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Mekong energy system: linkages to hydropower

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2 October 2011

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Outline and Key Messages

(1) Introduction to energy system

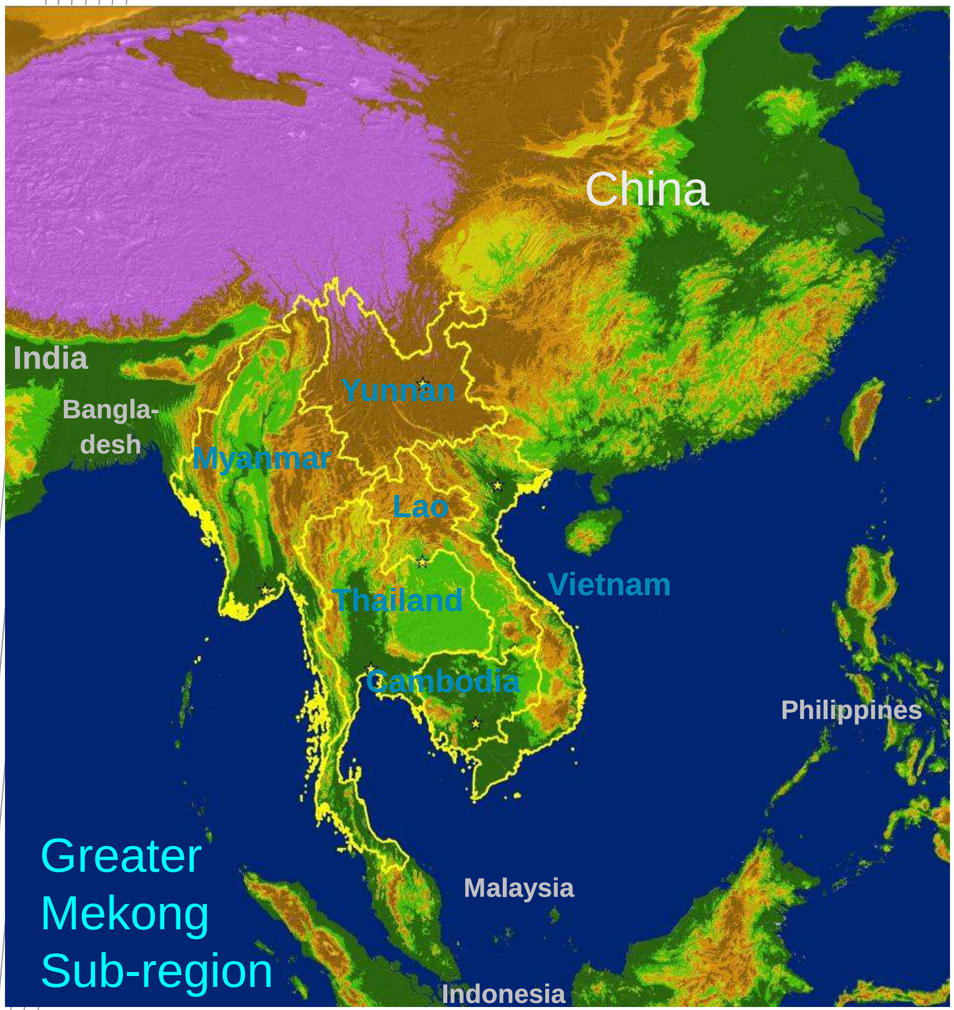
(2) Impacts of large hydropower on the energy system

KEY MESSAGES

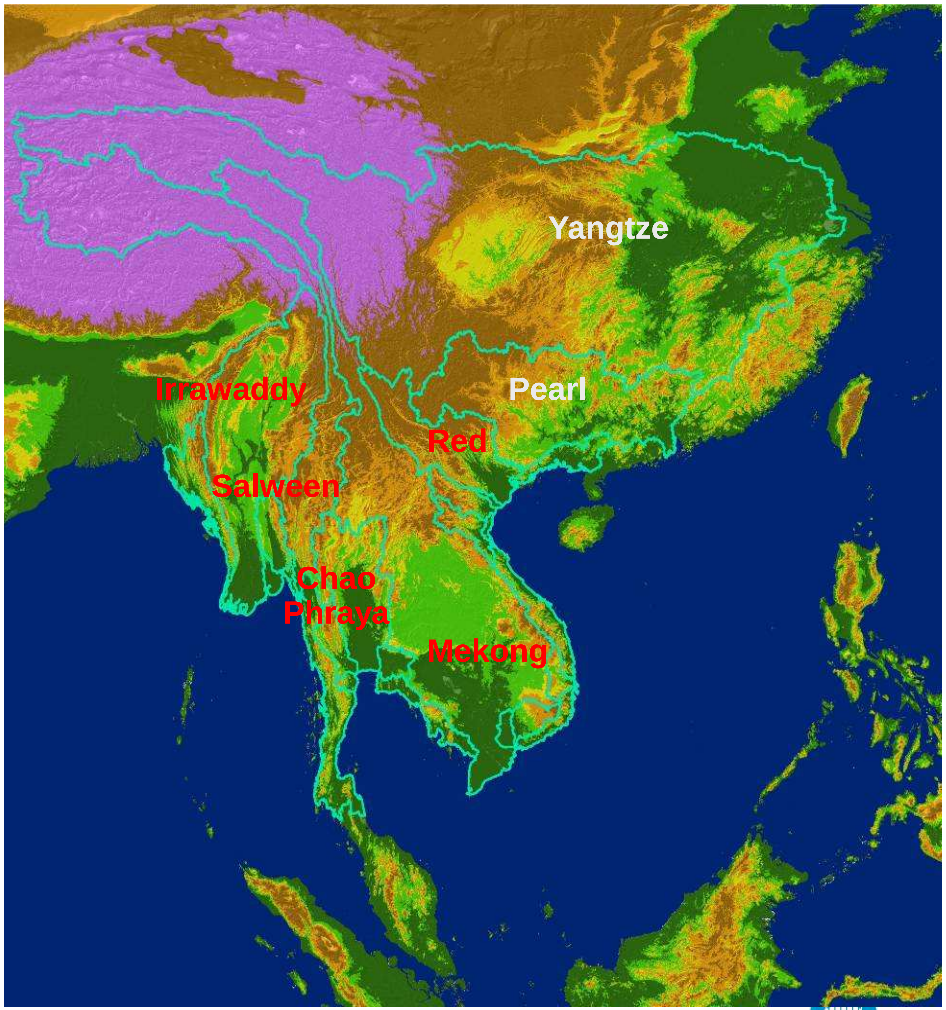
- GMS energy system is very large relative to Mekong hydropower
- In order to move the system towards greater sustainability, large hydropower needs to help integrate smaller renewable power
    - But rules of the system create many obstacles for that integration
- We can expect increased political contention, possibly leading to re-evaluation & improved decision making

