IMPACT OF CLIMATE CHANGE AND ADAPTATION PLAN IN MALAYSIA
Extreme rainfall events

Top Natural Disasters in Malaysia for the period 1900 to 2012

(source: www.emdat.be/result-country-profile)
GHG INVENTORY IN MALAYSIA

Energy Sector:
- Power Generation (47%)
- Transportation (29%) and
- Manufacturing Industries (21%)
- Others i.e. residential, commercial, agriculture (3%)

Total Emissions (gross): 223.1 Mt CO$_2$eq

(Source: NRE MALAYSIA - NC2, 2010)
OBSERVATION OF CLIMATE CHANGE IN MALAYSIA

- **Temperature:**
  - Increase mean surface temperature: Rate of warming based on 40 years record (1969-2009) increases from 0.6°C to 1.2°C per 50 years (*Source: MMD 2009*).

- **Rainfall**
  - Increased rainfall intensity -> 1-hour rainfall intensity (2000-2007) increase by 17% compared to 1970s values (*Source: JPS*).

- “Above average” rainfall
  - In 2007: Massive floods in Batu Pahat, Johor Baru, Kluang, Kota Tinggi, Mersing, Muar, and Segamat -> Typhoon Utor
  - Flood losses ~ RM 1.5 billion
## PROJECTION

<table>
<thead>
<tr>
<th>Climate Parameter</th>
<th>Peninsular Malaysia [RegHCM-PM]</th>
<th>Sabah [RegHCM-SS]</th>
<th>Sarawak [RegHCM-SS]</th>
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</thead>
<tbody>
<tr>
<td><strong>Annual mean surface temp.</strong></td>
<td>1.0-1.5°C [2050]</td>
<td>[2050] 1.3-1.7°C</td>
<td>[2050] 1.0-1.5°C</td>
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<tr>
<td></td>
<td></td>
<td>[2100] 2.9–3.5°C</td>
<td>[2100] 3.0-3.3°C</td>
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<tr>
<td><strong>Max. Monthly Rainfall</strong></td>
<td>[2050] +113mm (12%)</td>
<td>[2050] +59mm (5.1%)</td>
<td>[2050] +150mm (8%)</td>
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<tr>
<td></td>
<td></td>
<td>[2100] +111mm (9%)</td>
<td>[2100] +282mm (32%)</td>
</tr>
</tbody>
</table>

(Sumber: NAHRIM RegHCM-PM (2006), NAHRIM RegHCM-SS (2010))
SEA LEVEL RISE

Erosion and accretion in Peninsular Malaysia for a period of 10 years

<table>
<thead>
<tr>
<th>Negeri</th>
<th>Panjang Pantai (km)</th>
<th>Hakisan (km)</th>
<th>Penokokkan (km)</th>
<th>Stabil (km)</th>
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<tbody>
<tr>
<td>Perlis</td>
<td>20</td>
<td>12.70</td>
<td>3.95</td>
<td>3.35</td>
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<td>Kedah</td>
<td>148</td>
<td>32.10</td>
<td>2.43</td>
<td>113.47</td>
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<td>Pulau Pinang</td>
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<td>13.09</td>
<td>15.49</td>
<td>123.42</td>
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<td>14.91</td>
<td>135.69</td>
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<td>106.80</td>
<td>14.13</td>
<td>92.07</td>
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<tr>
<td>N. Sembilan</td>
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<td>8.97</td>
<td>2.13</td>
<td>46.90</td>
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<td>Melaka</td>
<td>73</td>
<td>17.16</td>
<td>0.89</td>
<td>54.95</td>
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<tr>
<td><strong>Johor</strong></td>
<td><strong>492</strong></td>
<td><strong>101.64</strong></td>
<td><strong>69.13</strong></td>
<td><strong>321.23</strong></td>
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<td>271</td>
<td>105.55</td>
<td>12.39</td>
<td>153.06</td>
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<td>Terengganu</td>
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<td>28.55</td>
<td>5.41</td>
<td>210.04</td>
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<td>Kelantan</td>
<td>271</td>
<td>6.40</td>
<td>1.49</td>
<td>263.11</td>
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<tr>
<td><strong>Jumlah (KM)</strong></td>
<td><strong>2172</strong></td>
<td><strong>512.36</strong></td>
<td><strong>142.35</strong></td>
<td><strong>1517.29</strong></td>
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<tr>
<td>(%)</td>
<td>-</td>
<td>23.59</td>
<td>6.55</td>
<td>69.86</td>
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</tbody>
</table>
Status Perubahan garis pantai di Negeri Pahang

Sumber: NAHRIM 2010
### Jadual 1: Kadar SLR (mm/yr) berdasarkan data satellite altimeter

