上海电气
SHANGHAI ELECTRIC

上海电气核电产业
NUCLEAR POWER BUSINESS OF SHANGHAI ELECTRIC

上海电气是一家大型综合性装备制造集团，主导产业聚焦能源装备、工业装备、集成服务三大领域，致力于为客户提供绿色、环保、智能、互联于一体的技术集成和系统解决方案。

核电是上海电气关键产业之一。

上世纪70年代发展至今，上海电气已成为国内发展历史最久、交付业绩最多、产品配套最全、技术路线最广、装备能力最强、全球合作最深的核电装备制造集团。

已成功实现了二代加、三代AP1000、EPR、华龙一号及四代高温气冷堆核电主设备产品的批量化、配套化交付；正在开发和研制三代国和一号、四代快堆、钍基熔盐堆等关键设备；同时，响应国家“核电装备走出去”战略发展要求，与Framatome集团合作承制的南非Koeberg核电站6台更换蒸汽发生器的正在紧张制造中。

Shanghai Electric is a large integrated equipment manufacturing group specialized in energy equipment, industrial equipment and integration services. It is committed to providing customers with technology integration and system solutions incorporating green, eco-friendliness, intelligence and Internet.

Nuclear Power Business is one of the key businesses of Shanghai Electric.

With the development since the 1970s, Shanghai Electric has become the nuclear power equipment manufacturing group in China with the longest development history, the most manufacturing deliveries, the most complete supply chain, the most widely applied manufacturing technology, the maximum equipment capacity and the broadest international cooperation. Shanghai Electric has realized the mass production and complete-set delivery of nuclear major equipment with the second generation plus technology, the third generation technology including AP1000, EPR & HPR1000 and the fourth generation technology such as High Temperature Gas Cooled Reactor (HTR) and is developing and manufacturing key equipment of the third-generation CAP1400 technology and the fourth generation technology such as China Fast Reactor (CFR) & Thorium Molten Salt Reactor (TMSR). Meanwhile, as a response to the national development strategy of “Nuclear Power Equipment Going Global”, Shanghai Electric is manufacturing 6 replacement steam generators for Koeberg nuclear power plant in South Africa in cooperation with Framatome.

发展历史最久
THE LONGEST DEVELOPMENT HISTORY

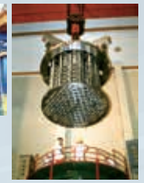
上海电气核电发展与我国核工业的发展紧密相连。自上世纪70年代我国自行设计制造建设的第一座核电站——秦山核电站（“七二八”工程）开始，上海电气参与了我国多个核电项目的建设，提供了各类的核电关键设备，由此开始了上海电气核电产业的发展历程。

The development of Shanghai Electric's nuclear power business is closely connected with the development of China's nuclear industry. From Qinshan NPP (the "728" Project) which was China's first NPP designed, manufactured and constructed on our own in the 1970s, Shanghai Electric has participated in the construction of many nuclear power projects in China and provided all kinds of key nuclear power equipment. Thus, the development of Shanghai Electric's nuclear power business was started.

1970

- 1970年代，参与“七二八”工程前期准备和研制工作

Participated in the preparation and research of the‘728’Project in the 1970s.



1996

- 1996–1998年，交付了我国首台出口巴基斯坦恰西玛核电站的堆内构件、控制棒驱动机构、蒸汽发生器、稳压器及汽轮发电机组

Supplied RVI, CRDM, SG, PZ and turbine-generator unit for Chashman NPP in Pakistan, China's first export project, from

2000

- 2000–2001年，交付了我国首台600MW核电站——秦山二期核电站的堆内构件、控制驱动机构、压力容器、蒸汽发生器及稳压器

Supplied RVI, CRDM, RV, SG and PZ for Qinshan Phase II, China's first 600MW NPP, from 2000 to 2001.

2011

- 2011–2016年，交付了国内承制的首台EPR台山核电站的堆内构件、控制棒驱动机构、安注箱；交付了国内首批EPR蒸汽发生器

Delivered RVI, CRDM, ACC tank for Taishan NPP, the first EPR NPP in China and the first batch of EPR SG manufactured in China from 2011 to 2016.

2018

- 2017–2018年，交付了全球首台华龙一号HPR1000暨福清5号机组的堆内构件、人桥吊、辅助吊；我国首台出口巴基斯坦卡拉奇项目的堆内构件、汽轮发电机组

Delivered RVI, spent fuel pit cranes & auxiliary cranes for Fuqing Unit 5, the first HPR1000 unit in the world, and the first RVI and turbine-generator unit exported to Karachi NPP in Parkistan from China.

1988

- 1988–1989年，交付了我国首个核电站——秦山核电站的堆内构件、控制棒驱动机构、蒸汽发生器、稳压器及汽轮机发电机组

Supplied RVI, CRDM, SG, PZ and turbine-generator unit for Qinshan NPP, China's first NPP, from 1988 to 1989.

1999

- 1999–2000年，交付了国内承制的首台1000MW核电站——岭澳一期核电站的堆内构件及控制棒驱动机构

Supplied RVI and CRDM for LingAo Phase I, China's first 1000MW NPP, from 1999 to 2000.

