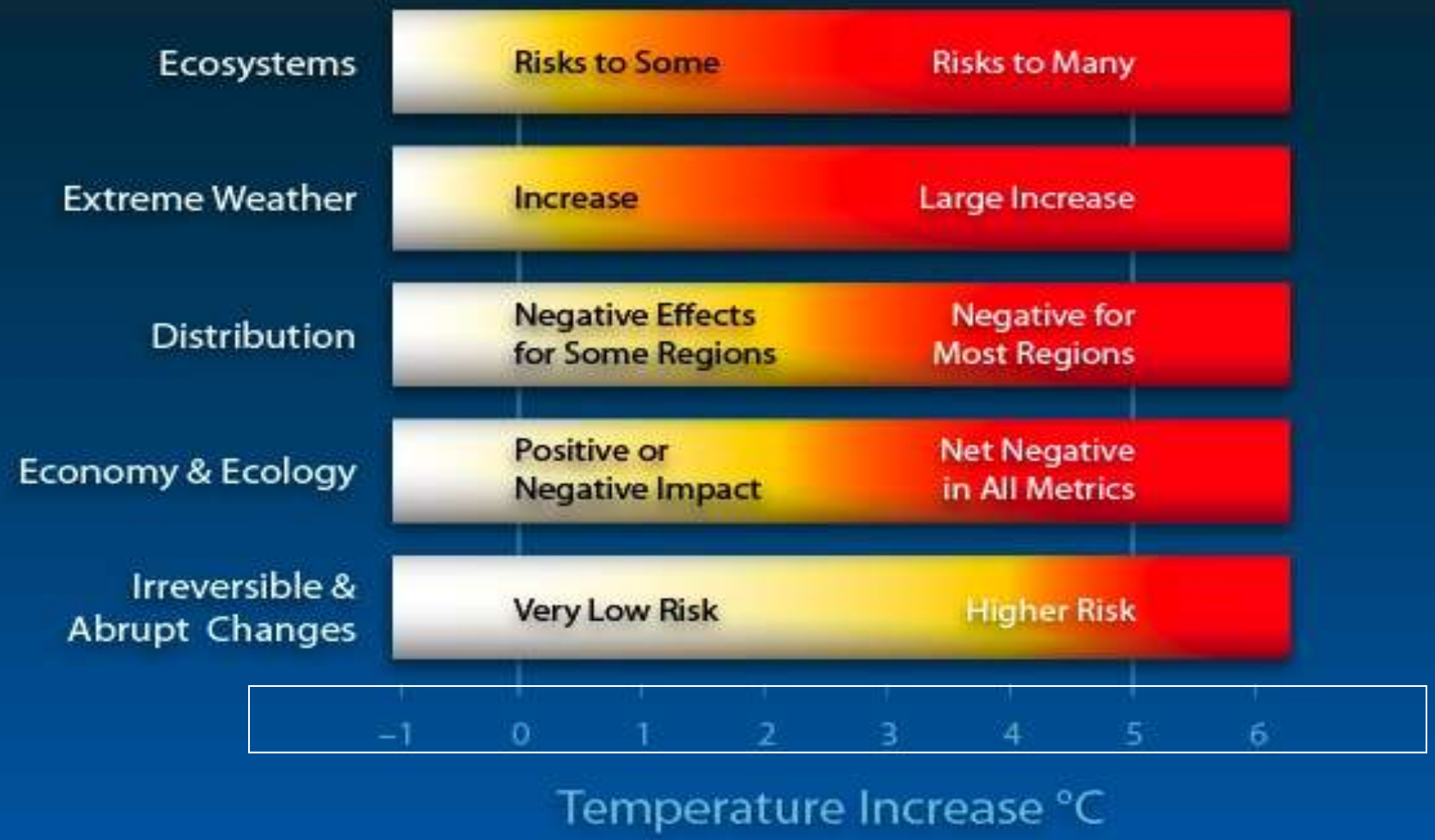


U.S. Greenhouse Gas Emissions in 2012

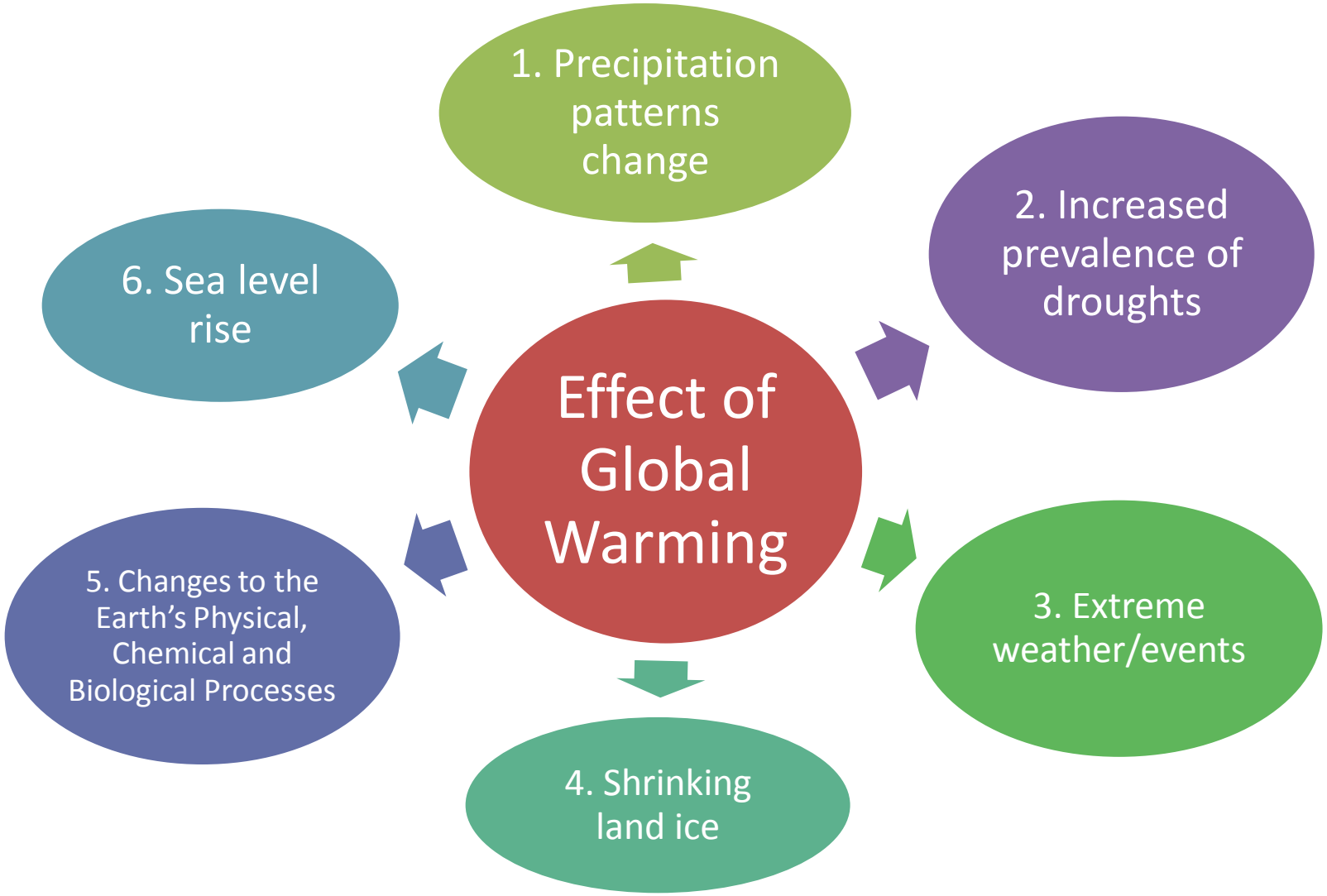


U.S. Greenhouse Gas Emissions by Economic Sector in 2012

Impacts of Global Warming



EFFECT OF GLOBAL WARMING



6. SEA LEVEL RISE

Pulau Pinang terselamat risiko paras laut naik

GEORGETOWN: Pusat Kajian Pantai, Institut Penyelidikan Hidraulik Kebangsaan Malaysia (NAHRIM) mendapati Pulau Pinang tidak menghadapi risiko peningkatan paras air laut kerana hanya mencatat kenaikan 2.33 milimeter (mm) setahun.

