The Challenges of Energy Governance in Southeast Asia

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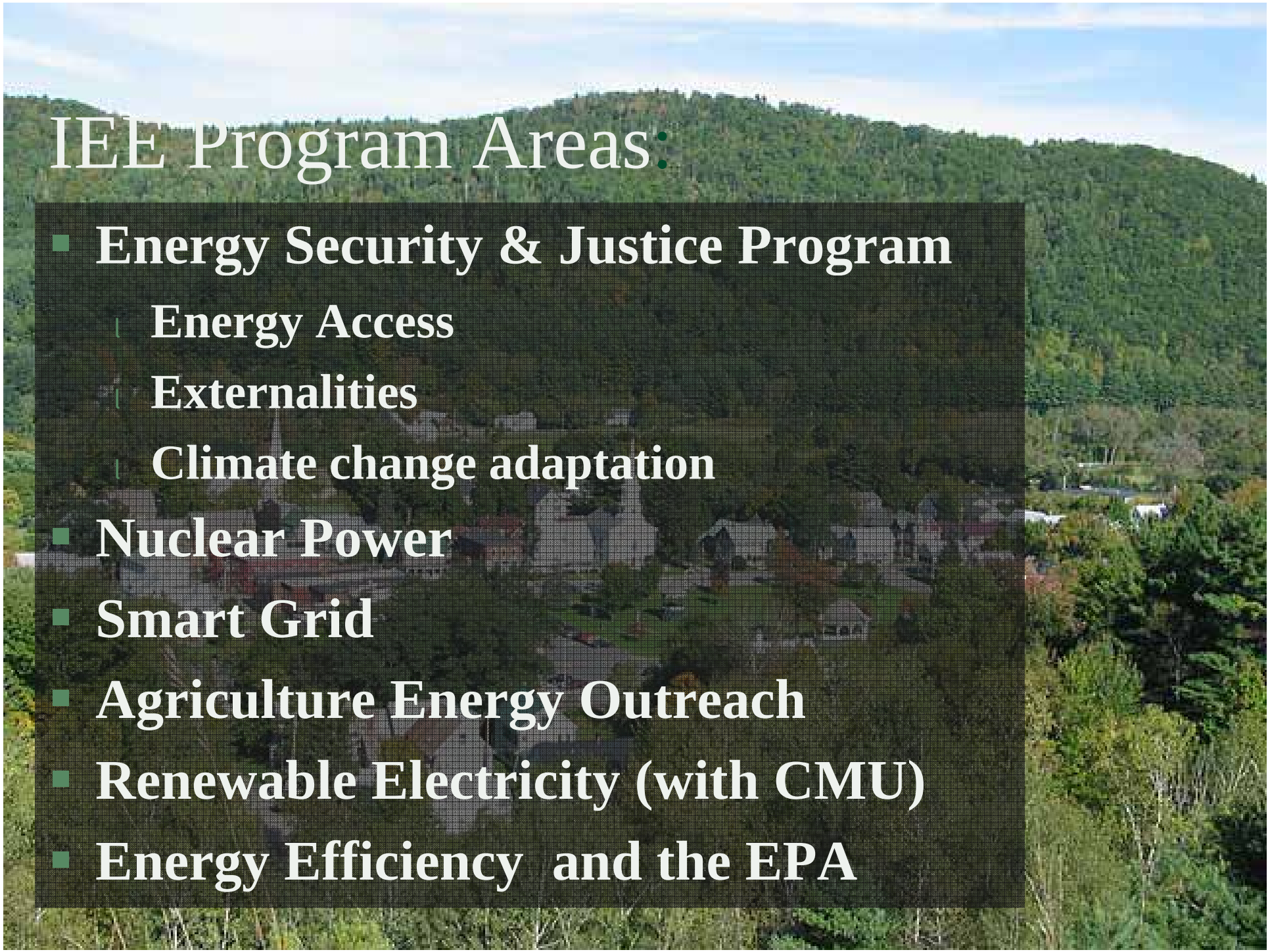

IEE Program Areas:

- **Energy Security & Justice Program**
  - **Energy Access**
  - **Externalities**
  - **Climate change adaptation**
- **Nuclear Power**
- **Smart Grid**
- **Agriculture Energy Outreach**
- **Renewable Electricity (with CMU)**
- **Energy Efficiency and the EPA**

What's "different" about energy governance?
What energy governance challenges are the most significant for the Asia Pacific?
What can we do as researchers?

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Key terms and concepts

Energy: the socio-technical system in place to convert energy fuels and carriers into services – not just technology or hardware such as power plants and pipelines, but also other elements of the "fuel cycle" such as coal mines and oil wells in addition to the institutions and agencies, such as electric utilities or transnational corporations, that manage the system

Governance:

Term	Definition
Governance	Any and all of the myriad ways in which groups of people attempt to solve collective action problems, deal with market failures and ensure the provision of public goods
Global governance	Efforts to deal with the wide range of border-crossing issues involving multiple states and other actors from multiple parts of the world
Global energy governance	Making and enforcing rules to avoid the collective action problems related to energy at a scale beyond the nation-state

What's unique about energy?

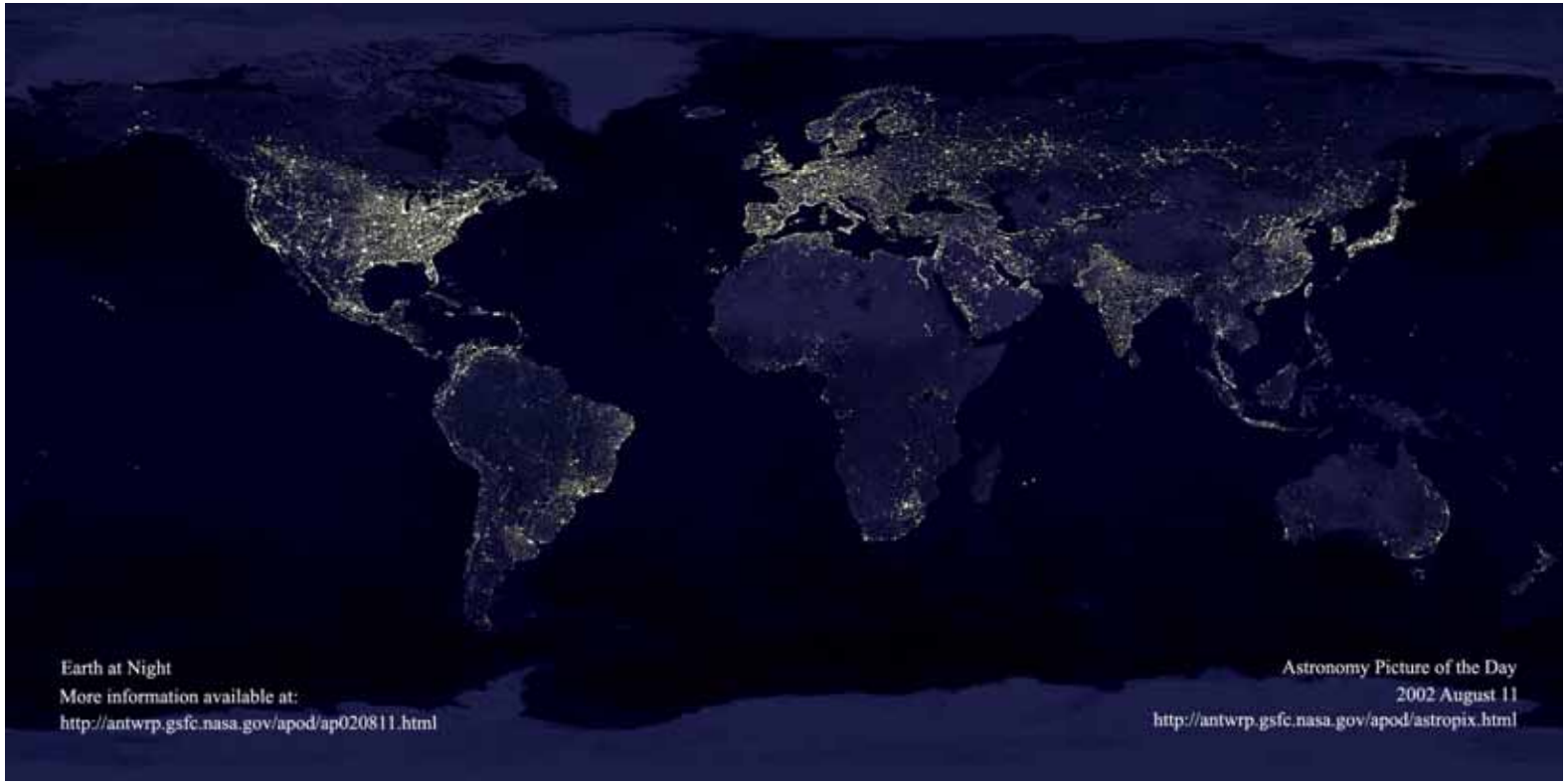
(1) Stronger vertical complexity

Energy involves multiple technological systems that cut across vertical scales within a country

- 170,000 generators provided electricity at more than 75,000 power plants in 2011—about half of them coal-fired, 440 of them nuclear-powered—and they transmitted electricity through roughly 4 million miles of transmission and distribution lines
- 87.8 million barrels of oil produced per day globally backed by more than one thousand refineries and almost one million gasoline stations, to the world's roughly one *billion* automobiles which drive on 11.1 million miles of paved roads—enough to drive to the moon and back 46 times

"Energy is not just another commodity, but the precondition of all commodities, a basic factor equal with air, water, and earth" – EF Schumacher

What's unique about energy?

