The Future Face of Global Energy Use

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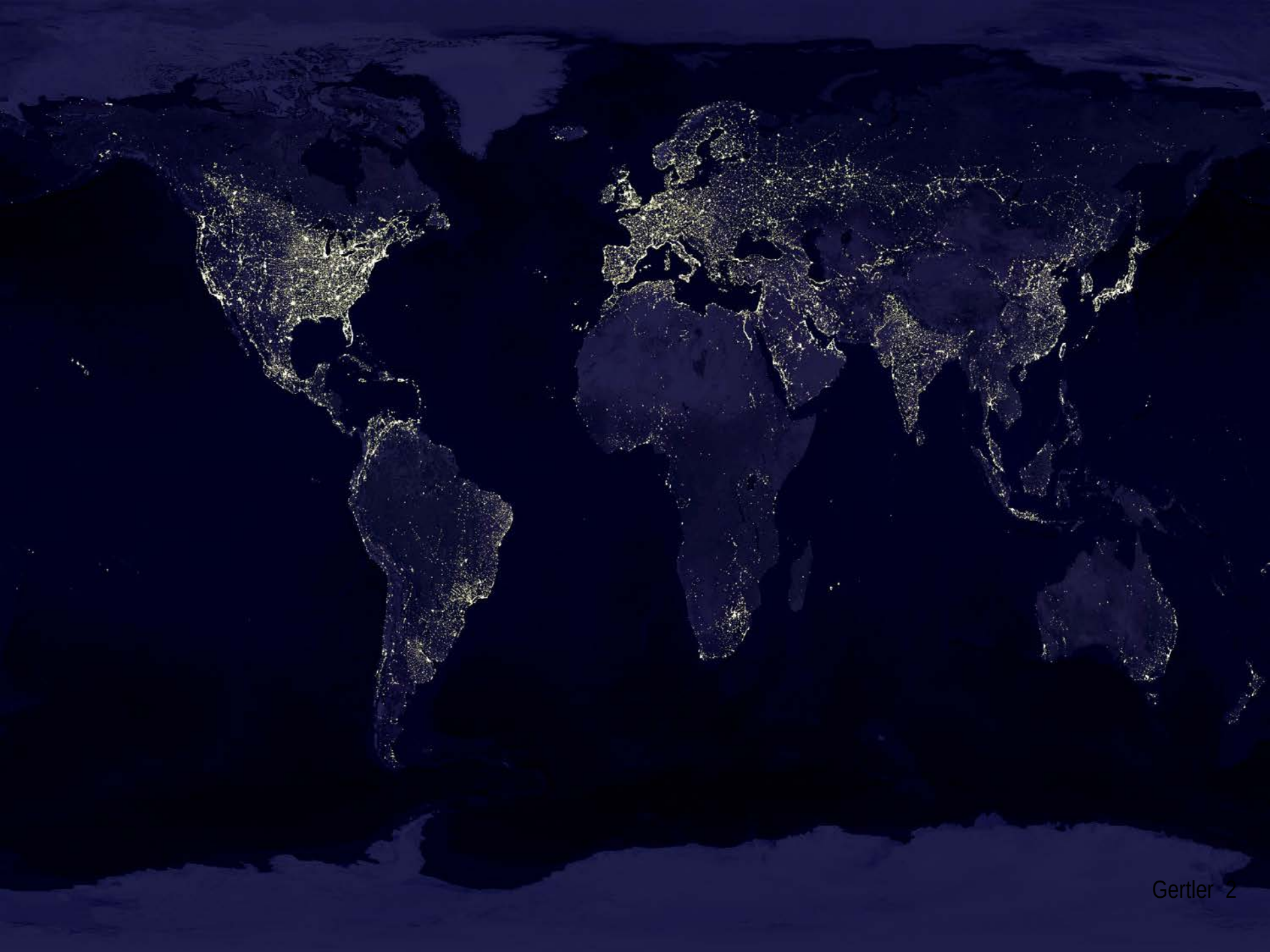
Why it's important to forecast energy use?

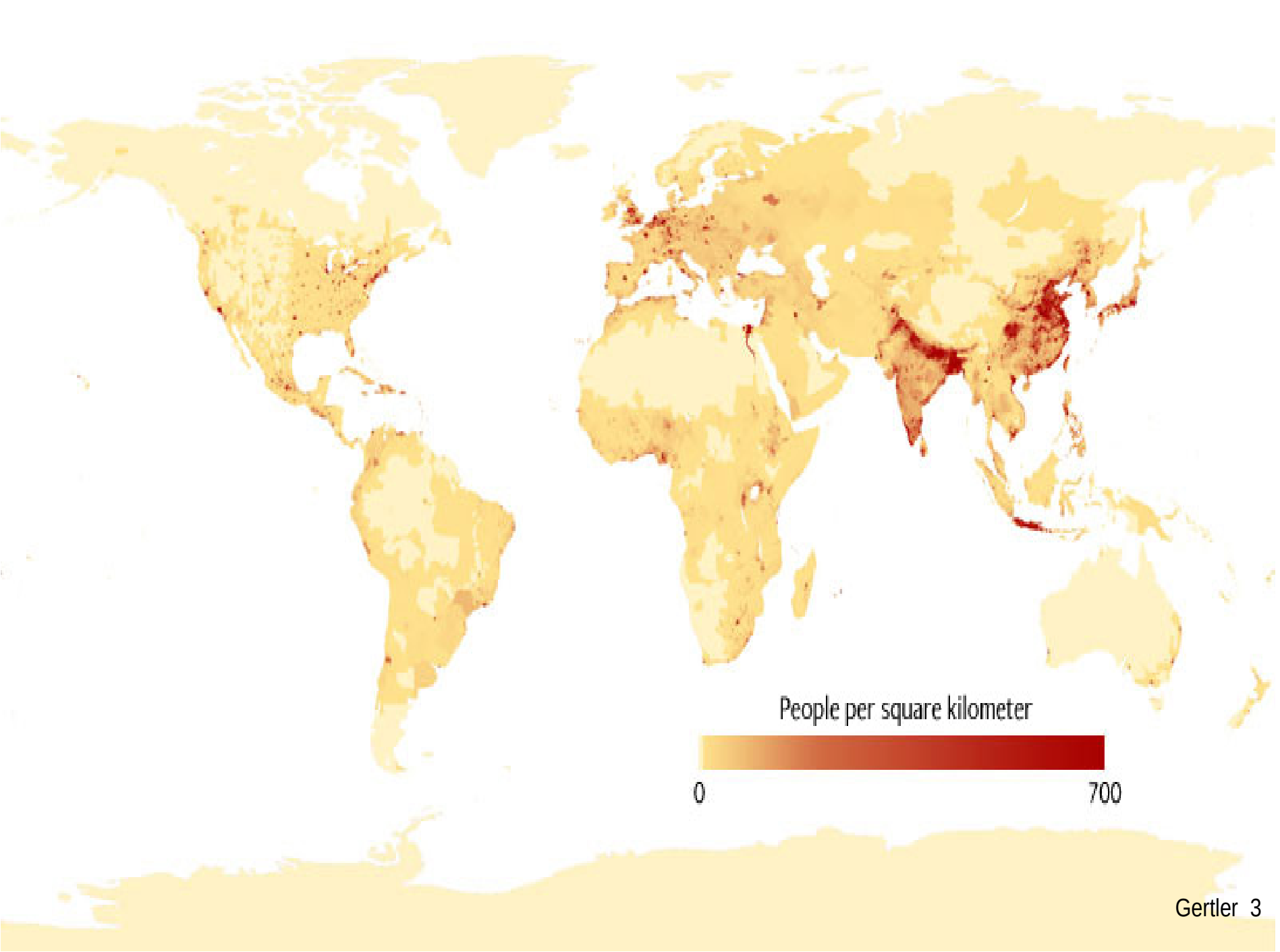
Fossil fuel major contributor to climate change

