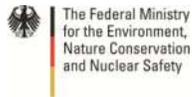


Program for Energy Efficiency in Kho Khao and Khao Lak

CASE STUDIES



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“Climate change is
the defining
challenge of our
age.”

*Ban Ki-moon, UN Climate Change Conference 2007, Bali,
Indonesia*

PEEK Project Description

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Objective

The overall aim of the “**Program for Energy Efficiency in Kho Khao and Khao Lak (PEEK)**” is to significantly reduce green house gas emissions from the hotel industry in Kho Khao and Khao Lak by means of innovative and replicable solutions for energy efficiency and renewable energy. PEEK is part of further efforts of UNWTO along with the Ministry of Tourism and Sports (MoTS) to create a model destination for sustainable tourism in Kho Khao and Khao Lak.

PEEK is a joint project of MoTS, Thailand and UNWTO. Through this project, UNWTO along with MoTS endeavor to mitigate the impact of climate change caused by the tourism sector.

PEEK is financed by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety under the International Climate Protection Initiative. The initiative supports climate protection projects worldwide in developing, newly

industrializing & transition countries in order to contribute to emission reductions and adaptation to climate change.

The core work streams of the project are:

- Stakeholder engagement and information dissemination,
- Energy efficiency measures,
- Renewable energy technologies,
- Feasibility study for decentralized energy supply of the island.

Through this project, efforts are also being made to create greater acceptance for sustainability and climate protection strategies, both, in the tourism sector and among the local population. The main target groups for PEEK are:

- Resorts and local municipalities in Kho Khao and Khao Lak,
- Local hotel and tourism associations,
- Eco-tourism organizations as well as the concerned state authorities.



Activities

- Collection of relevant environmental data of the island and the hotel resorts (including a projection of future development) as the basis for further planning measures was carried out initially.
- Energy audits were performed at the participating hotels on Kho Khao and individual energy-saving recommendations for these establishments relating to the potential for better organisation, lighting, air conditioning, ventilation, refrigeration plants etc. were made.
- The results of the audit reports were presented to the decision makers of the hotels. Upon the recommendations included in the audit reports, the hotels chose their preferred options based on their qualitative and economic benefits. The chosen energy efficiency measures were then tendered for in the Thai market and the technology and grant contracts were then signed.

- The construction process of the new technologies took mainly place in the off-season, so as to ensure no disturbance to the hotel guests.
- The installed technologies were handed over to the hotels after their staff was trained in operations and maintenance of the installed technologies.
- The project was initiated in Kho Khao but due to its success more interest was generated in the area. The program was then geographically extended to the Khao Lak on the main land.
- A self-audit process was developed for the hotels in Khao Lak. Verification of the data was achieved through walk-through audits by experts. The tender and construction process for installation of technologies followed.
- A regular monitoring of the data is being carried out in order to estimate reduction in CO₂ emissions achieved after installation of relevant technologies.



Outcomes & Lessons Learned

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Outcomes

- Great interest was generated along the wider Andaman coast region and there is a potential to replicate the PEEK project in others areas.
- Decision-makers in the tourism industry, local government authorities, private resort managements and the local population were acquainted with the possibilities for energy saving and the benefits of renewable energies which will motivate them to factor these aspects into their planning.
- The PEEK project will motivate the hotel owners to be more inclined to carry out their own feasibility studies and to implement energy efficiency measures on their own.
- The final energy savings and the reduction in CO2 emissions will contribute towards improving the national climate footprint and also stabilize the power grids in the area to a certain extent.
- The sustainability of the PEEK project will be upheld by various, trained local organisations.

Lessons Learned

- The hotel owners have to be interested in the concept and benefits of energy efficiency/renewable technologies for reducing the energy consumption and CO2 emissions for a project like PEEK to be successful.
- Awareness of the hotel management of the benefits of installation of energy efficient/renewable energy technologies in hotels, generally, correlates with the extent of tourism development in the area.
- The conventional form of electricity in Thailand is subsidized which makes it difficult for energy efficiency and renewable energy options to compete.
- A mixture of energy efficiency/renewable energy technologies are required to be implemented for optimal cost-benefit structure.
- Each hotel should be considered as one project in itself as individual needs require individual approaches.
- Not all hotels have access to relevant data on energy consumption, occupancy etc. There is sometimes reluctance, on the part of hotel management, to share their data which can cause difficulties in monitoring and analysis.
- Liquidity is an issue with the tourism industry, especially when there is an economic downturn or unexpected external disturbances which slow down the tourist influx in the region. Liquidity crunch affects the interest of the hotel management to invest and install newer technologies in their hotels.
- Psychologically, it is sometimes a very big step for the hotel management to trust in a new technology of which they are unsure of with regards to its feasibility and success. Demonstrations and pilot projects utilizing these energy efficiency/renewable technologies are very important for creating motivation and acceptance by the tourism establishments.