Greater Mekong Sub-region: River Basins & Political Units

States and Territories



River Basins



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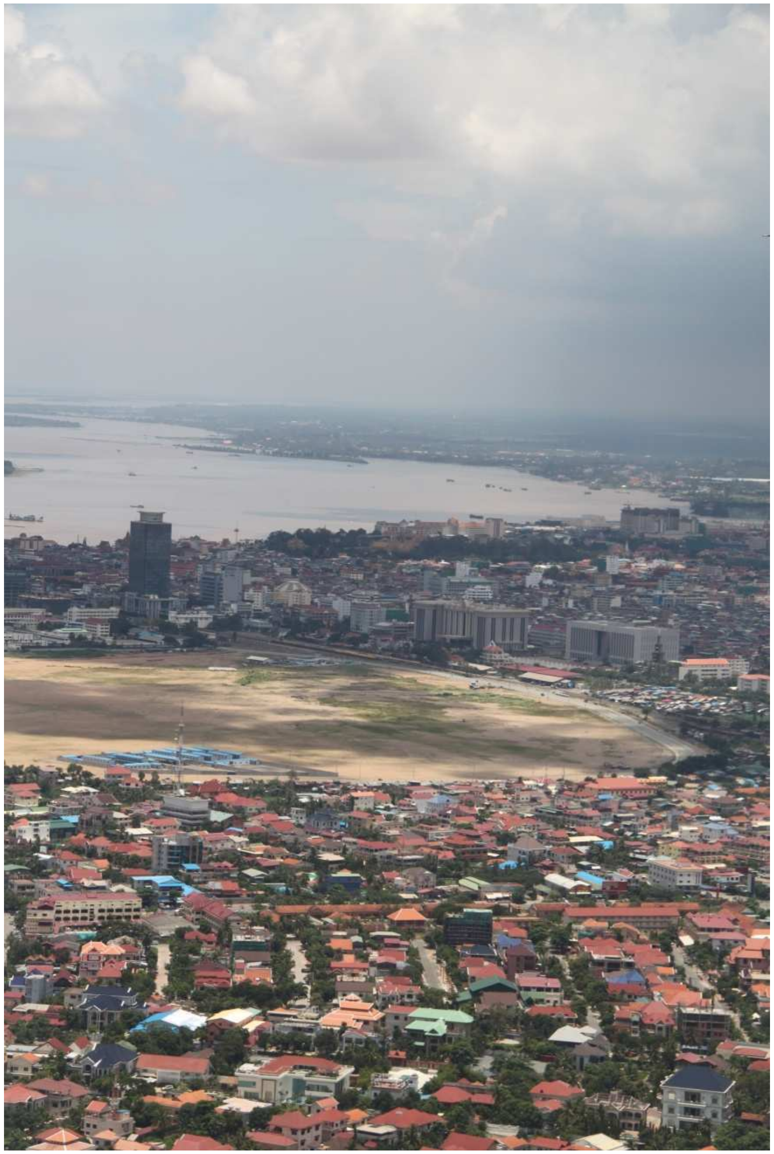
A dynamic . . .

And diverse region

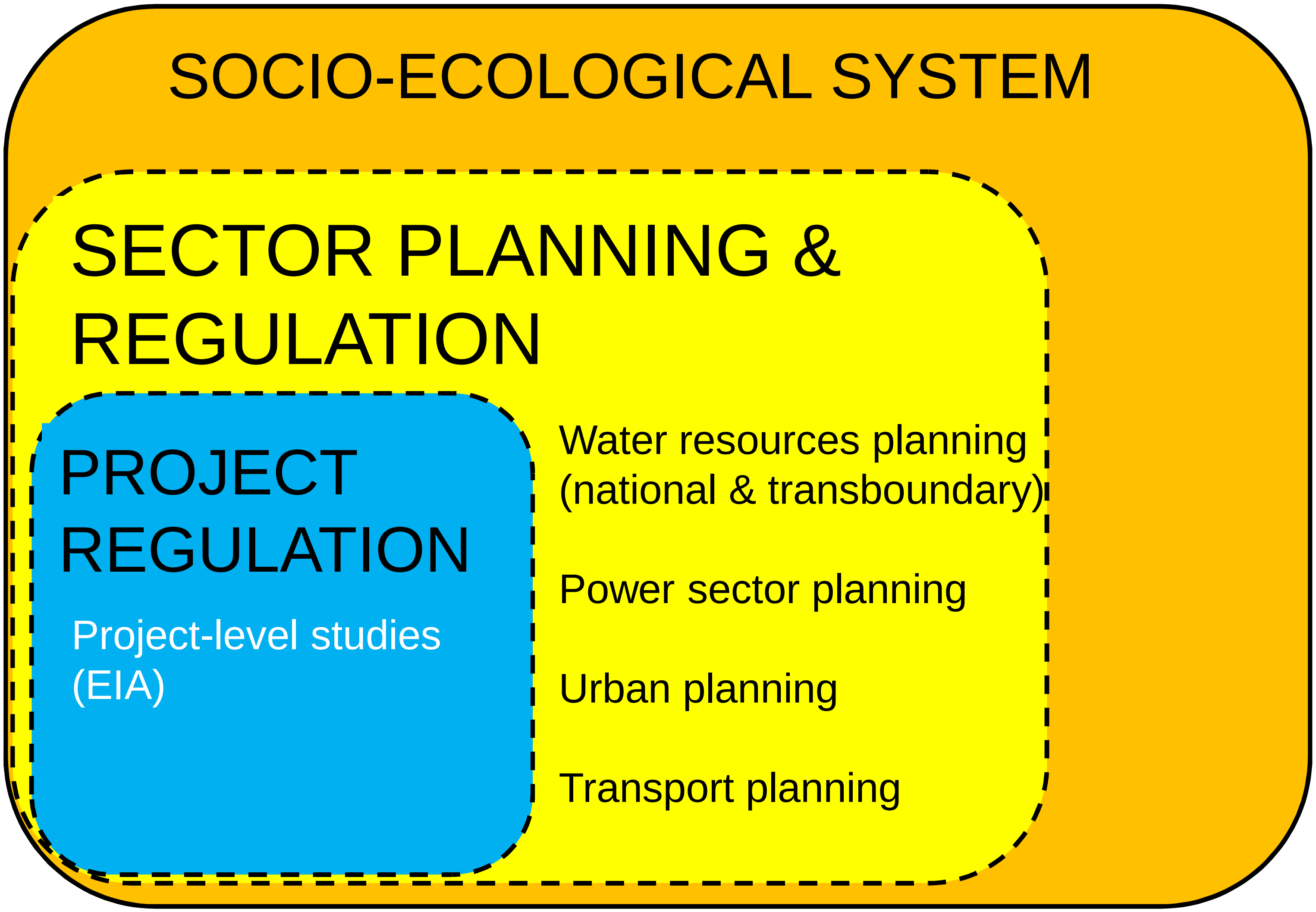
High levels of inequality

Most people live in rural areas

But rapidly urbanizing . . .



