



Energy Efficiency Award Challenge

Energy Efficiency in Buildings

www.german-energy-solutions.de/en

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Preface



The Energy Efficiency Award Challenge is a celebration of innovative German energy-efficient solutions in buildings in Singapore. It is a great opportunity to promote successful German-Singaporean partnerships, which have led to increased building quality, reduced energy costs and lower CO₂ emission levels in Singapore. The five innovative projects, which are being showcased in the framework of the award challenge, present Singapore as an attractive location for German companies seeking partnerships and market opportunities.

The advanced technologies, know-how and expertise from the German companies involved in these projects conducted in Singapore are representatives of a wider success story: Germany is a world leader in the field of energy efficiency. Cutting-edge German technologies are featured in all energy efficiency market segments, including insulation systems, insulated glazing, heating and cooling technologies, efficient home appliances, smart metering, energy-efficient lighting systems, cogeneration systems, as well as pumps and compressed air systems. German companies generate a turnover of about \$66 billion per year in this industry and double-digit growth rates are expected in the coming years.

Since 2004, the Federal Ministry for Economic Affairs and Energy has successfully supported German-Singaporean partnerships via the German Energy Solutions Initiative. The Singaporean market has proved to be very open to German suppliers of energy-efficient products, systems and services. Since this initiative was launched in 2002, the Singaporean-German Chamber of Industry and Commerce has been active in creating and hosting successful cooperation platforms such as trade missions and innovation seminars. This showcase project is the first one of its sort in Singapore and it gives the German Ministry for Economic Affairs and Energy a welcome opportunity to celebrate some great examples of German-Singaporean partnership in the building sector.

A handwritten signature in blue ink that reads "Christina Wittek".

Christina Wittek
Head of Division
German Energy Solutions Initiative
Federal Ministry for Economic Affairs and Energy

Dear Sir/Mdm,

On 22 April 2016, Singapore pledged to cut its emission intensity by 36% by 2030, as compared to 2005 levels, by signing the Paris Agreement on Climate Change. The city-state recognises that clean technologies and renewable energy are key factors for its economic growth.

Through the use of innovative technologies, energy conservation in every field of application holds enormous potential. Companies, private households and the public sector can tap on innovative technologies to save a previously unimagined amount of energy. The usage of efficient technologies in power generation and other sectors accounted for Singapore's reduction in energy intensity by 15% from 1990 to 2005 and by 16% between 2005 and 2010.

Buildings in Singapore consume about half of the country's electricity. Therefore, they play a major role in the national efforts to become more energy efficient. Through the implementation of energy conservation and efficiency measures, building owners can achieve significant energy and cost savings.

Singapore's Green Mark Certification programme is a benchmarking scheme for energy efficient buildings. It recognises efforts to reduce energy consumption, water and resource usage as well as the potential environmental impact of the building. Furthermore, the benefits of the Green Mark Certification include improved indoor environmental quality. The city-state has set itself the goal to have 80% of its buildings certified green by 2030.

To give an additional incentive for owners to reduce the energy consumption of their buildings, the government is publishing the details on energy consumption of commercial buildings. Currently, the data is given voluntarily but the Building and Construction Authority (BCA) is planning on making it mandatory in the coming years.

Energy efficiency can not only be achieved by building new efficient buildings but more importantly by retrofitting existing buildings. In 2017, office and retail buildings achieved a reduction of 14% - 16% through retrofitting. For hotels, electricity savings even amounted to 23%.

Building Type	No. of Buildings	EUI Before Retrofit (kWh/m ² .yr)	EUI After Retrofit (kWh/m ² .yr)	Average Percentage Improvement	Average Payback (year)
Office Buildings	47	249	210	16%	6.1-7.6
Hotels	23	349	268	23%	4.6-5.8
Retail Buildings	26	464	399	14%	5.6-7.0
Mixed Developments	17	300	257	14%	6.2-7.8
Educational Institutions	11	216	184	15%	4.9-6.1

Table 1: Energy Use Intensity (EUI) Tracking of Retrofitted Existing Buildings in Singapore, BCA Building Energy Benchmarking Report 2017

As air conditioning accounts for approximately 60% of energy consumption in buildings, a focus lies on developing innovative technologies in this sector. Focus themes are decoupling ventilation and cooling and self-adapting distributed aircon systems.

