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Demonstration of Friendly Interactive Grid Under the Background of Electricity Market Reform in China

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Background

Two big challenges: Energy consumption, Environmental pollution

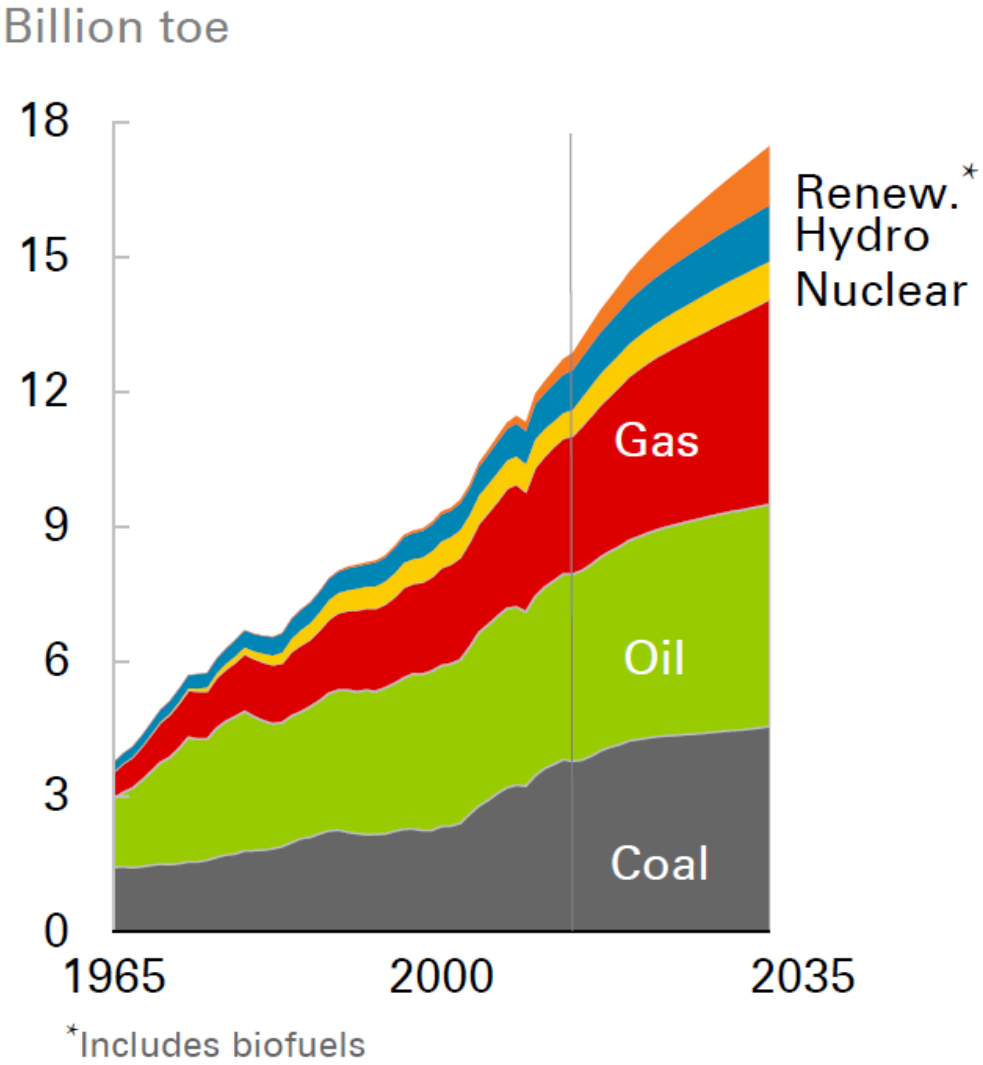

Fig.1. Growing increase of Energy Consumption[1]

Fig.2 Environmental Pollution

[1] Worldwide, B. P. "BP Energy Outlook 2035." (2015).

The increasing share of renewables in the power system

Fig.3 Renewable Energies (e.g. wind & photovoltaic)

Extra pressure of power system secure operation:

Less predictable and controllable;

High fluctuations and intermittence.

