

Supplementary - The accuracy improvement rate

This study finds that the accuracy of the measurement results has been significantly improved by constructing the accuracy improvement rate. The calculation method of the accuracy improvement rate is as follow:

$$\text{the accuracy improvement rate} = \frac{\text{The calculation results of seventeen energy} - \text{The calculation results of seven energy}}{\text{The calculation results of seven energy}} \cdot 100\%$$

The accuracy of energy consumption and carbon emissions in Chinese provinces is shown in Table 1 (2007, 2012, and 2017). After supplying the data of clean coal, briquette, and other energy types, we find that the calculation accuracy improvement rate can reach up to 144.21%, and the calculation accuracy improvement rate of carbon emissions can reach up to 183.70%.

Table 1 Accuracy improvement rate of energy consumption and carbon emissions measurement results (2007、2012、2017) (%)

Province	Energy consumption			Carbon emissions		
	2007	2012	2017	2007	2012	2017
Beijing	56.15	46.56	34.86	55.73	55.50	72.32
Tianjin	52.74	61.41	17.84	46.94	55.05	80.11
Hebei	34.83	36.43	14.87	31.01	33.75	32.28
Shanxi	46.61	31.94	90.42	45.20	31.53	17.67
InnerMongolia	15.36	11.48	28.18	14.14	11.50	14.17
Liaoning	89.14	75.47	37.67	74.53	66.63	79.79
Jilin	31.49	22.38	38.28	27.38	20.14	24.86
Heilongjiang	48.80	39.80	43.09	44.63	36.22	33.82
Shanghai	76.98	63.37	19.14	72.32	63.16	67.57
Jiangsu	37.58	34.75	49.35	32.68	32.06	36.32
Zhejiang	33.37	39.93	29.18	28.85	35.90	40.34
Anhui	27.98	14.63	60.26	25.57	13.68	17.86
Fujian	16.83	27.65	19.10	14.41	24.90	45.09
Jiangxi	38.65	33.02	38.16	33.71	30.99	27.14
Shandong	37.67	49.16	25.16	33.48	44.57	54.98
Henan	13.57	18.98	54.99	12.18	17.93	18.56
Hubei	30.14	25.01	48.22	27.58	23.27	35.84
Hunan	26.89	30.11	110.17	24.23	28.19	23.90
Guangdong	46.38	50.20	12.87	42.42	46.70	52.49
Guangxi	18.65	44.89	44.47	16.08	38.48	41.91
Hainan	144.21	82.81	12.39	183.70	106.27	131.87
Chongqing	12.47	20.76	20.31	13.55	23.09	14.68
Sichuan	17.18	28.57	16.97	18.20	31.26	49.27
Guizhou	8.71	13.28	48.75	8.62	12.63	11.20
Yunnan	15.76	23.86	14.30	14.84	23.62	19.24
Shaanxi	43.25	36.36	19.93	40.09	33.09	15.11
Gansu	68.27	47.88	27.07	59.28	41.71	44.38
Qinghai	26.34	14.47	31.44	28.60	15.45	16.16
Ningxia	13.88	18.77	34.86	12.71	17.28	18.00
Xinjiang	61.92	40.13	17.84	61.19	37.23	24.88