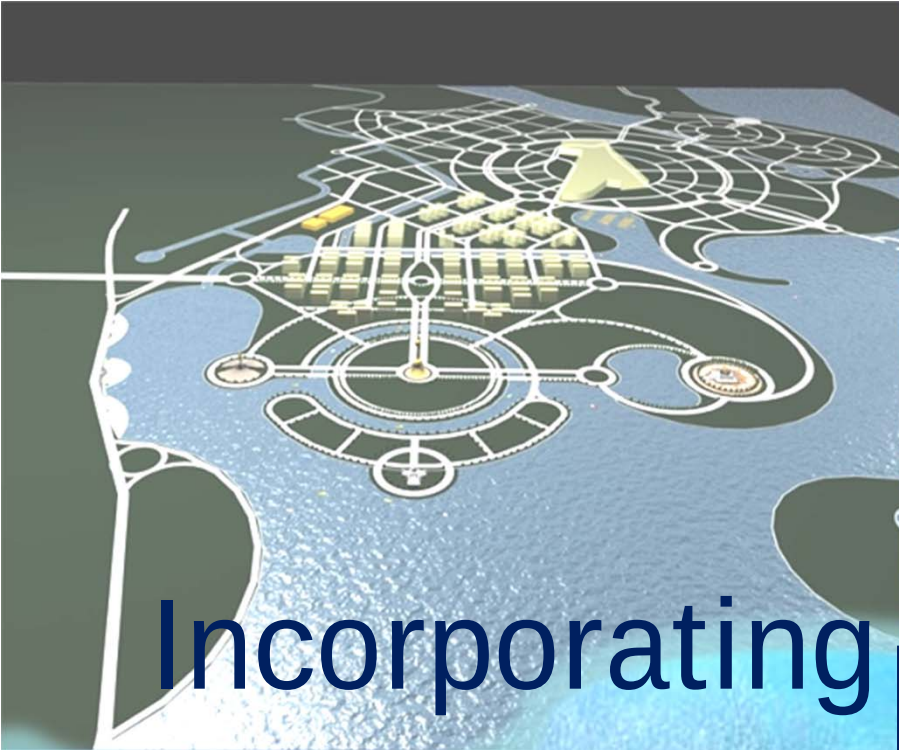




Incorporating



Climate Change  
Into Environmental  
Impact Assessment



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Ministry of the Environment (MoE)  
Republic of Indonesia

# EIA in Indonesia

EIA as a study, has been mandatory for project potentially significant impact to the environment which is needed for decision making process in Indonesia since 1986.

Climate change is not yet specify as an implicit criteria for significant impact but incorporate in some of criteria:

Article 23 Act Number 32 Year 2009 mentioned criteria for significant environmental impacts project are:

1. Land use and landscape change;
2. Exploitation of natural resources (renewable or non renewable);
3. Its process or activity potentially cause pollution or environmental degradation;
4. Its process or activity output could influence natural, manmade or socio and cultural environment;
5. Its process or activity output could influence preservation of natural resource conservation area or cultural reserve;
6. Introducing GMO;
7. Activity which influence or hav high risk to state defence;
8. Application of new technology which have potentially affected environment .

# EIA in Indonesia

Article 16 Act Number 32 Year 2009 regarding Environmental Protection and Management also mentioned, said " SEA shall contain analyses related to:

- a. Carrying capacity of the environment;
- b. Estimation of potential environmental impact and risk;
- c. Environmental service performance;
- d. Efficiency in the natural resource utilization;
- e. **Vulnerability and adaptability to climate change;**
- f. Resilience and potential of biodiversity."

In practical, incorporation of climate change into environmental impact assessment have been done by case by case, depend on the scoping process.

While project potentially contribute or affected by climate change, EIA could be a recommended tool to identify proper response for proper mitigation measure of Green House Gas emission and project adaptation from climate change impact at the project level.

EIA will be useful to incorporate climate change consideration on 3 categories:

- Project impact to climate change: potentially large emission or absorption capacity on green house gas
- Impact on climate change to the project
- Impact climate change to impact caused by project

| No | AMDAL Process                   | Green House Gas (GHG) consideration : proposed project may produce GHG                                                                                  | Impact justification: climate change may affected project                                                                                                                           |
|----|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Scoping                         | Scoping considering potential GHG                                                                                                                       | Scoping considering impact from climate change                                                                                                                                      |
| 2. | Data and information collection | Identification potential GHG: <ul style="list-style-type: none"> <li>• Industry profile</li> <li>• Project specification</li> </ul>                     | Identification climate change impact: <ul style="list-style-type: none"> <li>• Regional climate and other environmental considerations ;</li> <li>• Project sensitivity.</li> </ul> |
| 3. | Environmental Impact Assessment | Further assessment on GHG: <ul style="list-style-type: none"> <li>• Direct emission and indirect emissions</li> <li>• Impact on rosot carbon</li> </ul> | Climate change impact assessment: <ul style="list-style-type: none"> <li>• impact to the project;</li> <li>• further risk to community and environment</li> </ul>                   |
| 4. | Mitigation measures             | Prepare for mitigation: <ul style="list-style-type: none"> <li>• Jurisdiction justification</li> <li>• Project specific</li> </ul>                      | impacts management plan <ul style="list-style-type: none"> <li>• project specifics→ design review</li> <li>• Data clarification</li> </ul>                                          |
| 5. | Monitoring                      | Monitoring and adaptive management                                                                                                                      | Monitoring and adaptive management                                                                                                                                                  |

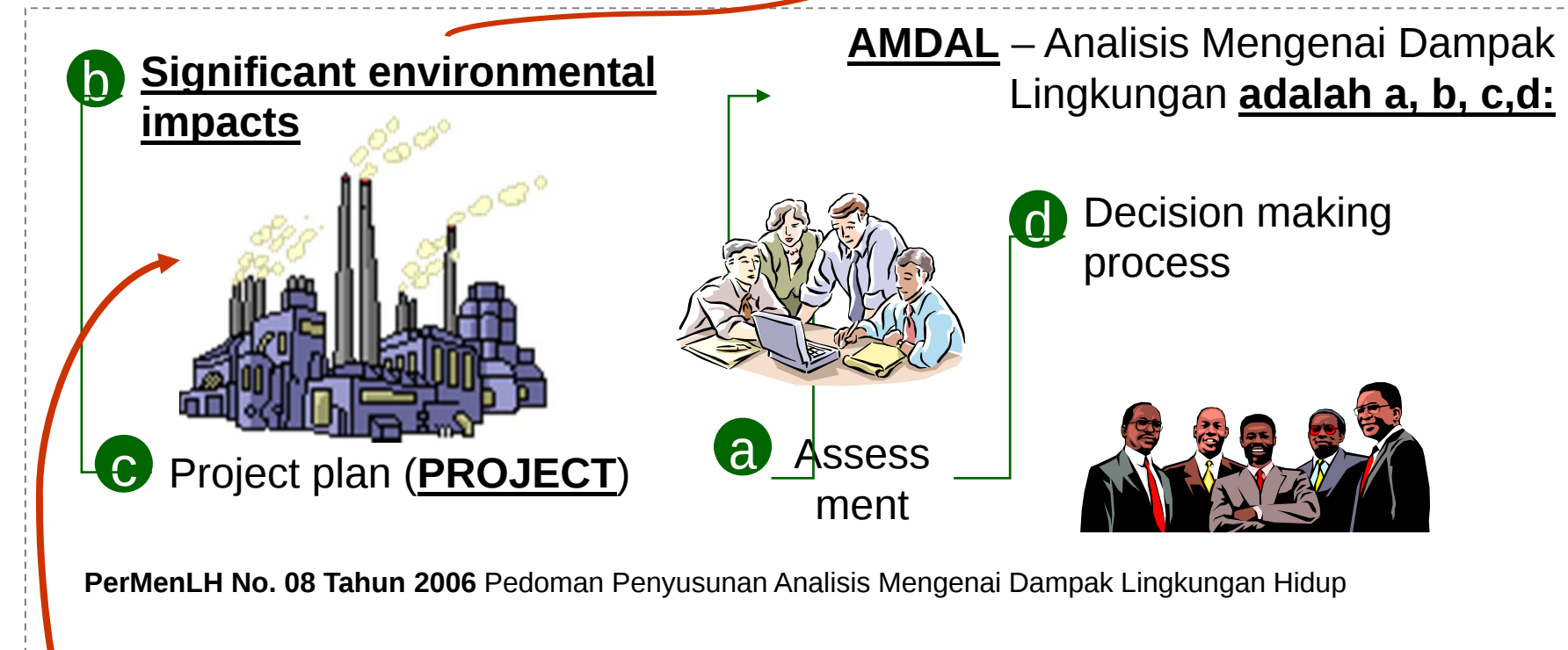
**Sumber:** Canadian Environmental Assessment Agency (CEAA)

