Poster ID: 350

The 2024 international workshop on the high energy Circular Electron Positron Collider

Oct 22 - 27, 2024



Dou Wang[#], Jie Gao, Yuhui Li, Jinshu Huang, Song Jin, Manqi Ruan, Mingshui Chen, Shanzhen Chen

Abstract

The Higgs factory is a kind of special energy consumer and the environmental impact for the given scientific outcome must be optimized carefully. The carbon footprint of CEPC was estimated based on simplified model including both construction process and operation process. The environmental impact of CEPC with different circumference, different energy source, different SR power and different Higgs number was studied. The carbon intensity of China electric grid will be reduced rapidly by 2040 due to the development of renewable energies. Some results to compare the future colliders, including linear colliders and circular colliders, are given. Assuming all the colliders will use the same clean energy (20 ton CO2e/GWh), CEPC has the lowest carbon emission to produce one Higgs boson.

Current Status of Chinese Electricity Grid

Carbon intensity (kgCO2/kWh)

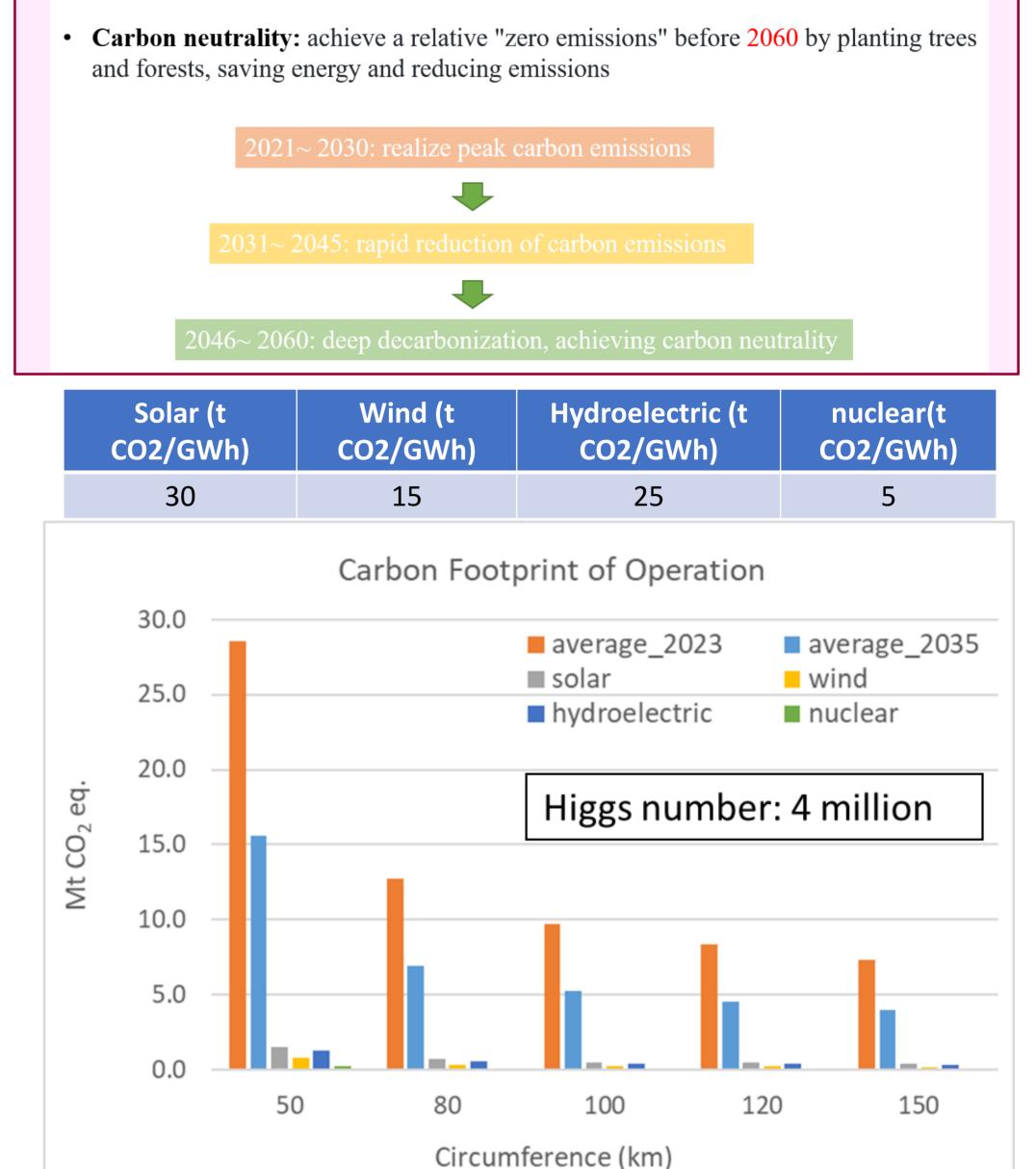


"Double Carbon Target" in China

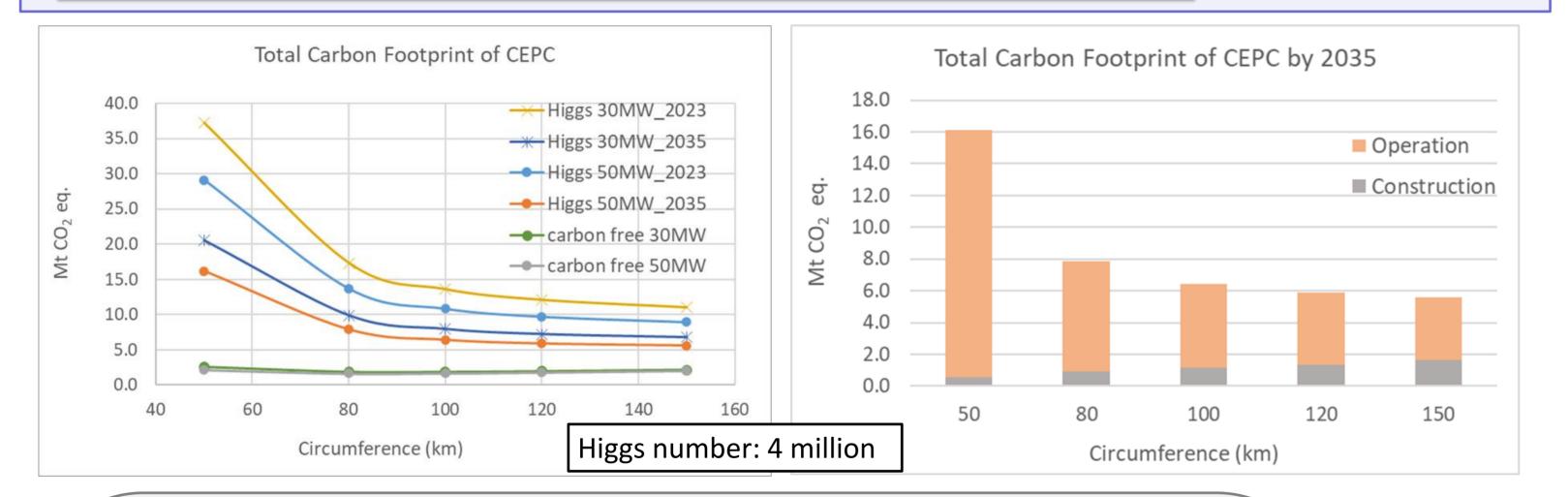
Peak Carbon Dioxide Emissions: China has pledged to reach carbon peak by 2030, and then gradually reduce carbon dioxide emissions.

