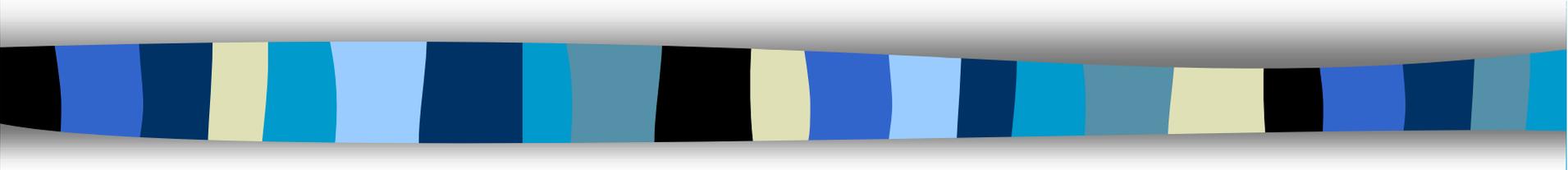


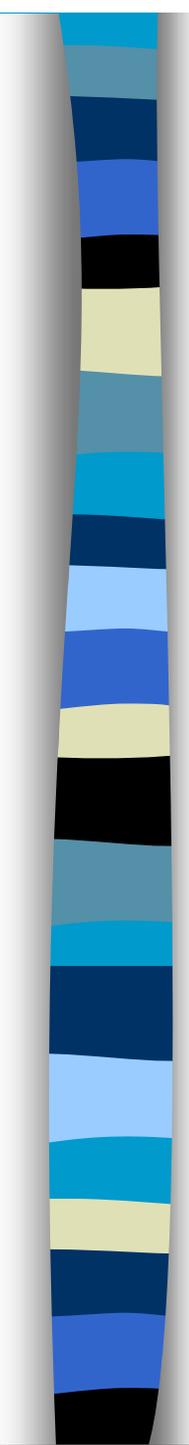
Measuring the benefits of modern fuels to poor households: An illustration from Guatemala



Vivien Foster, World Bank

‘Village Power’