Demand Response

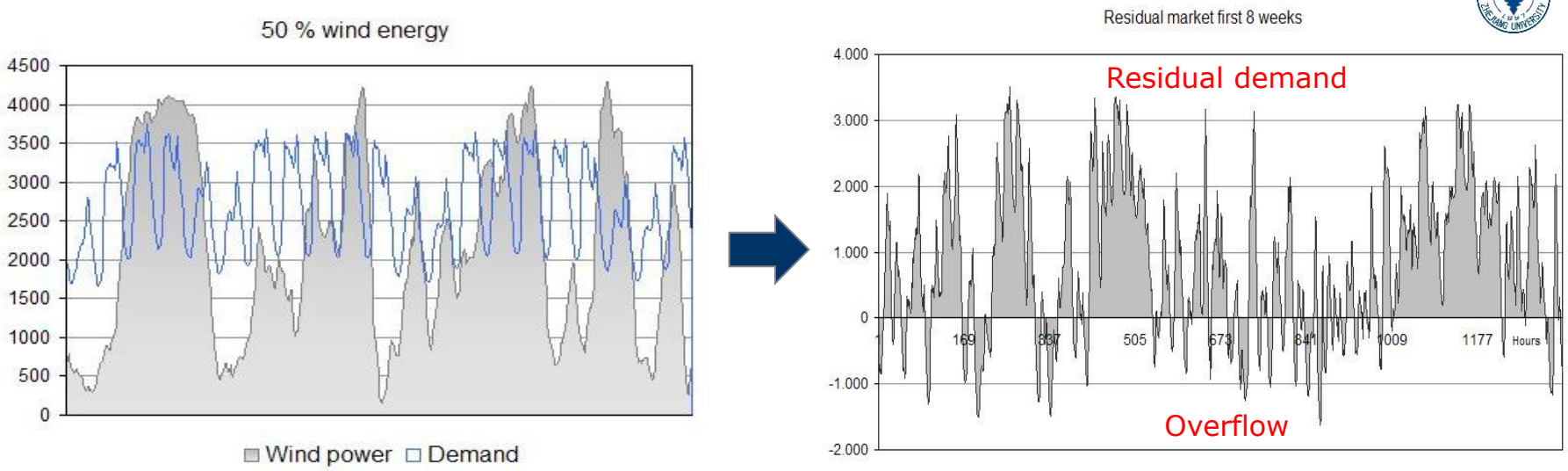

Fig.4 EcoGrid EU-assumed wind power capacity in 2025[2]

[2] Ding Y, Nyeng P, Ostergaard J, et al. Ecogrid EU-a large scale smart grids demonstration of real time market-based integration of numerous small DER and DR

Fig.5 Smart house

Fig.6 Conventional generating units

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The business model of demand response in Jiangsu Province

