Energy poverty

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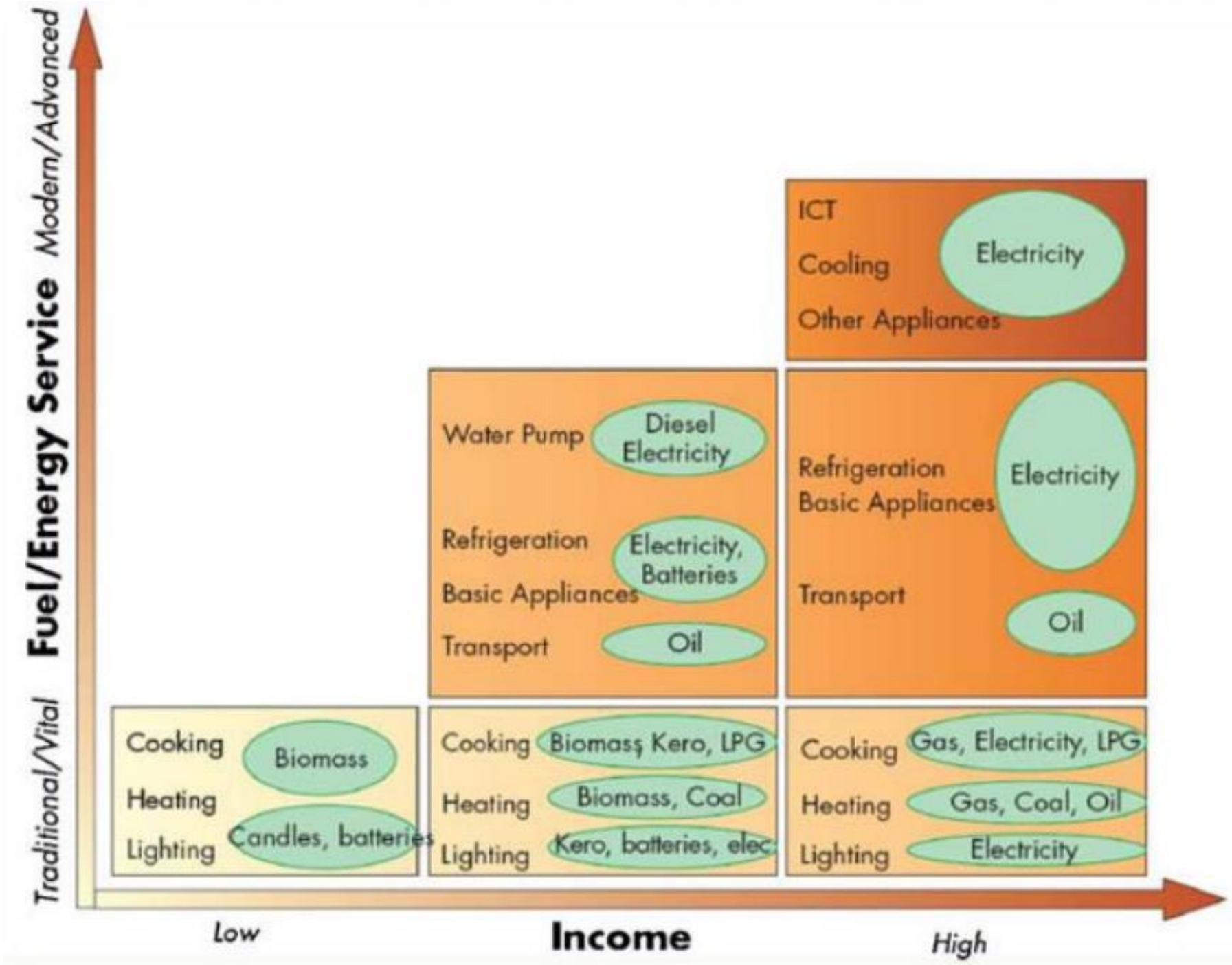
