

# Electric Load Characteristics Analysis of 5G Base Stations in Different Type of Area

Yunguo Yang, Jiansheng Hou,  
Jianjun Cai, Lina Zhang, Hongwei Ye  
Jinhua Electric Power Design Institute Co. Ltd  
Jinhua, China

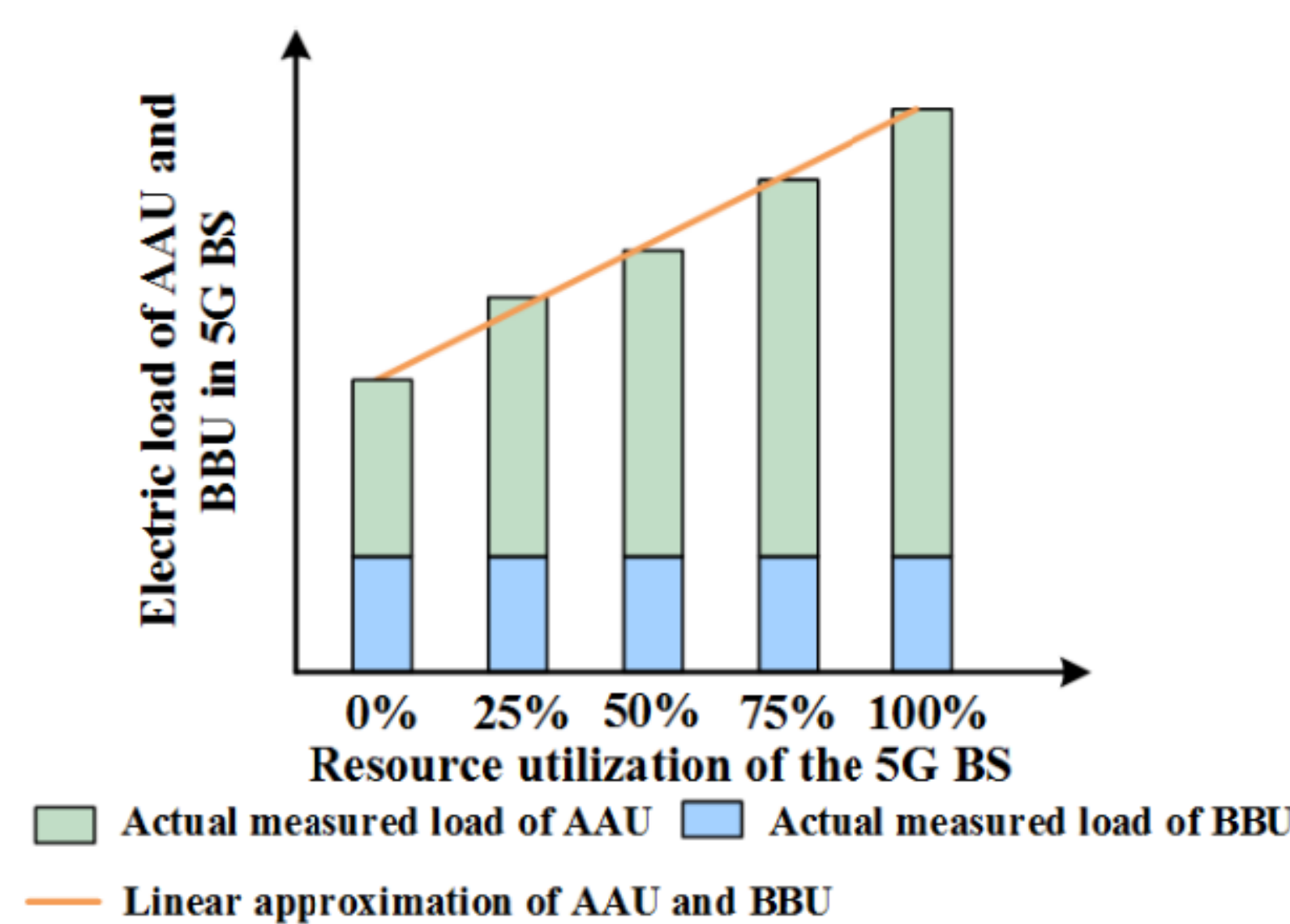
Yao Zou, Yuan Chi, Niancheng Zhou.  
Chongqing University  
Chongqing, China

## Introduction

In this paper, hourly electric load profiles of 5G BSs in residential, shopping, and office areas for future 5G application are simulated to compare and investigate their characteristics based on several key indices. The results are helpful to analyze the impacts of 5G BSs integration in distribution system considering future 5G application.

## Methods of your work

- The 5G BSs electric load is calculated by its power consumption characteristics.



