

RESIDENTIAL ELECTRICITY CONSUMPTION & TIME-USE QUANTIFIED LIFESTYLES IN URBANIZING CHINA

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INTRODUCTION

“Our actions leave traces in the physical world” (1995, p.35), stated by the father of time geography, Torsten Hägerstrand, serves as the fundamental hypothesis of the time-geographic approach. Urbanization, as one of the tremendous social change in the world, has transformed the traditional “vertically linked” agriculture society into the modern “horizontally linked” society. It promoted the specialization of knowledge, decoupled individuals from household collectives, altered human everyday life and built strong reliance on labour-saving electric devices.

In China, the rapid urbanization has also imposed critical impacts on population distribution, residents’ ways of living and consequently, traces has been left in energy uses. However, in the discussion of energy, “individual” aspect has often been neglected, with only limited studies investigated the relationship between individual everyday life and energy uses. Therefore, this study, focusing on residential electricity consumption, aims at exploring the implications on energy of the lifestyle difference between urban and rural Chinese in the perspective of time.

Data & Methods

Data collected from two sources, the 2008 Chinese Time Use Survey (CTUS) & the 2012 Chinese Residential Energy Consumption Survey (CRECS), were utilized in

I) Reconstructing the residential electricity consumption profile in the end use by activity, in the following fashion (Eq. 1):

$$E = \sum_i \sum_j E_{ij} = \sum_i \sum_j T_{ij} \cdot \frac{E_{ij}}{T_{ij}} = \sum_i \sum_j T_{ij} \times EI_{ij} \quad (\text{Eq. 1})$$

E : Average per person-day residential energy consumption;
 T_{ij} & EI_{ij} : average time use and electricity intensity of activity ij

II) Estimating the relative impacts in time use (E_T) and electricity intensity of the activity (E_{EI}) on residential electricity consumption, in utilization of LMDI decomposition analysis (Eq. 2 - 3)

$$\Delta E_{tot} = E_U - E_R = \Delta E_T + \Delta E_{EI} \quad (\text{Eq. 2})$$

$$\Delta E_T = \sum_i \sum_j \frac{E_{ij}^U - E_{ij}^R}{\ln E_{ij}^U - \ln E_{ij}^R} \ln \left(\frac{T_{ij}^U}{T_{ij}^R} \right) \quad (\text{Eq. 3})$$

E_T & E_{EI} = Difference in residential electricity consumption attributable to the time use (T) and electricity intensity of activity (EI).



RESULTS

i) Reconstructed residential electricity consumption profile by activity

- Overall consumption:**
 >80% of residential electricity consumed for in-house active activities (Figure 1), even if they only accounted for 1/3 of the time spent of the day (Urban: 7.42hour/day; Rural: 7.38 hour/day).
- Consumption for Inhouse activities:**
 Unpaid work, watching TV and other personal care activities were the three most electricity consuming activities.

