Clean cooking fuel options for India: the case of LPG

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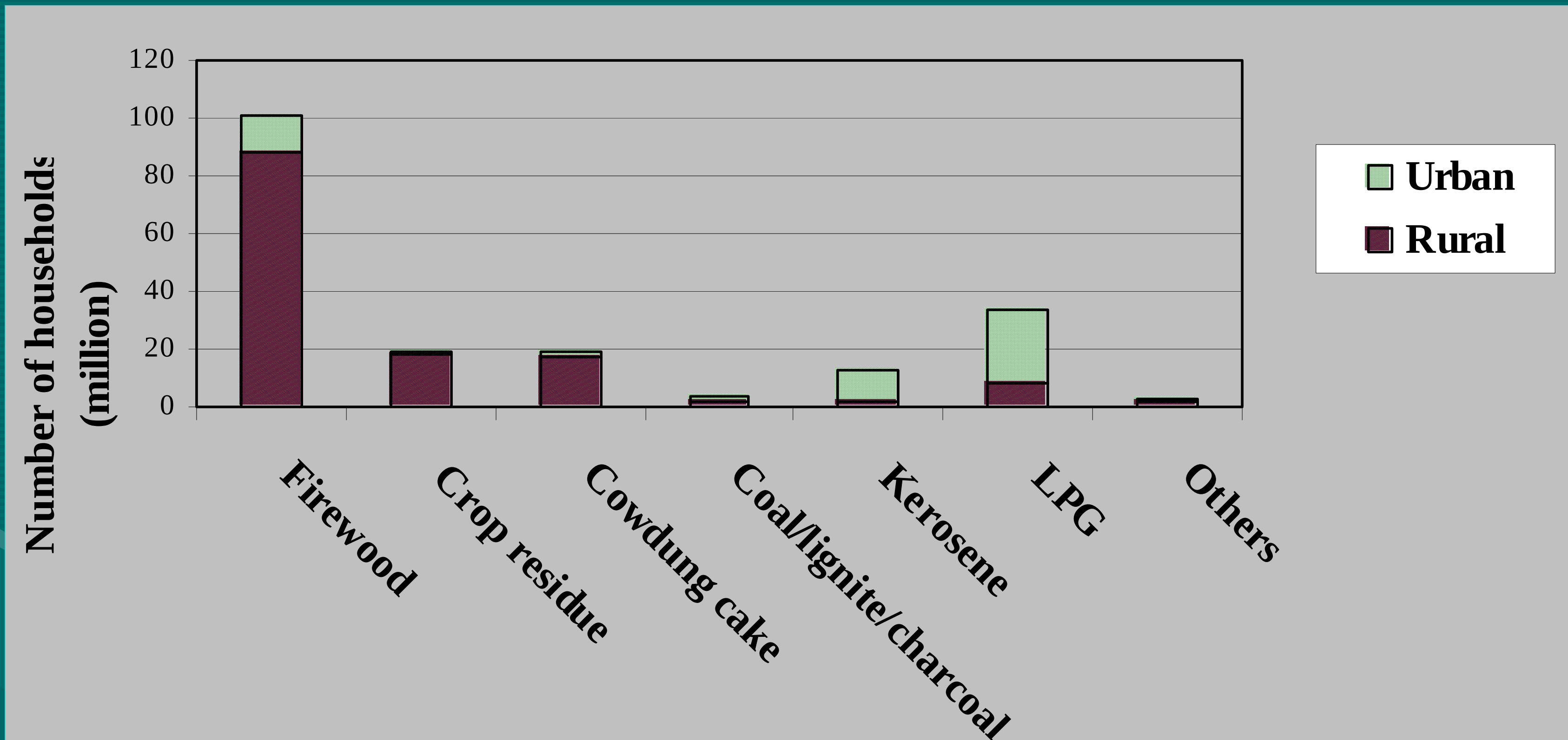
Study objectives

- ***Overview***
  - the domestic use of cooking fuels in India
  - the current problems
  - factors affecting domestic fuel use and scope for alternatives
- ***Case of LPG***
  - demand scenarios
  - existing supply and distribution system
  - the challenges
  - lessons from experiences elsewhere
  - suggested policies to meet the challenges

This presentation is based on "Report on the use of LPG as a domestic cooking fuel option in India" available at www.iei-asia.org

Indian household use of cooking fuels
(Census 2001)