One of the key projects in this area is the project “3for2”. It is conducted by the Singapore-ETH Centre Future Cities Laboratory and Siemens Building Technologies and consists of an office building located in the United World College South East Asia (UWCSEA) building. The “chilled ceiling” technology used allows three stories to be built at the height which is normally required for two, without any reduction in the usable height on each floor. The innovative technology is a new type of climate control concept, separating the cooling and dehumidifying process, allowing a reduction of energy consumption of up to 40%. The building is likely to become Singapore’s most energy-efficient office building in 2018.

Other technologies that are important for energy efficient buildings in Singapore are embedded intelligence in Building Management and Information Systems (BMIS) software and automated fault correction, as well as Integrated Design (ID) tools for multi-criteria optimization and predictive controls, integrated test-bedding of Building Envelope and Façade Systems (BEFS) and other systems. These focus technologies aim at monitoring and analysing energy use in real time to predict changes and anomalies and react accordingly, as well as maximising efficiency of the building.

Singapore will also host the International Green Building Conference from 5-7 September 2018 and the Building and Construction Authority (BCA) will soon publish a new roadmap with the goals and technologies required in the coming years.

About the Energy Efficiency Award Challenge

The Singaporean-German Chamber of Industry and Commerce is honoured to welcome you to the Energy Efficiency Award Challenge, organized on behalf of the German Federal Ministry of Economic Affairs and Energy. In this brochure you will be introduced to 5 German energy efficiency providers which are our finalists at this Award Challenge. With two site visits in the morning, a workshop in the afternoon and an evening reception, this unique event is the perfect opportunity to raise awareness for German innovation successfully implemented in Singapore.

The Energy Efficiency Award Challenge is part of the German Energy Solutions Initiative of the German Ministry for Economic Affairs and Energy to recognise the positive impact German solutions have on Singapore’s efforts to become more energy efficient.

Best regards,

Singaporean-German Chamber of Industry and Commerce (SGC)

Jury Members

Jury Members
Mr Yeo Kim Dek Business Development Manager, Sustainable Development Capital
Mr Tim Hill Research Director, Eco-Business
Mr Edgare Kerkwijk Managing Director, Asia Energy Transition Fund (AETF)
Dr Thomas Reindl Cluster Director, Solar Energy Systems at Solar Energy Research Institute of Singapore (SERIS)
Prof Dr Dipti Srinivasan Director Centre for Green Energy Management, National University of Singapore
Ms May Siu Director of Green Mark Department, Building Construction Authority (BCA)

HOESCH GmbH

Hoesch Bausysteme is the leading manufacturer in the field of Roof and Wall Cladding Systems (building envelope) and Floor Systems. The company started the production in Germany in the 1960s and in 1965 the company developed the first continuous production line of sandwich panels in the world. Hoesch Bausysteme manufactures and supplies metal sandwich systems and floor systems from Germany to the world.

Since March 2015, to expand their customer base and most importantly to seek wider product acceptance in the S.E.A region, Hoesch Bausysteme set up a headquarter in Singapore located in German Centre to better serve this region.