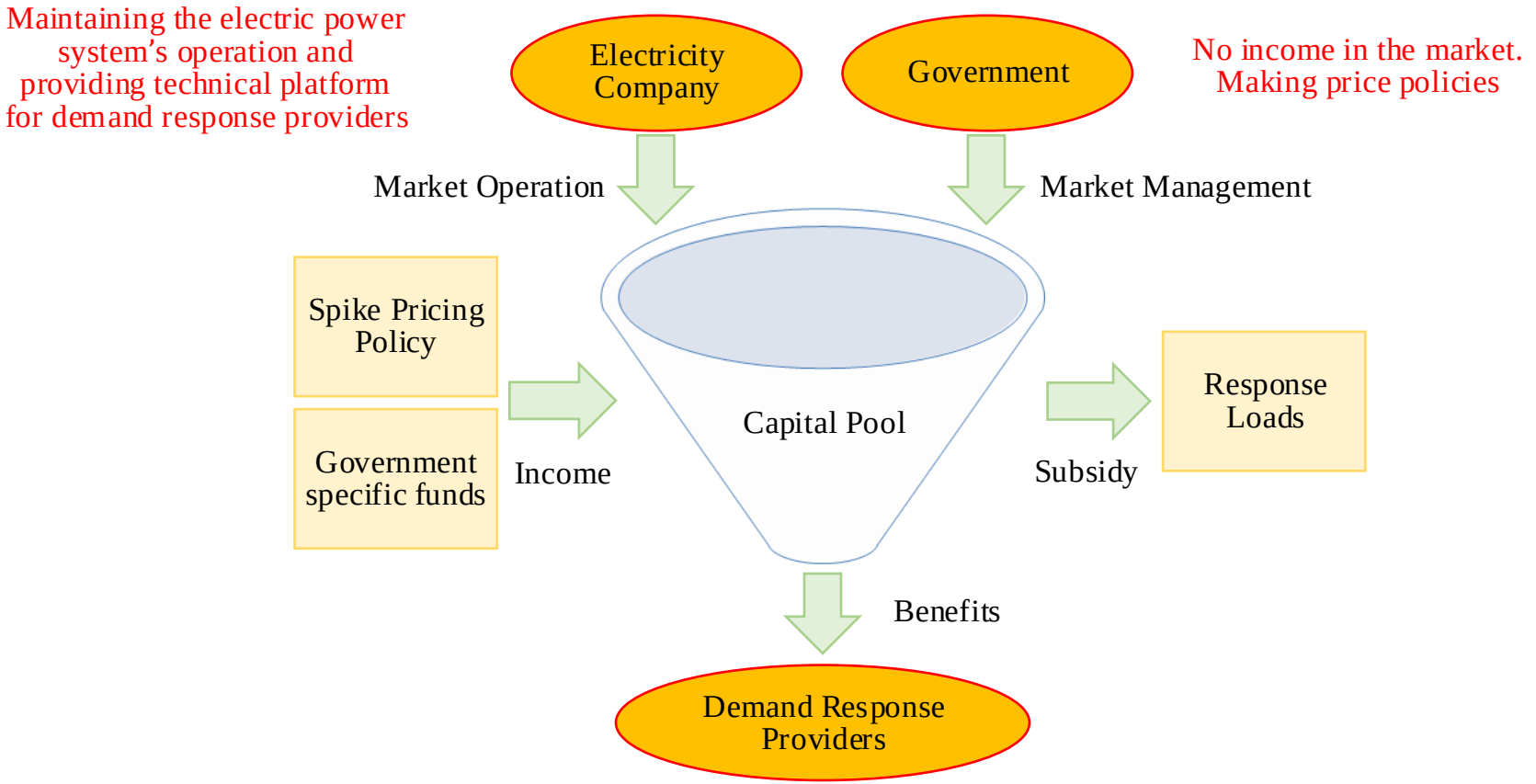
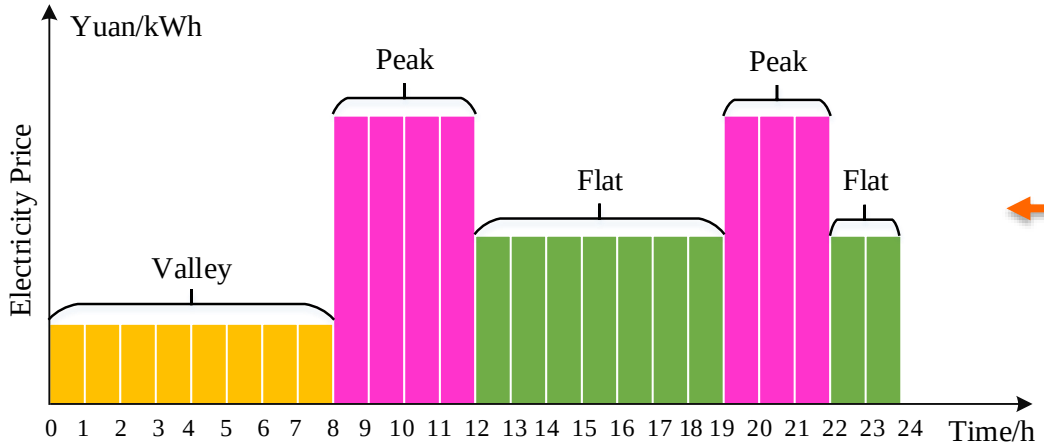