2010

- 2010–2012年，交付了国内承制的首台二代改进型1000MW核电站堆内构件、蒸汽发生器、控制棒驱动机构；交付了上海电气首台1000MW核电汽轮发电机组

Delivered RVI, CRDM and SG for China's first 1000MW NPP of second-generation plus and Shanghai Electric's first 1000MW nuclear turbine-generator unit from 2010 to 2012.

- 2010–2015年，交付了全球首台AP1000三门核电站的安注箱、堆芯补水箱、稳压器，交付了国内承制的首台AP1000堆内构件、控制棒驱动机构以及全球首批AP1000压力容器、蒸汽发生器

Delivered ACC tank, CMT and PZ for Sanmen NPP, the first AP1000 NPP in the world, the first AP1000 RVI & CRDM in China and the first batch of AP1000 RV and SG in the world from 2010 to 2015.

2016

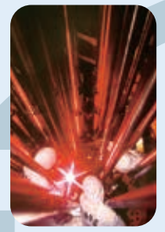
- 22016–2018年，交付了全球首台200MW高温气冷堆石岛湾核电站的压力容器、金属堆内构件、控制棒驱动机构、吸收球装置、汽轮机、主氦风机、氦气压缩机

Delivered world's first 200MW HTR RV, RVI, CRDM, absorption sphere device, turbine, helium fan and helium compressor for Shidao Bay NPP.

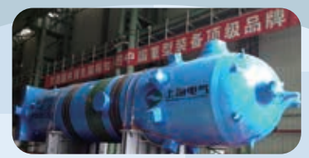
产品配套最全
THE MOST COMPLETE SUPPLY CHAIN

经过近50年的发展，上海电气已形成国内配套最全的核电设备制造产业链，所提供的核电产品包括核岛的反应堆压力容器、蒸汽发生器、堆内构件、控制棒驱动机构、主泵、稳压器、核二、三级泵、核二、三级容器、燃料输送设备、核级阀门，到常规岛的汽轮机、汽轮发电机、辅机、常规泵，以及大型铸锻件、核级风机、配套电机、仪控仪表、现场服务及备品备件等。

After nearly 50 years of development, Shanghai Electric has formed the most complete nuclear power equipment manufacturing industrial chain in China. It has the capability to supply reactor pressure vessel (RV), steam generator (SG), pressurizer (PZ), reactor vessel internal (RVI), control rod drive mechanism (CRDM), reactor coolant pump (RCP), pumps and vessels of Nuclear Class II & III, fuel handling equipment and nuclear valves in nuclear island, turbine, turbine-generator, auxiliary equipment and pumps in conventional island, large nuclear castings & forgings, nuclear fans, motors, nuclear control & instrumentation and spare parts & on-site services, etc.



驱动机构
Control Rod
Drive Mechanism



稳压器
Pressurizer

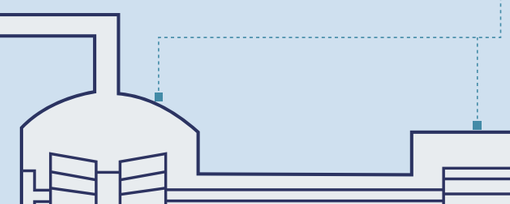
堆内构件
Rector Vessel Internals

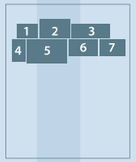
压力容器
Rector Pressure Vessel

反应堆主冷却剂泵
Rector Coolant Pump

蒸汽发生器
Steam Generator

汽轮发电机组
Turbine-generator Unit





1. 燃料输送设备
Fuel handling Machine
2. 核二三级容器
Class 2 & 3 Vessel
3. 核二三级泵
Class 2 & 3 Pump
4. 核级仪表
Instrumentation
5. 辅机
Heat Exchanger
6. 核电大锻件
Forgings
7. 电机
Forgings

核岛
NUCLEAR ISLAND

反应堆压力容器、蒸汽发生器、稳压器
REACTOR PRESSURE VESSEL, STEAM GENERATOR, PRESSURIZER

上海电气已实现三代AP1000百万千瓦级核岛重型容器—压力容器、蒸汽发生器、稳压器、堆芯补水箱和EPR蒸汽发生器、四代200MW高温气冷堆压力容器等设备的交付，标志着上海电气实现了制造能级从60万千瓦到100万千瓦、技术能级从二代加、三代到四代技术的重大突破。

目前上海电气在制的核岛重型容器包括我国自主三代技术的国和一号CAP1400石岛湾项目、华龙一号HPR1000惠州、宁德项目、CAP1000三门、海阳、陆丰等项目的反应堆压力容器、蒸汽发生器、稳压器；出口南非Koeberg核电站的6台蒸汽发生器及四代钍基熔盐堆堆容器等项目。

Shanghai Electric has realized the delivery of AP1000 1000MW nuclear island heavy components—reactor pressure vessel, steam generator, pressurizer, core coolant tank and EPR steam generator of the third generation, and reactor pressure vessel for 200MW high temperature reactor of the fourth generation. It marks a great breakthrough of Shanghai Electric from capacity level of 600MW to 1000MW and from technology level of the second generation plus and the third generation to the fourth generation.

