Lessons for North and South from California's Green Stimulus

David Roland-Holst

Department of Agricultural and Resource Economics
College of Natural Resources
UC Berkeley, dwrh@berkeley.edu

"It is not the strongest of the species that survives,
nor even the most intelligent,
but the one most responsive to change."
– Charles Darwin

Seminar Presentation to the IFC – 10 April 2010 – Washington DC

Contents

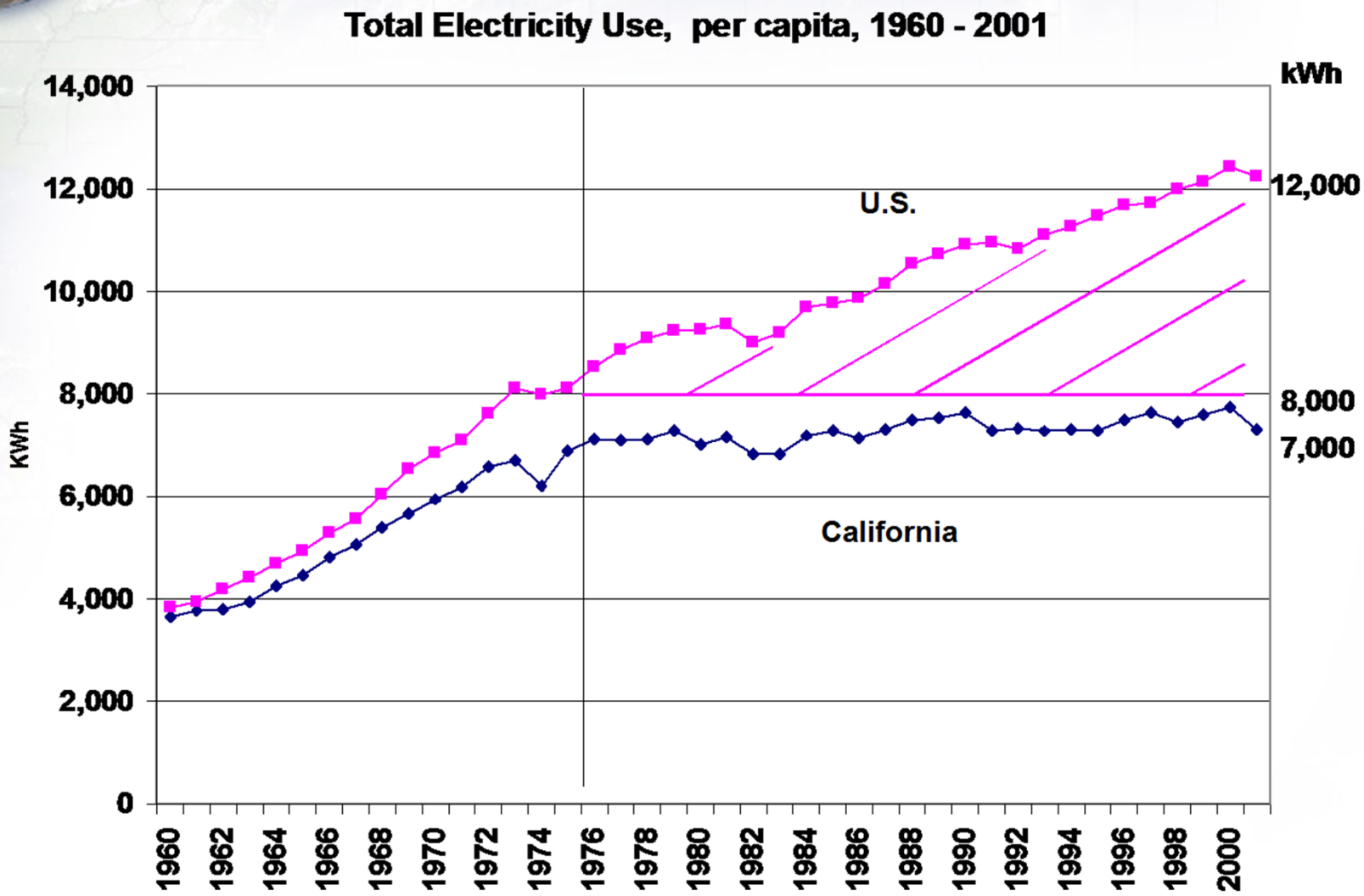
1. Energy Efficiency and Growth
   - California evidence
   - Implications for LDCs
2. From Mitigation to Adaptation
   - California again
   - Climate risk and response in a North-South context

Overview

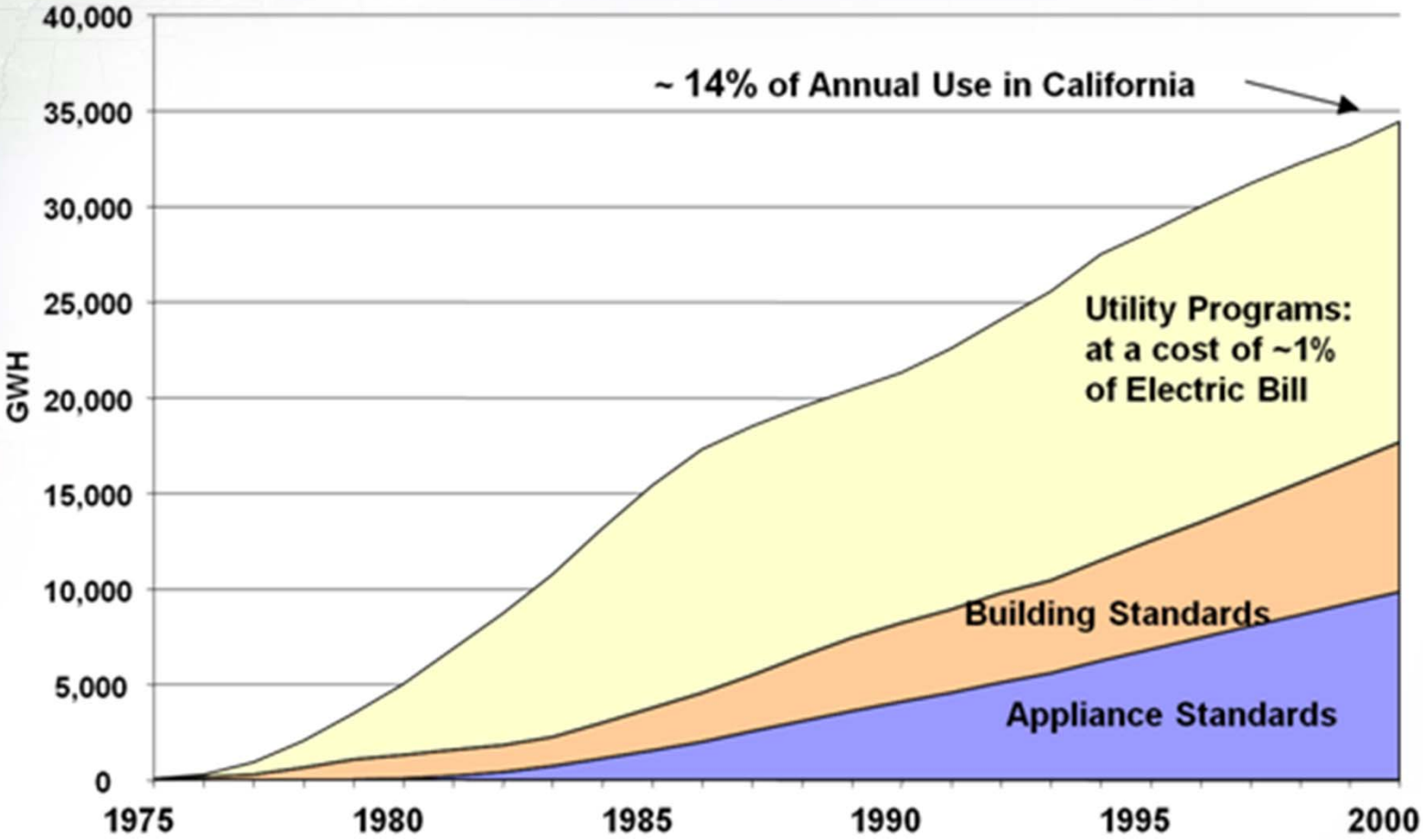
This talk summarizes results from three studies (available @ www.next10.org):

1. Energy Efficiency and Job Creation in California (September)
2. California Climate Risk and Response (November)
3. Energy Pathways for California (March)

Energy Efficiency and Jobs: California's Legacy



Energy Efficiency Gain Impacts from Programs Begun Prior to 2001



Historical Jobs Assessment

- A retrospective multiplier analysis of demand shifting
- Detailed BEA five-year Input-output Tables
- Employment data from California Employment Development Department dataset (CREE)

Job Creation from Household Energy Efficiency

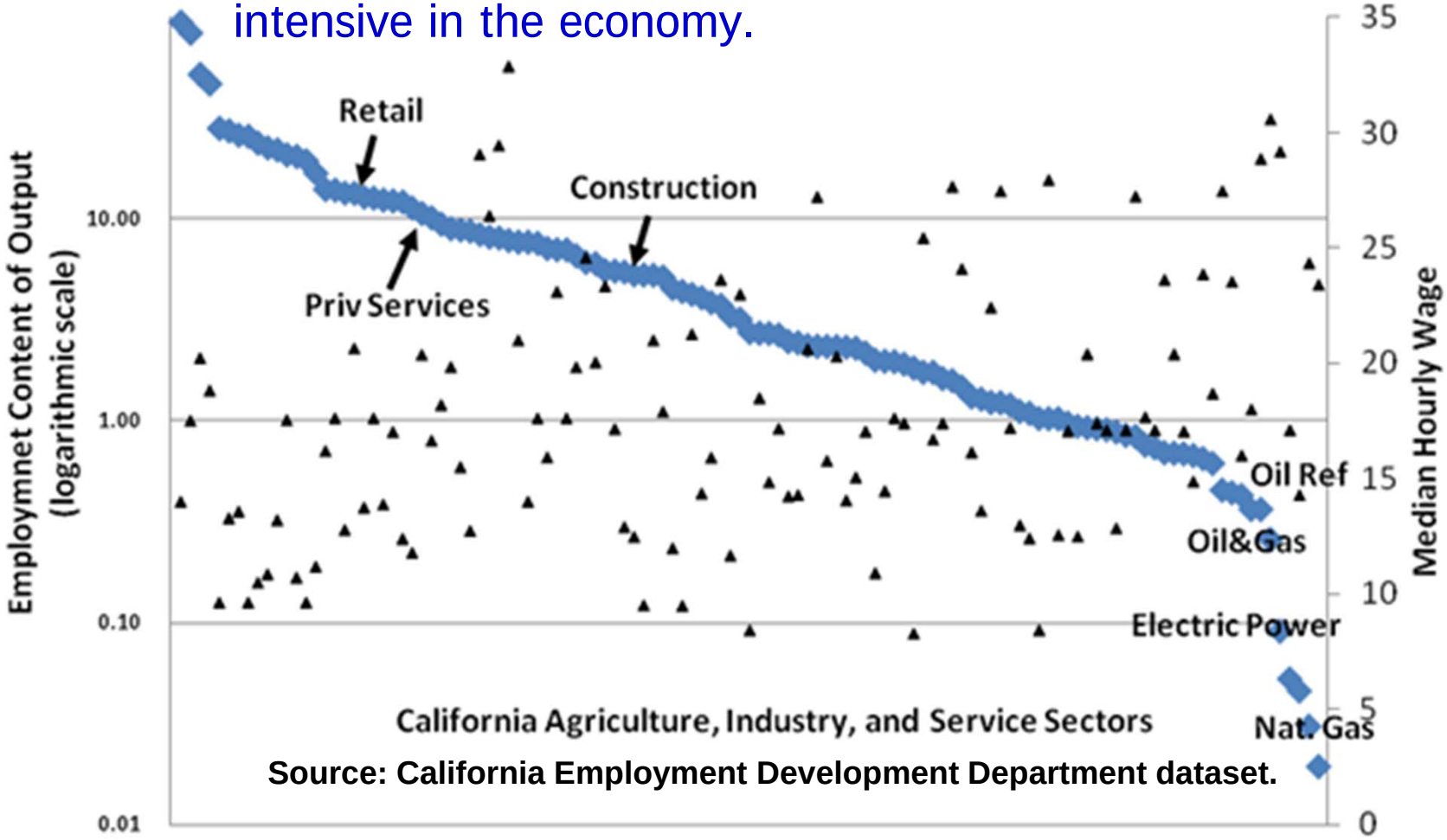
	1972	1977	1982	1987	1992	1997	2002	2007	Total
Agriculture	-	36	112	204	266	631	849	869	2,967
EnergyRes	-	0	-1	-1	0	-1	-1	-1	-5
ElectPwr	-	-266	-1,140	-2,236	-3,405	-4,720	-5,809	-5,944	-23,520
OthUtl	-	-12	-78	-2	13	71	77	79	149
Constructio	-	-	-	-	-	-	-	-	-
Light Indus	-	821	2,688	4,593	6,095	8,392	9,247	9,463	41,300
OilRef	-	-14	-6	-9	-10	-14	-24	-25	-102
Chemica	-	48	190	448	764	555	2,234	2,287	6,526
Cement	-	0	0	0	0	0	0	0	0
Metals	-	2	1	4	-5	-16	-16	-16	-46
Machinery	-	14	26	54	44	-38	-51	-52	-2
Semicon	-	0	0	3	8	176	318	325	830
Vehicles	-	20	38	133	133	240	427	437	1,428
OthInd	-	37	125	265	397	1,136	1,770	1,811	5,541
WhlRetTr	-	4,740	15,254	32,236	46,139	83,118	136,402	139,587	457,475
VehSales	-	-	-	-	-	215	0	0	215
Transport	-	9	31	-211	76	202	305	312	724
FinInsREst	-	1,191	5,340	15,075	30,808	21,500	34,201	35,000	143,114
OthServ		3,137	14,816	48,336	101,656	163,263	245,043	250,765	827,016
	-	9,763	37,396	98,892	182,977	274,710	424,974	434,898	1,463,161