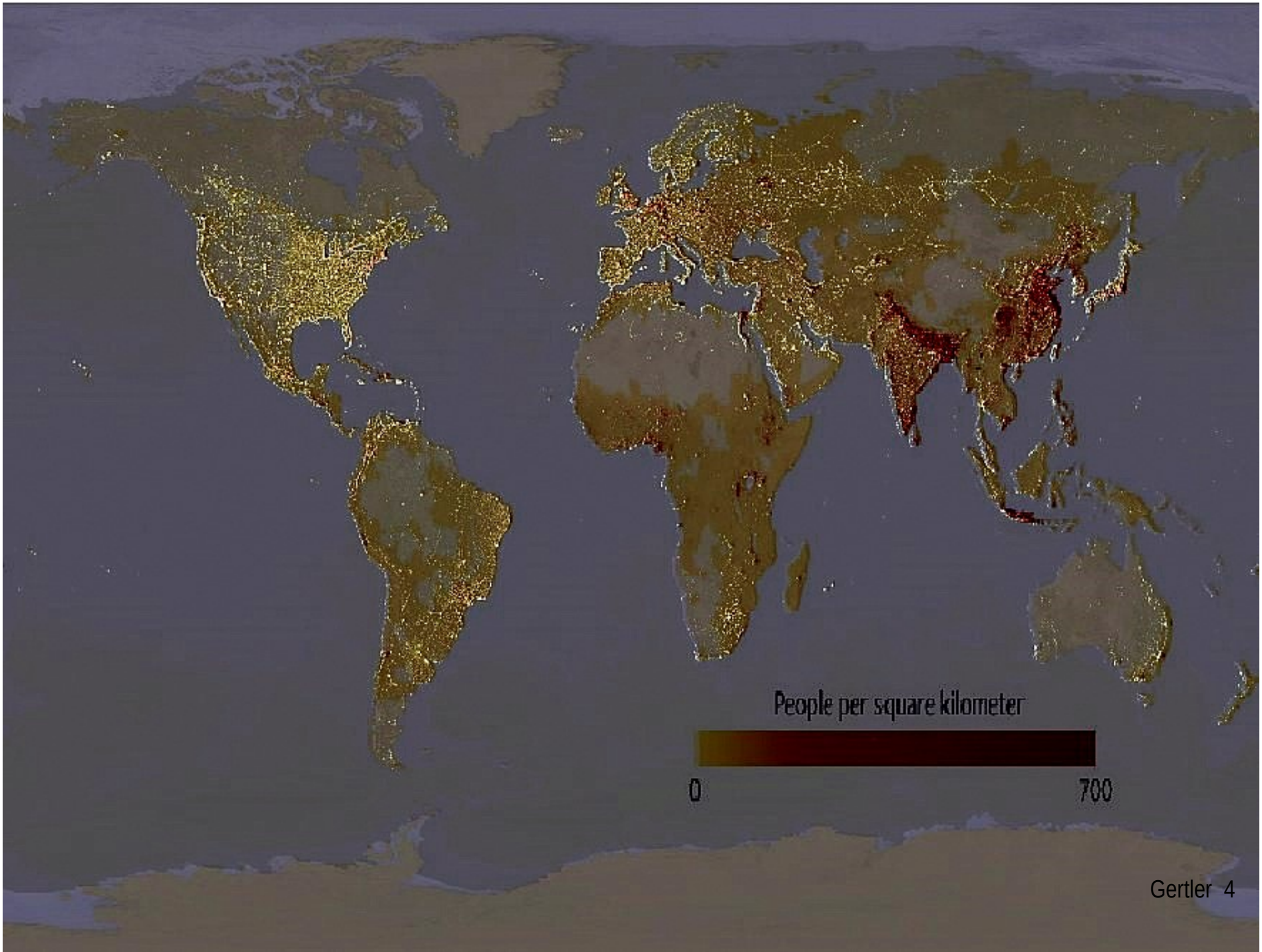
- Emissions forecasts inform likely damages
- Country forecasts are baselines for global negotiations

Infrastructure investments have long lead times

- Under-estimates ⇨ under-investment ⇨
- Local energy shortages & global price spikes