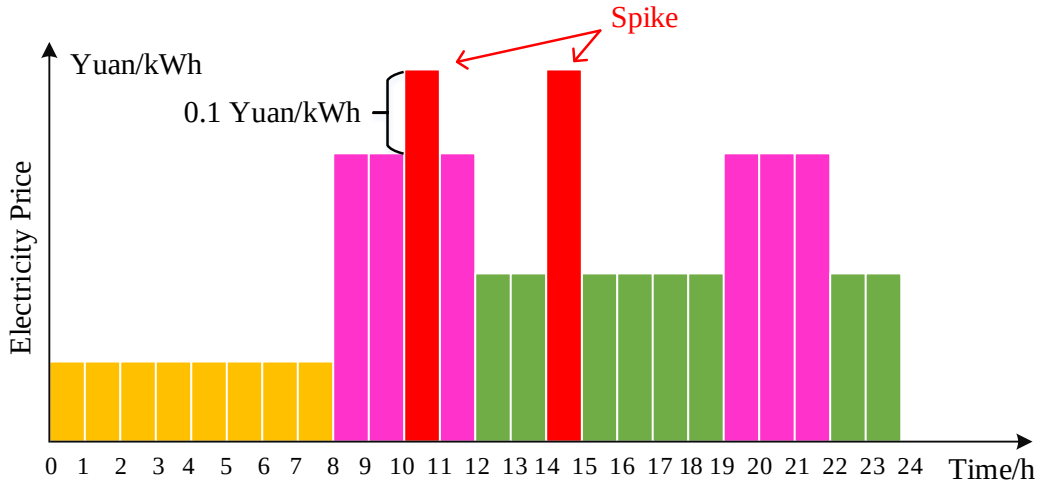
Fig.7 Business model of demand response in Jiangsu Province

- The business model includes three entities: Government, Electricity Company and Demand Response Providers (DRP).

The spike pricing policy



(1) Original peak-valley price policy



(2) Pilot spike price policy

Fig.8 Electricity price policy in Jiangsu Province

- Most of the provinces in China.

- The spike price is based on the original peak valley price. It increases 0.1 Yuan/kWh for the large industrial customers.
- The spike price policy will be carried out when the outside temperature is over 35 degrees Celsius in summer (July and August).

The Effect of Demand Response

- Around 56,000 large industrial customers were implemented the spike price policy.
- Compared with the original peak-valley price policy, the income of electricity increase 32 million Yuan and 45.51 million Yuan in 2015 and 2016, respectively.
- All the increased income were used to subsidize the customers or aggregators who successfully implemented DR.

TABLE I. THE EFFECT OF DEMAND RESPONSE

Typical days	*Number of industrial customers*	*Number of commercial customers*	*Number of residential customers*	*Number of aggregators*	*Reduction of Loads (MW)*	*Reduction of Peak-valley difference*
August 4, 2015	513	0	0	8	1,887	10.59%
July 26, 2016	1283	1526	321	24	3,520	18.47%

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Demonstration——Friendly Interactive System of Supply and Demand (FISSD)

It is approved and supported by *Ministry of Science and Technology of the People's Republic of China*.(2016-2020)

Demonstration area in **Suzhou**

- ➢ Administrative region: 78 km^2
- ➢ Resident population: 780,000
- ✓ Large industry customers: 1420
- ✓ Commercial customers: 32437
- ✓ Residential customers: 352,600
- ➢ Load aggregators: 5

Demonstration area in **Changzhou**

- ➢ Administrative region: 182 km^2
- ➢ Resident population: 1,600,000
- ✓ Large industry customers: 590
- ✓ Commercial customers: 21755
- ✓ Residential customers: 530,000
- ➢ Load aggregators: 3