# EIA and Climate Change

4

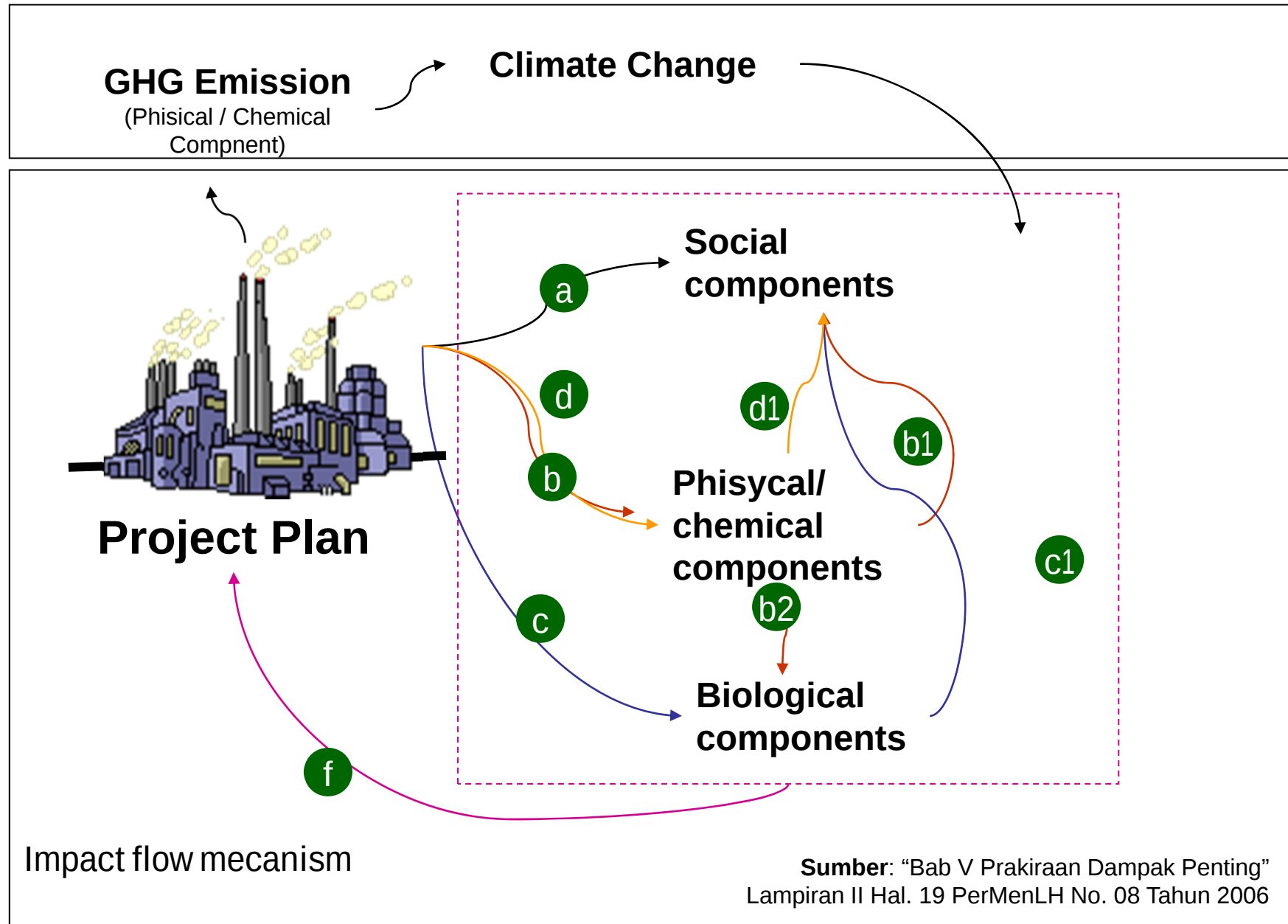
- 1 **Green house gas** : Project may produce / absorb green house gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs, HCFCs, HFCs, SF<sub>6</sub> )

- 3 **Combination** (1) and (2)

