



“Nuclear Energy: What are the Options?”

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Opportunities with Alternative Energy
organized by the Nation

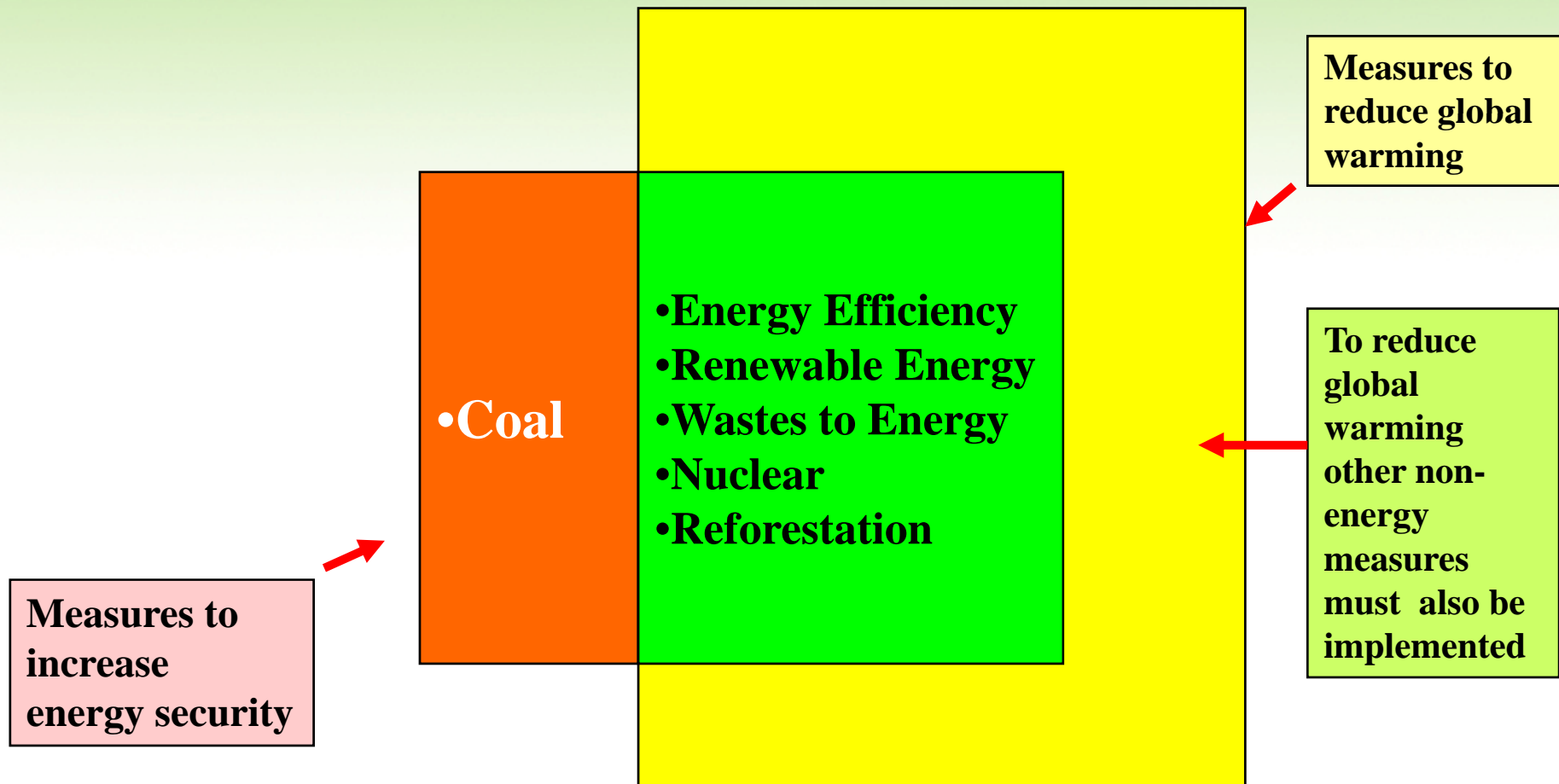
Bangkok, Thailand

22 May 2009





Threats facing the World: Energy Security and Global Warming



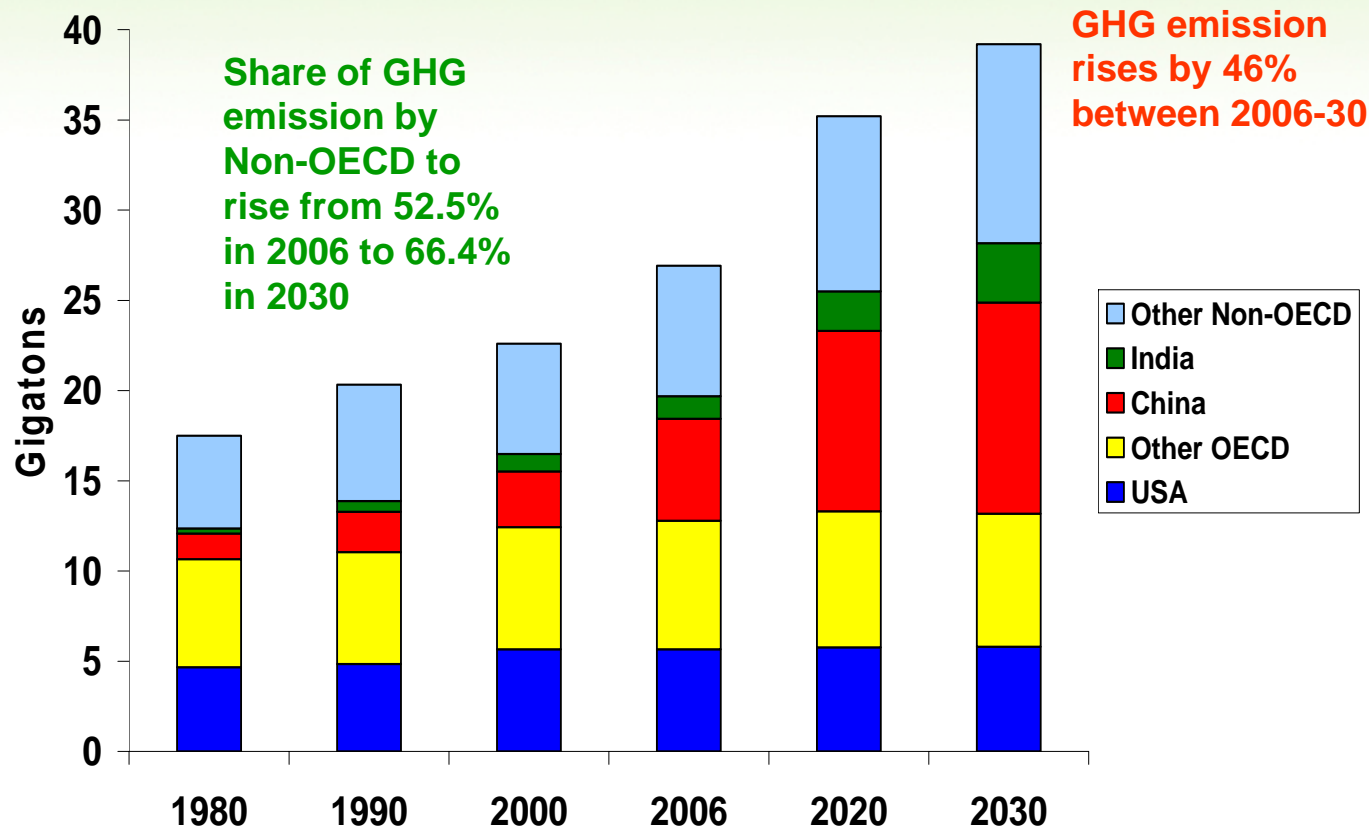


Global climate change is a real threat

• **Concentration of CO₂ to rise from 379 ppm to 1,000 ppm in 22nd century**

