Building Sector in Thailand

Architects, Engineers, Facility Managers and Ownership

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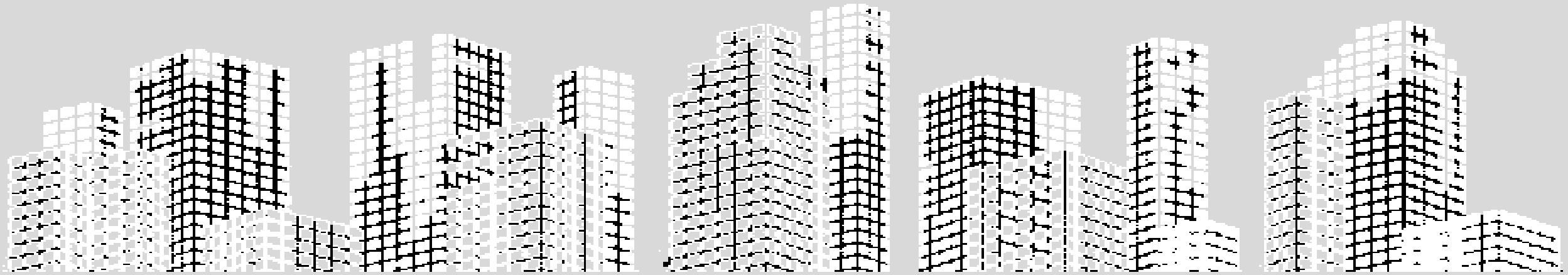
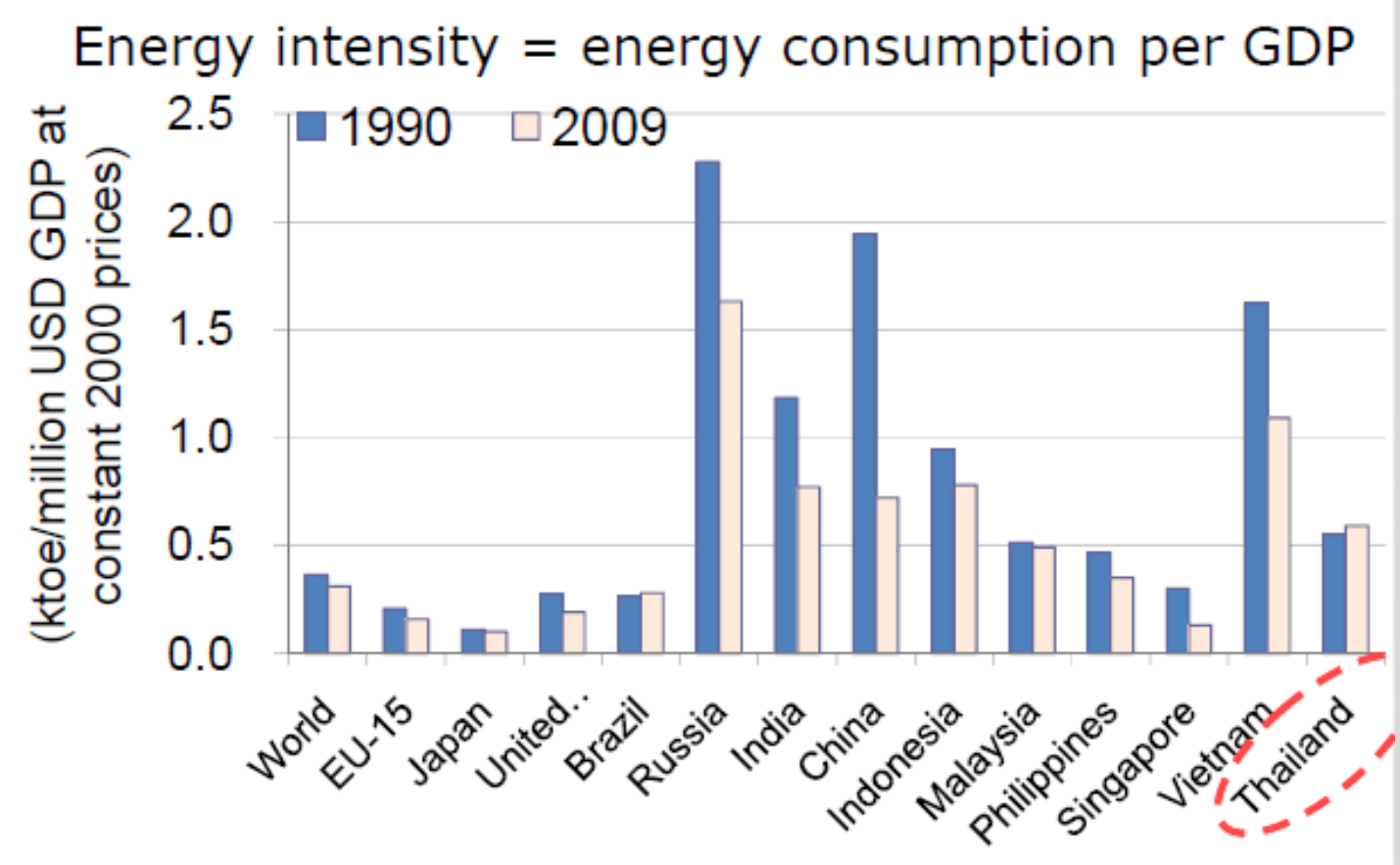
Outlines

