PV Activity in Thailand

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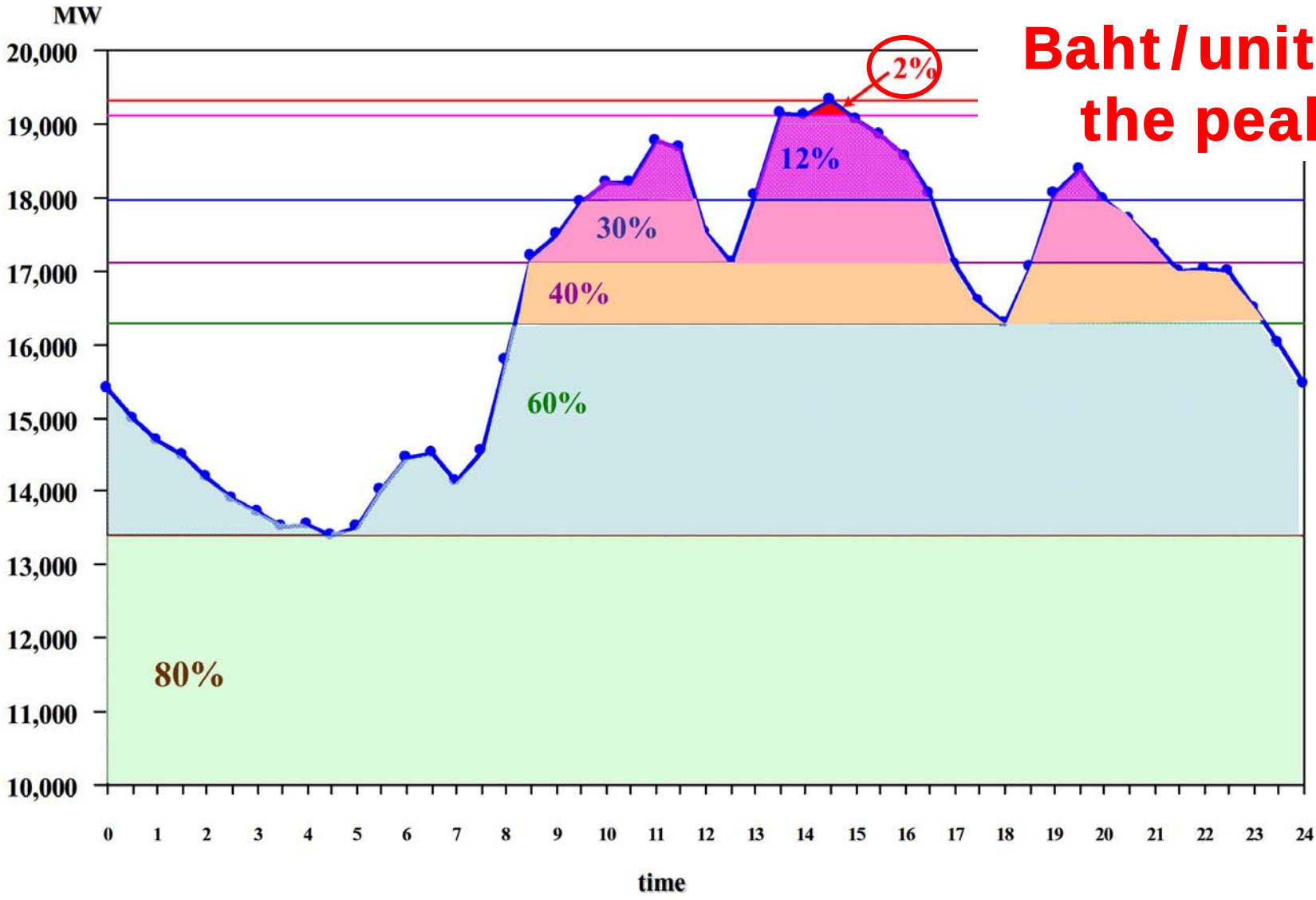
Outline

