CEPC Sites and Civil Engineering



Yu XIAO

Yellow River Engineering Consulting Co., Ltd. Nov. 2, 2021





05. Summary





Design Progress of Sites







黄河勘测规划设计研究院有限公司 Yellow River Engineering Consulting Co., Ltd.





中国电建集团华东勘测设计研究院有限公司 HUADONG ENGINEERING CORPORATION LIMITED





中南勘测设计研究院有限公司 ZHONGNAN ENGINEERING CORPORATION LIMITED



新加制规划设计研究院有限公司 Yellow River Engineering Consulting Co., Ltd.





From March 25 to 29, 2018

The starting point of Huzhou site

By October 2021

the work that has been done is as follows

- the General Office of the Zhejiang Provincial People's Government invited CEPC-SPPC project experts from The High Energy Institute to visit the four sites preselected in Zhejiang province, and organized a CEPC-SPPC site evaluation meeting in Zhejiang. Huzhou site was preliminarily recommended as candidate site of Zhejiang Province after analysis and study.
- CEPC report on site selection (Zhejiang Huzhou)

Answer the questions-Why did CEPC choose huzhou

- CEPC report on socio-economic assessment
 Answer the questions-Why did huzhou choose
 CEPC
- CEPC Technology Design Report on Civil engineering of the first stage
- CEPC report on science city concept plan

Find a comfortable home for scientists



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From December, 2018

The starting point of Changsha site

Zhongnan Company continually carries out necessity demonstration and study on construction technology on CEPC Changsha Site.

- In July 2021, the government of Changsha City entrusted Hunan University to take the lead in the demonstration of the settlement of the CEPC Project in Changsha.
- In September 2021, Hunan University organized the site review meeting of the Demonstration Report of China (Changsha) CEPC and New International Science City Project.







Civil Engineering Qinhuangdao Huzhou Changsha



2.1 Location





2.2 Climate





2.2 Climate

Huzhou

Changsha



Qinhuangdao





Annual mean precipitation

630mm	1023mm	1362mm



2.3 Engineering Geology





2.3 Engineering Geology

Tenow River Engineering Consulting Co., Ltd.	2.3 Engineering Geology	
Qinhuangdao	Huzhou	Changsha
	Stratum Lithology	
Gneiss Granite	Sandstone Tuff	Granite Sandstone, Slate



2.3 Engineering Geology





2.4 Project Layout









2.5 Equipment Layout

Linac & BTL Tunnel











2.6 Surface Buildings

IP1







2.7 International Science City

Huzhou



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Changsha







Auxiliary Facilities

• Electric power demand

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• Total: 270.37MW

	Contant for II'm		Location ar	nd Power R	lequirem	ent (MW)	T a t a 1
	(30 MW /beam)	Collider	Booster	Linac	BTL	IR	Surface building	(MW)
1	RF Power Source	103.8	0.15	5.8				109.75
2	Cryogenic System	15.67	0.89			1.8		18.36
3	Vacuum System	9.784	3.792	0.646				14.22
4	Magnet Power Supplies	47.21	11.62	1.75	1.06	0.26		61.9
5	Instrumentation	0.9	0.6	0.2				1.7
6	Radiation Protection	0.25		0.1				0.35
7	Control System	1	0.6	0.2	0.005	0.005		1.81
8	Experimental Devices					4		4
9	Utilities	31.79	3.53	1.38	0.63	1.2		38.53
10	General Services	7.2		0.2	0.15	0.2	12	19.75
	Total	213.554	20.972	10.276	1.845	7.385	12	270.37



- Power supplies and schemes
 - The voltage levels on the site
 - 220kV incomer of CEPC master substation.
 - 110kV power distribution system.
 - 10kV power distribution system for HV power equipment and step-down substation incomer.
 - 0.4kV power distribution system for dedicated and general services.
 - 220kV/110kV Master substation
 - 2 substations
 - Rated capacity of transformer: 2*210MW (220/110kV/10kV).
 - 220kV feeds connected to grid station nearby (State Grid Corporation of China).
 - Three-phase three-volume natural oil circulating air-cooled on-load regulating.



