

## **Appendix F**

### **Investment Equipment in Three Years of Energy and power Engineering Program**

## 1. Investment list within near 3 years

List 1 Invested equipment in research center of thermal and power engineering.

Instrument Equipment Name	Quantity	Type	Total Price (10,000 RMB)	Unit Price (10,000RMB)	Producing Area
Heat exchanger test bench	4	LL-564B	7.68	1.92	China
Micromanometer	8	Testo-510	2	0.25	Germany
Renault Test Bench	2	LL-579	1.04	0.52	China
Refrigeration compressor performance test bench	2	LL-516	5.1	2.55	China
Blackness test bench	4	LL-571R	2.96	0.74	China
Boiler flow deviation test bench	2	LL-938R	6.2	3.1	China
Industrial fluid system combined energy-saving demonstration device	1		2.05	2.05	China
Velocity distribution test bench for flat surface layer	6		8.7	1.45	China
Steam turbine power generation experiment system	1		33.84	33.84	USA
Flame propagation and stability test equipment	1	C552	8.46	8.46	UK
Comprehensive heat transfer test bench	1	H112	35.13	35.13	UK
Blackness meter	2	KTL-526	1.02	0.51	China
Along the resistance test bench	2	KTL-602	1.9	0.95	China
Thermal conductivity tester	8	YQF-1	10.32	1.29	China
Environmental protection island model for desulfurization, denitrification and dust removal	1		8.777	8.777	China
Coal-fired generator set model	1		26.018	26.018	China
Low frequency signal generator	1		1.76	0.22	China
Hotline wind speed suit	8	Testo-440	4.5592	0.5699	China
Ultrasonic sensor system	1	K-U-001	1.598	1.598	China
Muffle furnace	1	STM-3-12	0.5	0.5	China
Vacuum atmosphere tubular resistance furnace	1	STGK-60-12	1.05	1.05	China

Vacuum pump	1	2XZ-2	0.145	0.145	China
Vacuum drying oven	1	DZF-6020	0.3285	0.3285	China
Blast drying oven	2	DHG-9246A	1.014	0.507	China
Electronic balance	1	BSM120.4	0.14	0.14	China
Heating magnetic stirrer	1	IT-07A3	0.15	0.15	China
Tableting machine	1	MRX-CP60	0.32	0.32	China
Solvent filter	1	1L+GM-0.20	0.119	0.119	China
Ultrasonic cleaning machine	1	SB-3200DT	0.26	0.26	China
Planetary ball mill	1	YXQM-0.4L	0.998	0.998	China
Low temperature thermostat	1	DC2015	0.6	0.6	China
Leakage current tester	1	N8320	2.4	2.4	China
Super capacitor electrode forming press-in fixture	1	Custom Made	1.2	1.2	China
Water source heat pump	1	WPWE0405SN	1.85	1.85	China
Phase change energy storage test bench	1	Custom Made	4.85	4.85	China
Powder contact angle measuring instrument	1	JF99A	4.5	4.5	China
Stainless steel water tank	1	200L Custom Made	0.189	0.189	China
High shear mixing emulsifier	1	BME100LX	0.46	0.46	China
Muffle furnace	1	STM-3-12	0.50	0.50	China
Vacuum atmosphere tubular resistance furnace	1	STGK-60-12	1.05	1.05	China
Vacuum pump	1	2XZ-2	0.15	0.15	China
Vacuum drying oven	1	DZF-6020	0.33	0.33	China
Blast drying oven	2	DHG-9246A	1.01	0.51	China
Electronic balance	1	BSM120.4	0.14	0.14	China
Heating magnetic stirrer	1	IT-07A3	0.15	0.15	China
Tableting machine	1	MRX-CP60	0.32	0.32	China
Solvent filter	1	1L+GM-0.20	0.12	0.12	China
Ultrasonic cleaning machine	1	SB-3200DT	0.26	0.26	China
Planetary ball mill	1	YXQM-0.4L	1.00	1.00	China
Low temperature thermostat	1	DC2015	0.60	0.60	China
Leakage current tester	1	N8320	2.40	2.40	China
Super capacitor electrode forming press-in fixture	1	Custom Made	1.20	1.20	China
Water source heat pump	1	WPWE0405SN	1.85	1.85	China
Phase change energy storage test bench	1	Custom Made	4.85	4.85	China
Powder contact angle measuring instrument	1	JF99A	4.50	4.50	China
Stainless steel water tank	1	200L Custom	0.19	0.19	China