江苏	省份	2010 年	2012 年	2018 年	2020 年	
	辽宁	0.836	0.775	0.722	0.91	
新疆	吉林	0.679	0.721	0.615	0.839	
山西 — — — — — — — — — — — — — — — — — — —	黑龙江	0.816	0.797	0.663	0.814	
云南	北京	0.829	0.776	0.617	0.615	
可南	天津	0.873	0.892	0.812	0.841	
所江	河北	0.915	0.898	0.903	(1.092) - Q	in Huang
	山西	0.88	0.849	0.74	0.841	
14L	内蒙古	0.85	0.929	0.753	1.000	
	山东	0.924	0.888	0.861	0.742	
Electricity Transr	mission: 上海	0.793	0.624	0.564	0.548	
	江苏	0.736	0.75	0.683	0.695	
極		0.682	0.665	0.525		Hu Zhou
理 変 North-to-Sou	LN 安徽	0.791	0.809	0.776	0.763	
	福建	0.544	0.551	0.391	0.489	
West-to-East	江西	0.764	0.634	0.634	0.616	
та в станование на станов На станование на станование н	河南	0.844	0.806	0.791		Zheng Zho
	湖北	0.372	0.353	0.357	0.316	
ipi in the second se	湖南	0.552	0.517	0.499	0.487	Chang Sha
	重庆	0.629	0.574	0.441	0.432	
2江 Coal	四川	0.289	0.248	0.103	0.117	
ith Gas	广东	0.638	0.591	0.451		Shen Shar
調 - Biomass	广西	0.482	0.495	0.394	0.526	
【庆 Solar	海南	0.646	0.686	0.515	0.459	
(理] Wind	贵州	0.656	0.495	0.428	0.439	
Nuclear	云南	0.415	0.306	0.092	0.146	
	医	0.415	0.769	0.767	0.641	
	甘肃	0.612	0.573	0.491	0.46	
0 4000 8000 12000 16000	青海	0.226	0.232	0.26	0.095	
Electricity Generating Capacity in China 2020 (10000 kW)						
		0.818	0.779	0.62	0.872	
	新疆	0.764	0.79	0.622	0.749	