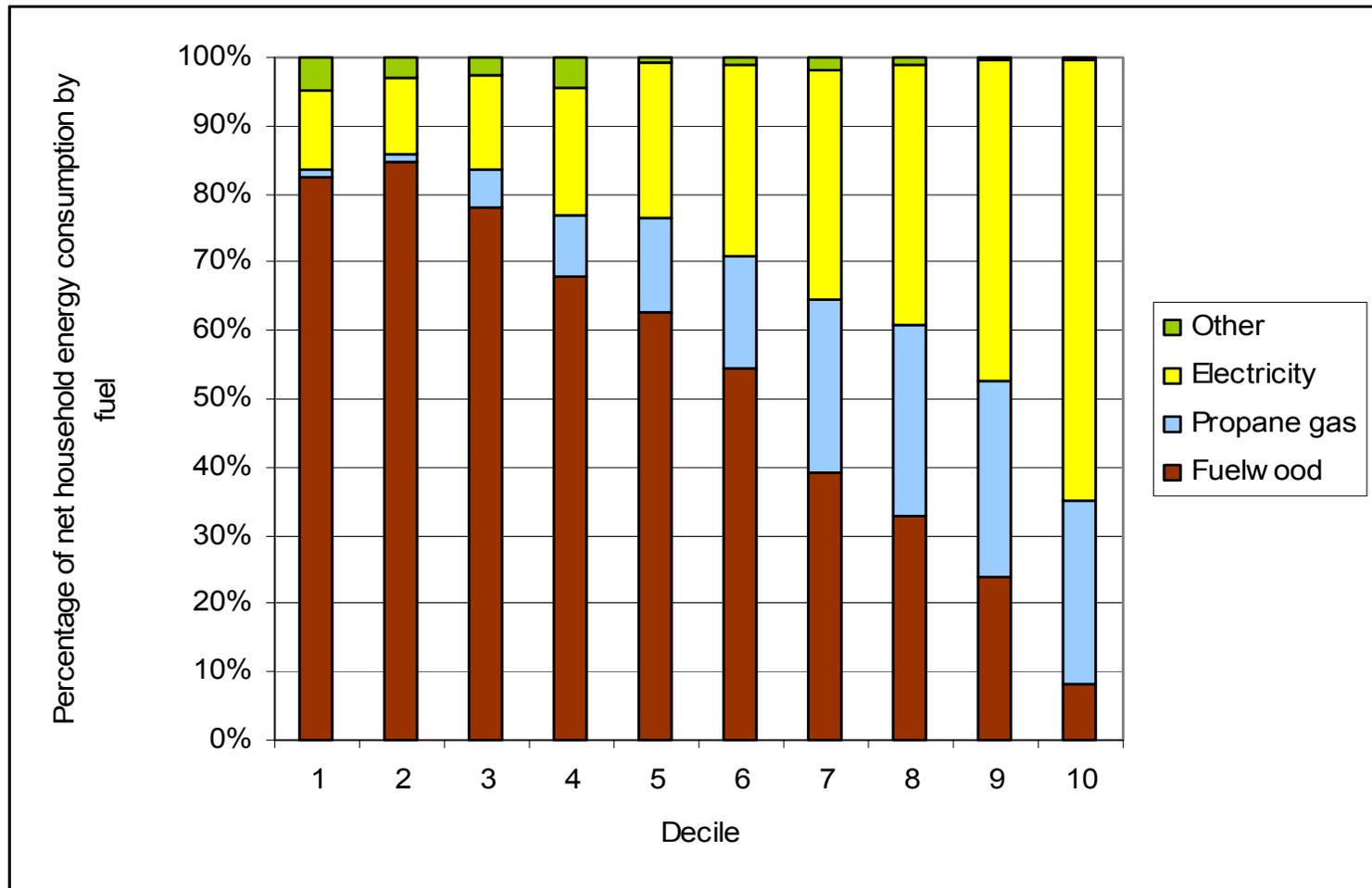
Washington, 7th December 2000



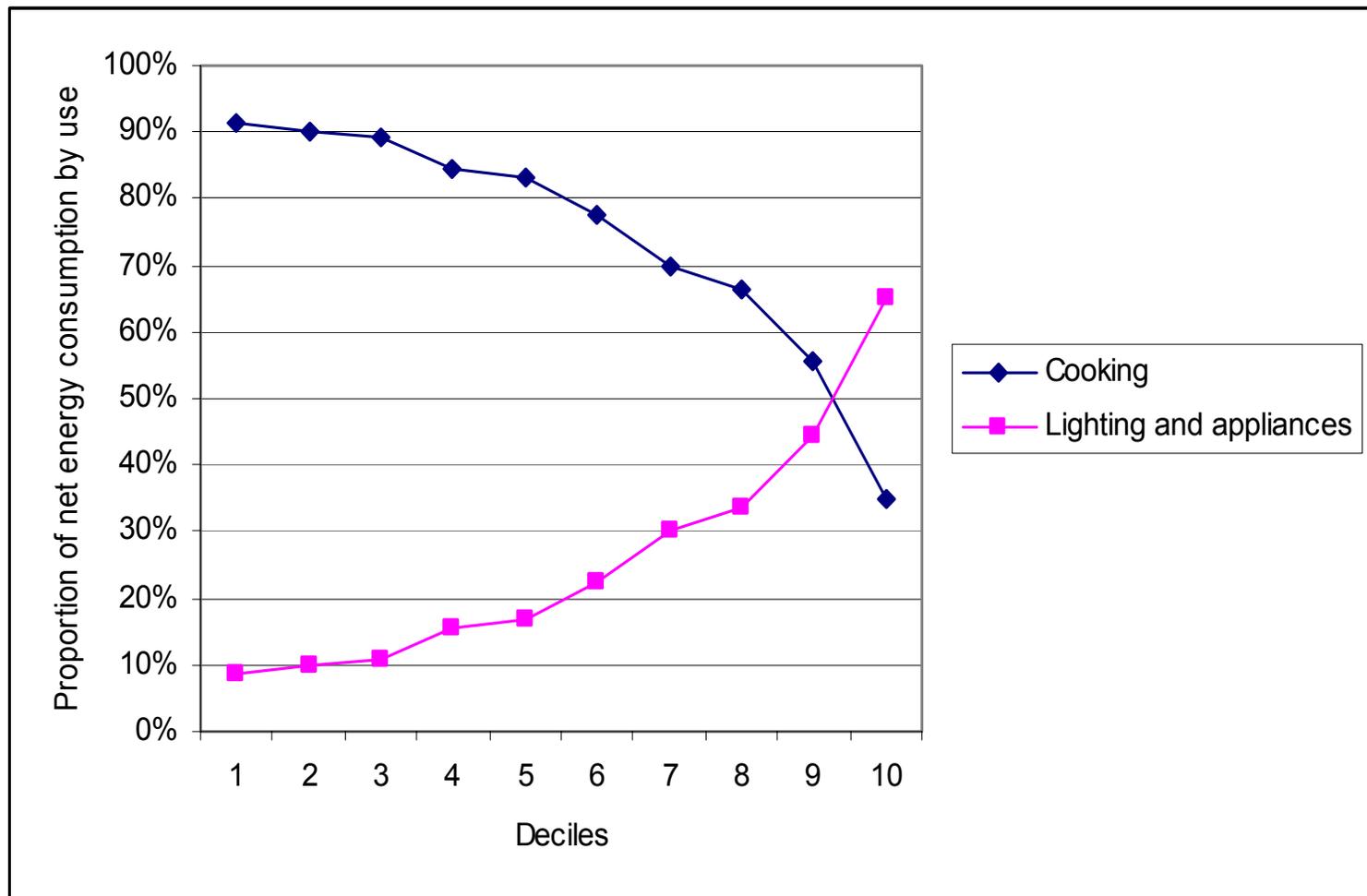
Outline

- Energy consumption and the poor
- Benefits of modern fuels
 - expenditure method
 - hedonic method
- Barriers to access
 - supply side
 - demand side