Problems with the current domestic fuel

- **In *rural* areas (72% of the total population) -- 90% of homes use biomass – wood, twigs, etc. (64%), crop waste (13%), animal dung (13%)**
  - mostly with traditional stoves/inadequate ventilation
  - inefficient combustion
    - **indoor pollution**
    - **respiratory ailments**
  - burden of collection
  - inconvenience of use
- **In both *urban & rural* areas, costs & supply inadequacies restrict the use of alternatives**

Improved alternatives

- ***Options:***
- **improved stoves / ventilation**
- **cleaner / more efficient fuels - examples**
  - biogas
  - kerosene
  - LPG
- ***Advantages:***
- **no / less smoke (healthier, cleaner)**
- **more efficient (less fuel use, quicker)**
- **easier to use, to collect (?)**

Basis of rational choice between options

- *Life-cycle costs* from the primary source (extraction or cultivation or import) -- through processing -- to the final fuel – transported/distributed – delivered to the user
- including all costs incurred -- *direct* (to the producers) and *indirect* (to society, the environment)

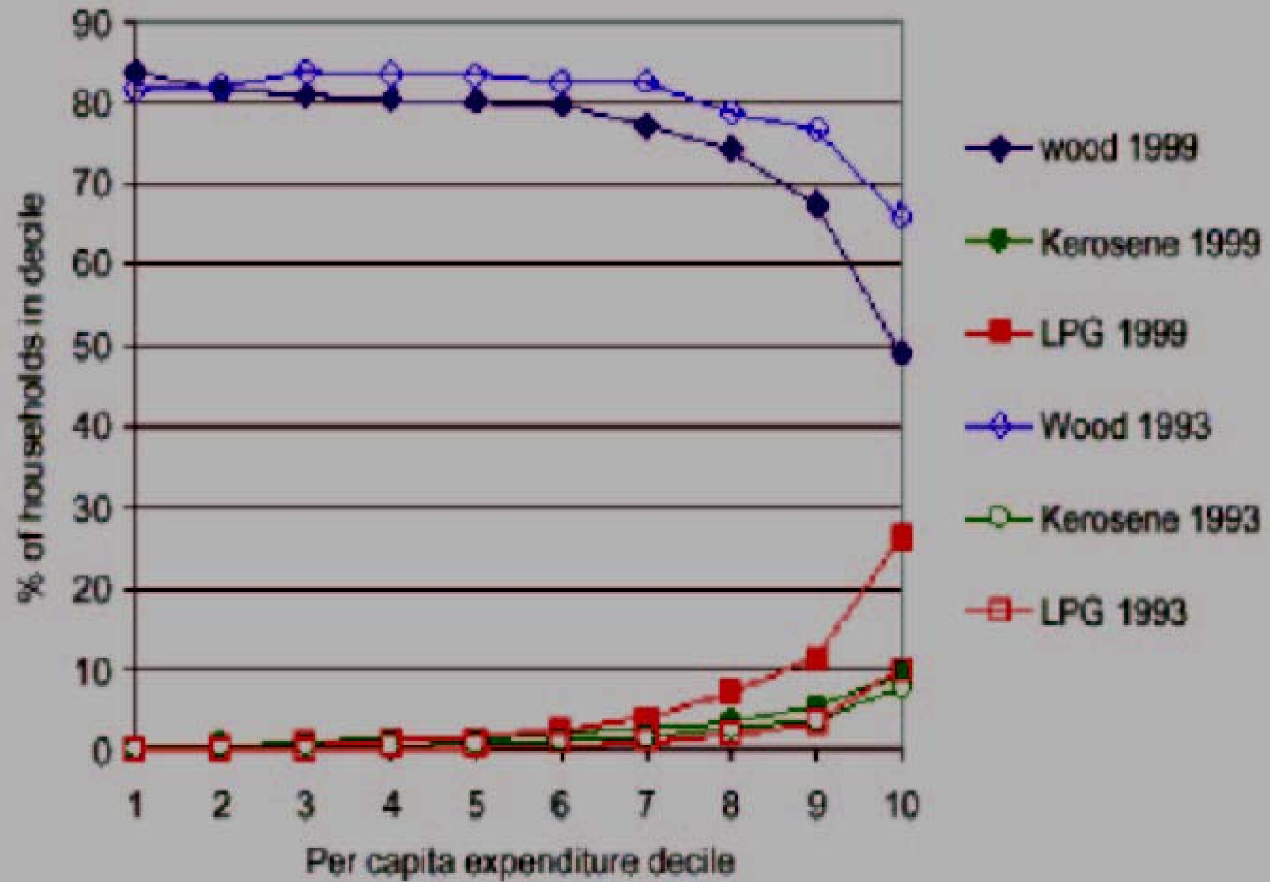
Derived factors influencing household choices (fuels/stoves)