谷份 2025 年 2030 年 0.035 (0.054) 0.037 (0.254) 近宁 (0.528,064) (0.432,0571) (0.31,048) 潮北 0.31 (0.307,0.317) (0.247,0.316) 市林 (0.559,054) (0.432,0571) (0.216,028) 潮市 0.453 (0.247,0.316) 東市 (0.559,054) (0.344,0472) (0.210,028) 潮市 (0.447,046) (0.97,0422) 東市 (0.648,063) (0.590,0621) (0.47,0538) (0.447,046) (0.97,0422) 北京 (0.559,054) (0.517,0612) (0.476,0532) (0.289 0.164 0.075 大津 (0.668,0709) (0.513,054) (0.415,048) (0.103,0107) (0.073,0075) 丁市 (0.668,0709) (0.537,054) (0.415,048) 广东 (0.316,053) (0.318,0351) 可計 (0.776,073) (0.559,043) (0.559,043) (0.517,043) (0.517,043) (0.517,043) (0.517,043) (0.517,043) (0.517,043) (0.317,043) (0.317,043) (0.318,043) (0.318,043) (0.317,043) (0.317,043) (0.317,043)	分子 0.6% 0.871 0.31 0.254 0.031 0.254 0.032 3 0.552.0654 0.432.0571 0.0342.0471 0.0342.0471 0.0370.0317 0.0247.0450 0.049 0.031 3 0.559.0591 0.584.0479 0.031 0.0470.0450 0.0490 0.031 0.0490 0.031 3 0.659.0591 0.590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.0590.021 0.04670.029 0.0310.029 0.0310 0.0250.039 0.0190.021 <	辽宁 吉林	0.578 (0.528-0.664)	0.496					
近宁 (0.528.0.664) (0.432.0.571) (0.342.0.408) (0.370.0.317) (0.247.0.316) 唐林 0.554 0.43 0.216 (0.370.0.317) (0.247.0.316) 憲紀江 0.6554 0.039 (0.210.281) (0.447.0.465) (0.397.0.422) 憲紀江 0.654 0.599 0.504 (0.447.0.458) (0.397.0.422) 北京 0.654 0.599 0.504 (0.447.0.458) (0.231.0.396) (0.193.0.04) 北京 0.658 0.519 0.289 \overline{D} (0.103.0.107) (0.073.0.075) 大市 0.6688 0.536 0.418 (0.415.0.448) (0.310.0.107) (0.073.0.075) 丁市 0.6688 0.536 0.418 (0.415.0.448) (0.312.0.51) (0.318.0.351) 丁市 0.6688 0.536 0.6152.0.571) (0.316.0.636) (0.312.0.32) (0.318.0.351) 丁市 0.707 0.7 0.7 0.78 (0.316.0.363) (0.312.0.32) (0.318.0.351) 丁市 0.6060 0.6546 0.498	1 - 7 $(0.528.064)$ $(0.432.051)$ $(0.324.047)$ $(0.324.047)$ $(0.324.047)$ $(0.324.047)$ $(0.244.0.316)$ $(0.244.0.316)$ $(0.194.0.216)$ $1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -$	吉林	(0.528-0.664)						
音杯 (0.559, 0.594) (0.384, 0.472) (0.210, 281) 湖南 (0.473) (0.497) 憲法記 (0.654) (0.599) (0.504) (0.474, 0.46) (0.377, 0.42) 北京 (0.654) (0.590, 0.621) (0.467, 0.253) (0.137, 0.42)<	δK $(0.599, 594)$ $(0.590, 694)$ (0.633) (0.049) (0.013)		0.564		(0.342-0.408)	湖北			0.202 (0.19-0.261
風光江 0.654 0.599 0.504 0.504 0.664 0.256 0.159 0.256 0.159 0.256 0.159 0.258 0.159 0.0280 0.010 0.0103 0.0132-0.0304 0.0159 0.0103 0.0159 0.0103 0.0159 0.0103 0.0103 0.0103 0.0173-0.075 0.0132 <td>0.684 0.594 0.594 0.594 0.634 0.595 0.595 0.645 0.636 0.256 0.179 $L\bar{L}$ 0.695 0.519 0.289 0.164 0.0210 0.0131 0.0111 0.0111 0.0111</td> <td>肥地江</td> <td></td> <td>(0.384-0.472)</td> <td>(0.210-0.281)</td> <td>湖南</td> <td></td> <td></td> <td>0.312</td>	0.684 0.594 0.594 0.594 0.634 0.595 0.595 0.645 0.636 0.256 0.179 $L\bar{L}$ 0.695 0.519 0.289 0.164 0.0210 0.0131 0.0111 0.0111 0.0111	肥地江		(0.384-0.472)	(0.210-0.281)	湖南			0.312