Pengarahnya, Ir Mohd Radzi Abdul Hamid, berkata pihaknya melakukan kajian di seluruh negara termasuk di Pulau Pinang melalui Stesen Tolok Pasang Surut yang ditempatkan di beberapa lokasi strategik dan pemantauan satelit.

"Kita akui ada peningkatan tetapi ia tidak memberi impak yang besar atau memberi gangguan kepada kawasan penduduk, pertanian dan perumahan.

"Hanya ada kenaikan di empat lokasi iaitu Sungai Sarawak, Sarawak; Kuala Kedah, Kedah; Kuala Terengganu, Terengganu dan Sandakan, Sabah dengan catatan 0.5 meter pada 2010, tetapi masih awal (kemungkinan ditenggelami) dan tidak memberi sebarang risiko," katanya ketika dihubungi.

Sejak 2004 sehingga awal tahun ini, paras air laut negara dikatakan meningkat purata 10 sentimeter (cm) setiap tahun.

Mohd Radzi berkata, pihaknya menjalankan kajian lanjut mengenai peningkatan paras laut bagi membolehkan tindakan diambil.

"Semua kajian yang dilakukan masih awal dan baru-baru ini kami membuat lawatan ke kawasan yang sudah diketahui pasti bagi melihat kesan dan risiko pada masa depan.

"Kajian terperinci dijangka dapat diketahui sebelum akhir tahun ini dan kenaikan bukan saja dialami di Malaysia tetapi bahkan seluruh dunia," katanya.

Kajian terperinci dijangka dapat diketahui sebelum akhir tahun ini dan kenaikan bukan saja dialami di Malaysia tetapi bahkan seluruh dunia

Mohd Radzi Abdul Hamid
Pengarah NAHRIM

MOHD Hafiq Abdullah menunjukkan pokok rhu dan kelapa yang tumbang akibat dipukul ombak di pantai Terengganu.

Pantai Sabah, Sarawak lesap 2100

Aras laut naik sehingga 1.06 meter

Oleh Syuhada Choo Abdullah
chooa@hariran.com.my

KUALA LUMPUR: Aras laut sepanjang pantai Sabah dan Sarawak dijangka mengalami kenaikan purata antara 0.43 meter (m) dan 1.06m pada 2100, dengan beberapa kawasan sepanjang garis pantai Sarawak akan ditenggelami air laut menjelang tempoh itu.

Berdasarkan kajian, kenaikan aras laut maksimum berlaku di bahagian utara dan timur pesisir pantai Sabah, manakala banjir dijangka di kawasan rendah serta muara sungai di barat daya Sarawak meliputi Meradong yang terletak antara Batang Igan dan Batang Rajang.

Kawasan berisiko dimuki air di Sabah pula ialah yang bertopografi rendah dan muara sungai meliputi Tawau, Semporna, Lahad Datu, Sandakan serta Kudat.

Kementerian Sumber Asli dan Alam Sekitar dalam kenyataan, semalam berkata kajian mendapati corak kenaikan aras laut sejak lima tahun lalu menunjukkan peningkatan signifikan berbanding trend bagi tempoh 20 tahun terdahulu.

Kadar kenaikan aras laut purata di sepanjang garis pantai Malaysia yang dikira daripada data satelit altimeter (1993-2010) ialah 2.75 hingga 7.10 milimeter (mm) setahun.

Unjuran kenaikan aras laut di Semenanjung antara 0.25m dan 0.52m menjelang 2100. Beberapa banjir kecil dijangka berlaku di sepanjang kawasan pantai Semenanjung menjelang 2100 dengan kenaikan aras laut maksimum berlaku di barat laut dan timur laut Semenanjung iaitu Kedah dan Kelantan.

Pakar Fakulti Kejuruteraan Awam dan Alam Sekitar, Universiti Tun Hussein Onn Malaysia (UTHM), sebelum ini mendakwa menerusi kemungkinan beberapa bandar di kawasan rendah terutama berhampiran pantai, ditenggelami air laut dalam tempoh sembilan tahun akan datang berikutan fenomena aras air laut yang semakin meningkat akibat pemanasan global.

Akhbar ini ketemuan memetik Timbalan Naib Canselor (Akademik dan Antarabangsa) UTHM, Prof Ir Dr Abdul Aziz Abdul Samad, sebagai berkata hasil analisis data paras air laut yang direkodkan Jabatan Pengairan dan Saliran (JPS) sejak 2004 sehingga awal tahun ini mendapati paras air laut negara meningkat secara purata 10 sentimeter (cm) setiap tahun.

Menurut kenyataan itu, Institut Penyelidikan Hidraulik Kebangsaan Malaysia (NAHRIM) iaitu agensi penyelidikan di bawah kementerian, pada dasarnya bersetuju kesan pemanasan global akan menyebabkan fenomena peningkatan paras air laut di pesisiran pantai Malaysia.

Selain itu, NAHRIM tidak menolak pendapat profesional dan pakar universiti mengenai fenomena berkenaan, namun kesepatan unjuran yang dibuat dipengaruhi banyak faktor seperti ketepatan data digunakan, tempoh data serta kaedah analisis.

NAHRIM sudah menjalankan kajian menggunakan kaedah analisis statistik data pasang surut untuk menentukan aras 50 peratus daripada data pasang surut yang direkodkan selama 25 tahun (1984-2010), di sebanyak 26 stesen pasang surut Jabatan Ukur dan Pemetaan Malaysia (JUPEM) serta data satelit altimeter selama 17 tahun (1993-2010) di sebanyak 30 stesen, semuanya di sepanjang pesisiran pantai Malaysia.

"Kesimpulan analisis mendapati corak graf kenaikan aras laut di Malaysia menggunakan data satelit altimeter lebih tinggi berbanding data tolok pasang surut" katanya.

HAKISAN pantai di Kampung Balok, Batu Pahat semakin serius.

CLIMATE CHANGE IN RELATION TO WATER RESOURCES

CLIMATE CHANGE AND ITS IMPACT ON WATER RESOURCES

Scenario 1: Increases in temperature and increased rainfall	Scenario 2: Increases in temperature and reduced rainfall
• Increased inflows to water storages • Increased pressure on water storage infrastructure • Increased availability of water for rain-fed agriculture • Increased risk of flood damage • Possible changes to ecosystems	• Reduced inflows to water storages (dams/reservoirs) • Reduced stream-flows • Reduced water availability for rain-fed agriculture • Reduced recharge of groundwater • Threatened water supplies to cities and towns, agricultural, industrial & environmental needs • Severe droughts

EFFECT OF GLOBAL WARMING TO WORLD WATER RESOURCE

What are our concerns?

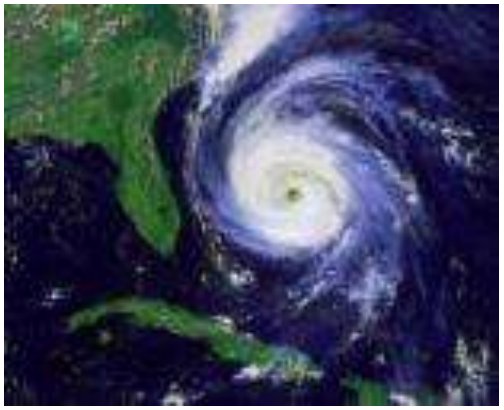
1. To what extent is the variation of climatic events will affect the hydrological characteristic of water resources in all time and space.
2. Degree of climatic variation – temperature changes, precipitation, evaporation rate, atmospheric properties.
3. How will the variation in hydrological characteristics of water resources such as water level in rivers, discharge of rivers, water amount in soil and so on pose hazards to human lives such as events of floods and droughts.
4. To what extent changes to soil properties affect the magnitude of the subsurface rate of the stream flow and the magnitude of the stream flow itself.

EFFECT OF GLOBAL WARMING TO WORLD WATER RESOURCE

5. Taking into consideration the effect of expected climate change, how human activity influences the hydrological processes mainly through change in land factors such as deforestation, changes in land cultivation and urbanization.
6. How climate change will affect natural vegetation which is always adapted to the climate and forms its morphology in agreement with climate.
7. The problem of climate change is very important for water management because it is also highly sensitive to climate variation in all timescales.
8. Water resources depend strongly on climate and the available water resources vary from one region to another in relation to the spatial variation of climate.