There were five hotels from Kho Khao and Khao Lak area which participated in the technology investment part of the PEEK project. A brief description of the participating hotels, including their pattern of energy consumption, at the onset of the PEEK project, is mentioned in the next section of this booklet. The selected energy efficiency/renewable energy technologies for each hotel and their potential for energy savings and reduction in CO₂ emissions are also briefly described.

Kho Khao:

Kho Khao Island Beach Resort

Technologies selected: Heat recovery & heat pump system and roof insulation

C&N Kho Khao Beach Resort

Technologies selected: Mini hybrid power system and heat recovery system

Khao Lak:

Mohin Tara Resort

Technologies selected: Key tag separation protection and pool pumps

Suwan Palm Resort

Technologies selected: Key tag separation protection and pool pumps

Khaolak Seaview Resort

Technologies selected: Heat pump system

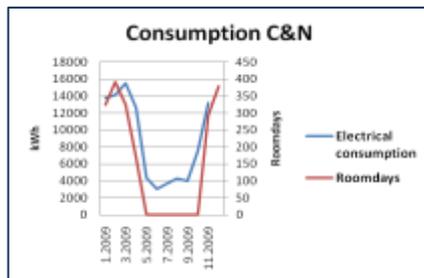
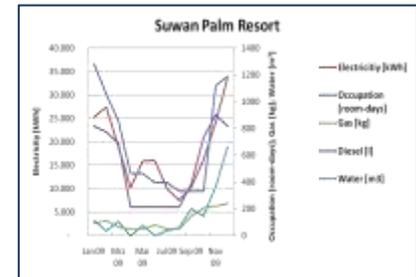
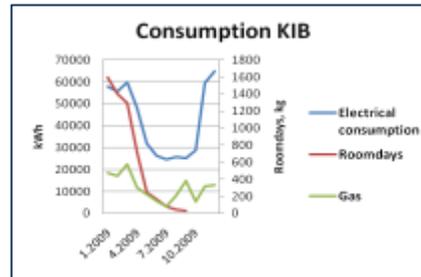
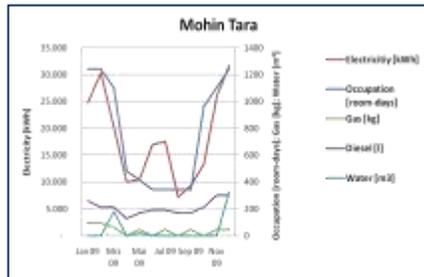


Overview Facts & Figures

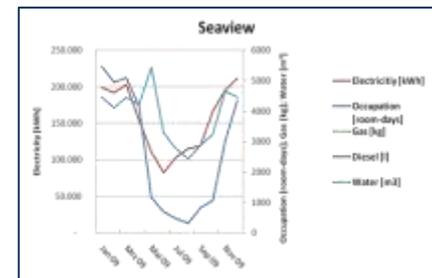
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PEEK financed investments	Anticipated organisational measures (Hotels with investment)	Anticipated organisational measures (Hotels without investment)
Total annual energy savings: ~200,020 kWh/year Total annual CO2 reduction: ~101 CO2 tons/year	Total annual energy savings: ~176,017 kWh/year Total annual CO2 reduction: ~88 CO2 tons/year	Total annual energy savings: ~84,008 kWh/year Total annual CO2 reduction: ~42 CO2 tons/year

For comparison, this is equivalent to not having used 55 average passenger cars with 15,000 km of distance driven or approximately 38 metric tons of oil not consumed.