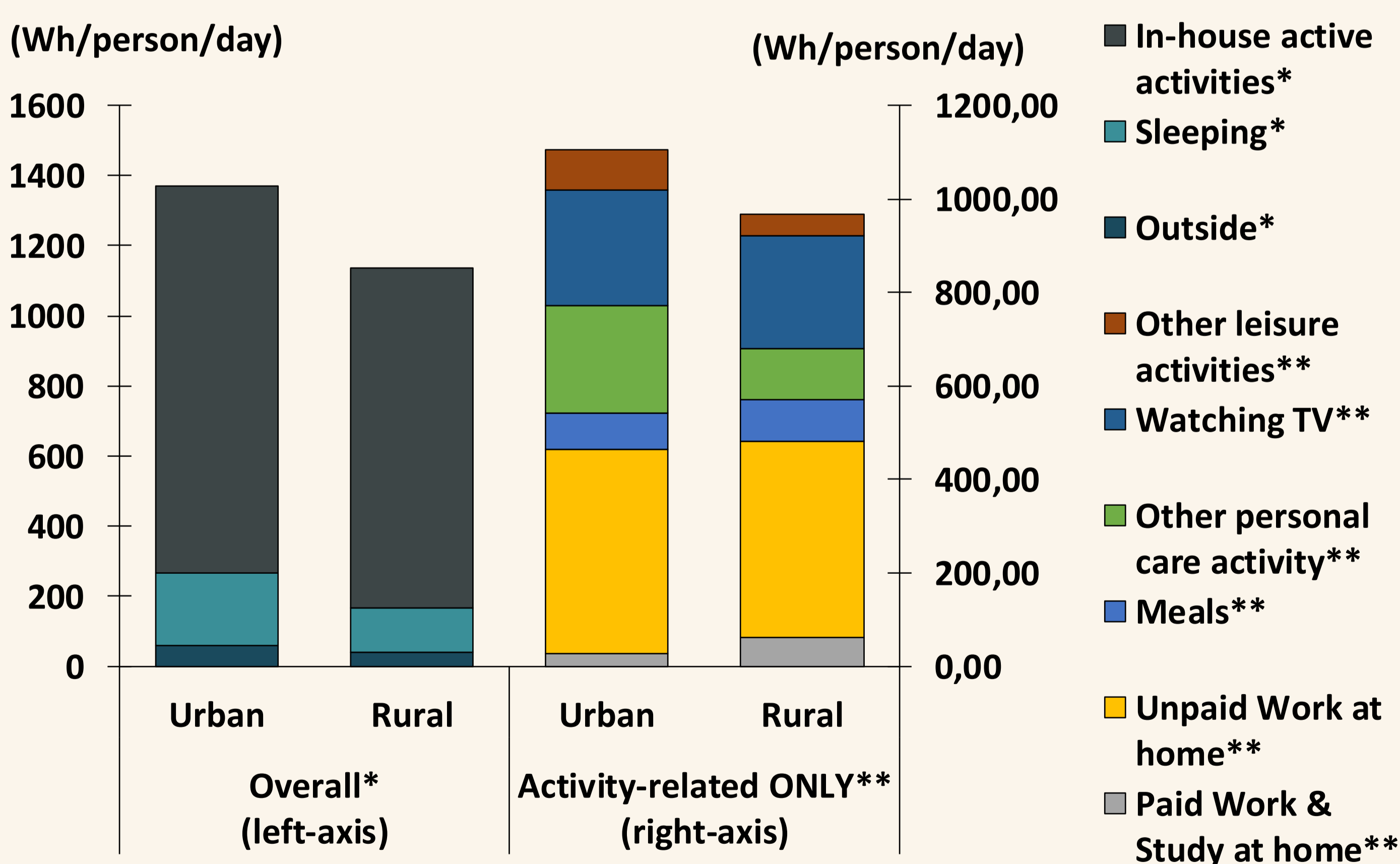


Figure 1. Reconstructed residential electricity consumption profile by occupancy status and by inhouse activities of the average urban and rural Chinese

ii) Decomposition analysis

- Electricity intensity effect: 85.5% of total difference**
 It implied the level of reliance and the choice of electric household devices in performing daily activities was the key factors contributing the difference in residential electricity consumption between urban and rural Chinese.
- Time effect: 14.5% of total difference**
 In relative to electricity intensity, residential daily time use pattern, how individuals allocate their day to activities, played only a minor role in determining residential electricity consumption.