Employee Compensation (millions of 2000 US dollars)

	1972	1977	1982	1987	1992	1997	2002	2007	Total
Agricultur	-	0	2	3	4	9	16	17	52
EnergyRes	-	0	0	0	0	0	0	0	0
ElectPwr	-	-10	-50	-111	-190	-303	-441	-546	-1,652
OthUtl	-	-1	-4	0	0	4	5	6	10
Constructi	-	-	-	-	-	-	-	-	-
LightIndus	-	20	70	117	162	214	284	323	1,190
OilRef	-	-1	0	0	-1	-1	-2	-3	-8
Chemica	-	2	7	16	27	23	87	97	258
Cement	-	0	0	0	0	0	0	0	0
Metals	-	0	0	0	0	-1	-1	-1	-2
Machinery	-	0	1	2	2	-1	-2	-2	-2
Semicon	-	0	0	0	0	11	25	32	69
Vehicles	-	1	2	7	7	11	22	22	72
OthInd	-	1	3	7	12	36	67	82	208
WhlRetTr	-	105	336	707	1,026	1,859	3,530	3,647	11,211
VehSales	-	-	-	-	-	7	0	0	7
Transport	-	0	1	-8	3	8	14	13	32
FinInsREs	-	31	158	512	1,207	971	2,036	2,415	7,329
OthServ	-	78	316	1168	2690	4,516	7,966	9,101	25,836
	-	227	840	2,420	4,950	7,363	13,605	15,205	44,611

Why it works

The carbon fuel supply chain is among the least employment intensive in the economy.



Source: California Employment Development Department dataset.

Efficiency for Growth

- Promoting efficiency saves money for individuals and enterprises, liberating resources for more job-intensive growth
- Standards and incentives should be extended nationally, using public policy to overcome adoption barriers and innovation constraints
- Energy efficiency is the next breakout technology sector, and domestic standards to promote innovation will establish global markets

Energy Efficiency in the LDC Context

Rather than promoting efficiency, many LDCs subsidize energy use. A stubborn artifact of the pre-climate change era:

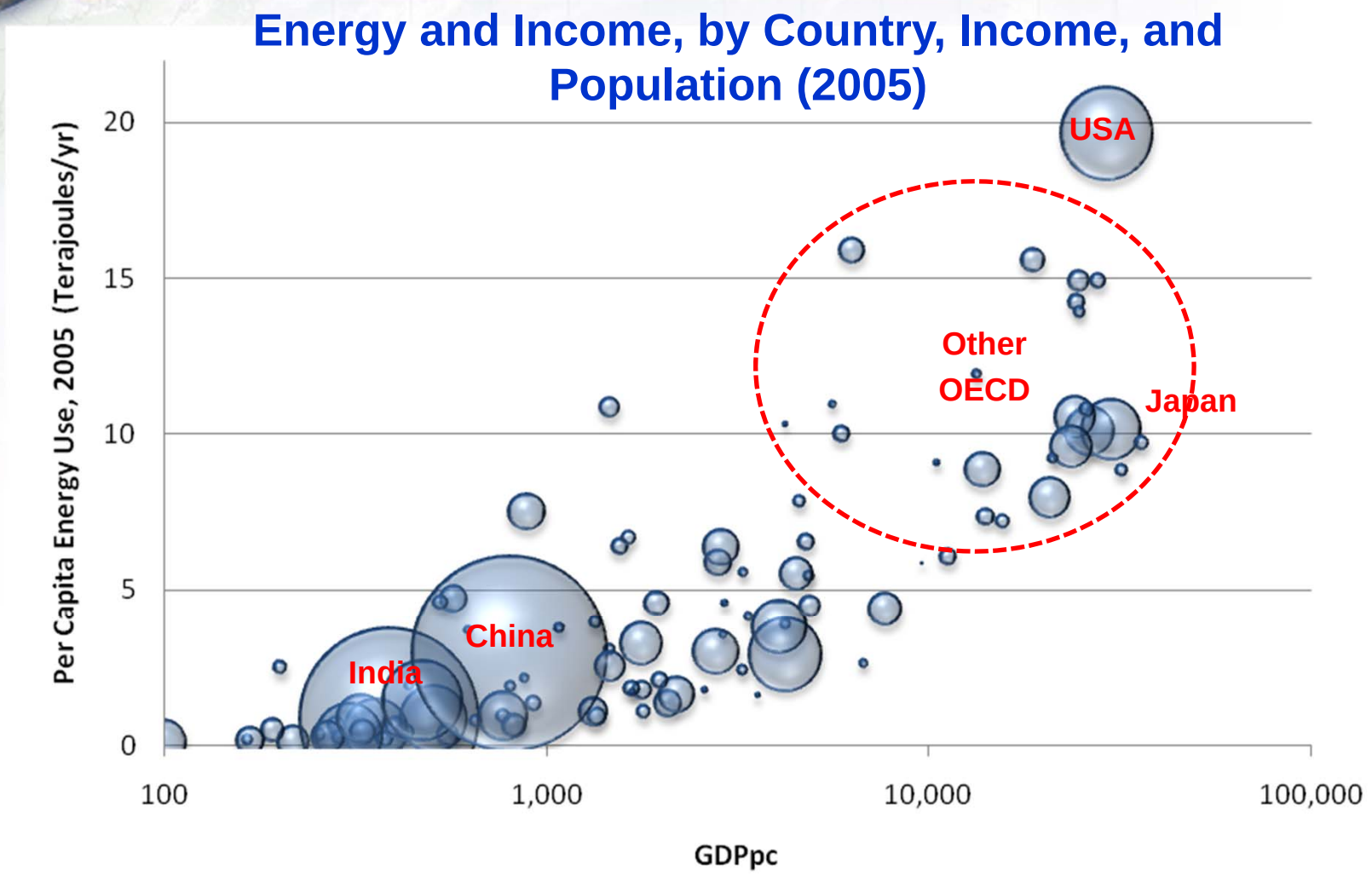
Pros

- Real incomes – essential energy services
- Market access – lower trade margins

Cons

- Biased technology choice/urban and regional development
- Sustainability: Environmental and Fiscal

Sustainability:
Can we really keep doing this?



Source: Author estimates from International Energy Agency and World Bank data. Bubble diameter is proportional to population

Energy Efficiency

- In principal, EE can confer the same benefits on non-OECD economies:
  - Higher real incomes – net energy savings
  - Market access – lower transport costs
- Without the main drawbacks:
  - Adverse technology bias
  - Unsustainable emission and fiscal trajectories
- Clean energy is great, but demand side management is far from realizing it's potential.
- To promote adoption, we must overcome:
  1. Lack of access to new technology
  2. Financial hurdles

Adoption versus Energy Subsidies

Consider the cost of new and old appliances with direct and indirect (energy) subsidies

$$C_1 = (1 - s_1)F_1 + \sum V_{1t} p_t \delta_t$$

$$C_0 = F_0 + \sum (1 - s_0) V_{0t} p_t \delta_t$$

where F are fixed and V are variable cost determinants (e.g. VMT/mpg), s is a subsidy rate, p_t are energy prices, and $\delta_t = 1/(1+r)^t$ is a discount rate.

The first approach can promote technology adoption, the second mainly promotes energy use and reinforces negative carbon externalities.

The second approach can also lead to fiscal problems in the face of rising energy prices.

Subsidizing Efficiency

Assuming constant variable costs and setting the $C_1 = C_0$ yields an adoption subsidy

$$s_1 F_1 = (F_1 - F_0) + [V_1 - (1 - s_0)V_0] \sum p_t \delta_t$$

which must compensate for

1. difference in initial cost and
2. present value difference in operating costs.

For identical appliances, we have

$$s_1 F = s_0 V \sum p_t \delta_t$$

i.e. the adoption subsidy equals the present value of the energy subsidies

Subsidizing Efficiency

For example, if improved energy efficiency equals the subsidy rate

$$V_1 = (1 - s_0)V_0$$

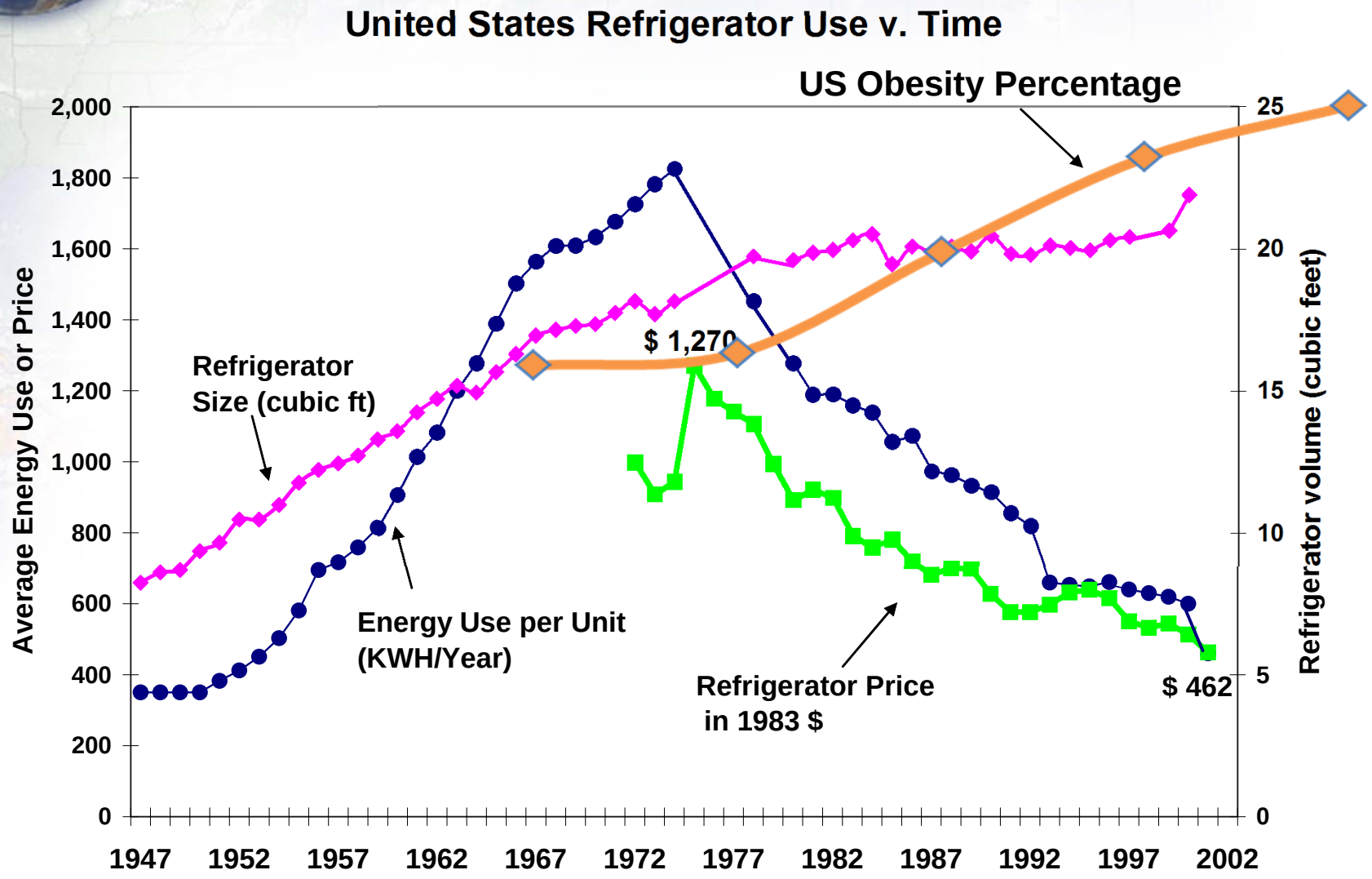
then the adoption subsidy need only compensate for the purchase price difference