Specific hotel consumption graphs



Technologies Used

Heat pump: A heat pump water heater (HPWH) operates on an electrically driven vapor-compression cycle and pumps energy from the air in its surroundings to water in a storage tank, thus, raising the temperature of the water. The advantage of these systems is that the transfer needs less energy than the production of heat. So a heat pump can transfer 1 kWh of electricity into 4 kWh of heating energy.

Air conditioning (A/Cs): Air conditioning is the largest energy consuming factor in the hotels. Generally, three technology options were identified: (1) Additional sleep mode for A/Cs: Sleep mode automatically controls the room temperature at a comfort level and saves energy during the sleeping time of customers; (2) replacing the old A/Cs with new, more efficient A/Cs; (3) heat recovery: the waste heat discharged from the refrigerant cycle of the air conditioner can be transferred to the water in the water heater - in effect, it turns hot air that would otherwise be wasted by the air conditioner into free hot water.

Pool pump: It is used to re-circulate the water through the filters and again back to the pool. Changing to variable-speed pumps reduces power consumption by delivering the actual power that is needed at every moment, therefore reducing power demand by up to 70%.

Insulation: Insulating decreases the heat flow from the environment to the guestroom and therefore, the air condition operating hours will decrease. All pipes, fittings and tanks with a flow at a temperature level other than the environment should be insulated, too. The highest losses can typically be observed at hot water storage tanks, hot water pipes and air condition fittings. Insulation yields a high return on investment in terms of energy savings.

Wind-solar hybrid power system: Hybrid systems (e.g. wind and PV), mostly used in off-grid applications, offer several advantages over a single generation system. Since the operating times of sun and wind normally occur at different times of day and year, these systems are more likely to yield energy when you need it. Capacities vary between a few Watts to several kW.

Key tag separation protection: Most keys are supplied with key tags. These key tags have to be inserted into a card holder in order to turn the air condition and lighting on in a room. When the guests leave the room and take out the key tag, the air conditioning automatically turns off. The separation protection keeps guests from taking the cards off the key ring and leaving it in the card holder whilst being outside the room.



Additional Organisational or Low-Cost Measures

Lighting:

As most hotels already use efficient lamps, the following is also needed: Firstly, lighting intensity should not be higher than necessary. Secondly, lights should be turned off when they are not needed (e.g. switch off landscape lights after 1 a.m.). An additional 20 % of the lighting costs could be reduced with these simple measures.

Kitchen refrigerators:

Provide refrigerator space at different temperature levels for different types of food and train personnel on how to store the food correctly.

Provide thin blankets:

Many visitors prefer to sleep without air-conditioning and will turn the system off or to low frequency, if they have the chance to do so. With thick comforters (quilts), the guests are forced to have the air conditioning running. To improve the comfort without air-conditioning, the beds should be covered with thin blankets by default and extra comforters should be offered additionally, e.g. stored in the closets.

Inform the guests:

Provide information on how to use the A/Cs. This information should lie in the rooms and contain:

- How to use the A/Cs
- What temperature they should adjust the A/C to
- How they can raise the temperature at night
- If there is a timer, how they should use it



Hotel Description

The Kho Khao Island Beach Resort and Spa (KIB) is a well-equipped 4 star holiday resort, with 75 rooms/villas in different categories.

- 24 rooms in 3-storey building
- 20 rooms in 2-storey building
- 31 rooms in villas

Occupancy:

- 40 % November, March, April
- 80% December, January, February

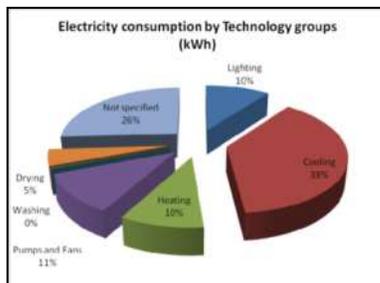
The resort uses electricity for most its energy needs. Besides that, gas is used for cooking and diesel oil for the emergency generator.

Energy consumption

The KIB hotel has an annual electricity consumption between 325,000 and 415,000 kWh. At the onset of the project, KIB was using a lot of conventional lighting systems such as the conventional incandescent and halogen light bulbs.

The main energy consumer was the A/C, responsible for more than 60% of the electricity consumption in the guest rooms and over one third of the elec. consumption of the whole resort.

The second largest energy consumer were the electrical water heaters, responsible for about 20 % of the electrical consumption in the rooms (9% of the whole resort).



