The Library Building

OVERALL ON-SITE DESIGN

The surroundings of the library building was designed properly and contributes to energy conservation with natural utilization.

For the ventilation system, the grass has been planted surrounding the building to reduce outside temperature of the building and prevent dust. Also, trees have been planted around the lot to make oxygen and shade. For landscape architecture and landscape, the front of the building faces north with a skywalk to the administration building. On the west side of the building, there is a pond to reduce the outside temperature of the building. The building is set back from the main road about 100 meters, which blocks out external noise very well. The glass wall tilts to avoid the heat of the sun, however, there is adequate lighting around the building to make it light during the daytime.

There is a pond on the east side of the building to reduce the outside temperature of the building and support the air system that uses "WATER COOL WATER CHILLER." The wind speed is low, making the noise level suitable for reading. Air is cooled into the pool instead of using a COOLING TOWER. The pool has a spherical radius of 15 meters with a capacity of approximately 2,000 m^3.

The building was designed well with regard to the wind and open space surrounding the building to air out the place. This reduces the amount of air conditioning, contributing to large energy savings.

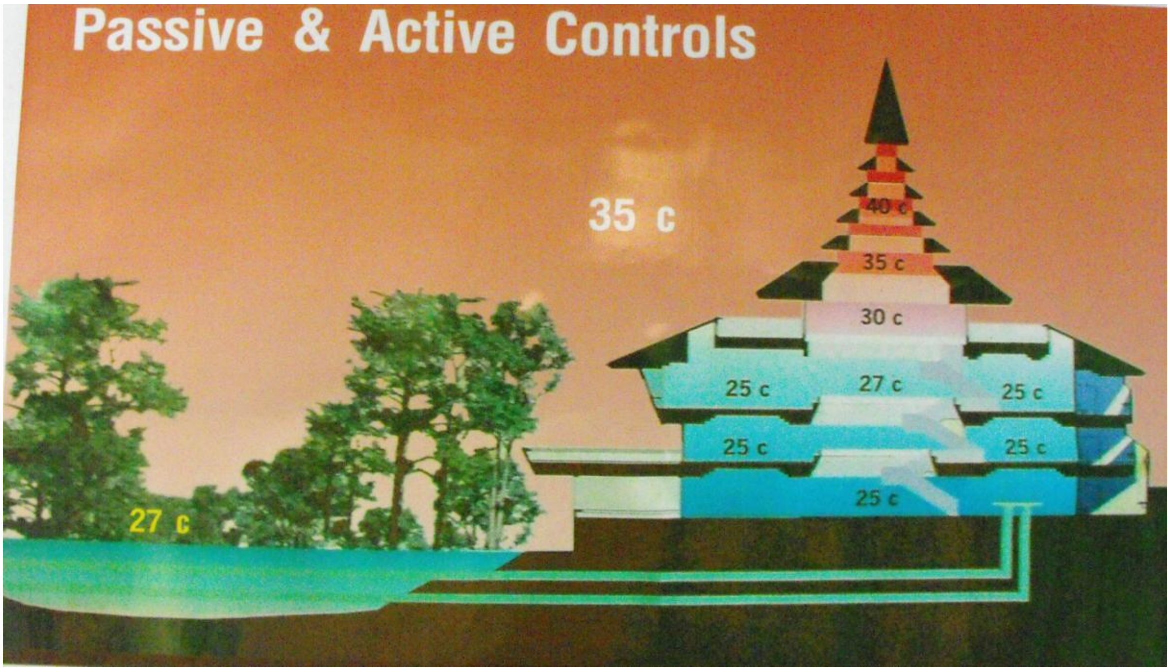
ACTIVE DESIGN

Air conditioning systems (kW/TR)

Coefficient of Performance : 1.56 kW/TR

Lighting system (W/m^2)

There is a large amount of natural light using along with the lighting system in the building, therefore, building energy consumption for lighting is only 5.5 W/m^2. Also, the designation of average luminance, when all lights are turned on, is 350 LUX without decreasing the air conditioning system's efficiency.