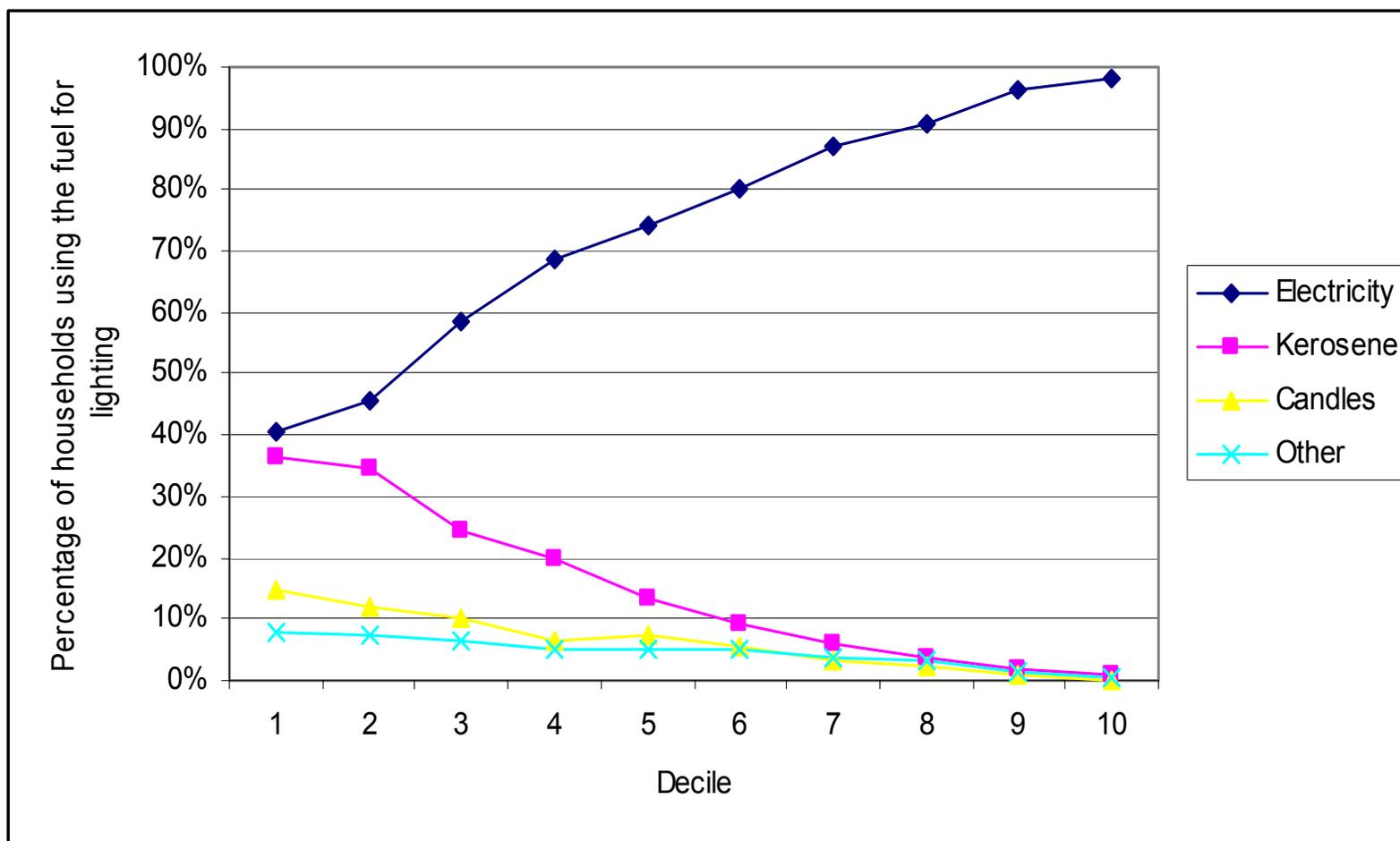
Energy portfolio: by fuel



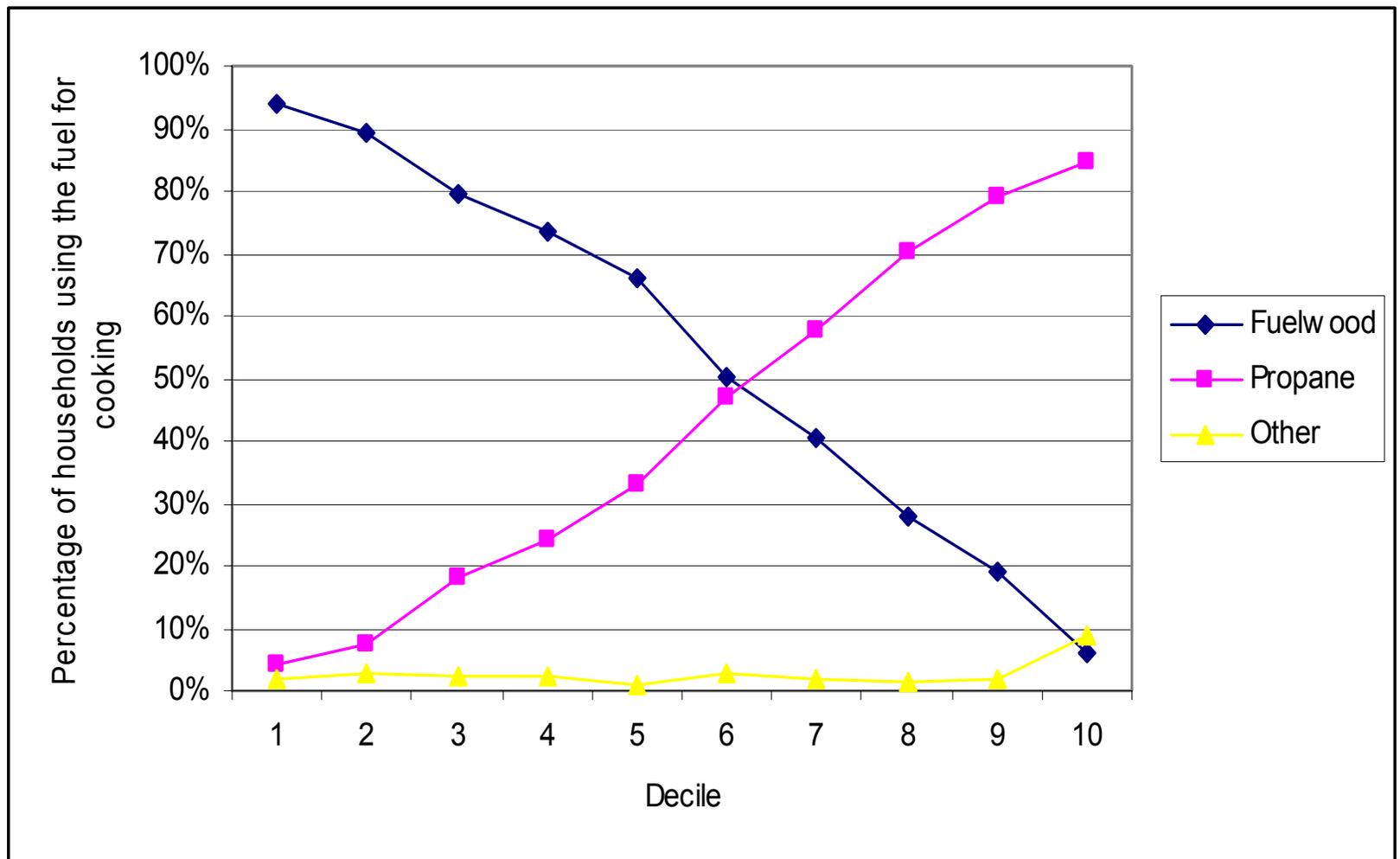
Energy portfolio: by use

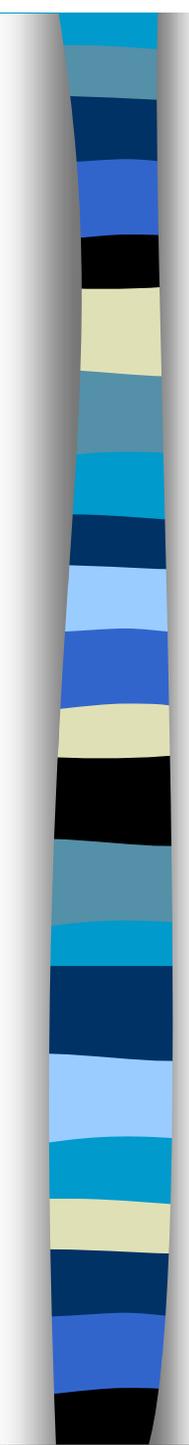


Coverage index: lighting



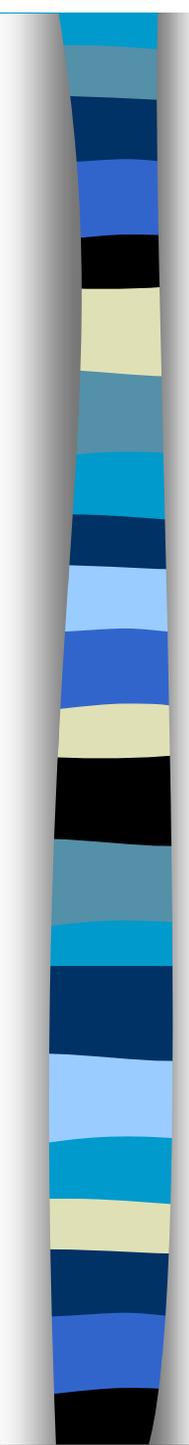
Coverage index: cooking fuels





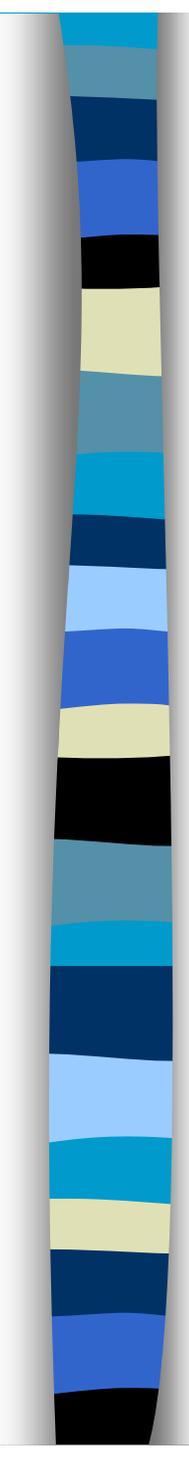
Expenditure method

- Modern fuels are substantially more efficient than traditional ones
- Access to modern fuels provides two kinds of benefits
 - lower prices
 - higher consumption