• **Global average temperature to rise from +1 deg. C pre-industrial level to +6 deg. C**

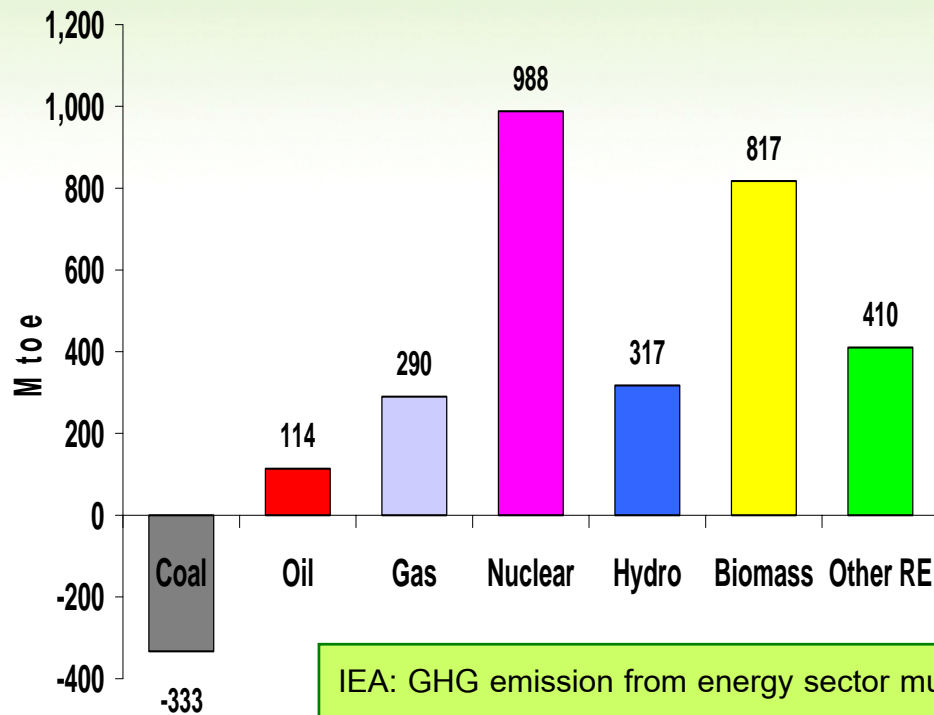
Energy-related CO₂ emissions by region in IEA's Reference Case





Drastic change in energy consumption needed to combat global warming

Change in World Energy Demand 2005-2030
(CO₂ stabilised at 450 ppm)

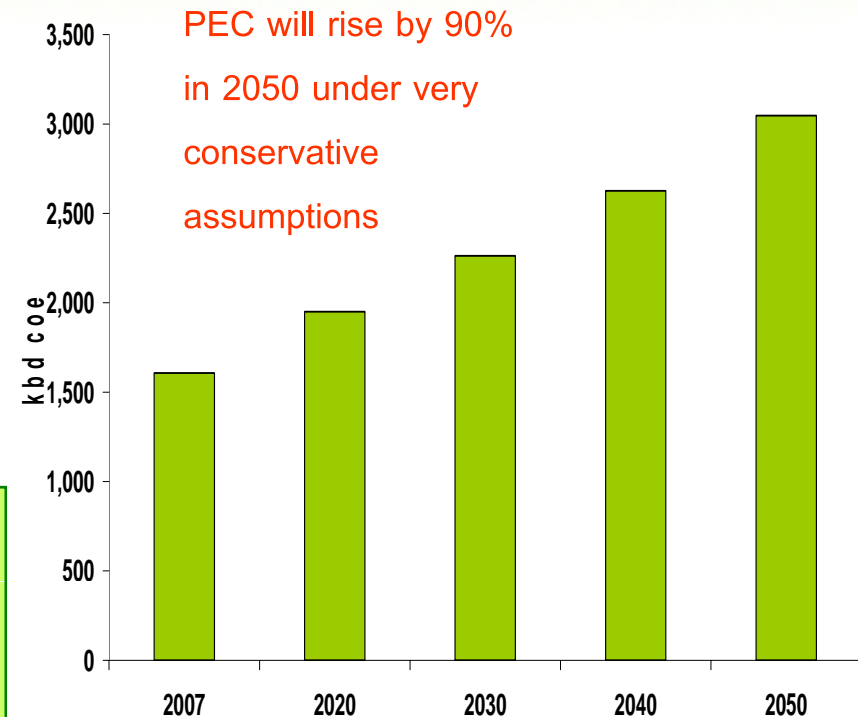


Source: IEA

IEA: GHG emission from energy sector must decline from 2012 with levels in 2030 and 2050 being lower than 2005 level by 13.5% and 48% respectively