People per square kilometer
0
700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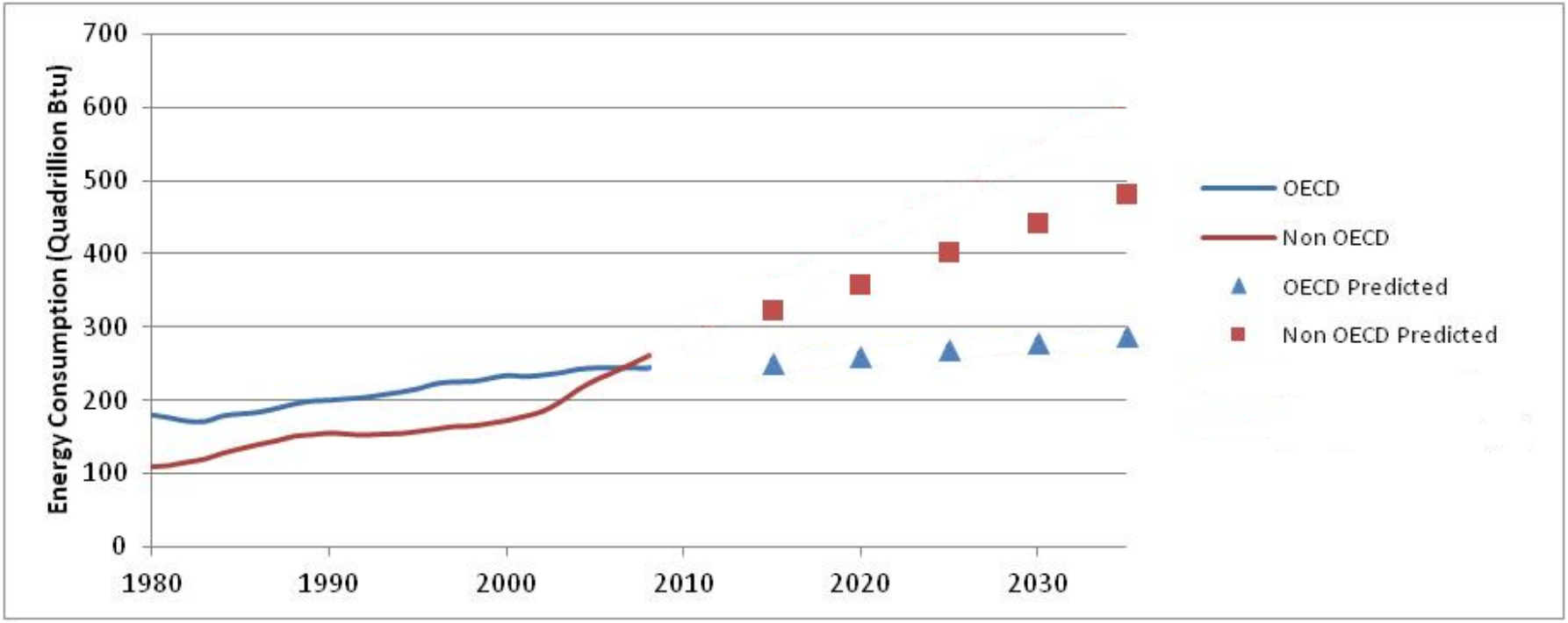
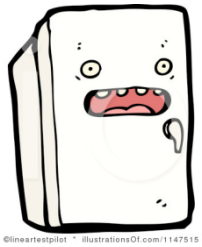
Most growth in Energy & CO_2 will be in Developing World



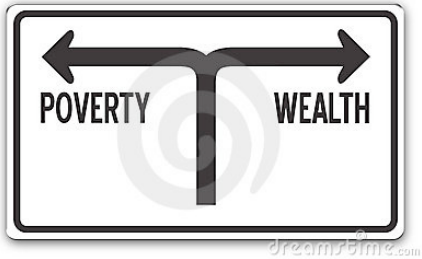
Source: Energy Information Administration.

Energy use increases with appliance ownership

- **Large jump in energy use from 1st time owners**
  - Both from manufacturing & use
  - Small effect of income on energy use of exiting owners



- **The Poor have few appliances**
  - China's poverty rate fell from 53% in 1981 to 8% in 2001
  - Brazil & Mexico have aggressive anti-poverty programs



Most 1st Time Buyers of Energy Using Durables

TABLE 1
Durable Good Saturation Levels By Country

	Refrigerators	Cars	Population (millions)
Brazil (2009)	93%	37%	192
China (2002)	48%	1%	1,325
India (2007/2008)	13%	2%	1,140
Indonesia (2004)	17%	5%	235
Mexico (2008)	83%	29%	111
Sub-Saharan Africa (2006)	11%	5%	578
Total	32%	5%	3,576

Notes: Population is from the World Bank for 2008. Saturation levels come from a variety of country-specific nationally-representative surveys. For sources and additional details see Wolfram, Shelef, and Gertler (2012).