北京 0.0573-0.612) 0.076-0.532) 0.0089-0.299 四川 0.104 0.075 天津 0.688 0.536 0.418 (0.103-0.107) (0.073-0.075) 河北 0.668-0709) (0.53-0.584) (0.413-0.448) 广东 0.369 0.332 河北 0.736 0.683 0.544 (0.512-0.571) (0.316-0.363) (0.318-0.351) 山西 0.69-0.738) (0.666-0.733) (0.512-0.571) 0.336 0.334 小西 0.707 0.7 0.583-0.633) (0.512-0.571) 0.316-0.363) (0.317-0.373) 小西 0.69-0.738) 0.684-0.738 (0.533-0.633) (0.317-0.373) (0.317-0.373) 小西 0.546 0.498 0.383 0.54 0.326 0.224 小市 0.546 0.498 0.383 3 3 0.276 0.216 山东 0.537-0.619 0.325 0.281 3 3 0.276 0.297 山东 0.546 0.498 0.325 0.281 3	北京 100 (0.573.0612) 0.476.0532) 0.0280.299) 周川 0.014 0.075 0.044 天津 0.658 0.536 0.418 (0.103-0.107) 0.073.0.075) (0.0440 河北 0.668.0709) (0.653.0544) (0.414.0484) 0.0369 0.332 0.276 河北 0.736 0.6683 0.544 0.612.0571) 0.369 0.334 0.279 山西 0.777 0.7 0.598 0.512.0571) 0.336 0.334 0.2276 小西 0.707 0.7 0.598 0.612.0571) 0.366 0.0314.0351) 0.0269.02 小西 0.707 0.7 0.598 0.0364 0.0316.0322) 0.0318.0351) 0.0269.02 小香 0.566 0.498 0.0530.0333 0.325 0.224 0.115 小香 0.536 0.792 0.673 0.6673 0.398 0.226 0.224 0.116 小香 0.536 0.489 0.0325 0.284 0.039 0.026.02	WAZELL.	(0.648-0.683)	(0.590-0.621)	(0.467-0.528)	重庆	0.363	0.256	0.179
大津 (0.668-0.709) (0.53-0.584) (0.413-0.448) ()	$\chi \pi$ $0.668.0.709$ $(0.53.0.584)$ $(0.413.0.488)$ $\mu \pi$ 0.369 0.332 0.276 $\eta \pi$ 0.736 0.683 0.643 $0.512.0.571$ $(0.319.0.382)$ $(0.318.0.351)$ $(0.2290.0.290)$ $\mu \pi$ 0.707 0.7 0.598 $\mu \pi$ 0.336 0.334 0.327 $0.6290.0.290$ $\mu \pi$ $0.690.738$ $0.684.0738$ $0.683.0633$ $0.616.0.363$ $(0.317.0.373)$ 0.0224 $0.115.0.290.0.290$ $\rho \pi \pi$ $0.690.738$ 0.792 0.673 0.673 $0.631.0.236$ 0.0224 $0.115.0.256.0.256$ $\rho \pi \pi$ $0.536.0.561$ $(0.783.0.836)$ $(0.665.0.714)$ 0.326 0.224 $0.115.0.256.0.566$ $0.0489.0.506$ $0.036.0.276$ 0.024 $\mu \pi$ $0.536.0.561$ $0.0489.0.506$ $0.036.0.276$ 0.024 $0.012.0.29.0.296.0.278$ $0.0276.0.296.0.278$ $0.0146.0.296.0.296.0.278$ $0.0246.0.262.0.278$ $0.0246.0.262.0.278$ $0.0146.0.266.0.278$ $0.0246.0.266.0.278$ $0.0246.0.278.0.296.0.296.0.296.0.296.0.296.0.296.0.296.0.2$	北京	(0.573-0.612)	(0.476-0.532)	(0.208-0.299)	四川	0.104	0.075	0.04
河北 0.730 0.038 0.044 0.014 0.014 0.018-0.382 0.0318-0.381 山西 0.707 0.7 0.598 0.016 0.0336 0.034 0.034 山西 0.0707 0.7 0.598 0.0336 0.0336 0.0317-0.373 小市 0.669-0.738 0.0684-0.738 0.0583-0.633 0.0326 0.224 小市 0.8 0.792 0.673 0.0312-0.332 0.188-0.236 小市 0.546 0.498 0.383 0.325 0.224 小市 0.536-0.56) 0.0489-0.506) 0.036-0.386 0.398 0.276 山东 0.532 0.281 0.398 0.276 0.1 小市 0.333 0.325 0.281 0.061 0.052-0.278) 山市 0.601 0.512 0.281 0.093-0.102 0.050-0.075) 江市 0.601 0.512 0.411 0.0601 0.528-0.619 山市 0.590 0.0386-0.435) 0.0386-0.435 0.533-0.623	河北 0.730 0.030 0.030 0.030 0.030 0.030 0.0310 0.0300 0.0310 0.0290 山西 0.707 0.7 0.598 β^2 0.336 0.336 0.334 0.0290 $0.650-738$ $0.6684-0738$ 0.6580 0.0586 $0.0316-0363$ $0.0317.0.373$ $0.0260.382$ 0.836 0.792 0.673 0.673 $0.316-0.363$ $0.0317.0.373$ $0.0260.382$ 0.836 0.792 0.673 0.673 $0.316-0.363$ 0.0214 $0.0116.01660.016$ 0.836 0.792 0.673 $0.6650.714$ 0.326 0.224 $0.0116.01660.016$ 0.536 0.792 $0.6650.714$ 0.338 0.276 0.024 $0.012-0.329$ $0.0160.0186.02361$ $0.0146.026.029$ $0.0160.0186.02361$ $0.0260.029$ 0.024 1.56 0.333 0.225 $0.281.0469$ $0.0326.029$ $0.0260.029$ $0.0250.075$ $0.0250.0759$ 0.0601 $0.02.00.050.07$	天津	(0.668-0.709)	(0.53-0.584)	(0.413-0.448)	广东	0.369	0.332	0.276