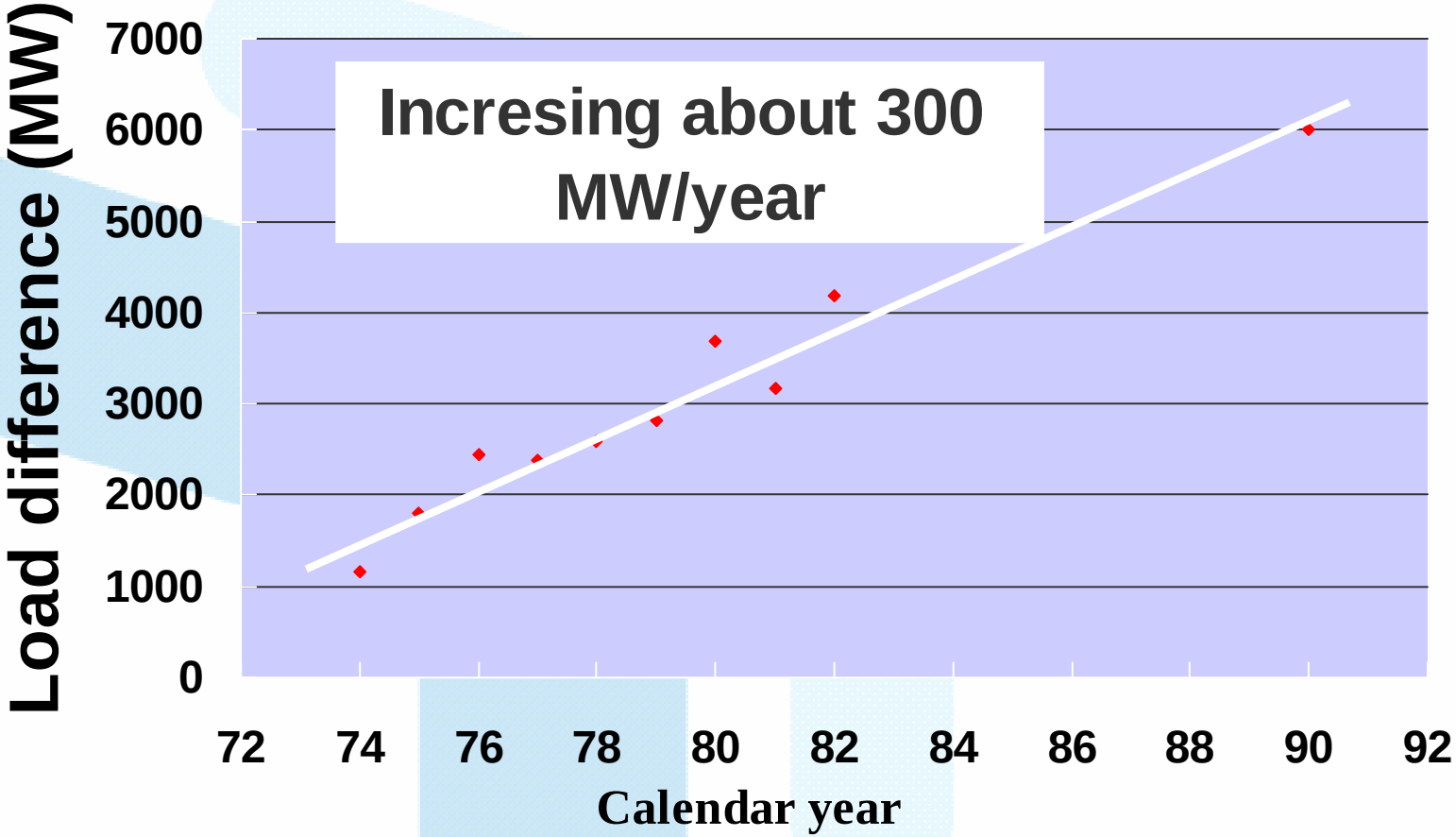
- PV status in Thailand
  - PV for peack cut
  - Policy
  - Total installation
  - Organization
- Policy and plan in the future