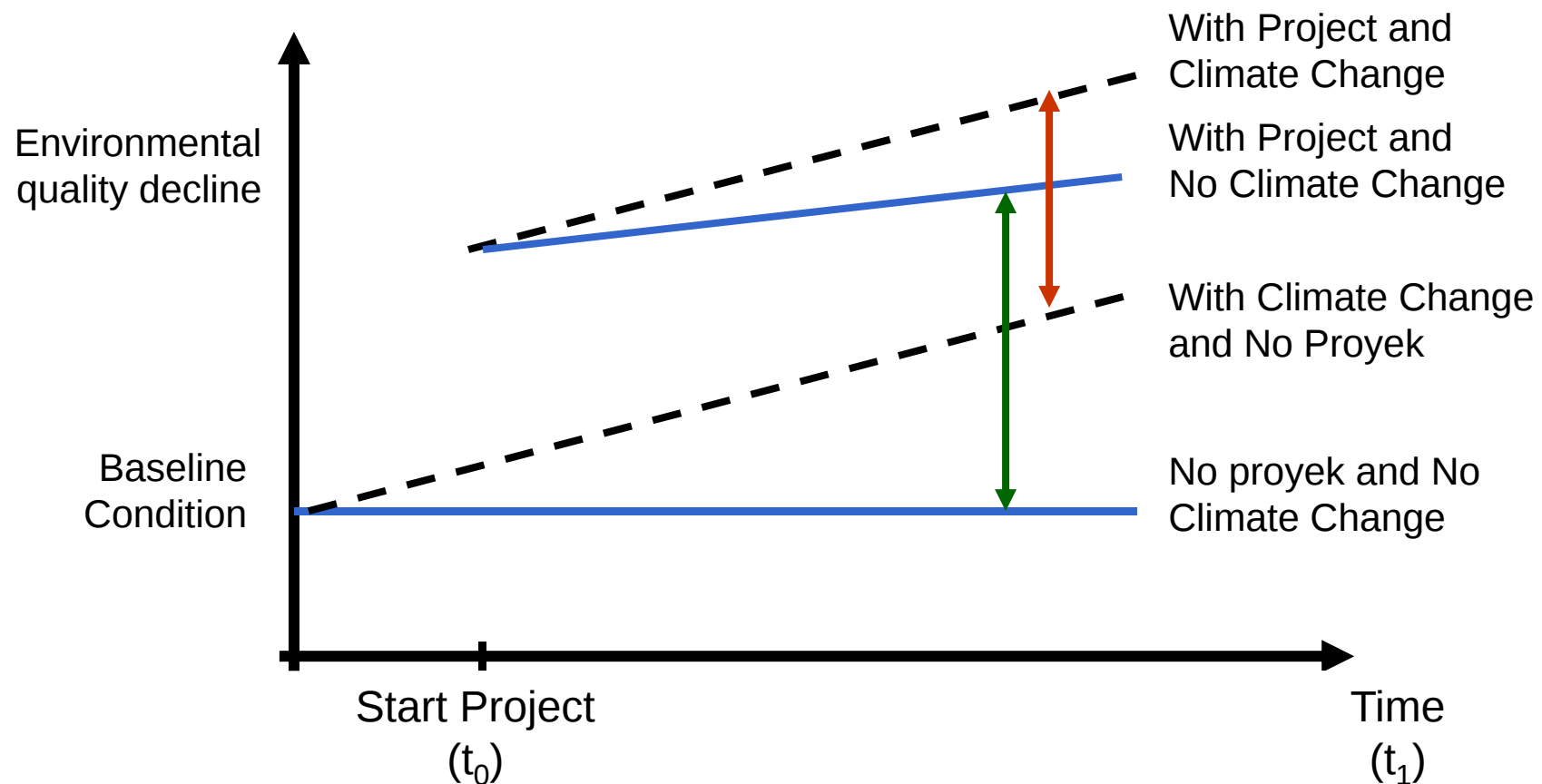


- 2 **Impact component**: climate change will affected to the project

- 4 **CDM** (Clean Development Mechanism) **Projects**



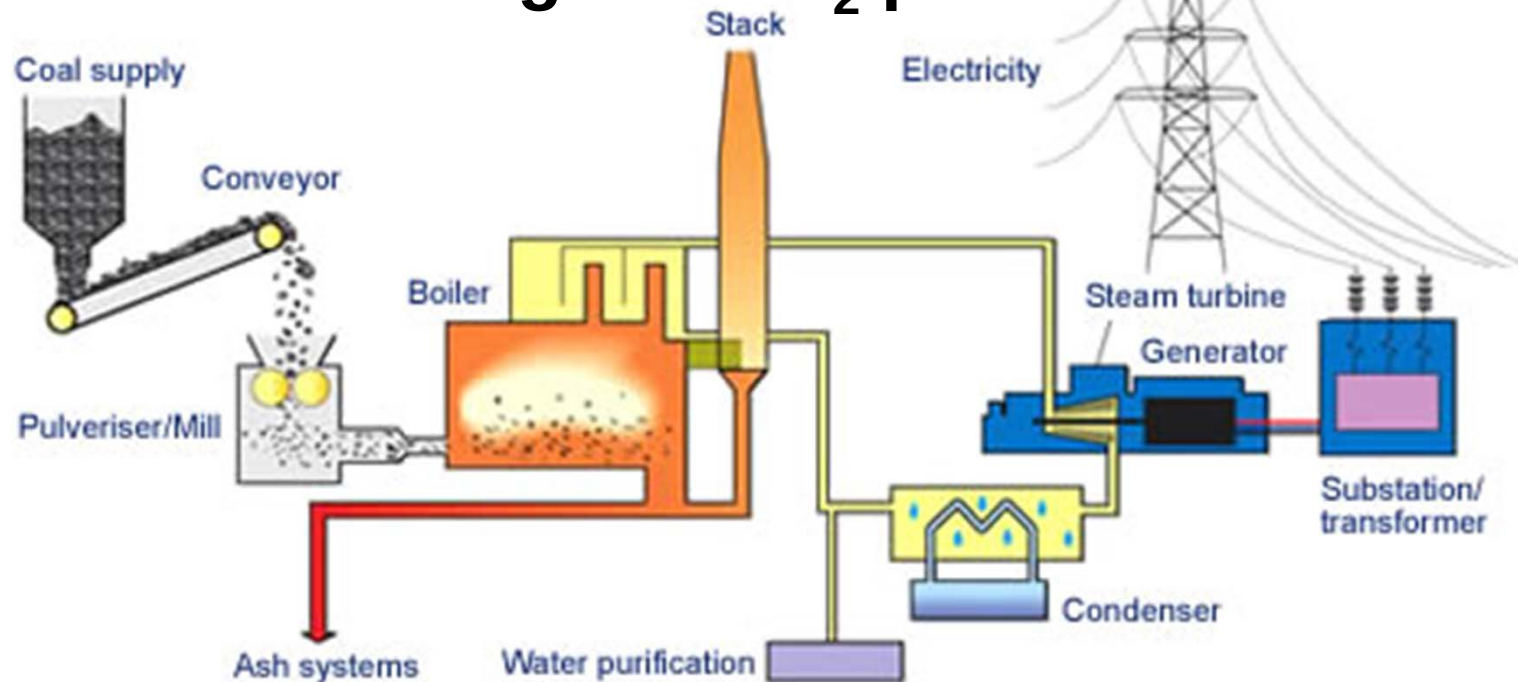
# Environmental Setting with and without Project



**Source:** Byer, Yeomans, and Lalani., 2001. Addressing Climate Change Uncertainties In Project Environmental Assessments. Ottawa: Canadian Environmental Assessment Agency

# Coal Power Generation

**Typical emission rate  
940 gram CO<sub>2</sub> per 1 kWh**



To produce 1 kWh electricity, coal power generation will produce approximately 940 gram CO<sub>2</sub>. Diesel power generation: 1 kWh = 798 gram CO<sub>2</sub>, Natural gas power generation 1 kWh = 581 gram CO<sub>2</sub> (Ajero 2003 dalam KLH 2004).

# Agriculture and Climate Change

**GHG:** Project could produce or absorb green house gas ( $\text{CH}_4$ ,  $\text{N}_2\text{O}$ )

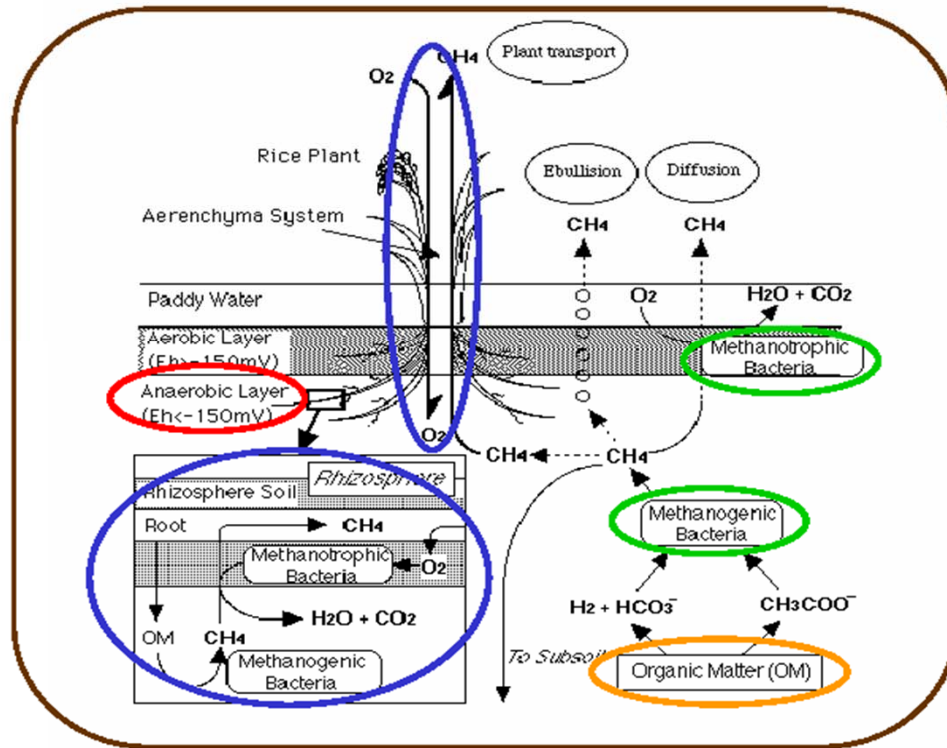
**Impact from CC:**  
Climate change will potentially affected project



**Environmental Impact**

**Minister Decree No. 11 Year 2006:** Agriculture sector with certain scale/ size is mandatory for EIA. One of potential impact should be incorporate is climate chance, subject to be scoping.