- The uncertainty data usage and terminal activation model in different types of area to calculate the hourly BSs load.
- Uncertainty Terminal Data Usage

$$f[Du_s(t)] = \frac{1}{\theta_{Du_s(t)}} \cdot e^{-\frac{Du_s(t)}{\theta_{Du_s(t)}}}, Du_s(t) > 0$$

- Area 5G BSs Load

$$P[x = Ters_r(t)] = \frac{\lambda_{Ters_r(t)}^x}{x!} \cdot e^{-\lambda_{Ters_r(t)}}, x = 1, 2, \dots$$

- Proper indexes to analyze the characteristics of the BSs load profile.
- Complexity Invariant Distance (CID)

$$I_1 = \sqrt{\sum_{t=1}^N [P(t) - P(t+1)]^2}$$

- Mean Absolute Change (MAC)

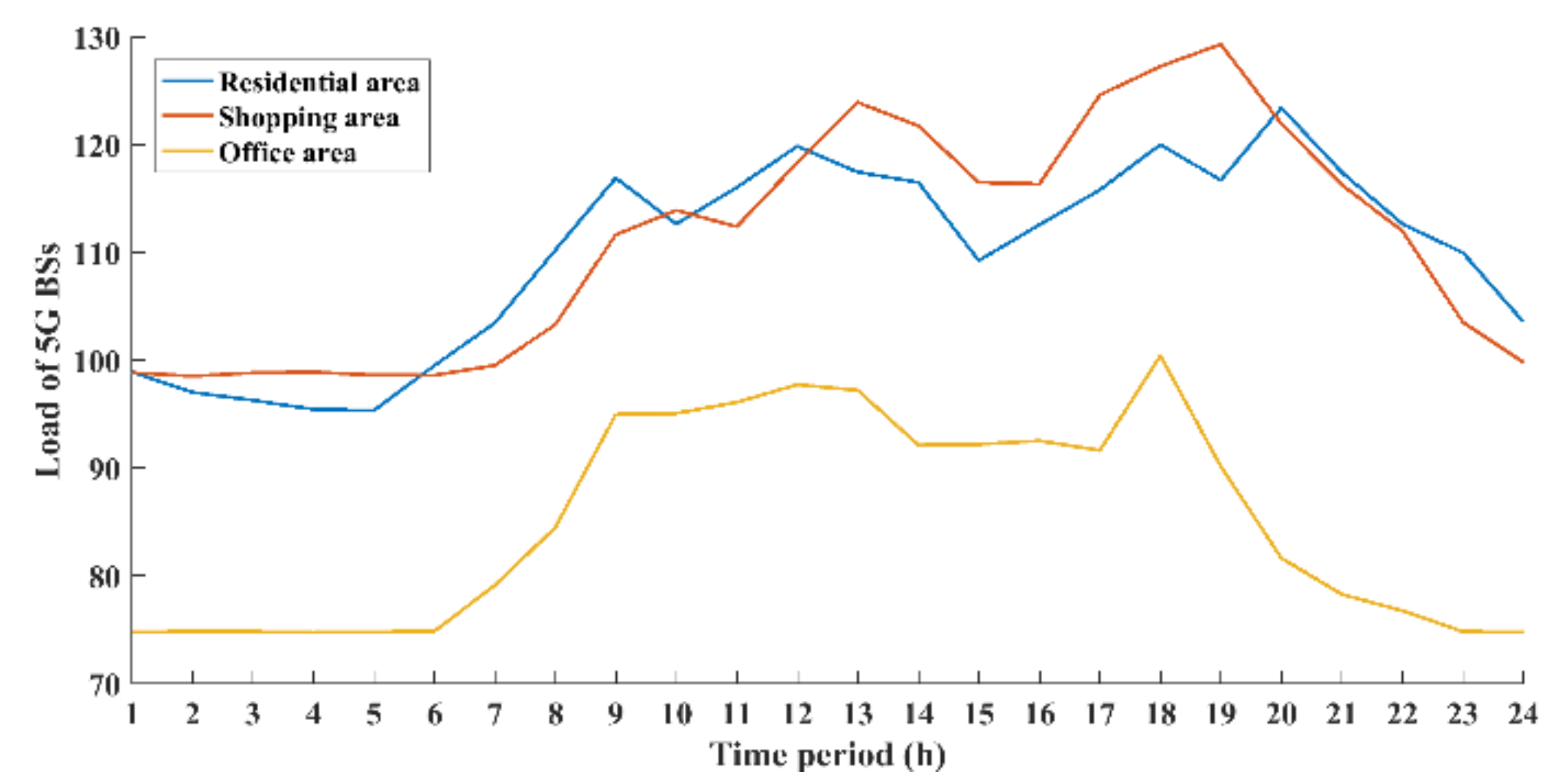
$$I_2 = \frac{1}{N} \sum_{t=1}^{N-1} |P(t) - P(t+1)|$$