HOESCH ISODACH INTEGRAL (roof)

- Excellent thermal insulation due to the PIR-foam core
- Simple installation due to the optimised joint design leading to higher productivity and low project costs
- The outer shell is a trapezoidal shape and the inner shell is lined
- Good load-bearing capacity due to the 3-ribbed upper shell
- The duplex joint system prevents the ingress of water from the upper surface (external seal) and the internal seal to complete the vapour barrier
- Fire performance B-s2 do in accordance with EN 13501-1
- Length: up to 24 m
- Available in panel thicknesses: 95 mm, 115 m, 135 mm, and 155 mm
- U-values in accordance with EN 14509 from 0.34 to 0.17 W/m²K

HOESCH ISOWAND INTEGRAL (façade)

- Concealed fastening with integrated clips
- Special elements for corners and parapet connections available
- Fire performance up to B-s1,do in accordance with EN 13501-1
- Length: up to 20 m
- Available in panel thicknesses: 60 mm, 80 mm, 100 mm, 120 mm, and 140 mm
- U-values in accordance with EN 14509 from 0.28 to 0.16 W/m² K

Successfully installed at Sandvik South East Asia



In 2006, Sandvik South East Asia Pte Ltd installed the Hoesch Isodach Integral® (roof) and the Hoesch Isowand Integral® (façade) for their new Airport Logistics Park in Changi, Singapore.

The premise serves as Sandvik's regional head office in South East Asia as well as logistics operations, namely Sandvik's tooling distribution and Asia Pacific distribution for Sandvik Mining and Construction service parts.

The state-of-the-art building is designed to meet the company's corporate responsibility towards a sustainable environment. One of the building's green features is the incorporation of a high level thermal insulation to substantially and efficiently reduce the energy required to cool the building. Faithful+Gould was the consultant for the project.

Year of Construction or Renovation: 2006

Achieved Energy Savings: The following overview shows a cost comparison of air-conditioned warehouses in Singapore.

Energy Cost	
Normal air-conditioned warehouse in Singapore	Sandvik Warehouse
SGD 0,45/sq ft	SGD 0.20/sq ft
SGD 4.84/m ²	SGD 2.15/m ²
SGD 94,453.31/month	SGD 41,979.25/month
Savings: SGD 52,474.06/month	

Klueber Lubrication

Klueber Lubrication's business offers their customers expert tribological solutions by supplying tailor-made specialty lubricants directly to customers in almost all branches of industry and regional markets. Their customers include producers of components, modules, machines and systems as well as companies using this equipment for their own production or processing activities.

Klueber Lubrication offers approximately 2000 different specialty lubricants, many of them developed and manufactured to specific customer requirements. With competent and customer-oriented consulting and wide-ranging services, their employees have established Klueber Lubrication's excellent reputation as a partner to industry and trade.

Klueber Lubrication was founded by Theodor Klueber in Munich in 1929 and to this day their headquarters is located there. Their 2,110 employees, however, work for their customers in more than 30 countries. More than 1,000 of them are sales specialists, working in close contact with customers to develop ideas for new, even more efficient and eco-friendly specialty lubricants.

Klueber Maintain

Klueber Maintain Service	Offer
Plant lubrication chart	Generation of a plant lubrication chart for all lubrication points based on documents provided by OEMs
Asset register and Standard Operating Procedures Production	Creation of a straightforward overview of lubrication tasks and lube point numbers
Compliance and labelling	Inspection for compliance with legal requirements; consistent labelling of all lubrication points
Management of lubrication tasks	Providing the data required for integration of plant lubrication chart in your IT system
Training (maintenance staff and operators)	Detailed training for machine maintenance and customised e-learning for operators

Successfully installed at Nestle Plant Singapore



In Singapore, Klueber Lubrication have carried out phase one of the project with Klueber Maintain which involved the plant lube chart creation. Through a site survey, lubrication points were identified and lubrication streamlining takes place. Through the information consolidated from different sites globally, for the same machine element/component, Klueber Lubrication recommends the correct amount and type of lubricants to be used to extend both the relubrication cycle as well as reduce labour hours required.

The result from phase one of the project aims to extend lifetime of the equipment, extend lubrication intervals and also ensure that the components are running efficiently (energy

efficiency) while reducing unscheduled downtime. For components that are identified as areas where energy saving can be further enhanced, Klueber Lubrication's energy study will be evaluated by their trained specialist and if the parameters are favorable for further saving with the help of specialty lubricants, on-site measurements will be taken and data will be consolidated and presented to their customer.

