



**4th International Conference on Rehabilitation and Maintenance
in Civil Engineering (ICRMCE)**

**Reducing Carbon Emission in Construction Base
on Project Life Cycle (PLC)**

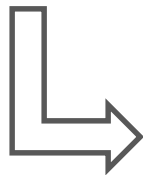
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construction sector is responsible for

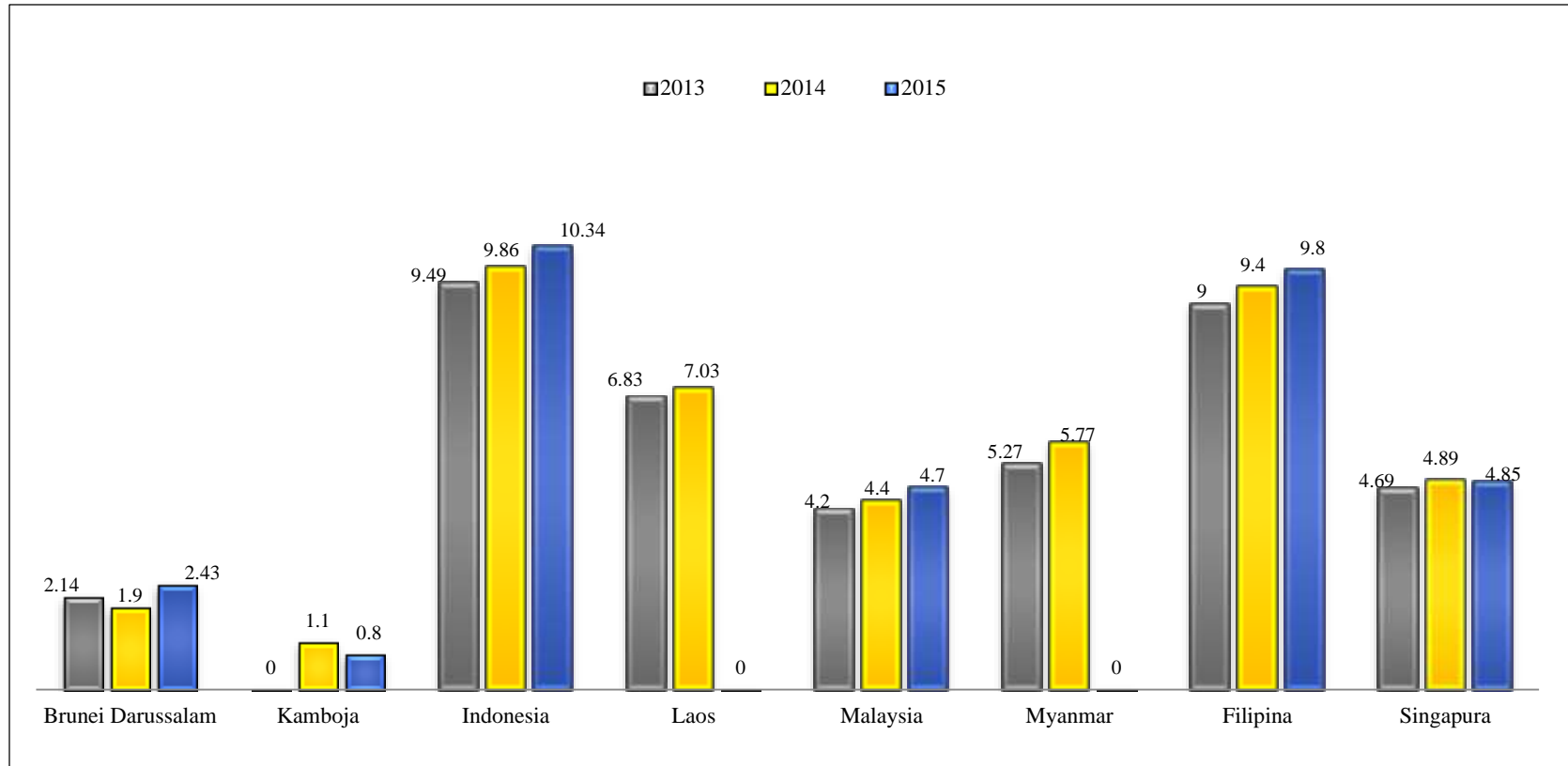
- 40% of global energy,
- 25% of global water ,
- 40% of global resources emitted
- 1/3 of the world's GHG emissions,
- 60% of the world's electricity is consumed



The commitment of the Indonesian government to reduce global warming

- Regulation of Minister of Public Works No. 11 of 2012 on National Action Plan of Climate Change Mitigation and Adaptation in 2012-2020
- Ministerial Regulation of PUPR Number 02 / PRT / M / 2015 on Green Building for reduction greenhouse gas (GHG) emissions sourced from buildings