Climate Change Impacts in Malaysia

Climate Parameter	Peninsular Malaysia [RegHCM-PM]	Sabah [RegHCM-SS]	Sarawak [RegHCM-SS]
Annual mean surface temp.	1.0-1.5°C [2050]	[2050] 1.3-1.7°C [2100] 2.9–3.5°C	[2050] 1.0-1.5°C [2100] 3.0-3.3°C
Max. Monthly Rainfall	[2050] +113mm(12%)	[2050] +59mm (5.1%) [2100] +111mm (9%)	[2050] +150mm (8%) [2100] +282mm (32%)
Sea Level Rise	0.25-0.52m [2100]	0.64-1.03m [2100]	0.43-0.63m [2100]



Note : On a smaller scale – district or region - impact could be much more extreme

Observed Climate Change in Malaysia

	GLOBAL*		MALAYSIA**
Surface temperature (ºC)	**1906-2005**		**1968-2002**
	0.74		**0.49 – 0.91**
Sea level rise (mm/yr)	1961-2003	1993-2003	1986-2006
	1.8	**3.1**	**1.25**

- Observations since 1968-2002 show that the average temperature of the Malaysia surface temperature has increased around 0.49 – 0.91^{0}C.
- Malaysia sea level has risen at an average rate of 1.25 mm per year over 1986 to 2006.

* IPCC 4TH ASESSMENT REPORT (AR4), 2007
** INITIAL NATIONAL COMMUNICATION, 2000
** NATIONAL COASTAL VULNERABILITY INDEX STUDY,DID, 2007

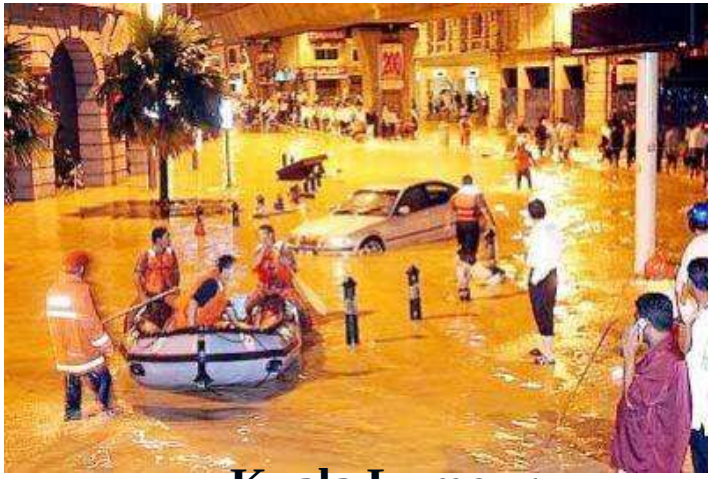
Floods

Tmn Sri Muda,
ah Alam, Dec1995

Kuching 2003

Padang Kelab Selangor…. 1949

PJ, 2000



Kuala Lumpur,
2005

Shah Alam 2006

Droughts

Dry spell can hit Kedah's 63,000 padi farmers soon

Planting season delayed by a month

By Abdul Razak Ahmad
razak@nstp.com.my

ALOR STAR, Wed. — The current dry spell, which has led to water shortages in several states, can soon affect Kedah's 63,000 padi farmers.

ning on March 25 followed by April 4 and 14.

Teoh said Mada originally scheduled to begin releasing the water from Friday, but decided to delay it as the water levels were currently lower than at the same time last year.

isfactory, prolonged lack of rain for the next few months could lead to shortages during the next planting season.

The Pedu dam is now registering an 87 per cent water level, with the critical level at 80 per cent.

The Muda dam was at 56 per cent capacity, six per cent over the criti-

Senior citizens hard hit by water rationing

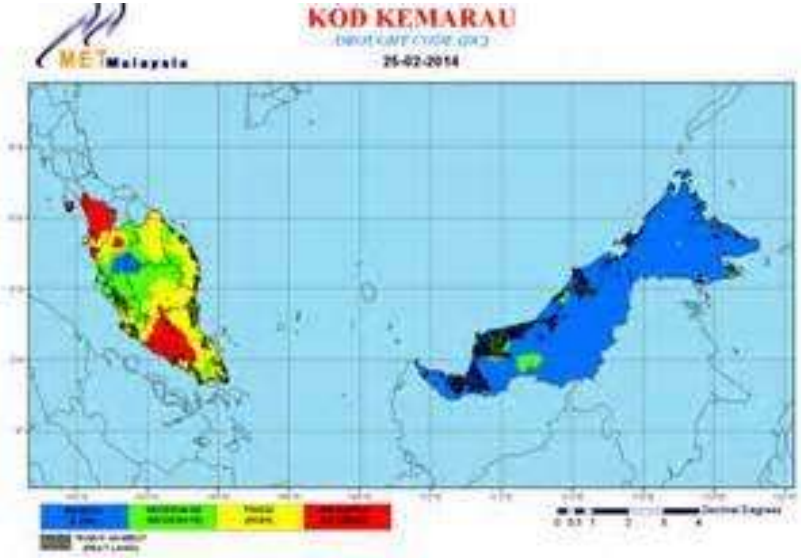
Lower water pressure at night to avoid disruptions

Cloud-seeding an uphill task

Dept: Rain only with right conditions

Malacca folk prepared for water rationing

2014



CLOSE WATCH: Water level at the Sungai Semenyih dam going down

Dams in S'gor drying up fast

By DENNIS CHUA

Impacts : Forest Fires & Haze


Shut down

Firemen battle peat fires

- 700 forest fires related cases reported in Jan – March 2014
- Forest fires and haze now have a common recurrent of 3-4 years in Malaysia and Indonesia
- Major threats causing the loss of peat swamp forests (2014 - Pahang and Barat Laut Coastal Peat of Selangor)

THREATS FROM CLIMATE CHANGE

- Global warming created extreme variability in the climate
- This impact causes sea level rise and further extremes in the flood and drought situations of the country

OVERVIEW – LATEST OBSERVED CLIMATE

- **Rate of warming (temperature): 1969-2009#**
  - **1.1ºC/50-yr - Semenanjung Malaysia;**
  - **0.6ºC/50-yr - Sarawak;**
  - **1.2ºC/50-yr - Sabah;**
- **Sea level rise** (satellite altimetry) – **2.73–7.00 mm/year (1993 to 2010)**
  - Short duration max. rainfall intensity – Period of 2000-2007 greater than 1970s (1971-80);
  - 1-hr & 3-hr rainfall intensity in 2000-2007) increased 17% & 29% respectively compared to 1970s
- **Rate of warming (temperature): (AR4, IPCC)**
  - **1906-2005: 0.74°C**
- **Global average sea level rise** (AR4, IPCC) – **1.8 [1.3 to 2.3] mm per year (1961 to 2003)**

Source: Malaysia Meteorology Department

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1. Climate change impacts and relations to resources Scarcity and the "water-food-energy" nexus:

Rapidly rising global population and growing prosperity are putting unsustainable pressures on resources.