- Peak Valley Difference (PVD)
- Maximum Utilization Hours (MUH)

$$I_3 = \frac{P_{max} - P_{min}}{P_{max}}$$

$$I_4 = \frac{P_{av}}{P_{max}}$$

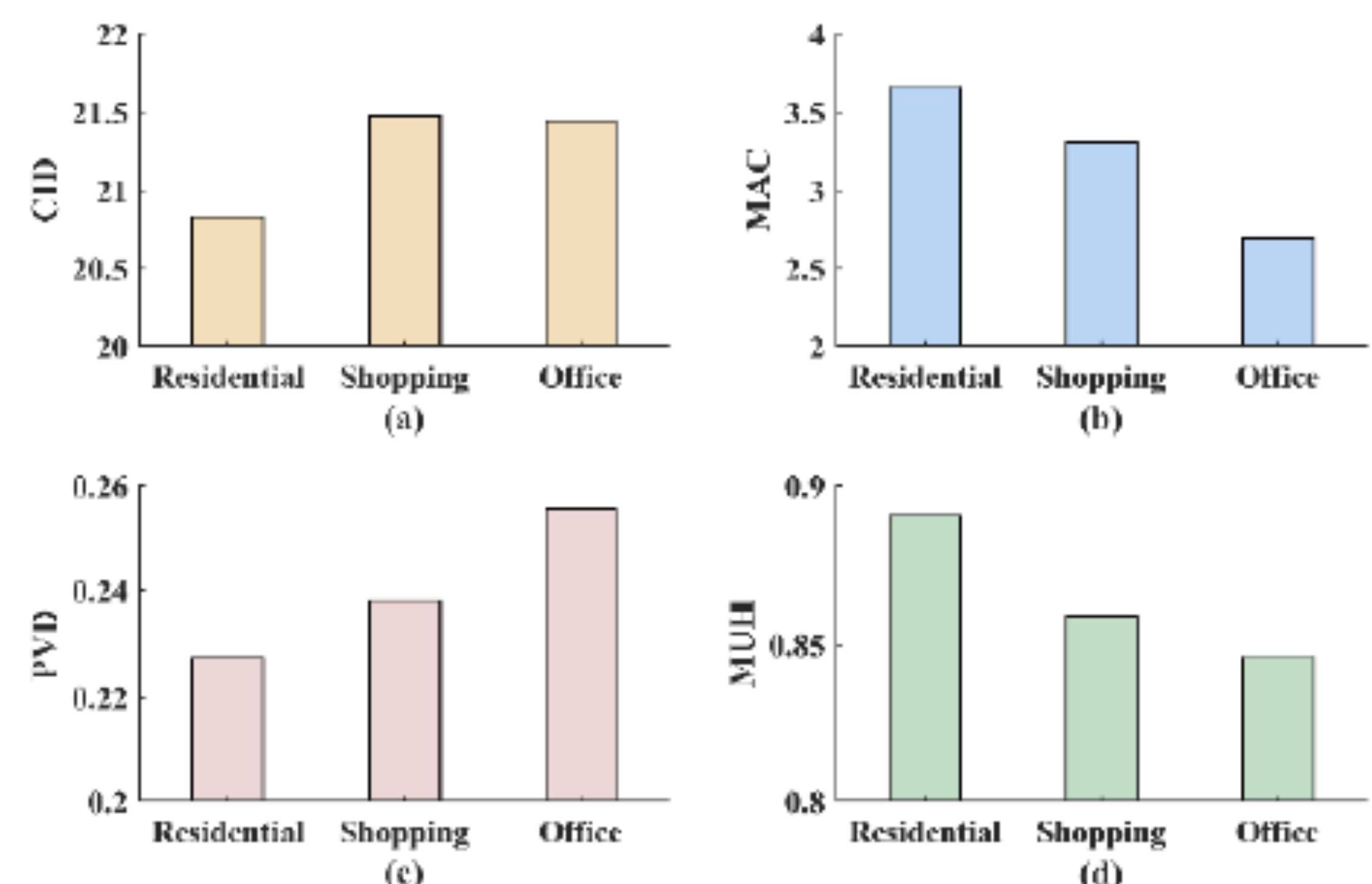
## Results of your work



Electric load profiles of 5G BSs in different areas

The change of BSs loads also begins to differentiate after 6h in three areas.

- In residential area, the BSs load profile shows 4 peaks.
- The peak load of BSs appears at meal time in shopping area (13 and 19h).
- The trend of BSs load is relatively flat at 9-18h in office area.



Characteristic indexes of 5G BSs load profiles in different areas

- CID value of shopping and office area are higher than residential area.
- The BSs load in residential area has the largest MAC value.
- BSs load in office area has the largest PVD value and the smallest MUH value.

## Conclusions of your work

The 5G BSs load considering future 5G application has different impact and characteristic corresponding to different area.