1. Direction and location determination and building design

Direction and location determination

The determination of direction and location mainly considers energy saving. Since the shape of library building is closed COURT and the center is SPACE. Stairs were designed to add light through the roof. Front of the building faces the north, with a skywalk to the administration building. On the east side, there is a designed pond to reduce the outside temperature of the building and support an air system that uses WATER COOL WATER CHILLER. The wind speed is low, making the noise level suitable for reading. Air is cooled into the pool instead of using a COOLING TOWER. On the west side, bathrooms of all three floors located in the same vertical position gain light and heat from the sun and also kill bacteria in the bathroom. The building is set almost 100 meters away from the main road, which can block out external noise very well. The glass wall is tilted to avoid the heat of the sun, however, there is adequate lighting around the building to make the building light during the day.

The shape of building

The shape of the library building is closed COURT. The center is SPACE. Stairs were designed to add light through the roof using advanced materials and construction processes. The building shape was designed to correspond with the environment and sun, wind and rain protection in mind. The building has a skywalk connected with the second floor of the administration building. A square shape was designed to correspond with the designed roof to gain air and light. The side of building is spherical which was designed as a ramp for the disabled. The height of the building from the ground floor to the roof is 26.80 meters. The total area is 3,811 square meters. The wall of the third floor has an 80 degree tilt angle to avoid the heat from the sun.

Location of the service area

The building’s stairs were designed in the middle of the building as an open hall to the roof. Therefore, the building has enough light during the day. There is a ramp designed for disabled persons that is positioned on the right side of the building for convenient travel. Bathrooms of all three floors are located in the same vertical position to gain light and heat from the sun and also to kill bacteria in the bathroom.

Building entrance

The second floor entrance was designed to connect the library building and the administration building. The building structure is a reinforced concrete structure. The width and length of the skywalk is 5 and 40 meters, respectively, with a gable roof covering through the skywalk. There is a road under the skywalk. For the first floor entrance, there is a two layered entrance to reduce energy consumption of air conditioning which also prevents outside sound from entering.

The use of material covering a surface area around the building

Several thousand square meters, of grass has been planted around the building exterior interspersed with garden arrangements to reduce heat outside the building and prevent dust.

The area utilization to most benefit

The shape of the library building is closed COURT. The center is SPACE high up the roof. Stairs were designed to add light through the roof. Stairs were designed to add light through the roof. Space was designed for a reading corner surrounding the buildings without having to turn on the light.

2. The design of wall (building frame)

Thermal protection

The type of frame building material of the academic services building exterior wall is an E.I.F.S. system wall covering with 4 inch thick and 1 pound/ft3 density of fire resistant foam. The property protects up to 52% of the heat from entering the building when compared with the usual construction with a thermal resistance (R value) between 4 - 5.9 per 1 inch thickness. The purpose of covering with polystyrene fire resistant foam type is protecting the heat from the sun very well. There is a heat stop glass which is two layers of reflective glass coated with a low radiation substance that allows only 5% of infrared heat to pass through the substance. Argon gas, which has a low thermal conductivity, is injected into the gap in the middle. Heat stop glass is installed using an 80 degree tilt of the wall to avoid heat from the sun. The roof is designed as a thermal protection system, with seven layers alternating with glass walls opening to gain light.

Moisture protection

Humidity of the library building was designed using natural methods comprising of planting of trees, building a pond, making springs and planting ground cover to reduce the heat entering the building. To reduce humidity, there is a hole for ventilation.

Color outside the building

Paint for the exterior and interior building is white acrylic paint which protects UV rays very well and can withstand the sun, rain, fungi and algae. The exterior remains easy to clean.

Controlling and preventing leakage

An inclined roof was designed to transfer rainwater quickly from the roof. Then rainwater flows into the drain trough surrounding the buliding. Therefore, there is no water in the building.

Efficiency of shading devices

The type of frame building material of the academic services building, exterior wall is a 4 inch thick E.I.F.S. system wall covering and 1 pound/ft^3 density of fire resistant foam. The property protects 52% of the heat from entering the building when compared with the typical construction. The thermal resistance (R value) is between 4 - 5.9 per 1 inch thickness. The purpose of covering with polystyrene fire resistant foam type is protecting the heat from the sun very well There is a heat stop glass which is two layers of reflective glass coated with a low radiation substance that allows only 5% of infrared heat to pass through the substance. Argon gas, which has a low thermal conductivity, is injected into the gap in the middle. Heat stop glass is installed using an 80 degree tilt of the wall to avoid heat from the sun. The roof is designed as a thermal protection system, with seven layers alternating with glass walls opening to gain light.