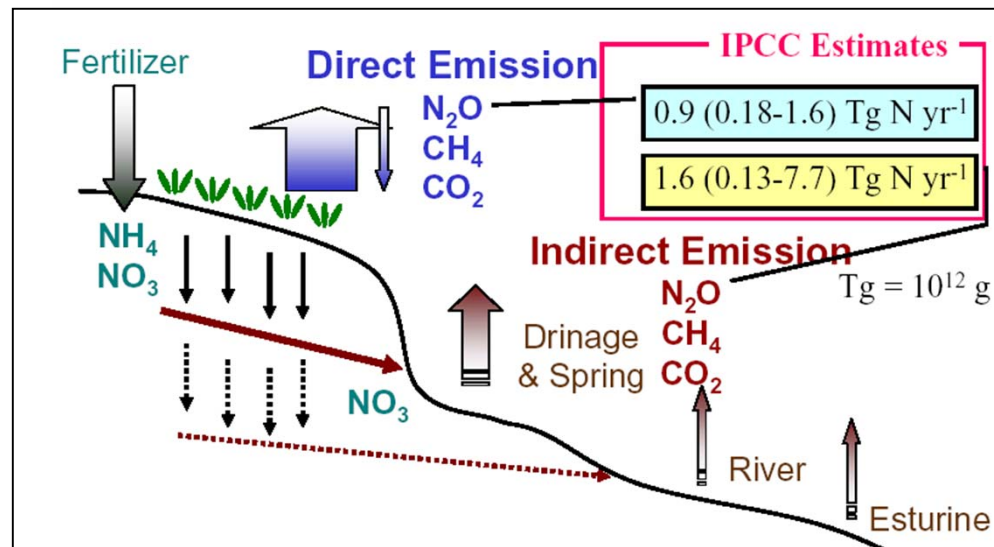
# Emission process of CH<sub>4</sub> from Padi Field



Average emission rate of methane (flux rate) is **16.0-26.1 mg/m<sup>2</sup>/hour** for area with chemical fertilizer application; and **23.3-34.9 mg/m<sup>2</sup>/hour** for area with rice straw application (Nugroho, Lumbanraja, Suprpto, Sunyoto, Ardjasa, Haraguchi & Kimura, 1996)