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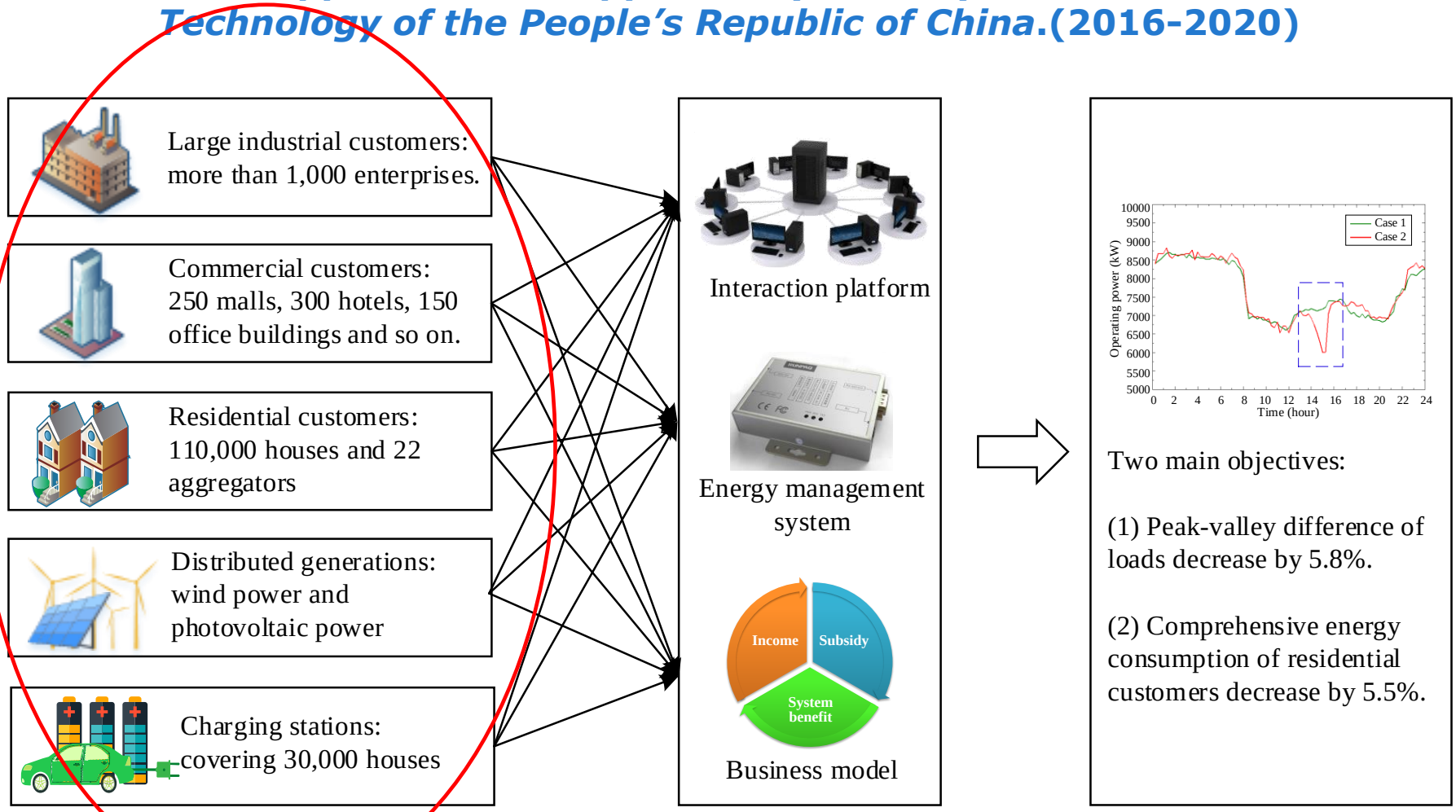