Efficiency factors

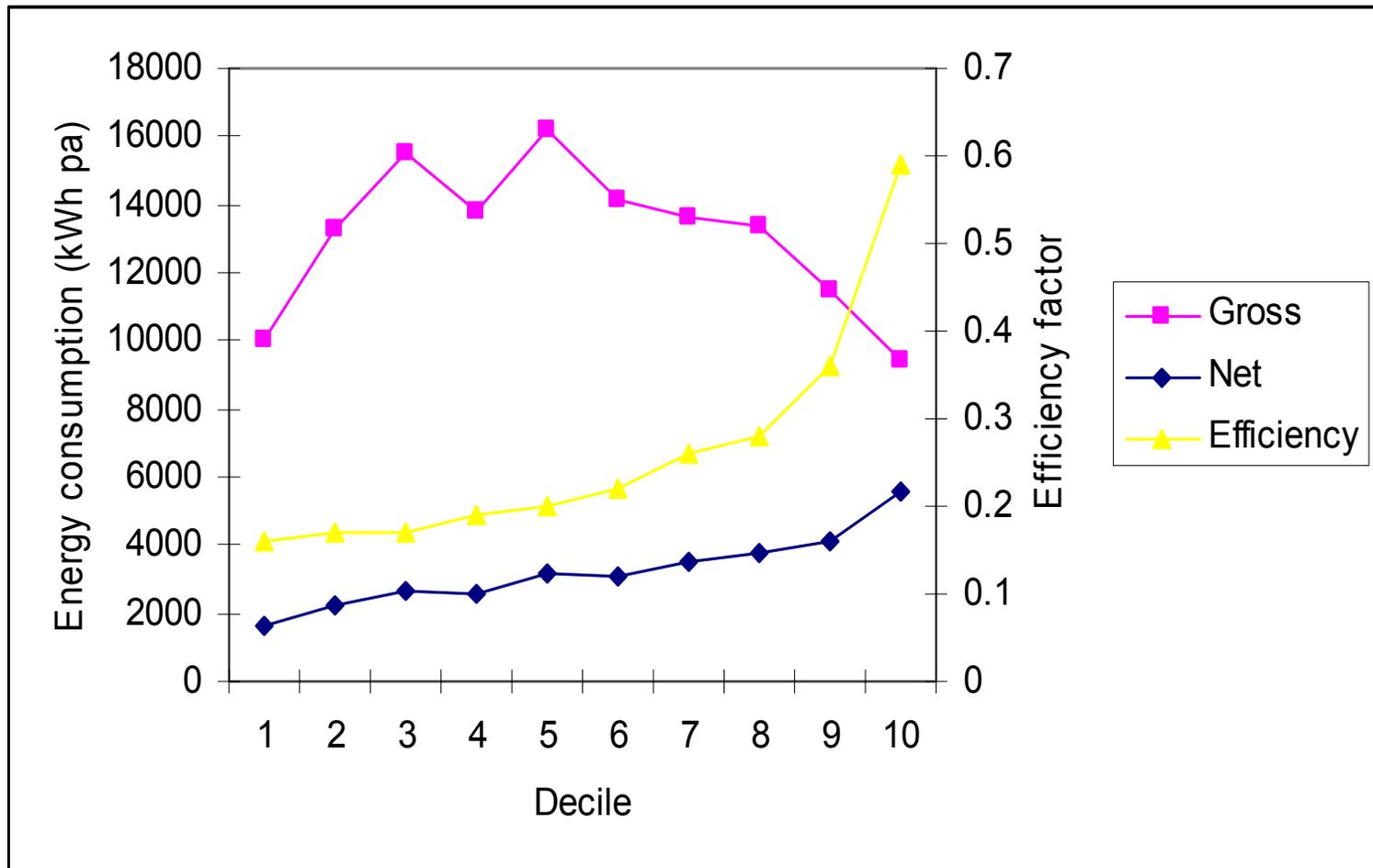
Cooking		Lighting		Appliances	
Fuel	Efficiency	Fuel	Luminous efficacy	Fuel	Efficiency
Electricity	1.00	Electricity	1.00	Electricity	1.00
Propane	0.77	Candles	0.02	Dry cell batteries	0.90
Fuelwood	0.15	Kerosene	0.01	Car batteries	0.90

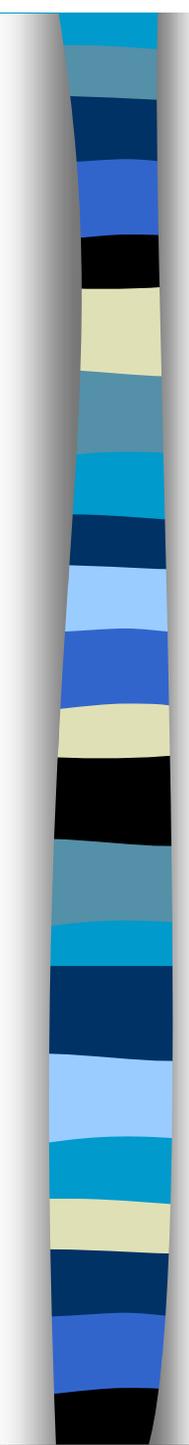


Efficiency adjusted prices

(US\$/kWh)	Gross	Net
Fuelwood	0.01	0.06
Propane	0.05	0.06
Electricity	0.08	0.08
Dry cell batteries	0.59	0.53
Car batteries	2.57	2.31
Kerosene	0.05	5.87
Candles	0.26	13.00