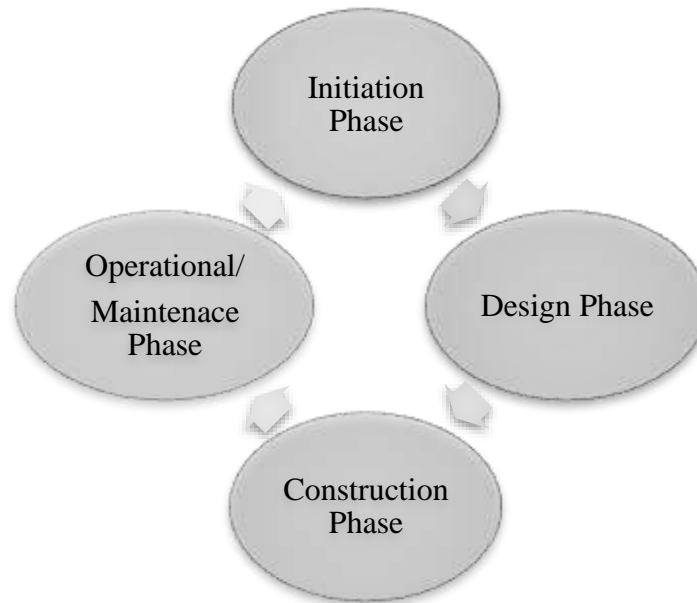
Contribution of gross domestic product of ASEAN construction sector (%) (Source: Central Bureau of Statistics, 2016)



This shows that the construction industry in Indonesia has a value of profitable investment in line with economic and political stability.

However, such investments sometimes also cause losses where if construction activities do not pay attention to environmentally-friendly development

Project life cycle (PLC)



	Phase I	Phase II	Phase III	Phase IV
	Initiation	Planning	Execution	Termination
Hypothesized	Project Mission	Project Mission	Schedule / Plans	Client
Dominant	Client	Top Management	Personnel Technical	Acceptance
Critical Success	Consultation	Client Consultation	Tasks	Client
Factors		Client Acceptance	Trouble-Shooting Client Consultation Monitoring and Feedback Communication	Consultation

Carbon emission in construction sector



materials with the highest contained energy content and they are also responsible for large quantities of CO₂ emissions

CO₂ emission gas comes from energy released during the life cycle of the building

Carbon energy is the energy spent during the construction process taking into account the energy derived from the manufacturing, distribution / supply, transportation and equipment used during development work.

Carbon emission relation with PLC

Initiation

- building concept should be based on low-carbon planning
- regulation on the concept of environmentally and sustainable development

Design Phase

- activity of design of tread space and form of building, low carbon material selection, and utilization of potential around the project area and prefer the green open space.

Construction and handover phase

- supply of materials, construction methods, use of tools and labour, waste management and cleaning of the remaining buildings and maintenance of the building before the building is handed over to the owner.

Research on carbon emission decrease strategies reviewed in the project life cycle

References	Year	Location	Type of Research / Analysis	Type of Construction	Parameter Studied	Life Cycle Project			Case Study
						Inisiasi	De sign	Konstruksi	
Hermawan et al.	2013	Indonesia	LCA	Building	CO ₂		x	x	Building Material
Malmqvist et al.	2014	UE	Comparing study / literary study	Build & Residential	Energy, CO ₂	x	x	x	Building Construction
Giesekam et al.	2014	UK	LCA	Building	CO ₂	x	x	x	Building Material
Efstratios and Alice	2014	UK	Quasy – experimental	Building	Energy, CO ₂	x	x	x	Building Construction
Krantz et al.	2015	Sweden	LCA – Experimental, modelling	Infrastruktur	Energy, CO ₂		x	x	Bridge Construction
Poyry et al.	2015	Finland	LCA I/O data, case study	Residential	CO ₂			x	Building Construction
Dixit et al.	2015	USA	Comparing study / literary study	Building	CO ₂		x	x	Building Construction
Yu et al.	2016	Australia	EA / Economic I/O data	Build & Residential	CO ₂			x	Building Material
Othman and Mohammed	2016	Malaysia	Comparing study / literary study	Building	CO ₂		x		Building Construction
Rasmussen et al.	2017	UE	Comparing study / literary study	Building	Energy, CO ₂	x	x	x	Building Construction

As for general efforts suggested by each researcher as follow:

Initiation Phase

- ✓ There is a need for stakeholder understanding to prioritize environmental considerations in terms of carbon degradation by applying regulations applicable to each type of construction activity [14, 19].
- ✓ The role of the government in providing stakeholder understanding of the importance of low-emission buildings and establishing a benchmark or reference of low-carbon building models that are in line with standards so that communities can see and compare the benefits of low-carbon planning concepts [19, 22].
- ✓ Stakeholders are required to follow and use environmentally sound building standards which have been established by government and international institutions before planning the building [17, 22].

Phase design

- ✓ Design is more emphasized on the concept of low carbon design with attention to optimizing the structure / building element.
- ✓ The choice of low carbon building materials is prioritised
- ✓ The design also takes into account the process of ease of disassembly
- ✓ The design should also consider the concept of renewable energy usage
- ✓ A deeper understanding of LCA will help the designer in designing low carbon design concepts especially on the use of cement, steel and ceramic materials.
- ✓ The highest use of energy and carbon emitters occurs at this operational stage should be a concern for planners to be more innovative in generating designs [16].

Construction and handover phase

- ✓ Optimisation of the supply chain should be done to shorten the flow of material and equipment distribution
- ✓ Machine optimisation and increased operator expertise will influence emissions reduction
- ✓ The choice of construction method will affect the efficiency of time and cost as well as material so that the waste generated will also be less.
- ✓ The use of eco-labelled materials in every building component also has an impact on carbon reduction
- ✓ Optimisation of energy, electricity, gas & water and material utilization in every construction operational activity
- ✓ Implement planned waste management through the concept of reduce, reuse and recycle.
- ✓ Utilization of new technologies and renewable energy will help in reducing the amount of carbon emissions [23].
- ✓ Engineering of building structures using green cement and the utilization of wood materials will further reduce carbon emissions [20].



Thank you!