Klueber's Lubrication's products are being used throughout the Nestle Singapore plant especially in the food processing areas. Equipment such as blenders, mixer, conveyors & packers generally consist of bearings, gearboxes and hydraulics in which Klueber Lubricants are applied. Besides the production equipment, Klueber Lubricants production also brings down the energy usage of air compressors, refrigeration compressors and cooling towers.

Year of Construction or Renovation: 2017

Achieved Energy Savings: With the Klueber Efficiency Support there are 3% Energy Savings, 2% Labor savings, 1% Spares Savings; reduction of water consumption, reduced energy consumption and thus less energy costs and operating costs.

OBO BETTERMANN

Things could not be shaken until 1952: If an anchor was to be placed, a hole had to be drilled in the right place. No one questioned this. Only an OBO engineer was dissatisfied. So, OBO developed a metallic anchor, the special construction of which permitted it to be knocked directly into the wall.

From this moment on, the OBO pioneering spirit had a name: OBO – ohne Bohren (without drilling). This mounting advantage simplified the work of the craftsmen of the time significantly.

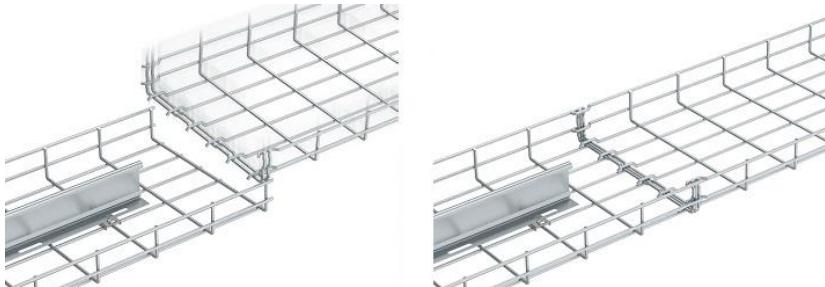
Snap-on connection Magic Cable Tray

What technology can be used to mount permanent and secure connections as efficiently as possible? OBO can provide the answer with its comprehensive Magic range. Thanks to the clever, practically tested connection technology, all the key system components, such as trays and fittings, can be snapped on.



Mesh Cable Tray System

For a purely straight connection, neither connection components nor installation tools are required. Just **connect the two parts** and you are done. This means that you do not need to store connection parts and thus save costs. The new GR-Magic® mesh cable tray really speeds up installation and manages this with no loss of stability and load-bearing capacity. Load tests show that GR-Magic® systems can fully match up to traditional screw connections. The electrical properties are also first class: The mechanical and electrical values required by the VDE guideline 0639 and in the new **IEC/EN 61537** are achieved easily. The GR-Magic® system can also be fastened on the bracket **without screws**



Successfully installed at German European School of Singapore

Conventional cable tray system uses bolts and nuts for the connection between each cable tray and is a very labour intensive installation activity. OBO's MAGIC cable tray system, from the trays to the fittings, is the world's first system in which all the major components are equipped with the innovative MAGIC Snap-On connector. The spring elements are permanently attached to the components so you do not lose them. Simply put them together, snap in place – and you are done. Coupled with better structural strength and mounting possibilities, lesser mounting supports are needed thus further reducing the installation time and labor resources needed.

Year of Construction or Renovation: 2017-2018

Achieved Energy Savings: On average, an overall savings of 35-40% on installation time is achieved.

	Magic Cable Tray	Conventional Cable Tray	
Production	2,600 tons less of CO ₂ are emitted than in standard methods		
Energy consumption during the Installation of the cable trays at German European School of Singapore	96,146.4 kwh	961,464.0 kwh	Energy savings due to reduced usage of drilling machines
Usage			No energy loss due to damaged cables

Schaetz Design & Construction

Schaetz Design & Construction GmbH is a German Design and Engineering Company whose main focus is the aviation industry. As the leading global specialist for rotating aircraft systems, Schätz has been recognized for innovative, efficient and award-winning design solutions. The company provides customised carousel parking decks, hangars and full design services for future airport facilities and aviation business parks. Schätz owns the patent for the unique aircraft storage device.