		Made			
High shear mixing emulsifier	1	BME100LX	0.46	0.46	China
Vertical open type electric furnace	1	16QK-YC	4.88	4.88	China
Three-phase transformer	1	SG-75KVA	1.90	1.90	China
Program Intelligent Controller	1	*	1.72	1.72	China
Plasma test power supply	1	CTP-2000K	1.95	1.95	China
Open tube furnace	1	YFK60*1000/12Q K-GC	1.80	1.80	China
Box type resistance furnace	1	YFX12/12Q-GC	0.99	0.99	China
Analytical Balances	1	BSA124S-CW	0.90	0.90	China
Vacuum drying oven	1	DZF-6050	0.57	0.57	China
Spray desulfurization test bench	1	Custom Made	6.95	6.95	China
Chromatograph	1	GC7900	4.94	4.94	China
Microcomputer	1	M910t	0.54	0.54	China
Flow meter O2	5	SEC-E40MK3	8.43	1.69	China
Vacuum Photovoltaic Photothermal Integrated Combined System	1	Custom Made	16.52	16.52	China
Flat-panel photovoltaic panel heat source platform	1	Custom Made	13.50	13.50	China
Smart electric heater	1	Custom Made	0.90	0.90	China
Multi-degree-of-freedom solution stirrer	1	Custom Made	0.64	0.64	China
Photovoltaic module energy synergist	3	Custom Made	0.96	0.32	China
Phase change heat sink	4	Custom Made	0.88	0.22	China
Inject into the cavity	1	Custom Made	0.46	0.46	China
Data collector	1	KEYSIGHT34972A	1.50	1.50	China
20 channel module	1	34901A	0.40	0.40	China
Differential pressure transmitter	1	50-150Pa	0.59	0.59	China
Laser-induced fluorescence concentration measurement system	1	Non-standard customization	12.95	12.95	China
Differential pressure transmitter	1	CCY3051-H-2	0.21	0.21	China
Projector	1	IN114x	0.26	0.26	China
Peristaltic pump	2	UIP	0.40	0.20	China
Conventional scale flow drag reduction control experiment system	1	Non-standard customization	17.86	17.86	China

Circulating fluidized bed solid waste liquid waste incineration test bench	1	Non-standard development	15.00	15.00	China
PH meter	1	FE28-standard	0.30	0.30	China
Vacuum filtration	1	SHZ-D(III)	0.20	0.20	China
Muffle furnace	1	SX2-5-12N	0.60	0.60	China
Drying oven	1	DHG-9030A	0.27	0.27	China
Electronic balance	1	FA2004	0.27	0.27	China
Ultrasonic cleaning machine	1	KQ-300DE	0.30	0.30	China
Fixed bed reactor	1	FINErEaCtor-4100	18.00	18.00	China
Photocatalytic VOC removal system	1	Custom Made	18.45	18.45	China
Xenon light source	2	PLS-SXE300	3.50	1.75	China
Xenon light source	1	PLS-SXE300	1.75	1.75	China
Catalyst molding die	1	Customized	0.60	0.60	China
Mass flow controller	4	3660-1/4SW-NO-1SLM-20°C	2.76	0.69	China
Intelligent control instrument	1	KL-500	0.33	0.33	China
Intelligent control instrument	1	CR400	0.53	0.53	China
Catalyst molding preparation platform	1	Custom Made	19.27	19.27	China
Ultra pure water machine	1	Jycs-20L	0.45	0.45	China
Vacuum drying oven	1	DZK-6020	0.43	0.43	China
Xenon lamp trigger power	1	PLS-SXE300	1.80	1.80	China
Magnetic stirring water bath	2	SHJ-6AB	1.40	0.70	China
Magnetic stirring water bath	1	SHJ-6AB	0.70	0.70	China
Hand-held pump suction nitrous oxide detection alarm instrument	1	N2ODetection and measurement accuracy 3%RA400-N2O	3.30	3.30	China
Ultrasonic Disperser	1	FS-250N	0.85	0.85	China
Tube furnace	1	SLG1100-60	1.54	1.54	China
Homogeneous stirred reactor	1	HZ-6	1.58	1.58	China
Mass flowmeter	1	CS100A	0.69	0.69	China
Electrochemical Workstation	1	CHI660E	4.95	4.95	China
Fourier infrared analyzer gas pool	1	2m	17.44	17.44	China
co2 photocatalytic conversion test system	1	Perfectlight-co2S witch to gas quantitative collection and	17.45	17.45	China

