

**Air Quality Improvement in the Greater Beijing–Tianjin–Hebei
Region—Shandong Clean Heating and Cooling Project**

Social Survey Report

November 2018

I. Overview of Survey Questionnaire

1. In order to review the direct and indirect impacts on women by the proposed “Air Quality Improvement in the Greater Beijing–Tianjin–Hebei Region—Shandong Clean Heating and Cooling Project”, a questionnaire survey was conducted to: (I) understand the heating systems which are being used, the willingness and the ability to pay by the of residents living in the project area, such as urban area in Jinan city and rural area in Shanghe county, and the awareness of the affected people, etc., and (ii) collect baseline information.

2. To effectively reflect the actual situation, many interviews were first conducted and then the Household Questionnaire Survey was designed after the interview, which involved individual and household information, family status, heating system are being used, awareness of clean heating and environmental protection, ability and willingness to pay, public participation, etc.

3. Project team visited Tianqiao District, Shizhong District, and Shanghe County to conduct the questionnaire survey from 29th March to 16th April 2018. Before the visit, the team had performed a **prophase** investigation in Licheng, Lixia, Shizhong, and Changqing districts. Therefore, the scope of this survey covers 5 districts (Licheng, Lixia, Shizhong, Tianqiao, Changqing) in Jinan, as well as urban area of Shanghe County; Yuhuangmiao Town, and the subordinate villages of Xusi, Fuchang, and Xindongjia; and Huairen town and its subordinate villages of Huairen, and Wali. Please find the distribution of sample households in Table 1 below. Questionnaires are filled out using standardized interviews, therefore the quality of feedbacks is high. A total of 560 questionnaires are distributed in the survey among which 545 are identified valid, with an effective rate of 97.3%.

II. Survey Result Analysis

A. Family status

Table 1 Basic Information of Respondents and Sample Households Members

Context	Information	Quantity	Percentage (N=545)
Age	18-30	82	15.05%
	31-40	106	19.45%
	41-60	278	51.01%
	Above 60	79	14.50%

Context	Information	Quantity	Percentage (N=545)
Sex	Male	305	55.96%
	Female	240	44.04%
Ethnic Group	Han	541	99.27%
	Hui	2	0.37%
	Mongolia	1	0.18%
Household Registration Type	Urban	212	38.90%
	Rural	333	61.10%
Marital Status	Unmarried	61	11.19%
	Married	454	83.30%
	Widowed	22	4.04%
	Divorced	8	1.47%
Location	Jinan City (5 district)	203	37.25%
	Shanghe County	53	9.72%
	Yuhuangmiao Town	164	30.09%
	Huairan Town	125	22.94%
Minimum Living Allowance Status	Ordinary Family	494	90.64%
	Low-income Family ¹	51	9.36%
Education	Illiterate	21	3.85%
	Primary or under	131	24.04%
	Junior high	153	28.07%
	Senior high or vocational college	64	11.74%

¹ The family who enjoys minimum living standard allowance. The minimum living standard allowance is CNY4,200 per annum for rural residents and CNY530 per month for urban residents.

Context	Information	Quantity	Percentage (N=545)
	Junior college	63	11.56%
	University	96	17.61%
	Graduate school	17	3.12%
	D/A	0	0
Occupation	Government civil servants	68	12.48%
	State owned enterprise staff	74	13.58%
	Private enterprise employees	37	6.79%
	Technicians	6	1.10%
	Small businesses (not street vendor)	15	2.75%
	Street vendors	6	1.10%
	Working outside of home	29	5.32%
	Farmers	244	44.77%
	Livestock	1	0.18%
	Housewives	18	3.30%
	Retired pensioner	17	3.12%
	Students	13	2.39%
	Unemployed	13	2.39%
Others ²	4	0.73%	
Age information of family members	0~18 (male)	193	9.58%
	0~18 (female)	208	10.33%
	18~45 (male)	403	20.01%

² Including 4 apprentices, 2 of them are the assistants of grain and livestock middlemen and the other 2 works in barber shops.

Context	Information	Quantity	Percentage (N=545)
	18~45 (female)	385	19.12%
	45~65 (male)	335	16.63%
	45 ~ 65 (female)	327	16.24%
	above 65 (male)	83	4.12%
	above 65 (female)	80	3.97%
Ethnic group information of family members	Han	2005	99.55%
	Hui	6	0.30%
	Mongolia	3	0.15%
Education level of family members	illiterate	153	7.60%
	Primary or under	475	23.58%
	Junior high	602	29.89%
	Senior high or vocational college	325	16.14%
	Junior college	190	9.43%
	University	222	11.02%
	Graduate	36	1.79%
	D/A	11	0.55%
Occupational information of family members	Government civil servants	126	6.26%
	State owned enterprise staff	133	6.60%
	Private enterprise employees	144	7.15%
	Technicians	41	2.04%
	Small businesses (not street vendors)	103	5.11%
	Street vendors	42	2.09%

Context	Information	Quantity	Percentage (N=545)
	Working outside of home	247	12.26%
	Farmers	494	24.53%
	Livestock	10	0.50%
	Housewives	129	6.41%
	Retired pensioners	85	4.22%
	Students	313	15.54%
	Unemployed	58	2.88%
	Others	89	4.42%

4. From the distribution of the overall sample, majority interviewees are 41 to 60 years old, accounting for 51.01%, and followed by people aging from 31 to 40 years old; more than half are males, accounting for 55.96%; and majority interviewees belong to Han ethnic group except that two persons are Hui and 1 person is Mongolia ethnic minority. The rural population is 1.5 times of the urban population. More than 80% of interviewees are married, and the rest were unmarried, divorced, and widowed. Nearly two-thirds of people believe that their family economic conditions are at average level, and one-fourth think they are below the average; more than 90% are ordinary families, and less than 10% households have members enjoying minimum living allowance. From the perspective of education, the number of people whose highest education levels are junior high school and primary school is the largest, and the rest are undergraduate, senior high school, and junior college. Regarding occupation, nearly half are farmers, and the others are migrant workers, state-owned enterprise staff and government servants. For the 545 households investigated, the total population is 2,014, and the average population of each household is 3.7. From the view of age information of all family members, majority family members aged from 18 to 45, and followed by family members aging from 45 to 65. The people over 65 years old, accounted for 8.1% of the total. Regarding education, the proportions of people, whose highest education are junior high school and primary school, are the largest; from the perspective of family members' occupations, the proportions of farmers, students, and migrant workers are relatively large.

Table 2 House Style

Location	House style											
	Apartment with central heating		Apartment without central heating		Terraced house with 1-2 floors and without yard		Separate houses in brick concrete structure with 1-2 floors and yard		Terraced house with shops		Brick-wood structure houses	
	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio	Number	Ratio
Jinan City	153	75.37%	25	12.32%	2	0.99%	6	2.96%	1	0.49%	16	7.88%
Shanghe County	40	75.47%	5	9.43%	0	0	0	0	3	5.66%	5	9.43%
Yuhuangmiao Town	14	8.54%	57	34.76%	1	0.61%	3	1.83%	0	0	89	54.27%
Huairan Town	1	0.80%	42	33.60%	1	0.80%	1	0.80%	3	2.40%	77	61.60%
Total	208	38.17%	129	23.67%	4	0.73%	10	1.83%	7	1.28%	187	34.31%

Table 3 House Information

Location	Average area (m ² per HH)	Self-owned		Rent	
		Number (HH)	Percentage	Number (HH)	Percentage
Jinan City	98.73	185	91.13%	18	8.87%
Shanghe County	121.02	49	92.45%	4	7.55%
Yuhuangmiao Town	144.23	162	98.78%	2	1.22%
Huairan Town	176.77	125	100%	0	0
Total	132.49	521	95.60%	24	4.40%

5. From the perspective of household heating system, the number of houses with centralized heating system is the largest, and the following are brick-wood structure houses and houses without centralized heating in rural areas. In terms of location, the largest proportion of houses with centralized heating system is in Jinan and urban area of Shanghe County, both reaching over 75%; while in Yuhuangmiao and Huairan Towns, most houses are brick-wood structure houses

and houses without centralized heating system. From the perspective of living area, Huairen Town had the largest living area while Jinan had the smallest living area; majority of the houses are self-owned.

B. Household Income and Expenditure Information

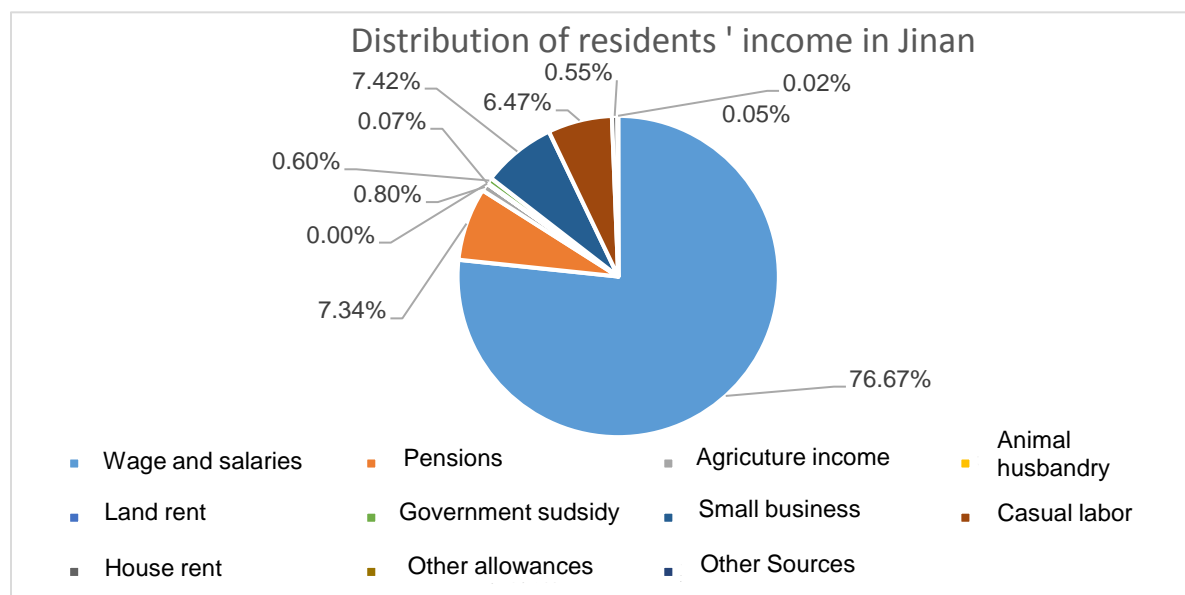
1. Income

**Table 4 Household Income Distribution for Sample Households by Location
(Unit: CNY/year)**

Location	The Gross Annual Household Income												Annual Income per capita
	Total	1.Wage and salaries	2.Pensions	3.Agriculture income	4.Animal husbandry income	5.Land rental income	6.Government subsidy	7.Small business activities	8.Casual employment	9.House rental income	9.Other allowances and subsidies	10.Other sources	
Jinan city	21,092,856	16,171,000	1,548,140	169,300	1,000	15,000	125,816	1,565,000	1,365,600	117,000	10,000	5,000	31,065
Shanghe county	7,833,600	4,843,000	697,400	185,000	0	27,000	1,200	1,030,000	1,010,000	40,000	0	0	11,537
Yuhuangmiao town	11,561,395	3,067,000	74,000	1,546,400	80,250	46,000	52,745	1,980,000	4,692,000	0	10,000	13,000	18,236
Huairan town	8,682,960	2,460,000	1,000	428,600	93,000	41,960	0	1,666,000	3,843,000	20,000	20,400	109,000	18,357
Total	49,170,811	26,541,000	2,320,540	2,329,300	174,250	129,960	179,761	6,241,000	10,910,600	177,000	40,400	127,000	24,524