- ***income* -> affordability**
  - greater financial resources -> higher-priced options
  - better education, awareness, social status
- ***location* -> accessibility**
  - distribution, distances, shortages
- ***alternatives* -> availability**
  - uncertain/intermittent supply, risk-reduction, back-up
- ***policies* -> sub-cost pricing, rationing, etc.**

Trend: LPG consumers and distributors

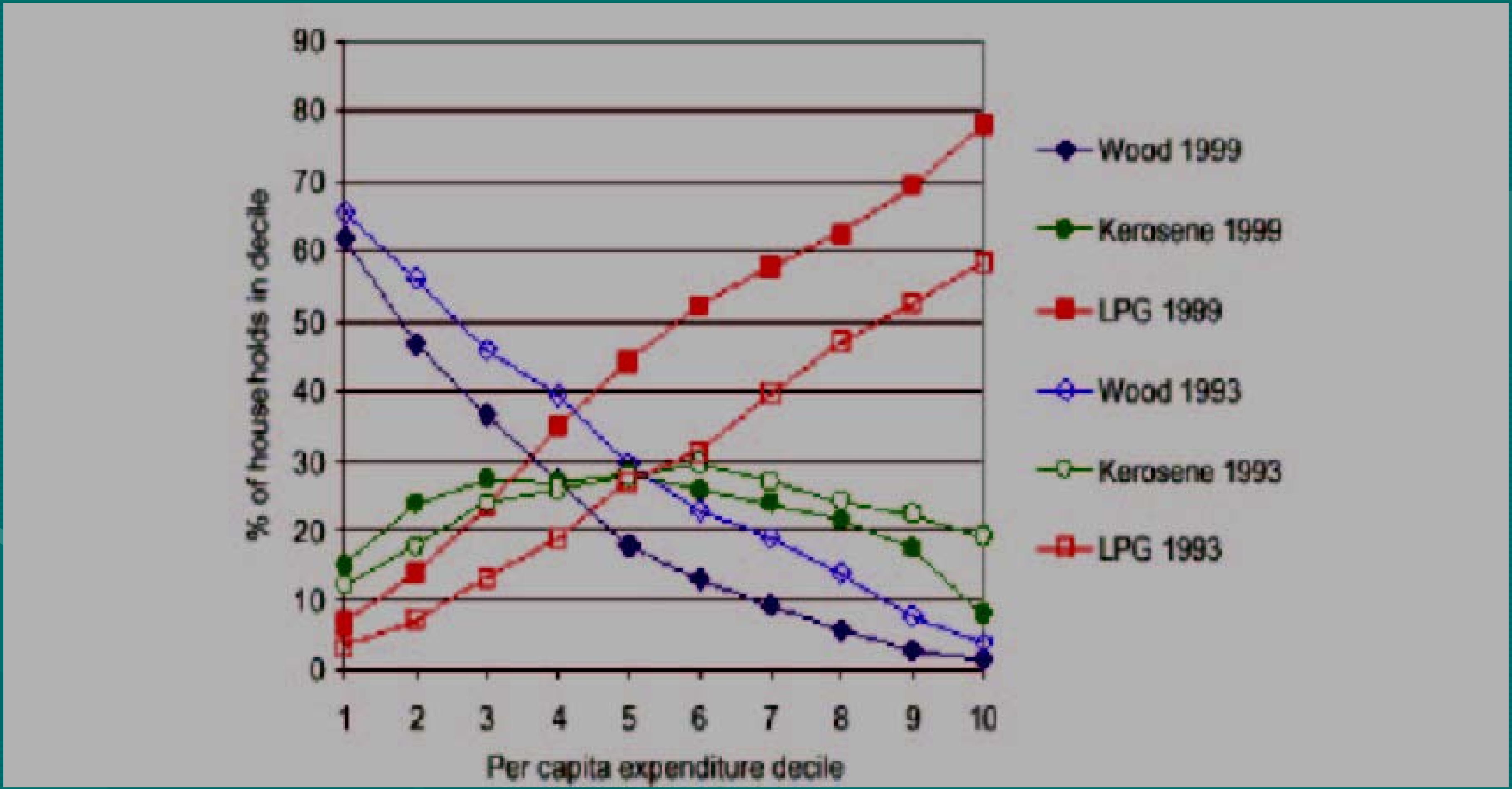
Years	Total (all sectors') consumption ('000 tonnes)	Number of consumers (millions)	Number of distributors (actual)
1980-81	405	3.3	1,105
1990-91	2,415	17.0	3,930
1995-96	3,849	25.7	5,165
1996-97	4,183	29.3	5,426
1997-98	4,581	33.7	5,538
1998-99	5,041	38.1	5,648
99-2000	6,029	47.3	6,161
2000-01	6,613	57.9	6,477
2001-02	7,310	63.5	7,486
2002-03	8,157	69.8	7,910