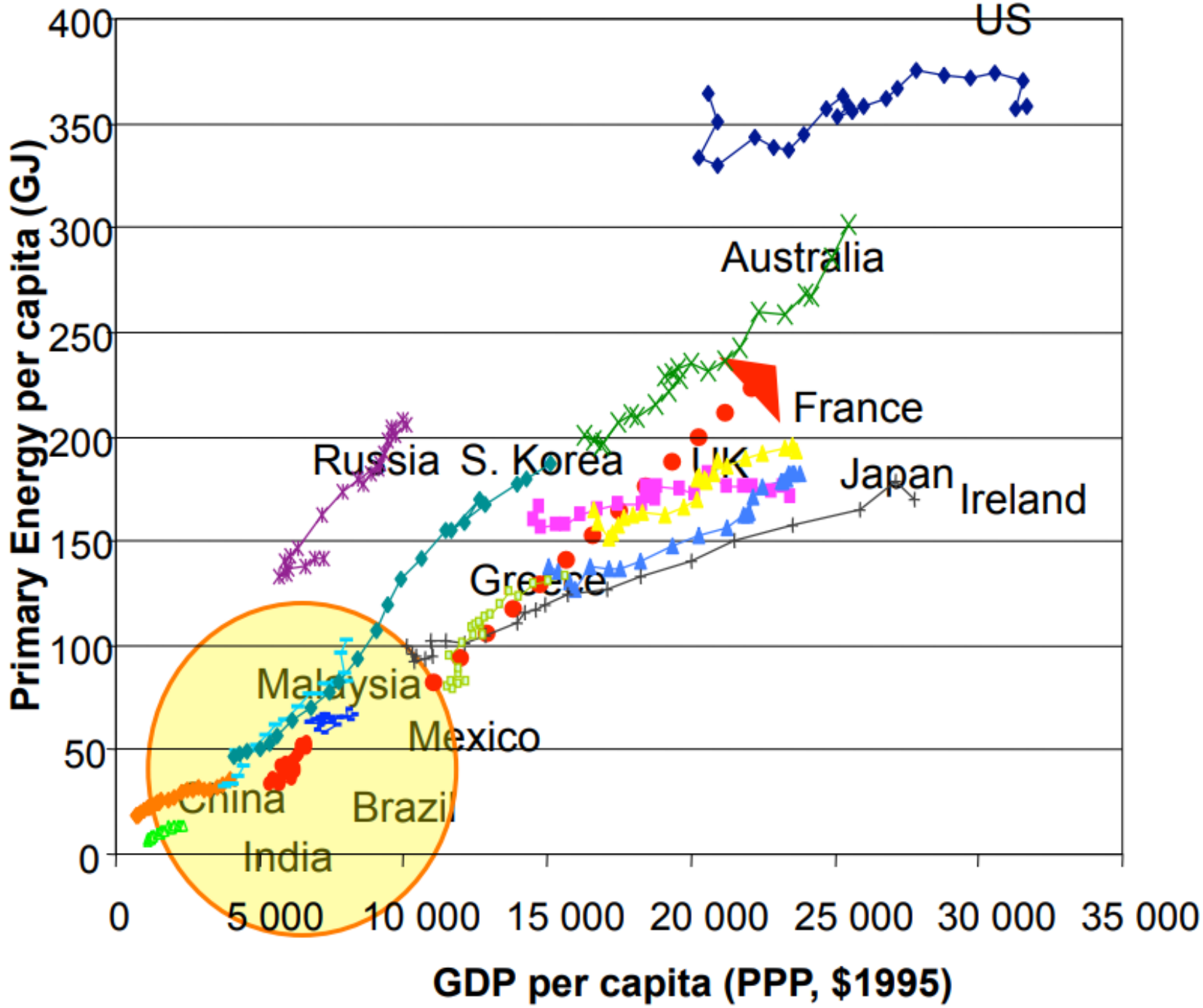
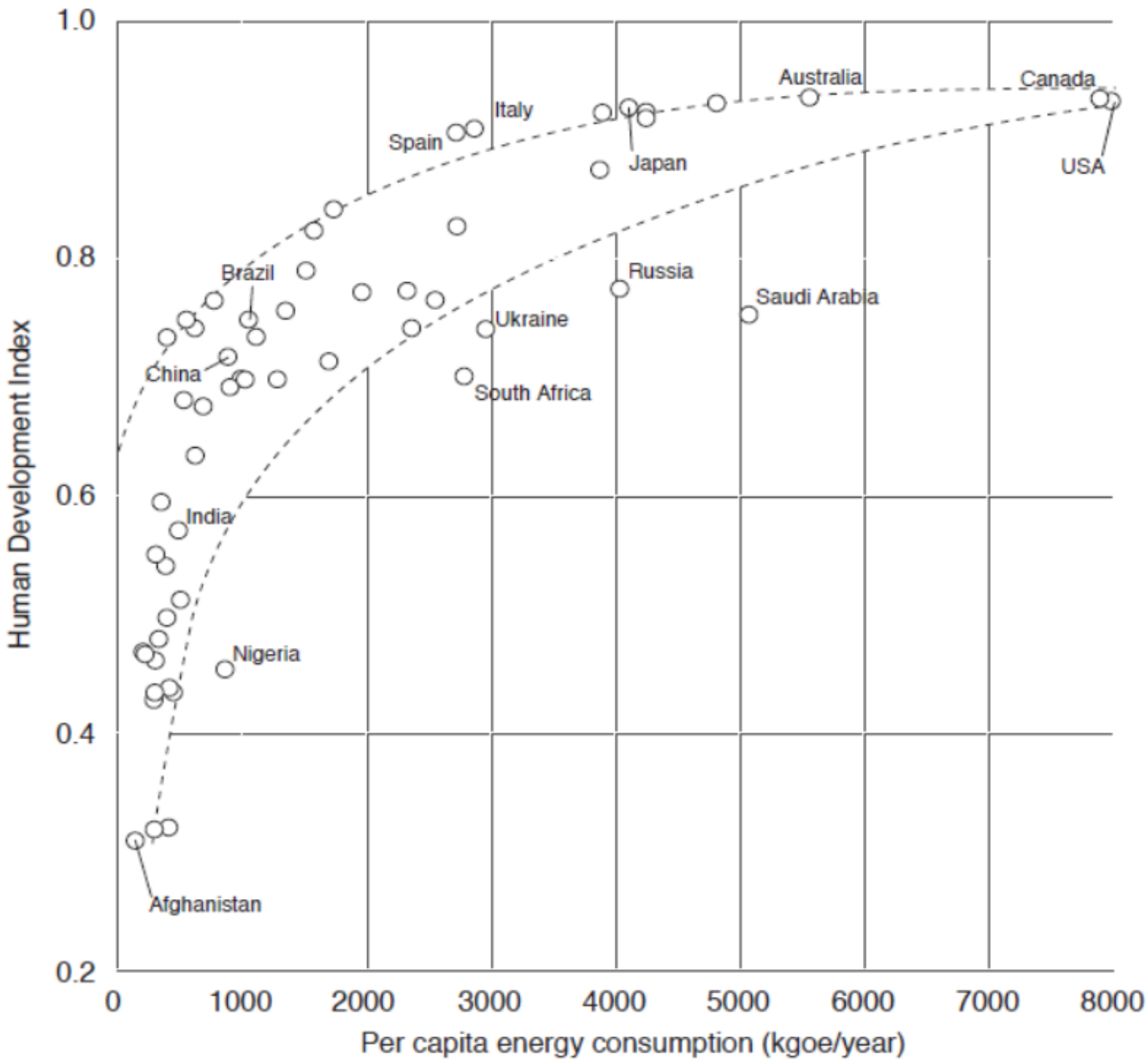
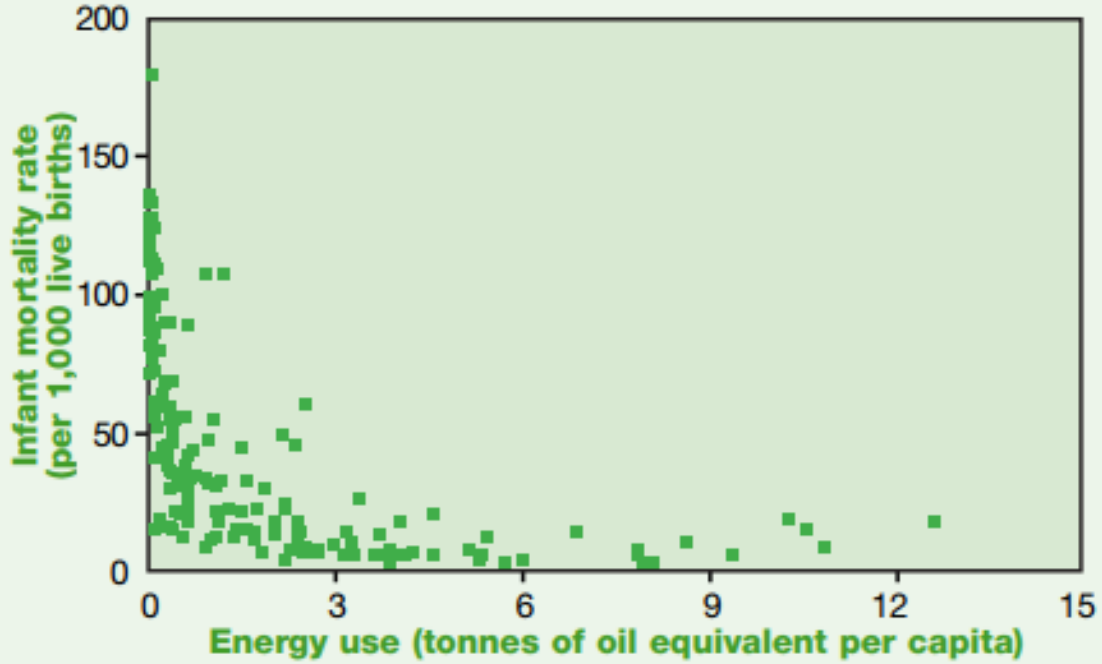
Lecture outline