Table 5 Household Income Distribution for Sample Households in Jinan City

Jinan city	Wage and salaries	Pensions	Agriculture income	Animal husbandry income	Land rental income	Government subsidy	Small business activities	Casual labor	House rental income	Other allowances and subsidies	Other sources
Proportion	76.67%	7.34%	0.80%	0.00%	0.07%	0.60%	7.42%	6.47%	0.55%	0.05%	0.02%

Figure 1 Income Sources Distribution of Sample Household in Jinan city**Table 6 Household Income Distribution for Sample Households in Shanghe County**

Shanghe town	Wage and salaries	Pensions	Agriculture income	Animal husbandry income	Land rental income	Government subsidy	Small business activities	Casual labor	House rental income	Other allowances and subsidies	Other sources
Proportion	61.82%	8.90%	2.36%	0.00%	0.34%	0.02%	13.15%	12.89%	0.51%	61.82%	8.90%

Figure 2 Income Sources Distribution of Sample Household in Shanghe County

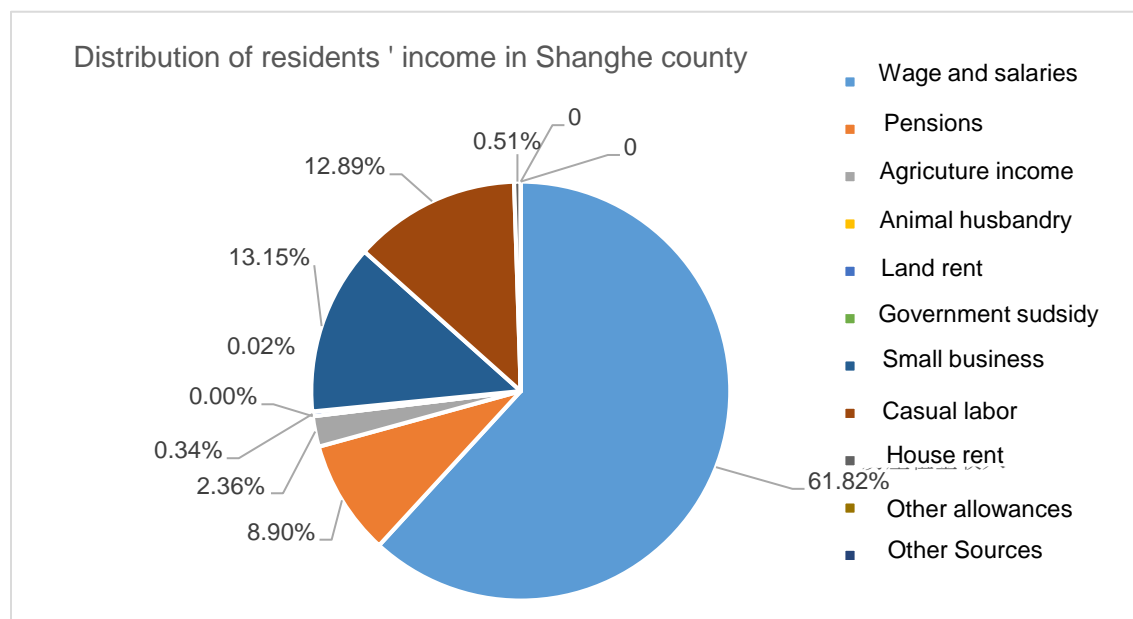


Table 7 Household Income Distribution for Sample Households in Yuhuangmiao Town

Yuhuangmiao town	Wage and salaries	Pensions	Agriculture income	Animal husbandry income	Land rental income	Government subsidy	Small business activities	Casual labor	House rental income	Other allowances and subsidies	Other sources
Proportion	26.53%	0.64%	13.38%	0.69%	0.40%	0.46%	17.13%	40.58%	0.00%	0.09%	0.11%

Figure 3 Income Sources Distribution of Sample Household in Yuhuangmiao County

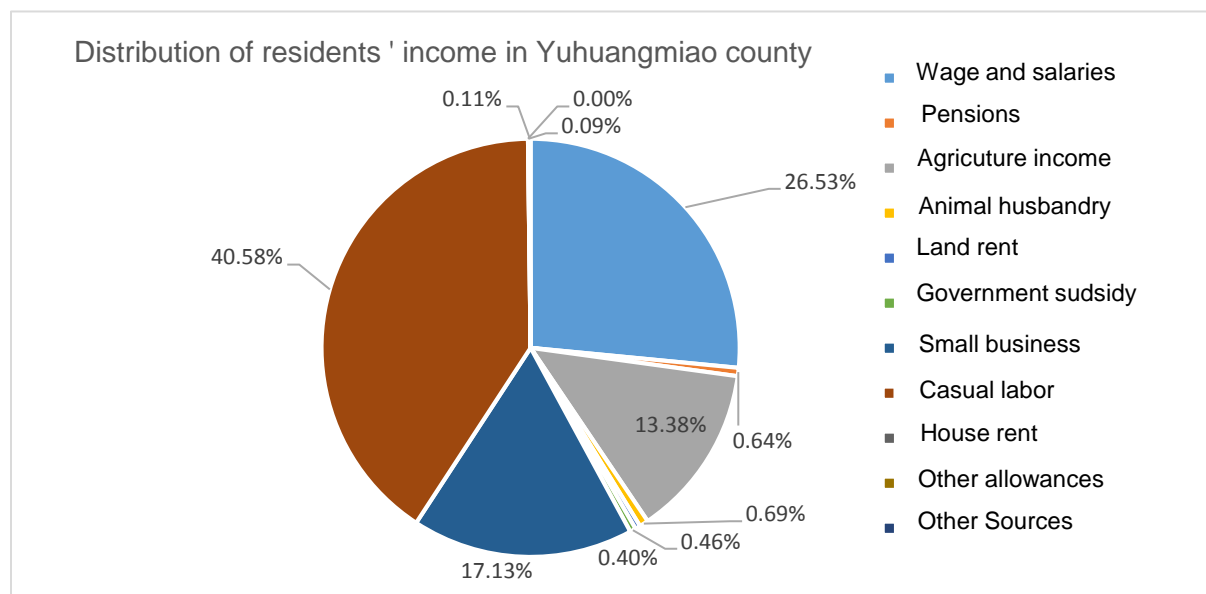
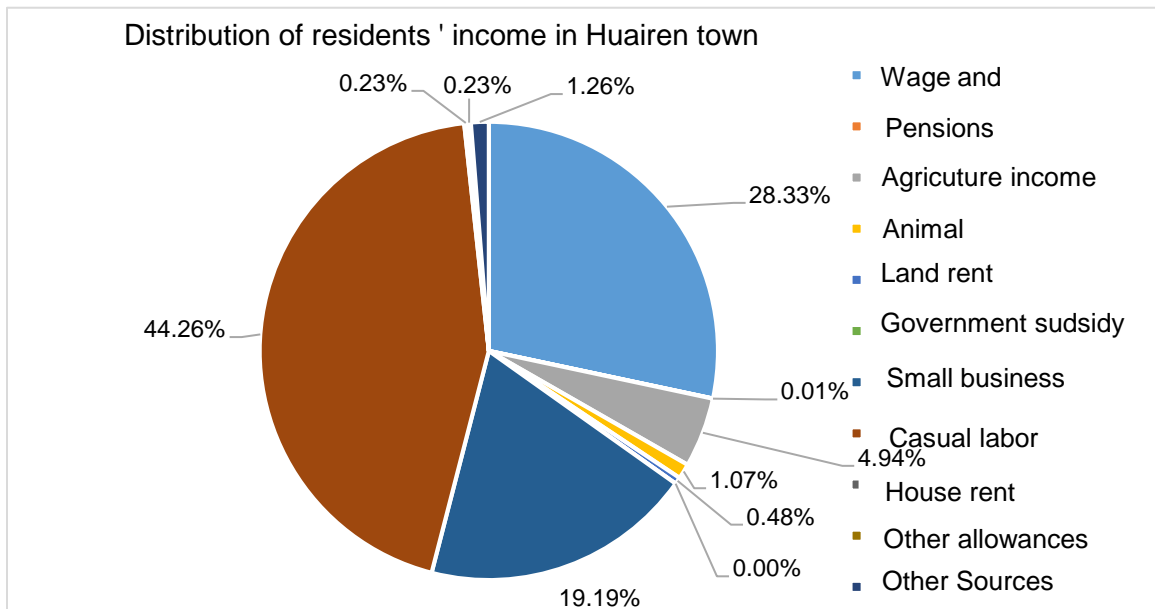


Table 8 Household Income Distribution for Sample Households in Huairen Town

Huairan town	Wage and salaries	Pensions	Agriculture income	Animal husbandry income	Land rental income	Government subsidy	Small business activities	Casual labor	House rental income	Other allowances and subsidies	Other sources
Proportion	28.33%	0.01%	4.94%	1.07%	0.48%	0.00%	19.19%	44.26%	0.23%	0.23%	1.26%

Figure 4 Income Sources Distribution of Sample Household in Huairen Town



6. From the income perspective, per capital gross income and per capital net income of Jinan city are the highest, Huairen town is the second, and the lowest is Shanghe county. Considering income component of each district, residents in Jinan gain income mainly from wages and salaries, and the next are from small business activities and pensions. Residents in Shanghe county mainly earn income from wages and salaries, and the next are from casual labor and small business activities. Residents in Yuhuangmiao and Huairen towns mainly make income from causal labor, and the next are from wages and salaries, and small business activities.

2. Expenditure

Table 9 Gross Household Expenditure Distribution for Sample Households by Location (Unit: CNY/year)

Location	Total expenditure	Food	Clothing	Property management cost	Tapping water tariff	Electricity	Electricity bill during winter	coal	Heating cost (collective heating)	Telecommunication	Transportation	Education and other costs	Pay to feed parents	Medical care expenditure	Rental or living house loan debt servicing	entertainment and leisure	cigar, alcohol and tea	Agricultural production spending
Jinan city	11,720,775	2,862,900	1,676,650	199,113	68,740	282,950	100,766	89,832	294,963	305,662	1,095,650	1,312,598	459,000	488,250	1,139,500	742,600	519,700	81,900
Shanghe county	2,873,263	830,000	359,300	19,854	22,100	69,412	24,784	16,300	81,040.8	83,980	226,720	214,600	128,000	111,200	325,972	209,000	114,100	36,900
Yuhuangmiao town	4,867,580	1,525,300	627,500	9,210	49,460	214,230	78310	174,360	27,600	169,230	253,570	384,460	98,400	123,700	265,200	86,850	113,750	666,450
Huairan town	3,393,273	1,088,100	543,400	1,440	37,780	150,700	52733	172,200	600	128,710	211,310	270,300	27,000	186,200	30,000	88,300	180,400	224,100
Total	22,854,891	6,306,300	3,206,850	229,617	178,080	717,292	256,594	452,692	404,204	687,582	1,787,250	2,181,958	712,400	909,350	1,760,672	1,126,750	927,950	1,009,350

Table 10 The proportion of Different Expenditure to Total HH Expenditure by Location

Location	Food	Clothing	Property management cost	Tap water tariff	Electricity tariff	Electricity during winter	coal	Heating cost (central heating)	Telecommunication	Transportation	Education and other costs	Support parents	Medical care expenditure	Rental or housing loan debt	Entertainment and leisure	Cigar, alcohol and tea	Agricultural production expenditure
Jinan city	24.43%	14.30%	1.70%	0.59%	2.41%	0.86%	0.77%	2.52%	2.61%	9.35%	11.20%	3.92%	4.17%	9.72%	6.34%	4.43%	0.70%
Shanghe county	28.89%	12.50%	0.69%	0.77%	2.42%	0.86%	0.57%	2.82%	2.92%	7.89%	7.47%	4.45%	3.87%	11.35%	7.27%	3.97%	1.28%
Yuhuangmiao town	31.34%	12.89%	0.19%	1.02%	4.40%	1.61%	3.58%	0.57%	3.48%	5.21%	7.90%	2.02%	2.54%	5.45%	1.78%	2.34%	13.69%
Huairan town	32.07%	16.01%	0.04%	1.11%	4.44%	1.55%	5.07%	0	3.79%	6.23%	7.97%	0.80%	5.49%	0.88%	2.60%	5.32%	6.60%

7. From the expenditure perspective, the main expenditure of the four regions is food; the second largest expenditures in Jinan, Shanghe and Huairen towns is clothing, while for Yuhuangmiao town is the expenditure for agriculture production. The ratios of expenditures on transportation, cost for property management and education fees in Jinan are higher than that in other three regions. The heating expenditure mainly included in the expenditure of electricity during winter, coal and central heating cost. The total amount of the abovementioned three kinds of expenditure accounted for 2.26% of the total household income. The highest proportion of heating expenditure to total income is in Huairen town which is 2.59% and the second highest is in Yuhuangmiao town which is 2.42%. The lowest proportion is in Shanghe county which is 1.56%.

