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Carbon Footprints of Urban Residential Buildings: A Household Survey-Based Approach

Xiaomei Yan [1,2,3], Shenghui Cui [1,3,*], Lilai Xu [1,3], Jianyi Lin [1,3] and Ghaffar Ali [1,3]

[1] Key Lab of Urban Environment and Health, Institute of Urban Environment, Chinese Academy of Sciences, 1799, Jimei Road, Xiamen 361021, China; xmyan@iue.ac.cn (X.Y.); llxu@iue.ac.cn (L.X.); jylin@iue.ac.cn (J.L.); ghafar.gs@gmail.com (G.A.)

[2] University of Chinese Academy of Sciences, Beijing 100049, China

[3] Xiamen Key Lab of Urban Metabolism, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen 361021, China

* Corresponding author: shcui@iue.ac.cn; Tel.: +86-0592-619-0777

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This document contains 7 pages, with 4 Figures and 7 Tables.

Table S1. Standards for transforming qualitative variables into ordinal variables.

Qualitative variables	Transform Standards
Household income (yuan/year)	<50,000 = 1; 50,000~100,000 = 2; 100,000~200,000 = 3; 200,000~400,000 = 4; >400,000 = 5
Education	Elementary or below = 1; Junior = 2; Senior = 3; College = 4; Graduate = 5; Others = 6
Building age	Before 1981 = 1, between 1981~1990 = 2, between 1991~2000 = 3, between 2001~2010 = 4, after 2010 = 5
Housing ownership	rental = 1; mortgage = 2
Housing type (Property Right)	Owner-occupied = 1，rented = 2，subsidized = 3，owner-built = 4，others = 5
Single parent	no = 0; yes = 1
Religion	no = 0; yes = 1
House structure	Wood = 1; wood-brick = 2; masonry-concrete = 3; steel-concrete = 4
Which religion	Buddhist = 3; Christian = 4; Muslim = 5; Taoist = 6
Windows	Transparent = 1; with color = 2
Do you encourage your family and friends to conserve energy?	Never = 1; seldom = 2; often = 3;very often = 4; always = 5
Do you support the government's Low-carbon initiative?	Never = 1; seldom = 2; often = 3;very often = 4; always = 5
Do you pay attention to the use of energy-saving products?	Never = 1; seldom = 2; often = 3; very often = 4; always = 5
If there is a preferential policy, do you value the practice of energy conservation?	Never = 1; seldom = 2; often = 3; very often = 4; always = 5
Do you think that saving energy is saving money?	Yes = 1; No = 2
Do you think that saving energy is required by environmental laws and regulations?	Yes = 1; No = 2

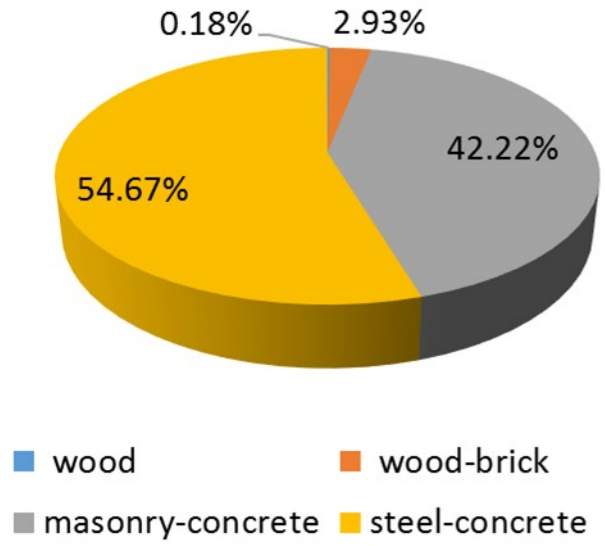


Figure S1. Urban residential building structure types in Xiamen city.

Table S2. Average carbon emission factors of Fujian Province grid from 2010 to 2014.

Grid	2010	2011	2012	2013	2014	Average
Fujian Grid	0.6123	0.7440	0.6455	0.6699	0.6397	0.6623

Table S3. Oxidation rates of fuel types.