CO2 and Electrical Savings

Considering previous consumption and potential for energy conservation, for the KIB hotel, insulation of the bungalows and a heat pump & heat recovery system for water heating were chosen as preferred options.

Installation of 4 A/C heat exchangers 28,000 British Thermal Unit (BTU)/hour combined with 1 heat pump 12kW as back up attached to a 5,000 litre storage tank was done.

If the A/Cs run 6 hours per day/night they can produce 4,855 litres of 60 °C hot water. Both installed energy measures have the potential to save 140,000 THB per year (3,500 EUR).

Energy saving measures	Annual kWh savings	CO2 reduction (ton/year)	Annual cost savings (Thai Baht)
Insulation	15,908	8.04	57,268
heat Pump and heat recovery System	23,088	11.67	83,117
No/low cost measures	21,089	10.67	75,956
Total	60,085	30.4	216,341

C&N Kho Khao Beach Resort



Hotel Description

The C&N Kho Khao Beach Resort is a small family-owned resort. It features 14 bungalow apartments located in seven twin-buildings, a pool and an open lobby and restaurant area with a small kitchen. Additionally, there is a small open bar on the beach.

The resort uses electricity from the grid for most of its energy needs. There is no emergency generator. Gas is only used for cooking.

An important difference between the C&N Kho Khao Beach and the other hotels on the island is that they already use a heat recovery air conditioning condenser which produces hot water for showering. By these means, the C&N saves about 10% of potential energy costs already.

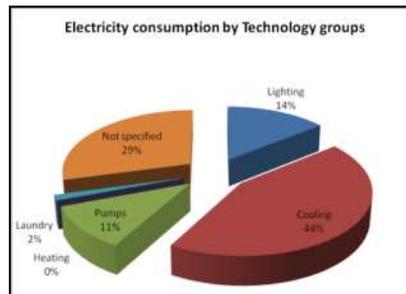
Energy Consumption

C&N had an annual electricity consumption of 108,000 kWh.

The largest share of the electricity was used in the bungalows. The pool, landscape lighting and the restaurant together with the kitchen were each responsible for about 10 percent of the electricity use.

A/C was responsible for the largest share of the energy use.

Half of the lighting costs were caused by large and small halogen and regular incandescent lamps.



CO2 and Electrical Savings

4 new Bungalows were constructed with new heat recovery systems from A/C for hot water heating.

In addition, a PV wind hybrid system was installed on top of the restaurant building consisting of:

-3 solar modules of 173 Watt Peak (Wp)

-1 Southwest air breeze wind turbine 200 Wp

Though the installation of technologies will contribute only a little in terms of electrical and CO2 reduction, but will make a visible example for others for such a hybrid system.

Energy saving measures	Annual kWh saving	CO2 Reduction (ton/year)	Annual cost saving (Baht)
Wind + PV System	880	0.45	3,168
heat recovery	2,373	1.2	8,542
No/low cost measures	7,415	3.75	26,694
Total	10,668	5.35	38,404

Suwan Palm Resort

Hotel Description

The Suwan Palm Resort offers 44 guest rooms spread across 3 main buildings. The hotel was built in 2004 and is rated as 3 ½ stars-category. It provides a variety of additional facilities such as a swimming pool, pub and restaurant.

Occupancy:

The hotel is open during the whole year with high occupation in high season during November-March (95%) and low occupation (25%) in off season during April-October. Relatively, occupancy during low season is still rather high.

The resort uses electricity from the grid for most of its energy needs. Gas is also used.

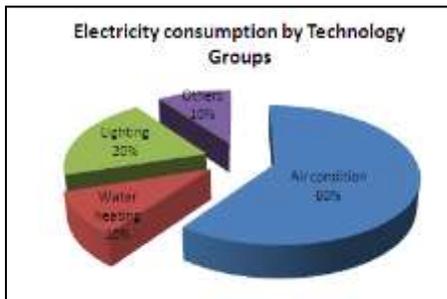
Energy consumption

Suwan Palm had an annual electricity consumption of around 242,000 kWh.

Air conditioning was estimated to be responsible for 60 % of the electricity consumption.

Electrical boilers supply hot water in the hotel. Water heating accounted for 10 % of the electricity consumption.