Part 1 Introduction to the Mekong energy system
Energy system has multiple scales



Future economic growth and oil prices
Some assumptions from International Energy Agency

Marginal to moderate economic stimulus → increase in regional GDP, demand for transport energy, construction materials

INDICATOR / DESCRIPTOR	BASE YEAR	FINAL YEAR
Real GDP growth (compound annual growth rate)	**2008**	**2035**
World (IEA 2010)	3.20%	
Asia (IEA 2010)	5.40%	
China (IEA 2010)	5.70%	
GMS Region (IRM-AG 2008)	**2005**	**2025**
Pre-financial crisis:	6.00%	
Thailand (IEA 2009)	**2007**	**2030**
Post-financial crisis:	3.30%	
Vietnam, Cambodia, Laos, Other ASEAN (IEA 2009)	4.60%	
Energy Price & Volatility	**2009**	**2035**
Average crude oil price (USD/bbl 2009)	60.4	110 -130
Volatility	high	

Definitions & units

- primary energy Energy embodied in natural resources prior to human conversion or transformation. *Examples:* Coal, crude oil, uranium, solar, wind.

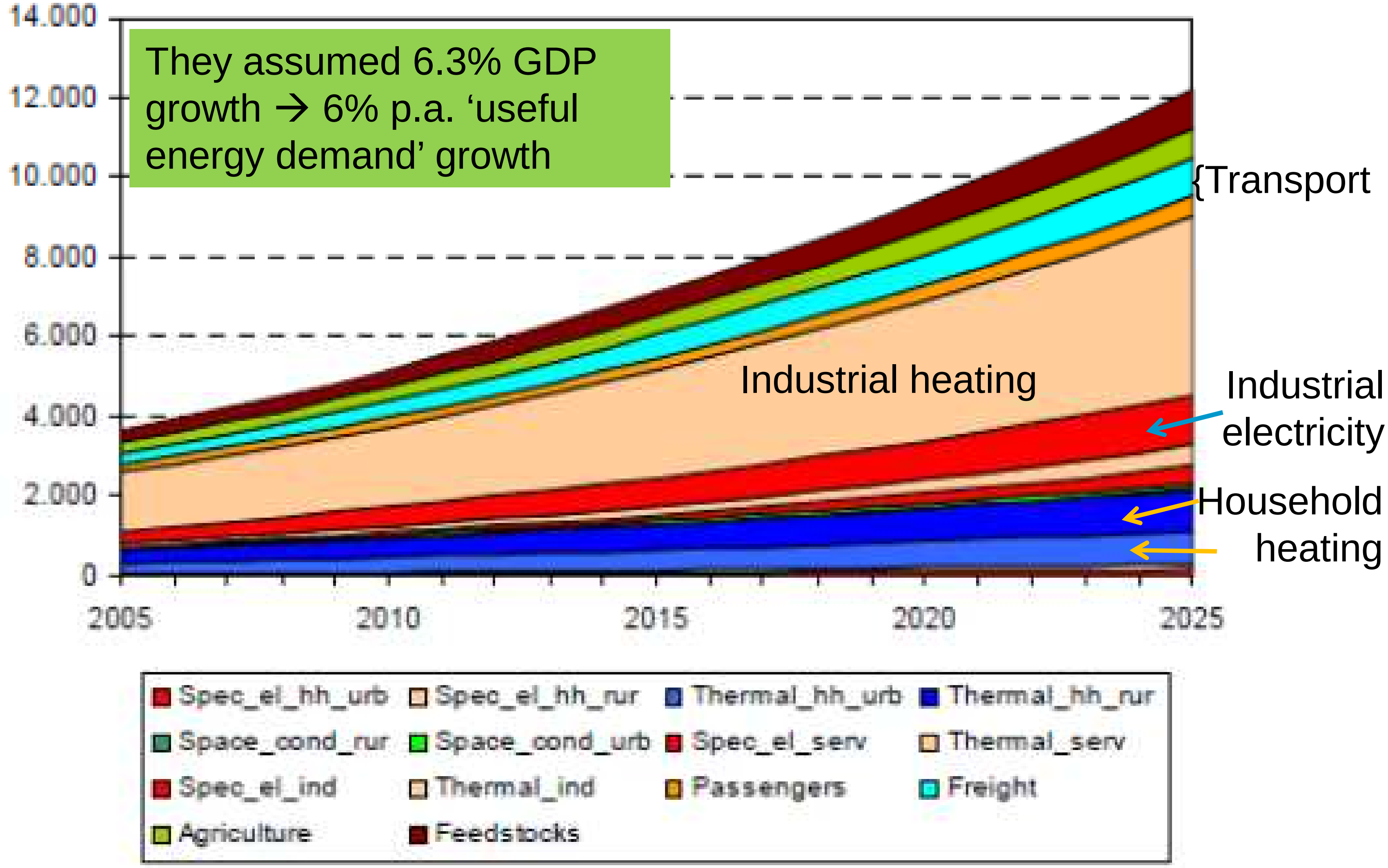
- final energy Includes primary energy minus inputs for {electricity, heat, refineries and other energy} plus {energy value of electricity}. *Examples:* Petroleum, electricity, fuelwood.

- useful energy Energy that provides services such as cooking, illumination, space conditioning, transport, industrial heating.

PJ	petajoule (10^{15} Joule, equivalent to 277.78 GWh, and 23.88 kiloton oil equivalent)
GWh	gigawatt-hour (equals one million kilowatt hours [kWh])
MWyr	megawatt-year (equals 8.76 GWh)
TWh	terawatt-hour (one thousand GWh)

