

INTRODUCTION

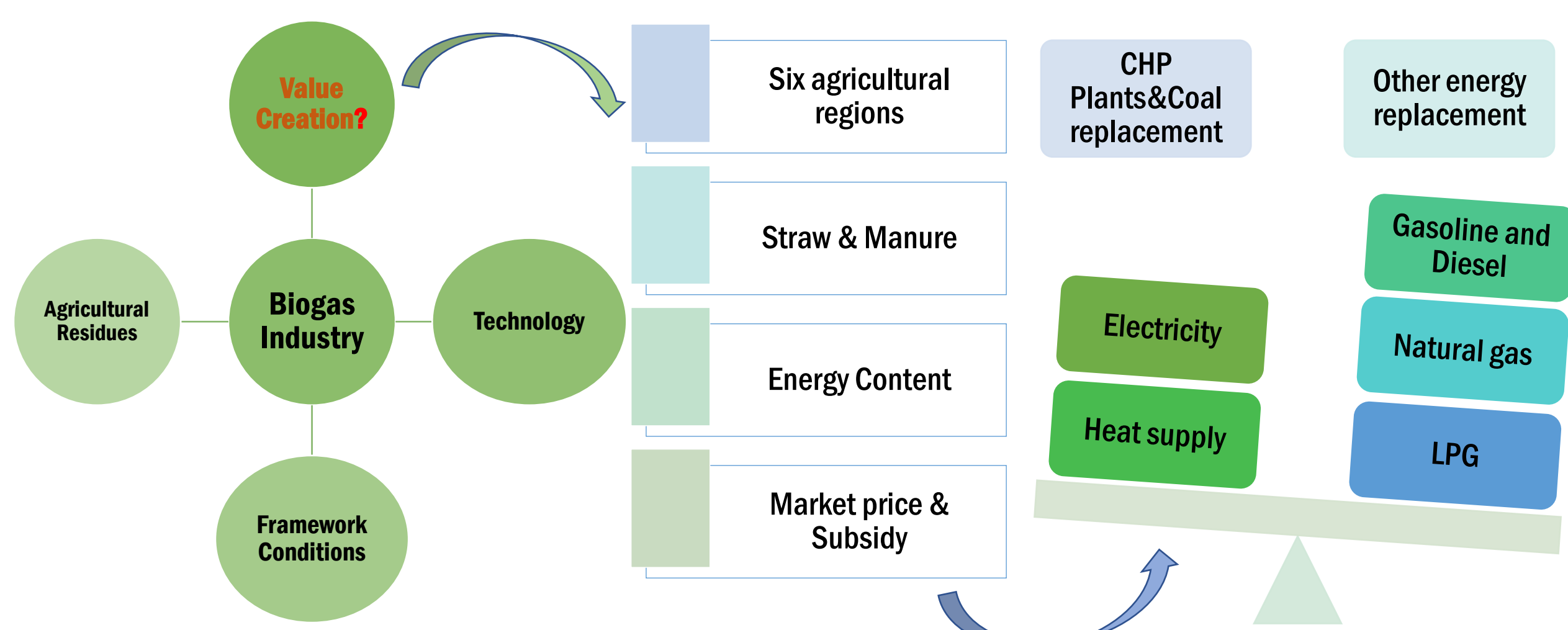


Fig. 1: Graphical introduction

How much value and unit value biogas creates as energy carrier in China in different utilization?

DATA AND METHODS

- Statistic data (2011-2020)
 - food production & major livestock
 - index in 6 agricultural regions of mainland China



