



Thailand Experience : Why Solar cooling and Barriers for Implementation



STAKEHOLDER CONSULTATION WORKSHOP
“POLICY DEVELOPMENT TO SUPPORT SOLAR COOLING IN
THAILAND AS DEMONSTRATION PROJECT in Southeast Asia”



Sustainable
Solutions
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Environment



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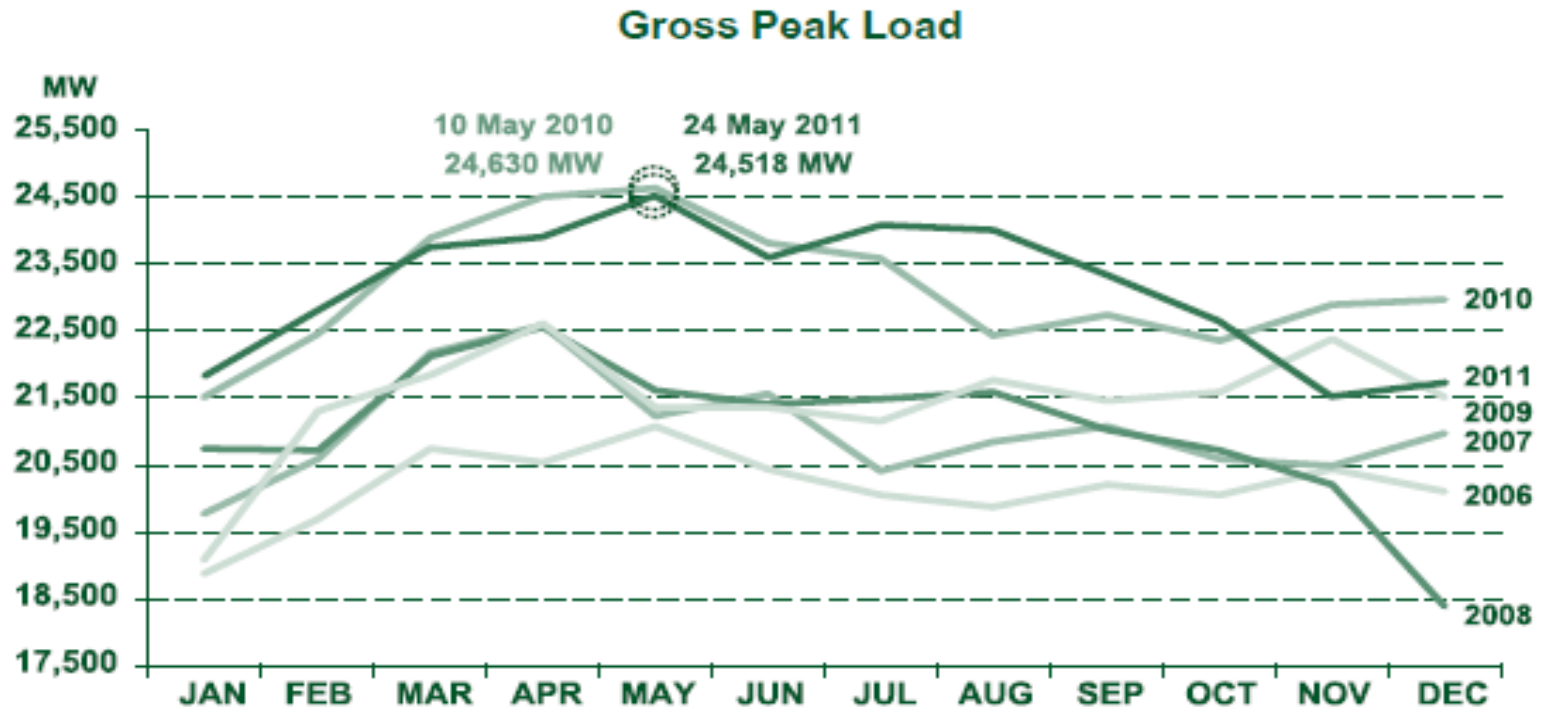
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ENERGY DEMAND FOR COOLING IN THAILAND



Gross Peak Load in Thailand 2006-2011

- The electricity energy demand in Thailand is increasing with an average annual rate of 3.6%.
- The electricity is majorly consumed in the air conditioners and the chillers.
- Conventional chillers in industrial sector generally consume 7% of the total electricity.
- In the large commercial buildings , the conventional air conditions are responsible for more than 50% of the electricity needs.