Comparison of electricity cost

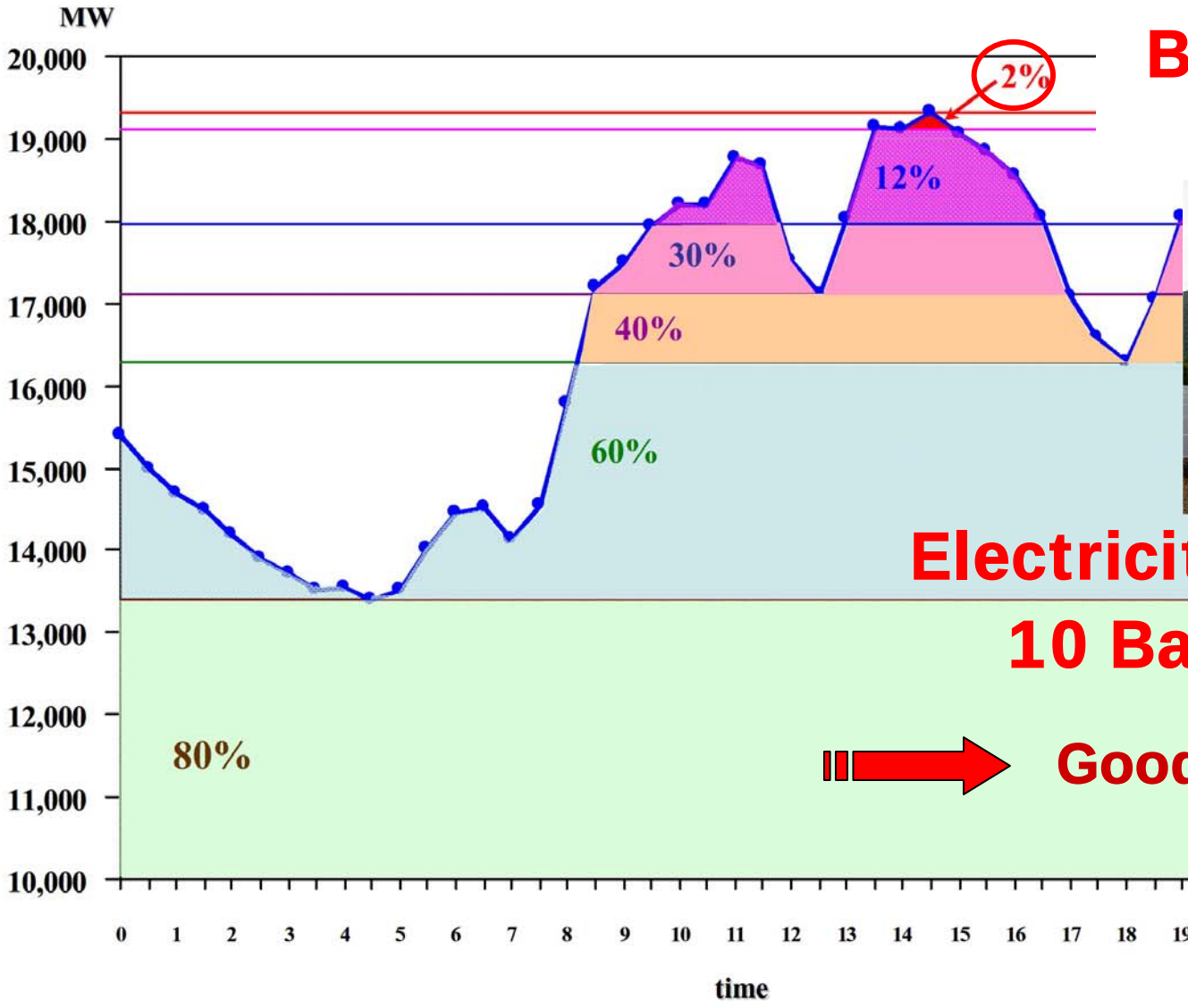


16.67 Baht/unit at the peak

Trend of load difference between peak and off peak



Comparison of electricity cost

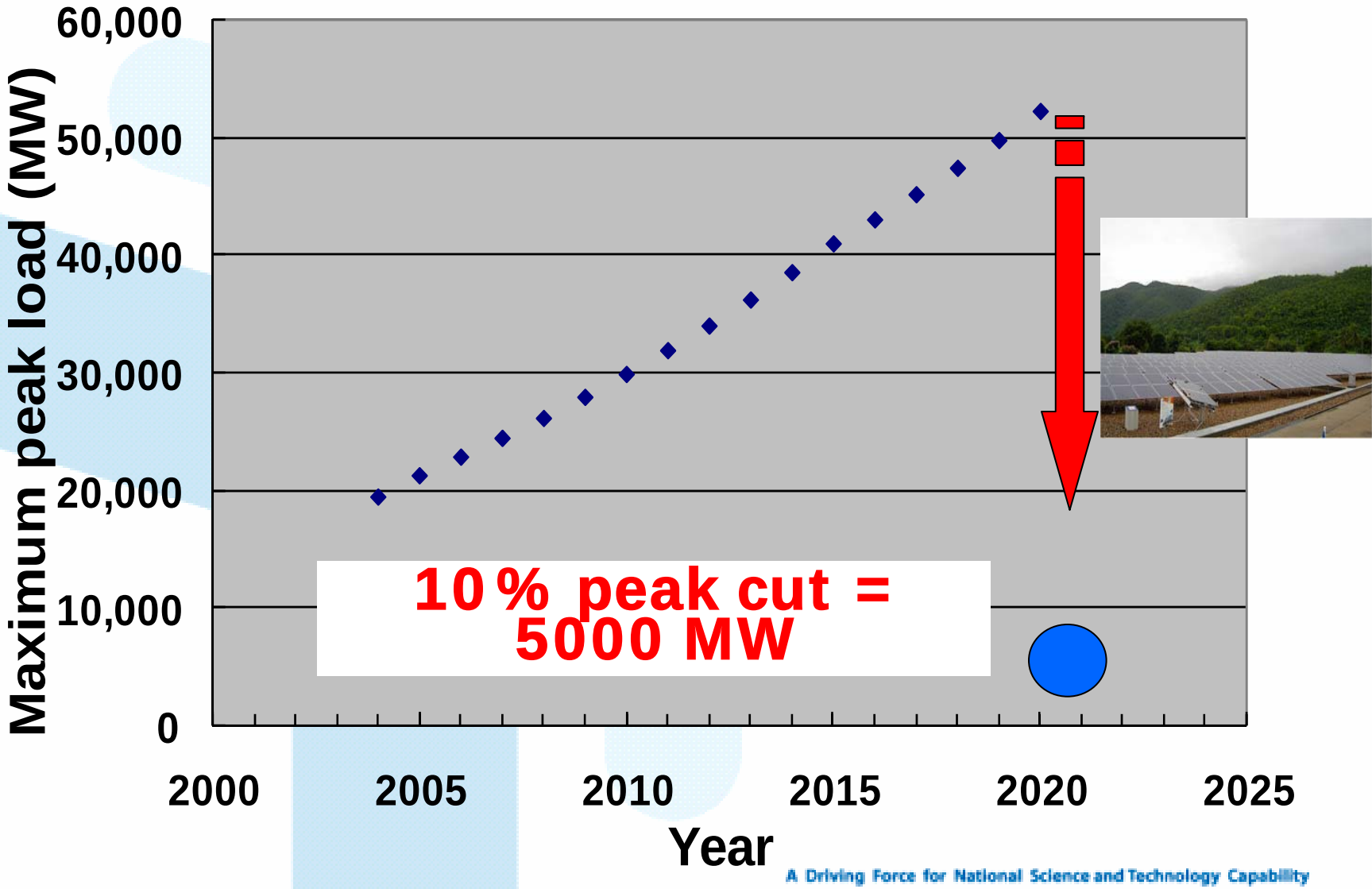


16.67 Baht/unit at the peak

Electricity from PV 10 Baht/unit

Good for peak cut

Trend of maximum peak load



Incentive program

- **Price adding system (2006)**
  - **+8 baht/unit more for 10 years**
  - **Net metering type (totally selling electricity only)**
  - **Not good for solar home system**
  - **Good for PV power plant**

Incentive program (cont')

- **Privilege for investment**
  - **PV industry is focused industry**
  - **No income tax for 8 years**
  - **No import tax for machine**
  - **No import tax for material**