- Current status in Thailand
  - Current consumption in building sector
  - Drivers for success
- Organizations involved in building sector
- Barriers to energy-efficient building design and construction
- Needs

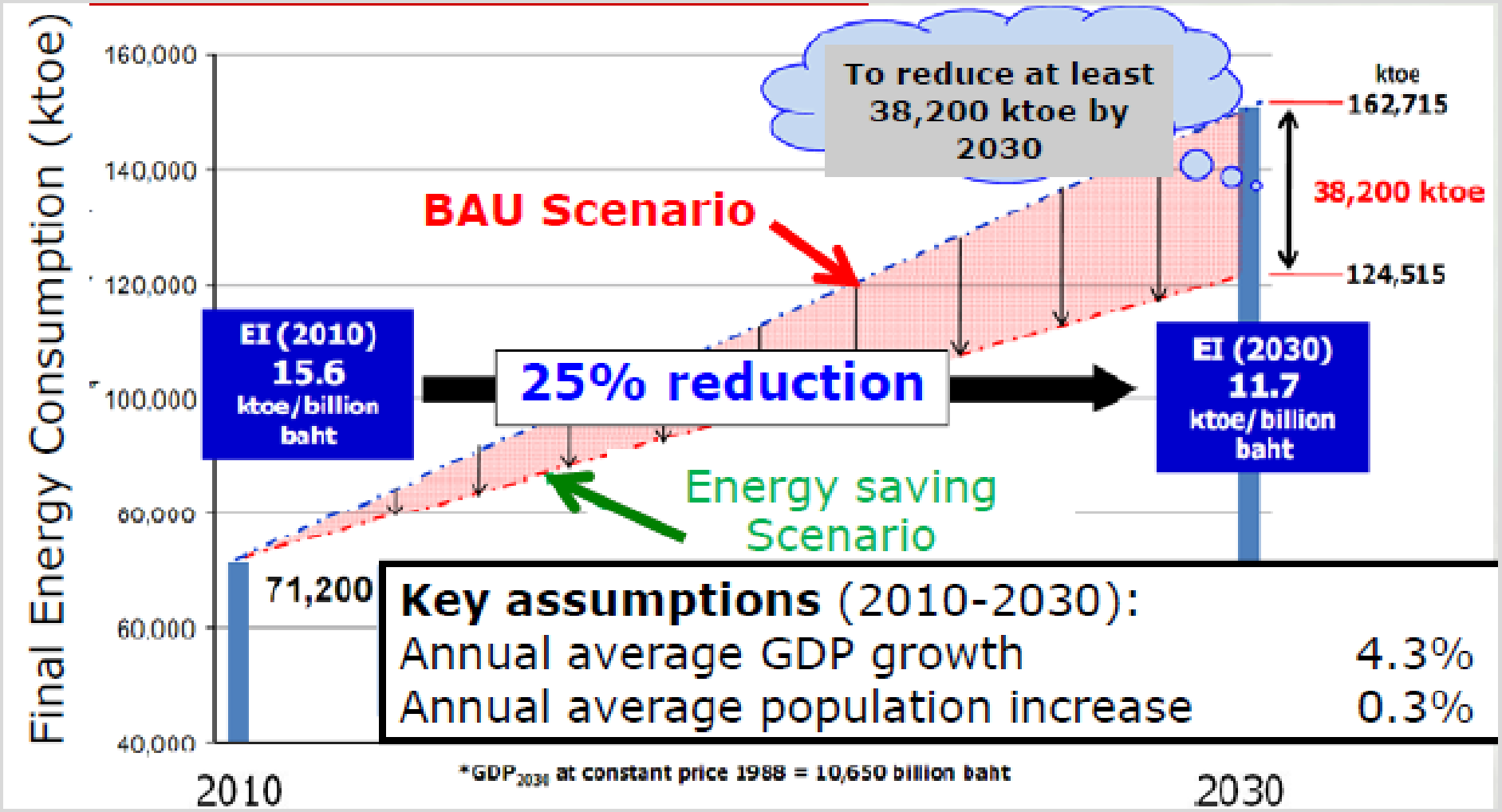


Relatively high energy intensity compared to world average



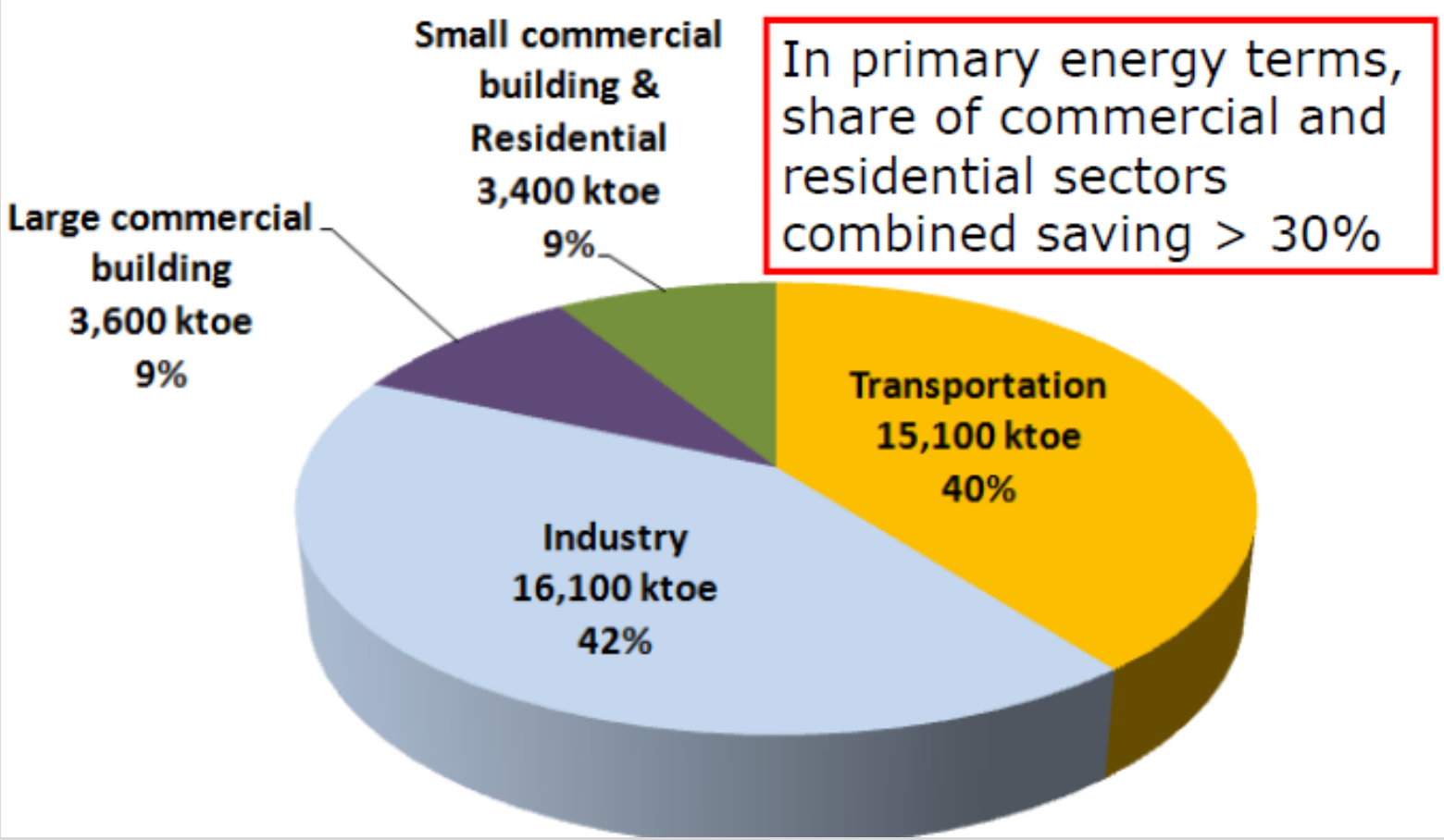
Source: JGSEE

Energy efficient plan overall target for Thailand by 2030



Source: EPPO, JGSEE

Sectorial share for final energy saving target for Thailand in 2030



Source: EPPO, JGSEE

Energy usage in residential households in Thailand

Appliance	Size (kW)	Hours/day	kWh/month	%
Remote Rural Household				
Lamps 5.1 (average number)	0.031	5.5	26.1	37.8
Others	NA	NA	42.9	62.2
Total	-	-	**69.0**	100.0
Urban Household				
Air conditioner One in bedroom One in common room Load cycle 75%	2.25	12	**607.5**	**70.9**
Refrigerator Load cycle 75 %	0.3	24	162.0	18.9
Lamps 8 fluorescents	0.4	4-8	72.0	8.4
Television	0.007	3	6.0	0.7
Washing machine	0.36	0.50	5.4	0.6
Rice cooker	0.60	0.25	4.5	0.5
Total			**857.4**	100.0

Source: survey by KMUTT

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Energy usage in non-residential buildings in Thailand

End Use	Energy use kWh/m/y		
	Case 1 Full A/C	Case 2 No A/C	Case 3 Eff. case
Air-conditioning	120	-	60
Ventilation	15	5	10
Lighting	40	10	30
Office equipment	40	40	40
Others	30	30	30
Total	245	85	170

Source: survey by KMUTT

Over 1500 buildings have been analyzed.