Primary cooking-fuel choices: *rural* India
(1993-94 and 1999-2000 NSS data)



Note: To make 1993 and 1999 data comparable, expenditure deciles are based on nominal expenditures.

Primary cooking-fuel choices: ***urban*** India
(1993-94 and 1999-2000 NSS data)



Monthly expenditure on LPG as primary cooking fuel in *rural* India (NSS 1999-2000)

Expenditure decile	Amount spent (Rupees)	Proportion of expenses (%)
1	53	4.8
2	91	3.9
3	84	3.9
4	102	4.9
5	138	5.5
6	141	4.8
7	137	4.8
8	152	4.4
9	148	4.1
10	153	3.3

Monthly expenditure on LPG as primary cooking fuel in *urban* India (NSS 1999-2000)

Expenditure decile	Amount spent (Rupees)	Proportion of expenses (%)
1	137	5.9
2	147	5.5
3	156	5.6
4	162	4.9
5	163	4.4
6	163	4.1
7	165	3.8
8	160	3.3
9	163	3.0
10	162	2.1

Current domestic dependence on LPG (2001)

For the base-year (2001):	Units	Rural	Urban	Total
Census data: Total number of households in the country	million	138.27	53.70	191.97
Census data: Number of LPG-dependent households	million	7.85	25.75	33.60
=> Proportion of households using LPG	%	5.67	47.96	17.50
Assumed average annual use per household (derived from NSSO Survey results)	kg/ year	101.4	119.3	115.1
=> Estimated total domestic LPG use	mmt	0.795	3.072	3.868

Demand Scenario 1: Business as usual
(current growth & usage rates)

Year	Number of households using LPG (million)			Proportion of total households using LPG (%)			Consumption of LPG (million tonnes)		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
2005-06	10.91	44.87	55.78	7.27	72.97	26.36	1.11	5.35	6.46
2010-11	15.17	63.38	78.56	9.30	90.00	33.64	1.54	7.56	9.10
2015-16	21.10	72.59	93.69	11.91	90.00	36.35	2.14	8.66	10.80

Demand Scenario 2: Increased rural growth
(double the growth of rural users but current use per household)

Year	Number of households using LPG (million)			Proportion of total households using LPG (%)			Consumption of LPG (million tonnes)		
	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
2010-11	20.67	63.38	84.06	12.68	90.00	36.00	2.10	7.56	9.66
2015-16	39.17	72.59	111.76	22.12	90.00	43.36	3.97	8.66	12.63

LPG supply in India

(in million tonnes or mmt)

Years	From crude oil refineries (a)	From natural gas fractionators (b)	Total indigenous production (a)+(b)	Net imports
1990-91	1.221	0.929	2.150	0.329
1995-96	1.539	1.714	3.253	0.596
1998-99	1.724	1.914	3.638	1.173
99-2000	2.487	1.986	4.473	1.587
2000-01	4.088	2.045	6.133	0.853
2001-02	4.778	2.205	6.983	0.659
2002-03	4.903	2.370	7.273	1.073

Petroleum product movement within India (2002-03)

- ***Railways*** **(40%)**
  - **country-wide extent, but intermittent tank-wagon shortages**
- ***Pipelines*** **(32%)**
  - **best for safety, efficiency, but currently limited routes**
- ***Roads*** **(28%)**
  - **least fuel-efficient, but the only alternative in some areas**