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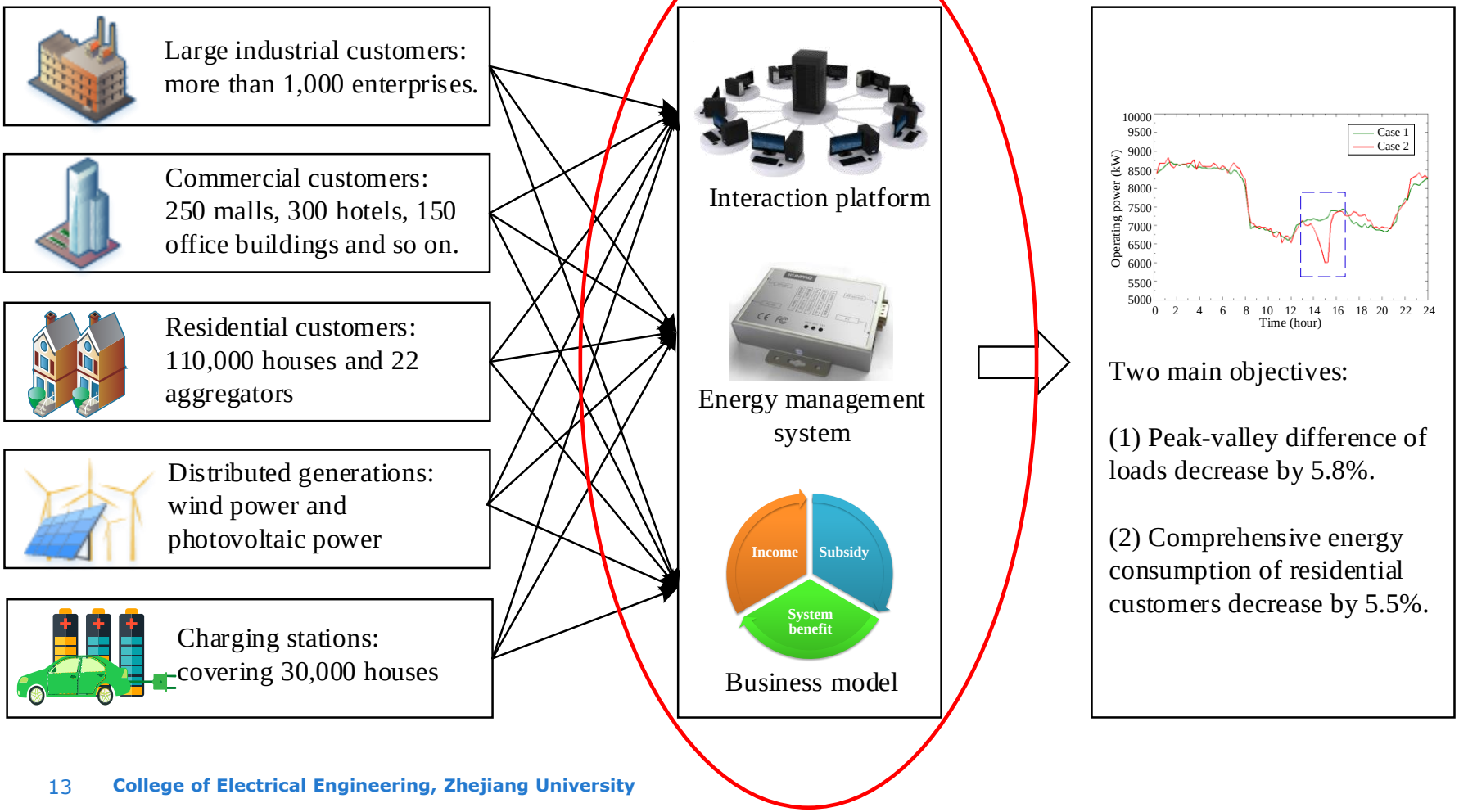

