



ASEAN cogeneration experiences

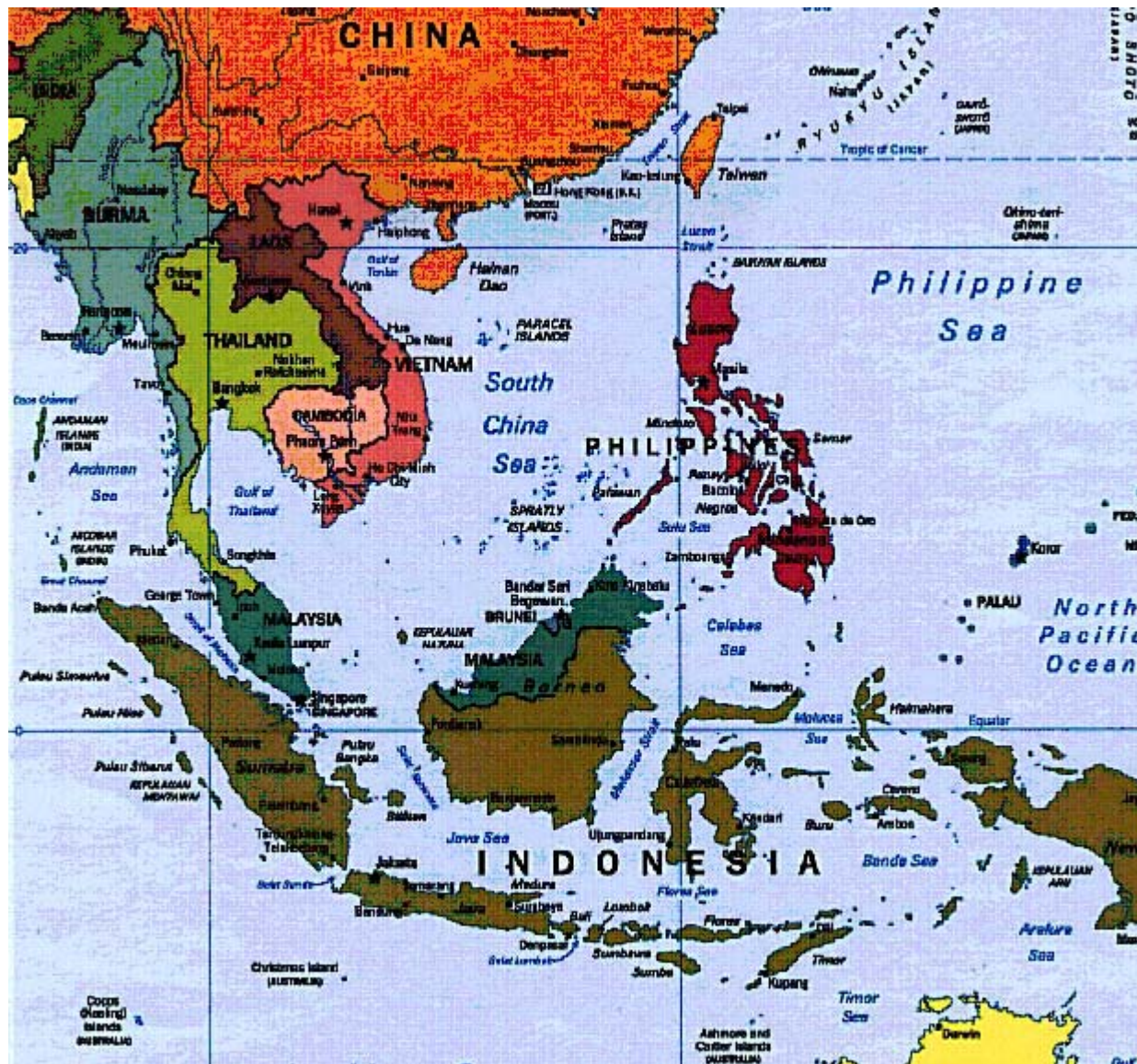
2004 Cogeneration Week in Vietnam
6 April 2004
Melia Hotel, Hanoi

Niels Beck-Larsen
COGEN 3 Biomass expert



Outline

1. ASEAN primary energy and EU Cogeneration achievements
2. Why cogeneration
3. Singapore, Malaysia and Thailand cogeneration development
4. WADE model
5. EU cogeneration directive
6. National Energy Policy Review
7. Conclusion
8. COGEN 3 - Policy activities 2004



ASEAN

**Population:
481 million ***

**Installed
Capacity:
82 GW ****

*http://www.stat.fi/index_en.html

**www.eia.doe.gov/emeu/iea/elec.html (1/1 2001)





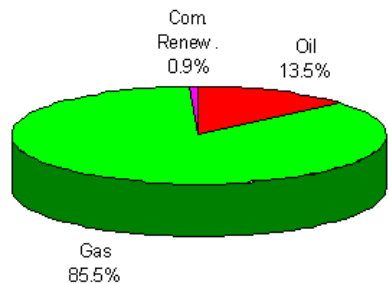
Brunei

Indonesia

Malaysia

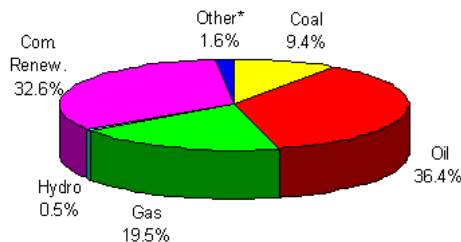
Myanmar

Energy Share of TPES in 2000



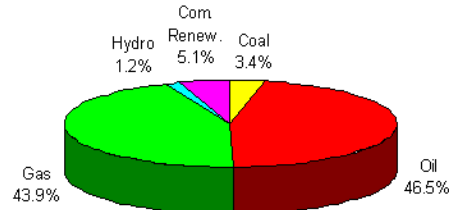
Excludes Electricity trade

Energy Share of TPES in 2000



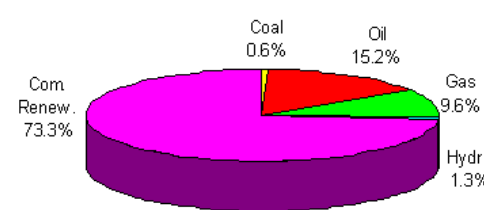
* Includes geothermal, solar, wind, etc.
Note: Excludes Electricity trade

Energy Share of TPES in 2000



Note: Excludes Electricity trade

Energy Share of TPES in 2000



Note: Excludes Electricity trade

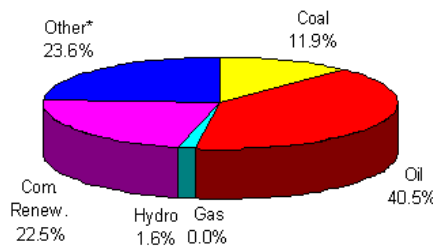
Philippines

Singapore

Thailand

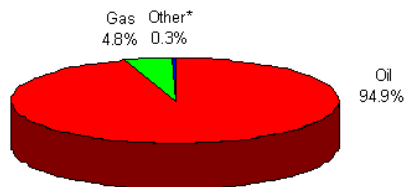
Vietnam

Energy Share of TPES in 2000



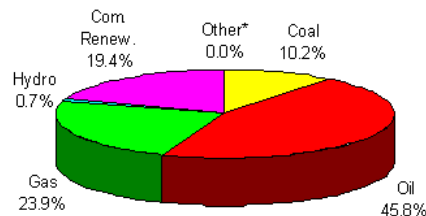
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Note: Excludes Electricity trade

Energy Share of TPES in 2000



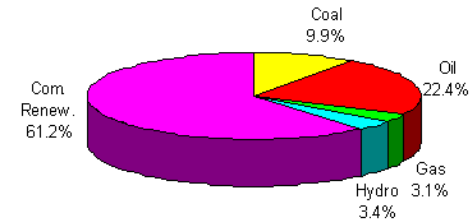
* Includes geothermal, solar, wind, etc.
Note: Excludes Electricity trade

Energy Share of TPES in 2000



* Includes geothermal, solar, wind, etc.
Note: Excludes Electricity trade

Energy Share of TPES in 2000



Note: Excludes Electricity trade





EUROPE (EC)