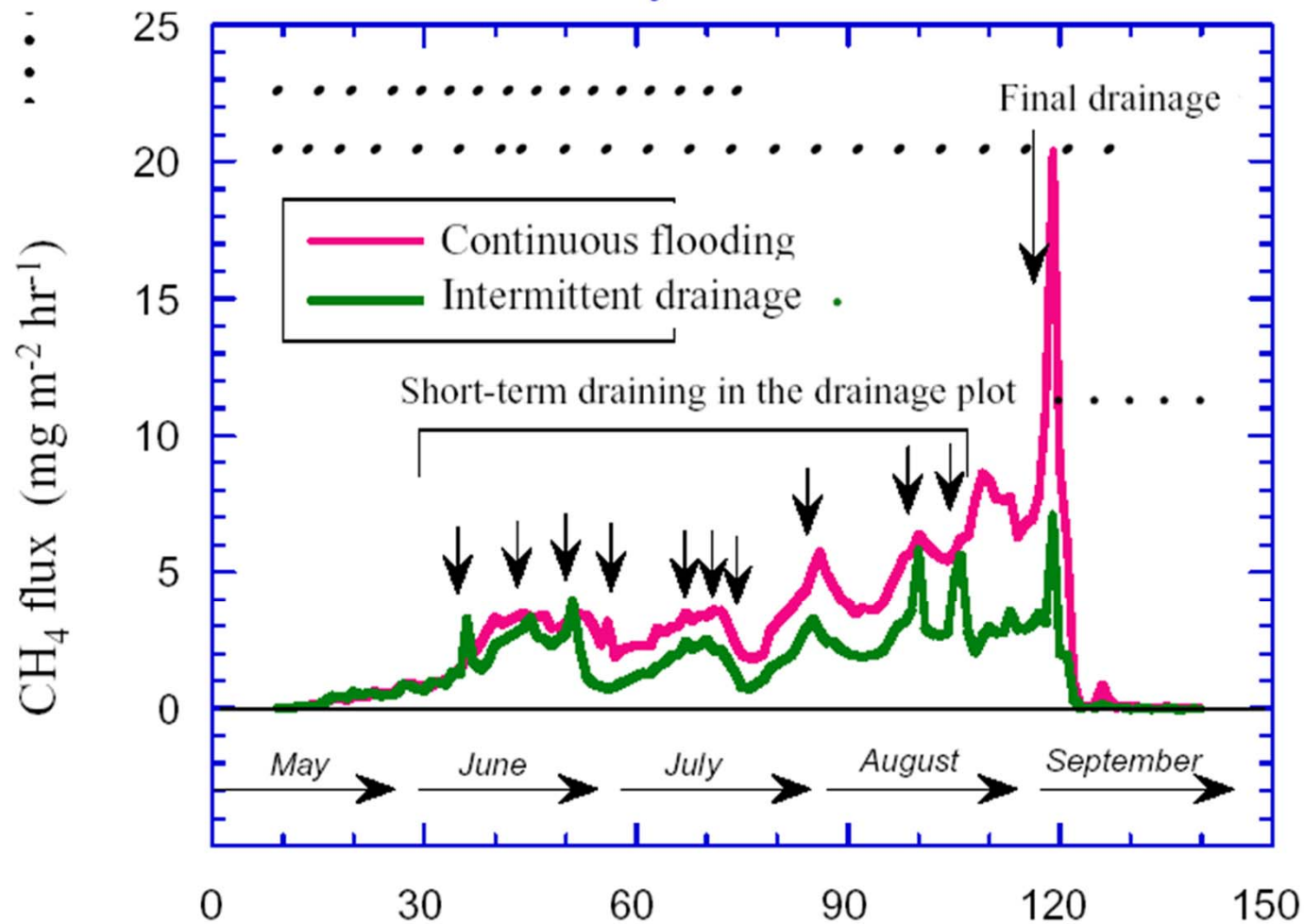


**GHG emission monitoring with Closed Chamber Techniques**

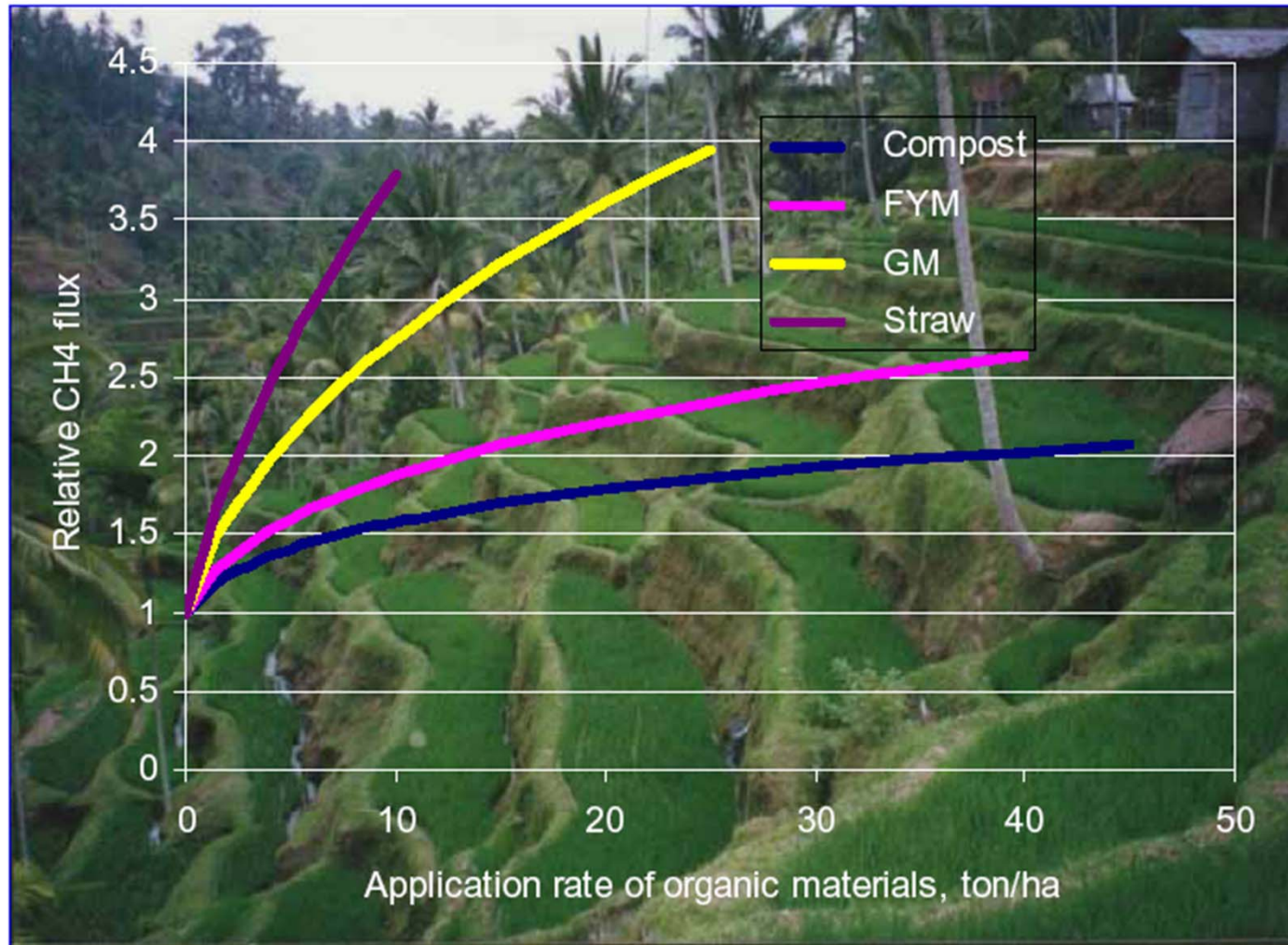


# Mitigation Measure for GHS management from Agriculture

## Effect of Water Management on $\text{CH}_4$ Emission from a Paddy Field



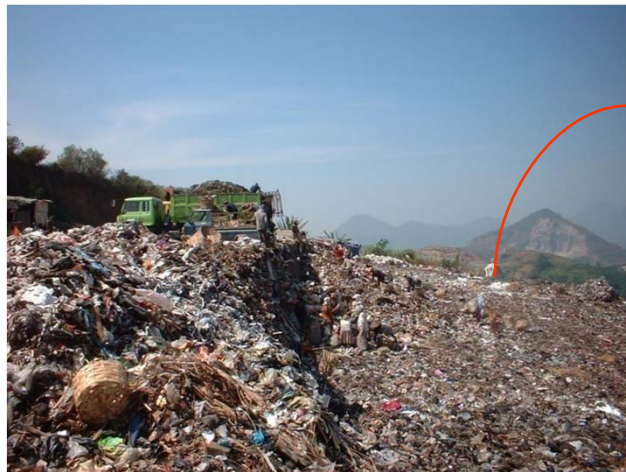
# Effect from Organic Material Application on Padi Field to Metane Emission



# Solid Waste Landfill and Climate Change

**GHG:** Project could produce or absorb green house gas( $\text{CH}_4$ ,  $\text{N}_2\text{O}$ )

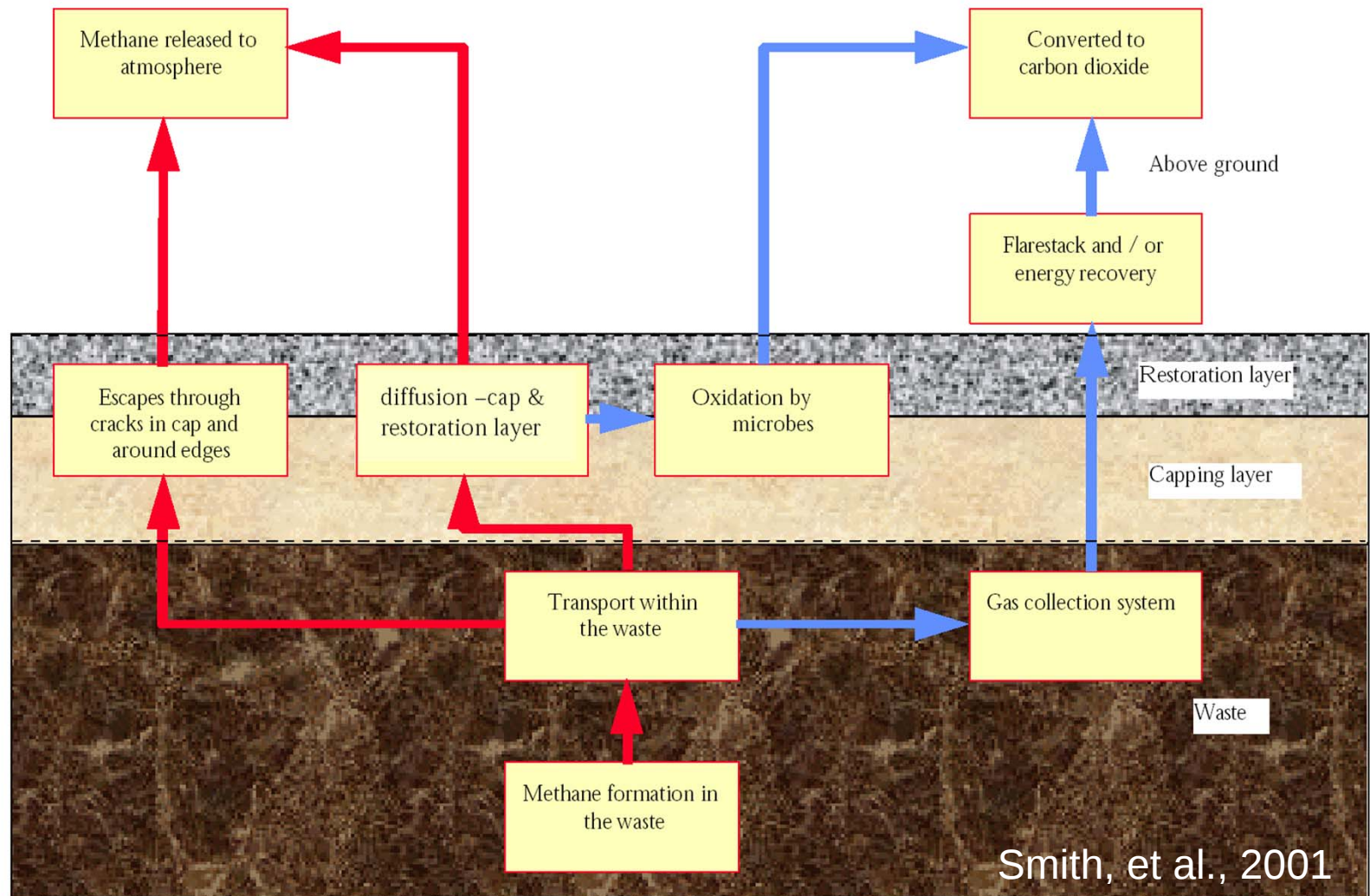
**Impact from CC:**  
Climate change will potentially affected project



**Environmental Impact**

**Minister Decree No. 11 Year 2006:** Solid waste landfill with certain scale/ size is mandatory for EIA. One of potential impact should be incorporate is climate chance, subject to be scoping.

# Metane (CH<sub>4</sub>) pathway in Landfill



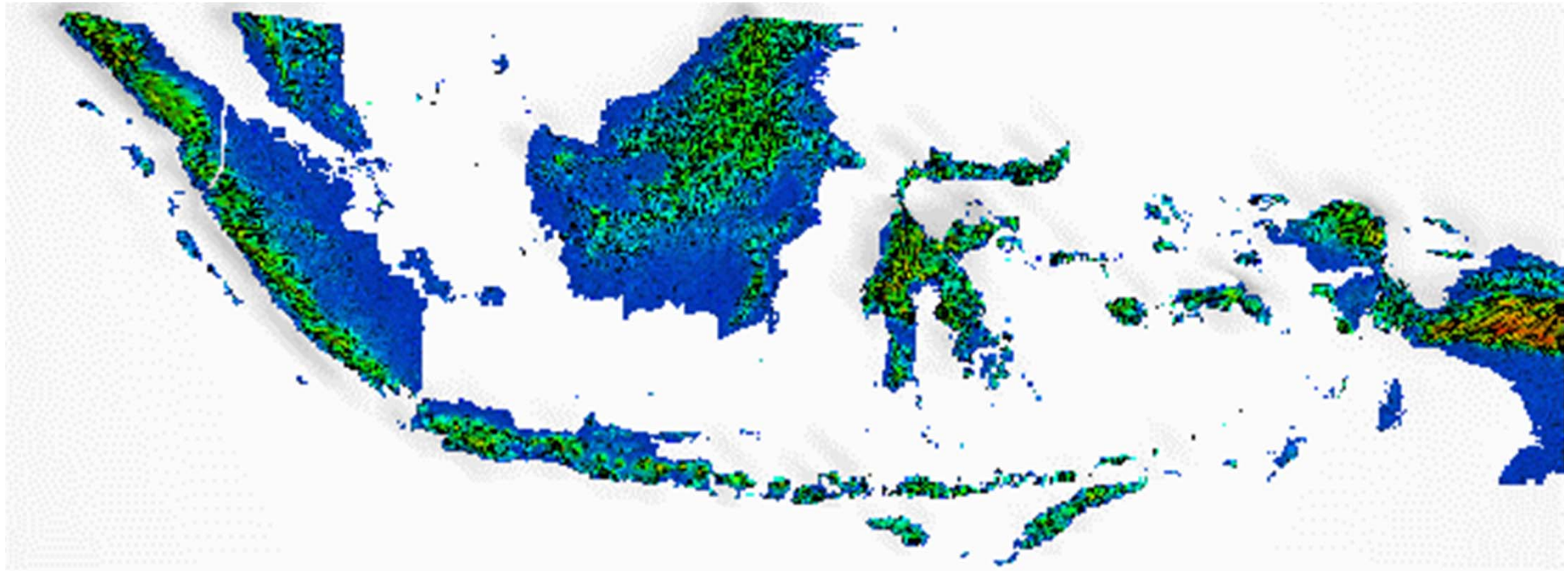
1 ton solid waste will produce approximately 50 kg methane gas (MoE2004)