Gross and net consumption





Subsistence threshold

- Comparison of two approaches

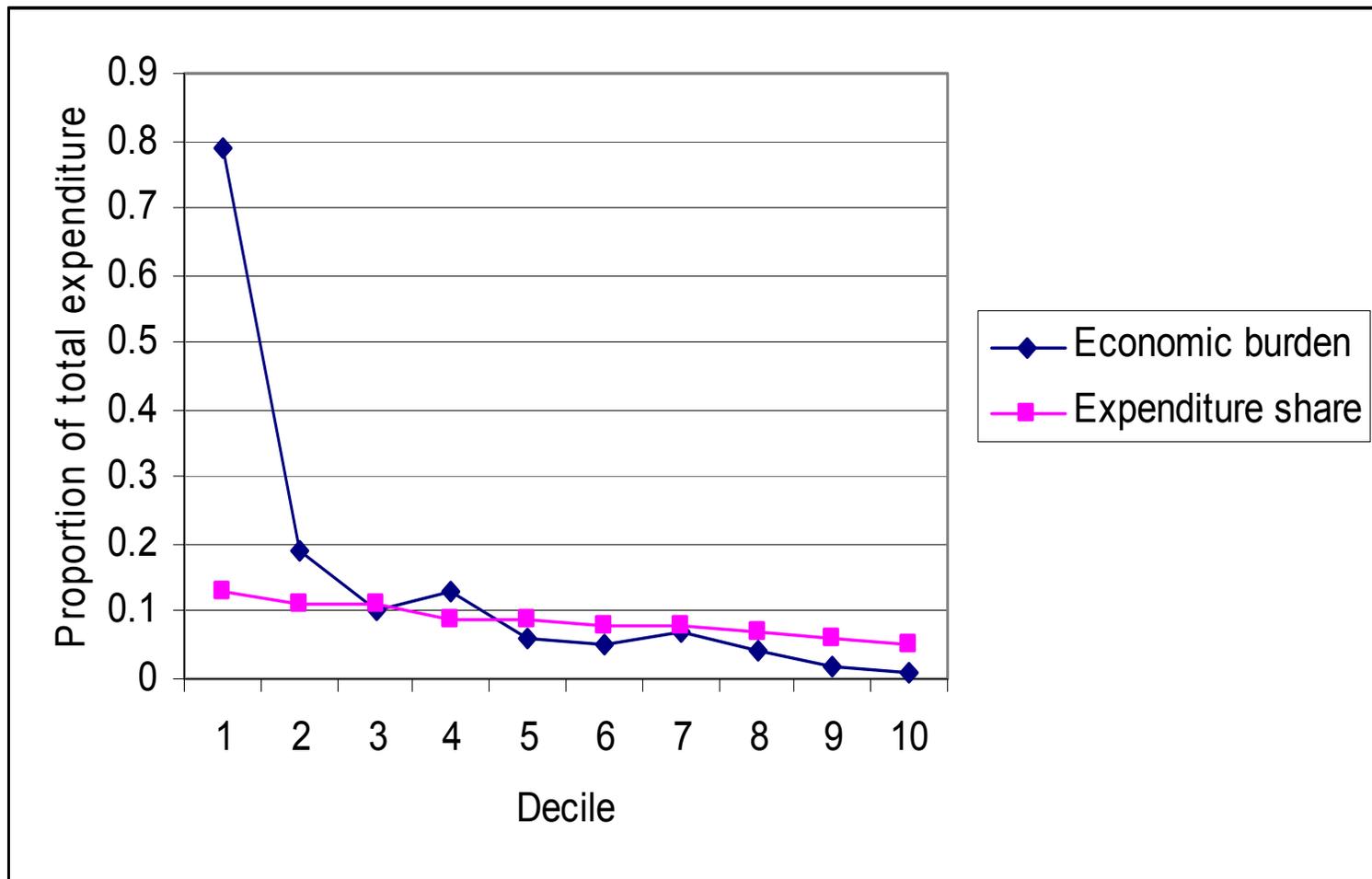
- *Actual consumption* of those within 10% of extreme poverty line (US\$1PPP)

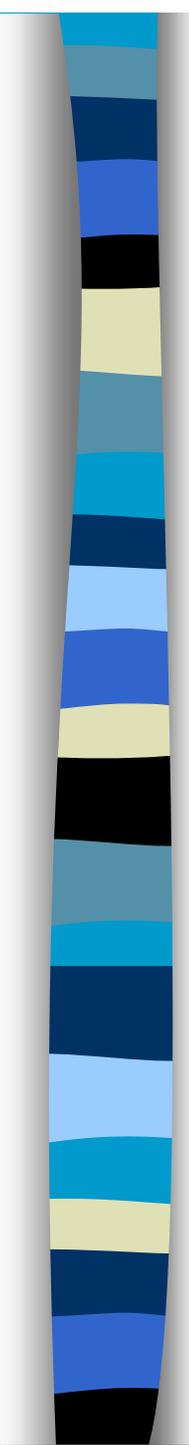
2,125 kWh per year

- *Bottom-up estimate* based on expert opinion of subsistence requirements

2,154 kWh per year

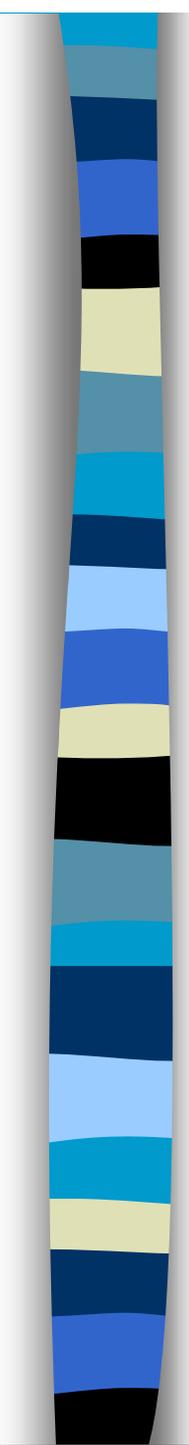
Cost of meeting subsistence





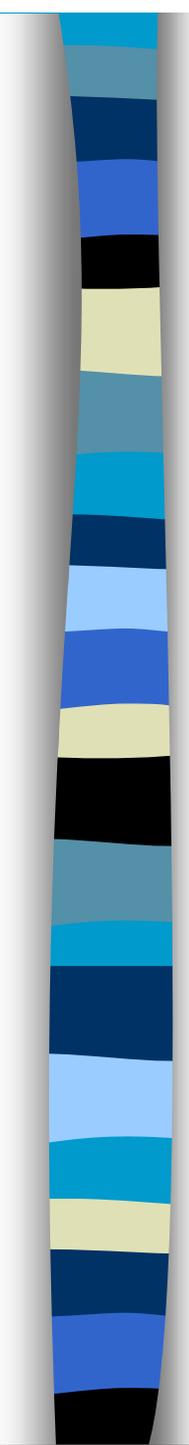
Results of expenditure method

	Without Access	With Access
Average price per net kWh	1.35	0.98
Average net consumption (kWh)	2,892	3,967
Fuel poverty rate	50.9%	36.5%