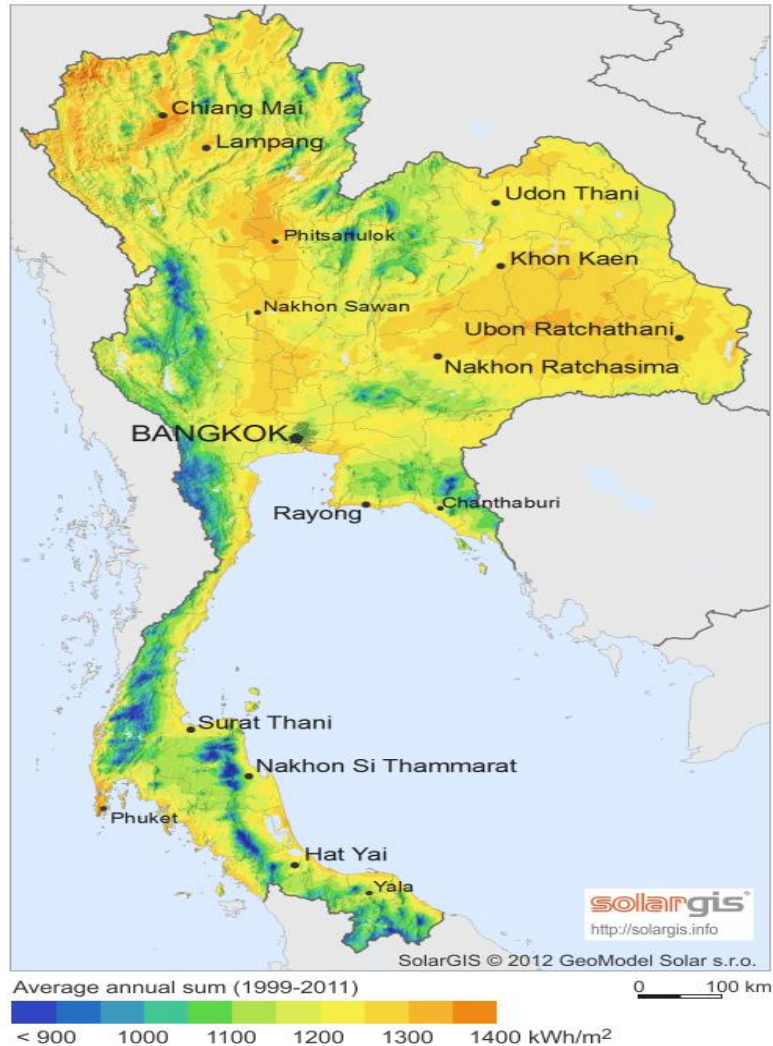
ENERGY DEMAND FOR COOLING IN THAILAND

Shopping Mall Categories	Specific Energy Consumption (kWh/year/m ²)	Specific Energy Consumption (kWh/year/m ²) in Air Conditioning	Energy Consumption (%) breakup in shopping malls			
			Air Conditioning	Lighting	Freezer/Refrigerator	Others
Department Store	241	133	55	20	2	23
Discount Store	336	160	47	21	11	21
Shopping Plaza	204	118	58	14	4	24
Supermarket	418	150	36	20	27	17

