FMM-MALAYSIAN INSULATION MANUFACTURERS GROUP

FIRST MALAYSIAN STUDY ON MINERAL WOOL INSULATION IN MALAYSIA

Solidiance Analyzes and Quantifies the Potential Impact of Housing Insulation in Malaysia

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I. STUDY BACKGROUND

Situation…
Energy efficiency and conservation of resources are priorities on the global agenda as energy demands soar, fossil fuel reserves are being depleted and global warming impacts our climate.

While the global community has reached consensus that immediate action is required, the "what" and "how" remains the challenging questions.

…in Malaysia During the United Nations Conference on Climate Change in Copenhagen, the Prime Minister has voluntarily offered to slash carbon emissions by 40% by 2020 compared with 2005 levels. This is of course conditional upon the transfer of technology and adequate financing from developed and industrialised nations.

Apart from that, new initiatives to ensure energy efficiency are also taking shape:

- establishment of the Ministry of Energy, Green Technology and Water and the Green Technology Policy
- sales tax exemptions for products and technologies which improve energy efficiency
- a Green Building Index rating tool for certification of green buildings

These initiatives are no coincidence given that Malaysia is expected to become a net importer of energy as early as 2013. Fluctuating and likely rising global energy prices further increase future uncertainty.

"We have to adopt green technologies to not only enhance efficiency and effectiveness of energy use, but also to effectively mitigate carbon emissions"

– NAJIB ABDUL RAZAK, PRIME MINISTER OF MALAYSIA, 2009

Policy makers therefore need to look for readily available, practical and cost effective technologies and solutions to increase energy efficiency and reduce energy wastage.

…. and in other countries In Europe thermal insulation is a key measure to reduce energy usage in buildings, and is enforced through corresponding building codes. Another interesting case is Australia - a country with its northern region having similar weather conditions as Malaysia. Australia introduced a heavily subsidized thermal insulation program for all residential premises to achieve ambitious energy conservation targets.

In these countries, insulation is already a widely recognised measure to reduce energy use in buildings. McKinsey & Company in its report suggested that insulation (especially for retrofit of existing buildings) is one of the 'lowest hanging fruit', meaning it is one of the most cost effective measures to save energy and reduce carbon emissions.

CAN MALAYSIA BENEFIT FROM THERMAL INSULATION?

To answer this question, the Malaysian Insulation Manufacturer Group (MIMG) asked independent consulting firm Solidiance to conduct the first in-depth study on the potential benefits of applying mineral wool in large scale to buildings in Malaysia.

PROJECT OBJECTIVES ARE TO DETERMINE:

- The potential savings on energy, government subsidies and reduced carbon emissions as a result of applying mineral wool insulation in buildings
- ROI analysis for various building stock segments
- Environmental and socio-economic benefits as a result of insulation

Energy usage and building insulation benefits are driven by a few main factors, the size of the building stock and design of the building envelope, energy cost and consumption patterns of its occupants.

To allow a detailed assessment, Solidiance segmented Malaysia's building stock into three main categories: residential, commercial and industrial buildings. Solidiance also assessed the size of the existing building stock and the number of upcoming buildings in order to quantify the impact of insulating only new buildings versus retrofitting existing buildings.

To measure insulation impact, the study applied readily available mineral wool (glass wool and stone wool) which has an R-Value of 1.5 (see appendix for more details).

II. MALAYSIA TODAY

Global focus has gradually evolved over the last 30 years, starting from emissions and pollution control to today's greater awareness for pre-emptive measures such as energy efficiency improvements.

In Malaysia, there is greater emphasis to optimize the use of energy since resource of fossil fuel part of which, natural gas is heavily subsidised and gradually depleting. In such a scenario, finding a cost-effective solution becomes critical. Rising energy prices and global warming issues have also in recent years drawn the government's attention towards the largely untapped green technology in the energy, transport, water and buildings sectors.