Pertinent data and number of each type of very large buildings (VLBs).

Building type	Average energy ($kWh\ m^{-2}$)	Average area (m^2)	Region		
			MEA	PEA	Total
Office	146.4	41,019	183	2	185
Hotel	173.3	36,844	65	65	130
Hospital	148.8	31,918	37	42	79
Department store	381.6	29,530	52	30	82
School	93.9	19,810	3	6	9
Hypermarket	394.6	26,021	50	20	70
Condominium	118.3	26,697	40	4	44
Miscellaneous	139.6	38,481	11	15	26

Source: S. Chirarattananont

Summary information related to energy indices of each type of very large DBs.

Item	Office	Hotel	Hospital	Dept store	School	Hypermarket	Condominium	Misc
AC energy/AC area, kWh m^{-2} Y^{-1}	131.7	172.0	155.4	361.9	122.1	210.4	168.1	265.9
Light energy/used area, kWh m^{-2} Y^{-1}	27.1	34.7	30.0	129.4	19.3	81.6	18.3	34.0
Total energy/used area, kWh m^{-2} Y^{-1}	146.4	173.3	148.8	556.0	93.9	394.6	118.3	139.6
AC area/total area, %	65.7	66.9	54.5	85.9	26.6	69.8	47.3	19.7
AC energy/total energy, %	59.1	66.4	56.9	55.9	34.6	37.2	67.2	37.6
Light energy/total energy, %	18.5	20.0	20.2	23.3	20.5	20.7	15.5	24.4
OTTV, $W.m^{-2}$	62.9	55.7	52.7	45.3	53.4	36.3	50.0	51.4
RTTV, $W.m^{-2}$	28.4	23.4	30.6	20.9	33.8	22.9	17.4	21.0
AC performance, kW/RFT								
-split type	1.51	1.64	1.59	1.48	1.51	0.20	0.20	na
-window type	1.83	1.76	na	na	2.03	1.45	na	na
-package type	1.38	na	1.30	1.06	na	na	na	na
-chillers	1.02	1.09	0.75	0.71	1.07	2.08	na	na

Source: S. Chirarattananont

Values of input parameters for a model of department store, for three cases: base, code compliance, and economic.

Item	Dept Store			Office		
	Base	Code	Econ	Base	Code	Econ
Envelope						
OTTV (Wm^{-2})	43.6	40.00	20.60	62.9	50.00	33.40
RTTV (Wm^{-2})	17.6	12.00	12.00	28.4	15.00	15.00
Air-conditioning						
Chiller, COP	4.95	5.41	6.39	3.45	5.87	7.03
Other part, COP	5.02	7.03	8.79	5.00	7.03	7.03
System, COP	2.49	3.06	3.70	2.04	3.20	3.52
Lighting						
Lighting power density in A/C area, LPD_a ($W\ m^{-2}$)	27.30	18.00	14.00	17.11	17.11	14.00
Diversity factor lighting in A/C area, D_{fla}	0.80	0.80	0.80	0.80	0.80	0.80
Lighting in unconditioned space, LPD_u ($W\ m^{-2}$)	6.26	6.26	5.00	7.50	7.50	4.20
Equipment						
Equipment power density in A/C area, EQD_a ($W\ m^{-2}$)	19.50	19.50	18.00	31.10	31.10	29.55
Diversity factor for equipment in A/C space, D_{feu}	0.90	0.90	0.90	0.60	0.60	0.60
Equipment power density for un-cond space, EQD_u ($W\ m^{-2}$)	5.00	5.00	5.00	5.30	5.30	5.04
Occupancy						
Occupancy in A/C space (person per 10 m^{-2})	2	2	2	1	1	1
Diversity of occupants in A/C area, D_{foa}	0.80	0.80	0.80	0.95	0.95	0.95
Ventilation ($l\ m^{-2}\ s^{-1}$)	1.00	1.00	1.00	1.00	1.00	1.00
Night (off-time) light & security power, P_n ($W\ m^{-2}$)	2.95	2.56	2.56	2.056	0.483	0.483
Lighting ($W\ m^{-2}$)	2.25	2.00	2.00	1.614	0.085	0.085
Equipment ($W\ m^{-2}$)	0.70	0.56	0.56	0.442	0.40	0.40
Work hours, N_{oh}	4380	4380	4380	2340	2340	2340
Night (off-time) hours, N_{nh}	4380	4380	4380	6420	6420	6420

Source: S. Chirarattananont

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Values of energy consumption indices from building models.