Specific Energy consumption in shopping mall

SOLAR ENERGY POTENTIAL

Direct Normal Irradiation Thailand

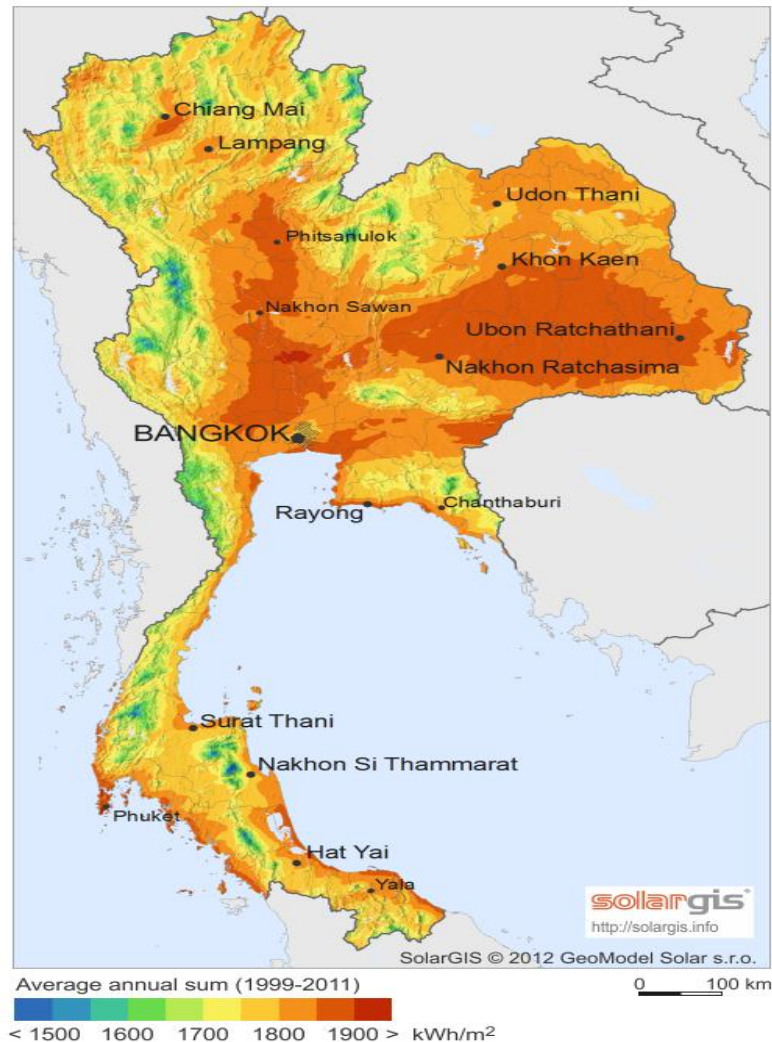


- **Direct Normal Irradiance (DNI)** is the amount of solar radiation received per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position in the sky. This value is of particular interest to Solar Concentration technologies.

- Direct normal irradiation (DNI) is higher in the winter months and decreases both in rainy and summer season. DNI is relatively low, not surpassing the 1,400 kWh/m² year.