$$F_1 - F_0$$

How to Promote EE Adoption

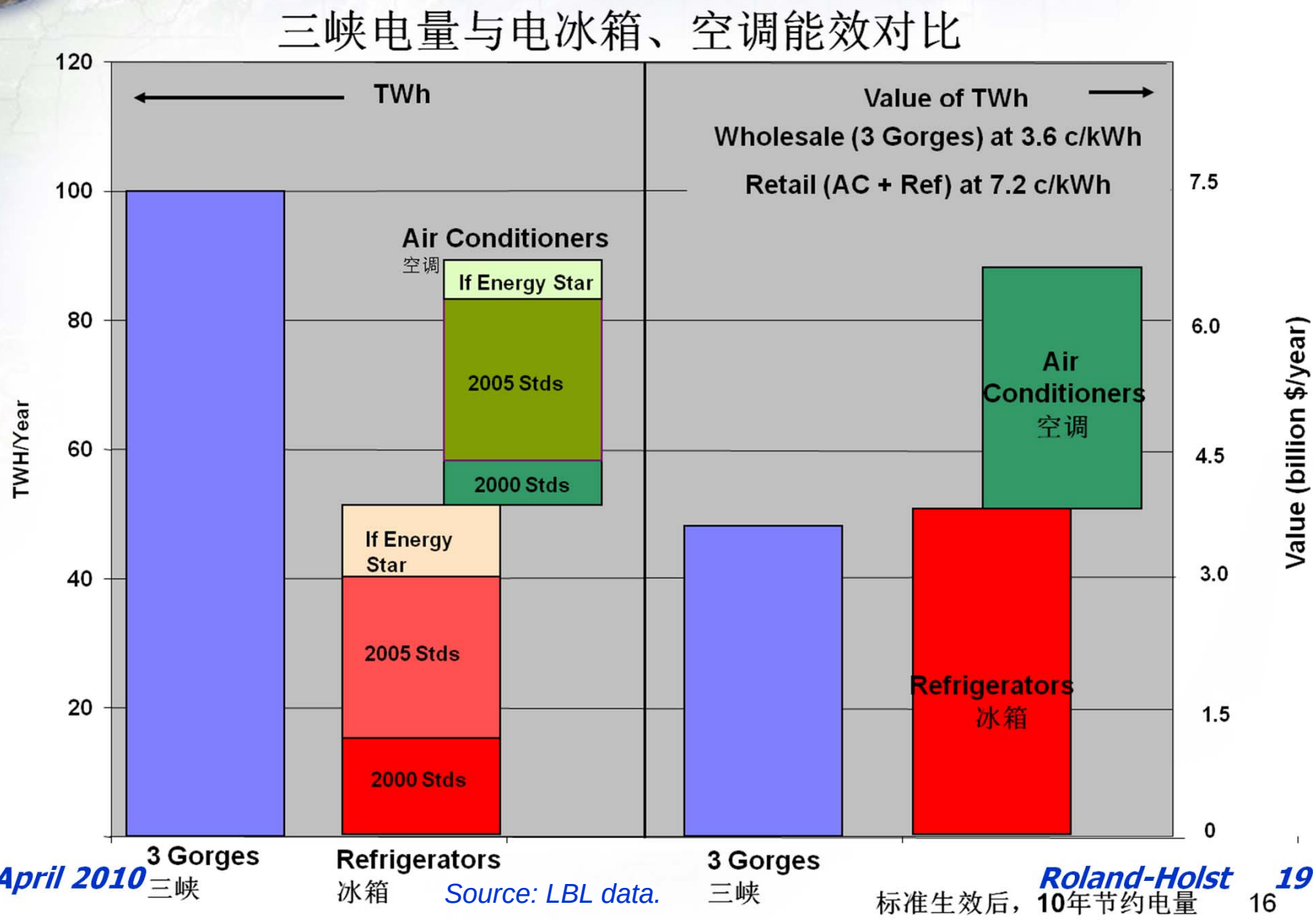
- US experience suggests that capital markets can fail here.
- California, the most successful state in promoting EE, has relied completely on standards (i.e. command and control).
- Even if the technology has to be imported, energy savings have domestic multiplier effects and usually reduce other (fuel) import dependence.

Demand Side Management: This Fruit is Ripe and Low Hanging



Source: A. Rosenfeld and CDC.

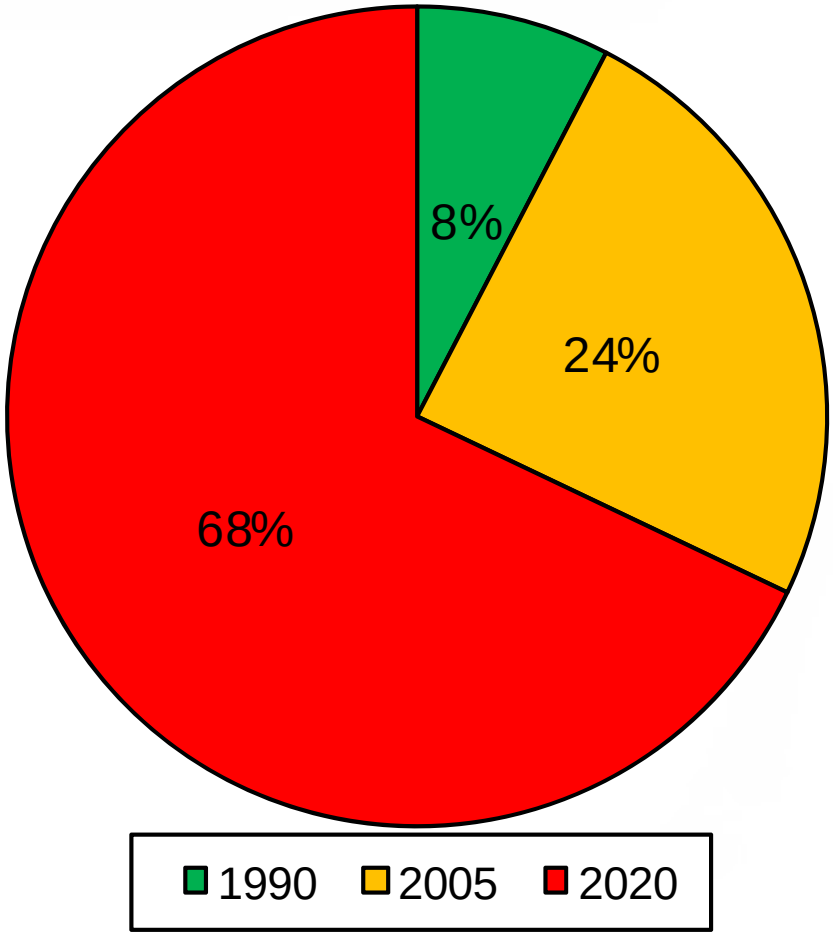
Demand vs. Supply Side Solutions: Electric Power in China



Source: LBL data.

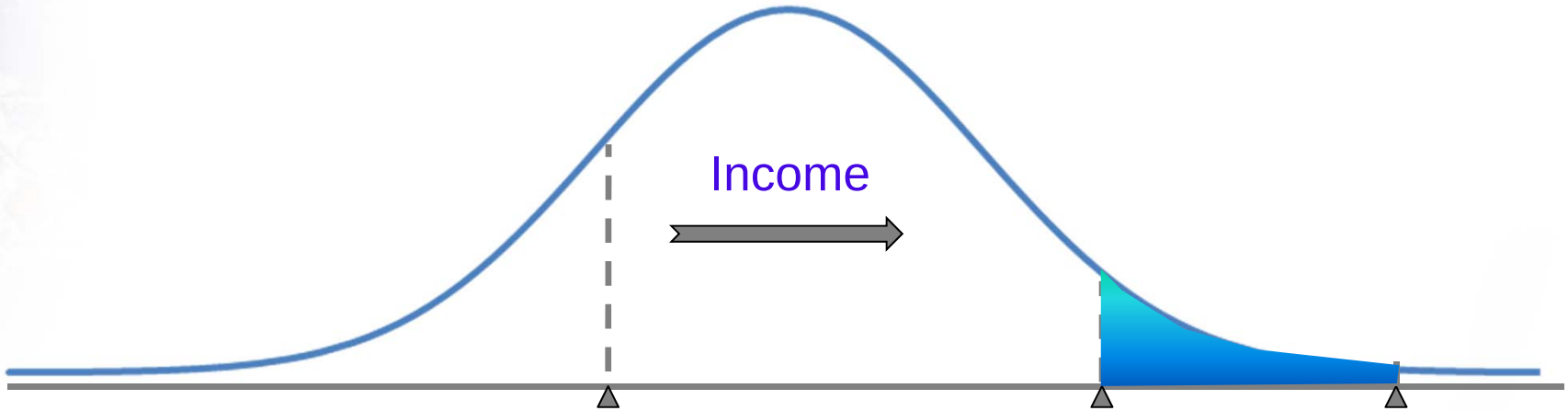
Supply-side Solutions and Climate: China's Electric Power Capacity

- Between now and 2020, more new capacity will be added than the entire installed capacity of the EU-25
- 87% coal-fired
- 30-50 year useful life



Why promote efficiency now...

Durable Goods: Linear Growth of Average Income
Induces Exponential Growth of New Demand



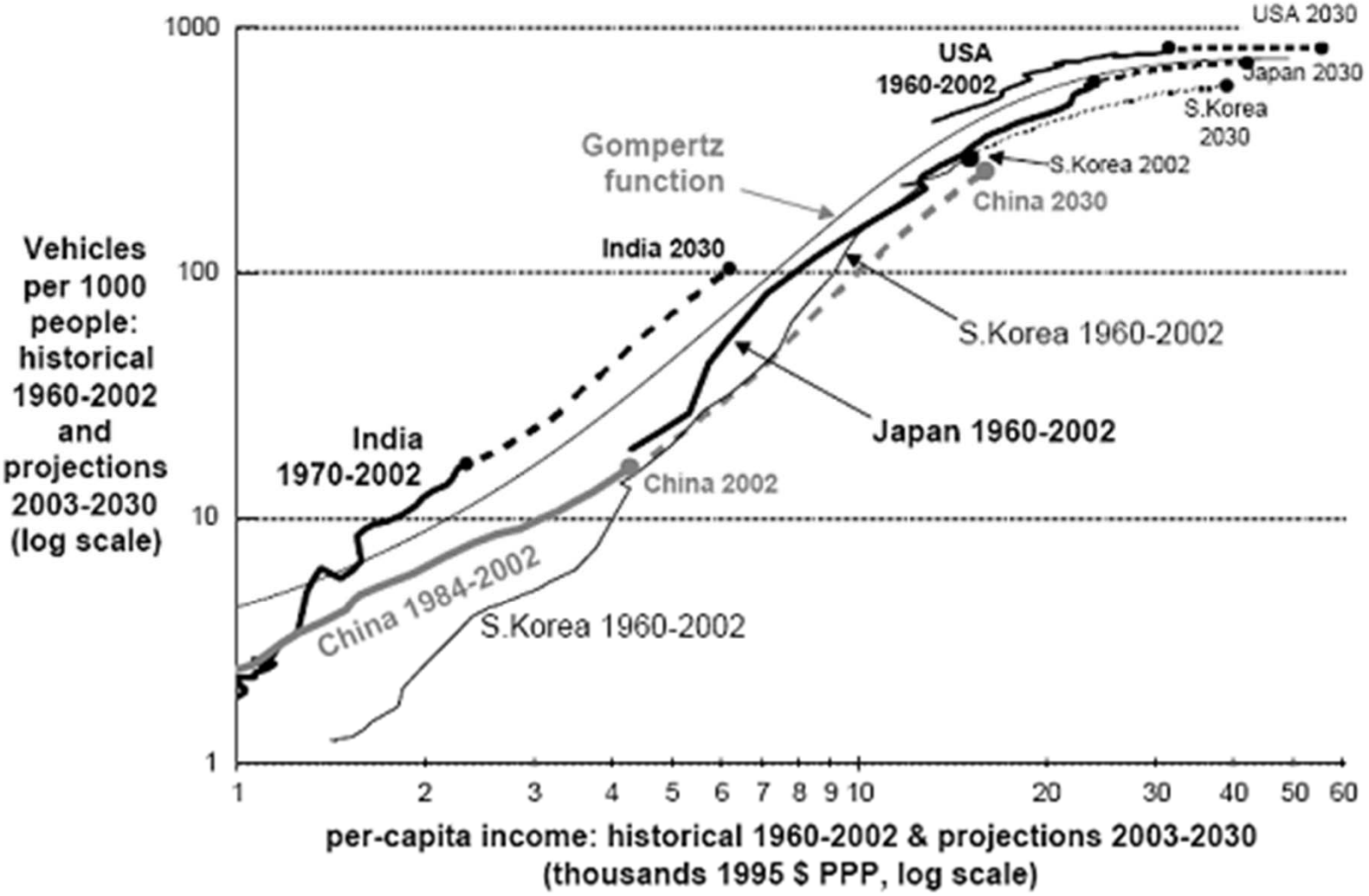
Consumption Milestones:

TV

Scooter

Auto

Vehicle Demand Growth: 1960-2030



Adaptation: The New Agenda of Climate Defense

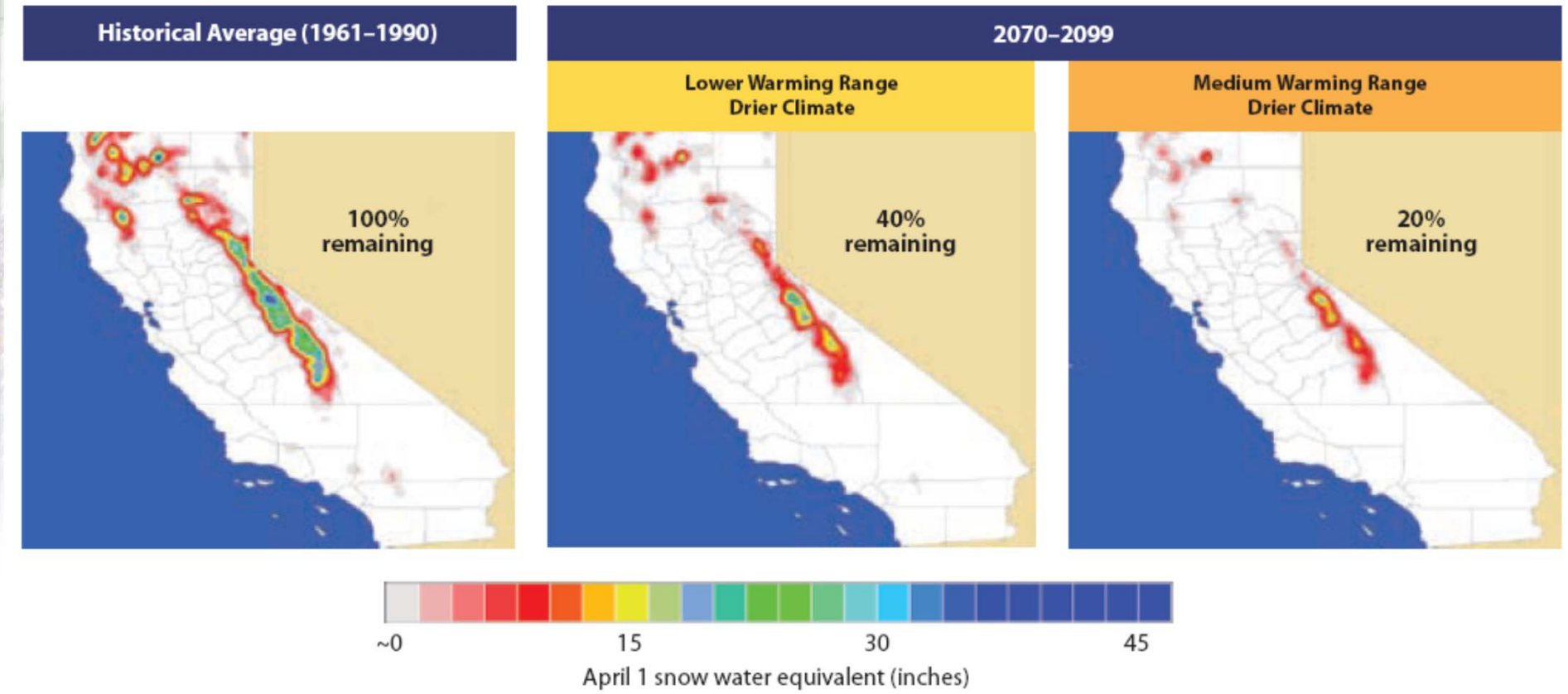
- No state or country can stop Climate Change alone, but each has a responsibility to protect itself
- Over the next century, we face enormous adaptation challenges, regardless of our own mitigation policies

Economic Damage and Asset Risk Estimates for California

2006 USD Billions Sector	Damage Cost/Year Low	High	Assets at Risk	
1 Water	NA	0.6	5	
2 Energy	2.7	6.3	21	
3 Tourism and Recreation	0.2	7.5	98	
4 Real Estate	0.2	1.4	900	Water
	0.1	2.5	1,600	Fire
5 Agriculture, Forestry, Fisheries	0.3	4.3	113	
6 Transportation	NA	NA	500	
7 Public Health	3.8	24	NA	
Total	7.3	46.6		

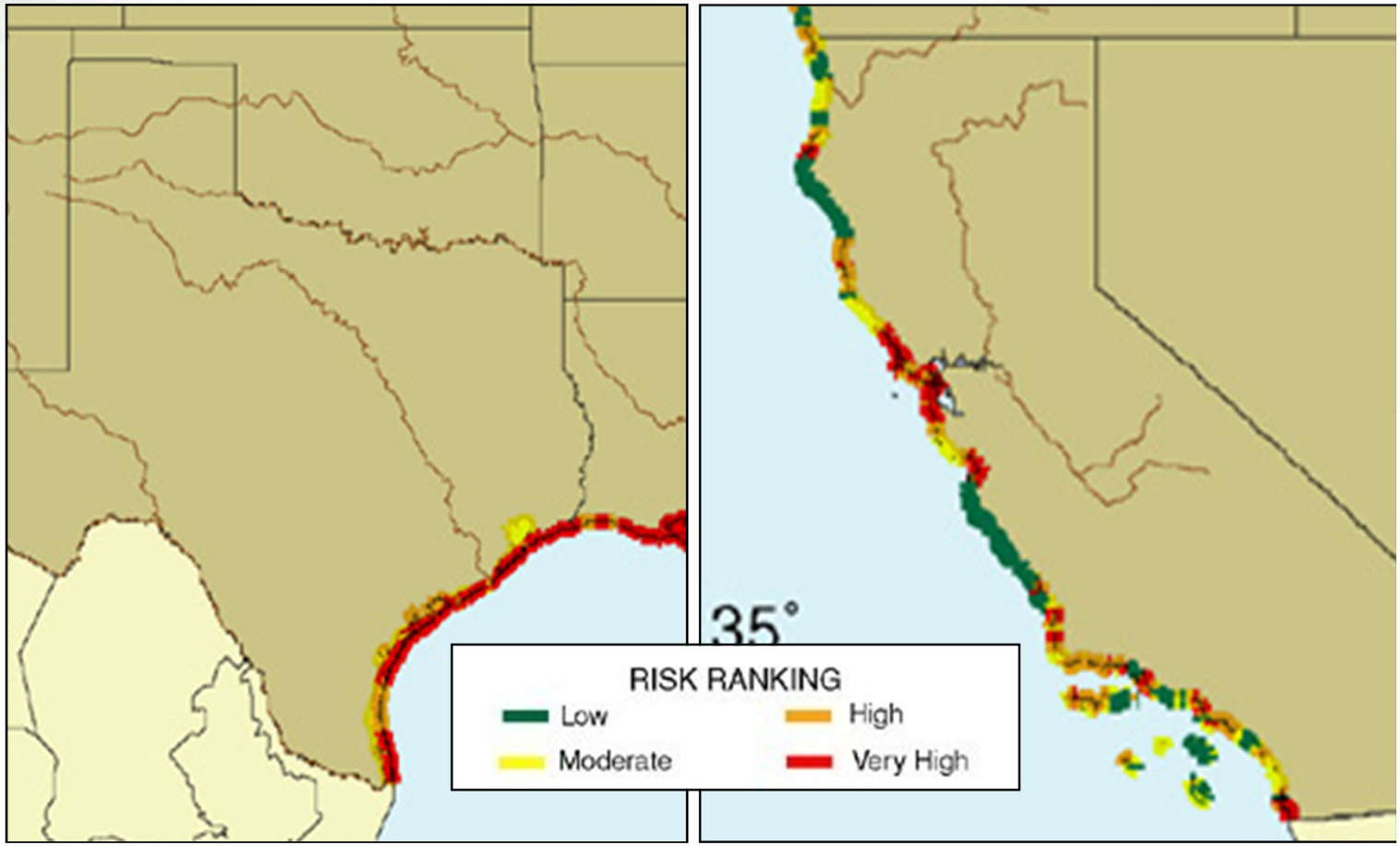
Source: Roland-Holst and Kahrl, "California Climate Risk and Response"
www.next10.org

Reduction in the Sierra Snowpack



Notes and Source: "Lower Warming Range Drier Climate" is based on an GFDL B1 scenario; "Medium Warming Range Drier Climate" is based on a GFDL A2 scenario. Luers et al., 2006.

Coastal Vulnerability



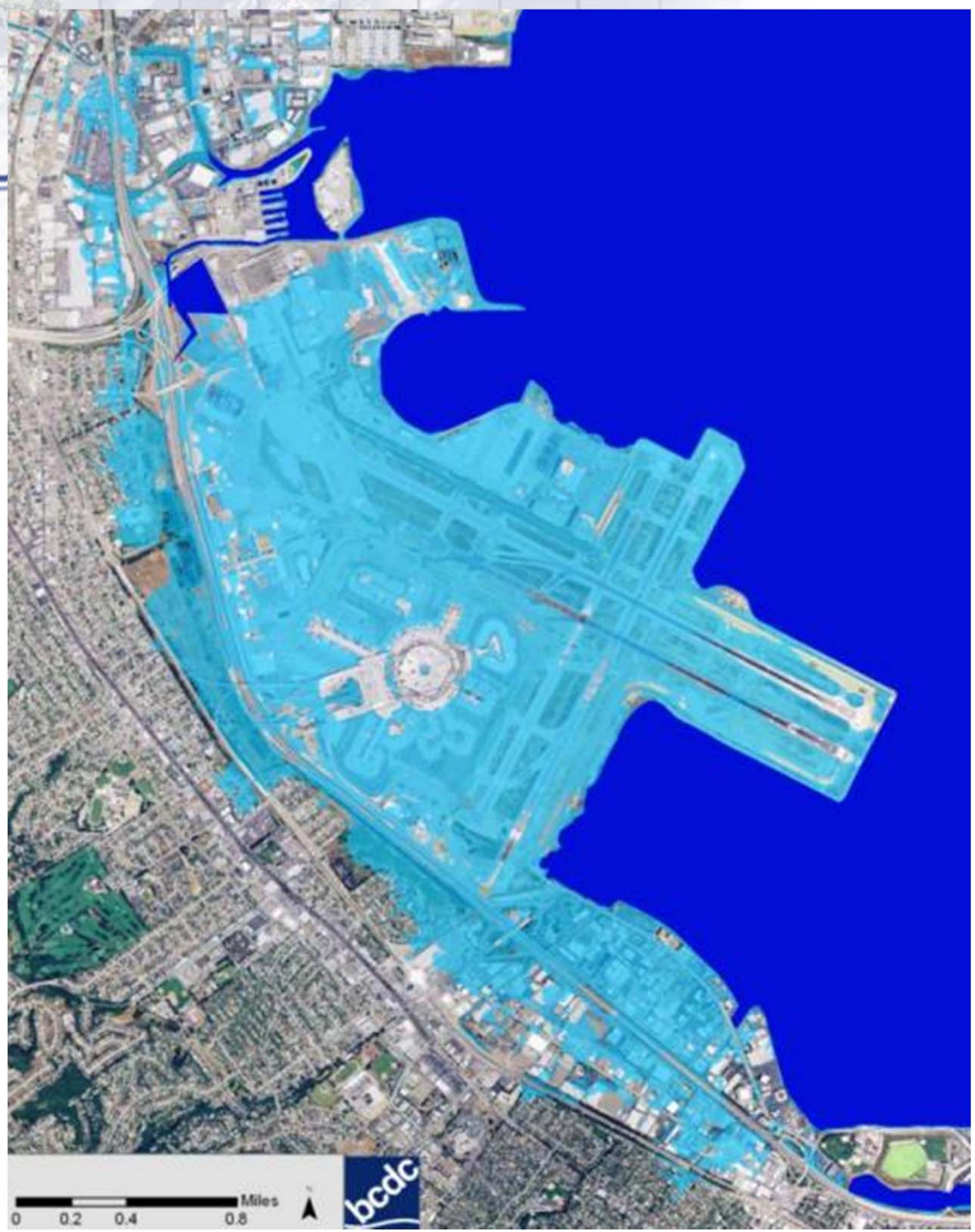
Source: Adapted from USGS Woods Hole Science Center website, http://woodshole.er.usgs.gov/project-pages/cvi/