The use of natural for shade

The library building was designed with the consideration of the wind, sun, rain, and saving energy. The west side wall is an opaque wall. Bathrooms gain sunlight and heat to kill bacteria and reduce humidity. For the open hole, trees were planted along the opening to reduce heat.

The use of beside building shadow for shade

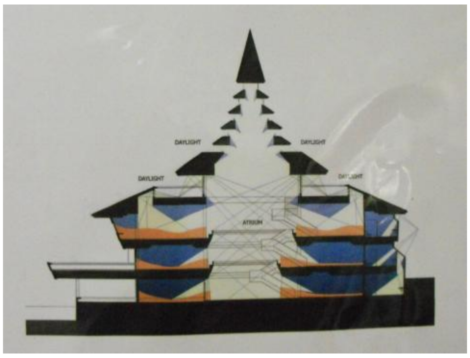
There is nothing beside the building on the east, west, and south sides. On the north, there is a connected administration building which help shade the front in the afternoon. Moreover, the building also has its own heat shield and natural utilization to reduce heat.

Loophole Design: the location and size of openings

The loophole of the building was designed using Heat stop glass with 1.20 meters of height. Heat stop glass has two layers of reflective glass that is coated with a low radiation substance that allows only 5% of infrared heat to pass through the substance. Argon gas, which has low thermal conductivity, is injected into the gap in the middle. Heat stop glass is installed at an 80 degree angle to avoid heat from the sun. The roof is designed as a thermal protection system, with seven layers alternating with glass walls opening to gain light.

3. The thermal transfer value of building

Overall Thermal Transfer Value (OTTV)	:	11.25 W/m^2
Roof Thermal Transfer Value (RTTV)	:	5.55 W/m^2



4. Lighting system (natural lighting)

Use of natural light indoors

The interior gains natural light from around the windows and roof which has seven layers alternating with glass walls opening to gain light. This does not require turning on the light during the day.

Space or areas requiring lighting of lamps and natural light

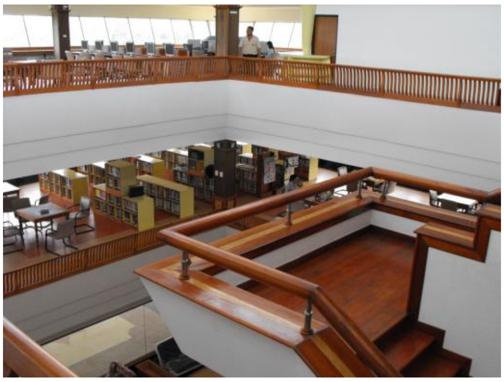
There is enough lighting indoors during the day that it is not necessary to turn on the light. Lights are only necessary during nighttime.

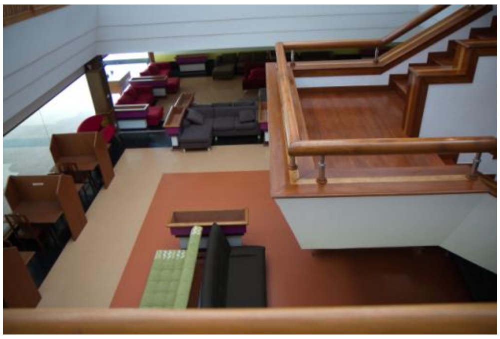
A difference of light in each area

Indoor gains lighting from around the windows and COURT, but the middle of building gains lighting from the roof.

5. Natural ventilation

The building was designed with angled openings on each floor for natural ventilation to reduce heat and humidity inside the building. The window was designed as an awning window.



MANAGEMENT AND MAINTENANCE

1. Energy management system

- Control the air conditioning system by adjusting the speed of the compressor automatically, instead of starting full range.
- Natural water system was used for condenser cooling instead of a cooling tower.