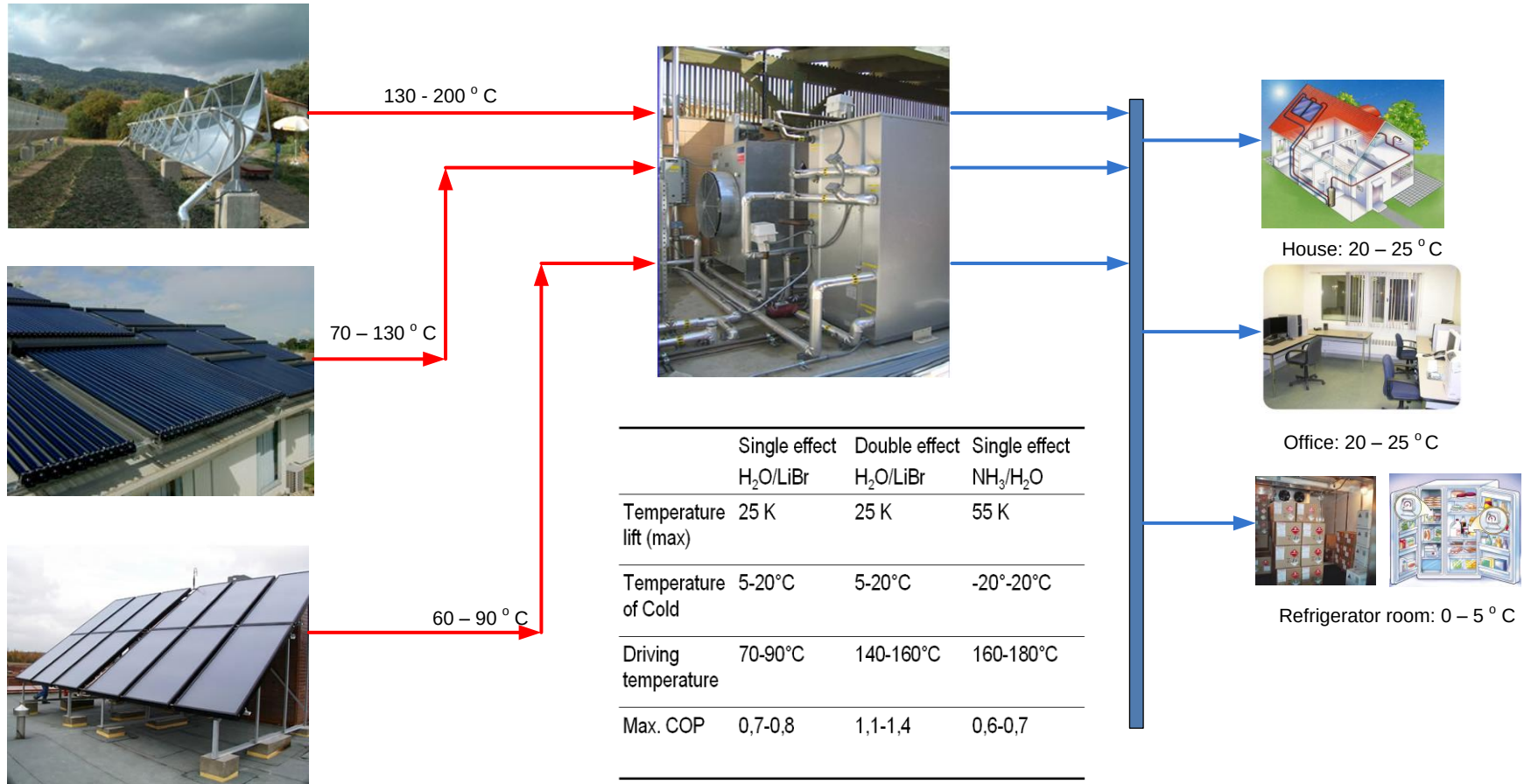
SOLAR ENERGY POTENTIAL

Global Horizontal Irradiation Thailand



- **Global Horizontal Irradiance (GHI)** is the total amount of shortwave radiation received from above by a surface horizontal in the ground. This value is of particular interest to photovoltaic installations.
- GHI registers higher values with regions surpassing the 1,900 kWh/m² year.

SOLAR ENERGY POTENTIAL



Solar Cooling system applications and thermal temperature driving require.

SOLAR POLICY IN THAILAND

AEDP 2012-2021

- **10 years Alternative Energy development Plan** has a target to develop 3,000 MW (solar energy based electricity generation)
- The plan also aims to develop solar thermal projects of capacity with a target of 100 ktoe (kilo tonnes oil equivalent) which includes following:
 - Promote the system installation of solar heating/ cooling, government buildings might be installed as the pilot scheme.
 - Develop the solar hot water system for households at low cost.
 - Develop the compulsory mechanism such as: Building Energy Code to enforce large buildings for installing the Solar Hot/ Cool Water System.
 - Promote the solar drying system for SMEs and local enterprises (OTOP)

EEDP 2011-2030

- **20 Year- Energy Efficiency Development Plan** has addressed air conditioners as one of the highest energy saving potential area in Thailand.
- EEDP promotes the solar driven air conditioning system for small commercial building and residential sector.
- EEDP aimed to achieve savings of 50% of the energy use in air conditioners including the use of Solar Cooling technology.