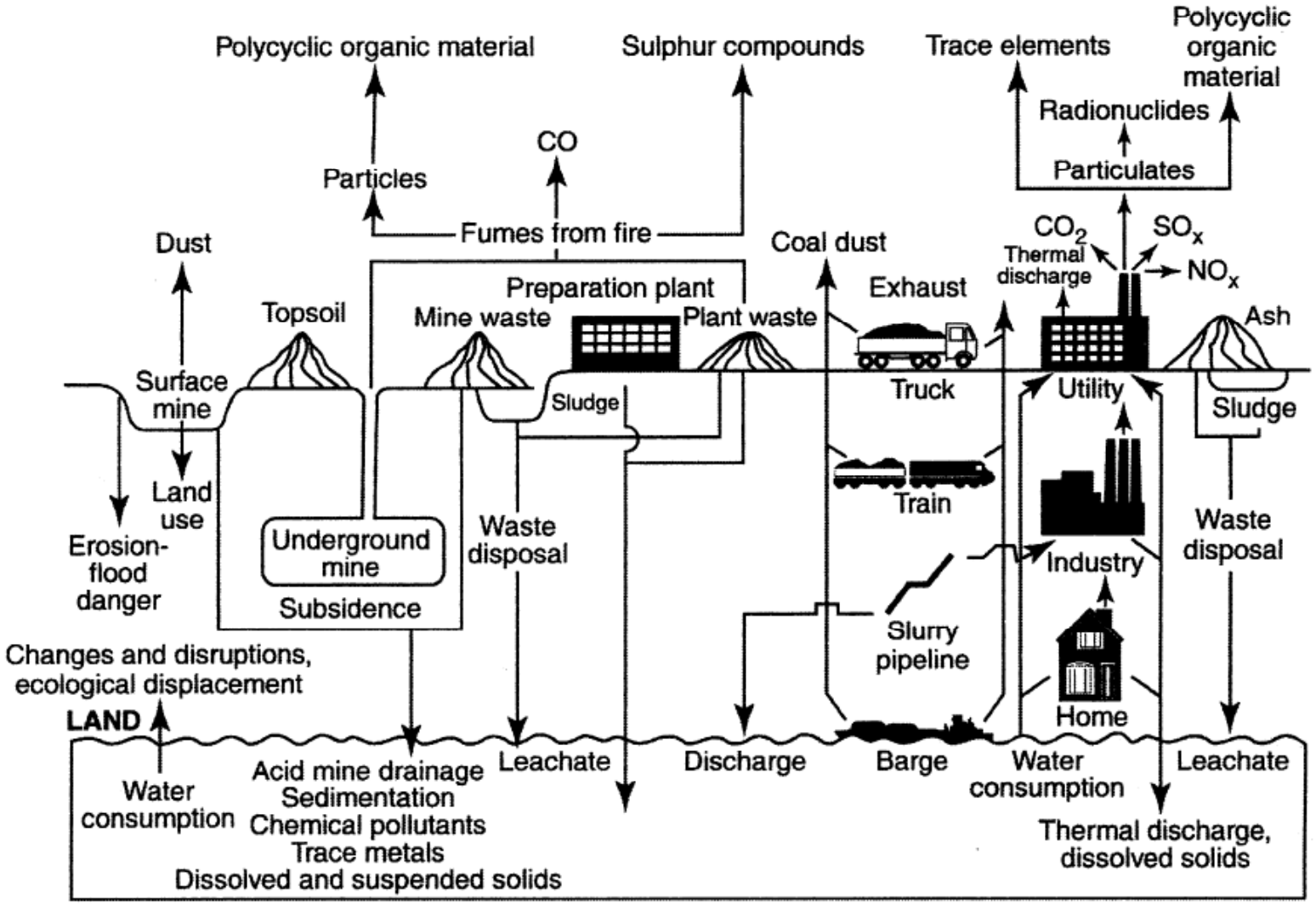


Creates complex governance regimes: a coal system that involves the coal mine and railway as well as the power plant and transmission and distribution network; or a wind farm which requires the production of aluminum, copper, concrete, and fiberglass "upstream" to make the turbines and other components as well as switching stations and interconnection to the electricity network "downstream" from the turbines themselves

What's unique about energy?

(2) More pronounced horizontal complexity

Energy transcends a variety of different scales, it is polycentric



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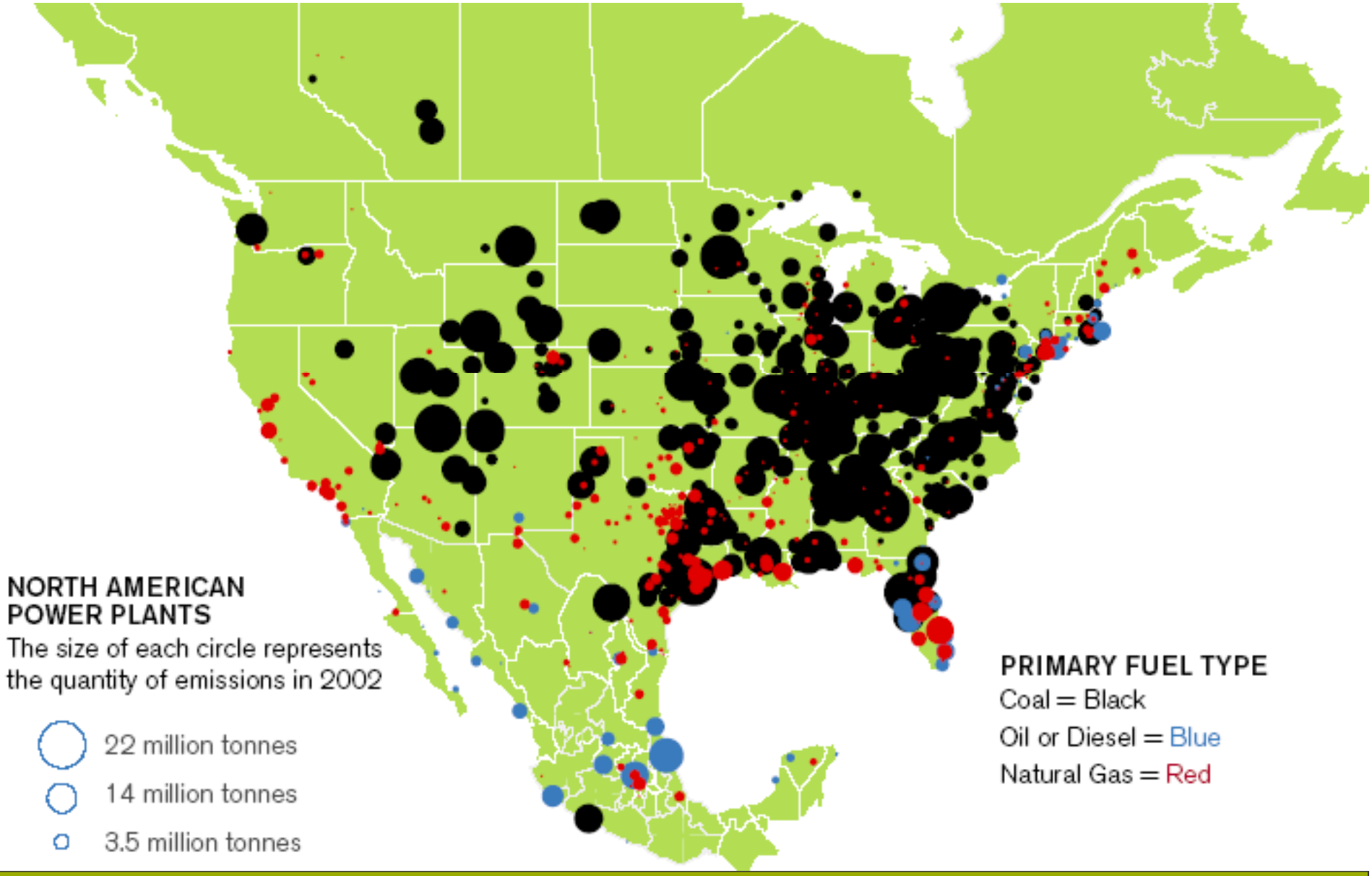