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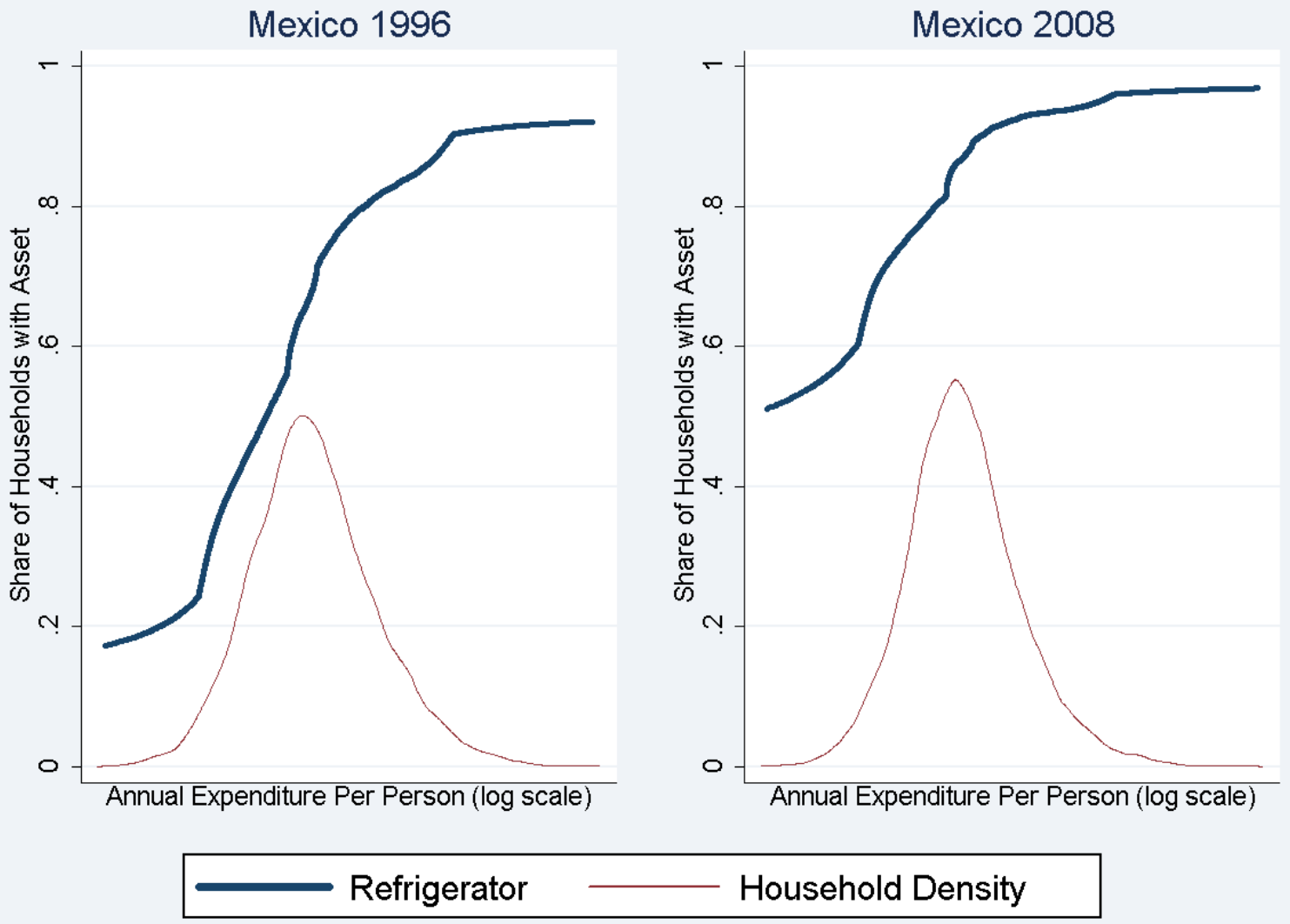
Refrigerator Ownership over the Income Distribution



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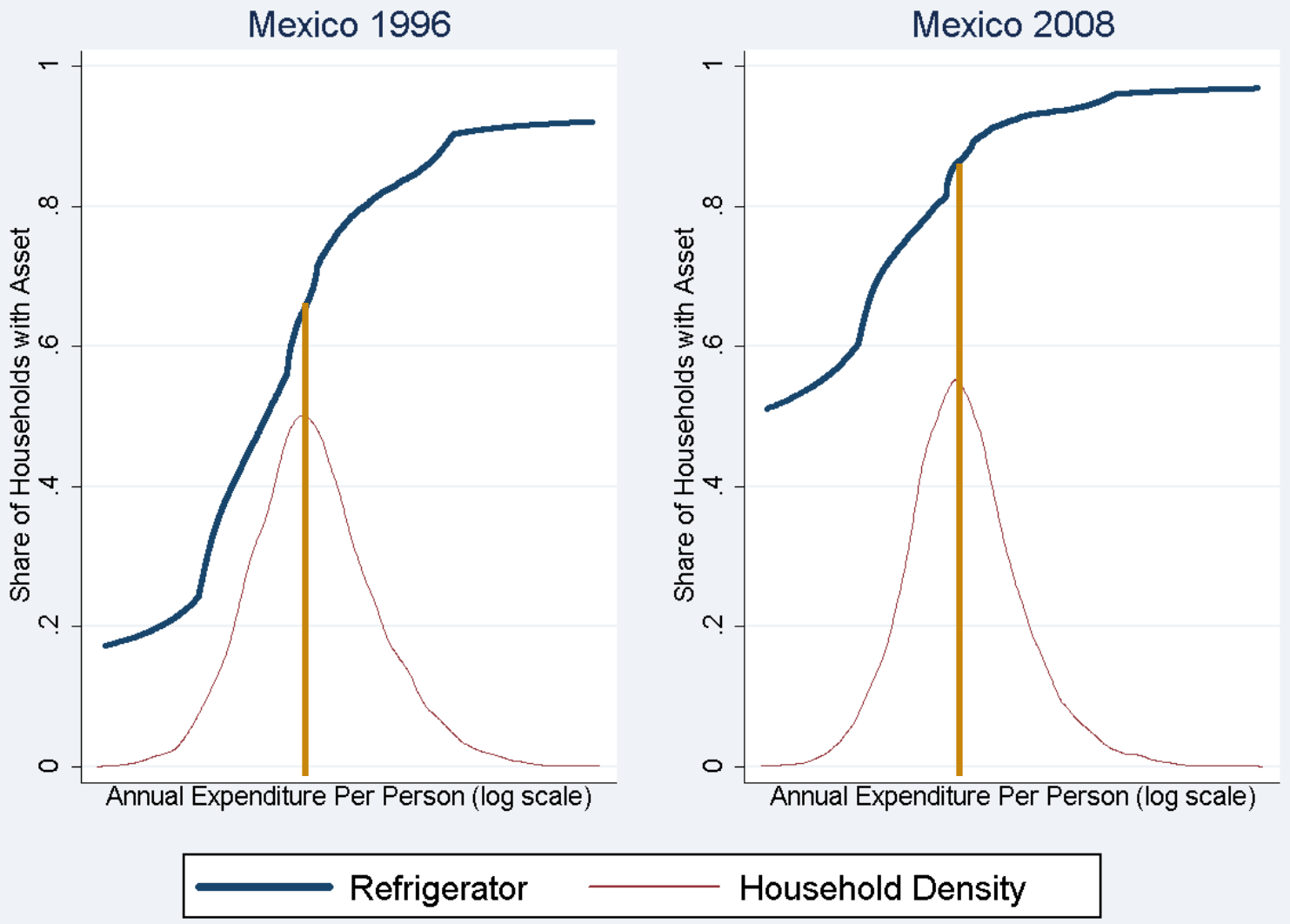