At present Shanghai electric is manufacturing heavy NI vessels including reactor pressure vessels, steam generators and pressurizers for domestic independent third generation CAP1400 Shidao Bay Project, HPR1000 Huizhou and Ningde projects, and CAP1000 Sanmen, Haiyang and Lufeng projects, six steam generators for Koeberg NPP in South Africa, and the fourth generation TMSR vessel, etc.

堆内构件和控制棒驱动机构
REACTOR VESSEL INTERNAL & CONTROL ROD DRIVE MECHANISM

上海电气已成功实现300MW、600MW、1000MW等级压水堆及200MW等级高温气冷堆堆内构件及控制棒驱动机构的批量化、配套化交付，市场占有率国内第一。

2015年以来，随着三代AP1000三门、海阳国产化依托项目和EPR台山项目的堆内构件和控制棒驱动机构的交付；四代200MW石岛湾高温气冷堆金属堆内构件、控制棒驱动系统的交付；以及全球首台华龙一号暨福清5号机组堆内构件的交付，标志着上海电气在设备制造能级及技术发展方面均迈向了新的台阶。

目前我国自主三代技术的国和一号CAP1400石岛湾项目、华龙一号HPR1000福清、卡拉奇、防城港、惠州、宁德项目、CAP1000三门、海阳以及四代霞浦快堆等项目的堆内构件及控制棒驱动机构正在抓紧制造中。

Shanghai Electric has realized the mass and complete-set delivery of reactor vessel internals and control rod drive mechanisms for 300MW, 600MW and 1000MW PWRs and 200MW HTRs, and holds the highest market share in China. Since 2015, Shanghai Electric has delivered reactor vessel internals and control rod drive mechanisms for the third generation AP1000 Sanmen and Haiyang localization supporting projects and EPR Taishan Project, reactor vessel internals and control rod drive mechanisms for the fourth generation 200MW Shidao Bay HTR and reactor vessel internals for Fuqing Unit 5, the first HPR1000 unit in the world, which marks a new stage of Shanghai Electric in both equipment manufacturing capacity and technology.

At present Shanghai Electric is manufacturing reactor vessel internals and control rod drive mechanisms for Shidao Bay Project of domestic independent third generation technology CAP1400, Fuqing, Karachi, Fangchenggang, Huizhou and Ningde projects of HPR1000 technology, Sanmen and Haiyang projects of CAP1000 technology, and Xiapu fast reactor project of the fourth generation technology, etc.

核电主泵
RCP FOR NUCLEAR POWER

上海电气引进德国KSB集团先进的主泵技术，提供具有国际领先技术水平的轴封型主泵及湿绕组电机主泵。为昌江核电站提供的4台轴封型主泵已于2015年交付现场。为CAP1400示范工程提供的4台湿绕组主泵已开工，样机试验将在2019年完成；用于华龙一号漳州1、2号机组的轴封型主泵已开工在制。上海电气正在积极研发CAP1000/CAP1700 50Hz湿绕组电机主泵，努力开拓新的核主泵市场。

Shanghai Eclectic has introduced KSB AG's advanced reactor coolant pump technology and provides shaft sealed RCPs and RUVs with the international leading technology. Shanghai Electric has delivered 4 shaft sealed RCPs for Changjiang NPP in 2015, has started to manufacture 4 RUVs for CAP1400 demonstration project, for which the prototype test will be completed in 2019, and is manufacturing shaft sealed RCPs for Zhangzhou Units 1&2 of HPR1000 technology. Shanghai Electric is actively developing CAP1000/CAP1700 50Hz RUV and making efforts to develop new RCP markets.

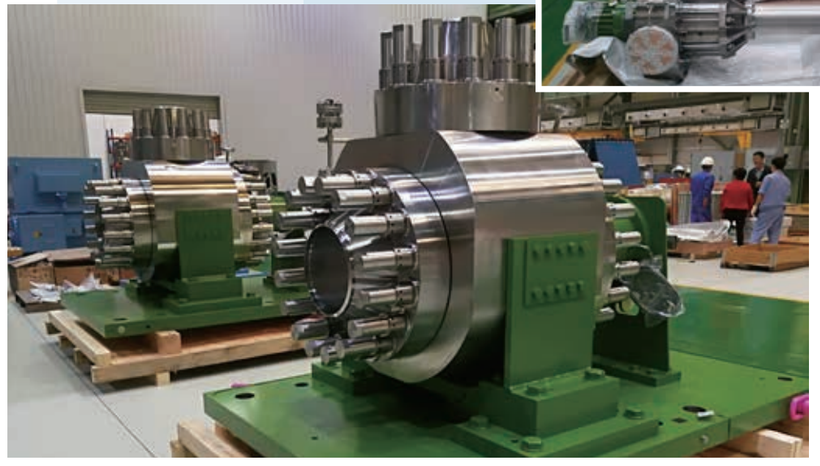
核二三级泵
PUMPS OF NUCLEAR CLASS II AND III

上海电气自2011年以来，已生产交付了超过140台套的核二三级泵，包括为AP1000三门和海阳依托项目提供的余热排出泵，为华龙一号福清5号机组提供的上充泵、余热排出泵、安注安喷泵等。

同时，上海电气也具备核电常规岛用泵及核级阀门的供货能力，目前正在执行国和一号CAP1400主给水泵、凝结水泵等项目设备。

Shanghai Electric has manufactured and delivered more than 140 sets of pumps of Nuclear Class II and III since 2011, including residual heat removal pumps for AP1000 Sanmen and Haiyang projects and charging pumps, residual heat removal pumps, safety injection pumps/containment spray pumps for HPR1000 Fuqing Unit 5.