<table>
<thead>
<tr>
<th>No. Stesen</th>
<th>Lokasi</th>
<th>latitut</th>
<th>longitud</th>
<th>Kadar Kenaikan Aras Laut (mm/tahun)</th>
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<tr>
<td>S1</td>
<td>Perairan Laut Andaman</td>
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<tr>
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<td>Sempadan Malaysia (Perlis-Thailand)</td>
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<tr>
<td>S3</td>
<td>Perairan Selat Melaka</td>
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<td>Sempadan P.Pinang - Perak</td>
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<td>Perairan Mersing</td>
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<td>Pulau Tioman</td>
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<td>Persisiran Pantai Pekan</td>
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<td>Pulau Perhentian Terengganu</td>
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<td>3.46</td>
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<td>Perairan Thailand</td>
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<td>101</td>
<td>5.20</td>
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<tr>
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<td>Sempadan Malaysia (Kelantan–Thailand)</td>
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<td>102</td>
<td>4.29</td>
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<tr>
<td>S13</td>
<td>Perairan Kelantan</td>
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<td>3.49</td>
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<tr>
<td>S14</td>
<td>Perairan Kuching dan Bau</td>
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<td>110</td>
<td>4</td>
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<tr>
<td>S15</td>
<td>Perairan Sarikie-Sibu</td>
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<td>111</td>
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<tr>
<td>S16</td>
<td>Luar Persisir Sarawak</td>
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<td>3.82</td>
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<tr>
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<td>Perairan Bintulu</td>
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<td>113</td>
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<td>Perairan Mukah</td>
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<td>Perairan Brunei</td>
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<td>Perairan Miri</td>
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<td>5.11</td>
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<tr>
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<td>113</td>
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<td>Teluk Marudu, Kota Marudu-Kudat</td>
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<td>Perairan Pitas</td>
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<td>Laut Sulu</td>
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<td>S27</td>
<td>Beluran</td>
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<td>Perairan Sandakan</td>
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<td>S29</td>
<td>Perairan Lahad Datu</td>
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<td>6.28</td>
</tr>
<tr>
<td>S30</td>
<td>Perairan Tawau</td>
<td>4</td>
<td>119</td>
<td>6.47</td>
</tr>
</tbody>
</table>
SLR Projection for the year 2100

Study on SLR 2010
Sourcer: NAHRIM & CHRL (2010).

0.307 – Unjuran Peningkatan aras laut pada 2100 (meter) di Kuantan Pahang

Lokasi Satellite altimeter
A. Change in Water Quantity/Discharge

Water excess (extreme rainfall, flows)
• Increase in severity of floods
• Increase in soil erosion -> scouring of drainage structures and sedimentation in rivers

Water shortage (drought)
• Reduced inflows to reservoirs
• Reduced stream-flows -> affect raw water abstraction
• Reduced recharge of groundwater
B. Change in Water Quality

Water excess (extreme rainfall, flows)
- Increase in pollution: litters, nutrients and sediments

Water shortage (drought)
- Concentrated pollutant level in streams
Impact on Water Quantity

I. **Physical changes** such as increased water temperature, more stable vertical stratification and less mixing of water of deep-water lakes, and changes in water discharge, affecting water level and retention time;

II. **Chemical changes**, such as increased nutrient concentrations and water colour (DOC), and decreased oxygen content

III. **Biological changes**, including northwards migration of species and alteration of habitats, affecting the structure and functioning of freshwater ecosystems.
Impacts of Excessive Flowing Water on Water Quality

1. Increased water colour due to increased input of humic substances as dissolved organic carbon (DOC) from the catchment.

2. Increased nutrients. Increased mineralisation and releases of nitrogen, phosphorus and carbon from soil organic matter and increased run-off and erosion will result in increased nutrient loads.

3. Reduced oxygen content. Increased biological respiration rates result in lower dissolved oxygen concentrations, particularly in summer low-flow periods and in the bottom layers of lakes. Higher temperature and lower oxygen concentrations will cause stress and may reduce the habitats in the lakes and rivers.
Impact on Water Quality

Nutrient Concentration and Pollutant Loading

High temperature, Intense rainfall
Increase surface and sediment runoff

algal bloom

Tasik Metropolitan 2012

macrophyte bloom

Tasik Chini 2012
Hazardous Substances in the waterway

- Affecting the **distribution** and **mobility** of **hazardous substances** in freshwater systems.

- Increase air and water temperature lead to changes migration and biological uptake of atmospherically-transported toxic organic pollutants.