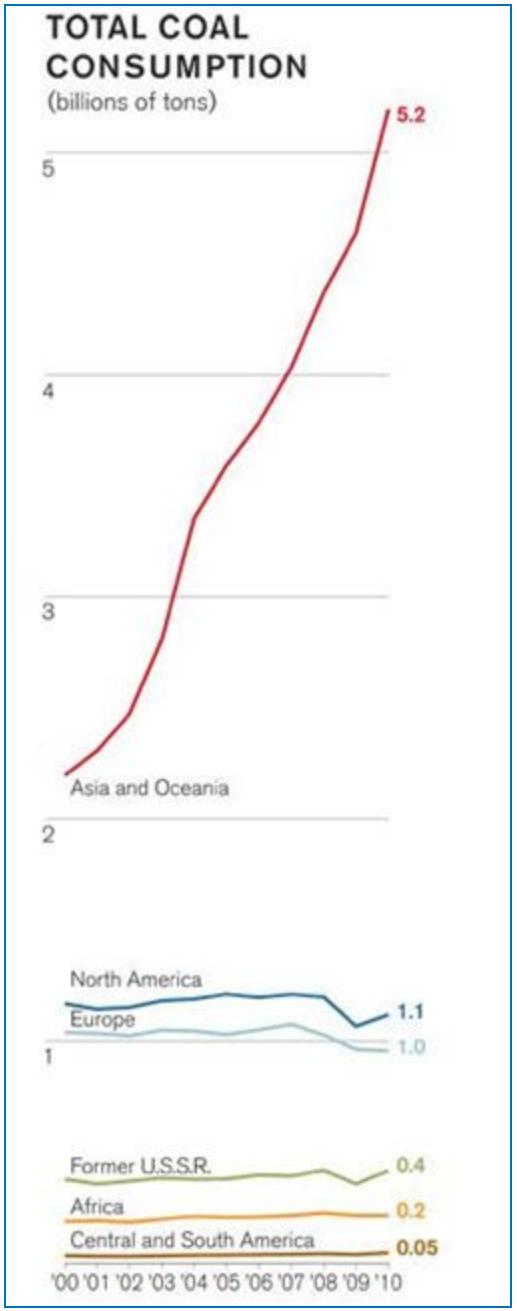
Ignoring Pro-Poor growth understates energy use forecasts…

China example:

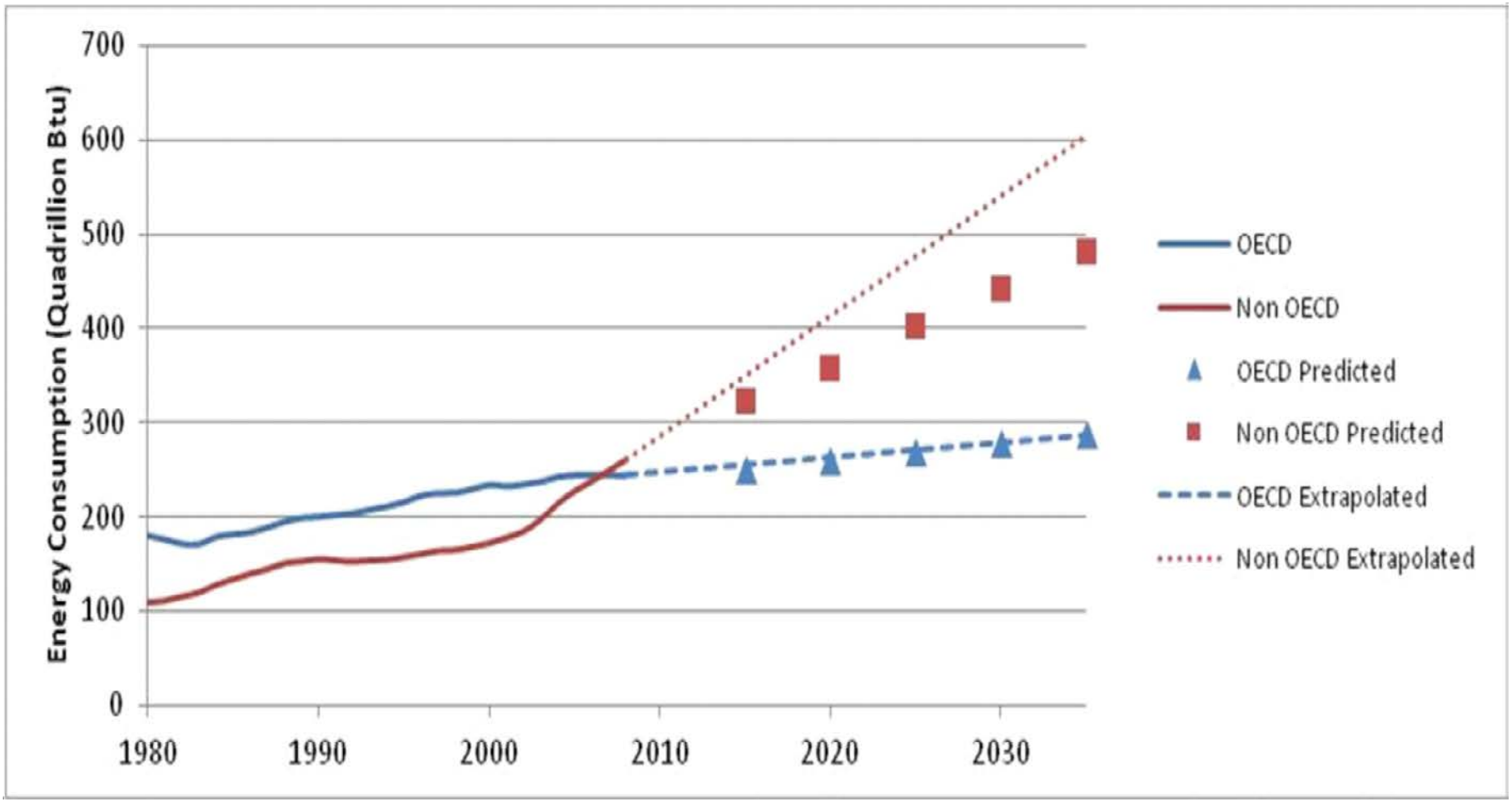
- Compare 2000 *World Energy Outlook* forecast of Chinese energy use for 2005….