Lighting was responsible for about 20 % (est.) of the electrical consumption.



CO2 and Electrical Savings

Use of a key separation and protection tag is one of the cheapest and easiest measures to save a lot of unnecessary energy consumption from A/Cs.

After installation, this measure is expected to save 34,000 Baht (850 EUR) of annual cost, and has a payback period of 6 months.

In addition efficient pool pumps were also supplied in the form of 3 Hurlcon Variable Pumps P300.

The variable speed pump is expected to reduce 50-70% of energy consumption compared to the old pumps.

Energy saving measures	Annual kWh saving	CO2 Reduction (ton/year)	Annual cost saving (Thai Baht)
Key separation tag	9,534	4.82	33,931
Pool Pumps	8,424	4.21	29,484
Low cost measures	16,042	8.2	57,751
Total	34,000	17.2	121,166

Mohin Tara Resort

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Hotel Description

The Khaolak Mohin Tara hotel offers 46 guest rooms spread across of two main buildings; in addition, there is a seminar building. The hotel was built in 2005 and is rated as 3 star-category. It provides a variety of additional facilities, such as swimming pool, diving pool, cocktail bar and a restaurant.

Occupancy:

The hotel is open during the whole year with high occupation in high season November-March (86%) and low occupation (33%) in off season April-October. Relatively, as compared to other hotels in the vicinity, occupancy during low season is still pretty high.

The resort uses electricity from the grid for most of its energy needs. There is an emergency diesel generator for power shortages. Gas is also used sometimes.

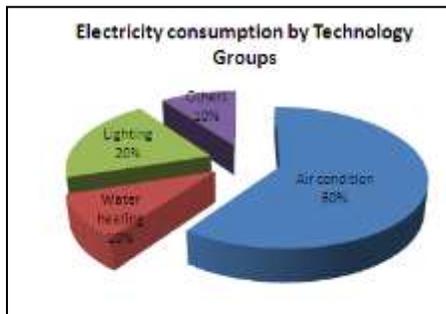
Energy consumption

Mohin Tara belongs to the same owners as Suwan Palm. It had an annual electricity consumption of around 218,000 kWh.

Air conditioning was estimated to be responsible for 60 % of the electricity consumption

Electrical boilers supply the hot water in the hotel. Water heating accounted for 10 % of the electricity consumption.

Lighting was responsible for about 20 % (est.) of the electrical consumption



CO2 and Electrical Savings

A key chain separation protection tag was installed.

This measure will help save about 42,600 Baht (1,050 EUR) of annual cost, and has a payback period of 4 months.

The pool pumps were changed with 4 Hurlcon Variable Pumps P300.

The variable speed pump is expected to reduce the energy consumption by 50-70% compared to the old pumps.

Energy saving measures	Annual kWh saving	CO2 Reduction (ton/year)	Annual cost saving (Thai Baht)
Key separation tag	12,160	6.15	42,628
Pool Pumps	8,424	4.21	29,484
Low cost measures	14,496	7.4	52,185
Total	35,080	17.74	124,297

Khaolak Seaview Resort

Hotel Description

The Khaolak Seaview hotel offers 197 guest rooms. The hotel was built in 2004 and is rated with 4 stars. It provides a variety of additional facilities including swimming pool, cocktail bar and a couple of restaurants. The hotel is open during the whole year.

Occupancy:

- 21 % April-October
- 78% November-March

The resort uses electricity from the grid for most of its energy needs. There is an emergency diesel generator for power shortages.

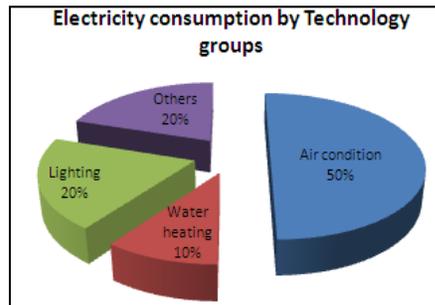
Energy consumption

Khaolak Seaview had an annual electricity consumption of around 1,850,000 kWh. It was the biggest consumer of energy as compared to other 6 hotels mentioned .

Air-conditioning was estimated to be responsible for 50 % of the electricity consumption.

Electrical boilers supply hot water in the hotel. Water heating causes an estimated 10 % of the electricity consumption.