		analysis system			
Homogeneous reactor	1	JXF-6-200	2.00	2.00	China
Plasma experimental power supply	1	CTP-2000K	2.45	2.45	China
Resistance furnace	1	SX2-10-12MP	1.01	1.01	China
Drying oven	1	BPG-9106A	0.50	0.50	China
High-speed centrifuge	1	TG18G- II	0.86	0.86	China
Theoretical calculation software	1	MedeA-VASP	18.80	18.80	China
Portable computer	1	L470	0.69	0.69	China
Platform car	1	PT300	0.17	0.17	China
Portable computer	1	Latitude5490	0.50	0.50	China
DISK Thermal constant analyzer module	1	TPS2500S	13.45	13.45	China
Improved test bench	1	Custom Made	9.05	9.05	China
Infrared imager	1	TI400	8.76	8.76	China
Circulating hot air test bench	1	Custom Made	2.70	2.70	China
Low temperature corrosion test sampling gun	1	Custom Made	9.36	9.36	China
monitor	1	271S7QJMB	0.15	0.15	China
Portable computer	1	T480s	0.99	0.99	China
Glove box	1	Super(1220/750/900)	12.00	12.00	China
Manual sealing machine	1	CR2016	0.24	0.24	China
Electrochemical analyzer	1	CHI660E	4.95	4.95	China
AC internal resistance tester	1	AT520	0.49	0.49	China
Electric roller press	1	BD-GY01	0.98	0.98	China
LAND Super capacitor test system	1	BT2013S-5V/50mA	0.45	0.45	China
LAND Battery test system	1	CT2001A-5V/2mA	0.45	0.45	China
Microcomputer	1	ThinkCentreM910t	0.86	0.86	China
Open tube sintering furnace	1	SLG1200-60	0.90	0.90	China
Pure water equipment	1	Jycs-10L	0.35	0.35	China
Ultrasonic processor	1	FS-300N	0.70	0.70	China
Gas Chromatograph	1	GC7900	6.78	6.78	China
UV-visible spectrophotometer	1	TU-1901	5.55	5.55	China
Xenon light source system	1	CEL-HXF300F3	1.60	1.60	China
Special optical power meter for strong light	1	CEL-NP2000-2	1.30	1.30	China
Photocatalytic reactor	1	CEL-HPR250T+	3.90	3.90	China
Vacuum drying oven	1	DZF-6020	0.25	0.25	China

MATLAB software	1	R2019a	2.37	2.37	USA
Cabinet	1	Kunpu 22U cabinet	0.22	0.22	China
Fully automatic sun tracking test bench	1	TMC-150D	18.00	18.00	China
Constant temperature and humidity test chamber	1	CX-H-800L	3.15	3.15	China
headphones	1	T90	0.29	0.29	China
Large-scale numerical calculation workstation	1	P510	2.97	2.97	China
Dynamic torque sensor	1	HK-TL3080_50N.M	0.37	0.37	China
Analytical Balances	1	HZ-104/35S	0.78	0.78	China
Thermostat	1	DC4006	0.96	0.96	China
CO2 heat pump performance test bench	1	Non-standard customization	50.22	50.22	China
Flowmeter	1	MIK-LZ	0.35	0.35	China
Multifunctional anemometer	1	TES-1341	0.16	0.16	China
workstation	1	P520	2.25	2.25	China
Low flow meter	1	FLR1011-D	0.45	0.45	China
Water pump	1	XL25WHBL3-15	0.16	0.16	China
Two-phase density meter	1	JN-300SL	0.35	0.35	China
High-precision fast thermal conductivity meter	1	TC3000L	15.30	15.30	China
server	1	P910	9.96	9.96	China
Physics simulation calculation program for subcritical reactor	1	SIMULINK-ADS	4.98	4.98	China
Steady-state integrated analysis program for lead-cooled fast reactor	1	STAC	4.99	4.99	China
Portable computer	1	EliteBook820	0.69	0.69	China
Thermal test power plant	1	Custom Made	4.53	4.53	China
Data acquisition and processing device	1	Custom Made	4.09	4.09	China
Two-phase flow hydraulic bench	1	Custom Made	4.35	4.35	China
Natural circulation thermal hydraulic device	1	Custom Made	4.95	4.95	China
Microcomputer	1	Lenovo P310	0.52	0.52	China
Wind resource environmental measurement system	1	Custom Made	1.94	1.94	China
Fully automatic tracking solar direct pyranometer	1	TBS-3	1.56	1.56	China