- … to actual Chinese energy use in 2005:

…a 25% underestimate



EIA's energy projections are linear extrapolations of GDP growth & ignore composition of GDP growth



Air Conditioners: The New Transformers

Rising temperatures from climate change….

- purchases of air conditioners
- use of air conditioners
- energy use
- CO_2 emissions

Mean temperature and AC Penetration in Mexico

Figure 4: Mean Temperature (°F)

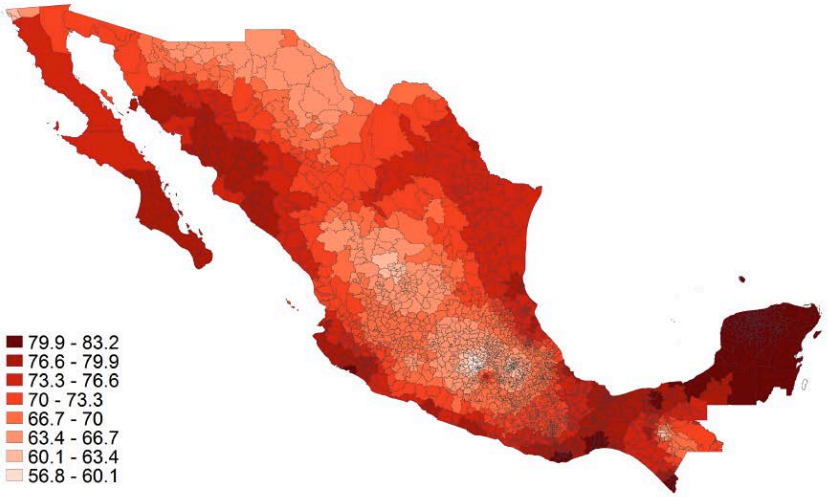
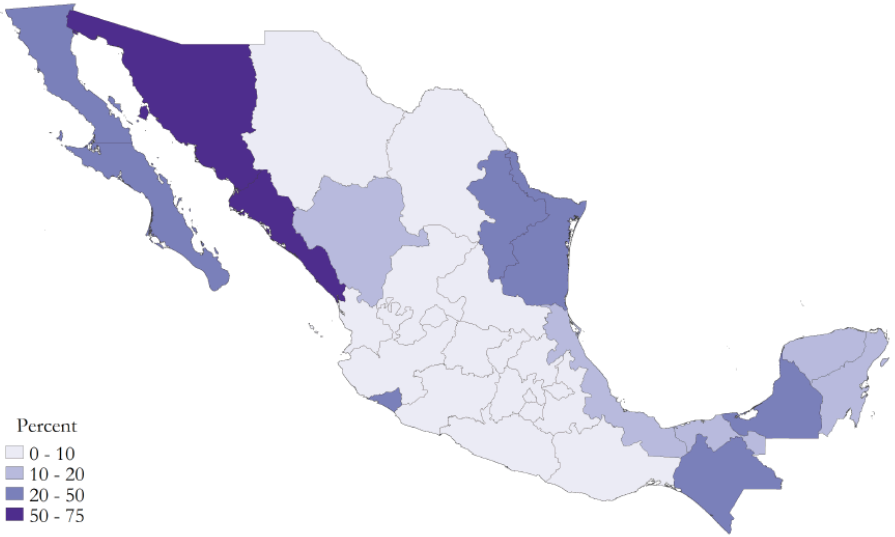
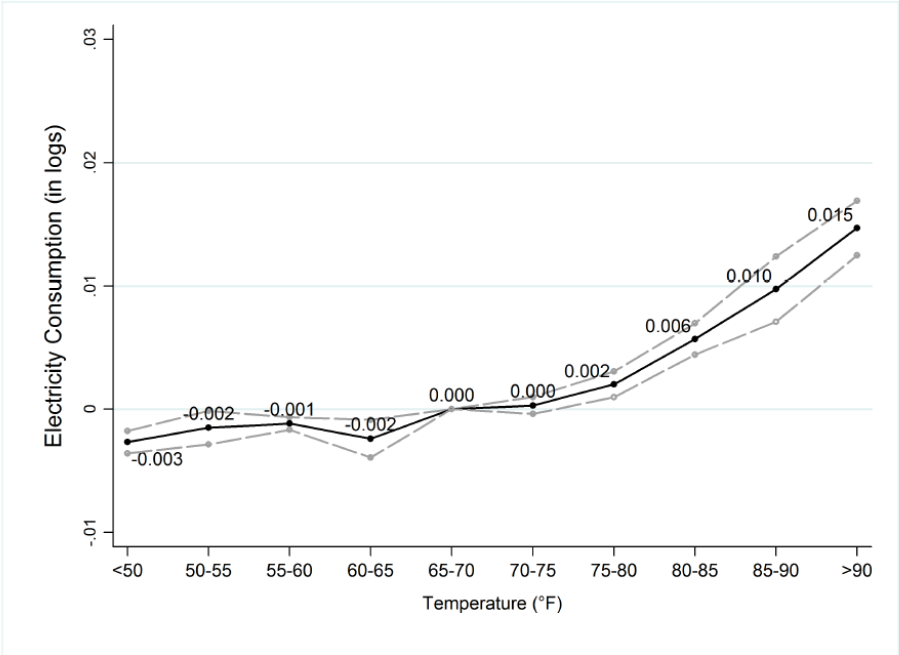