Building type	Very large buildings, kWh m^{-2}			Large buildings, kWh m^{-2}		
	Base	Code	Econ	Base	Code	Econ
Office	146.4	98.7	82.3	147.5	115.0	99.3
Hotel	173.2	117.0	101.7	209.3	165.7	145.1
Hospital	148.8	123.9	112.0	158.8	139.9	122.7
Dep store	381.6	273.7	228.5	270.9	230.2	169.7
School	94.0	79.3	67.2	65.2	54.9	43.7
Hyper	394.7	300.9	248.7	391.0	315.1	240.6
Condo	118.4	105.3	92.7	146.6	126.6	115.4
Misc	139.7	117.2	100.0	117.6	85.9	67.5

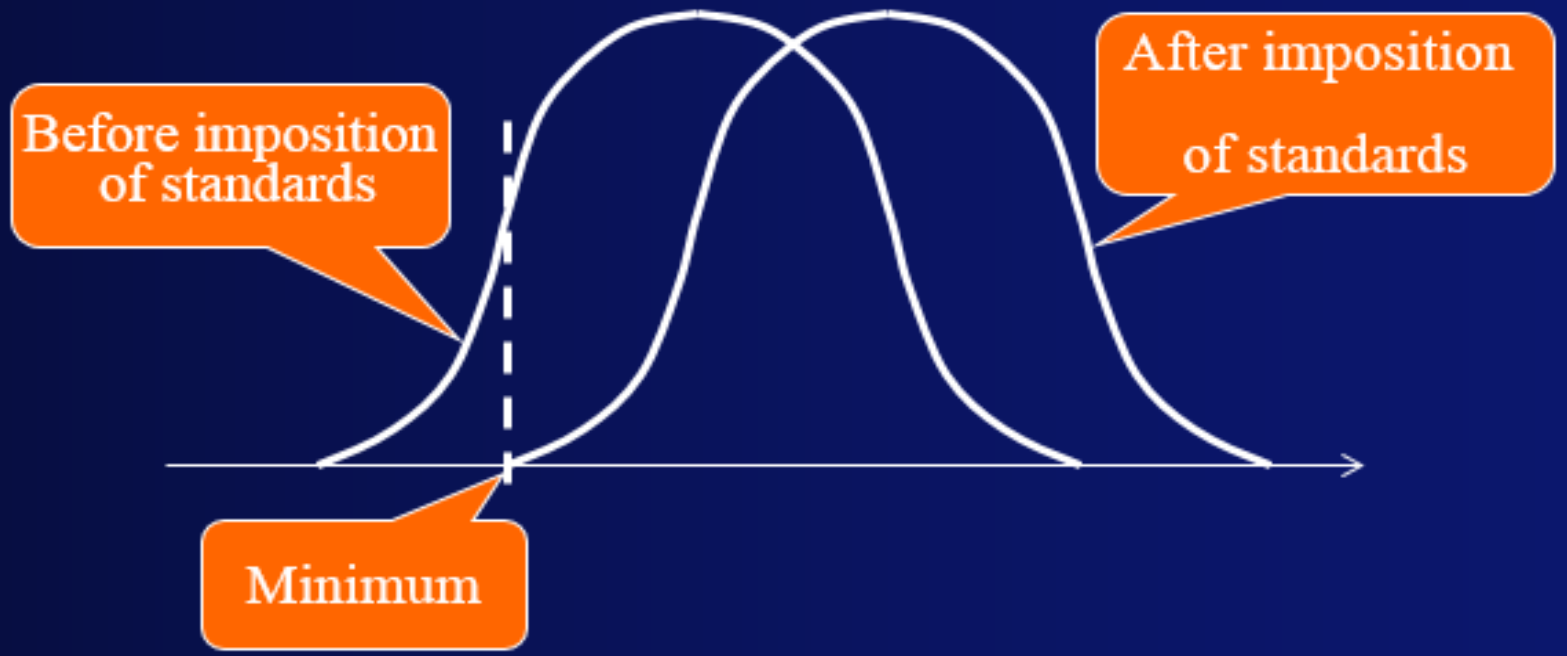
Energy and peak demand requirements of MEA and PEA and energy savings from very large and large buildings in 2021under the given assumption.