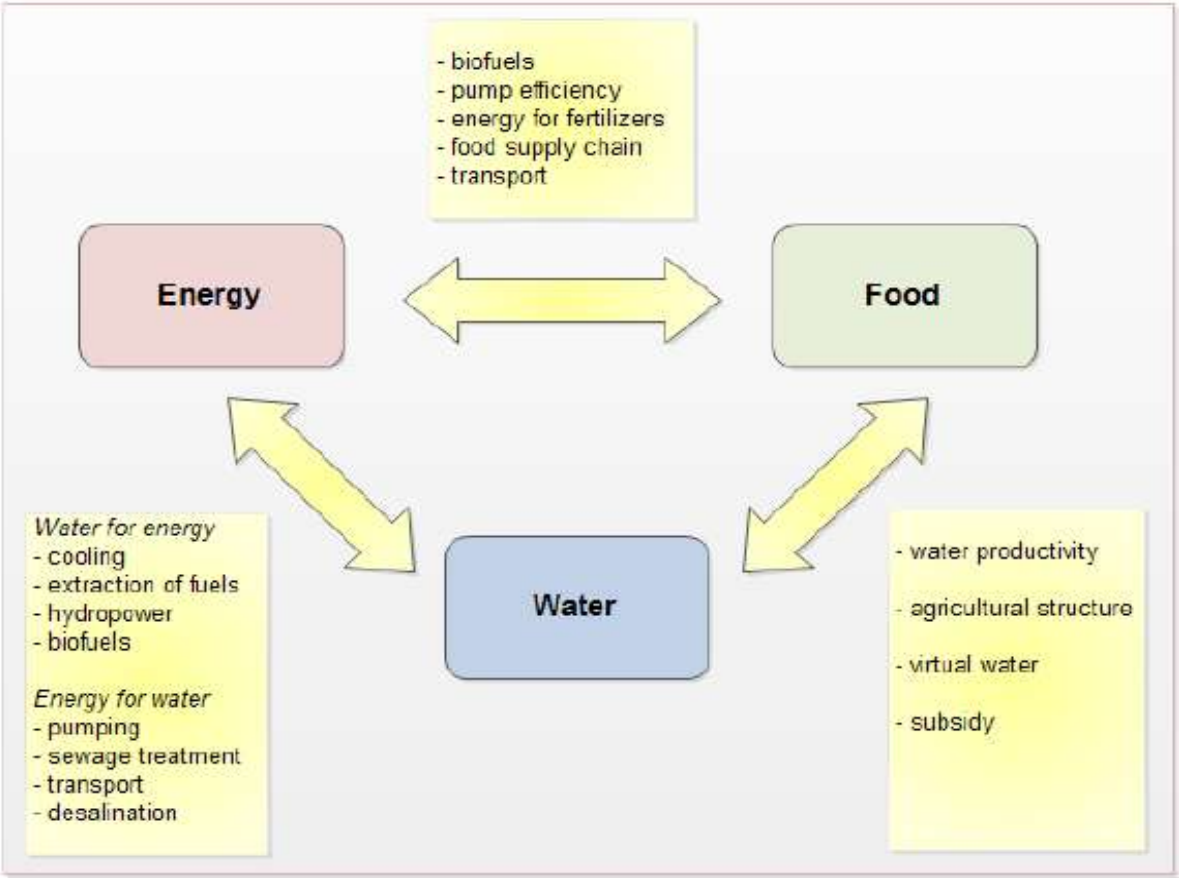
- ❖ In the next two decades; demand for water, food and energy is expected to rise by 30-50%
- ❖ Economic disparities motivate short-term responses in production and consumption that undermine long-term sustainability.
- ❖ Shortages could cause social and political instability, geopolitical conflict and irreparable environmental damage.

Any strategy that focuses on one part of the water-food-energy nexus without considering its interconnections risks serious unintended consequences.

- **World Economic Forum 2011 and the Davos Initiative**
- **Bonn2011 Nexus Conference - Initiating integrated solutions for the Green Economy**

Linking energy, water and food resources

Energy, water and food are inextricably linked



- Water for energy currently amounts to about 8% of global water withdrawals (45% in industrialized countries, e.g. in Europe).

- Food production and supply chain is responsible for around 30% of total global energy demand

- Food production is the largest user of water at the global level, responsible for 80–90% of consumptive blue water use

Source: Water-Energy-Food Security Nexus in the Asia Pacific Region: Adnan Hezri (ISIS)

The Nexus Approach

Recognizes interconnectedness of water, energy, and food across space and time. Its objectives are:

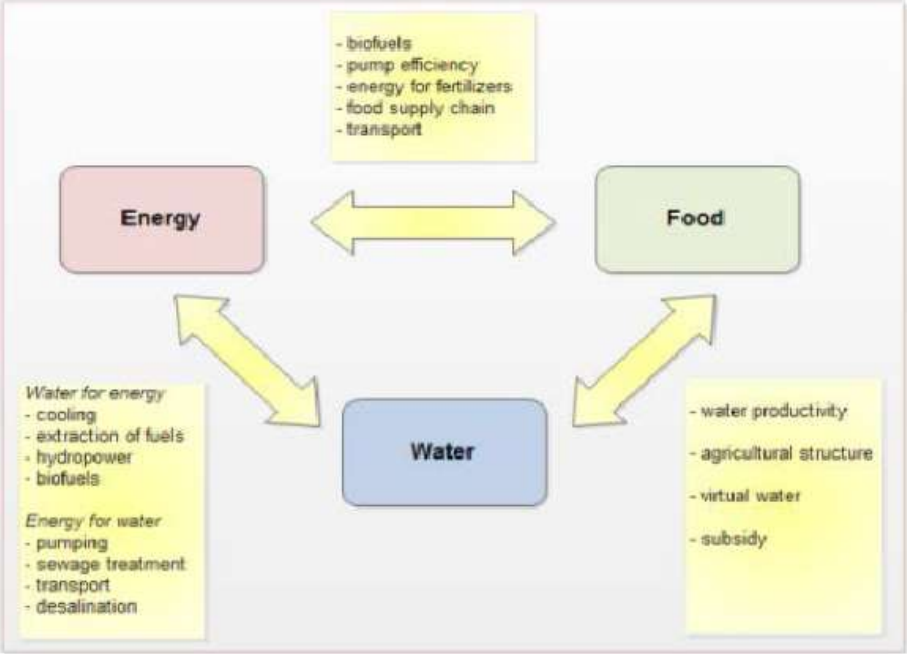
- Improve energy, water, and food security
- Address externality across sectors, and decision-making at the nexus
- Support transition to sustainability

Projections for 2050 with 9.2 billion people:

- 70% increase in agricultural demand for food by 2050

- 40% energy demand increase by 2050

- But by 2030: confronting water supply shortage of ~ 40%



Source: Water-Energy-Food Security Nexus in the Asia Pacific Region: Adnan Hezri (ISIS)

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S0ME INITIATIVES TO ADDRESS CLIMATE CHANGE AND WATER RESOURCES ISSUES IN MALAYSIA

- National Policy on Climate Change – 2009 (NRE)
- Water Resource Policy (DSAN 2012) (NRE/JPS)
- Study On The Impact Of Climate Change On Design Flood And Its Application For The Damansara, Johor And Kelantan River Basins (2011)
- Study Of The Impact Of Climate Change On The Hydrologic Regime And Water Resources Of Peninsular Malaysia (2006)
- Hydro Climate Model (NAHRIM)
- Incorporating CC factors in water infrastructural design (JPS)
- Flood Mitigation and MSMA Projects (JPS)
- Flood Hazard and Flood Risk Map (JPS)
- Water Energy Food Nexus Position paper (MIHP-JPS)
- Capacity Building : Water Footprint (MIHP) and Climate resilience workshop (MyWP)

FINAL REPORT (VOLUME I)

STUDY ON THE IMPACT OF CLIMATE CHANGE ON DESIGN FLOOD AND ITS APPLICATION FOR THE DAMANSARA, JOHOR AND KELANTAN RIVER BASINS

JULY 2011

SUBMITTED TO:

WATER RESOURCES AND HYDROLOGY DIVISION
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STUDY OF THE IMPACT OF CLIMATE CHANGE ON THE HYDROLOGIC REGIME AND WATER RESOURCES OF PENINSULAR MALAYSIA

Final Report

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INITIATIVES BY THE GOVERNMENT
National Climate Change Policy