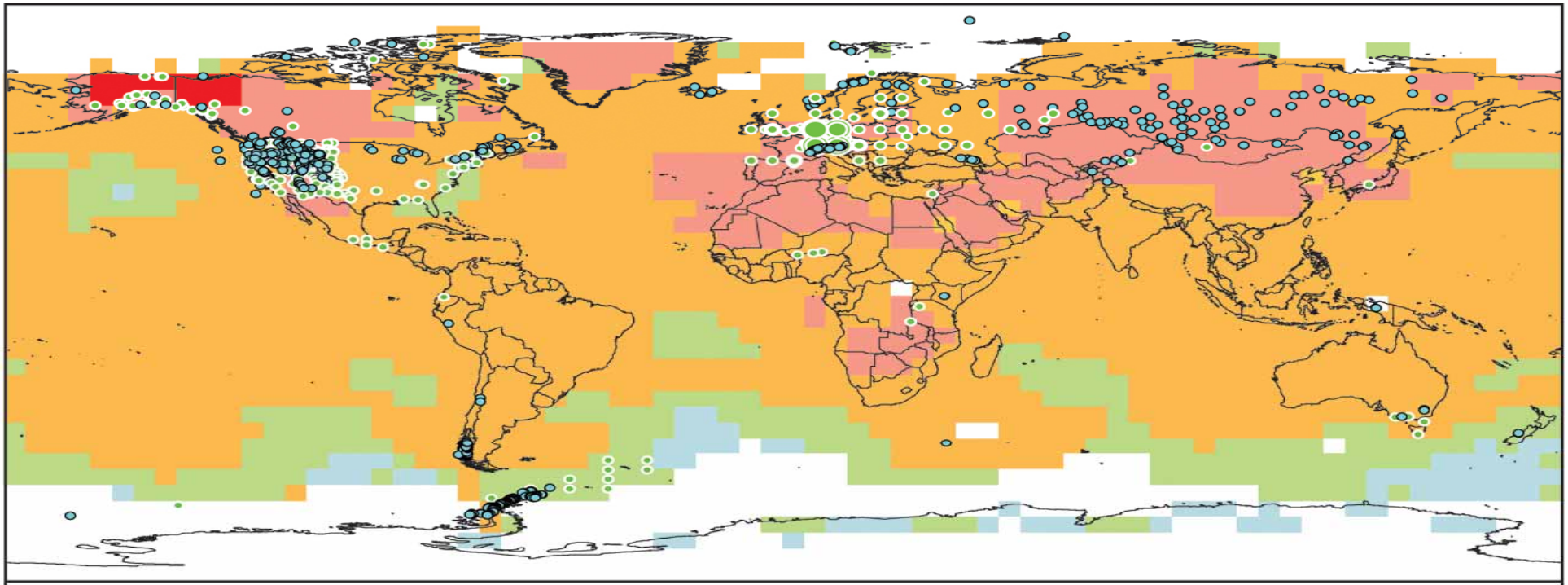

NAM		LA		EUR (28,115)		AFR		AS		ANZ		PR*		TER (28,586)		MFW**		GLO (28,671)	
355	455	53	5	119		5	2	106	8	6	0	120	24	764		1	85	765	
94%	92%	98%	100%	94%	89%	100%	100%	96%	100%	100%	–	91%	100%	94%	90%	100%	99%	94%	90%

Observed data series

- Physical systems (snow, ice and frozen ground; hydrology; coastal processes)
- Biological systems (terrestrial, marine, and freshwater)

Physical	Biological
Number of significant observed changes	Number of significant observed changes
Percentage of significant changes consistent with warming	Percentage of significant changes consistent with warming

Europe ***

○	1-30
○	31-100
○	101-800
○	801-1,200
○	1,201 -7,500

Temperature change °C
1970-2004

-1.0 -0.2 0.2 1.0 2.0 3.5

* Polar regions include also observed changes in marine and freshwater biological systems.

** Marine and freshwater includes observed changes at sites and large areas in oceans, small islands and continents. Locations of large-area marine changes are not shown on the map.

*** Circles in Europe represent 1 to 7,500 data series.

What's unique about energy?

(3) Higher entailed costs

Capital intensive infrastructure, subsidies, intimate connection with industrial manufacturing , externalities

Table 2.5 ▷ Cumulative investment in energy-supply infrastructure in the New Policies Scenario, 2012-2035 (billion in year-2011 dollars)

	Coal	Oil	Gas	Power	Biofuels	Total	Share of GDP
OECD	**204**	**3 341**	**3 720**	**6 787**	**206**	**14 258**	**1.0%**
Americas	79	2 666	2 337	2 852	131	8 065	1.3%
Europe	6	551	924	2 797	73	4 351	0.8%
Pacific	119	124	460	1 138	2	1 842	0.7%
Non-OECD	**963**	**6 641**	**4 854**	**10 080**	**149**	**22 687**	**2.1%**
E. Europe/Eurasia	36	1 239	1 455	1 182	4	3 917	3.5%
Russia	23	745	987	717	-	2 472	3.5%
Developing Asia	844	1 036	1 425	6 768	74	10 147	1.6%
China	634	576	577	3 712	43	5 541	1.3%
India	93	202	199	1 620	19	2 133	2.2%
Middle East	0	1 074	498	577	-	2 149	2.5%
Africa	56	1 604	936	745	1	3 342	4.3%
Latin America	27	1 688	540	808	69	3 132	1.9%
Inter-regional transport	57	259	103	-	22	422	n.a.
World	**1 224**	**10 242**	**8 677**	**16 867**	**357**	**37 366**	**1.5%**

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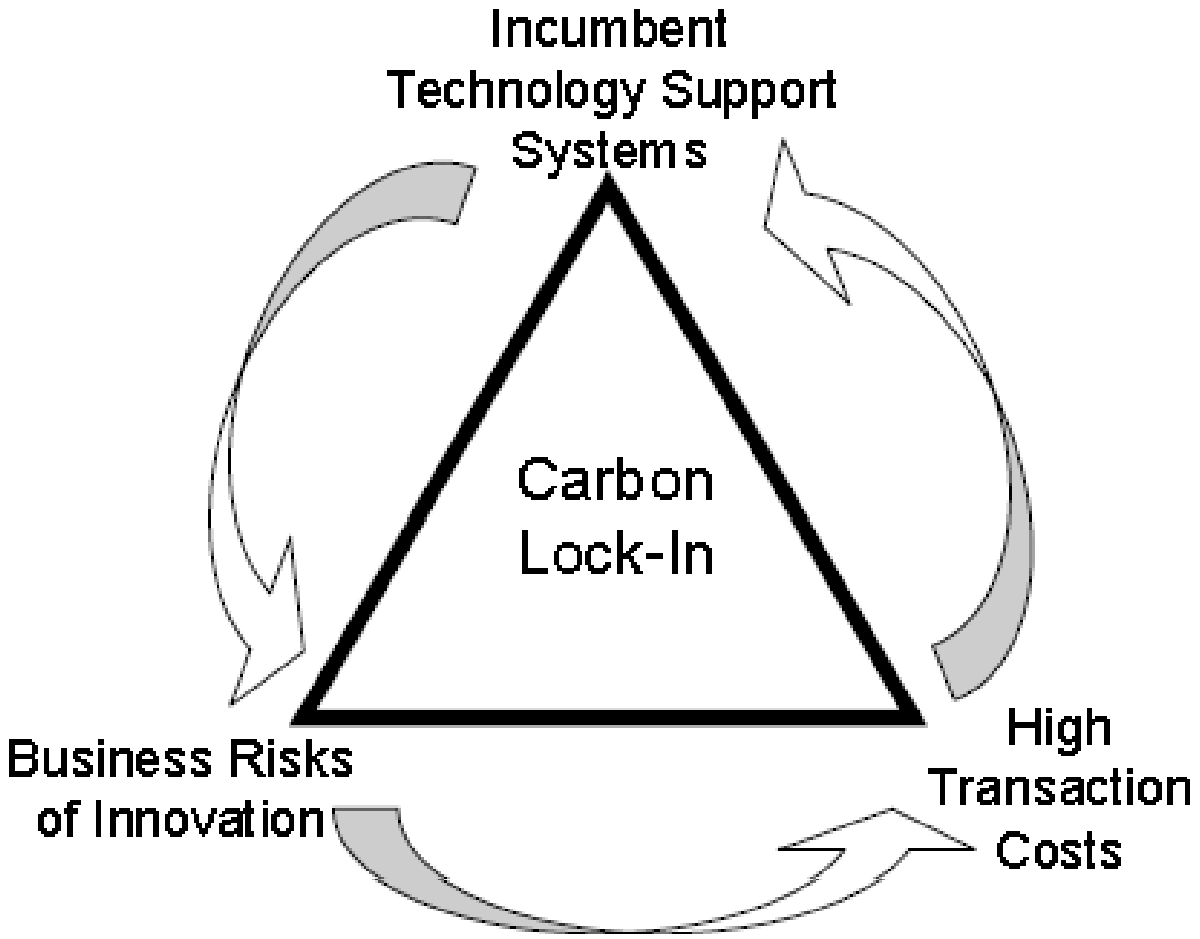
What's unique about energy?