# Typical Landfill Gas Components

| Component                                      | Percent by Volume | Characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>methane</b>                                 | <b>45–60</b>      | Methane is a naturally occurring gas. It is colorless and odorless. Landfills are the single largest source of U.S. man-made methane emissions                                                                                                                                                                                                                                                                                                                                               |
| <b>carbon dioxide</b>                          | <b>40–60</b>      | Carbon dioxide is naturally found at small concentrations in the atmosphere (0.03%). It is colorless, odorless, and slightly acidic.                                                                                                                                                                                                                                                                                                                                                         |
| nitrogen                                       | 2–5               | Nitrogen comprises approximately 79% of the atmosphere. It is odorless, tasteless, and colorless.                                                                                                                                                                                                                                                                                                                                                                                            |
| oxygen                                         | 0.1–1             | Oxygen comprises approximately 21% of the atmosphere. It is odorless, tasteless, and colorless.                                                                                                                                                                                                                                                                                                                                                                                              |
| ammonia                                        | 0.1–1             | Ammonia is a colorless gas with a pungent odor.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| NMOCs<br>(non-methane<br>organic<br>compounds) | 0.01–0.6          | NMOCs are organic compounds (i.e., compounds that contain carbon). (Methane is an organic compound but is not considered an NMOC.) NMOCs may occur naturally or be formed by synthetic chemical processes. NMOCs most commonly found in landfills include acrylonitrile, benzene, 1,1-dichloroethane, 1,2-cis dichloroethylene, dichloromethane, carbonyl sulfide, ethyl-benzene, hexane, methyl ethyl ketone, tetrachloroethylene, toluene, trichloroethylene, vinyl chloride, and xylenes. |
| sulfides                                       | 0–1               | Sulfides (e.g., hydrogen sulfide, dimethyl sulfide, mercaptans) are naturally occurring gases that give the landfill gas mixture its rotten-egg smell. Sulfides can cause unpleasant odors even at very low concentrations.                                                                                                                                                                                                                                                                  |
| hydrogen                                       | 0–0.2             | Hydrogen is an odorless, colorless gas.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| carbon monoxide                                | 0–0.2             | Carbon monoxide is an odorless, colorless gas.                                                                                                                                                                                                                                                                                                                                                                                                                                               |

Source: Tchobanoglous, Theisen, and Vigil 1993; EPA 1995

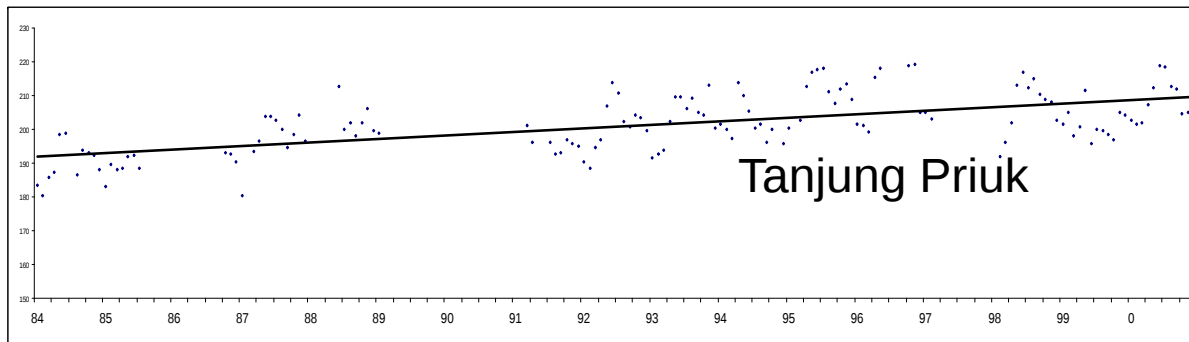
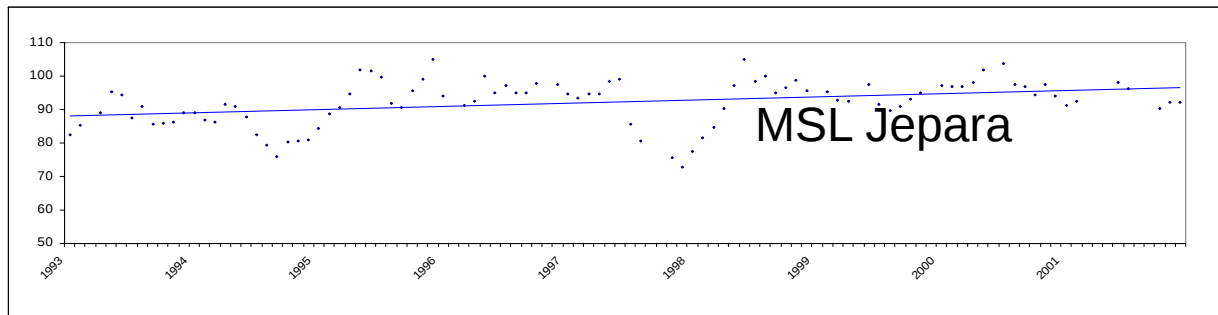
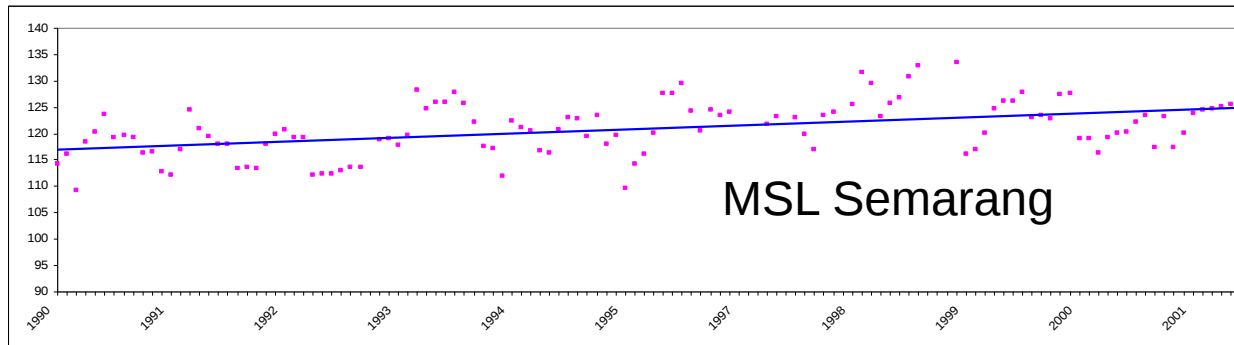
# Sea Level Rise Projection in INDONESIA



| Year | The area Inundated (km <sup>2</sup> ) | Sea Level Rise (m) |
|------|---------------------------------------|--------------------|
| 2010 | 7,408                                 | 0.4                |
| 2050 | 30,120                                | 0.56               |
| 2100 | 90,260                                | 1.1                |