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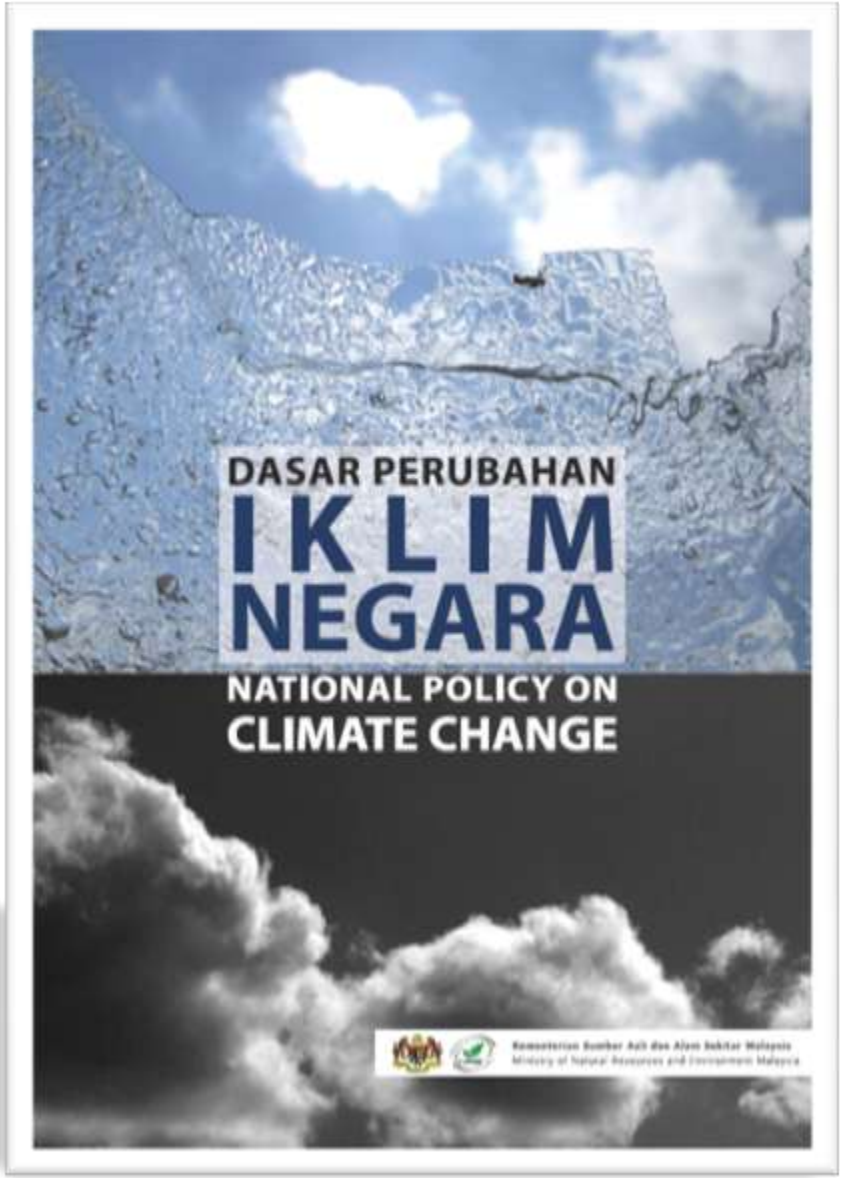


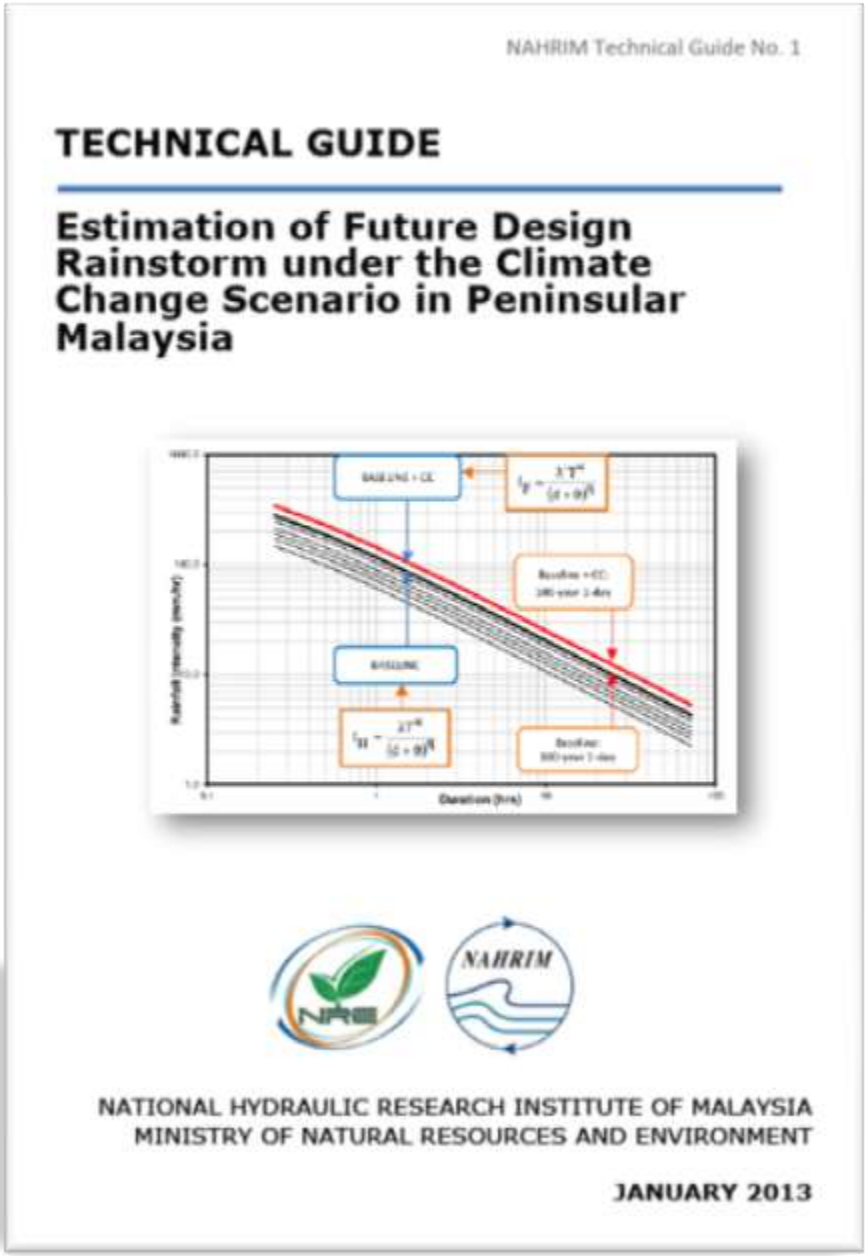
INITIATIVES BY THE GOVERNMENT

Objective :

To assist engineers, hydrologists and decision makers in designing, planning and developing water-related infrastructure under changing climatic conditions.

Aim :

To introduce an approach of quantifying the scale of climatic change to surface water systems, particularly due to variability and fluctuations in precipitation pattern, through the development of climate change factor and reformulation of the developed Intensity-Duration-Frequency relationship by DID for future conditions.