**Population:
377 million ***

**Installed Capacity:
541 GW ****

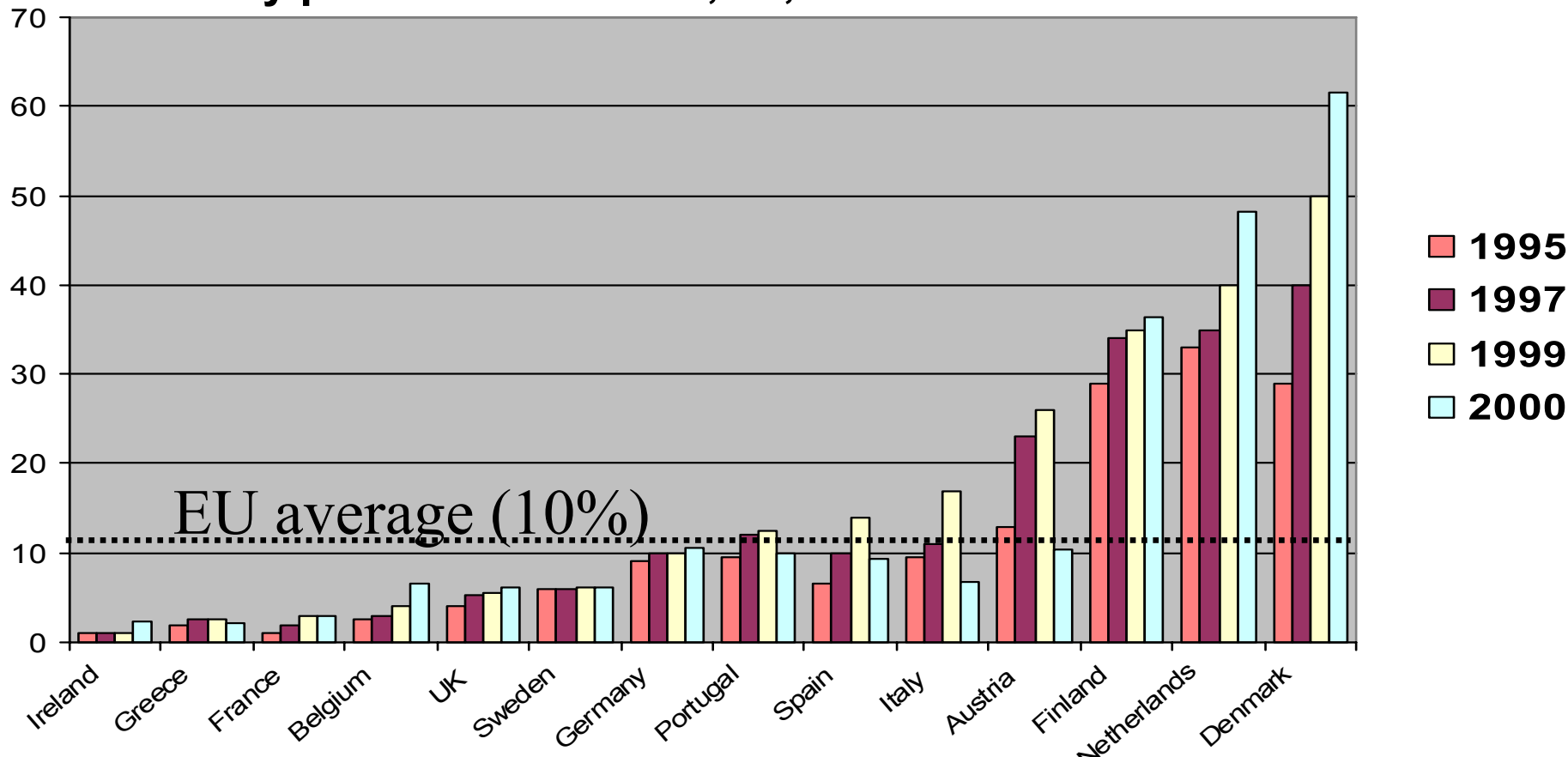
*http://www.stat.fi/index_en.html

**<http://www.cia.gov/cia/publications/factbook/>



Cogeneration in EU

% of electricity production in 1995, 97, 99 and 2000



2000 figures based on new methodology – see http://europa.eu.int/comm/energy_transport/etif/energy_electricity/cogeneration.html



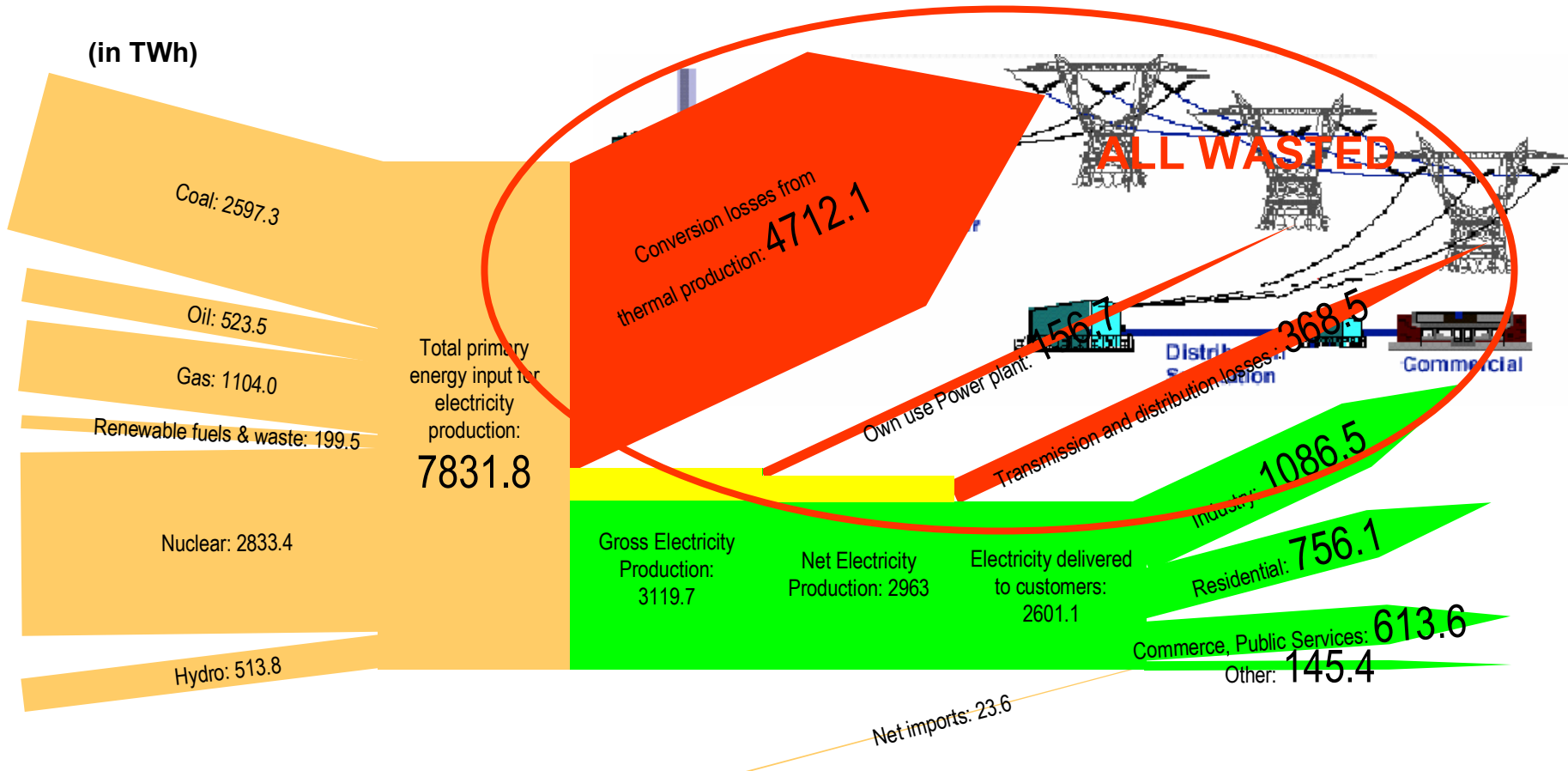
ASEAN Electricity Installed (GW) Capacity by Type, January 1, 2001

Region/Country	Thermal	Hydro	Nuclear	Geotherm/ Other	Total	COGEN share	
ASEAN countries rely on fossil fuels =>						13	60%
Cogeneration potential						16	36%
Sweden	7	16	9	0	33	6%	
ASEAN							
Burma	1	0	0	0	1		
Indonesia	17	3	0	1	21		
Malaysia	12	2	0	0	14		
Philippines	9	2	0	2	13		
Singapore	7	0	0	0	7		
Thailand	18	3	0	0	21		
Vietnam	2	3	0	0	5		