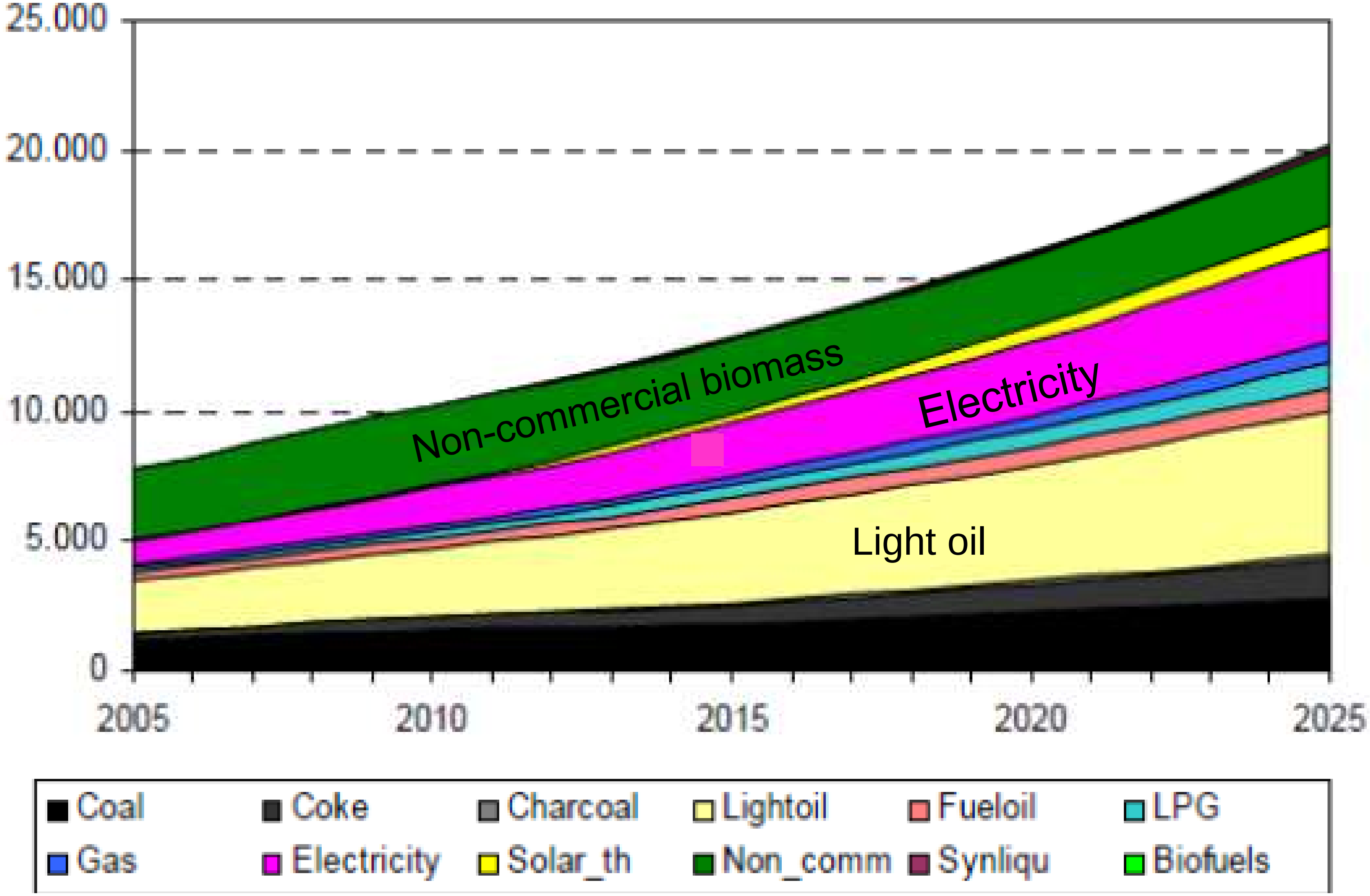
Useful energy demand, 2005-2025 (PJ)

Source: IRM-AG 2008: Fig. 96: Low Carbon scenario

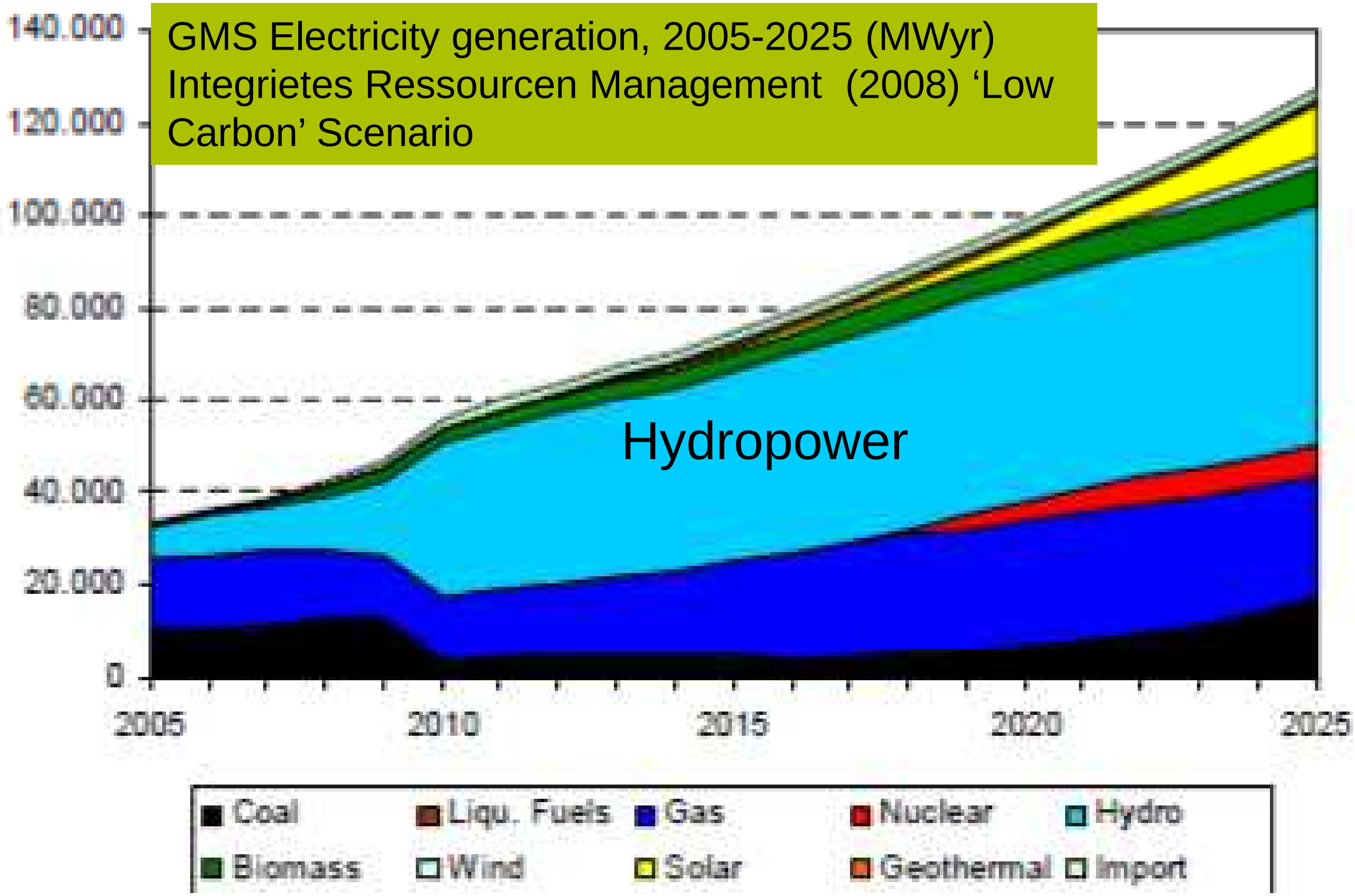


Final energy demand, 2005-2025 (PJ)

Source: IRM-AG 2008: Fig. 98: Low Carbon scenario



Rising electricity demand . . .
One scenario from ADB consultants



What impacts could all this hydropower development have on the *energy* system?