NAHRIM Technical Guide No. 1

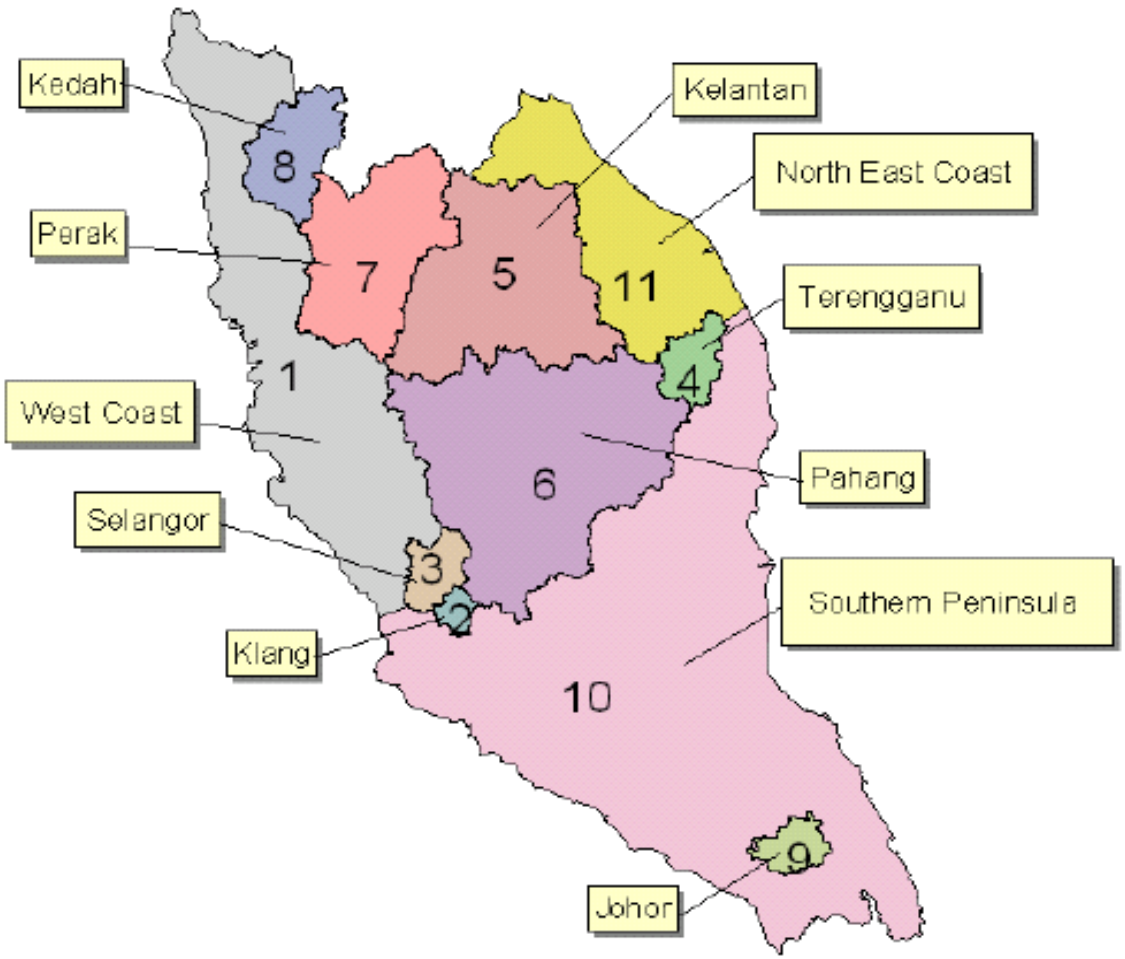
TECHNICAL GUIDE

Estimation of Future Design Rainstorm under the Climate Change Scenario in Peninsular Malaysia

NATIONAL HYDRAULIC RESEARCH INSTITUTE OF MALAYSIA
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

JANUARY 2013

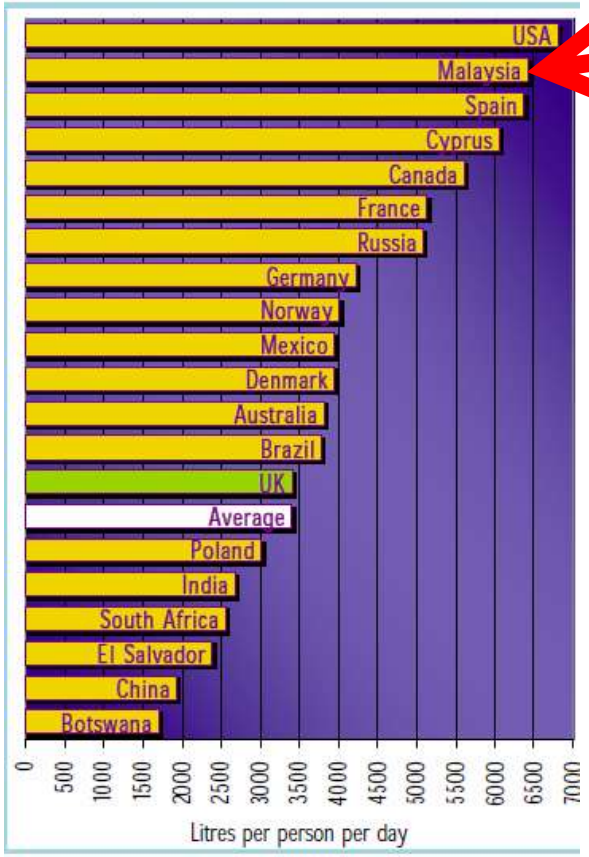
HYDROCLIMATE CHANGE MODEL 2050 – Forecasted Impact of Climate Change on Water Resources for Selected Sub-regions in Peninsular Malaysia by NAHRIM



New Direction – to look into Water Footprint vis as vis Ecological Sustainability

<u>Water Footprint</u>: Total volume of freshwater used to produce the goods and services consumed by an individual or community, or produced by the business, over the full supply chain.

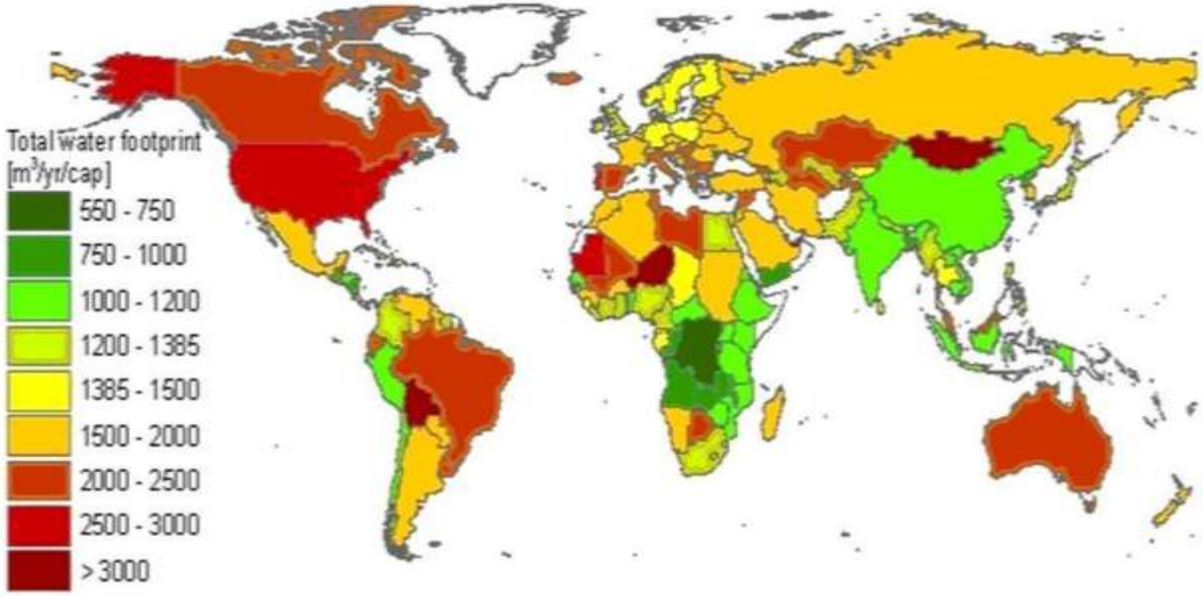
Virtual water use by Country



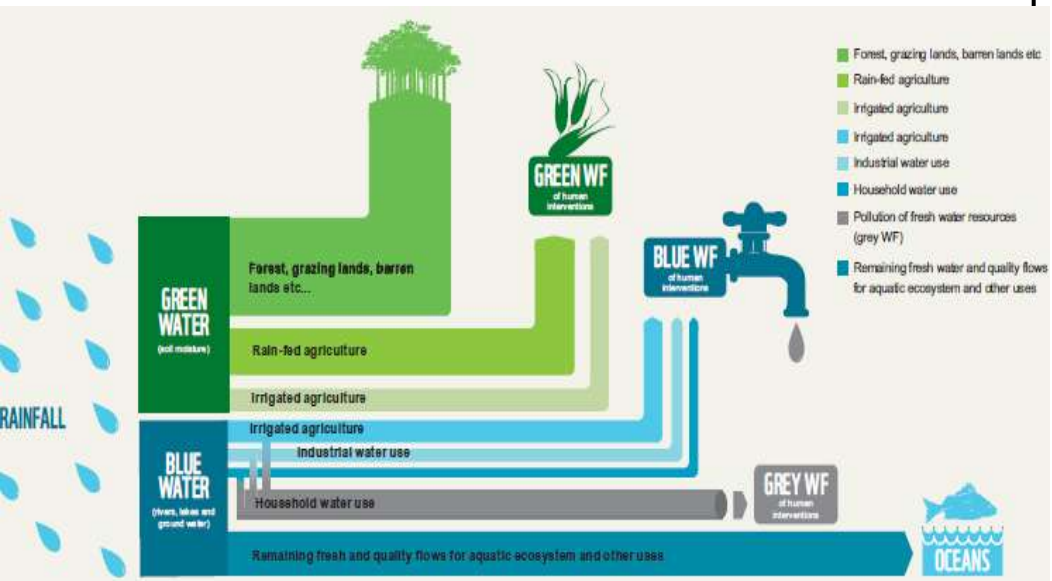
<u>Average National Water Footprint (1996 – 2005) in m^3/yr/capita:</u>