(4) Stronger path dependency and inertia

Greater degree of lock-in



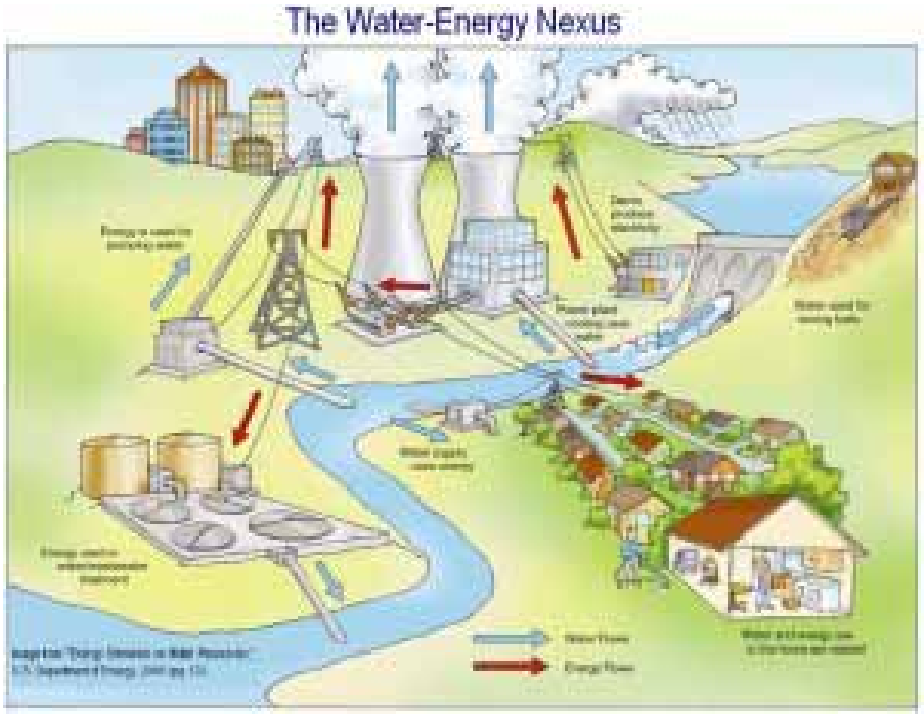
What challenges face the Asia Pacific?

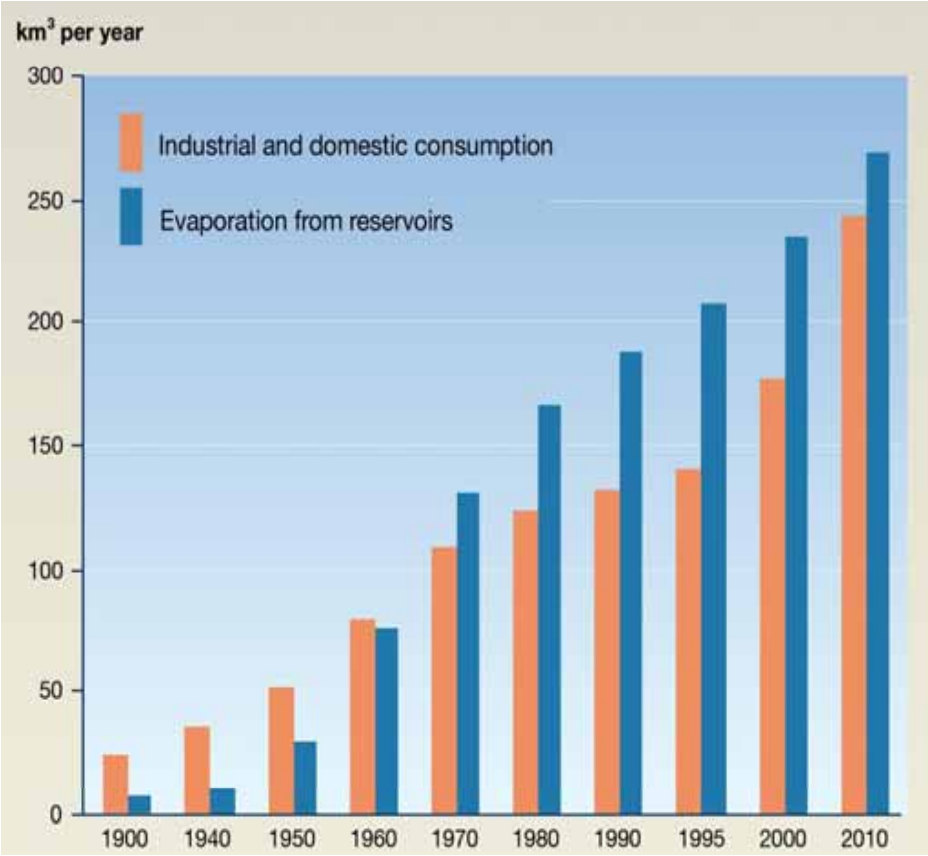
(1) Unclear levels of interference and authority, no global authority, no clear system boundaries

Actor	Role(s)
Central governments	Financing systems/programs through central budgets, setting national standards, coordinating international air programs
State and provincial governments	Financing systems/programs through state budgets
Local (community) government	Financing systems/programs through local budgets and promoting local development
Development agencies	Donating equipment, money, and other resources (such as technical capacity or resource assessments) to facilitate expansion of access
Nongovernmental organizations	Financing through third-party contributions, raising awareness
Private companies	Investment in projects offering adequate returns
Lending institutions	Investment in projects offering adequate returns
Cooperatives	Grouping of producers or consumers with common goals, provision of an institutional structure through which services can be delivered and paid for
Educational institutions	Investment in human capital
Villagers and end-users	Using and sometimes owning and operating equipment

What challenges face the Asia Pacific?

(2) Seamlessness with things like national defense, economic growth, transport and agriculture