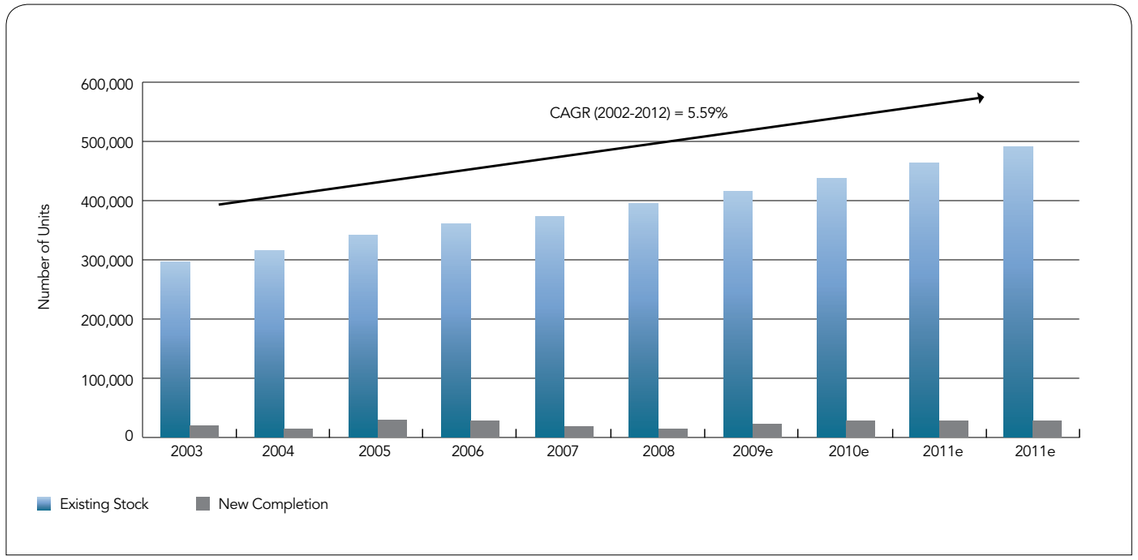
In view of this, the potential benefits of energy savings in buildings offer the government the possibility to reduce its usage of fossil fuel and reduce its subsidy on natural gas for power generation as well as helping to take a step closer towards achieving its ambitious carbon reduction emissions.

A. BUILDING STOCK

The study is based on projected new and existing buildings in Klang Valley which represents approximately 9% of total building stock in the country. However, the overall study findings for Malaysia has been calculated on a pro-rata basis on projections and data obtained from Malaysia's Valuation and Property Services Department, Quarterly property stock reports.

The construction industry has shown small but consistent growth despite the recent global recession of 2008/2009.

Klang Valley Residential Housing Units in Supply and New Editions



Stock of residential units has grown in Klang Valley as well as overall in Malaysia. Commercial buildings experienced only a small growth in Klang Valley and Malaysia.

The design of the building envelope also plays a major part on the energy consumption of a building. A conventional commercial building in Malaysia consumes as high as 275kWh/m^2 per year. Whereas, a well designed building with various energy saving measures, including insulation, such as the Low Energy Office of the Ministry of Energy, Green Technology and Water only consumes 100kWh/m^2 per year.

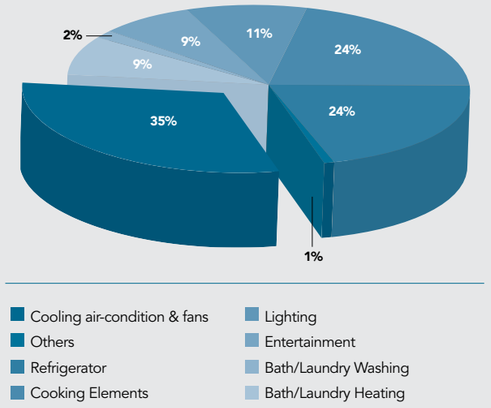
However, as it is not possible to drastically change the building envelope of existing buildings, except through measures like insulation, the aspect of design for energy efficiency improvements are not taken into account in this study.