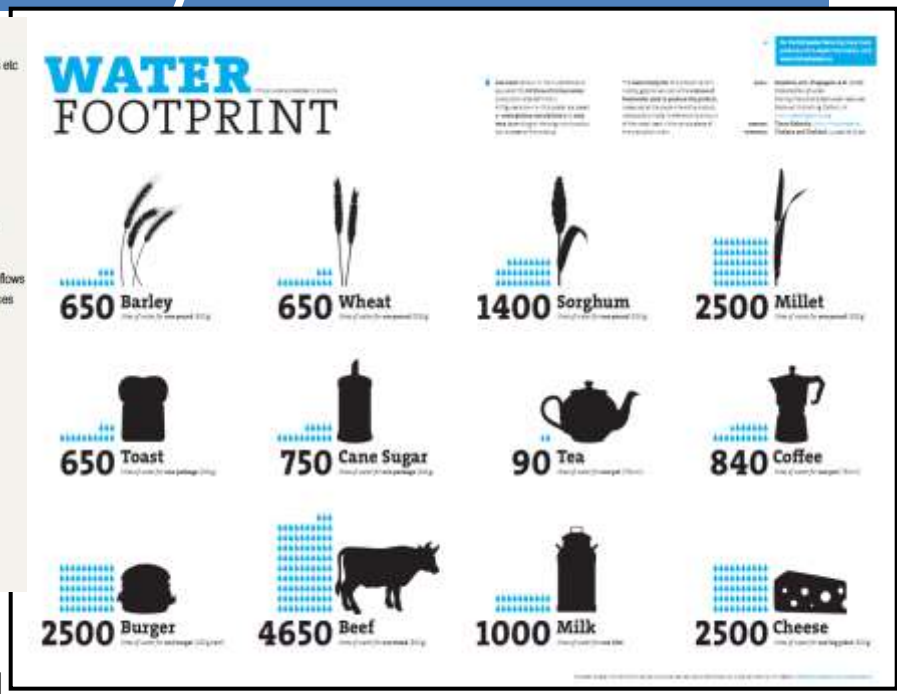
1. **Indonesia : 1,124**
2. **UK : 1,258**
3. **Global Average WF: 1,385 m^3/yr/capita**
4. **Malaysia : 2,103**
5. **USA : 2,842**

Average water footprint of national consumption in m^3 per year per capita in the period 1996-2005. Countries shown in green have a water footprint that is smaller than the global average; countries shown in yellow-red have a water footprint larger than the global average. Source: Mekonnen and Hoekstra (2011).



Water Footprint and Ecological Sustainability





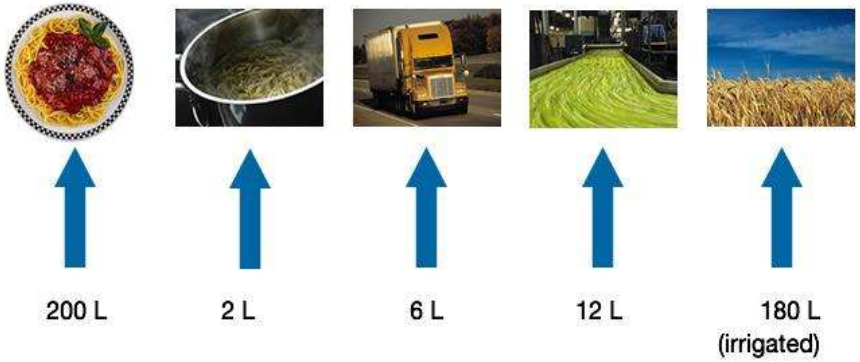
Source: Virtualwater.EU

Blue water footprint: **volume of surface water and ground water consumed during production processes (i.e. evaporated or incorporated into the product)**

Green water footprint: **volume of rainwater consumed (i.e. evaporated or incorporated into the product)**

Grey water footprint: **volume of freshwater that is required to assimilate the load of pollutants and calculated as the volume of water that is required to maintain the water quality according to agreed water quality standards.**

Source: WFN



[Source: WWF 2012]

ASPEC

Water Footprint and Ecological Sustainability

What is the country's actual water footprint and the associated cost ?

- **Are we exporting more water than we can afford, without knowing it?**
- **Are we <u>under-valuing our goods</u> because we have not taken water footprint into consideration in water pricing?**
- **How do we use rainwater more productively and lower our green water footprint?**
- **<u>Sustainability</u> – We need to identify the river basins' WF as <u>scarcity and pollution</u> will soon be an issue.**
- **<u>Sustainability Assessments</u> promote efficiency and cost reduction by identifying and reducing waste. (Reductions in water consumption will correlate to reductions in expenditures)**
- **Sustainability Assessments to help us change current policies and plan for emerging, stricter regulations. (New regulations, pricing schemes, and new or higher fines are most likely to emerge in hot spots and areas with increasing competition for water resources)**
- **Water footprint reduction is a <u>shared responsibility</u>.**

Sources: Hoekstra, A.Y., Chapagain, A.K., Aldaya, M.M. and Mekonnen, M.M. (2011) The water footprint assessment manual: Setting the global standard, Earthscan, London, UK.

INITIATIVES BY THE GOVERNMENT
National Climate Change Policy

PRINCIPLES

Malaysia recognises the adverse effects and impacts of climate change and undertakes to mainstream national responses that consolidate economic, social and environmental development goals based on the following principles:

P1: Development on a Sustainable Path

Integrate climate change responses into national development plans to fulfil the country's aspiration for sustainable development.

P2: Conservation of Environment and Natural Resources

Strengthen implementation of climate change actions that contribute to environmental

conservation and sustainable use of natural resources.

P3: Coordinated Implementation

Incorporate climate change considerations into implementation of development programmes at all levels.