Substitution impact: Hydropower replaces natural gas in Thai PDP

If use natural gas instead in CHP (combined heat and power)

-> raises efficiency of large buildings

If use more natural gas in transport -> lower pollution

Macro-economic impact

Increased demand for construction inputs

-> inflation ? -> income poverty

Political impact: Mekong dams may be controversial

? Local resistance -> delays -> financial risk to developers

? Opening up of electricity planning to public participation

(Nuclear and coal not popular in Thailand either)

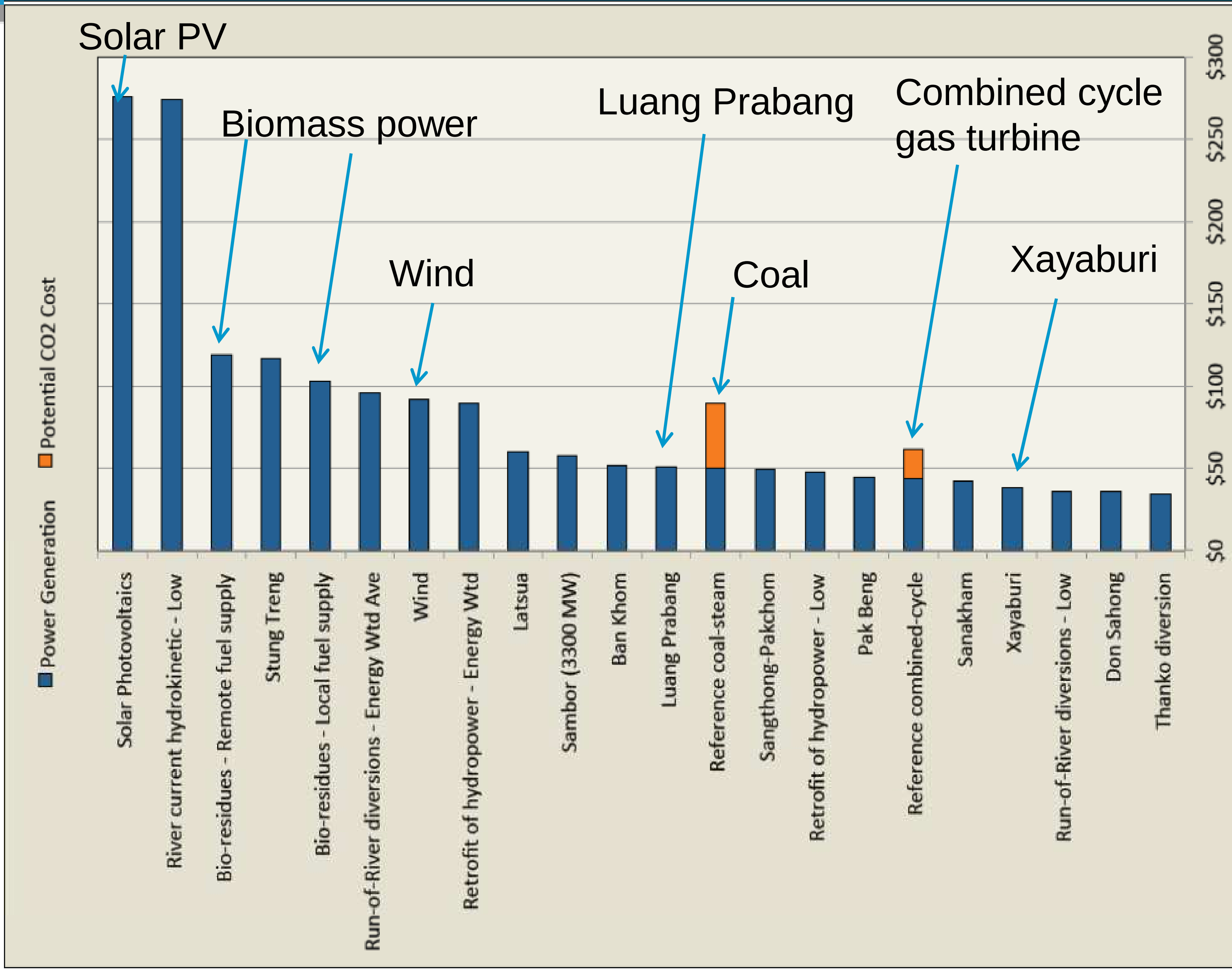
Part 2: Critique of electricity planning & regulation

Electricity planners' dominant way of thinking

- Economic growth → demand for energy services
- Modern energy services → reduction in poverty
- Electricity is a high-quality type of energy
- Need to provide energy at least-cost
    - High cost energy -> reduces income of consumer -> poverty
- Hydropower is a source of low-cost electricity
- Hydropower can compete with natural gas

Energy cost of resources ($/MWh)