- 110kV/10kV step-down substations
 - 4 substations(IP1~IP4)
 - Rated capacity of transformer: 7*50MW+3*63MW



LSS3

• 10kV step-down substations

- 10kV feeders from 110kV/10kV substation nearby.
- Surface 10kV loop : 40
- Underground 10kV loop
 - -- 96 substations (10/0.4kV) along the ring tunnel
 - -- near the load points.
- Dry-type transformers
- Centralized reactive compensation
- Back up diesel generator sets maybe required for personnel safety: lifts, smoke extraction etc.
- Instrumentation and power converter control systems may require uninterrupted power supplies (UPS).





3.1 Electric engineering

• 110kV Substation load distribution

• IP1: 96MW

• IP2: 43MW

- IP3: 101MW
- IP4: 43MW

Power suppl	ly load	statistics	of substation -	— IP1
-------------	---------	------------	-----------------	-------

		Location	and election	r <mark>ical</mark> dema	nnd(MW)	
System for Higgs 30MW	Ring	Booster	And electrical demand(MW) LINAC BTL Surface building TO Image: Stress of the stres	TOTAL		
RF Power Source	51.90	0.08				51.98
Cryogenic System	7.84	0.45				8.28
Vacuum System	2.45	0.95				3.39
Magnet Power Supplies	11.80	5.80				17.60
Instrumentation	0.23	0.15				0.38
Radiation Protection	0.06					0.06
Control System	0.25	0.15				0.40
Utilities	7.95	0.88				8.83
General services	1.80				3.00	4. <mark>8</mark> 0
Total	84.27	8.45			3.00	95.72

Power supply load statistics of substation - IP3

		Location an	d electrical	demand(MW)	
System for Higgs 30MW	Ring	Booster	IR	_	Surface building	TOTAL
RF Power Source			0.90			0.90
Cryogenic System	2.55	5.79				8.34
Vacuum System	9.25	0.01	0.13			9.40
Magnet Power Supplies	2.45	0.95				3.39
Instrumentation	0.23	0.15				0.38
Radiation Protection	0.06		0.00			0.07
Control System	0.25	0.15	2.00			2.40
Utilities	7.95	0.88	0.60			9.43
General services	1.80		0.10		6.00	7.90
Fotal	24.53	7.93	3.73		6.00	42.19

Power supply load statistics of substation — IP2/4

		Location	and electr	r <mark>ical</mark> dema	and(MW)	
System for Higgs 30MW	Ring	Booster	LINAC	BTL	Surface building	TOTAL
RF Power Source	51.90	0.08	5.80			51.98
Cryogenic System	7.84	0.45				8.28
Vacuum System	2.45	0.95	0.65			4.04
Magnet Power Supplies	11.80	5.80	1.75	1.06		19.41
Instrumentation	0.23	0.15	0.20			0.58
Radiation Protection	0.06		0.10			0.16
Control System	0.25	0.15	0.20	0.01		0.58
Utilities	7.95	0.88	1.38	0.63		10.84
General services	1.80		0.20	0.15	3.00	5.15
Total	84.27	8.45	10.28	1.85	3.00	100.66



3.1 Electric engineering

- 110kV Substation layout
 - IP1/IP3
 - Main electrical wiring of 110kV substation
 - -- 110kV lines connected by the line transformer bank.
 - -- 10 kV lines connected by sectionalized single busbar.
 - Main transformer Outdoor;
 - 10 kV Switchgear indoor
 - Double-row arrangement;
 - Outgoing line by cables.
 - 110 kV GIS equipment in single row.









• Detailed statistics and construction scale of 10kV substations

	Substation Name	Num. of Substation	Diagram of 10kV	Circuit Num.	Load of 10kV Substation	Scale of Substation (0.4kV)	Location of Substation
1	IP1, IP3 10kV Substation	2	Single Bus section	3 incoming 24 outgoing	53.63MW(10kV) 10.17MW (0.4kV)	2x2000kVA	Nearby 1# &2# RF Power Tunnel 1#~2# Power Hall
2	IP2, IP4 10kV Substation	2	Single Bus 2 section	2 incoming 26 outgoing	2.73MW(10kV) 4.57MW(0.4kV)	4x2000kVA	1# & 2# IR Equipment Hall 3#~4# Power Hall
3	LSS1~LSS4 10kV Substation	4	Single Bus 2 section	3 incoming 10 outgoing	2.73MW(10kV) 0.82MW(0.4kV)	2x1250kVA	5#~8# Power Hall
4	LINAC 10kV Substation (31#)	1	Single Bus 2 section	2 incoming 10 outgoing	5.8MW(10kV) 4.476MW	2x2500kVA	LINAC
5	BTL 10kV Substation(32#)	1	Single Bus 2 section	2 incoming 2 outgoing	1.845MW	2x2000kVA	BTL
6	1#~30# grounding 10kV Substation	30	Single Bus 2 section	2 incoming 10 outgoing	0.96MW	2x1250kVA	Surface Substation
7	1#~96# Auxiliary Tunnel	96	Single Bus 2 section	2 incoming 2 outgoing	0.78MW	2x1000kVA	Auxiliary Tunnel