Global Freshwater Evaporated from Dam Reservoirs, 1900 to 2010

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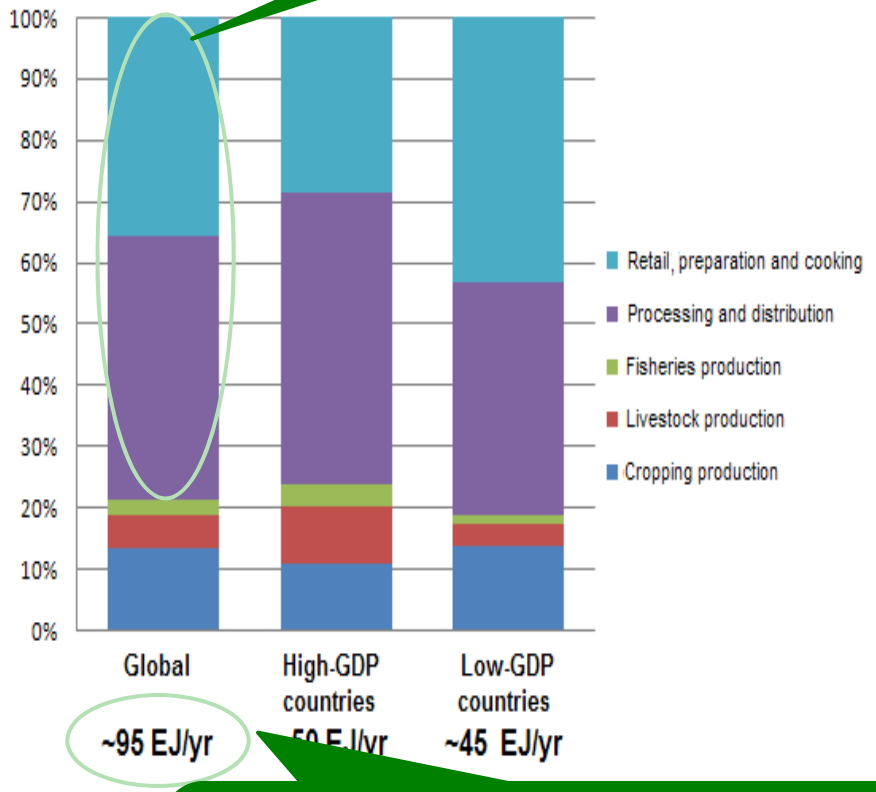
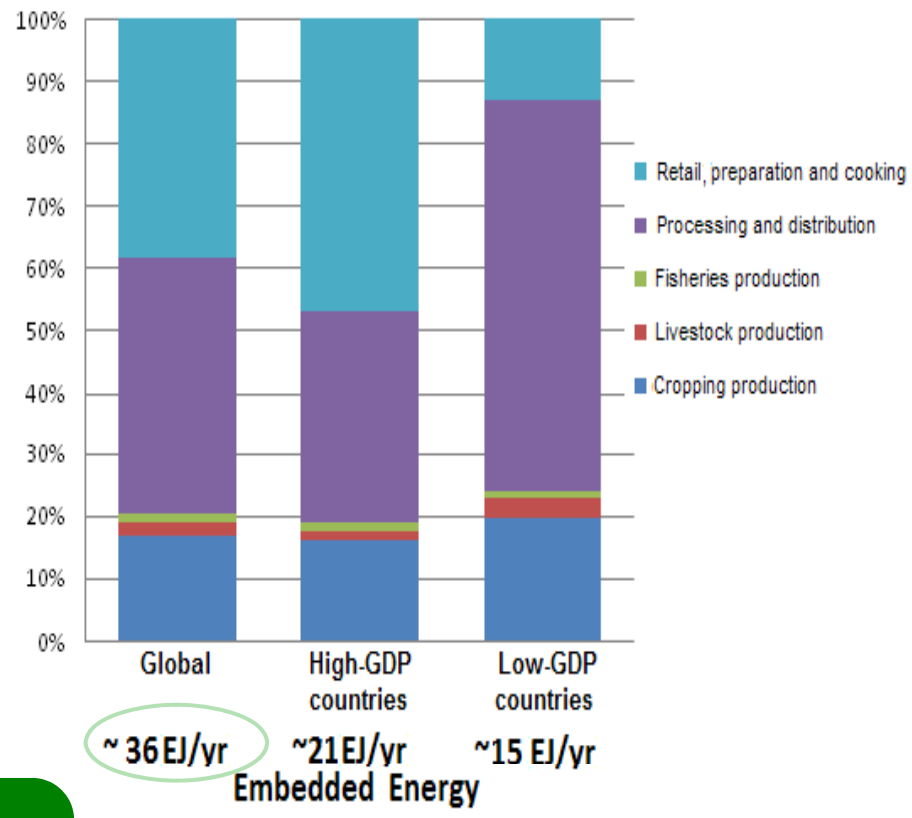
The energy food nexus

Energy inputs

>70% after the farm gate



Energy losses



Agrifood chain & energy:

- ~30% global energy use
- High dependence on fossil fuels

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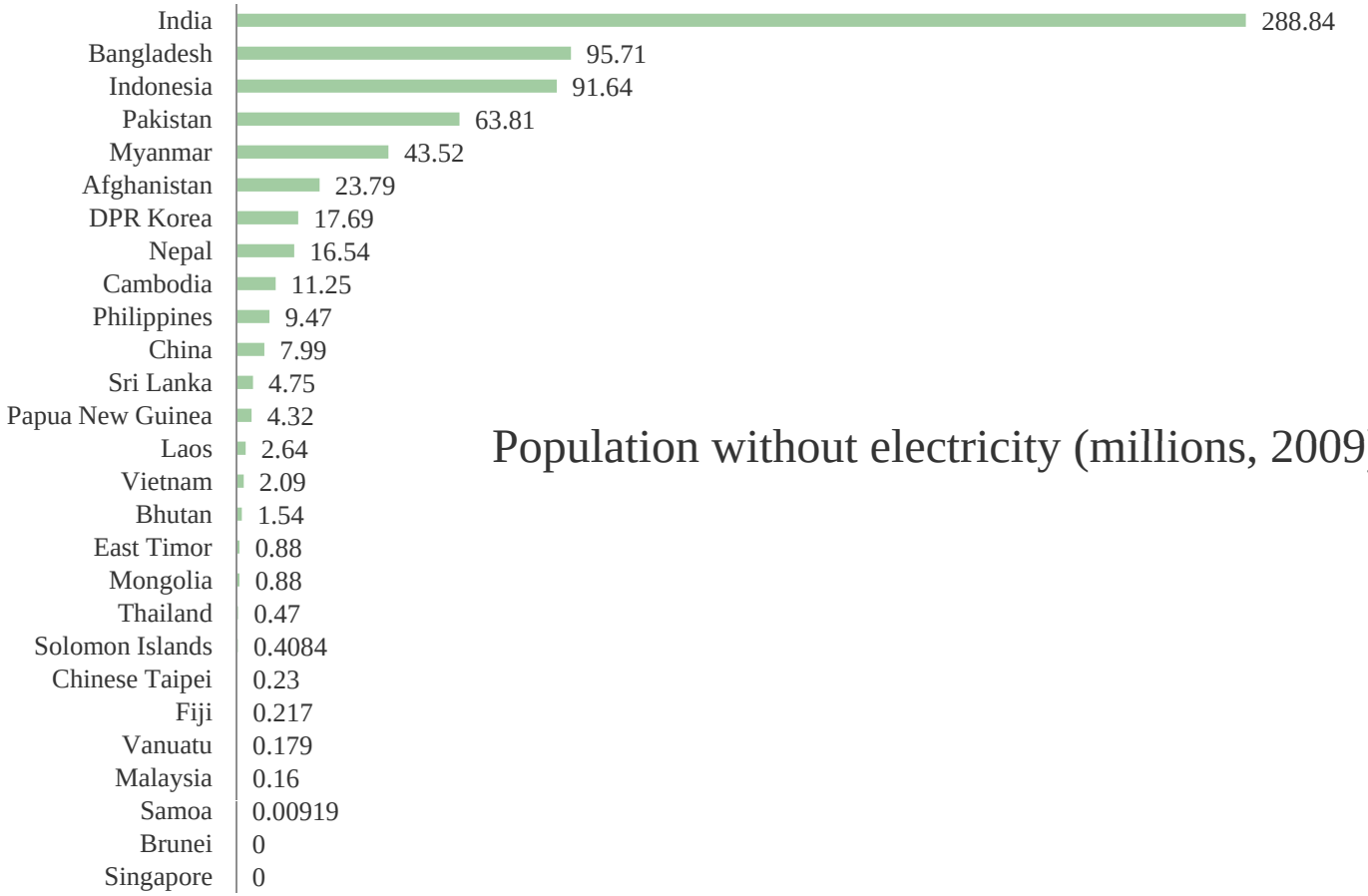
What challenges face the Asia Pacific?