3. Expenditure Determinant

Table 11 Expenditure Determination Factor 1

Location	Large one-off expenditure										Determination factor							
	Husband		Wife		Both		Elder		Self		No financial power		Tradition		Education level		No threshold	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Jinan city	38	18.72%	26	12.81%	120	59.11%	19	9.36%	0	0	14	6.90%	81	39.90%	4	1.97%	104	51.23%
Shanghe county	10	18.87%	10	18.87%	29	54.72%	1	1.89%	3	5.66%	2	4.00%	8	16.00%	1	0.02	39	78.00%
Yuhuangmiao town	37	22.56%	26	15.85%	87	53.05%	9	5.49%	5	3.05%	22	13.92%	48	30.38%	4	2.53%	84	53.16%
Huairan town	12	9.60%	5	4.00%	98	78.40%	10	8.00%	0	0	9	7.20%	35	28.00%	2	1.60%	80	64.00%
Total	97	17.80%	67	12.29%	334	61.28%	39	7.16%	8	1.47%	47	8.75%	172	32.03%	11	2.05%	307	57.17%

Table 12 Expenditure Determination Factor 2

Location	Fuel fee										Determination factor							
	Husband		Wife		Both		Elder		Self		No finance power		Tradition		Education level		No threshold	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Jinan city	32	15.76%	51	25.12%	100	49.26%	20	9.85%	0	0	9	4.43%	89	43.84%	1	0.49%	104	51.23%
Shanghe county	12	22.64%	16	30.19%	22	41.51%	0	0	3	5.66%	2	4.00%	6	12.00%	2	4.00%	40	80.00%
Yuhuangmiaotown	39	23.78%	35	21.34%	73	44.51%	12	7.32%	5	3.05%	16	10.06%	48	30.19%	1	0.63%	94	59.12%
Huairen town	20	16.00%	17	13.60%	62	49.60%	26	20.80%	0	0	8	6.40%	35	28.00%	1	0.80%	81	64.80%
Total	103	18.90%	119	21.83%	257	47.16%	58	10.64%	8	1.47%	35	6.42%	178	32.66%	5	0.92%	319	58.53%

Table 13 Expenditure Determination Factor 3

Location	Water and electricity fee										Determination factor							
	Husband		Wife		Both		Elder		Self		No finance power		Tradition		Education level		No threshold	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Jinan city	40	19.70%	60	29.56%	82	40.39%	21	10.34%	0	0	6	2.96%	87	42.86%	2	0.99%	106	52.22%
Shanghe county	6	11.32%	21	39.62%	23	43.40%	0	0	3	5.66%	2	4.00%	6	12.00%	1	2.00%	41	82.00%
Yuhuangmiaotown	34	20.73%	36	21.95%	76	46.34%	13	7.93%	5	3.05%	9	5.66%	61	38.36%	2	1.26%	89	55.97%
Huairentown	13	10.40%	23	18.40%	61	48.80%	28	22.40%	0	0	5	4.00%	32	25.60%	0	0	87	69.60%
Total	93	17.06%	140	25.69%	242	44.40%	62	11.38%	8	1.47%	22	4.04%	186	34.13%	5	0.92%	323	59.27%

Table 14 Expenditure Determination Factor 4

Location	Other recurrent expenditures										Determination factor							
	Husband		Wife		Both		Elder		Self		No finance power		Tradition		Education level		No threshold	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Jinan city	23	11.33%	53	26.11%	107	52.71%	20	9.85%	0	0.00%	9	4.43%	82	40.39%	1	0.49%	111	54.68%
Shanghe county	5	9.43%	22	41.51%	23	43.40%	0	0.00%	3	5.66%	2	4.00%	6	12.00%	1	2.00%	40	80.00%
Yuhuangmiaotown	33	20.12%	35	21.34%	86	52.44%	3	1.83%	5	3.05%	5	3.14%	61	38.36%	1	0.63%	90	56.60%
Huairen town	10	8.00%	25	20.00%	83	66.40%	7	5.60%	0	0.00%	5	4.00%	30	24.00%	2	1.60%	88	70.40%
Total	71	13.03%	135	24.77%	299	54.86%	30	5.50%	8	1.47%	21	3.85%	179	32.84%	5	0.92%	329	60.37%

8. From the perspective of expenditure determinant, for large one-off cost, more than 60% interviewees choose to make decision by both husband and wife, and the next are by husband and wife; over half of the interviewees choose no threshold. In terms of locations, they all showed similar trend that the decision is made mainly by both, and there is no threshold, or this had become a tradition.

C. Family Heating System

Table 15 Family Heating System Situation

Location	Heating types of sample households				Sample Households Distribution by Distributed Heating Appliances													
	Centralized heating system		Distributed heating		Individual coal stove		Household fuel gas heating		Carbon crystal electric panel		Air source heat pump		Straws-burning for Kang bed stove		Air conditioner heating		No heating	
	HH	Percent	HH	Percent	HH	Percent	HH	Percent	HH	Percent	HH	Percent	HH	Percent	HH	Percent	HH	Percent
Jinan city	155	76.35%	48	23.65%	45	22.17%	0	0	1	0.49%	0	0	1	0.49%	1	0.49%	0	0
Shanghe county	42	79.25%	11	20.75%	9	16.98%	0	0	1	1.89%	0	0	0	0.00%	6	11.32%	1	1.89%
Yuhuang miao town	13	7.93%	151	92.07%	137	83.54%	2	1.22%	0	0.00%	10	6.10%	8	4.88%	6	3.66%	0	0.00%
Huairan town	10	8.00%	115	92.00%	122	97.60%	0	0.00%	0	0.00%	1	0.80%	6	4.80%	4	3.20%	0	0.00%
Total	220	40.37%	325	59.63%	313	57.43%	2	0.37%	2	0.37%	11	2.02%	15	2.75%	17	3.12%	1	0.18%

9. From the perspective of household heating system, the most widely used is individual coal-stove, and the next is centralized heating through heating network. With respect to locations, Jinan mainly adopts centralized heating, and the next is individual coal-stove; the urban area of Shanghe county mainly chooses centralized heating system; Yuhuangmiao and Huairen towns mainly use individual coal stove, and some places in Yuhuangmiao town use air source heat pump which is mainly distributed in Xusi village. Some households in Xusi village have already installed air source hear pump. However, due to the late installation, the weather was not very cold when installation completed. Therefore, individual coal-stoves were still the main heating sources in 2017. Some parts of Huairen town use centralized geothermal heating which are mainly distributed in Huairen village. Due to the same reason of late installation, individual coal-stoves were still the main heating sources in 2017.

D. Central Heating System (N=220 households)

i. Price and Consumption of Central Heating

Table 16 Central Heating Price, Consumption and Payment Method

Location	Centralized boiler heating		Payment Method									
			Directly payment from the salary		House call by the heating company		Online payment		Go to the service hall of the company		Others	
	Average price	Average heating area	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Jinan city	26.4	82.88	6	3.87%	3	1.94%	60	38.71%	77	49.68%	9	5.81%
Shanghe county	20.27	110.88	3	7.14%	8	19.05%	10	23.81%	16	38.10%	5	11.90%
Yuhuangmiao town	20	89.5	0	0.00%	4	30.77%	3	23.08%	5	38.46%	1	7.69%
Huairan town	20	130	0	0.00%	0	0.00%	1	10.00%	9	90.00%	0	0.00%
Total	24.75	89.1	9	4.09%	15	6.82%	74	33.64%	107	48.64%	15	6.82%

Table 17 Status of Heating Tariffs Discount in Each Region

Location	Discount in heating tariff ^a			
	Number of HH enjoy the heating tariffs discount	Percentage	Discounted amount (CNY)	Average centralized heating days
Jinan city	14	9.03%	7.2/m ²	121
Shanghe county	0	0	0	120
Yuhuangmiao town	0	0	0	120
Huairan town	0	0	0	0

^a The heating tariff is CNY20/m² in Shanghe County and CNY26.7/m² in Jinan City, while for poor families the heating tariff is CNY17.5 /m² in Shanghe County and CNY19.5/m² in Jinan City.

10. Regarding the centralized heating tariffs, the average heating tariff in Jinan is the highest, and the following is Shanghe county. Among all the interviewees, there are 14 people enjoying heating discount with a discounted fee of CNY 7.2 per m², and the average heating time is 120 days. From the perspective of payment method, most people choose to pay in the service hall, and the next is paying online. The payment methods in each location show similar trend.

ii. Central Heating Quality

Table 18 Central Heating Quality in Each Region (1)

Location	Indoor temperature				Heating supply interruption				Daily heating supply				Efficiency of breakdown maintenance			
	Above 18°C	About 18°C	14°C to 18°C	Below 14°C	Never	Not frequent	Sometimes	Often	24 hours	12-24 hours	12 hours	Less than 12 hours	Very good	Good	Poor	Very poor
Jinan city	83.87%	16.13%	0.00%	0.00%	44.52%	44.52%	9.68%	1.29%	86.45%	13.55%	0.00%	0.00%	45.81%	50.32%	3.23%	0.65%
Shanghe county	57.14%	42.86%	0.00%	0.00%	9.52%	73.81%	14.29%	2.38%	61.90%	35.71%	2.38%	0.00%	9.52%	83.33%	7.14%	0.00%
Yuhuang miao town	30.77%	69.23%	0.00%	0.00%	23.08%	46.15%	30.77%	0.00%	84.62%	15.38%	0.00%	0.00%	30.77%	53.85%	15.38%	0.00%
Huairen town	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0
Total	74.88%	25.12%	0.00%	0.00%	36.02%	50.71%	11.85%	1.42%	81.52%	18.01%	0.47%	0.00%	37.44%	57.35%	4.74%	0.47%

Table 19 Central Heating Quality in Each Region (2)