山西 (0.69-0.738) (0.684-0.738) (0.583-0.633) (0.316-0.363) (0.317-0.373) 内蒙古 0.8 0.792 0.673 0.326 0.326 0.224 内蒙古 (0.591-0.836) (0.783-0.836) (0.665-0.714) 海雨 0.326 0.224 0.224 山东 0.546 0.498 0.383 0.383 0.398 0.276 0.266 山东 0.536-0.561 0.498 0.383 0.383 0.398 0.276 0.266 上海 0.333 0.325 0.281 0.386 0.498 0.601 0.0602 0.0602 江苏 0.601 0.512 0.411 0.607 0.601 0.601 浙江 0.418 0.386 0.307 0.607 0.601 0.528-0.619) 浙江 0.418 0.386 0.307 0.438 0.407 0.403 0.407 0.403 小江 0.755 0.694 0.395 0.695 0.443 0.407 0.403 0.407	hfg $(0.69-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.684-0.738)$ $(0.614-0.505)$ $(0.614-0.505)$ $(0.611-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$ $(0.610-0.505)$	河北	(0.714-0.784)	(0.666-0.733)	(0.512-0.571)	1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -			(0.269-0.29 0.279
内蒙古 0.8 0.792 0.673 海南 河南南 0.312-0.332 0.188-0.236 山东 0.546 0.0783-0.836 0.0665-0.714 0.312-0.332 0.188-0.236 山东 0.546 0.0489 0.383 贵州 0.398 0.276 0.536 0.0536-0.56) 0.0489-0.506 0.038-0.236 0.0393-0.408 0.026-0.278 上海 0.333 0.325 0.281 云南 0.1 0.062 (0.321-0.464) (0.312-0.432) (0.259-0.349) 云南 0.0607 0.0601 近苏 0.601 0.512 0.411 0.602 0.053-0.623) 0.0528-0.619) 浙江 0.418 0.386 0.307 0.053-0.623) 0.528-0.619) 浙江 0.418 0.386 0.307 0.413 0.407 (0.391-0.439) 小江 0.418 0.386 0.307 1 0.443 0.407 (0.391-0.439) 小江 0.418 0.564 0.596 0.433-0.469 0.407 (0.391-0.439)	$hggh$ 0.8 0.792 0.673 $hggh$ $hggh$ $(0.312.0.332)$ $(0.188.0.236)$ $(0.110.1)$ $hggh$ $0.791.0.836$ $(0.733.0.836)$ $(0.665-0.714)$ 0.398 0.276 0.204 $hggh$ 0.546 0.498 0.833 0.276 0.204 0.025 $(0.536.056)$ $(0.489.0506)$ $(0.36-0.386)$ \mathfrak{H} $0.0393.0.408$ $(0.26-0.278)$ $0.0146.0.25$ Lgg 0.333 0.325 0.281 \mathfrak{H} 0.010^2 0.0601 0.052^2 0.025^2 $0.312.0.404$ $(0.312.0.453)$ $(0.132.0.453)$ 0.025^2	山西	(0.69-0.738)	(0.684-0.738)	(0.583-0.633)				(0.26-0.308
山东 0.040 0.040 0.050 預州 (0.393-0.408) (0.26-0.278) 上海 0.333 0.325 0.281 元南 0.1 0.062 (0.321-0.464) (0.312-0.432) (0.259-0.349) 元南 (0.093-0.102) (0.05-0.075) 江苏 0.601 0.512 0.411 0.607 0.601 (0.579-0.639) (0.489-0.539) (0.386-0.435) 酸西 0.607 0.601 浙江 0.418 0.386 0.307 0.443 0.407 (0.391-0.439) 浙江 0.755 0.694 0.596 甘粛 0.433-0.469) 0.407 (0.391-0.439)	山东 0.050 0.0489-0.506 0.0489-0.506 0.050 0.050 0.0393-0.408 0.0.26-0.278 0.0146-0.200 上海 0.333 0.325 0.281 20.281 0.01 0.062 0.062 0.0250 上海 0.0321-0.464 0.0312-0.432 0.0259-0.349 20.01 0.0601 0.062 0.0022-0.0260 江苏 0.601 0.512 0.411 20.01 0.607 0.601 0.601 0.515 近苏 0.418 0.386 0.307 0.0433 0.4633 0.607 0.601 0.528-0.619 0.027-0.019 近江 0.418 0.386 0.307 1 0.433 0.407 (0.391-0.439) 0.223-0.01 近江 0.755 0.694 0.596 0.596 0.667 0.032 0.027-0.01 磁社 0.363 0.337 0.276 1 1 0.027-0.041 0.01-0.02 磁社 0.366 0.332 0.266-0.235 0.266-0.235 0.266 0.365 0.322-0.358	内蒙古	(0.791-0.836)	(0.783-0.836)	(0.665-0.714)	海南	*		(0.11-0.143
