Beijing, Qinhuang island	18	Full time, full space	26	someone is in the room
Shanghai	18	Part time, part space	26	
Guangzhou	18	Part time, part space	26	

2.2.5 The parameter settings of the ventilation

The user is supposed to switching windows according to their demands. So the ventilation is supposed to change between the maximum and minimum. The setting of the maximum of ventilation rate is 5. The settings of the minimum of ventilation rate are in table 7.

The ventilation rate of the high-performance envelop residence is set to 0.6 h^{-1}@50 Pa. It convert to 0.17 h^{-1}@4 Pa .4Pa is the pressure difference between indoor and outdoor air in normal.

The kitchen and the bathroom need some fresh air to keep the air clean. According to the "Residential design code" , the ventilation rate of the kitchen and bathroom are set to 3 h^{-1}.

The parameter settings of the ventilation are in table 7. The ventilation of whole day is in fig.5.

Table 7. The parameter settings of the ventilation

	Infiltration air		Fresh air	Exhaust air of kitchen	Exhaust air of bath
	Ventilation rate (min) (h^{-1})	Ventilation rate (max) (h^{-1})	Ventilation rate (h^{-1})	Volumn （m^3/h）	Ventilation rate (h^{-1})
Passive house	0.17	5	0.5	400 m^3/h (when using)	$3h^{-1}$ (24h)
Berlin current standard	0.6	5	0		
Harbin current standard	0.5	5	0		
Beijing, Qinhuang islang current standard	0.5	5	0		
Shanghai current standard	1	5	0		
Guangzhou current standard	1	5	0		

2.2.6 Climate

The climate in Berlin is warm in winter and cool in summer. The climate in Barbin is cold in winter and cool in summer. The climate in Qinhuang Island and Beijing is similar, where the winter is cold and the summer is hot. But the winter in Qinhuang Island is colder than that in beijng. In Shanghai and Guangzhou, the winner is warm and summer is hot. But in Guangzhou the average temperature is higher than that in Shanghai.

Table 8. The average temperature by mouth

The average temperature by mouth(℃)												
Mouth	1	2	3	4	5	6	7	8	9	10	11	12
Berlin	1.9	0.3	5.4	8.3	14.0	17.6	19.1	18.5	15.0	10.2	4.4	2.4
Harbin	-18.7	-14.5	-2.6	7.7	14.2	20.0	22.8	21.0	14.7	5.2	-6.6	-14.8
Beijing	-4.4	-1.7	5.5	12.3	18.0	21.5	25.6	24.7	19.6	12.3	4.1	-1.7
Qinhuang island	-3.8	-1.5	7.7	14.4	19.3	24.5	26.4	25.6	20.4	12.9	5.4	-0.5
Shanghai	4.5	6.3	9.9	15.3	20.6	24.3	27.5	27.0	24.4	18.9	13.6	7.4
Guangzhou	13.9	14.2	18.3	22.4	26.1	27.2	28.8	28.0	27.4	24.3	20.2	15.5

2.2.7 The parameters of the economy analysis

In order to compare the differences of operation cost between high-performance envelop residence and current standard residence, this article analysed the operation fee economy thoroughly. The related parameters are shown as below:

Table 9. The parameters of the economy analysis

Parameters	Value	Unit
fan efficiency	50%	
Air condition cooling COP	2.8	
Air condition heating EER	1.7	
Electricity prices in Harbin	0.51	RMB/kWh
Electricity prices in Qinhuang island	0.52	
Electricity prices in Beijing	0.49	
Electricity prices in Shanghai	0.69	
Electricity prices in Guangzhou	0.58	

3. Results

The simulation results are in fig.6 and fig.7.

Fig.6 shows the simulation results of the building heating load: in Berlin, Barbin, Qinhuang island and Beijing, the high-performance envelop residence has more advantages than the current standard residence, whose heating load is significant lower. The annual heating load in Berlin is 23.4kWh/m2.a, which is 40% heating load of the current standard residence and meet the requirement of low-energy building in Europe. In Harbin, the annual heating load of the high-performance envelop residence is 39.1kWh/m^2.a, being 34% heating load of the current standard residence. In Qinhuang Island and Beijing, the heating load of the current standard residence is 69.5 kWh/m2.a and 58.9 kWh/m2.a separately. While when implementing the high-performance envelop residence, the heating load of the current standard residence drops to 11.2kWh/m^2.a and 9.9kWh/m^2.a, meaning lower heating load in the winter. Thus, by installing a spare heating equipment to get through the coldest days, the central heating system can be withdrawn. In Shanghai and Guangzhou, the residence heating load itself is low. So implementing the high-performance envelop residence doesn't make any differences especially in Guangzhou where the heating load is close to zero.