Source: www.eia.doe.gov/emeu/iea/elec.html

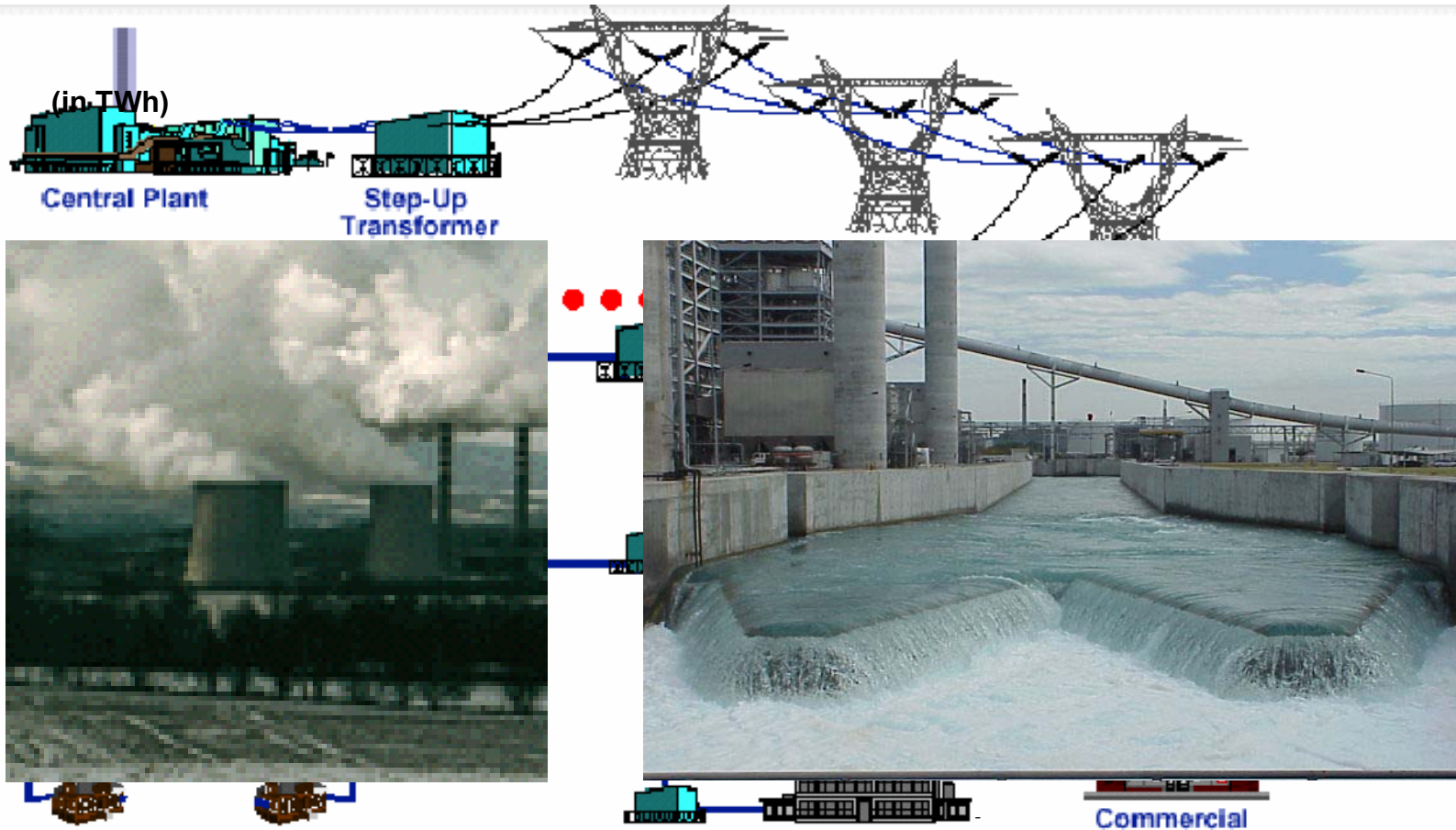


Electricity Generation in European OECD countries: What a Waste of Energy!



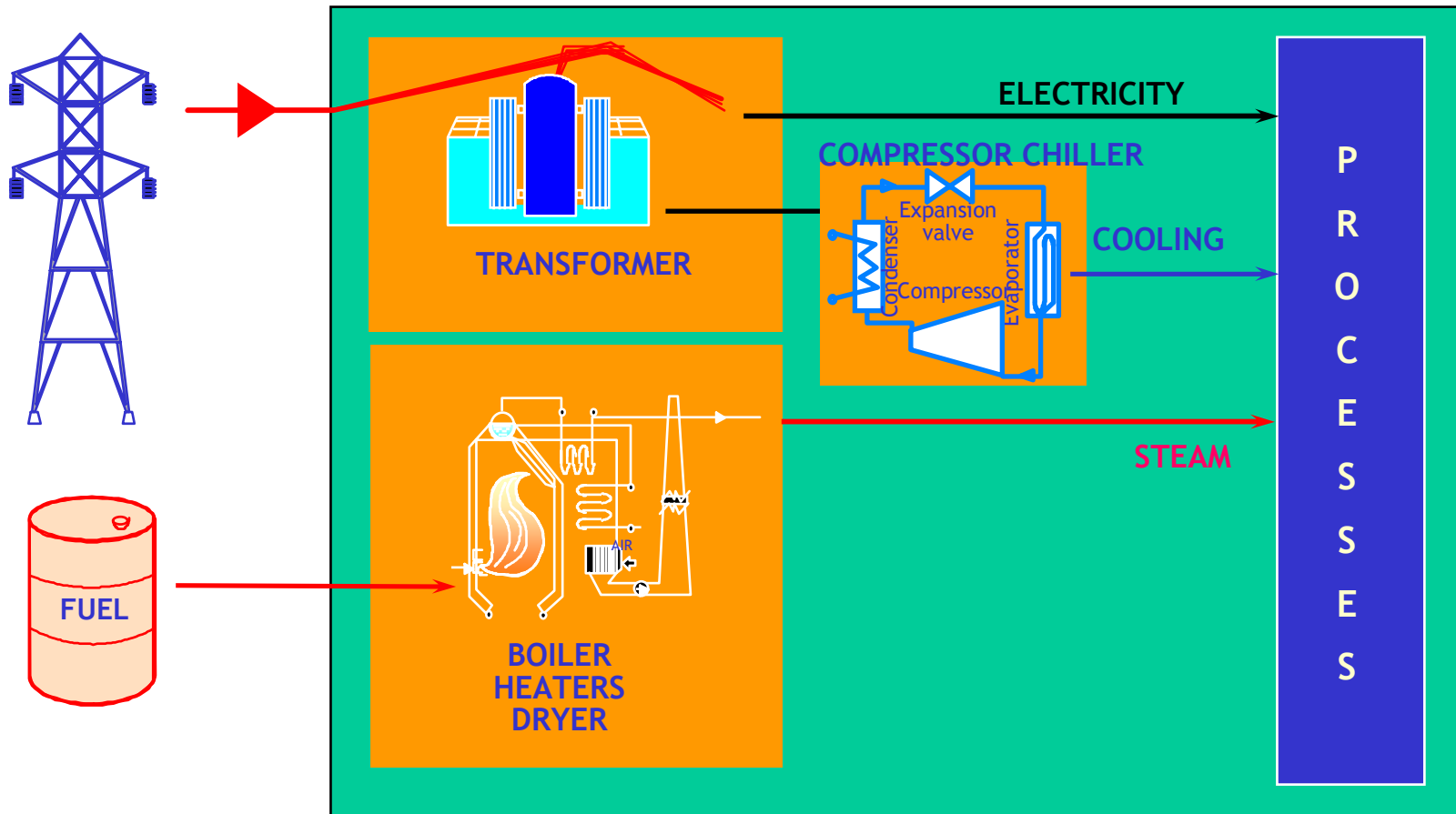
33% total efficiency of the electricity supply system