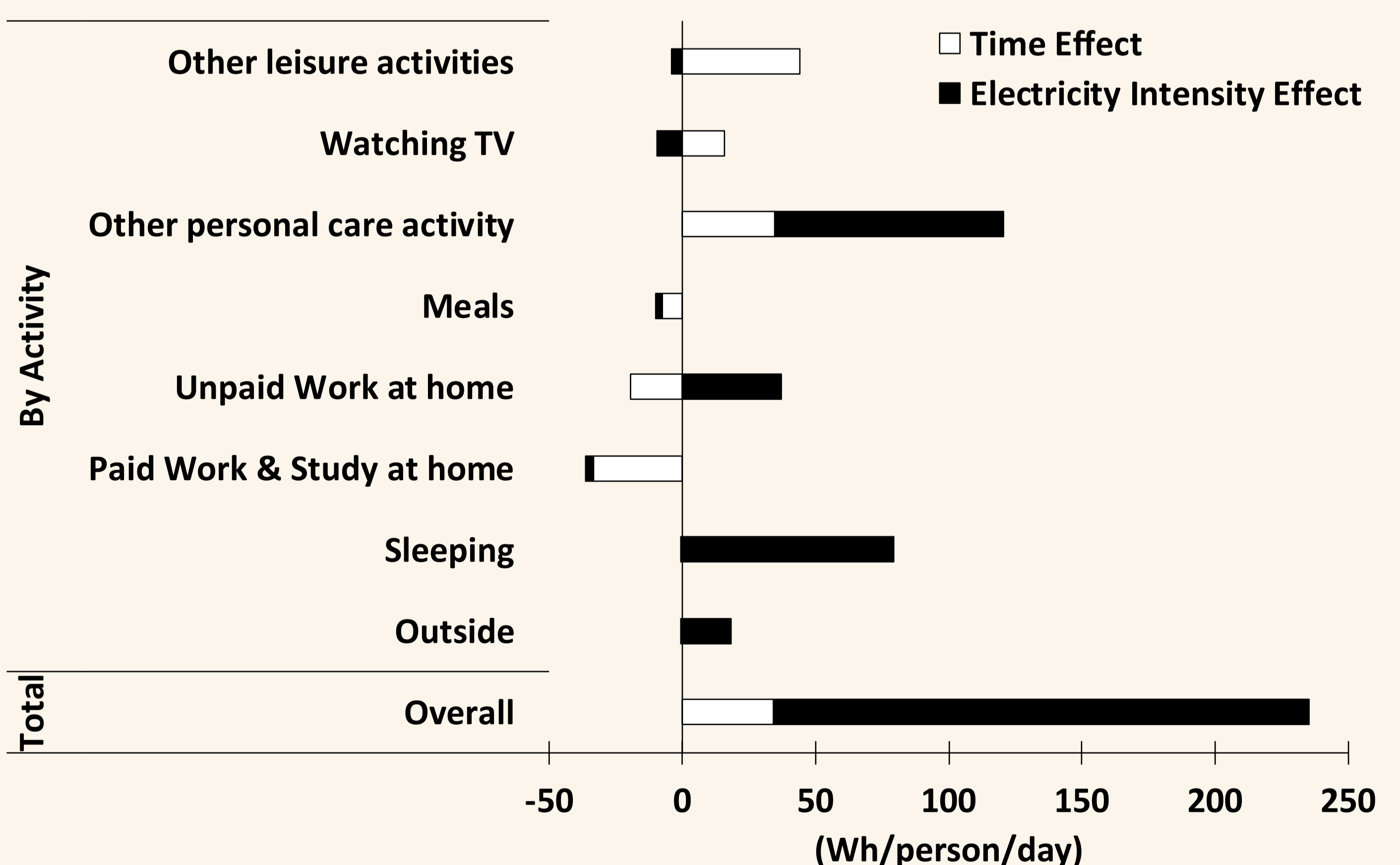


Figure 2. Relative contribution on residential electricity consumption of urban-rural difference time use (E_T) and electricity intensity of activity (E_{EI})

CONCLUSION

This study

- demonstrated the use of time use data in providing a novel perspective in understanding environmental impacts of human everyday activities.
- investigated and quantified the impacts of lifestyle factors
- identified the key lifestyle factors leading to urban-rural residential electricity consumption