This will be very tough for Thailand

Thailand's Primary Energy Consumption





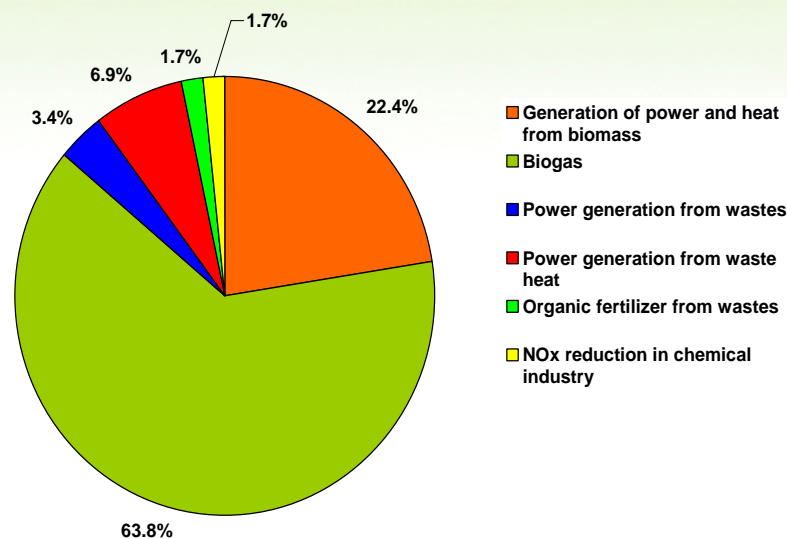
Thailand is not prepared to cope with global measures to reduce GHG

EMISSION OF CARBON DIOXIDE FROM FOSSIL FUELS IN 2005 & PRIMARY ENERGY CONSUMPTION (PEC) IN 2007

	CO2 Emissions		PEC
	Total (M.Tons)	Per capita (Tons/person)	Per Capita (Tons/person)
Australia	407	20.24	6.05
USA	5,957	20.14	7.98
Netherlands	270	16.44	5.59
Russia	1,696	11.88	4.85
S.Korea	450	10.27	5.34
Germany	844	10.24	3.77
Japan	1,230	9.65	4.06
UK	577	9.55	3.57
France	415	6.59	4.05
Malaysia	156	6.49	2.39
China	5,327	4.07	1.42
Thailand	234	3.65	1.33
India	1,166	1.07	0.37
World	28,193	4.37	1.72