Central Electricity Generation

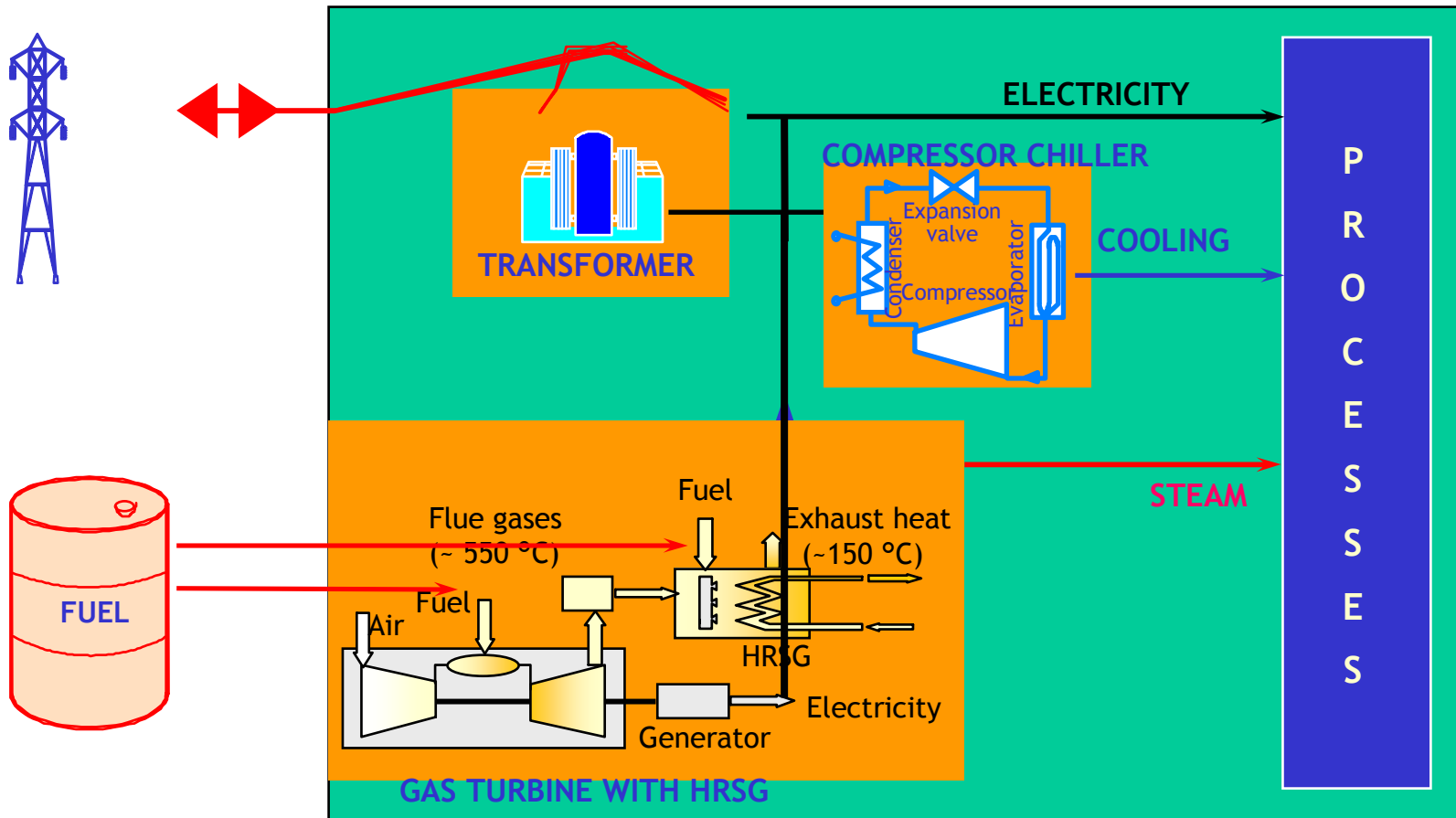


worldwide ~65% of fuel energy wasted directly

“Traditional” industrial or commercial unit



Cogen industrial or commercial unit



Typical Cogeneration Applications

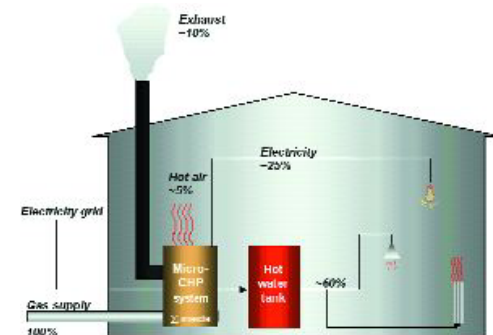
Industrial cogeneration

- wood and agro-industries, food processing, pharmaceutical, pulp and paper, oil refinery, textile industry, steel industry, cement industry, glass industry, ceramic industry



Residential/commercial/institutional cogeneration

- hospitals, schools & universities, hotels, houses & apartments, stores & supermarkets, office buildings



District cooling /district heating cogeneration

- airports, office and commercial buildings, dwellings and houses





National Energy Policy Review



The EC - ASEAN Business Facilitator

National Energy Policy Review

Thailand



December 2003

National Energy Policy Review – Thailand

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National Energy Policy Review

Table 3.1: Policy making Institutions responsible for Energy related activities in Thailand:

THE ENERGY SECTOR			
The Policy Maker		The economic and technical regulatory functions related activities.	
Institution	Area of Jurisdiction	Institution	Area of Jurisdiction
Energy Policy and Planning Office(EPPO)	<ul style="list-style-type: none"> - To propose policies and plans, to develop energy sector of Thailand. - To determine energy conservation strategies and boundary of budget management for estimating energy conservation projects. - To determine strategies to improve and structure policies during lack of fuel oil circumstances. - Also formulate related policies as per energy laws laid by Thai ministry of energy 	Department of Alternative Energy Development and Efficiency (DEDP)	<ul style="list-style-type: none"> - To research, develop and promote renewable and alternative energy. - To promote the energy conservation. - To determine rule, standard and distribution of technologies of production, transformation, utilisation and energy conservation. - To inspect and estimate results of development and energy conservation promotion. - To operate the other related functions which follow by laws of energy policies.



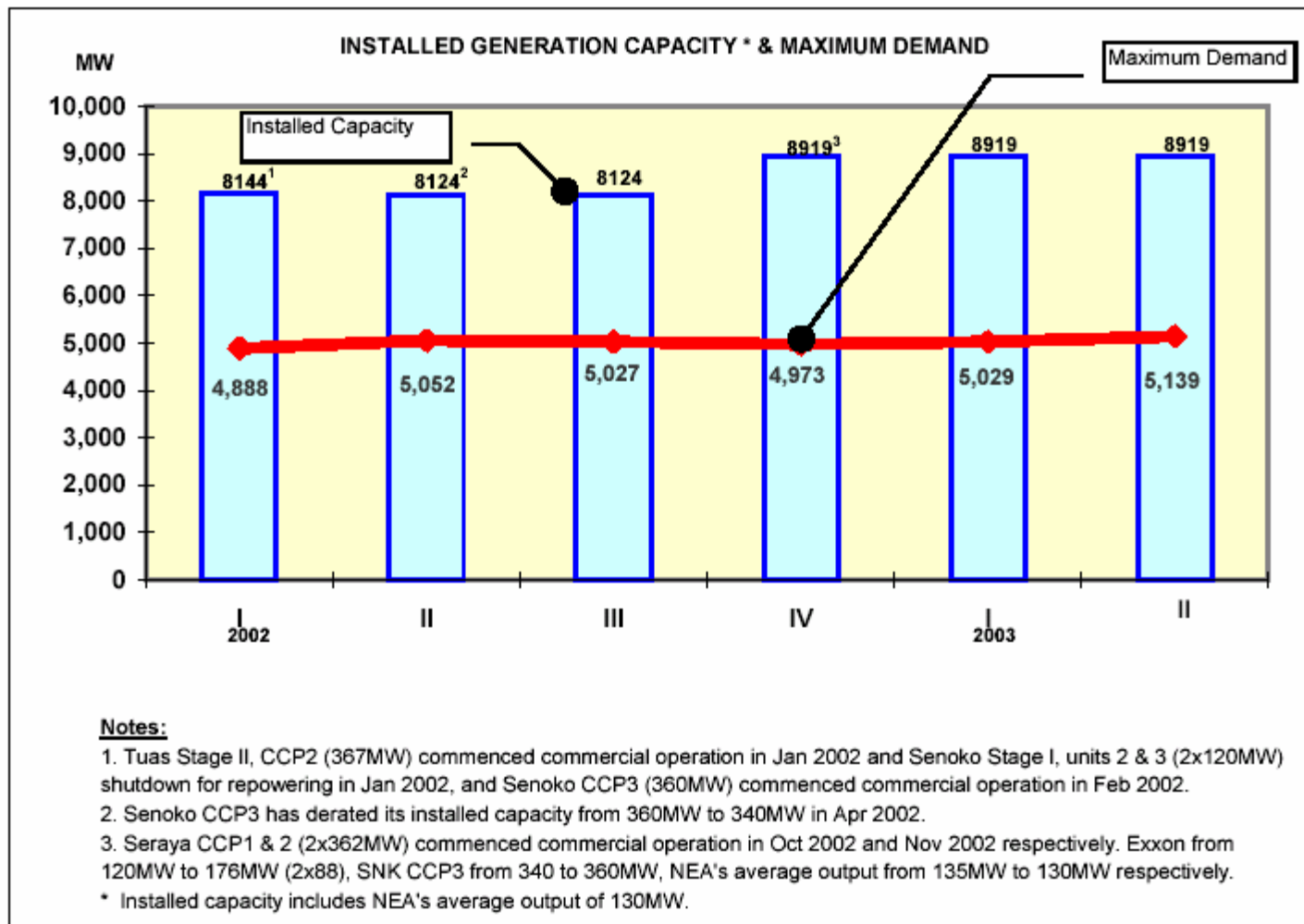


Singapore: Applications of Cogeneration

- SembCorp Cogen 900MW to serve petrochemical cluster on Jurong Island – today 600 MW in operation
- ExxonMobil 180MW for own use
- Singapore Syngas 20MW for own use
- Island Power 800MW – today 0 MW
- Keppel Merlimau Cogen 470MW
- 2 COGEN 3 supported FSDPs total 1.5MW using wood waste