Source: Costanza et al. 2011

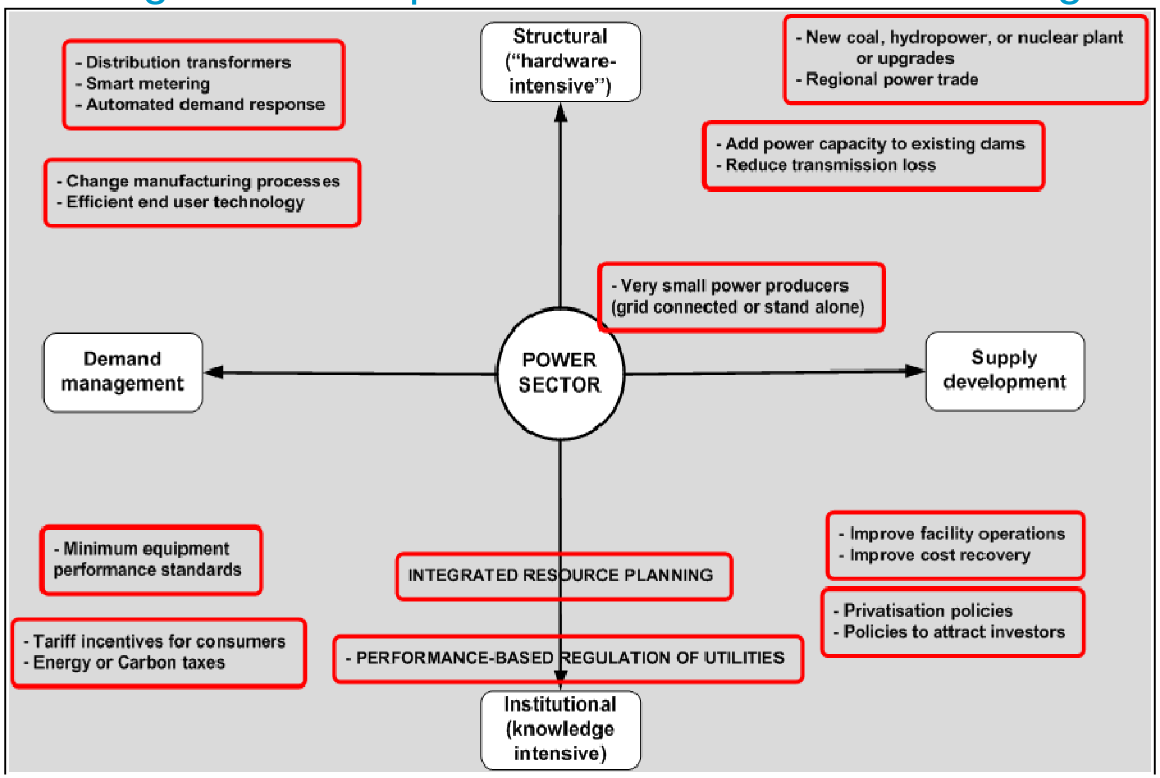


Some problems with electricity planning practices

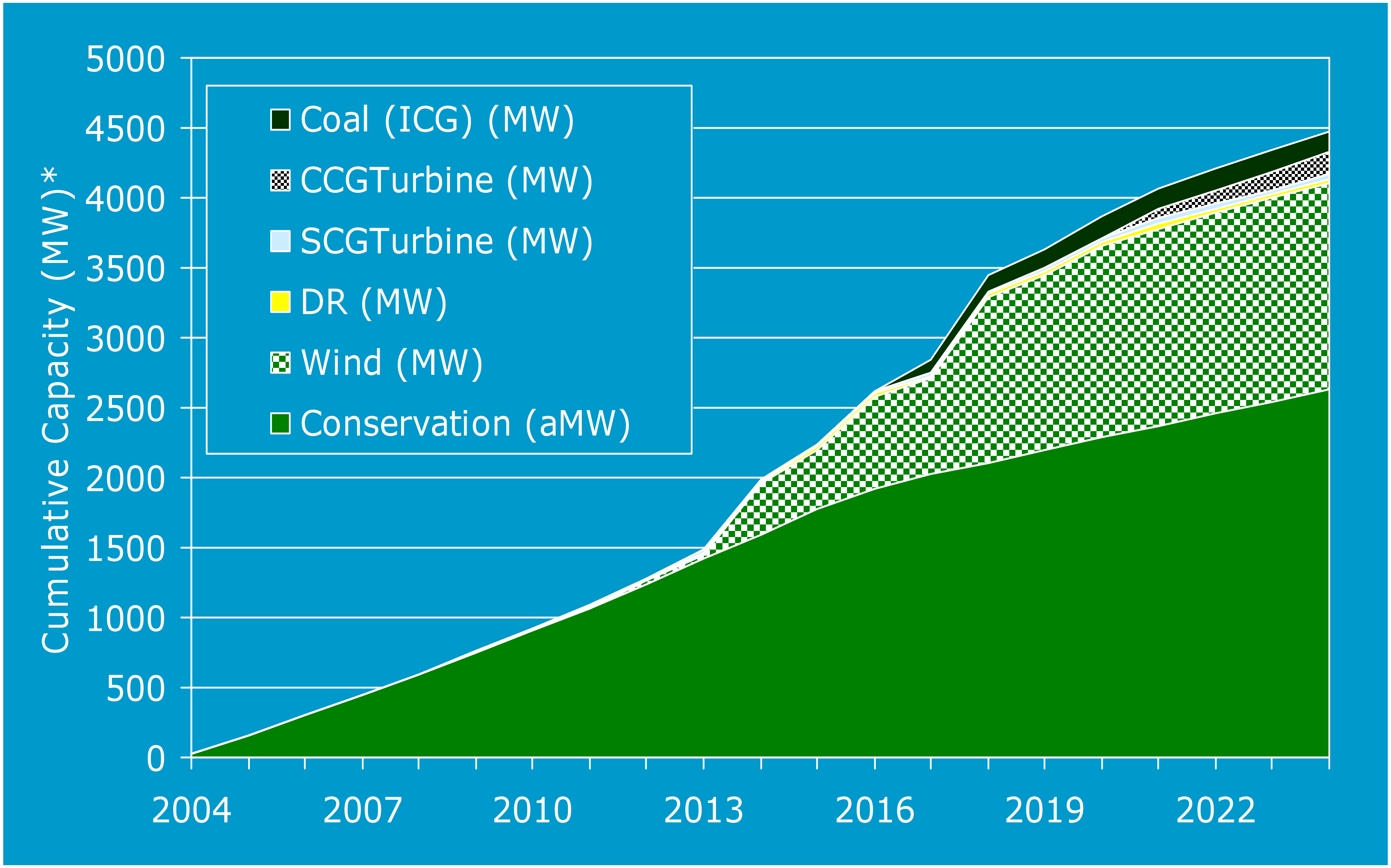
- All the economic impacts of hydropower are not known
  - Positive impacts on construction industry (etc.) can be estimated
  - But many kinds of impacts (social, ecological, economic) are difficult to value and extend across space and time
    - Loss of river capture fisheries (estimated 20% of current total)
    - Loss of services from beneficial flooding (nutrient recharge)
    - Decline in nutritional security
    - Loss of livelihoods -> migration
- And not fully included in modelling (!)
  - Modelling by IRM-AG assumed only 0.44-2.58 $/MWh damage cost << Stockholm Environment Institute estimate 40-90 $/MWh
  - SEI figure (Nilsson 2008) based on European reservoir fisheries
- Anyway, 'least-cost' modelling done by a electricity utilities focuses on its financial costs, not economic costs

Some problems with electricity planning practices (2)

- Very limited participation in options assessment
  - Options assessment is narrow
  - Limited discussion or disclosure of alternative power generation portfolios
  - Focus on minimizing cost, but not risk (e.g. fossil fuel price increases)
- End-use energy efficiency is an important, neglected option
- Distributed generation options also make sense but neglected