上海 (0.321-0.464) (0.312-0.432) (0.259-0.349) 云南 (0.093-0.102) (0.05-0.075) 江苏 0.601 0.512 0.411 0.607 0.601 0.601 (0.579-0.639) (0.489-0.539) (0.386-0.435) (0.533-0.623) (0.528-0.619) 浙江 0.418 0.386 0.307 0.443 0.443 小江 0.418 0.381-0.402) (0.289-0.314) 甘肃 0.443 0.755 0.694 0.596 1 0.433-0.469) 0.407 (0.391-0.439)	上海 (0.321-0.464) (0.312-0.432) (0.259-0.349) 云南 (0.093-0.102) (0.055-0.075) (0.022-0.075) 江苏 0.601 0.512 0.411 0.607 0.601 0.515 (0.579-0.639) (0.489-0.539) (0.386-0.435) 0.607 0.607 0.601 0.515 浙江 0.418 0.386 0.307 0.433-0.623) (0.528-0.619) 0.446-0 浙江 0.755 0.0381-0.402) 0.289-0.314) 甘肃 0.433 0.407 (0.391-0.439) 0.279 安徽 0.755 0.065-0.757) 0.546-0.644) 10.667 0.032 0.01 福建 0.333 0.279 10.048-0.078) 0.0077-0.041) 0.01-0.02 福建 0.363 0.33 0.279 10.048-0.078) 0.027-0.041) 0.01-0.02 福建 0.364-0.379) 0.0322-0.358) 0.266-0.293) 白星 0.724 0.665 0.459	山东	(0.536-0.56)	(0.489-0.506)	(0.36-0.386)	贵州	(0.393-0.408)	(0.26-0.278)	(0.146-0.20
江が (0.579-0.639) (0.489-0.539) (0.386-0.435) (0.586-0.435) (0.533-0.623) (0.528-0.619) 浙江 0.418 0.386 0.307 0.443 0.443 0.443 (0.412-0.427) (0.381-0.402) (0.289-0.314) 甘肃 0.443 0.407 (0.391-0.439) 0.418 0.694 0.596 1 1 0.443 0.407 (0.391-0.439)	近が (0.579-0.639) (0.489-0.539) (0.489-0.539) (0.386-0.435) (0.538-0.623) (0.533-0.623) (0.528-0.619) (0.446-0. が江 0.418 0.386 0.386 0.307 0.418 0.386 0.386 0.307 0.418 0.037 0.443 0.407 (0.391-0.439) 0.446-0. (0.412-0.427) (0.381-0.402) (0.289-0.314) 甘肃 0.443 0.407 (0.391-0.439) 0.223-0. (0.433-0.469) 0.433-0.469) 0.223-0. 交徹 0.363 0.65-0.757) (0.546-0.644) 青海 0.067 0.032 0.032 0.01 0.001 0.	上海	(0.321-0.464)	(0.312-0.432)	(0.259-0.349)	云南			0.025 (0.022-0.03
0.418 0.386 0.307 浙江 0.418 0.386 0.307 (0.412-0.427) (0.381-0.402) (0.289-0.314) 甘肃 0.443 0.407 (0.391-0.439) 0.755 0.694 0.596 1 1 0.407 (0.391-0.439)	浙江 0.418 0.386 0.307 0.413 0.443 0.279 (0.412-0.427) (0.381-0.402) (0.289-0.314) 甘肃 0.443 0.407 (0.391-0.439) 0.279 次位 0.755 0.694 0.596 (0.433-0.469) 0.032 (0.223-0.200) 安徹 (0.725-0.758) (0.65-0.757) (0.546-0.644) 青海 0.067 0.032 0.01 福建 0.363 0.33 0.27 (0.048-0.078) (0.027-0.041) (0.01-0.027-0.041) 福建 0.346-0.379) (0.322-0.358) (0.266-0.293) 白雪 0.724 0.665 0.459	江苏	(0.579-0.639)	(0.489-0.539)	(0.386-0.435)	陕西			0.515 (0.446-0.53
0.755 0.094 0.590	安徽 0.755 0.094 0.094 0.096 0.01 (0.725-0.758) (0.65-0.757) (0.546-0.644) 青海 0.067 0.032 0.01 0.363 0.33 0.27 (0.048-0.078) (0.027-0.041) (0.01-0.0 福建 (0.346-0.379) (0.322-0.358) (0.266-0.293) 会軍 0.724 0.665 0.459	浙江	(0.412-0.427)	(0.381-0.402)	(0.289-0.314)	甘肃			0.279
(0.725-0.758) (0.65-0.757) (0.546-0.644) 青海	福建 (0.346-0.379) (0.322-0.358) (0.266-0.293) 合面 0.724 0.665 0.459	安徽	(0.725-0.758)	(0.65-0.757)	(0.546-0.644)	青海	0.067		0.01
福建 (0.346-0.379) (0.322-0.358) (0.266-0.293) 合可 0.724 0.665	0.174 0.107 0.0750 (0.100.0.100)	福建	(0.346-0.379)	(0.322-0.358)	(0.266-0.293)	宁夏	0.724	0.665	0.459



