

Supplementary information

Manuscript title: *Differences in energy-saving benefits between the rich and poor:*

Data-driven method to study equity of mandatory energy efficiency policy in China

Supplementary information 1,

Household Survey Questionnaire on Energy Consumption of Residential Buildings in Chongqing

Energy consumption data

1. Electricity consumption data (kwh)

	Year-round		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
2016														
2015														
2014														

Building characteristics and occupant information

2. The size of your house: _____
3. The type of your house: _____
4. Number of permanent residents in your home (living at home more than 6 months): _____
5. Your total annual household income:
- A Under 30,000 yuan B 30,000-60,000 yuan C 60,000 - 120,000 yuan
- D 120,000 - 200,000 yuan E More than 200,000 yuan

Energy-using equipment and energy-using behavior

6. What is your summer cooling method? () [Multiple options available]
- A Air Conditioner B Fan C Air Conditioner Fan
- D Central air conditioner E Open the window
7. Under what circumstances does your home turn on the air conditioner? () [Multiple options available]
- A Basically not turn on B Turn on only when it's very hot
- C Turn on only when it's hotter D Turn on when it's slightly hot
- E Turn on whenever at home F Turn on when you have guests
- G Turn on when everyone gathered in one room H Other _____
8. When do you usually use air conditioner in summer?
- (Select and fill in the blank, write down the specific time used for each time period) :
- ① Working day () ② Weekends and holidays ()
- A Morning _____ B Midday bedtime _____
- C Afternoon _____ D After dinner _____
- E Sleeping at night _____ F No air conditioner _____
9. What is the temperature setting of your home air conditioner in summer? ()

A Above 26 degrees B 26 degrees C 20-26 degrees

D Below 20 degrees

10. What is your winter heating method? ()

(If don't heating in winter, skip questions 10, 11, 12)

A Air conditioner B Electric floor heating

C Other electric heating equipment D Gas heating E No heating

11. What is the temperature setting of your home air conditioner in winter? ()

A Above 28 degrees B 26-28 degrees C 20-26 degrees

D Below 20 degrees

12. When do you usually use air conditioner in winter?

(Select and fill in the blank, write down the specific time used for each time period) :

① Working day () ② Weekends and holidays ()

A Morning _____ B Midday bedtime _____

C Afternoon _____ D After dinner _____

E Sleeping at night _____ F No air conditioner _____

13. How would you treat unused household appliances? ()

A Turn off and unplug the power

B Turn off and not unplug the power C Standby

14. Are the lighting fixtures in your home energy-saving lamps and lanterns? ()

A All of them B Most of them C Part of them D None of them

15. Which method of hot water supply is used in your home ()

A Electric water heater B Gas water heater

16. Which other household appliances do you have in your home?

Energy consumption equipment		Quantity
Summer cooling appliances	Air conditioner	
	Fan	
	Air conditioner fans	
Winter heating appliances	Electric heater	
Cookery	Rice Cooker	
	Microwave Oven	
	Induction Cooker	
	Water dispenser	
	Range Hoods	
	Other _____	

	Other_____	
Other Appliances	TV	
	Washing machine	
	Refrigerator	
	Dryer	
	Desktop computers	
	Laptop	
	Fitness equipment	
	Vacuum Cleaner	
	Electric hair dryer	
	Electric iron	
	Other_____	
	Other_____	

Supplementary information 2,

Appendix A

Data for this study were collected in three ways. First, the building characteristics information including the status of BEEDS and built year was obtained from the CMCURD. Multilevel random sampling techniques and the probability proportional to size (PPS) were applied to select optimal samples. Second, the data of building characteristics, household characteristics, occupant behavior, appliance characteristics and energy characteristics were collected from survey conducted by the Chongqing University and SGCEPC. A team of 40 undergraduates, 10 graduate students and 4 Ph.D. students completed this survey over almost two months. To guarantee the quality of this survey, all members were required to attend a full-day lecture to receive trained in advance and were required to record all interviewees' telephone so that they could be called back. The household were selected if they met with three criteria: First, the selected household needed to provide the electricity billing number or the ID of the electric meter so that utilities can provide household monthly electricity consumption data. Second, the household used the energy for consumption rather than production purposes. Third, the household had been living in the building for more than one year. Finally, the household electricity consumption data were collected from the SGCEPC according to the electricity billing number or the ID of the electric meter of each household.