Location	Payment service				Price				Overall quality			
	Very convenient	Convenient	Inconvenient	Very limited	Low	Reasonable	High	Too high	Very good	Good	Poor	Very poor
Jinan city	55.48%	34.84%	7.10%	2.58%	3.87%	74.84%	19.35%	1.94%	32.90%	65.81%	1.29%	0.65%
Shanghe county	16.67%	71.43%	9.52%	2.38%	0.00%	69.05%	30.95%	0.00%	7.14%	78.57%	11.90%	0.00%
Yuhuangmiaotown	38.46%	46.15%	7.69%	0.00%	7.69%	46.15%	38.46%	0.00%	7.69%	61.54%	23.08%	0.00%
Huairen town	0	1	0	0	0	1	0	0	0	1	0	0
Total	46.45%	43.13%	7.58%	2.37%	3.32%	72.04%	22.75%	1.42%	26.07%	68.25%	4.74%	0.47%

11. Regarding the heating quality, over 70% of the interviewees show that the heating temperature is above 18°C. Heating temperature in Yuhuangmiaotown is relatively low, with most of time the temperature around 18°C. More than half of the interviewees claim that there is little interruption of heating; and more than 80% choose the 24-hour heating supply. 90% of the respondents think that the maintenance efficiency is good or very good, and the clear majority think that the payment service is convenient or very convenient. More than 70% of people believe that the heating tariff is reasonable, and the rest is in view that the tariff is relatively high. Interviewees think highly of the overall quality of the heating supply, and for most of the regions more than 90% believe that the overall quality is good or very good.

iii. Awareness of Central Heating

Table 20 Advantages of Central Heating

Location	Advantages of Central Heating						
	High temperature	Stable heat resource	Cheap annual expenditure for heating	Safety	Environmental protection	High efficiency	Easier management and maintenance
Jinan city	59.35%	76.77%	28.39%	50.32%	34.84%	25.81%	12.26%
Shanghe county	71.43%	85.71%	14.29%	69.05%	38.10%	2.38%	0.00%
Yuhuangmiao town	92.31%	61.54%	15.38%	46.15%	30.77%	15.38%	15.38%
Huairan town	100.00%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%
Total	63.98%	77.73%	24.64%	53.55%	35.07%	20.85%	9.95%

Table 21 Disadvantages of Central Heating

Location	Disadvantages of Central Heating					
	Low temperature	High expenditure for heating	Unable to adjust heat according to needs	Non-pleasant appearance	High cost to purchase and install	Smog in winter caused by coal as a main heat source
Jinan city	10.32%	41.94%	76.13%	35.48%	46.45%	68.39%
Shanghe county	26.19%	76.19%	73.81%	19.05%	30.95%	73.81%
Yuhuangmiao town	46.15%	76.92%	100.00%	15.38%	7.69%	61.54%
Huairan town	0.00%	100.00%	100.00%	0.00%	0.00%	100.00%
Total	15.64%	51.18%	77.25%	30.81%	40.76%	69.19%

Table 22 Awareness of Importance on the Current Central Heating System Development

Location	Most important issues in current central heating system						
	Increasing the temperature of the heating resource	Using clean energy for heating	Increasing the number of heating resources	Increasing the efficiency of heat network	Expanding the heating scope	Renovating the old buildings	Others
Jinan city	14.19%	81.94%	40.00%	43.23%	43.23%	70.32%	0.00%
Shanghe county	14.29%	76.19%	50.00%	35.71%	80.95%	45.24%	2.38%
Yuhuangmiao town	69.23%	76.92%	30.77%	23.08%	92.31%	7.69%	0.00%
Huairan town	100.00%	100.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Total	18.01%	80.57%	41.23%	40.28%	54.03%	61.14%	0.47%

11. Regarding the advantages of central heating, nearly 80% of the respondents believe that the advantage is the stable heat supply, and the next are high temperature and safety. From the perspective of locations, the top three advantages chosen by residents in Jinan and Shanghe county are heat resource stability, high temperature and safety; while the top three advantages chosen by residents in Yuhuangmiao town are high temperature, heat resource stability and safety.

12. In the understanding of the disadvantages of central heating, the widely chosen option is that users cannot adjust heat according to their own needs, and the next are that the coal as main heat source will cause smog in the winter, and that annual expenditure for central heating is expensive. From the perspective of locations, the top three disadvantages chosen by residents in Jinan are inability to adjust heat according to needs, smog in winter caused by coal and high cost for radiators purchasing and installation. Top three disadvantages chosen by residents in Shanghe county are high annual expenditure for heating, inability to adjust heat according to needs and smog in winter caused by coal. The top three disadvantages chosen by residents in Yuhuangmiao and Huairan counties are inability to adjust heat according to needs, high annual expenditure for heating and smog in winter caused by coal.

13. Regarding the awareness of central heating development, most respondents chosen using clean energy source for heating, renovation of the old building and extending the hearing scope. From the perspective of locations, residents in Jinan mostly choose using clean energy source for heating, renovation of the old building and extending the heating scope. Residents in Shanghe county mostly choose extending the heating scope, using clean energy source for heating and increasing the number of heating resource, and one person chooses others, claiming that the heating tariff should be charged according to actual heating area. For example, the kitchen and balcony are not heated and therefore should not be charged. Residents in Yuhuangmiao and Huairen county mostly choose extending the heating scope, using clean source for heating and increasing the temperature of the heating source.

iv. Willingness to Pay

Table 23 Willingness to Pay in Each Region

Region Content	Acceptable additional expense					Reasons of unwillingness to pay			
	CNY1	CNY3	CNY5	CNY7	Maximum amount willing to pay (CNY)	Too expensive to afford	Present heating is good, no need to change	Do not live here in winter	Others
Jinan city	81.94%	15.48%	1.29%	1.29%	24.5	63.23%	49.68%	0.65%	0.00%
Shanghe county	73.81%	21.43%	4.76%	0.00%	20.7	76.19%	54.76%	2.38%	0.00%
Yuhuangmiao town	84.62%	15.38%	0.00%	0.00%	17.8	84.62%	30.77%	0.00%	0.00%
Huiren town	100.00%	0.00%	0.00%	0.00%	20	100.00%	0.00%	0.00%	0.00%
Total	80.57%	16.59%	1.90%	0.95%	23.3	67.30%	49.29%	0.95%	0.00%

14. The heating tariff is CNY20/m² in Shanghe County and CNY26.7/m² in Jinan City, while for poor families the heating tariff is CNY17.5 /m² in Shanghe County and CNY19.5/m² in Jinan City. From the perspective of willingness to pay, majority interviewees are willing to pay CNY1 more than the current heating tariff, as shown in Table 23. The reason of unwillingness to pay for most interviewees is that the tariff is too expensive to afford, and the next reason is that the current heating system is good enough so there is no need to make any changes.

E. Distributed Heating System and Willingness to Pay

i. Household Energy Consumption (N=325 households)

Table 24 Household Energy Consumption

Location	Family size ^a	Energy using peak hour distribution ^b					Who's in charge of igniting, refilling, putting off, cleaning, maintaining the coal-stove ^c					hours of using the coal stove and straw heating per day	The average outdoor temperature when the heating started (°C)	The average indoor temperature when using the recent heating appliance (°C)	The average acceptably comfortable temperature
		Morning	Around lunch time	Dinner time	After dinner to bed time	From bed time to the morning	Husband	Wife	Children	Elder	Self				
Jinan city	2.7	0.00%	8.51%	46.81%	29.79%	14.89%	8.89%	62.22%	6.67%	22.22%	0.00%	23.7	4.7	15.5	20.3
Shanghe county	3.2	0.00%	0.00%	9.09%	72.73%	18.18%	9.09%	72.73%	0.00%	18.18%	0.00%	21.1	-0.5	14.9	20
Yuhuangmiao town	3.1	1.32%	6.62%	40.40%	43.05%	9.93%	20.53%	60.26%	3.31%	15.23%	0.66%	23.2	0.6	14.2	19.38
Huairan town	2.7	0.00%	12.10%	50.81%	36.29%	4.84%	7.09%	57.48%	4.72%	30.71%	0.00%	18.5	3.5	15.2	19.5
Total	2.9	0.60%	8.71%	44.14%	39.64%	9.01%	13.47%	59.88%	4.19%	22.16%	0.30%	21.5	2.2	14.8	19.6

^a Average number of family members.

^b The proportion of households with different peak hours of energy use. For example, among the sample households in Yuhuangmiao town, energy using peak hour for 40.4% of the household happened at dinner time while for 9.93% of the household it happened from bed time to the morning.

^c It reflects the labor division among the family members in the maintenance of coal-stove. The proportion of different family members who's in charge of maintaining the coal-stove. For example, among the sample households in Shanghe County, 72.73% of the households' coal-stoves are operated and maintained by wives and 9.09% are by husbands.

15. Regarding the peak hour of energy consumption, dinner time and after dinner to bed time for most interviewees is the peak time, and the wife is more responsible for the maintenance of coal stoves such as igniting and refilling. The time using coal stoves and burning straw is about 20 hours in average per day. By doing so, the heating temperature can reach 14°C~15°C, while the respondents think the comfortable temperature is about 20°C.

Table 25 Fuel Usage and Opinion on Fuel Price

Location	Fuel usage						Opinion on fuel price				
	Coal		Natural gas		Electricity		Very high	Relatively High	Reasonable	Relatively low	Very low
	Average price (CNY/ton)	Annual consumption (ton)	Average price	Annual consumption (m ³)	Average price	Annual consumption(kWh)					
Jinan city	1,244.4	1.48	0	0	0.55	1,000	2.13%	80.85%	17.02%	0.00%	0.00%
Shanghe county	1,312.5	1.25	0	0	0.55	800	9.09%	45.45%	36.36%	9.09%	0.00%
Yuhuangmian town	1,199	1.1	2.5	600	0.53	3 kWh/h	0.67%	75.33%	21.33%	2.67%	0.00%
Huairen town	1,253	1.2	0	0	0.55	800	1.63%	76.42%	21.95%	0.00%	0.00%
Total	1,229	1.2	2.5	600	0.55	866	1.51%	75.53%	21.45%	1.51%	0.00%

16. From the perspective of heating fuel consumption, the coal prices differ slightly among four regions, fluctuating between CNY1,200 and CNY1,300 per ton. In the survey, only interviewees in Yuhuangmiao town use natural gas, and the average annual consumption in winter is 600 m³. Respondents in Jinan, Shanghe county, and Huairen town mainly use electricity for heating via air-condition, and the average electricity consumption are 1,000 kWh and 800 kWh. As the air source heat pumps were just installed recently in Yuhuangmiao town, so the year-round electricity consumption is yet to be known. However, the daily electricity consumption is around 3 kWh per hour for the pilot installations, and villagers think that the electricity consumption is high and hope to have subsidies.

17. In terms of opinion on fuel price, many interviewees believe the fuel price is relatively high. During the survey, interviewees response that local government has been paying much attention

to environmental protection since last year, so the usage of coal is limited with only environment-friendly coal is allowed. As a result, the coal price increased.

ii. **Usage of Heating Equipment (N=325 households)**

Table 26 Price of Heating Equipment and Opinion on Their Price

Region Content	Average heating equipment fee	If any government subsidy			Opinion on heating equipment price				
		Yes	No	Subsidy amount	Very high	Relatively high	Reasonable	Relatively low	Very low
Jinan city	950	0	47	0	0.00%	25.53%	53.19%	21.28%	0.00%
Shanghe county	1330	0	10	0	0.00%	36.36%	63.64%	0.00%	0.00%
Yuhuangmiao town	816	23	128	8300	0.66%	33.77%	62.91%	2.65%	0.00%
Huairan town	923	0	124	0	0.00%	39.02%	51.22%	8.94%	0.81%
Total	891.7	23	309	8300	0.30%	34.64%	57.23%	7.53%	0.30%

18. Regarding the cost of heating appliance, the highest cost is in Shanghe county, and costs in other three regions differ slightly. The survey finds that respondents mainly use two types of stoves for heating. One is coal-stove with radiator which costs more. The other one is coal-stove solely which costs less, with amount fluctuating from CNY 30 to 200. Regarding the government's subsidies, the survey finds that subsidies are distributed in Xusi and Xindongjia villages of Yuhuangmiao town. The subsidies greatly reduced the burden of one-time purchase of heating appliance of the households. For example, the subsidy for procurement of air source heat pump is CNY10,400 per household, so the installation fee paid by each household is about CNY1,600. The subsidy of another kind of heating appliance is CNY 5,300 per household and thus the installation cost is CNY1,400 by each household. In terms of opinion on the price of heating equipment, more than half of the interviewees consider that the price is reasonable.