B. ENERGY COSTS AND CONSUMPTION PATTERNS

Sales of electricity by Tenaga Nasional Berhad have increased over 40% *[1] in the last 6 years, indicative of the increase in energy demand especially by the industrial, commercial and domestic sectors. Electricity tariffs remain relatively low due to the government's subsidy scheme, however demand for energy is still expected to increase.

On a global scale the building sector consumes as much as 40% of total energy used. Of these, two-thirds are used for heating, cooling and ventilation. In Malaysia, the

MALAYSIA



electricity sales breakdown *[3] showed that domestic and commercial use accounts for 51% of electricity consumed. Over 30% of electricity used in urban domestic households is for cooling purposes. In conventional commercial buildings, electricity used for cooling is over 40% of overall energy usage.

In view of this, each country needs to develop its own local strategy to reduce energy consumption and to target the area that consumes the most energy – buildings.

III. FINDINGS AND RESULTS OF THE 2009 INSULATION STUDY

STUDY REFERENCES

All detailed assumptions, data and calculations used can be provided in separate worksheets if required. A summary of some main assumptions and source of references are given in the enclosed indices.

IMPLEMENTATION CONSIDERATION

It is not feasible to assume all existing buildings can be retrofitted within a single year. Implementation on a large scale across the whole country will take time. Solidiance modelled a sample implementation period of 10 years.

A. ENERGY

Study results on Malaysia are conclusive and in line with other international research findings. Introducing building insulation in its most simple form would have a tangible, lasting positive impact for Malaysia.

The study shows that Malaysia can potentially save a total of 51,320 GWh annually – corresponding to the capacity of a ??MW power plant.

Annual Electricity Savings for Cooling Resulting from Insulating Buildings

New housing units	27 GWh	+	Existing housing units	1,091 GWh
New commercial units	1,913 GWh	+	Existing commercial units	47,973 GWh
New industrial units	3.0 GWh	=	Existing industrial units	313 GWh
Total savings	**1,943 GWh**		**Total savings**	**49,377 GWh**

Total 51,320 GWh savings
resulting from insulation

Annual Government Energy Subsidy Savings

New housing units	RM3,995k	+	Existing housing units	RM 163,686k
New commercial units	RM 229,620k	+	Existing commercial units	RM 5,757,000k
New industrial units	RM 430k	=	Existing industrial units	RM 46,906k
Total annual government savings – new units	**RM 234,045k**		**Total annual government savings – existing units**	**RM 5,968,000k**

Total RM 6.2 billion savings
for Malaysian government on energy subsidies every year

The study also documents the possibility for the government to reduce its spending on energy subsidies by as much as MYR 6.2 billion annually, thereby freeing up funds for various other socio-economic developments.

The largest savings potential comes from retrofitting existing buildings, which would result in almost 100 times more energy savings compared to insulating only new buildings. This is in part due to the large number of existing buildings which are not insulated.

According to the McKinsey/Vattenhall Climate Map, air conditioning use is estimated to triple before 2030. This may result in higher annual energy savings as an increasing number of Malaysians consider the use of air conditioning as a necessary and essential part of their every day life.

B. ENVIRONMENT

Burning of fossil fuel energy is the main source for CO_2 and emissions are increasing rapidly. South Asia is responsible for 12% of today's CO_2 emissions but its share is expected to more than triple up to 40% by 2030 *[4].

In Malaysia, electricity generation mix consists largely of fossil fuel, with gas, coal and oil accounting for 90% of the overall mix *[5]. With buildings being the largest consumers of electricity in this country, the reduction of energy used in buildings can be a substantial contribution towards achieving the 40% carbon intensity reduction pledged during the Conference on Climate Change in 2009.