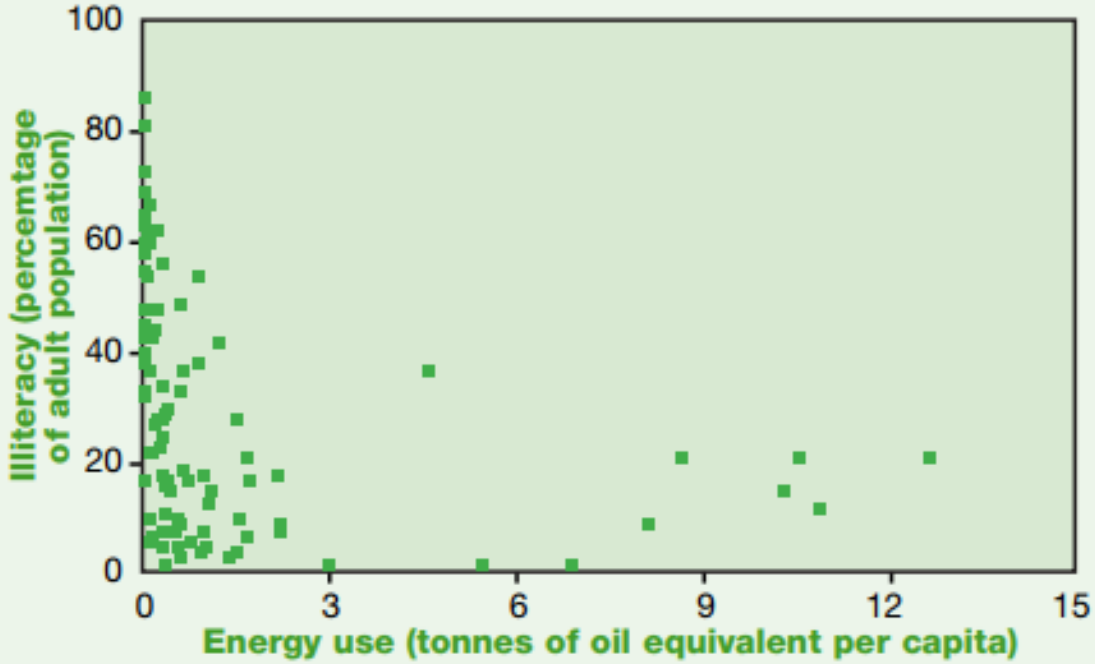
- Energy, development, inequality
- Energy poverty in energy-unintensive countries
- Energy poverty in energy-intensive countries