Source: US DoE and BP

Thailand: CDM projects with LoA as of 2 March 2009

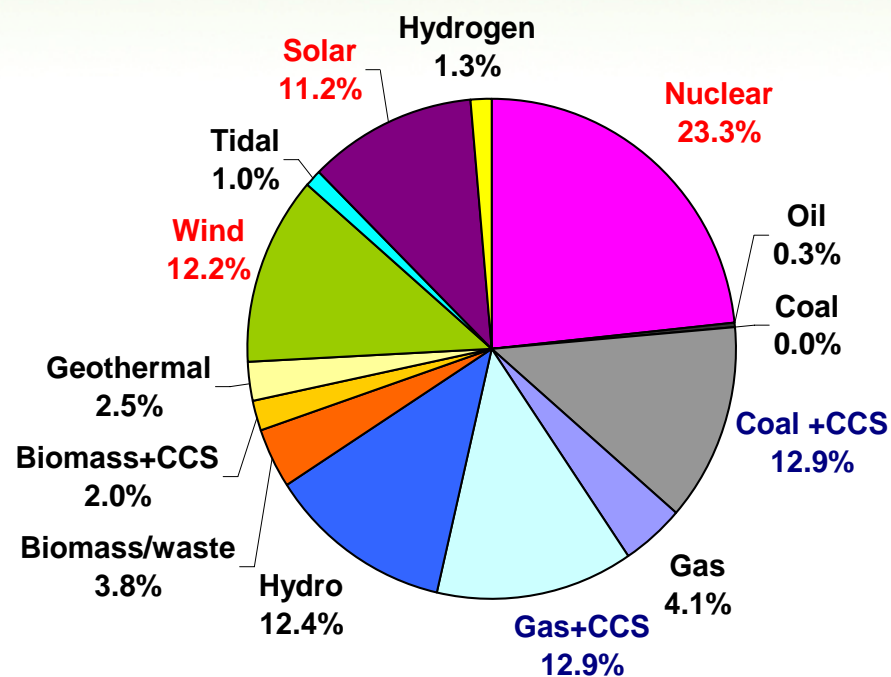


- 57 projects with LoA
- GHG reduction of 4.2 MtCO₂e/year



IEA's proposed global electricity production

Global Electricity Production by Type in 2050

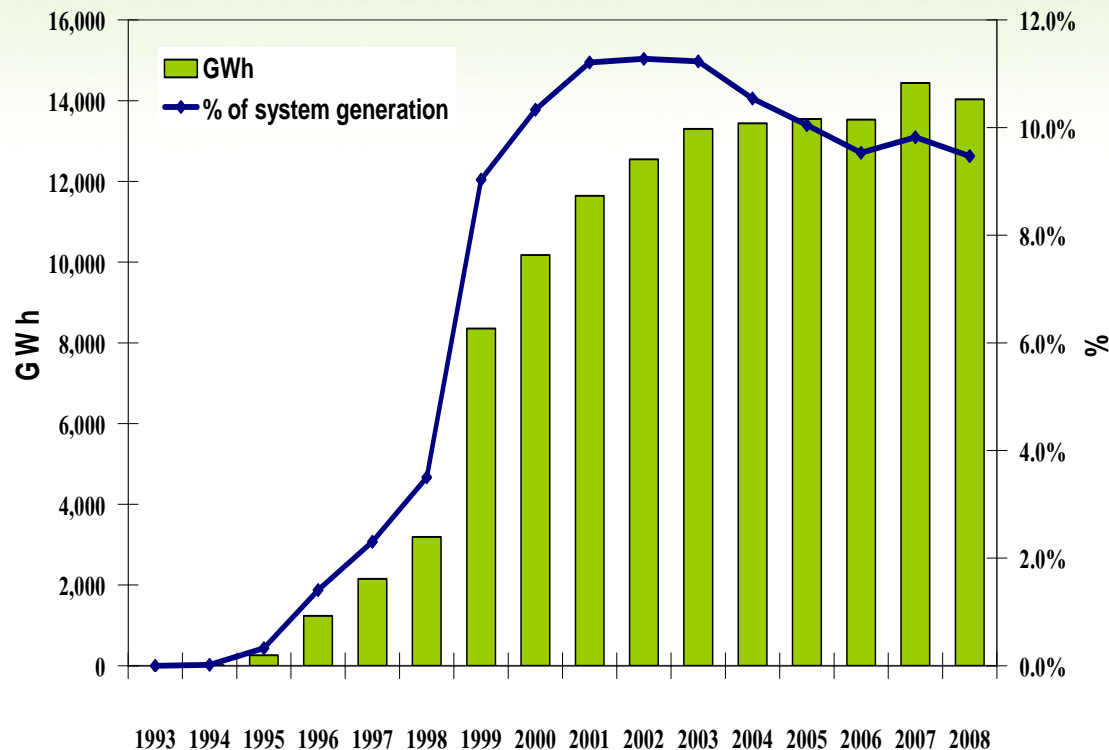


Source: IEA



CHP/DG has grown significantly in Thailand over the past 17 years

Power Purchase from SPP/VSPP



- **SPP/VSPP: regulations issued in 1993**
- **SPP/VSPP: cogeneration or generation of power from RE**
- **Most SPP/VSPP are CHP/DG**
- **SPP: sale of excess power to grid 10-90 MW**
- **VSPP: sale of excess power to grid < 10 MW**
- **Direct sale without using utility's wires allowed**
- **10% of national power supply is from SPP. But if direct sale is included, power generation from SPP/VSPP accounts for 16% of total electricity generation**



Price response by renewable energy is remarkable

สถานะ SPP/ VSPP ธันวาคม 2008	Projects Submitted			Projects Approved			Projects in Operation		
	Number	Gen. Capacity (MW)	Power Sale (MW)	Number	Gen. Capacity (MW)	Power Sale (MW)	Number	Gen. Capacity (MW)	Power Sale (MW)
Cogeneration/Fossil fuels	56	5,445	3,416	52	5,401	3,403	28	2,741	1,676
Non-conventional	1,324	10,101	8,347	580	3,704	2,578	145	1,269	621
Biomass	376	4,335	2,822	181	2,426	1,422	67	1,213	589
Wastes	53	240	212	21	119	101	4	6	3
Biogas	109	222	189	78	121	101	24	26	19
Solar	659	3,030	2,864	279	932	856	45	2	2
Wind	115	2,247	2,239	10	78	78	1	0	0
Hydro	9	7	7	8	6	6	2	0	0
Others	3	21	14	3	21	14	2	21	8
SPP- mixed fossil+non-conventional	4	476	233	4	476	233	4	476	233
Total non-conventional	1,328	10,577	8,580	584	4,180	2,811	149	1,745	854
Grand total	1,384	16,021	11,996	636	9,581	6,214	177	4,486	2,530



Biomass has become a valuable commodity

- **Potential for power generation: 4,400 MW**
- **Target: 3,700 MW in 2022**
- **Fuels: paddy husk, bagasse, woodchips, palm wastes, palm shell, palm branches, corn cob, straw, coconut fibre, black liquor**
- **SPP and VSPP projects in operation: 71 projects, generating capacity 1,689 MW, power sale to grid 822 MW.**
- **New projects: 309 projects with generating capacity of > 3,000 MW**

9 MW rice husk power plant



Woodchips becoming popular



Enormous wind potential in Northeast?

- **Potential: 1,600 MW??**
- **Target: 800 MW by 2022**
- **Current generating capacity: 3.5 MW (EGAT, MoE)**
- **VSP in operation: 1 project with generating capacity of 0.08 MW**
- **New projects: 114 projects with total generating capacity of 2,246 MW**