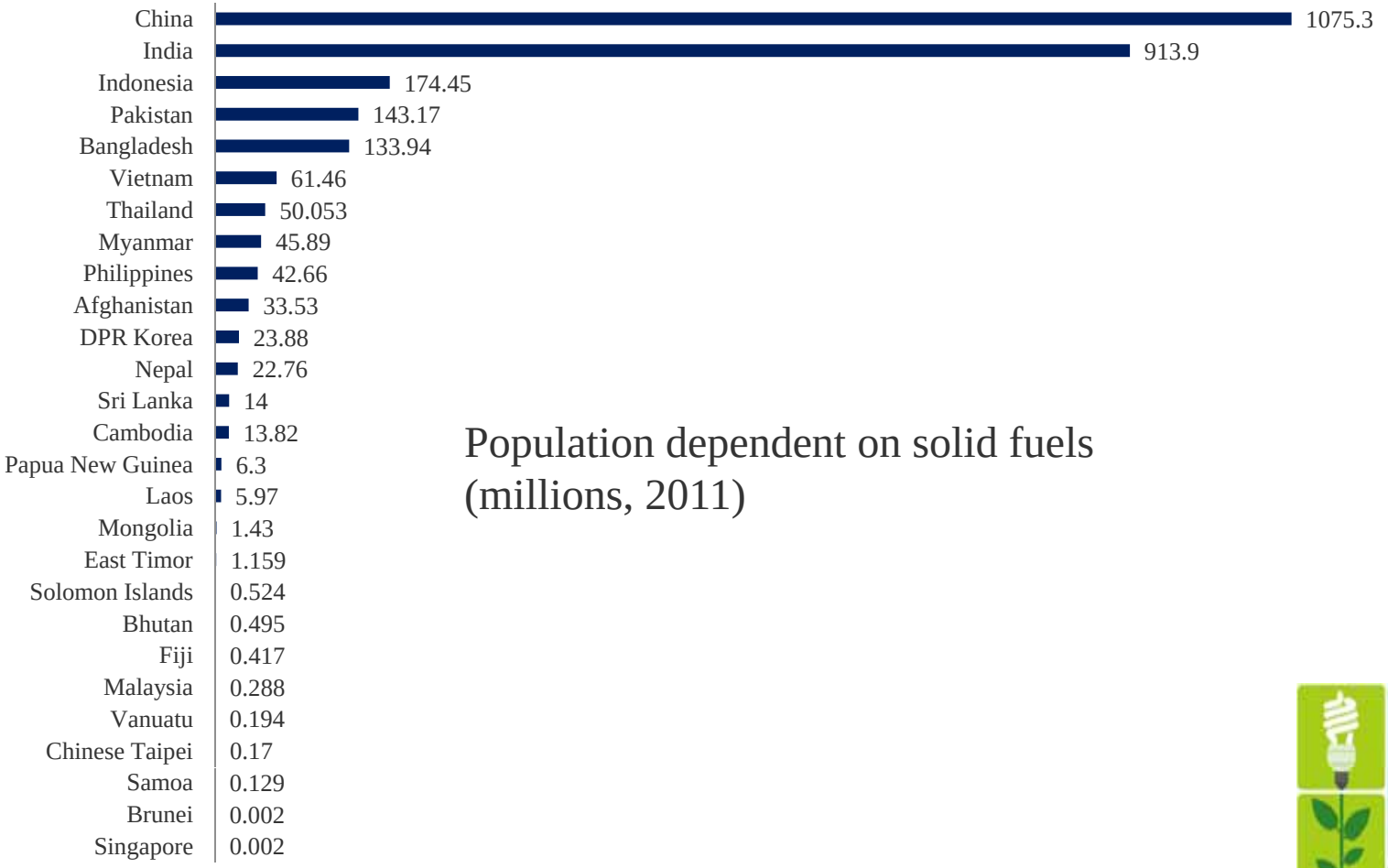
(3) Inequity, billions of people that consume large amounts of modern energy, and billions without any



Population without electricity (millions, 2009)

What challenges face the Asia Pacific?

(3) Inequity, billions of people that consume large amounts of modern energy, and billions without any



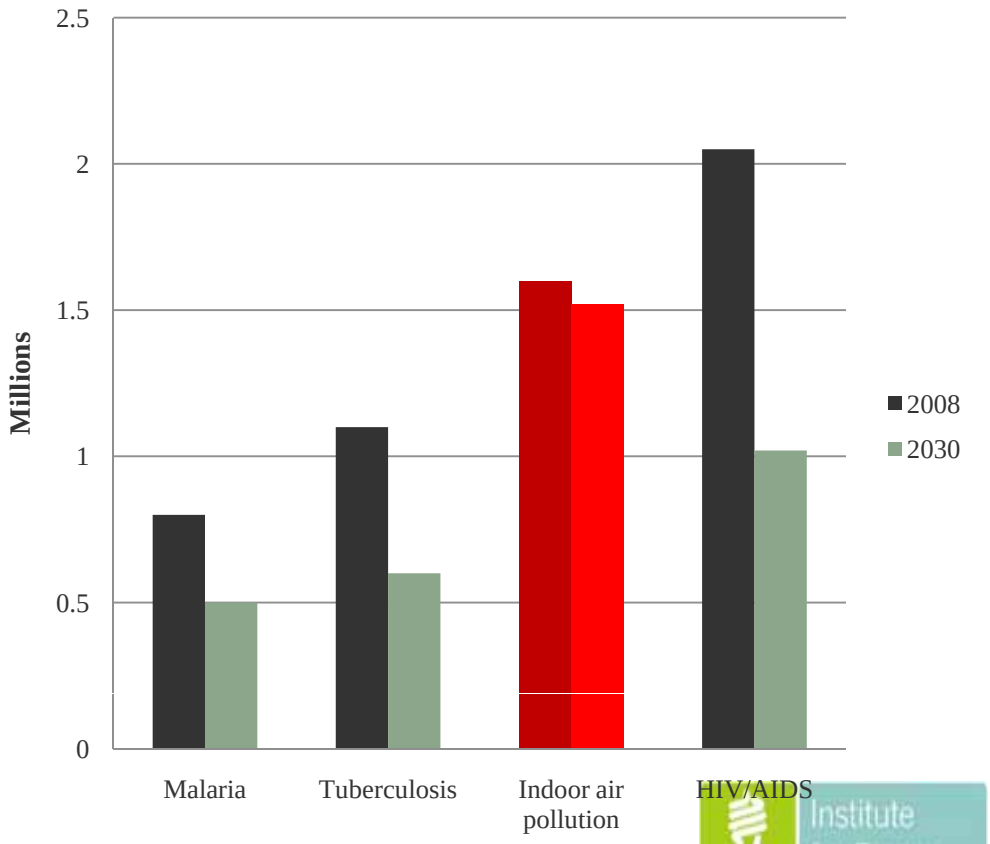
Population dependent on solid fuels (millions, 2011)

Level	Electricity Use	kWh per person per year	Solid Fuel Use	Mobility	Kilograms of oil equivalent per person per year
Basic human needs	Lighting, health, education, and communication	50 to 100	Cooking and heating	None, walking or bicycling	50 to 100
Productive uses	Agriculture, water pumping for irrigation, fertilizer, mechanized tilling, processing	500 to 1,000	Minimal	Mass transit, motorcycle, or scooter	150
Modern society needs	Domestic appliances, cooling, heating	2,000	Minimal	Private transportation	250 to 450

Why it's a public health issue:

Level of Development	Deaths in children under the age of 5	Adult deaths	Burden of diseases (thousands of daily adjusted life years)
High-mortality developing (38 percent of the population)	808,000	232,000	30,392
Lower-mortality developing (40 percent of the population)	89,000	468,000	7,595
Demographically and economically developed (22 percent of global population)	13,000	9,000	550
Total	**910,000**	**709,000**	**38,537**

Annual Deaths Worldwide by Cause, 2008 and 2030



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What challenges face the Asia Pacific?

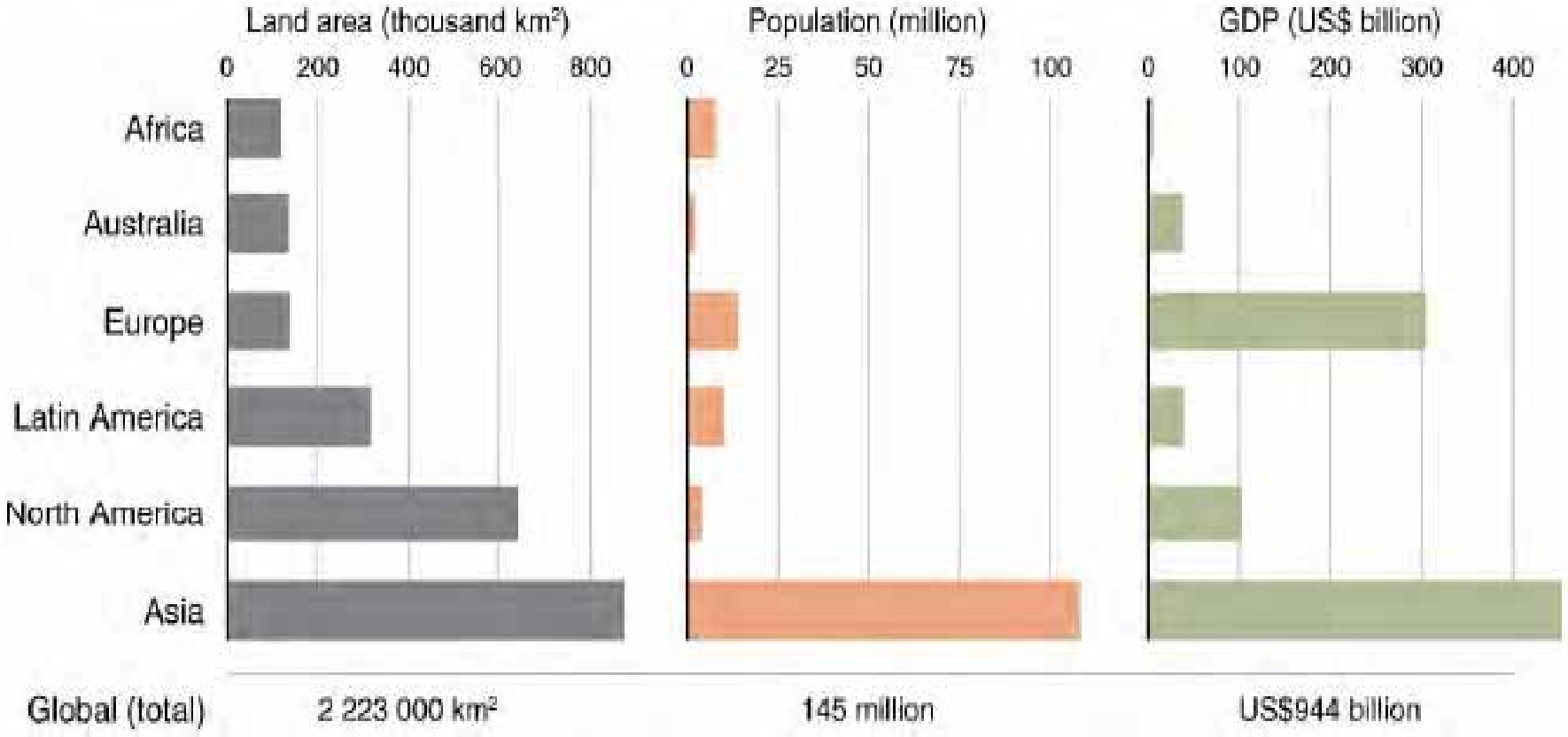
(4) Weak resilience, apparent system vulnerabilities that often cascade