2. Maintenance and monitoring plan

The maintenance plan of the library buildingas is as follows:

1. Manpower: Manpower includes students. This amount is not constant, but not less than 1,000 people. There is a maintenance activity on the weekends at least eight times per year and 6 hours each time. The total maintenance activity is 48 hours/year.
2. Organization or responsibility: teacher, student, electrical technician division, mechanical technician division, construction technician division, architecture technician division, mechanical plant technician division, electronic technician division, welding technician division, commerce division, account division, marketing division and business computer division
3. Senior engineer responsible for energy is Mr. Bunjong Jamsri who lays down measures, coordinates with all divisions and performance reports to superiors.
4. There is maintenance training for students to participate in the maintenance of the library building by teachers who are responsible for the maintenance of the academic services building.

4.1 Air conditioning system maintenance	3 hr
4.2 Lighting system maintenance	3 hr
4.3 General building maintenance	3 hr
4.4 General environmental maintenance	3 hr

ENVIRONMENTAL IMPACTS

The overview of the environmental impact of the library building both past and present

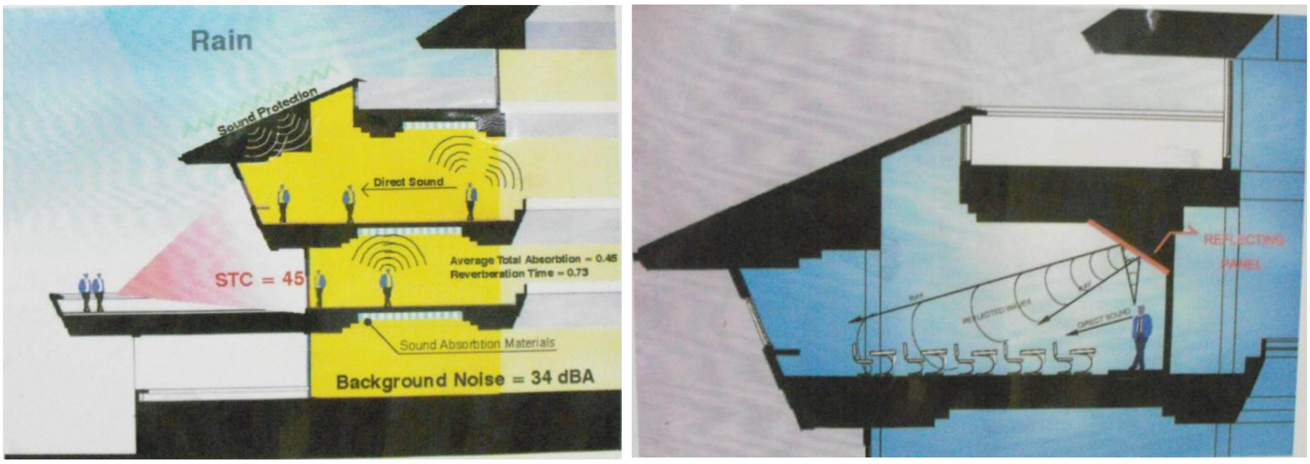
- Air pollution impacts

  Since the building is in the library, there are no air emissions.
- Noise pollution impact

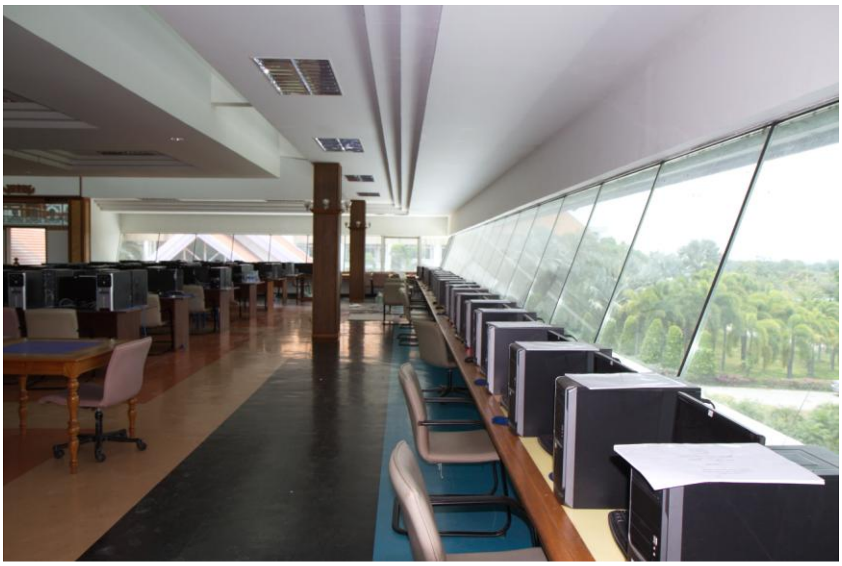
  The building was designed with an Average Total Sound Absorbtion of 0.45. The sound system of the lecture room was designed to describe without using speakers and can block out sound very well.
- Waste pollution impact