Table 27 Awareness of the Most Important Factor Influencing Heating Appliance Price

Location	Most important factor					
	Market price	Operational cost	Accessibility	Safety	Subsidy availability	Time spent on operation/maintenance/cleaning
Jinan city	4.26%	10.64%	23.40%	61.70%	0.00%	0.00%
Shanghe county	0.00%	18.18%	9.09%	72.73%	0.00%	0.00%
Yuhuangmiao town	14.94%	13.64%	18.18%	40.26%	8.44%	4.55%
Huairan town	41.27%	13.49%	11.90%	23.81%	6.35%	3.17%
Total	22.78%	13.31%	16.27%	38.17%	6.21%	3.25%

Table 28 Awareness of the Second Important Factor Influencing Heating Appliance Price

Location	Second important factor					
	Market price	Operational cost	Accessibility	Safety	Subsidy availability	Time spent on operation/maintenance/cleaning
Jinan city	16.67%	27.08%	31.25%	18.75%	4.17%	2.08%
Shanghe county	18.18%	27.27%	54.55%	0.00%	0.00%	0.00%
Yuhuangmiao town	13.07%	19.61%	28.10%	19.61%	14.38%	5.23%
Huairan town	15.08%	37.30%	13.49%	22.22%	3.97%	7.94%
Total	14.50%	27.51%	23.96%	19.82%	8.58%	5.62%

Table 29 Awareness of the Third Important Factor Influencing Heating Appliance Price

Region Content	Third important factor						
	Market price	Operational cost	Accessibility	Safety	Subsidy availability	Time spent on operation/maintenance/cleaning	Others
Jinan city	6.38%	29.79%	23.40%	17.02%	6.38%	17.02%	0.00%
Shanghe county	0.00%	50.00%	25.00%	8.33%	8.33%	8.33%	0.00%
Yuhuangmiao town	9.80%	16.34%	25.49%	11.76%	26.80%	9.15%	0.65%
Huairan town	6.45%	17.74%	25.81%	35.48%	3.23%	11.29%	0.00%
Total	7.74%	19.94%	25.30%	21.13%	14.58%	11.01%	0.30%

19. Regarding factors affecting heating appliance choice, the most important factor valued by respondents is safety, the next is the operational cost and the third one is the convenience to use. From the perspective of regions, interviewees in Jinan value safety the most, operational cost the next, and convenience to use the third. Interviewees in Shanghe county value safety the most, and convenience to use and operational cost the next. In Huairan town, the first factor respondents considered is market price, and the next are convenience to use and safety. Among them, one person from Yuhuangmiao town choose others, believing that ensuring the heating temperature is more significant.

iii. **Awareness of Risks of Heating Modality (N=325 households)**

Table 30 Identification of Risks of Current Heating Modality

Region Content	Satisfaction with current heating				Risks of existing heating modality							
	Very satisfied	Satisfied	Unsatisfied	Very unsatisfied	Air pollution	Respiratory diseases increase	Fire hazard	Carbon monoxide poisoning	The equipment often breaks down	Spending more time and labor on cooking and heating	Higher cost	Others
Jinan city	0.00%	55.32%	44.68%	0.00%	31.91%	57.45%	40.43%	40.43%	31.91%	21.28%	19.15%	2.13%
Shanghe county	0.00%	27.27%	72.73%	0.00%	45.45%	54.55%	63.64%	72.73%	18.18%	27.27%	18.18%	9.09%
Yuhuangmiao town	4.64%	45.70%	49.01%	0.00%	49.67%	43.05%	40.40%	67.55%	12.58%	17.22%	13.25%	1.99%
Huairan town	0.00%	70.97%	26.61%	0.00%	45.97%	59.68%	30.65%	70.16%	36.29%	32.26%	26.61%	0.81%
Total	2.10%	55.86%	40.84%	0.00%	45.65%	51.65%	37.54%	64.86%	24.32%	23.72%	19.22%	1.80%

20. In terms of awareness of heating mode, more than half of the interviewees report they are satisfactory. Regarding awareness of the associated risks for the heating modalities, most people choose carbon monoxide poisoning risks, and the next are increasing respiratory disease and air pollution. From the perspective of regions, most interviewees in Jinan, Yuhuangmiao and Huairan towns are satisfied with the current heating system, whereas interviewees in Shanghe county are unsatisfied. Regarding risk awareness in different regions, in Jinan the most popular risk chosen by interviewees is increasing respiratory disease, and the next are carbon monoxide poisoning and fire hazard; most of interviewees in Shanghe county, Yuhuangmiao and Huairan choose carbon monoxide poisoning. The three people who chose others think that the temperature is relatively low, heating is inconvenient, the heating space is limited, the washroom cannot be heated, the indoor air is dry, the energy consumption is too high; and no risks, respectively.

iv. Willingness to Pay of Urban or Semi-urban Residents (N=59 households)

Table 31 Willingness to Pay of Urban or Semi-urban Residents

Region Content	Willingness to have central heating service		Willingness to pay the following amount					Maximum amount willing to pay	Reasons for unwilling to pay			
	Yes	No	CNY 10	CNY 15	CNY 20	CNY 25	CNY 30		Too expensive	Present heating is good, no need to change	I do think central heating system is better.	We don't live here in winter.
Jinan city	100.00%	0.00%	72.34%	19.15%	4.26%	6.38%	0.00%	13.1	95.74%	40.43%	4.26%	4.26%
Shanghe county	90.91%	9.09%	45.45%	18.18%	27.27%	9.09%	0.00%	15	90.91%	9.09%	0.00%	0.00%

21. Among the 325 sample households who didn't connected to the central heating system, 59 households are the potential users of the central heating system of this project. The interviewees in Jinan city are mainly from Zhouyan village near the proposed biomass power plant, the average area of their existing houses is 138 m² and they may move to the apartment buildings according to the city planning soon. They think that they could afford the current heating price of Jinan City if they moved to the apartment buildings. But if the central heating system connected to their current houses, they thought the heating tariff should be lower, because the housing area is large and not all rooms need heating with poor insulation and the large heat loss which will make the temperature lower than the apartment buildings. For that reason, although most interviewees are willing to have central heating service, in terms of willingness to pay, most people choose to pay CNY10 per m². For those who are unwilling to pay, most of them think the heating tariff is too high, and the next reason is that they think that the current heating condition is good enough.

v. **Willingness to Pay of Rural Households in Shanghe County (N=266 households)**

Table 32 Willingness to Pay of Rural Households in Shanghe County (1)

Region Content	Opinion on rural clean heating project					Willingness to purchase the heating appliance ³		The heating appliance you prefer				
	Very welcome	Welcome	Indifferent	Discouraged	Very discouraged	Yes	No	Air source heat pump water heater	Air source heat pump wind heater	Carbon crystal electric heat panel	Thermal storage electric heater	Fuel gas wall stove
Yuhuangmiao town	30.46%	66.89%	1.32%	1.32%	0.00%	92.05%	7.28%	56.30%	29.63%	2.96%	2.96%	8.15%
Huairan town	59.50%	33.06%	4.96%	2.48%	0.00%	95.90%	4.10%	11.76%	26.05%	9.24%	38.66%	14.29%
Total	43.38%	51.84%	2.94%	1.84%	0.00%	94.12%	5.88%	35.43%	27.95%	5.91%	19.69%	11.02%

22. Regarding the willingness to pay of rural households, a clear majority of the villagers have a positive attitude towards clean heating projects and most are willing to purchase the heating appliance with subsidy. More than half of the interviewees in Yuhuangmiao are willing to purchase air source heat pump with hot-water heater. This willingness might be related to the good performance of pilot projects and thus villagers knew more about this. Residents in Huairan prefer to purchase electrical boiler, and the next is air source heat pump with hot-wind heater.

³ The heating appliances including air-to-air heat pump, air-to-water heat pump, carbon crystal plate radiator, heat-storage radiator and small household gas heater.

Table 33 Willingness to Pay of Rural Households in Shanghe County (2)

Location	Why willing to purchase								Why unwilling to purchase							
	Affordable	The coal stove is not safe and polluted	It is dirty and smelly to use coal for heating	The air conditioner has low energy efficiency	Heating time and room are controllable	The coal stove is time-consuming	Cleaning and maintenance of the coal stove are time-consuming	Others	Too expensive	The current power equipment cannot be compatible	The appliance is too big and noisy	Complicated to use	Do not have extra money for heat-insulating	Poor heating effect	Cooking and Boiling water are inconvenient without coal stoves	Others
Yuhuangmiao town	25.90%	64.03%	55.40%	15.83%	20.14%	32.37%	30.94%	0.72%	81.82%	0.00%	0.00%	9.09%	27.27%	72.73%	27.27%	9.09%
Huairan town	60.68%	82.91%	55.56%	35.04%	33.33%	29.06%	18.80%	0.00%	40.00%	0.00%	0.00%	40.00%	40.00%	0.00%	60.00%	20.00%
Total	41.80%	72.66%	55.47%	24.61%	26.17%	30.86%	25.39%	0.39%	68.75%	0.00%	0.00%	18.75%	31.25%	50.00%	37.50%	12.50%

23. Regarding willingness to purchase heating appliance, the main reason is that the interviewees are unsatisfied with the current heating method. Most people feel that the coal-stove is not safe with the risk of carbon monoxide poisoning. Besides, it is dirty and smelly to use coal for heating. Another reason is that the appliance subsidized by the government is affordable. Respondents who choose others claim that they are unsatisfied with the current heating temperature. Regarding the unwillingness to purchase, the main reason is that people think the price is relatively high, or that the heating effect is not good using the distributed heating system. Some interviewees choose others state that the distributed heating system consumes too much energy, and therefore people could hardly afford it even if the appliance is installed. Also, some people say that they do not know much about this heating system.

Table 34 Willingness to Pay of Rural Households in Shanghe County (3)

Location	Amount willing to pay per heating season					Maximum amount willing to pay each season	Reason unwilling to pay				
	CNY900	CNY1,350	CNY1,800	CNY2,250	CNY2,700		Too expensive to afford	Present heating is good	Not convenience as coal stoves	No enough electricity load	Do not live here in winter
Yuhuangmiao town	47.71%	49.02%	3.27%	0.00%	0.00%	1167	96.73%	15.03%	1.31%	1.31%	2.61%
Huairan town	67.48%	26.83%	5.69%	0.00%	0.00%	1093	92.68%	20.33%	4.88%	8.94%	0.00%
Total	56.52%	39.13%	4.35%	0.00%	0.00%	1134	94.93%	17.39%	2.90%	4.71%	1.45%

24. Regarding the willingness to pay, the amount of money that more than half of the interviewees are willing to pay is CNY900. From the perspective of regions, numbers of people who are willing to pay CNY900 and CNY1,350 in Yuhuangmiao town are close; and most respondents in Huairan town are willing to pay CNY900. The maximum amount of money people is willing to pay is about CNY1,100 per season. Regarding the unwillingness to pay, more than 90% of the interviewees think that it is too expensive to afford, and the next reasons are that the present heating is good and no need to change and the existing electricity load is not enough to power the new heating appliance.