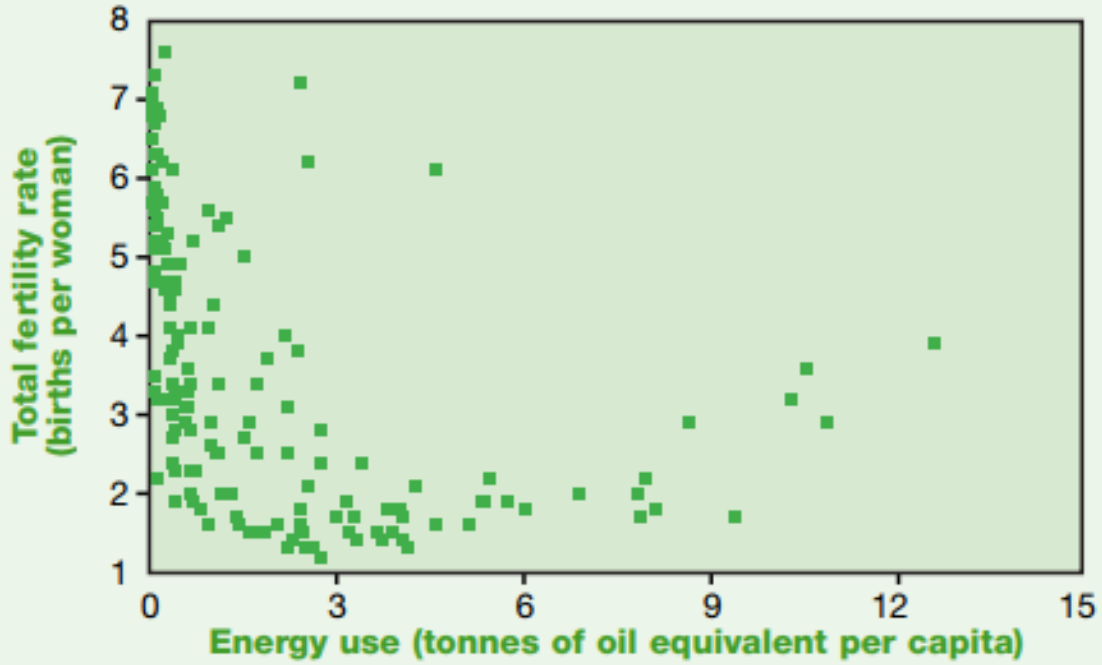

Traditional/Vital
Fuel/Energy Service
Modern/Advanced
ICT
Cooling
Other Appliances
Electricity
Water Pump
Diesel
Electricity
Refrigeration
Basic Appliances
Transport
Electricity,
Batteries
Oil
Refrigeration
Basic Appliances
Transport
Electricity
Oil
Cooking
Biomass
Heating
Lighting
Candles, batteries
Cooking
Biomass, Kero, LPG
Heating
Biomass, Coal
Lighting
Kero, batteries, elec
Cooking
Gas, Electricity, LPG
Heating
Gas, Coal, Oil
Lighting
Electricity
Low
Income
High

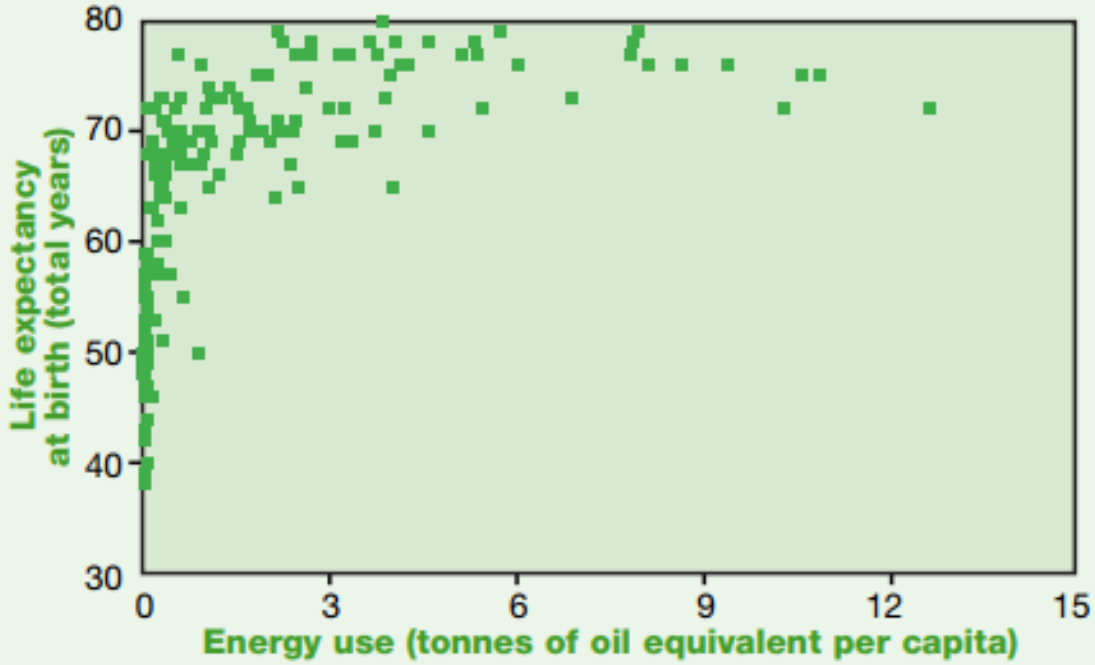

US
Australia
France
Russia
S. Korea
UK
Japan
Ireland
Greece
Malaysia
Mexico
China
Brazil
India
Primary Energy per capita (GJ)
0
50
100
150
200
250
300
350
400
0
5 000
10 000
15 000
20 000
25 000
30 000
35 000
GDP per capita (PPP, $1995)