Pyranometer	1	TBQ-2	0.30	0.30	China
Modular training system for photovoltaic power station	2	TRM-JX1	28.00	14.00	China
Modular training system for photovoltaic power station	1	TRM-JX1	14.00	14.00	China
Wind power virtual training system	1	V1.0	36.00	36.00	China
Gas booster	1	Custom Made	1.20	1.20	China
Cold flow simulation test bench	1	HT-WT-400	9.80	9.80	China
Heavy-duty gas turbine combustion chamber flow simulation test bench	1	Custom Made GT-C-3-M	19.80	19.80	China
Numerical simulation and analysis software package	1	Numerical simulation and analysis of the flow in the combustor of a heavy gas turbine, customized	4.80	4.80	China
High frequency digital image acquisition system	1	LAB110	21.29	21.29	China
Continuous laser light source system	1	MGL-H-532-1W	4.28	4.28	China
High-precision micro-differential pressure data acquisition system in combustion chamber	1	Custom processing	19.50	19.50	China
Wind resource environment simulation system	1	Non-standard customization	19.70	19.70	China
Small scale wind turbine test bench	1	SYHR-WIND-SBS Y	18.50	18.50	China
Wind power experimental teaching system	1	HSNE-WIND-FZ CS	7.90	7.90	China
Wind power experiment data acquisition system	1	HS-PWT-8, Wind pressure, wind speed and wind temperature multi-channel acquisition system	4.50	4.50	China
Microcomputer	1	M910z	0.54	0.54	China
Data acquisition card	1	PS2016V	0.22	0.22	China



Hydraulic coupling	1	YOX-200	0.35	0.35	China
Handheld ATP fluorescence detector	1	M180306	0.49	0.49	China
Optical platform	1	POT-G-MOT-F	1.94	1.94	China
Ultra-fast microscopic observation system	1	12X, High-speed camera i-SPEED220	16.00	16.00	China
Magnetic stirrer	1	MS7-H550-ProS uit	0.27	0.27	China
Micro syringe pump	3	LSP01-1A	2.28	0.76	China
Teaching resource library for some equipment of coal-fired generating set	1	Custom Made	3.00	3.00	China
Multidisciplinary simulation platform	1	V1.0	8.20	8.20	China
Three-dimensional virtual simulation software for thermal power plant	1	600MW	46.50	46.50	China
Three-dimensional animation teaching resource library for main equipment of boiler system	1	600MW	6.50	6.50	China
Three-dimensional animation teaching resource library for main equipment of steam turbine system	1	600MW	6.50	6.50	China
VR device	5	Custom Made	6.60	1.32	China
VR high-performance parser	5	GTX1060-6G	4.50	0.90	China
Speaker equipment	1	1000TC	2.05	2.05	China
switch	1	DGS-1024T	0.15	0.15	China
Simulation student station	4	7050MT	2.55	0.64	China
Simulation trainer station	1	7050MT	0.64	0.64	China
Typical one-machine three-mode simulation software system	1	STAR-90	65.50	65.50	China
Simulation server	1	T630	2.95	2.95	China
AI translator	2	900	0.72	0.36	China
Centrifugal fan	1	4-72-6C-7.5kw	0.94	0.94	China
SCR Cold state model of denitration device	1	Custom Made	3.66	3.66	China
Electric heating blast drying oven	1	DHG-9075A	0.26	0.26	China
ME Analytical Balances	1	ME54	1.11	1.11	China