Sites for New Wind Farms

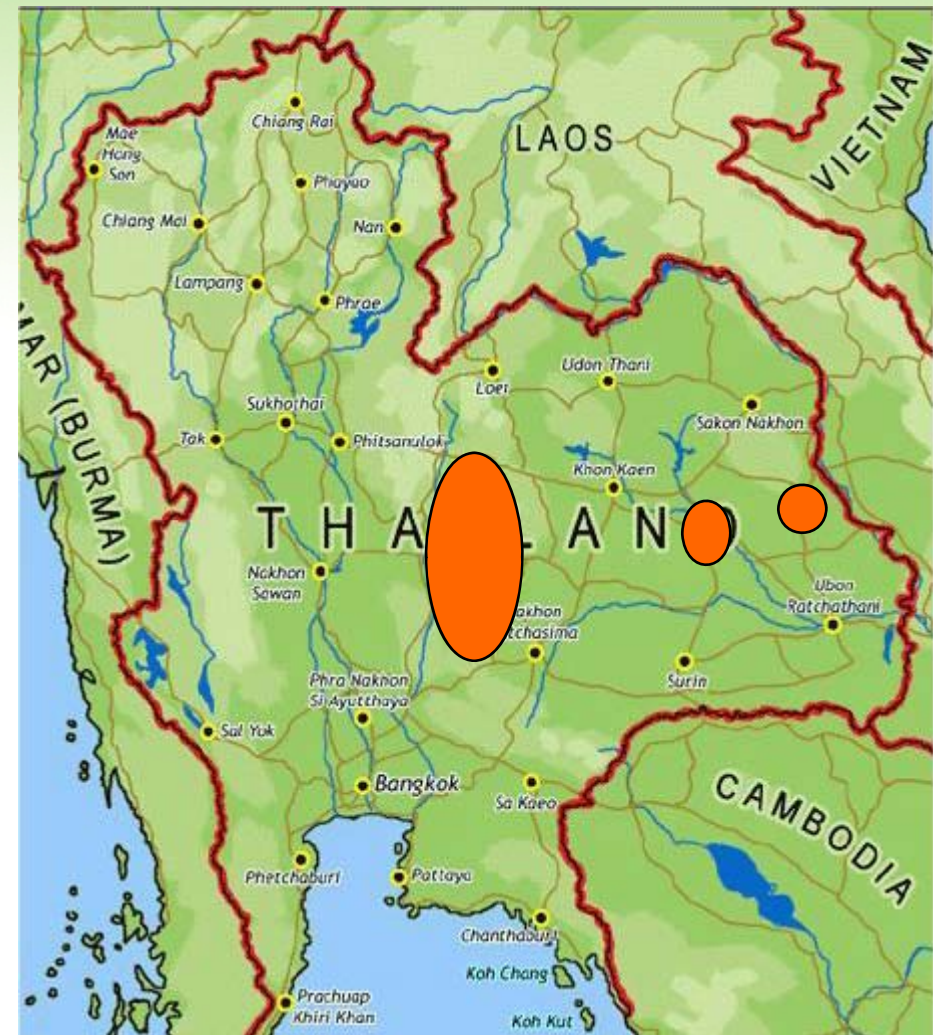
Petchabun

Nakornratchasima

Kalasin/Roi-ET

Chaiyaphum

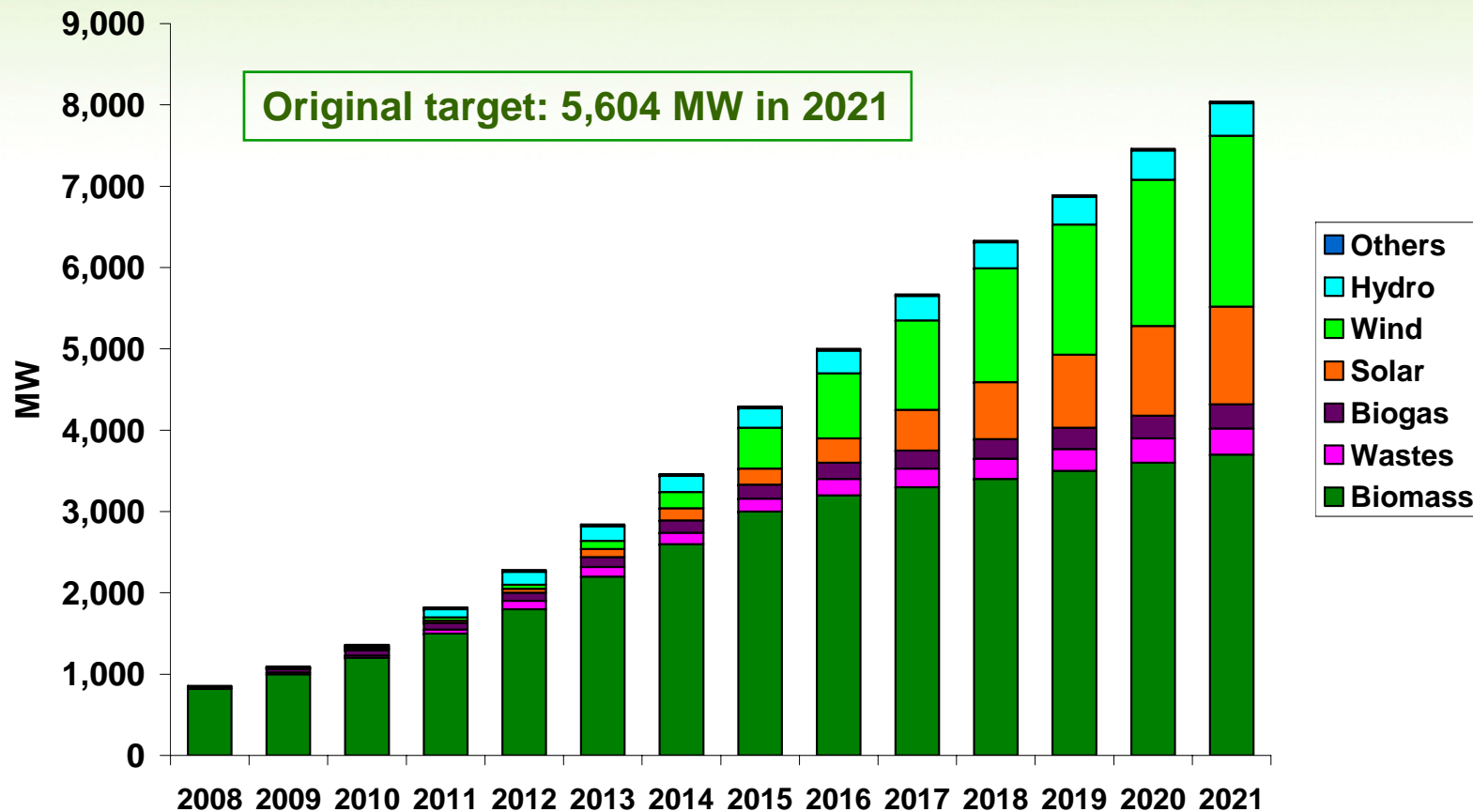
Mukdaharn





RE Target is far too low: 8,000 MW RE capacity is possible