Source: Susandi, et all. 2008

# Sea Level Rise in Indonesia



**Source: Sutisna S., et al., 2002**

**Variation and trend for MSL (Cm) from three permanent monitoring station 1984 s/d 2002.**

**Average rise : 8 mm/year**

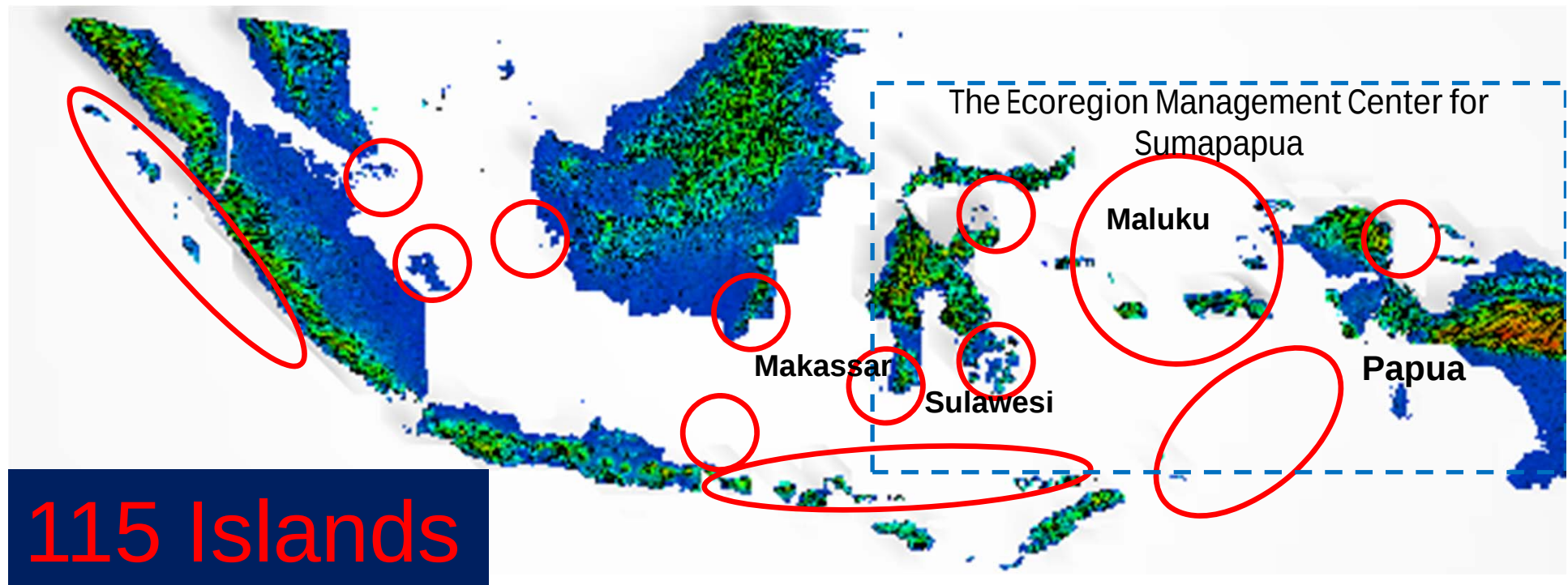


# Sea Level Rise in Indonesia

| Monitoring Station | Average rise in Mean Sea Level (mm/year) | Source                          |
|--------------------|------------------------------------------|---------------------------------|
| Cilacap            | 1,30                                     | Hadikusuma, 1993                |
| Belawan            | 7,83                                     | ITB, 1990                       |
| Jakarta            | 4,38                                     | ITB, 1990                       |
|                    | 7,00                                     | Berdasarkan data dari 1984-2006 |
| Semarang           | 9,37                                     | ITB, 1990                       |
|                    | 5,00                                     | Berdasarkan data dari 1984-2006 |
| Surabaya           | 1,00                                     | Berdasarkan data dari 1984-2006 |
| Sumatera           | 5,47                                     | ITB, 1990                       |
| Panjang, Lampung   | 4,15                                     | P3O-LIPI, 1991                  |

**Sumber:** MoE, 2007

# Sea Level Rises: Certain Regions of the Country Inundated in the Year of 2100



## 115 Islands

Sumatera Utara : Pulau Batu

Sumatera Barat : Pulau Sipora, Pulau Bagai Utara, Pulau Bagai Selatan

Kepulauan Riau : Pulau Singkep, Pulau Sebangka, Pulau Lingga, Pulau Abang Besar, Pulau Panuba, Pulau Benuwa, Pulau Tambelan, Pulau Pinangseribu

Bangka Belitung : Pulau Belitung

Kalimantan Barat : Pulau Karimata ; Kalimantan Selatan : Pulau Laut, Pulau Sebuku

Jawa Timur : Pulau Giliraya, Pulau Gili-genteng, Pulau Puteran, Pulau Sapudi, Pulau Raas, Pulau Kangean

Bali : Pulau Nusa Penida ; NTB : Pulau Giligede, Sangeang; NTT : Pulau Solor, Pulau Pantar, Pulau Adonara

Sulawesi Selatan : Pulau Selayar, Pulau Tanah Pulau Jampea, Pulau Bonerate, Pulau Kaloatoa