Total of MEA and PEA				
Total energy requirement, GWh	29,3489	Savings in year 2015	2.6%	7,715 GWh
Total peak demand, MW	45,990			1,641 MW
		Cumulative savings from 2010		78,346 GWh

Source: S. Chirarattananont

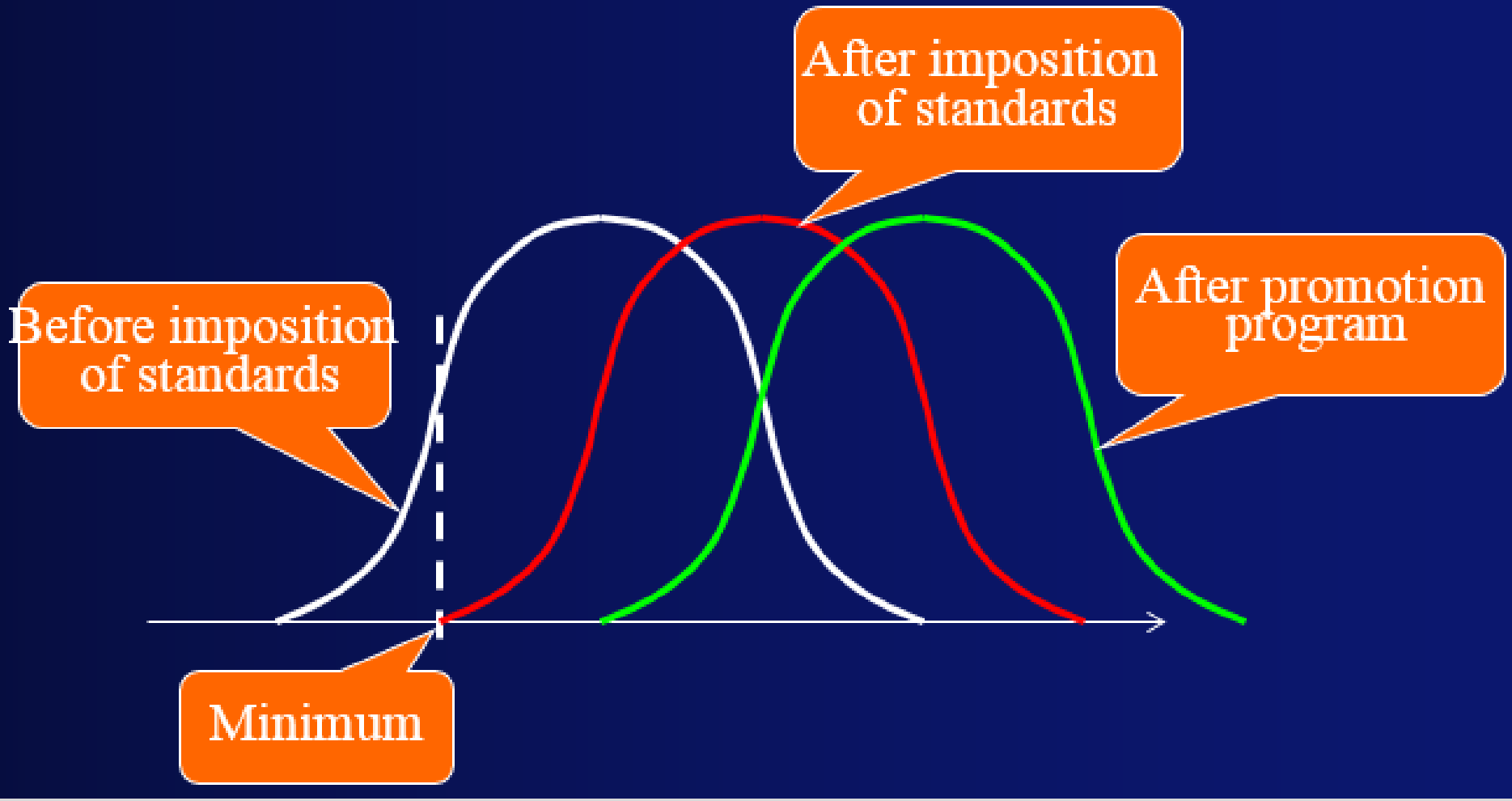
Mandatory and Voluntary Program for Market Transformation-a strategy

- It is believed that imposing minimum energy efficiency standards and promoting labeling (energy efficiency labeling) will transform the market towards more *energy efficient buildings and equipment*.
- The minimum energy efficiency standards requirement will eliminate appliances of low energy efficiency out from the market. This is a *push-market* action.



Mandatory and Voluntary Program for Market Transformation-a strategy

- Promotion will *pull* the market towards adopting more efficient products further.