Total Load: 2xIP1 Load+2xIP2 Load+4x LSS1 Load+ 1xLINAC Load+1x BTL Load+30x Grounding Load+96x Auxiliary Load=272.2MW

- Estimated cooling loads of HVAC
 - Ring tunnel: 6MW
 - Service buildings: (200W/m²) 28MW

Total: 34MW

- Coolant for air conditioning: chilled water
- Heat source for heating system in winter
 - Heat pump -- heat recover from cooling system.
 - Backup boiler

Design Parameter	Unit	Quantity
Total cooling load	MW	34
Total chilled water flow rate	m³/h	5850
Total cooling tower water flow rate	m³/h	7016
Total capacity of cooling towers	MW	41

- Indoor Design Parameters
 - Tunnel
 - Temperature: within 30-34°C and shall be kept below 35°C
 - -- Inlet: 18~20°C
 - -- Outlet: less than 35°C
 - Relative humidity: 50% ~ 60%, and shall be lower than 65%
 - Experimental halls
 - Temperature: about 26°C(summer), 20°C(winter)
 - Relative humidity: 50% ~ 60%, and shall be lower than 65%.

Control room (or electronics)

- Temperature: about 20-25°C
- Relative humidity: 45% ~ 60%
- Other service building
 - Temperature: about 28°C(summer), 18°C(winter),
 - Relative humidity: lower than 65%

3.2 HVAC

• Air-conditioning system in tunnel

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- Layout
 - The ring tunnel is divided into 32 independent sections.
 - Each shaft serves as a ventilation and exhaust passage for the underground main ring tunnel, and a ventilation pipe and a smoke exhaust pipe are arranged therein.
- Operation scenario
 - Machine operation mode
 - -- Temperature and humidity in tunnel are maintained by inlet air.
 - Transitional mode
 - -- To purge air in the tunnel before access.
 - Accessible mode
 - -- The air flow rate could be cut down.
 - Emergency mode
 - -- In case of smoke and gas extraction.



3.2 HVAC



- RF auxiliary tunnels and experiment hall
 - Air conditioned and ventilated by mechanical supply and extraction of air via ducts in access shaft.
 - AHU is on ground level.
 - Dedicated smoke, gas extraction systems
- Auxiliary stub tunnels
 - Air supply ducts are led out from the air supply trunk duct in the collider ring tunnel to feed cold air into the auxiliary stub tunnel, and then air exhaust ducts are connected to the air exhaust trunk duct in the collider ring tunnel for exhausting hot air from the stub tunnel.
- Other service buildings
 - AHU
 - fan-coil + fresh air system







- Ventilation and smoke exhaustion system
 - It is proposed to combine the smoke exhaust system with the mechanical air exhaust system based on the layout features of underground caverns. Emergency smoke exhaust is applied to both the collider ring tunnel and the experiment halls.





• Function:

- Absorb heat, cooling process equipment.
- Provide a constant temperature environment.
- Adjusting resonant frequency.
- Composition:
 - **Dual circuit cooling mechanism**
 - LCW Direct cooling process equipment.
 - CTW Provide cold source for LCW.
 - DW—Supply low-conductivity water for makeup.
 - Waste water collection and discharge system
 - Cooling water control system





- Layout principle
 - Close to the heat load center.
 - Relatively concentrated.

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- Reasonable water supply radius.
- Minimize operating pressure.
- Layout scheme
 - Centralized water supply station:20
 - -- Linac—1
 - -- BTL—1
 - -- IR—2
 - -- Ring/Booster—16
 - Site

CTW and DW on surface; LCW are underground.