Table 35 Energy Efficiency Renovation of Buildings^a

Location	Average number of rooms per household	Average number of rooms with heating device per household	Energy efficiency renovation situation		Willingness of energy efficiency renovation		
			Number of total households have energy efficiency renovation	Average cost of energy efficiency renovation per household (CNY)	Number of total households didn't have energy efficiency renovation	Yes	No
Jinan city	5.4	1.7	0	0	48	97.78%	2.22%
Shanghe county	4.2	1.4	1	1,000	10	100.00%	0.00%
Yuhuangmiao town	4.5	1.6	6	750	145	91.78%	8.22%
Huairan town	5	1.4	6	900	109	98.15%	1.85%
Total	4.8	1.5	13	895	312	96.41%	3.59%

^a Simple energy-saving renovation of rural housing, including ceiling insulation, adding insulation curtains on the doors and windows, etc., and at a minimum cost of several hundred yuan.

25. According to the survey, the 325 sample households without central heating system mainly put their heating equipment such as coal stove and air condition into the bedroom and the remaining two-thirds of the rooms without any heating. Among them, 13 households have simple energy efficiency renovation including ceiling insulation, adding insulation curtains on the doors and windows. The average cost ranges from CNY750 per household to CNY1,000 per household. For the remaining 312 households, the clear majority expressed their willingness to carry out energy efficiency renovation.

F. Clean Energy and Environment Protection (N=545 households)

Table 36 Environment Issues Concerned in Each Region

Location	Environmental issues in attention																	
	Water pollution			Garbage / solid waste			Lack of green space			Air pollution			Noise			Water and soil loss		
	Concern very much	Concern	No concern	Concern very much	Concern	No concern	Concern very much	Concern	No concern	Concern very much	Concern	No concern	Concern very much	Concern	No concern	Concern very much	Concern	No concern
Jinan city	49.26%	47.29%	3.45%	48.28%	49.75%	1.97%	38.42%	49.75%	11.82%	63.55%	34.48%	1.97%	48.28%	41.38%	10.34%	29.06%	53.20%	17.73%
Shanghe county	50.94%	49.06%	0.00%	79.25%	20.75%	0.00%	30.19%	69.81%	0.00%	83.02%	16.98%	0.00%	71.70%	28.30%	0.00%	32.08%	62.26%	5.66%
Yuhuangmiao town	51.22%	46.95%	1.83%	59.15%	34.76%	6.10%	43.90%	46.95%	9.15%	64.63%	31.71%	3.66%	54.88%	30.49%	14.63%	35.37%	47.56%	17.07%
Huairan town	60.00%	40.00%	0.00%	64.00%	36.00%	0.00%	39.20%	39.20%	21.60%	45.60%	48.80%	5.60%	27.20%	47.20%	25.60%	20.00%	44.00%	36.00%
Total	52.48%	45.69%	1.83%	58.17%	39.27%	2.57%	39.45%	48.44%	12.11%	61.65%	35.23%	3.12%	47.71%	38.17%	14.13%	29.17%	50.28%	20.55%

26. In terms of environment issues concerned by the interviewees, people concern about all the six issues. Among them, the most concerned issues are water pollution, garbage and solid waste, and air pollution. The followings are lack of green space, noise and soil erosion.

Table 37 Awareness of Air Quality in Jinan and Clean Energy Heating Resource

Location	Are you satisfied with the air quality of Jian city recently				Do you think the smog is related with emission from coal burning		Which of the following clean energy could be the heating resource							Are you willing to use clean energy for heating		
	Very satisfied	Satisfied	Unsatisfied	Very unsatisfied	Yes	No	Natural gas	Waste heat	Geothermal	Biomass	Air source	Soil	Others	Yes	No	No idea
Jinan city	2.96%	45.81%	46.80%	4.43%	89.16%	10.84%	75.37%	52.71%	63.05%	33.99%	35.47%	5.91%	0.00%	77.34%	5.42%	17.24%
Shanghai county	3.77%	71.70%	20.75%	3.77%	98.11%	1.89%	41.51%	39.62%	54.72%	39.62%	66.04%	5.66%	1.89%	81.13%	0.00%	18.87%
Yuhuan gmiao town	12.80%	62.80%	23.17%	1.22%	95.12%	4.88%	54.27%	42.07%	52.44%	26.83%	56.10%	18.29%	0.00%	76.83%	8.54%	14.63%
Huairen town	5.60%	69.60%	24.80%	0.00%	96.80%	3.20%	74.40%	34.40%	64.00%	35.20%	47.20%	6.40%	0.00%	90.40%	4.80%	4.80%
Total	6.61%	58.90%	32.11%	2.39%	93.58%	6.42%	65.50%	44.04%	59.27%	32.66%	47.34%	9.72%	0.18%	80.55%	5.69%	13.76%

27. Regarding the awareness of air quality, more than half of the respondents are satisfied and very satisfied with the air quality recently in Jinan. From the perspective of regions, people in Shanghe county, Yuhuangmiao and Huairen towns have relatively high satisfaction level. During interviews, respondents generally spoke highly of air quality in Jinan this year, believing that the air quality is improved more than the last two years. More than 90% of the interviewees think that the smog is related with emission from coal burning. Regarding the awareness of clean heating resource, natural gas and geothermal are more often chosen; people in Shanghe and Yuhuangmiao also choose air source heat pump. This might be related to the fact that geothermal resource is abundant in Shanghe. One person chooses others, claiming that there are some other clean resources such as wind energy, solar energy, biogas etc. 80% of the interviewees are willing to use clean energy, and the following is no idea.

Table 38 Awareness of Advantages and Disadvantages of Clean Energy

Location	Advantages of clean energy heating							Concerns on utilization of clean energies					
	Higher stability of heating supply	Environmental improvement	More residents will be included in central heating system	Waste reuse	Reducing smog	More secure	Others	Too expensive to buy and use	Groundwater consumption	Soil pollution	Temperature is less than expected	Too much noise	Occupy large space
Jinan city	58.13%	61.58%	46.31%	48.28%	55.67%	23.65%	1.97%	77.34%	27.59%	23.65%	64.53%	15.27%	9.85%
Shanghe county	83.02%	62.26%	16.98%	43.40%	69.81%	24.53%	1.89%	92.45%	9.43%	11.32%	92.45%	28.30%	0.00%
Yuhuangmiao town	57.93%	46.95%	38.41%	44.51%	49.39%	39.02%	0.61%	83.54%	26.83%	28.66%	62.20%	18.90%	13.41%
Huiren town	55.20%	52.80%	51.20%	41.60%	41.60%	62.40%	0.00%	88.80%	12.00%	17.60%	54.40%	17.60%	20.00%

Total	59.82 %	55.23%	42.20 %	45.14 %	51.93 %	37.25 %	1.10 %	83.30 %	22.02%	22.57 %	64.22%	18.17 %	12.29 %
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28. Regarding the awareness of advantages of clean energy, people often choose that with multiple clean heating sources heating supply is more stable; the following is that reducing the use of coal will save more energy, reduce air pollution and improve the environment. From the perspective of regions, residents in Jinan mostly choose the option that reducing the use of coal will save more energy, reduce air pollution and improve environment; residents in Shanghe mostly choose the option that with multiple clean heating sources, heating supply is more stable; residents in Yuhuangmiao mostly choose that with multiple clean heating sources, heating supply is more stable; and residents in Huairen mostly choose the option of heating being more secure, and the following is improved stability of heating supply. Regarding concern on clean energy, more than 80% of the interviewees are worried that the purchase and usage are too expensive to afford, and the following concern is that the temperature is less than expected. Trends in each region are consistent with the overall assessment.

2.7 Public Participation (N=545 households)

Table 39 Awareness of Positive Impacts of the Project

Location	Positive impacts								
	Improving heating supply in urban and rural areas	Improving the urban environment	Improving the heating supply quality	Opening opportunities for new employment	Multiple energy resources supply	Hot water is more accessible than steam transmission	More flexible heating mode	Reducing the diseases incidence	Waste reuse
Jinan city	91.63%	91.13%	90.64%	85.71%	81.77%	61.58%	87.68%	70.94%	71.43%
Shanghe county	92.45%	98.11%	96.23%	92.45%	98.11%	71.70%	96.23%	88.68%	81.13%
Yuhuangmiao town	93.90%	83.54%	86.59%	79.88%	82.32%	68.90%	80.49%	85.98%	80.49%
Huairan town	80.80%	94.40%	91.20%	77.60%	89.60%	66.40%	84.80%	76.80%	88.80%
Total	89.91%	90.28%	90.09%	82.75%	85.32%	65.87%	85.69%	78.53%	79.08%

Table 40 Awareness of Negative Impacts

Location	Negative impacts						
	Land acquisition and house demolition	More traffic noise	Temporary income loss of small businesses	Residents' safety during the pipeline excavation	Many influxes of migrant people	Inadequate affordability of heating service for the poor households	Coal seller and boiler worker need transition
Jinan city	73.89%	83.25%	70.94%	77.83%	60.59%	77.83%	64.04%
Shanghe county	86.79%	90.57%	88.68%	92.45%	75.47%	92.45%	94.34%
Yuhuangmiao town	83.54%	87.80%	70.73%	82.32%	55.49%	81.10%	54.27%
Huairan town	69.60%	84.00%	64.00%	87.20%	40.00%	70.40%	67.20%
Total	77.06%	85.50%	71.01%	82.75%	55.78%	78.53%	64.77%

29. Regarding the awareness of the respondents on the positive impact of the project, options selected by the respondents the most are improving the urban environment and improving heat supply quality in both urban and rural areas. At the same time, use multiple energy resources for heating and create new jobs opportunities also supported very much by the respondents. The proportion of respondents who choose other positive impacts are more than 70% which means the public support for this project is very high. For the negative impacts, more than 80% of the respondents think the potential impacts are the traffic noise and the safety during the pipeline excavation. More than 70% of the respondents think land acquisition and house demolition before the project construction, income loss of small businesses during the project construction and affordability of poor households during project operation are also the potential negative impacts of the project.

Table 41 Main Communication Media

Location	Main communication channels used						
	Television	Radio	Telephone	Newspaper	Social networking	Internet	Propaganda board or information bulletin
Jinan city	51.23%	39.90%	44.83%	34.98%	69.95%	54.68%	23.65%
Shanghe county	54.72%	16.98%	37.74%	22.64%	90.57%	75.47%	35.85%
Yuhuangmiao town	66.46%	28.66%	28.05%	16.46%	56.10%	32.93%	23.17%
Huairan town	63.20%	48.00%	31.20%	24.80%	60.00%	56.80%	28.80%
Total	58.90%	36.15%	35.96%	25.87%	65.50%	50.64%	25.87%

30. Regarding main communication channel, the three most often used channels in Jinan and Shanghe are social network, internet and television. In Yuhuangmiao and Huairan, the three most often used channels are television, social network and internet.

H. Time Consumption on Heating Equipment

31. Based on the investigations, interviews, and 545 valid questionnaires in Jinan and Shanghe, it concludes that heating equipment, especially coal-stove is mainly operated by women and the main purpose is for daily cooking, water-boiling, and heating in winter and. Time spent on coal-stove in suburb area and rural area is about 3.5 hours per day at most, with morning and evening being peak periods. The households normally spend at least 2 hours and 2.75 hours on

average per day on heating. Farmers in Shanghe spend more time on heating than residents in suburb area. CNY 41.25 per day could be saved on average according to the labor cost of CNY 15 per hour in Shanghe. If residents or farmers go out to work or do some temporary work during this time, they can earn more. In other words, the implementation of this project can indirectly bring more income to offset the increasing heating expenditure. As a result, the project will be welcomed and applauded by the beneficiaries.