Hedonic method

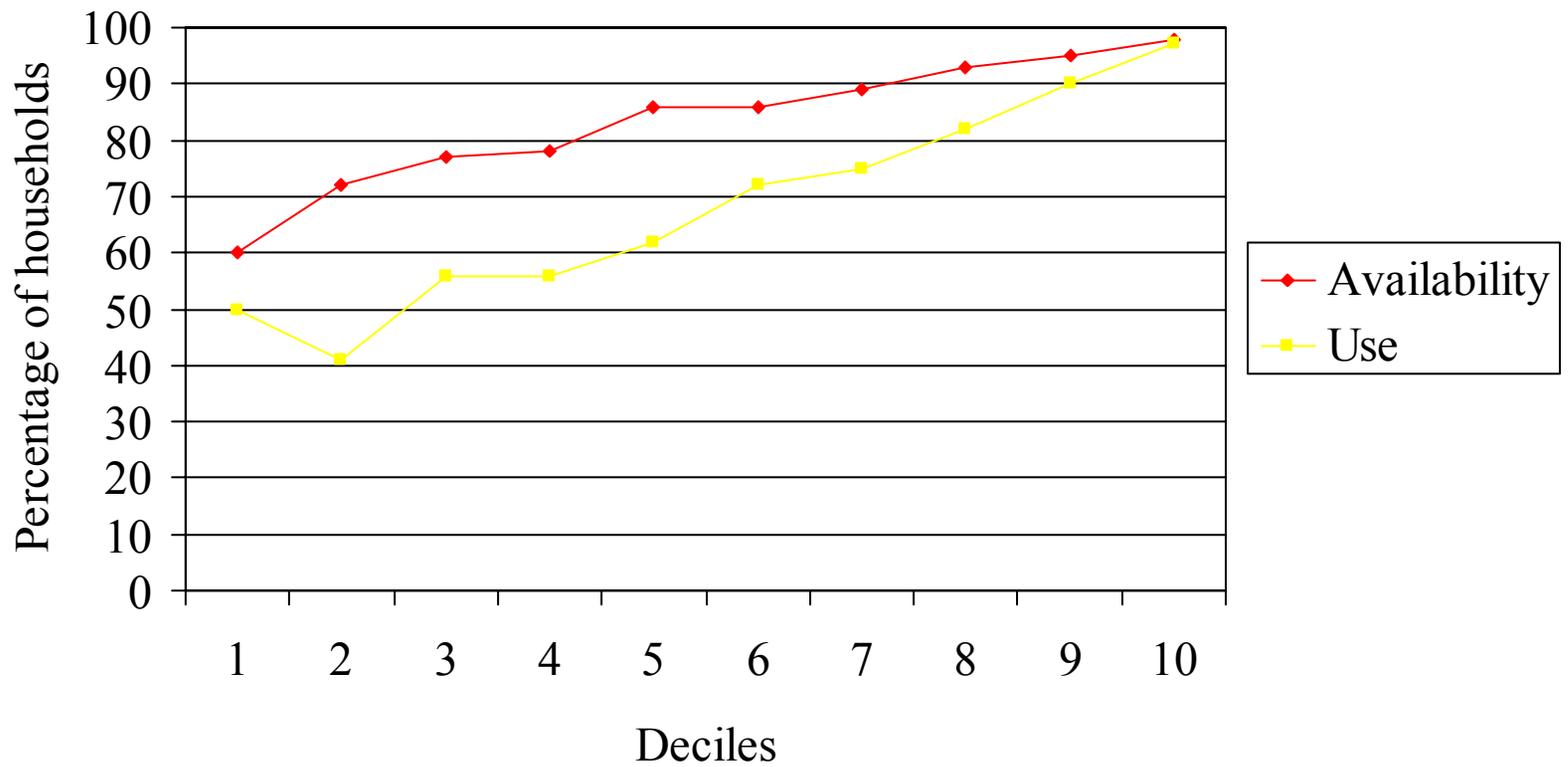
- Availability of basic services increases the rental value of housing
- Controlling for other housing characteristics it is possible to isolate the effect of electricity on rent
- This reflects households' willingness to pay for electricity