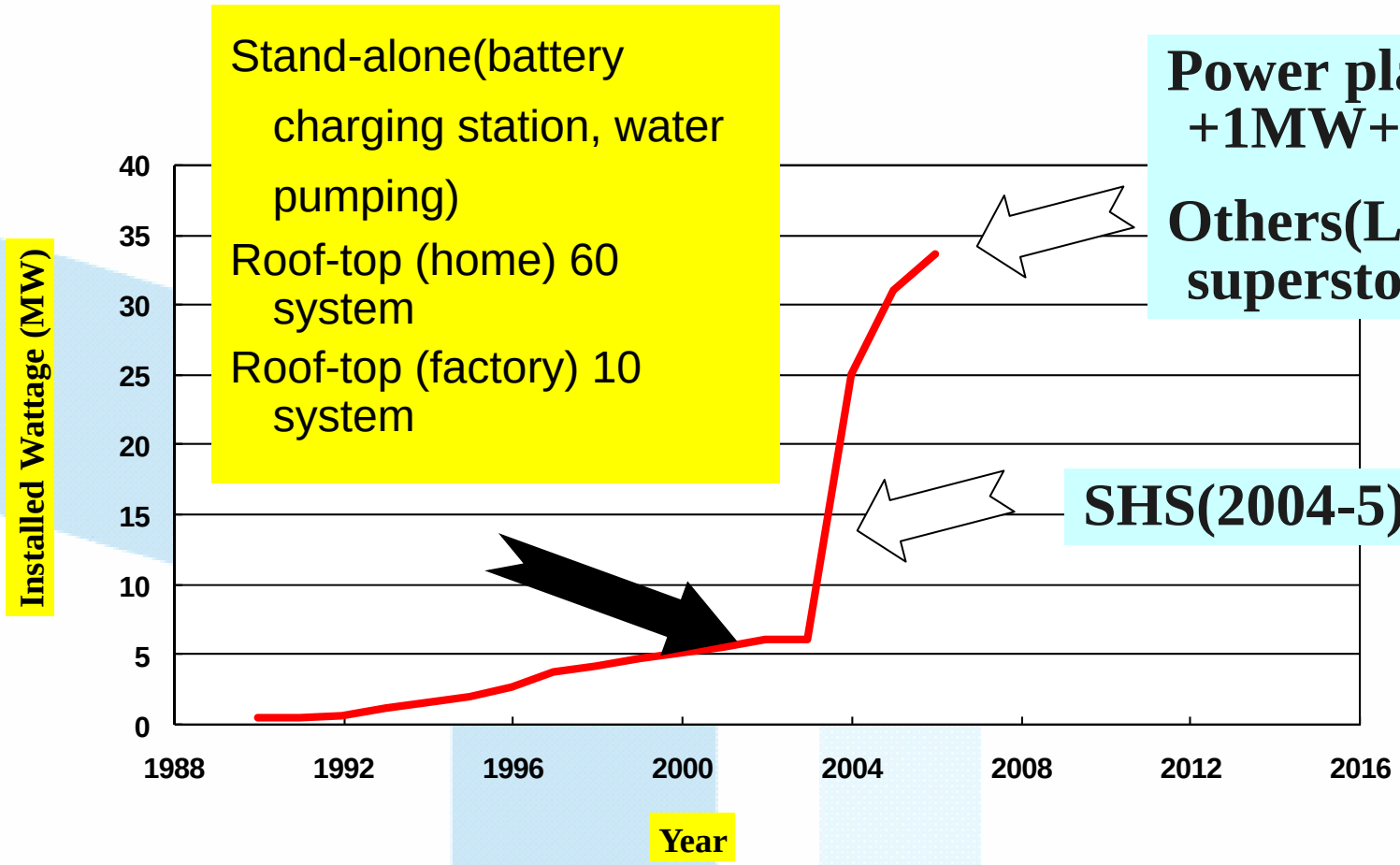
First Solar is planning to build 100MW CdTe plant in Thailand

Period of pay back year

	PV system price (Baht/Wp)			
Selling back price (Baht/kWh)	**110**	**120**	**160**	**200**
20		**5.0-6.0**	**7.0-8.0**	**8.5-11.0**
16		**6.5-8.0**	**8.0-11.0**	**10.7-15.5**
13		**8.0-10.0**	**10.0-15.0**	**13.0-21.0**
11 (Bangkok Solar) • **1.6MW** • **Self-made PV** • **Owned land**	**8.0-10.0**			

- The discount rate is assumed to be around 0-5%
- Adder program : +8 baht/kWh @ 10 yrs

PV installation in Thailand



PV network in Thailand

Ministry of S&T

NSTDA
- Efficiency improvement (Thin film Si)
- Manufacturing technology (Pilot plant)
- PV/T
- BIPV
- Module testing (3000 panels)

Ministry of Interior

- SHS (36 MW, 300k system)
  - 150k system for 2004
  - 50k system for 2005

Ministry of Industry

- Privileges
  (Tax exception for income and import)
- Factory roof-top (10 system, 42kW)

Ministry of Energy

DEDE
- Application (battery charing station, water pumping)

EPPO
- Policy
- Funding
  (R&D, installation)

EGAT
- Solar house
  (60 houses, 150kW)
- Power plant (500kW)

PV network in Thailand (con')

Company

BSC BANGKOK SOLAR CO., LTD.