III. Conclusion

32. Interviewees in the urban area of Jinan city showed a very high degree of satisfaction on the overall quality of the existing heating supply services, about 98.71% of them believe that the overall quality is good or very good. Compared with the urban areas, the interviewees in the urban areas of Shanghe county and townships have lower satisfaction of the existing central heating supply services mainly because the heating interruption is more frequent in these areas.

33. Regarding the advantages of the central heating, nearly 77.73% of the respondents believe that the advantage is the stable heating supply, and the next are high temperature (63.98%) and safety (53.55%). Only 35.07% believe that central heating system has advantage of better environmental protection. Mainly because they worried about the coal as main heating supply resource will cause smog in the winter (69.19%). In that case, 80.57% of the respondents think the first important measure for the development of heating system is using clean energy source for heating and 61.14% of them think energy efficiency renovation of the old building is also very important.

34. For the sample households in the regions which didn't have central heating system now, coal-stove is the main heating source and coal is the main form of fuel. According to the social survey, the average price of coal is CNY1,299 per ton and the average annual consumption is 1.2 ton per household, the heating cost is around 1.75% of the annual income of the sample households and 4.25% of the annual income of poor households. The usage of anthracite coal which is about 30% more expensive than ordinary coal increased the burden of poor households.

35. 40.84% of the interviewees who have not connected to central heating system report that they are unsatisfied with the existing heating supply, especially in Shanghai County, more than half of the interviewees think using coal-stove may cause carbon monoxide poisoning and fire, increasing respiratory disease and air pollution. 95.22% of the sample households in rural areas have a positive attitude towards clean heating projects and most of them are willing to purchase the heating appliance with subsidy. The most popular appliances are air-to-air heat and air-to-water heat pump. They also think the of existing electricity load is not enough for the new heating

appliance, should be updated accordingly. The price of the appliance is relatively high, and the high operational cost are the main reasons for the interviewees who are unwilling to switch to clean heating. But if peak-to-valley tariffs⁴ are imposed and with the subsidy for electricity tariff, they are willing to switch because their peak hours at home are concentrated at night.

36. Based on the results of the social survey, women are more sensitive to heating supply facilities and have more power in making decisions: (i) women are the main undertakers of housework (72.73% in Shanghe County and 62.22% in Jinan City in the sample households), they are closely related to the use of energy, and especially heating facilities which are mainly coal stoves in semi-urban and rural areas. The average time spent on the preparation of household energy for heating is 2.75 hours/day; (ii) except joint decision made by the couples (54.86%), 24.77% of the family decisions were made by women, especially for the recurrent expenditure such as monthly payment of fuel, water and electricity supply, which was higher than men (13.77%); and (iii) women also have strong awareness on clean energy and more sensitive to air quality, 39.58% of the female respondents were not satisfied with the recent air quality compared with male respondents which is 30.49%.

⁴ A kind of time of use (TOU) electricity tariff.

Appendix 1: Household Questionnaire

Shandong Provincial Government plans to carry out clean heating and cooling development project in both urban area and rural area which will be implemented by Jinan Thermal Power Co., LTD (JTTC) and Jinan Heating Group (JHG) in Jinan city and Shanghe County. There are 3 subprojects which are: 1) East Jinan Low-Emission Combined District Heating and Cooling Project; 2) Shanghe Winter Coal-Free Clean Heating Demonstration Project (De-coalification Clean Heating Project in Rural Area of Shanghe County); 3). West Jinan Waste Heat Utilization and Clean Energy Project (including biomass heat, electricity neighborhood and air source heat pump). Through the project, clean energy such as waste heat of thermoelectric plant, biomass heat, air source heat pump, natural gas and geothermal will be used as heating and cooling sources, central heating, central cooling and distributed heating will be applied in corresponding urban and rural areas.

The project will enhance the efficient utilization of clean energy in Jinan, ameliorate environmental pollution, and improve the living and environmental condition for both urban and rural residents. To make better preparatory work for this project and make the project adjusted to the actual demands from local people, public opinions and suggestions are necessarily required and included within the survey.

This survey is anonymous and guarantees no disclosure of any of your personal information. Thank you very much for your consideration and cooperation.

Jinan Project Management Office
Feb. 2018

Questionnaire Num.: _____; Time of survey: mm/dd/2018; Interviewer: _____
 Location of survey: _____ District/County, _____ Sub-district/Town,
 _____ Community/Village
 Hukou: _____ 1. Urban; _____ 2. Rural

A. Family Status

A.1 Please provide information on your house living now.

Style of house? Circle ONE ROW ONLY		Total living area? (m2)	Which floor are you living?	Own or rent? Circle: 1=Own, or 2=Rent
1. Apartment with central heating now	1			1 2
2. Apartment without central heating now	2			1 2
3. Apartment with central heating in plan	3			1 2
4. Terraced house with 1-2 floors and without yard	4			1 2
5. Separate house in brick concrete structure with 1-2 floors and yard	5			1 2
6. Terraced house with shops	6			
6. Brick-wood structure house	7			1 2
7. Other	8			1 2
	A1.1	A1.2	A1.3	A1.4

A2 Could you please describe your household economic status in the following table?

Questions	Code/Units/Remarks	
1. Please assess your family economic status	1. Above average; 2. Average; 3. Below average; 4. Poor	A2.1
2. Does your household enjoy minimum living allowance?	1. Yes; 2. No	A2.2
3. If 'yes', how many family members enjoy?	Please specify	A2.3
4. If 'yes', what is the monthly subsidy?	CNY/month	A2.4
5. If "yes", what is the main cause of your household poverty?	1. Disaster; 2. Diseases; 3. Has disabled members; 4. Jobless 5. Others (specify):	A2.5

A3. Please describe the information for each member of your household. Please begin with yourself.

A8 Could you please tell us the total annual household income in the last year? Include salaries, pensions, scholarships, allowances, remittances and all other sources.

Introduction for Member of the Household A3.1-A3.7								
No	Context	1 (respondent)		2	3	4	5	6
A3.1	Head of household? 1.Yes. 2. No		3.1.1	3.1.2	3.1.3	3.1.4	3.1.5	3.1.6
A3.2	Relationship with head of household :1 –himself/herself;2- spouse3 farther/mother;4- son/daughter;5-brother/sister;6- grandchild7 - grandparents 8 - another relative 9 -another non-relative		3.2.1	3.2.2	3.2.3	3.2.4	3.2.5	3.2.6
A3.3	Sex: 1 – M; 2 – F		3.3.1	3.3.2	3.3.3	3.3.4	3.3.5	3.3.6
A3.4	Age		3.4.1	3.4.2	3.4.3	3.4.4	3.4.5	3.4.6
A3.5	Ethnic group: 1.Han; 2. Hui; 3. Man; 4. Chaoxian; 5. Other(specify)		3.5.1	3.5.2	3.5.3	3.5.4	3.5.5	3.5.6
A3.6	Education: 1 –illiterate 2 - primary or less 3 - Junior high 4 - senior high or technical college 5 - junior college 6-university 7 – graduate 99- D/A		3.6.1	3.6.2	3.6.3	3.6.4	3.6.5	3.6.6
A3.7	Main Occupation: 1 - Government servant 2- state owned enterprise staff 3- private enterprise employee 4- migrant worker 5- service industry 6- driver 7–teacher 8- doctor 9-small business (not street vendor) 10-casual labor 11-street vendor 12– working outside of home 13-farmer 14- livestock; 15 – house-wife 16 – retired pensioner 17 – student 18 – unemployed 19 – disabled 20. Other (write down)		3.7.1	3.7.2	3.7.3	3.7.4	3.7.5	3.7.6

Income sources	Income (CNY/year)	
1.Wages and salaries		A8.1
2.Pensions		A8.2
3. Agriculture income		A8.3
4. Animal husbandry income		A8.4
5. Land rental income		A8.5
6.Government subsidy		A8.6
7.Small business activities		A8.7
8.Casual labor (including seasonal labor)		A8.8
9.House rental income		A8.9
10.Other Allowances		A8.10
11.Other sources (specify)		A8.11

A9 Could you please say how much your household spends in total last year and for each of the following items?

Item	Expenditure (CNY/year)	
1. Food (grain, vegetables, eggs, meat, oil, fruits, etc.)		A9.1
2. Clothing		A9.2
3. Cost for property management		A9.3
4. Tap water (including cost for waste water service)		A9.4
5. Electricity (please specify the cost in winter)		A9.5
6. Coal		A9.6
7. Heating fee (for centralized heating)		A9.7
8. Communication (telephone, other)		A9.8
9. Transportation (bus, taxi, car costs)		A9.9
10. Education fees and other expenditures		A9.10
11. Payment to support parents or other relatives		A9.11
12. Medical and health expenditures		A9.12
13. Rent or loan payments for your house		A9.13
14. Recreation		A9.14

Item	Expenditure (CNY/year)	
15. Tobacco and alcohol and tea		A9.15
16. Expenditure for agriculture production		A9.16

A 10 Could you tell me who decides on expenditure for the following things in your family and is there a threshold of decision making for wife/ husband?

Expenditures	Who did the decisions 1.Husband; 2. Wife; 3. Elder; 4. Both;5. Herself/himself		Which of the following is the threshold of decision making for wife/ husband? 1.He/she didn't earn money or earn less money and don't have finance power;2. Tradition; 3. Only the household head could make decision;4. Education level; 5. No threshold.	
1. New appliance		A10.1.1		A10.1.2
2. Other large one-off expenditure		A10.2.1		A10.2.2
3. Fee for fuel		A10.3.1		A10.3.2
4. Water and electric fee		A10.4.1		A10.4.2
5. Other recurrent expenditure		A10.5.1		A10.5.2

A11 Please describe the heating system of your family:

[1] Centralized heating pipe network	[2] Regional central heating (managed by heating company)	[3] Centralized geothermal heating
[4] Individual coal stove	[5] Household gas heating (wall hung gas boiler)	[6] Carbon crystal electrothermal plate
[7] Electricity boiler	[8] Air source heat pump	[9] Biomass particles boiler
[10] Straws-burning for Kang ⁵	[11] Air conditioner heating	[12] no heating

⁵ A kind of bed made by soil and with a channel connected to a kitchen stove, using the waste heat from

Indoor temperature	1.above 18°C	2. about 18°C	3.14°C to 18°C	4. below 14°C	B5.1
Heating supply interruption	1. never	2. infrequent	3. sometimes	4. often	B5.2
Daily heating time	1.24 hours	2.12-24 hours	3.12 hours	4.less than 12hours	B5.3
Effective of breakdown maintenance	1. very good	2. good	3. poor	4. very poor	B5.4
Payment service	1. very convenient	2. convenient	3. inconvenient	4. very limited	B5.5
Price	1.low	2.reasonable	3. high	4.too high	B5.6
Overall quality	1. very good	2. good	3. poor	4. very poor	B5.7

B6 What are the advantages of central heating do you think? (please choose 3 advantages from the follows)

1.Temperature is high; 2. Heat resource is stable; 3. Annual expenditure for heating is cheap; 4. Safe; 5. Environmental protection; 6. High efficiency; 7. Easier management and maintenance; 8. Others

B7 What are the disadvantages of central heating do you think? (please choose 3 disadvantages from the follows)

1. Temperature is low; 2. Annual expenditure for heating is expensive; 4. Users can't adjust heat according to their own needs; 5. Radiators look ugly; 6. High cost for radiators purchasing and installing; 7. The coal as mainly heat source will cause smog in the winter; 8. Others

B8 What do you think is the most important thing to do in the current central heating system development? (please choose 3 advantages from the follows) :

1.Increase the temperature of the heating resource; 2. Use clean energy source for heating; 3. Increase the number of heating resource; 4. Increase the efficiency of heat network; 5. Extend the heating scope; 6. Renovation the old building to meet the heat preservation standard. 7 others, please specify.
B8.1

C. Distributed Heating System and Willingness to Pay

THE FOLLOWING QUESTIONS WILL ASK THE RESPONDENTS WHO HAVE NOT INCLUDED IN CENTRAL HEATING SYSTEM NOW. AFTER QUESTION C8, THE RESPONDENTS OF FOLLOWING QUESTIONS WILL DEPARTED INTO TWO GROUPS, ONE IS THE RESIDENTS WHO WILL CONNECTED TO CENTRAL HEATING SYSTEM OF THIS PROJECT HAVE TO ANSWER QUESTION C9 TO C10, THE OTHER IS THE VILLAGERS AMONG 80,000 TARGET

CLEANING HEATING RURAL HOUSEHOLDS IN SHANGHE COUNTY HAVE TO ANSWER QUESTION C11 TO C13.