Figure 1: Air Conditioning Saturation By State

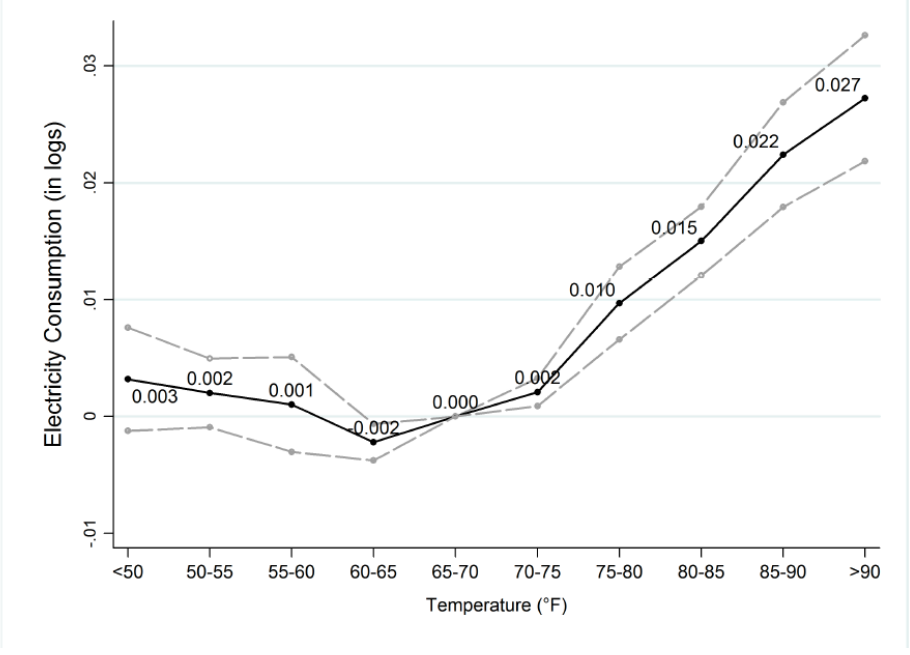


Climate warming ⇑ energy use more in areas with more AC

B. Households in States with Less than 10 Percent Saturation of Air Conditioning

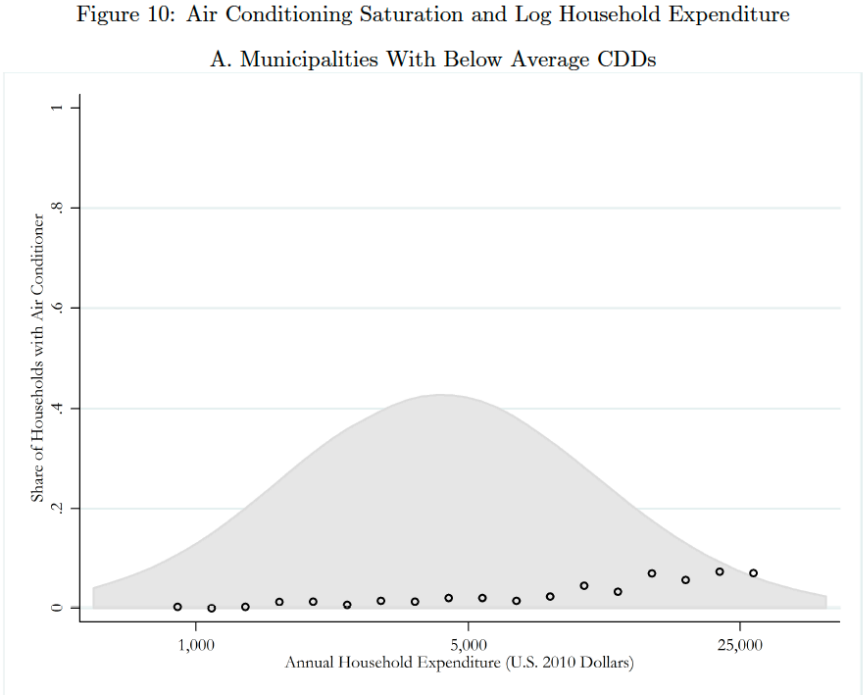


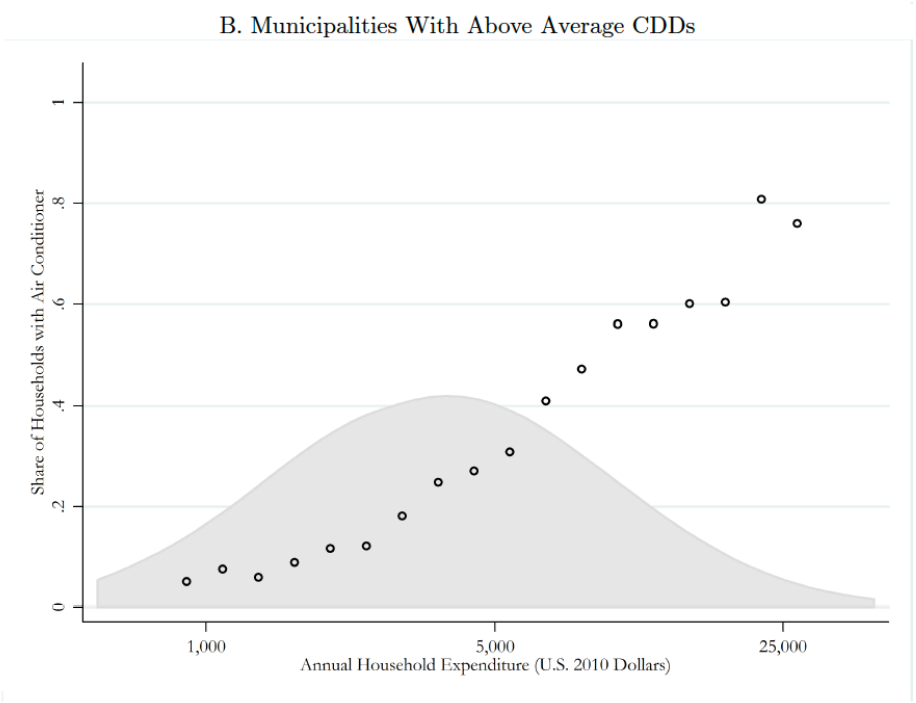
D. Households in States with More than 50 Percent Saturation of Air Conditioning