- Former Duna Solar's a-Si plant (2003)
- 15 MW (2006)
- 80 MW

SOLARTRON

- Add 30MW assembly line (2004)
- Cell processing (underway) 30MW

Ekarat Solar Co.,Ltd

- Module assemnbly (15MW)
- Cell processing (2007) 30MW

SPOT (Solar Power Technology)

- Module assemnbly (5MW)

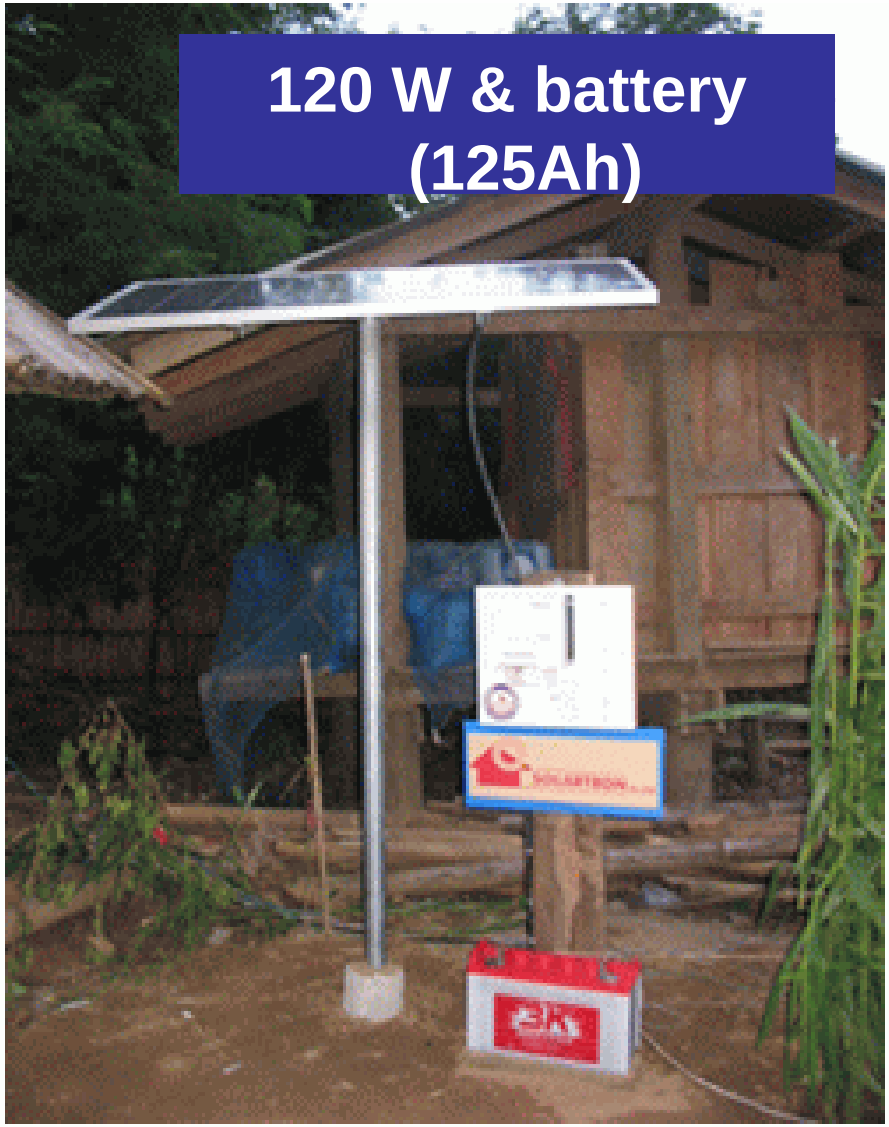
SHARP

- Module assemnbly (7MW)

University

- EVA (KMUTT)
- CIS cell (Chulalongkorn Uni.)
- System (KMUTT)
- Solar map (Silpakorn Uni.)