C1 Now I would like to talk about family members who are living here:

Numbers of family members living in the house: _____; C1.1

Energy using peak hours in one day: _____; C1.2

1. In the morning around breakfast; 2. Around lunch time; 3. Around dinner time; 4. After dinner to bed time; 5. From bed time to the morning

Who in the household spends time with igniting, refilling, putting off, cleaning, maintaining the coal stove? _____ C1.3

1. Husband; 2. Wife; 3. Young daughter; 4. Young son; 5. Elder

How much hours are used now in using the coal stove and straw heating? _____ C1.4

How many rooms in your house? _____ C1.5

Among them, how many use heating appliances? _____ C1.6

C2 How many degrees of the outdoor temperature will you start household heating?
_____ °C; C2.1

What degree of the indoor temperature can reach by using the recent heating appliance? _____ °C;
C2.2

What degree of the indoor temperature do you think is comfortable? _____ °C; C2.3

C3 Could you please tell us the price of following fuel you are using now for heating and annual consumption of it in winter time?

Name of the fuel.	Unit	Price (CNY/unit)		Household annual consumption (unit/year)	
C3.1 Coal	Ton		C3.1.1		C3.1.2
C3.2 Biogas	M3		C3.2.1		C3.2.2
C3.3 LPG	Tank		C3.3.1		C3.3.2
C3.4 Electricity	kWh		C3.4.1		C3.4.2
C3.5 Biomass particle	Ton		C3.5.1		C3.5.2

C4 What do you think of the price of fuels? _____

1	2	3	4	5
Very high	Relatively high	Reasonable	Relatively low	Very low

C5 Could you please tell us how much you pay for the heating applianceincluding install fee? CNY C5.1

Have you got subsidy from government when you buy the appliance and using it?

1. Yes; 2. No. C5.2

If “Yes”, how much is subsidy for buying the appliance? CNY C5.3How much is the subsidy for using it? CNY /unit C5.4**C6 What do you think of the price of the heat appliance?**

1	2	3	4	5
Very high	Relatively high	Reasonable	Relatively low	Very low

C7 What option below is the factors that you may value the most for heating appliance? (A max of three most important with ranking with most important on top.)

1	2	3	4	5	6	7
Market price	The cost of operating	Convenient to use	Safety	Have subsidy	Time use for operation/ maintenance/ cleaning	Others

C8 What do you think are the risks of existing mode of heating?

[1] The air pollution caused by burning straw and coal; [2] Increased respiratory disease; [3] Have a fire hazard; [4] Have carbon monoxide poisoning risk; [5] The appliance often breakdown and need maintenance and spend money; [6] Spend more time and labor on cooking and heating; [7] Higher cost; [8] Other, please specify 。

THE FOLLOWING QUESTION C9 TO C10 WILL ASK RESPONDENTS EXCEPT 60,000 TARGET CLEAN HEATING RURAL HOUSEHOLDS IN SHANGHE COUNTY.

C9 There will be a clean heating demonstration project in your county which will provide clean central heating and distributed heating solution in winter. Through the project, clean energy such as biomass heat, air source heat pump, natural gas and geothermal will be used as heating sources, central heating and distributed heating will be applied in corresponding urban and rural areas. Central heating will provide more stable and high temperature heating service in fixed winter heating period. As your house included in this central heating project, are you willing to get central heating service? 1. Yes; 2. No. C9.1

C10 the heating bills will be paid by usable area per year per household. Are you willing to pay

CNY10 / CNY15 / CNY20 / CNY25 / CNY30 per m2 for the central heating services to be provided following implementation of this project?

(Circle the respondent's answer of yes or no. If "Yes", put 1, if "No", put 2. Do not encourage them to change the response)

CNY10	CNY15	CNY20	CNY25	CNY30	
1	2	3	4	5	C10.1
					C10.2

What is the maximum amount you will be willing to pay per m² for improved central heating services? _____
CNY/M2 C10.3

What is the main reason that you are unwilling to pay a higher tariff than the maximum you mentioned?
C10.4

Reason	Yes
. TO expensive, I cannot afford.	1
. Present heating is good, no need to change.	2
. I do think central heating system is better.	3
. We don't live here in winter.	4
. Other, please specify.	5

THE FOLLOWING QUESTION C11 TO C13 WILL ASK RESPONDENTS OF 60,000 TARGET CLEAN HEATING RURAL HOUSEHOLDS IN SHANGHE COUNTY.

C11 There will be a rural clean heating project in your village which will provide subsidy for the replacement of coal stove and straw heating through purchasing clean energy heating appliance. What is your opinion?

[1] Very welcome; [2] welcome; [3] indifferent; [5] discouraged; [6] very discouraged

C12 Are you willing to purchase the following heating appliances with the subsidy?

1. Air source heating pump; 2. Electrical boiler; 3. Carbon crystal electrothermal plate; 4. Biomass particles.

[1] Yes; [2] No.

C12.1

If "yes", which one do you want to purchase? _____ C12.2

Please explain why you are willing to purchase the heating appliance?

C12.3

Reason	Yes
. We can afford the appliance with the subsidy.	1
. The coal stove is not safe and polluted.	2
. It is dirty and smelly to use coal for heating now.	3
. The air conditioner has low energy efficiency and not works well in winter.	4
. We can control the heating by ourselves for time and different rooms.	5
. It takes time to operate the coal stove	

. It takes time to clean and maintain the coal stove	
. Other, please specify.	6

Please explain why you are not willing to purchase the heating appliance?

C12.4

Reason	Yes
. Too expensive to use, I cannot afford.	1
. The current power equipment can't match the new appliance.	2
. The appliance is too big and noisy.	3
. It is complicated to use.	4
. We don't have additional money for heat-insulating.	5
. Poor heating effect and can't reach the temperature of central heating.	6
. Other, please specify.	7

C13 Are you willing to pay CNY15 / CNY20 / CNY25 / CNY30 / CNY35 per day in winter for the household heating buy using the clean energy heating appliance to be provided in this project?

(Circle the respondent's answer of yes or no. If "Yes", put 1, if "No", put 2. Do not encourage them to change the response)

CNY15	CNY20	CNY25	CNY30	CNY35
1	2	3	4	5

C13.1

C13.2

What is the maximum amount you will be willing to pay per day for a clean energy heating appliance provided by this project? _____ CNY C13.3

What is the main reason that you are unwilling to pay more per day than the maximum you mentioned?

C13.4

Reason	Yes
. Too expensive, I cannot afford.	1
. Present heating is good, no need to change.	2
. I do think central heating system is better.	3
. We don't live here in winter.	4
. Other, please specify.	5

D. Clean Energy and Environmental Protection

D1 Which environment issues do you concerned with? Please encircle number in the box below under degree of concern for each environmental issue.

Issues	Degree of Concern
1. Water pollution	1. Seriously concern; 2. concern; 3. not concern
2. Water supply	1. Seriously concern; 2. concern; 3. not concern
3. Garbage / solid waste	1. Seriously concern; 2. concern; 3. not concern

D1.1

D1.2

D1.3

4. Lack of green space (parks, clean and spacious place)	1. Seriously concern; 2. concern; 3. not concern	D1.4
5. Air pollution (bad smell/odor/smog)	1. Seriously concern; 2. concern; 3. not concern	D1.5
6. Noise	1. Seriously concern; 2. concern; 3. not concern	D1.6
7. Soil erosion	1. Seriously concern; 2. concern; 3. not concern	D1.7
8. Other(specify)	1. Seriously concern; 2. concern; 3. not concern	D1.8

D2 Are you satisfied with the air quality of Jian city recently?

1. Very satisfied; 2. Satisfied; 3. Unsatisfied; 4. Very unsatisfied.

D3 Do you think the smog is related with emission from coal burning?

1. Yes; 2. No; D3.1

D4 Which of the following clean energy do you think could be the heating resource? (Multiple choice)

1. Natural gas; 2. Waste heat; 3. Geothermal; 4. Biomass; 5. Air source; 6. Soil; 7. Other, please specify
D3.1

D5 What do you think about the advantages of using clean energy for heating?

1. With multiple sources, heating supply is more stable; 2. Reducing the use of coal will save more energy and reduce air pollutant emission and improvement environment; 3. More residents will be included in central heating system especially for the suburban area; 4. Change waste (such as wheat straw and animal waste) to treasure and increase the income; 5. Reduce smog and improve air quality. 6. More secure; 7. Other, please specify.

D6 What do you worried about using clean energy for heating?

1. Too expensive to buy and use, can't afford; 2. Groundwater reduction; 3. Soil pollution; 4. The temperature is less than expected; 5. Too much noise; 6. Need to occupy large space; 7. Other, please specify.

E. Public Participation

E1 Positive impacts

	Yes	No	
1. Project will improve the quality of living conditions through improved heating supply in both urban area and rural area.	1	2	E1.1
2. Project will improve the environment of the whole city.	1	2	E1.2
3. Quantity and quality of heating supply will improve.	1	2	E1.3
4. Opens opportunities for new employment during project construction and operation.	1	2	E1.4
5. With multiple sources, heating supply is more stable and less interruption.	1	2	E1.5

c. It is more convenient to carry hot water than to carry steam. It needs smaller diameter and less influence during construction.	1	2	E1.6
d. The heating mode is more flexible.	1	2	E1.7
e. Improving heating supply in rural areas and reducing the incidence of disease, especially for elderly people, women and children.	1	2	E1.8
f. Change waste (such as wheat straw and animal waste) to treasure and increase the income	1	2	E1.9
g. Other (please specify	1	2	E1.10

E2 Negative Impacts

	Yes	No	
a. Land acquisition and house demolition	1	2	E2.1
b. More traffic noise and exhaust emissions during construction	1	2	E2.2
c. Temporary income loss of small business due to pipeline excavation.	1	2	E2.3
d. Residents' safety during the pipeline excavation and well drilling especially for children.	1	2	E2.4
e. Trafficking for children and women as so many influxes of migrant people during project construction.	1	2	E2.5
f. Affordability of heating service for the poor households is not enough.	1	2	E2.6
g. Coal seller and boiler worker maybe need transition.			E2.7
h. Other (please specify	1	2	E2.8

E3 What are the main communication channels used?

E3.1

1. TV; 2. Radio; 3. Telephone; 4. Newspaper; 5. Social networking medium (WeChat, Weibo, etc.); 6. Internet media (news website, etc.); 7. Propaganda board or information bulletin; 8. Other social media, please specify?

E4 What are the problems with the current system? _____ E4.1

E5 What would they expect in an improved system? _____ E5.1