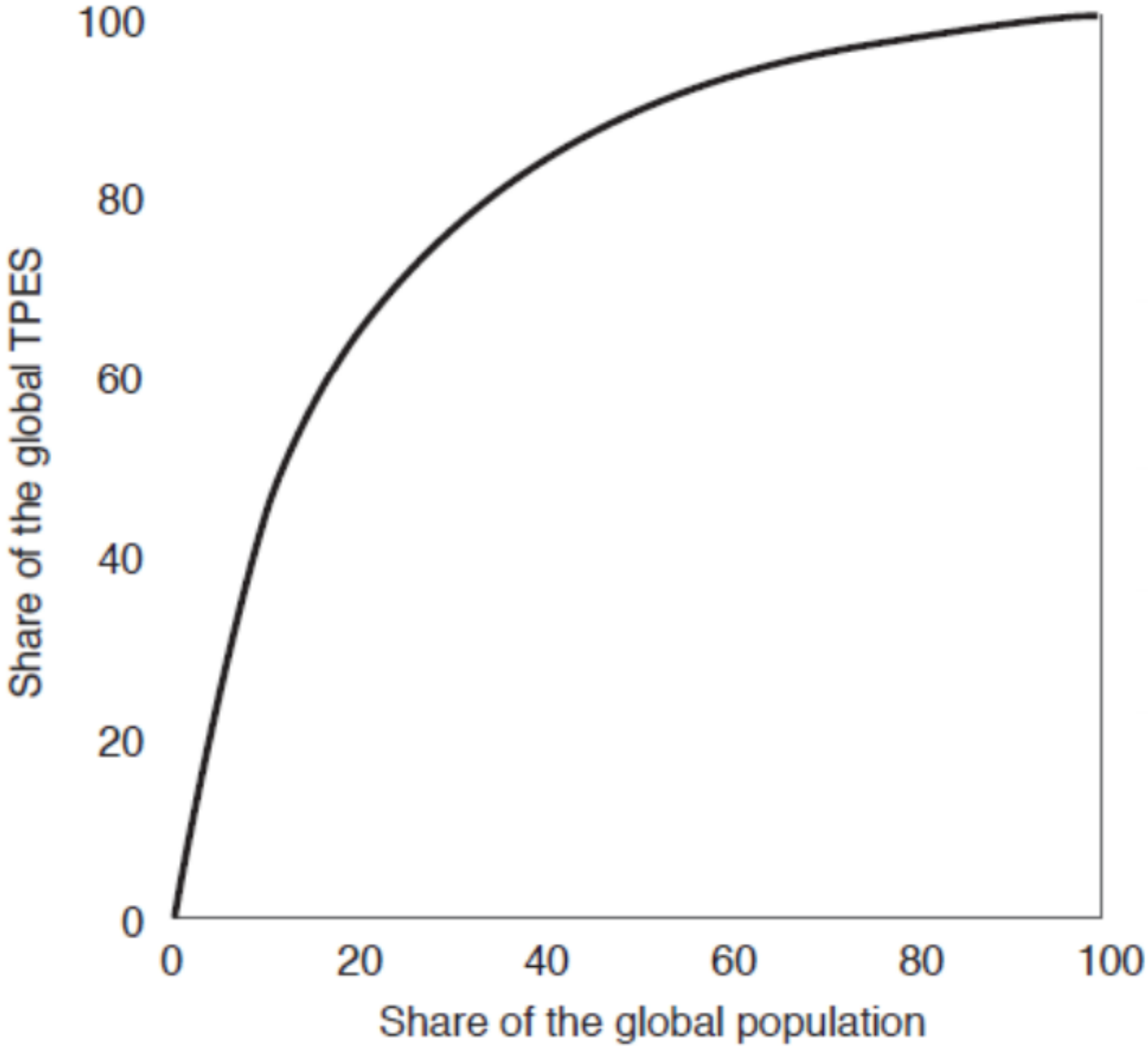

1.0
0.8
0.6
0.4
0.2
Human Development Index
0
1000
2000
3000
4000
5000
6000
7000
8000
Per capita energy consumption (kgoe/year)
Australia
Canada
Italy
Spain
Japan
USA
Brazil
Russia
Saudi Arabia
Ukraine
China
South Africa
India
Nigeria
Afghanistan


Infant mortality rate (per 1,000 live births)
200
150
100
50
0
0
3
6
9
12
15
Energy use (tonnes of oil equivalent per capita)


Illiteracy (percemtage of adult population)
100
80
60
40
20
0
0
3
6
9
12
15
Energy use (tonnes of oil equivalent per capita)


Total fertility rate (births per woman)
8
7
6
5
4
3
2
1
0
3
6
9
12
15
Energy use (tonnes of oil equivalent per capita)


Life expectancy at birth (total years)
80
70
60
50
40
30
0
3
6
9
12
15
Energy use (tonnes of oil equivalent per capita)


100
80
60
40
20
0
Share of the global TPES
0
20
40
60
80
100
Share of the global population

Energy poverty and fuel poverty: the meaning

- Energy poverty = lack of (physical) access to modern energy services
- Fuel poverty = inability to adequately heat (or provide necessary energy services in) one‘s home at affordable cost
- Often in literature however: energy poverty = fuel poverty
- No agreement on how to measure energy/fuel poverty

=> What policies shall be drafted to address the issue?

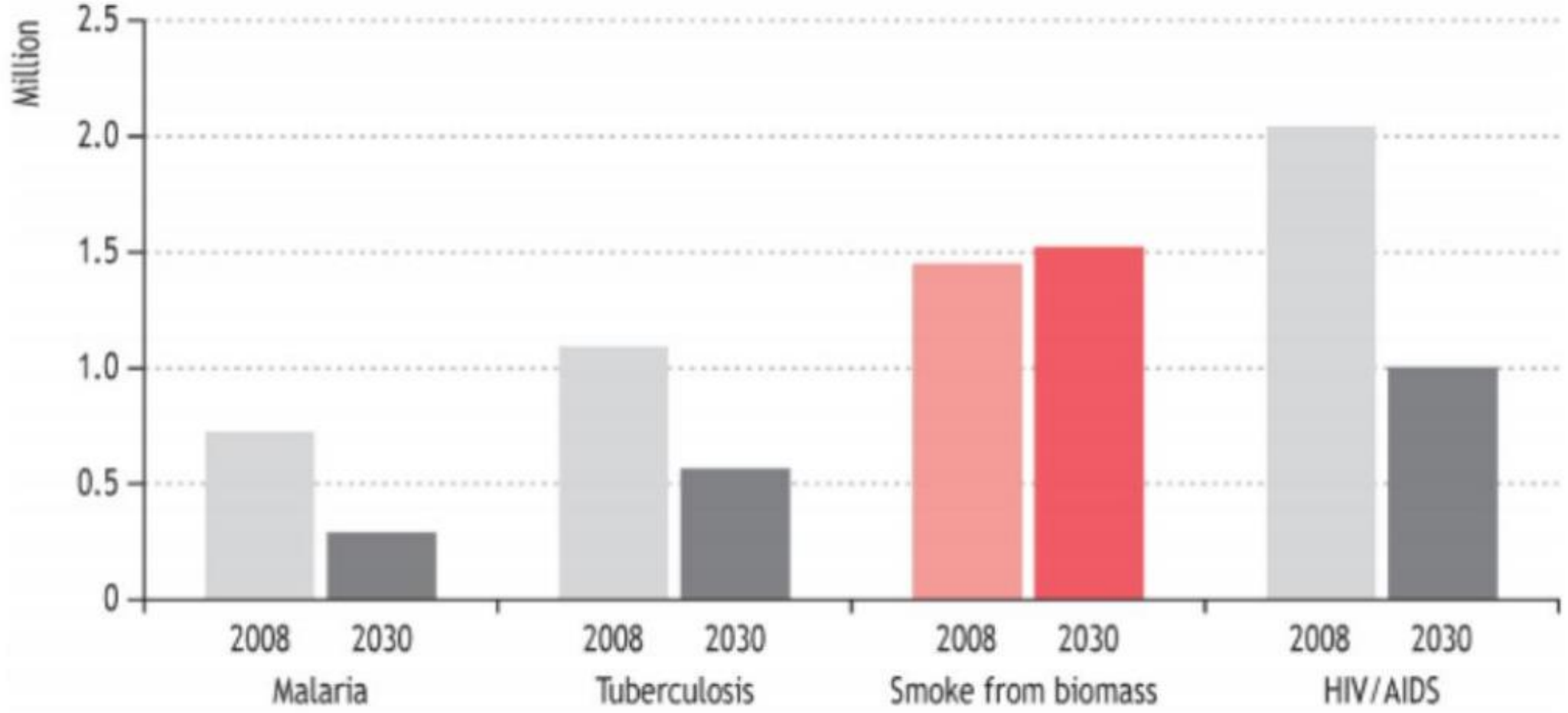
Energy poverty in energy-unintensive countries/regions