Cooling water system layout of CEPC



Subsystem partition

There are **50 closed-loop LCW and 20 CTW** subsystems in the LINAC, BTL, main ring, and experimental areas. They are defined **by equipment characteristics**, **operational requirements** (temperature, pressure, water quality, radiation dosage), and **location**.

System name	Location	Number	Main technical parameters	Number
Accelerating tube / Waveguide circuit	Linac	LCW-1	Q1=419m3/h, H=60m; Q2=476m3/h, H=40m; P=2519Kw	1
Power source (Linac) circuit	Linac	LCW-2	Q1=314m3/h, H1=40m; Q2=698m3/h, H2=40m; P=3692Kw	1
Power convert for Magent (Linac) circuitt	Linac	LCW-3	Q1=148m3/h, H1=55m; Q2=196m3/h, H2=40m; P=1035Kw	1
Magenet (Linac) ccircuit	Linac	LCW-4	Q1=244m3/h, H1=85m; Q2=280m3/h, H ₂ =40m; P=1483Kw	1
Cooling tower water circuit of Linac	Linac	CTW-1	Q1=1500m3/h, H1=40m, P1=8733KW; Q2=210m3/h, H2=40m, P2=1200KW	1
Power convert of Magent (BT) circuit	BT	LCW-5	Q1=17m3/h, H1=55m; Q2=22m3/h, H2=40m; P=120Kw	1
Magenet (BT) circuit	BT	LCW-6	Q1=151m3/h, H1=100m; Q2=176m3/h, H2=40m; P=931Kw	1
Cooling tower water circuit of BT	BT	CTW-2	Q1=198m3/h, H1=40m, P=1052KW; Q2=21m3/h, H2=40m, P=120KW	1
Magenet and condenser (Collide and Booste) circuit	Ring (Collide and Booste)	LCW-7	Q1=749m3/h, H1=120m; Q2=835m3/h, H2=40m; P=4427Kw	16
Vacum chamber circuit	Ring	LCW-8	Q1=677m3/h, H1=85m; Q2=762m3/h, H2=40m; P=4029Kw	16
Power source (Collide and Booste) circuit	Ring (Collide and Booste)	LCW-9	Q1=1984m3/h, H1=40m; Q2=4405m3/h, H2=40m; P=22839Kw	2
Power convert of Magent (Collide and Booste) circuit	Ring (Collide and Booste)	LCW-10	Q1=44m3/h, H1=55m; Q2=61m3/h, H2=40m; P=322Kw	8
Cooling tower water circuit of Ring — A	Ring	CTW-3	Q1=1380m3/h, H1=40m, P1=8009KW	8
Cooling tower water circuit of Ring — B	Ring	CTW-4	Q1=1440m3/h, H1=40m, P1=8334KW; Q2=60m3/h, H2=40m, P2=325KW	6
Cooling tower water circuit of Ring — C	Ring	CTW-5	Q1=5500m3/h, H1=40m, P1=31948KW; Q2=60m3/h, H2=40m, P2=325KW	2
Circuit for experiment area	IR	LCW-11	Q1=226m3/h, H1=80m; Q2=261m3/h, H2=40m; P=1380Kw	2
Cooling tower water circuit of experimeng area	IR	CTW-6	Q1=500m3/h, H1=40m, P1=2366KW; Q2=240m3/h, H2=40m, P2=1350KW	2
Cryogenic circuit	Ring (EX)	LCW-13	Q1=82m3/h, H1=50m; Q2=261m3/h, H2=40m; P=1380Kw	2
Cryogenic circuit	Ring (Collide and Booste)	LCW-12	Q1=555m3/h, H1=50m; Q2=1254m3/h, H2=40m; P=6630Kw	2
Deionized water system	Ring (Collide and Booste)	DW	$Q=5m3/h$, $12M\Omega$ cm	18

Subsystem partition of Cooling water



- Key requirements and parameters
 - Total heat load : 212.186MW
 - -- The heat load of 190.915MW dissipated by CEPC machine.
 - -- The heat load of 21.945MW dissipated by the motors of cooling water system.
 - Total flow rate of LCW: 30157 m³/h
 - Total flow rate of CTW: 40092 m³/h
 - Cooling water temperature
 - -- Cooling tower water temperature: < 29°C

(Base on wet-bulb air temperature of 27°C ambient; machine shut down in summer)

- -- LCW cooling water temperature: < 32 °C
- DW: Single DW unit can produce 3~5t/h deionized water with the effluent quality meets the following standards.
- -- Resistivity reach 18 MΩ•cm
- -- Other parameters satisfy EW-1 requirements.
- Water consumption: 14011m³/d (1.5% CTW)
- Storage capacity of low-level radioactive wastewater : 12150m³

- **LCW** (Low-conductivity water system)
 - Flow diagram :Take Accelerating tube / Waveguide circuit for example.