\succ The carbon intensity will be reduced rapidly until 2035 in China.

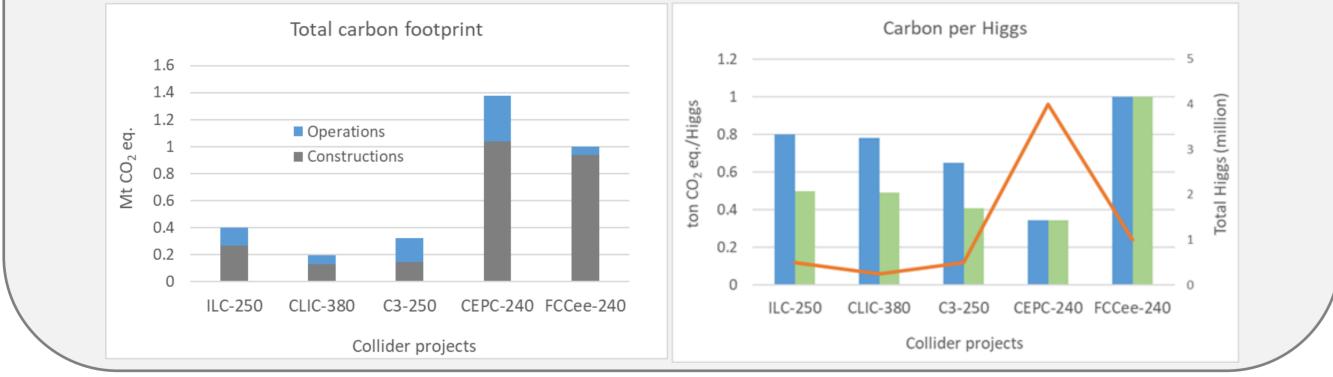


Carbon Footprint per Higgs boson 8.0 7.0 6.0 eq 5.0 CO_2 CO_2 for single Higgs: 0.5~ 2.5 ton 4.0 Ļ 3.0 2.0 1.0 0.0 80 100 120 140 40 60 160 Circumference (km)