Installed Capacity & Maximum Demand

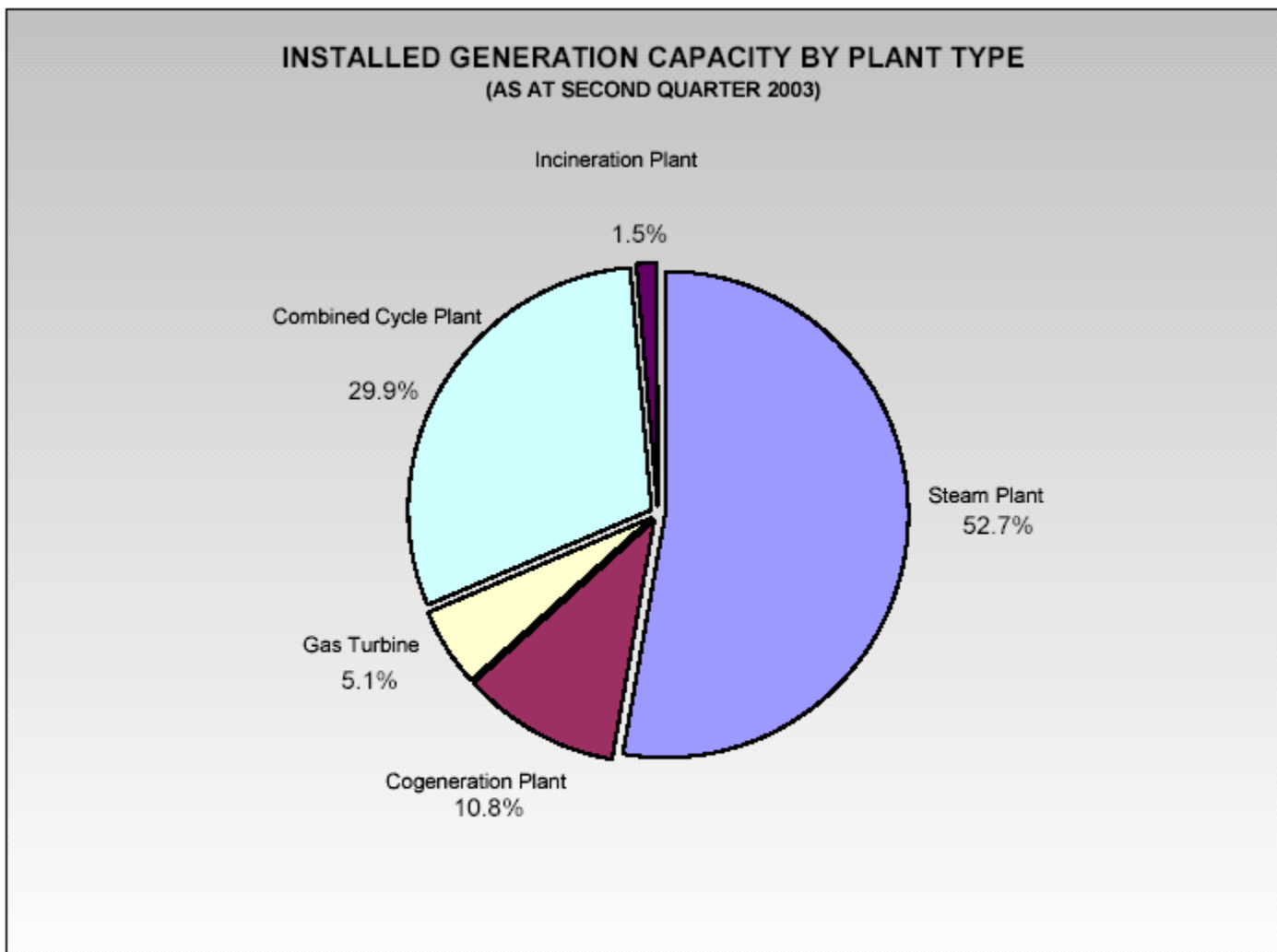




Future “Cogen share” of capacity in Singapore

Company	Capacity (MW)	Cogen (%)
Power Seraya	3,100	
Senoko Power	3,300	
Tuas Power	2,670	
SembCorp Cogen	600	5.6%
Island Power Company	0	0.0%
Singapore Syngas Pte. Ltd.*	20	0.2%
Exxon Mobil Asia Pacific Pte. Ltd.*	180	1.5%
Keppel Merlimau Cogen	470	4.0%
Elba Eastern (Pte) Ltd.*	50	
National Environment Agency	250	
TOTAL	11,740	11.9%

* exempt from New Energy Market rules



Note: Incineration plant refers to generation of electricity from refuse incineration by the National Environment Agency (NEA).



Prospects for further cogen applications

- Economic Review Commission's Sub-Committee on Manufacturing highlighted "utilities cost as consistently expensive in Singapore..." and recommended that "regulations around cogeneration and transmission and distribution charges be reviewed"
- Concerning the Electronics Industry Cluster it identified 7 Key Initiatives, among which: "Centralised co-generation facilities for wafer-fab parks that could generate cost savings..."
- "Review regulations to encourage co-generation. The chemical industry... are large consumers of electricity, while many petrochemical processes utilize large amount of steam, making the industry ideal for the use of highly efficient methods of power generation such as co-generation..."
- Similarly, for the Chemicals Cluster it listed 2 of 11 Key Initiatives as:
 - Review regulations to encourage more efficient methods of power generation including cogeneration
 - Ensure cost competitiveness of power, including reviewing transmission and distribution charges



Cogeneration in Malaysia

- Have existed in Malaysia for some time – especially in 90'ties IPP program
- 36 licenses issued – 13 public, 23 private
- ~350 palm oil mills
- Licensing from Energy Commission - under purview of Ministry of Energy, Communication & Multimedia
- District cooling is in - due to tropical climate



Cogeneration in Malaysia

Type

**Industrial
Cogeneration**

**Fully
Integrated
Cogeneration**

**District
Cooling
Cogeneration**

Area

**Pulp & paper, Palm
oil, Cement, Steel,
Glass, etc**

**Large industrial
complexes
requiring heating,
cooling &
electricity**

**Large commercial
complex or high
rise office buildings**

Examples

**Perwaja Steel,
Shell Refining,
Titan Petrochem.
350 palm oil mills**

**Petronas CUF,
Proton City**

**KLIA, KLCC,
KL Sentral,
Tractors Malaysia**



Cogeneration in Malaysia

- Fifth Fuel Policy formulated in 2001 to promote use of Renewable Energy (RE) – (in 8MP) together with energy efficiency (EE)
- Cogeneration is EE in supply and therefore encouraged – today most focus on RE
- Cogeneration using RE is especially encouraged
 - Will reduce dependence on fossil fuels
 - Will help dispose agricultural and municipal waste
- SREP program supports biomass cogeneration – tariff contract for 21 years, tax allowance
- No direct policy support for natural gas and coal cogeneration



Malaysia examples of District cooling

District Cooling System with Thermal Energy Storage

- University Tenaga Nasional
- Bangsar Energy System
- Plaza Rakyat Energy System
- Bandar Utama Shopping Complex

District Cooling System with Cogeneration Plant

- Kuala Lumpur City Center
- New Kuala Lumpur International Airport
- Putrajaya Government Administration Center
- KL Sentral

Individual Building with Thermal Energy Storage

- TNB's Building at Bangi
- TNB's Building at Jitra
- TNRD Research Center



Cogeneration in Thailand: major programs

- 1. Power Purchase Programs from Small Power Producers (SPPs) - 1992-1997 and 2001**
- 2. Subsidy for Renewable Energy SPPs**
- 3. Very Small Renewable Energy Power Producers (VSREPP)**



SPP Program

- **SPP = Cogeneration or Renewables**
 - **Cogeneration SPP:**
 - **Fossil-fuel-based SPPs**
 - **Steam utilization rate >10%**
 - **SPPs using more than 25% gas/oil as fuel :
Efficiency >45%**
 - **Renewable SPP: May use up to 25% commercial energy**
- **Sale into EGAT's transmission system no greater than 60 MW (90 MW on a case by case basis)**
- **Direct sale to industrial estates near SPPs**



SPPs by Type of Fuel (as of July 2002)

Type of Fuel	Received Notification of Acceptance			Supplying Power to the Grid		
	No. of Projects	Generating Capacity (MW)	Sale to EGAT (MW)	No. of Projects	Generating Capacity (MW)	Sale to EGAT (MW)
Non-Conventional Energy						
Bagasse	21	448.80	102.20	17	365.50	88.70
Rice Husk	3	24.90	18.80	1	6.00	5.00
Rice Husk/Wood Chips	5	137.30	85.10	4	134.80	82.90
Black Liquor	1	62.80	29.50	-	-	-
Municipal Waste	2	3.54	1.94	1	2.50	1.00
Waste Gas	2	19.00	12.00	-	-	-
Total	34	696.34	249.54	23	508.80	177.60
Commercial Energy						
Natural Gas	21	2,694.31	1,543.00	18	2,081.31	1,353.00
Coal	4	392.20	196.00	4	392.20	196.00
Oil	1	10.40	9.00	1	10.40	9.00
Total	26	3,096.91	1,748.00	23	2,483.91	1,558.00
Mixed Fuel						
Waste gas/Oil/Coal	1	108.00	45.00	1	108.00	45.00
Black Liquor/Coal	1	40.00	10.00	1	40.00	10.00
Coal/Eucalyptus bark	2	328.00	180.00	2	328.00	180.00
Total	4	476.00	235.00	4	476.00	235.00
Grand Total	64	4,269.25	2,232.54	50	3,468.71	1,970.60



SPPs (as of Jan 2004)

Type of SPPs	Exported to the grid	
	No.	MW
1. Cogeneration SPPs		
Natural Gas	19	1,413
Fuel Oil	1	9
Coal	4	196
Non-Conventional Fuels+Coal	3	190
Waste Gas	1	45
2. Renewable SPPs		
Non-Conventional Fuels (bagasse, rice husk, wood waste)	33	276
Total	61	2,129



3. Very Small Renewable Energy Power Producers – “the VSREPP Program”

On 14 May 2002 the regulations on power purchase from VSREPP was approved.

- A VSREPP is defined as a generator with own generating unit;
- utilizing RE sources, agricultural and industrial wastes and residues, or by-product steam;
- selling no more than 1 MW of electrical power to a distribution utility.