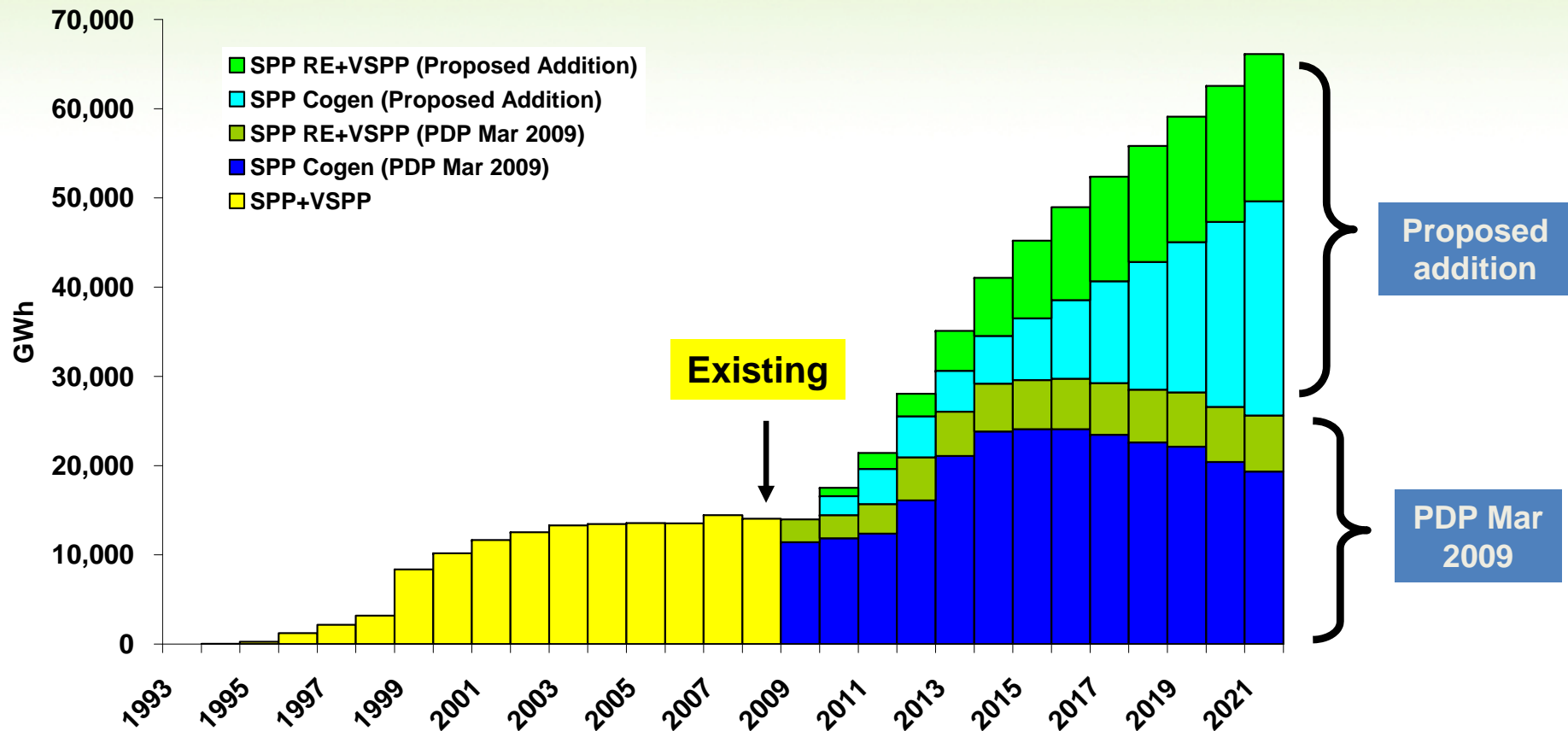
Proposed Power Purchase from SPP/VSP RE





EfE's proposed power purchase from SPP/VSPP

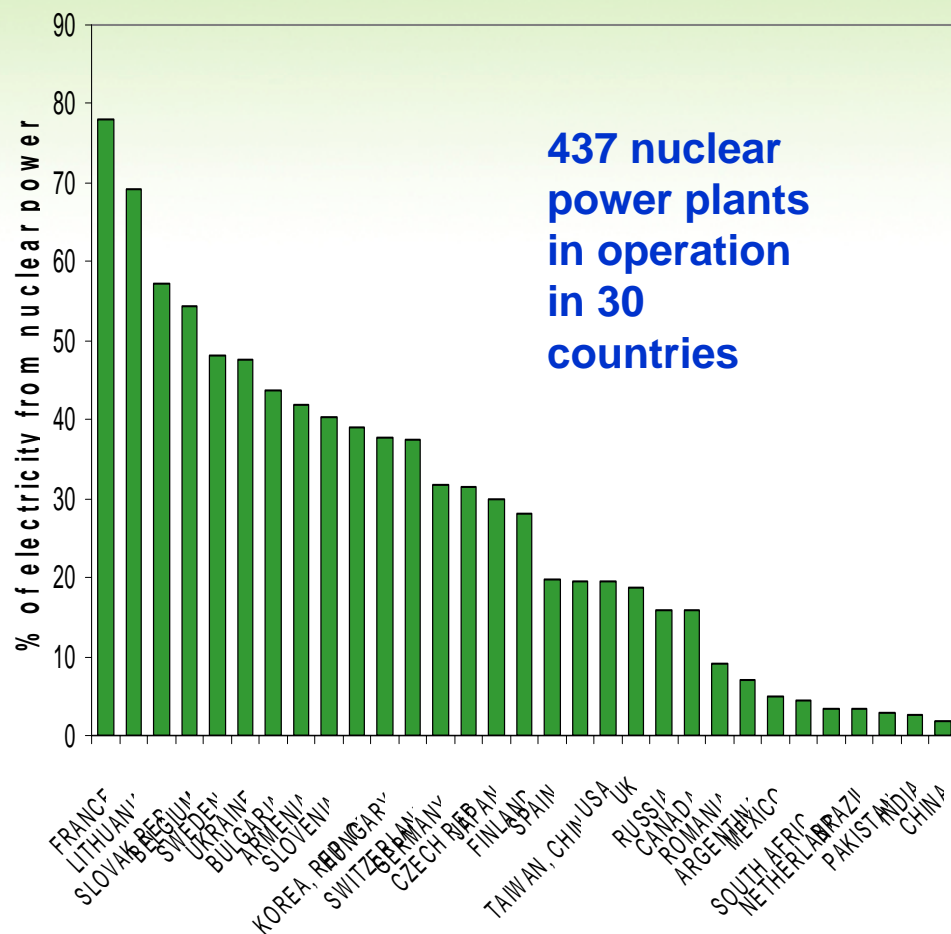
Power Purchase from SPP/VSPP Cogen and RE