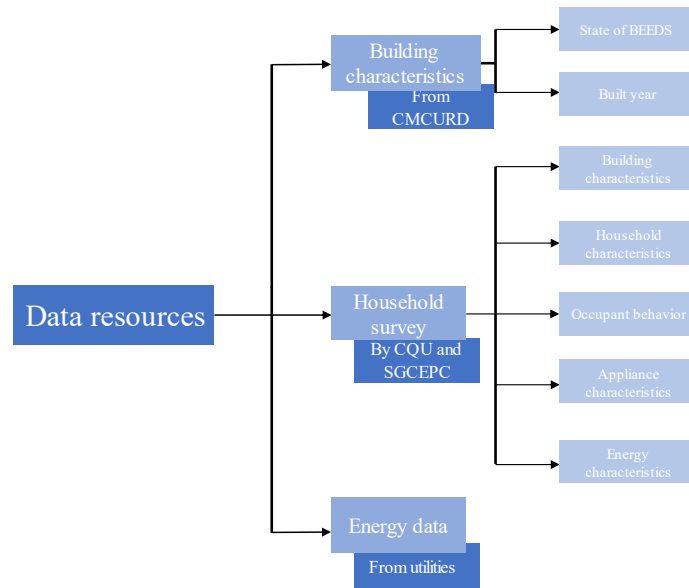


Fig A.1. Data resources

Supplementary information 3,

Supplementary Table B1

Matching methods	low-income group		middle-income group		high-income group	
	ATT	S.E.	ATT	S.E.	ATT	S.E.
Nearest Neighbor Matching	-0.296	0.091	-0.321*	0.080	-0.463*	0.129
Radius Matching	-0.246*	0.089	-0.315*	0.091	-0.497	0.158
Kernel Matching	-0.288	0.087	-0.304	0.080	-0.453	0.133

Note: * refers to significant

**Supplementary information 4,
Supplementary Appendix C**

Supplementary Table C1. Matching quality indicators of low-income group

	Unmatched				Nearest Neighbor Matching				Radius matching				Kernel matching			
	Mean		SB	t	Mean		SB	t	Mean		SB	t	Mean		SB	t
	Treated	Control			Treated	Control			Treated	Control			Treated	Control		
population	3.065	2.857	17.9	1.85	3.068	2.836	13.6	1.74	3.048	2.980	5.9	0.70	3.068	2.963	9.0	1.12
ACs	2.555	2.816	-24.3	-2.52***	2.588	2.560	-0.7	-0.10	2.594	2.595	-0.20	-0.01	2.588	2.603	-1.4	-0.20
Others	11.589	12.252	-17.6	-1.91	11.701	11.947	-6.6	-0.92	11.629	11.92	-7.8	-1.00	11.701	11.983	-7.5	-1.06
area	77.355	92.153	-45.2	-4.83***	78.781	80.13	-4.1	-0.57	78.861	81.373	-7.7	-1.01	78.781	81.035	-6.9	-0.95
rooms	3.348	3.640	-29.0	-3.01***	3.379	3.319	6.0	0.81	3.403	3.332	7.1	0.88	3.379	3.323	5.6	0.75
floors	13.298	7.293	79.1	7.58***	12.071	13.054	-13	-1.50	11.49	12.304	-10.7	-1.21	12.071	12.876	-10.6	-1.23
status of windows in summer temperature setting ACs	1.518	1.585	-7.3	-0.76	1.531	1.652	-13.3	-1.73	1.503	1.589	-9.4	-1.17	1.531	1.614	-9.1	-1.20
status of windows in winter temperature setting heaters	0.212	0.286	-10.8	-1.19	0.198	0.316	-17.5	-2.29	0.197	0.290	-13.7	-1.75	0.298	0.333	-19.8	-2.62
	0.476	0.401	6.3	0.62	0.410	0.489	-6.7	-0.91	0.374	0.463	-7.4	-1.01	0.410	0.540	-10.9	-1.47

time using ACs	6.764	6.531	7.8	0.81	6.726	6.876	-5.0	-0.69	6.742	6.717	0.8	-0.60	6.726	6.775	-1.6	-0.22
time using heaters	2.076	1.912	7.6	0.79	2.020	2.123	-4.8	-0.63	2.003	2.105	-4.7	-0.60	2.020	2.120	-4.6	-0.61
Mean Bias	21.2				8.9				7.7				8.6			
Ps R2	0.164				0.026				0.020				0.024			