-- Main loop

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Various measures are set up to ensure flow distribution and pressure balance.

Trap particulate matter to prevent process equipment from blocking waterways.

Keep the system temperature stable through constant temperature control.

-- Bypass circulation

The main function of bypass system is to regulate the water quality and maintain the microenvironment of the LCW system.





3.3 Cooling water system

• LCW

- In order to slow down the corrosion rate of copper, iron and other metals as much as possible, the water quality of the system needs to be stable at a certain level. Specific parameters are as follows:
- -- Conductivity: 0.2~1µS/cm
- -- PH: 6.7~7.5
- -- DO: **≤20**
- -- Total bacteria: ≤10 CFU/mL
- -- TOC: ≤1mg/L
- -- PM: ≤10/mL (>1um)











3.3 Cooling water system

• LCW

- A variety of measures will be adopted to achieve these water quality objectives
- -- The flow rate through ion-exchange resin is about 1~5%.
- -- H⁺ and Na⁺ type resin are used to adjust the PH value of the LCW system.
- -- **Degassing device** is designed to remove dissolved oxygen in the LCW system,.

-- Nitrogen isolation is adopted to avoid LCW system contact with air.



• CTW (Cooling tower water)

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• Flow diagram :Take CTW station of LINAC for example.

This process can realize different operation modes and provide cold source for LCW and hot sources for HVAC.

- -- CTW≤ 29°C (by cooling tower)
- -- chilled water ≤ 14.5°C

(by Heat recovery chiller or cooling tower)

-- hot water

(by Heat recovery chiller, heat exchange and backup boil)





DW(Deionized water)

DW system provides deionized water for LCW and laboratory. The system consists of three parts: Ultra-pure Water Treatment System, water distribution network and water terminal.

- Ultra-pure Water Treatment System
- -- Adopt two-stage RO(reverse osmosis) and EDI process.
- -- The device can provide ultra-pure water with a resistivity of $18M\Omega$ cm.
- Water distribution pipe network
- -- CPVC, S316L or PVDF
- Experimental water requirements can satisfied by adding terminal filtration and water quality lifting devices.



WW(Waste water collection and discharge system)

• Process wastewater of CEPC consists of ordinary wastewater and low-level radioactive wastewater.

-- Ordinary process wastewater is discharged directly or recycled after treatment.

-- Low-level radioactive wastewater should be collected and stored for **natural attenuation**, and discharged or recycled according to relevant national standards and regulations after testing.

• According to the distribution of low-level radioactive wastewater discharge points and the possible discharge volume, many facilities need to be set up to collect and store.

-- Drainage ditches and catchment wells need to be set up along the tunnel, with the preliminary design of collecting well(V=2m³) is **one every 500 meters**, with the drainage slope is about 1‰.

-- There are 18 storage areas for low-level radioactive waste water underground. each storage volume is **the maximum volume of the water cooling subsystems in the area**.







• System Configuration



- Design Characteristics
 - ✓ High reliability (fast-switch/pressure protection/mutual standby)
 - ✓ Simplified specifications (pipes and pipe components, valves, instruments, etc.)
 - Leakage limited (easy measuring and analyzing)



3.4 Compressed Air System

• Plant Design Principle

- ✓ Easy to replace any equipment
- ✓ Compact procession layout
- ✓ Reasonable cooling system
- Distribution Design Principal
- Coordinate with other pipeline and accelerator equipment
- $\checkmark\,$ Easy to add pneumatic actuator
- Field personal protection (outlet safety design/warning sign/noise protection/etc.)