Meanwhile, it is capable of supplying pumps for conventional islands and nuclear valves. At present, it is manufacturing the main feed water pumps and condensate pumps, etc for CAP1400 project.



燃料输送设备
FUEL HANDLING EQUIPMENT

上海电气自秦山核电站开始为国内外多个核电站提供了各类核电专用起重运输机械设备，包括百万千瓦级核电站燃料输送设备，含核燃料装卸料机、转运装置、乏燃料池吊车（人桥吊）、乏燃料容器吊、辅助吊等。2017年至今，华龙一号福清5号、6号机组人桥吊、辅助吊及首台出口巴基斯坦的华龙一号卡拉奇2号机组人桥吊、辅助吊已完工交付。

Shanghai Electric has provided varieties of special nuclear-rated crane equipment for domestic and foreign NPPs since Qinshan NPP, such as 1000MW NPP fuel handling system, including fuel handling machines, transfer devices, spent fuel pit cranes, cask crane and auxiliary cranes, etc. Since 2017, Shanghai Electric has delivered spent fuel pit cranes and auxiliary cranes for HPR1000 Fuqing Units 5&6 and the first spent fuel pit crane and auxiliary crane exported to Pakistan for HPR1000 Karachi Unit 2.

核二三级容器及热交换器
VESSELS AND HEAT EXCHANGERS OF NUCLEAR CLASS II & III

上海电气能够设计核安全二级设备（压力容器和热交换器），并能够制造核安全一、二、三级设备（压力容器、热交换器、闸门等），包括安注箱、卸压箱、柴油机主贮油罐、余热排出热交换器、安全喷淋热交换器和设备闸门等。

Shanghai Electric has the capability to design nuclear safety class II pressure vessels and heat exchangers, and manufacture nuclear safety class I, II & III vessels, heat exchangers and gates, including accumulator tank, pressurizer relief tank, diesel master oil tank, residual heat removal heat exchanger, safe spray heat exchanger and equipment hatch, etc.

文字文字 文字文字文字文字
Fuel handling Machine

常规岛
CONVENTIONAL ISLAND

汽轮发电机组
TURBINE-GENERATOR UNIT

上海电气为阳江核电及防城港核电共提供10套百万千万级汽轮发电机组。阳江1号机组于2014年3月25日投入商业运行，发电负荷达1104MW，汽轮 发电机组的性能大大超过同类其它产品。后续阳江2号、3号机组、阳江4号、阳江5号和防城港1号、防城港2号机组也顺利投入商业运行。

上海电气还将为我国自主设计的华龙一号—巴基斯坦卡拉奇2号、3号机组、防城港3号、4号机组、漳州1号、2号机组提供汽轮发电机组。

Shanghai Electric supply 10 Turbine-generation Units for Yangjiang & Fang Chenggang. Yangjiang unit-1 has been in commercial operation since Mar. 25th 2014. The output power can reach as high as 1104MW. It shows that the turbine- generator unit Shanghai Electric supplied is more efficient than any other same products. Yangjiang unit 2 to 5 and Fangchenggang unit 1 to 2 were put into commercial operation successively.

Shanghai Electric will supply turbine-generator units for HPR1000 projects, which is the domestic independent design, such as Karachi 2&3, Fang Chenggang Unit 3 &4, Zhangzhou Unin1&2.

焊接转子
WELDED ROTOR

上海电气拥有50余年焊接转子的研究开发和生产应用史，拥有比较完备健全的焊接转子结构设计、强度分析、焊缝设计、焊接工艺和焊接设备、材料技术、无损检测、转子安全性评价等技术体系。2008年上海电气实现了异种钢转子的焊接；2009年实现了超超临界百万等级火电汽轮机低压转子焊接生产制造；2010年实现了AP1000核电低压试验转子的焊接制造。至今上海电气已累计焊接各类转子467根，其中432根已经投入商业运行。目前已完成了巴基斯坦卡拉奇2号、3号机组、防城港3号、4号机组共8根低压转子的焊接和加工。

Shanghai Electric has over fifty years' history in the field of researching and producing of welded rotors, and Shanghai Electric also has a rounded system for welded rotors' structural design and strength analysis, welded joint design, welding technology, welding equipment, welding material technology, nondestructive examination, rotor safety evaluation and so on. In 2008, Shanghai Electric developed dissimilar steel welded rotor. In 2009, welded rotors were manufactured for 1000MW ultra-supercritical thermal turbine. In 2010, a welded rotor was manufactured and test for AP1000 NNP turbine. So far, there have been 467 rotors of different kinds manufactured, among which 432 rotors have been put into commercial running. Moreover, it's should be noted that 4 welded rotors for Karachi NPP were completed in 2018 and 4 welded rotors for Fangchenggang NPP are going to be completed in 2019 and 2020.