Note: ***refers significantly at 5% level.

status of windows :1 = “When AC is used, the door and window would be closed first”, 2 = “After AC is used for a while, turn off the doors and windows that are not closed”, 3 = “When AC is used, open a little window”

temperature setting :1 = “The initial value is set to the lowest temperature, when the indoor thermal temperature drops and then set the temperature”, 2 = “27 °C and above”, 3 = “26 °C”, 4 = “25 °C”, 5 = “24 °C”, 6 = “23 °C”, 7 = “22 °C and below”.

time using ACs:1 = “less than 1 hour”, 2 = “(1–2] hours”, 3 = “(2–3] hours”, 4 = “(3–4] hours”, 5 = “(4–5] hours”, 6 = “(5–6] hours”, 7 = “(6–7] hours”, 8 = “(7–8] hours”, 9 = “more than 8 h”.

Supplementary Table C2. Matching quality indicators of middle-income group

	Unmatched		Nearest Neighbor Matching						Radius matching				Kernel matching			
	Mean		SB	t	Mean		SB	t	Mean		SB	t	Mean		SB	t
	Treated	Control			Treated	Control			Treated	Control			Treated	Control		
population	3.644	3.783	-10.9	-1.03	3.669	3.626	3.3	0.44	3.669	3.582	6.8	0.90	3.669	3.604	5.1	0.67
ACs	3.027	3.426	-39.6	-3.58***	3.140	3.133	0.7	0.90	3.140	3.124	1.6	0.20	3.140	3.108	3.2	0.41
Others	12.515	14.104	-45.8	-4.45***	12.717	12.583	3.9	0.51	12.717	12.493	6.5	0.85	12.717	12.658	1.7	0.22
area	88.083	114.22	-78.5	-7.53***	78.781	80.13	-4.1	-0.57	90.584	93.566	-9.0	-1.25	90.584	93.318	-8.2	-1.15
rooms	3.781	4.087	-32.7	-3.00***	3.826	3.822	0.5	0.05	3.826	3.810	1.7	0.20	3.826	3.795	3.4	0.40
floors	15.266	12.861	26.5	2.52***	14.724	14.386	3.7	0.46	14.724	14.652	0.8	0.10	14.724	14.469	2.8	0.34
status of																
windows in	1.707	1.670	3.9	0.36	1.741	1.754	-1.4	-0.17	1.741	1.747	-0.7	-0.08	1.741	1.734	0.7	0.08
summer																
temperature																
setting ACs	2.844	2.983	-11.9	-1.10	2.900	2.843	4.7	0.57	2.890	2.869	2.5	0.30	2.898	2.918	-1.8	-0.22
status of																
windows in	0.287	0.322	-4.7	-0.44	0.259	0.356	-13.1	-1.55	0.259	0.337	-10.5	-1.27	0.259	0.313	-7.3	-0.91
winter																
temperature																
setting	0.608	0.530	5.8	0.51	0.464	0.778	-23.5	-2.52***	0.464	0.731	-20.0	-2.19***	0.464	0.667	-15.2	-1.77***
heaters																
time using																
ACs	7.470	6.452	35.5	3.56***	7.300	7.620	-11.1	-1.53	7.300	7.620	-11.0	-1.52	7.300	7.655	-12.4	-1.73***
time using																
heaters	2.216	1.948	12.3	1.13	2.113	2.110	0.2	0.02	2.112	2.045	3.1	0.38	2.113	2.078	1.6	0.19

Mean Bias	0.186	6.3	6.2	5.3
Ps R2	25.7	0.023	0.023	0.020

Note: ***refers significantly at 5% level.

status of windows :1 = “When AC is used, the door and window would be closed first”, 2 = “After AC is used for a while, turn off the doors and windows that are not closed”, 3 = “When AC is used, open a little window”

temperature setting :1 = “The initial value is set to the lowest temperature, when the indoor thermal temperature drops and then set the temperature”, 2 = “27 °C and above”, 3 = “26 °C”, 4 = “25 °C”, 5 = “24 °C”, 6 = “23 °C”, 7 = “22 °C and below”.

time using ACs:1 = “less than 1 hour”, 2 = “(1–2] hours”, 3 = “(2–3] hours”, 4 = “(3–4] hours”, 5 = “(4–5] hours”, 6 = “(5–6] hours”, 7 = “(6–7] hours”, 8 = “(7–8] hours”, 9 = “more than 8 h”.