VSREPPs (as of Dec 03)

Type of VSPP	Number of Submitted Requests	Maximum Capacity (kW)
PV Rooftop Systems	30	86.5
Landfill Gas	2	950
Wood Waste	1	90
Palm residues	1	NA
Biogas	5	NA
Rice husk	2	1000
Total	41	2,126.5



Cogeneration Policy in ASEAN

Country	Present Situation	Installed Capacity (MW)*	Forecasted Annual Growth of Power Demand	"Policy" on Cogeneration	Key Off Taker
Cambodia	No National Grid	160	~10%	Preparing Phase	EDC
Indonesia	Govt.- 56% Captive Power -40% IPP - 4%	23,425		IPP, Captive Power, Conservation	PLN
Malaysia	Govt. - 85% Private - 15%	13,760	6-10%	SREP, Cogeneration	TNB
Philippines	Govt. - 55% Private - 45%	14,700	~9%	Renewable Energy	RECS& NPC
Singapore	Power Pool	8,140		-	EMA
Thailand	Govt. - 60% Private - 40%	24,500	~10%	SPP, VSPP, Renewable	EGAT
Vietnam	Govt. - 90% Private - 10%	3,296	~13%	Preparing Phase	EVN



Market/regulatory barriers to Cogen

- Difficult to secure grid access on fair terms
- Inadequate competition in electricity markets
- Market rules which encourage inefficiency
- Opposition from powerful monopoly companies
- Inadequate price recognition of environmental and grid benefits
- Price and market uncertainty for investors
- Lack of awareness of benefits of Cogeneration
- No country has well-resourced cogeneration promotion organisations



ASEAN Energy Strategy Review – Summary I

- None of the ASEAN countries have today a direct active policy, legislation or support programme for cogeneration.
- Thailand supported in the 90es cogeneration in the SPP programme and cogeneration plants were implemented (contracts ongoing)
- Electricity sectors in ASEAN show substantial variation in terms of fuel choice, power prices, market structure and ownership
- Most of the ASEAN countries have started to implement a Renewable Energy development, where biomass cogeneration is supported in the legislation
- “Cogeneration Policy” is part of National Energy Policy which is often scattered between different agencies



ASEAN Energy Strategy Review – Summary II

- Thailand: SPP programme and VSREPP (<1MW),
- Malaysia: SREP programme
- Indonesia: 1 MW RE power plants
- Philippines finalising RE legislation
- RE programmes are under development in Vietnam and Cambodia
- Singapore is lacking a biomass/cogeneration policy



ASEAN Energy Strategy Review – Summary III

- Most ASEAN countries have indirectly a biomass cogeneration policy through biomass power and energy efficiency policy, legislation and support programmes
- Presently, none of the ASEAN countries have today an active policy, legislation or support programme for coal and Natural gas cogeneration
- No ASEAN country has initiated a cogeneration roadmap or a cogeneration directive similar to US and EU (and other regions in the world)



WADE model

Cost EU and US Electricity Supply 2020

- Cogeneration and distributed energy require less investments compared to traditional central electricity supply