低压长叶片
LOW PRESSURE LONG BLADE

上海电气建立了排汽面积按一定比例间隔配置的低压长叶片模块系列，开发了排汽面积为20m2的1420mm高度末叶片、排汽面积为26m2的1710mm高度末叶片以及排汽面积为30m2的1905mm高度末叶片。可满足现有百万级以上压水堆、各种背压机组的配置要求。1710mm末叶片已应用于巴基斯坦卡拉奇2号、3号机组、防城港3号、4号机组、漳州1号、2号华龙一号汽轮发电机组。1905mm末叶片是目前世界上开发成功的最长末级叶片。

SEC establishes low pressure long blade series whose exhaust areas conform to cetain proportion interval configuration and developed 1420mm blade with exhaust area 20 square meters, the 1710 mm blade with exhaust area of 26 square meters and the 1905 mm blade with exhaust area of 30 square meters, which can meet existing over 1000MW class pressure water reactor, and configuration requirements of various kinds of back pressure units. By now, 1710mm blades have been applied to HPR1000 turbines in projects of Karachi, Fangchenggang-2 and Zhangzhou. And 1905mm blades have been developed and tested, which is the longest low-pressure last stage blade with the largest exhaust area in the world.

辅机
AUXILIARY EQUIPMENT

上海电气有丰富的核电站常规岛辅助设备供货业绩，能够设计和制造常规岛高压加热器、低压加热器、凝汽器、除氧器及MSR汽水分离再热器，为岭澳、阳江、防城港、红沿河、福清、海阳等项目提供了大量的辅机产品。

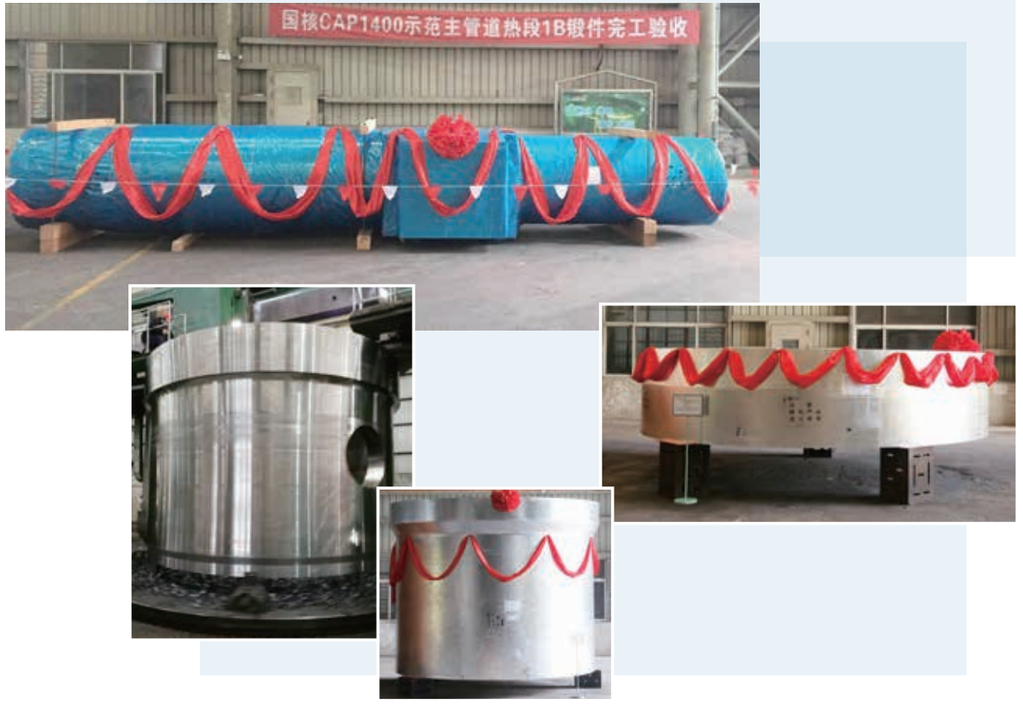
Shanghai electric has rich supply performance of auxiliary equipment and has the capability to design and manufacture high-pressure heater, low-pressure heater, condenser, deaerator and moisture separator reheater in conventional island, and provides a large number of auxiliary equipment for LingAo, Yangjiang, Fangchenggang, Hongyanhe, Fuqing and Haiyang project etc.