Energy poverty in energy-unintensive countries/regions

Reliance on biomass

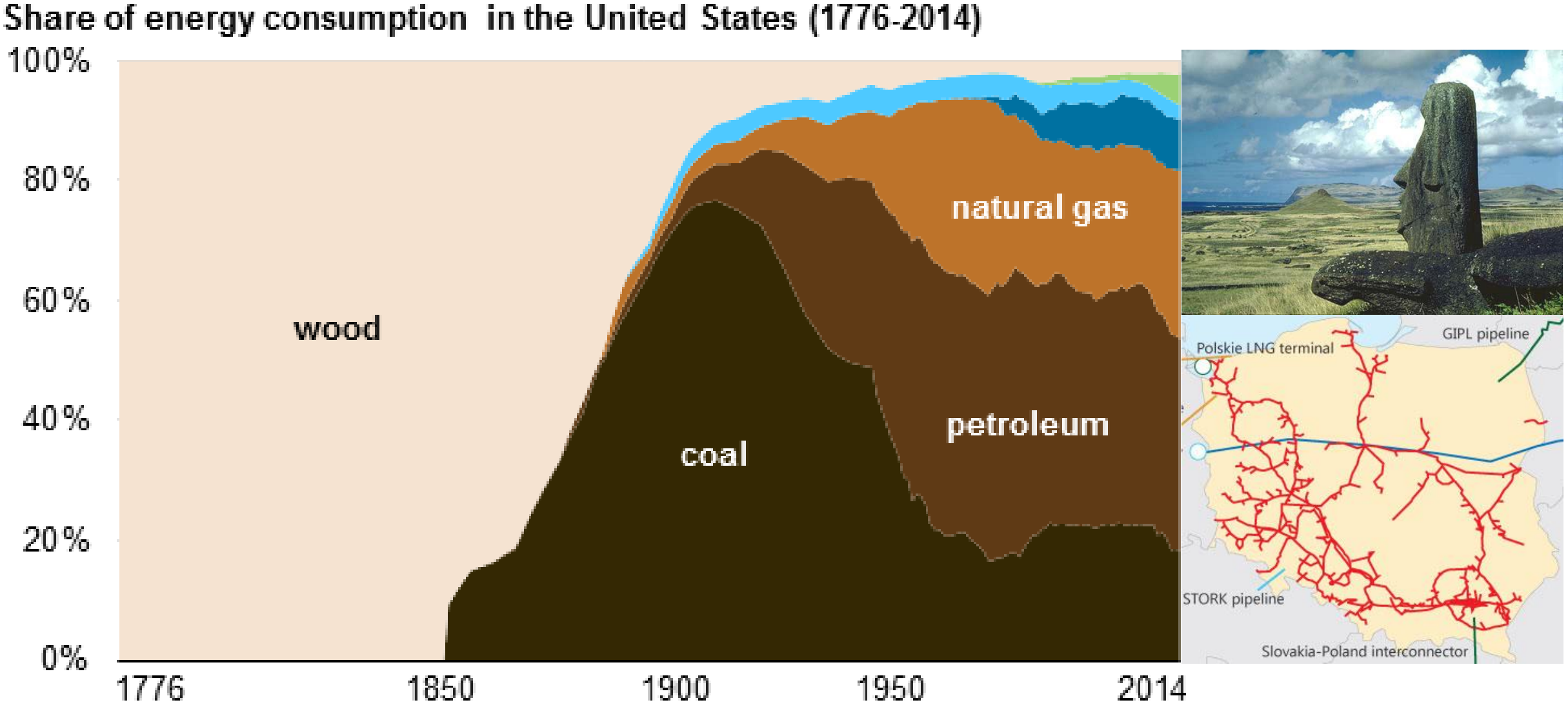
- Indoor air pollution
- Time and effort in collecting biomass
- Unsustainable harvesting practices

Premature annual deaths from household air pollution and other diseases



Sources: Mathers and Loncar (2006); WHO (2008); Smith *et al.*, (2004); WHO (2004) and IEA analysis.

100% reliance on wood



Energy poverty in energy-unintensive countries/regions

Energy poverty alleviation pathway: breaking the missing return on investment problem

- Scattered and small demand for energy
- Low purchasing power

=> Centralized solutions do not work

=> Micro-solutions need to be developed

Energy poverty in energy-intensive countries

- Recognized and reflected only recently (UK as a frontrunner – effects of market liberalization?)
- EU gathers data and discusses appropriate policies (defining vulnerable consumers)

  (see for example https://ec.europa.eu/energy/sites/ener/files/documents/INSIGHT_E_Energy%20Poverty%20-%20Main%20Report_FINAL.pdf)

- The issue of redistribution
- The social sustainability – environmental sustainability nexus

Equity and redistribution

- Should energy be subsidized?
- If yes, what and how?