  Since food and a drink cannot enter the building, waste impact is minimal.
- Water pollution impact

  There is only one way out which is well managed by the waste through water treatment and degradation process.



Picture - Sound system



BUILDING INFORMATION

A. General Information

Building name : An academic services building

Name of owner and management company : Luang Por Koon Parisuttho Technical College

Address : 999 Moo 6 subdistrict of Dan Khun Thot, Amphoe Dan Khun Thot, Nakhon Ratchasima 30210

Tel : +66-4420-4985

Fax : +66-4420-4986

B. Building physical information

History

Luang Por Koon Parisuttho gave 50 million baht to Dr. Samret Wongsukda, president of Luang Por Koon Parisuttho Technical College to develop the college and set the foundation. For this reason, the new library building was constructed as a modern energy saving building. This building will be a learning center for students in the future. It was designed by Prof. Dr. Soontorn Boonyatikarn of department of architecture, Chulalongkorn University.

Age of building :	5 years
Total number of storeys :	3
- Total number of basement floors :	-
- Number of car park stories :	-
Total gross floor area :	3,811 square meters
Surface area of the envelope including the roof to gross floor area ratio :	1,608.18 m^2 , 1,397 m^2 / 3,811m^2
Car park area :	0 square meters
- Gross lettable area :	3,811 square meters
- Air-conditioned area :	2,658 square meters
- Non-air conditioned area :	1,153 square meters

Total GFA per ground area (Plot ratio) : 247,496 m^2

C. Building design and practice information

Plant and landscape design / wind and natural ventilation / water features / day lighting / etc

Landscape architecture design, the grass has been planted around the building exterior to reduce heat outside the building and prevent dust. Also, trees have been planted around the lot to make oxygen and shade. The front of the building towards the north has a skywalk leading to the administration building. On the west side of the building, there is a pond to reduce the temperature outside the building. The building is set back from the main road about 100 meters, which can block out external noise very well. The glass wall is tilted to avoid the heat of sun, however, there is adequate lighting around the building to make it light in the daytime. Surface material around the building is grass to reduce the outside temperature and prevent dust. There is a pond in east side of the building to reduce the outside temperature of the building and support the air system that uses WATER COOLWATER CHILLER. The wind speed is low making the noise level suitable for reading. Air is cooled into the pool instead of using a COOLING TOWER. The pool has a spherical radius of 15 meters with a capacity of approximately 2,000 m^3. The building was designed with the wind very well designed with open space around the building to air out the place. The time without using air conditioning can save energy very well. This system was designed by Prof. Dr. Soontorn Boonyatikarn of department of architecture, Chulalongkorn University. The building was designed to determine the quality of light and sound at the right temperature which saves energy higher than 5 times of general buildings.

Façade and shading design

The building material frame type of the academic services building's exterior wall is the E.I.F.S. system wall covering with 4 inch thick and 1 pound/ft3 density of not fire foam. The property is protective of heat into the building for up to 52% when compared with the usual construction with the thermal resistance (R value) between 4 - 5.9 per 1 inch thickness. The property of covering with polystyrene not fire foam is preventing the heat from the sun very well. And there is a heat stop glass which is two layers of reflective glass that is coated with a low radiation substance prevents heat of infrared rays to pass through only 5%. Argon gas, which has low thermal conductivity, is injected into gap in the middle. Heat stop glass is installed in 80 degree tilt of the wall. Paint for the exterior and interior building is white acrylic paint which protect UV very well and can withstand sun, rain, fungi and algae and easy to clean.

The shading devices of library buildingwas designed to prevent heat well but the lighting was adequate. The roof is designed as a thermal protection system, which has seven layers alternating with glass walls opening to the light. Walls are designed to tilt 80 degrees to avoid the heat from the sun.