核电大锻件
LARGE NUCLEAR FORGINGS

上海电气已具备二代及二代加、三代AP1000压力容器、蒸汽发生器、稳压器锻件以及主管道大锻件的配套生产能力，也是国内唯一一家能够提供堆内构件不锈钢大锻件的企业。

自2016年底至今，先后投料3个机组压力容器、蒸发器大锻件101件，主管道等大锻件共5件。其中已出性能97件，均为一次性合格，一次合格率为100%（包括3件法兰接管段、3件堆芯筒体，2件CAP1400主管道热段等）。2017年以12个月的全球最短周期完成了华龙一号主泵泵壳锻件评定。2018年1月，实现了全球首件CAP1400主管道热锻锻件一次投制合格。

Shanghai Electric has the capability of manufacturing forgings for pressure vessels, steam generators, pressurizers and main pipes of the second generation and second generation plus and third-generation AP1000 units. It is the only one to supply large RVI stainless steel forgings in China. Since the end of 2016, 101 large forgings of pressure vessels and steam generators and 5 large forgings of main pipes for 3 units have been manufactured, of which 97 large forgings were qualified in the first attempt (including 3 flange pipe forgings, 3 core barrels, 2 CAP1400 main pipe hot legs), with a first qualification rate of 100%. Shanghai Electric completed the evaluation of HPR1000 RCP casing forgings within 12 months, which is the shortest period in the world, in 2017 and had the first CAP1400 main pipe hot forging in the world qualified in the first attempt in Jan 2018.



核电仪控仪表
CONTROL AND INSTRUMENTATION

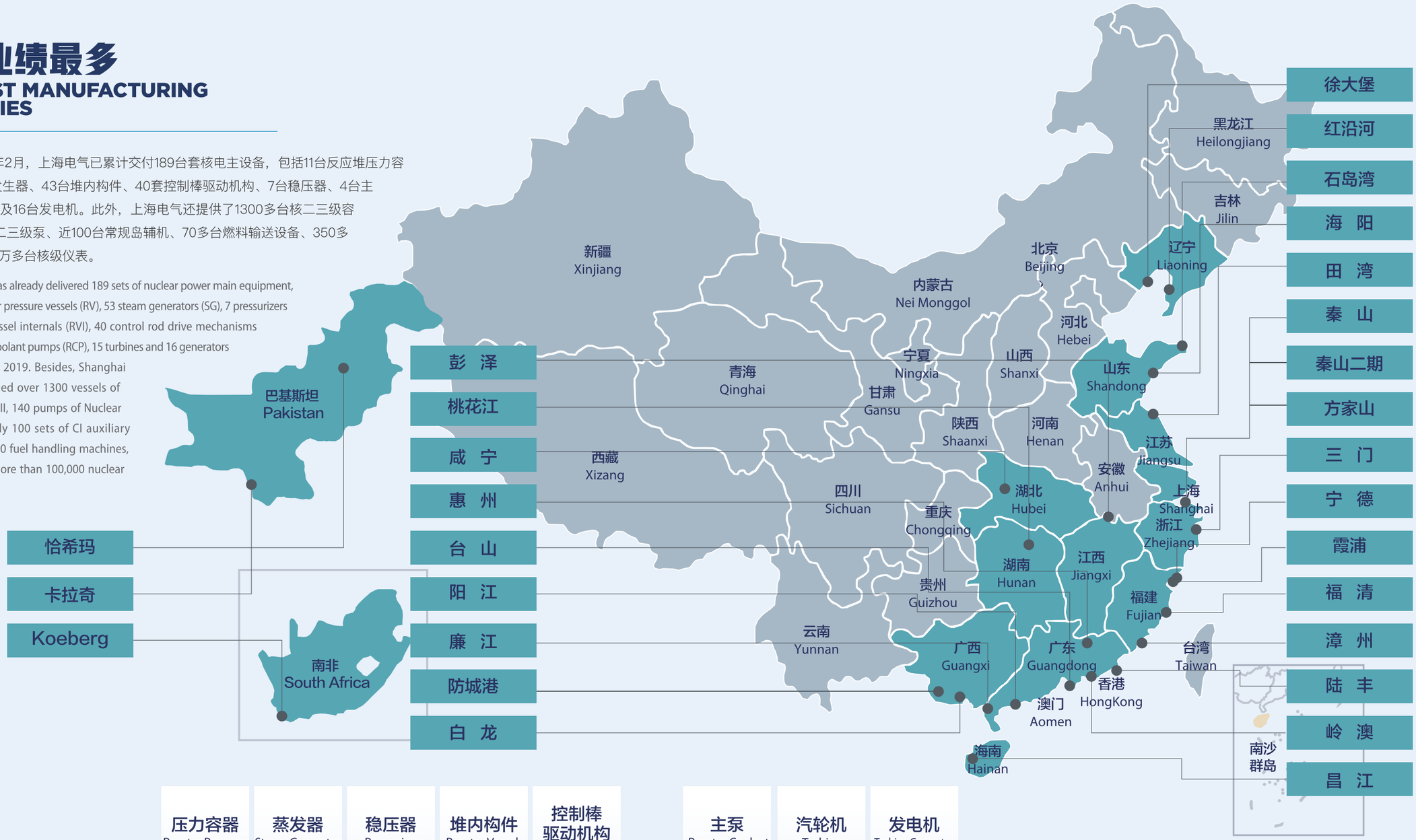
上海电气提供了近10万台核电仪表和盘箱柜、近百套各类核电系统装置。通过对第三代核电技术的消化、吸收和国债项目“大型压水堆核电站全数字化仪控系统及核电调节阀类产业化”的实施，上海电气正在开发新一代系统与仪表。项目完成后上海电气将具备提供大型压水堆核电站数字化控制系统与保护系统平台、自主知识产权的核电专用系统装置以及核级仪表、核级盘箱柜、核电调节阀类系列（核级电动执行机构与核级调节阀）等产品能力。

Shanghai Electric has supplied more than hundred thousands of nuclear instruments and cabinets, and nearly one hundred of nuclear system devices successfully used in plenty of nuclear power plants. Shanghai Electric is developing new generation of control systems and instruments by assimilation and absorption of the third-generation AP1000 technology and implementing the national debt project - “New complete digital control system and control valve industrialization for the large-scale PWR nuclear power plant”. After the completion of the project, Shanghai Electric will have the capability to supply the digital control system and protection system platform for the large size PWR nuclear power plant, and special control device with independent intellectual property rights, control valves for nuclear power plant (motor actuator in nuclear level and control valve in nuclear level).