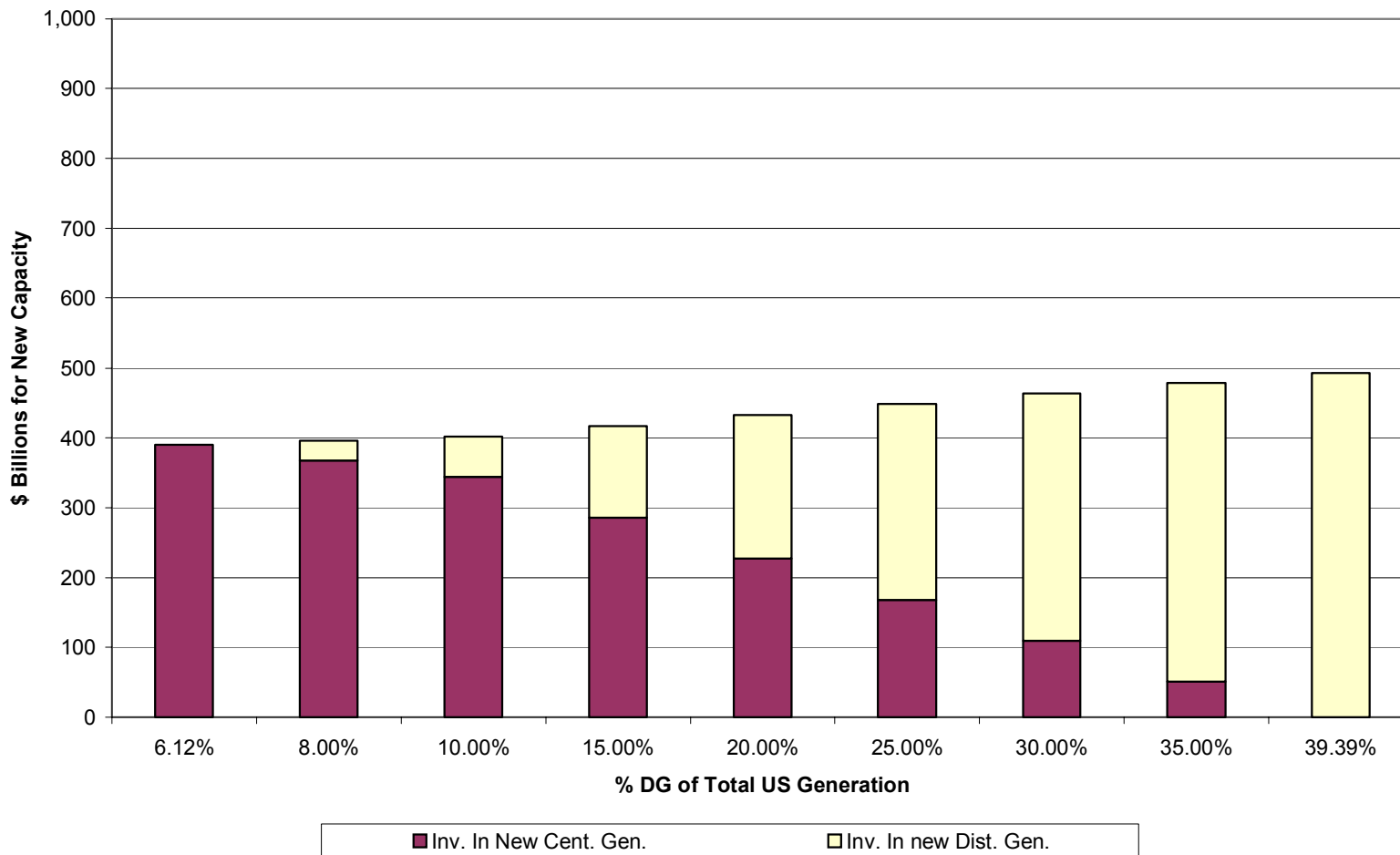
**IF YOU REMEMBER TO INCLUDE
TRANSMISSION AND DISTRIBUTION
INVESTMENTS**

Source: WADE



US – Electricity costs in 2020

Capital Cost to Supply 2020 Electric Load Growth

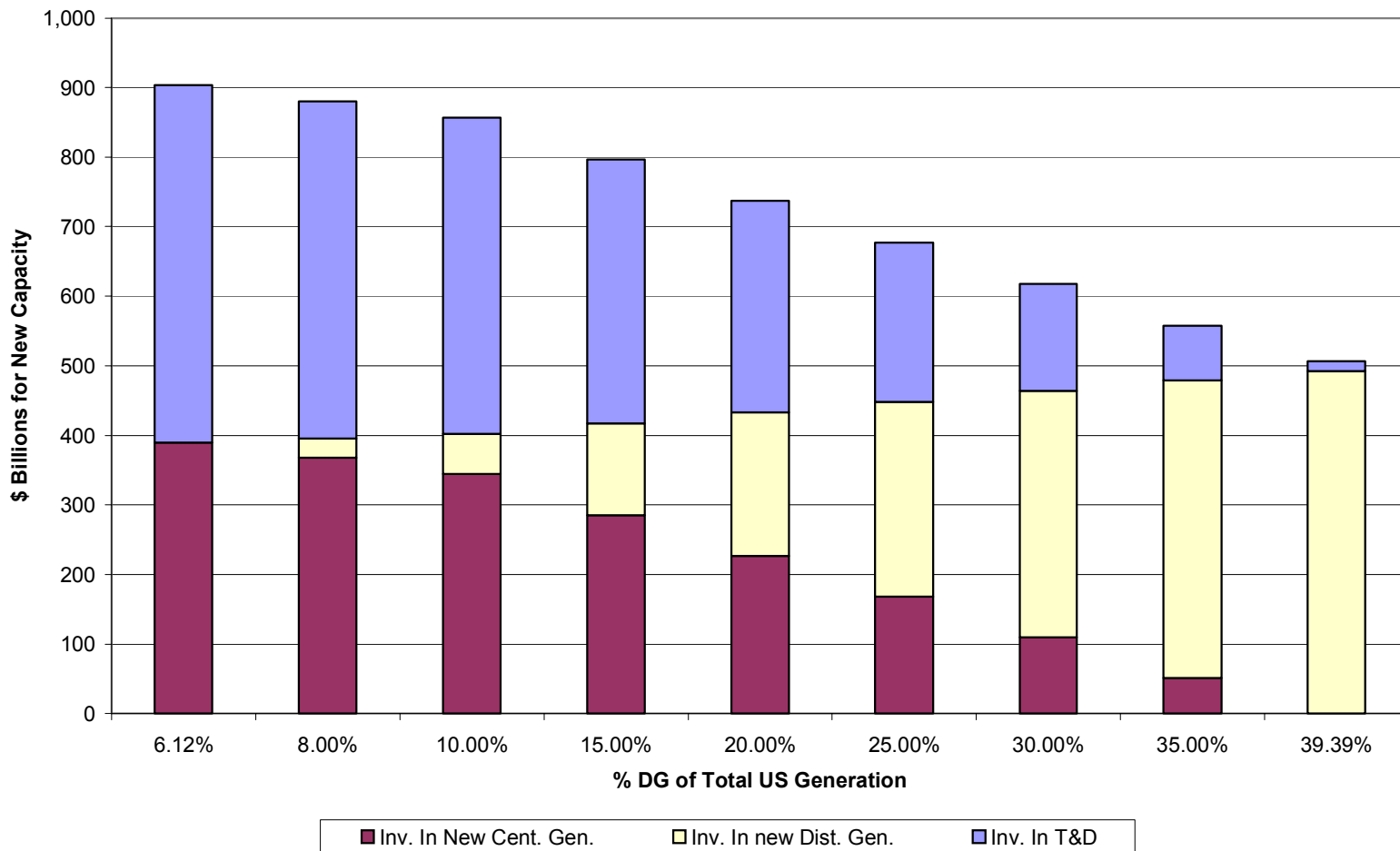


Source: WADE



US – Electricity costs in 2020

Capital Cost to Supply 2020 Electric Load Growth



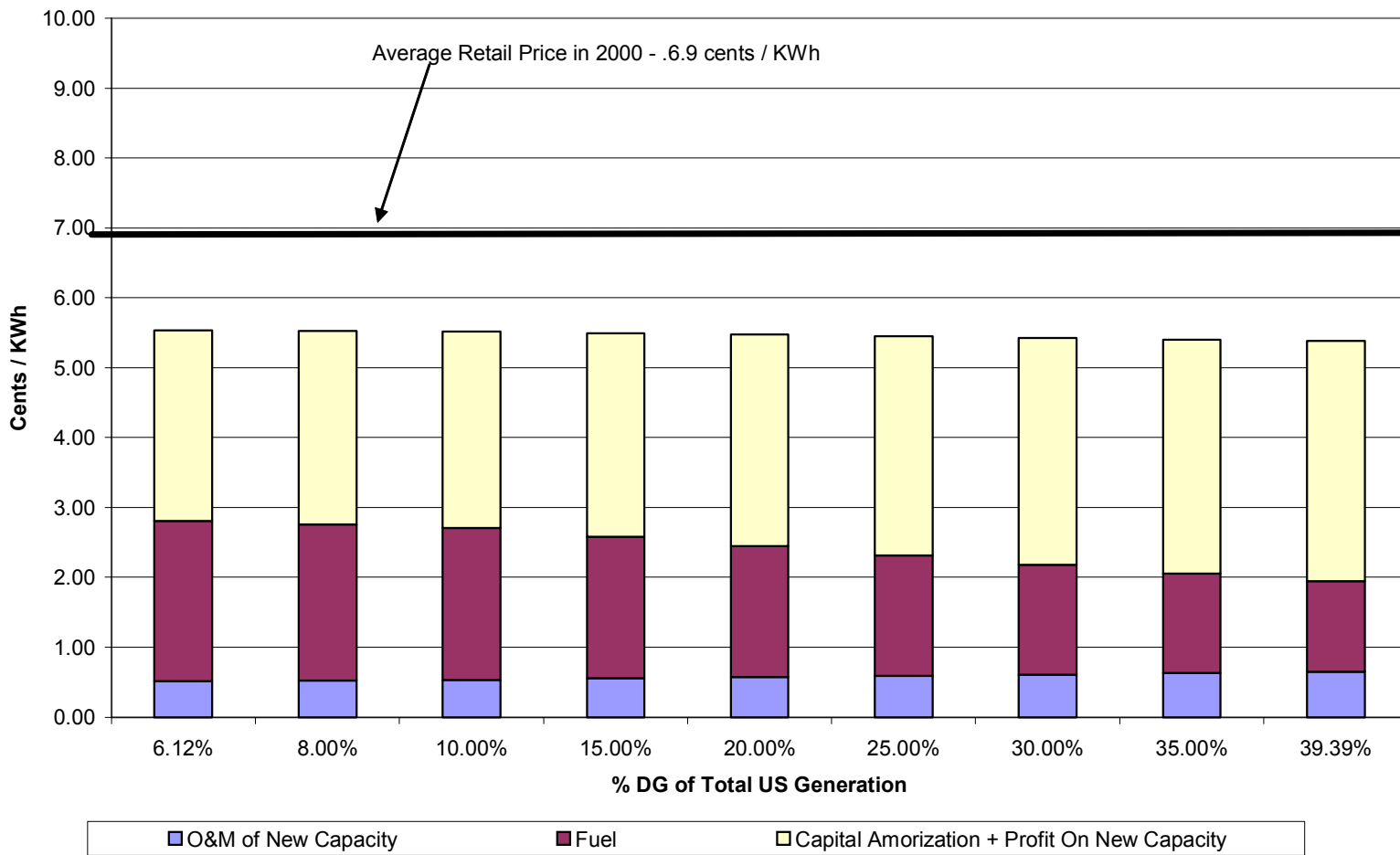
Source: WADE



US – Electricity costs in 2020

Retail Costs per KWh for Incremental 2020 Load

In 2000 dollars



Source: WADE

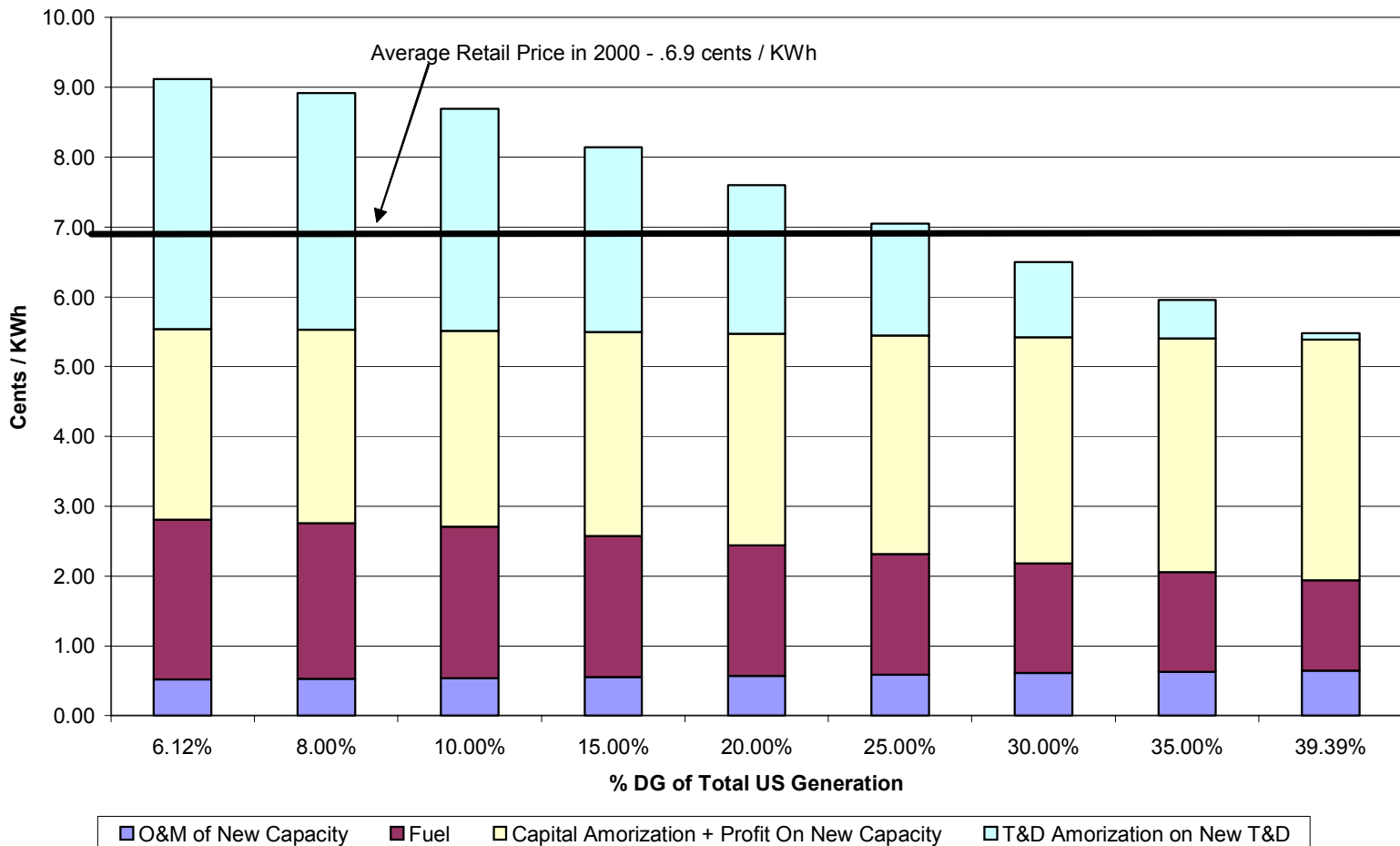




US – Electricity costs in 2020

Retail Costs per KWh for Incremental 2020 Load

In 2000 dollars



Source: WADE





European Commission Programmes on Cogeneration

- **EU's CHP goal – to promote highly efficient cogeneration**
 - In 1997 CHP Strategy - EU target to double the share of cogen from 10% to 18% of total electricity generation by 2010
 - The European Union is extremely dependent on its external energy supplies, increase of import from 50% today to 70% by 2030 if current trends persist.
 - EU CHP/cogeneration directive approved February 2004 in EU Parliament



EU - Reasons for political support

- A Community priority given the potential benefits of cogeneration with regard to **saving primary energy, avoiding network losses and reducing emissions** in particular of greenhouse gases (and contribute to meet the Kyoto targets).
- Efficient use of energy by cogeneration can also contribute positively to the **security of energy supply** and to the **competitive situation** of the **European Union**.
- Increased competition on electricity market because cogeneration allows new actors to enter the market.