laser printer	1	ProMFPM226dnPrinter	0.22	0.22	China
Flowmeter	1	MFM-SHY-200	0.32	0.32	China
3D printer	1	Z-603S	0.40	0.40	China
Double potentiostat	1	CHI760E	5.28	5.28	China
Xenon light source	1	HF-GHX-XE-300X	0.95	0.95	China
Blue Power Battery Test System	1	CT2001A	0.55	0.55	China
workstation	1	Wind Tiger T20	4.95	4.95	China
Projector	1	VPL-EX433	0.30	0.30	China
Dual temperature zone tube furnace	1	OTF-1200X-II	2.49	2.49	China
Electric heating furnace	1	AOZHAN Three-stage	1.00	1.00	China
Drying oven	1	(80L)	0.27	0.27	China
Programmable box type resistance furnace	1	SX2-8-10NP	0.56	0.56	China
Gas Chromatograph	1	7920-FPD	4.50	4.50	China
Magnetic stirrer	2	TO9-1S	0.85	0.43	China
Automatic six-way switching valve	1	Automatic six-way	0.70	0.70	China
Gas chromatography	1	GC7920-DTF2A	5.50	5.50	China
Low temperature cold source circulating pump	1	CEL-CR300(LX300)	0.50	0.50	China
Xenon light source system	1	CEL-HXF300E7	2.00	2.00	China
Photocatalytic activity evaluation system	1	CEL-SPH2N-D9	6.50	6.50	China
Metal 3D printer	1	EP-M250	136.52	136.52	China
High-precision multi-dimensional magnetic field test system	1	F-30	14.80	14.80	China
Interactive smart tablet	2	Xiwo F86EA	7.96	3.98	China
Projector	1	CB-2155W	1.07	1.07	China
Heat pipe-U-shaped tube heat storage system	1	Custom Made	4.60	4.60	China
Vacuum drying oven	1	DZF-6210	2.30	2.30	China
Constant temperature oil bath circulation tank	2	BILON-HH-30BS	5.20	2.60	China
Data collector	1	34972A	2.52	2.52	China
Ultrasonic Dispenser	1	Scientz-1500F	3.40	3.40	China
Manual powder tablet press	1	SYP-24BF	0.85	0.85	China
Blast drying oven	1	DHG-9245A	0.43	0.43	China

TRNSYS software	1	V18	3.00	3.00	China
Ceramic heating plate	1	CHP-170DF	0.23	0.23	China
Battery test platform	1	Custom Made	0.20	0.20	China
One-dimensional thermal fluid system flow analysis software	1	*	19.90	19.90	China
Detachable natural stratified cold storage water tank	1	Custom Made	13.98	13.98	China
Solar photovoltaic power generation teaching experiment platform	1	Non-standard customization	18.80	18.80	China
DC inverter compressor	1	BSG133SDFB7AT	0.28	0.28	China
Water tank	1	Custom-150L pressure	0.24	0.24	China
Heat pipe/heat pump composite system optimization test platform	1	Custom Made	17.83	17.83	China
Temperature and humidity sensor	3	QFM3160	0.46	0.15	China
Power plant virtual design and optimization simulation software	1	V15	9.00	9.00	China
LabVIEW Development System	2	LabVIEW full version	4.98	2.49	USA
Statistical analysis software	1	SPSSStatistics (Stand-alone Platinum Edition)	5.50	5.50	China
System operation modular dynamic simulation software	1	&TESS (V17)	5.00	5.00	China
server	1	PowerEdgeT430	3.40	3.40	China
Power station thermal calculation software	1	V12	14.48	14.48	China

## 2. Part of the laboratory equipment



Fig 1. Fluid Mechanics Laboratory

Fig. 2 1000MW ultra-supercritical unit model



Fig. 3 Rankine Cycle Experimental System

Fig. 4 Combustion experiment device