Inundation/Salinization Risk

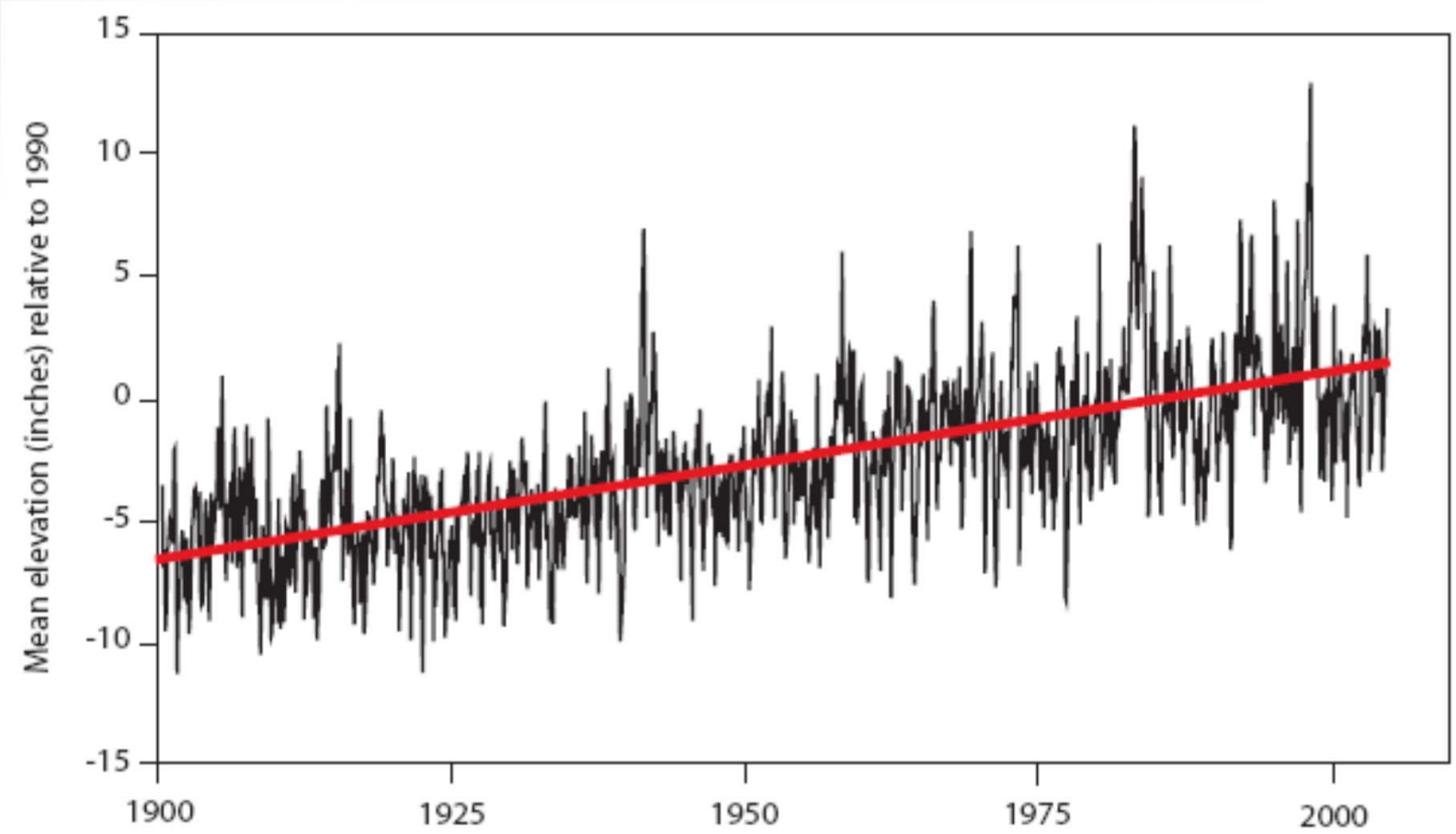
Source: San Francisco Bay Conservation and Development Commission

San Francisco International Airport

One Meter Sea Level Rise



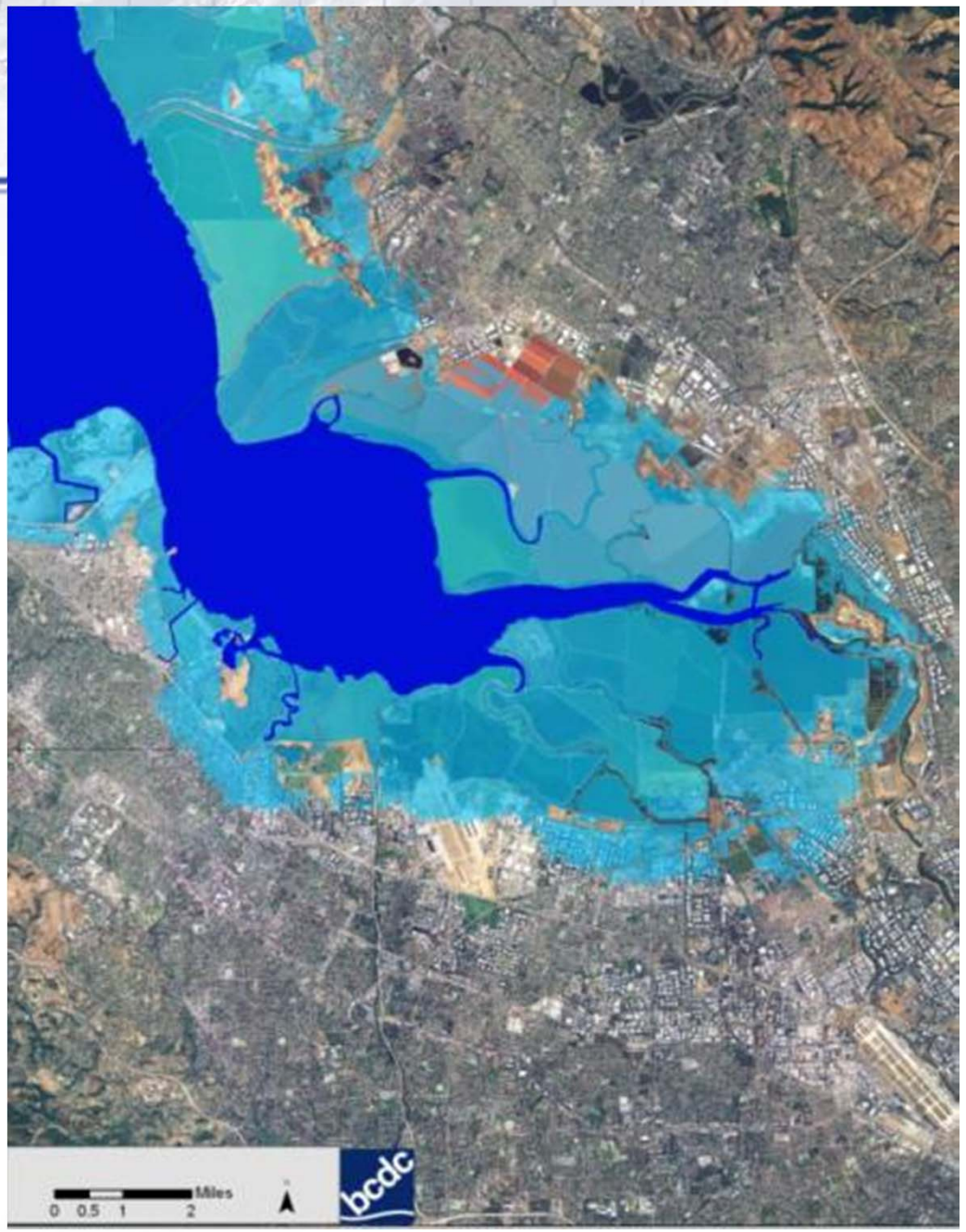
San Francisco Bay Sea Level



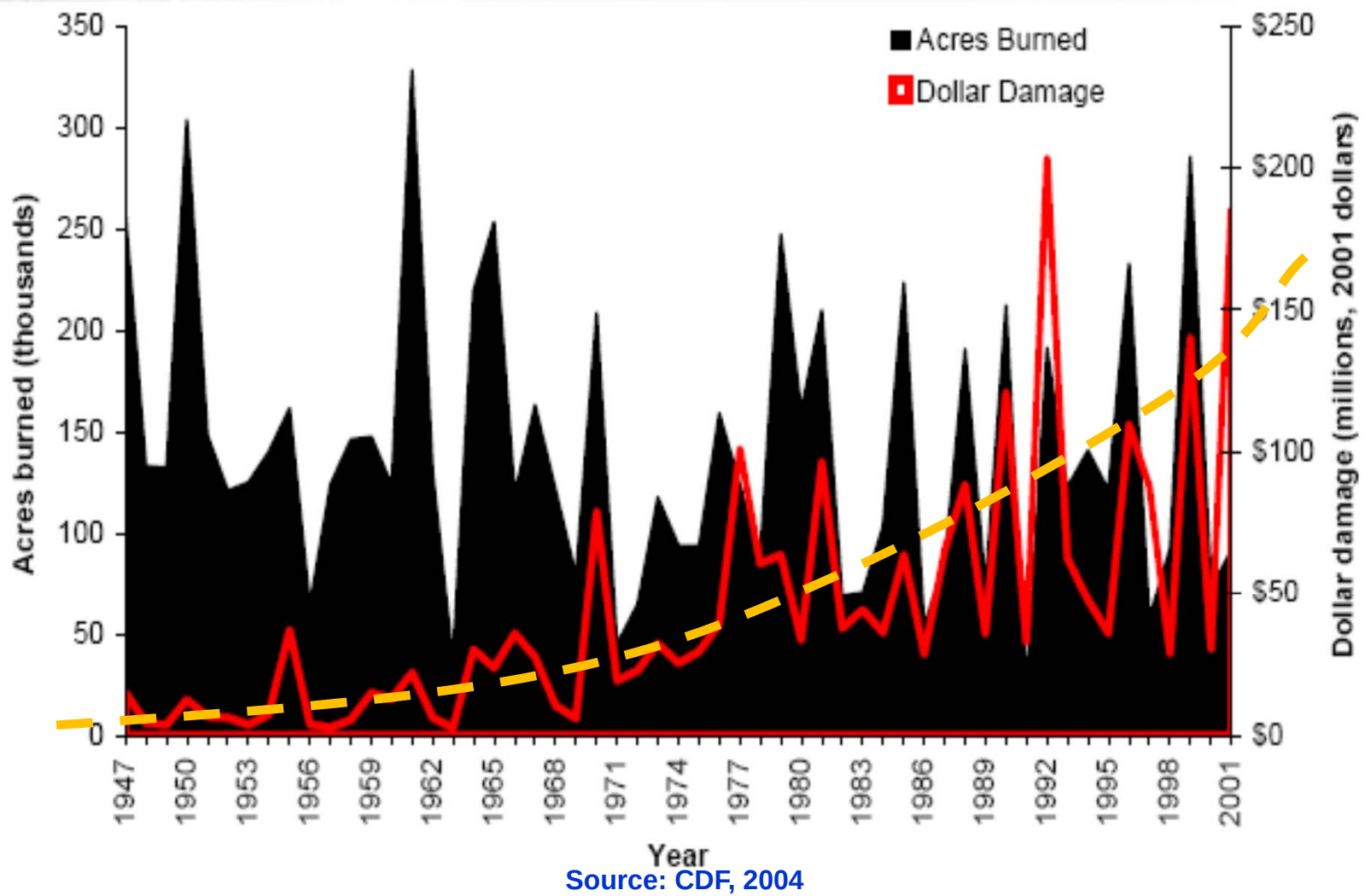
Notes and Source: "Lower Warming Range Drier Climate" is based on an GFDL B1 scenario; "Medium Warming Range Drier Climate" is based on a GFDL A2 scenario. Luers et al., 2006.

Silicon Valley

One Meter Sea Level Rise



Acres Burned and Dollar Damage



Source: CDF, 2004

Developing Country Perspectives

Adaptation in OECD economies will be mainly about protecting assets.