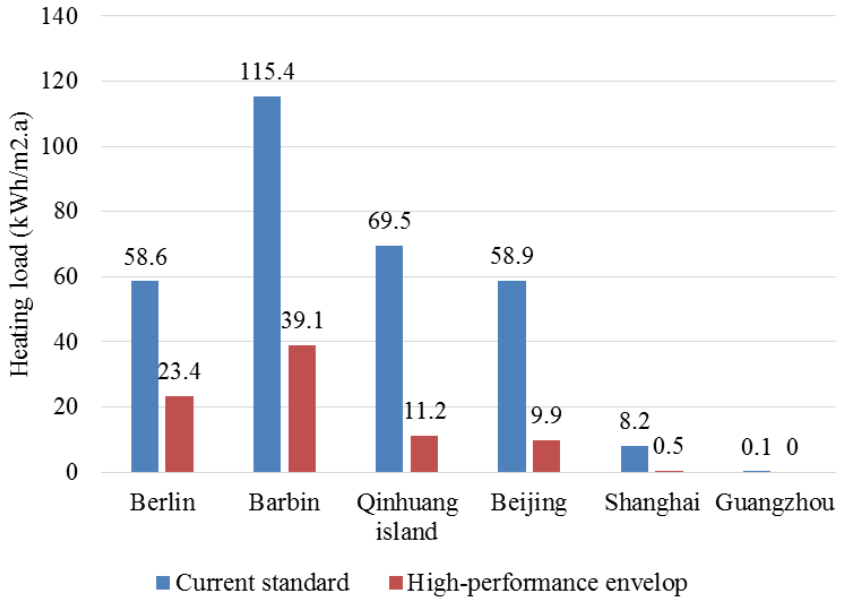

Fig.6 The simulation result of heating load

Based on the simulation results, the climate has a significant influence on the application of the high-performance envelop residence. It's more suitable built in cities like Berlin and north China. When it covers the south region, the disadvantage of the building is unveiled. Because it can reduce limited

heating load in the winter and add some cooling load in the summer. In conclusion, expanding the application of the high-performance envelop residence to South China still needs to be seriously discussed.

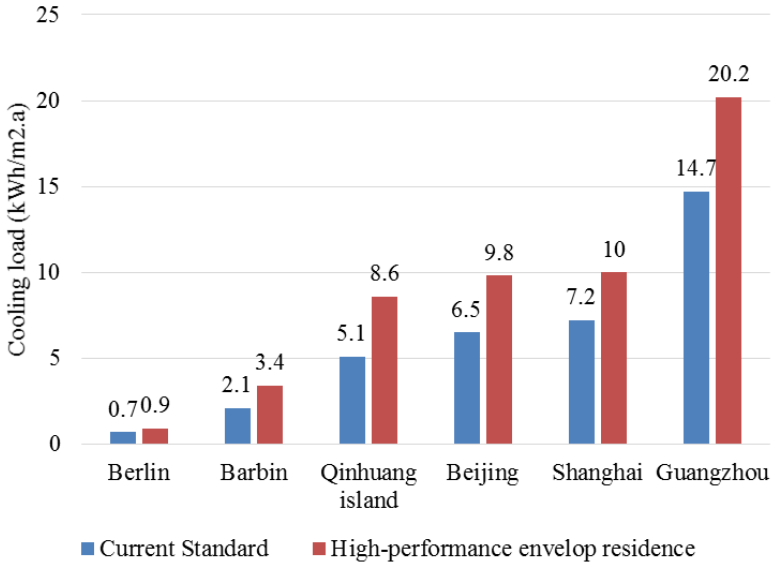

Fig.7 The simulation result of cooling load

In order to compare the differences of operation cost between high-performance envelop residence and current standard residence, this article did some calculation showing in Chart 8. And all the heating equipment of the current standard residence in the winter is heating pump. The result shows that in Harbin, the heating load decreased sharply by implementing the high-performance envelop residence and the cooling load increased a little. So the operation cost saving is most in Harbin, and the next in Qinhuang Island and Beijing. For Shanghai, the amount of the decreasing heating load and the increasing cooling load is almost the same, so as the operation cost. In Guangzhou the heating load itself is low. The application of the high-performance envelop residence will add its cooling load, which in turn increase the cost.

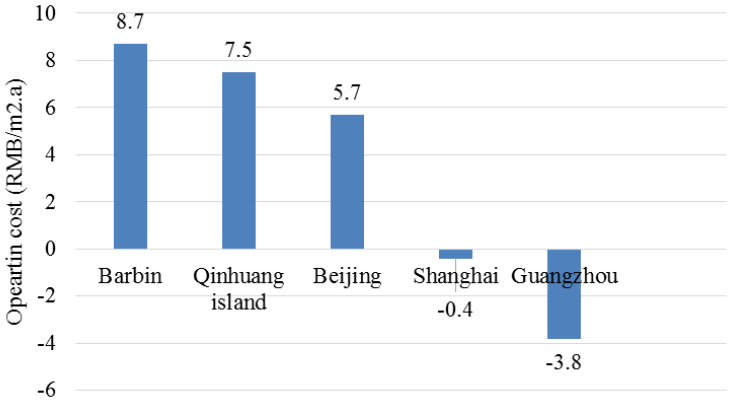

Fig.8 The reduced operating cost by using high-performance envelop residence

4. Conclusion

In order to study the application of the high-performance envelop residence in China, this article summarized the its current development and the discrepancy of research level in Europe and China, getting the key technical featuring factors of this type of building and taking them as input parameters. According to simulation in DeST, this article compared the differences of building energy consumption and operating cost between the high-performance envelop residence and the current standard residence. The results of the study as below:

(1) In North China (such as Barbin, Qinhuang island, Beijing), the heating load will reduce by using the high-performance envelop residence. Though it will add some cooling load, the annual operating cost still decrease. Thus considering the load and the operating fee, high-performance envelop residence is more apply for North China.

(2) In South China (such as Shanghai, Guangzhou), the heating load itself is low which is less important than cooling load. So expanding the application of the high-performance envelop residence to South China still needs to be seriously discussed.

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