Supplementary Table C3. Matching quality indicators of high-income group

	Unmatched				Nearest Neighbor Matching				Radius matching				Kernel matching			
	Mean		SB	t	Mean		SB	t	Mean		SB	t	Mean		SB	t
	Treated	Control			Treated	Control			Treated	Control			Treated	Control		
population	3.942	4.328	-20.7	-1.61	4	4.231	-12.4	-0.82	4.056	3.788	14.3	30.8	4	4.063	-3.4	-0.24
ACs	3.6104	3.547	5.3	0.34	3.577	3.579	-0.2	-0.02	3.417	3.786	-30.6	-1.86	3.577	3.692	-9.5	-0.71
Others	13.799	15.344	-40.2	-2.77***	14.298	14.51	-5.5	-0.44	14.431	14.175	6.7	0.45	14.298	14.352	-1.4	-0.12
area	99.316	133.89	-96.3	-7.25***	106.2	108.23	-5.7	-0.61	106.9	113.05	-17.1	-1.63	106.2	111.53	-14.9	-1.67
rooms	4.234	4.516	-33.0	-2.18***	4.25	4.349	-11.5	-0.82	4.319	4.513	-22.6	-1.33	4.25	4.466	-25.2	-1.80
floors	13.006	13.984	-10.9	-0.75	13.452	12.644	9.0	17.4	13.444	11.347	23.4	1.49	13.452	11.812	18.3	1.38
status of																
windows in	1.922	1.781	14.3	0.96	1.952	1.837	11.7	0.84	1.889	1.604	28.9	1.79	1.952	1.792	16.3	1.17
summer																
temperature																
setting ACs	3.091	3.406	-23.4	-1.54	3.289	3.399	-8.2	-0.59	3.347	3.559	-15.7	-0.92	3.289	3.441	-11.3	-0.84
status of																
windows in	0.526	0.1857	40.1	2.51***	0.288	0.322	-4.0	-0.30	0.292	0.213	9.3	0.64	0.288	0.402	-13.5	-0.95
winter																
temperature																
setting	0.831	0.391	29.3	1.91	0.596	0.469	8.5	0.68	0.514	0.350	10.9	0.80	0.596	0.547	3.3	0.25
heaters																
time using																
ACs	8.117	7.047	44.5	3.24	7.904	8.010	-4.4	-0.37	7.722	8.046	-13.5	-0.89	7.904	7.990	-3.6	-0.30
time using																
heaters	2.727	2.562	6.2	2.6442	2.644	2.901	-9.6	-0.73	2.583	2.997	-15.5	-0.92	2.644	2.979	-12.6	-0.95

Mean Bias	30.3	7.6	17.4	11.1
Ps R2	0.374	0.027	0.075	0.271

Note: ***refers significantly at 5% level.

status of windows :1 = “When AC is used, the door and window would be closed first”, 2 = “After AC is used for a while, turn off the doors and windows that are not closed”, 3 = “When AC is used, open a little window”

temperature setting :1 = “The initial value is set to the lowest temperature, when the indoor thermal temperature drops and then set the temperature”, 2 = “27 °C and above”, 3 = “26 °C”, 4 = “25 °C”, 5 = “24 °C”, 6 = “23 °C”, 7 = “22 °C and below”.

time using ACs:1 = “less than 1 hour”, 2 = “(1–2] hours”, 3 = “(2–3] hours”, 4 = “(3–4] hours”, 5 = “(4–5] hours”, 6 = “(5–6] hours”, 7 = “(6–7] hours”, 8 = “(7–8] hours”, 9 = “more than 8 h”.