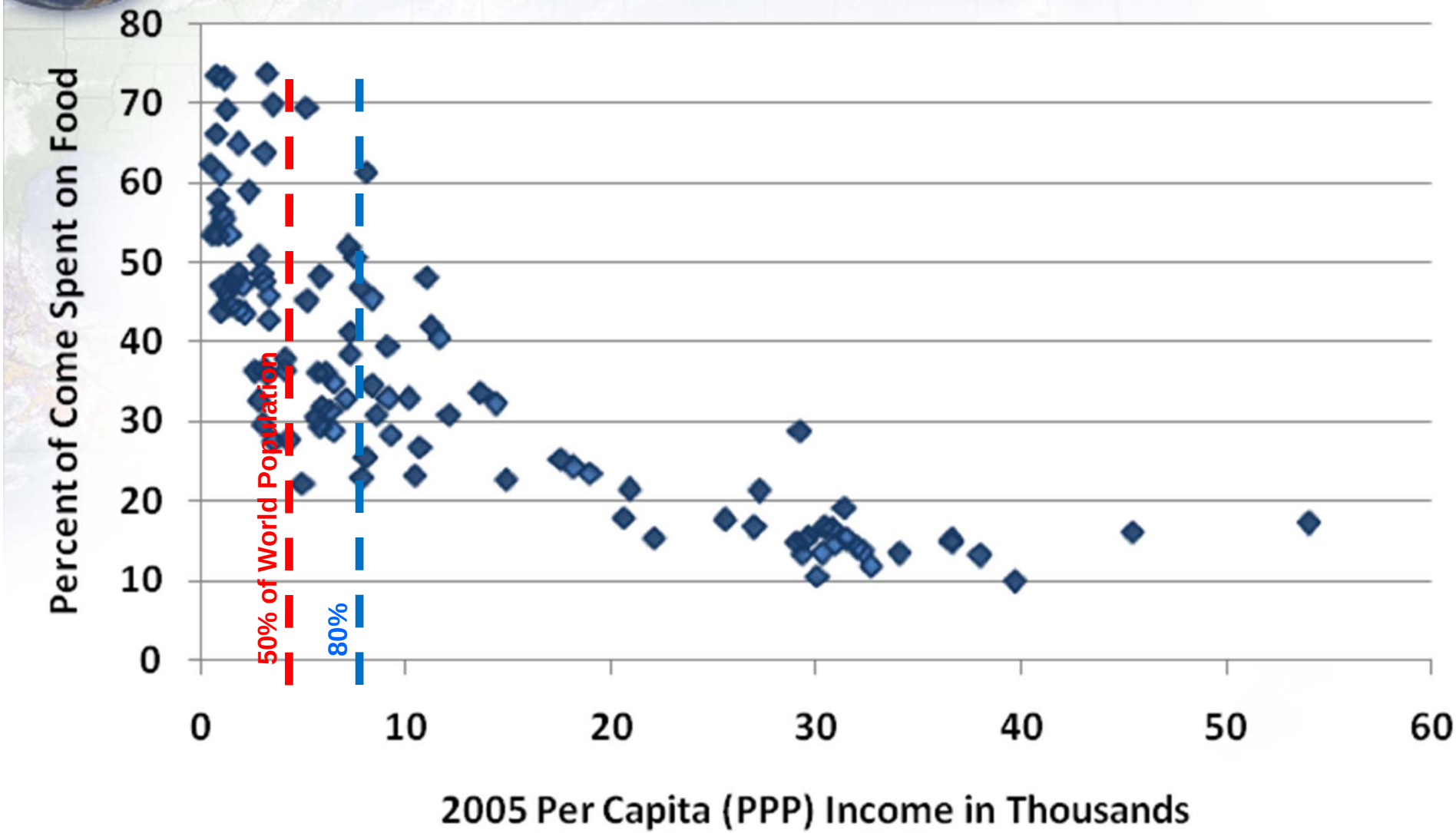
In Developing Countries, the main priority will be to protect people.

Because of differing initial conditions, adaptation will emerge to become a prominent or even dominant component of North-South assistance flows.

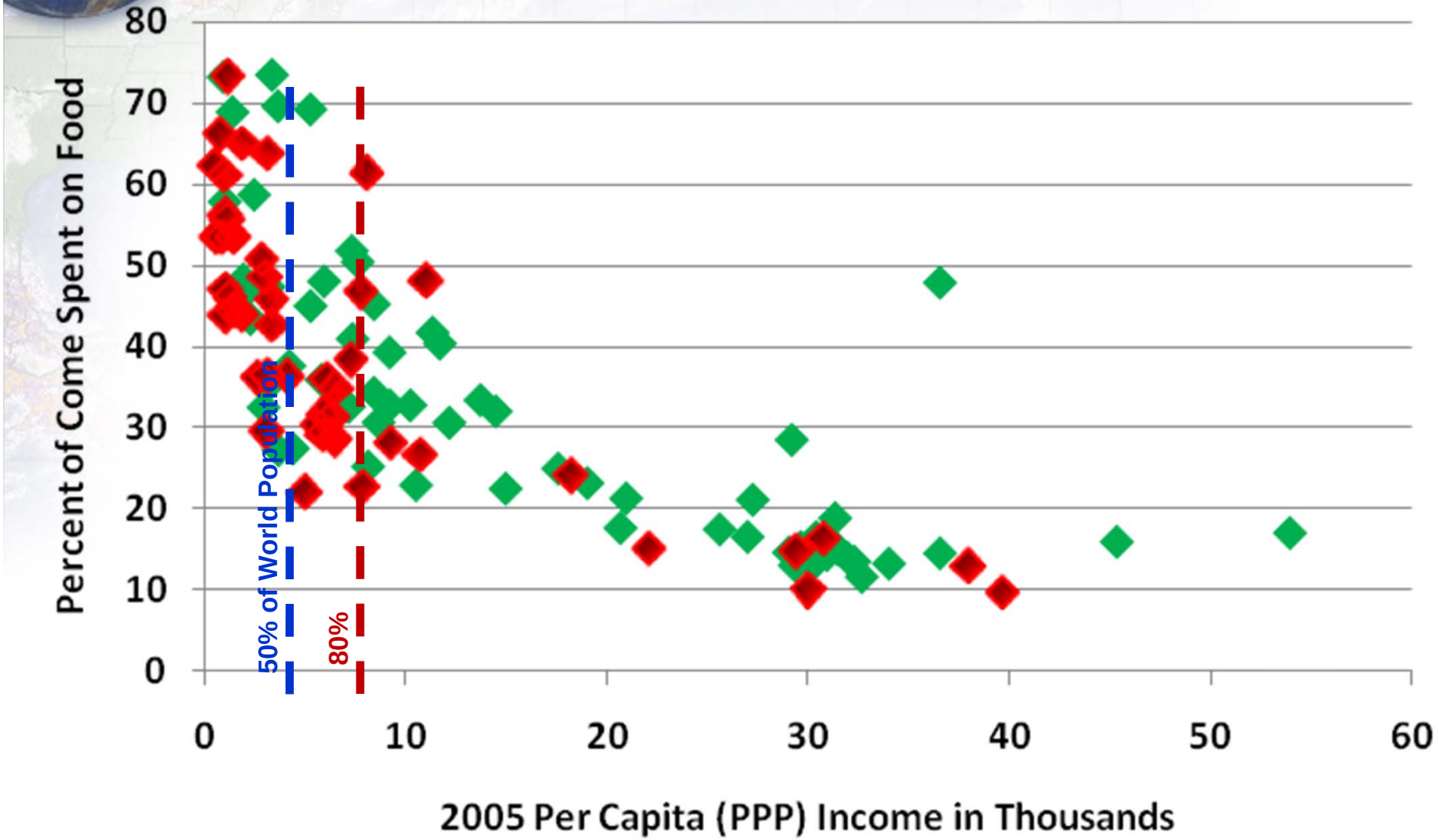
Two leading issues:

1. Food security
2. Sea level risk

Food Security and Income



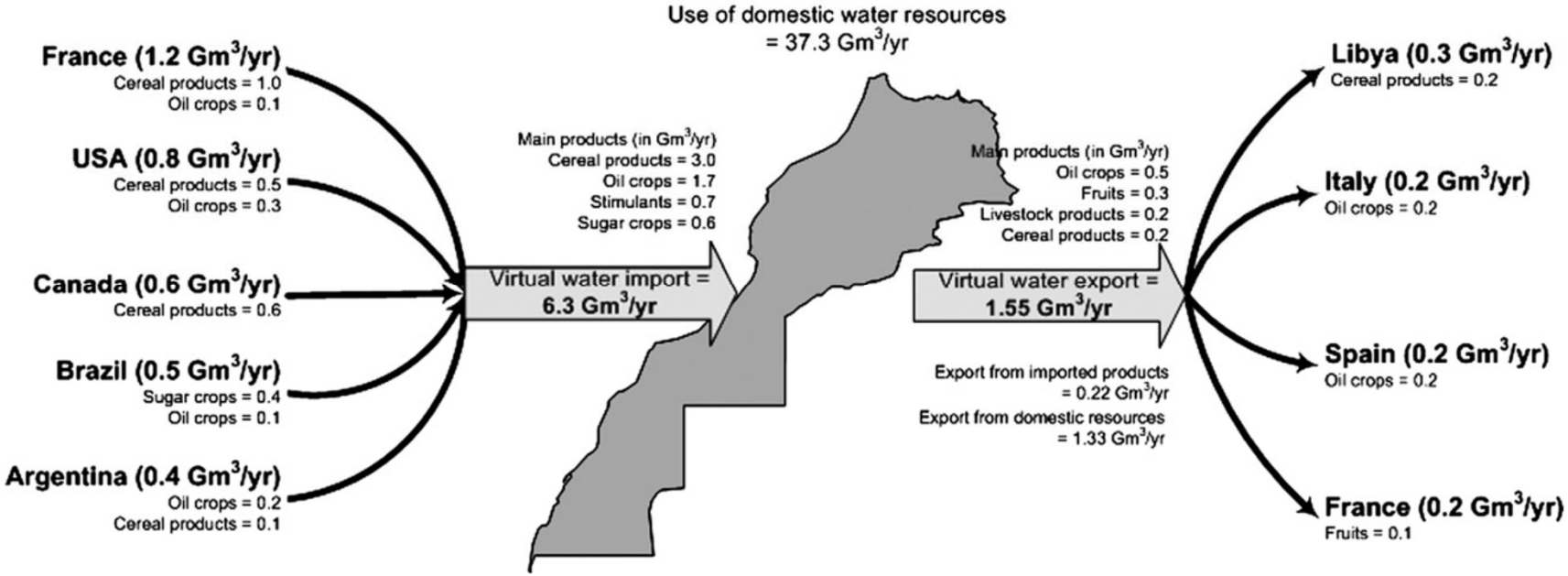
Tropical Countries in Red



Policy Responses

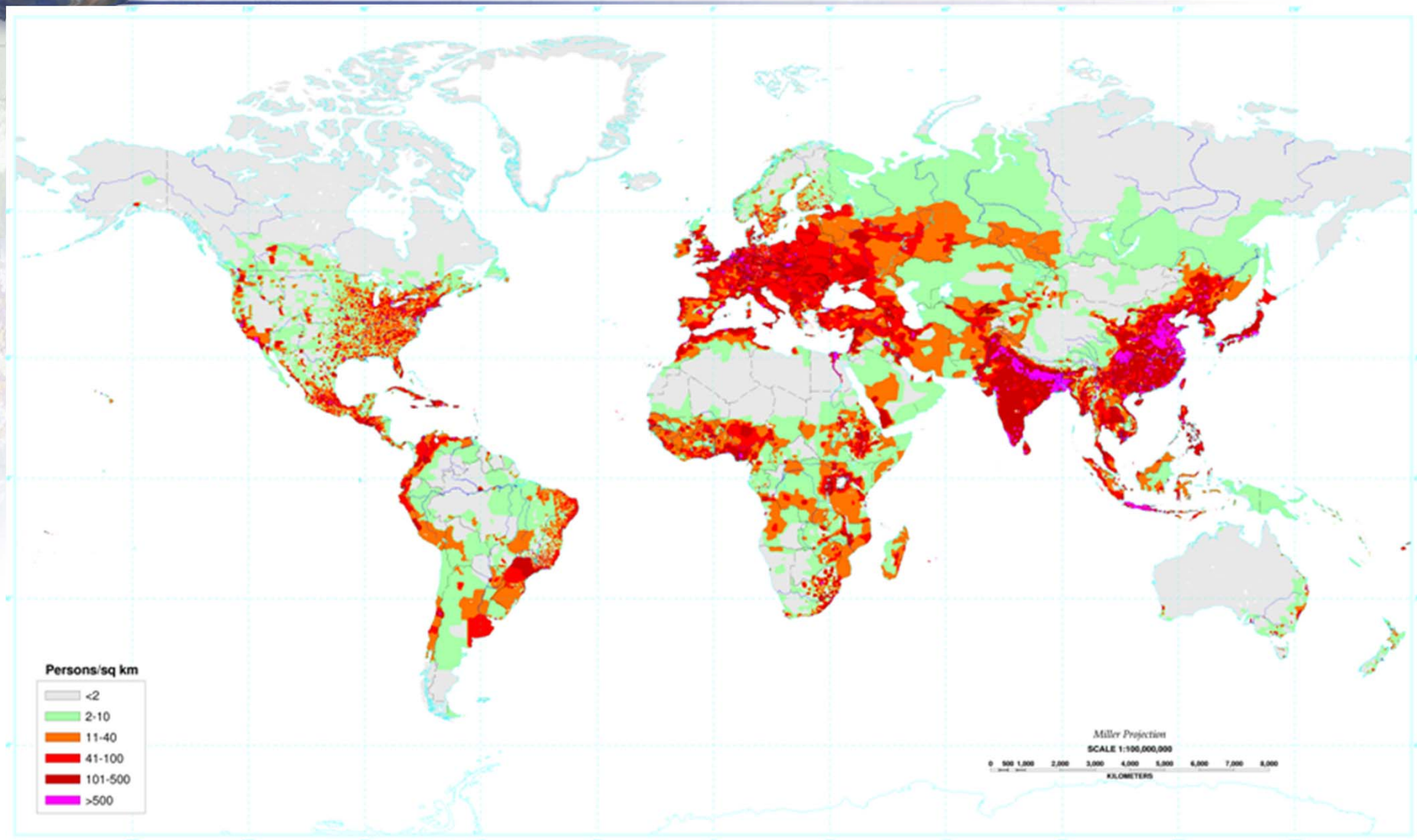
- Water pricing
- Ag. Biotech
- Contracting in domestic agro-food supply chains (Mars)
- Trade policy – import water services