Fig. 2: Spatial distribution of six agricultural regions in mainland China

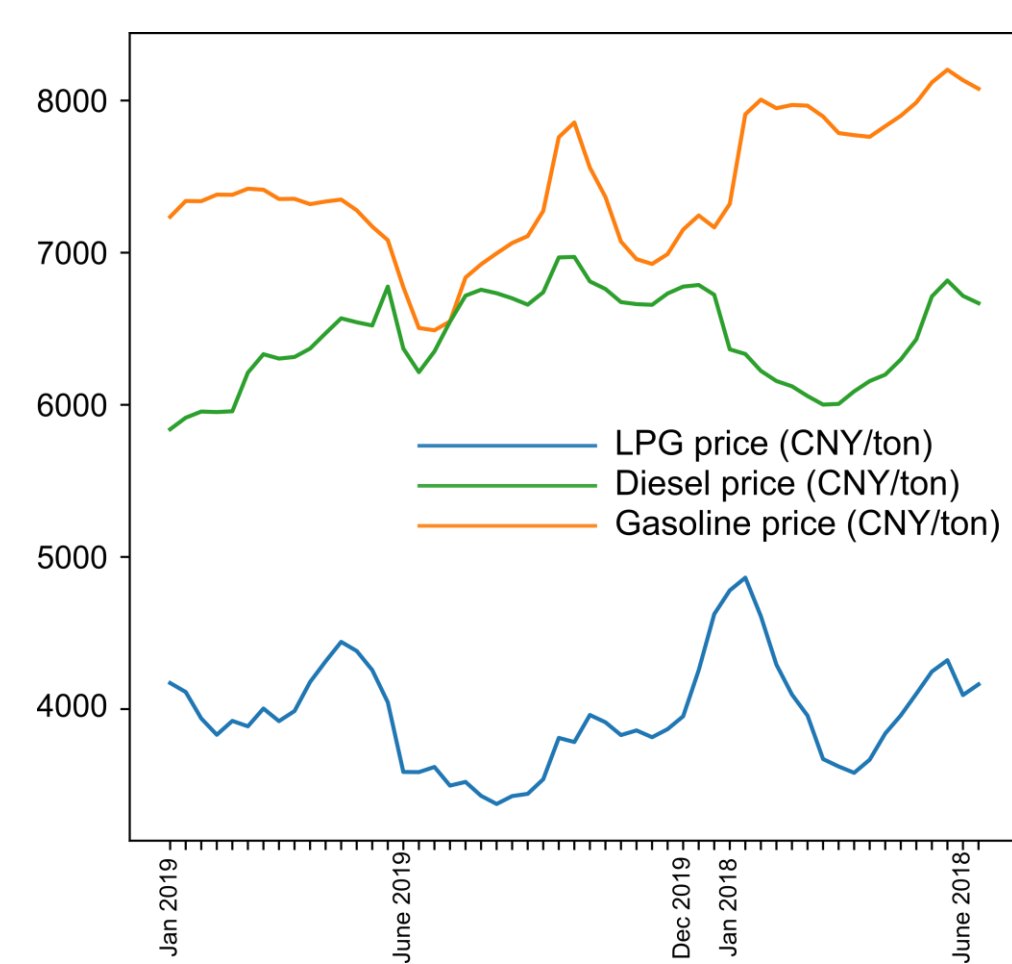


Fig. 3: Price of LPG, Gasoline, and Diesel in 2018 and 2019

Table 1: Biogas electricity price and subsidy by province

Biogas electricity price	Provincial desulfurization elec price	Subsidy	Special local bonus/price
Northeast power grid	√	√	
North China power grid	√	√	
*Hebei			🌸
East China power grid	√	√	
*Zhejiang	√	√	🌸
Central China regional grid	√	√	
Northwest regional grid	√	√	
Southern regional grid	√	√	

Hebei Province has a local unified price (in total). Zhejiang Province is the highest with temporary subsidy and subsidy for network connection.

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- Research data
 - straw (technical available)
 - mature (theoretical potential)
 - electricity price and subsidy (Table 1)
 - market prices (Fig.3)
- Based on methane potential, energy content of CH₄/coal/LPG/gasoline/diesel, energy substitution, value creation and unit value creation are calculated, analysed and compared.