Successfully installed at MAJ General Aviation Center at Seletar Airport Singapore



Schätz Vertical is the world's first rotating aircraft parking system measuring 22m in diameter and allows easy and safe handling of up to 14 aircraft on only 445 m² of land. The patented storage device saves land investment costs by 40% in addition to reducing delays, damages and high costs of manpower and operation while jockeying the aircraft.

It is the perfect solution for hangars susceptible to floods, located in extreme climates or any airports with limited or expensive land. Aircrafts are parked in a circular arrangement on a rotating disc to optimize space and operations. A hydraulic scissor-lift moves the aircraft five meters vertically between the two floors. In a conventional hangar it takes four men working for two hours to retrieve an aircraft. However, with the carousel system one worker can retrieve an aircraft from the lower deck in less than two minutes and from the upper deck in under seven minutes, which decreases manhours spent on parking and retrieval of an aircraft by 95%. As the system permits safe handling of the plane there are lower insurance and accident rates. For more information visit www.schaetz.biz.

Year of Construction or Renovation: 2012

Achieved Energy Savings: Pre-fabricated parts allow energy savings due to shorter installation times; the gross floor area is reduced by 70% so less energy for cooling is required. Possibility to integrate PV cells on the roof and façade of the project, also reduced costs in daily operation due to 300% decrease in plane parking time.

The design has returned significant space savings, reducing hangar plot area from 1,164 square meters to 490 square meters (with the carousel parking system itself taking up just 445 square meters), a 70 percent reduction in gross floor area. Hence, less energy for cooling is required. While the MAJ General Aviation Centre carousel is set in natural ventilation, in cases where the compact system is installed in mechanically heated or cooled spaces, there can be energy savings from the reduced space requirements. In addition, due to 300% decrease in plane parking time, there are reduced costs in the daily operation.

Compared to conventional hangar parking facilities, the filigree concrete structure reduces the amount of construction material used by 60 percent. Most parts were pre-constructed in the

factory while the concrete framework was cast in situ. Pre-fabrication coupled with the precision in engineering enabled the onsite installation to complete in just over 12 days – shorter than the usual seven days required for each level – with consequent energy savings.

With the Seletar General Aviation Centre carousel system as a model, Schätz Design & Construction is now working on a new design to fully automate the lifting and rotating system in order to serve a carousel disc of up to 56 meters in diameter and on three levels. The intention is to mix Category A, Category B and Category C aircraft up to 25 tonnes in takeoff weight and with a wingspan up to 28 meters. Besides the optimization of land usage, the fully automated functionality and operations of the parking facilities will give space to integrate about 1,300 square meters of polycrystalline silicon PV cells on the metal roof and louvre façade systems, with an estimated peak power of 182 kWp and energy output of 210,000 kwh/year.

SICC

SICC Coatings is a leading developer of paints and construction products that provide characteristics beyond the decorative aspect and which contribute immensely to the well-being and health of people. Far ahead of the trend to energy saving, years ago SICC Coatings already produced and provided coatings that are applied like any ordinary coat but clearly reduce energy consumption for heating and cooling buildings.

The products of SICC Coatings send clear messages even for removal of moss and algae on facades, solving interior and exterior problems with humidity, mildew-renovation and special hygienic demands of allergic persons. Next to the human wish for comfort through a well-balanced indoor climate, energy savings and environmental protection are main priorities.

SICC CLIMATE ACTIVE PAINT THERMO ACTIVE ROOF COATING



New roofing is usually up to 60% more expensive. The desire of many property owners to have a roof that looks as new and which remains sealed with a professional roof coating for many years is fulfilled with ClimateActivePaint ThermoActive.