Design and Construction Schedule



			-	P							.9 .													
Design Stage			20)22					20	23				,	20	24					20	25		
设计阶段	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12
Project Proposal 项目建议书					Tope Initi	ograp ial geo	hic Su otechi Proje	urveyi hical i ect Pr	ng, nvest opos	igatio al	ns													
Feasibility Study 可行性研究报告											Topo Det	ograp ailed	hic Si geote Spe	urveyi echnic ecial T	ing, al inv opic	estig	ations							
												Fea	sibility	y Stuc	у									
Preliminary Design 初步设计																				Sup geo	pleme echni Prel	ntary cal inv imina	estiga ry De	ations sign
Tender Design 招标设计																		Tende	r Des	ign				
Tender 施工招标																				Ten	der ar	nd Aw	ard	

Implementation Planning before Construction

Start of Construction



General Construction Schedule

The total construction period is 54 months, including preparatory work of 8 months, main works of 43 months and completion work of 3 months.

The critical activities are:



The surface buildings and electrical installation are carried out in parallel and not on the main path.



In-depth	n study of the	e Jiang Huzhou	u Site	Overla	ıp			
2026	2027	2028	2029	2030	2031	2032	2033	
1	2	3	(4)	5	6	7	8)
51 m (including proj	onths ect preparation) 2	۲ 2026.1~2030.3 TE	BM excavation		Total du	ration of CEPC 96 month	c project is <mark>s</mark>	
63 months	2026.1~203	1.3 Drilling & B	lasting excavation	2030.1~2030.12 First-stage Cont	2 12months rol network constr	ruction and survey		
1.CEPC pro physical eo	oduction Incl quipment. It	uding civil wo will begin in 2	rks and installat 026 and end in	tion of 2033 ,	2030.10~2031.9 Second-stage Cor 2031	12months htrol network construct .1~2032.6	tion and survey 8 months	
The total of 2.The total	l civil works p	EPC project is period is 63 m	96 months. onths.		Support inst	allation and alignment	t	
3.The tota	l installation	period of phy	sical equipment	is <mark>48</mark>	Dipole m	agnets installation	To monuns	
months.							2032.9~2033. Installation of oth	10 moi er equipm
4. The Ove	erlapping per	iod of civil wo	orks and equipm	ent		Overall alignment and	6 months	2033.7~



Construction Organization Design

 Eight open-type TBMs will be adopted for construction, and the shafts of permanent structures can be used as launch shaft and receiving shaft of the TBMs.

 The total TBM construction period is 52 months, including 6 months for construction preparation, 43 months for construction of main works, and 3 months for completion.