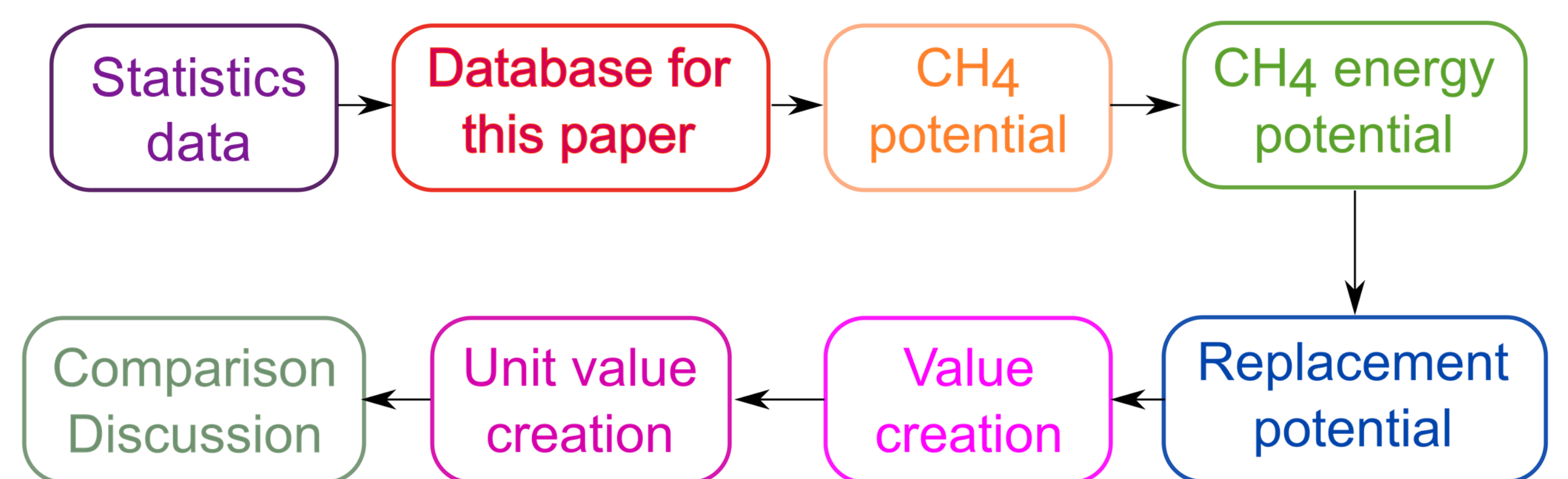


Fig. 4: Data and Calculation Steps

RESULTS AND DISCUSSION

Table 2: Comparison of unit value creation of biomethane

Type of energy/Unit value creation	UVC (CNY/m ³)	UVC (Euro/m ³)	UVC (USD/m ³)
Biogas Electricity (basic/with subsidy)	1.08/1.90	0.146/0.257	0.154/0.271
Biogas Heat	0.56	0,076	0.08
LPG Replacement	1.18/1.46/1.97	0.159/0.197/0.266	0.169/0.209/0.281
Natural Gas Replacement	1.41/3.17/3.53	0.191/0.428/0.477	0.201/0.453/0.504
Gasoline Replacement	5.52/6.57/8.16	0.746/0.888/1.103	0.789/0.939/1.166
Diesel Replacement	5.17/5.81/7.07	0.699/0.785/0.955	0.739/0.83/1.01

Based on the currency in December 2022, 1 Euro=7.40 CNY; 1 USD=7.00 CNY

- Vehicular use is the highest (gasoline>diesel), and followed by natural gas, and LPG.
- Electricity of CHP plant is low, and heat supply is the lowest. Higher provincial bonus promotes higher value creation.
- Work opportunity for both well-educated and less-educated people; rural vitalization

1 Chang Y, Stinner W, Thraen D, Value Creation of Biogas from Crop Residues in China (under review).
 2 Sun H, Wang E, Li X, Cui X, Guo J, Dong R (2021) Potential biomethane production from crop residues in China: Contributions to carbon neutrality. Renewable and Sustainable Energy Reviews 148:111360.
 3 National Bureau of Statistics; <http://www.stats.gov.cn/tjsj/>