Location of service core

The library building was designed with the skywalk to connect the exterior of the building and the administration building. The building structure is a reinforced concrete structure. The width and length of the skywalk is 5 and 40 meters, respectively, with a gable roof covering through the skywalk. There is a road under the skywalk. The building has two layered entrance to reduce energy consumption of air conditioning which also prevents outside sound from entering. There is a ramp designed for disabled persons that is positioned on the right side of the building for convenient travel. The building’s stairs were designed in the middle of the building as an open hall to the roof. Therefore, the building has enough light during the day.

Shape of the building

The shape of the library building is closed COURT. The center is SPACE. Stairs were designed to add light through the roof using advanced materials and construction processes. The building shape was designed to correspond with the environment and sun, wind and rain protection in mind. The building has a skywalk connected with the second floor of the administration building. A square shape was designed to correspond with the designed roof to gain air and light. The side of building is spherical which was designed as a ramp for the disabled. The height of the building from the ground floor to the roof is 26.80 meters. The total area is 3,811 square meters. The wall of the third floor has an 80 degree tilt angle to avoid the heat from the sun.

Overall heat Transfer trough building envelope

Overall Thermal Transfer Value (OTTV)	:	11.25 W/m^2
Roof Thermal Transfer Value (RTTV)	:	5.55 W/m^2

Lighting system

Lighting fixtures :	23	W/m^2 (for gross area)
Lighting load :	5.5	W/m^2 (for working area)

Building air-conditioner system and equipment

Type of air-conditioner system	:	Water Cooled Water Chiller
Fresh air exchange rate	:	0.97 m^3/hr
Device name	:	Central Air Conditioners
Energy efficiency of air-con chiller	:	1.56 kW/ton (75 kW)
Total cooling Load	:	28.21 W/m^2 (air-conditioned area)

D. Operation information (for 2011)

Occupancy rate	:	70 % of total area
Total number of occupants	:	38.46 %
Ownership of building	:	Luang Por Koon Parisuttho Technical College
Building operating schedule		
Weekdays	:	08.00 am - 08.00 pm
Weekend	:	-
Operation hours per year	:	3,168 hr/y
Building indoor environment	:	25 °C / 50 %
Temperature	:	25 °C
Relative humidity (RH)	:	50 %

E. Energy Consumption Information (for 2011)

Maximum peak demand	:	80.00 kW
Energy used (whole year)	:	93,928.00 kWh/year
Energy used (average)	:	7,827.33 kWh/month

F. Energy Management Information

Measure	Year		Results of the energy conservation (250 d/y)					Investment Cost (Bath)	Payback Period (Year)
	Start	End	Electricity			Fuel			
			(kWh)	(kW)	(Bath)	Amount	(Bath)		
Group 1 Non-Investment Measurement									
- Turning off lights when leaving	2010	2011	3,655	3.655	11,403	-	-	-	-
- Turning off the air-conditioning 30 minutes before leaving	2010	2011	12,250	36.26	38,220	-	-	-	-
Total group 1									
Group 2 Investment Measurement									
- Using high efficiency motor	-	-	-	-	-	-	-	-	-
- etc.	-	-	-	-	-	-	-	-	-
Total group 2									
Total group 1 and 2			**15,905**	**39.91**	**49,623**				

G. Maintenance Information

Maintenance program

- Manpower: > 1000 people, 48 hr/yr
- Maintenance contractor: teacher, student, electrical technician division, mechanical technician division, construction technician division, architecture technician division, mechanical plant technician division, electronic technician division, welding technician division, commerce division, account division, marketing division and business computer division
- Availability of energy management engineer: 1 engineer
- Training of maintenance workers: 16 hours/yr

H. Environmental Impacts

Impacts of waste

Since food and a drink cannot enter the building, waste impact is minimal.

Impacts of pollution

- Impacts of air pollution : Since the building is in the library, there are no air emissions.
- Impacts of noise pollution : The building was designed with an Average Total Sound Absorbtion of 0.45. The sound system of the lecture room was designed to describe without using speakers and can block out sound very well.
  Impacts of water pollution : There is only one way out which is well managed by the waste through water treatment and degradation process.