Example: Moroccan Embodied Water Trade

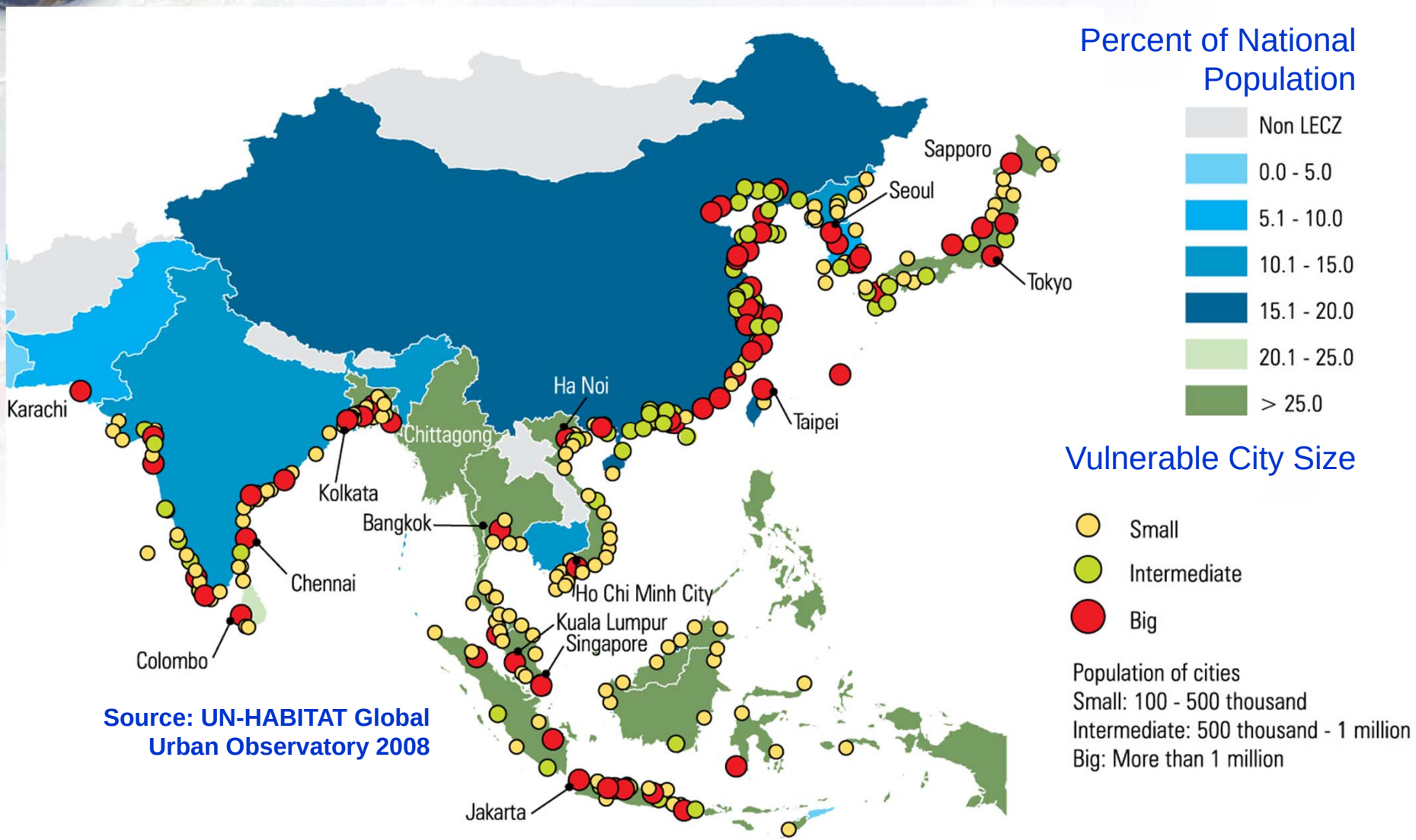


Source: Hoekstra and Chapagain: 2007

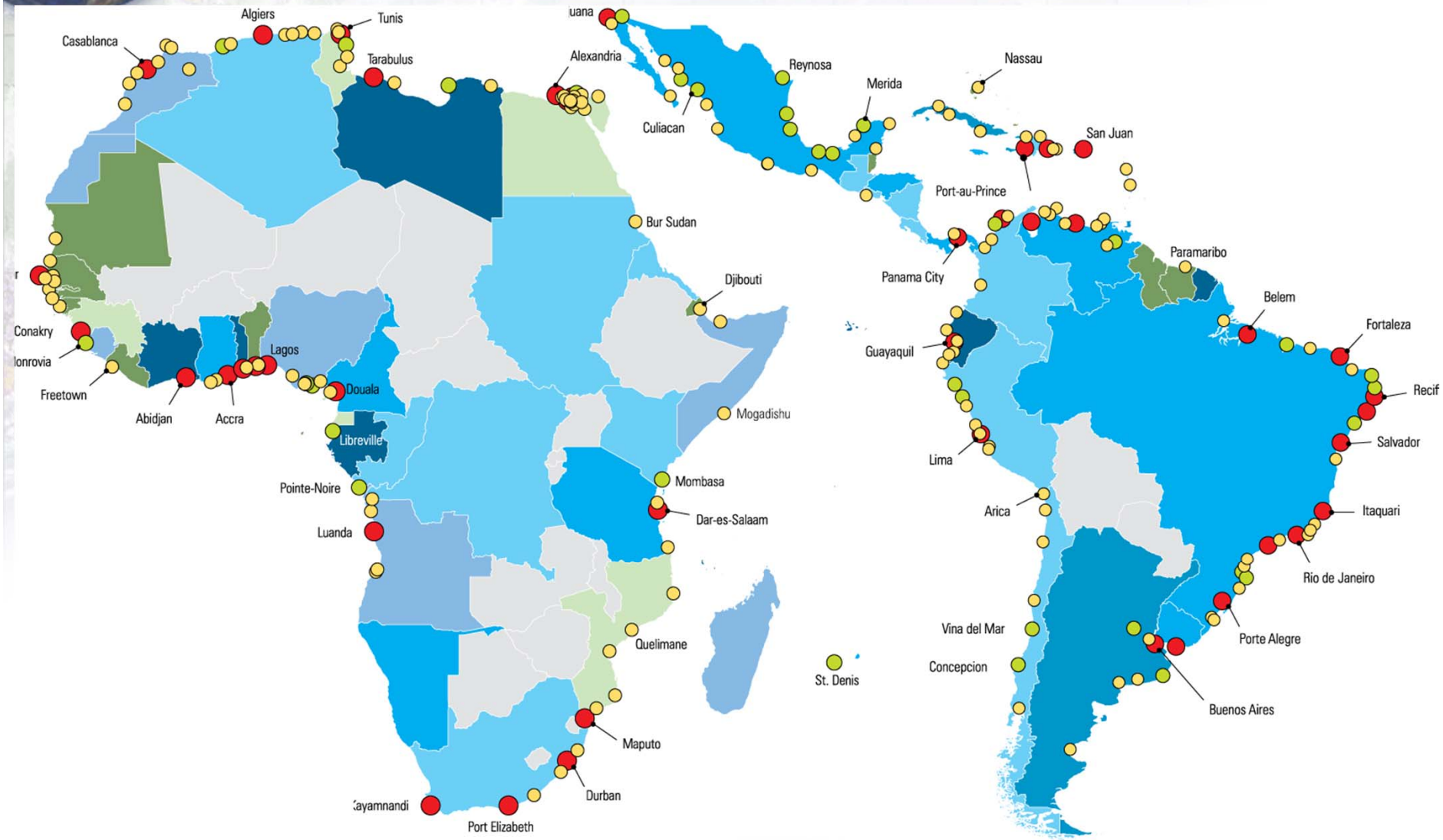
Sea Level Vulnerability



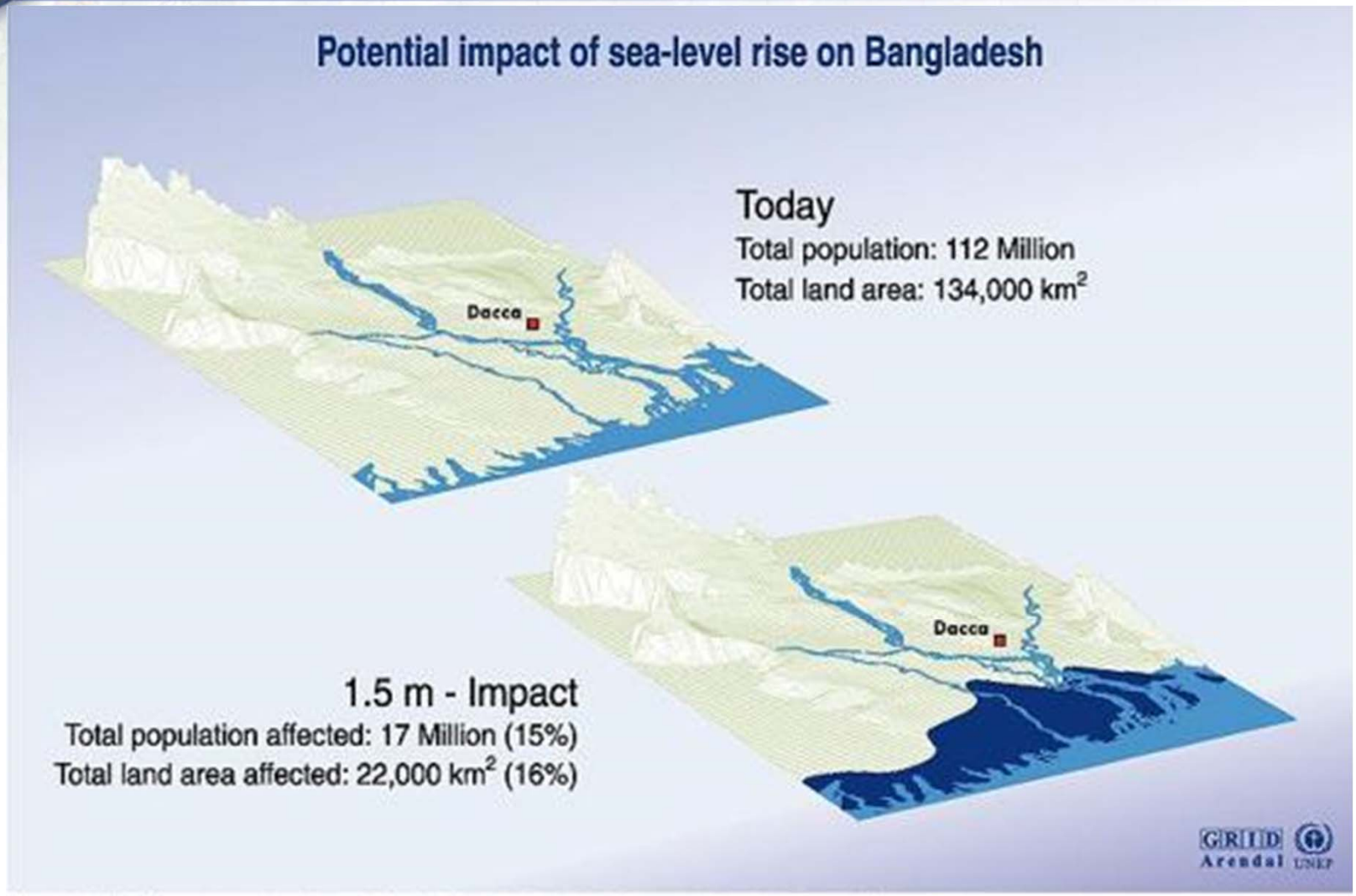
Low Elevation Coastal Zones



Source: UN-HABITAT Global Urban Observatory 2008

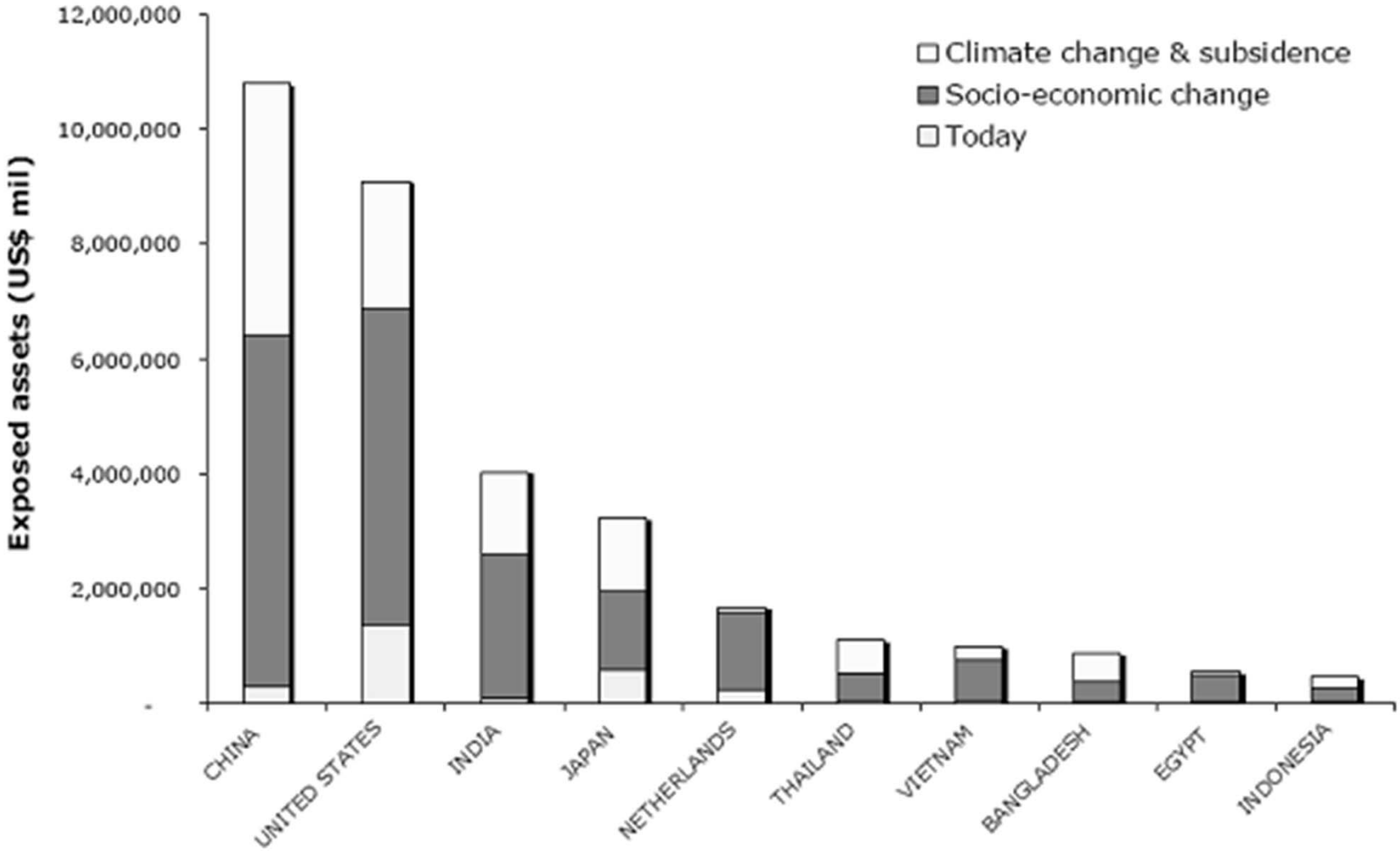

Algiers
Tunis
Casablanca
Tarabulus
Alexandria
uana
Reynosa
Merida
Nassau
Culiacan
San Juan
Port-au-Prince
Bur Sudan
Djibouti
Panama City
Paramaribo
Belem
Fortaleza
Conakry
Lagos
Guayaquil
Recif
Freetown
Douala
Abidjan
Accra
Mogadishu
Salvador
Libreville
Lima
Mombasa
Pointe-Noire
Arica
Itaquari
Dar-es-Salaam
Luanda
Rio de Janeiro
Vina del Mar
Quelimane
Porte Alegre
Concepcion
St. Denis
Buenos Aires
Maputo
Durban
Port Elizabeth

Climate Refugees: Everybody's problem



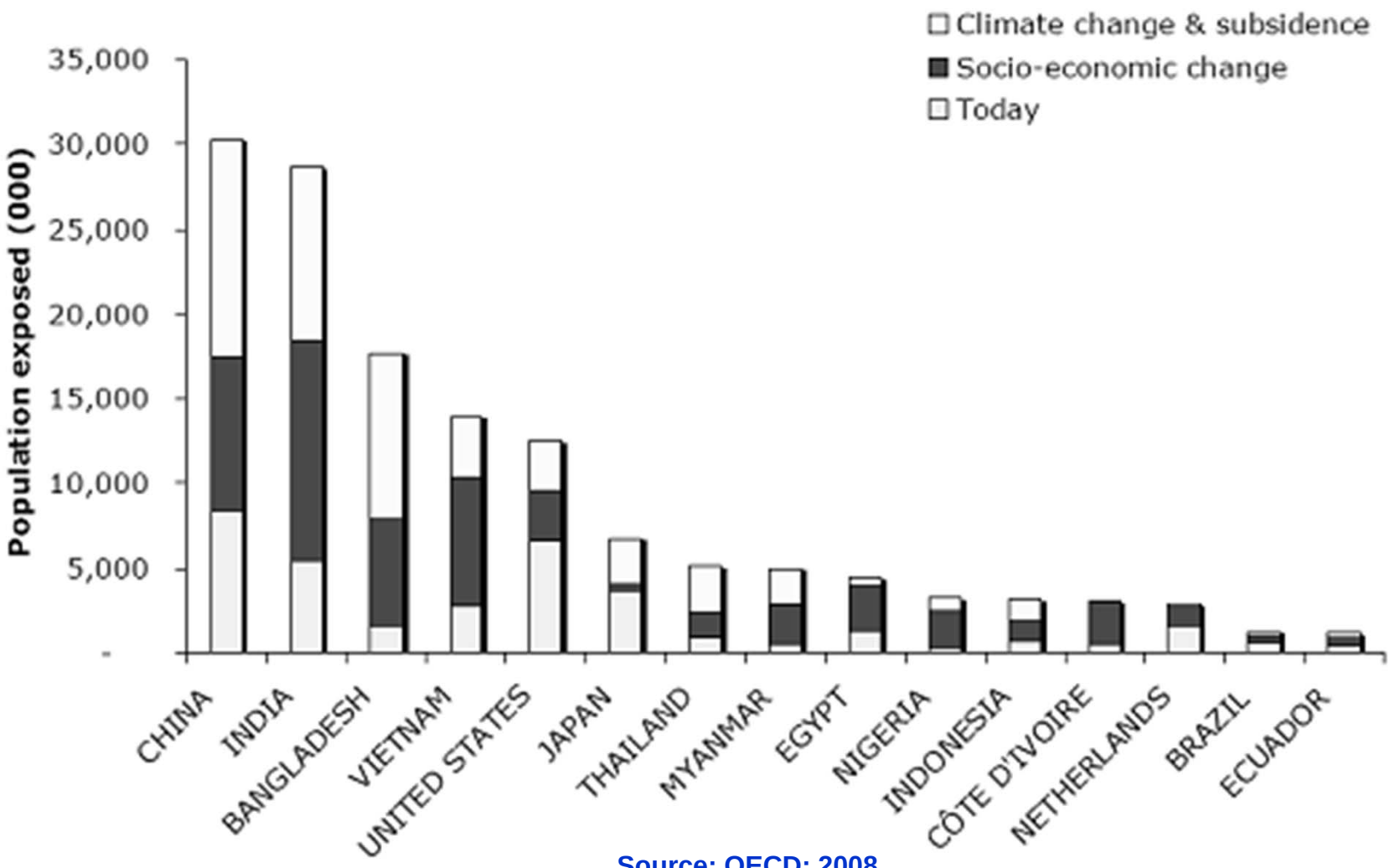
Source : UNEP/GRID Geneva; University of Dacca; JRO Munich; The World Bank; World Resources Institute, Washington D.C.