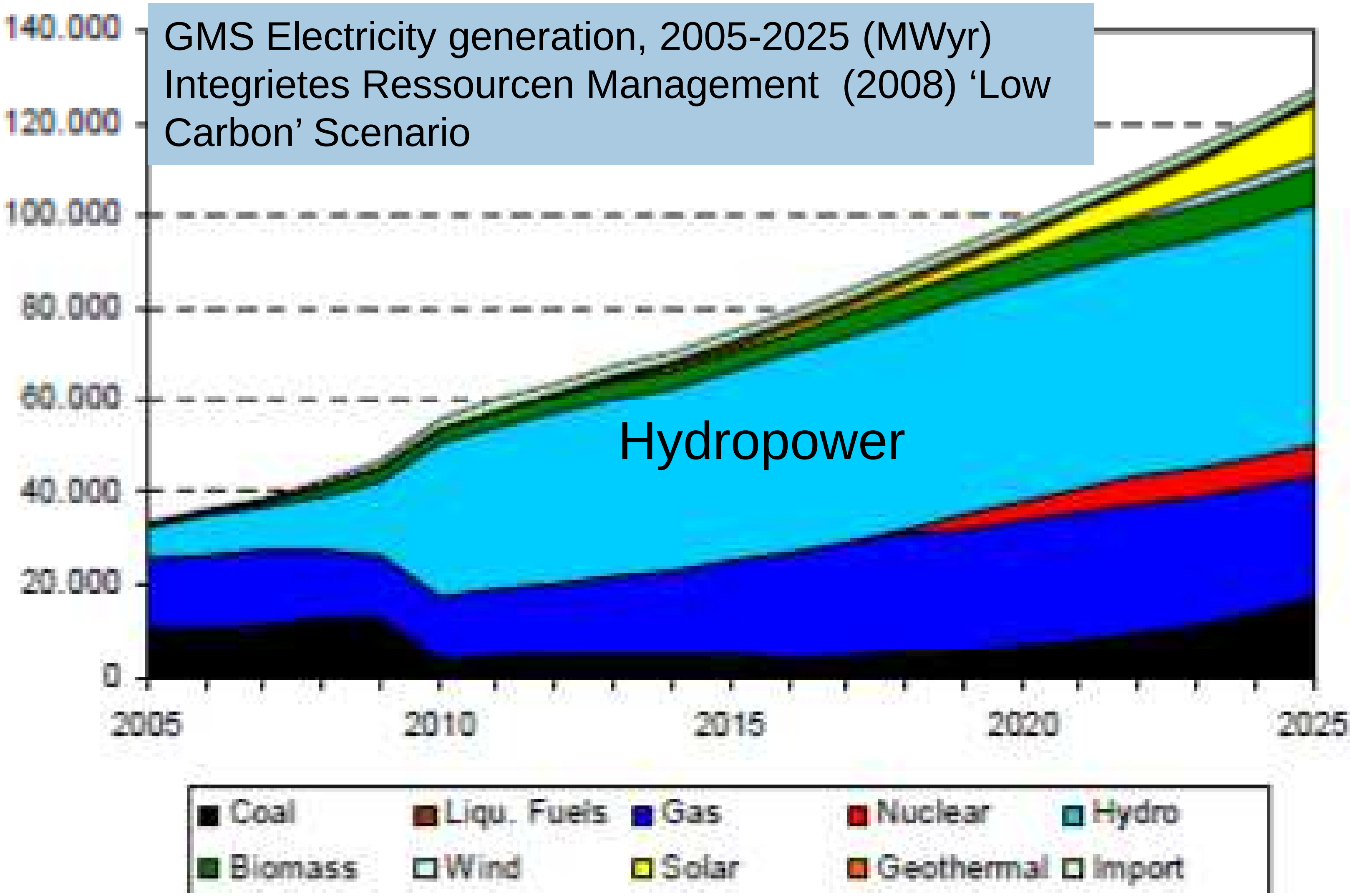


What status & priority given to energy efficiency?



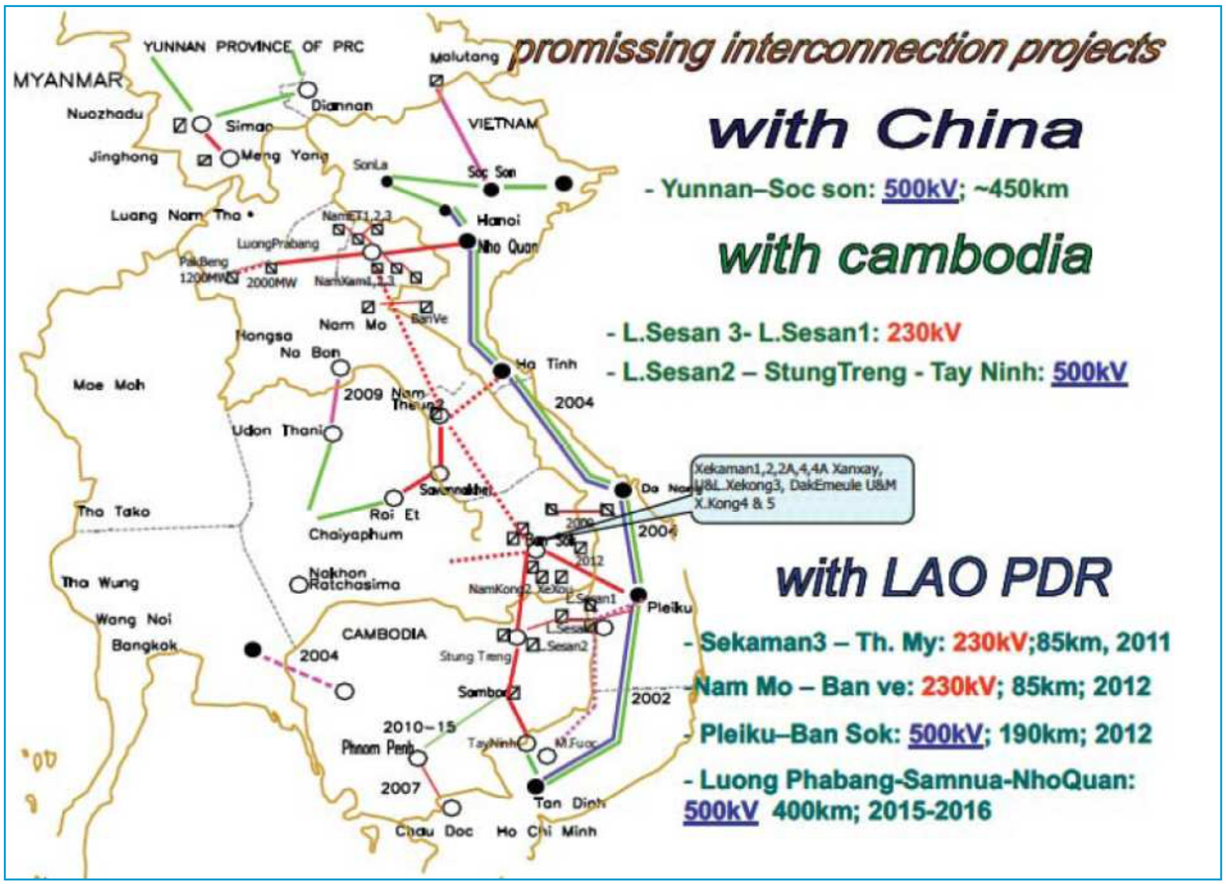
Source: U.S. Northwest Power & Conservation Council