交付业绩最多
THE MOST MANUFACTURING DELIVERIES

截止2019年2月，上海电气已累计交付189台套核电主设备，包括11台反应堆压力容器、53台蒸汽发生器、43台堆内构件、40套控制棒驱动机构、7台稳压器、4台主泵、15台汽轮机及16台发电机。此外，上海电气还提供了1300多台核二三级容器、140多台核二三级泵、近100台常规岛辅机、70多台燃料输送设备、350多台配套电机及十万多台核级仪表。

Shanghai Electric has already delivered 189 sets of nuclear power main equipment, including 11 reactor pressure vessels (RV), 53 steam generators (SG), 7 pressurizers (PZ), 43 reactor vessel internals (RVI), 40 control rod drive mechanisms (CRDM), 4 reactor coolant pumps (RCP), 15 turbines and 16 generators by the end of Feb 2019. Besides, Shanghai Electric has supplied over 1300 vessels of Nuclear Class II & III, 140 pumps of Nuclear Class II & III, nearly 100 sets of CI auxiliary equipment, over 70 fuel handling machines, 350 motors and more than 100,000 nuclear instruments.



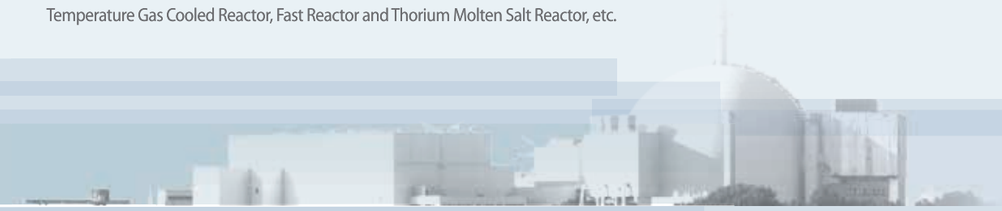
压力容器 Reactor Pressure Vessel	蒸发器 Steam Generator	稳压器 Pressurizer	堆内构件 Reactor Vessel Internals	控制棒驱动机构 CRDM
11 台	53 台	7 台	43 套	40 套

主泵 Reactor Coolant Pump	汽轮机 Turbine	发电机 Turbine Generator
4 台	15 台	16 台

技术路线最广
THE MOST WIDELY APPLIED MANUFACTURING TECHNOLOGY

上海电气所提供的核电产品技术涵盖300MW、600MW到1000MW等级的二代加和三代压水堆核电技术，包括华龙一号HPR1000、国和一号CAP1400、AP1000及CAP1000、EPR堆型，以及四代核电技术高温气冷堆、快堆及钍基熔盐堆等。

The nuclear product technologies provided by Shanghai Electric range from 300MW, 600MW to 1000MW PWR technologies of the second generation plus and the third generation, including HPR1000, CAP1400, AP1000 & CAP1000, EPR, and the fourth generation High Temperature Gas Cooled Reactor, Fast Reactor and Thorium Molten Salt Reactor, etc.



堆型	压力容器	蒸汽发生器	稳压器	堆内构件	控制棒驱动机构	液体悬浮式非能动停堆系统	主泵	装卸料机/（转运机、提升机）	主氦风机	主容器	（主）换热器
CNP300	●	●	●	●	●	/	●	●	/	/	/
CNP600	●	🏆	●	●	●	/	●	●	/	/	/
CNP1000	●	●	●	●	●	/	●	●	/	/	/
CPR1000	●	●	●	●	●	/	●	●	/	/	/
AP1000/ CAP1000	●	●	●	●	●	/	●	●	/	/	/
EPR	●	●	●	●	●	/	●	●	/	/	/
CAP1400	●	●	●	●	●	/	●	●	/	/	/
HPR1000	●	●	●	●	●	/	●	●	/	/	/
HTR-PM	●	●	/	●	●	/	/	●	●	/	/
CFR600	/	/	/	●	●	●	●	●	/	●	●
TMSR SF0	/	/	/	●	●	/	●	●	/	●	●
TMSR LF1	/	/	/	●	●	/	●	●	/	●	●
CiADS	/	/	/	●	/	/	●	●	/	●	●

装备能力最强
THE MAXIMUM EQUIPMENT CAPACITY

自2005年起，上海电气投资72亿元建成临港基地及改造完成闵行基地，拥有机加工、焊接、冶炼、锻造热处理、成型、起重、检测和试验等各类设备2500余台套，其中世界级的高端设备40多台，能够满足核电规模化发展需要。

通过临港和闵行两大基地的建设，上海电气已具备年产10台/套百万千瓦级堆内构件和控制棒驱动机构、6套核岛重型容器(压力容器、蒸汽发生器、稳压器等)、12台核主泵、6套汽轮发电机组的制造能力，并已形成最大钢锭600吨、最大铸件450吨、最大锻件350吨的核电配套大型锻件的配套加工能力。

Since 2005, Shanghai Electric has built Lingang Base and modified Minhang Base with an investment of 7.2 billion yuan, having more than 2,500 sets of machining, welding, smelting, forged hardening, forming, lifting, detection and testing equipment, including more than 40 sets of world-class advanced equipment to meet the large-scale development of nuclear power industry.