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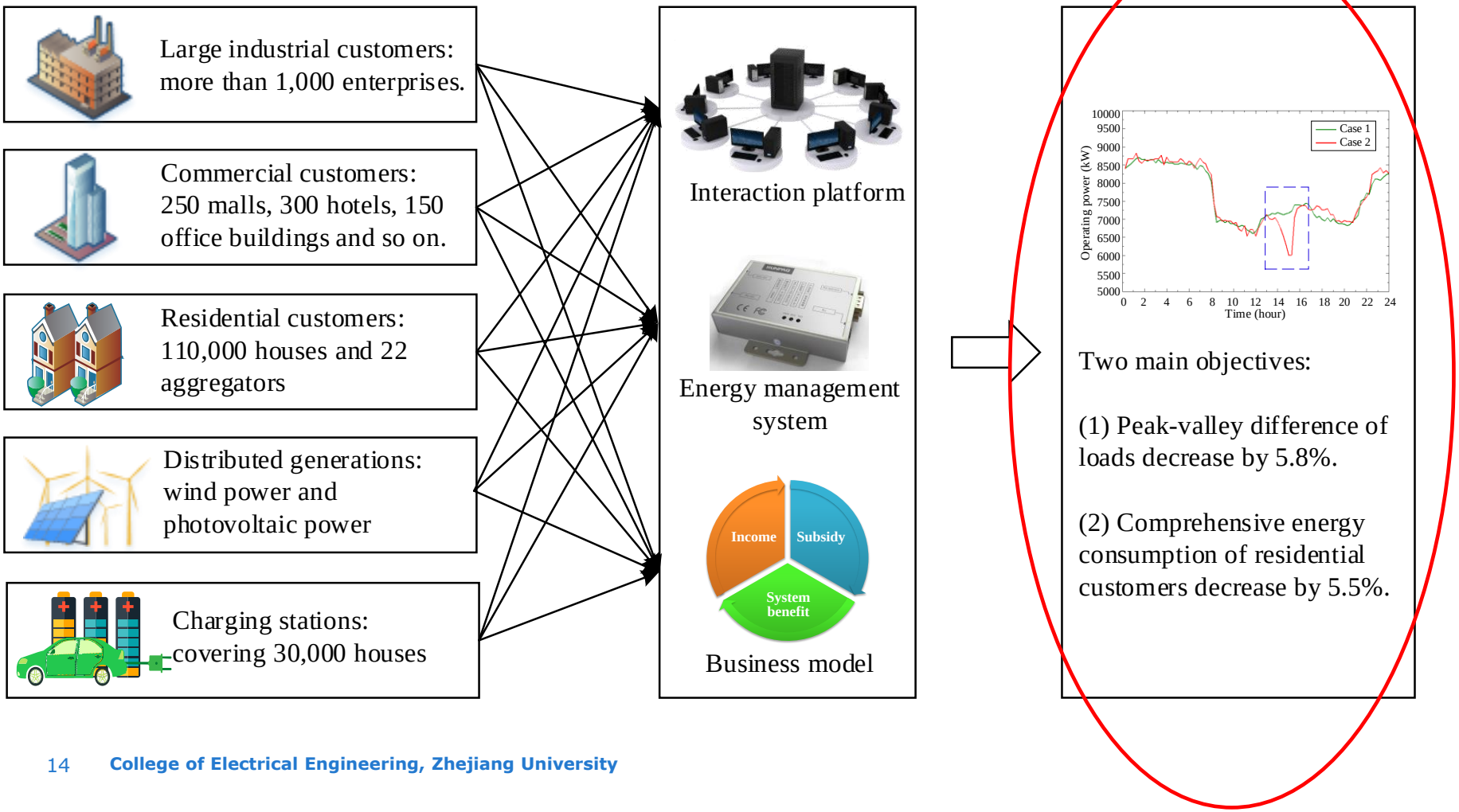

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Conclusions and discussions

- **Challenges:**
  - The future power system will be more fluctuating due to the high penetration of RES.
- **The pilot policy of demand response:**
  - The reduction of peak-valley difference can reach 18.47% and the average response capacity of residential customers can reach 590W.
- **Demonstration——Friendly Interactive System of Supply and Demand (FISSD):**
  - In order to do further study on DR, a demonstration project was implemented in Suzhou and Changzhou.
  - The FISSD will be one of the largest DR project in the world and make significant progress toward DR's study.
  - The demand response will make greater contributions to the future power system.

ZJU

Thank you for your attention!

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