POLICY SUPPORTING MECHANISM

Supporting Mechanisms	Responsible Government Authorities/ Organizations	Supporting Mechanism and Sub Programs
ESCO FUNDS	Two agencies act as fund Managers for ESCO funds allocated under ENCON fund: Energy for Environment Foundation (EFE) and The Energy Conservation Foundation of Thailand (ECFT).	This fund encourages private investment in Renewable Energy and Energy Efficiency project by offering opportunities of co-investment by the Government of Thailand. The fund managers provide project finance as ESCO Venture Capital, Equity Investment, Equipment Leasing, Technical Assistance and Credit Guarantee Facility.
Energy Efficiency Revolving Fund (EERF)	11 Participating banks in	This fund supports clients for investments in machinery and equipment in relation to Energy Efficiency and Renewable Energy projects through providing low-interest loans to banks, which then finance EE projects through financing with favorable interest rates.
Tax Incentives	Board of Investment (BOI)	Following are the tax incentives for Renewable Energy and Energy Efficiency projects: ✓ Exemption of import duties on machinery ✓ 8-year exemption of corporate income tax with no cap ✓ 5-year 50% reduction of corporate income tax on net profit ✓ 10-year double deduction of transportation, electricity and water supply costs ✓ Deduction of infrastructure installation or construction costs from net profit in addition to normal depreciation of not more than 25% of the investment in promoted project.

POLICY SUPPORTING MECHANISM

Supporting Mechanisms	Responsible Government Authorities/ Organizations	Supporting Mechanism and Sub Programs
Demand Side Management (DSM) by Bidding Mechanism and Standard Offer Program (SOP)	Energy Policy and Planning Office (EPPO),	✓ DSM by Bidding Mechanism promotes investment in energy conservation activities; the government considers proposed subsidy rates for achieved energy saving, giving priority to the minimum rate submitted, and the energy saving outcome will be verified and proven at each stage. ✓ SOP promotes investment in all sectors, particularly small energy consumers, e.g. SMEs, to implement energy conservation measures, by providing subsidies for the amount of energy that can be saved and/or reduced peak load, which can be verified and which do not have to undergo the bidding process.
Carbon Financing	Greenhouse Gas Organization (TGO),	Various domestic and international carbon financing mechanism are promoted by 's Greenhouse Gas Management Organization (TGO) keeping renewable energy and energy efficiency projects as the beneficiaries.

POLICY SUPPORTING MECHANISM

Subsidies in Solar Hot Water project

PLANS		YEAR	SUBSIDIES ON THE SOLAR COLLECTOR COST*
LONG TERM PLAN AS PER THE ALTERNATE ENERGY DEVELOPMENT PLAN FROM 2012 TO 2022	SHORT TERM	2008-2012	30%
	SHORT TERM	2013	25%
	SHORT TERM	2014	22.5%
	SHORT TERM	2015	20%
	SHORT TERM	2016	18.5%
	SHORT TERM	2017- 2022	15%

** This is system cost subsidies, which include all solar hot water system components such as solar collector, hot storage tank, piping, etc.*