Example:
- Loading of hazardous substances may increase due to
  
  I. sewage overflow,

  II. higher pesticide use and run-off due to heavy rains,

  III. higher temperatures increase the degradation rate of some pesticides and organic pollutants, which may reduce their concentrations in rivers and lakes.
ADAPTATION
OVERALL FRAMEWORK

Climate Change

Adaptation
  - Development
    - Vulnerability
    - Resilience
  - Resources
    - Land
    - Water
    - Forestry
    - Biodiversity
    - Mineral
  - Economy
    - Agriculture
    - Industry
    - Biotechnology
  - Social
    - Food Security
    - Water Sufficiency
    - Irrigation
    - Livelihood
    - Safety & Security
    - Social Welfare
  - Climate Resilient Development
  - Climate Proof Development

Mitigation
  - Development
    - Vulnerability
    - Resilience
  - Economic
    - Industry
    - Finance
    - Trade
    - Emission Reduction / Sink Enhancement
      - Carbon Offset Schemes
      - Climate Friendly Technology
      - Financing & Investment
      - Insurance Schemes
  - Economic Resilience
  - Low Carbon Economy
  - Climate Resilient Economy
Adaptation Measures

to provide greater coherent for addressing climate change:

- information sharing to enhance and develop National Climate Services;
- design specifications involving water management infrastructure should take climate change projections as key factor;
- Integrated Shoreline Management Plan (ISMP) should be formulated and supported by appropriate legislative;
- re-designing cities and towns to ensure sustainable regions with green townships, low carbon environment;
- promote renewable energy (RE) to overcome the initial barriers & improving public transportation as means to control emissions from vehicles;
- Enhance R&D and technology transfer & formulation of NGTP and NPCC
National Policy On Climate Change
..5 main principles..

- Development of sustainable path
- Conservation of env. & natural resources
- Main-streaming climate change
- Effective participation
- Coordinated implementation
National Green Technology Policy  
..4 main pillar..

- Officially launched by the Honorable Prime Minister of Malaysia in July 2009;

- **Policy statement** - Green technology shall be a driver to accelerate the national economy and promote sustainable development;

- **Main Pillars:**
  - **Energy** - seek to attain energy independence & promote efficient utilization
  - **Environment** - conserve and minimize the impact on the environment
  - **Economy** - enhance the national
economic development through the use of technology
  - **Social** - improve the quality of life for all

- **Main initiative** – to support GreenTech in mitigation and adaptation which are to curtail GHG and increase carbon sinks; and to reduce vulnerability and build resilience
National Water Resources Policy 2012*

..4 key core area..

Main Focus Directions

Water Resources Security

Water Resources Sustainability

Partnerships

Capacity Building and Awareness

Note: * launched by Deputy Prime Minister on 24 March 2012 in the opening ceremony of National World Water Day 2012.
Implementation Framework

National Policies and Policy Review

Roadmaps and Strategies

ADAPTATION

INTERNATIONAL GOVERNANCE FRAMESWORKS

MITIGATION

Action Plans

Regulations and Legislation
Adaptation on Water Resources

Kawalan Air Larian Permukaan – Pengurusan Air Hujan

Pelan Pengurusan Lembangan Sungai dan Guna Tanah

Kawalan Air Larian Permukaan – Kapasiti Penyimpanan (Empangan)

Maklumat semasa: Sistem Ramalan dan Amaran Banjir
Rain Water Harvesting (RWH) for portable uses.

- Storing 500m$^3$ for the daily consumption of 30m$^3$.

- Rainwater collected from a roof top and parking area - 5000m$^2$.

- 5000m$^2$ of rainwater catchment area

- 500m$^3$ underground water tank

- Filter sump

- Oil & grease trap

- Pump system to pump rainwater to lake through a water feature
Catchment area:

Roof:
[1] Admin office = 1134 m²
[2] Ticket counter = 300 m²
[3] Entrance = 720 m²
[5] Surau = 1000 m²

Surface runoff:
[4] VIP parking lot = 1920 m²

Total = 5074 m²

Daily water demand = 50 m³/d
(losses from evaporation & seepage)

Volume for
Rainwater = 30 m³/d
Groundwater = 20 m³/d
Hari ini

Pendekatan Adaptasi:

Penginapan

Perlindungan

Penambakan Pantai

Berundur

Garis Rujukan

Sumber: DID Manual, 2009
Platform Elevation

Figure 5.11(b) – Cross-sectional profile for MU1

Figure 5.15(a) – Cross-sectional profile for MUS at the loading jetty at Market Building
The Way Forward

• Continued Research and Development into Vulnerabilities, Adaptive Needs, and Innovative and Cost-effective Mitigation Measures;

• Coordinating Roadmaps to ensure Cross-cutting Issues are Addressed in a Holistic and Comprehensive manner;

• Enhanced Engagement with Local Communities and Corporate Entities;

• Development of a Carbon Disclosure Programme for the Private Sector, and,

• Continued Active Engagement at the International Level to Facilitate Sustainable Development in line with National and Global Objectives.

• Mainstreaming climate change adaptation options into planning and development.
Initiatives at the National Level

- Endorsement of National Climate Change Policy and National Green Technology Policy
- Integration of renewable, energy, energy efficiency and solid waste management in the 10th Malaysia Plan
- Voluntary carbon offset scheme involving corporate sector
- Provide Green Technology Financing Scheme (GTFS)
- Formulated Low Carbon Cities Framework & Assessment System (LCCF)
- National Water Resources Policy 2012