Example of a Solar House System



120 W & battery (125Ah)

Inverter & charger controller

Shell Solar installs Asia Pacific's largest solar system on Thailand's leading hypermarket

Shell Solar has installed Asia Pacific's largest rooftop solar photovoltaic system at TESCO-Lotus' latest hypermarket Rama 1, in Bangkok. The 460kWp solar array is a key contribution to the 'green stores' energy conservation design & environmental friendly initiatives. In a pioneer e-bidding process, Shell Solar was successfully selected on the basis of its strong technical expertise. Shell Solar's partners Solartron and Siemens Thailand provided local system support for project management.

TESCO-Lotus' new solar system generates electricity for consumption on site by the store. Occupying 7'376m2 (54% of the total roof area) the system will feed power to the Metropolitan Electricity Authority (MEA) grid via 3 x 150kVA inverters.

Shell Photovoltaic system in Bangkok. Photo: Shell Solar.

The system will produce 600,000 kWh which will cover 12,5% of the buildings' annual consumption. Moreover, the system will reduce peak demand on the grid with the added benefit of annually offsetting 400 tons of carbon dioxide emissions from Bangkok's fossil-fuel power plants. Christophe Inglin, Managing Director of Shell Solar Singapore Pte Ltd said, "We are very pleased with TESCO-Lotus' commitment to integrate a large scale photovoltaic system with Bangkok's electricity grid. It is our hope that one day all commercial rooftops in Thailand will follow this example, and contribute to a sustainable energy supply".

Power plant in Maehongsong Province

- Installed by EGAT
- Phase I 500kW
- 4MW in total

1.6 MW system at Bangkok Solar

BSC
BANGKOK SOLAR CO., LTD.

Bangkok Solar Power Technology

Electricity

การไฟฟ้าส่วนภูมิภาค
PROVINCIAL ELECTRICITY AUTHORITY

NSTDA's 5 years plan (2006-2010) to reduce manufacturing and system cost

Manufacturing cost

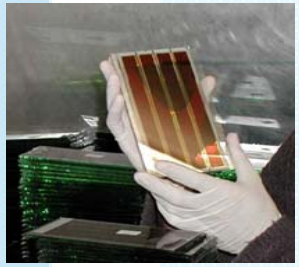
ZnO-coated glass

Machine, prototype production line

Efficiency improvement

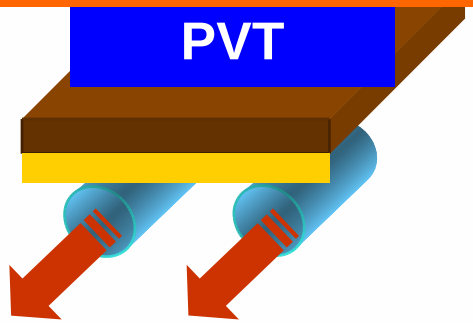
EVA

- PECVD
- Sputtering
- Laser scriber etc.



Organic(dye)

System cost



- lower cost
- Factory, hotel, house
- Air conditioning

PV-integrated solar roofing (BIPV, BIPVT)