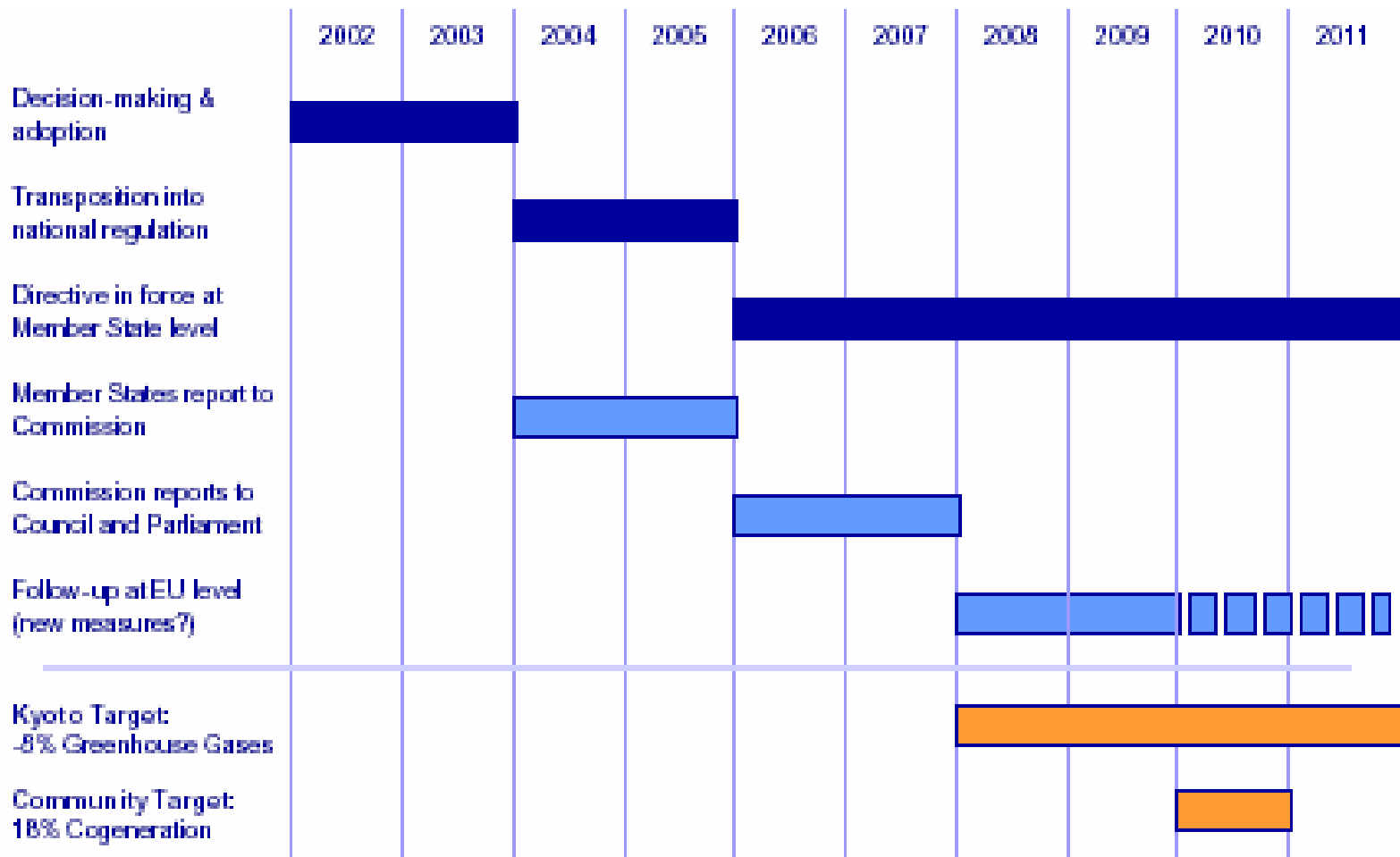


EU-Member state obligations

1. Member States shall establish an analysis of the national potential for cogeneration, including micro-cogeneration.
2. The analysis shall:
 - identify all potential for useful heating and cooling demands, suitable for cogeneration, as well as the availability of fuels and other energy resources
 - include a separate analysis of barriers, which may prevent the realisation of the national potential for cogeneration
 - in particular barriers relating to the prices and costs of and access to fuels, grid system issues, administrative procedures, and costs in energy prices
3. Member States shall every four years, evaluate progress towards increasing the share of cogeneration.



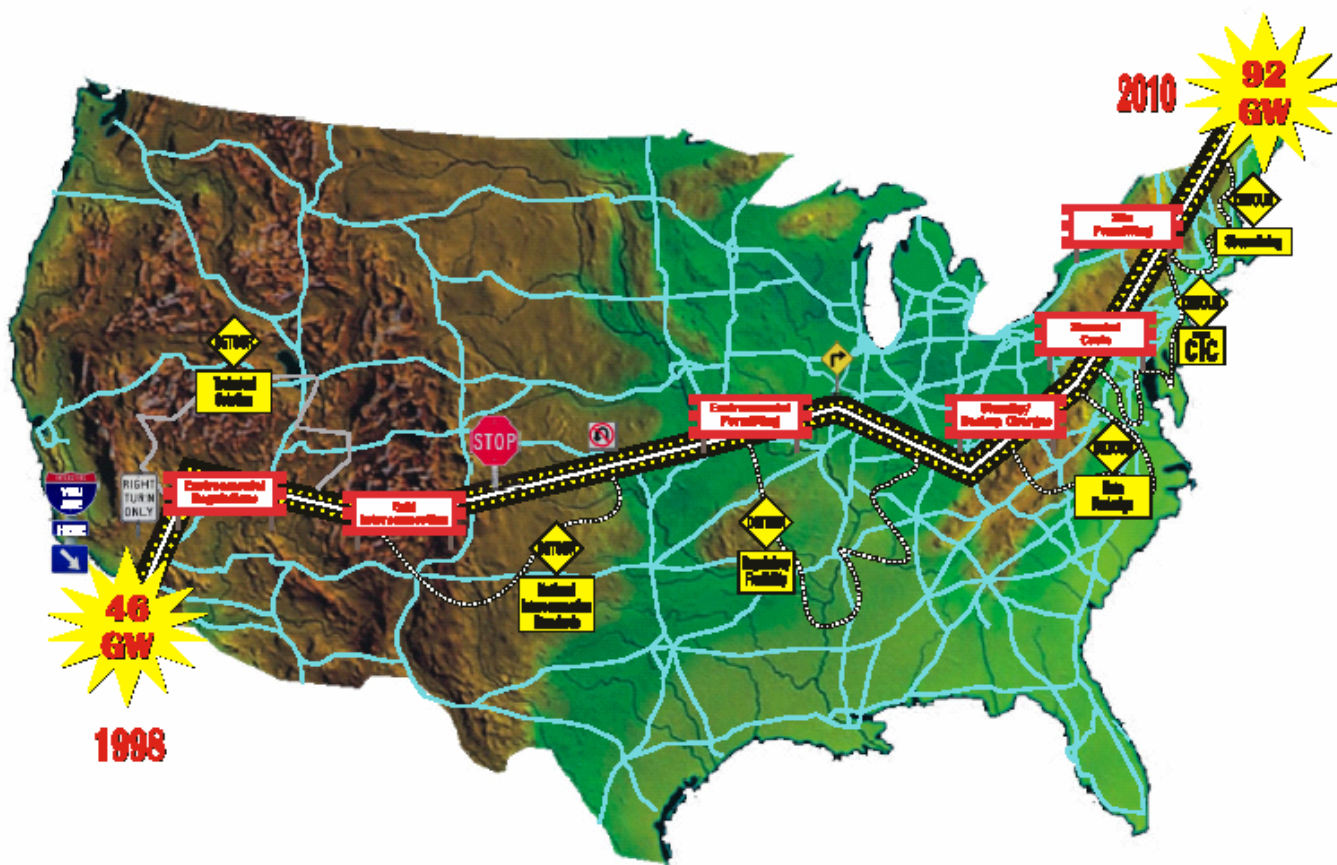
EU timetable for CHP directive





NATIONAL CHP ROADMAP

DOUBLING COMBINED HEAT AND POWER CAPACITY IN THE UNITED STATES BY 2010





Conclusions

- There is a need for a comprehensive Cogeneration Policy in the ASEAN countries – otherwise ASEAN will continue with energy waste at 50-70% directly in conversion
- Huge potential for Cogeneration but market conditions differ from one country to another
- The driving force for industry to invest in Cogeneration is lower energy cost. This force is independent of overcapacity present in some countries
- Financing largest obstacle for cogeneration investment despite market liquidity
- Fix tariffs and transparent interconnection cost speedup the cogeneration development



COGEN 3 - Policy activities 2004

- EU cogeneration policy study tour – Cogen Europe annual conference 26-27 February
- Update National Energy Policy Review – and prepare guidance for cogeneration development
- EU cogeneration policy study tour – in connection with Powergen Barcelona (24-28 May)
- Cogeneration weeks
- Individual policy meetings/seminars (incl. Brunei & Laos)
- ASEAN policy tour – expected in September / October
- WADE model – data collection and calculations for Thailand



For more information,
please visit COGEN 3 Website at:

<http://www.cogen3.net>

Thank You !