Fuel Type	Carbon Content (tc/TJ)	Average Low Calorific Value (KJ/Kg(m^3))	Standard Coal Coefficient (Kgce/Kg(m^3))	Oxidation Rate (%)
Coal	26.37	20,908	0.7143	81
LPG	17.20	50,179	1.7143	99
Gas	15.32	38,931	1.33	99
Reference	[1]	[2]	[2]	[1]

Table S4. Comparison by per capita CO2 emissions.

Area	CO2 Emissions (Metric Tons Per Capita)
World	4.97
East Asia & Pacific	6.29
European Union	6.38
Niger	0.11
India	1.73
United Kingdom	6.50
Japan	9.54
United States	16.49
United Arab Emirates	23.30
China	7.54
Min value of this study	0.19
Mean value of this study	1.40
Max value of this study	11.23

Source: The data of countries were taken from World Bank [3].

Table S5. Comparison of carbon footprints of building life cycle with other case studies.

Reference	Study Area	Min	Max	Mean	Lifespan
			tCO_2/m^2		Year
[4]	Review analyses of 95 case studies	0.3485	6.485		50
[5]	China			1.425	50
[6]	United Kingdom			4.25545	50
[7]	United States			2.210	65
[7]	Switzerland			1.7875	65
[8]	Malaysia			3.720	50
[9]	Spain			2.340	50
[10]	Canada	1.765	25.785	14.767	60
[11]	Italy	2.650	3.65	3.15	50
[12]	France	0.415	1.91	1.1625	50
Our analysis	Xiamen, China	0.76270	8.357	2.39874	50

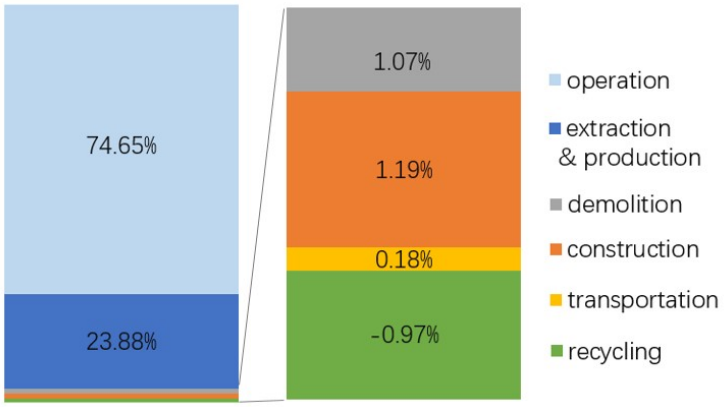
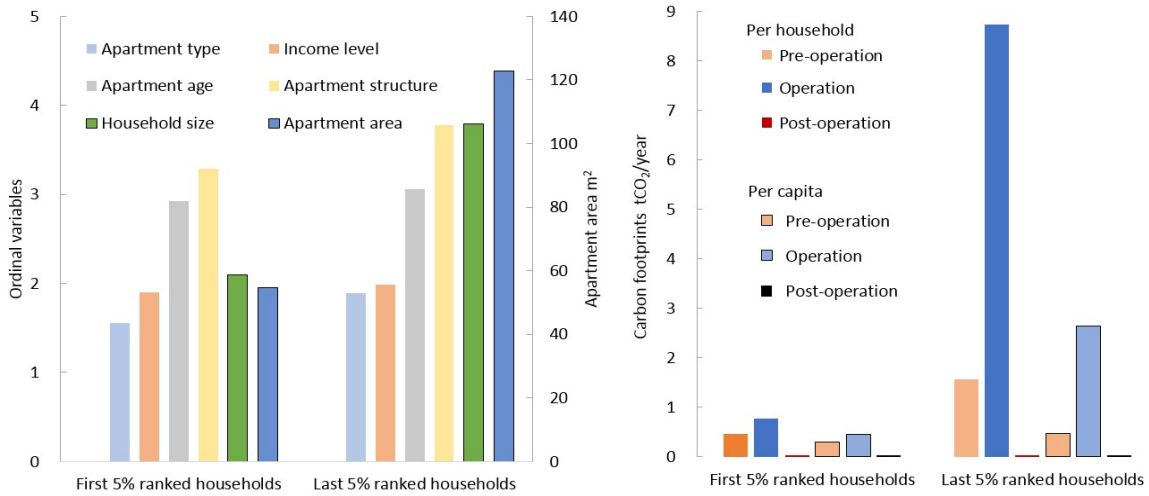


Figure S2. Percentage carbon footprint distribution of six stages.