Development of a-Si/μc-Si solar cell manufacturing technology

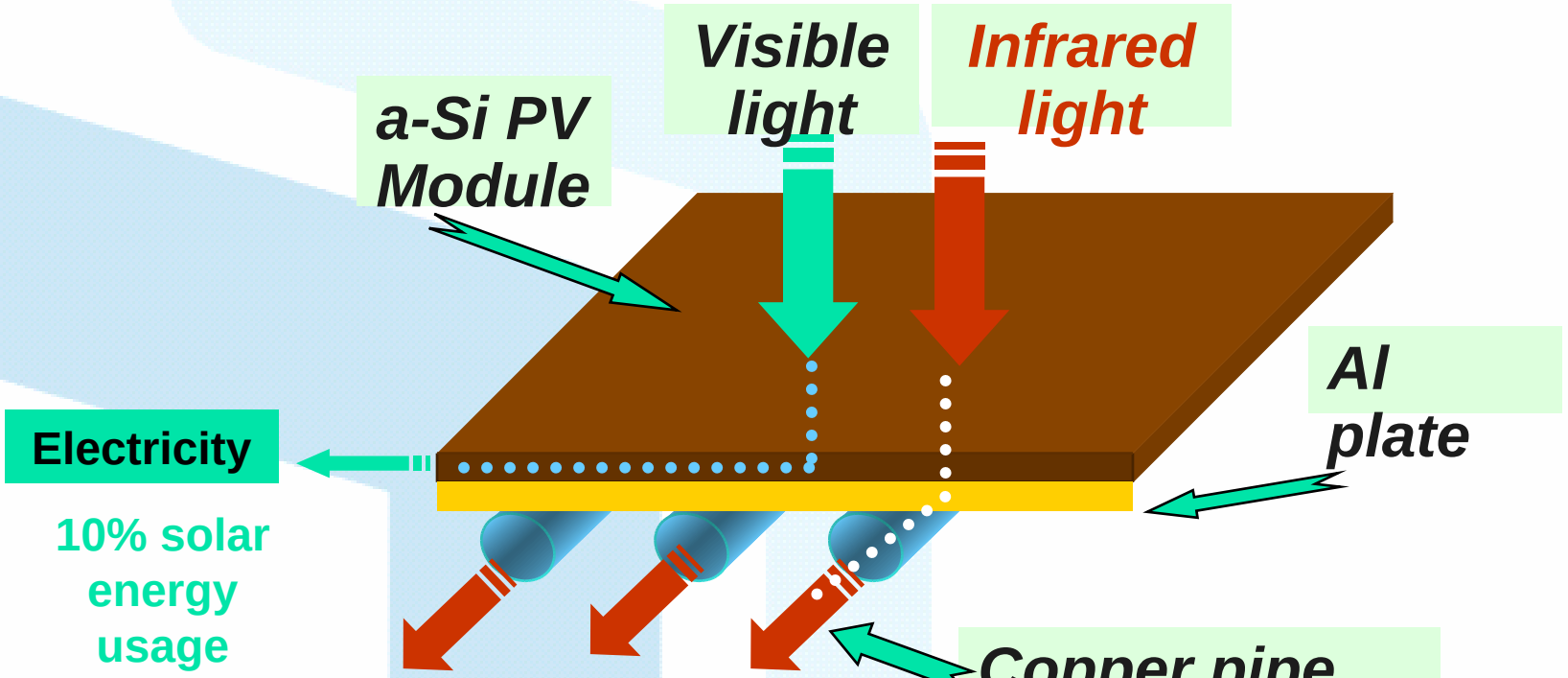
Cell processing system

Developed module

Installed site

Development of Photovoltaic/Thermal system (PV/T)

Structure and how it works



- Another 40% solar energy usage
- For airconditioning, cooking, bathing, washing

Development of PV&T system

First developed system for hospital

DC → Electricity

AC (3kW) → Use in hospital

Hot water

washing machine (25kg x3)

dish washing

PV : 3.0 kW

Hot water : 2,500 l/day

Another hybrid system (PV/T)

Queen Sirikrit's Hospital

Electricity: 9.7 kW

Hot water : 10,000 l/day

For hydrotherapy

Application to solar air-conditioning

PVT panels installed on the rooftop of the Ministry of S&T, Bangkok

Electricity: 5.6 kW

Local-made absorption chiller

Air conditioning : 20 tons
(cooling area: 260 m^2)

PV module testing facilify

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Welcome to Electrical and Electronic Products testing center : PTEC

Electrical and Electronic Products Testing Center (PTEC) was foundation in 1998 under the co-operation of National Science and Technology Development Agency (NSTDA) , and also King Mongkut's Institute of Technology Lardkrabang (KMITL) so as to establish Electromagnetic Compatibility (EMC) testing laboratory to test all electrical and electronic products designed

Services :

1. EMC Testing
   1.1 Electromagnetic Interference Testing : EMI
   1.2 Electromagnetic Susceptibility Testing : EMS
2. Product Safety Testing
3. Electromagnetic Site Servey
4. EMC Diagnostic and Troubleshooting
5. Technical Training
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Photo :

สวทช NSTDA
ECTI-21 NECTEC
สมาร์ท GITS

Policy and plan in the future

- Carbon credit program should be more promoted internationally
  - **Thailand Greenhouse Gas Management Organization has been established in 2007**
- Cooperation projects between Asia countries and developed countries should be more emphasized
  - **FP7 (EU)**
  - **NEDO (Japan)**

Policy and plan in the future (cont')

- Cooperation project on PV should be more emphasized within Asia by new approach or concept
  - **PVT – Bio diesel system in Cambodia**
  - **PVT system in India**
  - **Solar air-conditioning system**

Stand-alone Bio diesel production system

production of bio diesel

Electricity &
Hot water

PVT