Subsidized energy prices

- Alleviate (energy) poverty
- Foster purchasing power and consumer demand

- Burden state treasury
- Encourage overconsumption
- Challenge competitiveness of energy suppliers
- Leak to unintended groups

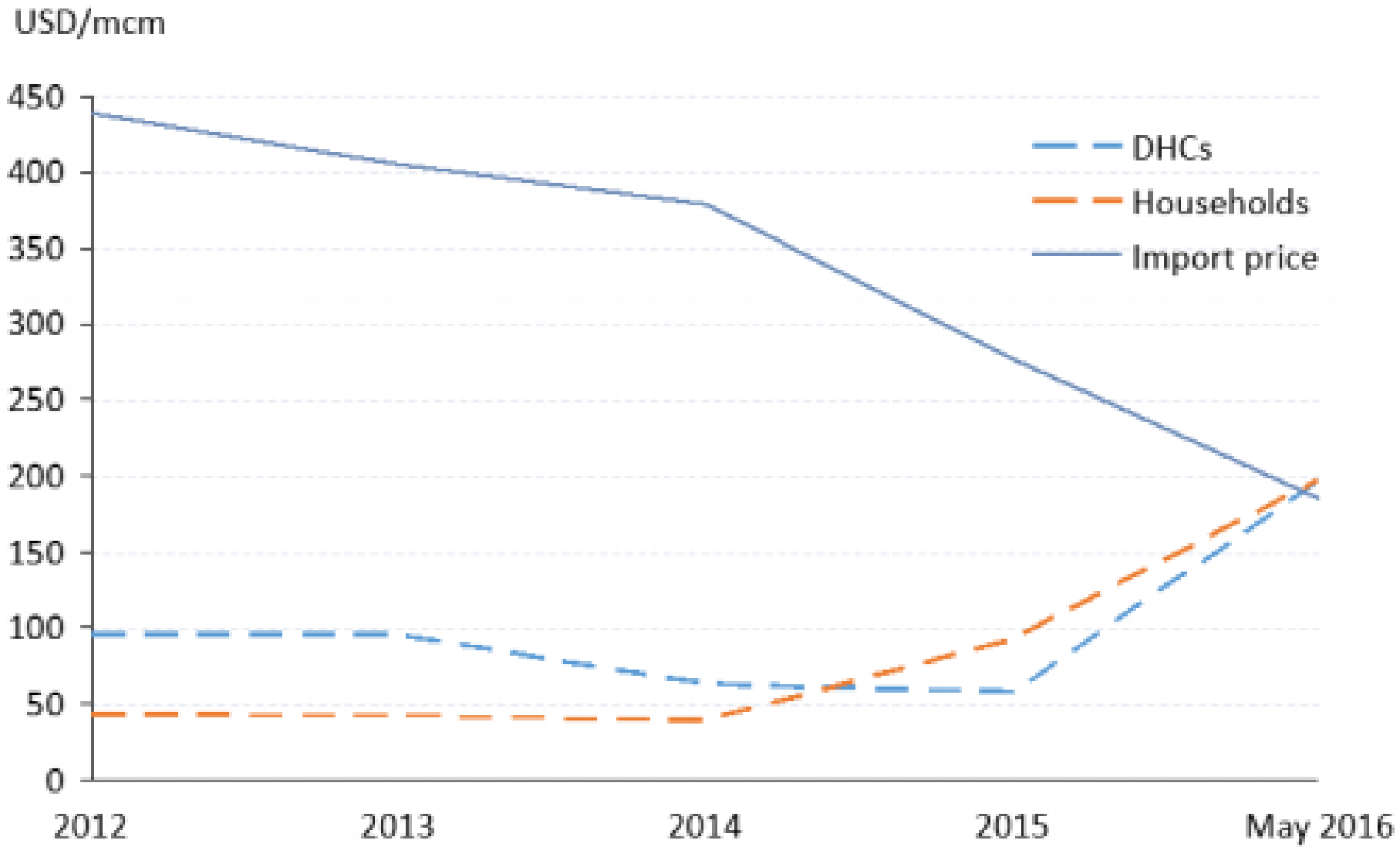
Natural gas wholesale market in Poland

- Goal: to decrease natural gas price for the end customers
- Tool: mixing cheap domestic production (30%) with expensive imports (70%) to reduce the wholesale price
- Result: even more expensive imports