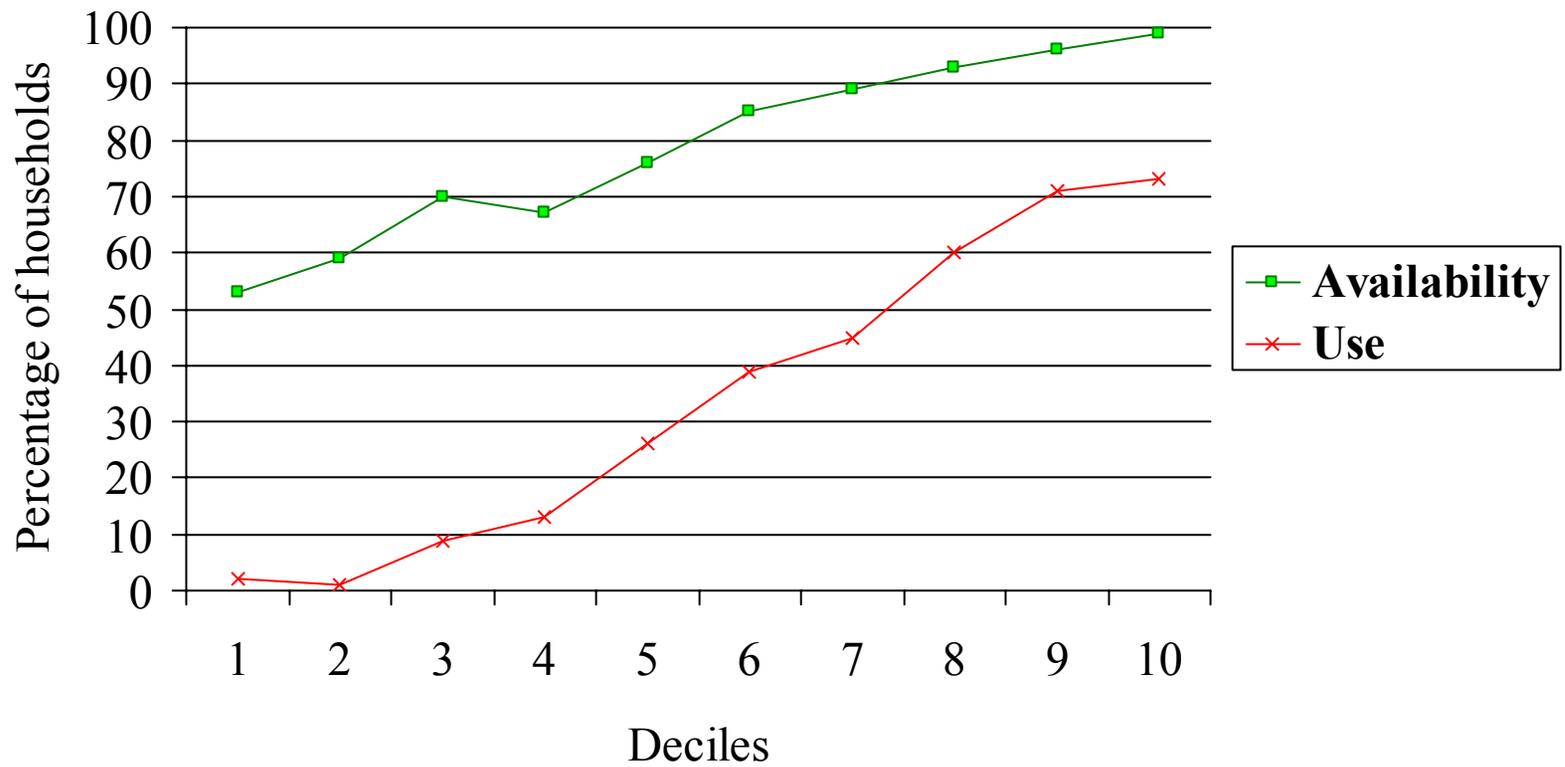
Results of hedonic method

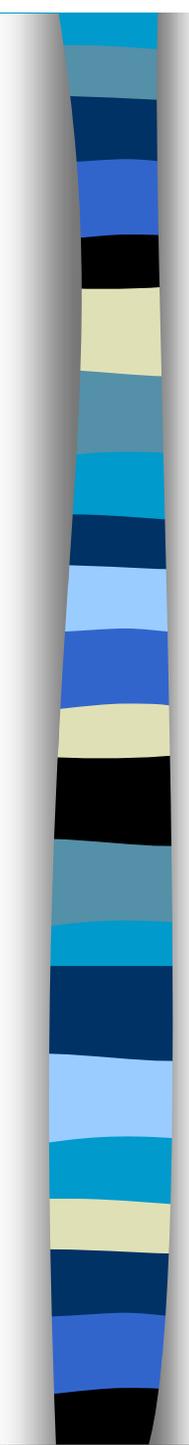
	Lower Bound	Upper Bound
Percentage increase in rent due to presence of electricity	20.4%	37.6%
Rent increase as a percentage of household consumption of the poor	1.6%	2.3%
Change in headcount poverty rate due to electricity access	from 26% to 24%	

Electricity: supply versus demand



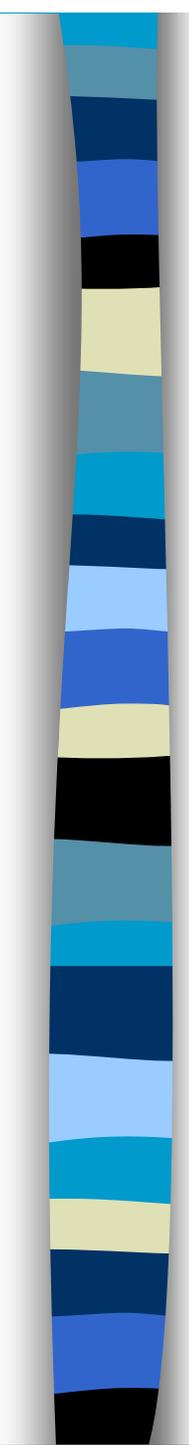
Propane: supply versus demand





Affordability of modern fuels

	Electricity	Propane
Start-up cost		
• Absolute value	\$146.00	\$116.00
• As % subsistence income	97.2%	57.6%
Typical bill		
• Absolute value	\$1.64	\$9.00
• As % subsistence income	1.0%	6.0%



Conclusions

- **Benefits of access to electricity**
 - reduces net price of energy by one third
 - reduces fuel poverty by one third
 - increases income of the poor by >2%
 - reduces poverty rates by 2%
- **Benefits of access to propane gas**
 - no apparent financial advantage
 - significant health and environmental benefits