(**a**) (**b**)

Figure S3. (**a**) The socioeconomic attributes of households ranked first 5% and last 5%; (**b**) Per household and per capita carbon footprints of households ranked first 5% and last 5%.

Table S6. Community ID.

Community	ID	Community	ID
Xiayang	1	Xiaoxue	24
Ruijing	2	Yingcui	25
Ridong	3	Huli	26

Fengchaoshan	4	Houlu	27
Xi'an	5	Chengxi	28
Songbai	6	Ningbao	29
Wenping	7	Hexiangxi	30
Lianyue	8	Weilaihai'an	31
Qianpu	9	Zengcuo'an	32
Sili	10	Dongdu	33
Lianyuewucun	11	Jinshan	34
Jinshang	12	Changle	35
Hetong	13	Tangbian	36
Biyue	14	Lianxiu	37
Haida	15	Wenzao	38
Shangli	16	Xiangqiao	39
Changqing	17	Xin'ancun	40
Yueyang	18	Xiangping	41
Binlang	19	Wuxing	42
Gulangyu	20	Maluan	43
Yuhou	21	Fanghu	44
Zhongshan	22	Xindian	45
Yinting	23	Yecuo	46

Table S7. Operational CF of steel- and masonry-concrete structure.

	Per Household	Per Capita	Per unit Area (m^2)	Apartment Area (m^2)	Household Size
Steel	3.1474	1.0285	0.0326	96.5	3.26
Masonry	2.9634	1.0650	0.0336	88.2	3.05

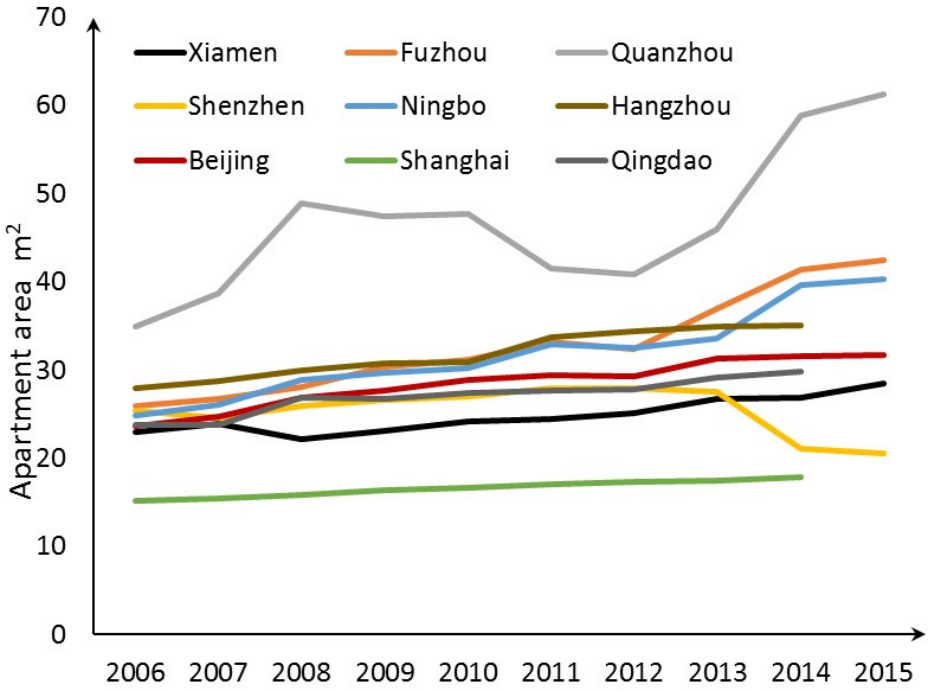


Figure S4. Per capita apartment areas of major cities in China.

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