Top 10 countries by assets exposed today and in the 2070s (OECD median scenario)



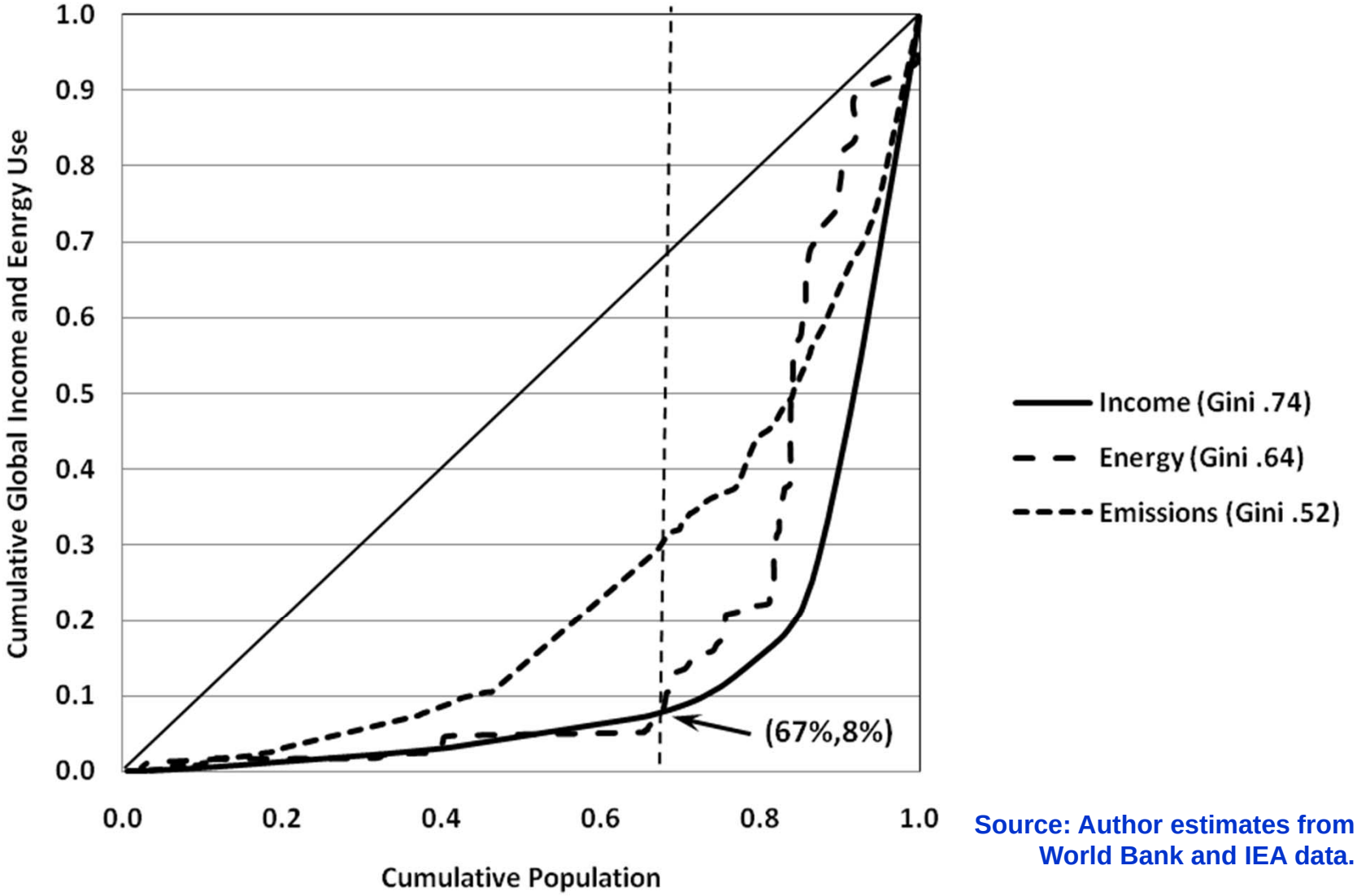
Source: OECD: 2008

Top 15 countries by population exposed today and in the 2070s



Source: OECD: 2008

Carbon, Energy, and Income Inequality: A Basis for Climate Multilateralism



Source: Author estimates from World Bank and IEA data.

Conclusions

1. Energy efficiency can be a potent catalyst for job creation and growth, not just in new technology sectors, but across the economy.
2. Demand side management has enormous potential for improving energy/environmental sustainability. Incentives and standards are needed, however.
3. We face substantial risks from climate change, but Climate Defense offers a new agenda for economic stimulus and growth that is employment, technology, and skill intensive
4. Globally, adaptation presents a momentous new agenda for North-South cooperation, including direct assistance, technology transfer, and a broad range of investment opportunities

Discussion