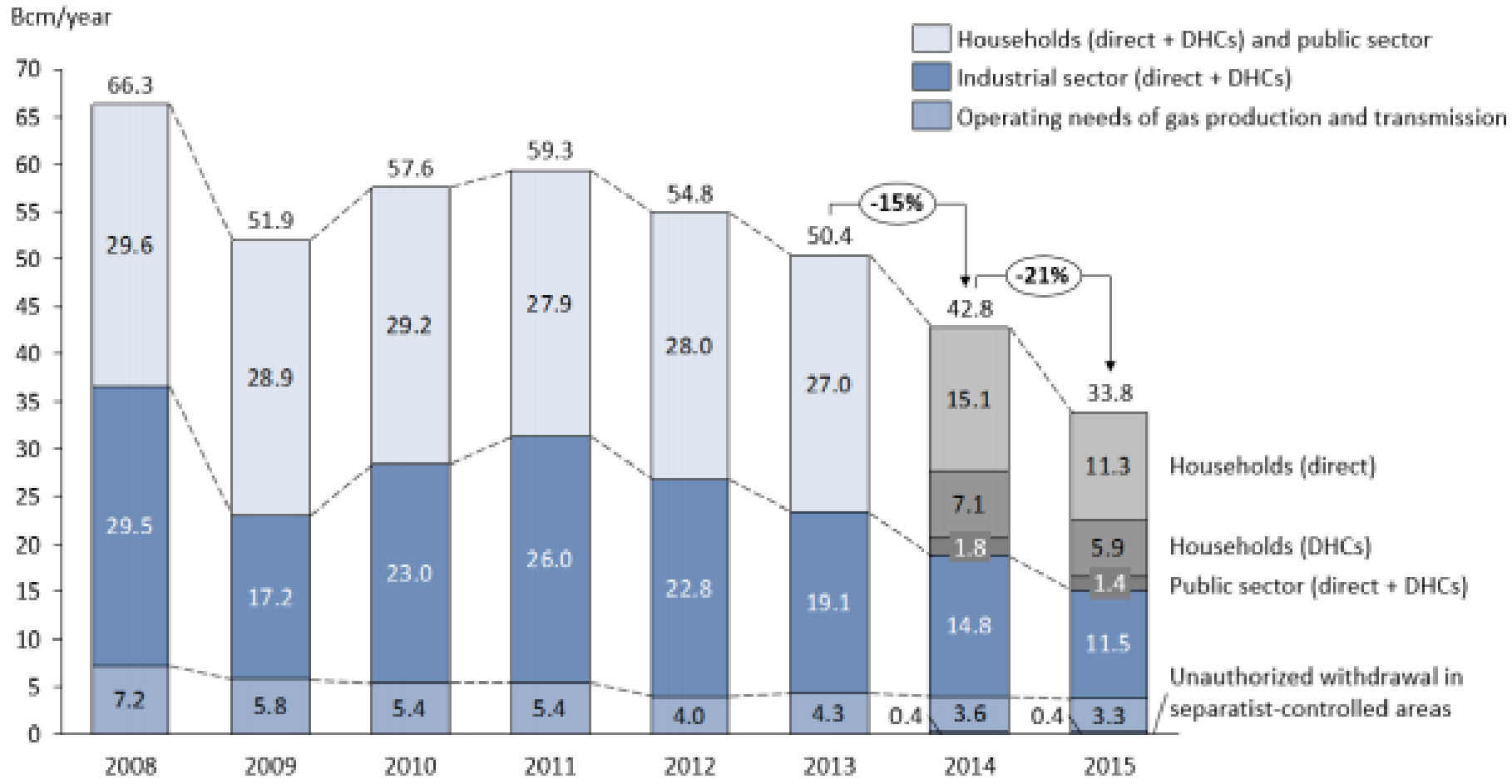
Natural gas retail market in the Ukraine

- Goal: affordable heat for households
- Tool: regulated retail gas price (subsidies equaled to 5.6% of GDP)
- Result: overconsumption which contributed to the political and national security crisis of 2014

Natural gas retail market in the Ukraine



Natural gas retail market in the Ukraine



The social sustainability – environmental sustainability nexus

Should the following measures/technologies be subsidized?

- Thermal efficiency of buildings
- Large scale renewable energy production sites
- Decentralized renewable energy sources
- Electrical mobility

The measurement issue: Energy Efficiency

How would you measure energy efficiency?

Energy Efficiency

How would you measure energy efficiency?

- Energy intensity: GDP/energy consumption
- Energy consumption per capita

Energy efficiency: the best of the best (USD2005 GDP PPP/kgoe)

1981-1985 | 1986-1990 | 1991-1995 | 1996-2000 | 2001-2005 | **2006-2010**

Country name	2006	2007	2008	2009	2010
Lesotho	136.1	142.1			
Vanuatu	26.4	25.0			
Kiribati	21.9	20.0			
Hong Kong SAR, China	19.5	19.3	20.0	18.4	
Solomon Islands	17.7	18.0			
Comoros	16.3	16.8			
Guinea-Bissau	15.8	15.4			
Cape Verde	13.8	14.8			
Singapore	10.9	14.6	13.9	12.5	
Peru	14.3	14.4	15.1	14.4	
Gambia, The	15.5	14.0			
Dominica	13.1	13.4			
Panama	11.5	13.4	14.2	13.2	

Energy efficiency: the worst of the worst (USD2005 GDP PPP/kgoe)

Tanzania	2.4	2.5	2.6	2.7		
Kazakhstan	2.4	2.4	2.4	2.5		
Iceland	2.6	2.3	2.2	2.1	2.0	
Ukraine	2.1	2.2	2.3	2.3		
Zambia	1.9	2.0	2.1	2.1		
Togo	2.0	2.0	2.0	2.0		
Ethiopia	2.4	1.9	2.0	2.2		
Mozambique	1.7	1.8	1.8	1.9		
Trinidad and Tobago	1.5	1.6	1.7	1.5		
Turkmenistan	1.3	1.3	1.4	1.7		
Uzbekistan	1.2	1.3	1.3	1.5		
Congo, Dem. Rep.	0.8	0.8	0.8	0.8		

Energy consumption: the lowest (kgoe per capita)

1981-1985 | 1986-1990 | 1991-1995 | 1996-2000 | 2001-2005 | **2006-2010**

Country name	2006	2007	2008	2009	2010	
Lesotho	9	9				
Timor-Leste	57	58				
Comoros	64	60				
Guinea-Bissau	64	67				
Gambia, The	74	84				
Kiribati	107	116				
Solomon Islands	122	129				
Eritrea	150	150	137	142		
Vanuatu	143	157				
Djibouti	174	170				
Bangladesh	178	184	192	201		

Energy consumption: the highest (kgoe per capita)

Country name	2006	2007	2008	2009	2010	
Czech Republic	4,464	4,430	4,281	4,004	4,022	
Turkmenistan	3,934	4,512	4,570	3,933		
Korea, Rep.	4,421	4,584	4,669	4,701	5,044	
Russian Federation	4,706	4,733	4,850	4,561		
Netherlands	4,700	4,844	4,837	4,729	5,016	
Belgium	5,509	5,367	5,470	5,300	5,221	
Sweden	5,529	5,472	5,380	4,883	5,414	
Saudi Arabia	6,380	5,650	5,888	5,888		
Oman	5,548	5,765	6,235	5,554		
Norway	5,817	5,849	6,249	5,849	6,332	
Australia	5,910	5,929	6,019	5,971	5,636	
Finland	7,076	6,953	6,641	6,213	6,639	
United States	7,692	7,749	7,481	7,045	7,232	
Canada	8,224	8,248	8,001	7,532	7,486	

GDP vs. Energy Efficiency
(Top 40 Economies by GDP)