	环形正负	电子	对撞机	(CEPC) म्ह	〔日	(长	;沙场址)		.)	±₹	こ建工程控制性施工进度表(TBM法)														
标识号	任务名称	工期	开始时间	完成时间				三年			=0:	二四年			=0=	五年		~	=0	二六年			;	コニ七年	ŧ
1	环形正负电子对撞机(CEPC)项目土建工程	1581 d	2023年1月1日	2027年4月30日	04	- <u>qr</u>	Q2	ųs	Q4	Q1	Q2	<u>ų</u> 3	Qt	QI	Q2	ų3	ų4	QI	ų2	Q3	Q.1		- <u>4</u> 2	Q3	<u> </u>
2	施工准备	181 d	2023年1月1日	2023年6月30日				施工准	备													<u> </u>		+	-
3	开工时间	0 d	2023年1月1日	2023年1月1日	-	• 1-1														1				+	-
4	完工时间	0 d	2027年4月30日	2027年4月30日																+			•	4-30	+
5	主环隧道工程(含直线加速器、伽马源等)	1188 d	2023年11月1日	2027年1月31日					-											 	 			+	-
6	通风竖井、交通竖井开挖	366 d	2023年11月1日	2024年10月31日									通风	竖井、	交通竖步	† 开挖				+				+	-
7	通风竖井、交通竖井衬砌	366 d	2024年2月1日	2025年1月31日					ᢡ)				通历	竖升、	交通昱:	并衬砌			1	1			+	-
8	组装洞、步进洞开挖	121 d	2023年11月1日	2024年2月29日					+	, i	1装洞、	步进洞	开挖							1				+	-
9	TBM安装	92 d	2024年3月1日	2024年5月31日						×	T	BM安装												-	
10	主环隧道开挖	638 d	2024年6月1日	2026年2月28日							×]3	:环隧1	开挖					
11	辅助隧道施工	61 d	2026年3月1日	2026年4月30日														Ť	- 舶	动隧道算	ίT.			-	
12	主环隧道衬砌和防水	276 d	2026年5月1日	2027年1月31日															*	 	 	= Ŧ	环隧道	衬砌和	防水
13	对撞区 (IR)	1066 d	2023年7月1日	2026年5月31日			•	_											-	+	+	h		-	-
14	交通洞开挖	336 d	2023年7月1日	2024年5月31日					-		ور ا	€通洞开	挖							1	1			-	
15	交通洞衬砌和防水	183 d	2024年6月1日	2024年11月30日							*		¢ر	通洞衬	砌和防2	ĸ				1	1			-	
16	竖井开挖	123 d	2023年7月1日	2023年10月31日				•	受力	开挖										-	1			-	
17	竖井衬砌	90 d	2024年12月1日	2025年2月28日									-	8	;井衬砌					-				-	
18	混凝土隔墙开挖	122 d	2024年6月1日	2024年9月30日					-		- *		混凝土	隔墙开	挖					1				+	-
19	隔墙混凝土	123 d	2024年10月1日	2025年1月31日									-	腦堆	混凝土					1				-	
20	试验大厅开挖	120 d	2025年2月1日	2025年5月31日										*	<u>ان</u>	、验大厅	开挖			1	1			-	
21	配厅开挖	122 d	2025年6月1日	2025年9月30日					-						- *		配厅开	挖		1				+	-
22	对撞区主环隧道开挖	487 d	2024年6月1日	2025年9月30日							*						对撞区	主环腱	道开挖					-	-
23	对撞区旁路隧道开挖	487 d	2024年6月1日	2025年9月30日							*						对撞区	务路隧	道开挖		1			-	
24	对撞区辅助隧道开挖	61 d	2025年10月1日	2025年11月30日													אך 📕	力撞区辅	助隧道	开挖				-	-
25	对撞区隧道衬砌和防水	182 d	2025年12月1日	2026年5月31日					+								*		n l	对撞区图	道衬砌	和動水		+	-
26	高频区(RF)	1066 d	2023年7月1日	2026年5月31日			•	-	-										-	 	 	Ħ		-	
27	交通洞开挖	336 d	2023年7月1日	2024年5月31日							لا	と通洞开	挖							1				+	-
28	交通洞衬砌和防水	183 d	2024年6月1日	2024年11月30日							+		19	通洞衬	砌和防2	ĸ				1	<u> </u>			+	
29	竖井开挖	123 d	2023年7月1日	2023年10月31日				+	竪扌	开挖										1	1		++	-	+
30	竖并衬砌	90 d	2024年12月1日	2025年2月28日									*	3	. 小衬砌					1	1		++	-	+
31	高频区主环隧道开挖	487 d	2024年6月1日	2025年9月30日							+						高頻▷	主环腿	道开救		1		++	-	+
32	高颏区辅助隧道开挖	487 d	2024年6月1日	2025年9月30日							±						高頻⊵	(辅助隧	道开救		+		++	+	+
33	高颏区辅助短隧道开挖	61 d	2025年10月1日	2025年11月30日													יו	「频区轴	助短	道开挖	+		++	+	+
3 4	高颏区隧道衬砌和防水	182 d	2025年12月1日	2026年5月31日													≛			高頻区層	道衬砌	和動水		+	-
35	设备安装	122 d	2026年6月1日	2026年9月30日																+	设备3	载	++	+	+
36	项目竣工验收	89 d	2027年2月1日	2027年4月30日																+	+	₩_	Ţ	町竣工	: 验收



Summary





Advance the preliminary civil engineering design as soon as possible.

In the early stage, comprehensive demonstration on technology, economy, social and environmental impact, water and energy conservation will be carried out to determine basically the sites through comparison. The demonstration will focus on project scale, technical proposal, land acquisition and resettlement, environmental impact and investment, and special demonstration will be conducted for key technical issues.



All sites can satisfy requirements for CEPC construction.



Construction method

Both drilling & blasting and TBM are feasible. Construction periods of the two methods are similar, and overall cost of drilling & blasting is lower.

With the continuous advancement of TBM technology, the cost of TBM equipment and operation are gradually reduced, while the labor cost of drilling & blasting method increases year by year. The advantages of TBM will be increasingly prominent for implementation of the Project.