Nuclear is staging a come back

Nuclear share in electricity generation 2006



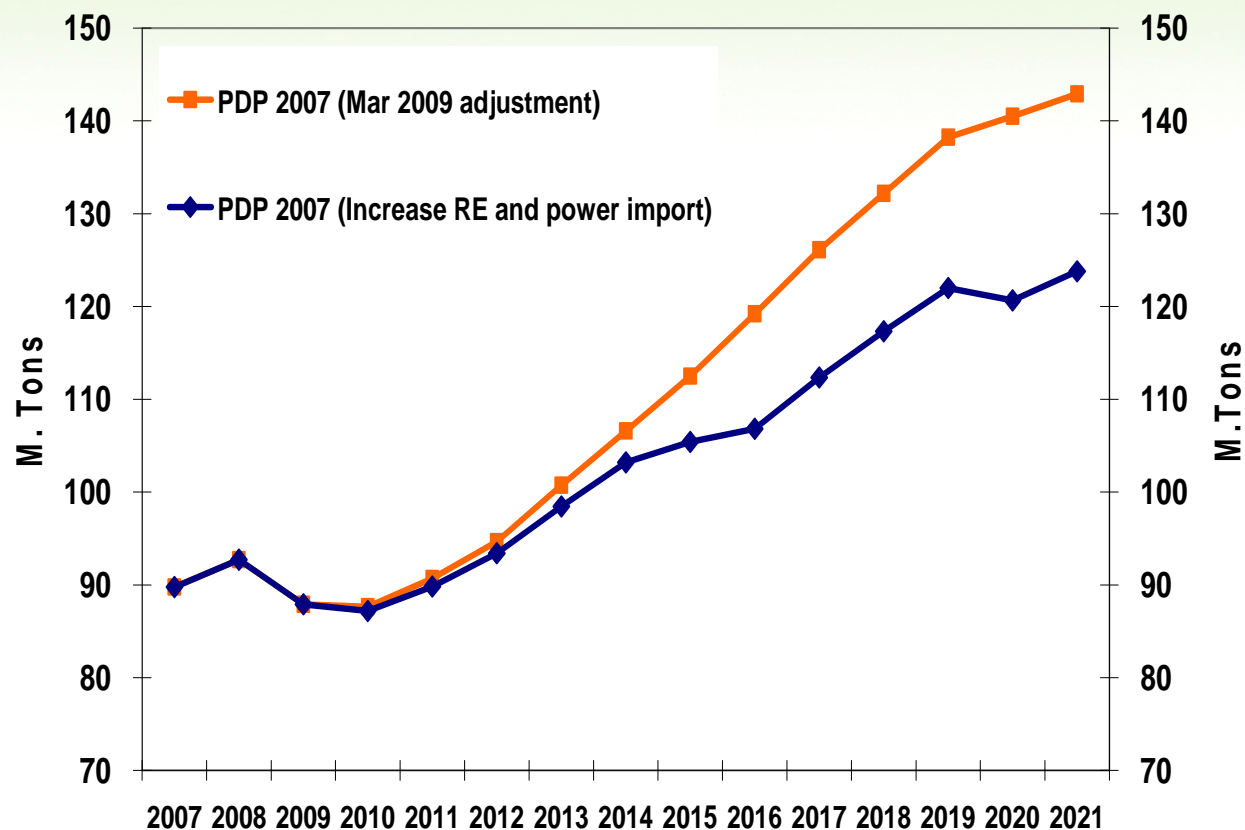
Nuclear power plants under construction (end-August 2008)		
Country	Number of reactors	Capacity (MW)
Argentina	1	692
Bulgaria	2	1,906
China	6	5,220
Chinese Taipei	2	2,600
Finland	1	1,600
France	1	1,600
India	6	2,910
Iran	1	915
Japan	2	2,166
Korea	3	2,880
Pakistan	1	300
Russia	7	4,724
Ukraine	2	1,900
United States	1	1,165
Total	36	30,578