Sulawesi Tenggara : Pulau Tukang Besi ; Sulawesi Tengah : Pulau Banggai

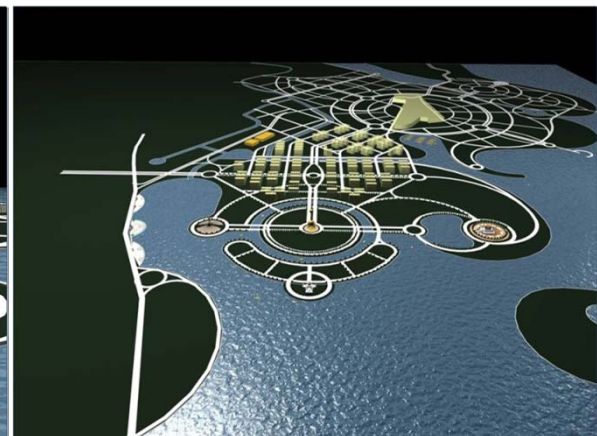
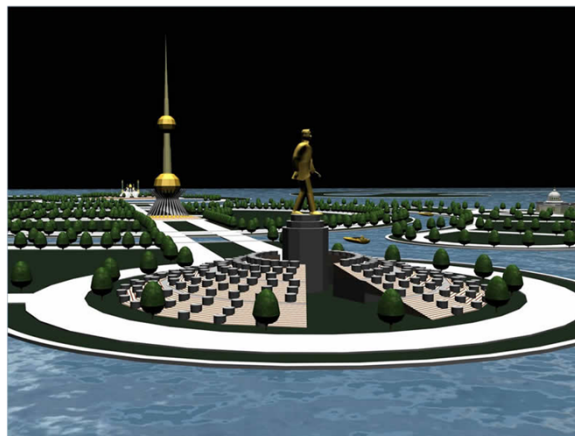
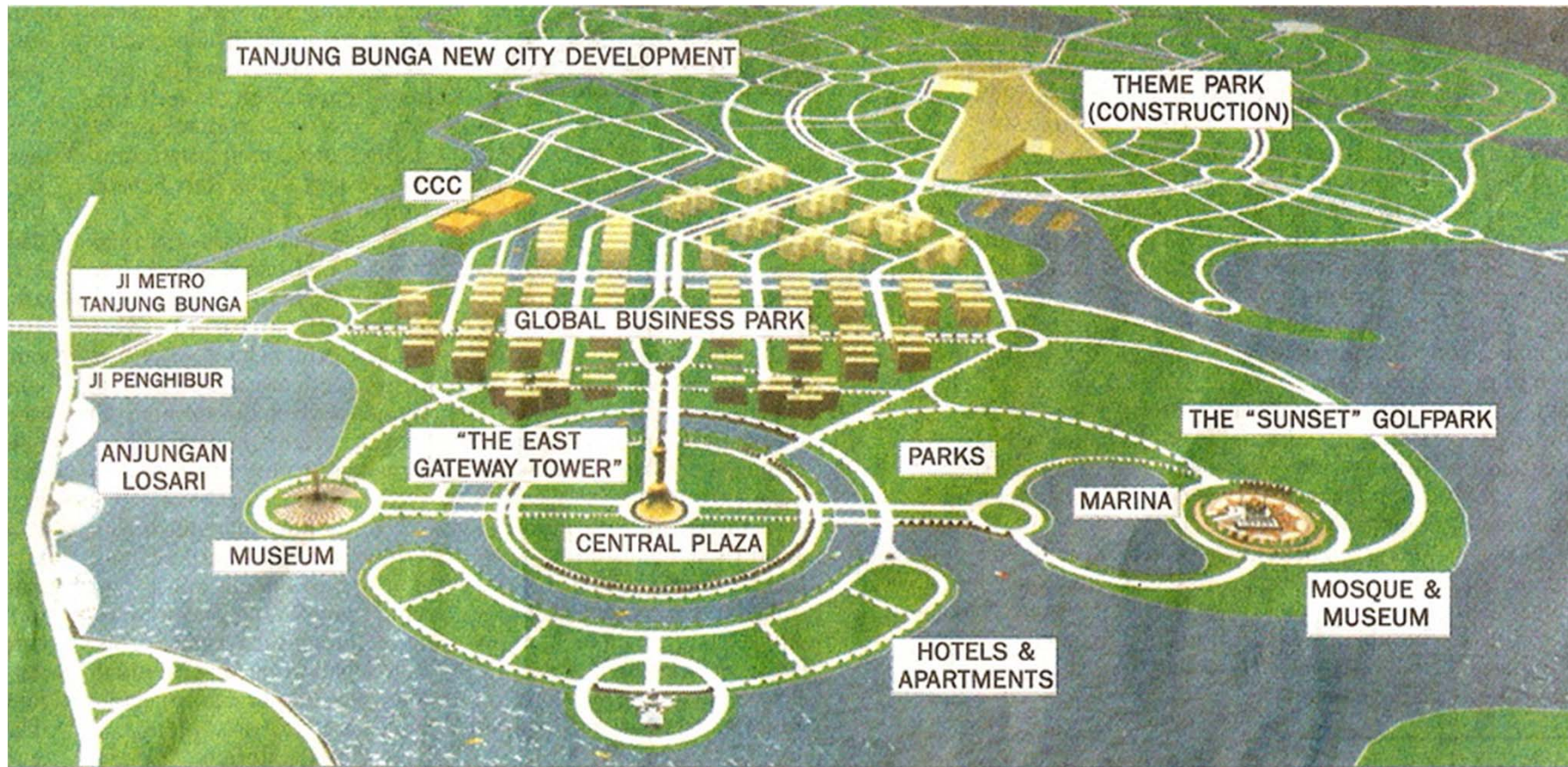
Maluku Utara : Pulau Mangole, Pulau Tubulai, Pulau Obi, Pulau Obilatu, Pulau Damar, Pulau Gebe

Maluku : Pulau Watubela, Pulau Wetar, Pulau Tanibar, Pulau Babar, Pulau Kai

West Papua : Pulau Rumberpon, Pulau Gag

Source : Susandi, et all. 2008

# Vision of Makassar: A World-Class Waterfront City



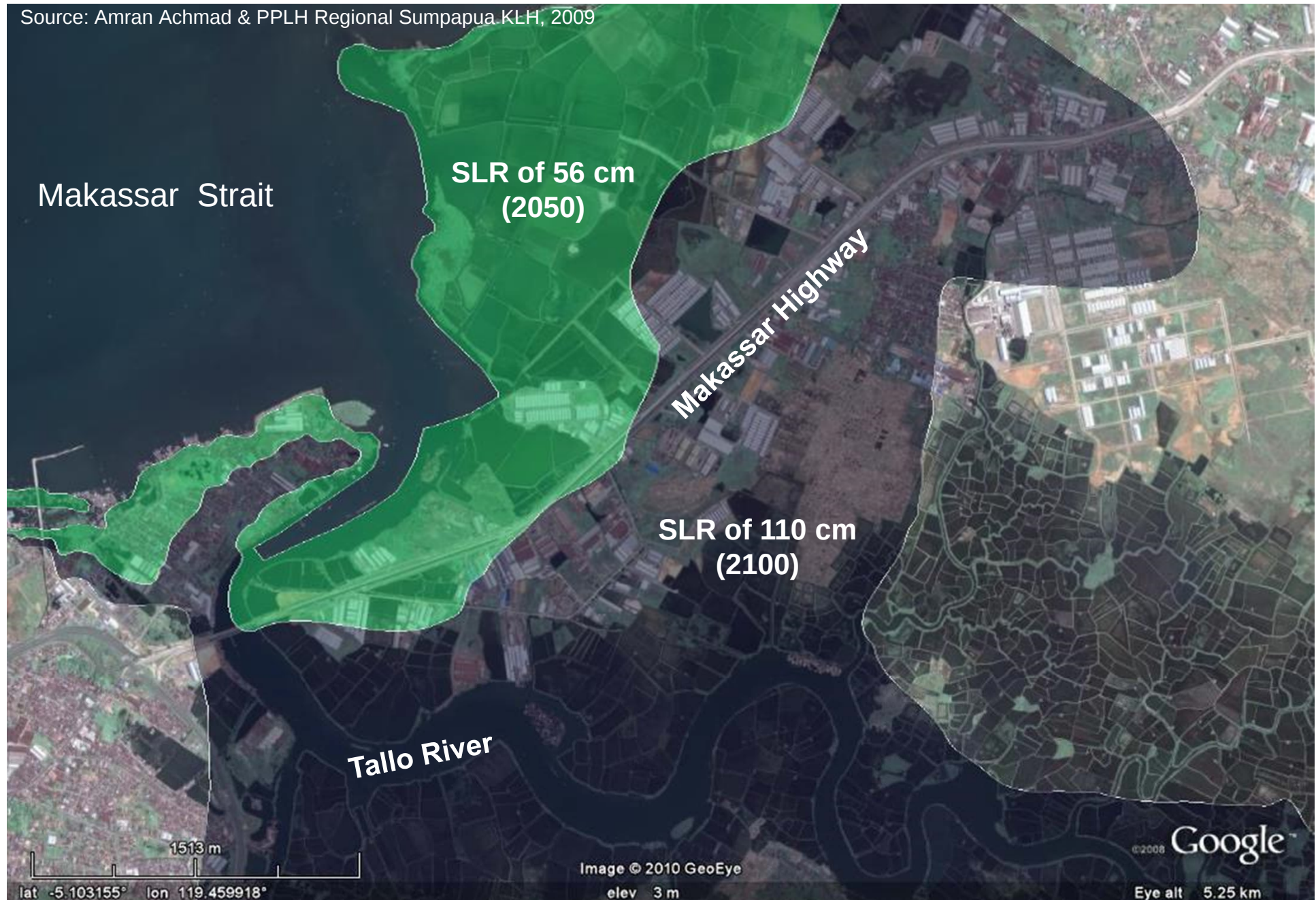
# SLR Impact on Tallo River & its Vicinity, Makassar in the Year of 2050 & 2100

Source: Amran Achmad & PPLH Regional Sumpapura KLH, 2009



## SLR Impact on the Area along the Makassar Highway & Its Vicinity in the Year of 2050 & 2100

Source: Amran Achmad & PPLH Regional Sumpapua KLH, 2009



# SLR Impact on Waterfront Planning



SLR has significant impacts of the Jakarta Waterfront Development. EIA must incorporate SLR



## Challenges:

1. Proper methodologies to predict impact;
2. Sufficient data availability on climate change and its impact *vice versa*;
3. Guidance for implementation of climate change incorporating climate change into EIA.

Indonesia has 1 EIA review commission at central government level, 33 EIA review commission at provincial level and more than 500 EIA review commission at district and municipality level

# Terima kasih

Untuk informasi lebih lanjut, dapat menghubungi:



**Kementerian Lingkungan Hidup (KLH)**

**Deputi I Bidang Tata Lingkungan – Asdep Kajian Dampak Lingkungan**

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