EXISTING SOLAR COOLING PROJECT IN THAILAND

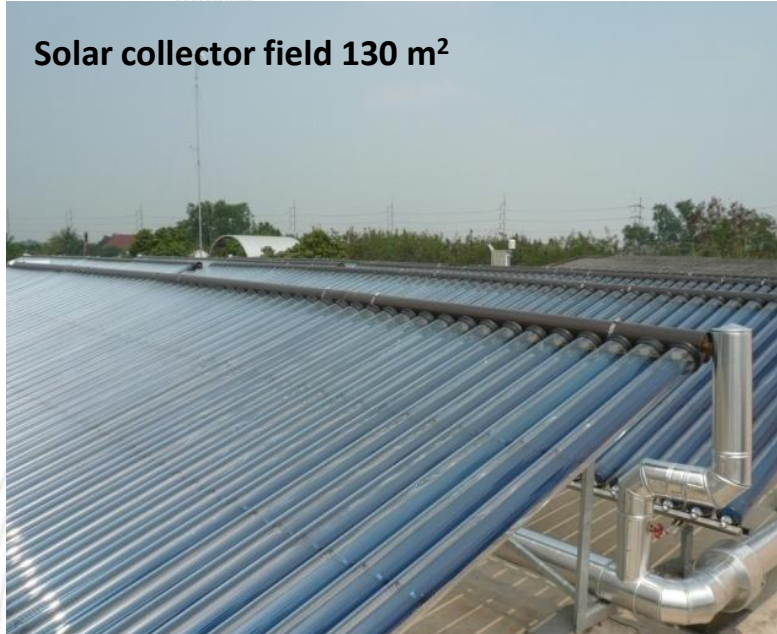
Name	Location	Capacity of Absorption chiller in ton of refrigeration [#]	Capacity in kW	Solar collector Size in m ²	Supporting Fund from	Description ^{**}
Tesco Lotus-Thailand	Salaya, Nakhorn Pathom	300	1,055	3,000	Tesco Lotus-Thailand	supply hot water 80-90 °C at 102-120 m ³ /hr
Ritta Co. Ltd.	Ladkrabang, Bangkok	70	246	120	Ritta Co. Ltd.	supply hot water 80-90 °C
School of Renewable Energy Technology, Naresuan University	Phitsanulok	10	35	72	ENCON Fund	supply hot water 80-90 °C at 6 m ³ /hr, 500 L hot storage and 200 L cold storage tanks
Experimental Research Center for Renewable Energy and Energy Conservation Pathumthani	Klong Loun, Pathumthani	10	35	130	Demonstration project by DEDE	supply hot water 80-90 °C at 9 m ³ /hr, 7,000 L hot storage tank

[#] 1 Ton of refrigeration = 3.5 KW.

^{**} All the installations as shown in the table above have evacuated type solar collector and Lithium Bromide-Water (LiBr/H₂O) absorption chiller.

EXISTING SOLAR COOLING PROJECT IN THAILAND

Solar collector field 130 m²



System control unit



35 kW absorption chiller machine



Backup heater



Cooling Tower



Fan coil unit



EXISTING SOLAR COOLING PROJECT IN THAILAND

35 kW Solar Cooling System,
School of Renewable Energy
Technology, Naresuan
University under ENCON Fund
supported.



Testing Building with Solar Cooling System



Chiller room



72 m² solar collector field

BARRIERS IN SOLAR COOLING IN THAILAND

- **RESEARCH AND DEVELOPMENT SUPPORT**

- research and development support through demonstration projects are required to gain the confidence of the user or investor into solar cooling technology.
- The objective of R&D in solar cooling would be local access of technology with reduction of investment cost and achieving better performance efficiency.

- **STANDARDIZATION OF SOLAR COOLING TECHNOLOGY**

- Standardization of solar cooling technology through testing and certifications of products and design plays major role to provide quality assurance.
- The designing of standardization approach is required to assure the quality at component level and at system level for solar cooling project.

- **LACK OF AWARENESS AND DISSEMINATION**

- Awareness on cost: The awareness on the benefits of solar cooling following a sustainable approach is recommended.
- Awareness on technology: The analysis of the demonstration projects should be documented and made available for stakeholder reference as experience sharing.

BARRIERS IN SOLAR COOLING IN THAILAND

- **HIGH UPFRONT COST AND LONGER PAYBACK PERIOD**

- The complete value chain of solar cooling technology is not developed yet in Thailand, it involves high upfront capital cost.
- The payback period as surveyed from the current demonstration projects is also very high.
- The policy intervention is required to introduce attractive business models for the beneficiaries and stakeholders.

- **NEED FOR TRAINING AND CAPACITY DEVELOPMENT**

- The realization of complete value chain for solar cooling technology in Thailand is lagging due to the lack of training and capacity development.
- Education on solar cooling technology should be imparted in energy efficiency and energy conservation workshops.
- The demonstration projects could be used as living labs for the capacity development requirements.