Estimated economic and social impact of disasters in selected Pacific Island countries (1950-2008)

			Average Population Affected		Average Impact on GDP	
No. of		Loses		%	%	
Country	Disasters	(US$ 2008)	Disaster Years	All Years	Disaster Years	All Years
American Samoa	6	237,214,770	5.81	0.61	7.76	0.82
Cook Islands	9	47,169,811	5.13	0.63	3.48	0.43
Fiji	43	1,276,747,934	5.39	2.74	3.48	0.78
French Polynesia	6	78,723,404	0.53	0.04	0.31	0.02
FSM	8	11,915,993	6.20	0.65	0.82	0.09
Guam	10	3,294,869,936	1.97	0.28	10.13	1.42
Kiribati	4	0	29.19	1.54	0.00	0.00
Marshall Islands	3	0	6.40	0.22	0.00	0.00
New Caledonia	15	69,623,803	0.14	0.03	0.09	0.02
Niue	6	56,461,688	73.15	7.70	80.88	8.51
Papua New Guinea	58	271,050,690	0.69	0.36	0.14	0.07
Samoa	11	930,837,187	21.15	3.71	16.97	2.98
Solomon Islands	21	39,215,686	2.93	0.98	0.52	0.17
Tokelau	4	4,877,822	39.70	2.79		
Tonga	12	129,344,561	21.32	3.37	5.76	0.91
Tuvalu	5	0	3.19	0.28	0.00	0.00
Vanuatu	36	406,402,255	5.33	2.06	3.78	1.46

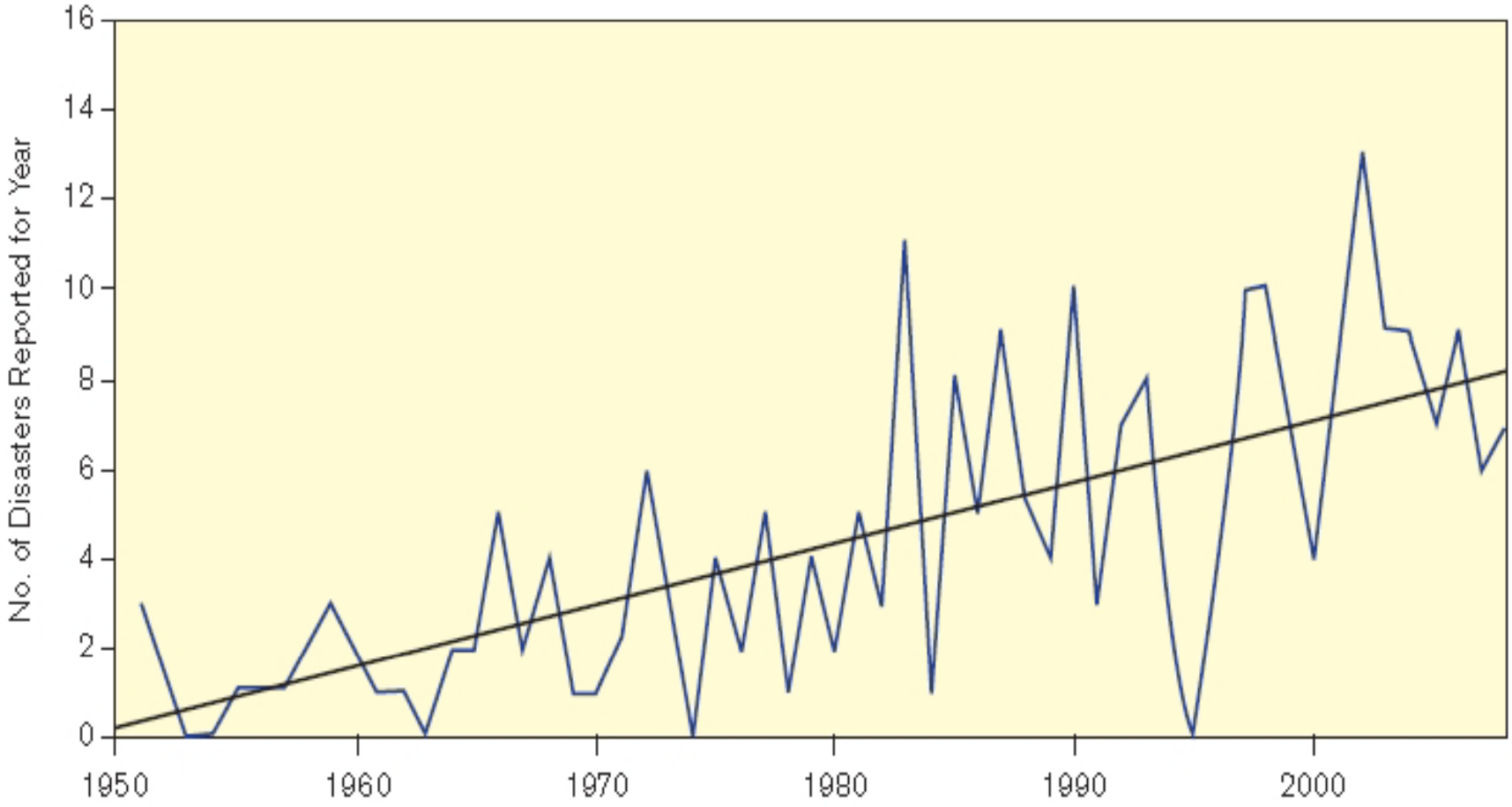
What challenges face the Asia Pacific?