Lighting was responsible for about 20 % (est.) of the electrical consumption.



CO2 and Electrical Savings

A heat pump system was installed which consisted of 7 heat pumps with 13 kW heat capacity 34,000 British Thermal Unit (BTU)/hour.

This system was able to produce 330 litres/h of warm water (60°C) average during 9.1 hours of runtime operations.

Annual electricity saving costs were estimated to be about 10,500 EUR with a payback period of 4 years.

The system installed at Khaolak Seaview resort will have the biggest impact regarding CO2 reduction as compared to all the other hotels mentioned.

Energy saving measures	Annual kWh saving	CO2 Reduction (ton/year)	Annual cost saving (Baht)
Replacing existing water heater with heat pumps	119,229	60.29	424,066
No low cost measures	115,071	58.20	414,256
Total	234,300	118.49	838,320

Additional Information

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Project Website

Additional information on the PEEK project is available at the project website at:

http://www.unwto.de/index.php?option=com_content&view=article&id=80&Itemid=83

Energy Efficiency Handbooks

Energy Efficiency Handbooks for Thai hotels have been produced in both, Thai and English. They can be downloaded at:

<http://www.unwto.de/images/pdf/handbook.pdf>

Project Information Flyer

An information leaflet on the project can be downloaded at:

<http://www.unwto.de/images/pdf/peekflyer.pdf>

The screenshot shows the UNWTO website page for the PEEK project. The header includes the UNWTO logo and the text 'WORLD TOURISM ORGANIZATION' and 'Sustainable Tourism for the Millennium Development Goals'. The main content area is titled 'PEEK - Program for Energy Efficiency in Koh Khai Hotels'. It features a 'PEEK Overview' section with text about Thailand's energy needs and the project's goals. There are also navigation links for 'Home', 'About Us', 'Contact Us', and 'Publications'. A sidebar on the left contains a 'Main menu' with links to 'Home', 'The UNWTO', 'Consulting Unit', 'Sustainable Tourism', 'Projects', 'Program for Energy Efficiency (PEEK)', 'Upcoming Events', 'Publications & Downloads', 'Contact', 'Links', and 'Information'. A map of Thailand is visible in the bottom right corner of the page.

The cover of the 'Energy Efficiency in Thai Hotels' handbook features the title in large green and blue letters. Below the title is a collage of four images: solar panels, a traditional Thai temple at sunset, a compact fluorescent light bulb, and a modern building facade. The text 'A Practical Guide' is at the bottom. The PEEK logo and tagline 'A sustainable concept.' are in the top right corner. At the bottom, there are logos for the UNWTO, the Ministry of Tourism and Sports, and the Thailand Institute of Certified Energy Conservation (TIEC).

The flyer cover has a white background with a green footer. The title 'Program for Energy Efficiency in Koh Khai (PEEK)' is at the top. Below it are three small images showing greenery and a building. The PEEK logo and tagline 'A sustainable concept.' are on the right. At the bottom, there are logos for the UNWTO and the Thailand Institute of Certified Energy Conservation (TIEC).

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Project Partners



The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety is the highest environmental authority in Germany. It is financing the PEEK project as part of its International Climate Initiative.



The Thailand Ministry of Tourism and Sport (MOTS) is a Cabinet ministry of the Government of Thailand. The primary area of responsibility for the ministry are Tourism and Sports in the Kingdom of Thailand.



The World Tourism Organization (UNWTO) is a specialized agency of the United Nations and the leading international organization in the field of tourism. It serves as a global forum for tourism policy issues and a practical source of tourism know-how.

UNWTO plays a central and decisive role in promoting the development of responsible, sustainable and universally accessible tourism, paying particular attention to the interests of developing countries.



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adelphi is a leading think tank for policy analysis and strategy consulting that offers creative solutions and services on global environment and development challenges for policy, business and civil society communities. adelphi's projects contribute to sustaining natural life systems and fostering sustainable enterprises.



IIEC

IIEC is a non-governmental (NGO), not-for-profit organization with offices in Africa, Asia, Europe, Latin America, and North America. It was established in 1984, to foster the implementation of energy efficiency in developing countries and countries in transition.

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For further information about the PEEK project or queries with regards to the information in this brochure, you can contact:

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