A more typical treatment of energy efficiency



High voltage transmission networks
Based on conventional planning logic

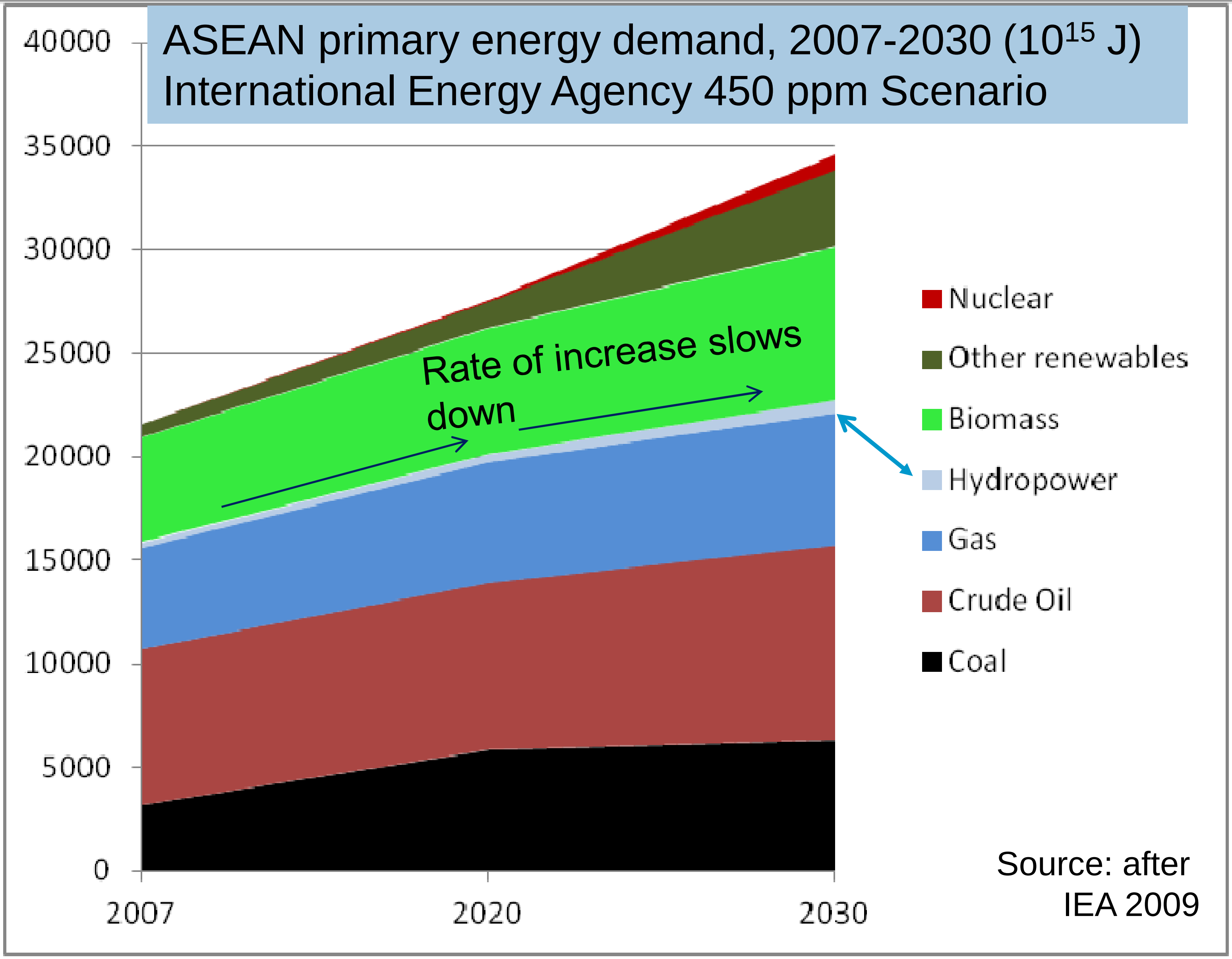
- Increasing cross-border trade, not (yet) a fully connected grid
- Allows hydropower stations (assumed to be low cost) to connect to wider markets
- Costs of transmission lines charged to consumers



Source: Vietnam (2009) presentation to ADB Regional Power Trade Coordinating Committee

Concluding remarks

Energy demand continues to rise
Even under an aggressive scenario from IEA

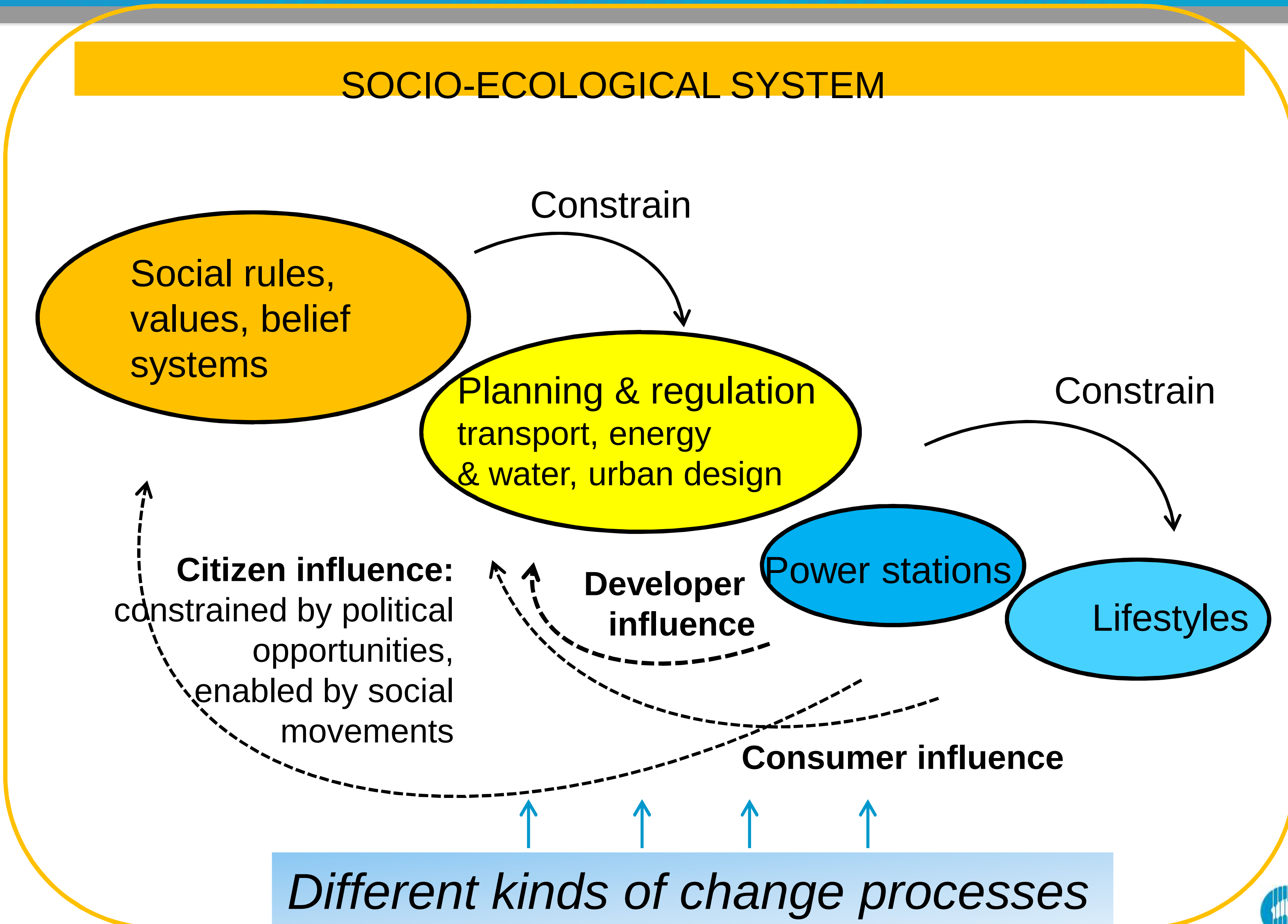


We see both small- and large-scale energy pathways

Country / Region	Approaches / *Major Challenges*
Mekong - Vision for regional power grid (ADB-GMS)	*Economic and social risk*
✓ Mekong - Domestic biogas for cooking (1 million units by 2015)	NGO-led with donor financing
✓ Thailand – Target for renewable share of total final energy = 14% by 2022 (of which 4% biofuel, 2.4% electric power)	✓ Multi-stakeholder consultation
✓ Laos – Estimated 60,000 pico-hydropower units installed by villages and households	Private sector led
✓ Vietnam - 5% renewable share of total commercial primary energy by 2020: giving priority to small hydropower and biomass renewable power Vietnam – 100+ percent increase in hydropower capacity by 2025	✓(?) Use of Strategic Environmental Assessment in power development planning

But can we find more sustainable ways of living?

A multi-scale, multi-level challenge



Source: revised from Ruesswig 2010

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Electricity generation, 2005-2025 (MWyr)

Source: IRM-AG 2008: Fig. 99: Low Carbon scenario & GMS Integrated scenarios