Source : IAEA



Without nuclear GHG emission from power sector will increase

Thailand's Carbon Dioxide Emission from Electricity Generation

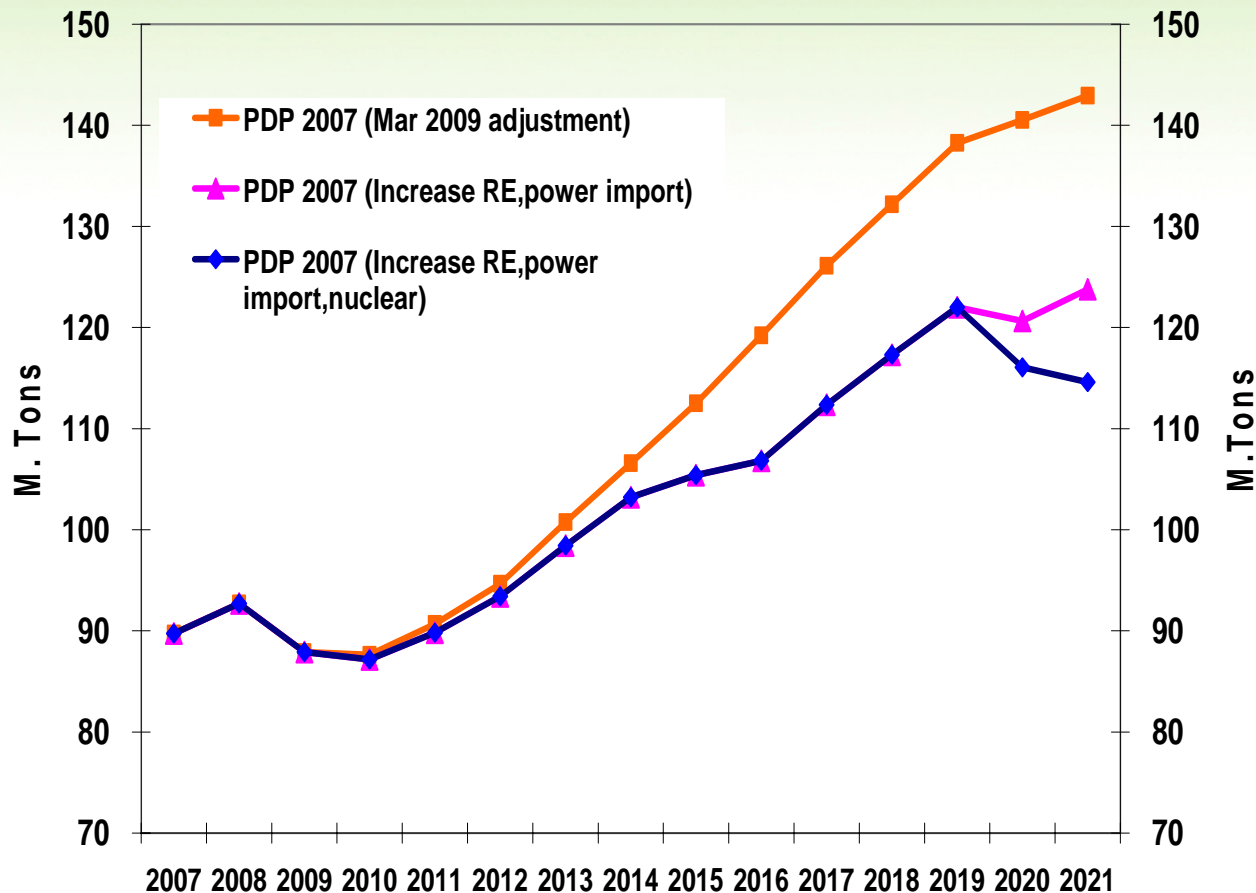


- GHG emission will increase drastically under current PDP (March 2009) which slows down nuclear power program
- Incorporate higher renewable energy production and power import, GHG emission declines slightly but the trend is still upwards.



Nuclear is inevitable if we are to combat global warming

Thailand's Carbon Dioxide Emission from Electricity Generation



Lower CO₂ emission is due to

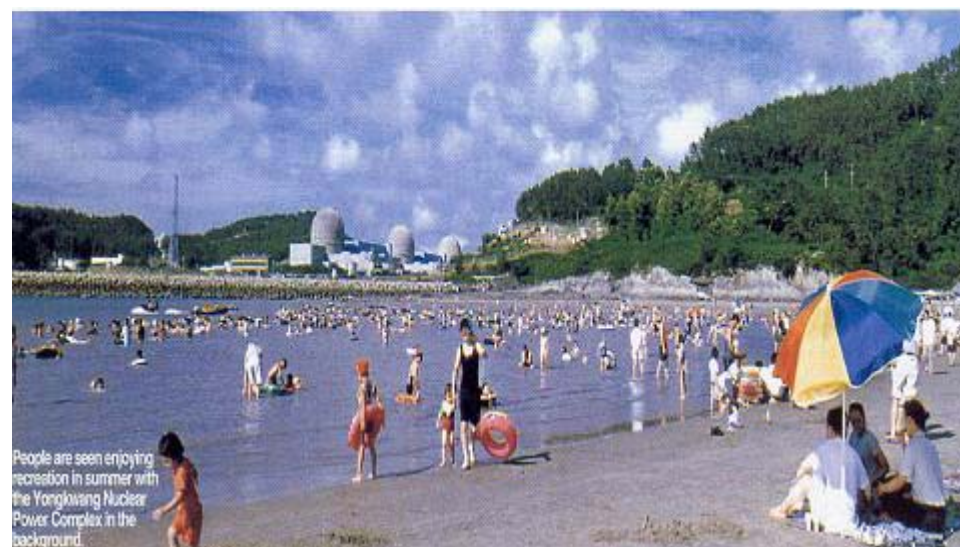
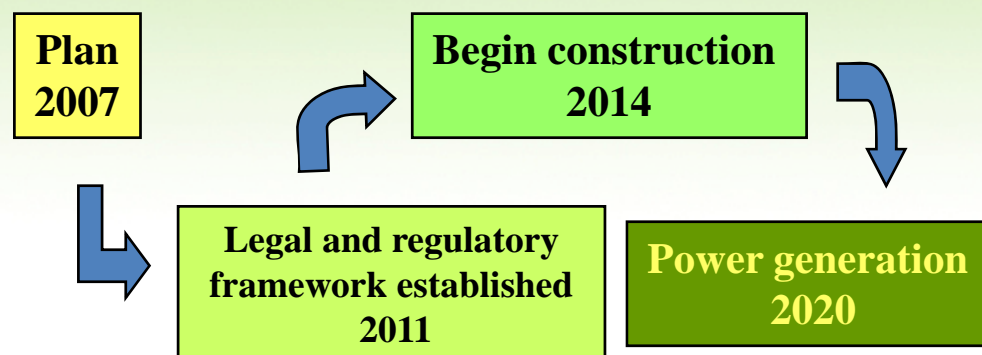
- Much higher RE and CHP
- Speed up of nuclear program
- Higher hydropower development in neighbouring countries

Unclear national policy on global warming has caused wavering support for RE and nuclear



Nuclear has long lead time—preparation must be speeded up

- Training, manpower
- Feasibility study (wastes disposal, decommissioning, fuel supply etc.)
- Location
- Safety and other standards
- Establishment of legal and regulatory framework
- International treaties
- Establishment of supporting industries
- Public acceptance





Community Development Fund - moving too slowly

Payment into Fund when in operation	
Fuel Type	Baht/kWh
Natural Gas	0.01
Fuel Oil and Diesel	0.015
Coal and Lignite	0.02
Renewable Energies	
- Wind and Solar	-
- Biomass, MSW, Waste	0.01
- Hydro	0.02

- Number of funds to be established: 102
- Number of funds already established: 71
- Number of funds being set up: 4
- Money already transferred: 1,656 million baht
- Estimate funds revenue in 2009: 1,822 m.baht





But this is not enough..To alleviate global warming we need..

New Technologies

- Carbon Capture and Storage (CCS)
- Non Conventional Oil, Oil Shale, Natural Gas Hydrate
- 2nd generation biofuels
- Solar (PV, CSP, Heating), Wind, other RE
- Hybrid vehicles, electric vehicles, hydrogen fuel cell vehicles
- Mass Transit
- Energy efficiency technologies

General Public

Change in behaviours in all aspects of our daily lives

Government

Create awareness, consensus and drive changes which will involve unpopular measures



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