Population, area, and economy directly affected by a one meter rise in sea level



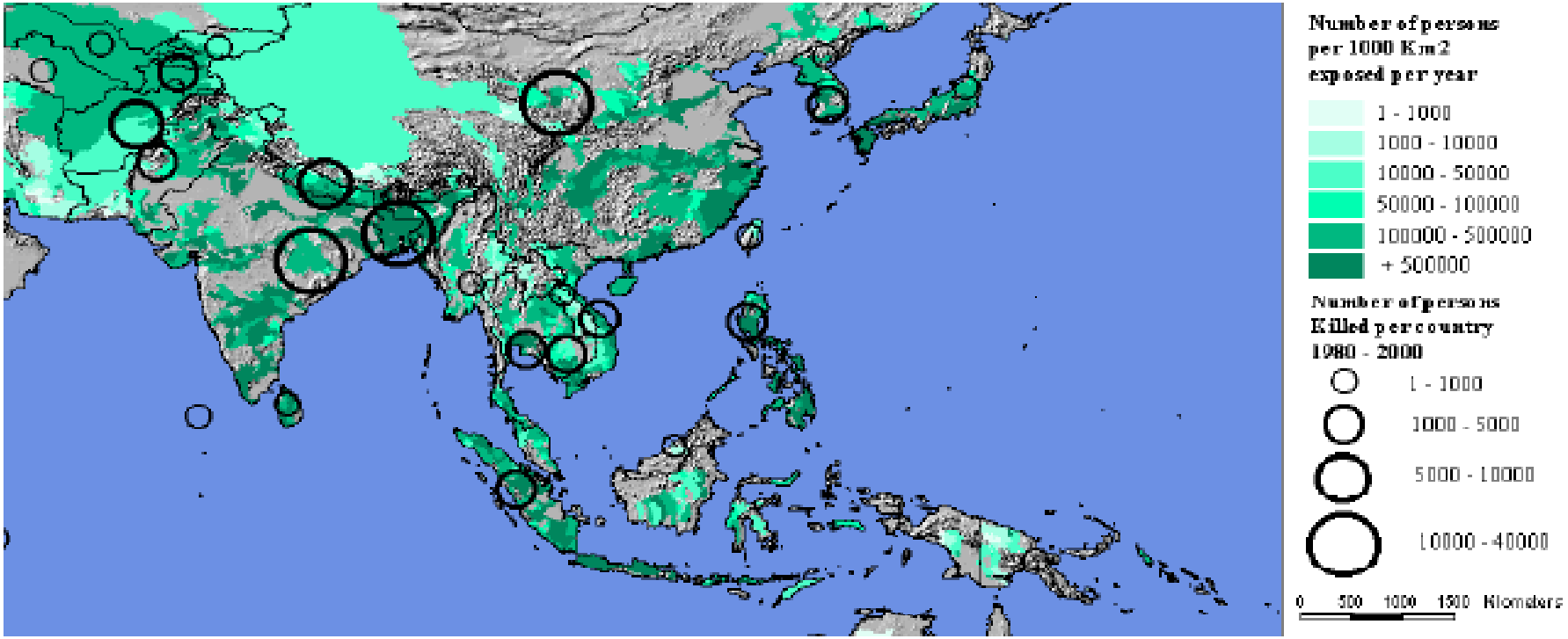
What challenges face the Asia Pacific?

Number of natural disasters reported in the Pacific Islands Region



What challenges face the Asia Pacific?

Density of persons exposed to and killed by floods in Asia and the Pacific, 1980-2000



Intensified floods in Thailand could place more than 5 million people at risk and cause $39 billion to $1.1 trillion in economic damages by 2050

What can we do as researchers?

(1) Better understand the political economies of energy transitions (at all scales)
(2) Continue to explore common pool resource issues (how cooperation, trust, and rule enforcement can alleviate problems)
(3) Conduct rigorous systems analysis (beyond the political or economics to the socio-technical)
(4) Incorporate neighboring disciplines (public policy, psychology, even communication studies and ethics)

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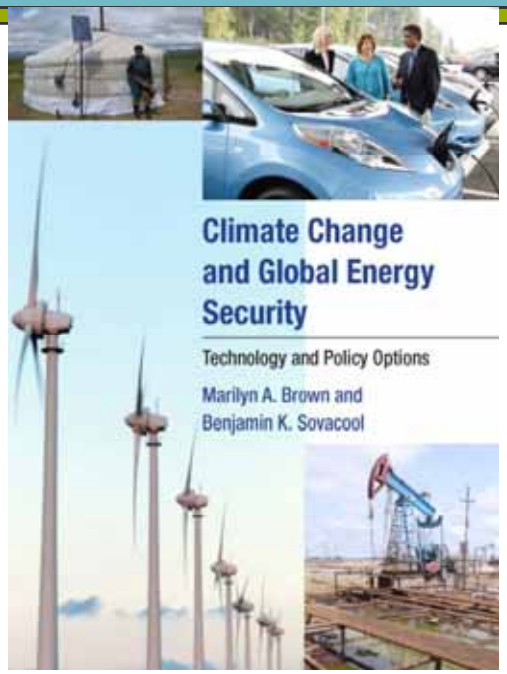
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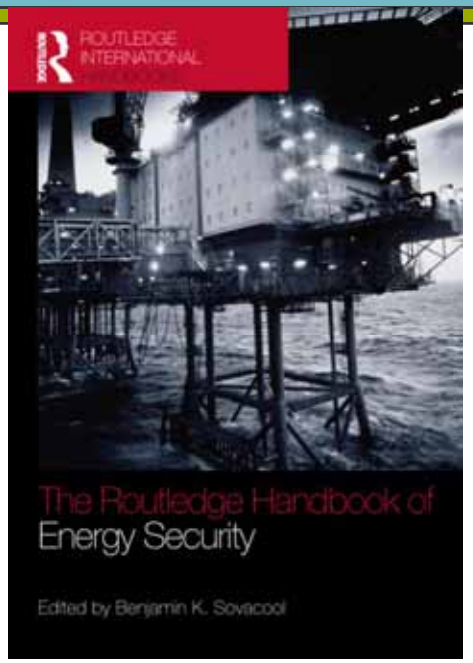
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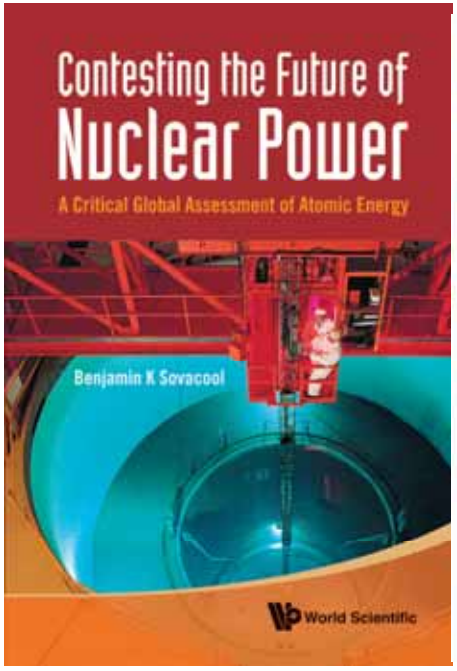
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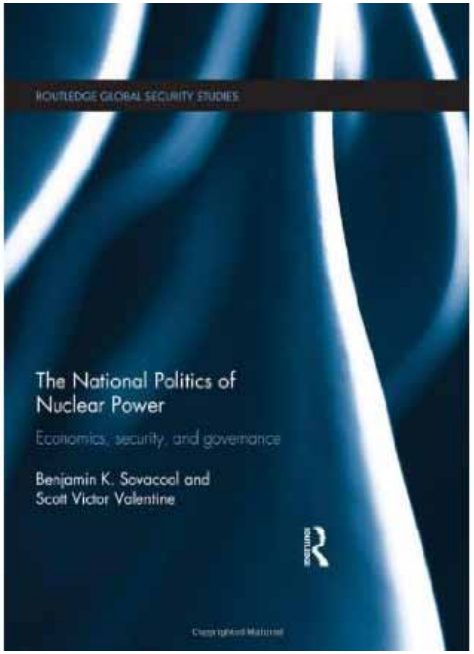
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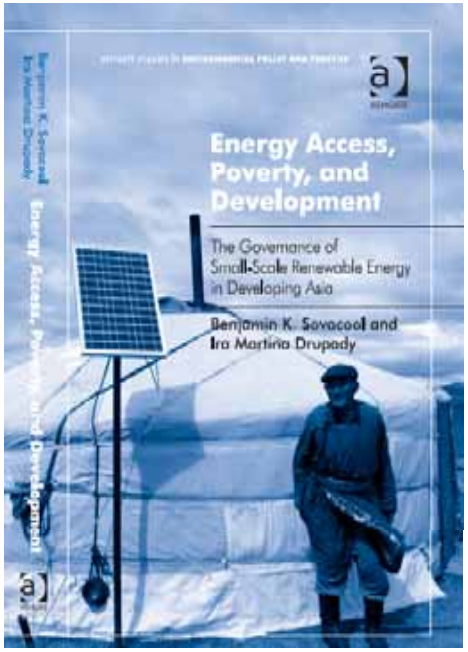
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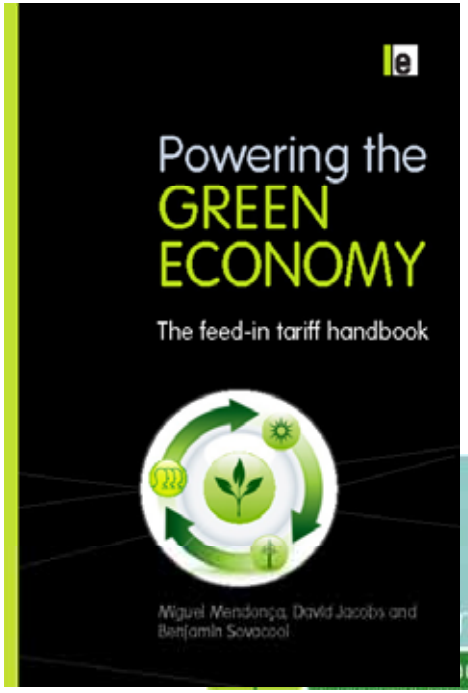
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