STAKEHOLDERS FEEDBACK ON POLICY DEVELOPMENT FOR SOLAR COOLING (THAILAND AND GLOBAL)

Key Stakeholders Surveyed	Points of Discussion
R&D institutes:	✓ Suitability of the Solar cooling technology as per climate should be primarily considered in designing and technology selection stage. For example Evacuated tube and flat plate are more suitable to the climate of as compared to concentrated solar thermal collectors. ✓ Financing is an issue, since capital cost and payback period is high ✓ There is a lack of credible experts in private sector, information on technology, quality standardization. ✓ The results from the demonstration project should be documented and presented for information dissemination purpose. ✓ Solar cooling technology is mature an enough examples exist as well as skilled companies manufacturing equipments, designing systems, installing and maintaining them. ✓ Solar cooling is seen in Europe as a seasonal application rather than an all-year application as in Thailand.

STAKEHOLDERS FEEDBACK ON POLICY DEVELOPMENT FOR SOLAR COOLING (THAILAND AND GLOBAL)

Key Stakeholders Surveyed	Points of Discussion
Suppliers/vendors:	✓ Air conditioning suppliers currently have no experience in supply or installing the absorption chillers in Thailand. ✓ Due to the lack of information and standards on Solar cooling technology, the Air Conditioning suppliers have not shown interest and participation yet. ✓ As per the air conditioning suppliers, the desired payback period to invest into energy efficiency project is 3 years. ✓ Manufacturers have wide portfolios catering for small, medium and large sizes. R&D efforts are continuous and improvements are possible. Demand in solar cooling specifically is the missing ingredient. ✓ Efficiencies are very dependent on external factors as air temperature, type of cooling tower and system design and insulation. ✓ Through partnerships with suppliers some Thai vendors are able to supply chillers. ✓ Industrial estate managers may take the lead as utilities to supply cooling to the industries in that estate. The primary source of energy would be the waste heat supplied from various industries which can be hybridized with solar cooling.

STAKEHOLDERS FEEDBACK ON POLICY DEVELOPMENT FOR SOLAR COOLING (THAILAND AND GLOBAL)

Key Stakeholders Surveyed	Points of Discussion
Financial/funding firm	✓ The funding criteria for ESCO Fund or financial institutions is to finance the integrated projects with a combination of energy efficiency technologies instead of specific technologies. ✓ From Funding agency point of view, performance demonstration through prototype projects and standardization of the technology are the most important aspects of new energy efficiency technology. ✓ Some Austrian bank willing to provide guarantees for solar cooling systems provided that Austrian companies are the integrators or main suppliers of equipments. Confidence in the market players is high. ✓ Some funding firm from Germany has also experience with solar cooling and may be willing to finance systems provided the integrator or main supplier is a German company.

STAKEHOLDERS FEEDBACK ON POLICY DEVELOPMENT FOR SOLAR COOLING (THAILAND AND GLOBAL)

Key Stakeholders Surveyed	Points of Discussion
Turn key engineering company / ESCO company	✓ The solar cooling technology requires information dissemination, capacity development and standardization through Government supporting fund. ✓ The designing of solar cooling project is to be done by experts, who have good understanding on the technology suitability with the climate of Thailand. ✓ Current cost of the installation as learnt from the existing projects is very high. It requires developing the complete value chain for solar cooling to bring down the cost of the system. ✓ The ESCO seek for Government supporting grants to install projects under ESCO models. ✓ Ready for the market. Opportunities exist throughout the world and ESCO models may be possible to implement in specific cases.

STAKEHOLDERS FEEDBACK ON POLICY DEVELOPMENT FOR SOLAR COOLING (THAILAND AND GLOBAL)

Key Stakeholders Surveyed	Points of Discussion
Private sector	✓ Solar cooling has been analyzed as an energy efficiency measure but not adopted due to high payback periods ✓ Comfortable with ESCO models where third party companies can take care of the system on a revenue sharing model. ✓ Solar cooling would only be opted by user under Government mandates and incentive based policies. ✓ Solar cooling is a good technology and is key on the energy efficiency strategy for malls and retail sector ✓ Very satisfied with the technology and the savings
Policy makers	✓ Subsidies should not be the only motivating factor for solar cooling

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Thank You...