CO_2 Savings Potential for Malaysia

	New buildings	Retrofitted
	Tonnes CO_2 saved	Tonnes CO_2 saved
Residential	16,353	670,020
Commercial	1,174,889	29,455,394
Industrial	1,762	192,003
Total	**1,193,004**	**30,317,416**

Total 31,510,420 tonnes CO_2 saved
Contributing to a cleaner and more sustainable future

The study has documented that mineral wool insulation of buildings would result in savings of over 32 million tons CO_2 across Malaysia.

Life cycle assessments in various studies have shown that over the course of 50 years, a typical mineral wool insulation will save more than 100 times more primary energy than was used for its production, transport and disposal. The energy balance becomes positive only a few months after installation of the product. In addition, the main raw materials for mineral wool insulation are sand and stone, which are natural materials readily available in Malaysia.

C. SOCIO-ECONOMIC

Building insulation has a positive impact for all stakeholders. Investors benefit as insulated buildings are more energy efficient, thus saving the owner money as soon as the insulation is in place. Expected future energy price increases will further reduce investment payback periods.

It is also important to realise that unlike cooling equipment, insulation once installed, does not require maintenance and lasts for the lifetime of the building.

Thermal insulation–Return on Investment			
Payback/Years*	**No change in electricity pricing**	**Increase of 10%**	**Increase of 20%**
Residential Housing	10.0	8.6	7.9
Office Units	7.7	6.7	6.1
Industrial Buildings	7.1	6.4	5.9

Payback periods in most cases are much shorter than average home loans or mortgage periods. As new energy saving concepts gain momentum and demand increases, property values of more energy efficient buildings will increase.

However, the payback value extends beyond tangible and monetary benefits to other less tangible but equally important ones like better home comfort, healthier indoor environment, improved noise protection and greater fire safety for its occupants.

Should Malaysia start to insulate its existing housing stock over a period of 10 years, Solidiance calculates the creation of more than 1,200 qualified jobs per year; providing more options in the job market. Over a 10-years period, this could create over 12,000 job opportunities.

IV. THE PATH FORWARD

Can mineral wool insulation become a viable option and contributor in Malaysia's move towards a more economically and ecologically sustainable future? Indeed, Solidiance's study shows that thermal insulation can play a pivotal role in helping Malaysia to address its long term competitiveness while securing a sustainable living and working conditions without compromising its environmental responsibility.

Mineral wool insulation can offer Malaysia a simple and cost- effective solution to reducing its energy consumption on a large scale. Insulation is already recognised by McKinsey & Company as one of the most cost-effective measures to save energy and reduce carbon emissions; making it one of the most appropriate technology for the average household.

In order to capitalise on the potential offered by mineral wool insulation, Solidiance recommends the Malaysian Government to support incentives and initiatives that can help promote this cost-effective green technology.

- Focus on retrofitting existing building stocks to unlock the large potential of savings
- Leverage Green Building Index to educate and measure building performance improvements, setting "Malaysian standards" in building codes.
- Making installation of prescribed insulation a mandatory practise through the building code or by-law. Changes could be phased in over 10 years, providing every house owner enough time to take action.
- A mandatory scheme could be supported by a rebate programme. Savings from reduced energy subsidies could be reinvested into monetary incentives to promote usage of insulation.
- Continuous awareness campaign to educate the general public of the tangible benefits of insulation needs to be instituted.
  Working together with relevant ministries, professional bodies and developers can promote the practise and implementation of insulation within the building industry.

ASSUMPTIONS, DATA AND SOURCES OF INFORMATION

PROJECT METHODOLOGY

Over the course of 4 months, Solidiance analyzed the market by assessing available secondary information followed by extensive interviews with industry stakeholders, such as construction companies, land developers, contractors, insulation manufacturers and government agencies. A detailed return on investment model was developed, split into

- residential
- commercial
- industrial

to quantify insulation values, energy savings potential, costing and payback periods. Solidiance then focused on the socio-economic impact, such as creation of new, qualified jobs. The last part was to identify and prioritize high impact areas for insulation solutions.