Design processes

1. Programming phase
2. Concept design phase
3. Schematic Design
4. Design Development phase
5. Contract/Construction Documents Phase
6. Tender
7. Submittals
8. Construction Administration Phase
9. Post construction –commissioning/programming

Organizations in design and construction processes

Source: Sathian Charoenrien
Dept of public work and town and planning

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Department of Public Works and T&C Planning	Building Control Act, T&C Planning Act, Earth Excavation-Fill Act
Department of Industrial Works	Factory Act
Department of Land	Land Code, Condominium Act, Immovable Property for Commerce and Industry Act
Pollution Control Department	National Environment Quality Act
Thai Industrial Standards Institute	Industrial Products Standards Act
Department of Energy Development and Promotion	Energy Conservation Act
National Housing Authority	National Housing Authority Act
Department of Internal Trade	construction material price
Local Administrations	i.e. Bangkok Metropolitan Administration

Source: Sathian Charoenrien
Dept of public work and town and planning

Technical Services

(1) Dept. of Public Works and T&C Planning
(2) Fine Arts Department
(3) Educational Institutes

Material/Product

(1) Thai Industrial Standards Institute
(2) Agencies created by specific laws

Public Utilities

Metropolitan Waterworks Authority, Provincial Waterworks Authority	Waterworks
Metropolitan Electricity Authority, Electricity Generating Authority of Thailand	Electricity
Telephone Organization of Thailand	Communication

Source: Sathian Charoenrien
Dept of public work and town and planning

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Associations/Private

Professional Associations

Association of Siamese Architects Under Royal Patronage	*Architects*
Thailand Interior Designer's Association	*Interior designers*
Landscape Architects Association	*Landscape architects*
Thai City Planner Society.	*City planners*

Property/Real Estate

(1) Housing Business Association
(2) Thai Real Estate Association
(3) Thai Condominium Association
(4) Thai Valuers Association
(5) Trade Association of Condominium

Construction

(1) Thai Contractors Association
(2) Thai Electrical and Mechanical Contractors Association
(3) Thai Steel Constructors Association

Bangkok Arena—government project
Bangkok own indoor arena 12,000 Seats
No facility manager know during design process yet
No clear owner or responsible department as a whole

The first energy-efficient indoor stadium in Thailand

Local integrity preservation

Thai local wisdom in design

Passive design

-Building orientation
-Evaporative cooling
-Double skin as shade
-Cool ambient temperature by water and tree
-Self-shading by zone design
-Daylight through skylight and side light via control
-EE skylight materials (Makrolon PC)

Active design
-Solar cooling 2000m2 for 150 RT for 3000m3 cool water tank
-A/C 3 x 500 RT
-PV 1MW on roof
-EE LED light

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Drivers for success

- Mandatory measures
  - Minimum energy performance standards for equipment/appliances, buildings, etc
  - Regulating energy consumption in large buildings and factories
- Building certification systems that drive the market
- Promotional incentives
  - Grants, loans, tax, ESCO fund, subsidies, etc
- Awareness and behavior change
- Technology and integrated innovation design
  - Research and development
  - Demonstration facilities
  - Extra investment time and budget for R&D, green design processes and equipment for better operation
- Human resources and institutional capacity

Barriers to manufactures/suppliers

- Technical staff have inadequate know-how and design capability for EE equipment, products, installation and maintenance
- Lack of government supports or incentives on policy for providing R&D grant, tax, subsidy (subsidy already exists and should be more Attractive at the very beginning), etc.
- Lack of response of industry stakeholder for R&D
- Low market demand on EE products (from building owners)