High quality raw materials give the ClimateActivePaint coating a high elasticity in the temperature range from -40°C to +150°C. The excellent flexible ThermoActive allows an easy bridging of material transitions. Sunlight reflection, deflection of the heat radiation and evaporation enthalpy work together as a free "air conditioning". In such way a clear drop in room temperatures is possible in the summer months. Cool roofs enable energy saving and environmental care within an urban area to clients, architects, engineers, energy consultants and policy makers.

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The cooling ClimateActivePaint ThermoActive roof coating can be used on many types of roofs, such as dwellings, industry buildings, office buildings, hospitals, etc.

Successfully installed at Caterpillar Asia

Previously, Caterpillar was facing problems with a hot environment inside the warehouse due to the warm weather and consequently there was the need to use energy to reduce the warm temperature inside the warehouse. To reflect heat, sunlight and UV for reducing energy consumption, Caterpillar applied THERMO ACTIVE ROOF Coating on their warehouse's metal roof.

Year of Construction or Renovation: 2017

Achieved Energy Savings:

Before coating roof surface temperature: 63.50 degree Celsius. After coating roof surface temperature: 40.00 degree.

BEFORE:**AFTER:**

A test report of TÜV Süd PSB SINGAPORE shows that the solar reflectance of emittance of Thermo Active (Roof Coating) was about 87.7% and 0.89, respectively, with the Solar Reflectance Index in the range of 110.5-110.26. In addition, the thermal conductivity and resistance of the Thermo Active (Roof Coating) was around 0.16 W/mK and 9.99E-3m²K/W, respectively.

About the German Energy Solutions Initiative

With energy prices on the rise and fossil fuel resources becoming scarce, both economic prosperity and competitiveness increasingly depend on our ability to use new energy sources and energy efficiency solutions. This applies to all countries worldwide. The use of innovative energy solutions offers enormous potential for energy conservation in all fields.



The promotion of smart and sustainable energy solutions in Germany has resulted in the establishment of an industry which offers some of the world's leading technologies. This industry encompasses several thousand small and medium-sized enterprises specialised in the development, design and production of renewable energy systems, energy efficiency solutions, smart grids and storage technologies. Also, new energy technologies like power-to-gas and fuel cells are the basis for cutting-edge energy solutions.

The transfer of energy expertise, the promotion of foreign trade and the facilitation of international development cooperation are part of the German Energy Solutions Initiative. We offer:

- networking and business opportunities both in your country and in Germany
- showcasing of reference projects
- capacity building.

Coordinated and financed by the German Federal Ministry for Economic Affairs and Energy (BMWi), the initiative is implemented in cooperation with partners such as the German bilateral chambers of commerce (the AHKs), the German Energy Agency (dena) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

For more information, please visit www.german-energy-solutions.de/en.

About the Singaporean-German Chamber of Industry and Commerce (SGC)

The Singaporean-German Chamber of Industry and Commerce (SGC) is part of a network of 140 offices of the German bilateral Chambers of Industry and Commerce abroad in 92 countries. The Chamber is

one of the largest national business chambers in Singapore with a membership of around 550 representatives from a variety of industries from Germany and Singapore. The SGC is a valuable and well-established networking platform and well connected with authorities in Singapore and Germany. Through its active industry committees, the SGC gives a voice to businesses.

With its distinct service unit and trade fairs arms - DEinternational and Fairs & More respectively - the SGC builds a primary source for receiving reliable information on the German and Singapore business environment as well as bilateral trade relations. DEinternational serves clients in their business needs e.g. searching for business partners, organizing business missions and business trips, finding staff members and providing market analysis. DEinternational has worked in many areas such as energy efficiency, education, Industrie 4.0, finance, research, mobility, start-ups and many more.



Singaporean-German Chamber
of Industry and Commerce
Deutsch-Singapurische
Industrie- und Handelskammer