R-Value is a measure of thermal resistance used in building and construction industry. It is the ratio of temperature difference across an insulator and the heat flow per unit area through it.. R-values are usually given in square-metre Kelvin per watt or $m^2 \cdot K/W$. The higher the number, the better the building insulation's effectiveness. Increasing the thickness of an insulating layer increases the thermal resistance (R-value).

The study uses a basic R-Value of 1.5 (m^2K/W). Other countries use R value between 2-3.5+ which further improves building performance and provides greater energy savings and lower CO_2 emissions.

ASSUMPTION	SOURCE	SECTOR	VALUE
Number of building units	Malaysia Valuation and Property Services Department Quarterly property stock reports	Residential, Commercial, Industrial	Details are provided in separate worksheet, available upon request.
Building occupancy rate	Malaysia Valuation and Property Services Department Quarterly property stock reports, Solidiance interviews with property agents, Technical Advisor PTM, news articles	Residential	40-60% fully occupied, 20-30% partially occupied, average 70%-80% occupancy
		Commercial	80% occupancy for private, 95% occupancy for government
		Industrial	80% occupancy
Roof and wall space, and resulting insulation usage	Solidiance calculation based on average unit floor space and number of floors in building, MIMG, Technical Advisor PTM	Residential, Commercial, Industrial	See separate worksheet for details 1 sqm R1.5 glasswool = 2.5 kg
Number of rooms (e.g. bedrooms and living rooms in residential, offices and lab rooms in industrial), % of unit with aircon, hours of aircon usage	Solidiance interviews with property agents, home owners, MIMG, Technical Advisor PTM,	Residential, Commercial, Industrial	See separate worksheet for details
Aircon power rating	Solidiance interviews with M&E contractors, building owners, aircon manufacturer publications, Technical Advisor PTM	Residential, Commercial, Industrial	See separate worksheet for details
Energy savings rate, wall vs roof insulation savings contribution	MyLisa study in Malaysia, Ecofys study in Spain, Solidiance interviews with M&E contractors, MIMG, Technical Advisor PTM	Residential	10% to 32% savings on air-con usage, average 17%
		Commercial offices and Industrial offices	10% savings on air-con usage for Commercial (predominantly high rises), 15% savings for Industrial
Cost of electricity and fuel subsidies on energy production	MyLisa study in Malaysia, PTM, Petronas, Technical Advisor PTM	Residential and Industrial	Average RM 0.30 for private, RM 0.15 subsidies from gov't
		Commercial	Average RM 0.38 for private, RM 0.12 subsidies from gov't
CO_2 emissions conversion and cost of carbon credits	CDM, PTM, Technical Advisor PTM	Residential, Commercial, Industrial	0.61 kg per kWh electricity produced, valued at USD 5.0 per tonne CO_2

REFERENCES

*1 Malaysian sales of electricity (GWh) by TNB from 2002 to 2008. Sourced from Performance & Statistical Information 2008 by Suruhanjaya Tenaga

*2 The Star, January 2006.

*3 Malaysian sales of electricity (GWh) by TNB in 2008. Sourced from Performance & Statistical Information 2008 by Suruhanjaya Tenaga.

*4 Asian Development Bank, 2009

*5 Generation Mix (by Fuel Type) in Malaysia. Sourced from Performance & Statistical Information 2008 by Suruhanjaya Tenaga.

FMM – MALAYSIAN INSULATION MANUFACTURERS GROUP
Federation of Malaysian Manufacturers (7907-X)
Wisma FMM, 3, Persiaran Dagang PJU 9, Bandar Sri Damansara, 52200 Kuala Lumpur, Malaysia.
Tel +603 6286 7200 **Fax** +603 6277 6714 **Email** info@mimg.org.my **Website** www.mimg.org.my