Transport of petroleum products by the Railways

Year	Freight hauled by rail (million tonnes)	Total (million tonnes)	Proportion (%)
1989-90	24.6	54.1	45.50
1990-91	25.1	55.0	45.60
1991-92	26.2	57.0	46.00
1992-93	26.5	59.0	44.90
1993-94	26.1	60.8	42.90
1994-95	28.6	65.4	43.70
1995-96	29.3	72.5	40.40

Petroleum product pipeline capacities (April 2002)

Product	No.	Existing Capacity (a)	No.	Proposed Capacity (b)	No.	Total Capacity (a+b)
Petrol / diesel						
West coast - inland	4	27.00	3	13.00	7	40.00
East coast - inland	3	6.70	1	1.40	4	8.10
Others	5	8.15	5	6.02	10	14.17
Total	12	41.85	9	20.42	21	62.27
LPG						
West coast - inland	1	1.70	1	0.80	2	2.50
East coast - inland	-	-	1	1.16	1	1.16
Total	1	1.70	2	1.96	3	3.66

Fuel storage capacity in the country
(number of days' requirement)

Product name	Marketing terminals / tankage	Refinery tankage	Total tankage
Petrol	47	17	64
Diesel	36	12	48
LPG[a]	10	6	16

LPG Infrastructure – Selected costs

Item	Capacity	Cost
Additional cylinder filling capacity at an existing facility	100 fills/day @ 12.5kg each	US$ 2,500 – US$ 3,500
Small LPG road tanker	6 – 7 tonnes	US$ 60,000 – US$ 70,000
Storage tank (at end-user site)	1 tonne	US$ 1,000 – US$ 2,000
LPG cylinder (e.g. for residential consumers)	12.5 kg	US$ 15 – US$ 20
LPG cylinder (e.g. for smaller residential consumers)	6 kg	US$ 10 – US$ 15

Challenges:
Increasing affordability

Issues

- Higher initial costs (connection, stove)
- higher fuel costs
  - comparison with "free" biomass
  - "lumpiness" of refills
- no financial benefits (unlike the kerosene –> electricity shift) -> loans difficult to service
- household perceptions –> purely consumptive expense

Challenges (continued): Improving accessibility and supply reliability

- ***Supply issues***
  - **current shortages**
  - **increasing demand-supply imbalances**
  - **international supply and price volatility**
  - **dependence on imports strategically unwise**
- ***Distribution/delivery issues***
  - **transport/storage/bottling infrastructure**
  - **widely dispersed demand**
  - **safety/consumer interests**

Challenges (continued): Existing subsidy-pricing policies

- Subsidies needed for lifeline support, but
  - heavy burden on exchequer
  - misuse of subsidies (other consumers and uses)
  - disincentive for efficiency of use
  - benefits garnered by the non-poor

Lessons from other LPG experiences

- Lower prices through *cross subsidies from other distillates*
- *favourable relative price/ supply* (in relation to substitutes)
- initial cost *financing*
- smaller cylinders/bottles - *lower periodic/incremental refuelling*
- *special subsidies targeted* to these smaller cylinders/bottles
- *dependable distribution* (transport, storage, re-fuelling)
- more market participants to *facilitate regional/local focusing*

Policies for delivering clean/efficient domestic fuels

- Rational choices based on comparison of total life-cycle costs (direct and indirect)
- If LPG, then:
  - Demand issues
  - Supply issues
- Else, other fuel choices

Policies for delivering clean/efficient domestic fuels – Demand issues

- ***Pricing***
  - Subsidies -- applicability, targeting (efficiency, efficacy, cost-effectiveness)
  - quantitative limits on subsidy recipients
- ***Funding*** **- cross subsidies from other distillates, progressive tariffs**
- ***Other funding*** **– earmarked taxes/cesses, state fund through divestment, etc.**
- ***Marketing*** **– financing schemes (instalments, smaller containers), public awareness campaigns**

Policies for delivering clean/efficient domestic fuels – Supply issues

- Supply security
- dependable distribution network (location-specific)
- regulation
- alternatives

Challenges to effective provision of clean cooking fuel

- Affordability
- Reliable supply and accessibility
- Pricing policies
- Help the poorest?
  - Would improved cooking fuels help in poverty alleviation? Is any income generation/increase possible?
  - would these fuels help the poor as much as the others?