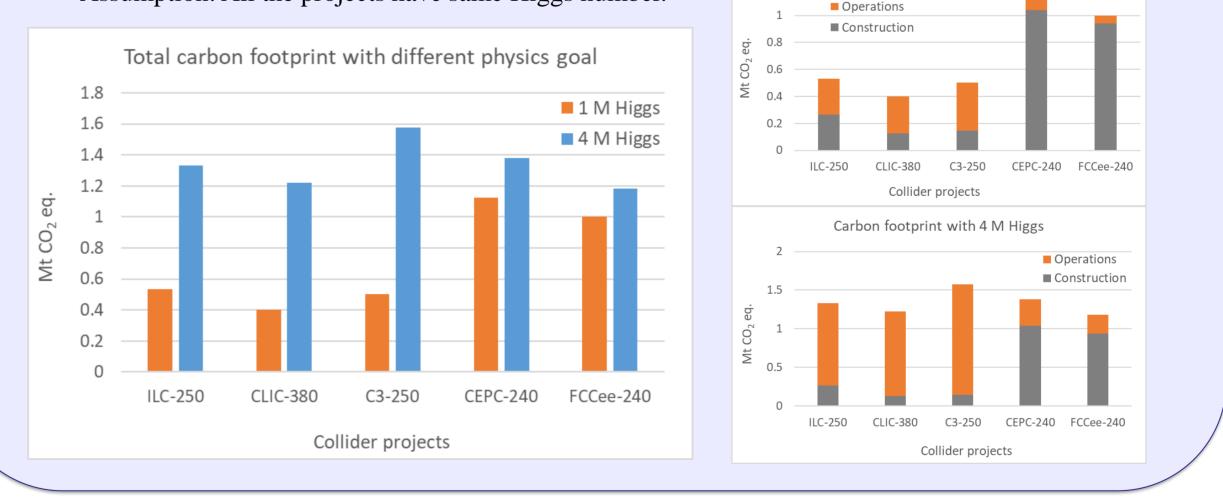
Total Carbon Emissions of Future Colliders

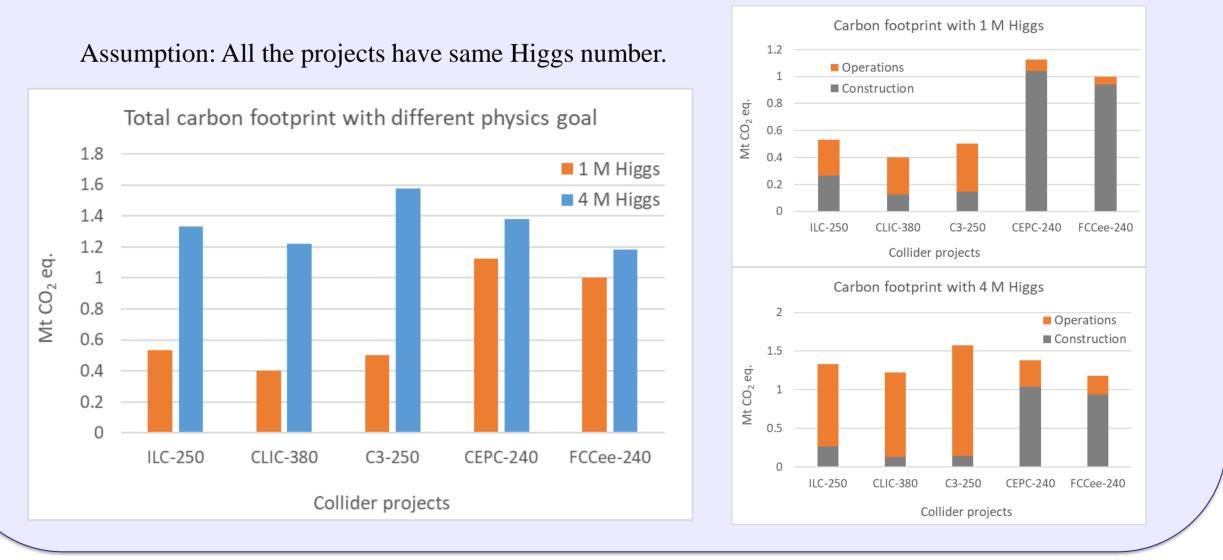
	ILC-250	CLIC-380	C3-250	CEPC-240	FCCee-240
Instantaneous power (MW)	111	110	150	340	290
Annual collision month	6.2	4.6	6.2	5.0	4.2
Annual collision time (E7 s)	1.6	1.2	1.6	1.3	1.1
Operational efficiency	0.75	0.75	0.75	0.57	0.75
Higgs operation time (years)	11.5	8	11.5	10	3
Higgs number (million)	0.5	0.25	0.5	4	1

Assumption: All the projects can use the same clean energy (20 ton CO2e/GWh (solar & nuclear))



Total Carbon emissions with different physics goal





- The carbon footprint of CEPC was estimated based on simplified model including both construction process and operation process.
- The environmental impact of CEPC with different circumference, different energy source, different SR power and different Higgs number was studied.
- The carbon intensity of the electric grid will be reduced rapidly by 2040 due to the development of renewable energies. And it is possible to consider using the dedicated renewable electricity plants for each collider project.
- Assuming all the colliders will use the same clean energy (20 ton CO_2e/GWh), CEPC has the lowest carbon emission to produce one Higgs boson.

The environmental impact of CEPC and strategies to lower the carbon footprint will be studied continuously.

#wangd93@ihep.ac.cn

Institute of High Energy Physics (IHEP), Beijing, China