AC Ownership rises with both income and climate warming

Figure 10: Air Conditioning Saturation and Log Household Expenditure





Expected Changes in Daily Temperature Distribution From Global Warming

Figure 6: Daily Mean Temperature, 2010

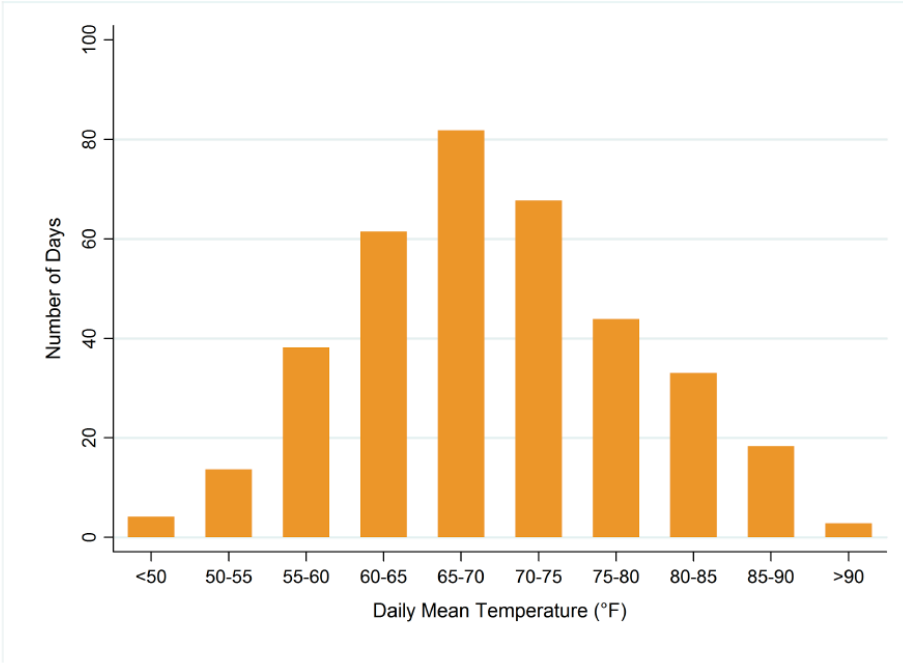
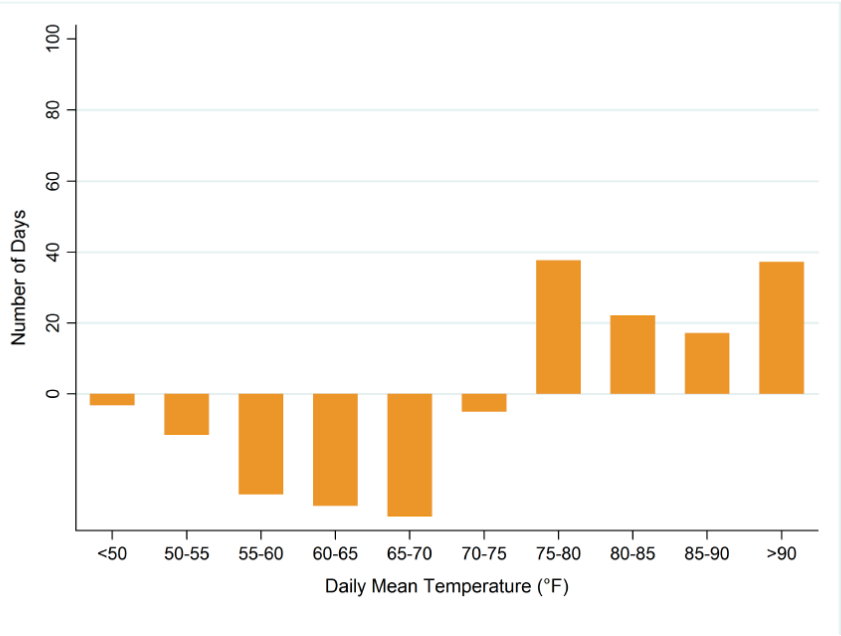


Figure 8: Changes in Daily Mean Temperature, HadCM3 A1B Scenario



Effect of Global Warming on Energy Use and Emissions in Mexico

	% Houses With AC	% Δ in Electricity Use	Δ in Annual CO_2 Emissions (Millions of Tons)
Intensive Margin (no Δ in AC ownership)	13%	21%	6.5
Intensive & Extensive Margins (Allow ΔTemp to raise AC ownership)	24%	26%	7.8
Intensive & Extensive Margins & 1% Annual Income Growth	44%	34%	10.5

Most increase in Energy Use from **developing world**

- **Forecasts grossly underestimate future use**
  - Pro-poor growth, poverty reduction, climate change
  - Both increased use & manufacturing of energy using durables
- **Need substantial new generation capacity**
  - Generation efficiency and fuel types
- **Many new connections to grid**
  - May changes the benefit-cost ratio of alternative energy
- **Many 1st time appliance & car owners**
  - Does it pay to make sure these are efficient?

Thank you….

References for this presentation:

1. Davis and Gertler (2013) “Climate Change and Air Conditioning,” processed, UC Berkeley
2. Gertler, Shelef, Wolfram, and Fuchs (2011) “Poverty, Growth and the Demand for Energy,” EI@Haas Working Paper 224. UC Berkeley
3. Wolfram, Shelef and Gertler. 2012. “How Will Energy Demand Develop in the Developing World?” Journal of Economic Perspectives, 26(1), 119-138.

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