Thanks to the construction of Lingang Base and Minhang Base, Shanghai Electric has formed the annual manufacturing capability of 10 sets of 1000MW reactor vessel internals and control rod drive mechanisms, 6 sets of heavy NI vessels (reactor pressure vessel, steam generator and pressurizer, etc), 12 sets of RCPs and 6 sets of turbine-generator units, and Shanghai Electric has large nuclear power large forging manufacturing capacity to supply the largest steel ingot of 600 tons, the largest casting of 450 tons and the largest forging of 350 tons.

龙门移动式数控铣镗床
The PATH technology has been used in IMTS, which belon

数控三轴深孔钻床
The PATH technology has been used in IMTS, which belo

全球合作最深

THE BROADEST INTERNATIONAL COOPERATION

上海电气从上世纪七十年代起开展了全球范围内的核电业务合作，目前合作过知名企业多达50余家；合作方式包括合资合作、技术转让、联合研发、项目分包、供应链合作等。

Since the 1970s Shanghai Electric has established global nuclear power business cooperation with more than 50 world-renowned enterprises by various approaches, such as joint venture, technology transfer, joint R&D, project subcontract and supply chain cooperation, etc.

涉核企业
COMPANY LIST

上海电气集团
SHANGHAI ELECTRIC POWER GENERATION GROUP

- 上海电气核电集团 Shanghai Electric Nuclear Power Group
  - 上海第一机床厂有限公司 Shanghai No.1 Machine Tool Works Co., Ltd. — 堆内构件、控制棒驱动机构、燃料输送设备等 Reactor Vessel Internals, Control Rod and Driver Mechanism, Fuel Handling Devices
  - 上海电气核电设备有限公司 Shanghai Electric Nuclear Power Equipment Co., Ltd. — 压力容器、蒸汽发生器、稳压器、堆芯补水箱等 Reactor Vessel, Steam Generator, Pressurizer, Core Makeup Tank etc.
  - 上海电气凯士比核电泵阀有限公司 Shanghai Electric-KSB Nuclear Pump & Valve Co., Ltd. — 核主泵、核二三级泵阀 Reactor Coolant Pump, Class II & III Pump & Valve
  - 上海核电技术装备有限公司 Shanghai Nuclear Power Technology & Equipment Co., Ltd. — 非标设备集成及系统集成、备品备件及专用工具、核电技术服务 Non-nuclear Equipment/System Integration Service, Spare Part, Special Tools & Service
  - 上海电气上重铸锻有限公司 Shanghai Electric SHMP Casting & Forging Co., Ltd. — 核电大型铸锻件、主管道等 Nuclear Casting & Forging, Main Pipe
- 上海电气电站集团 Shanghai Electric Power Generation Group
  - 上海电气电站设备有限公司汽轮机厂 Shanghai Electric Power Generation Equipment Co., Ltd., Shanghai Turbine Works — 汽轮机 Turbine
  - 上海电气电站设备有限公司发电机厂 Shanghai Electric Power Generation Equipment Co., Ltd., Shanghai Generator Works — 发电机 Generator
  - 上海电气电站设备有限公司电站辅机厂 Shanghai Electric Power Generation Equipment Co., Ltd., Power Station Auxiliary Equipment Works — 核二三级容器及热交换器、常规岛辅机。包括：高低加、凝汽器、除氧器、汽水分离再热器、安注箱、正常余热排出热交换器 Class II & III Vessel & Heat Exchanger, Auxiliary Equipment Including: HP heater, LP heater, Condenser, Deaerator, MSR, Accumulator .Tank, Spray heat exchanger
  - 上海电气集团上海电机厂有限公司 SEC Shanghai Electric Machinery Co. Ltd. — 核电用配套电机 Motor
  - 上海电气电站服务公司 Shanghai Electric Power Generation Service Co., Ltd. — 现场服务及备品备件 Site Service & Spare Part
  - 上海电气电站工程公司 Shanghai Electric Power Generation Engineering Co., Ltd. — BOP设备 BOP Engineering
  - 上海鼓风机厂有限公司 Shanghai Electric Blower Works., Ltd. — 核电用风机 Nuclear Fan
- 其它配套企业 Strategy & Marketing Dept.
  - 上海自动化仪表有限公司 Shanghai Automation Instrumentation Co.,ltd. — 仪控仪表 Control System & Instrumentation

ANSALDO能源集团 Strategy & Marketing Dept.

ANSALDO核能 Strategy & Marketing Dept.

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