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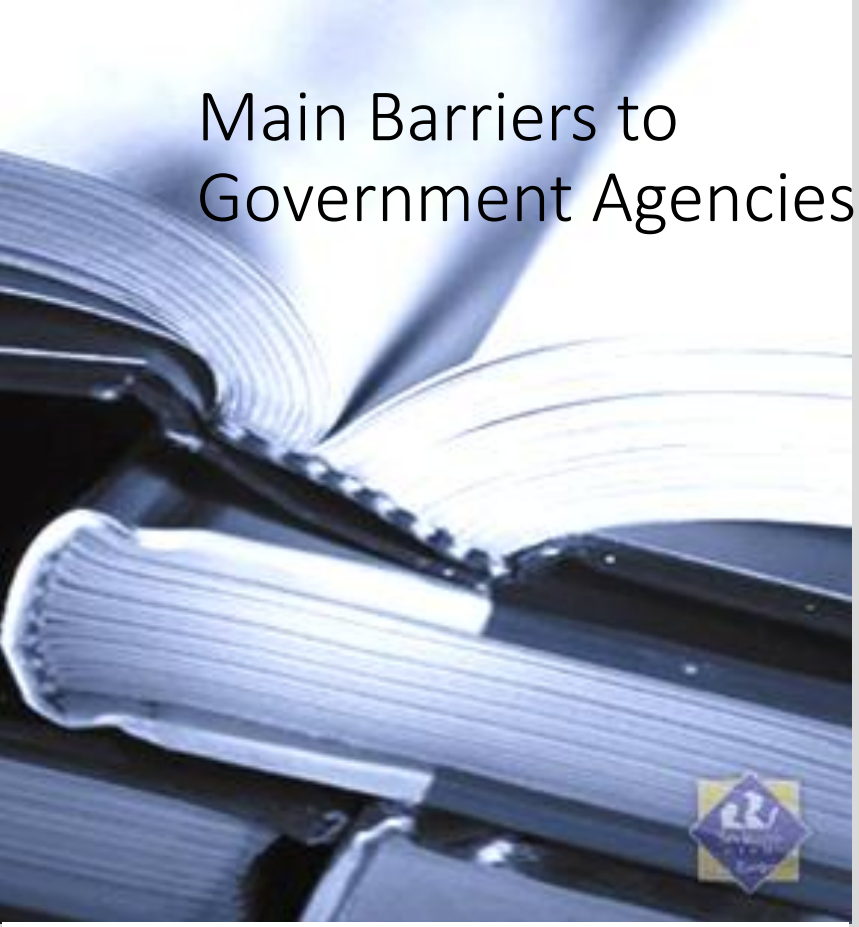
Main Barriers to Government Agencies



- Ministry of Energy lacks comprehensive policies and highly effective implementation plan on EE
- Ministry of Industry lacks comprehensive policies regarding to energy efficiency, thus only few standards of EE equipment or materials exist.
- There should be comprehensive regulations and code of practice in EE in buildings.
- Local administration office lack qualified technician for building management. Low awareness on EE buildings.

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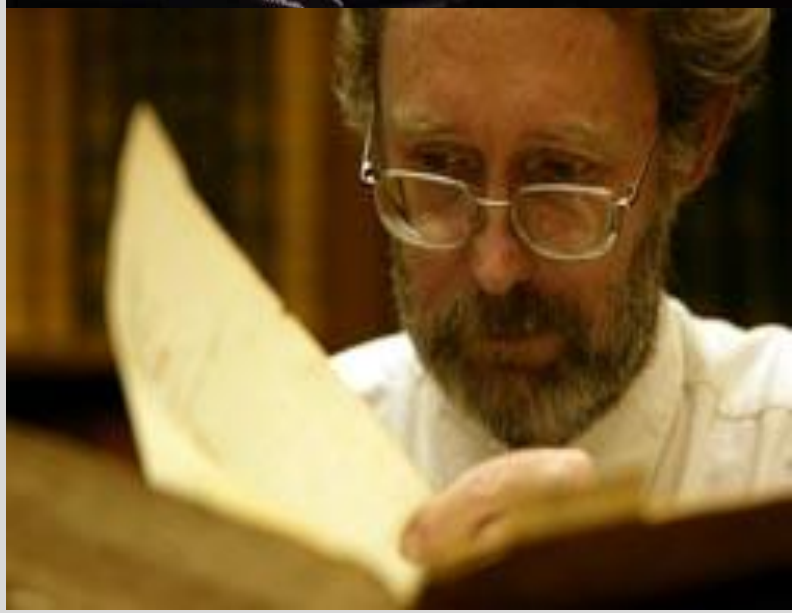
Barriers to EE in building Education

- Lack of knowledge center
- Lack of effective continuing study and training of academics and technical experts on integrated energy efficient technology.
- Limited human resources among professors
- Less awareness in the economic importance of efficient solutions.
- Inadequate laboratories and experimental equipment in the universities.



Barriers to Designers and Engineers

- Time consuming and limitation in designing/integrating energy efficient in building
- Lack of comprehensive and user-friendly design tool and demonstration facilities
- Limitation in access to know-how, information and resources in energy efficient design
- No incentive for design fee to invest time and effort for EE design and specification

Needs/Opportunities

- R&D and implementation on Zero or Plus Energy Buildings for hot and humid climate (non-residential and residential buildings)
- Innovative building design strategies and demonstration buildings (less fear and confirmation of design as a holistic approach)
- Development of building materials, lighting
- Government policies—code, regulation, incentives, solid GB certification operating system
- Smart control—human centered interface
- High efficiency equipment/appliances
- Energy simulation with LCCA tool (provide information for decision making)
- Communication and enhancement for knowledge accessibility among stakeholders also in tropical climate region.—brand awareness, sustainable architectural perception (healthier and better environment, aesthetic)and economic issues should be communicated.

Creativity for integrated and innovative design process (all stakeholders)

Training/communication/management/from building to community

You are keys for the future…

Thank you ….