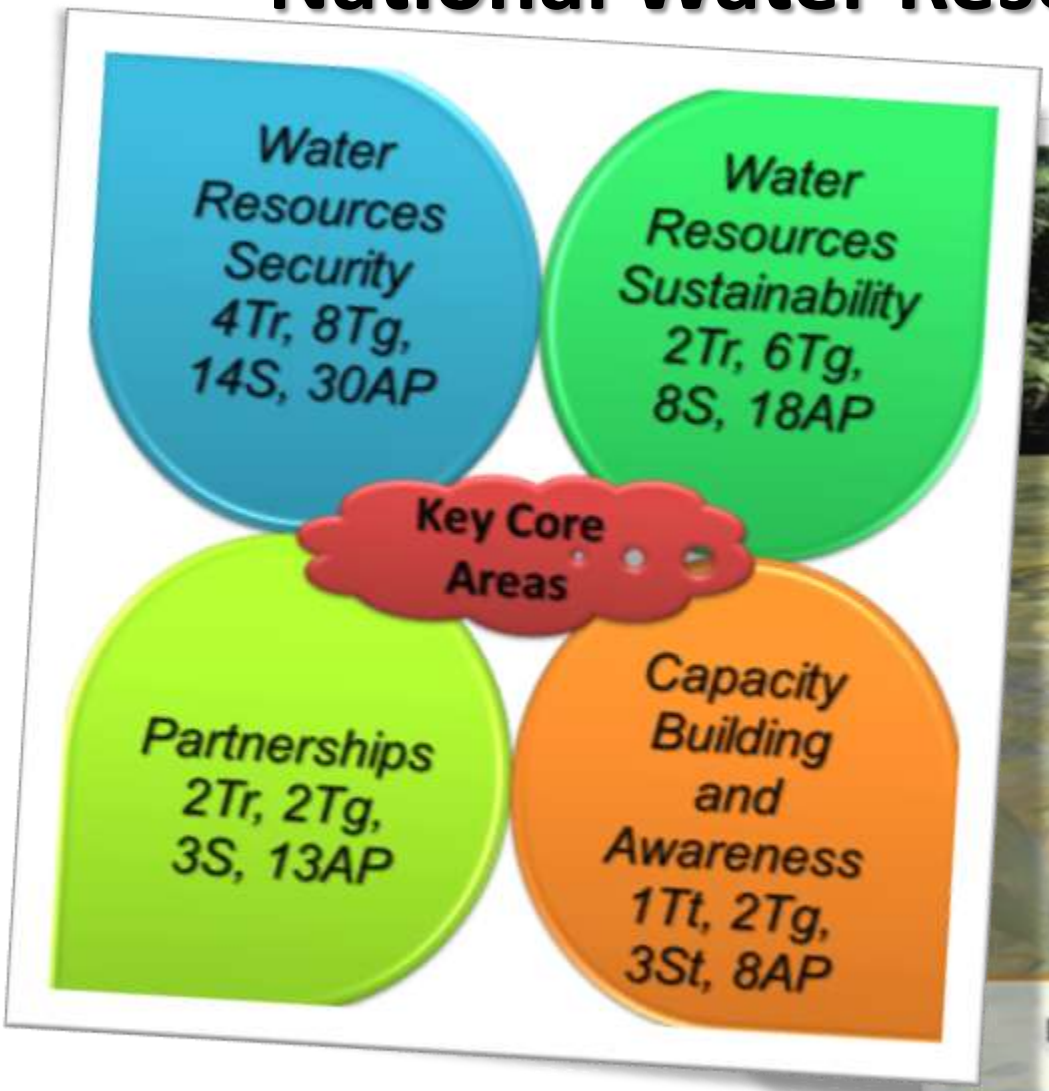
P4: Effective Participation

Improve participation of stakeholders and major groups for effective implementation of climate change responses.

P5: Common but Differentiated Responsibilities and Respective Capabilities

International involvement on climate change will be based on the principle of common but differentiated responsibilities and respective capabilities.

INITIATIVES BY THE GOVERNMENT
National Water Resources Policy



OUTLINES

1. Water Resources
2. Climate change finding (Global/ National)
3. Climate Change And Its Impact
4. Climate change in relation to Water-Food-Energy Nexus
5. Initiatives by the government
6. **National Water resources Policy in Addressing Climate Change**
   - **Plan of actions under NWRP addressing Climate Change**
7. Related immediate programs to be carried out by JPS
8. What Next ?
9. CONCLUSION

NATIONAL WATER RESOURCES POLICY (NWRP)

IN ADDRESSING CLIMATE CHANGE

National Policy on Climate Change - 2009

POLICY STATEMENT

Ensure climate-resilient development to fulfill national aspirations for sustainability




Water Resources related matters in the Climate Change Strategic Action Plan

- **Develop multiple national climate and hydro-climate projection models for identifying vulnerabilities and assessing potential impacts of climate change.**

- **Integrate CC measures into policies, plans, programmes and projects in natural resources and environment (water, biodiversity, forestry, minerals, soil, coastal)**

- **Integrate climate change considerations at the planning level by applying tools that includes the Integrated Environmentally Sensitive Areas i.e water catchments;**

- **Establish and implement a national R&D agenda on climate change taking into account the following areas: agriculture and food security; water security and services; Forestry and ecosystem services; localised modelling for projection of future scenarios; Vulnerability due to extreme weather events and natural disasters; and**

National Water Resources Policy

Action Plans addressing /related to Climate Change issue

Trust No.	Target No.	Strategy No.	Strategic Action Plan No.
2	5	8	13
			14
			15
			16
			17
	6	9	18
			19
			20
			21
4	8	13	27
			28
			29
6	10	16	33
			34
			35

National Water Resources Policy (DSAN) and Plan of actions under DSAN addressing Climate Change.

Target 5: Reduce Vulnerability Of Water Resources To Impacts And Threats As Well As Strengthen Adaptability To Ecosystems And Physical Changes	**Strategy 8:** Identify threats, impacts and hazards that affect water resources and bodies including all forms of threats, hazards and impacts ensuing from waterbodies.	**PTS13:** Identify existing and emerging threats to and from water resources as well as waterbodies;
		PTS14: Identify options and measures to reduce, mitigate and remove stress, threats, impacts and risks including transboundary risks, threats, impacts and hazard events;
		PTS15: Determine measures to aid adaptation of water resources to threats and emerging threats e.g. climate change and disasters;
		PTS16: Identify and develop water resources conservation plans for high risk areas; and
		PTS17: Identify options for ensuring resiliency of water resources from stress, threats, impacts, hazard and disaster events.

National Water Resources Policy (DSAN) and Plan of actions under DSAN addressing Climate Change.

Target 6: **Develop Water Resources Conservation Plans For Strategic, Sensitive And Critical Water Resources Areas And Bodies**	**Strategy 9:** Determine resiliency of waterbodies and areas to stress, risks, impacts and hazard events.	**PTS18:** Profile characteristics and nature of stress, risks, threats and hazards;
		PTS19: Identify water resources conservation options, targets and action plans;
		PTS20: Identify levels and classifications of sensitivity and delineate sensitive areas and zones; and
		PTS21: Identify key catchment areas and zoning options.

National Water Resources Policy (DSAN) and Plan of actions under DSAN addressing Climate Change.

Target 8: **Adopt A National Disaster Risk Reduction, Preparedness And Response Plan For Water Resources To Introduce Measures For Preparedness And Response, As Well As Reduction Of Risks And Threats Of Disasters From And To Water Resources**	**Strategy 13:** Develop national level scientific assessment procedures for risk, threat and hazard determination, as well as preparedness and response needs for water resources.	**PTS27:** Identify potential disaster events;
		PTS28: Identify areas and scale of potential impacts and risks; and
		PTS29: Develop risk assessment procedures.

Sasaran 10: **Determine Priority For Water Resources Use, Particularly In Times Of Crisis Or Threat**	**Strategi 16:** Develop criteria to determine water resources use priority.	**PTS33:** Identify key users and uses;
		PTS34: Identify key water resources use areas; and
		PTS35: Develop allocation and management plan for water resources based on demand priority and resource availability.

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RELATED IMMEDIATE PROGRAMS TO BE CARRIED OUT BY JPS

i. WACDEP project financed by GWP-SEA
ii. Study on Water-Food-Energy Nexus : Malaysia's Perspective – preparation of a position paper
iii. Water Footprint Course schedule in early 2015
iv. Guideline on Rainfall estimate due Climate Change
v. Environmental flow guideline
vi. Hydrological Procedure on low flow to be revised

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WHAT NEXT ?

What more we can do at National Level

- Implement the National Policy on Climate Change
  - Identify the "who, the where and the when"
  - Provide the necessary resources for the implementation
  - Main stream adaptation implementation and operations & maintenance requirements in all national development plans.
- Create awareness, build capacity and share information
- Bring in community participation
  - Policies may be at national level but
  - Impacts are felt at local level
- Continue Research on Adaptation
  - With focus on planning & design requirements of hydraulic structures
- Continue to engage actively with international organization
  - Always, there is something to learn and something to share
  - Identify what the country needs
    - Not only at the policy and trade level but also
    - At the technical level – especially cutting edge technology

WHAT NEXT ?

What we are doing at the global level

Continuing to search for better understanding of the issues and better and more confident solution from ;

- UN Agencies
  - IPCC – Inter-governmental Panel on Climate Change.
    - SREX – Special Publication on Extreme conditions
    - AR5
  - UN Waters group - UNESCO, UNDP, UNEP, UNHABITAT, UN Regional Commissions (ESCAP, ECLAC, ESCWA) etc
- APWF – Asia Pacific Water Forum
  - Working with partners and other Water Knowledge Hubs (WKH) in various countries.

CONCLUSION

- Need to accept the fact that climate change plays a fundamental role in shaping natural ecosystems, and the human economies and cultures,
- Climate change can affect many related aspects such as food production, availability and use of water, and health risks,
- translate national policies related to climate change to real action plans
- urgent need to develop programs related to adaptation of climate change in the water sector and secure funding
- more aggressive in educating publics and creating awareness on climate change and its impacts
- get all stakeholders to be involved

THANK YOU